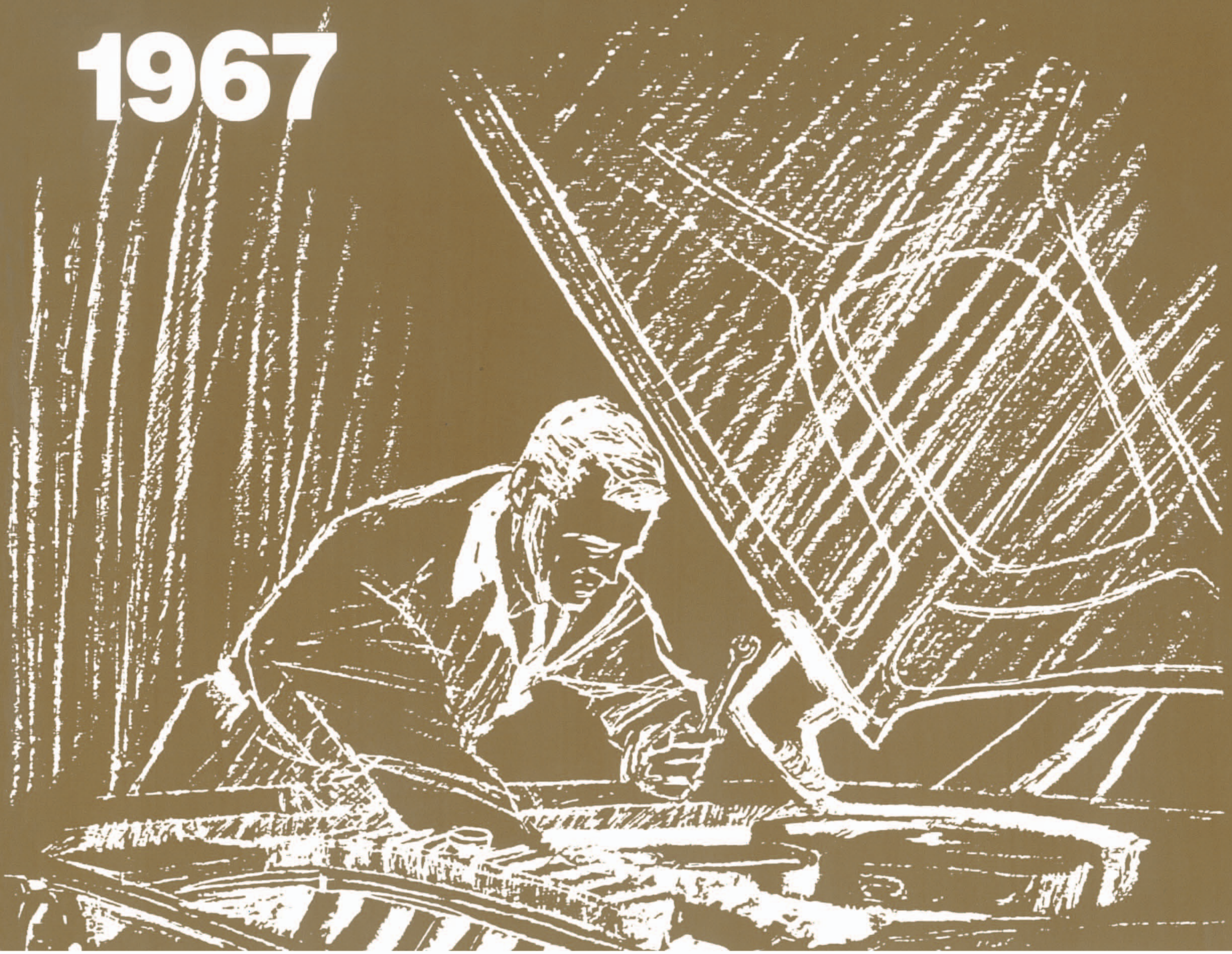
1967



CHASSIS
SERVICE MANUAL
CHEVROLET · CHEVELLE
CAMARO · CHEVY II
CORVETTE

CHEVROLET

ST 130-67

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

1967 CHEVROLET, CHEVELLE, CAMARO, CHEVY II AND CORVETTE CHASSIS SERVICE MANUAL

AND CORVETTE BODY SERVICE MANUAL

FOREWORD

This manual includes procedures for maintenance and adjustments, minor service operations, removal and installation for components, except the body, of Chevrolet, Chevelle, Camaro, Chevy II and Corvette vehicles, and service information for Corvette bodies. Procedures involving disassembly and assembly of major components for these vehicles are contained in the 1967 Chassis Overhaul Manual. Service information for 1967 Chevrolet, Chevelle, Camaro and Chevy II body items is contained in the 1967 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

SECTION INDEX

Printed in U.S.A.

SECTION 0
GENERAL INFORMATION AND LUBRICATION

CONTENTS OF THIS SECTION

GENERAL INFORMATION

MODEL IDENTIFICATION—CHEVROLET

Series	Model Number		Description
	6-Cyl	V-8	
Biscayne	15311	15411	2-Door Sedan, 6-Passenger
	15369	15469	4-Door Sedan, 6-Passenger
	15335	15435	4-Door Station Wagon, 2-Seat
Bel Air	15511	15611	2-Door Sedan, 6-Passenger
	15569	15669	4-Door Sedan, 6-Passenger
	15535	15635	4-Door Station Wagon, 2-Seat
	15545	15645	4-Door Station Wagon, 3-Seat
Impala	16387	16487	2-Door Sport Coupe, 5-Passenger
	16367	16467	2-Door Convertible, 5-Passenger
	16369	16469	4-Door Sedan, 6-Passenger
	16339	16439	4-Door Sport Sedan, 6-Passenger
	16335	16435	4-Door Station Wagon, 2-Seat
	16345	16445	4-Door Station Wagon, 3-Seat
Impala Super Sport	16787	16887	2-Door Sport Coupe, 4-Passenger
	16767	16867	2-Door Convertible, 4-Passenger
Caprice	—	16647	2-Door Custom Coupe, 5-Passenger*
	—	16639	4-Door Custom Sedan, 6-Passenger
	—	16635	4-Door Custom Wagon, 2-Seat
	—	16645	4-Door Custom Wagon, 3-Seat

*4-Passenger when optional bucket front seats are specified.

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	213.2"	213.2"	213.2"	212.4"
Width Overall (Body)	79.6"	79.6"	79.6"	79.6"
Height Overall	55.4"	54.4"	55.3"	56.7"
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"	62.4"	63.4"
Curb Weight: Approximately 3543 lbs. 4-Door 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	13211 13269	2-Door Sedan, 6-Passenger 4-Door Sedan, 6-Passenger
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 13539 13517 13567 13535	13669 13639 13617 13667 13635	4-Door Sedan, 6-Passenger 4-Door Sport Sedan, 6-Passenger 2-Door Sport Coupe, 5-Passenger* 2-Door Convertible, 5-Passenger* 4-Door Station Wagon, 2-Seat
Super Sport 396	— —	13817 13867	2-Door Sport Coupe, 5-Passenger* 2-Door Convertible, 5-Passenger*
Concours	13735	13835	4-Door Station Wagon, 2-Seat

*4-Passenger when optional bucket seats are specified.

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	197.0"	197.0"	197.0"	199.9"	199.9"
Width Overall (Body)	75.0"	75.0"	75.0"	75.0"	75.0"
Height Overall	54.1"	53.2"	53.9"	56.7"	56.7"
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 3104 lbs. 4-Door Sedan with L-6 Engine 3258 lbs. with V-8 Engine.					

MODEL IDENTIFICATION—CHEVY II

Series	Model Number			Description
	L-4	6 Cyl.	V-8	
100	11111 11169 —	11311 11369 11335	11411 11469 11435	2-Door Sedan, 6-Passenger 4-Door Sedan, 6-Passenger 4-Door Station Wagon, 2-Seat
NOVA	— — —	11569 11537 11535	11669 11637 11635	4-Door Sedan, 6-Passenger 2-Door Sport Coupe, 5-Passenger 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	183.0"	183.0"	187.4"
Width Overall (Body)	71.3"	71.3"	71.3"
Height Overall	56.7"	54.4"	57.6"
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 2668 lbs. 4-Door Sedan with L-4 Engine; 2767 lbs. with L-6 Engine; 2959 lbs. with V-8 Engine.			

MODEL IDENTIFICATION—CAMARO

Model Number		Description
6-Cyl	V-8	
12337	12437	2-Door Sport Coupe, 4-Passenger
12367	12467	2-Door Convertible, 4-Passenger

VEHICLE DIMENSIONS—CAMARO

Model	Sport Coupe	Convertible
Length Overall	184.7"	
Width Overall (Body)	72.6"	
Height Overall	50.8"	
Wheelbase	108.0"	
Tread-Front	59.0"	
Tread-Rear	58.88"	
Weight: Sport Coupe with L6 Engine 2908 lbs.; with V-8 Engine 3063 lbs.		

MODEL IDENTIFICATION—CORVETTE

Model Number	Description
19437	2-Door Sport Coupe, 2-Passenger
19467	2-Door Convertible, 2-Passenger

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.

VEHICLE DIMENSIONS—CORVETTE

Model	Convertible	Sport Coupe
Length Overall	175.1"	
Width Overall (Body)	69.6"	
Height Overall	49.8"	49.6"
Wheelbase	98.0"	
Tread-Front	56.8"	
Tread-Rear	57.6"	
Curb Weight: 3145 lbs. Convertible 3135 lbs. Sport Coupe with Base V-8		

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 Unit Number

The engine unit number (figs. 3 and 4) shows manufacturing plant, month and day of manufacture, and transmission type. A typical engine number would be F1210FA, which would breakdown thus:

F--Manufacturing Plant (F--Flint, T--Tonawanda)
12--Month of manufacture (December)
10--Day of manufacture (tenth)
FA--Transmission and engine 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	7	F	100025

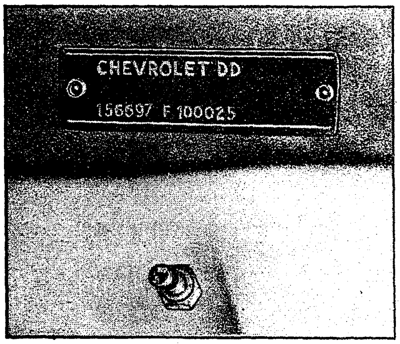


Fig. 1—Vehicle Serial Number Located on Left Front Hinge Pillar—Chevrolet Shown

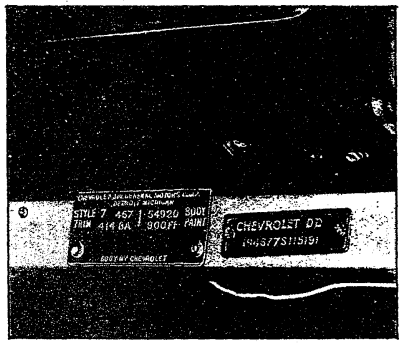


Fig. 2—Vehicle Serial Number and Body Style, Body Number Trim and Paint Combination Located on Instrument Panel Brace Under Glove Box—Corvette

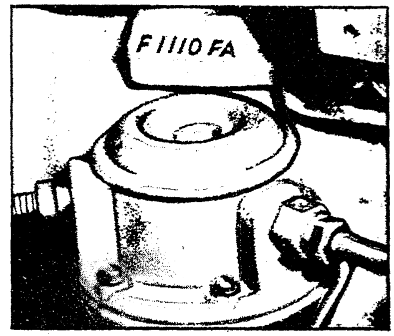


Fig. 3—Four and Six Cylinder Engine Unit Number Located on Pad at Right Hand Side of Cylinder Block at Rear of Distributor

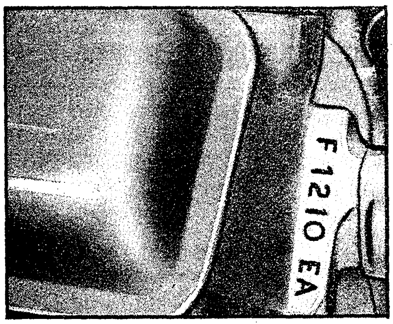


Fig. 4—Eight Cylinder Engine Unit Number Located on Pad at Front, Right Hand Side of Cylinder Block

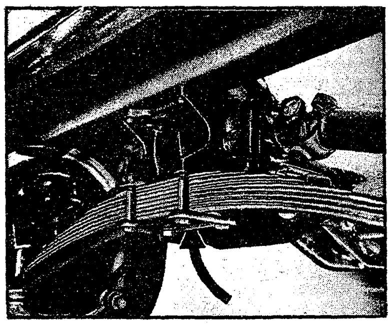


Fig. 5—Rear Axle Unit Number Located Bottom Surface of Carrier at Cover Mounting Flange—Corvette

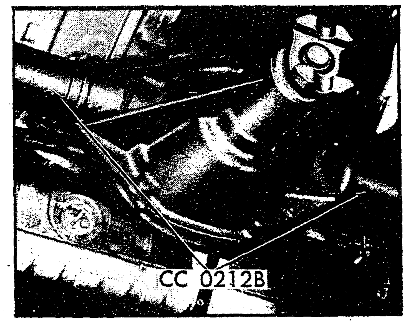


Fig. 6—Rear Axle Unit Number Located on Right or Left Axle Tube Adjacent to Carrier

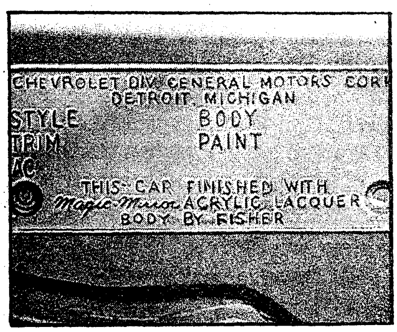


Fig. 7—Body Style, Body Number Trim Type and Paint Combination Located on Upper Right Hand Side of the Dash Panel—Chevrolet

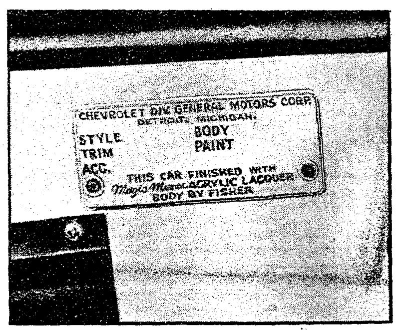


Fig. 8—Body Style, Body Number Trim Type and Paint Combination Located on the Upper Left Hand Side of the Dash Panel—Chevelle and Camaro

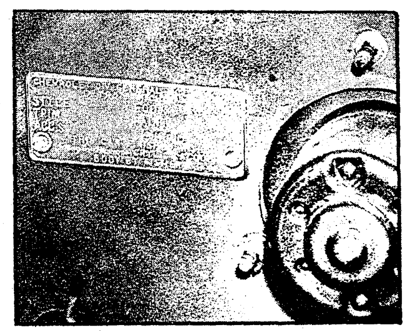


Fig. 9—Body Style, Body Number Trim Type and Paint Combination Located on the Upper Right Hand Part of the Dash Panel—Chevy II

1. Manufacturers identity number assigned to all Chevrolet built vehicles.
2. See Model Identification in this section.
3. Last number of model year (1967).
4. F-Flint
5. Unit numbering will start at 100,001 at all plants.

KEYS AND LOCKS

Four keys (two hexagonal head and two round head) are provided with each vehicle. The hexagonal-head key operates the ignition switch and front door locks. The round-head key operates the locks for the glove box and rear compartment lid.

Lock cylinders (except trunk) are furnished for service uncoded, this necessitates the coding of these replacement lock cylinders.

NOTE: In service, the trunk and glove box lock cylinders are provided together with the trunk lock cylinder coded and the glove box cylinder uncoded.

The side bar type lock (fig. 18) is used for the ignition, front doors and trunk. The glove box lock is of the wafer

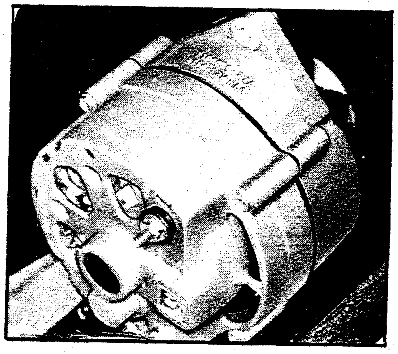


Fig. 10—Delcotron Unit Serial Number

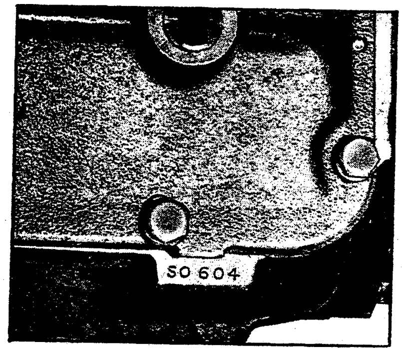


Fig. 11—3-4 Speed Transmission Unit Number Located on Lower Left Side of Case Adjacent to Rear of Cover (Saginaw)

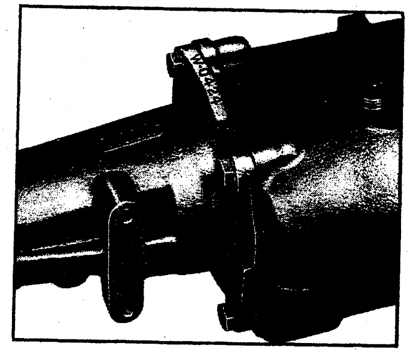


Fig. 12—3 Speed Borg-Warner Transmission Unit Number Located on Boss Right Rear Corner of Extension

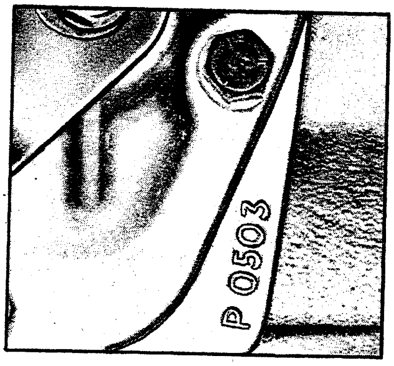


Fig. 13—4-Speed Transmission Source Data Code is Located on Left Side of Case at Lower Rear of Cover Flange (Muncie)

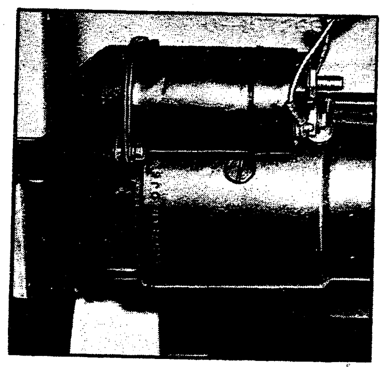


Fig. 14—Starter Serial Number and Production Date Stamped on Outer Case, Toward Rear

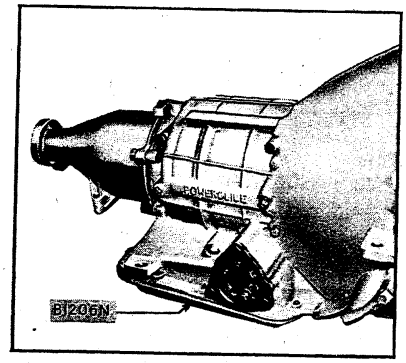


Fig. 15—Powerglide Transmission Unit Number Located on Right Rear Vertical Surface of Oil Pan

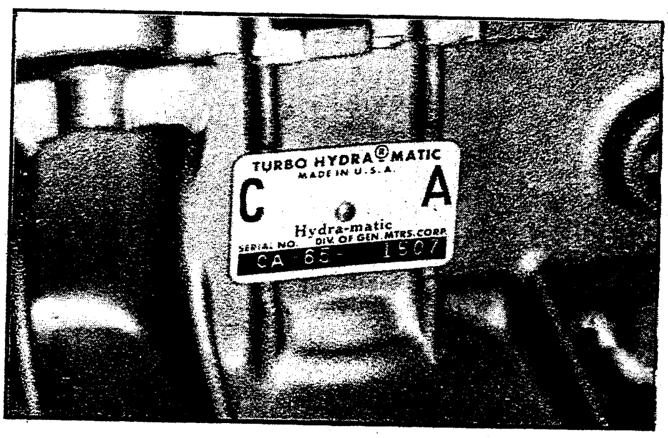


Fig. 16—The Turbo Hydra-Matic Transmission Serial Number is Located on the Light Blue Plate Location on the Right Side of the Transmission

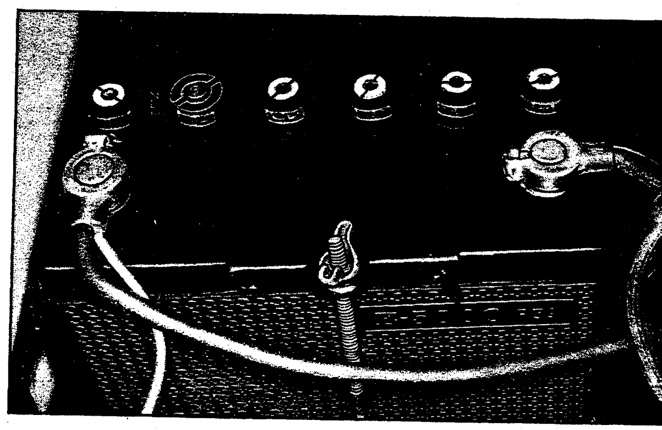


Fig. 17—Battery Code Number Located on Cell Cover Segment, Top of Battery

tumbler, single bitted type having four tumblers. To protect owners, automobile lock manufacturers stamp the lock numbers on the lock core, shaft, etc., where they will not show until lock is removed.

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.

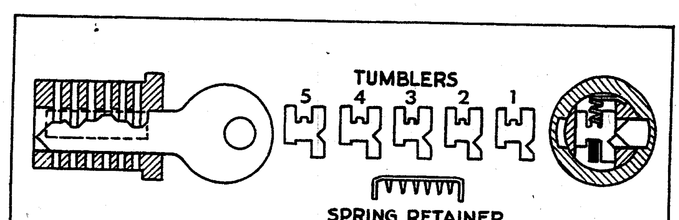


Fig. 18—Side Bar Lock

Once the code number of the lock is obtained look up this number in a key cutting book.

All side bar locks (except trunk) 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 five different depths, indicated by numbers.

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
0V11	545431
Cutting or Tumbler position from head of lock	123456

NOTE: Key blanks used for ignition and door locks are stamped with an "A" while rear compartment and glove box blanks are stamped with a "B".

The number that is written above the cutting or tumbler position indicates each different tumbler which is to be dropped into each tumbler slot of the lock.

In cases where a code book is not available, the diagram shown on Figure 19 may be used to determine the tumblers required to assemble an uncoded lock cylinder.

1. Lay the key on the diagram (fig. 19) with bottom of key flush with edge of the drawing, head and point carefully lined up.
2. Read the code in numbers 12345 from the head of the key to the end from positions 1 to 6 inclusive. As each depth is determined write that number in the blank space provided above the position numbers (1-2-3-4-5-6).
3. With key properly lined up on diagram, all cuts that show in the first section are marked "1".
4. Cuts that fall in the first black section, mark "2".
5. Cuts that fall in the first white section, mark "3".
6. Cuts that fall in second black section, mark "4".
7. Cuts that fall in the second white section, mark "5".

After the numbers have been determined and written above the cutting positions the lock cylinder should be assembled as follows.

Lock Cylinder Assembly—Refer to Figure 20

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.
2. After all tumblers are in place, check for correctness with the code. Then press tumblers down with one finger.
3. Insert one tumbler spring in the space provided above each tumbler.

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. 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

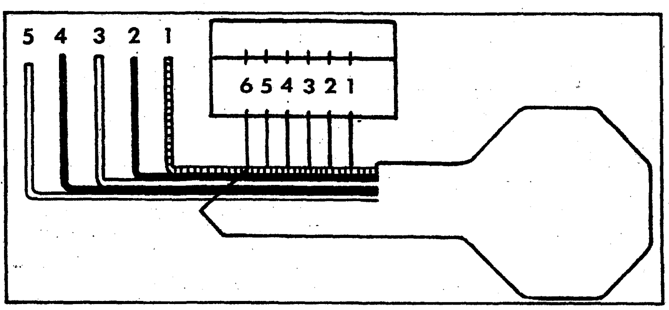


Fig. 19—Tumbler Requirement Diagram

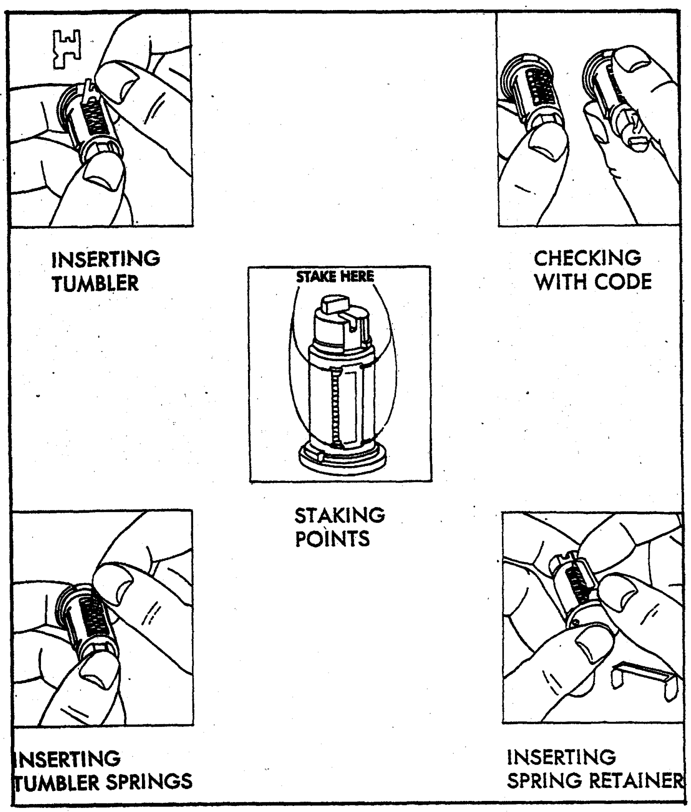


Fig. 20—Assembling Lock Cylinder

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 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

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

AUTOMATIC TRANSMISSION

Do not attempt to start the engine by pushing the car. Should the battery become discharged, it will be necessary to use an auxiliary battery with jumper cables to start the engine.

CAUTION: To prevent damage to electrical system, never connect booster batteries in excess of 12 volts and connect positive to positive and negative to negative.

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.

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.

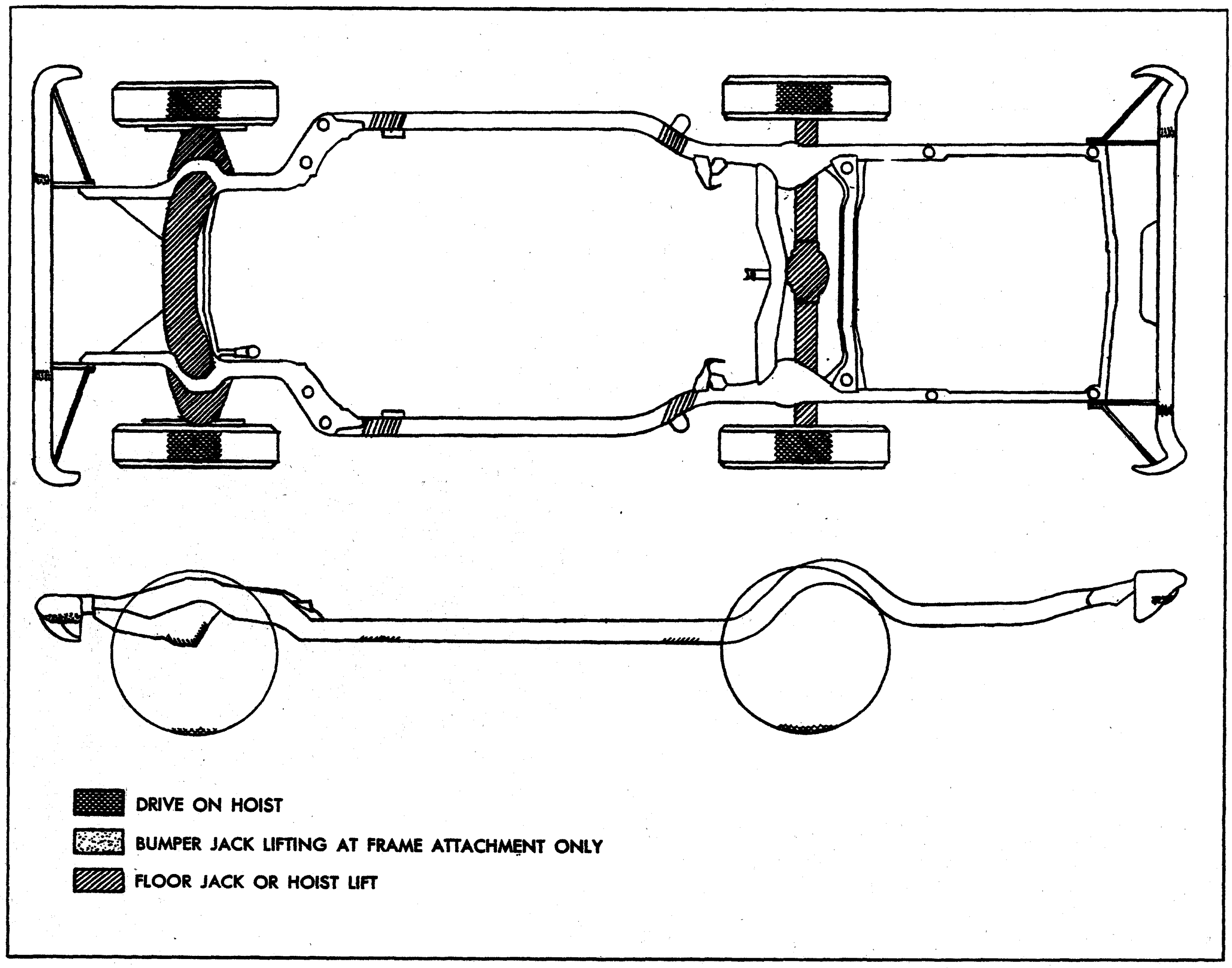


Fig. 21—Vehicle Lifting Points—Chevrolet

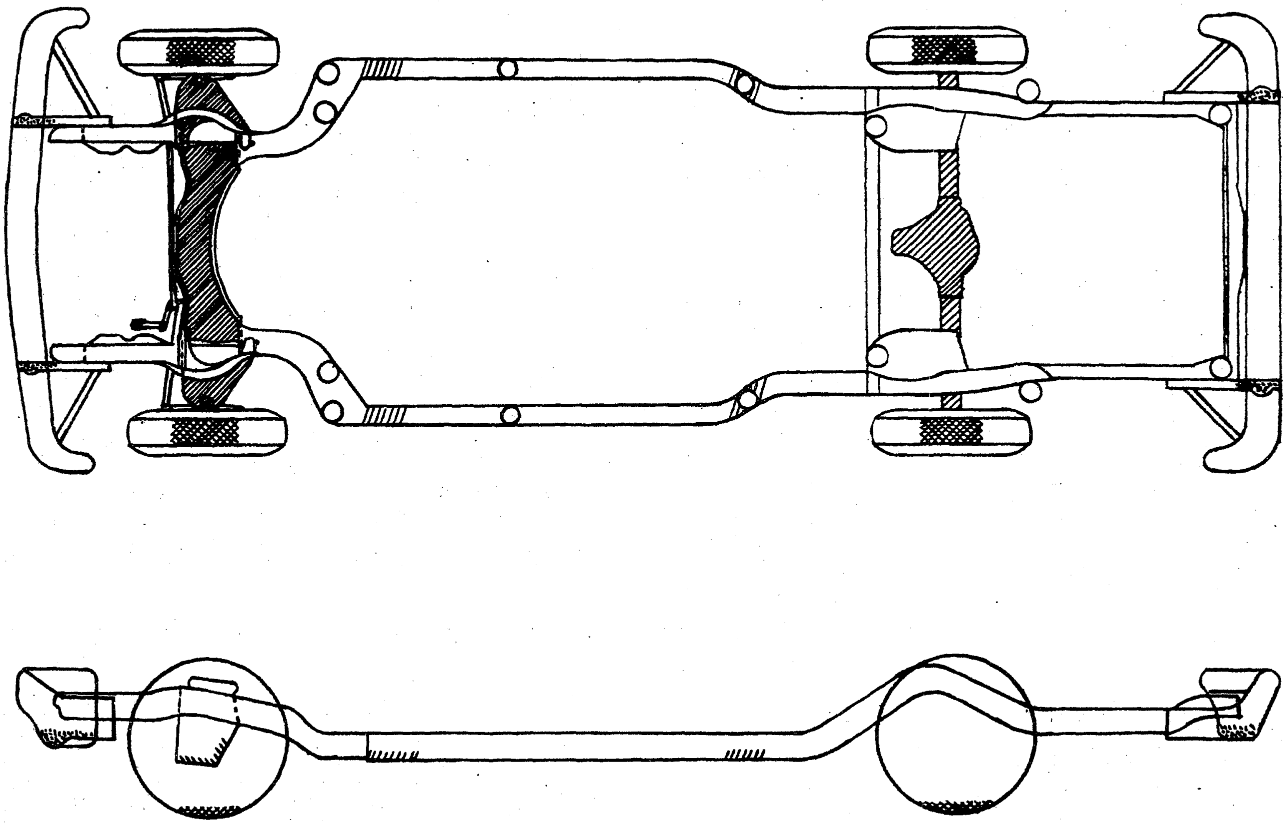


Fig. 22—Vehicle Lifting Points—Chevelle

TOWING THE CAMARO

The recommended method for towing the Camaro is as follows.

Front

Connect standard chain hooks near the outer ends of the front suspension lower control arms in between the coil springs and the stabilizer bar link bolt (fig. 23).

The chains should be attached to the lower lifting sling bar so that when the vehicle is raised the rubber straps protect the front valance panel (fig. 24). Caution should be exercised when attaching the lower lifting bar that the upper lifting bar does not damage the hood header panel.

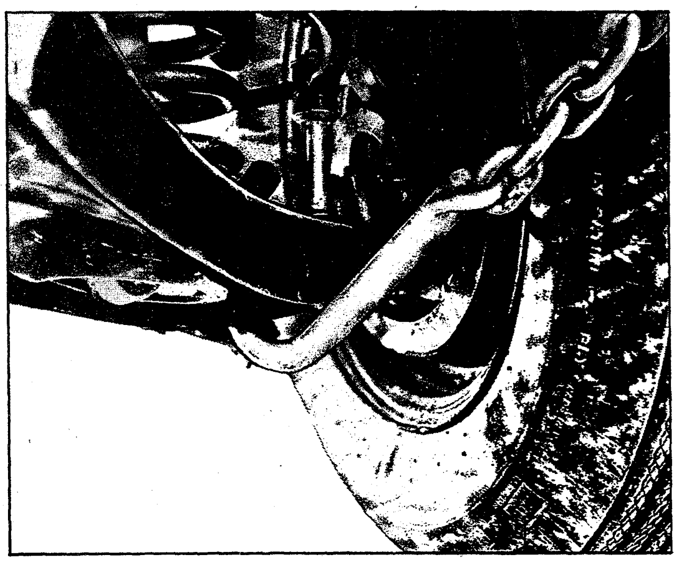


Fig. 23—Attachment of Towing Chain Hooks to Lower Control Arms

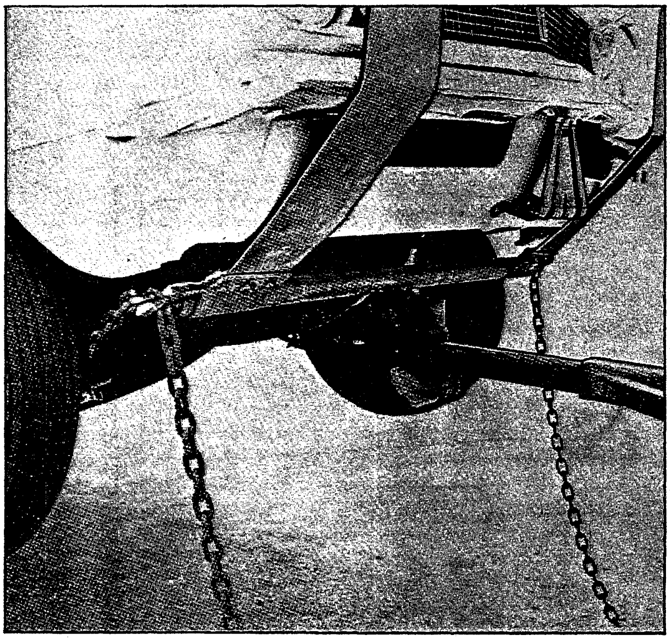


Fig. 24—Towing Sling Attachment—Front

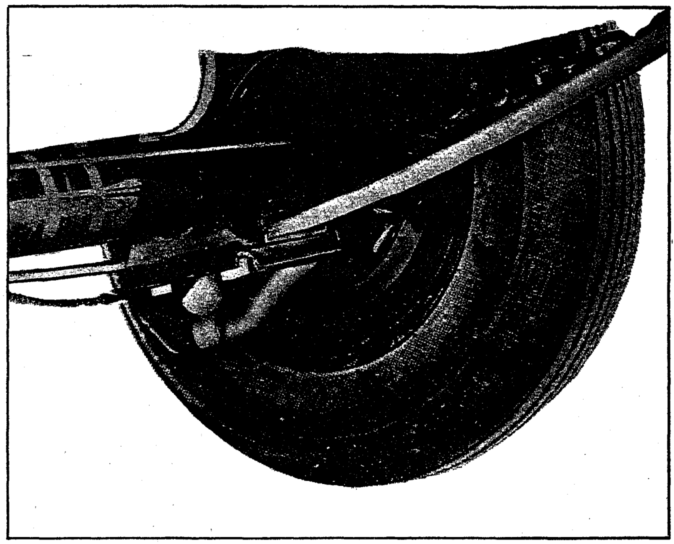


Fig. 25—Attachment of Towing Chain Hooks to Axle Tube

Rear

Connect standard chain hooks around the axle tube from the underneath side between the axle rear spring pad and the brake flange plate (fig. 25). It is mandatory that the chain hook be positioned as stated above so that the brake lines are not damaged.

The lower lifting bar should be positioned in below the vehicle so that the rubber straps protect the rear valance panel. With the lower bar in this position, it is necessary that the bar be spaced down a minimum of 1 5/8" to prevent damage to the fuel tank. This can be accomplished by placing 6.0" section of 2x4' wood blocks below the rear section of each rear spring (fig. 26).

To facilitate towing without a helper it will be necessary to attach the 2x4's to the rear spring by a strap or tape. See Figure 27.

Also it will be necessary to lock the steering wheel in the straight ahead position prior to actually moving the vehicle.

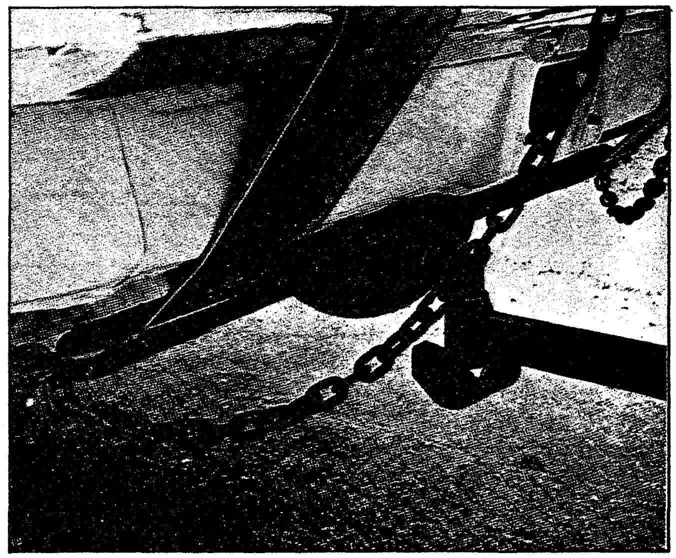


Fig. 26—Towing Sling Attachment—Rear

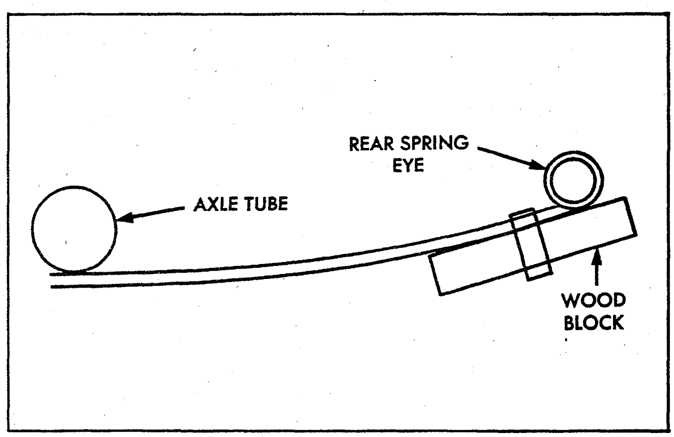


Fig. 27—Strapping Wood Block to Rear Spring

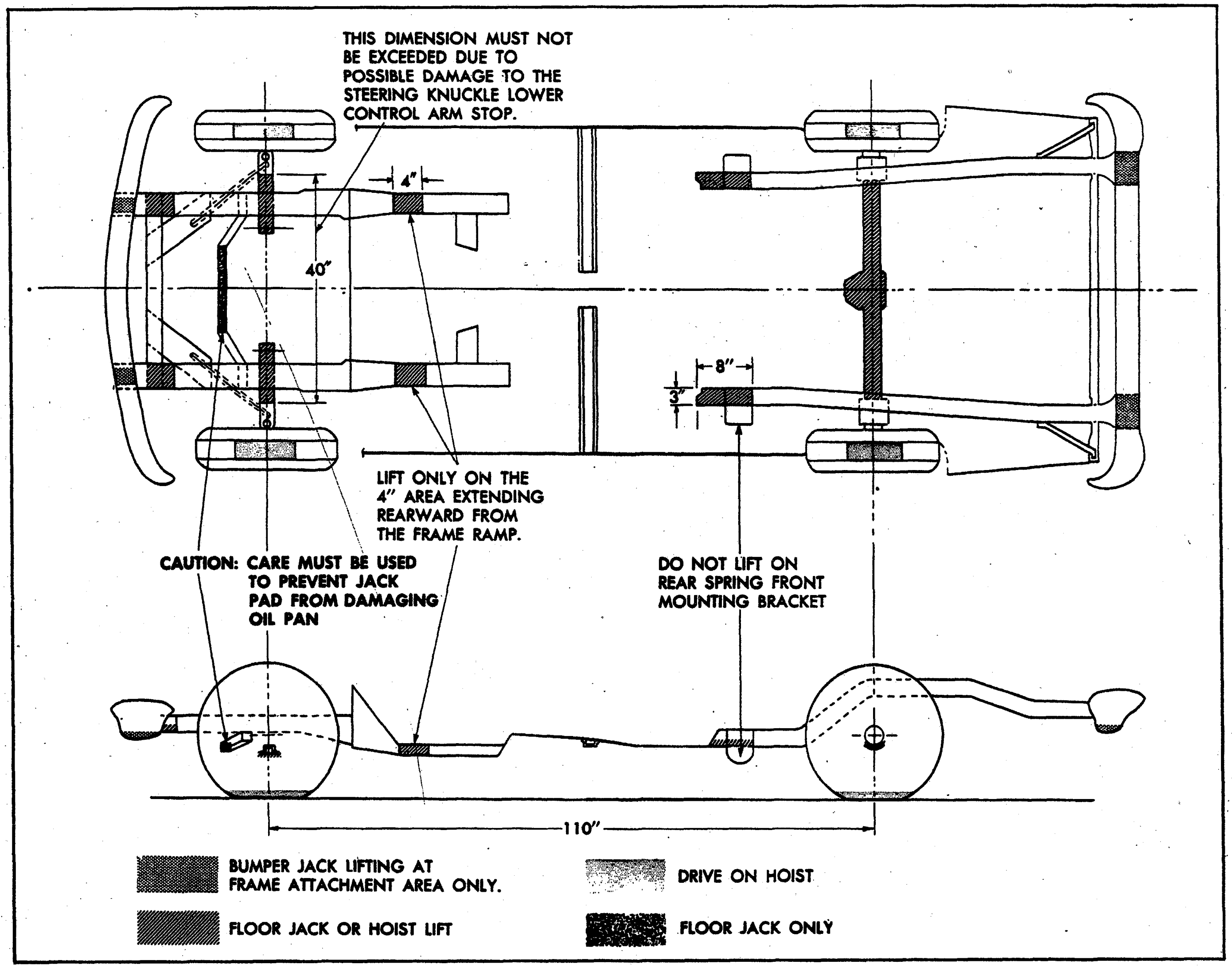


Fig. 28—Vehicle Lifting Points—Chevy II

Lifting With Auto Jack

The shaded areas on both the front and the rear bumpers, as shown in Figures 21, 22, 28, 29 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. On Corvettes, position jack on shaded areas indicated on Figure 30. Be sure jack load rest properly contacts frame before raising vehicle.

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 21, 22, 28, 29, 30 the shaded areas indicate areas recommended for hoist contact.

LIFTING THE CORVETTE

Shaded areas in Figure 30 indicate recommended points for hoist or jack contact. When using a single post hoist place hoist on frame side rail behind kickup at front and forward of #3 body mount at rear. When using a twin-post hoist, two methods are recommended.

a. If no rear axle or suspension work is contemplated, use either suspension adapters or drive-on adapters at the front, and drive-on adapters at the rear. If a need for axle work develops, use jack stands beneath the frame side rails on each side and lower rear post.
b. If rear axle work is contemplated, use either suspension adapters or drive-on adapters at the front and frame lift adapters as shown in Figure 31. If frame lift adapters are not available, use jack stands.

NOTE: Wooden blocks, bolted to steel beam shown in Figure 31 are necessary to allow beam to clear exhaust system.

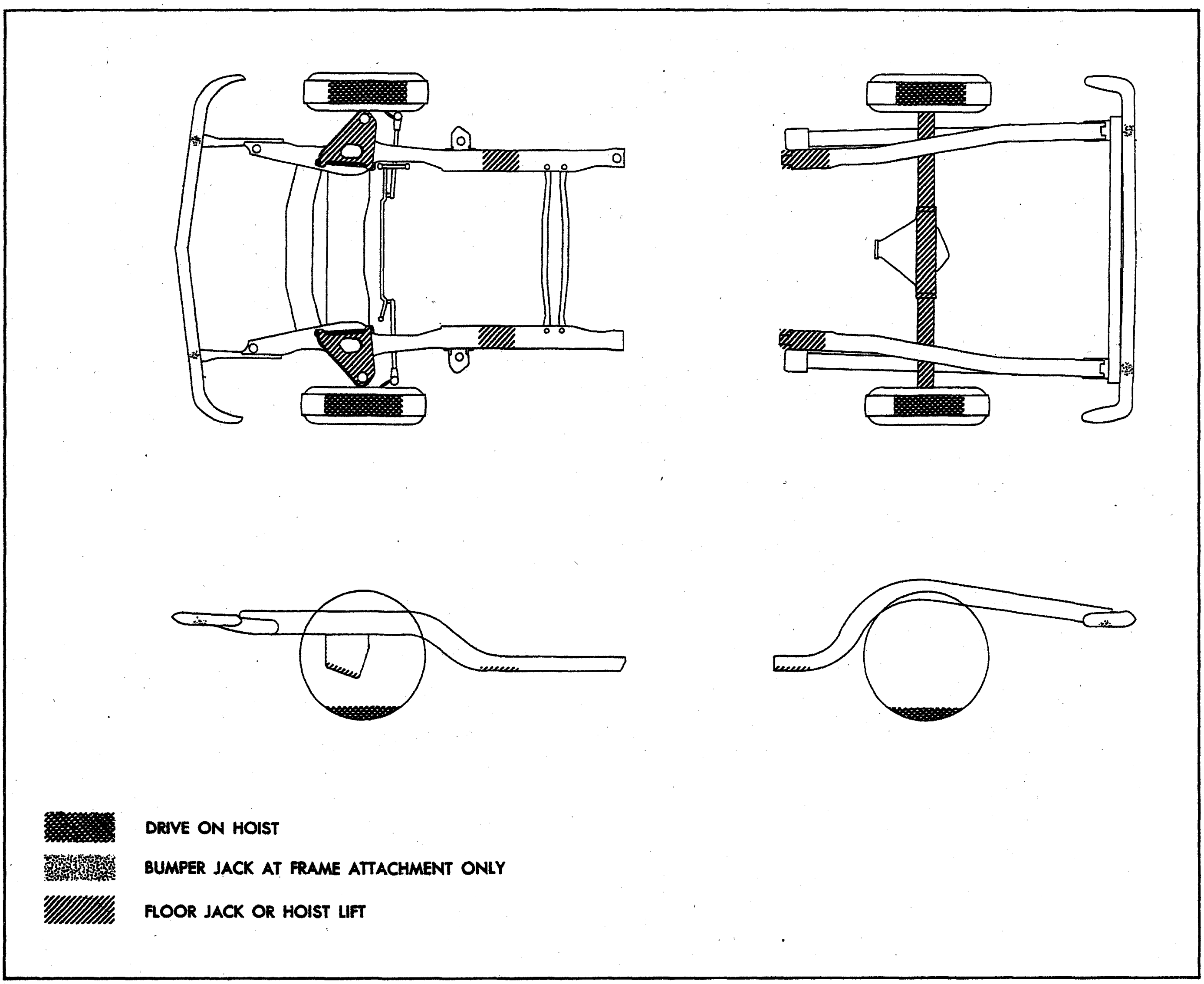


Fig. 29—Vehicle Lifting Points—Camaro

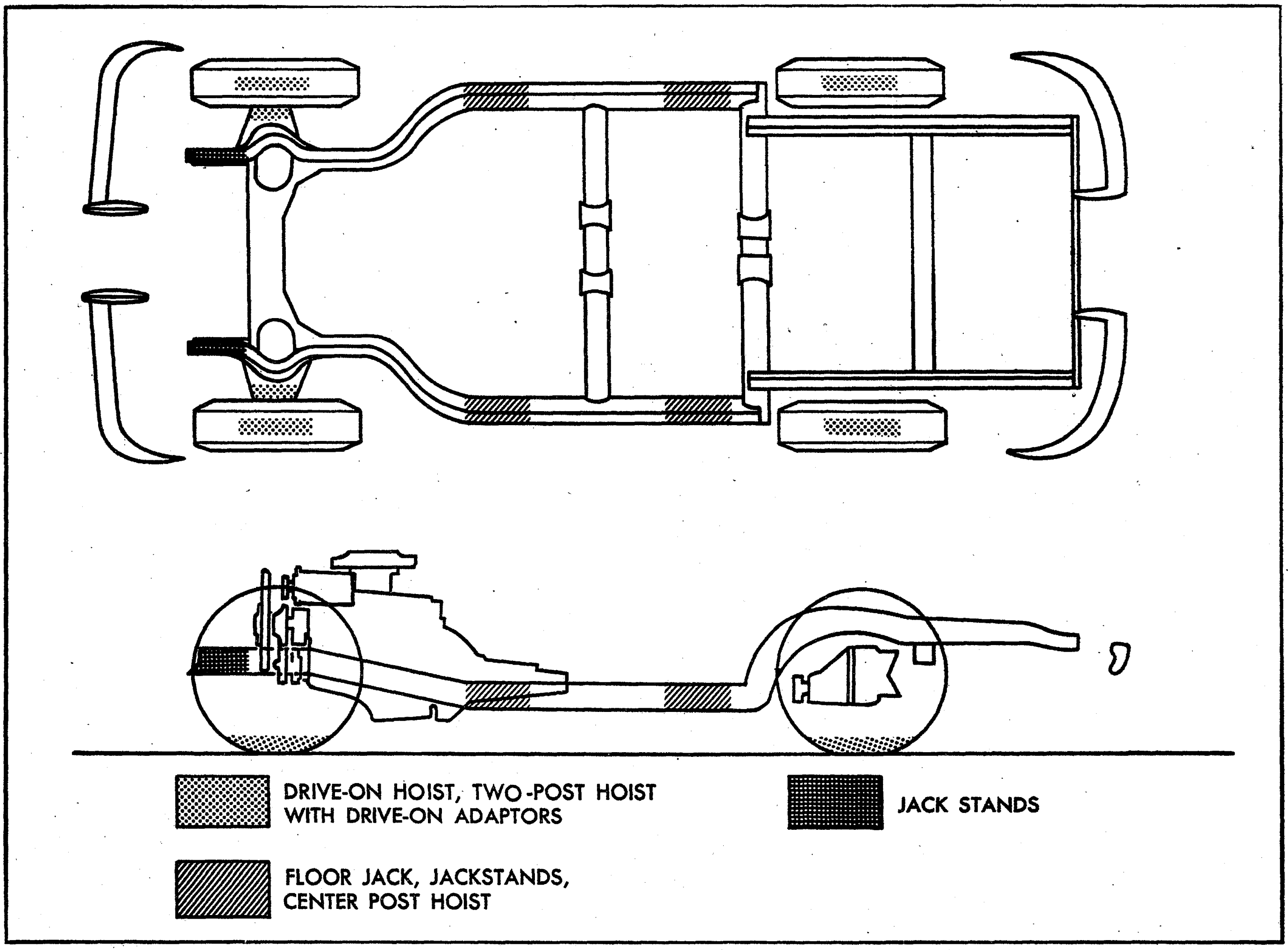


Fig. 30—Vehicle Lifting Points—Corvette

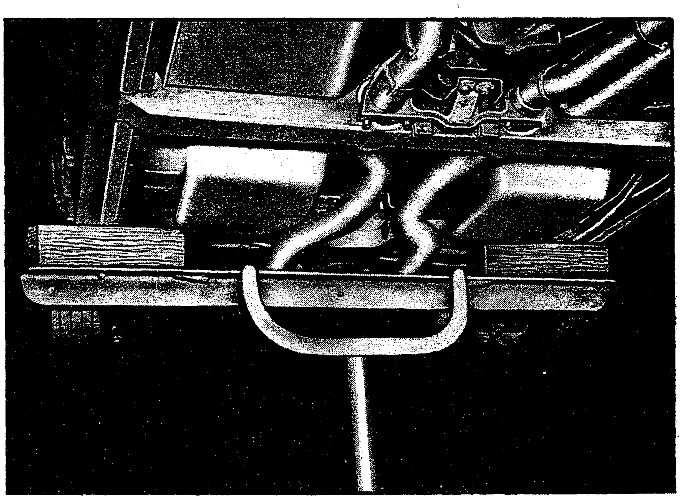


Fig. 31—Frame Lift Adapters—Corvette

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	4 qt.
6 Cylinder	4 qt.
8 Cylinder (283)	4 qt.
8 Cylinder (327)	4 qt.
8 Cylinder (350)	4 qt.
8 Cylinder (396)	4 qt.
8 Cylinder (427) Chevrolet	4 qt.
8 Cylinder (427) Corvette	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.

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.

NOTE: For Vehicles in heavy duty operation involving continuous start-stop or prolonged idling, engine oil should be changed after 2500-3000 miles of operation. The filter should be changed after 5000-6000 miles of operation.

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

NOTE: Under prolonged dusty driving conditions, it is recommended that these operations be performed more often. Every 12,000 miles or 12 months the valve should be replaced. Connecting hoses, fittings, flame arrestor and crankcase breather cap (where used) should be cleaned. At every oil change the system should be tested for proper function and serviced, if necessary.

FUEL FILTER

Replace filter element located in carburetor inlet if flooding occurs, if engine surges during constant speed operation (pulsating effect) or if poor performance is experienced during acceleration or at higher speeds.

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.

OIL WETTED 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

4 and 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 requires 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 "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 meeting U.S. Army Ord. Spec. MIL-L-2105B.

These lubricants can also be satisfactorily used in manual transmissions.

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 be 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

NOTE: Every 12,000 miles, it is recommended that the Powerglide low band be adjusted as specified in Section 7 of this manual.

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, adding a small amount of Automatic Transmission Fluid, General Motors Automatic Transmission Fluid (Part Numbers 1050568-69, 70) is recommended. If this fluid is not obtainable, use 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, 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 Camaro and Chevy II and two quarts for Chevrolet, Chevelle, and Corvette. Operate transmission through all ranges and check fluid level as described above.

*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.

TURBO HYDRA-MATIC

Lubrication recommendations for the Turbo Hydra-Matic are the same as outlined for the Powerglide transmission except for fluid capacity and filter change listed below.

After checking transmission fluid level it is important that the dip stick be pushed all the way into the fill tube.

Every 12,000 miles -- after removing fluid from the transmission sump, approximately 7 1/2 pints of fresh fluid will be required to return level to proper mark on the dip stick.

Every 24,000 miles, or at every other fluid change--the transmission sump strainer should be replaced.

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 wheel and hub 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 the mark AQ-ATF followed by a number and the suffix letter 'A' 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 repaired immediately.

BRAKE MASTER CYLINDER

Check level every 6,000 miles and maintain 1/4" below lowest edge of each 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.

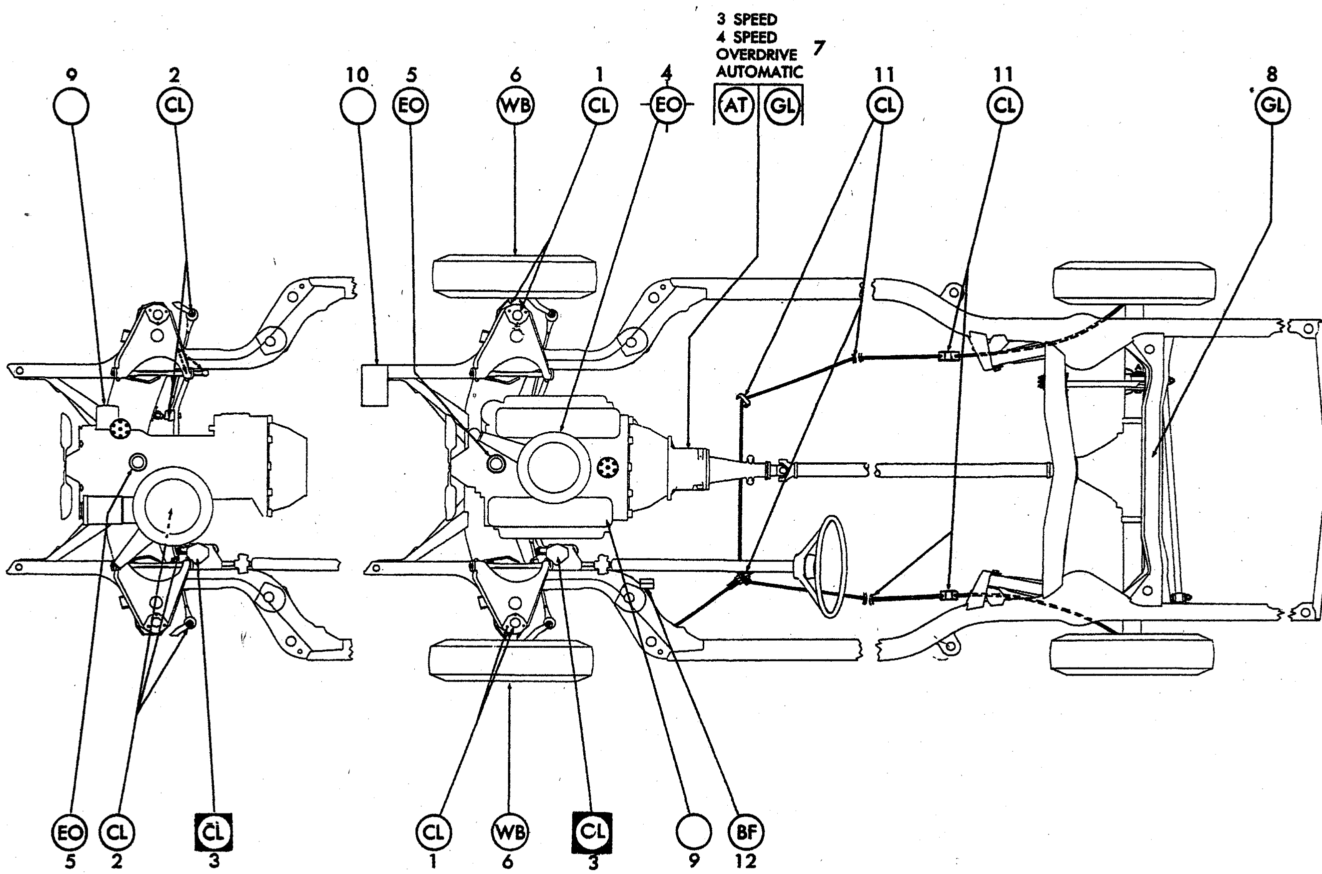
CLUTCH CROSS-SHAFT

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

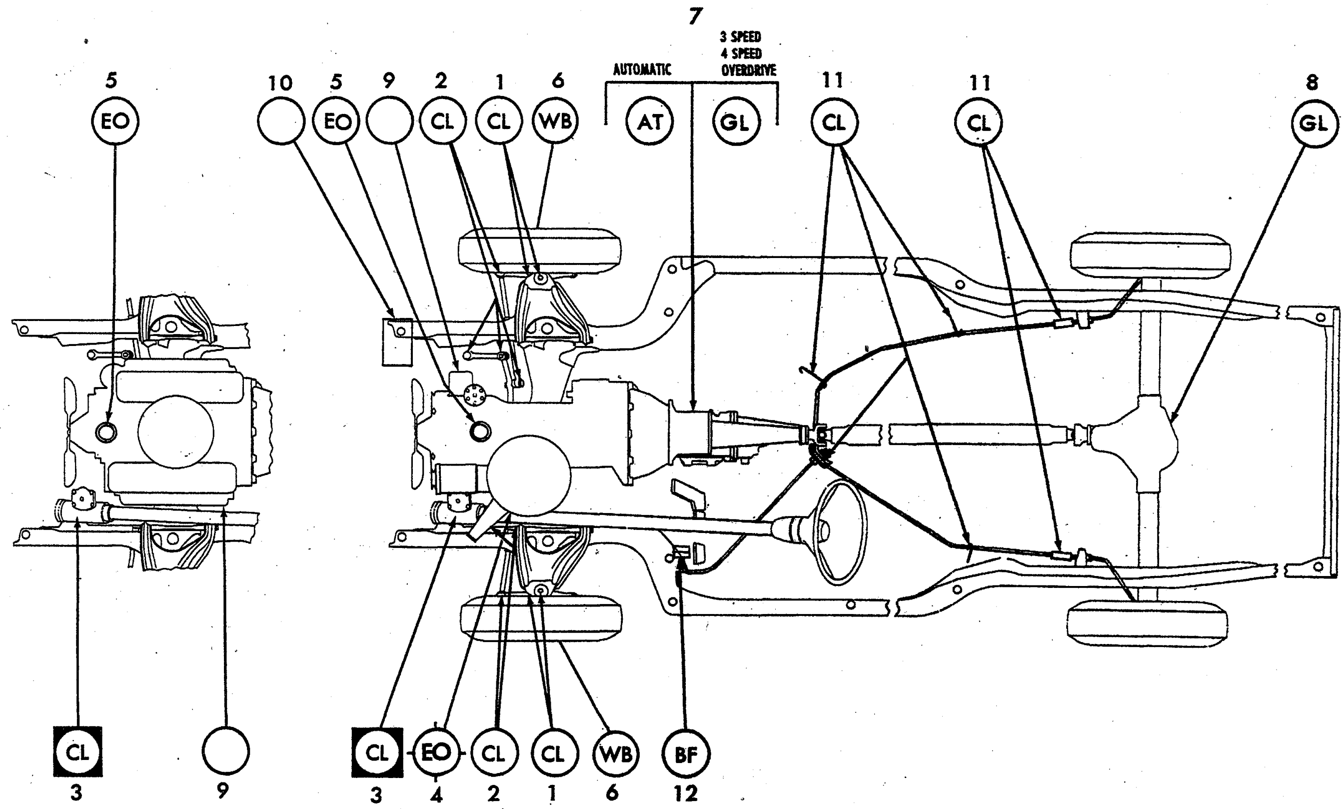
EO—Engine Oil

AT—Automatic Transmission Fluid (Type A)

BF—Brake Fluid

Fig. 32—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)

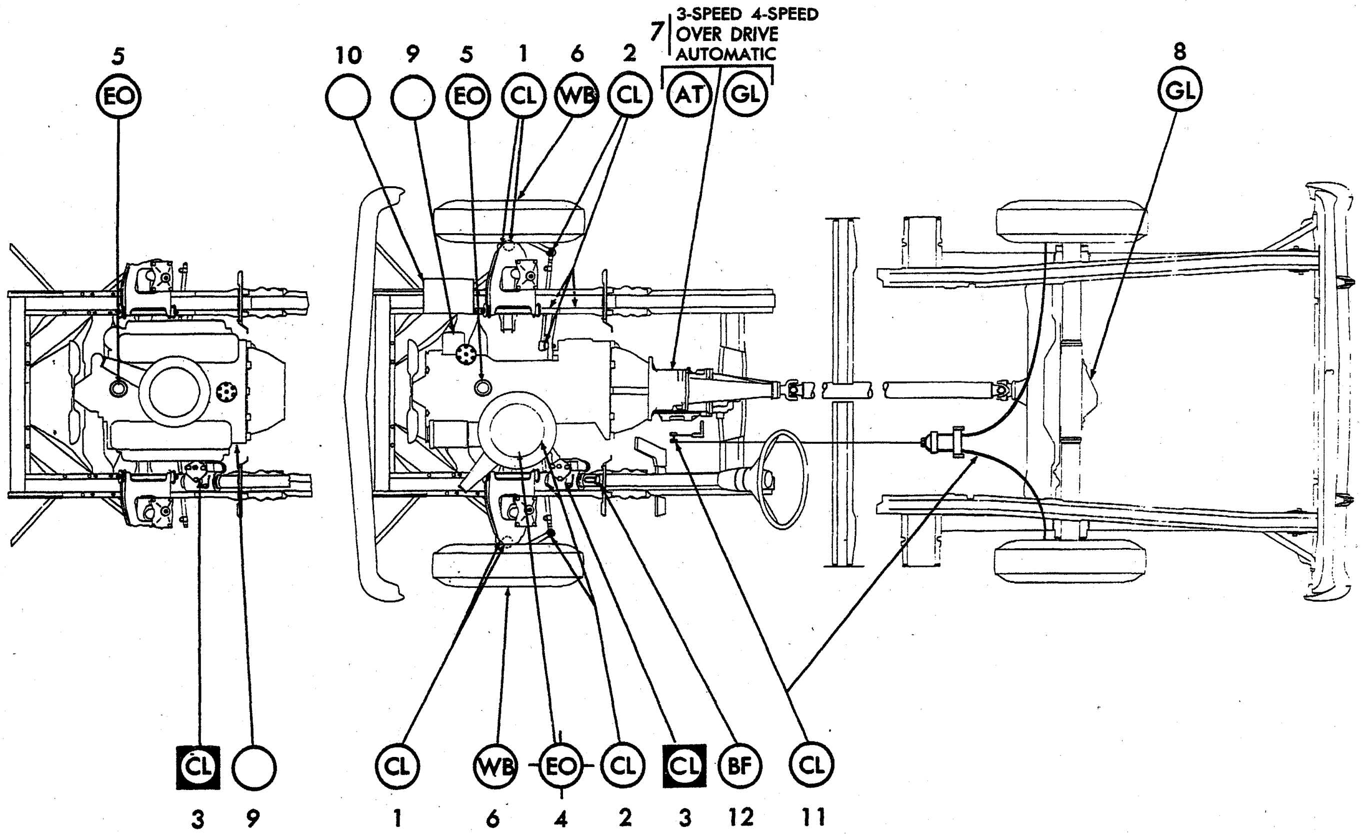
SL —Steering Gear Lubricant

BF —Hydraulic Brake Fluid

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

Fig. 33—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



LUBRICATE EVERY 6,000 MILES

LUBRICATE EVERY 12,000 MILES

LUBRICATE EVERY 36,000 MILES

*Refill Positraction Rear Axle with Special Lubricant Only.

GL—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. 34—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

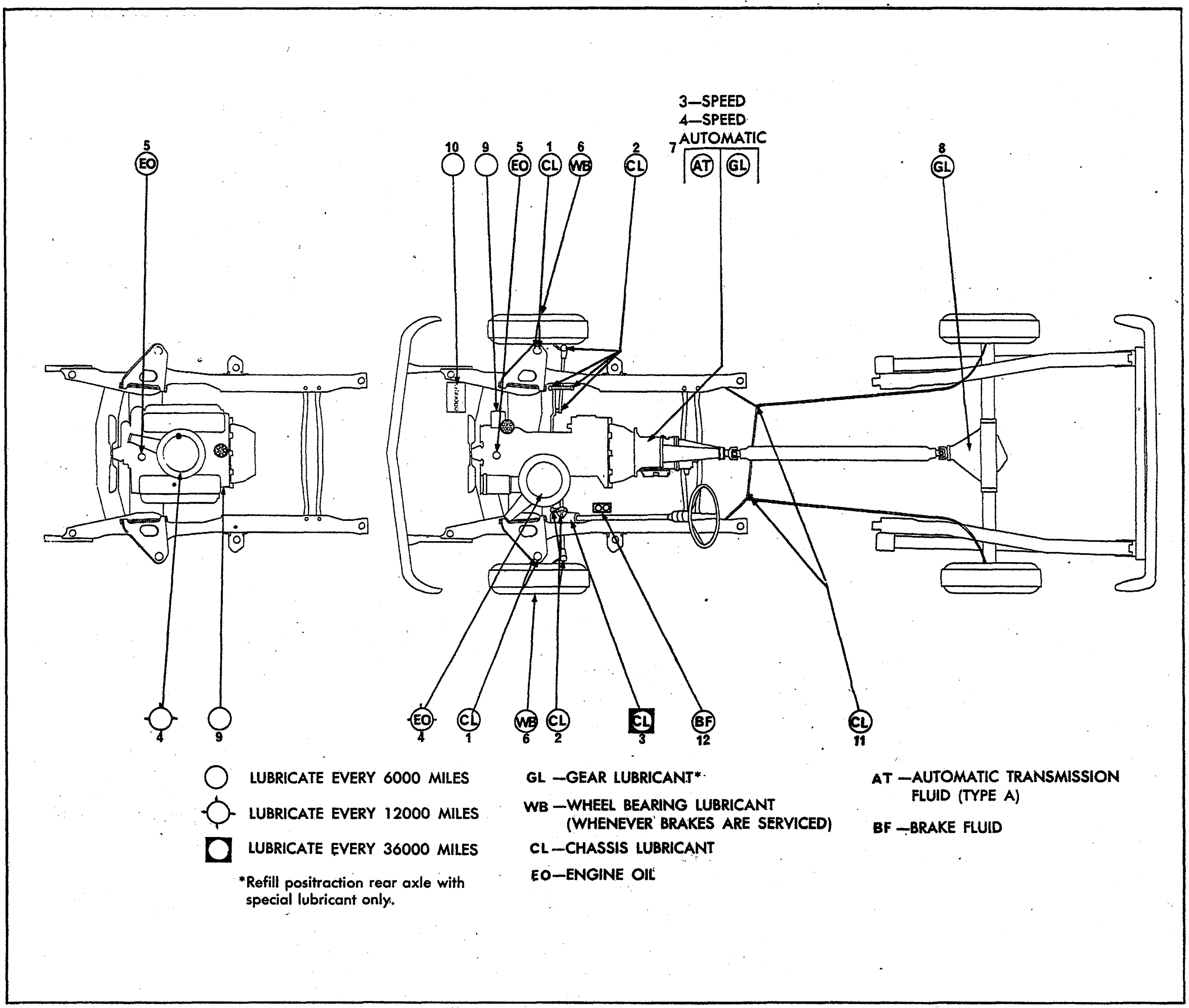
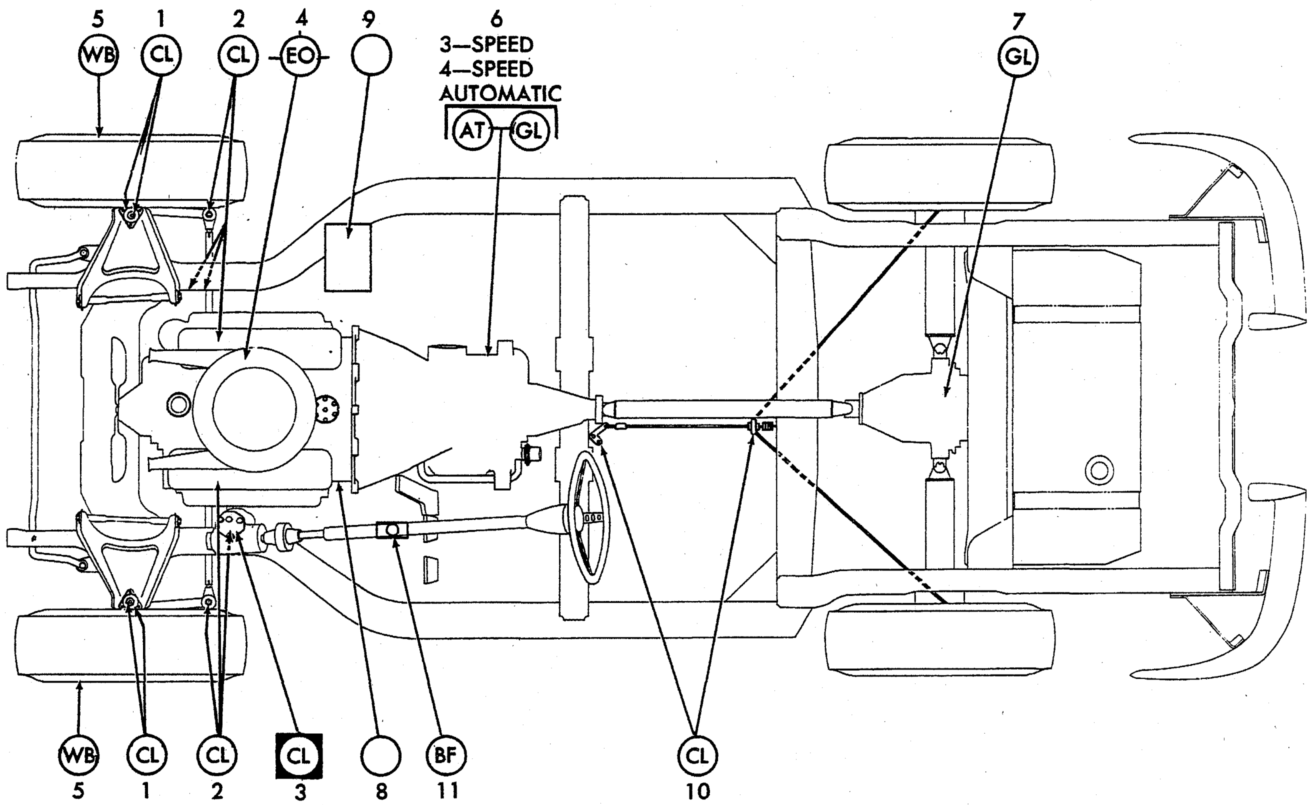


Fig. 35—Lubrication Diagram—Camaro

1. Front Suspension
2. Steering Linkage
3. Steering Gear
4. Air Cleaner
5. Crankcase Breathe 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. (Except Corvette)



○ 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 Lubrincant*

WB—Wheel Bearing Lubricant (Whenever Brakes are serviced)

CL —Chassis Lubricant

EO —Engine Oil

AT —Automatic Transmission Fluid (Type)

BF —Brake Fluid

Fig. 36—Lubrication Diagram—Corvette

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

BODY LUBRICATION POINTS (CORVETTE)

Lubricate the following items when possible.

Hood Latch Mechanism and Hinges --Apply light engine oil to pivot points. Don't oil lock pins or catch plates.

Rear Compartment Lid Release and Hinges --Apply light engine oil.

Side Door Hinge Pins--Apply light engine oil.

Door Lock Rotor and Striker Plate--Apply light engine oil or stainless stick lubricant.

Lock Cylinders--Lubricate with powdered graphite.

Window Regulators and Controls and Door Lock Remote Link --Apply light engine oil.

Gas Tank Filler Cap Hinge--Apply light engine oil.

Weatherstrips and Rubber Bumpers --Coat lightly with a rubber lubricant.

SECTION 1A
HEATER AND AIR CONDITIONING

CONTENTS OF THIS SECTION

HEATER

GENERAL DESCRIPTION

CHEVROLET, CHEVELLE, AND CAMARO

Components of the Chevrolet, Chevelle, and Camero 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 levers control all heater operations. The AIR-FAN lever is a combination control; moving the lever 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 lever operates the blower. The other levers 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 TEMPERATURE control lever, 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 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-FAN control lever, which is the air on-or-off control. This door will be open whenever the heater blower is in operation.

The defroster door, operated by the DEFROSTER lever, acts to divert the heated air flow up through the defroster ducts for de-fogging, defrosting or de-icing operations.

Figures 1 and 2 illustrate airflow through the heater.

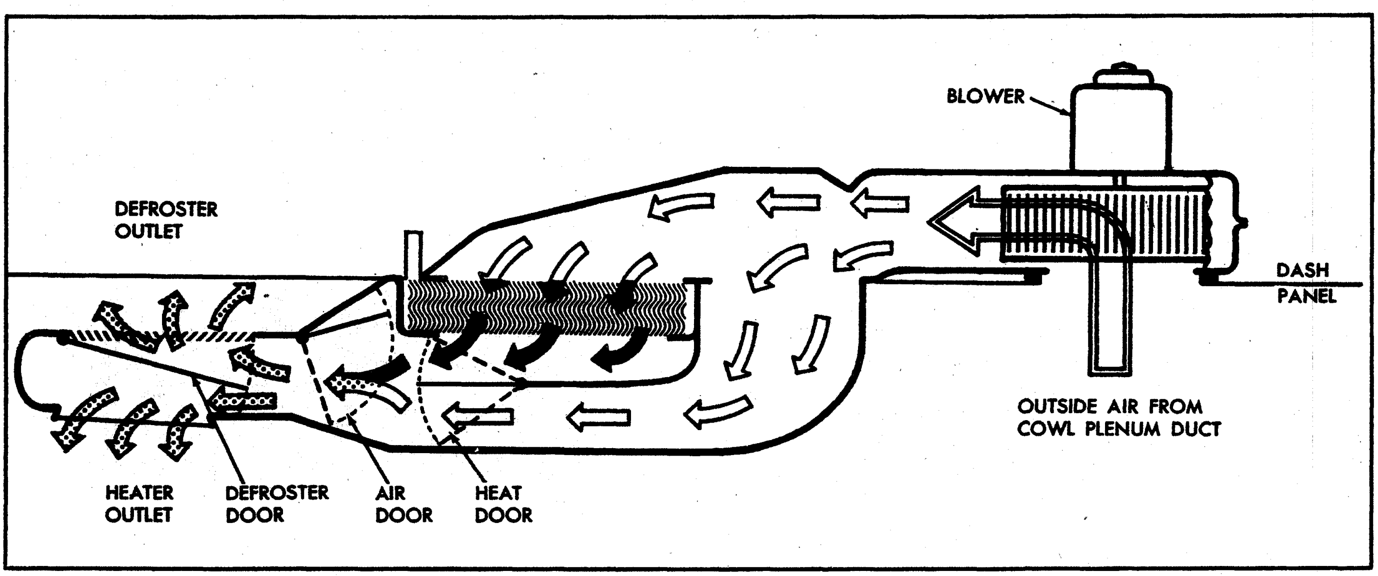


Fig. 1—Heater Air Flow (Chevrolet, Chevelle, Corvette, Camaro)

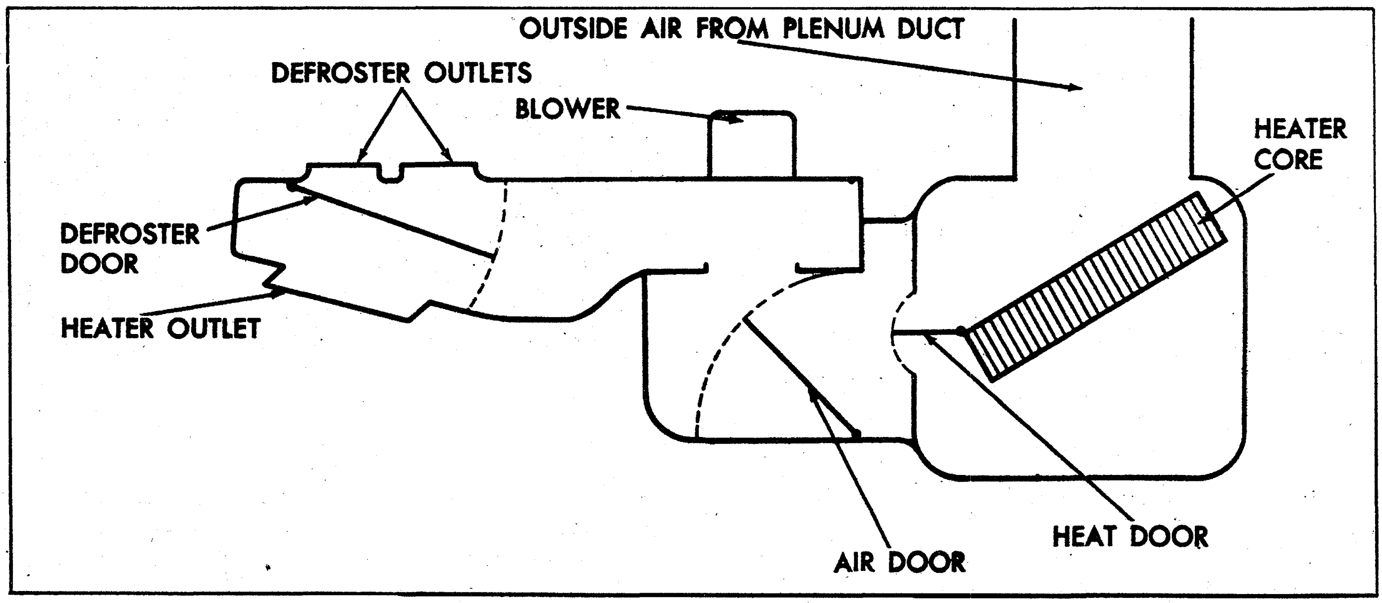


Fig. 2—Heater Schematic (Chevy II)

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 TEMPERATURE lever 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 DEFROSTER lever on the instrument panel. The AIR-FAN lever is the air OFF control as well as the blower control.

CONTROLS

Control Assembly (Chevrolet, Chevelle, Camaro, and Chevy II)

Air-Fan Lever

Since the heater makes use of outside air only, this lever serves as an "air on or off" control by actuating a damper in the distributor assembly downstream ("upstream" in the Chevy II heater) from the blower assembly. With the lever 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 Lever

Through its bowden cable, this lever controls the positioning of the temperature door in the distributor duct. This door allows airflow through either the heater core (full RIGHT) or the bypass duct around the heater core (full LEFT). Because the water temperature is constant, this knob acts as an air mixture control, controlling temperature by varying the proportions of heated and unheated 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 Lever

The defrost lever controls the position of the damper (or deflector) door located in the heater and defroster assembly. In the "off" position full airflow will go to the floor duct for car heating purposes. In the "de-ice" 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

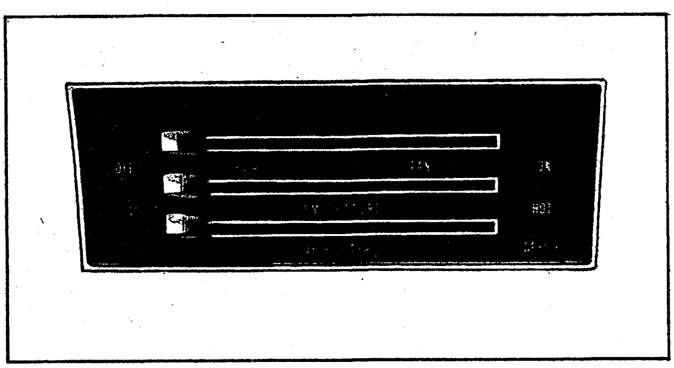


Fig. 3—Heater Control Panel (Chevrolet Shown as Typical)

linkage of this lever which will provide partial airflow only to the defroster duct and which should be used for all normal defogging operations.

CORVETTE

Heater components are attached to the dash panel on the right side of the vehicle with the air inlet assembly on the engine side and the heater and air distributor assemblies beneath the instrument panel within the passenger compartment.

The heater operates on outside air only with the blower receiving its air flow from the cowl vent plenum chamber.

No water valve is utilized in the system. Therefore, water flows through the heater core constantly while the engine is running, keeping the core at maximum temperature at all times.

Airflow through the system is shown in Figure 1.

Controls

Two knobs control all heater operations:

The FAN-TEMP knob is rotated to turn the blower on and off and control blower speed and is pulled out as desired to regulate heater temperature.

The AIR-DEF knob is the air on-and-off control as well as the defroster control.

Temperature Damper Door

At the heart of the heater operation is the temperature damper 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 damper door is placed in the duct so that, when closed, the path of the heated air leaving the heater core is blocked while the ambient air path remains open. Positive closing of this door when no heat is being called for is assured by a cam assembly at the door operating lever. As the FAN-TEMP knob is pulled out, the damper door is opened accordingly, allowing varying proportions of heated air to mix with the unheated airflow, thus providing heater outlet temperature control. With the knob pulled fully out the ambient air path is blocked and all airflow passes through the heater core. Final heater output temperature is dependent upon the proportion of heated and ambient air blended together according to the setting of the temperature damper door.

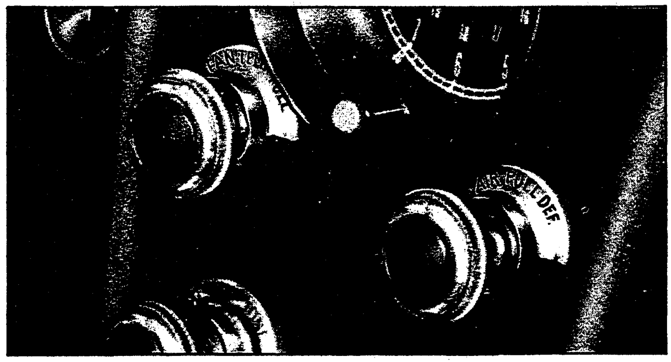


Fig. 4—Heater Controls (Corvette)

Air and Defrost Damper Doors

Beyond the temperature damper door are the air door and the defroster door, both operated through a single bowden cable by the AIR-DEF knob. The first half of the travel of this knob opens the AIR door allowing the airflow to pass into the interior of the car through the floor distributor openings. Pulling the AIR-DEF knob fully out causes the defroster door to open, diverting this airflow to the defroster ducts for defogging, defrosting or deicing operations.

NOTE: Since this knob is the air on-or-off control, it should be pulled at least halfway out before turning on the blower.

Fan Control

Rotate the FAN-TEMP knob to operate the three-speed blower, increasing the velocity of the air through the heater. The fully counter-clockwise position of the knob is the off position. Turn clockwise to the desired blower speed; fully clockwise for high blower speed.

COMPONENT REPLACEMENT AND REPAIR

CHEVROLET, CHEVELLE, AND CAMARO

Blower Assembly

Removal

1. Disconnect battery ground cable.
2. Unclip heater hoses from fender skirt.
3. (Chevrolet and Camaro) Remove right front fender and skirt assembly. (See Section 11 of the Service Shop Manual)

   (Chevelle) Move the vehicle front wheels to the extreme right turn position. Remove all right front fender retaining bolts. Allow the skirt to drop and rest on top of the tire. To gain maximum clearance for access to the blower motor attaching screws, 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. (See Figure 7.)
4. Disconnect the blower motor wire at the motor flange.
5. Remove the motor to case mounting screws and remove motor. Pry the flange gently if the sealer acts as an adhesive.
6. Remove the blower wheel retaining nut and separate blower and motor.

Installation

1. Assemble the blower wheel to the motor with the open end of the blower away from the motor.
2. Place the assembly into the case and replace the mounting screws. Connect the blower motor wire to the motor.
3. (Chevrolet and Camaro) Replace the fender and skirt assembly.

   (Chevelle) Replace the fender skirt.
4. Clip the heater hoses to the fender skirt and connect the battery ground cable.

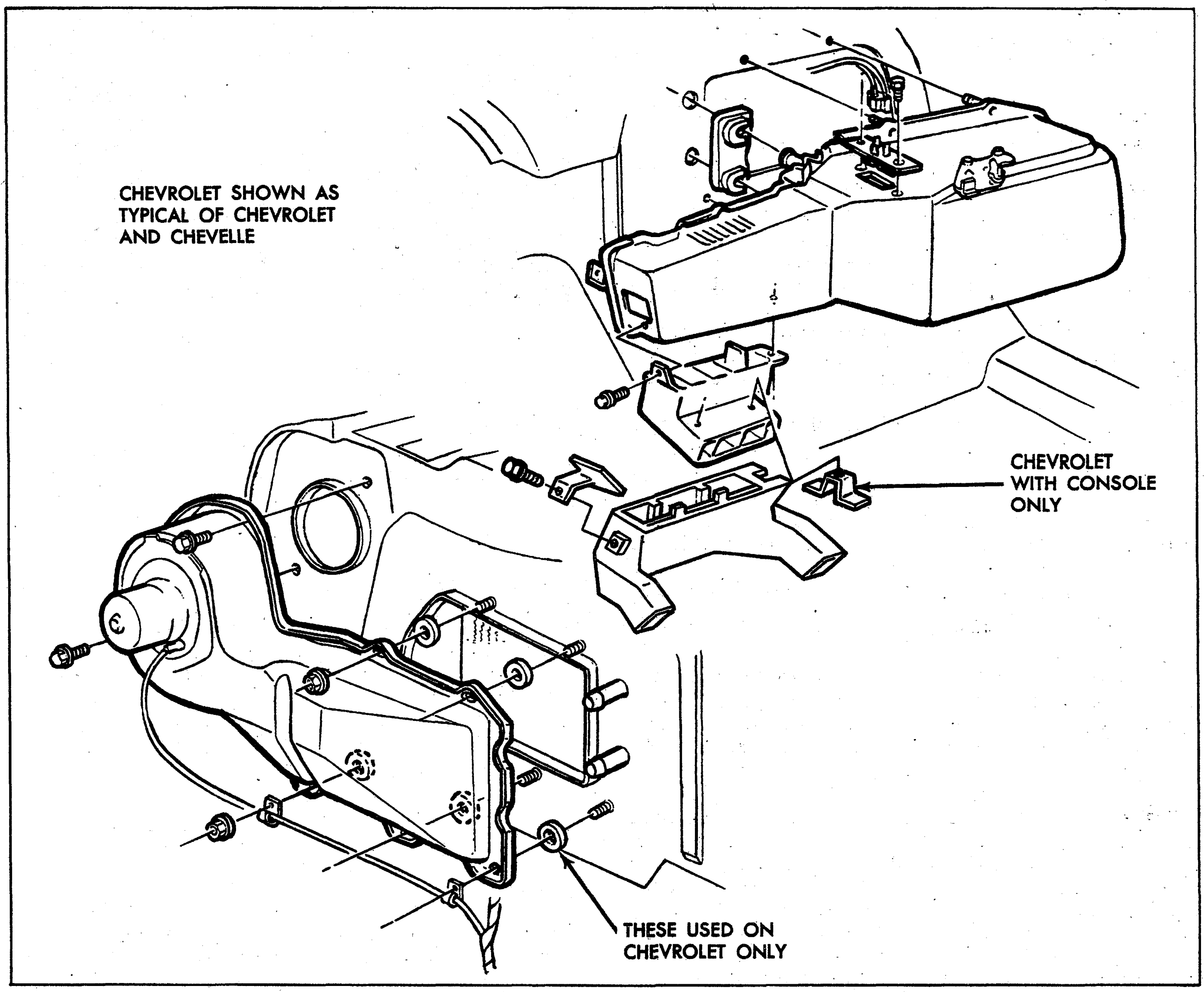


Fig. 5—Heater Blower and Air Inlet (Chevrolet, Chevelle, Camaro)

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. (See Figure 8)

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 nuts from the core case studs coming through from the inside of the car.
5. Inside the vehicle, remove the case to firewall mounting screws and 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 vehicle (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 case to firewall mounting screws and (on the engine side) the five stud nuts.
10. Replace the remaining bowden cables and electrical connectors.
11. Replace heater hoses, being careful to reinstall

them in their proper location. (See Figure 8)
12. Refill radiator.

Defroster Duct

Figure 9 illustrates the defroster duct installation on Chevrolet, Chevelle and Camaro vehicles.

Bowden Cables

Bowden cable attachment should be made in the following manner:

1. With the cables attached to the control assembly and levers, move the levers to their fully left or closed position.
2. Attach cable wires to the heater valve levers and tighten cable attaching bracket screws.
3. Check for proper cable operation and readjust as necessary.

Control Panel

Control panel installation is shown in Figures 10, 11, and 12.

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. Remove the glove box for access to the unit.

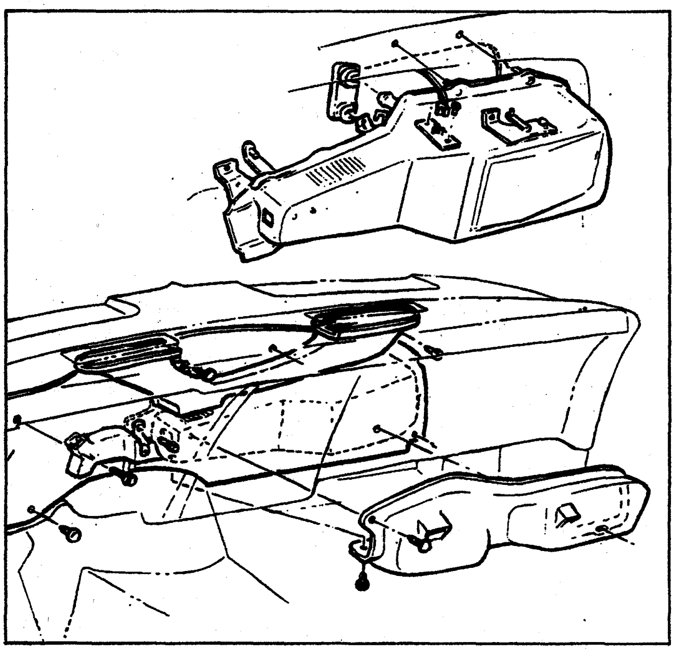


Fig. 6—Air Distributor Duct (Camaro)

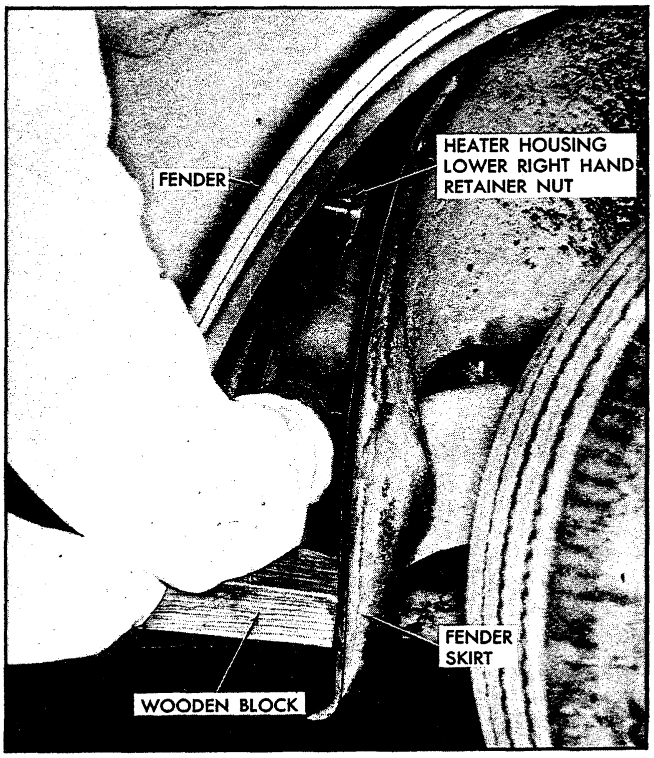


Fig. 7—Access to Blower and Housing (Chevelle)

CHEVY II

Heater Assembly

Removal (Fig. 13)

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.

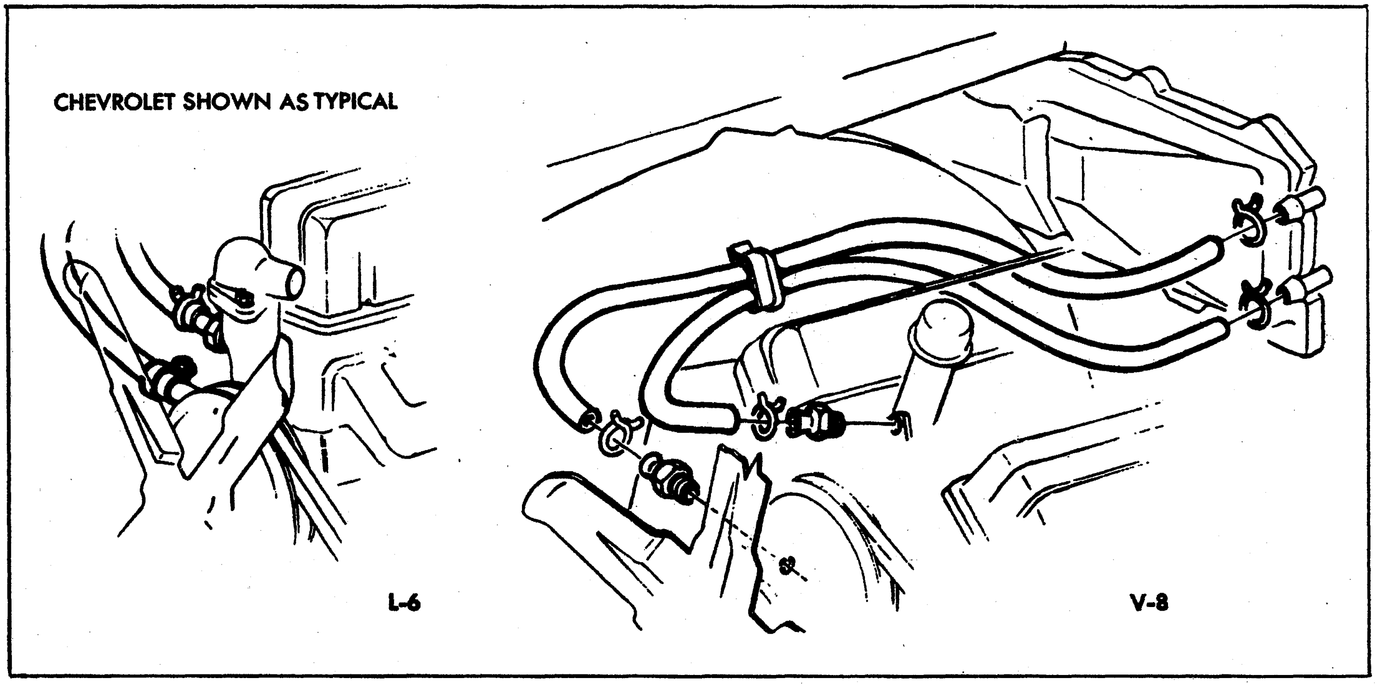


Fig. 8—Heater Hose Routing (Chevrolet Shown as Typical)

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.

Defroster Duct

Installation of the defroster duct as used in Chevy II vehicles is illustrated in Figure 14.

Blower Motor

Replacement

1. Remove the heater assembly from the firewall. 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 the screws at the dash lower edge which retain the control assembly and lower the assembly.
2. Disconnect the blower harness connector and remove the switch retaining screws and switch.
3. Install the replacement switch with the nylon bearing inserted into the AIR - FAN lever slot.
4. Connect the blower harness connector and remount the control assembly in the dash.

CORVETTE

Blower Assembly

Removal

1. Remove the radiator supply tank from its retaining straps and move it out of the way, then disconnect the battery positive cable.

   NOTE: It is not necessary to drain the radiator.

2. Remove the connectors from the blower motor.
3. Scribe or chalk a mark on the blower motor mounting plate and blower assembly.
4. Remove the five screws retaining the blower mounting plate to the blower inlet assembly.
5. Withdraw the blower assembly from the inlet assembly.

Disassembly

Remove the blower wheel from the motor by removing the nut and tapping the motor shaft with a soft hammer.

Installation

1. Assemble the blower to motor and using the scribe mark, properly position the blower assembly on the inlet assembly and install the five screws.
2. Replace the electrical connectors on the blower motor.
3. Replace the radiator supply tank and the battery positive cable.

Blower and Air Inlet Assembly

Removal

1. Drain the radiator.
2. Remove the radiator supply tank from its retaining straps and swing it out of the way.
3. Remove the battery.

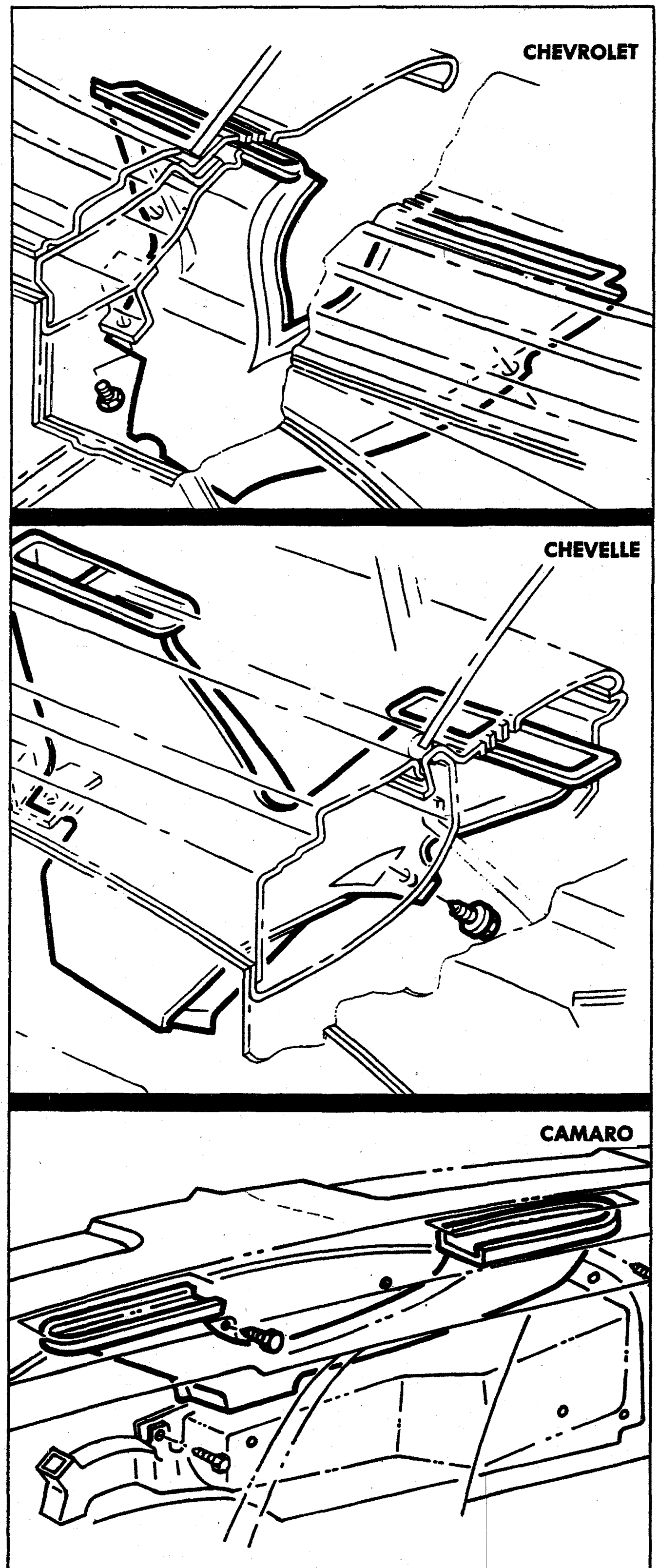


Fig. 9—Defroster Duct (Chevrolet, Chevelle, Camaro)

4. Disconnect the blower motor electrical connectors.
5. Remove the water hoses from the heater core inlet and outlet connections.

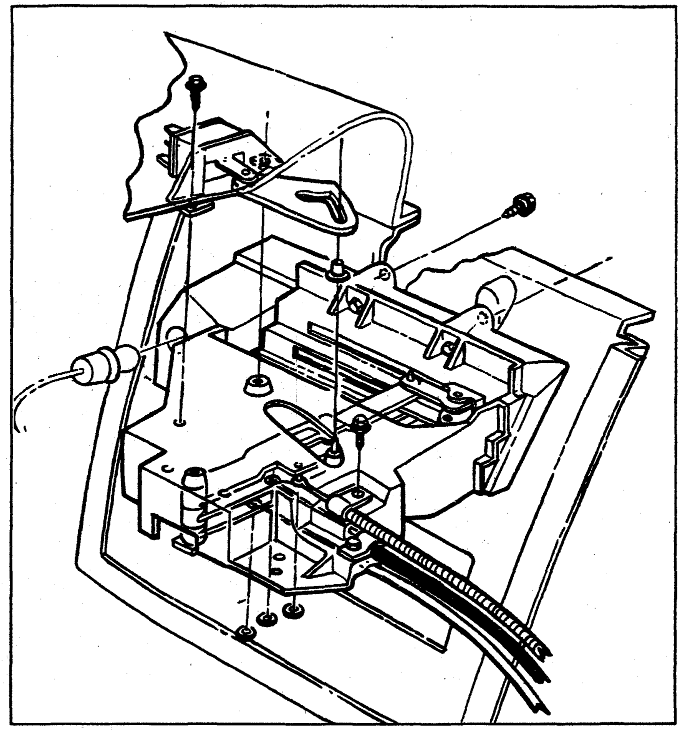


Fig. 10—Control Assembly (Chevrolet)

6. Remove the seven stud nuts attaching the blower and air inlet assembly to the dash panel.
7. Remove the blower and air inlet assembly from beneath the fender.
8. The blower assembly may be removed and disassembled as described under "Blower Assembly" above.

Installation

1. With the blower and air inlet assembly in place, install the seven attaching stud nuts.
2. Replace the blower motor electrical connectors.

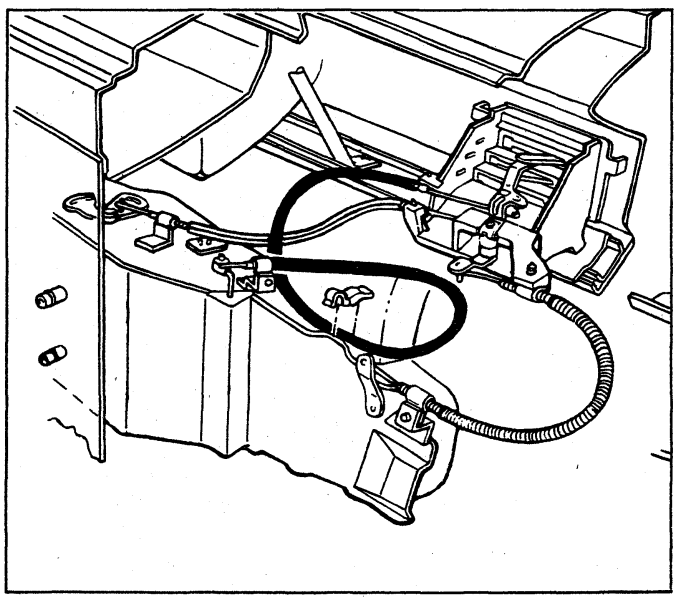


Fig. 11—Control Assembly (Chevelle)

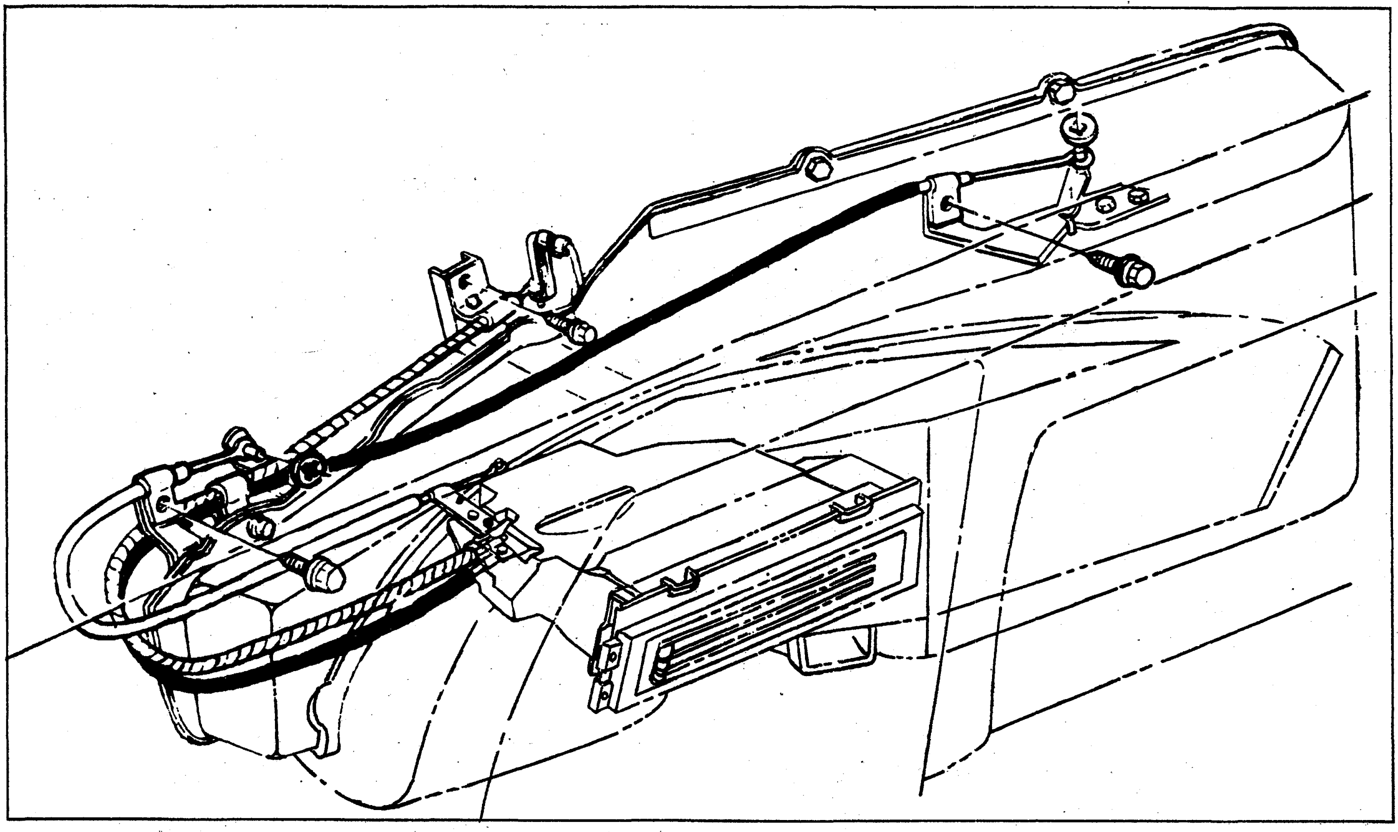


Fig. 12—Control Assembly (Camaro)

3. Replace the battery and radiator supply tank.
4. Replace each heater hose to its proper core connection.
5. Refill the radiator.

Defroster Duct

Figure 19 illustrates the installation of the Corvette defroster duct.

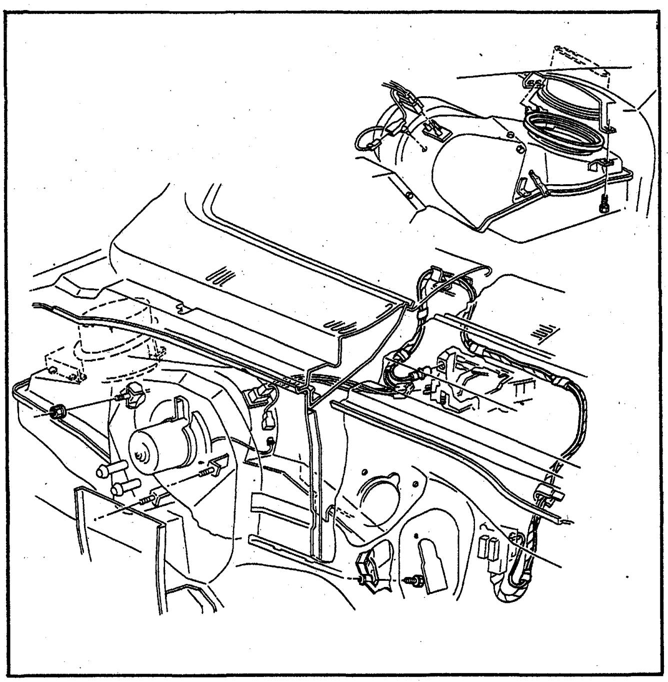


Fig. 13—Chevy II Heater Components Removal

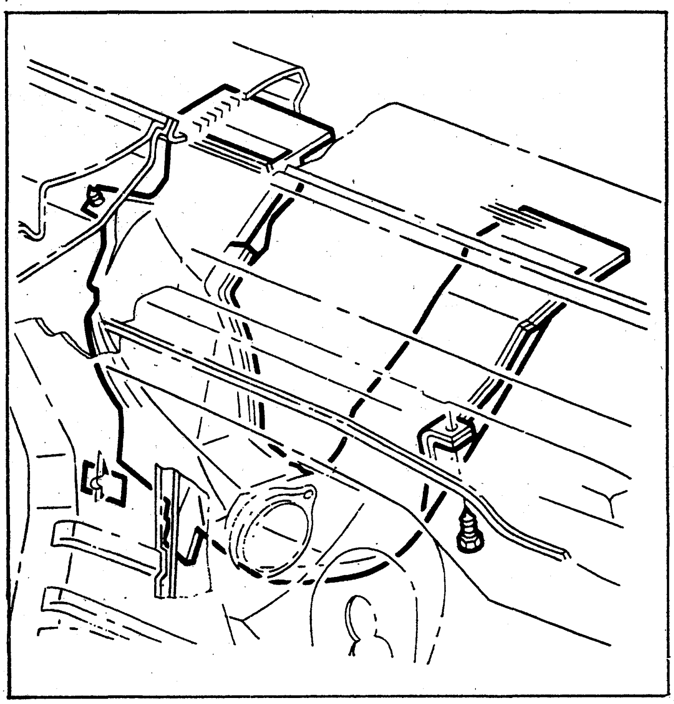


Fig. 14—Defroster Duct (Chevy II)

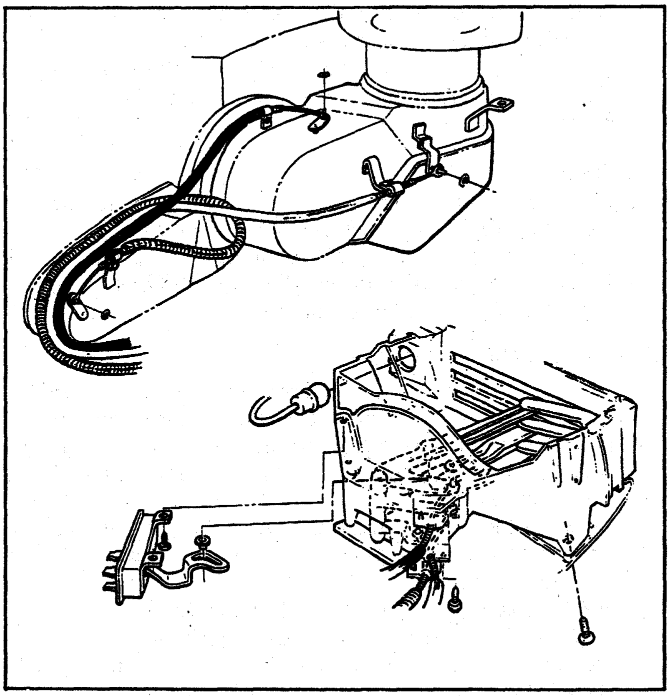


Fig. 15—Heater Control Assembly and Cables (Chevy II)

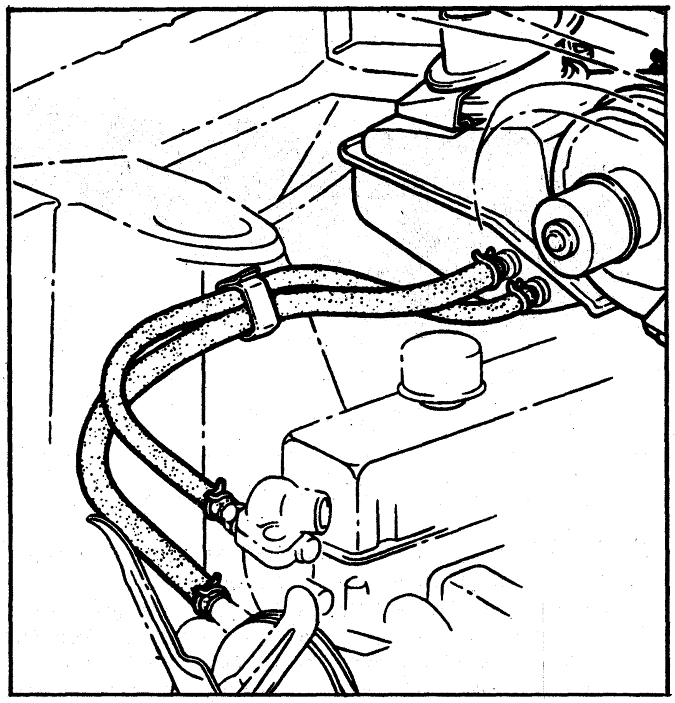


Fig. 16—Heater Hose Routing (Chevy II)

Resistor Removal

Two screws attach the resistor to the rear side of the heater assembly.

Heater Assembly

Removal

1. Drain the radiator.
2. Remove the radiator supply tank from its support straps and move it out of the way.
3. Remove the battery.
4. Remove the water supply hoses from the core connections.
5. Remove the blower and air inlet assembly as described above.
6. Remove the glove compartment and the panel on either side of the instrument panel console as outlined in the Body Section of this manual.

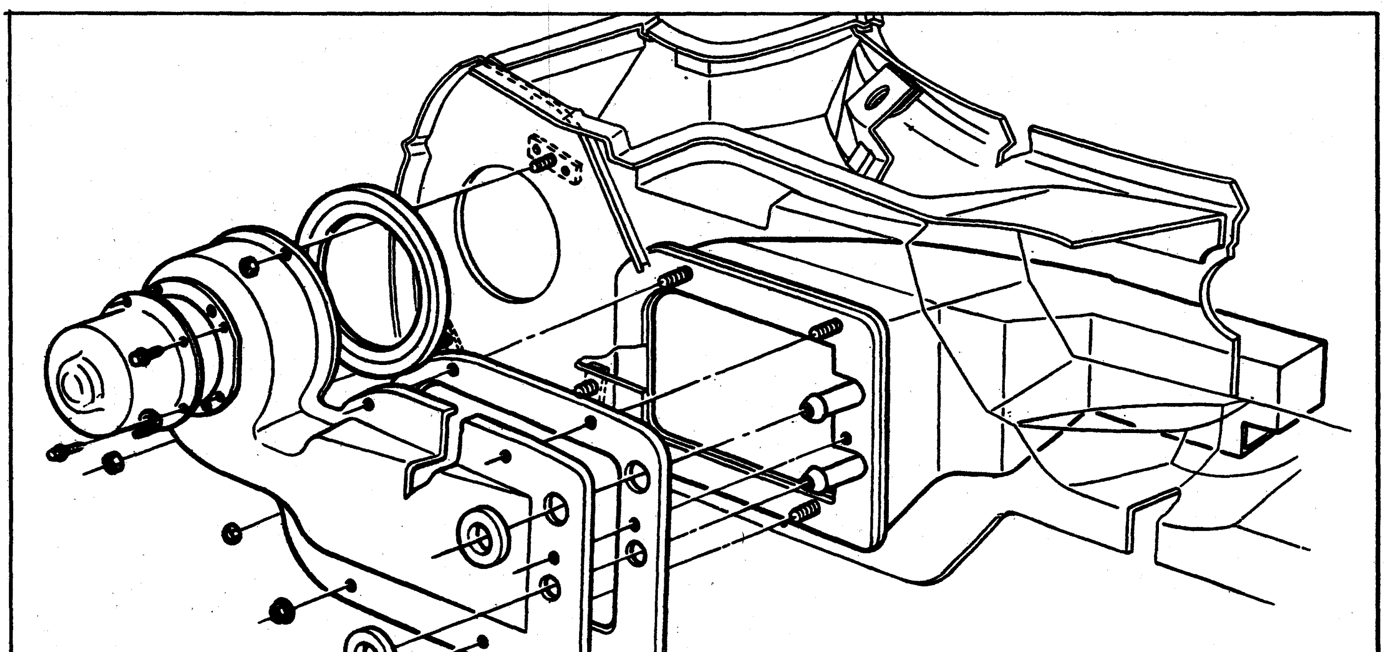


Fig. 17—Corvette Heater and Blower Inlet Assembly

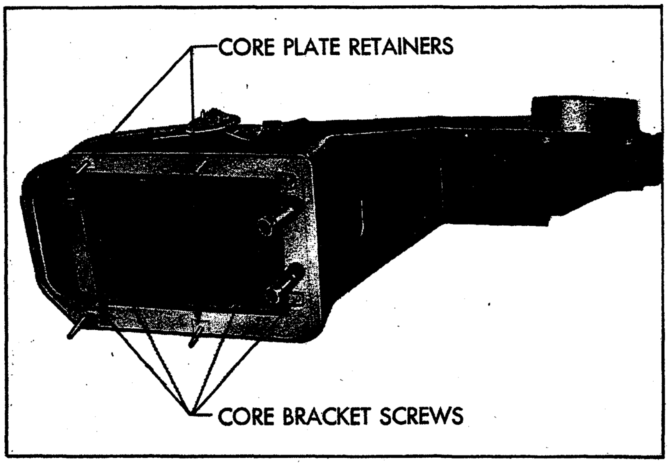


Fig. 18—Corvette Heater Core Removal

7. Place a protective covering (waterproof if possible) over the carpeting under the heater.
8. Remove the two bowden cables from the instrument panel and disconnect the wiring connectors from the blower switch and from the resistor.
9. Carefully work the heater assembly out from beneath the dash.

Core Removal

1. Remove the heater assembly as described above.
2. Remove the sheet metal nuts which retain the core mounting plate to the core housing.
3. Remove the screws attaching the core brackets to the core mounting plate and separate the core and plate.

Installation

1. Assemble the core to plate with non-hardening sealer. Attach the core mounting screws.
2. Attach the core and plate assembly to the case with the two sheet metal nuts. The assembly is ready for installation as described below.

Heater Assembly Installation

1. Carefully position the heater assembly in place on inner surface of dash panel, then install the blower and air inlet assembly on heater studs extending through to the engine side of the panel. Attach the seven stud nuts.
2. Install electrical connectors to the blower switch and resistor and reinstall the bowden cables to the instrument panel.
3. Replace the blower electrical connectors.
4. Replace the heater hoses. (See Figure 20)
5. Replace the battery and the radiator supply tank.
6. Refill the radiator and check for leakage.
7. Check heater operation and make control adjustments as necessary.
8. Replace the console panels and the glove compartment.

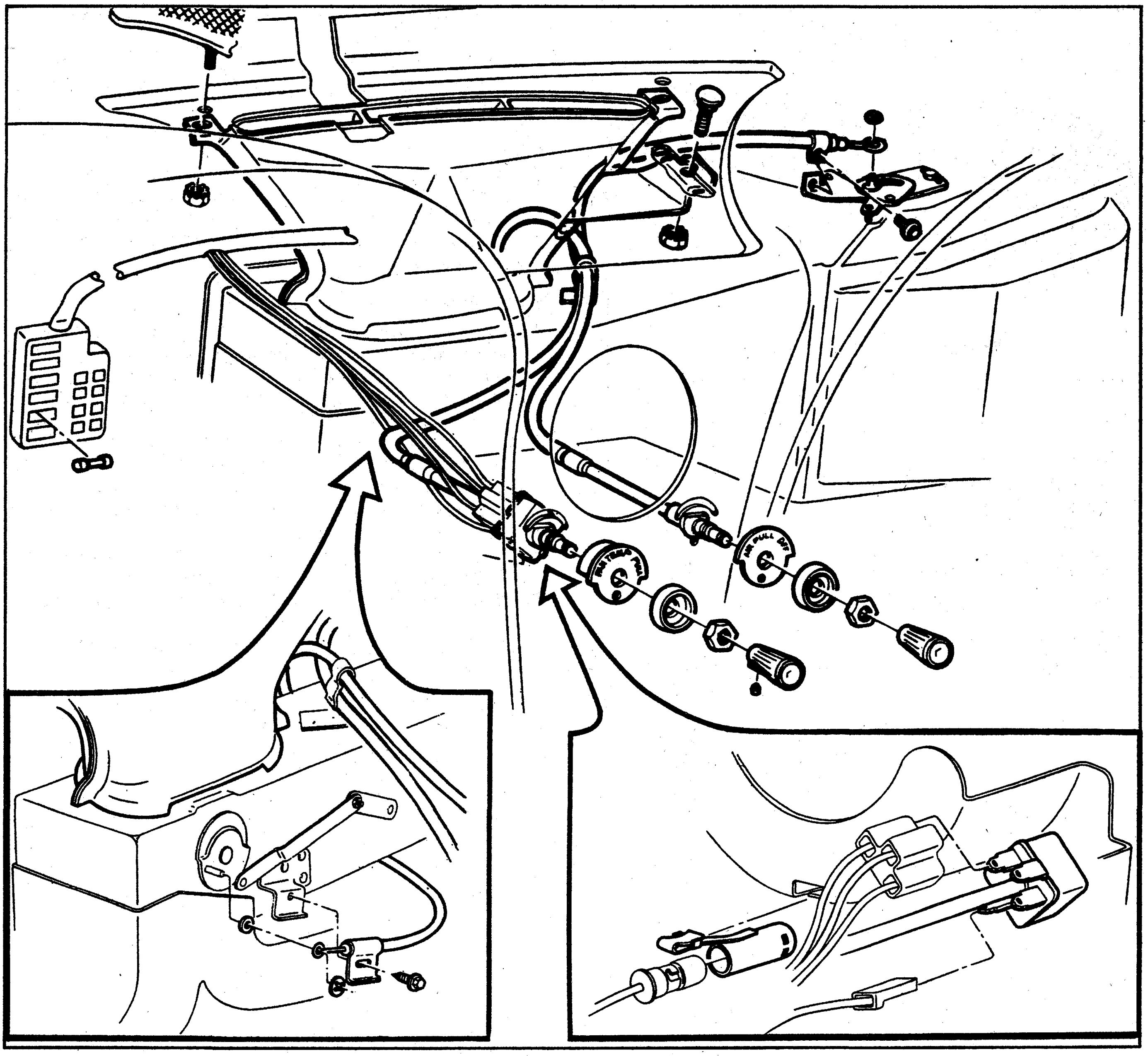


Fig. 19—Heater and Defroster Cables (Corvette)

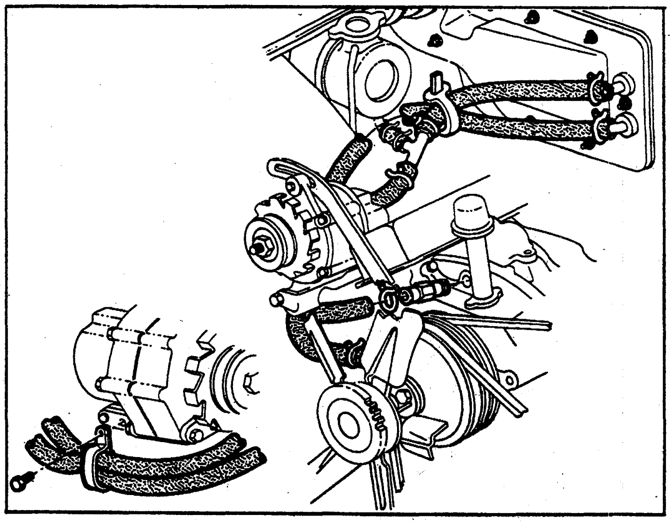


Fig. 20—Heater Hoses—Corvette

AIR CONDITIONING

INDEX

GENERAL DESCRIPTION

Four air conditioning systems are covered in this section. They are:

1. The Four-Season System (Chevrolet, Chevelle, Camaro and Corvette).
2. The Comfortron System (Chevrolet).
3. The All Weather System (Chevy II).
4. The Universal System (Chevrolet, Chevelle, Chevy II, Camaro)

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 used in the Chevrolet, Chevelle, Camaro, and Corvette vehicles may be identified by the fact that it uses an evaporator pressure control known as the POA (Pressure Operated Absolute) suction throttling valve.

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 control valve acts in the system only to control the evaporator pressure so that minimum possible temperature is achieved without core freeze-up. The valve is preset, has no manual control, is automatically altitude compensated, and non-repairable.

The heater core will be hot at all times since no water valve is present in the system.

System operation is as follows (See Figure 24 and 25): Air, either outside air or recirculated air 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 heater core

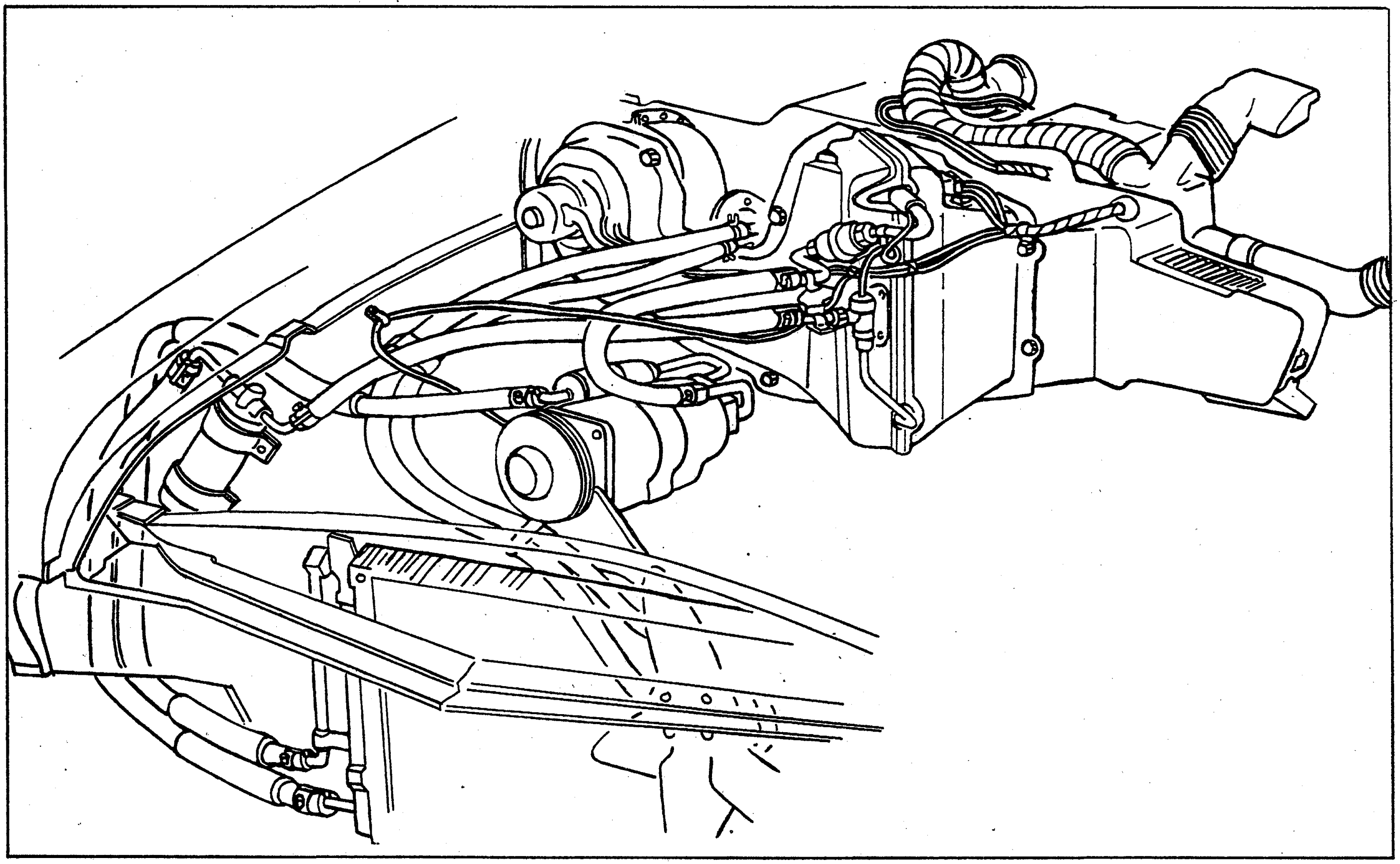


Fig. 21—Four-Season System Components (Chevrolet)

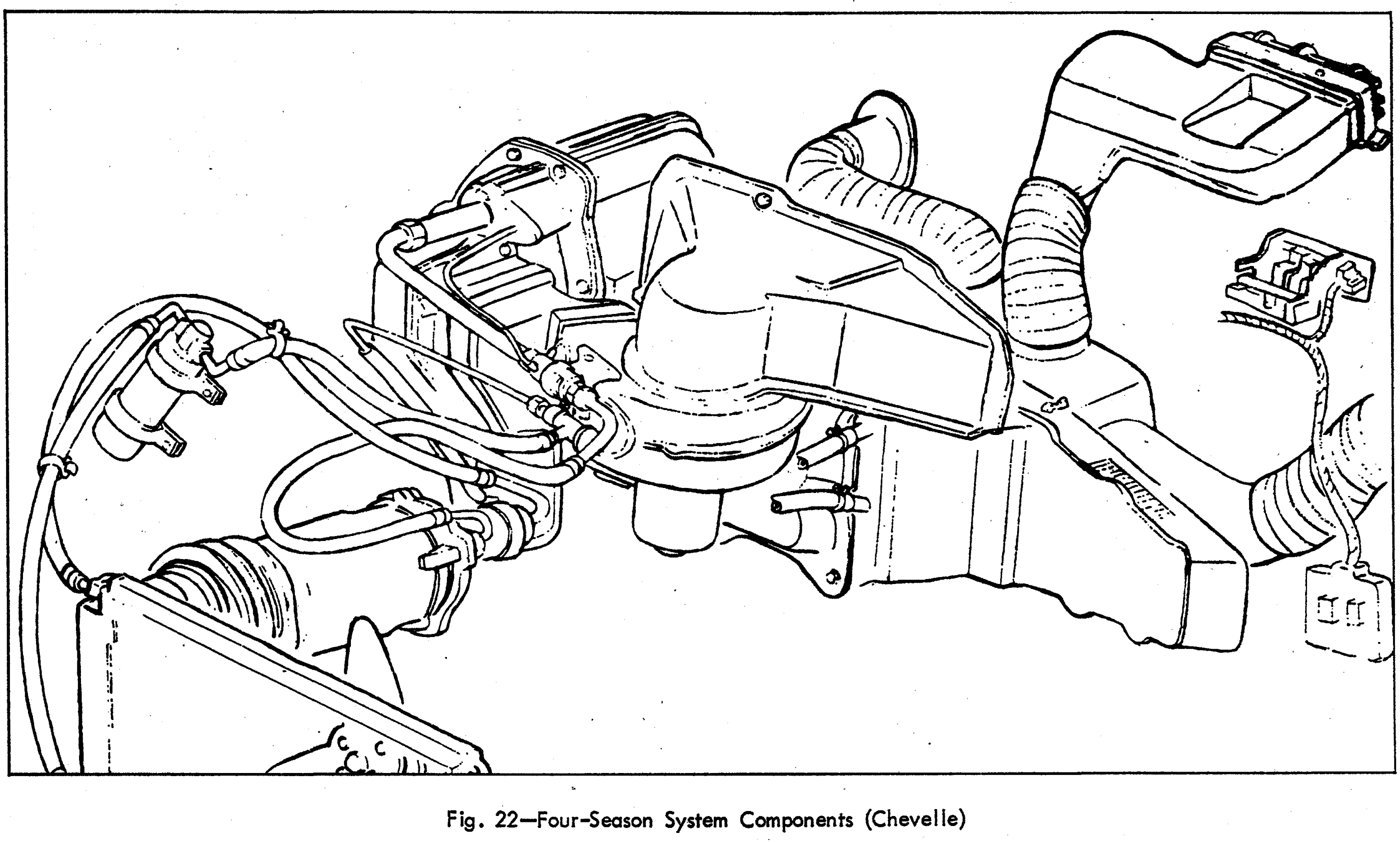


Fig. 22—Four-Season System Components (Chevelle)

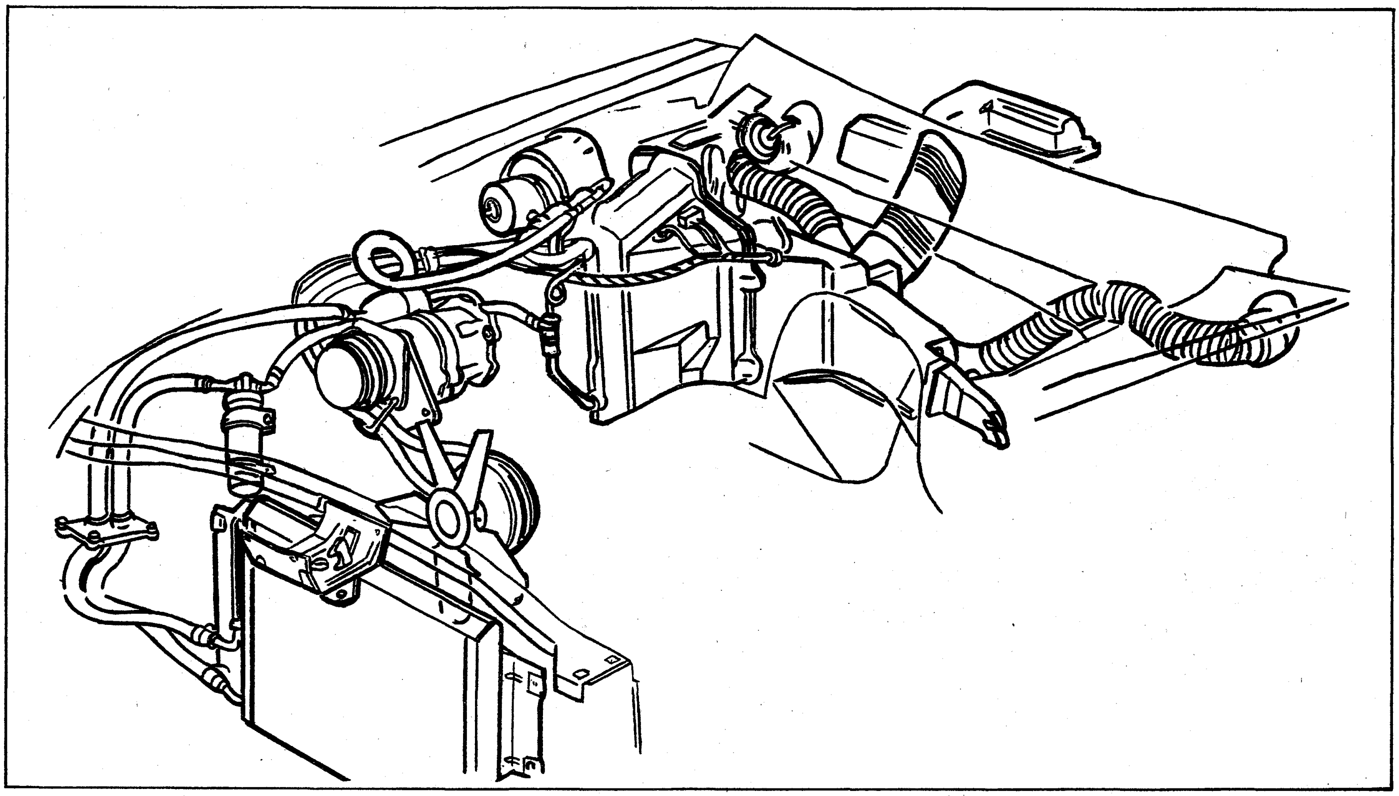


Fig. 23—Four-Season System Components (Camaro)

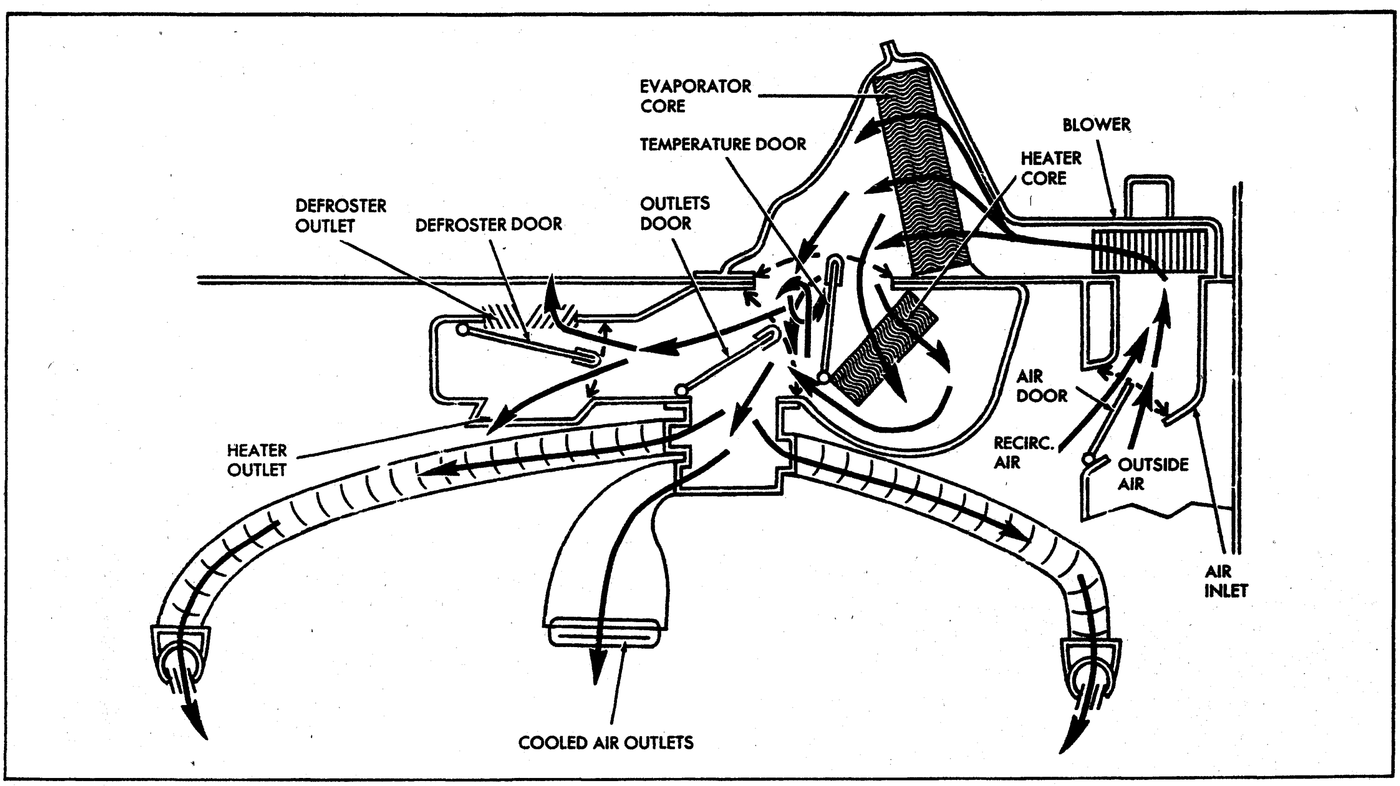


Fig. 24—Airflow—Four-Season (Chevrolet, Camaro) Comfortron (Chevrolet)

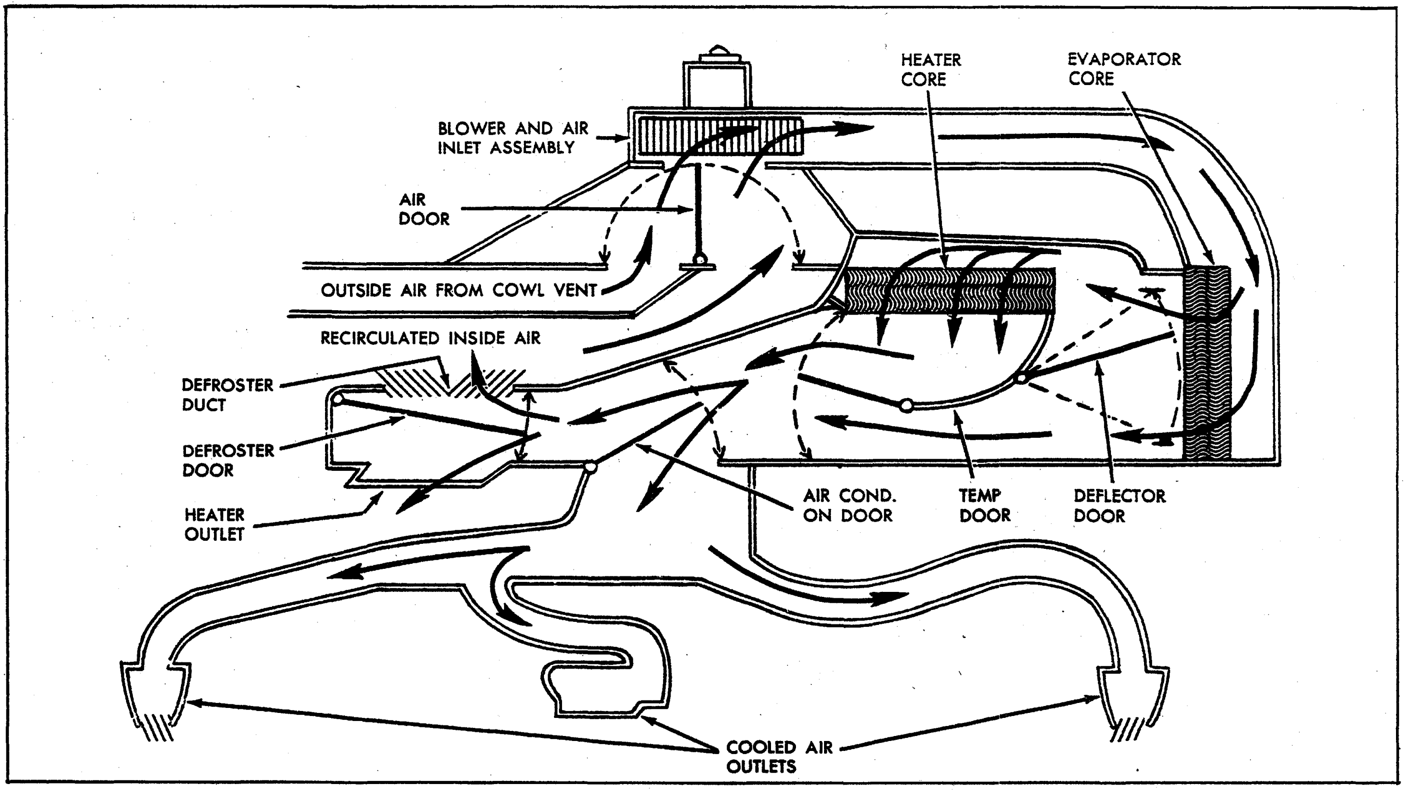


Fig. 25—Airflow—Four-Season (Chevelle)

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. 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 up or down or, if desired, shut it off.

Controls

Four-Season System (Chevrolet, Camaro)

Full control of the Four-Season System is obtained through the use of a single control panel (fig. 26). The control knobs make use of bowden cables to activate the 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.

Temperature Lever

The TEMPERATURE lever controls temperature door position, compressor operation, and air selector door position. When the lever is in the OFF position, the system is totally inoperative; airflow is shut off, the fan switch will not operate the blower, and the compressor is off. In the VENT position, the air selector door is in the "outside air" position and the blower is powered at low speed. At any lever position other than OFF, the blower will be powered at low, however, blower speed may be increased by moving the FAN switch. When the

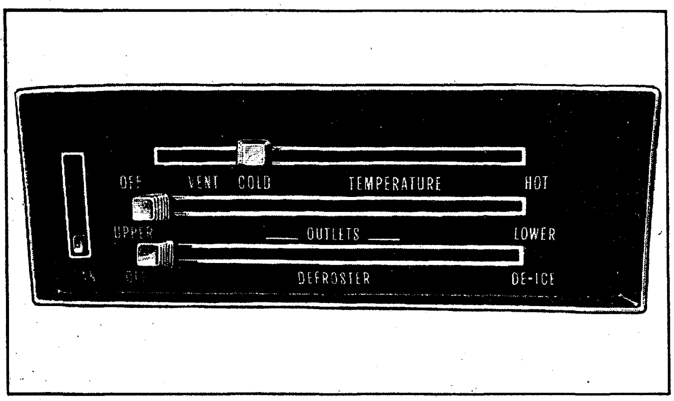


Fig. 26—Chevrolet Four-Season Controls

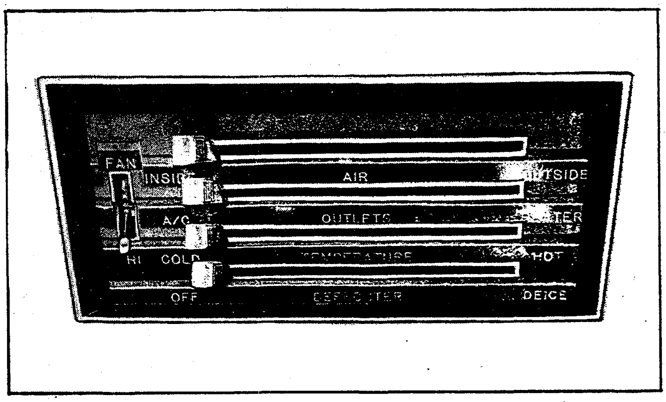


Fig. 27—Chevelle Four-Season Controls

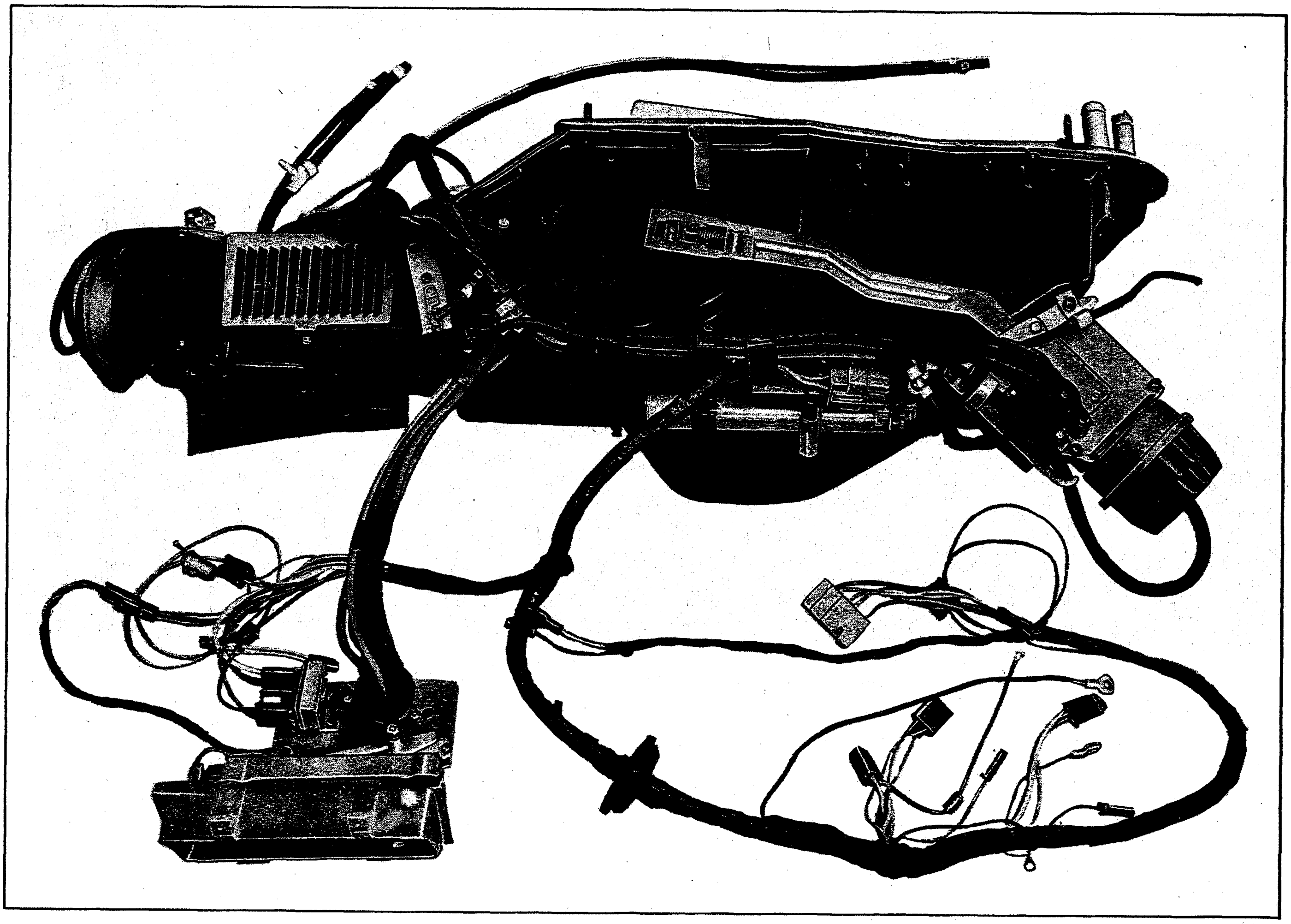


Fig. 28—Comfortron Underdash Components

lever is above and slightly left of the COLD position, the compressor is on, the air selector door is in the recirculation position, the temperature door is in the fully cold position, and the blower is operating. Moving the lever slightly to the right of COLD moves the air selector door to the full outside air position while temperature door, compressor, and blower functions remain the same as in the "recirculating - COLD" system operation.

Moving the TEMPERATURE lever further to the right moves the temperature door which channels some air through the heater core. At a point about midway between COLD and HOT, the compressor clutch switch opens and the system is operating as a heater only with untreated outside air (passing through the inoperative evaporator core) mixing with heated outside air. With the lever in the HOT position, all air (outside air) passes through the heater core for full heat output.

Outlets and Defroster Levers

While the TEMPERATURE lever is in any operating position, the OUTLETS and DEFROSTER levers may be operated as desired. The OUTLETS lever directs the air to either the heater outlet, both heater and dash outlets, or to the dash outlets only. The DEFROSTER lever directs air (which is flowing to the heater outlet) up to the defroster outlets. With the DEFROSTER lever, in the OFF position, a fixed bleed permits a small quantity of air to flow to the defroster outlets while the major volume of air flows from the heater floor distributor. In the DEFROST position, airflow is split between the heater and defroster outlets. In the DE ICE position, all air is diverted to the defroster outlets. Since the air must be in the heater duct in order to be directed by the defroster door, the OUTLETS lever must be in LOWER position which causes air to flow out the lower outlets. if the OUTLETS lever is in the UPPER position, defroster door movement will have no effect on the system.

Fan Switch

The fan switch controls the operation of the three speed blower motor except when the TEMPERATURE lever is in the OFF position.

Four-Season System (Chevelle)

Full control of the Chevelle Four-Season is obtained through the use of a single control panel (fig. 27) much the same as that previously described for the Chevrolet Four Season System. The Chevelle control differs in operation only in that AIR and TEMPERATURE are separate controls rather than a combination control as in the Chevrolet control panel. Except for this difference, operation of the levers is similar to the Chevrolet controls.

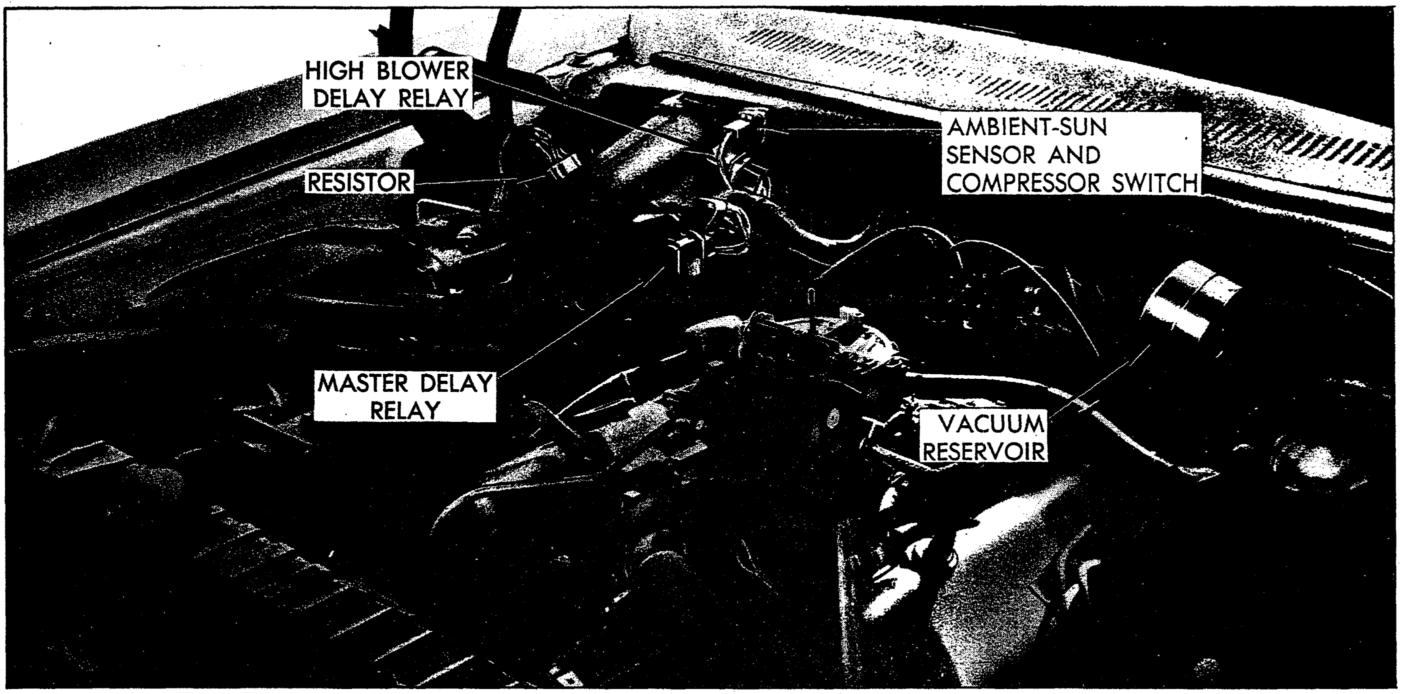


Fig. 29—Comfortron Engine Compartment Components

COMFORTRON SYSTEM

The Chevrolet Comfortron Air Conditioning System is basically the same as the Chevrolet Four-Season system but with the additional feature of completely automatic control. See Figures 28, 29 and 30 for views of the Comfortron system. To the customer, the most noticeable difference between the two systems, will be in the control panel. In place of the three-lever/one-switch panel of the Four-Season system, the Comfortron has a single control lever plus a temperature dial similar to that found in a home thermostat. After the dial is set to the desired temperature indication and the lever is moved to place the system in operation, the Comfortron will automatically control the heating and air conditioning functions to maintain the selected interior temperature regardless of changes in outside air temperatures.

Most Comfortron parts are located in the passenger compartment. (fig. 28)

In-Car Sensor

The function of the in-car sensor is to determine the temperature of the interior of the automobile. It is located beneath the overhang of the instrument panel.

Feedback Potentiometer

The feedback potentiometer indicates to the amplifier system the position of the temperature door.

Control Head

A thumb wheel is provided to select the desired in-car temperature. A control lever performs the following functions:

1. Operates a switch that allows the customer to select the type of blower program desired.
2. Operates the control head vacuum switch except when the TEMPERATURE lever is in the OFF position, thus programming the vacuum system.
3. Operates the defroster through the control head vacuum switch. The defroster door is partially opened in the "DE FOG" position, and fully open in the "DE ICE" position.

A two transistor amplifier is located on the bottom side of the control head. It receives information from the sensors, and in turn operates the transducer.

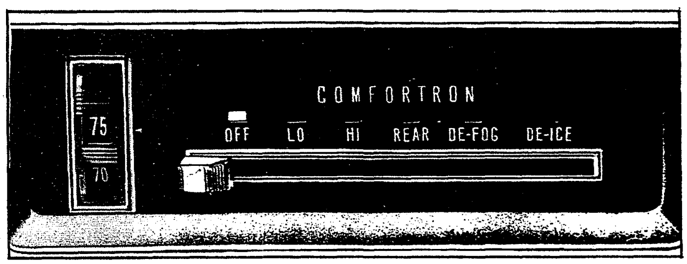


Fig. 30—Comfortron Control

Transducer

The transducer will produce a vacuum output that is completely adjustable by varying the input voltage which is provided by the amplifier. An increase in the applied voltage results in a reduced vacuum output.

Power Servo

The power servo receives a vacuum signal from the transducer, and it is capable of assuming any position that is called for by the sensors, amplifier, and transducer. The power servo performs the following functions:

1. Positions the temperature mix door via the temperature door link. The position of this door determines the portions of hot and cold air being blended and discharged into the car.
2. Operates the power servo vacuum valve which determines the air flow paths for heating and air conditioning.
3. Contains a printed circuit board which controls the blower speed. The power servo position determines the blower speed, but the control lever switch can override the blower program depending upon the customer's preference.
4. Contains the "Hi" blower delay thermistor and the "master delay thermistor".

Outside Air Diaphragm

When there is no vacuum applied to the hose, the outside air door is closed under spring tension. With the door closed, air is taken from the inside of the automobile and re-circulated. Applying vacuum to the diaphragm opens the door for outside air.

Mode Door Diaphragm

Located behind the duct work, the mode door diaphragm directs the air flow out either the air conditioning outlets, the heater floor outlet, or both the heater and air conditioning outlets. This is a push-pull type diaphragm actuated by vacuum through two hoses and controlled by the power servo vacuum switch.

Defroster Door

The defroster door is in the defog position until vacuum is applied to the actuator to obtain either full heat or full de-ice position.

High Blower Delay Thermistor

The high blower delay thermistor is located on the power servo housing under the power servo vacuum valve and printed circuit board assemblies. The function of the thermistor is to operate the blower at a reduced speed when the control is in the HI FRONT position until the residual cold air is discharged from the duct work. This function occurs when the blower first comes "on" in cold weather.

Vacuum Tank

During heavy acceleration, the vacuum supply from the carburetor drops. The vacuum tank, using a check valve, stores vacuum so that under these conditions vacuum will be available for the Comfortron.

Thermal Vacuum Valve (Hot Water Vacuum Switch)

When engine coolant temperature reaches 75°F, the valve opens and supplies vacuum to the outside air door if the system is calling for outside air.

Master Delay Thermister

This thermistor delays the initial operation of the blower when the system is in the heat mode. In cold weather this allows outside ram air to flow through the system thereby purging the cold air in the ducts gradually until the coolant reaches about 105°F. Then, the termistor passes enough current to energize the master delay relay which powers the blower at about nine volts.

Vacuum Relay Valve

This relay valve will shut off transducer vacuum to the power servo whenever the vacuum from the engine intake manifold falls below the vacuum in the power servo supply line (engine stopped or operating at low manifold vacuum). This causes the power servo to be held in position when the vacuum supply falls too low to maintain servo control.

Vacuum Bleeder

A vacuum bleeder insures that the outside air door will close (diaphragm will bleed down) after the system has been shut down. This prevents outside air from entering when starting the system on a cold day before the engine coolant temperature reaches 75°F.

Sun—Ambient Sensor

The sun-ambient sensor measures the temperature of the air entering the air intake grille in front of the windshield. The sensor is exposed to sun light so that it can lower the in-car temperature slightly when the sun is shining.

Ambient Switch

The ambient switch operates the air conditioning compressor clutch. When the outside temperature is above 40° F. the switch will be closed and the compressor will be running. This switch is included as part of the sun-ambient sensor assembly, but operates independently.

Resistor Assembly

The blower resistors are located in the evaporator housing. The printed circuit board switch in the power servo determines which of the resistors is being used, and as in conventional systems, the resistors control the blower speed.

System Operation

When starting the Comfortron System in cold weather, the following sequence of events occurs:

1. Initially the system is inoperative. In LO FRONT position the master delay thermistor is warming (self-heating because current is flowing through it)

and its resistance is decreasing. In the HI FRONT position, two thermistors (the master delay and high blower delay thermistors) are warming. The air door is in recirculation position until the engine coolant reaches 75 degrees.

2. The coolant reaches then 75 degrees and the thermal vacuum valve opens applying vacuum to the air door to admit outside air (unless the temperature dial is set for cooling). Ram air will flow through the system when the car is moving.
3. Next, the master delay thermistor attains the temperature at which it will pass sufficient current to close the circuit through the master delay relay. The relay circuit powers the blower motor at 9 volts.
4. If the control is in the HI FRONT position, the high blower delay thermistor will close the circuit through the high blower relay which supplies full available voltage to the blower motor. This function occurs after the master delay thermistor has taken effect because the high blower delay thermistor uses the master delay type thermistor with a 10 ohm 1/4 watt resistor connected in series. The high blower delay thermistor must then warm to a higher temperature than the master delay thermistor before its resistance (plus that of the 10 ohm resistor) drops enough to actuate the high blower relay.
5. If the controls are set for DE ICE, full outside air and full voltage to the blower motor are effective immediately regardless of temperatures or elapsed times.

In accomplishing automatic control, the system follows three steps to transform an electronic signal into mechanical energy through which the control is achieved.

Electronic Circuit

Two temperature sensors (Thermistors), and the duct potentiometer connected in series, are located so as to sense the temperature of the outside air, inside air and system output air. The resistance of each sensor will vary according to its temperature. The control head temperature dial varies in resistance as it is adjusted by the operator to suit his comfort requirements. The resistance of the temperature dial control is applied directly to the amplifier and is not in series with the sensors and duct potentiometer. Thus temperature differences in the sensor string plus the requirements fed into the system by the operator cause changes in total circuit resistance which allow a varying voltage flow through the circuit.

Changing the Electronic Signal to Electrical Voltage

This minute voltage flow from the sensor string - temperature dial circuit - is fed into the amplifier where it is transformed into a usable amplifier output voltage, the strength of which is determined by the strength of the original amplifier input signal. This voltage is then supplied to the transducer.

Changing the Electrical Voltage to a Vacuum Signal

Amplifier output voltage, varying according to temperature requirements, is converted by the Transducer into a modulator transducer output vacuum. This modulated vacuum is applied to the Power Servo.

Changing the Vacuum Signal to Mechanical Energy

The Power Servo, controlled by the modulated Transducer output vacuum, operates the vacuum electrical and mechanical components of the system as required to provide automatic control of system operation.

Other major system components are mounted conventionally in the engine compartment. Underhood components and system airflow remain much the same as in the Four-Season system except for the addition of the automatic control provisions. The system operates on 100% outside air, a mixture of outside and inside air, or 100% recirculated air depending on the demands of the system. The diaphragm operated air selector door will modulate outside air to the system during maximum air conditioning requirements when the control unit is in "Hi Front" position. Control of the blower is also completely automatic and dependent upon system demands.

Controls

The Comfortron controls the Chevrolet air conditioner and heater in such a precise manner that the automobile temperature remains relatively constant under all driving conditions. By adjusting the thumb wheel on the Control Head to any temperature desired between 65° and 85° F. (See Figure 27) the automatic system will adjust the in-car temperature even though the outside weather conditions may vary considerably. The system will provide maximum capacity for heating or cooling until the in-car temperature reaches the pre-set Control Head Temperature. Where cooling is required, the system will start immediately upon being turned "ON". During marginal ambient temperatures the system will not always start at the highest blower speeds of the control setting. Therefore, occasionally the system can't be heard starting.

Five over-riding functions are available so that special conditions can be handled. Each Control Head function will be discussed in detail below:

"Off" Position

In the "Off" position, the blower is turned off and the outside air door is closed. No outside air should enter the automobile.

"Lo Front" Position

The blower has five low to moderate speeds; Hi, M_3, M_2, M_1 and Lo. The blower voltage will shift as directed by the automatic controls. The "Lo Front" position provides a quieter mode of automatic operation due to reduction of blower noise.

"Hi Front" Position

The "Hi Front" position provides five high blower speeds as called for by the automatic controls: The use of the "Hi" blower speed results in a rapid cool down in hot weather and rapid heating during cold weather. As the in-car temperature approaches the temperature setting on the Comfortron Control Head, the blower speed will change, provided mild outside temperatures are experienced. During very hot or cold weather, the blower will reduce its speed only to the point where it is still capable of maintaining the correct in-car temperature.

"Rear" Position

The "Rear" position provides five high blower speeds. The automatic controls select these speeds and blend the discharge air to the proper temperature. By the use of high blower speeds, increased airflow is obtained for better rear seat passenger comfort.

"De-Fog" Position

In the event that the front windshield should require removal of a fogging condition, the owner at his option may direct air to the windshield. The "De-Fog" position directs part of the air to the windshield while retaining a certain amount through the floor outlets. The temperature of the air remains the same as it was prior to the control being placed in the "De-Fog" position. Five blower speeds are available. The temperature of the air and the blower speed are selected by the automatic controls and are dependent upon the in-car temperature.

"De-Ice" Position

The "De-Ice" position provides full heat with "Hi" blower directing the entire airflow to the windshield to melt ice. The automatic controls are completely defeated and as a result, full heat with "Hi" blower are the only conditions that can be received. The system will turn on immediately in this position even though the engine coolant might be cold.

General Information

Three start up conditions can be achieved with Comfortron.

Weather	Method of Starting System
Cold	System starts as soon as engine coolant is hot.
Hot	System starts immediately when AC is required.
Any	System starts immediately in "De-Ice" position.

UNIVERSAL SYSTEM

A self-contained unit, the dealer installed Universal System operates on recirculated air only and entirely independent of the vehicle heater. 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 compressor used with the Universal System is identical to that used for the Four-Season system except for displacement. Underhood components are similar in placement to the Four-Season system.

Controls

Universal system controls are the AIR knob controlling the three speed blower motor switch and the TEMP 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.

CHEVY II ALL-WEATHER SYSTEM

The Chevy II All-Weather Air Conditioning System, Figure 33, operates in conjunction with the heater to provide a complete air conditioning 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 34 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 the heater control on the instrument panel as well as the two knobs located on the air conditioning unit itself (fig. 35).

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 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 Lever

This lever actuates the damper within the assembly which chooses between recirculated air or outside air.

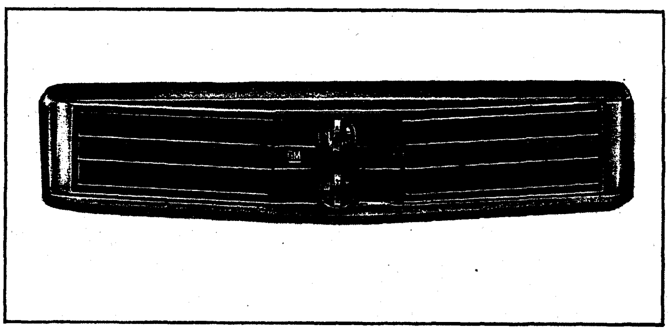


Fig. 31—Universal Air Conditioning Unit

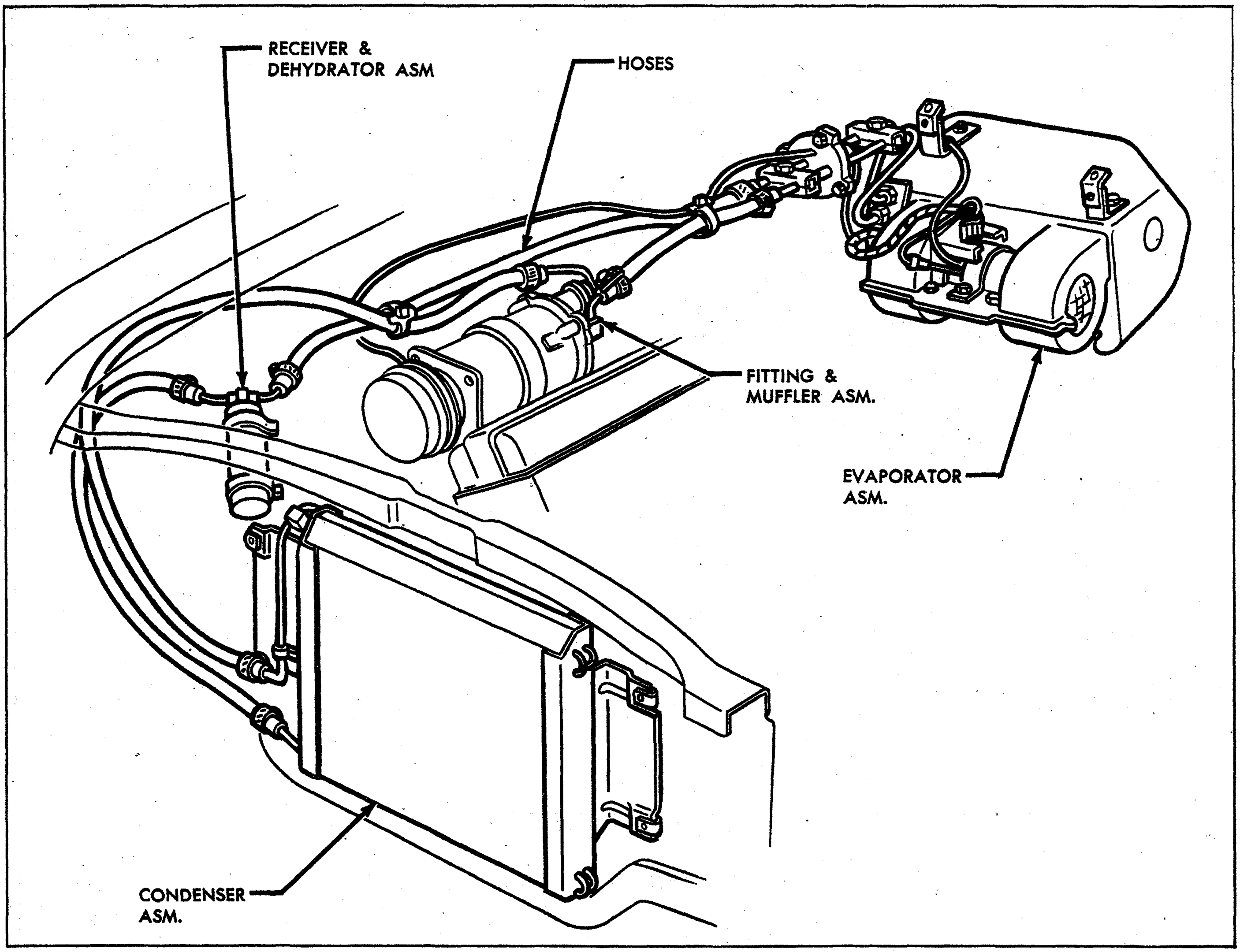


Fig. 32—Universal System Components

Full right position will supply 100% outside air (for heater operation) to the system while full left position will provide 100% inside (recirculated) air for cooling operation during city driving to shut out dust and fumes. Recommended setting of this lever for most air conditioning operations is about 1/4" to the right. This will provide a mixture of recirculated air and outside air.

Fan Switch

The switch operates the three-speed blower motor.

Temperature Lever

This lever operates the damper door which controls heater outlet temperature in the same manner as described in the heater section.

"Two-Level" Temperature Control

By moving the temperature lever to provide the desired temperature on the floor, pulling the "Air Cond—Pull" knob out halfway and moving the "Air" lever fully right 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.

CORVETTE

The Corvette Four-Season Air Conditioning System, by combining heating and cooling functions in a single unit, provides maximum driving comfort during every season of the year. Cooling and heating cores are mounted in this "reheat" system in such a way that full outside air, full recirculated air or a mixture, passes from the three-speed blower through the evaporator (cooling) core and then through and/or around the heater core. If the system is not calling for heat all of the air flow will bypass the heater core.

The cooling components of the system include the compressor, condenser, receiver-dehydrator and evaporator together with the expansion valve and suction throttling valve, all installed compactly beneath the hood. The evaporator provides maximum cooling of the system airflow when cooling is required. Cool airflow is tempered by mixing warm air from the heater with the cooled air from the evaporator. The POA valve controls evaporator pressure so that the unit may hold the lowest pressure possible without danger of core freeze up.

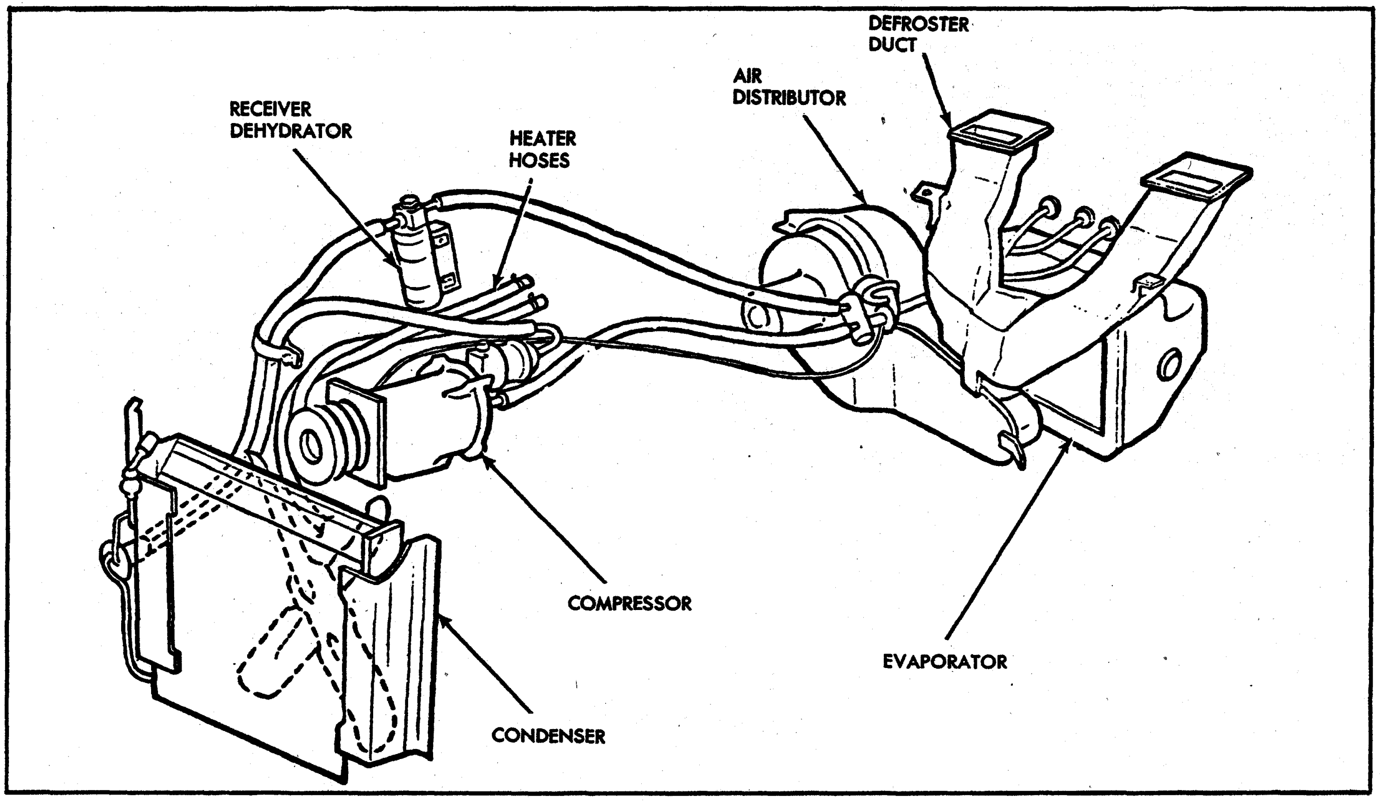


Fig. 33—All Weather System Components (Chevy II)

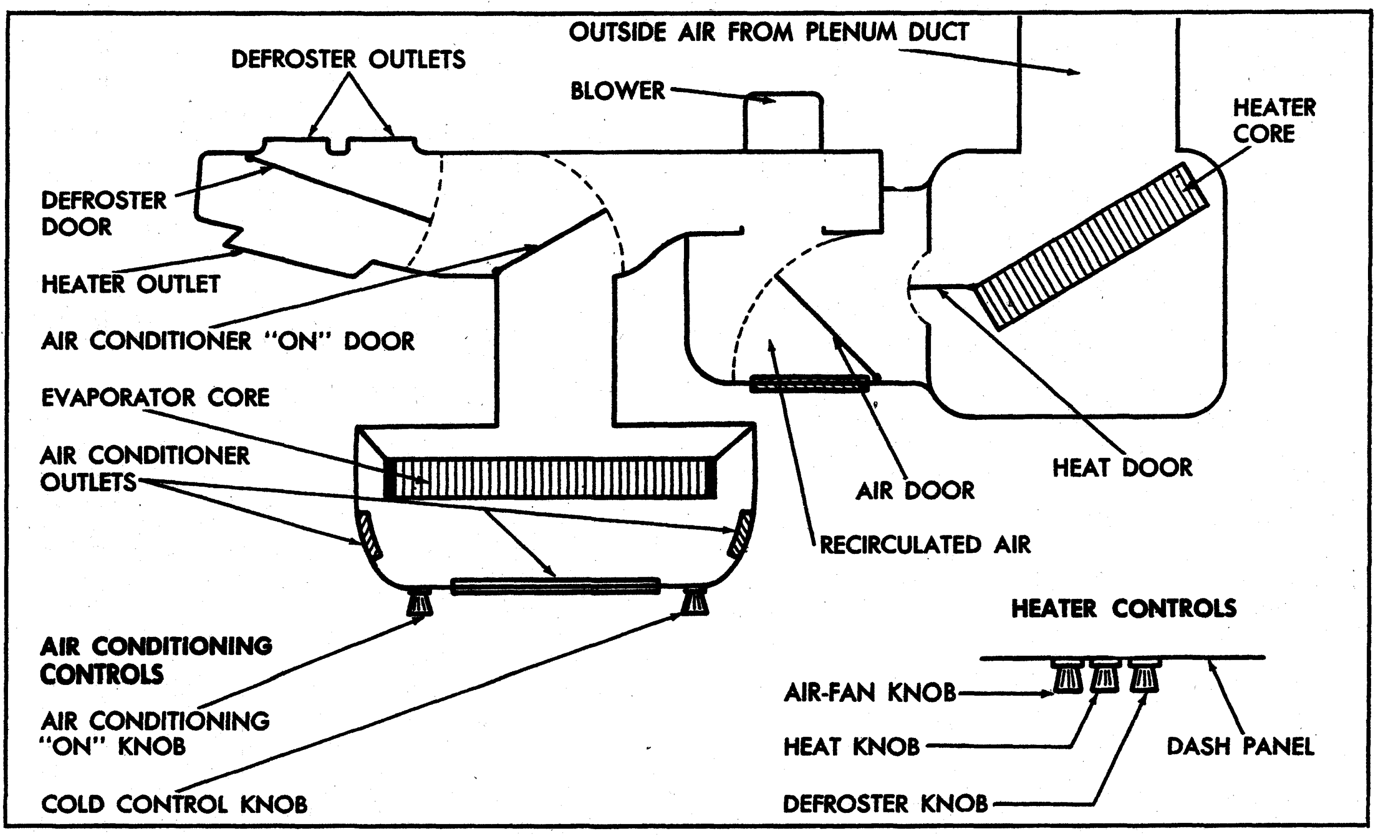


Fig. 34—All Weather System Schematic

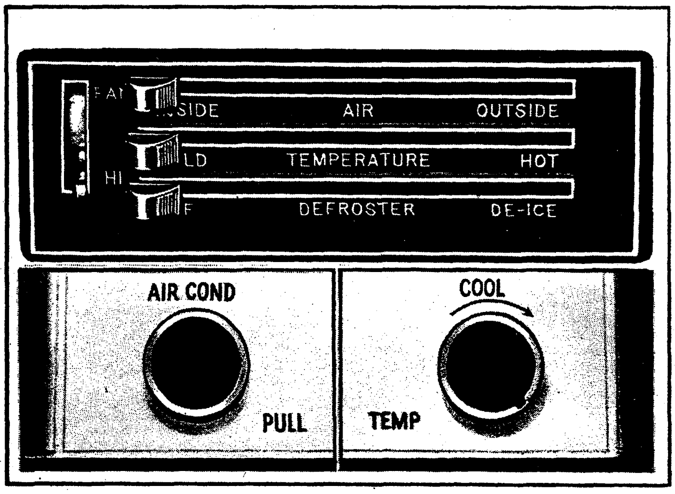


Fig. 35—Controls—All Weather (Chevy II)

The heater components of the system are similar to the standard Corvette heater with hoses routing engine coolant to and from the heater core. A vacuum operated shutoff valve assures that no coolant will pass through the heater core until the system calls for heat.

Four control knobs surrounding the clock on the instrument panel center console provide full control of the heating and cooling functions of the air conditioning system.

The general arrangement of the system components is pictured in Figure 37 while a schematic view of the system will be found in Figure 36.

Controls Corvette

Four control knobs, grouped around the clock on the instrument panel central console, provide full control of the heating and cooling functions of the Corvette Air Conditioning System. Each of the knobs, through a bowden cable, operates one of the air diverter doors in the air distributor assembly. In addition, the AIR COND.-PULL knob operates the compressor switch; blower speeds are controlled by turning the AIR PULL knob; and the heater hot water valve vacuum switch is actuated by the COOL IN-HOT PULL knob.

Air Conditioning "ON" Knob

The "AIR COND. PULL" knob controls the positioning of the air diverter door which routes conditioned air through either the dash diffuser ducts or the floor distributor outlets. Movement of this knob (hence, movement of the selector door) also controls the compressor switch. When the door is positioned to send air through the dash outlets the compressor is automatically turned on to place the cooling system in operation and the fan is turned on to LOW speed.

Blower Switch and Air Selector

The AIR PULL-FAN knob operates the selector door in the right hand plenum chamber and may be set to allow full outside air, full inside air, or a mixture of the two to

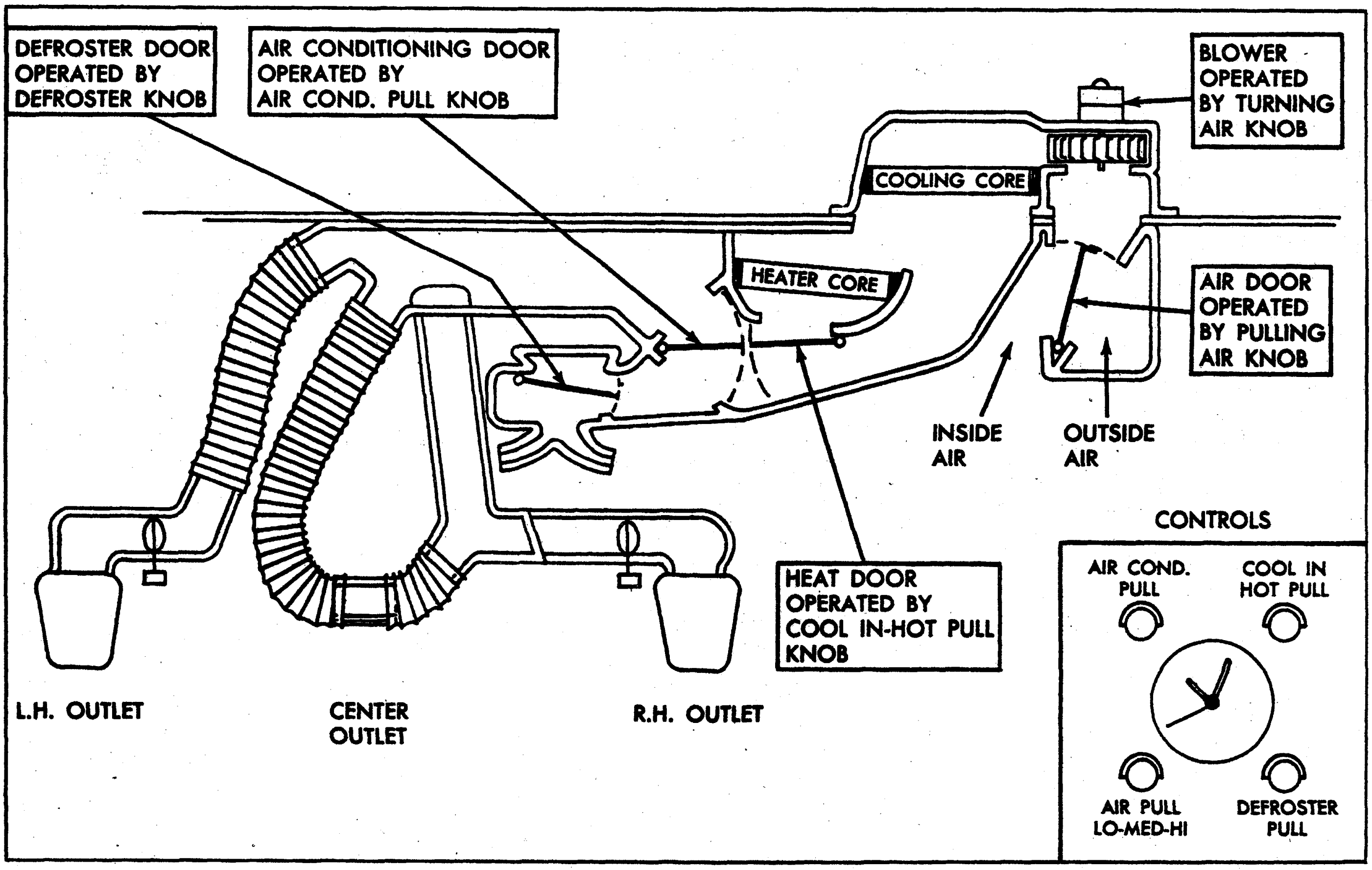


Fig. 36—Corvette Four-Season System Schematic

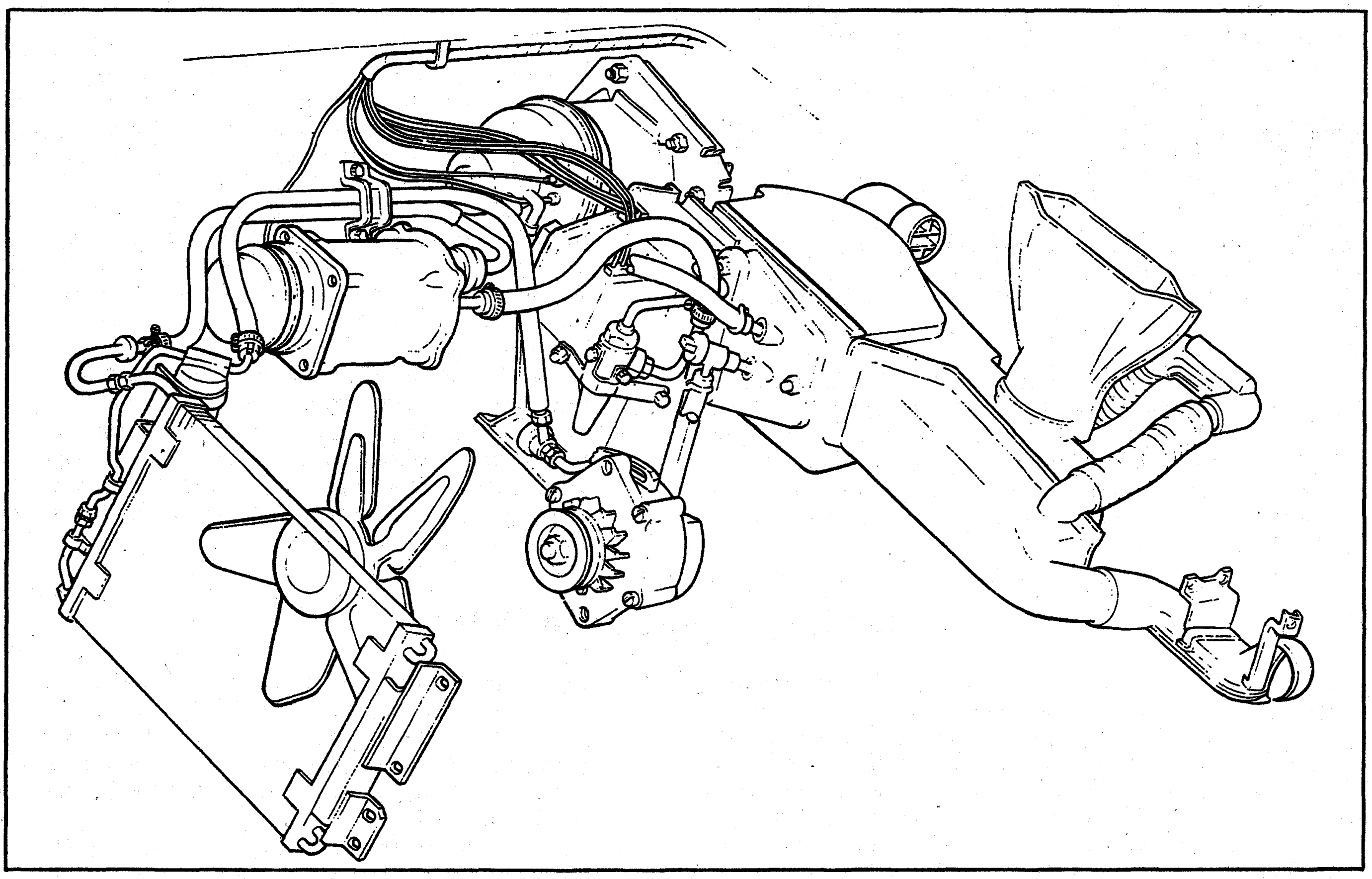


Fig. 37—Corvette Four-Season System Components

pass through the system. For heating operations it is suggested that full outside air (knob fully OUT) be used. For cooling operations under extreme heat conditions push knob fully in (recirculated inside air); under moderate temperature conditions pull the knob out to the detent position (a misxture of outside air and inside air); and under mild temperature conditions the knob may be pulled fully out (outside air).

After the AIR PULL knob is set to permit air to pass through the system, the knob may be rotated to control the three-speed blower. When the AIR COND.-PULL knob is pulled out the low blower is in operation. Select higher speeds as desired.

Temperature Adjustment

The COOL IN-HOT PULL knob controls the air output temperature during both heating and cooling operations. A vacuum switch (operated by the temperature door actuating cam) controls a vacuum operated water valve which allows engine coolant to flow through the heater core only when this knob is pulled out.

During heating operation cold ambient air enters the conditioner, passes through the inoperative cooling core and then passes through and around the heating core (the final mixture of hot and cold air being determined by the control knob - temperature door setting) and then enters the car.

Cooling operation is exactly the same except that the cooling core (evaporator) will be in operation at full capacity, removing as much heat and humidity as possible from the warm ambient air flowing through it. The COOL IN-HOT PULL knob may then be pulled out as needed to temper this maximum cold airflow should it become necessary.

Defroster Control

This control acts to divert heated air from the floor distributor duct into the defroster duct for windshield defogging, defrosting and deicing operations. A detent is built into the defroster linkage to indicate the setting at which a small portion of the heater air will be continaully passed over the windshield, thus keeping it clear.

Operating Instructions

Remember that the air conditioning system may be used for heating or cooling during any season of the year to provide just the desired comfort conditions.

Cooling

1. "Air Cond-Pull". This knob should be pulled fully out.
2. "Cool In-Hot Pull". This knob should be pushed fully in for maximum cooling. Pulling out the knob as required will mix warm air with the cool air to temper the cool air output.
3. "Air Pull-Fan". Set this knob fully in during extreme heat conditions; at the detent position during moderate temperature conditions; fully out during mild temperature conditions or whenever tempering of the cooled air flow is necessary. Turn the knob

clockwise for medium and high blower speed, as desired. Low blower speed is automatic during cooling operations.

4. "Def-Pull". This knob should be pushed fully in.

Additional Cooling Hints

1. The center barrel outlet in the dash may be rotated to deflect air as desired or used to act as a shut off door.
2. The right and left ball outlets may be rotated to deflect air in the direction desired. Each outlet has a shut off valve operated by a knob approximately 4 in. inboard. When the knob is horizontal, the valve is open.
3. There are two (2) additional outlets in the bottom of the ducts approximately 6" inboard from the valve knobs. A rotating cover will open these outlets to provide cool air for the feet if desired.
4. When first entering a very warm car, open the windows for a few minutes until the interior of the car has cooled off.

Heating

1. "Air Pull-Fan". Pull this knob fully out. Rotate the knob clockwise for low, medium or high blower speed as desired. If just a small amount of heat is desired, leave the fan on low or medium speed and regulate the temperature with the "Cool In-Hot Pull" knob.
2. "Air Cond-Pull". This knob should normally be pushed fully in. However, during cool, damp days it is possible, by pulling this knob fully out, to dehumidify the air by passing it through the evaporator core before reheating to the desired outlet temperature.
3. "Cool In-Hot Pull". Pull this knob out as far as necessary to provide the temperature desired.
4. "Def-Pull". Pull this knob all the way out for maximum defrosting or de-icing. When the knob is partly out, a portion of the hot air is used for defrosting and the balance is discharged through the heater outlet.

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, high pressure means that great forces are being exerted against the walls of the container. 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. 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. 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

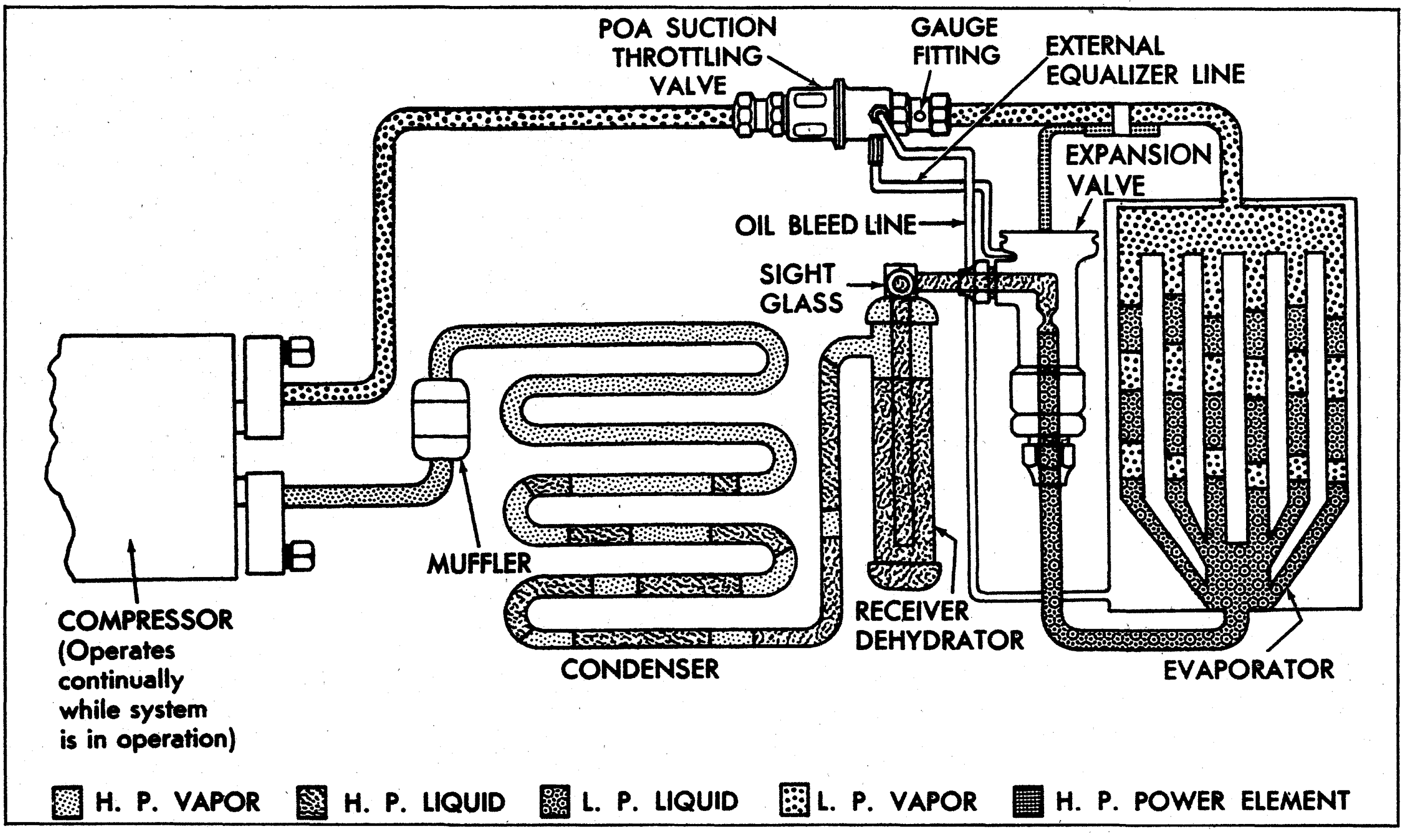


Fig. 38—Cycle of Operation—Four-Season and Comfortron

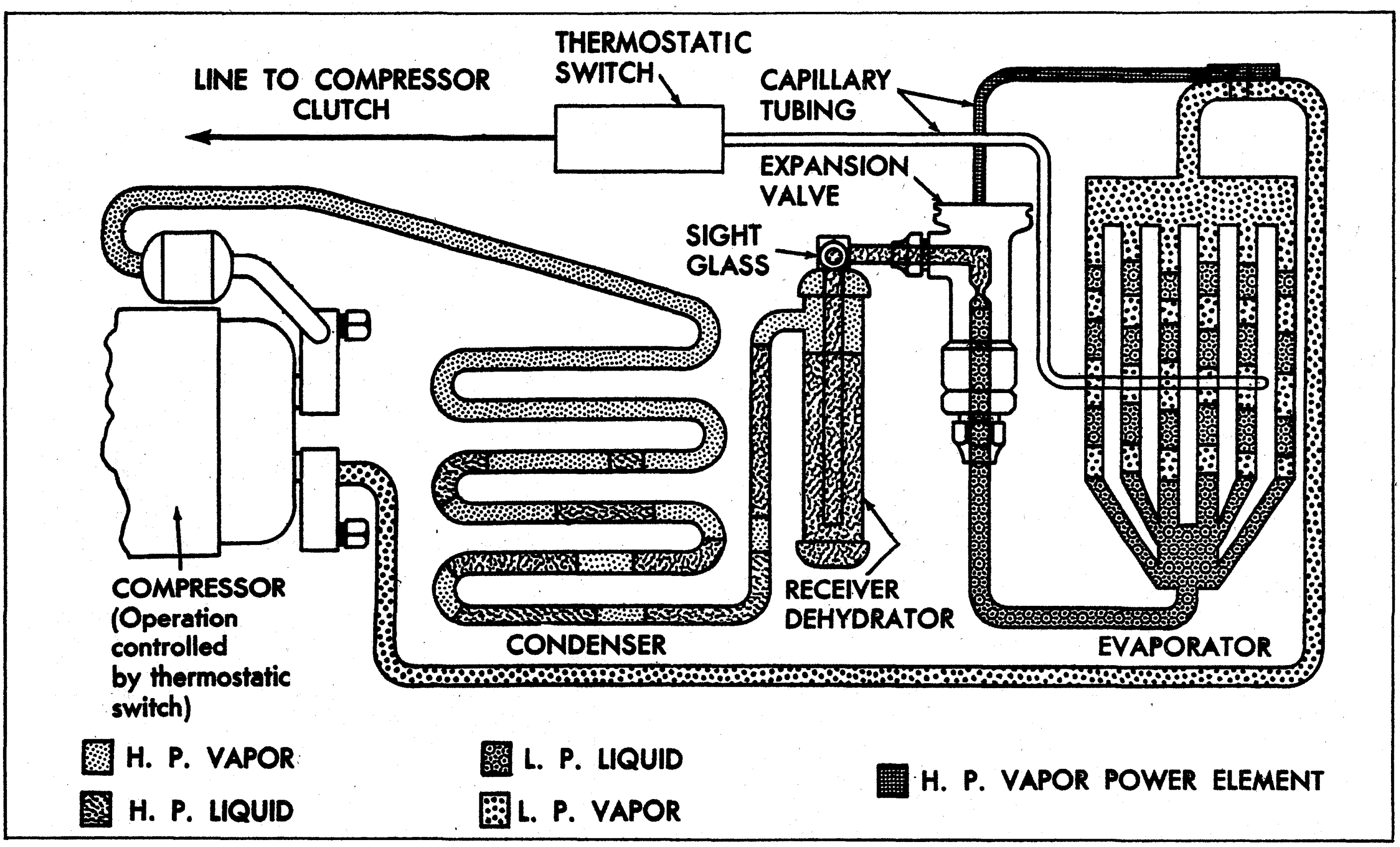


Fig. 39—Cycle of Operation—Universal and All Weather

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.
- 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 and uncontaminated 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. 40—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

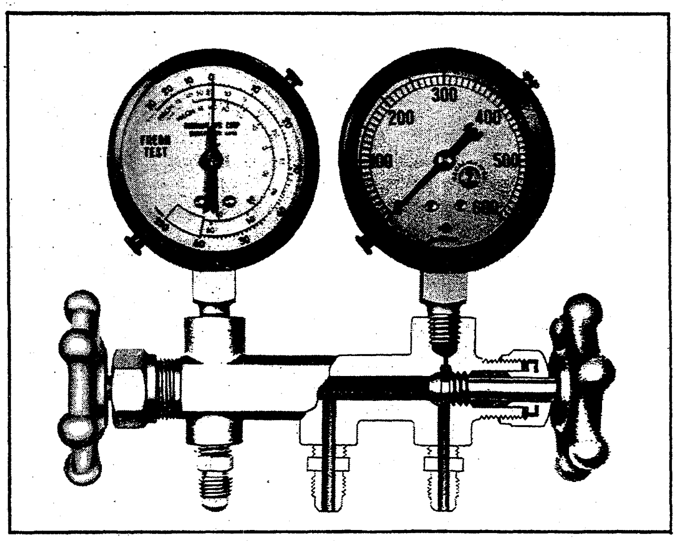


Fig. 41—Gauge Set

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. 41) 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 fails 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.

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. 42) which brings air conditioning service down to the basic problem of hooking on two hoses, and manipulating clearly labeled valves.

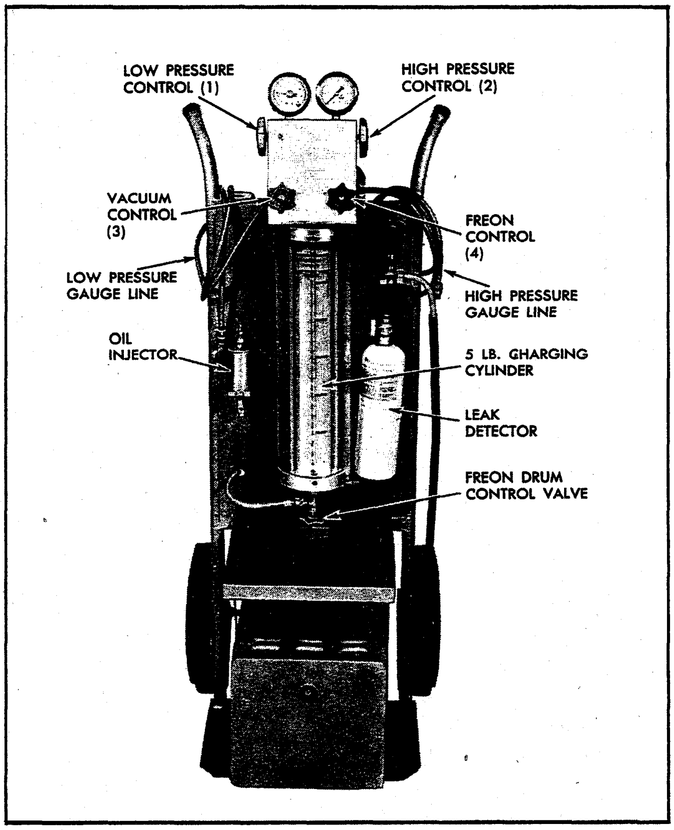


Fig. 42—System Charging Station

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.

NOTE: The use of a leak detecting dye within the system is not recommended because of the following reasons:

1. Refrigerant leakage can exist without any oil leakage. In this case the dye will not indicate the leak, however, a torch detector will.
2. The addition of additives, other than inhibitors, may alter the stability of the refrigeration system and cause malfunctions.
3. Dye type leak detectors which are insoluble form a curdle which can block the inlet screen of the expansion valve.

Leak Detector

Tool J-6084 (fig. 43) 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 the 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.

   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.

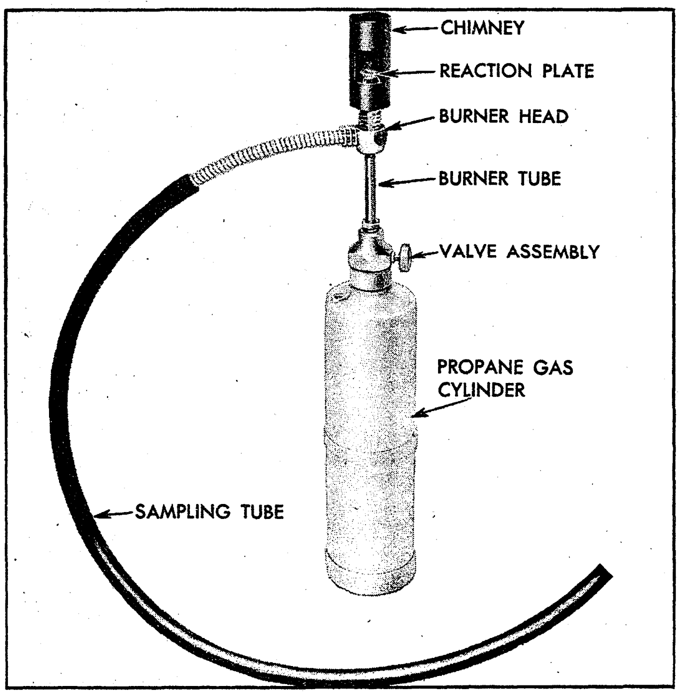


Fig. 43—Leak Detector

VACUUM PUMP

A vacuum pump should be used for evacuating air and moisture from the air conditioning system.

Vacuum pump, Tool J-5428, (fig. 44) 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.
- 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. 44). Recharge with 8 ounces of vacuum pump oil. 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. 45).

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

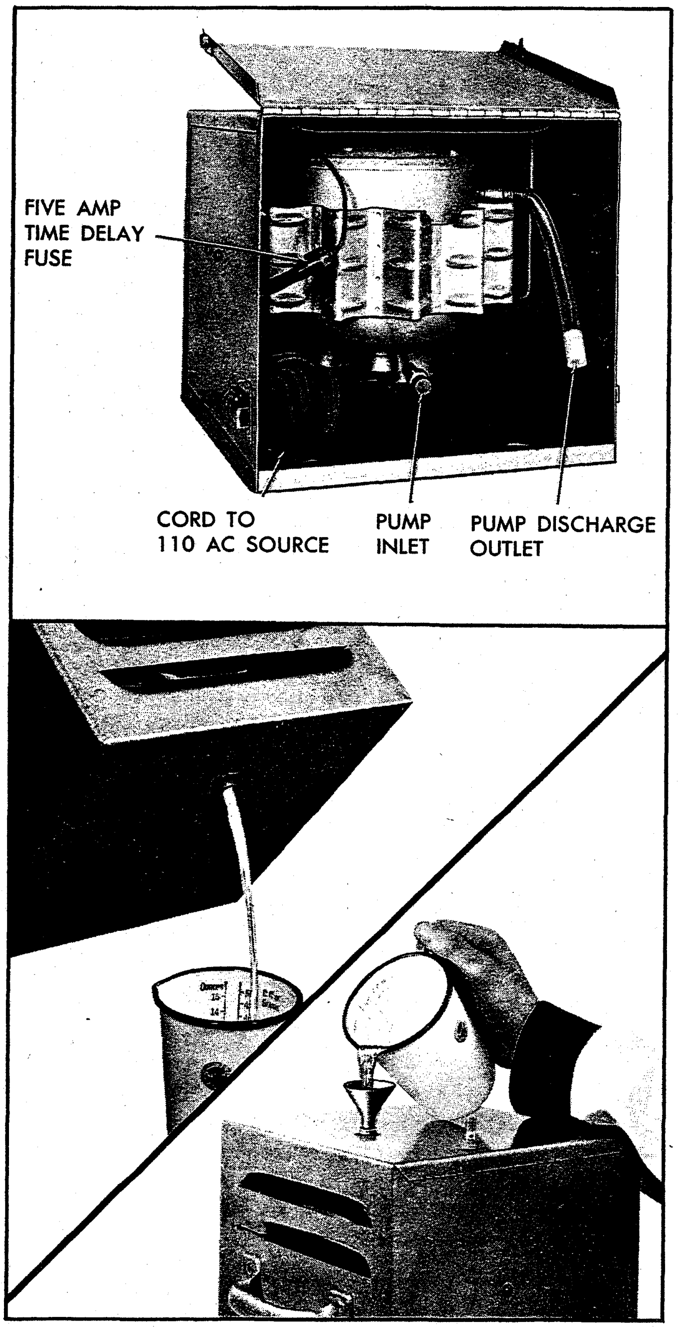


Fig. 44—Vacuum Pump

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

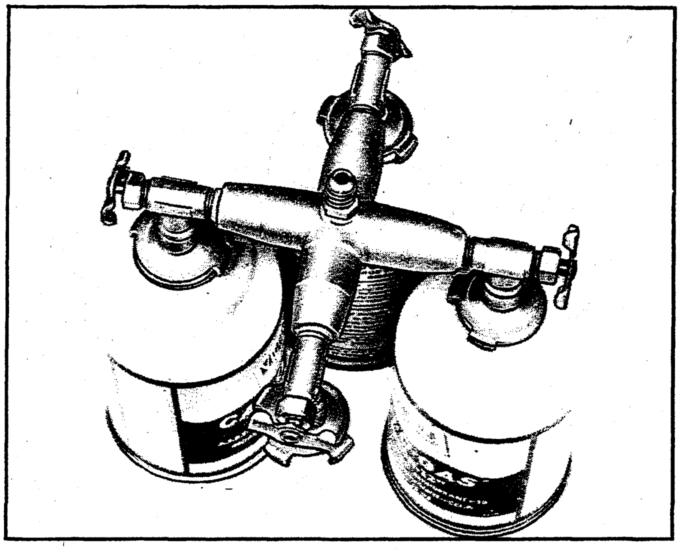


Fig. 45—R-12 Disposable Cans

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 commercial 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.

INSPECTION AND PERIODIC SERVICE

PRE-DELIVERY INSPECTION

1. Check that engine exhaust is suitably ventilated.
2. Check the belt for proper tension.
3. 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 compressor is operating at the same speed as the clutch pulley. Any speed variation indicates clutch slippage.
4. Before turning off the engine, 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.

5. Check hose clamp connections. If clamp screw torque is less than 10 lb. in., retighten to 20-25 lb. in. Do not tighten to new hose specifications or hose leakage may occur.
6. If there is evidence of an oil leak, check the compressor to see that the oil charge is satisfactory.
7. 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 as in step 5 above.
6. Check thermostatic switch setting (Universal and All-Weather Systems.)

PERIODIC SERVICE

- Inspect condenser regularly to be sure that it is not plugged with leaves or other foreign material.

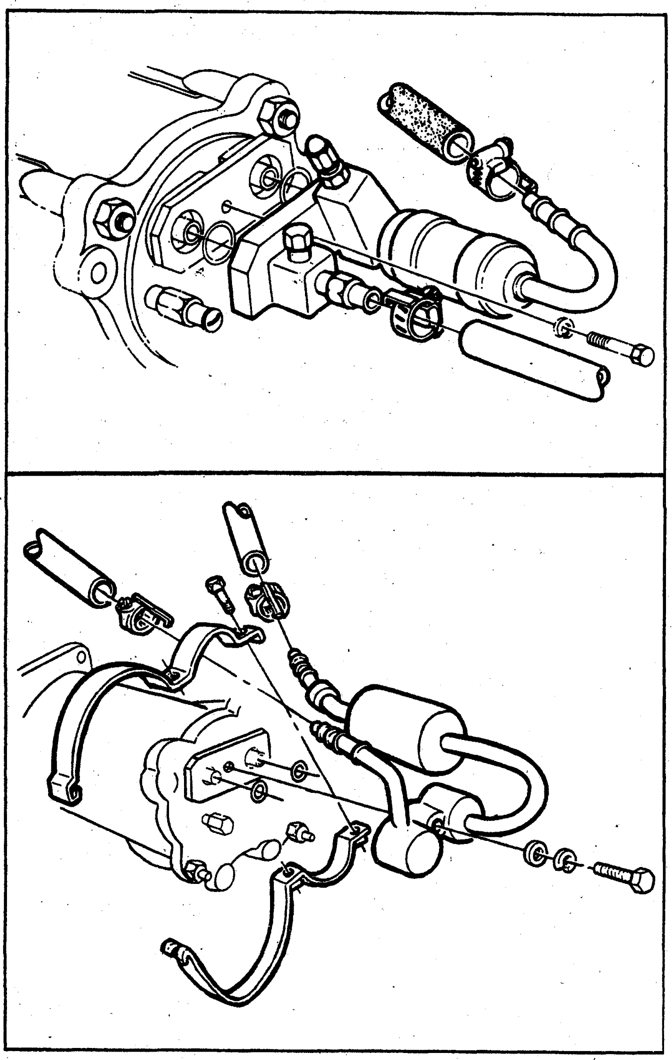


Fig. 46—Compressor Connector Block—Typical

- 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 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.

On Universal 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 Universal 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 and the low pressure gauge fitting is on the POA Valve.

The Chevy II All-Weather System compressor connector assembly is similar to the Universal System connector assembly described above except that the muffler extends straight out from the connector and is not bracket mounted to the compressor.

Universal and Chevy II All-Weather System

1. Install 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 and Comfortron Systems

Installation of the gauge set onto the Four-Season and Comfortron systems 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 POA valve. 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 POA 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.

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. (Car inside or in shade.)
2. Hood up and engine exhaust suitably ventilated.
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. On Comfortron systems move the control lever to REAR and pull the white vacuum hose from the transducer. Plug the hose. An alternate method is to install the J-22368 Tester (described later in this section) and operate it on MANUAL control to maintain maximum cooling and blower speed.
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 and Comfortron System

Chevrolet and Camaro

(Refrigerant Charge = 3 Lbs. - 12 Oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	145-155	170-180	205-215	255-265	260-270	295-305
Evaporator Pressure at POA	29.5 - 30.5 psi					
Discharge Air Temp. at Right Hand Outlet	38-41	39-42	41-43	42-45	43-46	45-48

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	175 185	210 220	250 260	280 290	290 300
Evaporator Pressure at POA	29.5 - 30.5 psi					
Discharge Air Temp. at Right Hand Outlet	37-40	37-40	38-41	39-42	40-44	41-45

Corvette

(Refrigerant Charge = 3 Lbs. - 4 Oz.)						
Temp. of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000 rpm					
Compressor Head Pressure	150-170	175-195	200-200	240-260	285-300	325-335
Evaporator Pressure at POA	29.5- 30.5 psi					
Outlet Air Temperature (at Right Outlet)	38-40	38-40	40-42	41-43	43-45	45-47

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

**When Compressor Clutch Releases

COMFORTRON SYSTEM OPERATIONAL TEST

This test, designed as a quick check of total system operation, must be made with the engine operating at minimum of 2000 rpm and coolant warm. Wait several seconds between operations to allow the system to move through its sequence of operation and arrive at the prescribed mode of operation.

1. With control lever in the OFF position, and Temperature Dial at 65°F.
   a. System is turned OFF, there is no air flow from any of outlets.
2. Control lever in HI Front and Temperature Dial set at 65°F.

a. Blower comes on High speed.
b. Cold air comes from A/C outlets.

3. Rotate Temperature Dial to 85°F.
   a. Blower speed will decrease to Low speed then increase to Medium or High.
   b. Air temperature changes from Cold to Hot and comes out heater outlet.
4. Move control lever to LOW Front, with Temperature Dial at 85°F. Blower operates at Low and Medium speeds.
5. Move control lever to Rear, set Temperature Dial at 65°F.
   a. Blower goes to High speed and maintains high air flow.
   b. All air comes from A/C outlets.
6. Move control lever to DE-FOG.
   a. Blower is on Medium or High Speeds.
   b. Air comes from Defroster and Heater Outlets.
7. Move control lever to DE-ICE.
   a. Blower is on High Speed.
   b. Air temperature goes to warm and most of air comes from defroster nozzle, with small amount of air coming from heater outlet.
   c. Outside air door is open - (door valve is closed to car body).
8. Move control lever to REAR (dial at 65°). Outside air door moves outboard. (Door valve is open to car body).

CHEVROLET COMFORTRON TESTER

The J-22368 Automatic Temperature Control Tester when in AUTOMATIC position, may be used to perform Comfortron system checks without disturbing normal car operation.

Under MANUAL control tester allows the operator to set and hold a predetermined blower speed and temperature. The tester can also be used to measure external system voltages by using the probe.

To Install the Tester

1. Remove the three-terminal male connector from the Amplifier on the Comfortron control head.
2. Plug this connector into the three terminal female connector (with yellow wire) on the Tester.
3. Plug the remaining three-terminal male connector on the Tester into the Amplifier on the control head.
4. Attach the black ground lead to any good ground point available in the car.
5. Remove the large vacuum hose from Transducer and connect it to the Tester vacuum hose nipple.
6. Connect the Tester vacuum hose (short hose) to the Transducer.

Quick Test Procedure

With the J-22368 Tester installed as outlined above, the following quick checks may be made to pinpoint the cause of system malfunctions. This quick check procedure is reproduced on the "swing out" plastic instruction card attached to the back of the Tester.

Before performing the checking procedure, start the engine and allow to run on fast idle until operating temperature is reached. Then set the dash control lever to HI-FRONT position and the dash control Temperature Dial to 75° and proceed with the following steps:

Step	Tester Settings			Tester Should Indicate:	To Correct Abnormal Indication:
	Rocker Switch	Voltage	Manual Control		
1	Manual	Source	150	Battery Voltage	Check fuse and wiring.
2	Manual	Sensor	150	Battery Voltage	Check for open in sensor circuit.
3	Manual	Amplifier or Control Cal.	a. Max. Heat*	0-4 Volts	See Service Manual: Malfunctioning Amplifier or Temperature Dial.
			b. Max. Cold*	8 Volts Min.	
4	Manual	Trans-ducer	a. Max. Cold*	8 Volts Min. 0-3 in. Vac.	Check for open or bad ground in trans-ducer circuit or replace transducer.
			b. Max. Heat*	0-4 Volts 9 in. Min. Vac.	
5A	Manual	Amplifier or Control Cal.	Set to 150 for Comfortron System	6.5 Volts	Rotate car temperature dial until meter reads 6.5 volts. Car temperature should indicate 75°. If not, see temperature calibration which follows.
5B	Auto-matic	Amplifier or Control Cal.	Same as 5A. Allow 5 min. for system to stabilize with doors and windows closed.	5.5 to 7.5 Volts	After 5 minutes of operation check for defective sensor.

*This setting should result in HIGH blower speed. Refer to shop manual for further operational checks.

Checking Condition of Thermistors (Sensors)

1. Install Tester J-22368 as previously described.
2. Start the engine and run at fast idle. Move the Comfortron control lever to HI-FRONT.
   - Set Rocker switch to MANUAL.
   - Set Manual Control Knob to 150 ohms on scale.
3. Set the Tester Voltage switch to AMPLIFIER.
4. Rotate Comfortron Temperature dial until the Tester voltmeter reads 6.5 volts. The dial should read 75°. Adjust dial if necessary.
5. After car has run (windows and doors closed) for at least 10 minutes, switch Rocker switch to AUTOMATIC. Voltage reading should remain at 6.5. A change in the voltage indicates a bad sensor.
6. If a bad sensor is indicated in Step 5, check each sensor, disconnected from the system, with an ohmmeter. Approximate resistance of each sensor at 75°F. should be as follows:

In-car Sensor	--	50-75 ohms
Ambient Sensor	--	55 ohms or less
Duct Delay Sensor	--	25-75 ohms
Feedback Potentiometer	--	—— ——
Master Delay Thermistor	--	70 ohms
High Blower Delay Thermistor	--	80 ohms including 10 ohm resistor

(Located in Power Servo casting)

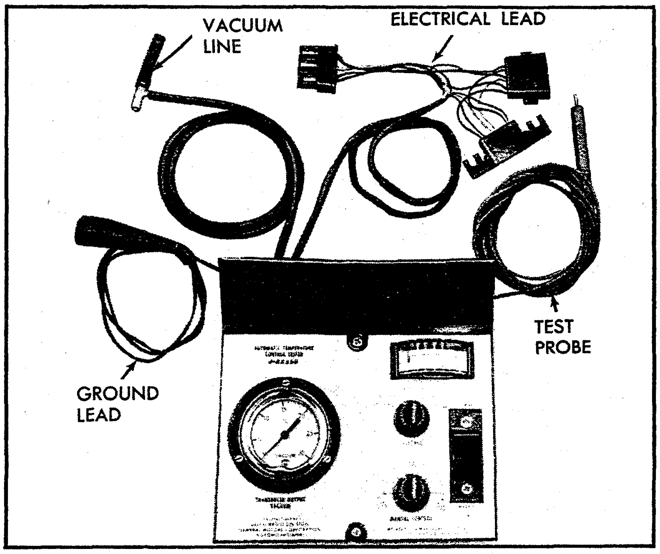


Fig. 47—Comfortron System Tester

COMPLETE SYSTEM CHECKS

The following information should be used whenever preliminary checks indicate the need for further, more specific, tests. Together with the Electrical Test Diagram (fig. 49) and the Vacuum Diagram (fig. 50), they may be used to accurately pinpoint any malfunction of the system.

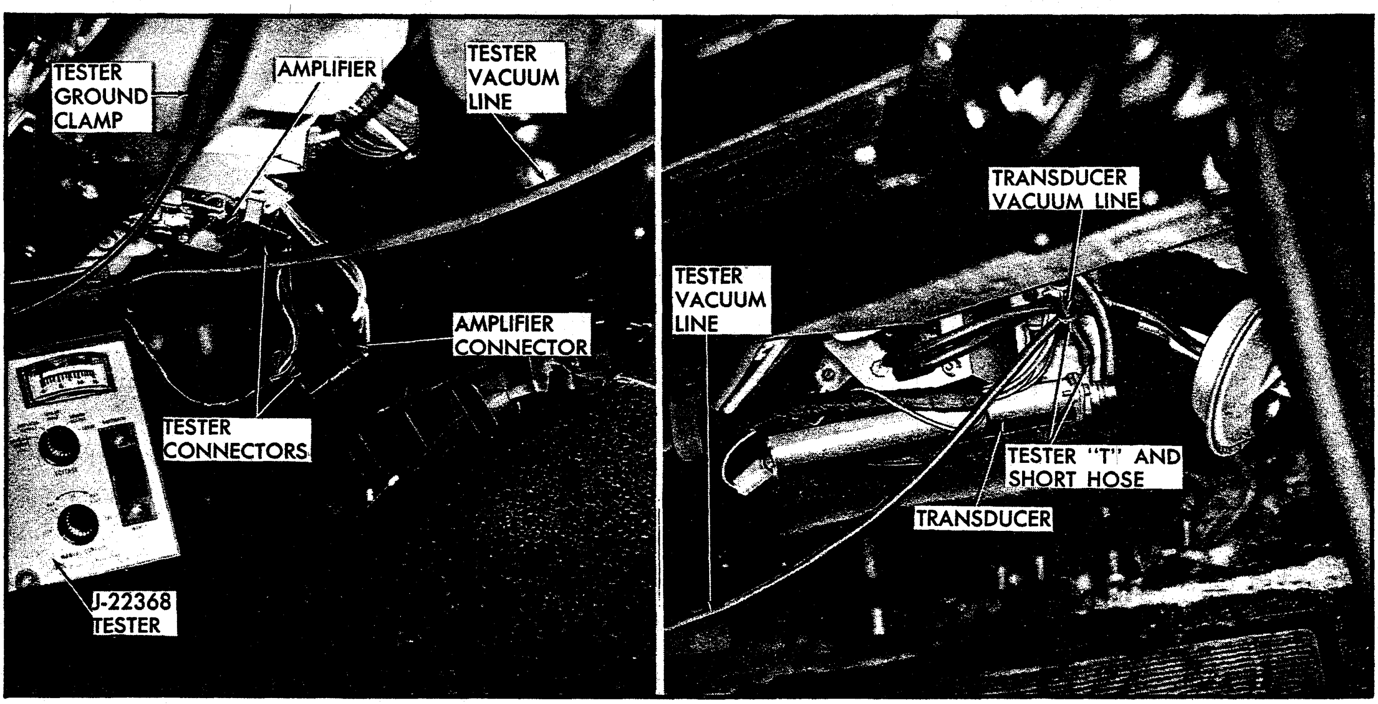


Fig. 48—Comfortron Tester Installation

(These tests should be performed with the engine at operating temperature.)

SYSTEM CHECKS							
Control Head Setting	Tester Settings: Function	Tester Settings: Manual Control	Tester Settings: Voltage	Tester Should Indicate:	If not, check the following:	Electrical Diagram Probe Points:	Voltmeter should read
High Front	Manual	Max. Heat	Trans- ducer	High Blower Maximum Heat	Fuse in Block	1-2	Battery Voltage
					In Line Fuse	8-9	Battery Voltage
					High Blower Delay Relay	10-21	Battery Voltage
						20	Minimum 6 volts
					Duct Delay Thermistor	18	Battery Voltage
					High Blower Delay Sensor	19	Minimum 6 volts
					Power Servo	39-46	Battery Voltage
					Blower Switch	3-17	Battery Voltage
					Resistor	22-15	Battery Voltage
					Blower Motor	16	Battery Voltage
					Wiring Harness	Checked during above procedure. (This is a complete step-by-step high blower circuit check which also checks wiring harness.)	
Lo Front				Reduced Blower Speed	Blower Switch	4	Battery Voltage
					Master Delay Thermistor	5	Battery Voltage
						6	Minimum 6 volts
					Master Delay Relay	12-13	Battery Voltage
						7	Minimum 6 volts
					Resistor	14	Battery Voltage
						22-15	Minimum 8 volts
					Power Servo	39-46	Minimum 8 volts
					Blower Motor	16	Minimum 8 volts
RESISTOR CHECK							
Lo Front	Manual	Rotate from Max. Heat to Max. Cold	Trans- ducer	Complete series of blower changes from Hi to Lo to Hi again.	Resistor	14	Battery Voltage
						22-40-42-44-15	Minimum 8 volts
AMPLIFIER CHECK							
Hi Front	Manual	150	Ampli- fier	Remove conn. from control head temperature dial. Voltage reading should be 9 volts minimum. Short this lead to ground. Voltage reading should be 0 volts. No voltage change indicates malfunctioning of amplifier.			
COMPRESSOR CLUTCH CHECK							
Hi Front	Manual	Max. Cold	Trans- ducer	Cooling System Operation	Compressor Clutch (Grille Temp. must be above 40°.)	24-25-26-27-28	Battery Voltage
DE-ICE CIRCUIT							
De-Ice 65° on Temp. Dial	Auto- Matic	Max. Cold	Probe	Assuming rest of system is operating normally: Max. Heat to windshield.	Blower Switch	3-23	Battery Voltage
					Master Delay Relay	20-10-21	Battery Voltage
					Transducer	38	Zero Voltage
SENSOR STRING CHECK							
Hi Front	Auto- matic	—	Probe	—	Sensor String	29-30-31-32-33-34-35-36	Battery Voltage
TRANSDUCER CHECK							
Hi Front	Manual	Max. Cold	Trans- ducer	0-3" Vac. Reading 8 Volts Min.	Transducer voltage (at Max. Cold position)	37-38	Battery Voltage
		Max. Heat		9" Min. Vac. Reading 0-4 Voltage Reading	Transducer Ground		
VACUUM FUNCTION CHECKS							
Hi Front	Manual	Max. Heat	Trans.	Hi Blower Outside air (air door closed to car body). Hot air from heater outlets.	Defective Power Servo; Leak in Vacuum System; Temp.; Door Link Disconnected or Jammed; Defective Vacuum Relay Valve		
		Max. Cold		Hi Blower Recirc. Air (air door open to car body) cold air from A/C outlets.	Defective Mode Door Diaphragm		

VACUUM SYSTEM COMPONENT FUNCTION

Component	Vacuum Applied		No Vacuum Applied
Air Door Diaphragm	Air Door Open to Outside Air (Closed to Car Body)		Air Door Open to Recirculated Air (Open to Car Body)
Power Servo	Maximum Heat		Maximum Cooling
Vacuum Relay Valve	Vacuum Applied to One Port Opens a Passage Through the Valve to Allow Transducer Vacuum to be Supplied to the Power Servo		No Vacuum Applied Closes Vacuum Supply to Power Servo
Mode Door Diaphragm	Vacuum to Linkage Side	Vacuum to Covered Side	Airflow Out of Upper and Lower Outlets Door Open 1" from 100% Lower Outlet Position
	Air Flow Out Heater Ducts	Airflow Out of Upper Outlets	
Defroster Diaphragm	Full Airflow Out Heater Outlet	Full Airflow Out Defroster Outlets (Full De-Ice)	Airflow Divided 1/3 Out Defroster Outlets 2/3 Out Heater Outlets
Transducer	Supplies Modulated Vacuum to Power Servo		
	Zero Voltage Applied to Transducer Results in Maximum Vacuum Supply	10 Volts Applied to Transducer Results in No Vacuum Supply	
Thermo Vacuum Valve	(Coolant Hot) Passes Vacuum When System is Calling For Outside Air		

MAINTENANCE AND ADJUSTMENTS

EVAPORATOR CONTROL VALVE (POA)

(Chevrolet, Chevelle, Camaro, and Corvette Four Season) (Chevrolet Comfortron)

The only check for proper POA valve operation is to check the suction pressure at the valve as during a performance test. The POA valve is an absolute valve and will provide different gauge readings based on the altitude where the readings are being taken. Correct gauge reading at sea level is 29.5 psig. Gauge readings will be one-half psi higher for each additional 1000 feet of elevation. The following table lists gauge readings at different altitudes. If a valve gives improper gauge readings, it must be replaced since it is not repairable or adjustable.

29.5 psig. -- Sea Level
30.0 psig. -- 1000 ft.
30.5 psig. -- 2000 ft.
31.0 psig. -- 3000 ft.
31.5 psig. -- 4000 ft.
32.0 psig. -- 5000 ft.
32.5 psig. -- 6000 ft.
33.0 psig. -- 7000 ft.
33.5 psig. -- 8000 ft.
34.0 psig. -- 9000 ft.
34.5 psig. -- 10000 ft.

THERMOSTATIC SWITCH

(Universal and Chevy II All-Weather System)

Thermostatic switches used in Universal 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.

Universal systems make use of a thermostatic switch with a fin sensing capillary or a self-supporting air sensing capillary. This capillary controls the switch by sensing the temperature of the metal fins or the air leaving the fins.

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

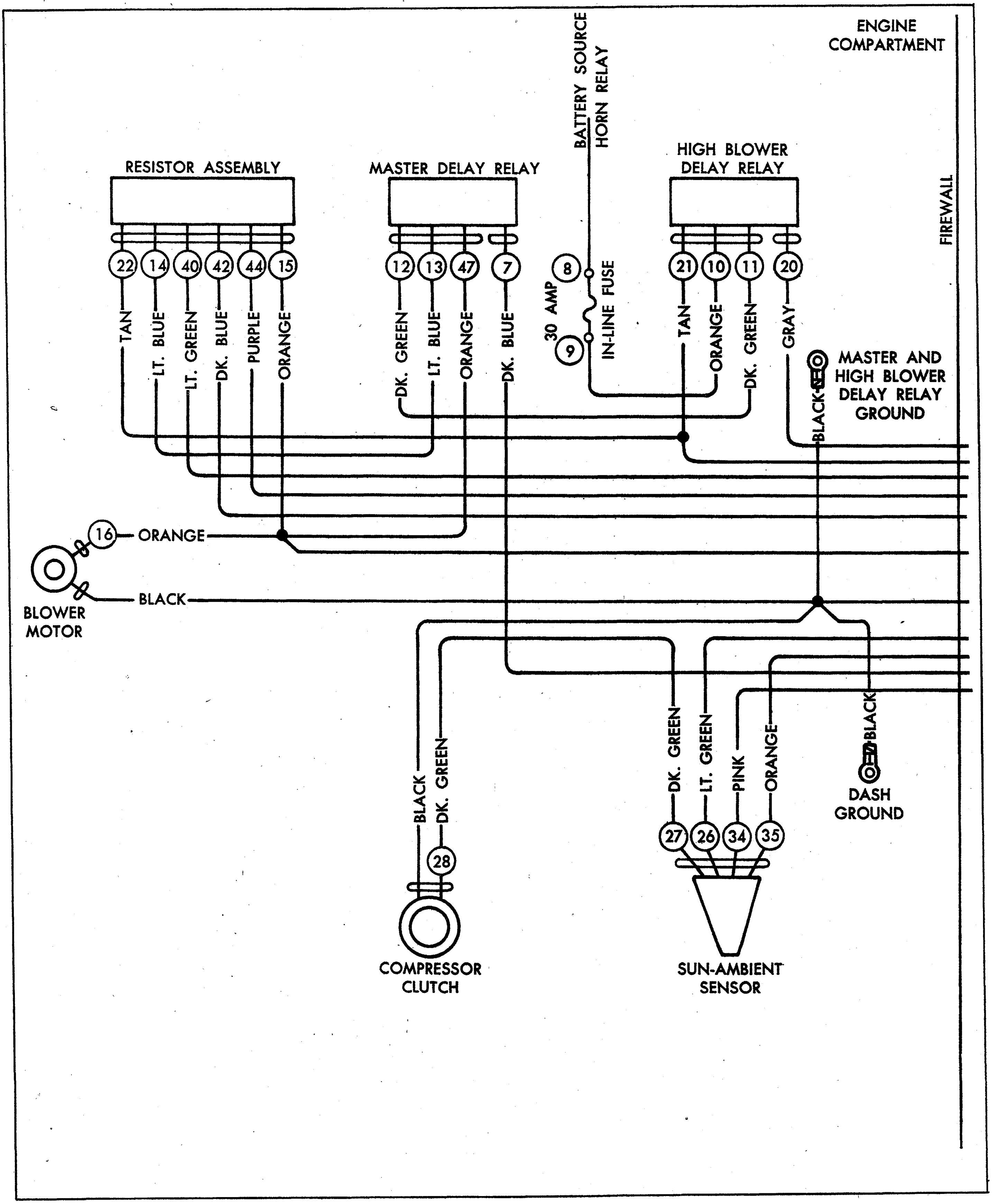


Fig. 49A—Comfortron Wiring Diagram—Underhood

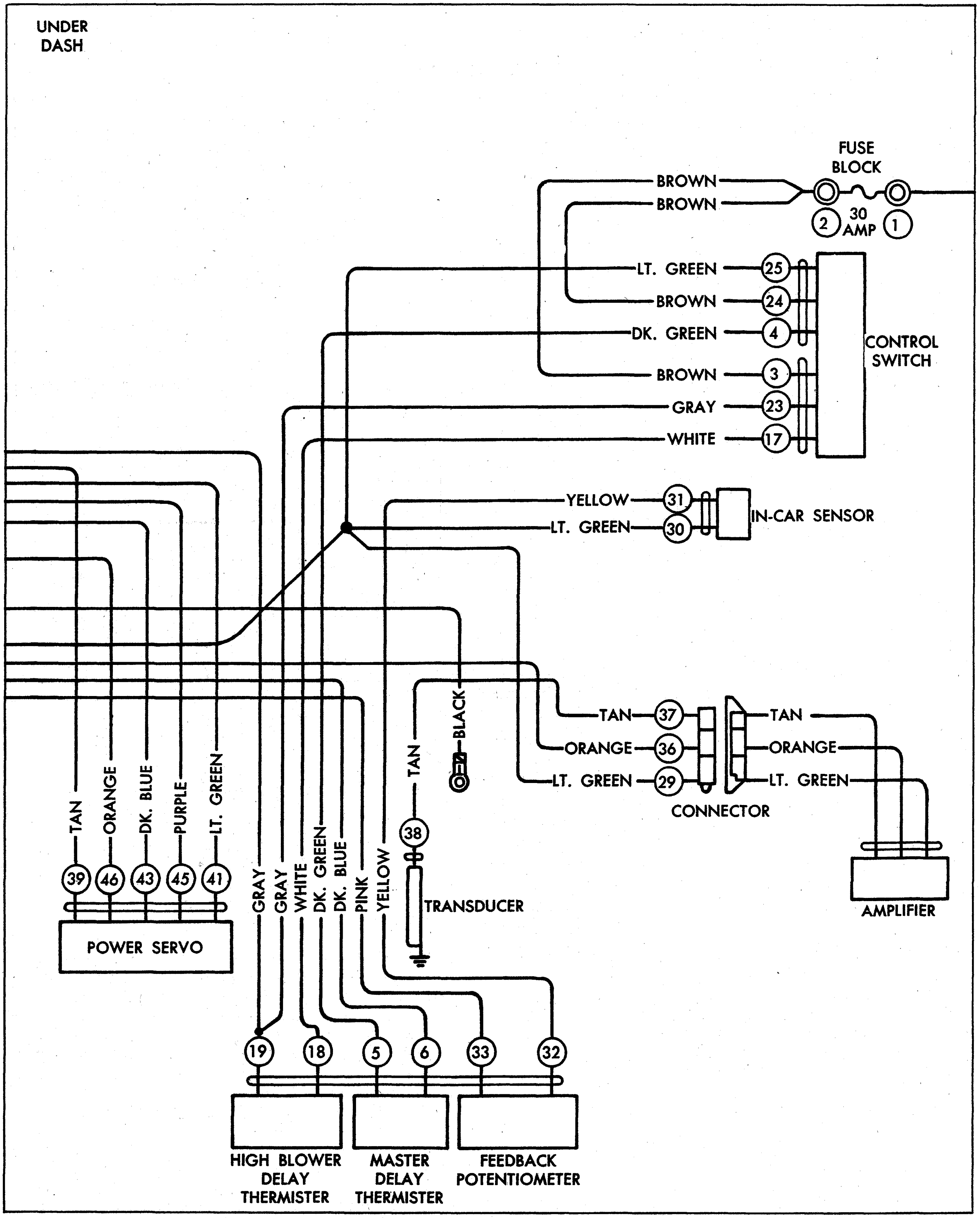


Fig. 49B—Comfortron Wiring Diagram—Underdash

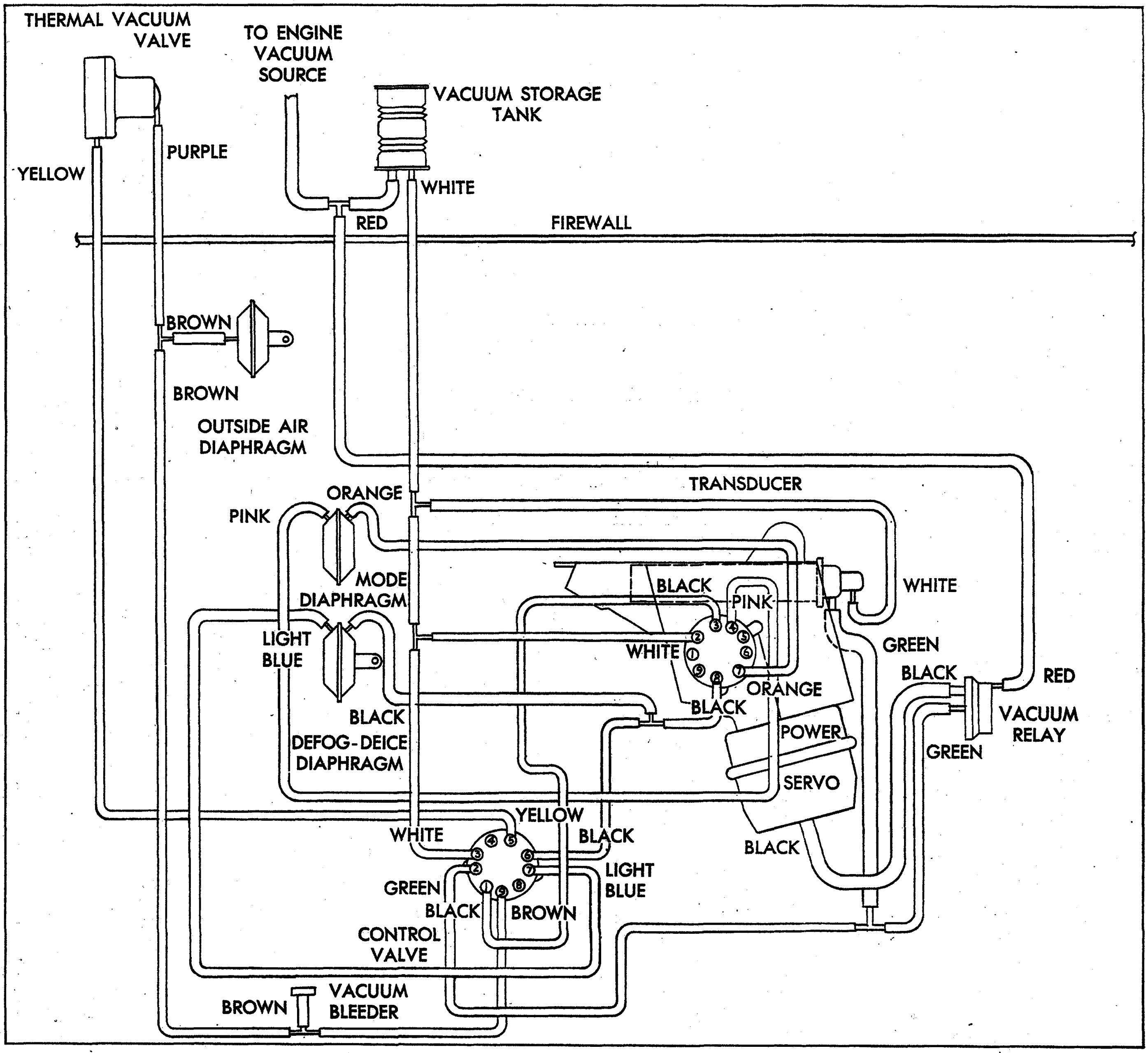


Fig. 50—Comfortron Vacuum Diagram

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 setting if necessary, as follows:

1. (Chevy II All-Weather) 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. (Universal) remove the face plate retaining screws. Pull the faceplate away from the case when ready to turn the switch adjusting screw.
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 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 54) clockwise in single

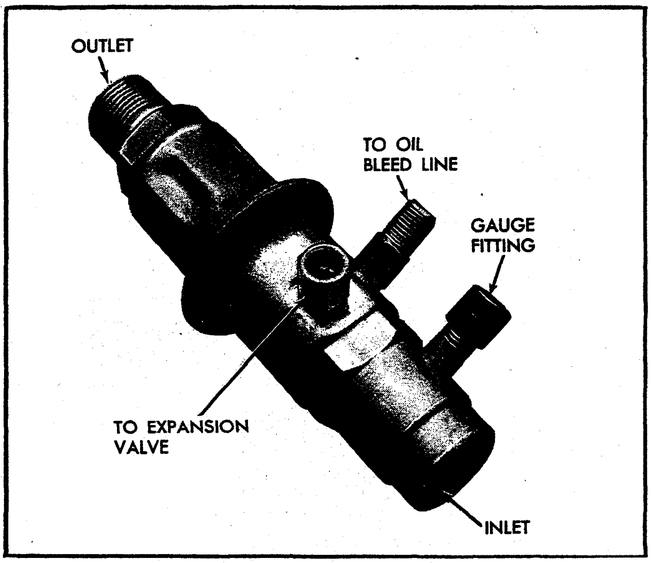


Fig. 51—Evaporator Pressure Control Valve—POA

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 pressure is reached.
6. After adjusting the switch, install the capillary to its normal position and 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.

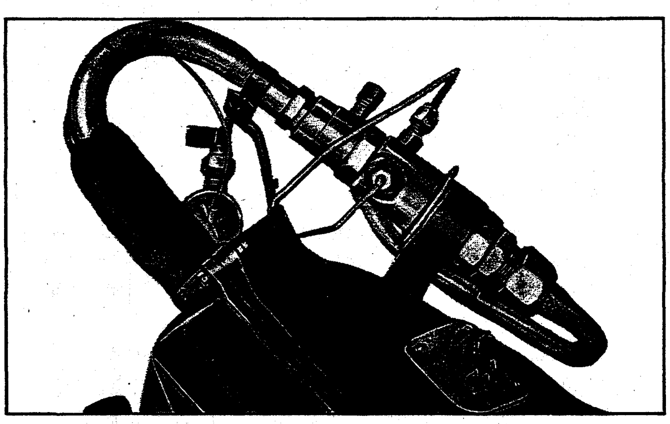


Fig. 52—P.O.A. Valve Installed

The external equalizer line shown in Figure 55 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.

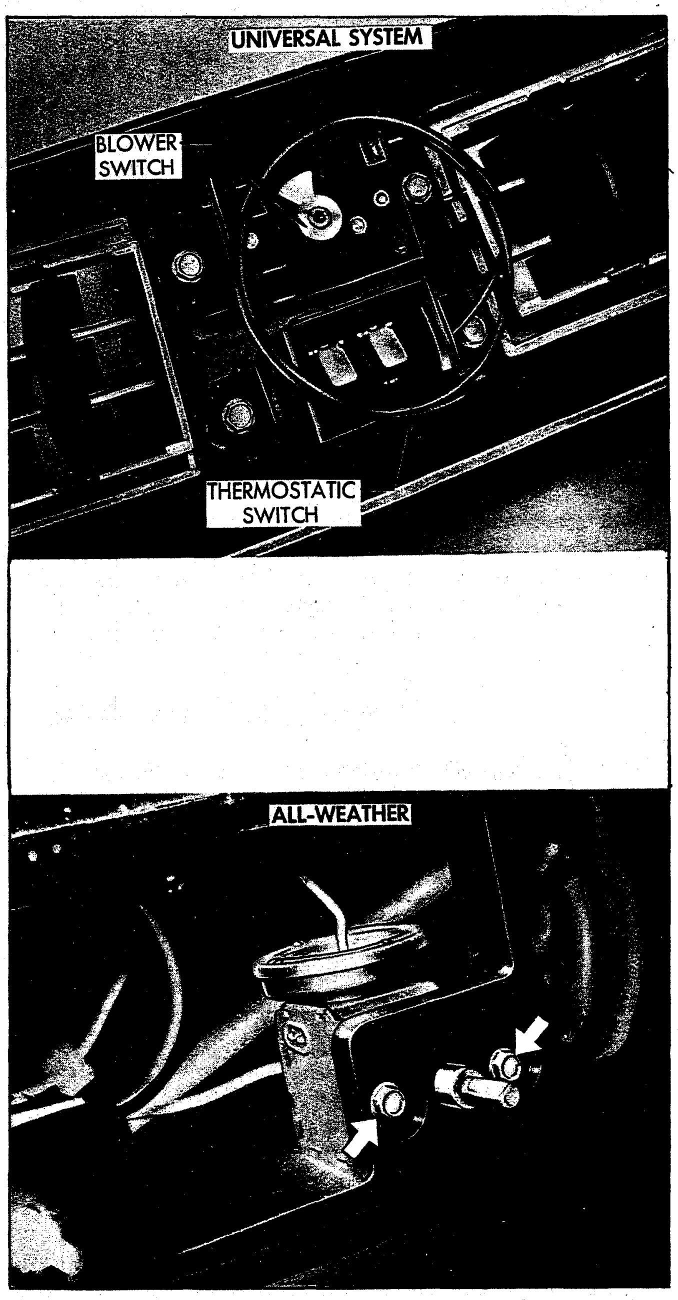


Fig. 53—Thermostatic Switch Removal

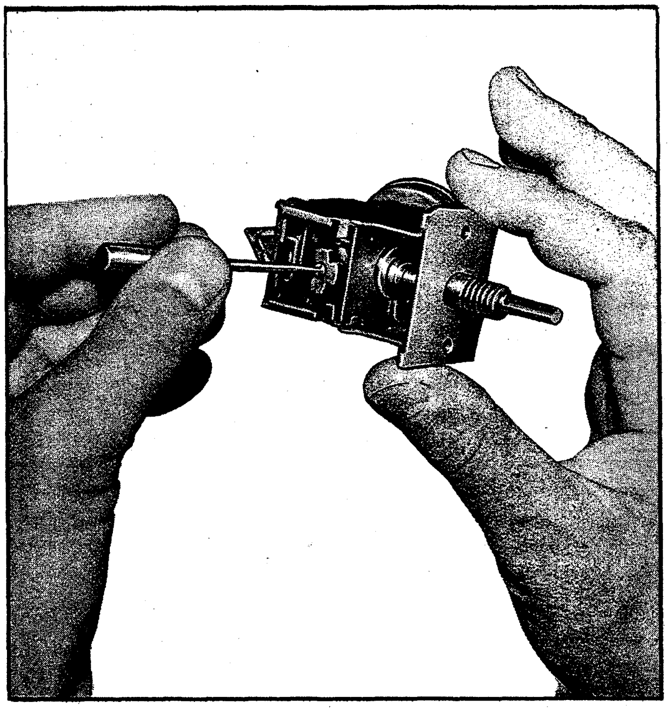


Fig. 54—Thermostatic Switch Adjustment

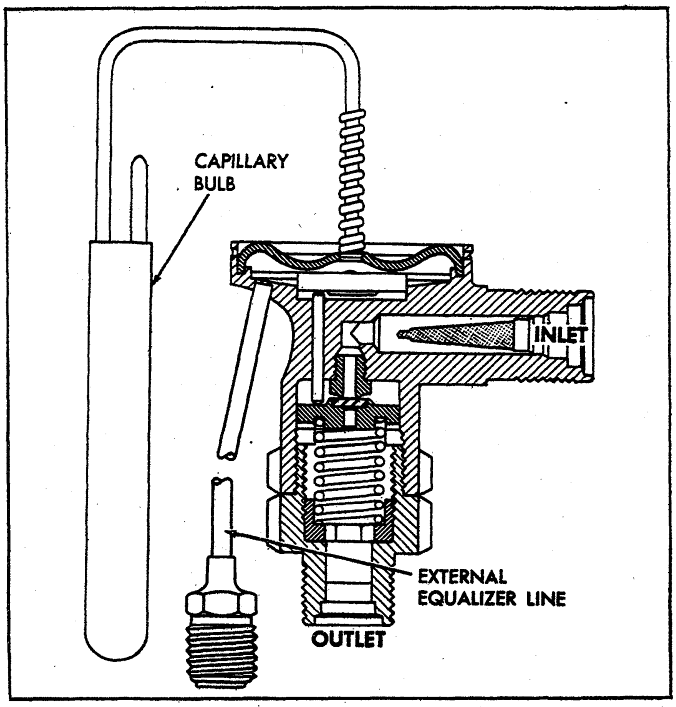


Fig. 55—Expansion Valve

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.

EVACUATING AND CHARGING PROCEDURES

1967 AIR CONDITIONING SYSTEM CAPACITIES

	Refrigerant Charge	Oil Charge
Four-Season Systems (Chevrolet and Chevelle)	3 lbs., 12 oz.	11 ozs. 525 viscosity
Universal System (Chevrolet, Chevelle and Camaro)	3 lbs.	11 ozs. 525 viscosity
Universal and All-Weather System (Chevy II)	2 lbs., 8 oz.	11 ozs. 525 viscosity

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.

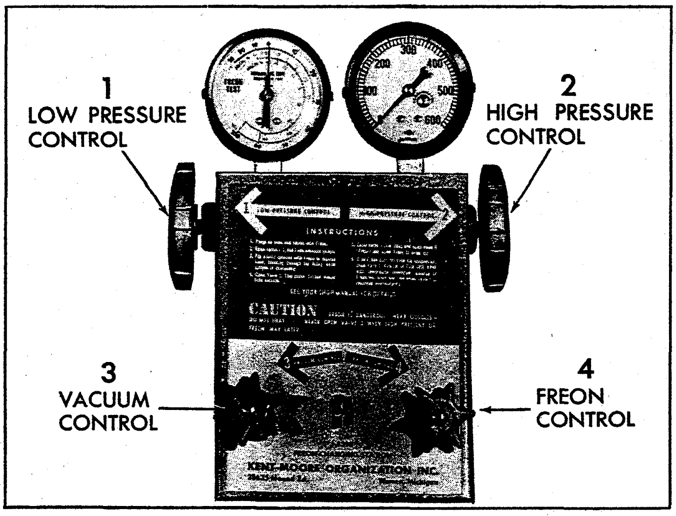


Fig. 56—Charging Station Controls

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 Sea 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 56. 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 56 and 57 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.
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. With High and Low pressure Valves (1 and 2) open, close Vacuum Control Valve (3) and open Freon Control Valve (4). Operating the heater and air conditioner blower with the controls set for cooling will help complete the charging operation.

NOTE: If the charge will not transfer completely from the station to the system, close the high pressure valve at the gauge set, set the air conditioning controls for cooling, check that the engine compartment is clear of obstructions, and start the engine. Compressor operation will decrease the low side pressure in the system.

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

CHECKING 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.

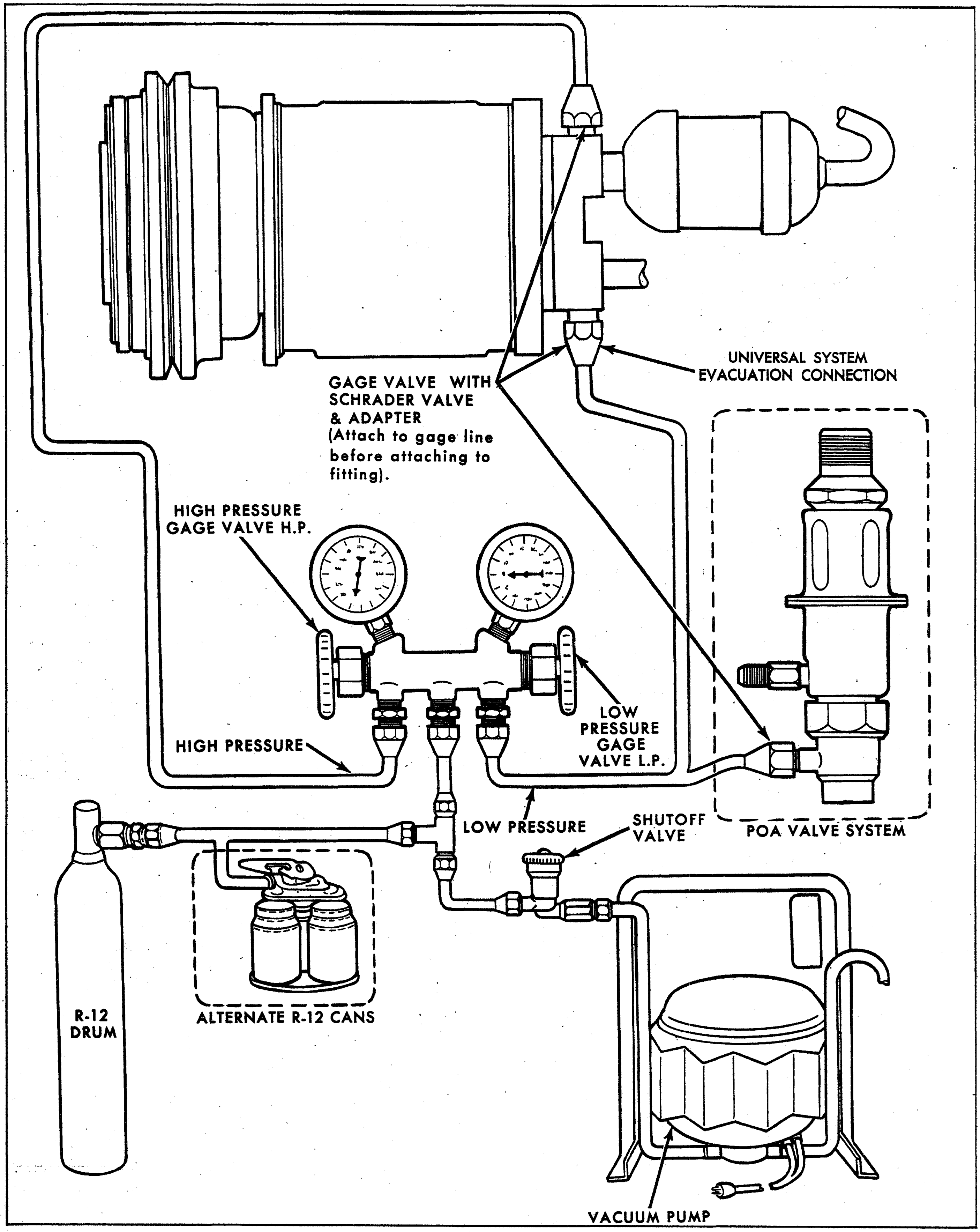


Fig. 57—Charging Schematic

- 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 refrigerant 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 specified volume of new refrigeration oil to the system.
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 ports. Do not set the compressor on the shaft end.

Adding Oil to the System

The system should be completely assembled and uncharged before adding oil. Use only uncontaminated refrigerant oil (525 viscosity) and add as follows:

1. Connect the low pressure line from the gauge set to the low pressure gauge fitting on the P.O.A. valve (Four-Season) or low pressure fitting on the compressor connector block (Universal System).
2. Connect the high pressure line from the charging station gauge set to the compressor muffler or high pressure side of the connector block.
3. Disconnect the high pressure line from the gauge set, make certain that the line is clean, and place the end in a graduated container.
4. Pour enough refrigerant oil into the container so that the required volume may be drawn into the system by the high pressure hose.
5. Close the high pressure valve at the gauge set, and open the low pressure valve.
6. Operate the vacuum pump to drop the pressure within the system and cause atmospheric pressure to force oil through the high pressure line into the system. When the oil level has dropped the required volume, pull the line out of the oil container and continue vacuum pump operation to force the oil contained in the line into the system.
7. Shut off the vacuum pump and connect the high pressure line to the gauge set. Open the high pressure valve and evacuate the system through the high and low pressure sides of the system. Complete the charging operation as outlined in Step 10 under "Evacuating and Charging System".

COMPONENT REPLACEMENT AND MINOR REPAIRS

REFRIGERANT LINE CONNECTIONS
"O" Rings

Always replace the "O" ring when a connection has been opened. When replacing the "O" ring, first dip it in refrigeration oil. Always use a backing wrench on "O" ring fittings to prevent the pipe 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	13	6
3/8	5/8	33	12
1/2	3/4	33	12
5/8	7/8	33	20
3/4	1-1/16	33	25

*Pound Feet

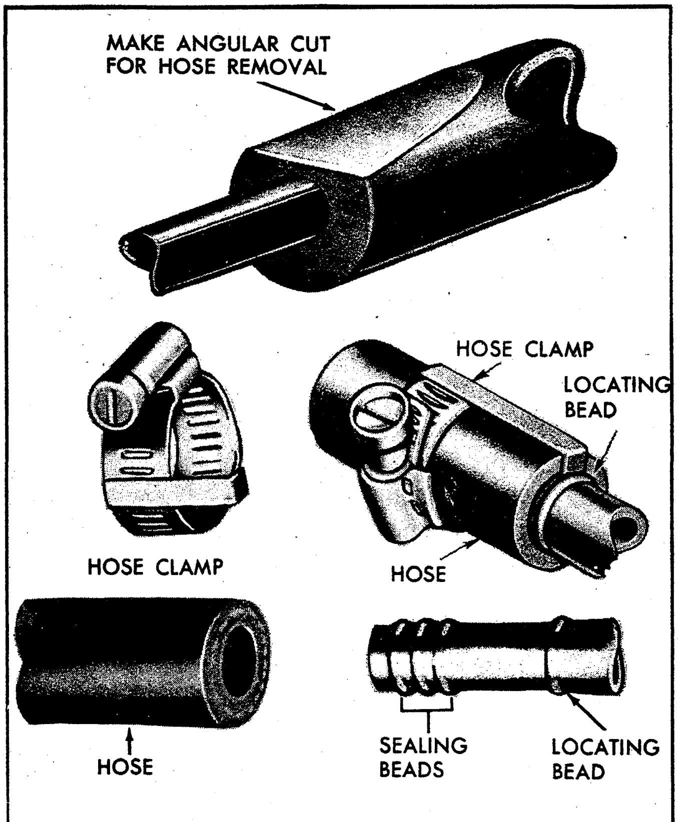


Fig. 58—Hose Clamp Connections

NOTE: Where steel to aluminum connections are being made, use torque for aluminum tubing.

Hose Clamps (Fig. 58)

When hose clamp connections are encountered special procedures are necessary for both installation and removal.

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 to 35-42 lb. in. (except Corvette) 30-38 lb. in. (Corvette). DO NOT RETORQUE.

Removal

1. Carefully, with a sharp knife, make an angle cut in the hose as shown in Figure 58. 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 reinstalled 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.

   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 tightness 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" in the Chassis Overhaul Shop Manual.

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.

PREPARING SYSTEM FOR REPLACEMENT OF COMPONENT PARTS

Air conditioning, like many other things, is farily 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 sytem.

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 which requires unsealing the refrigerant circuit 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.

FOREIGN MATERIAL IN THE SYSTEM

Whenever foreign material is found in the system, it must be removed before restoring the system to operation.

In the case of compressor mechanical failure, perform the following operations:

1. Remove the compressor.
2. Remove the receiver-dehydrator and discard the unit.
3. Flush the condenser to remove foreign material which has been pumped into it.
4. Disconnect the line from the receiver-dehydrator at the inlet connection of the expansion valve. Inspect the inlet screen for the presence of metal chips or other foreign material. If the screen is plugged, replace it. Reconnect the line to the expansion valve.
5. Install a new receiver dehydrator.
6. Install the replacement compressor.
7. Add the necessary quantity of oil to the system (one fluid ounce because of receiver-dehydrator replacement plus the quantity needed for the replacement compressor—see Checking Compressor Oil Charge under Checking Oil.
8. Evacuate and charge the system.
9. Check system performance.

CONDENSER

Chevrolet

Replacement

1. Remove the hood catch and hood catch - grille support.
2. With the system purged of refrigerant, disconnect the inlet and outlet hose clamp connections and the condenser to radiator support attaching screws.
3. Remove the condenser from the vehicle.

NOTE: If it is to be reused, cap or tape the receiver-dehydrator inlet and outlet connections at once.

4. Install new condenser, position the assembly and install the radiator support to condenser attaching screws and replace all line connections.
5. Replace the hood catch and grille support and its attaching bolts.
6. Replace the hood catch.
7. Evacuate, charge and check the system. Add one fluid oz. refrigerant oil after installing a new condenser.

Chevelle and Camaro

Replacement

1. Remove the hood lock catch support and catch.
2. With the system purged of refrigerant, disconnect the inlet and outlet hose clamp connections and the condenser to radiator support attaching screws.
3. Remove the condenser from the vehicle.

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

4. Install new condenser, position the assembly and install the radiator support to condenser attaching screws and replace all line connections.
5. Evacuate, charge and check the system. Add one fluid oz. refrigerant oil after installing a new condenser.

Chevy II

Replacement

1. Purge the refrigerant from the system.

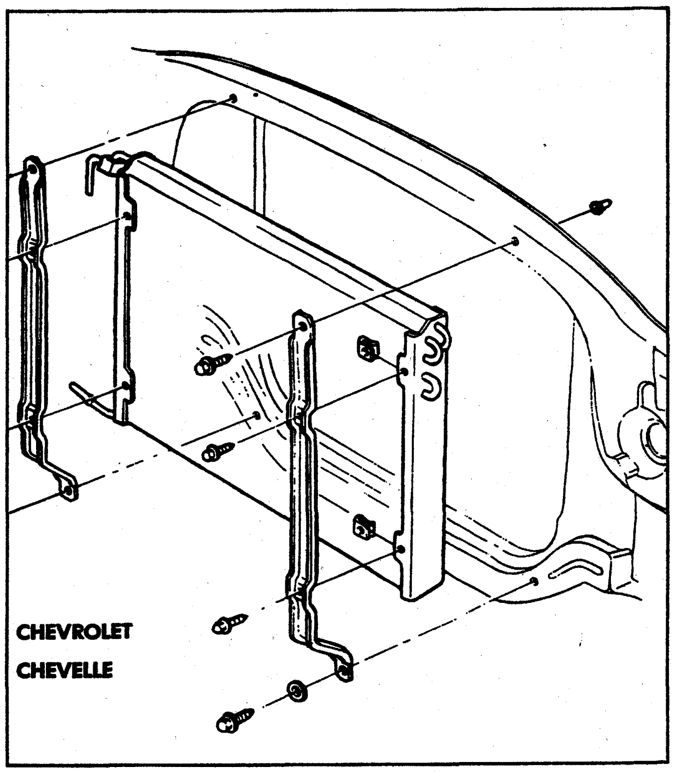


Fig. 59—Condenser Mounting (Chevrolet and Chevelle)

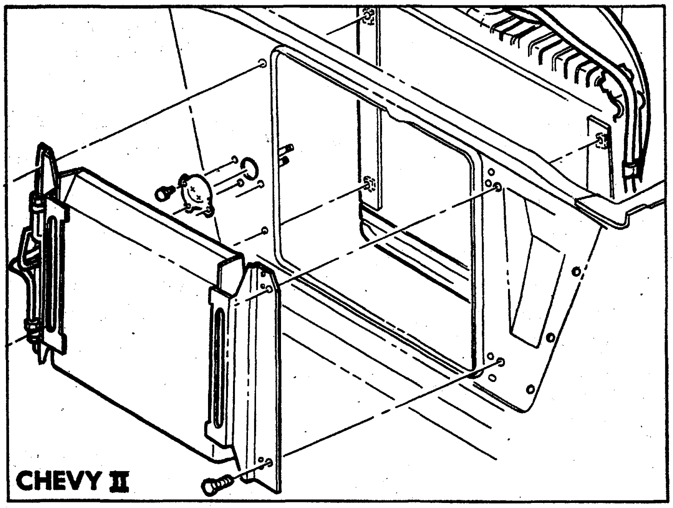


Fig. 60—Condenser Mounting (Chevy II)

2. Remove the bumper, bumper filler panel, grille, grille support, hood lock catch support and catch as described in Section 11, "Chassis Sheet Metal".
3. Disconnect connectors at condenser inlet and outlet tubes and remove screws attaching refrigerant line holding clips to the condenser baffle.
4. Remove bolts attaching condenser through 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. Add one fluid oz. of refrigerant oil after installing a new condenser.

Corvette

Replacement (Production Engine)

1. Remove the hood from the car, first scribing the hinge attachment location.
2. Purge the system of refrigerant.

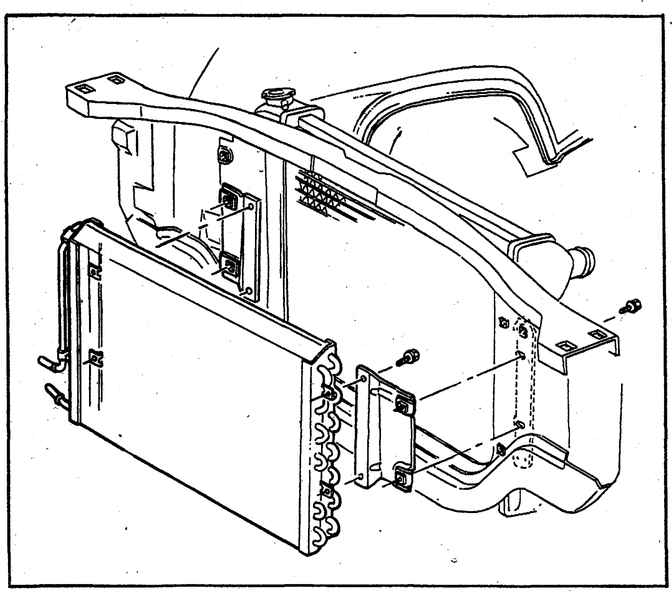


Fig. 61—Condenser Mounting (Camaro)

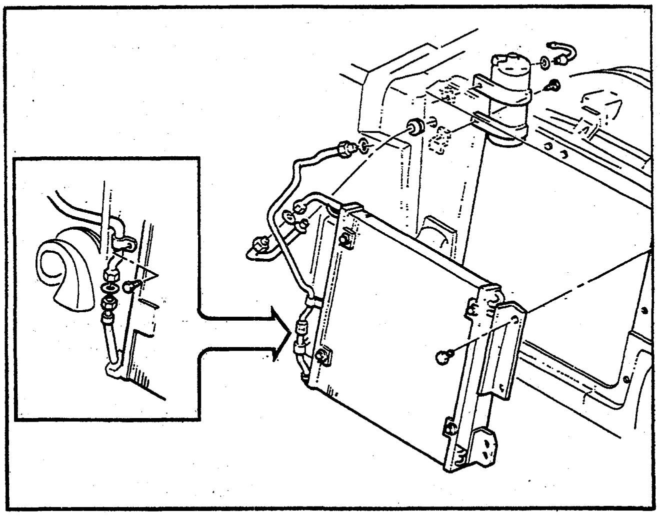


Fig. 62—Condenser Mounting (Corvette)

3. Disconnect the inlet line connection at the condenser inlet and the outlet line at the receiver-dehydrator. Cap the receiver-dehydrator immediately.
4. Remove the screws attaching the condenser to the radiator support and carefully lift the unit from the car.
5. Remove the receiver-dehydrator from the old condenser and install it, using a new "O" ring, on the new condenser.
6. Set new condenser in place on the radiator support and install the attaching screws, torquing them to 20 lbs. ft.
7. Make the inlet and outlet connections, using new "O" rings, and torque 13 lbs. ft.
8. Evacuate, charge and check the system. Add one fluid oz. of refrigerant oil after installing a new condenser.

Replacement (Optional Engine)

Replacement procedure remains much the same for the installation supplied with the optional engine except for the location of the receiver-dehydrator. Follow the steps given above except that the outlet line must be removed at the receiver outlet. (See Figure 64.)

RECEIVER-DEHYDRATOR

The receiver-dehydrator should be replaced if it has 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. 63):

> **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

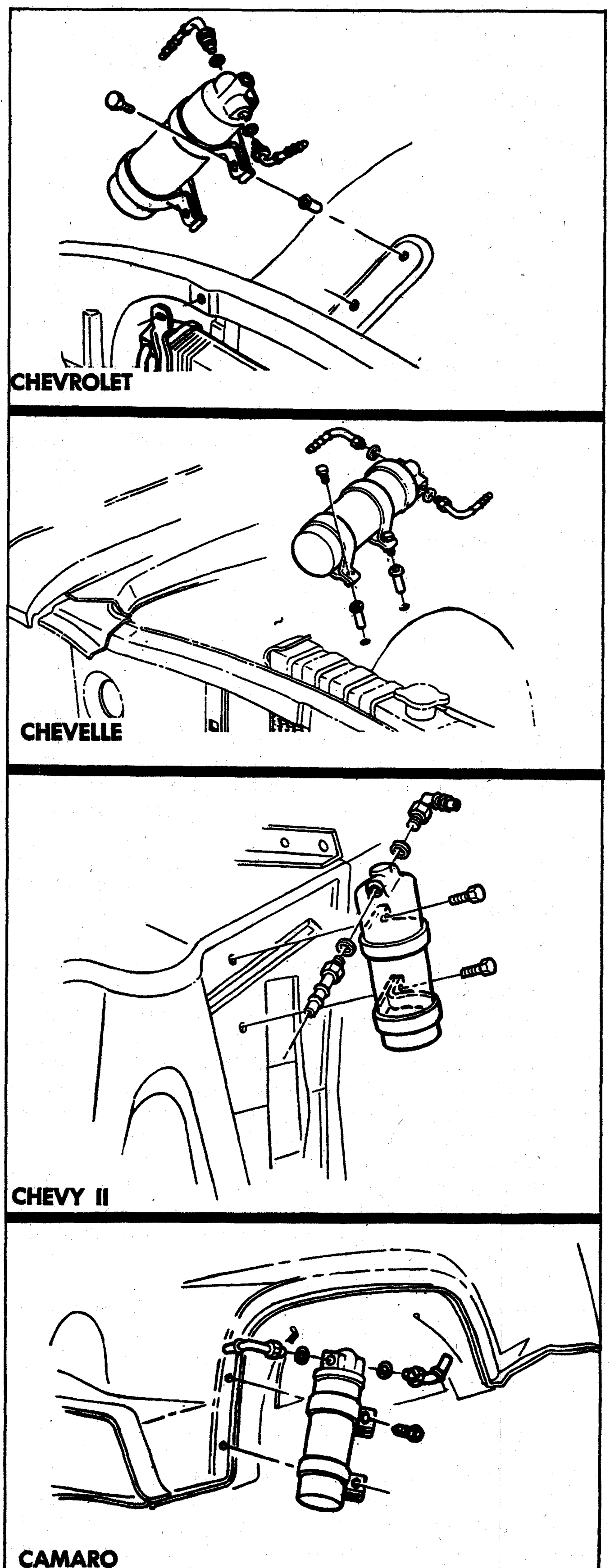


Fig. 63—Receiver-Dehydrator Mounting (Chevrolet, Chevelle, Chevy II, Camaro)

the last possible moment. Be certain that the direction of flow is correct before connecting the pipes.

Chevrolet, Chevelle, Chevy II, and Camaro

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.
4. Add one fluid oz. refrigerant oil, evacuate and charge the system.

Corvette

Replacement

1. Purge the system of refrigerant.
2. Disconnect the "O" ring inlet connection and the hose clamp outlet connection and tape the hose openings.
3. Remove the receiver-dehydrator to radiator support bracket screws (production engine) or receiver-dehydrator to condenser bracket screws (optional engine) and remove the unit from the car.
4. Install the new receiver-dehydrator applying 30 in. lbs. torque to the attaching screws.

   NOTE: Do not uncap the new receiver-dehydrator until the last instant before installation.

5. Connect the high pressure lines at the inlet (use a new "O" ring and torque connection to 13 ft. lbs.) and outlet (torque screw to 25 in. lbs.).
6. Add one fluid oz. refrigerant oil, evacuate, charge and check 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 65.)

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 and Camaro Four-Season System

The evaporator and blower case assembly is designed so that the core may be removed without the 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.

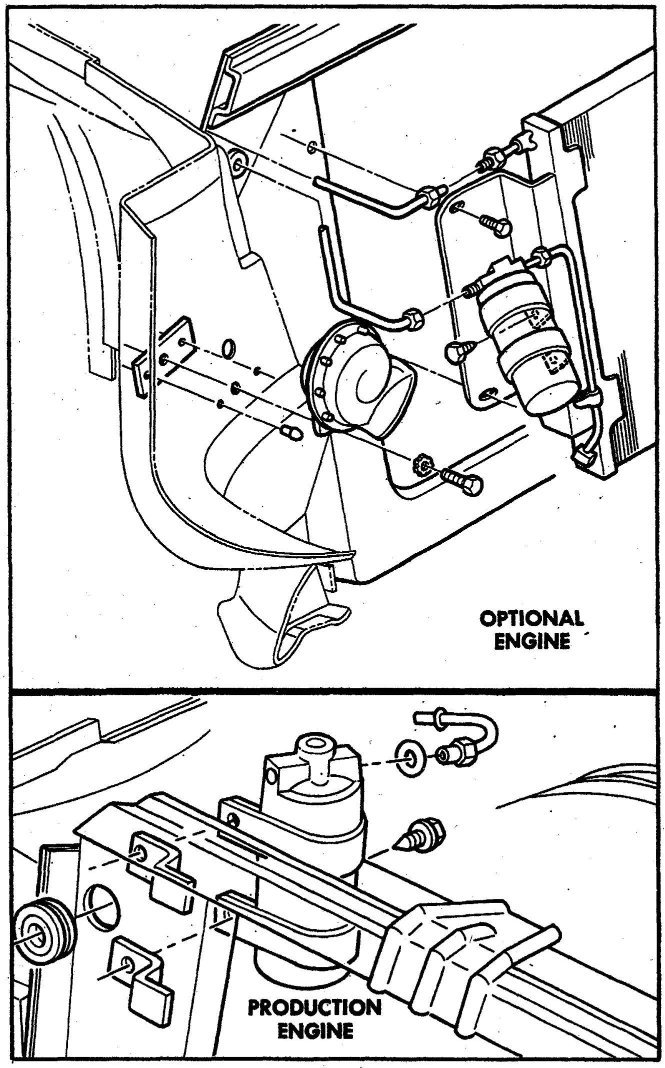


Fig. 64—Receiver-Dehydrator Mounting (Corvette)

3. To gain access to the blower motor end of the assembly, remove the fender and 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 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.
5. Add three fluid oz. refrigerant after installing a new core, evacuate and charge the system.

Comfortron

The evaporator assembly is nearly identical to that of the Four-Season system, and, with the exception of additional wiring and vacuum hoses, service procedures are the same.

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 an 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. Add three fluid oz. refrigerant oil after installing a new core.
7. Replace the fender skirt and hood hinge.

Universal System All Vehicles

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.

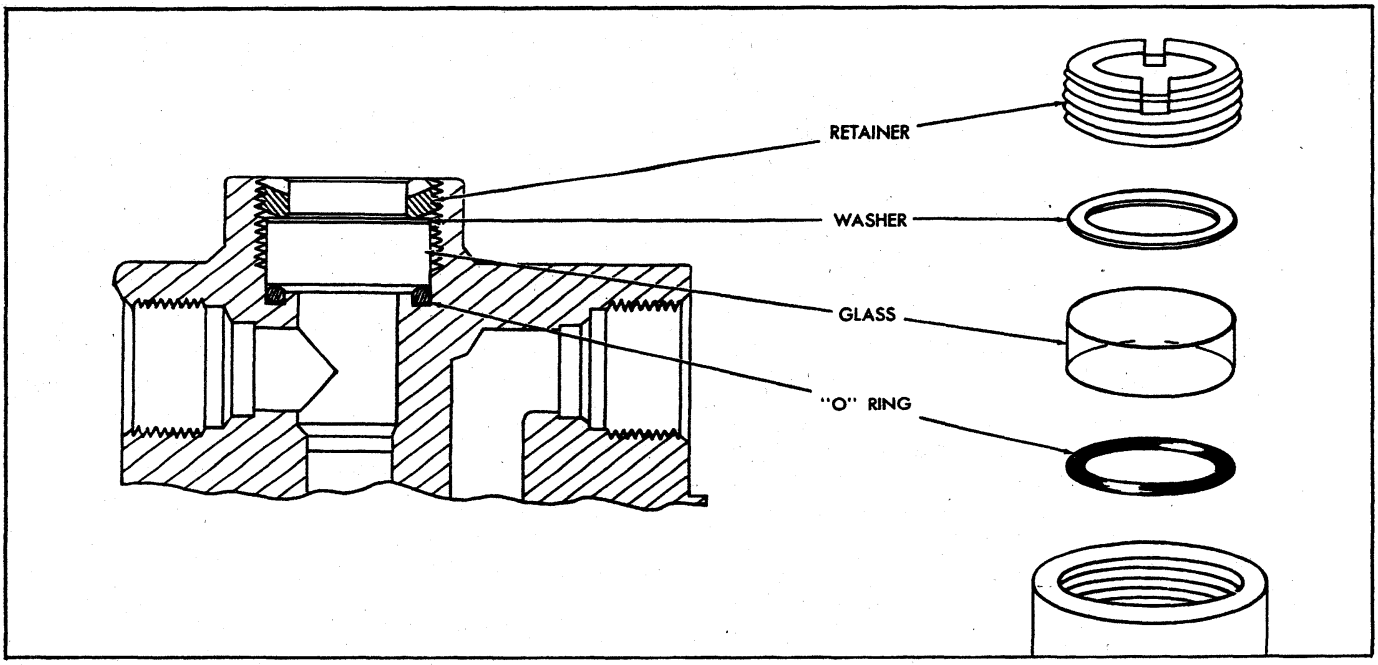


Fig. 65—Sight Glass Replacement

Removal

1. Purge the system.
2. Disconnect the refrigerant lines at the right rear of the unit.
3. Remove the unit from the dash. Disconnect all electrical connectors.
4. Remove the front cover, withdraw the thermostatic switch capillary, and separate to the case halves.
5. Remove the clamps from the evaporator inlet and outlet pipes.
6. Remove the screws which attach the evaporator to the case and remove evaporator.
7. Loosen the clamp which mounts the capillary bulb to the evaporator. Disconnect the inlet and outlet pipes from the expansion valve and remove the expansion valve.

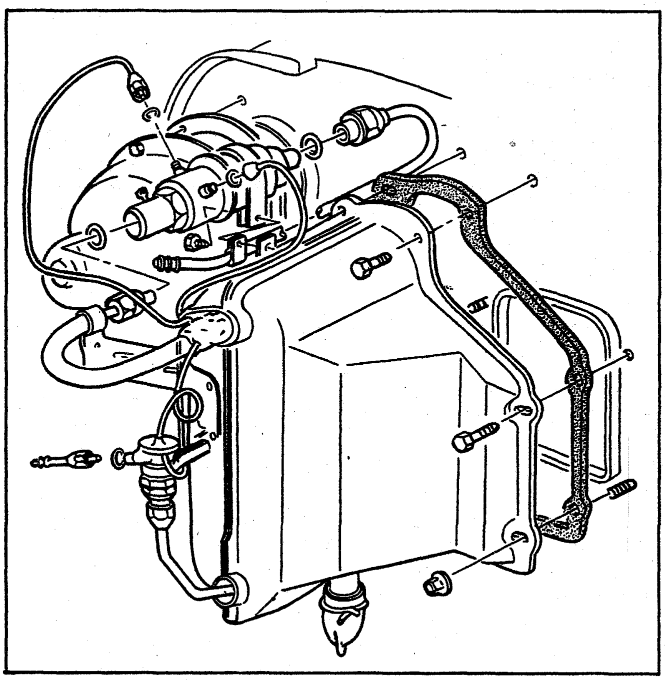


Fig. 66—Evaporator Mounting (Chevrolet and Camaro)

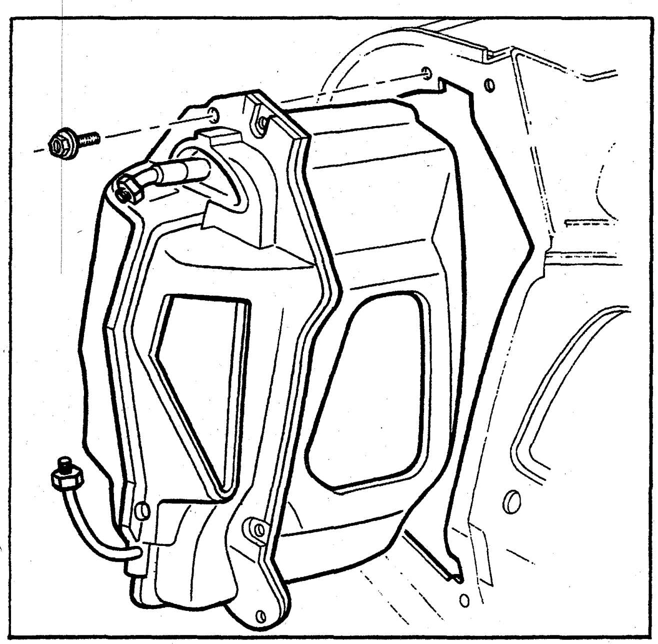


Fig. 67—Evaporator Mounting (Chevelle)

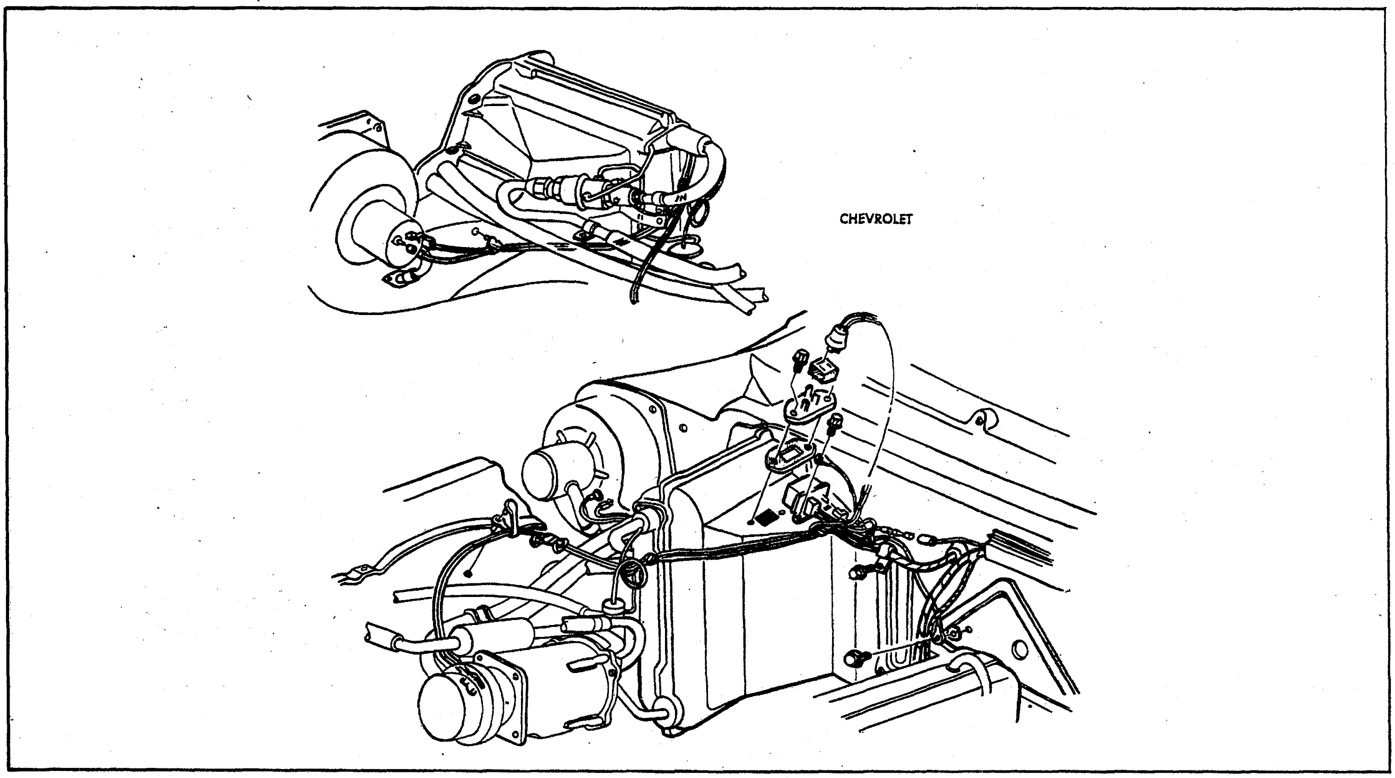


Fig. 68—Wiring and Vacuum Lines—Four-Season (Chevrolet)

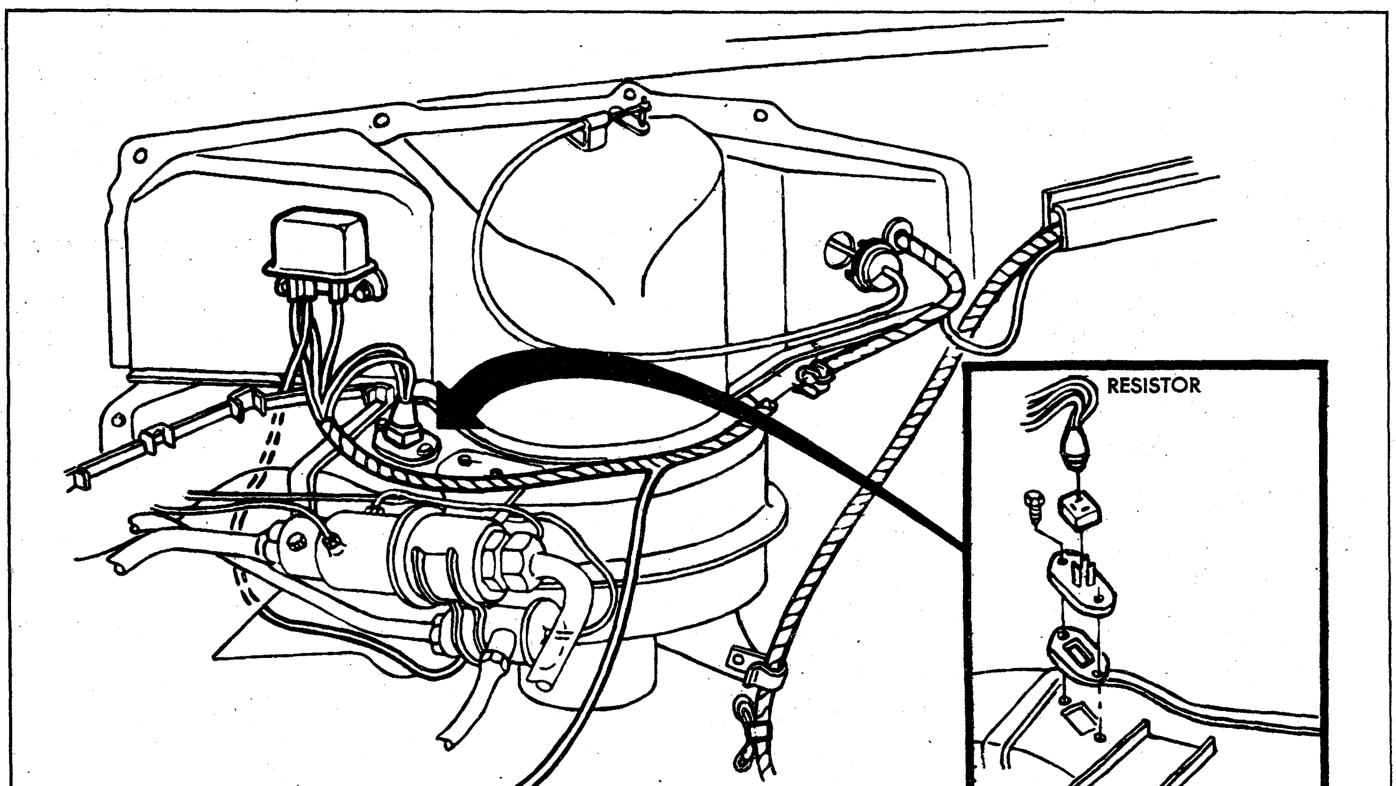


Fig. 69—Underhood Wiring—Four-Season (Chevelle)

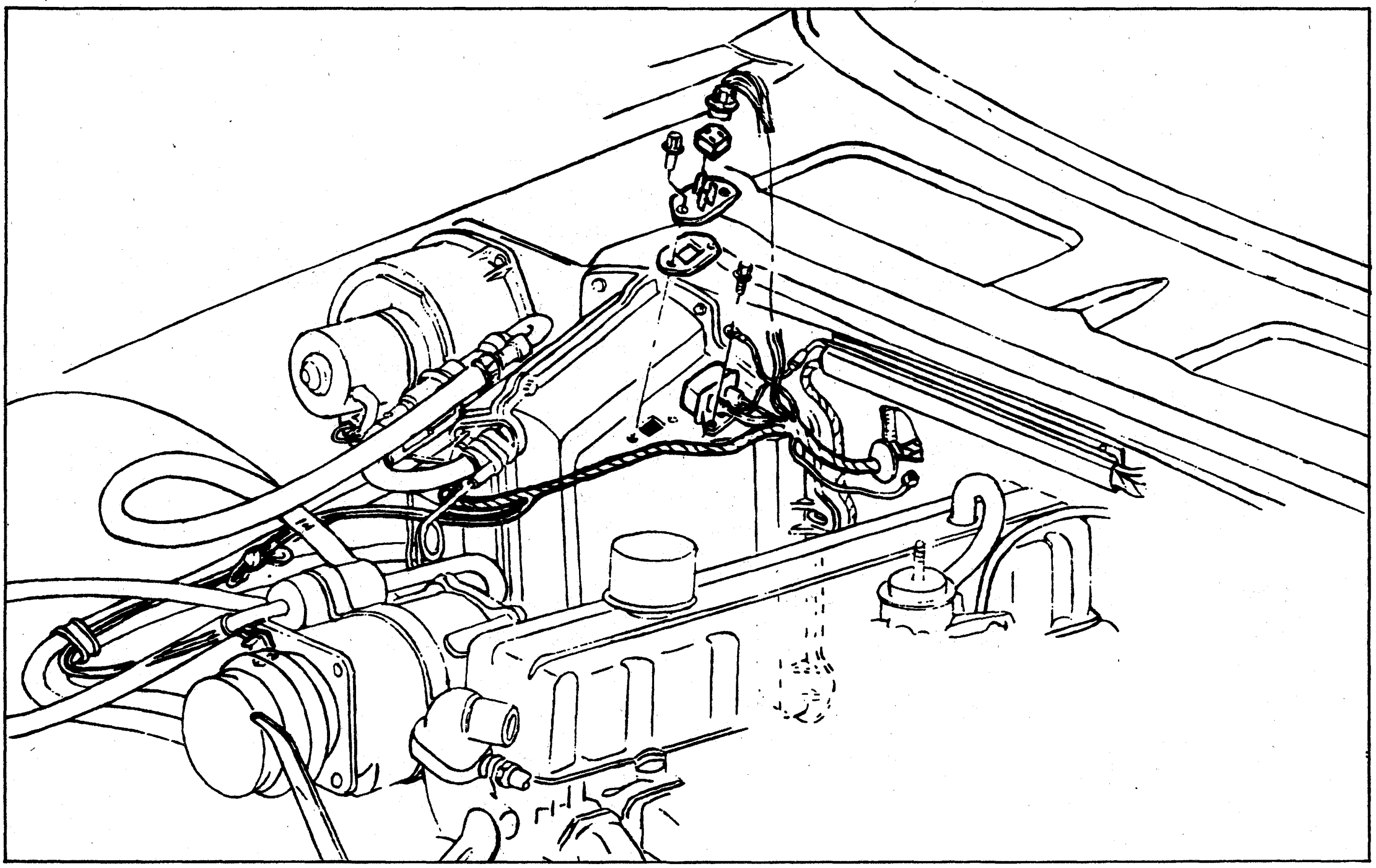


Fig. 70—Wiring and Vacuum Lines—Four-Season (Camaro)

Installation

1. Connect the expansion valve to the refrigerant pipes. Attach the capillary bulb to the evaporator.
2. Attach the evaporator to the case. Attach the inlet and outlet pipes clamps.
3. Assemble the case halves. Insert the capillary tube from the thermostatic switch between the fins as shown in Figure . Attach the cover plate to the case.
4. Mount the unit to the dash and connect the refrigerant lines.
5. Evacuate and charge the system. If a new evaporator was installed, add three fluid ounces of refrigerant oil to the system before charging.
6. Test system operation.

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.
3. Remove the screw, nut, spacer bracket and grommet from the outlet connection pipes.

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. 75).
6. Remove the two shield attaching screws and shield (A, fig. 76) which covers the lower right evaporator bracket-to-blower bracket attaching screw (B, fig. 76), 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. 76).
8. Reaching through the glove box door and ash tray openings, remove the two nuts and washers (D, fig. 76) 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. 77) 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 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.

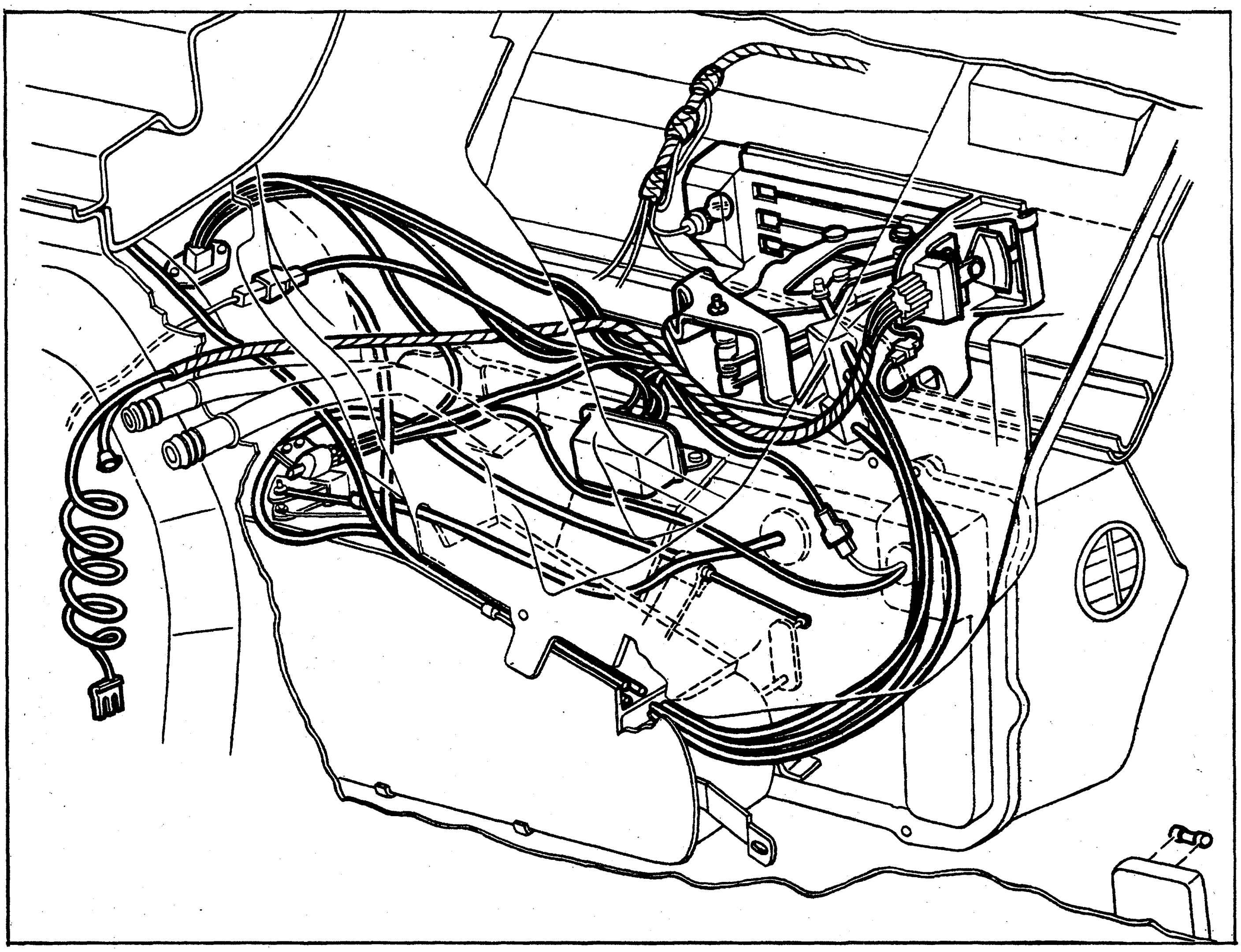


Fig. 71—Wiring—All Weather (Chevy II)

1. 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 nuts beneath the control knobs.
2. Remove the screws (located in the outer ball outlets) 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.

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.
   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.

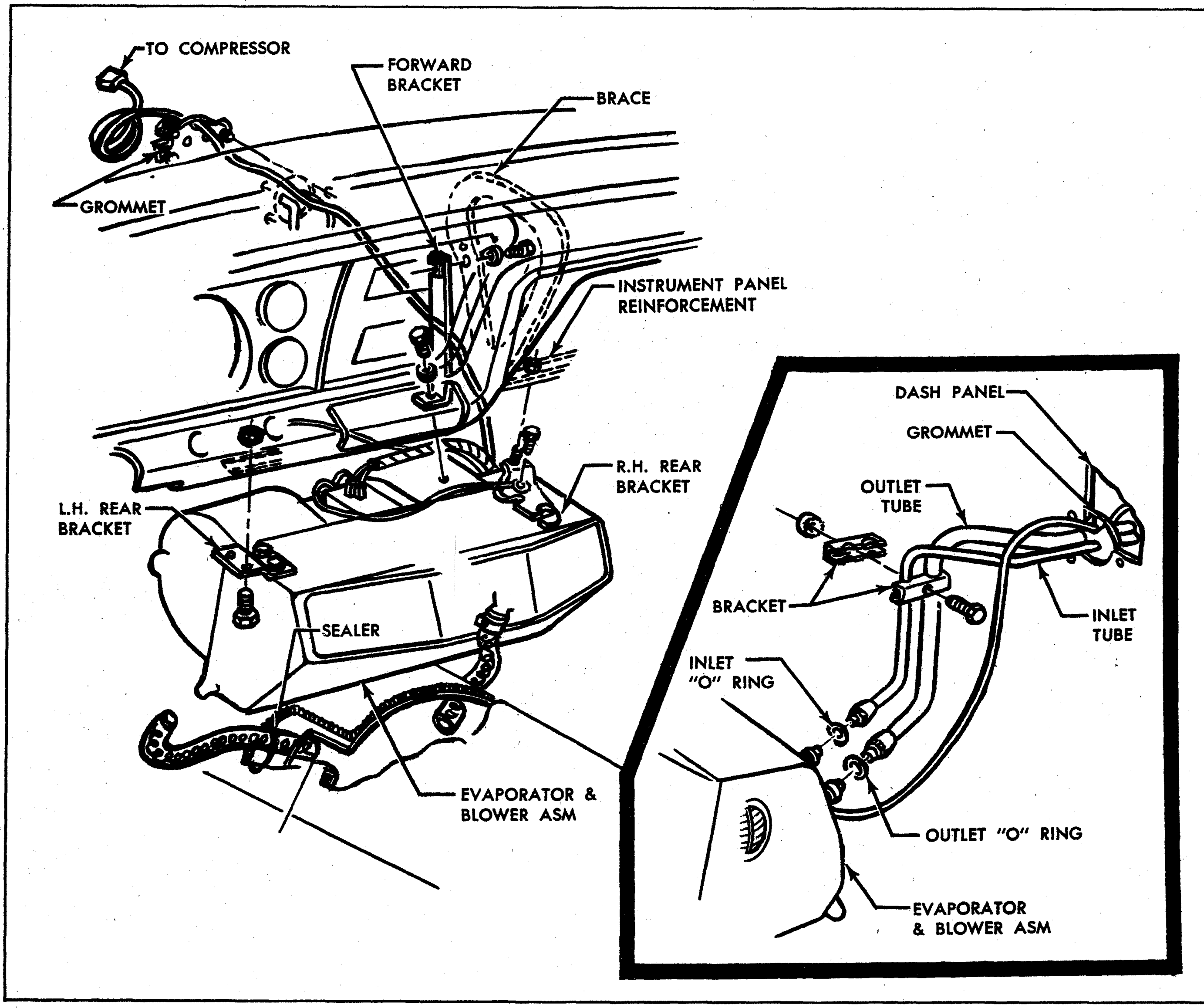


Fig. 72—Evaporator Mounting—Universal Unit

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

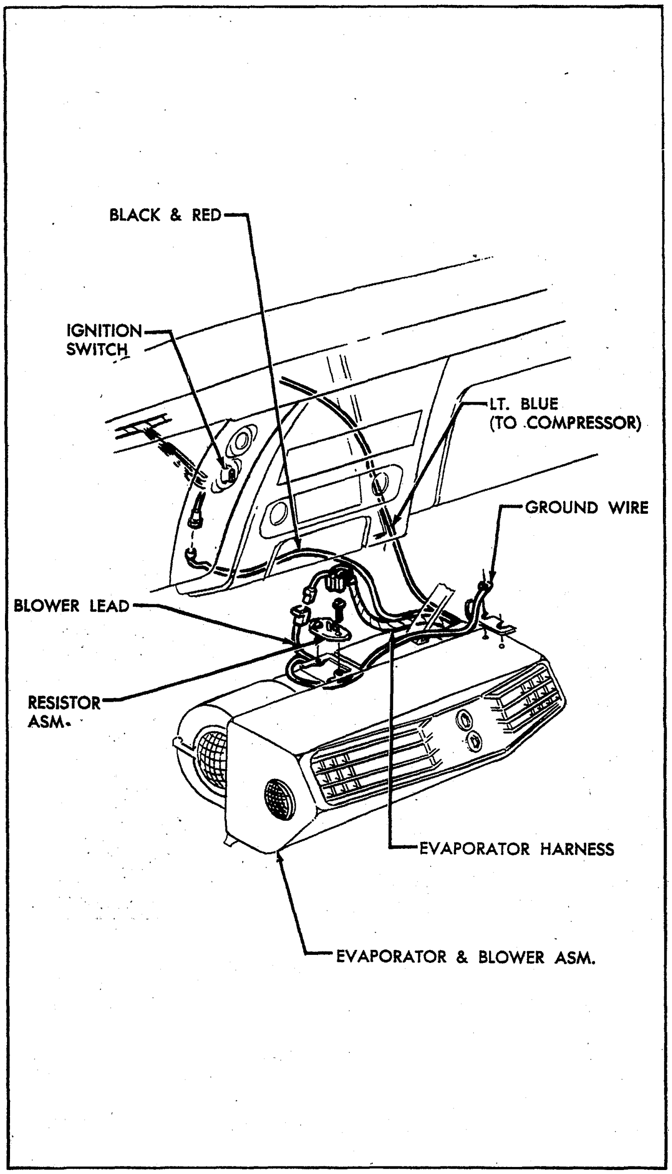


Fig. 73—Underdash Wiring—Universal System (Typical)

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. Add three fluid oz. refrigerent oil after installing a new core.
14. Check system performance.

Corvette

Replacement (Fig. 78)

1. Purge the system of refrigerant.
2. Drain the engine radiator. Then remove the radiator supply tank from its brackets, the heater water valve and vacuum line from the firewall, and the heater hoses from the core pipes. Carefully fold the hoses, valve and tank away from the evaporator case.
3. Remove the right hand hood lock support.

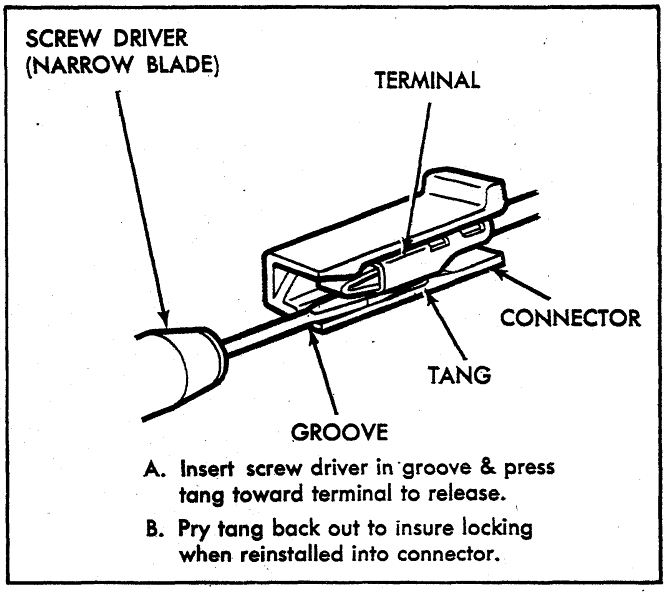


Fig. 74—Terminal Removal—Universal System

4. Disconnect the expansion valve equalizer line connection and the evaporator oil bleed line from the POA.
5. Disconnect the evaporator outlet to POA inlet connector.
6. Remove the POA bracket to evaporator case attaching bolts. Then carefully move the valve and its outlet hose away from the evaporator case.

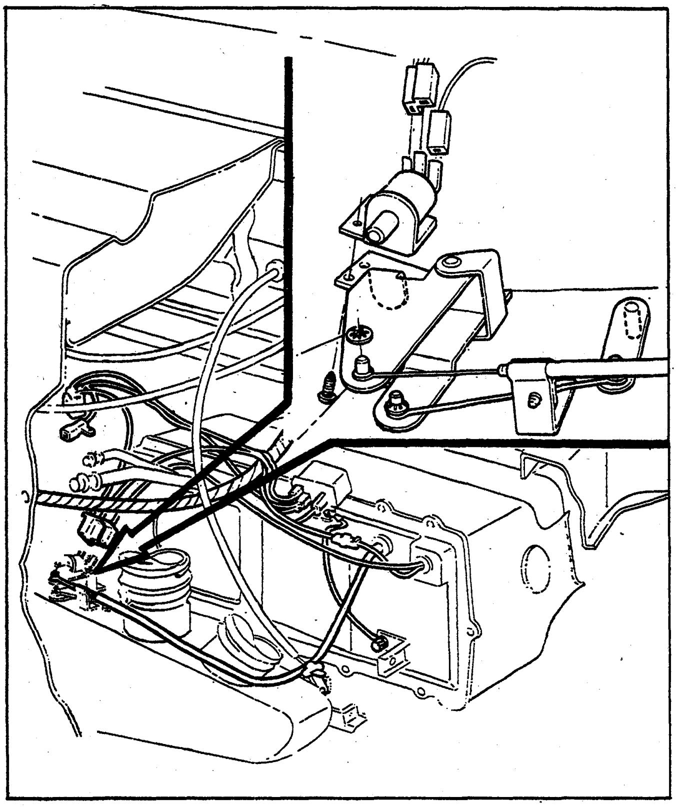


Fig. 75—Cable Removal—All Weather

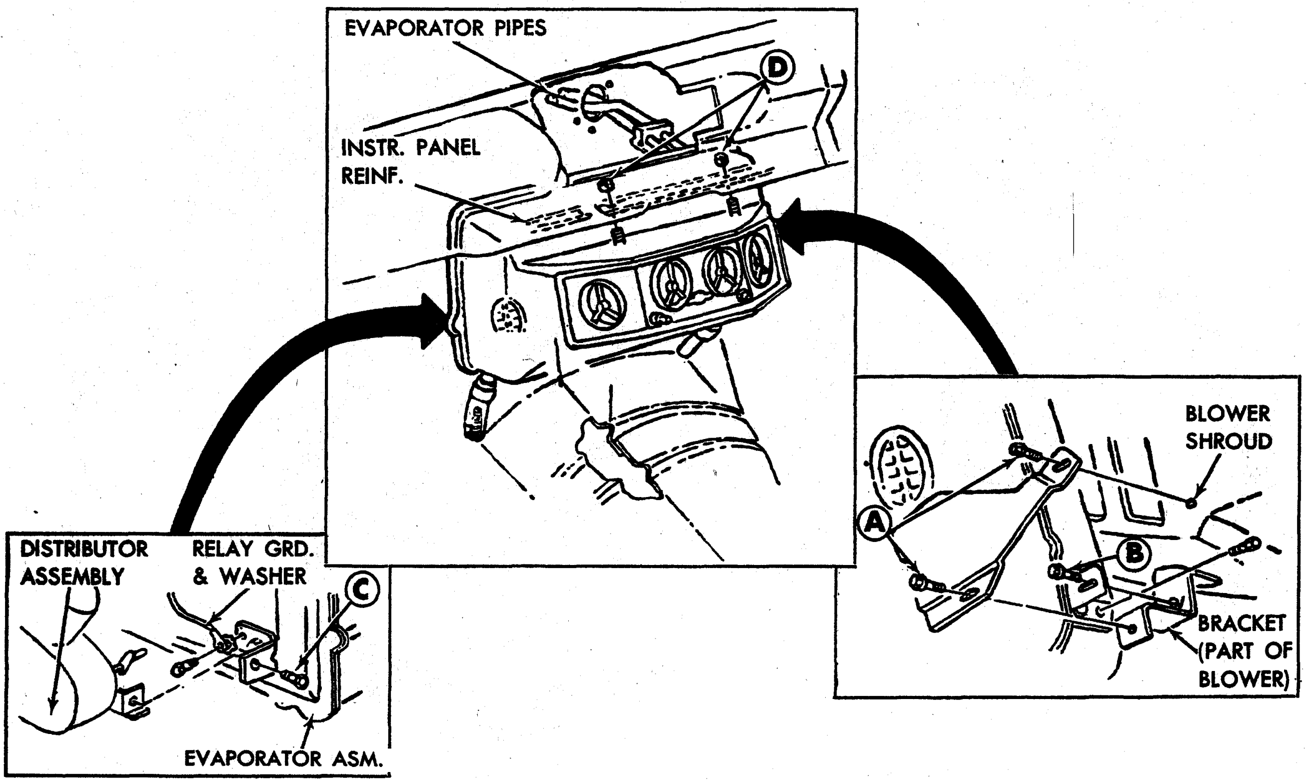


Fig. 76—Evaporator Removal—All Weather

7. Disconnect the thermostatic expansion valve to evaporator inlet connector, remove the power element bulb from the evaporator outlet line and carefully move the valve and its inlet hose away from the evaporator case.
8. Remove the electrical connectors from the relay and resistor terminals.
9. Remove the screws attaching the evaporator case cover to the case. See Fig. 79. The core is bracket mounted to the cover and the entire core and cover assembly may now be removed from the vehicle.
10. Remove the two cover to core bracket screws and separate the core from the cover.
11. Install the new core to the cover being sure that the grommets are properly installed around the inlet and outlet lines.
12. Reinstall the core and cover assembly into the evaporator case and replace the attaching screws.
13. Reinstall the STV and expansion valves, the equalizer line connection and the evaporator oil bleed line from the STV.

    NOTE: Use all new "O" rings.
14. Reinstall the radiator supply tank, water valve and vacuum line, and replace the heater hoses onto the core pipes being sure not to switch the hoses. Then refill the radiator.
15. Add three fluid oz. refrigerant oil after installing a new core, evacuate and charge the system.

EXPANSION VALVE

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

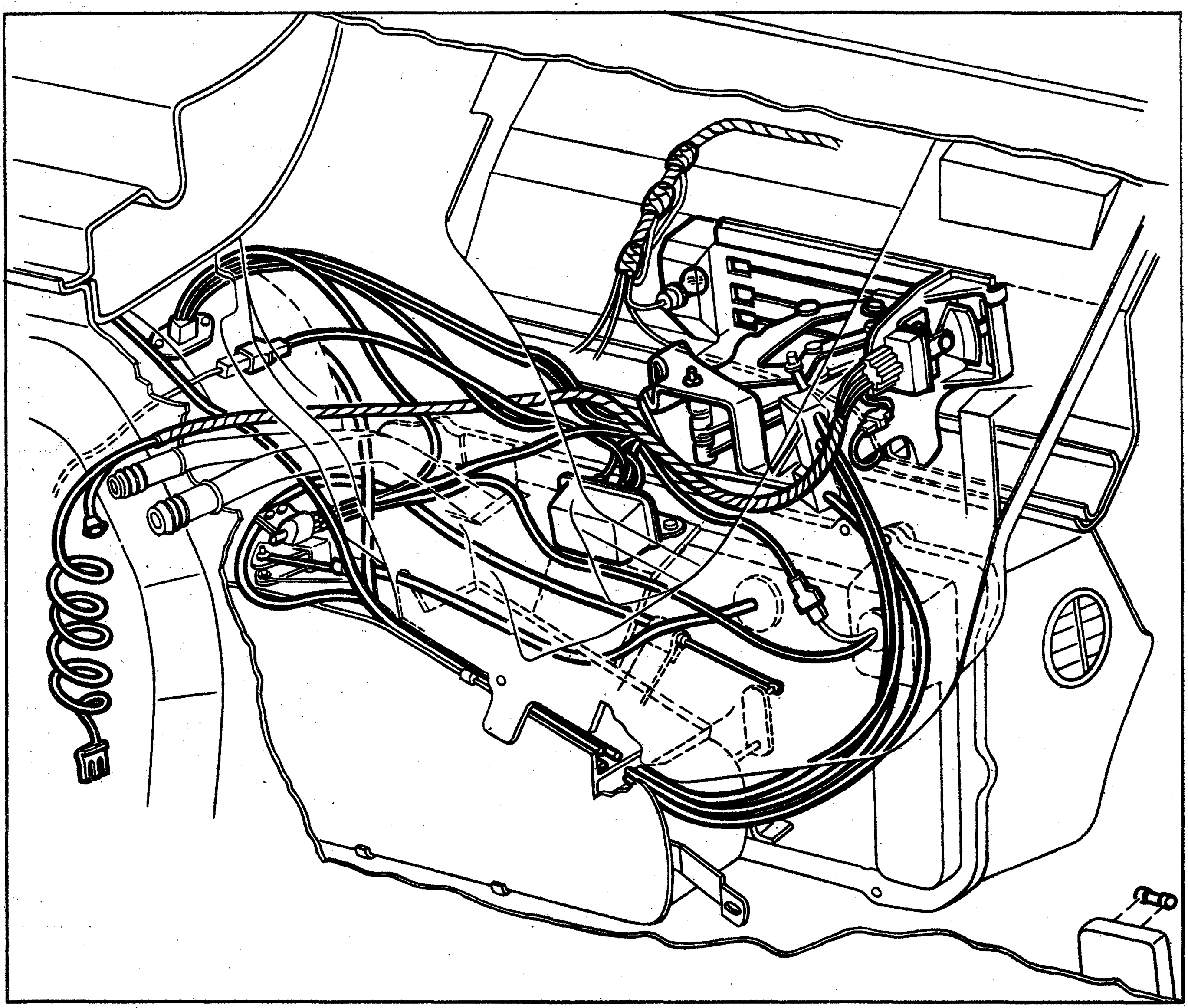


Fig. 77—Underdash Wiring—All Weather

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 thermo-bulb, 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, Chevelle, Corvette, and Camaro

Replacement

1. Purge the system and, on Chevelle models, drop the right fender skirt.
2. Remove the expansion valve power element bulb from the low pressure line and the equalizing line from the POA 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 blower 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.

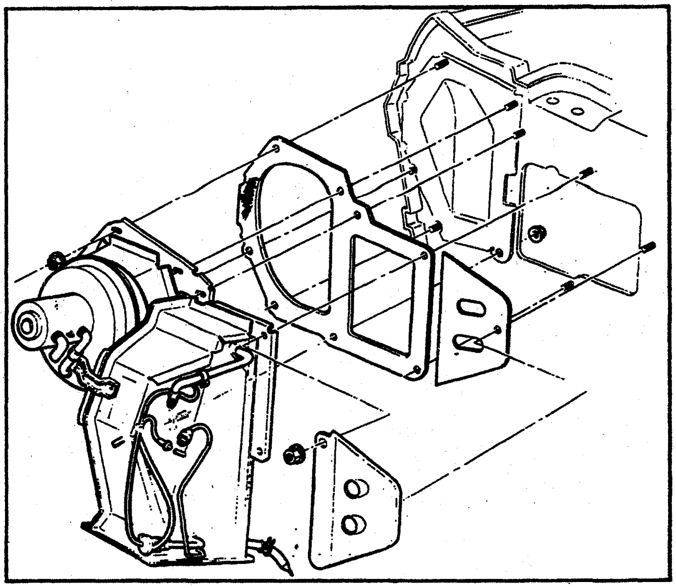


Fig. 78—Evaporator Mounting (Corvette)

7. Check the system for proper operation.

Universal System

Follow the procedure outlined under "Evaporator" for the Universal System.

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."

EVAPORATOR CONTROL VALVE (POA)

(Chevrolet, Chevelle, Camaro, Corvette)

No repairs or adjustments are available on the POA valve. A malfunctioning valve must be replaced. Figures 80, 81, 82 and 83 illustrate valve installation on the above vehicles.

THERMOSTATIC SWITCH OR BLOWER SWITCH

Universal System

Removal

1. Remove the screws attaching the cover plate to the unit and pull the cover rearward.
2. (Fin sensing type) Remove the thermostatic capillary tube from the evaporator core to permit access to the back of the cover plate.

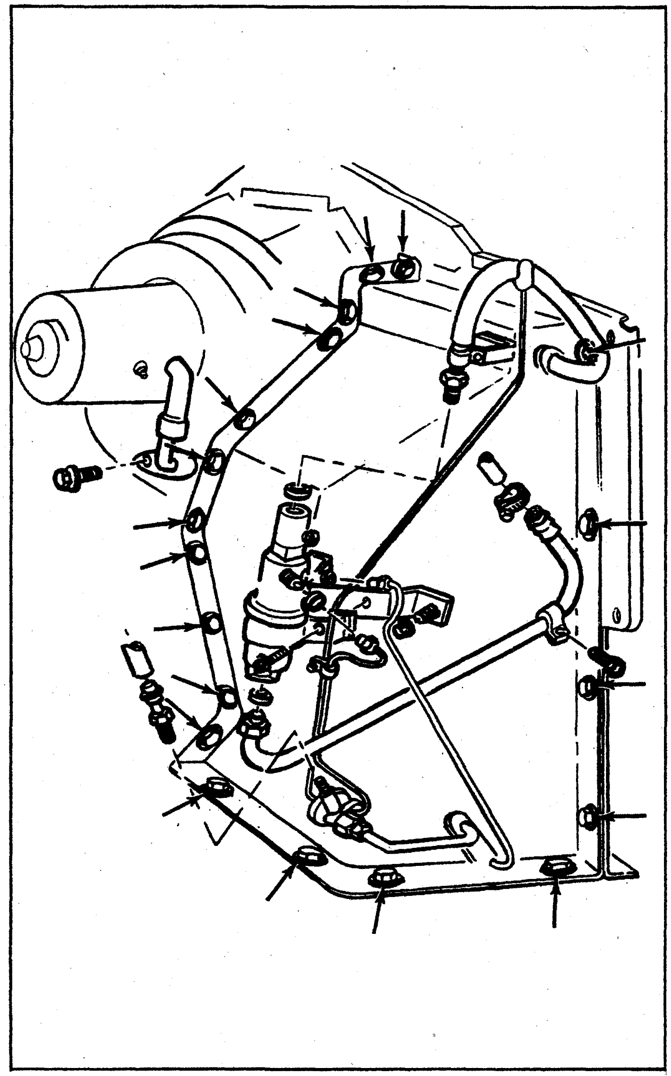


Fig. 79—Evaporator Core Removal (Corvette)

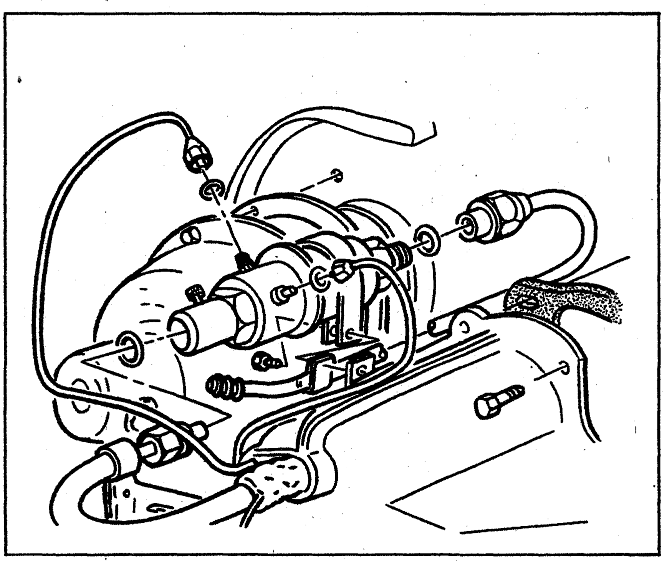


Fig. 80—P.O.A. Installation (Chevrolet)

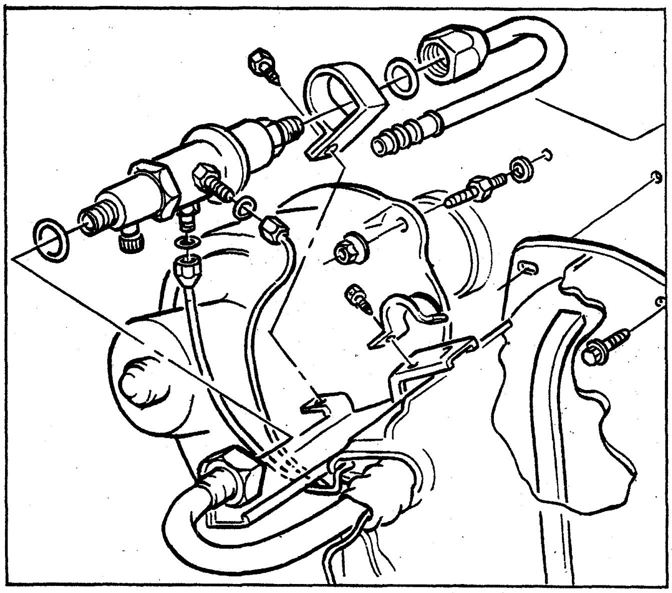


Fig. 81—P.O.A. Installation (Camaro)

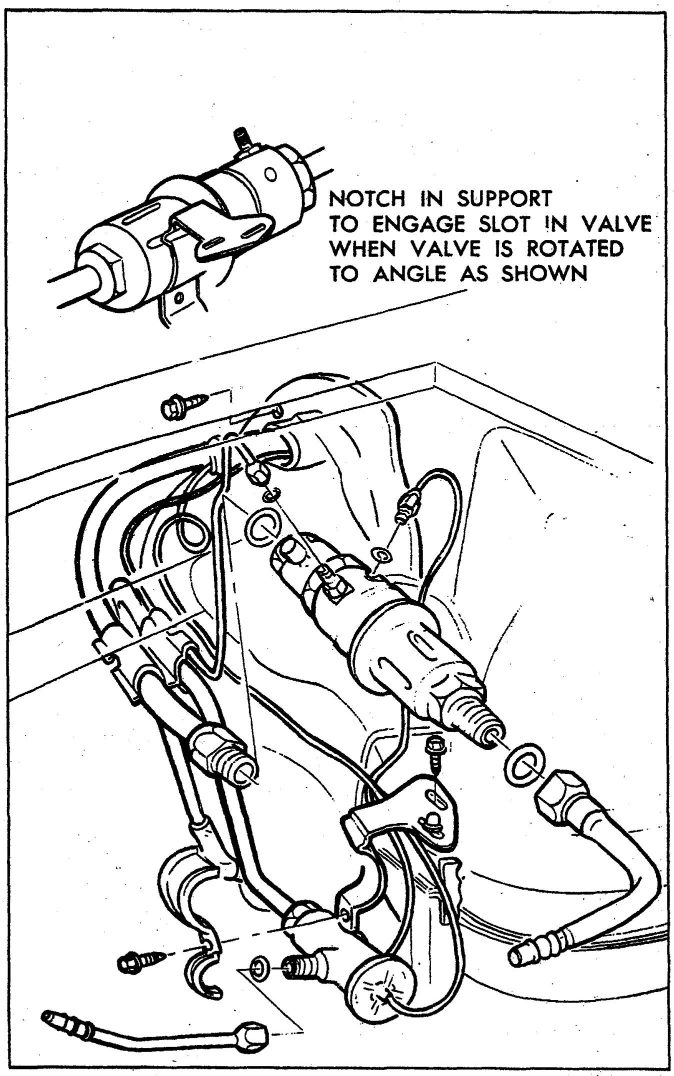


Fig. 82—P.O.A. Installation (Chevelle)

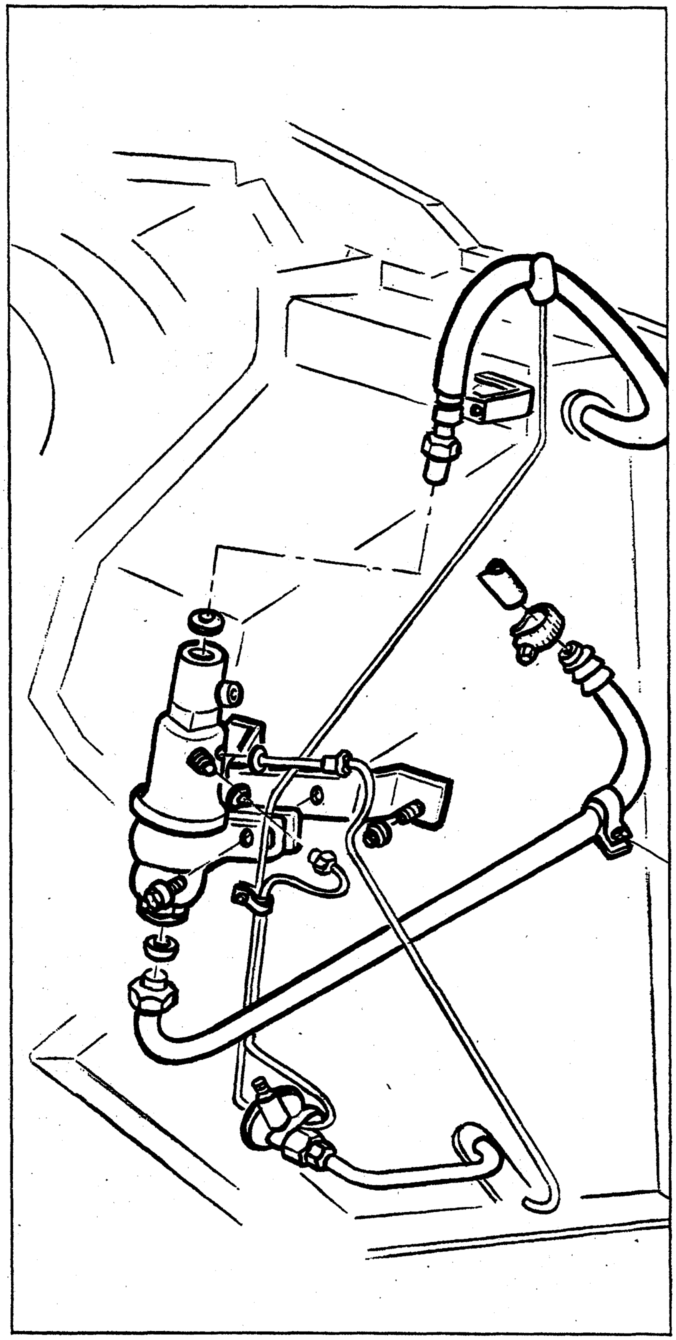


Fig. 83—P.O.A. Installation (Corvette)

3. Remove the electrical connector at the switch to be replaced.
4. Remove the switch knob. Remove the switch retaining screws and switch.

Installation

1. Insert replacement switch into face plate and attach.
2. Install the switch knob and connect the wiring connector.
3. If the thermostatic switch is being replaced, the capillary tube should be formed to the same shape as the unit removed.
4. Attach the capillary to the core (fin sensing type) and replace the face plate and attaching screws.

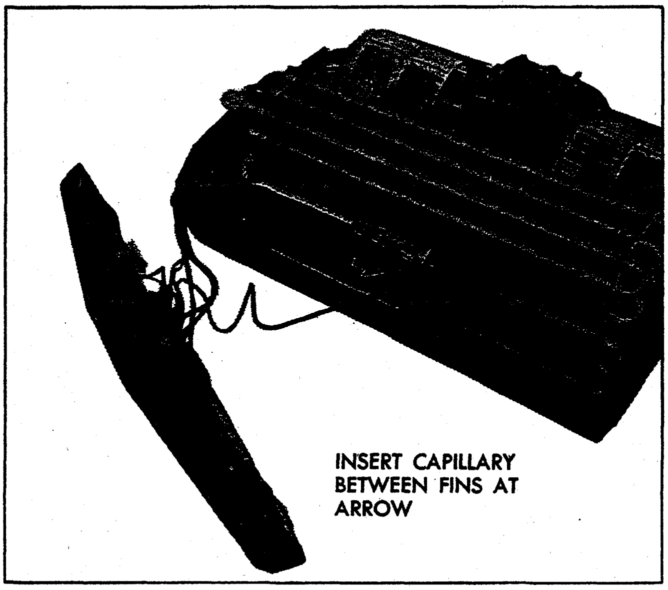


Fig. 84—Thermostatic Switch Capillary Installation

All-Weather System (Thermostatic Switch Only) Chevy II

Replacement (See Fig. 85)

1. Remove both control knobs and control stem bezels from the evaporator assembly.
2. Remove the face plate attaching screws located in the outer ball outlets 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. 84).
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.

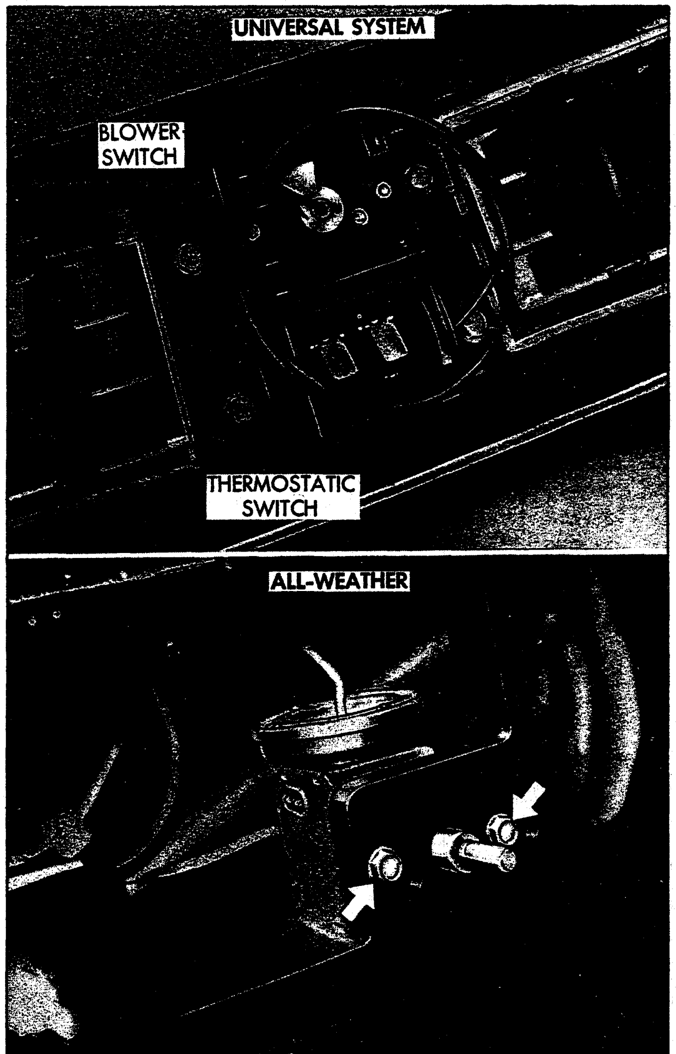


Fig. 85—Thermostatic Switch Removal

ALL-WEATHER—PULL CABLE

All-Weather System

Chevy II

Removal

1. Remove the evaporator unit as outlined under EVAPORATOR.
2. Remove the screws which attach the front and rear case halves.
3. Remove clamp from the evaporator pipes and separate case halves.
4. Remove face plate retaining screws located in outer ball outlets.
5. Remove control knobs and retaining nuts.
6. Remove face plate.
7. Remove cable to case retaining screw and thermostatic switch mounting screw.
8. Remove evaporator to case mounting screws.
9. Withdraw evaporator with cable and thermostatic switch assembly. Be careful to prevent kinks in the thermostatic capillary.
10. Pull the cable out toward the air outlet side of the evaporator.

Installation

1. Pass the replacement cable through the same channel in the evaporator fins. If a new evaporator is being installed, a channel will need to be opened between the evaporator fins. This may be done by pushing a pointed pencil between the fins beginning at the air outlet side of the core, two inches to the right of the left side of the fins and between the third and fourth tubes down from the top. The cable channel should exit at the air inlet side of the core between the first and second tubes down from the top.

2. Insert the evaporator assembly into the outlet case half and mount the evaporator, thermostatic switch, and cable to the case.
3. Install the face plate to the case and install control retaining nuts and knobs.
4. Assemble the case halves and mount the evaporator pipe clamp.
5. Install the evaporator assembly as previously described under EVAPORATOR.

BLOWER ASSEMBLY

Four-Season System

Chevrolet and Camaro

Removal

1. Disconnect battery ground cable.
2. Remove the right front fender and skirt assembly.
3. Disconnect the motor wire at the flange connector.
4. Disconnect the rubber air cooling tube from the motor.
5. Remove the motor to case attaching screws and remove the blower assembly. If the sealer acts as an adhesive, pry the assembly carefully away from the case.
6. Remove the blower from the motor shaft.

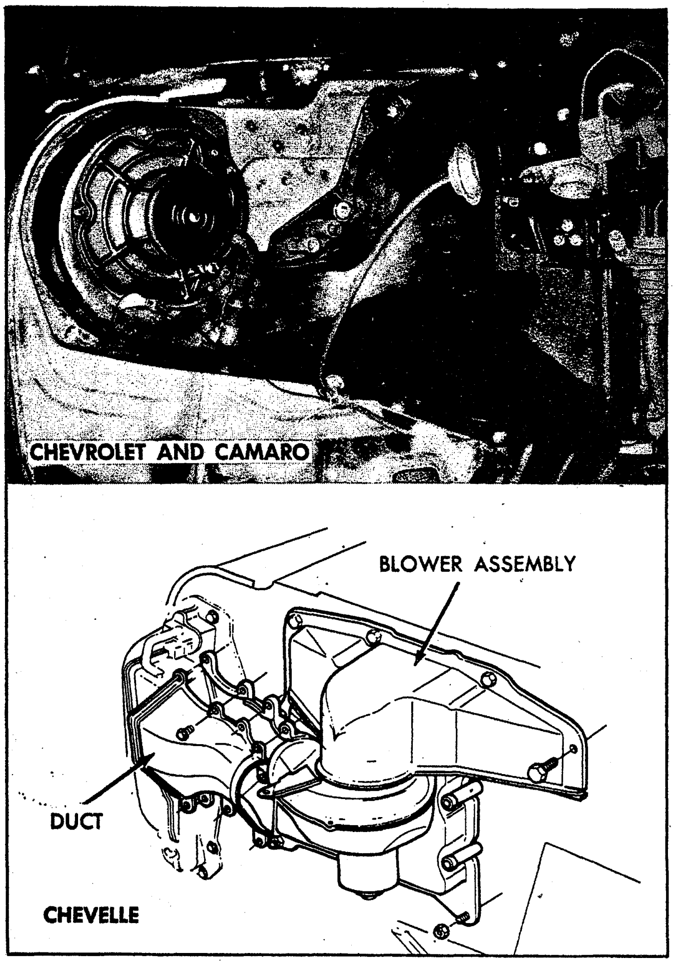


Fig. 86—Blower Assembly—Four-Season (Chevrolet, Chevelle, Camaro)

Installation

1. Mount the blower to the motor shaft with the open end of the blower away from the motor.
2. Mount the assembly to the case with the attaching screws.
3. Connect the rubber tube and blower wire to the motor.
4. Replace the right front fender and skirt assembly.
5. Connect battery ground cable.

Chevelle

The blower assembly (fig. 86) is mounted to the dash panel and contains the outside air-recirculated air diverter 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. If, because of engine accessories, hoses restrict lifting the blower assembly from the engine compartment, remove blower from motor and lift units out separately. Assemble replacement units under the restricting hoses.
4. Reinstall motor and fan into blower assembly. Replace cooling tube, ground wire and connect hot wire to connector.
5. Check blower operations.

Corvette

Replacement

1. Remove the radiator overflow tank and brackets and pull the tank out of the way as far as the length of the heater hose will permit.
2. Disconnect the electrical connector and the rubber air inlet tube from the blower motor.
3. Remove the five blower flange to case attaching screws and carefully remove the blower motor and drum assembly.
4. Remove the blower drum assembly and reinstall on a new blower motor.
5. Replace the blower motor and drum assembly in the case and reinstall all screws, hoses and electrical connections.

All-Weather System

Chevy II

Removal

Under the Hood

1. Purge the refrigerant from the system.
2. Drain the radiator.
3. Remove the refrigerant hoses at the evaporator pipes.
4. Remove the evaporator pipe clamp and grommet.
5. Remove three nuts from the blower case studs which pass through the firewall.
6. Remove heater hoses from core tubes.

Under Dash

7. Remove ash tray and retainer, and glove box.
8. Remove blower case to air inlet adapter bracket retaining screw.
9. Remove screw attaching air distributor to firewall.
10. Remove nuts retaining evaporator case to lower lip of dash. Withdraw evaporator drain tubes.
11. Lower complete heater - air conditioning assembly.
12. Remove screw retaining blower case to air distributor and separate them.
13. Remove blower to case attaching screws. Disconnect motor wire and remove blower assembly.
14. Remove blower from motor shaft.

Installation

1. Assemble blower to motor shaft.
2. Mount motor in blower case and connect wire.
3. Assemble blower case to air distributor and install retaining screw.
4. Lift the complete assembly into place and install attaching screws and nuts.
5. Replace ash tray retainer and tray and glove box.
6. Replace nuts (engine side of dash) on heater case studs and connect heater hoses.
7. Replace evaporator pipe clamp and grommet.
8. Replace the refrigerant hoses.
9. Evacuate and charge the refrigeration system and refill the cooling system.
10. Check system performance.

Universal Blower Assembly

Removal

1. Remove the universal unit from its dash mounts.
2. Remove the cover plate and separate the upper and lower case halves. Remove blower motor mounting strap screw and swing strap outward.
3. Remove blower assembly. Loosen the blower wheel setscrews and remove the wheels from the motor shaft.

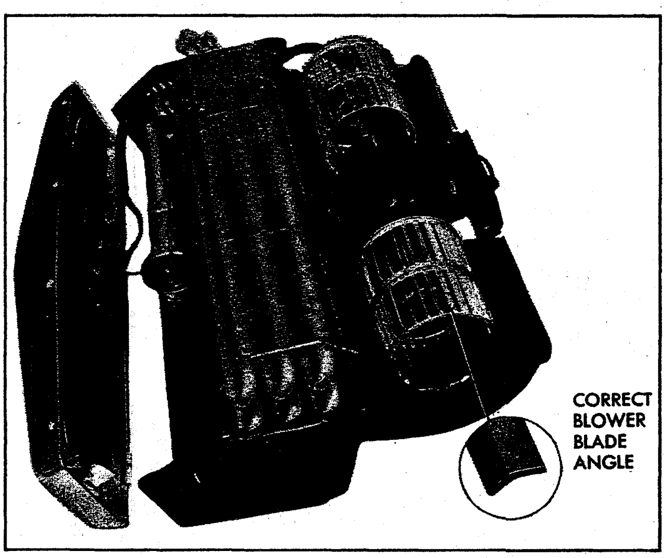


Fig. 87—Blower Assembly—Universal System

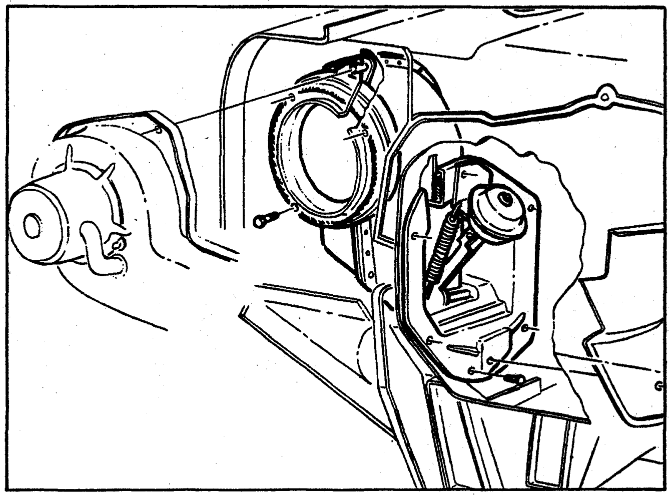


Fig. 88—Air Inlet Assembly (Chevrolet)

Installation

1. Install the blower wheels on the motor so that the lower blades curve toward the firewall side of the unit when the motor is placed in the case. Tighten the setscrews.
2. Place the motor in the bracket with the electrical connector side of the motor to the right side of the bracket. Attach the mounting strap.
3. Assemble the case halves and attach the cover plate.
4. Remount the unit to the dash.

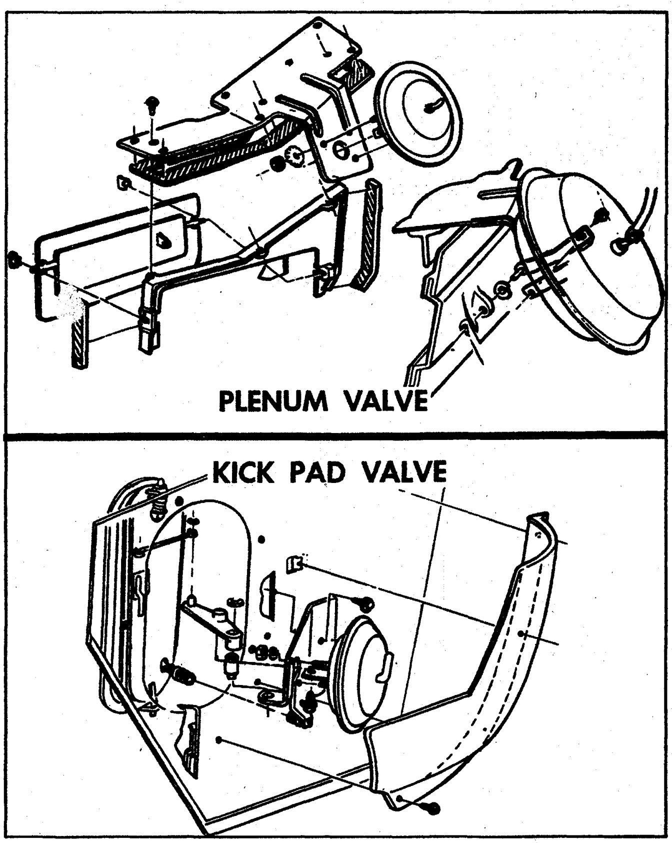


Fig. 89—Air Doors (Camaro)

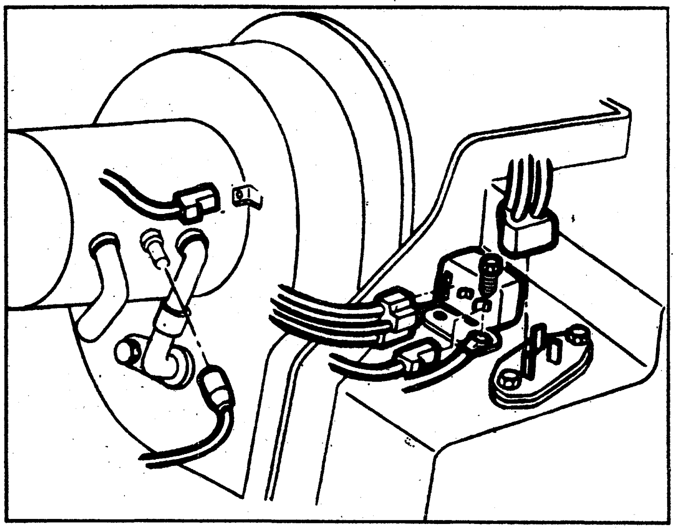


Fig. 90—Evaporator Wiring (Corvette)

AIR INLET VALVE

Four-Season System

Chevrolet

Figure 88 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.

Camaro

Figure 89 illustrates the outside air inlet door assembly, and the door in the kick pad which admits recirculated air to the system.

BLOWER AND EVAPORATOR ASSEMBLY (Corvette)

Replacement

1. Remove the evaporator core as outlined under "Evaporator Core Replacement".
2. Remove the blower motor as outlined under "Blower Motor Replacement".
3. Remove the heater and air conditioning distributor as outlined under "Air Distributor Duct Removal".
4. Remove the remaining nuts attaching the blower and evaporator assembly and the cover assembly to the studs on the firewall.
5. Replace the components removed by reversing the removal procedure.

AIR DISTRIBUTOR ASSEMBLY AND OUTLET DUCTS

Four Season System

Chevrolet and Chevelle

Figures 92 through 95 illustrate the air distributor and outlet ducts as used in the Chevrolet, Chevelle, Camaro, and Corvette.

Corvette

Right Outlet Duct

Removal

1. Remove the clamp screw at the inner end of the outlet duct and loosen the clamp.
2. Remove the screw and lock washer attaching the duct outer mounting tab to the body hinge pillar brace.
3. Pull the duct and clamp down and away from the distributor assembly. Disconnect the courtesy light.
4. The duct extension assembly may now be removed if desired as well as the deflector assembly. See Figure 95.

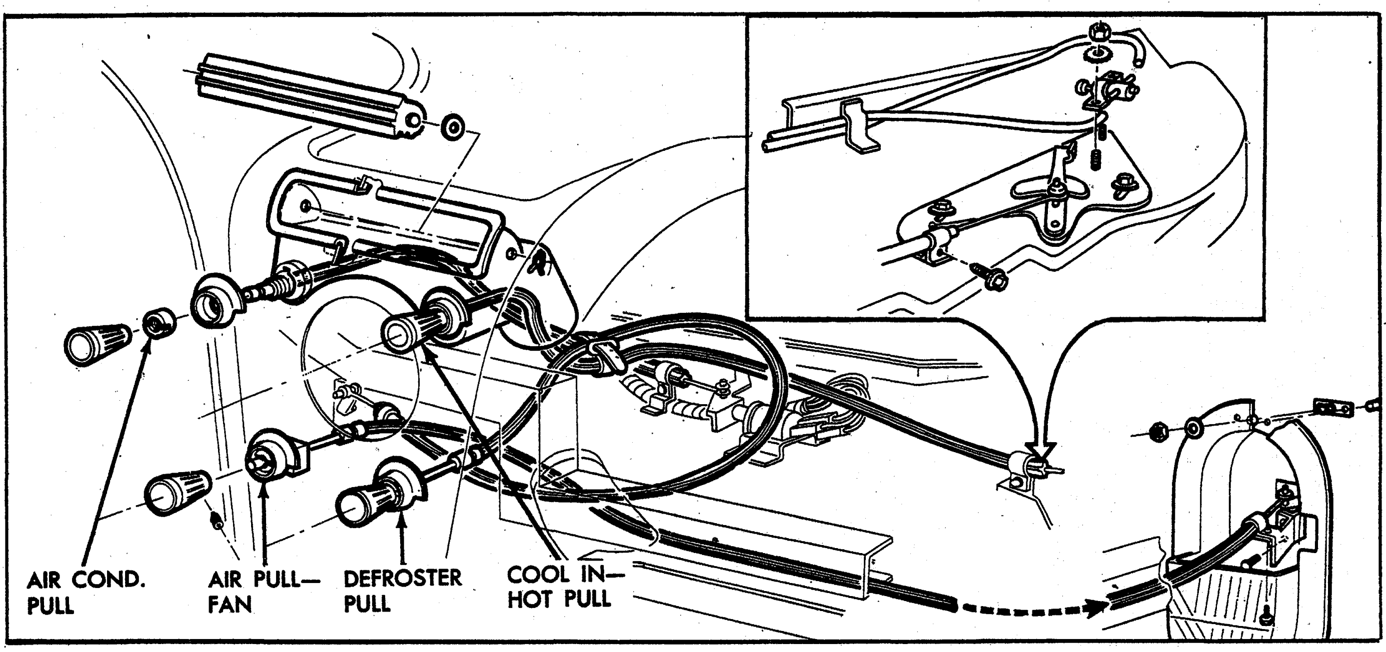


Fig. 91—Corvette Four-Season Controls

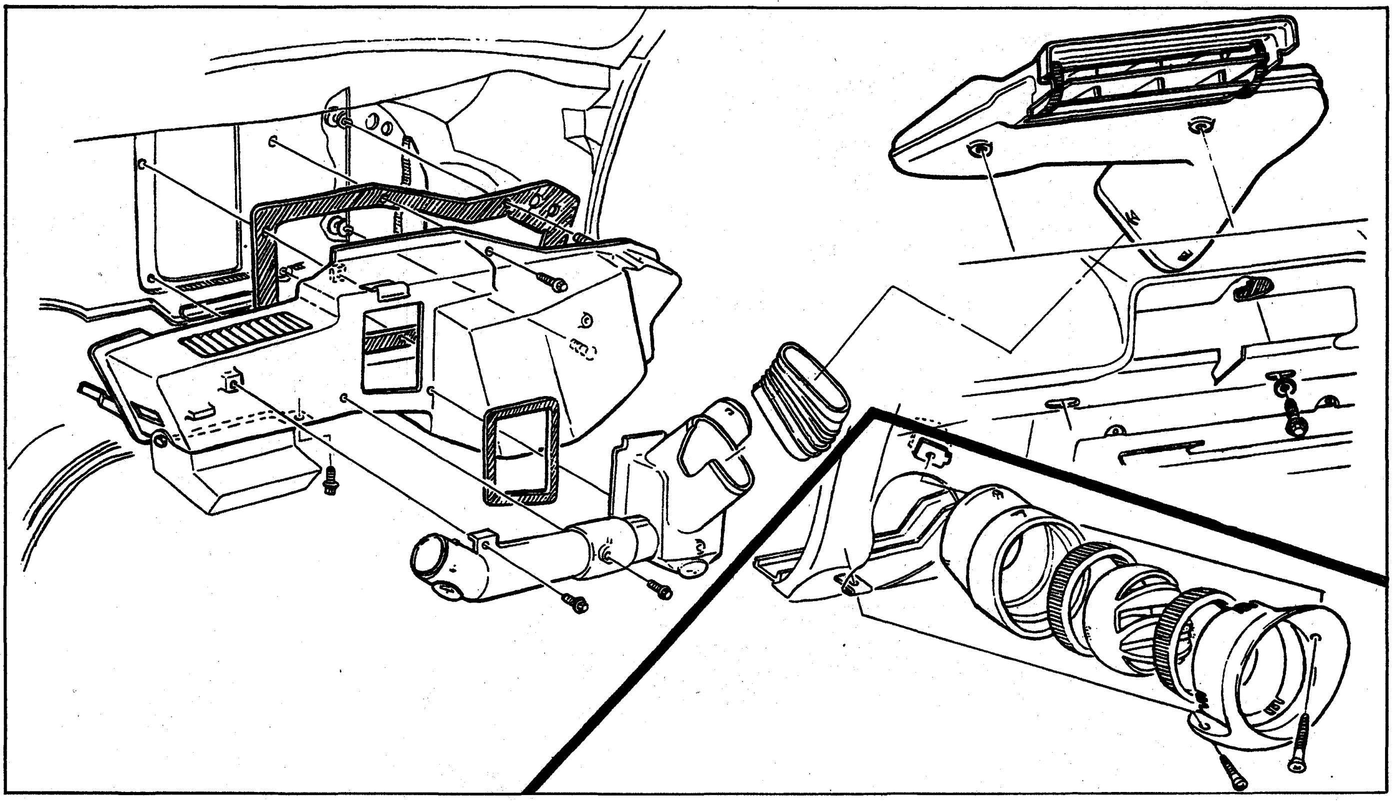


Fig. 92—Chevrolet Four-Season Ducts

Installation

Reverse the removal procedure to reinstall the duct assembly.

Left Outlet Duct

Removal

1. Remove the two parking brake lever bracket to dash brace attaching screws and move the lever and cable so they will not interfere with the duct removal.
2. Remove the screw and lock washer attaching the duct outer bracket to the hinge pillar support.
3. Remove the screws and lock washers attaching the duct assembly to the dash brace bracket.
4. Carefully pull the outer end of the duct downward, detaching the courtesy light from its bracket.
5. Loosen the screws clamping the outlet duct to distributor assembly flexible tubing at the outlet duct. The outlet duct may now be removed from beneath the instrument panel.
6. The duct extension assembly and the deflector assembly may be removed, if desired, as seen in Figure 95.

Installation

The duct assembly is installed by reversing the removal instructions.

Center Outlet Duct

Removal

1. Remove the right and left console trim panels.
2. Remove the radio receiver.
3. Remove the electric clock.
4. Remove the knobs, nuts and bezels from the two air conditioning controls above the clock, AIR COND. PULL and COLD IN-HOT PULL.
5. Carefully pull the outlet duct and control cables loose from the rear of the center console and work it down and out from under the dash. The left hand control cable runs through the left hand flexible tubing and may be left in the tubing after it is disengaged from the duct. The right hand control cable must also be pulled from the duct assembly as the duct is removed.
6. The center deflector barrel assembly may now be removed if necessary. Snap off the hairpin clips to remove the barrel and spacer washers.

Installation

Reverse the removal procedure for installation.

AIR DISTRIBUTOR ASSEMBLY

Removal

1. Drain the cooling system radiator.
2. Remove the heater hoses from the core pipes and remove the cover attaching nuts and cover surrounding the core pipes.
3. Remove the glove compartment assembly and the glove compartment door.

NOTE: See "Section 1 - Body" for removal and installation of body items.

4. Remove the right kick pad.
5. Remove the right and left center console trim panels.
6. Remove the radio receiver assembly.
7. Remove the defroster duct.

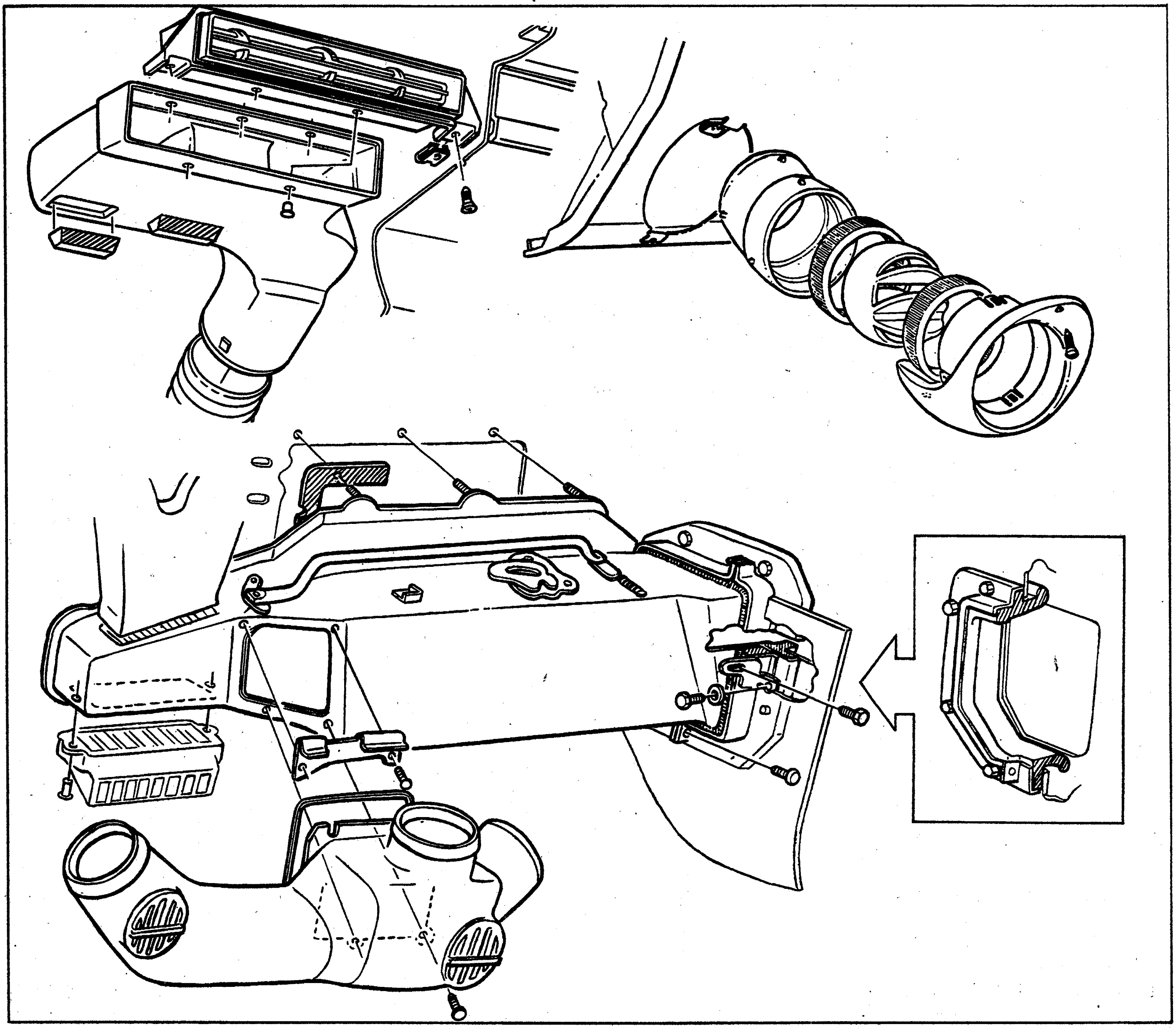


Fig. 93—Chevelle Four-Season Ducts

8. Remove the radio speaker and grille.
9. Remove the right outlet duct.
10. Disconnect the bowden cables from their brackets and operating levers on the distributor assembly.
11. Disconnect the flexible tubing from the center and left side outlet ducts at the air distributor assembly.
12. Remove the heated air distributor ducts from the air-distributor assembly.
13. Remove the single remaining distributor to dash panel attaching nut (the others were removed from beneath the hood when the core cover was removed in Step 2) located at the right end of the air distributor assembly.
14. Carefully pull the assembly out from under the dash, disconnecting the compressor switch wiring connector and the water valve control switch vacuum lines.

Installation

Reverse the removal procedure to reinstall the air distributor assembly.

COMFORTRON AUTOMATIC CONTROL COMPONENTS

The Comfortron system is the same as the Chevrolet Four Season system insofar as the basic system components are concerned. Most removal and installation procedures will remain as stated for the Four Season system except where the automatic control components are encountered. Each such component will be covered in the pages which follow.

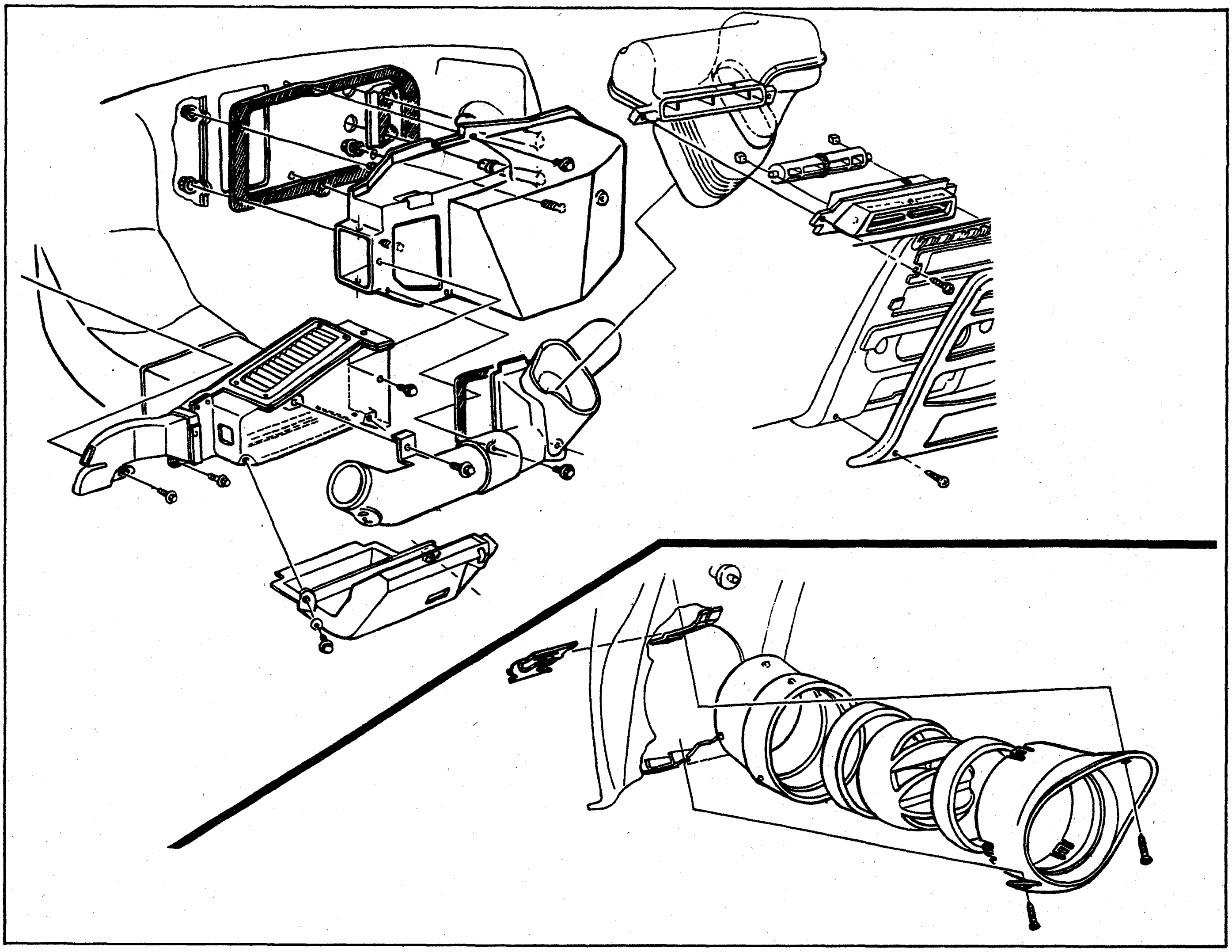


Fig. 94—Camaro Four-Season Ducts

Heater and Air Distributor Assembly

Removal

Under Hood

1. Disconnect battery ground cable.
2. Drain radiator (do not purge refrigerant system).
3. Disconnect all connectors attached to the Comfortron wiring harness which are on the engine side of the firewall. Push the wiring harness grommet through the firewall to the rear.
4. Disconnect the four vacuum hoses coming from the underdash through the large firewall grommet. Push the hose grommet through the firewall to the rear.
5. Remove the nuts from the heater and air distributor case studs which project through the firewall from the dash side.
6. Disconnect the heater hoses from the core tubes.

Under Dash

1. Remove glove box assembly.
2. Remove the dash center face plate, ash tray assembly, and any radio and/or tape equipment.
3. Remove the Comfortron control assembly mounting screws and lower the control unit.
4. Remove the vacuum line from the kick pad valve diaphragm.
5. Disconnect all harness connectors between the Comfortron harness and the rest of the dash wiring.
6. Remove the air distributor duct which supplies the dash outlets.
7. Remove the screws attaching the heater and air distributor to the firewall.
8. Pull the assembly rearward then down to remove from the dash. Pull the Comfortron wiring harness and vacuum hose assembly through the firewall.

Installation

1. Place the entire case assembly with wiring, vacuum hoses, and control assembly into the car on the floor.
2. Pass the underhood wiring harness and vacuum hose harness as far as possible through the appropriate firewall holes.
3. Lift the assembly up into position and pass the case studs through the firewall mounting holes. Attach the case to the firewall with the mounting screws.
4. Mount the dash outlet air distributor duct to the face of the case.

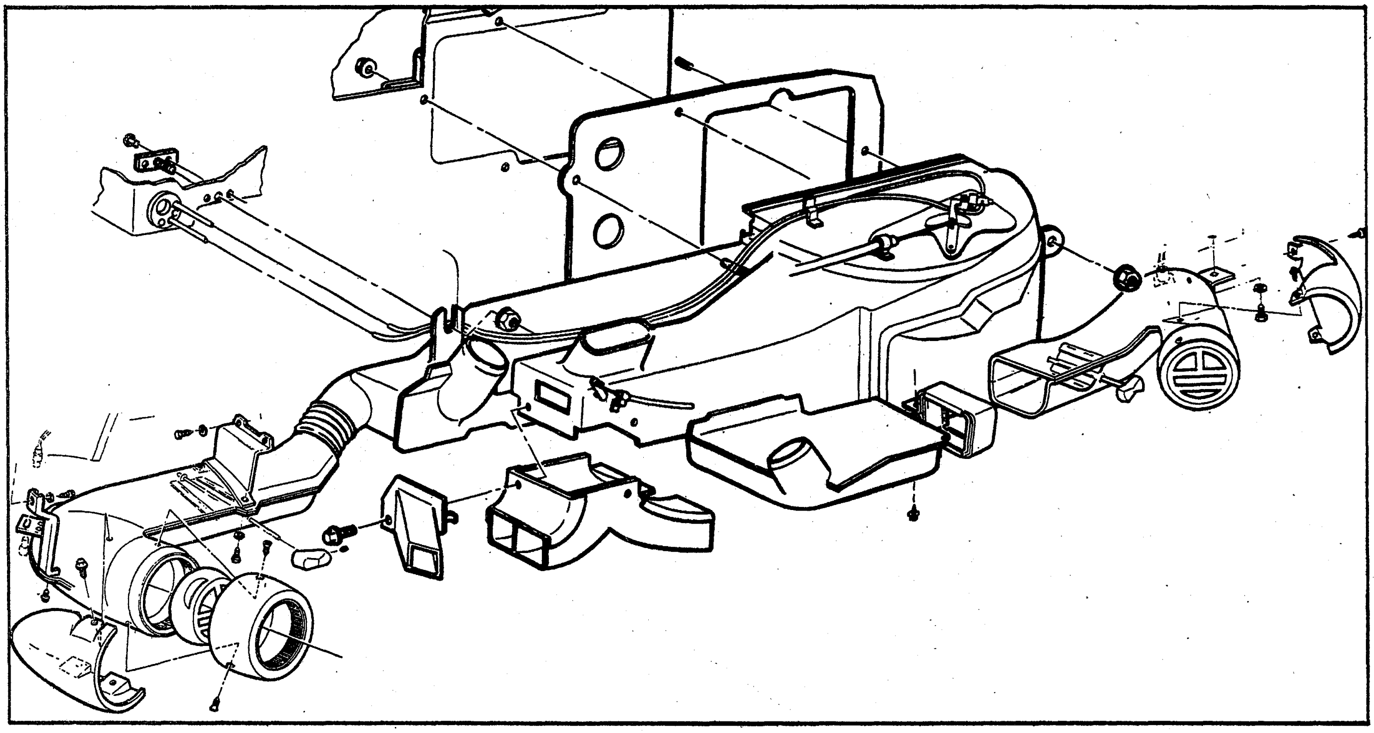


Fig. 95—Corvette Four-Season Ducts

5. Connect the various Comfortron harness connectors to the dash wiring and connect the vacuum hose to the kick pad valve diaphragm. Push the vacuum hose harness and wiring harness through the firewall to the proper location and install their respective grommets.
6. Raise the control unit into place and install the mounting screws. Check that all connections are complete.
7. Replace any radio and/or tape equipment, the ash tray assembly, and face plate.
8. Replace the glove box assembly.
9. Connect the heater hoses to the core tubes, and attach the nuts to the case studs through the firewall.
10. Reconnect the four vacuum hoses as follows: Purple to the cylinder on the thermo-vacuum valve, yellow tracer to the body of the thermo-vacuum valve, red tracer to the vacuum source "Tee" connection, and white tracer to the vacuum tank inlet.
11. Connect the wiring harness to the underhood air conditioning components.
12. Refill cooling system, connect battery ground cable and check system performance.

Vacuum Tank

The vacuum tank is mounted on the firewall as shown in Figure 97. Notice that the two vacuum lines are clamped to the vacuum tank ports.

Thermal Vacuum Valve

This heat operated vacuum valve is located in the heater core input line. Figure 98 illustrates valve installation with clamps attaching the water hoses as well as the vacuum hoses in place.

Resistor Assembly

Figure 99 illustrates the location and installation of the blower speed resistor assembly.

Relays

Two relays are used in the system, both mounted on the evaporator case as shown in Figure 100. The mounting bracket forms a common ground for the relays and as a plug for the hole in the evaporator housing used in the Four Season system for resistor installation.

Sensors (Thermistors)

Ambient Switch and Sensor

This combination unit, which engages the compressor clutch at about 40°F and also senses outside air temperature and sun load, is mounted to the firewall within the engine compartment with its long neck extending deep into the cowl vent plenum chamber. Figure 98 illustrates this installation.

In-Car Sensor

This sensor is located beneath the lip of the instrument panel overhand just to the right of the driver as shown in Figure 101.

Removal

1. Remove glove box assembly.
2. Disconnect sensor wires connector at harness.
3. Remove sensor mounting screws, remove sensor and pull wires and connector through hole in dash.

Installation

1. Insert connector and wires of replacement sensor through the dash hole.

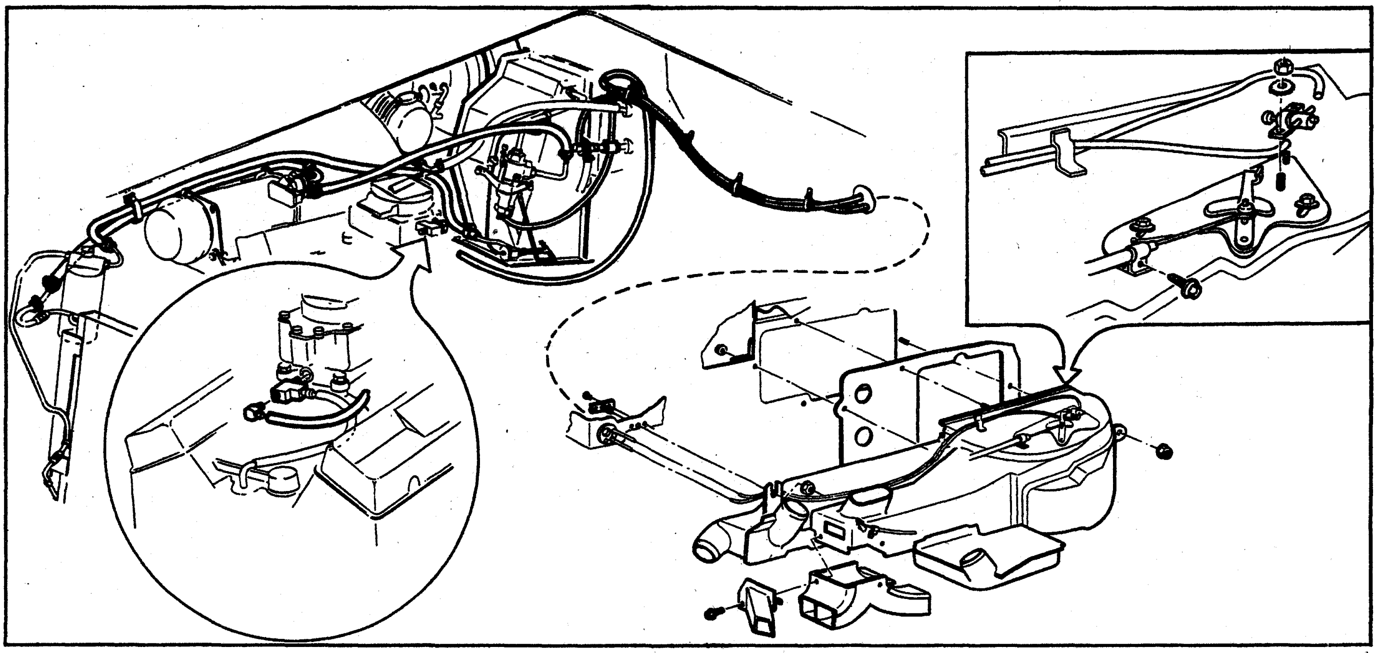


Fig. 96—Refrigerant and Vacuum Hoses (Corvette)

2. Mount the sensor to the dash and connect the wires to the Comfortron harness.
3. Replace glove box assembly.

Control Head

The control head is attached to the instrument panel flange in the same manner as the Four Season Control Panel (See Figure 105). Two screws hold the head in place. The amplifier, blower switch and servo and defrost control cables are all part of the control head.

Amplifier

After the control head is removed from the instrument panel, the amplifier may be removed as shown in Figure 107.

Temperature Dial Adjustment

1. Install Tester J-22368 as previously described.
2. Set Tester Voltage switch to Control Calibrate position.
3. Start the engine (fast idle) and set Comfortron Control lever to HI-FRONT.
4. Switch Rocker switch to MANUAL.
5. Set Manual Control Knob to 150 ohms on scale.
6. Rotate the Control Head Temperature Dial until the voltmeter on the tester reads 6.5 volts. The Temperature Dial should now indicate 75°.
7. If the Temperature Dial does not indicate 75°, insert Tool J-21530 in slot to the left of the Dial as shown in Figure 106.
8. With tool in position, rotate the Temperature Dial so that it indicates 75°F.

Transducer

Figure 104 illustrates the installation of the transducer assembly. Vacuum lines are clamped to the transducer vacuum ports.

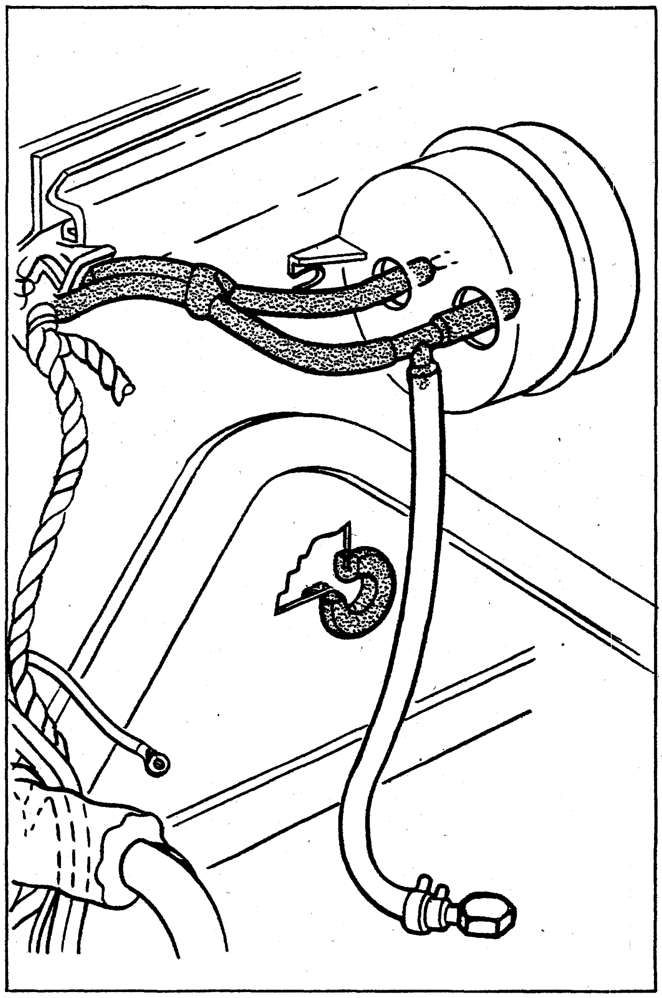


Fig. 97—Comfortron Vacuum Tank

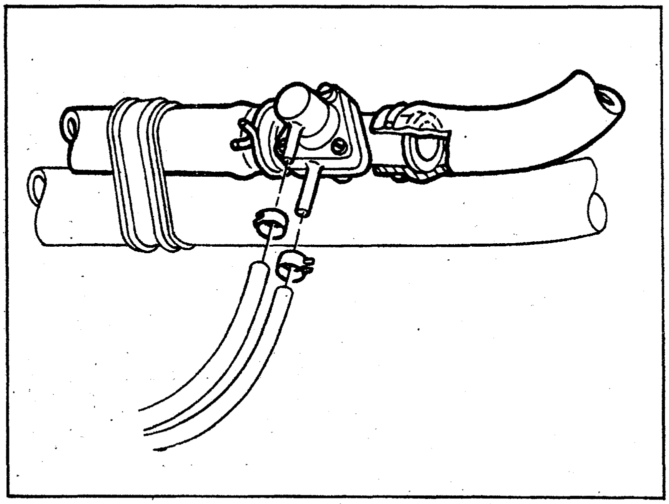


Fig. 98—Comfortron Thermal Vacuum Valve

Power Servo

The Power Servo is attached to the distributor duct. The entire installation consists of the Servo Assembly and its link assembly to the TEMP door. The Servo is attached to the Air Selector Duct as shown in Figure 108.

Mode Shift Vacuum Diaphragm

Replacement

1. Remove the heater distributor from the vehicle.
2. Reach into the distributor through the AIR door opening to reach and remove the vacuum diaphragm mounting screws and diaphragm to door link screw (remove plug from case to reach this screw).
3. Reverse this procedure to replace.
4. Adjust mode door without vacuum applied to diaphragm. The door should be open one inch from sealing against the air distributor opening (inside of case). (Figure 109).

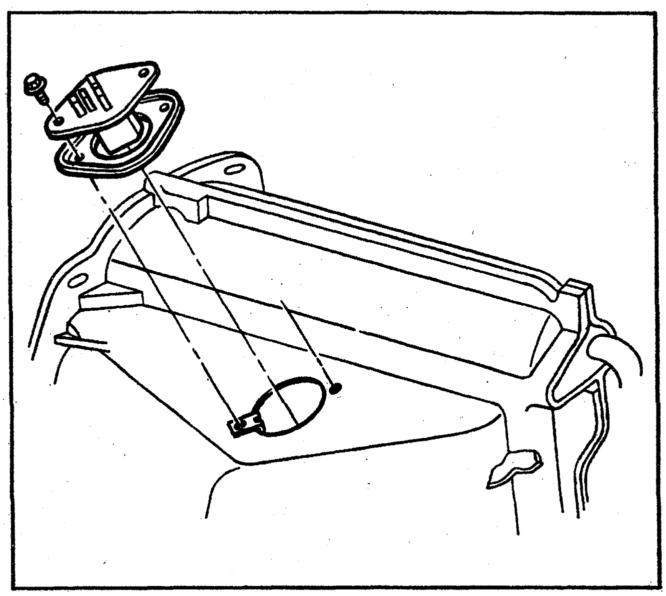


Fig. 99—Comfortron Resistor Assembly

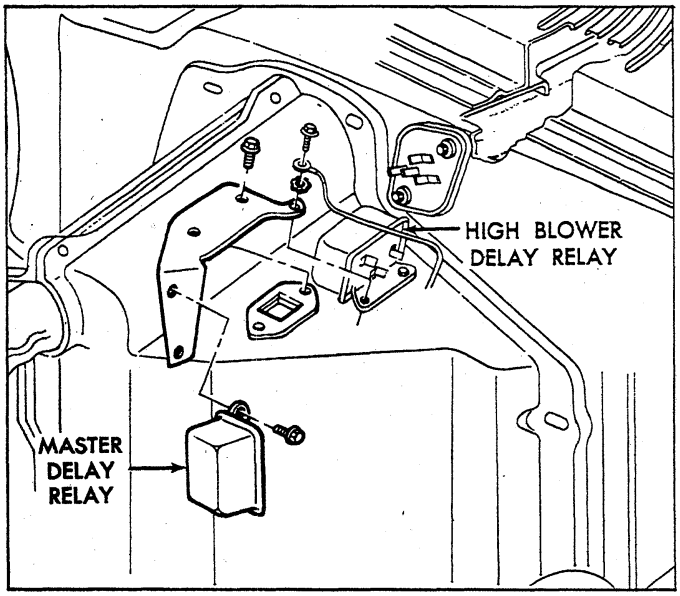


Fig. 100—Comfortron Relays

COLLISION PROCEDURE—All Systems

Whenever a car equipped with air conditioning unit is involed 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

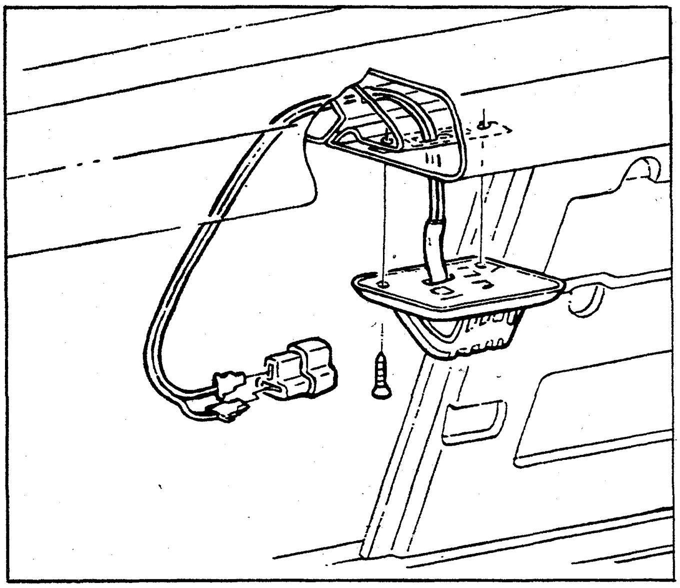


Fig. 101—Comfortron Sensor Installation

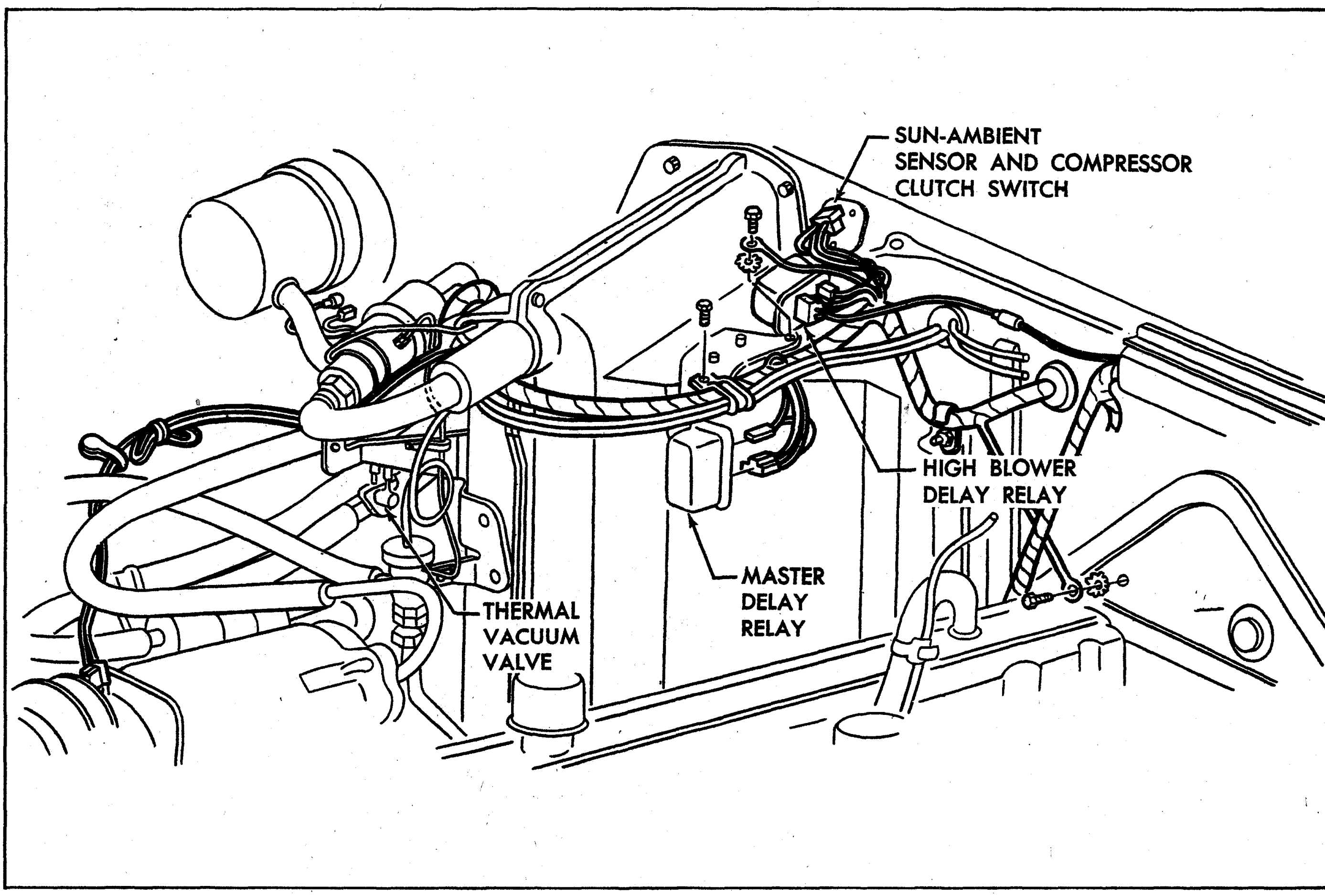


Fig. 102—Comfortron Underhood Wiring

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.

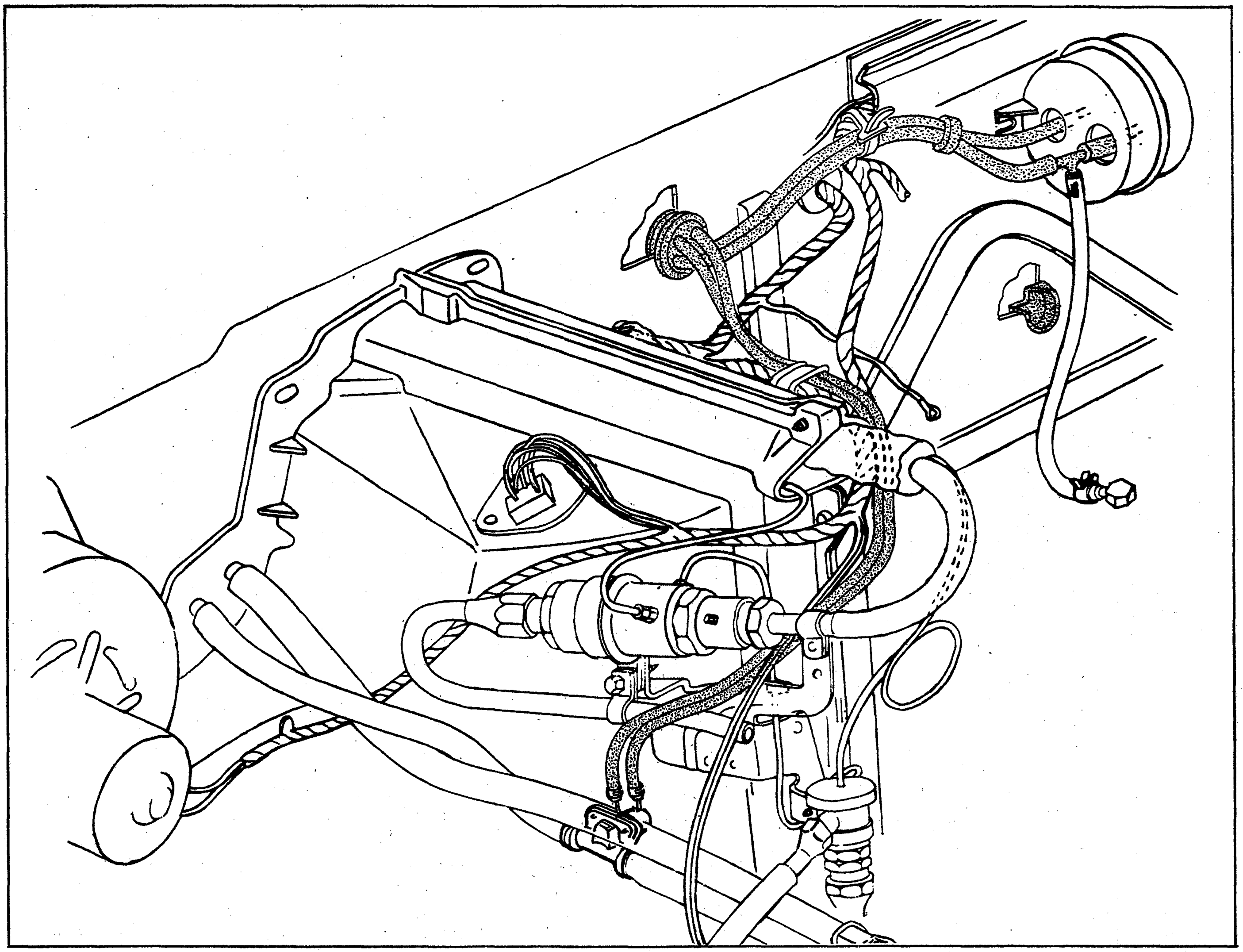


Fig. 103—Comfortron Underhood Vacuum Lines

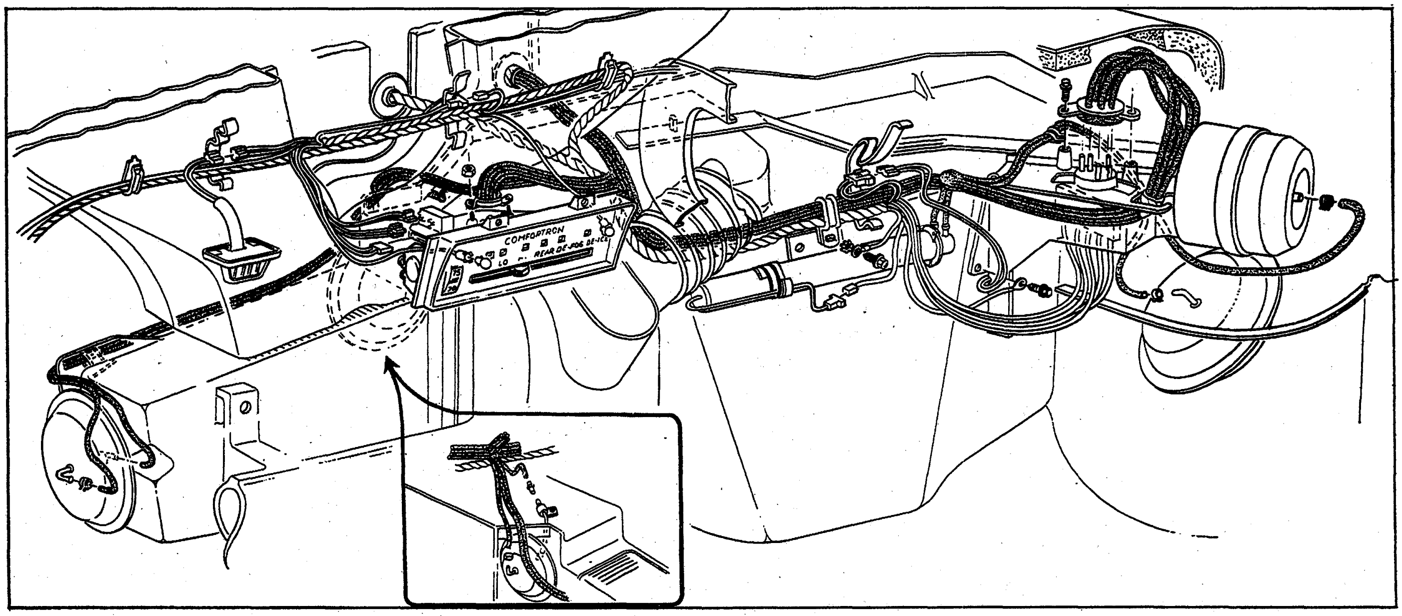


Fig. 104—Comfortron Underdash Vacuum Lines

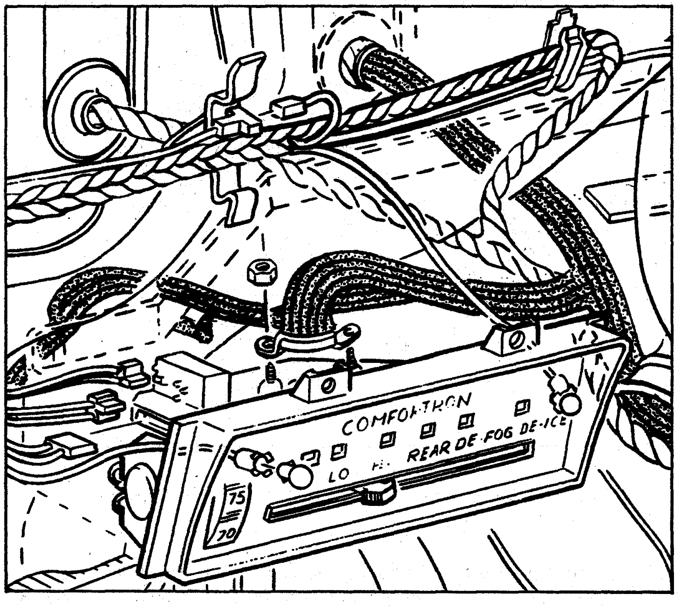


Fig. 105—Comfortron Control Head

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 horn relay and the Air Conditioner relay (except Universal). The Universal unit has a fuse in the line between the ignition switch and the Air Conditioner blower switch. See the specification page for the proper replacement fuse.

FOUR SEASON HEATER COMPONENTS

Corvette

The heater components of the system are, in general, much the same as those of the standard Corvette heater. Heater hoses carry the engine coolant to the heater core, located in the air distributor duct beneath the instrument panel.

A significant difference is that in the Corvette Air Conditioning System there is no flow through the heater core until the COOL IN-HOT PULL knob is pulled out. This movement opens the vacuum switch on the air distributor assembly and allows vacuum to be applied to the water valve mounted in the engine compartment, opening the valve. Thus the heater core is unheated until needed, at which time it receives full flow of the engine coolant. Air passing through the core receives maximum heat which is tempered by mixing with unheated air before entering the passenger compartment.

Heater Core

Replacement

The heater core in the Corvette Air Conditioning System is removed in the same manner as the core in the Corvette heater. The distributor assembly must first be removed from under the dash as covered previously in this section before the core can be removed and replaced.

Water Valve

Installation of the water valve is illustrated in Figure 113. An inoperative valve must be replaced.

Chevrolet

Heater Core

Removal

1. Disconnect battery ground cable.
2. Drain radiator
3. Remove right front fender and skirt assembly.

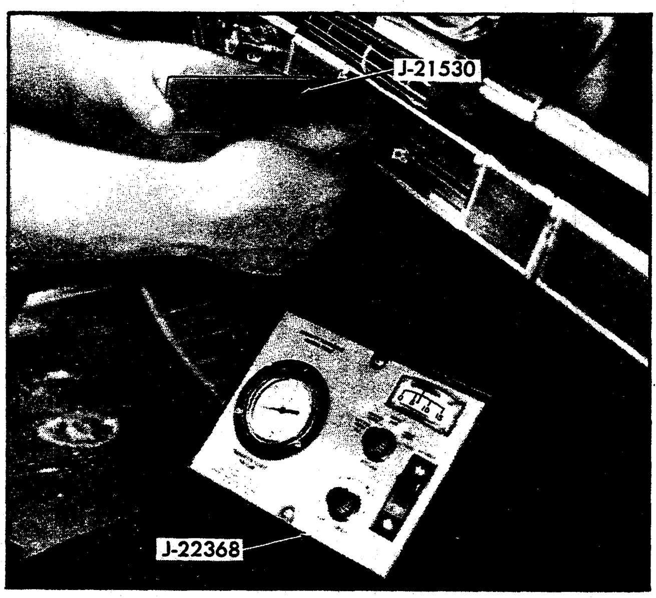


Fig. 106—Comfortron Temperature Dial Adjustment

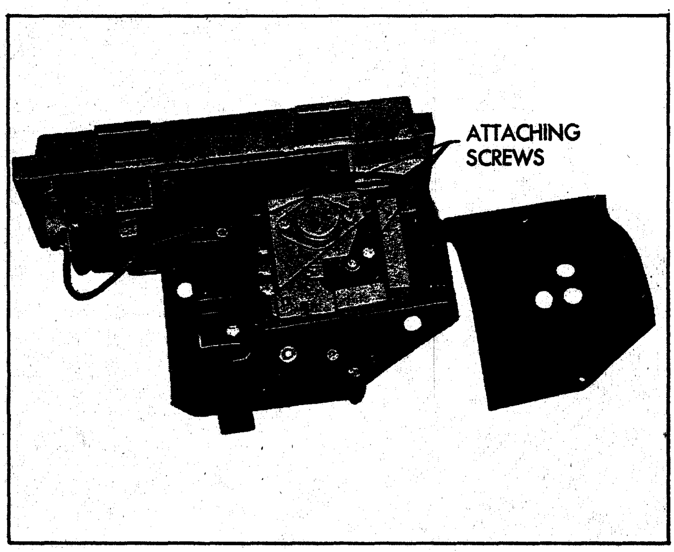


Fig. 107—Amplifier Removal

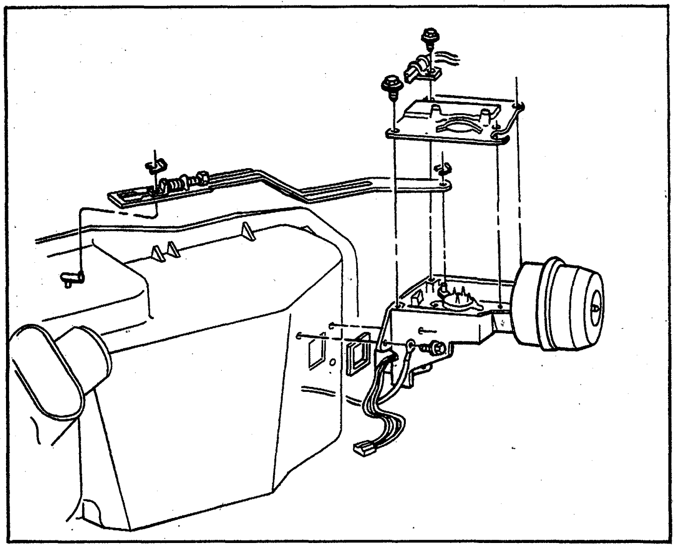


Fig. 108—Comfortron Power Servo Installation

4. Disconnect heater hoses from heater core (at firewall).
5. Remove glove box door.
6. Remove glove box interior.
7. Disconnect right, left, and center air conditioning outlet hoses from distributor duct.
8. Remove air distributor duct from heater housing.
9. Disconnect hose and cable clamps from heater housing.
10. Remove the remaining three heater housing stud retaining nuts (engine compartment) and one upper retaining screw (inside vehicle).
11. Pull the unit away from the firewall and out of the car.

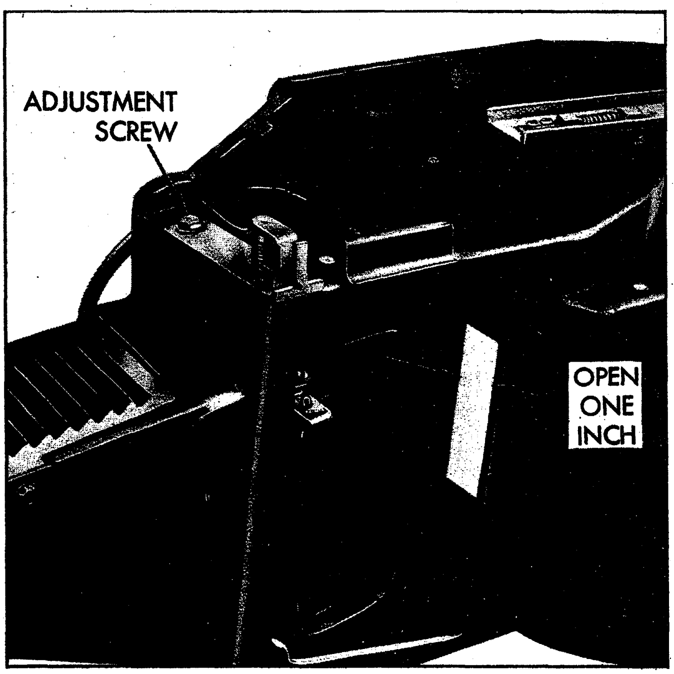


Fig. 109—Mode Shift Vacuum Diaphragm

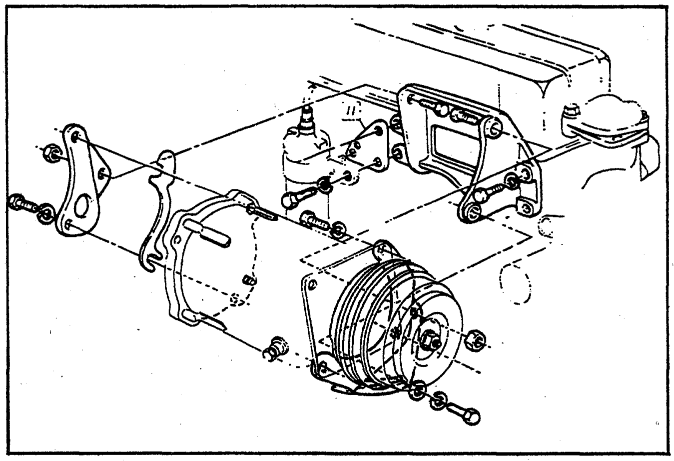


Fig. 110—Compressor Mount—L-6 Engines (Typical)

12. Remove heater housing cover from heater housing.
13. Remove heater core from heater housing cover by removing four (4) retaining screws and two "U" clamps.
14. Remove heater core.

Installation

1. Replace core in case using a non hardening sealer. Attach the core clamps and retaining screws.
2. Attach the heater housing cover to the housing.
3. Position the unit against the firewall and attach it with the retaining screw at the top of the case.
4. Attach the sheet metal nuts to the case studs which project through the firewall to the engine side.
5. Connect the control cables to the control doors and case.
6. Attach the air distributor duct to the case.
7. Connect the left, right, and center outlet hoses.
8. Replace the glove box assembly.
9. Connect heater hoses to core tubes.
10. Replace fender assembly.
11. Fill cooling system and connect battery cable.

Camaro

Lower Heater Hose

Removal

1. Drain radiator.
2. Remove side mouldings and retainers.
3. Remove lower fender attaching bolts.
4. Remove skirt to fender and skirt to reinforcement bolts.
5. pry the skirt away from the fender flange and away from the firewall. Block the skirt (four inch length of 2 x 4) clear of the lower hose and proceed with the hose replacement.

Installation

1. Connect the hose.
2. Remove the block, move the skirt into position and install all attaching bolts.
3. Replace fender attaching bolts and mouldings.
4. Refill cooling system.

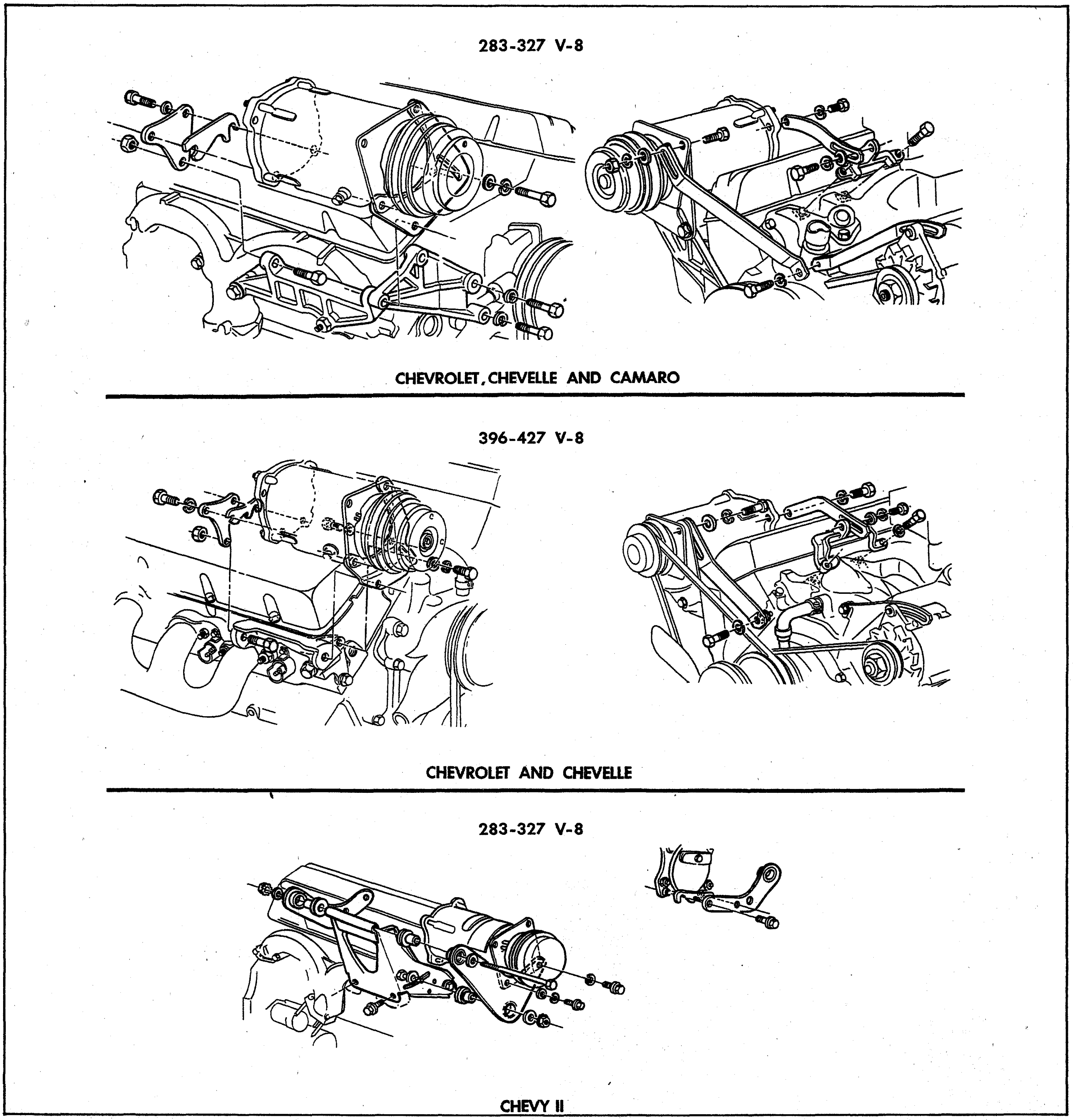


Fig. 111—Compressor Mount—V-8 Engines

COMFORTRON HEATER COMPONENTS

Heater Core

Removal

1. Remove the core case as previously described under Heater and Air Distributor Assembly.
2. Remove the screws attaching the die cast plate to the air inlet side of the case. Disconnect the temperature door linkage at the door shaft.
3. Remove the die cast plate with core from the case. Remove the core mounting screws and remove core.

Installation

1. Seal the core to the cast plate with non-hardening sealer and attach the core with the mounting straps and screws.
2. Install the plate to the case and connect the temperature door linkage.

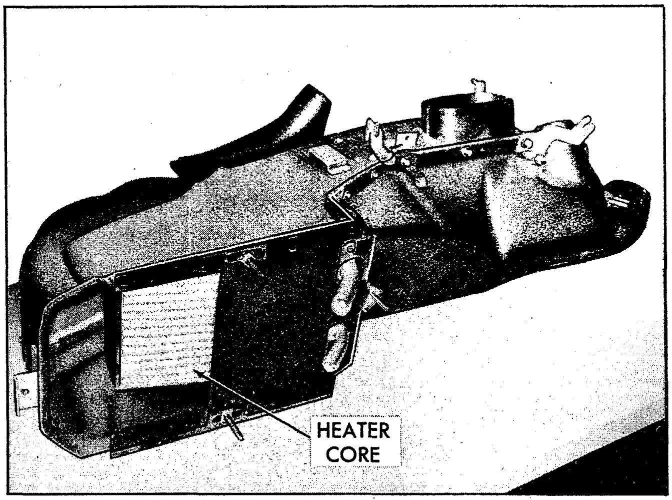


Fig. 112—Heater Core Removal—Four-Season System (Corvette)

3. Replace the core case into the car as described under Heater and Air Distributor Assembly.

COMPRESSOR

The same basic six cylinder reciprocating compressor is used in all 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 Universal and All-Weather Systems.

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 and measure oil in the compressor. Check for evidence of contamination to determine if remainder of system requires servicing. Compressor Servicing information is located in the Chassis Overhaul Manual.

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 compressor. (See Checking Compressor Oil Charge under Checking Oil)
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.

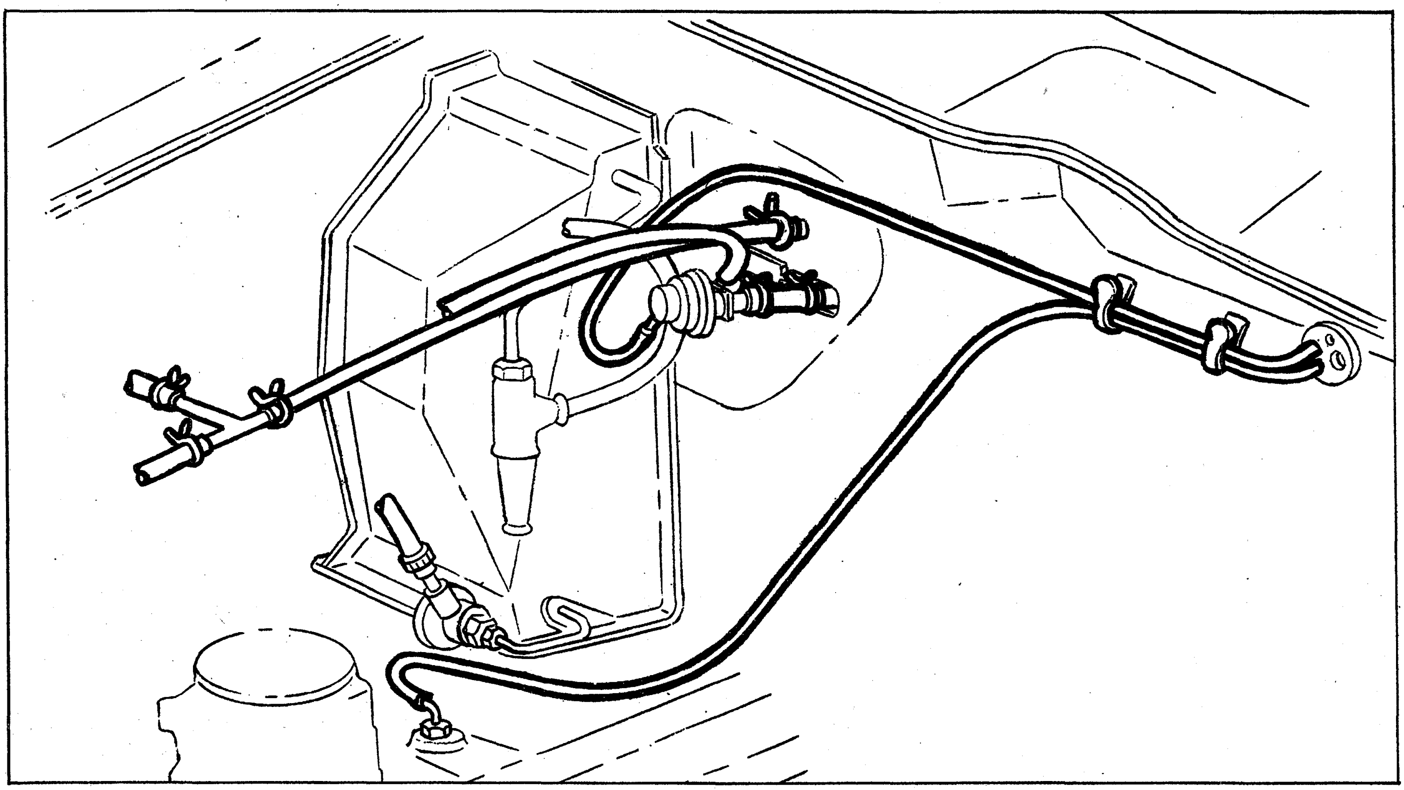


Fig. 113—Heater Hoses—Four-Season System (Corvette)

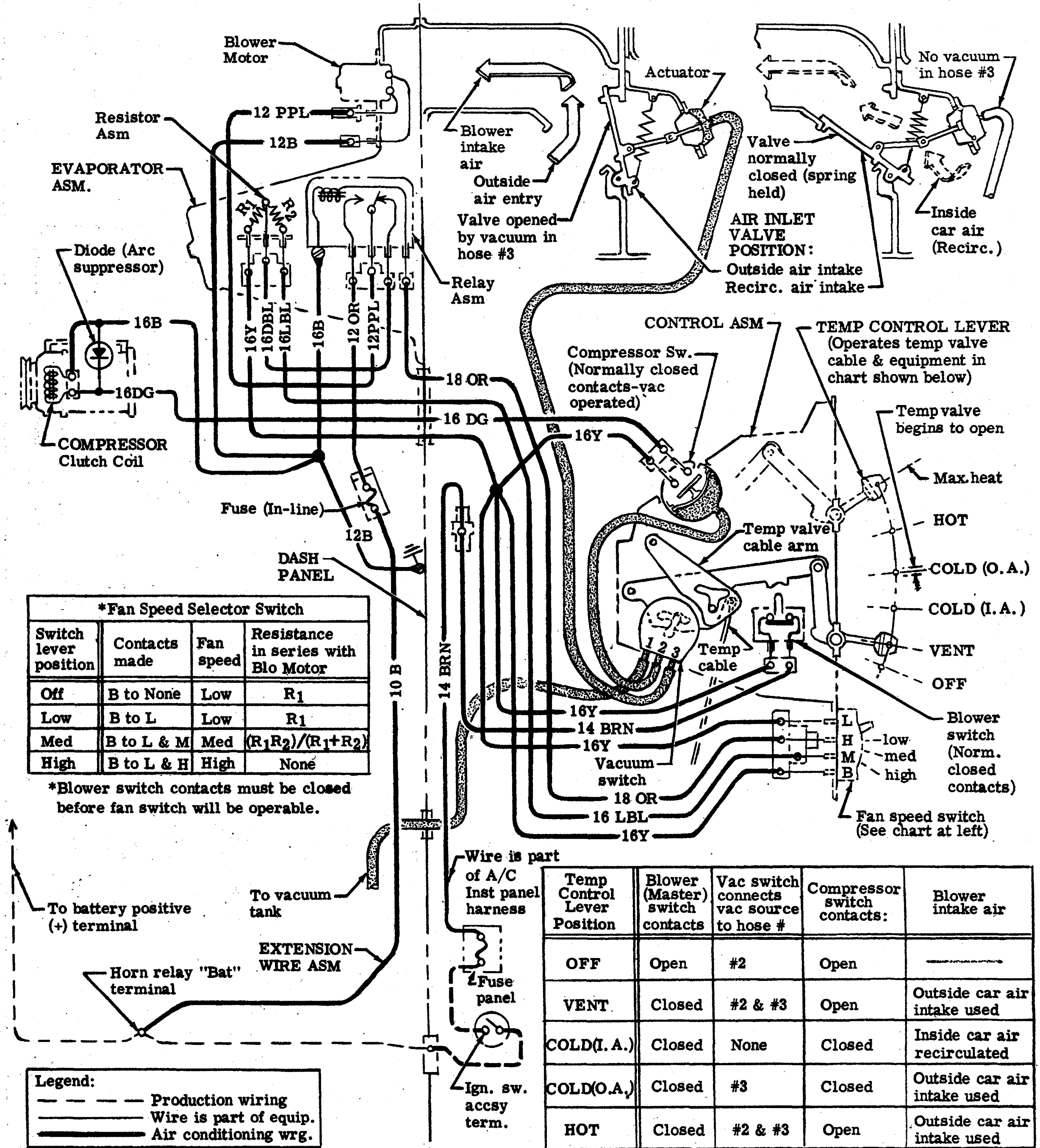
Compressor Belt Tension Adjustment

Adjust the compressor belt to the specifications shown in the Tune-Up chart in the Engine section of this manual.

COMPRESSOR FAILURE

If the compressor has failed mechanically to the extent that metal chips and shavings are found in it, the system should be checked for foreign material and cleaned as described under Foreign Material in the System.

WIRING DIAGRAMS



*Fan Speed Selector Switch			
Switch lever position	Contacts made	Fan speed	Resistance in series with Blo Motor
Off	B to None	Low	R_1
Low	B to L	Low	R_1
Med	B to L & M	Med	$(R_1R_2)/(R_1+R_2)$
High	B to L & H	High	None

*Blower switch contacts must be closed before fan switch will be operable.

Temp Control Lever Position	Blower (Master) switch contacts	Vac switch connects vac source to hose #	Compressor switch contacts:	Blower intake air
OFF	Open	#2	Open	———
VENT	Closed	#2 & #3	Open	Outside car air intake used
COLD(I. A.)	Closed	None	Closed	Inside car air recirculated
COLD(O.A.)	Closed	#3	Closed	Outside car air intake used
HOT	Closed	#2 & #3	Open	Outside car air intake used

Fig. 114—Chevrolet—Four-Season Wiring Diagram

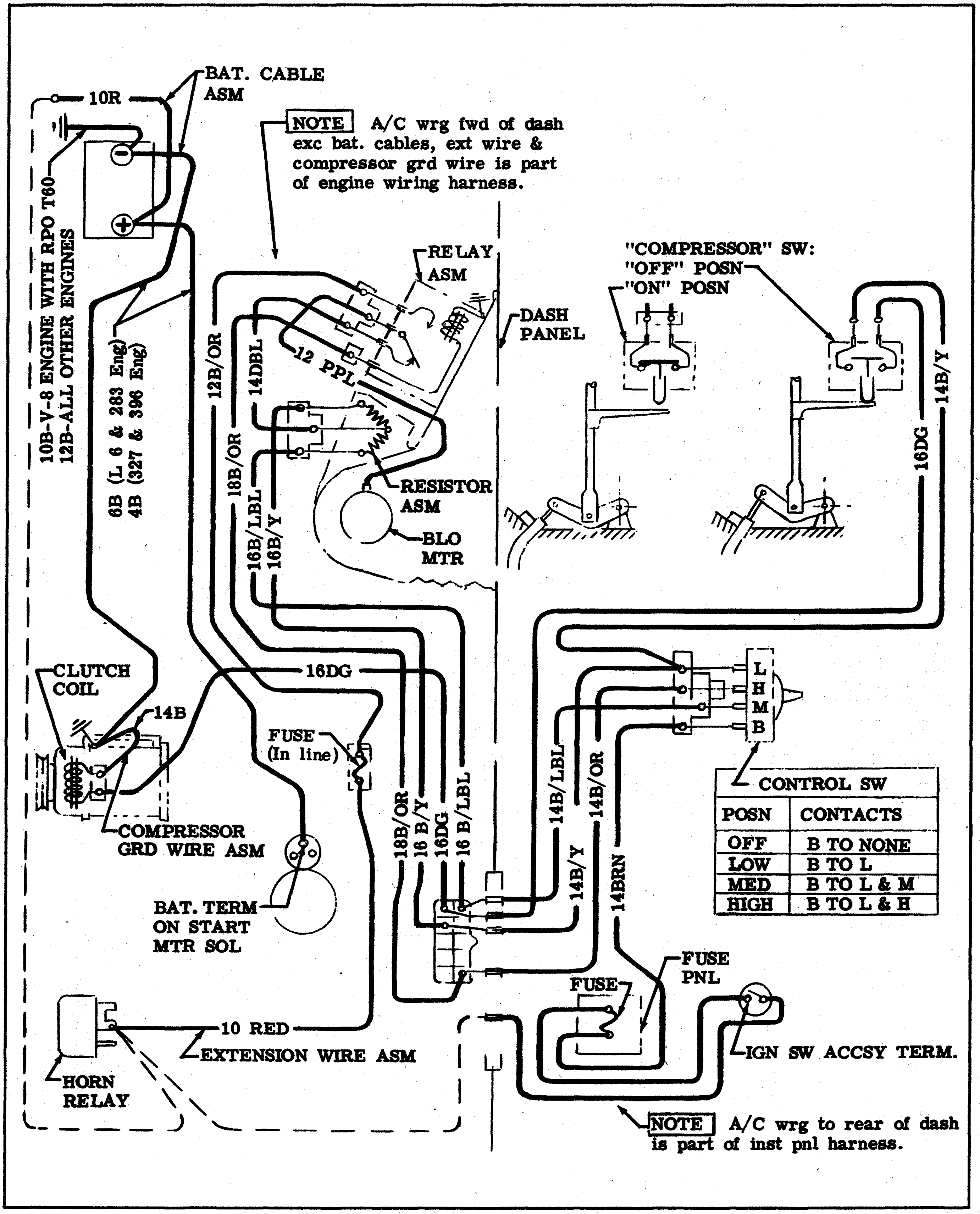
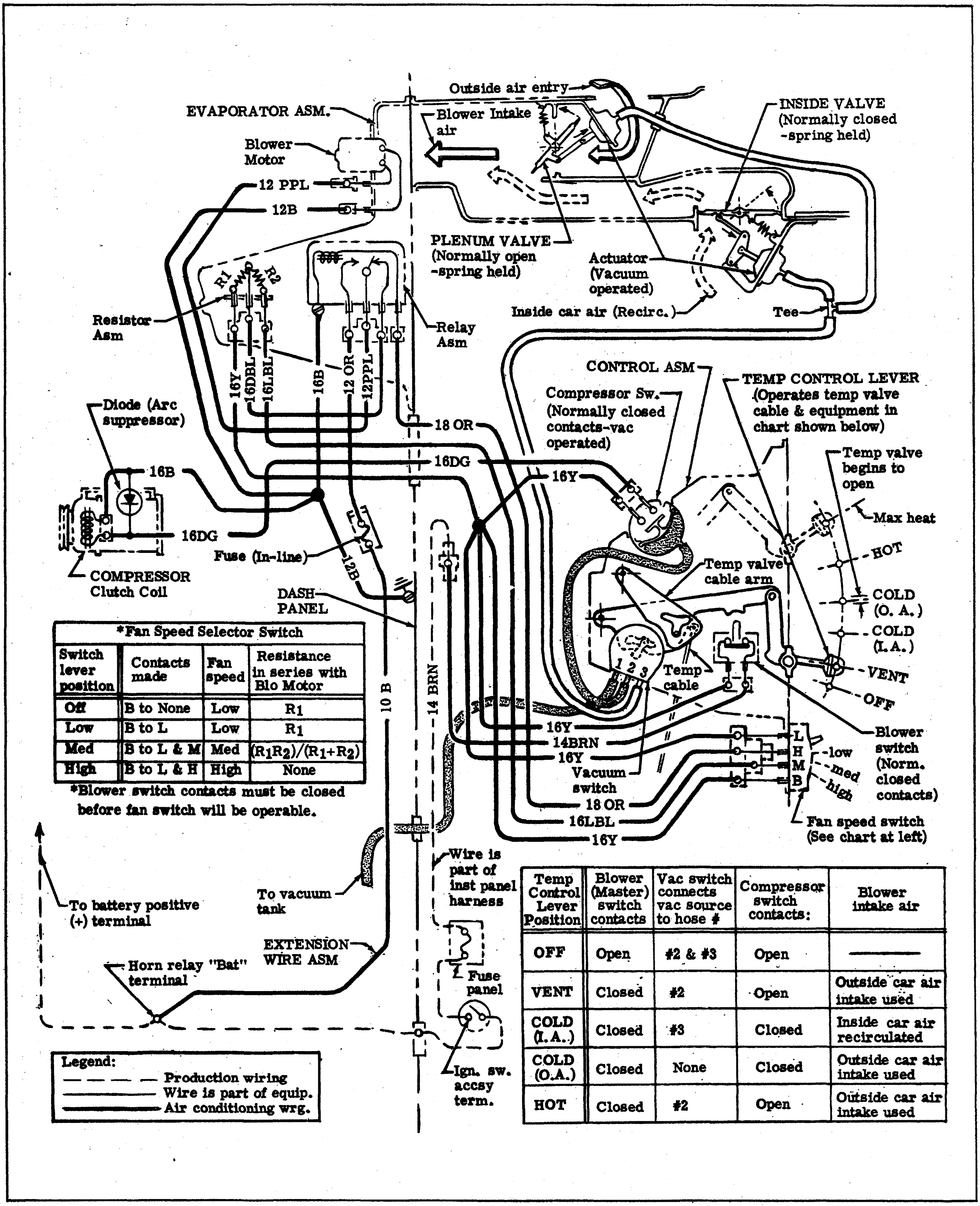


Fig. 115—Chevelle—Four-Season Wiring Diagram



***Fan Speed Selector Switch**

Switch lever position	Contacts made	Fan speed	Resistance in series with Blo Motor
Off	B to None	Low	R1
Low	B to L	Low	R1
Med	B to L & M	Med	$(R_1R_2)/(R_1+R_2)$
High	B to L & H	High	None

*Blower switch contacts must be closed before fan switch will be operable.

Temp Control Lever Position	Blower (Master) switch contacts	Vac switch connects vac source to hose #	Compressor switch contacts:	Blower intake air
OFF	Open	#2 & #3	Open	————
VENT	Closed	#2	Open	Outside car air intake used
COLD (I.A.)	Closed	#3	Closed	Inside car air recirculated
COLD (O.A.)	Closed	None	Closed	Outside car air intake used
HOT	Closed	#2	Open	Outside car air intake used

Fig. 116—Camaro—Four-Season Wiring Diagram

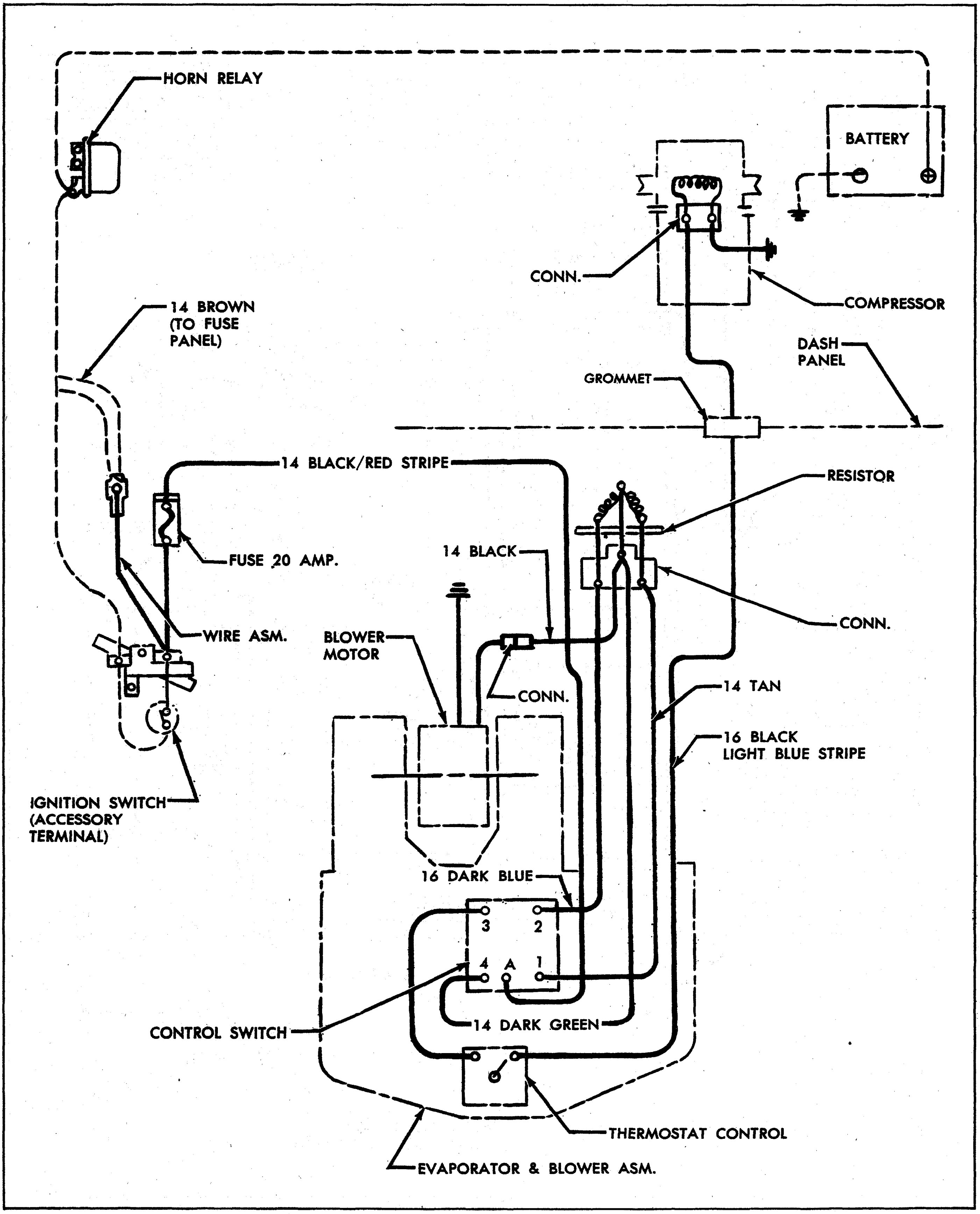


Fig. 117—Universal System Wiring Diagram (Typical)

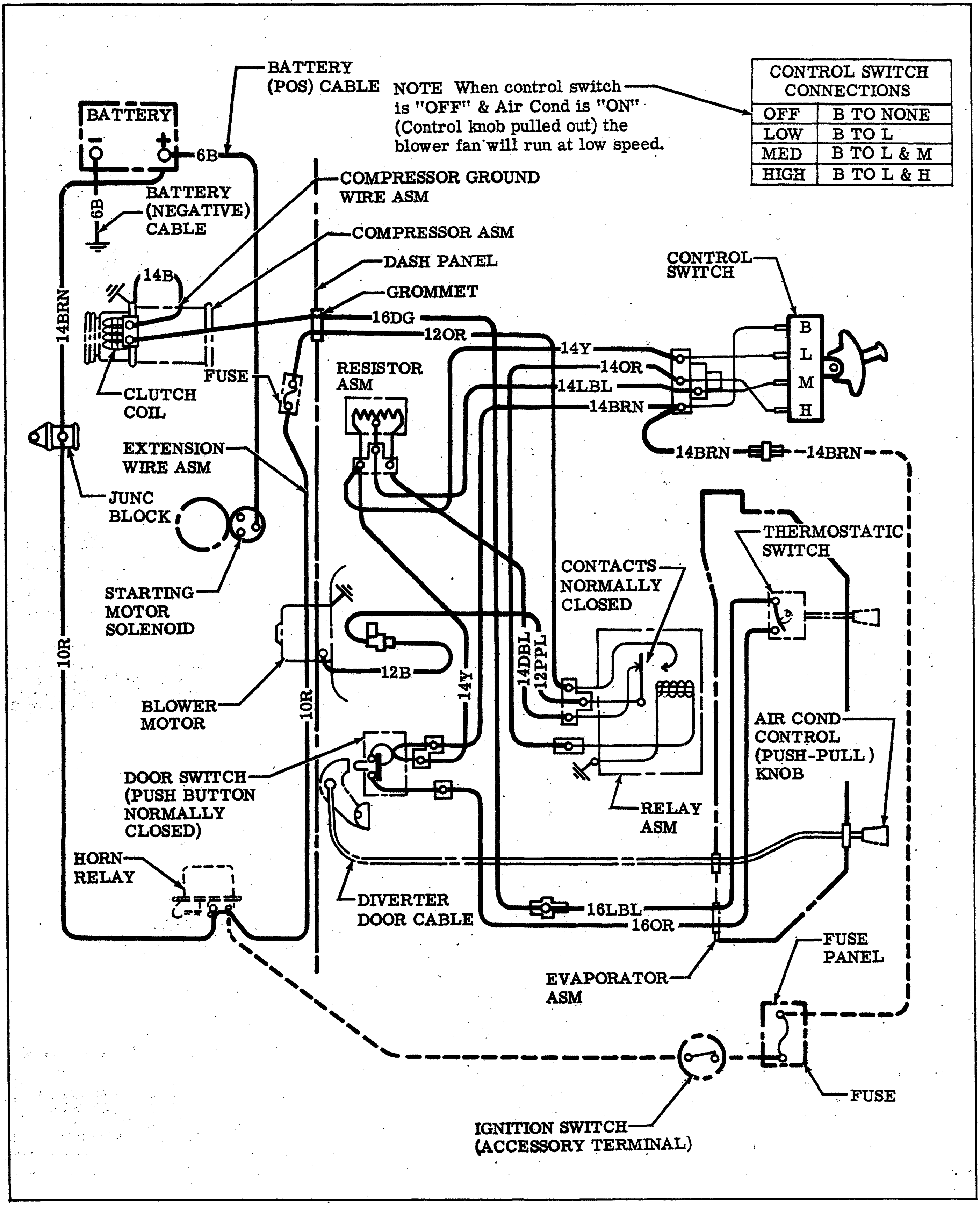


Fig. 118—All Weather Wiring Diagram (Chevy II)

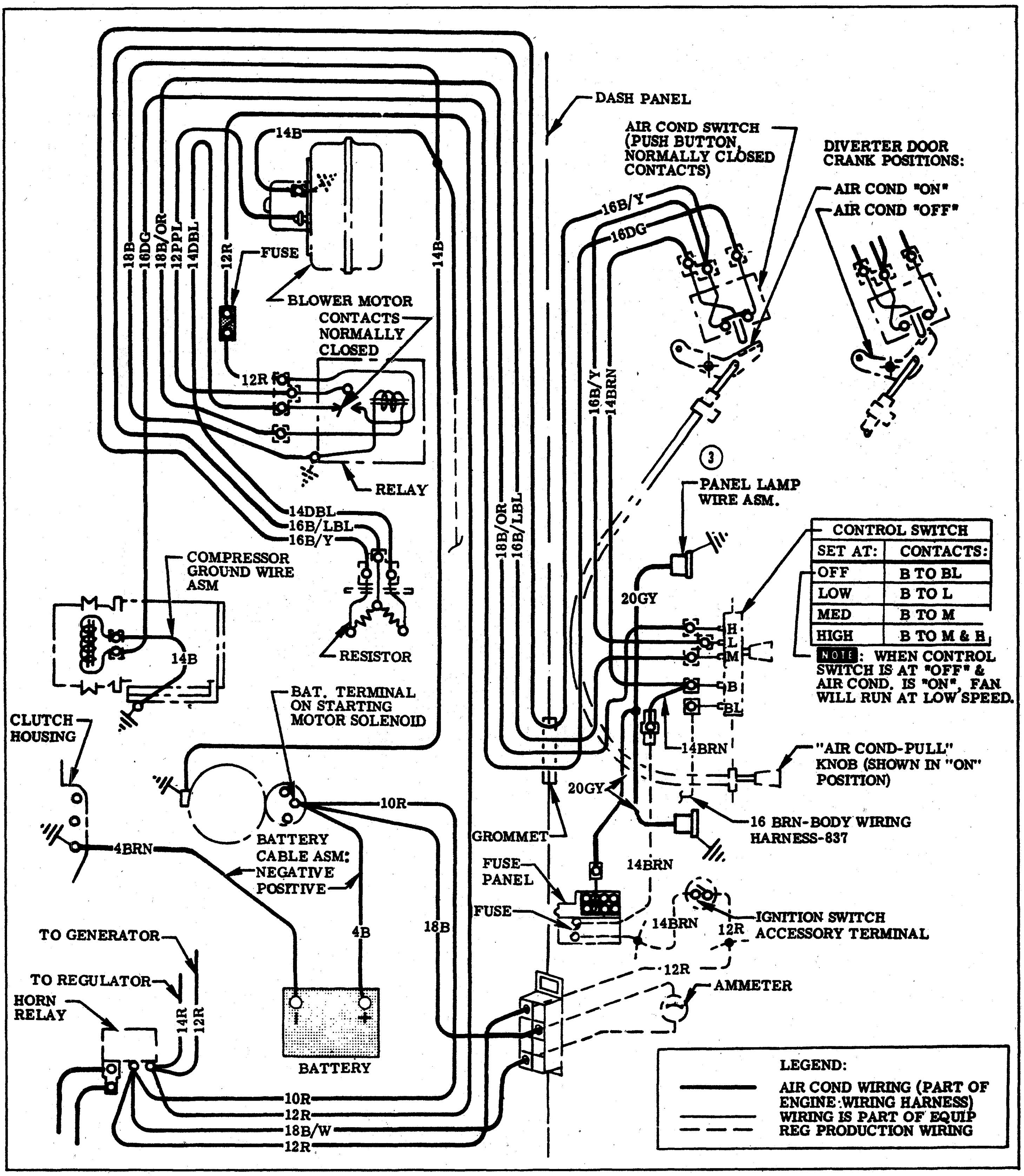


Fig. 119—Corvette—Four-Season Wiring Diagram

SPECIAL TOOLS

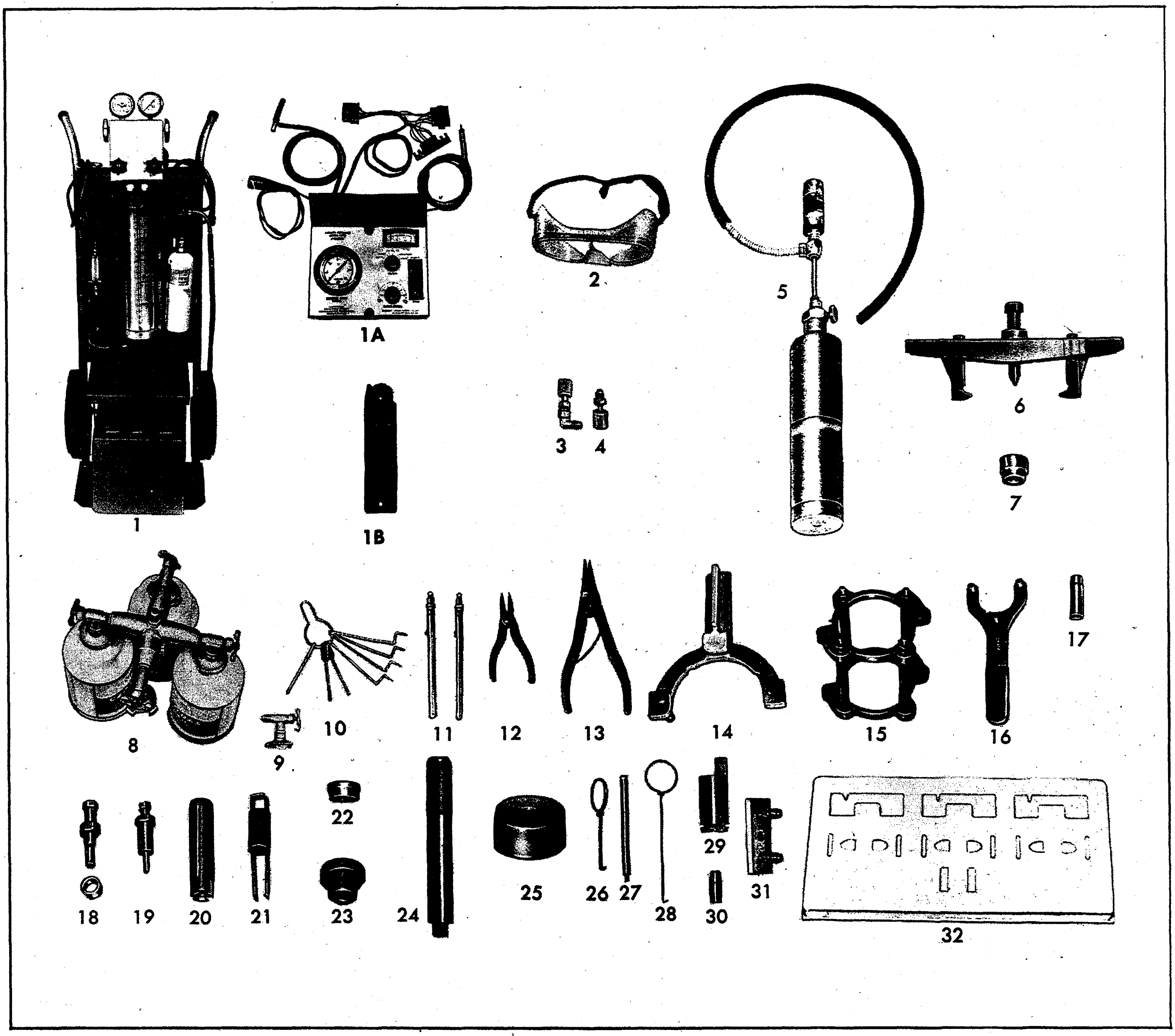


Fig. 120—Air Conditioning—Special Tools

1. J-8393 Charging Station
1A. J-22368 Comfortron System Tester
1B. J-21530 Comfortron Temperature Dial Adjuster
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 No. 3 Multi-Opener (3-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-9401 Hub and Drive Plate Assembly Remover
19. J-9480 Hub and Drive Plate Assembly Installer
20. J-9392 Seal Remover
21. J-9393 Seal Seat Remover
22. J-9298 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

SECTION 1B

CORVETTE BODY

INDEX

GENERAL DESCRIPTION

A structural network of steel forms the backbone of the Corvette body. When combined with the fiber-glass reinforced plastic body panels, the steel-plastic marriage results in a body with increased torsional rigidity and greater beaming strength.

Convertible models continue with two roof styles: the folding top and the removable hardtop. In operation, both tops function similar to those of previous models. Either top is standard and both are optional as determined by the top selected as base equipment.

MAINTENANCE & REPLACEMENTS

FRONT END

ADJUSTMENTS

(Refer to Figure 2)

Adjustments should be made in order - hood position first, then catch adjustments.

Hood

The position of the hood in relation to the hood body opening and the fender surfaces is controlled by the position of the hinges and position and adjustment of catch and bumpers.

The fore and aft position of the hood may be adjusted

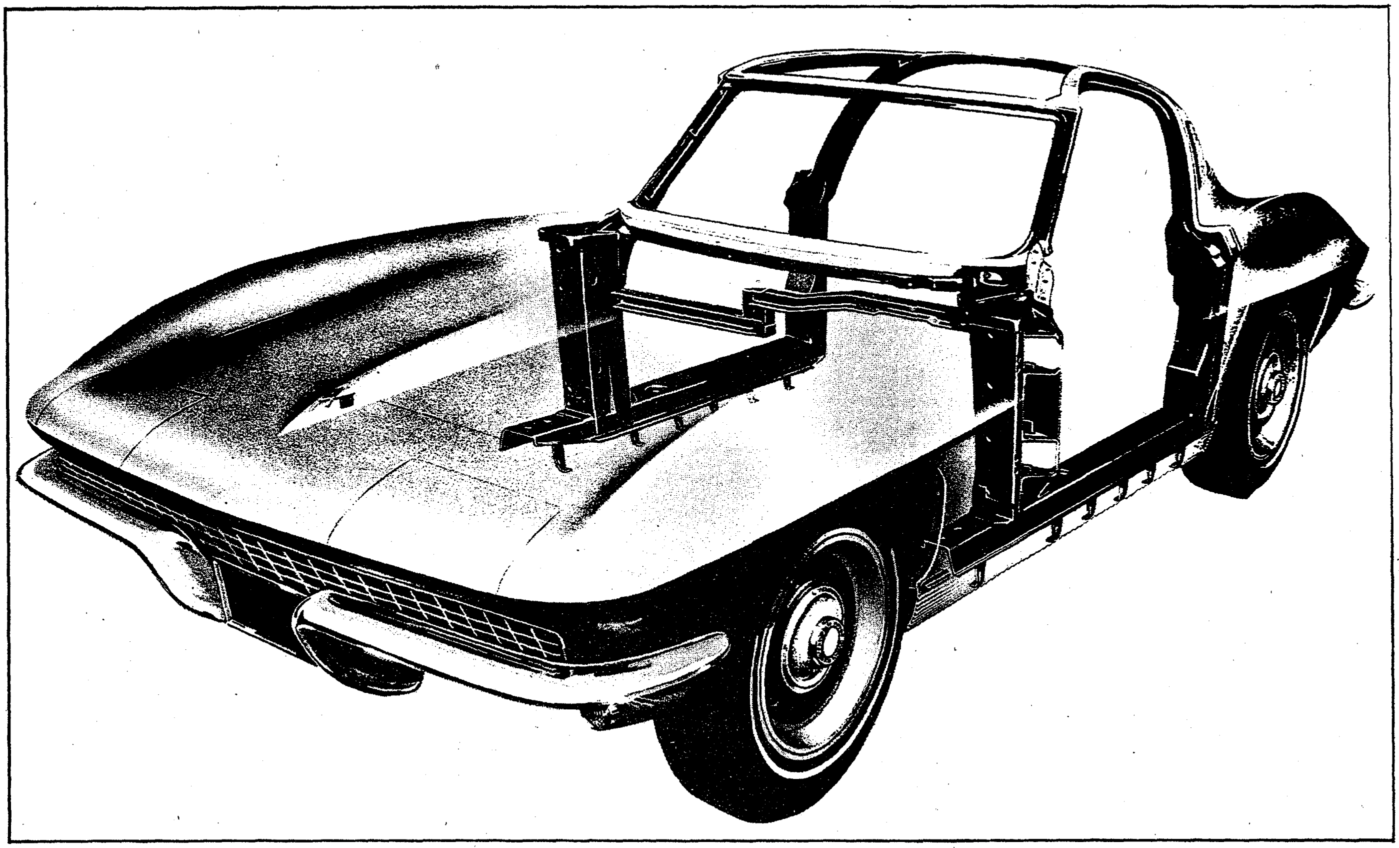


Fig. 1—Steel Reinforcing Members

by loosening the hinge retaining bolts (lower) and moving the hood to the limit of slotted holes in hinge strap.

The upper surface of hood may be brought flush with adjacent surfaces by shimming under hinges and adjustment of bumper screw and catch bolt engagement. Figure 3 illustrates desired spacing.

Hood Catch

The hood catch should be adjusted so that catch bolts enter lock plates freely and catch bolt length should be adjusted so that rubber bumpers are slightly compressed in latched position.

Entrance of catch bolt into the plate may be adjusted by loosening the three catch bolt mounting screws enough to allow movement of bolt assembly.

Synchronization of catch release may be made by adjusting the cable retainer located at left hand catch plate assembly.

HOOD ASSEMBLY

Removal

1. If hood is to be reinstalled, scribe a line around hood hinge upper strap as shown in Figure 4.
2. With aid of a helper to support hood, remove screws retaining hinge straps and support assembly to hood. If hinges are removed from vehicle, note amount of shims under each hinge.

Installation

In replacing original hood, align hinge with scribe marks made on removal and install retaining screws removed from hinges and support.

If adjustment is required, proceed as outlined in this section under Adjustments - Hood - Hood Catch.

HOOD PROP

Safety Retention Feature

When extended under hood service operations are anticipated, the hood prop track and slide should be secured by placing a 1/4" bolt and nut through the existing holes. This will prevent accidental closing of the hood that could result in a serious injury.

FRONT EMBLEM

The front emblem is retained by special nuts which may be reached by raising hood (fig. 5).

VENT GRILLES

Removal

1. Remove windshield wiper arm on side of car affected.
2. Remove four screws attaching grille to body (fig. 5).
3. Lift grille far enough to gain access to windshield washer hose and remove hose from nozzle.
4. Remove grille from vehicle.

Installation

Grille may be installed by following removal procedure in reverse order.

INSTRUMENT PANEL TRAY

The instrument panel tray may be removed from the

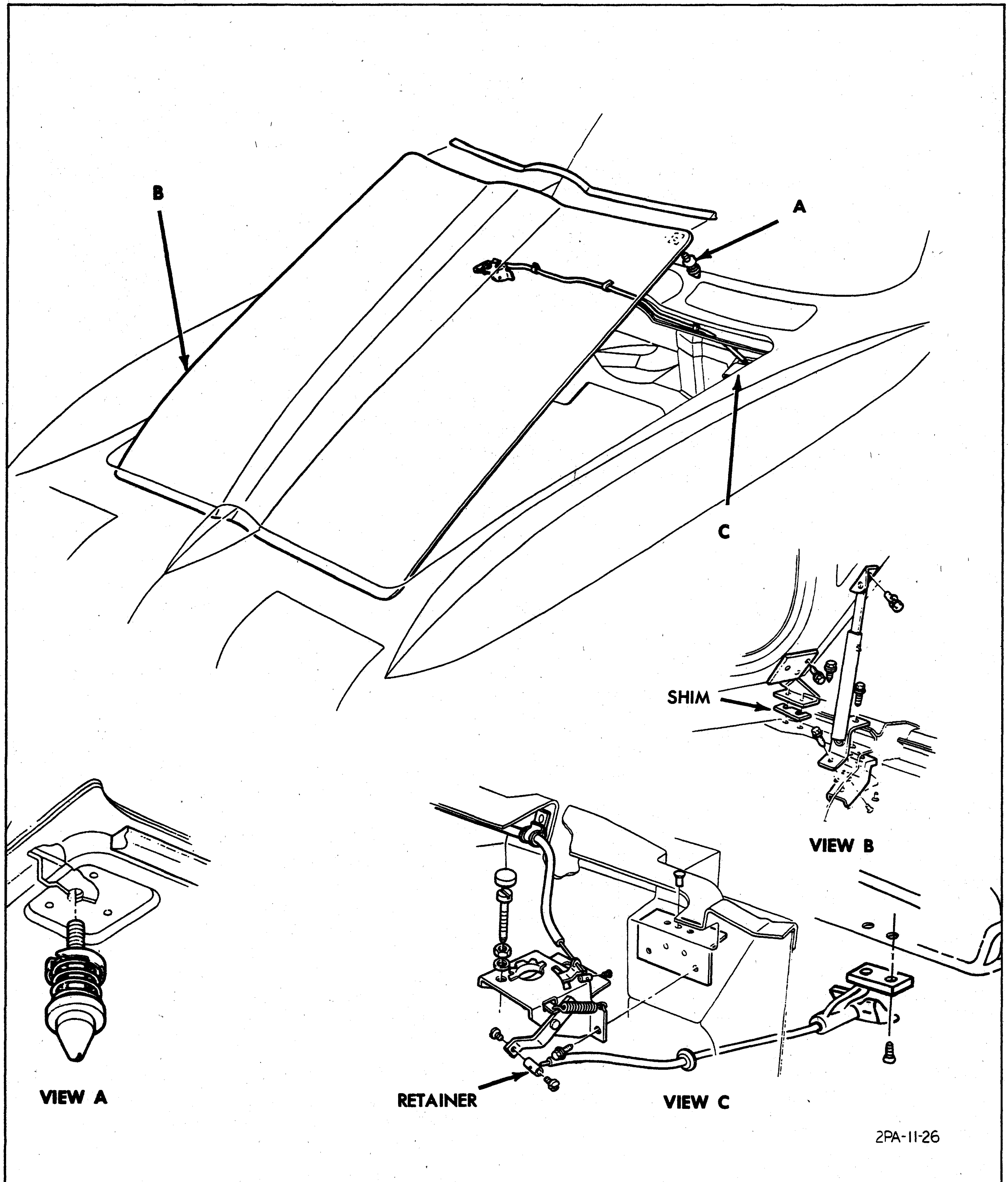


Fig. 2—Hood Hinge and Catch

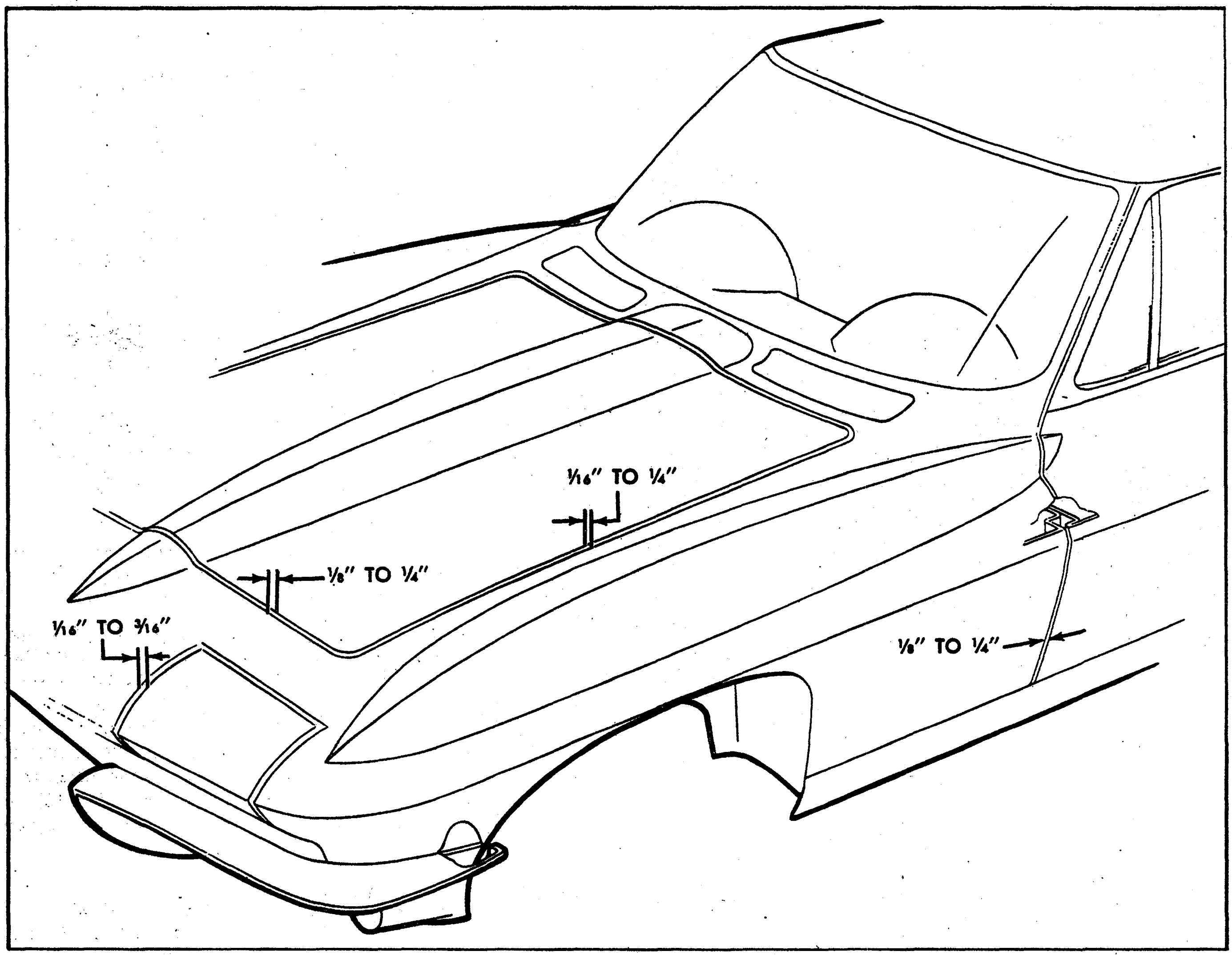


Fig. 3—Hood Spacing

vehicle as a unit by removing six screws around the outer edge of opening, two screws retaining striker plate and four screws which fasten compartment support to cowl cross brace under dash. For parts identification refer to Figure 6.

COWL AREA TRIM

Figure 7 illustrates instrument panel pads, cowl "kick" panels, radio grille cover and console-to-dash trim panel.

Figure 8 illustrates trim and moldings which are installed in the console area.

When installing instrument panel pads, it is advisable to use new clips. Position of these clips upon installation is illustrated in Figure 9.

REAR VIEW MIRROR

Outside

Removal

The outside rear view mirror may be removed from the door by removing the set screw, located on the inboard side of the mirror support, with an allen wrench.

Installation

Mirror may be installed by following the removal procedures in reverse order.

Inside

Installation of inside mirror may be seen in Figure 10. Tension of mirror stud may be adjusted by loosening or tightening adjusting screw.

SUN VISOR

Attachment of sun visor assembly to windshield header is made as shown in Figure 10. Turning adjusting screw in increases friction.

COWL VENTILATOR ASSEMBLY

The following outline covers either the right of left hand side. Refer to Figure 11.

Removal

1. Disconnect positive cable from battery.

Fig. 4—Scribing Line Around Hood Hinge

2. Remove cowl "kick" pad grille.
3. Disengage control cable fastened to cowl vent by nut retainer.
4. Remove vent control knob retained by set screw.
5. Remove center console trim and pass control cable under instrument panel with care, avoiding damage to electrical connections.

Installation

Install vent assembly following removal procedure in reverse order. Check operation of vent. Connect positive battery cable.

WINDSHIELD

Consult Figure 12 for parts identification.

Removal

1. Remove side, upper and lower garnish moldings (fig. 13).

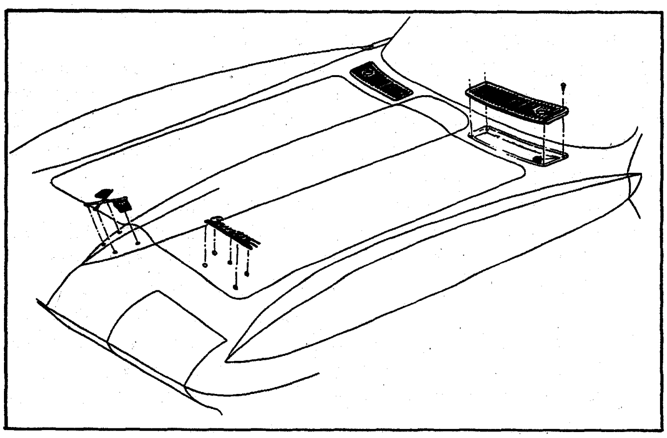


Fig. 5—Emblem and Vent Grille

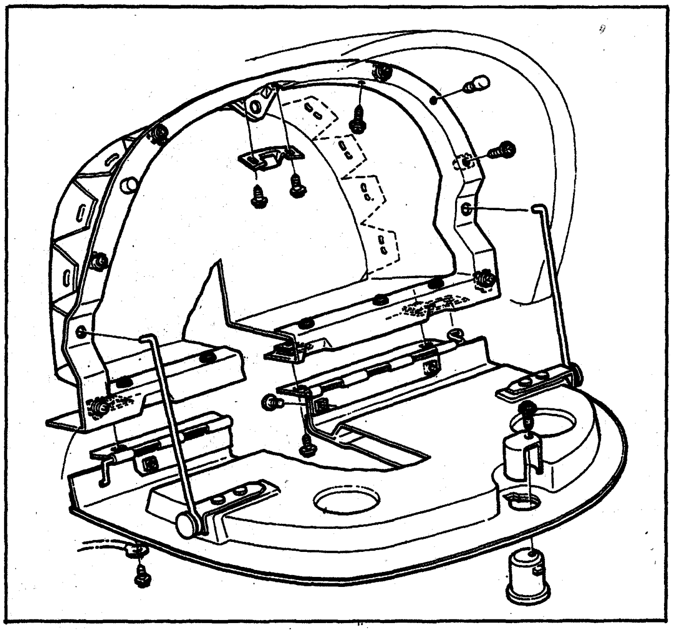


Fig. 6—Instrument Panel Tray

2. Remove four screws retaining side reveal moldings.
3. Remove upper reveal molding after marking molding and header rail to ease reinstallation as shown in Figure 14.
4. Mark position of lower reveal molding as shown in Figure 15 and pry molding out of weatherstrip.
5. From inside vehicle carefully pry weatherstrip from pinchweld flange of windshield frame (fig. 16) and work windshield-weatherstrip assembly out of body opening toward front of vehicle.

Checking Windshield Body Opening

When the vehicle has been involved in a collision or in cases where windshield has been subject to "strain

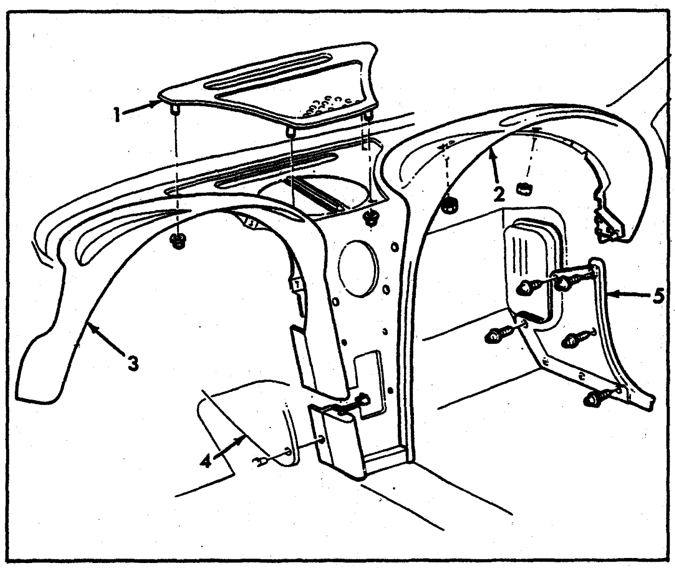


Fig. 7—Cowl Area Trim

1. Screen Assembly
2. Pad Assembly L.H.
3. Pad Assembly R.H.
4. Trim Panel
5. Cover Assembly

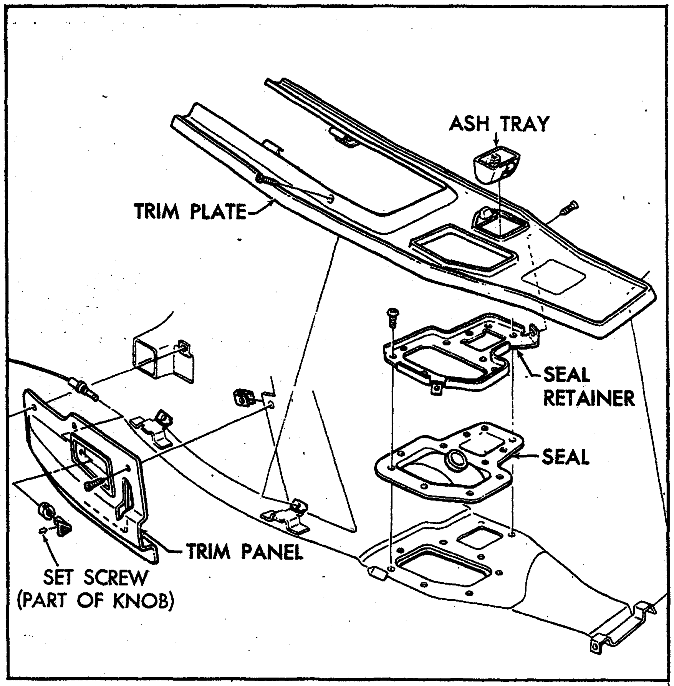


Fig. 8—Console Trim

cracks'', the windshield opening must be carefully checked for irregularities and deformation. To check windshield opening proceed as follows:

1. With weatherstrip and all foreign material removed from perimeter of opening and with molding clips in place, install windshield checking blocks (Special Tool J-8942) as shown in Figure 17. Note that checking blocks must be placed over molding clips to obtain proper alignment.
2. Place a new windshield glass in opening, resting on J-8942 blocks as shown in Figure 18.
3. Check fit of glass carefully. Space between glass and frame should not vary more than 1/8".
4. Mark and repair any imperfections. Recheck fit as required.

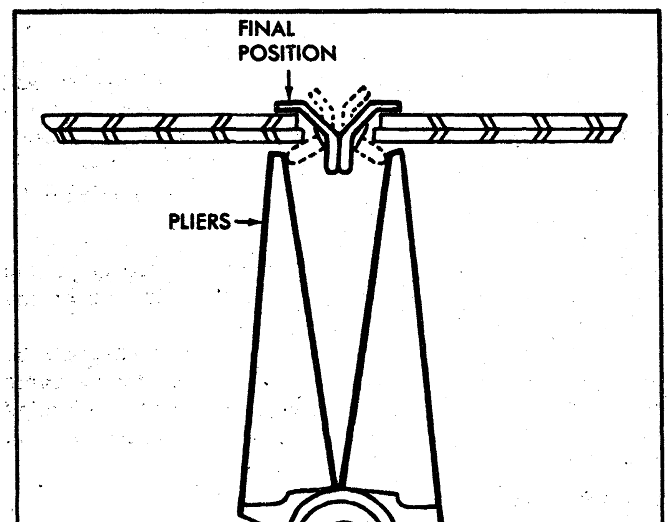


Fig. 9—Special Clip

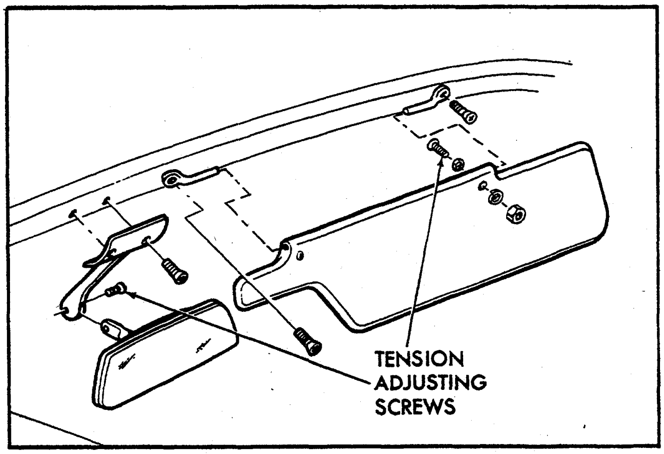


Fig. 10—Sun Visor and Inside Rear View Mirror

Installation

1. Carefully clean all loose material out of windshield frame (fig. 19).
2. Install new molding clips (Item 9, fig. 12). Both models use 13 type B clips equally spaced on lower frame section. 37 Models use 11 type A clips equally spaced on the top frame section.
3. Apply a bead of gun grade body sealer such as 3M-1170 in apex of windshield frame as shown in Figure 20.
4. Install weatherstrip on windshield glass.
5. Starting at bottom center of glass, insert a piece of heavy cord such as chalk line, etc. in groove of weatherstrip. Cut cord long enough so that about 10" of free length exists after going around windshield. Knot ends of cord together where they meet at bottom center of glass and draw knot into groove (fig. 21). Tape loose ends to inside surface of glass as shown.
6. Place weatherstrip windshield assembly in windshield frame. From inside of vehicle grasp ends of cord and pull toward you. It is wise to have an assistant exert gentle but firm pressure on outside surface of glass in the area where string is emerging from weatherstrip. Figure 22 illustrates action of string on weatherstrip. Lip of seal is pulled out of frame apex and over pinchweld flange.
7. When string has been removed, carefully inspect seating of lip over entire perimeter of windshield, paying particular attention to corners.
8. Apply 2 beads of sealer on outer surface of weatherstrip as shown in Figure 23. Inject a moderate quantity of windshield cement such as 3M-6699B between windshield glass and weatherstrip using pressure gun as shown in Figure 23.
9. Install lower reveal molding, aligning it with mark made upon disassembly. Refer to Figure 12, View A, before attempting installation; note that flange of molding and clips (item 9) at ends of molding must pass between molding retaining clips and windshield frame. If difficulty is met in engaging molding flange with retaining clips, a piece of shim stock may be used as a ''shoe horn'' to place flange behind clips.
10. Install in order named: Upper reveal molding (aligning marks made at disassembly); side weatherstrip

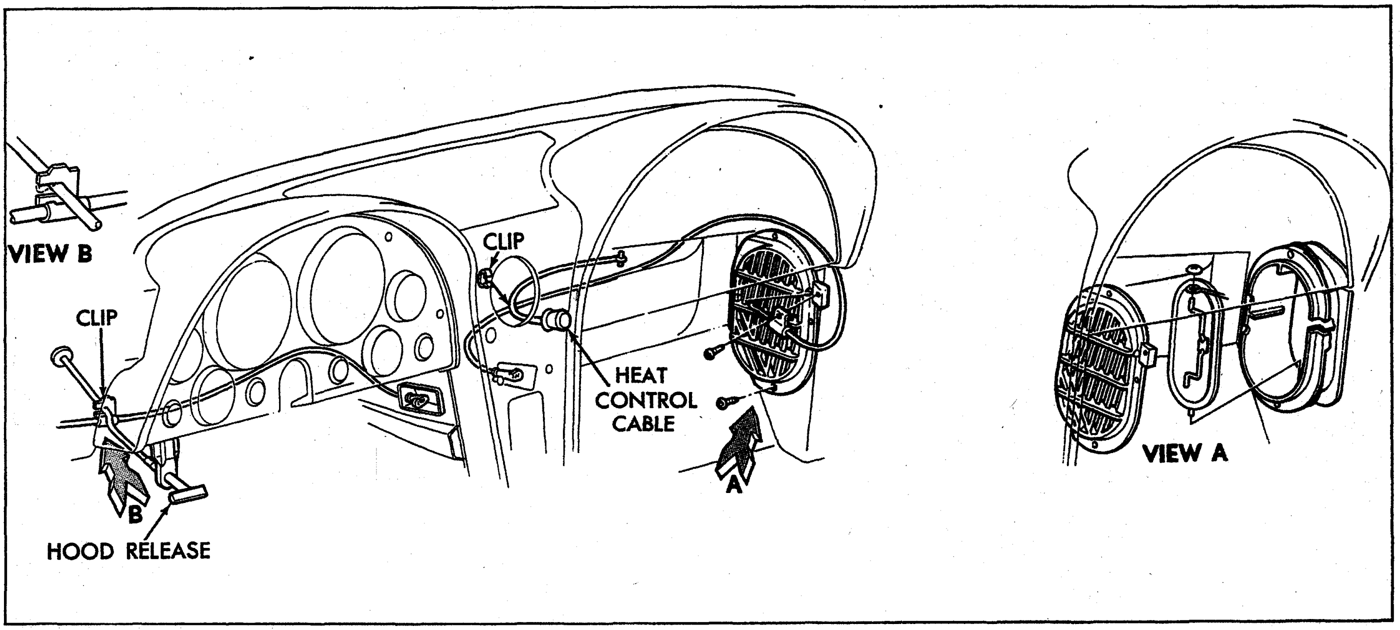


Fig. 11—Cowl Ventilator and Controls

and reveal moldings; upper garnish molding; lower garnish molding; side garnish molding; header latch plates on 19467 Models and rear view mirror.

11. Clean up excess sealer and cement with rag dampened with oleum spirits, prep-sol or kerosene; install wiper arm assemblies.

DOORS

ADJUSTMENTS

Door Lock Striker

Door lock strikers incorporate an inter-lock feature consisting of a notch in the striker into which the lock bolt housing extension engages. With the inter-lock feature it is very important that the lock extension engages properly in the striker notch and that, where necessary, the correct striker emergency spacers are used to obtain proper engagement.

1. To adjust striker up, down, in, or out loosen striker plate screws and shift striker and adjusting plates as required, then tighten screws.
2. To determine if door lock striker emergency spacers are required, apply modeling clay or body caulking compound in the door lock striker notch where the lock extension engages, and then close the door to form a measurable impression in the clay or caulking compound, as shown in Figure 24. Remove all clay or compound when adjustment is completed.

When dimension "A" from inside face of striker teeth to center of lock extension is less than 3/16", install emergency spacers and proper length striker attaching screws.

NOTE: Dimension "B" from center of lock extension to inside face of striker notch should never be less than 1/8".

If check indicates need for emergency spacers, proceed as follows:

1. With pencil, scribe position of striker on body pillar.
2. Remove three door lock striker attaching screws and remove striker and adjusting plates from pillar.
3. To install, place striker, shims and adjusting plates within scribe marks on pillar and tighten screws.

IMPORTANT: Whenever a door has been removed and installed, or realigned, the door SHOULD NOT be closed completely until a visual check is made to determine if the lock extension will engage in the striker notch. Where required, door lock striker emergency spacers should be installed so that door can be closed and an accurate check made to determine emergency spacer requirements.

Door Window and Vent Adjustment

To move the top of the window in or out, the bottom ends of both run channels are adjustable. The rear channel is adjusted by loosening the lower of the two screws on the rear face of door, "C" Figure 25, and moving channel as necessary. The front channel is adjusted by removing the trim pad and moving the channel in or out by a stud and nut adjustment, "B" Figure 25. The top end of the rear channel is not adjustable in or out.

On 19467 models an adjustment may be made to the closed-door relationship of the vent assembly to the windshield frame. This adjustment is controlled by the stud-nut assembly "B" Figure 25.

The closed position of the window is controlled by bumper assemblies located at each end of window frame as shown in Figure 26. Access to bumper retaining screw may be gained through holes "D" and "E" in Figure 25.

Door Hinges

The position of the door assembly in the body opening is adjusted by the striker plate position covered previously and the position of the door on the hinge rear

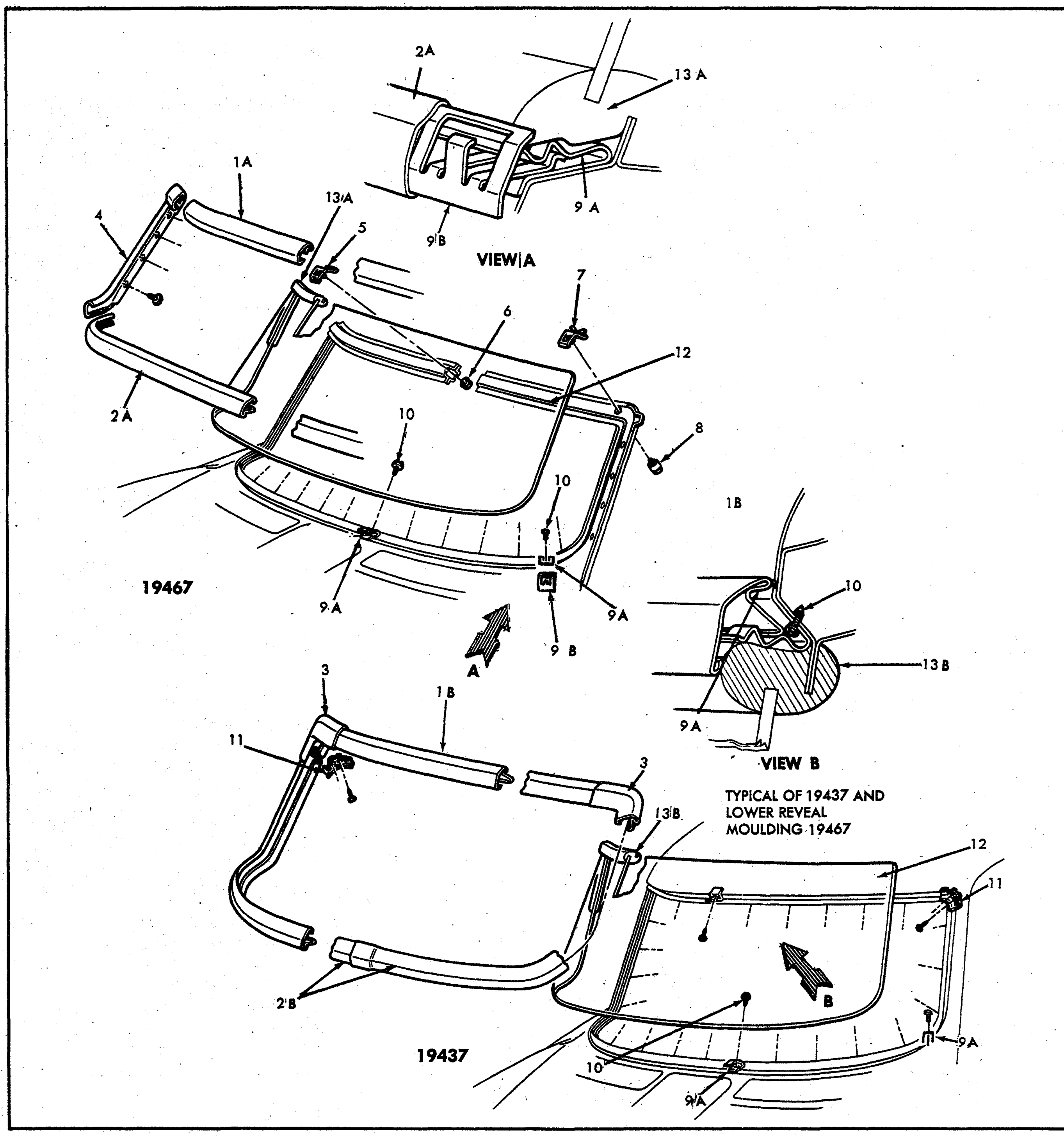


Fig. 12—Windshield Glass and Reveal Moldings

1. Upper Reveal Molding: A-67; B-37
2. Lower Reveal Molding: A-67; B-37
3. Upper Corner Reveal Molding Caps
4. Side Reveal Molding - 67
5. Upper Reveal Molding Retainer (67 only)
6. Upper Reveal Molding Retainer Nut (67 only)
7. Side Reveal Molding Upper Retainer (67 only)
8. Side Reveal Molding Upper Retainer Fastener (67 only)
9. Molding Clip: A-67 and 37 B-67 only
10. Molding Retaining Clip Screw
11. Upper Reveal Molding Cap Retainer
12. Windshield Glass
13. Weatherstrip Assembly A-67; B-37

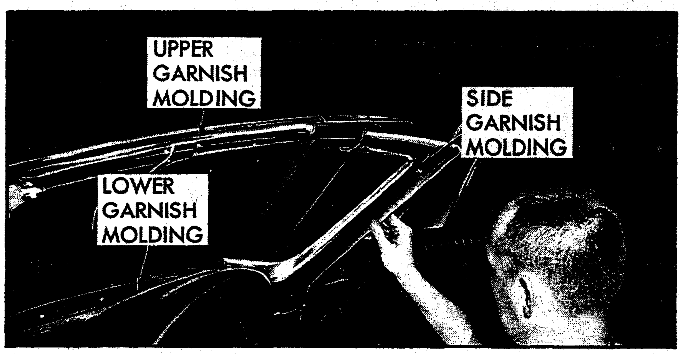


Fig. 13—Removing Garnish Moldings

Fig. 14—Removing Upper Reveal Molding

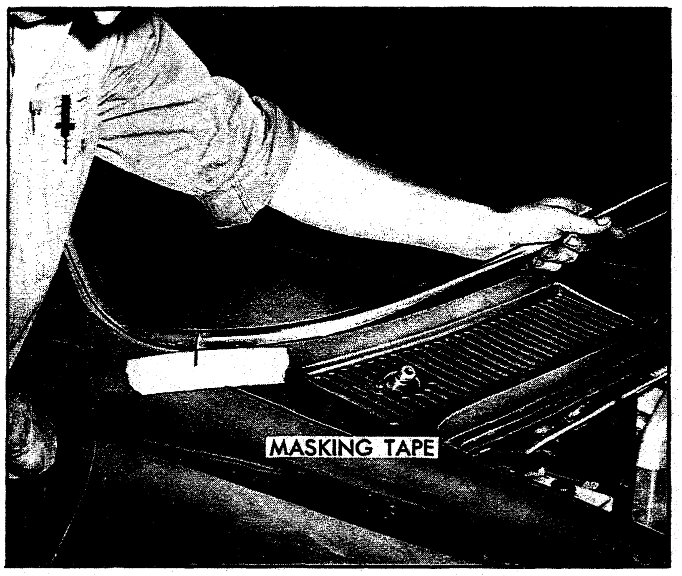


Fig. 15—Removing Lower Reveal Molding

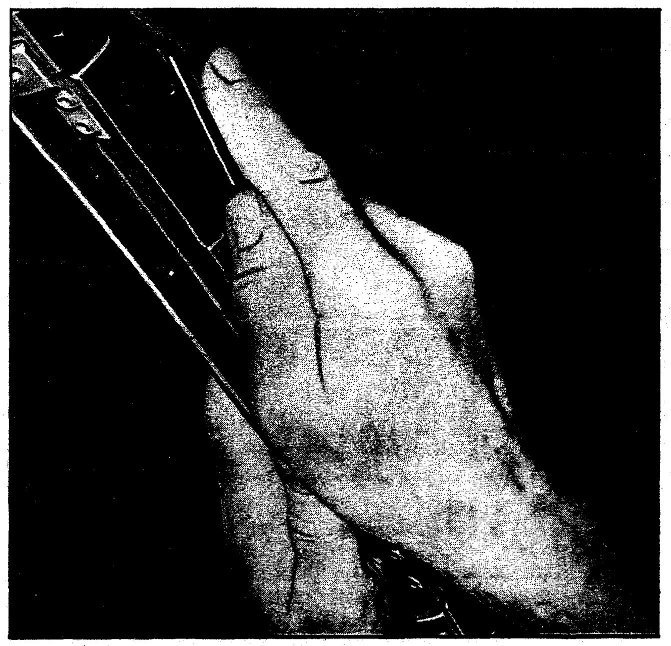


Fig. 16—Removing Weatherstrip From Frame

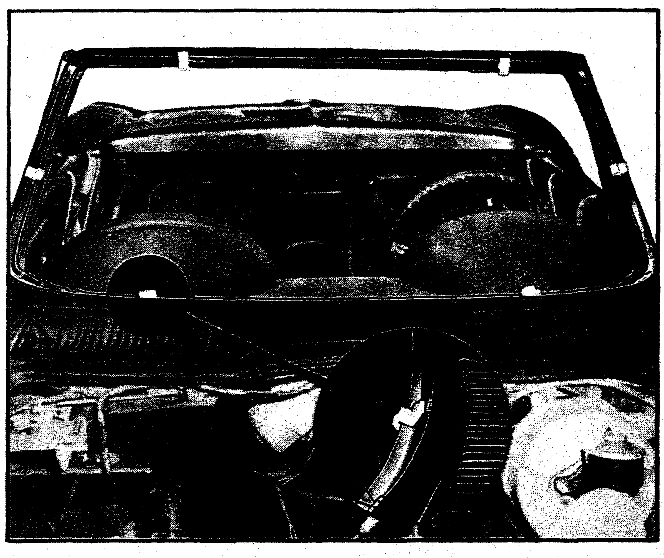


Fig. 17—Windshield Checking Blocks

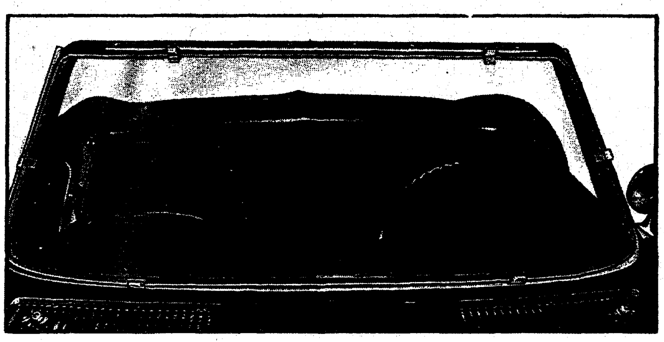


Fig. 18—Windshield Glass On Blocks

Fig. 19—Cleaning Windshield Frame

straps. The position of the door is adjusted by sliding the door fore and aft to the limit of the slotted holes in hinge strap or by moving door toward or away from the center of the vehicle, as desired, by installation or removal of shims located between hinge rear strap and door (fig. 27). To adjust door proceed as follows:

1. Remove door trim panel as outlined in this section.
2. Remove lock striker plate after first scribing a line around it on lock pillar to ease alignment when reinstalled.

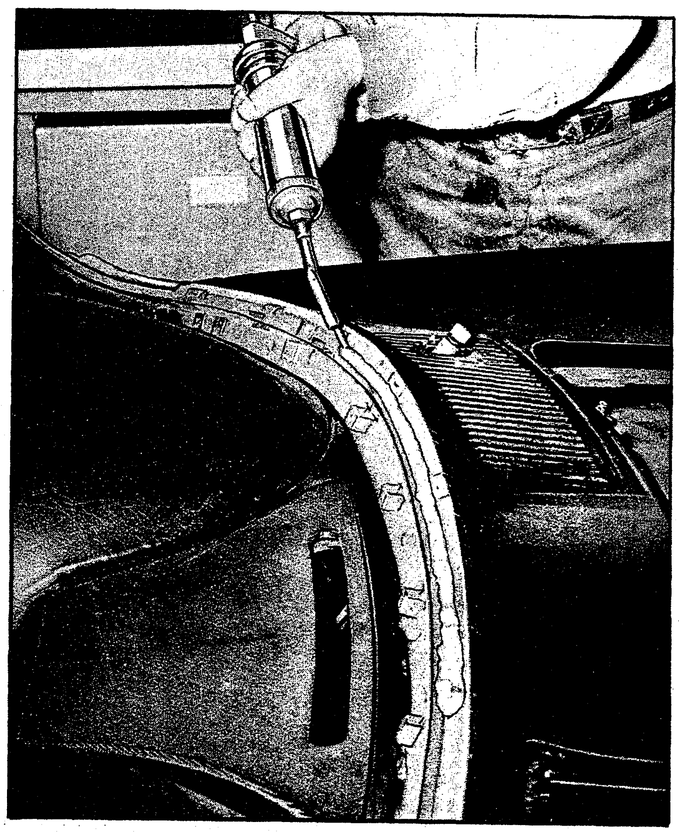


Fig. 20—Applying Sealer

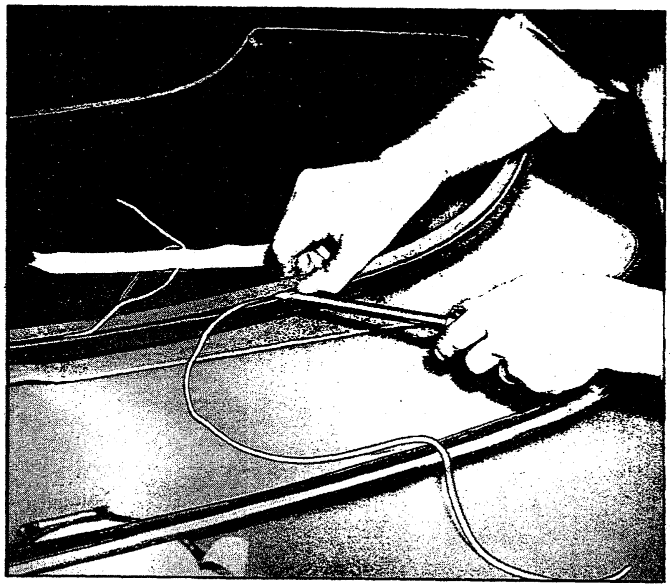


Fig. 21—Installing Cord

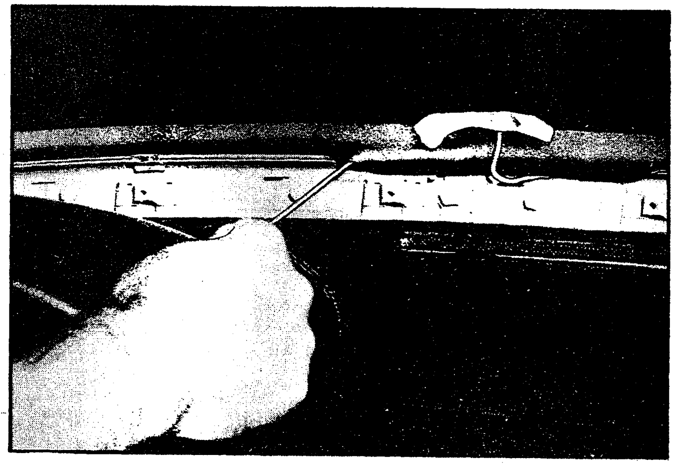


Fig. 22—Seating Weatherstrip

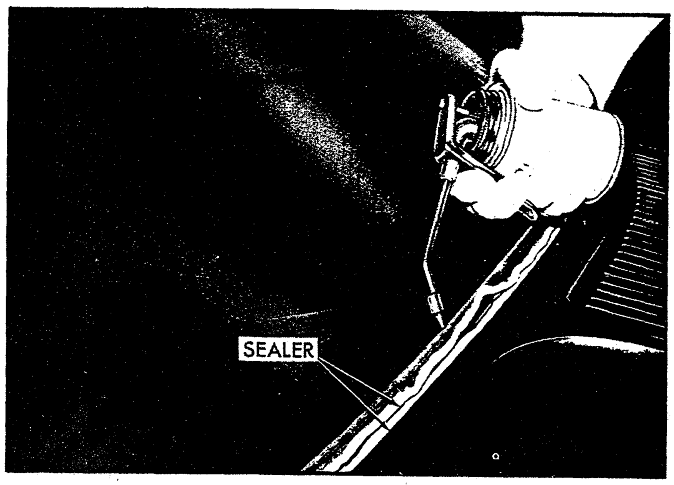


Fig. 23—Applying Sealer and Cement

Fig. 24—Checking Adjustment of Striker

3. Adjust door as required. Location of hinge retaining bolts may be seen in Figure 25 at "A". Do not allow doors to hang on one hinge without support.
4. Install trim pad and lubricate door "hold opens" and hinges with Lubriplate or its equivalent.

NOTE: After performing any door adjustment, the window and door post should be checked for alignment and adjusted as necessary. In addition, never slam the door after adjustment without first checking the door lock and striker plate engagement. An adjustment may be necessary.

TRIM PANEL, AND INSIDE HANDLES

Figure 29 is an exploded view of integral arm rest, inside handles, and trim panel fastenings.

Removal of trim panel may be accomplished as follows:

1. Remove two screws under arm rest.
2. Using Tool J-7797, remove clips retaining window crank and lock remote control as shown in Figure 28.

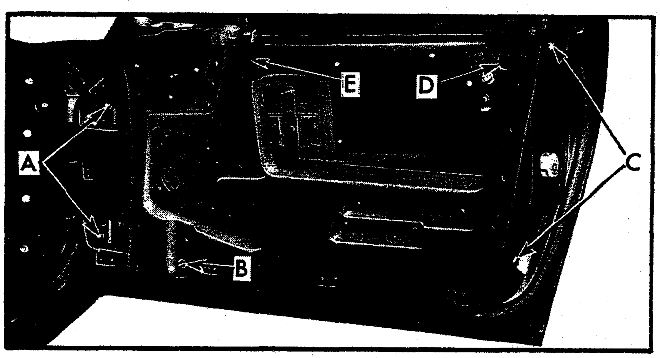


Fig. 25—Door Adjustment Points

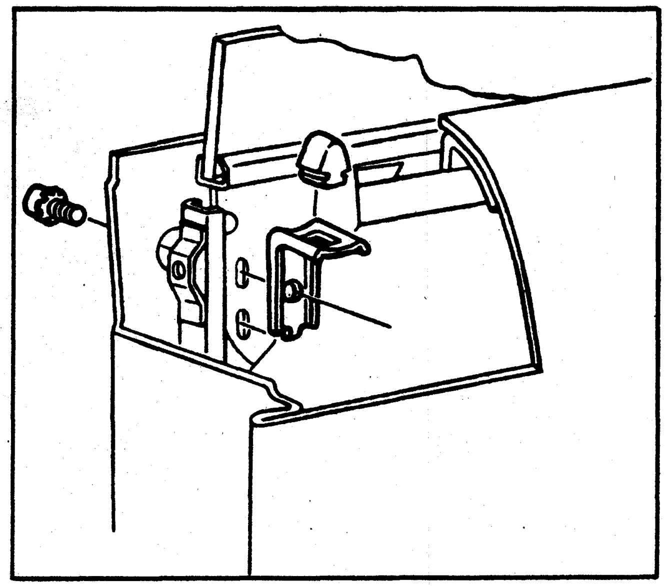


Fig. 26—Window Rear Stop - Typical

3. Remove knob from door lock control by turning counter-clockwise.
4. Remove 2 screws retaining inside pull handle.
5. Remove sheet metal screws and special washers retaining trim panel to door assembly.
6. Pull trim panel out at bottom, tap bottom edge of trim panel with hand to disengage from top of door. Remove trim panel from vehicle.

WEATHERSTRIP

Figure 30 illustrates both 19437 and 19467 model door

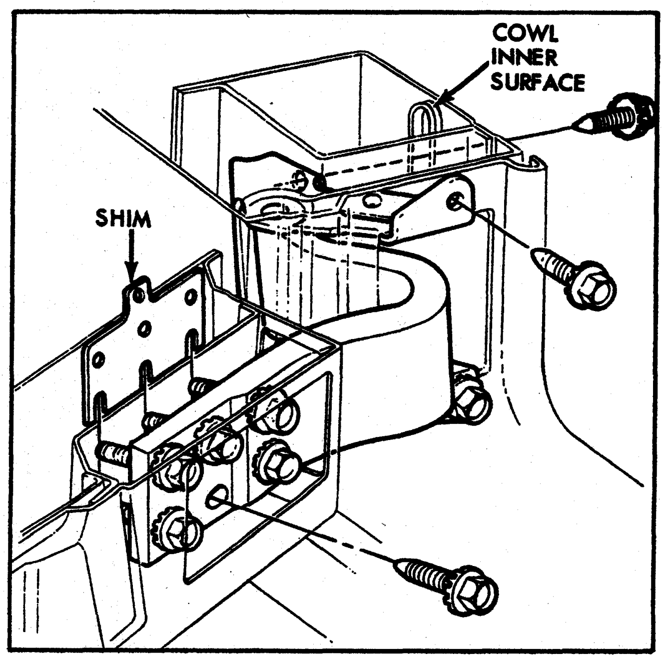


Fig. 27—Door Hinge

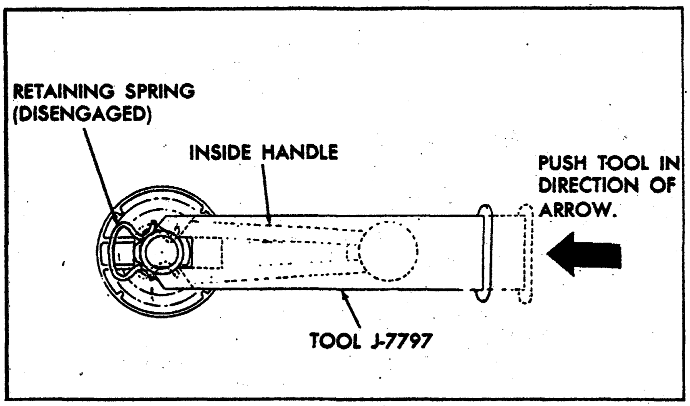


Fig. 28—Removing Window Crank With J7797

weatherstrip installation. When installing new weatherstrip, all dirt, loose paint and old cement must be removed to insure a good bond. Use only high quality cement designated by the manufacturer as being suitable for weatherstrip application.

DOOR VENTILATOR ASSEMBLY

19437 Model

For parts identification refer to Figure 31.

Removal

1. Remove door trim panel as previously outlined.
2. Remove door water deflector and large inspection plate from inner surface.
3. Roll window fully up and remove rear glass run channel.
4. Lower window and move to rear of door.
5. Remove regulator mounting screws (3) and regulator support mounting screws (3); remove mounting plate.
6. Remove window drive pin retaining screw and remove regulator from drive pin.
7. Remove ventilator assembly to door frame retaining screws (3).
8. Remove ventilator lower mounting nut and push stud through inner panel.
9. Pry upper glass run channel out of door enough to allow ventilator assembly to be tilted rearward; pull ventilator assembly up and out of door (fig. 33).

Installation

The door ventilator assembly may be installed by following the removal procedure in reverse order.

Ventilator Window Assembly Replacement

Window and frame assembly may be replaced without removing entire ventilator assembly from vehicle. Proceed as follows:

1. Remove door trim panel as outlined in this section.
2. Drill rivet from window upper pivot.

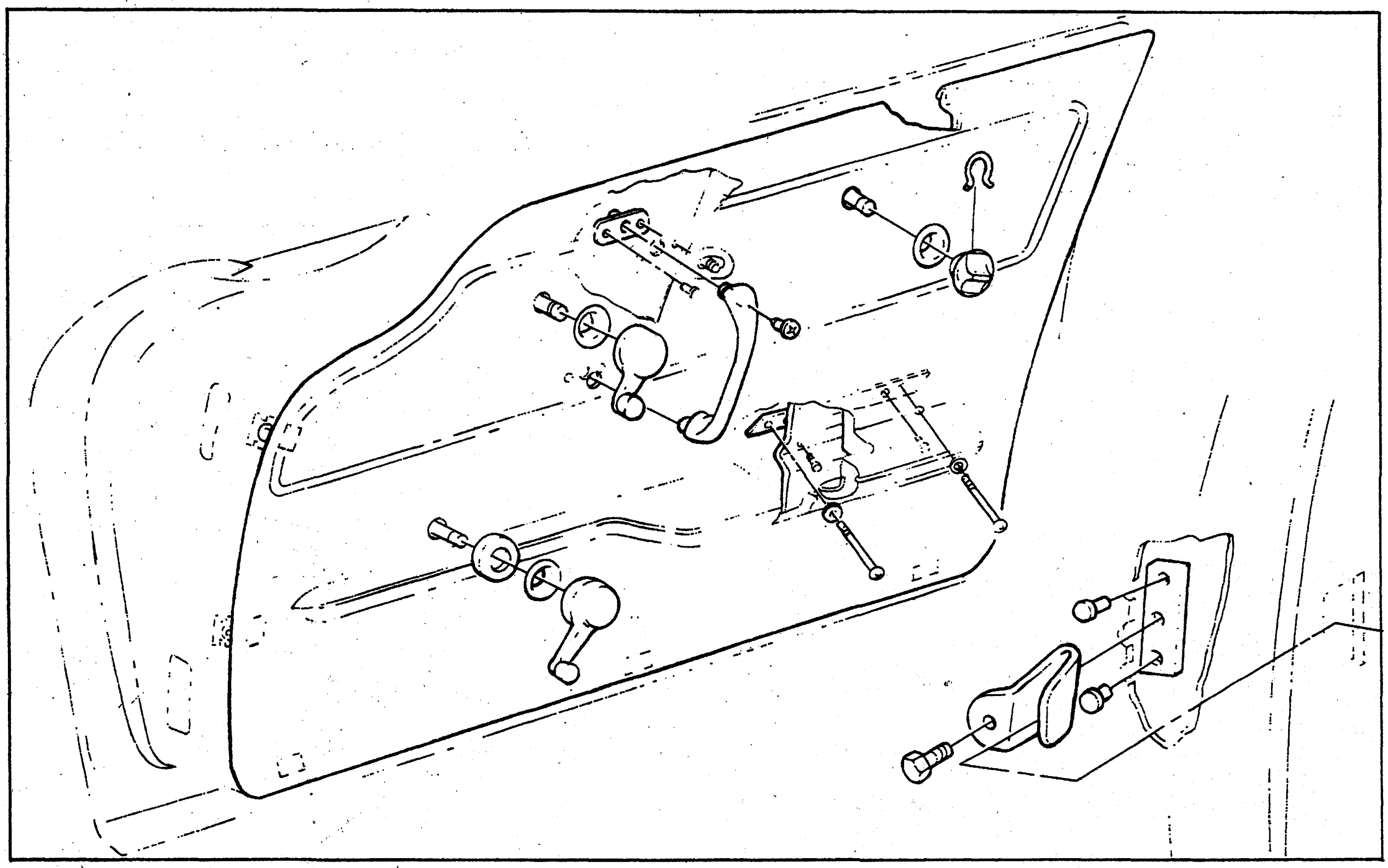


Fig. 29—Trim Panel, Arm Rest and Handles

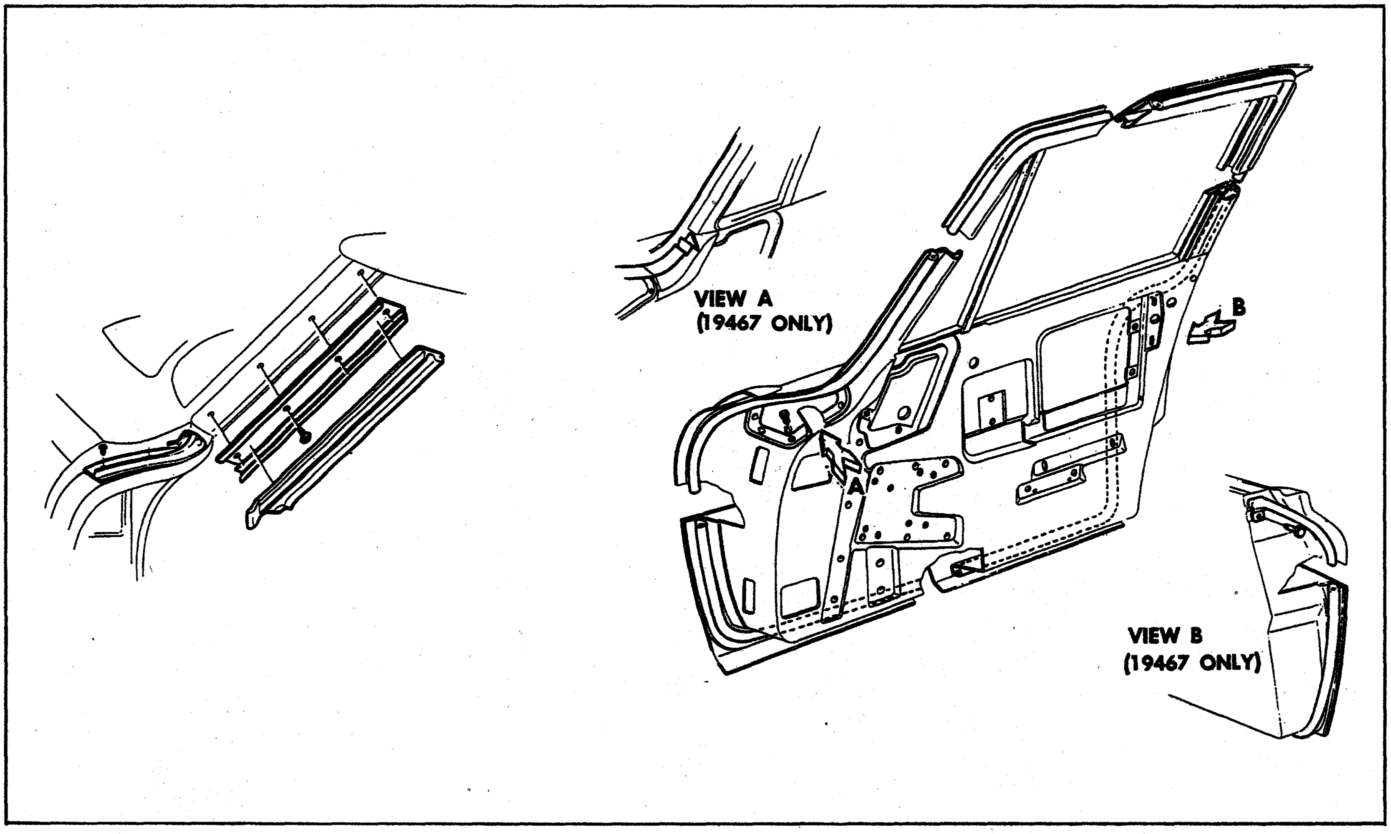


Fig. 30—Door Weatherstrip

3. Remove window drive pin retaining screw.
4. Loosen regulator support mounting screws.
5. Pull windows up and out of ventilator assembly.

19467 Model

Refer to Figure 34 for parts identification.

Removal

1. Perform Operations 1 and 8-19437 Model--Removal.
2. Remove ventilator assembly mounting screws and loosen ventilator assembly mounting nut - upper.
3. Lift ventilator assembly up and out of door pocket, rotating so that lower bracket will pass through window slot as shown in Figure 35.
4. Regulator may be separated from the ventilator assembly by removing window drive pin retaining screw and regulator mounting screw.

Installation

1. Pass lower bracket through window slot; rotate assembly and align mounting holes.
2. Install all mounting screws loosely.
3. Roll door window up carefully making sure forward edge of window is seated in its glass run channel.
4. Reach through larger access opening and insert lower mounting stud through door inner panel.
5. Tighten ventilator assembly mounting screws and install upper and lower mounting nuts.
6. Adjust as necessary as outlined under Doors - Adjustments - Door Windows.

Ventilator Window Assembly Replacement

Window and frame assembly may be replaced without removing entire ventilator assembly from vehicle. Proceed as follows:

1. Remove door trim panel as outlined in this section.
2. Remove window drive pin retaining screw.
3. Push down on window to disengage upper pivot pin from frame as shown in Figure 36.
4. Pull window assembly up and out of door.

WINDOW GLASS

Removal

1. Remove door trim panel and access covers as outlined in this section.
2. Remove ventilator assembly as outlined in this section. Consult write-up intended for body style involved.
3. Position window so that sash retaining nuts are accessible through door inner panel and remove screws (fig. 37).
4. Lower window at least 3/4 of total travel and remove from door pocket as shown in Figure 38.

Installation

1. If regulator upper guide rail has been removed from door pocket, replace it on regulator rollers. Note curvature of rail.
2. Insert glass in door pocket with convex curvature to the outside of car. Roll window regulator up until sash bolt locations are visible through holes in inner panel.
3. Align holes in sash with holes in upper guide rail and install bolts and nuts.
4. Install ventilator assembly. Consult write-up in-

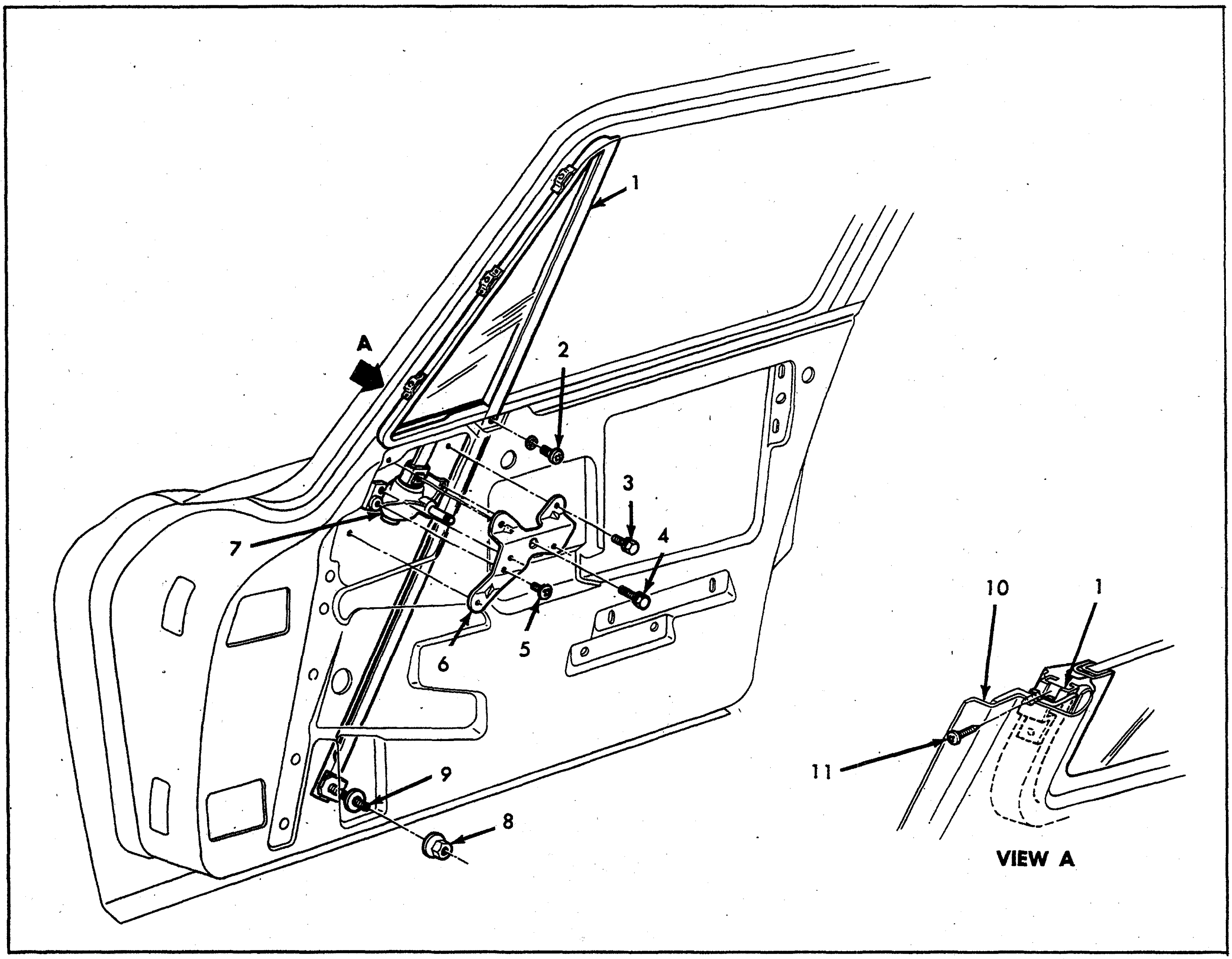


Fig. 31—Model 19437 Ventilator Assembly

1. Ventilator Assembly
2. Ventilator Assembly Upper Mounting Screw
3. Regulator Support Mounting Screw
4. Window Drive Pin Retaining Screw
5. Regulator Mounting Screw
6. Regulator Support
7. Regulator
8. Ventilator Assembly Lower Mounting Nut
9. Ventilator Assembly Lower Mounting Stud
10. Door Frame
11. Molding Mounting Screw

tended for body style involved.

5. Install trim panel and door handles as outlined in this section.

GLASS RUN CHANNEL—UPPER

Figure 39 illustrates the installation of the glass run channel used on 37 Models. The channel is retained in the body by means of snap fasteners which engage in holes in the door frame. Channel may be removed by simply lowering window and prying out with screw driver.

WINDOW OUTER SEAL ASSEMBLY

Removal

1. Remove door trim panel as outlined in this section.
2. Remove door window assembly as outlined in this section.
3. Remove retaining screws (4 on 37, 5 on 67). Refer to Figure 39.

Installation

1. Position seal assembly on door, aligning holes with holes in panel.
2. Start screws in holes and tighten after all are installed.
3. Replace door window and door trim panel.

WINDOW INNER SEAL

Removal and Installation

The window inner seal shown in View A of Figure 39 is retained to the door trim panel with staples. It is necessary to remove the trim panel from the vehicle to replace the inner seal.

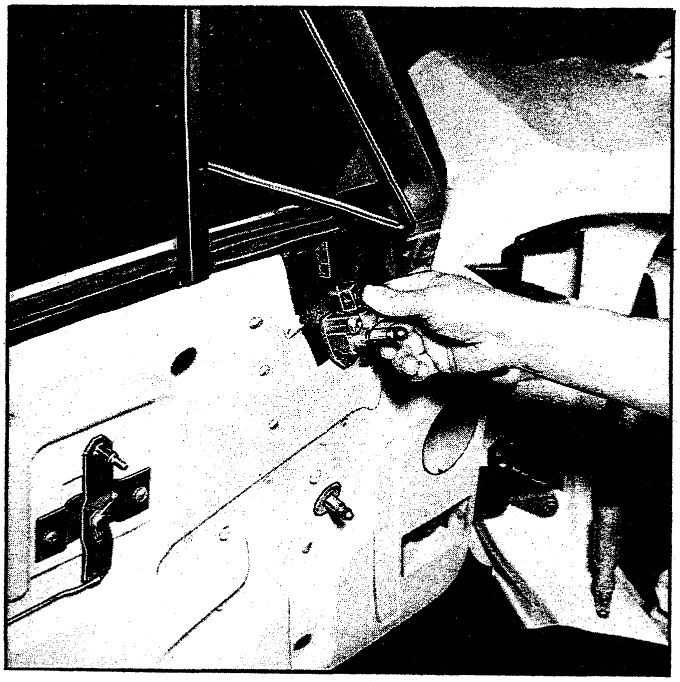


Fig. 32—Removing Regulator

GLASS RUN CHANNEL—REAR

Removal

For parts identification refer to Figure 41.

1. Remove door trim assembly as outlined in this section.
2. Remove window glass assembly as outlined in this section.
3. Remove 2 channel retaining screws and pass channels out through large opening in door inner panel (fig. 42).

Fig. 33—Removing Ventilator Assembly 19437

Installation

1. Position run channel in door and install bolts loosely.
2. Install window glass as outlined in this section.
3. Make necessary adjustments to channel as outlined under Doors - Adjustments - Door Windows.
4. Replace door window and door trim panel.

WINDOW REGULATOR—MANUAL

For parts identification see Figure 41.

Removal

1. Remove trim panel as outlined in this section.
2. Remove door window glass as outlined in this section.
3. Remove screws retaining regulator assembly to door panel.
4. Remove screws holding lower guide rail to door panel.
5. Remove regulator assembly from large access opening as shown in Figure 43.

Installation

Regulator may be installed by following removal procedure in reverse order. Always lubricate all guide rails and rollers when regulator is disassembled. Test regulator thoroughly before installing door trim panel. Adjust window as outlined in this section.

WINDOW REGULATOR—POWER

In cases where window will not operate, check electrical connections first. Figure 44 illustrates location of junctions, switches and circuit breaker.

Removal

Perform operations 1 thru 5 under Window Regulator-Manual Removal. Note, however, that electrical connectors must be removed from motor before performing any operation on regulator. Figure 44 illustrates installation of regulator on door and regulator wiring.

Disassembly

> **NOTE:** Do not attempt to remove motor from regulator until the following operations are performed. THIS IS A SAFETY ITEM; arm is spring-loaded and may cause injury if not locked in position when motor is removed.

Refer to Figure 45.

1. Place regulator assembly in vise.
2. Using jumper leads to 12 volt power supply, operate motor until semi-circular hole in sector gear centers over one of two weld nuts on mounting plate.
3. Screw a 1/4"-20 x 1" bolt into weld nut so that end passes through hole in sector gear. It may be necessary to enlarge hole in gear slightly with file or drill. Install nut on bolt to lock arm in position.

Installation

1. Be sure lock bolt has been removed if regulator has been disassembled.
2. Install lubricated regulator assembly and guide rails in door in reverse order of removal.
3. Install window as outlined in this section.
4. Making sure connectors are securely installed on motor, test operation of window thoroughly.
5. Install door trim panel and handles as outlined in this section.

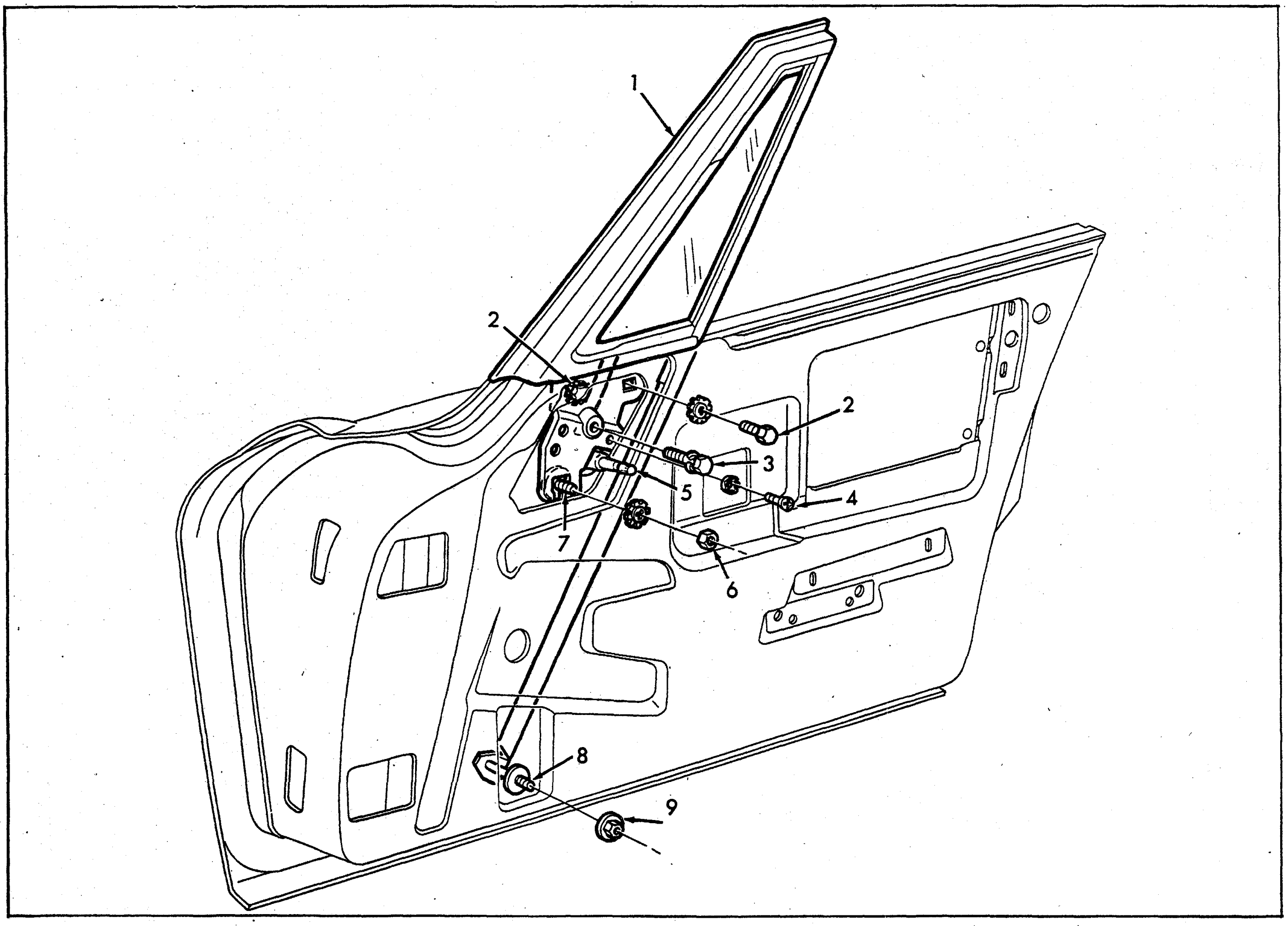


Fig. 34—Model 19467 Ventilator Assembly

1. Ventilator Assembly
2. Ventilator Assembly Mounting Screw
3. Window Drive Pin Retaining Screw
4. Regulator Mounting Screw
5. Regulator
6. Ventilator Assembly Mounting Nut - Upper
7. Ventilator Assembly Mounting Stud - Upper
8. Ventilator Assembly Mounting Stud - Lower
9. Ventilator Assembly Mounting Nut - Lower

DOOR LOCK AND REMOTE CONTROLS

For parts identification refer to Figure 46.

Removal

1. Roll door window fully up.
2. Remove door trim panel as outlined in this section.
3. Remove two screws holding door lock remote control assembly and disengage control from lock remote control rod.
4. Remove cover from larger access hole in door inner panel.
5. Remove two screws retaining remote locking control assembly and disengage control from remote control locking rod.
6. Remove 4 screws retaining lock assembly, disengage control rods and remove lock from door pocket.

Installation

To install lock and controls follow removal assembly in reverse order. All components should be lubricated before installation.

OUTER HANDLE

For parts identification refer to Figure 47.

Removal

1. Remove door trim panel as outlined in this section. Remove larger access hole cover.
2. Roll door window fully up.
3. Working through access hole, remove 2 door handle retaining screws.
4. Remove handle from door outer surface. Retrieve reinforcement from inside door pocket. Discard old gaskets.

Installation

1. Install new gaskets and position door handle on door outer panel.
2. Position reinforcement on door inner panel and install handle retaining screws.
3. Carefully check operation of door lock.
4. Install door trim panel as outlined in this section.

Fig. 35—Removing Ventilator Assembly - 67

LOCK CYLINDER

Replacement

1. Perform Operations 1 and 2 under Outer Handle - Removal.
2. Tap retainer (fig. 47) toward trailing edge of door until free of cylinder.
3. Disengage cylinder from rod and remove cylinder and escutcheon from door.

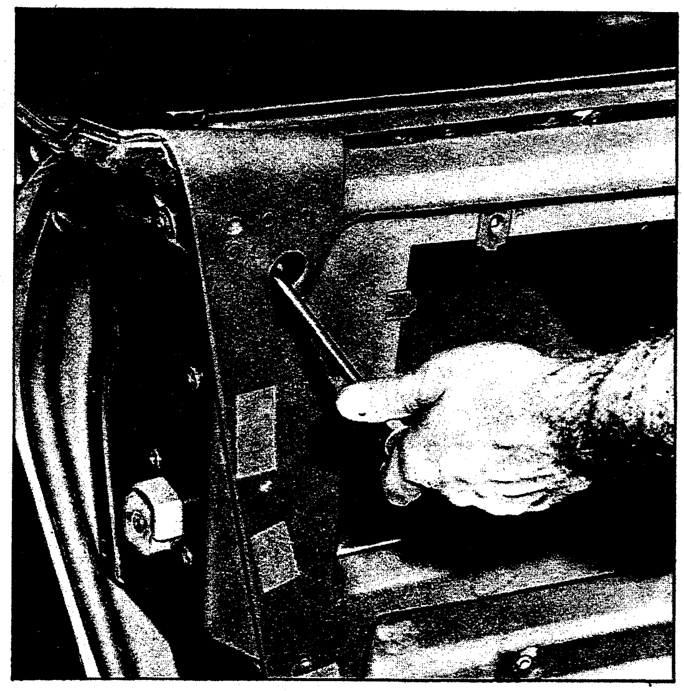


Fig. 37—Removing Sash Retaining Screws

4. Installation may be made by following removal procedure in reverse order.

HINGES—DOOR ASSEMBLY

Refer to Figure 48.

Removal

1. Remove door sill plate.
2. Remove door inner trim panel as outlined in this section.

Fig. 36—Removing Vent Window Assembly - 67

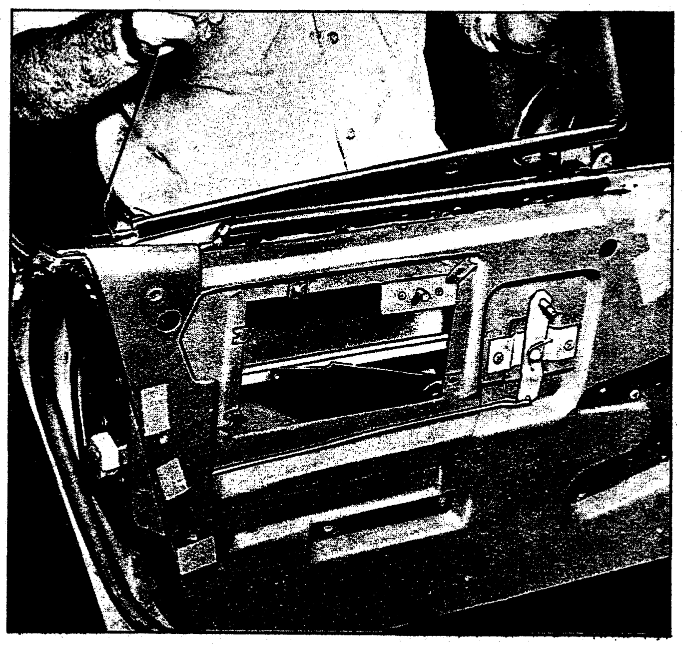


Fig. 38—Removing Door Window

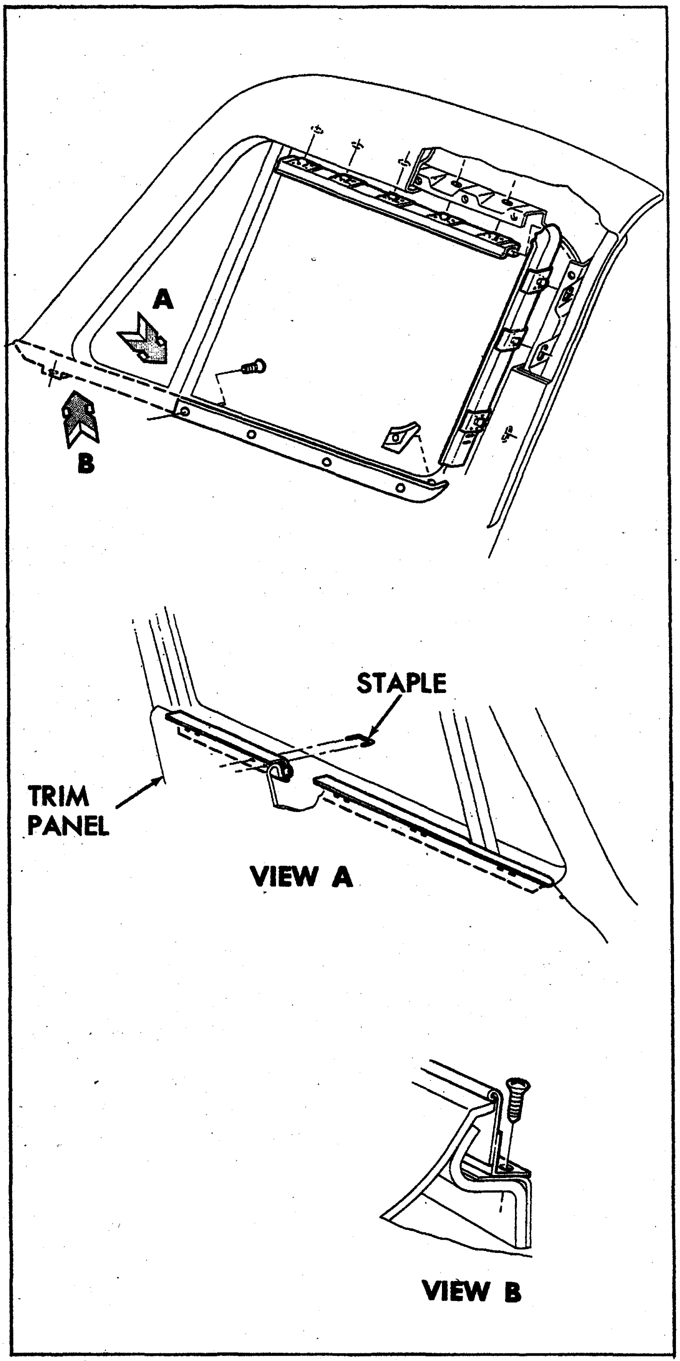


Fig. 39—Window Run and Seal Assembly

3. If entire door is to be removed and door has electric power window, disconnect and remove wiring between hinge pillar and door.
4. If hinge is to be replaced in same position, scribe around inner strap on door panel and record number of shims found between hinge strap and door panel.
5. Remove bolts retaining hinge to door; do no allow door to hang unsupported on one hinge.
6. Remove cowl panel inner trim as explained under Front End-Cowl Area and Console Trim.
7. Remove cap screws retaining hinge to body. Access to forward screws is provided by openings in cowl inner surface.

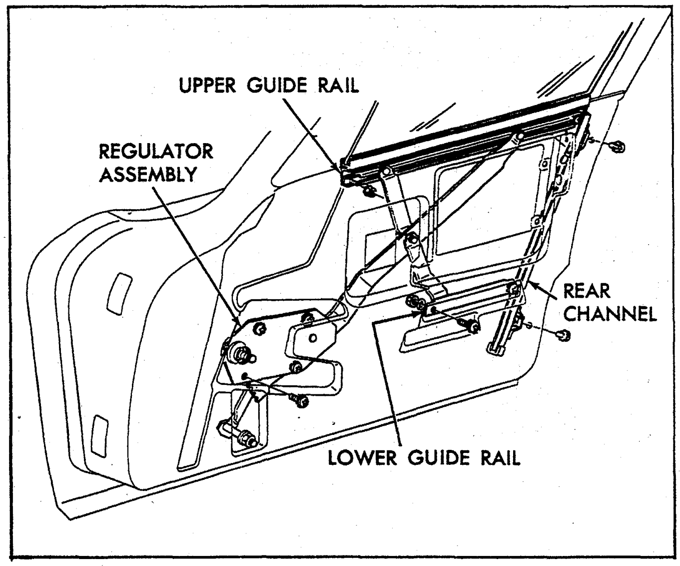


Fig. 41—Rear Channel and Regulator Assembly

Installation

1. If door assembly has been removed from car, scribe around lock striker as explained under Adjustments-Lock Striker, and remove striker from lock pillar.
2. Install hinges, replacing same number of shims removed and aligning door hinge straps with marks scribed upon disassembly.
3. Perform door adjustments as outlined in this section.
4. If door is equipped with power windows, replace wiring.
5. Replace all trim removed upon disassembly.

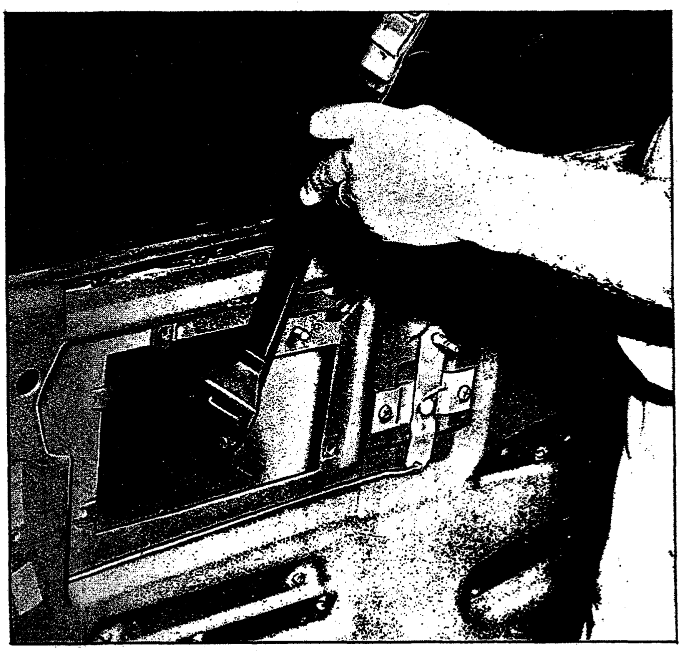


Fig. 42—Removing Rear Channel

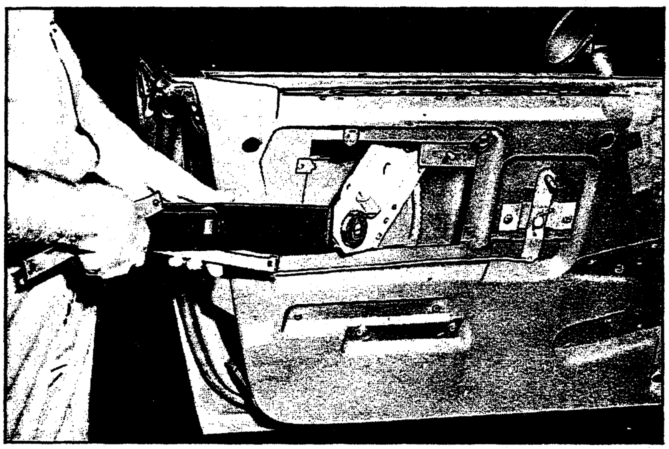


Fig. 43—Removing Regulator Assembly

REAR QUARTER

DOOR SILL PLATE AND MOLDING

Figure 49 shows assembly details of both the door sill plate and molding. The sill plate which retains the carpet, the cowl trim windlace and lock pillar front edge trim are retained to the body by six screws.

The molding assembly, which replaces a rocker panel, is quickly and easily replaced by removing 10 retaining screws. The sill molding retainer is also fastened to the body with screws.

REAR END

FOLDING TOP COMPARTMENT LID

Adjustments

Hinges

The folding top compartment lid should be adjusted so that in the closed position the surface of the lid is flush with surrounding body surfaces and space between lid edge and body is 1/16" to 3/16" at sides and 3/16" to 1/4" at rear. Whenever lid position is changed on hinges, lock engagement must be inspected and adjusted if necessary. Adjust hinge position as follows:

1. Scribe a line on lid surface following contour of hinge strap. This will ease observation of lid movement during adjustment (fig. 51).
2. To raise or lower top surface of lid, add or remove hinge shims.
3. To adjust spacing between lid edges and body, loosen hinge-to-lid screws and shift lid as required.

Lock

Lock engagement may be adjusted as follows:

1. Striker plates may be shimmed to adjust the depth of lock engagement in striker plate. When this adjustment is made, release of lock should be tested and adjusted as required.
2. Release of lock may be adjusted by loosening lock assembly retaining bolts and moving lock in appropriate direction to the limit of slotted holes in lock base. Further adjustment may be gained by moving cable retainer in appropriate direction.

Hinges

(Refer to Figure 52)

Removal

1. Scribe around hinge as shown in Figure 51.
2. Hinge may be removed as an assembly by opening top compartment lid fully and removing 3 retaining screws. Note number of shims found between hinge frame and compartment floor.
3. To remove spring from hinge assembly, close top compartment lid as far as possible and insert Tool J-9559 between expanded coils in spring. Opening top compartment lid fully will allow removal of spring as shown in Figure 53.
4. 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 54.
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.

Installation

1. Install same number of shims as removed or, if repairing collision damage, etc., position hinge in compartment, install upper mounting screws, fill gap between floor and hinge frame with shims and install lower mounting screw.
2. If spring has been removed from hinge, install spring in J-9559 and place spring on hinge with compartment lid raised; closing lid releases J-9559 for removal. Upper end of spring should rest in one of three notches yielding best lid operation. About 3 pounds pressure should be necessary to close lid.

Lock

Removal

1. Remove cable mounting clamps. Remove retainer from control cable assembly and disengage cable from control.
2. Scribe a mark on lid following outer contour of lock assembly.
3. Remove 3 lock assembly retaining screws and remove lock from compartment lid.

Installation

1. Place lock assembly on compartment lid within scribed line and install retaining screws.
2. Install end of cable in control assembly and fasten retainer securely.
3. Test operation of lock thoroughly, adjusting if necessary as outlined in this section.

Control

Removal

1. Remove inner mounting clamps from both cables and disengage cables from control by removing retainers.

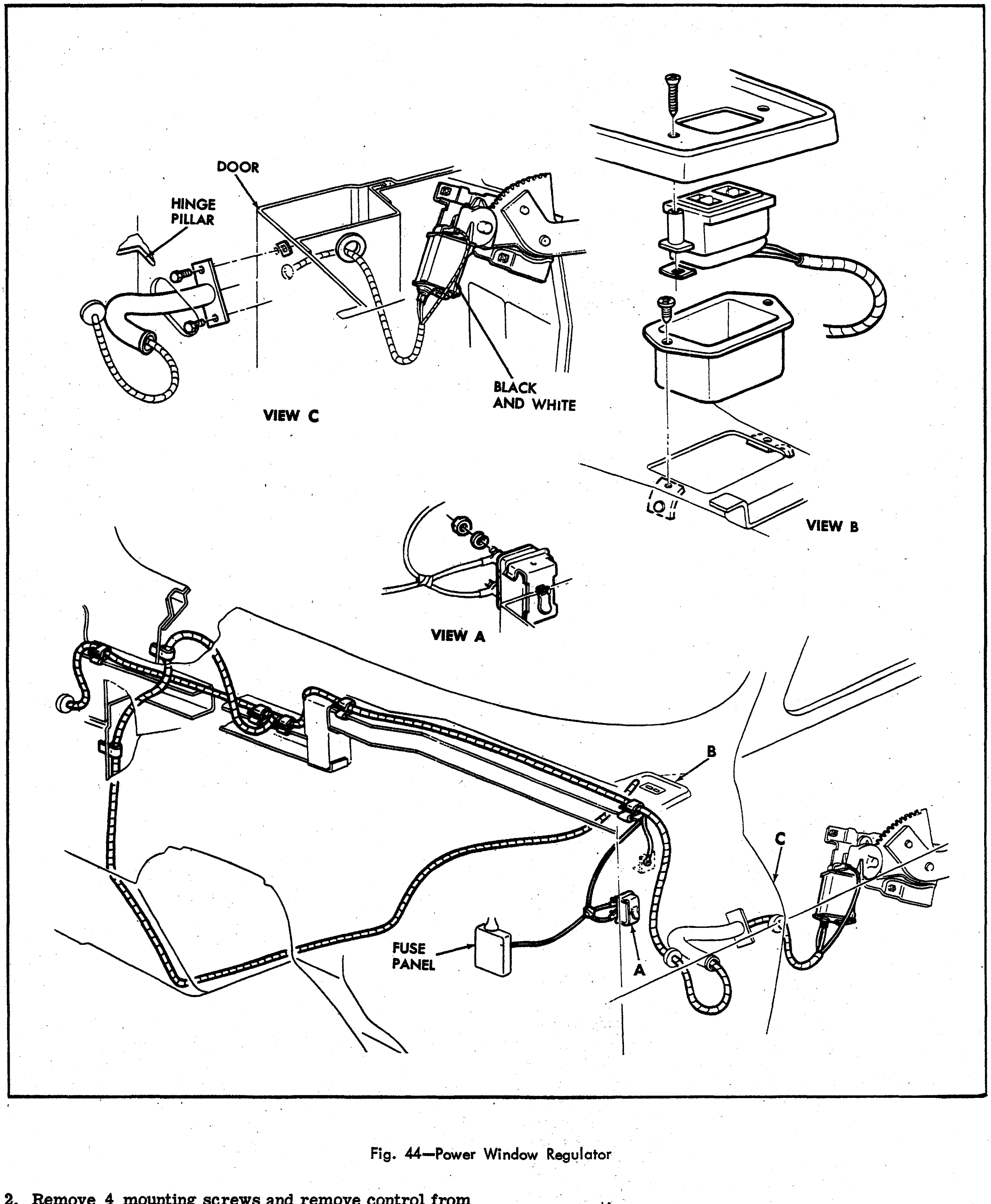


Fig. 44—Power Window Regulator

2. Remove 4 mounting screws and remove control from compartment lid.

Installation

1. Position control on compartment lid and install mounting screws.
2. Install ends of cables in control and fasten securely with retainers.
3. Test operation of locks and adjust if necessary.

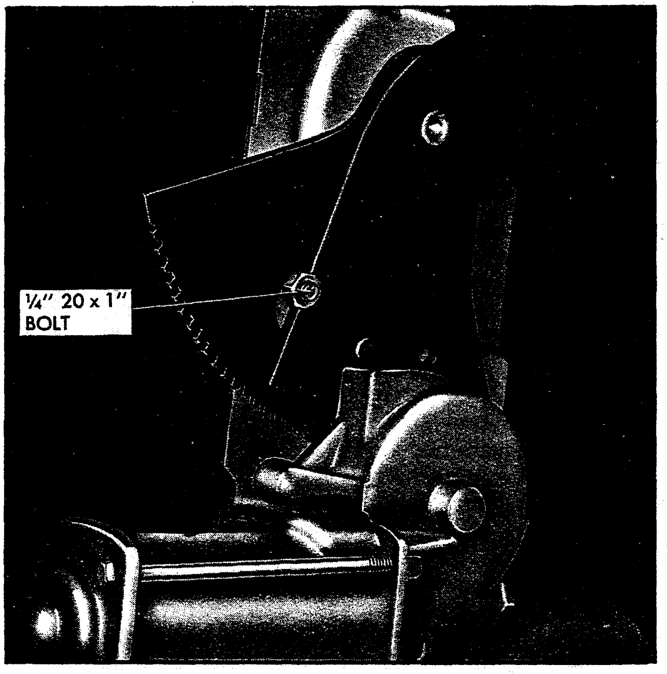


Fig. 45—Locking Regulator Arm in Place

REAR WINDOW—ADHESIVE CAULKED—19437 MODEL

For parts identification refer to Figure 55.

1. Remove the 2 rear window garnish moldings by removing the 14 attaching screws.
2. Pry molding caps from reveal moldings.
3. Carefully remove lower, side, and top reveal moldings after marking their position on body with tape.
4. Secure one end of steel music wire to piece of wood for handle. Insert other end through caulking material at lower corner of rear window; then secure end of wire to another piece of wood (fig. 56).
5. With the aid of helper, carefully cut through caulking material (using a sawing motion) with the steel wire; up side of window, across top, down opposite side, and across bottom of window.
6. Remove old glass from window opening.
7. Using a sharp scraper or wood chisel, remove adhesive caulking material from body pinchweld flange.

   NOTE: It is not necessary to clean off all the old caulking material completely from body opening; however, there should not be any loose pieces of caulking material left in the opening.

8. Check all reveal molding retaining clips for damage (24 required). Replace those that are bent or distorted with clips provided in kit.
9. Using weatherstrip adhesive, cement rubber spacers at bottom, sides, and top of window opening. The step-type spacers are used at bottom and sides, the flat type are used at the top, sides, and bottom of window opening as shown on Figure 55.
10. Using suction cup holders, position replacement glass in body opening. Carefully check relationship of glass to body pinchweld completely around opening. The overlap of glass to body pinchweld and retaining flanges should be equal with a minimum overlap of 3/16". Where necessary, position shims under the lower spacers to obtain required overlap of glass to body upper and lower flanges.
11. After proper glass to pinchweld relationship has been attained, mark position with grease pencil on glass and body as shown in Figure 57.
12. Remove glass from body opening and place on protected surface.
13. Clean inside edge surface of glass so that glass is free of any foreign material (oil, grease, etc.). Using 3/4" masking tape, place tape approximately 1/2 inch from edge of inside surface of glass completely around glass. Then apply a film of silane primer to inside edge surface completely around glass, also apply silane primer to sealing surface of pinchweld as shown in Figure 58.

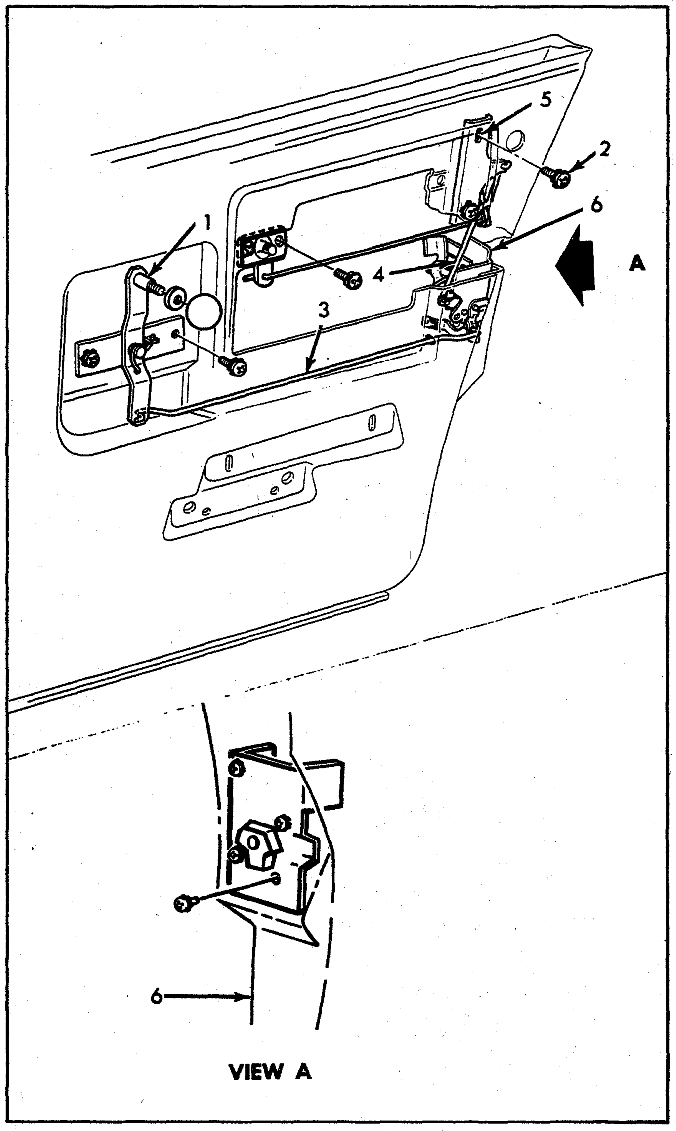


Fig. 46—Door Lock and Remote Controls

1. Door Lock Remote Control Assembly
2. Door Lock Remote Control Knob
3. Door Lock Remote Control Rod
4. Remote Control Locking Rod
5. Remote Locking Control Assembly
6. Lock Assembly

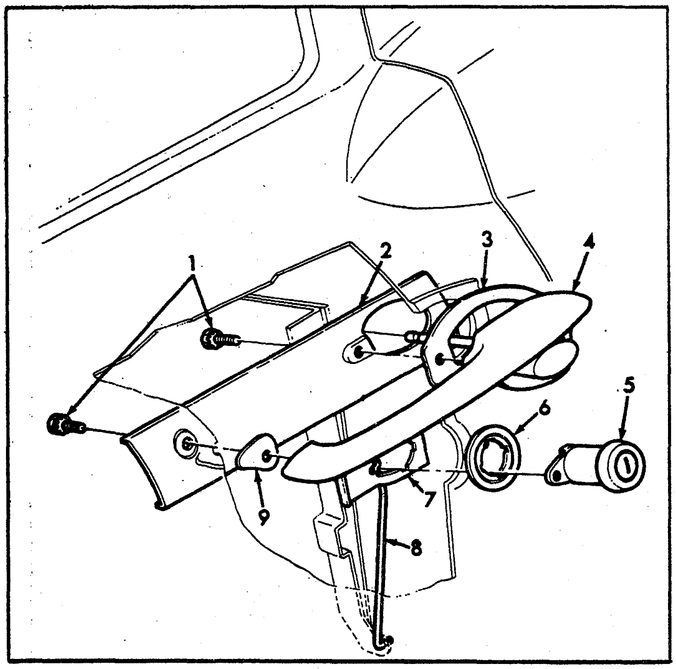


Fig. 47—Door Handle and Lock Cylinder

1. Screw - Handle Retaining
2. Reinforcement
3. Gasket - Rear
4. Handle Assembly
5. Cylinder Assembly - Lock
6. Escutcheon
7. Retainer
8. Rod - Lock Cylinder
9. Gasket - Front

14. Cut off painted portion of cartridge nozzle along edge of paint line.
15. Mix adhesive caulking material and accelerator thoroughly according to directions on container.

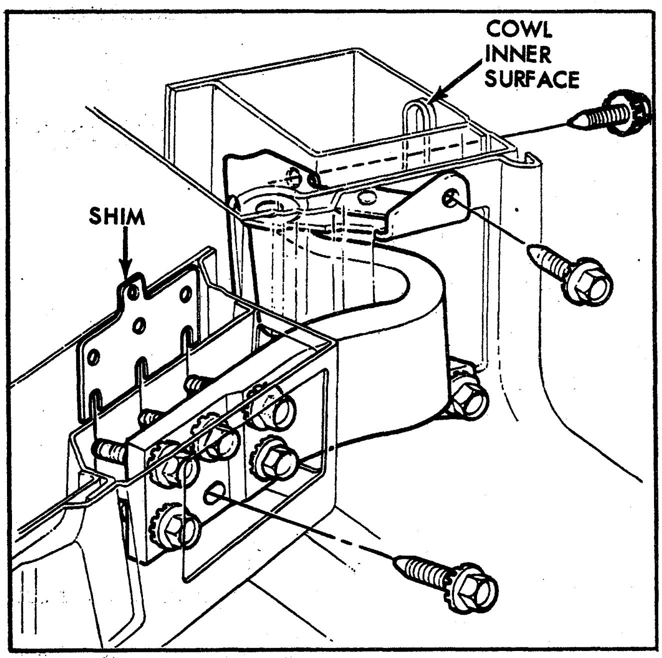


Fig. 48—Door Hinge

NOTE: Once caulking material is mixed, there will be approximately 35 minutes of working time with the material. Subsequent steps should be performed immediately after caulking material is mixed.

16. Place caulking material in cartridge as shown in Figure 59.
17. Carefully apply a smooth continuous bead of caulking material on inside surface of glass next to edge completely around glass (fig. 60). Caulking material should be approximately 1/4 inch wide at the base and form a pyramid 3/8 inch high. If during application the pyramid collapses, wait about 2-3 minutes for material to set up. If an air bubble is encountered in material back up the applicator and apply sufficient material to fill void and to dispense the bubble before continuing.
18. The reveal molding clips are self sealing and do not require sealing before installing the rear glass.
19. With aid of helper, lift glass and carefully position glass on spacers, matching up marks on glass and body as shown in Figure 61.
20. Press glass lightly to set caulking material to rear window opening flanges. Paddle material where necessary to insure proper seal.
21. Watertest rear window immediately using a cold water spray. If any water leaks are encountered, use flat bladed screw driver or stick and paddle caulking material into leak point to correct leak. Correction of leak is usually more effectively performed by paddling material from inside the body.

CAUTION: Do not run a heavy stream of water directly on caulking material while the material is still soft.

22. Install the reveal moldings in the following sequence: Top, sides, lower and the caps in each upper corner.
23. Carefully remove masking tape from inside of glass and install garnish moldings.

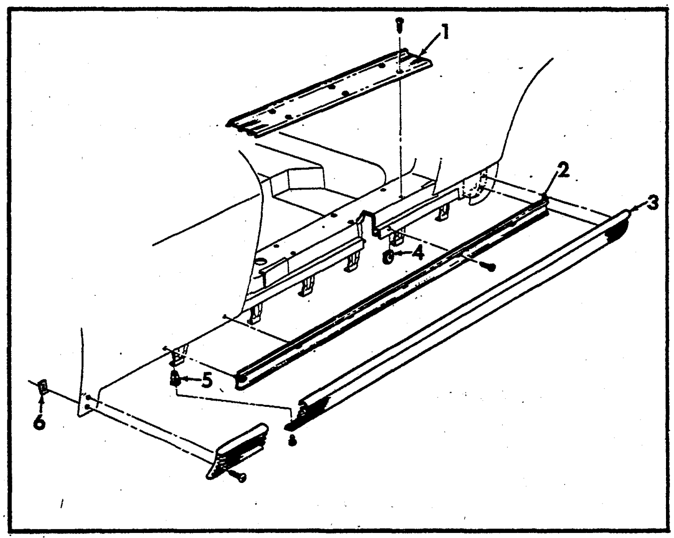


Fig. 49—Door Sill Plate and Molding

1. Plate - Door Sill
2. Retainer - Sill Molding
3. Sill Molding
4. "U" Nut - Sill Molding Retainer
5. Special Nut
6. Spring Nut - Sill Molding

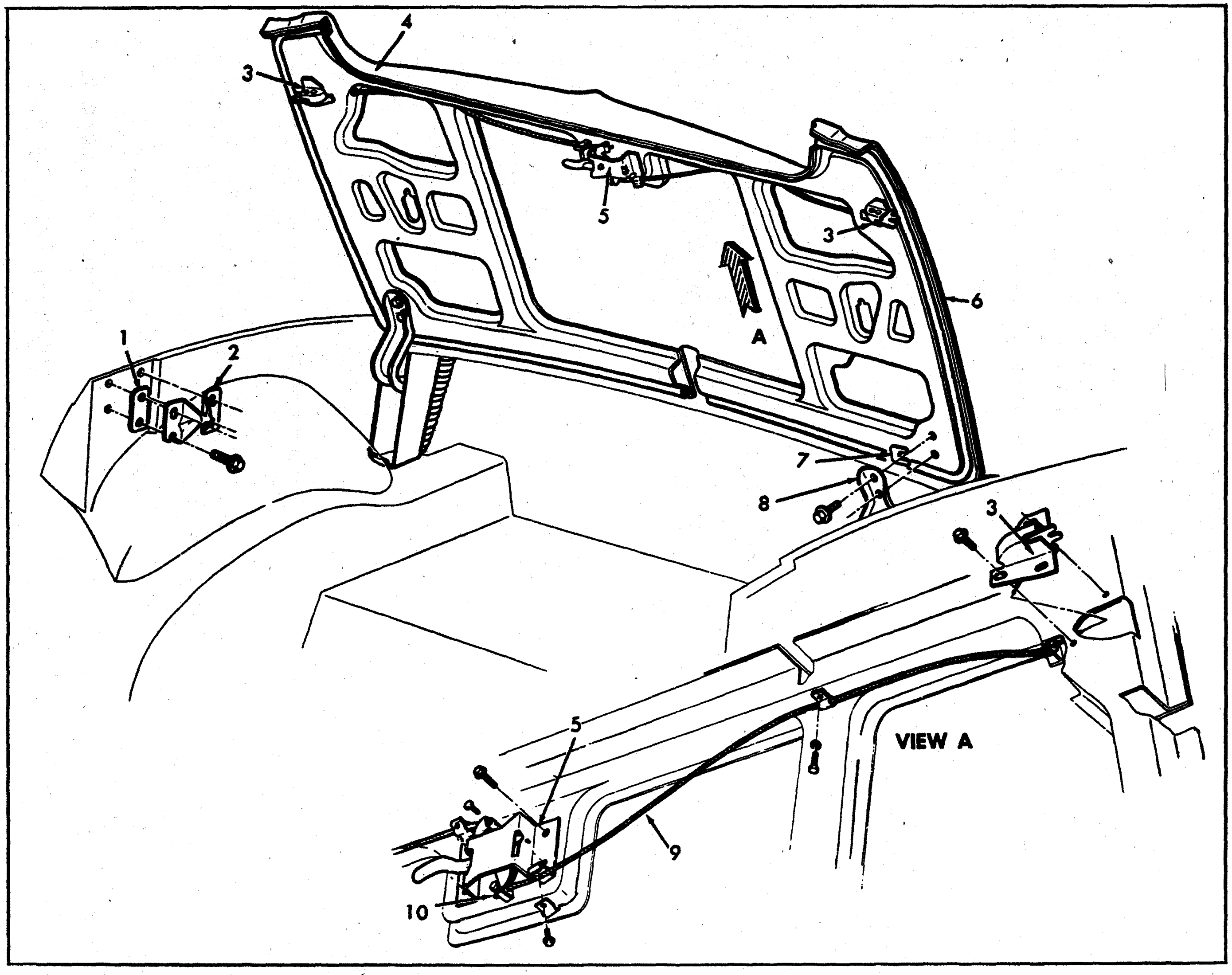


Fig. 50—Folding Top Lid Assembly

1. Striker Shim
2. Striker
3. Lock Assembly
4. Lid Assembly
5. Control Assembly
6. Weatherstrip Assembly
7. Hinge Shim
8. Hinge Assembly
9. Cable Assembly
10. Cable Retainer

24. Clean up excess material with Oleum spirits, prepsol or kerosene.

GAS TANK DOOR AND REAR TRIM PLATE

Figure 62 illustrates installation details of gas tank door and rear trim plate.

Gas tank door and bezel may be replaced by removing sheet metal screws located on inner circumference of bezel.

Trim plate is retained by five special nuts which are accessible from under right rear corner of vehicle.

REAR FILLER PANEL

Removal

1. Remove rear license plate and license plate housing as explained in Section 14.
2. Remove tail pipes from mufflers.
3. Remove ten screws holding filler panel to body (fig. 62).

Installation

Reverse removal procedure.

SPARE TIRE MOUNT

Refer to Figure 63.

Removal

1. Remove spare tire.
2. Loosen pivot bolt lock nuts and turn pivot bolts out of weld nuts in crossmember.
3. Remove two screws retaining swivel bolt assembly to body.
4. Remove four bolts holding cover assembly to body.

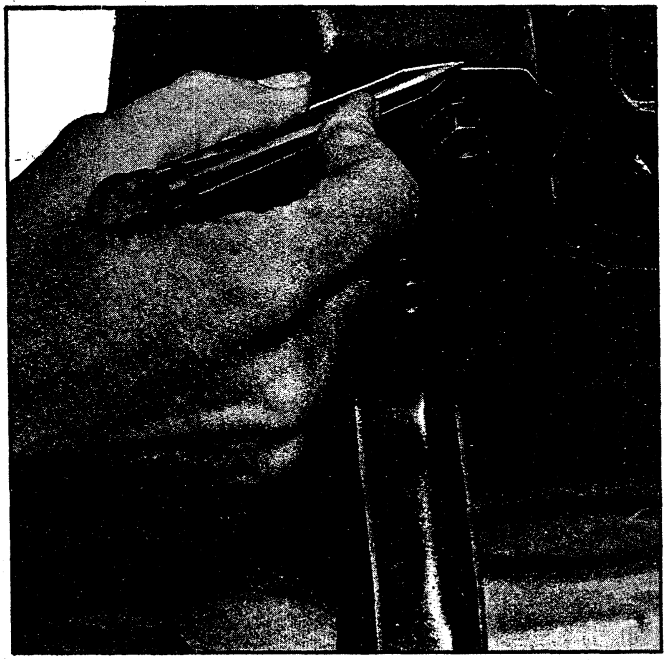


Fig. 51—Marking Hinge Position

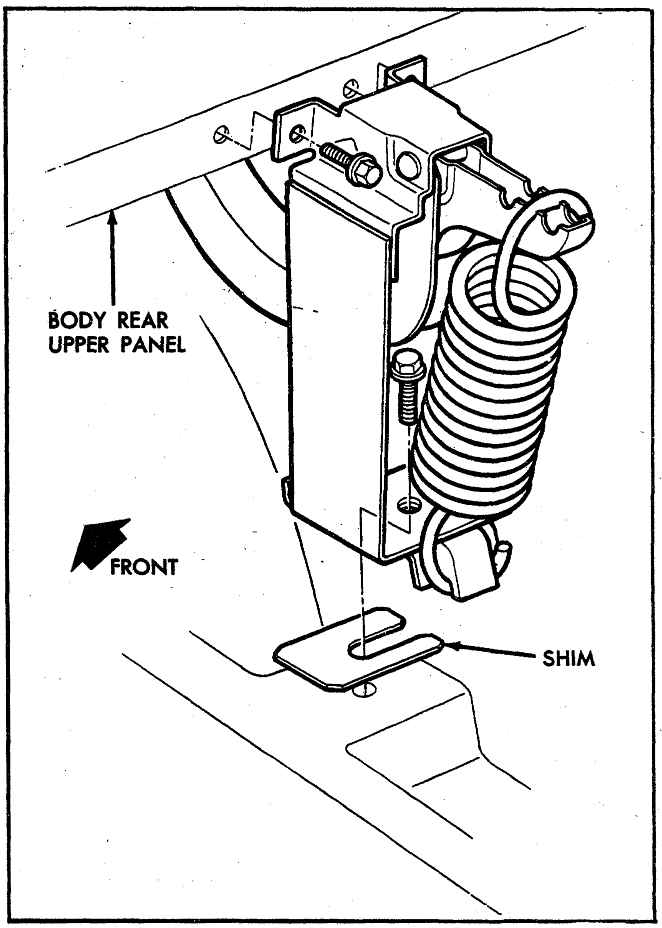


Fig. 52—Folding Top Lid Hinge

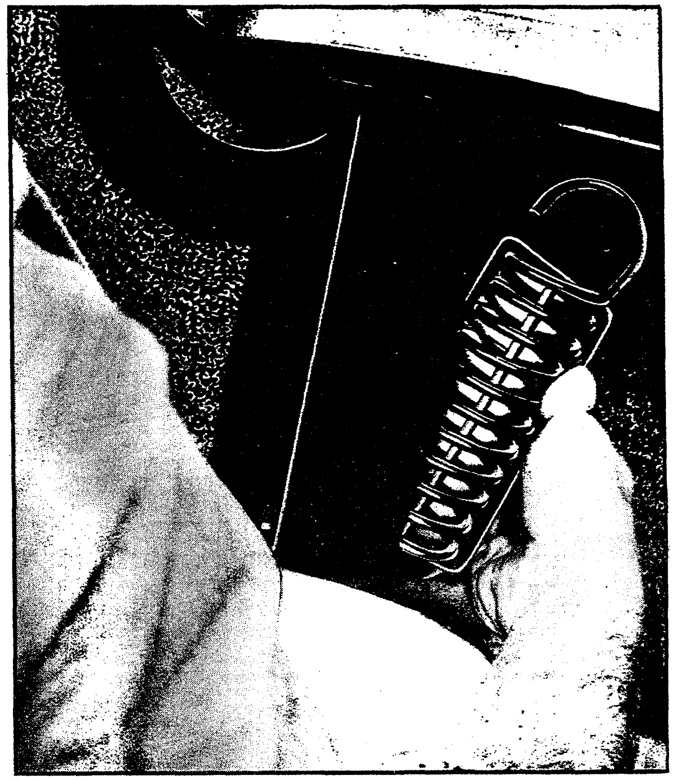


Fig. 53—Removing Hinge Spring

Installation

Installation may be made by following removal procedure in reverse order. Before installing swivel bolt assembly, coat nut and bolt threads with chassis grease.

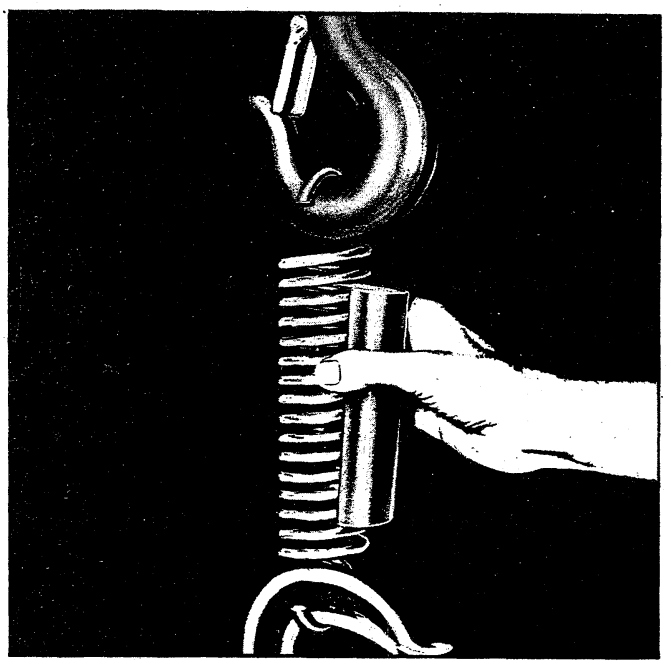


Fig. 54—Installing Tool J9559 in New Spring

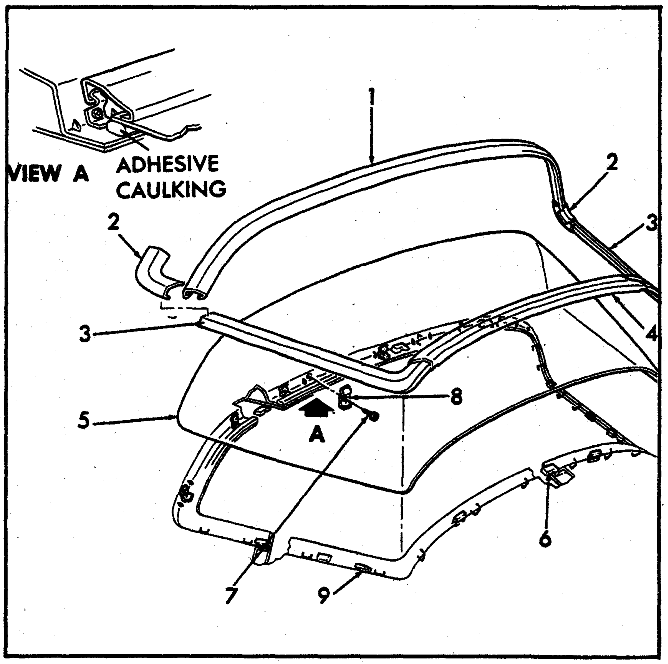


Fig. 55—Rear Window Glass and Reveal Moldings

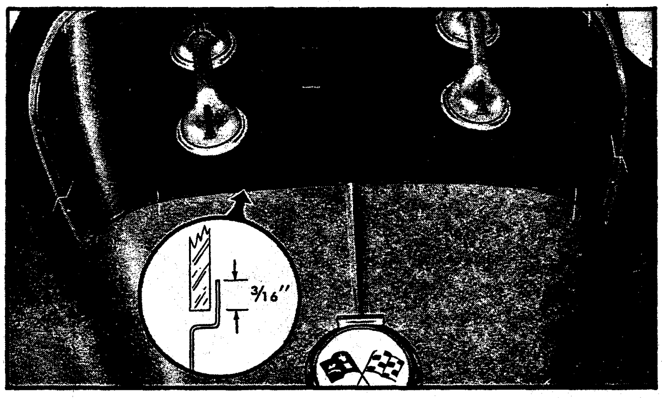


Fig. 57—Fitting Glass to Window Opening

the whole top with water; then apply a mild foaming type cleanser on an area of approximately two square feet. Scrub area with a small soft bristle hand brush, adding water as necessary until the cleaner foams to a soapy consistency. Remove the first accumulated soilage with a cloth or sponge before it can be ground into the top material. Apply additional cleanser to the area and scrub until the top is clean. Care must be exercised to keep the cleanser from running on body finish as it may cause streaks if allowed to run down and dry.

RUGS AND INTERIOR TRIM

CLEANING SOFT TRIM

Procedure for Cleaning Folding Top Material

The top should be washed frequently with neutral soap suds, lukewarm water and a brush with soft bristles. Rinse top with sufficient quantities of clear water to remove all traces of soap.

If the top requires additional cleaning after using soap and water, a mild foaming cleanser can be used. Rinse

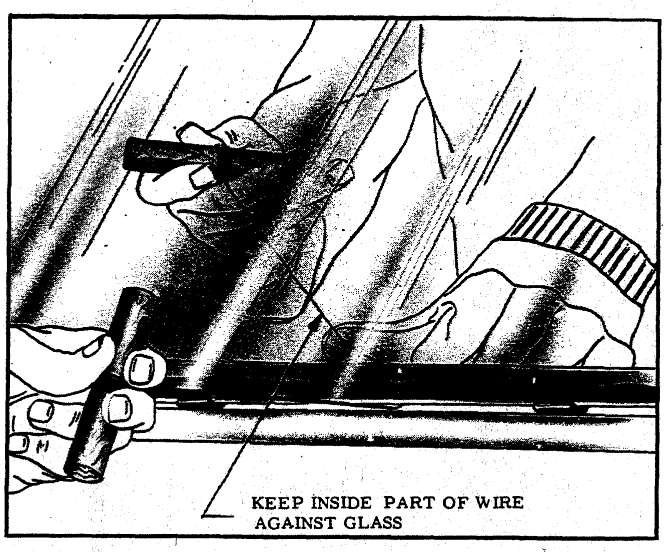


Fig. 56—Removing Old Glass From Window Opening

Procedure for Cleaning Coated Fabrics

Care of genuine leather and coated fabrics (includes vinyl coated formed headlining) is a relatively simple but important matter. The surface should be wiped occasionally with a dry cloth, and whenever dirt accumulates, the following cleaning instructions should be used:

1. Lukewarm water and a neutral soap should be used. Apply a thick suds, worked up on a piece of gauze or cheesecloth, to the surface.
2. The operation should be repeated, using only a damp cloth and no soap.
3. The surface should then be wiped dry with a soft cloth.

Polishes and cleaners used for auto body finishes, volatile cleaners, furniture polishes, oils, varnishes or household cleaning and bleaching agents should never be used.

Procedure for Cleaning Carpet

Thoroughly brush or vacuum the floor carpet. In many instances the floor carpet may require no further cleaning. If the carpet is extremely soiled remove carpet from car and thoroughly vacuum to remove loose dirt; then with a foaming type upholstery cleaner, clean approximately one (1) square foot of carpet at a time. After each area is cleaned, remove as much of the cleaner as possible with a vacuum cleaner. After cleaning the carpet use an air hose to "fluff" the carpet pile, then dry the carpet. After the carpet is completely dried, use an air hose to again fluff the carpet pile.

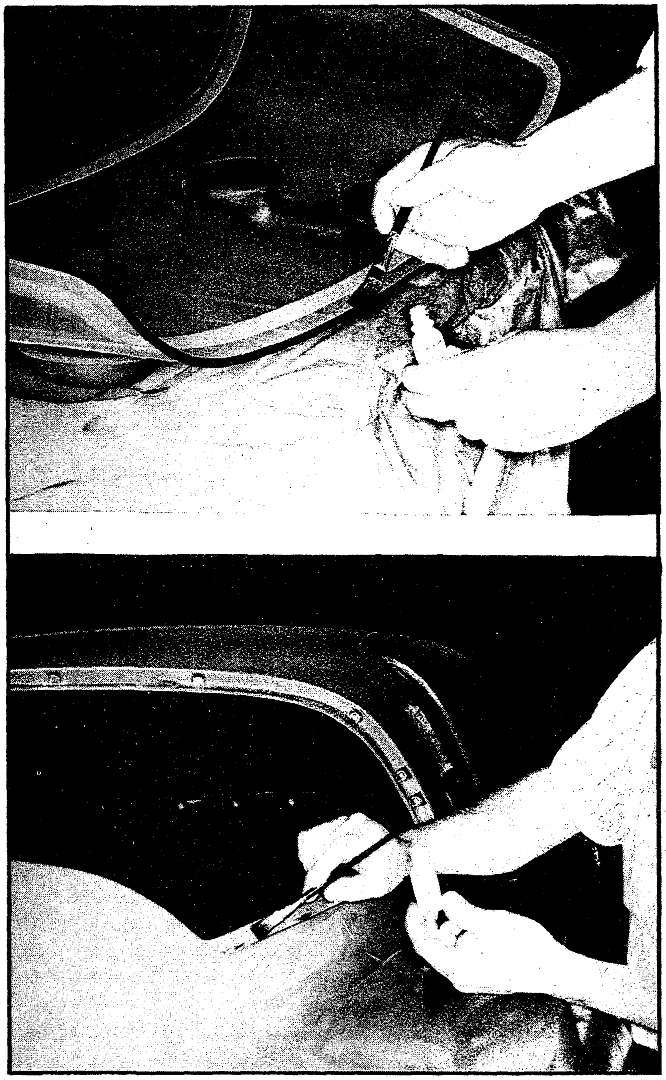


Fig. 58—Applying Silane Primer

NOTE: If the carpet is not extremely soiled, the carpet may be cleaned in the car by applying a sparing amount of foaming type upholstery cleaner with a brush.

CARPETS AND COVERS—ALL MODELS

Removal of front compartment carpeting will require removal of sill plates and loosening of console trim; service of these items is covered in this section under Front End-Cowl Area and Console Trim.

In areas where carpeting is to be cemented, proceed as follows:

1. Remove all old carpeting, jute, etc. which may adhere to floor after original carpet is pulled up.
2. Apply 3M-1711 cement or its equivalent, following directions furnished with package. Be sure floor is reasonably clean and dry before applying cement.

REAR BODY TRIM

For parts identification refer to Figure 64.

Soft Covers

The soft covering is cemented to the body in rear window area. Replacement of all or part will require removal of rear window garnish moldings as explained further on in this section.

After part to be replaced has been pulled off, all bits of fabric and other foreign material should be removed from body inner surface by scraping or through the use of a solvent such as prep-sol or its equivalent. Both the new cover and the body surface should be reasonably clean and dry before application of cement.

Trim may be applied with 3M-1711 cement or its equivalent. Follow manufactorer's directions supplied with package for best results.

Rigid Plastic Trim

The roof trim panel and rear quarter trim panels are retained by screws as shown in Figure 64. To remove roof panel it will be necessary to remove dome lamp assembly.

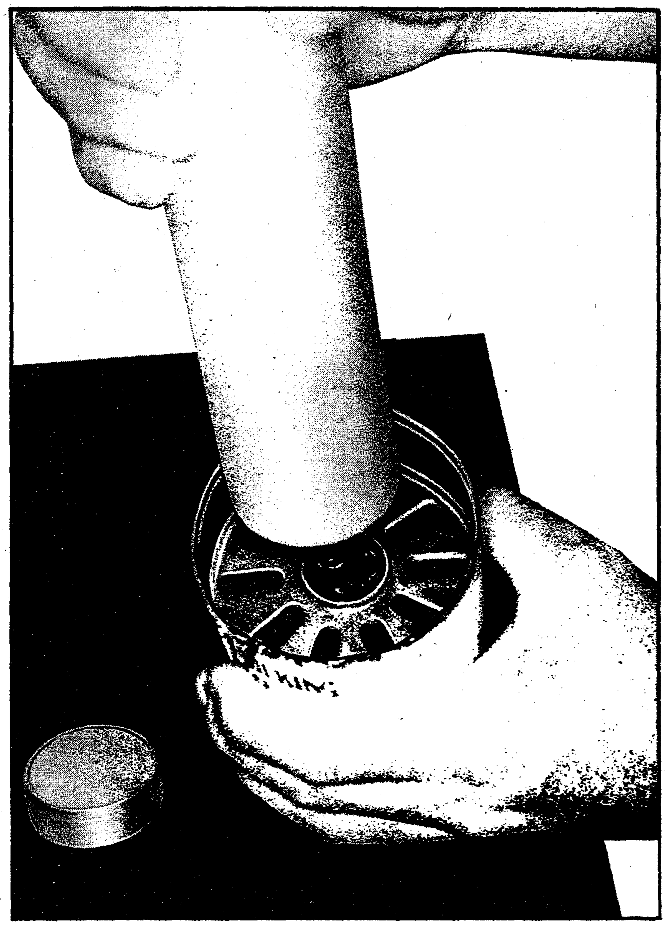


Fig. 59—Placing Caulking Material in Cartridge

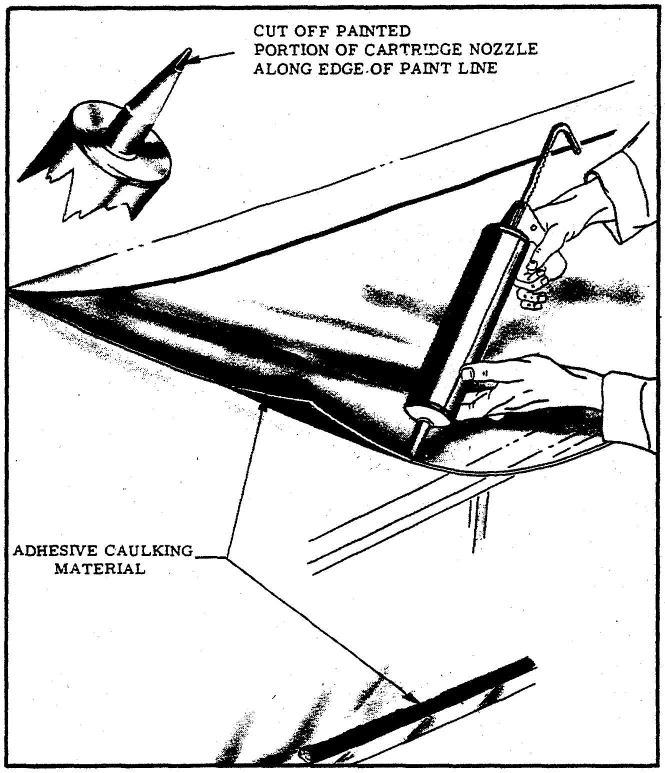


Fig. 60—Applying Caulking Material to Glass

GARNISH MOLDINGS PLUS HEADLINER—19437 MODEL

Figure 64 illustrates installation details of garnish moldings and headlining.

Headlining is not cemented in place.

Removal of dome lamp and garnish moldings is necessary.

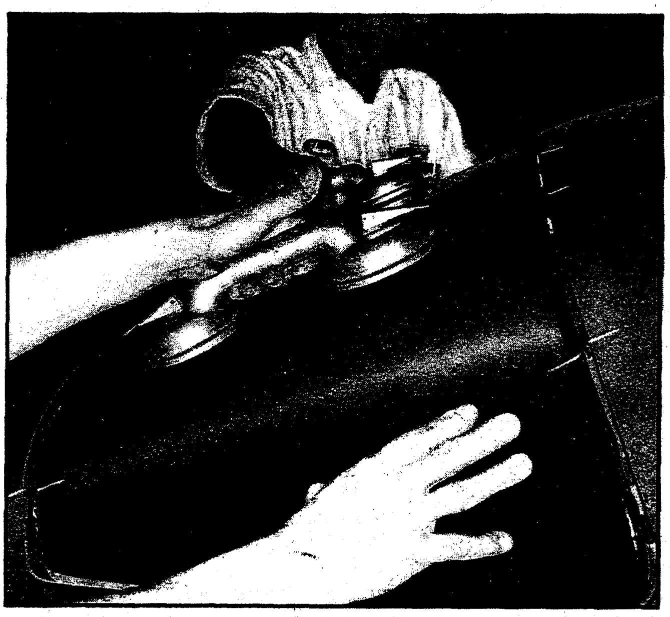


Fig. 61—Installing Rear Glass

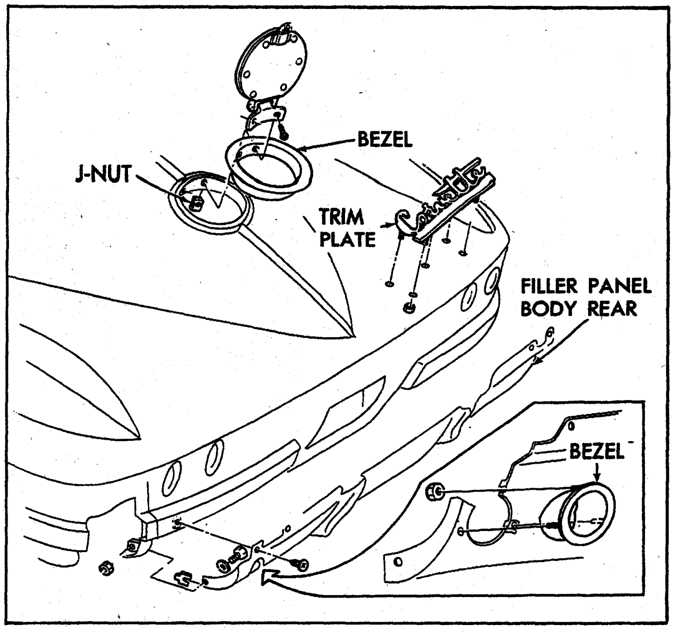


Fig. 62—Gas Tank Door and Rear Trim Plate

SEATS

Removal

1. Remove bolt retaining each forward support to floor.
2. Fold seat back forward.
3. Loosen two bolts retaining each seat hold-down bracket.
4. Move seat forward and out of brackets.

Adjustments

Height of seats is adjustable at both front and rear by means of shims or washers.

Angle of seat backrest may be changed by adjusting stops located on lower edge of seat back.

BODY MOUNTING

Figure 65 illustrates underbody attachment-to-frame body mounting brackets. Shims which are shown on rear crossmember are cemented in place.

The torque of all body mounting bolts should be checked periodically as an aid to preventing annoying squeaks and rattles. All bolts shown in Figure 65 should be torqued to 45 lbs. ft.

BODY REPAIRS

GENERAL INSTRUCTIONS

The following gives information necessary for repair of collision damage and performance of general maintenance on both the 19437 and 19467 Corvette bodies. Included here is information dealing with availability of repair panels, general installation procedures for installing panels and repairing damage to the body.

Repair of fiber glass reinforced plastic bodies is a relatively easy matter if a few simple precautions are observed.

In cases where welding must be done on steel parts which are still installed on body, do not allow flame or direct welding heat to come into direct contact with

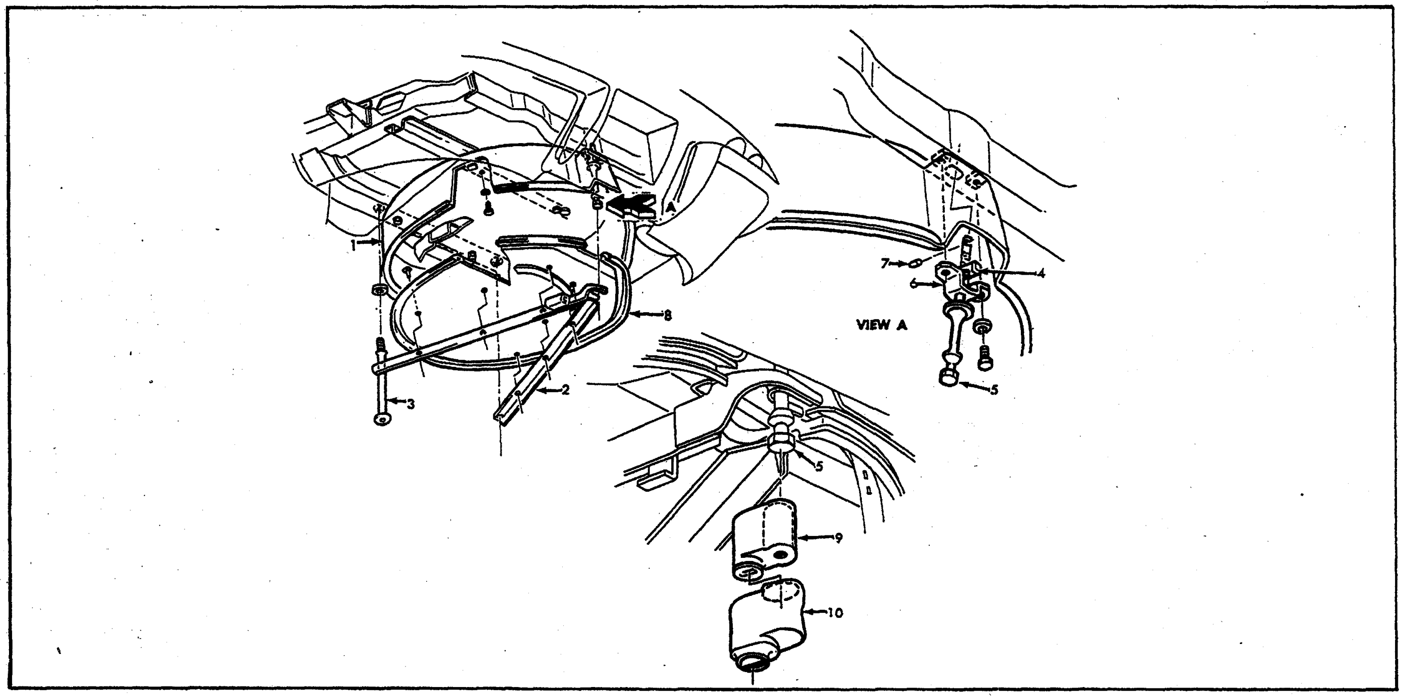


Fig. 63—Spare Tire Mount

1. Cover
2. Strap Assembly
3. Strap Assembly Pivot Bolt
4. Swivel Bolt Nut
5. Swivel Lock Bolt
6. Swivel Bolt Bracket
7. Swivel Bolt Pin
8. Tray
9. Lock Case
10. Lock Cover

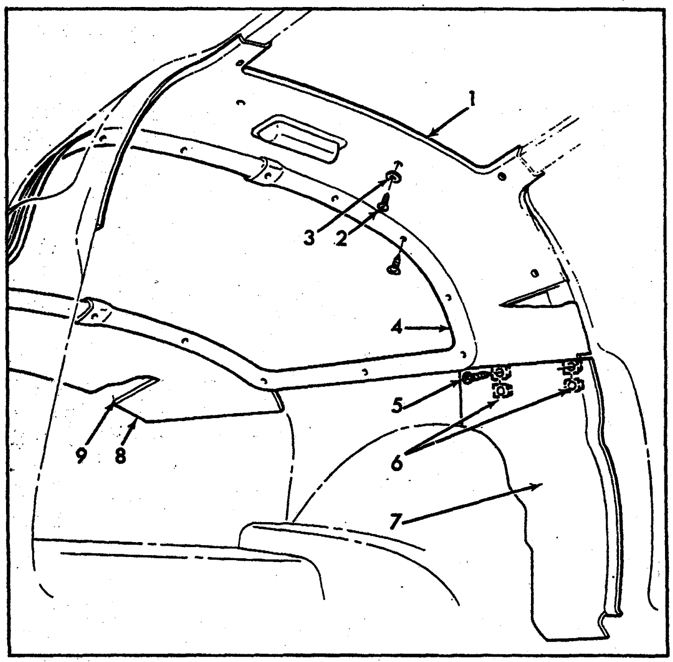


Fig. 64—Rear Body Trim

1. Panel Roof Trim
2. Panel Retaining Screw
3. Washer
4. Chart Molding
5. Screw - Rear Quarter Trim Panel Retaining
6. "J" Nut - Rear Quarter Trim Panel Retaining
7. Panel Assembly - Rear Quarter Trim
8. Cover - Rear Lower
9. Cement - 3M-1711 or Equivalent

plastic body panels. The general area around the welding operation should be protected with wet asbestos or any other like method (several thicknesses of aluminum foil makes an excellent heat shield if out of the way of direct flame).

Straightening of steel parts while still in body must be done with care. When applying hydraulic jacks or like equipment which operates by exerting force, bear in mind that the part being used to brace the stationary end of tool must be able to withstand such usage and that fiber glass parts, though tougher than steel, will not yield or "take a set" as with steel parts, so naturally they cannot be "straightened". If poor alignment exists due to collision or other physical damage, check steel reinforcements in cowl, roof and sill areas (fig. 69) with care.

Tracing line of damaging force and checking body carefully for broken bonds and cracks before, during and after repairs will pay off repeatedly.

Small cracks and faults in bonds and panels will usually grow larger if left unattended.

REPAIR PANELS

Body repair panels are illustrated in Figures 66 through 70. Those shown are typical of panels which are available through Chevrolet parts sources. Procedures which may be used for installing panels are explained in the following pages.

Figure 71 illustrates various bonds which will be encountered during repair procedures. The legend for Figure 71 cites typical applications for bonds shown.

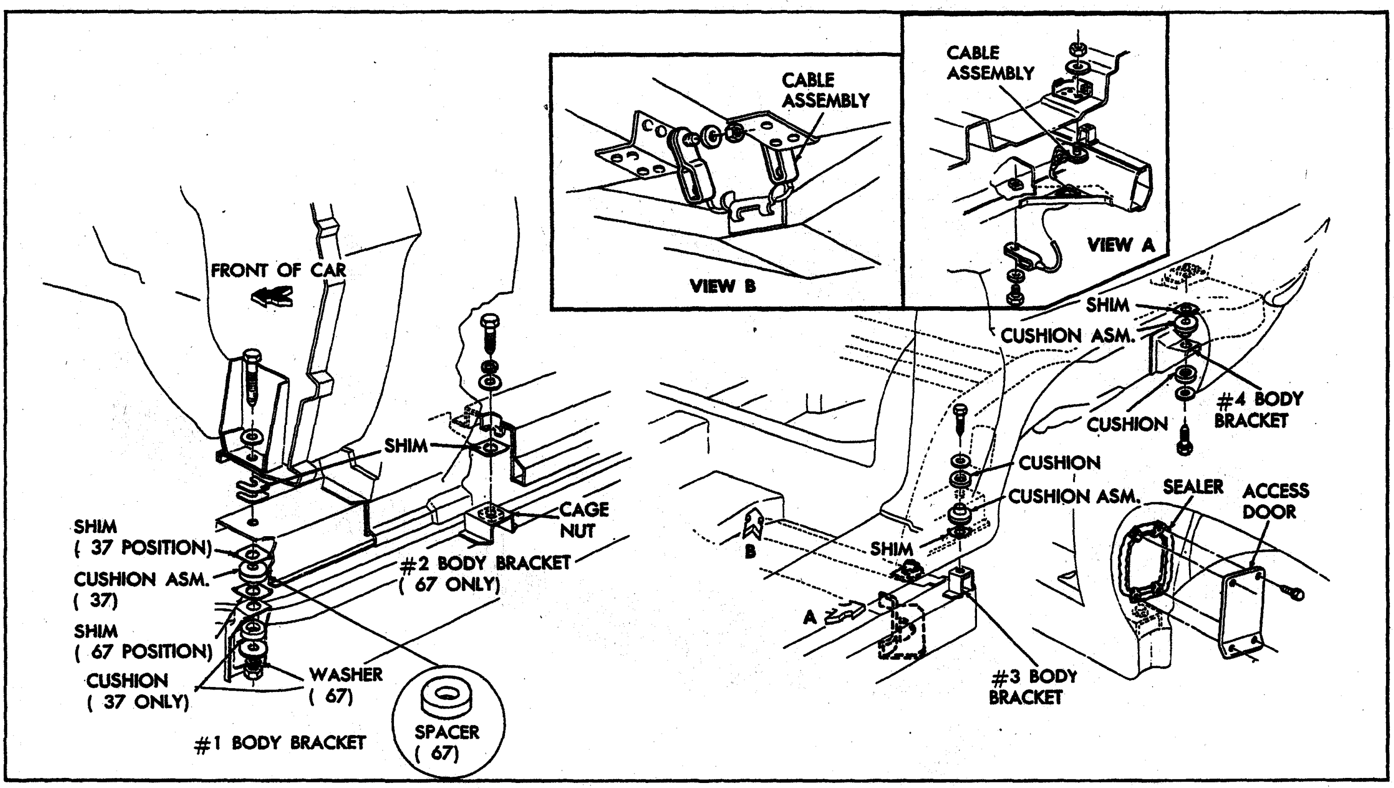


Fig. 65—Body Mounts

PRECAUTIONS

Creams are available to protect the skin from a condition known as occupational, or contact dermatitis. This common type of dermatitis is not contagious. Improved resin formulas in the approved kits have almost eliminated skin irritation. Cream is supplied with the kit for men who may have a tendency toward skin irritation from the resins or dust.

The application of these creams is recommended whenever the Resin Kit materials are used. Generally, the cream is not required when the plastic solder kit is being used. Directions for using the cream is as follows:

a. Wash hands clean. Dry thoroughly.
b. Squeeze about 1/2 inch (or 1/2 teaspoonful) of #71 cream into palm of hand.
c. Spread evenly and lightly until cream disappears. Work cream into cuticle, between fingers and around wrists.
d. Apply second coat, repeating Steps b and c.
e. Hold hands briefly under cold running water to set cream.

2. Remove resin mixture from hands as soon as possible and imperatively before mixture starts to gel. This can be observed by the action of the material being used. Resin may be removed with lacquer thinner by washing in soap and water.
3. Respirators are recommended when grinding. Also some minor skin irritation from glass and powdered cured resin may be evident. Washing in cold water will help to minimize.
4. Use a belt sander with a vacuum attachment for dust control if possible.
5. Resin mixtures may produce toxic fumes and should be used in well ventilated areas.
6. Be careful not to get any resin material on clothing.
7. Use the right materials for the job. It is important to use the approved kits because Chevrolet's rigid quality standards assure you the right material to do the job. Other materials available may not meet the required engineering and safety standards.
8. Keep the materials, utensils and work area clean and dry. These repairs involve chemical reactions, and dirt or moisture may upset the chemical balances and produce unsatisfactory results.
9. Before starting repair operations, look for hidden damage by applying pressure around the damaged area, looking for hairline cracks and other breakage. Check for minor damage at other points in the vehicle such as around exhaust pipes, grille, headlamps and points of wear or rub. Early repair of this minor damage may prevent major repair later.

PLASTIC SOLDER KIT

The Plastic Solder Repair Kit is used for minor repairs on the Corvette body. These materials will produce an easy, quick and lasting repair in the case of small cracks, surface imperfections and small holes.

1. Use paint remover or power sander, and remove finish from damaged area. Carefully inspect for other areas requiring repair.
2. Mix the materials (fig. 72).
3. Apply the material, using a putty knife or rubber squeegee, Figure 73. Work the material into the repair and build the material up to the desired

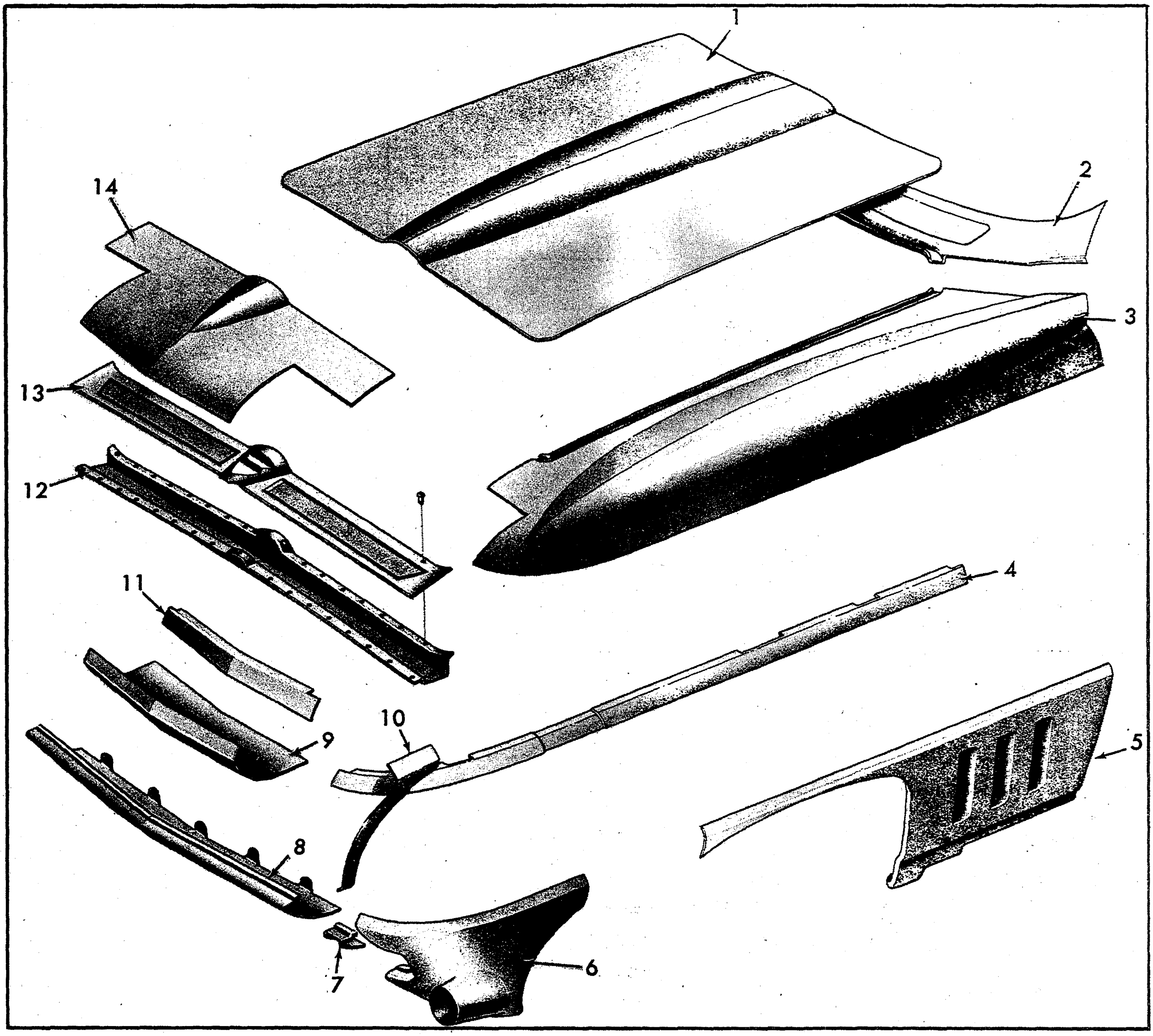


Fig. 66—Front Body Construction

1. Panel - Hood
2. Panel - Cowl Upper
3. Panel - Front Fender Upper
4. Bonding Strip - Front Fender Upper to Lower
5. Panel - Front Fender Lower Rear
6. Panel - Front Fender Lower Front
7. Bonding Strip
8. Panel - Radiator Grille Lower
9. Panel - Radiator Grille Upper - Lower Half
10. Bonding Strip - Front Fender Lower Front to Rear
11. Bonding Strip - Front Fender Upper to Radiator Grille Upper Panel
12. Reinforcement - Front Fender
13. Bonding Strip - Front Fender Upper Reinforcement
14. Panel - Radiator Grille Upper - Upper Half

contour. For deep filling and on vertical surfaces, several layers may be used, each about 1/2" thick.

4. Finish the repair by grinding, sanding and painting in the usual manner, Figure 74.

RESIN KIT

The Resin Repair Kit, for major repairs, contains resin, hardener, Thixatrope, fiberglass cloth, protecting creams and mixing utensils. Repairs such as torn panels and separated joints require the adhesive qualities of the resin and the reinforcing qualities of the glass fibers.

The following procedure is basic for repairing any plastic (fiberglass component or panel).

1. Look for hidden damage. Apply pressure by hand around the damaged area.
2. Use paint remover and remove finish from around damage area. Inspect area again for signs of other damage.
3. Grind or file the damaged area to form a "V" at

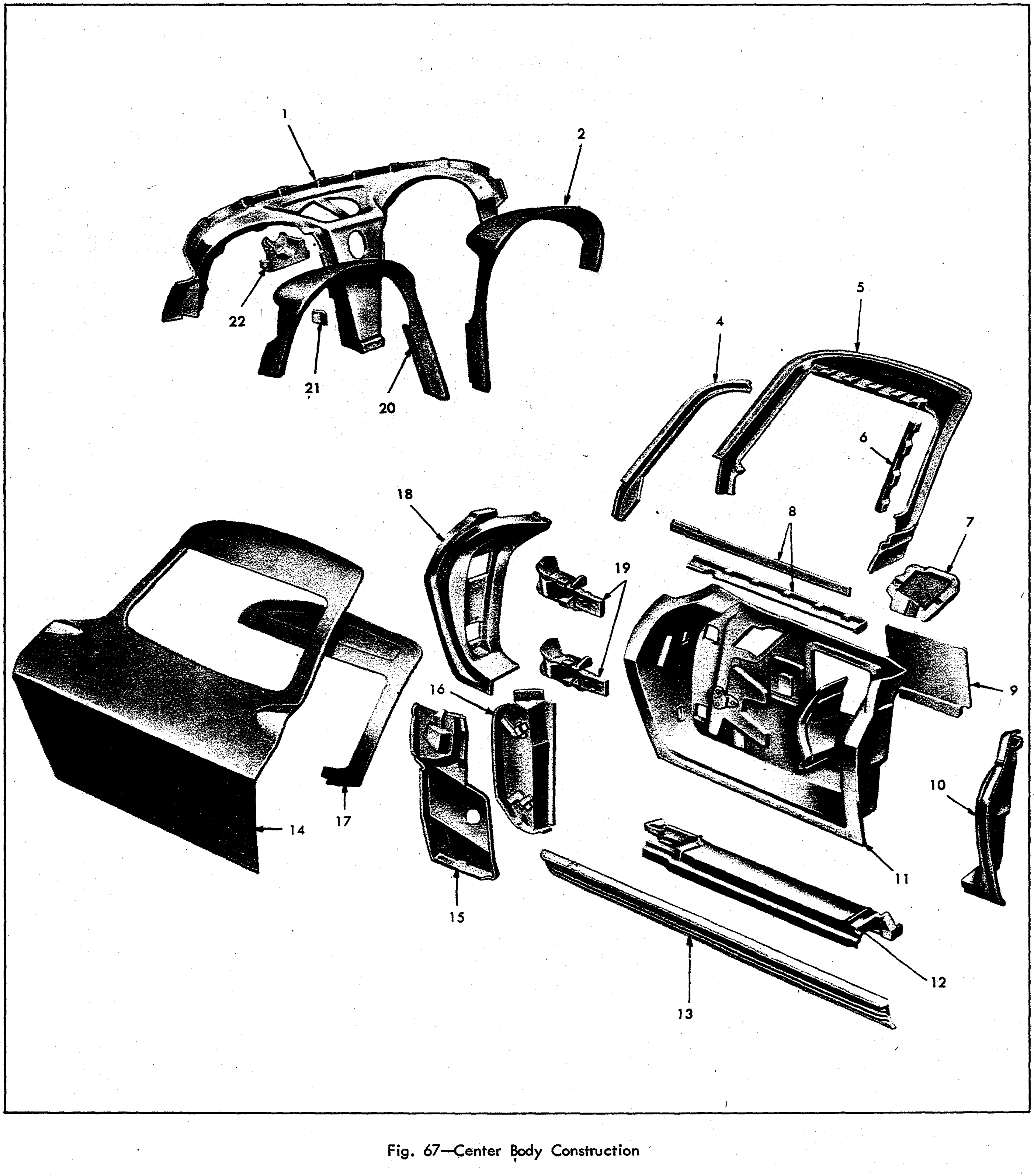


Fig. 67—Center Body Construction

1. Panel—Instrument
2. Pad Assembly Instrument Panel - Right Hand
4. Reinforcement - Door Upper Front
5. Panel - Door Inner Upper
6. Reinforcement - Upper Rear
7. Cover - Front Access Hole
8. Reinforcement - Door Outer Panel Inner
9. Cover - Rear Access Hole
10. Pillar Assembly - Door Lock
11. Panel - Door Lower Inner
12. Sill - Door
13. Molding - Rocker
14. Panel - Side Door Outer
15. Panel - Door Hinge Reinforcing
16. Reinforcement Assembly - Side Door Inner
17. Bonding Strip - Side Door Upper Bonding
18. Pillar Panel - Hinge
19. Hinge Assembly
20. Pad Assembly Instrument Panel - Left Hand
21. Bracket - Radio Mounting
22. Bracket - Clock Mounting

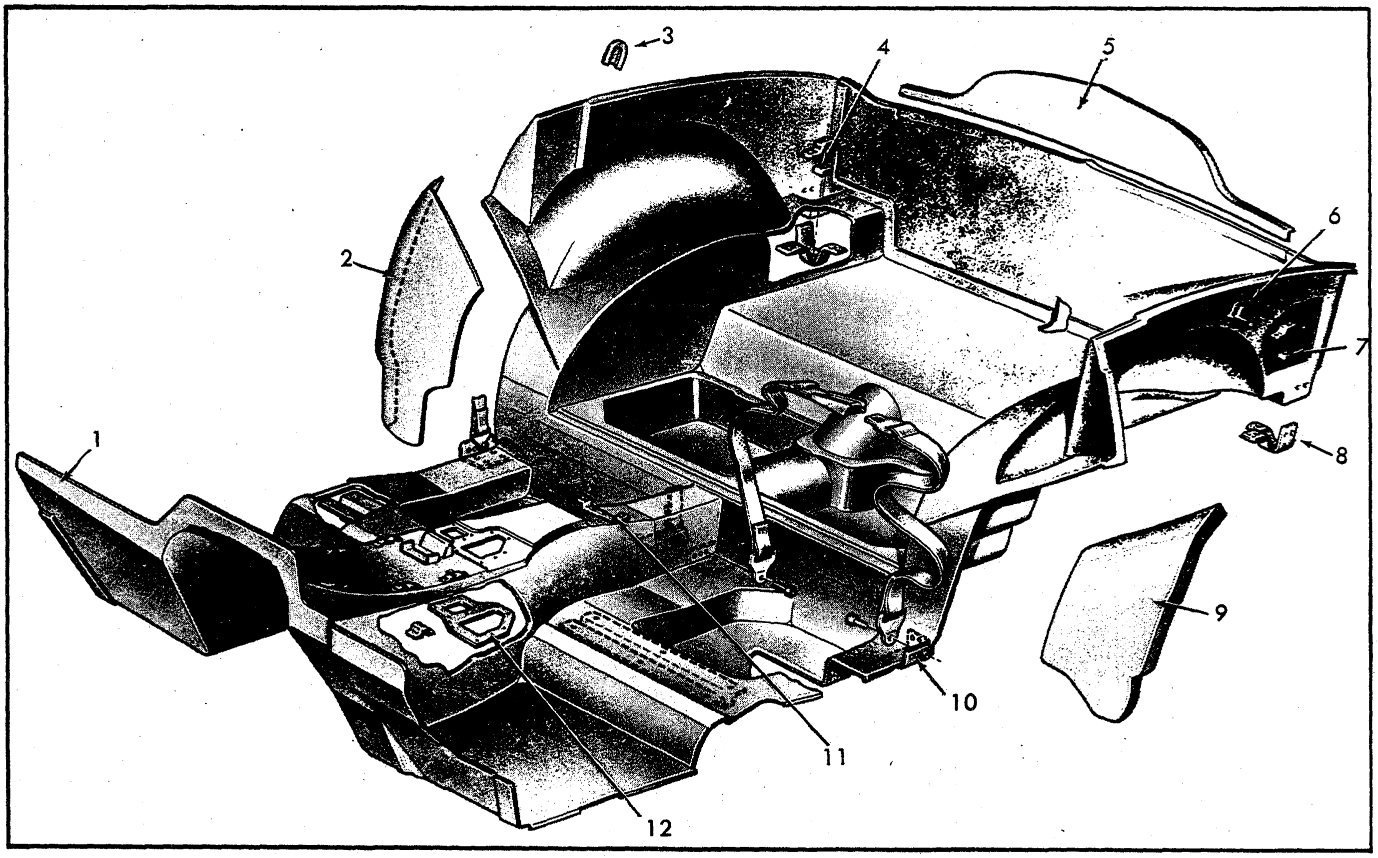


Fig. 68—Underbody Construction

1. Panel - Underbody
2. Panel - Wheel Housing Closing - Right Hand
3. Shield - Right Hand Splash
4. Nut
5. Panel - Underbody Closing
6. Shield - Left Hand Splash
7. Nut
8. Reinforcement - Body Mounting
9. Panel - Wheel Housing Closing - Left Hand
10. Plate - Seat Belt Mounting
11. Bracket - Center Cover Mounting
12. Plate - Transmission Control Boot Retaining

the broken or cracked portion. Side of "V" should have a shallow pitch for maximum bonding surface. A belt sander with a vacuum attachment will minimize the dust problem, Figure 75.

4. If rear of damage is accessible, use a button-type repair. Clean back of area to permit the use of laminate (resin-saturated glass-cloth) on both sides of damaged area.
5. Cut fiberglass cloth to size. Make certain a minimum of five layers is cut for the average repair.
6. Mix resin and hardener, 1 part hardener to 4 parts resin. Add Thixatrope to the mix to give the mix body and reduce the "runniness" of the material.

CAUTION: Cleanliness is most important. Be certain all containers are dry and clean and the resin and hardener cans are kept closed when not in use. Do not use waxed cups for mixing and do not allow resin to enter hardener can or vice versa.

7. Saturate layers of fiberglass (fig. 76). Place laminate over damage area. Smooth out wrinkles and make sure general contour of area is maintained, Figure 77.
8. Apply heat to repair area. Heat lamps are recommended, used at least 12" away from repair. Allow 15 to 20 minutes curing time. Trim repair to shape at gel stage.
9. After the repair is cured, grind, file or sand to contour. Files other than body files may be more suitable. A belt sander with a vacuum cleaner attachment will minimize the dust problem. Feather edge and finish sand.

NOTE: After Resin Repair, small pits or irregularities may appear in finished surface. Imperfections should be repaired using the Plastic Solder Repair Kit.

SPECIFIC REPAIRS

Scratched Panels, Spot Refinishing

In many instances, a scratched panel will involve only a paint refinishing job. Figure 78 shows the top of a fender panel which has been scratched through to the plastic.

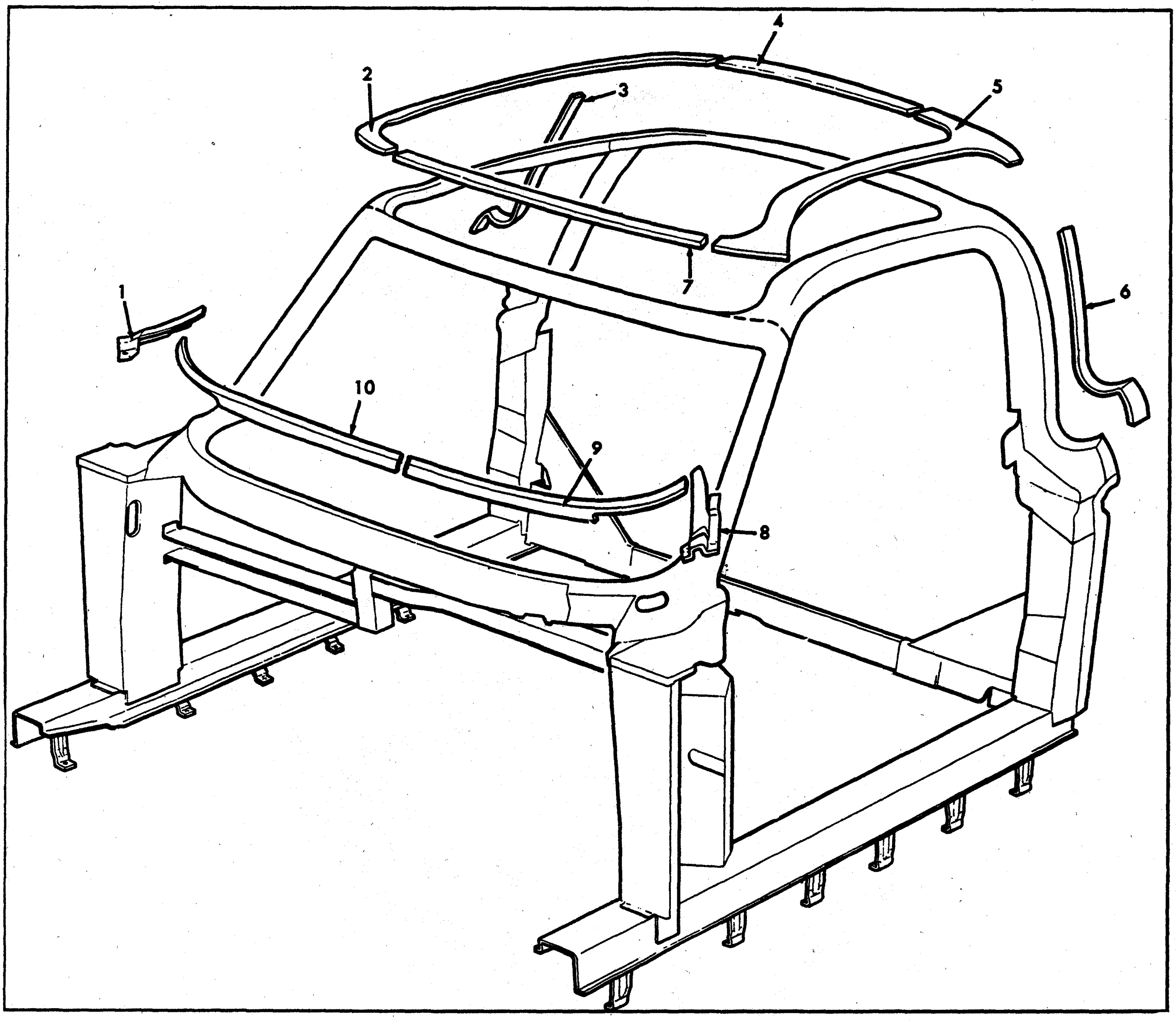


Fig. 69—Bonding Strips - Roof Reinforcement

1. Body Hinge Pillar - Right Hand
2. Roof Panel Side Front - Right Hand
3. Roof Panel Side Rear - Right Hand
4. Roof Panel Rear
5. Roof Panel Side Front - Left Hand
6. Roof Panel Side Rear - Left Hand
7. Roof Panel Front
8. Body Hinge Pillar - Left Hand
9. Windshield Lower Outer - Left Hand
10. Windshield Lower Outer - Right Hand

1. Remove all paint down to the plastic from the area surrounding the scratch with Lacquer Removing Solvent.
2. Featheredge the repair area with No. 220 wet or dry sandpaper and finish block sand with No. 320 wet or dry paper, Figure 79.

CAUTION: Do not sand too deeply into fiberglass mat. Should it be necessary to cut fairly deep into the glass mat use the repair procedure suggested for dents and pits in plastic panels.

3. Clean up repair area Prep-Sol or its equivalent, then finish the clean-up with a tack rag.
4. Protect surrounding panels by masking before performing paint refinishing operations. Use only non-staining type masking tapes on Corvette plastic body.
5. Refinish panel as described in paint refinishing portion of this manual.

Dents or Pits in Panels, Cracks in Glaze Coat

Figure 80 shows a panel which has received a heavy glancing blow, resulting in an indentation or large pit in the panel. The following procedure is advised for a

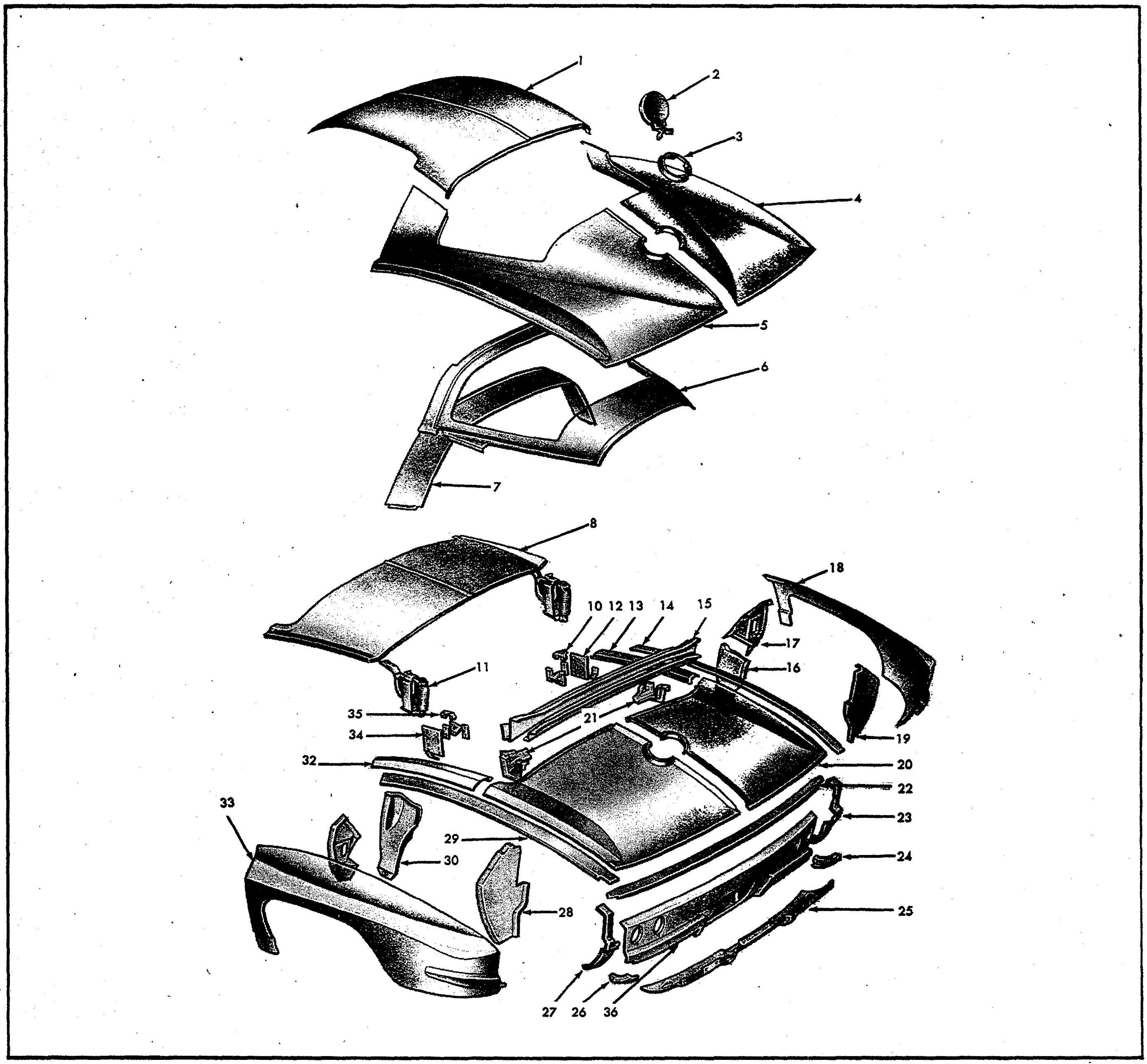


Fig. 70—Rear Body Construction

1. Panel - Roof
2. Door Assembly - Fuel Tank Filler
3. Bezel - Fuel Tank Filler Door
4. Panel - Body Rear Upper - Right Hand
5. Panel - Body Rear Upper - Left Hand
6. Frame - Rear Window Inner
7. Panel - Roof Inner Trim
8. Lid Assembly - Folding Top Compartment
9. Hinge Assembly - Folding Top Lid - Right Hand
10. Striker Plate Assembly - Right Hand
11. Hinge Assembly - Folding Top Lid - Left Hand
12. Plate - Nut - Right Hand
13. Extension - Body Rear Upper Panel
14. Bonding Strip - Body Rear Upper Panel to Quarter Panel - Right Hand
15. Support - Body Rear Upper Panel
16. Panel - Body Lock - Right Hand
17. Panel - Body Lock Pillar - Right Hand
18. Panel - Rear Quarter - Right Hand
19. Shield Rear Quarter Splash
20. Panel - Body Rear Upper
21. Extension - Body Rear Upper Panel Support - Right Hand and Left Hand
22. Bonding Strip - Body Rear Upper Panel at Body Rear Lower
23. Bonding Strip - Body Lower Panel to Right Hand Quarter Panel
24. Bonding Strip - Rear Filler Panel Lower - Right Hand
25. Panel - Rear Filler
26. Bonding Strip - Rear Filler Panel Lower - Left Hand
27. Bonding Strip - Body Lower Panel to Left Quarter Panel
28. Shield - Rear Quarter Splash - Left Hand
29. Bonding Strip - Body Rear Upper Panel to Quarter Panel - Left Hand
30. Panel - Body Lock
31. Panel - Body Lock Pillar
32. Extension - Body Rear Upper Panel
33. Panel - Rear Quarter - Left Hand
34. Plate - Nut - Left Hand
35. Striker Plate Assembly - Left Hand
36. Body Rear Lower Panel

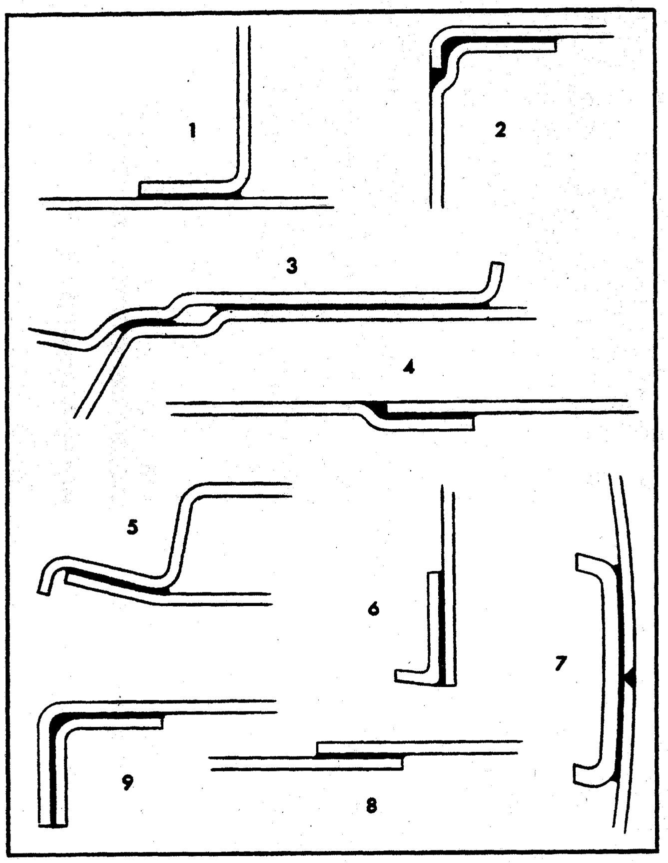


Fig. 71—Typical Body Bonds

1. Door Sill to Underbody
2. Dash Panel Extension to Dash Panel
3. Grille Upper Panel to Upper Panel Reinforcement and Bonding Strip
4. Rear Quarter Panel to Underbody (Rocket)
5. Instrument Panel to Door Hinge Pillar
6. Rear Upper Panel Rear Support Extension to Rear Upper Panel Support
7. Body Rear Upper Extension Panel and Rear Quarter Panel to Bonding Strip
8. Body Rear Upper Panel to Splash Shield
9. Rear Upper Panel Rear Support Extension to Rear Upper Panel Support

repair of this type of damage. Cracks in the glaze or finish coat of plastic and paint may also use this procedure.

NOTE: This repair may be used wherever the damage is not extensive and the plastic is not pierced, but the damage area does require a plastic build-up.

1. Remove paint down to the plastic form area surrounding the damage with Lacquer Removing Solvent, or its equivalent.
2. Scuff area surrounding damaged area to provide a good bonding surface.
3. Clean up work area with Prep-Sol then use tack rag for finish clean-up.
4. Use the Plastic Solder Repair (previously described) to fill the imperfections.
5. Feather sand damaged area with No. 220 sandpaper and finish sand with No. 320.
6. Prepare repair area for paint refinishing operation.

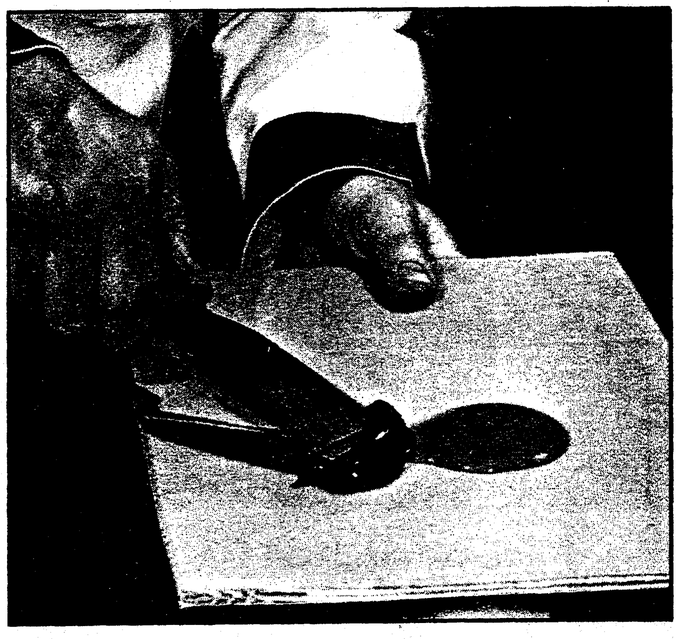


Fig. 72—Mixing Plastic Solder Material

Cracked Panels

NOTE: For best results, temperature should be at least 70°-75°F.

1. In the case of a cracked panel, such as shown in Figure 81 cut along the break line with a hacksaw blade and remove broken portion of the panel.
2. Remove the paint down to the plastic from both portions of the panel with a Lacquer Remover or its equivalent.
3. Remove dirt and deadener thoroughly, back approximately 2 to 3 inches from the fracture, on

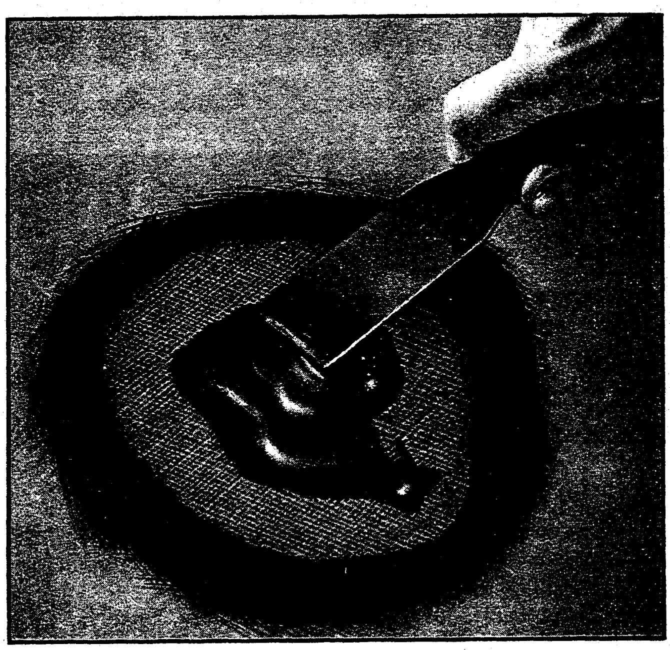


Fig. 73—Applying Plastic Solder

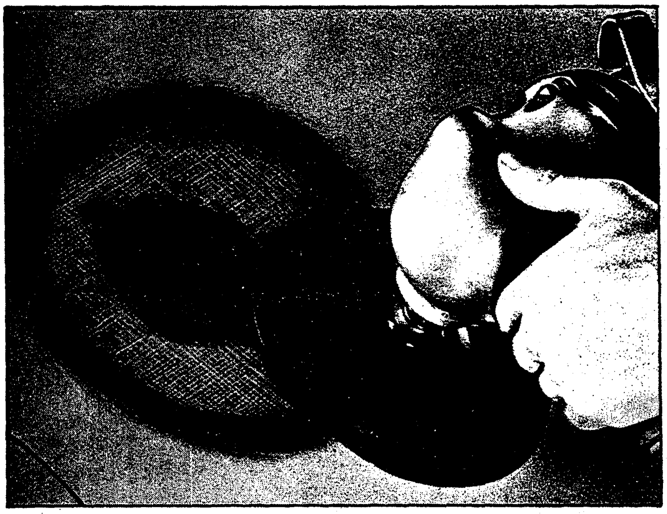


Fig. 74—Finishing Plastic Solder Repair

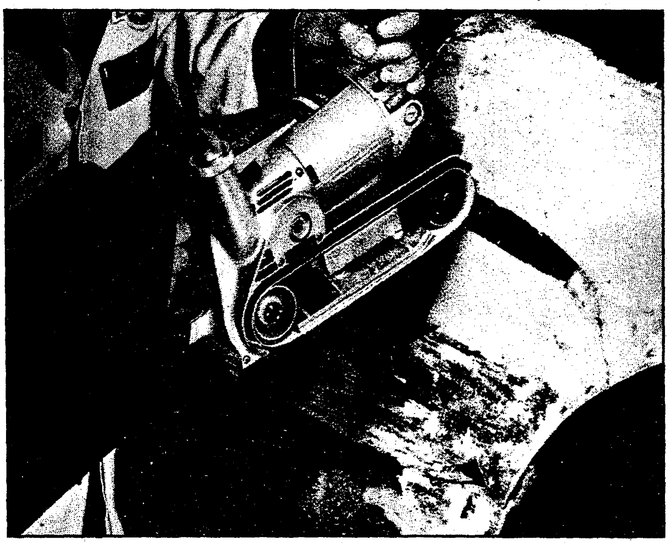


Fig. 75—Grinding "V" at Damaged Area

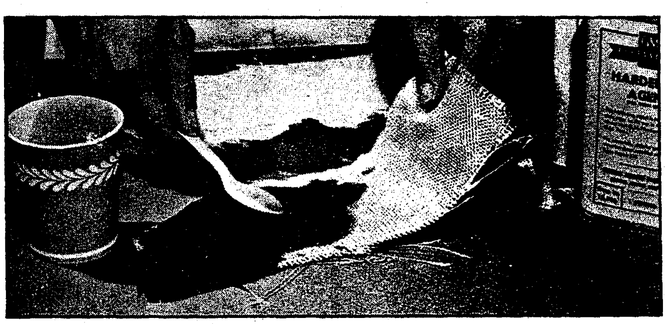


Fig. 76—Applying Resin Mixture to Fiber Glass

the under side of both portions of the panel. Also, remove paint and scuff area clean to provide a good bonding surface.

4. Remove all cracked and fractured material along the break. Bevel the attaching edges of the panels at approximately a 30° angle with a file or grinder and scuff plastic surfaces along edges of break.

Fig. 77—Applying Laminate to Body

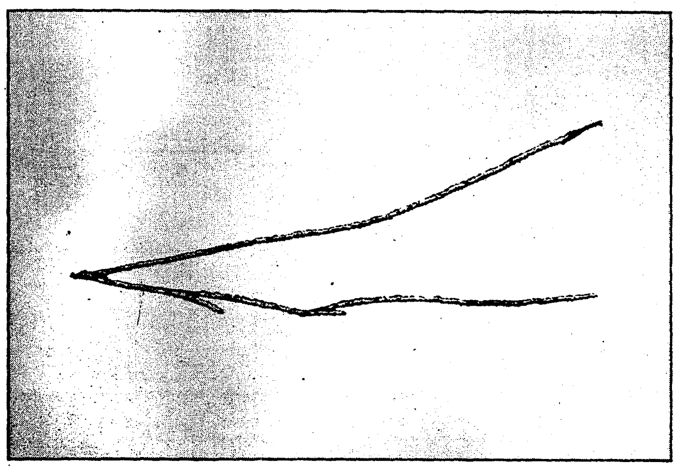


Fig. 78—Typical Scratched Panel

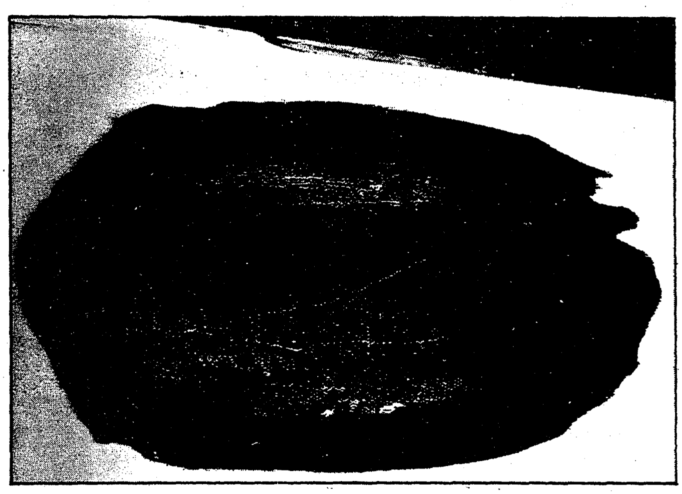


Fig. 79—Repair Area Finish Sanded

NOTE: Mask surrounding panels using a non-staining masking tape.

Fig. 80—Typical Pitted Panel

5. Use "C" clamps to align panel portions allowing approximately 1/8" between the panels or as necessary to provide proper alignment of panels, Figure 82.
6. Cut two pieces of woven glass fiber cloth for backup of sufficient size to overlap the fracture by approximately two inches.
7. Clean up repair area with Prep-Sol, then use tack rag for finish cleanup.
8. Use the Resin Repair Procedure previously described.

NOTE: In some cases it may be desirous to provide additional reinforcements along a fracture. This may be accomplished by placing glass cloth strips in the panel break before applying the plastic mixture.

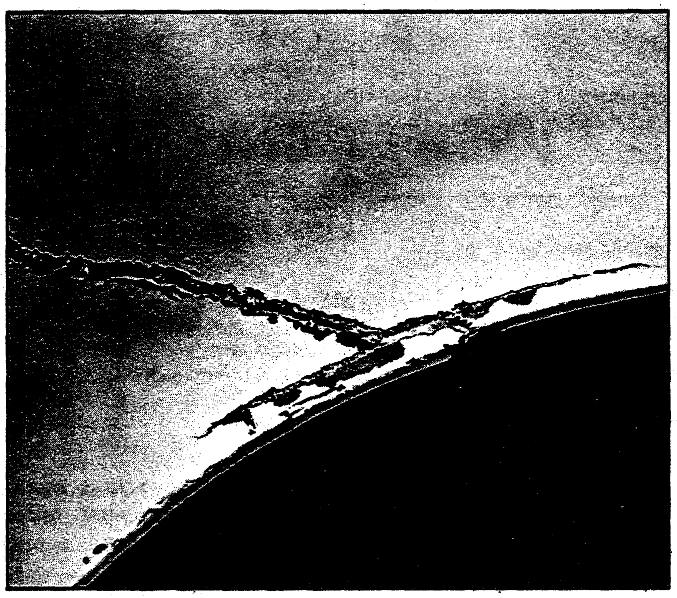


Fig. 81—Typical Cracked Panel

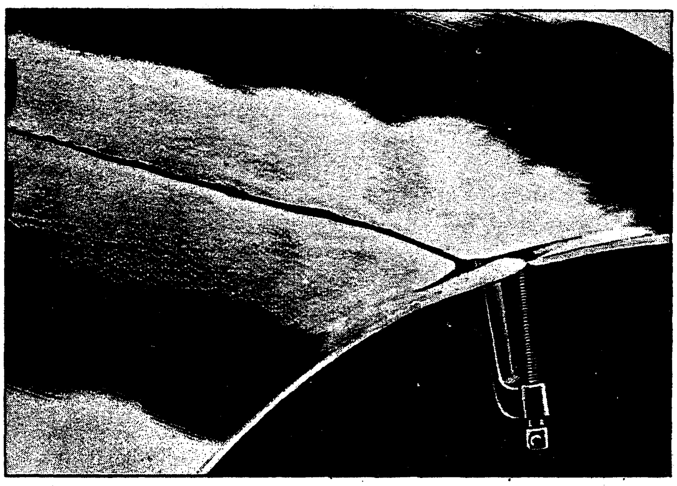


Fig. 82—Cracked Panel Preparation

Fractured Panels

Sometimes damage will occur to panels where the underside is inaccessible or for reasons of panel contour it is impractical to use back plies of fiberglass cloth. The following repair operations are typical of this type of damage.

1. Prepare the damaged area by grinding or filing all cracked and splintered material away from the fracture.
2. Bevel the edge of the fracture at approximately a 20° angle.
3. Remove paint from area surrounding fracture with Lacquer Solvent, or its equivalent.
4. Scuff surface to provide a good bonding surface. Then, clean up area with Prep-Sol and wipe dry.
5. Protect adjacent panels by masking, use non-staining masking tape.
6. Cut a strip of fiberglass cloth of sufficient size, so the fracture will be lapped from 1 to 2 inches on all sides.
7. Prepare plastic mixture in an unwaxed paper cup. (See Resin Repair Kit procedure.)
8. Impregnate glass fiber cloth by brushing or dipping in plastic mixture. Squeeze excess mixture from cloth.

   NOTE: Avoid over-rich plastic areas in the glass cloth, as the strength of the patch is directly proportional to the glass content of the patch.

9. Position plastic impregnated fiberglass over the fracture on the exterior of the panel, lap the break by 1 to 2 inches, and depress into fracture.
10. Carefully work excess plastic out of woven glass by "squeegeeing" from the center of the break outward.

    NOTE: Hold woven glass in place until plastic resin "gels" with Saranwrap or some similar material.

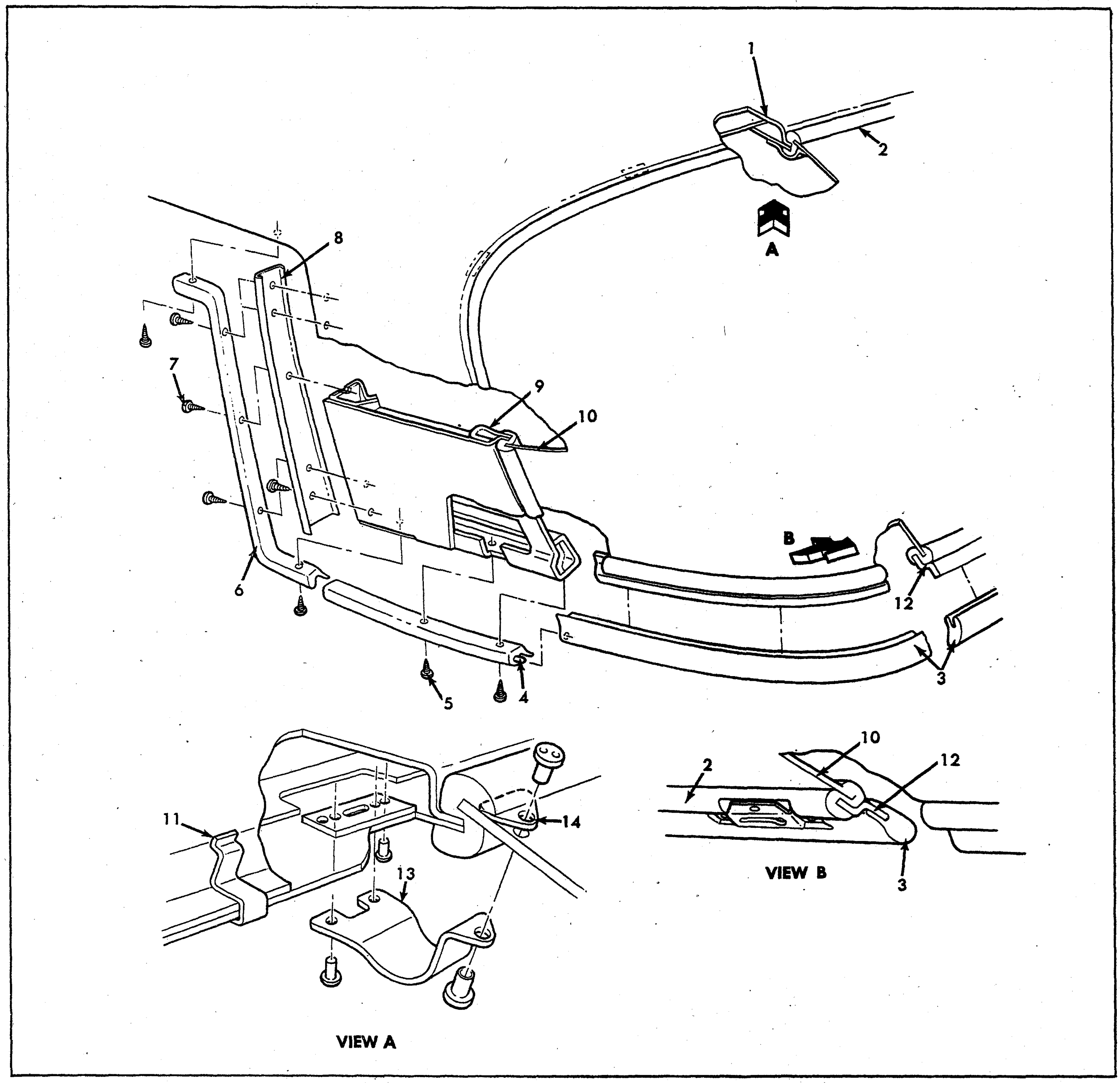


Fig. 83—Hard Top Weatherstrip and Moldings

1. Roof Panel
2. Window Weatherstrip Assembly
3. Lower Weatherstrip - Rear
4. Lower Weatherstrip - Side
5. Lower Weatherstrip Retaining Screw
6. Door Window Weatherstrip Assembly
7. Door Window Weatherstrip Retaining Screws
8. Side Reveal Molding
9. Window Frame Reinforcement
10. Window
11. Retainer - Window Reveal Molding Upper
12. Frame - Window Lower
13. Plate - Inner
14. Plate - Outer

11. Trim excess or loose strands of fiberglass from patch.
12. If low spots exist, prepare another plastic mixture of resin and hardener and mix thoroughly. To this mixture add short fibers cut from glass cloth to give the mixture a putty-like consistency.
13. Liberally apply the plastic mixture with a spatula to fracture and surrounding area. Deposit enough material build-up to allow for filing and sanding operations.
14. Allow the patch to harden.

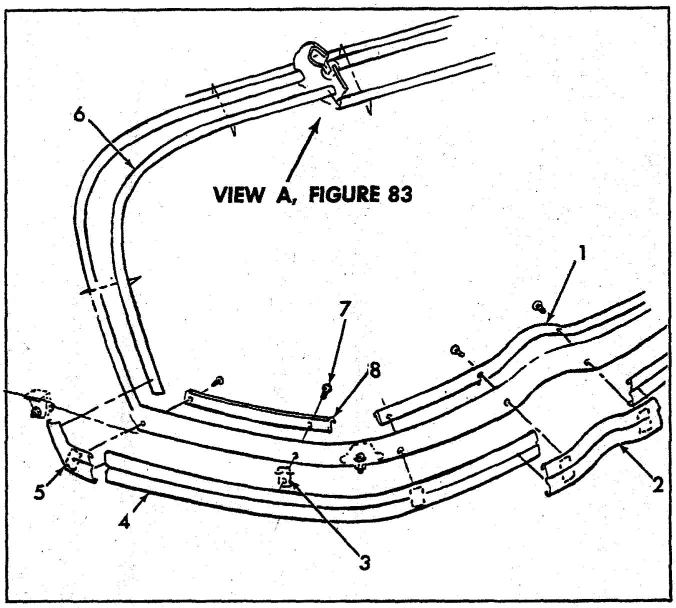


Fig. 84—Hard Top Window Moldings

1. Retainer - Lower Reveal Molding - Center
2. Cap - Lower Reveal Molding - Center
3. Nut - Special Molding Retaining
4. Molding - Lower Reveal - Left Hand
5. Cap - Lower Reveal - Left Hand
6. Molding - Upper Reveal - Left Hand
7. Screw - Lower Reveal Molding Retaining
8. Retainer - Lower Reveal Molding - Left Hand

15. File or grind patch to match the general contour of the panel. Exercise care when performing these operations to avoid gouging the patch or surrounding panel.
16. Use plastic solder as necessary to fill any imperfections.
17. Allow fill to harden, then sand finish preparatory to paint operation.

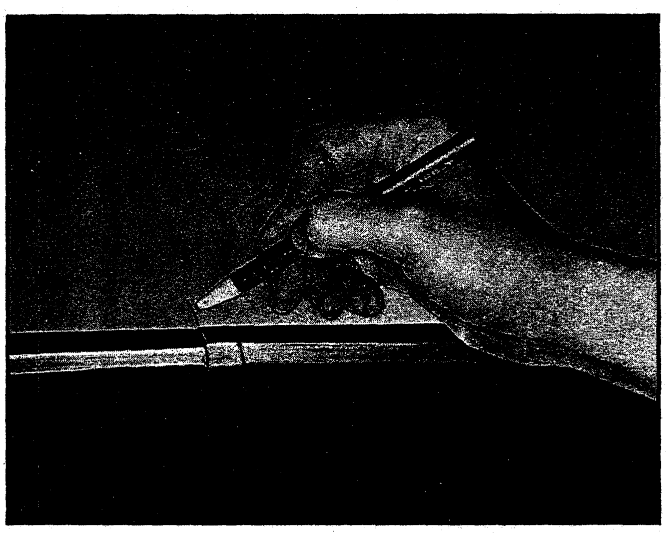


Fig. 85—Marking Molding Position

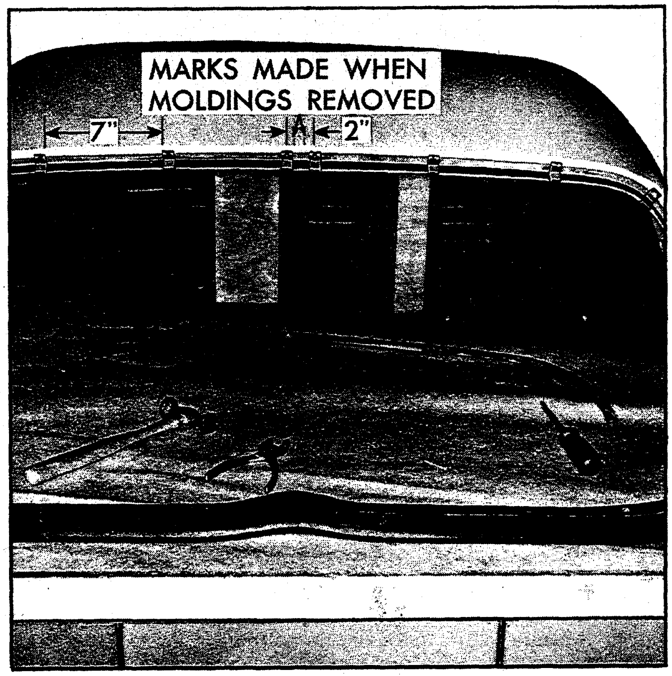


Fig. 86—Installing Reveal Molding Retainers

Panel Replacement

To install a replacement panel, the following method may be used. Various repair panels are available for service. See Repair Panels in general instructions at beginning of this section. These complete panels may be used or sections may be cut to accommodate the type of repair necessary. The panels should be fitted in and all attaching parts installed to insure proper alignment.

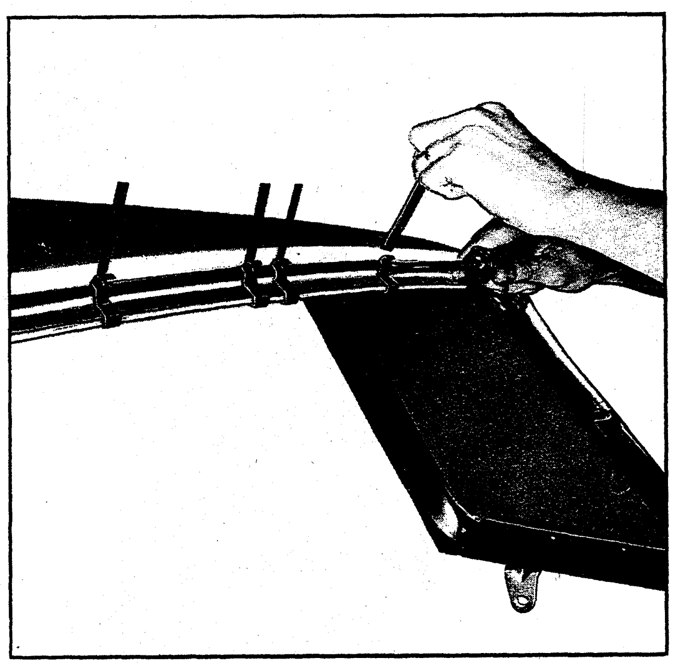


Fig. 87—Placing Shim Stock Behind Retainers

Fig. 88—Applying Sealer to Frame

To replace panel, proceed as follows:

1. Cut out damaged panel with a hacksaw blade and thoroughly remove all dirt and paint from the underside of the old panel or panels for a distance of approximately 2 to 3 inches back from the attaching line.
2. Remove the paint from the finish side, for a distance of 2 to 3 inches on the panel adjacent to the replacement panel location with lacquer solvent, or its equivalent.
3. Scuff the surface on both the replacement panel and adjacent panel for a distance of 2 to 3 inches back from the attaching line and wipe clean.
4. Bevel all attaching edges at approximately 30° across the entire thickness of the plastic so a single "V" butt joint will be formed on the finish surface when the pieces are joined. If the replacement panel does not fit closely to the break, reshape to suit.
5. Cut two backup pieces of woven glass fiber cloth to run the entire length of the joint or shorter lengths of fiber cloth may be lapped over entire length of joint, also cut wide enough to lap the junction line on either side by two or three inches.
6. Prepare a sufficient amount of liquid plastic in an un-waxed paper cup by mixing resin with hardener (See Resin Repair procedure).
7. Align replacement panel, then clamp panel in place to form a closed "V" butt joint at the panel junction. When panel cannot be clamped, use 3/16" bolts with large washer on inner and outer of panel to hold panels in alignment or use straps and sheet metal screws.

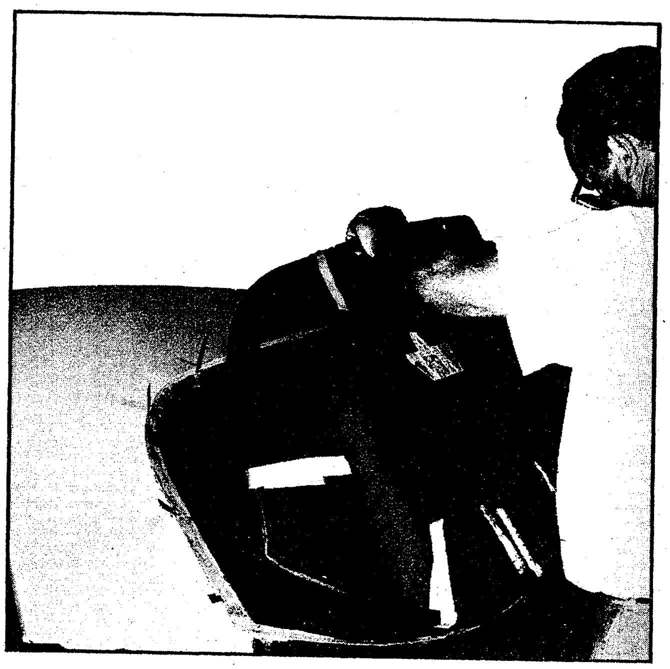


Fig. 89—Installing Window Assembly

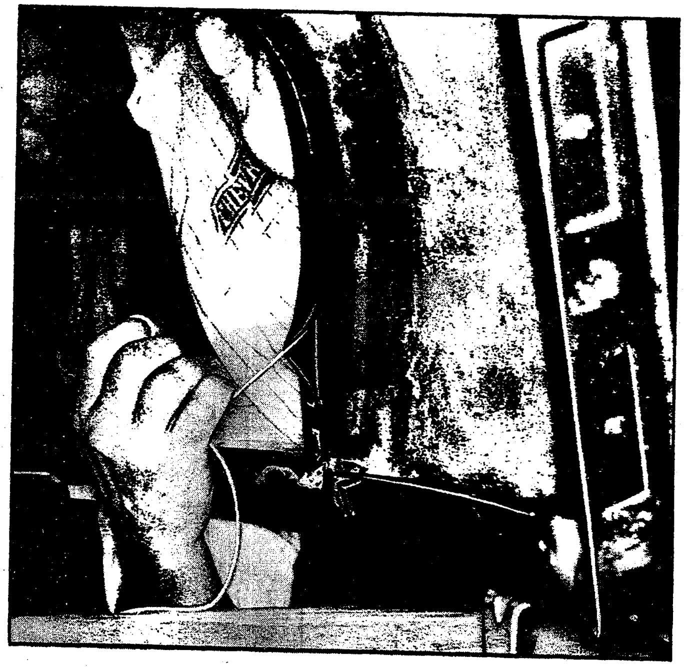


Fig. 90—Pulling Cord From Weatherstrip

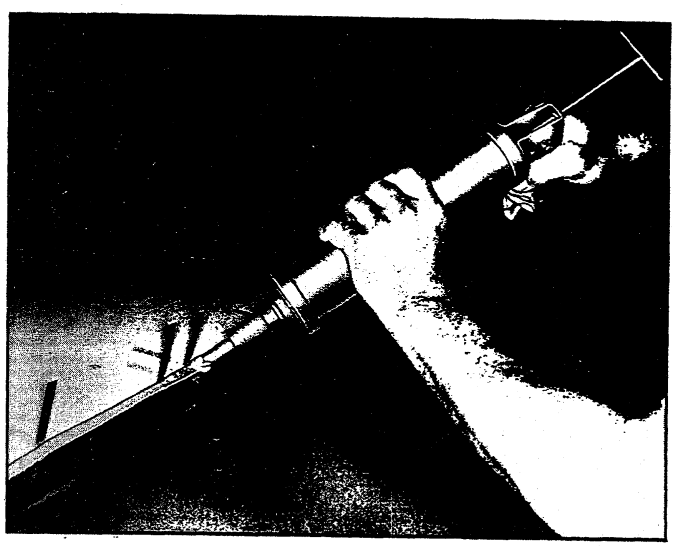


Fig. 91—Applying Sealer to Weatherstrip

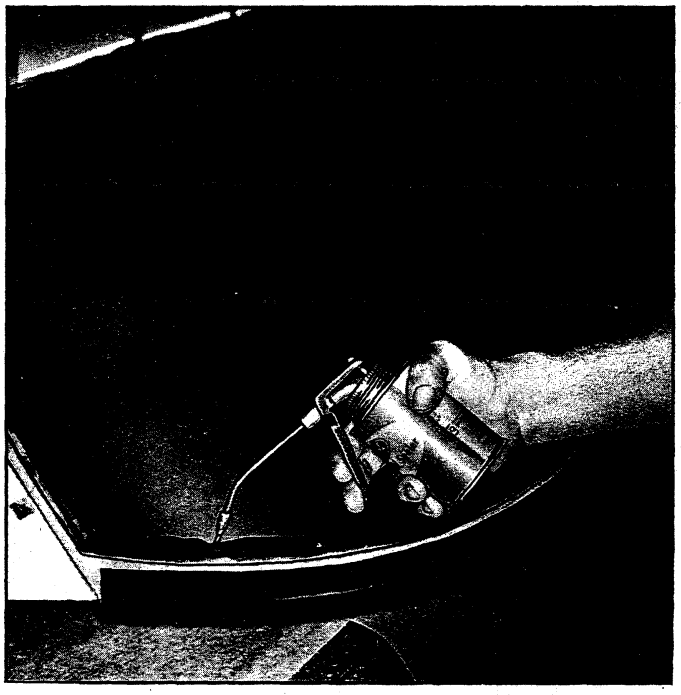


Fig. 92—Applying Cement to Window

8. Impregnate backup plies of woven glass cloth with prepared plastic mixture by dipping or brushing. Remove excess plastic from cloth by squeezing.
9. Place impregnated backup plies on underside of panels. If necessary, hold backup plies in place with paper until plastic "gels."
10. Prepare another plastic mixture of resin and hardener and mix thoroughly. To this mixture add cut glass fiber (1/2" lengths) until mixture has a putty-like consistency, or utilize glass cloth.

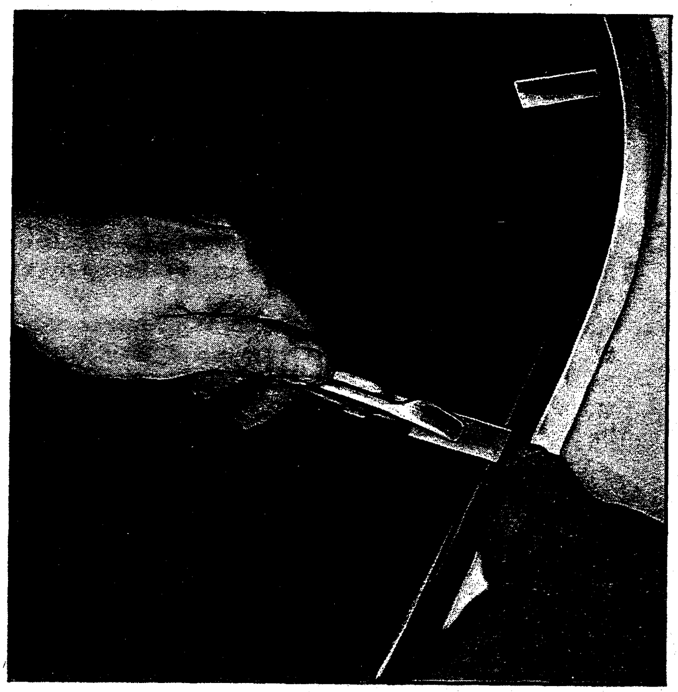


Fig. 93—Removing Feeler Stock

11. Fill "V" groove with reinforced plastic material or saturated glass cloth. Build up surrounding area with sufficient material to allow for finish operations.
12. Allow patch to harden.
13. File or sand (#80-D sandpaper) to general panel contour.
14. Allow plastic fill to harden, then sand, preparatory to paint operations.

HARD TOP

CARE AND STORAGE

The outside painted finish of the hard top should be cleaned the same way as the rest of the car. The inside headlining should be cleaned as outlined under Cleaning Soft Trim.

When not using hard top, store it indoors where it can be kept clean and dry. If the top is to be stored for a long period of time, keep it covered to avoid dirt settling on top and headlining. It is not advisable, however, to wrap top assembly in a manner which will stop air circulation.

The hard top rear window is plexiglas and should be cared for in exactly the same manner as outlined for the convertible top rear window (see Care of Folding Top in this section). Never scrape ice from rear window—scratches are sure to result.

REAR WINDOW

Consult Figures 83 and 84 for parts identification.

Removal

1. Remove hard top from vehicle. Place protective covering over headlining.
2. Remove screws retaining lower reveal moldings and cap.
3. Mark position of right hand upper reveal molding end on top (fig. 85) and pry molding out of weatherstrip. Repeat on left hand molding.
4. Remove rear garnish moldings as outlined farther on in this section.
5. Working from inside of top, carefully work weatherstrip from frame flange and push weatherstrip-window assembly toward rear of top until free of window frame.
6. Remove weatherstrip from window and inspect carefully. If weatherstrip is damaged, it should be discarded. If it is in usable condition, clean off all foreign material.

Installation

1. Clean window frame of all old sealer, dirt, etc. Remove and discard upper reveal molding retainers.
2. Install twelve new upper reveal molding retainers using mark made when removing reveal moldings as guide. The two middle retainers should be 2" center to center, those remaining should be approximately 7" apart as shown in Figure 86.
3. As an aid to engaging reveal moldings in retainers later on, place a short length of feeler stock behind each as shown in Figure 87.
4. Install weatherstrip on window.

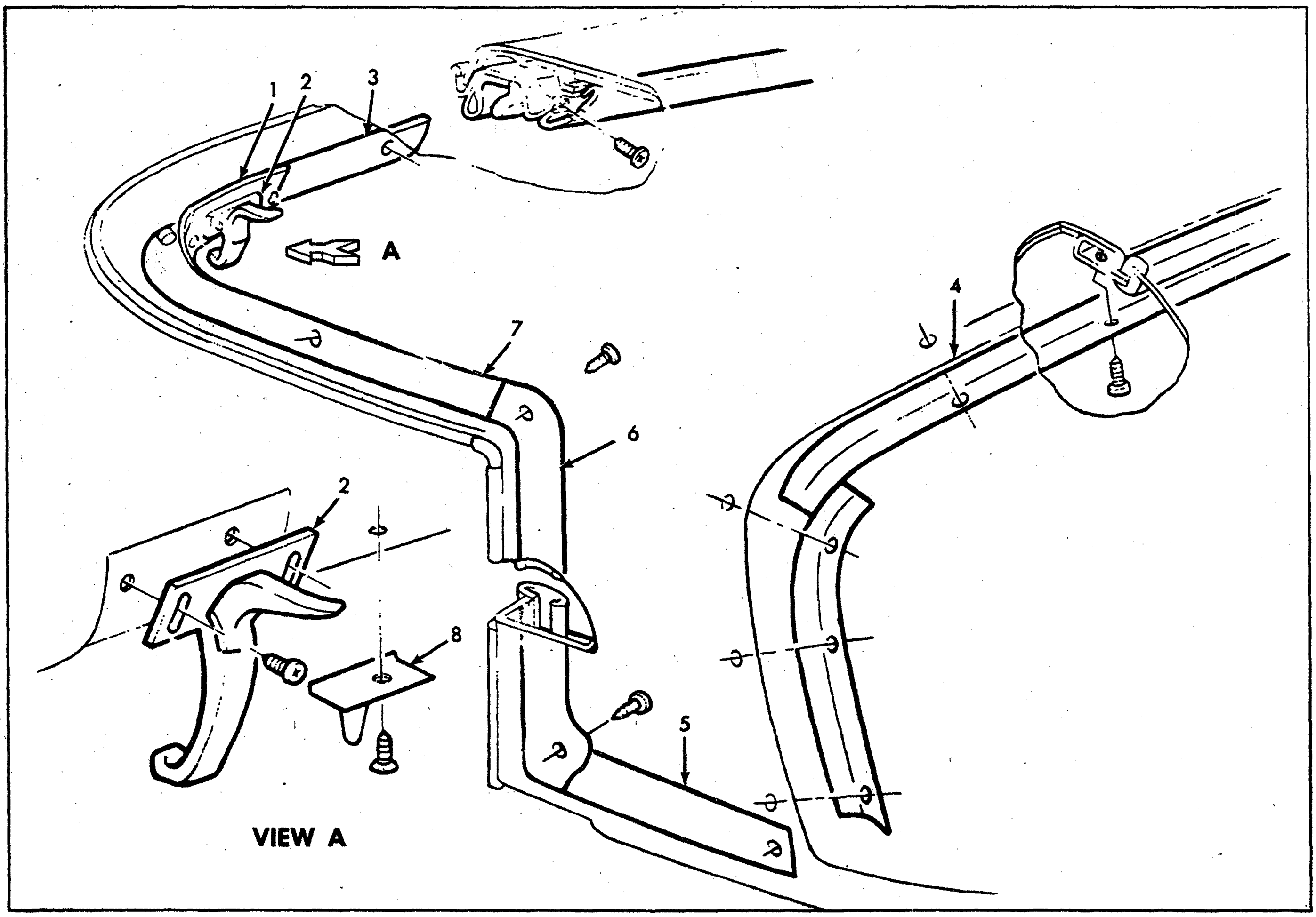


Fig. 94—Garnish Moldings and Latch

1. Molding - Latch
2. Latch Assembly
3. Molding - Forward Header
4. Molding - Rear Upper
5. Molding - Rear Lower
6. Molding - Side
7. Molding - Forward Corner
8. Guide

5. Starting at bottom center of glass, insert a piece of heavy cord, such as chalk line, in groove of weatherstrip. Cut the cord long enough so that about 10" of free length exists at each end after going around the weatherstrip. Tie ends of the cord together in overhand knot and tape loose ends to inside surface glass. Masking tape may be used to hold weatherstrip to glass (fig. 89).
6. Apply a bead of sealer such as 3M1170 or equivalent to apex of frame as shown in Figure 88.
7. Place window assembly in opening as shown in Figure 89.
8. Grasp ends of cord and pull toward front of top assembly. Exert gentle but firm pressure on outside of window in the area where string is emerging from weatherstrip. Figure 90 shows action of string on weatherstrip; lip of seal is pulled out of frame apex and over frame flange.
9. When string has been removed, carefully inspect seating of lip over entire perimeter of window, paying particular attention to corners. Remove tape strips if used.
10. Apply a band of sealer in groove formed by weatherstrip and edge of window opening as shown in Figure 91.
11. Inject a moderate quantity of cement (3M-6699B or its equivalent) between window and weatherstrip as shown in Figure 92.
12. Install garnish and reveal moldings in reverse order of removal. Note that upper reveal molding flanges must pass between retainer and feeler stock. Feeler stock is removed as molding is installed as shown in Figure 93.

GARNISH MOLDINGS AND LATCHES

Figure 94 shows garnish molding and latch installation. Note that latch may be adjusted to regulate header weatherstrip pressure on windshield frame. To adjust latch, mark original position, loosen mounting screws and move latch in desired direction. Be sure latch is engaged in serrations before tightening mounting screws.

When removing garnish moldings, note that short moldings under latches (Item I, Figure 94) are the

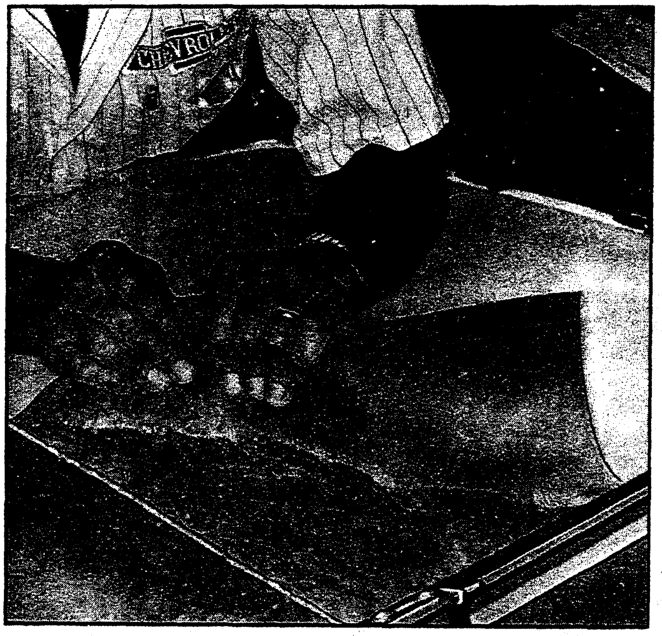


Fig. 95—Removing Headlining

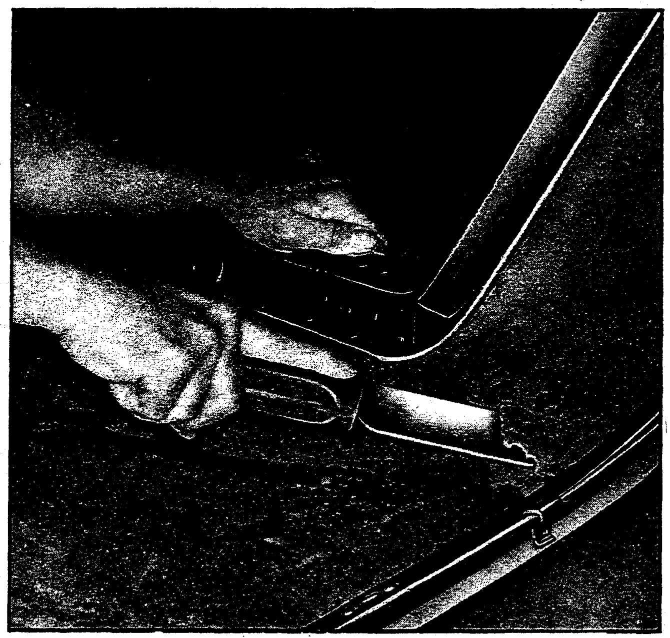


Fig. 96—Cleaning Top Inner Surface

"keys", or first to be removed; next in order of progression are Items 5 and 6. Items 3, 4, and 7 may then be removed.

HEADLINING

Removal

1. Remove all garnish moldings.
2. Pull damaged headlining from top (fig. 95).
3. Soak remaining particles of sponge which cling to top with Prep-Sol or its equivalent and scrape off (fig. 96).

Installation

Be sure that top inner surface is clean and dry before applying cement. Use only cement specified as suitable for polyfoam material and follow directions supplied with package. Install garnish moldings in reverse order of removal.

WEATHERSTRIP AND DRIP MOLDINGS

Figure 97 and 98 illustrate installation of moldings and weatherstrips on a hard top. Assembly and disassembly of many of these parts will be apparent upon study of the figures, but do not attempt servicing until reading the following special information.

Outer Weatherstrips (Item 8, Fig. 97)

Outer weatherstrip is attached to drip moldings with retainers as shown in view A, Figure 97. To replace weatherstrip, the weatherstrip drip molding assembly is removed from the top as a unit and the weatherstrip may then be removed from under retainers. Replace any broken or distorted retainers with new parts. Do not install drip molding-weatherstrip assembly until familiarizing yourself with Special Sealer information which follows weatherstrip instructions.

Inner Forward Weatherstrips (Item 9, Fig. 97)

These are cemented to inner side weatherstrips (item 5, Figure 97) and are retained to the top frame with barbed plastic retainers which are pushed into holes in frame. Figure 99 shows a cross section of weatherstrip and retainer.

Weatherstrip Special Sealer

A polyurethane sealer which may be obtained through Chevrolet parts sources must be applied between top frame surface and the following moldings whenever they are removed for service and reinstalled or installed new:

Figure 97 Item 3
Figure 97 Item 4
Figure 97 Item 10
Figure 98 Item 8

Top frame and moldings to be reused must have all old sealer removed and be free of grease, dirt, etc. Follow directions supplied with sealer carefully to insure a successful job. Figure 100 shows sealer being applied.

VINYL COVERING ON REMOVABLE HARDTOP

Removal

1. Remove weatherstrip assemblies.
2. Remove reveal moldings.
3. Place masking tape on clean plastic rear window for protection. Roof glue solvent will harm the rear window if it is allowed to come in contact.
4. Prior to removing fabric cover, application of heat to cemented areas will permit easier loosening of cemented edges.

   CAUTION: Apply heat by lamps held 18" (minimum) from fabric only until fabric is warm. If lamps are held too close, or fabric cover is heated over 200°F, the fabric may loose its grain, blister, or become very shiny.

5. Loosen cemented edges of fabric roof cover.

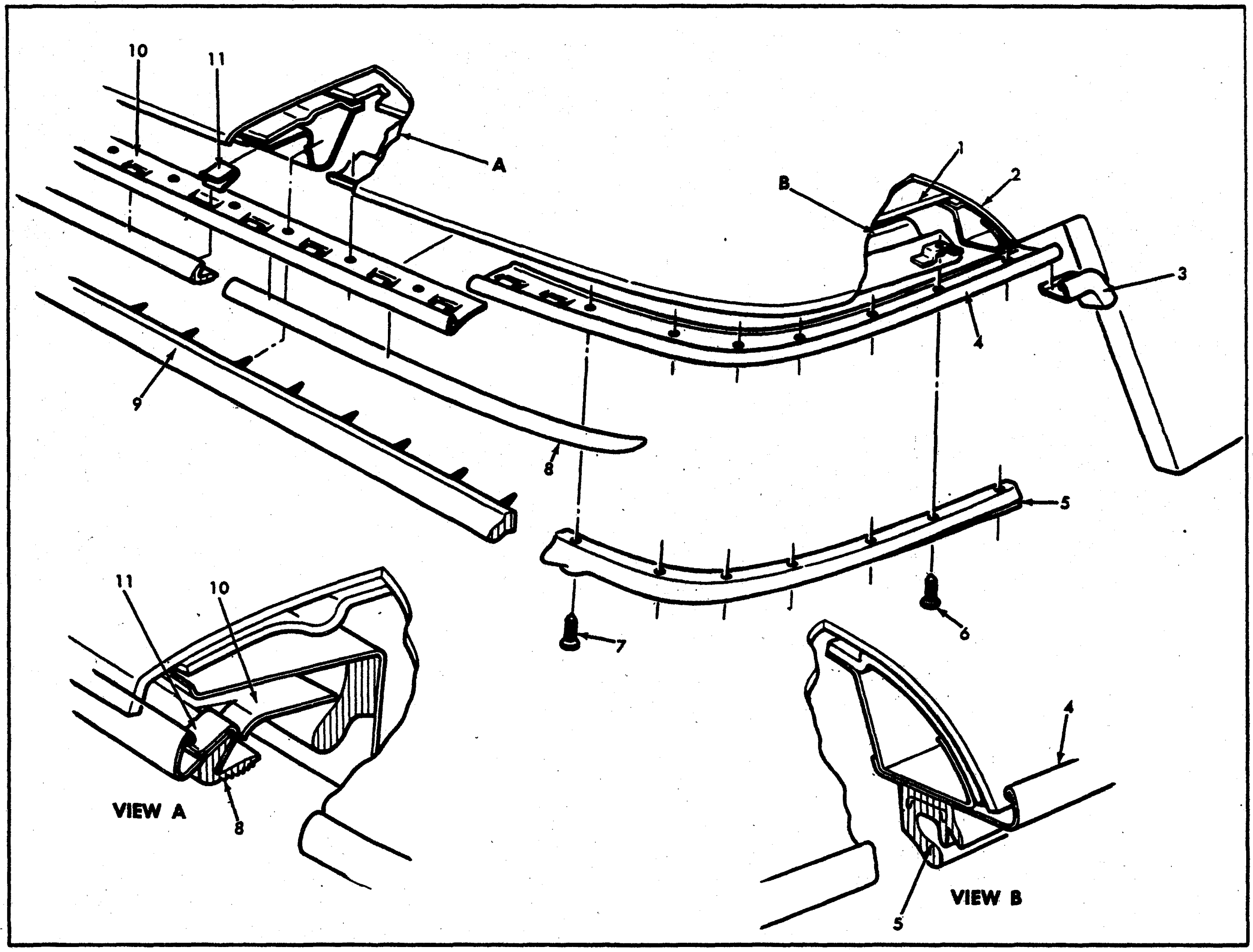


Fig. 97—Weatherstrip and Drip Moldings

1. Headlining
2. Roof Panel
3. Cap
4. Drip Molding - Side
5. Weatherstrip Assembly - Inner Side
6. Weatherstrip Assembly - Retaining Screw
7. Weatherstrip Assembly - Retaining Screw Special
8. Weatherstrip Assembly - Outer
9. Weatherstrip Assembly - Inner Forward
10. Drip Molding - Forward
11. Retainer - Weatherstrip Assembly, Outer

Installation

1. Wipe roof panel with a Xylol solvent such as 3M Adhesive cleaner or equivalent, should be used to remove or smooth out excess old cement. Apply solvent and allow to soak before rubbing.
2. Where possible, install new cover at room temperature (approximately 72°) to permit easier fitting and removing of wrinkles from the cover assembly.
3. Determine center line of roof panel by marking center points on front of hard top and back window opening. Fold cover lengthwise. Lay cover on roof panel. Determine overhang (approximately 1").
4. Apply nitrile non-staining vinyl trim adhesive (such as 3M Vinyl Trim Adhesive) to the roof panel adjacent to center line of fabric roof cover.
5. Application of nitrile vinyl trim cement should be as thin as possible. An excessive amount of cement may result in trapped solvents (blisters) between fabric cover and roof panel. A mohair roller should be used for thin adhesive application.

   NOTE: If nitrile non-staining cement is not available, neoprene type non-staining weatherstrip cement (3M weatherstrip cement or equivalent) may be used.
6. Apply cement to entire fabric roof cover.

   NOTE: Allow approximately 15 minutes for cement to dry.
7. Fold vinyl cover back to contact adhesive on roof panel. Vinyl cover seam must be parallel to centerline of vehicle.
8. Repeat above steps for opposite side of roof.
9. Use suitable spatula or roller to remove wrinkles and/or bubbles from vinyl cover.
10. Trim excess vinyl around entire top to provide a

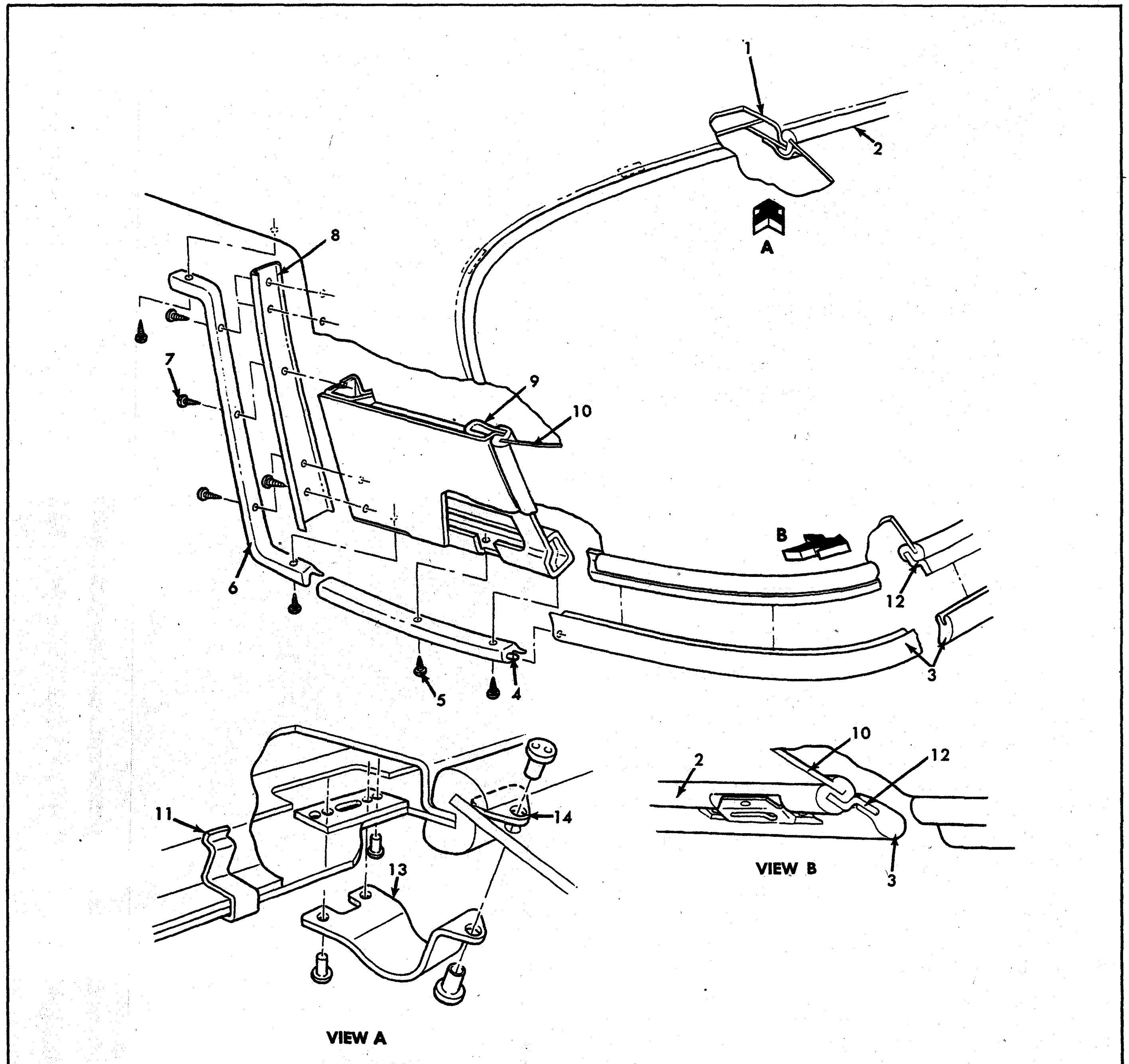


Fig. 98—Hardtop Weatherstrips and Moldings

1. Roof Panel
2. Window Weatherstrip Assembly
3. Lower Weatherstrip - Rear
4. Lower Weatherstrip - Side
5. Lower Weatherstrip Retaining Screw
6. Door Window Weatherstrip Assembly
7. Door Window Weatherstrip Retaining Screws
8. Side Reveal Molding
9. Window Frame Reinforcement
10. Window
11. Retainer - Window Reveal Molding Upper
12. Frame - Window Lower
13. Plate, Inner
14. Plate, Outer

minimum of 1/2" flange which will be cemented to substructure of removable hardtop with adhesive.

11. Reinstall reveal moldings and weatherstrips.

Vinyl Roof Cover Repairs

Certain types of fabric roof cover discrepancies can successfully be repaired without replacing or removing the cover.

Scuffs or Small Cuts Near Exterior Moldings

If a small cut is present, an attempt should be made to cement the loose ends prior to performing the following:

1. Obtain a scrap piece of fabric roof cover material,

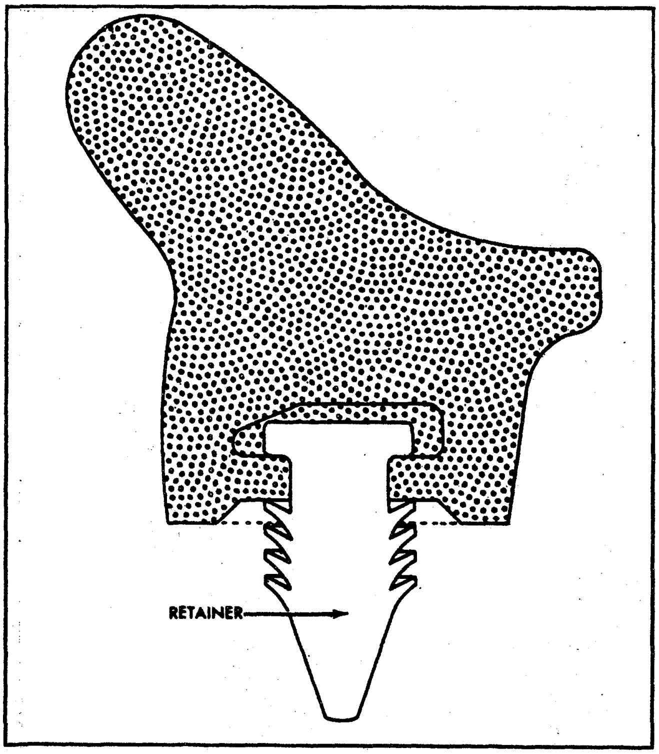


Fig. 99—Inner Forward Weatherstrip

or material from a hidden area directly on complaint car (such as under reveal moldings).

2. Using an electric wood burning needle or low heat soldering gun, scrape off an appropriate amount of vinyl from scrap piece of material or from hidden area and immediately apply to scuffed or cut area on car.

CAUTION: Be certain low heat is maintained to prevent discoloration of cover.

3. Carefully blend applied vinyl to fabric roof cover, utilizing electric needle or soldering gun.

Wrinkles, Blisters and Bubbles

1. Pierce each wrinkle, blister and bubble on fabric roof cover with a small needle.
2. Completely saturate a clean shop towel with water and wring out.
3. Apply cloth to wrinkle or blistered area.
4. Apply a home type laundry iron over shop towel using back and forth strokes until towel is dry. (If iron has heat control settings, control should be set to "wool".)

CAUTION: Do not continue to use iron after towel has become dry as excess heat may cause permanent damage to vinyl roof cover.

5. Remove towel and inspect area. If slight wrinkles or blisters are still present, perform the following steps:
6. Using a syringe and hypodermic needle filled with clear water, inject sufficient water into wrinkle or bubble to dampen fabric backing.
7. Repeat steps 2 through 4.

FOLDING TOP

CARE OF THE FOLDING TOP

To avoid water stains, mildew, or possible shrinkage of the top material, do not keep the top folded for extended periods of time if it is damp or water soaked. Permit top to dry out in a raised position before stowing. Also avoid pasting advertising stickers, gummed labels or masking tape on the plastic back window. In addition to being difficult to remove, the adhesive on these stickers may also be injurious to the plastic composition of the window.

Care of Rear Window

The large plastic rear window in the folding top will remain in good condition for the life of the top if given proper care. Due to the texture of the plastic window, it is susceptible to scratches and abrasions; therefore, when cleaning the window, follow the steps outlined below.

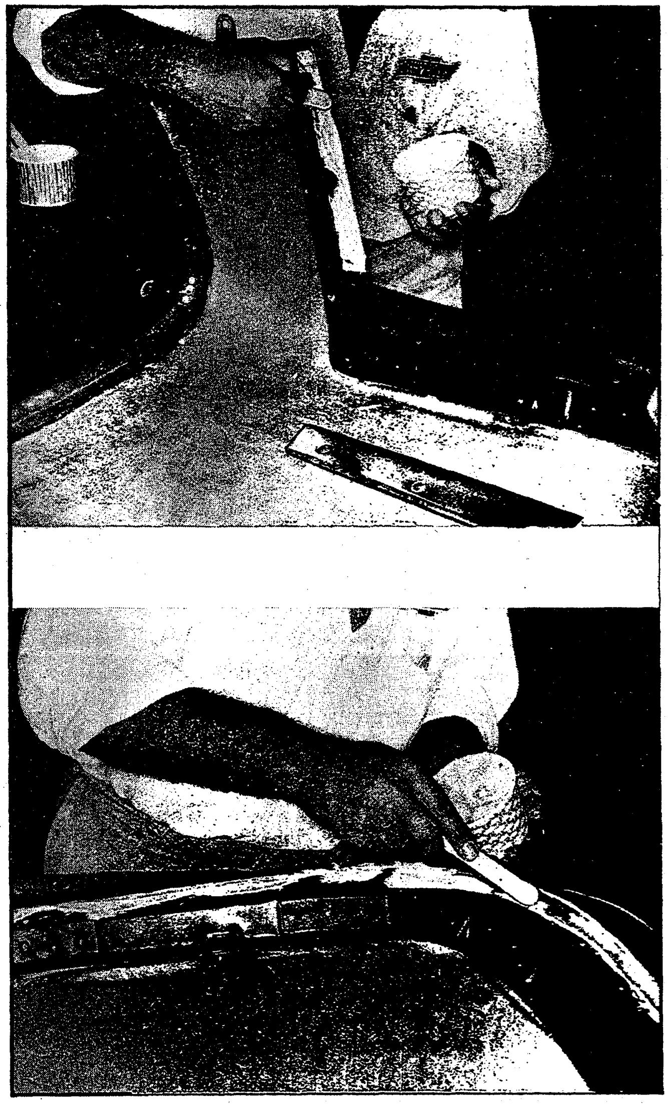


Fig. 100—Applying Sealer

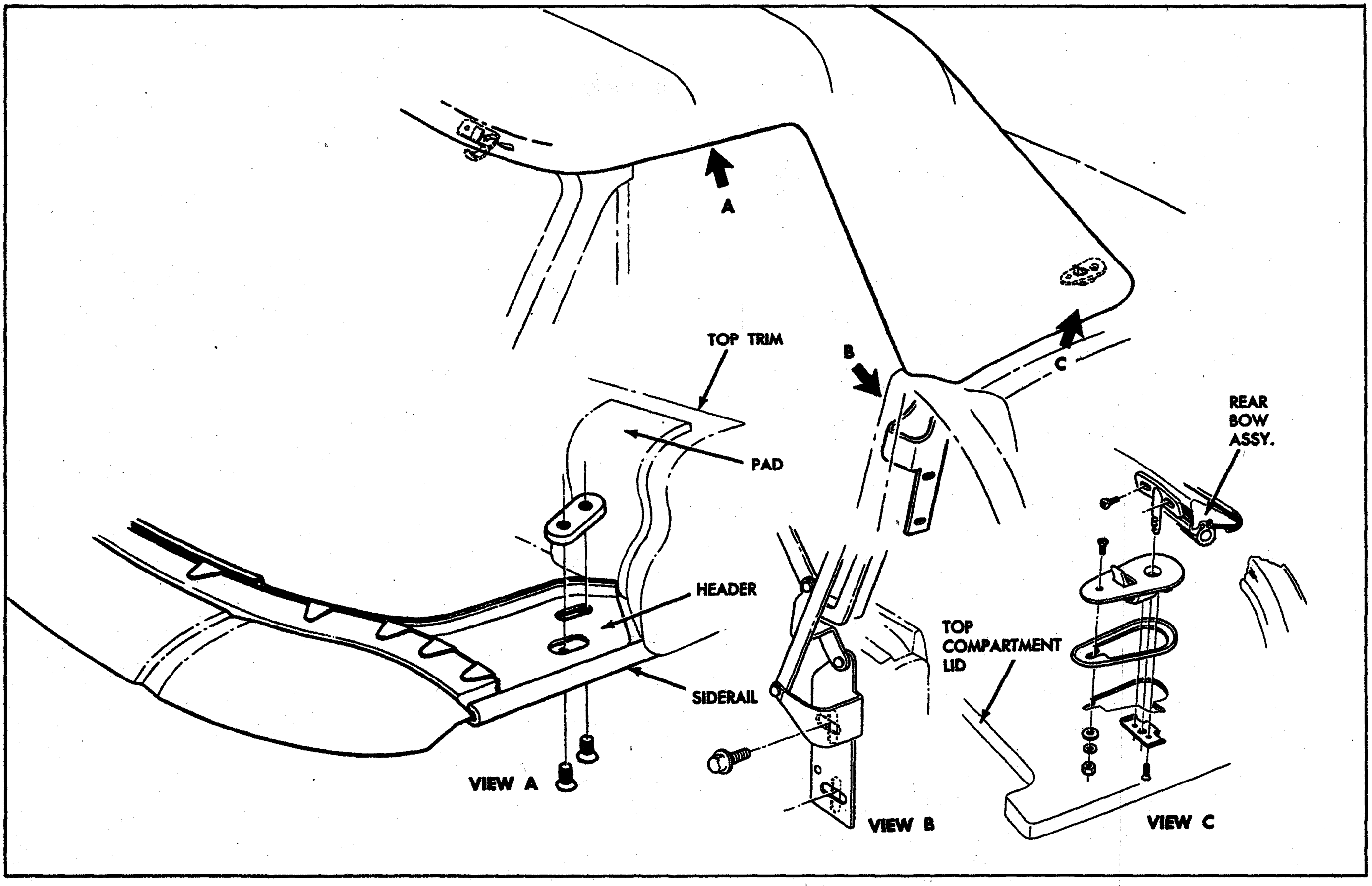


Fig. 101—Folding Top Adjustments

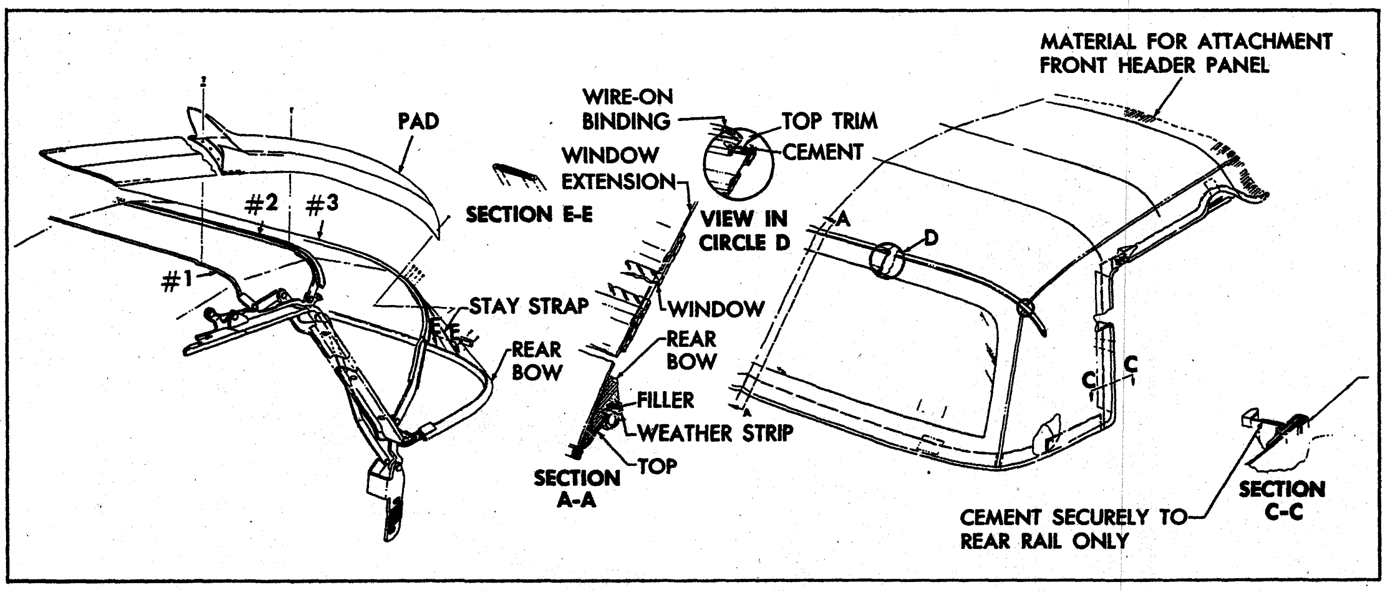


Fig. 102—Folding Top Trim Installation

1. To remove superficial dust, do not use a dry cloth. Use a soft cotton cloth moistened with water and wipe cross-wise of the window.

2. To wash the rear window, use cold or tepid (not hot) water and a mild neutral soap suds. After washing, rinse with clear water and wipe with a slightly moistened clean soft cloth. A high quality plastic window cleaner is available from Chevrolet parts sources.

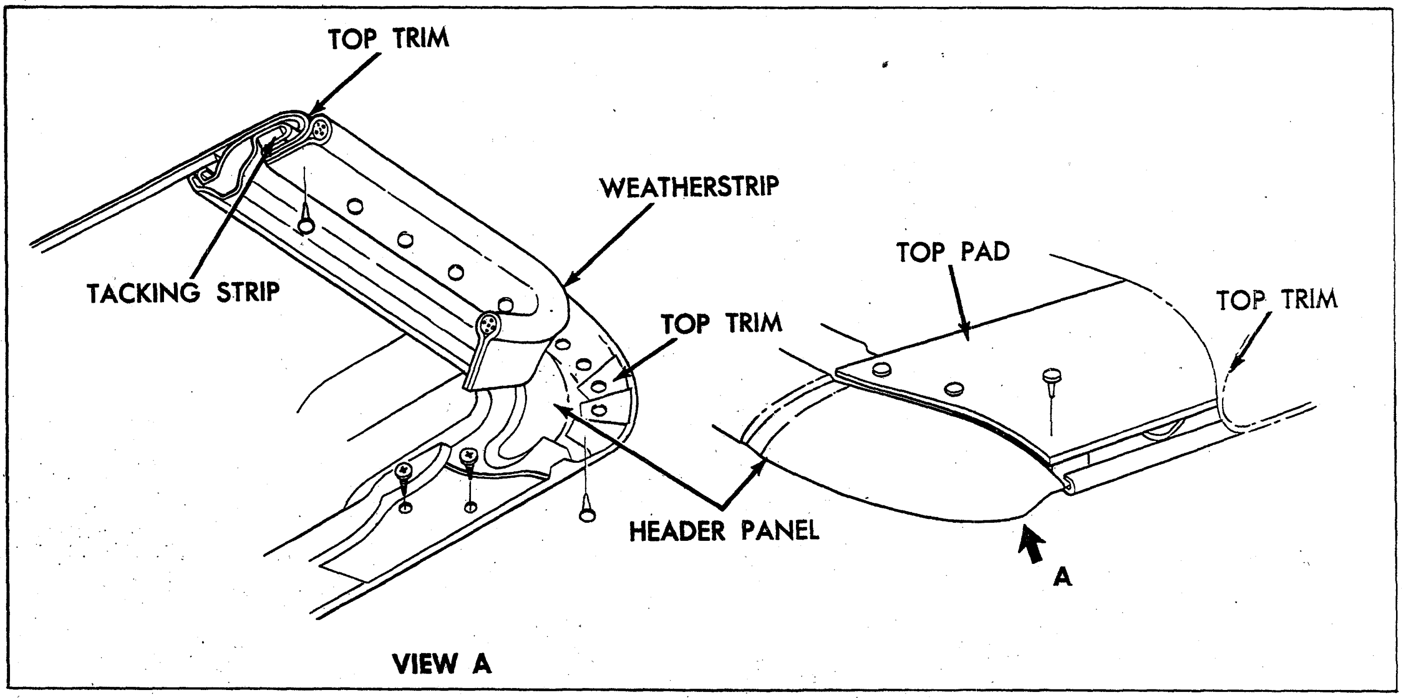


Fig. 103—Trim at Header

CAUTION: Never use solvents such as alcohol or volatile cleaning agents on the plastic window. These liquids may have a deteriorating effect on the plastic and if spilled, may spot the painted finish on the rear body panels directly below the rear window.

3. When removing frost, snow or ice from the plastic window, DO NOT USE A SCRAPER. In an emergency, warm water may be used. Use care that the warm water does not contact the glass windows or windshield.

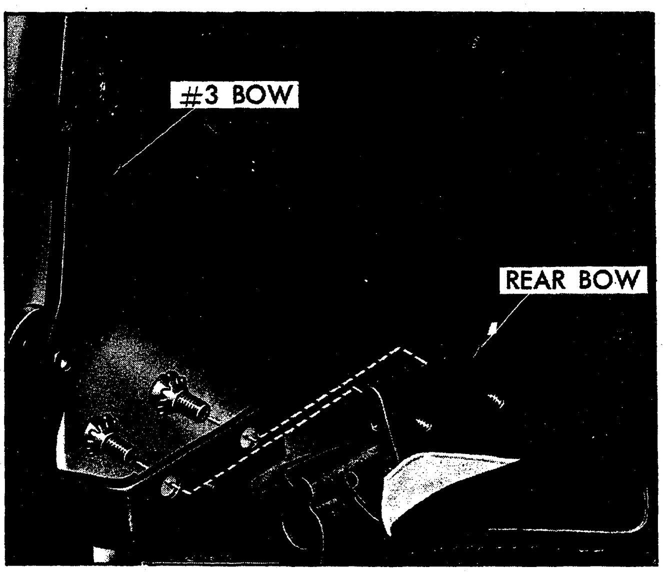


Fig. 104—Rear Bow Retaining Screws

ADJUSTMENTS

To correct variations in the top fit, adjustments may be made at three locations shown in Figure 101. A combination of adjustments may be necessary to correct any given problem, including door and window adjustments which are covered elsewhere in this section.

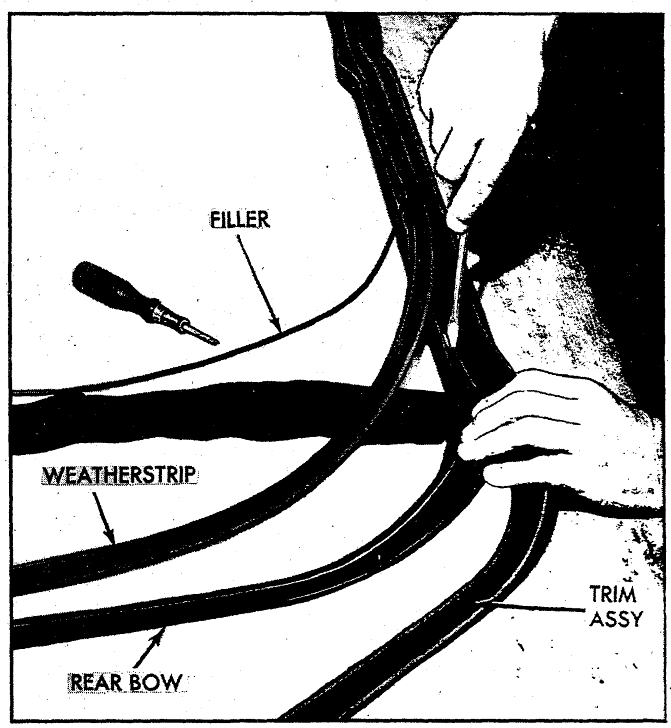


Fig. 105—Installing Trim and Weatherstrip to Rear Bow

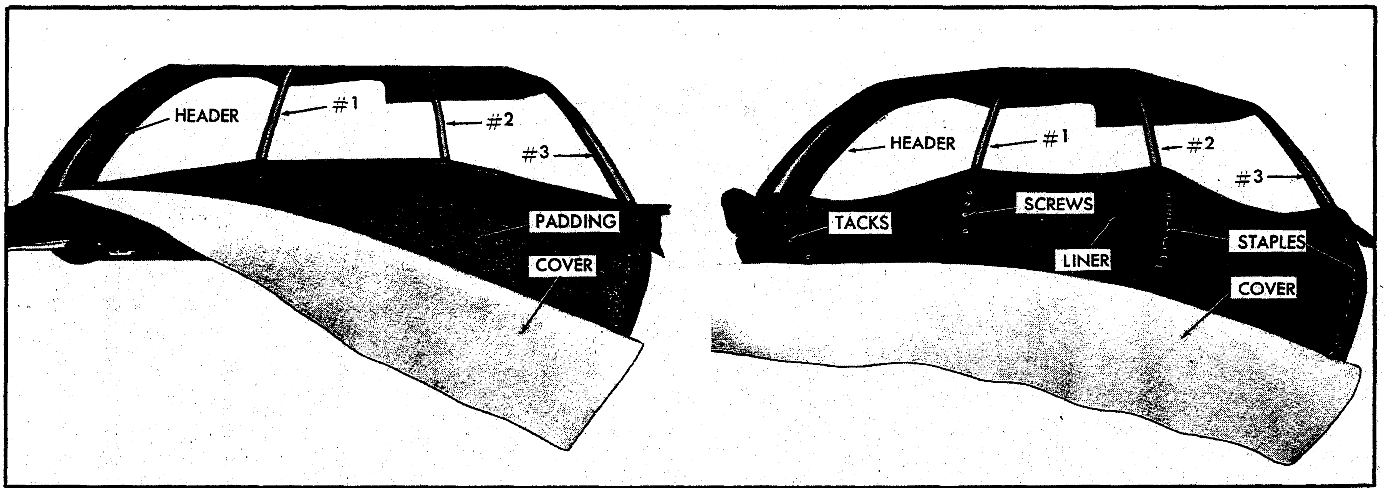


Fig. 106—Pad Construction

The folding top adjustments are:

Header (View A, Fig. 101)

Header assembly may be moved fore and aft when the two clamping screws are loosened. This will correct such conditions as header latch guide pin alignment with the holes in the windshield upper frame. Symptoms of misalignment are such conditions as loose top trim when top is up and locked, and excessive effort required to engage header locks. Note that it will be necessary to remove side roof rail weatherstrip to gain access to header outer clamping screw. Refer to Weatherstrip portion of this section.

Hinge (View B, Fig. 101)

The hinges may be moved up and down and fore and aft to the limit of the slotted holes in hinge plate and body. To gain access to hinge, remove rigid plastic trim as explained in Interior Trim portion of this section. Repositioning hinge will correct conditions such as poor top fit at upper and rear edge of windows; faulty fore and aft engagements of rear bow hold-down pins in lock assemblies and loose or over-tight top rear panel when top is raised and properly locked in position.

Rear Bow Hold-Down Locks (View C, Fig. 101)

The hold-down pins may be moved to left or right to center top on body in raised position; thus correcting poor alignment at windows and difficult entry of pins in locks.

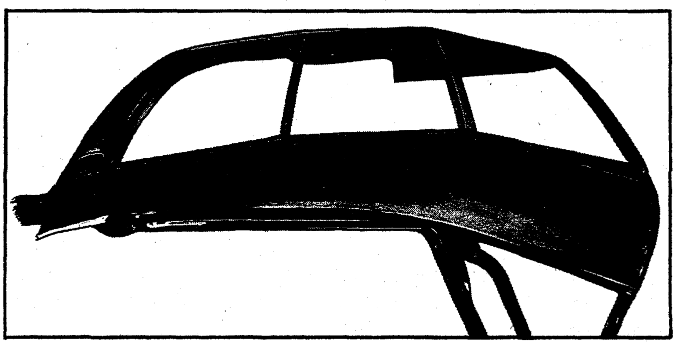


Fig. 107—Pad Installed

TOP ASSEMBLY REMOVAL AND INSTALLATION

The entire top assembly (frame with trim attached) may be removed from vehicle as follows:

1. Raise top, but do not engage header or rear bow locks.
2. Remove rigid plastic trim as outlined in Interior Trim portion of this section.
3. Mark installed position of hinge by scribing outline of hinge plate on lock pillar surface.
4. Remove two screws retaining each hinge to lock pillar and remove top assembly from vehicle.
5. When installing top assembly, carefully match hinge plate with scribed marks on body lock pillar and

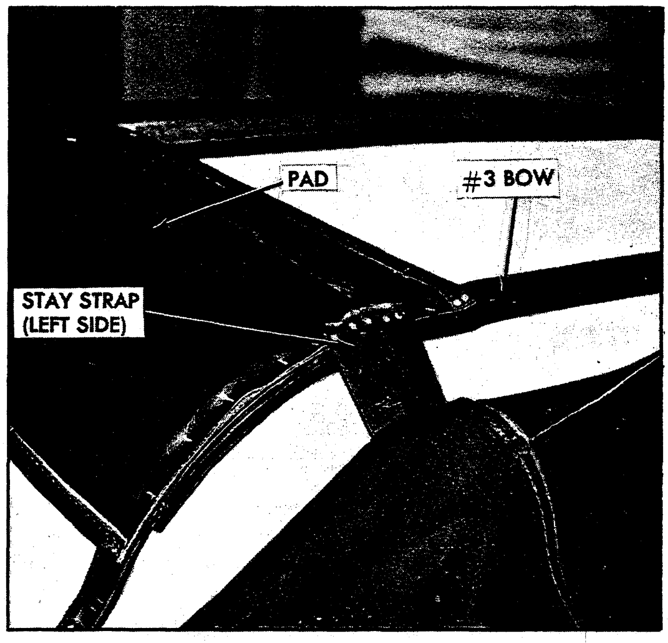


Fig. 108—Installing Stay Strap

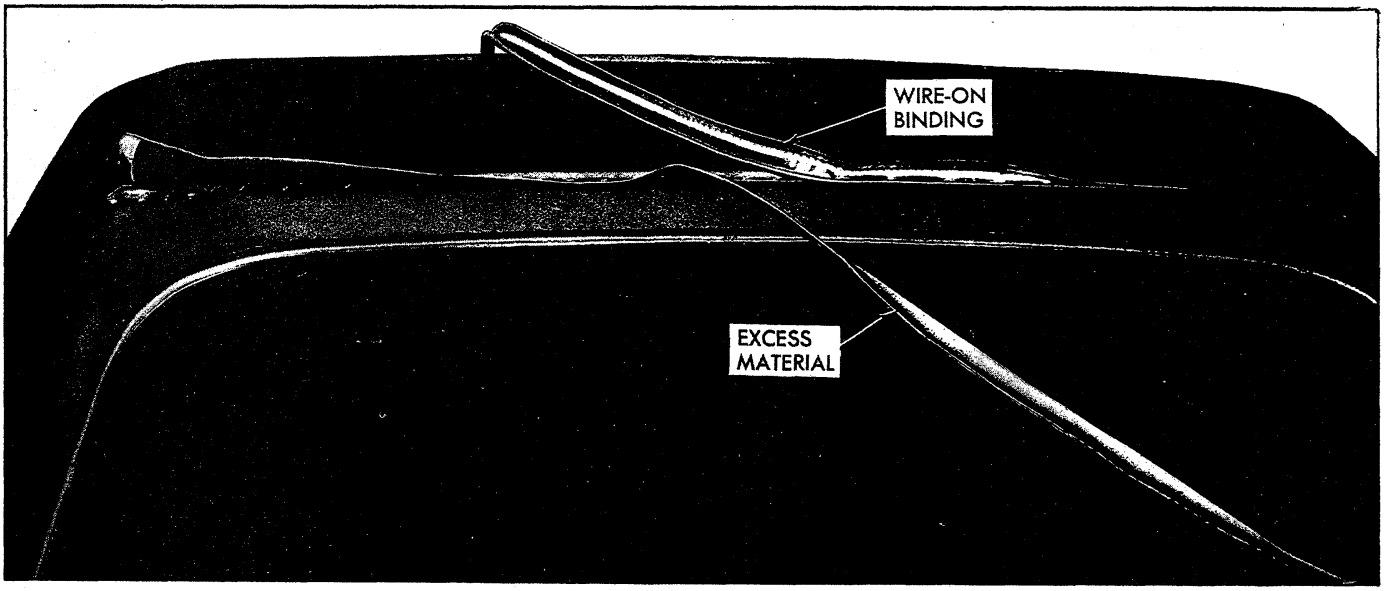


Fig. 109—Installing Binding

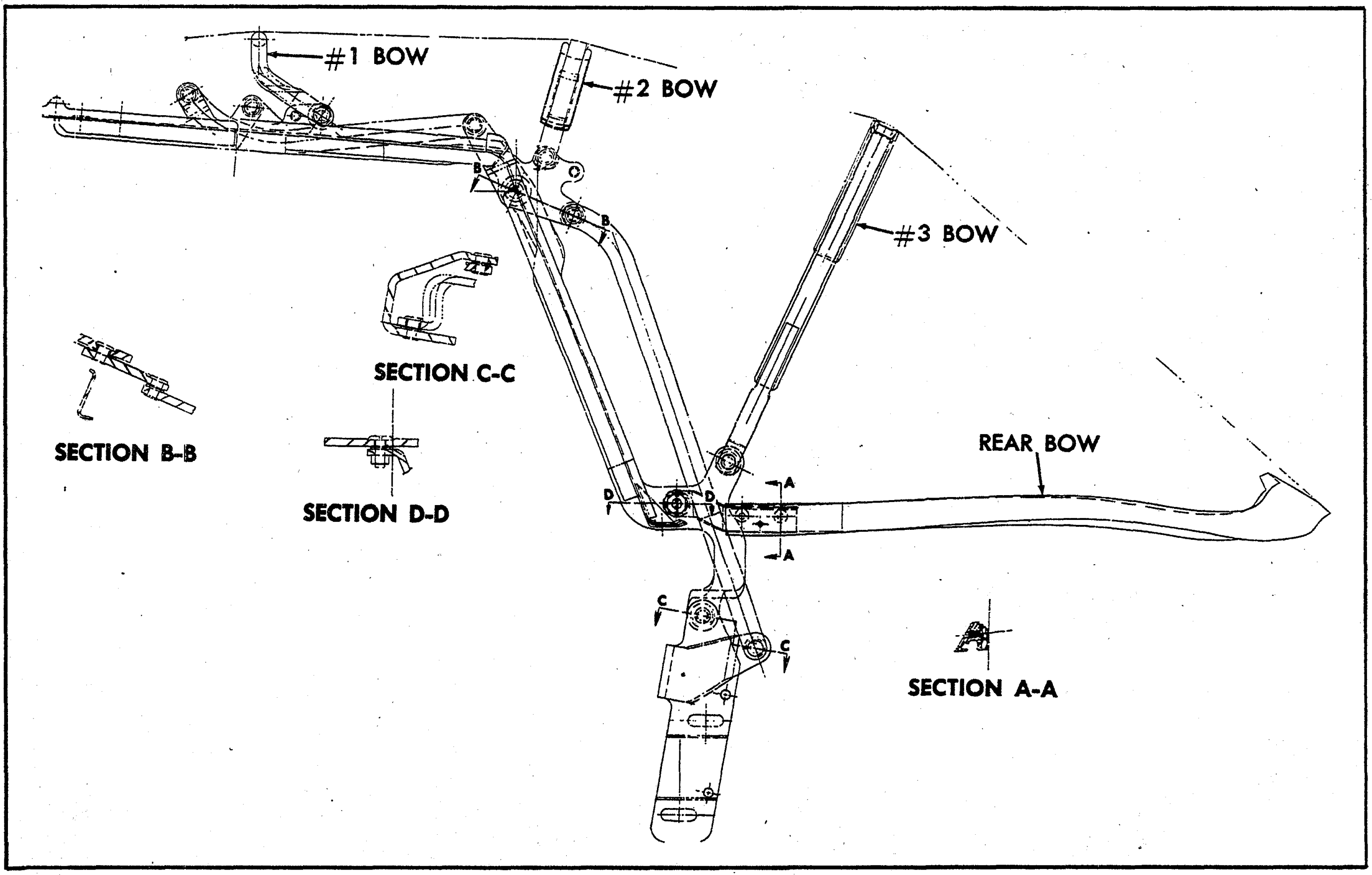


Fig. 110—Top Frame and Linkage

install screws. If necessary, proceed as outlined under Top Adjustments.

TOP TRIM AND REAR WINDOW ASSEMBLY

The following information deals with removal and installation of the folding top trim and window assembly complete. Figure 102 may be referred to for parts identifications. Lettered sections (i.e. Section A-A) referred to in the instructions may also be found in Figure 102. Note that the sections are illustrated as they would

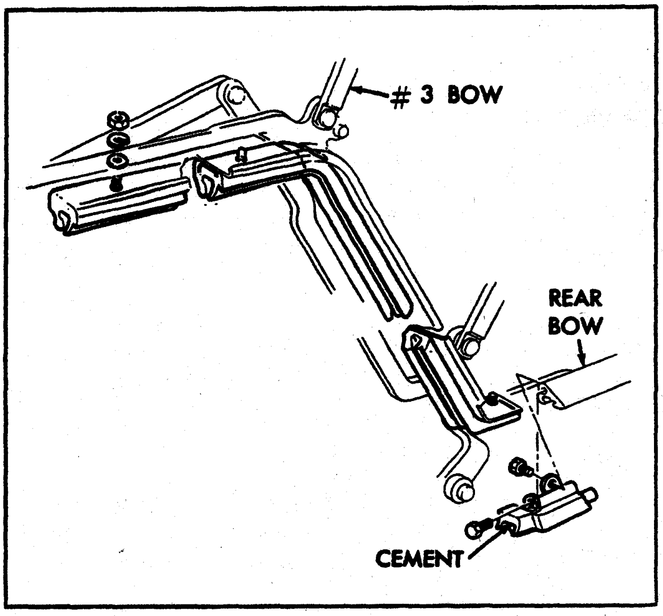


Fig. 111—Side Rail Weatherstrips

appear if the parts were cut through on the lettered lines on the top assembly and the cut surface exposed. Arrows indicate direction in which you would have to look in order to see the view shown.

Before old trim assembly is removed, top should be thoroughly adjusted as outlined in this section. As loose parts are removed such as stay straps and pads, their installed positions should be marked as an aid to installation of replacements.

Removal

1. Remove rear side rail window sealing weatherstrip as explained further on in this section; also remove screws from ends of header inner weatherstrip.

   Note, however, that it is not necessary to remove header weatherstrip entirely and that header strip must be in place during final installation procedures of top trim so that correct tension of installed trim is achieved.

2. Remove tacks securing top and header outer weatherstrip to header (Figure 103).
3. Pull cemented trim from rear side rail (Section C-C).

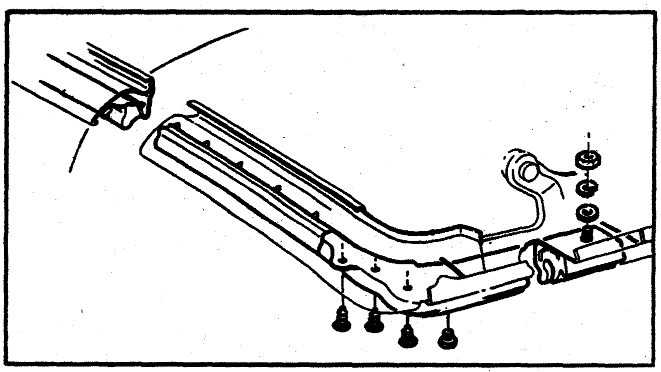


Fig. 112—Header Weatherstrip

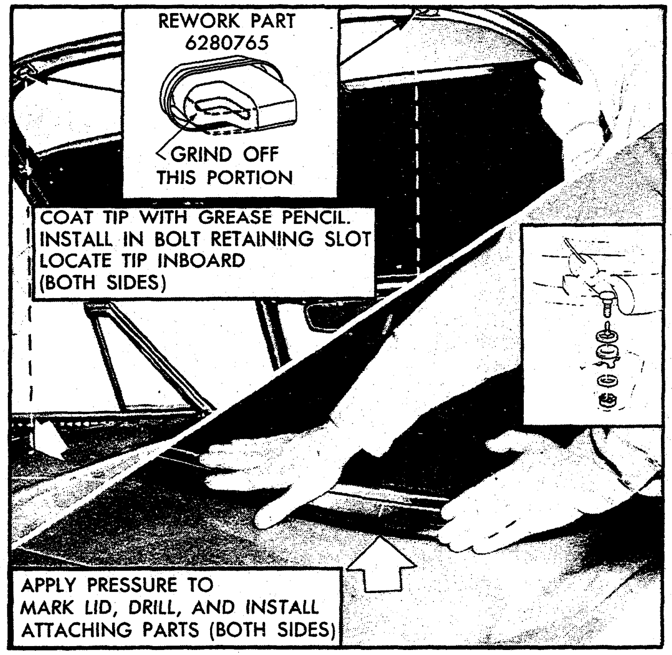


Fig. 113—Hardtop Attachments at Rear Bow

4. Remove end caps from wire-on binding; remove tacks securing binding to #3 bow (View F.). See frame and linkage portion for bow identification.
5. Remove staples securing trim to #3 bow.
6. Remove tacks securing upper ends of stay straps to #3 bow. Pads may be removed at this time, if desired. Mark position of pads and straps on head and #3 bow before removal.
7. Disconnect rear bow from top frame assembly. Two screws retain at each side Figure 104.
8. Remove trim-rear bow assembly from vehicle to clean work bench or table.
9. Remove plastic filler from rear bow weatherstrip

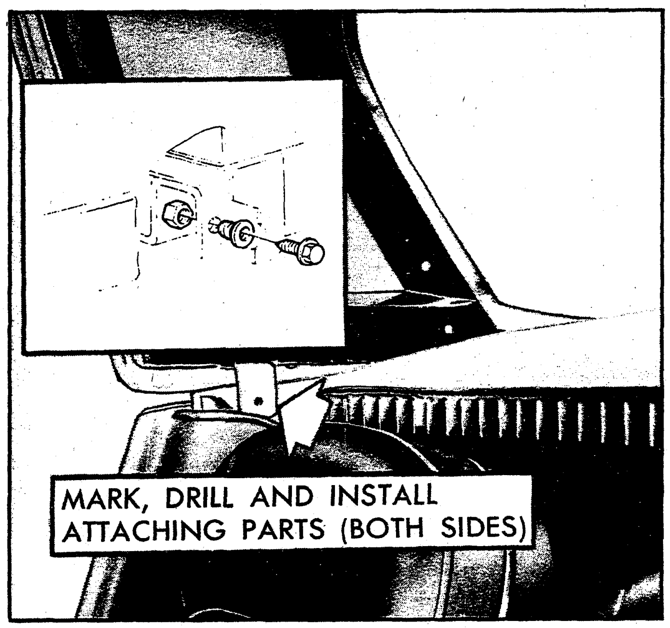


Fig. 114—Hardtop Attachments at Lock Pillar Area

and pull weatherstrip and trim from rear bow. Section A-A shows installed position of these components. Refer also to figure 105.

Installation

1. Find and mark center of header, #3 bow, rear bow and leading and trailing edges of top trim. Align these marks during installation and recheck their alignment from time to time while installation is in progress, especially during tacking or stapling.
2. Assemble top trim and weatherstrip to rear bow, referring to Section A-A and Figure 105. Note that filler strip locks this assembly together and goes in last. Align center marks.
3. If new pads are required, install at this time, aligning with marks made when old pads were removed. Figure 106 shows pad construction; Figure 107 shows pad installed.
4. Install top trim-rear bow assembly on top frame with four screws removed at disassembly.
5. Lock down rear bow in desired "top up" position. Pull up stay straps and staple or tack to #3 bow (fig. 108).
6. Pull leading edge of trim up to header and align center marks. Smooth out fabric and clamp, tack or staple temporarily to header.
7. Draw window extension up to #3 bow, aligning centering marks. Turn an ample amount of fabric under and tack to #3 bow. Apply neoprene trim cement, GM Part #3695016 or equivalent, to area shown in View D of Figure 102. Follow directions on package.
8. Draw roof portion of trim over #3 bow, align marks and tack on staple.
9. Trim off excess material and install wire-on binding as shown in Figure 109 and View D of Figure 102. Install binding caps.
10. Remove temporary clamps or fastenings holding trim to header.
11. With header locked down, pull trim assembly up tight and mark for final installation.
12. Apply trim cement to header and rear side rail.
13. Release header from windshield. Tack or staple trim to header (fig. 103).
14. Apply trim to rear side frame, previously cemented.
15. Install weatherstrips which were removed at disassembly and install retaining screws in header weatherstrip.
16. Make any adjustments necessary, following instructions listed under Folding Top—Adjustments.

FRAME AND LINKAGE

Figure 110 illustrates construction features of the folding top frame and linkage. Various cross sections in Figure 110 show the pivoting joints and their assembly.

If an operation is being performed which requires removal of folding top trim, follow directions in this section. The entire frame assembly may be removed and replaced as a unit. Follow instructions for Folding Top Trim and Rear Window Assembly and Top Assembly—Removal and Installation.

The pivoting joints should be lubricated with light machine oil once a year. Apply oil sparingly so as not to stain top trim.

WEATHERSTRIP

Side Rail Weatherstrip

Figure 111 illustrates installation of side rail weatherstrip which acts to seal window opening. The weatherstrip is held in place by studs which are part of the weatherstrip assembly, and by neoprene base cement which is applied between weatherstrip and side rail surface.

When replacing weatherstrip remove all rust, old cement and foreign material from the surfaces to be cemented, to assure successful bonding. Use only good quality neoprene cement suitable for weatherstrip application.

Header Weatherstrip

Weatherstrip assembly is retained to the header panel by a combination of studs, sheet metal screws and special fasteners as shown in Figure 112, along with neoprene base weatherstrip cement.

Figure 99 shows a cross section of weatherstrip taken through a special fastener. To replace fastener, rotate ninety degrees to align fastener head with slot. Follow directions for cementing in the Side Rail Weatherstrip instructions preceding this write up.

ADDING HARDTOP (ROOF PANEL ASSEMBLY)

An available roof panel assembly (hardtop) complete can be added to convertible model Corvettes. The hardware is included with the panel assembly.

Reworking of a plastic part (one for each side of the roof panel) can be used as a marker for drilling of two required holes in the folding top compartment lid. Hardware is attached at four locations — two on the lid and two (one each side) at the lock pillar area as follows:

1. Rework two plastic retainers (#6280765) (used on Chevrolet and Corvair door inner panels for trim retention) as shown by Figure 113.
2. Slide the reworked plastic retainers into the bolt retainer slots on each side of the hardtop rear bow (position plastic tip inboard).
3. Mark the hardtop reveal molding at the approximate location of the two plastic retainers.
4. Mark the tips of the two plastic retainers with a china marker pencil.
5. Close the soft top compartment lid.
6. With aid of an assistant, position front of hardtop onto header and lower onto vehicle. Do not fasten latches at windshield header.
7. Apply hand pressure at reveal molding marks.
8. Mark roof panel attachment hole location at each lock pillar area (fig. 114).
9. With aid of an assistant, lift roof panel straight up off body and set roof panel aside.
10. Mark the drill position at the four china marks with a center punch.
11. Place a 2" x 4" board under the top compartment lid to prevent drill damage to folding top material. Make certain the compartment lid is securely locked before drilling.
12. Drill 1/8" pilot hole at the 4 marked locations.

13. Drill 1/2" hole at pilot hole locations.
14. Insert ferrules furnished for holes drilled in top compartment lid. Crimp ferrule tabs.
15. With aid of an assistant, place the hardtop onto the vehicle and install attaching parts at all four locations. Lock latches at windshield header.

SPECIAL TOOLS

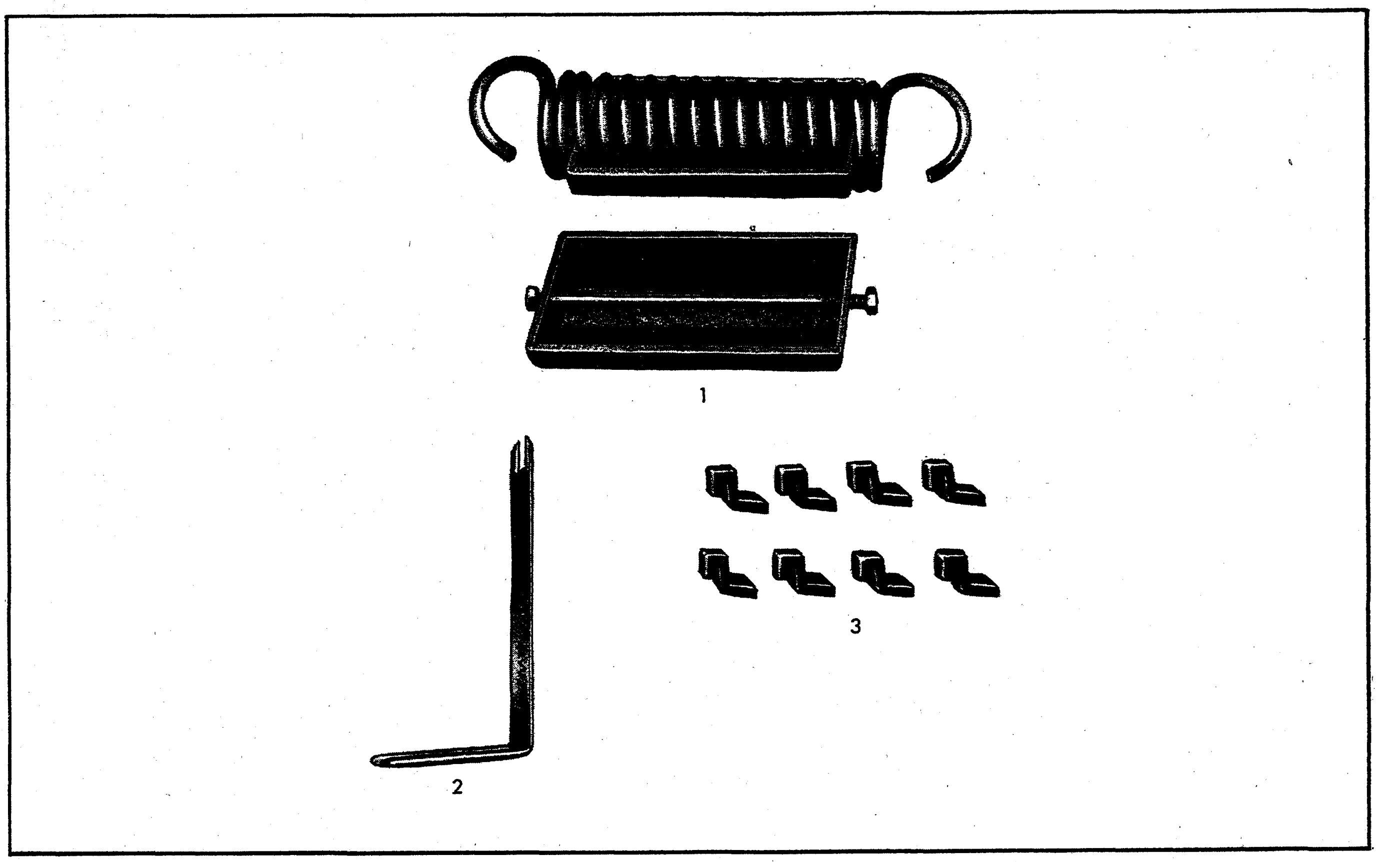


Fig. 115—Special Tools

1. J9559 - Hood Spring Tool
2. J7797 - Door Handle Clip Remover
3. J8942 - Windshield Opening Checking Blocks

SECTION 2
FRAME

INDEX

GENERAL DESCRIPTION

CHEVROLET AND CHEVELLE

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.

CORVETTE

The Corvette frame is a rigid perimeter unit, with five crossmembers. From the rear kick-up forward, trapazoidal shaped, closed side members outline and protect the passenger compartment. At the cowl area, the side members curve inward in a sweeping "S" shape, to provide a sturdy foundation for the engine mounts and clearance for front wheel movement. From the kick-up rearward, box-sectioned side rails provide fore and aft support for the rear axle and suspension. Lateral support is provided by five variously shaped welded-in crossmembers, including the front unit, which formerly was bolted-in.

CHEVY II AND CAMARO

Underbody alignment checking procedures will be found in the Body Service Manual.

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 trâm 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. 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.

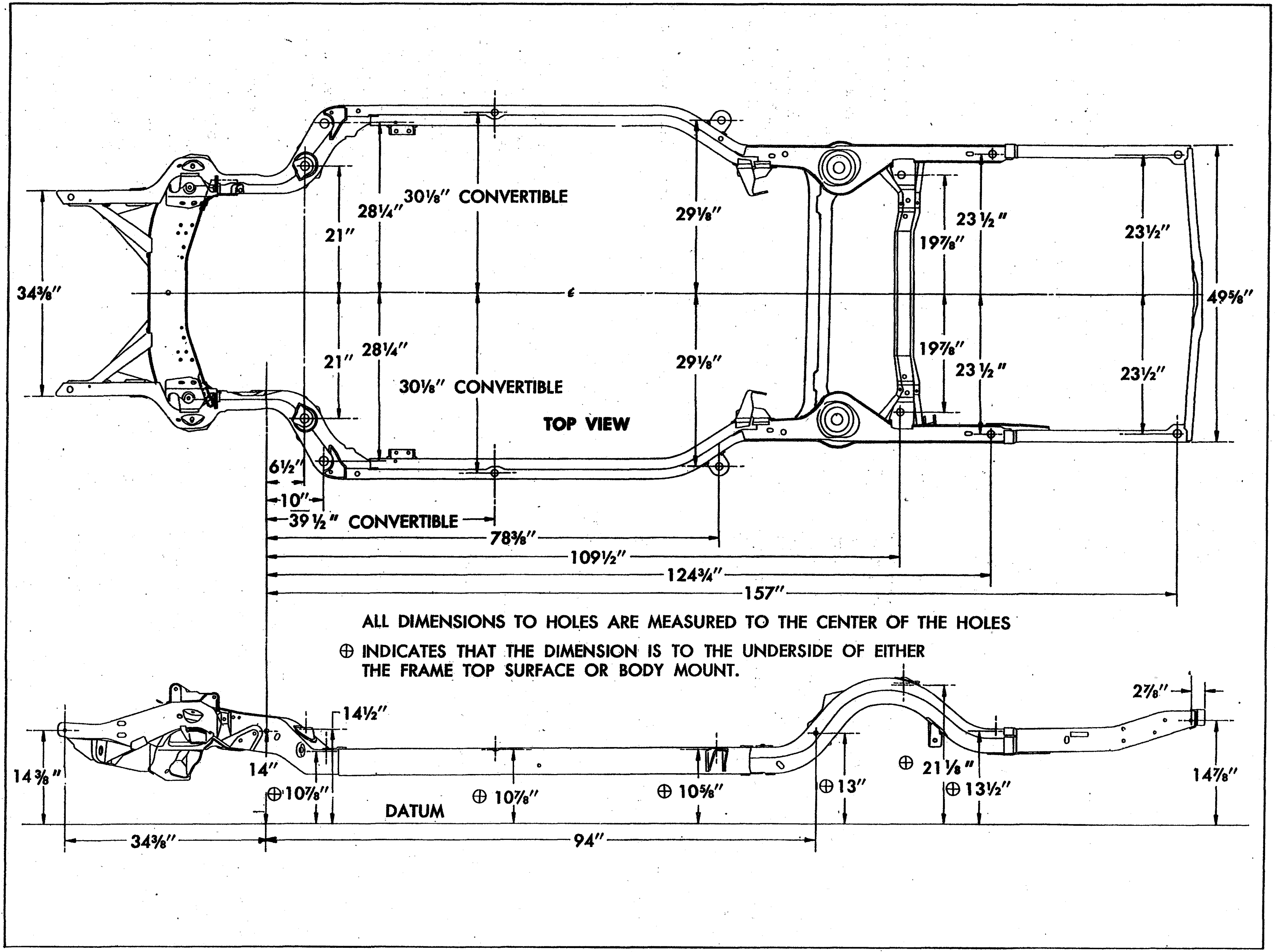


Fig. 1—Frame Dimensions (Chevrolet)

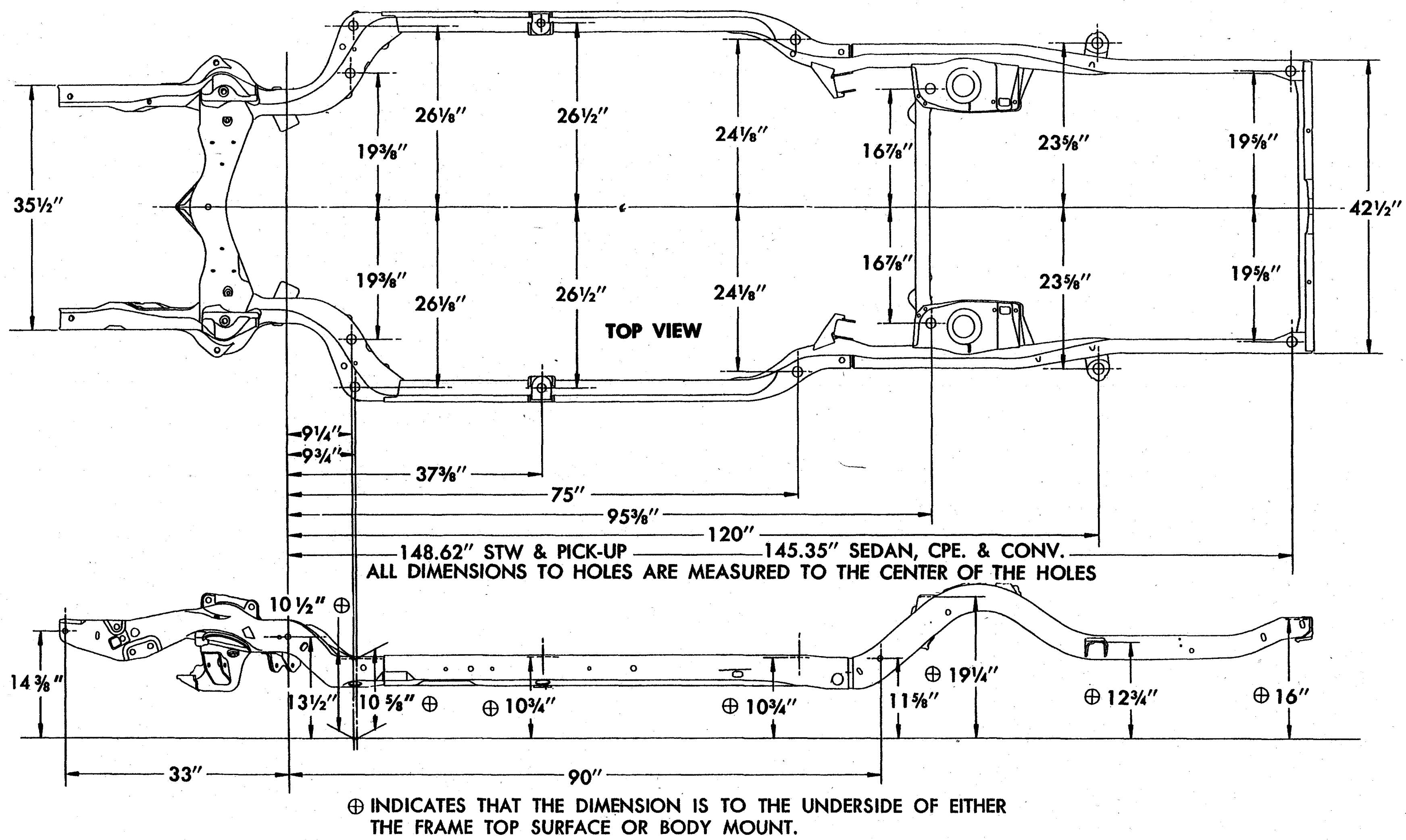


Fig. 2—Frame Dimensions (Chevelle)

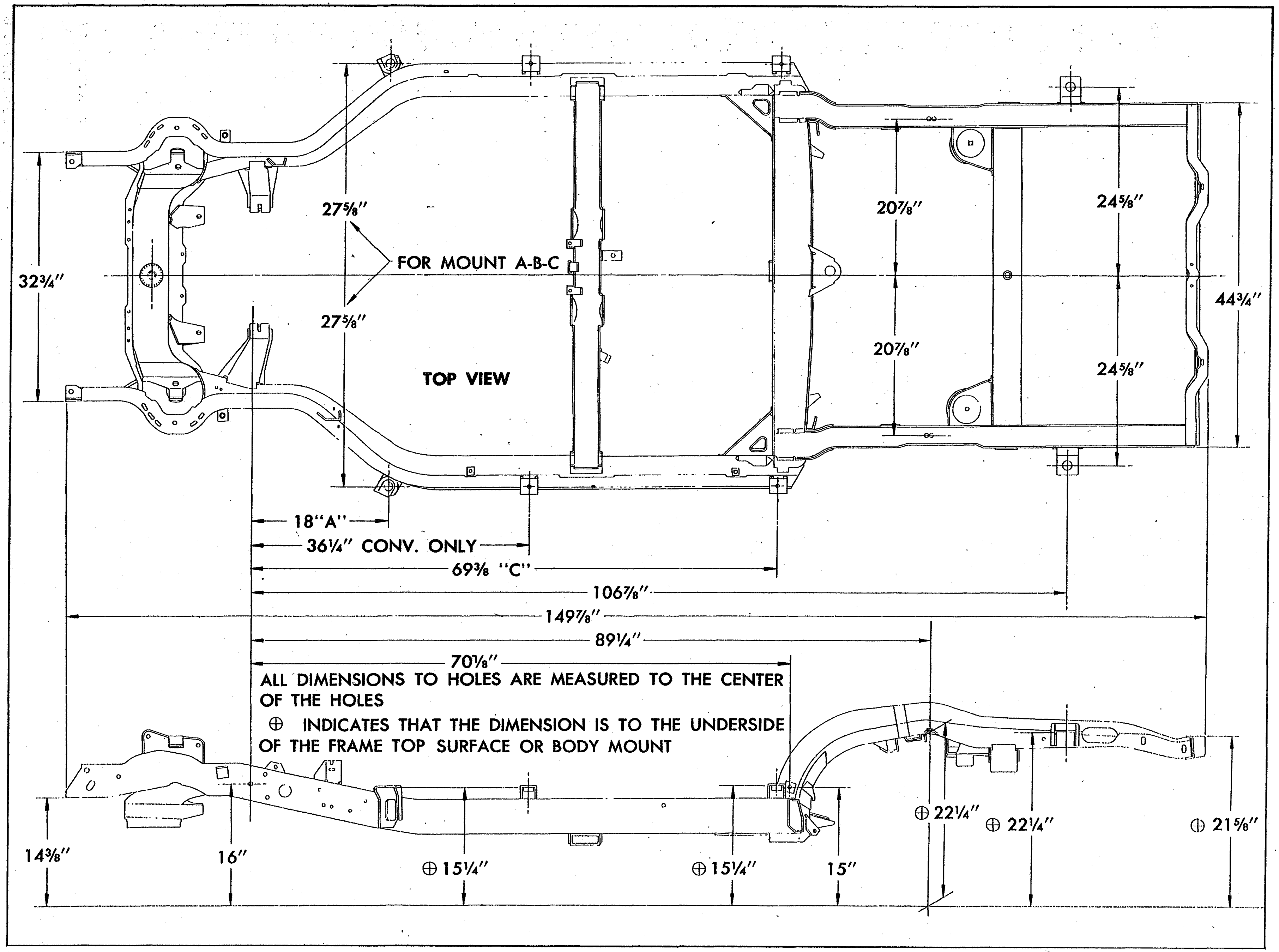


Fig. 3—Frame Dimensions (Corvette)

SECTION 3
FRONT SUSPENSION

INDEX

GENERAL DESCRIPTION

The 1967 Chevrolet, Chevelle, Camaro, Chevy II and Corvette front suspension systems are basically similar, being of the S.L.A. (short-long arm) type with independent coil springs. In the Chevrolet, Chevelle, Camaro and Corvette 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.

Camber angle is adjusted, on the Chevrolet and Chevy II

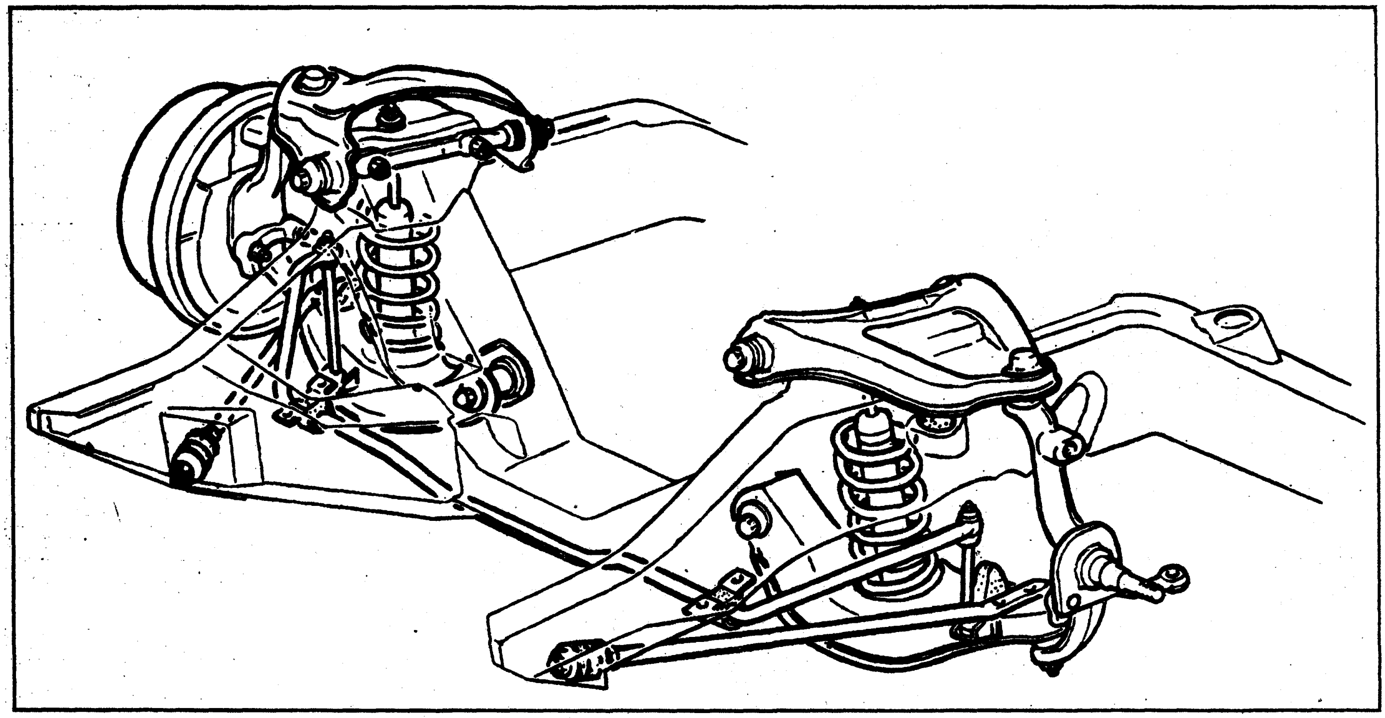


Fig. 1 - Front Suspension - Chevrolet

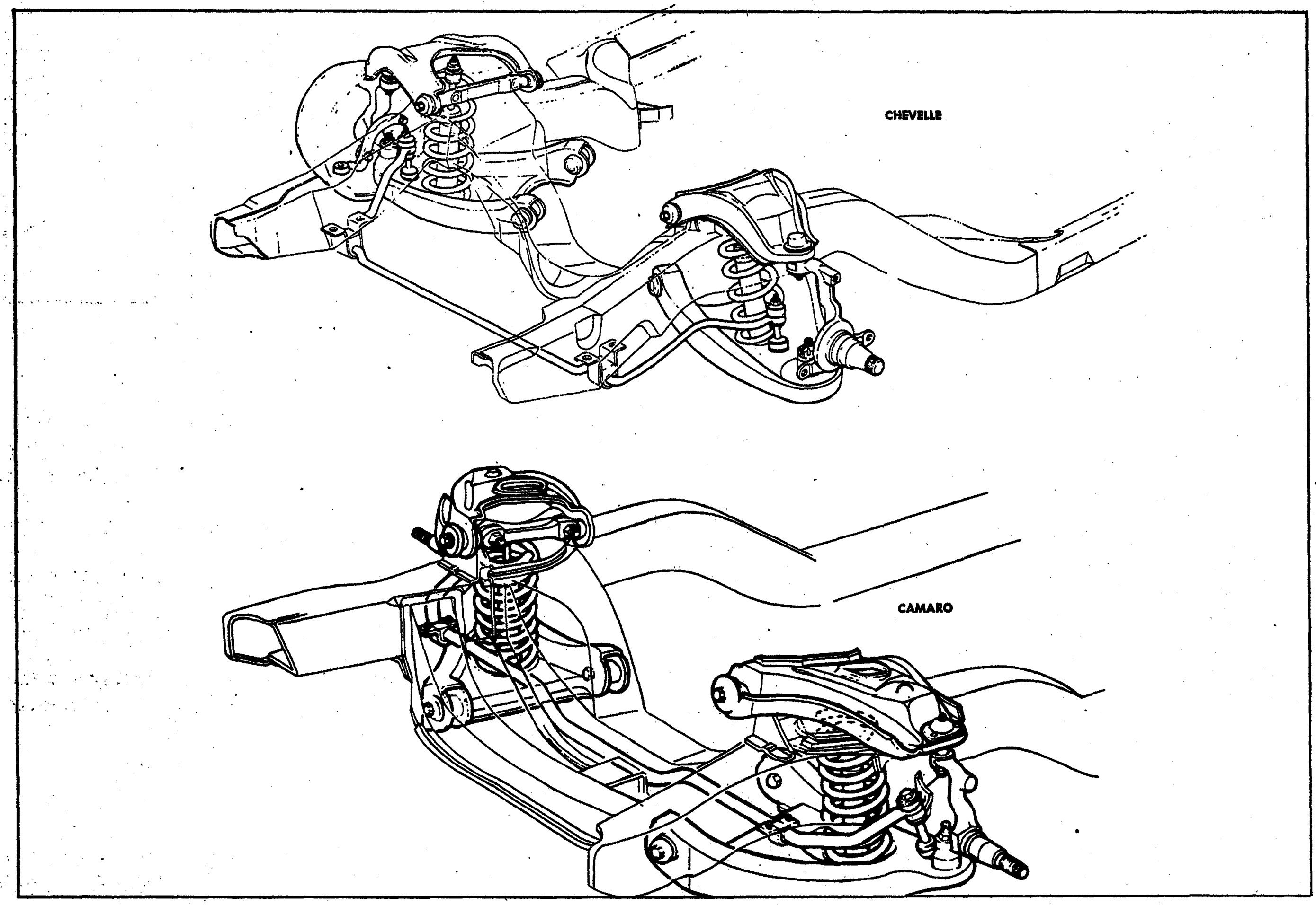


Fig. 2 - Front Suspension - Chevelle & Camaro

by means of a lower control arm inner pivot cam; on the Chevelle, Camaro and Corvette 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, Camaro and Corvette by means of upper control arm inner support shaft shims.

A stabilizer bar is used on all Chevelle and Corvette models. Chevrolet Impalas, station wagons and V-8 engine equipped models are fitted with the stabilizer bar.

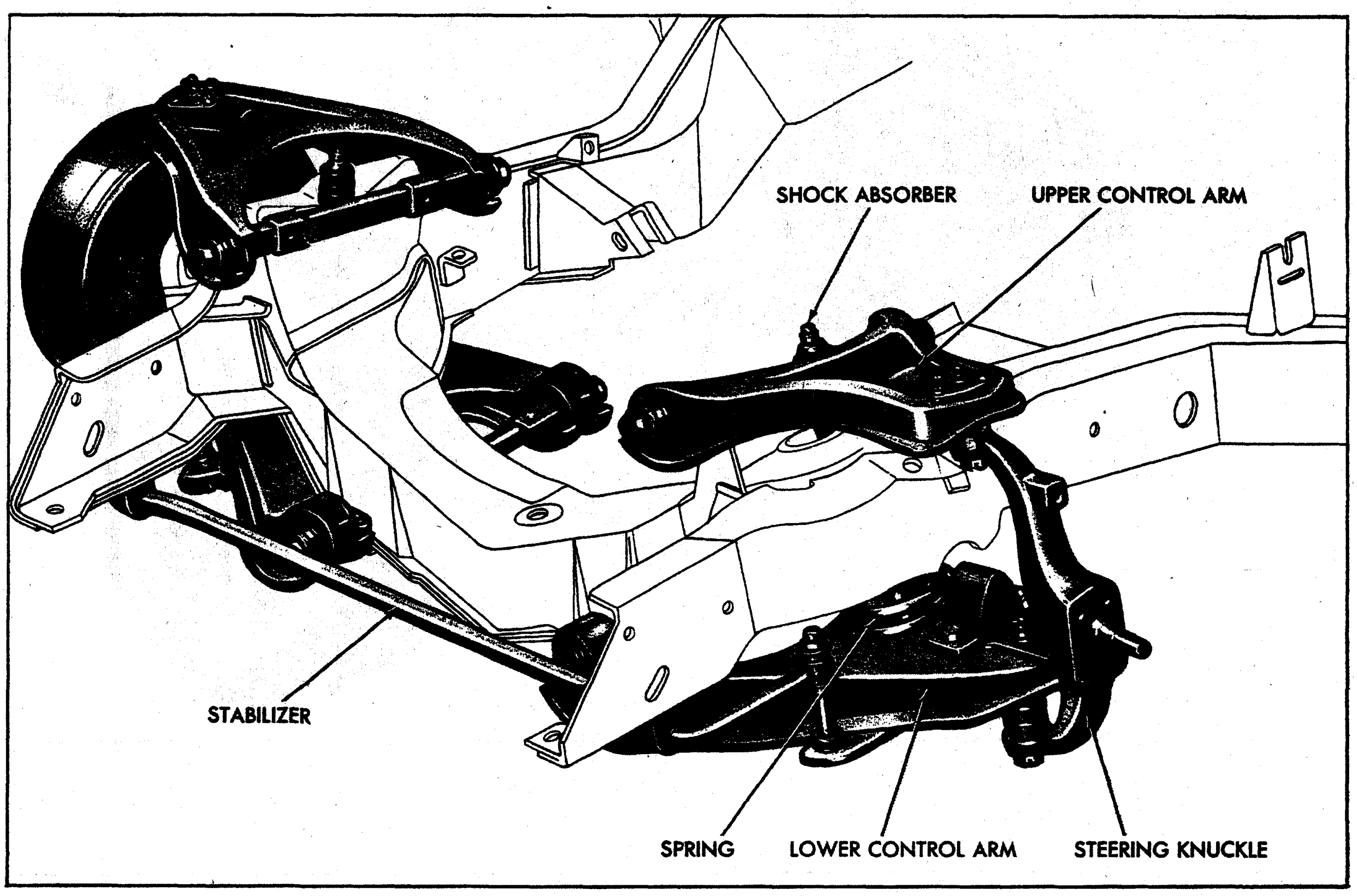


Fig. 3 - Front Suspension - Corvette

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 five 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 12 lbs. ft. torque.
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 .001" to .008" end movement when properly adjusted on Chevrolet, Chevelle, Camaro and Corvette; .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.

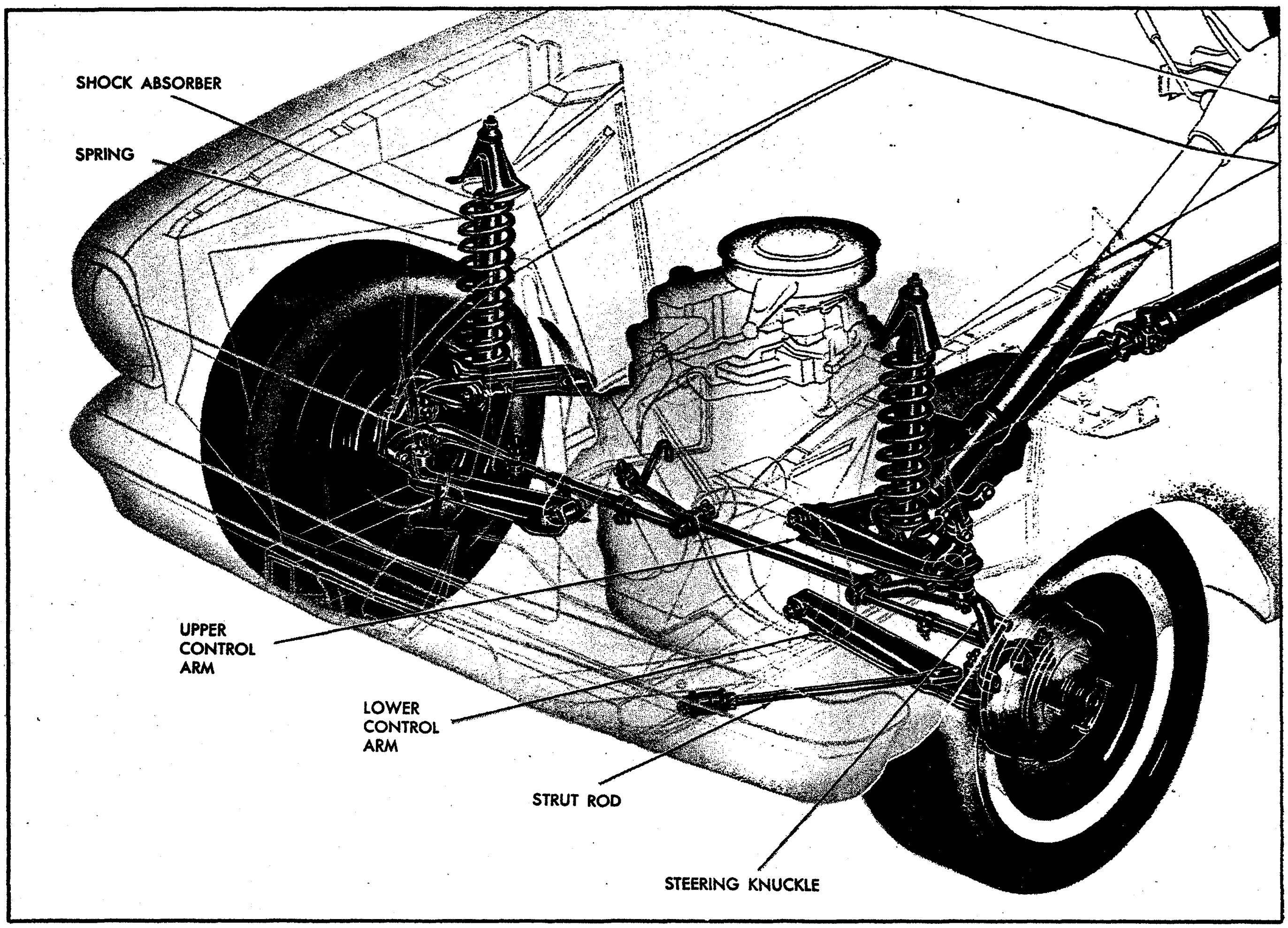


Fig. 4 - Front Suspension - Chevy II

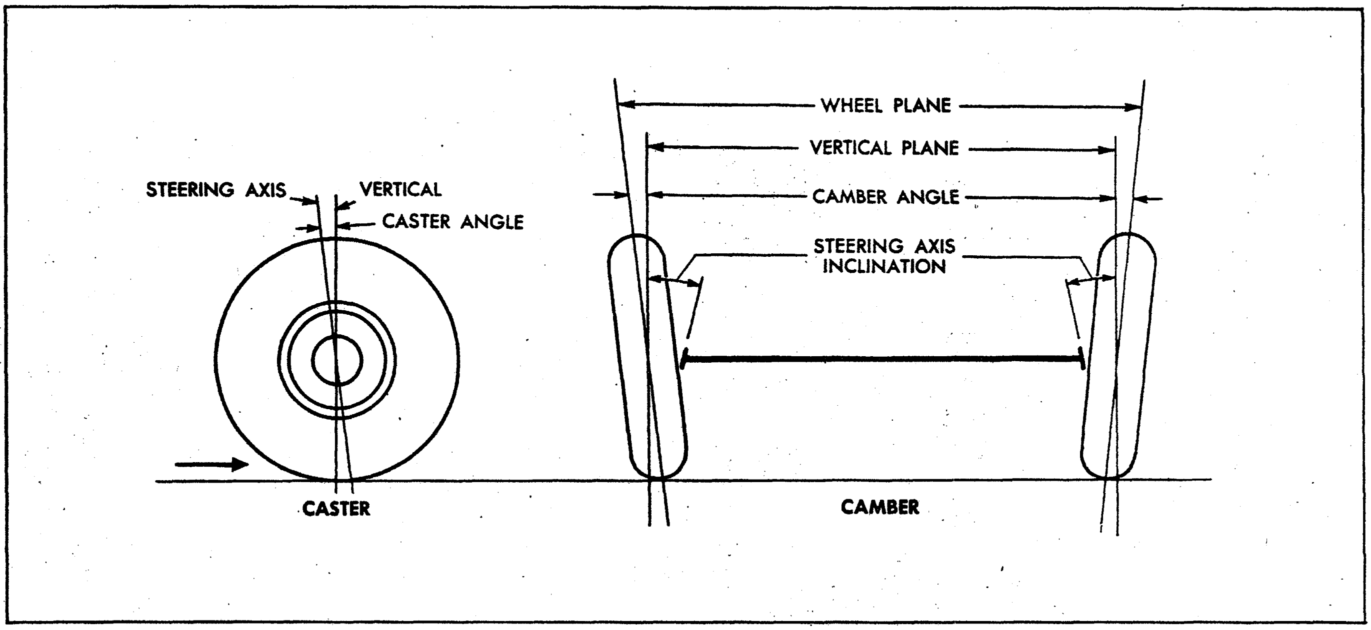


Fig. 5 - Caster and Camber

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.

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.

Wheel alignment should always be made with the vehicle rolled forward taking out any slack in the same manner as when the vehicle is traveling forward.

Caster and Camber Adjustment

NOTE: Before adjusting caster and camber angles, the front bumper should be raised and quickly released to allow car to return to its normal height.

Chevelle, Camaro and Corvette

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. 6). Shims may be added, subtracted or transferred to change the readings as follows:

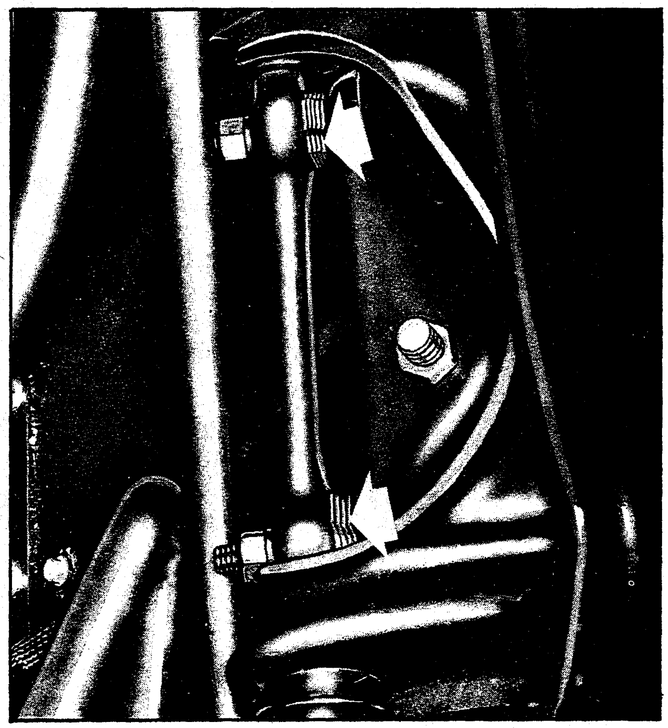


Fig. 6 - Caster and Camber Adjustment - Chevelle Typical of Corvette and Camaro

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° (Chevelle and Camaro); 1/6° (Corvette).

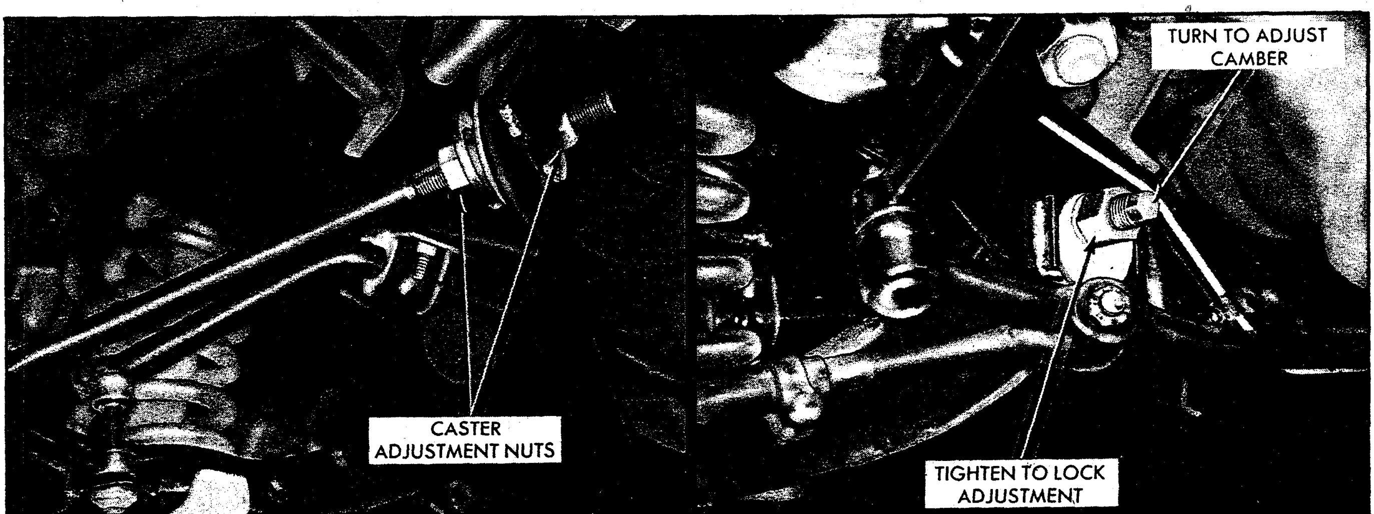


Fig. 7 - Caster and Camber Adjustment Points - Chevrolet

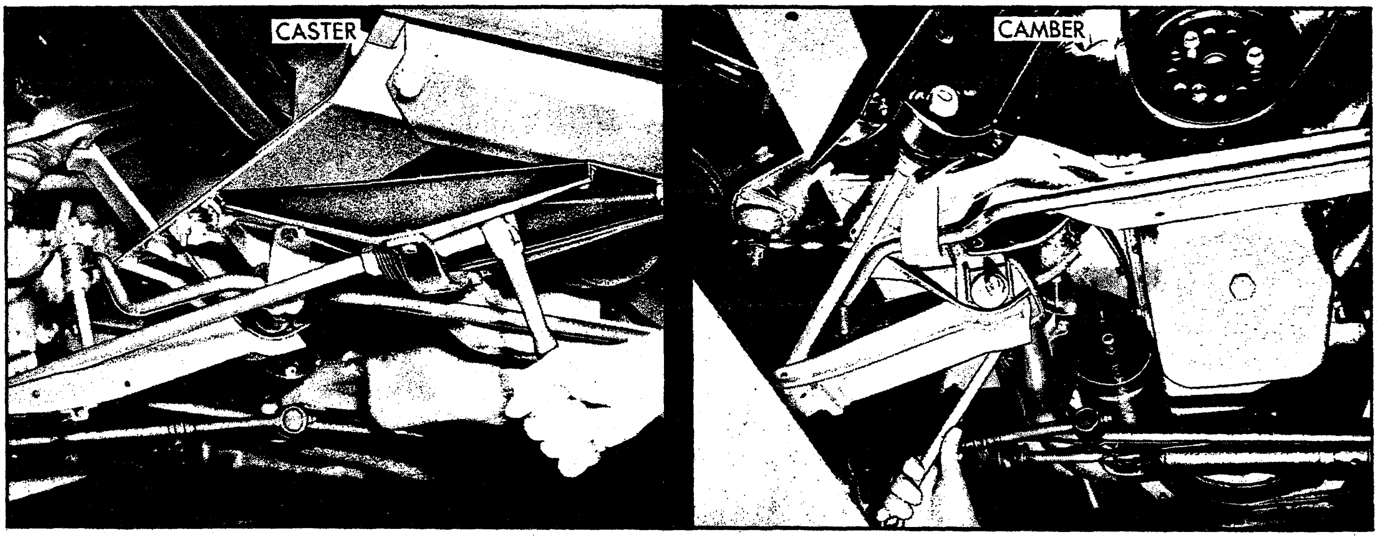


Fig. 8 - Caster and Camber Adjustments - Chevy II

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. 7 and 8). 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. 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.

NOTE: Toe-in must be adjusted after caster and camber adjustment.

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.
   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. Chevrolet--Position inner tie rod clamp bosses forward to 90° down to avoid stabilizer link bolt interference.
      b. Chevelle--Position the tie rod clamp bosses down to 45° forward to avoid interference.
      c. Chevy II--Position the outer tie rod clamp bosses forward and not more than 45° up or down from horizontal to avoid interference. Inner clamps forward and vertical.
      d. Corvette--Position inner tie rod clamps with bolt horizontal and down. Position outer clamps with bolt vertical and to the rear.
      e. Camaro--Position inner tie rod clamps with open end of clamp and slot in line. Position relative to ground unimportant. Position outer clamps with bolt top and 30° either side of vertical. Position relative to slot unimportant.

RIDING HEIGHT AND COIL SPRING SAG

The following check will quickly determine whether or

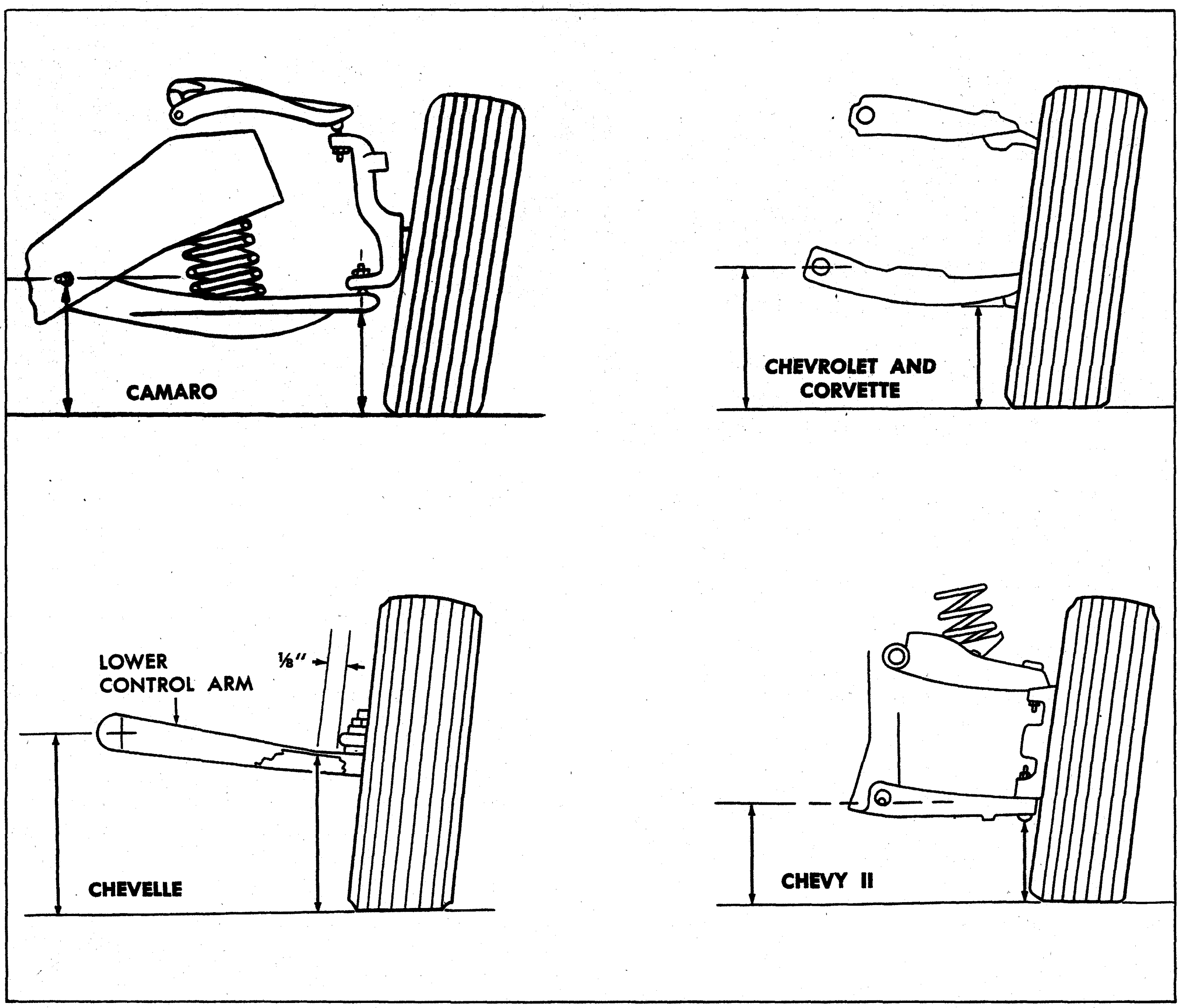


Fig. 9 - Checking Riding Height

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. 9):
   a. From the floor to the center of the inner pivot of the lower control arm. (On the Chevrolet and Camaro, 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.

      Corvette--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.

      Camaro--From the floor to the lower inboard edge of ball 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 five 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—CHEVROLET, CAMARO, CHEVELLE, CHEVY II

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 or (on Corvette) brake caliper and brake disc.

   NOTE: On the Corvette, the hub and brake disc are serviced as a complete assembly.

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.

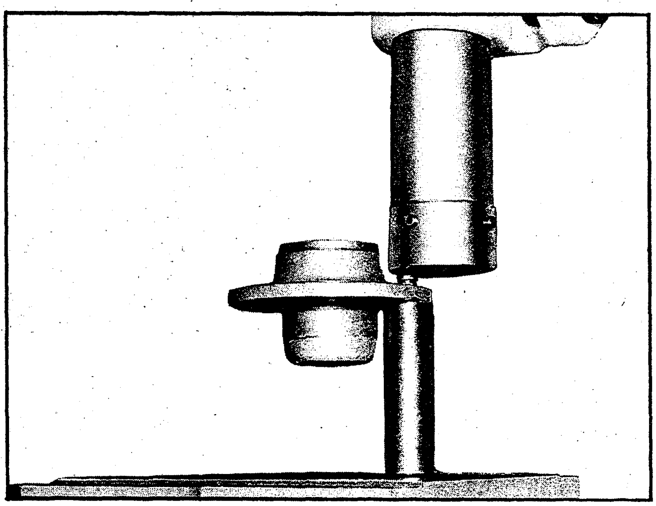


Fig. 10 - Pressing Front Hub Bolts (Typical)

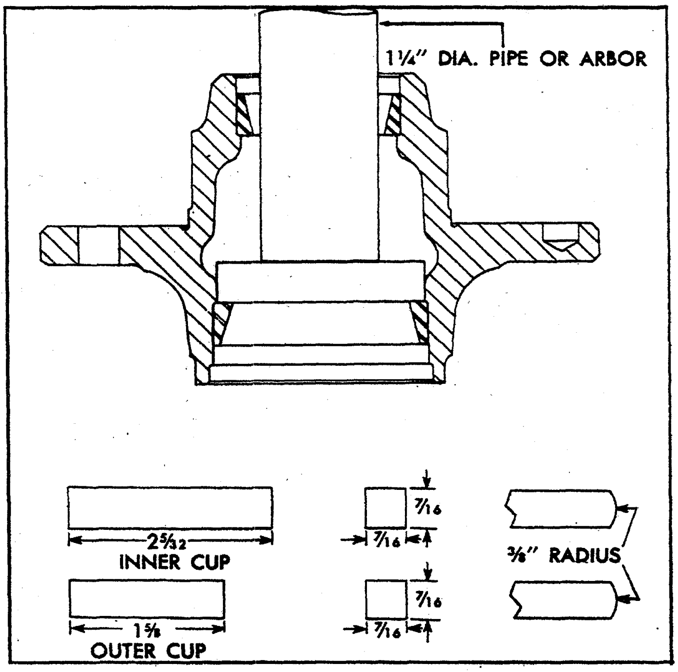


Fig. 11 - Front Wheel Bearing Cup Removers

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.
3. Press bolt into flange until head is fully seated against hub flange (fig. 10).

FRONT WHEEL BEARINGS

Removal

1. Remove wheel hub as described above.

   NOTE: Discard cotter pin. Install new cotter pin when assembling.

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 lip 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 11.
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. 12). 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.
2. Place inner bearing in hub, then install a new inner bearing lip 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, Chevelle, Camaro and Corvette--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. 13), 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, (or, on Corvette--brake caliper and disc and hub assembly, See Section 5) and wheel hub and bearing assembly from steering knuckle spindle.
3. Remove brake shoes from backing plate (except Corvette, See Section 5) 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 (fig. 13). Do not disconnect brake line.

   NOTE: Refer to Section 9 - 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.

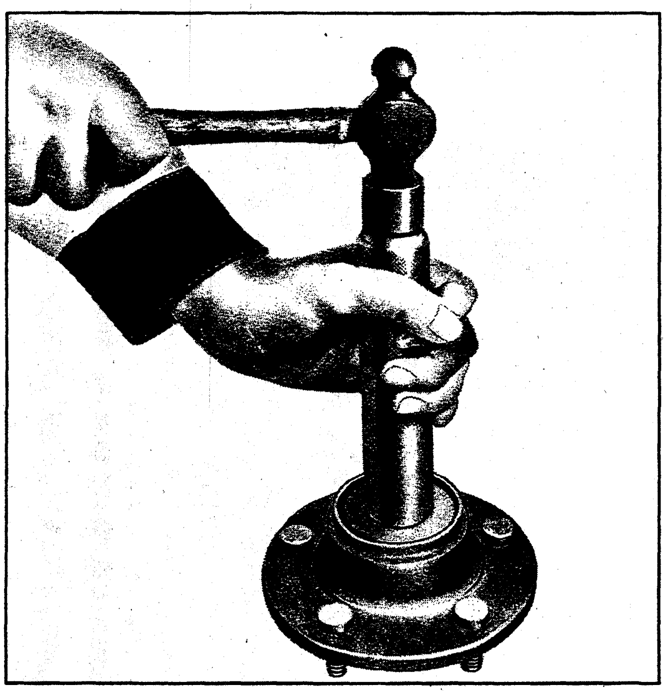


Fig. 12 - Installing Front Hub Inner Bearing

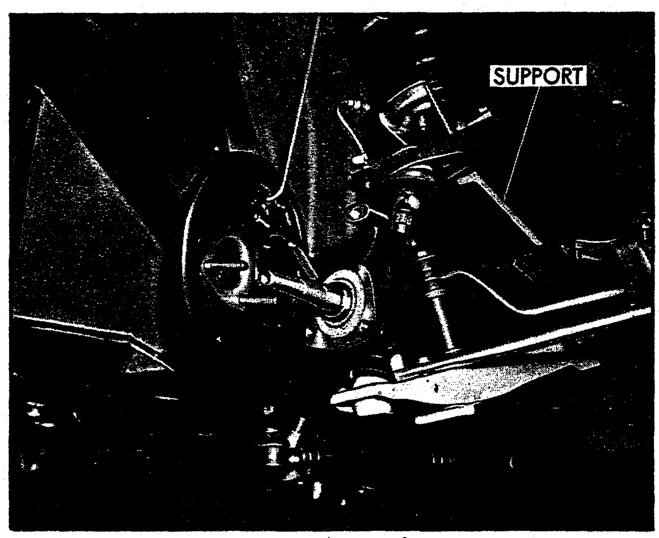


Fig. 13 - Backing Plate Removed - Chevy II

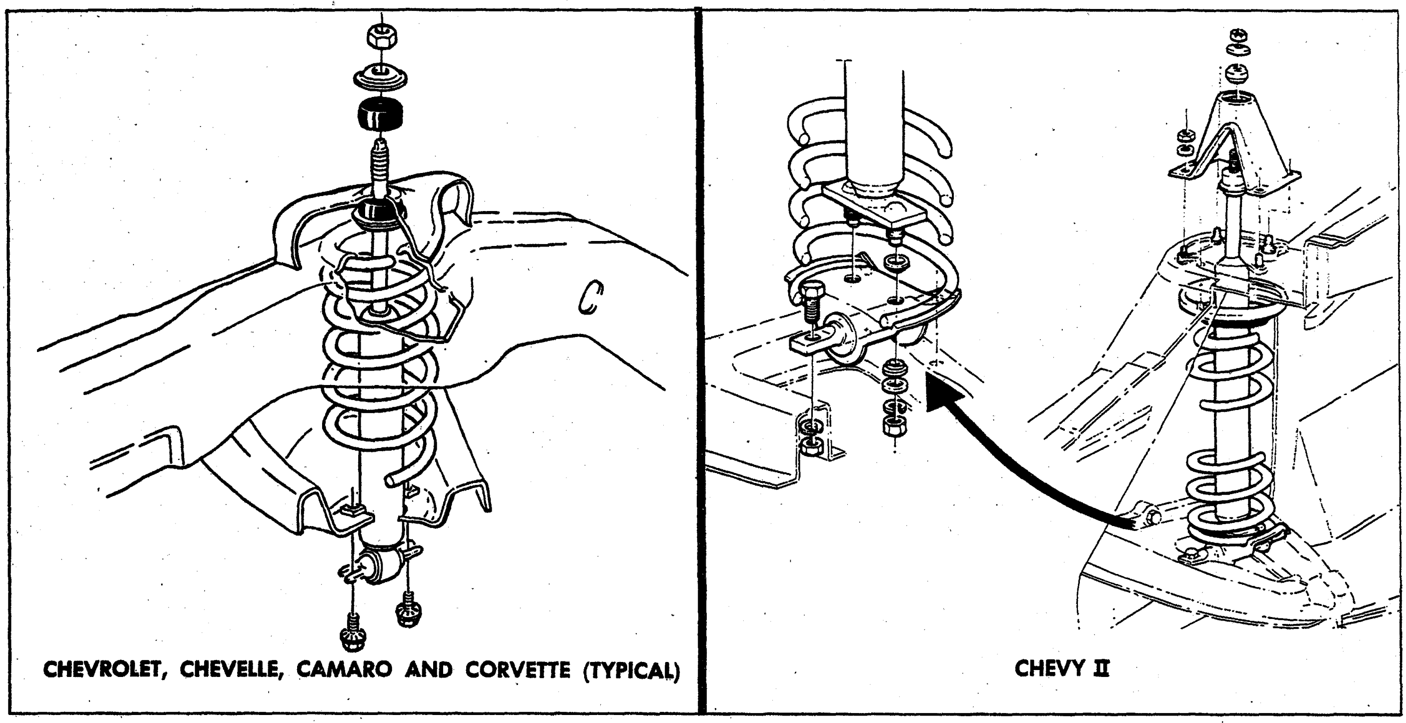


Fig. 14 - Shock Absorber

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, except Corvette. (See Section 5.)
7. Install wheel hub, brake drum (or, on Corvette--brake caliper and disc and hub assembly), 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, Chevelle, Camaro and Corvette (Fig. 14)

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. 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 abosrber (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 abosrber lower pivot to the lower control arm and tighten. (See Specifications.)

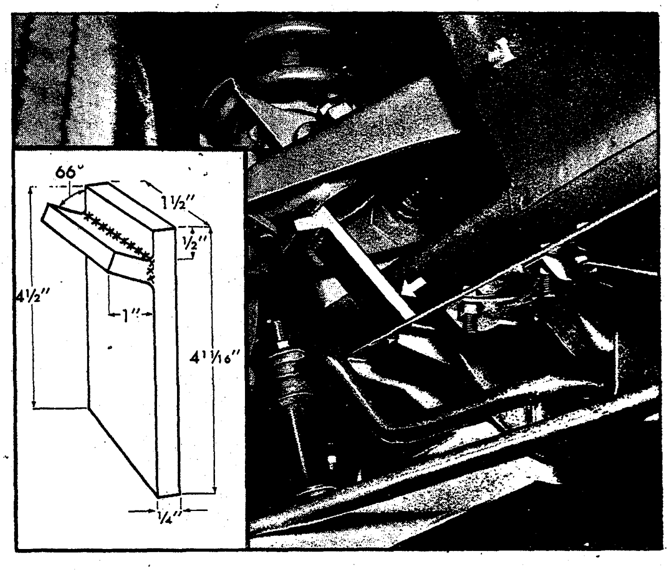


Fig. 15 - Upper Control Arm Support Installed - Chevy II

Chevy II (Fig. 14)

Removal

1. While vehicle weight is still on front wheels, position support between upper control arm and frame side rail (fig. 15).

   NOTE: Right side control arm support bracket is illustrated in Figure 15. 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. 16).
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 14).
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.

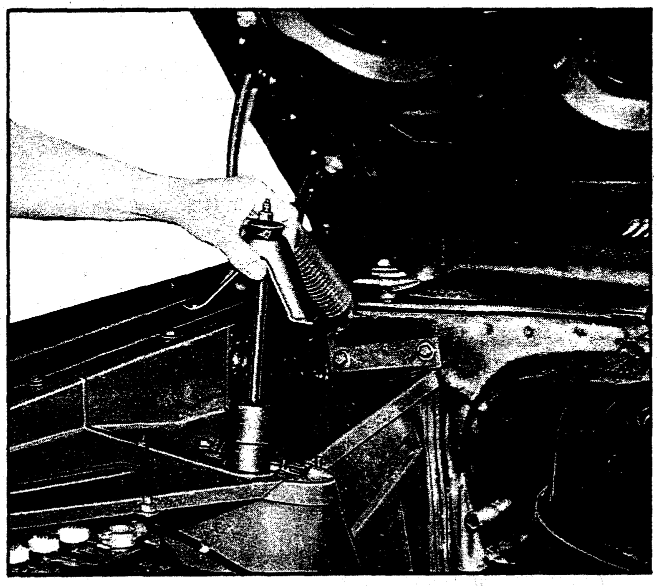


Fig. 16 - Removing Shock Absorber and Bracket - Chevy II

STABILIZER BAR (FIG. 17)

Removal

1. Raise vehicle and support both front wheels.
2. Disconnect stabilizer bar from lower control arm. Remove stabilizer bar brackets from the frame (Chevrolet, Chevelle, Camaro and Corvette) 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 frame bushings into position.
2. Insert stabilizer brackets over bushings 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.

   NOTE: Never get lubricant on outside of frame stabilizer bar bushings or they may slip out of brackets.

STRUT ROD (FIG. 18)

Chevrolet and Chevy II

Removal

1. Raise vehicle to provide sufficient working clearance.

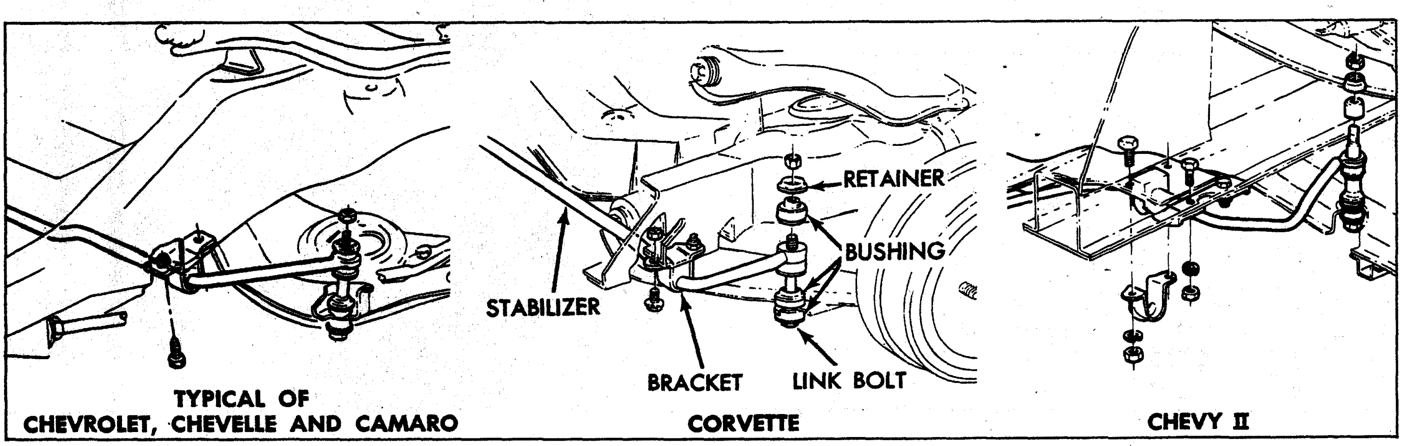


Fig. 17 - Stabilizer Bar

2. Remove forward nut, retainer and rubber bushing from front end of strut rod.
3. Remove two nuts from strut rod to lower control arm bolts and remove bolts and washers.
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.

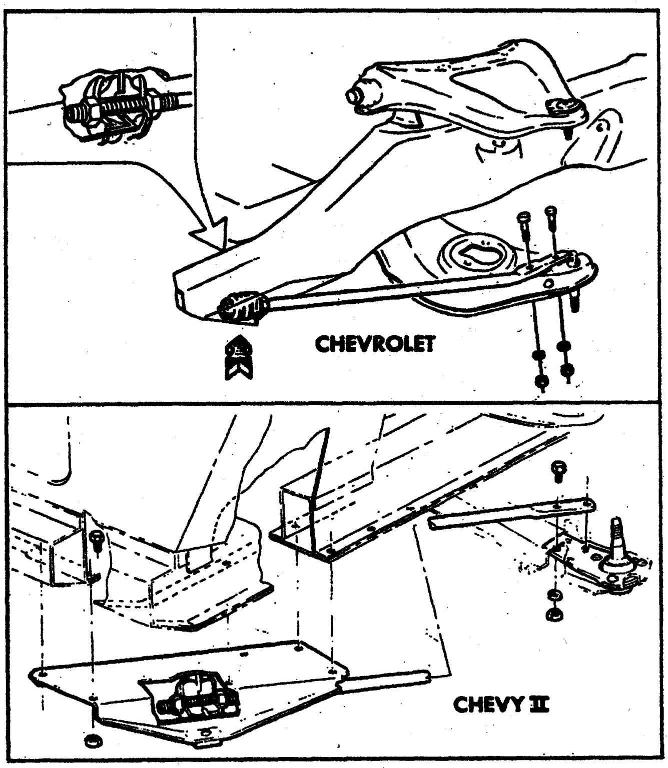


Fig. 18 - Strut Rod

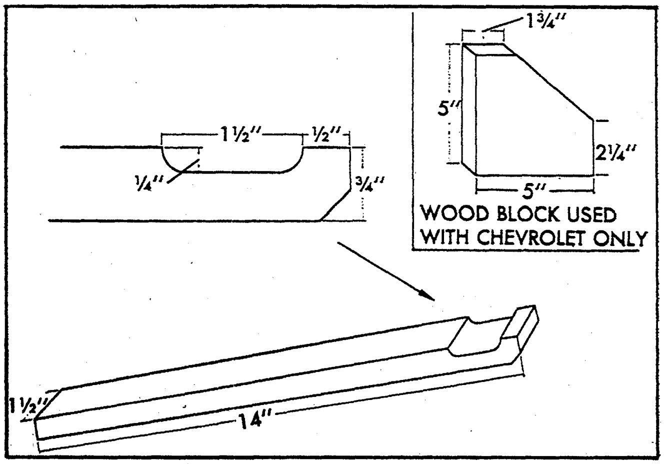


Fig. 19 - Spring Removal Tools - Chevrolet, Chevelle and Camaro

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, 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 19) through the shock abosrber 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 19) between the bar and the bushing as shown in Figure 20.
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.

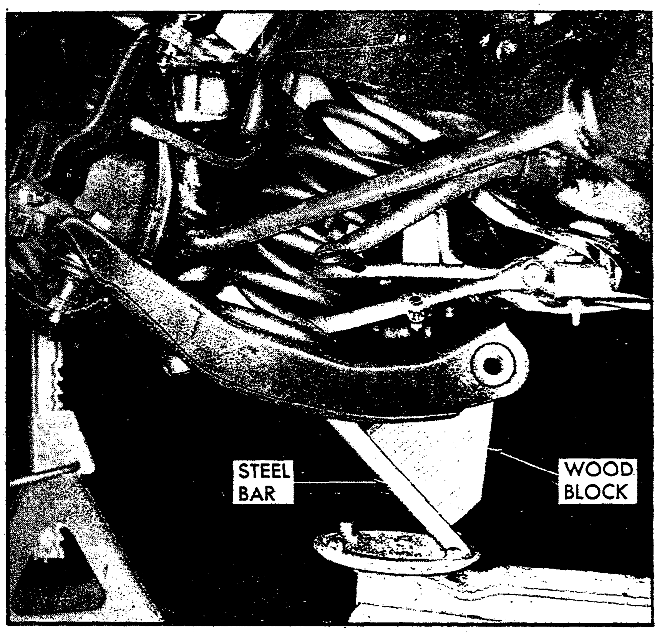


Fig. 20 - Front Spring Removal - Chevrolet

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.
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 20 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 and Camaro

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.

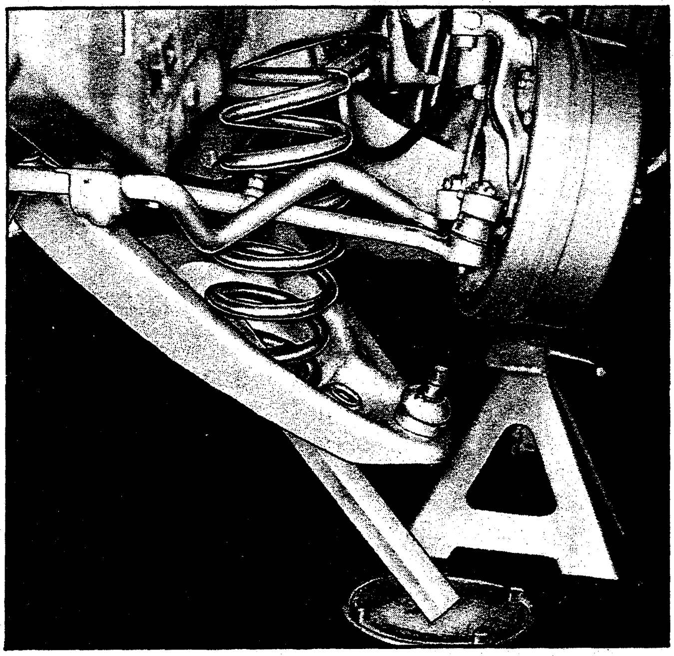


Fig. 21 - Front Spring Removal - Chevelle & Camaro

3. Place a steel bar (fabricated as shown in Figure 19) 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. With a suitable jack or hoist lift up slightly on the end of the bar.
5. Remove the lower ball stud cotter pin and attaching nut and remove the ball stud from the knuckle.

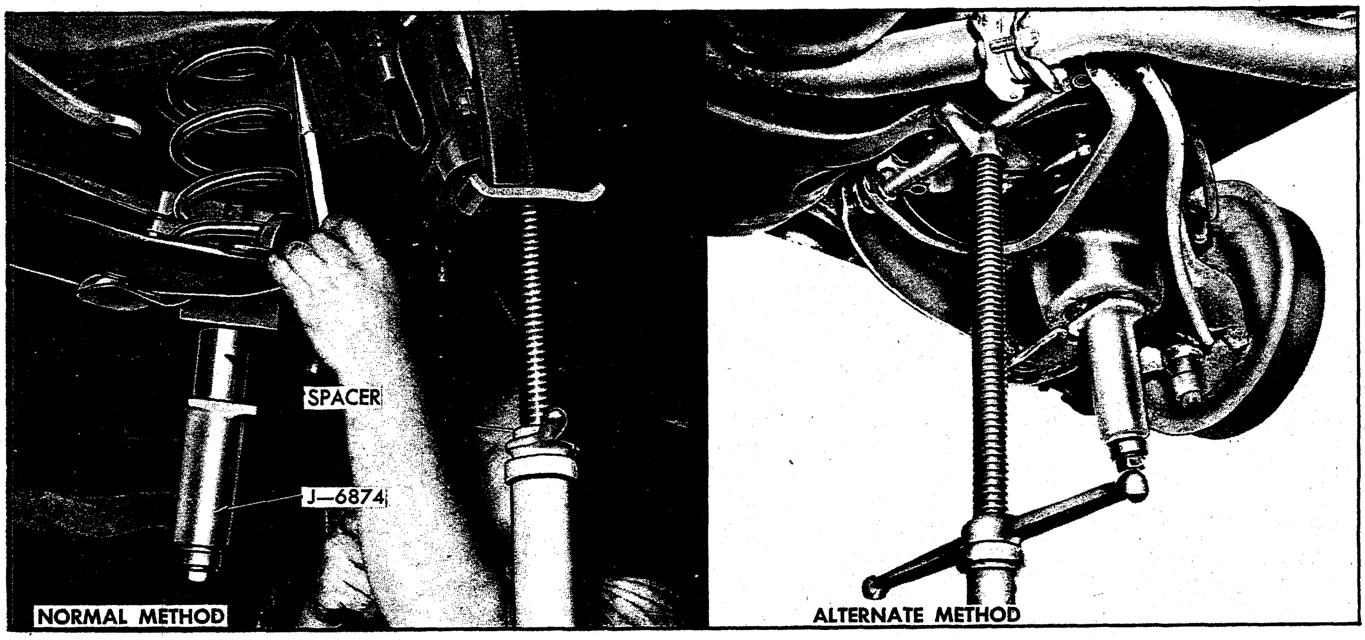


Fig. 22 - Removing or Installing Front Coil Spring - Corvette (Typical)

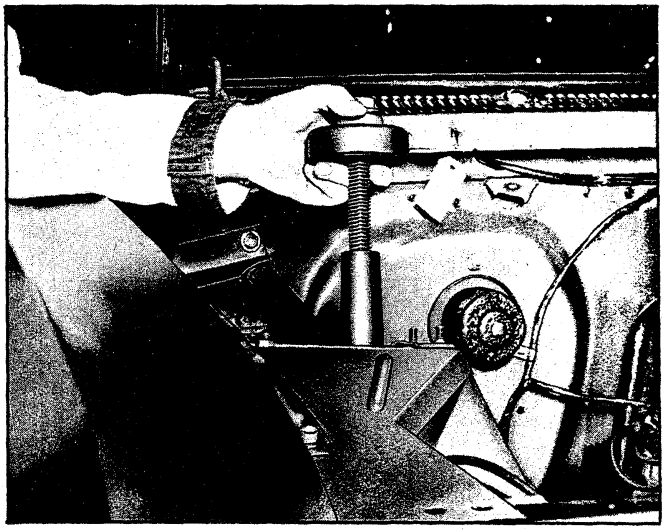


Fig. 23 - Installing Spring Compressor - Chevy II

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

6. Lower control arm as shown in Figure 21, 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 21, 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.

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.

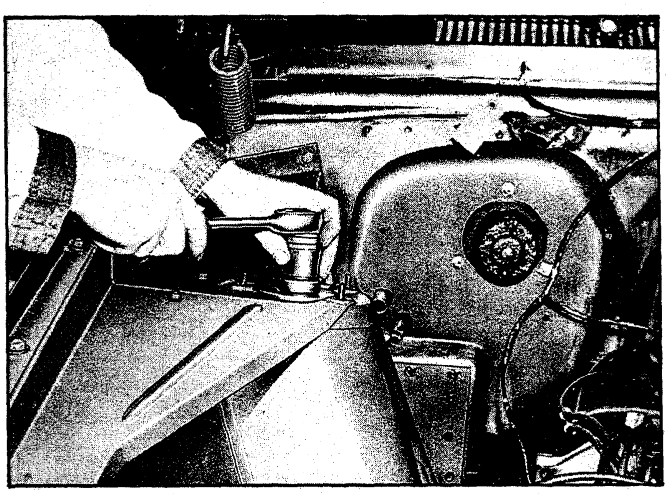


Fig. 24 - Compressing Front Spring - Chevy II

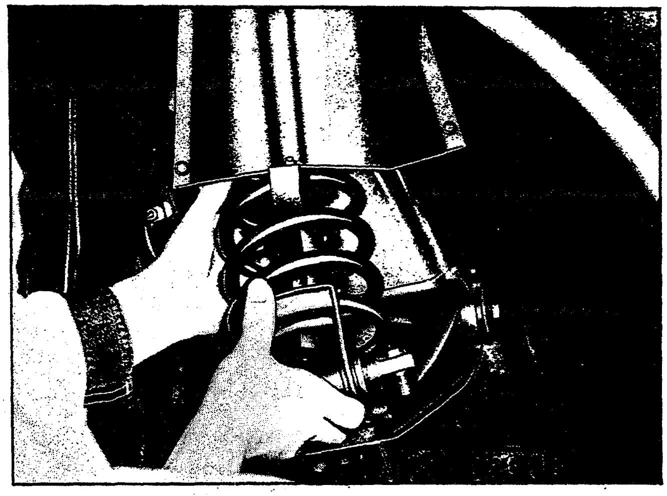


Fig. 25 - Removing Spring and Seal Assembly - Chevy II

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).

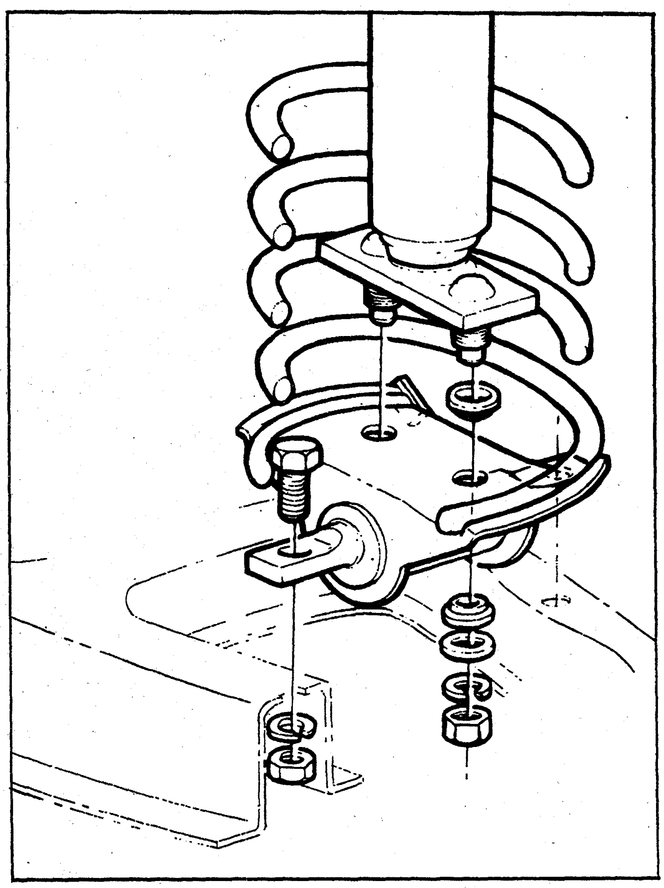


Fig. 26 - Spring Seat - Exploded View - Chevy II

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.
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 Replacement (Fig. 26)

1. Release spring tension and disconnect spring compressor from spring seat.
2. Install new 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 abosrber as outlined under Shock Absorber--Installation in this section.

Corvette

Removal

1. With car on suitable hoist or jack, (support vehicle by frame so control arms may swing free) remove wheel and tire assembly, stabilizer bar and shock absorber. Loosen the lower ball joint to steering knuckle nut, and the two lower control arm cross shaft bushing bolts.
2. Place Tool J-6874-1 across top of sixth coil (approx.), then loosely secure Tool J-6874-2 to the upper shoe, with attaching capscrews and lock washers. The upper shoe "V" notch and lower shoe raised land should contact spring.
3. Insert Tool J-6874 up through center of spring and attach to upper and lower shoe assembly.
4. Position spacers under shock absorber mounting hole and against bottom of lower control arm. Install special bearing washer and Tool J-6874-5. Locate bearing against spacer and large washer against bearing. Feed screw up through large washer bearing and spacer and thread into Tool J-6874 and tighten snugly (fig. 22).
5. Center shoe assembly on spring and tighten screw until a very slight compression is placed on spring (fig. 22). Then firmly tighten down the two capscrews securing the upper and lower shoes to lock these shoes to spring.
6. Turn head of screw until spring is compressed just enough to clear the spring tower, then remove the lower ball joint to steering knuckle nut (fig. 22).

   NOTE: It may be necessary to assist the spring out of the spring tower with a pry bar or a similar tool.

7. Disconnect the lower ball joint from the steering knuckle and lower the control arm with the compressed spring. Immediately release compression on spring by backing off long screw. Release spring and tool and withdraw spring.

   CAUTION: The spring force under compression is very large. Exercise every safety precaution when performing this operation to see that individuals and materials subject to damage are removed from the path of the spring when the control arm is being lowered. Also, the compressed spring should be relaxed immediately after lowering the control arm to reduce the time of exposure to the large compressive force.

Installation

1. Position spring with closely coiled end up. Place Tool J-6874-1 across the top of the sixth coil (approx.) then loosely secure Tool J-6874-2 to the upper shoe with attaching capscrews and lock washers. The upper shoe "V" notch and lower shoe raised land should contact spring.
2. Insert Tool J-6874 up through center of spring and attach to upper and lower shoe assembly with bolt and nut.
3. Set spring in its seat on the lower control arm.
4. Position spacers centrally under shock absorber mounting hole and against bottom of lower control arm. Install bearing, large washer and Tool J-6874-5. Locate bearing against spacer and large washer against bearing. Feed the screw up through large washer, bearing and spacer and thread into yoke rod. Tighten snugly, but do not start to draw down yet.
5. Center the shoe assembly on the spring and tighten the lag screw until a very slight compression is placed on spring, then firmly tighten down the two capscrews securing the upper and lower shoes. This will lock the shoes to the coil spring.
6. Turn head of screw until spring is compressed just enough to clear the spring tower.

   NOTE: It may be necessary to assist the spring into the spring tower with a pry bar or similar tool.

7. Immediately install the lower ball joint into steering knuckle and secure in place with attaching nut.
8. Release compression on spring and at the same time use a drift to guide the coil spring into its proper seat. End of coils must be 3/8" from coil stops in spring seat.
9. Tighten the lower ball joint to steering knuckle nut and lock with cotter key.
10. Install shock absorber and stabilizer bar.
11. Install wheel, tire and drum assembly.
12. Remove car from hoist or jack stands.
13. Tighten the two lower control cross shaft bushing bolts to 45-55 lbs. ft. torque.

Alternate Method

NOTE: If a suitable adjustable jack-stand is available the following procedure may also be used (fig. 22—Alternate Method).

1. Support car on suitable hoist or jack (so control arms may swing free) and remove the wheel and tire assembly, shock absorber, and stabilizer link at control arm.
2. Place suitable jack stand under the lower control arm cross shaft.
3. Follow Steps 2-5 as outlined on previous page.
4. Turn head of tool screw to partially compress spring.
5. Remove the three control arm cross shaft attaching bolts, washers and nuts.
6. Carefully lower jack stand and if necessary increase compression on spring and when coil spring is out of its upper seat, relax tension on spring (fig. 22).
7. By using a pry bar to assist, if necessary, remove the coil spring from the lower control arm.
8. Installation is the reverse of the above procedure. Carefully follow instructions for installing spring tool.

LOWER CONTROL ARM SPHERICAL JOINT

Chevrolet, Chevelle, Camaro and Corvette

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:

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 joints 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

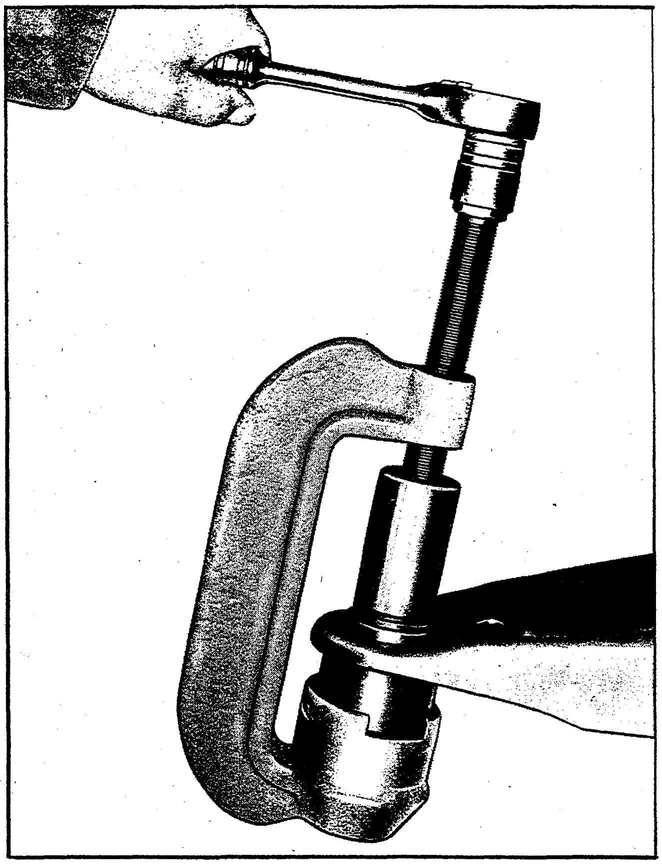


Fig. 27 - Removing Lower Ball Joint - Chevelle & Camaro

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 lbs. ft., 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 lbs. ft. can be obtained without bottoming stud or ball joint against knuckle. If bottoming occurs, replace ball joint or steering knuckle.

Chevrolet and Corvette

Removal

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

1. Install new joint against underside of control arm and

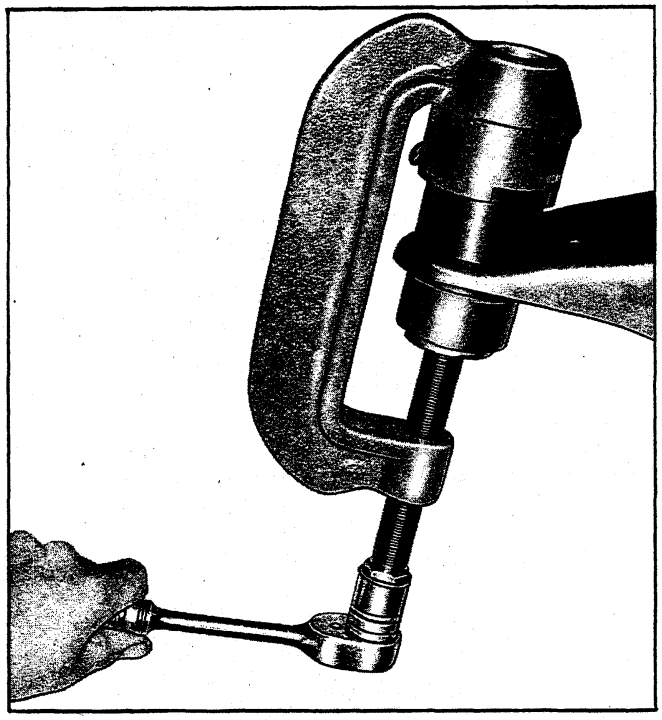


Fig. 28 - Installing Lower Ball Joint - Chevelle & Camaro

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 to Specification shown at the end of this book.
3. Lubricate the joint.

Chevelle and Camaro

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 27 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 28.
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 15, 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 9 lbs. ft. 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. 15).
2. Raise vehicle and remove cotter pin and nut from lower ball joint stud (fig. 29).
3. Disconnect stabilizer at upper link. Break loose the lower ball stud. Drop lower control arm until lower ball joint is easily accessible.
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.

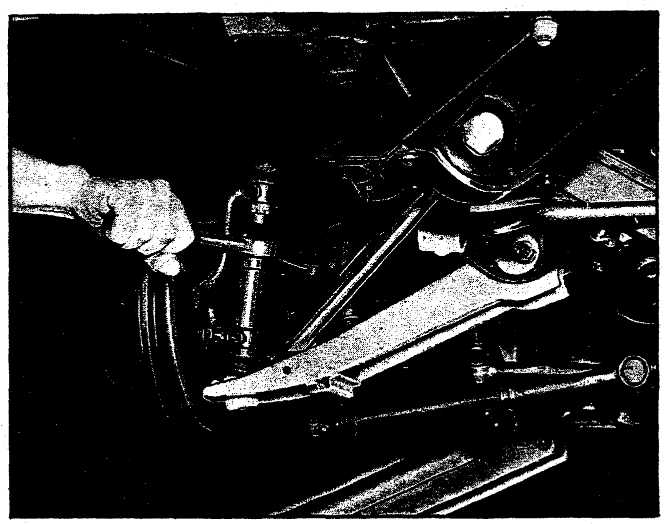


Fig. 29 - Disassembling Lower Ball Stud - Chevy II

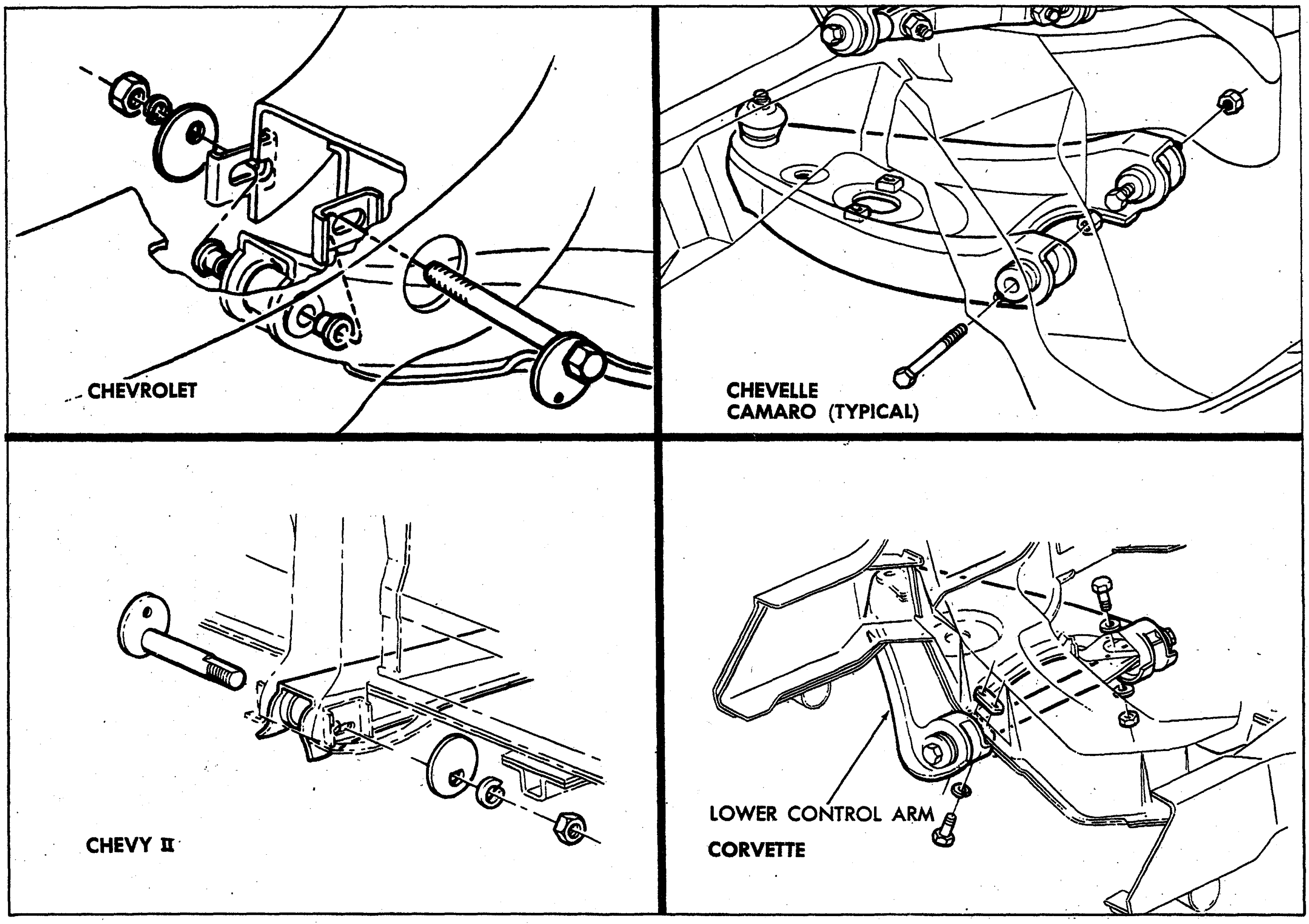


Fig. 30 - Lower Control Arm Attachment

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. 30)

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.
3. Tighten nuts to torque shown in Specifications.

Chevelle and Camaro (Fig. 30)

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 to torque shown in Specifications.

Chevy II (Fig. 30)

Removal

1. With vehicle weight still on front wheels, install

spacer between upper control arm and frame side rail (fig. 15). 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 to torque shown in Specifications.
2. Raise lower control arm ball stud into steering knuckle boss and install nut. Tighten nut to torque shown in Specifications and insert new cotter pin.
3. Lower vehicle and remove upper control arm to frame support.

Corvette (Fig. 30)

Removal

1. Remove the front coil spring as outlined under "Front Spring, Removal".
2. Remove the two front cross shaft to frame attaching bolts and lock washers and the rear frame attaching nut and lock washer.
3. Remove the lower control arm assembly from the vehicle.

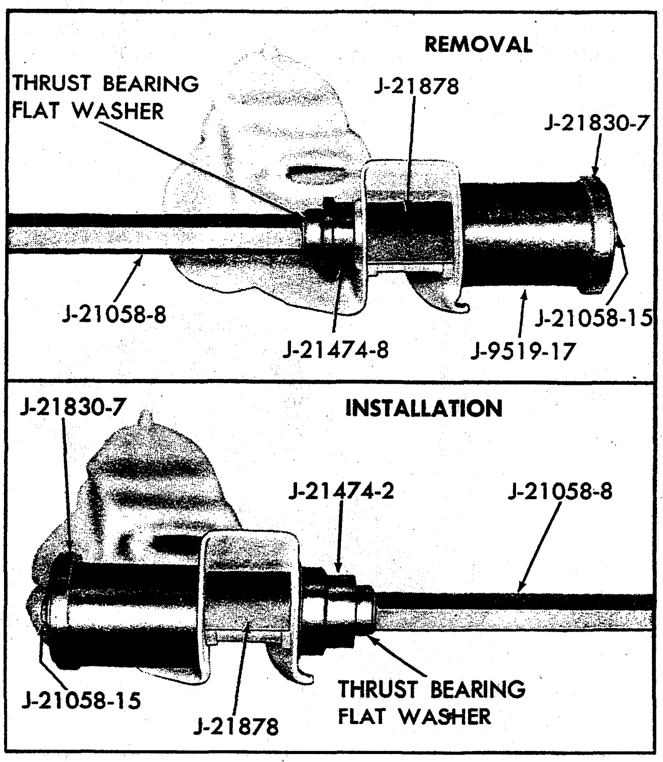


Fig. 31 - Lower Control Arm Bushing - Chevrolet

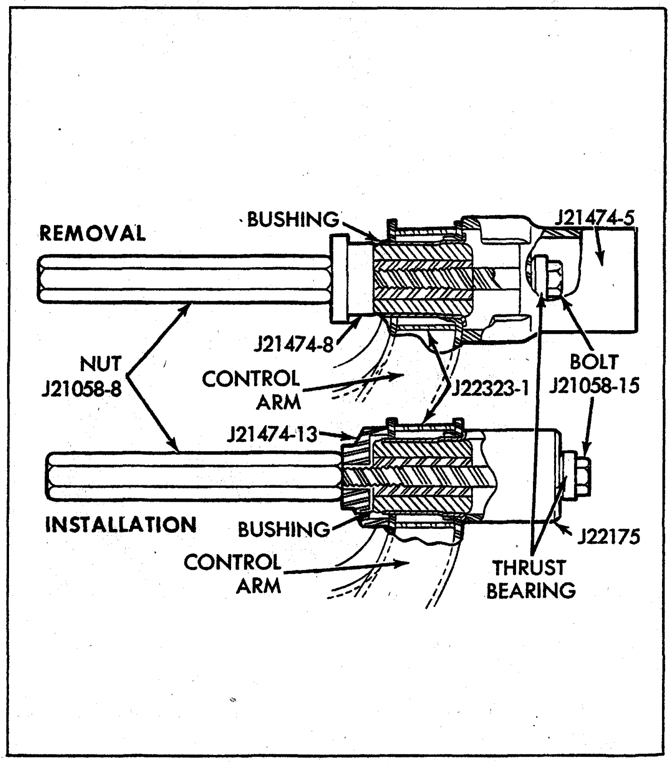


Fig. 32 - Lower Control Arm Bushing - Large - Chevelle & Camaro

Installation

1. Place the control arm so that the cross shaft aligns with its attaching points.
2. Attach the cross shaft at the front with two bolts and lock washers inserted from below into the anchor

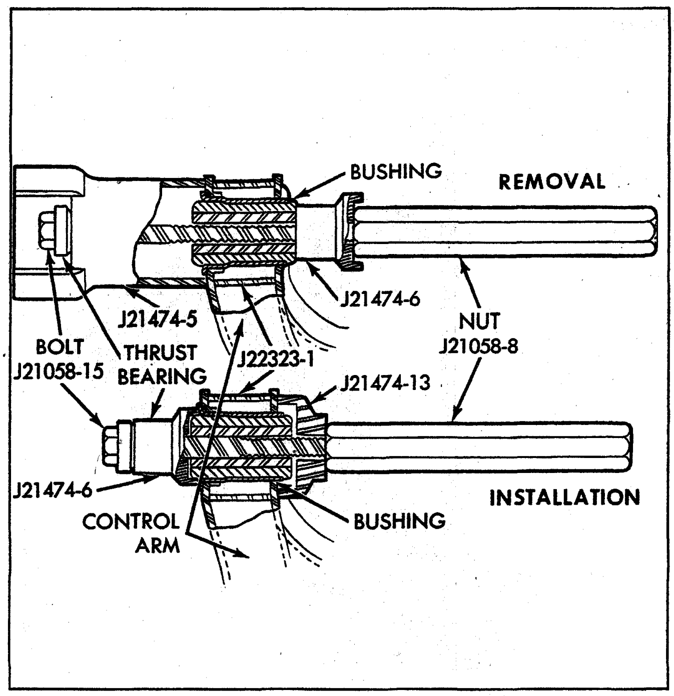


Fig. 33 - Lower Control Arm Bushing - Small - Chevelle & Camaro

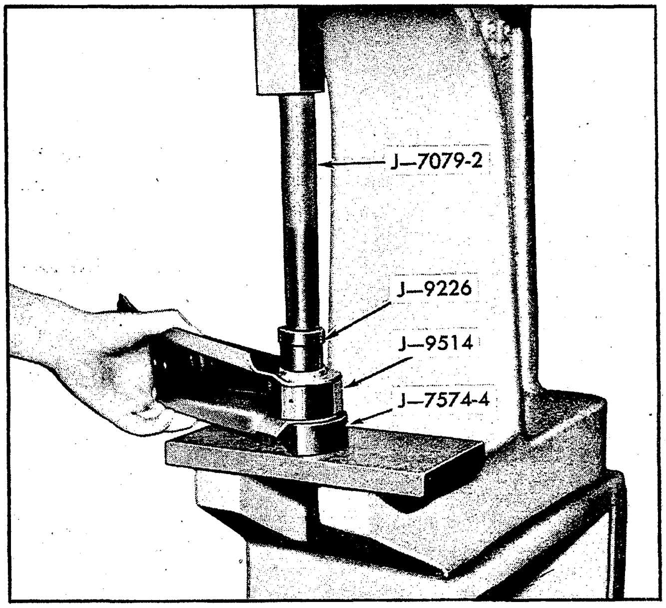


Fig. 34 - Removing Lower Control Arm Pivot Bushing - Chevy II

nut. Attach the cross shaft at the rear by a bolt and special washer inserted from above using a lock washer and nut below. Tighten front and rear bolts to specified torques.

3. Install coil spring as outlined under "Front Coil Spring Installation".
4. With unit on floor, tighten cross shaft bushing bolts to torque shown in Specifications.

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 31. 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 31.
2. Turn down on the puller screw nut to install the bushing in the control arm.

Chevelle and Camaro

Large Bushing

Removal and Installation

1. Remove the lower control arm.
2. To remove the large bushing, use Tools J-21058-8, J-21058-15, J-21474-5, J-21474-8, J-22323-1 and the thrust bearing installed as shown in the removal illustration in Fig. 32.
3. Turn down on the hex head screw of J-21058 until the bushing is pushed out. Discard the bushing.
4. Install the new bushing with Tools J-21058-8, J-21058-15, J-21474-13, J-22175, J-22323-1 and the thrust bearing installed as shown in the installation illustration in Fig. 32.
5. Replace the control arm.

Small Bushing

Removal and Installation

1. Remove and install the small bushing as described above using Tools J-21058-8, J-21058-15, J-21474-5, J-21474-6, J-22323-1 and the thrust bearing for installation and Tools J-21058-8, J-21058-15, J-21474-6, J-21474-13, J-22323-1 and the thrust bearing for removal as shown in Fig. 33.

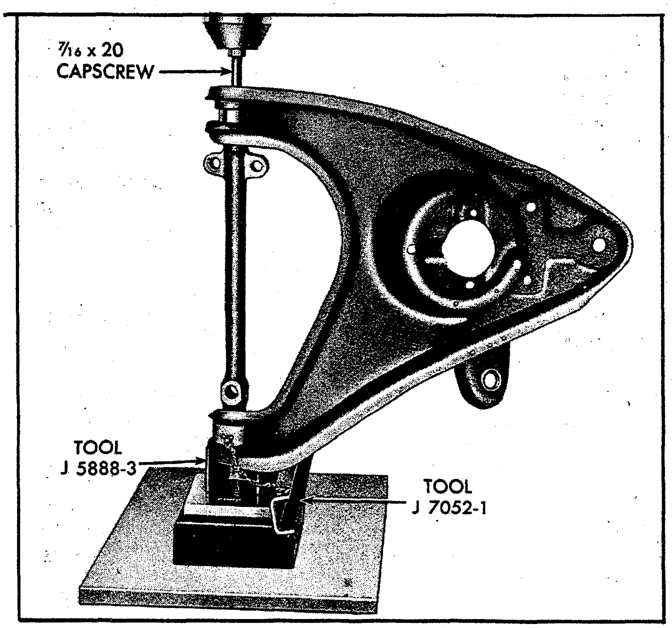


Fig. 35 - Removing Lower Control Arm Cross Shaft Bushing

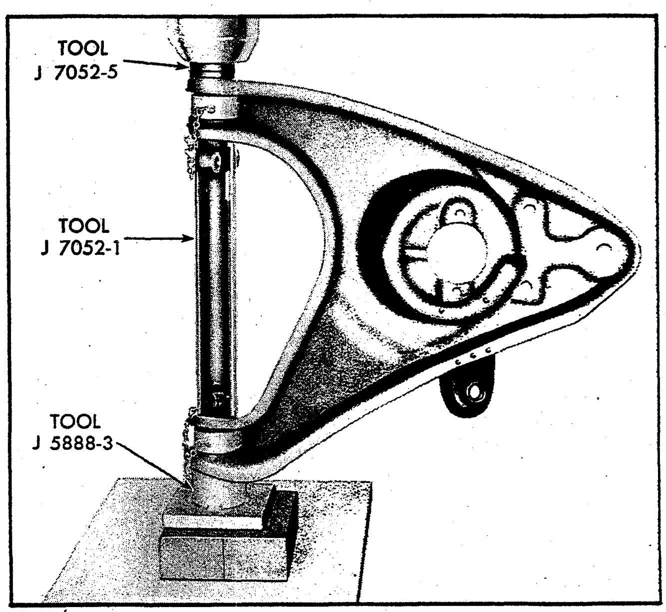


Fig. 36 - Installing Lower Control Arm Cross Shaft Bushings

Chevy II

Removal

1. Support control arm on Tool J-7574-4 and insert Spacer J-9514 (fig. 34).
2. Press bushing out with Tool J-9226 and Handle J-7079-2 (fig. 34).

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.

CROSS SHAFT AND/ON BUSHINGS

Corvette

Removal

1. Remove bolt, lock washer and collar from each end of cross shaft.
2. Thread a 7/16 x 20 capscrew (furnished with Tool J-5888) to the bottom of the threads in one end of the cross shaft.
3. Support control arm in an arbor press on Tool J-5888-3, as shown in Figure 35.

   NOTE: Be certain bushing flange does not contact support.

4. Press on cap screw until bushing is free of control arm. Discard bushing.
5. Remove cap screw from cross shaft. Insert it in other end of shaft. Invert control arm on support. Again be certain bushing flange does not contact support.
6. Press on cap screw until bushing is free of control arm. Discard bushing.

Installation

1. With cross shaft in control arm and Tool J-7052-1 in position, place control arm on Tool J-5888-3. Hand start bushing into control arm and over end of cross shaft.

   NOTE: The end of the shaft with the two bolt holes should be toward front of control arm.

2. Install Tool J-7052-5 over bushing. Be certain three-piece spacer is not over-lapping bushing holes in control arm.
3. Press bushing into control arm until flange contacts control arm (fig. 36).
4. Invert arm in press and repeat the process on the other bushing. After installation, cross shaft should be free enough to be rotated by hand.
5. Install collar, lock washer and cap screw in each end of cross shaft. Tighten to torque shown in Specifications after spring installation.

UPPER CONTROL ARM SPHERICAL JOINT

Chevrolet, Chevelle, Camaro and Corvette

Inspection

The upper spherical joint is checked for wear by checking the torque required to rotate the ball stud in the assembly. After performing the first four steps under "Replacement" below, install a stud nut on the stud and measure the torque required to turn the stud in the assembly with a torque wrench. Specified torque for a new joint is 9 lbs. ft. If torque readings are excessively high or low, replace the ball joint. If excessive wear is indicated in upper joint, both upper and lower joints should be replaced.

> **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. 15). 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.
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. It may be necessary to drill out rivet heads before chiseling.

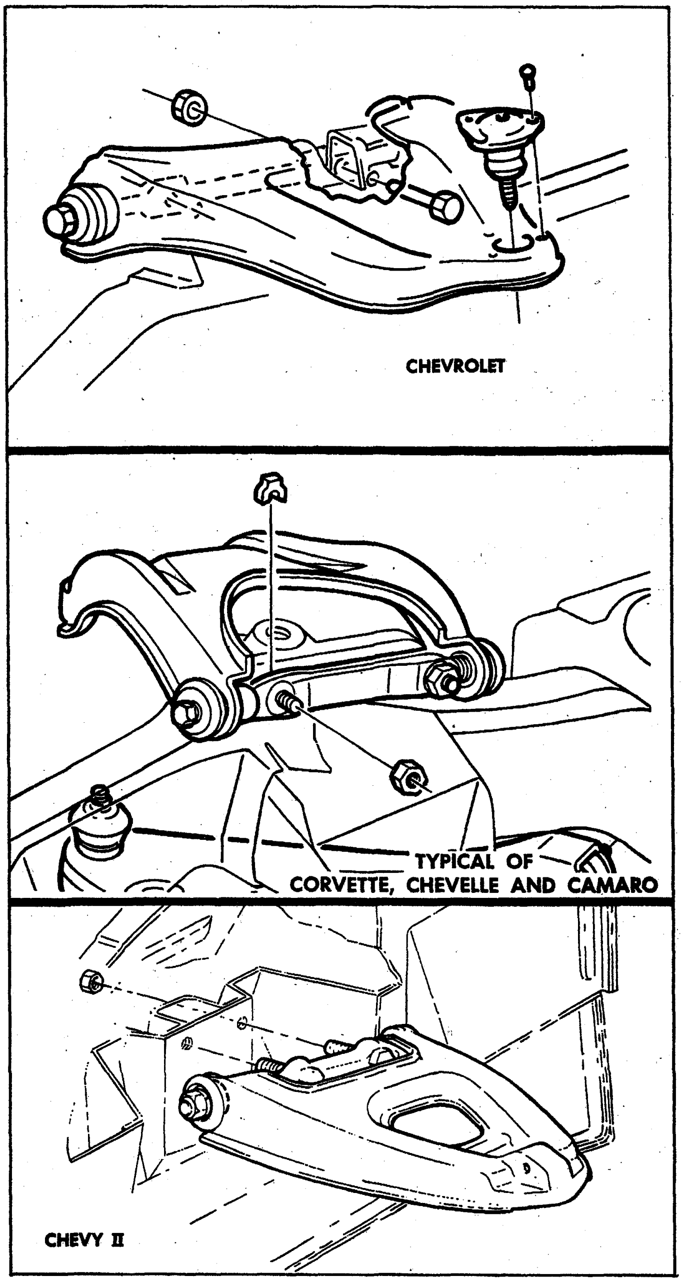


Fig. 37 - Upper Control Arm Attachment

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, Chevelle, Camaro and Corvette (Fig. 37)

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, Camaro and Corvette--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 if necessary.
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, Camaro and Corvette--Install same number of shims as removed at each bolt.)
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 (Fig. 37)

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.

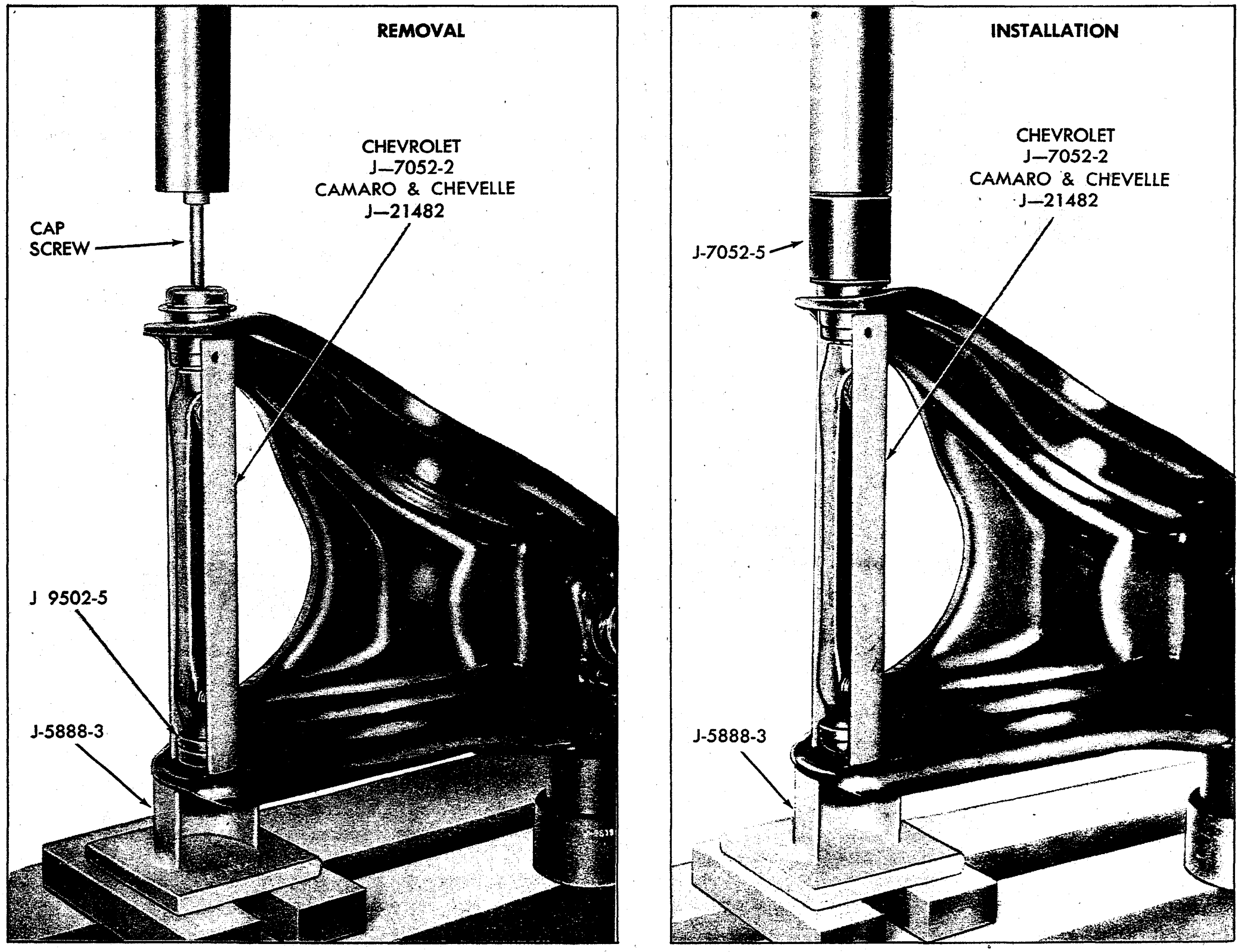


Fig. 38 - Removal and Installation of Upper Control Arm Bushings - Chevrolet and Chevelle (Chevelle shown as typical)

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 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, Chevelle and Camaro

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 38.

   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 is deteriorated to the extent that the bushing sleeve cannot be pushed out, release the press, install J-9502-3 as shown in Figure 38 and press out the sleeve.

Installation

1. Install arm in arbor press with Tool J-7052-2 (Chevrolet) or J-21482 (Chevelle and Camaro) in place and press in one bushing using J-7052-5 as shown while supported on Tool J-5888-3 as shown in Figure 38.
2. Install cross shaft in arm, invert in press, and press in second bushing as above.
3. Cross shaft should be able to be turned by hand.

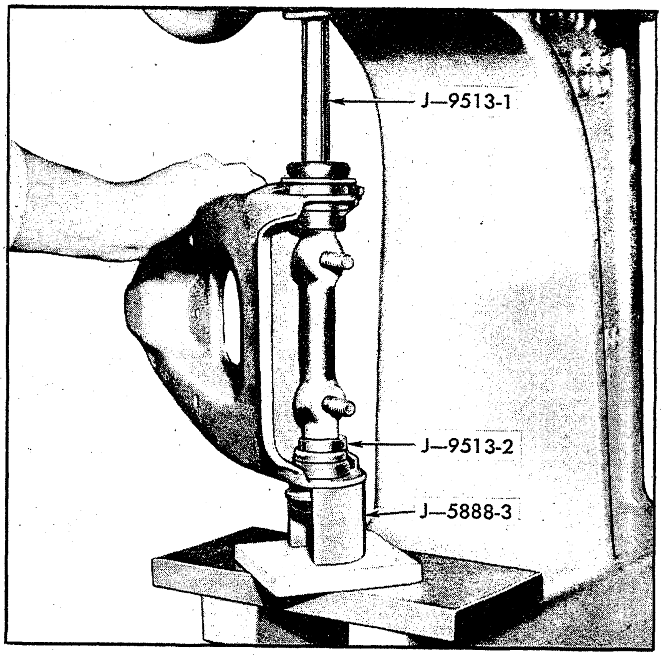


Fig. 39 - Removing Pivot Shaft Bushing - Chevy II

4. Install collar, lock washer and cap screw in ends of cross shaft. Do not tighten.

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.

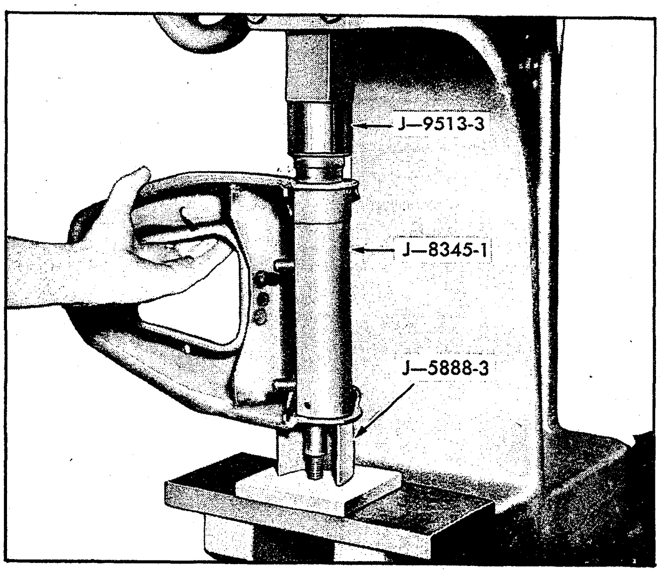


Fig. 40 - Installing Pivot Shaft Bushing - Chevy II

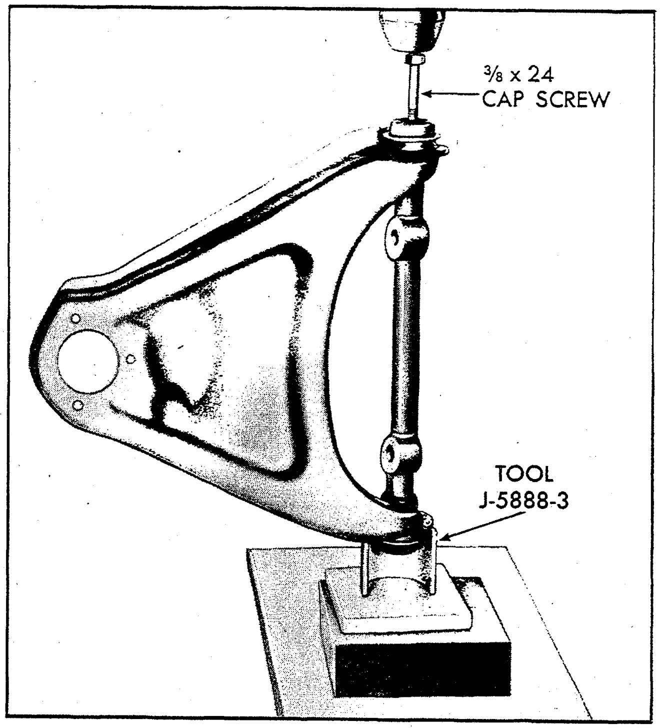


Fig. 41 - Removing Upper Control Arm Cross Shaft Bushings

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. Release tension on pivot shaft.
5. Invert control arm, support on J-5888-3 and press out bushing with J-9513-1 (fig. 39).
6. Press remaining bushing out in the same manner.

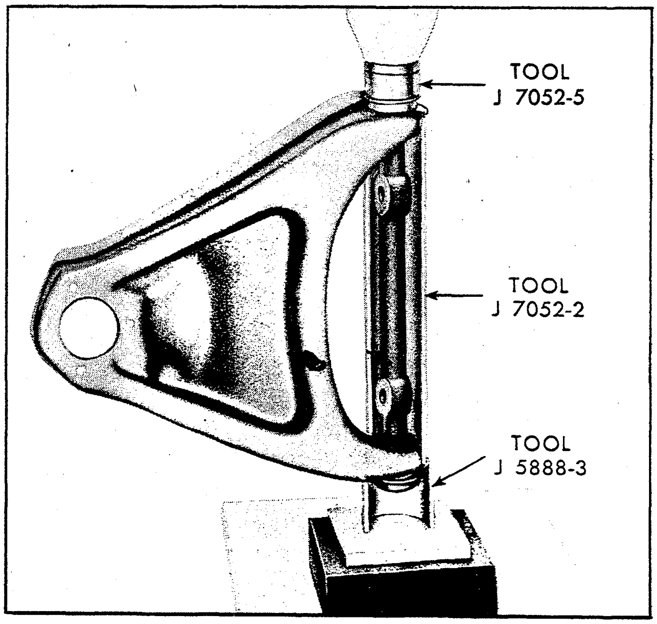


Fig. 42 - Installing Upper Control Arm Cross Shaft Bushing

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. 40).
4. Invert arm and press remaining bushing in place with J-9513-3.
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.

Corvette

Removal

1. Remove cap screws, lock washers and collars from both ends of cross shaft.
2. Install a 3/8-24 cap screw (furnished with Tool J-5888) in one end of cross shaft.
3. Support control arm in an arbor press on Tool J-5888-3 as shown in Figure 41.

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.

Installation

1. Install arm in arbor press with Tool J-7052-2 in place and press in one bushing 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.

SPECIAL TOOLS

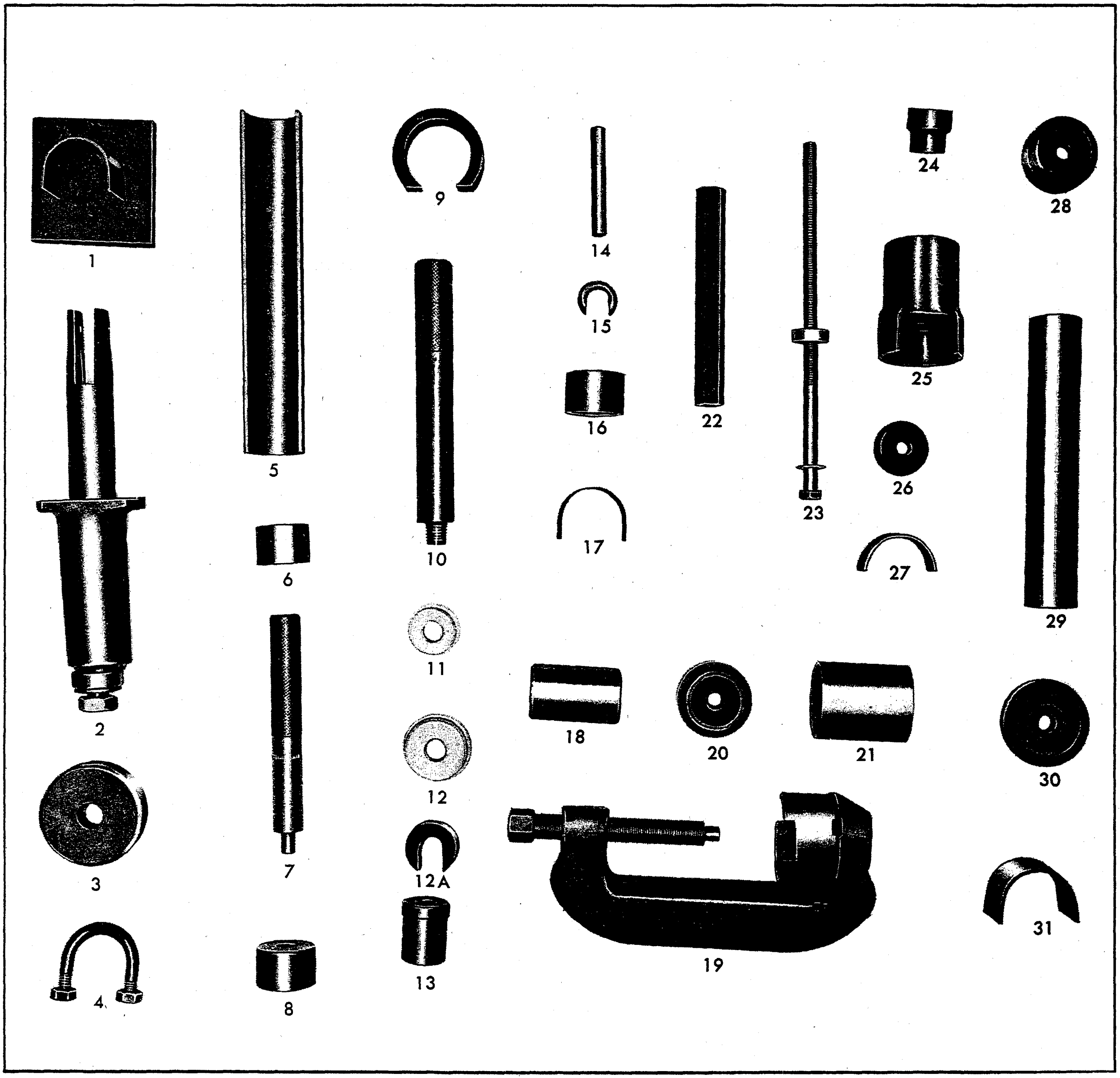


Fig. 43 - Front Suspension Special Tools

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
12A. J-9502-3 Remover
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 Receiver
26. J-21474-8 Remover
28. J-21474-13 Installer
29. J-21482 Spacer
30. J-21830-7 Receiver Bridge
31. J-21878 Spacer
32. J-21474-3 (Not Illustrated)
33. J-21474-4 (Not Illustrated)
34. J-21474-5 (Not Illustrated)
35. J-21474-6 (Not Illustrated)
36. J-22323-1 (Not Illustrated)
37. J-22323-2 (Not Illustrated)

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 and all station wagons) 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

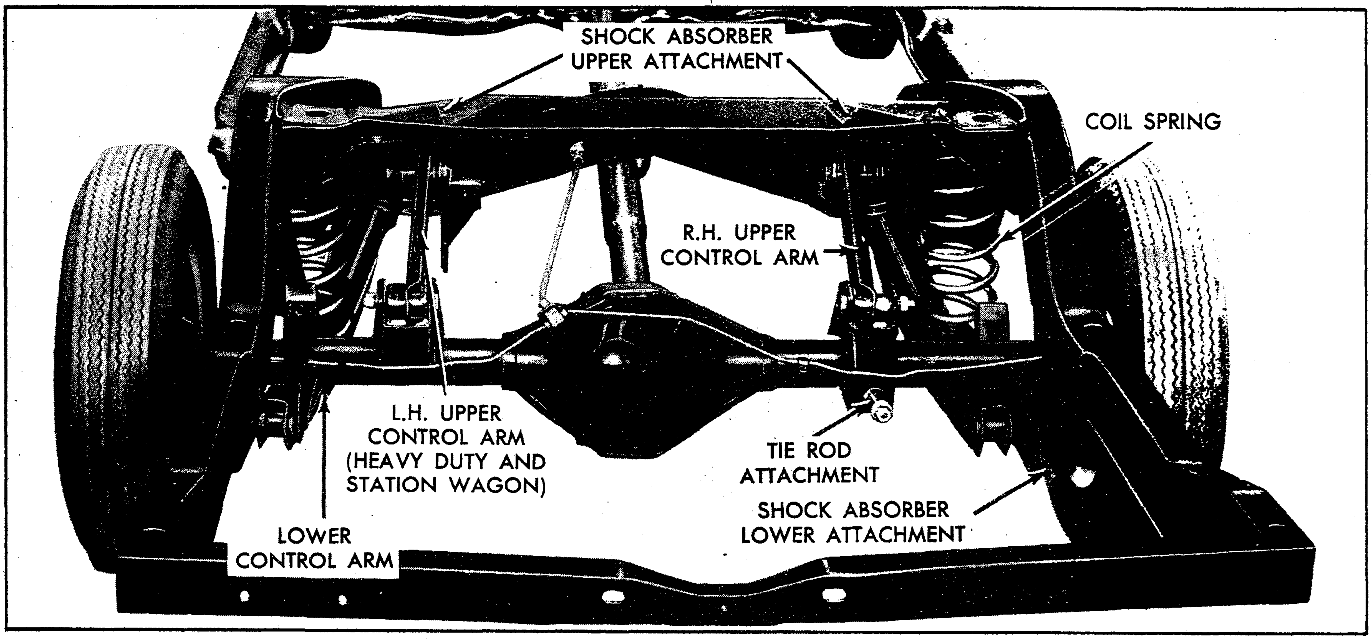


Fig. 1—Chevrolet Rear Suspension Components

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 pigtailed at both ends; the upper end is isolated from the frame seat by a rubber insulator, while the lower end seats on the axle mounted spring bracket which has a vertical flange to retain the spring.

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 AND CAMARO

The Chevy II and Camaro rear suspension (fig. 3 and fig. 4) 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

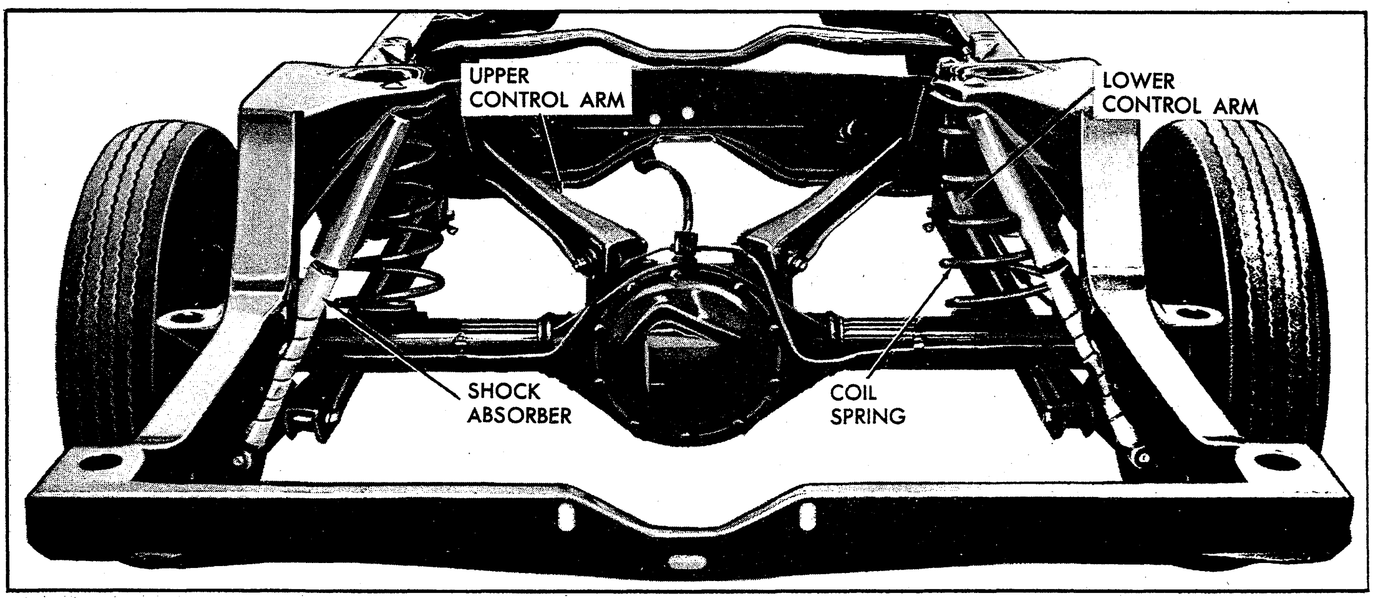


Fig. 2—Chevelle Rear Suspension Components

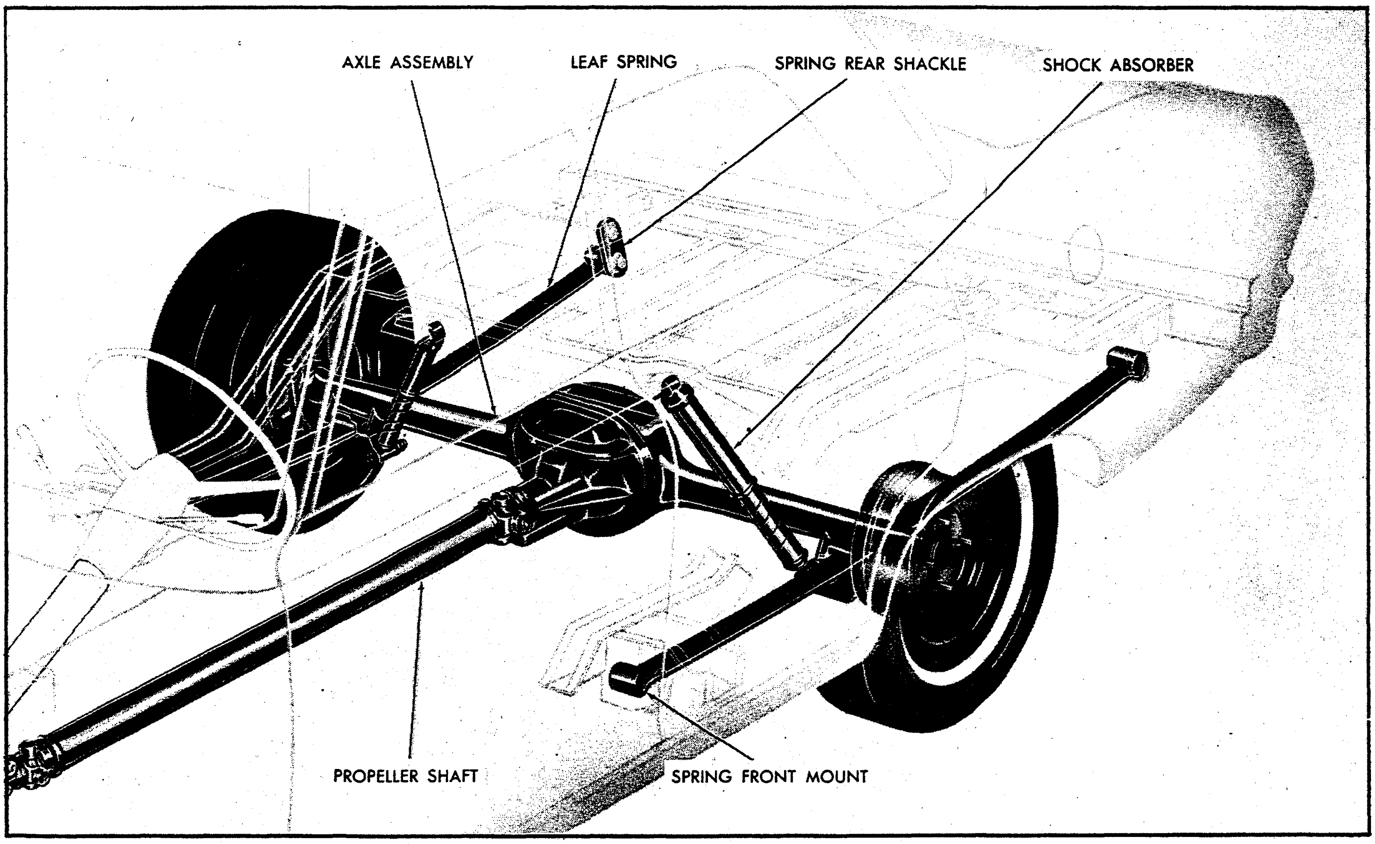


Fig. 3—Chevy II Rear Suspension Components

absorb axle wind-up. The springs are positioned to the axle spring seats by locating pins butt welded to the spring leaf.

CORVETTE

The Corvette independent three-link type rear suspension consists of a fixed differential carrier which is

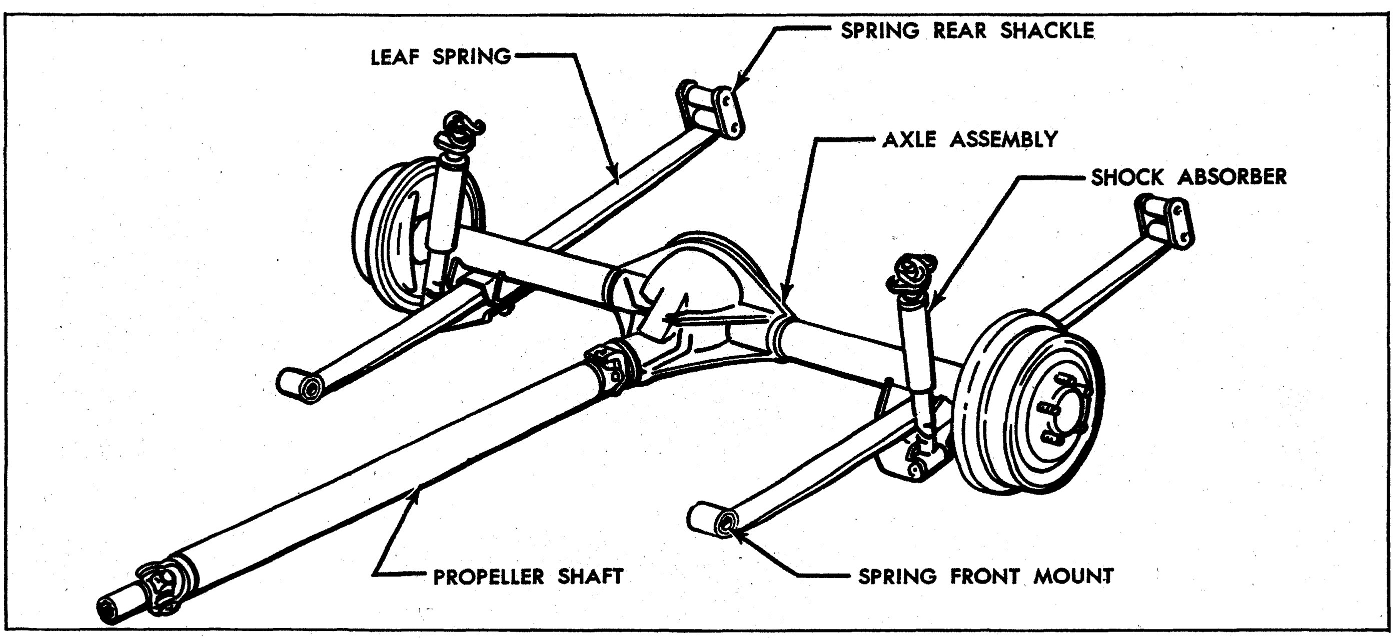


Fig. 4—Camaro Rear Suspension Components

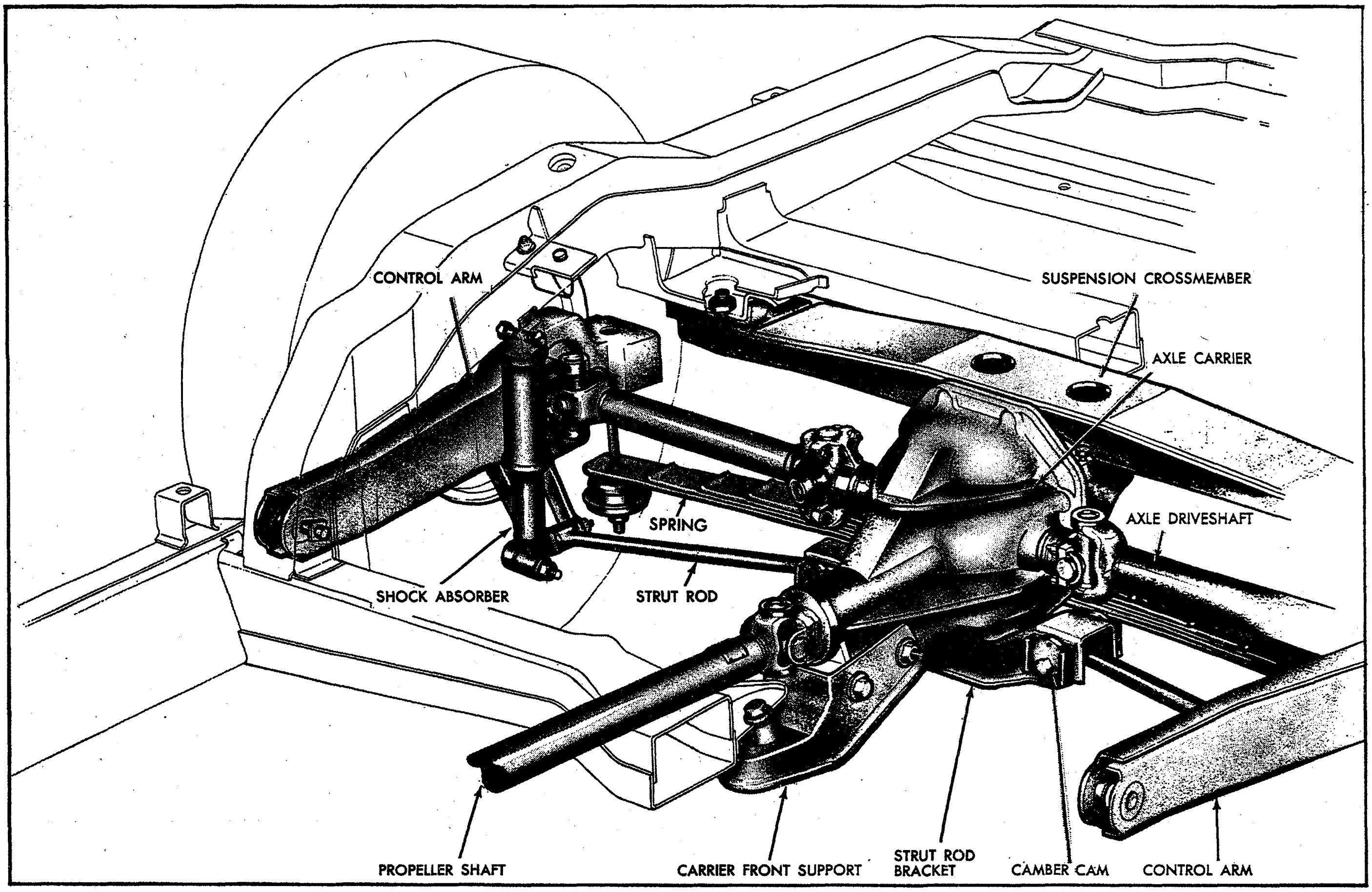


Fig. 5—Corvette Rear Suspension and Driveline Components

rubber mounted to the frame at three points, with the strut rods, drive shafts and torque control arms forming the three links at each wheel, and a transversely mounted multi-leaf spring (fig. 5).

The box section trailing torque control arms are mounted at the forward end into frame side member openings through pivot bolts and rubber bushings, and extend rearward to connect to the leaf spring. The wheel spindles and spindle supports are attached to the torque arms through four bolts pressed into the arm. Rear wheel toe-in angle is adjusted through the use of variable thickness shims inserted between the torque arm and the frame side member web at the forward pivoting joint.

The rear wheel spindles are driven through double "U" jointed, tubular driveshafts which are flange mounted to a splined spindle flange at their outboard end and bolted to the differential side gear yokes at their inboard end. Wheel spindle support houses the inner and outer tapered roller bearings, two to each wheel. Bearing adjustment is made through the use of a spacer and variable thickness shims between the bearings.

The spindle supports also incorporate integrally forged, fork-shaped mounting brackets to accept the outer ends of the rubber-bushed strut rods. The strut rods are mounted laterally from the spindle support to a bracket bolted to the lower surface of the axle carrier. The strut rod connection at this point is with an eccentric cam arrangement and provides for rear wheel camber adjustment.

The direct, double-acting shock absorbers are attached at the upper eye to a frame bracket and at the lower eye to the strut rod mounting shaft which incorporates a threaded stud for the shock absorber lower eye.

The transversely mounted multi-leaf spring is clamp bolted at the center section to a lower mounting surface on the differential carrier cover. The outer ends of the main leaf are provided with a hole through which the spring is link bolted to the rear of the torque control arms. The spring assembly is provided with full length liners.

An optionally available stabilizer shaft attaches to the upper rear section of the torque arms, and stretches rearward where it is connected to the frame by two rubber-bushed mounting brackets.

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.

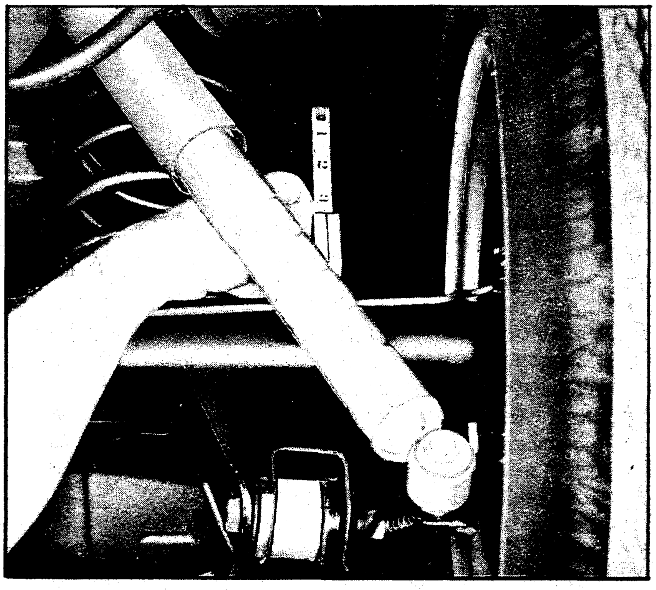


Fig. 6—Measuring Rear Riding Height (Chevrolet and Chevelle)

RIDING HEIGHT CHECK
(Chevrolet, Chevelle Camaro and Chevy II)

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. 6).
4. On Chevy II models, measure riding height as the distance from lower surface of bumper support bracket to top of axle housing (fig. 7).
5. On Camaro models measure riding height as the distance from jounce bumper upper attaching bolt to top of axle housing (fig. 8).
6. Riding heights vary between models. Refer to specifications section for vehicle and model application.

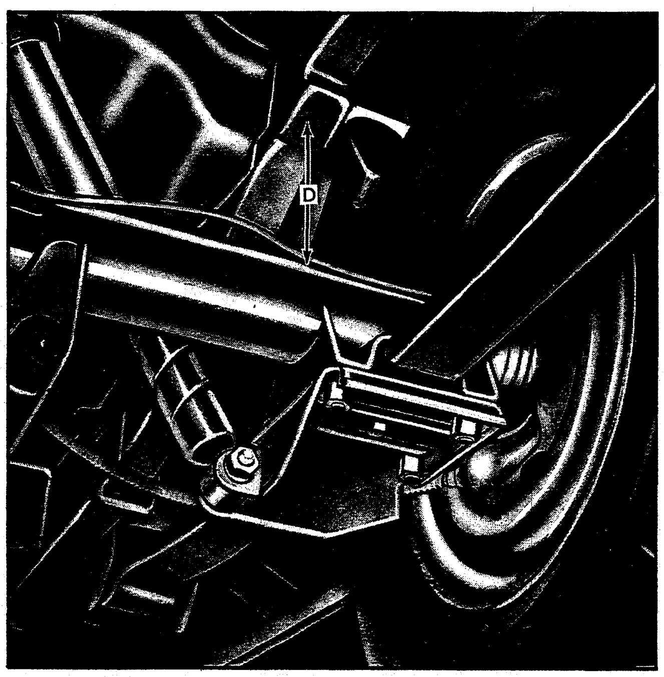


Fig. 7—Rear Riding Height (Chevy II)

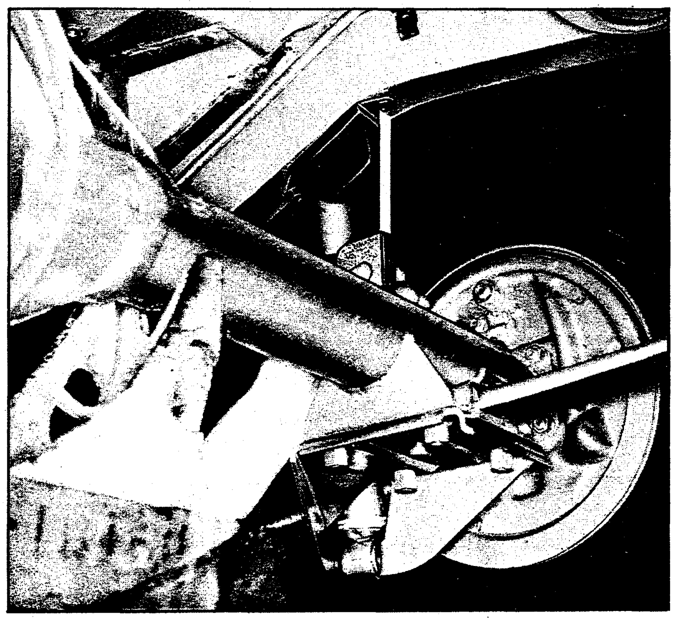


Fig. 8—Measuring Rear Riding Height (Camaro)

WHEEL ALIGNMENT (CORVETTE)

Camber

Wheel camber angle is obtained by adjusting the eccentric cam and bolt assembly located at the inboard mounting of the strut rod (fig. 9). Place rear wheels on alignment machine and determine camber angle. To adjust, loosen cam bolt nut and rotate cam and bolt assembly until specified camber is reached. Tighten nut securely and torque to specifications.

Fig. 9—Adjusting Rear Wheel Camber (Corvette)

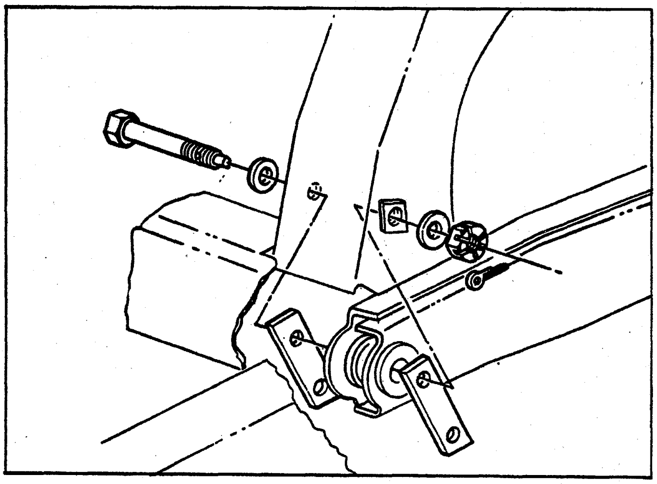


Fig. 10—Toe-In Adjusting Shim Location (Corvette)

Toe-in

Wheel toe-in is adjusted by inserting shims of varying thickness inside the frame side member on both sides of the torque arm pivot bushing (fig. 10). Shims are available in thicknesses of 1/64", 1/32", 1/8" and 1/4". To adjust toe-in, remove torque arm pivot bolt; then position torque arm to obtain specified toe-in. Shim gap toward vehicle centerline between torque arm bushing and frame side inner wall.

NOTE: Do not use thicker shim than necessary, and do not use undue force when shimming inner side of torque arm - to do so may cause toe setting to change.

Shim outboard gap as necessary to obtain solid stack-up between torque arm bushing and inner wall of frame side member. After correct shim stack has been selected, install pivot bolt and hardened washers (fig. 10) - making sure that all shims are retained - torque nut to specifications and install cotter pin. If specified torque does not permit cotter pin insertion, tighten nut to next flat.

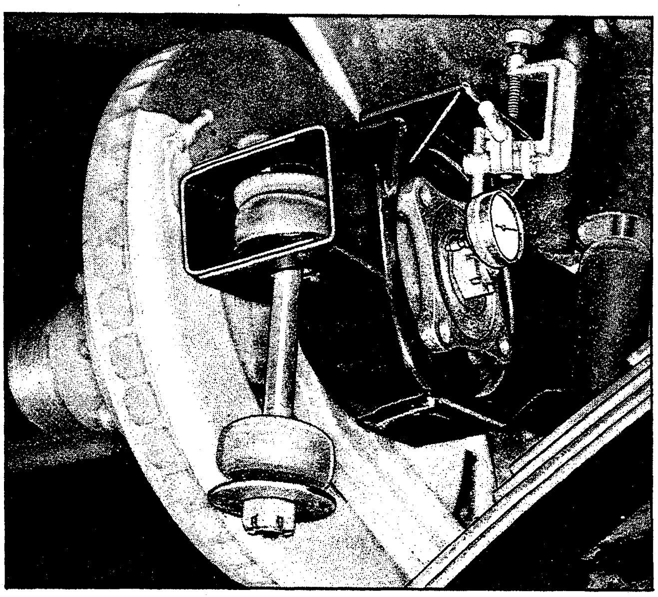


Fig. 11—Checking Wheel Bearing Adjustment (Corvette)

WHEEL BEARING ADJUSTMENT (CORVETTE)

Inspection

The tapered-roller spindle bearings should have end play of .001" to .008". During inspection, check end play and, when necessary, adjust as outlined in this section.

1. Raise rear of vehicle until wheels clear ground.
2. Disengage bolt lock tabs and disconnect outboard end of axle drive shaft from wheel spindle flange.
3. Mark camber cam in relation to bracket. Loosen and turn camber bolt until strut rod forces control arm outward. Position loose end of axle drive shaft to one side for access to spindle.
4. Remove wheel and tire assembly. Mount dial indicator (Tool J-8001) on torque arm or adjacent surface and rest pointer on flange or spindle end (fig. 11).
5. Grasp brake disc and move axially (in and out) while reading movement on dial indicator. If end movement is within the .001" to .008" limit, bearings do not require adjustment. If not within .001" to .008" limit, record reading for future reference and adjust bearings as outlined below.

Adjustment

1. Apply parking brake to prevent spindle from turning and remove cotter pin and nut from spindle.
2. Release parking brake and remove drive spindle flange from splined end of spindle.
3. Remove brake caliper and brake disc as outlined in Section 5.
4. Install Thread Protector J-21859-2 over spindle threads; then remove drive spindle from spindle support, using Tool J-22602 as shown in Figure 12.

CAUTION: When using Tool J-22601 to remove drive spindle, make sure puller plate is posi-

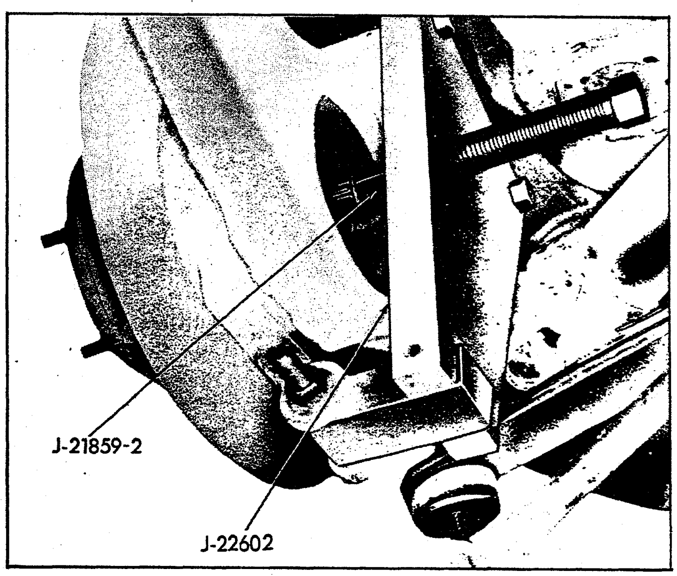


Fig. 12—Removing Drive Spindle from Support (Corvette)

tioned vertically in the torque arm before applying pressure to the puller screw.

5. Remove shim and bearing spacer from spindle support.
6. Note size of shim used. If dial indicator reading was more than .008", select a shim thinner by the amount needed to bring end play within limits. If dial indicator reading was less than .001", select a shim thicker by the amount needed to bring end play within limits.

   NOTE: Shims are available in thicknesses from .097" to .148" in increments of .003".

   EXAMPLE: Bearing end play reading obtained on dial indicator was .011", .003" over limit. Bearing shim removed from spindle measures .145". New shim installed measures .139", .006" smaller. End play is now decreased by .006" and is .005", which is within the .001" to .008" limit.

7. After determining shim thickness, install bearing spacer and shim on spindle. Position spindle in spindle support.
8. Press inner bearing race and roller assembly on spindle as follows.
   a. Position Tool J-4731 over spindle and against bearing inner race.
   b. Position washer and spindle nut on spindle and proceed to tighten nut until bearing is forced on spindle sufficiently to allow spindle drive flange to be installed (fig. 13). Remove spindle nut, washer and Tool J-4731. Discard nut and use a new one for final assembly.
9. Position drive flange over spindle, making sure flange is aligned with spindle splines. Install washer and nut on spindle then tighten nut to specifications and install cotter pin. If specified torque does not permit cotter pin insertion, tighten nut to next flat.
10. Seat spindle support outer seal in bore by using screw driver, or other suitable tool, to press against metal portion of seal.
11. Install brake disc and caliper. Refer to Section 5 for details of brake disc and caliper installation.
12. Install axle drive shaft, wheel and tire assembly, adjust camber cam to original position and torque all components to specifications.

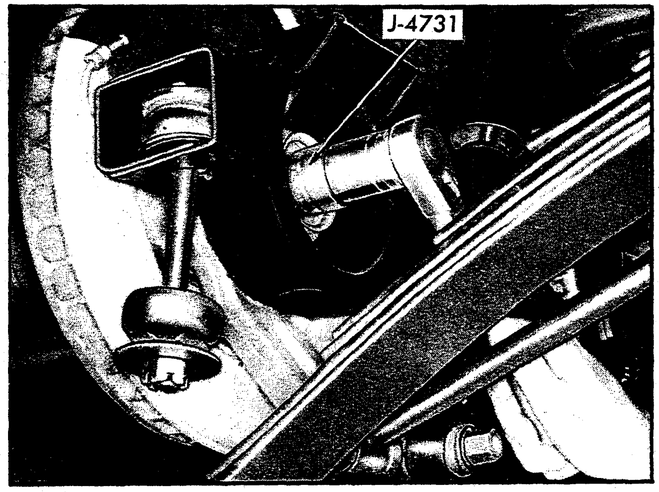


Fig. 13—Installing Drive Spindle to Support (Corvette)

COMPONENT PARTS REPLACEMENT

(Chevrolet, Chevelle, Chevy II and Camaro)

COIL SPRING

Chevrolet

Removal

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

1. Raise rear of vehicle and place jack stands under frame. Support vehicle weight at rear, using either a jack or post of twin-post hoist under axle.
2. Remove both rear wheels from vehicle.
3. With the car supported as in Step 1, so that the rear springs are compressed by weight of vehicle; perform the following:
   a. Disconnect both rear shock absorbers from the anchor pin lower attachment.
   b. Loosen the upper control arm(s) rear pivot bolt (do not remove the nut).
   c. Loosen both the left and the right lower control arm rear attachment (do not disconnect from axle brackets).
   d. Remove the rear suspension tie rod from the stud on the axle tube.
4. At the lower seat of both rear coil springs, slightly loosen the nut on the bolt that retains the spring and seat to the control arm. When the nut has been backed off the maximum permissible, all threads of the nut should still be engaged on the bolt.

   CAUTION: Under no condition should the nut, at this time, be removed from the bolt in the seat of either spring.

5. Slowly lower the support (jack or hoist post) that has been in place under the rear axle, thereby allowing the axle to swing down, carrying the springs out of their upper seat and providing access for spring removal.
6. Remove the lower seat attaching parts from each spring, then remove the springs from the vehicle (fig. 14).

Installation

1. Position the springs in their upper seat so that end of top coil is 3/8" ± 1/8" from end of stop. Install the lower seat parts on the control arm, with the nut finger tight on the spring retainer bolt.

   NOTE: Omit the lock washer under the special high carbon bolt, so that sufficient bolt thread will be available to start the nut. The lock washers will be installed later (in Step 4).

2. By alternately raising the axle slightly and then re-snugging the nut on each spring lower seat bolt, move the axle upward until vehicle weight is fully

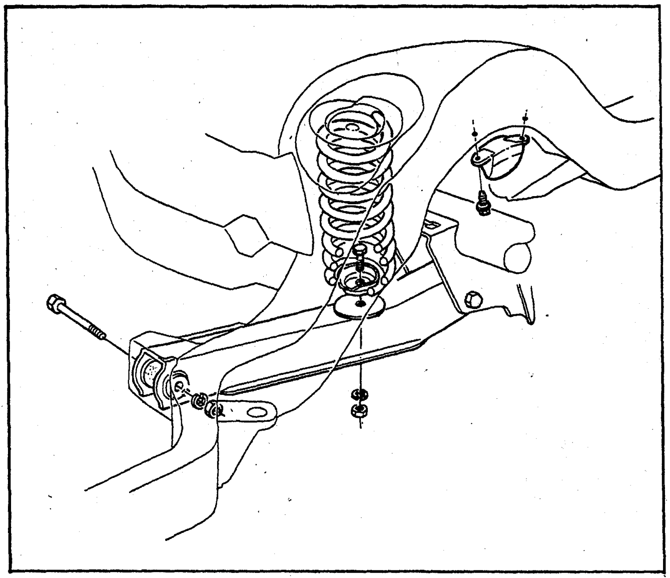


Fig. 14—Coil Spring Installation (Chevrolet)

supported on the jack. With the spring now compressed to approximately curb height, positively position the springs in the lower seats by torquing the nut on the lower seat bolt (fig. 15).

3. Re-connect shock absorbers, torque rear attachment of upper and lower control arms, and reconnect the axle tie rod at proper torque.
4. With the rear of vehicle still supported by jack under axle; remove the nut from the lower seat bolt of one rear spring, slide proper lock washer on the bolt and reinstall the nut to proper torque. Similarly install a lock washer at the lower seat of the other rear spring.
5. Install rear wheels and lower vehicle to floor.

Fig. 15—Installing Coil Spring to Lower Control Arm (Chevrolet)

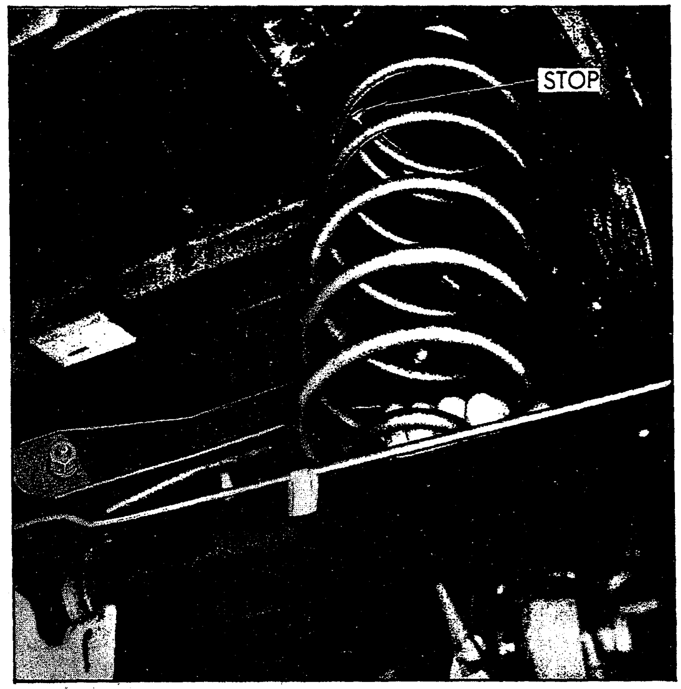


Fig. 16—Coil Spring Installation (Chevelle)

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 pry lower pigtail over vertical retainer on axle bracket and remove spring and insulator from vehicle.

Installation

1. Position rubber insulator on end of spring, making sure that end of pigtail is butted against stop in insulator. Install insulator and spring in upper spring seat so that insulator is properly indexed against stop (fig. 16).
2. Pry lower pigtail portion of spring over vertical flange of the axle bracket spring seat.
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.

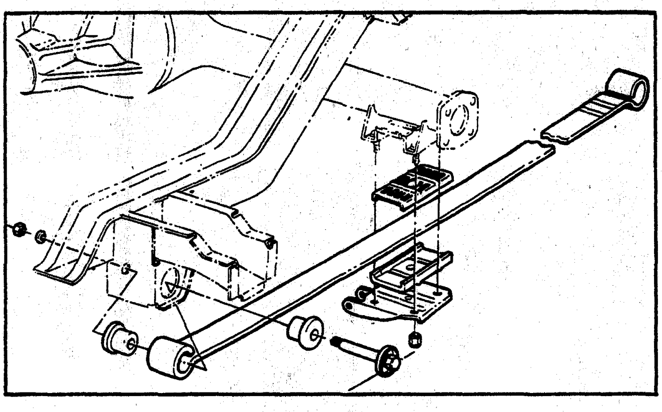


Fig. 17—Rear Spring—Exploded View (Chevy II)

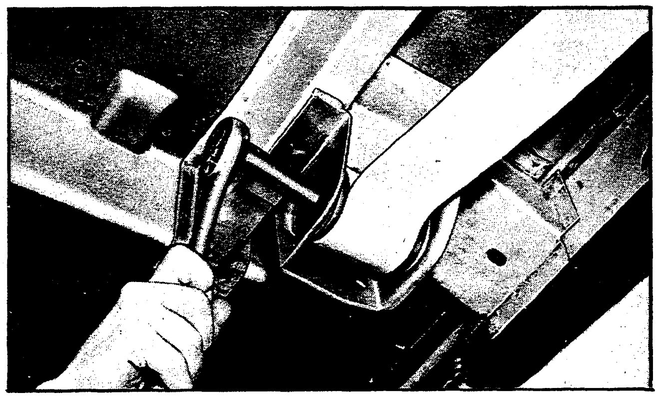


Fig. 19—Removing Front Eye Bushings (Chevy II)

LEAF SPRING, SPRING SEAT PADS, SPRING EYE BUSHINGS Chevy II (Fig. 17)

Removal

1. Raise vehicle and support rear axle assembly.
2. Pull parking 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. 18). 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. 19).
4. Remove nuts from rear spring shackle (fig. 20), 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. 21).

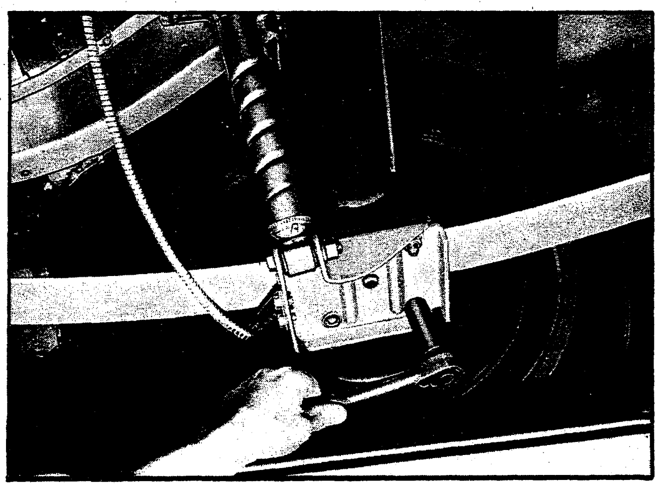


Fig. 18—Removing Lower Pad Bracket (Chevy II)

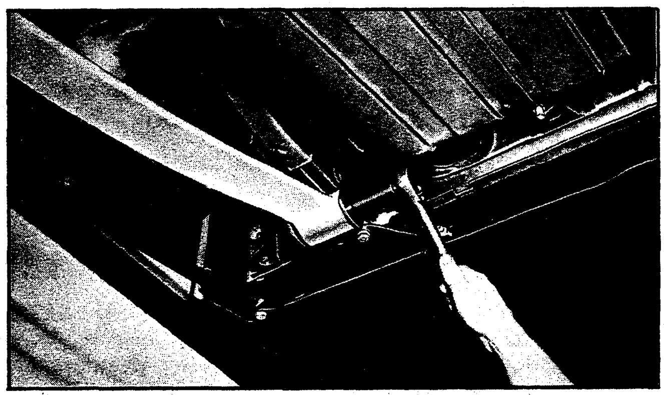


Fig. 20—Disassembling Rear Spring Shackle (Chevy II)

      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. 22):
      When installing shackle as in Step 2 above, top nut should be toward centerline of vehicle and bottom nut toward outboard of vehicle.
3. Insert inboard rubber bushing into front spring eye.

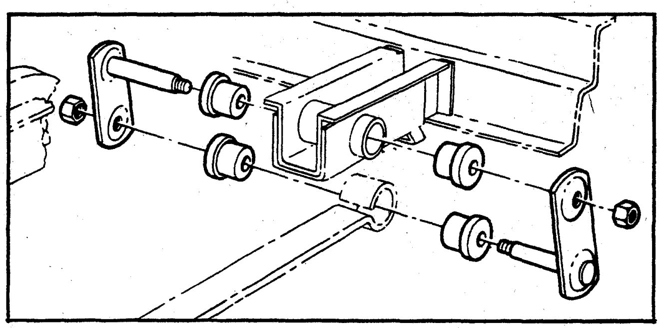


Fig. 21—Rear Spring Shackle Exploded View—All Except Station Wagon (Chevy II)

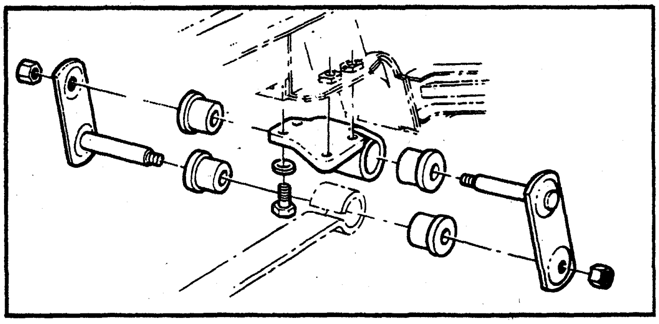


Fig. 22—Rear Spring Shackle Exploded View—Station Wagon (Chevy II)

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.

Camaro (Fig. 23)

Removal

1. Raise rear of vehicle sufficiently to allow axle assembly to hang freely; then support weight of vehicle at both frame side rails and near front eye of spring.

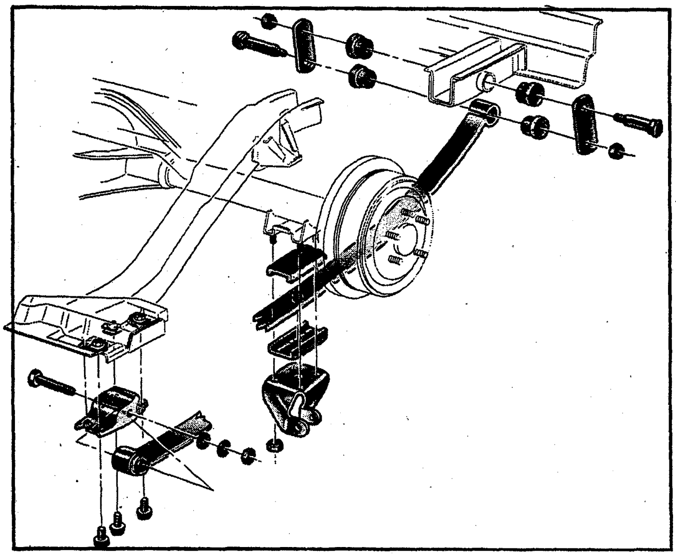


Fig. 23—Rear Spring—Exploded View (Camaro)

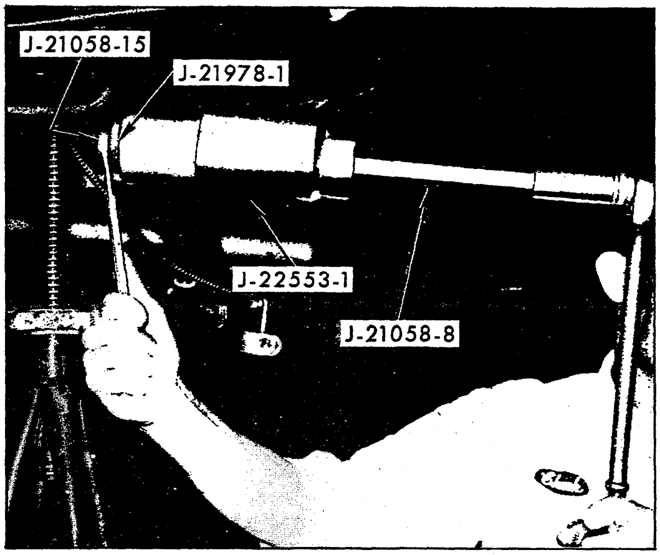


Fig. 24—Removing Spring Front Bushing (Camaro)

2. Raise axle assembly so that all tension is removed from spring.
3. Loosen and remove shock absorber lower attaching bolt.
4. Loosen the spring eye-to-bracket retaining bolt.
5. Remove the screws securing the spring retainer bracket to the underbody.
6. Lower axle assembly sufficiently to permit access to spring retainer bracket and remove bracket from spring.
7. The spring eye bushing can be replaced without completely removing the spring from the vehicle, if bushing requires replacement proceed as follows.
   a. Position remover adapter J-21978-1 over puller screw J-21058-15 so that adapter is against head of puller screw. Refer to Figure 24 for view of removal tools.
   b. Position puller screw through eye of bushing so that remover adapter J-21978-1 is against unflanged side of bushing.
   c. Position large end of barrel J-22553-1 over puller screw and seat barrel against spring eye.
   d. Position thrust bearing on puller screw then install and tighten nut J-21058-8 against thrust bearing.
   e. Check to make sure that all puller parts are properly aligned then proceed to tighten nut until bushing is pulled free of spring eye--disassemble puller tool.
   f. Position installer adapter J-22553-2 over flange end of bushing then position puller screw J-21058-15 through installer adapter and bushing. Refer to Figure 25 for view of installation tools.
   g. Position puller screw through spring eye until bushing contacts spring. Install small end of barrel J-22553-1 over puller screw and seat barrel against spring.
   h. Install thrust bearing and nut J-21058-8. Check puller tools and bushing for proper alignment; then tighten nut to pull bushing into spring.

NOTE: Do not apply additional torque to nut J-21058-8 after bushing flange contacts spring.

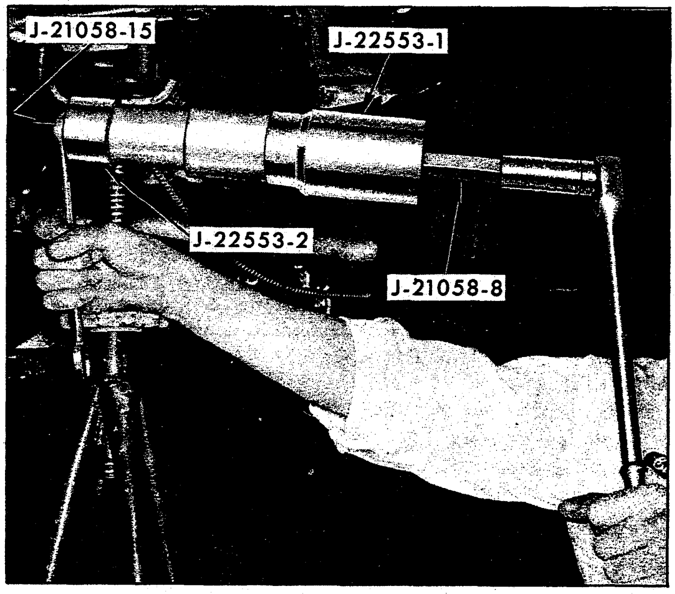


Fig. 25—Installing Spring Front Bushing (Camaro)

Unnecessary torque applied after flange is seated will tend to distort flange and reposition bushing in spring.

i. Disassemble bushing installation tools and remove from spring.

8. Pry parking brake cable out of the retainer bracket mounted on the spring mounting plate.
9. Remove spring bracket-to-axle bracket retaining nuts, remove upper and lower rubber spring pads and bracket.
10. Support spring, then remove lower bolt from spring rear shackle. Separate shackle and withdraw spring from vehicle.
11. Remove rear spring shackle upper bolt and withdraw shackle bushings from frame.

Installation

1. Position spring front mounting bracket to spring front eye. Spring attaching bolt must be installed so that head of bolt is toward center of vehicle.
2. Position spring shackle upper bushings in frame, position shackles to bushings and loosely install bolt and nut.
3. Install bushing halves in spring rear eye, place spring to shackles and loosely install shackle lower bolt and nut.

NOTE: When installing spring, make sure spring is positioned so that parking brake cable is on underside of spring.

4. Raise front end of spring and position bracket to underbody. Guide spring into position so that it will index in the axle bracket and also make sure that the tab on spring bracket is indexed in slot provided in the underbody.
5. Loosely install spring-to-underbody bracket.
6. Position spring upper cushion between spring and axle bracket so that spring cushion ribs align with axle bracket locating ribs.
7. Place lower spring cushion on spring so that cushion is indexed on locating dowel. Upper cushion and lower cushion will be aligned if installation is correct.
8. Place lower mounting plate over locating dowel on spring lower pad and loosely install retaining nuts.
9. If new mounting plate was installed, transfer parking brake cable retaining bracket to new plate.
10. Position shock absorber to spring mounting plate and loosely install eye bolt and nut - head of bolt should be toward front of vehicle.
11. Position parking brake cable in retaining bracket and securely clamp bracket to retain cable.
12. Remove stand jacks and lower vehicle so that weight of vehicle rests on suspension components. Torque all affected parts to specifications.

SHOCK ABSORBER

Chevrolet and Chevelle

Removal

1. Raise rear of vehicle and support rear axle assembly.
2. If equipped with superlift shock absorber, disconnect air line from shock absorber.
3. Disconnect shock absorber at upper mounting bracket by removing the two retaining bolts. Refer to Figure 26 for shock absorber mounting details. (Chevelle components shown as typical.)
4. 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.

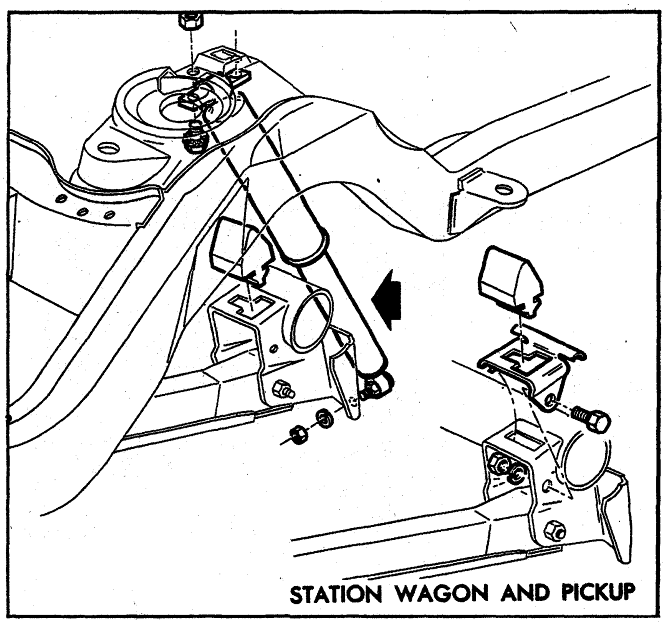


Fig. 26—Shock Absorber Mounting—Exploded View (Chevelle)

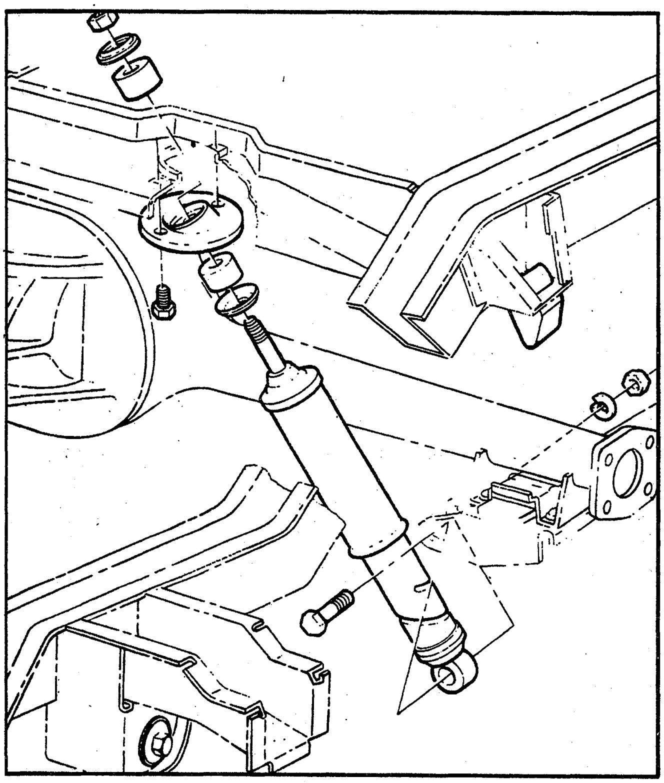


Fig. 27—Shock Absorber Mounting—Exploded View (Chevy II)

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.
3. Torque upper attaching bolts to specifications.
4. Torque lower attaching nut to specifications, observing procedure outlined in Removal procedure.
5. If equipped with superlift shock absorbers, connect air line to shock absorber and add air to obtain a minimum of 10 psi.
6. Lower vehicle and check shock absorber action.

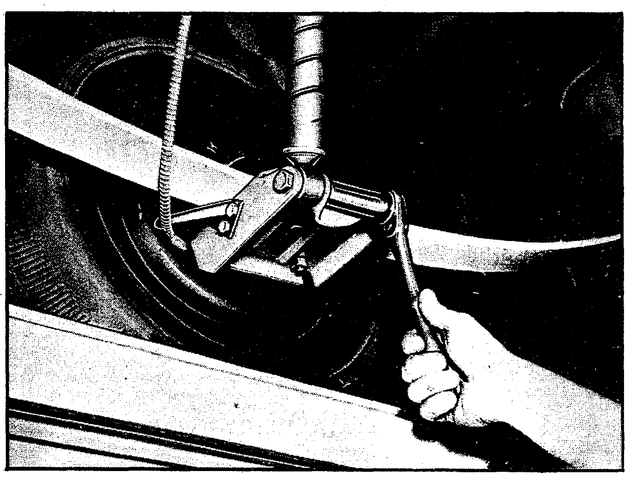


Fig. 28—Removing Shock Absorber Eye Bolt (Chevy II)

Chevy II

Removal (Refer to Fig. 27)

1. Raise vehicle and support axle housing with adjustable jackstand.
2. Loosen and remove shock absorber lower mounting bolt from shock absorber eye (fig. 28).
3. Remove shock absorber upper mounting bracket bolts and withdraw shock absorber and bracket.
4. Remove nut, washers, 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.

Camaro

Removal (Refer to Fig. 29)

1. Raise rear of vehicle and support rear axle assembly.
2. Loosen and remove shock absorber lower attaching bolt from shock absorber eye.
3. Remove shock absorber upper mounting bracket-to-underbody retaining screws and withdraw shock absorber and bracket.
4. Remove nut, upper retainer and grommet, gasket and bracket, and lower grommet and retainer from the shock absorber rod.
5. Inspect rubber grommets and gasket for damage and deterioration--replace as required.

Installation

1. Assemble lower retainer and grommet, bracket and gasket, upper grommet and retainer and nut to the shock absorber rod. Torque nut to specifications.
2. Position shock absorber bracket to underbody and install bracket retaining screws. Torque retaining screws to specifications.
3. Insert shock absorber eye into lower bracket, install bolt with head toward front of vehicle. Torque nut to specifications.
4. Lower vehicle and test shock absorber action.

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. 30).

   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

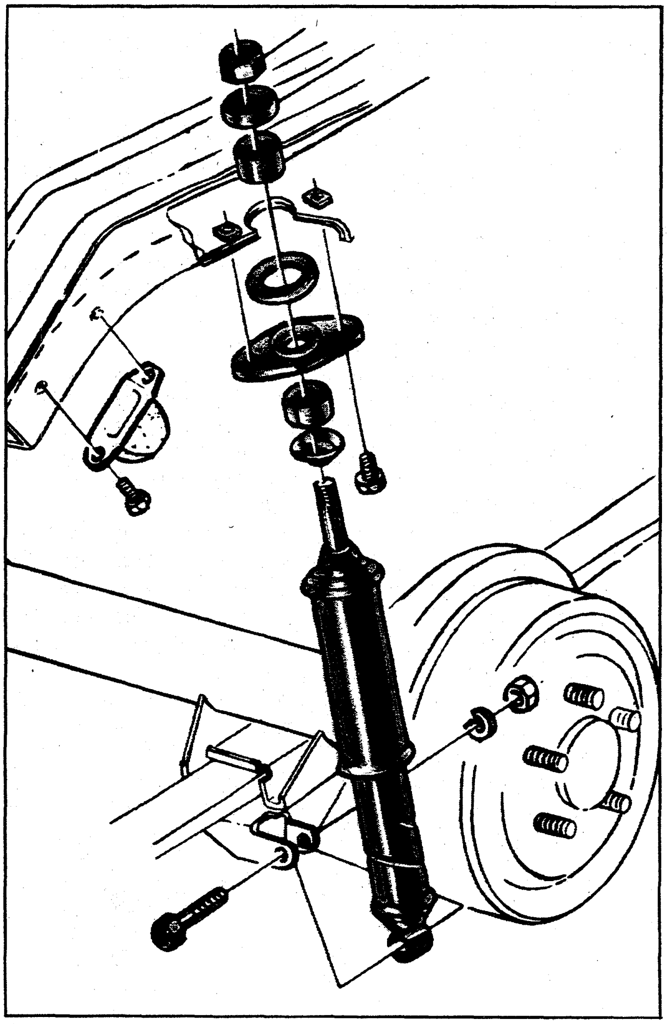


Fig. 29—Shock Absorber Mounting—Exploded View (Camaro)

crossmember.

3. Separate the control arm bracket from the cross-member. 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 31 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.

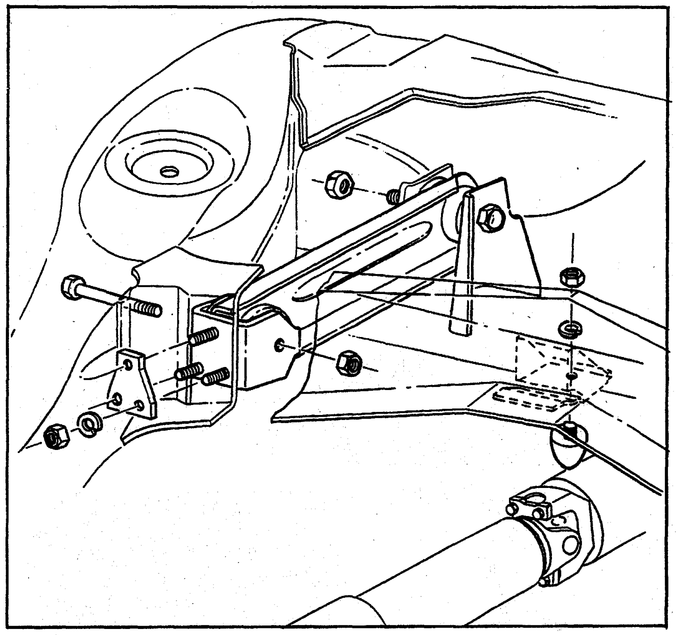


Fig. 30—Rear Suspension Upper Control Arm Attaching Points (Chevrolet)

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 32.
6. Install receiver, bridge, thrust bearing and nut to complete installation as shown in Figure 32.
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.

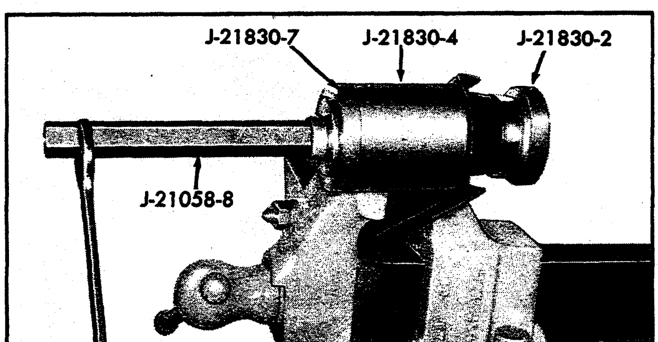


Fig. 31—Upper Control Arm Bushing Removal (Chevrolet)

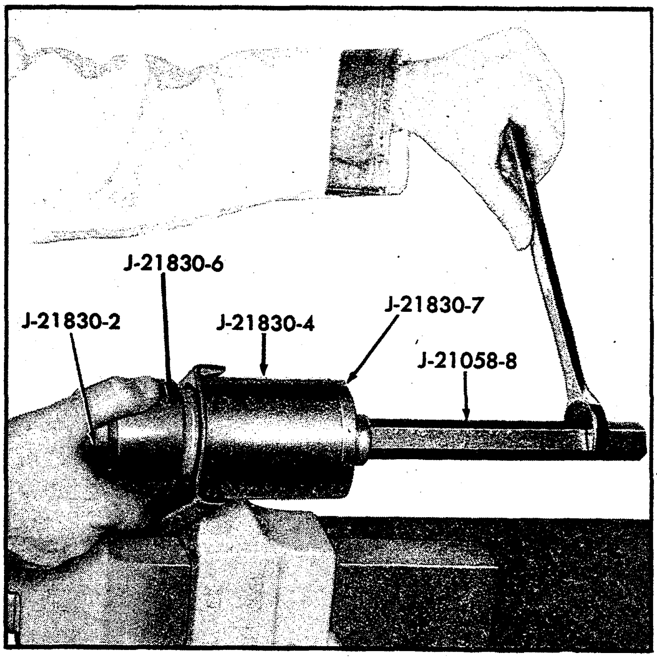


Fig. 32—Upper Control Arm Bushing Installation (Chevrolet)

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 crossmember reinforcement plate, lock washers and nuts to retain bracket in place.
4. Position vehicle so that weight is on suspension components and torque all affected parts to specifications.

Chevrolet Lower

Removal

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

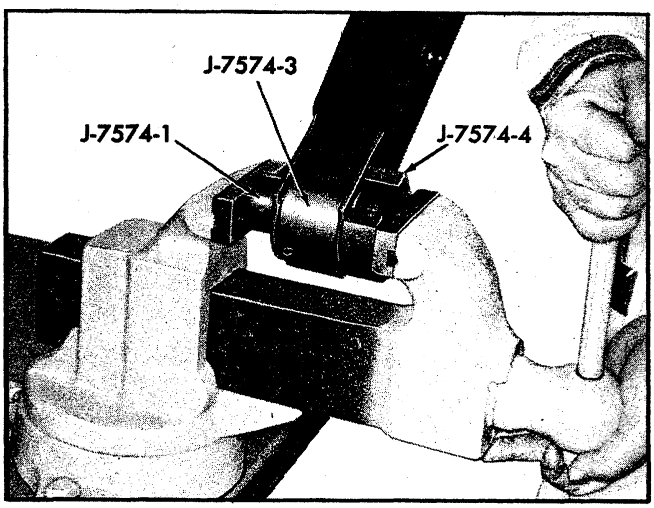


Fig. 33—Lower Control Arm Front Bushing Removal (Chevrolet)

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. Note position of control arm in forward attaching bracket and disconnect control arm at forward and rearward attaching points. 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 33 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.
   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. 34).
   e. Install thrust bearing and Nut J-21058-8. Screw nut against J-21058-7 to maintain proper relation-

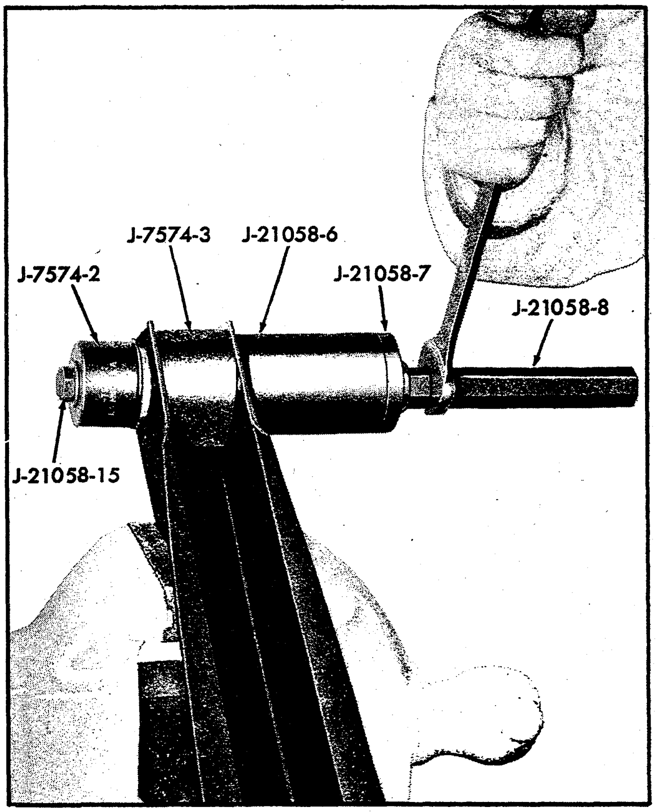


Fig. 34—Lower Control Arm Front Bushing Installation (Chevrolet)

ship 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.

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 35 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 36. 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

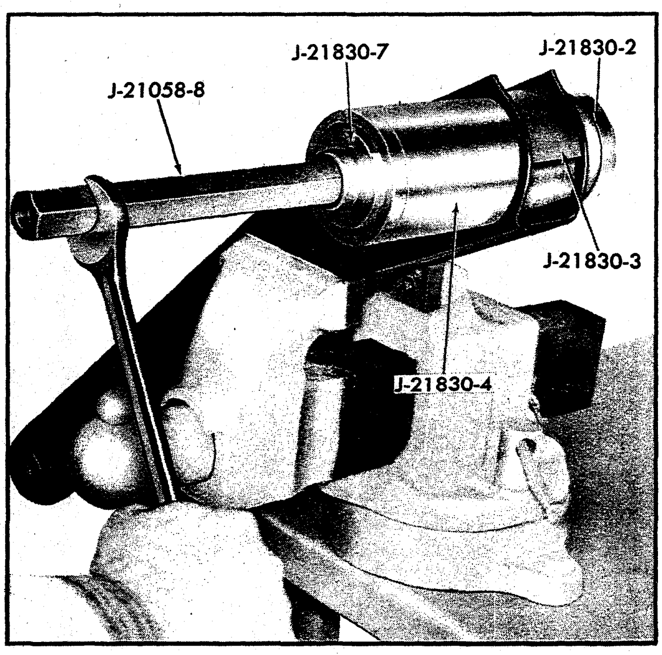


Fig. 35—Lower Control Arm Rear Bushing Removal (Chevrolet)

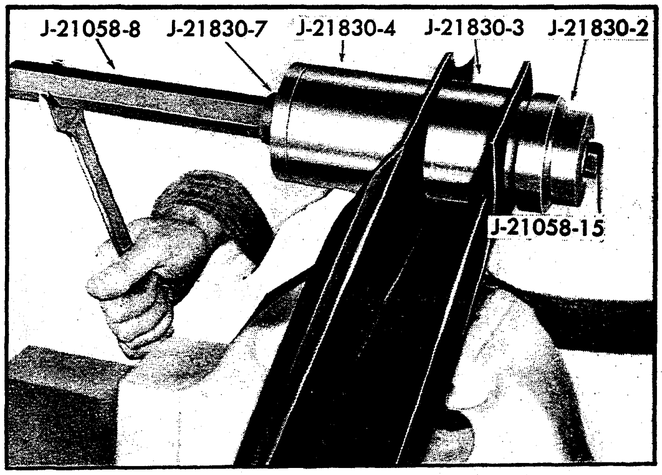


Fig. 36—Lower Control Arm Rear Bushing Installation (Chevrolet)

against side of control arm. Do not apply undue pressure to J-21058 after bushing is seated--to do so may cause permanent distortion to control arm.

g. Disassemble tools and check bushing for proper installation.

Installation

NOTE: Make sure control arm is reinstalled in proper forward attaching position. Reinstall in same hole as noted during removal. Top attaching hole is used for all installations except station wagons and heavy-duty suspension (RPO F41). Opposite arm must be installed in corresponding position.

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.

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 hand 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.

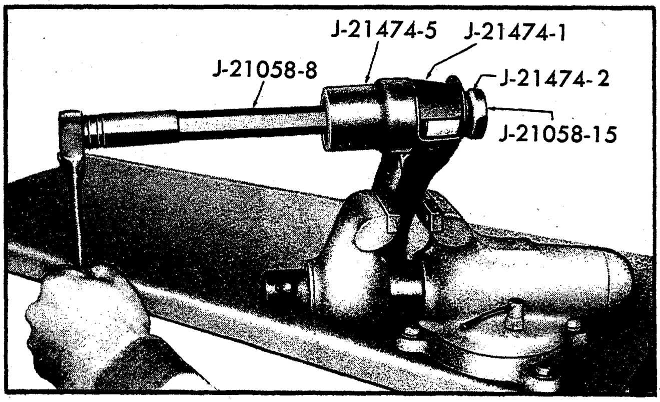


Fig. 37—Control Arm Bushing Removal (Chevelle)

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 37 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

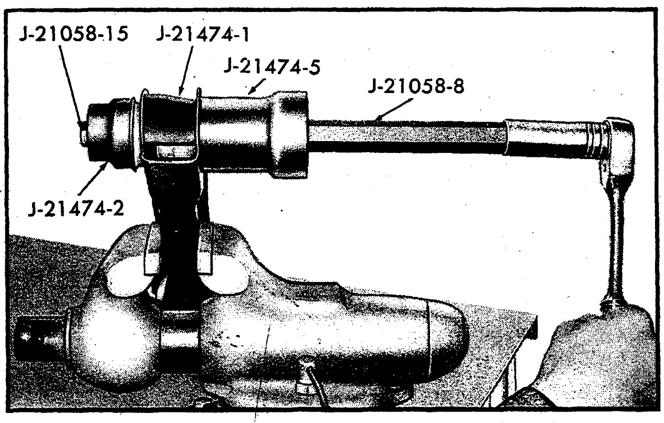


Fig. 38—Control Arm Bushing Installation (Chevelle)

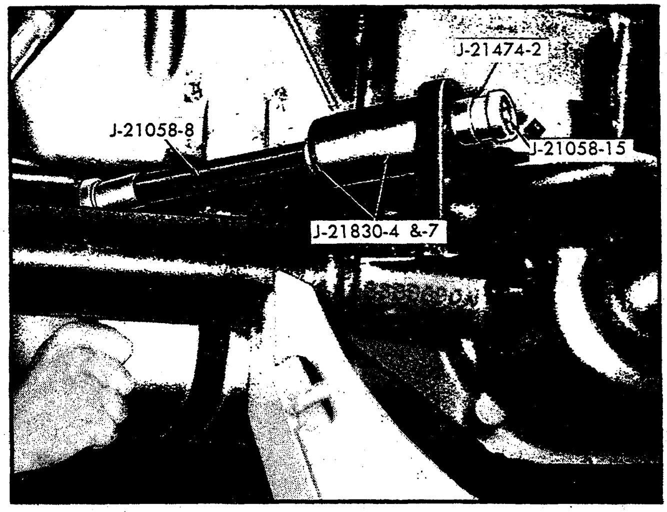


Fig. 39—Carrier Mounted Suspension Bushing Removal (Light-Duty) (Chevelle)

   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 38 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 39 for installed view of tools.

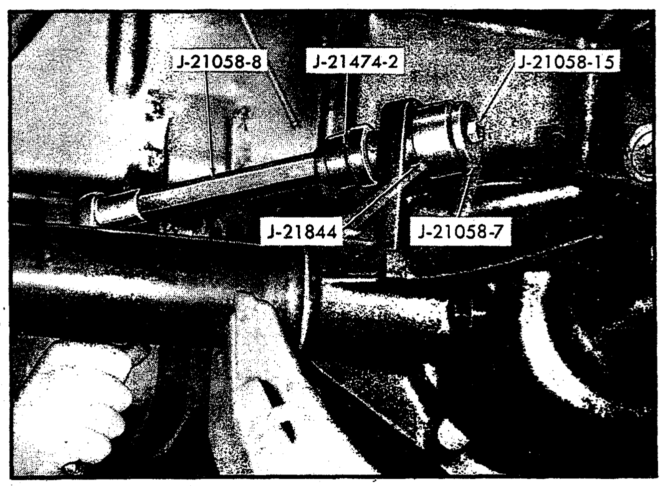


Fig. 40—Carrier Mounted Suspension Bushing Installation (Light-Duty) (Chevelle)

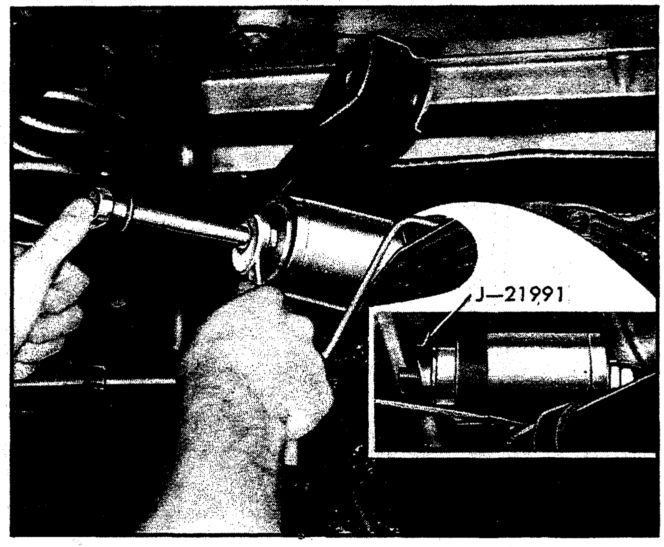


Fig. 41—Carrier Mounted Suspension Bushing Removal (Heavy-Duty) (Chevelle)

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 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 40 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.

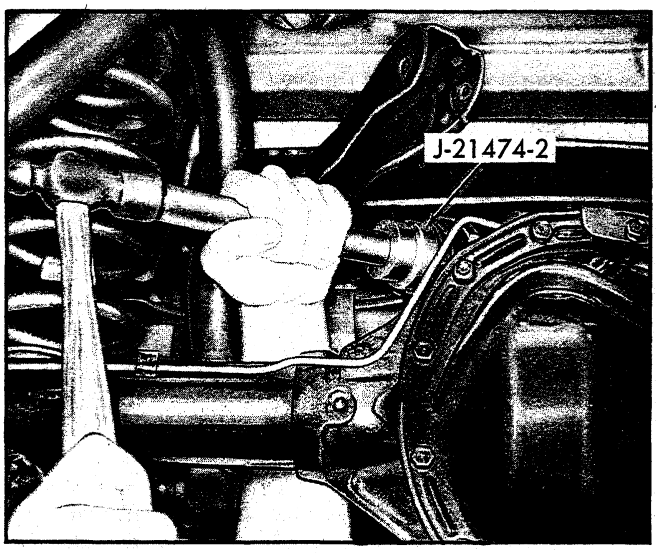


Fig. 42—Carrier Mounted Suspension Bushing Installation (Heavy-Duty) (Chevelle)

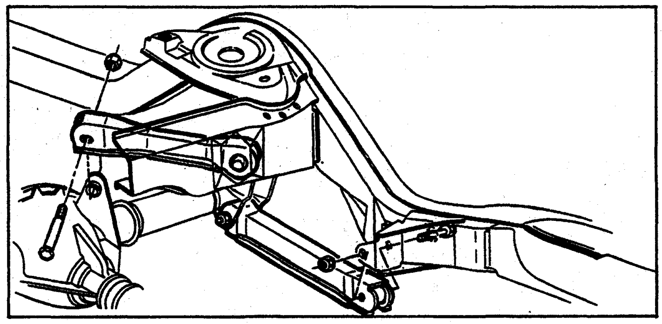


Fig. 43—Upper and Lower Control Arm Assembly (Chevelle)

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 41 for installed view of removal tools.
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 42 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 43 for installation view of control arms.
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 side and the nut and washer from the stud on the right side that secure the tie rod to the brackets (fig. 44). Withdraw the rod from under the vehicle. An external shell service bushing is available for left side on all models and both right and left on station wagons.

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.

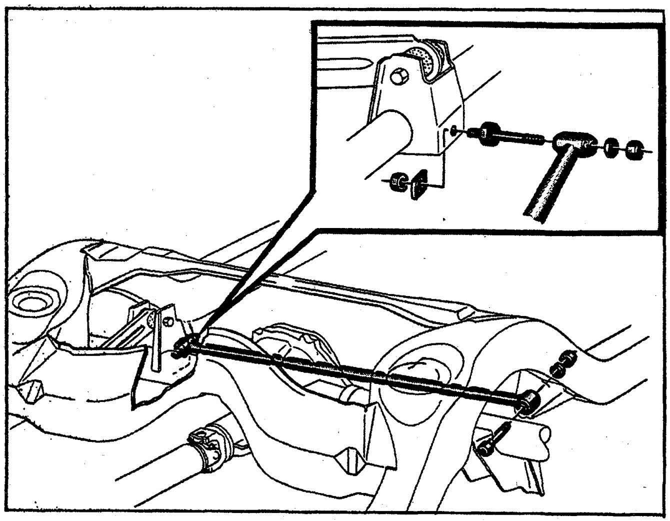


Fig. 44—Rear Suspension Tie Rod Attaching Points (Chevrolet)

Bushing Replacement

The following bushing removal procedure is effective for both ends of the tie rod used on station wagons and the left end of the tie rod used on all models except station wagons.

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 45.
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 45. Tool J-7877-3 should bottom on tie rod when bushing is fully installed.

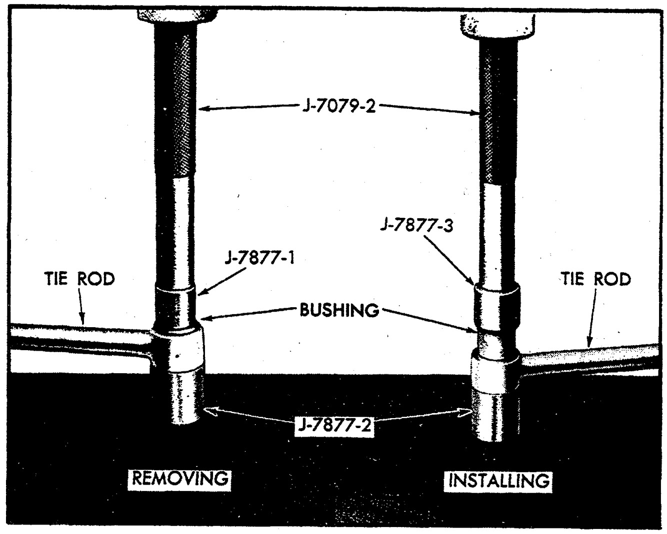


Fig. 45—Tie Rod Bushing Replacement (Chevrolet)

Installation

1. Mount the tie rod to the axle bracket stud. Install nut and special washer but do not tighten.

   NOTE: On the tie rod used on all models except station wagons, place flanged portion of bushing against attaching bracket.

2. Install the bolt, lock washer and nut to the frame bracket (fig. 44). Do not tighten.

   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.

COMPONENT PARTS REPLACEMENT (CORVETTE)

WHEEL SPINDLE AND SUPPORT (Fig. 46)

Removal

Remove wheel drive spindle as outlined previously in this section under "Wheel Bearing Adjustment".

Repairs

1. Out of 3/8" square steel bar stock, make bearing removers and use as shown in Figure 47.
2. After removing deflector, spindle inner grease seal and inner bearing race, bearing cups may be removed while spindle support is still mounted to the torque arm, by inserting remover tool and tapping cup out. New bearing cups are installed using Tool J-7817 cup installer and handle J-8092 (fig. 48).
3. To remove spindle support from torque arm, proceed as follows.
   a. Disconnect parking brake cable from actuating lever.
   b. Remove four nuts securing support to torque arm and withdraw brake backing plate and position it out of the way.
   c. Disconnect shock absorber lower eye from strut rod mounting shaft. It may be necessary to support spring outer end before disconnecting shock absorber, as shock absorber has internal rebound control.
   d. Remove cotter pin and nut from strut rod mounting shaft, then pull shaft from support and strut rod.
   e. Spindle support may then be removed and bearing cups serviced as in Step 2 above.
4. To remove drive spindle outer bearing and seal proceed as follows.
   a. Position Tool J-8331 between chamfered edge of bearing seat and inner race of bearing (fig. 49). Clamp Tool J-8331 in a vise and apply pressure to unseat bearing.

   CAUTION: Use extreme caution when positioning Tool J-8331 against machined surface of spindle. Make sure all tool imperfections such as nicks and burrs are removed from spindle contact area before applying pressure to unseat bearing.

   b. Position Tool J-8331 and spindle in an arbor press and press bearing from spindle (fig. 50).
   c. Remove outer seal and inspect for damage--replace if necessary. Outer seal must be placed on spindle before outer bearing inner race and roller

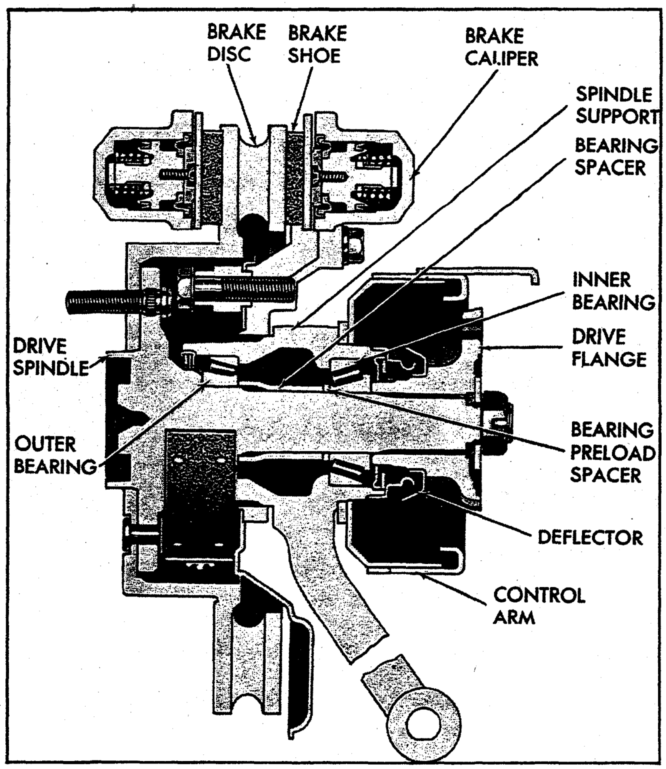


Fig. 46—Wheel Spindle and Support Cross-Section (Corvette)

assembly is installed.

d. Pack outer bearing with a high-melting point wheel bearing lubricant and position on spindle. Large end of bearing should be toward shoulder on spindle.

e. Press bearing on spindle using a bearing spacer and Tool J-9436 as installers, as shown in Figure 50.

5. Pack spindle inner bearing with a high-melting point wheel bearing lubricant and position bearing in spindle support - small end of bearing should be positioned inward.

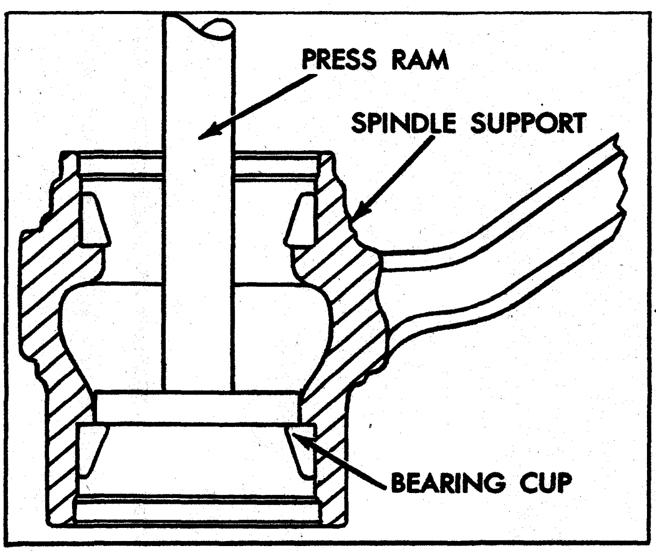


Fig. 47—Bearing Cup Removal (Corvette)

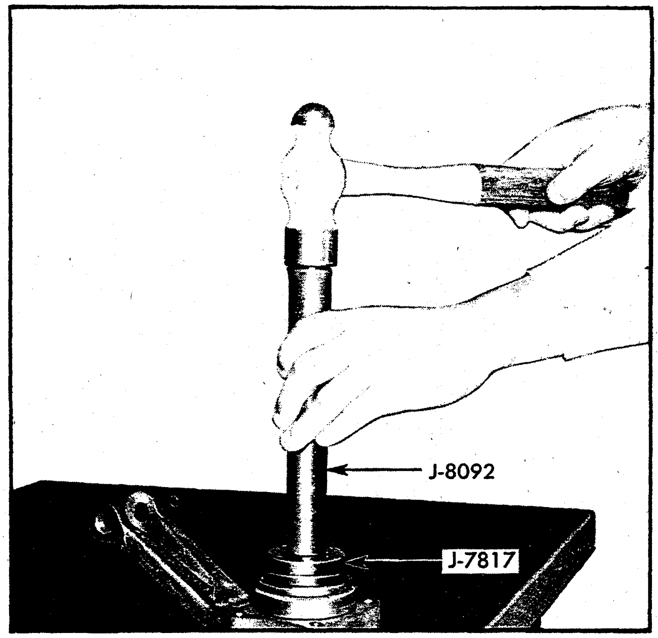


Fig. 48—Installing Spindle Bearing Cup (Corvette)

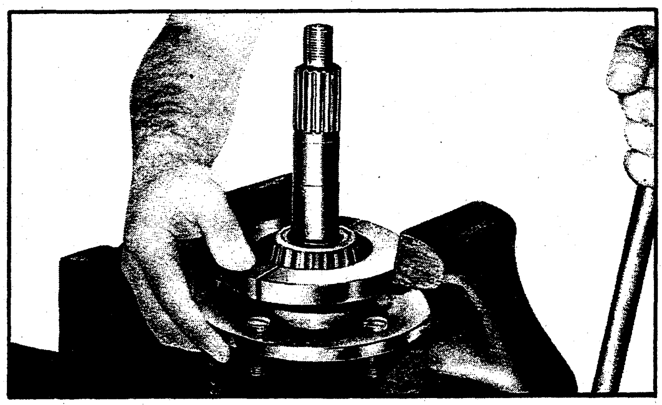


Fig. 49—Unseating Drive Spindle Outer Bearing (Corvette)

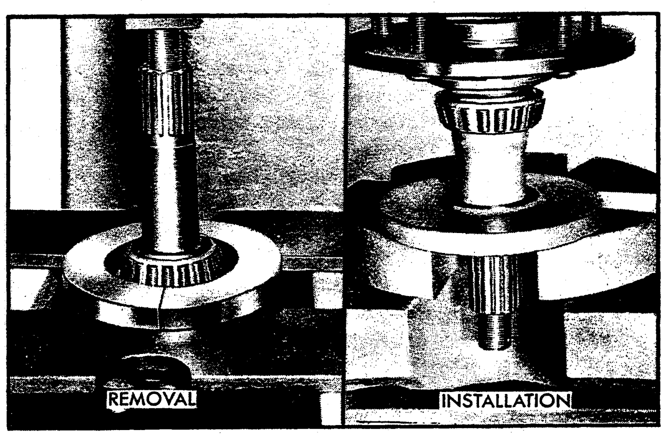


Fig. 50—Removing and Installing Drive Spindle Outer Bearing (Corvette)

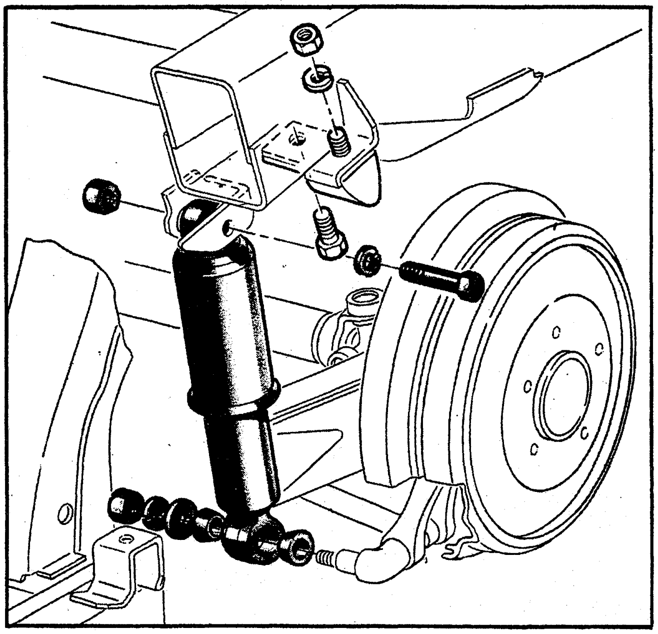


Fig. 51—Shock Absorber Installation (Corvette)

6. Tap new spindle inner grease seal into seal bore and install deflector over support inner end.

Installation

1. Position support over torque arm bolts with strut rod fork toward center of vehicle and downward. Place backing plate over studs and torque nuts to specifications.
2. Connect parking brake cable to actuating lever.
3. Install drive spindle assembly as outlined previously in this section under "Wheel Bearing Adjustment".
4. If new spindle support or associated parts are installed, determine correct shim size as follows.
   a. Assemble spindle to support, using a .145" shim.
   b. Check bearing adjustment and correct as necessary, following adjustment procedures previously outlined.

DIFFERENTIAL CARRIER SUPPORT BRACKET REPLACEMENT

1. Place a 1/2" thick block of wood or steel between nose of differential carrier and floor pan. This will prevent carrier from twisting upward when support bracket is disconnected.
2. Remove carrier support-to-crossmember attaching bolt.
3. Remove nut from both of the bracket-to-carrier through bolts.
4. Slide bolts to one side until bolt head contacts floor well. Mark the floor well at this point and drill a 3/4" diameter hole for each bolt in floor well and remove bolts.
5. Assemble carrier support bracket by reversing above procedure. Torque all affected parts to specifications.
6. Insert plastic plugs from the inside of the floor well holes to prevent dust and water entry.

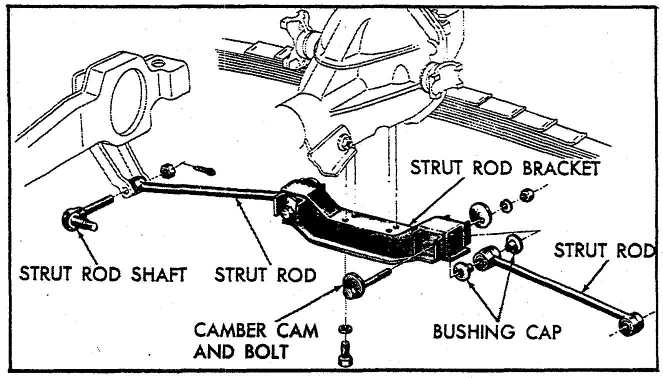


Fig. 52—Strut Rods (Corvette)

SHOCK ABSORBER (Fig. 51)

Removal

1. Disconnect shock absorber upper mounting bolt.
2. Remove lower mounting nut and lock washer.
3. Slide shock upper eye out of frame bracket and pull lower eye and rubber grommets off strut rod mounting shaft.
4. Inspect grommets and shock absorber upper eye for excessive wear.

Installation

1. Slide upper mounting eye into frame mounting bracket and install bolt, lock washer and nut.
2. Place rubber grommet, shock lower eye, inboard grommet, washers and nut over strut rod shaft.
3. Torque nuts to specifications.

STRUT ROD AND BRACKET (Fig. 52)

Removal

1. Raise vehicle enough to provide working clearance.
2. Disconnect shock absorber lower eye from strut rod shaft.
3. Remove strut rod shaft cotter pin and nut. Withdraw shaft by pulling toward front of vehicle (fig. 53).
4. Mark relative position of camber adjusting cam and

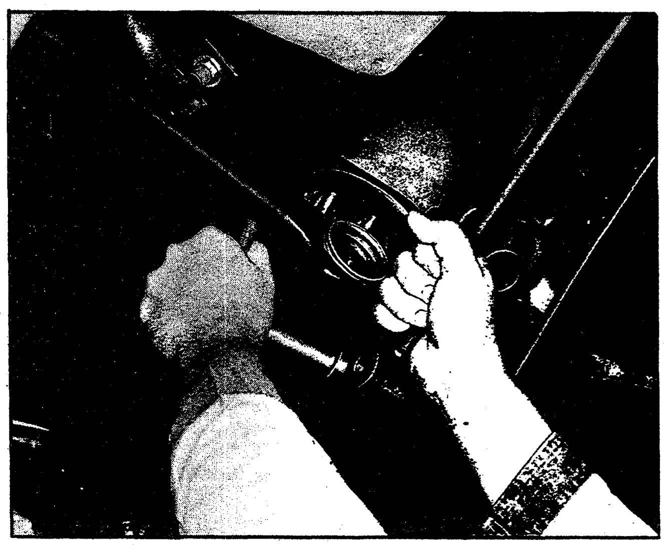


Fig. 53—Removing Strut Rod Shaft (Corvette)

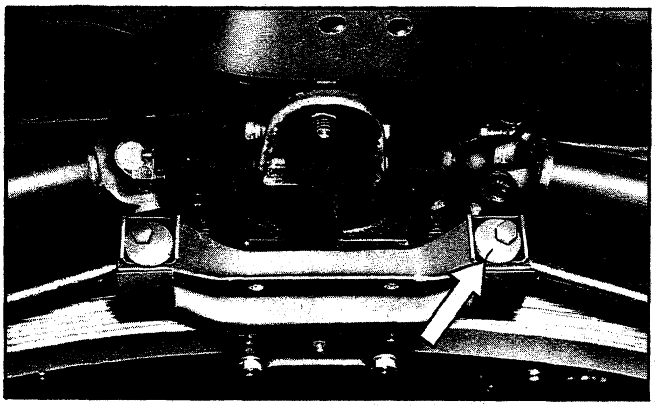


Fig. 54—Marking Camber Cam and Bracket (Corvette)

bracket, so they may be reassembled in same location (fig. 54).

5. Loosen camber bolt and nut. Remove four bolts securing strut rod bracket to carrier and lower bracket.
6. Remove cam bolt nut and cam and bolt assembly. Pull strut down out of bracket and remove bushing caps.
7. Inspect strut rod bushings for wear and replace where necessary. Replace strut rod if it is bent or damaged in any way.

Repairs

1. With strut rod bushing centered over Tool J-7877-2 and with strut rod supported horizontally, press or drive bushing from rod, using Tools J-7877-1 and J-7079-2 as shown in Figure 55.
2. With strut rod end 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 55. Tool J-7877-3 should bottom on strut rod when bushing is fully installed.

Installation

1. Place bushing caps over inboard bushing and slide rod into bracket. Install cam and bolt assembly and adjust cam to line up with mark on bracket. Tighten nut but do not torque at this point.

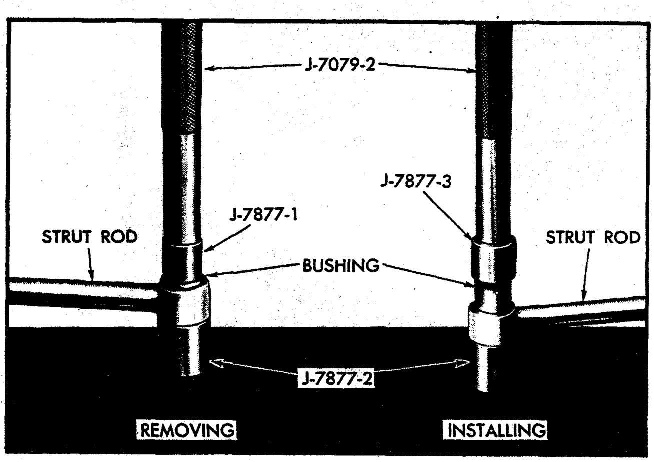


Fig. 55—Strut Rod Bushing Replacement

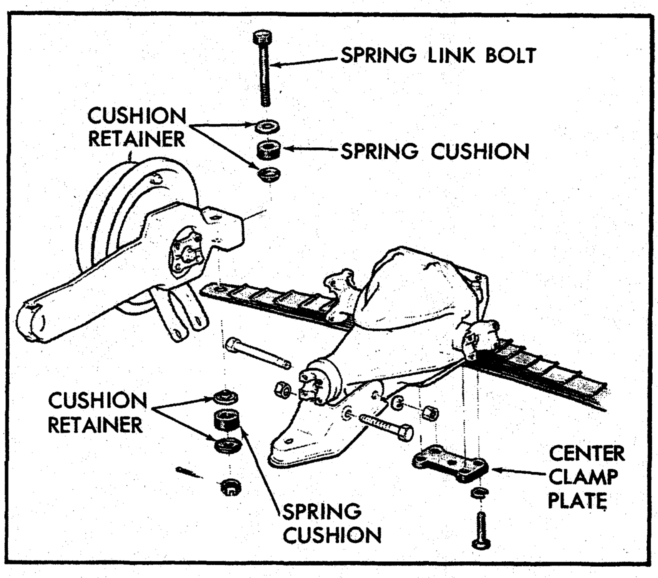


Fig. 56—Spring Mounting (Corvette)

2. Raise bracket and assemble to carrier lower mounting surface. Torque bolts to specifications.
3. Raise outboard end of strut rod into spindle support fork and insert strut rod shaft into fork so that flat on shaft lines up with corresponding flat in spindle fork. Install retaining nut, but do not torque.
4. Place shock absorber lower eye and bushing over strut shaft, install washer and nut and torque to specifications.
5. Lower vehicle to floor and torque camber cam nut and strut rod shaft nut to specifications. Then install cotter pin through rod bolt.
6. Check rear wheel camber and adjust where necessary.

SPRING (Fig. 56)

Removal

1. Raise rear of vehicle and support on frame slightly forward of torque control arm pivot points. Remove wheels and tires.

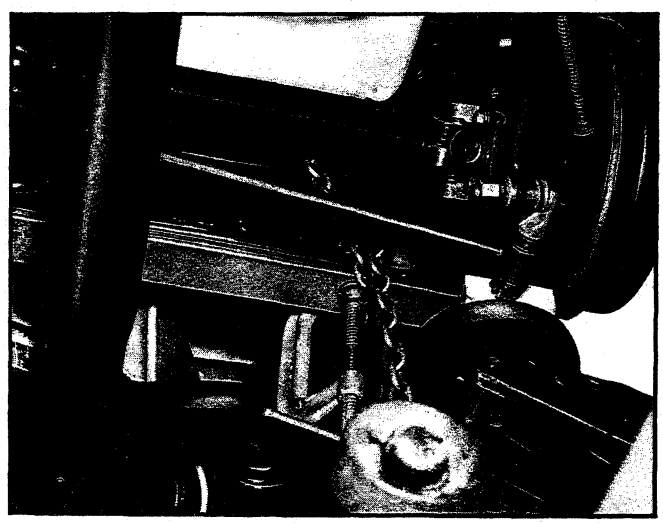


Fig. 57—Chain Installation (Corvette)

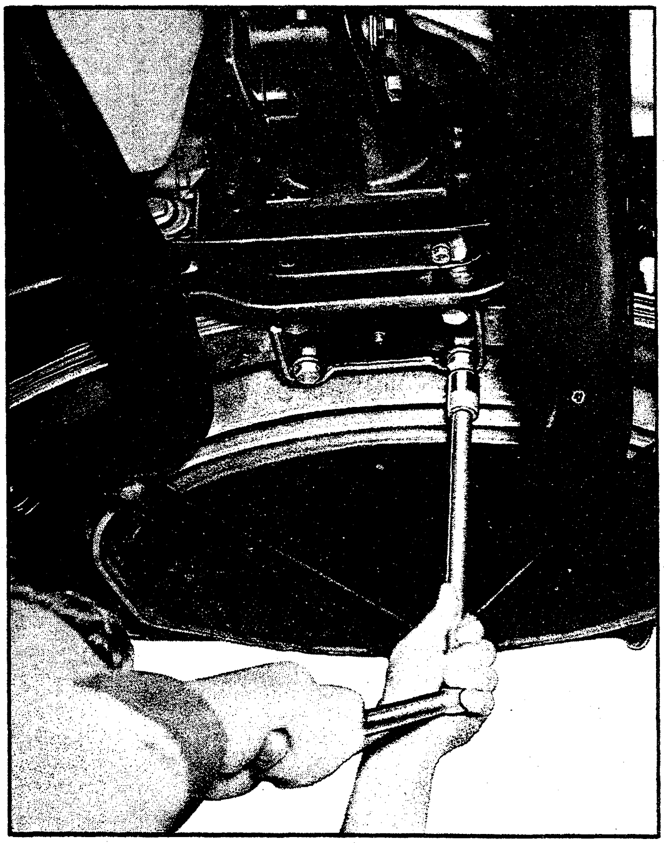


Fig. 58—Removing Clamp Plate (Corvette)

2. Place floor jack under spring at link bolt, and raise spring until nearly flat.
3. Wrap 1/4" or 5/16" chain with grab hook around suspension crossmember and spring and hook chain securely with grab hook. Secure chain to spring with C clamp to prevent slipping (fig. 57).

CAUTION: Use 1/4" or 5/16" chain only with a safe grab hook for this operation. Do not use rope, wire, cable or other method of retaining spring.

4. Lower jack to free link bolt and remove link bolt cotter pin, nut and rubber cushions.

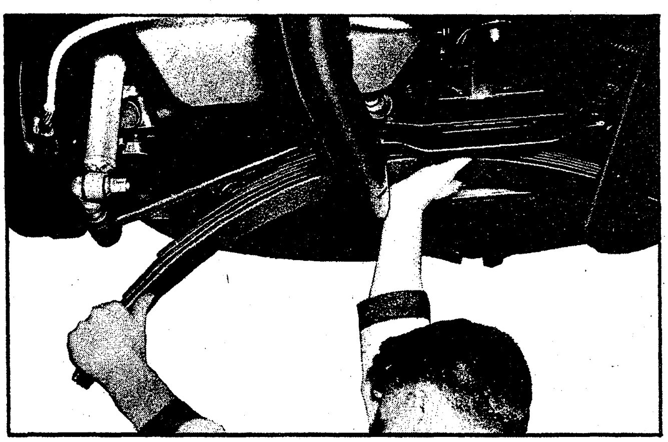


Fig. 59—Lowering Spring (Corvette)

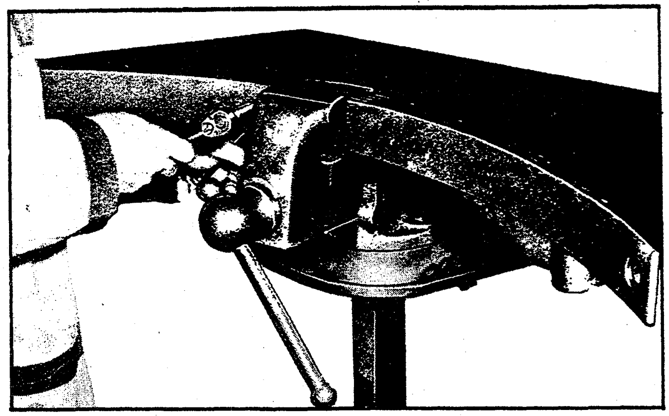


Fig. 60—Removing Center Bolt (Corvette)

5. Support and raise spring end as in Step 2 above, remove chain when loose.
6. Carefully lower jack until spring tension is completely released.
7. Repeat Steps 2-6 on other side.
8. Remove four bolts and washers securing spring center clamp plate (fig. 58).
9. Drop spring and slide out from under vehicle (fig. 59).

Repairs

1. Clamp spring center section in vise and remove center bolt (fig. 60).
2. Release vise, remove spring and separate leaves.
3. Replace worn or damaged liners as necessary and replace any broken leaves.
4. Replace main leaf spring cushion retainers by chiseling over flared portion until retainer may be knocked out of leaf. Place new retainers into position and flare over with a ball peen hammer or other suitable tool.
5. Insert drift into center bolt holes in leaves to align spring leaves (fig. 61). Install center bolt and tighten securely.

Installation

1. Place spring on carrier cover mounting surface, indexing center bolthead with hole in cover.

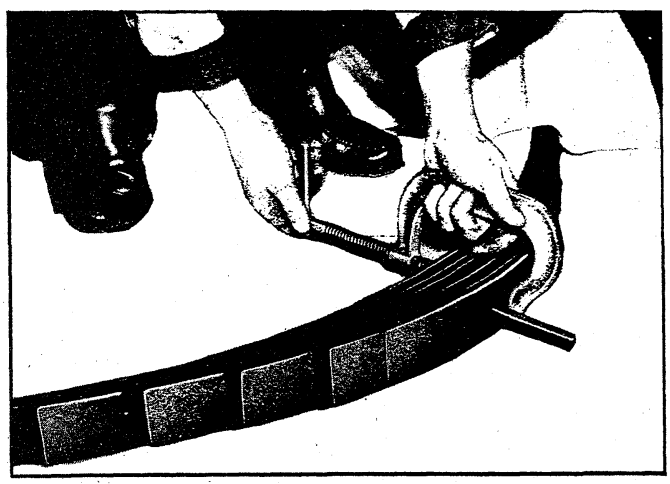


Fig. 61—Aligning Spring Leaves (Corvette)

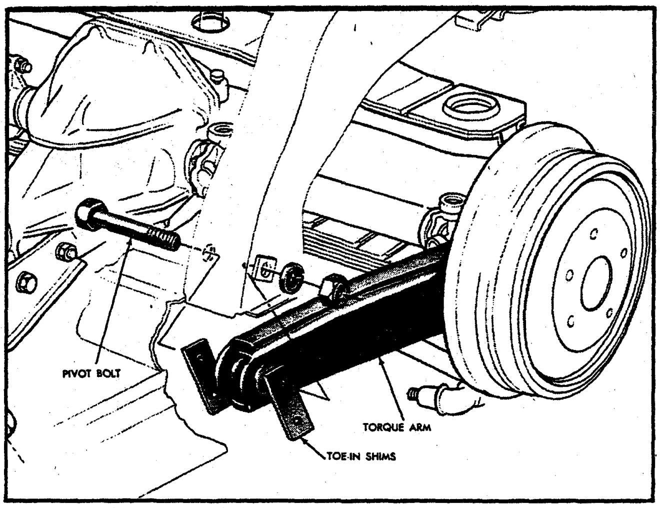


Fig. 62—Torque Control Arm (Corvette)

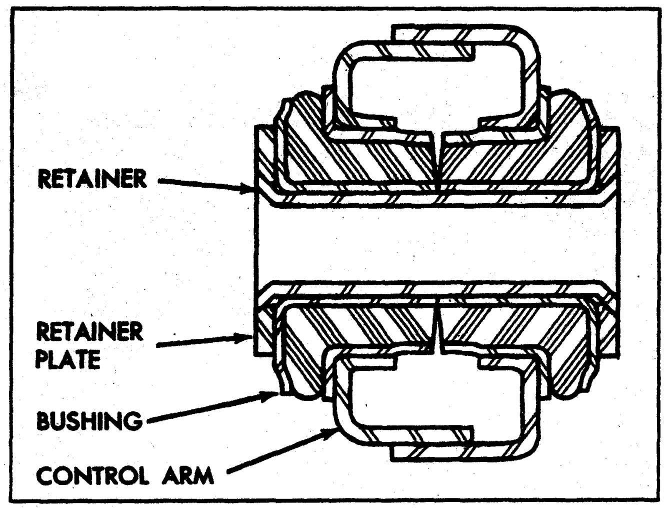


Fig. 63—Torque Control Arm Bushing Cross-Section (Corvette)

2. Place center clamp plate in position and install four bolts and washers. Tighten bolts and torque to specifications.
3. Raise spring outer end with floor jack until spring is nearly flat and secure with chain as in Step 3—Removal.
4. Lower jack, align torque control arm with spring end and insert link bolt, rubber cushions and retainers. Install castellated nut on link bolt and tighten until cotter pin hole in bolt is visible. Insert new cotter pin and bend ends around.
5. Raise spring end with jack under link bolt, and remove chain and C clamp when loose.
6. Carefully lower jack, making sure rubber cushions remain indexed in retainers.
7. Remove jack and repeat on opposite side. Install wheels and tires, remove frame supports and lower vehicle to floor.

TORQUE CONTROL ARM (Fig. 62)

Removal

1. Disconnect spring on side torque arm is to be removed. Follow Steps 1-6, Spring-Removal.

   NOTE: If vehicle is so equipped, disconnect stabilizer rod from torque arm - refer to "Stabilizer Rod Replacement".

2. Remove shock absorber lower eye from strut rod shaft.
3. Disconnect and remove strut rod shaft and swing strut rod down.
4. Remove four bolts securing axle drive shaft to spindle flange and disconnect drive shaft.

   NOTE: It may be necessary to force torque arm outboard to provide clearance to drop drive shaft.

5. Disconnect brake line at wheel cylinder inlet or caliper and from torque arm. Disconnect parking brake cable.
6. Remove torque arm pivot bolt and toe-in shims and pull torque arm out of frame. Tape shims together and identify for correct reinstallation.

NOTE: For service operations pertaining to the spindle support assembly, refer to service operations under Wheel Spindle and Support earlier in this section.

Repairs (Fig. 63)

1. Using 11/16" drill, drill out flared end of bushing retainer (fig. 64).
2. Remove special retainer plate and tap retainer out of bushing.
3. Remove bushings by spreading them apart with a chisel and tap out of arm (fig. 65).

   NOTE: If bushing diameters are severely rusted in torque arm, and arm tends to spread during removal, clamp arm in a C-clamp to prevent spreading.

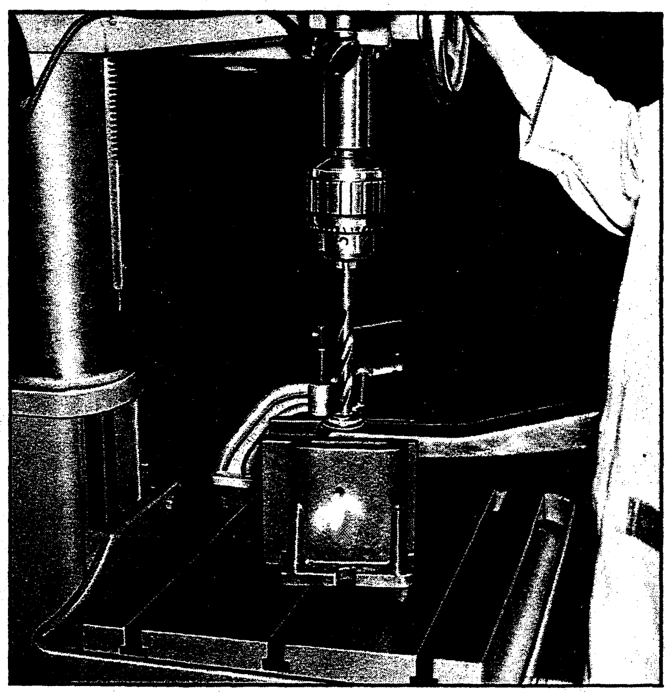


Fig. 64—Drilling Out Retainer Flare (Corvette)

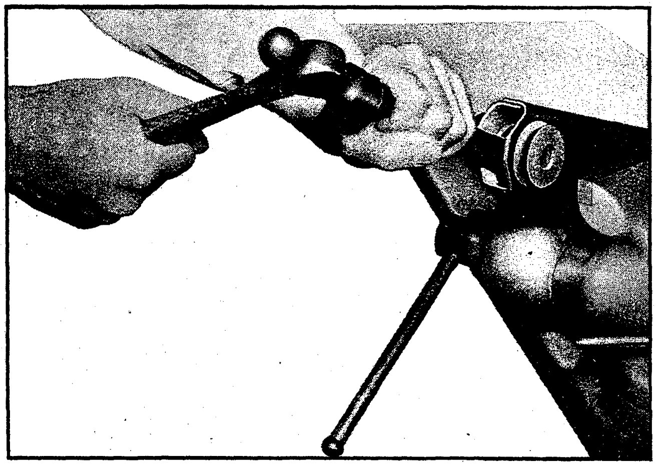


Fig. 65—Removing Bushings (Corvette)

4. Lightly oil new bushing diameters (not rubber portion) and start bushings squarely in arm.
5. Install Tool J-7055-1 as shown in Figure 66 and press bushings into place.
6. When bushings are fully installed, place special plate over flared portion of new bushing retainer and insert retainer into bushing.
7. Out of 5/8" thick steel plate 1-1/2" wide make flaring tool support to the dimensions shown in Figure 67 and drill clearance holes as shown for 2 – 1/2" bolts.
8. Place fabricated back-up plate on flared end of bushing retainer and assembly Tool J-8111-23 to plate with 2–1/2" bolts 5" long. Make sure threaded hole in J-8111-23 is centered over unflared end of bushing retainer and that chambered retainer plate is centered over retainer tube.
9. Lightly oil pointed end of J-8880-5 screw and thread into J-8111-23 until pointed end contacts bushing retainer. Continue threading J-8111-23 until retainer is flared (fig. 68).

Installation

1. Place torque arm in frame opening.
2. Place toe-in shims in original position on both sides of torque arm, install pivot bolt and tighten but do not torque at this point.

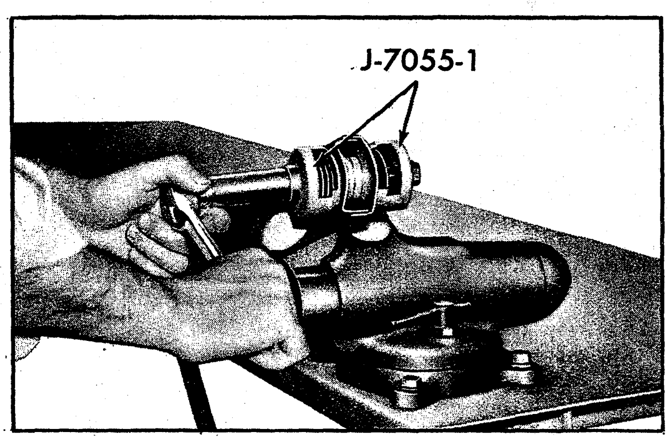


Fig. 66—Installing Bushings (Corvette)

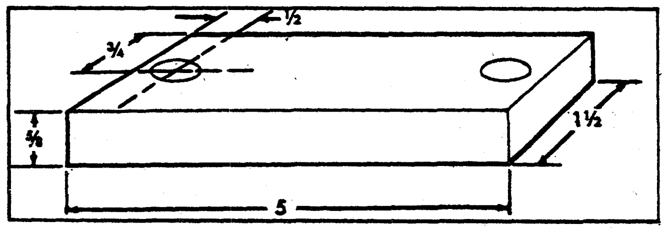


Fig. 67—Flaring Tool Back-Up Plate (Corvette)

3. Raise axle drive shaft into position and install to drive flange. Torque bolts to specifications.
4. Raise strut rod into position and insert strut rod shaft so that flat lines up with flat in spindle support fork. Install nut and torque to specifications.
5. Install shock absorber lower eye and tighten nut to specifications.
6. Connect spring end as outlined under Spring-Installation, Steps 3-6.

   NOTE: If vehicle is so equipped, connect stabilizer shaft to torque arm - refer to "Stabilizer Shaft Replacement".

7. Install brake disc and caliper, wheel and tire and lower vehicle. Tighten torque arm pivot bolt. Bleed brakes as outlined in Section 5-Brakes.

SUSPENSION CROSSMEMBER

Removal

1. Disconnect and remove spring as outlined under Spring-Removal.
2. Remove differential carrier assembly as outlined under Differential Carrier-Removal in this section.
3. Support crossmember, remove bolts securing crossmember isolation mounts to frame and lower crossmember (fig. 69).

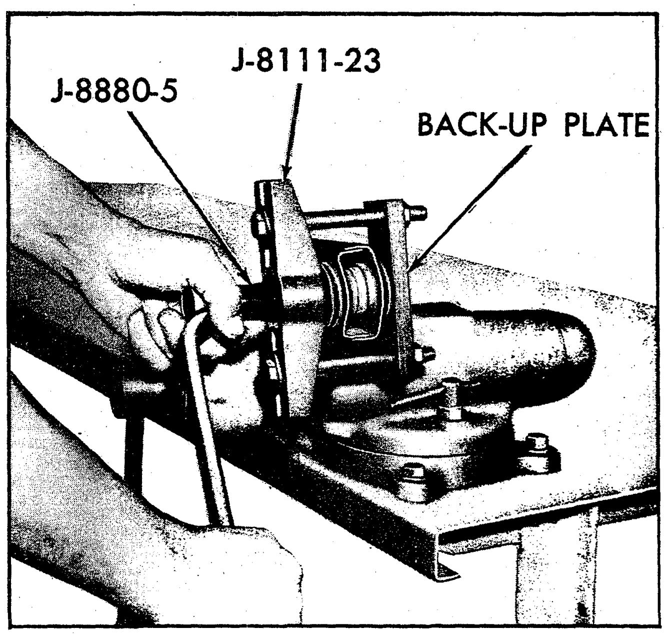


Fig. 68—Flaring Retainer (Corvette)

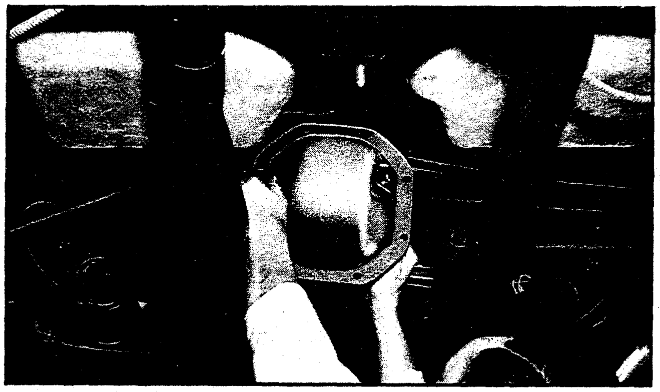


Fig. 69—Removing Crossmember (Corvette)

4. Remove bolts securing carrier cover to crossmember.
5. Inspect rubber isolation mounts for aging and replace where necessary.

Repairs—Isolation Mount

1. Bend back isolation mount tabs to allow mount removal (fig. 70).
2. Place crossmember on a suitable support and press mount out of arm using a piece of suitable size pipe or tubing on outer shell or inner insert.
3. Place new mount into position on crossmember, compress outer sleeve and press mount into place until it is fully and squarely seated.
4. After installation, bend over locking tabs.

Installation

1. Install carrier cover to crossmember and torque bolts to specifications.
2. Raise crossmember into position and install mounting bolts. Torque bolts to specifications.
3. Install differential carrier assembly as outlined under Differential Carrier - Installation in this section.
4. Install wheels and tires, remove frame supports and lower vehicle.

STABILIZER SHAFT REPLACEMENT

1. Raise rear of vehicle and support at frame side rail with stand jacks.
2. Disconnect stabilizer shaft at both torque arms (fig. 71). Remove stabilizer shaft brackets from the frame and withdraw assembly from vehicle.

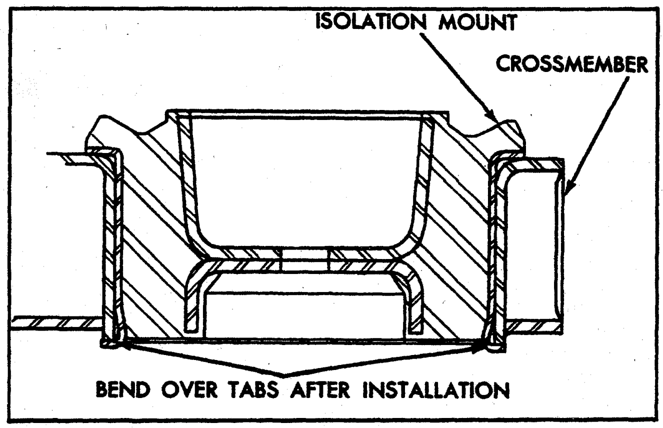


Fig. 70—Crossmember Mount Cross-Section (Corvette)

3. Inspect bushings for signs of deterioration, and inspect shaft for bends, breaks or other defects - do not attempt to straighten shaft - replace parts as deemed necessary.
4. Position bushings on shaft and loosely install shaft to torque arms and at frame brackets.
5. Align shaft to assume proper placement when bolts are torqued, and torque attaching bolts to specifications.

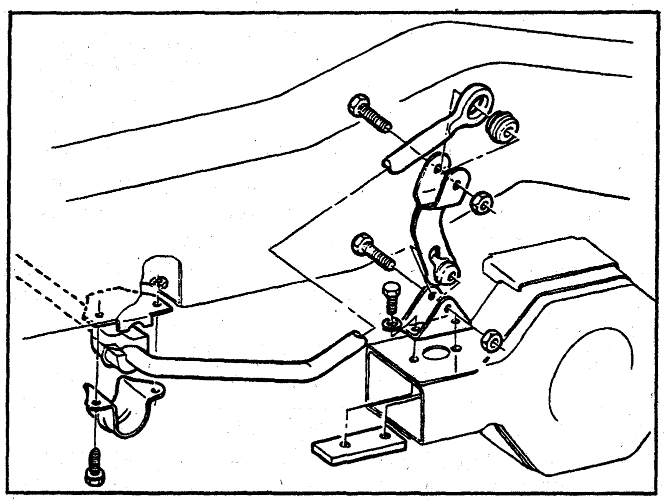


Fig. 71—Stabilizer Shaft Installation (Corvette)

DRIVE LINE
REAR AXLE

INDEX

GENERAL DESCRIPTION

CHEVROLET, CHEVELLE, CHEVY II AND CAMARO

The rear axle (fig. 72) is a semifloating, fabricated construction 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 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 and Camaro 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 supported by 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 supported by two preloaded tapered roller bearings.

CORVETTE

The Corvette rear axle is of the type where the differential carrier housing enclosing the differential and hypoid gears is supported on a crossmember mounted to the chassis frame. The differential is connected through universal joints to the drive shafts and wheels (fig. 73).

The internal components of the carrier are of conventional design, incorporating a hypoid gear set with an overhung pinion supported on two pre-loaded, tapered roller bearing assemblies, and a two-pinion differential assembly supported on tapered roller bearings. Pinion mounting distance adjustments are made through the use of shims, as are the differential bearing pre-load and backlash adjustments. The differential side gears drive two splined yokes which are retained laterally by snap rings located on the yoke splined end. The yokes are supported on caged needle bearings pressed into the carrier, adjacent to the differential bearings. A lip seal, pressed in outboard of the bearings, prevents oil leakage and dirt entry. The carrier cover is bolted to the carrier and provides accessibility to the internal parts. The cover incorporates two integral, reinforced mounting pads which serve as the carrier attaching point to the suspension crossmember, and an attaching point for the spring center section. The filler plug is located on the right side of the cover near the bolting flange.

All service operations allow carrier removal without removing the carrier cover. Cover removal is not necessary in any of the service procedures except in the case of complete carrier housing replacement, as the carrier and cover are serviced as an assembly.

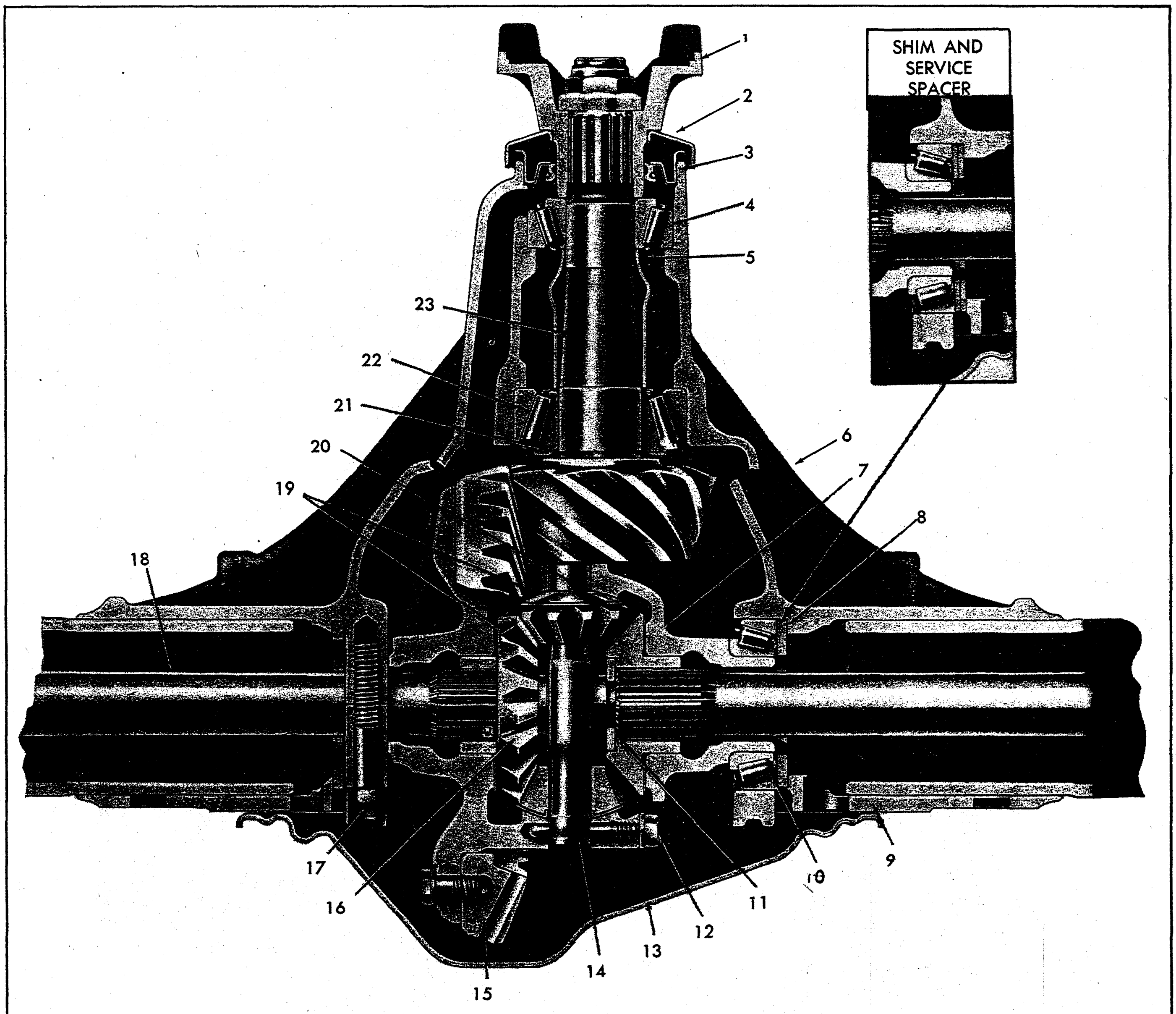


Fig. 72—Rear Axle Cross-Section (Chevrolet, Camaro, Chevelle and Chevy II)

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

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.

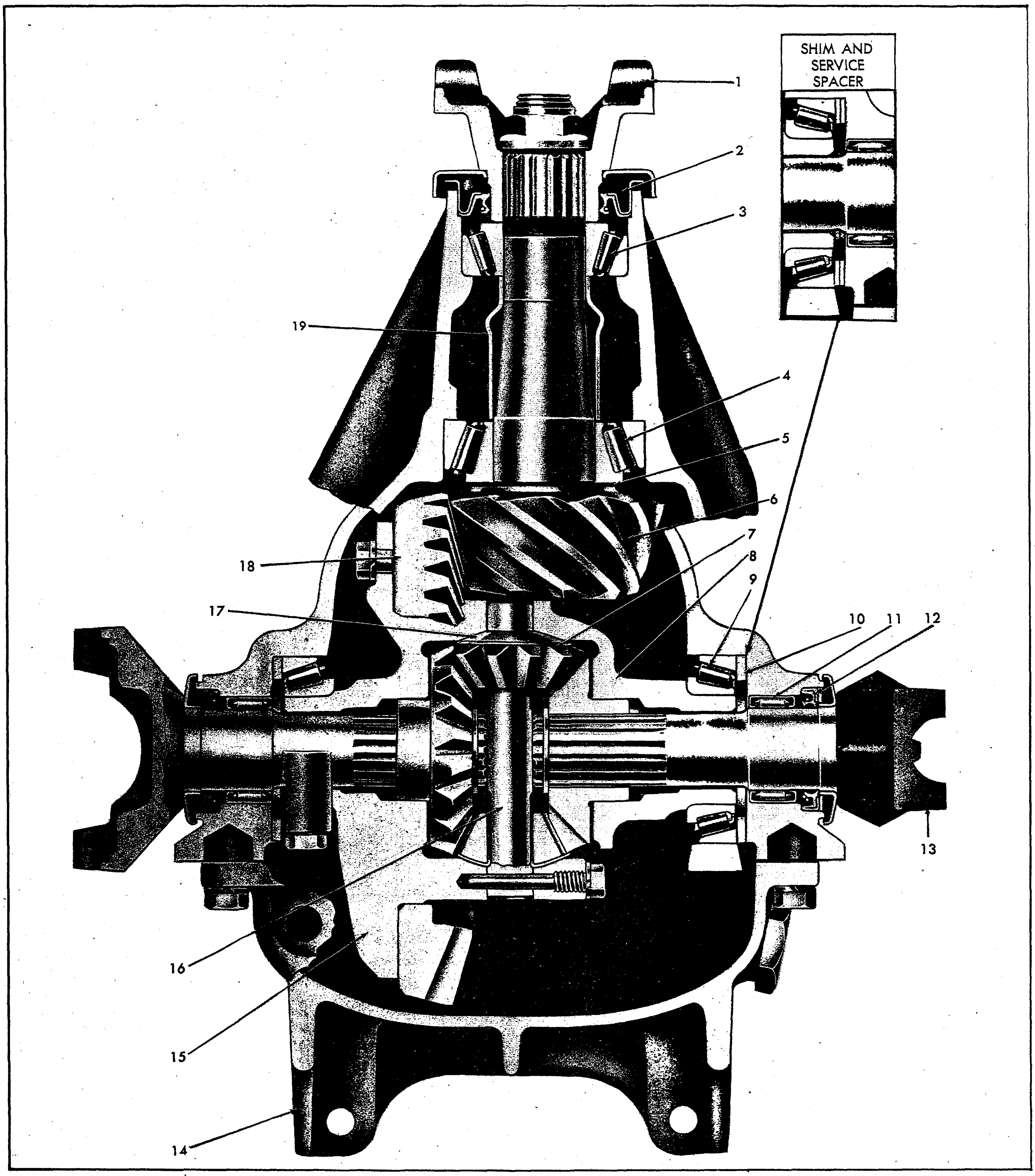


Fig. 73—Rear Axle Cross-Section (Corvette)

1. Companion Flange
2. Pinion Seal
3. Front Pinion Bearing
4. Rear Pinion Bearing
5. Pinion Shim
6. Pinion
7. Differential Pinion
8. Differential Side Gear
9. Differential Bearing
10. Differential Bearing Shim
11. Yoke Bearing
12. Yoke Bearing Seal
13. Side Gear Yoke
14. Carrier Cover
15. Differential Case
16. Differential Pinion Shaft
17. Thrust Washer
18. Ring Gear
19. Pinion Bearing Spacer

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.

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 eliminiate 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.

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 seldom 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.

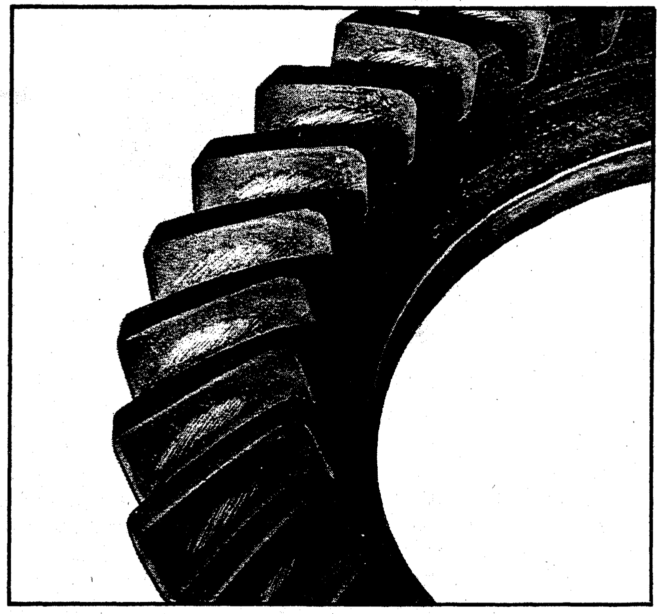


Fig. 74—Scored Hypoid Ring Gear

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.

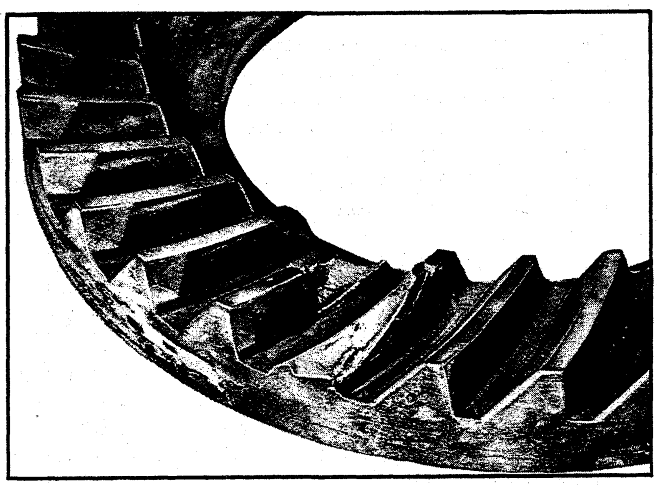


Fig. 75—Cracked Hypoid Ring Gear

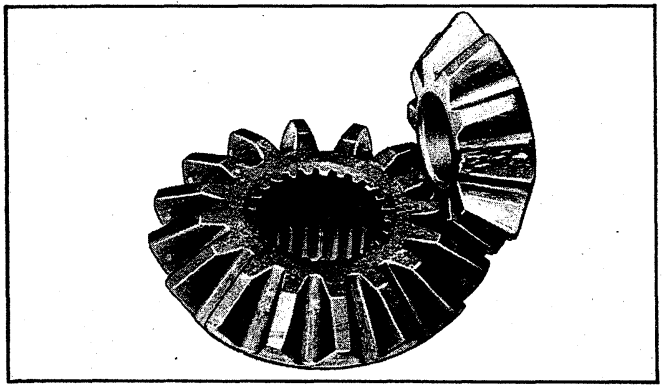


Fig. 76—Differential Gear Failure

Hypoid Gears

Hypoid gear tooth scoring (fig. 74) is caused generally by improper break-in, incorrect lube, 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. Another cause of hypoid tooth fracture (fig. 75) 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. 76).

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 eventual failure. This failure may also lead to hypoid gear scoring due to the resultant misalignment of the hypoid gear set.

COMPONENT PARTS REPLACEMENT

(Chevrolet, Chevelle, Chevy II and Camaro)

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 and Camaro models, remove four nuts securing lower spring seat to axle housing, then remove spring front eye bolts or spring attaching bracket 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 models, position coil springs in upper seats so that end of spring is indexed in seat.
4. On Chevrolet 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 Chevelle pry lower pigtail of spring over vertical flange of the axle bracket spring seat.
6. On Chevy II and Camaro 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.
7. Install spring front eye bolt and tighten, then install spring seat lower mounting bracket and retaining nuts.
8. 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.
9. 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.
10. Reassemble rear universal joint to companion flange.
11. Support vehicle at axle and remove supports from beneath the frame side rails.
12. Remove supports and lower vehicle to floor. Torque all affected parts to specifications.

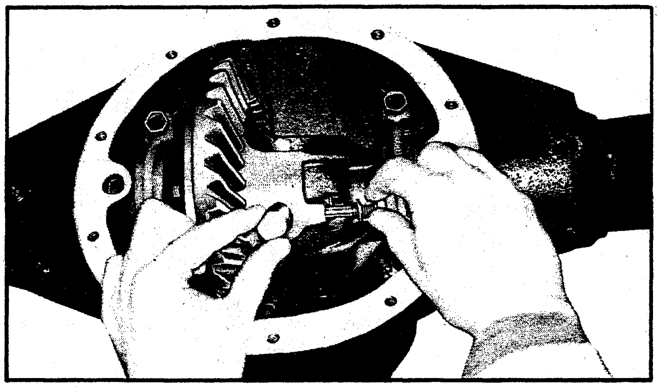


Fig. 77—Differential Pinion Shaft Removal

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. 77).
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 78) and press new bolts into place, making sure that they are tight and square with flange.

Oil Seal and/or Bearing Replacement

1. Remove the oil seal by using the button end of the axle shaft - insert the button end of the shaft behind the steel case of the oil seal, then pry seal out of bore being careful not to damage housing.
2. Insert Tool J-8119 into bore and position it behind bearing so that tangs on tool engage bearing outer race. Remove bearing, using slide hammer as shown in Figure 79. Figure 80 shows a detail of axle housing outer end.
3. Lubricate new bearing with wheel bearing lubricant, and install bearing so that it bottoms against shoulder (fig. 81). To install bearing use Tool J-21491 for the Chevelle, Camaro and Chevy II light-duty axle and Tool J-21051 for all Chevrolet models and also for Chevelle, Camaro and Chevy II models with heavy-duty axle.
4. Pack cavity between the seal lips with a high melting point wheel bearing lubricant; position seal on tool (Use J-21491 for the Chevelle, Camaro and Chevy II light-duty axle and J-21051 for all Chevrolet models and also for Chevelle, Camaro and Chevy II models with heavy-duty axle) and position seal in axle housing bore, tap seal into place so that it bottoms against bearing (fig. 81).

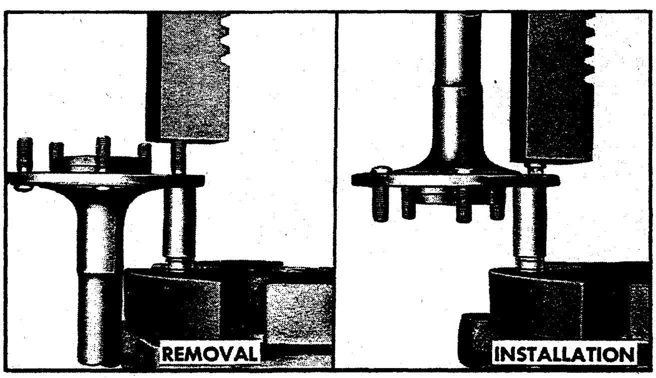


Fig. 78—Wheel Bolt Replacement

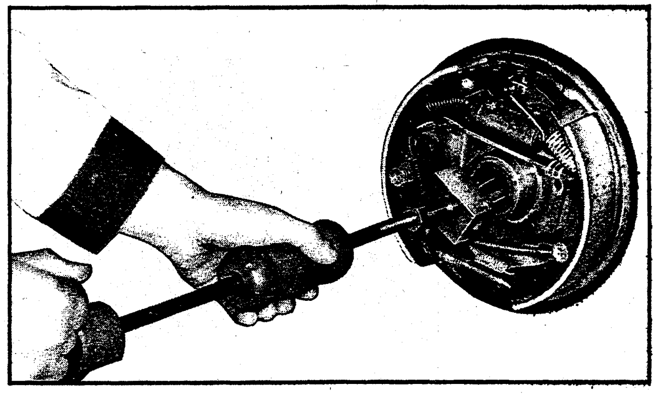


Fig. 79—Wheel Bearing Removal

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.

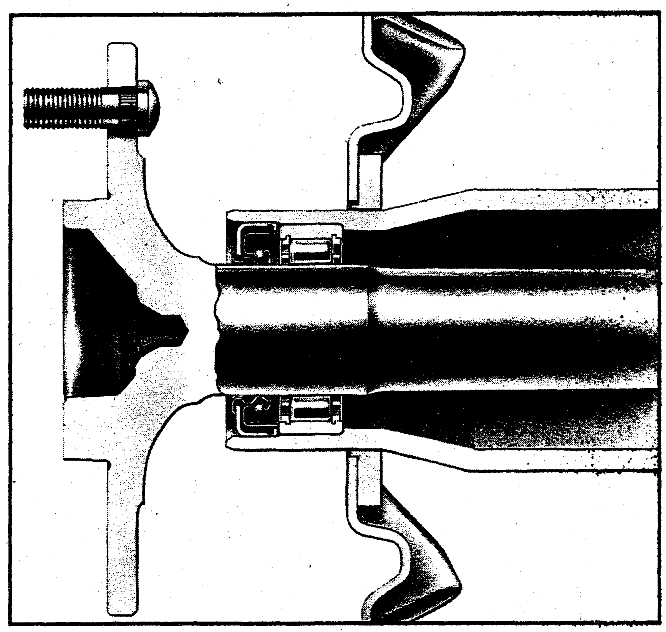


Fig. 80—Axle Housing Detail

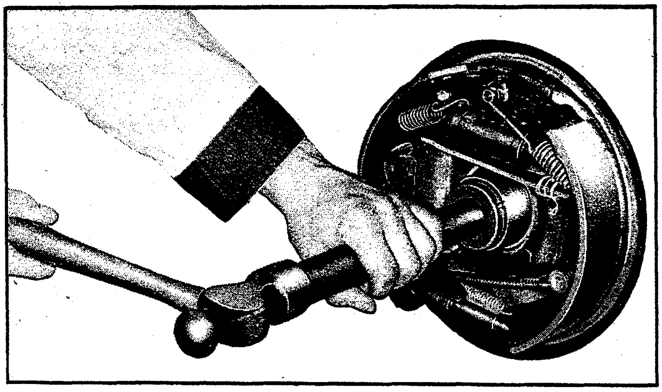


Fig. 81—Wheel Bearing and/or Oil Seal Installation

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.

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. 82). 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. 83). (Position J-8614-1 on flange so that the four notches are toward flange.) Discard nut and use a new one upon reassembly.

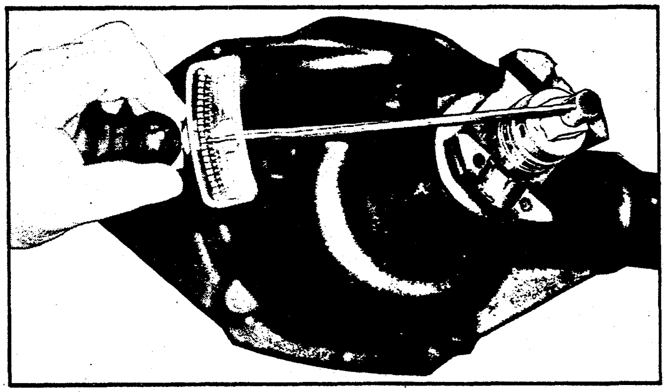


Fig. 82—Measuring Drive Pinion Bearing Preload

6. Thread pilot end of Tool J-8614-3 into small O.D. 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. 84).
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

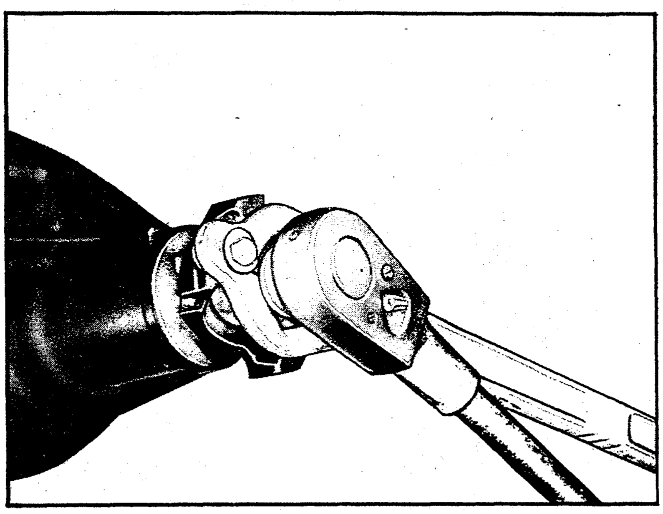


Fig. 83—Drive Pinion Nut Removal

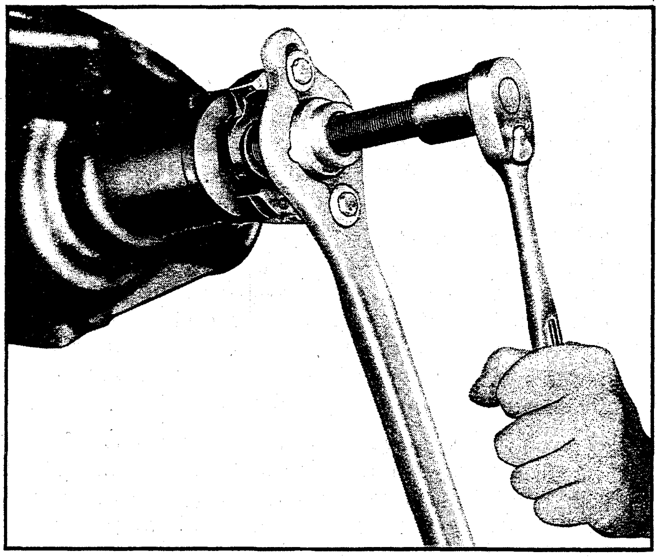


Fig. 84—Drive Pinion Flange Removal

J-21057 for heavy-duty axle, press seal into bore until it seats against shoulder (figs. 85 and 86).

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.

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. 87). Remove

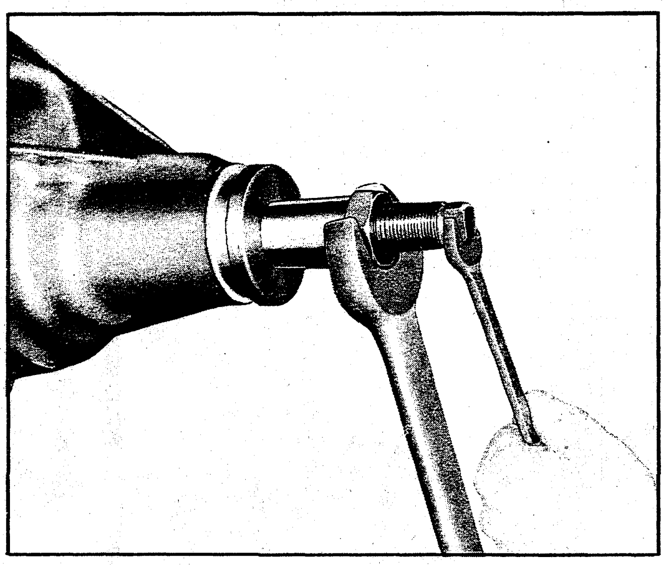


Fig. 85—Drive Pinion Flange Oil Seal Installation (Light-Duty)

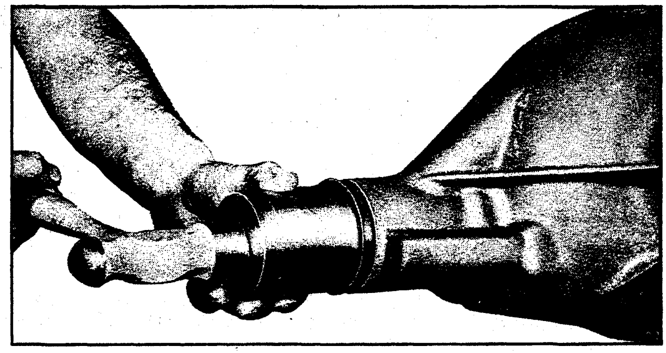


Fig. 86—Drive Pinion Flange Oil Seal Installation (Heavy-Duty)

J-9458 after flange is seated.

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.

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 alternately tightening in small increments and checking preload with torque wrench until it is the same as that recorded in Step 4.
14. Reassemble the rear universal joint, and torque "U" bolt nuts to specifications.
15. Lower vehicle to floor and road test for leaks.

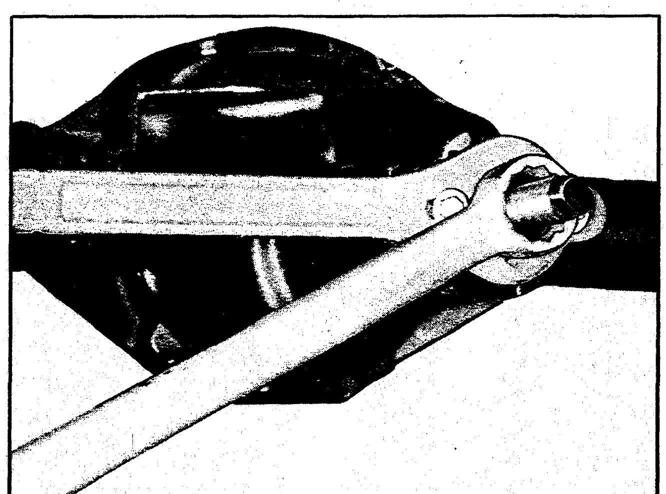


Fig. 87—Drive Pinion Flange Installation

COMPONENT PARTS REPLACEMENT (CORVETTE)

AXLE DRIVESHAFT—FIGURE 88

Removal

1. Disconnect inboard driveshaft trunnion from side gear yoke.
2. Bend bolt lock tabs down and remove four bolts securing shaft flange to spindle drive flange.
3. Pry driveshaft out of outboard drive flange pilot and remove by withdrawing outboard end first (fig. 89).

Repairs

1. Remove bearing lock ring from trunnion yoke.
2. Support turnnion yoke on a piece of 1-1/4" pipe on arbor press bed.
3. Using suitable socket or rod, press trunnion down far enough to drive opposite bearing cup from yoke.
4. Remove trunnion and press other bearing cup from yoke, being careful not to drop cup or lose bearing rollers.
5. Remove trunnion and yoke from other joint in a similar manner.

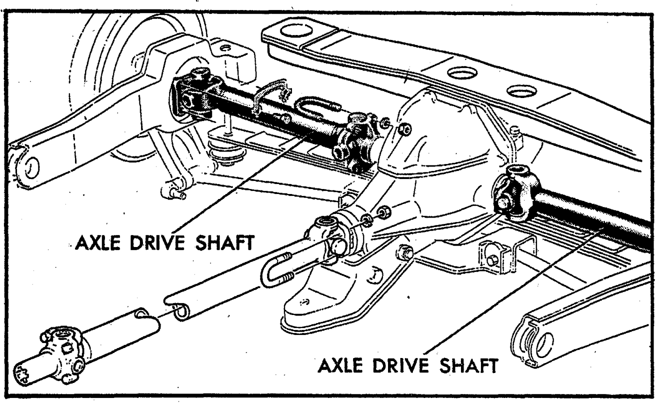


Fig. 88—Axle Driveshaft

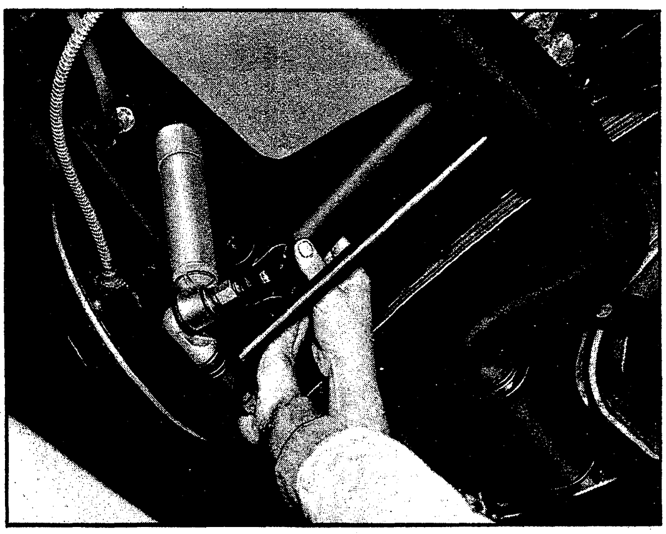


Fig. 89—Removing Driveshaft

6. Remove dust seals from trunnion, clean and inspect bearing rollers and trunnion. Relubricate bearings with a high-melting point wheel bearing type lubricant.

   NOTE: In addition to packing the bearings, make sure that the lubricant reservoir at the end of each trunnion is completely filled with lubricant. In filling these reservoirs, pack lubricant into the hole so as to fill from the bottom. This will prevent air pockets and ensure an adequate supply of lubricant.

7. Place new dust seals on trunnion, cavity of seal toward end of trunnion - then position Tool J-21556 over end of trunnion and into cavity portion of seal. Press seal onto trunnion until tool bottoms against trunnion (fig. 90).

   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.

8. 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, being careful to keep trunnion aligned in bearing cups.
9. Press bearing cups far enough to install lock rings, and install lock rings.

   NOTE: It may be more convenient, if necessary, 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.

Installation

1. Place driveshaft inboard trunnion into side gear yokes and assemble "U" bolts. Rotate yokes so that trunnion seats are phased 90° apart.
2. Install outboard drive flange into spindle drive flange pilot, position bolt lock over bolt holes and install four bolts. Torque bolts to specification and bend lock tabs flat against bolt heads.

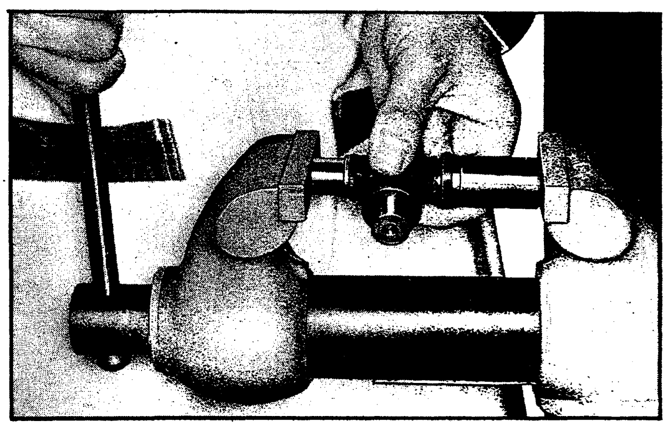


Fig. 90—"U" Joint Trunnion Seal Installation

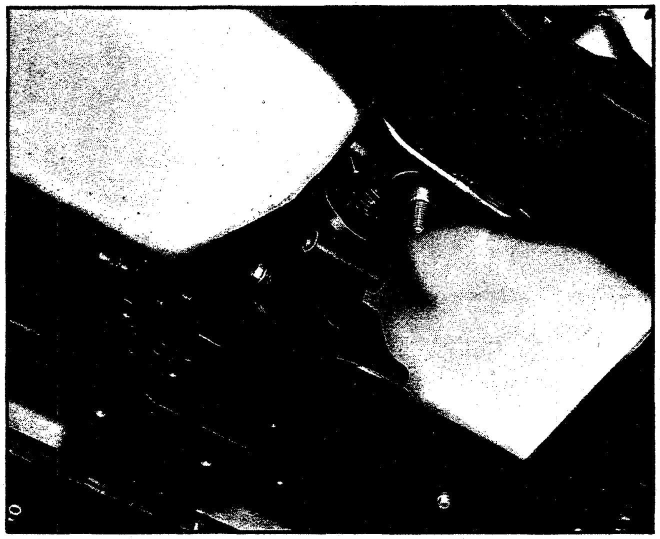


Fig. 91—Removing Carrier Front Support

PINION FLANGE, DUST DEFLECTOR AND/OR OIL SEAL

Removal

1. Raise vehicle and place jackstand under frame to allow wheels to hang free.
2. Place 1/2" thick block of wood or steel between carrier upper surface to rear of companion flange, and body floor. This will prevent carrier assembly from twisting upward when front support bracket is disconnected.
3. Disconnect carrier front mounting bracket bolt from frame crossmember.
4. Remove nut from carrier bracket front bolt and slide bolt to one side until bolt head contacts floor well. Mark the floor well at this point and drill a 3/4" diameter hole - remove bolt.
5. Loosen bracket rear bolt and swing bracket down and to the rear (fig. 91).
6. Disconnect propeller shaft at transmission and at companion flange. Slide transmission yoke forward, and lower propeller shaft down and out.
7. Mark companion flange nut and pinion relative location. This is necessary to reset original pinion bearing pre-load during reassembly of companion flange.
8. Attach J-8614-1 companion flange holder and remove flange nut and washer (fig. 92).
9. Remove companion flange by driving off with brass drift and hammer (fig. 93).
10. Using screw driver, pry oil seal out of carrier.

Inspection

Inspect companion flange splines for excessive wear or twisting and check deflector for looseness. If deflector is loose or damaged, break stake marks and remove. Install new deflector and stake in place.

Installation

1. Place sealing compound around O.D. of new seal and install seal in carrier using seal Installer J-21057 (fig. 94).

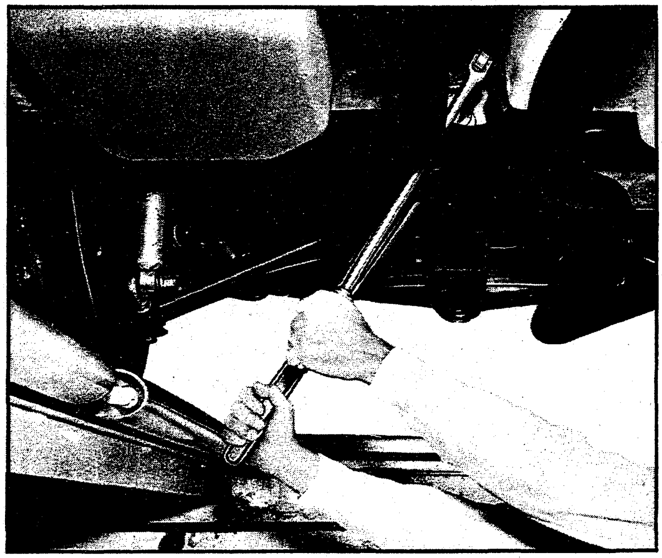


Fig. 92—Removing Companion Flange Nut

NOTE: Seal should be started squarely in bore to eliminate seal distortion.

2. Tap seal into position until there is a 1/8" gap between seal flange and carrier (fig. 95).
3. Lubricate companion flange splines and tap into place.
4. Install companion flange washer and nut, and tighten nut so that it lines up with mark on pinion.
5. Raise propeller shaft into position and connect to companion flange and transmission yoke.
6. Place rubber cushion on carrier front mounting bracket and raise bracket into position and loosely install nut.
7. Install carrier bracket front bolt. With vehicle at curb, torque all affected parts to specifications and install cotter pin to carrier bracket front bolt.
8. Insert a plastic plug from the inside of the floor well to prevent dust and water entry.

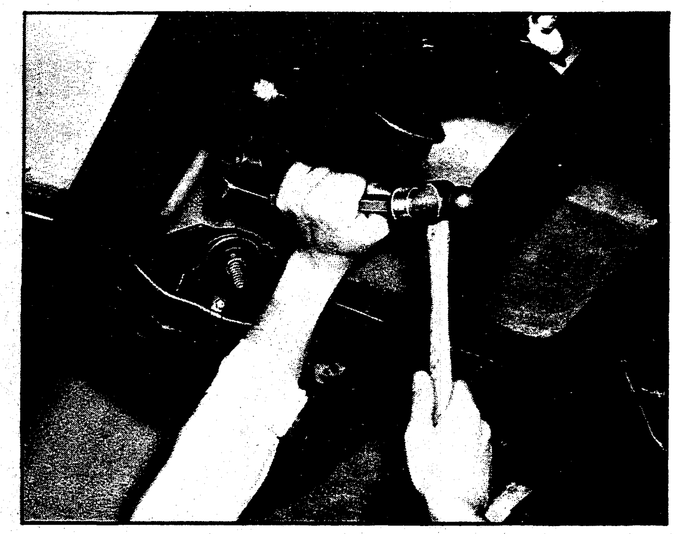


Fig. 93—Removing Companion Flange

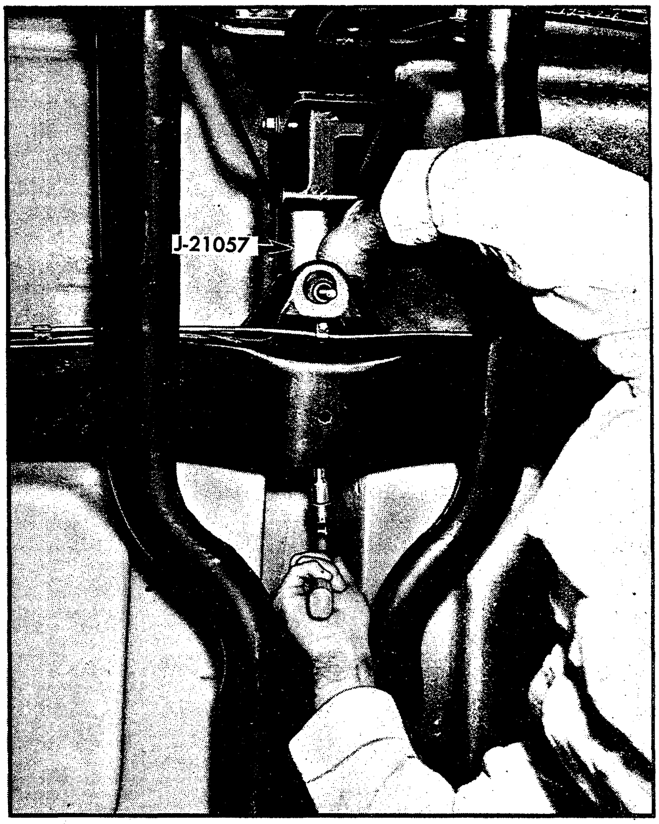


Fig. 94—Installing Pinion Oil Seal

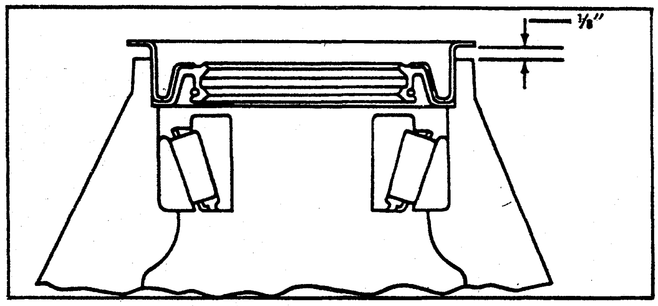


Fig. 95—Pinion Seal Installed

DIFFERENTIAL CARRIER

Removal

1. Disconnect spring end link bolts as outlined in Spring—Removal, in this section.
2. Disconnect axle drive shafts at carrier by removing "U" bolts securing trunnion to side gear yoke.
3. Disconnect carrier front support bracket at frame crossmember.
4. Disconnect propeller shaft at transmission and at companion flange. Slide transmission yoke forward into transmission. Drop propeller shaft down and out toward the rear.
5. Mark camber cam and bolt relative location on strut rod bracket and loosen cam bolts.
6. Remove four bolts securing bracket to carrier lower surface and drop bracket. Remove camber cam bolts and swing strut rods up and out of the way.
7. Remove eight carrier-to-cover bolts. Loosen bolts gradually to allow lubricant to drain out.
8. With mounting bolts removed, pull carrier partially out of cover, drop nose to clear crossmember and gradually work carrier down and out.

Installation

1. Clean inside of carrier cover and liberally grease gasket surface. Place new gasket on cover.
2. Cut heads off two 1/2"-13 x 1-1/4" bolts and slot unthreaded end. Install these aligning studs into two below-center carrier bolt holes, one on each side.
3. Raise carrier into position aligning studs into cover (fig. 96).
4. Install carrier-to-cover bolts and tighten securely.
5. Connect propeller shaft to companion flange and transmission yoke.
6. Install rubber cushion on bracket and position to frame crossmember. Install nut and torque to specifications.
7. Raise axle drive shafts into position and assemble inboard trunnion to side gear yokes with "U" bolts.
8. Assemble strut rods to bracket and raise bracket into position under carrier. Install four bolts and torque to specifications. Move camber cams to marked location and tighten cam nuts.

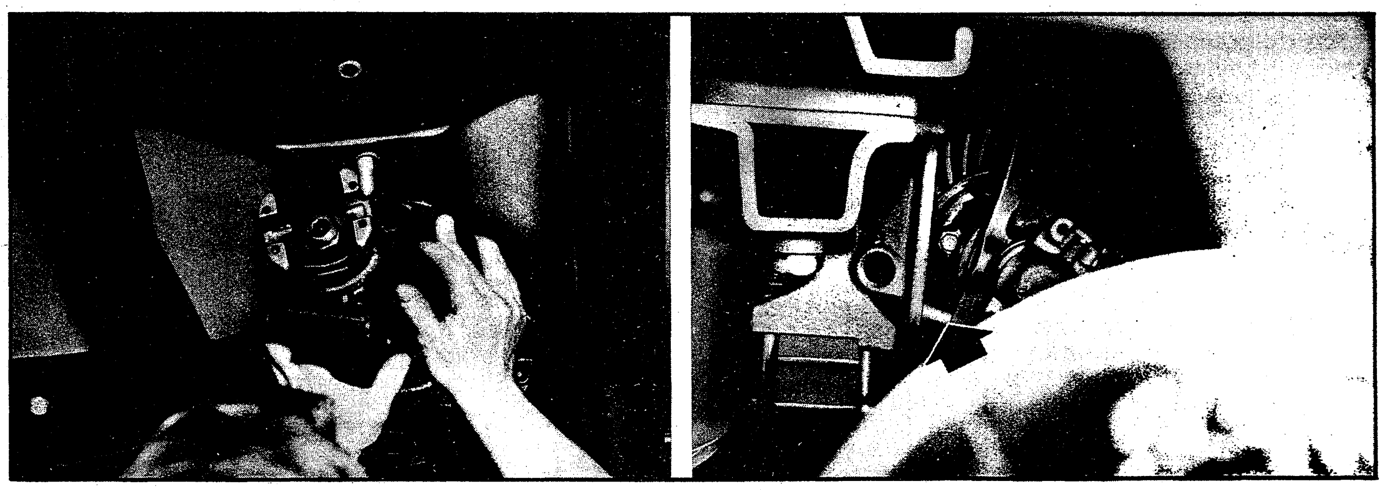


Fig. 96—Installing Carrier Assembly

9. Connect spring end link bolts as outlined under Spring--Installation, in this section.
10. Remove filler plug, located on right side of cover, and fill with hypoid lubricant to level of filler hole.
11. Lower vehicle and road test for leaks, noise and general performance.

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. 97).
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 ft. lbs. minimum new, and no less than 40 ft. lbs. if used.

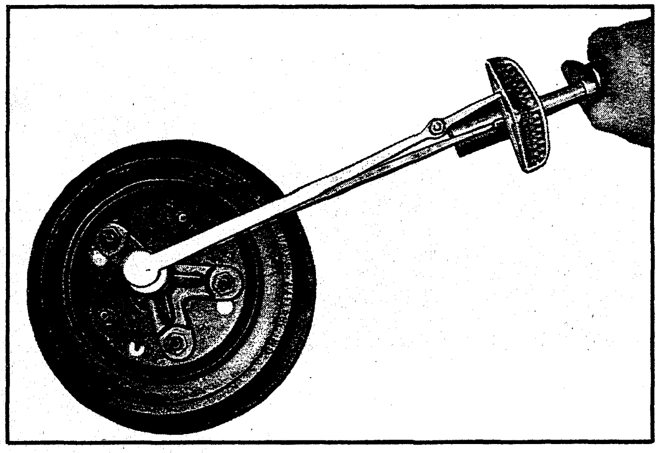


Fig. 97—Measuring Positraction Rotating Torque

PROPELLER SHAFT AND UNIVERSAL JOINTS

INDEX

GENERAL DESCRIPTION

The one-piece, exposed-type, tubular propeller shaft is used on all models. The cardon-type universal joints are of the extended-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.

A light duty (fig. 98) and a heavy duty (fig. 99) version of the tubular propeller shaft is used. The heavy-duty shaft incorporates a damper, as part of the sleeve yoke, at the transmission end of the shaft. This damper is not serviced separately—the sleeve and damper (fig. 100) must be replaced as an assembly.

Two different methods are used to retain the trunnions

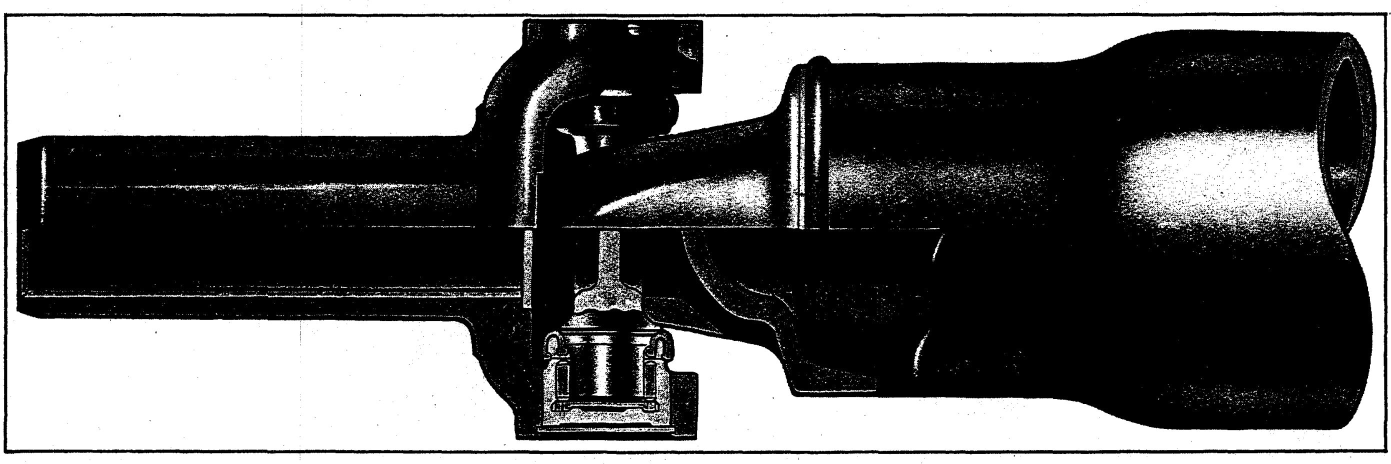


Fig. 98—Light-Duty Propeller Shaft Cross-Section (Dana Design)

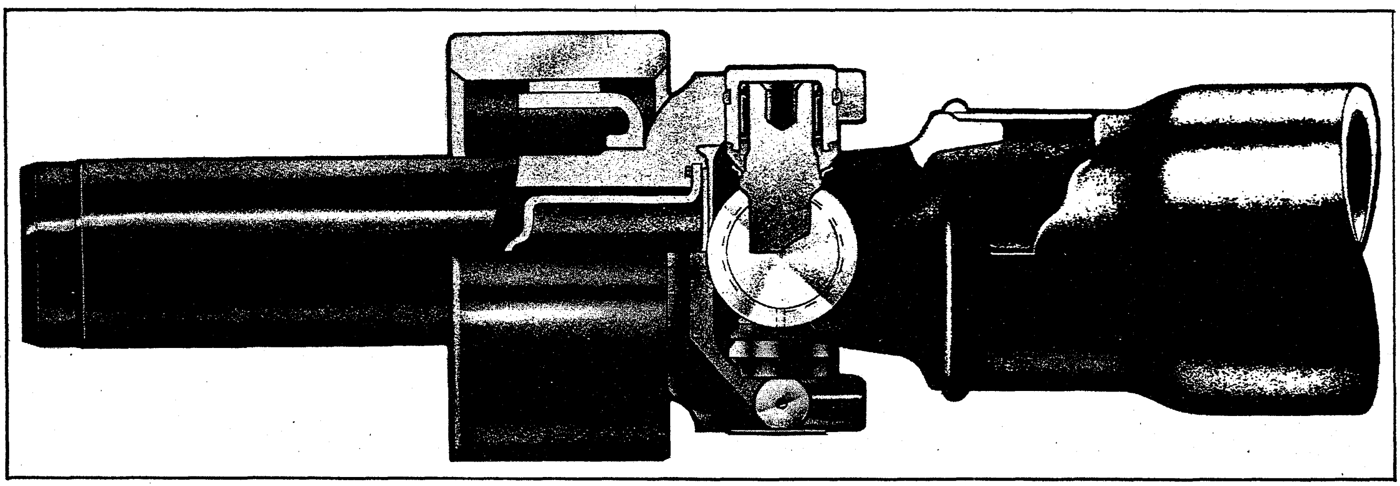


Fig. 99—Heavy-Duty Propeller Shaft Cross-Section (Saginaw Design)

in the propeller shaft yokes. Conventional snap rings are used as one method--these units can be disassembled and reassembled using the same trunnions if desired. However, the alternate method of retaining the trunnions does not permit reusing the trunnions once they have been pressed from the yokes. These trunnions are retained by nylon material which is injected through a small hole in the yoke and into the annular grooves between the trunnion and yoke.

COMPONENT PARTS REPLACEMENT

PROPELLER SHAFT (DANA)

Removal

1. Raise vehicle, mark relationship of shaft to companion flange and disconnect the rear universal joint by removing trunnion bearing "U" bolts (fig. 101). Tape bearing cups to trunnion to prevent dropping and loss of bearing rollers.

   NOTE: On Corvette models, remove trunnion "U" bolts at transmission yoke also.

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 (fig. 102) are of the extended-life design and do not require periodic inspection or lubrication; however, when

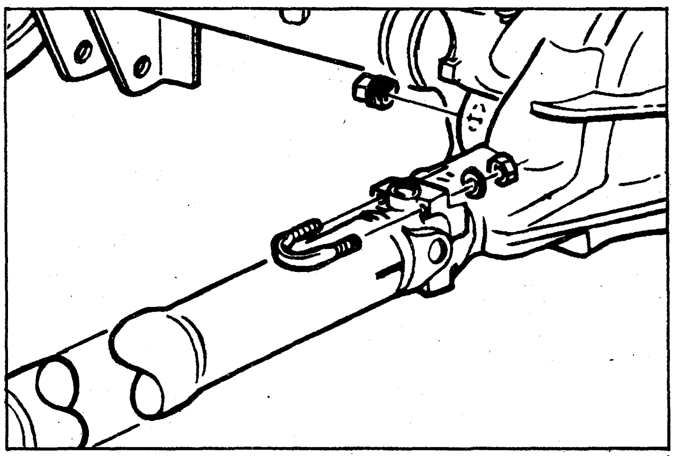


Fig. 101—Removing Propeller Shaft from Companion Flange

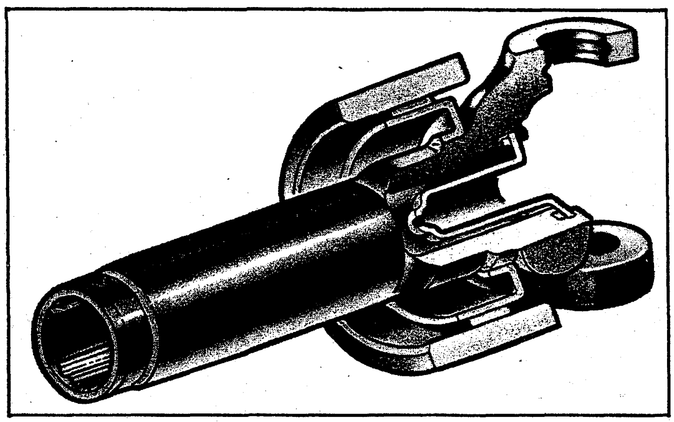


Fig. 100—Propeller Shaft Sleeve and Damper Assembly

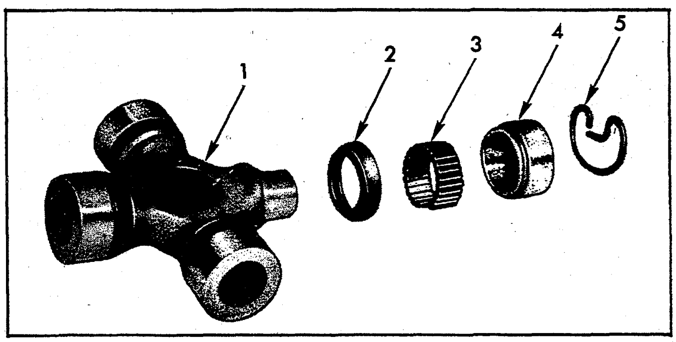
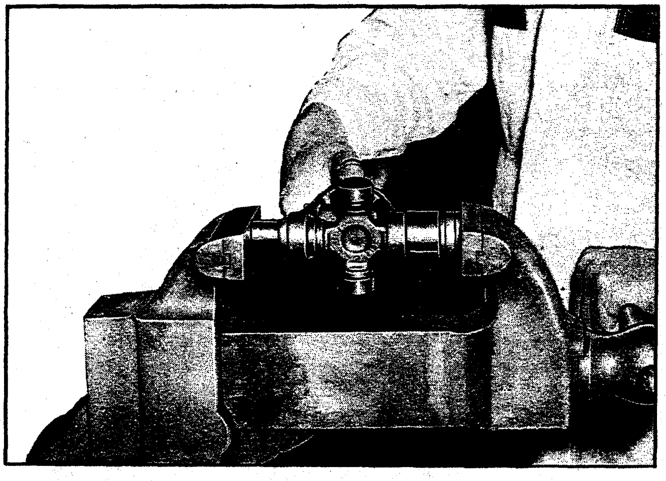


Fig. 102—Propeller Shaft Trunnion (Dana Design)



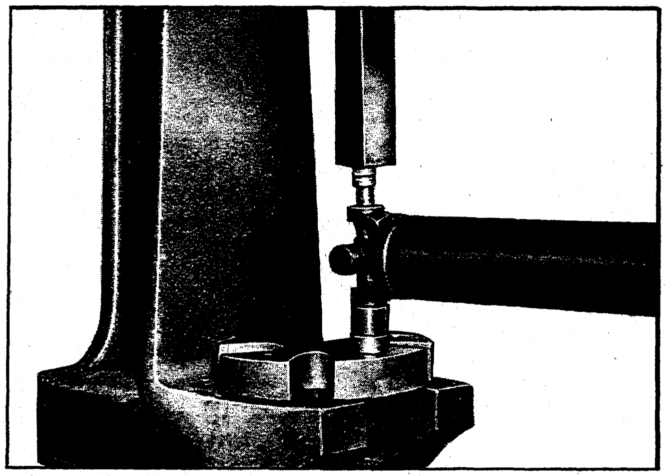


Fig. 103—Removing Bearing Caps

these joints are disassembled, repack bearings and lubricate reservoir at end of trunnions with high-melting point wheel bearing lubricant and replace the dust seals.

1. Remove bearing lock rings 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. 103).
4. Remove dust seals from trunnion, clean and inspect bearing rollers and trunnion. Relubricate bearings with a lithium base chassis lubricant.

NOTE: In addition to packing the bearings, make sure that the lubricant reservoir at the end of each trunnion is completely filled with lubricant. In filling these reservoirs, pack lubricant into the hole so as to fill from the bottom. This will prevent air pockets and ensure an adequate supply of lubricant.

5. Place new dust seals on trunnions - 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 (fig. 104).

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. 105) being careful to keep trunnion aligned in bearing cups.
7. Press bearing cups far enough to install lock rings, and install lock rings.

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.

NOTE: On Corvette models, install front yoke into transmission then position propeller shaft between yoke and companion flange; install "U" bolts to front yoke.

3. Align propeller shaft with companion flange, using reference marks established in "Removal" procedure, connect the rear universal joint by installing "U" bolt clamps over bearing trunnions - torque nuts to specifications.

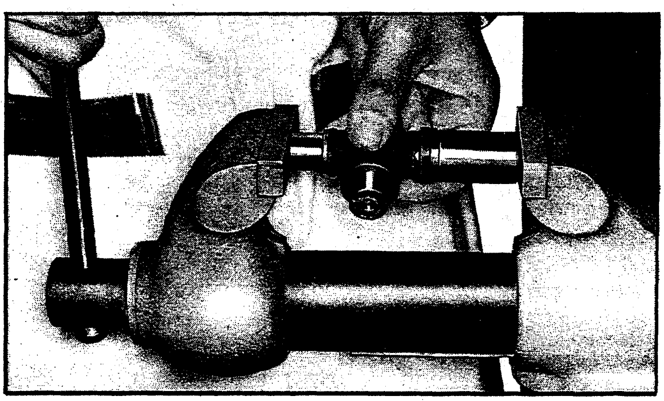


Fig. 104—"U" Joint Trunnion Seal Installation

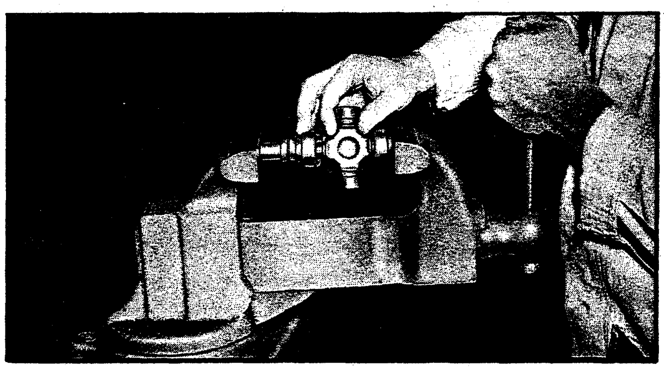


Fig. 105—Installing Bearing Cup and Trunnion

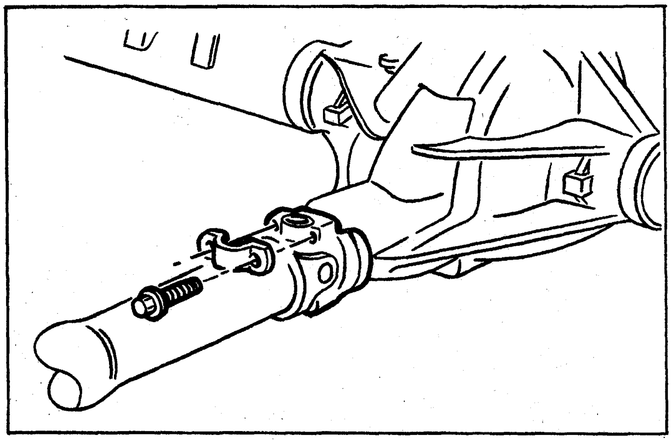


Fig. 106—Removing Propeller Shaft from Companion Flange

PROPELLER SHAFT (SAGINAW)

Removal

1. Raise vehicle sufficiently to permit access to propeller shaft and mark relationship of rear yoke to companion flange.
2. Remove trunnion bearing retaining strap attaching screws from both bearings (fig. 106).
3. Lower rear of propeller shaft, being careful not to dislodge bearing caps from trunnion, and tape bearing caps to trunnion.
4. 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: Because of the elastic properties of the nylon retainers, the trunnions must be pressed from the yokes. Pressing the trunnions from the yokes will shear the retainers which renders the bearing caps unsuitable for reuse. A service kit, which employs a snap ring to retain the trunnion, must be used when reassembling the propeller shaft (fig. 107).

1. Remove trunnion at differential end of propeller shaft using the following procedure:
   a. Support trunnion on a press bed so that the propeller shaft yoke can be moved downward. Support front of propeller shaft so that shaft is in a horizontal position.
   b. Using a piece of pipe or similar tool, with an inside diameter slightly larger than 1 1/8", press bearing from yoke (fig. 108).
   c. Apply force on yoke around bearing until nylon retainer breaks. Continue to apply force until the downward movement of the yoke forces the bearing as far as possible from the yoke (fig. 109).
   d. Complete removal of bearing by tapping around circumference of exposed portion with a small hammer (fig. 110).
   e. Rotate propeller shaft so that opposite bearing may be removed in the manner described above.
   f. Remove trunnion from yoke.
2. Remove trunnion at transmission end of propeller shaft using the following procedure:
   a. Support splined yoke on a press bed and the rear of the propeller shaft on a stand so that shaft is horizontal. Be sure that weight is evenly distributed on each side of the splined yoke and that the fixed yoke half of the "U" joint is free to move downward.
   b. Using a piece of pipe or similar tool, with an inside diameter slightly larger than 1 1/8", press bearing from yoke (fig. 108).
   c. Apply force on yoke around bearing until nylon retainer breaks. Continue to apply force until the downward movement of the yoke forces the bearing as far as possible from the yoke (fig. 109).
   d. Complete removal of bearing by tapping around circumference of exposed portion with a small hammer (fig. 110).
   e. Rotate propeller shaft so that opposite bearing may be removed in the manner described above.
   f. Remove splined yoke and trunnion from propeller shaft.

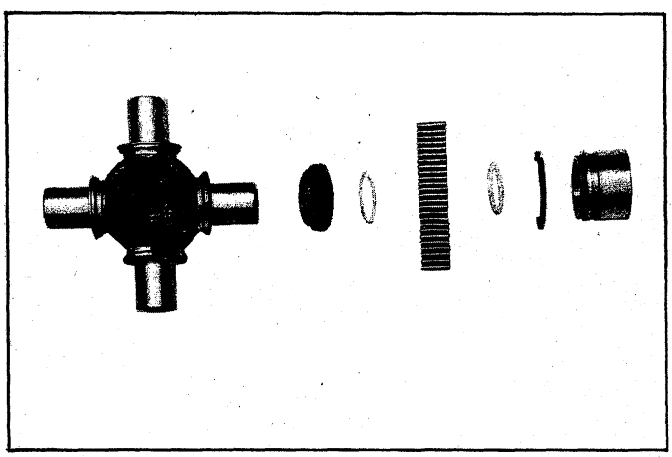


Fig. 107—Service Kit Trunnion (Saginaw)

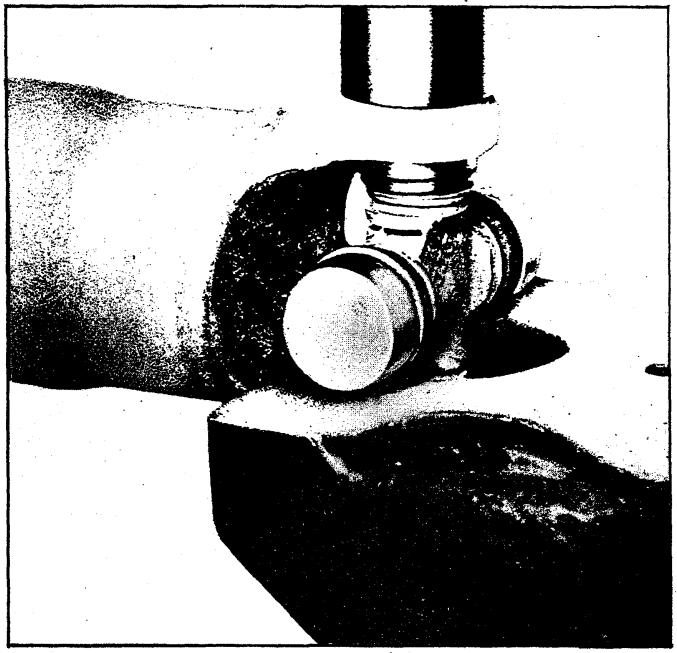


Fig. 108—Pressing Trunnion Bearing from Propeller Shaft

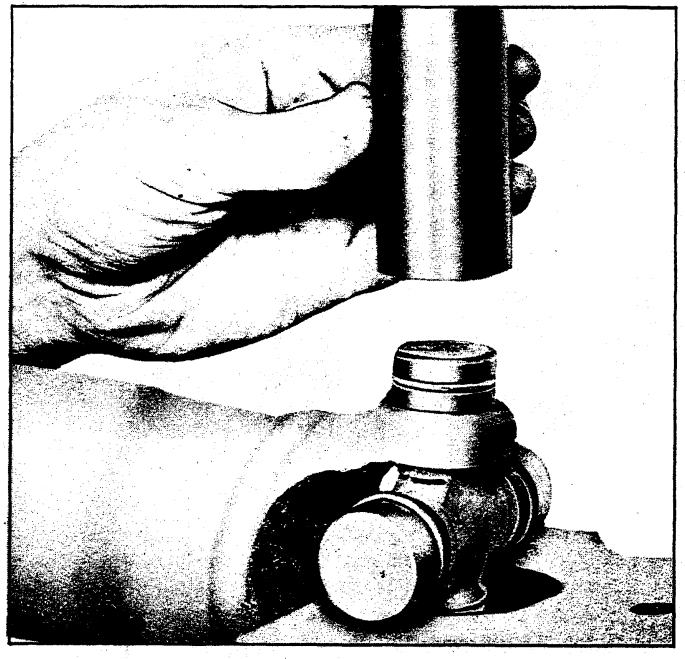


Fig. 109—Bearing Partially Pressed from Propeller Shaft

g. Support exposed trunnion fingers on press bed and press splined yoke from bearing caps using method described above.
h. Remove trunnion from splined yoke.

3. Install trunnion and bearing assembly to the propeller shaft yokes using the following procedure:

NOTE: The trunnion and bearing assembly used at the differential end of the propeller shaft incorporates two different size bearing caps. The larger bearing caps (with the annular grooves) must be mated with the propeller shaft yoke.

a. Install bearing cap and seal about one-fourth way in on one side of yoke, using a soft-faced hammer to tap the bearing into position. Check bearing cap during installation to ensure that it does not become cocked in yoke.

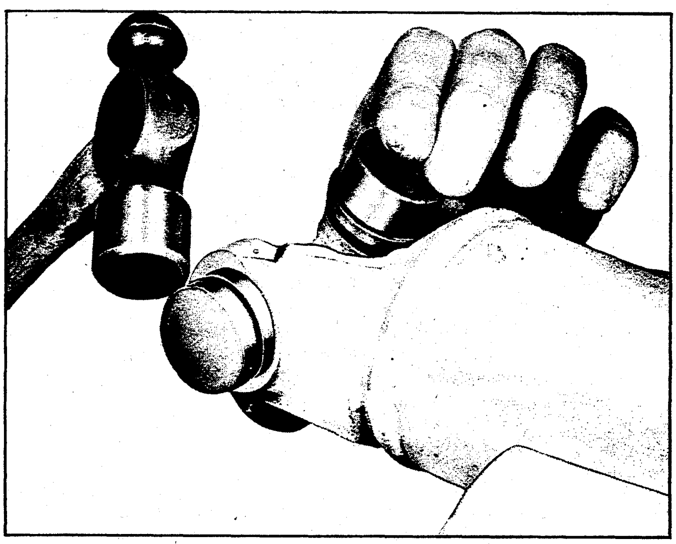


Fig. 110—Removing Bearing from Propeller Shaft

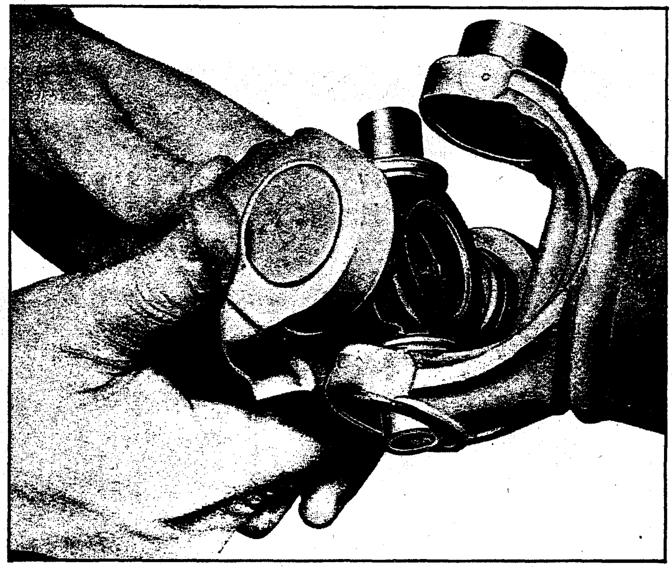


Fig. 111—Installing Trunnion to Propeller Shaft

b. Insert trunnion into yoke (fig. 111).
c. Firmly seat trunnion into bearing cup and press bearing cup into yoke until it is flush with yoke.
d. Install opposite bearing cap and seal making sure that rollers do not become jammed on trunnion. Check for free movement of trunnion in yoke.
e. Install bearing retainer snap rings making sure that gap in ring is toward yoke (fig. 112).

Installation

1. Inspect yoke seal in the transmission extension, replace if necessary as described in the transmission section.
2. Insert propeller shaft front yoke into transmission extension, making sure that output shaft splines mate with propeller shaft yoke splines.
3. Align propeller shaft with companion flange using reference marks established in "Removal" procedure; remove tape used to retain trunnion bearing caps; connect exposed bearing caps to companion flange by installing retaining strap and screws--torque screws to specifications.

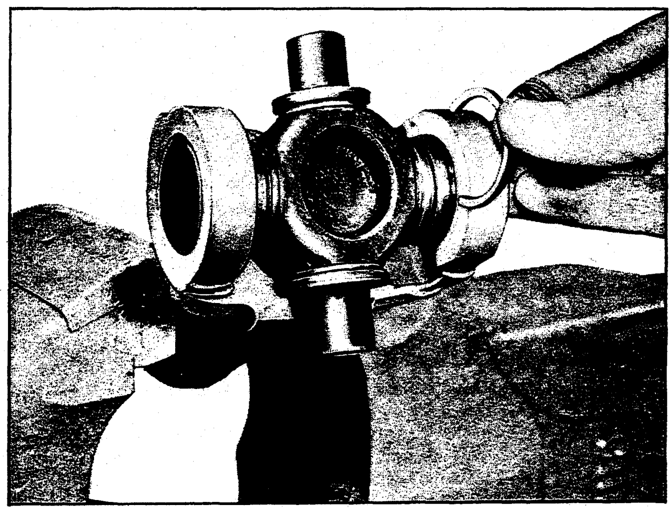


Fig. 112—Installing Snap Ring to Retain Trunnion

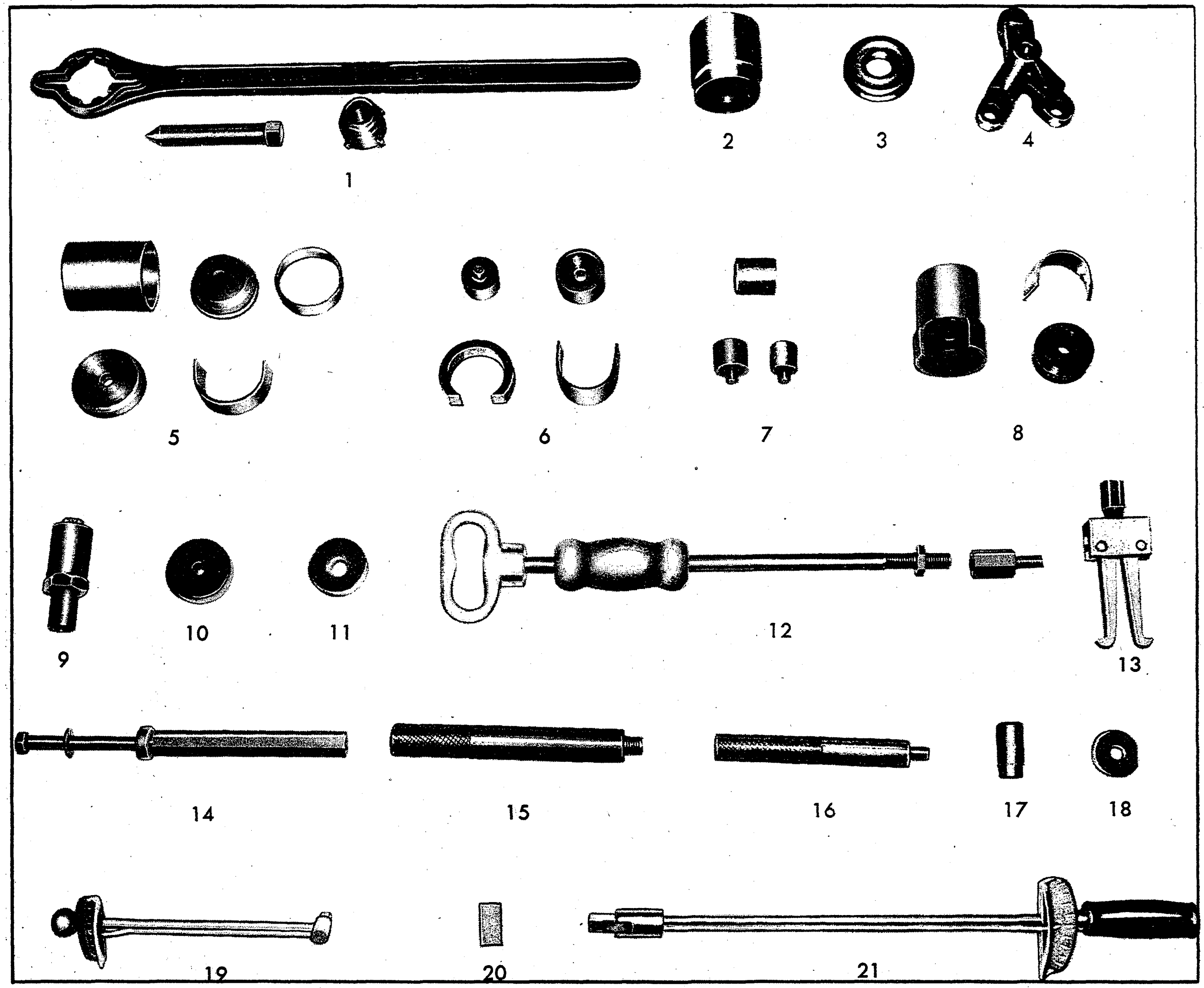


Fig. 113—Rear Suspension Special Tools (Chevrolet, Camaro, Chevelle and Chevy II)

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

Tools Not Illustrated

J-22553 Rear Spring Front Bushing Remover/Installer Consists of J-22553-1 Receiver, J-22553-2 Installer--Used with J-21978-1 Receiver, J-21058-8 Nut and J-21058-15 Puller Screw.

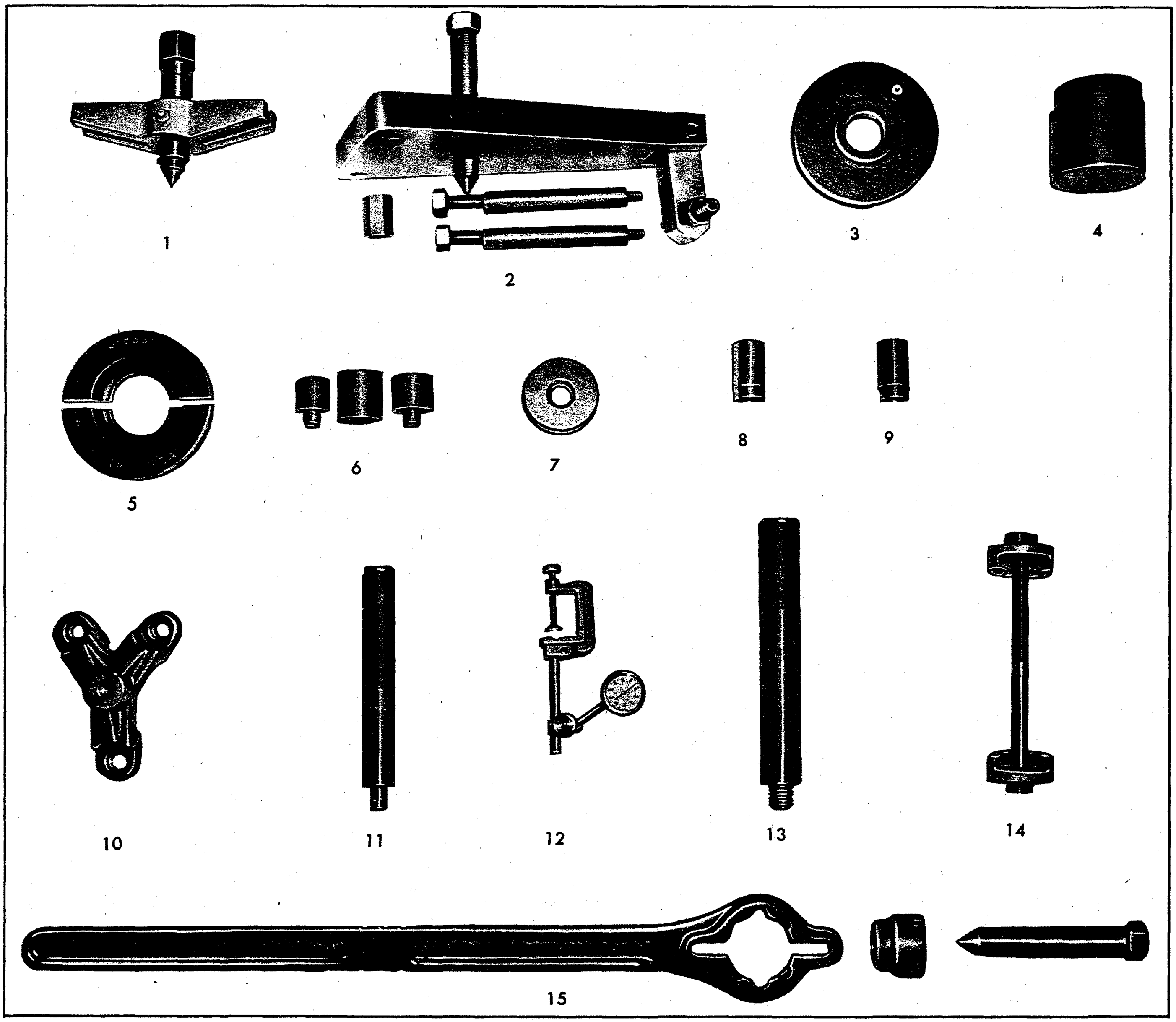


Fig. 114—Rear Suspension Special Tools (Corvette)

1. J-8111-23 Torque Control Arm Spacer Flaring Tool
2. J-22602 Wheel Drive Spindle Remover
3. J-9436 Wheel Drive Spindle Outer Bearing Installer
4. J-21057 Drive Pinion Oil Seal Installer
5. J-8331 Wheel Drive Spindle Outer Bearing Remover
6. J-7877 Strut Rod Bushing Replacement Set
7. J-7817 Wheel Drive Spindle Bearing Cup Installer
8. J-21548 Propeller Shaft "U" Joint Trunnion Seal Installer
9. J-21556 Axle Drive Shaft "U" Joint Trunnion Seal Installer
10. J-5748 Positraction Torque Measuring Adapter
11. J-7079-2 Driver Handle (Insert Type)
12. J-8001 Dial Indicator Set
13. J-8092 Driver Handle (Threaded Type)
14. J-7055-1 Torque Control Arm Bushing Installer
15. J-8614 Rear Axle Companion Flange Holder

BRAKES

SECTION 5

CONTENTS OF THIS SECTION

DUO-SERVO BRAKES

INDEX

GENERAL DESCRIPTION

All 1967 models are equipped with a new split brake system as a safety feature. If a wheel cylinder or brake line should fail at either the front end or rear end of the vehicle, the operator can still bring the vehicle to a controlled stop. The system is designed with separate hydraulic systems for the front and rear brake using a dual master cylinder (fig. 1). The design of the master cylinder is similar to that used on the 1966 Corvette in that it has two entirely separate reservoirs and outlets in a common body casting. The front reservoir and outlet is connected to the front wheel brakes, and the rear reservoir and outlet is connected to the rear wheel brakes. Two pistons within the master cylinder receive mechanical pressure from the brake pedal push rod and transmit it through the brake lines as hydraulic pressure to the wheel cylinders. The filler cap is accessible from inside the engine compartment.

A new brake pipe distribution and switch assembly is mounted below the main cylinder. The front and rear hydraulic brake lines are routed from the main cylinder, through the brake pipe distribution and switch assembly, to the front and rear brakes as shown in Figure 2. The switch is wired electrically to the brake alarm indicator light on the instrument panel. In the event of fluid loss in either the front or rear brake system the indicator on the instrument panel will illuminate red. (The indicator will also be illuminated when the parking brake is applied.)

On Camaro models equipped with air conditioning, the rear brake hydraulic line is routed through a pressure regulator valve mounted on the left frame side rail (fig. 3). The valve controls the hydraulic pressure to the rear brakes resulting in the correct pressure balance between the front and rear hydraulic systems.

The self-adjusting brakes (fig. 4), used 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. The 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 Chevrolet, Chevelle, and Camaro parking brakes have 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. The intermediate cable attaches to the

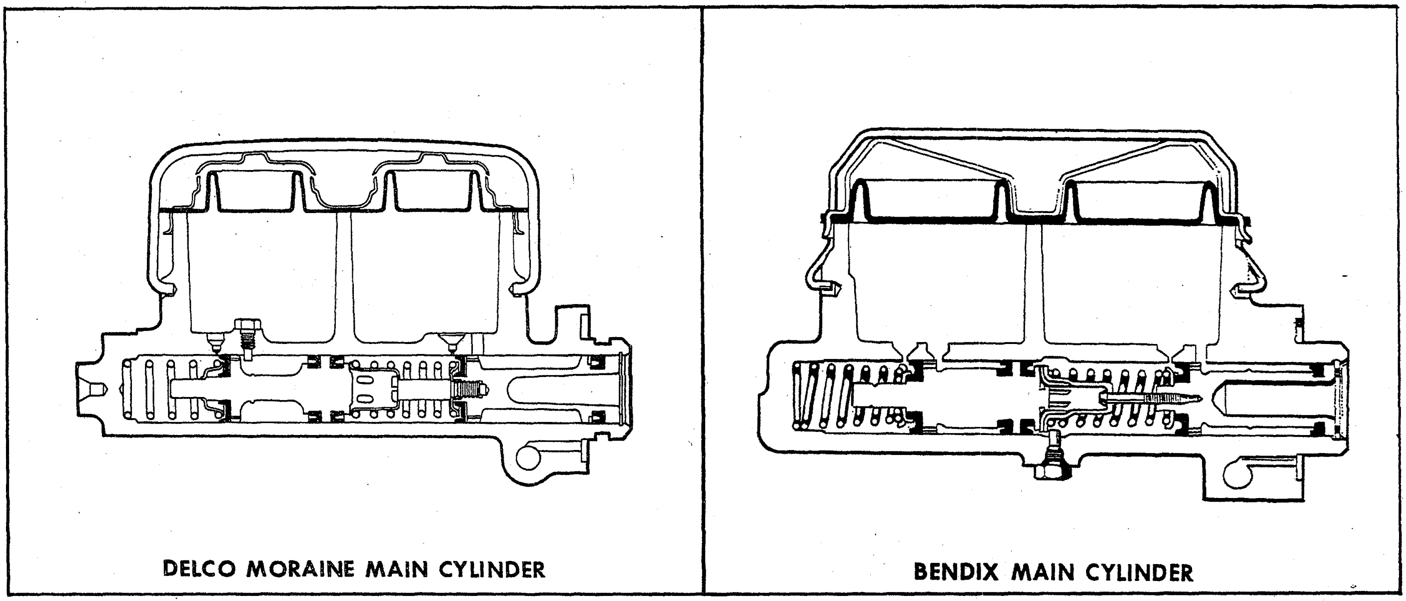


Fig. 1—Main Cylinder

two rear cables which operate the rear service brake.

The Chevy II has a single-stroke, ratchet-type parking brake release lever, located to the right of the steering column. The lever 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 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.

The Corvette is equipped with a ratchet-type parking brake lever located behind the console. The parking brake cable runs forward from the lever to a pulley assembly mounted on a frame crossmember, then back to an equalizer near the rear frame crossmember. A single piece rear cable passes through the equalizer and back to the rear service brakes.

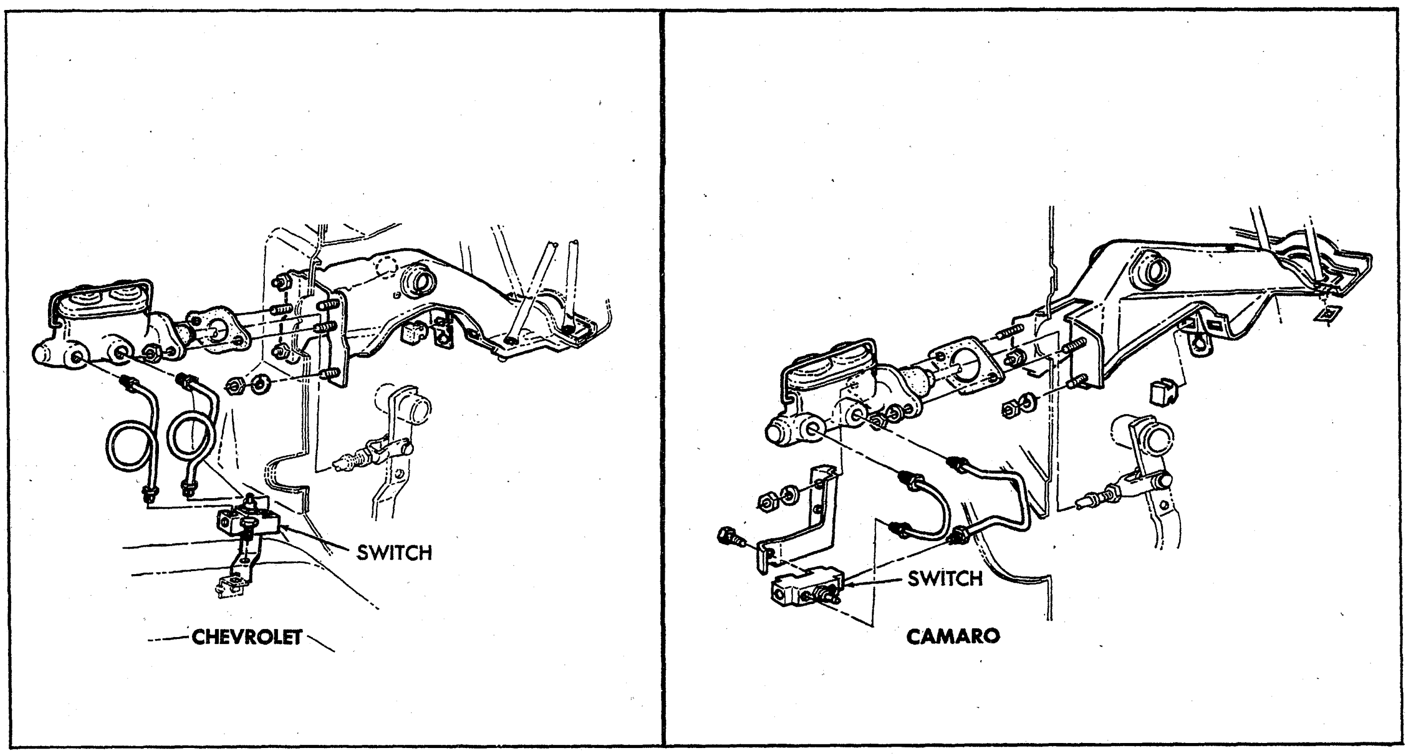


Fig. 2—Brake Pipe Distribution and Switch Assembly

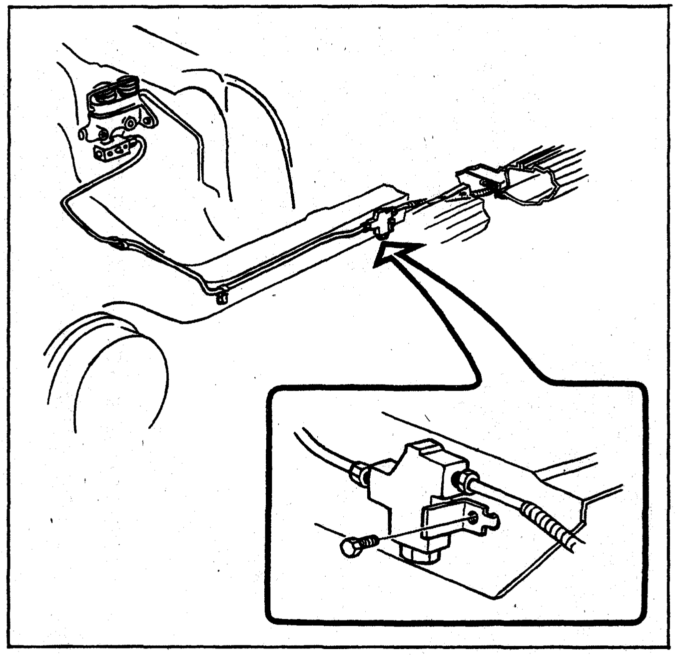


Fig. 3—Camaro Pressure Regulator Valve

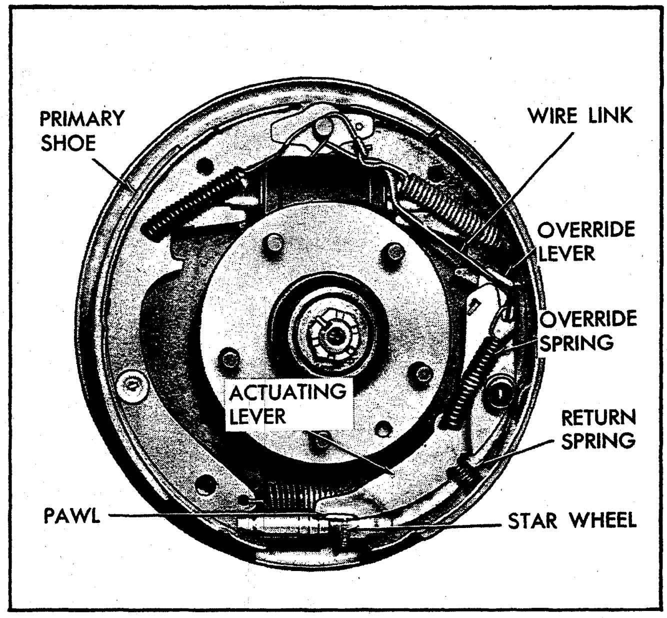


Fig. 4—Self-Adjusting Brake

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.

The split system consists basically of two separate brake systems. When a failure is encountered on either, the other is adequate to stop the vehicle. If one system is not functioning, it is normal for the brake pedal lash and pedal effort to substantially increase. This occurs because of the design of the master cylinder which incorporates an actuating piston for each system. When the rear system loses fluid and takes in air, its piston will bottom against the front piston. When the front system loses fluid and takes in air, its piston will bottom on the end of the main cylinders body. The loss of fluid in one of the systems causes an uneven hydraulic pressure balance between the front and rear systems. The brake pipe distribution and switch assembly, near the main cylinder, detects the loss of pressure and illuminates the brake alarm indicator light on the instrument panel. The pressure loss is felt at the brake pedal by an apparent lack of brakes for most of the brake travel and then, when failed chamber is bottomed, the pedal will harden.

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 proper 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 service the system as follows:

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.
5. Bleed 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. A "spongy" pedal feeling when the brakes are applied may indicate presence of air in the system. The system must be absolutely free of air at all times. Bleeding should be done on the longest line first; the proper sequence to follow is left rear, right rear, right front, and left front (fig. 5). Bleeding of brake system may be performed by one of two methods—either pressure or manual.

PRESSURE BLEEDING

1. Clean all dirt from top of main cylinder and remove cylinder cover and rubber diaphragm.
2. Reduce fluid level in main cylinder until reservoirs are approximately half full.

   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 brake bleeder adapter J-22489 (fig. 6) on main cylinder. Connect hose from bleeder equipment to bleeder adapter and open release valve on bleeder equipment.

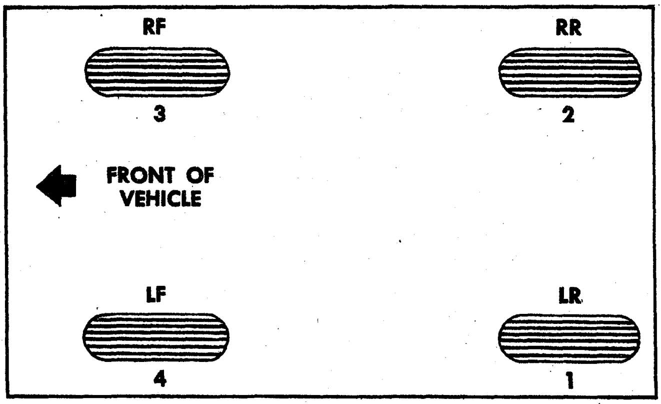


Fig. 5—Correct Bleeding Sequence

4. Install brake bleeder wrench, Tool J-21472 on bleeder valve at wheel cylinder and install one end of bleeder hose on bleeder valve (fig. 7).
5. Pour a sufficient amount of brake fluid into a transparent container to insure that end of bleeder hose will remain submerged during bleeding. Place the loose end of bleeder hose into the container. Be sure the hose end is submerged in the fluid.
6. Open wheel cylinder bleeder valve by turning Tool J-21472 counterclockwise approximately 1/3 of a turn and observe flow of fluid at end of bleeder hose.
7. Close bleeder valve tightly as soon as bubbles stop and brake fluid flows in a solid stream from the bleeder hose.
8. Remove brake bleeder wrench and bleeder hose from wheel cylinder bleeder valve.
9. Repeat Steps 4 through 8 on the remaining wheel cylinders in the correct bleeding sequence (fig. 5).
10. Disconnect bleeder equipment from brake bleeder adapter cover J-22489.

NOTE: The main cylinder on certain passenger car models is tilted upward. When removing the bleeder adapter on these models, place a clean dry cloth behind and below the cylinder to absorb any fluid spillage as the cover is removed.

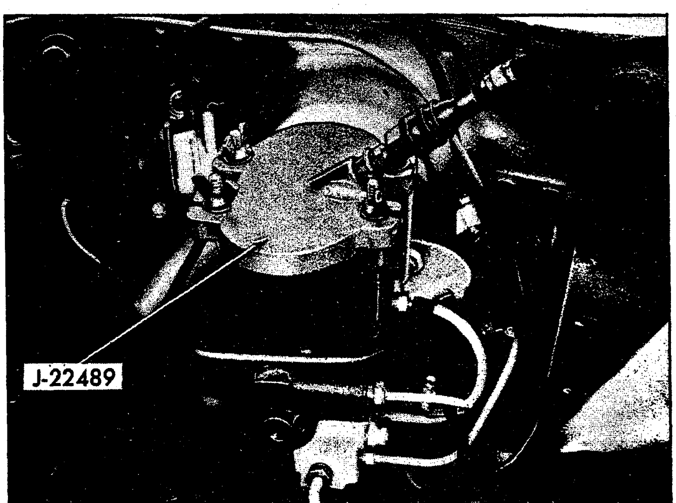


Fig. 6—Brake Bleeder Adapter Tool J-22489—Installed

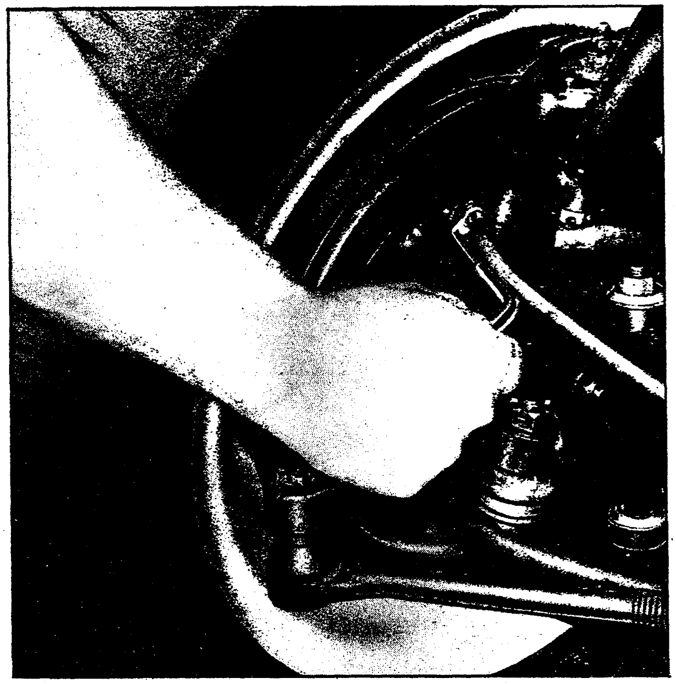


Fig. 7—Bleeding Brakes Using Brake Bleeder Wrench Tool J-21472

11. Remove bleeder adapter J-22489. Wipe all area dry of fluid if fluid was spilled during adapter removal.
12. Fill master cylinder reservoirs to within 1/4" of reservoir rims as shown in Figure 8.
13. Install main cylinder diaphragm and cover.

MANUAL BLEEDING

1. Clean all dirt from top of main cylinder and remove cylinder cover and rubber diaphragm.
2. Fill main cylinder reservoirs.
3. Install brake bleeder wrench, Tool J-21472 on bleeder valve at wheel cylinder and install one end of bleeder hose on bleeder valve (fig. 7).
4. Pour a sufficient amount of brake fluid into a transparent container to insure that end of bleeder hose will remain submerged during bleeding. Place the loose end of bleeder hose into the container. Be sure the hose end is submerged in the fluid.

NOTE: Carefully monitor fluid level at main cylinder during manual bleeding operations. Do not bleed enough fluid at one time to drain the reservoir completely. Replenish the reservoirs with fluid while bleeding to insure a sufficient amount of fluid is in the main cylinder at all times. To insure that outside air is not sucked back into the hydraulic system, the bleeder valve should be closed before the brake pedal reaches the floor.

5. Open wheel cylinder bleeder valve by turning Tool J-21472 counterclockwise approximately 1/3 of a turn. Slowly depress brake pedal. Just before 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

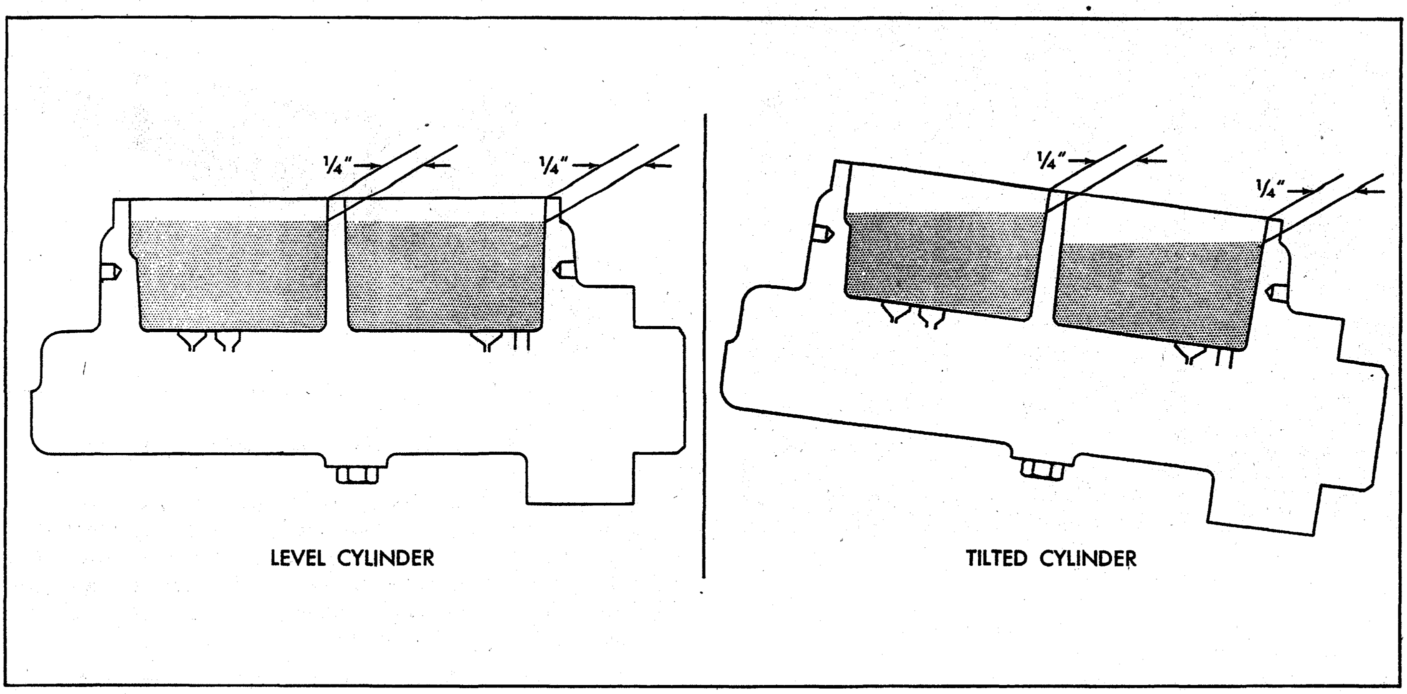


Fig. 8—Correct Main Cylinder Fluid Level

expelled brake fluid flows in a solid stream from the bleeder hose and no bubbles are present, then close bleeder valve tightly.

6. Remove brake bleeder wrench and bleeder hose from wheel cylinder bleeder valve.
7. Repeat Steps 2 through 7 on the remaining wheel cylinders in the correct bleeding sequence (fig. 5).
8. Fill the main cylinder to the levels shown in Figure 8.
9. Install main cylinder diaphragm and cover.

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 pistons must be 1/16" to 1/4" (fig. 9).
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. 10).

   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 tough 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

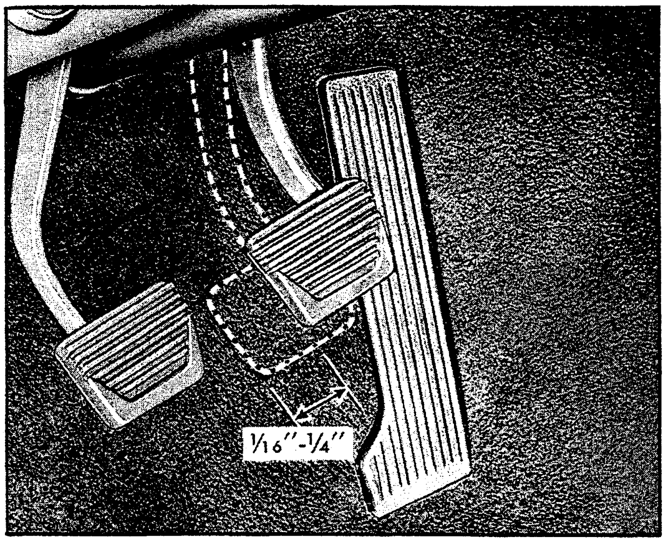


Fig. 9—Brake Pedal Free Movement

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.
8. Do not tighten male end (wheel cylinder end) once the other end is fixed. If necessary to tighten male end, disconnect hose at opposite end, then reconnect following above procedure.

Hydraulic Brake Tubing

Hydraulic brake tubing is a double layer annealed steel terne plate 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.

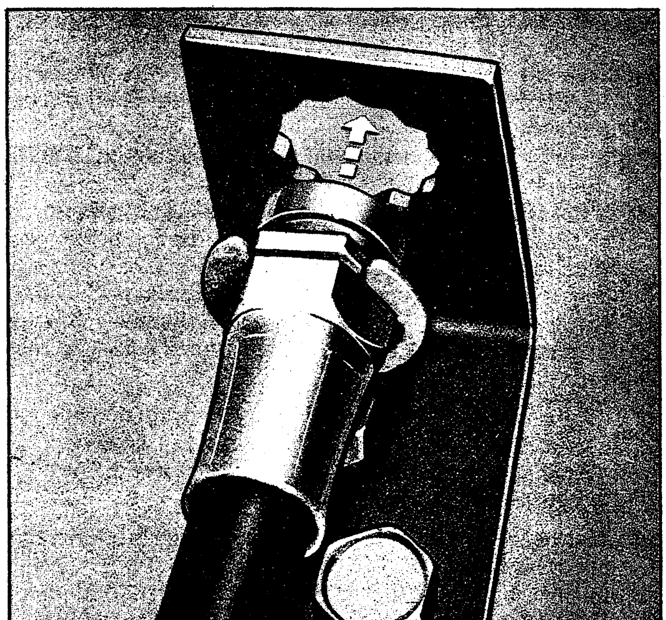


Fig. 10—Brake Line Support Bracket

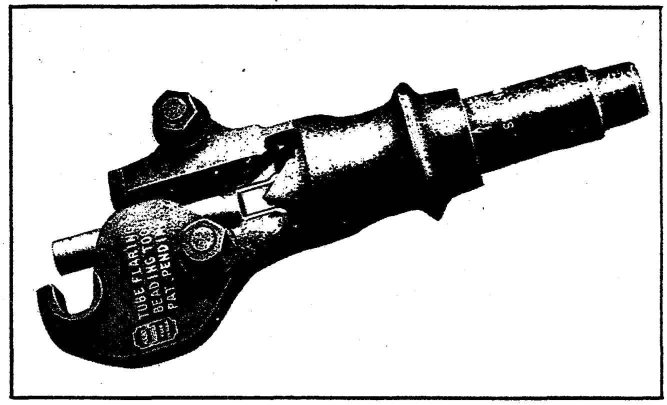


Fig. 11—Hydraulic Brake Tube Double Flaring Tool

CAUTION: When necessary to replace brake tubing, always use special steel 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. 11) is used to form the double-lap flare.

Figure 12 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.

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.

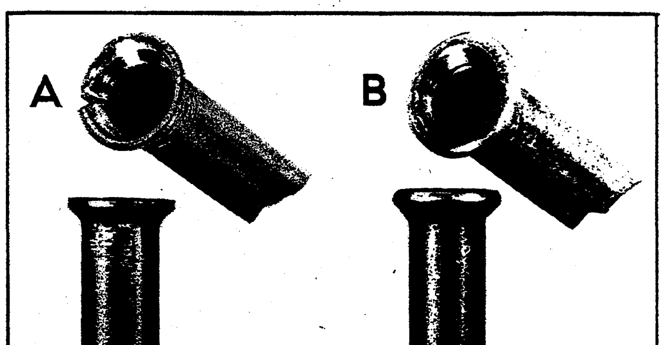


Fig. 12—Single and Double Lap Flaring

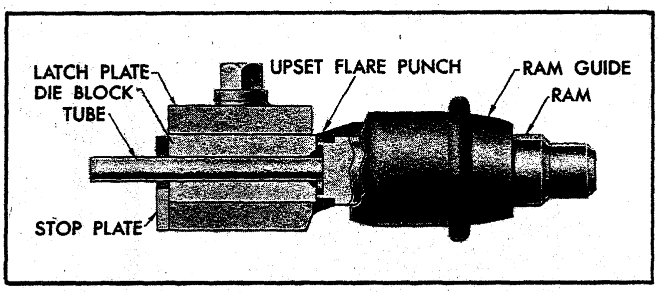


Fig. 13—Flaring Operation—Positioning Tubing

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 on-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. 13).
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. 14). 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. 15).

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

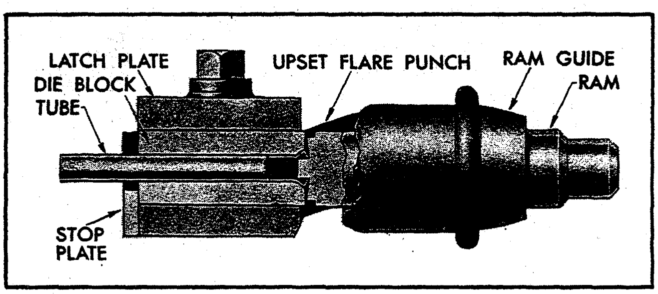


Fig. 14—Flaring Operation—First Flare

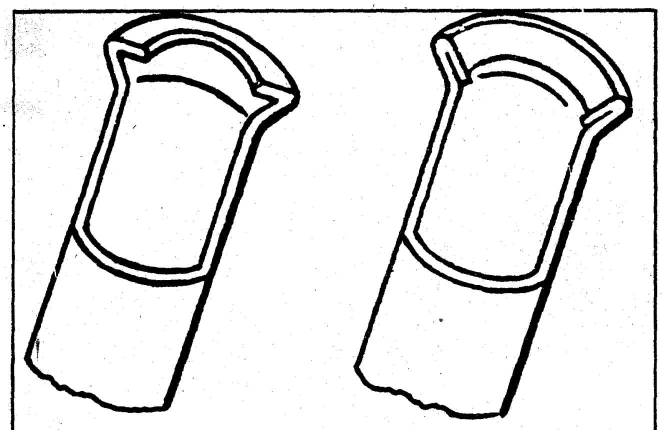


Fig. 15—Flaring Operation—First and Second Flare

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. 16).

Fig. 16—Using Drum-to-Brake Shoe Clearance Gauge Tool J-21177

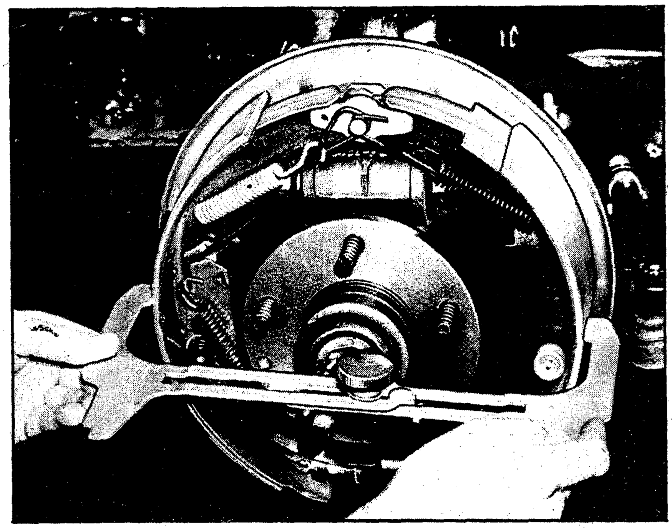


Fig. 17—Checking Brake Shoe Lining Clearance Using Tool J-21177

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. 17).
c. Rotate the gauge around the brake shoe lining surface to assure prpper 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 is 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. 18).

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.

Fig. 18—Aligning Drum Tang with Wheel Hub

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 or loosen 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 brake 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.

COMPONENT REPLACEMENT AND REPAIRS

PARKING BRAKE—CHEVROLET, CHEVELLE AND CAMARO (Figs. 19 and 20)

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 located in engine compartment.
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.
6. On Chevelle, if necessary, remove rubber tube from front cable.

Installation

1. On Chevelle, if necessary, replace rubber tube over front cable.
2. 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.
3. Feed stud end of cable through frame rail and secure with retainer on inner side of frame.
4. 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.
5. Adjust parking brake as outlined in this section.
6. 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 cable from 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 cable in cable guides (figs. 19 and 20).
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 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 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.

PARKING BRAKE—CHEVY II (Fig. 21)

Lever Assembly

Removal

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

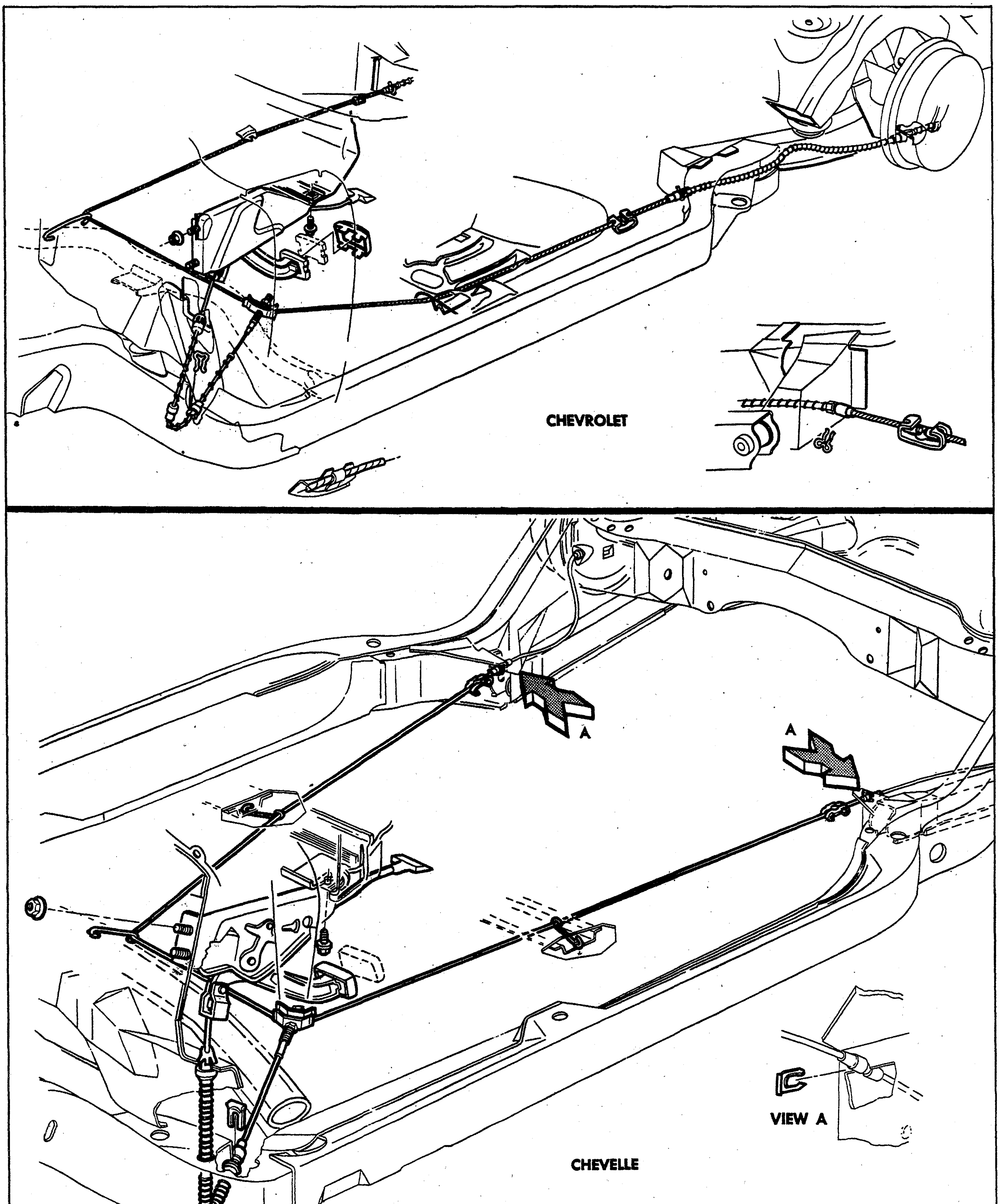


Fig. 19—Parking Brake System—Chevrolet and Chevelle

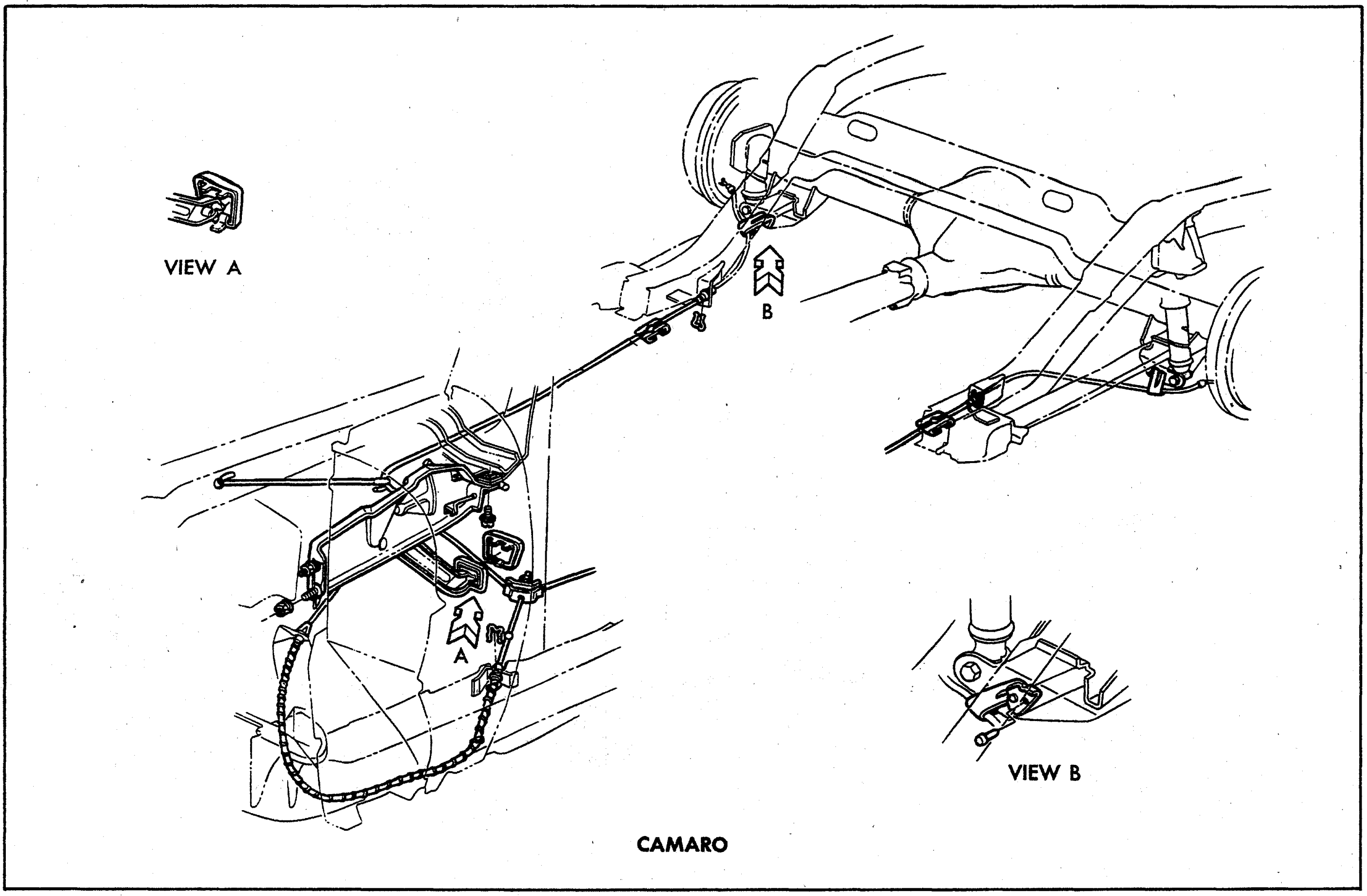


Fig. 20—Parking Brake System—Camaro

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 clip and pin from idler lever assembly.
5. Remove two lever dash attaching screws, and remove lever assembly from vehicle.

Installation

1. Place lever assembly into position and secure with the two lever to dash attaching screws.
2. Place idler lever in position with lever assembly, align holes and install clevis pin and clip.
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 clip and pin from idler lever assembly.
5. Remove cable ball from idler lever.
6. Remove pivot pin clip and pivot pin, then remove idler lever from vehicle.

Installation

1. Place, idler lever into position and secure with the pivot pin and clip.
2. Connect cable ball to idler lever.
3. Place idler lever in position with lever assembly, align holes and install clevis pin and clip.
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.

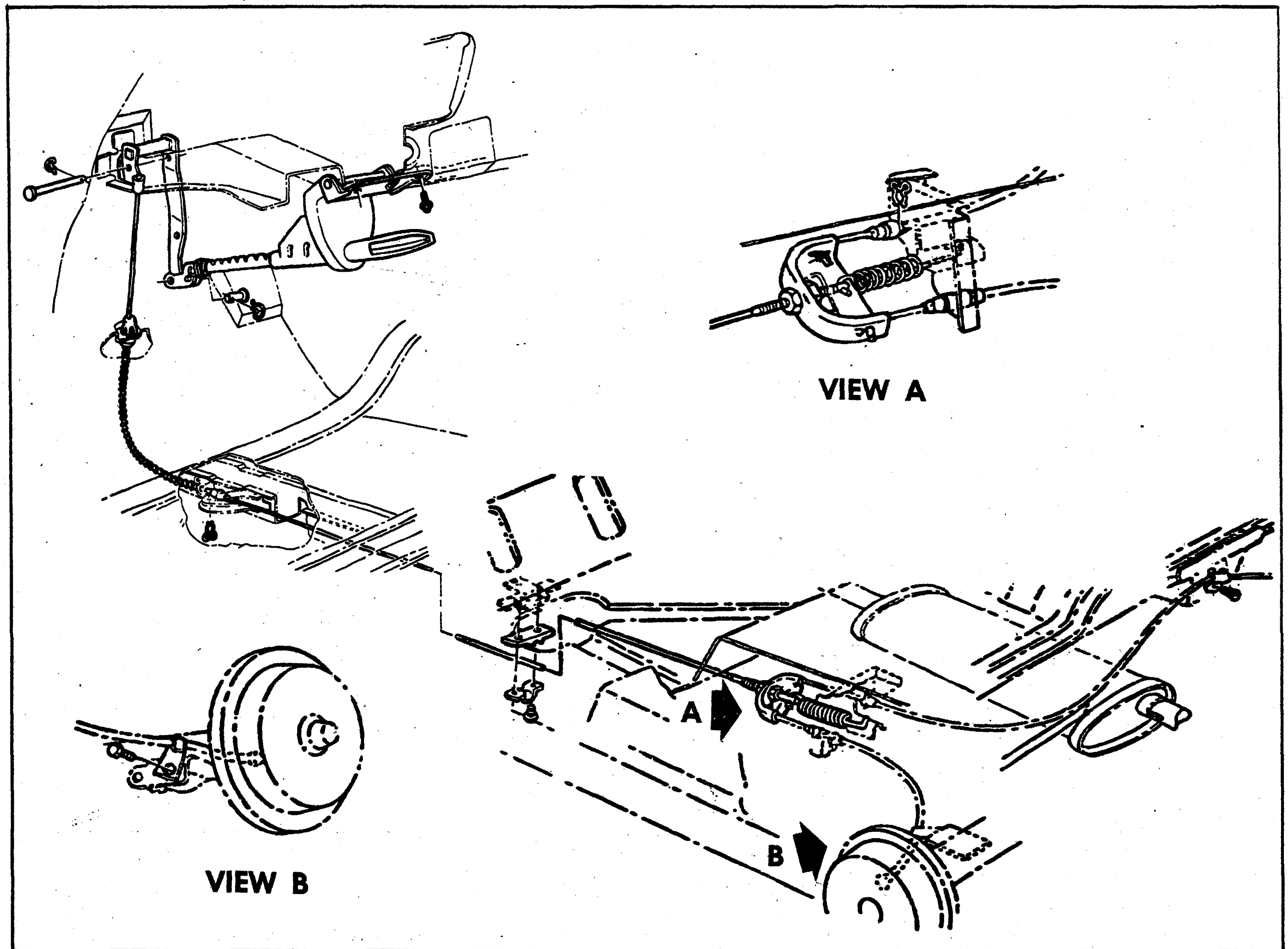


Fig. 21—Parking Brake System—Chevy II

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 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. Present parking brake lever to one notch.
3. Place 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 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 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.

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

PARKING BRAKE—CORVETTE (Fig. 22)

Lever Assembly

Removal

1. Place parking brake lever in the fully released position.
2. Under vehicle, unhook and remove return spring.
3. Remove rear nut from cable stud at equalizer and allow front cable to hang down.
4. Inside vehicle, remove six screws securing cover to underbody. It is necessary to push the seat cushion down as shown in Figure 23 to gain access to the lower mounting screw on each side. Remove the retainer. Lift the cover upward and to the rear to allow seal to slide out of cover slot and remove cover.
5. Remove trim seal from lever (fig. 24).
6. Remove screw and washer securing parking brake alarm switch to side of lever assembly.
7. Remove four bolts securing lever assembly to underbody and lift lever assembly upward. Remove lever forward mounting bracket.

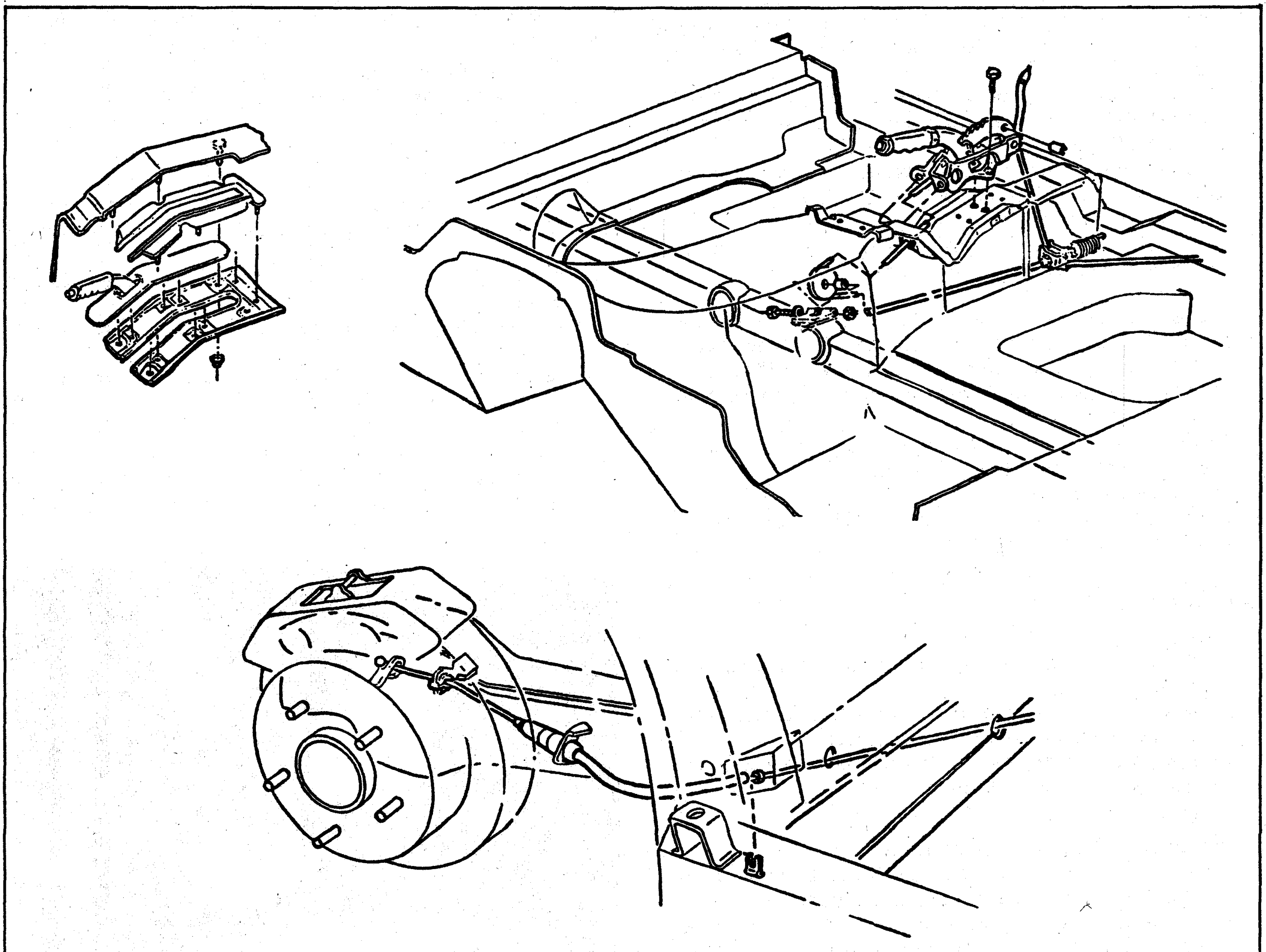


Fig. 22—Parking Brake System—Corvette

Fig. 23—Removing or Installing Cover Lower Mounting Screws

8. Remove front cable from lever assembly using long nose pliers as shown in Figure 25. Remove lever from vehicle.

Installation

1. Install front cable in lever assembly using long nose pliers as shown in Figure 25. Slide slack cable through hole and place lever assembly in position.
2. Place forward mounting bracket in position and secure plate and lever assembly to underbody with four mounting bolts.
3. Secure parking brake alarm switch to side of lever assembly with washer and screw (fig. 24).
4. Install trim seal on lever (fig. 24).
5. Insert the end of the trim seal into the slot in the cover and slide the cover forward and down into position.
6. Place the retainer in position. Secure retainer and cover to underbody with six screws. It is necessary to push the seat cushion down as shown in Figure 23 to gain access to the lower mounting screw hole on each side.
7. Under vehicle, insert front cable stud through equalizer assembly and secure with nut.
8. Install return spring.
9. Adjust parking brake as outlined under Maintenance and Adjustments in this section.

Front Cable

Removal

1. Perform the complete parking brake lever removal procedure above.
2. Under vehicle, remove nut, washer, and bolt securing pulley to pulley bracket (fig. 22).
3. Remove seal grommet from underbody cable hole.
4. Pull front cable out of vehicle.

Installation

1. Install seal grommet around front cable.
2. Slide front cable into position through cable hole and work seal grommet into installed position.
3. Under vehicle, loop front cable around pulley wheel and secure pulley wheel to bracket with bolt, washer, and nut (fig. 22).
4. Perform the complete parking brake lever installation procedure above.

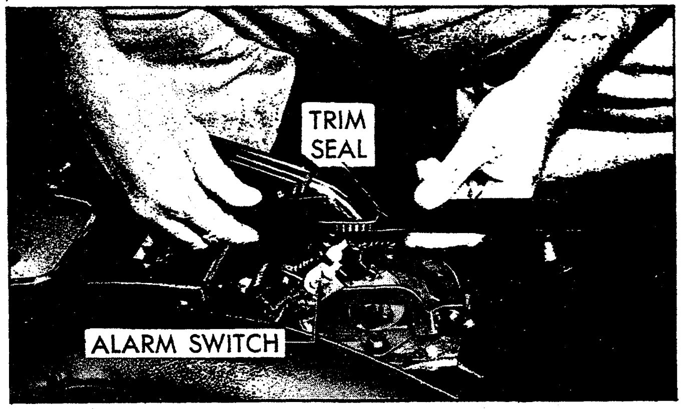


Fig. 24—Removing or Installing Trim Seal

Removal

1. Remove the cable clip retainers on the back side of the frame rail from each of the rear brake cable ends.
2. Disconnect the cable at the rear wheel flange plate.
3. Remove the cable ball out of the recess in the brake lever assembly clevis.
4. Disconnect the cables at the equalizer connector and remove the cables.

Installation

1. Attach the rear cable balls on the rear cable ends to the rear wheel recess in the brake lever assembly clevis.
2. Attach the cable assembly to the rear wheel flange plate.
3. Connect the cable assemblies along the frame rail area.
4. Insert the cable end through the equalizer and attach to the equalizer connector.
5. Adjust as outlined under Maintenance and Adjustments.
6. Lubricate the cables and all moving parts for trouble-free operation—see Lubrication, Section 0.

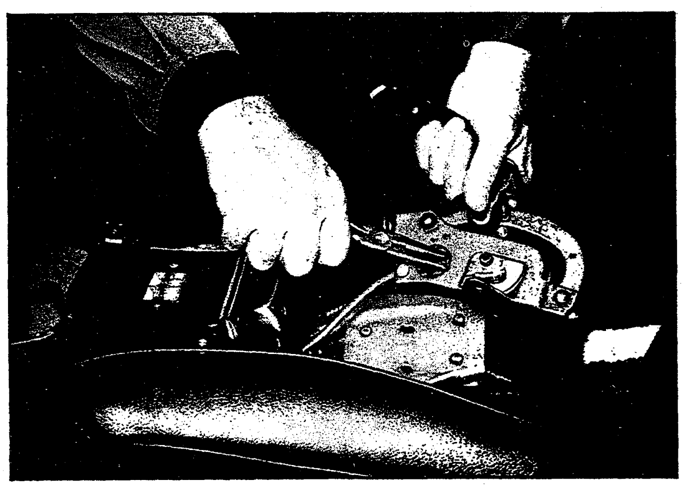


Fig. 25—Removing or Installing Front Cable

Brake Shoes

Refer to parking brake shoe service procedures under Disc Brakes in this section.

BRAKE PEDAL (Fig. 26)

Removal

NOTE: Refer to Section 1A for removal of air conditioning components if necessary.

1. Disconnect clutch pedal return spring (manual transmission models only).
2. Disconnect clutch push rod at pedal.
3. Disconnect brake pedal return spring (Chevelle and Camaro only).
4. Disconnect brake pedal from main cylinder push rod by removing retainer and clevis pin.
5. Corvette only:
   a. Remove steering column from vehicle as outlined in Section 9.
   b. Support main cylinder from inside engine compartment and remove four support brace nuts.
   c. Remove four nuts and bolts securing support plate to bracket and remove support plate.
   d. Remove two screws securing bracket to underside of instrument panel and lower bracket and pedals to floor.
6. Remove retainer from right side of pedal pivot shaft.
7. Slide clutch pedal assembly to the left and remove from support brace.
8. 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 cleaning 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 support brace cutout, and through both ends of brake pedal bore.
2. Chevrolet, Chevy II, and Corvette: Position brake pedal return spring on pedal arm and place pedal assembly in support brace. Index return spring in support brace cutout.
3. Chevelle and Camaro: Place pedal assembly in support brace.
4. Slide pedal pivot shaft through support brace and brake pedal bore.
5. Install retainer to right side of pedal pivot shaft.
6. Corvette only:
   a. Install bracket with pedal assemblies to underside of instrument panel with two screws.
   b. Install support plate on bracket with four bolts and nuts.
   c. Place main cylinder in position and install four bracket and cylinder mounting bolts; secure entire assembly with four nuts.
   d. Install steering column in vehicle as outlined in Section 9.
7. Chevelle and Camaro: Install brake pedal return spring.
8. On manual transmission models, connect clutch pedal push rod to pedal bracket and install retainer. Install clutch pedal return spring.
9. Adjust brake pedal free travel as outlined in this section. Adjust stoplight switch as outlined in Section

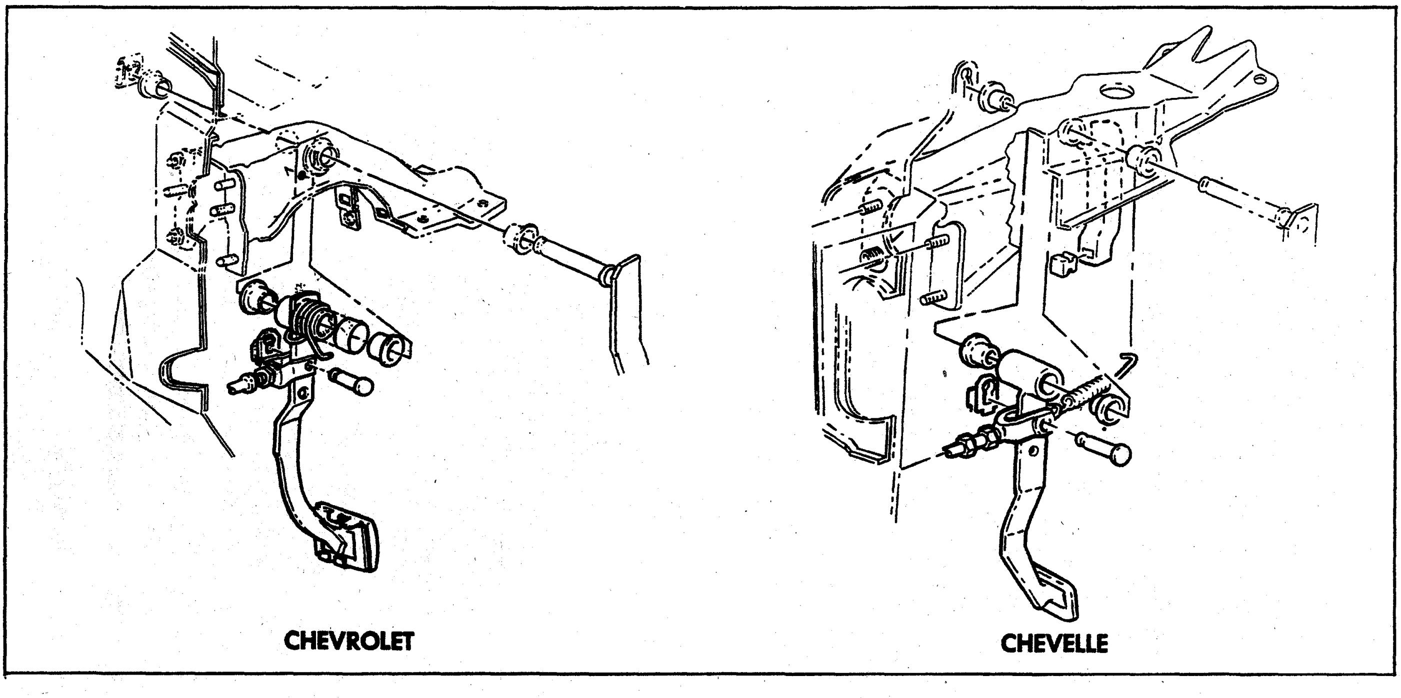


Fig. 26—Brake Pedal Installation

6Y. Adjust clutch pedal travel as outlined in Section 7.

SHOES AND LININGS

Organic 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 plate 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. 27).
5. Remove the actuator return spring and link.
6. Remove hold-down pins and springs (fig. 28).
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.
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.

4. Check cylinders with internal boots by carefully pulling a small part of the boot out of the cylinder. 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.
5. 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. 29), using fine emery cloth.

Installation

CAUTION: Make certain to install recom-

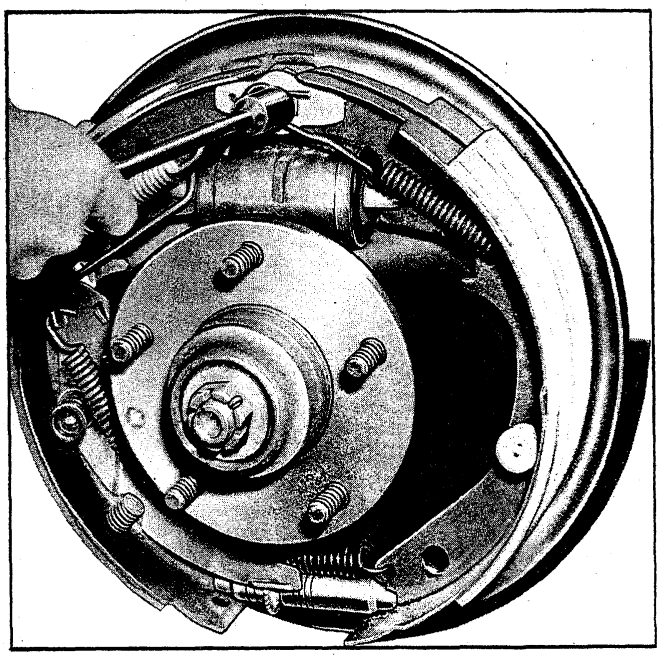


Fig. 27—Unhooking Pull Back Spring

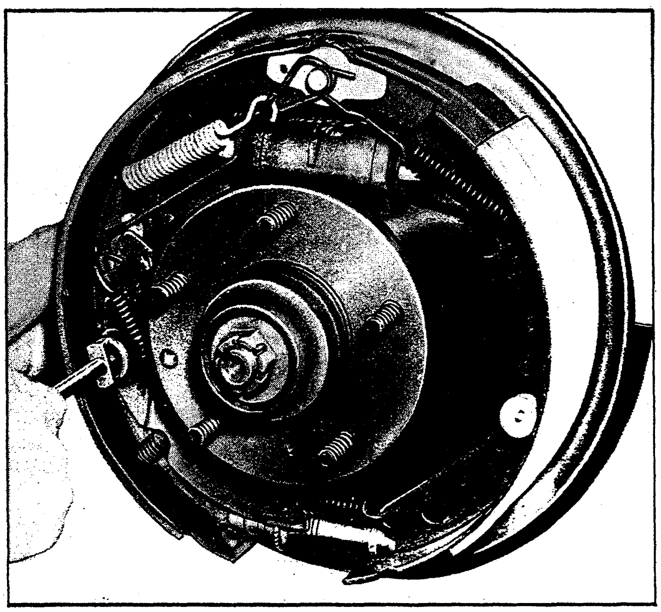


Fig. 28—Removing Hold-Down Springs and Pins

mended shoe and lining assemblies. Otherwise, serious fade or 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.

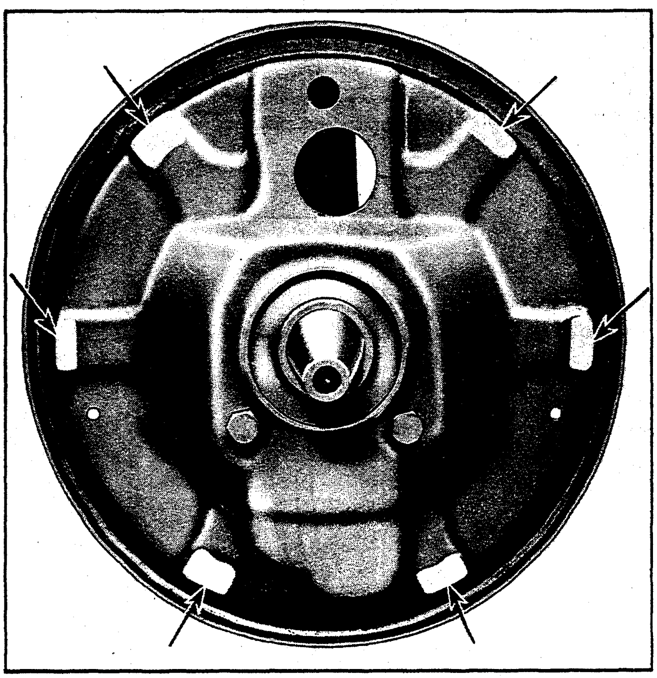


Fig. 29—Backing Plate Contact Surfaces

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. Engages 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. 29).

    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. 30).
16. Follow the above procedure for all wheels.
17. Adjust the service brakes and parking brake as outlined under "Maintenance and Adjustments" in this section.

Metallic Linings

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.

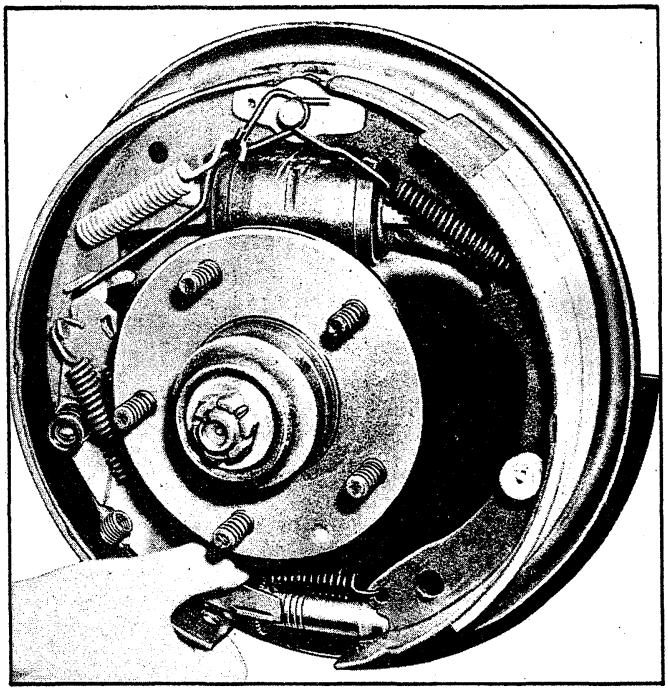


Fig. 30—Checking Operation of the Actuating Lever

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 (Fig. 31)

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. 31).

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.

MAIN CYLINDER

When servicing the Delco Moraine dual master cylinder, follow the rules below when replacing either complete master cylinder or the component pistons of the cylinder. It is equally important to use only the

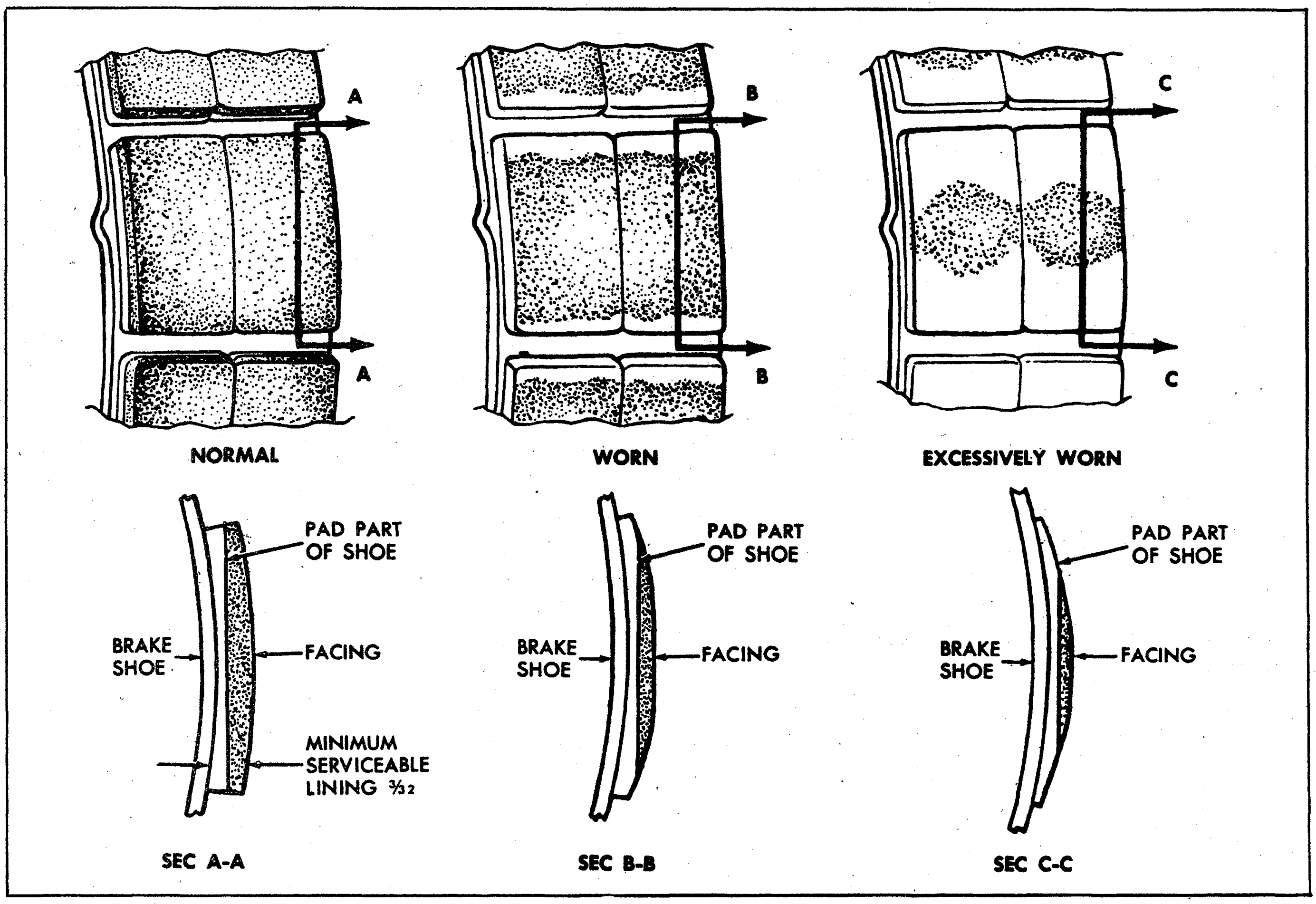


Fig. 31—Identification of Worn Metallic Brake Lining

correct service parts when servicing a Bendix main cylinder.

1. The two-letter identification stamp on the end of the master cylinder indicates the displacement capabilities of that particular cylinder. Master cylinders should only be replaced with another cylinder bearing the same two-letter identification.
2. The length of the component pistons in the master cylinders are critical factors in displacement capabilities of a particular master cylinder. These pistons are coded, using rings or grooves in the shank of the piston. It is mandatory that when pistons are replaced, the replacing piston must contain the same identification marks and the same contour at the push rod end as the piston which is removed.
3. Delco Moraine dual master cylinders, used with drum-type brakes, contain a rubber check valve and check valve spring in each outlet boss. When the car is equipped with disc brakes on the front and drum brakes on the rear, the dual master cylinder will have a check valve and spring in the outlet boss for the rear brakes. No check valve is required for four wheel disc brakes, and, therefore, the outlet

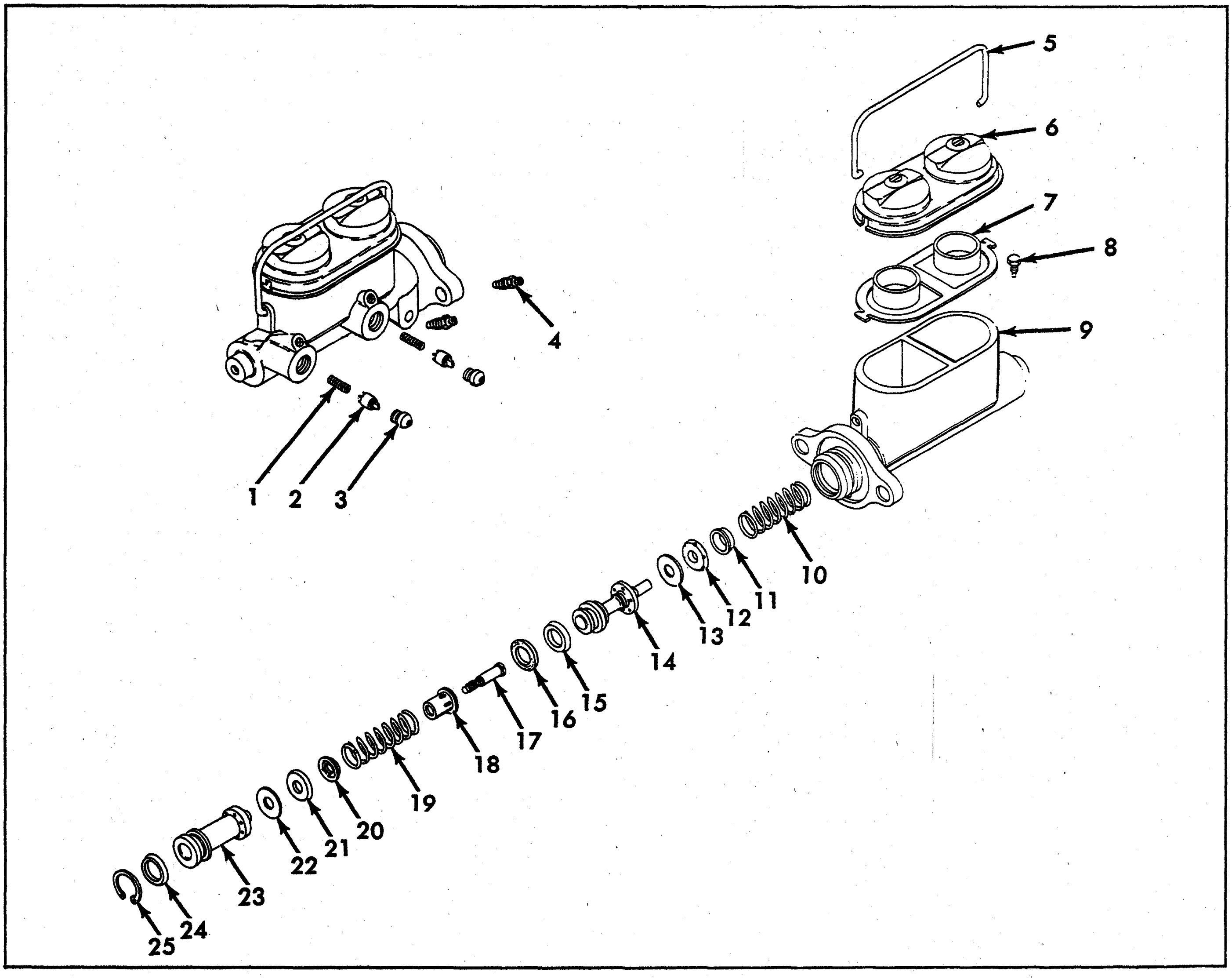


Fig. 32—Main Cylinder for Drum Type Brakes—Exploded View

1. Spring
2. Check Valve
3. Valve Seat
4. Bleeder Valve
5. Bail Wire
6. Cover
7. Diaphragm
8. Stop Screw
9. Body
10. Spring
11. Retainer
12. Seal
13. Seal Protector
14. Primary Piston
15. Seal
16. Seal
17. Piston Extension Screw
18. Secondary Piston Stop
19. Spring
20. Spring Retainer
21. Seal
22. Seal Protector
23. Secondary Piston
24. Seal
25. Retaining Ring

boss to the front brakes will not contain a check valve and spring.

Removal

1. Wipe main cylinder and lines clean with a clean cloth. Place dry cloths below main cylinder area to absorb any fluid spillage.
2. Disconnect hydraulic lines at main cylinder. Cover line ends with clean lint-free material to prevent foreign matter from entering the system.
3. Disconnect the push rod from the brake pedal.
4. Unbolt and remove the main cylinder from the firewall.
5. Remove the main cylinder mounting gasket and boot.
6. Remove the main cylinder cover and dump out the fluid. Pump the remaining fluid from the cylinder by depressing the push rod.

Disassembly (Fig. 32)

1. Clamp main cylinder in a bench vice.
2. Remove push rod retainer.
3. Remove secondary piston stop bolt from bottom of front fluid reservoir.
4. Remove the snap ring retainer and primary piston assembly. Remove the secondary piston, piston spring, and retainer by blowing air through the stop bolt hole. (If no air is available, a piece of wire may be used. Bend approximately 1/4 inch of one end into a right angle, hook the secondary piston and pull it out.)
5. Position main cylinder in vice with outlet holes facing up.
6. Drill a 13/64 inch hole through both check valve seats.
7. Tap out both seats using a 1/4 - 20 tap.
8. Install a spare brake line tube nut in the outlet hole. Place a flat washer on a one inch screw (threaded to screw into tapped hole), and thread screw into threaded hole in tube seat. Hold the screw to keep it from turning and back out the tube nut. This will remove the tube seat.
9. Repeat Step 8 above on second tube seat.
10. Remove the check valves and springs from the cavities beneath the tube seats.
11. Remove the primary seal, primary seal protector, and secondary seals from the secondary piston. Remove the piston extension screw securing the primary piston spring to the primary piston. Remove the spring retainer, primary seal, primary seal protector, and secondary seal from the primary piston.

Cleaning and Inspection

1. Remove main cylinder casting from vice and inspect the bore for corrosion, pits, and foreign matter. Be sure that the outlet ports are clean and free of brass cuttings from the tube seat removal operation.
2. Inspect the fluid reservoirs for foreign matter. Check the bypass and compensating ports to the cylinder bore to insure that they are not restricted. Do not use wire to check ports.

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

3. Use Declene or equivalent to clean all metal parts thoroughly. Immerse parts in the cleaning fluid and brush with hair brush to remove foreign matter. Blow out all passages, orifices, and valve holes. Air dry the parts and place on clean paper or lint-free clean cloth.

NOTE: Be sure to keep parts clean until reassembly. Rewash parts, if there is any occasion to doubt cleanliness.

4. Check pistons for scratches or other visual damage; replace if necessary.

Assembly (Fig. 32)

Use care when reassembling the main cylinder check valves. Improper assembly of the check valve seats will result in distortion of the seats. If this occurs, there will be no check valve action and a loss of brake pedal travel will result; the pedal will have to be pumped one or more times before actual car braking occurs.

1. Place the main cylinder in a vice with the outlet holes facing up. Place the check valve springs in the outlet holes. Be sure the springs are seated in the bottom of the holes. Place new rubber check valves over the springs, being careful not to displace the springs from the spring seats.
2. Place new brass tube seats in the outlet holes. Be sure seats are not cocked as this would cause burrs to be turned up as the tube seats are pressed in. Thread a spare brake line tube nut into the outlet hole and turn the nut down until the tube seat bottoms. Remove the tube nut and check the outlet hole for loose burrs, which might have been turned up when the tube seat was pressed down. Repeat this process to bottom the second seat.
3. Put new secondary seals in the two grooves in the end of the secondary piston assembly. The seal which is nearest the end will have its lips facing toward that end. The seal in the second groove should have its lips facing toward the portion of the secondary piston which contains the small compensating holes.
4. Assemble a new primary seal protector and primary seal over the end of the secondary piston with the flat side of the seal seats against the seal protector, and the protector against the flange of the piston which contains the small compensating holes.
5. Assemble the new secondary seal into the groove on the push rod end of the primary piston. The lips of this seal should face toward the small compensating holes in the opposite end of the primary piston.
6. Assemble the new primary seal protector and primary seal on the end of the primary piston with the flat side of the seal seated against the seal protector, and the protector against the flange on the piston which contains the compensating holes.
7. Assemble the spring retainer in one end of the primary piston spring and the secondary piston stop in the other end. Place the end of the spring over the end of the primary piston with the spring retainer seats inside of the lips of the primary seal.
8. Remove all cleaning liquid from the threaded hole in the primary piston. Place the piston extension screw down through the secondary piston stop and the primary spring retainer and screw it into the primary piston until it bottoms out.
9. Coat the bore of the master cylinder with clean

brake fluid. Coat the primary and secondary seals on the secondary piston with clean brake fluid. Insert the secondary piston spring retainer into the secondary piston spring. Place the retainer and spring down over the end of the secondary piston until the retainer locates inside of the lips of the primary cup.

10. Hold the master cylinder with the open end of the bore down. Push the secondary piston into the bore until the spring seats against the closed end of the bore.
11. Position the master cylinder in a vise with the open end of the bore up. Coat the primary and secondary seal on the primary piston with clean brake fluid. Push the primary piston assembly, spring end first, into the bore of the master cylinder. Hold the piston down and snap the lock ring into position in the small groove in the I.D. of the bore.
12. Push the primary piston down to move the secondary piston forward far enough to clear the stop screw hole in the bottom of the front fluid reservoir. Install the stop screw.
13. Install reservoir diaphragm in the reservoir cover and install the cover on the main cylinder. Push bail wire into position to secure the reservoir cover.

Installation

1. Assemble the push rod through the push rod retainer, if it has been disassembled.
2. Push the retainer over the end of the main cylinder. Assemble new boot over push rod and press it down over the push rod retainer. Slide new mounting gasket into position.
3. Secure the main cylinder to the firewall with mounting bolts.
4. Connect the push rod clevis to the brake pedal with pin and retainer.
5. Connect the brake lines to the main cylinder.
6. Fill the main cylinder reservoirs to the levels shown in Figure 8. Bleed the brake system as outlined in this section.
7. If necessary, adjust the brake pedal free play as outlined in this section.

WHEEL CYLINDER (Fig. 33)

The wheel cylinder boots should be removed from a cylinder body only when they are visibly damaged or leaking fluid. Wheel cylinders having torn, cut, or heat-cracked boots should be completely overhauled.

Removal

1. Raise vehicle and place on jack stands.

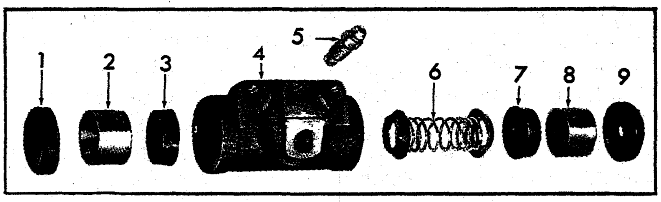


Fig. 33—Chevelle Wheel Cylinder—Exploded View

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

2. Remove wheel and tire assembly. Back off brake adjustment, if necessary, and remove drum.
3. Disconnect brake system hydraulic line from cylinder.
4. Remove brake shoe pull back springs.
5. Remove screws securing wheel cylinder to flange plate. Disengage cylinder push rods from brake shoes and remove cylinder.

NOTE: On Chevrolet, it is necessary to remove the anchor pin which holds the front wheel cylinder to flange plate to remove the front wheel cylinder.

Disassembly

1. Remove boots from cylinder ends with pliers and discard boots.
2. Remove and discard pistons and cups.

Inspection and Cleaning

NOTE: Staining is not to be confused with corrosion. Corrosion can be identified as pits or excessive bore roughness.

1. Inspect cylinder bore. Check for staining and corrosion. Discard cylinder if corroded.
2. Polish any discolored or stained area with crocus cloth by revolving the cylinder on the cloth supported by a finger. Do not slide the cloth in a lengthwise manner under pressure.

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.

3. Wash the cylinder and metal parts in Declene or equivalent.
4. Shake excess cleaning fluid from the cylinder. Do not use a rag to dry the cylinder as lint from the rag cannot be kept from the cylinder bore surfaces.
5. Check piston for scratches or other visual damage; replace if necessary.

Assembly (Fig. 33)

1. Lubricate the cylinder bore and counterbore with clean brake fluid and insert spring-expander assembly.
2. Install new cups with flat surfaces toward outer ends of cylinder. Be sure cups are lint and dirt free before insertion. Do not lubricate cups prior to assembly.
3. Install new Durex pistons into cylinder with flat surfaces toward center of cylinder. Do not lubricate pistons before installation.
4. Press new boots into cylinder counterbores by hand. Do not lubricate boots prior to installation.

Installation

1. Position wheel cylinder to brake flange plate. Install 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 130 lb. ft. To secure, peen over the flat washer on the anchor pin.

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 outlined in this section.

ANCHOR PIN

Front Wheel

1. Raise front 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. Disengage anchor pin lock and remove anchor pin by turning counterclockwise.
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 130 lb. ft. 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 in this section. Test brake operation.

Rear Wheel

Two type anchor pins are used in production for the rear wheels. The riveted type is not serviced and if failure or damage 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 80 lb. ft.
6. Install brake shoe guide plate, link and pull back springs.
7. Adjust brakes and install drum and wheel as 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 wihtout removing the axle shaft.

A lanced "knock out" area (fig. 34) 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.

A small screw driver or hooked wire may be inserted to disengage the automatic adjuster actuating lever so the star wheel may be turned.

Removal

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

Inspection 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 oil substance may be left on the braking surface that may later cause difficulty.

Installation

1. Make brake adjustment as outlined in this section.

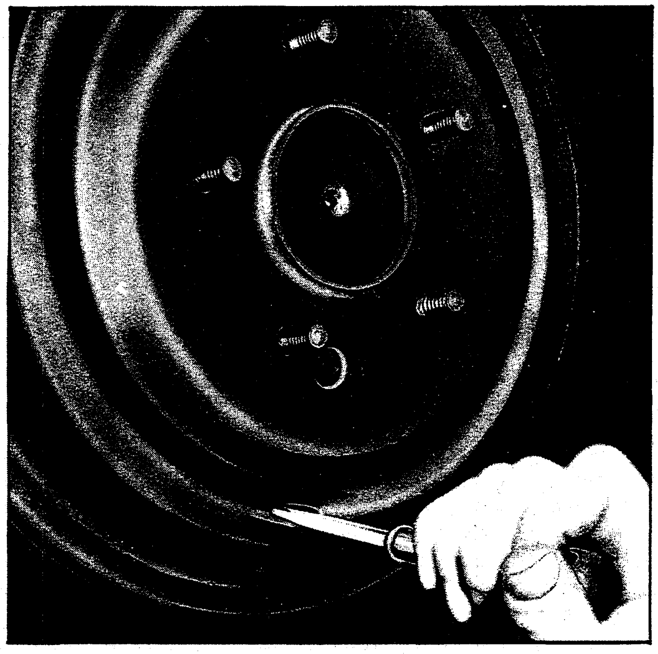


Fig. 34—Brake Drum Access Hole

2. Install brake drum, aligning tang with wheel hub (fig. 18).
3. Install wheel and tire assembly.
4. Make final brake adjustment as outlined in this section and check brake operation.

BRAKE PIPE DISTRIBUTION AND SWITCH ASSEMBLY (Fig. 2)

Removal

1. Disconnect battery cable.
2. Disconnect electrical lead from switch assembly.
3. Place dry rags below the switch to absorb any fluid spilled during removal of switch.
4. Disconnect four hydraulic lines from connections at switch. If necessary, loosen line connections at main cylinder to loosen lines. Cover open line ends with clean, lint-free material to prevent foreign matter from entering the system.
5. Remove mounting screw and remove switch from vehicle.

Installation

1. Make sure new switch is clean and free of dust and lint. If any doubt exists, wash switch in Declene, or equivalent, and dry with air.
2. Place switch in position and secure to bracket with mounting screw.
3. Remove protective material from open hydraulic brake lines and connect lines to switch. If necessary, tighten brake line connections at main cylinder.
4. Connect switch electrical lead.
5. Connect battery cable.
6. Bleed the brake systems as outlined in this section.

CAMARO PRESSURE REGULATOR VALVE (AIR CONDITIONED MODELS ONLY)

Removal (Fig. 3)

1. Place dry rags below valve to absorb any fluid spilled during removal of valve.
2. Disconnect hydraulic brake lines from both sides of switch. Cover open line ends with clean, lint-free material to prevent foreign matter from entering the system.
3. Remove mounting screw and remove switch from vehicle.

Installation

1. Make sure new valve is clean and free of dust and lint. If any doubt exists, wash valve in Declene, or equivalent, and dry with air.
2. Place valve in position and secure to frame side rail with mounting screw.
3. Remove protective material from open hydraulic brake lines and connect lines to each side of valve.
4. Bleed brake system as outlined in this section.

DISC BRAKES

INDEX

GENERAL DESCRIPTION

Four wheel disc brakes are standard equipment on the 1967 Corvette, as in 1966. The Corvette may also be equipped with heavy duty disc brakes which include new front calipers, shoes, linings, and rear pressure regulator valve. This heavy duty option is used in conjunction with a vacuum power unit. Front wheel disc brakes are installed as optional equipment on Chevrolet, Chevelle, Camaro, and Chevy II models.

The disc brake, (fig. 35), consists of a fixed caliper, rotating disc, splash shield, and mounting bracket. The caliper assembly contains four pistons and two shoe and lining assemblies with the lining riveted to the steel shoes. A seal and dust boot are installed on each piston, with a piston spring in the caliper cylinder bore beneath each piston. A retaining pin extends through each caliper half and both shoes to hold the shoes and linings in position in the caliper. On Corvette heavy duty disc brakes, two retaining cotter pins are used at each end of the caliper to secure the shoes and linings. Machined surfaces within the caliper prevent the shoe and lining assembly from rotating with the brake disc when pressure is applied.

The disc, which has a series of air vent louvers to provide cooling, is mounted on the front wheel-hub. The caliper straddles the disc and mounts on a mounting bracket attached to the steering knuckle with two bolts.

The Corvette heavy duty option includes a pressure regulator valve mounted in the rear brake line just below the main cylinder. Chevrolet, Chevelle, Camaro, and Chevy II models with disc brakes have a pressure regulator valve mounted in the front brake line just below the main cylinder. The valve controls the hydraulic pressure to the front or rear brakes, as applicable, resulting in the correct pressure balance between the front and rear hydraulic systems. This valve guards against premature lock-up of front or rear wheels when brakes are applied.

Maintenance, adjustment, and service operations which are not included in this section are the same as for the Duo-Servo type brakes.

MAINTENANCE AND ADJUSTMENTS

BLEEDING HYDRAULIC SYSTEM

The operation of bleeding the disc brake hydraulic system is the same as for Duo-Servo system outlined in the front of this section. Note the exceptions below and refer to bleeding procedures under Duo-Servo brakes.

1. When pressure bleeding equipment is used, the correct pressure setting for bleeding disc brakes is 10-20 lbs. on Corvette, and 40 lbs. on all other models.
2. The front calipers contain one bleeder valve. The rear calipers on Corvette contain two bleeder valves (one inboard and one outboard) which necessitates the removal of the rear wheels for bleeding.
3. Tapping the caliper with a rawhide mallet as the fluid is flowing out may assist in obtaining a good bleeding job.
4. On Chevrolet, Chevelle, Camaro and Chevy II, the spring loaded end of the pressure regulator valve (fig. 36) must be held (valve in open position) while bleeding. This is done by depressing and holding in the plunger in the end of the valve either by hand, by taping, or by clamping.

PARKING BRAKE—CORVETTE

Adjustment

1. Raise rear end of vehicle and place on jack stands.
2. Remove rear wheels.
3. Loosen brake cables at the equalizer until the parking brake levers move freely to the "off" position with slack in the cables.
4. Turn the disc until the adjusting screw can be seen through the hole in the disc.
5. Insert an adjusting tool or screw driver through the hole in the disc and tighten the adjusting screw by moving your hand away from the floor on both the left and right sides (fig. 37).
6. Tighten until the disc will not move, then back off ten (10) notches.
7. Apply the parking brake four (4) notches from inside the car.
8. Tighten the brake cables at the equalizer to produce a light drag with the wheels mounted.
9. Fully release the parking brake handle and rotate the rear wheels. No drag should be evident with the handle released.

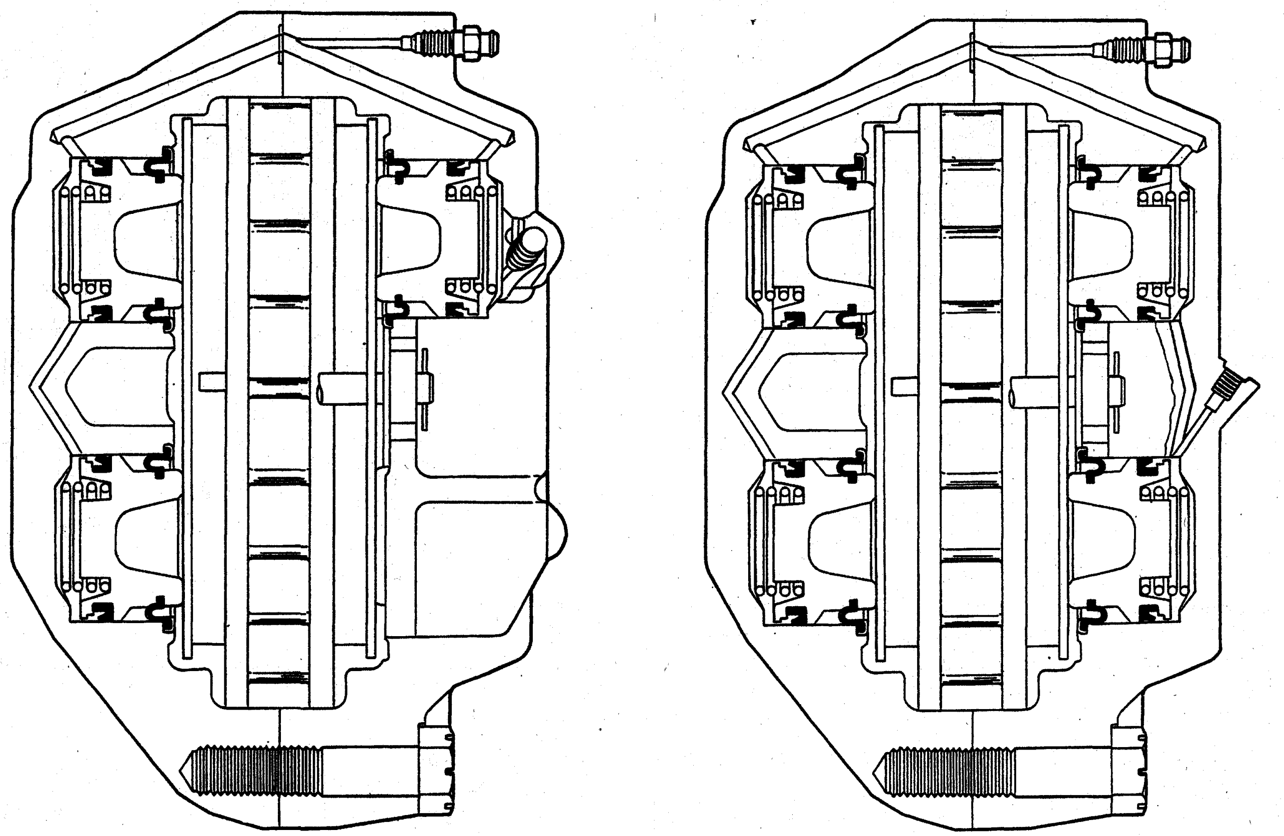


Fig. 35—Disc Brake—Cutaway View

COMPONENT REPLACEMENT AND REPAIRS

BRAKE SHOES

Shoes with bonded linings should be replaced when the groove in the center of the lining is worn off leaving approximately 1/16 inch of lining thickness. Shoes with linings retained by rivets should be replaced when the lining is worn to approximately .020" thickness over the rivet heads.

Removal

1. Siphon 2/3 of the brake fluid from the main cylinder reservoirs.

   CAUTION: If fluid is not removed, insertion of the new full thickness lining will force the pistons back into the housing displacing fluid into the master cylinder. This will cause the main cylinder to overflow. Do not drain the reservoirs completely or air will be pumped into the system.

2. Raise vehicle and place on jackstands.
3. Remove wheels.
4. Remove and discard the cotter pin from the inboard end of the shoe retaining pin and slide out the retaining pin. On Corvette with heavy duty disc brakes, two retaining pins must be removed, one on each end of the caliper assembly.
5. Remove the inboard shoe by rotating either end of shoe out of caliper and pulling shoe out.
6. Insert new shoe with lining into position. Use a putty knife to push each piston back as the shoe is inserted as shown in Figure 38.
7. Replace the outboard shoe as described above. When both caliper shoes have been replaced, install the shoe retaining pin through outboard caliper half, outboard shoe, inboard shoe, and inboard caliper half. Insert a new 3/32 x 5/8 plated cotter pin through the retaining pin and bend back ends of cotter pin. (On Corvette heavy duty front caliper,

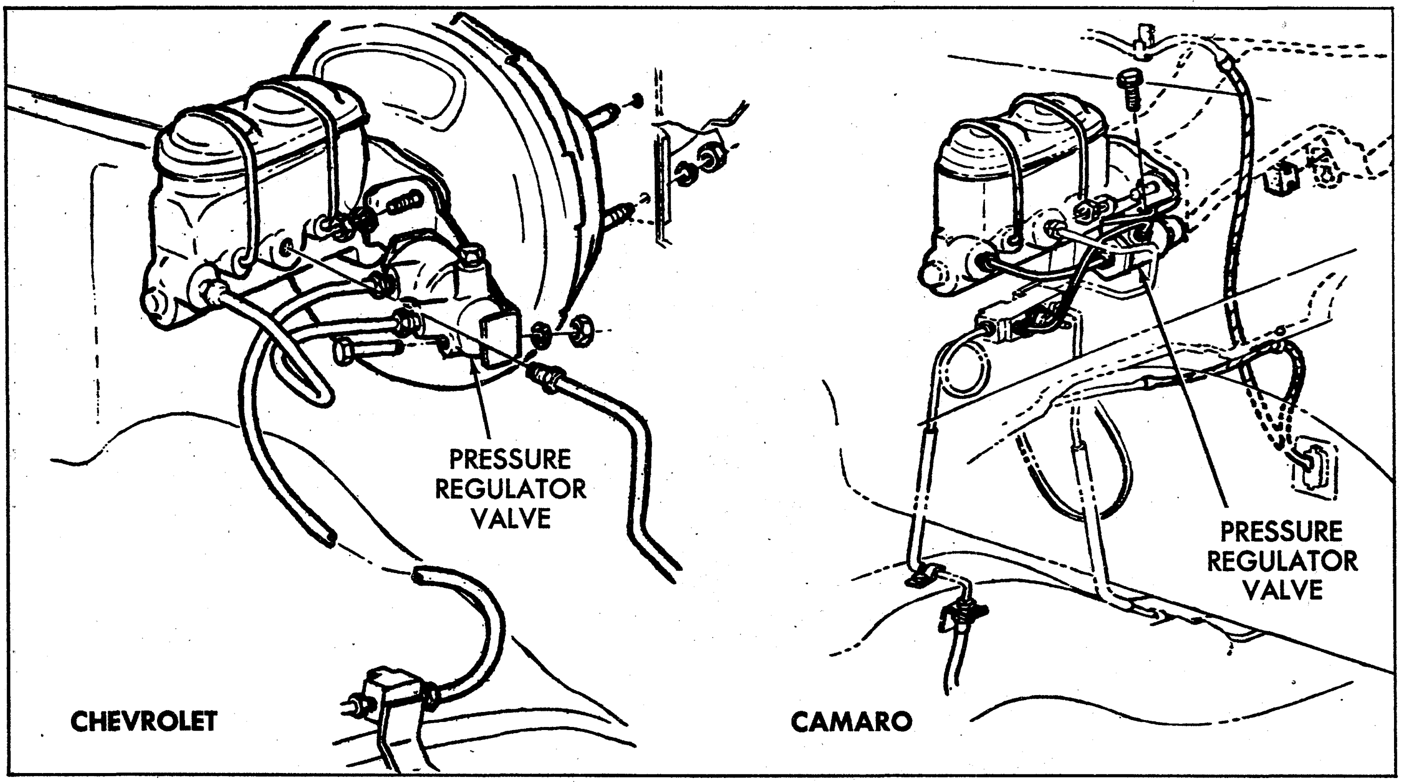


Fig. 36—Pressure Regulator Valve—Chevrolet and Camaro Shown

install two retaining cotter pins, one at each end of the caliper.)

8. Repeat above procedure at each wheel where shoes are to be replaced.
9. Refill main cylinder to fluid level shown in Figure 8. If necessary, bleed brake system as outlined in this section.
10. Install wheels and lower vehicle.

BRAKE CALIPER

Removal

1. Raise vehicle and place on jackstands.
2. Remove wheel.
3. On front caliper, disconnect the brake hose at brake line support bracket. On Corvette rear caliper, disconnect the brake tubing from the inboard caliper. Tape the open tube or line end to prevent foreign matter from entering the system.
4. Pull cotter pin from end of shoe assembly retaining pin. Remove the pin and shoe assembly from the

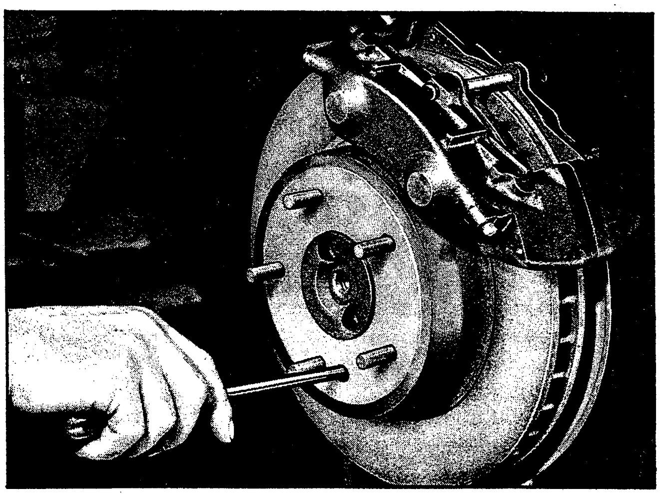


Fig. 37—Adjusting Parking Brake Shoes

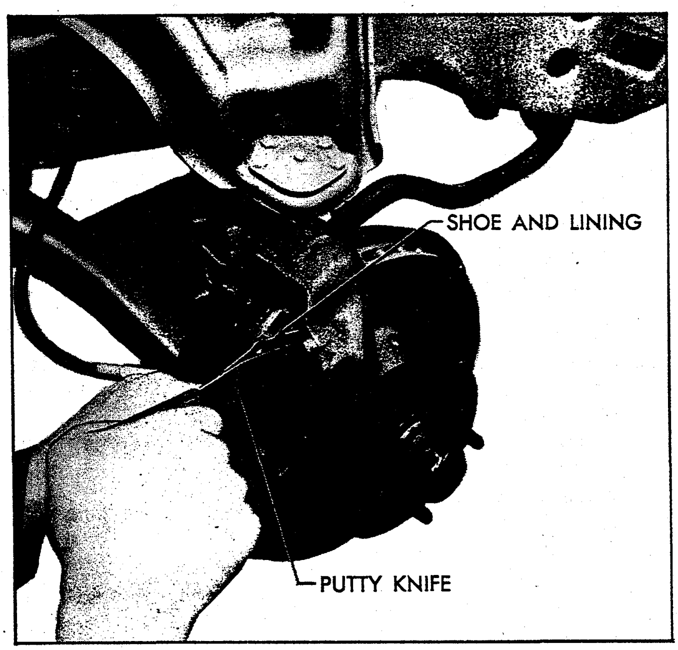


Fig. 38—Replacing Shoe and Lining Assembly

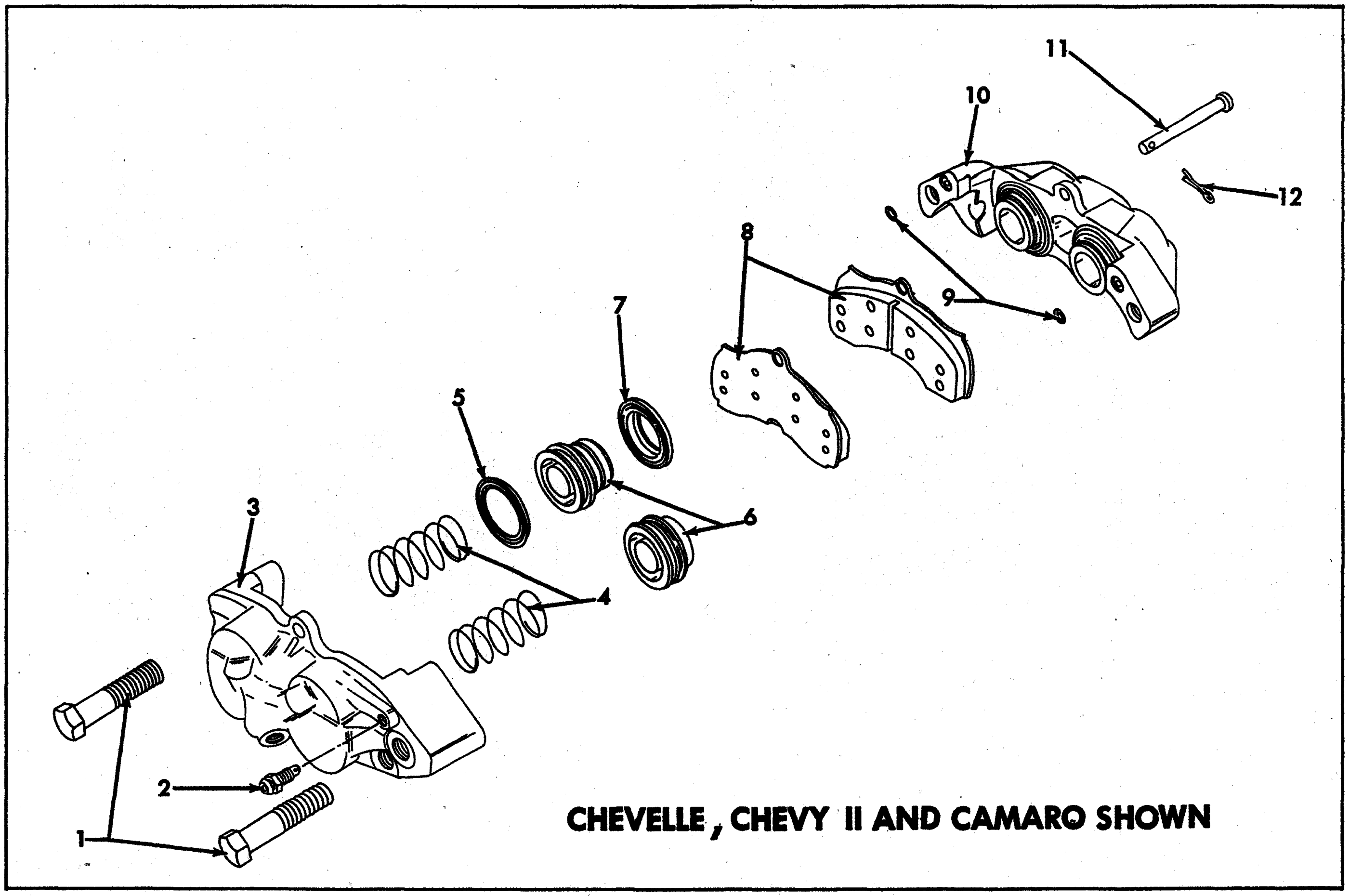


Fig. 39—Caliper Assembly—Exploded View

1. Caliper Belts
2. Bleeder Valve
3. Caliper Half
4. Piston Spring
5. Seal
6. Piston
7. Piston Boot
8. Brake Shoes
9. "O" Rings
10. Caliper Half
11. Retaining Pin
12. Cotter Pin

caliper. Two retaining pins must be removed on heavy duty Corvette front calipers. Identify the inboard and outboard shoe if they are to be reused.

5. Remove the end of brake hose at bracket by removing U-shaped retainer from the hose fitting and withdrawing the hose from bracket.
6. Remove the caliper assembly from the mounting bracket by removing two hex head bolts.

Disassembly (Fig. 39)

1. Clean exterior of caliper with Declene, or equivalent. On Chevrolet and Corvette front caliper, remove brake hose.
2. Separate the caliper halves by removing the two large hex head bolts. Remove the two small "O" rings from the cavities around the fluid transfer holes in the two ends of the caliper halves.
3. To free the piston boots so that the pistons may be removed, push the piston down into the caliper as far as it will go. Insert a screwdriver blade under the inner edge of the steel ring in the boot, and using the piston as a fulcrum, pry the boot from its seat in the caliper half.

CAUTION: Use care not to puncture seal when removing pistons from caliper.

4. Remove the pistons and piston springs from the caliper half. Remove the boot and seal from their grooves in the piston.

Cleaning and Inspection

1. Clean all metal parts using Declene, or equivalent. Remove all traces of dirt and grease. Do not use mineral base solvents to clean brake parts.
2. Using an air hose, blow out all fluid passages in the caliper halves, making sure that there is no dirt or foreign material blocking any of these passages.
3. Discard all rubber parts. Boots, seals, and "O" rings should be replaced with new service kit parts.
4. Carefully inspect the piston bores in the caliper halves. They must be free of scores and pits. A scored or otherwise damaged bore will cause leaks and unsatisfactory brake operation. Replace the caliper half if either bore is damaged to the extent that polishing with very fine crocus cloth will not restore it.

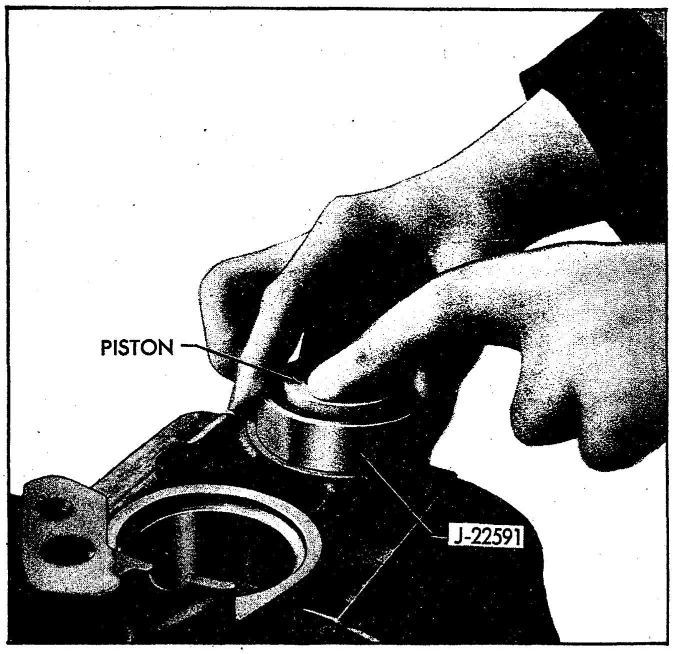


Fig. 40—Installing Piston in Caliper Bore Using Tool J-22591

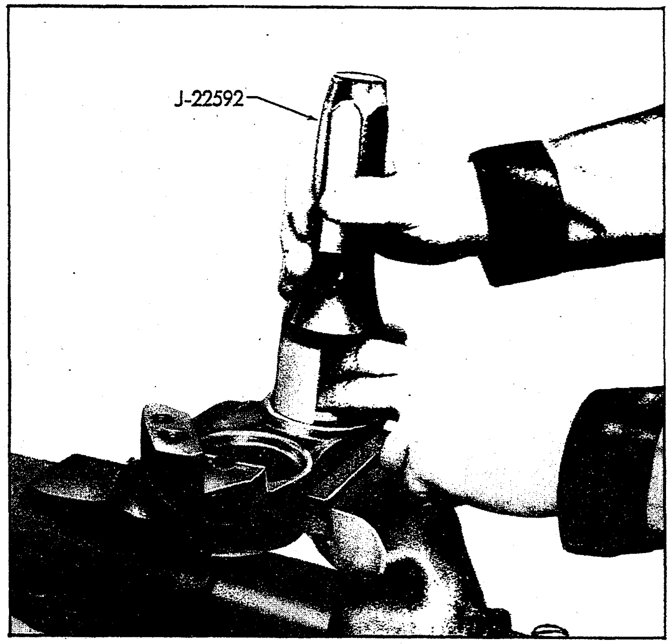


Fig. 41—Installing Boot Seal in Caliper Bore Using Tool J-22592

5. Check the fit of the piston in the bore using a feeler gage. Clearance should be as follows:

2 1/16 inch Bore	.0045 to .010
1 7/8 inch Bore	.0045 to .010
1 3/8 inch Bore	.0035 to .009

If the bore is not damaged, and the clearance exceeds either of the upper limits, a new piston will be required.

Assembly

1. Assemble the seal in the groove in the piston which is closest to the flat end of the piston. The lip on the seal must face toward the large end of the piston. Be sure lips are in the piston groove and do not extend over the step in the end of the groove.
2. Place the spring in the bottom of the piston bore.
3. Lubricate the seal with clean brake fluid.
4. Install the piston assembly in the bore using applicable piston rign compressor Tool J-22639, 22629 or 22591 as shown in Figure 40. Use care not to damage the seal lip as piston is pressed past the edge of the bore.
5. Assemble the boot in the groove of the piston closest to the concave end of the piston. The fold in the boot must face toward the end of the piston with the seal on it.
6. Depress the pistons and check that they slide smoothly into the bore until the end of the piston is flush with the end of the bore. If not, recheck piston assembly and location of the piston spring and the seal.
7. Position applicable boot seal installer Tool J-22592, J-22628, or J-22638 over the piston and seat the steel boot retaining ring evenly in the counterbore as shown in Figure 41. The boot retaining ring must be flush or below the machined face of the caliper. Any distortion or uneven seating could allow contaminating and corrosive elements to enter the bore.
8. Position the "O" rings in the small cavities around the brake fluid transfer holes in both ends of the outboard caliper halves. Lubricate the hex head bolts with Delco Brake Lube or clip in clean brake fluid. Fit caliper halves together and secure with bolts. Refer to torque specifications in rear of manual for correct torque valves.

Installation

1. Carefully mount the assembled caliper over the edge of the disc. Use a putty knife to depress pistons so that the caliper can be lowered into position on the disc (fig. 42). Use care to prevent damage to boots on the edge of the disc as the caliper is mounted.
2. Secure the caliper to the mounting bracket with two hex head bolts. Refer to torque specifications in rear of manual for correct torque values.

CAUTION: If replacing old shoe assemblies, be sure to get the shoes in the same position from which they were removed. New shoe assemblies have an arrow printed on the back, showing the direction of forward disc rotation.

3. Install the shoe and lining assemblies as outlined in this section.
4. On Chevrolet and Corvette front calipers, place a new copper gasket on the male end of the front wheel brake hose. On all models, install brake hose in the calipers. With the wheels straight ahead, pass the female end of the brake hose through the support bracket.
5. Make sure the tube seat is clean and connect the break line tube nut to the caliper. Tighten securely.
6. Allowing the hose to seek a normal position, without twist, insert hex of the hose fitting into the 12-point hole in the support bracket and secure it in place with the "U"-shaped retainer. Turn the steering geometry from lock to lock while observing the hose.

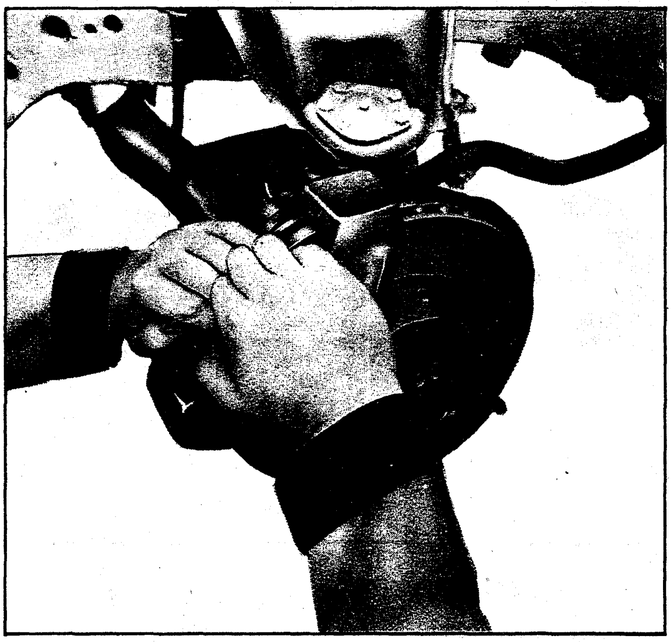


Fig. 42—Installing Caliper on Disc

Check that the hose does not touch other parts at any time during suspension or geometry travel. If contact does occur, remove the U-shaped retainer and rotate the end of the hose in the support bracket one or two points in a direction which will eliminate hose contact. Reinstall the retainer and recheck for hose contact. If it is satisfactory, place the steel tube connector in the hose fitting and tighten securely.

7. If rear brake caliper is being serviced, connect brake line to caliper.
8. Bleed brakes as outlined in this section.
9. Install wheels and lower vehicle.

BRAKE DISC

Servicing of the disc brakes is extremely critical due to tolerances required in machining of the brake disc to insure proper brake operation. In manufacturing the brake disc, tolerances of the rubbing surfaces for flatness is .001 and for parallelism is .0005, while lateral runout of the faces must not exceed .004 total. The maintenance of these close controls of the shape of the rubbing surfaces is necessary to prevent brake roughness. In addition, the surface finish must be non-directional and maintained at 30-50 micro-inches. This control of the rubbing surface finish is necessary to avoid pulls and erratic performance and promote long lining life and equal lining wear of both left and right brakes.

Light scoring of the disc surfaces not exceeding .015 in depth, which may result from normal use, is not detrimental to brake operation.

When the total disc thickness is less than .965 for the 1" thick disc or 1.215 for the 1-1/4" thick disc, it should be replaced. Disc thicknesses less than this can permit the shoes to come out of contact with the shoe abutments and cause malfunction.

Because performance is not impaired by surface imperfection not exceeding .015 deep, refinishing of the rubbing surface is not necessary.

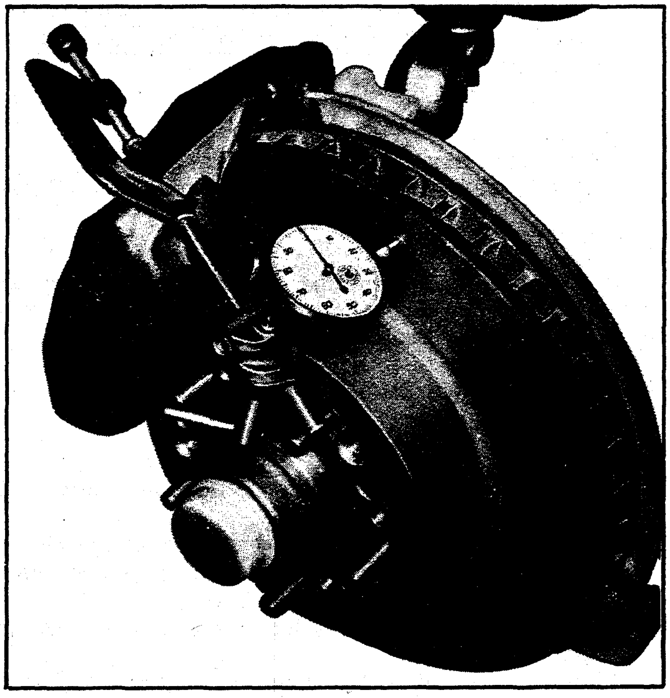


Fig. 43—Dial Indicating Disc Runout

Since extremely accurate control of the finishing operation is necessary for proper performance and excess metal removal can cause malfunction, refinishing of the rubbing surface is not recommended.

Checking Procedure (Fig. 43)

Front

Tighten the adjusting nut of the wheel bearing until all play has been removed. It should be just loose enough to allow the wheel to turn. Clamp a dial indicator to the caliper so that its button contacts the disc at a point about 1 inch from the outer edge. When the disc is turned, the indicator reading should not exceed .002 inches. If runout exceeds this amount the hub and disc assembly should be replaced. Due to the close tolerances involved it is not recommended that the front discs be machined or serviced separately.

After checking the runout, readjust the wheel bearings as outlined in Section 3 of this manual.

Rear—Corvette Only

Check the rear wheel bearing end play, as outlined in Section 4 of this manual. Then dial indicate the disc face. If lateral runout of the disc exceeds the bearing end play by .003 inches, the disc should be refaced (not to exceed .040 inches) or replaced.

Removal

1. Raise vehicle and remove wheel and tire assembly.
2. Remove brake caliper as outlined in this section.
3. Drill out the five rivets attaching the disc to the hub or spindle.
4. Remove brake disc from vehicle.
5. Complete the removal of the five rivets from the hub or spindle.

Installation

1. Install the disc to the hub or spindle aligning the lug bolts with the holes in the disc.

CAUTION: Be sure the emergency brake adjusting holes of the spindle and disc are in alignment.

2. Install the brake caliper and shoes as outlined in this section.
3. Bleed the brakes as outlined in this section.
4. Install wheel and tire assembly and lower vehicle.

MAIN CYLINDER

The service operations for the main cylinder are the same as for Duo-Servo main cylinder. Refer to service procedures under Duo-Servo Brakes.

PARKING BRAKE SHOES

Corvette (Fig. 44)

Removal

1. Remove tire and wheel assemblies and brake disc as outlined in this section.
2. Remove retractor spring at the top of the shoes. Remove hold down springs on primary and secondary shoes.
3. Remove shoes by pulling them away from the anchor pin.
4. Remove the adjusting screw spring and adjusting screw from the shoes.

Installation

1. Put light coat of lubriplate on pads, backing plate, and the threads of the adjusting screw.
2. Attach adjusting screw spring to the bottom hole in each shoe.
3. Insert the star wheel between the shoes. (On left hand brakes, the star wheel goes next to the rear shoe; on right hand brakes, the star wheel goes next to the forward shoe).
4. Install the shoes on the backing plate by spreading them and placing them around the anchor pin.
5. Install the hold down springs on the hold down nails.

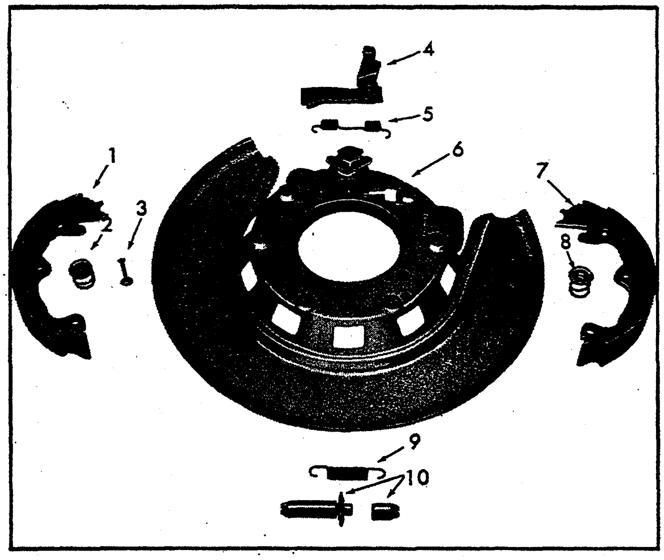


Fig. 44—Exploded View of Parking Brake Shoes

1. Parking Brake Shoe
2. Hold Down Spring and Cap
3. Hold Down Pin
4. Actuating Lever
5. Retractor Spring
6. Backing Plate
7. Parking Plate
8. Hold Down Spring and Cap
9. Adjusting Screw Spring
10. Adjusting Screw Assembly

6. Install retractor spring on one shoe and stretch to other shoe.

CAUTION: Make sure that the lever assembly which spreads the shoes is located so that the notches on the lever fit against the shoes.

7. Install disc and caliper as outlined in this section.
8. Bleed brakes as outlined in this section.
9. Adjust the parking brake as outlined in this section.
10. Install wheels and lower vehicle.

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 brake fluid level in the hydraulic reservoirs. The reservoirs should be filled to the levels shown in Figure 8.
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 lines at main cylinder.
3. Disconnect push rod at brake pedal assembly.
4. Remove 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 are 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

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 lines 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.

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

SPECIAL TOOLS

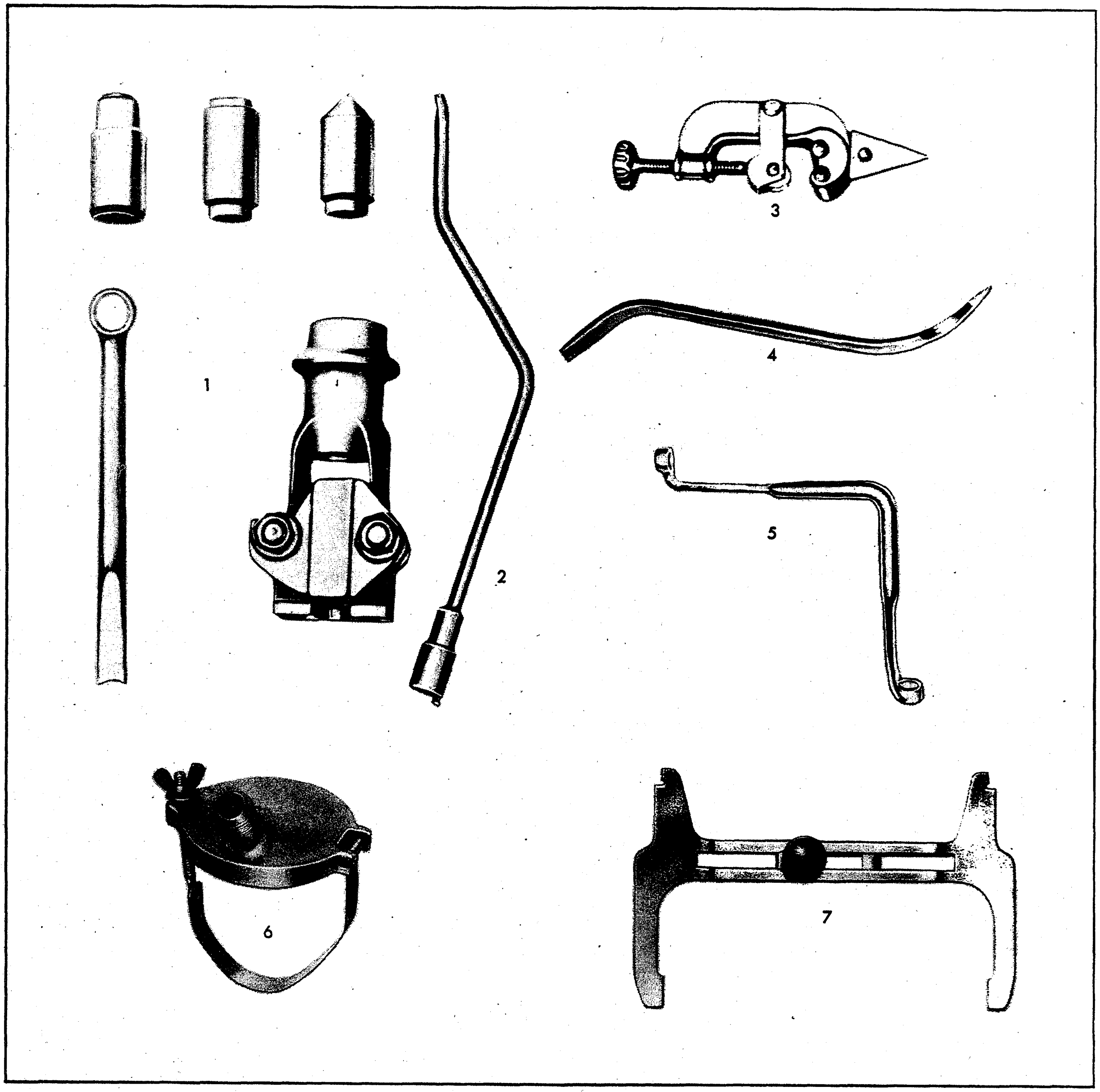


Fig. 45—Brake Special Tools

1. J-8051 Brake Tool Flaring Tool
2. J-8049 Brake Spring Remover and Installer
3. J-8113 Brake Tube Cutter
4. J-22591, J-22629, J-22639 Piston Ring Compressors
5. J-21472 Brake Bleeder Wrench
6. J-22489 Pressure Bleeder Adapter
7. J-21177 Drum-to-Brake Shoe Clearance Gauge
8. J-22592, J-22628, J-22638 Boot Seal Installers

SECTION 6
ENGINE

CONTENTS OF THIS SECTION

ENGINE TUNE UP

INDEX

GENERAL DESCRIPTION

The engine tune up is important to the modern automotive engine with its vastly improved power and performance. The higher compression ratios, improved electrical systems and other advances in design, make today's engines more sensitive and have a decided effect on power, performance and fuel consumption.

It is seldom advisable to attempt a tune up by correction of one or two items only. Time will normally be saved and more lasting results assured if the technician 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 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 can 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 or the Passenger Chassis Overhaul Manual for detailed service information.

Typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation. Illustrations showing bench operations are used for clarification however all operations can be performed on the vehicle.

MECHANICAL CHECKS AND ADJUSTMENTS

Spark Plug Removal

Remove any foreign matter from around spark plugs by blowing out with compressed air, then disconnect wires and remove plugs.

Test Compression (Fig. 1)

The compression check is important because an engine with low or uneven compression cannot be tuned successfully. It is essential that improper compression be corrected before proceeding with the engine tune up.

1. Remove air cleaner and block throttle and choke in wide open position.
2. Hook up starter remote control cable and insert compression gauge firmly in spark plug port.

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 burnt, sticking or not 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.

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 (Fig. 2)

1. Inspect each plug individually for badly worn electrodes, glazed, broken or blistered porcelains and replace plugs where necessary. Refer to spark plug diagnosis information presented in 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.
4. Adjust spark plug gaps to specifications using a round feeler gauge.

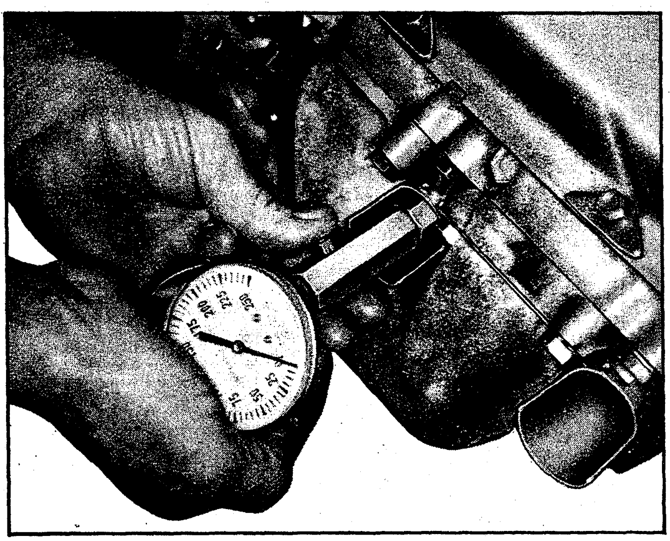


Fig. 1 - Checking Compression

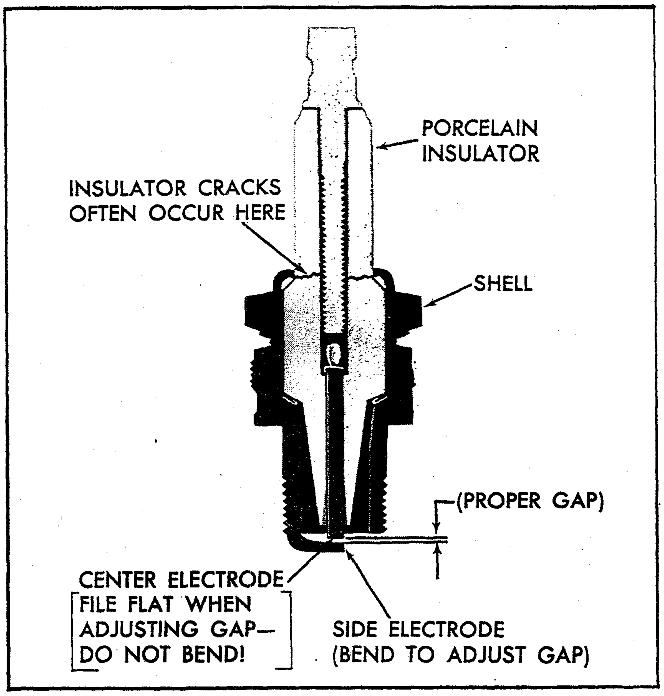


Fig. 2 - Spark Plug Detail

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 grease on tap to catch chips.)

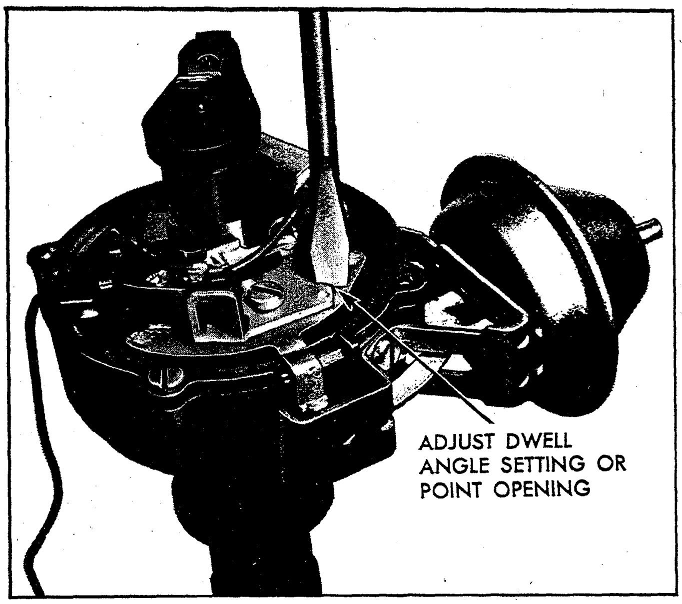


Fig. 3 - Distributor (In Line)

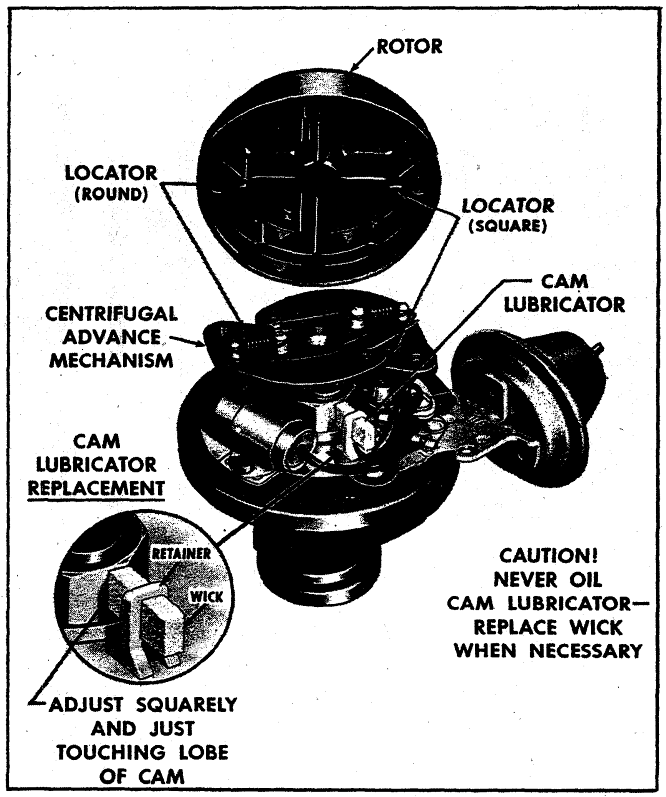


Fig. 4 - Distributor (V8)

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

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

NOTE: The following are some of the greatest causes of unsatisfactory spark plug performance.

- 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 into corroded spark plug hole threads.

8. Connect spark plug wiring.

Service Ignition System

1. Remove distributor cap, clean cap and inspect for cracks, carbon tracks and burned or corroded terminals. Replace cap where necessary.
2. Clean rotor and inspect for damage or deterioration. Replace rotor where necessary.
3. Replace brittle, oil soaked or damaged spark plug wires. Install all wires to proper spark plug. Proper positioning of spark plug wires in supports is important to prevent cross-firing.
4. Tighten all ignition system connections.
5. Replace or repair any wires that are frayed, loose or damaged.

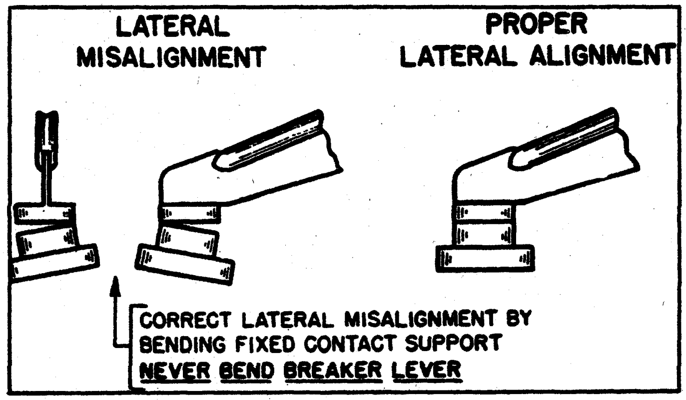


Fig. 5 - Point Alignment

Magnetic Pulse(Breakerless) Distributor

There are no moving parts in the ignition pulse amplifier, and the distributor shaft and bushings have permanent type lubrication, therefore no periodic maintenance is required for the magnetic pulse ignition system. Refer to Section 6Y for an analysis of problems and/or repair procedures encountered on the Transistorized (Magnetic Pulse) ignition system.

Standard (Breaker Point) Distributor (Figs. 3 or 4)

1. 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.
2. 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.
3. Examine distributor points and clean or replace if necessary.

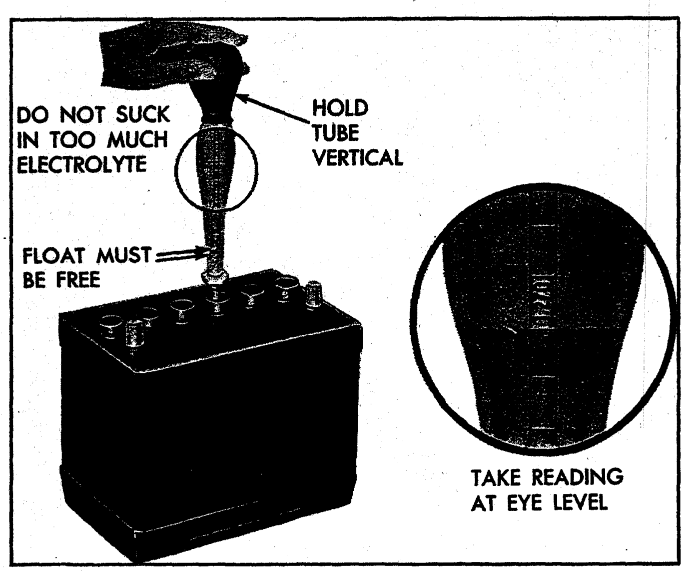


Fig. 6 - Testing Specific Gravity of Battery

- Contact points with an overall gray color and only slight roughness or pitting need not be replaced.
- Dirty points should be cleaned with a clean point file.

  Use only a few strokes of a clean, fine-cut contact file. The file should not be used on other metals and should not be allowed to become greasy or dirty. Never use emery cloth or sandpaper to clean contact points since particles will embed and cause arcing and rapid burning of points. Do not attempt to remove all roughness nor dress the point surfaces down smooth. Merely remove scale or dirt.
- 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.

- Check point alignment (fig. 5) then, adjust distributor contact point gap to .019" (new points) or .016" (used points). Breaker arm rubbing block must be on high point of lobe during adjustment.

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

- Check distributor point spring tension (contact

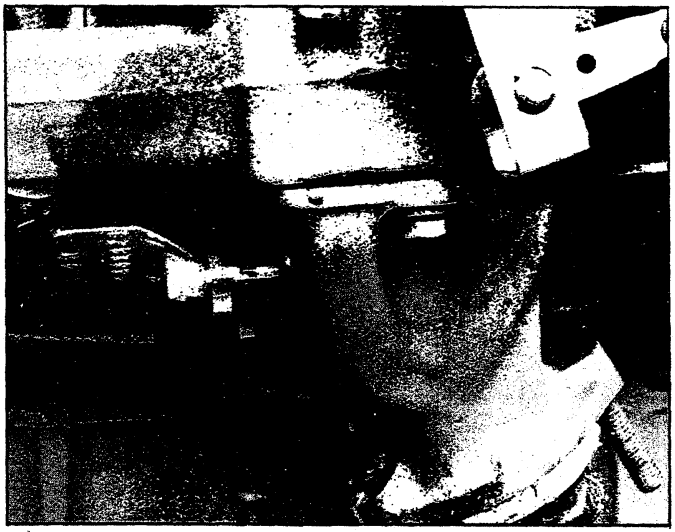


Fig. 8 - Manifold Heat Control Valve (In Line)

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 rubber block. Weak point pressure permits bouncing or chattering, resulting in arcing and burning of the points and an ignition miss at high speed.

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

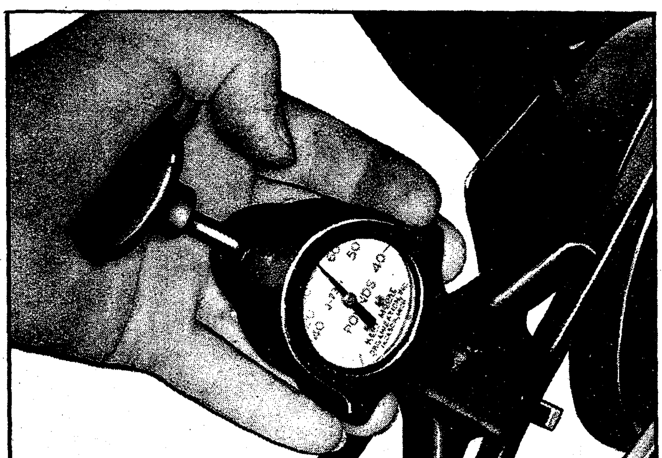


Fig. 7 - Checking Fan Belt Tension

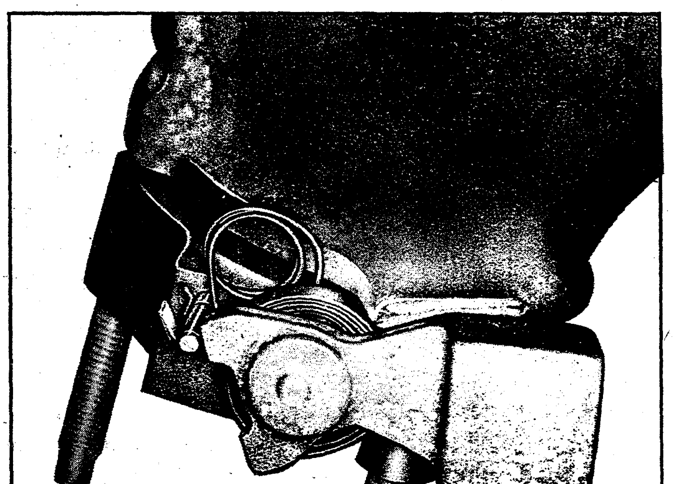


Fig. 9 - Manifold Heat Control Valve (V8)

Service Battery and Battery Cables

1. Measure the specific gravity of the electrolyte in each cell (fig. 6). 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 (disconnect the coil primary lead at the negative terminal during this check to prevent engine from firing). If the terminal voltage is less than 9.0 volts at room temperature, approximately 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".

   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. When cleaning batteries, wash first with a dilute ammonia or soda solution to neutralize any acid present and then flush off with clean water. 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 battery terminal felt washer. If the battery posts or cable terminals are corroded, the cables should be cleaned separately with a soda solution and 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.

Service Belts (Fig. 7)

Inspect belt condition.

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

- Using a strand tension gauge, check the belt tension.
- Adjust belt until the specified tension is reached. (See Tune Up Chart.)

Service Manifold Heat Valve (Figs. 8 or 9)

Check manifold heat control valve 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 intake manifold bolts to specifications in the

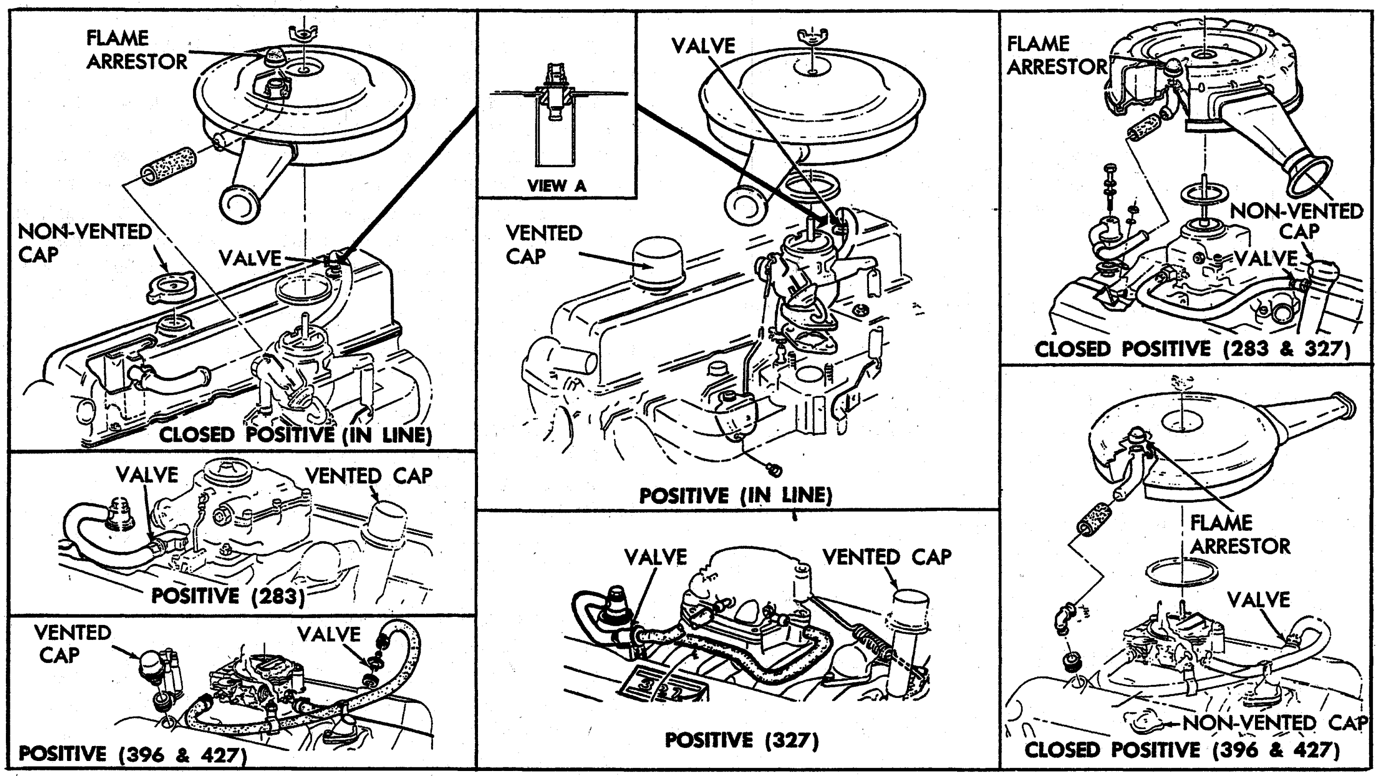


Fig. 10 - Crankcase Ventilation Systems

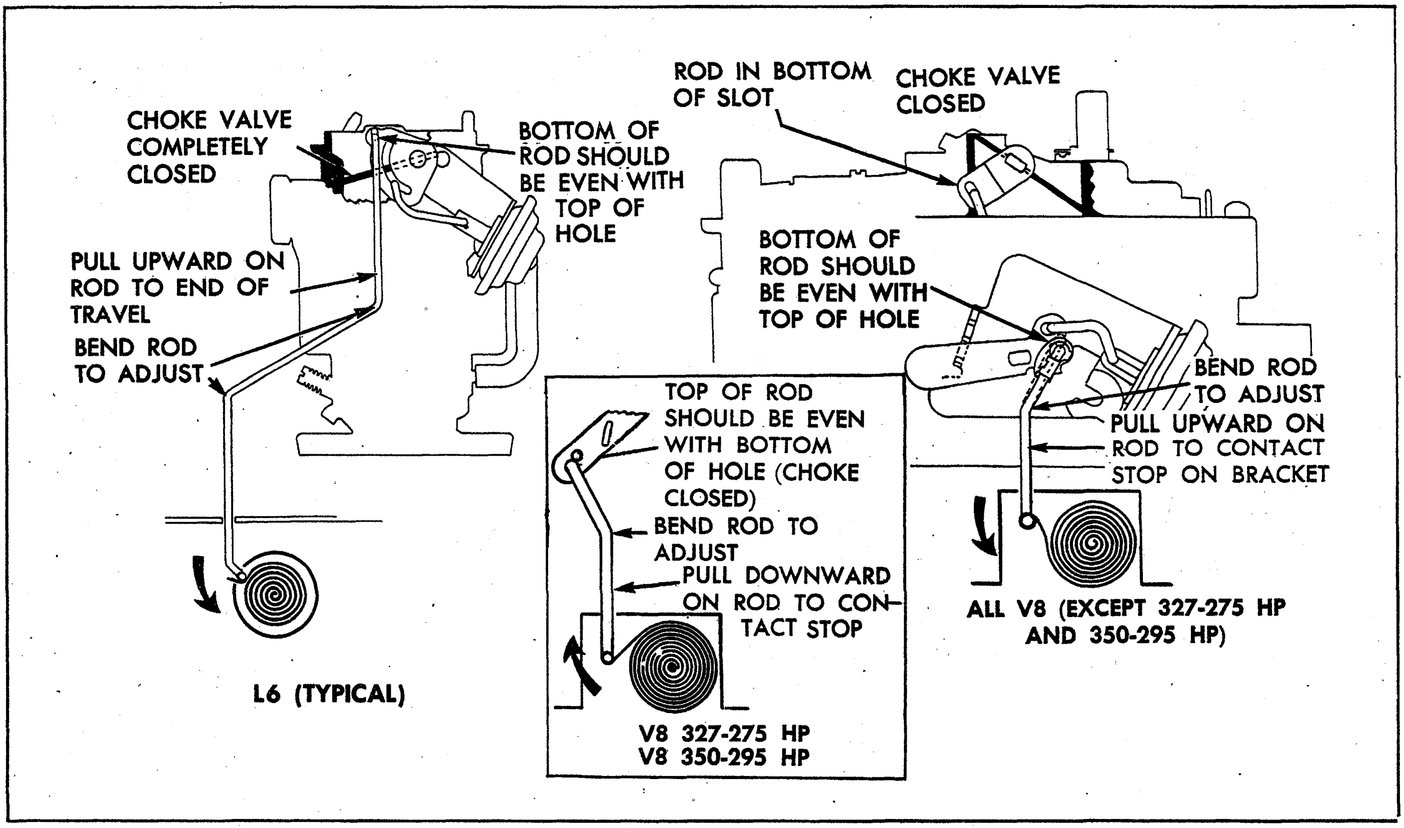


Fig. 11 - Remote Choke Adjustment

sequence outlined on Torque Sequence Chart. A slight leak at the intake manifold destroys engine performance and economy.

Service Fuel Lines and Fuel Filter

1. Inspect fuel lines for kinks, bends or leaks and correct any defects found.
2. Inspect filter and replace if plugged.

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.
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 (Fig. 10)

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 is drawn through the engine, (through a regulating valve) into the manifold, drawing crankcase vapors and fumes with it to be burned. "Positive" ventilation uses a vented-meshed 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.

1. Ventilation valve may be checked as outlined under "Additional Checks and Adjustments".
2. Inspect for deteriorated or plugged hoses.
3. Inspect all hose connections.
4. On closed positive ventilation systems, remove flame arrestor and wash in solvent then dry with compressed air.

Service Air Injection Reactor System

Inspect air injection reactor system for evidence of leaks, deteriorated hoses, cracked air manifolds or tubes and loose hose clamps. Inspect air injection pump belt condition and tension. Make all necessary repairs as outlined in "Section 6T".

Because of the relationship between "Engine Tune Up" and "Unburned Exhaust Gases", the condition of Engine

Tune Up should be checked whenever the Air Injection Reactor System seems to be malfunctioning. Particular care should be taken in checking items that affect fuel-air ratio such as the crankcase ventilation system, the carburetor and the carburetor air cleaner. Carburetors and distributors for engines with the Air Injection Reactor System are designed, particularly, for these engines; therefore, they must not be interchanged with or replaced by a carburetor or distributor designed for an engine without the Air Injection Reactor System.

Choke Adjustment (Fig. 11)

With Remote Choke

1. Remove air cleaner and check to see that choke valve and rod move freely.
2. Disconnect choke rod at choke lever.
3. Check choke adjustment as follows:
   On all except 275 hp 327 cu. in. engines, hold choke valve closed and pull rod up against stop. The top of choke rod end should be 1/2 - 1 rod diameter above top of hole in choke valve lever.
   On 275 hp 327 cu. in. engines, hold choke valve closed and push rod down against stop on thermostat bracket. The top of the choke rod should be 1/2 - 1 rod diameter below the top of the hole in the choke lever.
4. If necessary, adjust rod length by bending rod at offset. (Bend must be such that rod enters choke lever hole freely and squarely.)
5. Connect rod at choke lever and install air cleaner.

With Manual Choke

1. Remove air cleaner.
2. Push hand choke knob in to within 1/8" of instrument panel.
3. Loosen choke cable 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.

INSTRUMENT CHECK-OUT

Instrument Hook Up

Connect vacuum gauge, dwell meter, tachometer and timing light as recommended by the manufacturer of the equipment being used.

Check and Adjust Dwell

1. Start engine then check ignition dwell.
2. If dwell is not within specifications, adjust dwell as follows:
   V8 ENGINES
   - With engine running at idle, raise the adjustment screw window and insert an Allen wrench in the socket of the adjusting screw (fig. 12).
   - Turn the adjusting screw as required until a dwell reading of 30° is obtained. A 2° variation is allowable for wear.
   - Close access cover fully to prevent the entry of dirt into the distributor.

NOTE: 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.

   IN LINE ENGINES
   - Remove distributor cap and recheck point setting. If dwell is still not within specifications check the distributor as outlined in Section 6Y.

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.

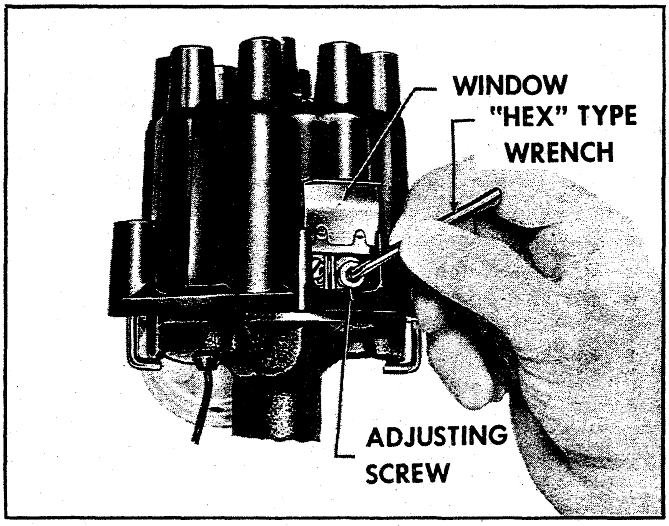


Fig. 12 - Setting Point Dwell (V8)

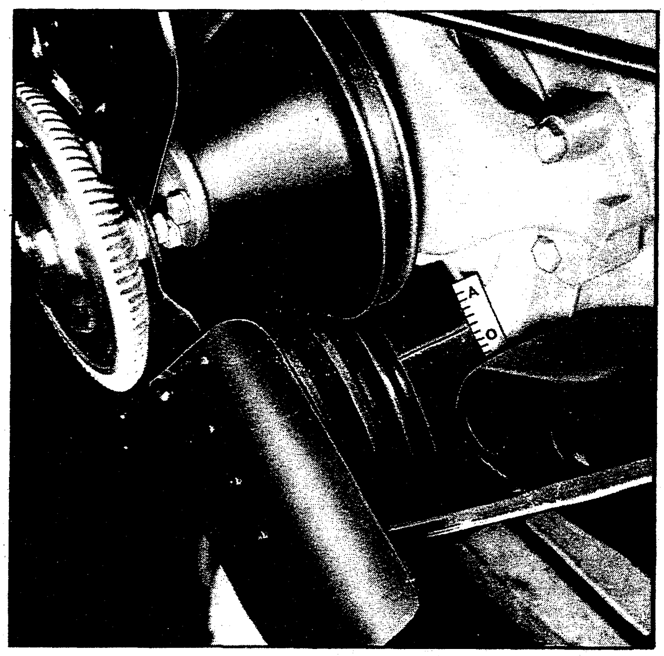


Fig. 13 - Ignition Timing Marks

Check and Adjust Ignition Timing (Fig. 13)

1. Disconnect the distributor spark advance hose 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.

   NOTE: The markings on the tabs are in 2° increments (the greatest number of markings on the "A" side of the "O"). The "O" markings is TDC of #1 cylinder and all BTDC settings fall on the "A" (advance) side of "O".

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.

Adjust Idle Speed and Mixture (Fig. 14) (Except when equipped with Air Injection Reactor System)

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

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

2. With engine running at operating temperature (choke wide open) adjust idle speed screw to bring idle speed to specified rpm (automatic transmission in drive, manual transmission in neutral).
3. Adjust idle mixture screw to obtain highest steady idle speed (1/4 turn out from lean roll).
4. Repeat Steps 2 and 3 as needed for final adjustment.
5. Shut down the engine, remove gauges and install air cleaner.

Adjust Idle Speed and Mixture (Fig. 14) (With Air Injection Reactor System)

The recommended adjustment procedure for Air Injection Reactor System equipped engines is as follows:

1. As a preliminary adjustment, turn idle mixture screws lightly to seat and than back out 3 turns.

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

2. With engine running at operating temperature, choke wide open, and parking brake applied, adjust idle speed screw to specified idle speed (automatic transmission in "drive"-manual transmission in "neutral").
3. Adjust idle mixture screw (turn in) to "lean roll" position; then turn screw out 1/4 turn (1/4 turn rich from "lean roll"). The definition of "lean roll" point is a 20 to 30 rpm drop in engine speed, obtained by leaning the idle mixture.
4. Repeat Steps 2 and 3 as needed for final adjustments.

ADDITIONAL CHECKS AND ADJUSTMENTS

Testing Crankcase Ventilation Valve (Fig. 15)

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.
3. Disconnect ventilation hose at valve, block opening of valve and read engine rpm change.
4. A change of less than 50 rpm indicates a plugged ventilation valve - replace the valve.

Cylinder Balance Test (Fig. 16)

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.

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

L4 Firing Order

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

L6 Firing Order

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

V8 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

The battery should be checked with special testing equipment and to the equipment manufacturers specifications. See Section 6Y for complete information on battery tests.

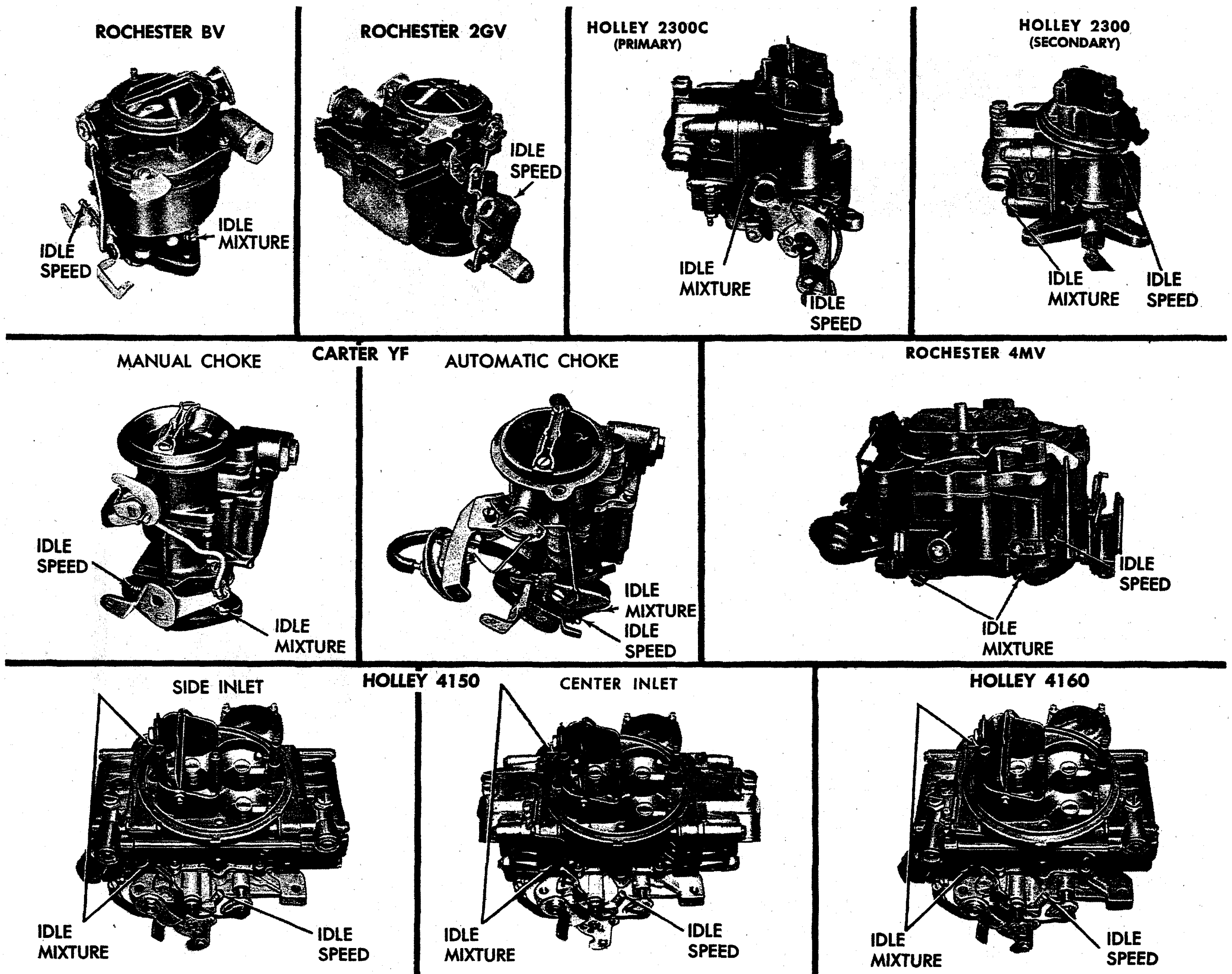
Ignition

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

Cranking Voltage (Fig. 17)

1. Disconnect coil primary lead at the coil negative terminal to prevent engine from firing during cranking.
2. Connect voltmeter between primary terminal of coil (resistance wire side) and ground.
3. Operate starting motor.



APPLICATION ▶ CARBURETOR ▼		Chevrolet	Chevelle	Chevy II	Camaro	Corvette	IN LINE				V-8													
							153	194	230	250	283		327				350	396		427				
							90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435
ROCH. BV		1	2	3	4			3	2	1234														
ROCH 2GV		1	2	3	4						1234	4												
ROCH 4MV		1	2	3	4								1234				4	1-2		1				
CARTER YF	Man.			3			3																	
	Auto.	1	2	3	4			3	2-4	1234														
HOLLEY 4150	Side		2												2									
	Center					5																	5	
HOLLEY 4160			2			5								5		5			2		5			
HOLLEY 2300	C Prim.					5																5		5
	Sec.					5																5		5

Fig. 14 - Idle Speed and Mixture Screws

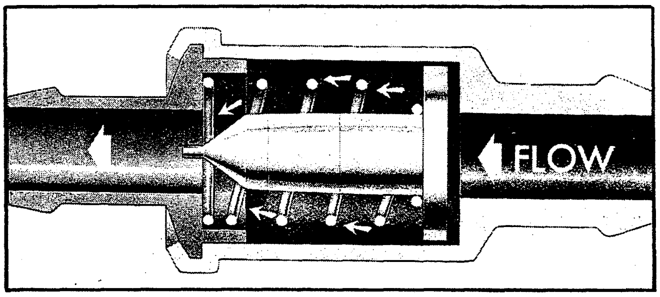


Fig. 15 - Crankcase Ventilation Valve

a. If voltage is 9 volts or more and cranking speed is satisfactory, the battery, starter, cables, starter switch and ignition circuit to coil (by-passing 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.

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.

Distributor Resistance

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

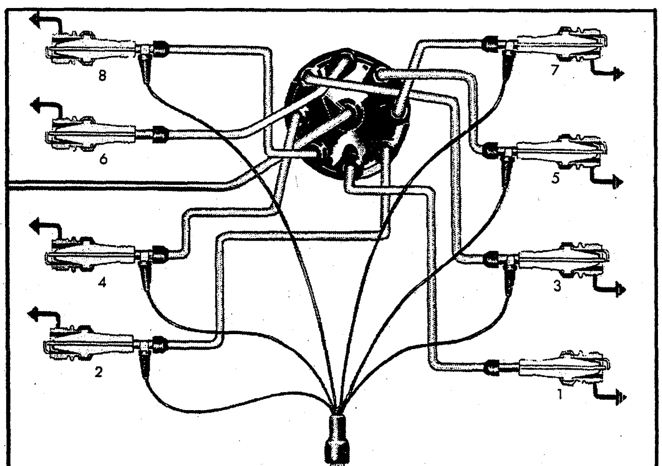


Fig. 16 - Cylinder Balance Test

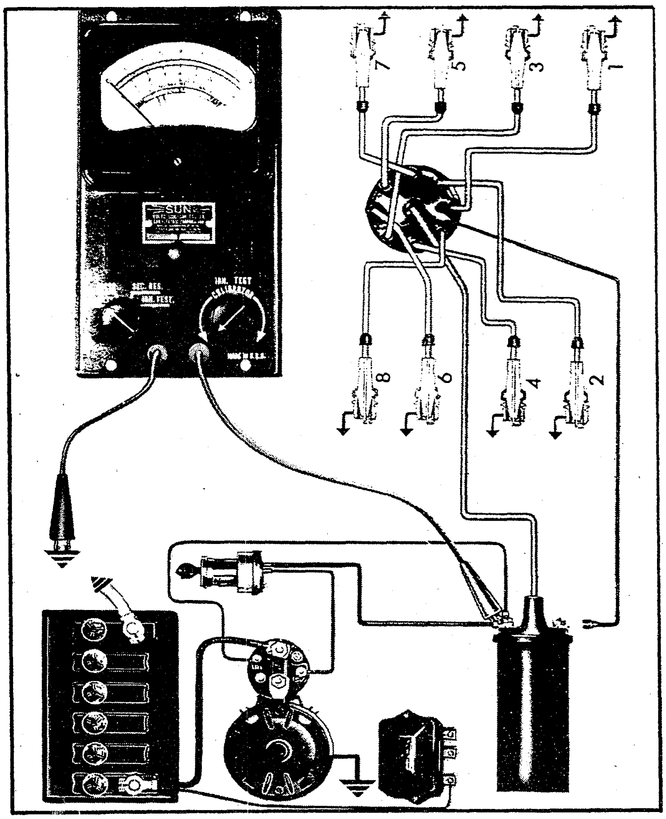


Fig. 17 - Testing Cranking Voltage

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, poorly 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.

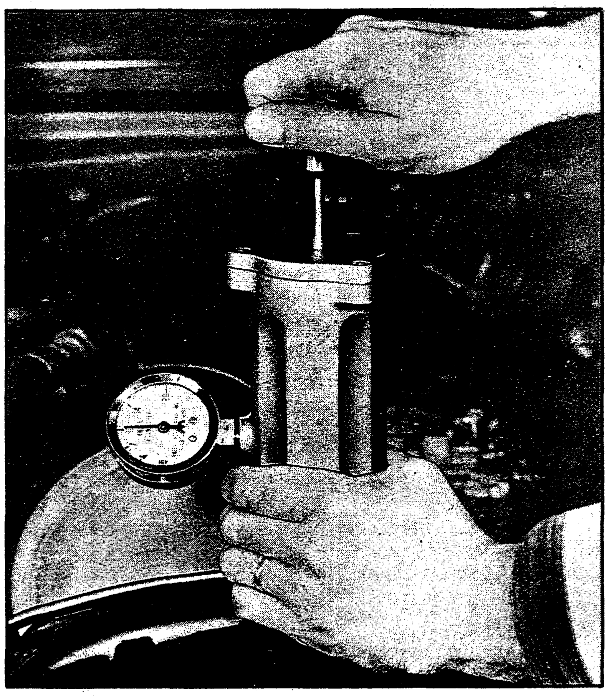


Fig. 18 - Cooling System Pressure Test

Carburetor

Refer to Section 6M to perform adjustments such as idle vent, float level, 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 delievered 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. 18). i.e. 18 pounds for a 15 pound cap.
3. If the pressure will not hold, there is either an internal or external leak in 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.

Before adjusting the valve lash, 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.

Hydraulic

1. After the engine has been normalized, remove rocker arm covers and gaskets.

CAUTION: Do not pry rocker arm cover loose. Gaskets adhering to cylinder head and rocker arm cover may be sheared by bumping end of rocker arm cover rearward with palm of hand or a rubber mallet.

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.

5. Repeat Steps 2, 3 and 4 to adjust the rest of the valves.
6. Clean gasket surfaces on cylinder heads and rocker arm covers with degreaser then install rocker arm covers, using new gaskets, and torque bolts to specifications.

Mechanical

1. Normalize the engine.
2. Remove rocker arm covers and gaskets.

CAUTION: Do not pry rocker arm cover loose. Gaskets adhering to cylinder head and rocker arm cover may be sheared by bumping end of rocker arm cover rearward with palm of hand or a rubber mallet.

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, clean gasket surfaces on cylinder heads and rocker arm covers with degreaser then install rocker arm covers, using new gaskets, and torque bolts to specifications.

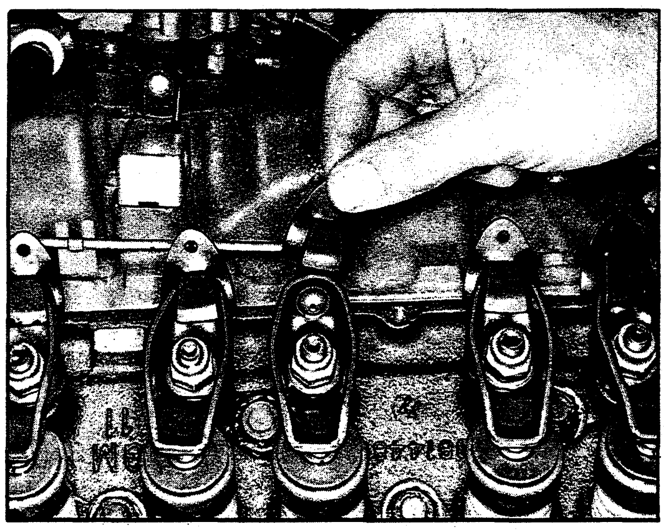


Fig. 19 - Oil Deflector Clips Installed

ENGINE MECHANICAL

IN LINE

INDEX

GENERAL DESCRIPTION

The In Line engines (fig. 1L) covered in this section are the 153 cu. in. L4, the 194, 230 and 250 cu. in. L6, regardless of which passenger vehicle they are used in.

This section covers the removal and installation of engine assemblies; the removal, installation and adjustment of some sub-assemblies and replacement of some components. For service to all components and sub-assemblies (after removal) and removal of some sub-assemblies, refer to Section 6 of the Chassis Overhaul Manual.

Because of the interchangeability and similarity of many engine sub-assemblies and engine parts, regardless of which passenger vehicle they are used in, typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation. Although illustrations showing bench operations are used, most single operations, when not part of a general overhaul, should be performed (if practical) with the engine in the vehicle.

COMPONENT REPLACEMENT AND ADJUSTMENT

ENGINE ASSEMBLY

Removal

1. Drain cooling system and engine oil.
2. Remove air cleaner and disconnect battery cables at battery.
3. Remove hood as outlined in Section 11.
4. Remove radiator and radiator shroud as outlined in Section 13.
5. Remove fan blade and pulley as outlined in Section 6K.
6. Disconnect wires at:
   - Starter Solenoid
   - Delcotron
   - Temperature Switch
   - Oil Pressure Switch
   - Coil
7. 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).
8. Raise vehicle and place on jack stands.
9. Remove propeller shaft.

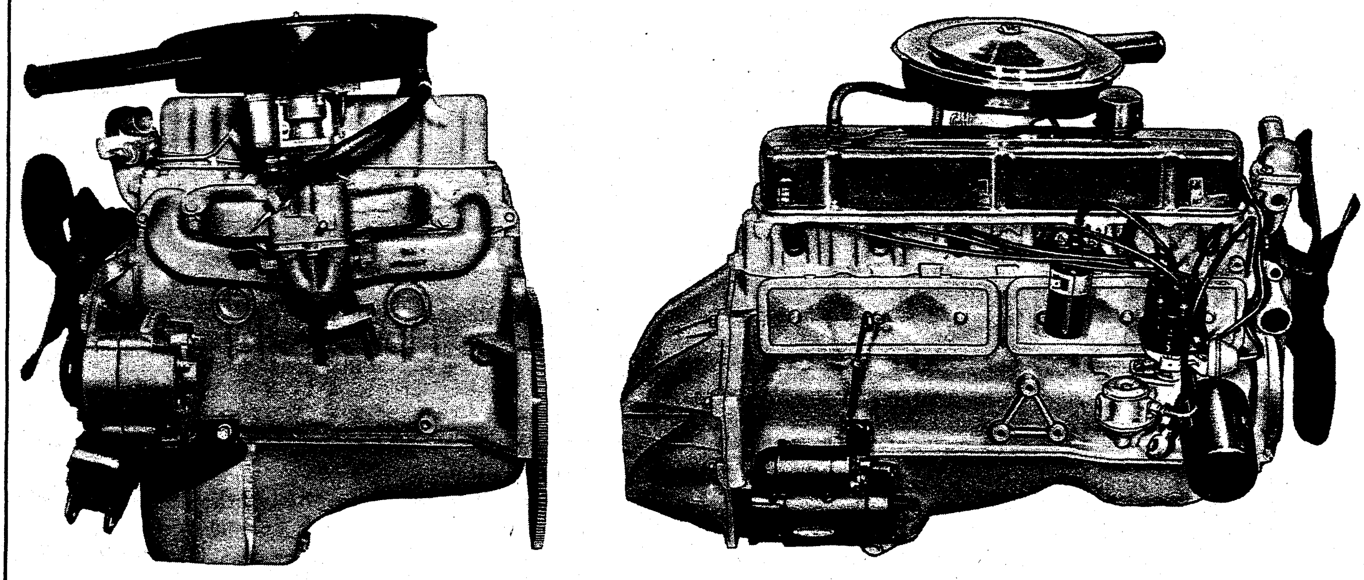


Fig. 1L - In Line Engines (Typical)

NOTE: If plug for propeller shaft opening in transmission is not available, drain transmission.

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 rocker arm cover as outlined, then attach engine lifting adapter at the proper cylinder head bolt locations.
13. Remove front mount through bolts.
14. Attach lifting device and 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.

    NOTE: On Camaro vehicles it will be necessary to remove mount from transmission and loosen rear frame cushion bolts 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 rear cover.
    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 underpan.
    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 rear 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 converter with the flywheel.

b. Bolt transmission to engine, then raise engine and transmission assembly and install flywheel to converter attaching bolts.
c. Install converter housing underpan 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 through bolts and torque to specifications.
5. Raise engine enough to install rear crossmember, then install crossmember, install rear mount, lower engine and torque bolts to specifications.
6. Remove lifting device and lifting adapter then install rocker arm cover as outlined.
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 propeller 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 and fan belt as outlined in Section 6K.
14. Install radiator and shroud as outlined in Section 13.
15. Install and adjust hood as outlined in Section 11.
16. Connect battery cables.
17. Fill with coolant, engine oil and transmission oil, then start engine and check for leaks.
18. Perform necessary adjustments and install air cleaner.

MANIFOLD ASSEMBLY

Removal

1. Remove air cleaner.
2. Disconnect both throttle rods at bellcrank and remove throttle return spring.
3. Disconnect fuel and vacuum lines at carburetor. Disconnect choke cable on L4 engines.
4. Disconnect crankcase ventilation hose at rocker arm cover.
5. Disconnect exhaust pipe at manifold flange and discard packing.
6. Remove manifold attaching bolts and clamps then remove manifold assembly and discard gaskets.
7. Check for cracks in manifold castings.
8. If necessary to replace either intake or exhaust manifolds, separate them by removing one bolt and two nuts at center of assembly. Reassemble manifolds using a new gasket. Tighten finger tight and torque to specifications after assembly to cylinder head. Transfer all necessary parts.

Installation

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

   NOTE: On L6 engines center bolt and end bolt torque differ.

5. Connect exhaust pipe to manifold using a new packing.
6. Connect crankcase ventilation hose at rocker arm cover.
7. Connect fuel and vacuum lines at carburetor.
8. On L4 engines connect choke cable and adjust as outlines in Section 6M.
9. Connect throttle rods at bellcrank and install throttle return spring.
10. Install air cleaner, start engine, check for leaks and adjust carburetor idle speed and mixture.

ROCKER ARM COVER

Removal

1. Disconnect crankcase ventilation hose(s) at rocker arm cover.
2. Remove air cleaner.
3. Disconnect temperature wire from rocker arm cover clips.
4. Remove rocker arm cover.

   CAUTION: Do Not pry rocker arm cover loose Gaskets adhering to cylinder head and rocker arm cover may be sheared by bumping end of rocker arm cover rearward with palm of hand or a rubber mallet.

Installation

1. Clean gasket surfaces on cylinder head and rocker arm cover with degreaser then, using a new gasket, install rocker arm cover and torque bolts to specifications.
2. Connect temperature wire at rocker arm cover clips.
3. Install air cleaner.
4. Connect crankcase ventilation hoses.

VALVE MECHANISM

Removal

1. Remove rocker arm cover as outlined.
2. Remove rocker arm nuts, rocker arm balls, rocker arms and push rods.

   NOTE: Place rocker arms, rocker arm balls and push rods in a rack so they may be reinstalled in the same location.

Installation and Adjustment

NOTE: Whenever new rocker arms and/or rocker arm balls are being installed, coat bearing surfaces of rocker arms and rocker arm balls with Molykote or its equivalent.

1. Install push rods. Be sure push rods seat in lifter socket.

2. Install rocker arms, rocker arm balls and rocker arm nuts. Tighten rocker arm nuts until all lash is eliminated.
3. Adjust valves when lifter is on base circle of camshaft lobe as follows:
   a. Mark distributor housing, with chalk, at each cylinder position (plug wire) then disconnect plug wires at spark plugs and coil and remove distributor cap and plug wire assembly (if not previously done).
   b. Crank engine until distributor rotor points to number one cylinder position and breaker points are open. Both valves on number one cylinder may now be adjusted.
   c. Back out adjusting nut until lash is felt at the push rod then turn in adjusting nut until all lash is removed. This can be determined by checking push rod side play while turning adjusting nut (fig. 2L). When play has been removed, turn adjusting nut in one full additional turn (to center lifter plunger).
   d. Adjust the remaining valves, one cylinder at a time, in the same manner.
4. Install distributor cap and spark plug wire assembly.
5. Install rocker arm cover as outlined.
6. Adjust carburetor idle speed and mixture.

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

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 "pickup" 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, disasssmbled, 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.

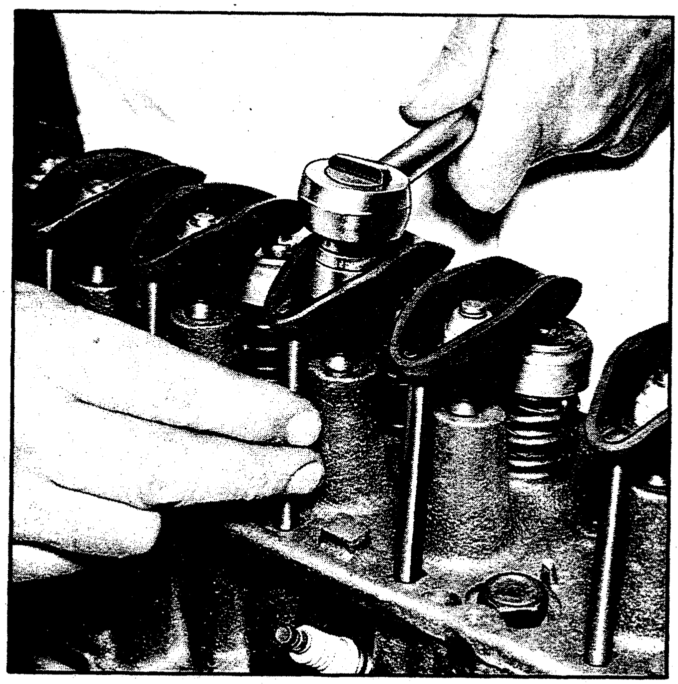


Fig. 2L - Valve Adjustment

Removal

1. Remove valve mechanism as outlined.
2. Mark distributor housing, with chlak, at each cylinder position (plug wire) then disconnect plug wires at spark plugs and coil and remove distributor cap and plug wire assembly.
3. Crank engine until distributor rotor points to number one position, then disconnect distributor primary lead at coil and remove distributor.
4. Remove push rod covers (discard gaskets).
5. Remove valve lifters.

NOTE: Place valve lifters in a rack so they may be reinstalled in the same location.

Installation

1. Install valve lifters.

NOTE: Whenever new valve lifters are being installed, coat foot of valve lifters with Molykote or its equivalent.

2. Install push rod covers, using new gaskets, and torque bolts to specifications.
3. Install distributor, positioning rotor to number one cylinder position, then connect primary lead at coil.
4. Install and adjust valve mechanism as outlined.

5. Adjust ignition timing and carburetor idle speed and mixture.

VALVE STEM OIL SEAL AND/OR VALVE SPRING

Replacement

1. Remove rocker arm cover as outlined.
2. Remove spark plug, rocker arm and push rod on the cylinder(s) to be serviced.
3. Apply compressed air to the spark plug hole to hold the valves in place.

   NOTE: A tool to apply air to the cylinder is available through local jobbers or may be manufactured. In manufacturing this Tool a AC-46N Spark Plug or its equivalent is recommended. This will make the Tool universal for all Chevrolet engines. Chisel the spark plug as shown, then drive the porcelain out of the plug by tapping the center electrode against a hard block. Using a 3/8" pipe tap, cut threads in the remaining portion of the spark plug and assemble as shown (fig. 3L).

4. Using Tool J-5892 to compress the valve spring, remove the valve locks, valve cap, valve shield and valve spring and damper (fig. 4L).
5. Remove the valve stem oil seal.
6. To replace, set the valve spring and damper, valve shield and valve cap in place. The close coiled end of the spring is installed against the cylinder head. Compress the spring with Tool J-5892 and install oil seal in the lower groove of the stem, making sure the seal is flat and not twisted.

   NOTE: A light coat of oil on the seal will help prevent twisting.

7. Install the valve locks and release the compressor tool, making sure the locks seat properly in the upper groove of the valve stem.

   NOTE: Grease may be used to hold the locks in place while releasing the compressor tool.

8. Install spark plug, using a new gasket, and torque to specifications.
9. Install and adjust valve mechanism as outlined.

CYLINDER HEAD ASSEMBLY

Removal

1. Remove manifold assembly as outlined.
2. Remove valve mechanism as outlined.
3. Drain cooling system (block).
4. Remove fuel and vacuum line from retaining clip at water outlet then disconnect wires from temperature sending units.
5. Disconnect upper radiator hose at water outlet housing and battery ground strap at cylinder head.
6. Remove coil (L6 engines only).
7. 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.) Do not use gasket sealer on composition steel asbestos gasket.

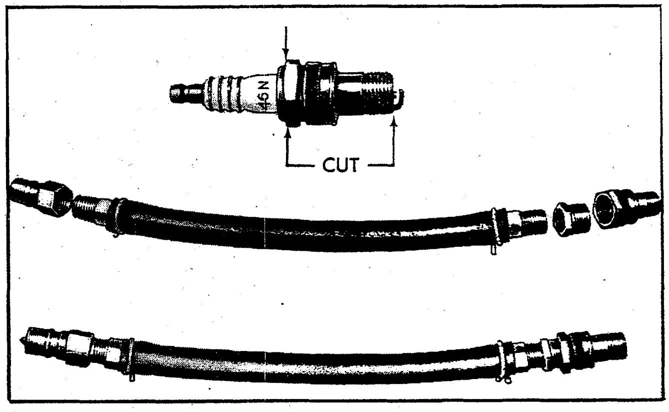


Fig. 3L - Air Adapter Tool

1. Place the gasket in position over the dowel pins with the bead up.
2. Carefully guide cylinder head into place over dowel pins and gasket.
3. Coat threads of cylinder head bolts with sealing compound and install finger tight.
4. Tighten cylinder head bolts a little at a time in the sequence shown on the torque sequence chart until the specified torque is reached.
5. Install coil (if removed).
6. Connect upper radiator hose and engine ground strap.
7. Connect temperature sending unit wires and install fuel and vacuum lines in clip at water outlet.
8. Fill cooling system.
9. Install manifold assembly as outlined.
10. Install and adjust valve mechanism as outlined.

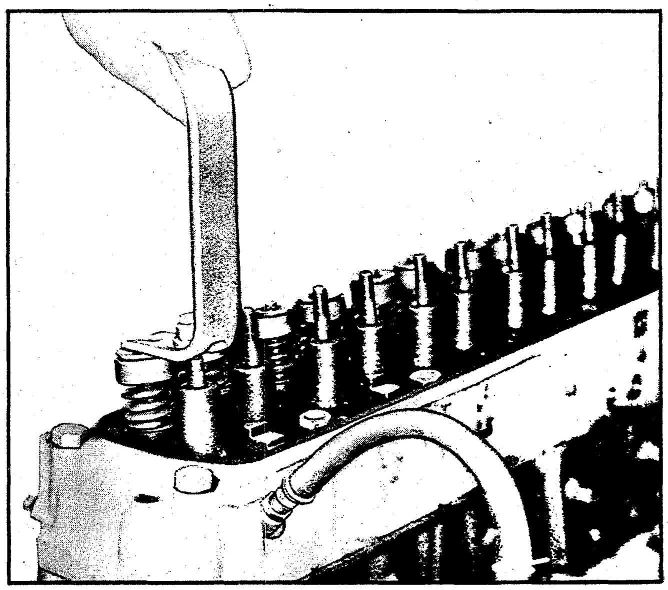


Fig. 4L - Compressing Valve Spring

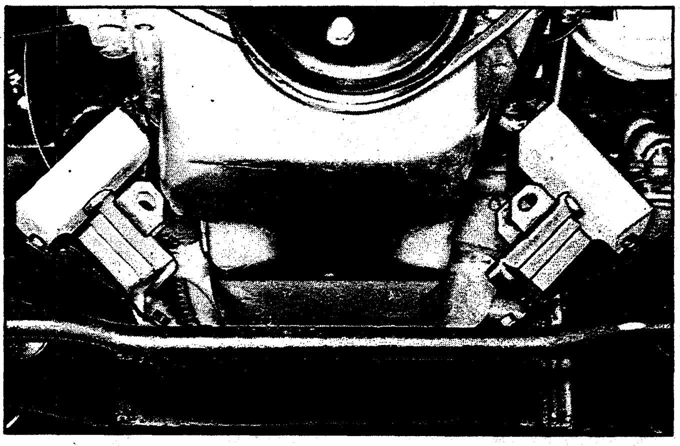


Fig. 5L - Engine Blocked for Pan Removal

NOTE: Do not install rocker arm cover.

11. Start engine and allow warm up then retorque cylinder head as outlined in Step 4 and readjust valves as outlined under Engine Tune Up.

OIL PAN

Removal

Chevrolet and Camaro

1. Disconnect battery positive cable.
2. Remove through bolts from engine front mounts.
3. Drain radiator, then disconnect upper and lower radiator hoses at radiator.
4. Remove fan blade as outlined in Section 6K.
5. Raise vehicle then drain engine oil.
6. Disconnect and remove starter.
7. On vehicles equipped with automatic transmission, disconnect transmission cooler lines at transmission and remove converter housing underpan.
8. Disconnect steering rod at idler lever then swing steering linkage for oil pan clearance.
9. Rotate crankshaft until timing mark on torsional damper is at 6:00 o'clock position.
10. 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. 5L), then lower engine onto blocks.

    NOTE: If 2" x 4" wood blocks are cut 5-1/2" long they can be used on all Chevrolet engines. The 5-1/2" length up for in line engines and the 4" side up for V8 engines.

11. Remove oil pan and discard gaskets and seals.

Chevelle

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 converter housing underpan.
4. Remove starter.
5. Remove oil pan and discard gaskets and seals.

Chevy II

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 L6 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 (fig. 6L).
5. Complete installation as follows:

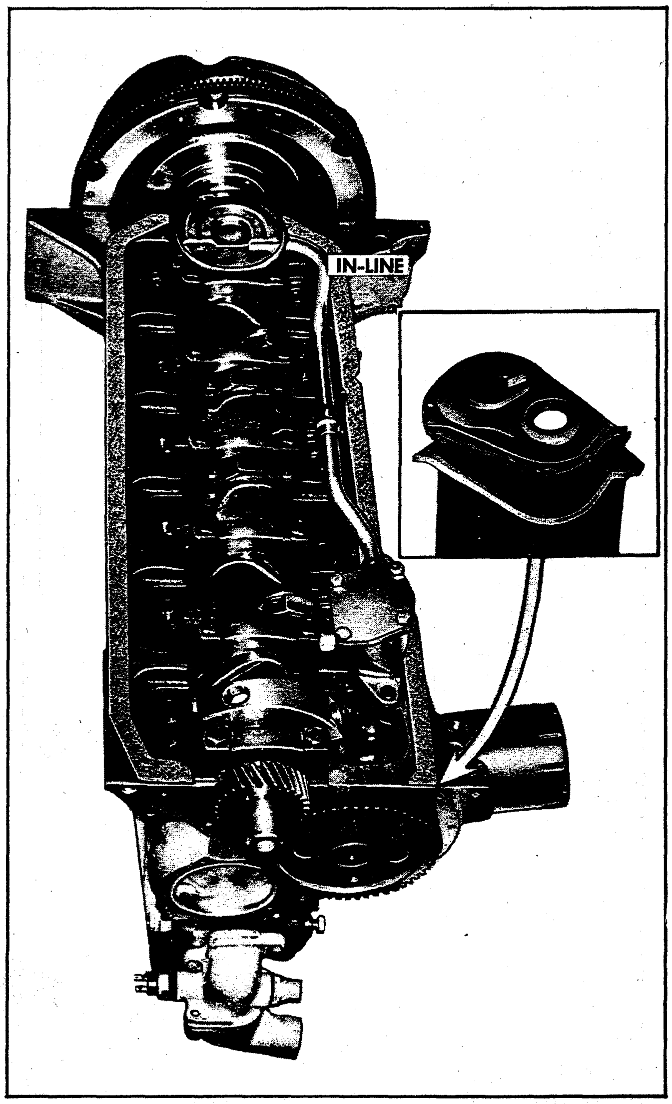


Fig. 6L - Pan Gaskets and Seals

NOTE: Bolts 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.

Chevrolet and Camaro

a. If crankshaft was rotated while pan was off, place timing mark at 6:00 o'clock position.
b. Install oil pan and torque bolts to specifications.
c. 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.
d. On vehicles equipped with automatic transmission install converter housing underpan, then connect transmission cooler lines.
e. Install and connect starter.
f. Lower vehicle and install fan blades as outlined in Section 6K.
g. Connect upper and lower radiator hoses.
h. Install through bolts in engine front mounts.
i. Connect battery positive cable.
j. Fill radiator with coolant and fill engine with oil, then start engine and check for leaks.

Chevelle

a. Install oil pan and torque bolts to specifications.
b. On vehicles equipped with automatic transmission, install converter housing underpan.
c. Install starter.
d. Install engine as outlined.

Chevy II

a. Install oil pan and torque bolts to specifications.

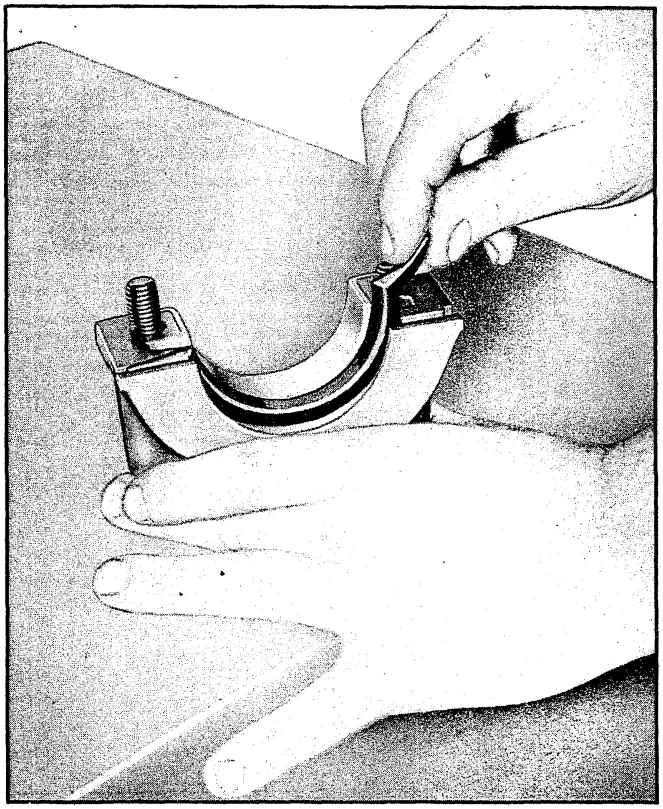


Fig. 7L - Removing Oil Seal (Lower Half)

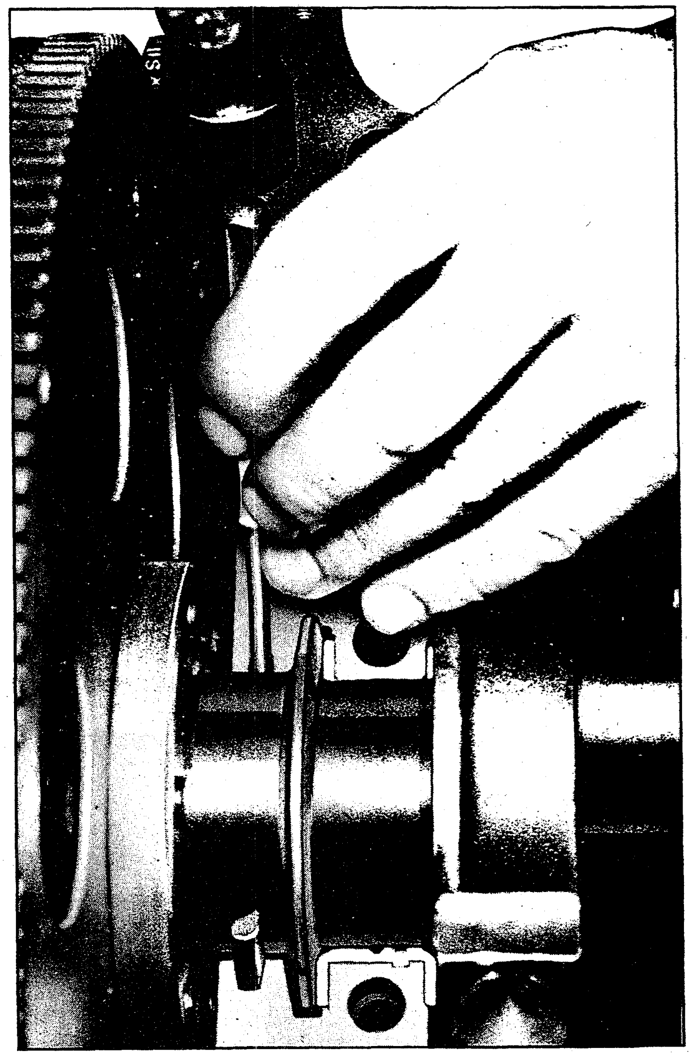


Fig. 8L - Removing Oil Seal (Upper Half)

b. On L6 engines, install front crossmember.
c. Connect steering idler arm.
d. Install starter and connect wires.
e. Connect battery cable, fill with oil, start engine and check for leaks.

OIL PUMP

Removal

1. Remove oil pan as outlined.
2. Remove two flange mounting bolts, pickup 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 outlined.

OIL SEAL (REAR MAIN)

Replacement

The rear main bearing oil seal can be replaced (both halves) without removal of the crankshaft.

NOTE: Always replace the upper and lower seal as a unit. Install with the lip facing toward the front of the engine.

1. With the oil pan removed, remove the rear main bearing cap.
2. Remove oil seal from the groove by lifting the end tab (fig. 7L) then clean seal groove.
3. Lubricate the lip and O.D. of a new seal with engine oil. Keep oil off the parting line surface. Insert seal in cap and roll it into place with finger and thumb, using light pressure so beads on seal O.D. are not cut by seal groove at cap parting line. Be sure tabs on seal are properly located in cross grooves.
4. To remove the upper half of the seal, use a small hammer to tap a brass pin punch on one end of seal until it protrudes far enough to be removed with pliers (fig. 8L).

NOTE: Always clean crankshaft surface removing all foreign deposits before installing a new seal. Also clean seal groove.

5. Lubricate the lip and O.D. of a new seal with engine oil. Keep oil off the parting line surface. Gradually push with a hammer handle, while turning crankshaft, until seal is rolled into place. (Similar to installing a main bearing.) Be careful that seal bead on O.D. is not cut. Compress seal towards crankshaft as much as possible.
6. Install the rear main bearing cap (with new seal) and torque to specifications. Be sure cross seal tabs are in place and properly seated.

CRANKSHAFT PULLEY AND HUB

(Chevy II with L4 Engine)

Removal

1. Drain radiator and disconnect upper and lower radiator hoses at radiator.
2. Remove radiator core 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 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.

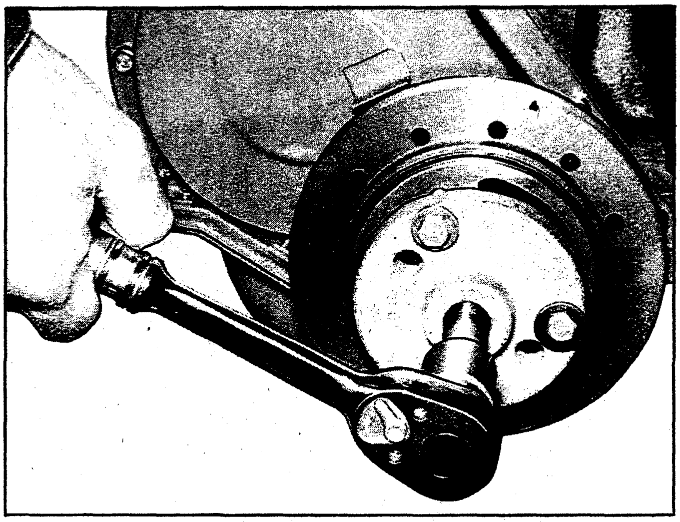


Fig. 9L - Removing Torsional Damper

3. Install fan belt and adjust using strand tension gauge.
4. Install radiator as outlined in Section 13.

TORSIONAL DAMPER

Removal

1. Remove radiator core, as outlined in Section 13.
2. Remove fan belt and (if so equipped) accessory drive pulley and belt.
3. Install Tool J-6978 to damper and turn puller screw to remove damper (fig. 9L). Remove tool.

Installation

1. Coat front cover oil seal contact area of damper with engine oil.

CAUTION: <u>It is necessary to use installer Tool J-22197 to prevent the inertia weight sec-</u>

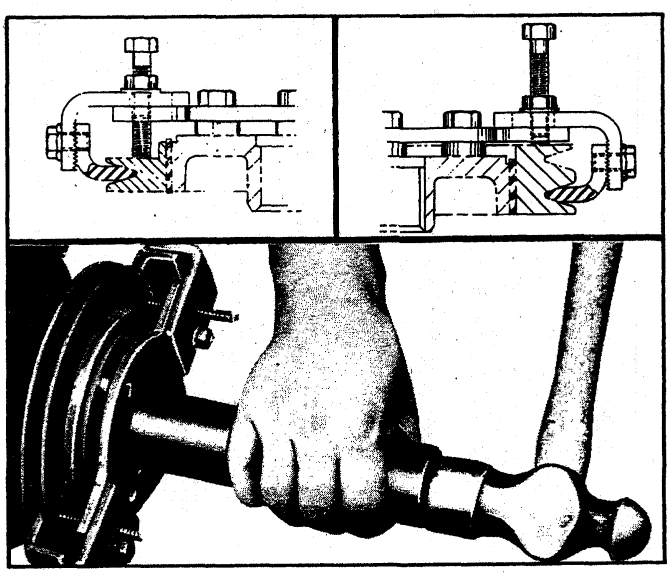


Fig. 10L - Installing Torsional Damper

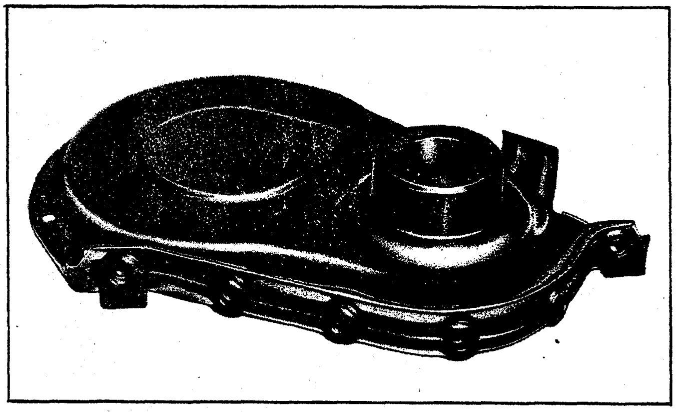


Fig. 11L - J-21742 Centering Tool in Cover

tion from walking off the hub during installation of damper.

2. Attach damper installer Tool J-22197 to damper. Tighten fingers of tool to prevent weight from moving (fig. 10L).
3. Position damper on crankshaft and drive into position, using J-5590, until it bottoms against crankshaft gear (fig. 10L). 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. Fill cooling system and check for leaks.

CRANKCASE FRONT COVER

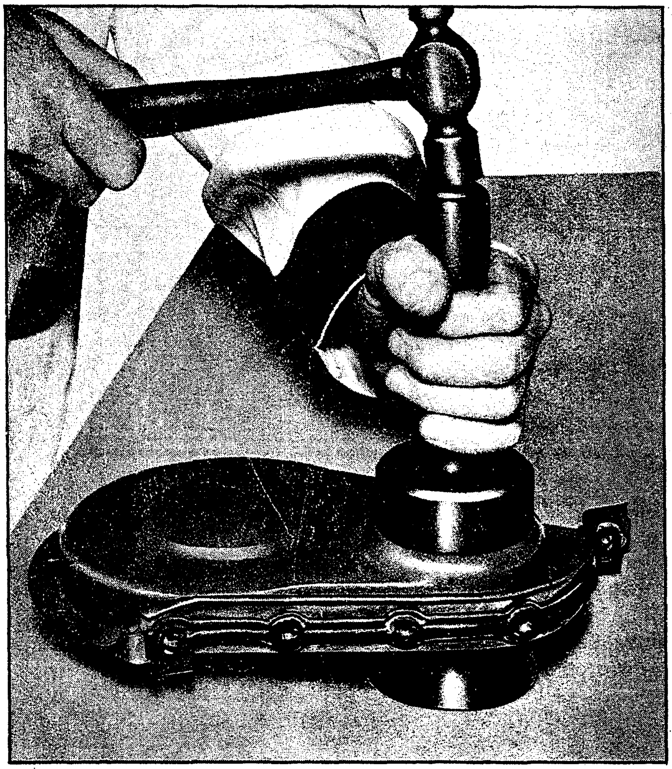


Fig. 12L - Installing Oil Seal (Cover Removed)

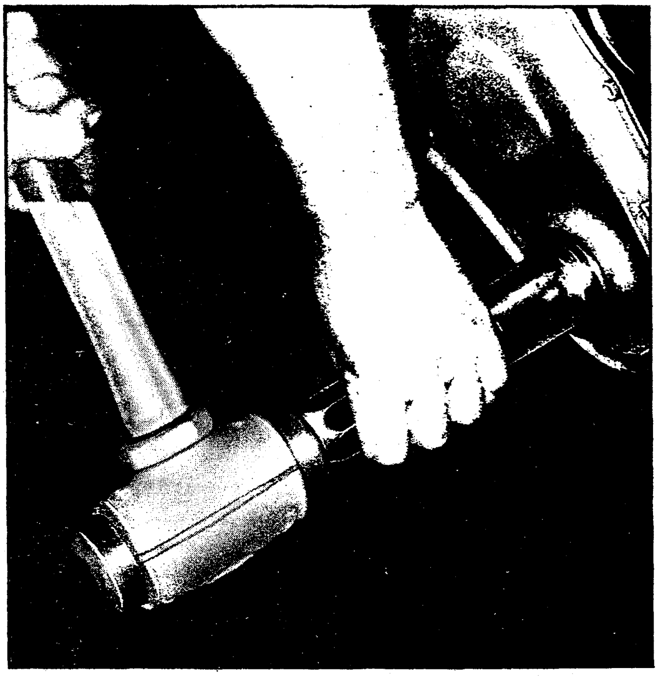


Fig. 13L - Installing Oil Seal (Cover Installed)

Removal

1. Remove oil pan as outlined.
2. Remove crankshaft pulley and hub or torsional damper as outlined.
3. Remove crankcase front cover attaching bolts, remove cover and gasket.

Installation

1. Clean gasket surfaces on block and crankcase front cover.
2. Install centering Tool J-996 or Tool J-21742 in crankcase front cover seal (fig. 11L).
3. Coat the gasket with gasket sealer and place in position on cover, then install crankcase front cover to block and torque bolts 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 torsional damper installation will not damage seal and to position seal evenly around the balancer or hub surface.

5. Install crankshaft hub and/or torsional damper as outlined.
6. Install oil pan with new gaskets and seals as outlined.

OIL SEAL (FRONT COVER)

Replacement

With Cover Removal

1. With cover removed, pry old seal out of cover from the front with screw driver being careful not to distort cover.
2. Install new seal so that open end of the seal is toward the inside of cover and drive it into position with Tool J-995 (fig. 12L).

CAUTION: Support cover at sealing area. (Tool J-971 may be used as support.)

Without Cover Removal

1. With crankshaft pulley and hub or torsional damper removed, pry old seal out of cover from the front with a large screw driver, being careful not to damage the seal surface on the cover.
2. Install new seal so that open end of seal is toward the inside of cover and drive it into position with Tool J-8340 (fig. 13L).

CAMSHAFT

Measuring Lobe Lift

NOTE: Procedure is similar to that used for checking valve timing. If improper valve operation is indicated, measure the lift of each push rod in consecutive order and record the readings.

1. Remove valve mechanism as outlined.
2. Position indicator with ball socket adapter on push rod (fig. 14L).
3. Rotate the crankshaft slowly in the direction of rotation until the lifter is on the heel of the cam lobe. At this point, the push rod will be in its lowest position.
4. Set dial indicator on zero, then rotate the crankshaft slowly, or attach an auxiliary starter switch and "bump" the engine over, until the push rod is in the fully raised position.

CAUTION: 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.

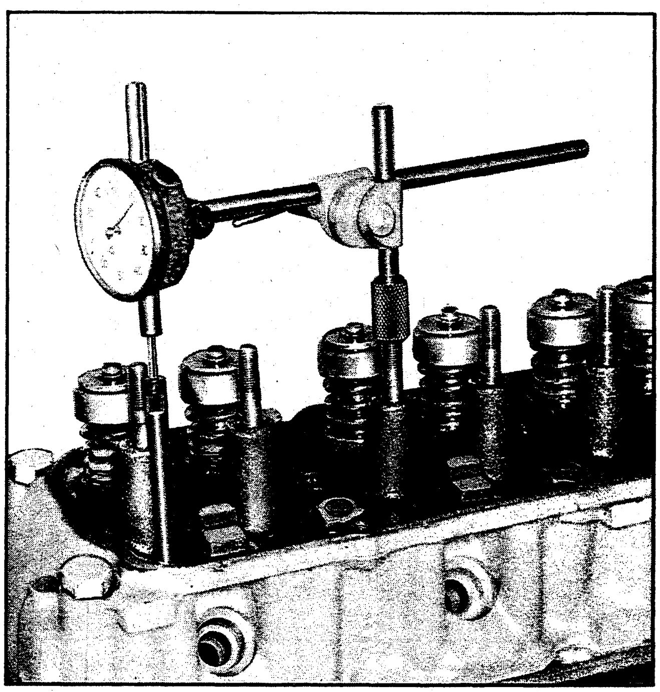


Fig. 14L - Measuring Camshaft Lobe Lift

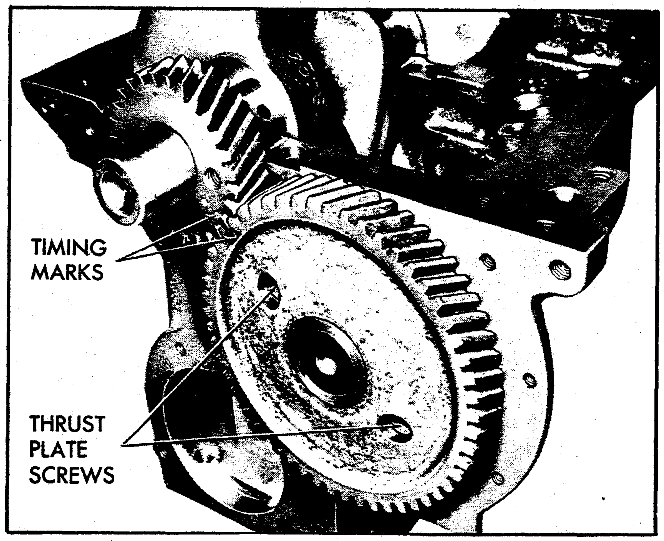


Fig. 15L - Timing Gear Marks

5. Compare the total lift recorded from the dial indicator with specifications.
6. Continue to rotate the crankshaft until the indicator reads zero. This will be a check on the accuracy of the original indicator reading.
7. If camshaft readings for all lobes are within specifications, remove dial indicator assembly.
8. Install and adjust valve mechanism as outlined.

Removal

1. Remove valve lifters as outlined.
2. Remove crankcase front cover as outlined.
3. Remove radiator as outlined in Section 13.
4. Remove grille as outlined in Section 13.
5. Remove fuel pump as outlined in Section 6M.
6. Align timing gear marks then remove the two camshaft thrust plate bolts by working through holes in

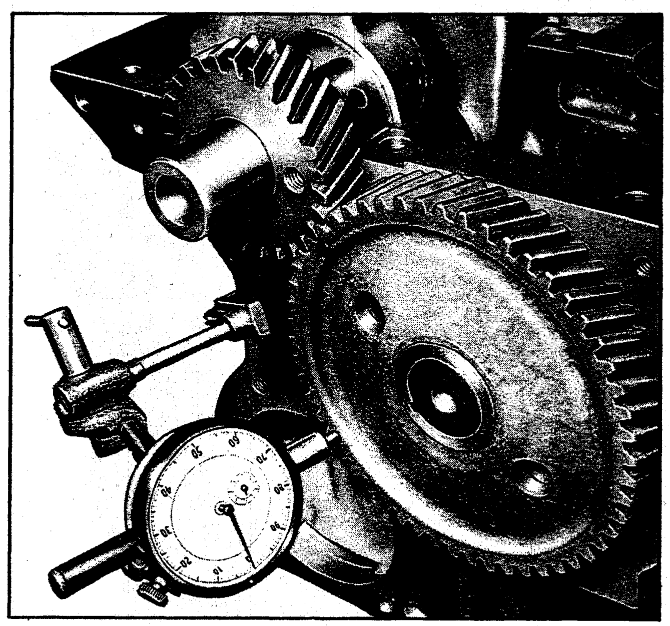


Fig. 16L - Checking Camshaft Gear Runout the camshaft gear (fig. 15L).

7. Remove the camshaft and gear assembly by pulling it out through the front of the block.

NOTE: Support camshaft carefully when removing so as not to damage camshaft bearings.

Installation

1. Install the camshaft and gear assembly in the engine block, being careful not to damage camshaft bearings or camshaft.
2. Turn crankshaft and camshaft so that the valve timing marks on the gear teeth will line up (fig. 15L). Push camshaft into position. Install camshaft thrust plate-to-block bolts and torque to specifications.
3. Check camshaft and crankshaft gear run out with a dial indicator (fig. 16L). The camshaft gear run out should not exceed .004" and the crankshaft gear run out should not exceed .003".
4. If gear run out is excessive, the gear will have to be removed and any burrs cleaned from the shaft or the gear will have to be replaced.
5. Check the backlash between the timing gear teeth with a dial indicator (fig. 17L). The backlash should not be less than .004" nor more than .006".
6. Install fuel pump as outlined in Section 6M.
7. Install grille as outlined in Section 13.
8. Install crankcase front cover as outlined.
9. Install radiator as outlined in Section 13.
10. Install valve lifters as outlined.

TIMING GEARS

Replacement

With camshaft removed, crankshaft gear may be removed using Tool J-8105 (fig. 18L). To install crankshaft gear use Tool J-5590 (fig. 19L). For camshaft gear replacement, refer to Section 6, "Camshaft Disassembly" of the Overhaul Manual.

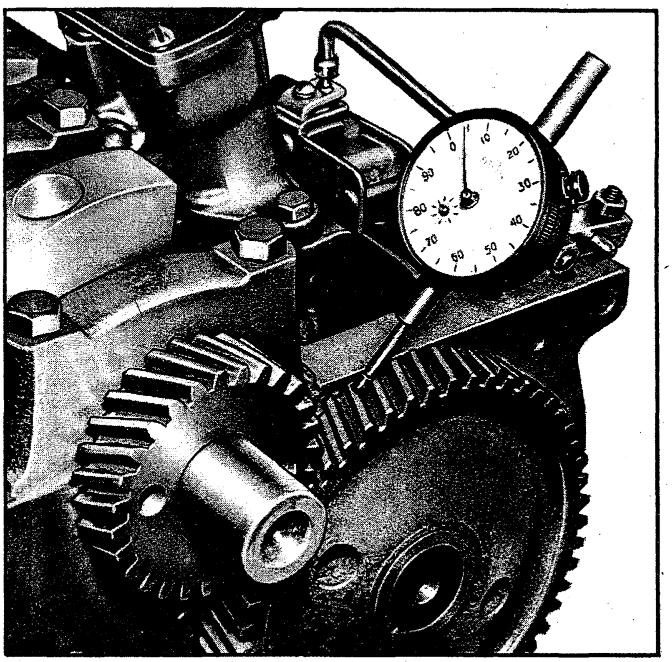


Fig. 17L - Checking Timing Gear Backlash

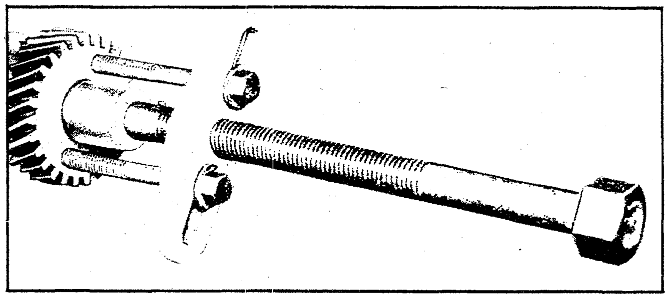


Fig. 18L - Removing Crankshaft Gear

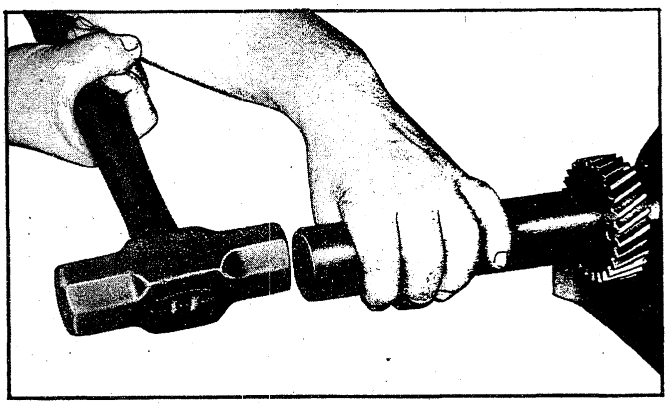


Fig. 19L - Installing Crankshaft Gear

FLYWHEEL

Removal

With transmission and/or clutch housing and clutch removed from engine, remove the flywheel.

Installation

1. Clean the mating surfaces of flywheel and crankshaft to make certain there are no burrs.
2. Install flywheel on crankshaft and position to align dowel hole of crankshaft flange and flywheel (fig. 20L).

   NOTE: On Automatic Transmission equipped engines, the flywheel must be installed with the flange collar to transmission side (fig. 20L).

3. Install bolts and torque to specifications.

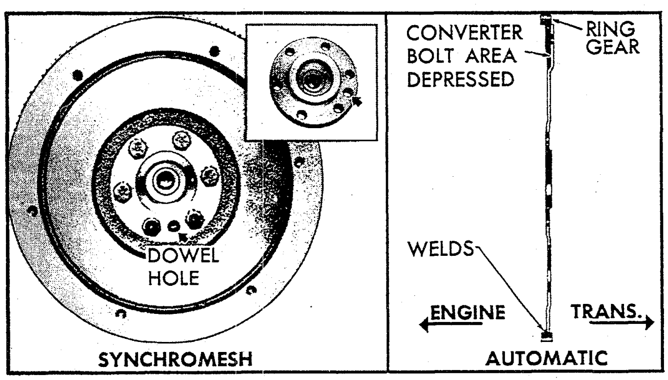


Fig. 20L - Flywheel Installation (Typical)

ENGINE MOUNTS

Engine mounts (fig. 21L) 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

Chevrolet, Chevelle, and Camaro

1. Remove nut, washer, spacer then engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove mount, stop bracket and frame bracket assembly from crossmember, then remove stop bracket and mount from frame bracket.
4. Install stop bracket and new mount on frame bracket, then install assembly on crossmember.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

Chevy II

1. Remove nut, washer and engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove bracket-to-mount bolt, then remove mount.
4. Install new mount on bracket.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

Rear Mount Replacement

Chevrolet

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 crossmember-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

Chevelle and Camaro

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 crossmember-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

Chevy II

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 crossmember-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

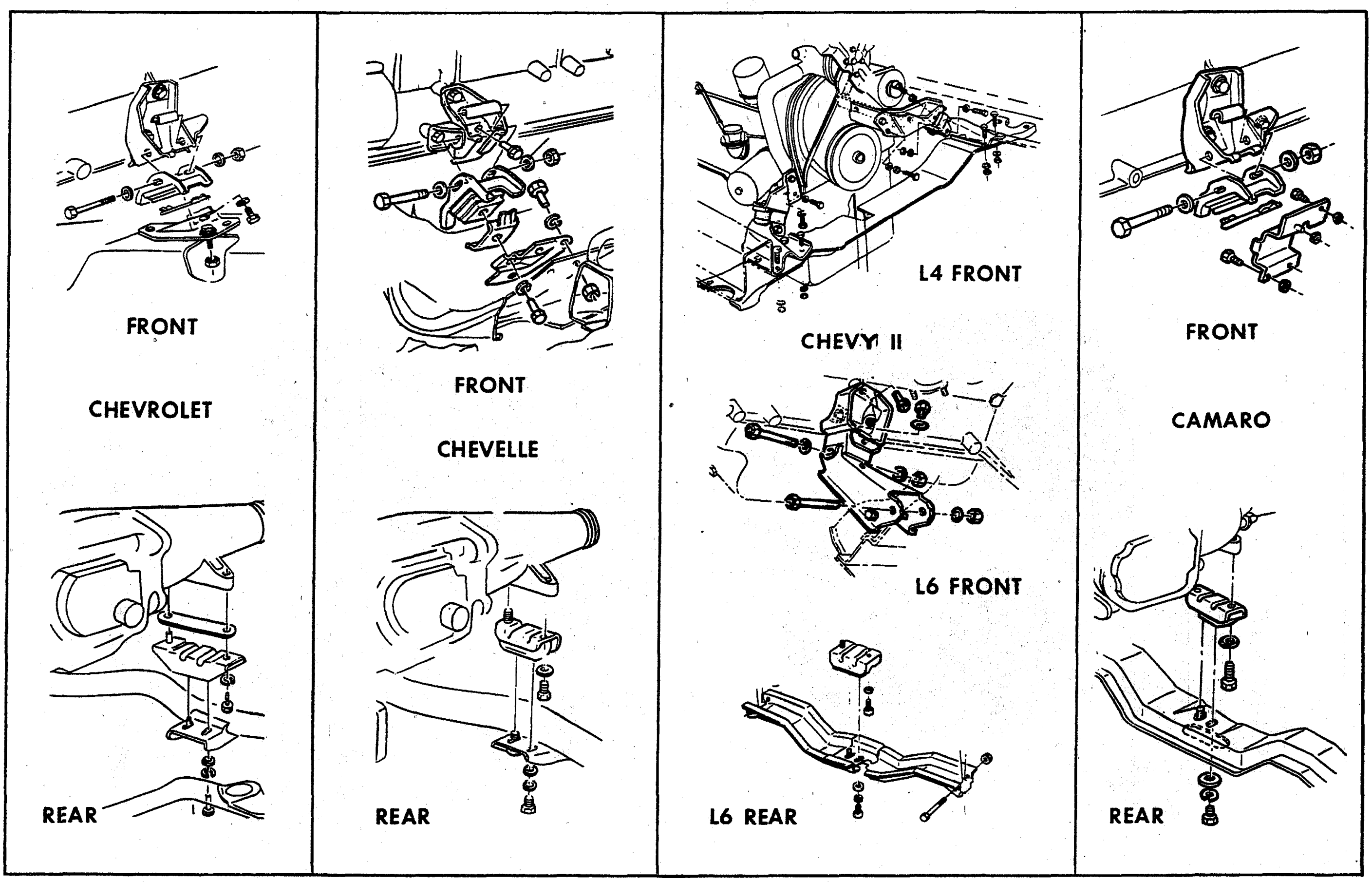


Fig. 21L - Engine Mounts

ENGINE MECHANICAL (V8)

INDEX

GENERAL DESCRIPTION

The V8 engines (fig. 1V) covered in this section are the 283, 327, 350, 396, and 427 cu. in. engines, regardless of which passenger vehicle they are used in.

This section covers the removal and installation of engine assemblies; the removal, installation and adjustment of some sub-assemblies and replacement of some components. For service to all components and sub-assemblies (after removal) and removal of some sub-assemblies,

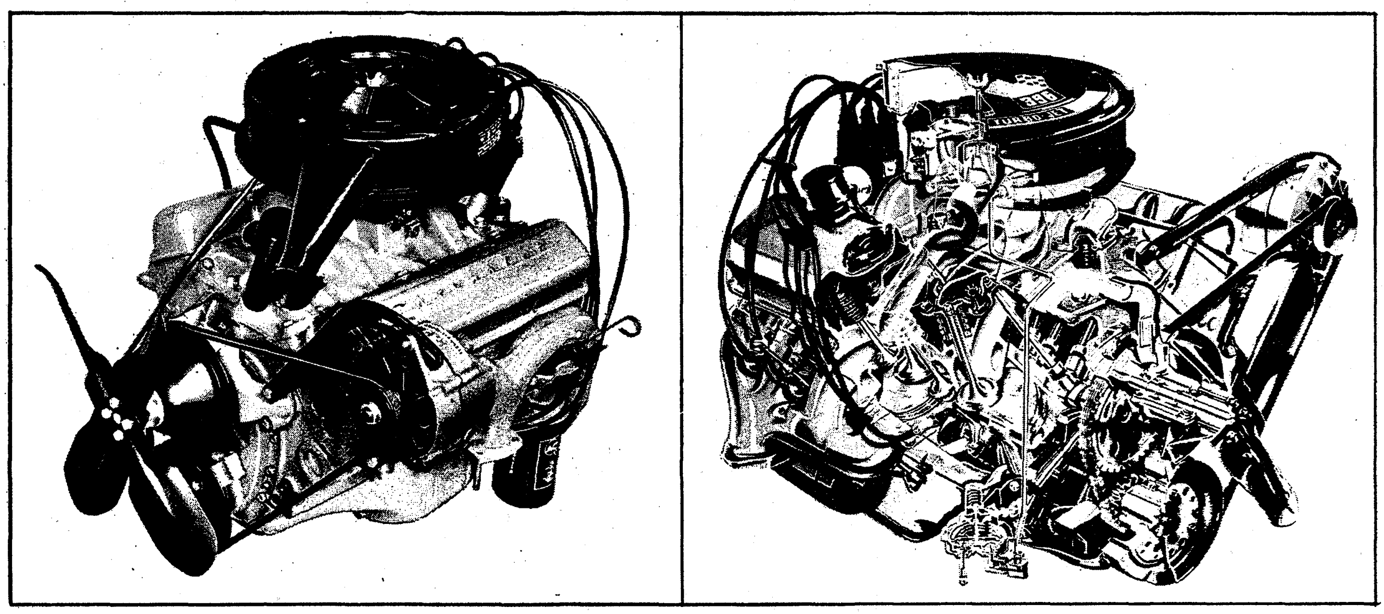


Fig. 1V - V8 Engines (Typical)

refer to Section 6 of the Chassis Overhaul Manual.

Because of the interchangeability and similarity of many engines, engine sub-assemblies and engine parts, regardless of which passenger vehicle they are used in, typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation. Although illustrations showing bench operations are used, most single operations, when not part of a general overhaul, should be performed (if practical) with the engine in the vehicle.

COMPONENT REPLACEMENT AND ADJUSTMENT

ENGINE ASSEMBLY

Removal

1. Drain cooling system and engine oil.
2. Remove air cleaner and disconnect battery cables at battery.
3. Remove hood as outlined in Section 11.
4. Remove radiator and shroud as outlined in Section 13.
5. Remove fan blade and pulley as outlined in Section 6K.
6. Disconnect wires at:
   - Starter solenoid
   - Delcotron
   - Temperature switch
   - Oil pressure switch
   - Coil
7. Disconnect:
   - Accelerator linkage at pedal lever.
   - Exhaust pipes at manifold flanges.
   - Vacuum line to power brake unit at manifold (if so equipped).
   - Power steering pump lines at pump end (if so equipped).
   - Fuel line (from tank) at fuel pump.
   - Engine cooler lines (if so equipped).
   - Oil pressure gauge line (if so equipped).
8. Raise vehicle and place on jack stands.
9. Remove propeller shaft.

   NOTE: If plug for propeller shaft opening in transmission is not available, drain transmission.

10. Disconnect:
    - Shift linkage at transmission.
    - Speedometer cable at transmission.
    - Transmission cooler lines (if so equipped).
11. On synchromesh equipped vehicles, disconnect clutch linkage at cross-shaft then remove cross-shaft engine bracket.
12. Remove rocker arm covers as outlined, then attach engine lifting adapter at the proper cylinder head bolt locations.
13. Remove front mount bolts.
14. Attach lifting device and 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 Chevrolets 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 rear 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 underpan.
    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 rear cover and starter.
   c. Install transmission and clutch housing as outlined in Section 7.
   d. Install clutch housing cover screws and tighten securely.

   Automatic Transmissions

   a. Position engine adjacent to the transmission and align the converter with the flywheel.
   b. Bolt transmission to engine, then raise engine and transmission assembly and install flywheel to converter attaching bolts.
   c. Install converter housing underpan 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 torque to specifications.
5. Raise engine enough to install rear crossmember, then install crossmember, install rear mount, lower engine and torque rear mount to specifications.

6. Remove lifting device and lifting adapter then install rocker arm covers as outlined.
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.
   - Transmission cooler lines (if so equipped).
9. Install propeller shaft.
10. Remove jack stands and lower vehicle.
11. Connect:
    - Power steering pump lines (if so equipped).
    - Vacuum line to power brake unit (if so equipped).
    - Exhaust pipes at manifold flanges.
    - Accelerator linkage at pedal lever.
    - Fuel line at fuel pump.
    - Engine cooler lines (if so equipped).
    - Oil pressure gauge lines (if so equipped).
12. Connect wires at:
    - Coil
    - Oil pressure switch
    - Temperature switch
    - Delcotron
    - Starter solenoid
13. Install pulley, fan blade and fan belt as outlined in Section 6K.
14. Install radiator and shroud as outlined in Section 13.
15. Install and adjust hood as outlined in Section 11.
16. Connect battery cables.
17. Fill with coolant, engine oil and transmission oil, then start engine and check for leaks.
18. Perform necessary adjustments and install air cleaner.

INTAKE MANIFOLD

Removal

1. Drain radiator and remove air cleaner.
2. Disconnect:
   - Battery cables at battery.
   - Upper radiator and heater hose at manifold.
   - Accelerator linkage at pedal lever.
   - Fuel line at carburetor.
   - Wires at temperature sending switch and coil (both sides).
   - Power brake hose at carburetor base.
   - Spark advance hose at distributor.
   - Crankcase ventilation hoses (as required).
3. Remove distributor cap and mark rotor position with chalk. Remove distributor clamp and distributor, then position distributor cap rearward clear of manifold.
4. Remove coil.
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:
   - Carburetor and carburetor mounting studs.
   - Temperature sending switch.
   - Water outlet and thermostat (use new gasket).
   - Heater hose adapter.
   - Choke coil.

Installation

1. Clean gasket and seal surfaces of manifold, cylinder heads and block.
2. Install manifold end seals on block as shown (fig. 2V).
3. Install side gaskets on cylinder heads using sealing compound around water passages (fig. 2V).
4. Install manifold bolts, and torque to specifications in the sequence outlined on the Torque Sequence Chart.
5. Install coil.
6. Install distributor with the rotor pointing at the chalk mark, then install distributor cap.

NOTE: If the crankshaft has been rotated while the distributor was removed, time distributor to number 1 cylinder as outlined in Section 6Y.

7. Connect:
   - Battery cables at battery.
   - Upper radiator and heater hose at manifold.
   - Accelerator linkage at pedal lever.
   - Fuel line at carburetor.
   - Wires at temperature sending switch and coil (both sides).
   - Power brake hose at carburetor base.
   - Spark advance hose at distributor.
   - Crankcase ventilation hoses (as required).

   Fill with coolant, start engine, check for leaks and adjust timing and carburetor idle speed and mixture.

EXHAUST MANIFOLD

Removal

NOTE: If equipped with "Air Injection Reactor System", remove air manifold and tubes as outlined in Section 6T.

1. Disconnect battery ground cable.
2. Disconnect and remove Delcotron (as required).
3. On 396 and 427 cu. in. engines, remove spark plugs

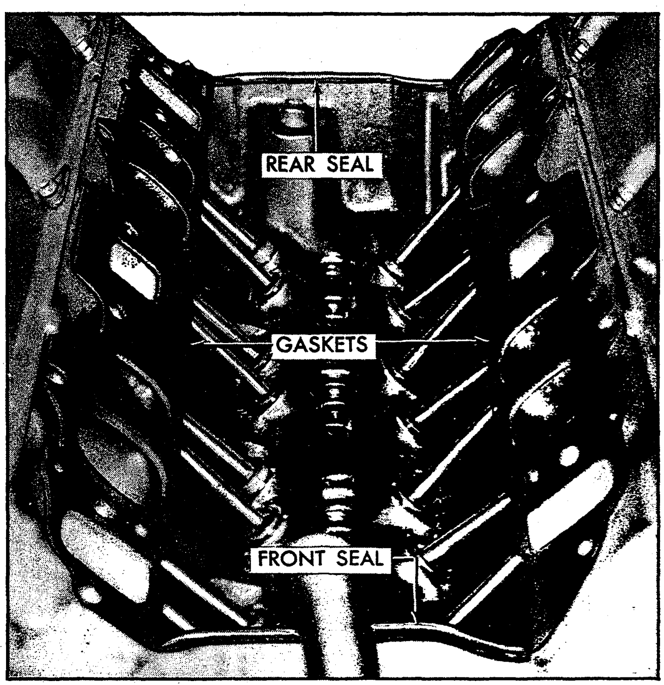


Fig. 2V - Intake Manifold Gasket and Seal Location

and spark plug shields.
4. Remove exhaust manifold flange nuts, then lower exhaust pipe assembly (hang exhaust pipe from frame with wire).
5. Bend french lock tabs (fig. 3V), 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.
4. Using a new flange gasket install exhaust pipe to manifold flange.
5. On 396 and 427 cu. in. engines, clean and install spark plugs using new gaskets. (Torque spark plugs to specifications.)
6. Install and connect Delcotron.
7. Connect the battery ground cable.
8. Start engine and check for leaks.

ROCKER ARM COVER

Removal

1. Remove air cleaner.
2. Disconnect crankcase ventilation hoses (as required).
3. Disconnect temperature wire from rocker arm cover clips.
4. Remove rocker arm cover.

CAUTION: DO NOT pry rocker arm cover loose. Gaskets adhering to cylinder head and rocker arm cover may be sheared by bumping end of rocker arm cover rearward with palm of hand or a rubber mallet.

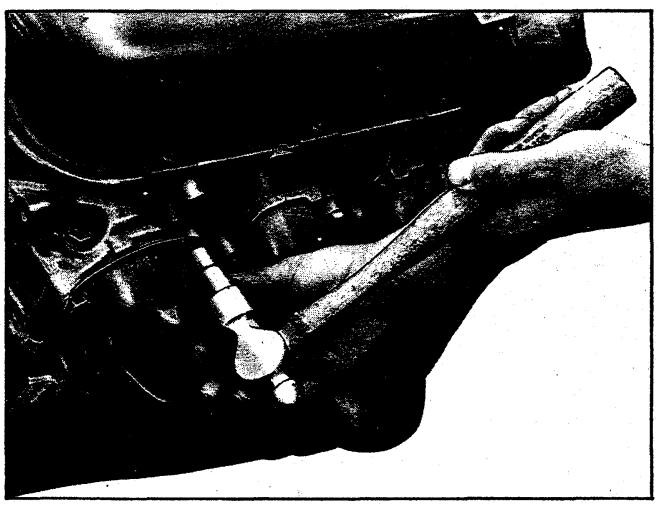


Fig. 3V - Exhaust Manifold French Locks

Installation

1. Clean gasket surfaces on cylinder head and rocker arm cover with degreaser then, using a new gasket, install rocker arm cover and torque bolts to specifications.
2. Connect crankcase ventilation hoses (if disconnected).
3. Connect temperature wire at rocker arm cover clips.
4. Install air cleaner.

VALVE MECHANISM

Removal

1. Remove rocker arm covers as outlined.
2. Remove rocker arm nuts, rocker arm balls, rocker arms and push rods.

NOTE: Place rocker arms, rocker arm balls and push rods in a rack so they may be reinstalled in the same location.

Installation and Adjustment

NOTE: Whenever new rocker arms and/or rocker arm balls are being installed, coat bearing surfaces of rocker arms and rocker arm balls with Molykote or its equivalent.

1. Install push rods. Be sure push rods seat in lifter socket.
2. Install rocker arms, rocker arm balls and rocker arm nuts.
3. Adjust valves when lifter is on base circle of camshaft lobe as follows:

With Hydraulic Valve Lifters

a. Crank engine until mark on torsional damper 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

Fig. 4V - Valve Adjustment (Hydraulic)

damper comes near the "0" mark on the front 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 revolution 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 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. 4V). When push 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 torsional damper mark are again in alignment. This is number 6 firing position. With the engine in this position the following valve may be adjusted.

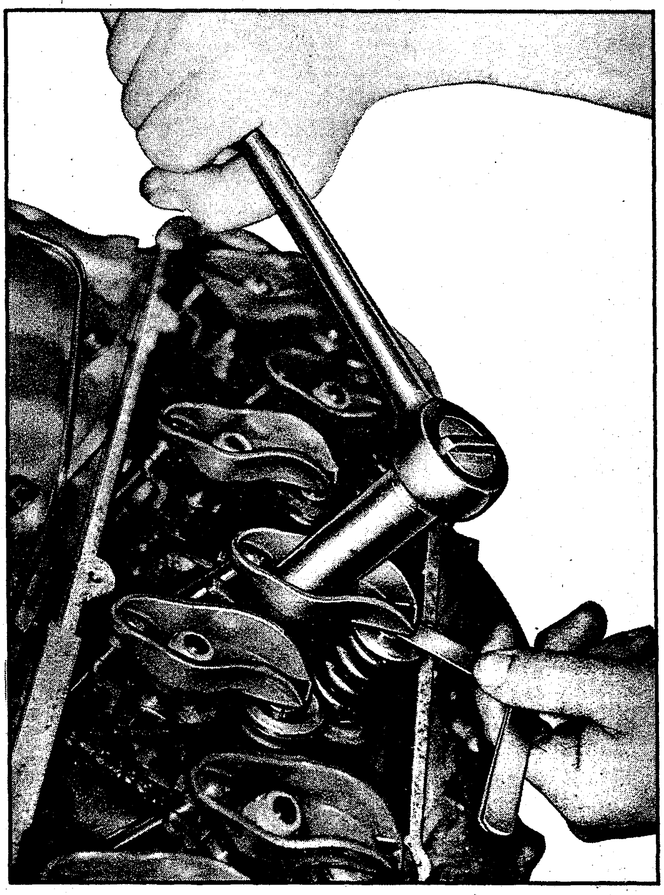


Fig. 5V - Valve Adjustment (Mechanical)

   Exhaust - 2, 5, 6, 7
   Intake - 3, 4, 6, 8

With Mechanical Valve Lifters

a. Crank engine until mark on torsional damper 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 damper comes near the "0" mark on the front 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 revolution 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 (fig. 5V).
   Exhaust - 4, 8
   Intake - 2, 7

c. Turn crankshaft 1/2 revolution (180°) clockwise and adjust the following valve to specifications with a feeler gauge.
   Exhaust - 3, 6
   Intake - 1, 8

d. Turn crankshaft 1/2 revolution (180°) clockwise until the pointer "0" mark and torsional damper 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 - 5, 7
   Intake - 3, 4

e. Turn crankshaft 1/2 revolution (180°) clockwise and adjust the following valves to specifications with a feeler gauge.
   Exhaust - 1, 2
   Intake - 5, 6

f. Readjust valves (hot and running) as outlined under "Engine Tune Up".

4. Install rocker arm covers as outlined.
5. Adjust carburetor idle speed and mixture.

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, corrosion, 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 intake manifold as outlined.
2. Remove valve mechanism as outlined.
3. Remove valve lifters.

NOTE: Place valve lifters in a rack so they may be reinstalled in the same location.

Installation

1. Install valve lifters.

NOTE: Whenever new valve lifters are being installed coat foot of valve lifters with Molykote or its equivalent.

2. Install intake manifold as outlined.
3. Install and adjust valve mechanism as outlined.

VALVE STEM OIL SEAL AND/OR VALVE SPRING

Replacement

1. Remove rocker arm cover(s) as outlined.
2. Remove spark plug, rocker arm and push rod on the cylinders to be serviced.
3. Apply compressed air to the spark plug hole to hold the valves in place.

NOTE: A tool to apply air to the cylinder is available through local jobbers or may be manufactured. In manufacturing this Tool a AC-46N Spark Plug or its equivalent is recommended. This will make the Tool universal for all Chevrolet engines. Chisel the spark plug as shown, then drive the porcelain out of the plug by tapping the center electrode against a hard block. Using a 3/8" pipe tap, cut threads in the remaining portion of the spark plug and assemble as shown (fig. 6V).

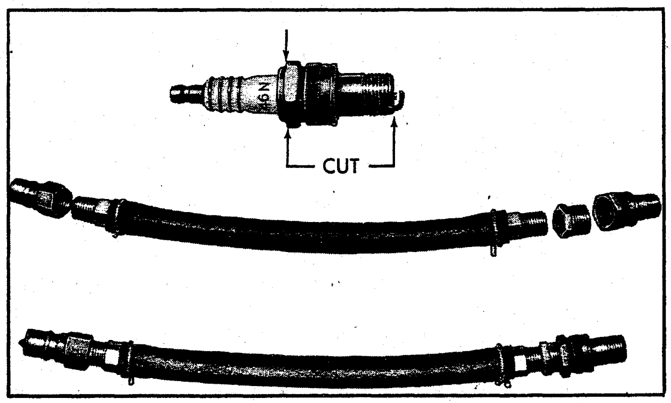


Fig. 6V - Air Adapter Tool

4. Using Tool J-5892 to compress the valve spring, remove the valve locks, valve cap, and valve spring and damper (fig. 7V).
5. Remove valve stem oil seal.
6. Remove as follows:

283, 327 and 350 cu. in. Engines

  a. To replace, set the valve spring and damper, valve shield and valve cap in place. The close coiled end of the spring is installed against the cylinder head.
  b. Compress the spring with Tool J-5892 and install oil seal in the lower groove of the stem, making sure the seal is flat and not twisted.

NOTE: A light coat of oil on the seal will help prevent twisting.

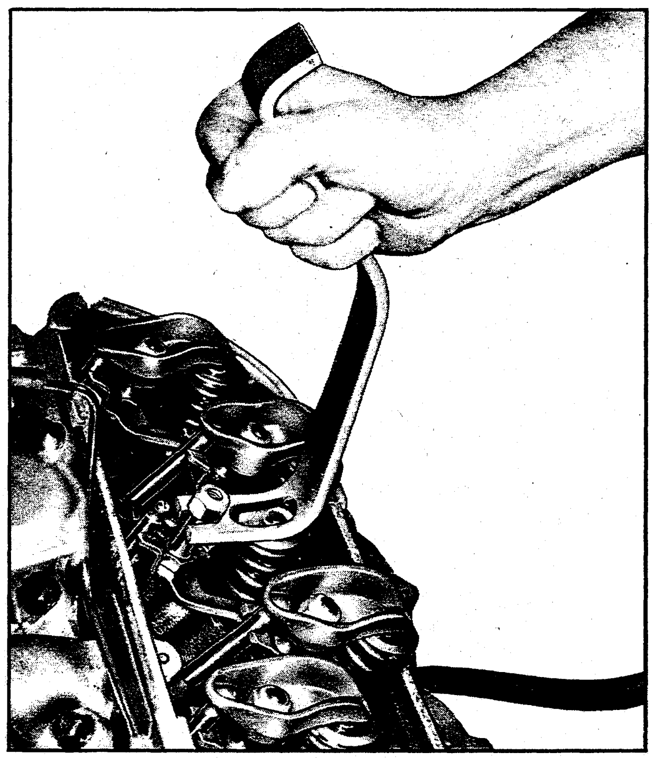


Fig. 7V - Compressing Valve Spring

c. Install the valve locks and release the compressor tool making sure the locks seat properly in the upper groove of the valve stem.

NOTE: Grease may be used to hold the locks in place while releasing the compressor tool.

396 and 427 cu. in. Engines

a. Install new valve stem oil seal (coated with oil) in position over valve guide.
b. Set the valve spring and damper and valve cap in place.
c. Compress the spring with Tool J-5892 and install the valve locks, then release the compressor tool, making sure the locks seat properly in the groove of the valve stem.

NOTE: Grease may be used to hold the locks in place while releasing the compressor tool.

7. Install spark plug, using a new gasket, and torque to specifications.
8. Install and adjust valve mechanism as outlined.

CYLINDER HEAD ASSEMBLY

Removal

1. Remove intake manifold as outlined.
2. Remove exhaust manifolds as outlined.
3. Remove valve mechanism as outlined.
4. Drain cooling system (block).
5. 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. On engines using a STEEL gasket, 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. Too much sealer may hold the beads of the gasket away from the head or block.

CAUTION: Use no sealer on engines using a composition STEEL ASBESTOS gasket.

2. Place the gasket in position over the dowel pins with the bead up.
3. Carefully guide cylinder head into place over dowel pins and gasket.
4. Coat threads of cylinder head bolts with sealing compound and install finger tight.
5. Tighten cylinder head bolts a little at a time in the sequence shown on the torque sequence chart until the specified torque is reached.
6. Install the exhaust manifold as outlined.
7. Install the intake manifold as outlined.
8. Install and adjust the valve mechanism as outlined.

OIL PAN

Removal

Chevrolet and Camaro

1. Disconnect battery positive cable.
2. Disconnect distributor cap from distributor (to prevent breaking distributor cap when engine is raised).
3. Drain radiator, then disconnect lower radiator hose at water pump and remove oil dip stick and tube (where necessary).
4. Remove fan blade.
5. Raise vehicle then drain engine oil.
6. Remove through bolts from engine front mounts. Disconnect and remove starter.
7. On vehicles equipped with automatic transmissions, remove converter housing underpan.
8. Disconnect steering rod at idler lever then swing steering linkage down for oil pan clearance.
9. Rotate crankshaft until timing mark on torsional damper is at 6:00 o'clock position.
10. 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 5-1/2" long they can be used on all Chevrolet engines. The 5-1/2" length up for In-line engines and the 4" side up for V8 engines.

11. Remove oil pan and discard gaskets and seals.

    NOTE: On the 396 and 427 cu. in. engine, the oil pan has three 1/4" x 20 attaching bolts at crankcase front cover. One located at each corner and one at lower center.

Chevelle

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 converter housing underpan.
5. Remove oil pan and discard gaskets and seals.

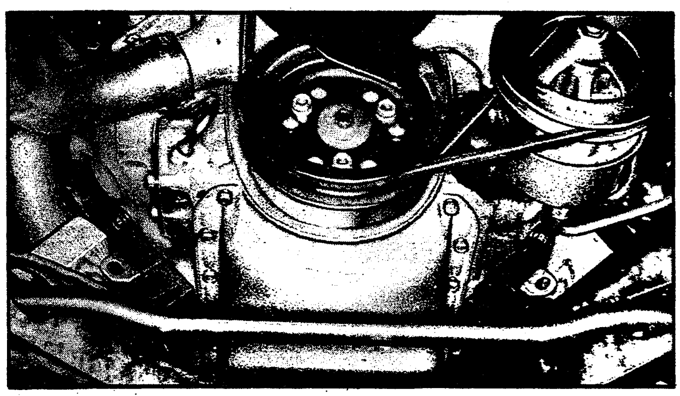


Fig. 8V - Engine Blocked for Pan Removal

Chevy II

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.

Corvette

1. Disconnect battery positive cable then remove oil dipstick and tube.
2. Raise and support vehicle then drain engine oil.
3. Remove starter and flywheel underpan.
4. Disconnect steering linkage idler at frame and lower the linkage.
5. Remove oil pan and discard gaskets and seals.
6. On Hi-Performance engines, the oil baffle must be removed before additional operations can be performed.

NOTE: On the 427 cu. in. engine, the oil pan has three 1/4" x 20 attaching bolts at crankcase front cover. One located at each corner and one at lower center.

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.
3. Install rear oil pan seal in groove in rear main bearing cap with ends (fig. 9V) butting side gaskets.
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.

NOTE: On 396 and 427 cu. in. engines, start three 1/4" x 20 bolts into crankcase front cover before tightening any other pan bolts.

7. Complete installation as follows:

Chevrolet and Camaro

a. 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.
b. On vehicles equipped with automatic transmission install converter housing underpan.
c. Install through bolts in engine front mounts.
d. Install and connect starter. Connect steering rod at idler lever.
e. Lower vehicle and install fan blade.
f. Connnect lower radiator hose, then install oil dip stick tube and dip stick.
g. Connect distributor cap and battery positive cable.
h. Fill radiator with coolant and fill engine with oil, then start engine and check for leaks.

Chevelle

a. On vehicles equipped with automatic transmission install converter housing underpan.
b. Install starter.
c. Install engine as outlined.

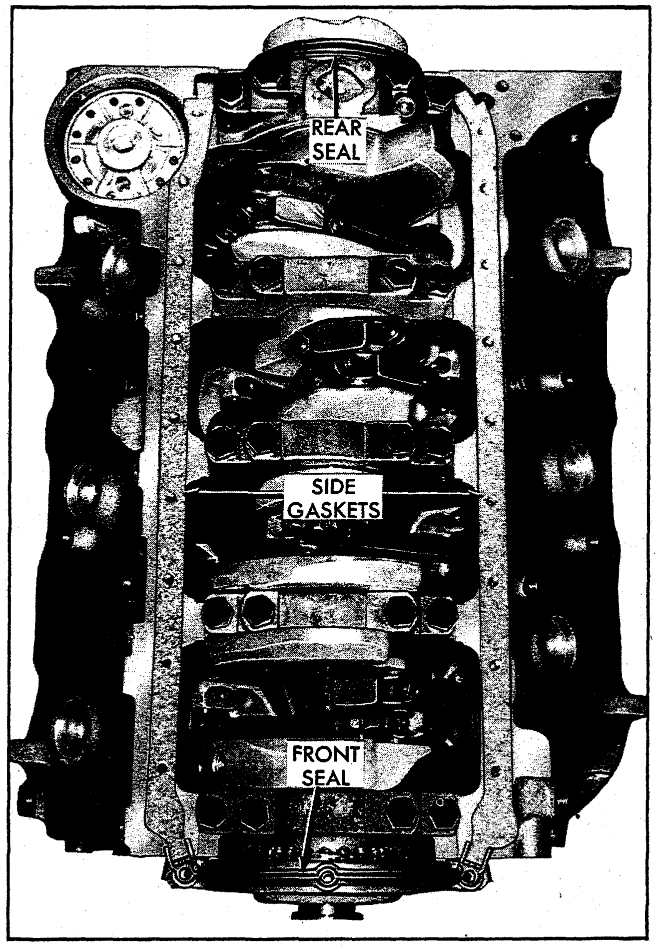


Fig. 9V - Oil Pan Gasket and Seal Location

Chevy II

a. Connect exhaust pipe to manifold flange using new packing seals.
b. Connect steering idler arm bracket.
c. Connect starter wires.
d. Connect battery cable.
e. Fill with oil, start engine and check for leaks.

Corvette

a. Connect steering linkage.
b. Install oil dip stick tube and dip stick then connect battery cables.
c. 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 and extension shaft.

Installation

1. Assemble pump and extension shaft to rear main

Fig. 10V - Removing Oil Seal (Lower Half)

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: Installed position of oil pump screen is with bottom edge parallel to oil pan rails.

3. Install oil pan as outlined.

OIL SEAL (REAR MAIN)

Replacement

The rear main bearing oil seal can be replaced (both halves) without removal of the crankshaft.

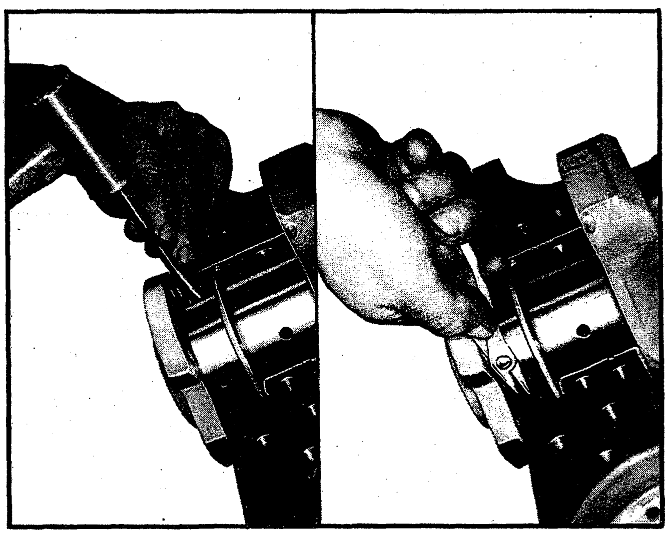


Fig. 11V - Removing Oil Seal (Upper Half)

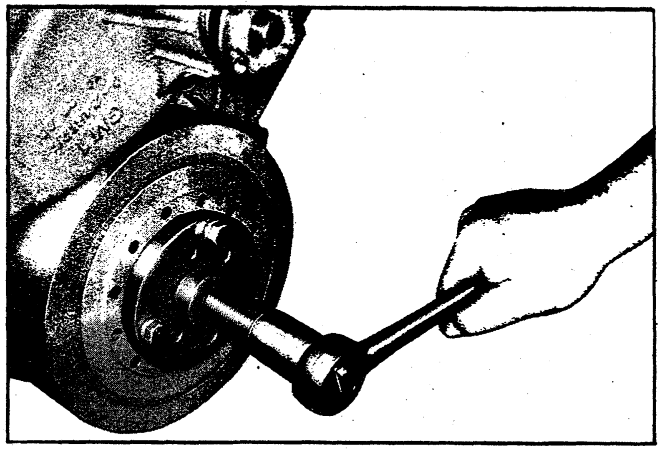


Fig. 12V - Removing Torsional Damper

NOTE: Always replace the upper and lower seal as a unit. Install with the lip facing toward the front of the engine.

1. With the oil pan and oil pump removed, remove the rear main bearing cap.
2. Remove oil seal from the groove by prying from the bottom with a small screw driver (fig. 10V).
3. Lubricate the lip of a new seal with engine oil. Keep oil off the parting line surface as this is treated with glue. Insert seal in cap and roll it into place with finger and thumb, using light pressure so seal tangs at parting line do not cut bead on back of seal.
4. To remove the upper half of the seal, use a small hammer to tap a brass pin punch on one end of seal until it protrudes far enough to be removed with pliers (fig. 11V).

   NOTE: Always wipe crankshaft surface clean before installing a new seal.

5. Lubricate the lip of a new seal with engine oil. Keep oil off the parting line surface as this is treated with glue. Gradually push with a hammer handle, while turning crankshaft, until seal is rolled into place. (Similar to installing a main bearing.) Be careful that seal tangs at parting line do not cut bead on back of seal.
6. Install the rear main bearing cap (with new seal) and torque to specifications.

TORSIONAL DAMPER

Removal

1. Remove fan belt, fan and pulley as outlined in Section 6K.
2. Remove the radiator and shroud as outlined in Section 13.

   NOTE: If additional operations such as camshaft removal are not being performed, the radiator will not have to be removed on Chevrolets and Corvettes equipped with 396 and 427 cu. in. engines.

3. On Corvettes equipped with 427 cu. in. engines, remove engine front mount through-bolts and raise front of engine enough for torsional damper to clear frame crossmember.

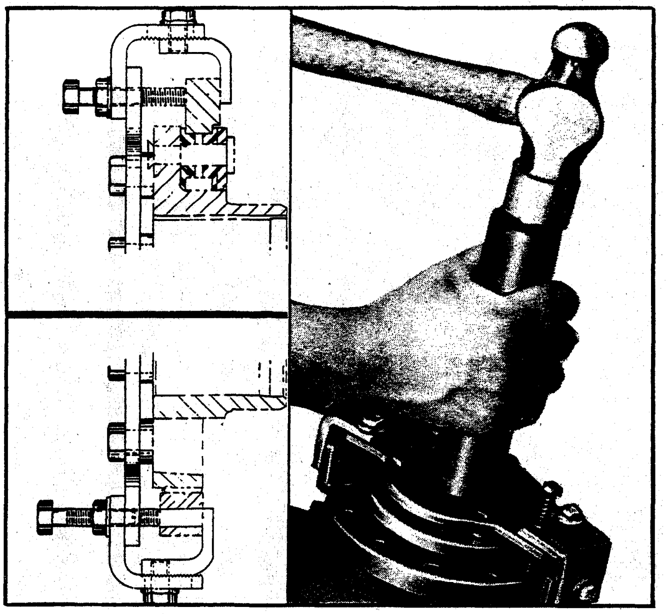


Fig. 13V - Installing Torsional Damper (283, 327 and 350)

4. Remove accessory drive pulley, then remove torsional damper retaining bolt (if so equipped).
5. Install Tool J-6978 to torsional damper and turn puller screw to remove damper from crankshaft (fig. 12V).
6. Remove tool.

Installation

CAUTION: It is necessary to use installer tool to prevent the inertia weight section from walking off the hub during installation of damper.

283, 327 and 350 cu. in. Engines (Except 327-325 HP & 350 HP)

1. Coat front cover seal contact area (on torsional damper) with engine oil.

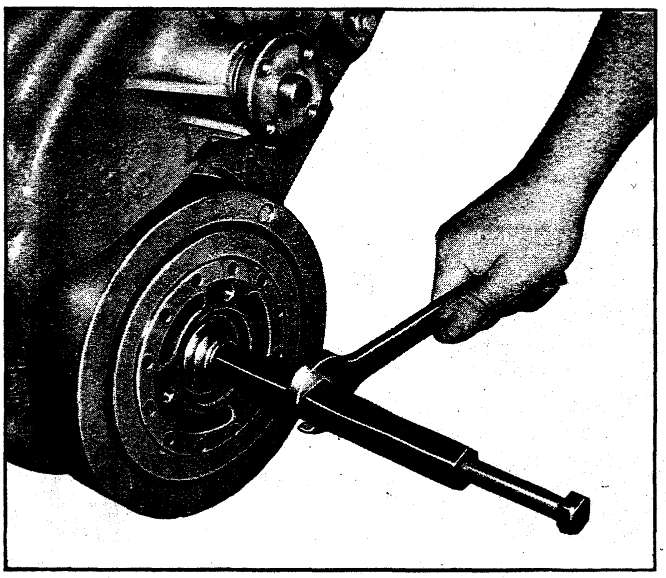


Fig. 14V - Installing Torsional Damper (396 and 427)

2. Attach damper installer Tool J-22197 to damper. Tighten fingers of tool to prevent weight from moving (fig. 13V).
3. Position damper on crankshaft and drive into position until it bottoms against crankshaft sprocket (fig. 13V). Remove installer tool.
4. Install accessory drive pulley.
5. Install radiator and shroud as outlined in Section 13.
6. Install fan pulley and fan as outlined in Section 6K.
7. Install fan belt and adjust to specifications using strand tension gauge.
8. Fill cooling system, start engine and check for leaks.

396 and 427 cu. in. Engines

1. Coat front cover seal contact area (on damper) with engine oil.
2. Place damper in position over key on crankshaft.
3. Using Tool J-21058 pull damper onto crankshaft (fig. 14V).

NOTE: If engine or radiator has not been removed from the vehicle a 1/2"-20 x 5" bolt and a 1/2"-20 nut may be used in place of the bolt and nut of Tool J-21058.

CAUTION: Install bolt in crankshaft with sufficient thread engagement (min. 1/2").

4. Remove tool from crankshaft.
5. Install damper retaining bolt and torque to specifications, then install accessory drive pulley.
6. Install radiator and shroud as outlined in Section 13.
7. Install fan pulley and fan as outlined in Section 6K.
8. Install fan belt and adjust to specifications using strand tension gauge.
9. On Corvettes, lower engine and install front mount through-bolts.
10. Fill cooling system, start engine and check for leaks.

327 cu. in. (325 & 350 HP) Engine

Install damper as outlined for 396 and 427 cu. in. engines, using a 7/16"-20 x 5" bolt and nut in place of the bolt and nut furnished with J-21058.

CRANKCASE FRONT COVER

Removal

1. Remove oil pan as outlined.
2. Remove torsional damper as outlined.
3. Remove water pump as outlined in Section 6K.
4. Remove crankcase front cover attaching bolts and remove front cover and gasket, then discard gasket.

Installation

283, 327 and 350 cu. in. Engine

1. Make certain that cover mounting face and cylinder block front 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 bolts to specifications.
4. Install water pump as outlined in Section 6K.
5. Install torsional damper as outlined.
6. Install oil pan as outlined.

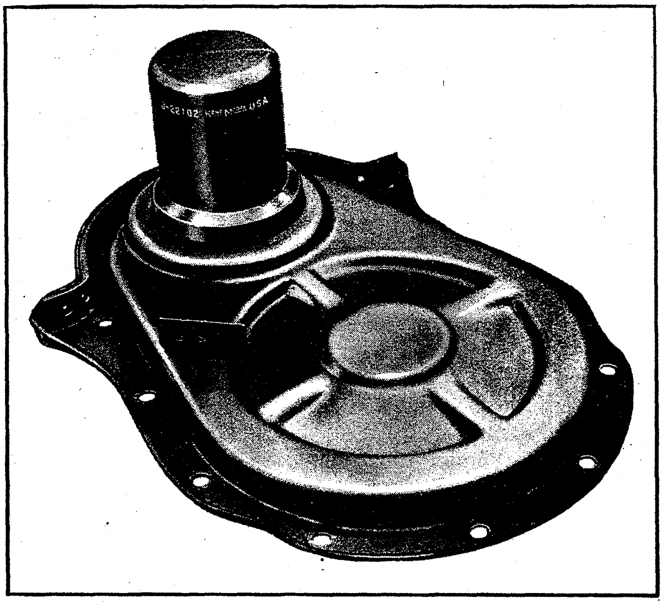


Fig. 15V - Centering Tool in Cover (396 and 427)

396 and 427 cu. in. Engine

1. Make certain that cover mounting face and cylinder block front face are clean and flat.
2. Coat the oil seal with engine oil and install Aligning Tool J-22102 in oil seal (fig. 15V) then using a new cover gasket coated with gasket sealer, install cover and gasket on cylinder block.
3. Install cover screws and torque bolts to specifications, then remove Aligning Tool J-22102.
4. Install water pump as outlined in Section 6K.
5. Install torsional damper as outlined.
6. Install oil pan as outlined.

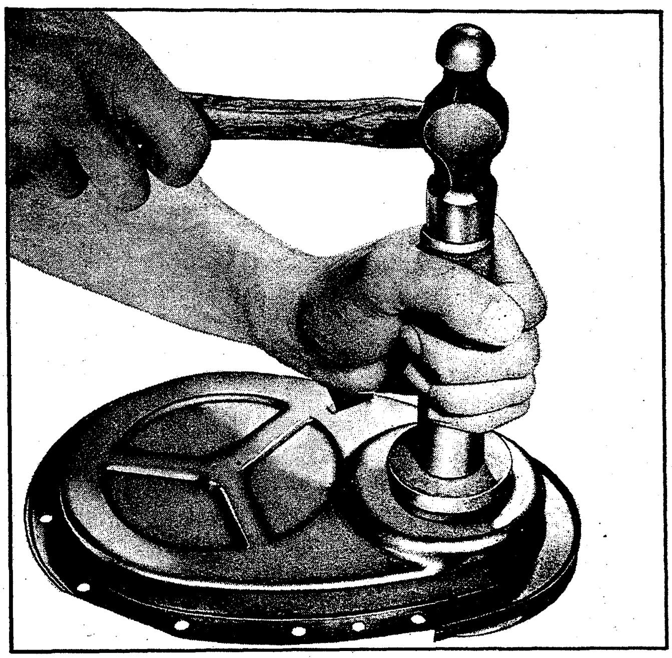


Fig. 16V - Installing Oil Seal (Cover Removed) 283, 327 and 350

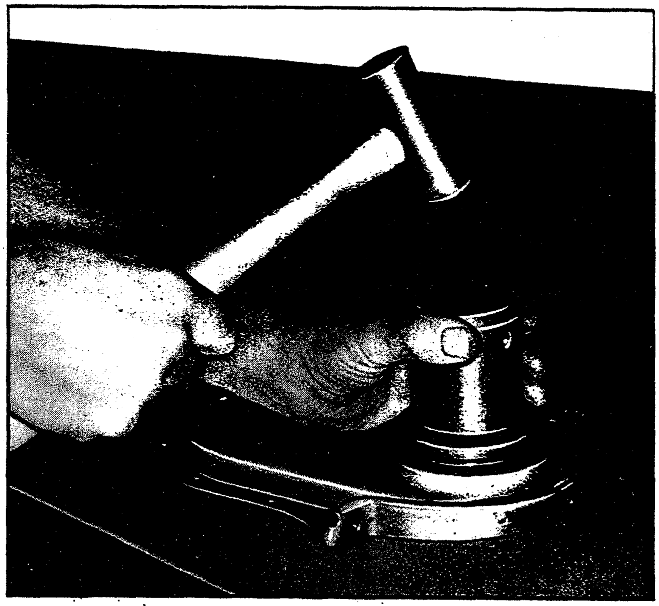


Fig. 17V - Installing Oil Seal (Cover Removed) 396 and 427

OIL SEAL (FRONT COVER)

Replacement

With Cover Removal

1. With cover removed, pry old seal out of cover from the front with a large screw driver.
2. Install new seal so that open end of the seal is toward the inside of cover and drive it into position with Tool J-995 on 283, 327 and 350 cu. in. engines (fig. 16V) or Tool J-22102 on 396 and 427 cu. in. engines (fig. 17V).

CAUTION: Support cover at sealing area to avoid distorting cover.

Without Cover Removal

1. With torsional damper removed, pry old seal out of cover from the front with a large screw driver, being careful not to damage the surface on the crankshaft.
2. Install new seal so that open end of seal is toward the inside of cover and drive it into position with Tool J-8340 on 283, 327 and 350 cu. in. engines (fig. 18V) or Tool J-22102 on 396 and 427 cu. in. engines (fig. 19V).

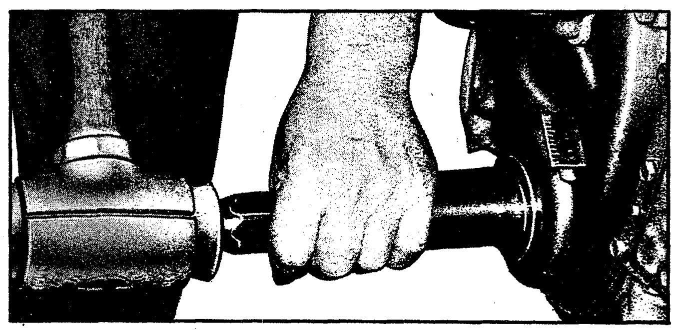


Fig. 18V - Installing Oil Seal (Cover Installed) 283, 327 and 350

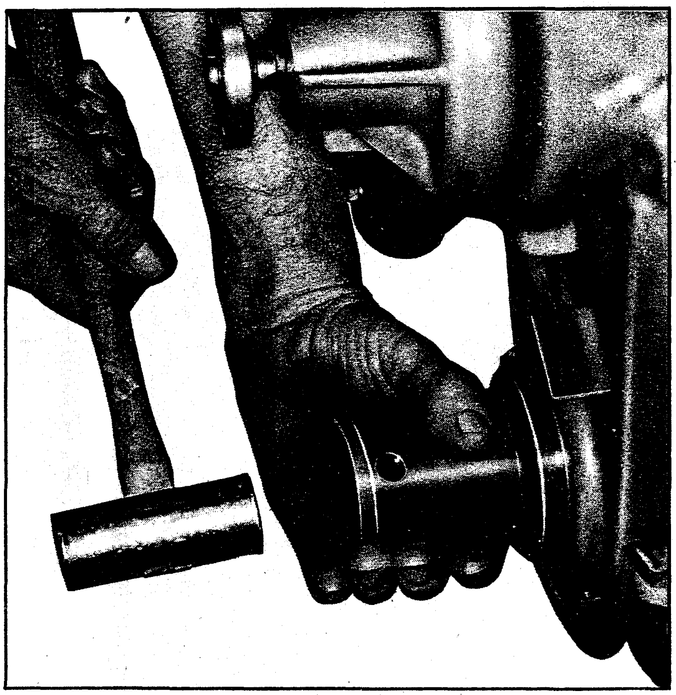


Fig. 19V - Installing Oil Seal (Cover Installed) 396 and 427

TIMING CHAIN AND/OR SPROCKETS

Replacement

1. Remove torsional damper and crankcase front cover as outlined.
2. Crank engine until marks on camshaft and crankshaft sprockets are in alignment (fig. 20V).
3. Remove three camshaft sprocket to camshaft bolts.
4. Remove camshaft sprocket and timing chain together.

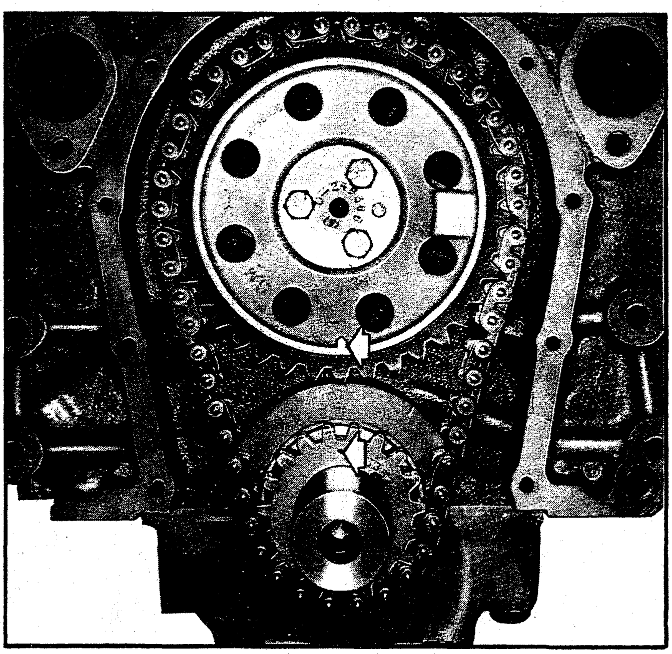


Fig. 20V - Timing Sprocket Marks

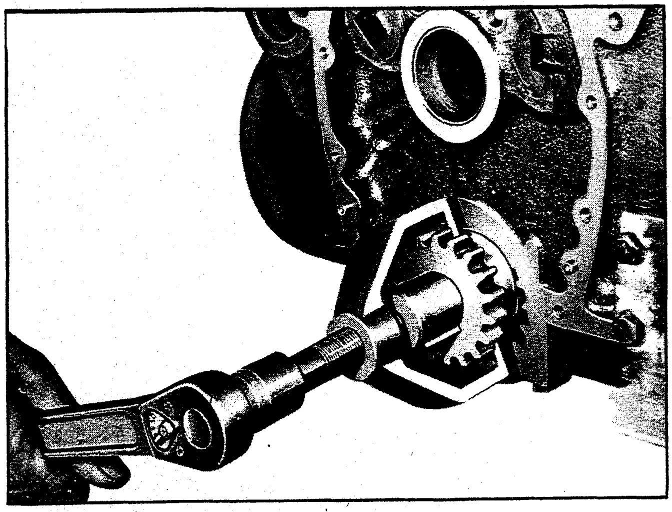


Fig. 21V - Removing Crankshaft Sprocket (283, 327 and 350)

NOTE: Sprocket is a light press fit on camshaft. To dislodge, tap lightly on lower edge of camshaft sprocket with a plastic hammer.

5. If crankshaft sprocket is to be replaced, remove sprocket using Tool J-5825 on 283, 327 and 350 cu. in. engines (fig. 21V) or Tool J-1619 on 396 and 427 cu. in. engines (fig. 22V). Install new sprocket using Tool J-5590 on 283, 327 and 350 cu. in. engines (fig. 23V) or Tool J-21058 on 396 and 427 cu. in. engines (fig. 24V).
6. Install timing chain on camshaft sprocket. Hold the sprocket vertical with the chain hanging below, and orient to align marks on camshaft and crankshaft sprockets (fig. 20V).
7. Align dowel in camshaft with dowel hole in camshaft sprocket and install sprocket on camshaft (fig. 25V).

NOTE: Do not attempt to drive cam sprocket on shaft as welsh plug at rear of engine can be dislodged.

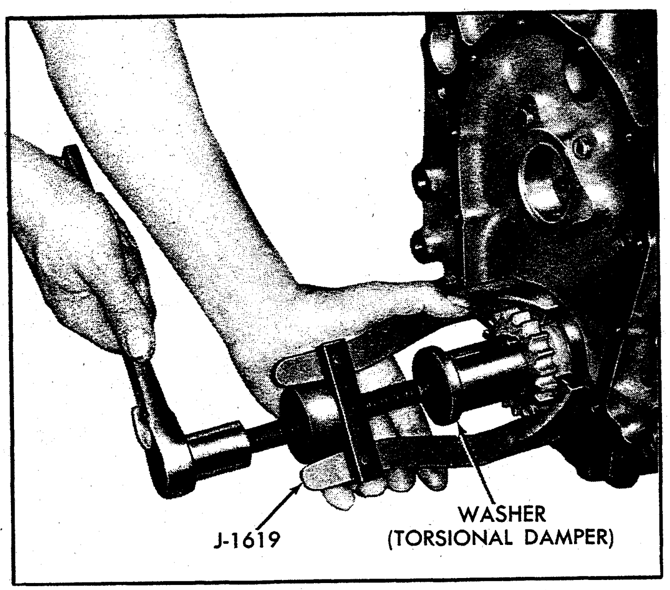


Fig. 22V - Removing Crankshaft Sprocket (396 and 427)

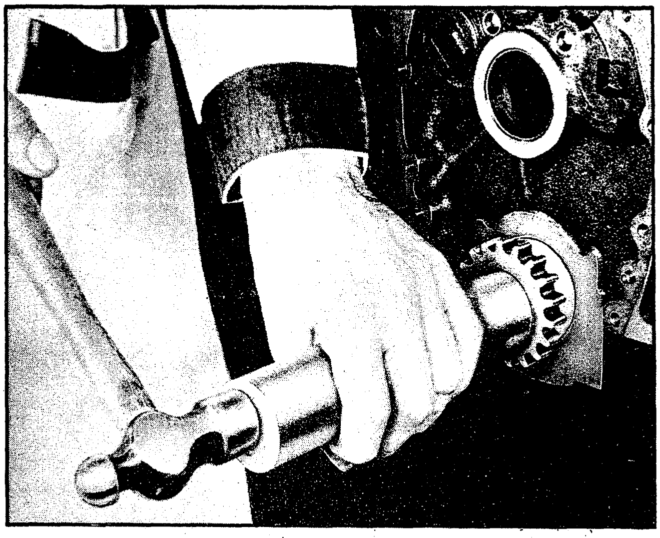


Fig. 23V - Installing Crankshaft Sprocket
(283, 327 and 350)

8. Draw camshaft sprocket onto camshaft, using the three mounting bolts. Torque to bolt specifications.
9. Lubricate timing chain with engine oil.
10. Install crankcase front cover and torsional damper as outlined.

CAMSHAFT

Measuring Lobe Lift

NOTE: Procedure is similar to that used for checking valve timing. If improper valve operation is indicated, measure the lift of each push rod in consecutive order and record the readings.

1. Remove valve mechanism as outlined.
2. Position indicator with ball socket adapter on push rod (fig. 26V).
3. Rotate the crankshaft damper slowly in the direction of rotation until the lifter is on the heel of the cam lobe. At this point, the push rod will be in its lowest position.

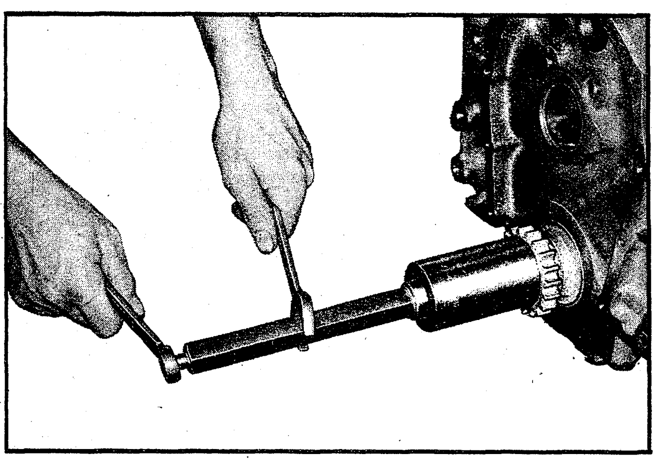


Fig. 24V - Installing Crankshaft Sprocket
(396 and 427)

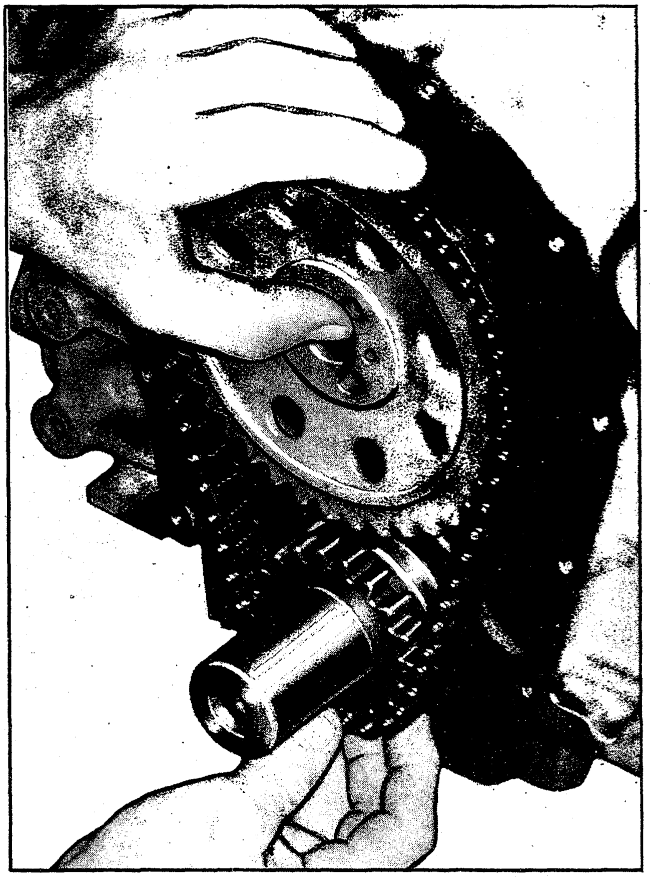


Fig. 25V - Installing Timing Chain

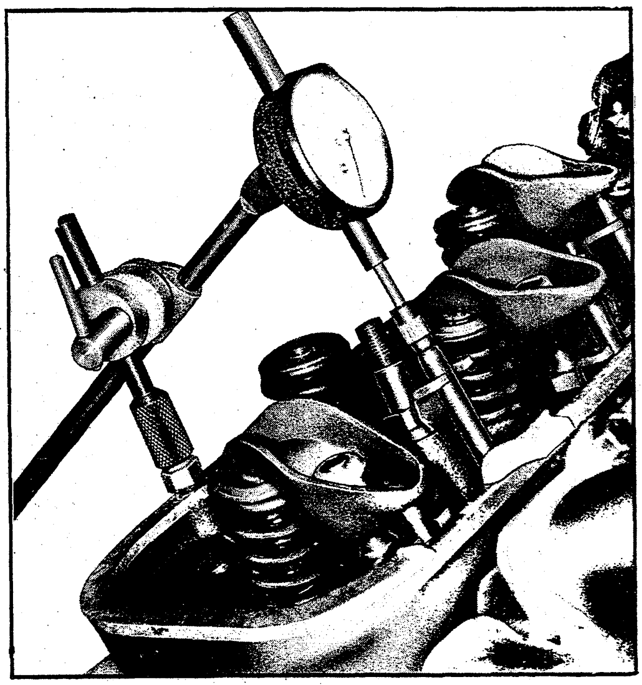


Fig. 26V - Measuring Camshaft Lobe Lift

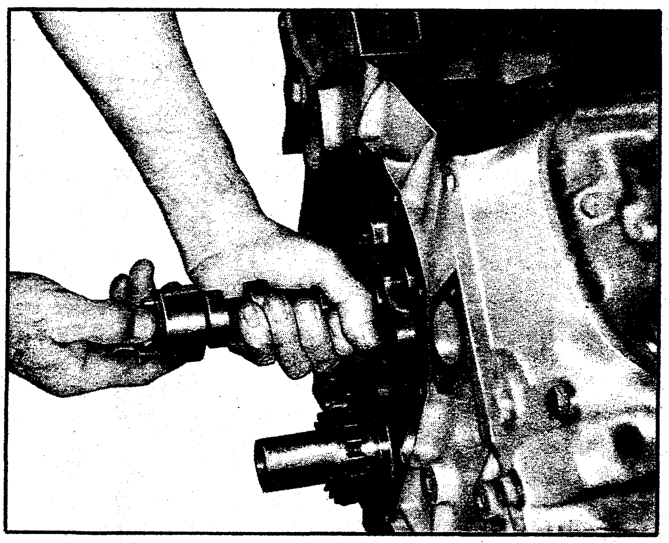


Fig. 27V—Removing Camshaft

4. Set dial indicator on zero, then rotate the damper slowly, or attach an auxiliary starter switch and "bump" the engine over, until the push rod is in the fully raised position.

CAUTION: 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.

5. Compare the total lift recorded from the dial indicator with specifications.
6. Continue to rotate the crankshaft until the indicator reads zero. This will be a check on the accuracy of the original indicator reading.
7. If camshaft readings for all lobes are within specifications, remove dial indicator assembly.
8. Install and adjust valve mechanism as outlined.

Removal

1. Remove valve lifters as outlined.
2. Remove crankshaft front cover as outlined.
3. Remove grille as outlined in Section 13.
4. Remove fuel pump push rod as outlined in Section 6M.
5. Complete camshaft removal as follows:

CAUTION: All camshaft journals are the same diameter and care must be used in removing camshaft to avoid damage to bearings.

Remove camshaft sprocket to camshaft bolts then remove sprocket and timing chain together. Sprocket is a light fit on camshaft. If sprocket does not come off easily a light blow on the lower edge of the sprocket (with a plastic mallet) should dislodge the sprocket.

Install two 5/16" - 18 x 4" bolts in camshaft bolt holes then remove camshaft (fig. 27V).

Installation

NOTE: Whenever a new camshaft is installed coat camshaft lobes with Molykote or its equivalent.

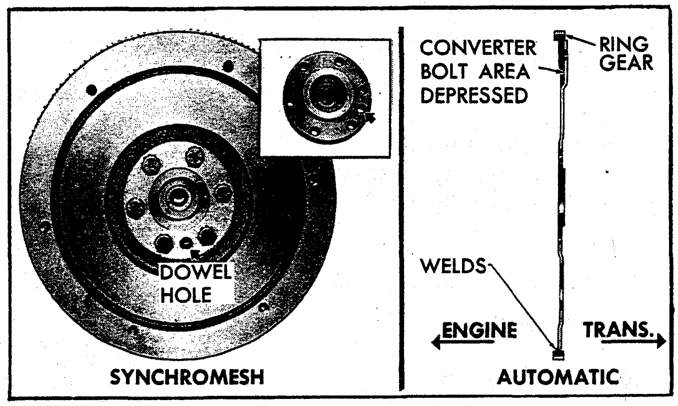


Fig. 28V - Flywheel Installation (Typical)

1. Lubricate camshaft journals with engine oil and install camshaft.
2. Install timing chain on camshaft sprocket. Hold the sprocket vertical with the chain hanging down, and orient to align marks on camshaft and crankshaft sprockets. Refer to Figure 20V.
3. Align dowel in camshaft with dowel in hole in camshaft sprocket then install sprocket on camshaft. Refer to Figure 25V.
4. Draw the camshaft sprocket onto camshaft using the mounting bolts. Torque to specifications.
5. Lubricate timing chain with engine oil.
6. Install fuel pump push rod as outlined in Section 6M.
7. Install grille as outlined in Section 13.
8. Install crankcase front cover as outlined.
9. Install valve lifters as outlined.

FLYWHEEL

Removal

With transmission and/or clutch housing and clutch removed from engine, remove the flywheel.

Installation

1. Clean the mating surfaces of flywheel and crankshaft to make certain there are no burrs.
2. Install flywheel on crankshaft and position to align dowel hole of crankshaft flange and flywheel (fig. 28V).

NOTE: On Automatic Transmission equipped engines, the flywheel must be installed with the flange collar to transmission side (fig. 33V).

ENGINE MOUNTS

Engine mounts (fig. 34V) 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

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 (and spacer on Chevrolets).
4. Install new mount (and spacer on Chevrolets) on transmission.
5. While lowering transmission, align and start crossmember-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

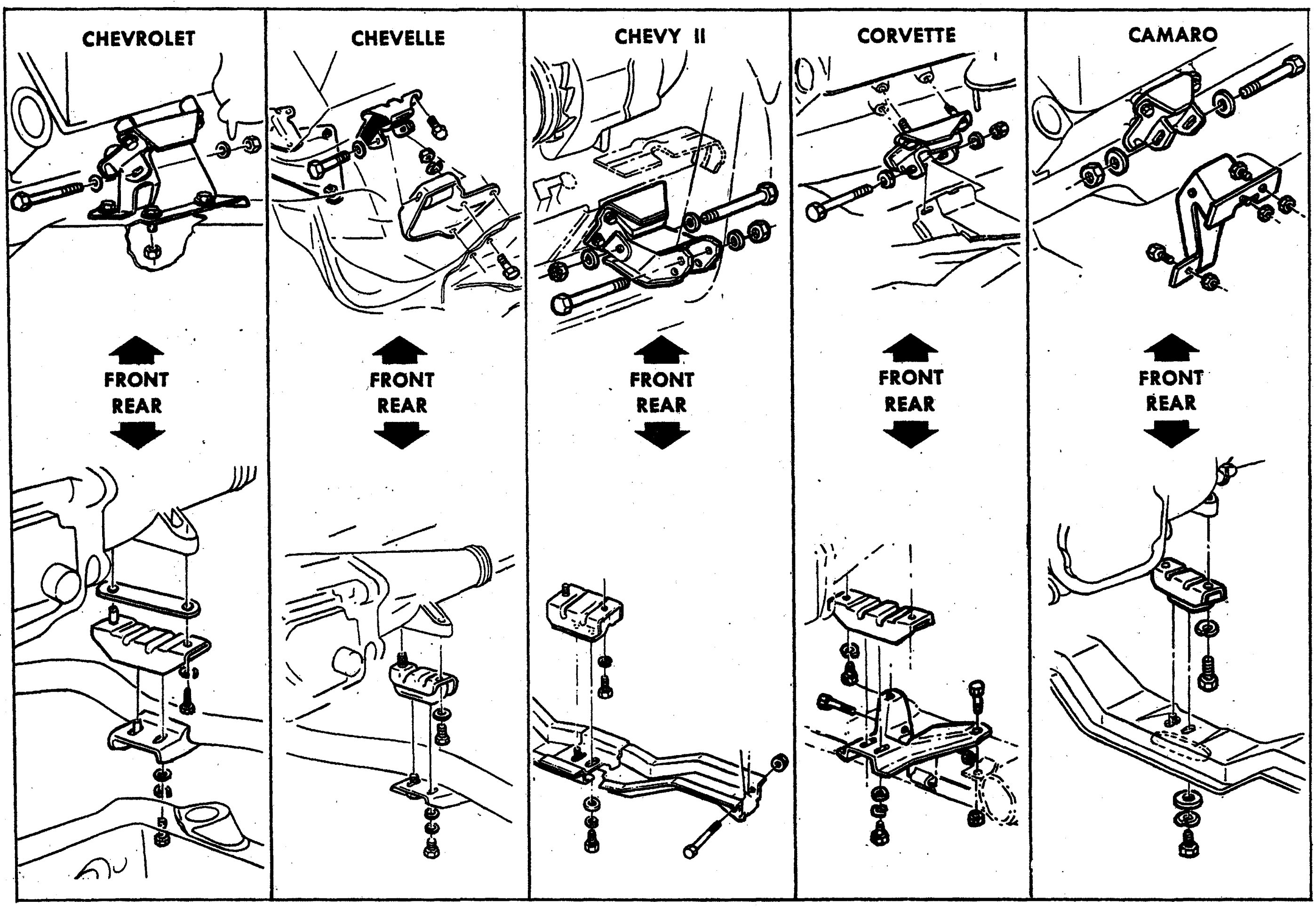


Fig. 29V - Engine Mounts

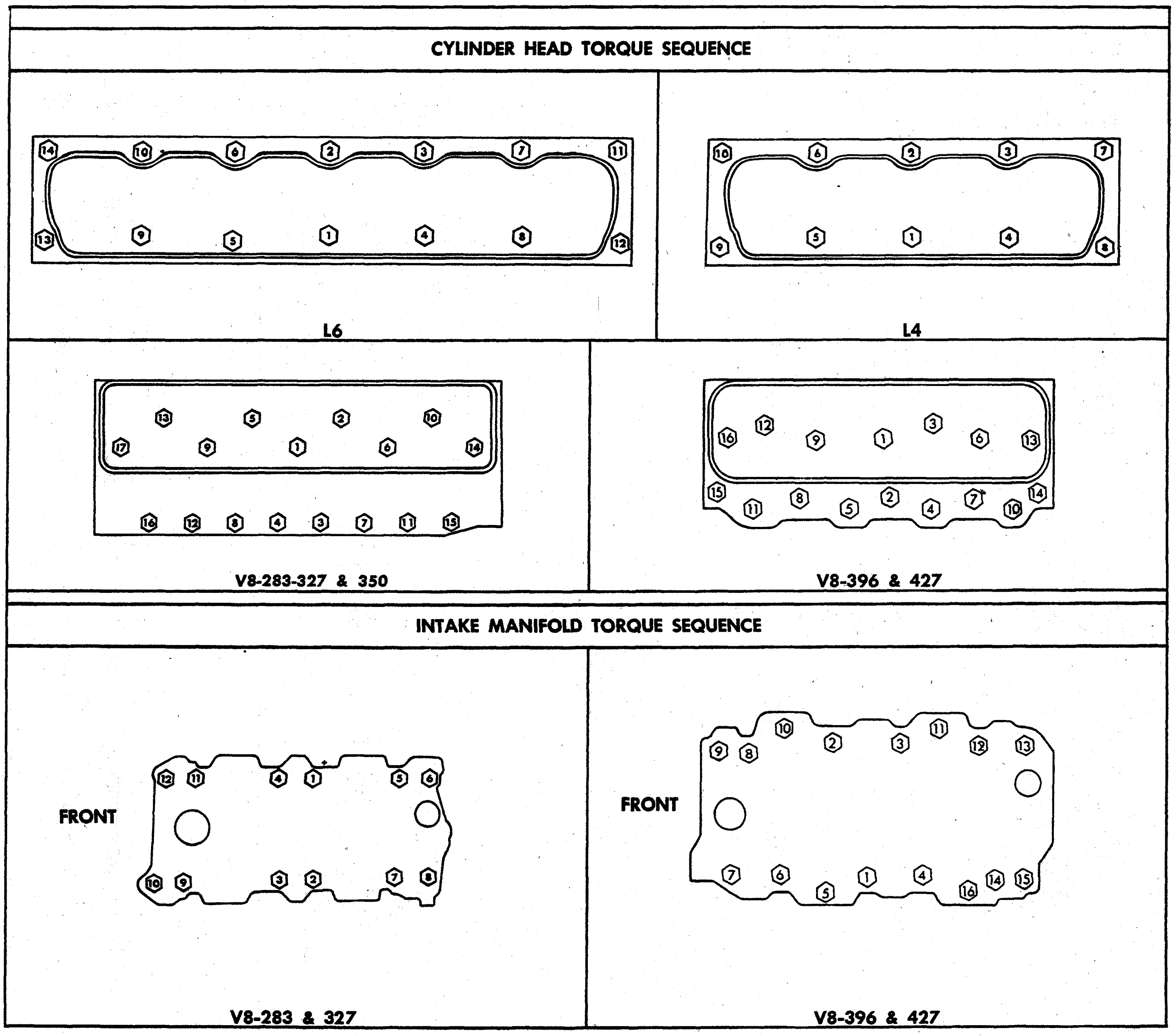


Fig. 1T - Torque Sequence

SPECIAL TOOLS

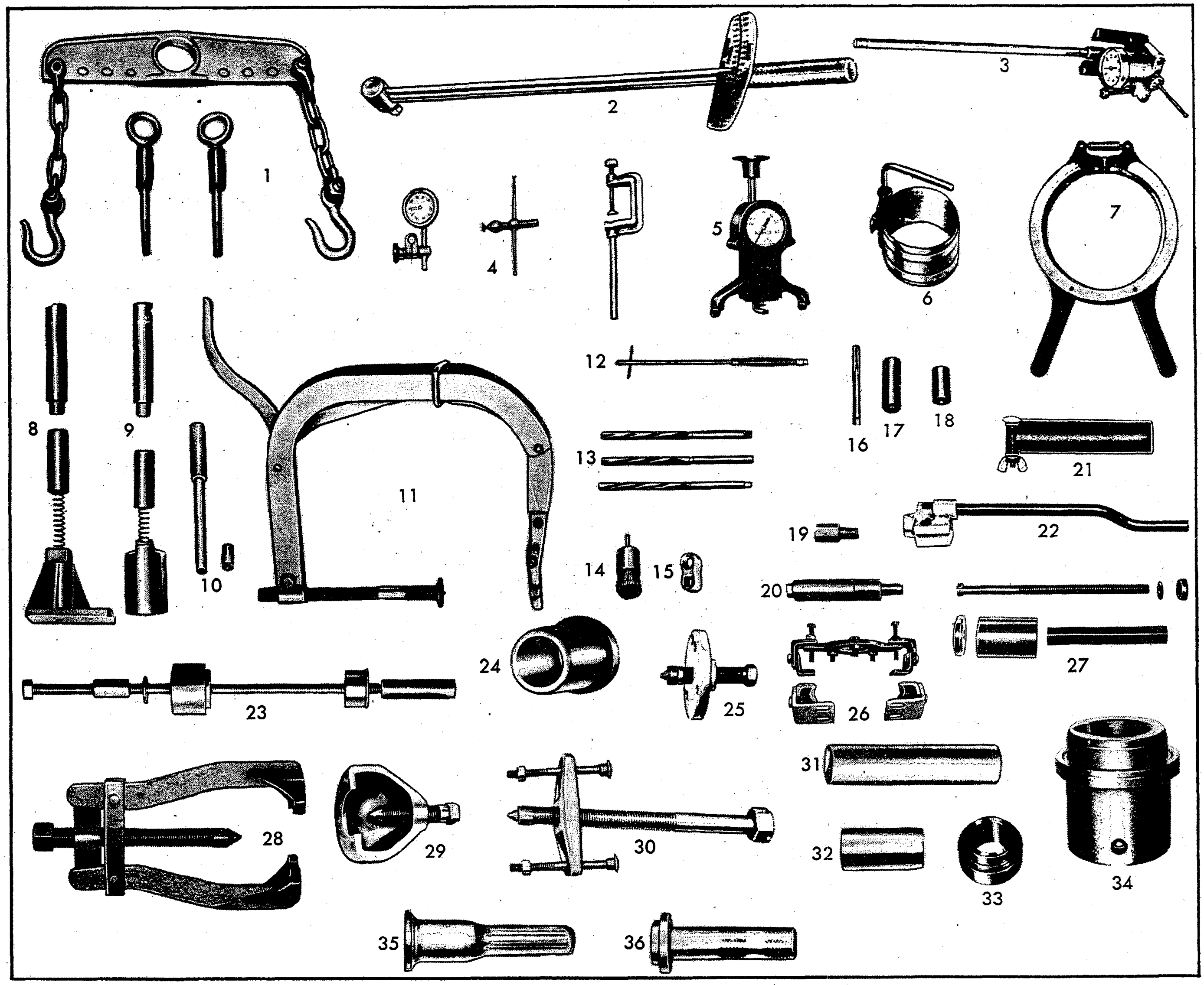


Fig. 2T - Engine Special Tools

1. J-4536 Engine Lift Kit
2. J-1264 (0-200 ft. lb.) Torque Wrench
   J-8058 (0-50 ft. lb.)
   J-5853 (0-100 in. lb.)
3. J-8087 Indicator Set (Cylinder Bore)
4. J-8001 Indicator Set (Universal)
5. J-7316 Belt Tension Gauge
6. J-8037 Piston Ring Compressor
7. J-8020 (3 9/16") Piston Ring Expander
   J-8021 (3 7/8")
   J-8032 (4")
   J-22249 (3 15/16")
   J-22147 (4 3/32")
   J-22250 (4 1/4")
8. J-6994 Piston Pin Assembly Tool
9. J-9510 Piston Pin Assembly Tool
10. J-5239 (3/8") Connecting Rod Guide Set
    J-6305 (11/32")
11. J-8062 Valve Spring Compressor
12. J-8101 Valve Guide Cleaner
13. J-5830 (11/32") Valve Guide Reamer Set
    J-7049 (3/8")
14. J-8089 Carbon Removing Brush
15. J-5860 Cylinder Head Bolt Wrench
16. J-5715 (.003") Rocker Arm Stud Reamer
    J-6036 (.013")
17. J-6880 Rocker Arm Stud Installer
18. J-5802 Rocker Arm Stud Remover
19. J-9534 Distributor Lower Bushing Remover
20. J-9535 Distributor Lower Bushing Installer
21. J-22144 Oil Pick-up Screen Installer
22. J-8369 Oil Pick-up Screen Installer
23. J-6098 Cam Bearing Tool
24. J-0971 Camshaft Gear Support
25. J-6978 Torsional Damper Puller
26. J-22197 Torsional Damper Installer
27. J-21058 Torsional Damper and Sprocket Installer
28. J-1619 Crankshaft Sprocket Puller
29. J-5825 Crankshaft Sprocket Puller
30. J-8105 Crankshaft Gear Puller
31. J-5590 Crankshaft Sprocket or Gear Installer
32. J-0966 Crankcase Cover Centering Gauge
33. J-21742 Crankcase Cover Centering Gauge
34. J-22102 Crankcase Cover Tool
35. J-8340 Crankcase Cover Seal Installer
36. J-5595 Crankcase Cover Seal 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 above atmospheric pressure in the cooling system. Excessive pressure is relieved by a valve within the cap that opens to radiator overflow.

The water pump 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 is covered in this section. For overhaul procedures of the water pump refer to Section 6K of the Passenger Chassis Overhaul Manual.

For radiator, refer to Section 13 of this manual. For radiator shroud, refer to Section 11 of this manual.

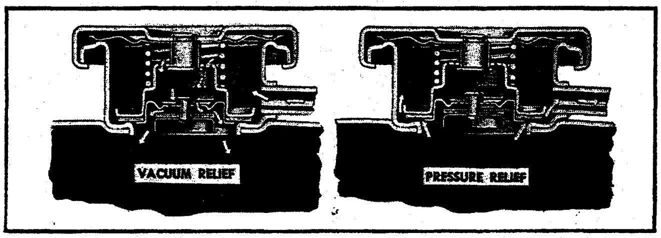


Fig. 1—Pressure Radiator Cap

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 247°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.
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, "Engine 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.

Replacement

1. Remove radiator to water outlet hose.
2. Remove thermostat housing bolts and remove water outlet and gasket from thermostat housing (fig. 2).
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.
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.

Fig. 2—Replacing Thermostat

Water Pump

Removal

1. Drain radiator and break loose the fan pulley bolts.
2. Disconnect heater hose, lower radiator hose and by pass hose (as required) at water pump.
3. Loosen Delcotron and remove fan belt then remove fan bolts, fan and pulley.
4. 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.

Installation

1. Install pump assembly on cylinder block and tighten bolts securely. Use on new pump to block gasket(s).
2. Install pump pulley and fan on pump hub and tighten bolts securely.

   NOTE: A guide stud (5/16"-24 x 1-1/2" bolt with the head removed) installed in one hole of the fan hub will aid in aligning hub, pulley and fan. Remove stud after starting the remaining three bolts.

3. Connect hoses and fill cooling system.
4. Install fan belt and adjust as previously outlined.
5. Start engine and check for leaks.

SECTION 6M

ENGINE FUEL

CONTENTS OF THIS SECTION

CARBURETORS

INDEX

GENERAL DESCRIPTION

Various carburetors (fig. 1c) are used with Chevrolet, Chevelle, Chevy II, Camaro and Corvette passenger vehicles. These carburetors are designed to meet the particular requirements of engines, transmissions and vehicles, therefore carburetors that look alike are not always interchangeable. (Refer to carburetor part number and/or specifications.)

Because many service procedures for the various carburetors are similar, typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation.

This section covers removal, installation and adjustments (on engine) of carburetors. Also covered in this section are maintenance procedures for choke coils, throttle linkage and fuel filters. For carburetor overhaul procedures and additional adjustments (bench), refer to Section 6M of the Overhaul Manual under the carburetor being serviced.

Specifications for carburetors are located in the back of this manual.

SERVICE PROCEDURES

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 (Except Air Injection Reactor System)

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. (automatic transmission in drive, synchronized transmission in neutral).
5. Adjust idle mixture screw to obtain highest steady vacuum at specified idle speed.

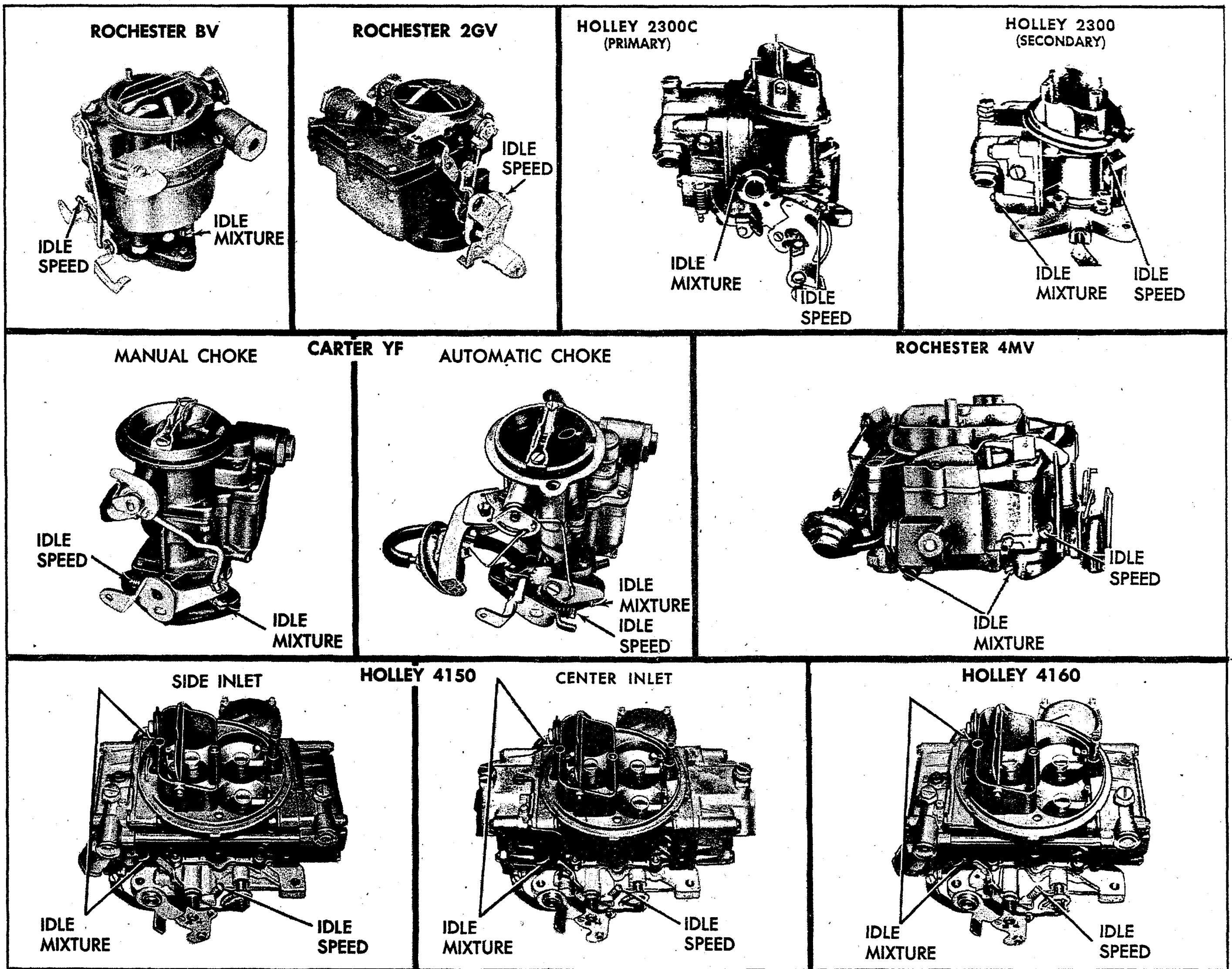
   NOTE: On air conditioned vehicles, turn air conditioning to the "on" position and hold the hot idle compensator valve closed while adjusting idle speed and idle mixture screws.

   NOTE: On Rochester BV carburetors the idle mixture screw should be turned out 1/4 turn from the "lean roll" position. The definition of "lean roll" point is a 20 to 30 rpm drop in engine speed obtained by leaning the idle mixture.

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. Turn engine off, remove gauges and install air cleaner.



APPLICATION ➧ CARBURETOR ⬇		Chevrolet	Chevelle	Chevy II	Camaro	Corvette	IN LINE				V-8													
							153	194	230	250	283		327				350	396		427				
							90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435
ROCH. BV		1	2	3	4			3	2	1234														
ROCH 2GV		1	2	3	4						1234	4												
ROCH 4MV		1	2	3	4								1234				4	1-2		1				
CARTER YF	Man.			3			3																	
	Auto.	1	2	3	4			3	2-4	1234														
HOLLEY 4150	Side		2												2									
	Center					5																	5	
HOLLEY 4160			2			5								5		5			2		5			
HOLLEY 2300	C Prim.					5																5		5
	Sec.					5																5		5

Fig. 1C—Carburetors

Idle Speed and Mixture Adjustment (With Air Injection Reactor System)

The following is the recommended procedure for Air Injection Reactor System equipped engines.

NOTE: This adjustment should be performed with engine at operating temperature and parking brake applied.

1. Remove air cleaner.
2. Connect tachometer 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 3 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. (Automatic transmission in dirve, synchronized transmission in neutral).
5. Adjust idle mixture screw (turn in) to "lean roll" position; then turn screw out 1/4 turn (1/4 turn rich from "lean roll"). The definition of "lean roll" point is a 20 to 30 rpm drop in engine speed, obtained by leaning the idle mixture.

NOTE: On air conditioned vehicles, turn air conditioning "OFF" on in-line, 283, 327, and 350 cu. in. engines, and turned "ON" and hot idle compensator held closed on 396 and 427 cu. in. engines.

6. Repeat Steps 4 and 5 as needed for final adjustment.

NOTE: If necessary, final adjustment of the carburetor may be made with air cleaner installed.

7. Shut down the engine, remove gauges and install air cleaner.

Fast Idle Adjustment

Rochester 4MV and Holley

With fast idle lever on high step of cam and choke valve open (engine warm) set fast idle to give specified engine rpm. Adjust screw on Rochester 4MV and bend fast idle lever on Holley.

Choke Adjustment

With Remote Choke (Fig. 2c)

1. Remove air cleaner and check to see that choke valve and rod move freely.
2. Disconnect choke rod at choke lever.
3. Check choke adjustment as follows:

   On all except 275 and 300 h.p. 327 cu. in. engines, hold choke valve closed and pull rod up against stop. The top of choke rod end should be 1/2-1 rod diameter above top of hole in choke valve lever.

   On 275 and 300 h.p. 327 cu. in. engines, hold choke valve closed and push rod down against stop on thermostat bracket. The top of the choke rod should be 1/2-1 rod diameter below the top of the hole in the choke lever.
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.

With Manual Choke (Carter YF)

1. Remove air cleaner.

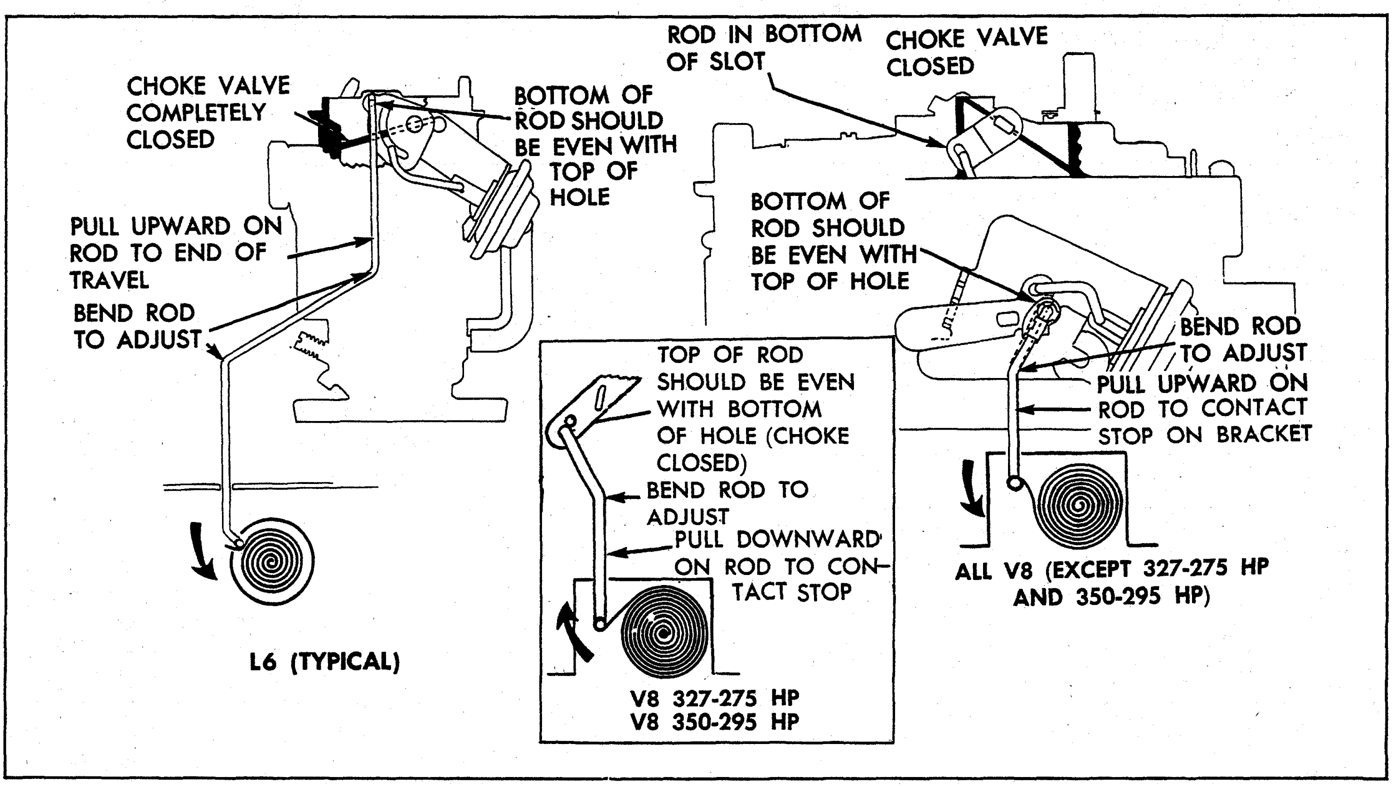


Fig. 2C—Remote Choke Adjustment

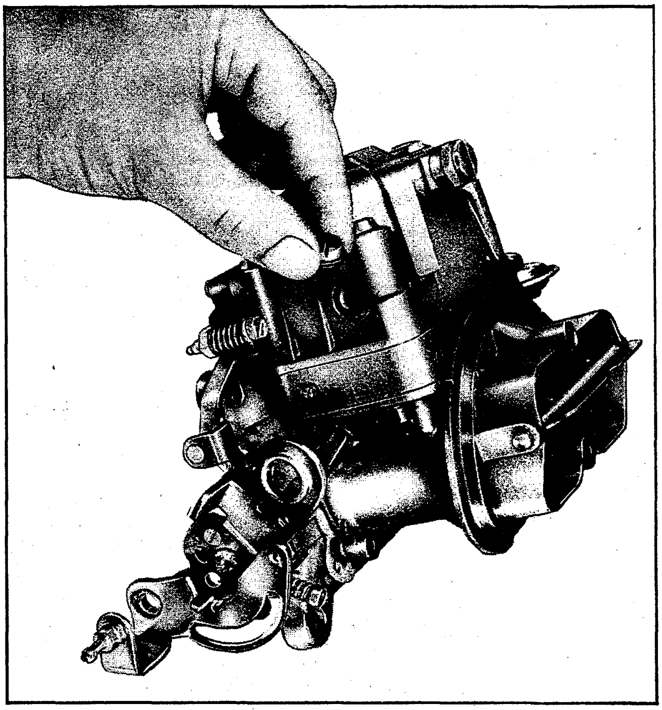


Fig. 3C—Fuel Level Sight Plug

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 (Model 4150 Center Inlet & Model 2300)

1. Remove air cleaner then remove the fuel level sight plugs (Fig. 3c)
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.

   NOTE: 1/6 turn of adjusting nut equals approximately 1/16" fuel level change.

5. Allow a minute for fuel level to stabilize then re-check 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.

Additional Adjustments

The following adjustments may be made without removing the carburetor from the engine. For procedure refer to Section 6M of the Overhaul Manual under the carburetor being serviced.

Rochester BV

- Float
- Idle Vent
- Choke Rod (Fast Idle)
- Choke Vacuum Break
- Choke Unloader

Rochester 2GV

- Float
- Accelerator Pump
- Idle Vent
- Choke Rod (Fast Idle)
- Choke Vacuum Break
- Choke Unloader
- Secondary Throttle Opening
- Secondary Throttle Lockout

Rochester 4MV

- Float
- Accelerator Pump
- Idle Vent
- Air Valve
- Choke Rod
- Choke Vacuum Break
- Choke Unloader
- Air Valve Lockout
- Secondary Opening
- Secondary Lockout

Carter YF

- Float
- Idle Vent
- Choke Rod (Fast Idle)
- Choke Vacuum Break
- Choke Unloader

Holley 4160 and 4150 (Except End Inlet)

- Float
- Air Vent Valve
- Accelerator Pump
- Choke Vacuum Break
- Choke Unloader

Holley 2300 and 4150 (End Inlet)

- Air Vent Valve (except 2300)
- Accelerator Pump
- Choke Vacuum Break
- Choke Unloader

Removal

Flooding, stumble on acceleration and other performance complaints are, in many instances, caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the cause of the complaint, the carburetor should be carefully removed from the engine without draining the fuel from the bowl. The contents of the fuel bowl may then be examined for contamination as the carburetor is disassembled.

1. Remove air cleaner and gasket.
2. Disconnect fuel and vacuum lines from carburetor.

3. Disconnect choke rod or choke cable.
4. Disconnect accelerator linkage.
5. If equipped with Automatic transmission, disconnect TV linkage.
6. Remove carburetor attaching nuts and/or bolts and remove carburetor.

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.

Installation

1. Be certain throttle body and intake manifold sealing surfaces are clean.
2. Install new carburetor to manifold flange gasket (if required).
3. Install carburetor over manifold studs.
4. Start vacuum and fuel lines at carburetor.
5. Install attaching nuts and/or bolts and tighten securely.
6. Tighten fuel and vacuum lines.
7. Connect and adjust accelerator and TV linkage.
8. Connect choke tube or choke rod.
9. Adjust idle speed and mixture, then install air cleaner.

Fuel Filter Maintenance

1. Disconnect fuel line connection at inlet fuel filter nut.
2. Remove inlet fuel filter nut from carburetor with a 1" box wrench or socket.
3. Remove filter element and spring (fig. 4c).

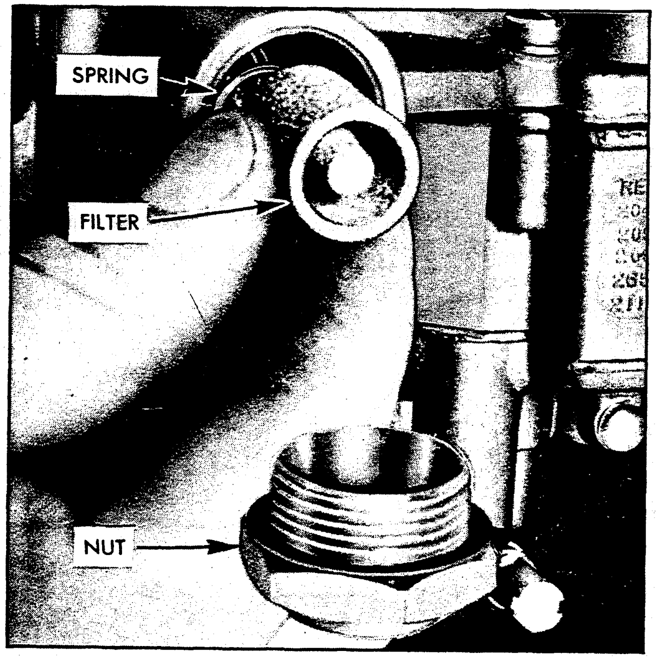


Fig. 4C—Fuel Filter

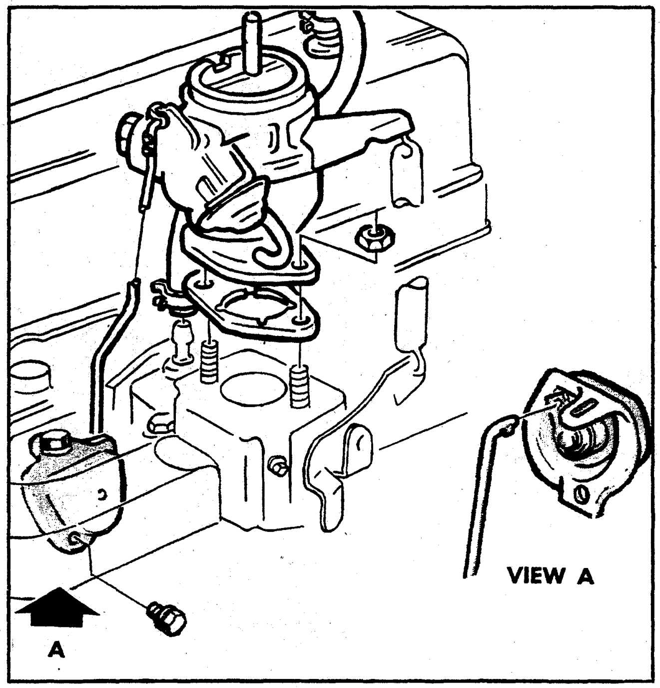


Fig. 5C—Choke Coil—L6 Engine

4. Check element for restriction by blowing on cone end, element should allow air to pass freely.
5. Clean element by washing in solvent and blowing out. Blow in opposite direction of fuel flow.

   NOTE: Element should be replaced if plugged or if flooding occurs. A plugged filter will result in a loss of engine power or rough (pulsating) engine feel, especially at high engine speeds.

6. Install element spring, then install element in carburetor so small section of cone faces out.
7. Install new gasket on inlet fitting nut then install nut in carburetor and tighten securely.
8. Install fuel line and tighten connector.

Choke Coil Replacement

L6 Engines (Fig. 5c)

1. Remove air cleaner then 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.
7. Start and warm-up the engine then check operation of choke and install air cleaner.

V8 Engines (Fig. 6c)

1. Remove air cleaner then disconnect choke rod upper clip.
2. Remove choke coil as follows:

   WITH ROCHESTER 2GV CARBURETOR

   - Remove the choke coil shield by prying with a screw driver in the cut out provided then remove the choke rod.

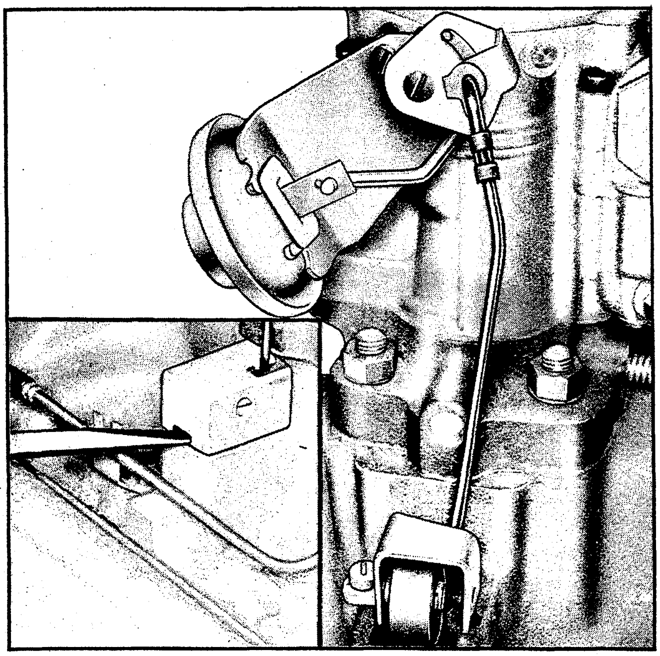


Fig. 6C—Choke Coil—V8 Engine

- Remove bracket and choke coil assembly.

WITH ROCHESTER 4MV AND
HOLLEY CARBURETORS

- Remove the choke coil shield by prying with a screw driver in the cut out provided then lift shield carefully over rod.
- Remove choke rod, bracket screw and choke coil assembly

3. Install a new choke coil assembly being sure the locating tab is in the forward hole of the intake manifold then install mounting screw.
4. Complete installation as follows:

   WITH ROCHESTER 2GV CARBURETOR
   - Check that the choke rod eye of the coil is below the stop tab on the bracket then install the choke rod and adjust if necessary.
   - Install the choke coil shield over the choke coil and move shield to best fit along manifold.

   WITH ROCHESTER 4MV AND
   HOLLEY CARBURETORS
   - Install the choke rod and adjust as necessary (without choke coil shield installed).
   - Disconnect choke rod upper end and lower choke coil shield over choke rod and install over choke coil.
   - Move shield to best fit along manifold and connect upper end of choke rod.
5. Be sure choke valve moves freely from full open to full closed position.
6. Start and warm up the engine and check operation of the choke.
7. Install the air cleaner.

Throttle Linkage Adjustment (Fig. 7c or 8c)

1. Disconnect throttle rod swivel at throttle lever on carburetor.
2. On automatic transmission equipped vehicles disconnect TV rod at throttle lever.
3. Hold carburetor throttle in wide open position, push throttle rod rearward (to position accelerator 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.

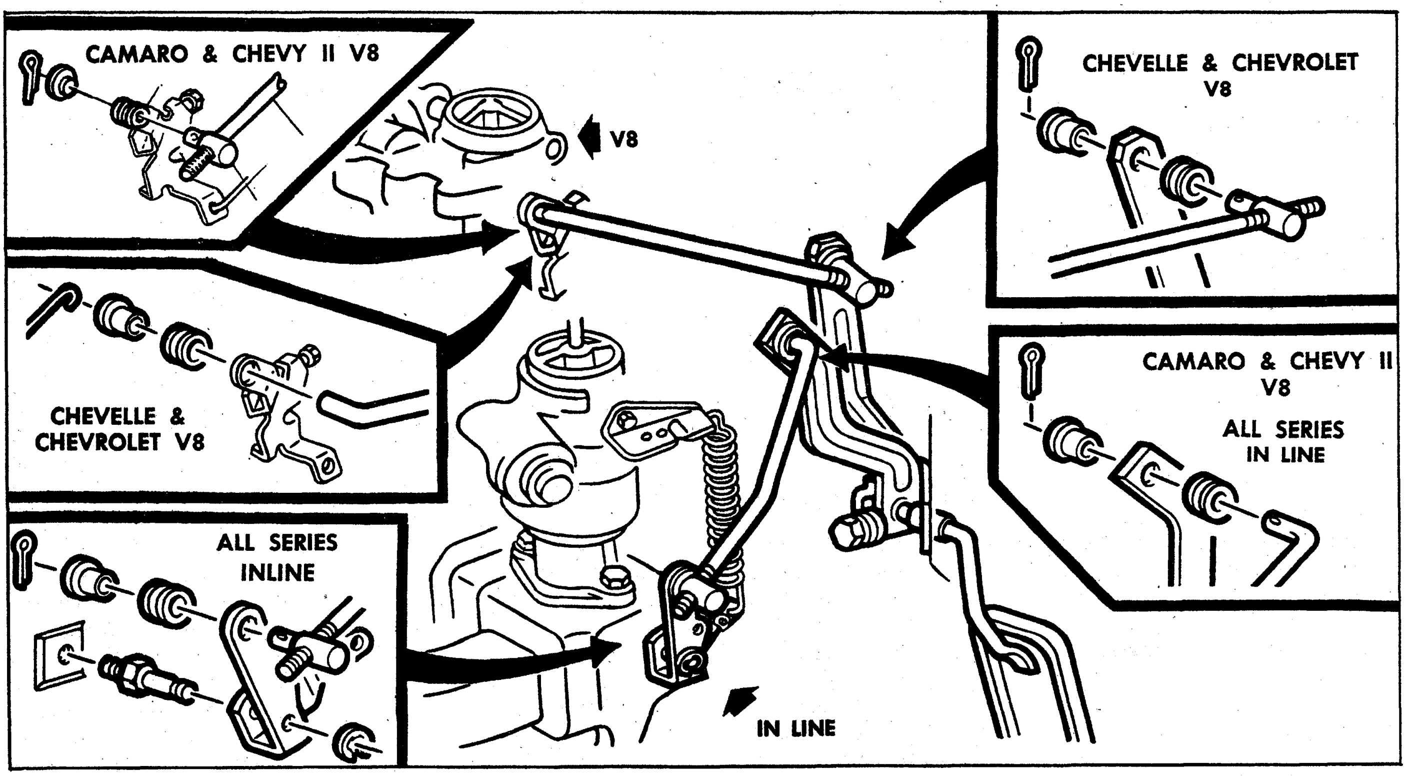


Fig. 7C—Throttle Linkage—Chevrolet, Chevelle, Chevy II and Camaro

5. On vehicles equipped with automatic transmission hold throttle rod in full throttle position, pull TV rod to full detent position and adjust TV rod to just enter hole on throttle lever, then connect TV rod at throttle lever.

NOTE: If equipped with anti-stall device (dash-pot), set carburetor fast idle cam on high step and adjust dash-pot to just contact throttle lever.

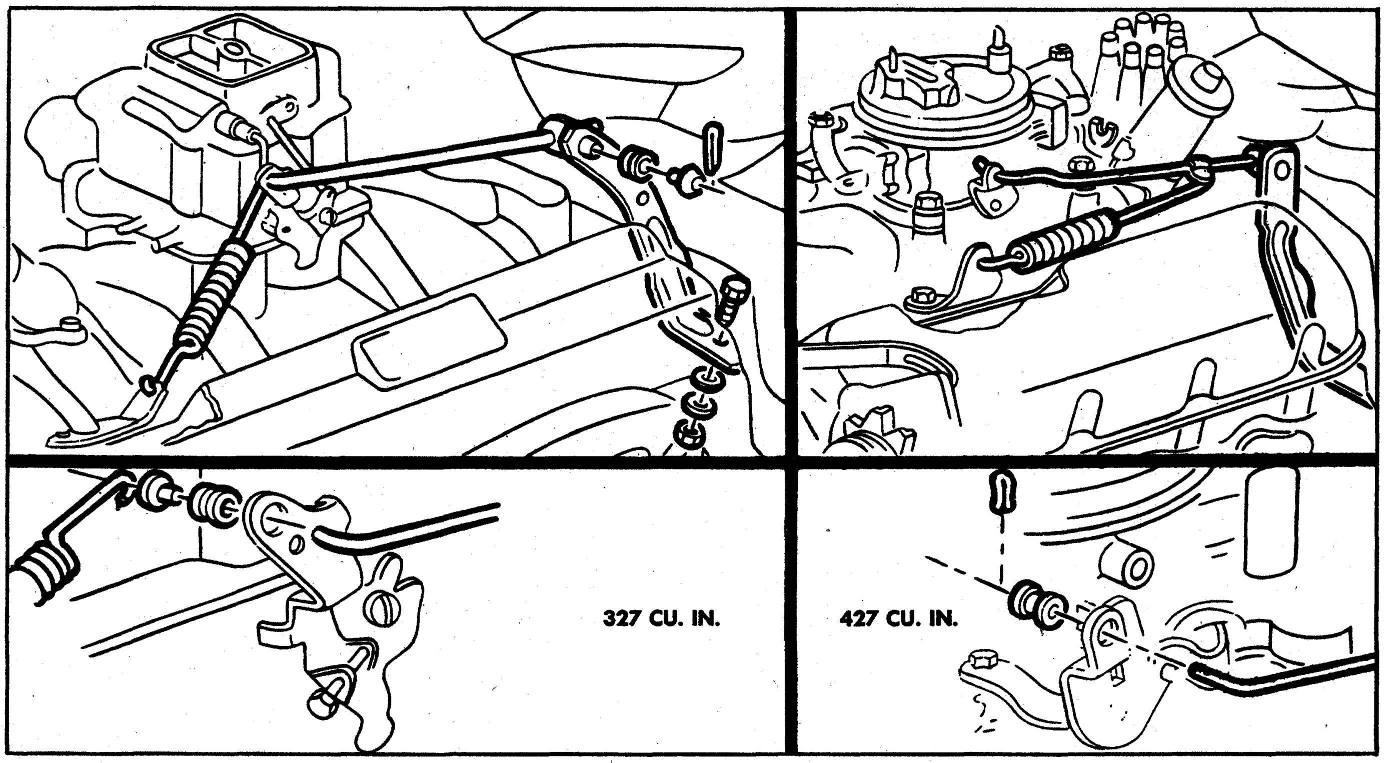


Fig. 8C—Throttle Linkage—Corvette

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. 1A) 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. The optional, oil bath air cleaner (available on Chevrolets with L6 engine) should be cleaned and refilled with oil at oil change intervals.

On the V8 engines, a replaceable, oil wetted paper element type is used (fig. 2A). Both ends of the paper element are bonded with plastisol sealing material. The improved oil wetted paper elements have increased filtering capacity over their dry paper predecessors. Oil on the paper causes the element to become discolored by a small amount of dirt but does not necessarily mean the element is plugged or reduced in efficiency. 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.

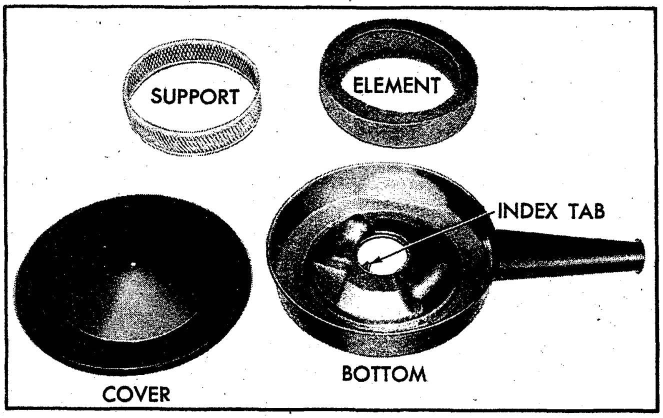


Fig. 1A—Polyurethane Element Air Cleaner

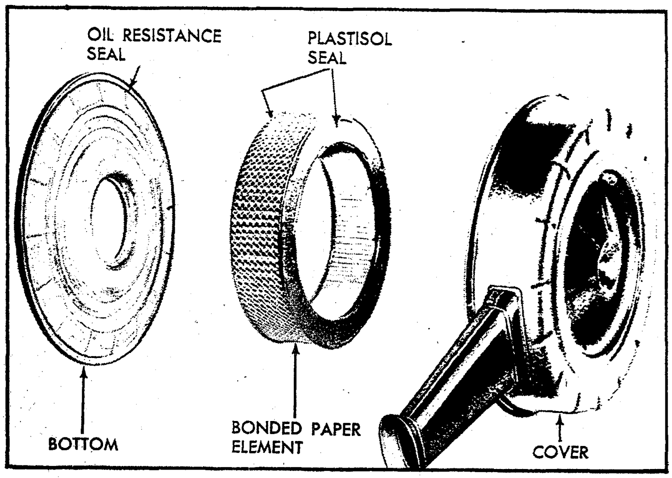


Fig. 2A—Paper Element Air Cleaner

SERVICE PROCEDURES

POLYURETHANE ELEMENT

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 air horn to air cleaner gasket.
4. Remove support screen from element and wash element in kerosene or mineral spirits; then squeeze out excess solvent (fig. 3A).

   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.

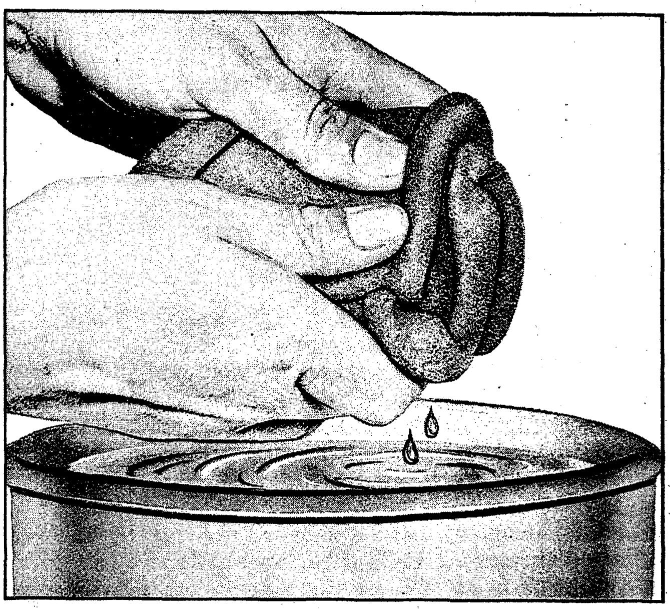


Fig. 3A—Cleaning Polyurethane Element

   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. 4A).
7. Using a new gasket, replace air cleaner body over carburetor air horn.
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 BATH

Maintenance

1. Remove air cleaner assembly.
2. Remove cover and filter element assembly.
3. Empty oil out of cleaner and clean out all oil and accumulated dirt.

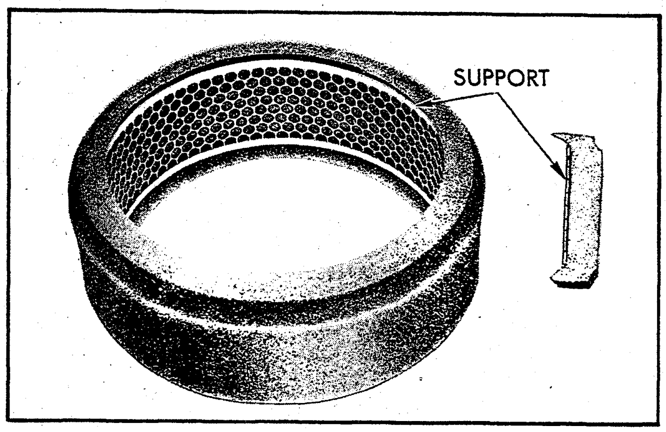


Fig. 4A—Polyurethane Support

4. Wash body with cleaning solvent and wip dry.
5. Wash filter element by sloshing up and down in cleaning solvent.
6. Dry filter unit with an air hose or let stand until dry.
7. Fill body of cleaner to full mark with SAE 50 engine oil. If expected temperatures are to be consistently below freezing, use SAE 20 engine oil.
8. Assemble filter and cover assembly to body of cleaner.
9. Install cleaner, making sure it fits tight and is set down securely.

OIL WETTED PAPER ELEMENT

Replacement

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 (Fig. 5A)

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.

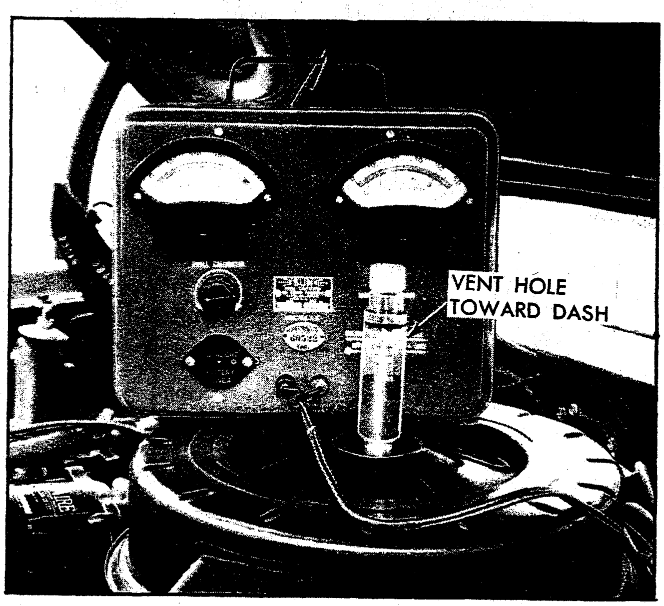


Fig. 5A—Testing Air Cleaner

NOTE: Before testing, inspect for holes or breaks in the element, as these defects require immediate replacement. If no holes or breaks exist, proceed as follows:

1. Remove all hoses and plug all openings except air cleaner inlet.
2. Install air cleaner, using Tool J-7825 in place of the wing nut. 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.
3. Connect a tachometer and place it so that it may be read simultaneously with Tool J-7825.
4. 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.
5. Start engine. If engine is cold, allow to run for 2 to 3 minutes. The automatic choke must be fully open.
6. Accelerate the engine slowly until the inner tube oil level of Tool J-7825 just reaches the 1/4 mark. Allow engine speed to stabilize and note tachometer (rpm) reading. Decelerate engine.
7. 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. 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.

Engine		Minimum Allowable RPM
Displacement	Horsepower	
283 cu. in.	195	2300
327 cu. in.	210	
	275	2100
	300	2100
	325	2600
	350	2600
350 cu. in.	295	
396 cu. in.	325	1550
	350	1950
427 cu. in.	385	1850
	390	1850
	425	2140

8. Remove tachometer and Tool J-7825 from vehicle and push down inner tube until seal is below vent hole to prevent oil loss.

Tool J-7825
Filling Tool

Tool J-7825 is shipped dry and must be filled with the red gauge oil (specific gravity .826) provided.

Pull the knurled inner tube completely out of the gauge and add oil to the reservoir until the oil level is between

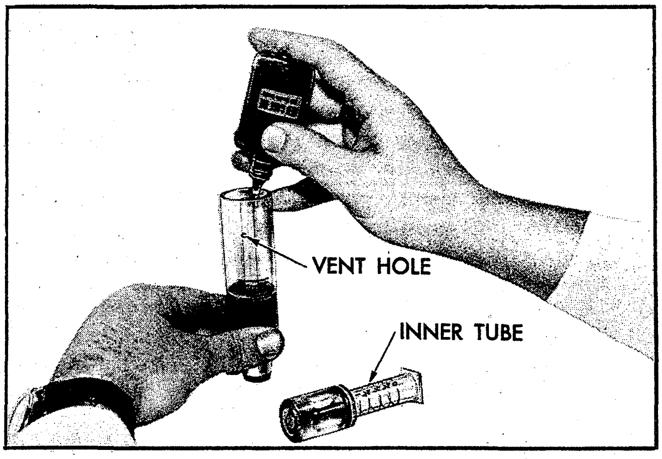


Fig. 6A—Filling Tool with Oil

the two "FILL" lines (fig. 6A). Refill whenever the level falls below the lower "FILL" line.

Storing Tool

When the tool is not used, 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

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GENERAL DESCRIPTION

The fuel pump (fig. 1P) used on all Chevrolet vehicles covered in this manual are of the diaphragm type. The pumps are actuated by an eccentric located on the engine camshaft. On in-line engines, the eccentric actuates the rocker arm. On V-8 engines, a push rod (located between the camshaft eccentric and fuel pump) actuates the pump rocker arm. Because of design, this pump is serviced as an assembly only.

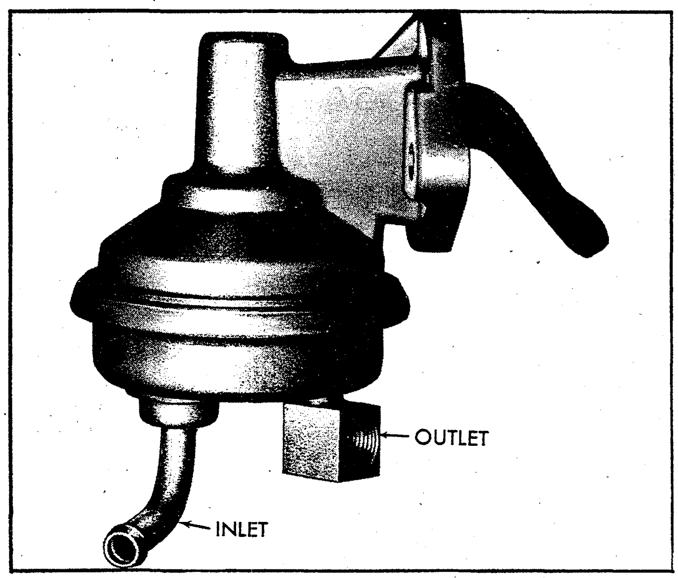


Fig. 1P—Fuel Pump (Non-Serviceable)

SERVICE PROCEDURES

Inspection

The fuel pump should be checked to make sure the mounting bolts 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.
2. 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 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.

3. If fuel flows from pump in good volume from pipe at carburetor, check fuel delivery pressure to be certain that pump is operating withint specified limits as follows:
   a. Attach a fuel pump pressure test gauge to disconnect end of pump to carburetor pipe.
   b. Run engine at approximately 450-1,000 rpm (on gasoline in carburetor bowl) and note reading on pressure gauge.
   c. If pump is operating properly the pressure will be within specifications and will remain constant at speeds between 450-1,000 rpm. If pressure is too low, too high, or varies materially at different speeds, the pump should be replaced.

Removal

1. Disconnect fuel inlet and outlet pipes at fuel pump.

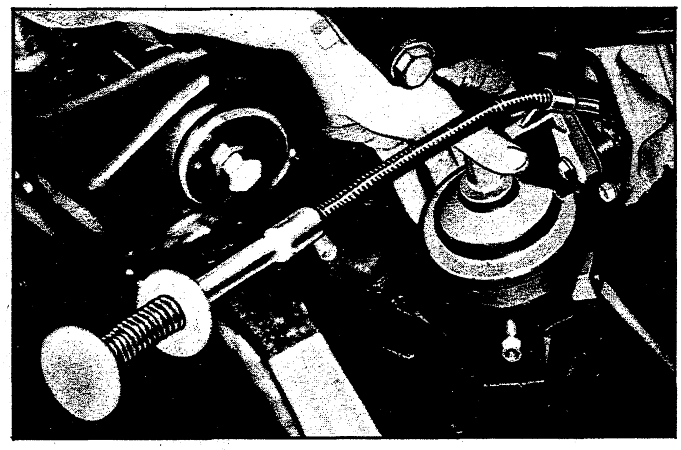


Fig. 2P—Installing 283, 327, 350 V8 Engine Fuel Pump

2. Remove fuel pump mounting bolts and remove pump and gasket.
3. On V8 engines; if push rod is to be removed, remove pipe plug then remove push rod (396 and 427 cu. in. engines), remove fuel pump adapter and gasket then remove push rod (283 and 327 cu. in. engines).
4. If a new fuel pump is to be installed, transfer fittings.

Installation

1. On V8 engines; if removed, install fuel pump push rod and pipe fitting or fuel pump adapter. Use gasket sealer on gasket or pipe fitting.
2. Install fuel pump using a new gasket and tighten securely. Use sealer on fuel pump mounting bolt threads.

   NOTE: On V8 engines, a pair of mechanical fingers may be used to hold fuel pump push rod up while installing fuel pump (fig. 2P).

3. Connect fuel pipes to pump.
4. Start engine and check for leaks.

SPECIAL TOOLS

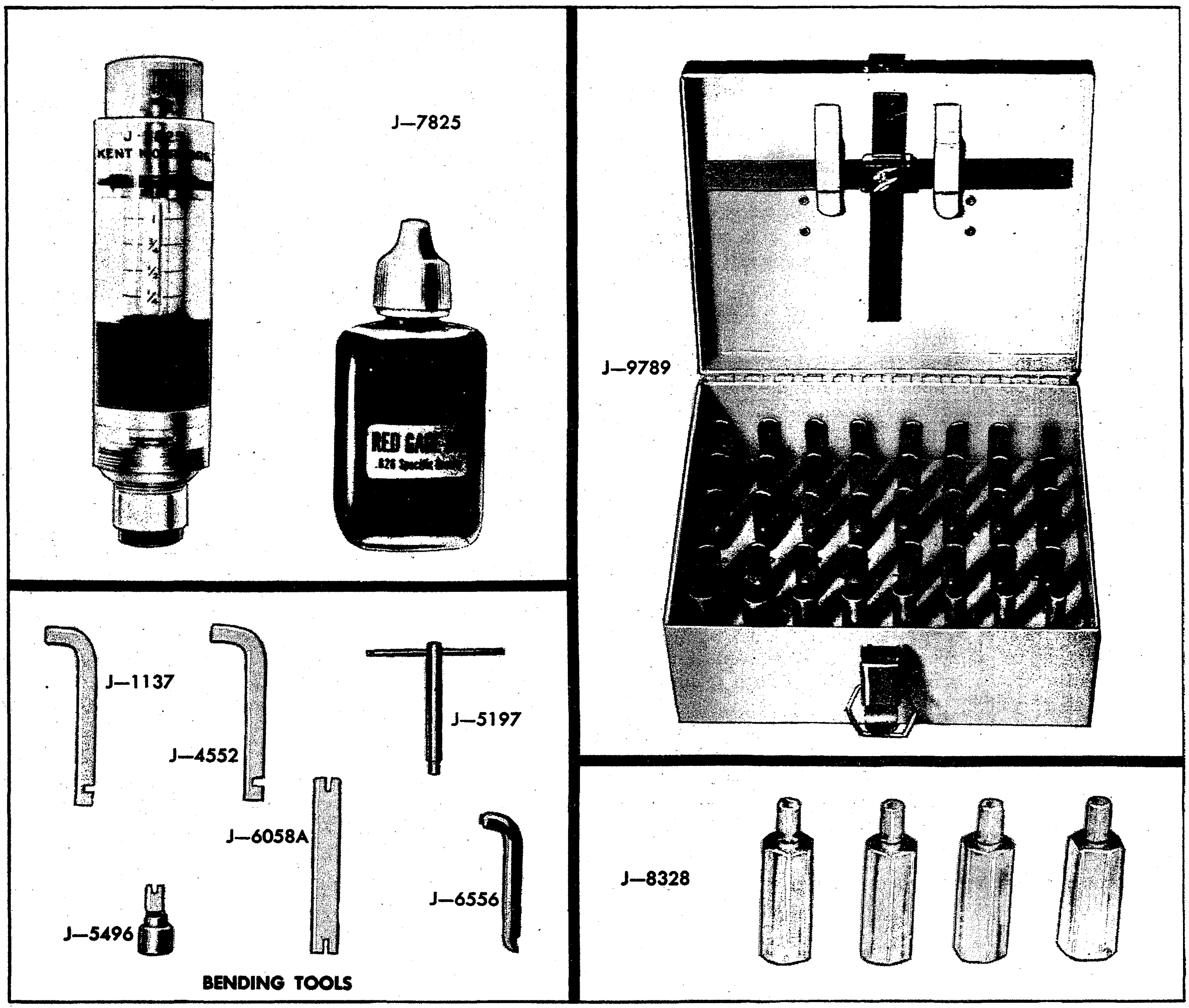


Fig. 1T—Engine Fuel Special Tools

SECTION 6T
AIR INJECTION REACTOR SYSTEM

INDEX

GENERAL DESCRIPTION

The Air Injection Reactor (A.I.R.) System (fig. 1) consists of: the air injection pump (with necessary brackets and drive attachments), air injection tubes (one for each cylinder), a mixture control valve, check valves (one for In Line engines, two for V8 engines) and air manifold assemblies, tubes and hoses necessary to connect the various components.

Carburetors and distributors for engines with the A.I.R. System are designed, particularly, for these engines; therefore, they should not be interchanged with or replaced by a carburetor or distributor designed for an engine without the A.I.R. System.

The air injection pump (fig. 2) picks up fresh filtered air from the air cleaner, compresses the air and injects it through the air manifolds, hoses and injection tubes into the exhaust system in the area of the exhaust valves. The fresh air ignites and burns the unburned portion of the exhaust gases in the exhaust system, thus minimizing exhaust contamination.

The mixture control valve (fig. 3) when triggered by a sharp increase in manifold vacuum, supplies the intake manifold with fresh filtered air to lean out the fuel-air mixture and prevent exhaust system backfire.

The check valve(s) prevent exhaust gases from entering and damaging the air injection pump, as back flow can occur even under normal operating conditions.

When properly installed and maintained, the A.I.R. System will keep exhaust emissions well below requirements. However, if any A.I.R. component or any engine component that operates in conjunction with the A.I.R. system should malfunction, the exhaust emissions might be increased.

Because of the relationship between "Engine Tune Up" and "Unburned Exhaust Gases", the condition of Engine Tune Up should be checked whenever the A.I.R. System seems to be malfunctioning. Particular care should be taken in checking items that affect fuel - air ratio such as the crankcase ventilation system, the carburetor and the carburetor air cleaner.

Because of the similarity of many parts, typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation. For Repair Procedures on the Air Injection Pump, refer to the Passenger Chassis Overhaul Manual.

MAINTENANCE PROCEDURES

Drive Belt

Inspection

- Inspect drive belt for wear, cracks or deterioration and replace if required.
- Inspect belt tension and adjust if below 50 lb. using a strand tension gauge.

Adjustment

- Loosen pump mounting bolt and pump adjustment bracket bolt.
- Move pump until belt is tight (55±5 lb. used belt or 75±5 lb. new belt using a strand tension gauge) then tighten adjustment bracket bolt and mounting bolt.

CAUTION: Do not pry on the pump housing. Distortion of the housing will result in extensive damage to the Air Injection Pump.

Replacement

- Loosen pump mounting bolt and pump adjustment bracket bolt then swing pump until drive belt may be removed.
- Install a new drive belt and adjust as outlined above.

Drive Pulley

Replacement

- Remove drive belt as outlined above then replace drive pulley.
- Install and adjust drive belt as outlined above.

Pump Pulley

Replacement

- Hold pump pulley from turning by compressing drive belt then loosen pump pulley bolts.
- Remove drive belt as outlined above then remove pump pulley.
- Install pump pulley with retaining bolts hand tight.

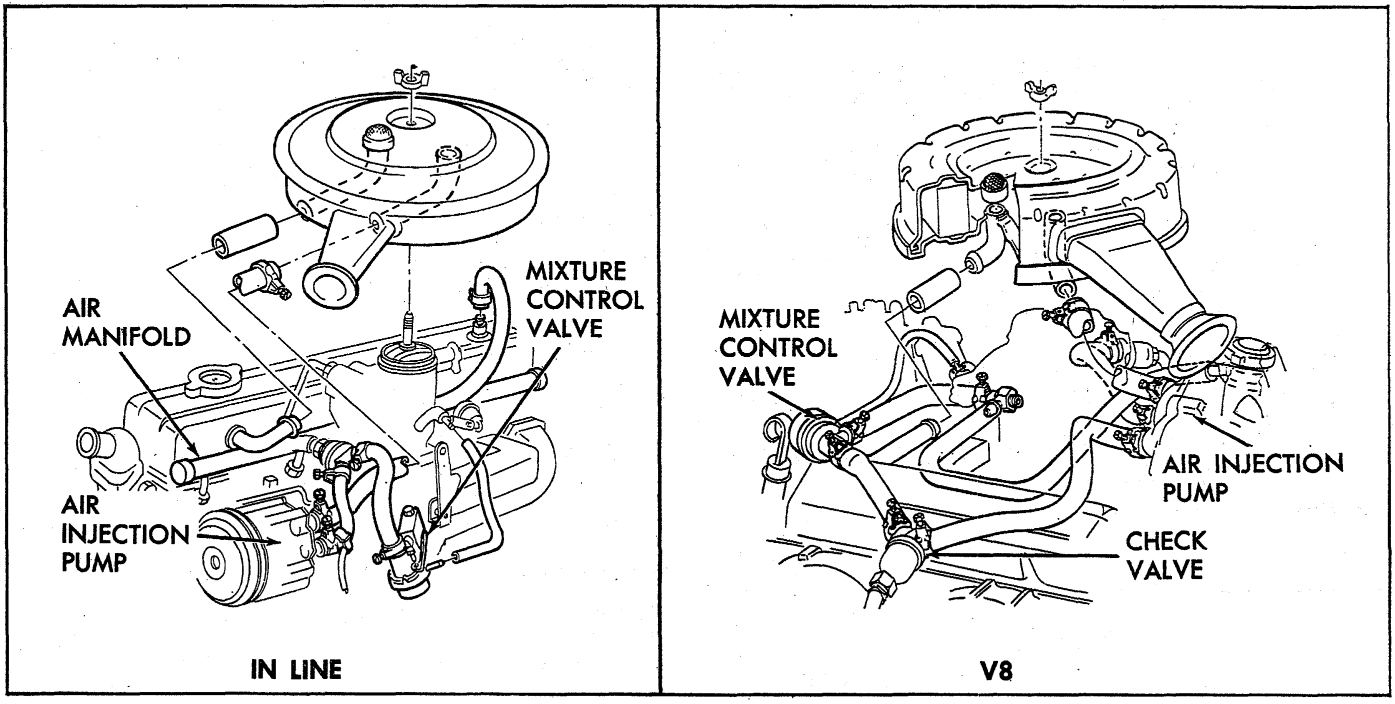


Fig. 1—Air Injection Reactor System (Typical)

- Install and adjust drive belt as outlined above.
- Hold pump pulley from turning by compressing drive belt then torque pump pulley bolts to 25 ft. lbs.
- Recheck drive belt tension and adjust if required.

Air Manifold, Hose and Tube

Inspection (Fig. 4)

- Inspect all hoses for deterioration or holes.
- Inspect all tubes for cracks or holes.

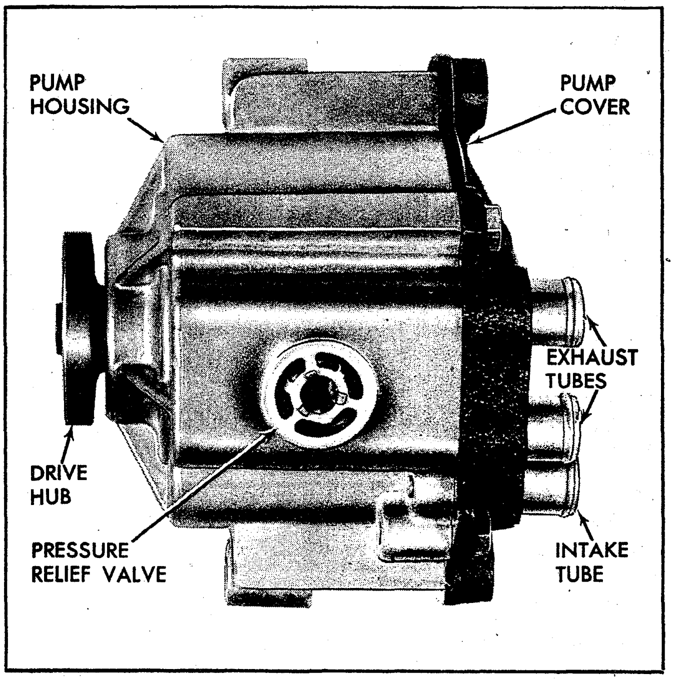


Fig. 2—Air Injection Pump

- Check all hose and tube connections.
- Check all tube and hose routing. Interference may cause wear.
- If a leak is suspected on the pressure side of the system or any tubes and/or hoses have been disconnected on the pressure side, the connections should be checked for leaks with a soapy water solution. With the pump running, bubbles will form if a leak exists.

Replacement

- To replace any hose and/or tube, note routing then remove hose(s) and/or tube(s) as required.

CAUTION: The 1/4" pipe threads at the cylinder head (In Line) or exhaust manifold (V8) are

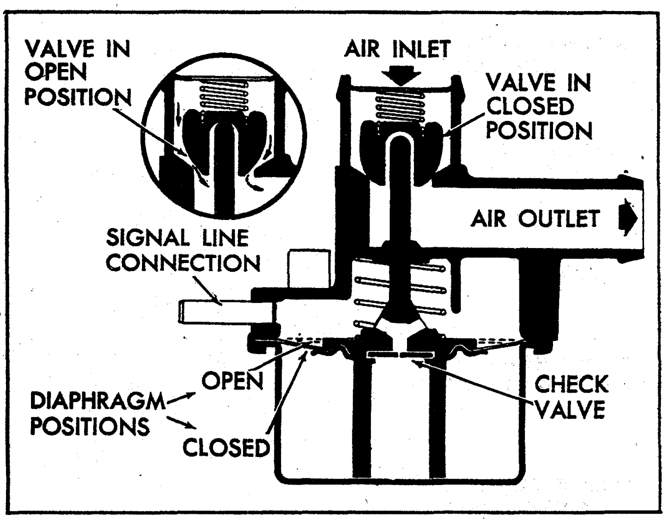


Fig. 3—Mixture Control Valve

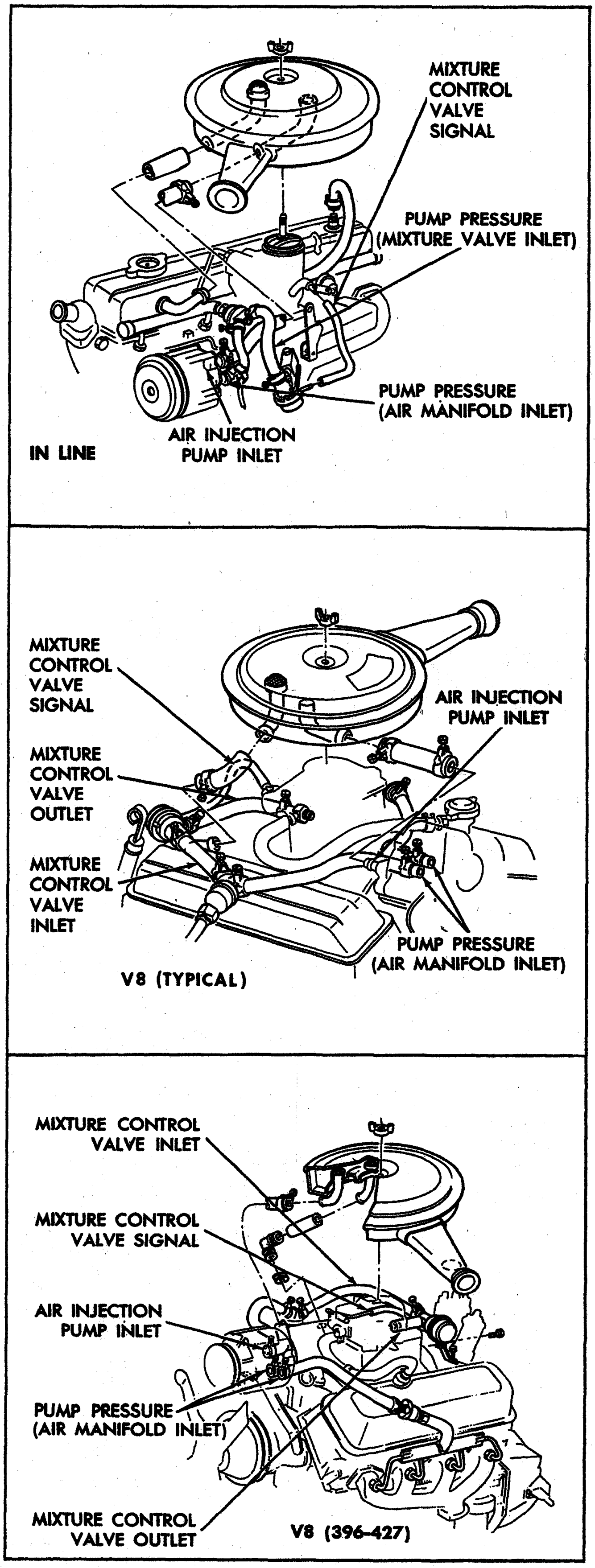


Fig. 4—Air Manifold Hose and Tube Routing (Typical)

a straight pipe thread. Do not use a 1/4" tapered pipe tap. The hoses of the Air Injection Reactor System are a special material to withstand high temperature. No other type hose should be substituted.

- Install new hose(s) and/or tube(s), routing them as when removed.
- Tighten all connections.

NOTE: Use anti seize compound on threads of the air manifold to exhaust manifold or cylinder head connections.

NOTE: On Chevy II vehicles equipped with a V8 engine, the air injection tubes are part of the air manifold and care must be used in removing them from the exhaust manifold. It may be necessary to remove the exhaust manifold and use penetrating oil on the injection tubes before the air manifold can be removed.

Check Valve

Inspection

- The check valve should be inspected whenever the hose is disconnected from the check valve or whenever check valve failure is suspected. (A pump that had become inoperative and had shown indications of having exhaust gases in the pump would indicate check valve failure).
- Orally blow through the check valve (toward air manifold) then attempt to suck back through check valve. Flow should only be in one direction (toward the air manifold).

Replacement

- Disconnect pump outlet hose at check valve. Remove check valve from air manifold, being careful not to bend or twist air manifold.

Mixture Control Valve

Inspection

- Check condition and routing of all lines especially the signal line. A defective signal or outlet line will cause malfunctioning of the mixture control valve.
- Disconnect pump to valve inlet hose at pump.
- Leaking valve will be indicated by an air gushing noise coming from the hose. Place palm of hand over hose; little or no pull with a gradual increase is normal. If immediate strong pull is felt or air noise is heard, valve is defective and should be replaced.
- Open and close throttle rapidly. Air noise should be evident and then gradually decrease. Check for proper valve usage. If strong pull is not felt immediately or air noise is not present, valve is not functioning properly and should be replaced.
- A noisy valve should be replaced.

Replacement

- Disconnect the signal line, air inlet and air outlet hoses then remove the valve.
- Install new valve and connect air outlet, air inlet and signal line hoses.

CAUTION: Mixture control valves, though similar in appearance are designed to meet particular requirements of various engines, therefore, be sure to install the correct valve.

Air Injection Tube

Inspection (Fig. 5)

- There is no periodic service or inspection for the air injection tubes, yet on In Line engines whenever the cylinder head is removed or on V8 engines whenever the exhaust manifolds are removed, inspect the air injection tubes for carbon build up and warped or burnt tubes.
- Remove any carbon build up with a wire brush.
- Warped or burnt tubes must be replaced.

Replacement

- On In Line engines remove carbon from tubes and using penetrating oil, work tubes out of cylinder head.
- On V8 engines clamp exhaust manifold in a vise, remove carbon from tubes and using penetrating oil, work tubes out of manifold.
- Install new tubes in cylinder head or manifold.

Air Injection Pump

Inspection

Accelerate engine to approximately 1500 RPM and observe air flow from hose(s). If air flow increases as engine is accelerated, pump is operating satisfactorily. If air flow does not increase or is not present, proceed as follows:

- Check for proper drive belt tension.
- Check for a leaky pressure relief valve. Air may be heard leaking with the pump running.

NOTE: The Air Injection Reactor System is not completely noiseless. Under normal conditions noise rises in pitch as engine speed increases. To determine if excessive noise is the fault of the Air Injection Reactor System, operate the engine with the pump drive belt removed.

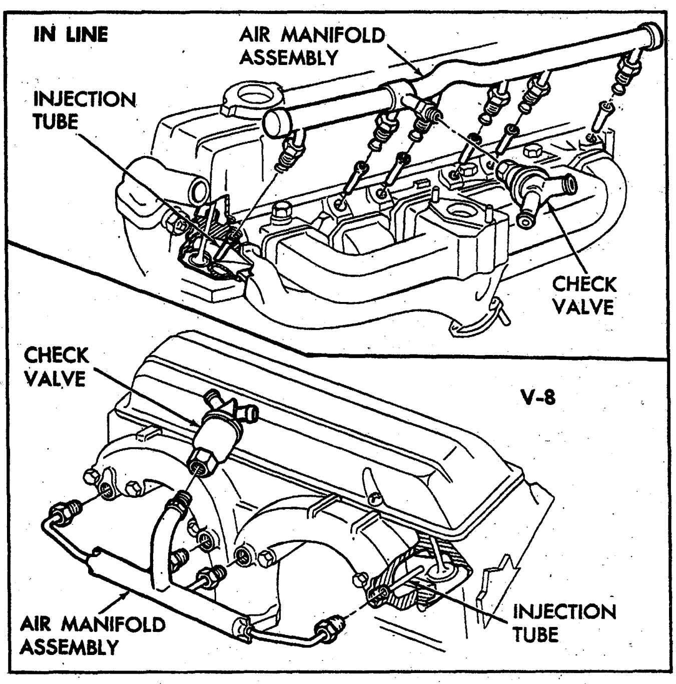


Fig. 5—Air Injection Tube (Typical)

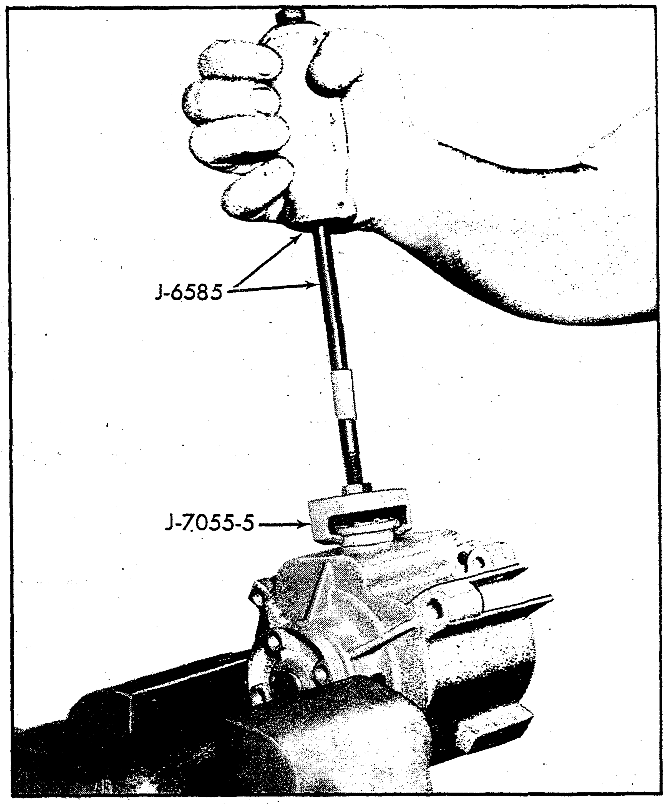


Fig. 6—Removing Pressure Relief Valve

If excessive noise does not exist with the belt removed proceed as follows:

- Check for proper installation of relief valve silencer on L-6 and 283, 327, 350 cu. in. V-8 engines.
- Check for a seized Air Injection Pump.
- Check hoses, tubes, air manifolds and all connections for leaks and proper routing.
- Check carburetor air cleaner for proper installation.
- Check air injection pump for proper mounting.
- If none of the above conditions exist and the air injection pump has excessive noise remove then repair as outlined in the Overhaul Manual.

Replacement

- Disconnect the hoses at the pump.
- Remove pump pulley as outlined.
- Remove pump mounting bolts and remove pump.
- Install pump with mounting bolts loose.
- Install pump pulley as outlined.
- Install and adjust belt as outlined.
- Connect the hoses at the pump.

Pressure Relief Valve Replacement

1. Using J-7055-5 and J-6585 pull relief valve from housing (fig. 6).
2. Using a 15/16" socket tap the relief valve into housing until the valve shoulders on the housing (fig. 7).

CAUTION: Use extreme care to avoid distorting housing.

NOTE: Various length pressure setting plugs (fig. 8) designed for the particular requirements of vehicle - engine combinations, determine the

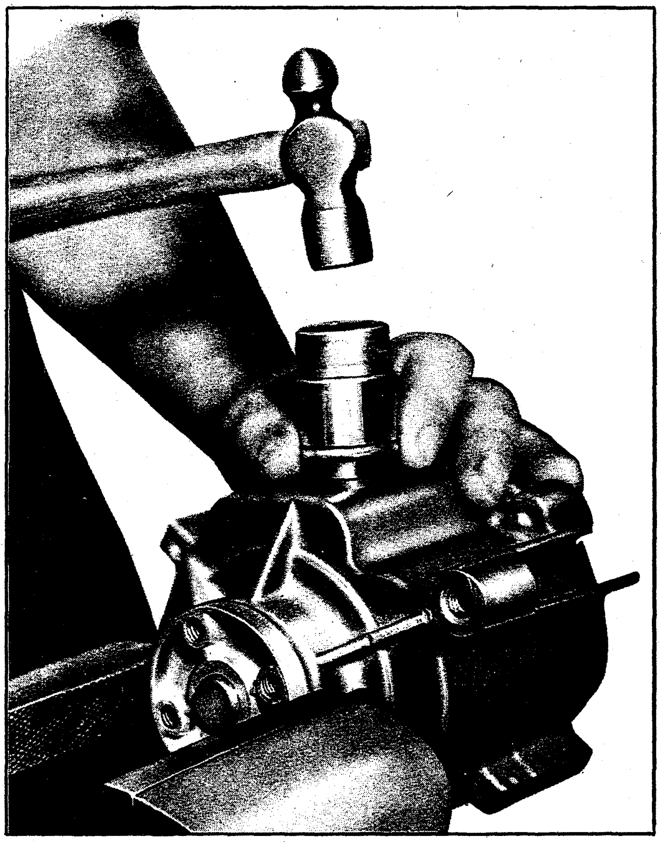


Fig. 7—Installing Pressure Relief Valve

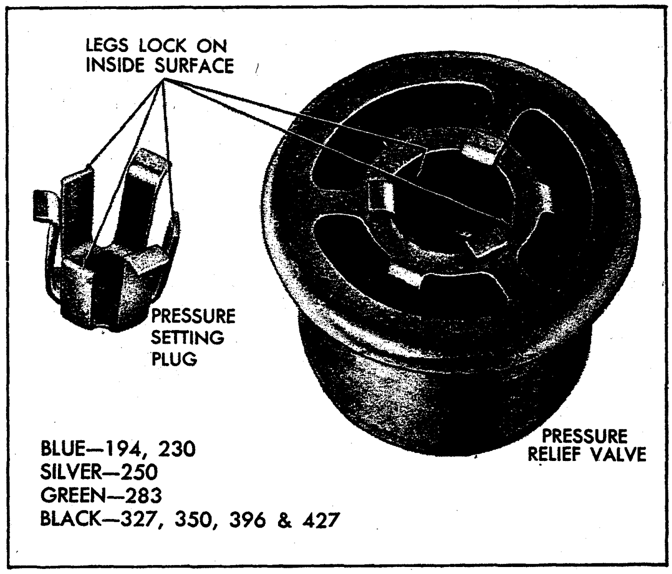


Fig. 8—Pressure Setting Plug

pressure required to open the relief valve. For identification, the pressure setting plugs are color coded. To remove the pressure setting plug, carefully unlock legs from inside surface of relief valve with a small screw driver. To install the pressure setting plug, carefully push into relief valve until legs lock. If a pressure setting plug is to be reused be sure leg angles are sufficient for the pressure setting plug to lock in place.

SPECIAL TOOLS

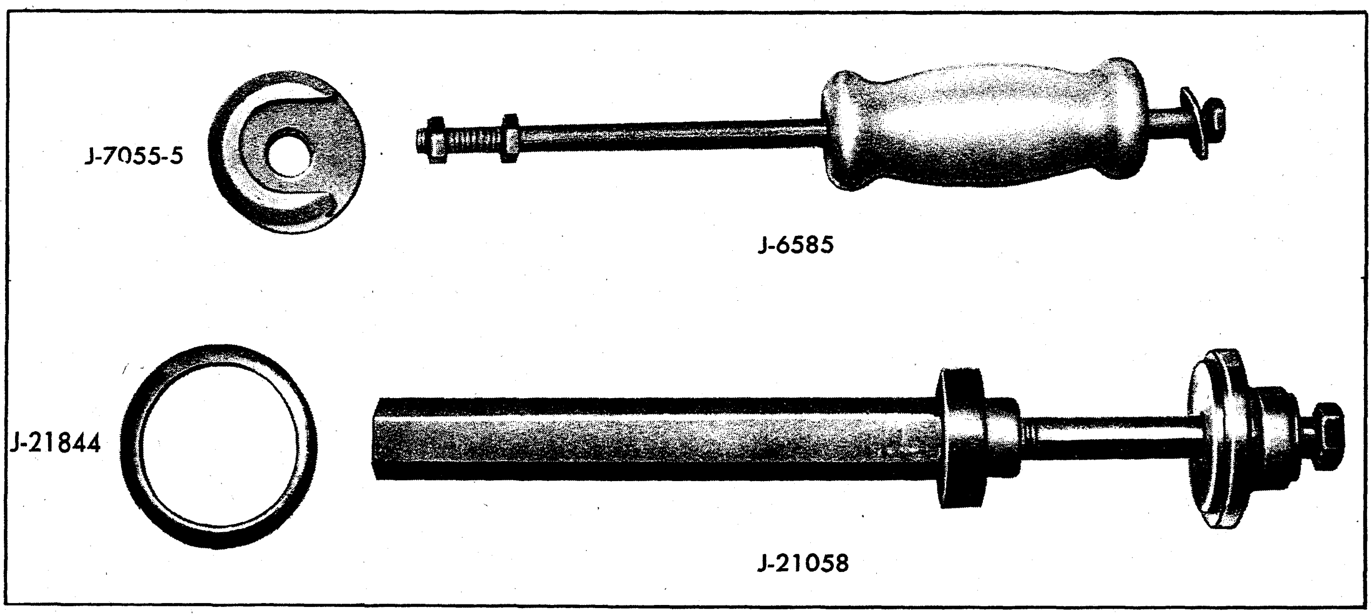


Fig. 9—Special Tools

SECTION 6Y
ENGINE ELECTRICAL

CONTENTS OF THIS SECTION

BATTERY

INDEX

GENERAL DESCRIPTION

The battery (fig. 1b) is made up of a number of separate elements, each located in an individual cell in a hard rubber case. Each element consists of an assembly of positive plates and negative plates containing dissimilar active materials and kept apart by separators. The elements are immersed in an electrolyte composed of dilute sulfuric acid. Plate straps located on the top of each element connect all the positive plates and all the negative plates into groups. The elements are connected in series electrically by connectors that pass directly through the case partitions between cells. The battery top is a one-piece cover of hard rubber construction. The cell connectors, by-passing through the cell partitions, connect the elements along the shortest practical path (fig. 2b).

With the length of the electrical circuit inside the Battery reduced to a minimum, the internal voltage drop is decreased resulting in improved performance, particularly during engine cranking at low temperatures.

The hard, smooth one-piece cover greatly reduces the tendency for corrosion to form on the top of the Battery. The cover is bonded to the case with sealing compound that forms an air tight seal between the cover and case.

Protection for the Battery charging circuit (10 gage wire) is provided by a pigtail lead which is a fusible link off the battery positive cable (14 gage wire). This lead is an integral part of the Battery cable assembly and servicing requires replacing the complete cable assembly.

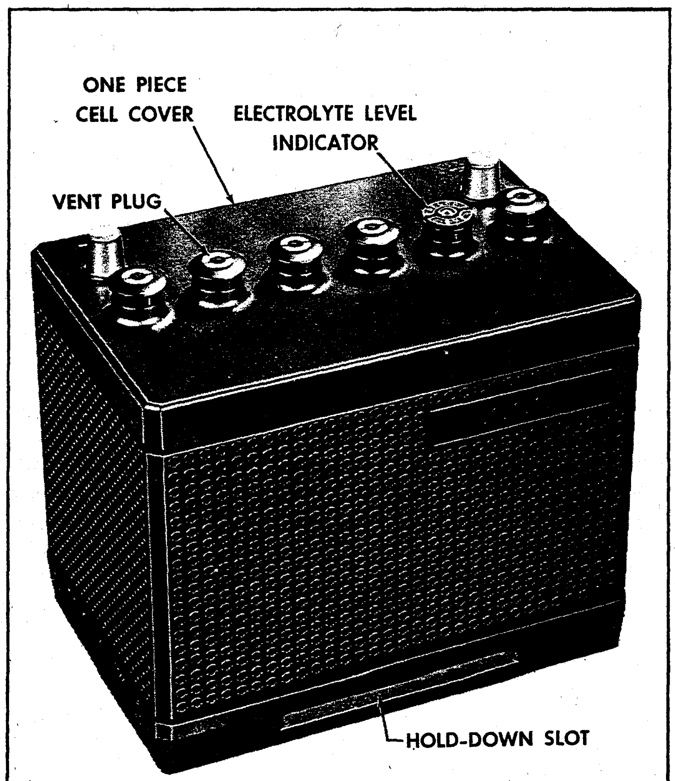


Fig. 1b—Battery

TYPES OF BATTERIES

There are two types of Batteries—the "dry charge" type and the "wet charge" type. The difference in types depends on the method of manufacture.

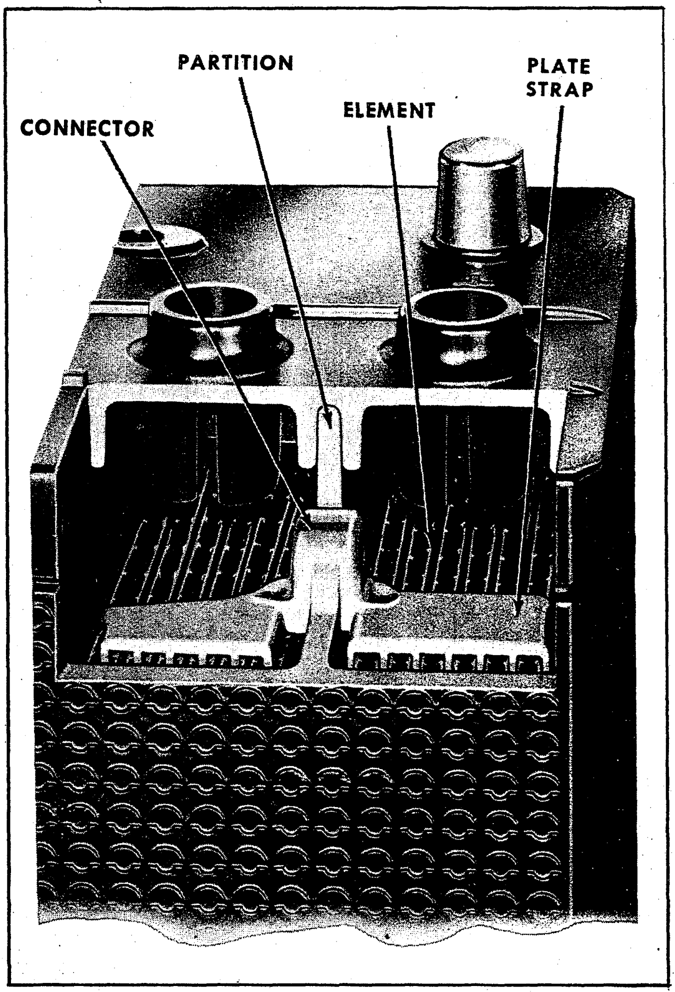


Fig. 2b—Internal View of Two Cells Showing Connector through Partition

DRY CHARGED BATTERIES

A "dry charge" Battery contains fully charged elements which have been thoroughly washed and dried. This type of Battery contains no electrolyte until it is activated for service in the field and, therefore, leaves the factory in a dry state. Consequently, it is called a "dry-charge" Battery.

Each vent well in a "dry charge" Battery has an integral hard rubber seal to prevent the entrance of air and moisture which would oxidize the negative active materials and reduce the freshness of the Battery (fig. 3b). The integral hard rubber seals and the sealing compound between the case and one-piece cell cover make possible a vacuum sealed assembly which can be stored for very long periods of time without detrimental effects.

Before activating the "dry charge" Battery, the integral hard rubber seals may be broken simply by pushing the Delco Eye down into each vent well. The seals drop into the cells, and can remain there since they are not chemically active and will cause no harm. (The Delco Eye is a special type of vent plug that is described in the section entitled "Periodic Servicing".)

ACTIVATING DRY CHARGED BATTERIES

A "dry charge" Battery is activated by filling each cell with electrolyte, which is a dilute solution of sulfuric

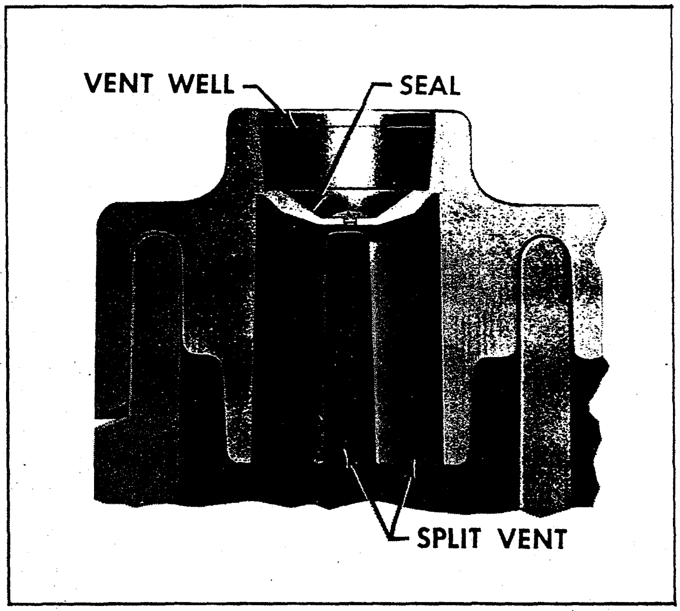


Fig. 3b—Vent Well Construction Showing Seal

acid having a specific gravity of 1.265 at 80°F. The cells are properly filled when the electrolyte level reaches the bottom of the "split vent" at the bottom of the vent well. The split vent is a visual level fill feature designed into the cell cover of Delco Batteries (fig. 4b). The electrolyte surface will appear distorted when it contacts the split vent.

The electrolyte level of each cell should be checked after filling the Battery initially. If the level has fallen below the split vent, additional electrolyte should be added. NEVER ADD WATER TO THE ELECTROLYTE WHEN ACTIVATING BATTERY.

Long and trouble-free service can be anticipated only if the Battery is properly activated. Improper activation results in poor performance and short Battery life.

After electrolyte has been added to a "dry charge" Battery, it then becomes a wet charged Battery and should be maintained in the same manner as any other "wet" Battery.

WET CHARGED BATTERIES

Wet charged Batteries contain fully charged elements and are filled with electrolyte before being shipped from the factory.

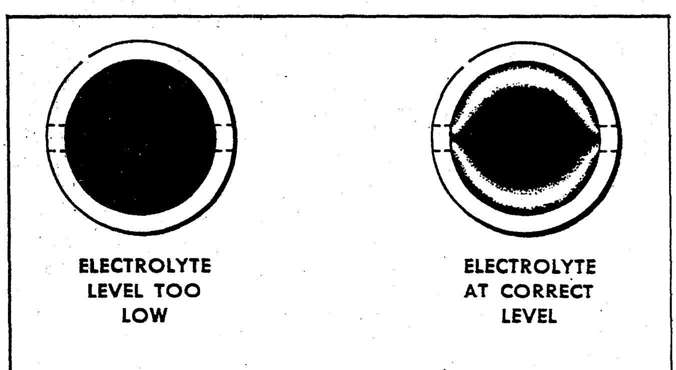


Fig. 4b—View Inside Vent Well Showing Electrolyte

PERIODIC SERVICING

Since the Battery is a perishable item which requires periodic servicing, a good maintenance program will insure the longest possible Battery life.

COMMON CAUSES OF FAILURE

If the Battery tests good but fails to perform satisfactorily in service for no apparent reason, the following are some of the more important factors that may point to the cause of the trouble.

1. Vehicle accessories inadvertently left on overnight to cause a discharged condition.
2. Slow speed driving of short duration, to cause an undercharged condition.
3. A vehicle electrical load exceeding the generator capacity.
4. Defect in the charging system such as high resistance, slipping fan belt, faulty generator or voltage regulator.
5. Battery abuse, including failure to keep the Battery top clean, cable clamps and posts clean and tight, and improper addition of water to the cells.

LEVEL INDICATOR

The Battery features an electrolyte level indicator, which is a specially designed vent plug with a transparent rod extending through the center (fig. 5b). When the electrolyte is at the proper level, the lower tip of the rod is immersed, and the exposed top of the rod will appear very dark; when the level falls below the tip of the rod, the top will glow.

The Indicator reveals at a glance if water is needed, without the necessity of removing the vent plugs (fig. 6b).

The Level Indicator is used in only one cell (second cell cap from positive Battery post) because when the electrolyte level is low in one cell, it is normally low in all cells. Thus when the Indicator shows water is needed, check the level in all six cells.

An alternate method of checking the electrolyte level is to remove the vent plug and visually observe the electrolyte level in the vent well. The bottom of the vent well features a split vent which will cause the surface of the electrolyte to appear distorted when it makes contact. The electrolyte level is correct when the distortion first appears at the bottom of the split vent (fig. 4b).

ELECTROLYTE LEVEL

The electrolyte level in the Battery should be checked regularly. In hot weather, particularly during trip driving, checking should be more frequent because of more rapid loss of water. If the electrolyte level is found to be low, then colorless, odorless, drinking water should be added to each cell until the liquid level rises to the split vent located in the bottom of the vent well. DO NOT OVERFILL because this will cause loss of electrolyte resulting in poor performance, short life, and excessive corrosion.

CAUTION: During service only water should be added to the Battery, not electrolyte.

The liquid level in the cells should never be allowed to drop below the top of the plates, as the portion of the plates exposed to air may be permanently damaged with a resulting loss in performance.

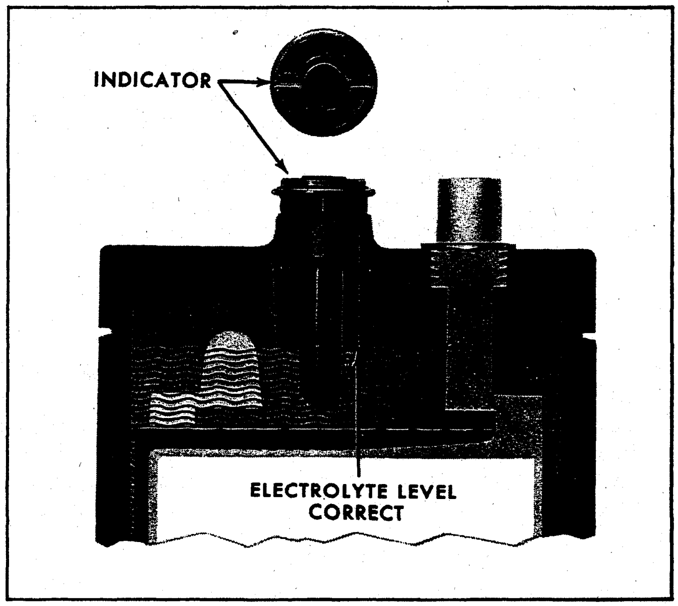


Fig. 5b—Cut-Away View Showing Electrolyte at Proper Level with Indicator Having Dark Appearance

WATER USAGE

Excessive usage of water indicates the Battery is being overcharged. The most common causes of overcharge are high Battery operating temperatures, too high a voltage regulator setting, poor regulator ground wire connection. Normal Battery water usage is approximately one to two ounces per month per battery.

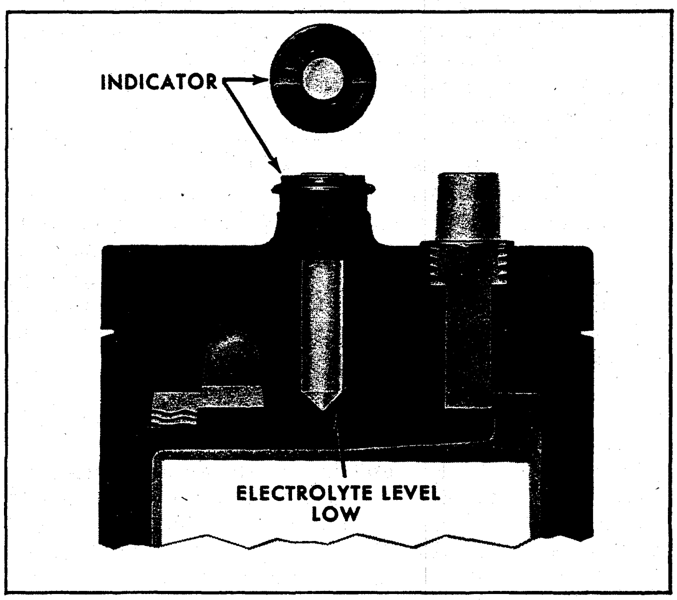


Fig. 6b—Cut-Away View Showing Electrolyte at Low Level with Indicator Having Light Appearance

CLEANING

The external condition of the Battery should be checked periodically for damage or for the presence of dirt and corrosion. The top of the Battery should be kept clean. An accumulation of acid film and dirt may permit current to flow between the terminals, which will slowly discharge the Battery. For best results when cleaning the top of Batteries, wash first with a diluted ammonia or a soda solution to neutralize any acid present; then flush with clean water. Care must be taken to keep vent plugs tight, so that the neutralizing solution does not enter the cells.

CABLES

To insure good electrical contact, the cables should be clean and tight on the Energizer posts. If the posts or cable terminals are corroded, the cables should be disconnected and the terminals and clamps cleaned separately with a soda solution and a wire brush. After cleaning and installing clamps, apply a thin coating of petroleum jelly on the cable clamps to retard corrosion.

CARRIER AND HOLD-DOWN

The Battery carrier and hold-down should be clean and free from corrosion before installing the Battery. The carrier should be in a sound mechanical condition so that it will support the Battery securely and keep it level.

To prevent the Battery from shaking in its carrier, the hold-down bolts should be tight (60-80 in. lbs.). However, the bolts should not be tightened to the point where the Battery case or cover will be placed under a severe strain.

BATTERY SAFETY PRECAUTIONS

When Batteries are being charged, an explosive gas mixture forms in each cell. Part of this gas escapes through the holes in the vent plugs and may form an explosive atmosphere around the Battery itself if ventilation is poor. This explosive gas may remain in or around the Battery for several hours after it has been charged. Sparks or flames can ignite this gas causing an internal explosion which may shatter the Battery.

The following precautions should be observed to prevent an explosion:

1. Do not smoke near Batteries being charged or which have been very recently charged.
2. Do not break live circuits at the terminals of Batteries because a spark usually occurs at the point where a live circuit is broken. Care must always be taken when connecting or disconnecting booster leads or cable clamps on fast chargers. Poor connections are a common cause of electrical arcs which cause explosions.

BATTERY CHARGING PROCEDURES

There are three methods of recharging Batteries. They differ basically in the length of time the Battery is charged and the rate at which charging current is supplied. One is the Slow Charge method, the second is the Fast Charge method, and the third is the Emergency Boost Charge method.

Before recharging a Battery by any method, the electrolyte level must be checked and adjusted if necessary.

SLOW CHARGING

The Slow Charge method supplies the Battery with a relatively low current flow for a relatively long period of time. This is the only method that will bring the Battery to a full state of charge.

The Slow Charge method consists of charging at approximately a 4 ampere rate for 24 hours or more if necessary to bring the Battery to full charge. A fully charged condition is reached when the cells are gassing freely and three corrected specific gravity readings taken at hourly intervals show no increase.

FAST CHARGING

The Fast Charge method supplies current to the Battery at a 40 to 50 ampere rate for a 1 1/2 hour period of time. If the electrolyte temperature reaches 125°F before the 1 1/2 hour period is completed, the Battery must be taken off charge temporarily, or the charging rate reduced to avoid damage to the Battery.

Although a Battery cannot be brought to a fully charged condition during Fast Charge, it can be substantially recharged or "boosted". In order to bring the Battery to a fully charged condition, the charging cycle must be finished by the Slow Charge method.

EMERGENCY BOOST CHARGING

In cases where the Battery is not sufficiently charged to crank the engine, an emergency boost charge may be applied as a temporary expedient in order to crank the engine. The Emergency Boost Charge method consists of charging at a 40 to 50 ampere rate for a period of one-half hour.

It should be particularly noted that the Emergency Boost Charge will not necessarily restore the Battery to a useful state of charge for continued service. After an emergency boost charge, failure to charge the Battery further, either by a long uninterrupted driving period or by the Fast Charge or Slow Charge method, may result in failure to crank the engine the next time cranking is attempted. A Battery should never be condemned on the basis of failure to crank the engine after an emergency boost charge. Although an emergency boost charge may put enough energy into the Battery to crank the engine once, further charging usually is necessary in order to create a sufficient reserve to crank a second and third time.

12 VOLT BATTERY SUGGESTED CHARGING RATES

(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

BATTERY TESTING PROCEDURES

Testing procedures are used to determine whether the Battery is (1) good and usable, (2) requires recharging or (3) should be replaced. Analysis of Battery conditions can be accomplished by performing a visual inspection, Instrument Test. and the full charge hydrometer test.

1. VISUAL INSPECTION

The first step in testing the Battery should be a visual inspection, which very often will save time and expense in determining Battery condition.

- Check the outside of the Battery for a broken or cracked case or a broken or cracked cover. If any damage is evident, the Battery should be replaced.
- Note the electrolyte level. Levels that are too low or too high may cause poor performance, as covered in the section entitled "Periodic Servicing".
- Check for loose cable connections, and for evidence of corrosion as covered in section entitled "Periodic Servicing". Correct as required before proceeding with tests.

2. INSTRUMENT TEST

A number of suppliers have approved testing equipment available. These testers have a programmed test procedure consisting of a series of timed discharge and charge events, requiring approximately 2 to 3 minutes, that will determine the condition of the Battery with a high degree of accuracy. When using these testers, the procedure recommended by the tester manufacturer should be followed. Batteries should not be charged prior to testing as doing so may alter the test results. If a tester is not available for testing, the "Specific Gravity Cell Comparison Test" may be used or an alternate method, but with a sacrifice in testing accuracy.

3. FULL CHARGE HYDROMETER TEST

This test should be used only on Batteries which test good with testing equipment or "Specific Gravity Cell Comparison Test" but which subsequently fail in service.

- Remove the Battery from the vehicle, and adjust the electrolyte level as necessary, by adding colorless, odorless, drinking water.
- Fully charge the Battery at the Slow Charging rate as covered in the section entitled "Battery Charging".
- Measure the specific gravity of the electrolyte in each cell and interpret as follows:
  Hydrometer Reading Less Than 1.230—Full charge hydrometer readings less than 1.230 corrected for temperature indicate the Battery is defective and should be replaced.

  Hydrometer Readings Above 1.310—Full charge hydrometer readings above 1.310 corrected for temperature indicate that the cells have been improperly filled (activation) or improperly serviced. Poor service and short Battery life will result.

SPECIFIC GRAVITY READINGS

A hydrometer can be used to measure the specific gravity of the electrolyte in each cell.

The hydrometer measures the percentage of sulphuric acid in the battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, the acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. An indication of the concentration of the electrolyte is obtained with a hydrometer.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean, inside and out, to insure an accurate reading.
2. Hydrometer readings must never be taken immediately after water has been added. The water must be thoroughly mixed with the electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer, draw liquid into it several times to insure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard the curvature where the liquid rises against float stem due to surface tension.
5. Avoid dropping battery fluid on car or clothing as it is extremely corrosive. Any fluid that drops should be washed off immediately with baking soda solution.

The specific gravity of the electrolyte varies not only with the percentage of acid in the liquid but also with temperature. As temperature increases, the electrolyte expands so that the specific gravity is reduced. As temperature drops, the electrolyte contracts so that the specific gravity increases. Unless these variations in specific gravity are taken into account, the specific gravity obtained by the hydrometer may not give a true indication of the concentration of acid in the electrolyte.

A fully charged Battery will have a specific gravity reading of approximately 1.270 at an electrolyte temperature of 80°F. If the electrolyte temperature is above or below 80°F, additions or subtractions must be made in order to obtain a hydrometer reading corrected to the 80°F standard. For every 10° above 80°F, add four specific gravity points (.004) to the hydrometer reading. Example: A hydrometer reading of 1.260 at 110°F would be 1.272 corrected to 80°F, indicating a fully charged Battery. For every 10° below 80°F, subtract four points (.004) from the reading. Example: A hydrometer reading of 1.272 at 0°F would be 1.240 corrected to 80°F, indicating a partially charged Battery.

Specific Gravity Cell Comparison Test—This test may be used when a instrument tester is not available. To perform this test measure the specific gravity of each cell, regardless of state of charge, and interpret the results as follows:

- If specific gravity readings show a difference between the highest and lowest cell of .050 (50 points) or more, the Battery is defective and should be replaced.

INSTALLING BATTERIES

To install a Battery properly, it is important to observe the following precautions:

- Connect grounded terminal of Battery last to avoid short circuits which may damage the electrical system.

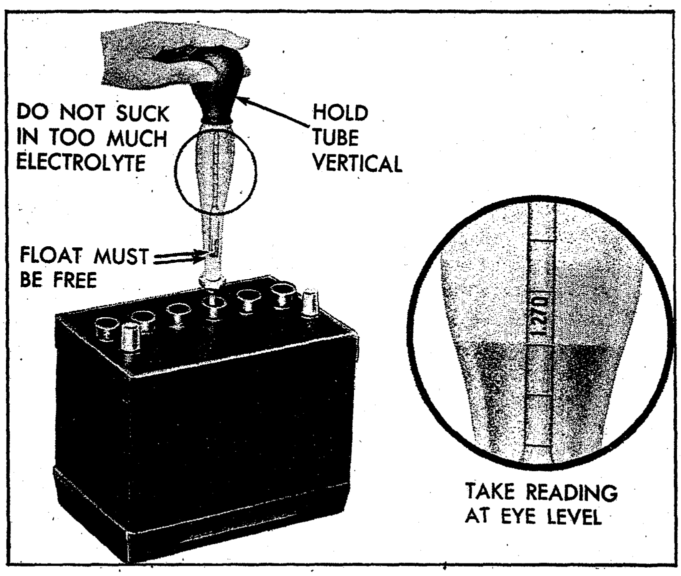


Fig. 7b—Testing Specific Gravity

- Be sure there are not foreign objects in the carrier, so that the new Battery will rest properly in the bottom of the carrier.
- Tighten the hold-down evenly until snug (60-80 in. lbs.). Do not draw down tight enough to distort or crack the case or cover.
- Be sure the cables are in good condition and the terminal clamps are clean and tight. Make sure the ground cable is clean and tight at engine block or frame.
- Check polarity to be sure the Battery is not reversed with respect to the generating system.

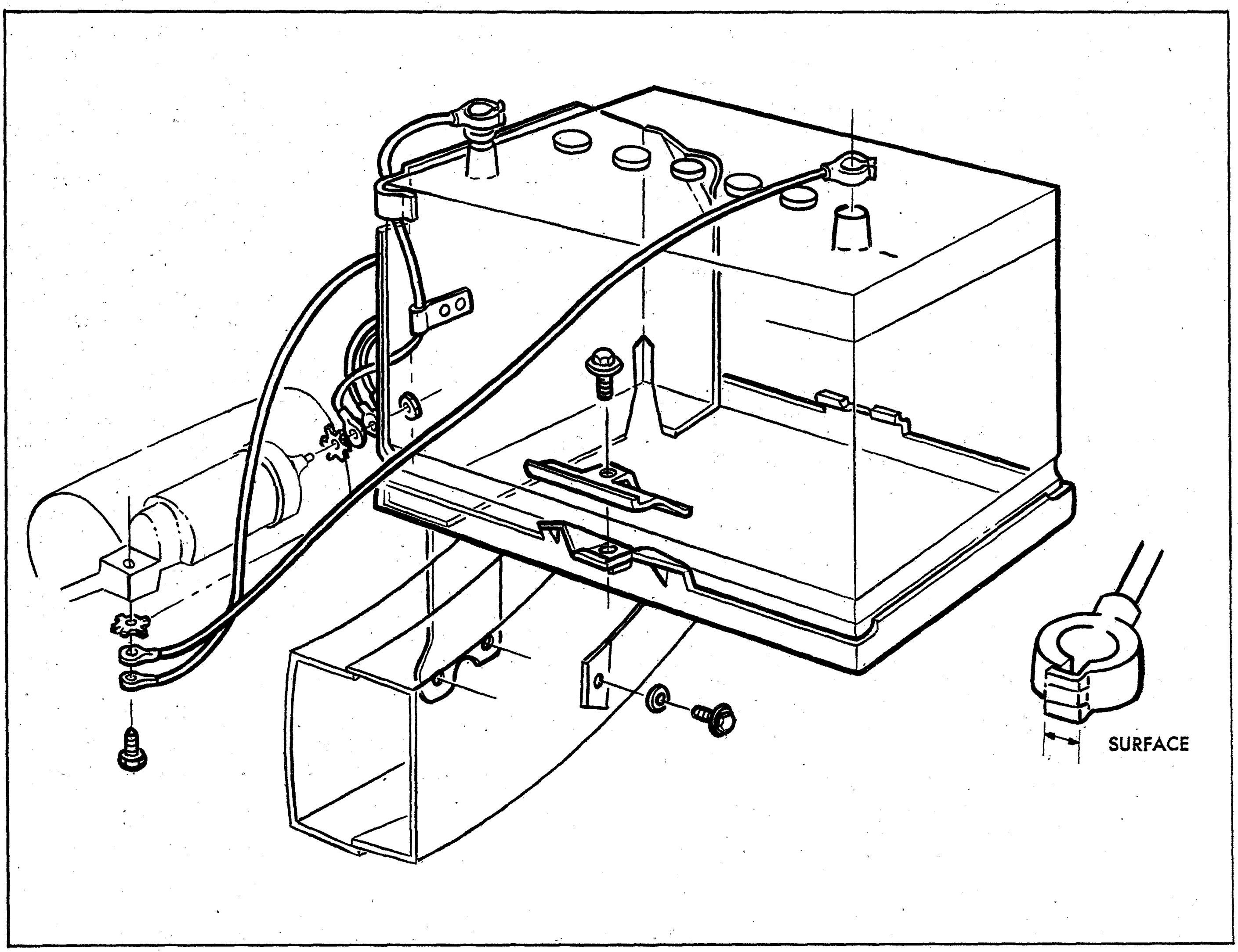


Fig. 8b—Battery Installation (Corvette Shown)

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 1967 vehicles, a double contact two unit type and a transistor 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 telltale 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, when used with the special 63 amp air conditioning model generator (4 ohm field coil) uses a field discharge diode internally in the field circuit (figs. 3c and 4c). The added diode adapts the

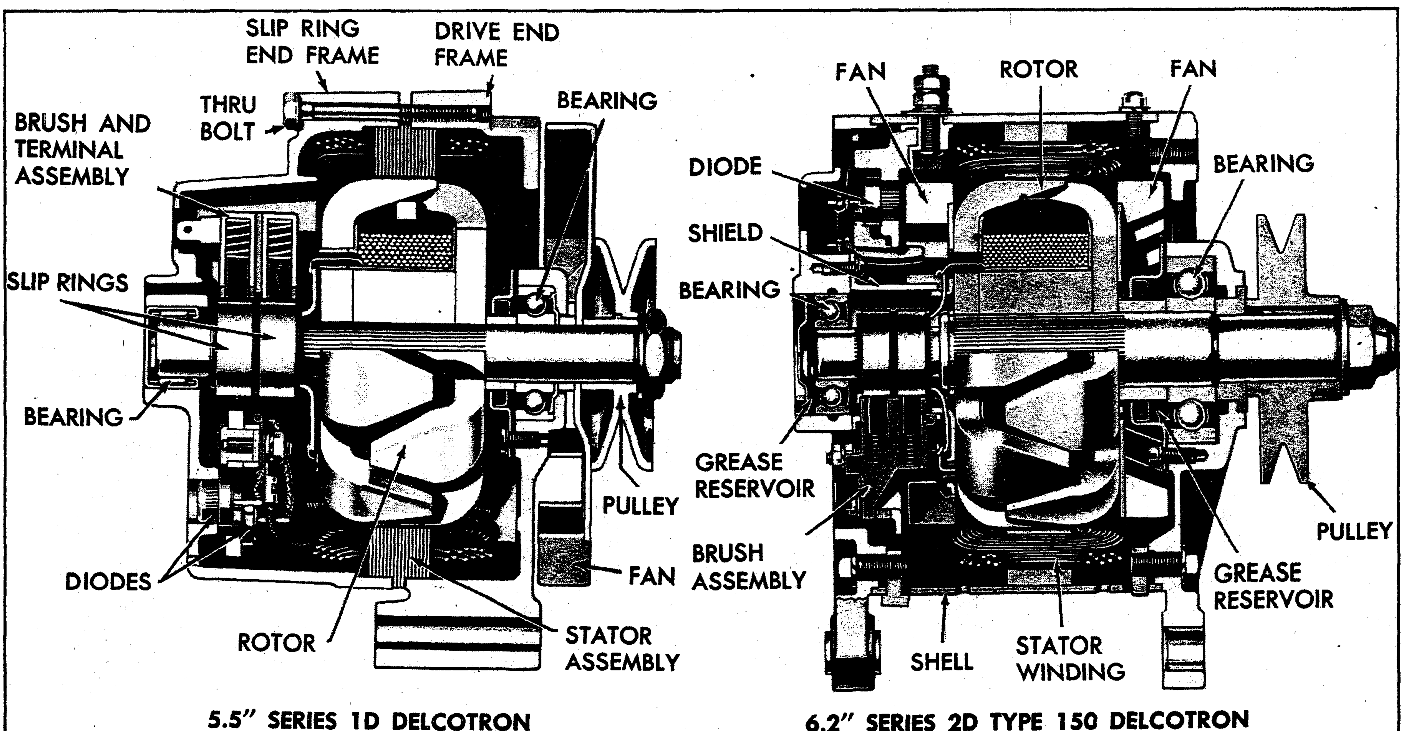
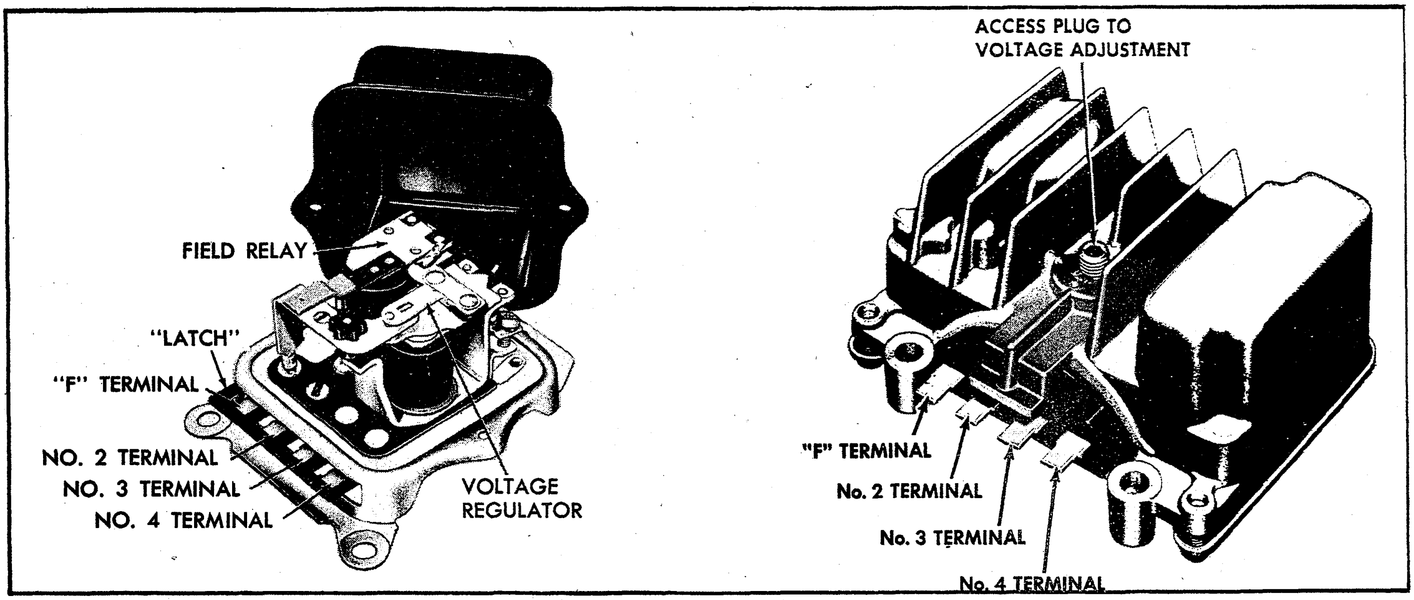


Fig. 1c—Delcotron Cross-section View



Double Contact — Fig. 2c—Voltage Regulator Assemblies — Transistor

regulator to handle the higher field current and enables it to absorb the increased inductive voltages of the field coil with satisfactory contact point life.

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. Internal circuit wiring diagrams of the double contact regulator are shown in Figures 3c and 4c.

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. Wiring diagrams of the transistor regulator are shown in Figures 3c and 4c.

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.

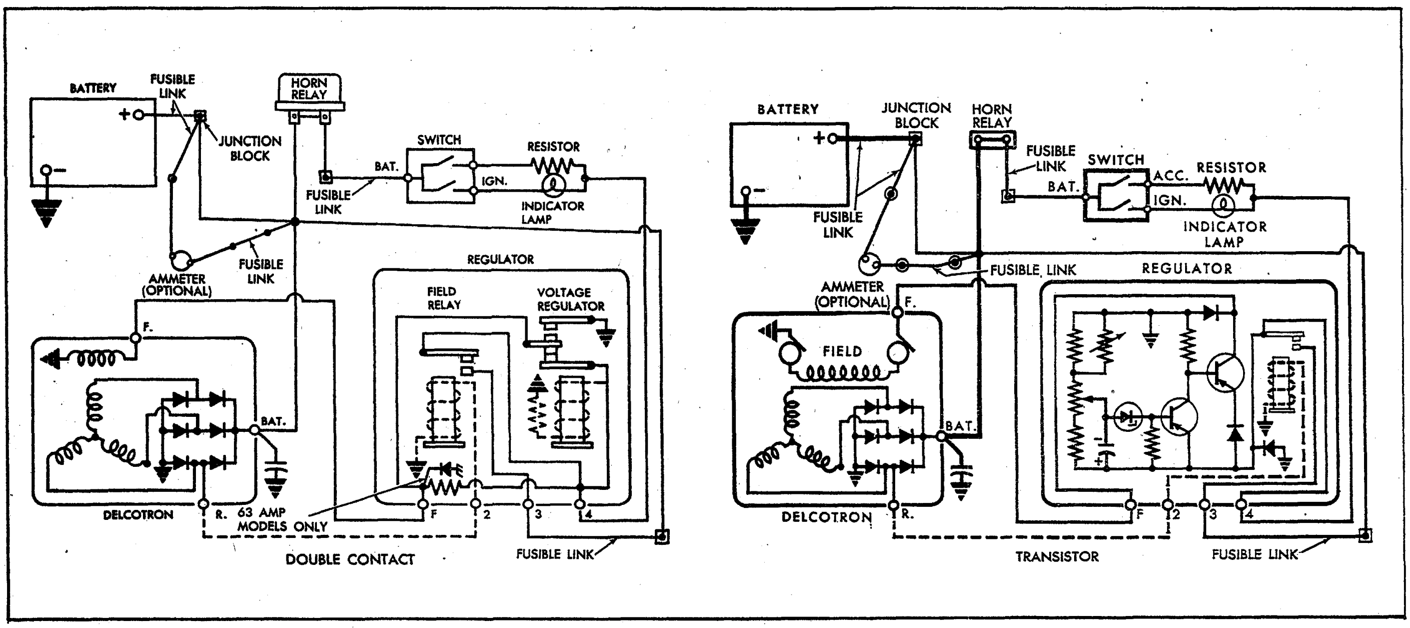


Fig. 3c—Circuity - Voltage Regulator Assemblies (Except Corvette)

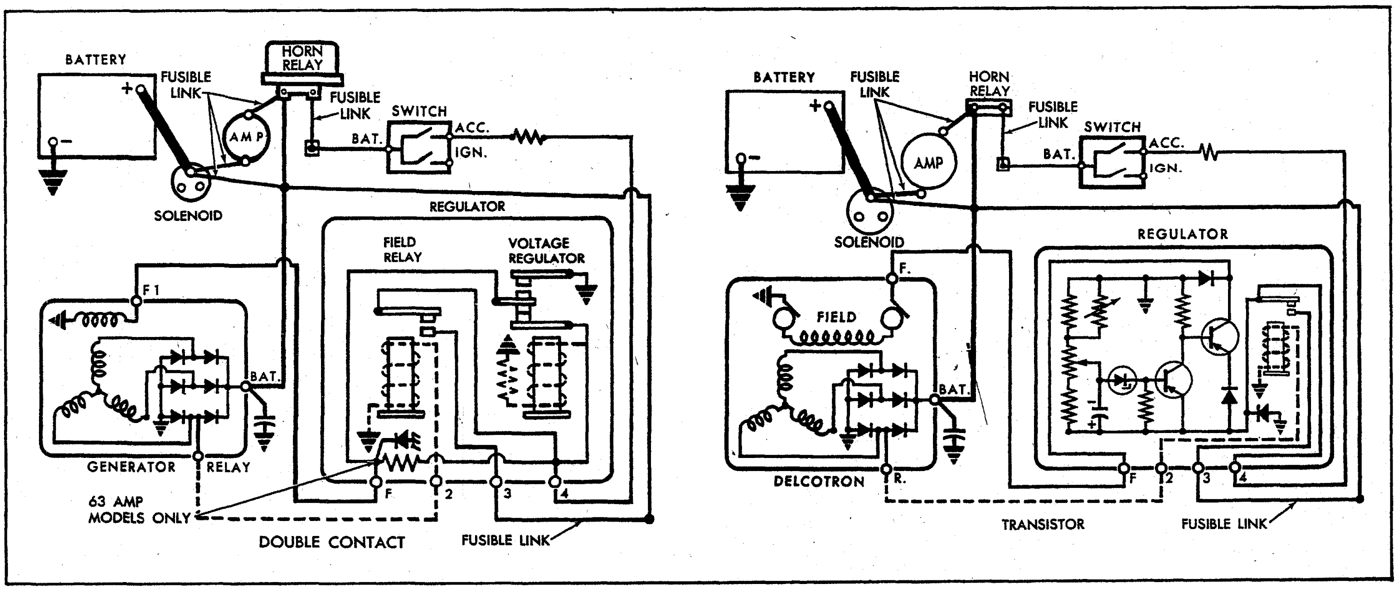


Fig. 4c—Circuitry - Voltage Regulator Assemblies (Corvette)

Engine compartment wiring harness incorporates several fusible links. Each link is identified with its gage size. A fusible link is a length of special wire (normally four wire gages smaller than the circuit it is protecting) used in wiring circuits that are not normally fused, such as the ignition circuit. The same size wire with a hypalon insulation must be used when replacing a fusible link. The links are:

1. The pigtail lead at the battery positive cable (except Corvette) is a 14 gage, brown fusible link protecting the 10 gage battery charging circuit. This wire is an integral part of the battery cable assembly and servicing requires replacing the complete battery cable assembly. On Corvette models this link is installed as a molded splice at the solenoid "Bat" terminal and servicing requires splicing in a new link.
2. A 16 gage black fusible link is located at the horn relay to protect all unfused wiring of 12 gage or larger. It is installed as a molded splice and servicing requires splicing in a new link.
3. The generator warning light and field circuitry (16 gage wire) is protected by a fusible link (20 gage orange wire) used in the "battery feed to voltage regulator #3 terminal" wire. The link is installed as a molded splice in the generator and forward lamp harness and is serviced by splicing in a new 20 gage wire as required.
4. The ammeter circuit on all models is protected by two orange, 20 gage wire fusible links installed as molded splices in the circuit at the junction block or the solenoid "Bat" terminal (Corvette only) and at the horn relay. Each link is serviced by splicing in a new 20 gage wire as required.

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 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

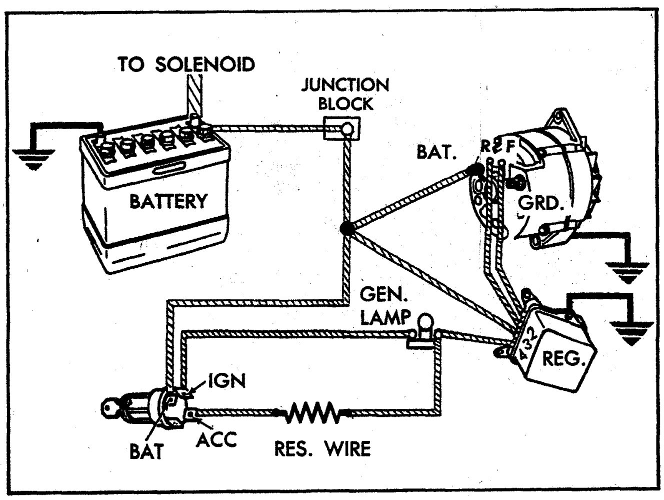


Fig. 5c—Typical Wiring Diagram Showing Lead Connections

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.

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.

NOTE: On Corvette models difficulty may be encountered when attempting to make the required test connections at the voltage regulator. It is advisable to remove the regulator from its mounting location to perform the necessary connections at the regulator for the following tests but make sure unit is grounded.

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 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. Models equipped with Indicator Lamp: Turn ignition switch on "ON" position and check indicator lamp. If lamp fails to glow, perform appropriate tests and corrections (Indicator Lamp Circuit Tests) before continuing.

   Models equipped with Ammeter: Turn ignition switch to "ACC" with an accessory on and check ammeter. If ammeter fails to read discharge, check ammeter circuit before continuing.
5. 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.

   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.

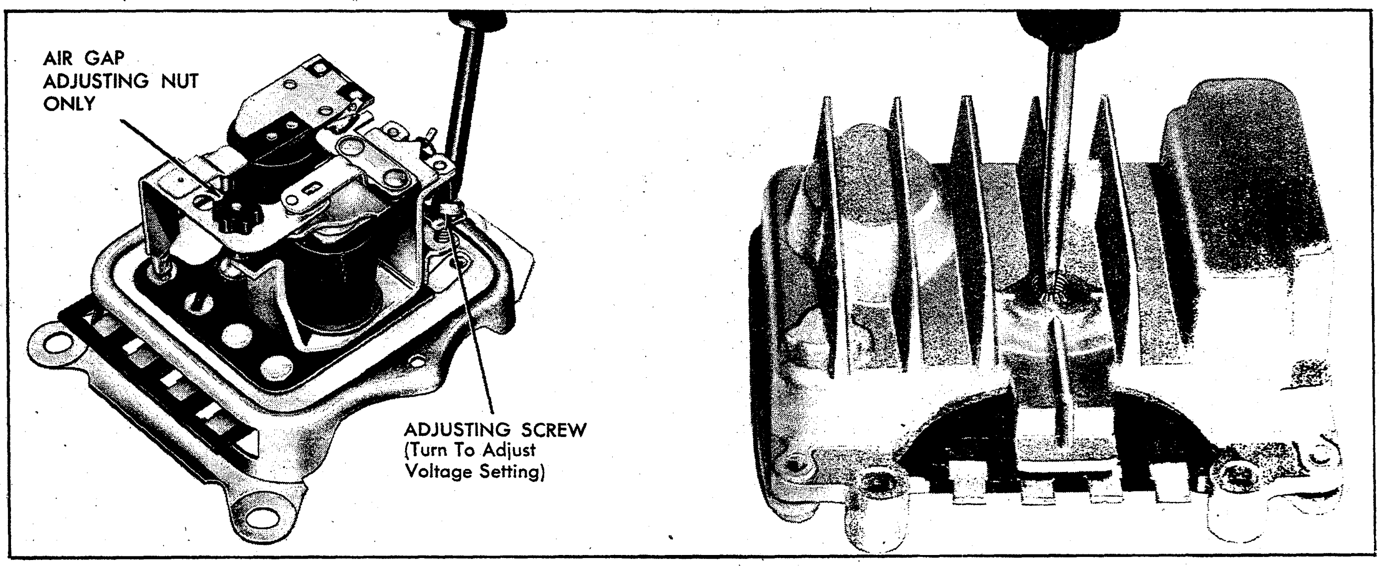


Fig. 6c—Adjusting Voltage Setting

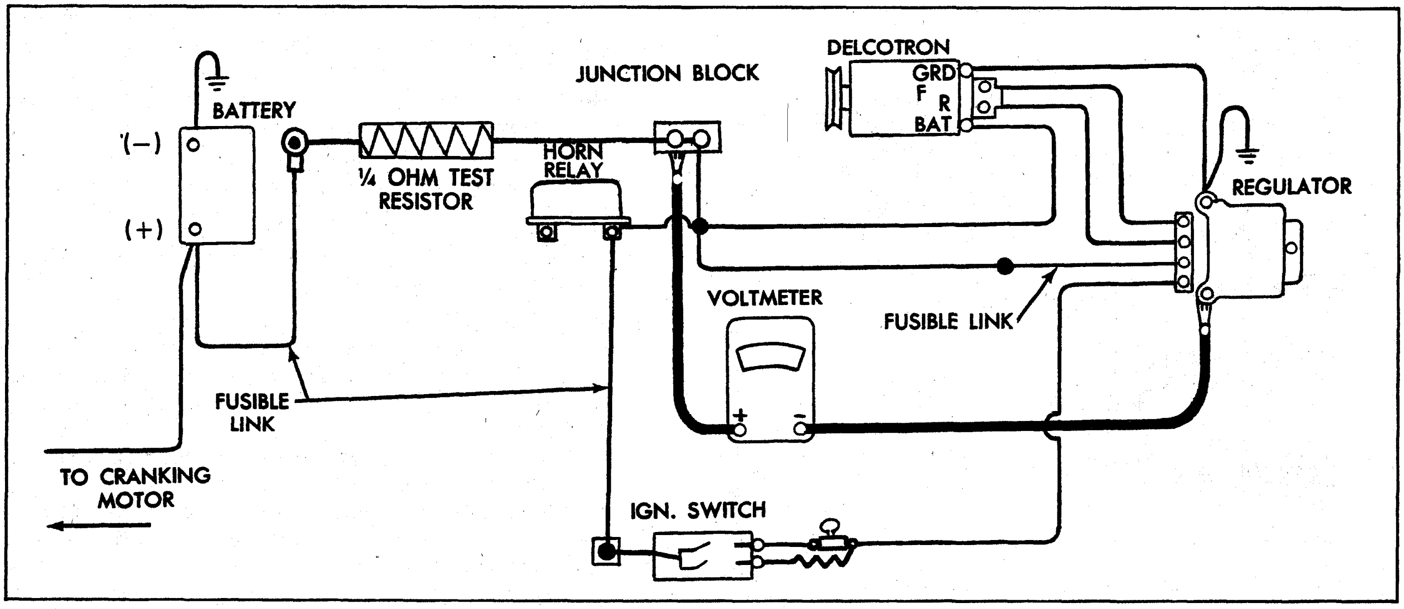


Fig. 7c—Voltage Setting Test Connections

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. 6c) to raise setting to 12-1/2 volts. On transistor regulator remove pipe plug (fig. 6c), insert screw driver into slot and turn clockwise one or two 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 the 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. 6c).

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 re-connecting regulator connector. Read voltage. A reading between 13.5 and 15.2 indicates a good regulator.

CAUTION: Be sure four terminal regulator connector is disconnected when removing or installing cover. This is to prevent regulator damage by short circuits.

DELCOTRON OUTPUT TEST

Ammeter Method (Fig. 8c)

1. Disconnect the battery ground cable at the battery.
2. Disconnect the red wire at Delcotron battery terminal and connect an ammeter in series between the wire and terminal.
3. Connect a voltmeter from battery terminal to a good ground on the generator.
4. Disconnect the F-R terminal connector at the Delcotron.
5. Connect the jumper wire between Delcotron "F" and battery terminals.
6. Connect the battery ground cable at the battery.
7. Connect an adjustable carbon pile across the battery posts.
8. Start the engine and slowly bring the speed to 1500 RPM and at the same time adjust the carbon pile load to hold the voltage at 14 volts.
9. Read the amperage and compare with a specifications chart.

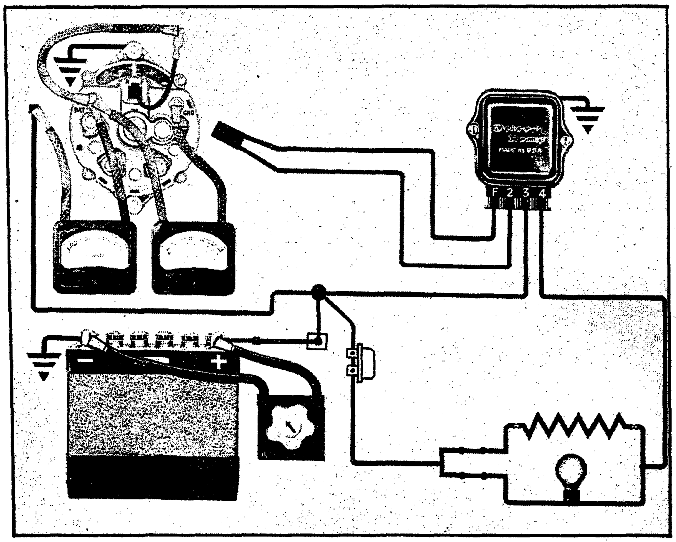


Fig. 8c—Ammeter Method Test Connections

10. Turn off ignition, disconnect battery ground cable, and remove all test equipment.
11. If the Delcotron meets the test specifications, the problem is not in the generator.
12. If the Delcotron fails to meet the test specifications, remove it and perform bench tests and make repair needed.

DELCOTRON DIODE AND FIELD TEST (Fig. 9c)

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.
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".

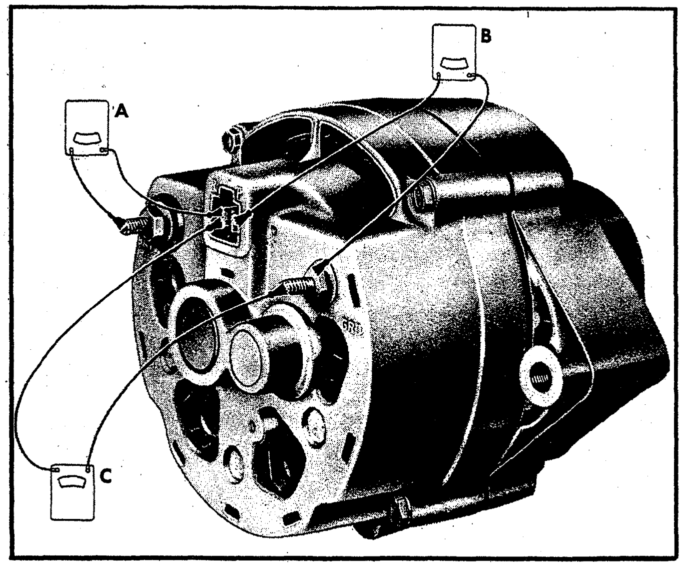


Fig. 9c—Delcotron Diode and Field Test

INDICATOR LAMP/INITIAL FIELD EXCITATION CIRCUIT TESTS (Fig. 10c)

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.
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. 10c, 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. 10c, 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

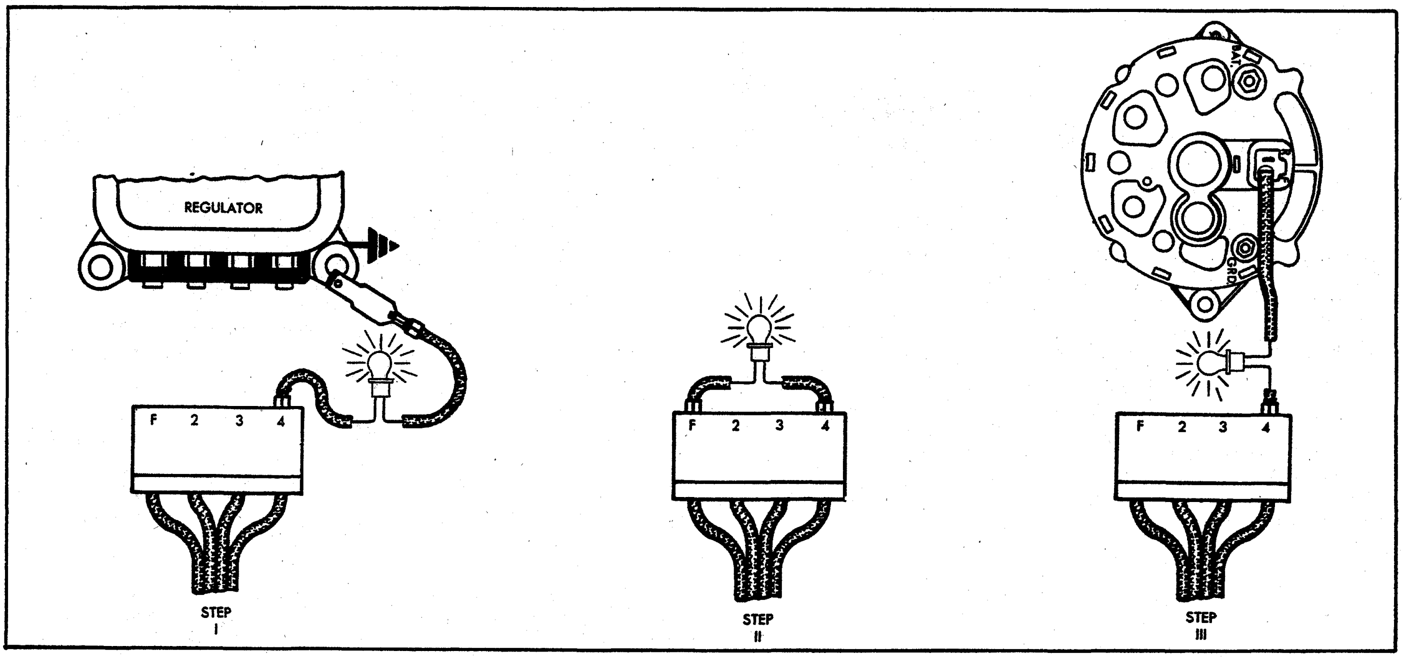


Fig. 10c—Initial Field Excitation Circuit Tests

connect to "F" terminal on Delcotron (fig. 10c, 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).
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 10c (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.

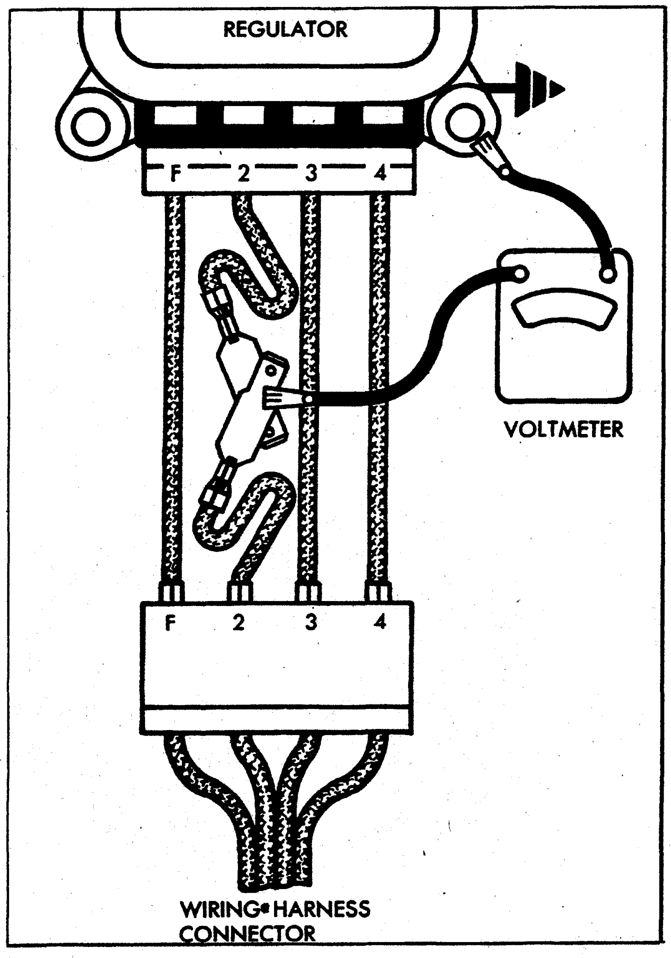


Fig. 11c—Testing Field Relay

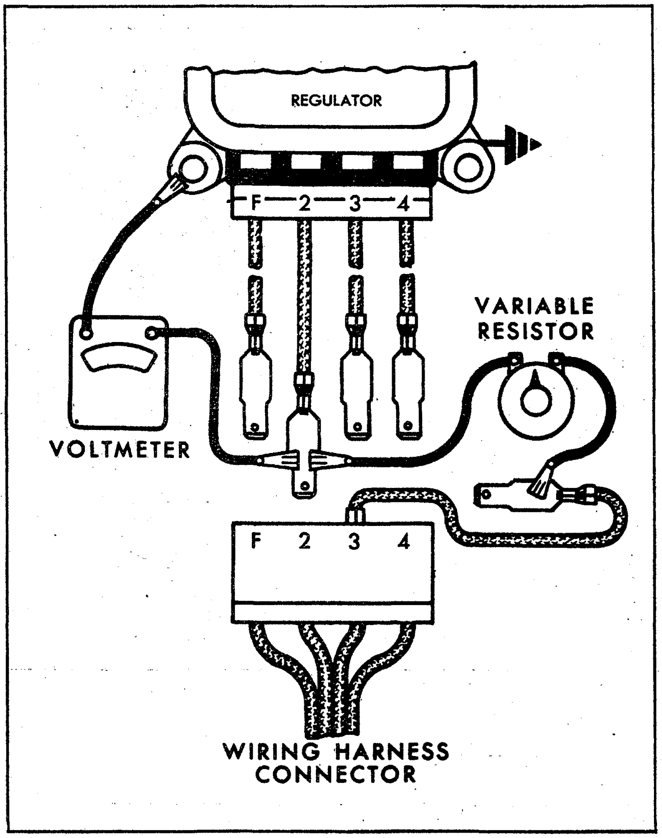


Fig. 12c—Field Relay Closing Voltage Test

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. 11c).
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:

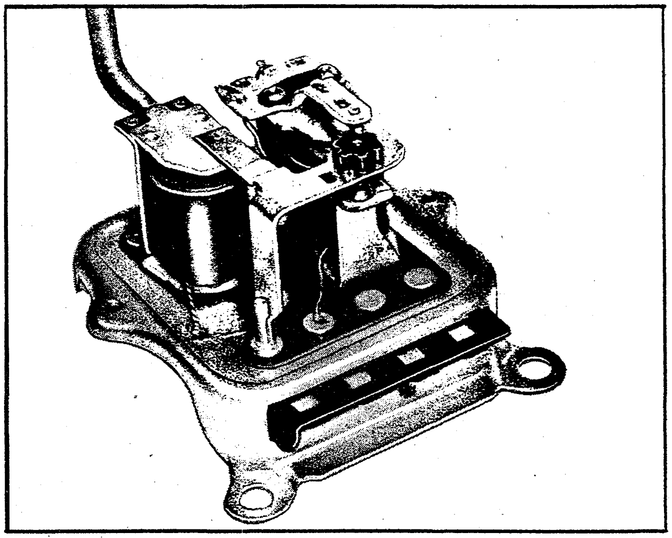


Fig. 13c—Adjusting Field Relay Closing Voltage

CLOSING VOLTAGE ADJUSTMENT

1. Make connections as shown in Figure 12c 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 13c.

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. 14c). Where important differences are encountered separate mention will be made of the two generators.

GENERATOR

REMOVAL AND INSTALLATION

1. Disconnect the battery ground strap at battery to prevent damaging diodes.
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) 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).

Double Groove Pulley

1. Place a 15/16" socket (with wrench flats on the drive

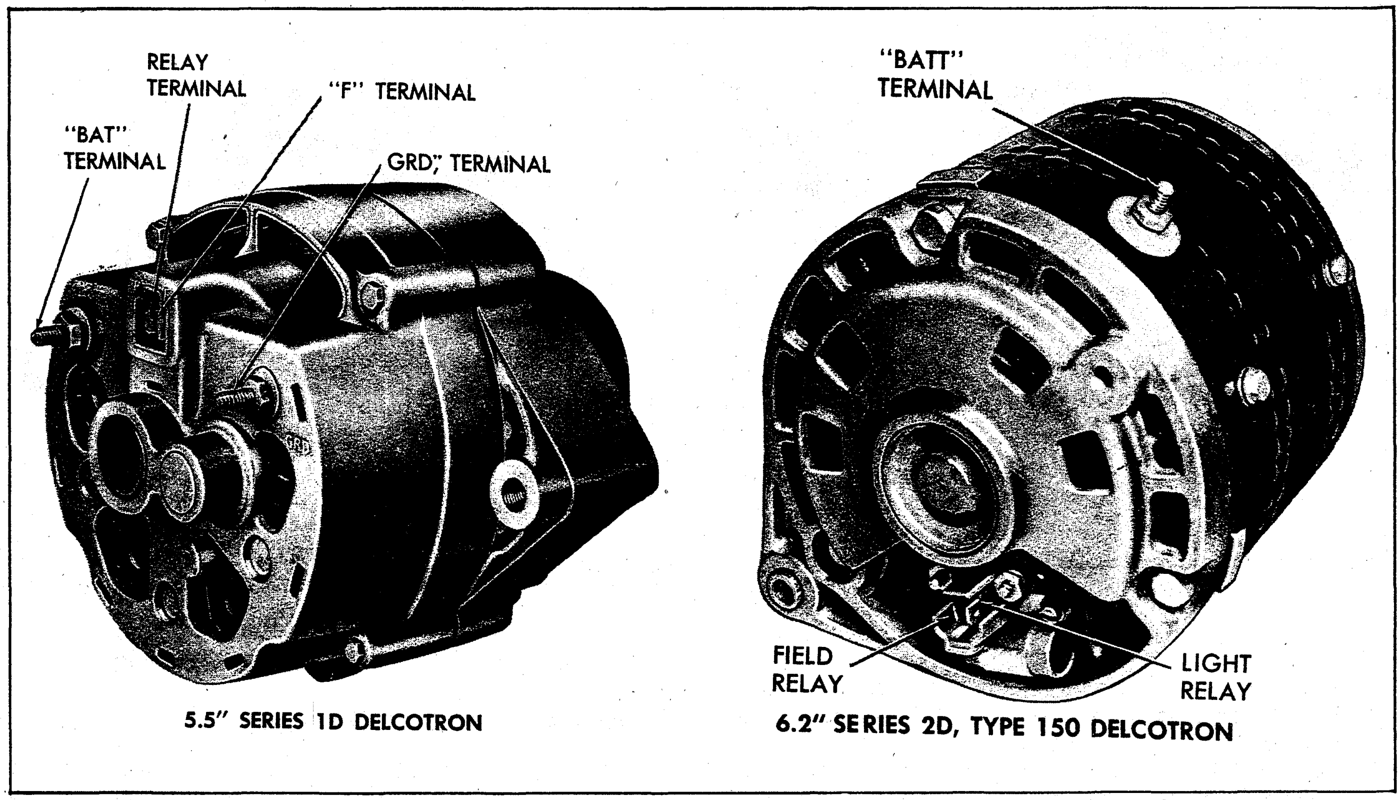


Fig. 14c—Delcotrons - Full View

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.
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 install pin 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.

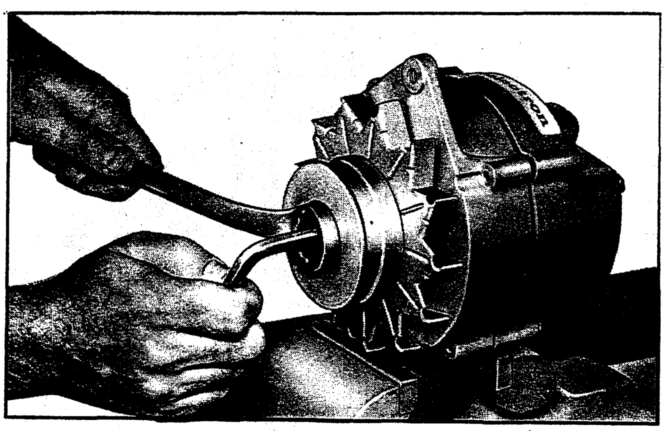


Fig. 15c—Pulley Removal

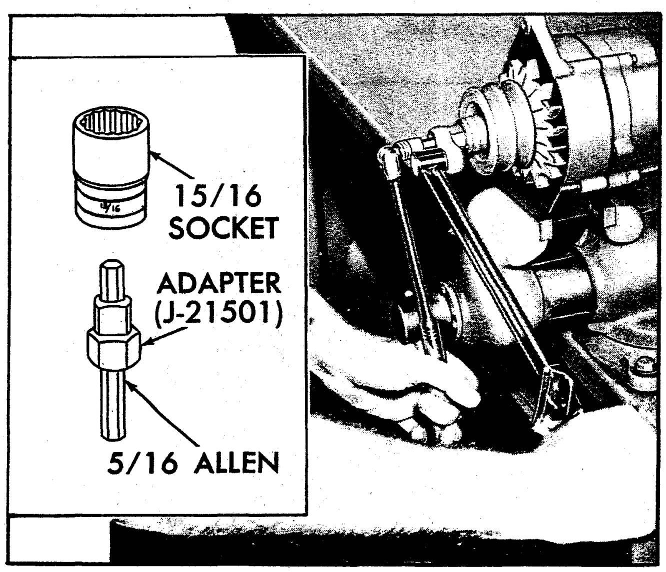


Fig. 16c—Torquing Pulley Nut

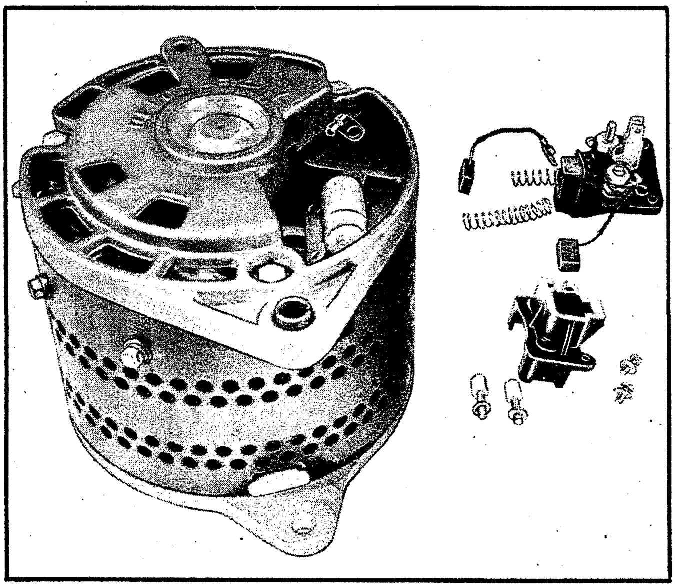


Fig. 17c—6.2" Brush Holder Assembly

5. Rearrange leads as shown in Figure 18c with right-hand brush lead connected under the right hand hex-head stud.
6. Remove pin and attach terminal cover with two screws, making sure leads are not caught underneath the cover.

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.

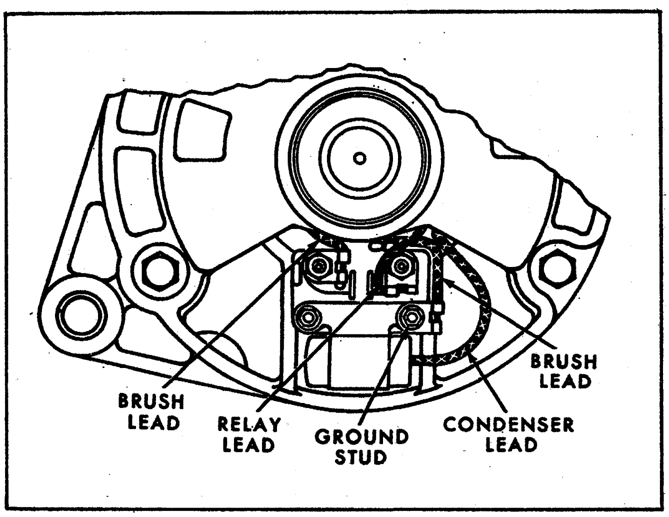


Fig. 18c—Lead Arrangement after Assembly

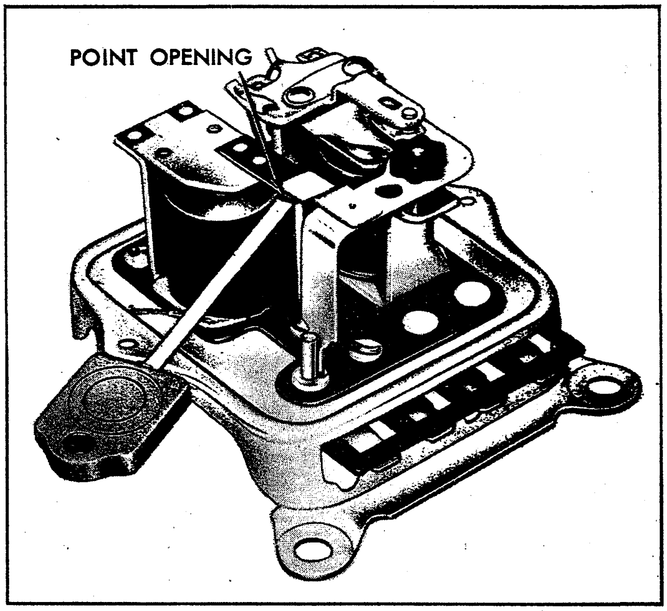


Fig. 19c—Checking Field Relay Point Opening

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.

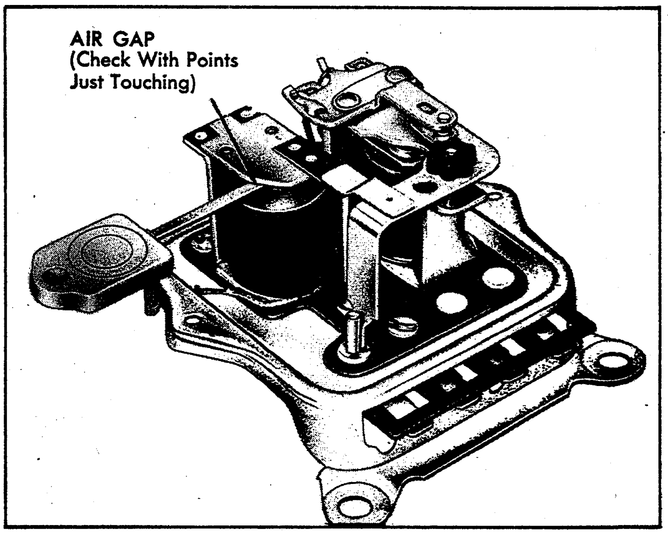


Fig. 20c—Checking Field Relay Air Gap

Field Relay Adjustment

1. Point Opening: The point opening is checked as illustrated in Figure 19c. If adjustment is necessary, carefully bend the armature stop.
2. Air Gap: Check the air gap with the points just touching (fig. 20c). 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 1967 vehicles. The breaker point type which is continued as the regular production system and the optional (Corvette only) 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.

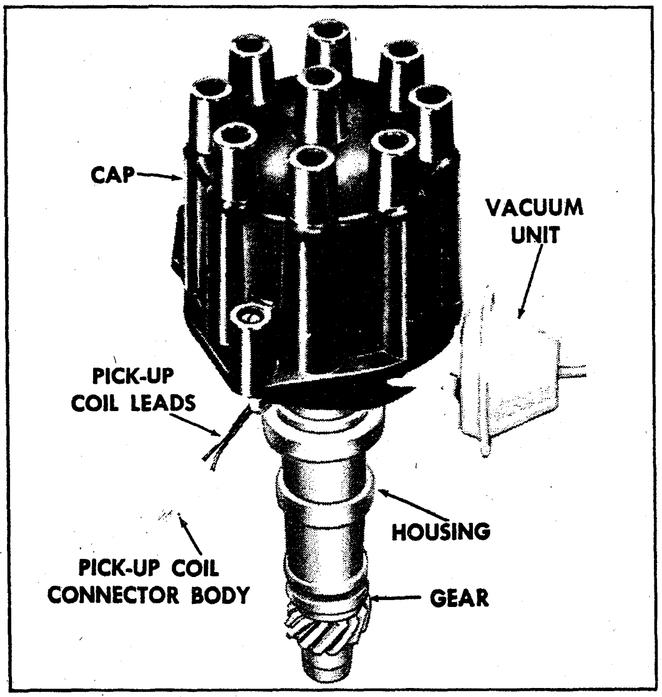


Fig. 1i—Magnetic Pulse Distributor

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.

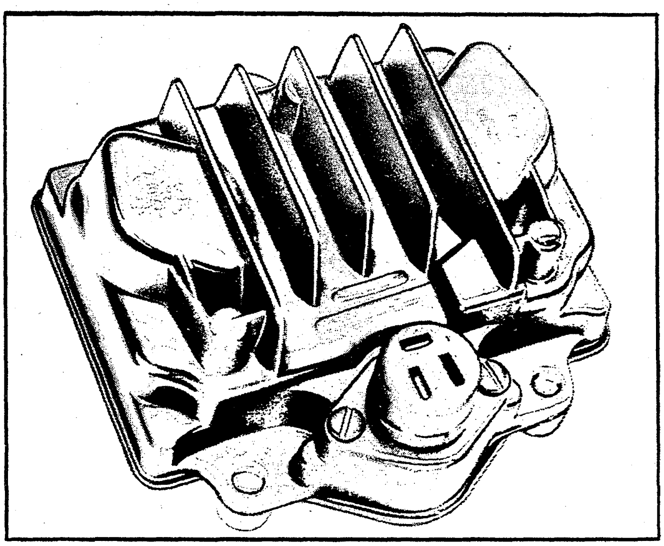


Fig. 2i—Ignition Pulse Amplifier Unit

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.

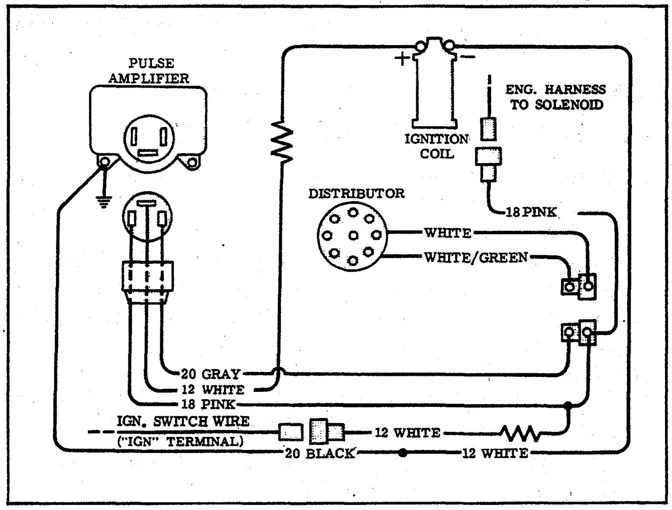


Fig. 3i—Breakerless Ignition System

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.

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.

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.
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 dwell and ignition timing.

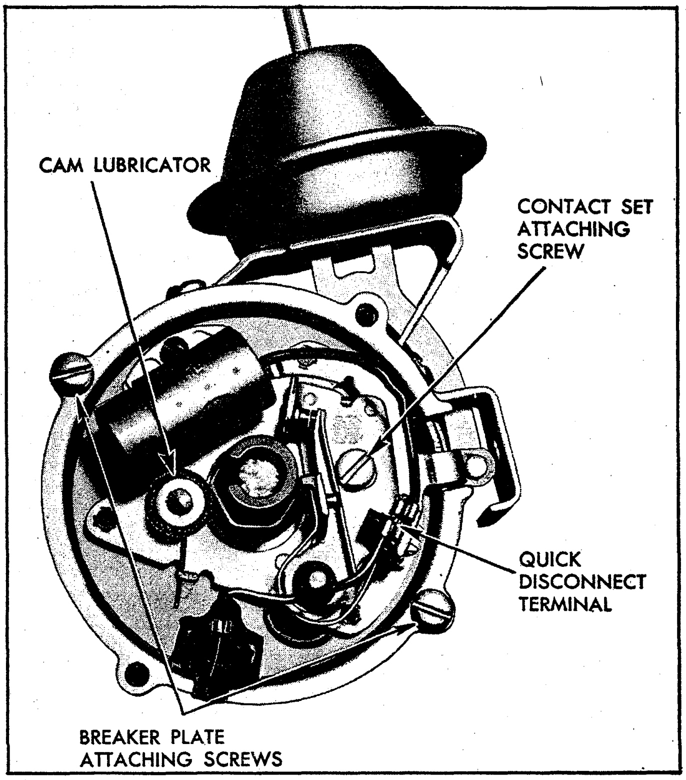


Fig. 4i—Breaker Plate and Attaching Parts

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 installation 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.

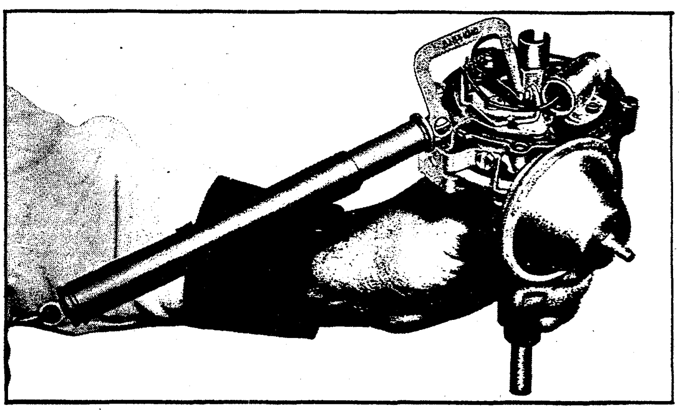


Fig. 5i—Checking Breaker Arm Spring Tension

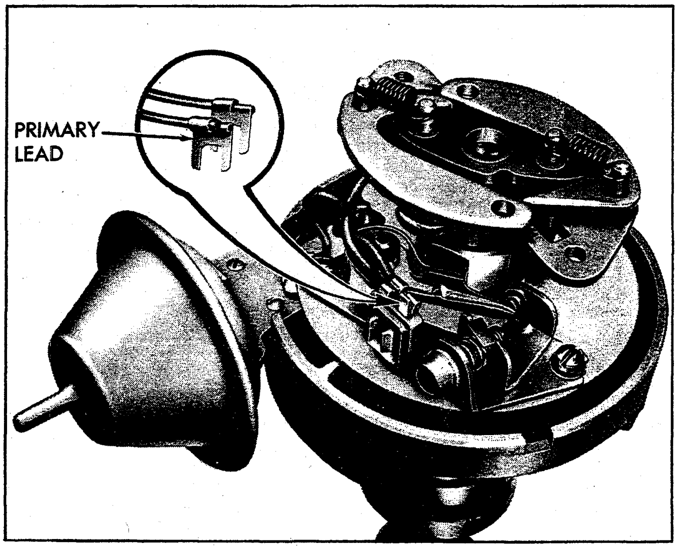


Fig. 6i—Distributor Lead Arrangements

NOTE: End of cam lubricant wick should be adjusted to just touch cam lobes. Over lubrication of cam resulting in grease on contact points 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.

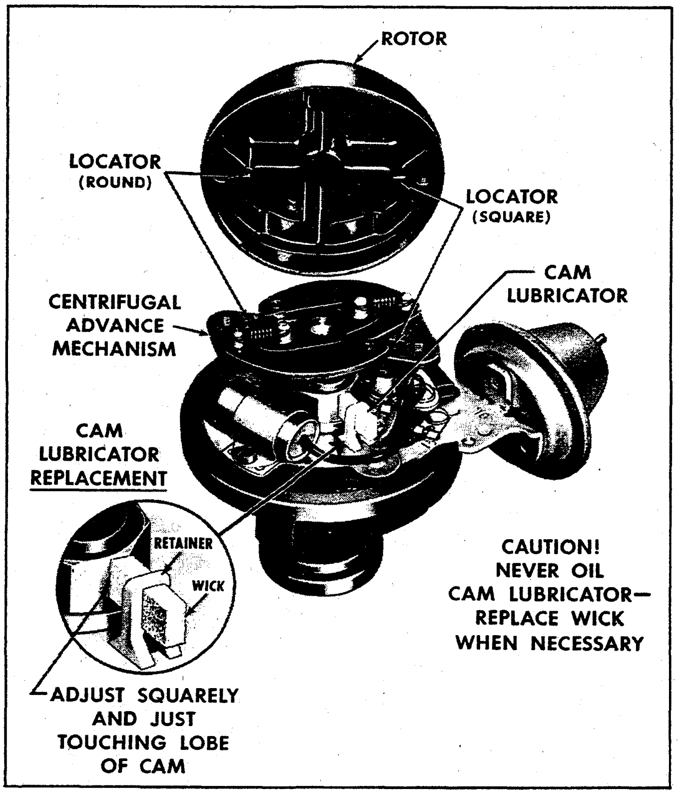


Fig. 7i—Top View of Distributor

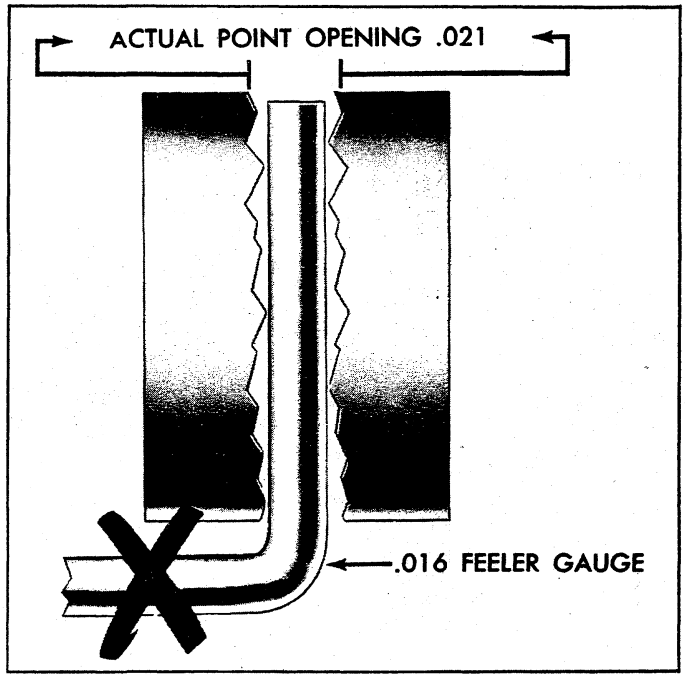


Fig. 8i—Inaccurate Gauging of Rough Points

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.

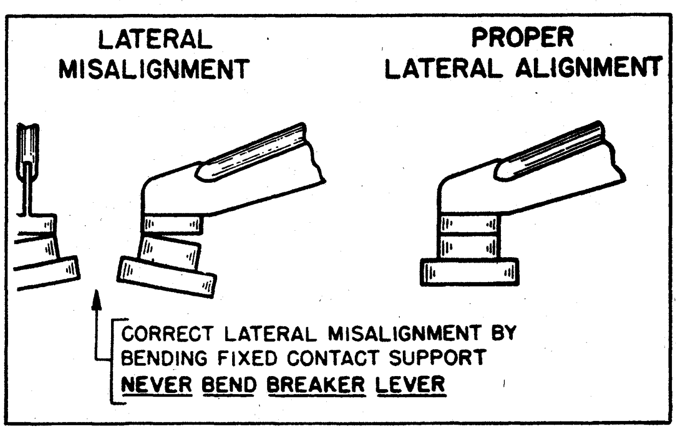


Fig. 9i—Alignment of Points

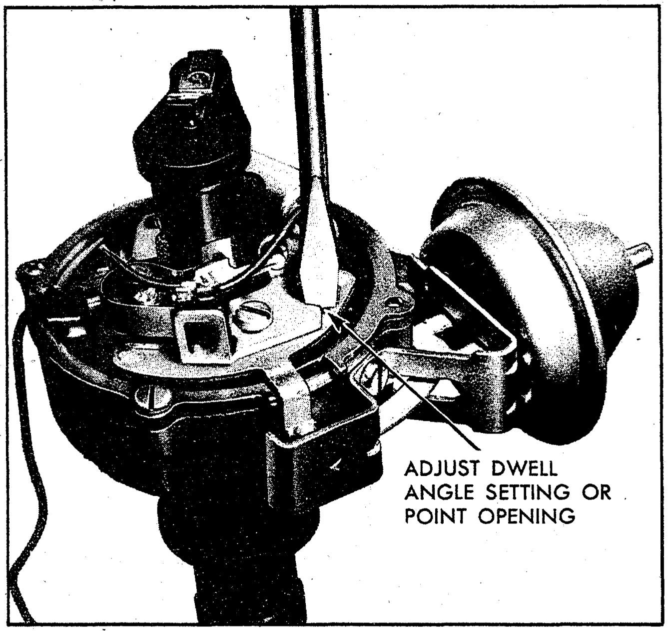


Fig. 10i—Setting Point Opening

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.
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).

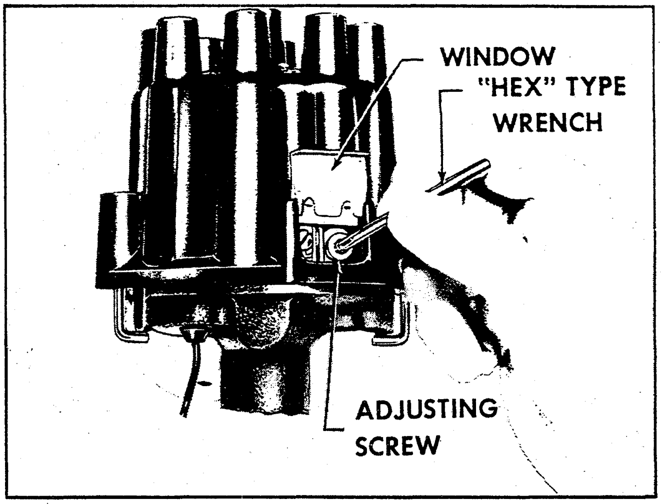


Fig. 11i—Adjusting Dwell Angle

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 (counter-clockwise). 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.
   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.
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. On radio equipped Corvettes, remove ignition shield from over distributor and coil. One bolt is accessible from top of shield, the other two are at rear of shield, facing firewall.
2. 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.

3. Disconnect the distributor primary lead from the coil terminal.
4. Scribe a realignment mark on the distributor bowl and engine in line with the rotor segment.
5. Disconnect vacuum line to distributor and tachometer drive cable (Corvette). Remove the distributor hold-down bolt and clamp and 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.

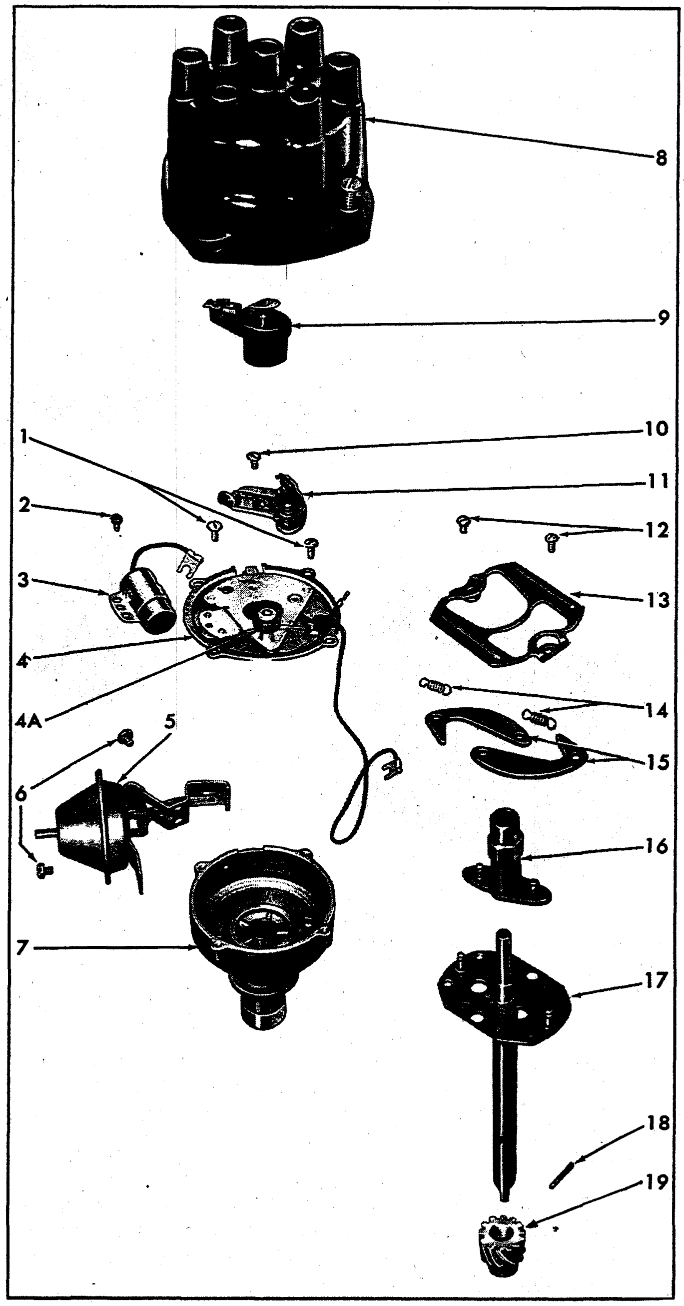


Fig. 12i—L-6 Distributor-Exploded View

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
9. Rotor
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

DISASSEMBLY

It is advisable to place the distributor in a distributor testing machine or synchroscope prior to disassembly.

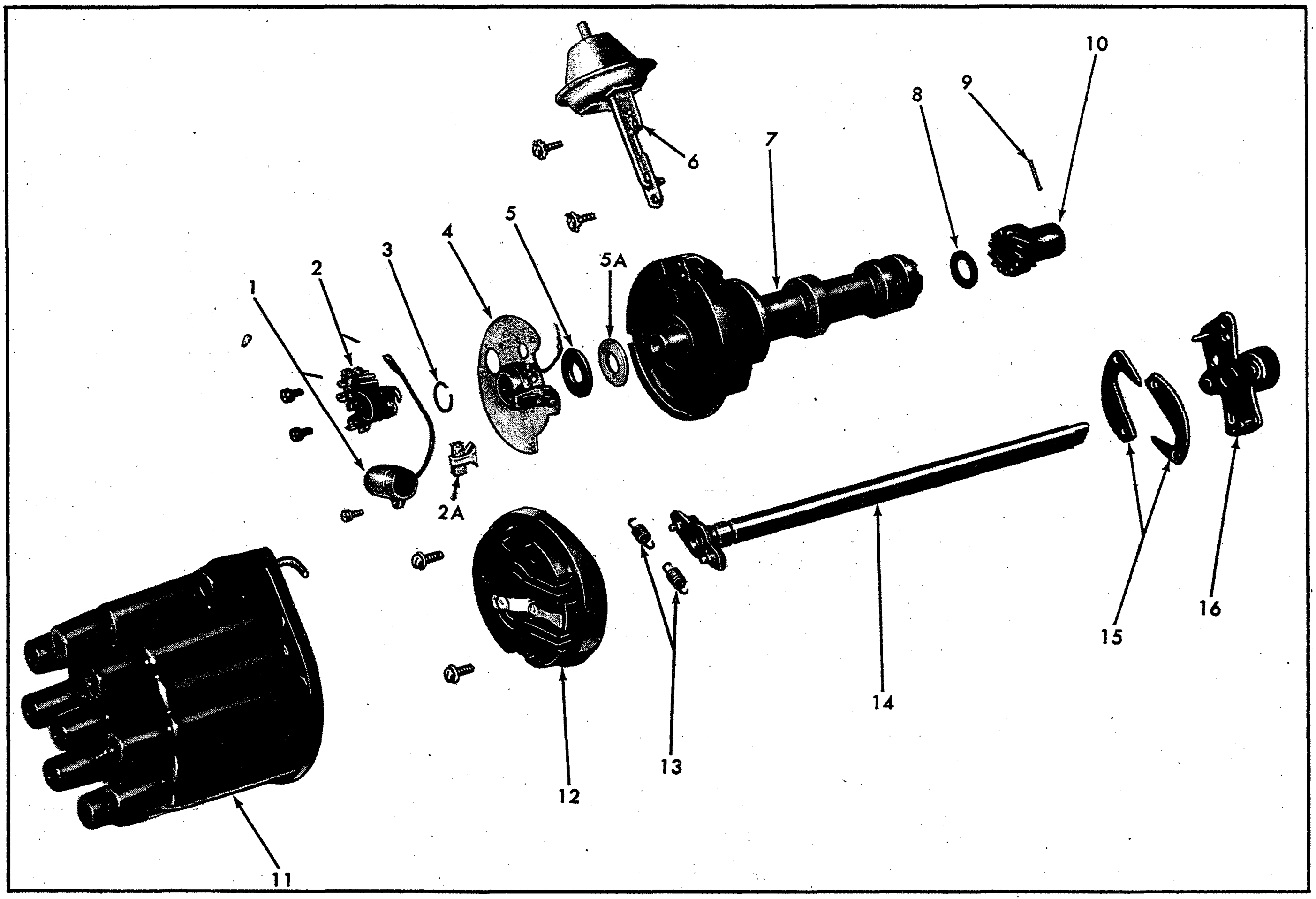


Fig. 13i—V-8 Distributor (Typical)-Exploded View

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

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. Remove tachometer drive gear on Corvette models.
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.

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 guage. 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 attaching 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.
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. Install tachometer drive gear on Corvette models.
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 6i.

   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.

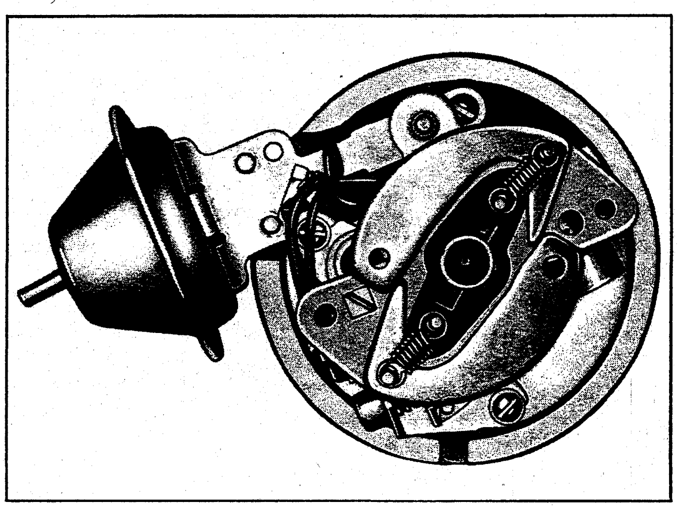


Fig. 14i—Advance Weights Installed

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.

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

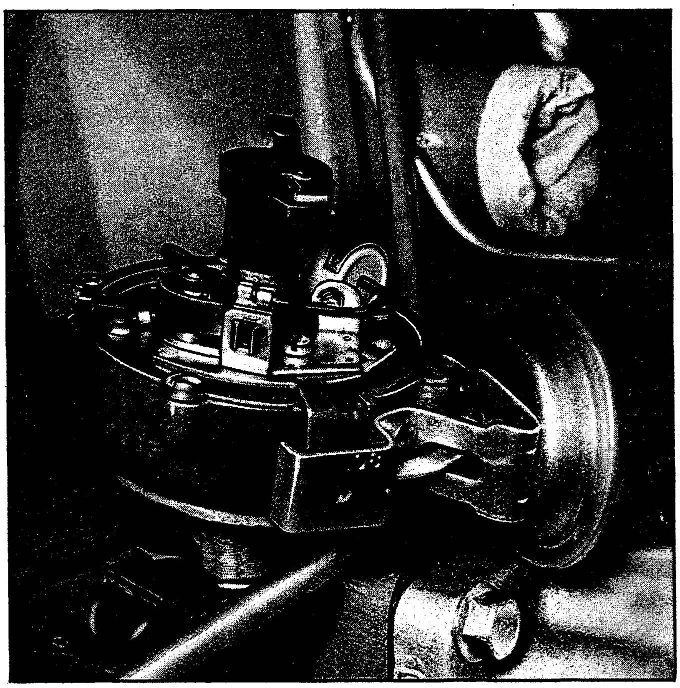


Fig. 15i—Six Cylinder Engine Distributor

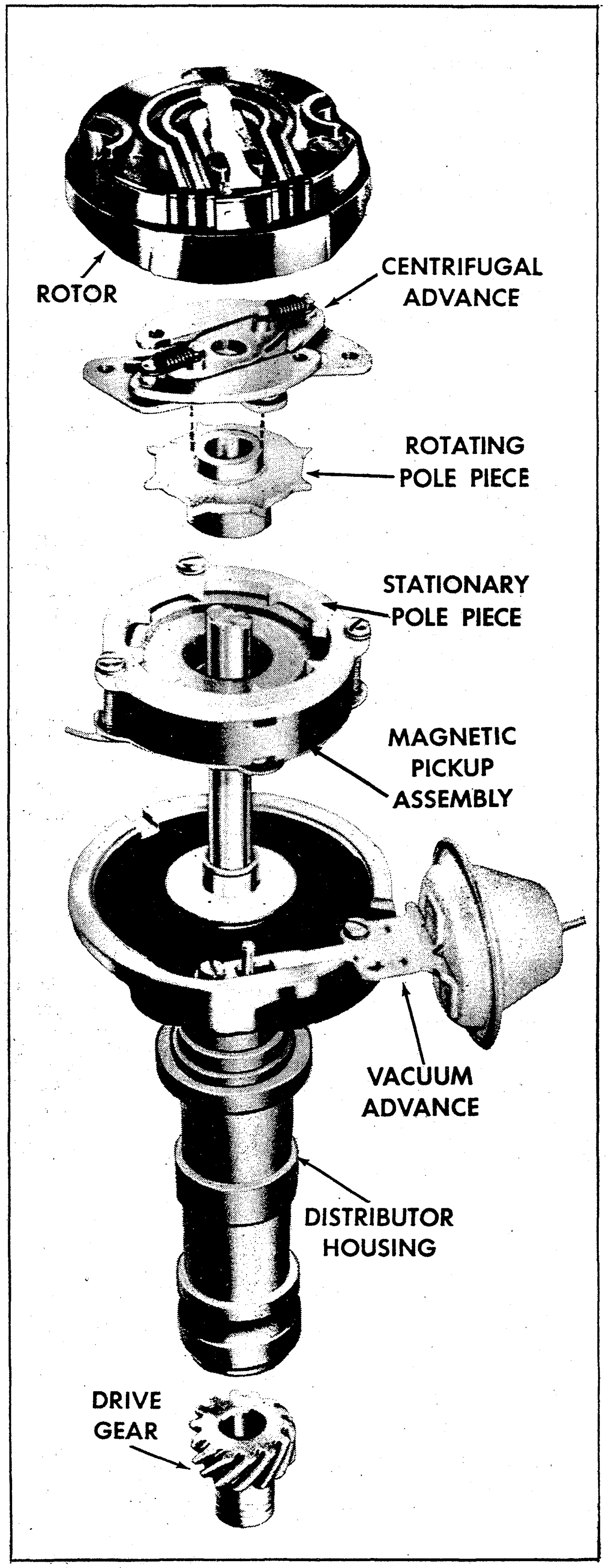


Fig. 16i—Magnetic Pulse Distributor Components

timing mark on pulley lines up with timing tab.
2. Position distributor to opening in block in normal installed attitude (fig. 15i), 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 (CORVETTE)

1. If vehicle is equipped with radio, remove three bolts securing ignition shield over distributor and coil. One bolt is accessible from the top of shield, the other two are at rear of shield, facing firewall.
2. Disconnect tachometer drive cables from distributor housing.
3. Disconnect pickup coil leads at connector.
4. Remove distributor cap.
5. Crank engine so rotor is in position to fire No. 1 cylinder and timing mark on harmonic balancer is indexed with pointer.
6. Remove vacuum line from distributor.
7. Remove distributor clamping screw and hold-down clamp.
8. 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, 9, and 12 of the service procedure listed below.

1. Remove screws securing rotor and remove rotor.
2. Remove centrifugal weight springs and weights.
3. Remove the tachometer drive gear from the distributor (Corvette only).
4. 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.

5. Remove drive shaft assembly.
6. Remove centrifugal weight support and timer core from drive shaft.
7. Remove connector from pickup coil leads.
8. Remove retaining ring which secures magnetic core support plate to distributor shaft bushing in housing.
9. As a unit, remove the entire magnetic pickup assembly from the distributor housing.
10. Remove brass washer and felt pad.
11. Remove vacuum advance unit.
12. To reassemble distributor, perform the above steps in reverse order.

INSTALLATION (CORVETTE)

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.
10. Connect tachometer drive cables to distributor body.
11. Replace ignition shields.

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 involves 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. On Corvettes equipped with radio, remove bolts securing ignition shield over distributor and 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. Replace ignition shield on Corvettes.
6. Start engine and test coil operation.

IGNITION PULSE AMPLIFIER

DISASSEMBLY

To check the amplifier for defective components, proceed as follows:

1. Remove the bottom plate from the amplifier.
2. To aid in reassembly, note the locations of the lead connections to the panel board.
3. Remove the three panel board attaching screws, and lift the assembly from the housing.
4. To aid in reassembly, note any identifying markings on the two transistors and their respective locations on the panel board and heat sink assembly.
5. Note the insulators between the transistors and the heat sink, and the insulators separating the heat sink from the panel board.
6. Remove the transistor attaching screws, and separate the two transistors and heat sink from the panel board.
7. Carefully examine the panel board for evidence of damage.

COMPONENT CHECKS (Figs. 17i and 18i)

With the two transistors separated from the assembly, an ohmmeter may be used to check the transistors and components on the panel board for defects. An ohmmeter having a 1-1/2 volt cell, which is the type usually found in service stations, is recommended. The low range scale on the ohmmeter should be used except where specified otherwise.

A 25 watt soldering gun is recommended, and a 60% tin 40% lead solder should be used when re-soldering. Avoid excessive heat which may damage the panel board. Chip away any epoxy involved, and apply new epoxy which is commercially available.

In order to check the panel board assembly, it is necessary to unsolder at the locations indicated in Figure 18i the two capacitors C2 and C3. In all of the following checks, connect the ohmmeter as shown and then reverse the ohmmeter leads to obtain two readings. The amplifier circuitry is shown in Figure 19i.

1. Transistors TR1 and TR2: Check each transistor by referring to Figure 20i. If both readings in Step 1 are zero, the transistor is shorted. If both readings in Step 2 are zero, the transistor is shorted; and if both readings are infinite, the transistor is open. Interpret Step 3 the same as Step 2.
2. Trigger Transistor TR3: If both readings in Step 1 are zero, the transistor is shorted. If both readings in Step 2 are zero, the transistor is shorted; and if both readings are infinite, the transistor is open. Interpret Step 3 the same as Step 2.
3. Diode D1: If both readings are zero, the diode is shorted; and if both readings are infinite, the diode is open.
4. Capacitor C1: If both readings are zero, the capacitor is shorted.
5. Capacitors C2 and C3: Connect the ohmmeter across

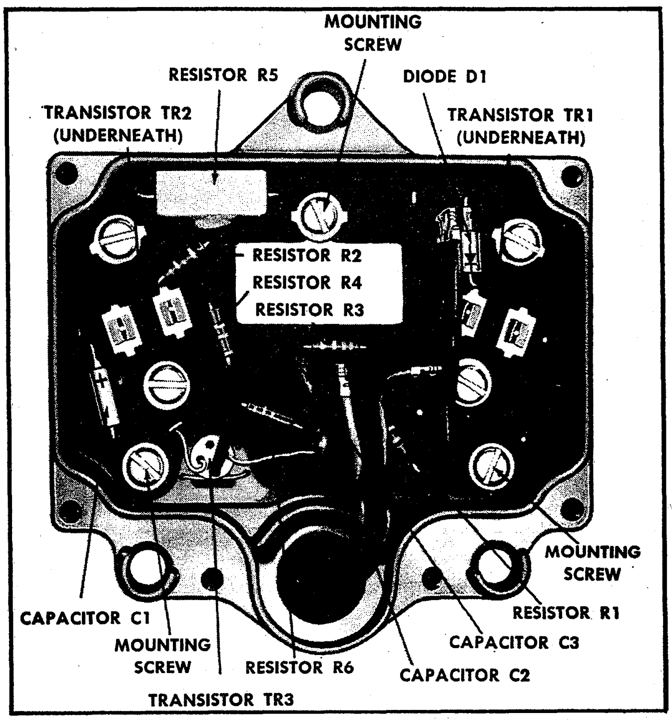


Fig. 17i—Pulse Amplifier Panel Board

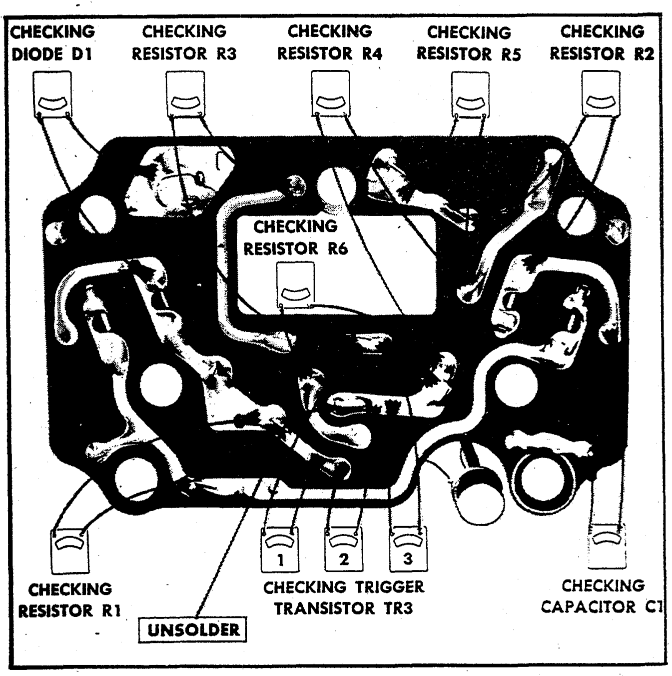


Fig. 18i—Pulse Amplifier Component Checks

each capacitor (not illustrated). The capacitor is shorted if both readings are zero.

6. Resistor R1: The resistor is open if both readings are infinite.
7. Resistor R2: Use an ohmmeter scale on which the 1800 ohm value is within, or nearly within, the middle third of the scale. If both readings are infinite, the resistor is open.
8. Resistor R3: Use an ohmmeter scale on which the 680 ohm value is within, or nearly within, the middle third of the scale. If both readings are infinite, the resistor is open.
9. Resistor R4: Select an ohmmeter scale on which the 15000 ohm value is within, or nearly within, the middle third of the scale. If either reading is infinite, the resistor is open.
10. Resistor R5: Use the lowest range ohmmeter scale. The resistor is open if either reading is infinite.

    NOTE: This resistor on some applications may be located in the vehicle wiring harness, and not on the panel board.

11. Resistor R6: An ohmmeter scale on which the 150 ohm value is within or nearly within, the middle third of the scale should be used. If both readings are infinite, the resistor is open.

REASSEMBLY

During assembly, coat with silicone grease both sides of the flat insulators used between the transistors and heat sink, and also the heat sink on the side on which the transistors are mounted. The silicone grease, which is available commercially, conducts heat and thereby provides better cooling.

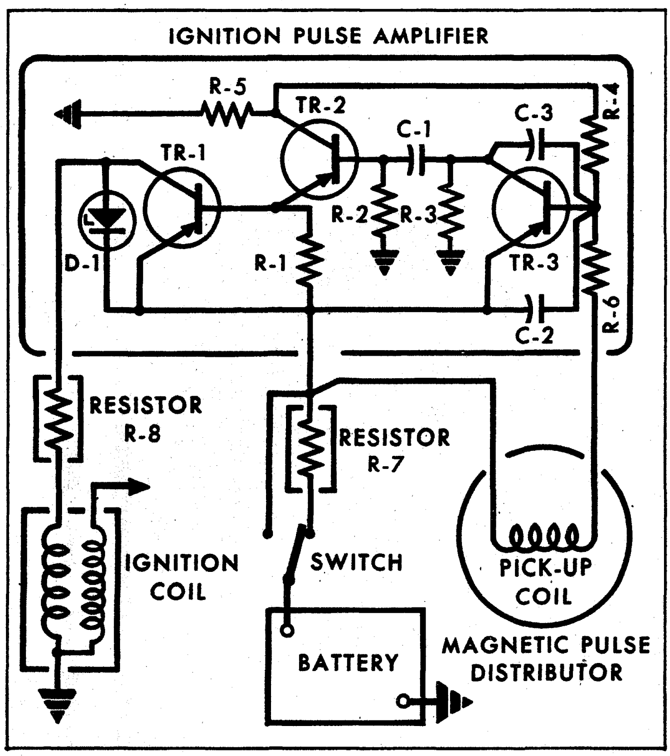


Fig. 19i—Pulse Amplifier Internal Circuitry

IGNITION SWITCH REPLACEMENT (Figs. 21i to 23i) CHEVROLET, CHEVY II AND CORVETTE

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 using Tool J-7607 (Fig. 21i).
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 tangs on the connector from their position on the switch as shown in Figure 22i. 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.

CHEVELLE

1. Disconnect battery ground cable.
2. Remove ash tray, retainer attaching screws and retainer.
3. Remove A/C distributor duct retaining screws and duct.

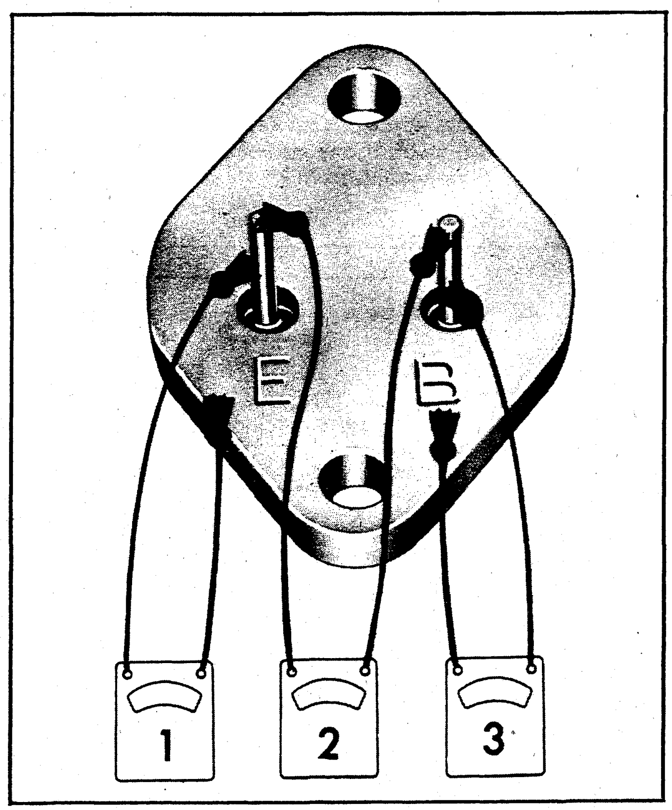


Fig. 20i—Transistor Checking

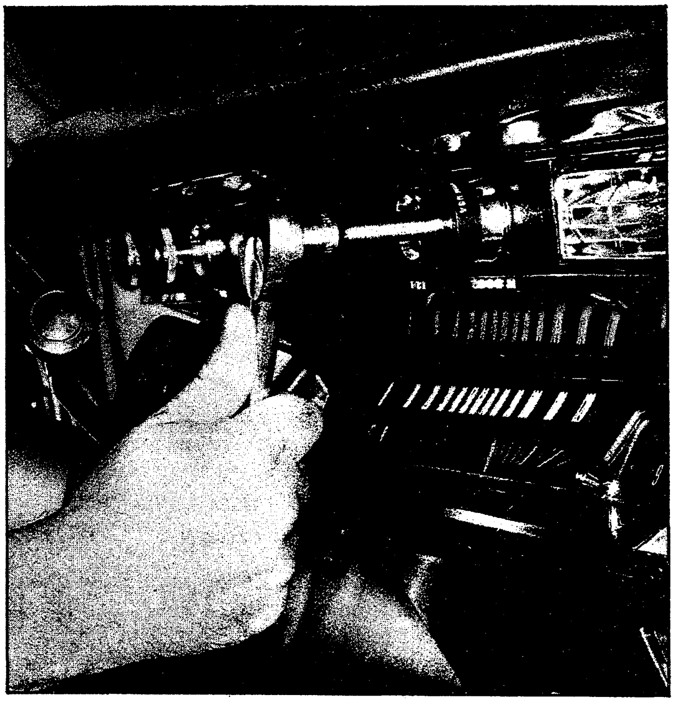


Fig. 21i—Removing Ignition Switch Nut

4. Remove heater and/or A/C control panel assembly retaining screws and push panel assembly from console.

   NOTE: If interference between control panel and radio is encountered, loosen radio retaining nuts.

5. Remove radio control knobs, bezels and retaining nuts.
6. Disconnect radio wiring harness and antenna lead-in.
7. Remove radio rear brace attaching screw and remove radio from vehicle.

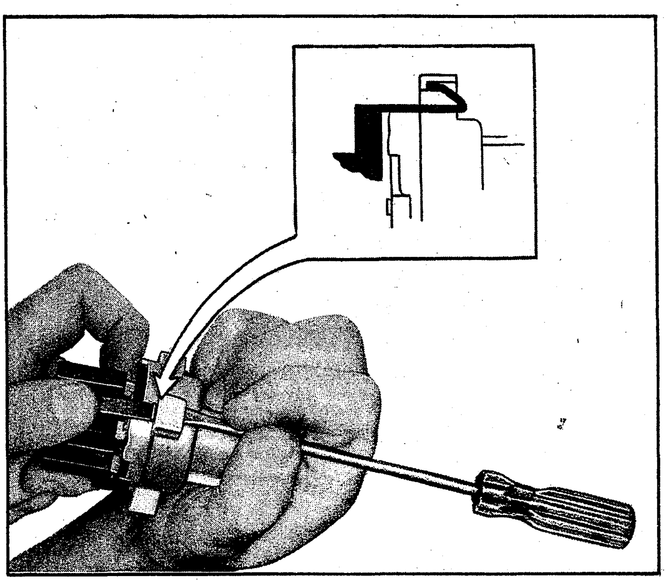


Fig. 22i—Unlocking Ignition Switch Connector

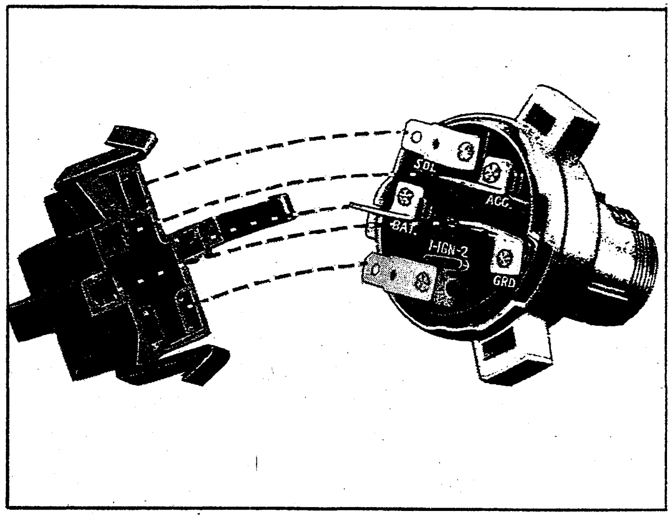


Fig. 23i—Switch and Connector Unplugged

8. Remove ignition switch bezel nut using Tool J-7607 and push switch rearward from panel opening.
9. Disconnect wiring connector from rear of switch.
10. To install, reverse removal procedure.

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 plug gap to specifications (fig. 24i).

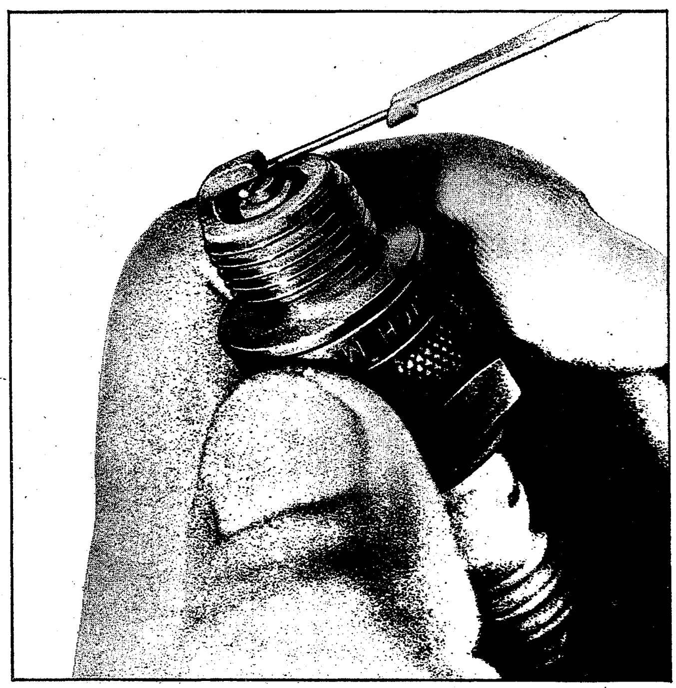


Fig. 24i—Setting Spark Plug Gap

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 specifications. 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 shaft 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).

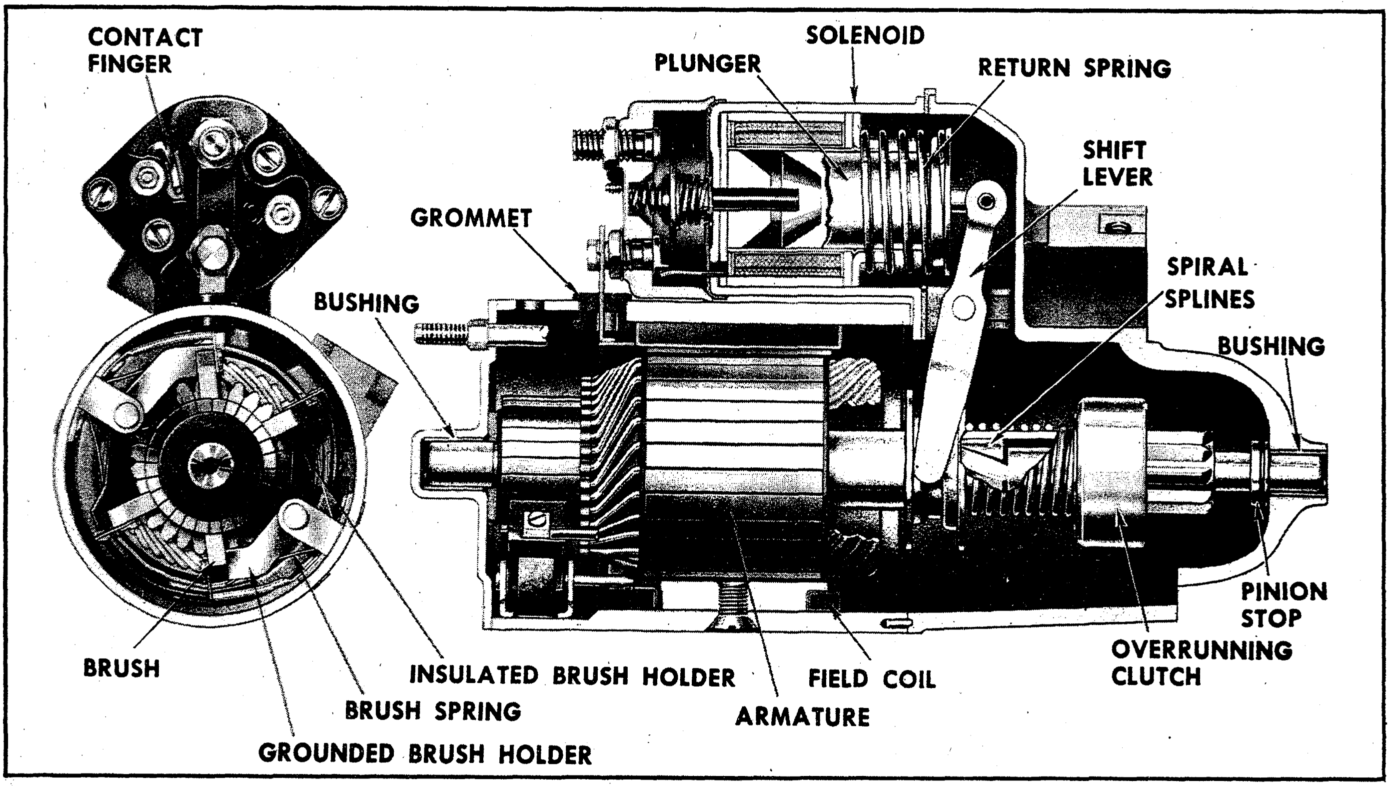


Fig. 1s—Starting Motor Cross Section (Typical)

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 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.

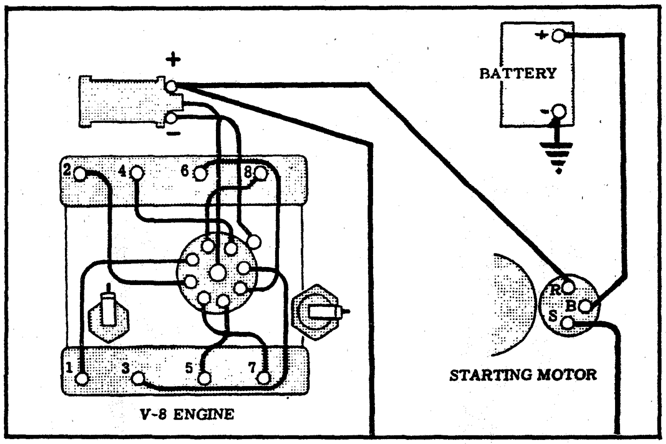


Fig. 2s—V-8 Starting Circuit Diagram

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)

The following procedure is a general guide for all vehicles and will vary slightly depending on series and model.

1. Disconnect battery ground cable at battery.
2. Raise vehicle to a good working height.
3. Disconnect all wires at solenoid terminals.

   NOTE: 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. Torque the mount bolts to 25-35 ft. lbs. first, then torque brace bolt.
7. Check operation of starter on vehicle.

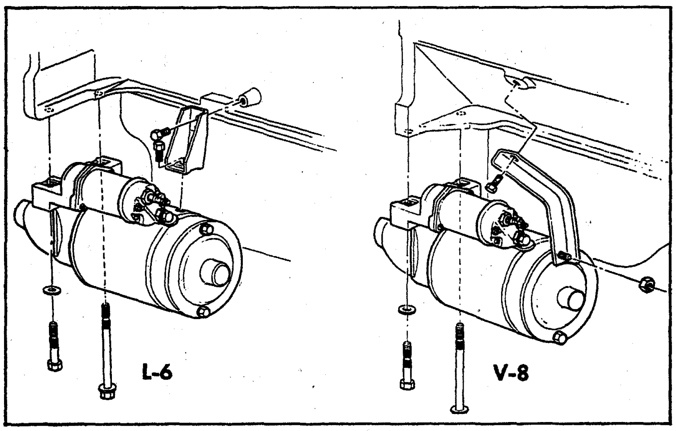


Fig. 3s—Starter Mounting

SPECIAL TOOLS

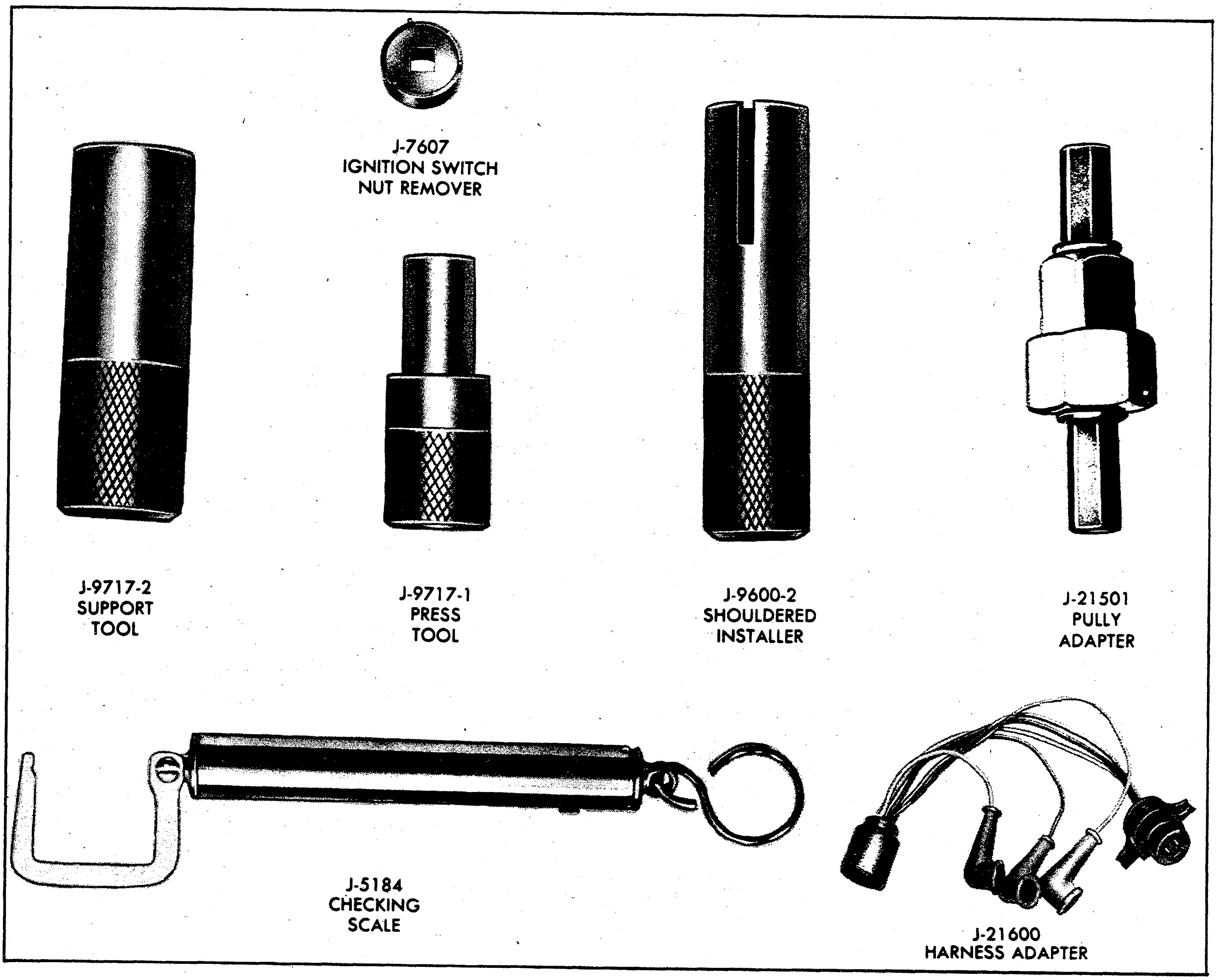


Fig. 4s—Special Tools

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 reengagement 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.

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

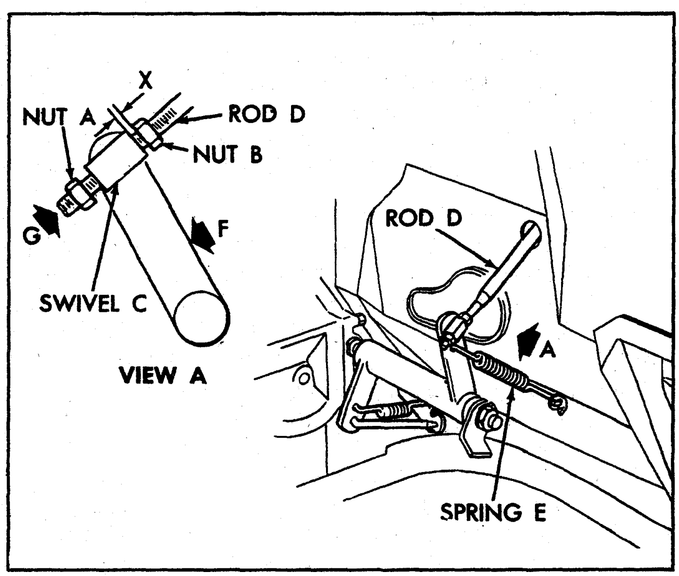


Fig. 1 - Chevrolet Clutch Pedal Free Travel Adjustment

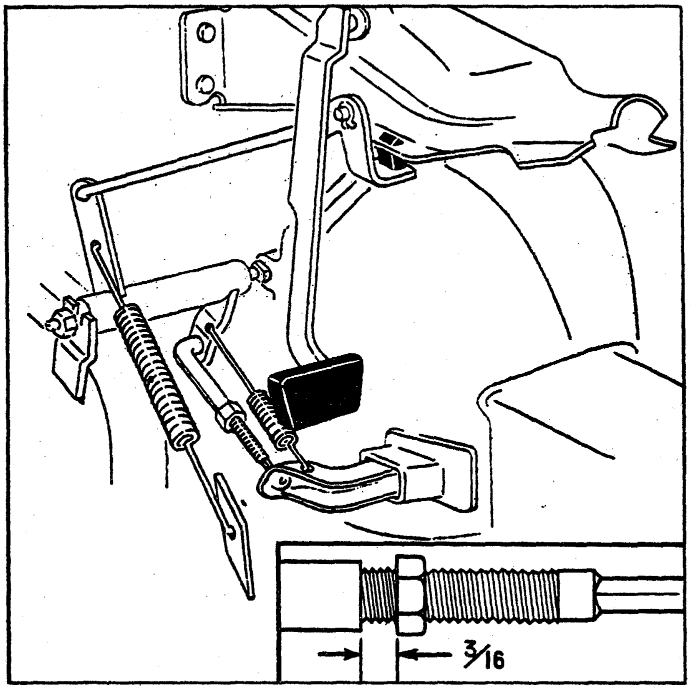


Fig. 2 - Chevelle Clutch Pedal Free Travel Adjustment (V-8 Shown)

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 1-1/4" free travel (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 9/32". 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 1" to 1-1/2" 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 (1" to 1-1/2" 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 locknut "A".
3. Recheck pedal free travel.

NOTE: A measurement of approximately 3/16" 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 3/16" clearance between clutch fork and end of rod, then tighten locknut to 8-12 lbs. ft. and check free travel at pedal. Pedal free travel on all models should be 1" to 1-1/2".

Corvette Linkage Adjustment

Refer to fig. 1 and the following procedure:

1. Disconnect pedal return spring.
2. With Nuts (A) and (B) loose on Rod (D) apply push hard load in direction of arrow (F) to eliminate clearance between throwout bearing and clutch fingers.
3. Run Nut (B) towards Swivel (C) until dimension (X) is 3/8" to 7/16".
4. Tighten Nut (A) to lock swivel against Nut (B).
5. Connect pedal return spring and check pedal free travel for 1-1/4" minimum to 2" maximum.
6. Check every 3,000 miles.
7. Adjust free travel to 2" to 2-1/2" for heavy duty operation. The return spring may be removed for heavy duty conditions.

Camaro Linkage Adjustment

Refer to Figure 4 and the following procedure:

Apply a 10 lb. load in direction of Arrow (E) to hold Clutch Pedal against Clutch Pedal Bumper.

Apply a 10 lb. load to Clutch Fork in direction of Arrow (D) to eliminate clearance between throwout bearing and clutch fingers.

Insert a .198 Spacer (F) between clutch fork and Adjusting Rod (A).

Rotate Adjusting Rod against Spacer until it has a 5 in. lb. torque.

Hold Adjusting Rod and tighten Nut (C) against Swivel (B) or Rod (B).

Remove Spacer. Install return spring and extension to clutch fork.

Pedal will have approximately 1" to 1-1/8" free travel.

A clutch that has been slipping prior to free play adjustment may still slip right after the new adjustment due

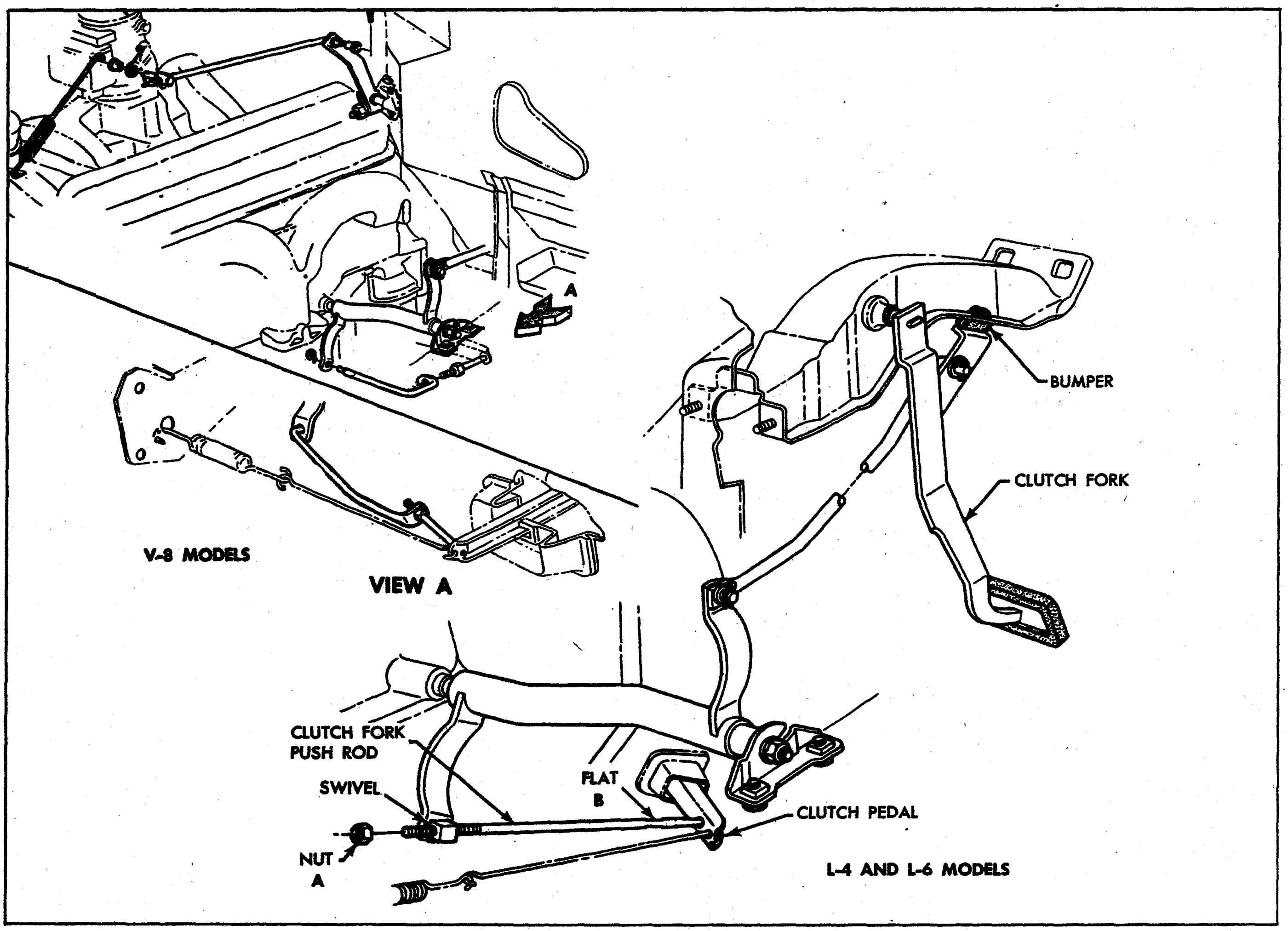


Fig. 3 - Chevy II Clutch Pedal Free Travel Adjustment

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.

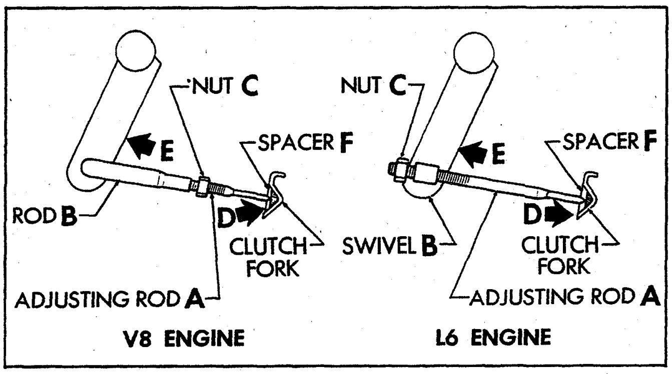


Fig. 4 - Clutch Pedal Free Travel Adjustment

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. On Corvette models use Moly Grease.
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). On Corvette models use Moly Grease.
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.

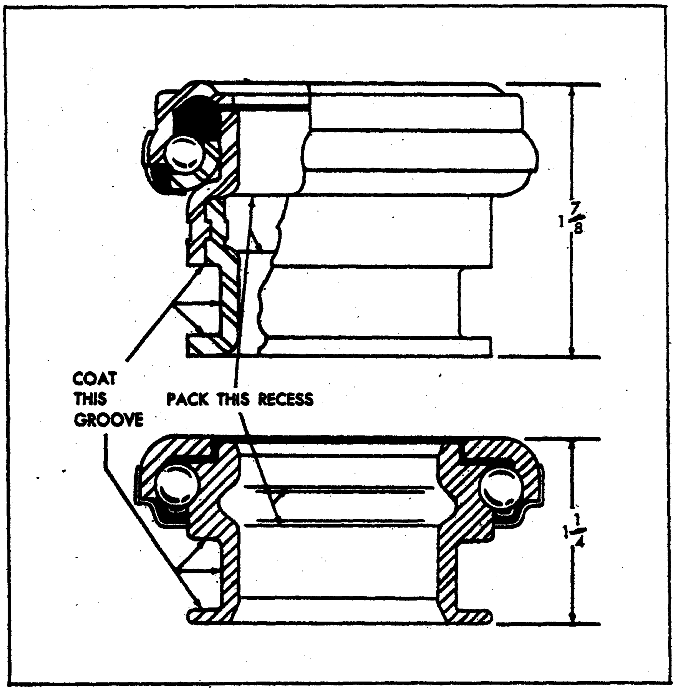


Fig. 5 - Release Bearing Lubrication and Comparison

CLUTCH CROSS SHAFT (Figs. 6, 7 & 8)

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.

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. Figures 6, 7 & 8 show 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.

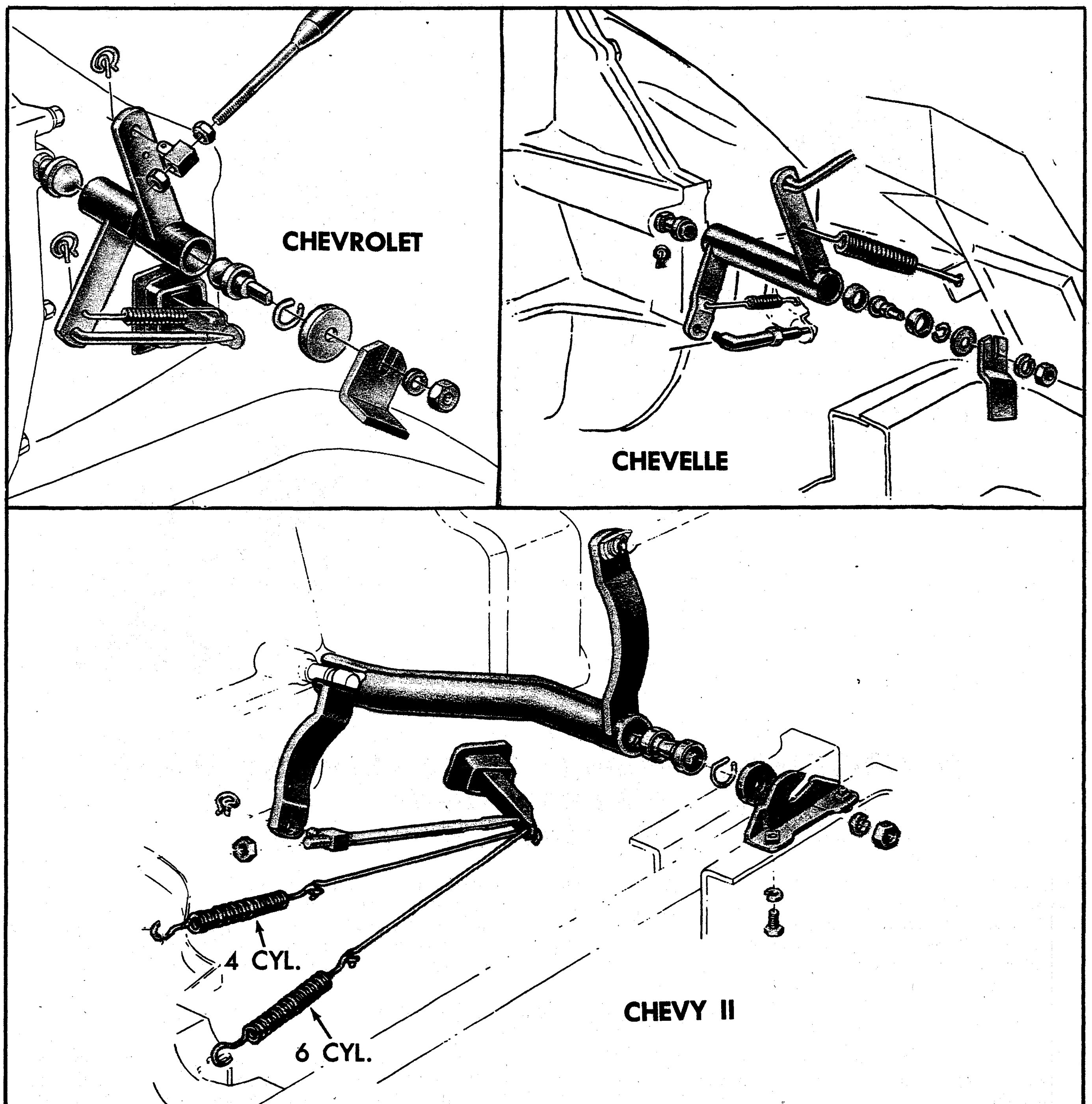


Fig. 6 - Lower Linkage Details (Chevrolet, Chevelle & Chevy II)

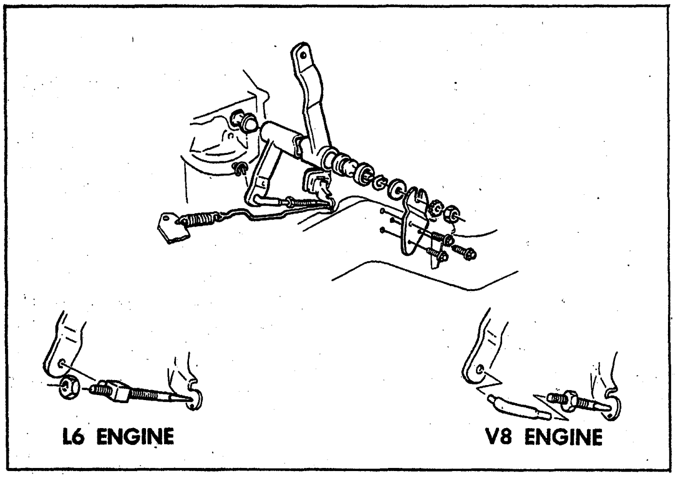


Fig. 7 - Lower Linkage Details - Camaro

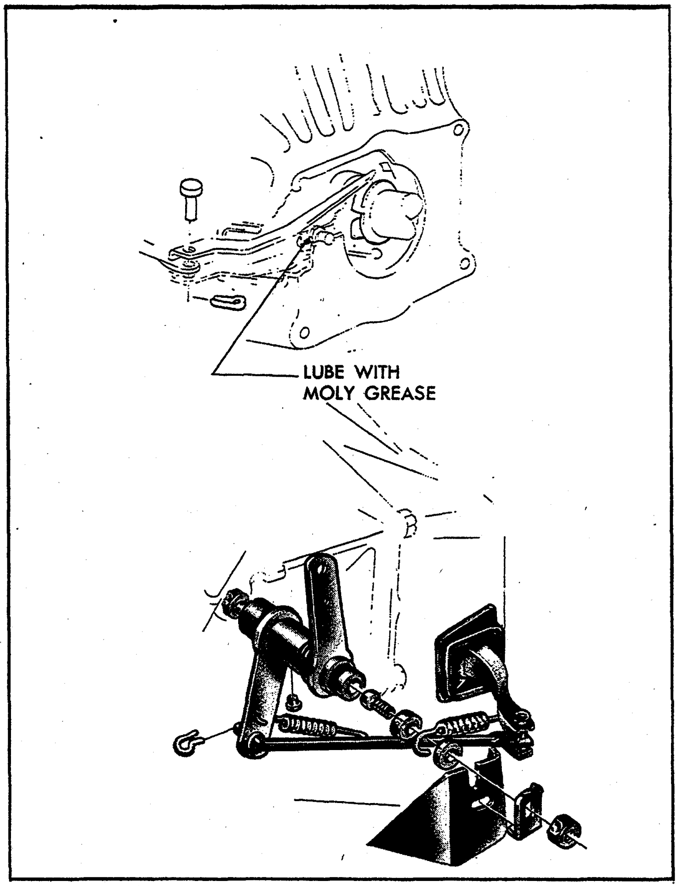


Fig. 8 - Corvette Lower Linkage Details

THREE-SPEED (SAGINAW FULLY SYNCHRONIZED) TRANSMISSION

INDEX

GENERAL DESCRIPTION

The Saginaw three speed fully synchronized (all forward gears) transmission incorporates helical drive gears throughout.

The main drive gear is supported by a 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 ball bearing mounted in the front of the extension housing.

The countergear is carried on a single 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. An anti-rattle plate assembly at the front of the countergear provides a constant spring tension between the counter and clutch gears to reduce torsional vibrations. The reverse idler gear is carried on a bushing finish bored in place. It rotates on a short idler shaft with a steel thrust washer tanged into the case against the rear face. Forward movement is stopped by a snap ring on the idler shaft.

Gear shifting is manual through shift control rods to the rearward shift lever of the side cover assembly for first and reverse gear; and through a cross shaft assembly (Chevrolet models) attached to the forward side cover lever for second and third gear. All three forward gears are fully synchronized. The synchronizer assemblies consist of a clutch hub, clutch sleeve, two clutch key springs and three energizer clutch keys and are retained as an assembly on the main shaft by a snap ring.

The transmission may be used as an aid in deceleration by downshifting in sequence without double-clutching or any gear clashing. Reverse is not synchronized, however, it is a helical gear to insure quiet operation.

MAINTENANCE AND ADJUSTMENTS

CHEVROLET, CHEVELLE, CHEVY II, CAMARO, SHIFT LINKAGE ADJUSTMENT

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. This may be done by having an assistant hold the mast jacket shift levers aligned in neutral position or use a simple gauge or pin to align these levers in neutral.
3. Make necessary adjustment to align shift control rods and transmission levers in neutral position.

Move selector lever through all positions to check adjustment and to insure over-travel in all positions.

FLOOR SHIFT LINKAGE ADJUSTMENT

1. Set Transmission Levers (K) and (L) in neutral detent position.
2. Move Transmission Control Lever (A) to neutral detent and insert Locating Pin (D) into notch of Lever and Bracket Assembly.
3. Install Nut (N) and Clevis (M) on Rod (J) loosely, attach Rod to Lever (B) and secure with retainer.
4. With Lever (B) against Locating Pin, adjust Clevis at Lever (L) until Clevis pin passes freely through holes and secure with washer and cotter pin. Tighten Nut (N).
5. Install Nuts (E) and (G) and Swivel (F) loosely on Rod (H), attach Rod to Lever (K) and secure with retainer.
6. With Lever (C) against Locating Pin, attach Swivel to lever and secure with retainer. Run Nut (G) against Swivel, then tighten Nut (E) against Swivel.
7. Remove Locating Pin and check shifts to insure proper operation. Readjust clevis and swivel if necessary.

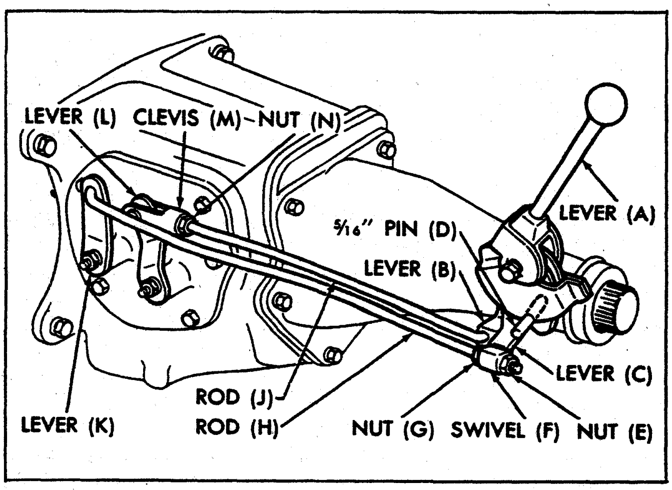


Fig. 1A - Shift Linkage Adjustment (Typical)

SHIFT CONTROL LEVER AND BRACKET ASSEMBLY

If disassembly of this control lever and bracket assembly is necessary refer to Figure 2A for parts breakdown and relative positioning for assembly.

SPEEDOMETER DRIVEN GEAR

Disconnect speedometer cable, remove lock plate to extension bolt and lock washer and remove lock plate. Insert screwdriver in lock plate slot in fitting and pry fitting gear and shaft from extension. 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 extension and install in extension. Push fitting into extension until lock plate can be inserted in groove and attach to extension.

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 straight in bore in case extension. Using Tool J-5154, tap seal into counterbore until flange bottoms against extension.

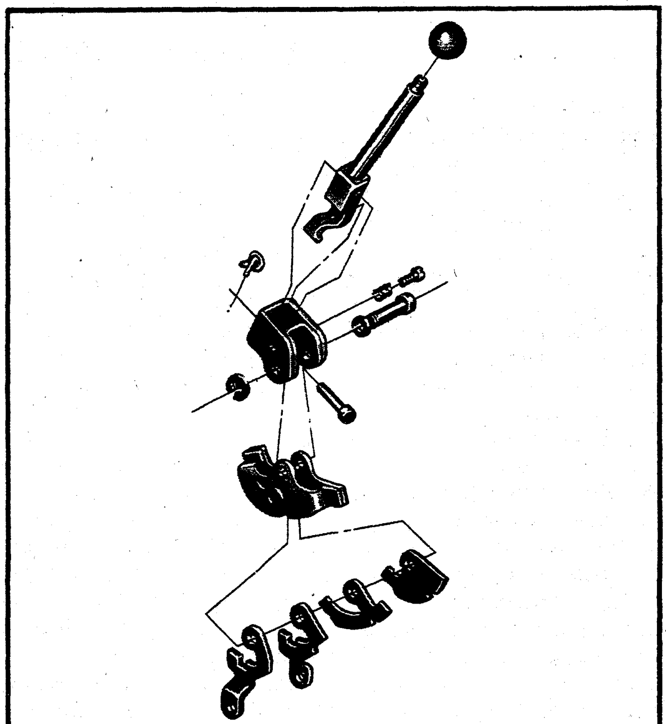


Fig. 2A - Corvette 3 Speed Control Lever and Bracket Assembly

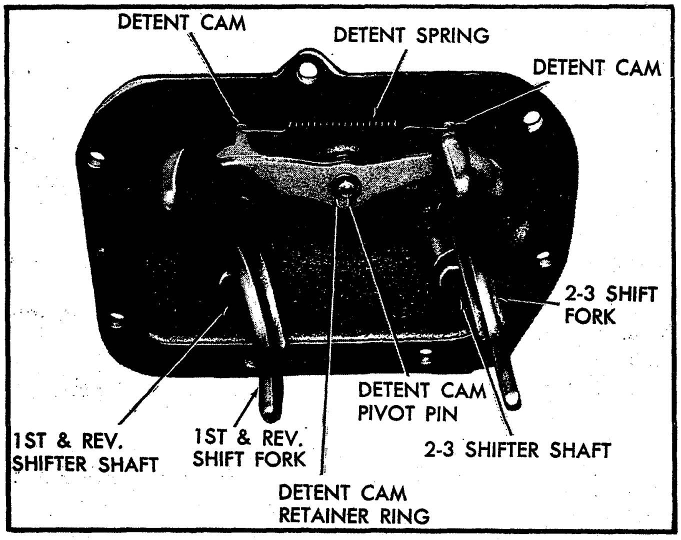


Fig. 3A - Transmission Side Cover, Shift Fork and Detent Assembly

5. Reinstall propeller shaft and any items removed to obtain clearance.

TRANSMISSION SIDE COVER

Removal

1. Disconnect control rods from levers; remove 2-3 cross shaft (Chevrolet)
2. Shift transmission into neutral detent positions before removing cover.
3. Remove cover assembly from transmission case carefully and allow oil to drain.

Disassembly (Fig. 3A)

1. Remove the outer shifter levers.
2. Remove both shift forks from shifter shaft assemblies. Remove both shifter shaft assemblies from cover. "O" ring seals around shifter shaft 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 damaged parts.

Assembly (Fig. 3A)

1. With detent spring tang projecting up over the 2nd and 3rd shifter shaft cover opening install the first and reverse detent cam onto the detent cam pivot pin. With the detent spring tang projecting up over the first and reverse shifter shaft cover hole install the 2nd and 3rd detent cam.
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 seals. Install both shift forks to shifter shaft assemblies, lifting up on detent cam to allow forks to fully seat into position.
4. Install outer shifter levers, flat washers, lock washers and bolts.

Installation

1. Shift shifter levers into neutral detent (center) 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 specified torque.
4. Remove filler plug and add lubricant specified in Section 0, to level of filler plug hole.

COMPONENT PART REPLACEMENT

TRANSMISSION REPLACEMENT (EXC. CORVETTE)

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 clutch 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 50 ft. lbs.
3. Repositioning 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. (Fig. 4A)

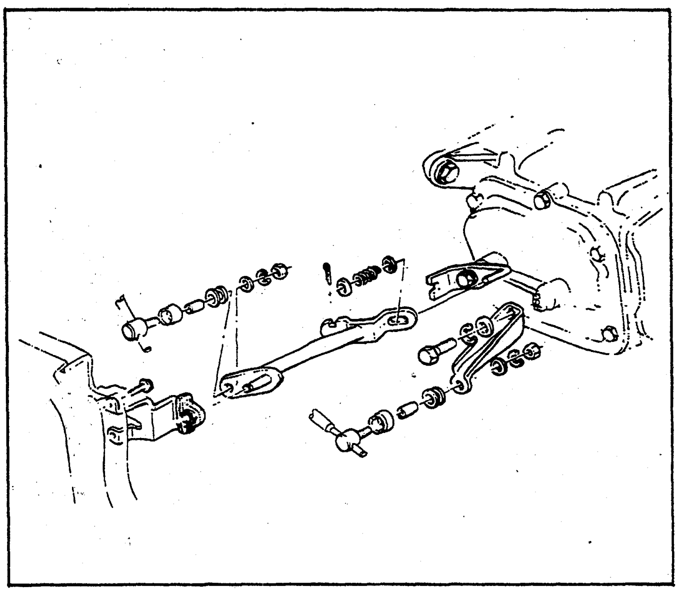


Fig. 4A - Chevrolet 2-3 Shift Lever Cordon Shaft

6. Connect speedometer cable.
7. Install propeller shaft assembly.
8. Fill transmission with lubricant specified in Section O.

CORVETTE TRANSMISSION REPLACEMENT

1. Disconnect battery ground cable.
2. Disassemble transmission shift control lever by unscrewing ball from lever, lifting out "T" handle return spring and "T" handle, then remove the anti-rattle bushings.
3. Raise front and rear of vehicle.
4. Insert a block of wood between the top of the differential carrier housing and the underbody (to prevent upward travel of the carrier when the carrier front support is disconnected).
5. Disconnect the differential carrier front support from its frame bracket, by removing the nut on the underside of the biscuit mount.
6. Pry the carrier downward to relieve load while removing the two center mounting bolts from the carrier front support. (To pry carrier downward insert crowfoot end of a pry bar through the opening in the carrier front support, hooking end of bar over top of the center mounting bolt pad cast in the underside of the carrier.)
7. Pivot carrier support downward for access to prop shaft "U" joint.
8. Disconnect prop shaft front and then rear "U" bolts.
9. Disconnect parking brake cable from ball socket at idler lever located near center of underbody.
10. Remove prop shaft by moving shaft forward.
11. Remove heat deflectors from the right and left exhaust pipe.
12. Remove left bank exhaust pipe.
13. Remove right bank exhaust pipe and heat riser.
14. Disassemble the transmission mount, as follows:
    a. Remove the two bolts that attach rear mount cushion to the rear mount bracket.
    b. Support engine under oil pan and raise engine to remove load from rear mount cushion.

CAUTION: To avoid damage to oil pan, a suitable wide base, heavy wood platform should be placed between the jack pad and the oil pan.

    c. Remove the three transmission mount bracket-to-crossmember bolts and remove mount bracket.
    d. Remove the two bolts from mount pad to transmission case and remove rubber mount cushion and exhaust pipe "yoke".

15. Disconnect transmission linkage by removing the shift levers at the transmission side cover.
16. Disconnect speedo cable at transmission extension.
17. Remove transmission output shaft slip yoke.

NOTE: The yoke is removed to avoid tearing the heat reflecting pad on the underbody, when the transmission is being removed.

18. Remove two bolts to disconnect the transmission gearshift control lever and bracket assembly from its adapter plate on side of transmission. Lower transmission assembly from the vehicle, letting the gearshift lever slide down and through the dust boot in the console.
19. Remove transmission-to-clutch housing attaching bolts.
20. Slide transmission assembly rearward from clutch and rotate transmission for access to the three flat head machine screws in the control lever bracket adapter plate. Remove adapter plate. Rotate transmission back to the upright position.
21. To allow room for transmission removal slowly lower the rear of engine until the tachometer drive cable at the distributor just clears the horizontal ledge across the front of dash.

CAUTION: The tachometer cable can be easily damaged by heavy contact with the dash. Slide transmission rearward out of the clutch, then tip front end of transmission downward and lower the assembly from vehicle.

22. Reinstall transmission assembly by performing above steps in reverse order.

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.

With the overdrive unit engaged, the transmission should not be left in any forward gear with intent of locking the drive-line as the overrunning clutch is a free-wheeling condition.

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.
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/OR "O" RING OIL SEALS

To remove the control shaft, disconnect the control cable, remove tapered pin and pull lever out. Replace the two "O" ring seals on the control shaft. Insert shaft and new "O" ring seals into housing 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.

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.

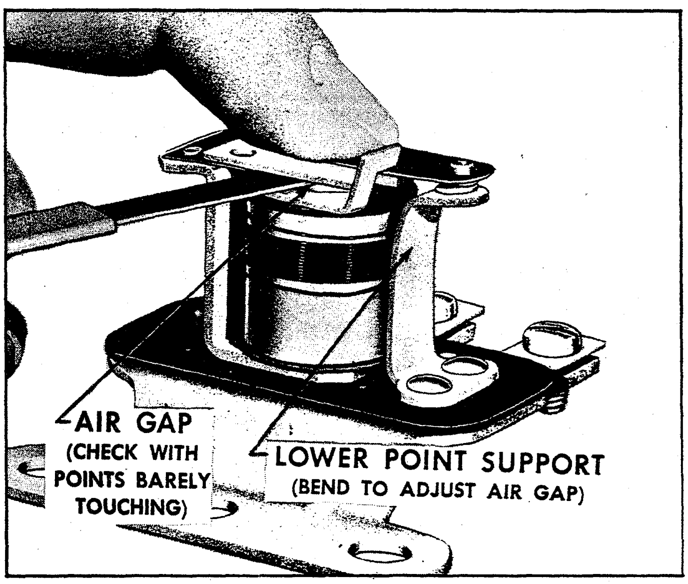


Fig. 1B - Checking Relay Air Gap

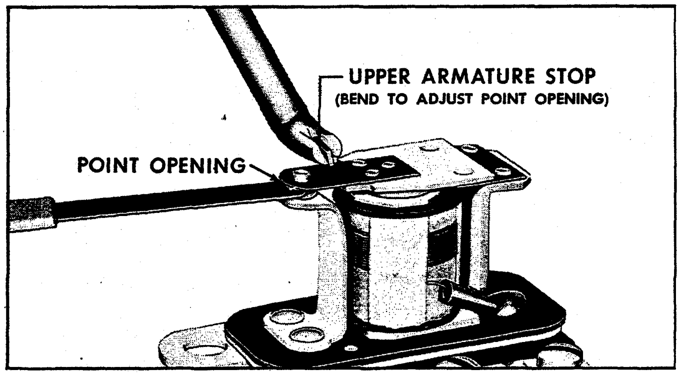


Fig. 2B - Adjusting Relay Point Opening

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).

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.

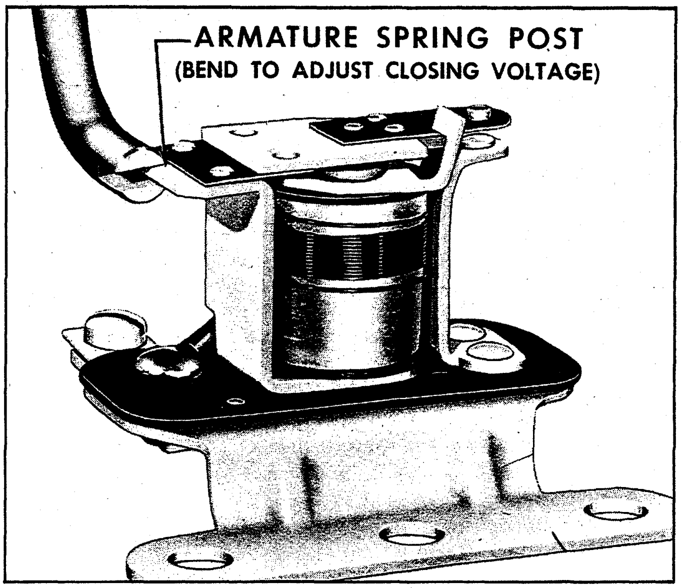


Fig. 3B - Adjusting Relay Closing Voltage

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.

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 adpater 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".

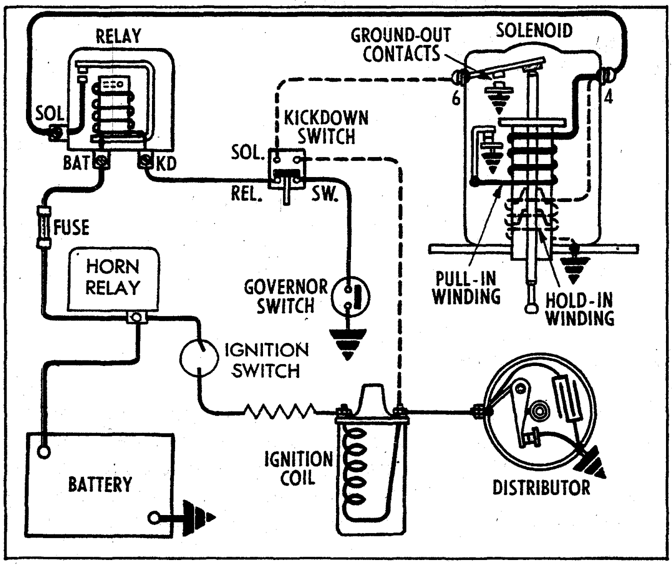


Fig. 4B - Overdrive Electrical Circuit Wiring Diagram

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 release 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 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.

THREE-SPEED HEAVY DUTY TRANSMISSION (WARNER MODEL T 16)

INDEX

GENERAL DESCRIPTION

The Borg-Warner heavy duty three speed fully synchronized (all forward gears) transmission incorporates helical gears throughout specially designed to provide high torque capacity, and gear teeth proportion 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 in the front of the extension housing.

The countergear 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. An anti-rattle plate assembly at the front of the countergear provides a constant spring tension between the counter and clutch gears to reduce torsional vibrations. The reverse idler gear is carried on 25 roller bearings while thrust is taken on thrust washers located between the ends of the gear and the thrust bosses of the case.

Gear shifting is manual through shift control rods from the shifter tube in the mast jacket to the rearward shift lever of the side cover assembly for first and reverse gear; and through a cross shaft assembly attached to the forward side cover lever for second and third gear. All three forward gears are fully synchronized. The synchronizer assemblies consist of a clutch hub, clutch sleeve, two clutch key springs and three energizer clutch keys and are retained as an assembly on the main shaft by a snap ring. The transmission may be used as an aid in deceleration by downshifting in sequence without double-clutching or any gear clashing. Reverse is not synchronized, however, it is a helical gear to insure quiet operation.

MAINTENANCE AND ADJUSTMENTS

Refer to similar procedures under the 3-speed Saginaw Transmission Section for--Column Mounted Shift Linkage Adjustment, Speedometer Driven Gear and Oil Seal Replacement, Extension Oil Seal Replacement and Transmission Replacement.

Camaro and Corvette Floor Shift Linkage Adjustment (Fig. 1c)

1. Set Lever (L), (K) in neutral position.
2. Move Lever Assembly (A) and Levers (C), (D) to neutral position and insert Locating Gauge (B) into control Lever Bracket Assembly.
3. Install Rod (H) with Retainer (M) on Lever (L).
4. With two Jam Nuts (G), (E) and Swivel (F) loose on Rod (H) insert and attach Swivel with Retainer (N) to Lever (D).
5. Repeat steps 3 and 4 for Rod (J) and Levers (C & K).
6. Remove Locating Gauge and check shift to insure proper operation.

SIDE COVER ASSEMBLY

Removal

1. Drain transmission and disconnect control rod and cross shaft from side cover levers.
2. Remove nine cap screws securing the transmission side cover assembly to transmission case and remove cover assembly, shifting forks and gasket.

Disassembly (Fig. 2C)

1. Remove shifting forks from shift lever assemblies.
2. Remove nut and lock washer from each shift lever shaft.
3. Remove outer shift levers and lightly tap shift lever shafts from assembly.
4. Remove two steel balls, poppet spring, interlock pin and interlock sleeve from cover.
5. Remove "O" ring seals from shift lever shafts.

Assembly (Fig. 2C)

1. Install new "O" ring seals to shift lever shafts.
2. Install low and reverse shifter shaft and plate assembly to cover.
3. Place shifter shaft and plate assembly in neutral position, middle detent, and install interlock sleeve, ball, poppet spring and interlock pin.
4. Install remaining poppet ball and then install second and third shifter shaft and plate assembly.

NOTE: Installation is easiest if shifter shaft and plate assembly passes over ball in its neutral position.

5. Check clearance between end of interlock sleeve and shifter shaft and plate cams when one plate is in neutral and the other is shifted into gear position.

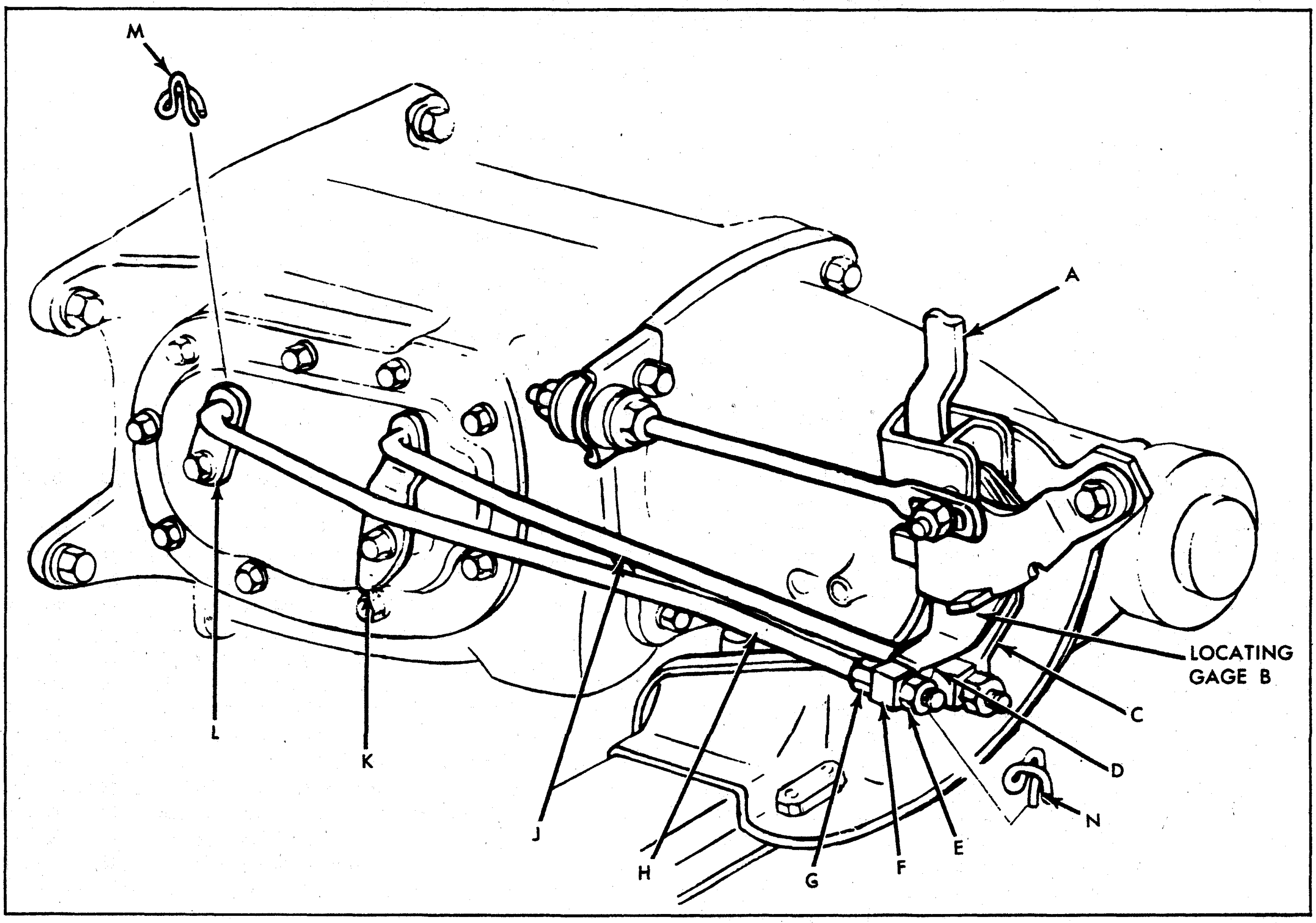


Fig. 1C - Warner T-16 3-Speed Lever and Linkage Adjustment (Camaro and Corvette)

Clearance should be .002 to .008. Interlock sleeves are available in four sizes to give the proper clearance.

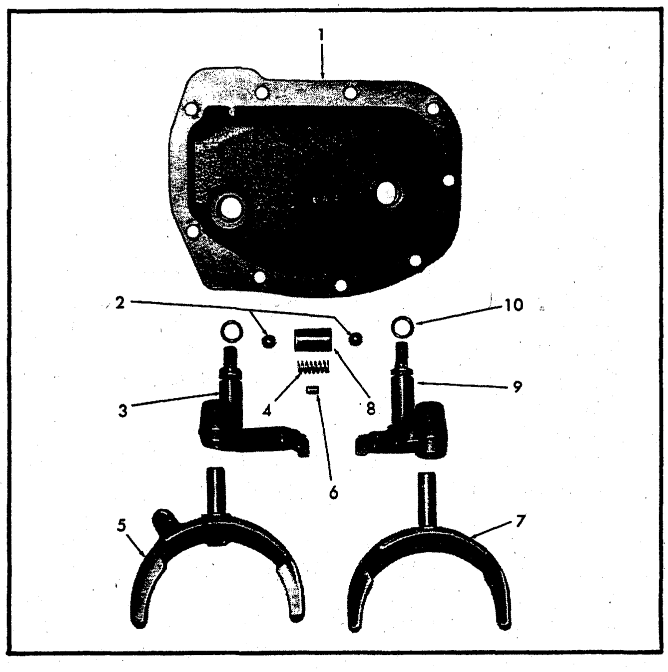
6. Install outer shifter levers to shafts with lock washers and nuts. Tighten securely.
7. Install shifting forks to shift levers (1st and reverse fork "hump" towards bottom).

Installation

1. Install new side cover gasket to transmission case, install cover and secure with lock washers and cap screws.

   NOTE: The two rear side cover to case attaching bolts have a special oil sealing spline and must be used at these two "through" hole locations.

2. Connect control rod and cross shaft to control levers.



1. Side Cover
2. Poppet
3. 1st and Reverse Shifter Lever and Shaft
4. Poppet Spring
5. 1st and Reverse Shifter Fork
6. Interlock Pin
7. 2nd and 3rd Shifting Fork
8. Interlock Sleeve
9. 2nd and 3rd Shifter Lever and Shaft
10. "O" Ring Seal

Fig. 2C - Side Cover Assembly - Layout

FOUR-SPEED TRANSMISSION (MUNCIE)

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 (EXC. CORVETTE AND CAMARO) (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.

CORVETTE AND CAMARO SHIFT LINKAGE ADJUSTMENT (Fig. 2M)

1. Set Transmission Shift Levers in neutral position.
2. Move Shift Lever (A) to neutral position and insert Locating Gauge (C) into control Lever Bracket Assembly (B).
3. Install Reverse Rod (J) with Retainer on Lever (O).
4. With two Jam Nuts and Swivel loose on Rod (J) insert and attach Swivel with Retainer to Lever (D).

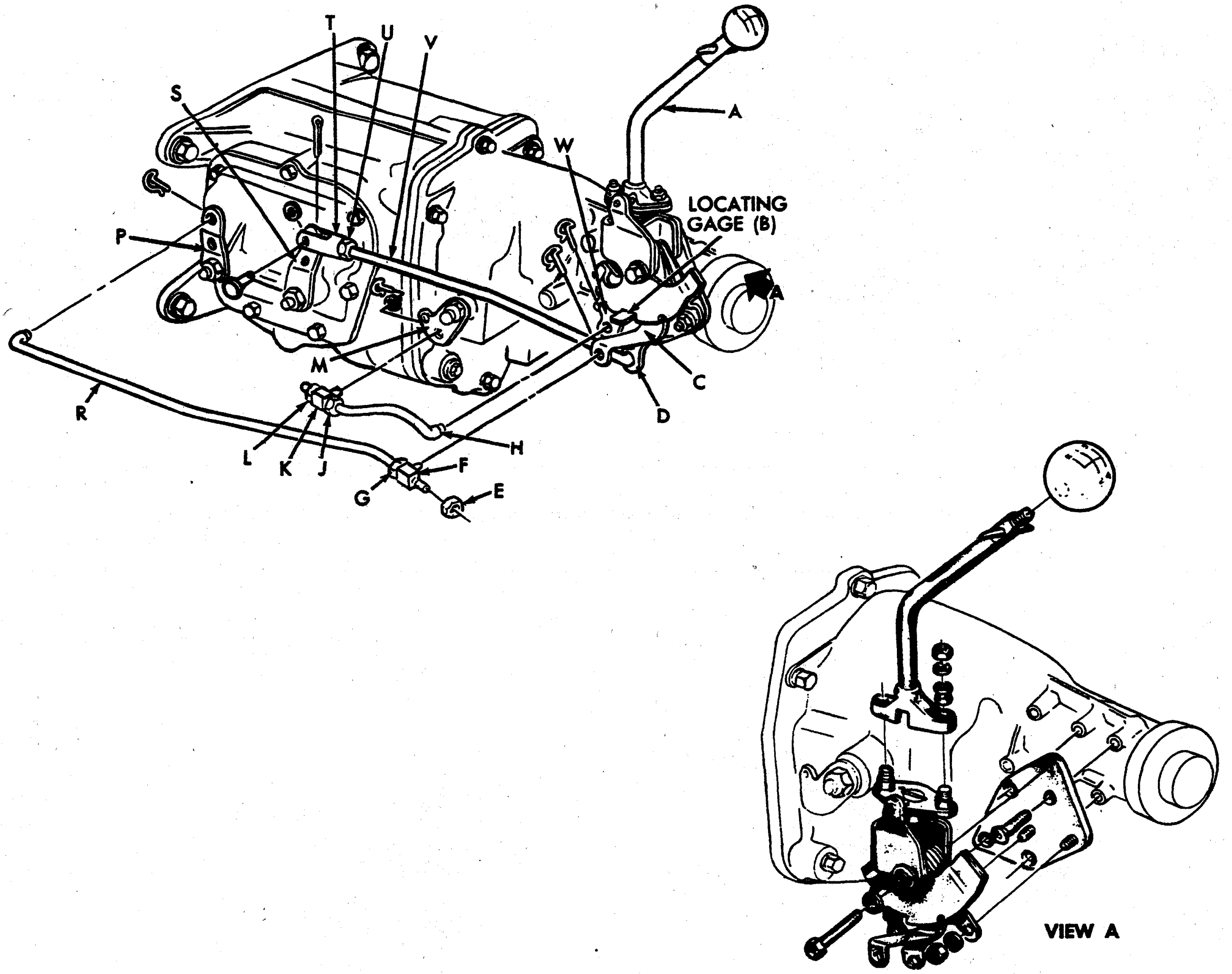


Fig. 1M - Four-Speed (Muncie) Transmission Gearshift Linkage (Chevrolet Shown)

5. Repeat steps 3 and 4 for Rod (K) and (L).
6. Remove Locating Gauge and check shift to insure proper operation.

GEAR SHIFT LEVER REVERSE BLOCKER CABLE (Fig. 3M)

Replacement

In the event replacement is necessary use the following procedure.

1. Remove seat separator (console) assembly.
2. Remove shift lever seal retainer and slide seal up on lever.
3. Remove shift lever knob, and the 2 lever to bracket retaining nuts and remove the lever assembly.
4. Replace blocker cable - thread new cable up through lever and "T" handle and install cable retainer through access slot. Adjust retainer to hold blocker end .010/.020" above lever bracket surface, then lock and cut off excess cable.
5. Reverse Steps 1, 2 and 3 to install.

Figure 3M shows the adjustment and lubrication procedure for the mechanism. This Figure applies to both models of lever assemblies.

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 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 3M.

Adjustment

1. With set screw loose, assemble cable through hole in cylindrical retainer above handle.

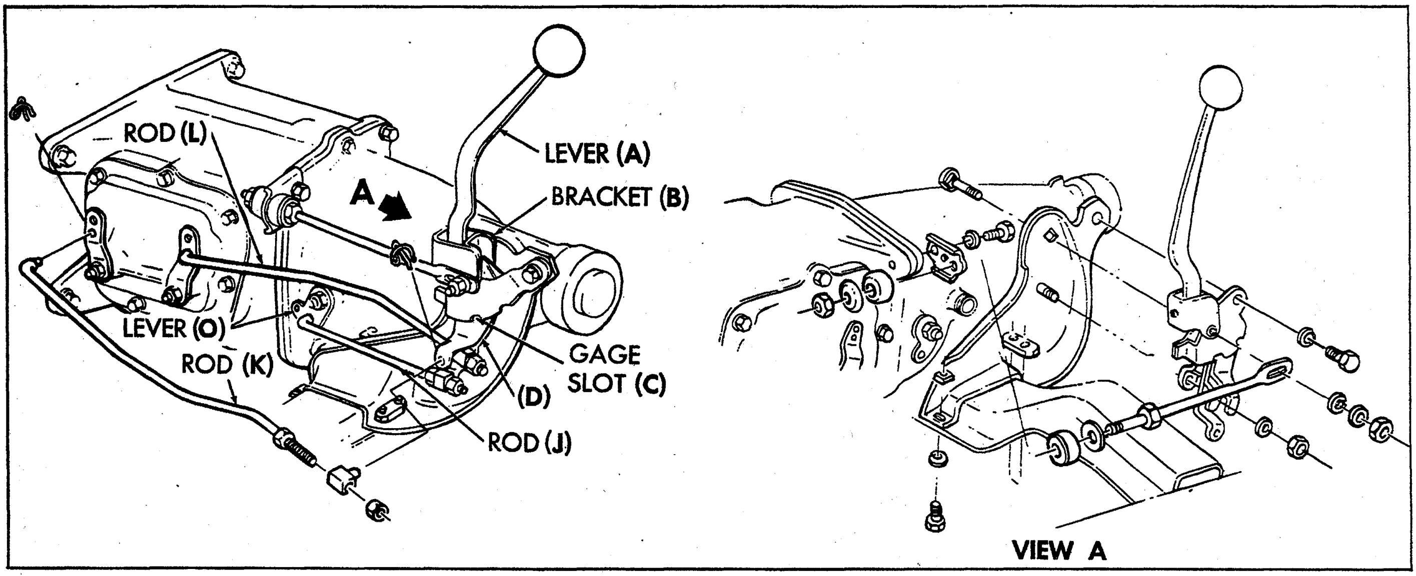


Fig. 2M - Four-Speed (Muncie) Transmission Gearshift Linkage Camaro & Corvette (Typical)

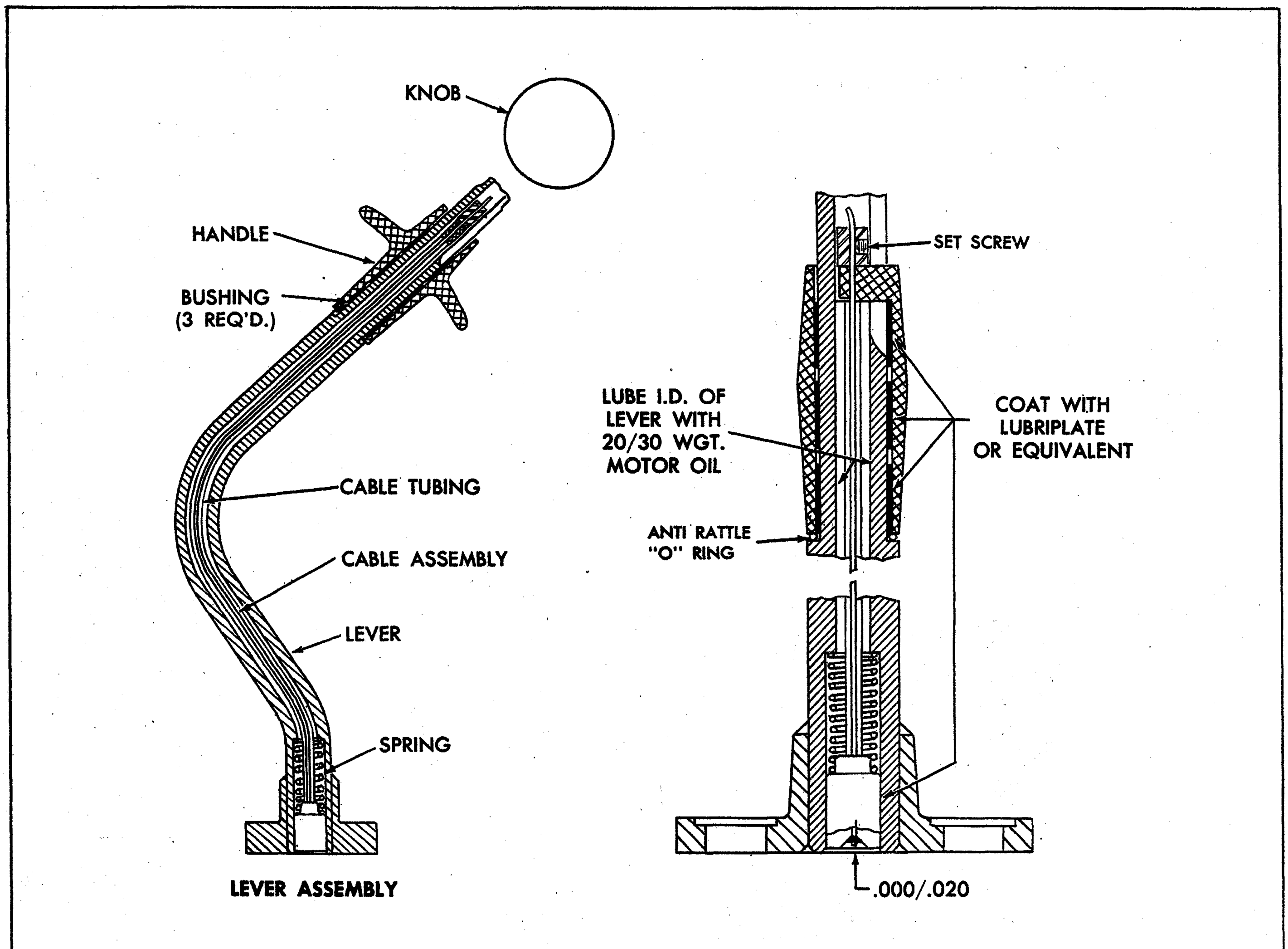


Fig. 3M - Gearshift Lever Assembly and Adjustment (Typical)

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 in 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.
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. 4M)

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.

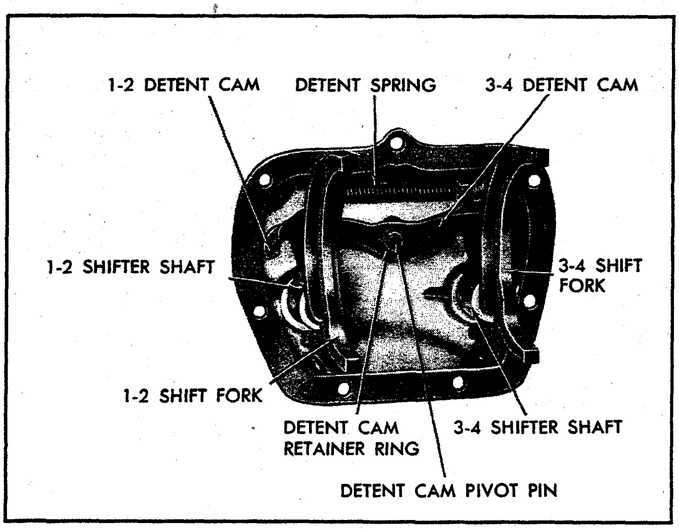


Fig. 4M - Transmission Side Cover, Shift Fork and Detent Assembly

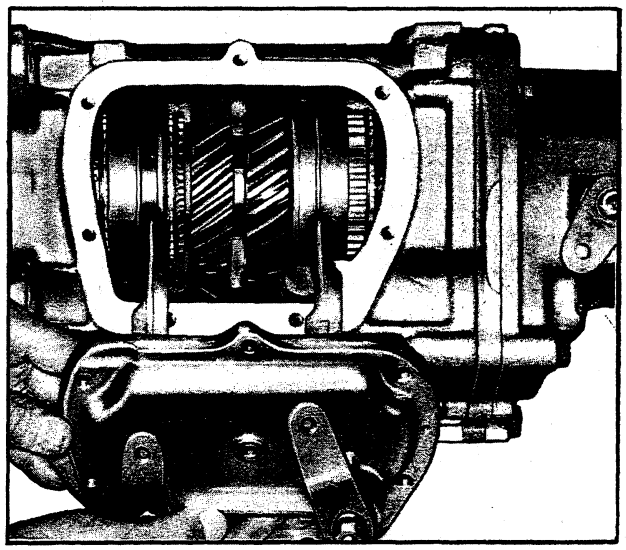


Fig. 5M - Installing Side Cover Assembly

3. Remove detent cam spring and pivot retainer "C" ring. Remove both detent cams.
4. Replace necessary parts.

Assembly (Fig. 4M)

1. Install 1-2 detent cam to cover pivot pin first, then install 3-4 detent cam so the detent spring notches are offset or opposite each other. Detent cam notches must be facing downward.
2. Install detent cam retaining "C" ring to pivot shaft, and hook spring into detent cam notches.
3. Install both shifter shaft assemblies in cover being careful not to damage lip seals. Install both shift forks to detent plates, lifting up on detent cam to allow forks to fully seat into position.
4. Install outer shifter levers, flat washers, lock washers and nuts.

Installation (Fig. 5M)

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 specified in Section 0, 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.

CAUTION: Do not excessively force the seal against the seat in the extension.

COMPONENT PARTS REPLACEMENT

TRANSMISSION REPLACEMENT (EXC. CORVETTE)

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 and remove all 3 transmission shifter levers from 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 to 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 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. Install control lever bracket assembly to transmission extension and connect shifter levers to shifter shafts.
7. Fill transmission to level of filler plug hole with correct lubricant specified in Section 0.
8. Lower vehicle and install shift lever assembly, check shift pattern and adjust linkage as required.
9. Install trim plate and dust boot.

CORVETTE TRANSMISSION REPLACEMENT

Refer to similar procedure under 3-Speed Corvette Transmission.

FOUR-SPEED (SAGINAW) TRANSMISSION

INDEX

GENERAL DESCRIPTION

The Saginaw four speed fully synchronized (all forward gears) transmission incorporates helical drive gears throughout.

The main drive gear is supported by a 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 ball bearing mounted in the front of the extension housing.

The countergear is carried on a single 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. An anti-rattle plate assembly at the front of the countergear provides a constant spring tension between the counter and clutch gears to reduce torsional vibrations. The sliding reverse idler gear is carried on a bushing finish bored in place. It rotates on a short idler shaft retained by a woodruff key.

The synchronizer assemblies consist of a clutch hub, clutch sleeve, two clutch key springs and three energizer clutch keys and are retained as an assembly on the main shaft by a snap ring.

A great deal of similarity and interchangeability now exists between the new 3 and 4-speed Saginaw transmissions.

However, the synchronizer assembly at the front of the mainshaft is used for the third and fourth rather than the second and third shift. The synchronizer assembly at the rear of the mainshaft is used for the first and second rather than the first and reverse shift. Gear teeth cut in the first and second synchronizer sleeve (reverse gear) distinguish it from the third and fourth synchronizer sleeve.

Starting from the front, gears on the mainshaft are third, second and first rather than second, first and reverse. A fourth blocker ring is used between the 1-2 synchronizer assembly and first gear on the four-speed transmissions.

The cover on the new four-speed transmission is located on the left-hand side of the case. It is similar to the three-speed cover with the addition of a reverse shifter shaft assembly, detent ball and detent spring.

Disassembly and assembly procedures are covered in this section.

MAINTENANCE AND ADJUSTMENTS

SHIFT LINKAGE ADJUSTMENT (CHEVROLET & CHEVELLE)

1. Set Lever (L) (M) and (P) in neutral detent position.
2. Move Lever Stud (A) to neutral detent position and insert Locating Gauge (B) into Control Lever Bracket Assembly.
3. Install Reverse Rod (H) with retainer on Lever (T).
4. Maintaining Lever (T) against Locating Gauge, Adjust Clevis (R) at Lever (P) until Clevis Pin freely passes through holes in Clevis (R) and Lever (P).
5. Install Clevis Pin, Washer and Cotter Pin; tighten Nut (S) against Clevis (R).
6. Install Rod (K) with retainer on Lever (C).
7. Maintaining Lever (C) against Locating Gauge, adjust Clevis (N) at Lever (M) until Clevis Pin freely passes through holes in Clevis (N) and Lever (M).
8. Install Clevis Pin, Washer and Cotter Pin; tighten Nut (O) against Clevis (N).
9. Install Rod (J) with retainer on Lever (L).
10. With two Jam Nuts (G), (E) and Swivel (F) loose on Rod (J) insert and attach Swivel (F) with retainer to Lever (D).
11. Maintaining Lever (D) against Locating Gauge (B) while holding Swivel (F) run Jam Nut (G) against Swivel (F) then tighten other Jam Nut (E) against swivel.
12. Remove Locating Gauge and check shifts to insure proper operation, readjust if necessary.

SHIFT LINKAGE ADJUSTMENT (CHEVY II)

1. Set Levers (H) (R) and (T) in neutral detent position.
2. Move Lower Control Lever (A) to neutral detent position and insert Locating Gauge (B) into Control Lever Bracket Assembly.
3. Install Reverse Control Rod (G) with retainer on Lever (X).
4. Maintaining Lever (X) in neutral position with Locating Gauge (B), Adjust Clevis (V) at lever (T) until Clevis Pin freely passes through hole in Clevis (V) and Lever (T).
5. Install Clevis Pin, Washer and Cotter Pin. Tighten Jam Nut (W) to specified torque against Clevis.
6. Install Control Rod (F) with retainer on Lever (C).
7. Maintaining Lever (C) in neutral position with Locating Gauge (B), Jam Nuts (M and S) and Swivel (N) loose on Rod (F), attach to Lever (R) with retainer.
8. While holding Swivel (N) run Jam Nut (M) against Swivel (N) and tighten Jam Nut (S) against Swivel (N).
9. Install Rod (E) with retainer on Lever (D).
10. Maintaining Lever (D) in neutral position with Locating Gauge (B) and Jam Nut (J and L) and Swivel (K) loose on Rod (E) attach to Lever (H) with retainer.
11. While holding Swivel (K) run Jam Nut (J) against Swivel (K) and tighten Jam Nut (L) against Swivel (K).
12. Remove Locating Gauge (B) and shift to insure proper operation. Readjust clevis and swivels if necessary.

SHIFT LINKAGE ADJUSTMENT (CAMARO AND CORVETTE)

1. Set Transmission Shift Levers in neutral position.
2. Move Lever Arm (A) and Lever (C) (D) and (E) to neutral position and insert Locating Gauge (B) into Control Lever Bracket Assembly.

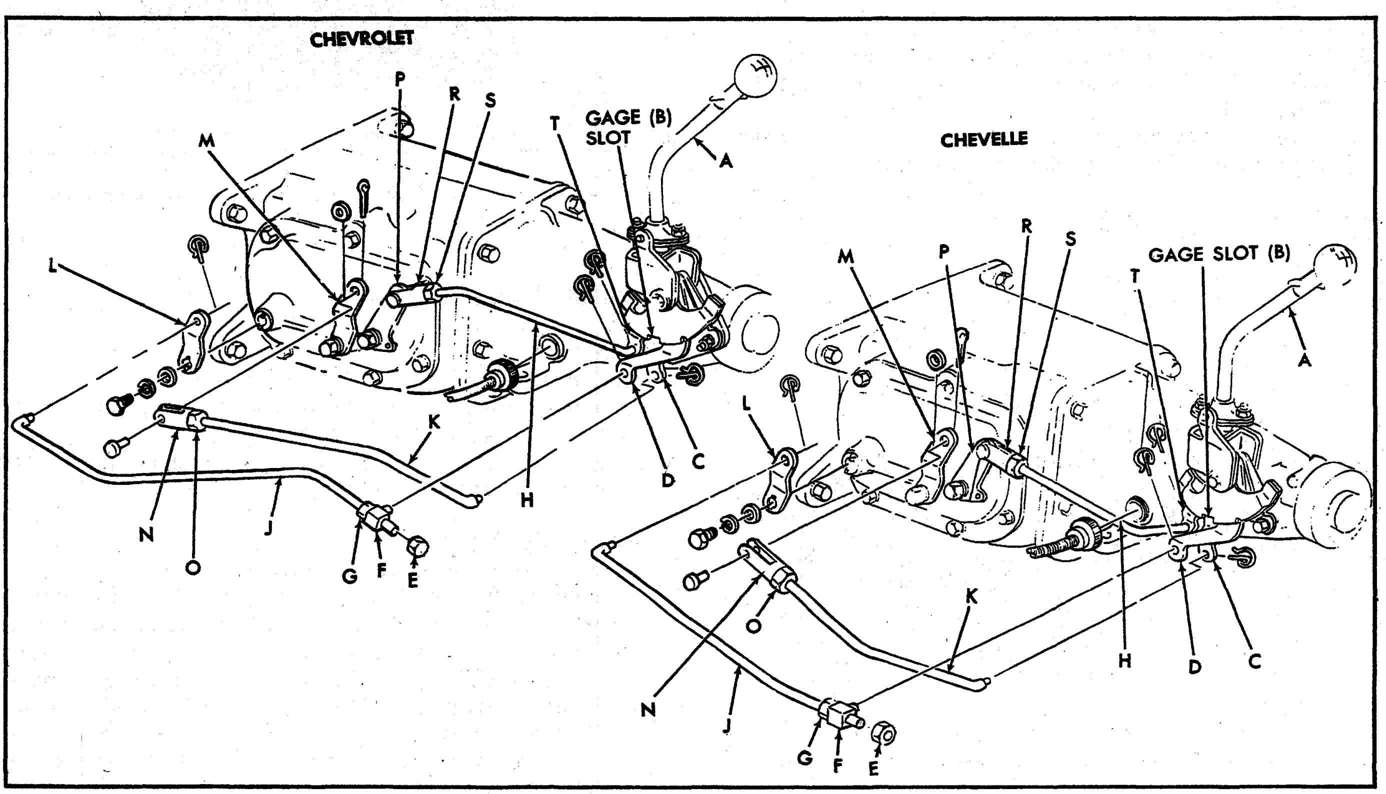


Fig. 1X - Shift Linkage (Chevrolet & Chevelle)

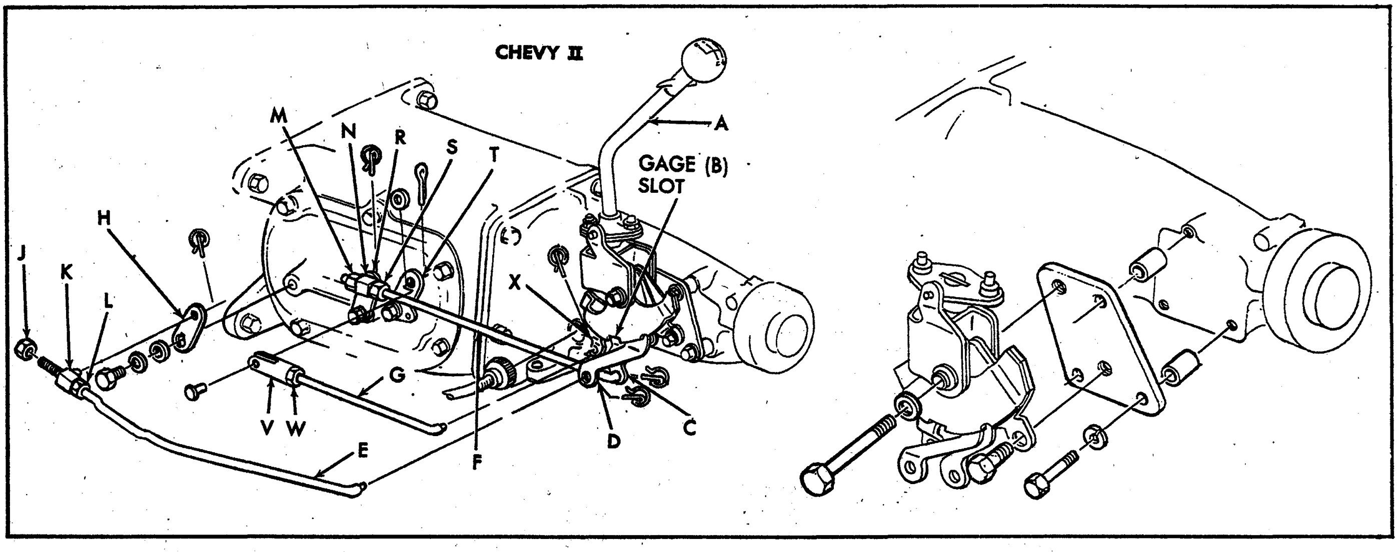


Fig. 2X - Shift Linkage (Chevy II)

3. Install Reverse Rod (J) with Retainer on Lever (N).
4. With two Jam Nuts and Swivel loose on Rod (J) insert and attach Swivel with Retainer to Lever (E).
5. Maintaining Lever (E) against Locating Gauge (B) while holding Swivel run front Jam Nut against Swivel then tighten rear Jam Nut against Swivel to specified torque.
6. Install Rod (O) with Retainer on Lever (M).
7. With two Jam Nuts and Swivel loose on Rod (O) insert and attach Swivel with Retainer to Lever (C).
8. Repeat Step 5 Maintaining Lever (C) against Locating Gauge (B).
9. Install Rod (K) with Retainer on Lever (L).
10. With two Jam Nuts and Swivel retain to Lever (D).
11. Repeat Step 5 maintaining Lever (D) against Locating Gauge (B).
12. Remove Locating Gauge and check shift to insure proper operation. Readjust if necessary.

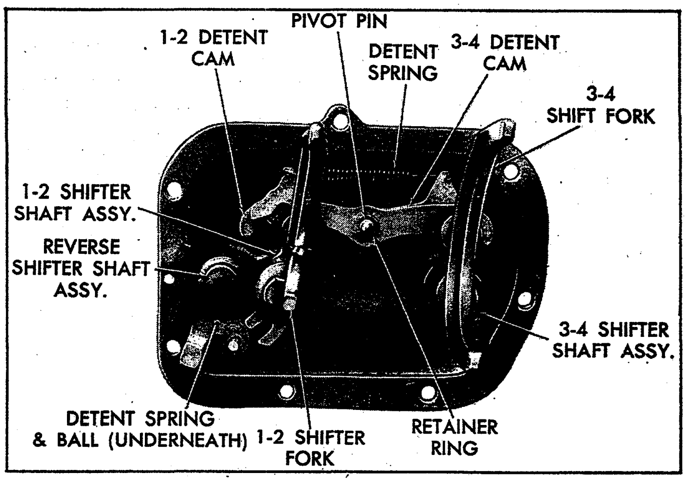


Fig. 4X - Transmission Side Cover, Shift Fork and Detent Assembly

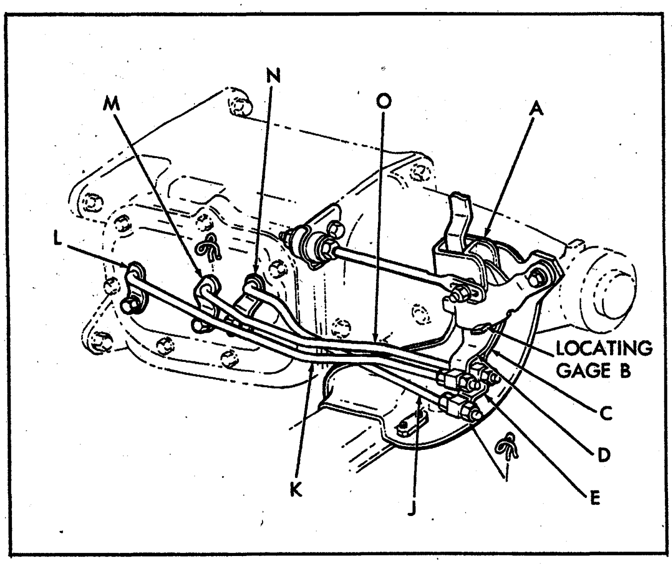


Fig. 3X - Camaro and Corvette Shift Linkage

TRANSMISSION SIDE COVER

Removal

1. Disconnect control rods from levers.
2. Shift transmission into neutral detent positions before removing cover.
3. Remove cover assembly from transmission case carefully and allow to drain.

Disassembly (Fig. 4X)

1. Remove the outer shifter levers.
2. Remove both shift forks from shifter shaft assemblies. Remove all three shifter shaft assemblies from cover. "O" ring seals around shifter shaft may now be pryed out if required because of damage. Remove reverse shifter shaft detent ball and spring.
3. Remove detent cam spring and pivot retainer "C" ring. Mark to identify for reassembly, then remove both detent cams.
4. Replace damaged parts.

Assembly (Fig. 4X)

1. With detent spring tang projecting up over the 3rd and 4th shifter shaft cover opening install the first and second detent cam onto the detent cam pivot pin. With the detent spring tang projecting up over the first and second shifter shaft cover hole install the 3rd and 4th detent cam.

   NOTE: The 1-2 detent cam has a .090" greater contour on the inside detent notch.

2. Install detent cam retaining "C" ring to pivot shaft, and hook spring into detent cam notches.
3. Install 1-2 and 3-4 shifter shaft assemblies in cover being careful not to damage seals. Install both shift forks to shifter shaft assemblies, lifting up on detent cam to allow forks to fully seat into position.
4. Install reverse detent ball and spring to cover, then install reverse shifter shaft assembly to cover.
5. Install outer shifter levers, flat washers, lock washers and bolts.

Installation

1. Shift shifter levers into neutral detent (center) 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 specified torque.
4. Remove filler plug and add lubricant specified in Section 0, to level of filler plug hole.

ALUMINUM POWERGLIDE

INDEX

GENERAL DESCRIPTION

The case and converter housing of the two speed aluminum Powerglide Transmission is 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 oil 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 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 CHECK

The transmission oil level should be checked periodically as recommended in Section 0. Oil should be added only when level is on or below 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 0.

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.

PERIODIC OIL CHANGE

The transmission oil should be changed periodically as recommended in Section 0, and whenever transmission is to be removed from the vehicle for repairs.

1. Run engine for one minute in neutral prior to changing.
2. Be sure vehicle is level or raise from the rear only.
3. Remove the oil pan drain plug and allow oil to drain thoroughly into a pan or can.
4. Replace drain plug and refill with approximately two quarts of oil specified in Section 0.

NOTE: 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. Refill capacity is approximately 2 qts.

Fig. 1PG - Adjusting Low Band Using J-21848

PERIODIC LOW BAND ADJUSTMENT (Fig. 1PG)

Low band adjustment should be periodically performed at 12,000 mile intervals, or sooner, as necessary if operating performance indicates low band slippage.

1. Raise vehicle and place selector lever in neutral.
2. Remove protective cap from transmission adjusting screw.
3. a. On Corvette Models: Drop left exhaust pipe for clearance.
   b. On Chevelle Models: To gain clearance between underbody and transmission, it may be necessary to remove rear mount bolts from crossmember, and move transmission slightly toward passenger side of vehicle.
4. Loosen adjusting screw lock nut 1/4 turn and hold in this position with wrench.
5. Using Special Tool J-21848 adjust band to 70 in. lbs. and back off four (4) complete turns for a band which has been in operation for 6,000 miles or more, or three (3) turns for one in use less than 6,000 miles.

   CAUTION: Be sure to hold the adjusting screw lock nut at 1/4 turn loose with a wrench during the adjusting procedure.

6. Tighten the adjusting screw lock nut to specified torque.

   CAUTION: The amount of back-off is not an approximate figure, it must be exact.

MANUAL SHIFT LINKAGE CHECK & ADJUST
(Column Type)

1. The shift tube and lever assembly must be free in the mast jacket. See Section 9 for alignment of steering column assembly if necessary.
2. To check for proper shift linkage adjustment, lift the transmission selector lever towards the steering wheel. Allow the selector lever to be positioned in drive (D) by the transmission detent.

   NOTE: Do not use the indicator pointer as a reference to position the selected lever. When performing linkage adjustment, pointer is adjusted last.

3. Release the selector lever. The lever should be inhibited from engaging low range unless the lever is lifted.
4. Lift the selector lever towards the steering wheel, and allow the lever to be positioned in neutral (N) by the transmission detent.
5. Release the selector lever. The lever should now be inhibited from engaging reverse range unless the lever is lifted.
6. A properly adjusted linkage will prevent the selector lever from moving beyond both the neutral detent, and the drive detent unless the lever is lifted to pass over the mechanical stop in the steering column.
7. In the event that an adjustment is required, place the selector lever in drive (D) position as determined by the transmission detent. See Steps 2 and 3.
8. Loosen the adjustment swivel at the cross-shaft, and rotate the transmission lever so that it contacts the drive stop in the steering column.
9. Tighten the swivel and recheck the adjustment. See Steps 2 and 6.

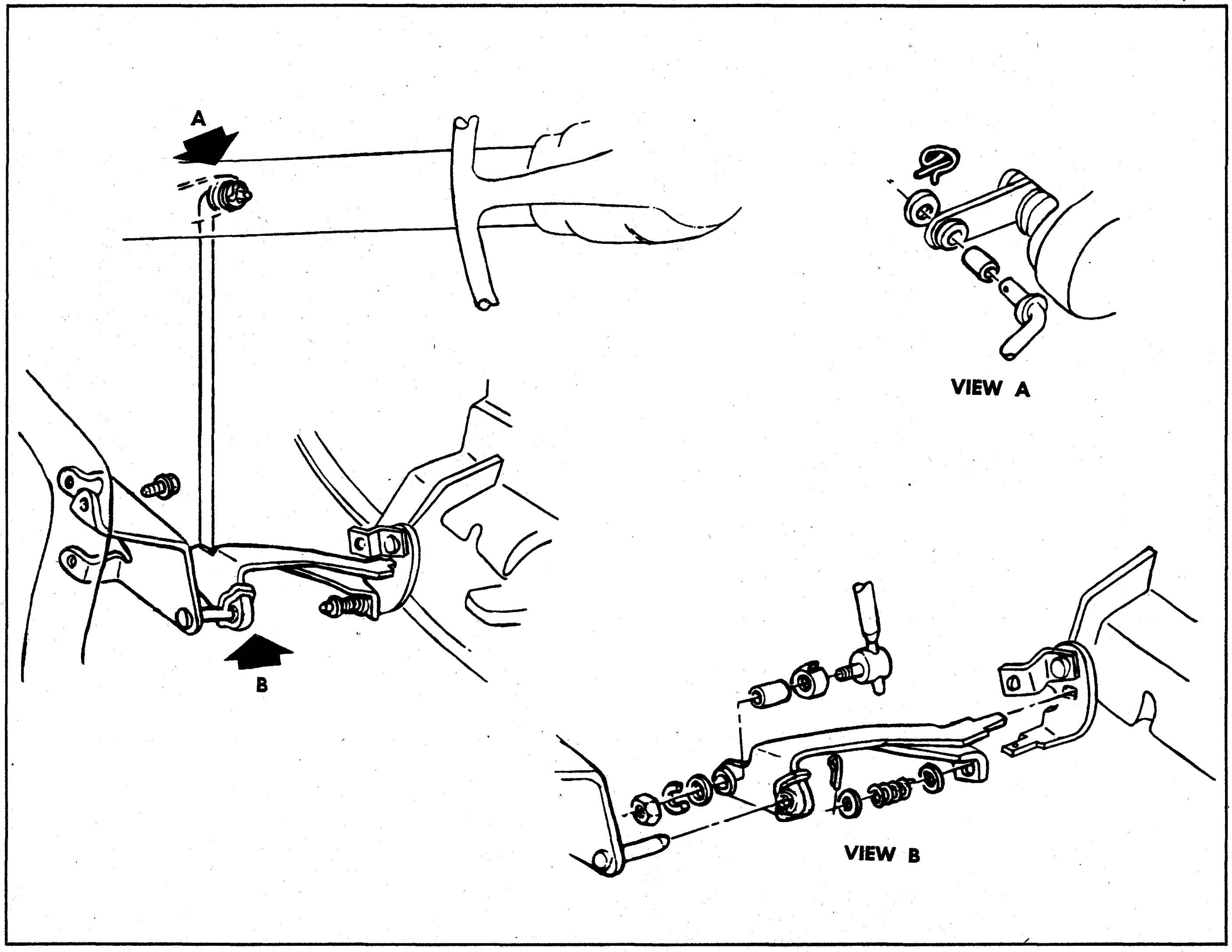


Fig. 2PG - Chevrolet Shift Linkage Adjustments

10. Readjust indicator needle if necessary to agree with the transmission detent positions. See Section 9.
11. Readjust neutral safety switch if necessary to provide the correct relationship to the transmission detent positions. See Section 12.

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. 6PG)

1. Loosely assemble Nuts (A) and (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 7/64" Spacer (H) between Nut (A) and Swivel (J), run Nut (A) until it touches spacer. Remove Spacer and apply load in the direction on Arrow (X) until it touches Nut (A). Tighten Nut (B) against Swivel and lock Swivel between Nuts (A) and (B). See View B.

Chevelle Linkage Adjustment (Fig. 7PG)

1. Assemble Nuts (A) and (B) on Lower Rod (C) loosely.
2. Set Transmission Lever (D) in drive position.

NOTE: Obrain drive position by moving Trans-

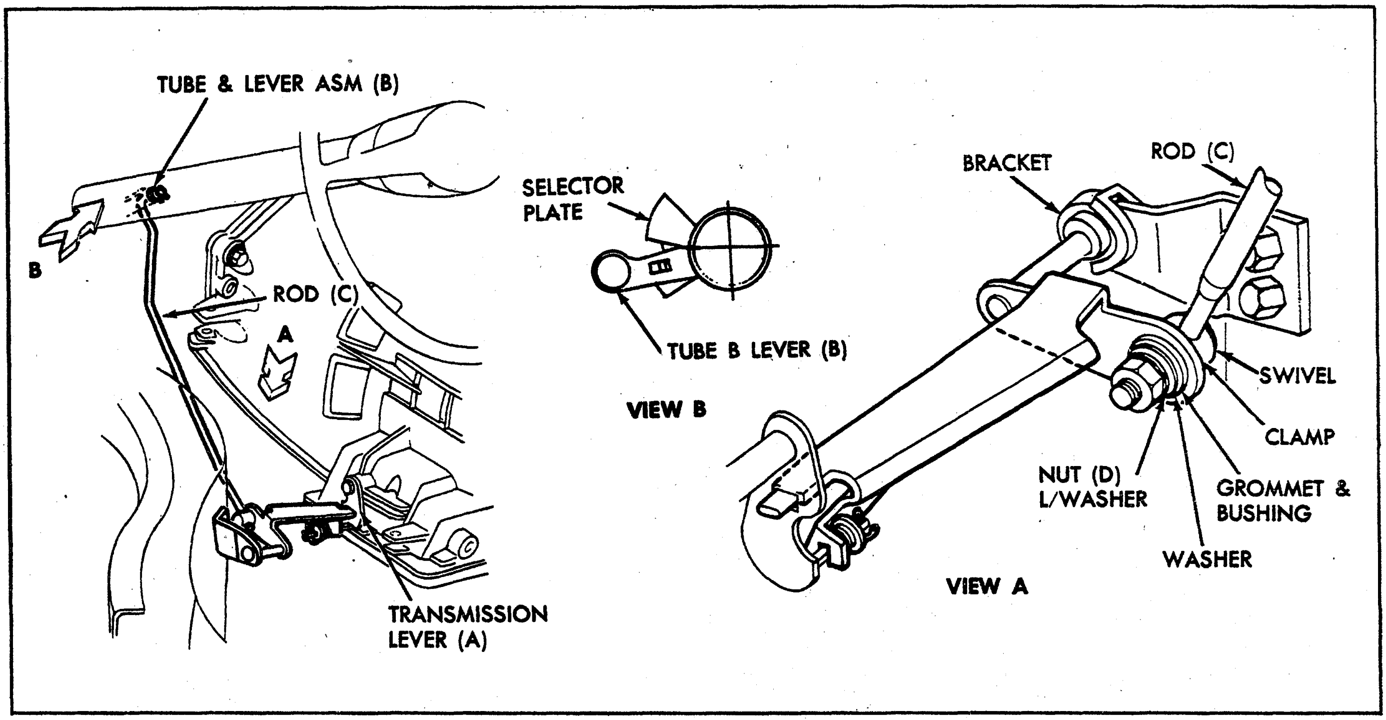


Fig. 3PG - Chevelle Shift Linkage Adjustments

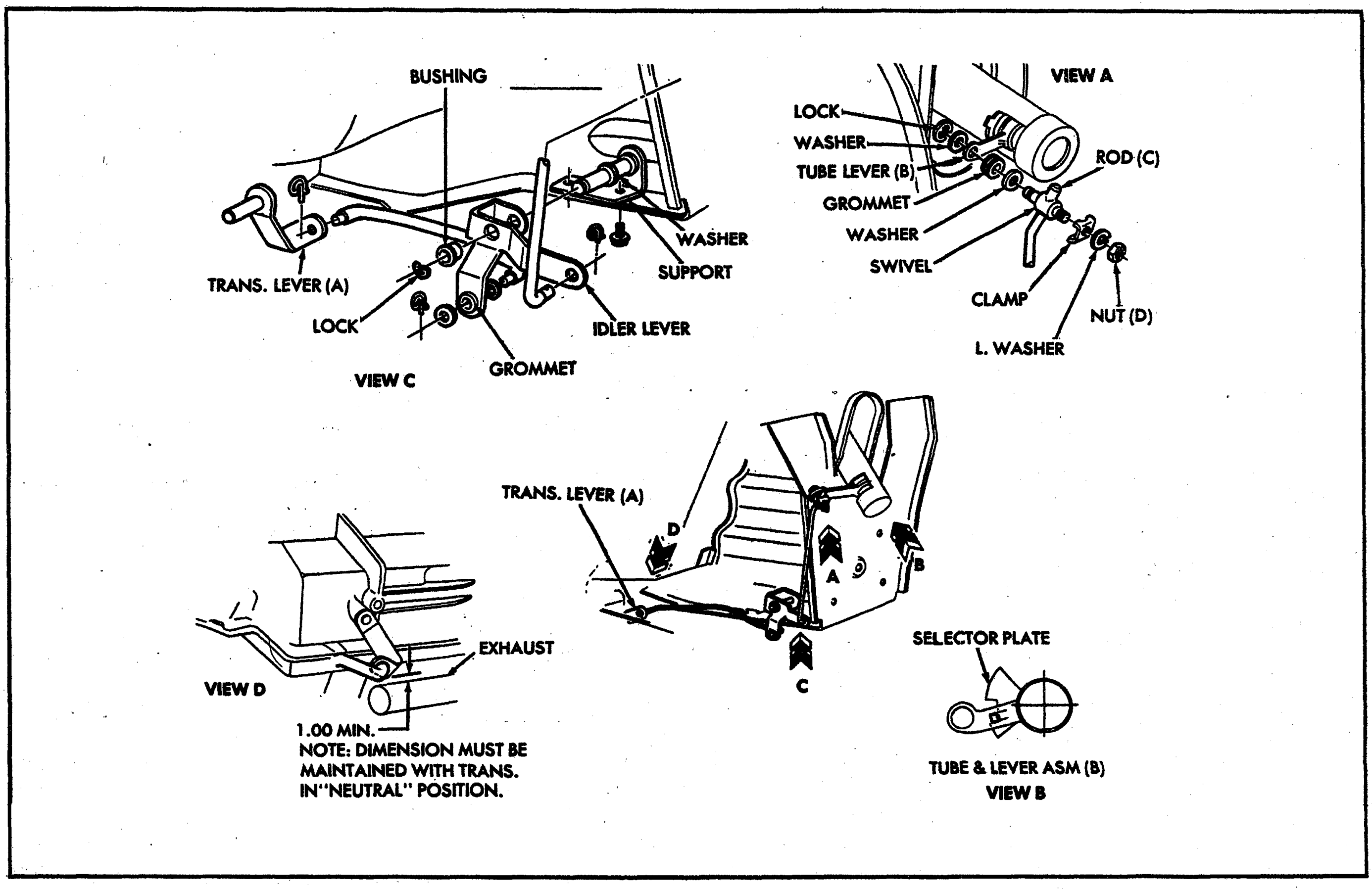


Fig. 4PG - Chevy II Shift Linkage Adjustments

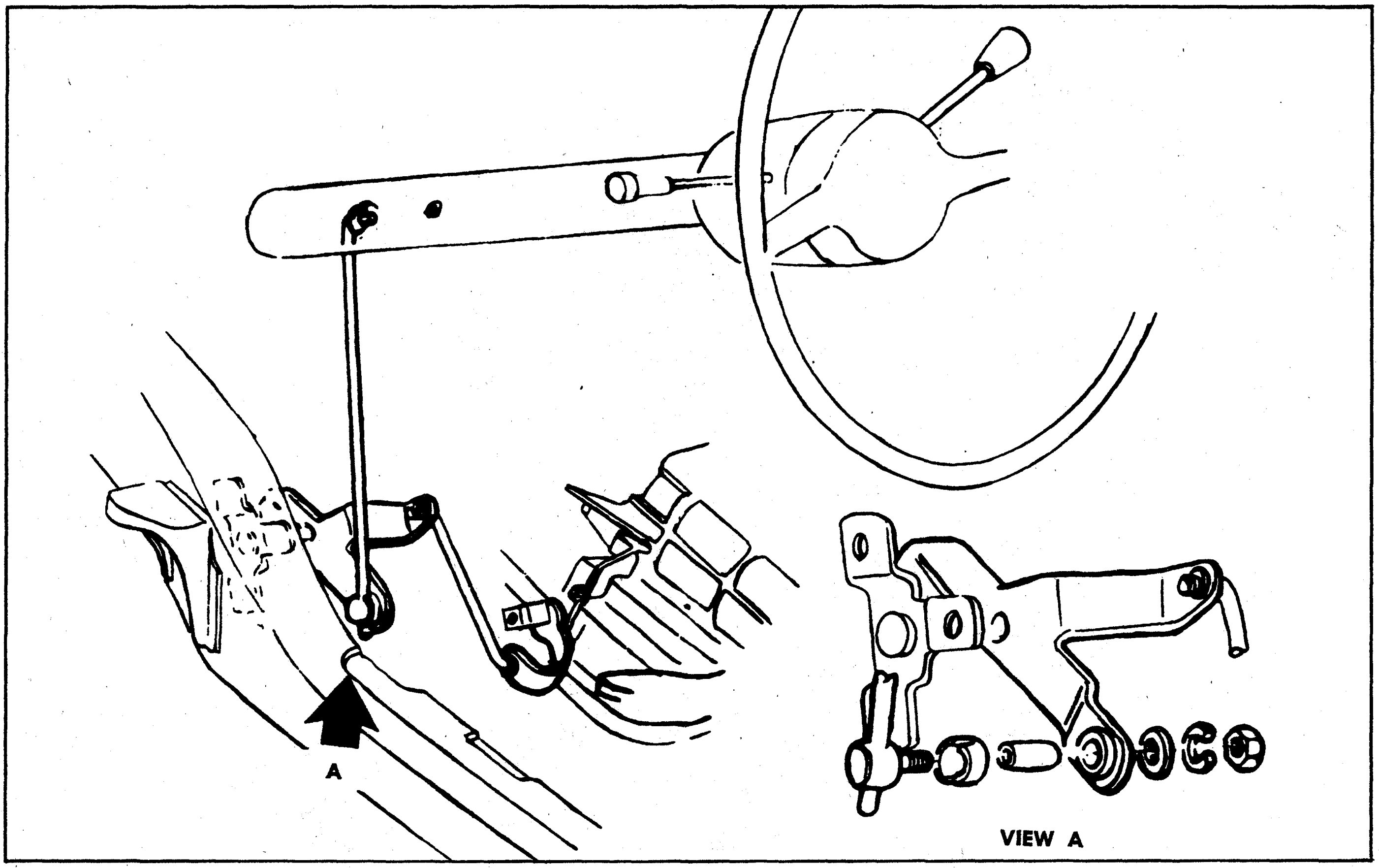


Fig. 5PG - Camaro Shift Linkage Adjustment

mission 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 (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. 8PG)

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.
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 .090" 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 .070" over travel gap in the notches of Detent (K).

Camaro Linkage Adjustment (Fig. 9PG)

1. Loosely assemble nuts (A) and (B) on Lower Rod (C).
2. Set Transmission Lever (D) in "DRIVE" position.

NOTE: Obtain "DRIVE" position by moving Trans. Lever Counter clockwise to "LOW" detent, then clockwise one detent position to "DRIVE."

3. Set Control Pawl 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 and B.
5. Place a .094" Spacer (H) between Nut (A) and Swivel (J), run Nut (A) until it touches Spacer. Tighten Nut (B) against Swivel and lock Swivel between Nuts (A) and (B). See View B.

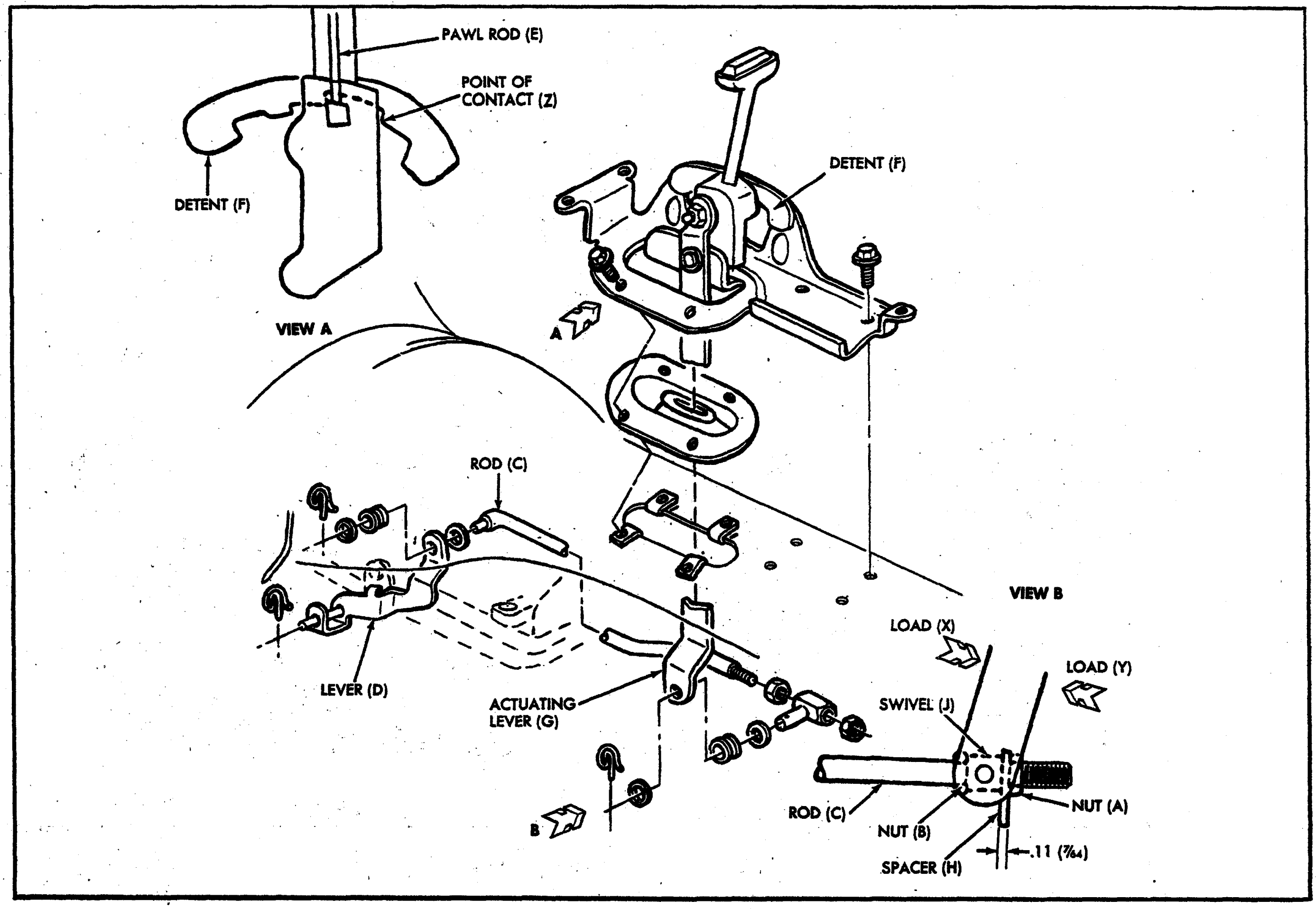


Fig. 6PG - Chevrolet Floor Shift Linkage Adjustment

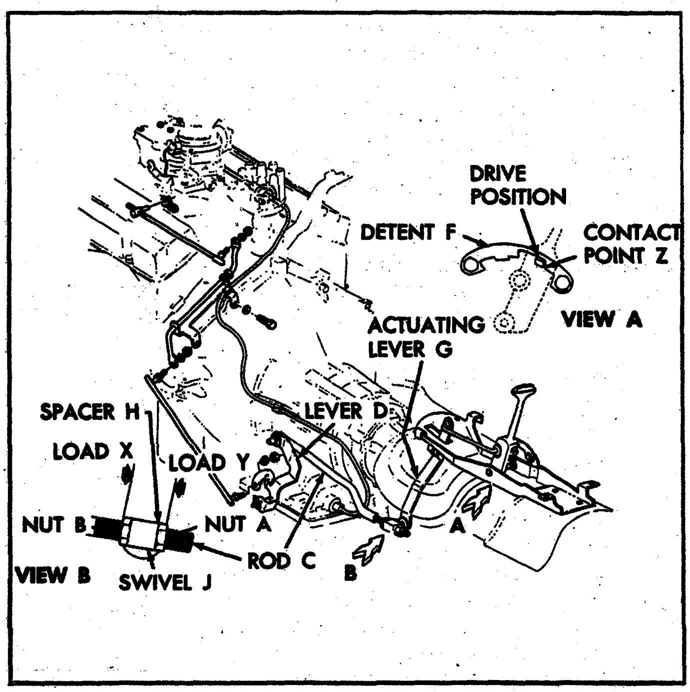


Fig. 7PG - Chevelle Floor Shift Linkage Adjustment

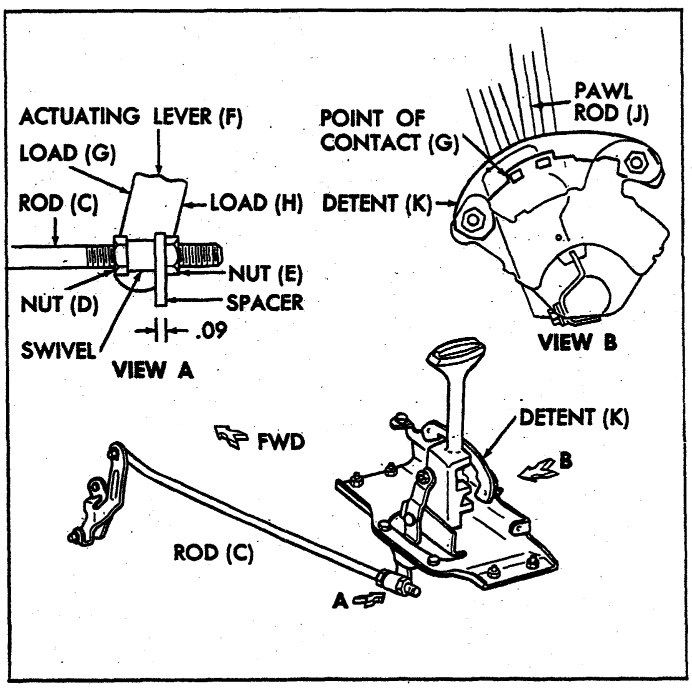


Fig. 8PG - Chevy II Floor Shift Linkage Adjustment

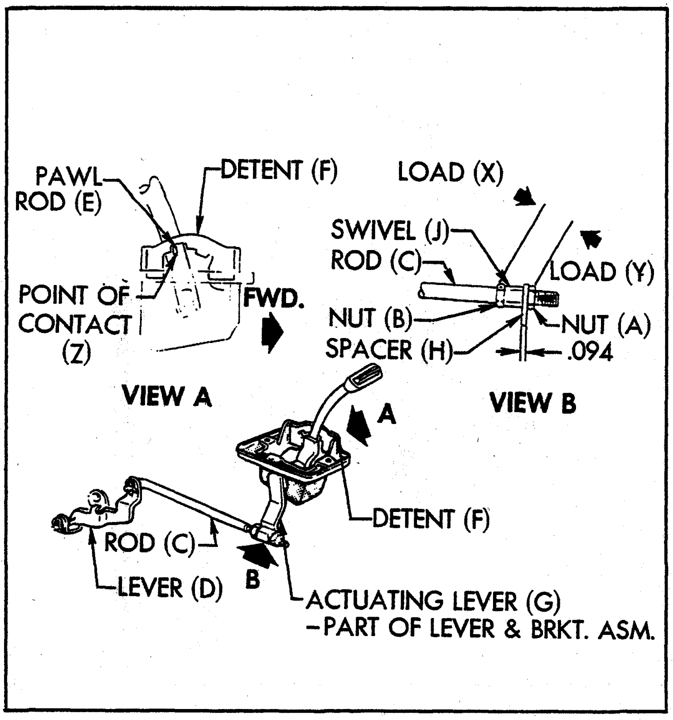


Fig. 9PG - Camaro Floor Shift Linkage Adjustment

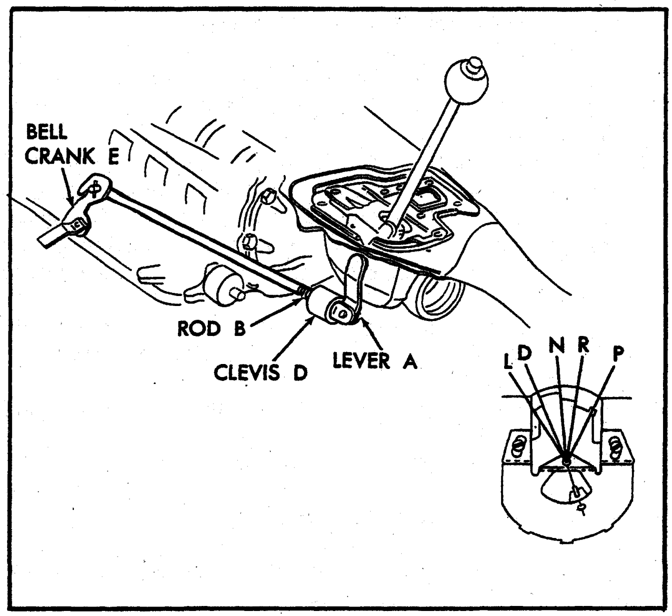


Fig. 10PG - Corvette Gear Shift Control Adjustment

The foregoing procedure will provide a .050" over travel gap in the notches of Detent (F).

Corvette Linkage Adjustment (Fig. 10PG)

1. Set Transmission Bell Crank (E) in "PARK" position.
2. Set Control Shaft Lever (A) in "PARK" position.
3. Install Clevis (D) on Rod (B) loosely, attach Rod to Bell Crank (E) and secure with retainer.
4. With Lever (A) in "PARK" position, adjust Clevis at Lever (A) until clevis pin passes freely through holes and secure with washer and cotter pin.
5. Check shifts to insure proper operation. Readjust clevis as necessary.

Corvette Powerglide Control Lever and Bracket Assembly

Powerglide control lever and bracket assembly is a straight line shift type, mounted to the floor of the body rather than the transmission extension as in the past. Shifting from one detent position to another is done by depressing a round button located in the center of the spherical shift lever knob. If disassembly of this control lever and bracket assembly is necessary, refer to Figure 11PG for parts breakdown and relative positioning for assembly.

Floor Mounted Control Lever and Bracket Assembly (Exc. Corvette)

If disassembly of this control lever and bracket assembly is necessary, refer to Figure 12PG for parts break down and relative positioning for assembly.

Throttle Valve Linkage Adjustment

L-4 and L-6 Models

With accelerator pedal depressed, Bell Crank on L-4 and L-6 models must be at wide open throttle position.

Dash Lever must be 1/64"-1/16" off Lever Stop and Transmission Lever must be against transmission internal stop.

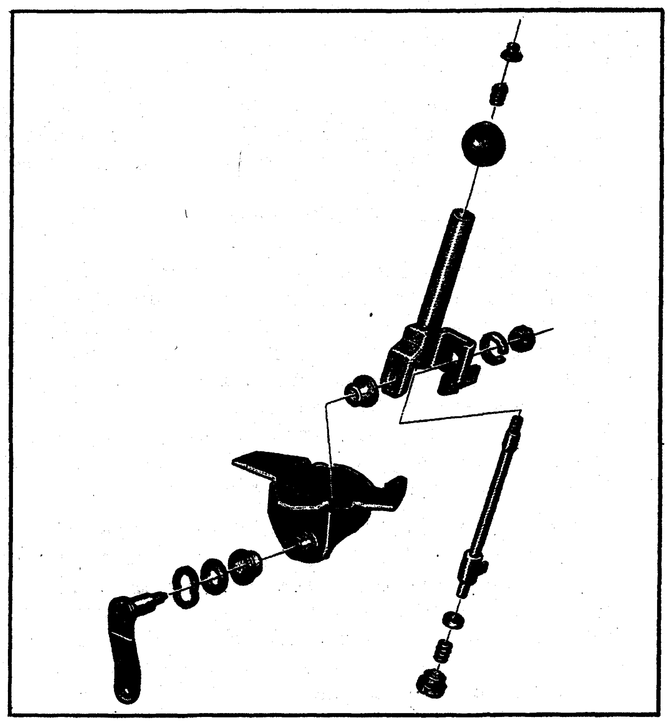


Fig. 11PG - Corvette Control Lever and Bracket Assembly - Exploded

V-8 Models—With Uni-Directional Linkage

1. Remove air cleaner.
2. Disconnect accelerator linkage at carburetor.
3. Disconnect accelerator return and TV rod return springs.
4. With right hand, pull TV upper rod forward until transmission is through detent. With left hand, open carburetor to wide open throttle position. Carburetor must reach wide open throttle position at the same time the ball stud contacts end of slot in upper TV rod.
5. Adjust swivel on end of upper TV rod to obtain setting described in Step 4. Allowable tolerance is approximately 1/32".
6. Connect and adjust accelerator linkage as described in Section 6.
7. Check for throttle linkage freedom.

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.

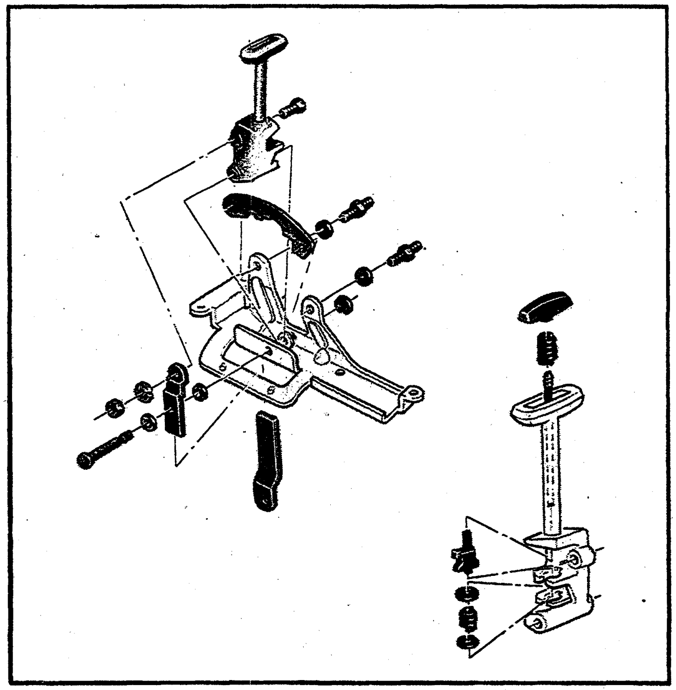


Fig. 12PG - Floor Mounted Control Lever and Bracket Assembly (Chevrolet Shown)

COMPONENT PARTS REPLACEMENT

TRANSMISSION REPLACEMENT (EXC. CORVETTE)

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.

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 13PG, 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 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, 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 35 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 attaching bolts. Torque bolts to 15-20 ft. lbs.
6. Install converter under pan.
7. Reinstall transmission support crossmember to transmission and frame.
8. Remove transmission lift equipment.
9. Connect propeller shaft to transmissions.
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.

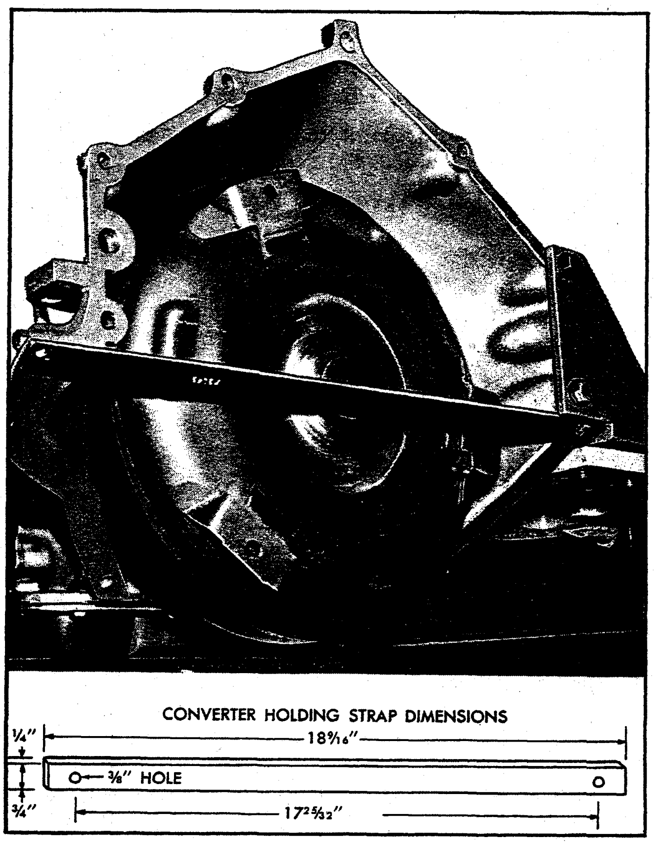


Fig. 13PG - Converter Holding Tool

CORVETTE POWERGLIDE TRANSMISSION

Replacement

1. Disconnect battery ground cable.
2. Remove ball end from transmission shift control lever.
3. Raise front and rear of vehicle.
4. Insert a block of wood between the top of the differential carrier housing and the underbody (to prevent upward travel of the carrier when the carrier front support is disconnected).
5. Disconnect the differential carrier front support from its frame bracket, by removing the nut on the underside of the biscuit mount.
6. Pry the carrier downward to relieve load while removing the two center mounting bolts from the carrier front support. (To pry carrier downward insert crowfoot end of a pry bar through the opening in the carrier front support, hooking end of bar over top of the center mounting bolt pad cast in the underside of the carrier).
7. Pivot carrier support downward for access to prop shaft "U"-joint.
8. Disconnect prop shaft front and then rear "U" bolts.
9. Disconnect parking brake cable from ball socket at idler lever located near center of underbody.
10. Remove prop shaft by moving shaft forward.
11. Remove left bank exhaust pipe.
12. Remove right bank exhaust pipe and heat riser.
13. Disassemble the transmission mount, as follows:
    a. Remove the two bolts that attach rear mount cushion to the rear mount bracket.
    b. Support engine under oil pan and raise engine to remove load from rear mount cushion.

    CAUTION: To avoid damage to oil pan, a suitable wide base, heavy wood platform should be placed between the jack pad and the oil pan.

    c. Remove the three transmission mount bracket-to-crossmember bolts, then remove mount bracket.
    d. Remove the two bolts from mount pad to transmission case and remove rubber mount cushion and exhaust pipe "yoke".
14. Disconnect oil cooler lines at transmission and swing lines clear.
15. Remove connector underpan.
16. Remove converter to flywheel attaching bolts.
17. At transmission disconnect vacuum modulator line and speedometer cable.
18. Disconnect transmission shift linkage from transmission gearshift control lever. Remove shift lever.
19. At transmission, remove throttle valve linkage and disconnect neutral safety switch linkage, also remove the gearshift control linkage.
20. Remove neutral safety switch from transmission control bracket.

21. Remove transmission output shaft slip yoke and insert a plastic shipping plug in end of extension to prevent spillage of transmission fluid.

    NOTE: The yoke is removed to avoid tearing the heat reflecting pad on the underbody, when the transmission is being removed.

22. Remove bright metal ignition shielding from distributor area.
23. Remove the transmission dip stick and tube assembly.
24. Disconnect transmission vacuum modulator line at distributor advance line tee.
25. Position transmission hoist under transmission and attach safety chain to transmission.
26. Remove transmission converter housing-to-engine attaching bolts and slide transmission rearward.

    NOTE: Observe converter when moving transmission rearward. If converter does not move with the transmission, pry it free of flywheel before proceeding.

27. Install converter retaining strap.
28. Lower and remove transmission from vehicle by tilting the front down and to the right while intermittently lowering the transmission to facilitate its removal.
29. Reinstall transmission assembly by performing the above steps in reverse order.

Bolt Torques

Transmission Case to Flywheel
Housing Bolts . . . . 35 ft. lbs.
Converter to Flywheel Bolts. . . . . 35 ft. lbs.

OTHER SERVICE OPERATIONS

Although certain operations, such as oil pan or gasket replacement, valve body, governor, filler pipe "O" ring, 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 light 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 AND CONDITION

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.

When checking oil level, a burned smell and discoloration indicate burned clutches or bands and the transmission will have to be removed.

MANUAL LINKAGE

Manual linkage adjustment and the associated neutral safety switch are important from a safety standpoint. The neutral safety switch should be adjusted so that the engine will start in the Park and Neutral positions only.

With the selector lever in the Park position, the parking pawl should freely engage and prevent the vehicle from rolling. The pointer on the indicator quadrant should line up properly with the range indicators in all ranges.

OIL LEAKS

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases the source of the leak can be deceiving due to "wind flow" around the engine and transmission.

The suspected area should be wiped clean of all oil before inspecting for the source of the leak. Red dye is used in the transmission oil at the assembly plant and will indicate if the oil leak is from the transmission.

The use of a "black light"* to identify the oil at the source of leak is also helpful. Comparing the oil from the leak to that on the engine or transmission dip stick (when viewed by black light) will determine the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the car by the air stream. For example, a transmission "oil filter tube to case leak" will sometimes appear as a leak at the rear of the transmission. In determining the source of an oil leak it is most helpful to keep the engine running.

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 pump square seal ring, pump seal assembly, or pump bolt sealing washers.

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.
- 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. 14PG). Run the gauge line into the driving compartment by pushing aside the mast jacket seal. The 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 lower servo apply (main line) gauge.

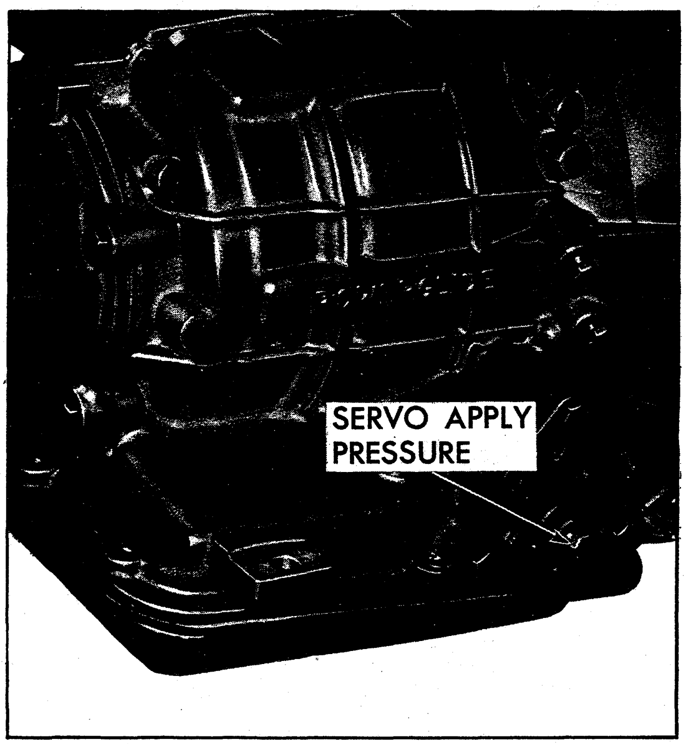


Fig. 14PG - Pressure Test Plug

- 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

Engine	Wide Open Throttle Upshift (psi)	Idle Pressure In "Drive" Range		Manual "Low" Range @ 1000 RPM (psi)	Drive Range Overrun (Coast) @ 20 - 25 MPH (20" Hg. Approx.) - psi
		16" Hg.	10" Hg.*		
L-4 - 153 and L-6 - 194	93 - 104	35 - 48	60 - 71	105 - 118	48 - 54
L-6 - 230	96 - 112	60 - 74	88 - 101	124 - 139	48 - 54
L-6 - 250 (Pass.)	91 - 105	59 - 72	84 - 95	105 - 118	48 - 54
L-6 - 250 (Taxi & Police)	96 - 112	60 - 74	88 - 101	124 - 139	48 - 54
V-8 - 283	90 - 105	60 - 73	86 - 98	115 - 128	48 - 54
V-8-327(2BBL Camaro)	91 - 107	60 - 74	88 - 101	124 - 139	48 - 54
V-8 - 327 & 427	104 - 119	60 - 74	88 - 101	124 - 139	48 - 54
V-8 - 396	104 - 119	60 - 74	88 - 101	124 - 139	48 - 54
V-8-327(W/RPO K-19)	99 - 113	54 - 69	83 - 95	109 - 124	42 - 48
V-8 - 350	91 - 106	60 - 74	88 - 101	124 - 139	48 - 54

*Partially open throttle until vacuum reads 10" Hg.

1967 SHIFT POINTS—POWERGLIDE

Chevrolet Models (MPH)

Engine	L250 (Base) 3.36 Axle - 8.25 14 Tire		L250 (Base) Taxi 3.07 Axle - 8.15 15 Tire		L250 (Base) Police 3.31 Axle - 8.25 14 Tire		V283 (Base) 3.36 Axle - 8.25 14 Tire		V327 (L30) 3.08 Axle - 8.25 14 Tire		V327 (L30/K19) 3.08 Axle - 8.25 14 Tire		V396 (L35) 3.07 Axle - 8.25 14 Tire	
Throttle Position	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
Closed	13.5-16.8	12.3-15.8	15.1-18.8	13.8-17.7	13.7-17.0	12.5-16.0	13.5-16.7	12.4-15.8	15.0-18.5	13.7-17.4	15.0-18.5	13.8-17.6	15.1-18.6	13.8-17.5
Detent Touch	40.8-50.0	22.4-34.2	45.9-57.2	24.7-38.0	41.5-51.7	22.3-34.3	43.7-53.2	15.3-23.1	53.8-65.1	16.9-27.9	53.8-65.1	17.1-28.4	54.0-65.3	17.0-28.0
Full Detent	49.5-56.9	45.8-53.6	55.6-63.9	51.2-60.0	50.2-57.7	46.2-54.2	52.5-59.4	49.2-56.5	65.8-73.5	61.5-69.7	65.8-73.5	61.7-69.9	66.0-73.8	61.7-69.9

Chevelle Models (MPH)

Engine	L230 (L26) 3.08 Axle - 7.35 14 Tire		L250 (L22) 3.08 Axle - 7.35 14 Tire		V283 (Base) 3.08 Axle - 7.35 14 Tire		V327 (L30) 3.08 Axle - 7.35 14 Tire		V327 (L30/K19) 3.08 Axle - 7.35 14 Tire		V396 (L34) 3.31 Axle - F70 14 Tire		V396 (L35) 3.07 Axle - F70 14 Tire	
Throttle Position	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
Closed	14.0-17.4	12.8-16.4	14.0-17.4	12.8-16.4	14.0-17.4	12.8-16.3	14.3-17.6	13.0-16.6	14.3-17.6	13.2-16.7	13.9-17.1	12.7-16.1	14.8-18.3	13.5-17.2
Detent Touch	42.3-52.8	22.8-35.0	42.3-52.8	23.3-35.4	45.3-55.2	15.8-23.9	51.1-61.9	16.1-26.5	51.1-61.9	16.2-27.0	56.7-68.8	15.7-21.6	55.3-67.4	16.7-20.8
Full Detent	51.3-59.0	47.2-55.3	51.3-59.0	47.5-55.6	54.4-61.5	51.0-58.5	62.5-69.9	58.5-66.2	62.5-69.9	58.7-66.4	70.7-78.5	65.8-74.1	68.9-76.9	64.1-72.6

Chevy II Models (MPH)

Engine	L194 (Base) M35 3.08 Axle - 6.95 14 Tire		L194 (Base) C60 3.36 Axle - 6.95 14 Tire		L250 (L22) 3.08 Axle - 6.95 14 Tire		V283 (Base) Chevy II 3.08 Axle - 6.95 14 Tire		V283 (Base) Super Sport 3.08 Axle - 6.95 14 Tire		V327 (L30) 3.08 Axle - 6.95 14 Tire		V327 (L30/K19) 3.08 Axle - 6.95 14 Tire	
Throttle Position	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
Closed	13.1-16.9	12.4-15.9	12.4-15.5	11.4-14.6	13.7-17.0	12.5-16.0	13.8-17.1	12.6-16.1	13.7-17.0	12.5-16.0	14.0-17.2	12.8-16.2	14.0-17.2	12.9-16.3
Detent Touch	39.8-49.8	22.6-33.9	36.5-45.6	20.8-31.1	41.4-51.6	22.8-34.7	46.1-56.0	15.6-24.3	44.3-54.0	15.5-23.4	50.0-60.5	15.7-25.9	50.0-60.5	15.9-26.4
Full Detent	48.2-55.6	44.7-52.4	44.2-51.0	41.0-48.1	50.2-57.7	46.4-54.4	55.3-62.5	51.9-59.4	53.2-60.2	49.9-57.3	61.1-68.3	57.2-64.8	61.1-68.3	57.4-65.0

Corvette Models (MPH) / Camaro Models (MPH)

Engine	V327 (Hi. Perf.) 3.36 Axle - 7.75 15 Tire		V427 (L36) 3.36 Axle - 7.75 15 Tire		L230 (L26) (M35 & D55) 2.72 Axle - 7.35 14 Tire		L250 (L22) (M35 & D55) 2.73 Axle - 7.35 14 Tire		V327 (M35 & D55) 2.73 Axle - 7.35 14 Tire		V327 (K19) (M35 & D55) 2.73 Axle - 7.35 14 Tire		V327 (Base) 28RL 2.73 Axle - 7.35 14 Tire	
Throttle Position	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
Closed	13.8-17.0	12.6-16.0	13.8-17.0	12.6-16.0	15.8-19.6	14.4-18.5	15.8-19.6	14.4-18.5	16.1-19.9	14.7-18.7	16.1-19.9	14.8-18.8	16.9-18.3	15.6-17.2
Detent Touch	49.3-59.7	15.5-25.5	55.7-66.9	15.5-28.5	47.8-59.5	25.7-39.5	47.8-59.5	26.2-40.0	57.7-69.8	18.2-29.9	57.7-69.8	18.3-30.4	56.7-63.4	34.4-42.9
Full Detent	60.3-67.4	56.4-63.9	68.1-75.6	63.7-71.6	57.9-66.5	53.2-62.4	57.9-66.9	55.5-62.3	70.5-78.8	66.0-74.1	70.5-78.8	66.7-74.9	68.4-71.9	64.8-68.6

TURBO HYDRA-MATIC TRANSMISSION

INDEX

GENERAL DESCRIPTION

The Turbo Hydra-Matic transmission is a fully automatic unit consisting primarily of a 3-element hydraulic torque converter and a compound planetary gear set. Three multiple-disc clutches, one sprag unit, one roller clutch and two bands provide the friction elements required to obtain the desired function of the compound planetary gear set.

The torque converter couples the engine to the planetary gears through oil and provides hydraulic torque multiplication when required. The compound planetary gear set produces three forward speeds and reverse.

The 3-element torque converter consists of a pump or driving member, a turbine or driven member, and a stator assembly. The stator is mounted on a one-way roller clutch which will allow the stator to turn clockwise but not counter-clockwise.

The torque converter housing is filled with oil and is attached to the engine crankshaft by a flex plate and always rotates at engine speed. The converter pump is an integral part of the converter housing, therefore the pump blades, rotating at engine speed, set the oil within the converter into motion and direct it to the turbine, causing the turbine to rotate.

As the oil passes through the turbine it is traveling in such a direction that if it were not re-directed by the stator it would hit the rear of the converter pump blades and impede its pumping action. So at low turbine speeds, the oil is re-directed by the stator to the converter pump in such a manner that it actually assists the converter pump to deliver power or multiply engine torque.

As turbine speed increases, the direction of the oil leaving the turbine changes and flows against the rear side of the stator vanes in a clockwise direction. Since the stator is now impeding the smooth flow of oil, its roller clutch releases and it revolves freely on its shaft. Once the stator becomes inactive, there is no further multiplication of engine torque within the converter. At this point, the converter is merely acting as a fluid coupling as both the converter pump and turbine are being driven at approximately the same speed - or at a one-to-one ratio.

A hydraulic system pressurized by a gear type pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections to transmission are:

Manual Linkage	-	To select the desired operating range.
Engine Vacuum	-	To operate a vacuum modulator unit.
12 Volt Electrical Signal	-	To operate an electrical detent solenoid.

A vacuum modulator is used to automatically sense any change in the torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator for line pressure control, to the 1-2 accumulator valve, and to the shift valves so that all torque requirements of the transmission are met and smooth shifts are obtained at all throttle openings.

The detent solenoid is activated by an electric switch on the carburetor. When the throttle is fully opened, the switch on the carburetor is closed, activating the detent solenoid and causing the transmission to downshift at speeds below approximately 70 MPH.

The selector quadrant has six selector positions: P,R, N,D, L2, L1.

P. - Park position positively locks the output shaft to the transmission case by means of a locking pawl to prevent the vehicle from rolling in either direction. The engine may be started in Park position.

R. - Reverse enables the vehicle to be operated in a reverse direction.

N. - Neutral position enables the engine to be started and run without driving the vehicle.

D. - Drive Range is used for all normal driving conditions and maximum economy. Drive Range has three gear ratios, from the starting ratio to direct drive. Detent downshifts are available by depressing the accelerator to the floor.

L2. - L2 Range has the same starting ratio as Drive Range, but prevents the transmission from shifting above second speed to retain second speed acceleration when extra performance is desired. L2 Range can also be used for engine braking. L2 Range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second until the vehicle speed or the throttle are changed to obtain first gear operation in the same manner as in D Range.

L1. - L1 Range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 40 MPH, depending on axle ratio. L1 Range position prevents the transmission from shifting out of first gear.

It is very important that any communication concerning the Turbo Hydra-Matic always contain the transmission serial number and that all transmission parts returned to Chevrolet Motor Division always be tagged with the transmission serial number.

MAINTENANCE AND ADJUSTMENTS

TRANSMISSION FLUID

Transmission fluid level should be checked with transmission warm and selector lever in "P" Park position, every time engine oil level is checked or as specified in Section 0 when engine oil is changed.

CAUTION: Since the Turbo Hydra-Matic transmission is very sensitive to oil level, special precautions should be taken when checking the oil level, to insure against an overfill.

Transmission fluid should be changed as specified in Section 0.

FLUID LEVEL INDICATOR

The fluid level indicator is located in the filler pipe at the right rear corner of the engine. To bring the fluid level from the add mark to the full mark add 1 pint.

Fluid level should be to the full mark with transmission at normal operating temperature. With cold fluid the level should be at the add mark or slightly below.

SHIFT CONTROL LINKAGE ADJUSTMENT

Adjust linkage as shown below and in Figure 2.

1. The shift tube and lever assembly must be free in the mast jacket. See Section 9 for alignment of steering column assembly if necessary.
2. To check for proper shift linkage adjustment, lift the transmission selector lever towards the steering wheel. Allow the selector lever to be positioned in drive (D) by the transmission detent.

   NOTE: Do not use the indicator pointer as a reference to position the selector lever. When performing linkage adjustment, pointer is adjusted last.

3. Release the selector lever. The lever should be inhibited from engaging low range unless the lever is lifted.
4. Lift the selector lever towards the steering wheel, and allow the lever to be positioned in neutral (N) by the transmission detent.
5. Release the selector lever. The lever should now be inhibited from engaging reverse range unless the lever is lifted.
6. A properly adjusted linkage will prevent the selector lever from moving beyond both the neutral detent, and the drive detent unless the lever is lifted to pass over the mechanical stop in the steering column. See schematic diagram.
7. In the event that an adjustment is required, place the selector lever in drive (D) position as determined by the transmission detent. See Steps 2 and 3.
8. Loosen the adjustment swivel at the cross-shaft, and rotate the transmission lever so that it contacts the drive stop in the steering column.
9. Tighten the swivel and recheck the adjustment. See Steps 2 and 6.
10. Readjust indicator needle if necessary to agree with the transmission detent positions. See Section 9.
11. Readjust neutral safety switch if necessary to provide the correct relationship to the transmission detent positions. See Section 12.
12. When properly adjusted the following conditions must be met by manual operation of the steering column shift lever:
    a. From reverse to drive position travel, the transmission detent feel must be noted and related to indicated position on dial.
    b. When in drive and reverse positions, pull lever rearward (towards steering wheel) and then release. It must drop back into position with no restrictions.

NEUTRAL SAFETY SWITCH ADJUSTMENT

The neutral safety switch must be adjusted so that the car will start in the park or neutral position, but will not start in the other positions. For replacement refer to Section 12 of this Manual.

DRAINING AND REFILLING TRANSMISSION

Drain oil immediately after operation before it has had an opportunity to cool.

To drain oil proceed as follows:

1. Remove bottom pan attaching screws, pan, and gasket.
2. Remove oil strainer. Remove "O" ring seal from pick-up pipe and discard.
3. Discard strainer if dirty.
4. Install new "O" ring seal on pick-up pipe and install strainer and pipe assembly.
5. Thoroughly clean bottom pan.
6. Affix new gasket to bottom pan with petroleum jelly.
7. Install bottom pan with attaching screws and torque to specifications.
8. If only the pan has been removed, pour approximately 7-1/2 pints of fluid into the transmission. If the valve body has also been removed use 9-1/2 pints. After a complete overhaul approximately 19 pints are required. Be sure container, spout, or funnel is clean.
9. Start engine and let idle (carburetor off fast idle step). Place selector lever in P position and apply hand brake.
10. With transmission warm (approximately 150°F), add fluid to bring level to full mark on indicator.

    CAUTION: Do not overfill. Foaming will result.

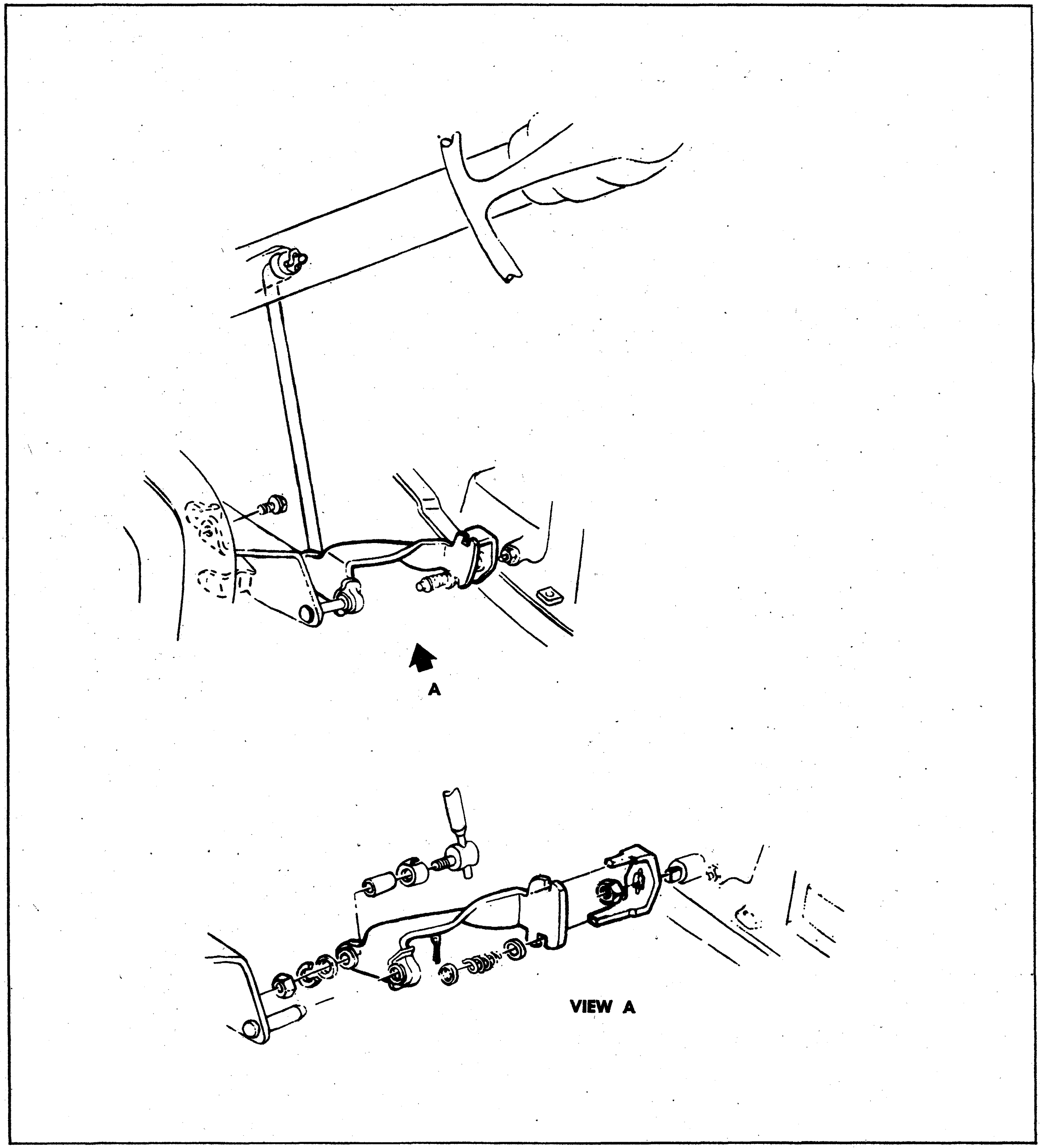


Fig. 1T - Gearshift Controls (column) - Typical

PRESSURE REGULATOR VALVE

Removal

1. Remove bottom pan and strainer.
2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring, using J-5403 pliers.
3. Remove regulator boost valve bushing and valve.
4. Remove pressure regulator spring.
5. Remove regulator valve, spring retainer, and spacer(s) if present.

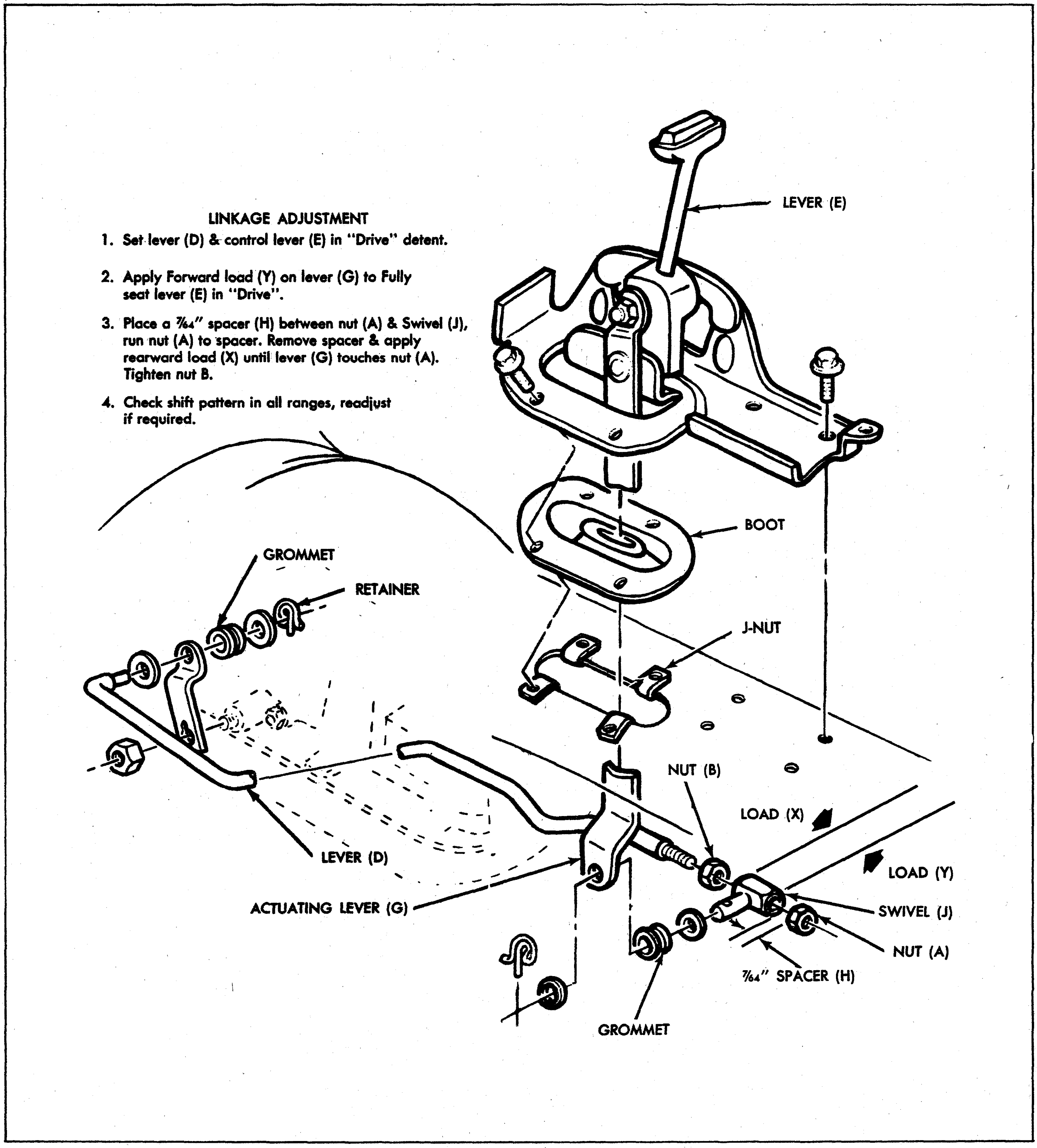


Fig. 2T - Gearshift Controls (console) - Typical

Installation

Installation of the pressure regulator valve is the reverse of the removal.

CONTROL VALVE BODY

Removal

1. Remove bottom pan and strainer.
2. Disconnect solenoid lead from connector terminal.
3. Remove control valve body attaching screws and detent roller spring assembly.

   NOTE: Do not remove solenoid attaching screws.
4. Remove control valve body assembly and governor

pipes. If care is taken in removing control valve body the six (6) check balls will stay in place above the spacer plate.

CAUTION: Do not drop manual valve.

5. Remove the governor pipes and manual valve from control valve body.

Installation

Installation of the control valve body is the reverse of the removal.

GOVERNOR

Removal

1. Remove governor cover attaching screws, cover, and gasket.
2. Discard gasket.
3. Withdraw governor assembly from case.

Installation

Installation of the governor assembly is the reverse of the removal. Use a new gasket under the governor cover.

MODULATOR AND MODULATOR VALVE

Removal

1. Remove modulator assembly attaching screw and retainer.
2. Remove modulator assembly from case. Discard "O" ring seal.
3. Remove modulator valve from case.

Installation

Installation of the modulator assembly and modulator valve is the reverse of the removal. Use a new "O" ring seal on the modulator assembly.

PARKING LINKAGE

Removal

1. Remove bottom pan and oil strainer.
2. Unthread jam nut holding detent lever to manual shaft.
3. Remove manual shaft retaining pin from case.
4. Remove manual shaft and jam nut from case.

   NOTE: DO NOT remove manual shaft seal unless replacement is required.

5. Remove parking actuator rod and detent lever assembly.
6. Remove parking pawl bracket attaching screws and bracket.
7. Remove parking pawl return spring.

   NOTE: The following steps should not be completed unless part replacement is required.

8. Remove parking pawl shaft retainer.
9. Remove parking pawl shaft, cup plug, parking pawl shaft, and parking pawl.

Installation

Installation of the parking linkage is the reverse of the removal. Use new seal and cup plug, if removed, and new bottom pan gasket.

REAR SEAL

Removal

1. Remove propeller shaft.
2. Pry seal out with screw driver.

Installation

1. Using Tool J-5154 or J-21359 install new seal.
2. Re-install propeller shaft.

OTHER SERVICE WITH TRANSMISSION IN VEHICLE

The following operations when done as single operations and not as part of a general overhaul should, as a practical matter, be performed with the transmission in the vehicle. Refer to the "Transmission Disassembly and Reassembly" section of the Overhaul Manual for service procedures.

a. Oil filler pipe and "O" ring seal.
b. Oil pan and gasket.
c. Down shift solenoid or connector.
d. Valve body spacer plate, gasket and check balls.
e. Front accumulator piston.
f. Rear servo and rear accumulator assembly.
g. Rear band apply checking with Tool J-21370.
h. Front servo assembly.
i. Speedo driven gear.
j. Case extension or gasket.
k. Strainer and "O" ring.

TRANSMISSION REPLACEMENT

Before raising the car, disconnect the battery and release the parking brake.

1. Remove propeller shaft.
2. Disconnect speedometer cable, electrical lead to case connector, vacuum line at modulator, and oil cooler pipes.
3. Disconnect shift control linkage.
4. Support transmission with suitable transmission jack.
5. Disconnect rear mount from frame crossmember.
6. Remove two bolts at each end of frame crossmember and remove crossmember.
7. Remove oil cooler lines, vacuum modulator line, speedo cable, and detent solenoid connector wire at transmission.
8. Remove converter under pan.
9. Remove converter to flywheel bolts.
10. Loosen exhaust pipe to manifold bolts approximately 1/4 inch, and lower transmission until jack is barely supporting it.
11. Remove transmission to engine mounting bolts and remove oil filler tube at transmission.
12. Raise transmission to its normal position, support engine with jack and slide transmission rearward from engine and lower it away from vehicle.

CAUTION: Use converter holding Tool J-5384 when lowering transmission or keep rear of transmission lower than front so as not to lose converter.

The installation of the transmission is the reverse of the removal.

TURBO HYDRA-MATIC DIAGNOSIS PROCEDURE

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular, knowing which units are involved in the various speeds or shifts so that the specific units or circuits involved in the problem can be isolated and investigated further. Analytical diagnosis will protect the technician from come backs and certainly will improve owner satisfaction.

An important and often overlooked aspect of diagnosis is finding out specifically what the customer is complaining of. For this purpose a short ride with the customer will often prove beneficial. It may be found that the condition the customer wants corrected is standard and should not be altered.

The following sequence, based on field experience, provides the desired information quickly and in most cases actually corrects the malfunction without requiring the removal of the transmission. Details of the items listed in this sequence are covered further in the text.

SEQUENCE FOR TURBO HYDRA-MATIC DIAGNOSIS PROCEDURE

1. Check oil level and condition.
2. Check and correct detent switch.
3. Check and correct vacuum line and fittings.
4. Check and correct manual linkage.

OIL LEVEL AND CONDITION CHECK

Always check the oil level before road testing. Oil must be visible on dip stick prior to operating the vehicle. Erratic shifting, pump noise, or other malfunctions can in some cases be traced to improper oil level.

Oil level should be checked with the selector lever in the Park (P) position, engine running, and the vehicle on level pavement.

Fluid level should be to the FULL mark with the transmission at normal operating temperature (170°-190°F.). With warm fluid (room temperature), the level should be at or slightly below the ADD mark.

If oil level was low, refer to Oil Leaks.

The condition of the oil is often an indication of whether the transmission should be removed from the vehicle, or to make further tests. When checking oil level, a burned smell and discoloration indicate burned clutches or bands and the transmission will have to be removed.

MANUAL LINKAGE

Manual linkage adjustment and the associated neutral safety switch are important from a safety standpoint. The neutral safety switch should be adjusted so that the engine will start in the Park and Neutral positions only.

With the selector lever in the Park position, the parking pawl should freely engage and prevent the vehicle from rolling. The pointer on the indicator quadrant should line up properly with the range indicators in all ranges.

OIL LEAKS

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak can be deceiving due to "wind flow" around the engine and transmission.

The suspected area should be wiped clean of all oil before inspecting for the source of the leak. Red dye is used in the transmission oil at the assembly plant and will indicate if the oil leak is from the transmission.

The use of a "black light"* to identify the oil at the source of leak is also helpful. Comparing the oil from the leak to that on the engine or transmission dip stick (when viewed by black light) will determine the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the car by the air stream. For example, a transmission "oil filler tube to case leak" will sometimes appear as a leak at the rear of the transmission. In determining the source of an oil leak it is most helpful to keep the engine running.

POSSIBLE POINTS OF OIL LEAKS

1. TRANSMISSION OIL PAN LEAK
   a. Attaching bolts not correctly torqued.
   b. Improperly installed or damaged pan gasket.
   c. Oil pan gasket mounting face not flat.
2. REAR EXTENSION LEAK
   a. Attaching bolts not correctly torqued.
   b. Rear seal assembly — damaged or improperly installed.
   c. Gasket seal — (extension to case) damaged or improperly installed.
   d. Porous casting.
3. CASE LEAK
   a. Filler pipe "O" ring seal damaged or missing; misposition of filler pipe bracket to engine — "loading" one side of "O" ring.
   b. Modulator assembly "O" ring seal — damaged or improperly installed.
   c. Governor cover, gasket and bolts — damaged, loose; case face leak.
   d. Speedo gear — "O" ring damaged.
   e. Manual shaft seal — damaged, improperly installed.
   f. Line pressure tap plug — stripped, shy sealer compound.
   g. Parking pawl shaft cup plug — damaged, improperly installed.
   h. Vent pipe (refer to Item 5).
   i. Porous case.
4. FRONT END LEAK
   a. Front seal — damaged (check converter neck for nicks, etc., also for pump bushing moved forward); garter spring missing from pump to converter seal.
   b. Pump attaching bolts and seals — damaged, missing, bolts loose.

c. Converter — leak in weld.
d. Pump "O" ring seal — damaged. (Also check pump groove and case bore.)
e. Porous casting (pump or case).

5. OIL COMES OUT VENT PIPE
   a. Transmission over-filled.
   b. Water in oil.
   c. Pump to case gasket mispositioned.
   d. Foreign material between pump and case, or between pump cover and body.
   e. Case — porous, pump face improperly machined.
   f. Pump — shy of stock on mounting faces, porous casting.

CASE POROSITY—REPAIR

Transmission leaks caused by aluminum case porosity have been successfully repaired with the transmission in the vehicle by using the following procedure.

1. Road test and bring the transmission to operating temperature.
2. Raise the car and, with the engine running, locate the source of the oil leak. Check for leaks in all operating positions.

   NOTE: The use of a mirror will be helpful in finding leaks.

3. Shut off engine and thoroughly clean area with a solvent and air dry.
4. Using the instruction of the manufacturer, mix a sufficient amount of epoxy cement, part #1360016, to make the repair.
5. While the transmission is still hot, apply the epoxy to the area, making certain that the area is fully covered.
6. Allow epoxy cement to dry for three hours and retest for leaks, as outlined in Steps 1 and 2.

OIL PRESSURE CHECK

With Car Stationary

Transmission oil pressure gauge and engine tachometer should be connected and the oil pressures should check as follows:

1. Pressures indicated below are at 0 output speed with the vacuum modulator tube disconnected and with engine at 1200 rpm.

Approximate Altitude of Check (Ft. above sea level)	Drive Neutral Park	L1 or L2	Reverse
0	150	150	244
2,000	150	150	233
4,000	145	150	222
6,000	138	150	212
8,000	132	150	203
10,000	126	150	194
12,000	121	150	186
14,000	116	150	178

2. Pressures indicated below are with the vacuum tube connected for normal modulator operation, and with the engine at 1200 rpm.

   NOTE: Pressures are not significantly affected by altitude or barometric pressure when the vacuum tube is connected.

Drive, Neutral, Park	L1 or L2	Reverse
70	150	107

TURBO HYDRA-MATIC SHIFT POINTS

Chevrolet Models (MPH)

Engine	V327 (L30) 2.73 Axle - 8.25 - 14 Tire				V396 (L35) 2.73 Axle - 8.25 - 14 Tire				V427 (L36) 2.73 Axle - 8.25 - 14 Tire			
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn
Closed	7.7-11.5	10.9-6.9	17.5-22.6	19.5-14.6	8.0-12.9	10.3-4.3	17.2-27.8	18.3-12.6	8.6-12.6	11.7-6.6	17.5-30.7	18.9-14.3
Detent Touch												
Thru Detent	36.4-50.1	74.8-91.4	85.1-67.6	43.3-26.6	38.4-55.9	45.6-25.2	74.8-91.7	83.7-65.0	44.1-58.5	45.8-27.2	81.1-99.4	92.6-73.4

Chevelle Models (MPH)

	V396 (L34) 3.07 Axle - F70 - 14 Tire				
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn	
Closed	7.4-10.9	9.6-5.7	15.1-26.4	16.3-12.4	
Detent Touch					
Thru Detent	38.1-50.4	39.5-23.5	69.9-85.7	79.8-63.3	

SPECIAL TOOLS

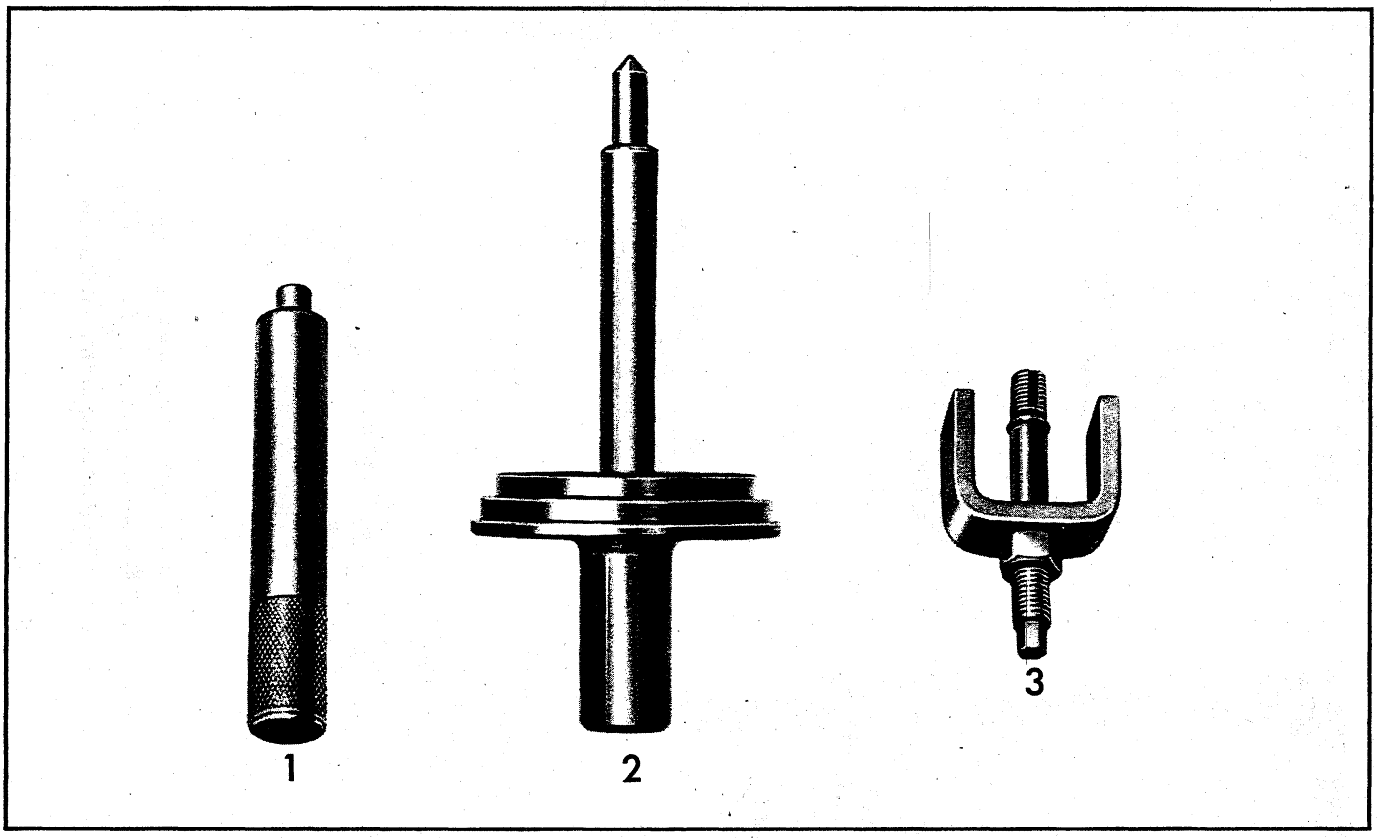


Fig. 3T - Clutch Special Tools

1. J-1522 Pilot Bearing Driver
2. J-5824 Clutch Pilot Tool
3. J-1448 Pilot Bearing Puller

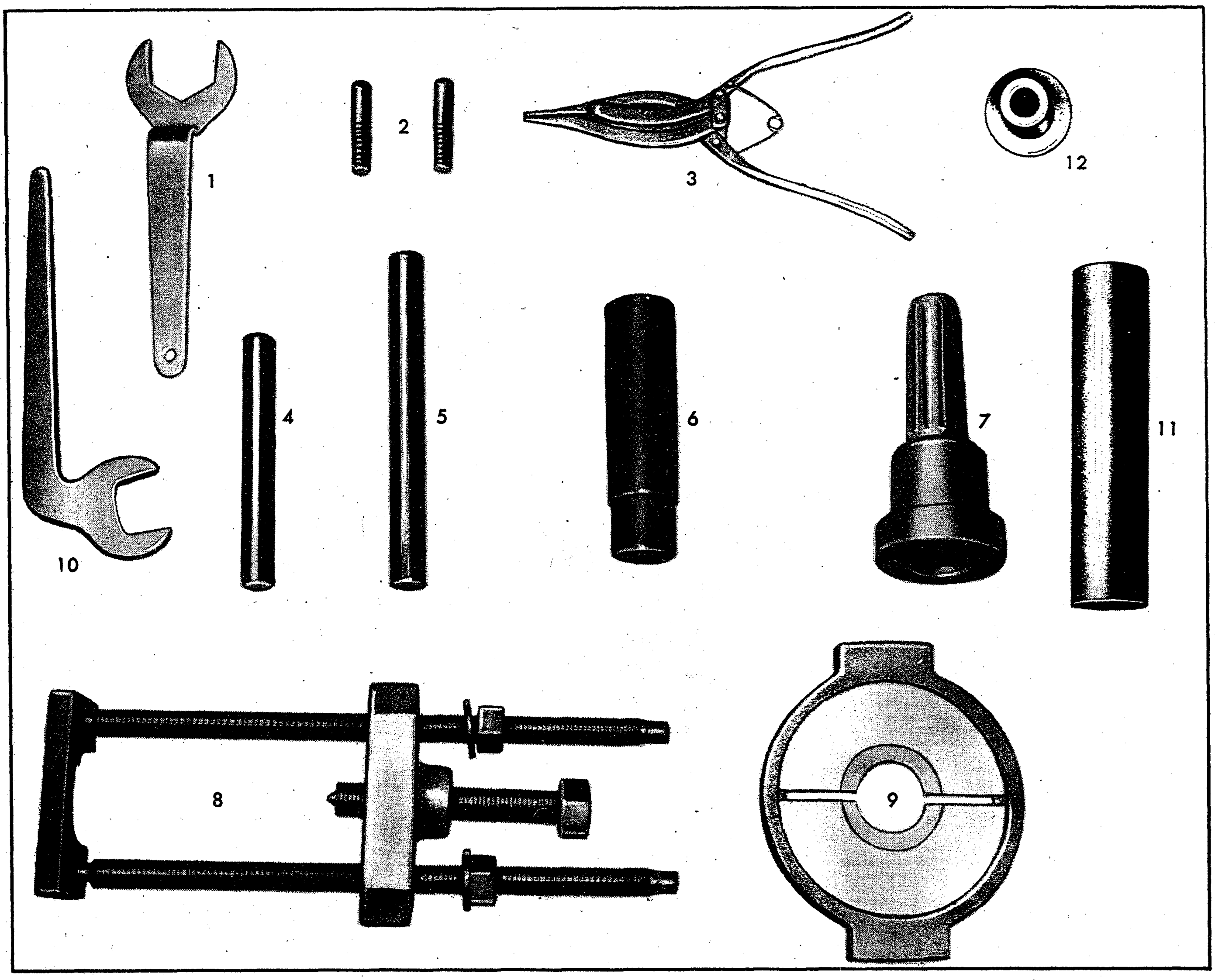


Fig. 4T - Manual Transmission Special Tools

1. J-0933 Clutch Gear Bearing Retainer Wrench
2. J-1126 Transmission Guide Pins
3. J-8059 Retainer Snap Ring Pliers
4. J-21629 Countergear Loading Tool
5. J-22246 Countergear Loading Tool
6. J-5778 Extension Housing Bushing Remover and Installer
7. J-5154 Extension Housing Seal Installer
8. J-5814-15 Speedometer Drive Gear Remover
9. J-1453-01 Speedometer Drive Gear Press Plates
   J-358-1 Press Plate Holder
10. J-4653 Overdrive Governor Wrench
11. J-5590 Clutch Gear Bearing Installer
12. J-7785 Clutch Gear Retainer Lip Seal Installer

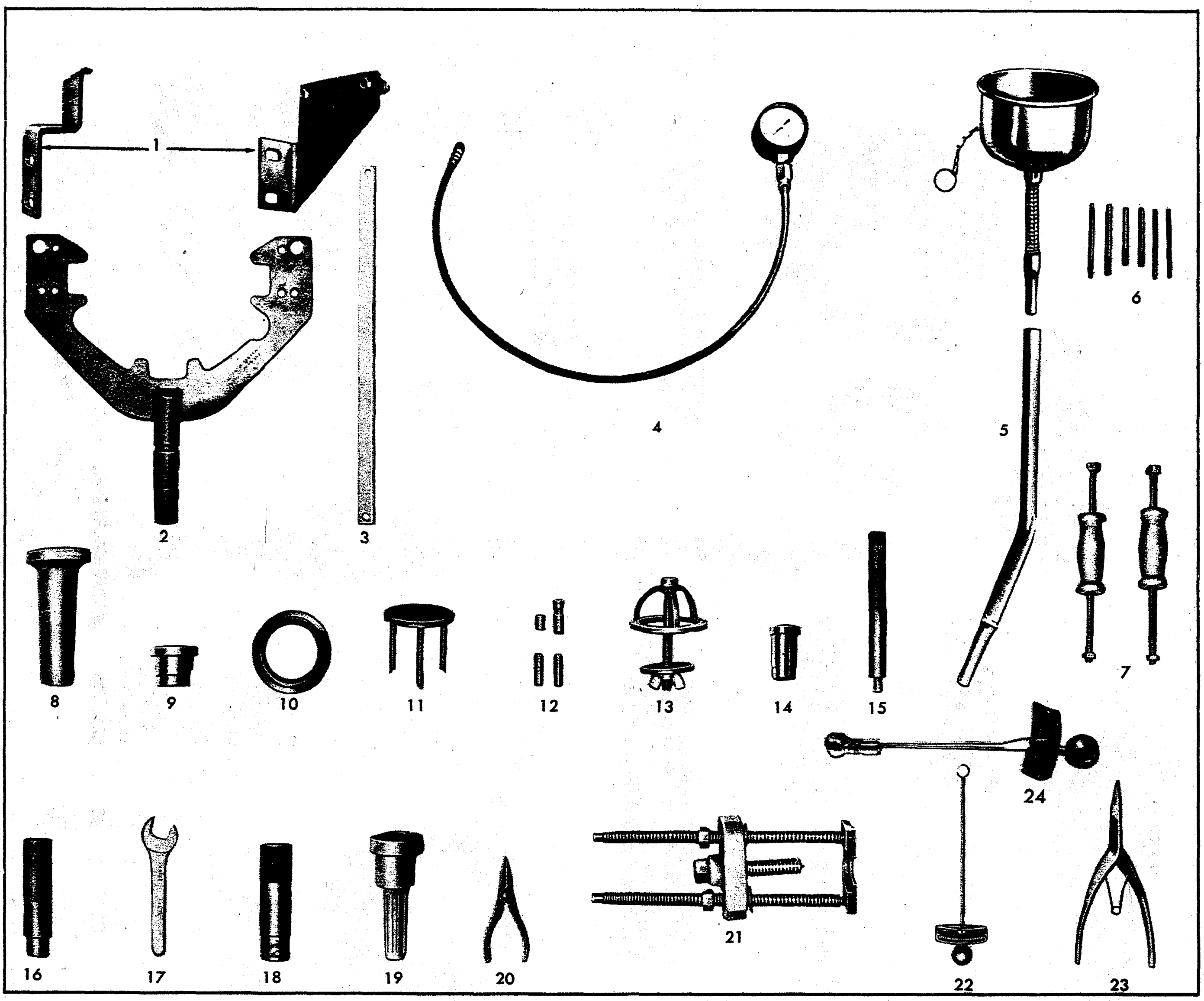


Fig. 5T - Aluminum Powerglide Special Tools

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.	J-9557	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
24.	J-21848	Low Band Adjusting Tool
	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)

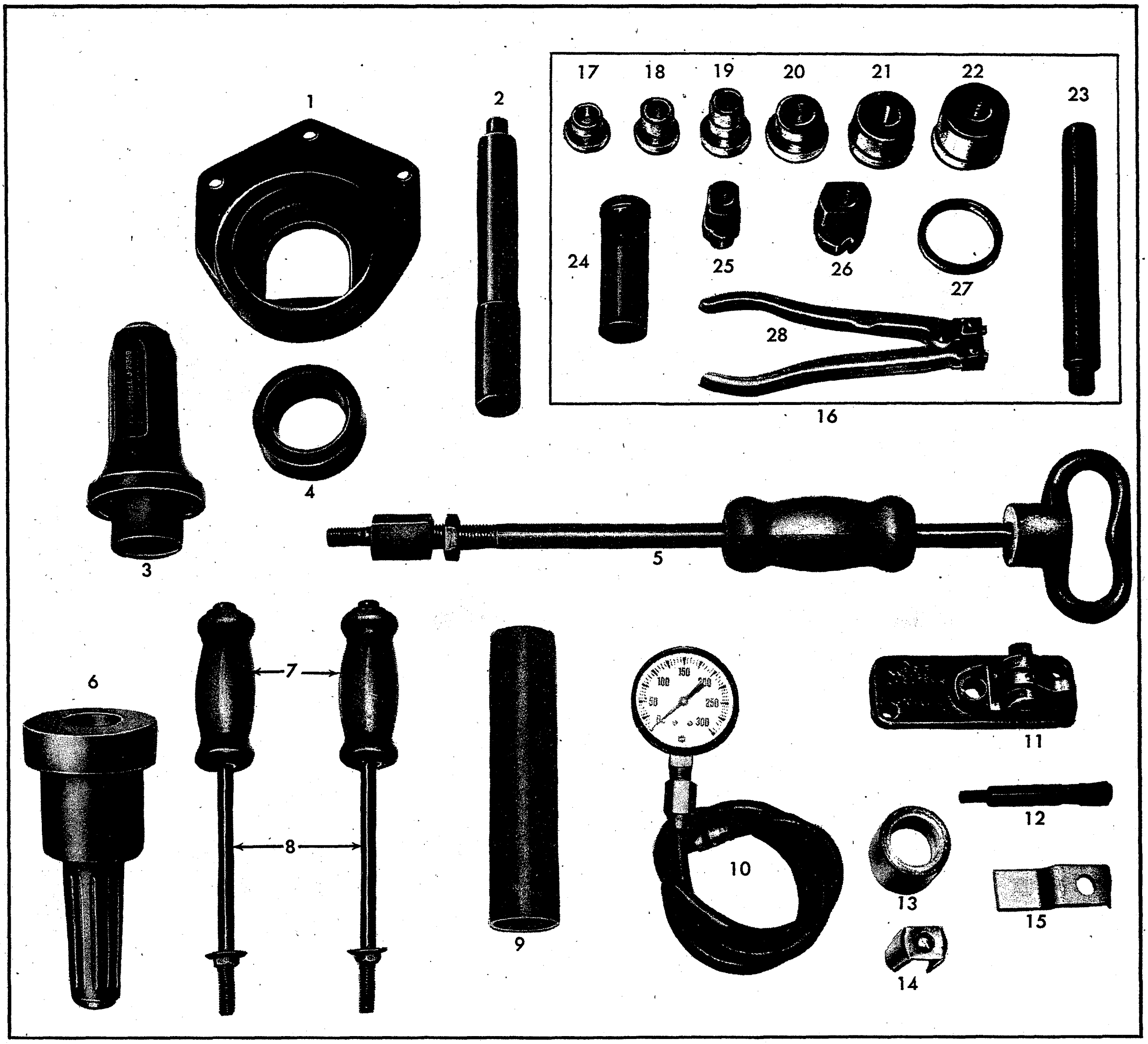


Fig. 6T - Turbo Hydra-Matic Special Tools

1.	J-6116-01	Rear Unit Holding Fixture
2.	J-8092	Driver Handle
3.	J-21359	Pump Oil Seal Installer
4.	J-21364	Holding Fixture Adapter (Used with J-6116-01 Fixture)
5.	J-2619	Slide Hammer (Used with 2619-4 Adapter and Remover Tools J-21465-01)
6.	J-5154	Extension Oil Seal Installer
7.	J-6585	Slide Hammer Weights
8.	J-9539	Slide Hammer Bolts (3/8 - 16 Threads)
9.	J-5590	Speedo Gear Installer
10.	J-21867	Pressure Gauge and Hose
11.	J-21370-6	Rear Band Apply Fixture
12.	J-21370-5	Rear Band Apply Pin
13.	J-21795-1	Gear Unit Assembly Holding Tool
14.	J-21795-2	Part of Above Holding Tool
15.	J-5384	Converter Holding Strap
16.	J-21465-01	Bushing Tool Set
17.	J-21465-5	Part of Bushing Tool Set
18.	J-21465-3	Part of Bushing Tool Set
19.	J-21465-2	Part of Bushing Tool Set
20.	J-21465-1	Part of Bushing Tool Set
21.	J-21465-17	Part of Bushing Tool Set
22.	J-21465-8	Part of Bushing Tool Set
23.	J-21465-13	Part of Bushing Tool Set
24.	J-21465-6	Part of Bushing Tool Set
25.	J-21465-15	Part of Bushing Tool Set
26.	J-21465-16	Part of Bushing Tool Set
27.	J-21465-9	Part of Bushing Tool Set
28.	J-21465-10	Part of Bushing Tool Set
29.	J-22182	Extension Bushing Remover & Installer (Not Illustrated)

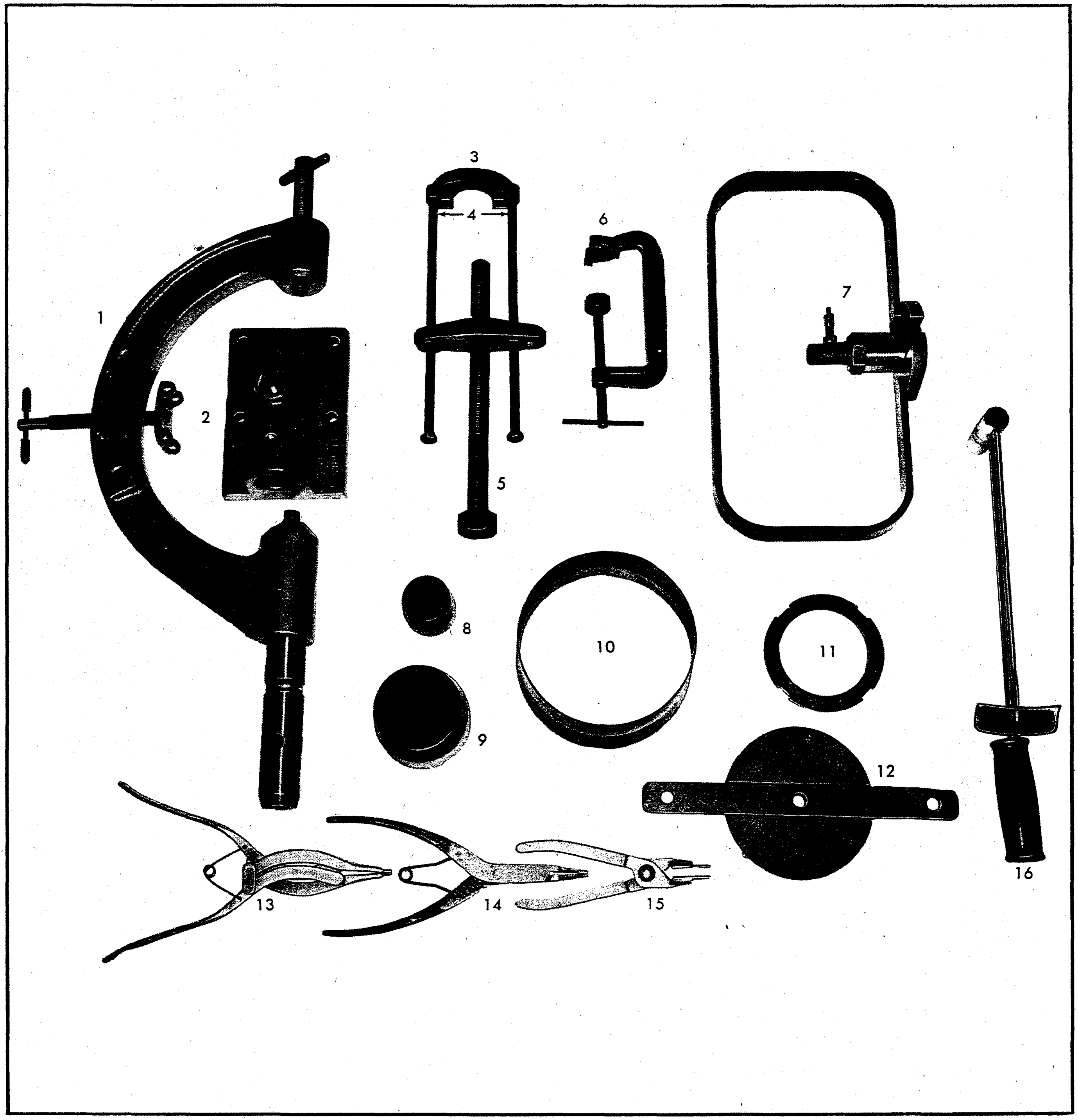


Fig. 7T - Turbo Hydra-Matic Special Tools

1.	J-8763	Transmission Holding Fixture
2.	J-3289-14	Holding Fixture Base
3.	J-21427-1	Speedo Gear Remover
4.	J-9539	Slide Hammer Bolts (3/8" - 16 Threads)
5.	J-8105	Speedo Gear Remover Puller
6.	J-21885	Accumulator Piston Installer
7.	J-21369	Converter Pressure Check Fixture
8.	J-21362	Seal Protector - Forward & Direct Clutch - Inner
9.	J-21363	Seal Protector - Intermediate Clutch - Inner
10.	J-21409	Seal Protector - Forward Clutch - Outer
11.	J-21664	Clutch Spring Compressor Adapter Ring
12.	J-4670	Clutch Spring Compressor
13.	J-8059	Snap Ring Pliers
14.	J-5586	Snap Ring Pliers
15.	J-5403	Snap Ring Pliers
16.	J-1313	Torque Wrench 0-140 Ft. Lbs.

SECTION 8
FUEL TANK AND EXHAUST SYSTEMS

CONTENTS OF THIS SECTION

CHEVROLET
FUEL TANKS

INDEX

GENERAL DESCRIPTION

All sedan models (fig. 1) use a 24 gallon capacity (approx.) 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 24 gallon capacity (approx.). 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. 1).

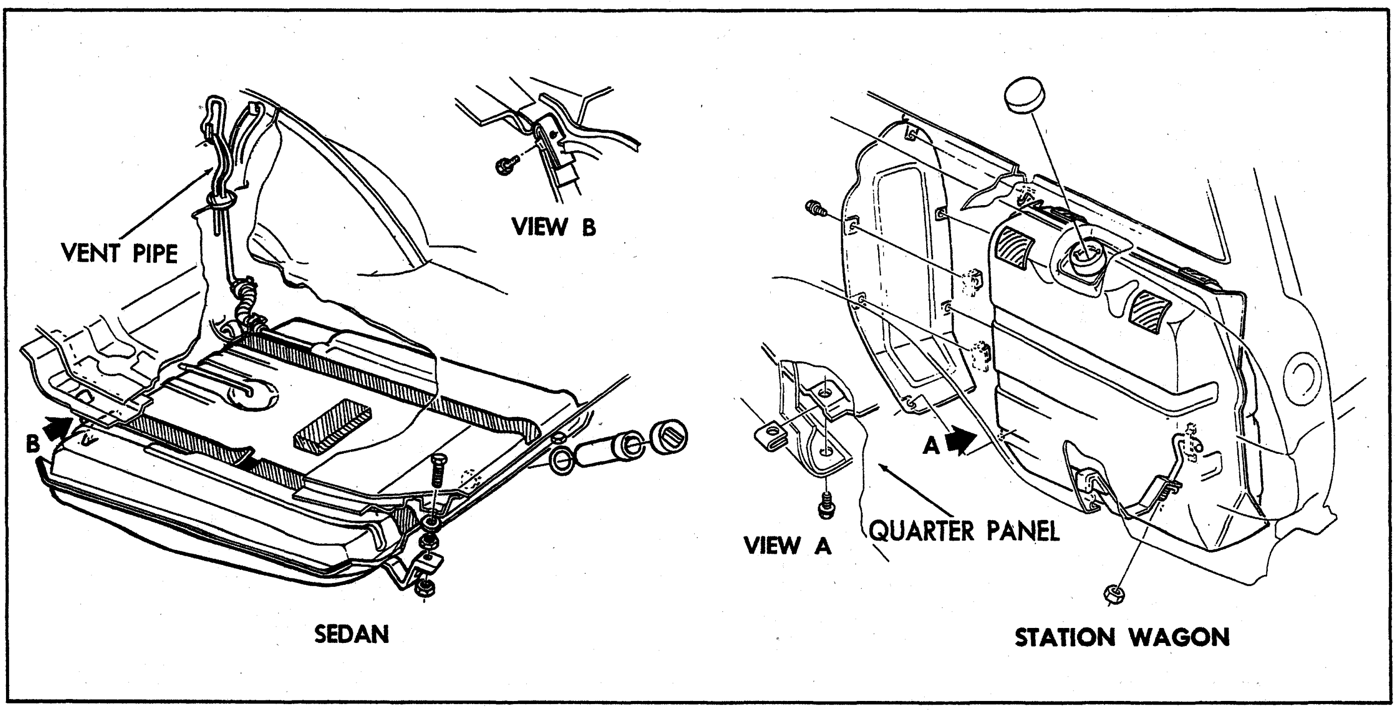


Fig. 1—Fuel Tanks

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 2).
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 contaner insert an air hose in downward direction in the flap-type slit and trigger the flow of fuel.

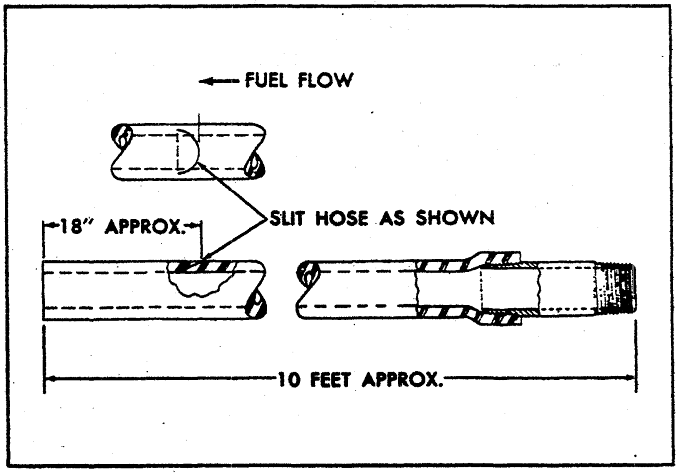


Fig. 2—Siphon Construction

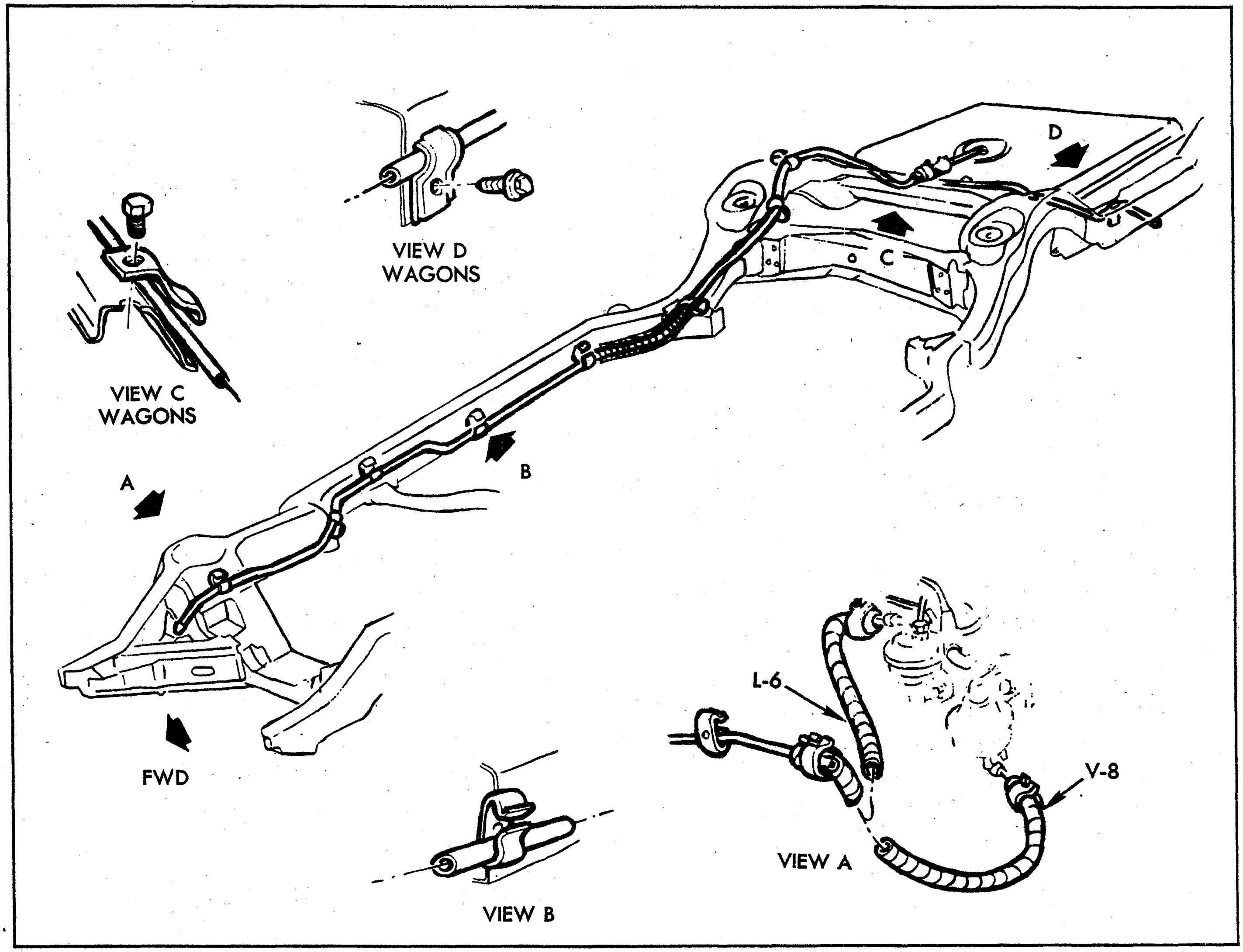


Fig. 3—Fuel Lines

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, ground wire.
4. Disconnect meter wire at rear harness connector.
5. Disconnect vent pipe hose.
6. Remove tank support straps and lower tank carefully.
7. 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 ground wire attaching bolt at body location.
6. Remove strap assembly nut and carefully lower tank.
7. Reverse removal procedure to install.

FUEL LINES (Fig. 3)

The fuel lines extend from the fuel tank pickup to fuel pump are routed on the underside of the right side of the

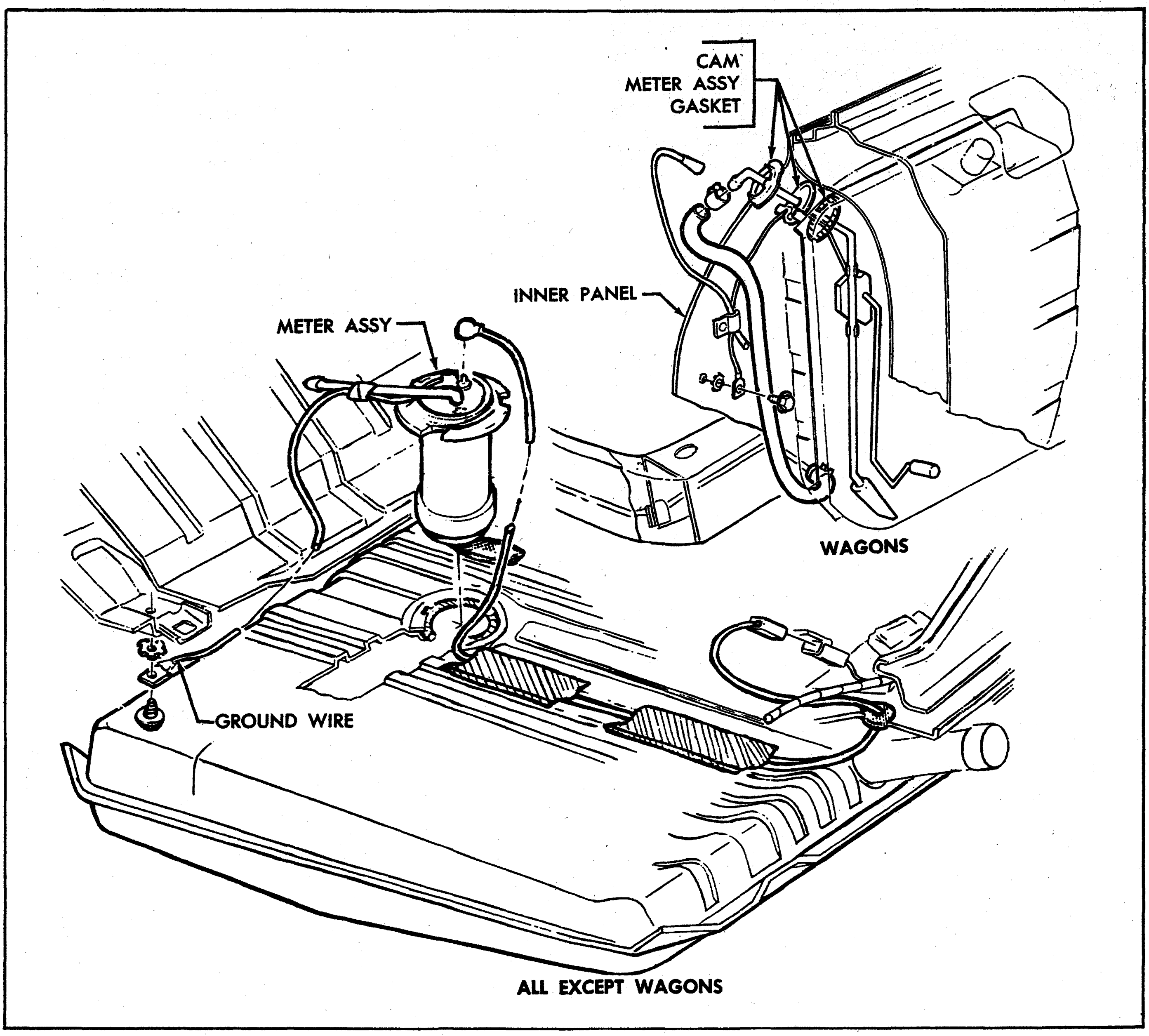


Fig. 4—Gauge Unit Assembly

Fig. 5—Meter Assembly Removal Using Tool J-22554

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 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 sedan 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 tank.

GAUGE UNIT AND FUEL STRAINER

Removal and Installation (Fig. 4)

1. Follow tank removal procedure.
2. Use Special Tool J-22554 (fig. 5) to remove cam lock on sedan models and Tool J-8950 on station wagons.
3. Remove unit and rubber gasket.
4. Reverse procedure to install.

EXHAUST SYSTEMS

INDEX

GENERAL DESCRIPTION

All exhaust systems used on the 1967 Chevrolet are the split system type in which the component parts are secured together with clamps. The single exhaust system used on L-6 engine models (fig. 6) consists of an exhaust pipe, muffler, tailpipe and attaching hardware. On V-8 engine single exhaust models a crossover pipe is added to connect the right exhaust manifold to the system. Dual exhaust systems (fig. 7) are available as regular production equipment on the 427 cu. in. displacement V-8 engines and as an option on the other (except 283 cu. in.) V-8 engines. These systems consist of two exhaust pipes, mufflers, tailpipes with resonators and attaching hardware. All exhaust systems are suspended on brackets with insulators for rattle free operation.

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.

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. Disengage muffler at exhaust and tail pipe connections.
4. Three-fourths inch clearance should be allowed between the muffler bracket (hanger) and crossmember at installation.
5. Install unit with 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 AND/OR RESONATOR

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.

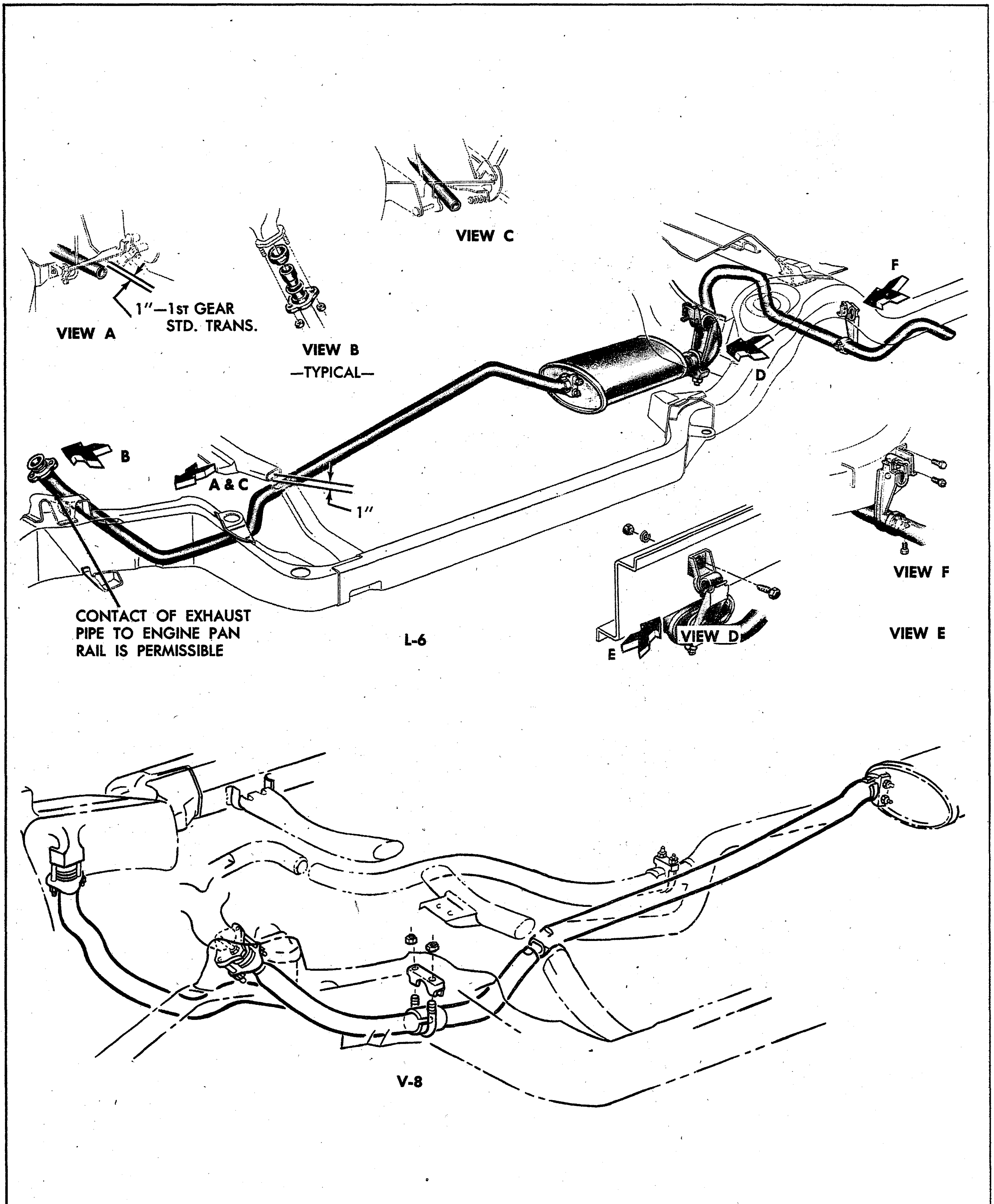


Fig. 6—Single Exhaust Systems

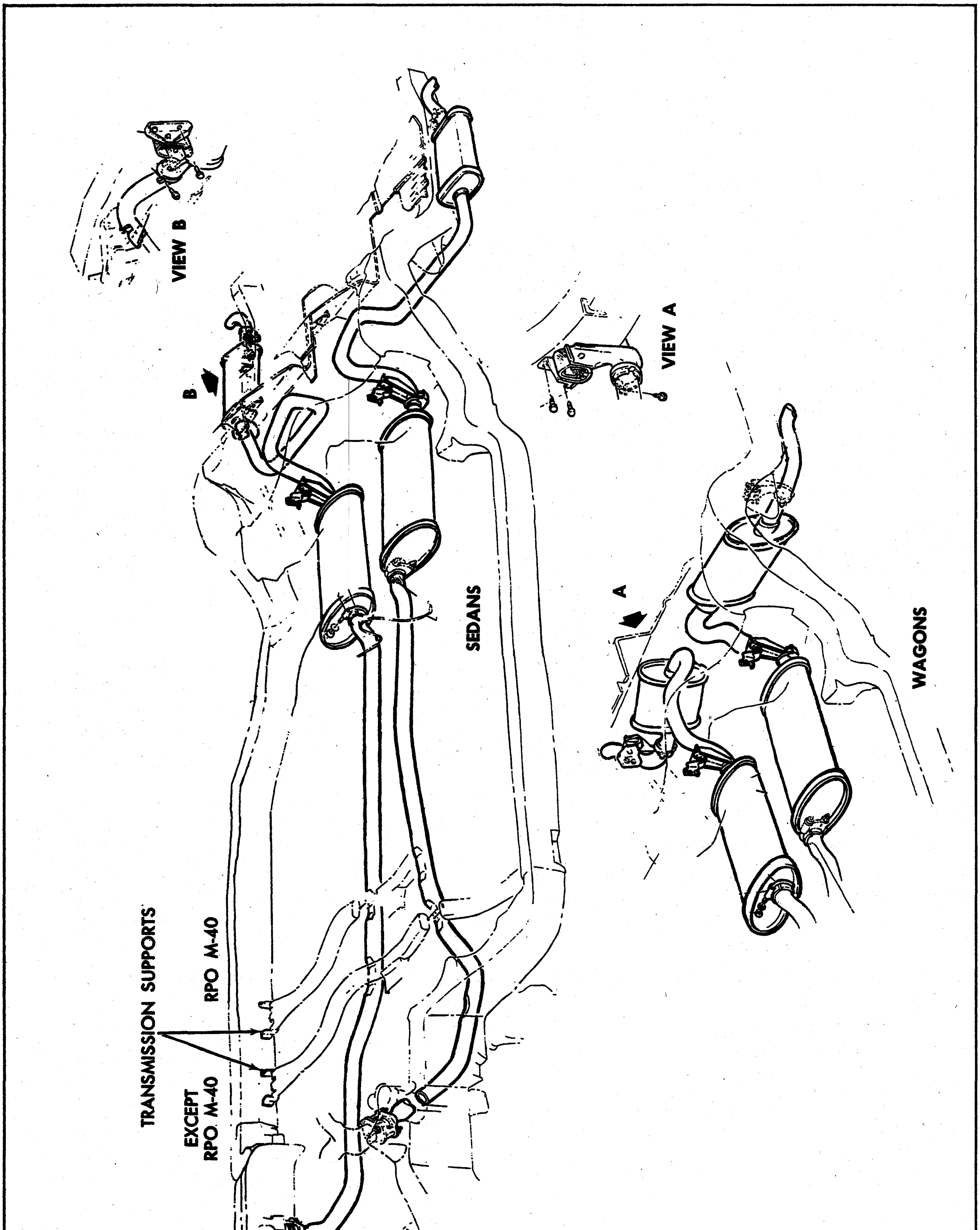


Fig. 7—Dual Exhaust Systems

CHEVELLE FUEL TANKS

INDEX

GENERAL DESCRIPTION

All models use a 20 gallon capacity (approx.) 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 (fig. 8).

All fuel tanks are vented to the atmosphere. Sedan model tanks have an external vent hose and pipe assembly (fig. 11) 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. 8) and use a vented, anti-surge type gas cap. The fuel caps are two different designs conforming to SAE standards and are not interchangeable.

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. Refer to the recommended draining procedures previously outlined under Chevrolet Models in this section.

Removal and Installation (Sedan Models)

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.

Removal and Installation (Station Wagon and Pickup)

1. Follow Steps 1 thru 3 outlined under sedan models.
2. Remove tank support straps.
3. Remove frame screw attachments from the front support (fig. 8).
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. 10). After removal of the old clip from the frame, position the new clip in the location of the old clip. Index the "blind rivet" and press hard (hand pressure should do) to expand rivet.

GAUGE UNIT AND FUEL STRAINER

Removal and Installation (Fig. 11)

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").

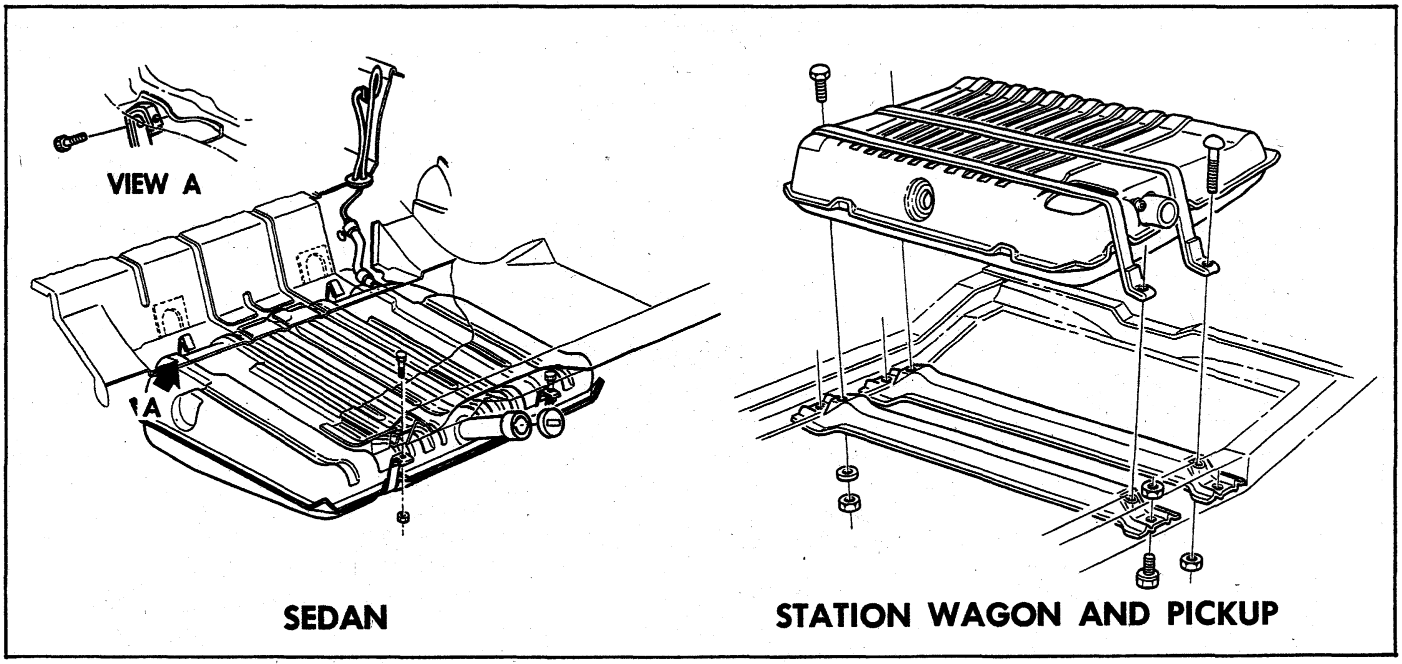


Fig. 8—Fuel Tanks

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 8. 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. 9) 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.

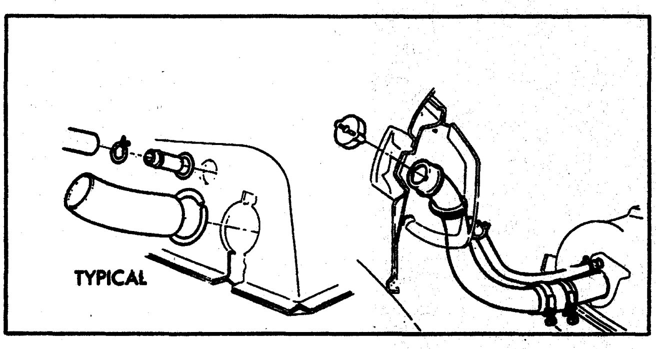


Fig. 9—Filler Neck and Vent Assemblies

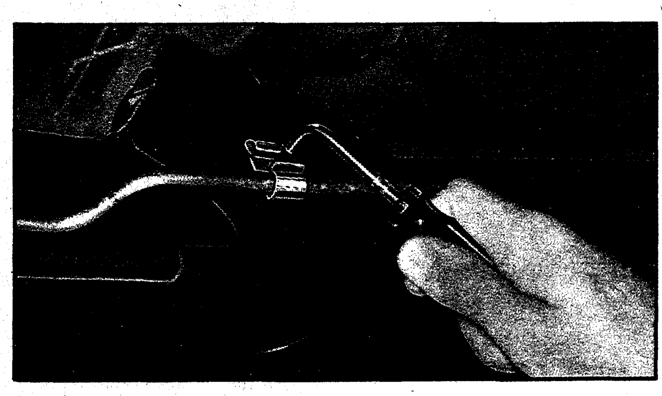


Fig. 10—Installing Fuel Line Retainer Clip

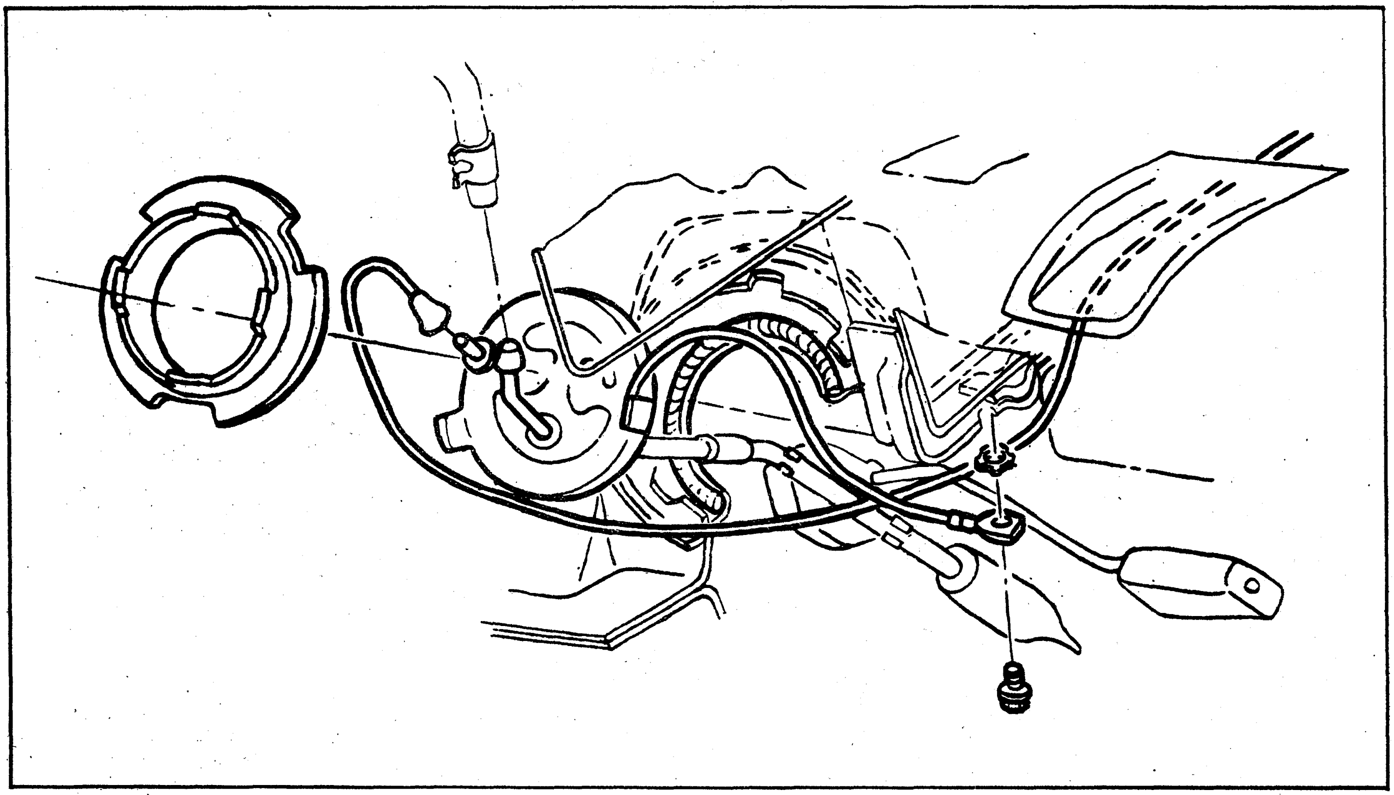


Fig. 11—Gauge Unit Assembly

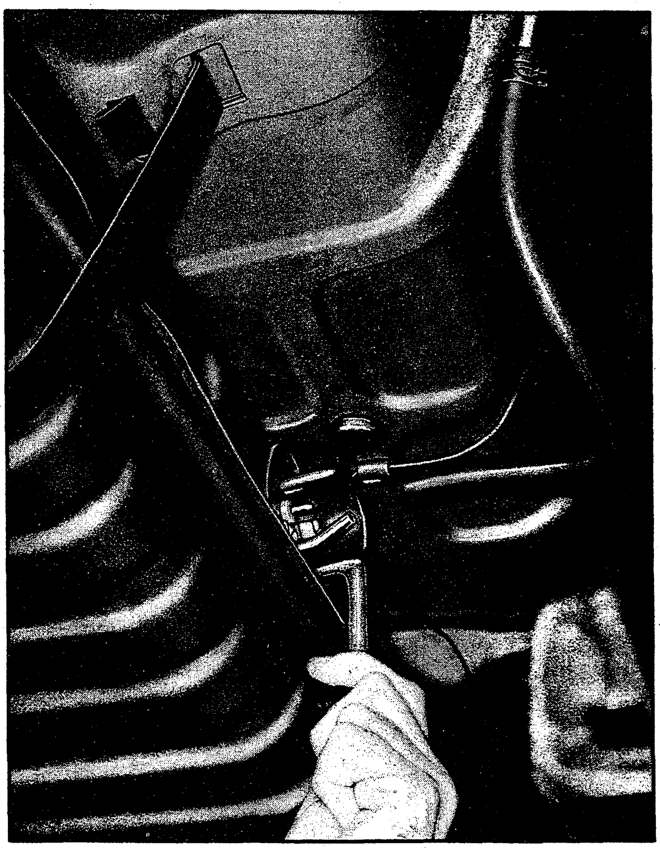


Fig. 12—Fuel Tank Gauge Unit Removal

EXHAUST SYSTEMS

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GENERAL DESCRIPTION

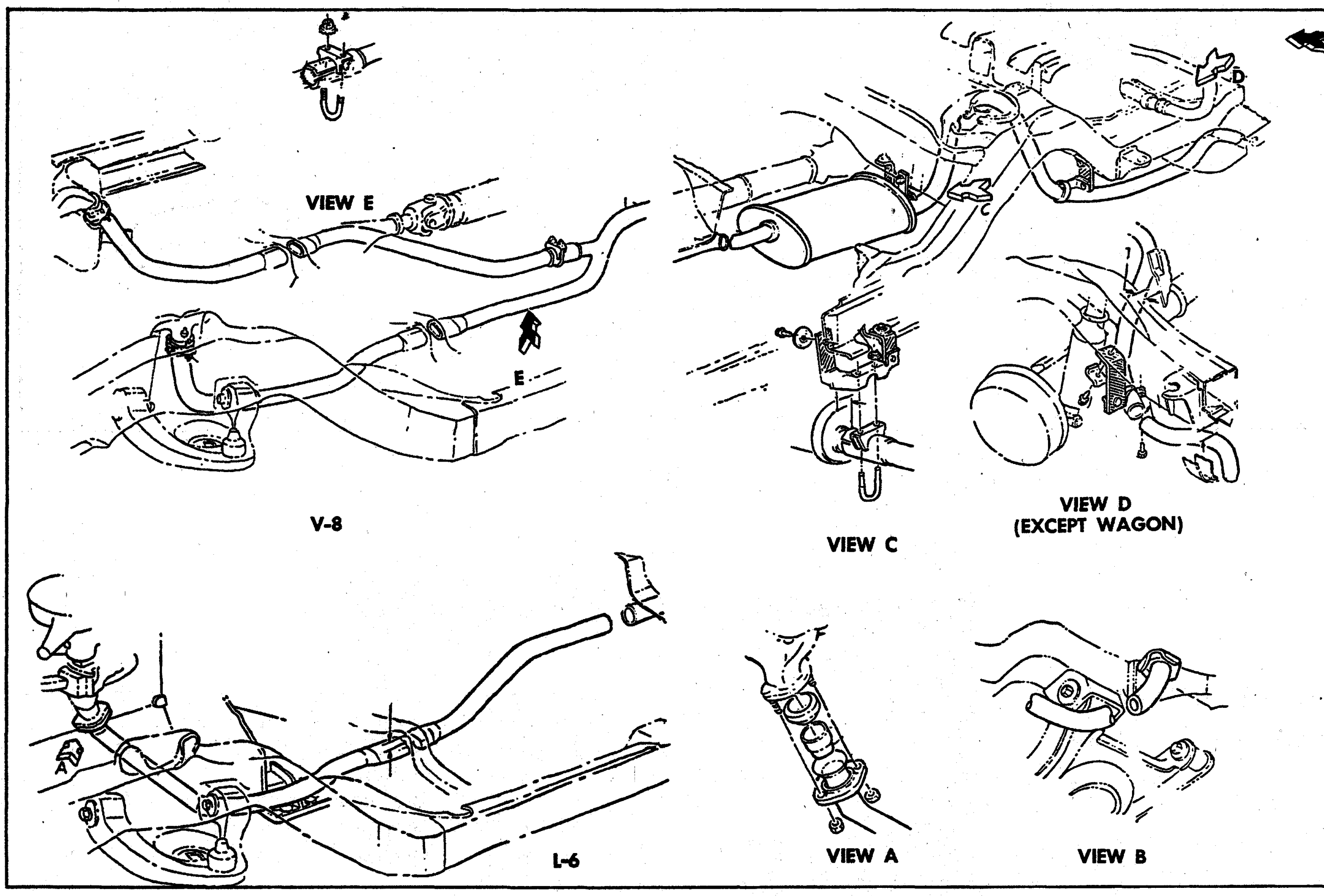

Fig. 13—Single Exhaust System

The single exhaust system used on all six cylinder engine models consists of an exhaust pipe, muffler and tail pipe (fig. 13). An exhaust crossover pipe is added on V-8 engine single exhaust models to connect the exhaust manifolds to the system. A dual exhaust system, available on V-8 engine models includes two exhaust pipes, mufflers, and tail pipes and attaching hardware (fig. 14). 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. 13) 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. 13).

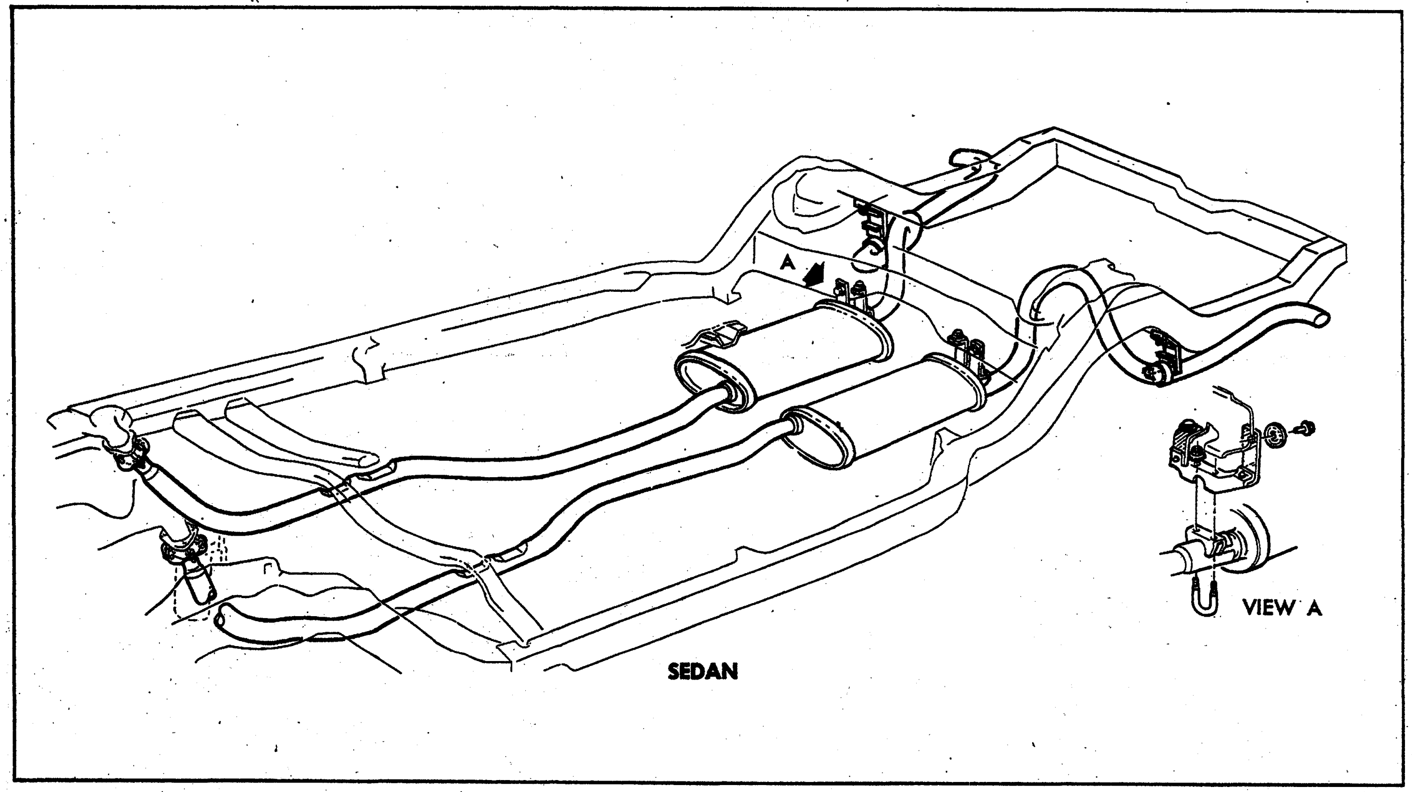

Fig. 14—Dual Exhaust System

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. Remove clamp attachment at muffler and at tail pipe rear hanger.
2. Disengage tail pipe from muffler and remove from vehicle.
3. Install tail pipe to rear of muffler.
4. Position tail pipe to obtain proper clearance to rear spring bracket and underside of frame rail.
5. Install tail pipe clamp over rear hanger and position on pipe to maintain vertical position of insulator without twist.
6. Tighten nuts on "U" bolt clamp at rear of muffler, then secure rear tail pipe clamp.

CHEVY II
FUEL TANKS

INDEX

GENERAL DESCRIPTION

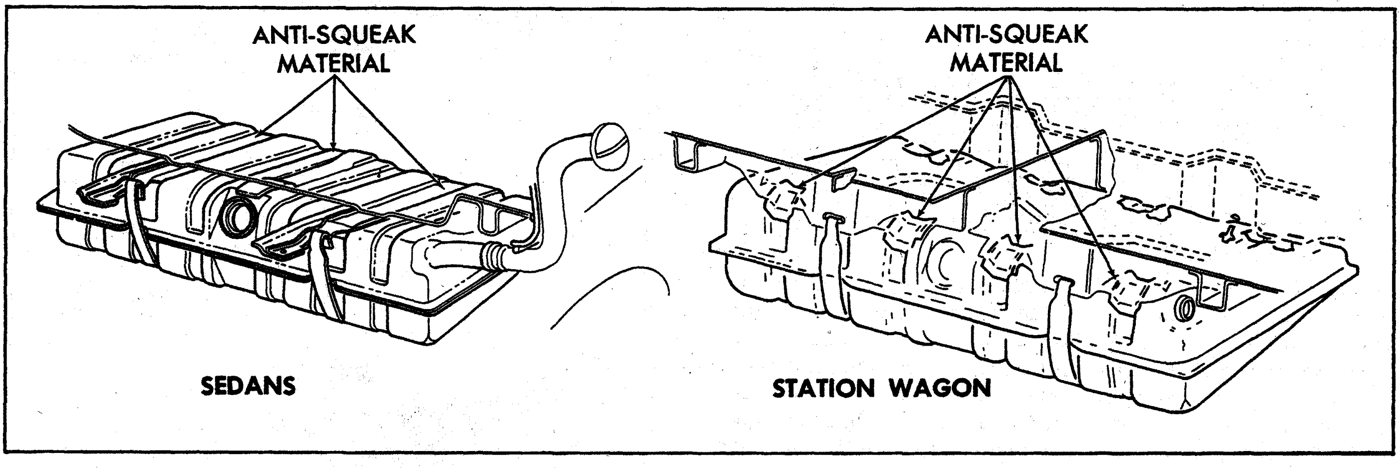

Fig. 15—Chevy II Fuel Tanks

All Chevy II Models have 16 gallon capacity (approx.) fuel tanks mounted between the frame rails to the rear of the rear axle (fig. 15). 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 pickup 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.

COMPONENT PART REPLACEMENT

FUEL TANKS

Draining Tank

The absence of a drain plug in the Chevy II Model gas tanks makes it necessary to siphon fuel from the tank when draining is needed. Refer to the recommended draining procedures previously outlined under Chevrolet Models in this section.

Removal and Installation

1. Drain fuel tank.
2. Raise and support vehicle.
3. Disconnect the filler neck inlet hose and the vent connection (fig. 15).
4. Remove the gas tank sending gauge unit access hole cover on station wagons.
5. Disconnect fuel tank gauge sending unit with special spanner Tool J-8950, detach wire and fuel pickup 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. The fuel strainer is located at the end of these sending units.

FUEL TANK GAUGE SENDING UNIT AND FUEL STRAINER (Fig. 16)

Replacement

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 LINES (Fig. 17)

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 extend from the fuel tank, joint 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.

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 (Fig. 18)

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.

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.

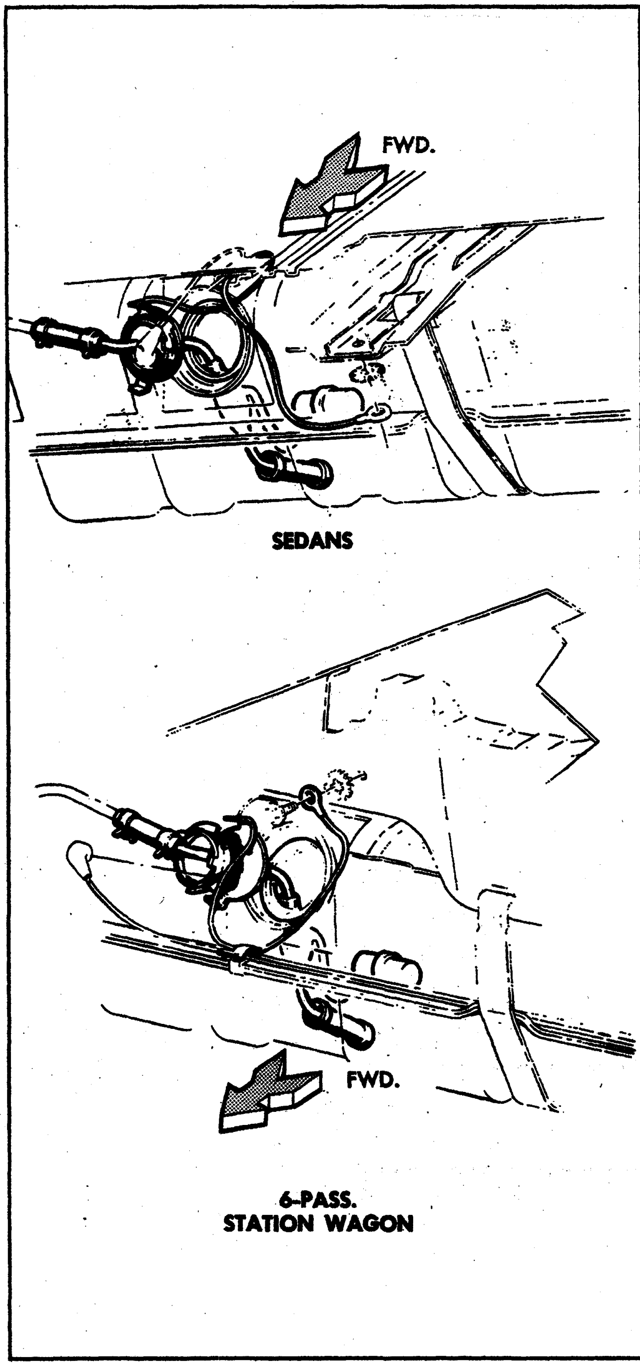

Fig. 16—Fuel Tank Gauge Sending Units and Strainers

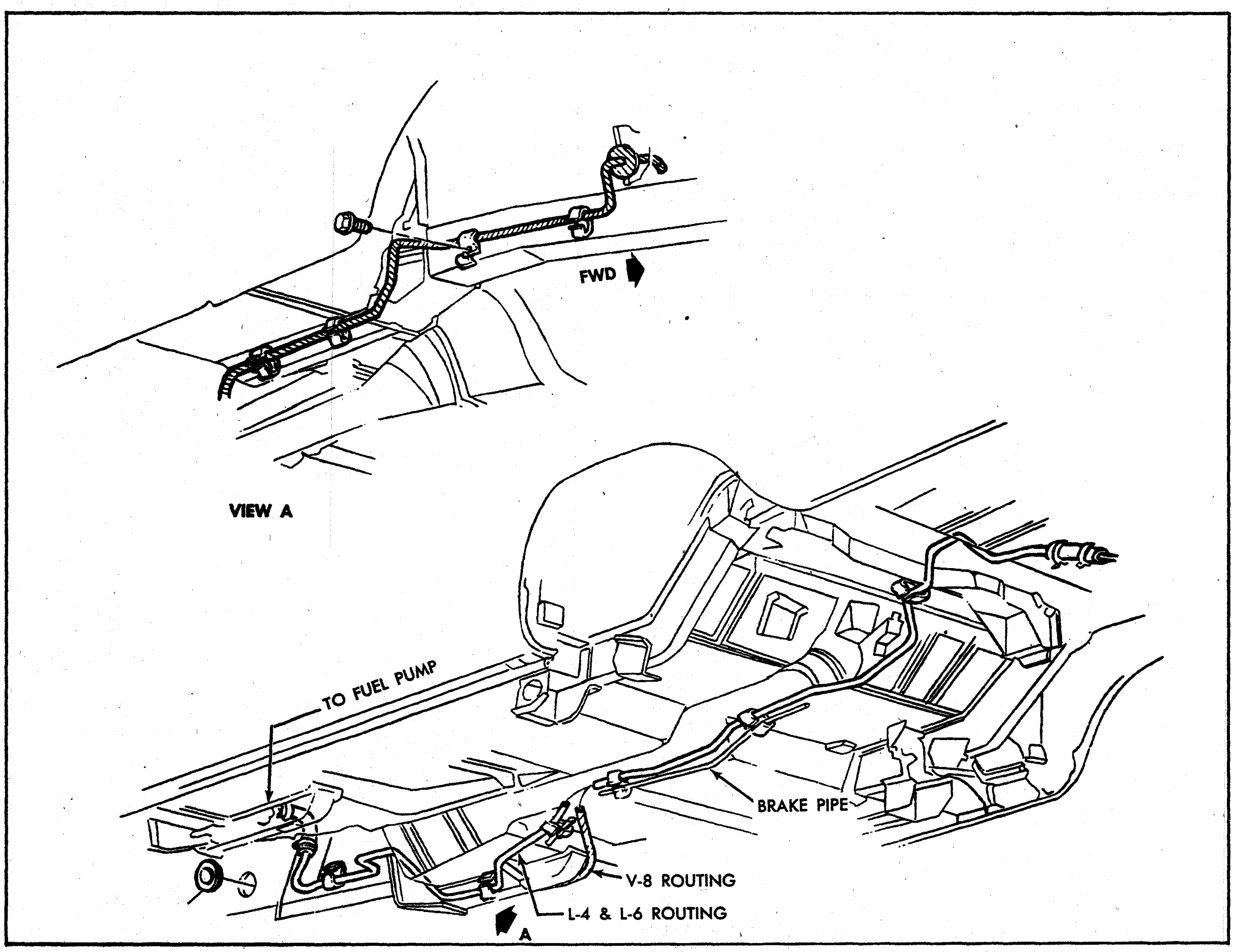

Fig. 17—Fuel Lines

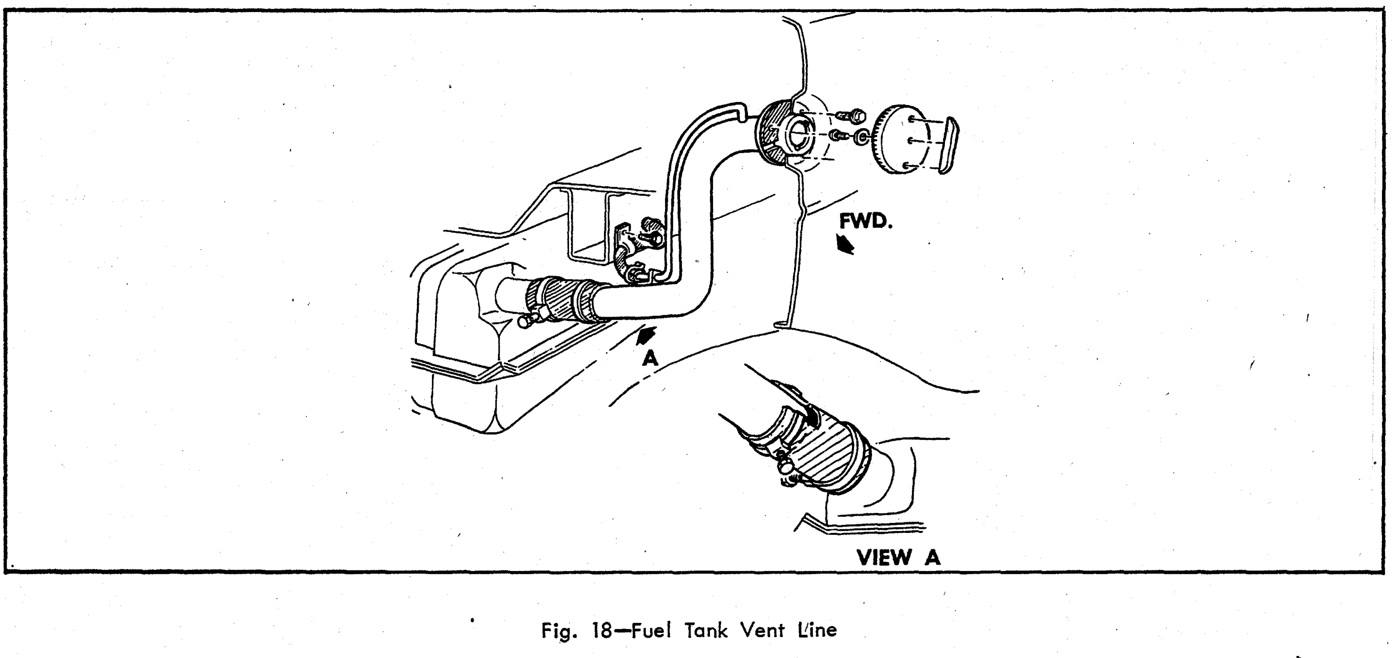

Fig. 18—Fuel Tank Vent Line

EXHAUST SYSTEMS

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GENERAL DESCRIPTION

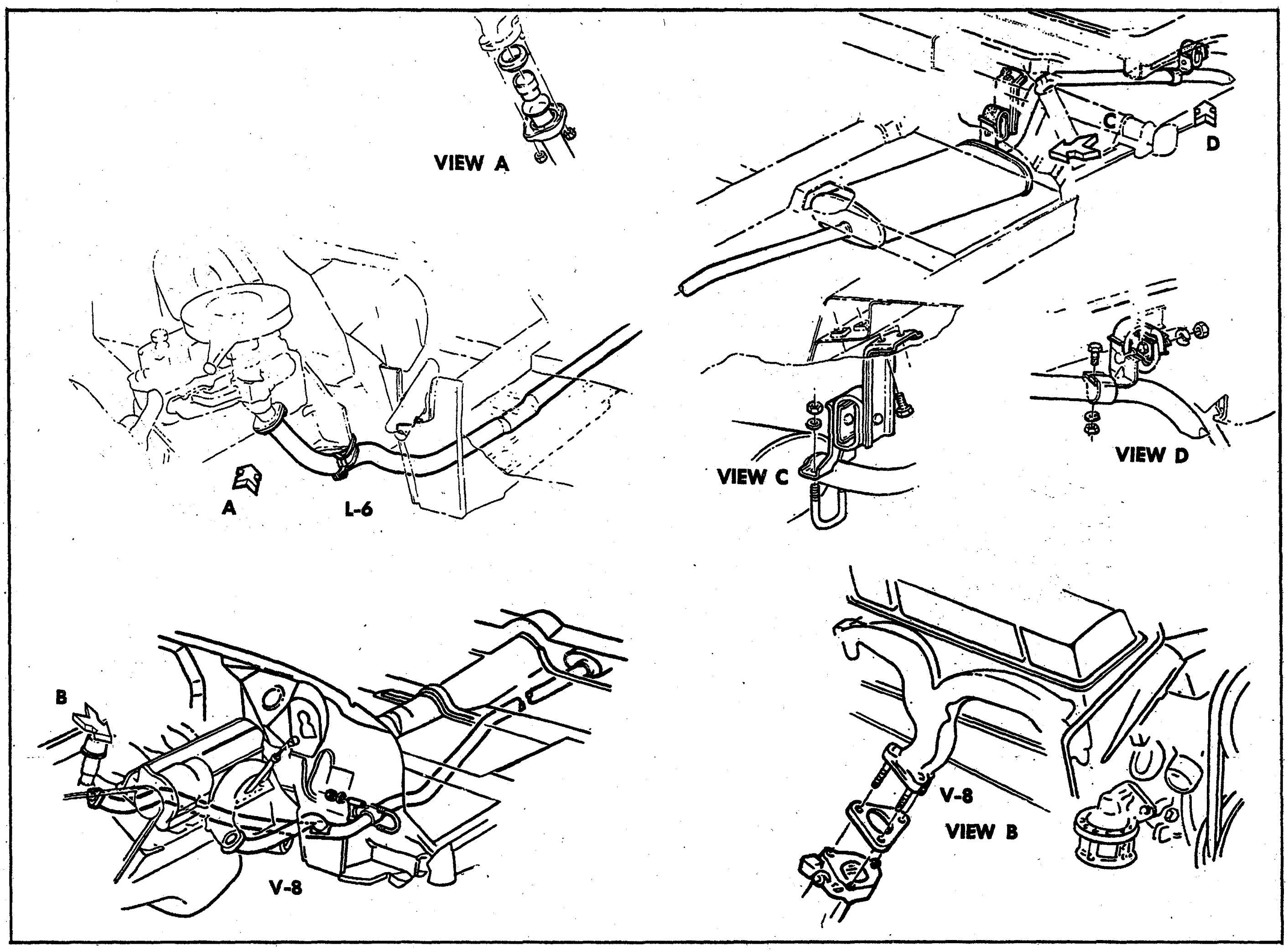

Fig. 19—Chevy II—Single Exhaust Systems

The single exhaust system on Chevy II models for six cylinder engines (fig. 19) consists of an exhaust pipe, muffler and tail pipe. On V-8 engines with single exhaust assemblies (fig. 19) an exhaust crossover pipe is added to connect the right exhaust manifold to the system. A dual exhaust system (fig. 20), available on the V-8 engine (except station wagons) includes two exhaust pipes, mufflers, tail pipes with resonators and attaching hardware.

The assemblies are secured to the engine at the exhaust manifolds, to the center mounting at the muffler location and adjacent to the gas tank at the end of the tail pipe. The assemblies are suspended on brackets with insulators for rattle free operation.

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 are welded to eliminate a chance of premature failure or rattle.

The exhaust system center mounting at the muffler location 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.

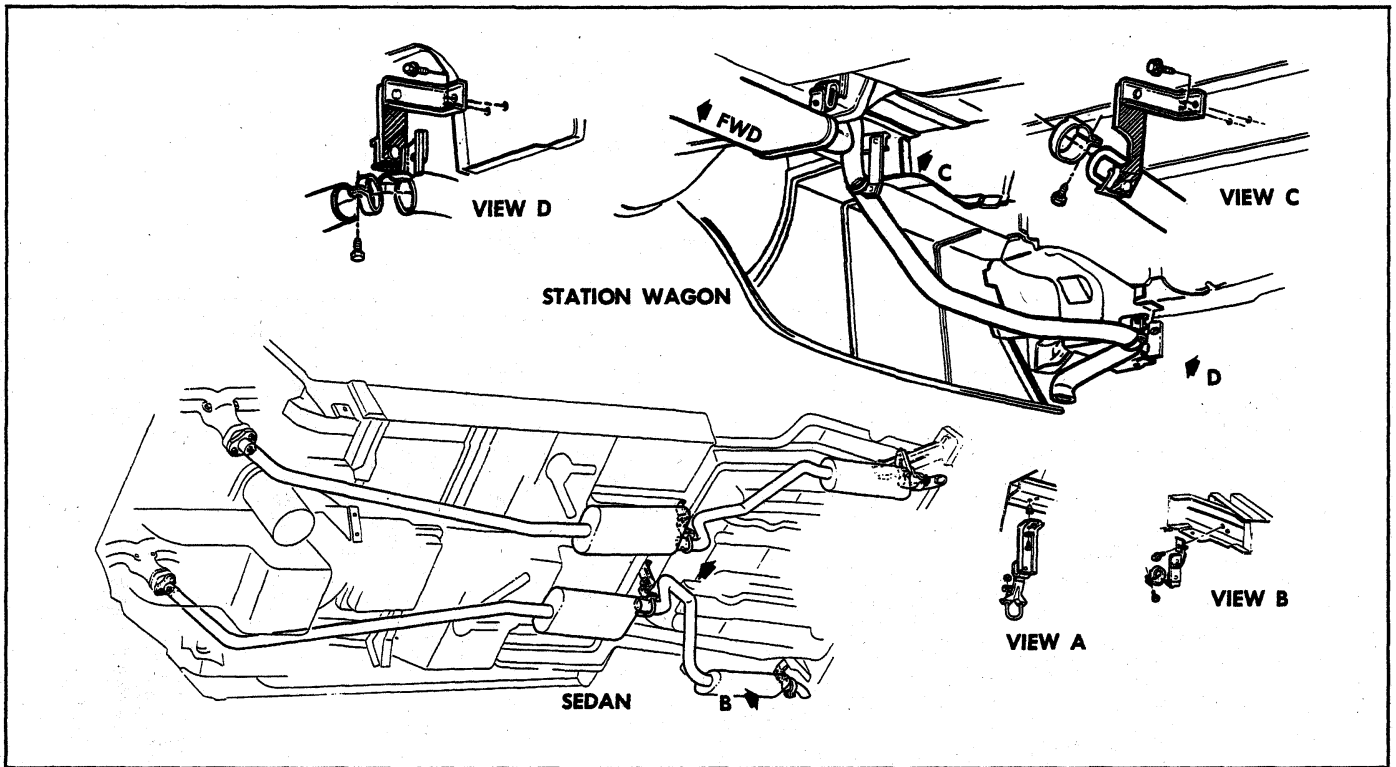

Fig. 20—Chevy II—Dual Exhaust Systems

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 engine 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 AND/OR RESONATOR

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.

CORVETTE FUEL TANK

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GENERAL DESCRIPTION

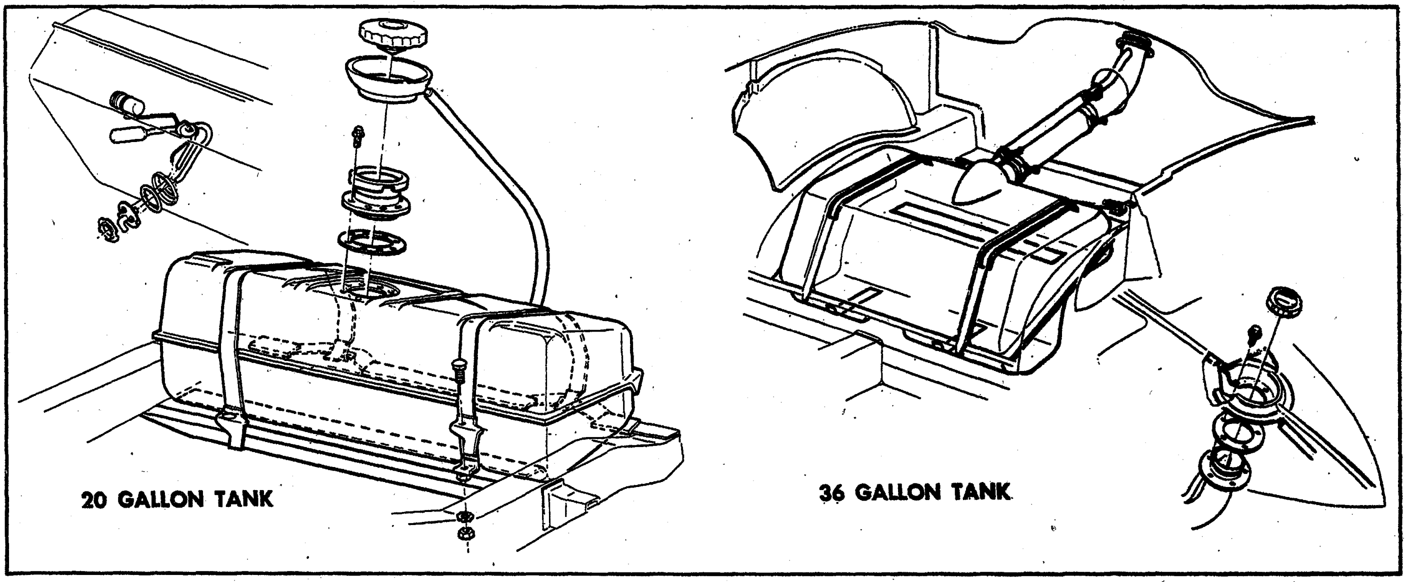

Fig. 21—Corvette Fuel Tanks

The Corvette is equipped with a standard 20 gallon (approx.) tank or an RPO 36 gallon (approx.) fiberglass tank (fig. 21). The tanks are installed at the very rear of the vehicle, convenient for direct fuel filling into the tank. The tanks are held in place by two metal straps attached individually to a removable gas tank frame support. Two guides at the end of the straps are adjustable for securing the straps onto the tank support. The tank support is secured to the frame rail with flat washers, lockwashers, bolts and nuts. The tanks rest on six felt anti-squeak pads. One pad centers on the rear frame crossmember and one at each side on the same crossmember. At the same rear location two pads are placed on the tank at the metal support strap (rear) attachment location and another anti-squeak pad cemented on the support at the front of the tank.

The fuel tanks are equipped with a gas gauge metering unit, a fuel pickup, fuel strainer and vent line. If it becomes necessary, the tank can be completely drained by removing the fuel pickup hose which is located at the bottom of the tank, or by removing the metering for quicker draining.

A pressure vacuum type, positive vented design cap, conforming to I.C.C. regulations, is used on both regular production and optional fuel tanks. The cap is interchangeable with past model tanks for service replacement purposes.

SERVICE OPERATIONS

FUEL TANK

CAUTION: IF THE GAS TANK SHOULD BE REMOVED AND INSTALLED, CARE SHOULD BE EXERCISED TO AVOID PUNCTURING, DROPPING OR DENTING THE GAS TANK.

Removal (20 Gallon Tank)

WARNING: FIRST REMOVE BATTERY CABLE.

1. Remove the spare tire from tire carrier.
2. Remove spare tire carrier bolted attachments and carrier (fig. 22).
3. Remove the "U" bolt attachments at both rear tail pipe (See Figure 23).
4. Separate the exhaust system at the transmission support crossmember by loosening the "U" bolt nuts.
5. Remove both rear muffler brackets from the frame and slide the muffler system rearward.

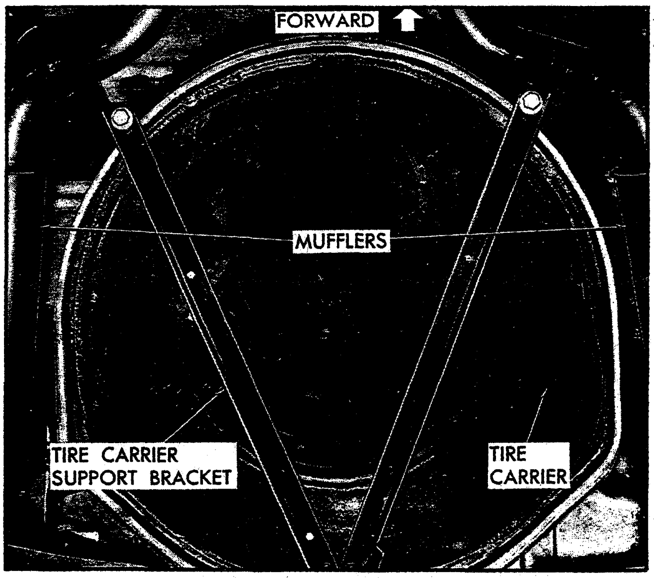

Fig. 22—Spare Tire Carrier Installed

6. Remove two fuel tank retaining strap bottom nuts from forward support member located at forward front side of tank.
7. Remove fuel tank metering unit wires (fig. 25).
8. Remove fuel pickup line and drain tank.
9. Remove gas cap, filler neck boot from the top of tank and disconnect drain line (fig. 24).

   NOTE: Coupe Models—Remove filler neck.

10. Remove fuel tank support frame attachment bolts and support.
11. Lower tank and rotate toward the front of vehicle.

Installation (20 Gallon Tank)

NOTE: Place hoses and wires to one side and position anti-squeak pads to the crossmember, cemented to the support and attached to the tank. Replace with new pads as required.

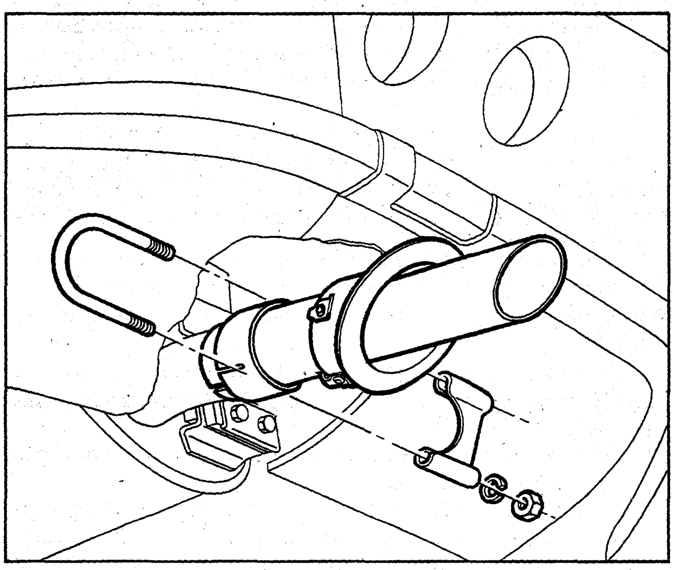

Fig. 23—Exhaust System Tail Pipe Attachment

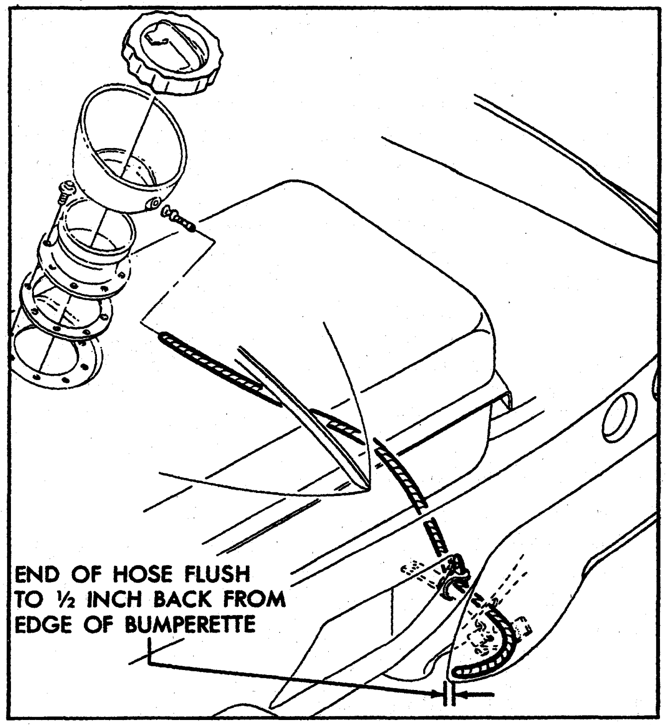

Fig. 24—Gas Tank Filler Neck Vent Hose

1. Hook retaining straps at the rear frame crossmember. (Crimp strap ends at rear frame attachment.)

   NOTE: Make certain strap ends are hooked and anti-squeak pads are properly positioned.

2. Slowly rotate fuel tank into position.

   CAUTION: Coupe—Install filler neck after tank is installed.

3. Attach fuel tank support at the frame side rails.

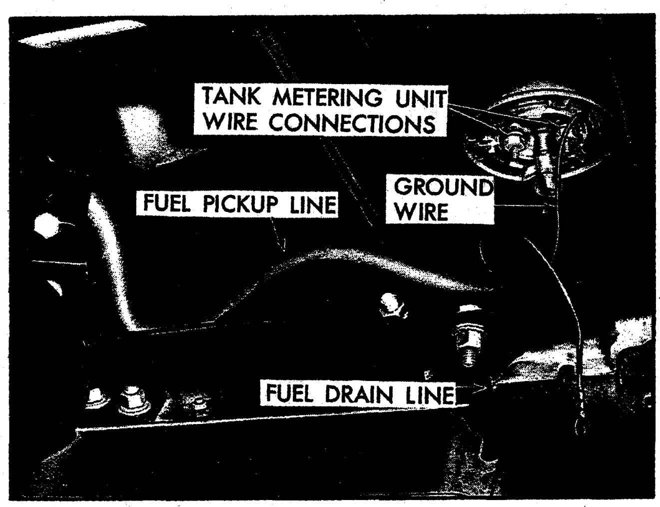

Fig. 25—Fuel Tank Metering Unit, Wires and Lines

4. Attach the retaining straps with strap guide attached to the fuel tank support and secure with the nut and lockwasher assembly.
5. Connect the filler neck boot to the drain hose of the tank and install boot around filler neck.
6. Connect the fuel pickup line, ground wire and make certain that the fuel drain line is flush to 1/2" inboard of the rear bumper opening.
7. Attach tank metering unit wires (fig. 25).
8. Replace fuel in tank. Replace gas cap.
9. Check for possible leaks.
10. Reconnect the exhaust system by reversing the above removal procedures (see "Exhaust System").
11. Install spare tire carrier by securing the bolt attachment.
12. Install the spare tire in the tire carrier.

Removal (36 Gallon Tank)

1. Remove cover (fig. 26).
2. Disconnect hoses and drain tank and remove two fittings at bottom of tank.
3. Disconnect fuel and vent lines and wires at tank (fig. 27).
4. Remove straps.

Installation (36 Gallon Tank)

Reverse removal procedure to install.

FUEL TANK METERING UNIT OR GAUGE SENDING UNIT AND STRAINER

The fuel tank metering unit is located at the bottom of the fuel tank. The fuel strainer is attached at the end of the sending unit inside the tank.

Replacement (20 Gallon Tank)

1. Follow fuel tank removal procedure through Step 2.
2. Drain the tank. Disconnect the attaching wires.
3. Remove metering unit with a fuel tank gauge unit Spanner J-8950 (revised).
4. Remove metering unit and gasket.

CAUTION: Carefully remove unit so as not to damage screen on the end of the pipe.

5. Clean strainer screen by blowing out with compressed air.
6. Reverse procedure to install.

Replacement (36 Gallon Tank)

1. Remove cover.
2. Follow Steps 2 thru 6 as outlined under replacement for 20 gallon tank.

FUEL LINES

20 Gallon Tank

The fuel lines are conveniently located along the outside of the right frame rail (fig. 28). The lines extend from the fuel tank pickup at the bottom of the tank, along the rear frame crossmember to the right frame rail, extending through the rail at the kickup area and along the top inside edge of the frame to the fuel pump. Flexible hoses are located at the fuel tank pickup and at the fuel pump.

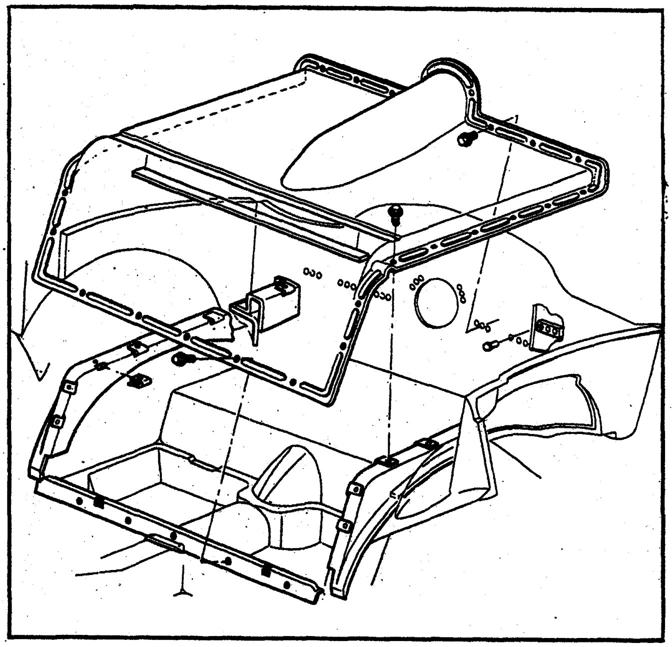

Fig. 26—Gasoline Tank (36 Gallon) Compartment Cover

36 Gallon Tank

The 36 gallon tank fuel lines are routed from the bottom of both sides of the tank to the right frame rail (fig. 29).

Maintenance

CAUTION: Always drain gasoline from the complete fuel system including carburetor, fuel pump and all fuel lines and fuel tank if the vehicle is to be stored for any great 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, especially when work has been done on the underside of car or after the car has been traveling over rough or stone roads at higher speeds. If evidence of dirt is found in the carburetor or fuel pump at disassembly, the lines should be disconnected and blown out. Check the fuel tank strainer for damage or omission.

Fuel lines are beaded-type ends for connection to hoses and flared ends for secure metal-to-metal line connections.

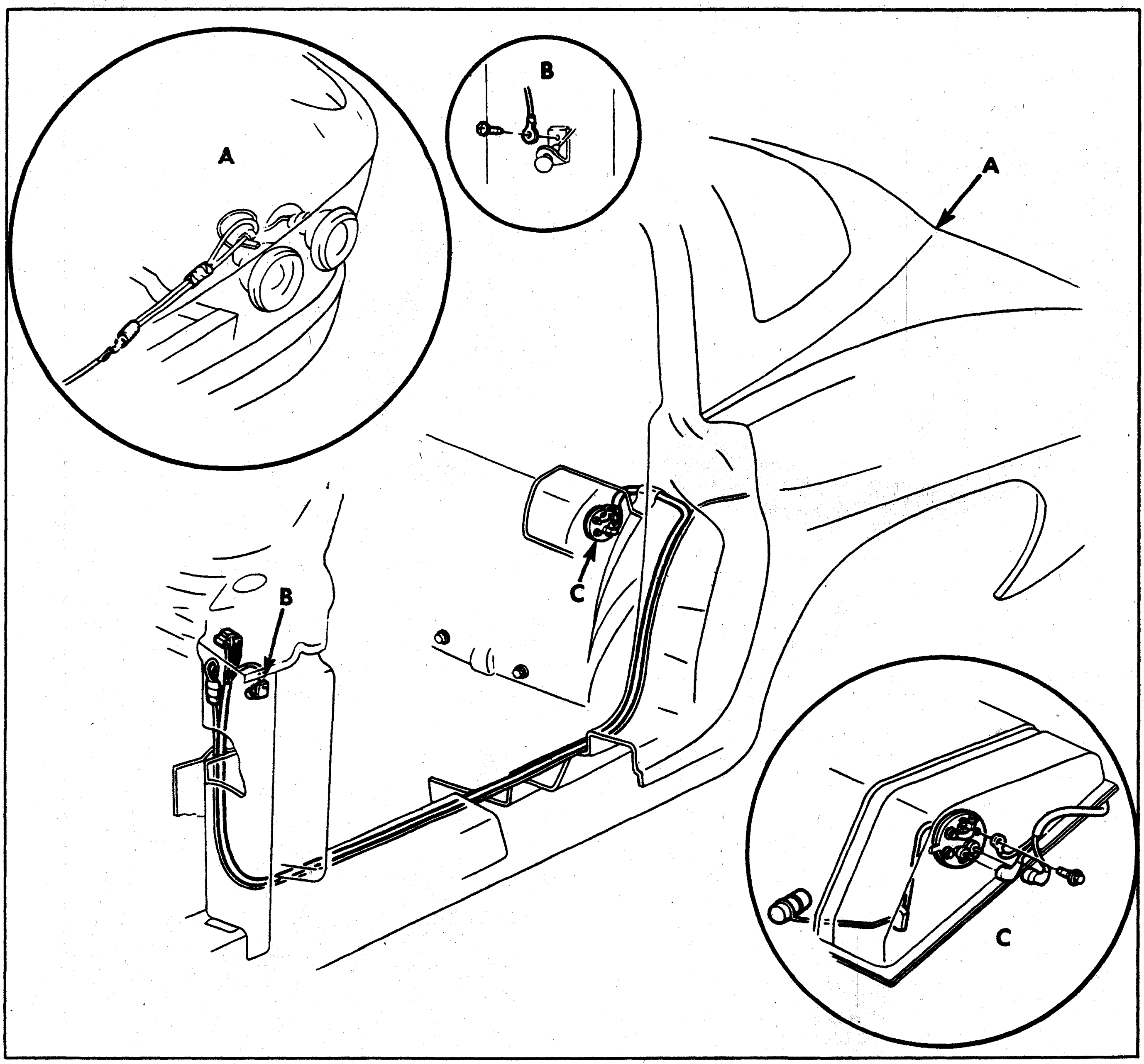

Fig. 27—Gasoline Tank (36 Gallon) Wiring

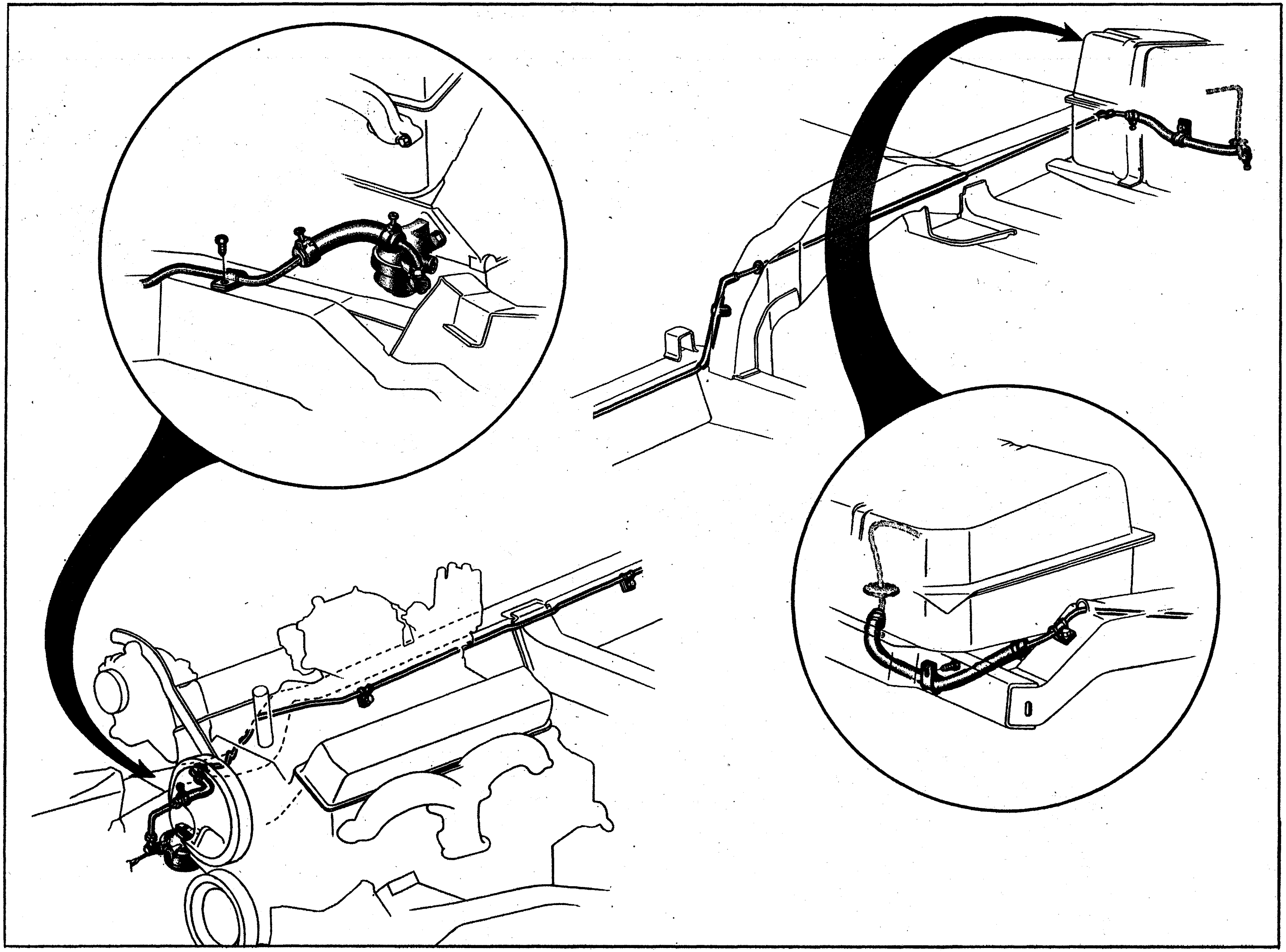

Fig. 28—Corvette Fuel Lines (20 Gallon Tank)

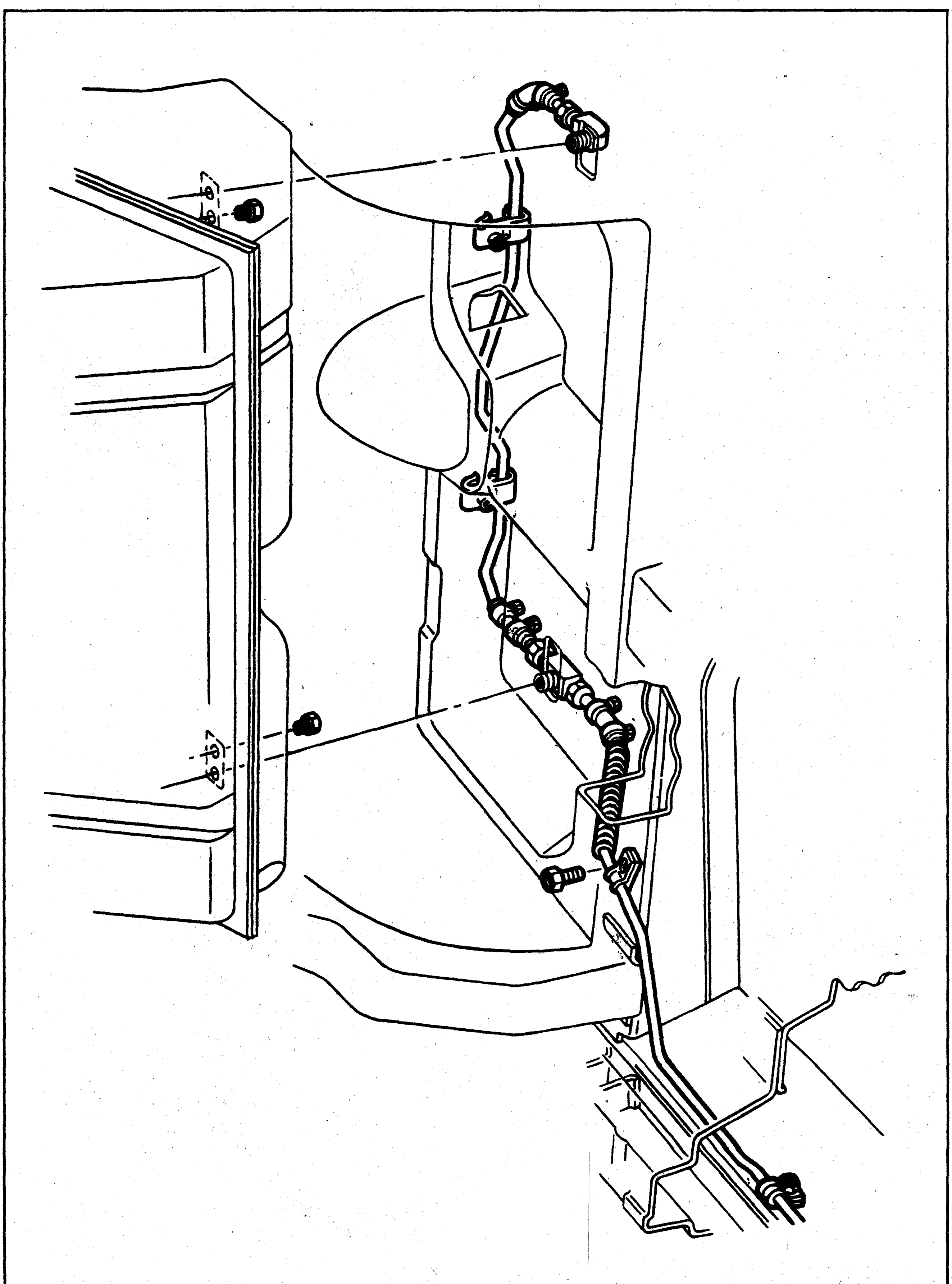

Fig. 29—Corvette Fuel Lines (36 Gallon Tank)

EXHAUST SYSTEMS

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GENERAL DESCRIPTION

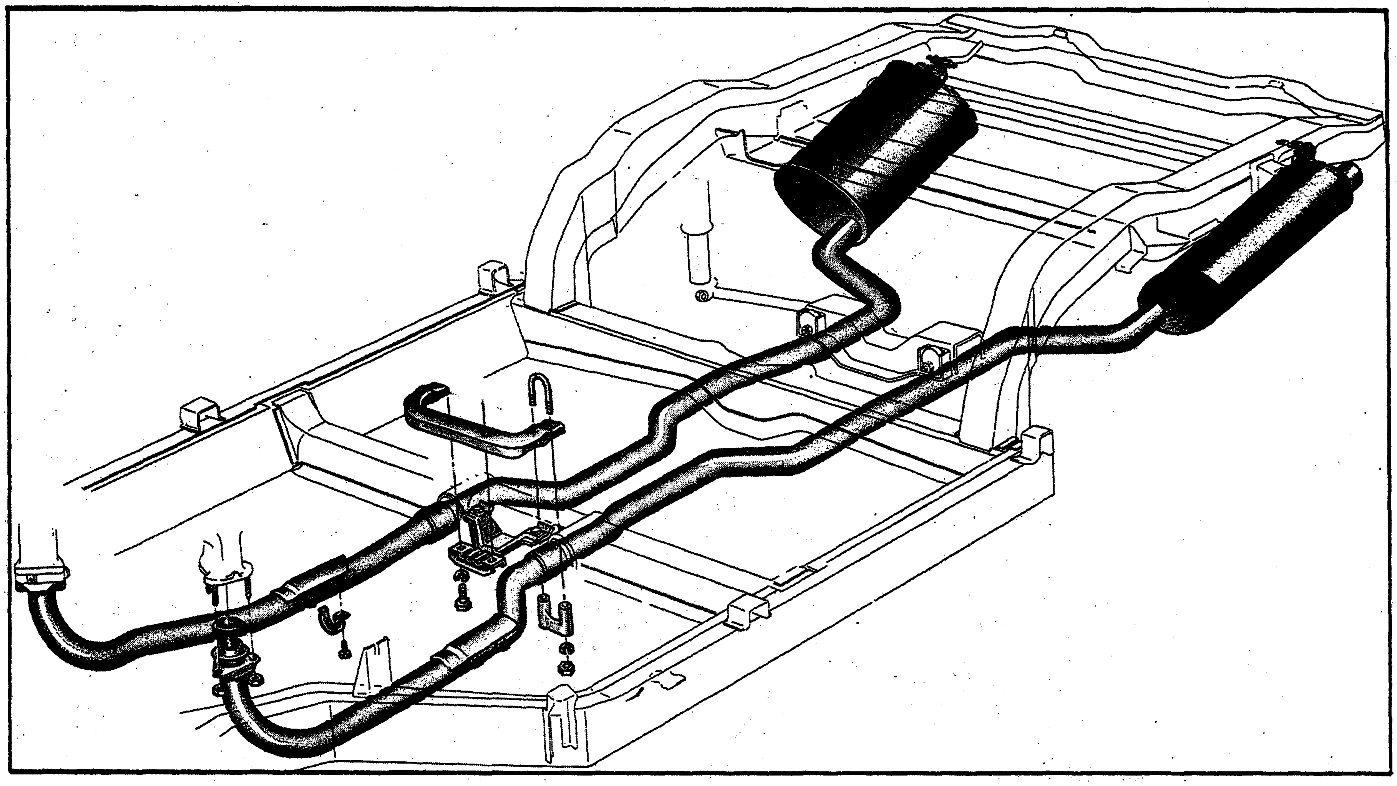

Fig. 30—Standard Dual

All Corvettes are equipped with dual exhaust systems (fig. 30). Each exhaust assembly is connected to its own exhaust manifold and carries the exhaust gases to the rear, discharging them on each side of the rear bumpers.

The dual exhaust system includes two front and rear exhaust pipe sections, mufflers, tail pipes and attaching hardware. The system is suspended on brackets with insulators for rattle free operation. Adjustment is only required at the rear muffler bracket.

In addition to the regular dual system an optional side mounted, off-road exhaust system is available as an RPO (fig. 31). Extending between front and rear wheels, the dual units are mounted outboard of the frame side rails at the rocker panel level, and completely replaces the regular dual assemblies.

Flow characteristics are improved and back pressures reduced by the more direct exhaust routing and by the use of chambered pipes for sound muffling in place of conventional mufflers.

SERVICE OPERATIONS

Proper relationship of parts is necessary in the exhaust system for carefree operation. Annoying rattles are usually a result of incorrect alignment of the exhaust system due to incorrect clearances.

MUFFLER ASSEMBLY

Replacement (Also Rear Exhaust and Tail Pipes)

1. Remove "U" bolt attachments at both rear tail pipe shields.
2. Separate the exhaust system at the crossmember tube by loosening the "U" bolt nuts.
3. Remove both rear muffler brackets from the frame and slide the muffler system forward.

CAUTION: Before cutting the rear exhaust pipe, measure service muffler exhaust pipe end and make certain to allow 1 1/2" for engagement of the rear exhaust pipe into service muffler pipe.

4. Cut the exhaust pipe near the muffler (see caution above) to allow sufficient pipe for muffler replacement.
5. Replace muffler and secure with new clamps.

NOTE: Clamps must be assembled with nuts attached toward the rear of the vehicle - reference 90° to sawcuts in service muffler pipe.

6. Reverse procedure for installation.

NOTE: If bracket mounting insulators (tire carcass mountings) are fatigued, replace to insure a secure exhaust system.

7. In the event the tail pipe bezel has been damaged and replacement is required, remove three screws and replace the bezel.

SIDE MOUNTED EXHAUST (Fig. 31)

Replacement

1. Raise and support vehicle.
2. Remove sill molding attaching screws and disengage molding from the retainer.
3. Remove cover retaining screws, cover and retainer assembly.
4. Remove exhaust pipe-to-manifold attaching nuts, and rear bracket retaining nut, then detach exhaust pipe from manifold studs and remove from vehicle.

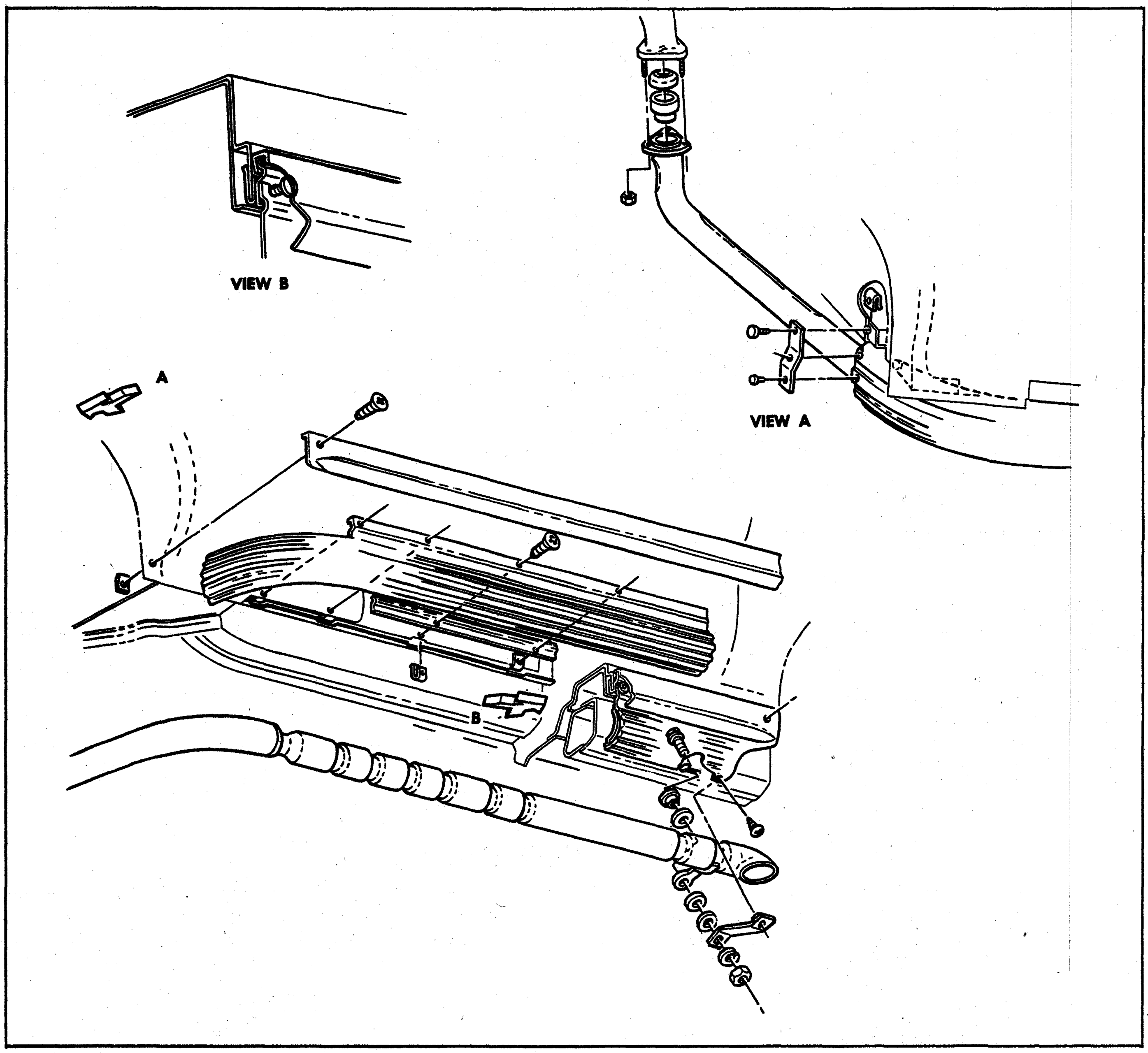

Fig. 31—Side Mounted Exhaust System

5. To install, assemble the bolt, washers, insulator, cover bracket and retaining nut to the exhaust pipe rear bracket.
6. Insert rear bracket bolt in frame opening, position exhaust pipe to the manifold attaching studs and install pipe-to-manifold retaining nuts. Tighten all retaining nuts.
7. Position molding retainer and cover to sill and install retaining screws.
8. Position sill molding and install retaining screws.

CAMARO

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GENERAL DESCRIPTION

All models use an 18.5 gallon capacity (approx.) fuel tank mounted between the frame rails behind the rear axle (fig. 32). All fuel tanks are vented through an anti-surge type filler cap assembly consisting of cap and handle. The carrying straps hook through a double slot in the front of the rear compartment reinforcements and attach to strap bolts positioned in slots provided at the rear panel reinforcements. A conventional fuel meter

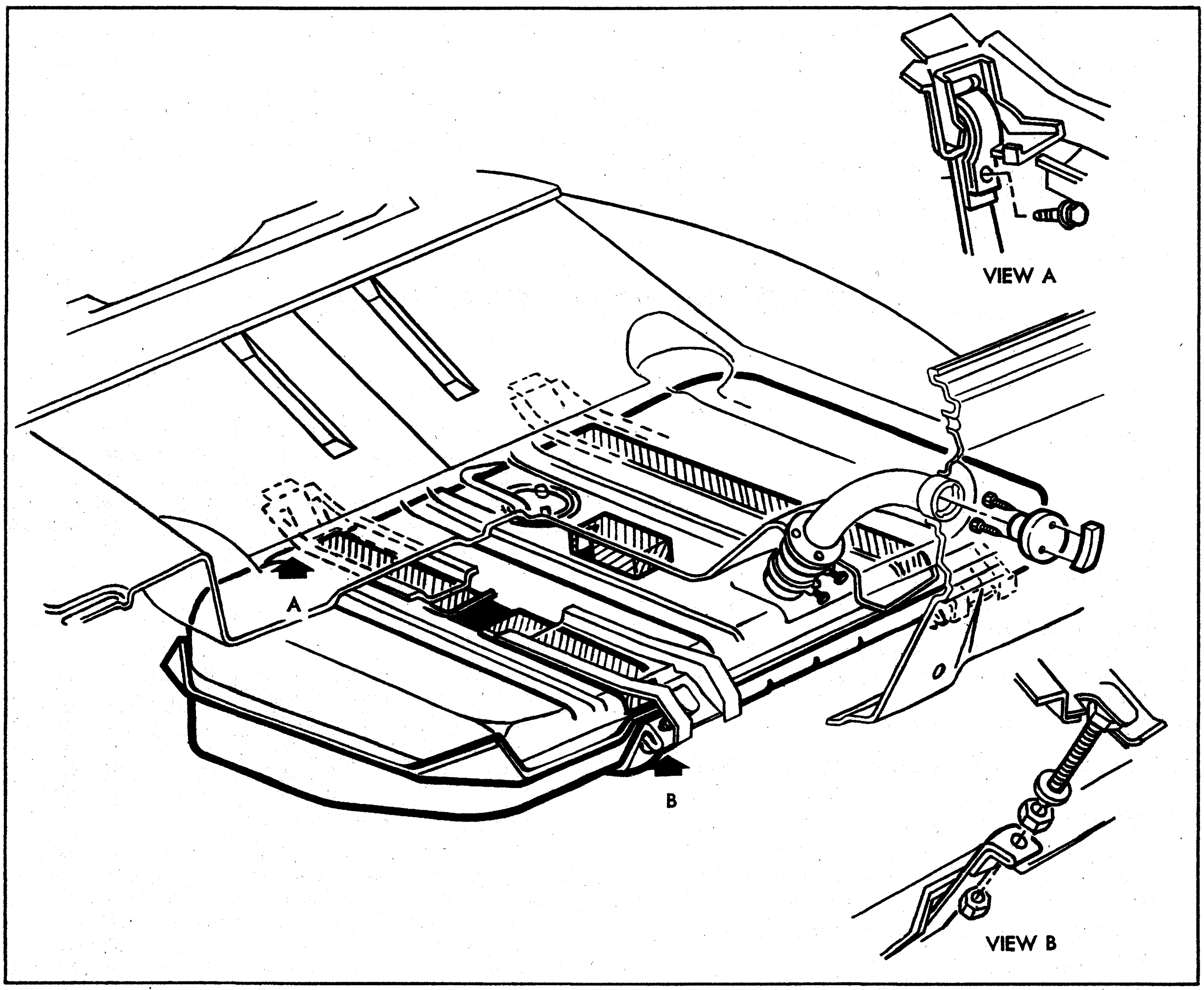

Fig. 32—Fuel Tank Assembly

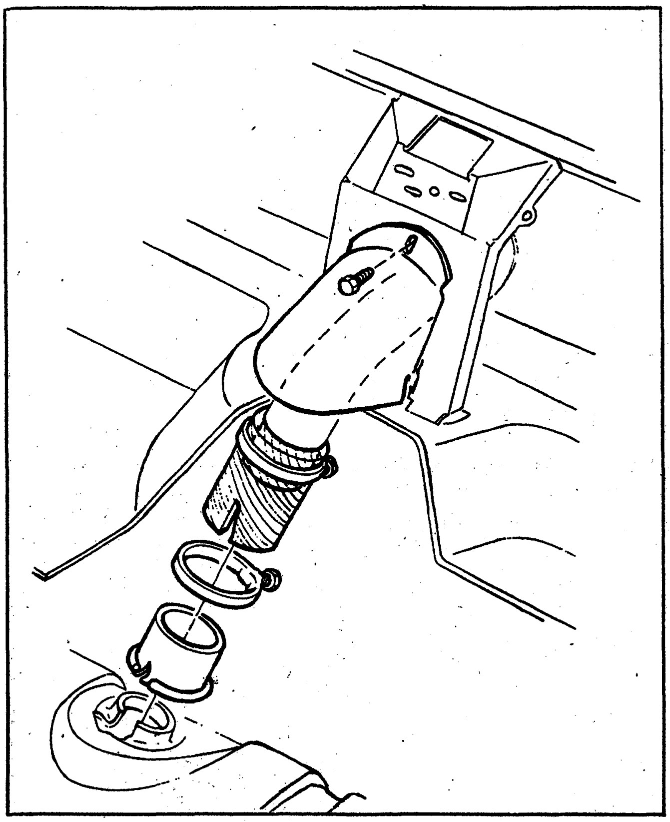

Fig. 33—Filler Neck Assembly

assembly is mounted on top of the tank and cannot be removed for service without lowering the tank. The upper filler neck assembly is routed through an opening in the rear panel above the bumper and through the trunk floor pan (fig. 33). The filler neck is not centered in the rear panel but offset to the right to obtain the proper fill rate.

The fuel pickup pipe is an integral part of the tank meter unit, 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.

COMPONENT PART REPLACEMENT

FUEL TANK

Draining Tank

Refer to Chevrolet page 8-2.

Removal and Installation

1. Drain fuel tank.
2. Raise vehicle.
3. Disconnect fuel pickup line, gauge wire and ground lead from tank unit.
4. Loosen filler neck inlet hose clamp.
5. Remove tank support strap bolts and straps, then lower tank carefully.
6. Reverse procedure to install.

FUEL TANK GAUGE SENDING UNIT (Fig. 34)

Replacement

1. Remove fuel tank.
2. Remove cam lock using special Tool J-8950.
3. Remove meter unit and rubber gasket.

   CAUTION: Carefully remove unit so as not to damage screen on end of pipe.

4. Clean screen by blowing out with compressed air.
5. Reverse removal procedure to install.

FUEL LINES (Fig. 35)

The gasoline lines extending from fuel tank to fuel pump, are routed on the underside of the underbody, on the right side, opposite the single exhaust system. The lines extend from the fuel tank to the right side of the engine to the fuel pump and over the front of the engine to the carburetor.

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.

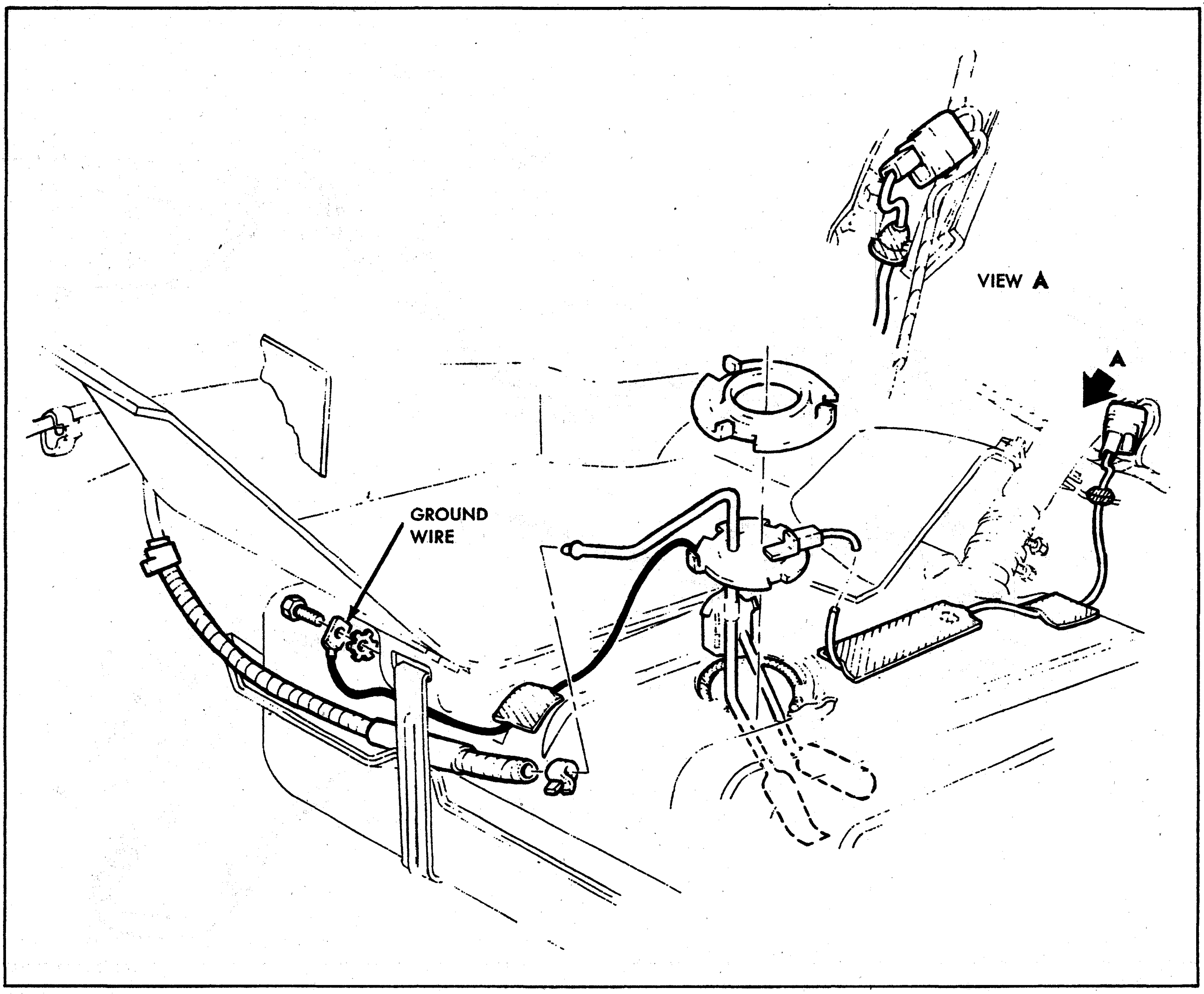

Fig. 34—Fuel Tank Meter Assembly

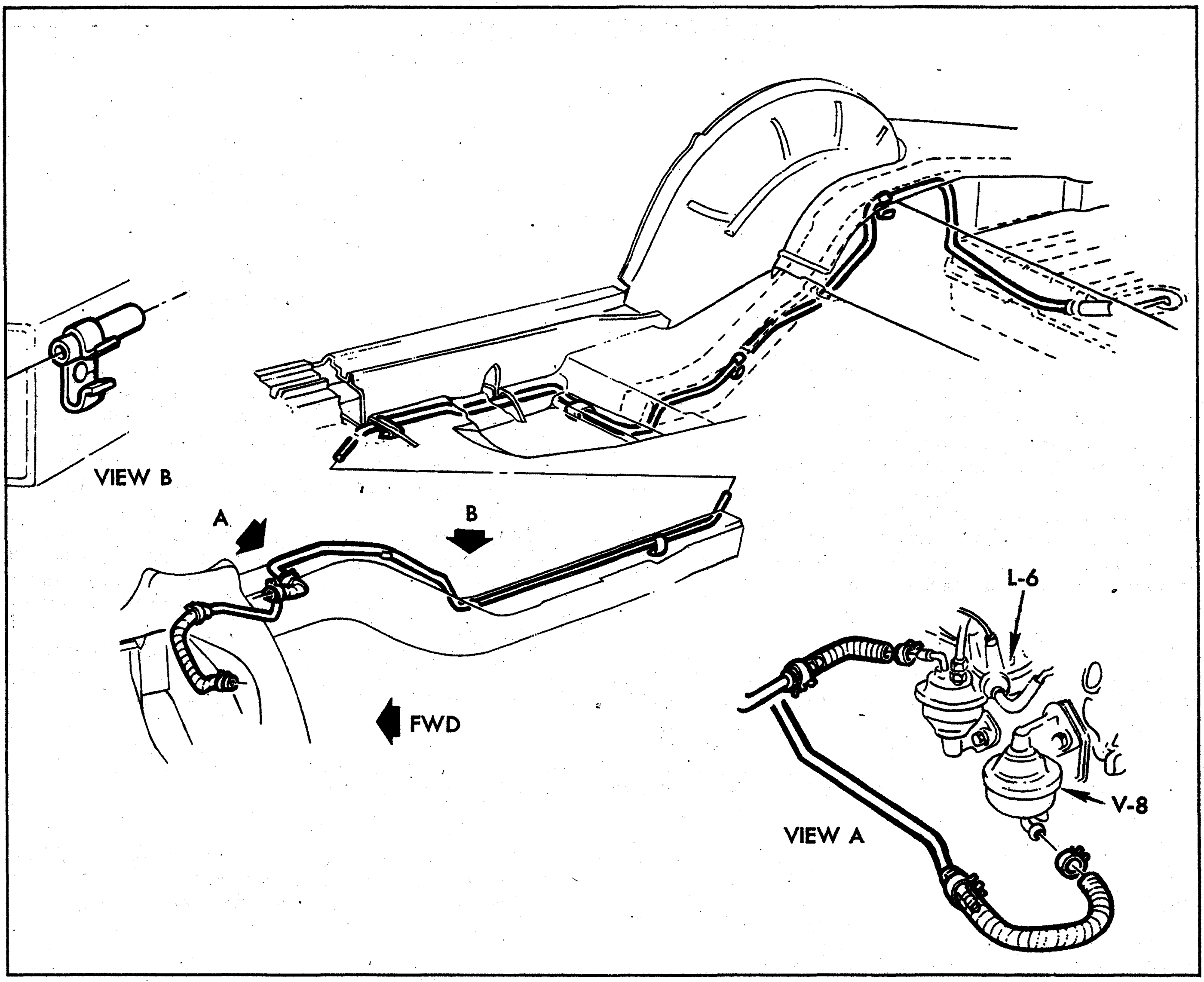

Fig. 35—Fuel Line Routing

EXHAUST SYSTEMS

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GENERAL DESCRIPTION

The single exhaust system on six-cylinder engine models (fig. 36) consists of an exhaust pipe, extension, muffler and tailpipe with necessary attaching brackets and clamps. On V-8 engine models with single exhaust assemblies (fig. 36) an exhaust crossover pipe is added to connect the right exhaust manifold to the system. The dual exhaust system available on V-8 engine models (fig. 37) includes two front exhaust pipes with or without resonators, two rear exhaust pipes, dual inlet-outlet muffler, tailpipes and attaching hardware.

The assemblies are secured to the engine at the exhaust manifolds, to the rear compartment pan reinforcement ahead of axle and adjacent to the gas tank at the end of the tailpipe. The assemblies are suspended on brackets with insulators for rattle free operation.

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 are electric welded to eliminate premature failure or rattle.

The exhaust system center mounting at the muffler location consists of an underbody bracket, an insulator and a clamp. The clamp holds the muffler and tailpipe 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 tailpipe secures the pipe to a bracket assembly and insulator attached to an existing underbody bracket.

COMPONENT PART REPLACEMENT

EXHAUST PIPE

Replacement

1. Loosen "U" bolt clamp at rear exhaust pipe connection.
2. Remove exhaust pipe to manifold attaching nuts, extension and packing then separate pipe from manifold studs.

   NOTE: Right exhaust crossover pipe on V-8 engine single exhaust models is an integral part of the exhaust pipe assembly and is not serviced separately.

3. Separate front exhaust pipe from rear exhaust pipe extension.
4. To install exhaust pipe, connect pipe to rear exhaust pipe extension or resonator and secure to exhaust manifold. Note clearances for the standard and automatic control linkages, underbody and crossmember.
5. Tighten exhaust pipe to manifold attaching nuts and rear "U" bolt clamp nuts.

EXHAUST PIPE EXTENSION

Replacement

1. Remove "U" bolt clamps at muffler inlet and exhaust pipe or resonator connections.
2. Disconnect exhaust pipe extension at muffler and exhaust pipe or resonator connection.
3. To install extension, connect extension to exhaust pipe or resonator and to muffler.
4. Install "U" bolt clamps and tighten clamp nuts.

MUFFLER ASSEMBLY

Replacement

1. Remove "U" bolt clamp at muffler inlet.
2. Remove tailpipe support clamp.
3. Separate muffler from rear exhaust pipe and remove muffler from vehicle.
4. If usable, cut tail pipe from muffler.
5. Connect muffler inlet to exhaust pipe and install "U" bolt clamp at muffler inlet.
6. Connect tailpipe to muffler outlet and install rear support clamp.
7. Install "U" bolt clamp at tailpipe to muffler outlet connection and tighten nuts.

TAIL PIPE

Replacement

1. Remove "U" bolt clamp at muffler outlet. If replacing right tail pipe, cut pipe at muffler outlet.
2. Remove tail pipe rear hanger clamp and detach pipe from muffler.

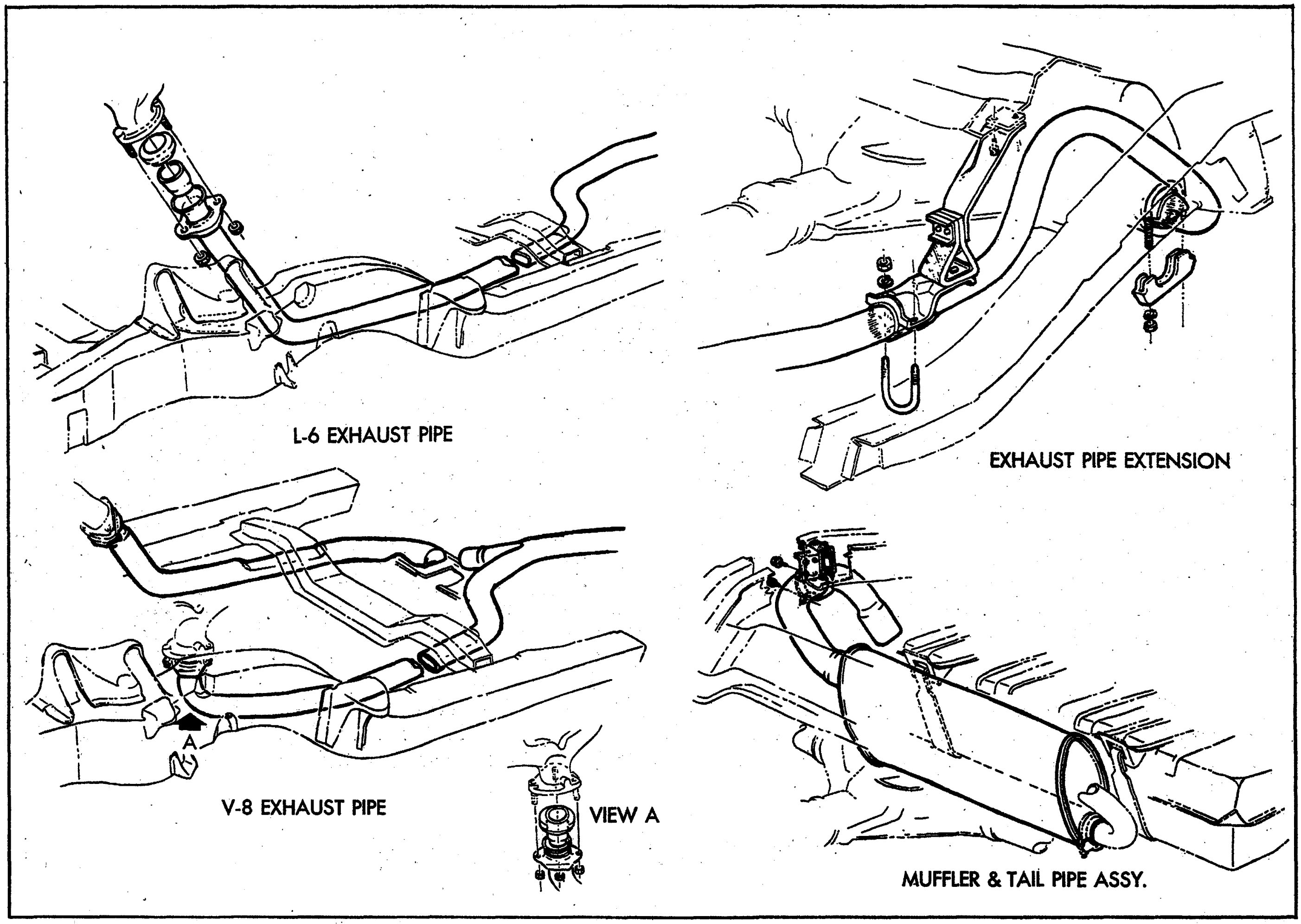

Fig. 36—Single Exhaust System

3. Position tail pipe at muffler, then install at hanger. Do not secure attachments until clearances have been checked. Check position of hanger so that inter-plates are parallel.
4. Tighten nuts at "U" bolt clamp then secure rear tail pipe clamp.

RESONATOR

Replacement

1. Cut exhaust pipe at resonator inlet.
2. Loosen "U" bolt clamp nuts and separate resonator from rear exhaust pipe extension.
3. Assemble resonator to front and rear exhaust pipes.
4. Install front and rear "U" bolt clamps and tighten nuts.

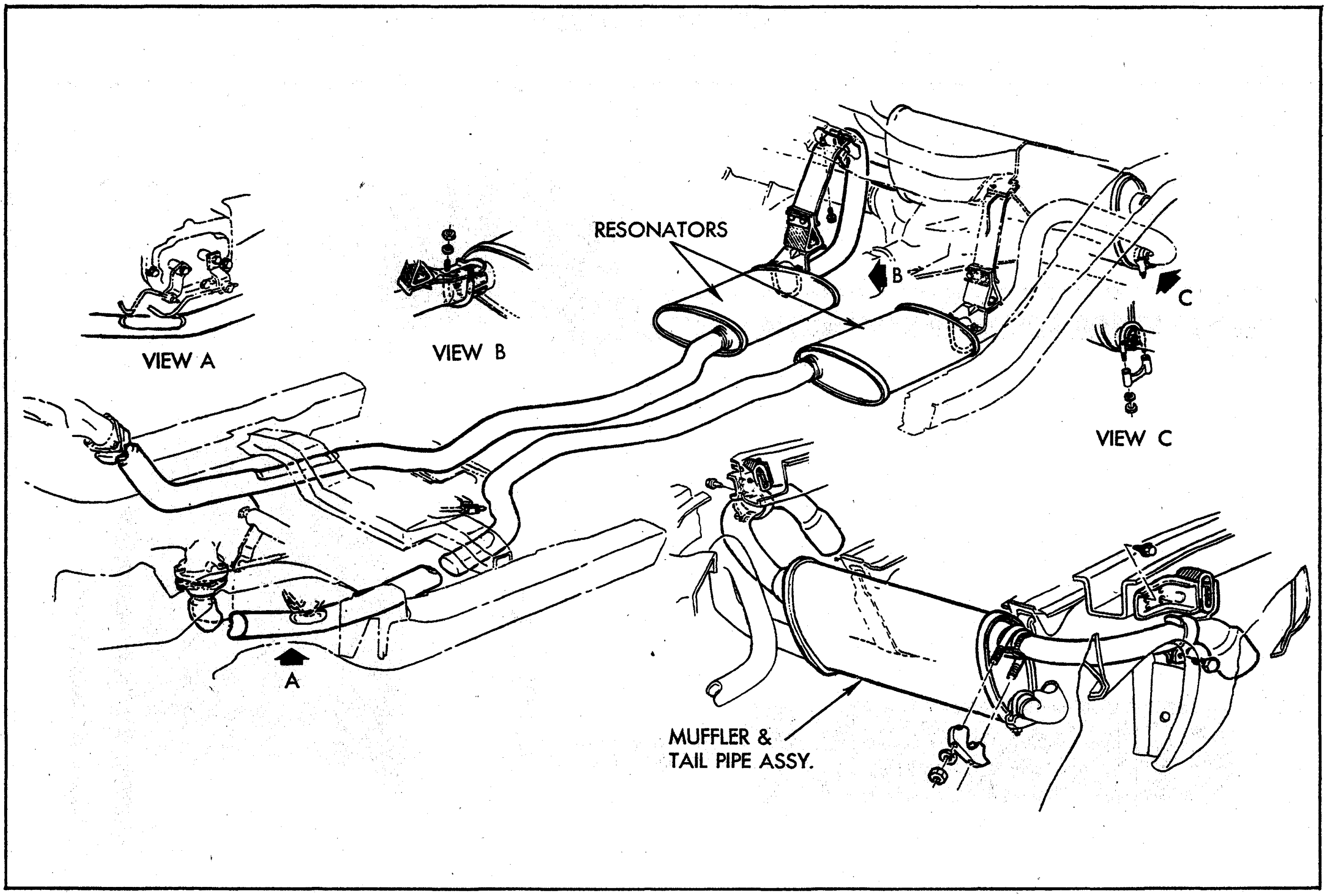

Fig. 37—Dual Exhaust System

SPECIAL TOOLS

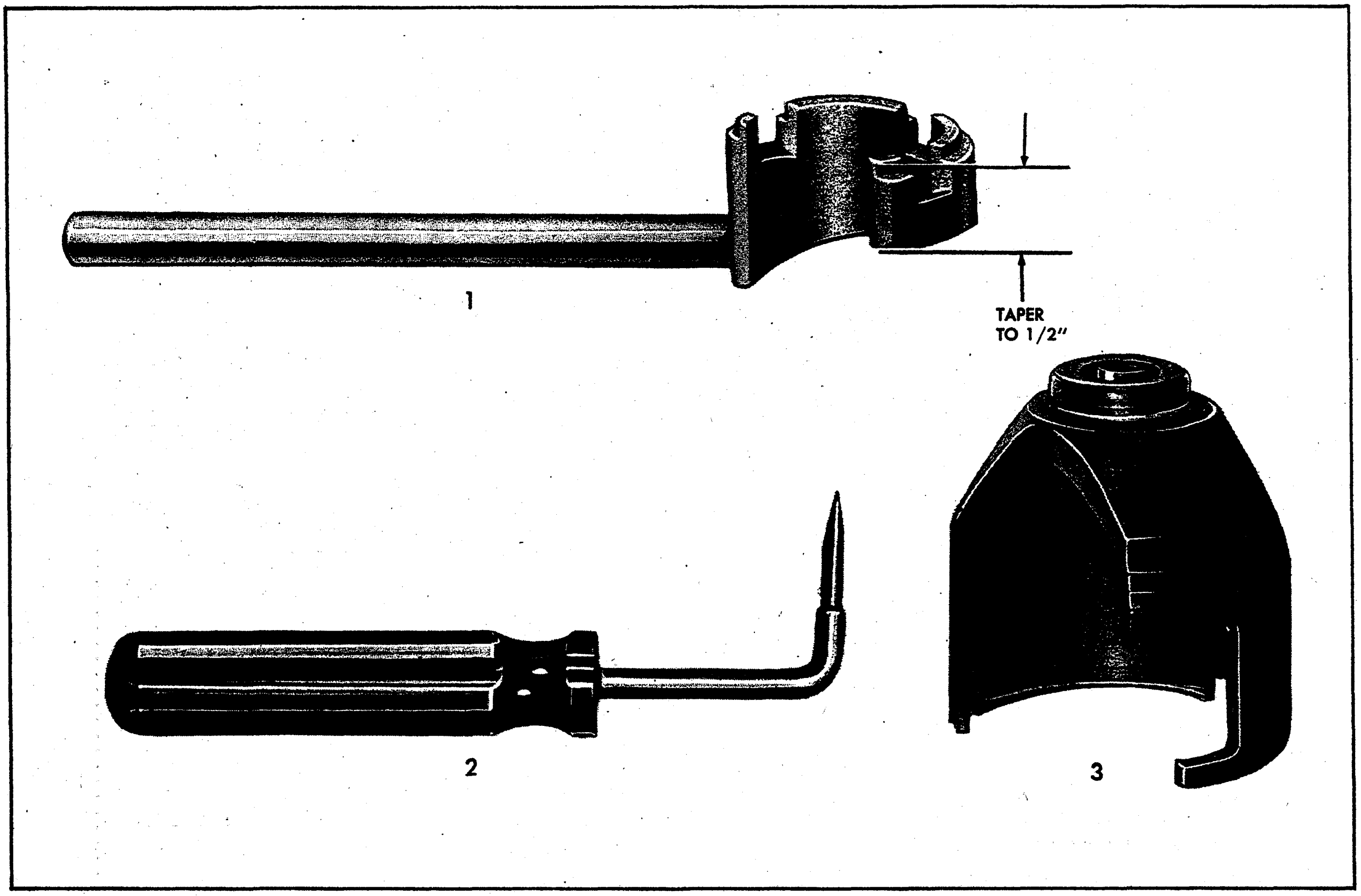

Fig. 38—Special Tools

1. J-8950 Fuel Tank Gauge Unit Spanner
2. J-7777 Fuel Line Clip Installer
3. J-22554 Fuel Tank Gauge Unit Spanner (Chevrolet)

SECTION 9
STEERING

CONTENTS OF THIS SECTION

STANDARD STEERING

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GENERAL DESCRIPTION

The regular production steering gear is the recirculating ball type. This gear provides for ease of handling by transmitting forces 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. Two adjustable tie rods connect the relay rod to the steering arms.

All passenger car models for 1967 are equipped with new energy absorbing steering columns. The mast jacket, shift tube, and steering shaft are designed to collapse under various front impact conditions. All new columns are of this design, including the tilt option and telescope option.

MAINTENANCE AND ADJUSTMENTS

The manual steering gear is filled at the factory with a water resistant grease. Seasonal change of this lubrication 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 six 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.

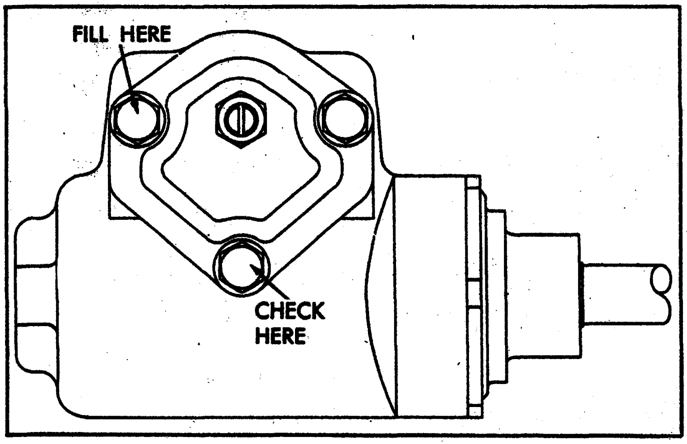

Fig. 1—Cover Attaching Bolts—Chevy II Shown

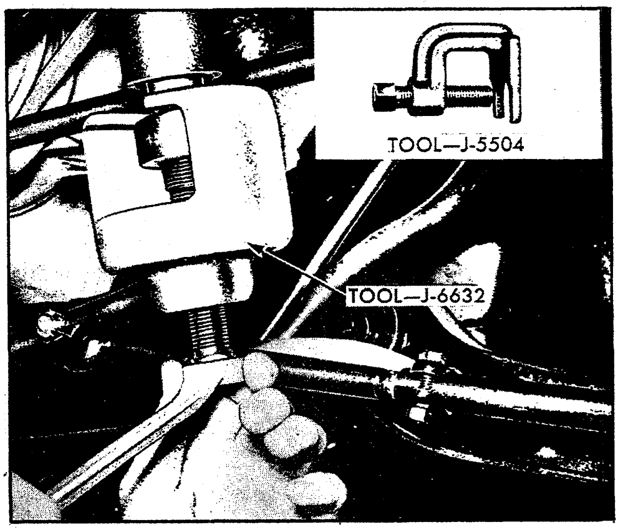

Fig. 2—Removing Pitman Arm

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 etc., a careful check should be made of front end alignment, shock absorbers, wheel balance and tire pressure for possible cause.

Correct adjustment of the steering gear is very important. Perform adjustments following the sequence listed below.

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. All except Corvette and telescopic columns:
   a. Disconnect steering column harness at chassis wiring connector plug.
   b. Remove horn cap or ornament and using an inch pound torque wrench and socket on steering wheel nut, measure torque required to keep the wheel in motion.

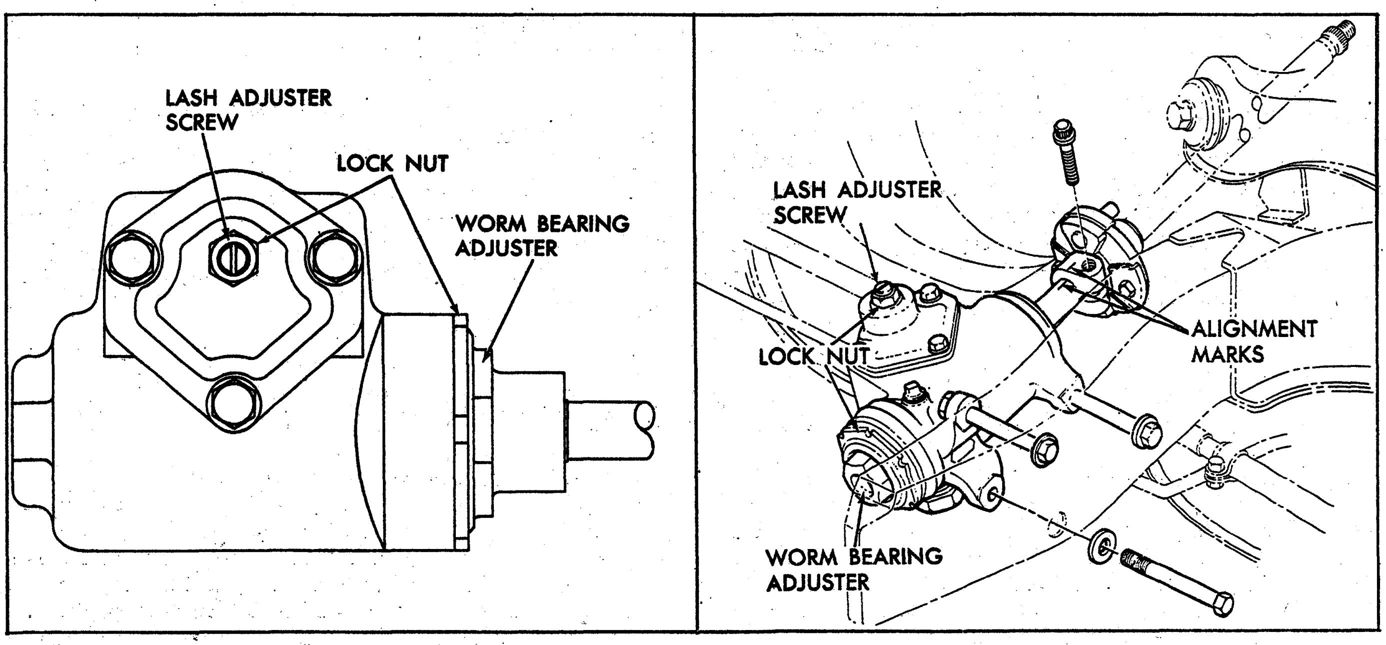

Fig. 3—Steering Gear Adjustment Points

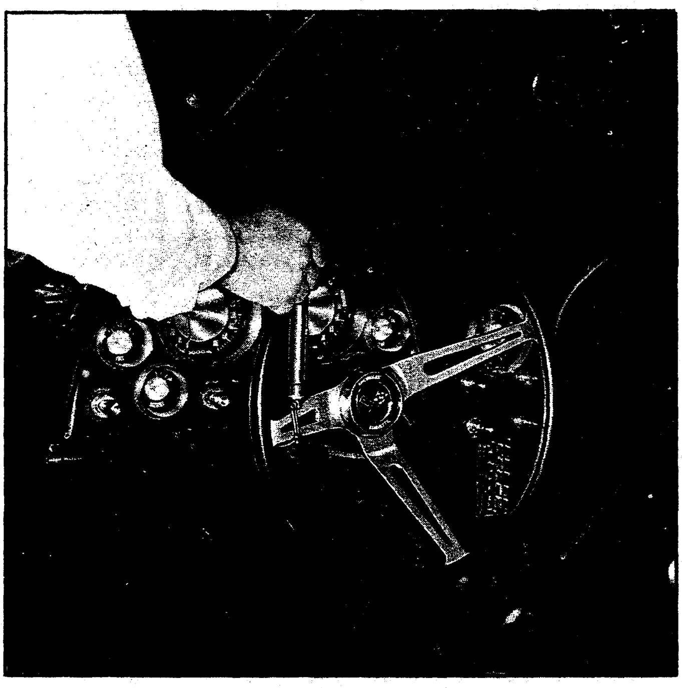

Fig. 4—Checking Wheel Pull—Corvette

c. If torque does not lie within limits given in specifications at rear of manual, adjustment is necessary.

4. Corvette and telescopic columns:
   a. Use Tool J-5178 to measure pull at rim of wheel required to keep wheel in motion (fig. 4).
   b. If pull does not lie within limits given in specifications in rear of manual, adjustment of worm bearings is necessary.

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.

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, 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.
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 taking highest reading as wheel is turned through center position. See specifications in rear of manual for proper sector lash adjustment. Readjust if necessary to obtain proper pull.

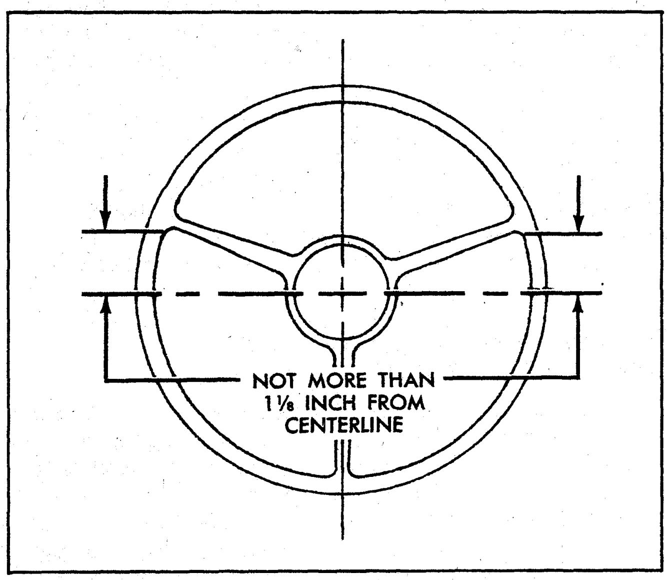

Fig. 5—Steering Wheel Alignment

NOTE: If maximum specification is exceeded, turn lash adjuster screw counterclockwise, 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 readings.

Fig. 6—Adjusting Steering Ratio—Corvette

8. Reassemble pitman arm to sector shaft, lining up marks made during disassembly. Refer to torque specifications at rear of manual for correct torque value.
9. Install horn cap or ornament and connect steering column harness at chassis connector.

NOTE: Chevy II models are equipped with a shim at the frame to steering gear mounting bolts. Shims may be removed or installed as required for proper steering gear alignment.

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 differential 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 horizontal spoke to the horizontal centerline of the steering wheel (fig. 5). If the horizontal spokes are over 1-1/8 inches from the horizontal position the wheel should be removed and centered. (See steering wheel removal in this section.)

TOE-IN ADJUSTMENT

Adjust the steering linkage for proper toe-in setting as outlined in Section 3.

CORVETTE STEERING RATIO (Fig. 6)

The Corvette steering ratio may be changed as follows:

CAUTION: Do not use the rearward hole in the steering arm with power steering equipment or interference may result.

1. Remove tie rod ball stud nut at steering arm and disconnect tie rod from steering arm.
2. Move tie rod end to forward hole for 17.6:1 ratio (fast ratio) or rear hole for 20.2:1 ratio (standard ratio).
3. Install tie rod stud nut and tighten securely. Repeat operation on opposite steering arm.

COMPONENT REPLACEMENT AND REPAIRS

STEERING WHEEL

REGULAR PRODUCTION (Fig. 7)

Removal

1. Disconnect steering column harness from chassis wiring harness at connector (fig. 8).
2. Pull out horn button cap or center ornament and retainer.
3. Remove three screws from the receiving cup.
4. Remove the receiving cup, belleville spring, bushing, and 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. 9).

Installation

CAUTION: Direction signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

1. With directional cancelling cam and horn contact assembly in place, set wheel onto steering shaft.

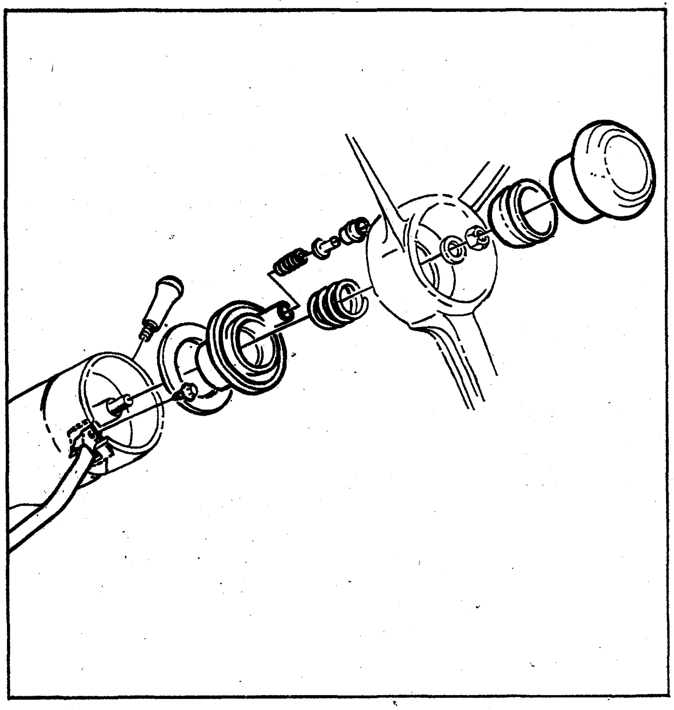

Fig. 7—Regular Wheel and Horn Attachments

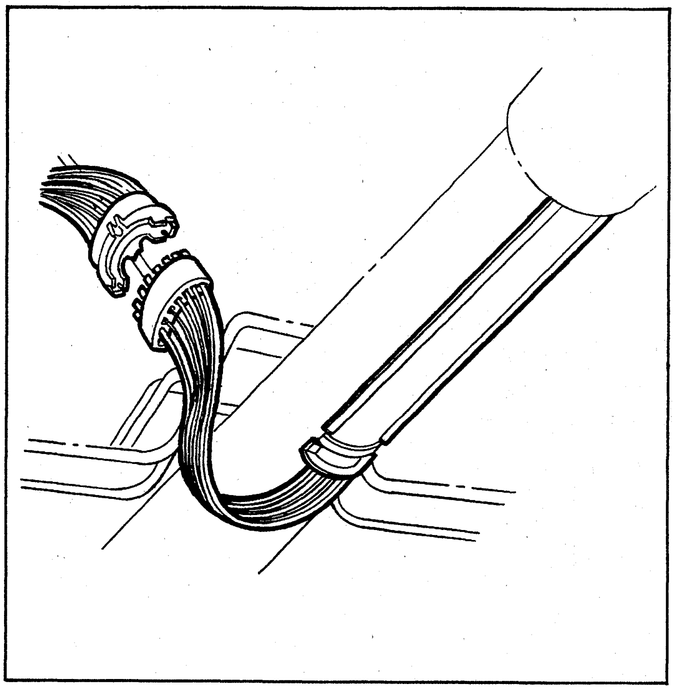

Fig. 8—Steering Column Wiring Connector

Secure with washer and nut. Refer to torque specifications at rear of manual for correct torque values.
2. Install belleville spring (with dish of spring up), pivot ring, bushing and receiving cup with screws.
3. Install retainer and horn button cap or center ornament.
4. Connect steering column harness to chassis wiring connector.

Fig. 9—Removing Steering Wheel with J-2927

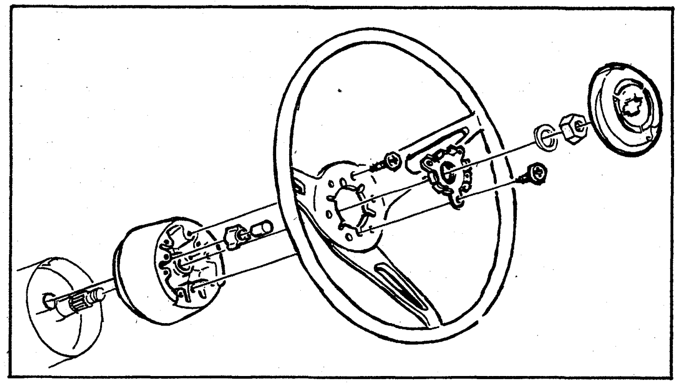

Fig. 10—Simulated Wood Steering Wheel and Attaching Parts

SIMULATED WOOD (Fig. 10)

Removal

1. Disconnect steering column harness from chassis wiring harness at connector.
2. Remove horn cap assembly by pulling up.
3. Remove contact assembly attaching screws and remove contact assembly.

   NOTE: If steering wheel only is to be replaced, perform step 4. If directional signal cancelling cam is to be replaced, omit step 4 and proceed with steps 5 and 6.

4. Remove remaining screws from steering wheel and remove wheel from hub assembly.
5. Remove 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 hub assembly. Turn center bolt of tool clockwise to remove hub assembly.

Installation

CAUTION: Directional signal control assembly must be in neutral position when assembling hub assembly to prevent damage to cancelling cam and control assembly.

1. With directional cancelling cam and horn contact in place, install hub assembly on steering shaft. Secure with washer and nut. Refer to torque specifications at rear of manual for correct torque value.
2. Attach steering wheel to hub assembly using the six attaching screws and tighten securely.
3. Place horn contact on steering wheel and attach with three screws. Tighten securely.
4. Snap horn button in place.
5. Connect steering column harness to chassis wiring connector.

CORVETTE TELESCOPING (Fig. 11)

Removal

1. Disconnect steering column harness at wiring connector.
2. Pry off horn button cap.
3. Remove three screws securing horn contact to spacer and hub.
4. Remove two screws securing lock screw to lock knob, and remove lock screw, lock knob, and spacer.

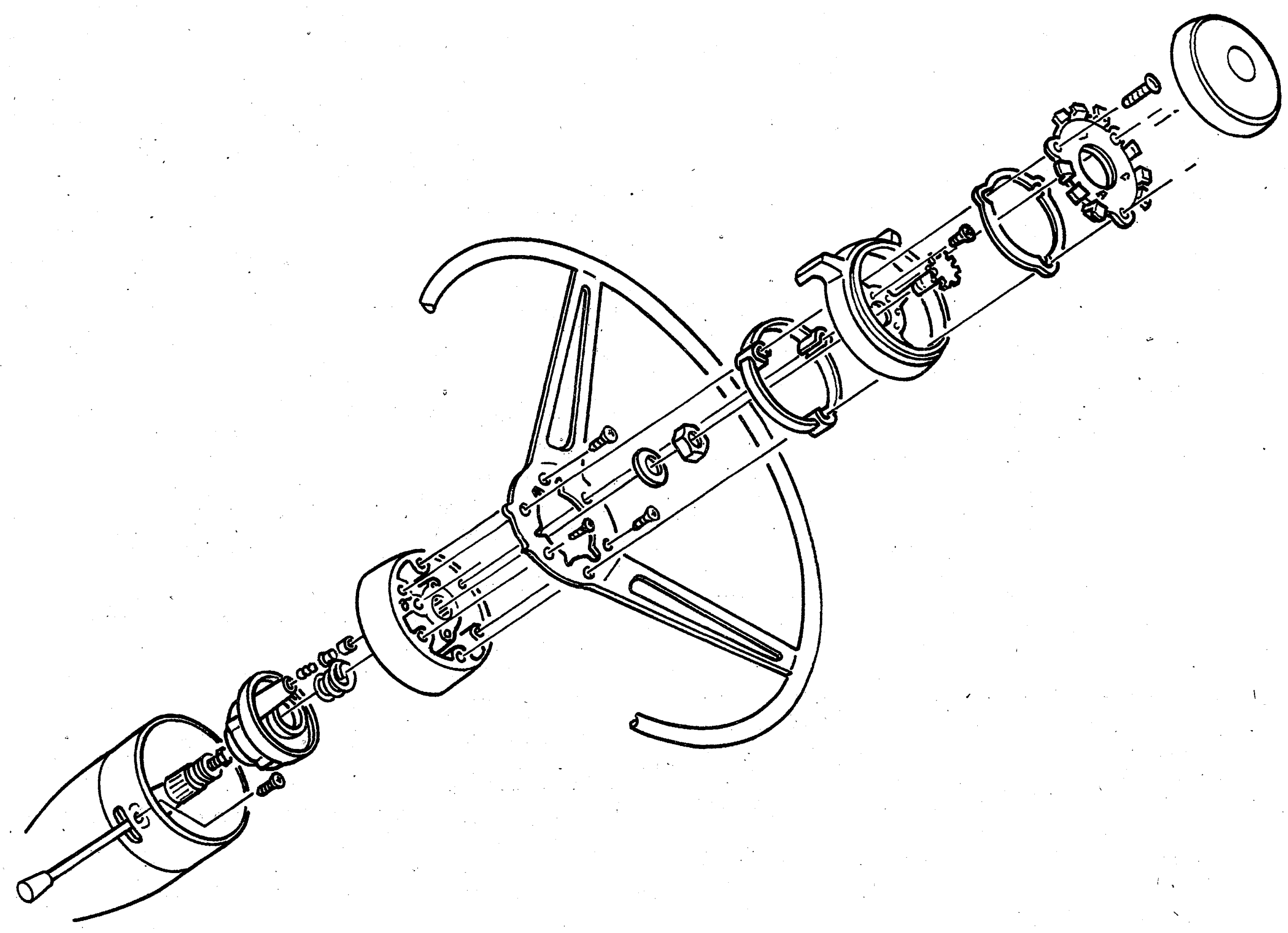

Fig. 11—Corvette Telescoping Wheel Option

NOTE: If steering wheel only is to be replaced, perform Step 5 below only. If directional signal cancelling cam is to be replaced, omit Step 5 and proceed with Steps 6 and 7.

5. Remove six screws securing steering wheel to hub and remove wheel.
6. Remove nut and washer from shaft and using steering wheel puller Tool J-2927, remove steering wheel and hub from vehicle.
7. Slide cancelling cam and spring off shaft.

Installation

NOTE: Refer to torque specifications at rear of manual for correct torque values.

1. If necessary, slide cancelling cam and spring on end of shaft.
2. If hub was removed from steering wheel, attach hub to steering wheel with screws removed during disassembly.
3. Place steering wheel and hub assembly in position and secure to column with washer and nut.
4. Position spacer on steering wheel.
5. Position lock knob on steering wheel.
6. Install lock screw through lock knob, turn into shaft, and adjust to lock position.
7. Attach spacer to wheel with three screws.
8. Place lock knob in lock position and attach to lock screw with two screws.
9. Remove three screws holding spacer. Attach horn contact to spacer and steering wheel with three screws.
10. Install horn button cap.
11. Connect steering column harness at chassis plug.

STEERING COUPLING (Fig. 12)

Removal

NOTE: Chevy II models are equipped with a clamp arrangement rather than the conventional "rag joint" steering coupling. Refer to Steering Gear - Chevy II, for service procedures.

1. Remove nuts and washers securing steering coupling to flanged end of steering column (fig. 12).
2. Remove coupling clamp bolt (fig. 12) and slightly spread coupling clamp.

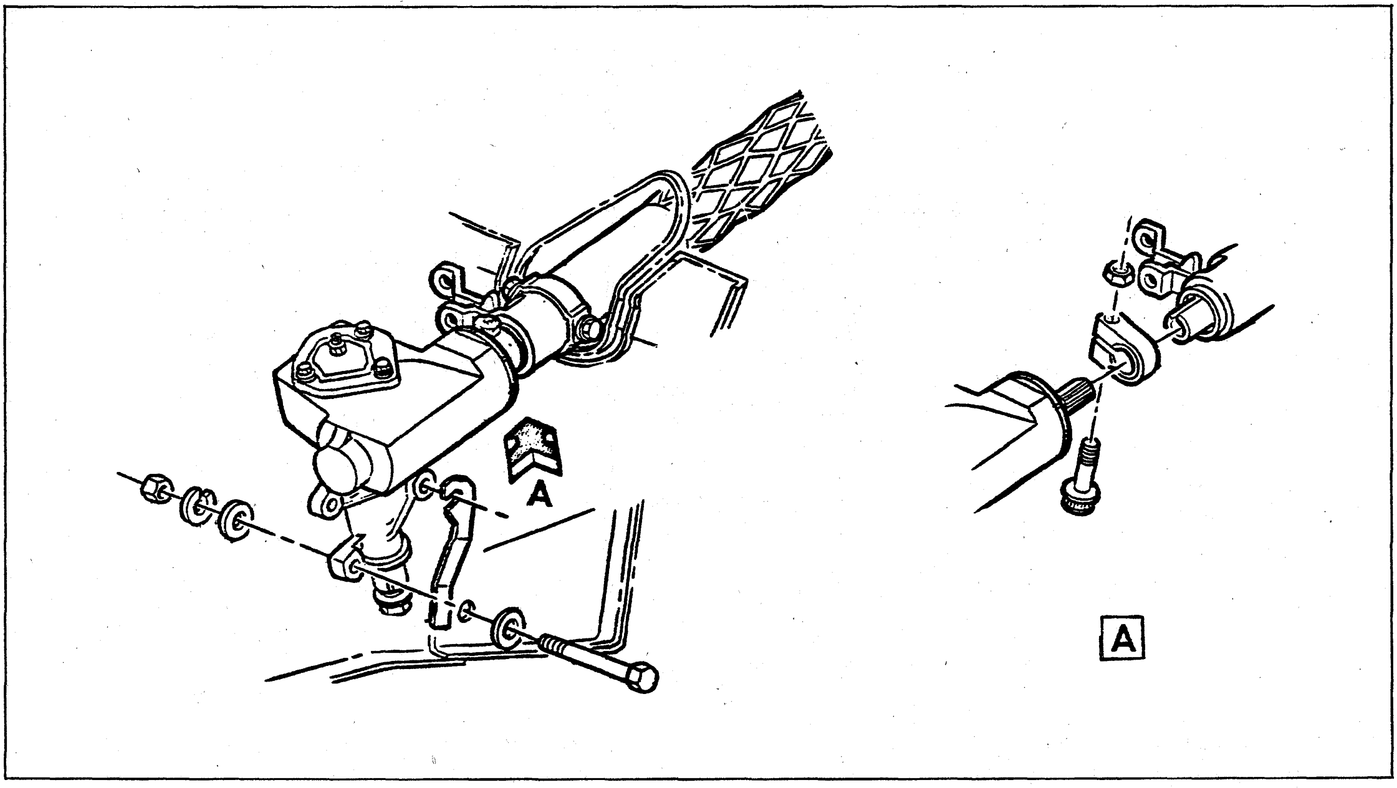

Fig. 12—Steering Coupling

3. Disconnect transmission controls from levers at bottom of column, if so equipped.
4. Inside vehicle, remove trim cover or boot, protective covers, and seal from dash panel as shown in Figure 13. On Corvette models the covers are removed in the engine compartment side. Also on Corvette models, remove screws securing escutcheon (fig. 14) to instrument panel.
5. Disconnect steering column harness and back-up lamp/neutral safety switch at connector plugs.

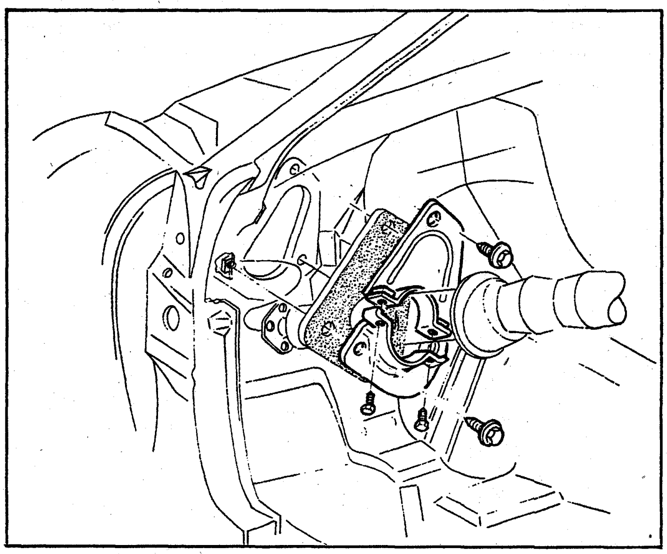

Fig. 13—Removing or Installing Dash Panel Covers and Seal

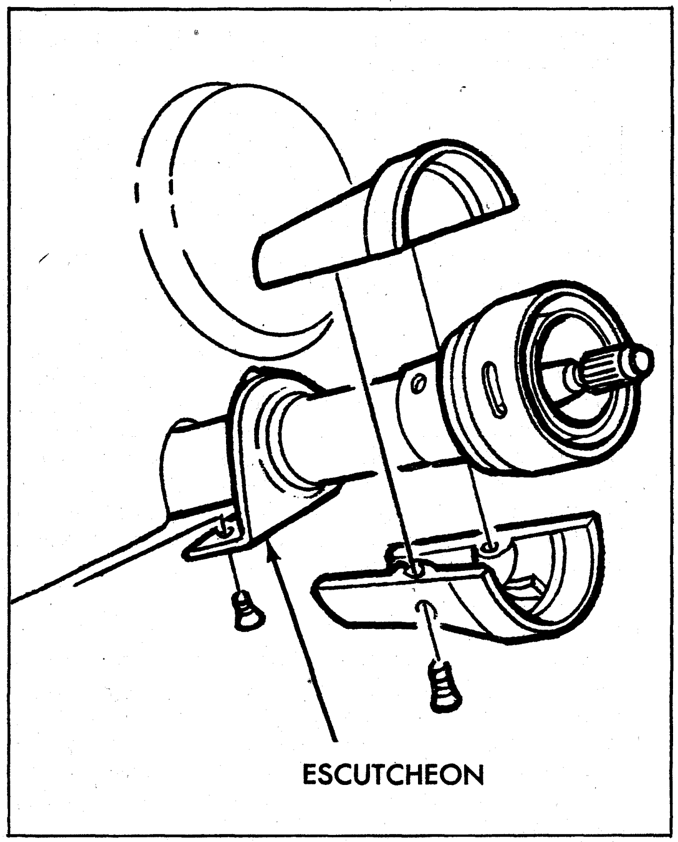

Fig. 14—Steering Column Escutcheon—Corvette

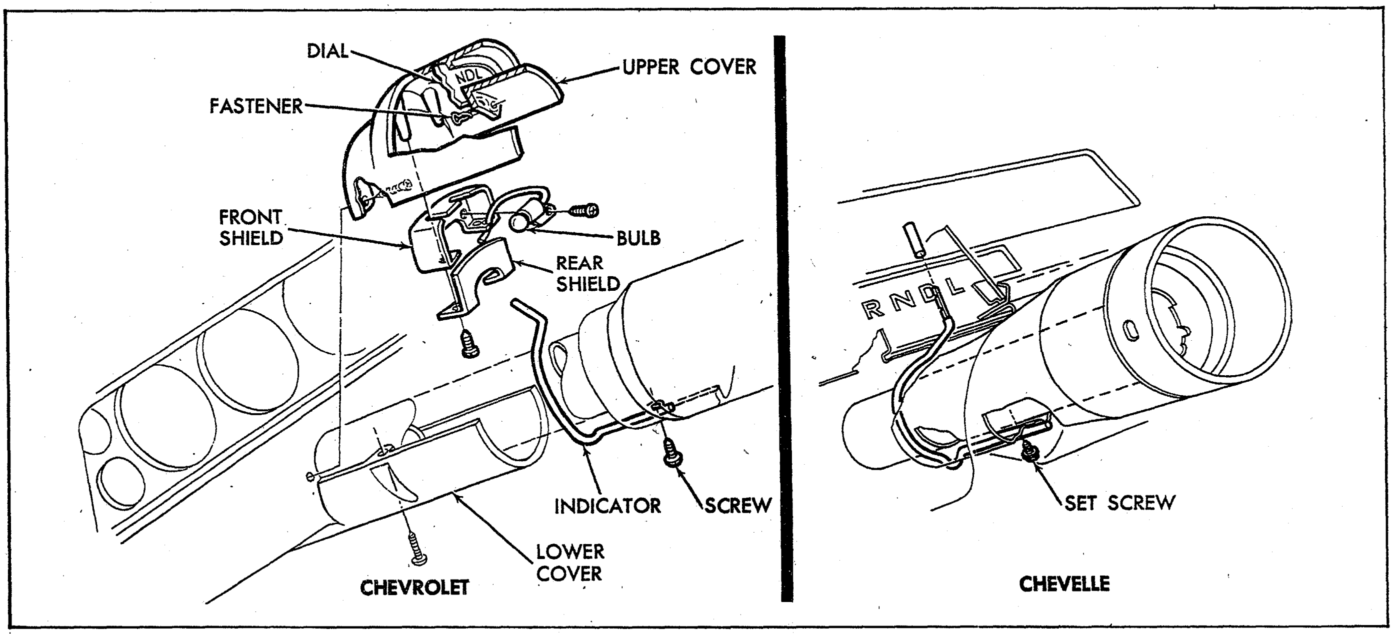

Fig. 15—Powerglide Indicator Connection—Chevrolet and Chevelle

6. Chevrolet and Chevelle only:
   a. Remove lower mast jacket cover (fig. 15).
   b. If vehicle is equipped with Powerglide, remove indicator pointer wire by removing screw from six o'clock position at bottom of mast jacket (fig. 15). Work indicator wire out of position and remove.
7. Remove instrument panel column mounting bracket attaching hardware and remove bracket.

CAUTION: Do not allow steering column to hang down from dash panel area or distortion to column will result. When instrument panel mounting bracket is removed, be sure column is supported in its normal position.

NOTE: The following step requires two men, one in the driver's seat and one at engine compartment.

8. Lift steering column upward enough to permit removal of steering coupling from steering gear. Mechanic at engine compartment can pilot column shift levers, if so equipped, through dash panel opening as column is listed. If it is necessary to leave the vehicle at this point, place steering column in correct mounted position and loosely install instrument panel mounting bracket to support column.
9. Remove steering coupling from vehicle.

Installation

1. Lift steering column enough to provide clearance and loosely install steering coupling on steering gear shaft. Be sure column is supported in its normal mounted position at all times when not moving for clearance. Mechanic at engine compartment can pilot column shift levers through dash panel opening as column is moved.
2. Slide steering coupling into correct installed position and install clamp bolt (fig. 12).
3. Secure steering coupling to flanged end of steering column with washers and nuts. Maintain coupling adjustment shown in Figure 16.
4. Install instrument panel column mounting bracket. Refer to torque specifications at rear of manual for correct torque values.
5. Chevrolet and Chevelle only:
   a. If vehicle is equipped with Powerglide, work shift indicator pointer wire into position on column and secure with screw at six o'clock position at bottom of mast jacket (fig. 15).
   b. Install mast jacket lower cover (fig. 15).
6. Connect steering column harness at connector plug. Connect back-up lamp/neutral safety switch plug, if so equipped.
7. Inside vehicle, install seal, protective covers, and trim cover or boot (fig. 13). On Corvette models the covers are installed in the engine compartment side.
8. Connect transmission controls to shift levers at bottom of column if so equipped.

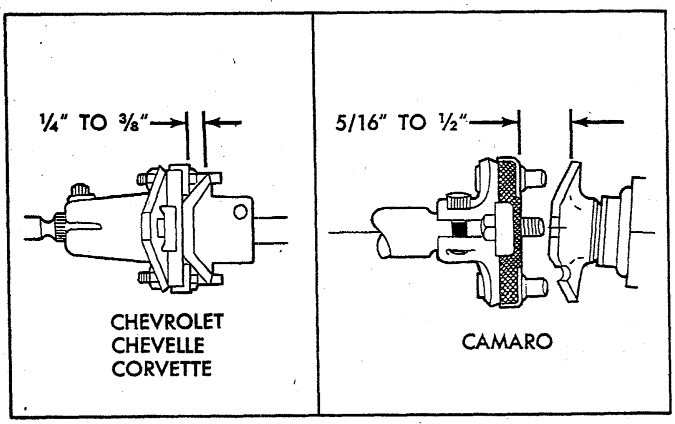

Fig. 16—Steering Coupling Clearance Adjustment

STEERING GEAR—CHEVROLET, CHEVELLE, CAMARO, AND CORVETTE (Fig. 12)

Removal

1. Remove retaining nuts, lock washers, and bolts at steering coupling. (No bolts are used on Corvette.) On Corvette, loosen clamp bolt and slide coupling upper flange upward on steering shaft.
2. Remove pitman arm nut and washer from sector shaft and mark relation of arm position to shaft.
3. Remove pitman arm with Tool J-6632 as shown in Figure 2.
4. Chevelle only:
   a. Remove stabilizer bar to frame mounting brackets.
   b. Remove bolt, washer, and nut securing left front bumper bracket and brace to frame. (See Section 14, Figure 3.) Scribe a mark around adjustment washer for position reference, then loosen bolt at adjustment washer location enough to release washer from notches in bracket.

NOTE: On Camaro models, use care not to bend or fracture brake pipe when removing steering gear.

5. Remove screws securing steering gear to frame and remove gear from vehicle.

Installation

1. Place gear into position so that steering coupling mounts properly to flanged end of steering shaft. Secure gear to frame with washers and bolts. On Corvette models, install gear with bolts, washers, and nuts. Maintain coupling adjustment shown in Figure 16.
2. Chevelle only:
   a. Holding front bumper in place, loosely install bolt, washer, and nut to secure bumper bracket and brace to frame.
   b. Position adjustment washer in notches of bumper bracket and align washer with mark made during removal. Tighten mounting bolts.
   c. Install stabilizer bar to frame mounting brackets. Refer to torque specifications at rear of manual for correct torque values.
3. Install pitman arm aligning marks made during removal and secure with washer and retaining nut.
4. Secure steering coupling to flanged end of steering column with lock washers, and nuts.

CHEVY II (Fig. 17)

Removal

1. Remove clamp nut and bolt from clamp securing column to steering gear and loosen clamp.
2. Remove pitman arm retaining nut and washer. Scribe mark on arm and shaft, and remove arm using Tool J-6632.
3. Remove nuts, washers, and bolts securing steering gear to frame and remove gear from vehicle.

Installation

NOTE: Steering assembly alignment must be checked each time a steering gear is installed. Proceed with steering alignment and gear installation as outlined below.

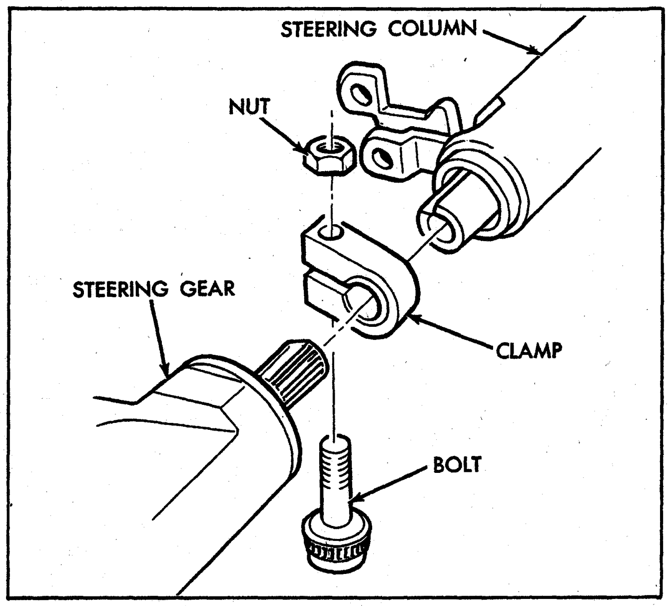

Fig. 17—Steering Column to Steering Gear—Chevy II

1. Support steering gear in position and loosely install bolts, washers, and nuts.
2. Slide steering gear to steering shaft clamp into position and install clamp bolt and nut. Tighten nut securely; refer to torque specifications at rear of manual for correct torque value.
3. Disconnect transmission control linkage, if so equipped, from lower column shift tube levers.
4. Remove screws attaching upper and lower mast jacket covers together and remove lower cover (fig. 18).
5. Loosen collar, clamp, retainer, and seal at toe plate.
6. Loosen screws and bolts securing instrument panel column mounting bracket to underside of instrument panel. Remove two forward bracket mounting bolts and remove wedge shims.
7. Tighten the forward upper steering gear mounting bolt to 5 lb. ft., so that the forward upper boss is contacting the frame.
8. Determine the gap at the rear mounting bolt area and shim as required.
9. Tighten rear (closest to driver's seat) bracket mounting bolt to 5 lb. ft.
10. Holding wedge shims in correct position install and tighten remaining bracket mounting bolts and screws; refer to torque specifications at rear of manual for correct torque values.
11. Tighten rear (closest to driver's seat) bracket mounting bolt to torque valve specified in specifications.
12. Tighten all steering gear mounting bolts and nuts to torque values specified in specifications.
13. Install mast jacket lower cover.
14. Tighten seal, retainer, clamp, and collar at toe plate.
15. Connect transmission control linkage at lower shift levers. Adjust linkage as outlined in Section 7. Adjust back-up/neutral start switch as outlined in Section 12.
16. Install pitman arm at aligning marks made during removal, and install arm retaining washer and nut.

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. Loose lash adjuster lock nut and turn lash adjuster screw several turns counterclockwise.
2. Remove three cap screws holding side cover to gear bushing.
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 with 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 COLUMN

All models are equipped with new energy absorbing steering columns. The columns are of five basic designs as follows:

1. Syncromesh. The syncromesh column is used on models with standard, column mounted, conventional shift levers. The shift tube, within the outer mast jacket, includes two lower shift levers for connection to the transmission control linkage.
2. Automatic and floor shift. This column is used on models equipped with column mounted powerglide shift levers, or models with floor shift. If the vehicle has the column mounted powerglide shift control, the inner shift tube has a single lower shift lever for connection to the transmission control linkage. On floor shift models, no lower shift levers are present on the shift tube.
3. Tilt wheel option. The upper end and steering shaft of this column is specially designed to accommodate the optional tilt steering wheel.
4. Standard Corvette Column. The standard Corvette column is similar in design to the Automatic and Floor Shift column used on other models, except no shift tube is used. Other differences are pointed out in the disassembly and assembly procedures for Standard Corvette column.
5. Telescopic wheel option. The upper end and steering shaft of this column is specially designed to accommodate the optional telescoping steering wheel.

To perform service procedures on steering column upper end components, it is not necessary to remove the column from the vehicle. The steering wheel, horn components, turn signal switch, upper housing with bearing, shift control lever, hazard warning knob, and upper shift bowl may all be removed with the column remaining in the vehicle. When servicing the above components, omit the removal procedure and proceed with the applicable disassembly procedures. Because of the numerous differences in steering column types, be sure to refer to the set of instructions below which apply to the exact column to be serviced:

CAUTION: The outer mast jacket, shift tube, steering shaft, and instrument panel column mounting bracket are designed as energy absorbing units. Because of the design of these components, it is absolutely necessary to handle the column with care when performing any service operation required. Avoid hammering, jarring, dropping, or leaning on any portion of the column.

Removal

1. Disconnect steering column harness at connector. Disconnect neutral safety switch and back-up lamp switch connectors if so equipped.
2. Remove steering wheel as outlined in this section.
3. Remove nuts and washers securing flanged end of column to steering gear. On Chevy II models, remove nut and clamp bolt securing lower end of steering column to steering gear.
4. Disconnect transmission control linkage, if so equipped, from lower column shift tube levers.
5. Chevrolet and Chevy II only: Remove screws attaching upper and lower mast jacket covers together. On Chevrolet, remove screws attaching lower cover to instrument panel (figs. 15 and 18). Remove lower cover.
6. Chevelle only: Remove screws securing mast jacket trim cover to instrument panel and remove cover (fig. 15).
7. Corvette only: Remove screws securing escutcheon to instrument panel. Remove screws securing upper and lower covers together and remove covers.
8. On Chevrolet and Chevelle columns with Powerglide shift levers, loosen set screw at six o'clock position at bottom of column and remove the transmission shift indicator pointer (fig. 15).
9. Chevrolet only (fig. 19):
   a. Remove screws securing cover trim to dash panel and remove cover trim.

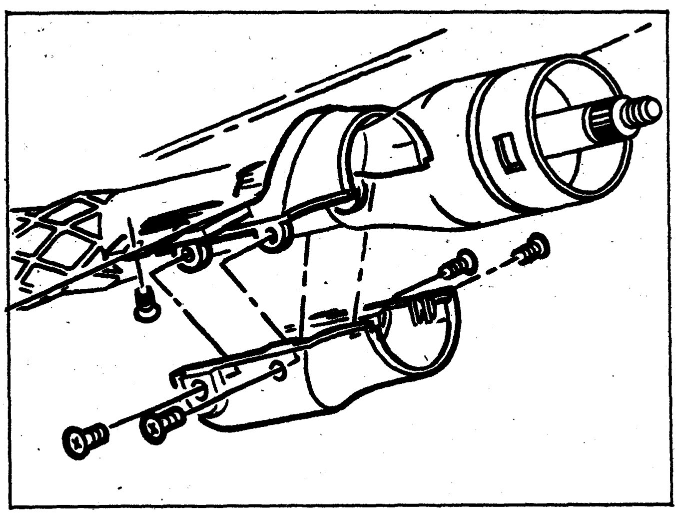

Fig. 18—Mast Jacket Cover Attachments—Chevy II

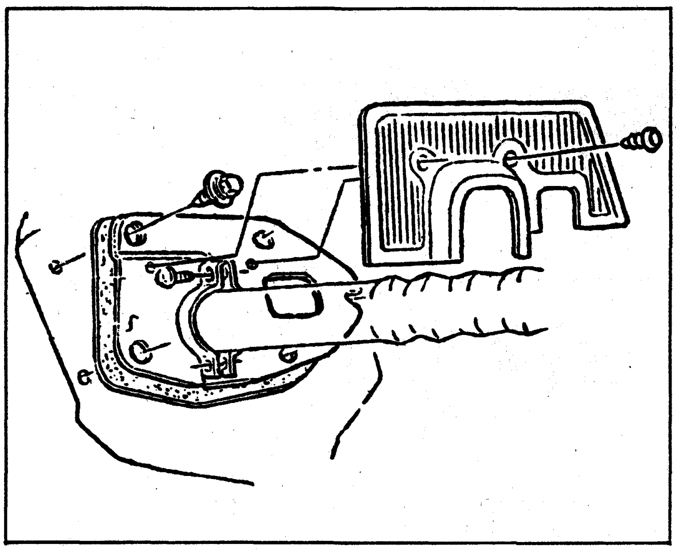

Fig. 19—Steering Column to Dash Panel—Chevrolet

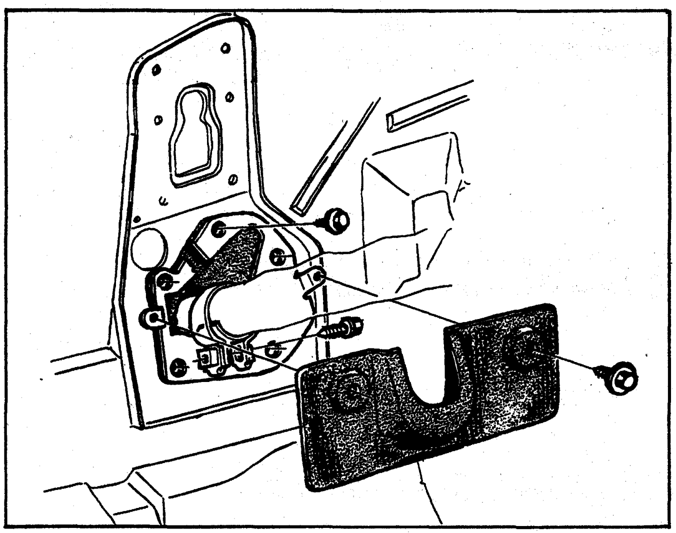

Fig. 20—Steering Column to Dash Panel—Chevelle

b. Remove clamp screw and loosen clamp.
c. Remove screws securing cover and seal to dash panel.

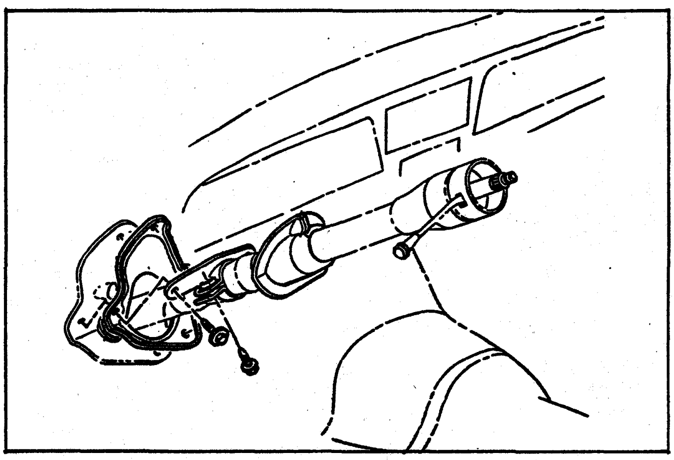

Fig. 21—Steering Column to Dash Panel—Chevy II

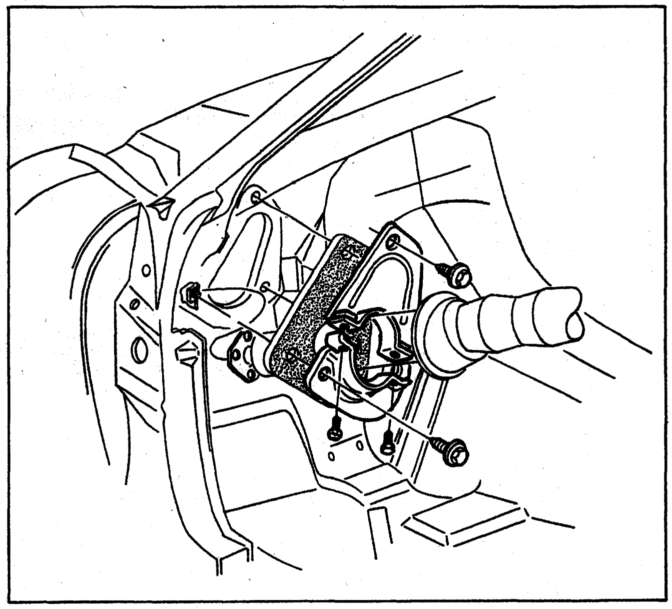

Fig. 22—Steering Column to Dash Panel—Camaro

10. Chevelle only (Fig. 20):
    a. Remove screws securing cover trim to dash panel and remove cover trim.
    b. Remove screws securing inner cover to outer cover.
    c. Remove screws and washers securing inner cover, outer cover, and seal to dash panel and remove covers.
11. Chevy II only (Fig. 21):
    a. Remove staple from collar and loosen collar.
    b. Remove screws securing clamp and loosen clamp.
    c. Remove screws securing clamp to dash panel and slide clamp up on column.
    d. Remove screws securing retainer and seal to dash panel.
12. Camaro only (Fig. 22):
    a. Fold grommet back on column.
    b. Remove screws securing lower cover to upper cover.
    c. Remove screws securing upper cover, lower

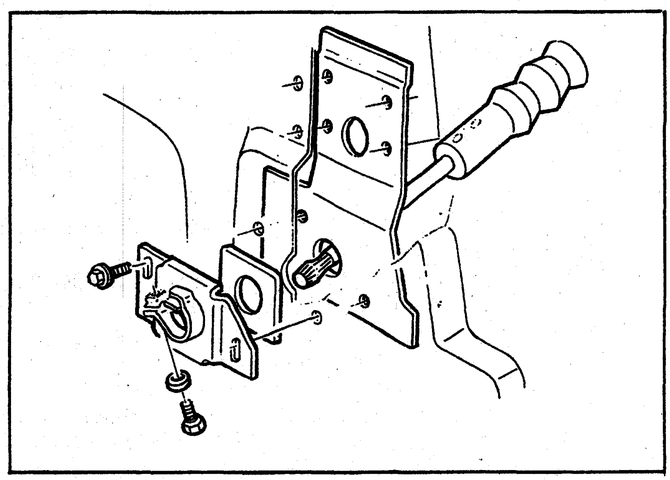

Fig. 23—Steering Column to Dash Panel—Corvette

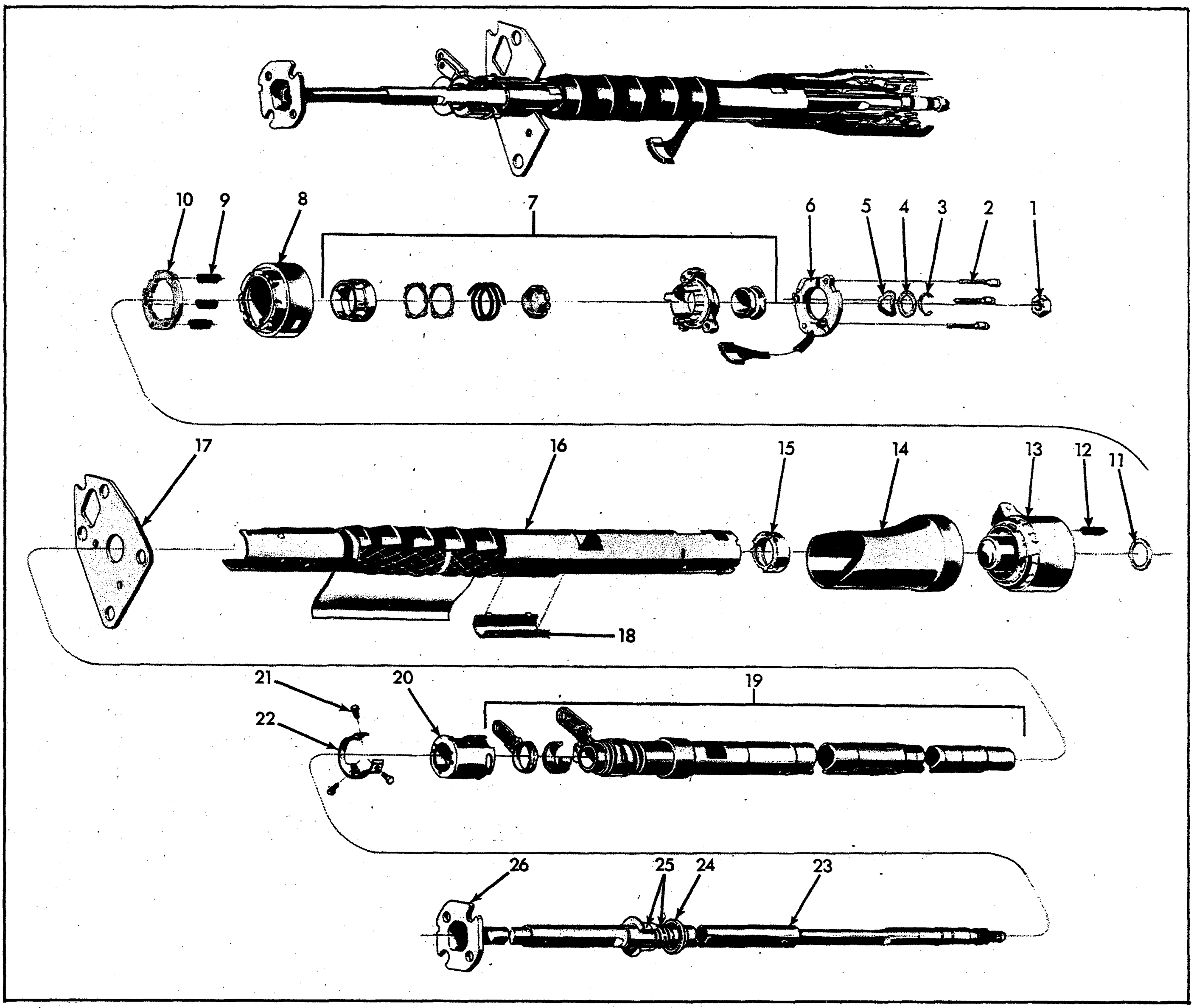

Fig. 24—Syncromesh Steering Column—Exploded View

1. Steering Wheel Nut
2. Screw
3. Retaining Ring
4. Thrust Washer
5. Wave Washer
6. Turn Signal Switch
7. Upper Bearing and Housing Assembly
8. Cover
9. Spring
10. Lock Ring
11. Thrust Washer
12. Shift Lever Spring
13. Shift Bowl
14. Shroud
15. Bearing
16. Mast Jacket
17. Flange Plate
18. Wiring Protector
19. Shift Tube Assembly
20. Adapter
21. Bolt
22. Reinforcing Ring
23. Steering Shaft
24. Bearing
25. Tolerance Ring Kit
26. Flange

cover, and seal to dash panel and remove covers.

13. Corvette only (Fig. 23)
    a. Remove clamp bolt and washer from support assembly on engine side of dash panel.
    b. Remove screws securing support assembly and seal to engine side of dash panel.
14. Support column and remove screws, nuts, and bolts securing instrument panel mounting bracket to underside of instrument panel. On Chevrolet, Chevelle, Camaro, and Chevy II models, remove and retain wedge shims. On Chevrolet models, remove retainers.
15. Move front seat back as far as possible to provide maximum clearance, and carefully lift column up out of position and remove from vehicle. If column is equipped with lower shift levers, mechanic at engine compartment can pilot levers through dash panel opening as column is lifted.

Disassembly—Syncromesh Column (Fig. 24)

1. Unsnap and remove wiring protector (fig. 25).

CAUTION: Secure column in bench vise for service one of two ways shown in Figure 26. Clamping column in vise in any other manner

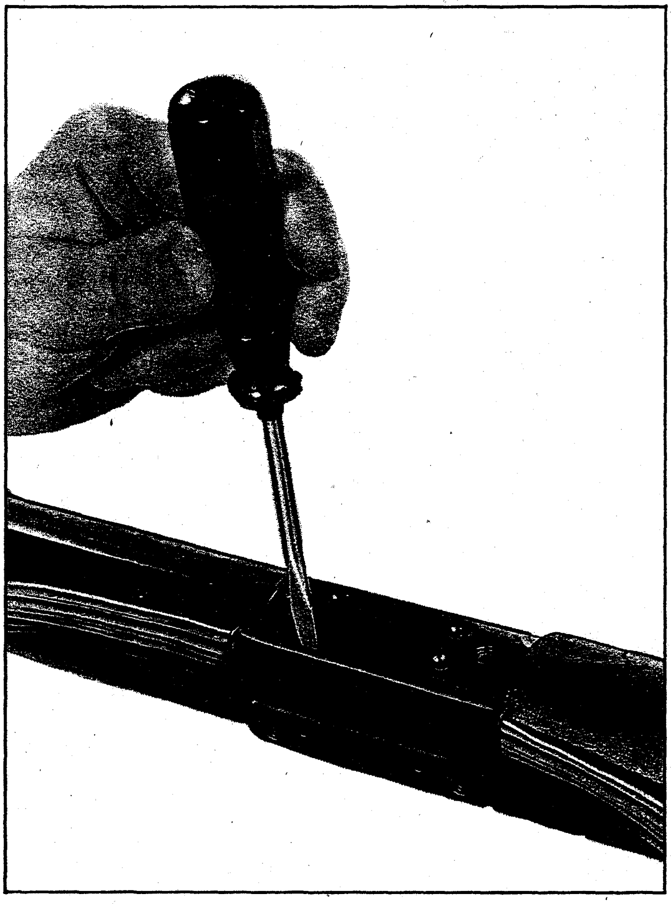

Fig. 25—Removing Wiring Protector

will damage the column. If support fixture J-22573 is not used, frequently check position of column in vise jaws to insure column is not working free of jaws.

2. Clamp column in a bench vise as shown in Figure 26.
3. Slide upper bearing preload spring and cancelling cam off end of shaft (fig. 26).
4. Remove turn signal lever retaining screw and re-

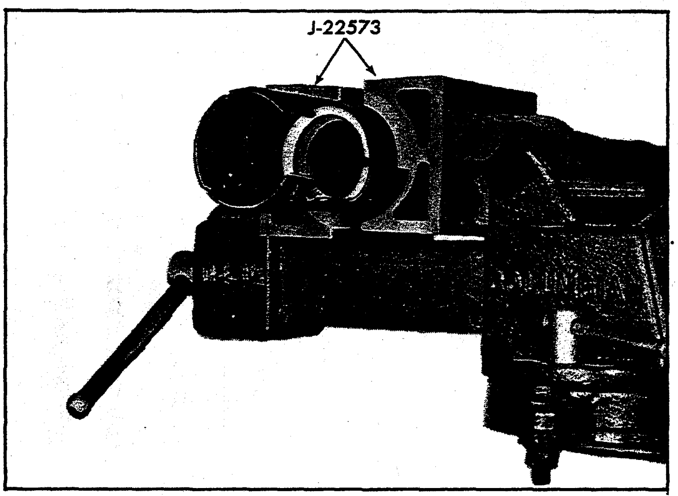

Fig. 26—Column Secured in Bench Vice

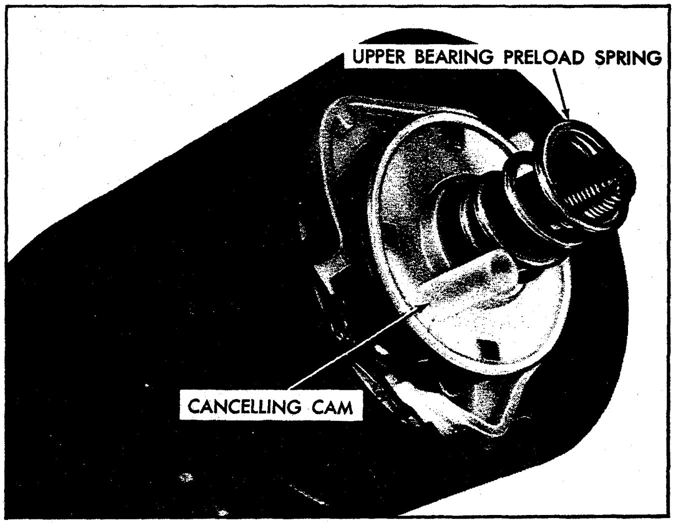

Fig. 27—Upper Bearing Preload Spring and Cancelling Cam

move lever. Push hazard warning switch in, unscrew and remove knob.

5. Drive out shift control lever retaining pin and remove shift lever.
6. Remove "C" retaining ring from upper steering shaft using snap ring remover Tool J-22569 as shown in Figure 28.
7. Slide thrust washer and wave washer off upper steering shaft (Fig. 28).
8. Loosen three turn signal switch mounting screws until the switch cover can be rotated counterclockwise. It may be necessary to push on top of screws to loosen the cover assembly.

NOTE: Do not remove the three turn signal switch screws completely unless it is necessary

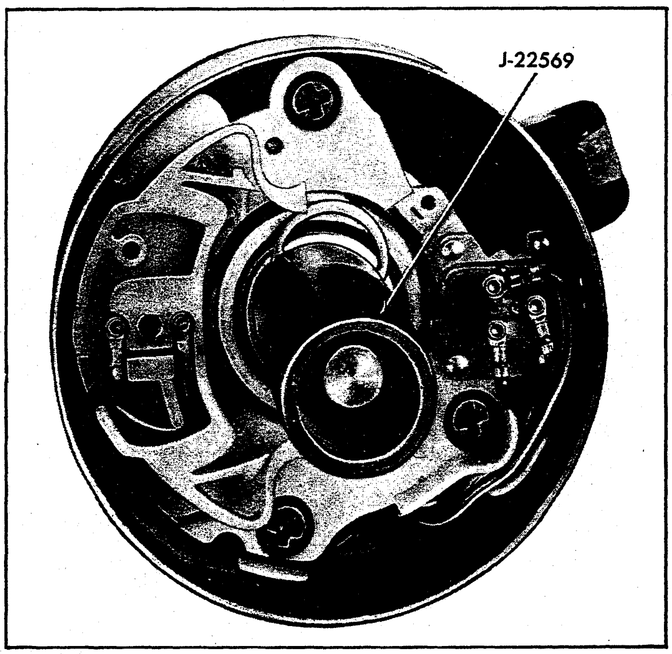

Fig. 28—Removing or Installing "C" Ring Retainer Using Tool J-22569

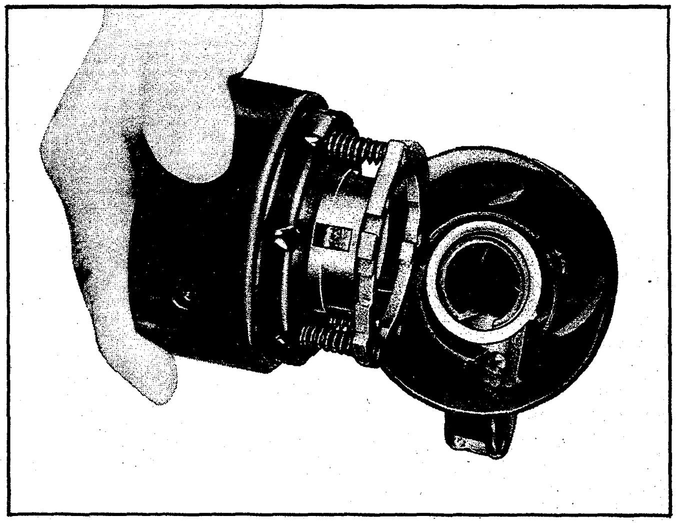

Fig. 29—Removing Turn Signal Switch Cover from Column

to replace the turn signal switch, lockplate, or upper bearing housing and bearing.

9. Rotate turn signal switch cover counterclockwise and pull cover off top of jacket (Fig. 29).
10. Remove shift lever bowl from top of jacket.
11. If necessary, pry upper shift lever spring (fig. 30) from bowl and discard spring. Remove bowl washer (fig. 30).
12. If necessary to service components within the signal switch cover, remove the three signal switch mounting screws completely from engagement with the lockplate. Use care to control three springs as screws are removed.
13. Remove turn signal switch and upper bearing housing assembly from cover.
14. Carefully pull steering shaft assembly from bottom of column.
15. Remove nuts securing back-up lamp switch to column and remove switch. Retain these mounting nuts.
16. Remove three bolts securing reinforcing ring to adapter just above the lower gearshift levers. It is very important to retain these bolts for reassembly. Use of the wrong size bolts during reassembly would result in damage to the column.
17. Remove reinforcing ring, adapter with bearing, first and reverse shift lever, and spacer from lower end.
18. Withdraw shift tube assembly from lower end.
19. Remove the lower bowl bearing from the top end of the jacket by inserting a suitable length of pipe or wooden rod through the lower end and tapping the bearing out. This bearing may be reused in this column or discarded. It may not be used as a replacement part in another column.
20. If necessary, remove and discard lower bearing.
21. If necessary, unwrap mesh cover from jacket.

Assembly—Syncromesh Column (Fig. 24)

1. Apply a thin coating of lithium soap grease to all friction surfaces.
2. If lower bearing was removed, press a new lower bearing into the adapter.
3. If lower shift bowl bearing was removed from jacket, press bowl bearing into top end of jacket.
4. Insert the shift tube assembly into the lower end of the jacket.

NOTE: Be sure friction surfaces of lower levers and mating bearing surfaces are greased before performing the next step.

5. Assemble the lever spacer, first and reverse lever, adapter with bearing, and reinforcing ring. Place this assembly into position on the lower end of the

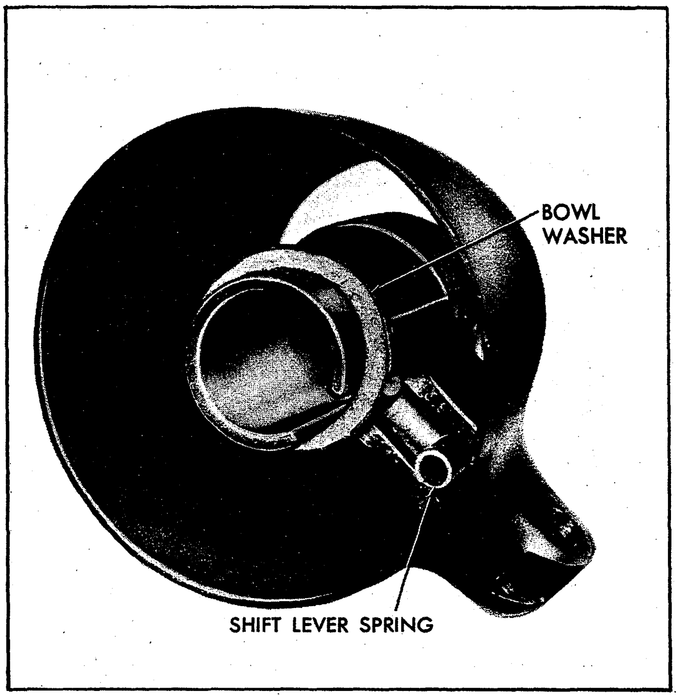

Fig. 30—Upper Shift Lever Spring and Bowl Washer

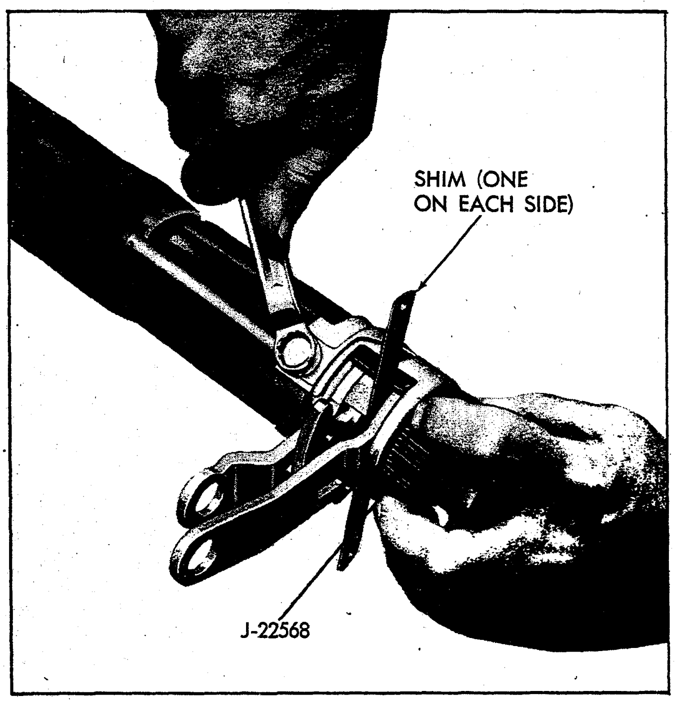

Fig. 31—Bottoming Shift Levers Using Spanner Wrench J-22568

jacket and loosely secure using the three bolts removed during disassembly.

6. Place a 0.005 maximum shim on each side of the shaft, between either one of the shift levers and the spacer (fig. 31).
7. Using spanner wrench J-22568 installed in spanner holes in adapter, rotate the adapter clockwise until the shift levers are bottomed out (fig. 31). Bottom the adapter against the jacket while rotating to remove end play.
8. Tighten the three adapter bolts. Remove the two 0.005 shims.
9. Insert the steering shaft assembly into position through the lower end of the jacket.
10. Attach the back-up lamp switch loosely to the jacket using the same nuts removed during disassembly. Install these nuts loosely, switch will be tightened to the jacket when column is installed in vehicle and shift levers are aligned.
11. If upper shift lever spring was removed, press a

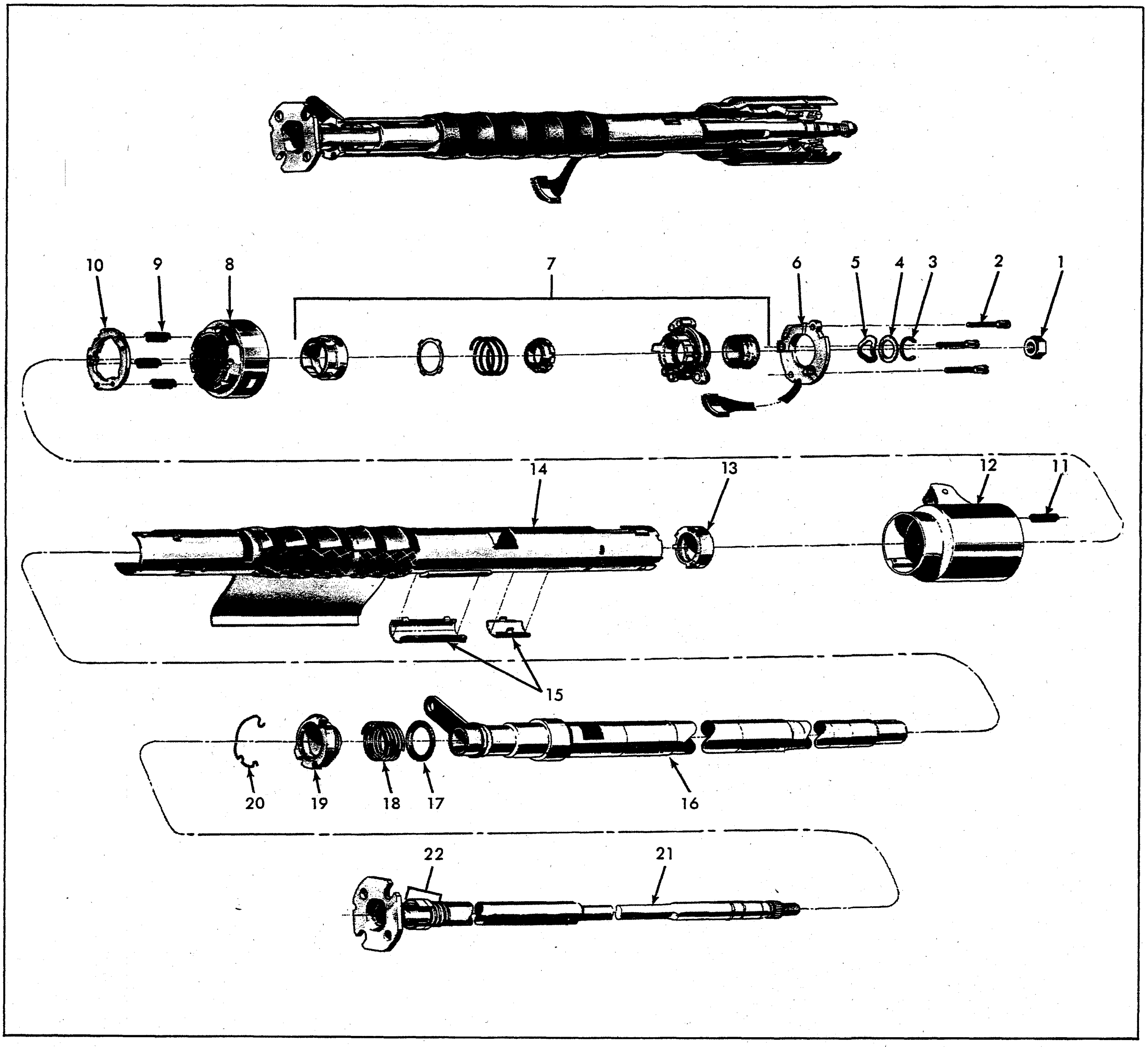

Fig. 32—Column Mounted Powerglide Lever or Floor Shift Column—Exploded View

1. Steering Wheel Nut
2. Screw
3. Retaining Ring
4. Thrust Washer
5. Wave Washer
6. Turn Signal Switch
7. Upper Bearing Assembly
8. Cover
9. Spring
10. Lock Plate
11. Shift Lever Spring
12. Bowl
13. Bearing
14. Mast Jacket
15. Wiring Protector
16. Shift Tube
17. Washer
18. Spring
19. Bearing
20. Retainer
21. Steering Shaft
22. Tolerance Ring Kit

new upper shift lever spring into bowl pocket. Be sure spring is seated in bowl pocket. Install bowl washer (fig. 30).

12. Insert the upper bearing housing assembly and the turn signal switch assembly into the cover, feeding the signal switch wires through the back of the cover.
13. Align the signal switch and bearing housing holes with the holes in the cover. Install three mounting screws through the holes.
14. Slide three springs onto screw ends at rear of cover and place lockplate in position over screws and springs. Turn screws three turns into lockplate.
15. Feed switch wire through the shift lever bowl and place upper end assembly on top of bowl.
16. Place the shift lever bowl and signal switch cover assembly on top of jacket, aligning the tangs on the I.D. of the lockplate with the slots in the top of the jacket. Shift tube key should align in bowl keyway as bowl is pushed on.
17. Lock upper end assembly into position by pushing down on the cover assembly and rotating assembly fully clockwise. Tangs of lock plate must engage slots in jacket.
18. Tighten three turn signal switch mounting screws in a gradual criss-cross sequence to avoid cocking the lock plate.
19. Slide wave washer and thrust washer over steering shaft and against upper bearing housing.
20. Start "C" retaining ring over steering shaft taper. Complete installation of retaining ring using snap ring installer J-22659 as shown in Figure 28. Be sure "C" retaining ring is completely seated into steering shaft groove.
21. Place turn signal switch lever in position and secure with screw. Screw hazard warning knob into position.
22. Remove column from vise and pull wires flat against jacket. Snap wire protector into place.
23. If mesh cover was removed, wrap mesh cover around jacket and secure with electricians or friction tape.
24. Slide cancelling cam and upper bearing preload spring onto end of shaft.

Disassembly—Column Mounted Powerglide Lever or Floor Shift Column (Fig. 32)

NOTE: In this procedure, automatic refers to a column with a column mounted, Powerglide shifting lever. Floor shift refers to a column taken from a vehicle with conventional or Powerglide floor shift controls.

1. Unsnap and remove wiring protector and wiring clip.

CAUTION: Secure column in bench vise for service one of two ways shown in Figure 26. Clamping column in vise in any other manner will damage the column. If support fixture J-22573 is not used, frequently check position of column in vise jaws to insure column is not working free of jaws.

2. Clamp column in a bench vise as shown in Figure 26.
3. Slide upper bearing preload spring and cancelling cam off end of shaft.
4. On automatic columns removed from Chevy II or Camaro, remove screws securing dial retainer to column and remove retainer and dial (fig. 33). Slide

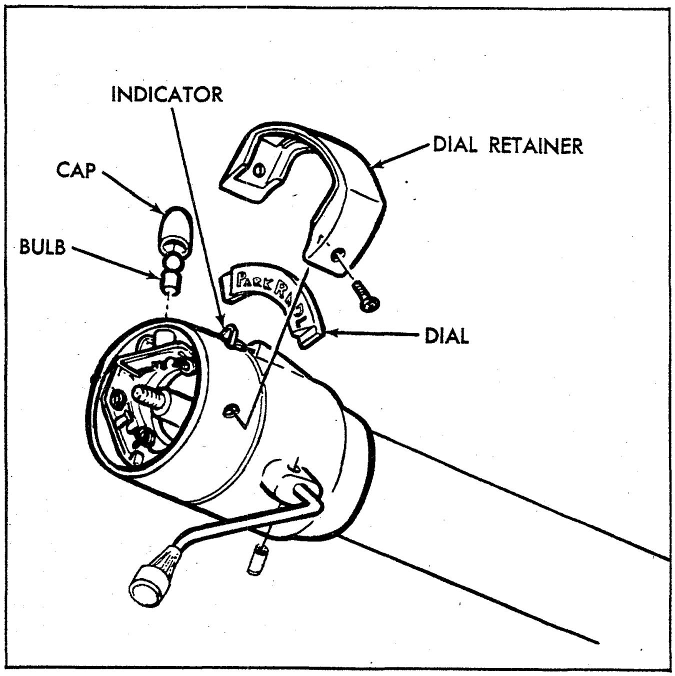

Fig. 33—Powerglide Dial Indicator Assembly—Chevy II and Camaro

indicator out of shift bowl and remove indicator. Remove cap and bulb from turn signal switch housing.

5. Remove turn signal lever retaining screw and remove lever. Push hazard warning knob in; unscrew and remove knob.
6. On automatic columns, drive out shift control lever retaining pin and remove shift lever.
7. Remove "C" retaining ring from upper steering shaft using snap ring remover Tool J-22569 (fig. 28).
8. Slide thrust washer and wave washer off upper steering shaft (fig. 28).
9. Loosen three turn signal switch mounting screws until the switch cover can be rotated counterclockwise. It may be necessary to push on top of screws to loosen the cover assembly.

NOTE: Do not remove the three turn signal switch screws completely unless it is necessary to replace the turn signal switch, lockplate, or upper bearing housing and bearing.

10. Rotate turn signal switch cover counterclockwise and pull cover off top of jacket (fig. 29).
11. If necessary, pry upper shift lever spring (fig. 30) from bowl and discard spring.
12. Remove shift lever bowl from top of jacket.
13. If necessary to service components within the signal switch cover, remove the three signal switch covers, remove the three signal switch mounting screws completely from engagement with the lockplate. Use care to control three springs as screws are removed.
14. Remove turn signal switch and upper bearing housing assembly from cover.
15. Carefully pull steering shaft assembly from bottom of column.
16. Remove securing back-up lamp/neutral start switch to column, if so equipped, and remove switch. Retain these mounting nuts.

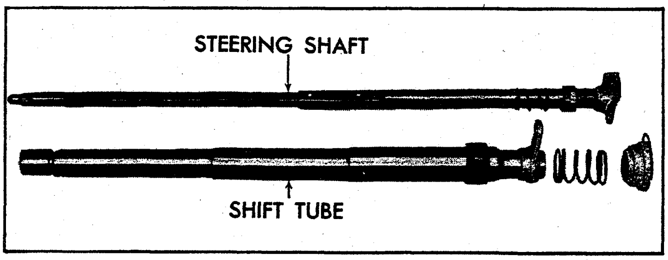

Fig. 34—Shift Tube and Steering Shaft

17. Remove bearing adapter clip (fig. 34).
18. Remove bearing adapter with bearing, and shift tube spring. On automatic columns, remove spring thrust washer (fig. 32).
19. If necessary, press bearing out of bearing adapter.
20. Withdraw shift tube assembly from lower end.
21. Remove the lower bowl bearing from the top end of the jacket by inserting a suitable length of pipe or wooden rod through the lower end and tapping the bearing out. This bearing may be reused in this column or discarded. It may not be used as a replacement part in another column.
22. Slide steering shaft lower bearing spring, plunger, tolerance ring and sleeve assembly, and thrust washer off upper end of shaft.
23. If necessary, unwrap mesh cover from jacket.
24. Remove flange clamp bolt and flange at bottom of steering shaft, if so equipped.

Assembly—Column Mounted Powerglide Lever or Floor Shift Column (Fig. 32)

1. Apply a thin coating of lithium soap grease to all friction surfaces.
2. If lower shift bowl bearing was removed from jacket, press bowl bearing into top end of jacket.
3. If lower bearing was removed from adapter, press lower bearing into adapter.
4. On automatic columns, install spring thrust washer on end of shift tube against lower shift lever.
5. Install shift tube spring and adapter on end of shift tube and secure with bearing adapter clip (fig. 34).
6. Slide shift tube into position through lower end of jacket.
7. Attach the back-up lamp/neutral start switch, if so equipped, to the jacket using the same nuts removed during disassembly. Install these nuts loosely; the switch must be adjusted after column is installed in the vehicle.

NOTE: If the steering shaft assembly, mast jacket, upper bearing housing assembly, or lower bearing assembly has been replaced, the component stack-up in the column will be different. Replace the lower plastic injected tolerance ring and bearing preload spring with the necessary tolerance ring kit as described below.

8. Slide thrust washer, tolerance ring kit, plunger, and kit spring into position from top of steering shaft.
9. Slide steering shaft assembly into position through lower end of jacket.
10. On automatic columns, if upper shift lever spring was removed, press a new upper shift lever spring into shift lever bowl. Be sure spring is seated in bowl pocket.

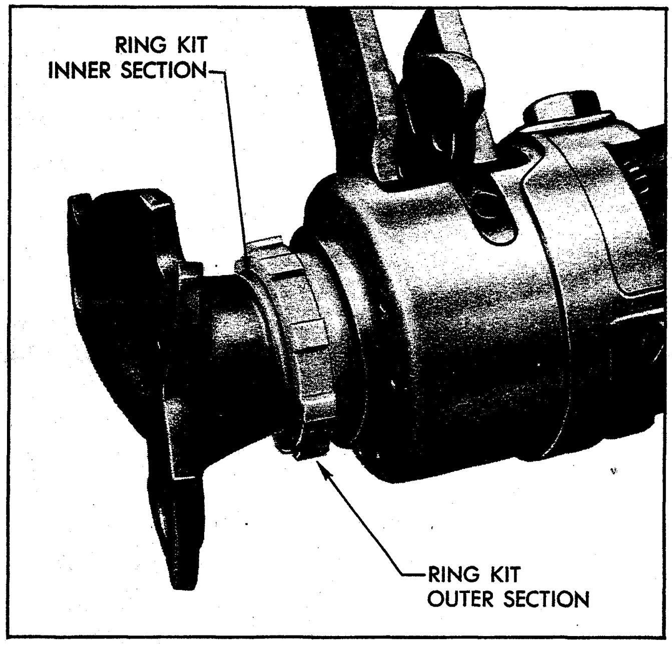

Fig. 35—Tolerance Ring Kit—First Adjustment

11. Insert the upper bearing housing assembly and the turn signal switch assembly into the cover, feeding the signal switch wires through the back of the cover.
12. Align the signal switch and bearing housing holes with the holes in the cover. Install three mounting screws through the holes.
13. Slide three springs onto screw ends at rear of cover and place lockplate in position over screws and springs. Turn screws three turns into lockplate.
14. Feed switch wire through the shift lever bowl and place upper end assembly on top of bowl.
15. Place the shift lever bowl and signal switch cover assembly on top of jacket, aligning the tangs on the

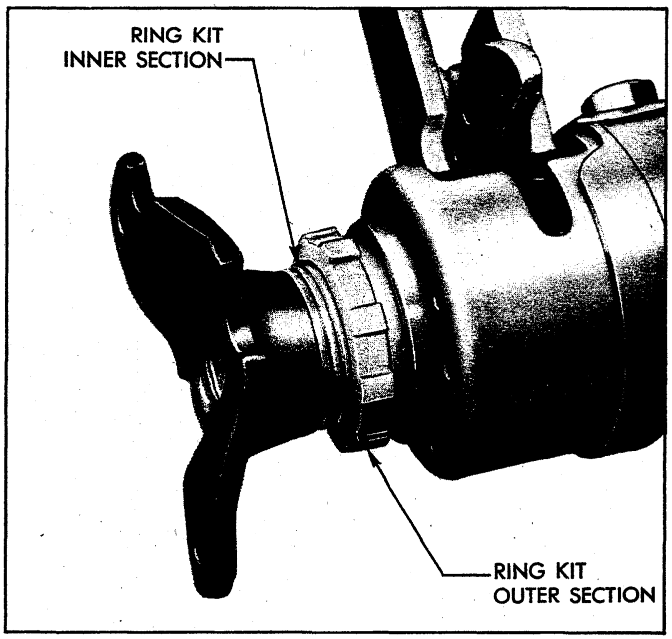

Fig. 36—Tolerance Ring Kit—Final Adjustment

I.D. of the lockplate with the slots in the top of the jacket.

16. Lock upper end assembly into position by pushing down on the cover assembly and rotating assembly fully clockwise. Tangs on lock plate must engage slots in jacket.
17. Tighten three turn signal switch mounting screws in a gradual criss-cross sequence to avoid cocking the lock plate.
18. Screw tolerance ring kit sections together leaving enough inner edge exposed for later adjustment as shown in Figure 35.
19. Slide wave washer and thrust washer over steering shaft against upper bearing housing.

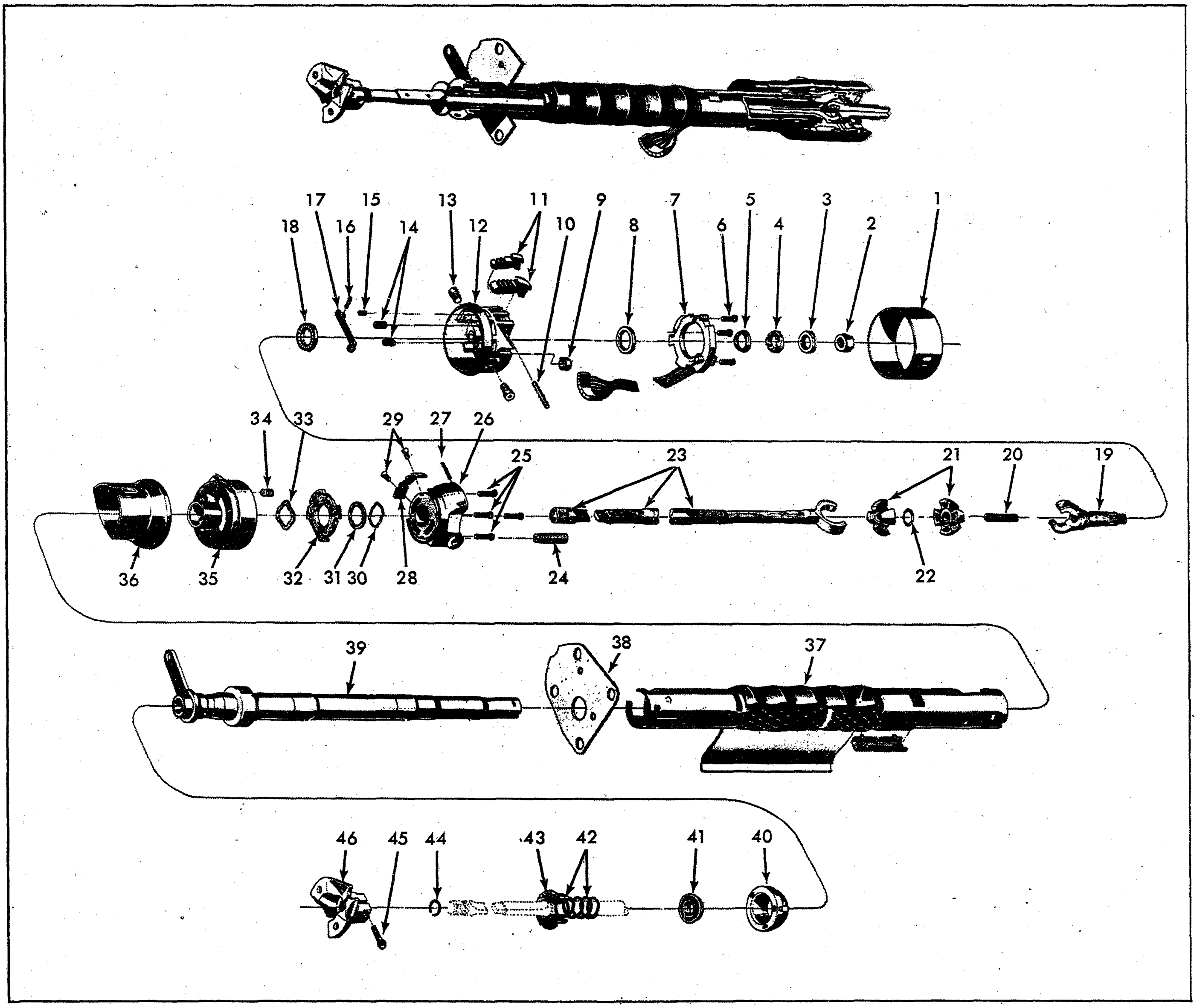

Fig. 37—Tilt Steering Column—Exploded View

1. Cover
2. Steering Wheel Nut
3. Nut
4. Seat
5. Race
6. Screw
7. Turn Signal Switch
8. Bearing Assembly
9. Spring Retainer
10. Lock Shoe Pin
11. Shoe
12. Bearing Housing
13. Pivot Pin
14. Shoe Springs
15. Spring
16. Release Lever Pivot Pin
17. Release Lever
18. Bearing
19. Upper Shaft
20. Spring
21. Sphere
22. Wave Washer
23. Lower Shaft
24. Tilt Spring
25. Screw
26. Support
27. Lock Shoe Guide Pin
28. Stop Plate
29. Screw
30. Retainer
31. Thrust Washer
32. Lock Plate
33. Wave Washer
34. Shift Lever Spring
35. Shift Bowl
36. Shroud
37. Mast Jacket
38. Dash Seal
39. Shift Tube Assembly
40. Adapter
41. Bearing
42. Tolerance Ring Kit
43. Washer
44. Retaining Ring
45. Bolt
46. Flange

20. Start "C" retaining ring over steering shaft taper. Complete installation of retaining ring using snap ring installer J-22659 as shown in Figure 28. Be sure "C" retaining ring is completely seated into steering shaft groove.
21. Remove any remaining looseness from internal column stack-up by unscrewing inner tolerance kit ring section; then screw inner kit ring section back in 1/8 to 1/4 turn (fig. 36).
22. Touch the outer surface of the tolerance ring kit at several locations with a hot soldering iron to melt the threads of the inner and outer ring sections together.
23. Place turn signal switch lever in position and secure with screw. Screw hazard warning knob into position.
24. If column is automatic and to be installed in a Chevy II or Camaro, install the bulb and cap (fig. 33). Slide the indicator into the shift bowl. Install dial and retainer with screws removed during disassembly.
25. Install flange and clamp bolt at bottom of steering shaft, if so equipped.
26. Remove column from vise and pull wires flat against bottom of jacket. Snap wire protector and clip into place.
27. If mesh cover was removed, wrap mesh cover around jacket and secure with electricians or friction tape.
28. Slide cancelling cam and upper bearing preload spring onto end of shaft.

Disassembly—Tilt Column (Fig. 37)

NOTE: This procedure covers disassembly and assembly instructions for all tilt columns. Automatic refers to a tilt column with a column mounted, Powerglide shifting lever. Floor shift refers to a tilt column taken from a vehicle with conventional or Powerglide floor shift controls.

1. Unsnap and remove wiring protector.

CAUTION: Secure column in bench vise for service one of two ways shown in Figure 26. Clamping column in vise in any other manner will damage the column. If support fixture J-22573 is not used, frequently check position of column in vise jaws to insure column is not working free of jaws.

2. Clamp column in a bench vise as shown in Figure 26.
3. Slide upper bearing preload spring and cancelling cam off end of shaft.

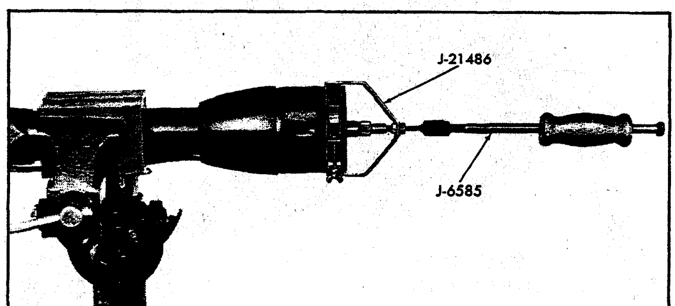

Fig. 38—Removing Turn Signal Cover Using Tools J-21486 and J-6585-1

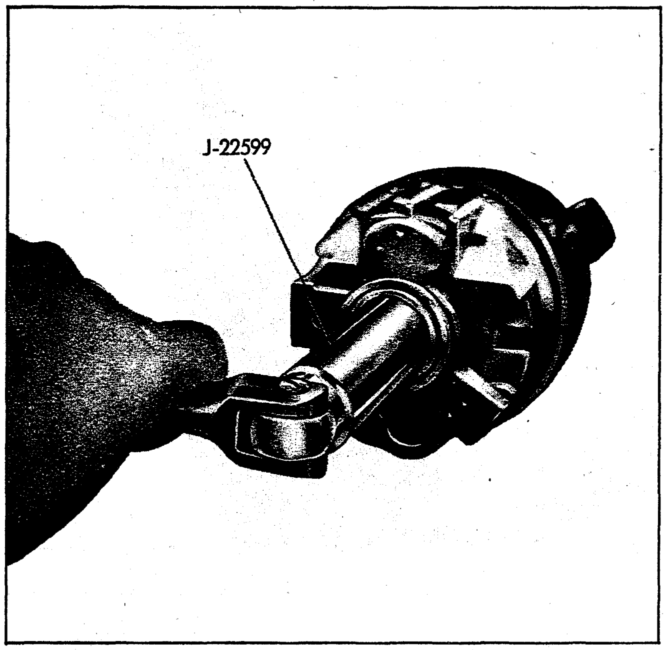

Fig. 39—Removing Steering Shaft Bearing Lock Nut Using Lock Nut Wrench J-22599

4. On automatic columns removed from a Camaro, remove screws securing dial retainer to column and remove retainer and dial (fig. 33). Slide pointer out of bowl and remove pointer. Remove cap and bulb from turn signal switch housing.
5. Remove turn signal lever retaining screw and remove lever. Unscrew and remove tilt release lever. Push hazard warning knob in, unscrew and remove knob.
6. On Automatic columns, drive out shift control lever retaining pin and remove shift lever.
7. Assemble slide hammer Tool J-6585-1 to turn signal cover remover Tool J-21486. Place cover remover over turn signal cover, tighten clamp, and pull cover from end of column with slide hammer (fig. 38).
8. Remove three turn signal switch mounting screws. Note short length of secure removed from top position.
9. Lift signal switch assembly off bearing housing and allow to hang by the wires. On some columns, the switch and wires can be removed at this time; remove switch and wires if possible. If switch and wires cannot be removed, allow assembly to hang by wires.
10. Install tilt release lever and place column in full up position. Remove tilt spring retainer using screwdriver blade that just fits into slot opening. Insert screwdriver in slot, press in approximately 3/16-inch; rotate retainer approximately 1/8 turn clockwise until ears align with grooves in housing, and remove retainer and spring. Use care when removing spring, it is tightly compressed.
11. Remove steering shaft bearing lock nut using lock nut wrench Tool J-22599 (fig. 39). Remove inner race seat and inner race.
12. Remove two pivot pins from bearing housing using pivot pin remover Tool J-21854 (fig. 40).

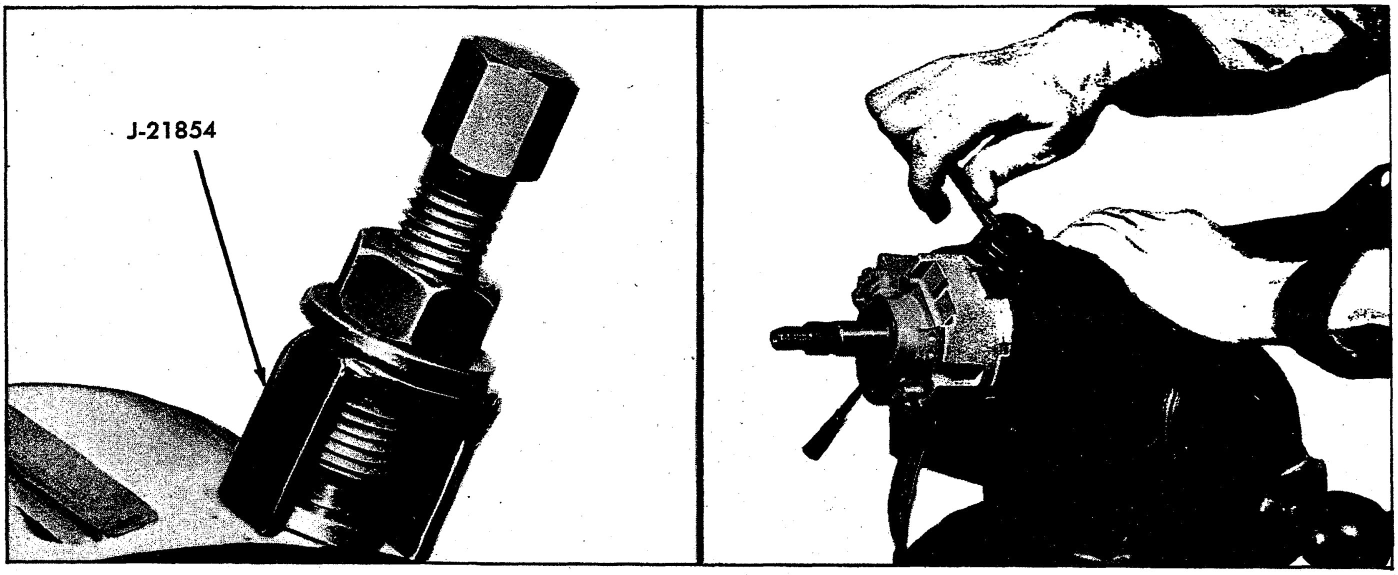

Fig. 40—Removing Pivot Pins Using Pivot Pin Removal Tool J-21854

13. Pull up on tilt release lever to disengage lock shoes. Remove bearing housing and hang with signal switch, if present, until further disassembly. If signal switch and wires were removed earlier, bearing housing may be completely removed. Remove tilt release lever.
14. Remove steering shaft flange bolt and flange from lower end of shaft.
15. Remove retaining ring, washers, sleeve and plunger assembly and spring from lower end of shaft.
16. Slide steering shaft out of top end of jacket.
17. If necessary to disassemble steering shaft, proceed as follows:
    a. Slide bearing and race off top of shaft.
    b. Turn upper shaft slightly from center line of lower shaft.
    c. Using a narrow blade screwdriver, work preload spring out of upper shaft and remove spring (fig. 41).
    d. Turn upper shaft 90° from center line of lower shaft and remove shaft.
    e. Rotate centering spheres and remove spheres and wave washer from lower shaft.
18. Remove screws securing the support assembly to the lockplate and mast jacket and remove support.
19. Remove shift tube retaining ring with a screwdriver. Remove thrust washer (fig. 42).
20. Remove lower bearing adapter from bottom of shift tube by depressing plastic fingers, one at a time, and pulling adapter out.
21. Remove nuts securing back-up lamp, neutral start switch to column, if so equipped, and remove switch. Retain these mounting nuts.
22. Remove shift tube assembly from bowl using shift tube remover Tool J-22551 (fig. 43). Insert the hooked end of the tool into the notch of the shift tube below the bowl key. Pilot sleeve into upper end of shift tube. Force shift tube out of bowl by turning

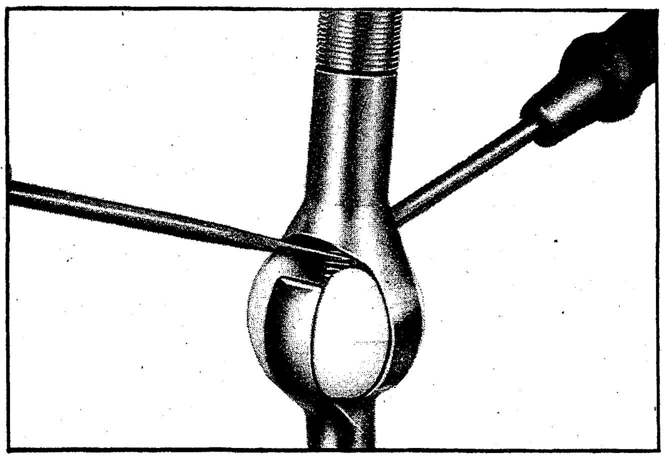

Fig. 41—Removing Preload Spring from Centering Spheres

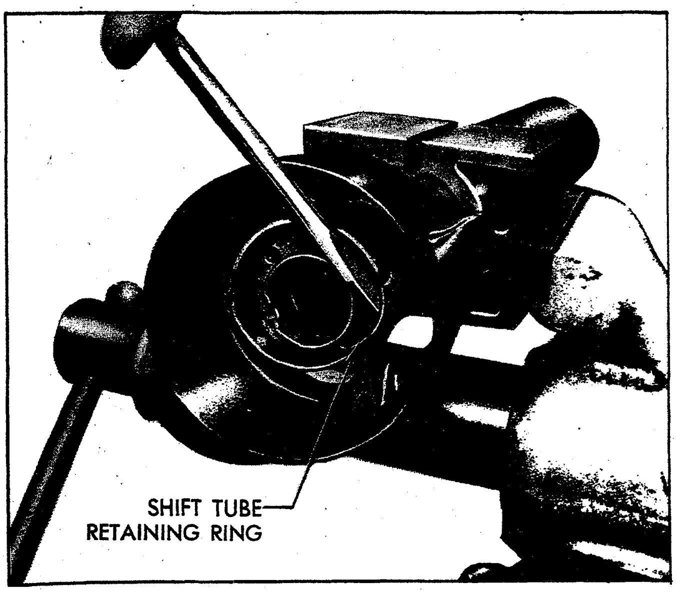

Fig. 42—Shift Tube Retaining Ring and Lower Bushing

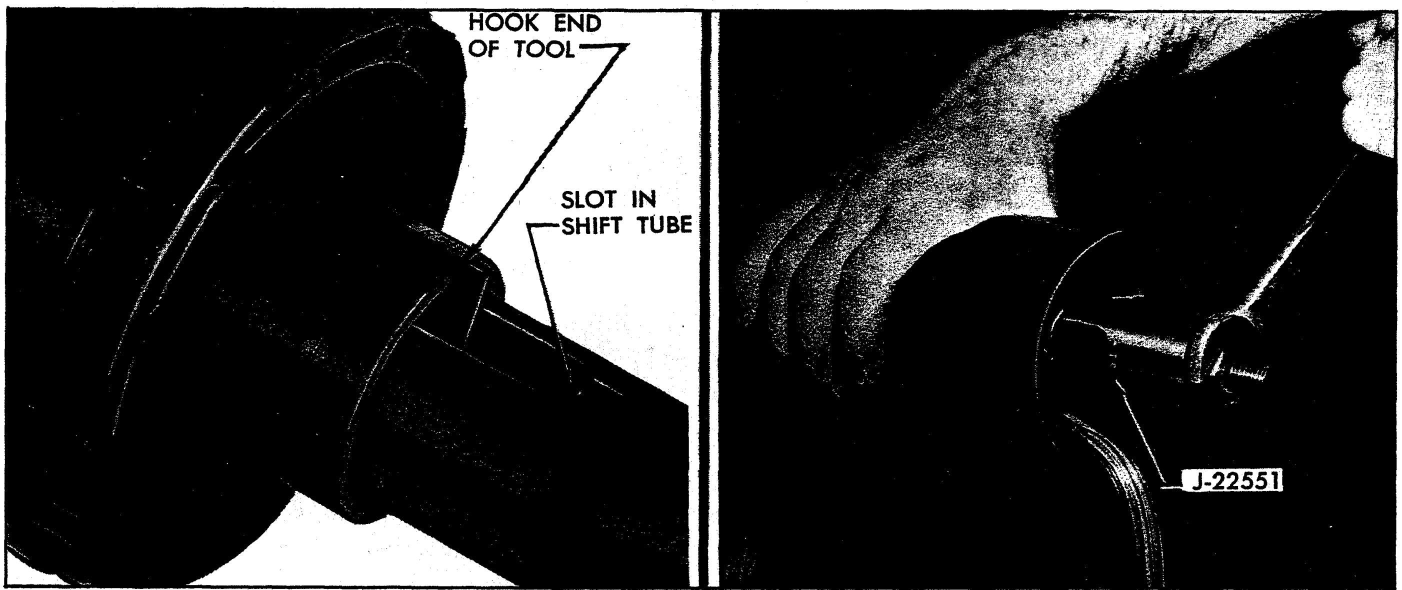

Fig. 43—Removing Shift Tube Using Shift Tube Remover J-22551

nut on tool. If the shift tube is not completely free when tool is removed, complete removal by hand. As shift tube is removed from automatic columns, use care as lower shift lever is lowered through bottom of mast jacket. Do not hammer or force shift tube during removal from mast jacket.

23. Remove lockplate (fig. 44) by sliding out of jacket notches. Tip plate down toward bowl hub and slide out from under top edge of jacket opening. Remove wave washer.
24. Remove bowl from mast jacket. Remove signal switch and bearing housing if not previously removed.
25. On automatic column, remove shift lever spring from bowl by winding spring up with pliers and pulling out.
26. On automatic column, remove screws securing shift stop plate to support, if necessary.
27. Remove upper bearing from upper bearing housing, if necessary.

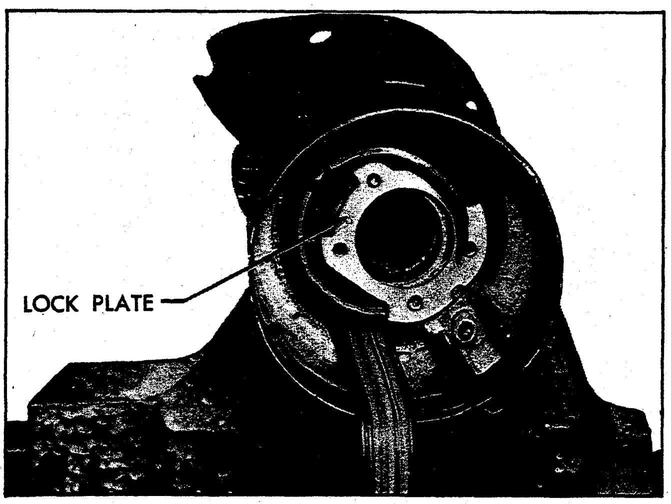

Fig. 44—Lockplate Installed

28. Remove lower bearing from lower bearing adapter, if necessary.
29. Service lock shoes, release springs, or shoe release if necessary, as follows:
    a. Drive the lock shoe retaining pin out of the housing using release lever pivot remover Tool J-22635 (fig. 45, View A).
    b. Hold the shoe springs in compression by rocking lock shoes in with a wedge to relieve the load on the shoe release lever; drive out shoe release lever pin using Tool J-22635 (fig. 45, View B). Remove shoe release lever and release lever spring.
    c. Remove lock shoes and lock shoe springs.
30. If necessary, remove seals from lower end of shift tube and discard seals.
31. Unwrap mesh cover from jacket, if necessary.

Assembly—Tilt Column (Fig. 37)

1. Apply a thin coating of lithium soap grease to all friction surfaces.
2. Assemble bearing housing components as follows:

   NOTE: With tilt lever opening on the left side, shoes facing up, position the four slot shoe on the left.

   a. Place lock shoe springs and lock shoes in position in bearing housing. Line up shoes for pin installation using Tool J-22635 (fig. 45). Install shoe pin flush with housing face on shoe release lever pin side.
   b. Hold the shoe springs in compression by rocking lock shoes in. Insert pin through release lever and install pin and lever.
3. If lower bearing was removed, press lower bearing into adapter.
4. If upper bearing was removed, press upper bearing into race on top of bearing housing.
5. On automatic columns, install stop plate on support

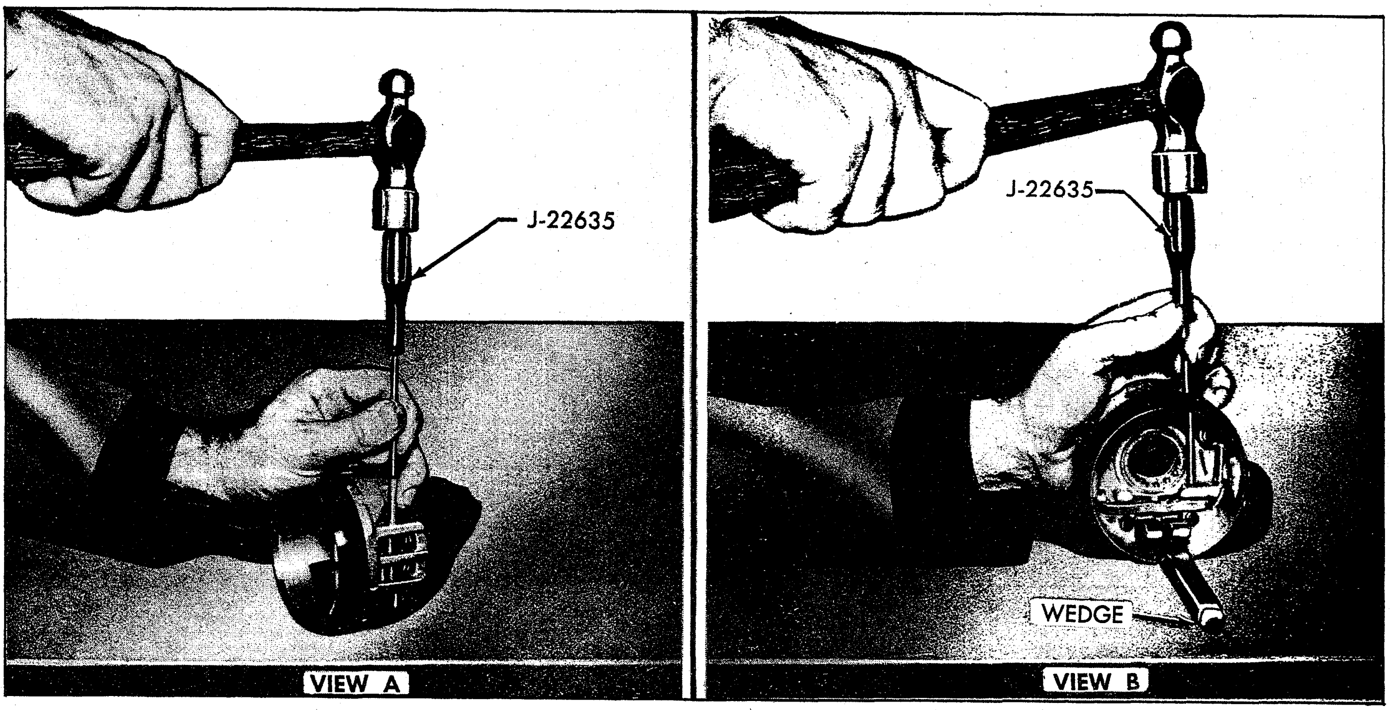

Fig. 45—Removing Lock Shoe Retaining Pin Using Tool J-22635

with screws, if plate was removed during disassembly.
6. On automatic columns, press a new shift lever spring into bowl, if original spring was removed.
7. Insert the signal switch wire harness and connector through the bearing housing and bowl. Retain the housing and bowl together during remaining assembly. (On columns where signal switch connector can be inserted through bowl, it is not necessary to retain bearing housing and bowl together.)

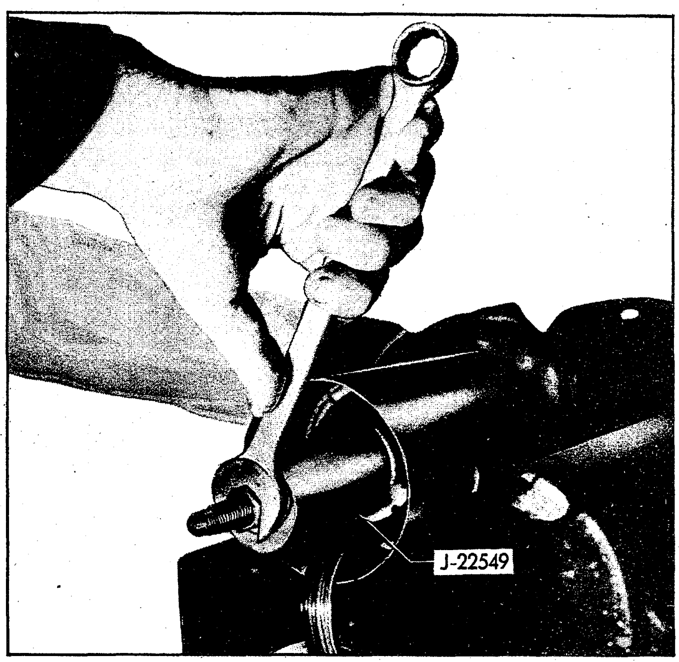

Fig. 46—Installing Shift Tube Using Shift Tube Installer Tool J-22549

8. Slide bowl into top of mast jacket.
9. Place wave washer and lockplate into position. Work lockplate into notches in jacket by tipping lockplate toward bowl hub under the top edge of the jacket.
10. If seals were removed from lower end of shift tube, cement new seals into place.
11. Carefully install shift tube in lower end of mast jacket. On automatic columns, align keyway in tube with key in bowl. Complete installation of shift tube using shift tube installer Tool J-22549 as shown in Figure 46. Do not hammer or force tube when installing in jacket.
12. Pull up on bowl to compress wave washer and install thrust washer and shift tube retaining ring.
13. Insert support into jacket by aligning "V" in support with "V" notch in jacket. Insert mounting screws through support into lockplate and tighten screws.
14. Align fingers of lower bearing adapter with holes in jacket and pilot adapter over shift tube. Snap adapter into place.
15. Install back-up lamp/neutral start switch on column, if so equipped, using the same mounting nuts removed during disassembly. Install the switch loosely, it is to be adjusted when column is installed in the vehicle.
16. Assemble the steering shaft as follows:
    a. Clamp the lower portion of the steering shaft in a vise with the socket facing upward.
    b. Apply front wheel bearing lube to the centering spheres and the steering shaft sockets. Assemble the spheres, with the wave washer in between, and place the spheres in the upper shaft socket.
    c. Turn the spheres so the lower shaft may be installed over the grooves.

NOTE: The locating marking on the end of the

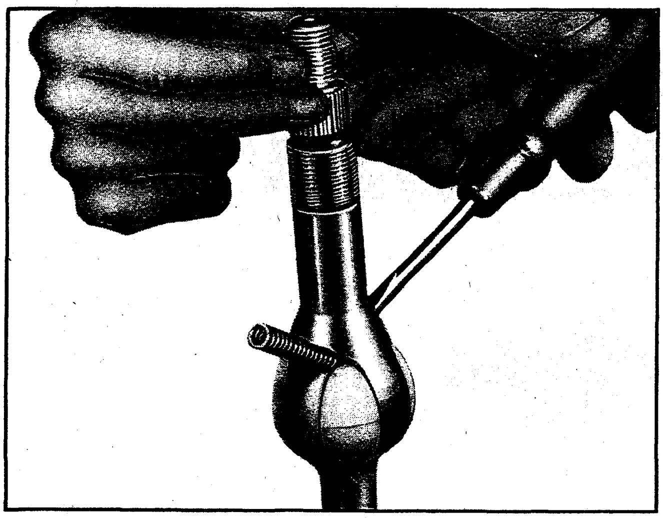

Fig. 47—Installating Spherical Joint Spring

upper shaft should be on the same side as the flat on the lower shaft.

d. Install the upper shaft with spheres into the lower shaft.
e. Insert the joint preload spring through the spheres into the lower shaft. Using the upper shaft to hold the spring in place, carefully feed the spring into the upper shaft joint with a narrow bladed screwdriver (fig. 47).

17. Slide the race and bearing over the top of steering shaft and install shaft in shift tube from upper end. Carefully guide shaft through shift tube, taking care not to tear or push out foam seal cemented inside lower end of shift tube.
18. Install tilt control lever and, holding lock shoes in disengaged position, assemble bearing housing on the shaft over the support until pivot pin holes line up.
19. Secure bearing housing in position by pressing in the pivot pins.
20. Place housing in full up position and install tilt spring, tapered end first. Install tilt spring retainer using screwdriver in retainer slot.
21. Install turn signal switch with three mounting screws. Place short length screw in top position above lock shoes.

NOTE: If the steering shaft, adapter, mast jacket, support or bearing housing has been replaced, the component stack-up in the column will be different. Replace the lower plastic injected tolerance ring and the lower bearing preload spring with the necessary tolerance ring kit as described below.

22. Slide kit spring, tolerance ring kit, washers, and retaining ring on steering shaft from lower end. Seat retaining ring in steering shaft groove.
23. Screw tolerance ring kit sections together leaving enough inner edge exposed for later adjustment as shown in Figure 35.
24. Install inner race, inner race seat, and bearing locknut on end of steering shaft, using locknut wrench Tool J-22599 (fig. 39).
25. Remove any remaining looseness from internal column stack-up by unscrewing inner tolerance kit ring section; then screw inner ring section back in 1/8 to 1/4 turn (fig. 36).
26. Tighten bearing locknut installed in Step 24 above until the torque required to rotate the steering shaft, with the housing in the mid position, is 23 lb. in.
27. Touch the outer surface of the tolerance ring kit at several locations with a hot soldering iron to melt the threads of the inner and outer sections together.
28. Check to insure hazard warning switch is pushed in. Remove tilt release control lever and install turn signal switch cover using turn signal cover installer Tool J-21853 (fig. 48). On automatic column, be sure key in the cover is aligned with keyway in bearing housing.
29. Place turn signal control lever in position and secure with mounting screw. Screw tilt release control lever in. Screw hazard warning knob in.
30. On automatic columns, place transmission shift control lever in position and insert lever retaining pin.
31. On automatic columns to be installed in a Camaro, insert the bulb and cap into the turn signal switch housing (fig. 33). Slide pointer into position in bowl. Install dial and dial retainer with mounting screws removed during disassembly.
32. Install steering shaft flange on bottom of shaft and secure with flange bolt.
33. Remove column from vise. Pull wires back against column leaving a small amount of slack. Snap wiring protector into position. Be sure enough slack remains in wires to allow column head to tilt to full up position.
34. If mesh cover was removed, wrap mesh cover around mesh portion of jacket and secure with friction or electricians tape.
35. Slide cancelling cam and cancelling cam spring on upper end of shaft.

Disassembly—Standard Corvette Column (Fig. 49)

1. Place column on a suitable work bench.
2. Remove upper bearing preload spring and cancelling cam from end of column.
3. Slide escutcheon clear of wiring protector and remove protector.
4. Remove turn signal lever retaining screw and remove lever. Push hazard warning knob in; unscrew and remove knob.

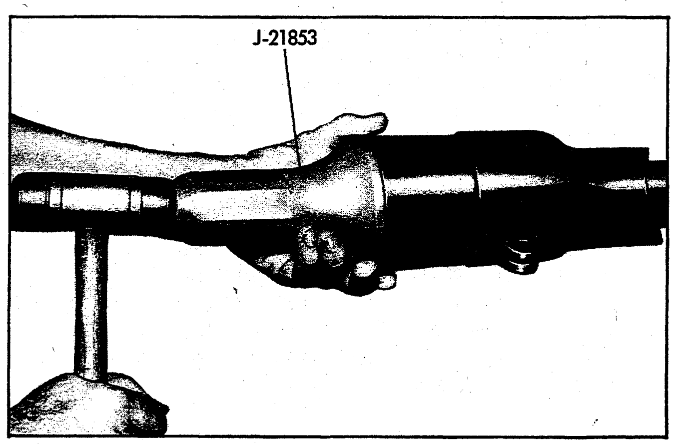

Fig. 48—Installing Turn Signal Switch Cover Using Signal Switch Installer Tool J-21853

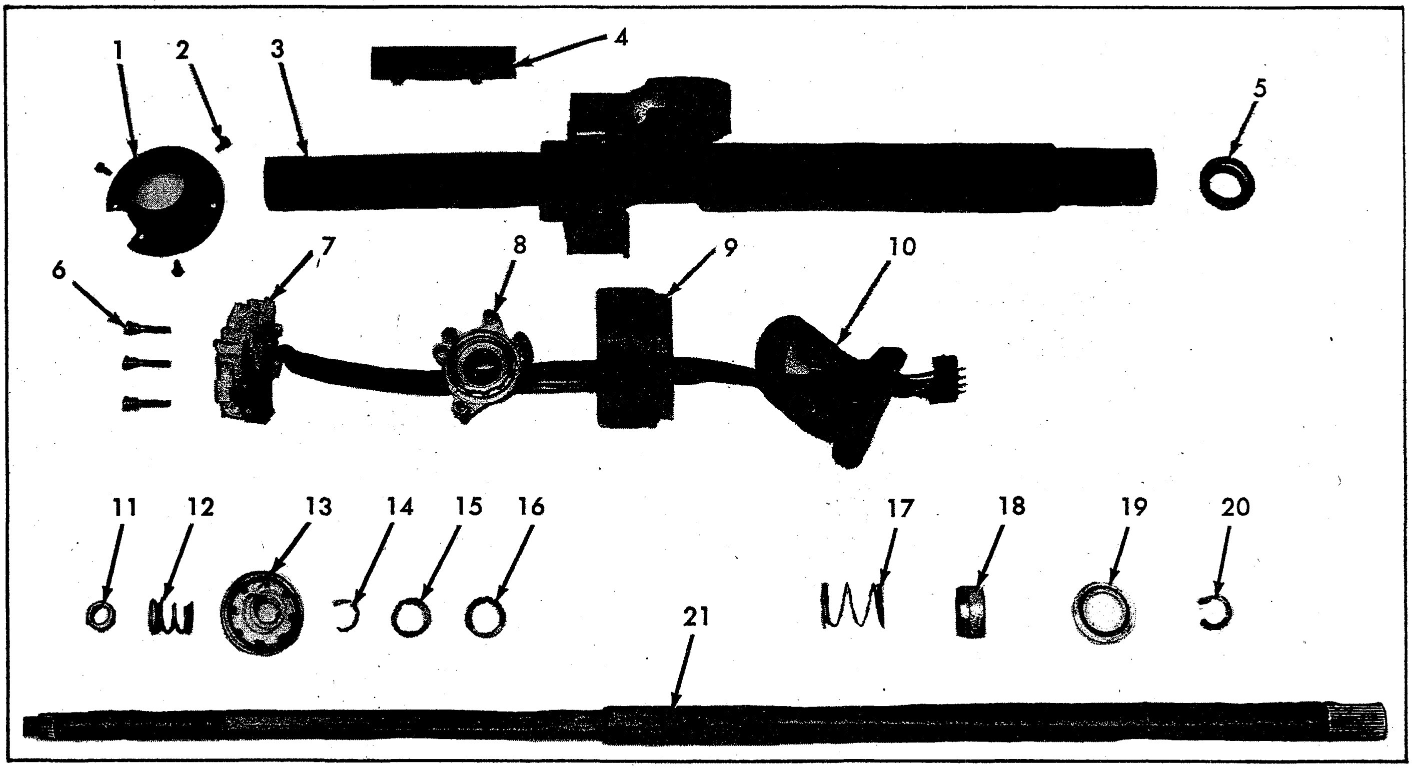

Fig. 49—Standard Corvette Column—Exploded View

1. Upper Flange
2. Retaining Screws
3. Mast Jacket
4. Wiring Protector
5. Bearing
6. Signal Switch Screws
7. Turn Signal Switch
8. Upper Bearing Housing
9. Signal Switch Cover
10. Escutcheon
11. Steering Wheel Nut
12. Upper Bearing Preload Spring
13. Cancelling Cam
14. Retaining Ring
15. Thrust Washer
16. Wave Washer
17. Spring
18. Spacer
19. Washer
20. Retaining Ring
21. Steering Shaft

5. Remove "C" retaining ring from upper steering shaft using snap ring remover Tool J-22569 (fig. 50). Remove thrust washer and wave washer.
6. Remove three upper flange mounting bolts.
7. Slide upper end assembly with escutcheon off end of column.
8. If necessary to service upper end components, remove the turn signal switch mounting screws. Remove the switch and upper bearing housing from cover.
9. Carefully slide steering shaft assembly out of lower end of mast jacket.
10. If necessary, remove lower bearing assembly from lower end of mast jacket and discard bearing assembly.
11. Remove flange bolt and flange from steering shaft.

NOTE: If the steering shaft assembly, mast jacket, bearing housing, jacket flange, or lower bearing assembly has been replaced, the component stack-up in the column will be different. Replace the lower plastic injected tolerance ring and lower bearing preload spring with the tolerance ring kit.

12. Slide lower bearing spring, plunger, tolerance ring and sleeve assembly, and thrust washer off shaft.

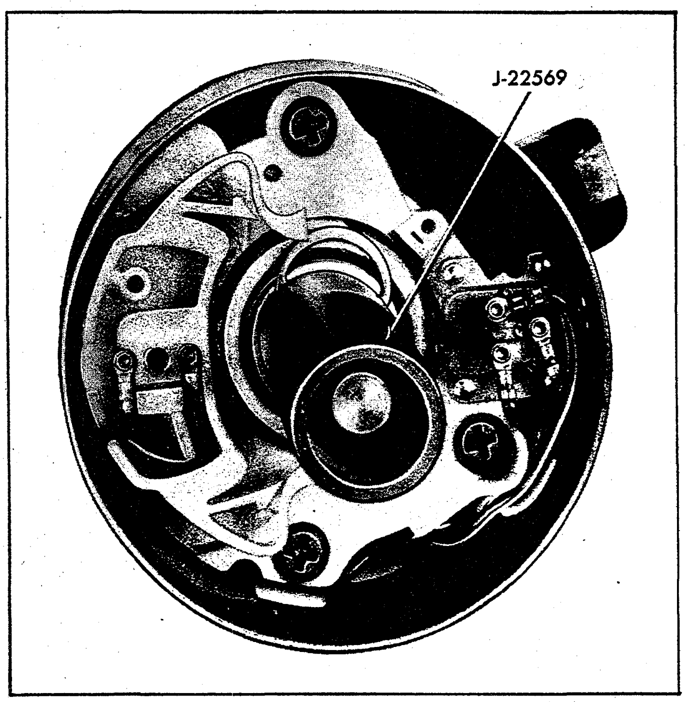

Fig. 50—Removing "C" Ring Retainer Using Tool J-22569

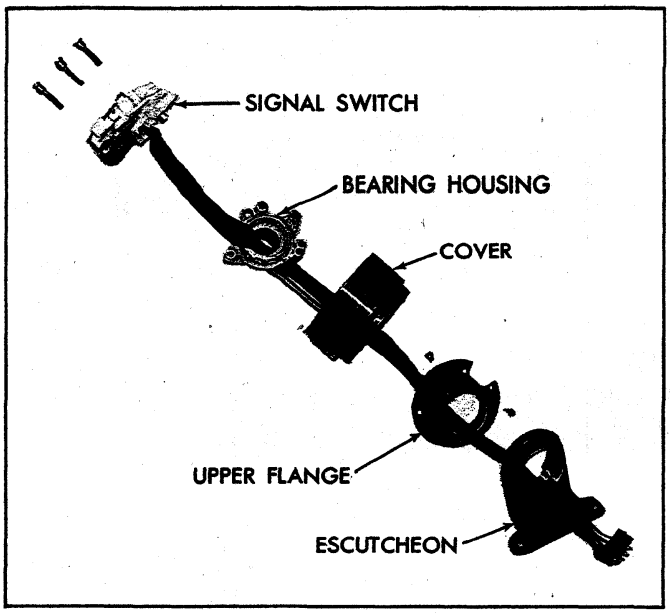

Fig. 51—Assembling Upper End

13. If necessary, remove two seals from lower end I.D. of jacket.
14. If necessary, unwrap mesh cover from jacket.

Assembly—Standard Corvette Column (Fig. 49)

1. Apply a thin coating of lithium soap grease to all friction surfaces.
2. If seals were removed from lower end I.D. of jacket, cement two new seals into position.
3. If lower bearing assembly was removed, press new lower bearing into position at lower end of mast jacket.
4. Slide thrust washer, tolerance ring kit, plunger, and new kit spring into position from top of steering shaft.
5. Install flange and flange bolt on lower end of steering shaft.
6. Carefully slide steering shaft into lower end of mast jacket.
7. Assemble upper bearing housing and turn signal switch into cover and secure entire assembly to mast jacket upper flange with three signal switch mounting screws as shown in Figure 51.
8. Feed turn signal switch wires through escutcheon.
9. Slide escutcheon and upper assembly onto upper end of column. Secure upper flange to column with three mounting bolts.
10. Screw tolerance ring kit sections together leaving enough inner edge exposed for later adjustment (fig. 52).
11. Slide wave washer, thrust washer, and "C" retaining ring loosely into place at top of shaft.
12. Complete installation of "C" retaining ring using snap ring installer Tool J-22659 as shown in Figure 50. Be sure retaining ring is completely seated into steering shaft groove.
13. Remove any remaining looseness from internal column stack-up by unscrewing inner tolerance ring kit section; then screw inner kit section back in 1/8 to 1/4 turn. See Figure 53.

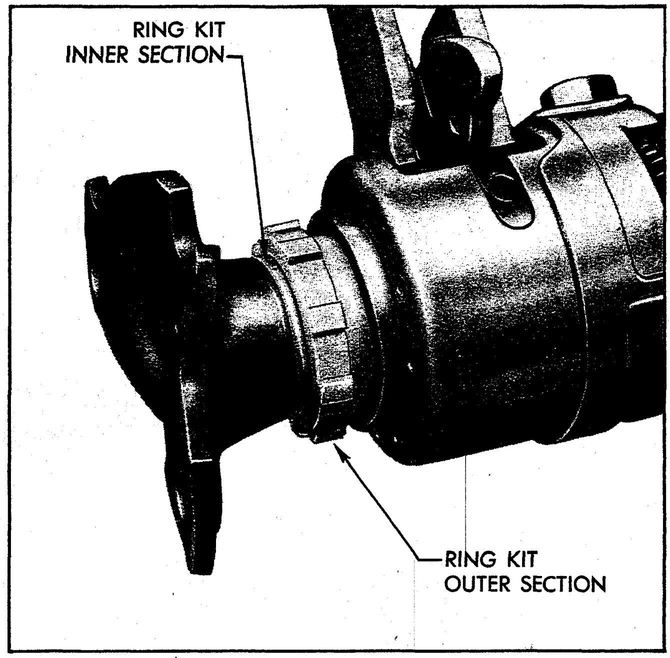

Fig. 52—Tolerance Ring Kit—First Adjustment

14. Touch the outer surface of the tolerance ring kit at several locations with a hot soldering iron to melt the threads of the inner and outer ring sections together.
15. Place turn signal switch lever in position and secure with screw. Screw hazard warning knob into position.
16. Pull signal switch wires flat against column, install wiring protector, and slide escutcheon into position.
17. If mesh cover was removed, wrap mesh cover around mesh portion of mast jacket and secure with friction or electricians tape.
18. Install spring and cancelling cam on end of shaft.

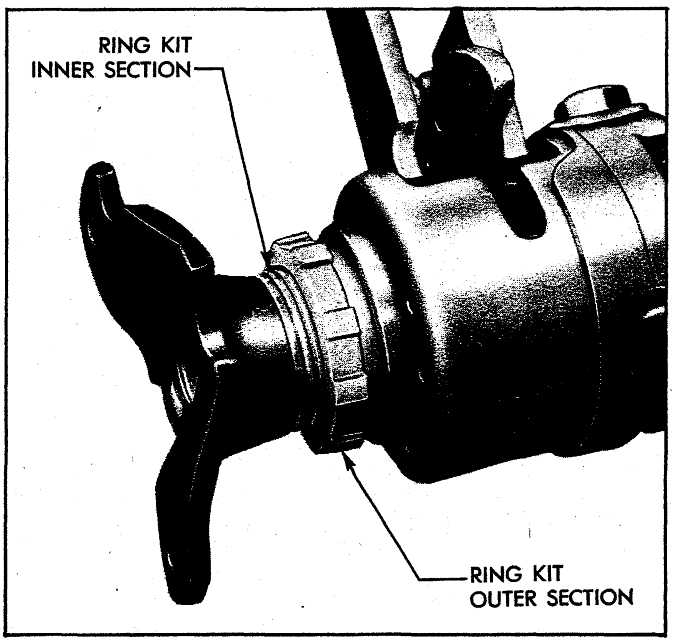

Fig. 53—Tolerance Ring Kit—Final Adjustment

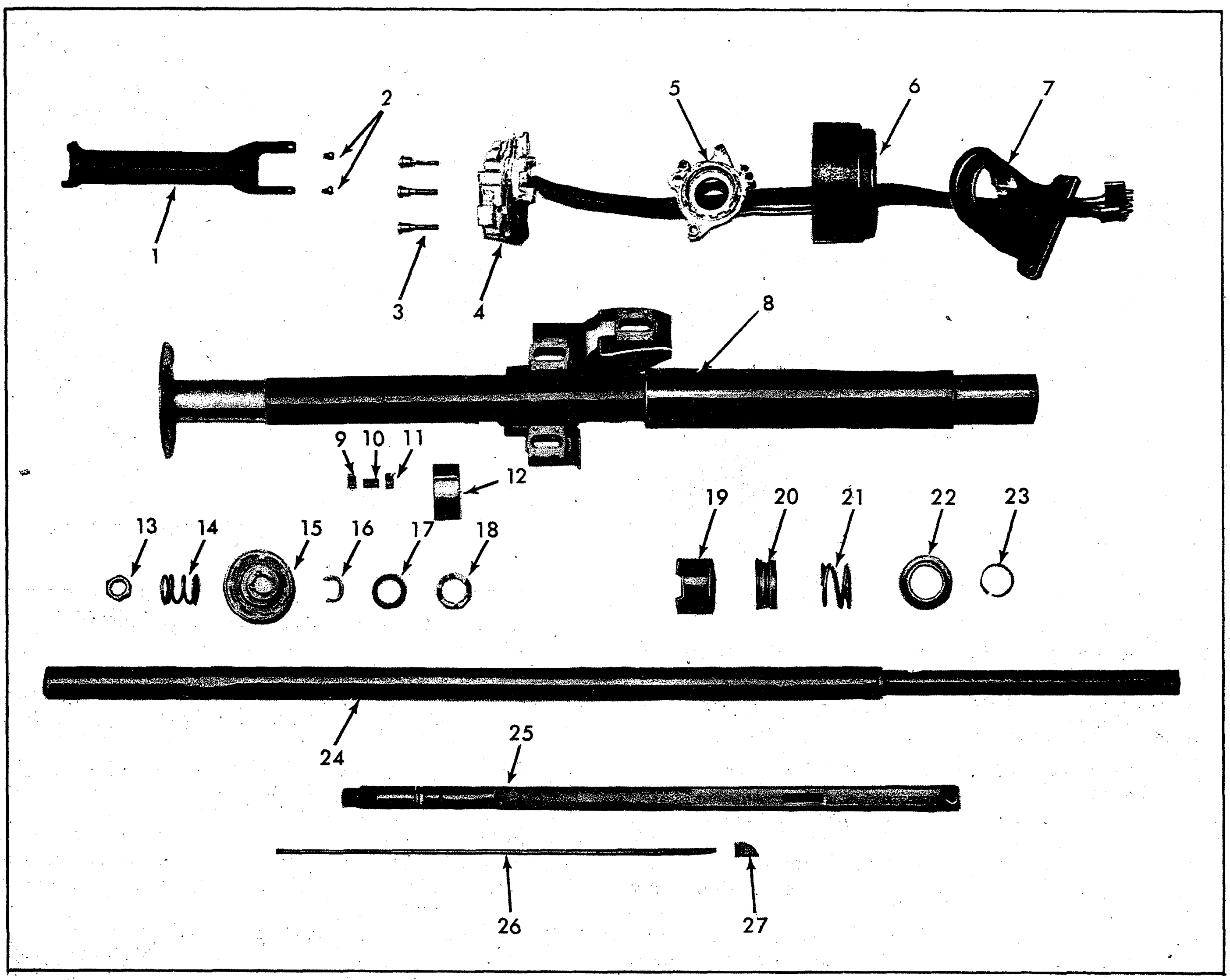

Fig. 54—Corvette Telescoping Column—Exploded View

1. Wiring Protector
2. Screw
3. Screw
4. Turn Signal Switch
5. Upper Bearing Housing
6. Signal Switch Cover
7. Escutcheon
8. Mast Jacket
9. Bumper
10. Key
11. Bumper
12. Bumper Key Strap
13. Steering Wheel Nut
14. Upper Bearing Preload Spring
15. Cancelling Cam
16. Retaining Ring
17. Thrust Washer
18. Wave Washer
19. Retainer
20. Bearing
21. Spring
22. Washer
23. Retaining Ring
24. Lower Steering Shaft
25. Upper Steering Shaft
26. Locking Rod
27. Wedge

Disassembly—Corvette Telescoping Column (Fig. 54)

1. Place column on a suitable work bench.
2. Remove upper bearing preload spring and cancelling cam from end of shaft.
3. Remove turn signal lever retaining screw and remove lever. Push hazard warning knob in; unscrew and remove knob.
4. Remove upper retaining ring from upper steering shaft using a screwdriver. Remove thrust washer and wave washer.
5. Remove three screws from the lower bearing retainer.
6. Carefully slide steering shaft assembly out of lower end of mast jacket.
7. Remove flange bolt and flange from lower end of shaft.

CAUTION: Use caution when removing the lower retaining ring in the following step. The lower bearing washer is under load from the compressed spring and could cause injury when the lower retaining ring is removed.

8. Carefully remove lower retaining ring as shown in Figure 55. Remove washer, spring, packing, and

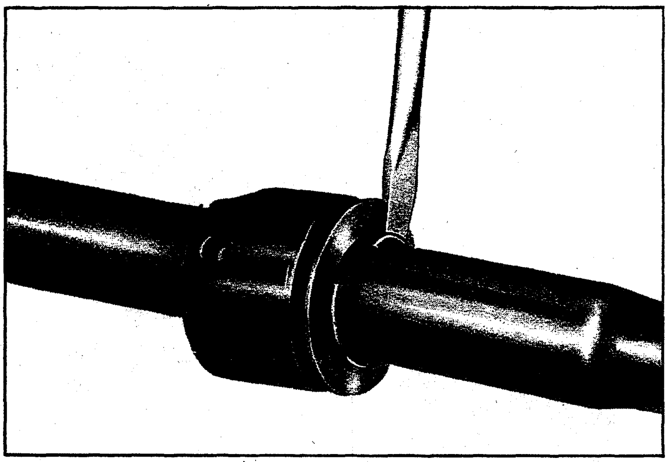

Fig. 55—Removing Lower Bearing Retaining Ring

bearing assembly from lower end of shaft.

9. Push upper steering shaft section into lower section until spring pin is visible at pin access hole in lower section. Drive out spring pin.
10. Remove upper shaft section from lower section. If necessary, replace locking wedge and locking rod at this time.
11. Remove bumper key strap (fig. 56). Remove keys and bumper assembly.
12. Remove screws securing bottom of wiring protector to column.
13. Slide inner jacket section, switch cover, switch, upper bearing housing, wiring protector, and escutcheon off top end of jacket.
14. If necessary, remove three turn signal switch mounting screws and remove switch and upper bearing housing.
15. If necessary, remove seals from I.D. of mast jacket.
16. If necessary, unwrap mesh cover from jacket.

Assembly—Corvette Telescoping Column (Fig. 54)

1. Apply a thin coating of lithium soap grease to all friction surfaces.
2. If seals were removed from I.D. of mast jacket, cement new seals in positions where old seals were removed.
3. Place locking wedge and locking rod into upper shaft and slide upper shaft into lower shaft.
4. Align upper and lower shafts and insert spring pin into access hole.
5. Install bearing, packing, spring, washer, and retaining ring on bottom of steering shaft. Seat the retaining ring into the steering shaft groove with a screwdriver.
6. Carefully slide steering shaft into lower end of mast jacket.
7. Install bearing retainer over lower end of shaft and lower end of jacket. Secure retainer with three screws.
8. Install flange and flange bolt on lower end of steering shaft.
9. Feed wires of turn signal switch through turn signal switch cover and escutcheon, and place switch and upper bearing housing in cover. Secure switch to cover with three mounting screws.
10. Place wiring protector inside escutcheon.
11. Start escutcheon and wiring protector, with signal switch wires, over end of outer jacket.
12. Slide inner jacket section into outer jacket section.
13. Secure switch cover to flange of inner jacket section by tightening the signal switch mounting screws.
14. Secure the bottom of the wiring protector to the column with two screws.
15. Assemble keys and bumper and place the entire assembly in position in the jacket. Install bumper key strap.
16. Slide wave washer, thrust washer, and upper retaining ring into place at top of shaft. Seat retaining ring in steering shaft groove with a screwdriver.
17. Place turn signal switch lever in position and secure with screw. Screw hazard warning knob into position.
18. If mesh cover was removed, wrap mesh cover around mesh section of jacket and secure with electricians or friction tape.
19. Slide cancelling cam and upper bearing preload spring over top end of shaft.

Installation

NOTE: Before placing column in position in vehicle, refer to figures 19 through 23 and slide dash panel seals, covers, plates, and clamps loosely into position on column for later installation.

1. Move front seat back as far as possible to provide

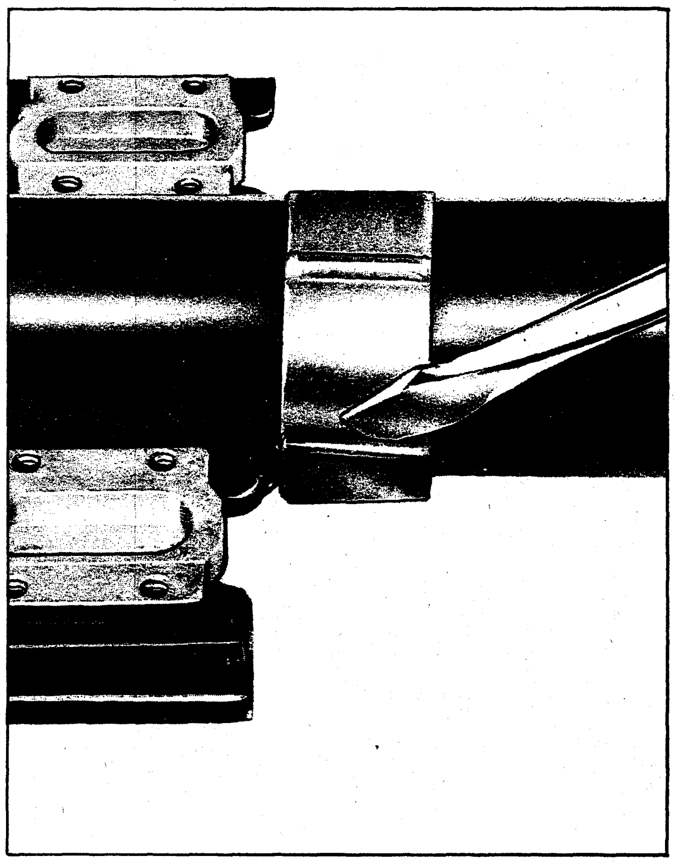

Fig. 56—Removing Bumper Key Strap

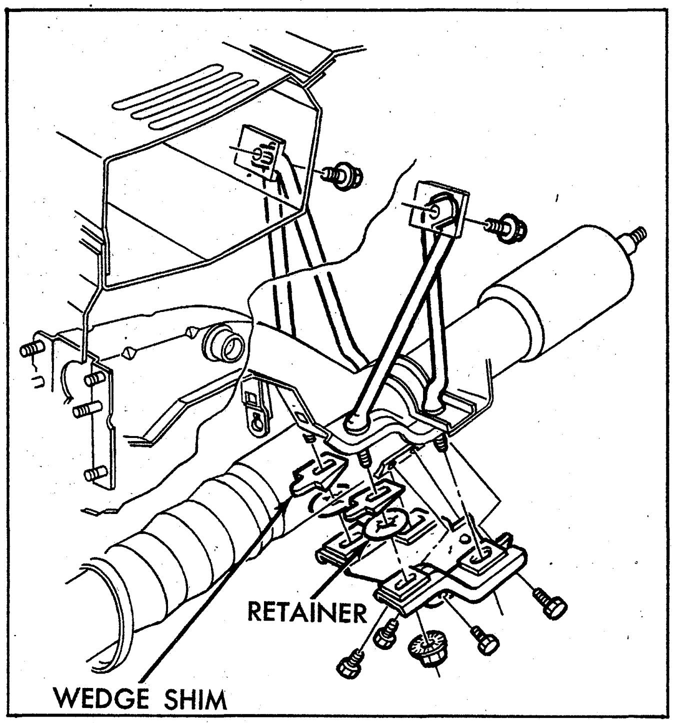

Fig. 57—Instrument Panel Mounting Bracket—Chevrolet

maximum clearance. Carefully work column into position in vehicle and at steering gear. If column is equipped with lower shift levers, mechanic at engine can pilot levers through dash panel opening as column is lowered into position.

NOTE: Install instrument panel column mounting bracket loosely as instructed in applicable step below. Bracket is not to be tightened securely until after steering coupling is connected.

2. Chevrolet only (fig. 57):
   Lay retainers and wedge shims in position on instrument panel column mounting bracket and place bracket in correct position on underside of instrument panel. Loosely install bracket using bracket to column mounting screws and bracket nuts.
3. Chevelle only (fig. 58):
   Lay wedge shim in position on instrument panel column mounting bracket and place bracket in correct position on underside of instrument panel. Loosely install bracket using bracket to column mounting bolts, bracket nuts, and bracket to instrument panel washer and bolt as shown in Figure 58.
4. Chevy II only (fig. 59):
   Lay wedge shims in position on instrument panel

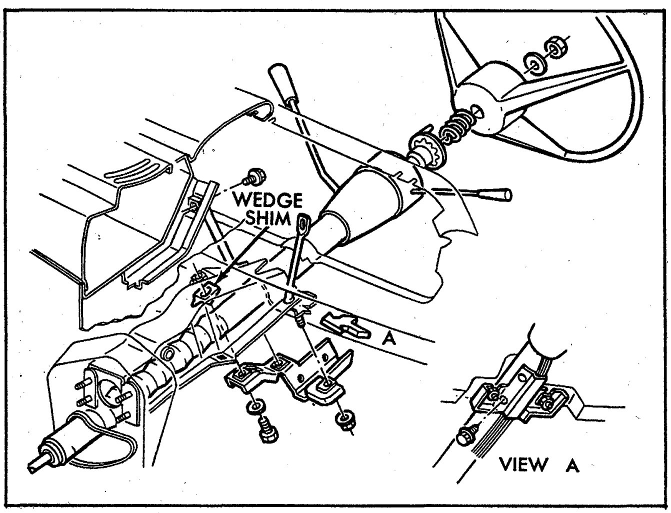

Fig. 58—Instrument Panel Mounting Bracket—Chevelle

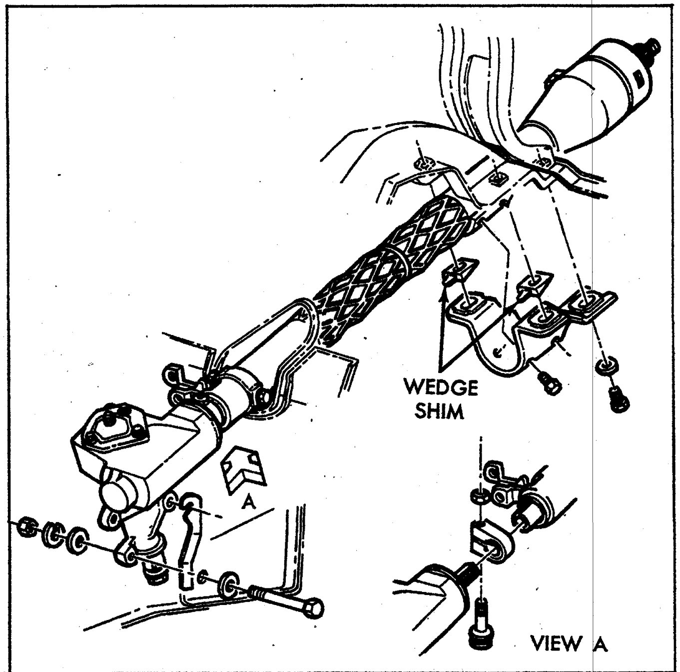

Fig. 59—Instrument Panel Mounting Bracket—Chevy II

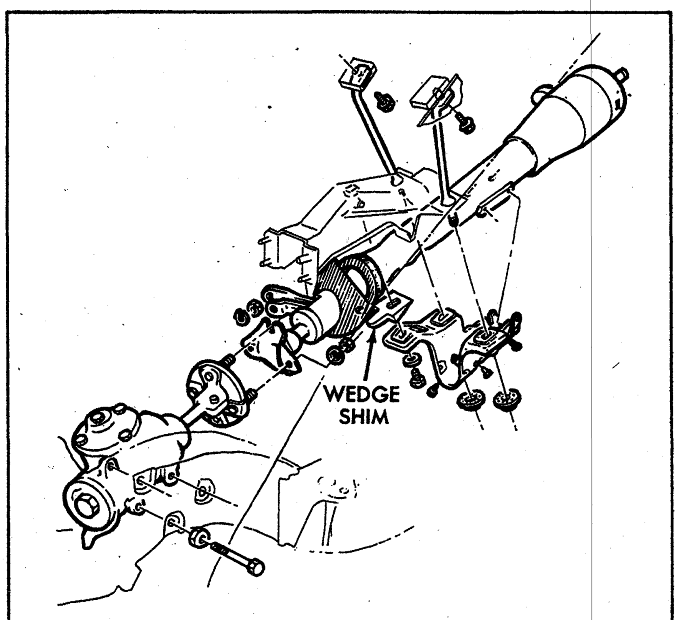

Fig. 60—Instrument Panel Mounting Bracket—Camaro

column mounting bracket and place bracket in correct position on underside of instrument panel. Loosely install bracket using bracket to column mounting screws and bracket to instrument panel washers and bolts.

NOTE: Steering shaft to gear clamp must be tightened before column attaching bolts are torqued. Refer to "Steering Gear-Chevy II", installation procedure, for correct Chevy II steering column alignment procedure.

5. Camaro only (fig. 60):
   Lay wedge shim in position on instrument panel column mounting bracket and place bracket in correct position on underside of instrument panel. Loosely install bracket using bracket to column mounting screws, nuts, and washer and bolt as shown in Figure 60.
6. Corvette only (fig. 61):
   Loosely secure column mounting bracket to support plate and instrument panel with washers and bolts.
7. Secure flanged end of column to steering coupling with lockwashers and nuts. On Chevy II, connect column to steering gear with clamp, clamp bolt, and nut. On Corvette, slide steering shaft flange into lower coupling half, and install upper clamp bolt loosely; also secure support, seal and clamp loosely at dash on engine side.
8. Tighten instrument panel mounting bracket bolts and nuts. Refer to torque specifications at rear of manual for correct torque values.
9. Chevrolet only (fig. 15):
   Place upper and lower mast jacket covers in position and secure covers together and to instrument panel using nuts and screws as shown in Figure 15.
10. Chevy II only (fig. 18):
    Place lower mast jacket cover in position under mast jacket and secure to upper cover with screws.
11. Chevelle only (fig. 15):
    Place mast jacket trim cover in position over column on underside of instrument panel and secure with screws.
12. Corvette only (fig. 14):
    Slide escutcheon into position at instrument panel and secure with screws. Place upper end lower covers in position and secure with screws.
13. On Chevrolet and Chevelle models with column mounted powerglide controls, secure transmission shift indicator pointer into position with set screw (fig. 15).
14. Chevrolet only (fig. 19):
    a. Secure seal and cover to dash panel with screws.
    b. Place clamp assembly in position and install clamp screw.
    c. Install dash panel trim cover with mounting screws.
15. Chevelle only (fig. 20):
    a. Secure seal and inner and outer covers to dash panel with screws.
    b. Secure inner and outer covers together with screws.
    c. Install trim cover to dash panel with two retainers.
16. Chevy II only (fig. 21):
    a. Secure seal, retainer, and clamp to dash panel with screws.
    b. Install clamp screw.
    c. Slide collar into position. Pinch and staple upper tabs together.
17. Camaro only (fig. 22):
    a. Secure seal, upper cover, and lower cover to dash panel with screws.
    b. Secure upper and lower cover together with screws.
    c. Fold rubber boot over securely against dash panel to conceal covers.
18. Corvette only (fig. 23):
    a. Secure seal and support assembly to dash panel on engine compartment side.
    b. Tighten clamp, washer, and clamp bolt on engine compartment side.
19. Connect transmission linkage to lower shift tube levers in engine compartment, if column is so equipped. Adjust levers as outlined in Section 7.
20. Install steering wheel as outlined in this section.
21. Connect directional signal, horn, back-up lamp, and neutral start switch at wiring harness plugs. Adjust back-up lamp, neutral start switch as outlined in Section 12.
22. Adjust steering gear and align and center steering wheel as outlined in this section.

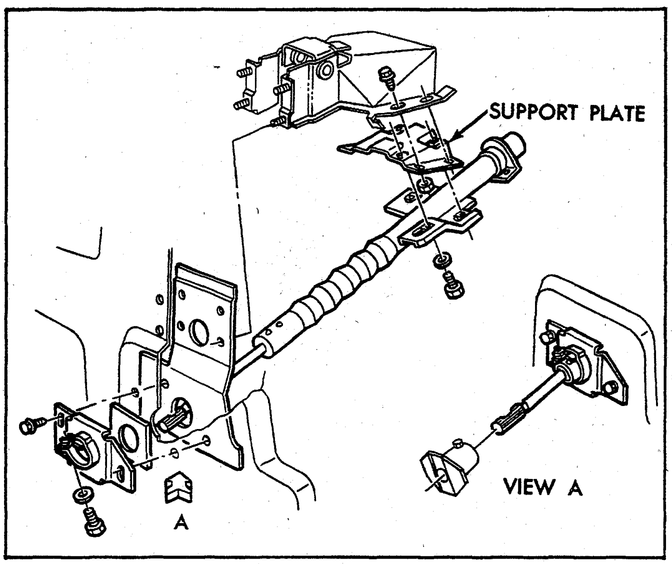

Fig. 61—Instrument Panel Mounting Bracket and Support Plate—Corvette

STEERING LINKAGE (Fig. 62)

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

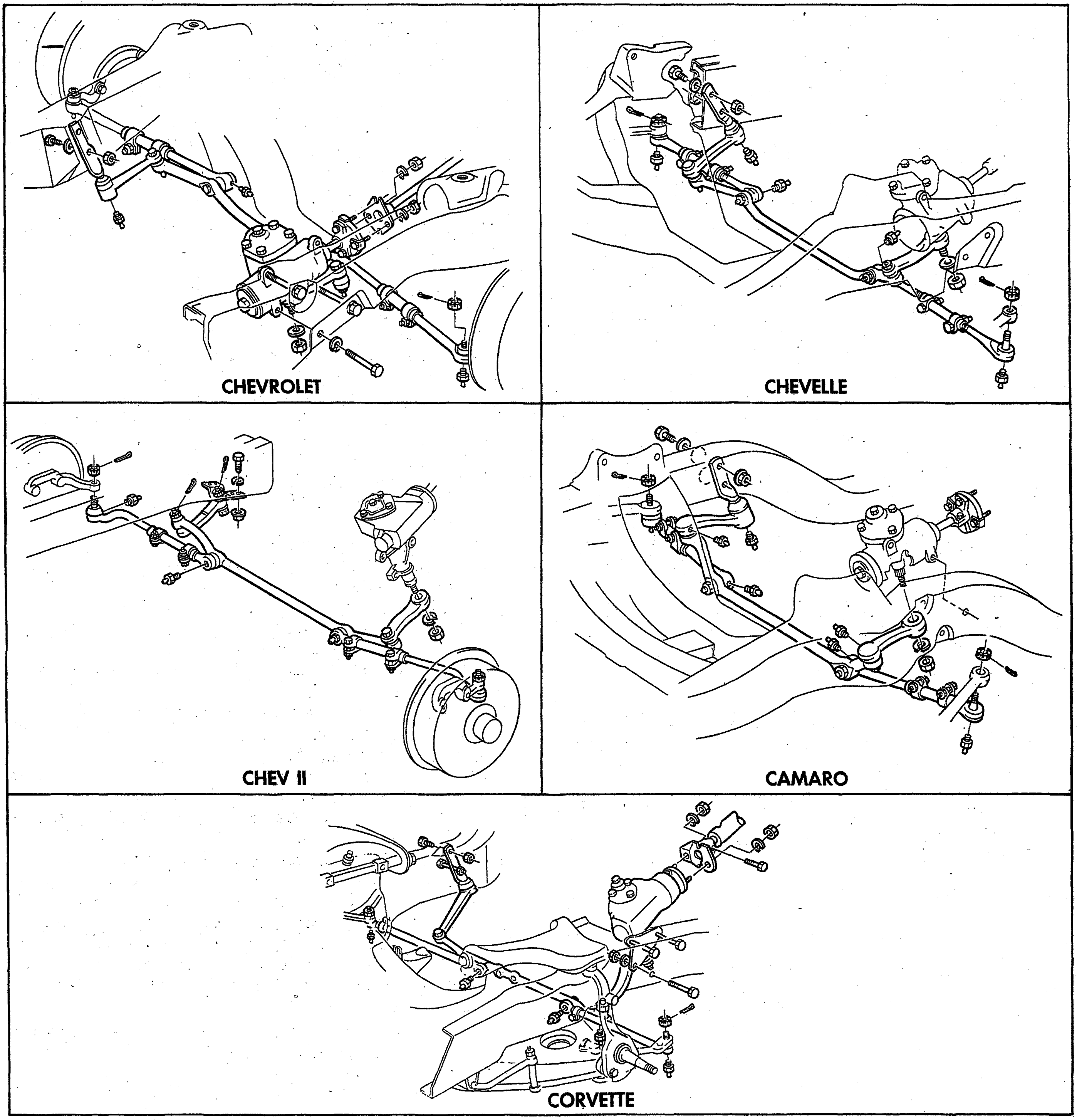

Fig. 62—Steering Linkage

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. 63). 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

Fig. 63—Freeing Ball Stud

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.
2. Make sure that threads on ball stud 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.

3. Install ball studs in steering arms and relay rod.
4. Install ball stud nut, 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—ALL MODELS EXCEPT CORVETTE

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. 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.

RELAY ROD—CORVETTE

Removal

1. Remove steering damper from relay rod as outlined under Steering Damper-Removal. Remove anchor bracket from relay rod by disconnecting two mounting bolts.
2. Remove inner ends of tie rods from relay rod as described under Tie Rod--Removal.
3. Remove cotter pin from end of relay rod at pitman arm ball stud attachment, and remove stud nut.
4. Tap ball stud out of pitman arm and lower relay rod.
5. Remove cotter key and nut from idler arm and remove relay rod from idler arm. Remove washer and seal from idler arm.

Installation

1. Place relay rod on idler arm stud, making certain idler stud seal and washer are in place, then install and tighten nut. Advance nut just enough to align castellation with cotter pin hole and install pin.
2. Install new seal and clamp over ball at end of pitman arm.
3. Install inner spring seat and spring to relay rod.
4. Raise end of rod and install on pitman arm.
5. Install spring seat, spring, and end plug.
6. Tighten end plug until springs are compressed and plug bottoms, then back off 3/4 turn plug amount necessary to insert cotter pin. Insert cotter pin to lock adjustment.
7. Install tie rod ends to relay rod as previously described under Tie Rods.
8. Lubricate tie rod ends and pitman arm to relay rod ball joint.
9. Install steering damper bracket and tighten bolts. Install damper as outlined under Steering Damper--Installation.
10. Adjust toe-in and align steering wheel as described previously in this section.

IDLER ARM

Chevrolet, Chevelle, Camaro, and Corvette (Fig. 62)

Removal

1. Remove idler arm to frame nut, washer, and bolt. No washer is used on Corvette.
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 using a heavy hammer as a backing.
4. Remove idler arm.

Installation

1. On Chevrolet, place seal in position on idler arm stud; position stud up through frame, and secure with lock washer and nut.
2. On Chevelle, Camaro, and Corvette, position idler

arm on frame and install mounting bolts, washers and nuts. No washer is used on Corvette.
3. Install relay rod to idler arm, making certain seal is on stud. Install and tighten nut.
4. Install cotter pin.
5. Refer to torque specifications at rear of manual for correct torque values.

Chevy II (Fig. 62)

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 in Figure 2.

Installation

1. Install pitman arm on sector shaft, lining up the marks made upon removal.
2. Install sector shaft nut.
3. Position relay rod on to pitman arm. Install nut. Continue to tighten arm enough to align castellation with hole in stud and install cotter pin.

STEERING ARM

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. On models with disc brakes, remove caliper and disc.
3. With wheel and drum assembly or caliper and disc 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.
2. Install nuts. 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. On disc brake models, install disc and caliper.
4. Install keyed washer and spindle nut. Proceed as outlined under "Front Wheel Bearing Adjustment" 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.

STEERING DAMPER—CORVETTE

Removal

1. Remove bolt from damper pivot bracket at relay rod.
2. Remove nut from damper pivot at frame bracket and withdraw damper assembly.
3. Damper is serviced as a unit. Replace damper if damaged or excessively worn.

Installation

1. Place piston rod end into frame bracket and install retainers, bushings, and nut.
2. Insert cylinder end pivot into relay rod bracket and install through bolt.

POWER STEERING

INDEX

GENERAL DESCRIPTION

Two types of power steering are used for 1967. One is the conventional linkage type for Chevy II and Corvette vehicles and the other is the integral gear type for Chevrolet, Chevelle, and Camaro. For both types the hydraulic pressure is provided by an engine-driven vane-type pump.

On the Chevy II and Corvette linkage type power steering, hydraulic pressure is delivered through a hose from the pump to a valve which senses the requirement for power assistance and supplies the power cylinder accordingly. The steering gear used with this power steering is the same basic unit used on manually steered vehicles; it is serviced as outlined in the manual steering part of this section except for adjustment, which is covered in the following pages. The steering linkage also is serviced the same as manual counterparts.

The Chevrolet, Chevelle and Camaro integral gear type power steering has the hydraulic pressure delivered from the pump through two hoses to the steering gear. In the power 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

BLEEDING HYDRAULIC SYSTEM

1. Fill oil reservoir to proper level and let oil remain undistrubed 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.
10. Check oil level and refill as required.
11. 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. 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.

FLUID LEVEL

1. Check oil level in the reservoir by checking the dip stick when oil is at operating temperature. On Chevelle models equipped with remote reservoir, the reservoir should be maintained approximately 3/4 full when oil is at operating temperature.
2. Fill, if necessary, to proper level with GM Power Steering Fluid or, if this is not available, automatic

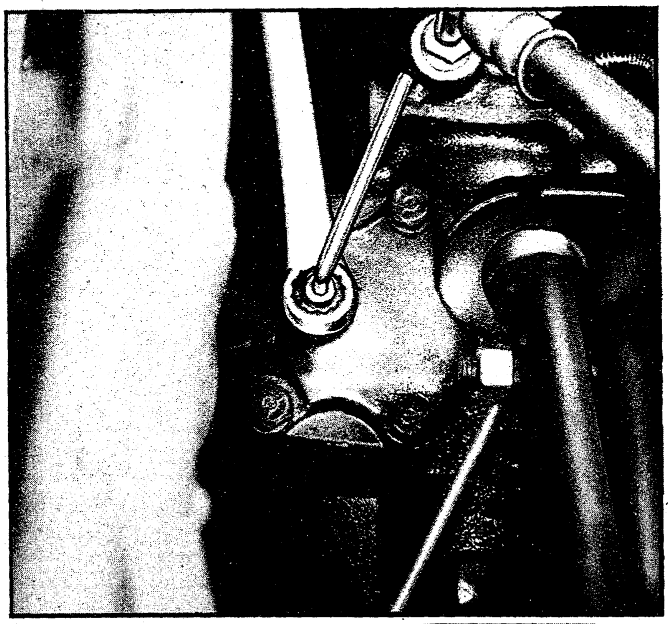

Fig. 64—Over Center Adjustment

transmission fluid "Type A" bearing the mark "AQ-ATF" followed by a number and the suffix letter "A".

ADJUSTMENTS

POWER STEERING GEAR

Chevrolet, Chevelle, and Camaro

The over-center adjustment (fig. 64) 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.

If the vehicle is equipped with a tilt column it will be necessary to disconnect the steering coupling to obtain a torque reading of the column. This torque should then be subtracted from any reading taken on the gear.

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 side cover.
3. Disconnect steering column harness at chassis wiring connector plug.
4. Remove horn button.
5. Turn the steering wheel through its full travel, then locate the wheel at its center of travel.
6. 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.
7. Tighten the pitman shaft adjusting screw and check torque at steering shaft nut until over center preload and total steering gear preload falls within specifications. Refer to torque specifications at rear of manual for correct torque values.
8. Install horn button. Connect steering column harness at wiring connector plug.

Chevy II and Corvette

The steering gear used with power steering is adjusted in the same manner as the manual steering gear.

PUMP BELT TENSION

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 specifications as indicated by Tool J-7316 (Fig. 65).
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 125 lbs. on new belts and 75 lbs. on old belts, as indicated by Tool J-7316 (Fig. 65).

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

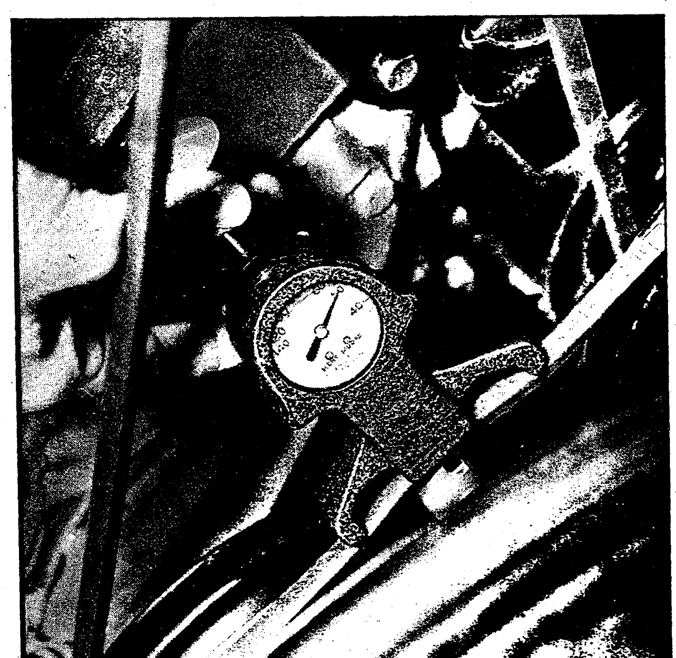

Fig. 65—Checking Belt Tension with Tool J-7316

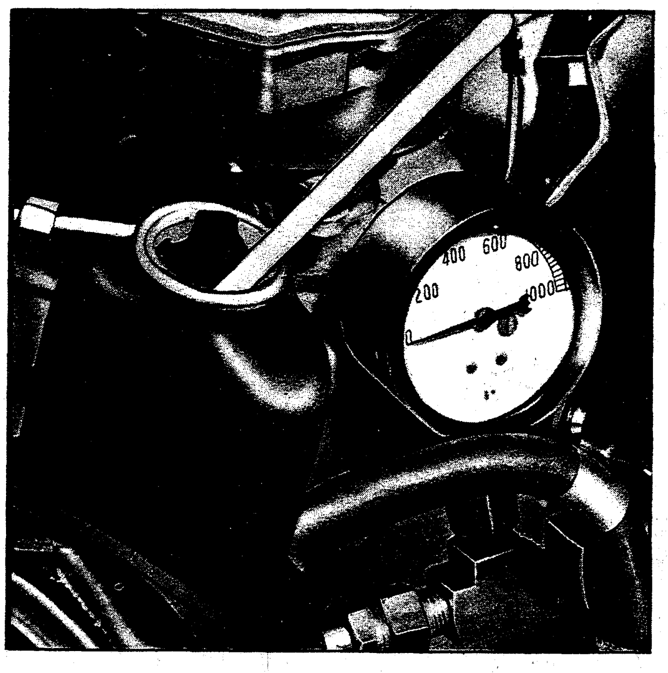

Fig. 66—Power Steering Diagnosis

shown in Figure 66. Gauge must be between shut-off valve and pump. Open shut-off valve.

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°F.

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.

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. 67)

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.

   NOTE: Chevelle with 396 engine uses a remote reservoir. It is necessary to disconnect the reservoir to pump hose before removing the pump. Hold a 1 qt. container under the reservoir when the hose is removed to catch the fluid.

2. Install two caps at pump fittings to prevent drainage of oil from pump.
3. Remove pump belt.
4. On Corvette with 427 engine, loosen alternator adjustment and remove pump to alternator belt.
5. Remove pump from attaching parts and remove pump from vehicle.

   NOTE: On Chevrolet and Chevy II equipped with 283 and 327 engine it may be necessary to remove pump brace.

6. Remove drive pulley attaching nut.
7. Remove pulley from shaft with Tool J-21239 (for stamped pulleys) or Tool J-8433-1 with J-8433-2 adapter (for cast iron pulleys). Do not hammer pulley off shaft as this will damage the pump.

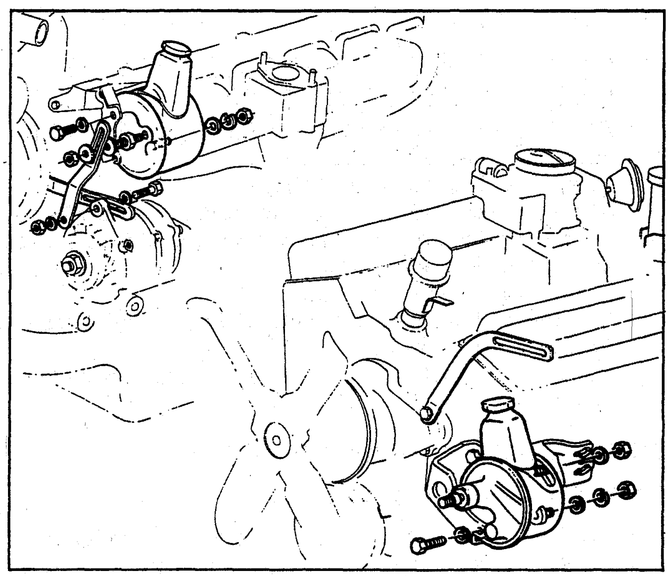

Fig. 67—Power Steering Pump Mounting

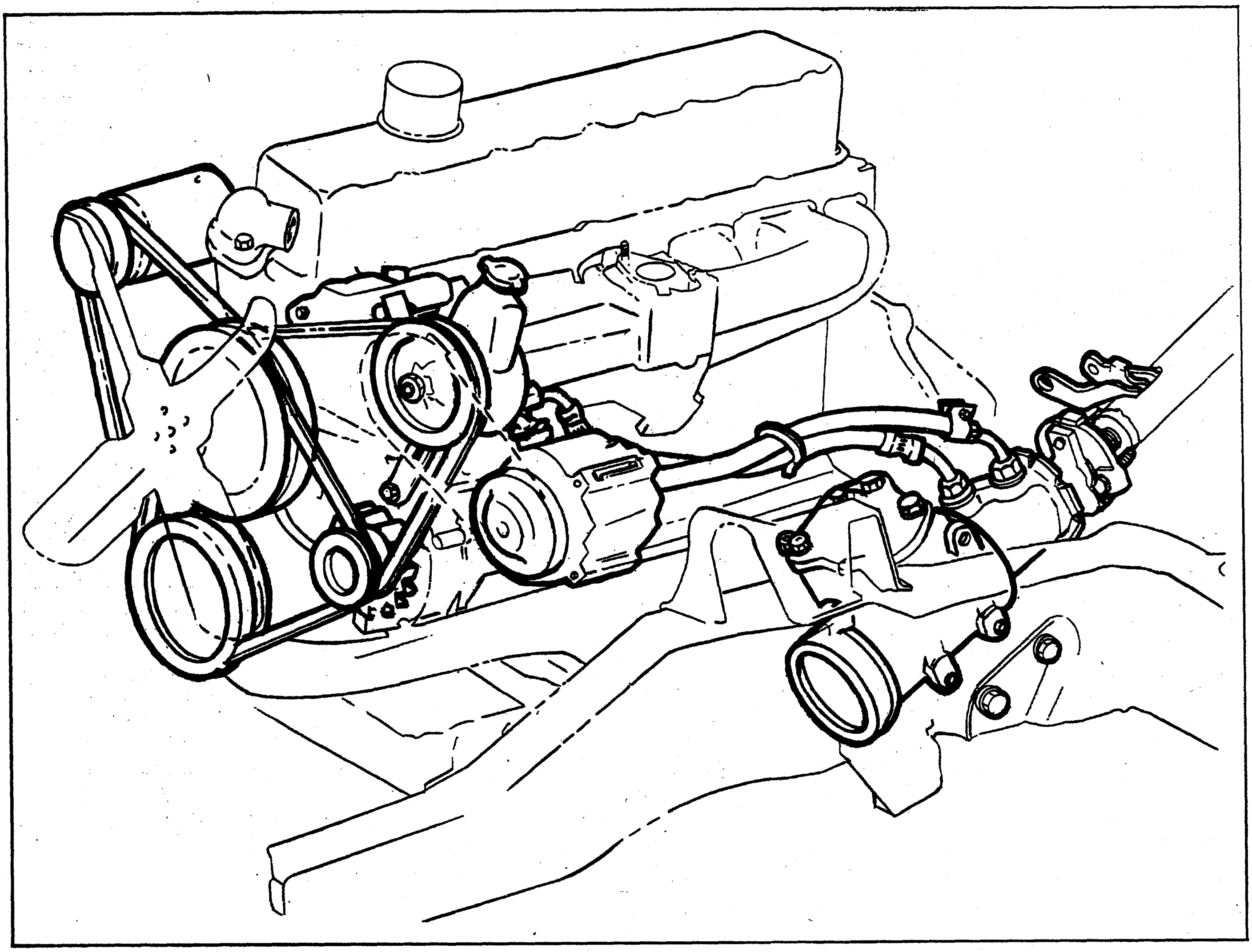

Fig. 68—Power Steering Gear—Chevrolet Shown

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. 67) and install attaching parts loosely.
3. Connect and tighten hose fittings.
4. Fill reservoir. Bleed pump by turning pulley backward (counterclockwise 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."

POWER STEERING GEAR (Fig. 68)

Chevrolet, Chevelle, and Camaro

Replacement procedures for the power steering gear are the same as for the manual type steering gear. Refer to steering gear procedures near the beginning of this section under "Component Replacement and Repairs".

In addition, disconnect pressure and return hoses from the steering gear housing. Cap both hoses and steering gear outlets to prevent foreign material from entering the system. After service is performed and steering gear is installed, connect the pressure and return hoses to the steering gear housing. Bleed system as outlined under Maintenance and Adjustment in this section. Refer to torque specifications at rear of manual for correct torque values.

CONTROL VALVE AND ADAPTER ASSEMBLY

Chevy II and Corvette

Ball Stud Seal Replacement (Fig. 69)

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" in this section.
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.)

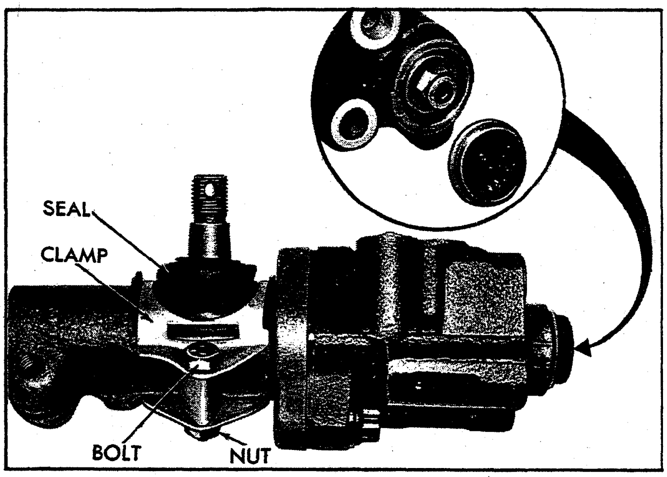

Fig. 69—Control Valve Ball Stud Seal Replacement (Service Type)

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.
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. 70)

Chevy II and Corvette

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.

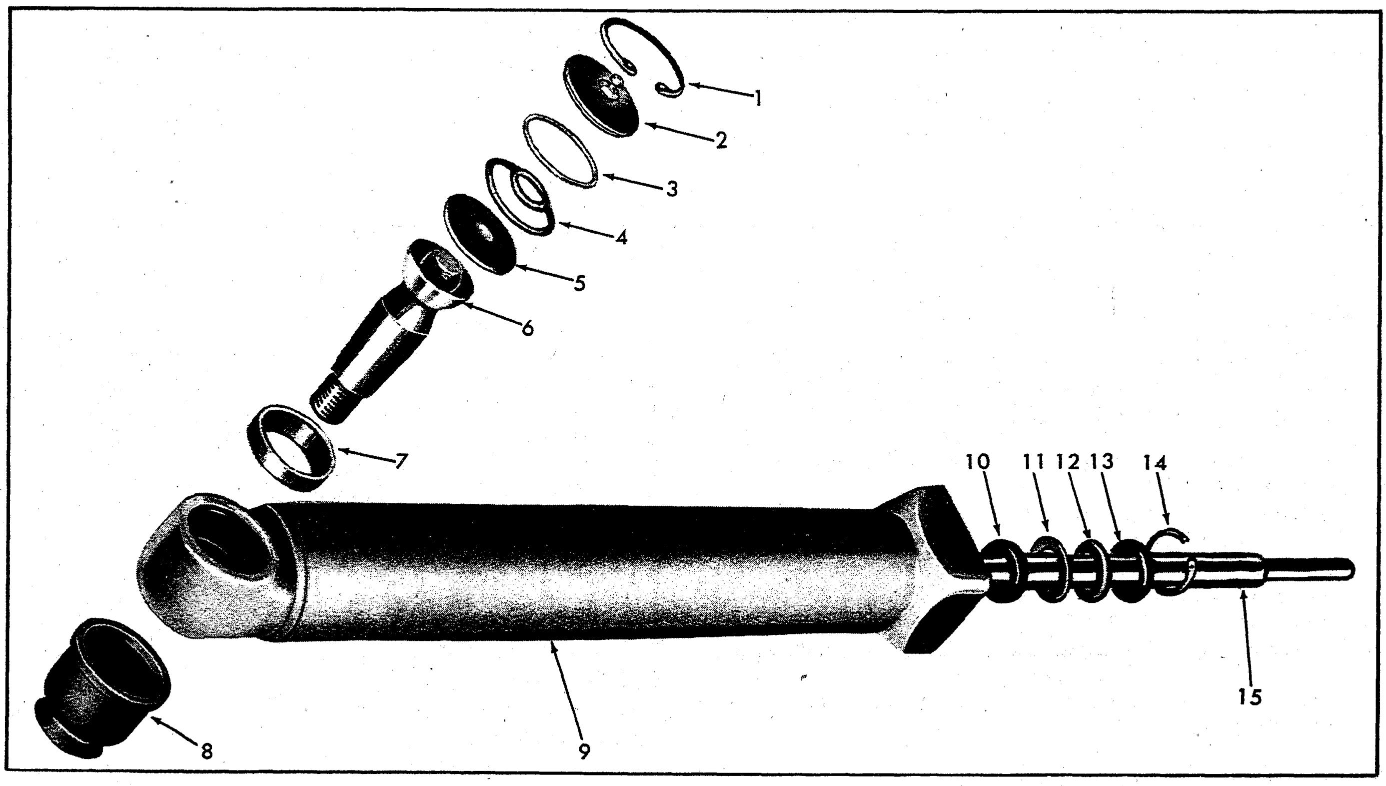

Fig. 70—Power Cylinder—Exploded View

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

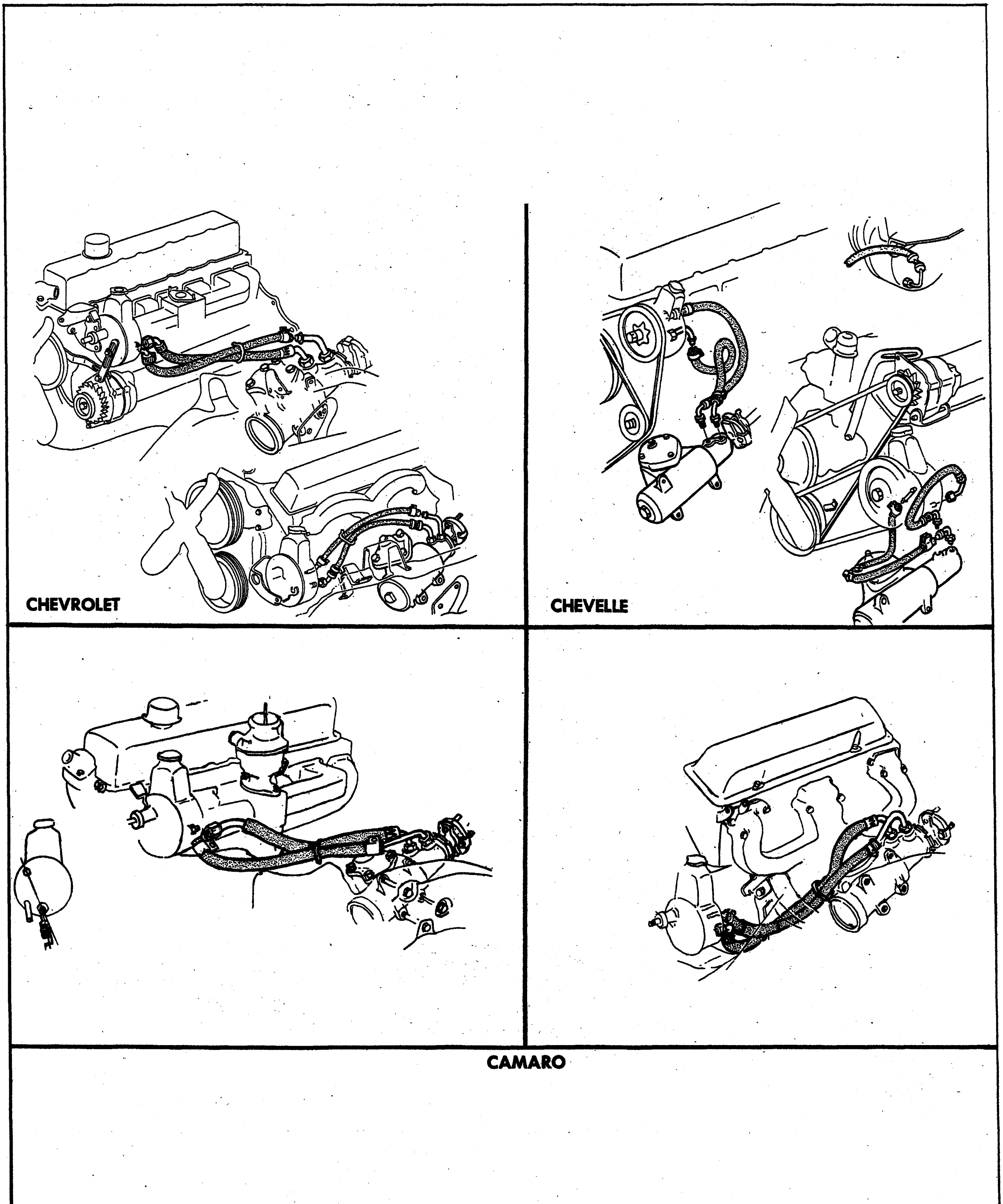

Fig. 71—Power Steering Hose Installation

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.
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 lube 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

When servicing the power steering hoses be sure to align the hoses in their correct position as shown in Figure 71. On Chevelle models with 396 engine, install the upper hose so that there is at least .6 inch clearance between the hose and the Delcotron or the inner fender skirt.

It is important that the power steering hoses be installed correctly. Hoses installed out of position may be subjected to chafing or other abuses during sharp turns. Always make hose installations with front wheels in straight ahead position. Do not twist hoses unnecessarily during installation.

CAUTION: Do not start engine with any power steering hose disconnected.

SPECIAL TOOLS

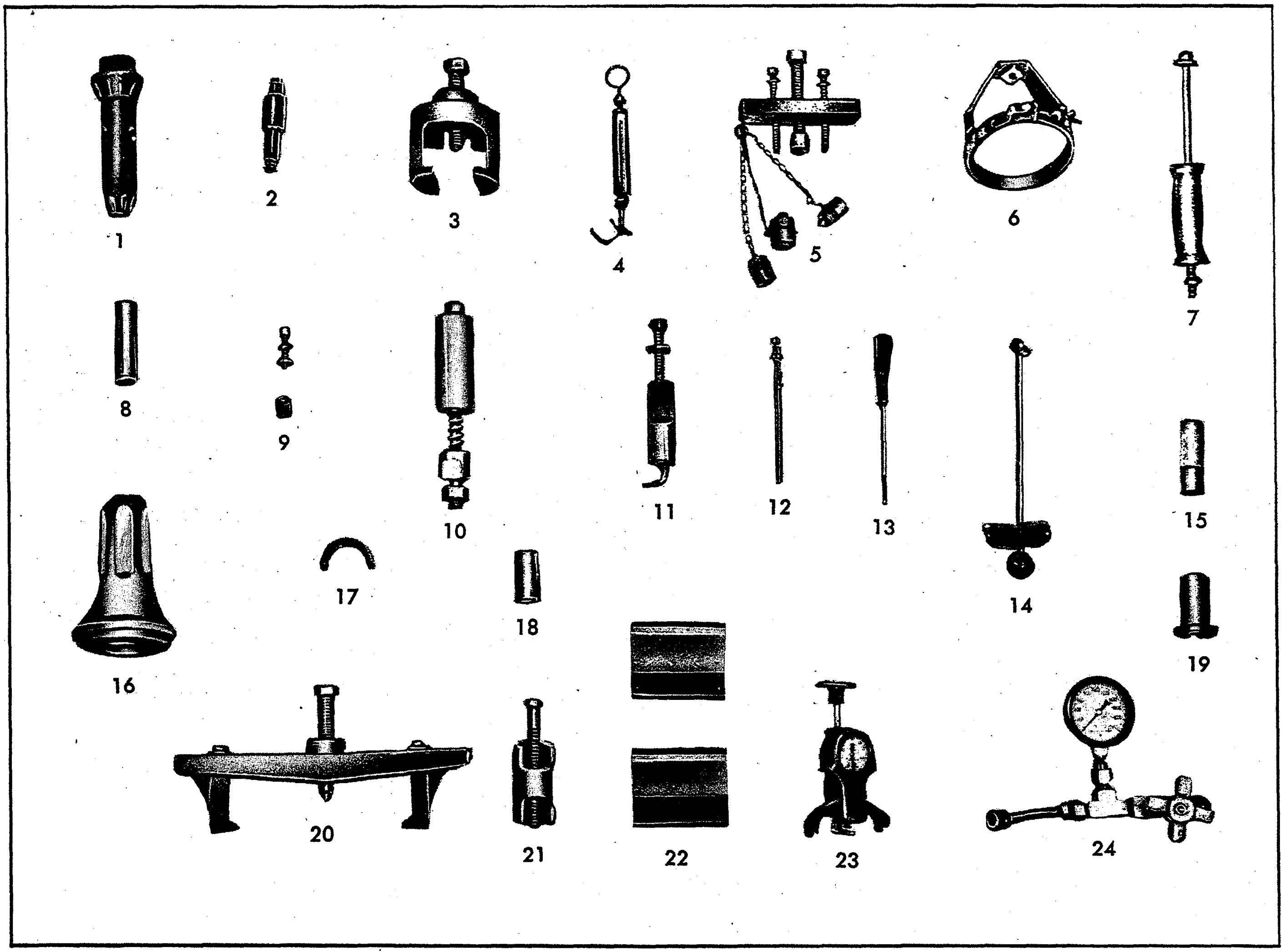

Fig. 72—Special Tools

1. J-22572 Steering Column Bearing Installer
2. J-8937 Power Piston Ball Seat Installer
3. J-6632 Pitman Arm Puller
4. J-5178 Pull Gauge
5. J-2927 Steering Wheel Puller
6. J-21486 Actuator Cover Remover
7. J-6585 Slide Hammer
8. J-22599 Lock Nut Wrench
9. J-21854 Pivot Pin Remover
10. J-22549 Shift Tube Installer
11. J-22551 Shift Tube Remover
12. J-5421 Thermometer
13. J-22635 Locking Shoe Guide Pin and Release Lever Pin Remover and Installer
14. J-7754 Inch Pound Torque Wrench
15. J-22569 Snap Ring Remover and Installer
16. J-21853 Actuator Cover Installer
17. J-22568 Spanner Wrench
18. J-22670 Pump Main Shaft Seal Installer
19. J-22686 End Play Gauge
20. J-8433 Pump Pulley Remover
21. J-21239 Pump Pulley Remover
22. J-22573 Column Support Fixture
23. J-7316 Belt Tension Gauge
24. J-5176 Pressure Gauge

SECTION 10

WHEELS AND TIRES

INDEX

GENERAL DESCRIPTION

WHEELS

Chevrolet, Chevelle, Camaro, Chevy II, and Corvette are base equipped with welded steel wheels. Five studs with nuts fasten each wheel to the front hub or rear axle flange. Disc brake equipped vehicles (except Chevrolet and Corvette) require special 14 inch diameter wheels with a revised design for clearance. Chevrolet disc brake equipped vehicles have 15 in. diameter wheels as do all Corvettes.

Chevrolet station wagons, Chevelle Super Sport 396, Corvette and Camaro Super Sport 350 are base equipped with 6 in. width wheels. All other vehicles have 5 in. width wheels, except Chevy II 100, 300 and 500 Series Sedans, which have 4 in. width wheels.

Do not install 6 inch width wheels or snow chains on Chevrolets equipped with rear fender skirts.

TIRES

The factory installed tires on Chevrolet passenger cars are selected to provide the best all around tire performance for all normal operation. They are designed to operate satisfactorily with loads up to and including the specified full rated load capacity of the automobile when inflated as recommended in the Vehicle Capacity Rating and Recommended Tire Inflation Pressures Table (see Specifications).

Optional Oversize and 8-Ply Rating Tires (Chevrolet and Chevelle Only)

Oversize or 8-ply rating tires are not necessary on passenger cars for normal requirements. However, an extra margin of tire service is available when these options are used at loads up to and including full rated load.

Optional oversize 4-ply rating and/or 8-ply rating tires are available on models as indicated in the Tire Usage Chart (see Specifications). On some models (example--Station Wagon), space limitations do not permit the use of a larger size tire; hence, the 8-ply rating tire is an available option.

In either case, these tires are applicable to extended operation at or near full rated load or for trailer towing when an extra margin of tire service is desired. However, use of a larger tire or an 8-ply rating tire should not be construed as permitting an increase in the full rated vehicle load (see Specifications).

MAINTENANCE AND ADJUSTMENTS

TIRES

Inflation Pressures

To ensure the proper tire inflation pressure for the owners particular requirements follow the recommendations in the Vehicle Capacity Rating and Recommended Tire Inflation Pressures Table (see Specifications). Keep tires properly inflated, and check inflation pressures periodically. This will ensure the best tire life and riding comfort, over the full range of driving conditions.

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. 1). 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 noticeable.

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

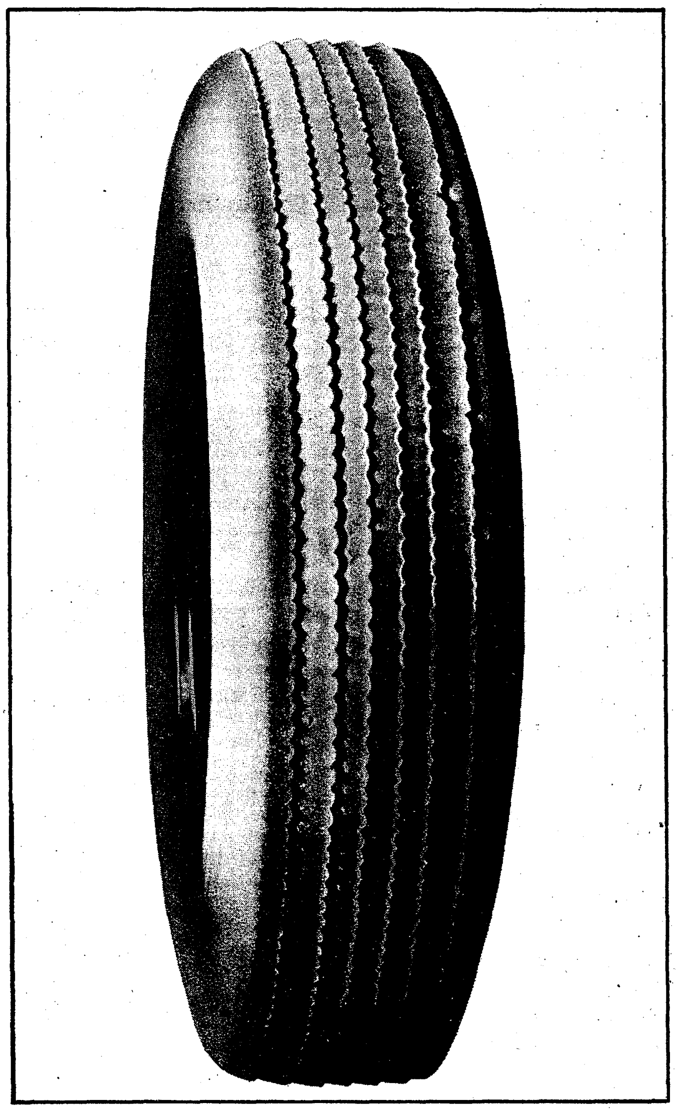

Fig. 1 - Toe In or Toe Out Misalignment Wear

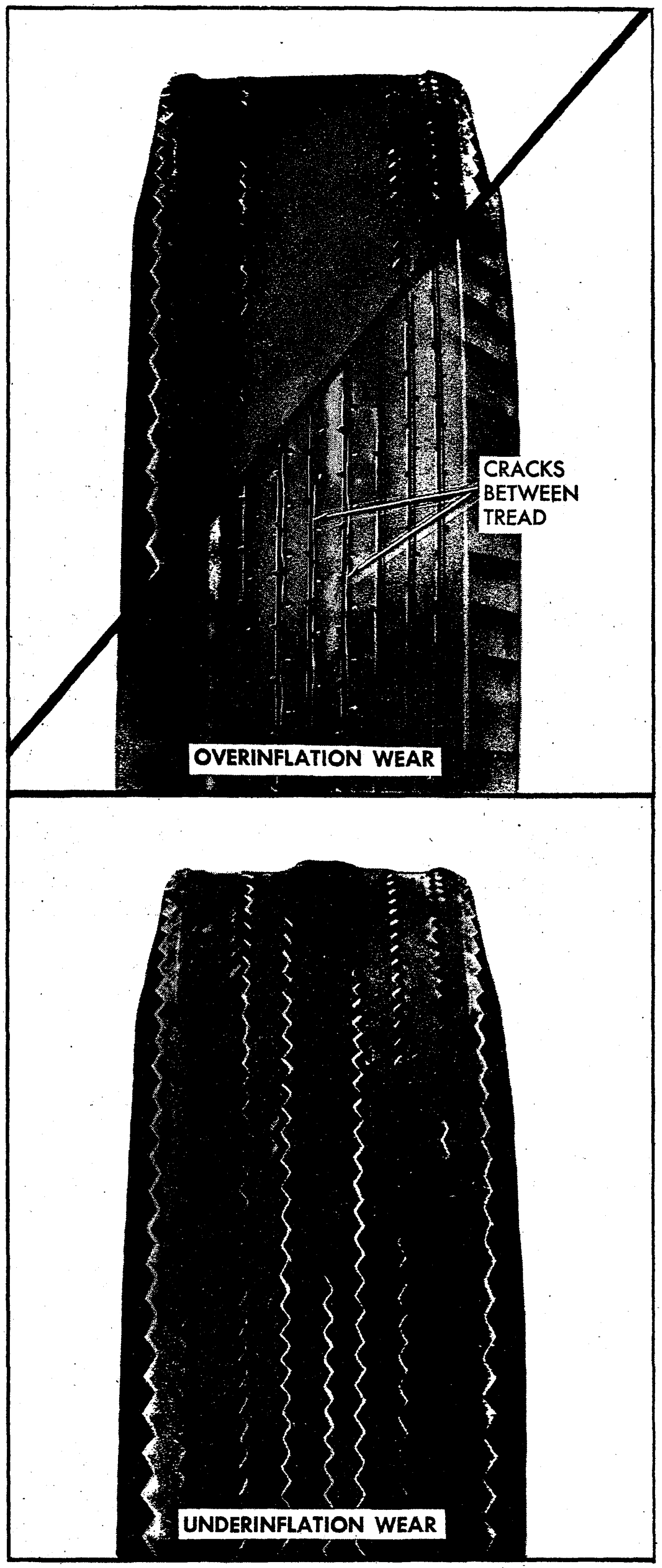

Fig. 2 - Over and Under Inflation Wear

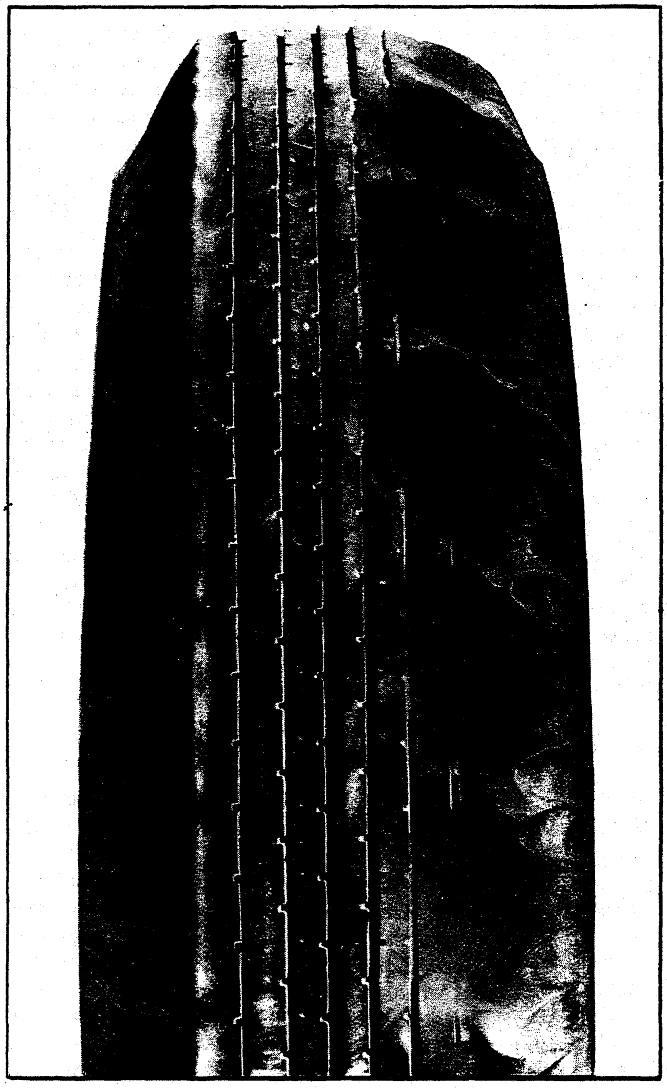

Fig. 3 - Spot Wear

to cautioning the owner of 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. 2).

There is, of course, no correction for high cambered roads. Cornering wear is discussed further on.

Center

This is caused primarily by overinflation of the tire (fig. 2). Invisible fabric damage can also be caused by overinflation.

Uneven

Uneven or spotty wear (fig. 3) is due to such irregularities as unequal caster or camber, bent front or rear suspension parts, out-of-balance wheels, brake drums

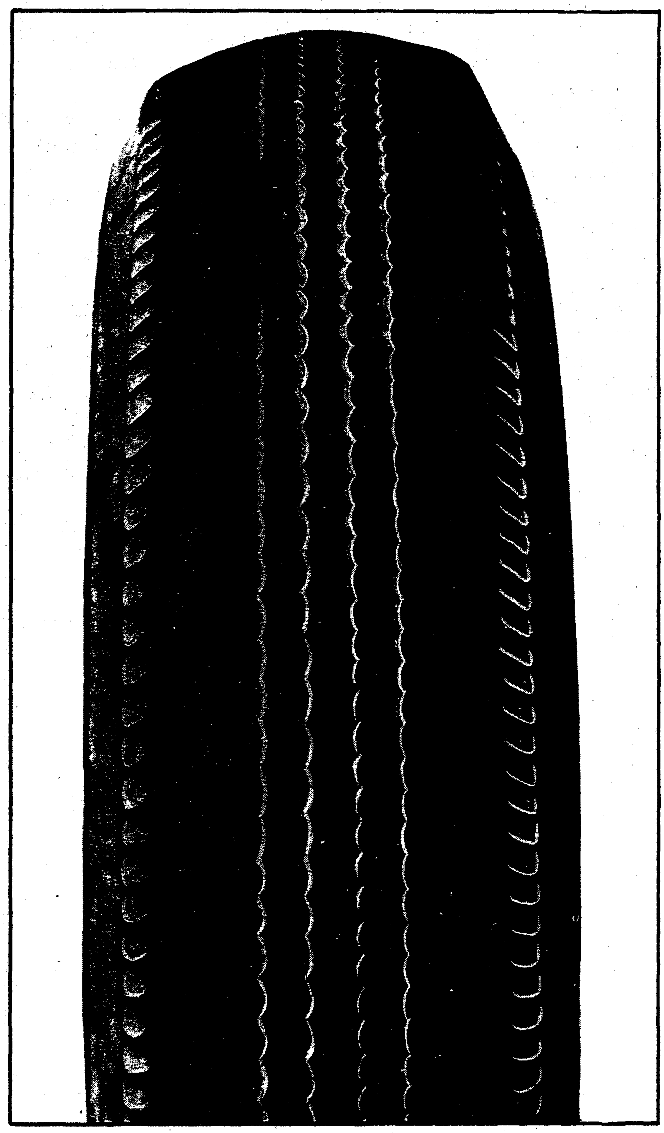

Fig. 4 - Cornering Wear

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, curves are being taken at higher speeds with the result that a type of tire wear called "Cornering Wear" (fig. 4), 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.

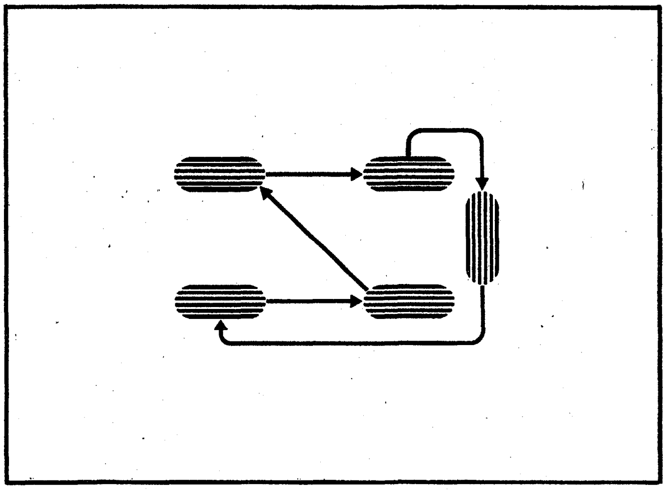

Fig. 5 - Tire Rotation

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 5 or more frequently in the case of extremely heavy wear.

NOTE: Rotate Corvette tires at 4000 miles or sooner.

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 fourth change. 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 55-75 ft. lbs. torque (70-85 ft. lbs. for Corvette aluminum wheel nuts).

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.)

WHEELS

The wheel and tire assembly should be removed from vehicles equipped with disc brakes to properly perform balancing operations. This is necessary due to drag of the spring loaded brake shoes on the disc.

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 dynamic 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.

NOTE: Vehicles with wire wheel covers should have the wheels balanced with the wire wheel covers installed on the wheels.

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".

Cleaning Aluminum Wheels

Do not use wire brush or abrasive cleaners when cleaning wheels. Use only cleaners that will not react with aluminum.

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: <u>Never use tire irons with sharp edges or corners.</u>

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

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 air 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: <u>DO NOT use a hammer, as damage to the bead will result.</u>

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

When a tire loses all or most of its air pressure, particularly when driving at high legal speeds on today's super-highways, recommended procedure is to remove it from the wheel for complete inspection to be sure no tire damage has occurred. Punctured tires should be removed from the wheel and permanently repaired from the inside.

Externally applied plug type repairs should be considered temporary and the tire should be permanently repaired as soon as possible.

Hot Patch Method

It is essential to thoroughly clean and remove all foreign matter from the hole left by the puncturing object without enlarging the injury and then follow the manufacturer's instructions for vulcanizing the patch.

Rubber Plug Methods

There are several types of rubber plugs--some are inserted from the inside of the tire; others are inserted from the outside of the tire without demounting the tire from the rim.

When using the plug method be sure to clean and lubricate the hole with repair cement before inserting the plug. Your tire supplier has available complete kits containing materials, tools and detailed instructions for making repairs with plugs. Follow instructions in the kit you use.

Cold Patch Method (Self Vulcanizing Type)

In this method it is essential to thoroughly clean and remove all foreign matter from the hole left by the puncturing object without enlarging the injury; also on the inside of the tire, buff an area large enough for the patch. Follow the manufacturer's instructions for application of the special cement and self-vulcanizing cold patch.

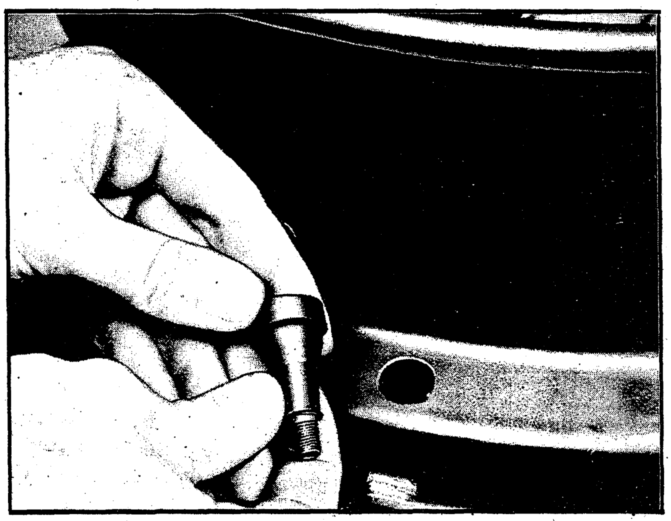

Fig. 6 - Installing Valve

Pressure Gun Method

Several types of pressure guns are available. Consult your tire supplier for materials and instructions.

Tire Installation Safety Precautions

When tires are mounted on dirty or corroded rims, or when they are not properly centered on rims, the tire bead may "bind" on the rim, and refuse to seat. Allowing pressure to continue to build up within the assembly in an attempt to seat the tire bead is a DANGEROUS PRACTICE which can result in a broken tire bead, and serious injury to the serviceman.

1. Make sure that rim flanges and bead ledge (especially hump and radius) areas are smooth and clean. Remove any oxidized rubber, dried soap solution, rust, heavy paint, etc. with a wire brush, or, in extreme cases, a file.
2. Lubricate tire beads, rim flanges, and bead ledge areas with a liberal amount of thin vegetable oil soap solution, or approved rubber lubricant.
3. Insure that air pressure build-up during the bead seating process is not allowed to exceed 40 pounds pressure. If beads have not seated by the time pressure reaches 40 pounds, assembly should be deflated, re-positioned on rim, re-lubricated and re-inflated.
4. Make sure valve core is inserted in valve stem prior to inflating.
5. Use an extension gauge with clip on chuck so air pressure build-up can be closely watched and so that you can stand well back from the assembly during the bead seating process.

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.

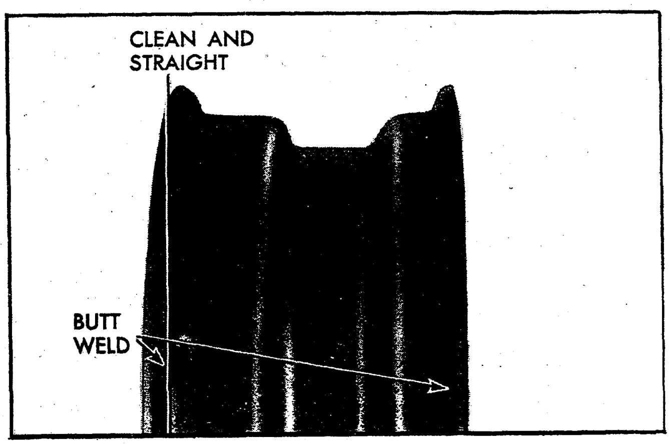

Fig. 7 - Rim Inspection

3. Coat O.D. of new valve assembly liberally with the mounting compound.
4. Insert assembly through rim from inside (fig. 7). Snap into place, using a pair of slip-joint pliers with one jaw on rim and one jaw on base of valve assembly.

Rim

Repair

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. 8).
4. If air loss occurs at valve it can be corrected by replacing valve core or valve assembly.

SECTION 11

CHASSIS SHEET METAL

CONTENTS OF THIS SECTION

CHEVROLET AND CHEVELLE

INDEX

GENERAL DESCRIPTION

The new front end appearance of the 1967 Chevrolet and Chevelle passenger cars affects the servicing and replacement of the chassis sheet metal. Refer to Section 13 for Radiator and Grille service procedures, Section 14 for Bumpers, and Section 1A for Air Conditioning components. Figures 1 and 2 illustrate the Chevrolet and Chevelle sheet metal components.

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 properly adjusted. To align the hood and lock proceed as follows:

HOOD HINGE (Fig. 3)

NOTE: 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.

1. Scribe a line around the entire hinge plate to be repositioned.
2. Loosen the appropriate screws and shift the position of the hood into correct alignment using the scribe marks to check amount of movement. Check alignment by tightening screws and closing the hood.

HOOD BUMPERS

Adjust hood bumpers so that hood top surface is flush with the fender and grille top surfaces. Refer to Figures 4 and 5 for correct sheet metal adjustment dimensions.

HOOD CATCH AND LOCK

The hood catch assembly (fig. 6) mounting holes are slotted to provide adjustment for the hood lock bolt. Adjust the hood lock bolt until hood engages securely when closed and hood bumpers are slightly compressed.

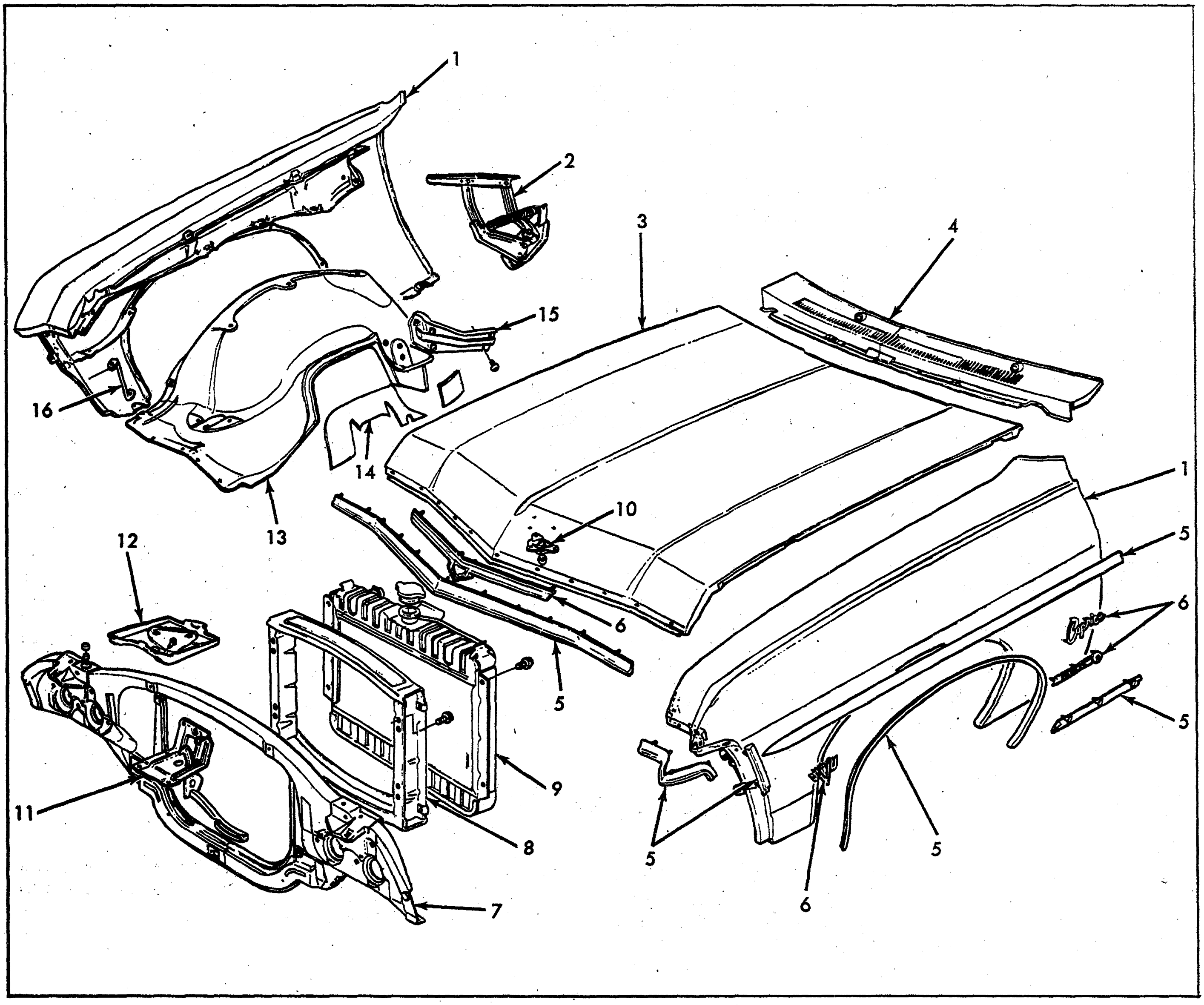

Fig. 1 - Front End Sheet Metal - Chevrolet

1. Fender
2. Hood Hinge
3. Hood
4. Cowl Vent Grille
5. Molding
6. Trim
7. Radiator Support
8. Shroud
9. Radiator
10. Hood Lock
11. Hood Catch
12. Battery Tray
13. Skirt
14. Dust Shield
15. Bracket
16. Brace

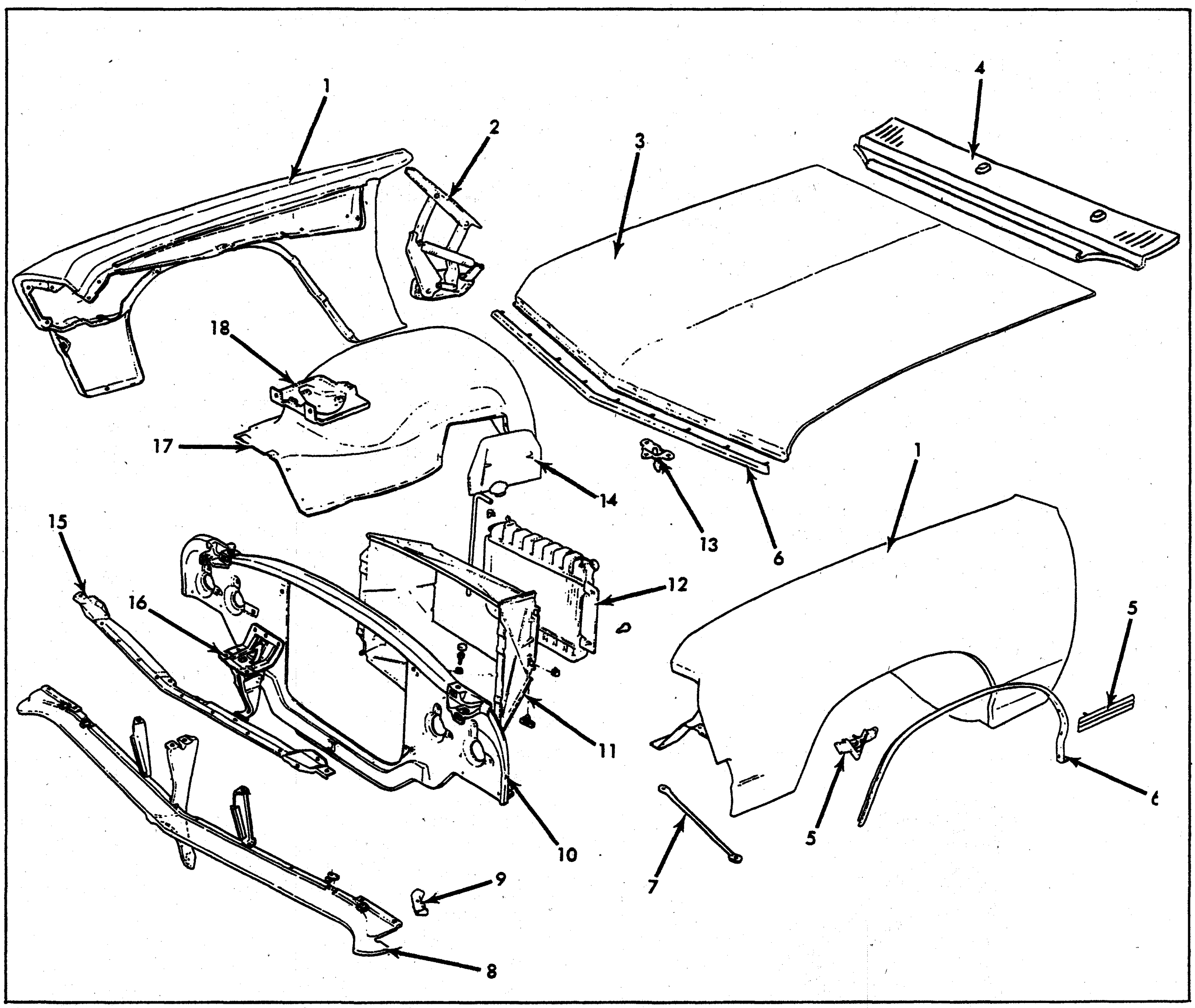

Fig. 2 - Front End Sheet Metal - Chevelle

1. Fender
2. Hood Hinge
3. Hood
4. Cowl Vent Grille
5. Trim
6. Molding
7. Brace
8. Filler Panel
9. Reinforcement
10. Radiator Support
11. Shroud
12. Radiator
13. Hood Lock
14. Seal
15. Tie Bar
16. Hood Catch
17. Skirt
18. Battery Tray

FENDERS

Fenders are adjustable with shims at the cowl and rocker panel. To add or remove shims, loosen bolts at shim locations (fig. 7) and carefully apply force with pry bar to provide clearance for shim removal or installation.

SHEET METAL ADJUSTMENTS

For proper operation of doors and hood, and for presentable appearance, adjust front sheet metal to the tolerances shown in Figures 4 and 5.

COMPONENT PART REPLACEMENT

NOTE: When replacing sheet metal components on Chevrolet or Chevelle, note position and attachment of all seals and dust shielding and replace as necessary.

BATTERY TRAY

Removal

1. Disconnect battery cables.
2. Remove screw retaining battery hold down clamp and remove battery from vehicle.
3. Remove screws retaining battery tray to fender skirt and radiator support.
4. On Chevrolet, remove headlamp bezel and remove screw retaining tray to radiator support.
5. Remove battery tray from vehicle.

Installation

Reverse removal procedure.

RADIATOR SUPPORT

Removal

1. Remove front bumper (Section 14).
2. Remove grille and related components (Section 13).
3. Remove battery tray as outlined above.
4. Remove all electrical connections from radiator support.
5. Remove windshield washer bottle from bracket on radiator support.
6. Remove shroud and radiator (Section 13).
7. Remove screws and bolts securing support to skirts, fenders, and frame horns (figs. 8 and 9).
8. Spread fenders apart enough to allow support movement and remove support from front of vehicle.

Installation

1. Position the radiator support in vehicle, aligning mounting screw and bolt holes with drift punch.
2. Install screws and bolts loosely until all are started.
3. Replace all parts removed following removal procedure in reverse order.
4. Refer to torque specifications in rear of manual for correct torque values.
5. Aim headlamps as outlined in Section 12.

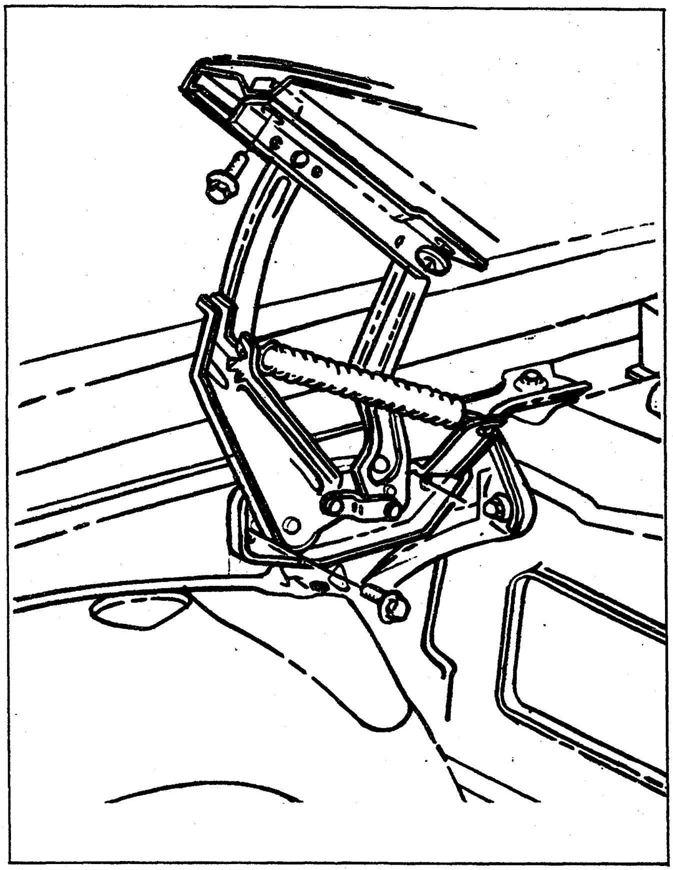

Fig. 3 - Hood Hinge - Chevrolet

FENDER ASSEMBLY

Removal

1. Remove hood with hinges from vehicle as outlined in this section.
2. On Chevrolet models, remove headlamp bezels and headlamps; on Chevelle models, remove grille extension panels (fig. 1 or 2 as applicable).
3. Disconnect wiring harness clips from fender to be removed.
4. If applicable, remove horn assembly from fender.
5. If applicable, remove radio antenna.
6. Remove fender brace (fig. 1 or 2 as applicable).
7. Remove screws retaining fender to radiator support, skirt, cowl, filler panel, tie bar, and rocker panel. Note number and location of shims removed from locations shown in Figure 7.
8. Remove fender from vehicle.

Installation

Refer to disassembly procedure for location of screws and install screws loosely. Install the shimmed screws at rocker panel and cowl and adjust fender (figs. 4 and 5) before tightening other screws. Always start adjustment with original amount of shims, then add or remove shims as required.

FENDER SKIRT

Removal

CAUTION: Chevelle air conditioned models have condenser hoses routed through the right front fender skirt. Cut skirt and bend as necessary to move hoses clear of skirt. If necessary, refer to Section 1A for air conditioning components and procedures.

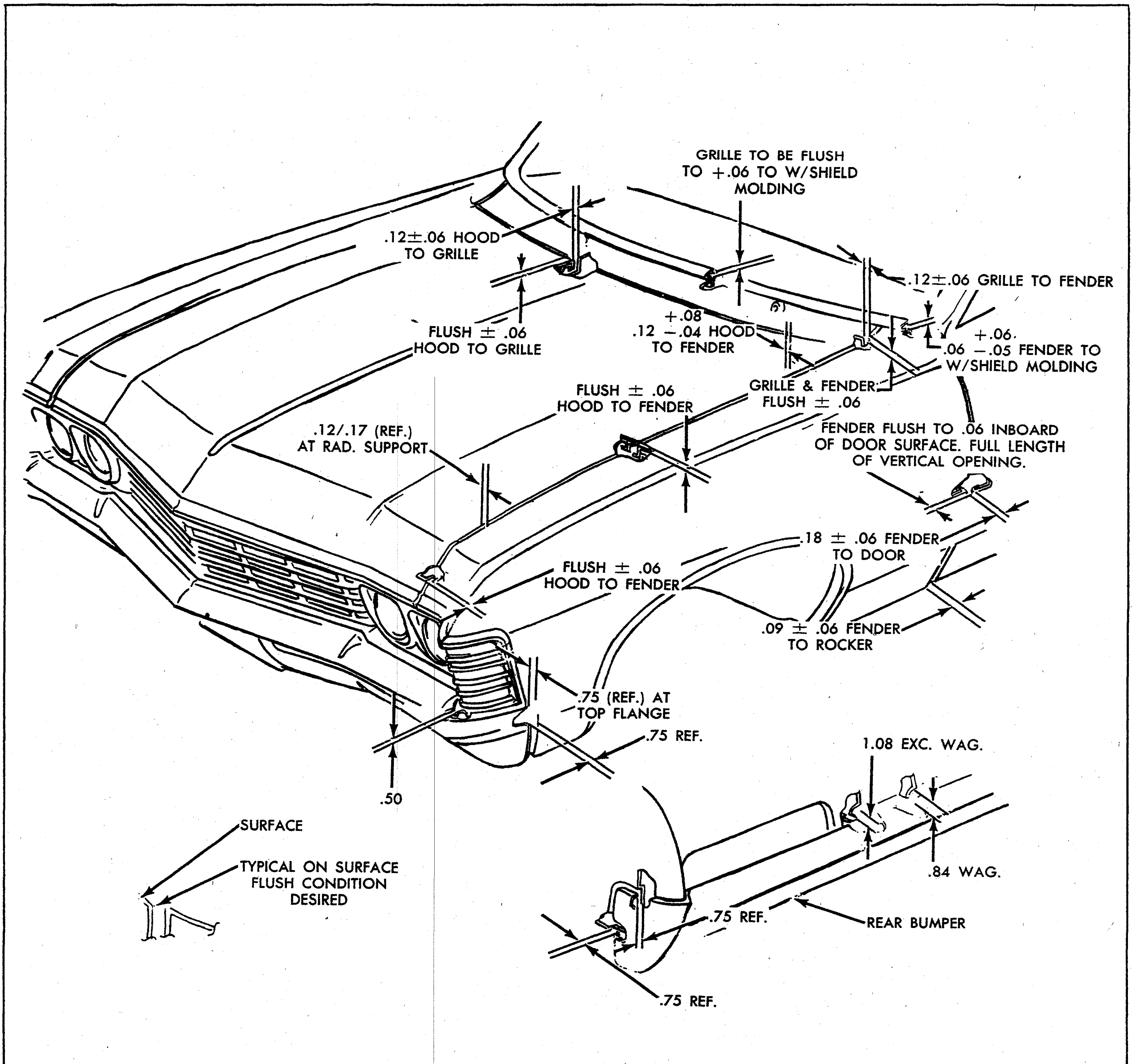

Fig. 4 - Sheet Metal Adjustments - Chevrolet

1. Remove fender as outlined above.
2. Jack up front end of vehicle and remove wheel.
3. Remove all wires, hoses, cruise control, etc. attached to skirt; also remove bolt attaching battery tray bracket to skirt. Remove battery.
4. Remove battery tray from vehicle.
5. On Chevrolet, remove screws securing brace (fig. 1) to skirt and dash panel and remove brace.
6. Remove skirt attaching screws and remove skirt from vehicle..

Installation

Install skirt and fender following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

FENDER TRIM

On Chevelle, to gain access to spear molding and emblem retaining nuts, remove skirt to fender flange screws top center rearward and pry skirt forward several inches. Wedge skirt in this position with a wood block and remove nuts from inside fender retaining molding to fender. Emblem attaching hardware is accessible from inside engine compartment.

On Chevrolet, open front door and rear inside door hinge pillar for access to trim retaining nuts. Remaining trim retaining nuts, and emblem retaining nuts are accessible from inside engine compartment.

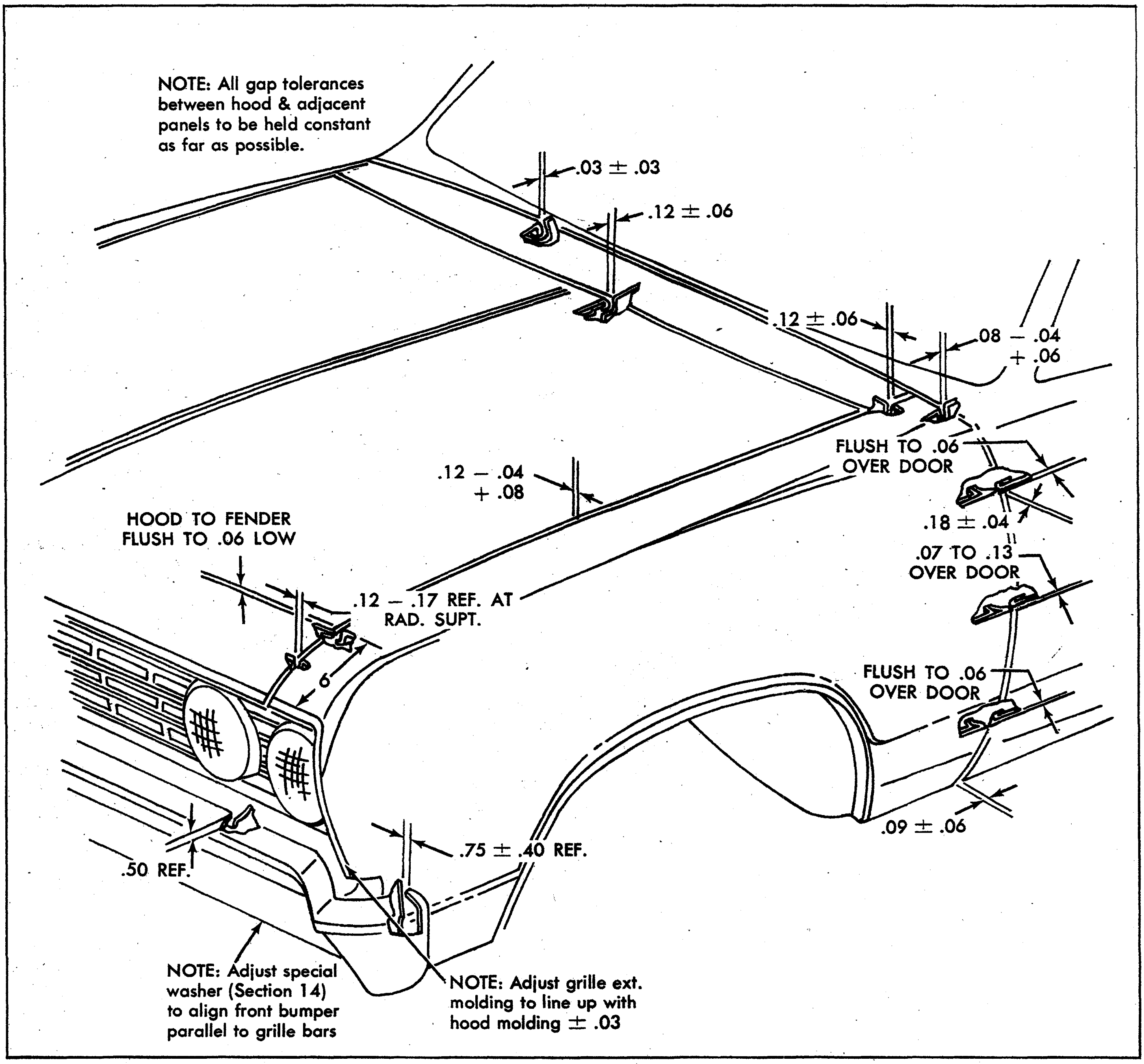

Fig. 5 - Sheet Metal Adjustments - Chevelle

HOOD ASSEMBLY (Fig. 10)

Hood may be removed either with or without hinges. To shorten aligning time, scribe a mark on hood around the hinge plate. See adjustment procedures in this section for hood adjustment. Hood hinge springs may be easily and safely removed and installed using Tool J-9559 as follows:

1. Remove bolt from Tool J-9559. Open hood far enough to allow passage of tool between hood and fender and insert ends of tool between coils of spring until barrel of tool contacts outer diameter of spring.
2. Open hood full while holding spring (with tool installed) in hand; when hood is in opened position, remove spring as shown in Figure 11.
3. When spring is removed, insert long bolt supplied with J-9559 through holes in ends 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 hoist as shown in Figure 12.
3. Stretch the spring enough to allow insertion of J-9559. Install bolt if spring is not to be installed on hinge at once.

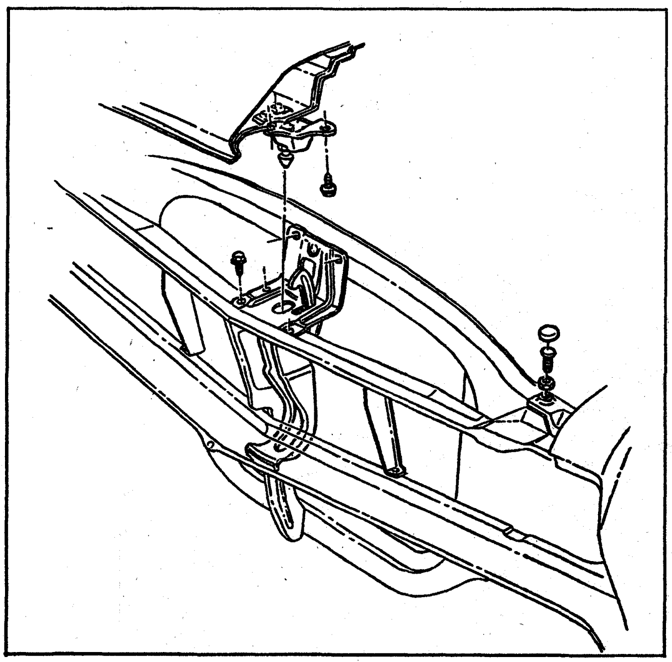

Fig. 6 - Hood Catch and Lock Plate - Chevelle Shown

HOOD CATCH AND LOCK (Fig. 6)

Removal

1. Remove catch plate assembly by removing screws retaining catch to radiator support, center support, and tie bar.
2. Remove lock plate by removing screws retaining lock plate to hood and remove lock plate.

Installation

1. Install lock and catch plate following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.
2. Adjust lock and catch plate as outlined under adjustment procedure in this section.

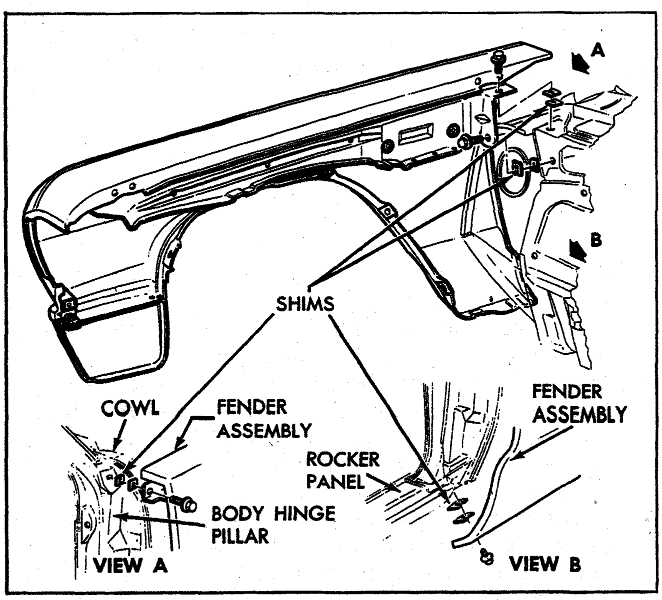

Fig. 7 - Fender to Cowl and Rocker Panel Shimming

HOOD TRIM AND INSULATION (Figs. 13 and 14)

Figure 13 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.

COWL VENT GRILLE (Figs. 1 and 2)

Removal

1. Raise hood.
2. Remove windshield wiper arms and disconnect washer hoses from tubes. Remove screws securing washer tubes to cowl vent grille. Pull tubes out from under rubber molding and remove.
3. Remove cowl vent grille retaining screws.
4. Leaving rubber molding in place, remove cowl vent grille from vehicle.

Installation

Install cowl vent grille following removal procedure in reverse order. Refer to Figure 4 and 5 for correct sheet metal adjustments.

REAR WHEEL COVER (CAPRICE, AND OPTIONAL ON OTHER CHEVROLET MODELS EXCEPT STATION WAGONS)

Removal and Installation

Lift the skirt (fig. 15) retaining lever (at the bottom inside skirt flange) over the lip of the flange and pull it downward. Pull the skirt downward and out of the opening. To install the skirt: position it inside the opening, insert the rod into the slot, lift the skirt and attach the hook to the wheel opening flange. Hold the skirt from below and behind to assure proper hook attachment then lift the retaining lever up and into the skirt lip. Check to insure cover is firmly engaged to fender.

SIMULATED WOOD GRAIN MOULDING (STATION WAGONS ONLY)

The wood grain transfer film is a vinyl material with a pressure sensitive adhesive backing. The transfers are serviced in pre-cut panels. The shelf life of this material is 90 days at a maximum temperature of 105°F.

Removal

Remove the mouldings from the affected panel. Remove the transfer film by lifting an edge and peeling the material from the painted surface. Exercise care so as not to damage the paint.

> **NOTE:** Application of heat to the transfer and panel with a heat gun or heat lamp will aid in the removal.

Installation

Preparation of the surface to which the transfer will be applied is very important. In cases where body metal repair has been made it is necessary to prime and color coat these areas to blend with the undamaged surface. Apply the transfer film to color coated panels only, never to bare metal or primer. The surface must be free of any imperfections that may high-light through the film. Remove dirt nibs and other foreign material in the paint by light sanding with 600 grit sandpaper.

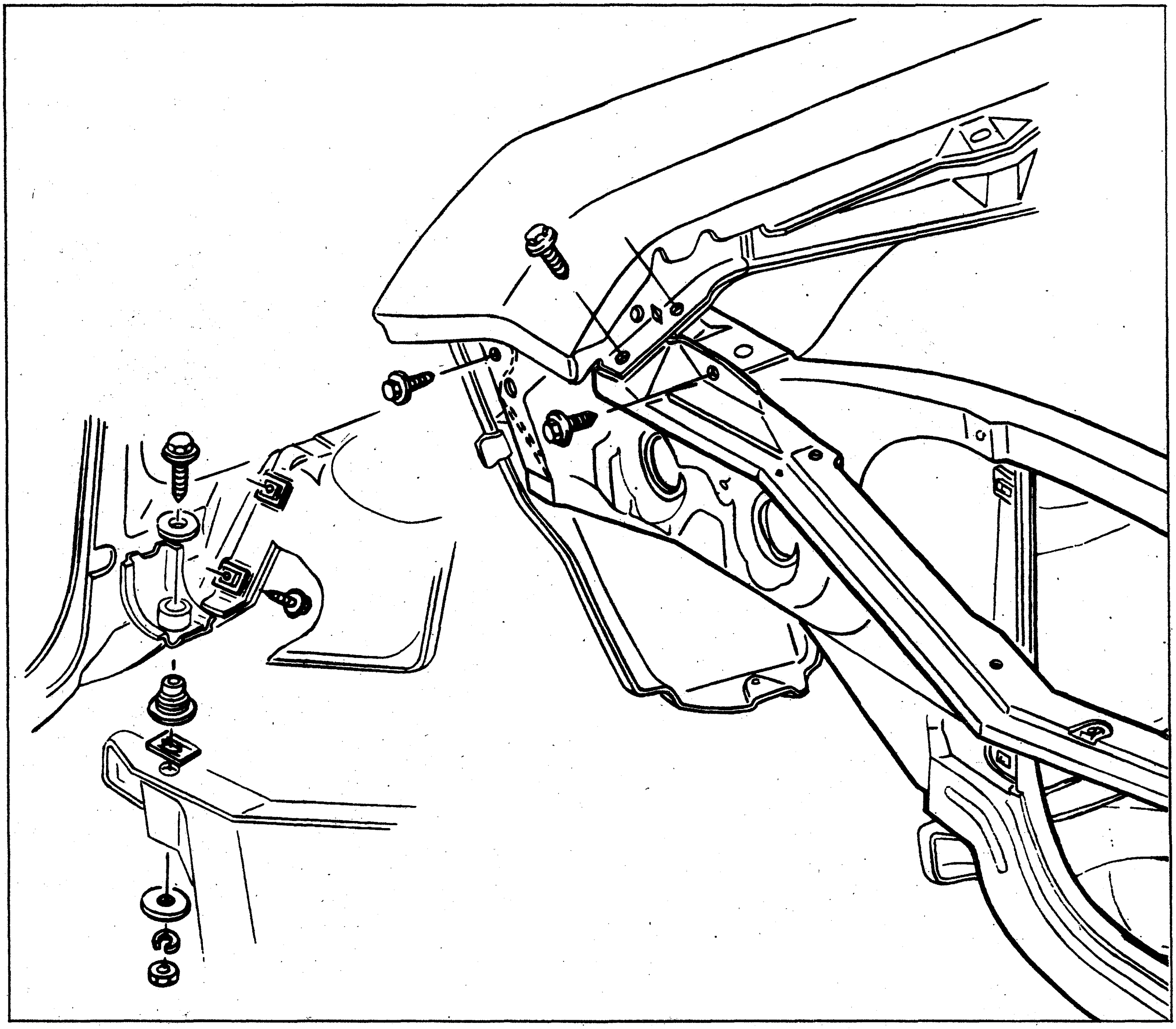

Fig. 8 - Chevrolet Radiator Support to Frame, Fenders, and Skirts

The temperature of the body must be maintained at a moderate level between approximately 65 and 90 degrees. Too warm a body will cause the wood grain film to stick prematurely while too cool a body will reduce the adhesion of the wood grain film. Cool the body panel with cool water when too warm and heat the body panel with a heat gun or a heat lamp when too cold. Just prior to application of the transfer film clean the painted surface with a non-petroleum base volatile cleaner and allow to dry.

Follow the steps below for easy application of the film.

1. Cut the tape backing the entire width of the transfer at the approximate centerline of the film exercising care not to damage the transfer film.
2. Peel the paper backing from one half of the film.
3. Align the upper edge of the half of the film with the paper backing to the lower edge of the pierced molding holes making sure that the transfer is centered on the panel.
4. Starting at the center of the transfer and using a water dampened rag, press that half of the transfer with the backing removed on to the panel. Work outboard from the middle to the edges. Remove all air bubbles.

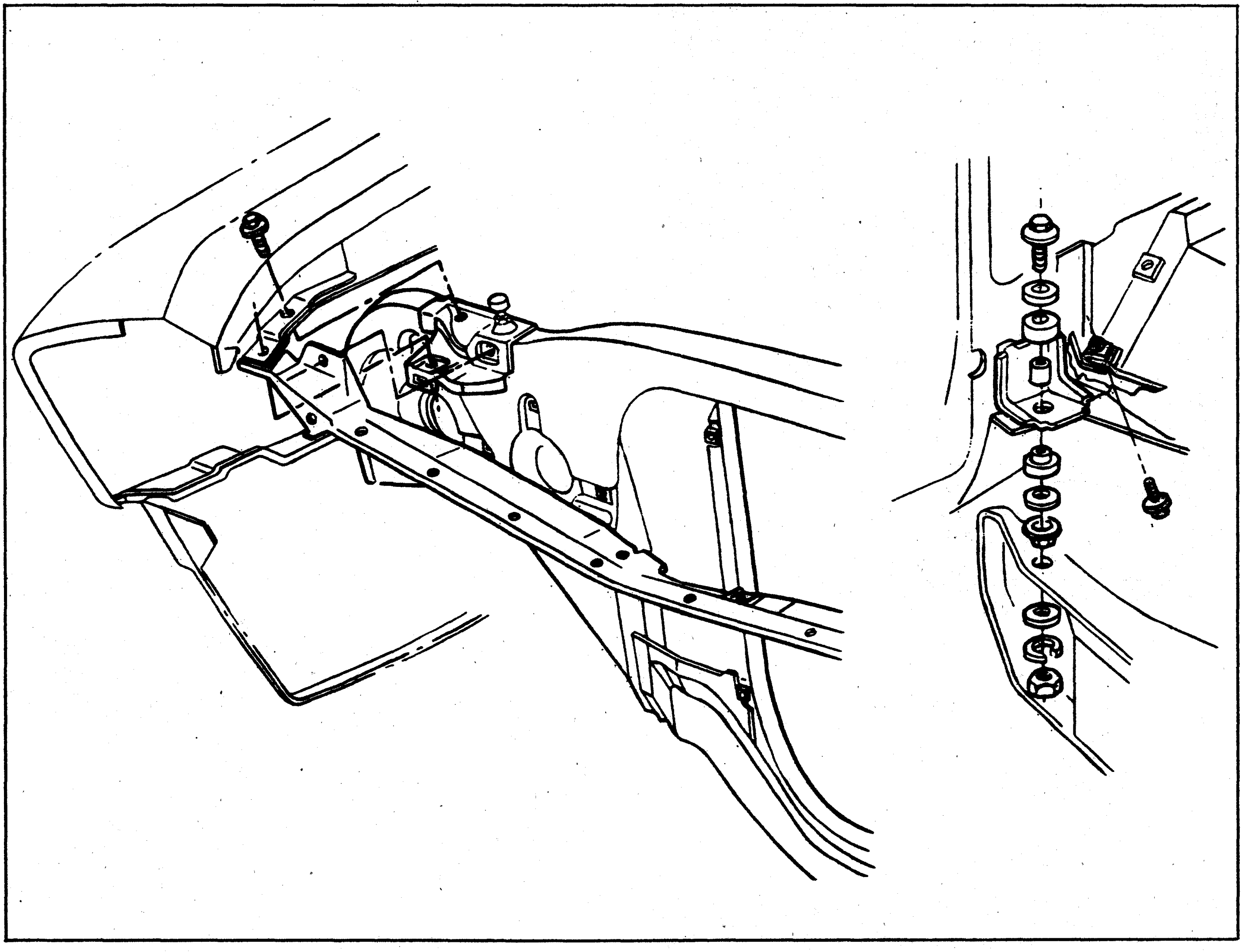

Fig. 9 - Chevelle Radiator Support to Frame, Fenders, and Skirts

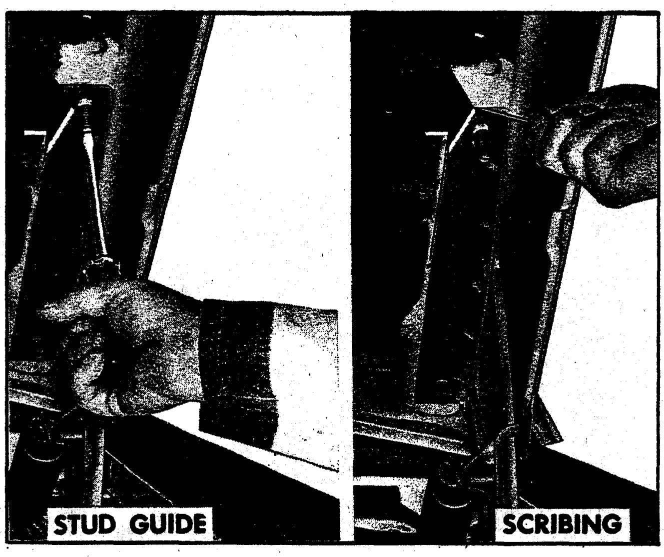

Fig. 10 - Hood Replacement

NOTE: The transfer can be pulled back from the panel and reinstalled if large air pockets develop. Exercise care not to stretch the material. Small air bubbles may be removed by piercing the film at the bubble with a pin and pressing the bubble down.

5. Remove the backing from the other half of the transfer. Apply this half in the same manner working from the center to the end and from the middle to the upper and lower edges.
6. Fold the transfer over the door or quarter edges and press to the hemming flanges. Application of heat with a heat lamp or heat gun will aid in folding the transfer over the edge.

NOTE: If the transfer film will not adhere to the flange, brush a clear vinyl adhesive to the back edge of the film and reapply.

7. Install the moldings.

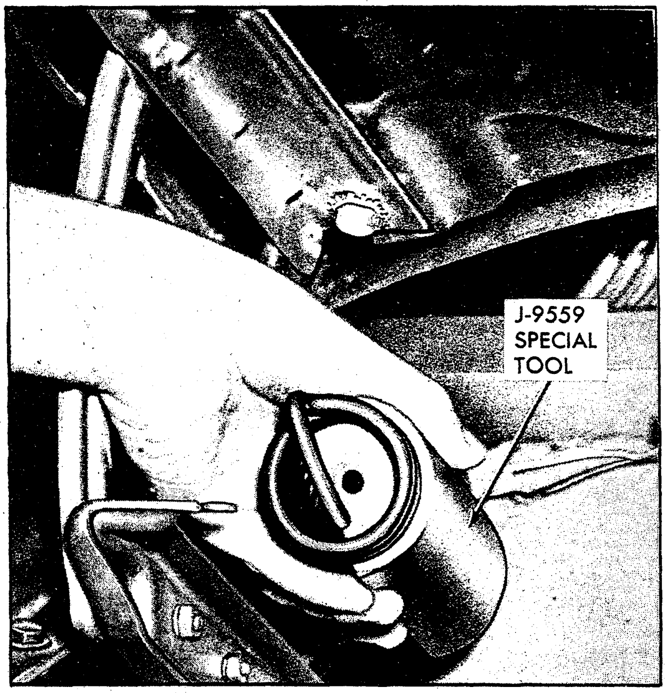

Fig. 11 - Removing Spring with J-9559

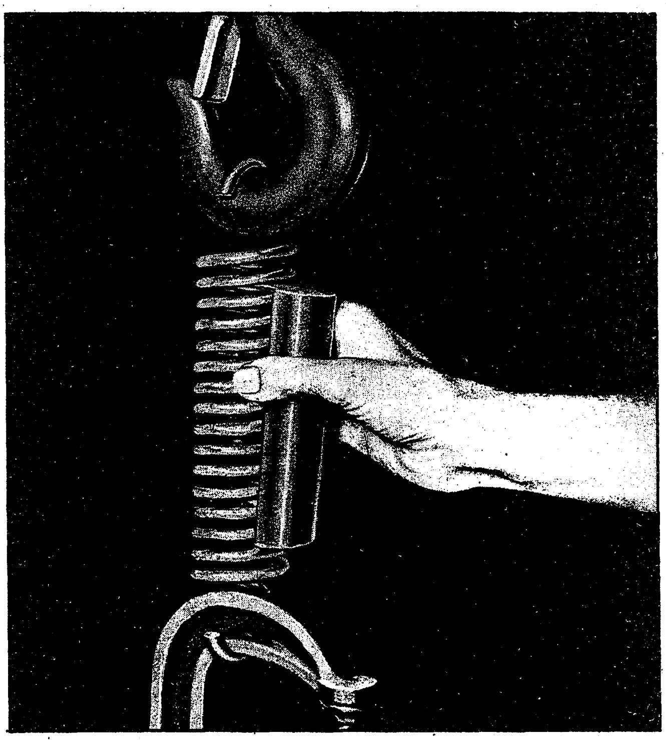

Fig. 12 - Installing J-9559 in New Spring

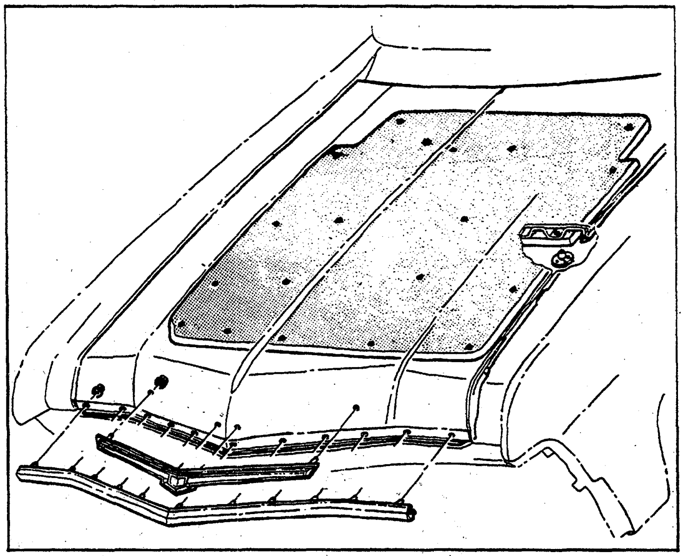

Fig. 13 - Hood, Insulator, and Molding - Chevrolet

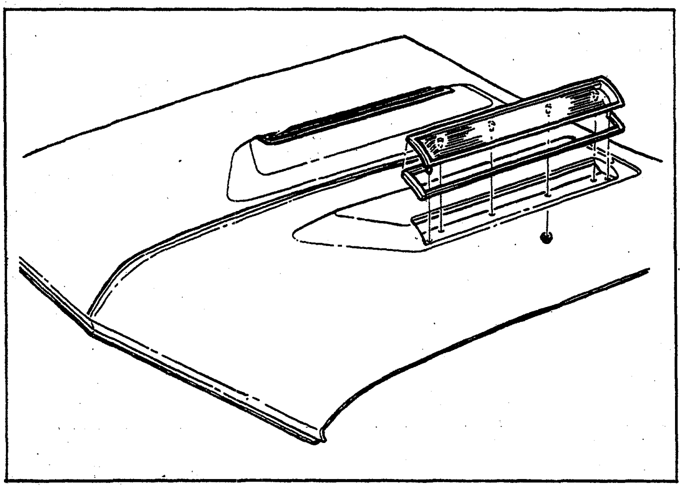

Fig. 14 - Hood and Hood Ornament - Chevelle

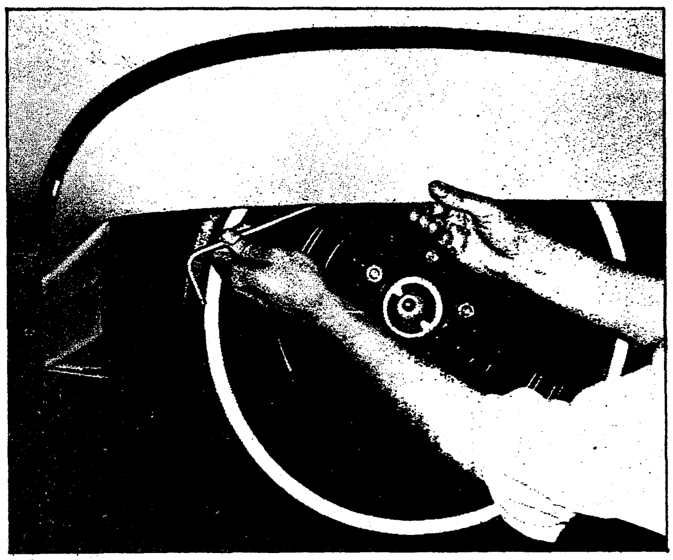

Fig. 15 - Removing Rear Wheel Cover

CHEVY II

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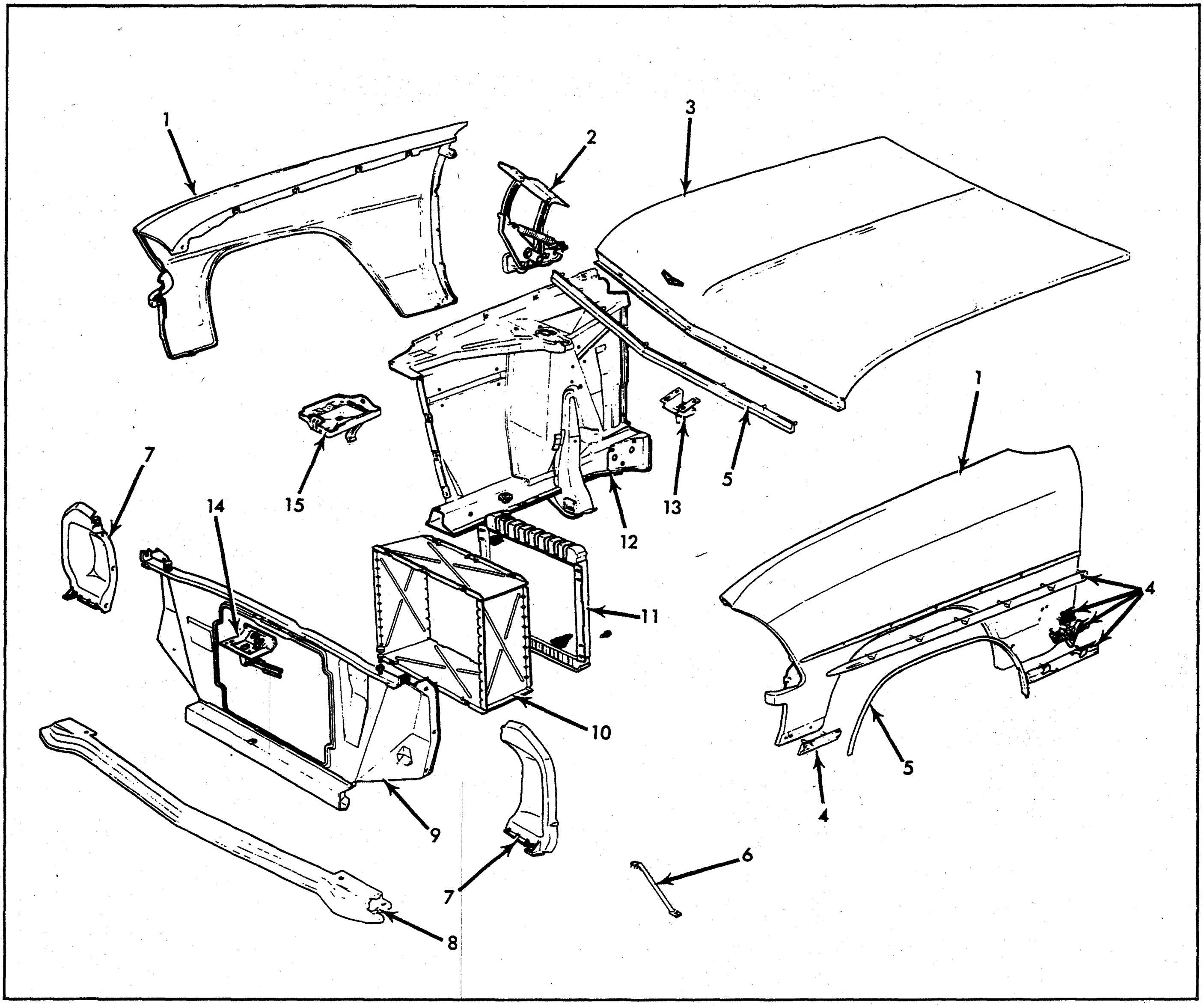

Fig. 16 - Front End Sheet Metal - Chevy II

1. Fender
2. Hood Hinge
3. Hood
4. Trim
5. Molding
6. Brace
7. Headlamp Filler Panel
8. Filler Panel
9. Radiator Support
10. Shroud
11. Radiator
12. Skirt
13. Hood Lock
14. Hood Catch
15. Battery Tray

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.16).

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

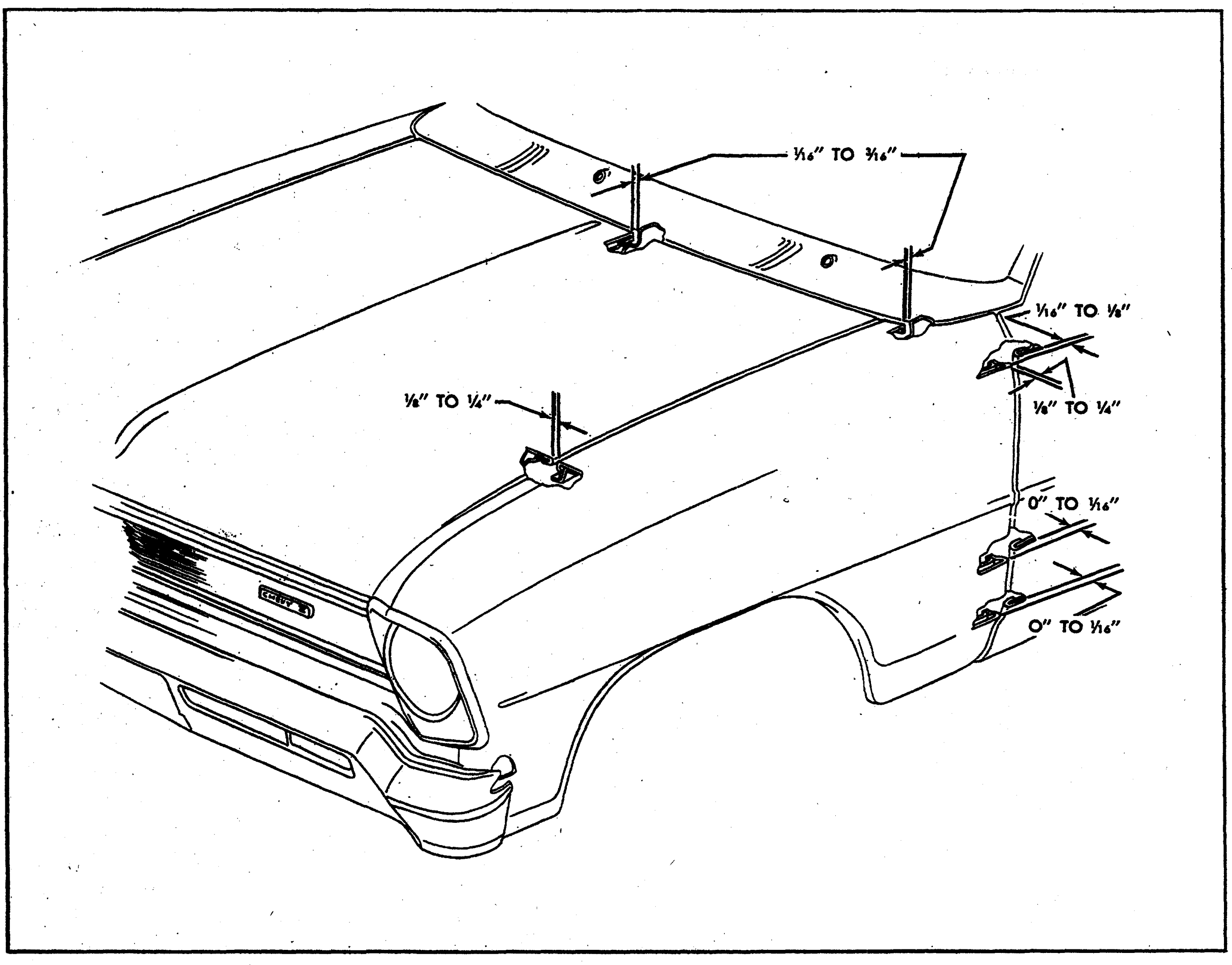

Fig. 17 - Sheet Metal Adjustment - Chevy II

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 17. Latch adjustments are made so that effort required to open and close the hood is reasonable, and 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. 18)

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.

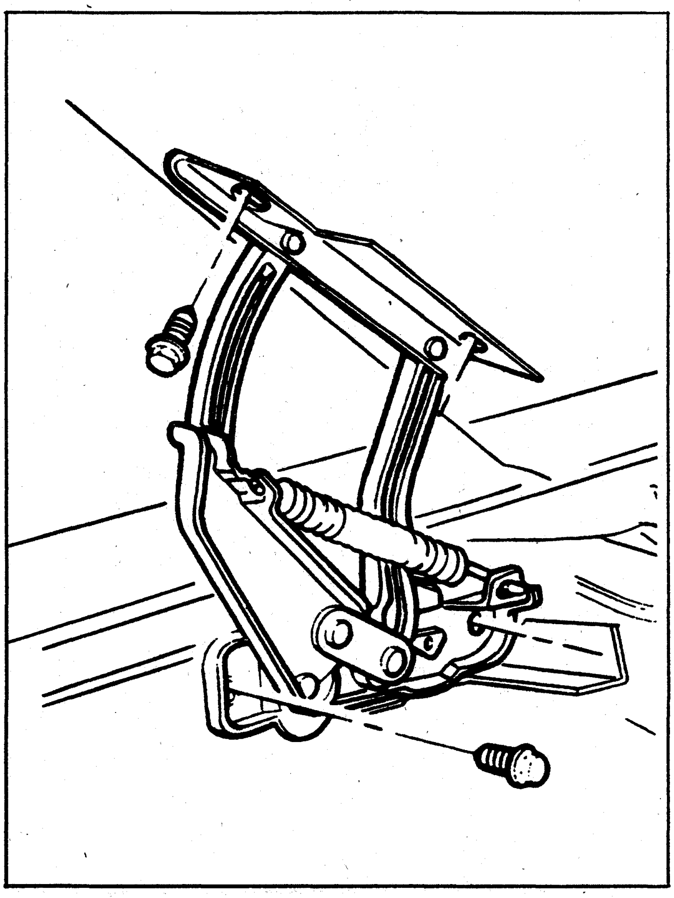

Fig. 18 - Hood Hinge - Chevy II

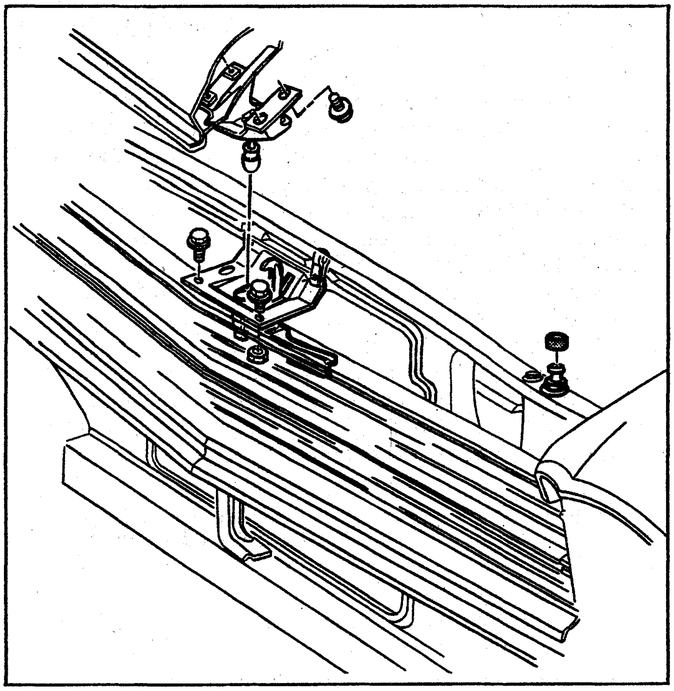

Fig. 19 - Hood Lock, Catch and Support - Chevy II

HOOD BUMPERS

Hood bumpers must be adjusted until hood and fender line up as shown in Figure 17.

HOOD CATCH AND LOCK (Fig. 19)

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.

FENDER ADJUSTMENT (Figs. 17 and 20)

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.

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 20 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 disasembled, 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

BATTERY TRAY (FIG. 21)

Removal

1. Disconnect battery cables.
2. Remove screw retaining battery hold down clamp.
3. Remove battery from vehicle.
4. Remove screws retaining tray assembly to fender skirt and support, and remove tray from vehicle.

Installation

Reverse removal procedure.

RADIATOR SUPPORT (FIG. 22)

Removal

1. Remove grille and related components (Section 13).
2. Remove battery tray as outlined in this section.
3. Remove shroud attaching screws and remove shroud if vehicle is so equipped.
4. Remove horn relay, horns, voltage regulator, and wiring harness from radiator support.
5. Remove shroud and radiator (Section 13).
6. Remove screws attaching radiator support to frame, skirts, fenders.
7. Remove radiator support from vehicle (fig. 23).

Installation

1. Position radiator support in vehicle; align mounting screw and bolt holes with drift punch.
2. Install screws and bolts loosely until all are started, then tighten.
3. Complete installation following removal procedure in reverse order. Refer to torque specifications at rear of manual for correct torque values.
4. Aim headlamps as outlined in Section 12.

FRONT FENDER ASSEMBLY

Removal

1. Remove headlamp door.
2. Open hood and remove screws joining fender top flange to skirt. Remove, and record number of shims at first cap screw forward of windshield (fig. 24).
3. Remove screw located on upper surface of headlamp cavity.
4. From under forward end of fender, remove screw retaining fender to radiator support.
5. From inboard side of rocker panel extension, remove cap screw retaining fender to extension. Remove, and record number of shims.
6. Separate headlamp filler panel from fender by removing remaining screws.
7. Remove fender from vehicle.

Installation

1. Inspect condition of cowl-to-fender seal and replace, if necessary, as shown in Figure 25.
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 rocedure 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 check headlamp aiming as outlined in Section 12.

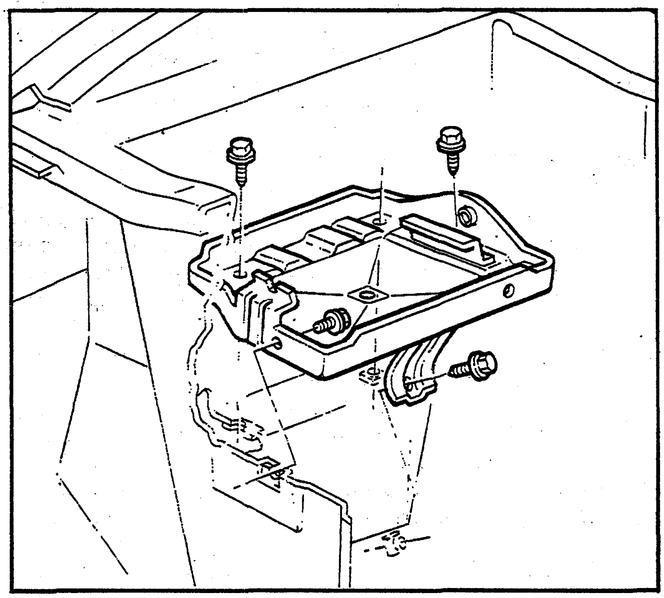

Fig. 21 - Battery Tray

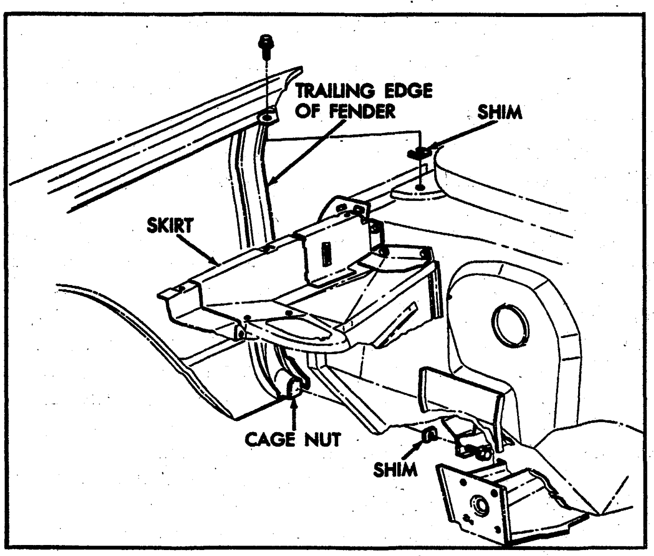

Fig. 20 - Front Fender Shimming

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 grille and radiator support as outlined in Section 13.
3. Remove fender assembly 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.
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. 26); record shims removed.
12. Remove skirt assembly with remaining suspension parts attached as shown in Figure 27.
13. Suspension parts may be detached as outlined in Section 3.

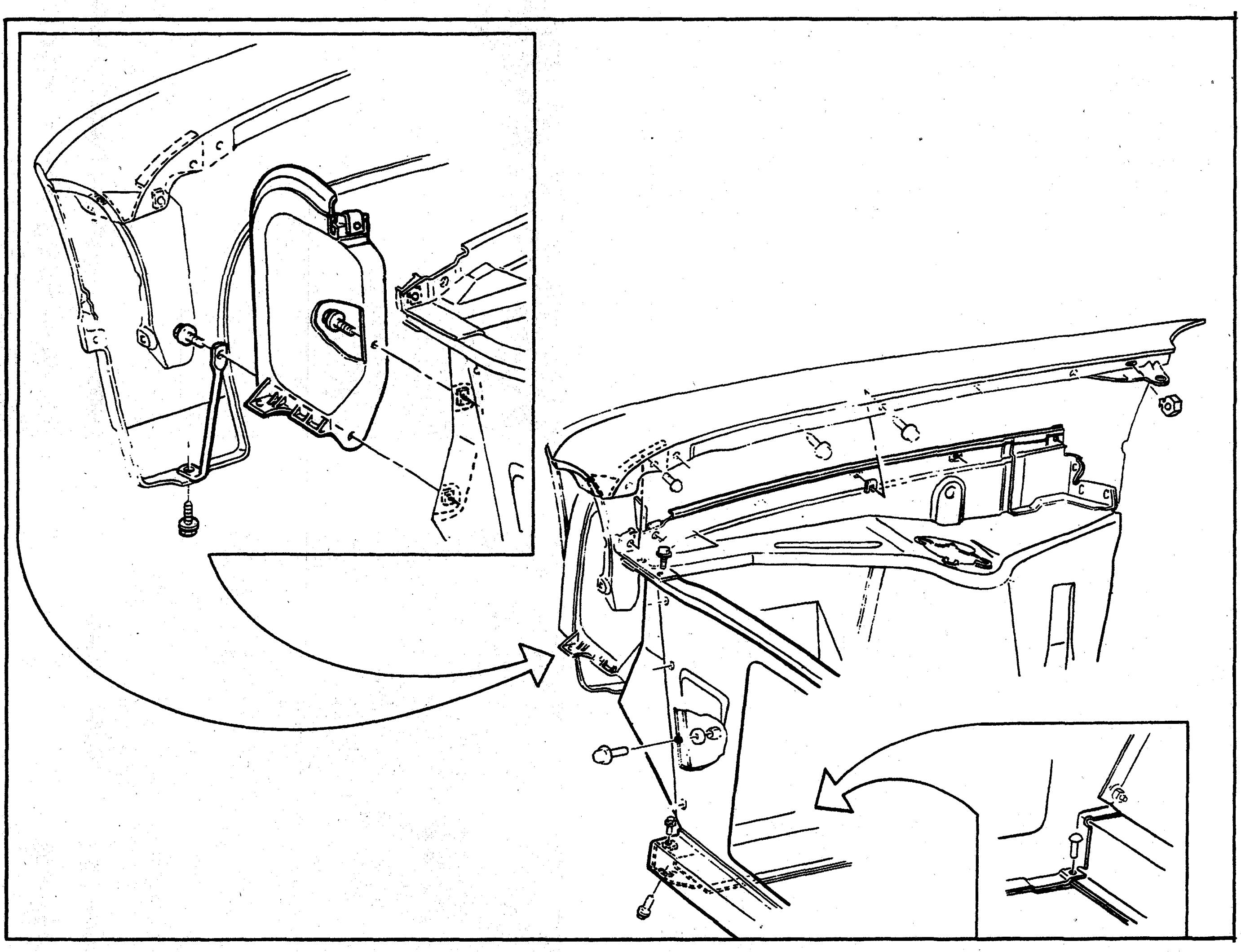

Fig. 22 - Radiator Support Assembly

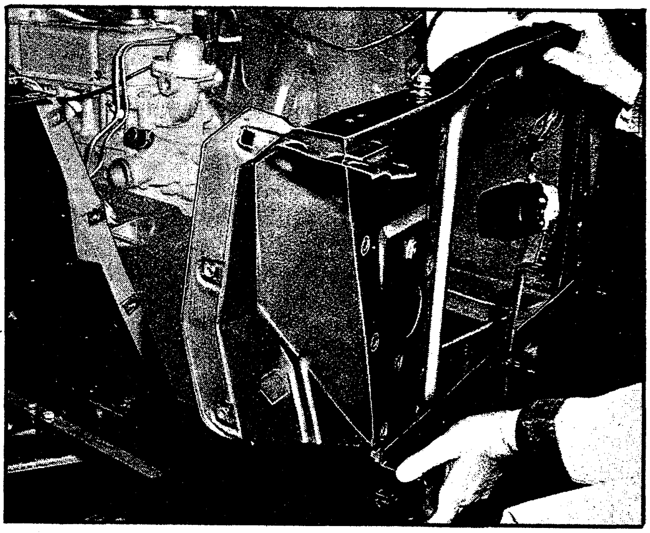

Fig. 23 - Removing Radiator Support from Vehicle

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 Fisher Body Manual. 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.

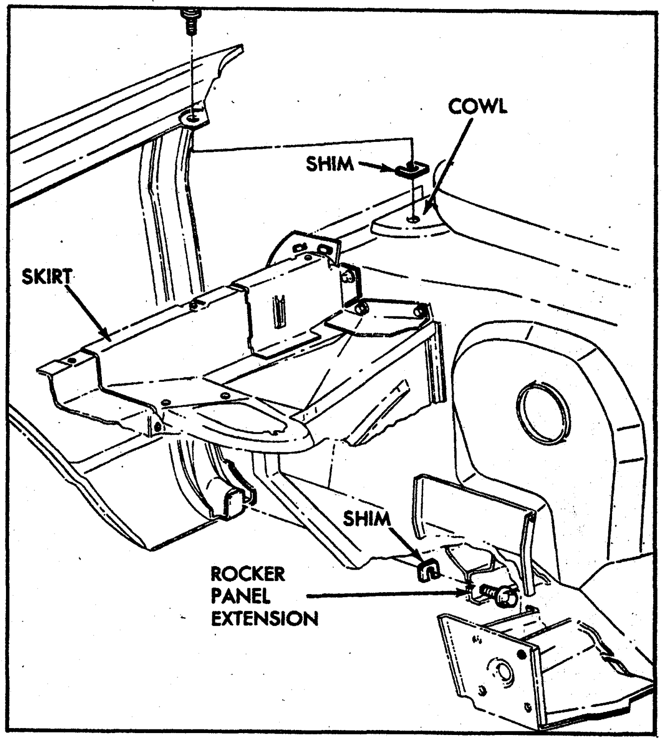

Fig. 24 - Fender Mounts

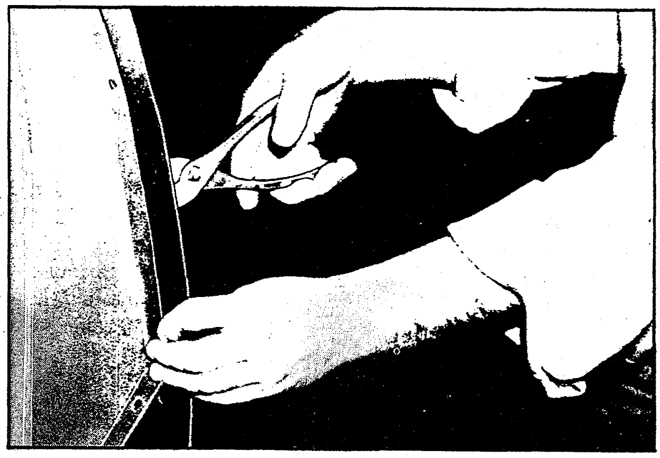

Fig. 25 - Replacing Fender Seal

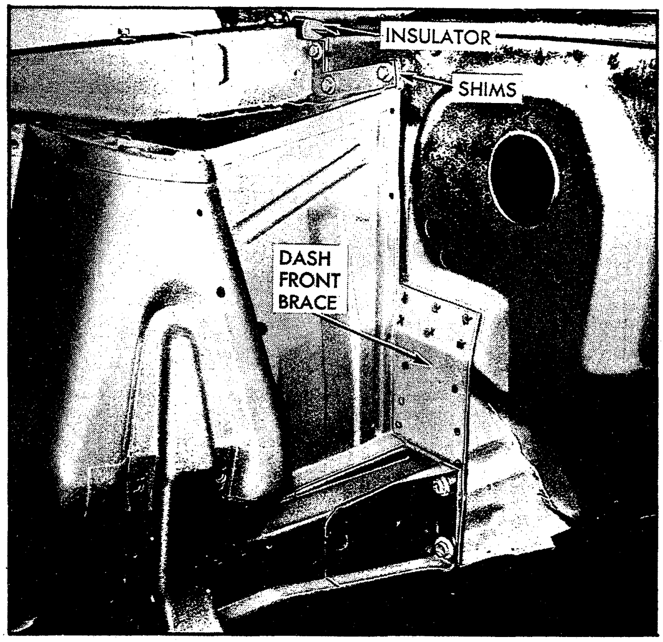

Fig. 26 - Skirt Mounting Bolts

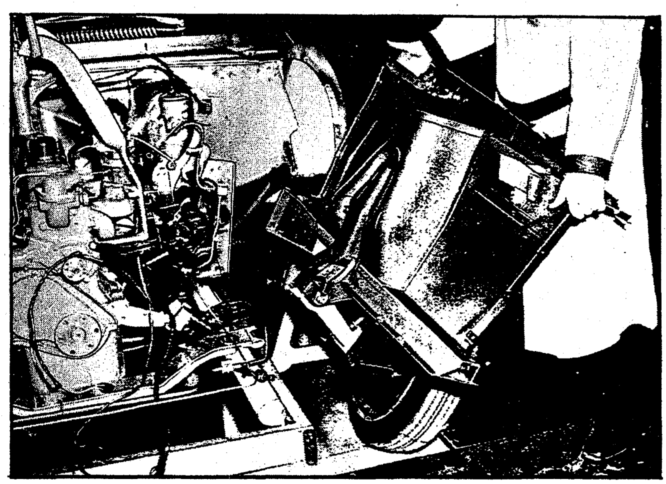

Fig. 27 - Removing Skirt Assembly

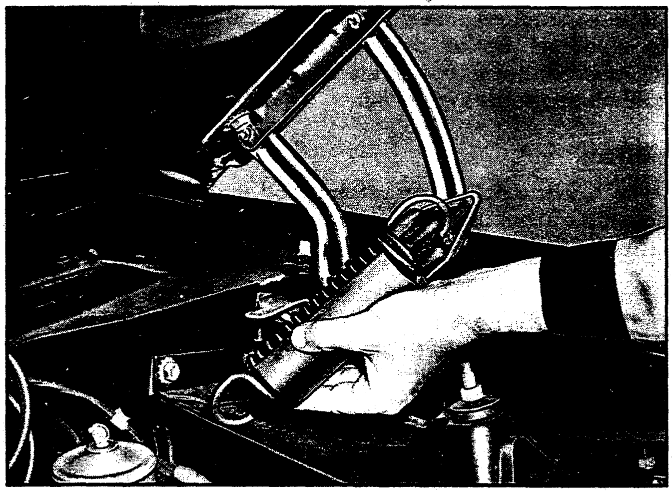

Fig. 28 - Hood Spring Removal

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 26, 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.

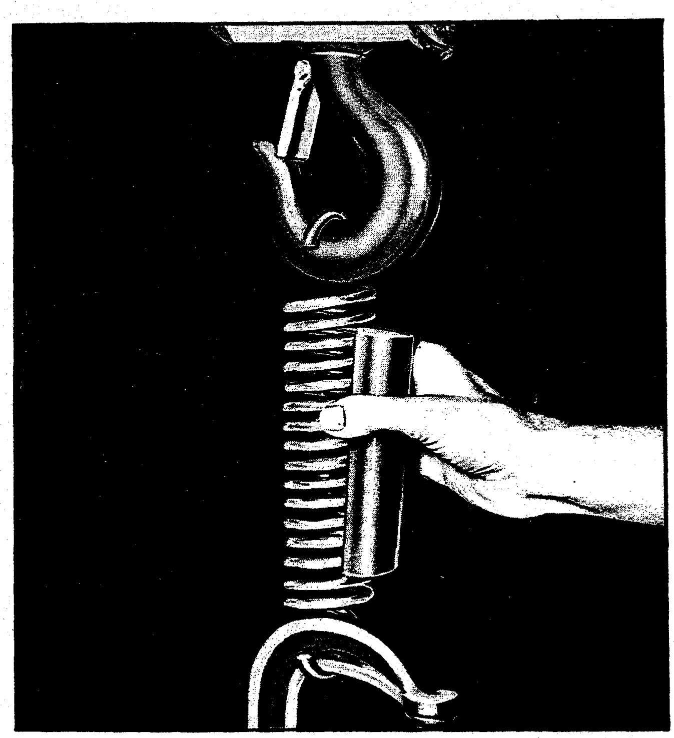

Fig. 29 - Installing Tool J-9559 in New Spring

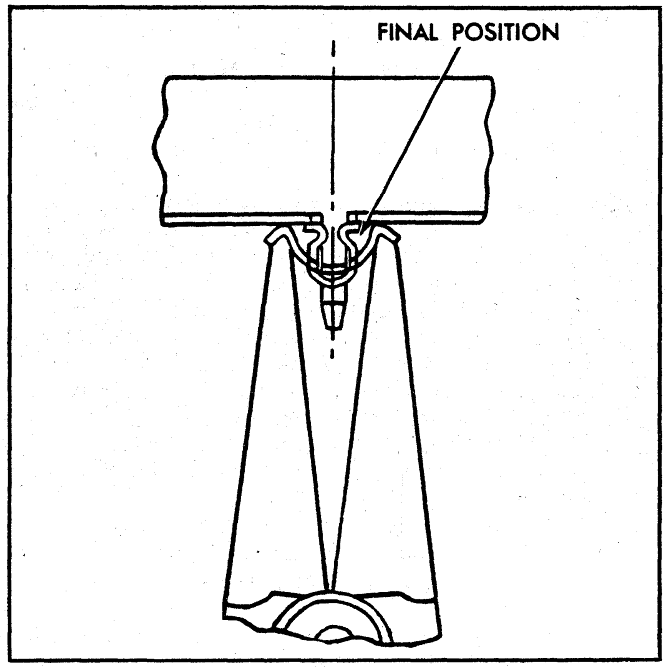

Fig. 30 - Installing Hood Molding Clip

6. Install radiator support and fender assembly as outlined in this section. Install grille (Section 13).
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 Fisher Body Service Manual.

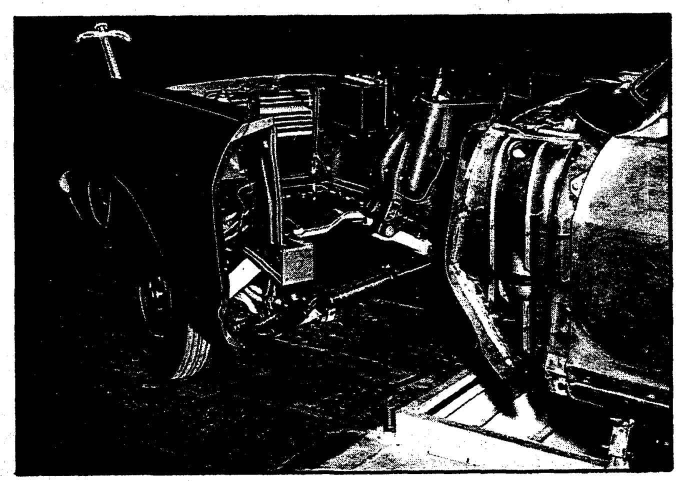

Fig. 31 - Removing Front End Assembly from Vehicle

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 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 28.
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 a hoist as shown in Figure 29.
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 (Fig. 19)

Removal

1. Remove catch assembly as follows:
   a. Remove screws retaining catch assembly to radiator support.
   b. Remove screws retaining catch assembly to catch support assembly.
   c. Remove screws retaining catch assembly to grille upper bar.
2. Before removing hood lock plate from hood, locate position on hood by scribing around base of lock plate. Remove 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.

HOOD TRIM

Crown Molding

Hood crown molding is retained by clips installed on underside of hood. Clips may be removed by carefully pressing them off molding mounting studs with screw driver.

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 30.

Emblem

The hood emblem is retained by four nuts which are accessible from under the hood.

COWL VENT GRILLE

The cowl vent grille replacement procedure for Chevy II is the same as for Chevrolet and Chevelle. Refer to Chevrolet and Chevelle Cowl Vent Grille replacement procedure and see Figure 16.

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 of sheet metal. 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 31 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 31.
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.
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 31.

Inspection

If car has been involved in a collision, it is advisable to carefully inspect cowl and dash area for damage. 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 Fisher Body Service Manual.

CAMARO

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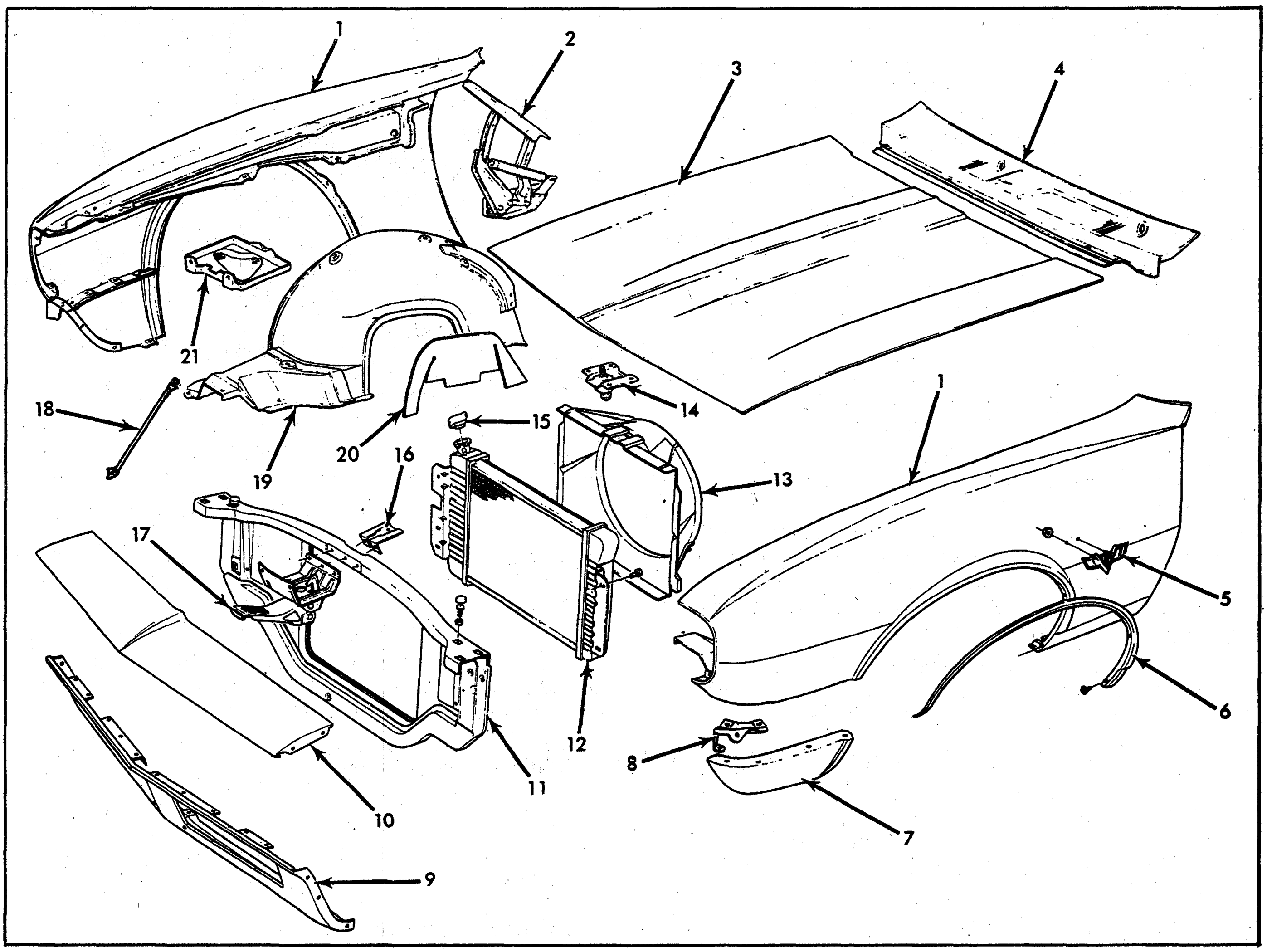


Fig. 32 - Front End Sheet Metal - Camaro

1. Fender
2. Hood Hinge
3. Hood
4. Cowl Vent Grille
5. Trim
6. Molding
7. Fender Extension
8. Bumper Bracket
9. Valance Panel
10. Header Panel
11. Radiator Support
12. Radiator
13. Shroud
14. Hood Lock
15. Radiator Cap
16. Bracket (V-8 Engine Only)
17. Hood Catch
18. Brace
19. Skirt
20. Seal
21. Battery Tray

GENERAL DESCRIPTION

The Camaro sheet metal components are much the same as other Chevrolet passenger models as shown in Figure 32. The front end design is such that servicing of the fenders and skirts is most efficiently performed by removing the fender and skirt as an assembly. Refer to Section 14 for bumper service procedures, Section 13 for radiator and grille, and Section 1A for air conditioning components.

MAINTENANCE AND ADJUSTMENTS

HOOD ADJUSTMENT

The Camaro hood is adjusted in the conventional manner, by adjustment of the hood bumpers and hinges. The two hood bumpers are located on each side at the top of the radiator support. Do not attempt hood latch adjustments until the hinges and bumpers are correctly adjusted. Latch adjustments are made so that effort required to open and close the hood is reasonable, and hood alignment obtained by hinge and bumper adjustment is maintained when the hood is closed. Note that the hood latch is not designed to correct basic hood misalignment.

HOOD HINGE (Fig. 33)

NOTE: 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.

1. Scribe a line around the entire hinge plate to be repositioned.
2. Loosen the appropriate screws and shift the position of the hood into correct alignment using the scribe marks to check amount of movement. Check alignment by tightening screws and closing the hood.

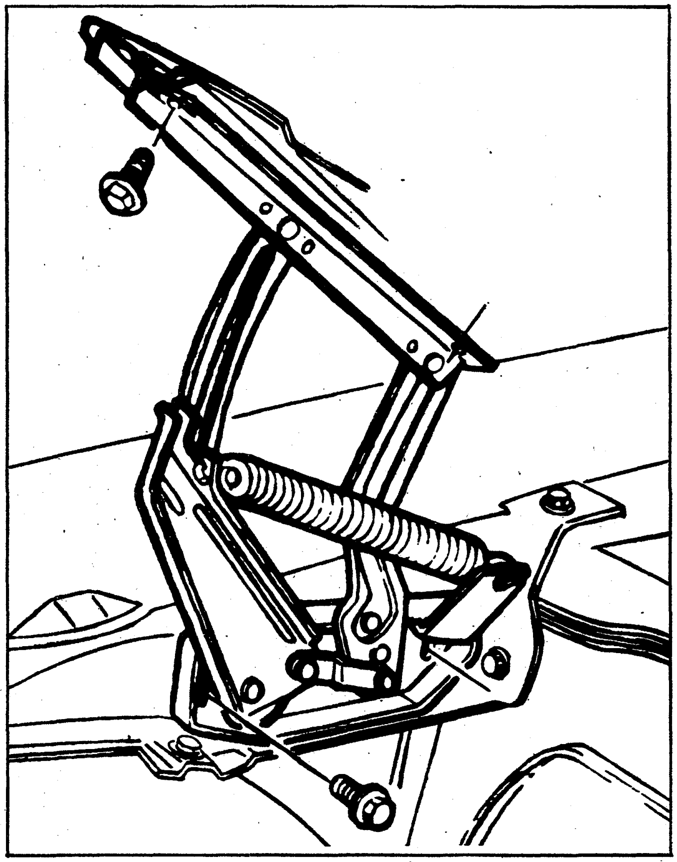


Fig. 33 - Hood Hinge - Camaro

HOOD BUMPERS

Adjust hood bumpers so that hood top surface is flush with fender and header panel top surfaces. See Figure 34 for correct sheet metal adjustment dimensions.

HOOD CATCH AND LOCK (Fig. 35)

Adjust hood lock bolt so that top surface of hood is flush with top surface of header panel. 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 effort required to release the hood catch is reasonable. Close the hood and insure catch engages securely.

FENDERS

Fenders are adjustable with shims at the cowl and rocker panel. To add or remove shims, loosen bolts at shim locations (fig. 36) and carefully apply force with pry bar to provide clearance for shim removal or installation.

SHEET METAL

For proper operation of doors and hood, and for presentable appearance, adjust front sheet metal to the dimensions shown in Figure 34.

COMPONENT PART REPLACEMENT

NOTE: When replacing sheet metal components on Camaro, note position and attachment of all seals and dust shielding and replace if necessary.

BATTERY TRAY

Removal

1. Disconnect battery cables and remove battery from vehicle.
2. Remove screws securing battery tray to fender skirt and radiator support.
3. Remove battery tray from vehicle.

Installation

Install battery tray following removal procedure in reverse order.

RADIATOR SUPPORT

Removal

1. Raise hood, disconnect battery cables, and remove battery.
2. Remove front bumper (Section 14).
3. Remove grille and related components (Section 13).
4. Disconnect horns, horn relay, voltage regulator,

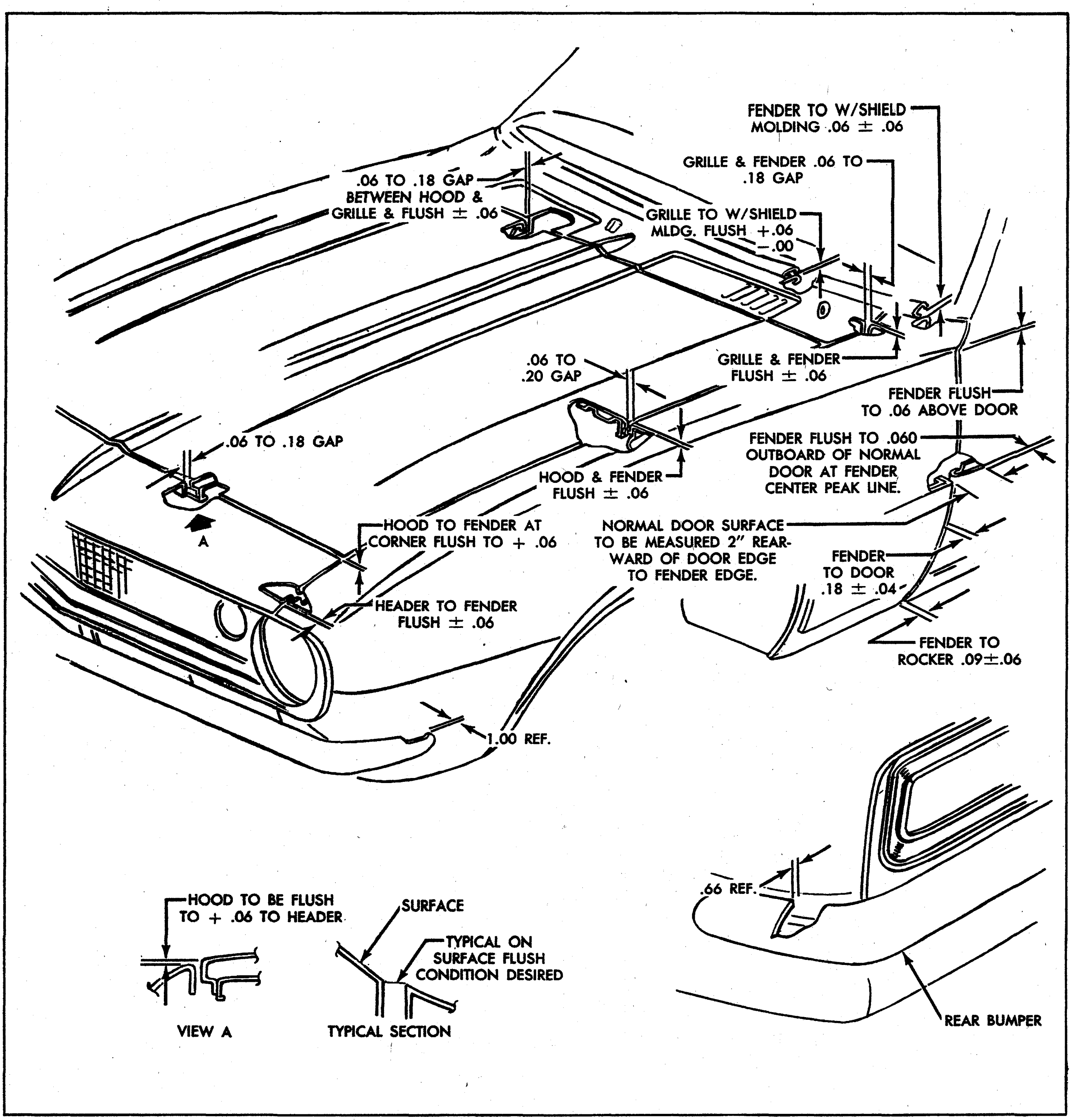


Fig. 34 - Sheet Metal Adjustments - Camaro

wiring harness, and washer bottle from radiator support.
5. Remove screw connecting battery tray to radiator support.
6. Remove shroud from vehicle if so equipped.
7. Remove shroud and radiator (Section 13).
8. Remove screws securing support to frame, skirts, and fenders.
9. Remove radiator support from vehicle.

Installation

Install radiator support following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values for radiator support, grille, and bumper.

FENDER AND SKIRT ASSEMBLY

Removal

1. Remove front bumper (Section 14).
2. Remove hood and hood hinges (two men).
3. Remove bolts securing brace to skirt and dash panel and remove brace (fig. 32).
4. Disconnect any components attached to fender and skirt such as cruise control, hoses, electrical harness etc.
5. Remove screws securing radiator support to fender and skirt.
6. Remove headlamp bezel and headlamp.
7. Remove screws securing fender and skirt assembly to header panel, headlamp housing and valance panel. Remove screw securing fender extension to valance panel.
8. Remove screws securing fender and skirt assembly to vehicle and remove fender and skirt assembly.
9. If necessary, remove screws attaching fender extension and bumper bracket to fender and remove extension and bracket. Replace fender trim if necessary.

Installation

Install fender and skirt assembly following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

HOOD ASSEMBLY

Procedures for hood removal and installation for Camaro are the same as for Chevrolet and Chevelle. Refer to Chevrolet and Chevelle hood removal and installation procedures, Figure 35 for Camaro hood catch, support, and lock plate, and Figure 37 for Camaro hood and insulator.

HOOD CATCH AND LOCK (Fig. 35)

Removal

1. Remove catch plate assembly by removing screws retaining catch to header panel, center support, and radiator support.

NOTE: Before removing hood lock plate from hood, locate position on hood by scribing around base of lock plate.

2. Remove lock plate by removing screws retaining lock plate to hood and remove lock plate.

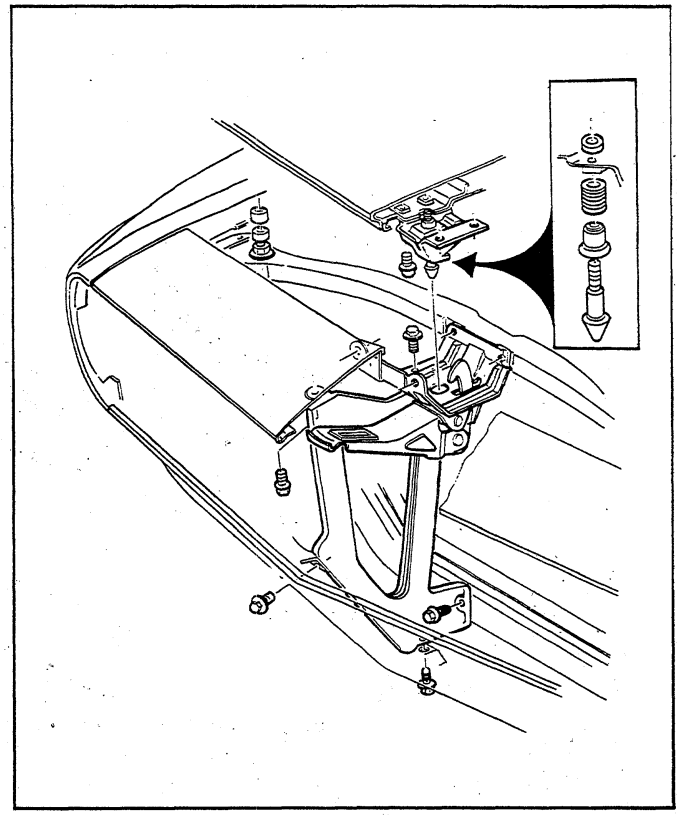


Fig. 35 - Hood Catch, Support, and Lock Plate - Camaro

Installation

Install lock and catch plate following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values. Adjust lock and catch plate as outlined under adjustment procedure in this section.

HOOD TRIM AND INSULATION (Fig. 37)

Figure 37 shows the installation details of the Camaro hood ornament and insulation pad. The insulation and ornament retainers and nuts are accessible from under the raised hood.

COWL VENT GRILLE

Procedures for Camaro cowl vent grille replacement are the same as for Chevrolet and Chevelle. Refer to Chevrolet and Chevelle cowl vent grille replacement.

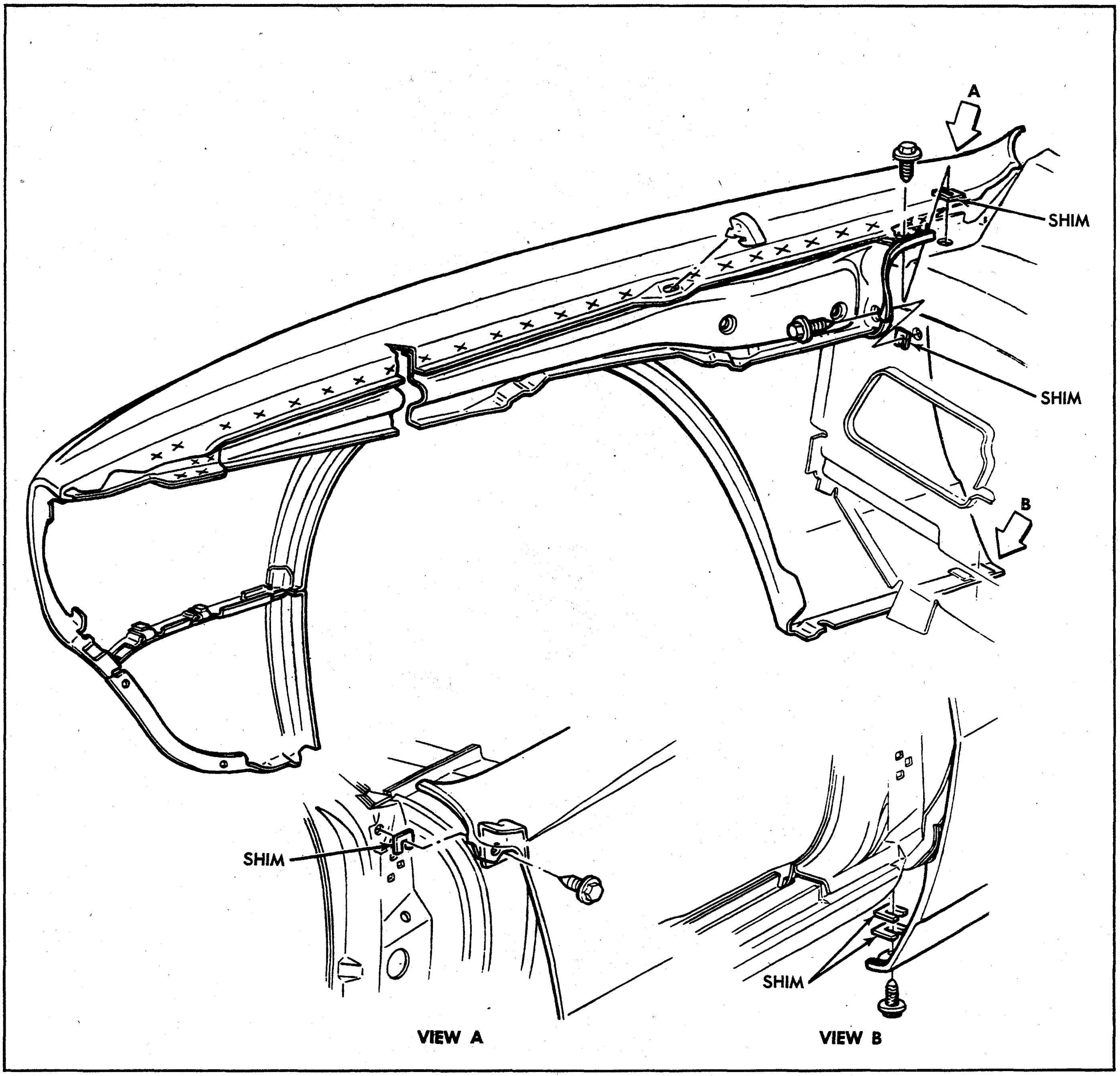


Fig. 36 - Fender to Cowl and Rocker Panel Shimming - Camaro

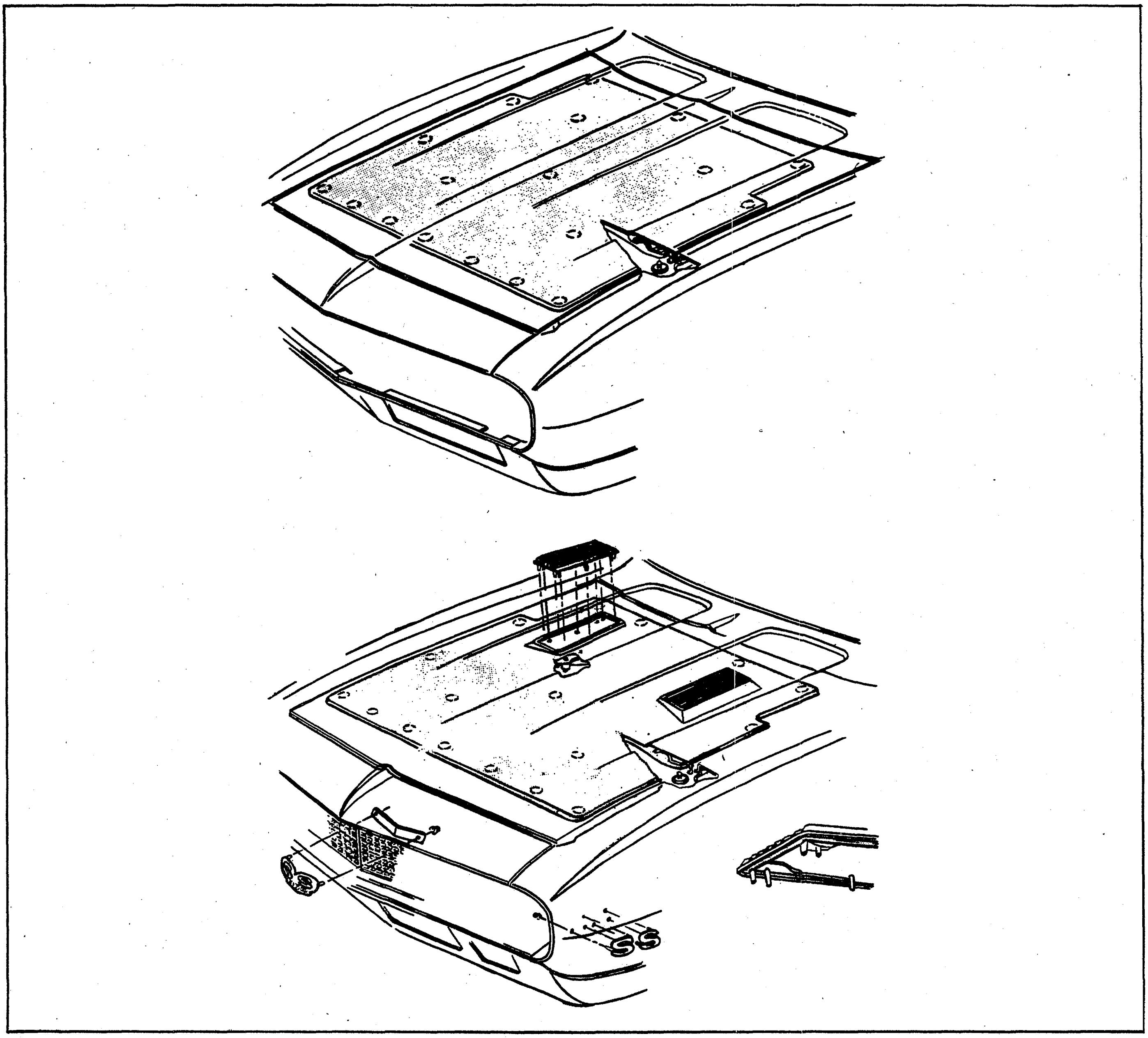


Fig. 37 - Camaro Hood, Insulator, and Ornament

SPECIAL TOOLS

The only special tool required for 1967 chassis sheet metal servicing is the hood spring removal and installation Tool J-9559. See Figure 38.

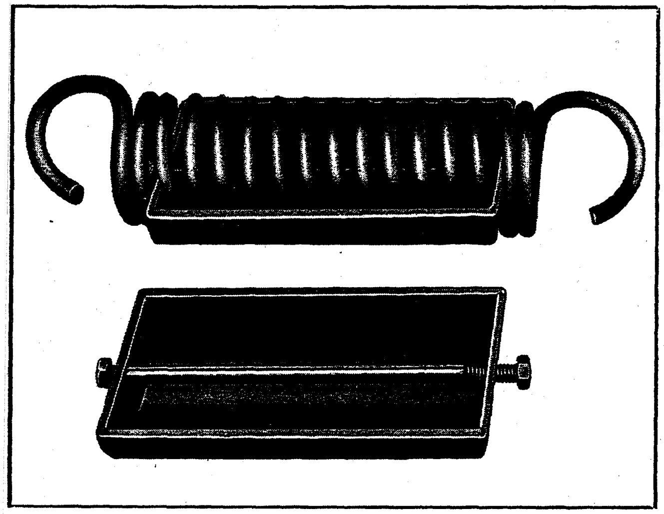


Fig. 38 - Special Tools - All Models - Hood Spring Tool J-9559

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, dimmer, and backing lamp switches, headlamps, parking lamps, stop, tail and directional 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 the appropriate circuits (fig. 1).

Chevrolet and Chevelle headlamp installation is all new in that the headlamps are located in the radiator support with adjusting screws and springs. Eliminating the need for having separate headlamp housings. Chevrolet and Chevelle headlamp retainers and springs are interchangeable.

Chevy II headlamp housings are new because of revised front end styling and Corvette front end lighting is basically carryover.

Front fender lamps have been added as an option for Chevrolet models and as standard equipment on Caprice series.

Camaro models use single headlamps and the Rally Sport model headlamps are covered by a retractable section of the grille when lamps are not used. The section of the grille covering the headlamps folds back when lights are required; the headlamps are stationary. The covering is retracted by a small electric motor mounted to the headlamp housing. The headlamps are automatically uncovered when the headlight switch is pulled "ON" for illumination. If at any time the electrical circuit becomes inoperative, the lamps can be uncovered manually. The ignition switch must be "ON" in order to close the headlamp doors.

Parking lamp for Chevelle and Chevrolet models are new due to revised front end sheet metal and bumper styling. Parking lamps are located in the bumper on Chevrolet, Chevelle and Chevy II models

Camaro parking lamps are located in the radiator grille except for the Rally Sport models on which the parking lamps are in the valance panel. For styling reasons, the lens is white and an amber glass bulb is used. All Camaro parking lamps require a separate ground wire to assure a good ground contact because of the plastic grille and painted contact surfaces.

The Chevrolet tail, stop, and directional lamps are in one housing with a three section lens design on Impala and Caprice sedans. The center lens for Impala series is the back-up lamp. The center lens on the Caprice is a tail lamp with the back-up lamps being located in the rear bumper. Chevrolet station wagons have three individual housings with three lenses, the center lamp being the back-up. Biscayne and Bel-Air sedans have a single housing and lens for tail, stop, and directional lamp with a similarly constructed back-up lamp inboard and adjacent to it.

Chevelle tail, stop, and directional lamps are a single lens design that follows through with the rear fender styling. The back-up lamp is located in rear bumper.

Camaro models except Rally Sport have tail lamps with integral back-up lamps mounted inboard of the rear fenders between the trunk opening and bumper. The Rally Sport model has dual tail lamps in the rear housing and valance mounted back-up lamps.

Corvette, Chevy II, and Corvair tail and directional signal lights are carryover. The Corvette has new back-up lamps center mounted above the license plate opening.

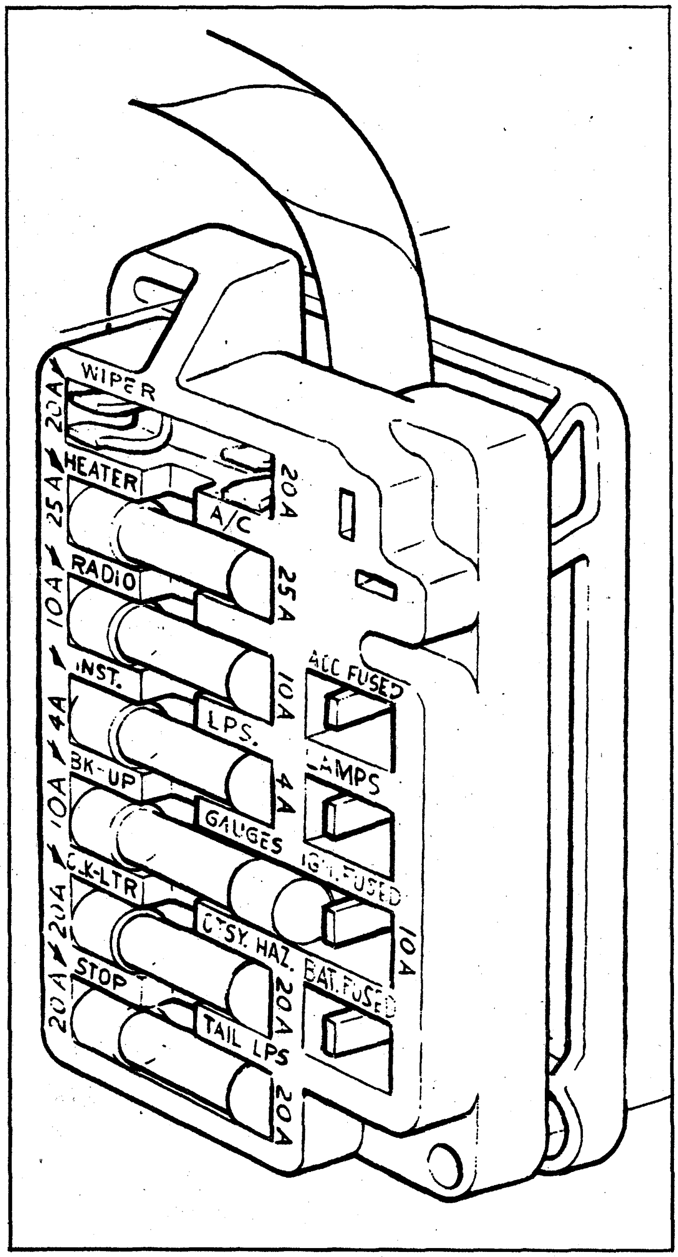


Fig. 1 - Fuse Panel Assembly

All power window and tailgate circuits require the ignition switch to be "ON" to open or close the windows unlike past model designs which were operated independently of the ignition switch.

The windshield wiper and washer switch is new in that washer button in the center of the knob has been deleted and its function will be accomplished by pushing the knob. A set screw is used to retain the knob to the shaft.

In addition to fuses, the wiring harness incorporates fusible links to protect the wiring. Links are used rather than a fuse in wiring circuits that are not normally fused, such as the ignition circuit. Fusible links in the Chevrolet wiring are four gauge sizes smaller than the cable it is designed to protect. The links are marked on the insulation with wire gauge size because of the heavy insulation which makes the link appear a heavier gauge than it actually is.

Engine compartment wiring harness incorporate several fusible links. Each link is identified with its gauge size. A fusible link is a length of special wire (normally four wire gauges smaller than the circuit it is protecting) used in wiring circuits that are not normally fused, such as the ignition circuit. The same size wire with a special hypalon insulation must be used when replacing a fusible link.

The links are:

1. The pigtail lead at the battery positive cable (except Corvette) is a 14 gauge, brown fusible link protecting the 10 gauge battery charging circuit. This wire is an integral part of the battery cable assembly and servicing requires replacing the complete battery cable assembly. On Corvette models this link is installed as a molded splice at the solenoid "Bat" terminal and servicing requires splicing in a new link.
2. A 16 gauge black fusible link is located at horn relay to protect all unfused wiring of 12 gauge or larger. It is a serviceable piece with an in-line connector and is not integral with the wiring harness.
3. The generator warning light and field circuitry (16 gauge wire) is protected by a fusible link (20 gauge orange wire) used in the "battery feed to voltage regulator #3 terminal" wire. The link is installed as a molded splice in the generator and forward lamp harness and is serviced by splicing in a new 20 gauge wire as required.
4. The ammeter circuit on all models is protected by two orange, 20 gauge wire fusible links installed as molded splices in the circuit at the junction block or the solenoid "Bat" terminal (Corvette only) and at the horn relay. Each link is serviced by splicing in a new 20 gauge wire as required.

The wiring harnesses use a standarized color code common to all Chevrolet vehicles. Under the color code, the color of the wire designates a particular circuit. The harness title indicates the type of harness, single or multiple wire, and also describe the location of the harness. The body harness is a flat, solid wire assembly and is routed through the vehicle near the center of the body. Composite wiring diagrams (figs. 104 thru 124) are included at the end of this section.

MAINTENANCE AND ADJUSTMENTS

Maintenance of the lighting units and wiring system consists of an occasional check to see that all wiring connections are tight and clean, that the lighting units are tightly mounted to provide good ground and that the headlamps are properly adjusted. Loose or corroded connections may cause a discharged battery, difficult starting, dim lights, and possible damage to generator and regulator. Wire harnesses must be replaced if insulation becomes burned, cracked, or deteriorated. Whenever it is necessary to splice a wire or repair one that is broken, always use solder to bond the splice. Always use rosin flux solder on electrical connections. Use insulating tape to cover all splices or bare wires.

When replacing wires, it is important that the correct size be used. Never replace a wire with one of a smaller size.

Each harness and wire must be held securely in place by clips or other holding devices to prevent chafing or

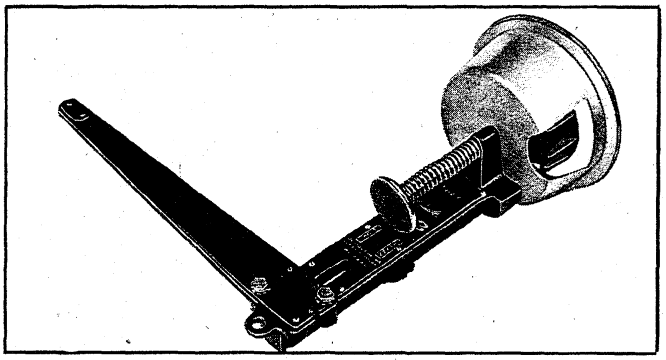


Fig. 2 - T-3 Safety Aimer

wearing away the insulation due to vibration.

By referring to the wiring diagrams, circuits may be tested for continuous circuit or shorts with a conventional test lamp or low reading volt meter.

HEADLAMP ADJUSTMENT—T-3 HEADLAMPS

CAUTION: Check and tighten radiator support grille retaining bolts prior to attempting headlamp aiming. Distorted grille or supports in this area will hinder proper aiming of headlamps. On Corvette models make sure headlamp panel is adjusted properly - refer to "Headlamp Panel Travel Adjustment".

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.

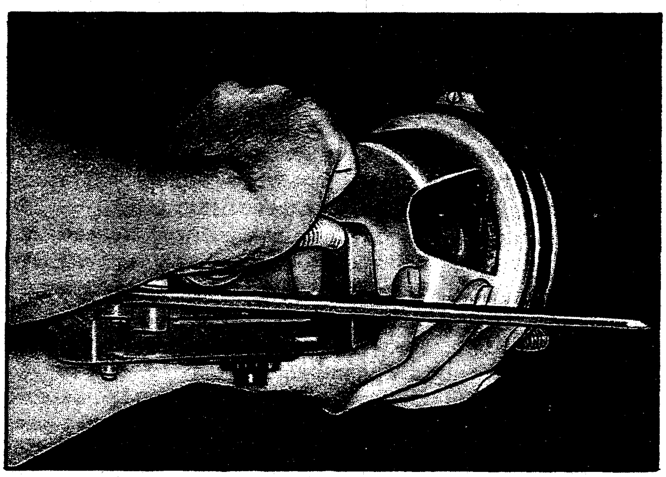


Fig. 3 - Installing Aimer on Headlamp Unit

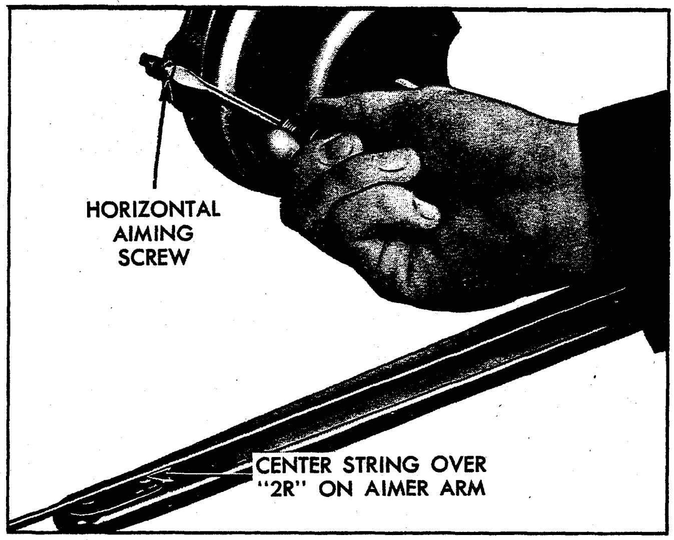


Fig. 4—Headlamp Horizontal Adjustment

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.

   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-

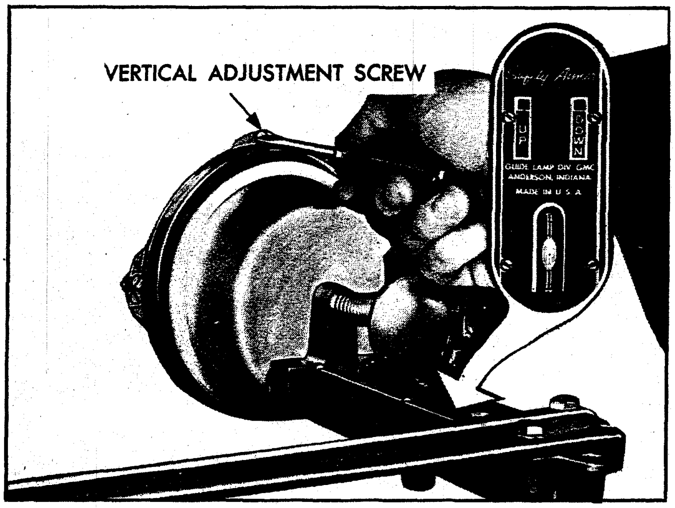


Fig. 5 - Headlamp Vertical Adjustment

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.
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 smoooth 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 adjustment 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.

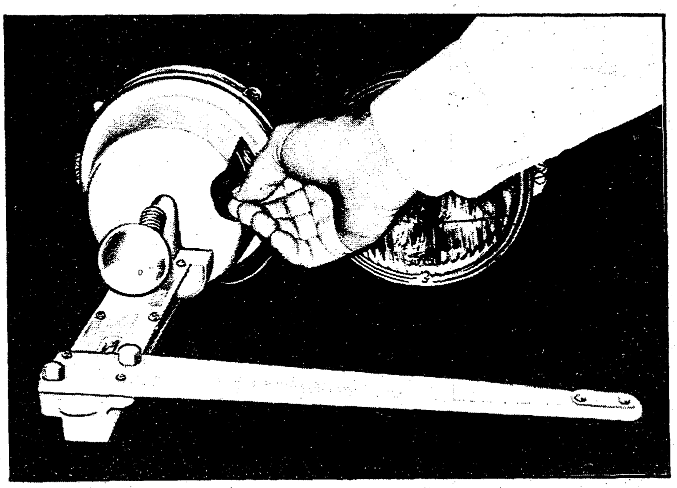


Fig. 6 - Removing Aimer from Headlamp

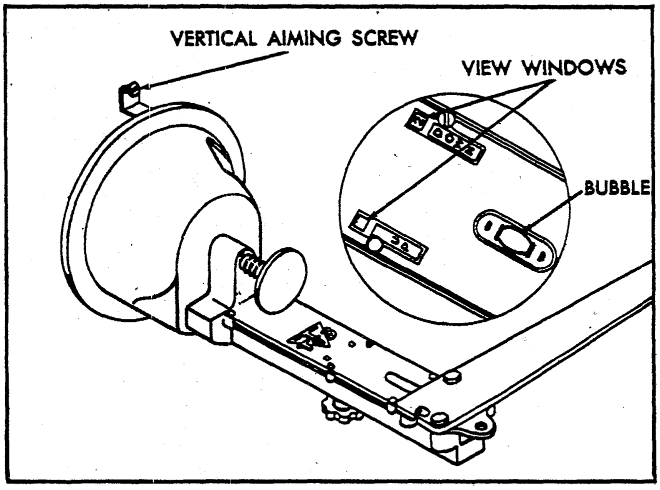


Fig. 7 - Selecting Level Aiming Area

4. After both bubbles are centered, turn the car around end for end, making sure the tires are in the spots made on the floor before the car was moved.
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 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 other vehicles can be located in the same position.

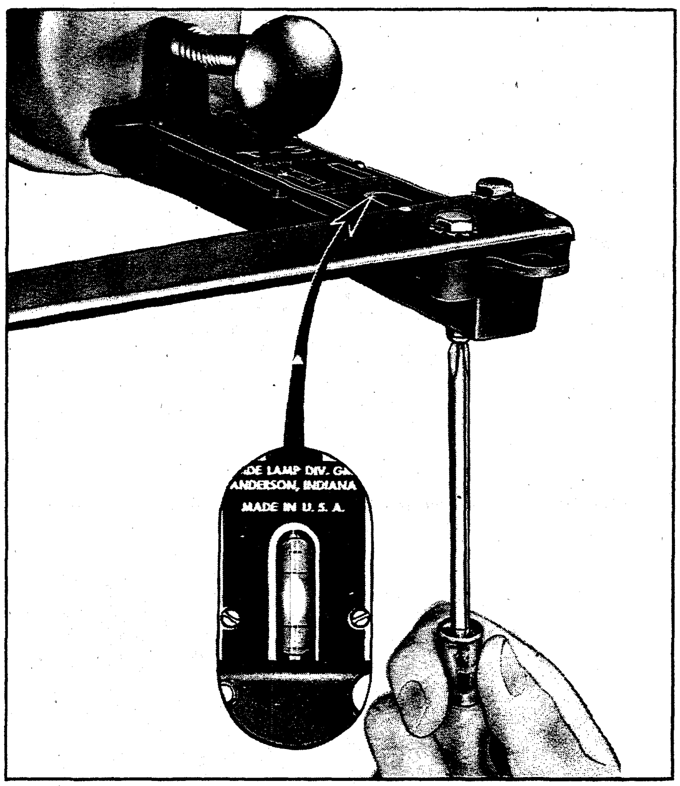


Fig. 8—Turning Level Adjusting Screw to Calibrate Aimer

HEADLAMP PANEL TRAVEL ADJUSTMENT

Corvette (Fig. 9)

The headlamp panel travel is limited by two adjusting screws which are located on the arms of the shaft mounted stop.

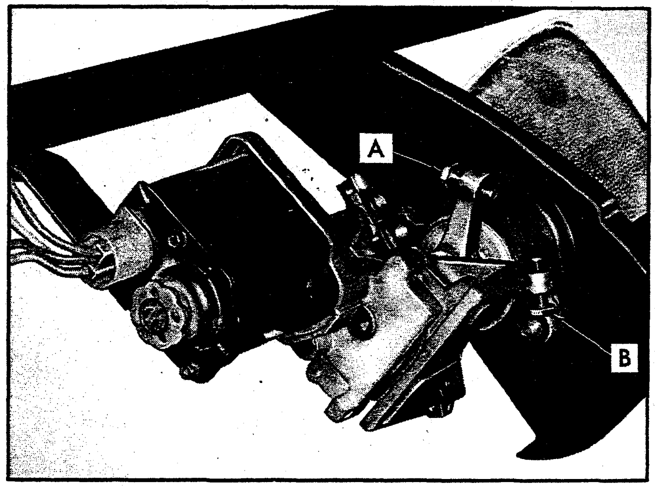


Fig. 9—Headlamp Panel Travel Adjusting Screw

1. Raise hood and as a safety precaution install a bolt through the hole in the hood support - secure bolt with a nut.
2. Adjusting screw (A) limits headlamp panel travel in open position - adjust this screw so that mounting face of panel is within 2 degrees of vertical in the fully open position.

   NOTE: Each headlamp operates independently of the other, therefore individual adjustment is required for each panel.

3. Adjusting screw (B) limits headlamp panel travel in closed position - adjust this screw so that panel is flush to upper body panel in the fully closed position.
4. Lock both screws by tightening lock nut against stop.
5. Remove safety bolt as installed in Step 1 and close the hood.

SERVICE OPERATIONS

FRONT LIGHTING

HEADLAMP REPLACEMENT (Figs. 10 and 13)

1. On Corvette and Camaro Rally Sport models, rotate the headlamp panel to the open position.
2. Remove headlamp bezel retaining screws and remove bezel. On Chevrolet, Chevelle and Camaro models lift bezel to disengage retaining tabs from slots in filler panel.
3. On Chevy II models remove three retaining ring attaching screws. On other models disengage spring from the retaining ring and remove two attaching screws.
4. Remove retaining ring, disconnect sealed beam unit at wiring connector and remove the unit.
5. Attach connector to replacement unit and position unit in place making sure the number molded into the lens face is at the top.

   NOTE: In the dual headlamp installation the inboard unit (NO. 1) takes a double connector, the outboard unit (No. 2) takes a triple connector plug.

6. Position retaining ring into place and install the retaining ring attaching screws and spring (as applicable).
7. Check operation of unit and install the headlamp bezel.

PARKING LAMP REPLACEMENT

Bulb

1. Remove two lens retaining screws and disengage lens from housing.
2. Replace bulb, check operation of lamp, reinstall lens and retaining screws.

Lamp Housing

Chevrolet, Chevelle and Chevy II (Figs. 10 and 11)

1. Disconnect lamp wire assembly in-line connector from wiring harness.

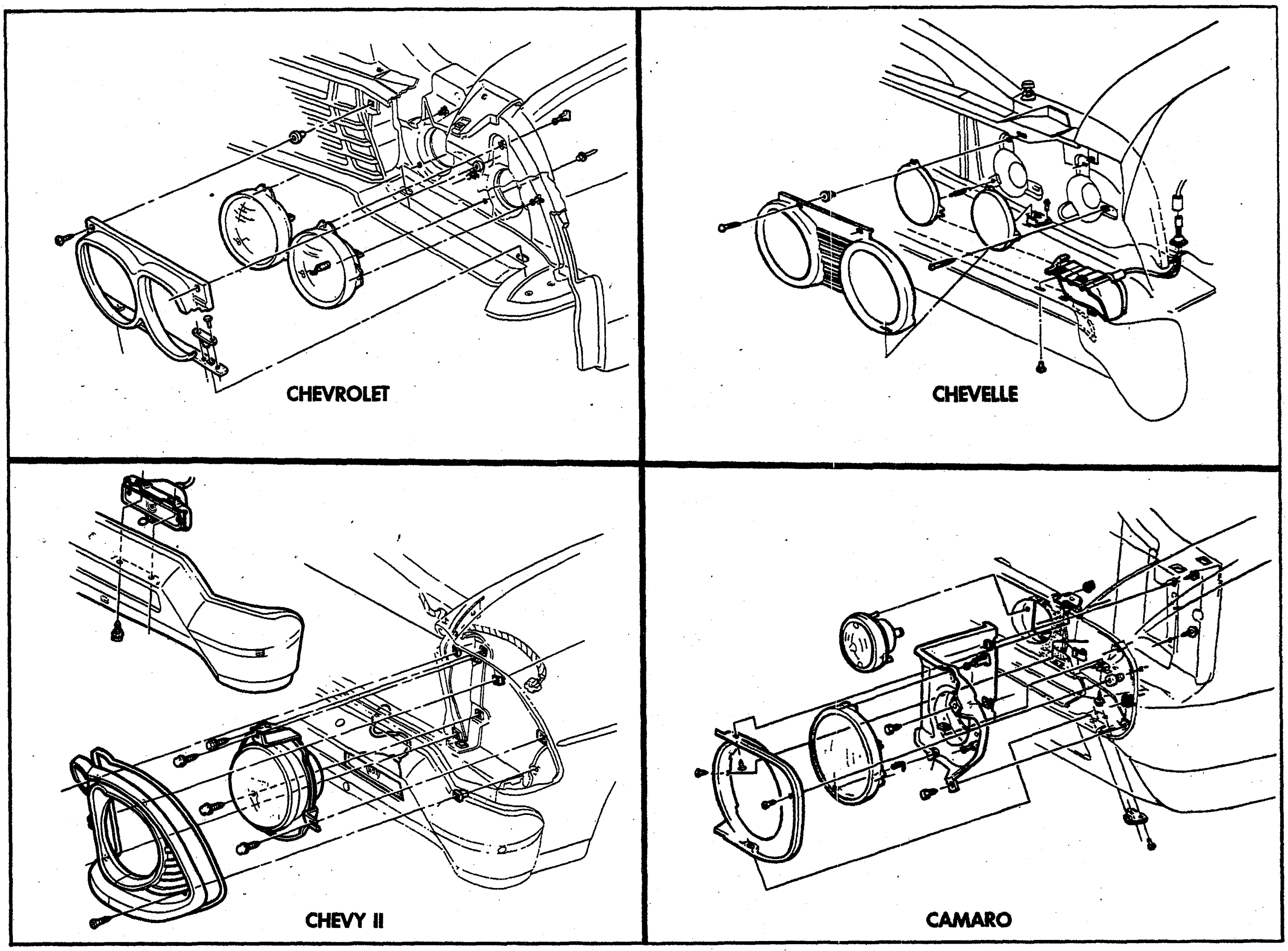


Fig. 10 - Headlamp Assemblies (Exc. Corvette)

2. Remove two bolts retaining housing assembly in bumper and remove housing.
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.
5. Position lamp assembly in place and install retaining bolts.

Camaro (Fig. 10)

1. Raise hood.
2. Disconnect wiring harness at rear of lamp socket.
3. Remove attaching nut and disconnect ground wire at sheet metal connection.
4. Remove retaining nuts and housing from grille opening.
5. Transfer lens and bulb to new unit.
6. To install, position lamp housing to grille opening and install retaining nuts.
7. Connect ground wire to attaching point and install retaining nut.
8. Connect wiring harness to lamp socket and check operation of lamp.

Corvette (Fig. 12)

1. Raise hood and disconnect harness connector from lamp unit skirt-mounted connector; then remove lamp unit connector from underside of skirt.
2. Working at the forward portion of the wheel well, remove the two lamp assembly retaining nuts and remove the lamp assembly and support from the vehicle.
3. Route the lamp assembly lead wires through fender cutout and position support over lead wires.
4. Position lamp unit studs through support and install retaining nuts, making sure that the studs are horizontal.
5. Connect harness to lamp unit skirt-mounted connector and close vehicle hood.

FENDER LAMP SERVICE (Fig. 11)

Chevrolet 16600 Models

1. Disconnect parking lamp wiring from forward harness connector.

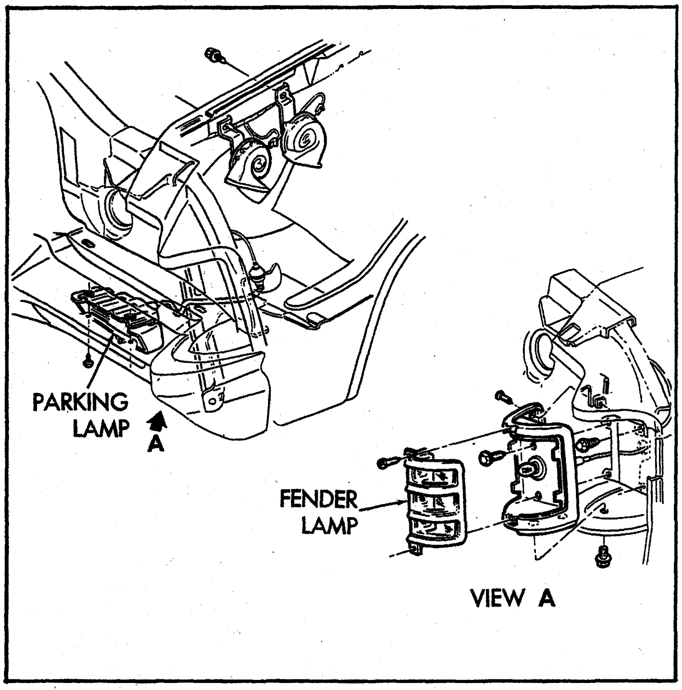


Fig. 11 - Parking and Fender Lamps (Chevrolet)

2. Remove two screws retaining lens housing to the lamp assembly and remove lens unit.
3. Replace bulb, lens or housing as required and position assembly to fender opening. Make sure wiring

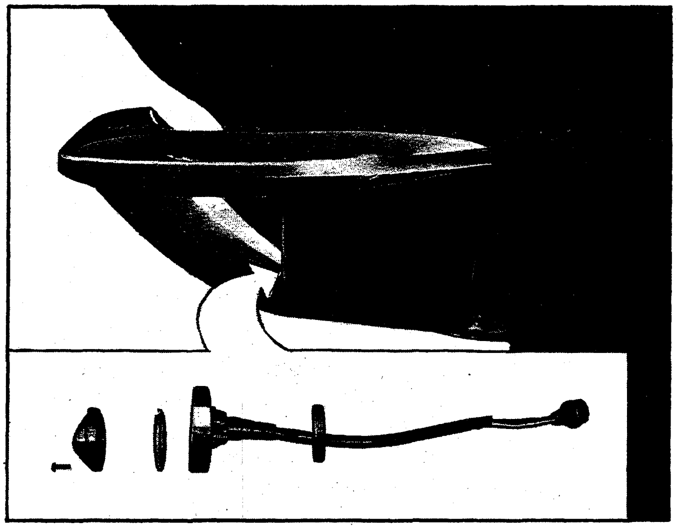


Fig. 12 - Parking Lamp Installation (Corvette)

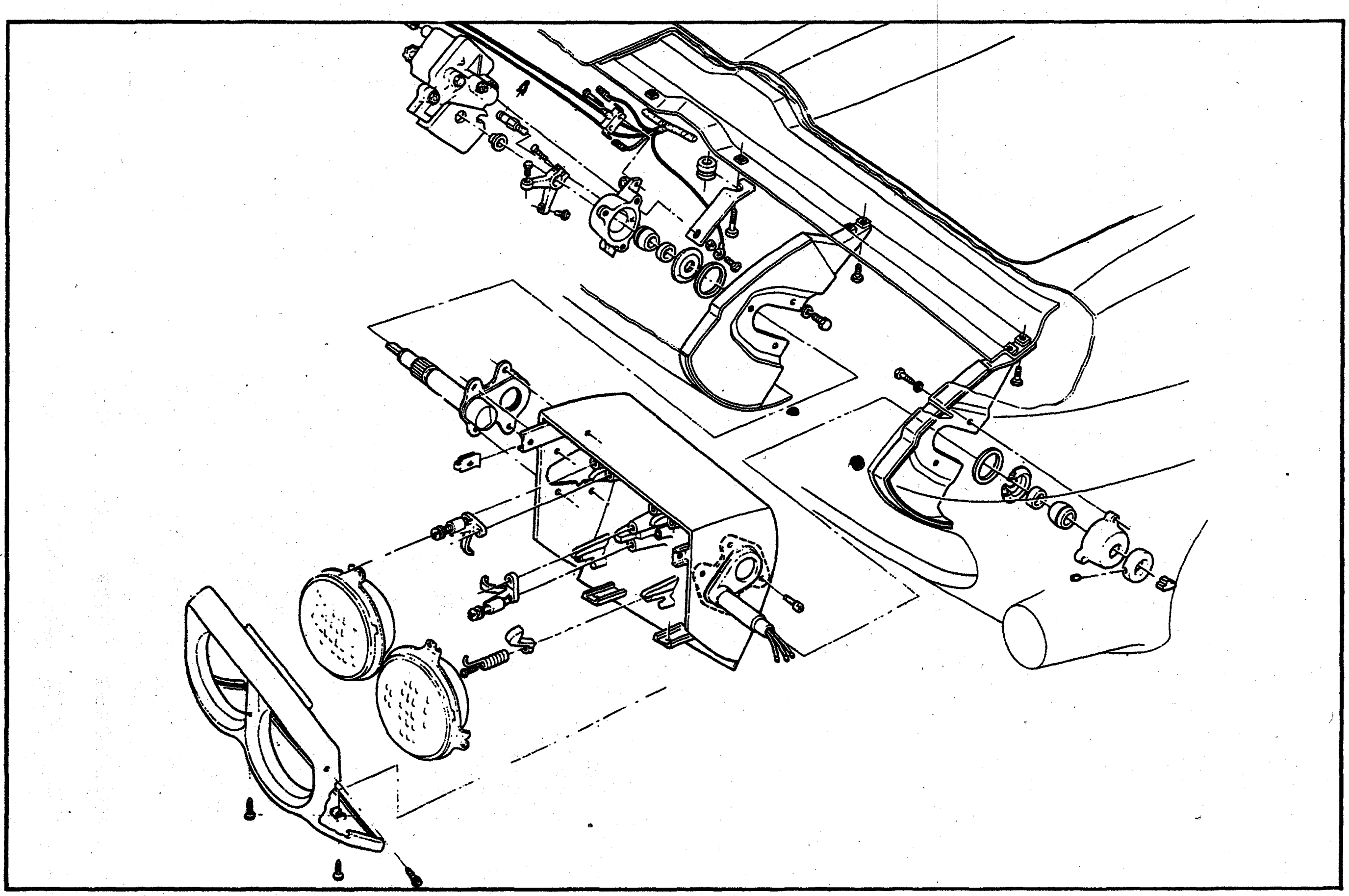


Fig. 13 - Headlamp Panel and Motor Details (Corvette)

is inserted through radiator support opening.
4. Remove two screws retaining lamp assembly to lower sheet metal.
5. Remove three screws retaining lamp assembly to fender.
6. To replace lamp assembly, reverse removal procedure and check operation of the unit.

HEADLAMP PANEL REPLACEMENT—CORVETTE

Refer to Figure 13 for Panel Mounting details.
1. Remove engine compartment hood as outlined in Section 1.
2. Actuate headlamp panel to the open position.

NOTE: In the event headlamp motor is inoperative, manual positioning of the panel can be accomplished by turning the knurled knob at inboard end of motor. As an assist in manual operation of panel, apply light hand pressure to panel in desired direction of rotation.

3. Remove positive lead from battery terminal.
4. Remove headlamp bezel retaining screws and bezel.
5. Remove the sealed beam housing unit as an assembly - disconnect sealed beam leads at harness connector and remove connector from sealed beam leads; remove the housing-to-panel retaining screws and remove housing unit and wiring from panel.
6. Remove motor from panel pivot shaft - see motor removal procedure. Then remove the panel stop from panel inboard pivot shaft, and disconnect switch lead wires from panel, support-mounted motor switch.
7. Remove the panel retaining bolt access hole plugs from inside the panel then rotate panel as required and remove the retaining bolts and slide supports from ends of panel pivot shaft. Remove bearing, felt seal, retainer and washer from inboard pivot shaft.
8. Remove panel from its location by alternately disengaging pivots from their retaining slots and withdrawing unit forward through opening in body (fig. 14).
9. Loosen allen screw in spacer and disassemble parts from the panel outboard pivot shaft.
10. Install washer, retainer, felt seal, bearing and spacer, in that order, to panel outboard pivot shaft. Do not tighten spacer on shaft at this time.
11. Position panel in body opening and index panel pivot shafts in retaining slots; then loosely install support retaining bolts.
12. Install washer, retainer, felt seal, bearing and support, in that order, to panel inboard pivot shaft, and loosely install support retaining bolts.
13. Check side-to-side alignment of panel, making sure that there is no panel-to-body contact; position spacer snugly against bearing; then tighten spacer seat screw to 30-50 in. lbs.
14. Install stop on panel inboard shaft so that it rests against bearing, being sure that index mark on stop is aligned with flat on pivot shaft. Install stop lock bolt and torque bolt to 45-60 in. lbs. Make sure that side-to-side panel alignment is not changed when installing and tightening the stop.

CAUTION: Do not exceed specified torque when tightening stop lock bolt.

15. Check and align panel to body as follows:
    a. Tighten panel pivot support bolts snugly but still allowing panel to be moved by applying hand pressure.
    b. Position panel to the closed position and align with body so that all surfaces are flush.
    c. With the panel in the closed position the outboard access hole is aligned with the forward bolt head. Tighten this bolt with the panel in the closed position - access to bolt head can be obtained by working through opening between the hood and body.
    d. Rotate panel to obtain access to each bolt head and torque bolts to 100-140 in. lbs.
    e. Connect switch lead wires to support-mounted limit switch.
16. Install sealed beam housing unit and at the same time position sealed beam lead wires through panel outboard pivot shaft. Install housing unit retaining screws and install lead wires in connector, making sure to match colors between harness and connector.
17. Install motor assembly - see motor replacement procedure.
18. Connect positive lead to battery terminal.
19. Adjust headlamp panel as outlined under "Headlamp Panel Travel Adjustment".
20. Adjust headlamp aiming as outlined under "Headlamp Adjustment".
21. Install headlamp bezel and engine compartment hood - refer to Section 1 for hood installation.

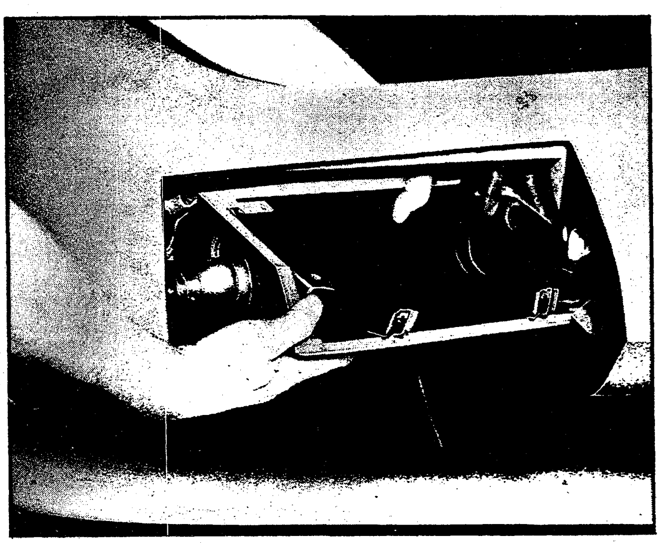


Fig. 14 - Headlamp Panel Removal (Corvette)

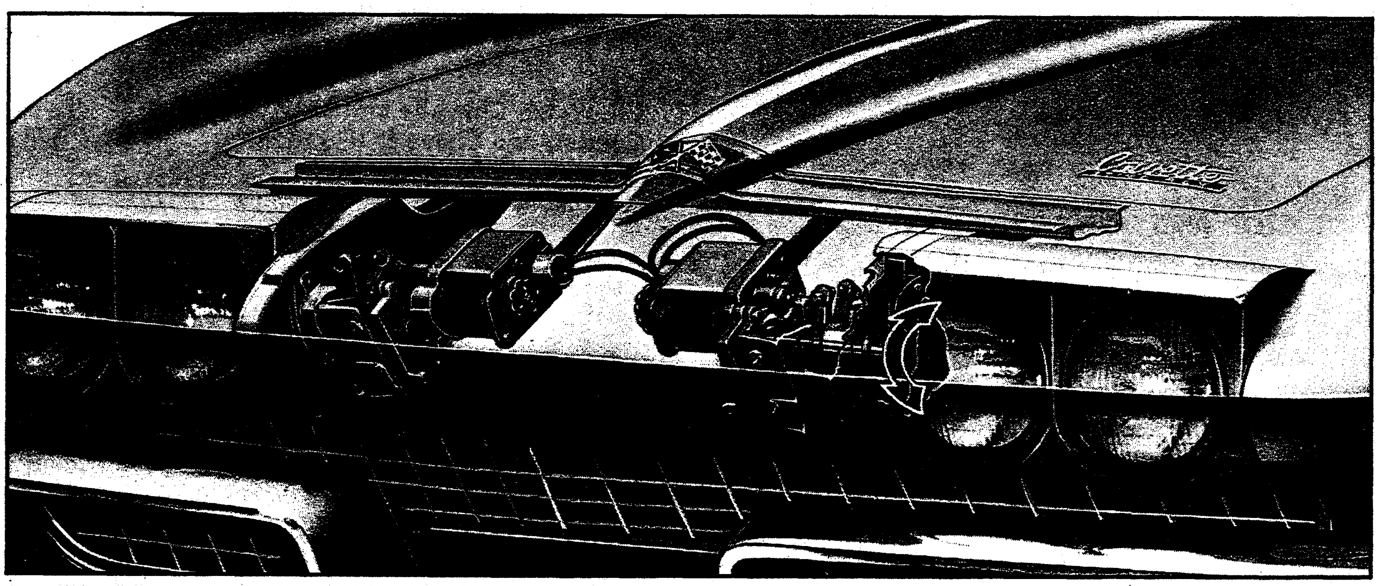


Fig. 15 - Headlamp Panel Actuating Motor Mounting (Corvette).

HEADLAMP PANEL MOTOR—CORVETTE (Fig. 15)

Removal

1. Raise hood and as a safety precaution install a bolt through the hole in the hood support - secure bolt with a nut.
2. Remove positive lead from battery terminal.
3. Disconnect motor lead wire and position it out of the way.
4. Turn the knurled knob at inboard end of motor until the gear seems to turn freely - turn the knob in one direction until a definite drag is experienced, then rotate knob approximately six complete turns in the opposite direction.

NOTE: The above step is necessary to produce a no-load condition on the drive gear and to permit separation of motor from the panel pivot shaft.

5. Remove the retainer from groove in motor locating stud then remove the motor-to-support retaining screw and remove motor assembly from the vehicle.

Installation

1. Rotate motor and headlamp panel as required to align slot in motor with headlamp panel pivot shaft, and install motor on shaft so that the bracket is aligned with the locating stud.

NOTE: It may be necessary to turn knurled knob on end of motor to permit alignment of motor with shaft.

2. Slide motor onto shaft until it seats against shaft shoulder; then install retainer in groove on locating stud.
3. Install motor-to-support retaining screw making sure ground wire is installed between screw head and bracket.
4. Connect motor lead wires, making sure that contacts are clean and that connection is secure.
5. Connect positive lead battery terminal, remove bolt from hood support, close hood and check operation of headlamp panel.

HEADLAMP MOTOR REPLACEMENT—CAMARO (Fig. 16)

1. Disconnect battery ground cable and when working on right headlamp unit, remove battery from vehicle to gain access to housing retaining bolts.
2. Remove bezel retaining screws and bezel.
3. Remove headlamp cover retaining screws and cover from door assembly.
4. Manually open door assembly (push door toward center of vehicle) and disconnect limit switch connections.
5. Remove four screws retaining assembly to radiator support (note location and number of shims, if any).
6. Rotate assembly toward center of vehicle until rear of unit is exposed, then disconnect wiring connectors at headlamp and motor assemblies.
7. Rotate assembly until headlamp is facing downward and carefully remove the assembly from the vehicle opening.
8. Remove nut attaching motor assembly to pivot arm.
9. Remove two nuts and bolts retaining motor assembly to base plate and remove motor assembly.

10. To install, replace motor assembly, and reverse removal procedure.

REAR LIGHTING SERVICE

TAIL, STOP AND DIRECTIONAL LAMPS

Bulb Replacement (Fig. 17)

1. Disconnect lamp socket from rear of lamp unit and remove bulb from socket.

   NOTE: Bulb removal on station wagon models and Corvette requires removal of the lens to gain access to the bulb.

2. Replace bulb and plug socket back into lamp housing.

Lamp Housing Replacement

Chevrolet, Chevelle Station Wagon, Camaro and Chevy II (Fig. 17)

1. Disconnect bulb socket from rear of lamp unit.

   NOTE: On station wagons 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.

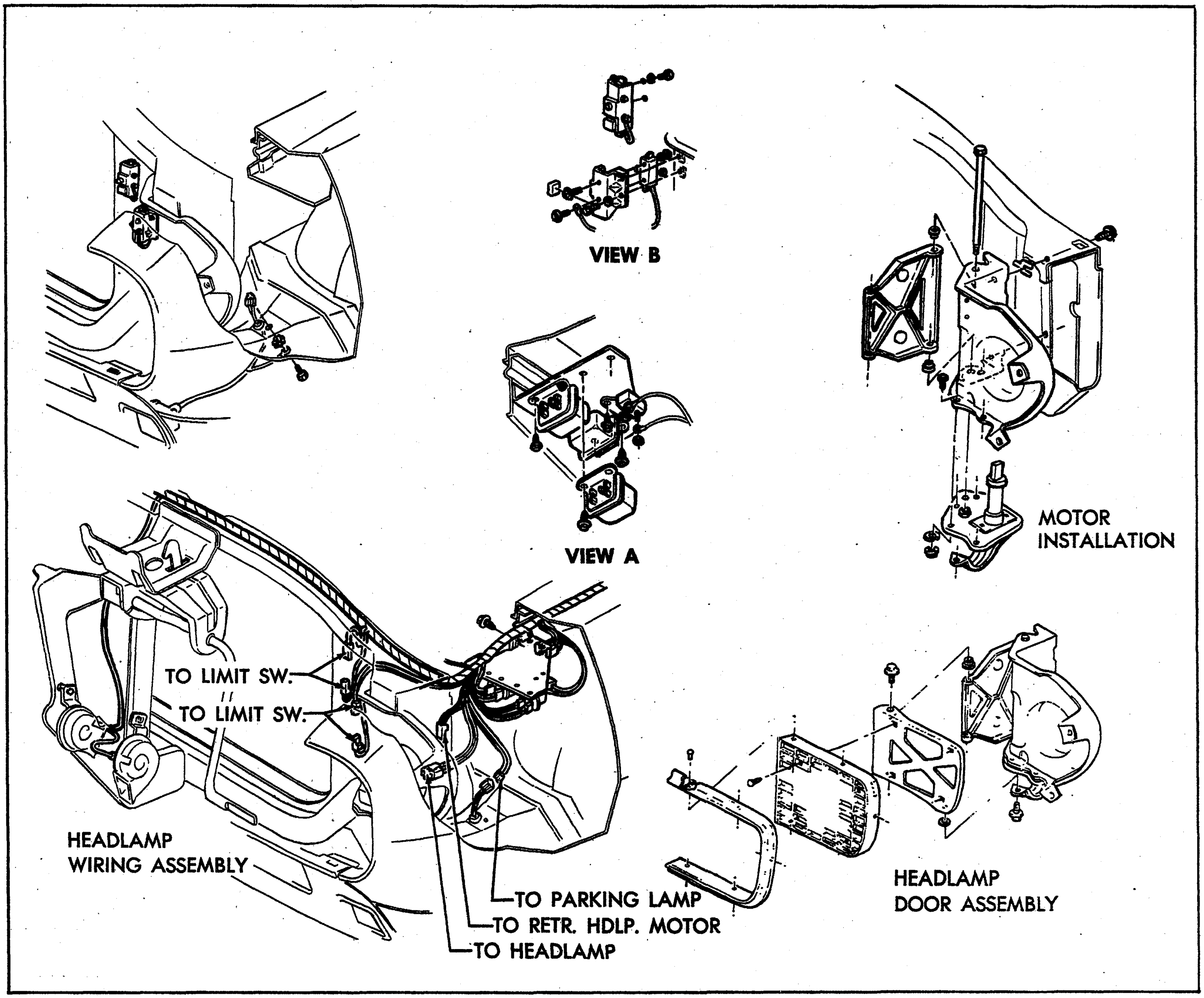
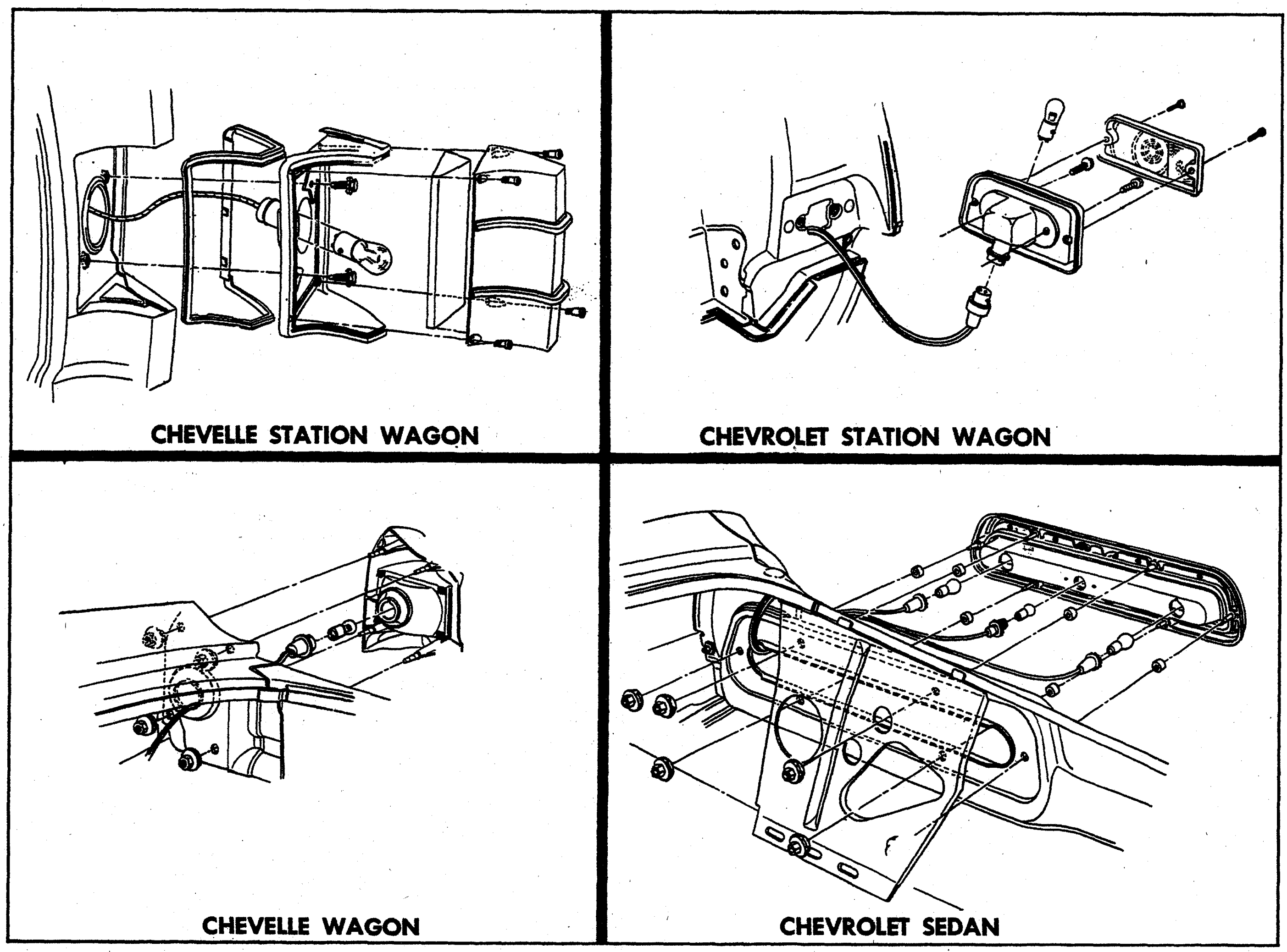


Fig. 16 - Headlamp Motor Installation (Camaro)



OPERATION	METHOD	BODY TYPE					
		Chevelle	Chevelle 35	Chevrolet	Chevrolet 35-45	Camaro F	Chevy II X
Bulb Replacement	Remove Lens (Outside)		X		X		X
	Remove Socket (Inside Rear Compartment)	X		X		X	
Lens Replacement	Remove Retaining Screws (Outside)		X		X		X
	Remove Housing and Disassemble	X		X		X	
Housing Replacement	Remove From Outside (Retaining Nuts in Rear Compartment	X		X		X	
	Remove From Inside						
	Remove From Outside (Retaining Bolts Under Lens)		X		X		X
	Lower Rear Bumper						

Fig. 17 - Rear Lighting Composite (Exc. Corvette)

NOTE: Gasket must be carefully installed to prevent body leaks.

Corvette (Fig. 18)

1. Working at the underside of the body rear panel, disconnect the harness connector at the lamp assembly; then remove the lamp assembly retaining nuts and remove lamp assembly from recess in body panel.

NOTE: Remove tail pipe extensions and rear body valance panel to facilitate removal of the outboard lamp assemblies.

2. Position lamp assembly in body panel recess so that studs are aligned with holes in panel.
3. Position lamp assembly ground wire over stud; then install remaining nuts and tighten securely.
4. Install harness connector to lamp assembly and test operation of light.

Bulb Replacement (Fig. 19)

1. Remove lens retaining screws and disengage lens from housing.
2. Replace bulb, check operation of unit.
3. Reinstall lens and retaining screws.

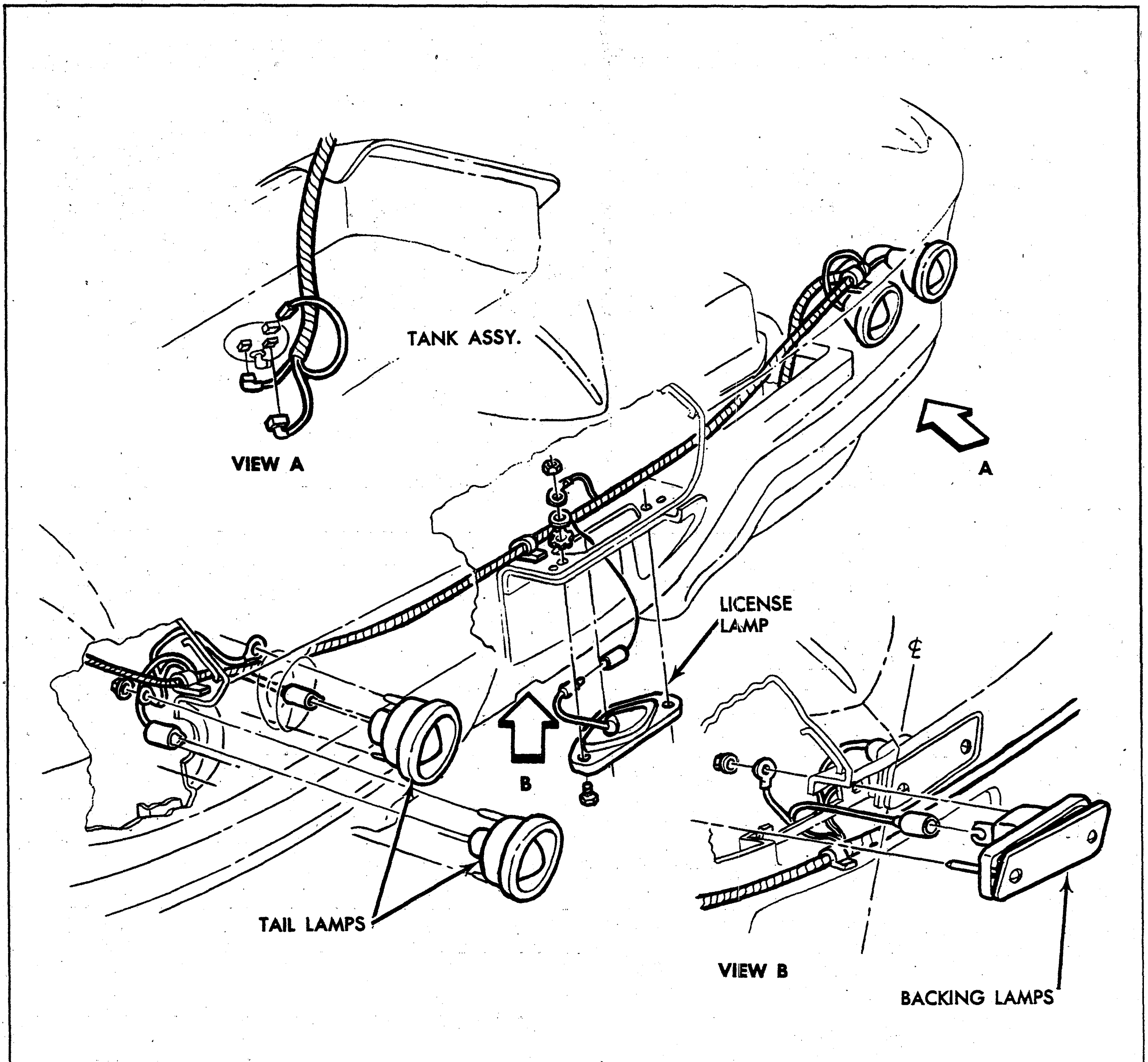


Fig. 18 - Rear Lighting (Corvette)

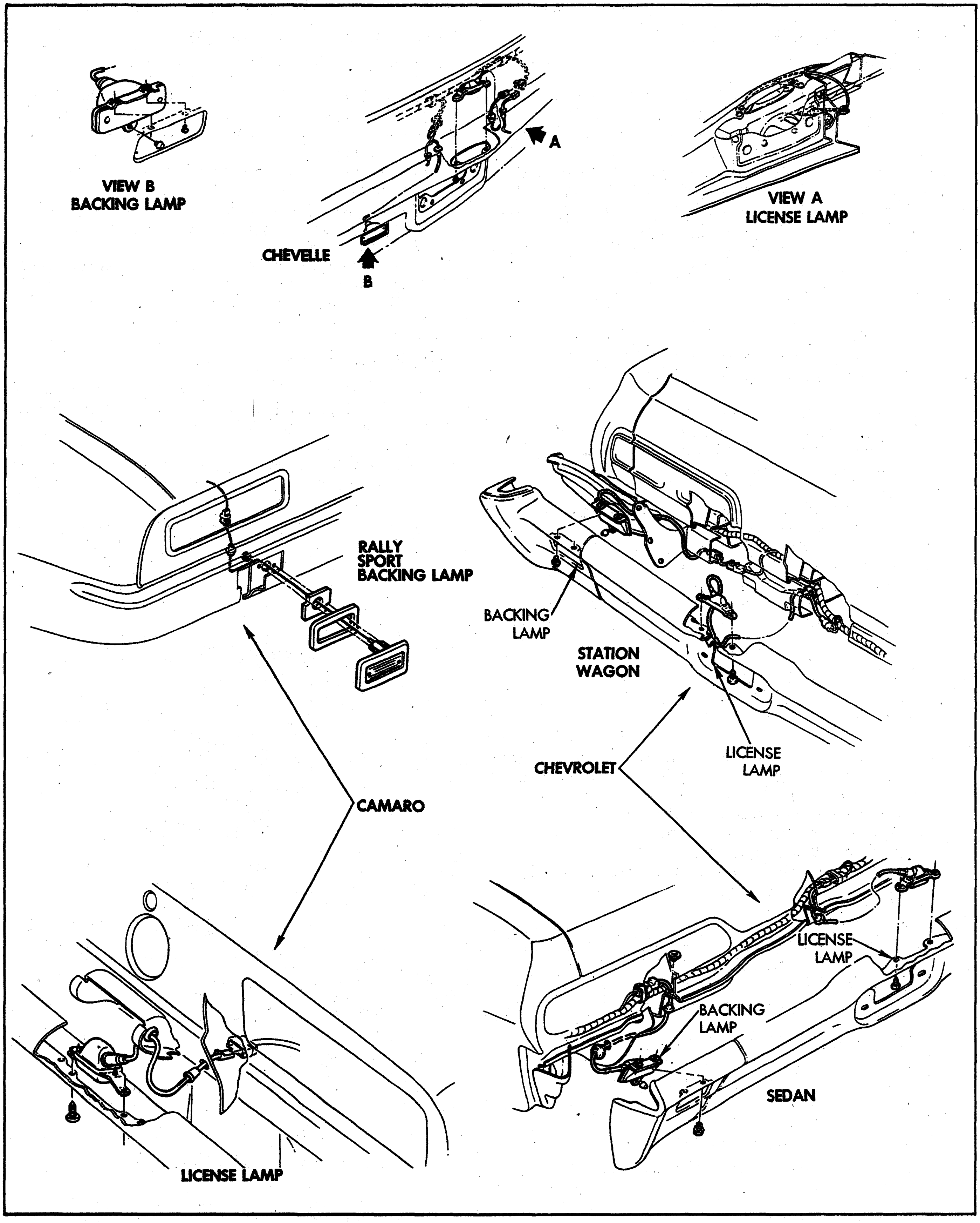


Fig. 19 – Backing and License Lamps

BACKING LAMPS

Lamp Housing Replacement (Fig. 19)

Bumper Installation

1. Remove two screws retaining housing assembly in the bumper and remove housing.
2. Disconnect lamp wire assembly connector from wiring harness.
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.
5. Position lamp assembly in place and install retaining screws.

Corvette (Fig. 18)

1. Remove license plate and bracket assembly.
2. Remove tailpipe extensions and rear body valance panel.
3. Remove backing lamp attaching nuts.
4. Disengage backing lamp assembly from body opening and disconnect wiring harness at rear of lamp.
5. Transfer bulb, gasket and lens to replacement housing.
6. Connect chassis wiring connector to housing and position lamp assembly to body opening.
7. Attach ground wire to housing and install retaining nuts to housing.
8. Install body valance panel.
9. Position license plate assembly to body and install retaining screws.

LICENSE PLATE LAMP SERVICE

Lamp Housing

1. Remove the lamp assembly retaining screws and remove lamp assembly from mounting location (rear bumper center face bar most models). On Corvette models remove rear valance panel.
2. Disconnect lamp wiring from chassis harness connector (inside trunk on some models).
3. Force grommet and wiring down through body opening (where applicable) and remove assembly from vehicle.
4. To install replacement unit, insert grommet and wiring through body opening where applicable and connect wiring to chassis harness.
5. Position assembly and install retaining screws. On Corvette models make sure ground wire is properly installed.
6. Check operation of lamp assembly.

Bulb Replacement

1. Remove lens retaining screws and lens.

   NOTE: On Camaro models loosen housing retaining screws.

2. Remove and replace bulb.
3. Position lens and install retaining screws.

AUTOMATIC TRANSMISSION

QUADRANT LAMP REPLACEMENT

Chevrolet (Fig. 20)

1. Remove four screws retaining lower mast jacket cover to upper cover.
2. Remove two screws retaining upper cover to instrument console.
3. Remove two screws securing shield to upper cover assembly.
4. Remove and replace bulb.
5. Position shield to upper cover assembly and install retaining screws.
6. Position upper cover assembly to instrument console and install retaining screws.
7. Position lower cover and install four retaining screws.

Chevy II and Camaro (Fig. 21)

1. Remove two screws attaching retainer and dial to directional signal housing; remove retainer and dial face from housing.
2. Remove cap and bulb.
3. Replace bulb and cap, then position dial and retainer to housing and install attaching screws.

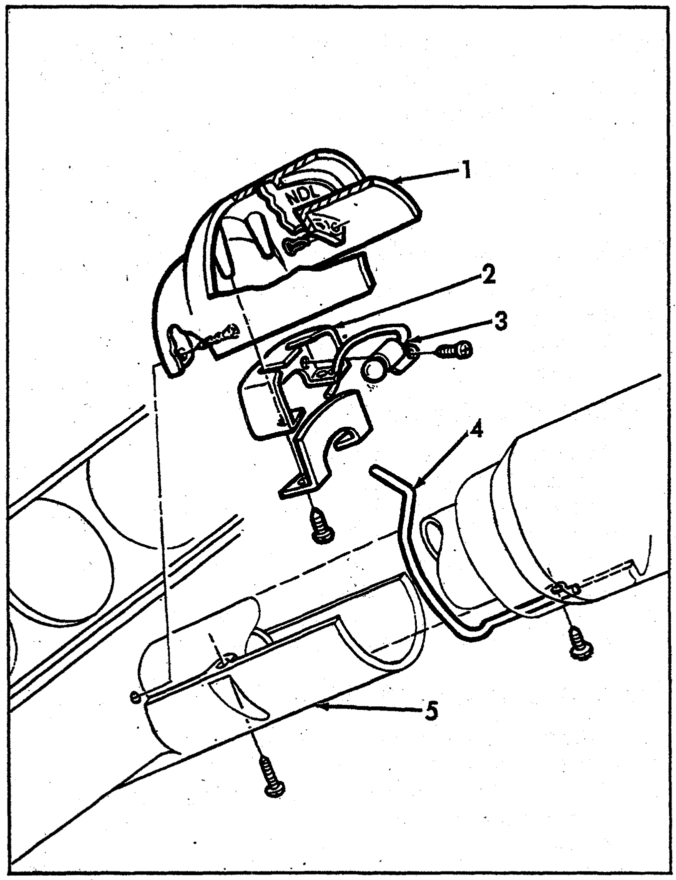


Fig. 20 - Dial Quadrant Lamp — Chevrolet

1. Upper Cover
2. Shield
3. Lamp and Socket
4. Dial Pointer
5. Lower Cover

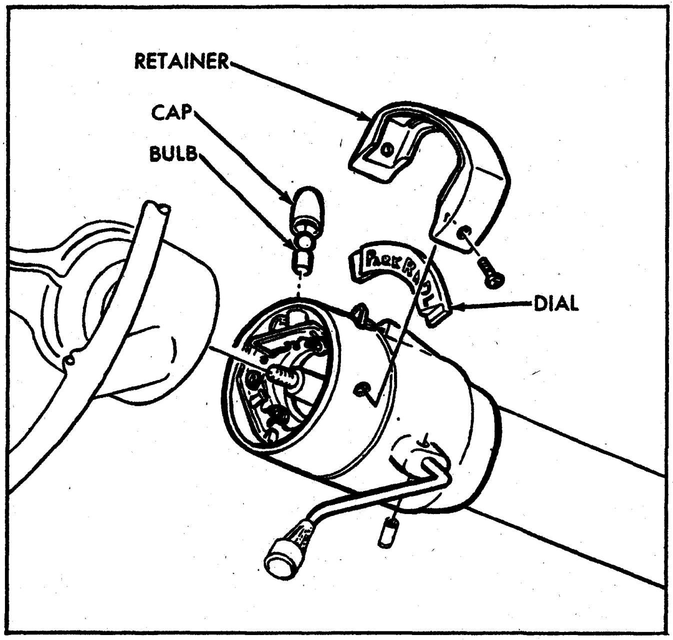


Fig. 21 - Dial Quadrant Assembly -- Camaro

SEAT SEPARATOR CONSOLE LAMPS

COMPARTMENT LAMP REPLACEMENT (Fig. 22)

1. Remove (pry up) switch assembly from console opening in the instrument compartment.
2. Remove bulb from the socket.
3. Replace bulb and install switch assembly in console opening.

COURTESY LAMP REPLACEMENT (Fig. 22)

1. Remove two screws and lens at rear of console.
2. Remove bulb from retainer.
3. Replace the bulb, position the lens and install attaching screws.

QUADRANT LAMP REPLACEMENT (Fig. 22)

1. Remove Dial Quadrant Trim plate retaining screws and lift trim plate assembly from console opening.
2. Disconnect lamp socket from the retainer and remove bulb from the socket.
3. To install, insert bulb into the socket and snap the socket assembly into the retainer.
4. Position the trim plate assembly into the console opening and install the retaining screws.

LIGHTING SWITCH REPLACEMENT (Fig. 24)

1. Disconnect battery ground cable.
2. Pull control knob out of headlamp ON position.
3. Reach under instrument panel and depress the switch shaft retainer (Fig. 25) and remove knob and shaft assembly.
4. Remove ferrule nut using Tool J-21932 and remove switch assembly from instrument panel.

   NOTE: Some Chevelle models require use of Tool J-4880.

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.
6. Connect the multi-plug connector to the replacement switch (Fig. 23). 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 and bezel to panel mounting hole and install ferrule nut.
8. Insert switch control knob and shaft assembly into switch until retainer engages shaft.

WIPER SWITCH REPLACEMENT (Fig. 26)

1. Disconnect battery ground cable.
2. Remove the connectors from the rear of the switch.

   NOTE: On Air Conditioned models it is necessary to remove left A/C outlet duct for accessibility to rear of switch.

3. Loosen set screw and pull knob from switch shaft.
4. Remove retaining nuts using special Tool J-21932 and withdraw wiper switch from behind console.

   NOTE: Some Chevelle models require special Tool J-4880.

5. To install, reverse removal procedure and check operation of wipers.

STOPLIGHT SWITCH REPLACEMENT (Fig. 27)

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.
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. 28)

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.

BACKING LAMP SWITCH REPLACEMENT

Located on Mast Jacket (Fig. 29)

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.

Located on Transmission (Fig. 30)

1. Raise and support vehicle.

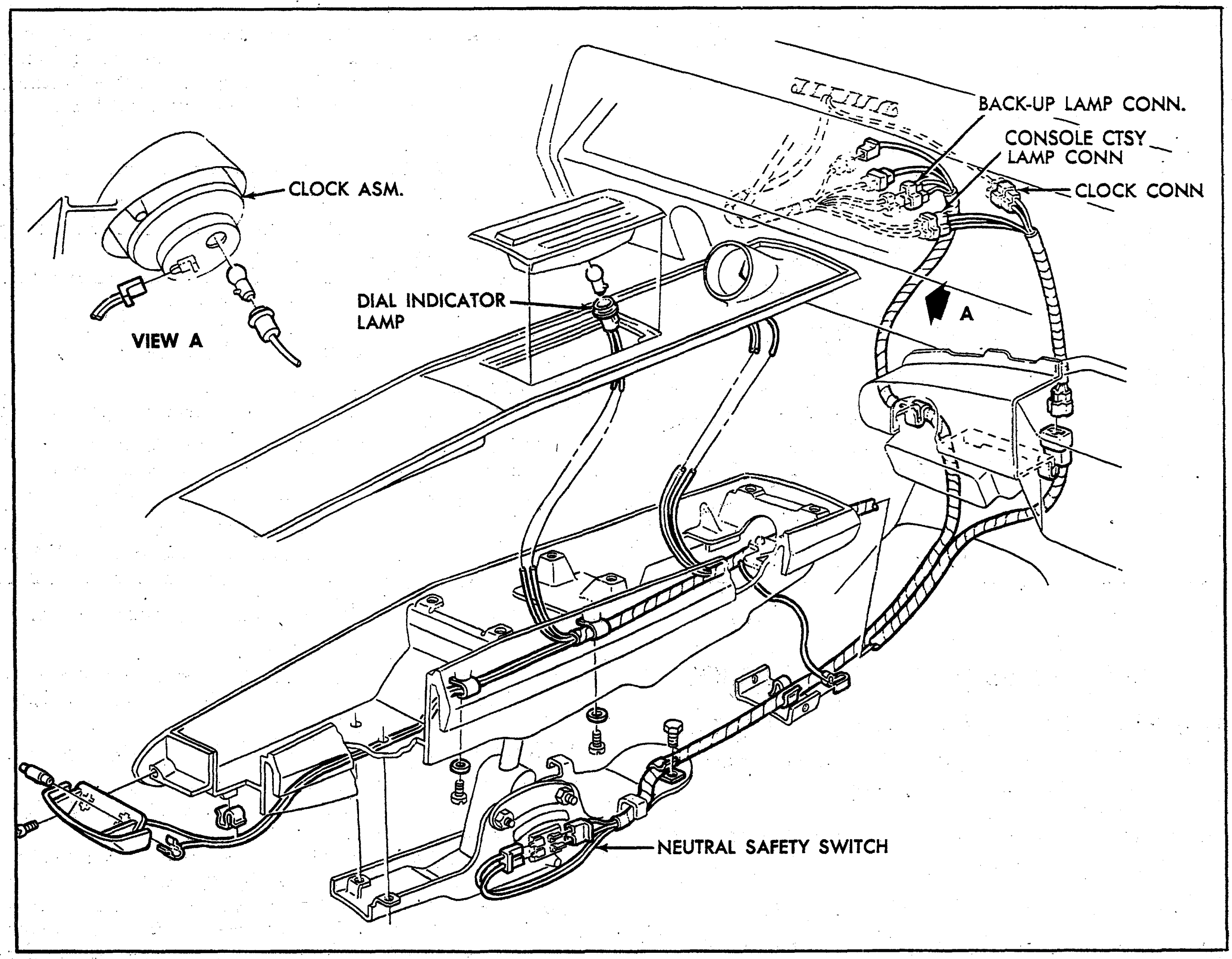


Fig. 22 - AutoTrans -- Seat Separator Wiring -- Chevelle

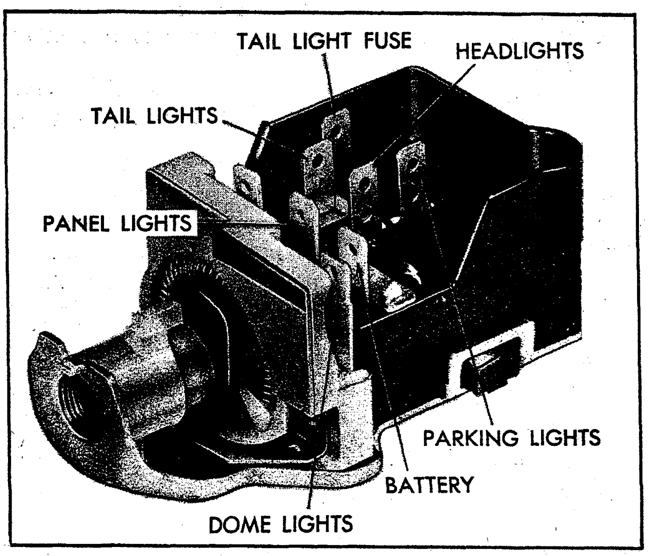


Fig. 23 - Light Switch Terminal Connections

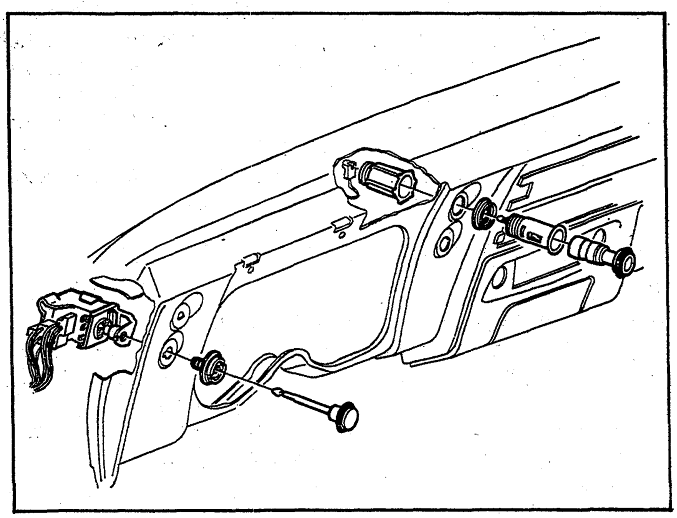


Fig. 24 - Light Switch and Cigarette Lighter Installation

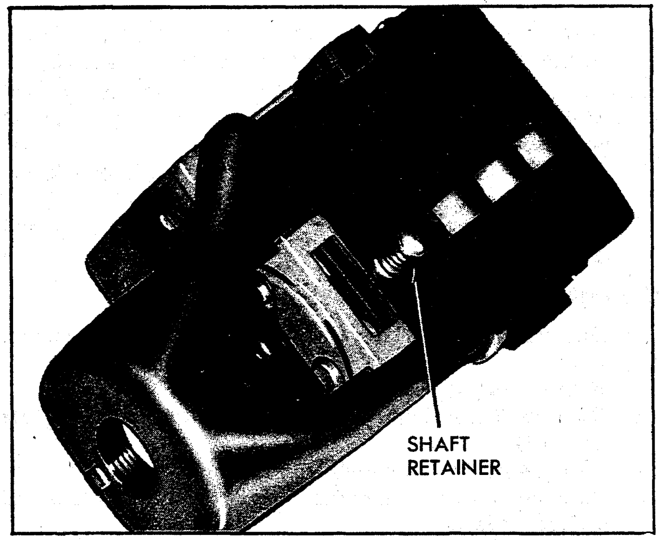


Fig. 25 - Shaft Retainer

2. Disconnect switch wiring from harness wiring at in-line connector.
3. Remove bolt retaining wiring attaching clip to transmission.
4. Remove wire clip retaining reverse lever rod to switch.
5. Remove screws retaining switch and shield assembly to transmission, remove switch.

NOTE: Do not remove transmission-to-bracket retaining bolts.

6. To install, reverse removal procedure and check switch for operation in transmission reverse range.

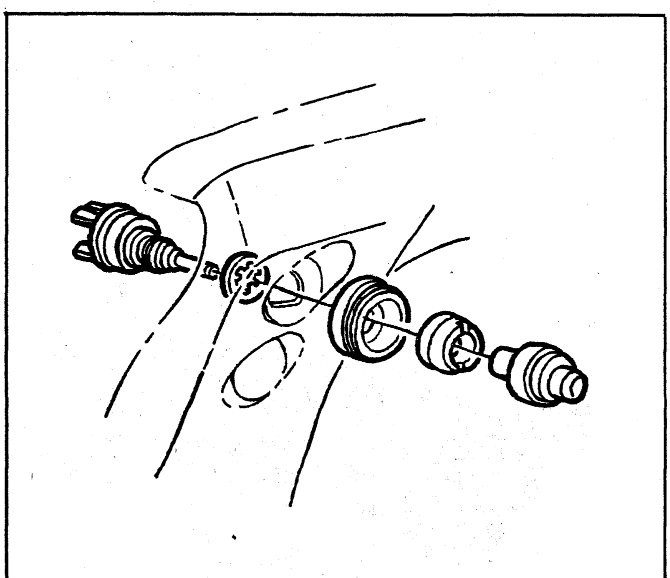


Fig. 26 - Windshield Wiper Switch

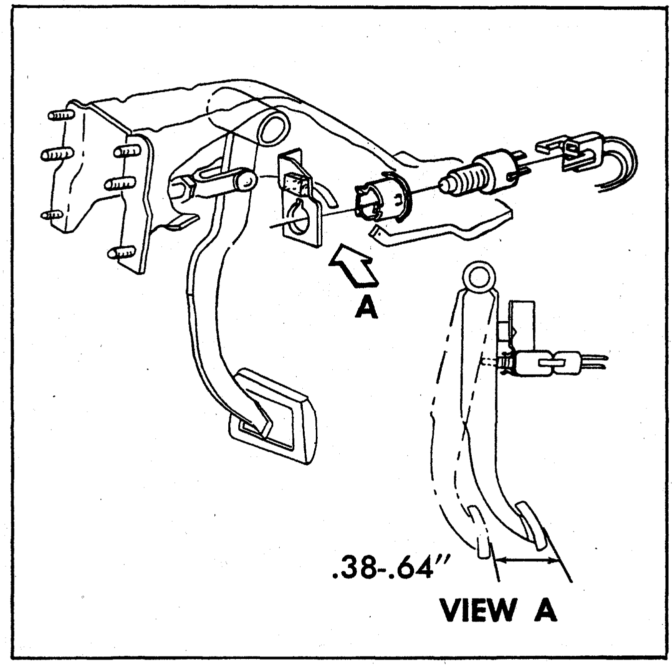


Fig. 27 - Stoplight Switch Assembly

NEUTRAL SAFETY SWITCH REPLACEMENT

Column Shift (Fig. 31)

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 locate lever tang against transmission selector plate.
4. Align slot in contact support with hole in switch and insert pin (3/32" dia.) to hold support in place. Switch is now in drive position.
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 and check operation of switch.

Floor Shift

Chevrolet, Chevelle, Chevy II and Camaro (Fig. 31)

1. Position shift lever in drive position. Remove ash

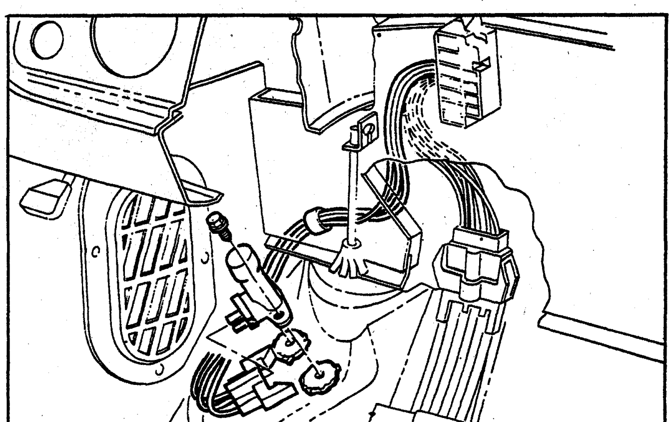


Fig. 28 - Dimmer Switch

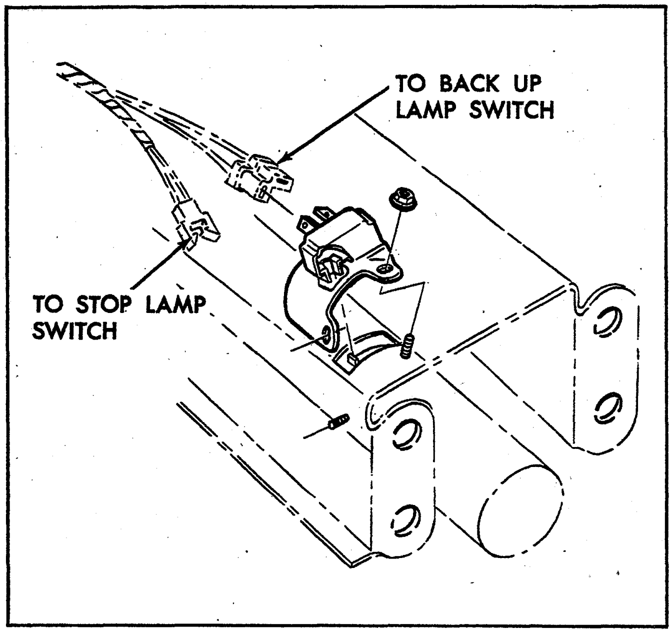


Fig. 29 - Backing Lamp Switch on Mast Jacket (Chevelle)

tray, trim plate assembly, and indicator lens and housing from console.

2. Disconnect bulbs from housing. Disconnect multiple connector at switch terminals or on Camaro models from the wiring harness at the 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 a pin (3/32" dia.) to hold in place. Switch is now in drive position.
5. Position switch to lever and bracket assembly with lever engaged in contact support and install retaining nuts.
6. Remove clamp and pin, connect wiring and check operation of switch.
7. Install indicator lamps, housing, lens, ash tray and trim plate assembly.

Corvette (Fig. 32)

1. Disconnect shift control lever arm from the control rod.
2. Remove the shift control knob.
3. Remove Trim Plate retaining screws and trim plate assembly.
4. Remove control assembly retaining screws.
5. Remove control assembly from the seal and cut switch wiring.
6. Remove switch retaining nuts and switch from the control assembly.
7. To install, position gearshift in "Drive" position align hole in contact support with hole in switch and insert pin (3/32" dia.) to hold support in place.
8. Place the contact support drive slot over the drive tang and tighten switch mounting screws.
9. Splice wiring harness to switch wiring.
10. Install trim plate assembly and shift lever control knob.
11. Connect shift lever arm to the transmission control rod.

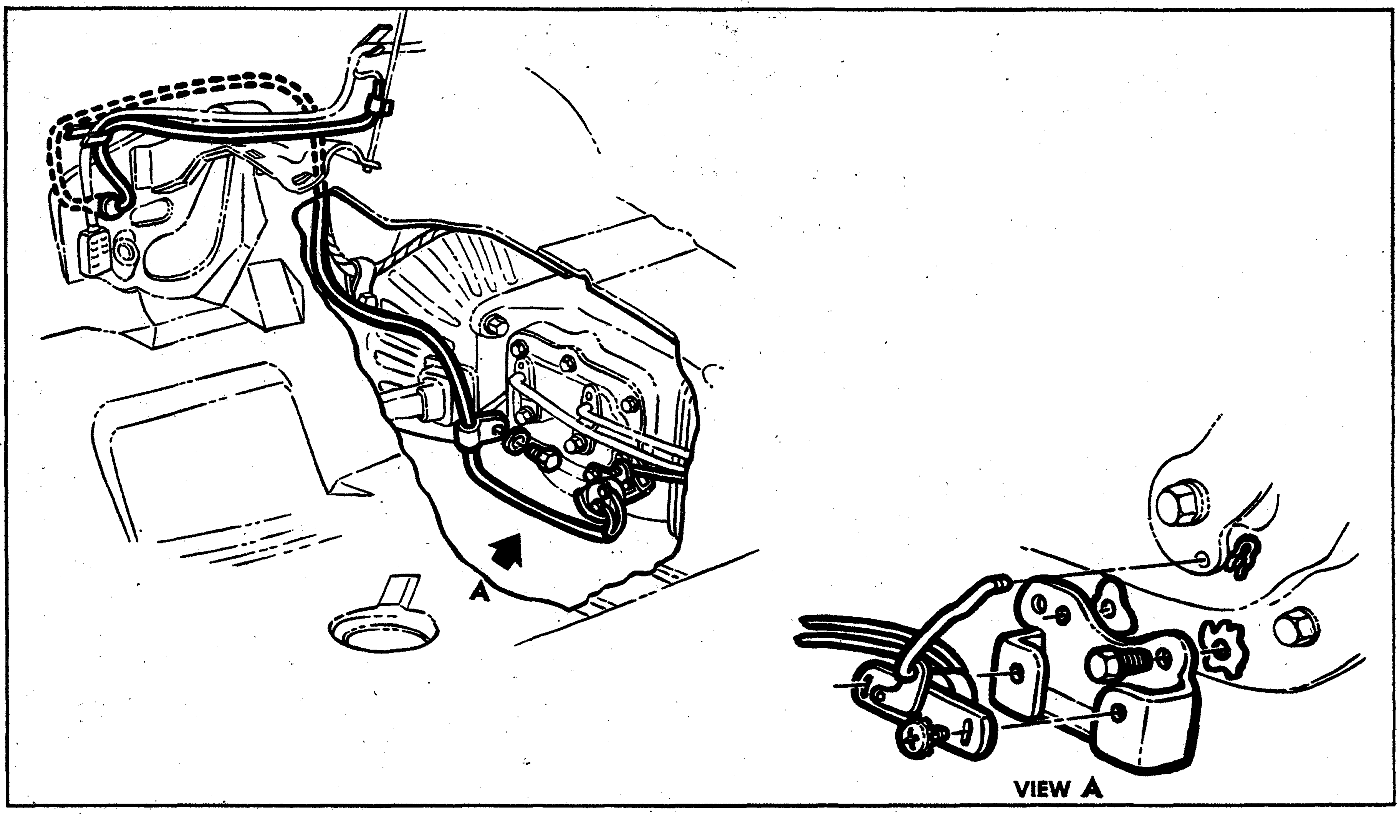


Fig. 30 - Backing Lamp Switch on Transmission

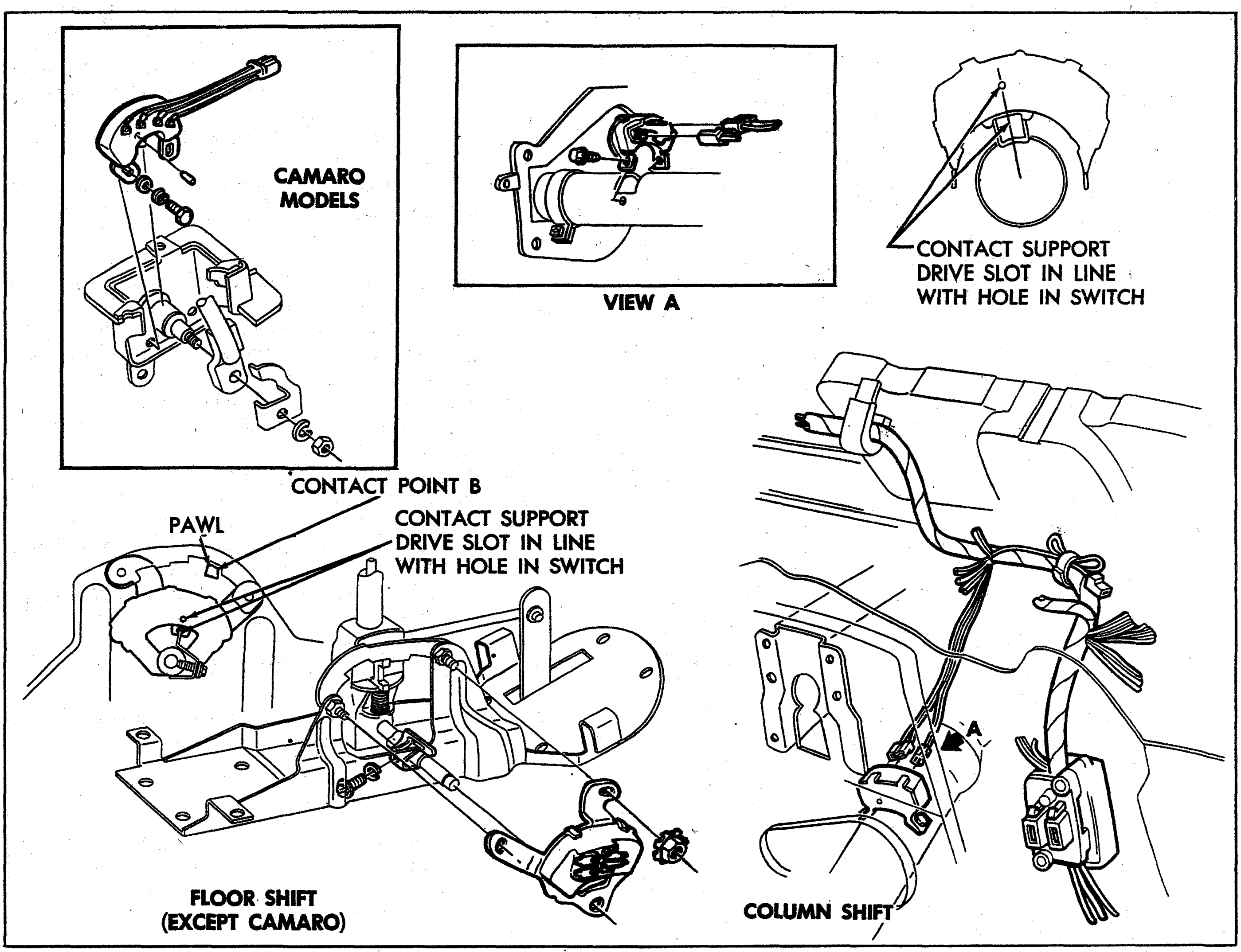


Fig. 31 - Neutral Safety Switches

PARKING BRAKE ALARM SWITCH REPLACEMENT

Corvette (Fig. 33)

1. Remove seat belt retainer and parking brake cover assembly from center console.
2. Disconnect wire from brake alarm switch.
3. Remove retaining screw and switch from reinforcement.
4. Position new switch to reinforcement and install retaining screw.
5. Connect switch wire and check operation of switch.
6. Install cover and seat belt retainer assembly.

Chevrolet, Chevelle, Chevy II and Camaro (Fig. 34)

1. Disconnect wiring connector at switch terminal.
2. Remove nut and lock washer or retaining bolt and disengage switch from brace.
3. To install, reverse removal procedure.

INSTRUMENT PANEL COMPARTMENT LAMP/SWITCH REPLACEMENT

1. Disconnect battery ground cable.
2. Reach into glove box, depress bulb in end of switch and turn counterclockwise 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

Chevrolet, Chevy II, Camaro and Corvette (Fig. 23)

1. Disconnect battery ground cable.
2. Disconnect wire connector at rear of lighter unit under dash.
3. Remove retainer from rear of housing assembly and disengage lighter unit from panel.
4. To install, reverse removal procedure.

Chevelle (Fig. 35)

1. Disconnect battery ground cable.

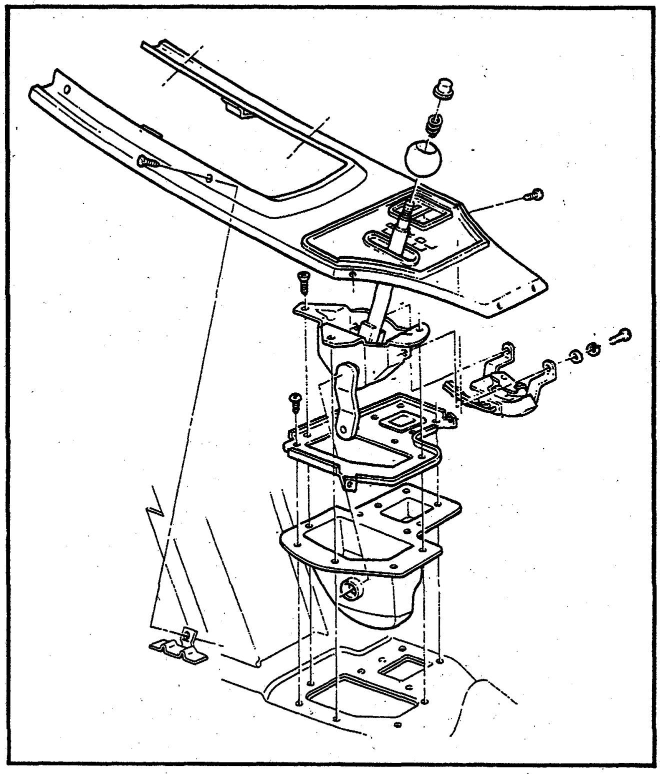


Fig. 32 - Neutral Safety Switch -- Corvette

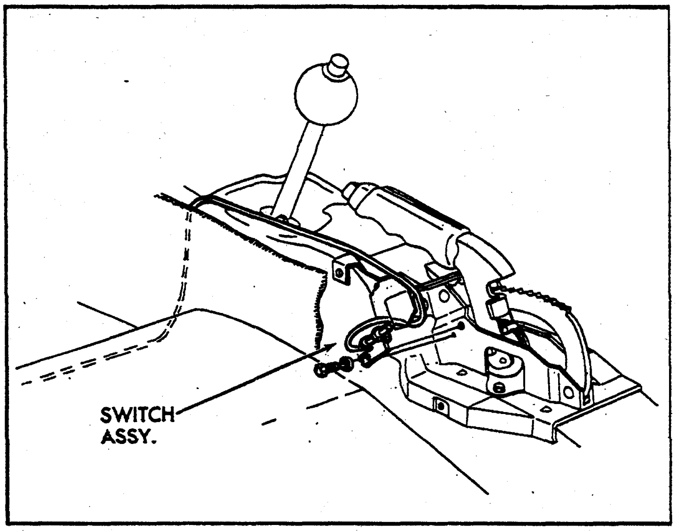


Fig. 33 - Parking Brake Alarm Switch -- Corvette

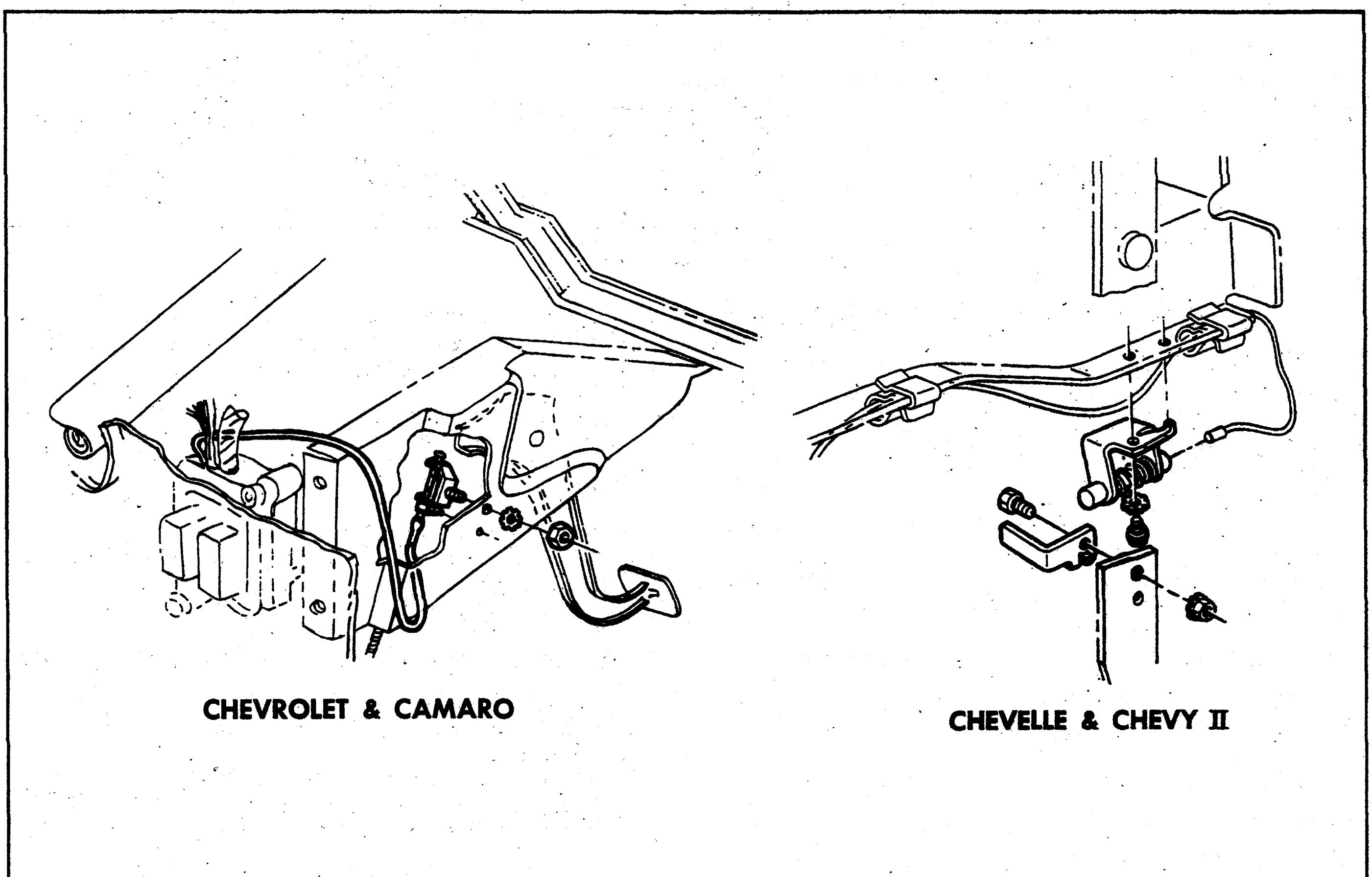


Fig. 34 - Parking Brake Alarm Switch Exc. Corvette

2. Remove ash tray, retainer attaching screws and retainer.
3. Remove Air Conditioning distributor duct retaining screws and duct.
4. Remove heater and/or Air Conditioning control panel assembly retaining screws and push panel assembly from console.

   NOTE: If interference between control panel and radio is encountered, loosen radio retaining nuts.

5. Remove radio control knobs, bezels and retaining nuts.
6. Disconnect radio wiring harness and antenna lead-in.
7. Remove radio rear brace attaching screw and remove radio from vehicle.
8. Remove ignition switch bezel nut using Tool J-7607 and push switch rearward.
9. Disconnect cigarette wiring connector.
10. Remove cigarette lighter retainer and lighter assembly from console.
11. To install, reverse removal procedure.

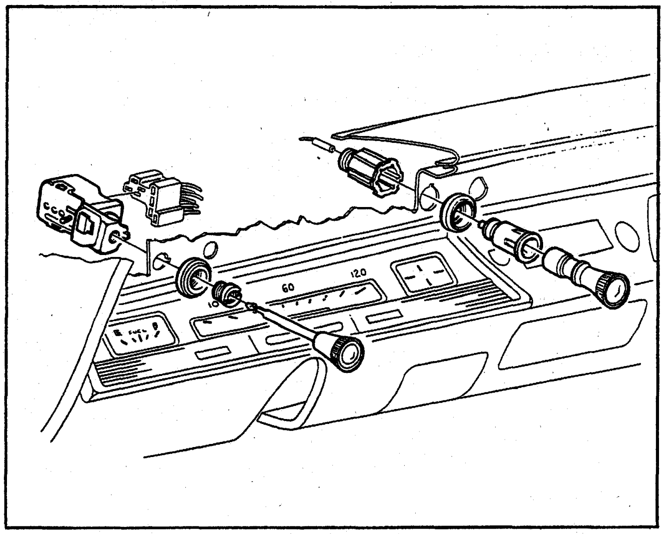


Fig. 35 - Cigarette Lighter -- Chevelle

CHEVROLET INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The standard instrument cluster on all models contains seven circular housings consisting of: a speedometer; fuel gauge; oil pressure, generator and temperature indicators; right and left directional signal indicators; brake warning and high beam indicators; and includes a clock on deluxe models. An optionally available instrument cluster provides special instrumentation which includes in addition to the speedometer and clock: a tachometer; fuel, oil pressure, ammeter and engine temperature gauges; which replace the standard fuel gauge and indicator lights. The brake warning indicator is relocated to the tachometer dial face and the high beam and directional indicators are positioned in the speedometer dial face.

Instrument cluster removal is recommended before attempting to service the printed circuit and gauges even though some units may be accessible from behind the cluster. Limited working space under the instrument panel increases the possibility of electrical malfunctions due to poor connections, and damaged or improperly installed printed circuit. The printed circuit is serviceable but not repairable and requires complete replacement.

The brake warning light serves a dual purpose. It functions as an indicator when the parking brake is applied and also warns if a malfunction (loss of hydraulic pressure) should occur in the brake system. The two separate switches, which provide the signal to operate the indicator, are located at the parking brake support and in the hydraulic brake line at the master cylinder. Service of the brake pressure differential switch unit at the master cylinder is described in Section 5 of this manual.

All indicator and cluster illuminating lamps may be replaced without removing the cluster from the vehicle. The bulbs are installed in plastic holders which lock into the cluster housing and make contact with the printed circuit. An instrument lamp is used to illuminate the ignition switch. A special fibre optic lucite wiring transmits light from the lamp to the switch.

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 (Figs. 36 thru 40)

1. Disconnect battery ground cable.
2. Remove four screws retaining instrument bezel to top edge of instrument console. Disengage tabs on bezel lower section from clips on instrument console and remove bezel.
3. Protect mast jacket to prevent scratching when removing cluster assembly.
4. Remove eight screws securing leading edges of instrument cluster to console and pull cluster forward from console opening.
5. Reaching behind cluster disconnect speedometer cable, chassis harness connector, clock and speed warning device connections (if so equipped) at rear of cluster.

   NOTE: On models with gauge pack, disconnect oil pressure line also.

6. When all disconnects are made, remove cluster assembly from vehicle.
7. To install, position cluster assembly to console opening and connect speedometer cable, chassis harness connector and other electrical connections as required.
8. Position cluster in console opening and install eight retaining screws.

   NOTE: Make sure ground strap between cluster case and center right lower attachment is properly installed.

9. Engage tabs on instrument bezel with clips on console and position bezel in console opening, then install four retaining screws.
10. Install speed warning device control attaching nut and knob, if so equipped.
11. Connect battery ground cable and check operation of cluster assembly.

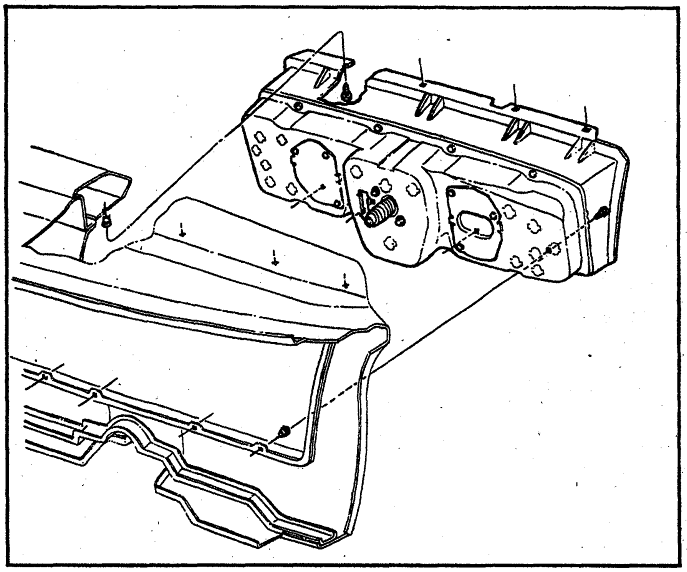


Fig. 36 - Instrument Cluster Installation -- Chevrolet

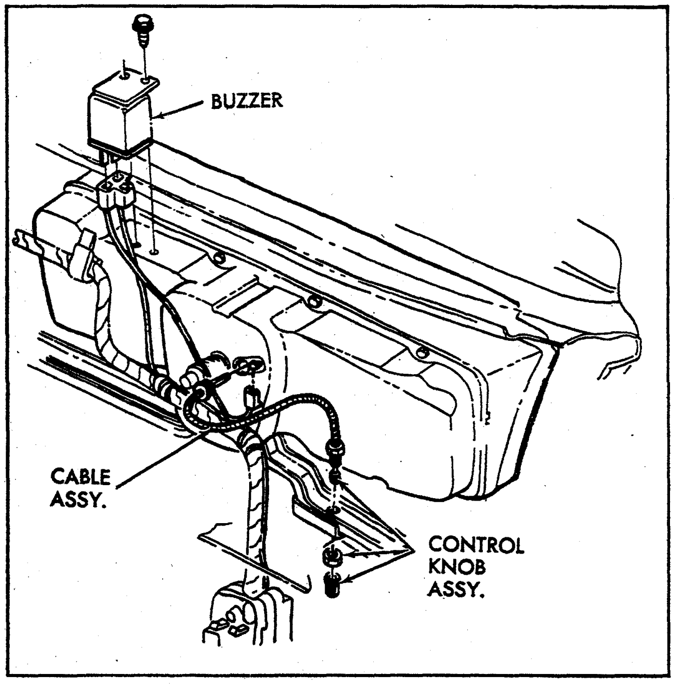


Fig. 37 - Speed Warning Device

INSTRUMENT CLUSTER LAMP REPLACEMENT (Figs. 38 and 39)

1. Rotate socket counterclockwise to remove from rear of cluster housing.
2. To remove bulb, if socket is black color, pull bulb straight out. If socket is gray color, depress and rotate bulb, then pull out.
3. Install replacement bulb in socket, pressing inward to lock in place.
4. Insert socket into housing, with lugs entering notches in case, and rotate clockwise to lock in place.

PRINTED CIRCUIT REPLACEMENT (Figs. 38 and 39)

1. Remove instrument cluster as previously described in this section.
2. Remove all cluster illuminating and indicator lights from cluster housing.
3. Remove fuel gauge and clock terminal nuts securing printed circuit to housing.
4. Remove four hex head screws retaining printed circuit to the cluster housing and remove the printed circuit.
5. To install, reverse removal procedure.

   CAUTION: The retaining screws and terminal nuts are part of the grounding circuit and must be installed to provide the proper ground connections for the printed circuit.

SPEEDOMETER REPLACEMENT

1. Remove instrument cluster as previously described in this section.
2. Remove screws retaining rear cover to the cluster assembly. Bend ground strap away from cover and remove cover.

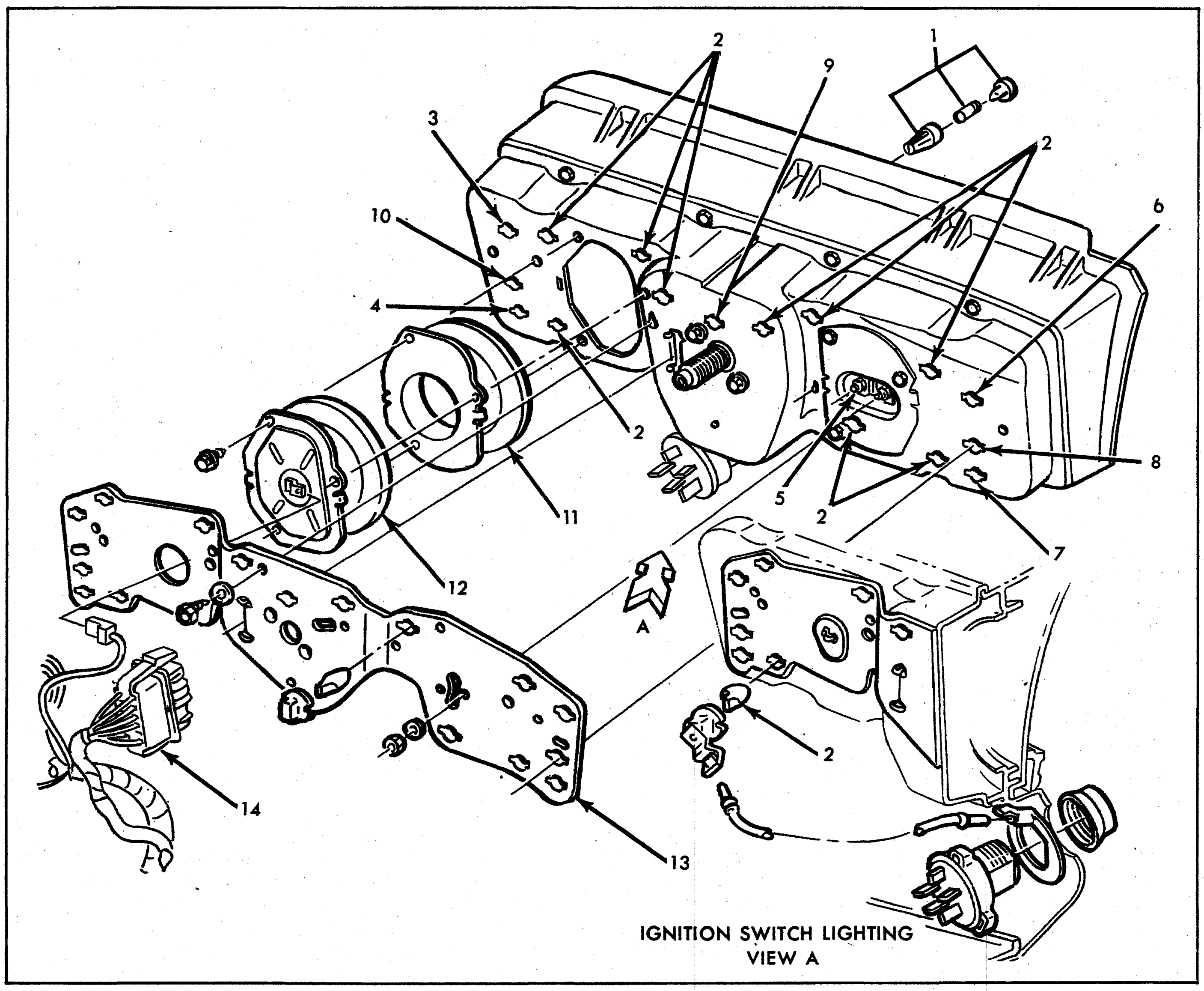


Fig. 38 - Instrument Cluster Connections

1. Clock Knob Assembly
2. Instrument Cluster Lamps
3. R.H. Directional Indicator
4. "Gen" Indicator
5. Fuel Gauge
6. L.H. Directional Indicator
7. "Hot" Indicator
8. "Brake" Indicator
9. "Bright" Indicator
10. "Oil Press" Indicator
11. Clock Cover (15,000)
12. Clock Assembly (16,000)
13. Printed Circuit
14. Instrument Panel Connector

3. Remove screws retaining speedometer to the housing and remove speedometer from rear cover.

NOTE: Servicing of the speedometer assembly should be performed by an authorized AC Speedometer Service Station.

4. To install, reverse the removal procedure.

SPEEDOMETER 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.

FUEL GAUGE REPLACEMENT

1. Remove instrument cluster as previously described in this section.
2. Remove cluster lamps from gauge cover plate and remove terminal nuts attaching circuit to gauge.
3. Carefully move printed circuit away from gauge and remove screws retaining gauge assembly to the cluster housing.
4. Remove gauge assembly from cluster housing and remove three terminal nuts attaching gauge to the cover plate.

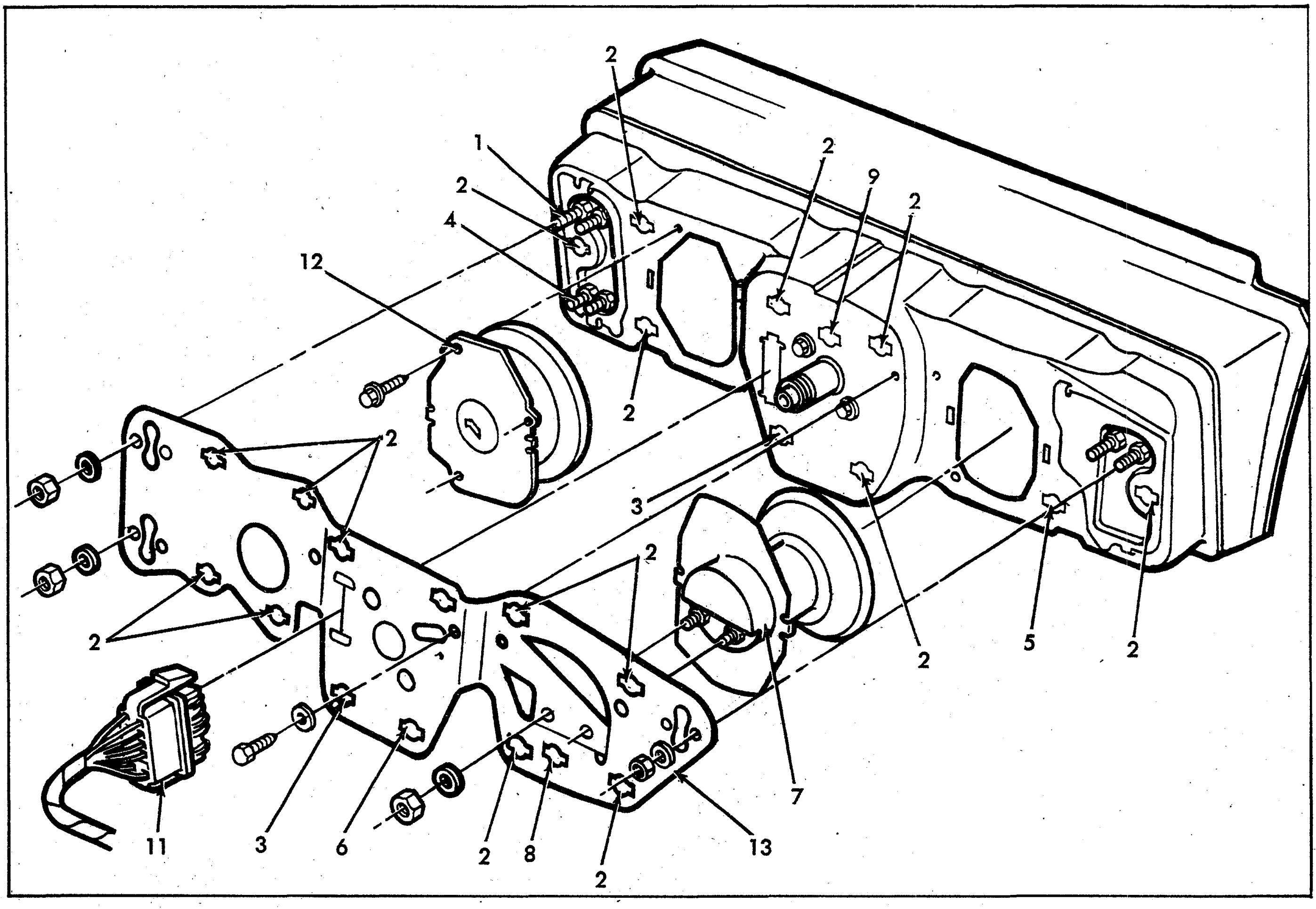


Fig. 39 - Optional Gauge Cluster

1. Temperature Gauge
2. Instrument Cluster Lamp
3. R.H. Directional Indicator
4. Ammeter Gauge
5. Fuel Gauge
6. L.H. Directional Indicator
7. Tachometer
8. "Brake" Indicator
9. "Bright" Indicator
10. Oil Pressure Fitting
11. Chassis Harness Connector
12. Clock Assembly
13. Printed Circuit

NOTE: Observe carefully the stack up of the internal parts of the fuel gauge assembly.

5. To install, reverse removal procedure.

CLOCK OR TACHOMETER REPLACEMENT

NOTE: The tachometer is a self-contained, all transistor unit requiring very little service other than keeping the terminal nuts clean and tight. The unit is not serviceable and must be replaced, if defective.

1. Remove instrument cluster as previously described in this section.
2. For clock replacement, remove clock set shaft knob at front of console.
3. Remove cluster lamps from cover, circuit attaching screws, and terminal nuts at circuit to gauge attaching points.
4. Move printed circuit away from gauge and remove screws retaining gauge or clock to the cluster housing.
5. Remove unit from housing and cover plate from gauge unit.
6. To install, reverse removal procedure.

AMMETER TEMPERATURE AND OIL PRESSURE GAUGES REPLACEMENT

1. Remove instrument cluster as previously described in this section.
2. Remove instrument lamps, attaching screws or nuts and wiring connections as required.
3. Remove gauge assembly backing plate retaining screws and remove gauge assembly from cluster housing.
4. Remove terminal nuts and/or screws retaining gauge to the backing plate and separate plate from the gauge.
5. To install, reverse removal procedure.

OIL PRESSURE INDICATOR

If the light does not come on when the ignition switch is turned on, or if the light comes on and remains on after the engine is started, one or more of the following conditions is indicated:

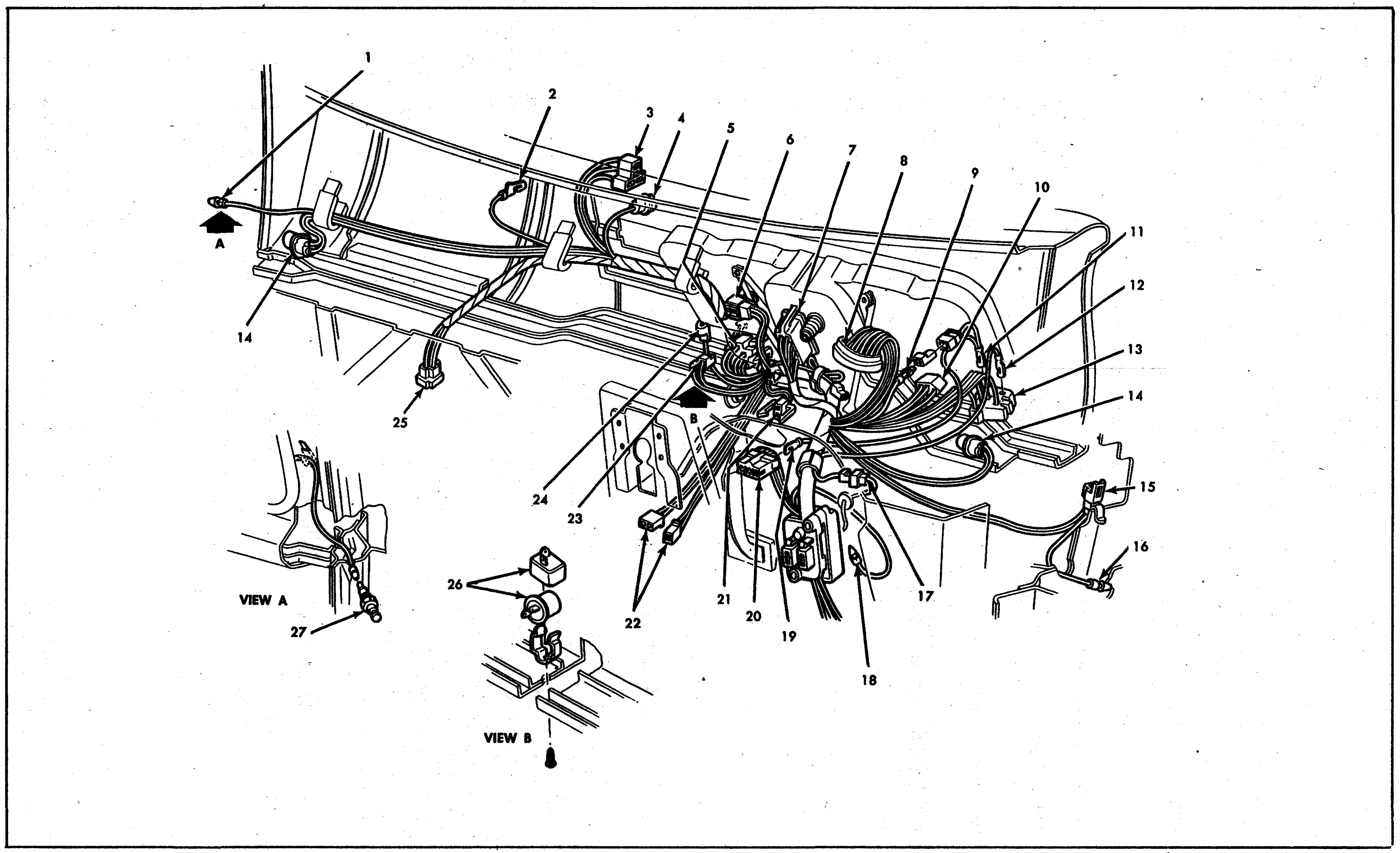


Fig. 40 - Instrument Panel Wiring

1. To R.H. Door Jamb Switch
2. To Inst. Panel Compt. Light
3. To Heater Control
4. Heater Control Lamp
5. To Ignition Switch
6. To Seat Separator Harness Conn.
7. Inst. Cluster Conn.
8. To Directional Signal Conn.
9. Door Jamb Switch to Light Switch Conn.
10. To Wiper Switch
11. To Light Switch Conn.
12. To Gen. and Fwd. LP. Harness Asm.
13. To Light Switch
14. Courtesy Lamp
15. To Dome Lamp Conn.
16. To L.H. Door Jam Switch
17. Gen. and Fwd Harness Conn.
18. To Parking Brake Alarm Switch
19. To Rear Door Jamb Switch
20. To Fisher Body Conn.
21. To Stop Lamp Switch
22. To Back-Up Lamp Switch
23. To Directional Signal Flasher
24. To Cigarette Lighter
25. To Heater Resistor
26. Directional Signal Flasher
27. Door Jamb Switch

- Low oil pressure
- High engine temperature
- Defective wiring or switch

Sending 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 using Tool J-21757 or 12 point socket, replace with new unit and check operation.

GENERATOR INDICATOR

1. Ignition on, Engine not Running and Telltale Light Off.
   - Indicator bulb burned out, replace bulb.
   - Open circuit or loose connection in the telltale light circuit.
2. Telltale Light Stays on after Engine is Started.

   If indicator light does not go out at engine idle speed, refer to Charging Systems under Engine Electrical, Section 6Y.

TEMPERATURE (COOLING SYSTEM) INDICATOR

The temperature indicator circuit consists of two remotely located units, indicator gauge and engine sender unit. The indicator gauge, located in the instrument panel, consists of a red light which will indicate an overheated engine condition.

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 on V-8 engines and in the cylinder head near an exhaust port on L-6 engines) and replace with new unit.
3. Refill cooling system and check operation of unit.

CHEVELLE INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The Chevelle instrument cluster assembly consists of: a speedometer; a fuel gauge; a generator, an engine temperature and an oil pressure indicator lamp, and includes a clock on deluxe models. On super sport models, ammeter, coolant temperature and oil pressure gauges replace the appropriate indicator lights. Except for the speedometer, all of the indicator lamps, instruments and gauges of these clusters may be serviced without removing the instrument cluster assembly from the vehicle.

In addition to the instrument indicator lamps, a brake warning lamp is included in the cluster as standard equipment. The indicator is connected to the parking brake and brake pressure differential switches and serves a dual function. It lights when the parking brake is applied and also when the brake pedal is applied, if a malfunction should occur in the brake system due to a loss of hydraulic pressure. Servicing of the hydraulic pressure differential switch is covered in Section 5 of this manual.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean and tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

SERVICE OPERATIONS

INSTRUMENT PANEL ASSEMBLY

INSTRUMENT CLUSTER (Figs. 41 thru 44)

Removal

1. Disconnect battery ground cable.
2. Remove steering coupling bolt and disconnect steering shaft from coupling.
3. Loosen mast jacket lower clamp.
4. Remove air conditioning center distributor duct (if so equipped).
5. Remove radio rear support bracket screw.
6. Remove mast jacket upper support clamp and retaining bolts from lower support (refer to Section 9, Steering).

CAUTION: Cover mast jacket and parking brake handle with a suitable material to prevent scratching.

7. Disconnect speedometer cable at rear of cluster housing and speed warning control knob at panel (if so equipped).
8. Remove instrument panel retaining screws (nine upper and five lower).
9. Working under the console remove four lower retaining screws from instrument cluster housing.
10. Pull instrument panel assembly from console and lay forward on mast jacket.
11. Disconnect wiring harness, cluster lamps and wiring

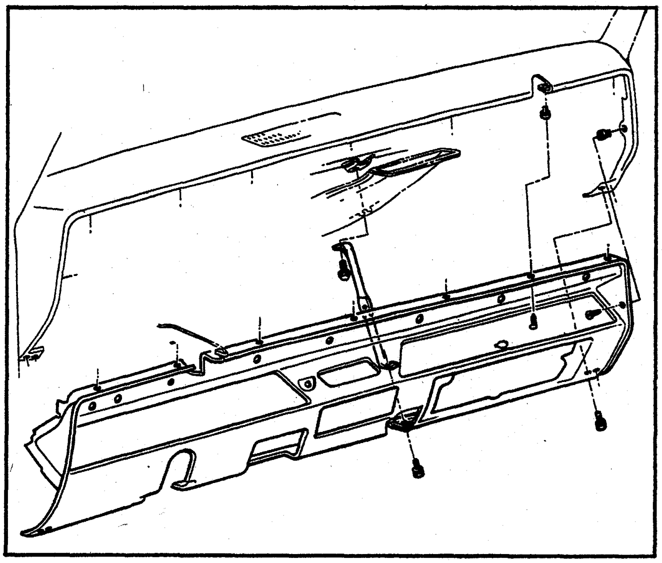


Fig. 41 - Instrument Panel Installation -- Chevelle

terminals from rear of cluster assembly (figs. 43 and 44).

12. Remove four screws retaining upper section of cluster housing to panel and remove cluster from the instrument panel and to a suitable working area for necessary service (fig. 42).

Installation

1. Position cluster assembly to rear of panel and install four upper retaining screws.
2. Connect cluster lamps, wiring connectors and wiring harness assembly to the cluster assembly.
3. Position instrument panel assembly into console (hold panel at center and install center screws) and install upper and lower retaining screws.

   NOTE: At this point temporarily reconnect battery and check operation of cluster.

4. Working under the console, install four lower screws retaining lower section of cluster cover to rear of panel.
5. Install radio brace screw at rear of radio.
6. Connect speedometer cable to speedometer and speed warning device control knob.
7. Install A/C distributor duct and connect A/C hoses to duct (if so equipped).
8. Install mast jacket upper support clamp.
9. Position steering shaft in the steering coupling and install retaining bolt.
10. Tighten mast jacket lower clamp (refer to Steering, Section 9 for spring tension adjustment).
11. Connect battery ground cable.

FUEL GAUGE AND/OR AMMETER REPLACEMENT

1. Disconnect battery ground cable.
2. On air conditioned models, disconnect hose and remove air outlet from panel.
3. Disconnect wiring connectors and cluster lamps from rear of gauge assembly.
4. Remove mounting plate retaining screws (3) and remove fuel gauge from rear of cluster housing.
5. Remove terminal nuts (3) securing gauge to template and replace gauge.
6. To install, reverse the removal procedure.

CLOCK REPLACEMENT

1. Disconnect battery ground cable.
2. Remove clock set shaft knob retaining nut and knob.
3. Disconnect wiring connector at clock terminal and cluster lamp from clock housing. On A/C models, disconnect hose from air distributor duct.
4. Remove two screws retaining clock housing to cluster cover and remove clock.
5. To install, reverse removal procedure.

SPEEDOMETER REPLACEMENT

1. Disconnect battery ground cable.
2. Remove instrument cluster assembly as previously outlined in this section.
3. Remove screws (8) attaching cover to rear of cluster housing.
4. Remove two screws attaching speedometer assembly to cluster cover and carefully remove speedometer head.

   NOTE: Servicing of the speedometer assembly should be performed by an authorized AC speedometer service station.

5. To install, reverse removal procedure.

SPEEDOMETER 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.

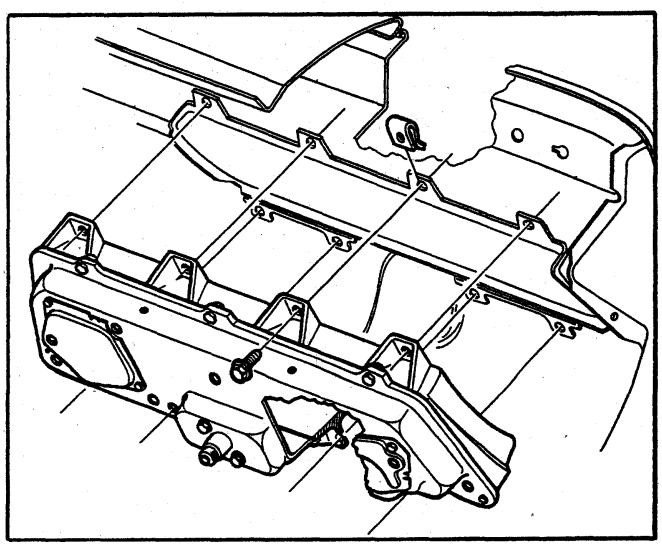


Fig. 42 - Instrument Cluster Installation

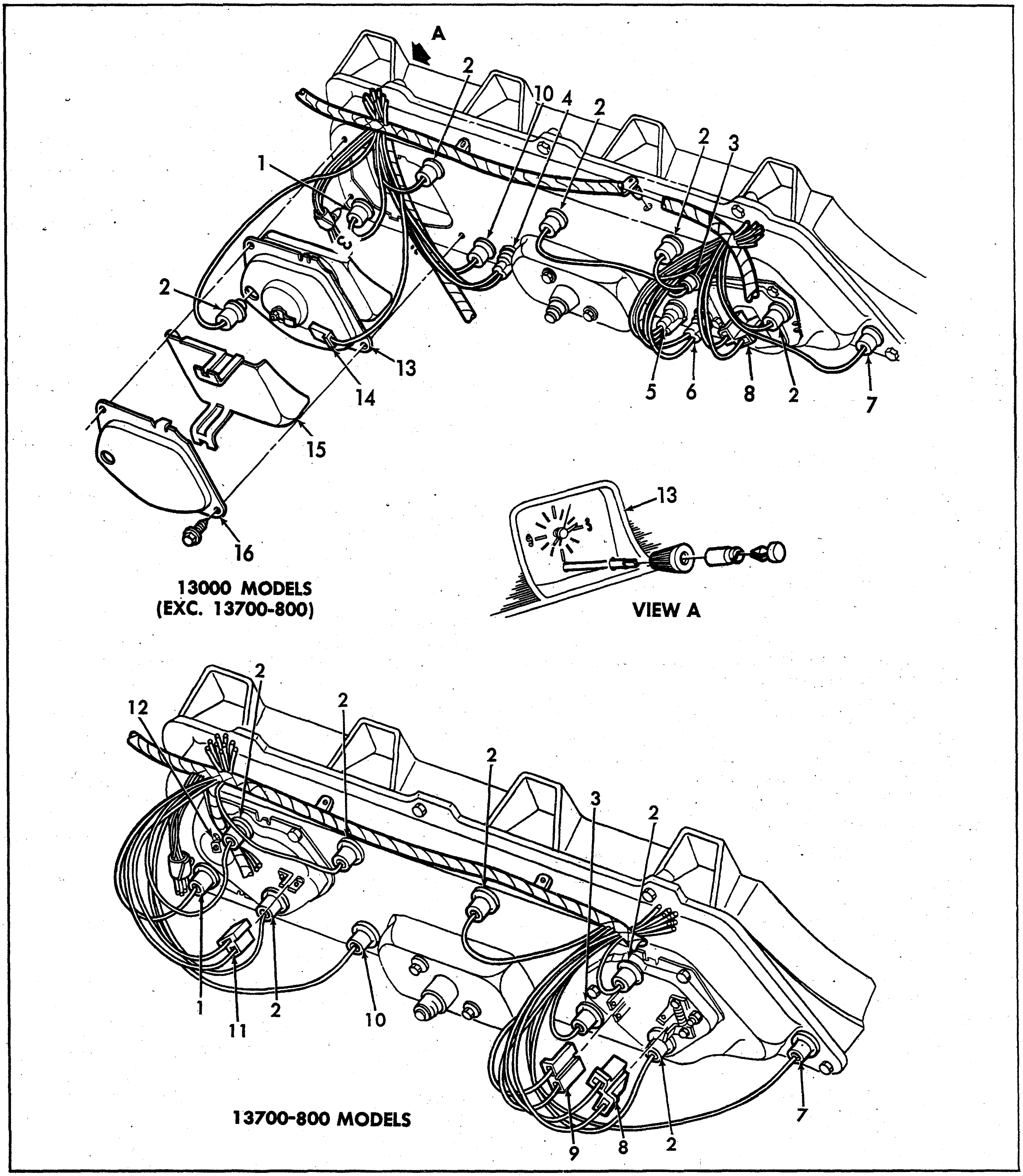


Fig. 43 - Instrument Cluster Assembly

1. R.H. Directional Indicator
2. Instrument Cluster Lamp
3. "Bright" Indicator
4. "Gen" Indicator
5. "Temp" Indicator
6. "Oil" Indicator
7. L.H. Directional Indicator
8. Fuel Gauge Connector
9. "Batt" Gauge Connector
10. Parking Brake Alarm Indicator
11. "Temp" Gauge Connector
12. Oil Pressure Gauge Fitting
13. Clock Assembly
14. Clock Connector
15. Cover (13100-400)
16. Plate (13100-400)

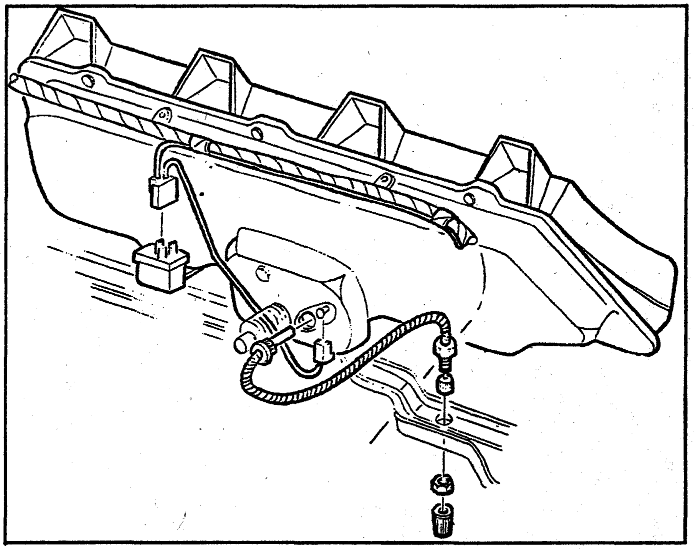


Fig. 43b - Speed Warning Device

TEMPERATURE AND/OR OIL PRESSURE GAUGE

1. Disconnect battery ground cable.
2. Remove ash tray and ash tray retainer.
3. Disconnect A/C hose from the distributor duct.
4. Disconnect wiring connectors and lamp bulbs from rear of gauge.
5. Disconnect oil pressure pipe fitting from rear of oil pressure gauge.
6. Remove (3) screws retaining gauge assembly to cluster cover and disengage unit from cover.
7. Remove (4) retaining nuts and remove gauge from template.
8. To install, reverse removal procedure.

INDICATOR LIGHT REPLACEMENT

To replace any indicator or cluster bulb, unsnap the proper socket from rear of instrument cluster, remove and replace bulb, and reinsert unit into rear of cluster housing.

OIL PRESSURE INDICATOR

If the light does not come on when the ignition switch is turned on, or if the light comes on and remains on after the engine is started, one or more the following conditions is indicated:

- Low oil pressure
- Defective wiring or switch
- High engine temperature

Switch 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 using Tool J-21757, replace with new unit, and check operation.

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

If indicator light does not go out at engine idle speed, refer to Charging Systems under Engine Electrical, Section 6Y.

TEMPERATURE (COOLING SYSTEM) 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.

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 on V-8 engines and in the cylinder head near an exhaust port on L-6 engines) and replace with new unit.
3. Refill cooling system and check operation of unit.

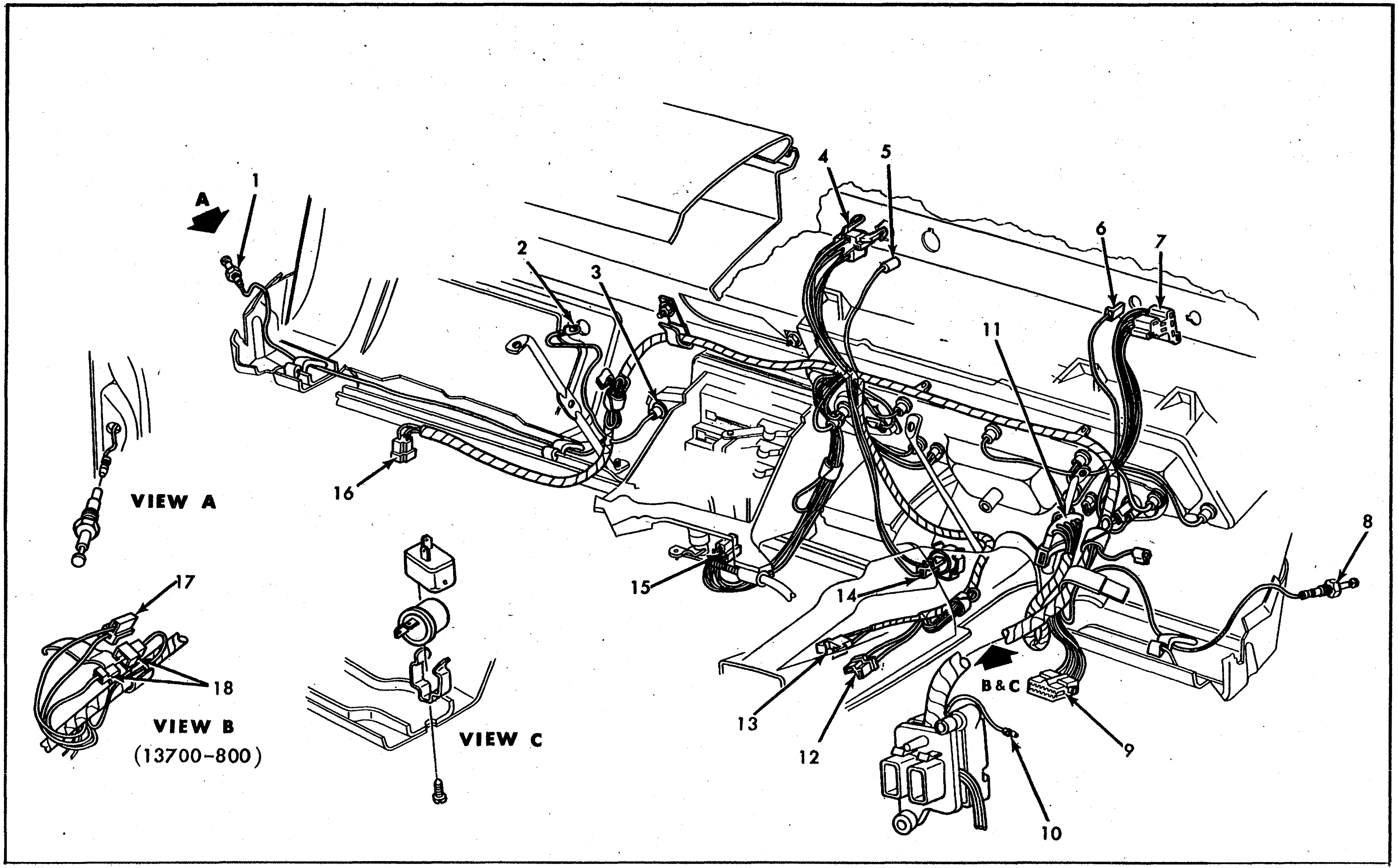


Fig. 44 - Instrument Panel Wiring Harness

1. R.H. Door Jamb Switch
2. To Instrument Panel Compartment Light
3. Heater Control Lamp
4. Ignition Switch Connector
5. Cigarette Lighter Connector
6. W/S Wiper Switch Connector
7. Light Switch Connector
8. L.H. Door Jamb Switch
9. To Body Harness Connector
10. Parking Brake Alarm Switch Connector
11. Directional Signal Switch Connector
12. Backing Lamp Switch Connector
13. Stop-Lamp Switch Connector
14. Flasher Unit
15. Heater Control Switch Connector
16. Heater Resistor Connector
17. Console Courtesy Lamp Connector
18. Neutral Safety Switch Connector

CHEVY II INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The Chevy II instrument cluster assembly consists of: a speedometer; a fuel gauge; a generator, temperature and oil pressure indicator lamps, and includes a clock on deluxe models. Except for the speedometer, all of the cluster lamps, instruments and gauges of the cluster may be serviced without removing the instrument cluster assembly from the console.

In addition to the instrument indicator lamps, a brake warning lamp is included in the cluster as standard equipment. The indicator is connected to the parking brake and brake pressure differential switches and serves a dual function. It lights when the parking brake is applied and also when the brake pedal is applied, if a malfunction should occur in the brake system due to a loss of hydraulic pressure. Servicing of the hydraulic pressure differential switch is covered in Section 5 of this manaul.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean and tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

SERVICE OPERATIONS

INSTRUMENT PANEL

INSTRUMENT CLUSTER

Removal and Installation (Figs. 45 thru 48)

1. Disconnect battery ground cable.
2. Remove mast jacket upper support clamp (refer to Steering, Section 9, for complete procedure on lowering jacket) and lower steering column.

NOTE: Apply protective material to the mast jacket to prevent damage to the painted surfaces.

3. Disconnect retaining collar securing speedometer cable to speedometer head.
4. Remove screws retaining cluster to console.
5. Pull cluster forward of console opening and disconnect all wiring and lamp connections. Remove cluster from vehicle.

CAUTION: Do not pull cluster outward further than slack in wiring harness will allow, other-

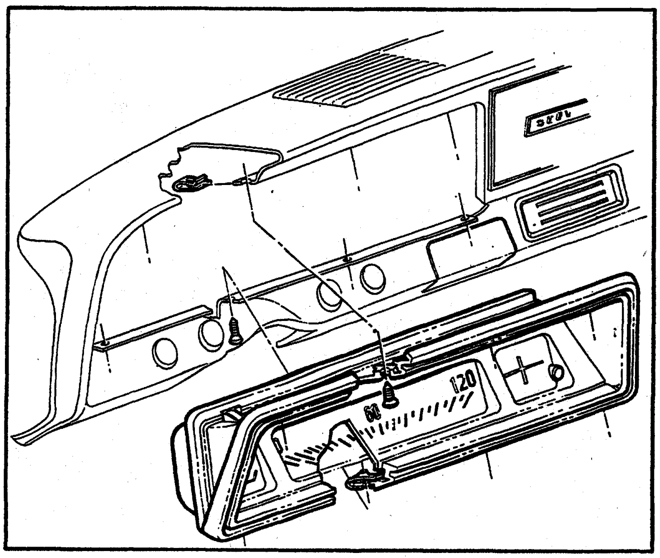


Fig. 45 - Instrument Cluster Installation -- Chevy II

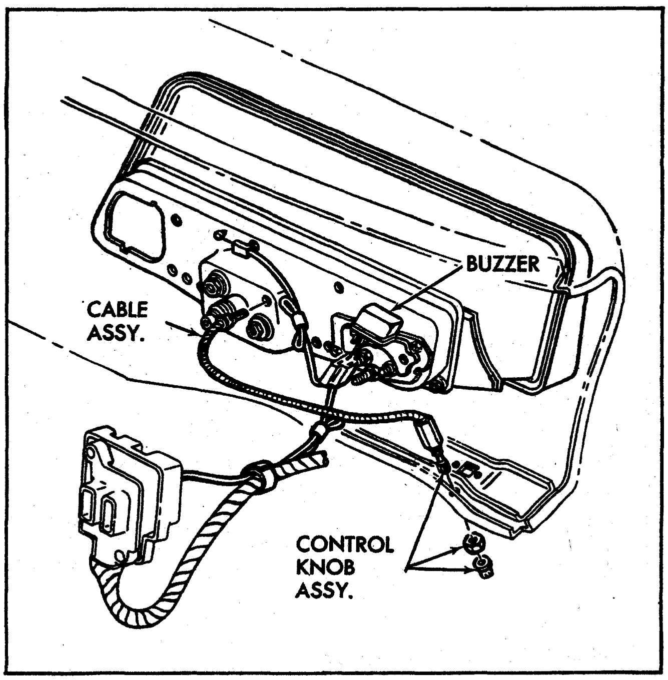


Fig. 46 - Speed Warning Device

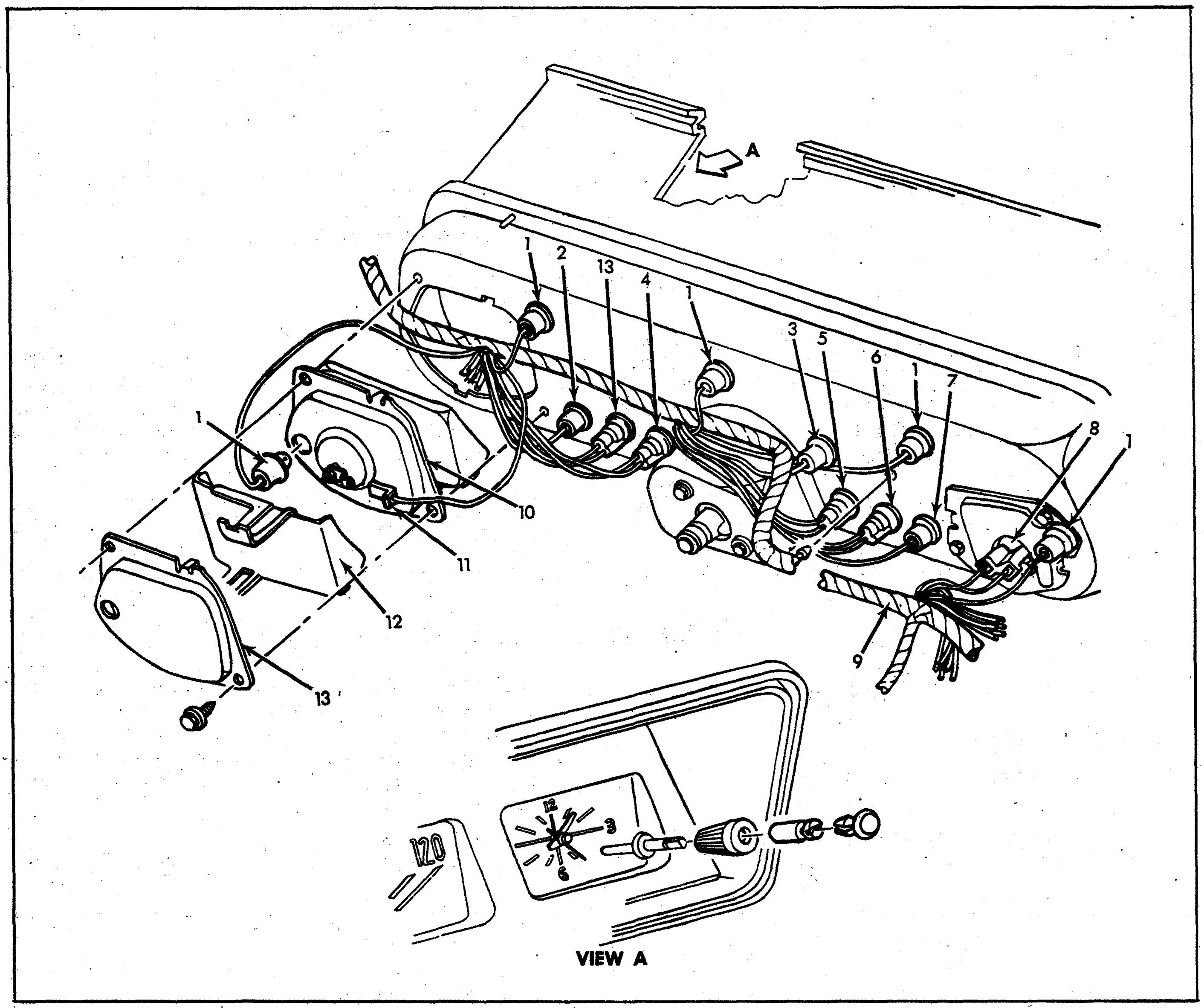


Fig. 47 - Instrument Cluster Wiring

1. Instrument Cluster Bulb
2. R.H. Directional Indicator
3. Bright Indicator
4. Gen Indicator
5. Temp Indicator
6. Oil Indicator
7. L.H. Directional Indicator
8. Fuel Gauge Connector
9. Instrument Panel Wiring Harness
10. Clock Assembly (11700-800)
11. Cover (exc. 11700-800)
12. Plate (exc. 11700-800)
13. Brake Alarm Indicator

wise wiring and lamp connections may be damaged.

6. To install, position cluster to console opening and connect all wiring and lamp connections.
7. Position cluster in console and attach speedometer cable to the speedometer head.
8. Install eight screws retaining cluster to console.
9. Install mast jack upper clamp assembly.
10. Connect battery ground cable and check operation of instruments and gauges.

FUEL GAUGE REPLACEMENT

1. Disconnect battery ground cable.
2. Disconnect cluster lamp and wiring harness connections at rear of gauge.
3. Remove two screws retaining gauge to rear of cluster housing and remove gauge from housing.
4. Remove terminal nuts attaching gauge unit to cover plate and remove unit from plate.
5. To install, reverse the removal procedure.

CLOCK REPLACEMENT

1. Disconnect battery ground cable.
2. Remove clock set shaft knob retaining screw and knob from set shaft.
3. Disconnect wiring and lamp connections from rear of clock.
4. Remove two screws attaching clock to rear of housing and remove clock from cluster housing.

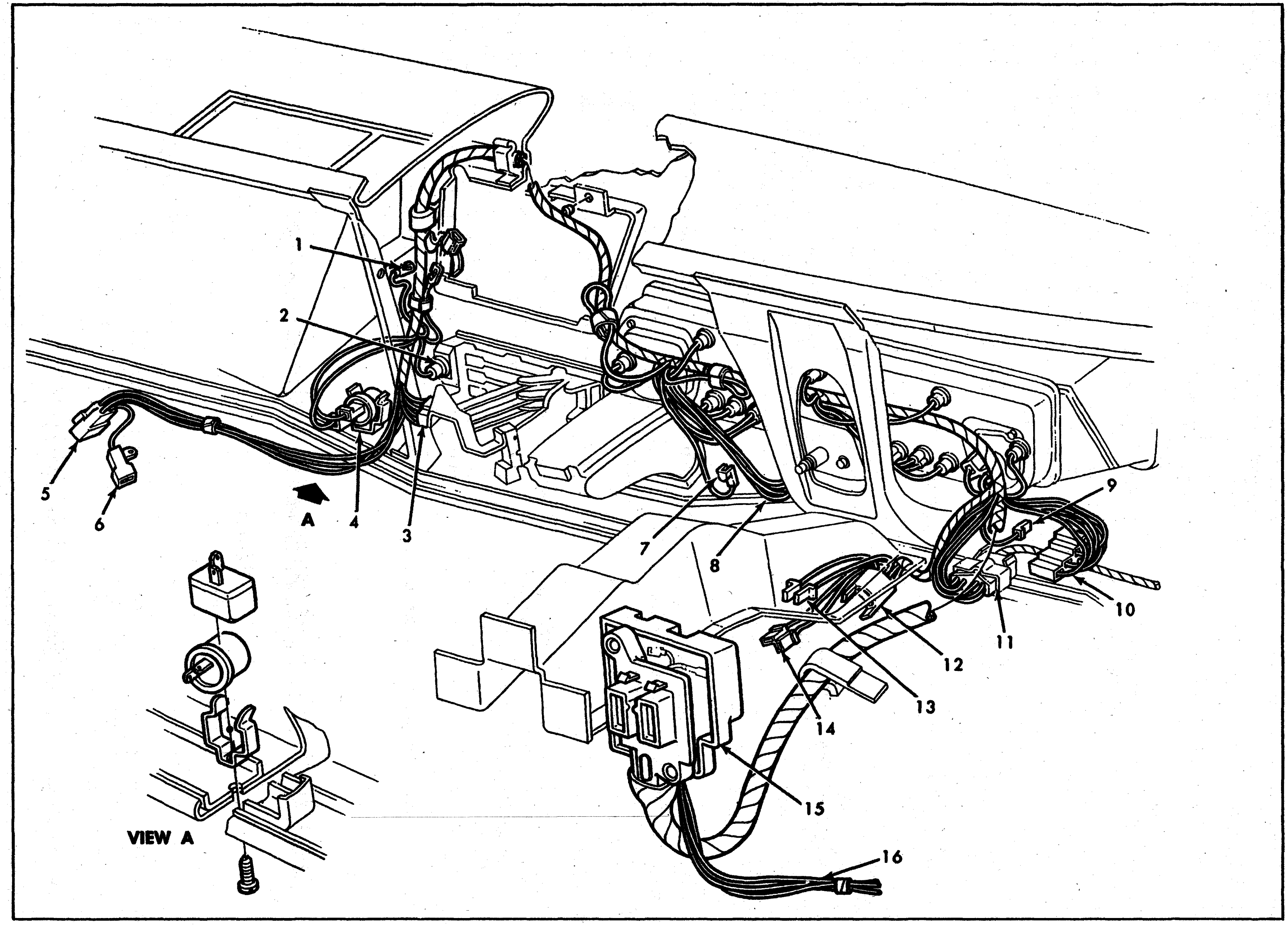


Fig. 48 - Instrument Panel Wiring Harness

1. To Instrument Panel Compartment Light
2. Heater Control Bulb
3. To Heater Switch
4. To Directional Signal Flasher
5. To Heater Resistor
6. To Blower Motor Connector
7. To Cigarette Lighter
8. To Ignition Switch
9. To Wiper Switch
10. To Light Switch
11. To Fisher Body Connector
12. To Directional Signal Connector
13. To Stop Lamp Switch
14. To Backing Lamp
15. Fuse Panel
16. To Dimmer Switch

5. To replace, reverse the removal procedure.

SPEEDOMETER REPLACEMENT

1. Remove instrument cluster as previously described in this section.
2. Remove clock set shaft knob.
3. Remove eight screws securing cluster housing to bezel trim panel. Separate parts carefully observing stack up of parts.
4. Remove two screws securing speedometer head to rear of cluster housing.

NOTE: Servicing of the speedometer head should be performed by an authorized AC Speedometer Service Station.

5. To install, reverse the removal procedure.

SPEEDOMETER 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.

INDICATOR LIGHT REPLACEMENT

To replace any indicator or cluster bulb, unsnap the proper socket from rear of instrument cluster, remove and replace bulb, and reinsert unit into rear of cluster housing.

OIL PRESSURE INDICATOR

If the light does not come on when the ignition switch is turned on, or if the light comes on and remains on after the engine is started, one or more of the following conditions is indicated:

- Low oil pressure
- High engine temperature
- Defective wiring or switch

Switch 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.

GENERATOR INDICATOR

1. Ignition on, engine not running and telltale light off.
   a. Indicator bulb burned out, replace bulb.
   b. Open circuit or loose connection in the telltale light circuit.
2. Telltale light stays on after engine is started.
   a. If indicator light does not go out at engine idle speed, refer to Charging Systems under Engine Electrical, Section 6Y.

TEMPERATURE (COOLING SYSTEM) 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.

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 on V-8 engines and in the cylinder head near an exhaust port on L-6 engines) and replace with new unit.
3. Refill cooling system and check operation of unit.

CORVETTE INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

All Corvette instruments and gauges are conveniently located in the dash-mounted cluster. The entire cluster is removable to permit servicing of the various instruments and gauges. The indicator and cluster illuminating bulbs may be replaced without removing the cluster from the panel.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean and keeping the speedometer and tachometer cables properly lubricated.

SERVICE OPERATIONS

INSTRUMENT CLUSTER

REMOVAL AND INSTALLATION (Fig. 49)

1. Remove mast jacket assembly. Refer to Section 9 for removal procedures.
2. Disconnect tachometer drive cable at distributor.
3. Disconnect the headlamp panel control switch from instrument cluster.
4. Remove lighting switch as outlined in this section.

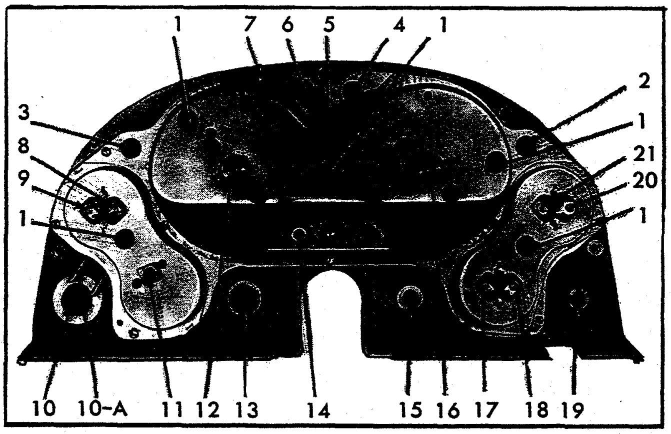


Fig. 49 - Instrument Cluster Connections

1. Cluster Illuminating Bulbs
2. Direction Signal Indicator Bulb L.H.
3. Direction Signal Indicator Bulb R.H.
4. Headlamp Actuating Motor Indicator
5. Headlamp Hi Beam Indicator
6. Parking Brake Alarm Indicator
7. Ground Lead Attaching Point
8. Temperature Indicator "I" Terminal
9. Temperature Indicator "S" Terminal
10. Ignition Switch Receptacle
10A. Ignition Switch Illuminating Bulb
11. Oil Pressure Indicator
12. Tachometer
13. Lighter Receptacle
14. Trip Odometer
15. Wiper Switch Receptacle
16. Speedometer
17. Ammeter "Gen" Terminal
18. Ammeter "Battery" Terminal
19. Lighting Switch Receptacle
20. Fuel Gauge "I" Terminal
21. Fuel Gauge "S" Terminal

5. Remove the ignition switch. Refer to Section 6Y for removal procedure. Then disconnect ignition switch lamp support at instrument panel.
6. Disconnect oil pressure line at oil pressure gauge then remove the lead wires from ammeter, wiper switch and cigarette lighter. Disconnect trip odometer at mast jacket support.
7. Remove the instrument cluster-to-dash retaining screws and pull cluster assembly slightly forward to obtain clearance for removal of speedometer cable, tachometer cable, cluster ground wire, fuel gauge lead wires and remaining indicator and cluster illuminating lamps.
8. To install cluster in dash panel, reverse removal procedure.

FUEL GAUGE

The gasoline fuel gauge circuit consists of an electrical indicator in the instrument cluster and a float-controlled rheostat in the fuel tank.

Since the fuel gauge consists of two remotely located units and connecting wires, it is sometimes difficult to determine which unit is at fault when the gauge fails to operate properly. Cluster removal is necessary to replace the fuel gauge.

NOTE: Be sure to check gas gauge fuse in fuse panel before attempting to trouble shoot for inoperative gauge or tank sending unit.

SPEEDOMETER AND/OR TACHOMETER

Removal and Installation

Cluster must be removed from vehicle to service speedometer head assembly (see Cluster Removal procedure). With cluster removed from vehicle:

1. Remove five screws securing cluster back panel to cluster assembly; separate the parts carefully.

   CAUTION: Care must be used to avoid marring instrument cluster face.

2. Remove two screws securing speedometer or tachometer head to cluster back panel; carefully remove speedometer or tachometer head.

   NOTE: Servicing of speedometer or tachometer head should be performed by an authorized AC service station.

3. Reverse above procedure to install speedometer.

Cable Replacement or Lubrication

1. Disconnect the cable from the speedometer or tachometer 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 or distributor end of conduit as applicable.

2. Lubricate the lower 3/4 of cable with AC speedometer cable lubricant and push the cable into the conduit. Connect the upper end to the speedometer or tachometer head and road test vehicle for proper operation.

TEMPERATURE GAUGE

The temperature indicator requires very little service other than testing for malfunctioning and replacing defective units. Cluster must be removed to service temperature gauge.

Do not attempt to repair either the engine unit or the gauge. When installing new engine unit, do not use thread compound on unit threads, as this will increase electrical resistance of unit and cause faulty reading on gauge.

AMMETER OR OIL PRESSURE GAUGE

The ammeter or oil pressure gauge requires very little attention other than keeping ammeter terminals clean and tight. If the oil pressure control line should become restricted it should be blown out or replaced. Cluster must be removed to service these gauges.

CAMARO INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The standard Camaro instrument cluster assembly consists of two circular units which house the speedometer and fuel gauge assemblies. The oil pressure, left-hand directional and brake warning indicators are located in the face of the speedometer bezel while generator, temperature and right-hand directional indicators are grouped with the fuel gauge unit. The high beam indicator is located between the cluster bezels.

A special instrumentation package is available with the eight-cylinder engine and center floor console combination. The special cluster includes: a clock; coolant temperature, oil pressure, fuel and ammeter gauges, mounted forward on the seat separator console; a tachometer in the right circular housing of the dash instrument cluster; and a low fuel level indicator replacing the oil pressure indicator lamp in the instrument cluster.

The instruments and gauges, may be serviced only after the instrument cluster is removed from the vehicle. Indicator and cluster lamps except for the high beam indicator may be replaced without removing the cluster assembly. Partial cluster removal is necessary when replacing the high beam indicator due to its proximity to the upper brace rod anchor plate. The bulbs are installed in plastic sockets which lock into the cluster housing and make contact with the printed circuit.

A low level fuel warning system is a special feature available with the floor console gauge pack. This system includes an indicator lamp in the dash cluster and a semi-conductor unit senses the change in electrical resistance of the fuel system circuitry as variations in fuel level occur. The sensing device is replaced as a unit if found defective.

The brake warning light serves a dual purpose. It functions as an indicator when the parking brake is applied and also if there is a malfunction (loss of hydraulic pressure) in the brake system. Switches which provide the signal to operate the light are located at the parking brake assembly and at the brake master cylinder in the hydraulic lines. Service of the brake pressure differential switch unit is covered in Section 5 of this manual.

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 properly lubricated.

SERVICE OPERATIONS

INSTRUMENT CLUSTER (Figs. 50 thru 53)

Removal and Installation

1. Disconnect battery ground cable.
2. Remove mast jacket lower support screws at toe pan.
3. Remove mast jacket upper support bolts and allow steering wheel to rest on seat cushion.

CAUTION: Both supports must be detached to prevent distortion of mast jacket.

4. Remove cluster attaching screws from face of panel and partially remove assembly from console opening.
5. Reaching behind cluster assembly, disconnect speedometer cable, speed warning device (if so equipped - Fig. 51) and chassis harness connector at rear of panel.
6. Remove assembly from console opening to a suitable bench area for required service operations.
7. To install, reverse removal procedure.

INSTRUMENT CLUSTER LAMP REPLACEMENT

1. Turn bulb holder counterclockwise and pull out to remove from the cluster housing.
2. Pull bulb straight out to remove from socket.
3. Press replacement bulb inward to lock in socket.
4. Insert lamp assembly into housing, with lugs on holder entering notches in housing, and turn clockwise to lock in place.

PRINTED CIRCUIT REPLACEMENT

1. Remove instrument cluster as previously described in this section.
2. Remove all cluster illuminating and indicator lamps from housing.
3. Remove fuel gauge terminal nuts or tachometer retaining nuts securing printed circuit to housing.
4. Remove four hex head screws retaining printed circuit to the cluster housing and remove circuit from housing.
5. To install, reverse removal procedure.

CAUTION: The retaining screws are part of the grounding circuit and must be installed to provide proper connections for the printed circuit.

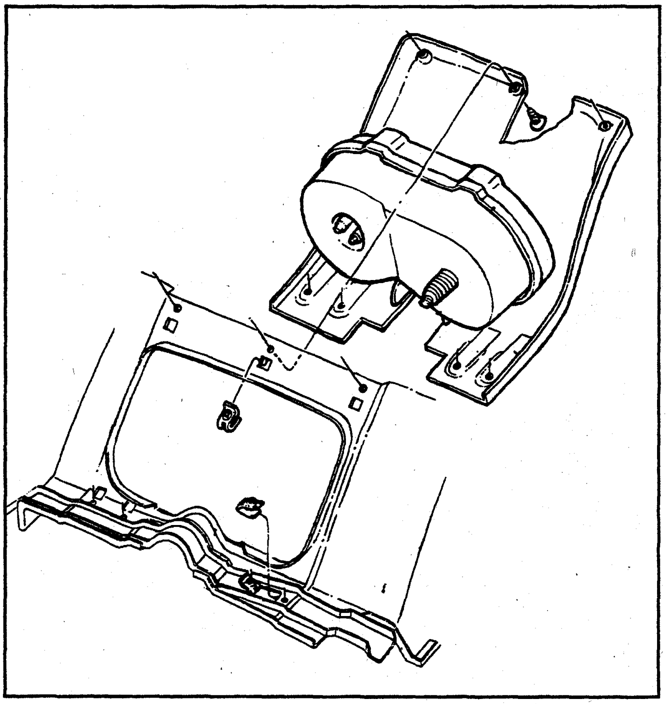


Fig. 50 - Instrument Cluster Installation -- Camaro

FUEL GAUGE REPLACEMENT

1. Remove instrument cluster assembly as previously described.
2. Remove cluster lamps from gauge cover plate, ground screw and terminal nuts attaching printed circuit to fuel gauge.
3. Remove three screws retaining gauge assembly to cluster housing.
4. Carefully move printed circuit away from gauge and remove gauge assembly from cluster housing.
5. Remove terminal nuts securing gauge to cover plate, and detach gauge unit.
6. To install, reverse removal procedure.

TACHOMETER

NOTE: The tachometer is a self-contained, all transistor unit requiring very little service other than keeping the terminal nuts clean and tight. The unit is not serviceable and must be replaced, if defective.

1. Remove instrument cluster as previously described in this section.
2. Remove cluster lamps from rear of gauge cover and disconnect harness wiring connections from gauge terminals.
3. Remove three screws retaining gauge to cluster housing.
4. Move printed circuit away from gauge area and remove gauge unit from housing.
5. Remove terminal nuts securing gauge to cover and detach unit.
6. To install, reverse removal procedure.

SEAT SEPARATOR INSTRUMENT CONSOLE (Fig. 54)

(Fuel, Ammeter, Temperature, Oil Pressure Gauges, Low Fuel Warning Unit, and Clock)

1. Disconnect battery ground cable.
2. Remove clock shaft knob from face of cluster.
3. Remove cover retaining screws (4) and cover from cluster assembly.

   NOTE: Use an allen wrench to remove the two screws located in the top of the cover below the instrument console.

4. Remove four screws retaining gauge mounting plate to cluster housing.
5. Carefully disengage gauge plate from housing and disconnect oil pipe and all electrical connections at rear of gauges.

   NOTE: At this point, with gauge package removal from housing all gauges including the low fuel warning system may easily be serviced.

6. To install assembly, use reverse of removal procedure.

OIL PRESSURE INDICATOR

If the light does not come on when the ignition switch is turned on, or if the light comes on and remains on after the engine is started, one or more of the following conditions is indicated.

- Low oil pressure
- Defective wiring or switch

Sending 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).

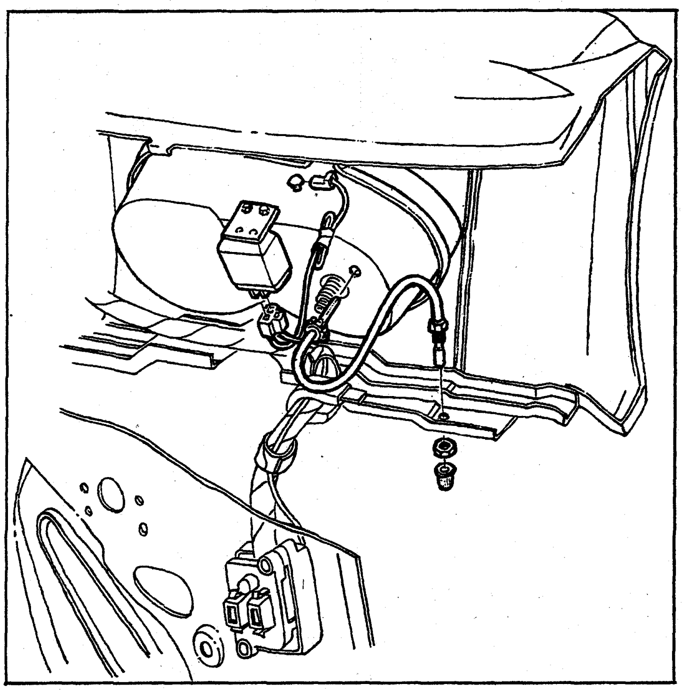


Fig. 51 - Speed Warning Device

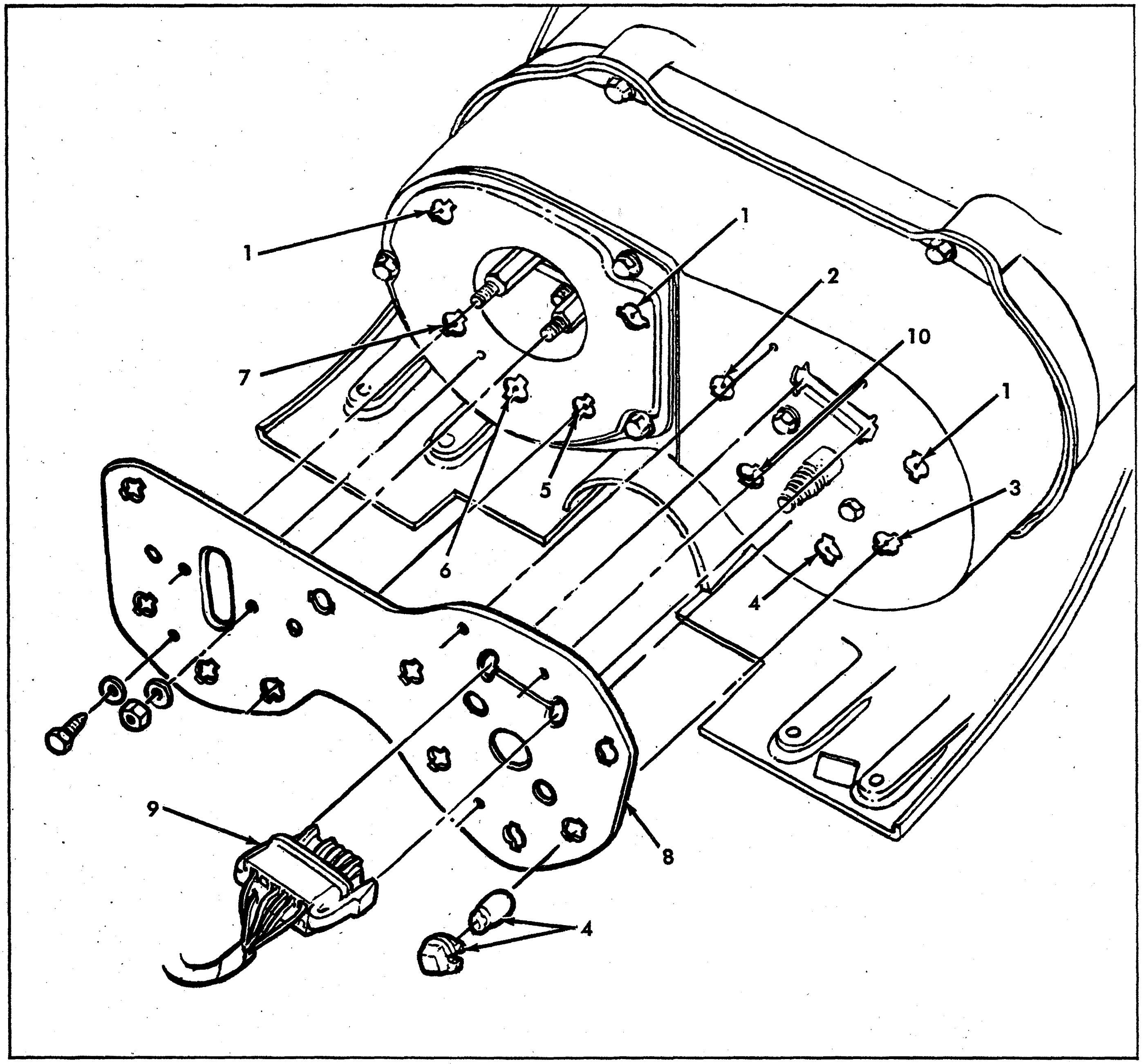


Fig. 52 - Instrument Cluster Lighting

1. Cluster Lamp
2. # High Beam Indicator
3. Oil Pressure Indicator
4. L.H. Directional Indicator
5. Generator Indicator
6. R.H. Directional Indicator
7. Temperature Indicator
8. Printed Circuit
9. Chassis Harness Connector
10. Brake Warning Indicator

2. Remove sender unit.
3. Replace with new unit and check operation.

GENERATOR INDICATOR

1. Ignition on, engine not running and indicator light off:
   - Indicator bulb is burned out, replace bulb.
   - Open circuit or loose connection in the indicator light circuit.
2. Indicator light stays on after engine is started:
   - If indicator light does not go out at engine idle speed, refer to Charging System Tests in Section 6Y, Engine Electrical.

TEMPERATURE (COOLING SYSTEM) INDICATOR

The temperature indicator circuit consists of two remotely located units, indicator lamp and sending unit. The indicator lamp, located in the instrument cluster

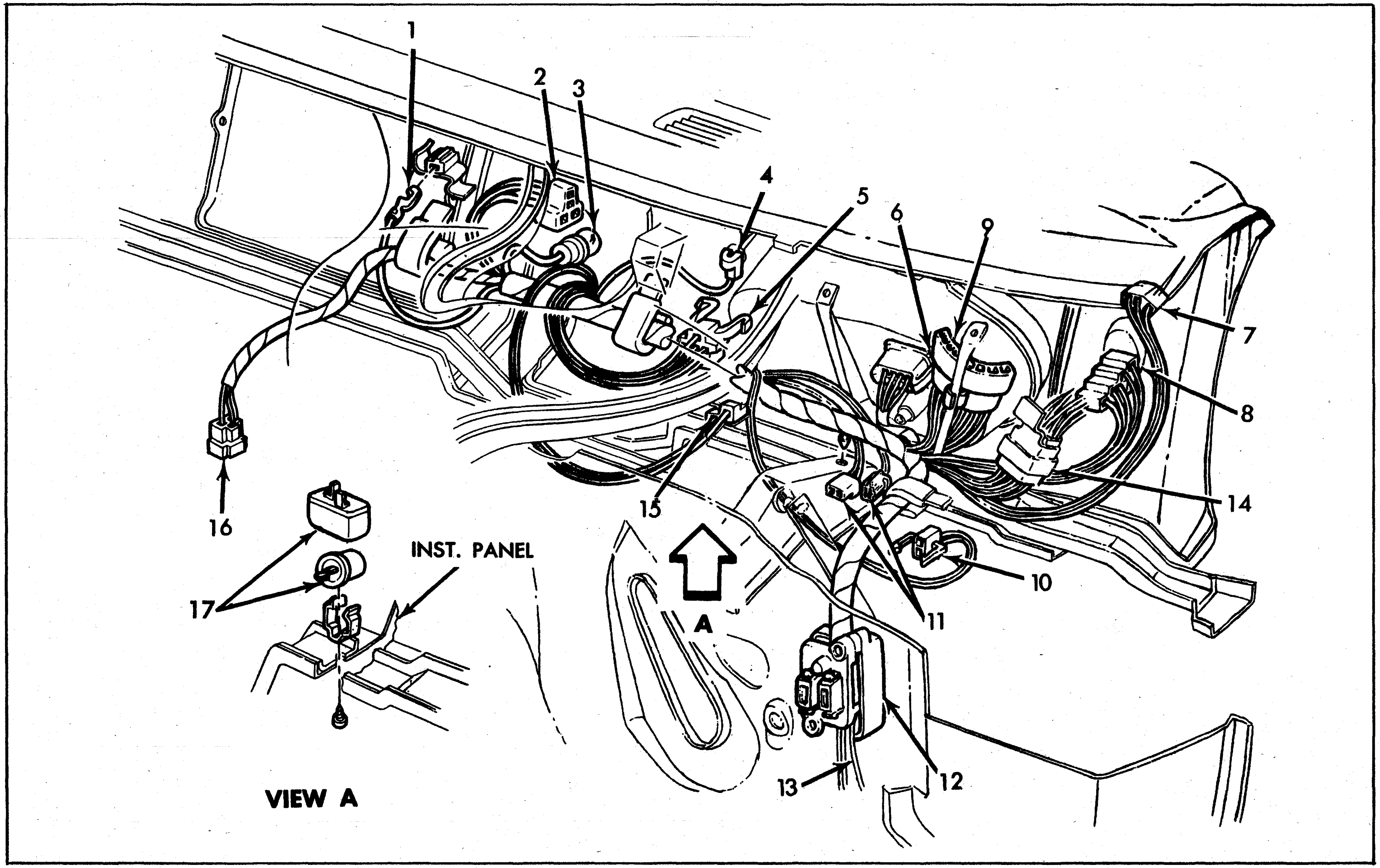


Fig. 53 - Instrument Panel Wiring Harness

1. To Glove Box Light
2. To Heater Control
3. Heater Control Lamp
4. To Cigarette Lighter
5. To Ignition Switch
6. To Instrument Cluster
7. To Wiper Switch
8. To Light Switch
9. To Directional Signal Switch
10. To Stop Lamp Switch
11. To Backing Lamp Switch
12. Fuse Panel
13. To Dimmer Switch
14. To Fisher Body Connector
15. To Directional Signal Flasher
16. To Heater Resistor
17. Directional Signal Flasher

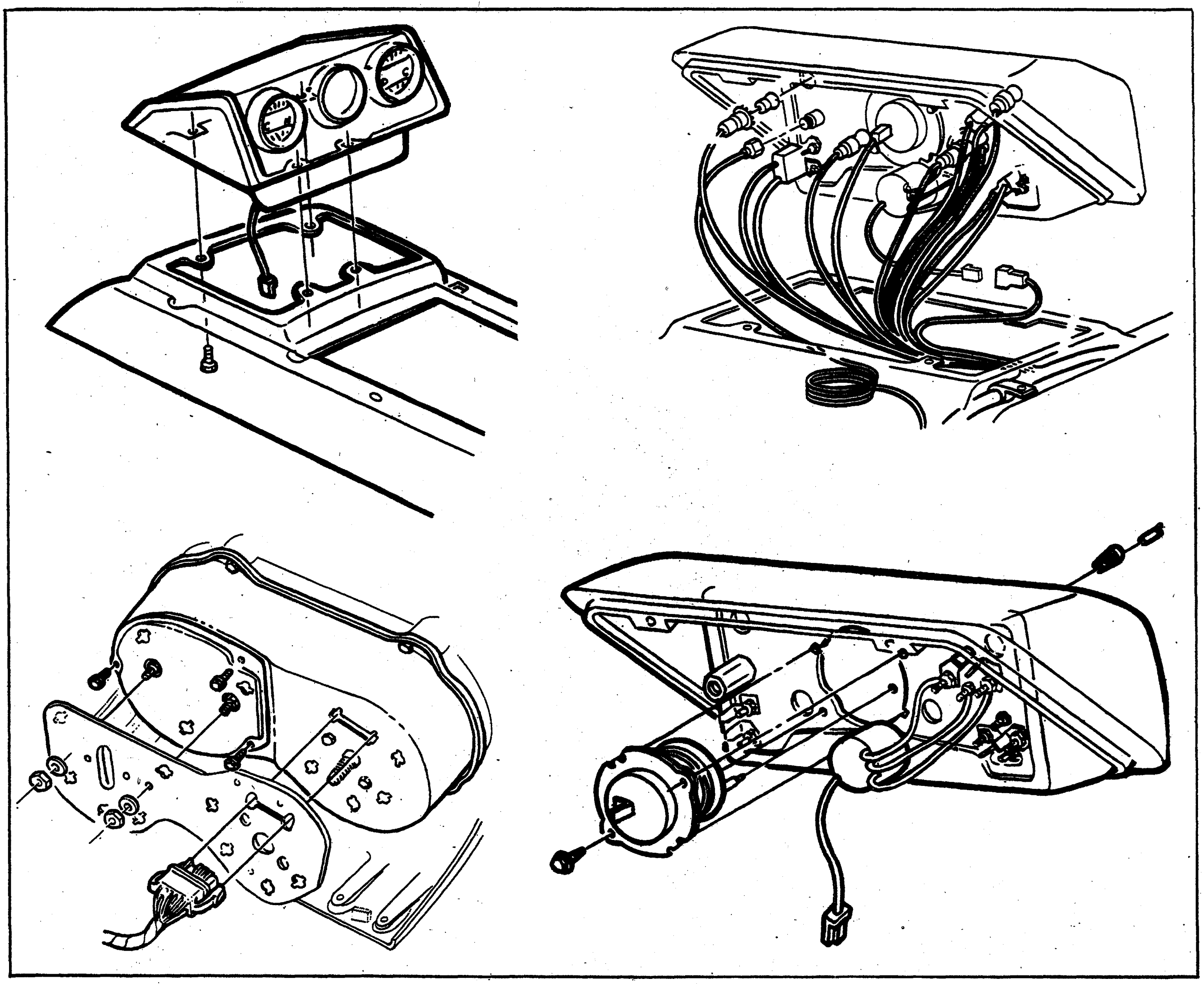


Fig. 54 - Seat Separator Instrument Console

consists of a single red light which will indicate an overheated engine condition.

Engine Sender Unit Replacement

1. Drain engine cooling system to a level below unit.
2. Remove sender unit (located in cylinder head near an exhaust port on L-6 engines and in the inlet manifold near water pump housing on V-8 engines).
3. Replace unit, refill cooling system and check operation of unit.

DIRECTIONAL SIGNAL

Directional signal assemblies provide as standard production equipment a lane changing feature and hazard warning system on all model applications. Two different design switches are used as shown in Figure 55. Major difference between the two units is that one type has cancelling and detent springs which are serviceable, otherwise both units are not repairable and must be replaced as an assembly in service.

Due to the integral design relationship of the signal switch and the energy absorbing steering column, reference should be made to Steering, Section 9 of this manual whenever any service operations are performed on the steering column. The directional signal switch replacement procedures covered in this section are intended to supplement the detail service operations outlined in Section 9.

Special note should be taken of the fact that different signal flasher units are used in Chevrolet models dependent on the number of lamps to be operated. The hazard warning unit, even though an integral component of the directional switch assembly, requires the installation of an additional flasher unit in the fuse panel capable of op-

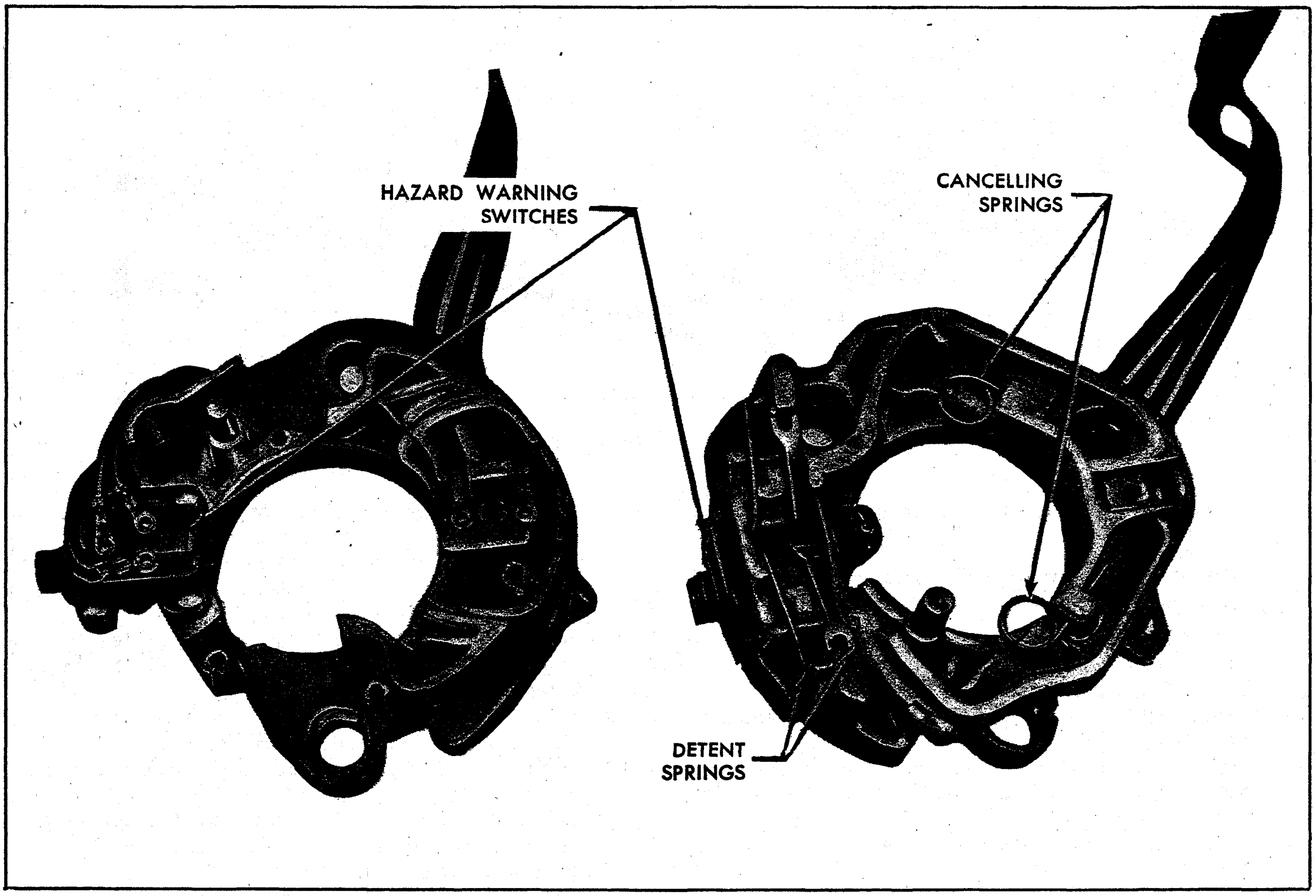


Fig. 55 - Directional Signal Switches

erating six to eight lamps simultaneously depending vehicle series and model.

DIRECTIONAL SIGNAL SWITCH REPLACEMENT

All steering columns except tilt and telescoping.

Chevrolet, Chevelle, Chevy II and Camaro (Fig. 56)

1. Disconnect battery ground cable.
2. Disconnect signal switch wiring from chassis harness at multiple connector under instrument panel.
3. Remove steering wheel assembly as outlined in Section 9, Steering.
4. Remove shift lever roll pin and shift lever from column (if applicable).
5. Push in hazard warning switch knob and unscrew knob. Remove switch lever arm.
6. On Chevy II and Camaro models equipped with automatic transmission remove column mounted dial indicator housing and lamp assembly (if applicable).
7. Remove mast jacket lower trim cover retaining screws and remove trim cover(s).
8. On Chevrolet and Chevelle models equipped with automatic transmission loosen set screw and remove quadrant dial pointer (if applicable).
9. Remove retaining "C" ring from upper steering shaft using snap ring remover Tool J-22569 (Refer to Steering, Section 9). Slide thrust and wave washers from steering shaft.
10. Loosen three signal switch mounting screws until assembly can be rotated counterclockwise.

    NOTE: Do not remove three screws from assembly until unit is on the bench.

11. Rotate switch assembly counterclockwise and pull unit from top of mast jacket. Allow unit to hang from end of column.

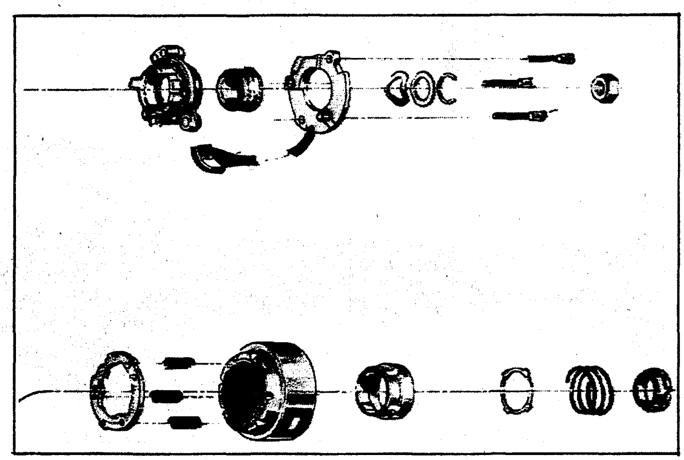


Fig. 56 - Standard Steering Column

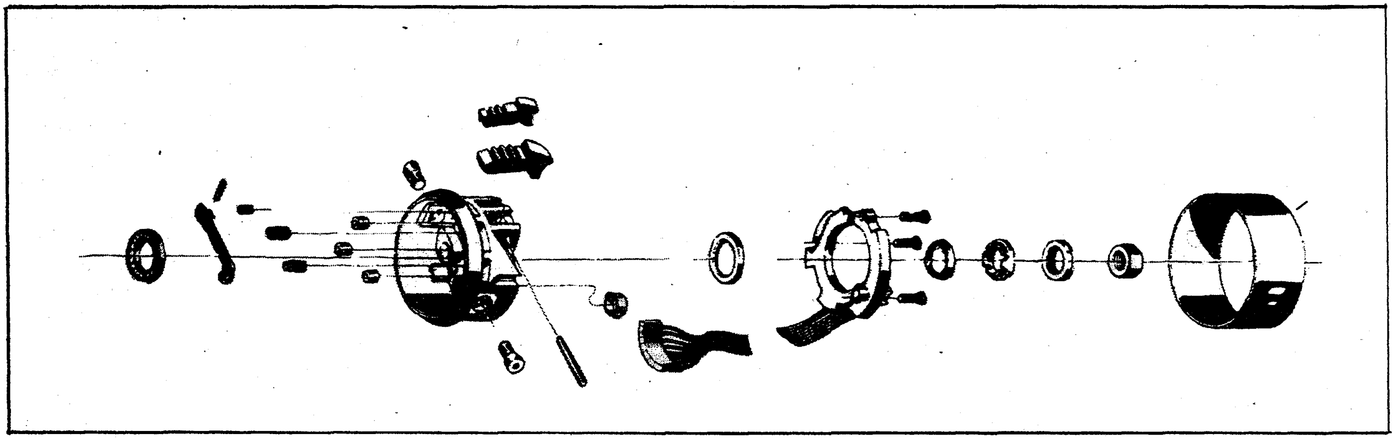


Fig. 57 - Tilt Steering Column

12. Remove upper support bracket bolts and bracket assembly.

    CAUTION: Do not suspend column by lower reinforcement only.

    Reinforce column and remove wiring harness protector and clip, then position bracket and reinstall bolts (finger tight).
13. Remove shift lever bowl from mast jacket and disengage from wiring harness.
14. Remove three mounting screws from engagement with lockplate. Use care not to lose 3 springs as screws are removed.
15. Disassemble switch and upper bearing housing from switch cover.

    NOTE: Directional switch is not repairable and must be replaced.
16. Insert the upper bearing housing assembly and signal switch assembly into the cover, feeding the signal switch wires through the cover.
17. Align signal switch and bearing housing holes with holes in the cover. Install three mounting screws through the holes.
18. Slide three springs on to screws and place lockplate in position over screws and springs. Tighten screws three turns into lockplate.
19. Feed switch wire through the shift lever bowl and place upper end assembly on top of bowl.
20. Place shift lever bowl and signal switch assembly on top of jacket, aligning the tangs on the I.D. of the lockplate with slots in jacket. Lock upper end of assembly into position by pushing down on cover assembly and rotating fully clockwise.
21. Tighten 3 turn signal mounting screws.
22. Remove mast jacket support clamp, position wiring and install wiring cover and clip, then reinstall mast jacket mounting bracket assembly.

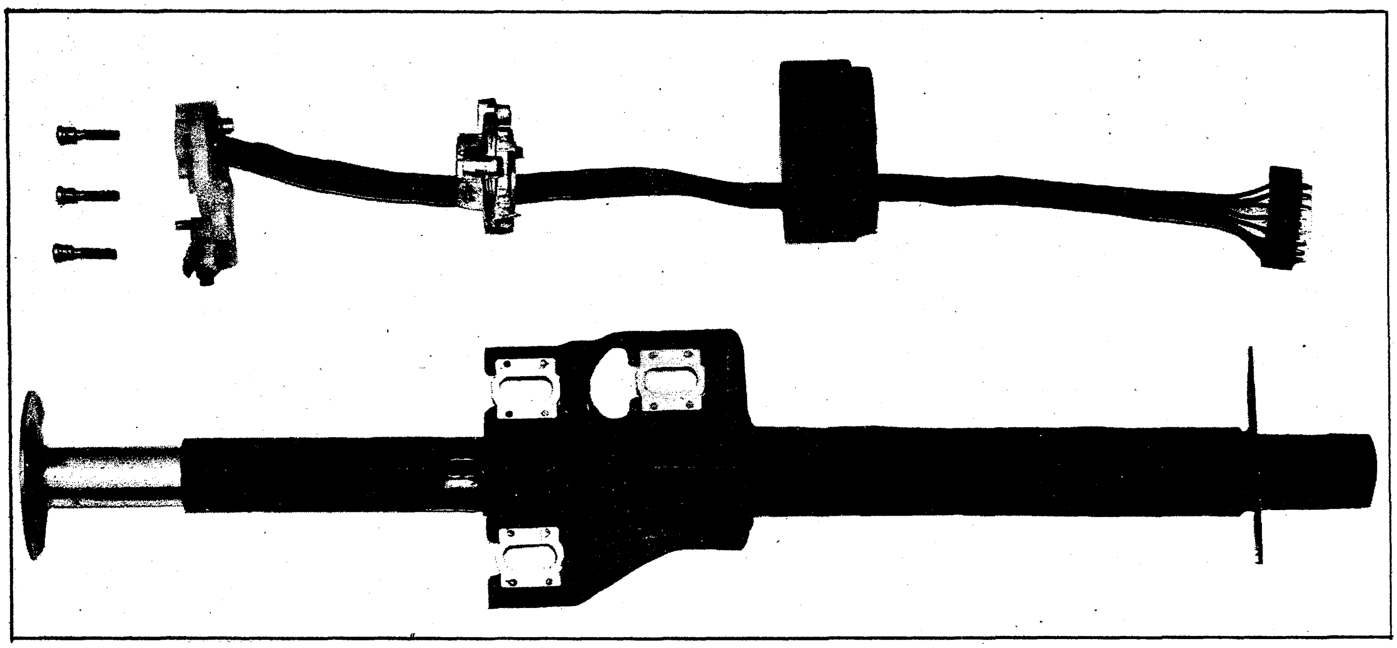


Fig. 58 - Telescoping Column

23. Install "C" ring over steering shaft using snap ring installer J-22659 (refer to Section 9).

    NOTE: Be sure retaining ring is completely seated into groove.

24. Install dial pointer on Chevrolet and Chevelle models equipped with automatic transmission (if applicable).
25. Install dial indicator and lamp assembly on Camaro and Chevy II models equipped with automatic transmission.
26. Install mast jacket lower trim covers (if applicable).
27. Install hazard warning knob and turn signal lever.
28. Install shift lever.
29. Install steering wheel.
30. Install multiple connector to switch wiring using old harness for wire color guide and connect to body harness connector.
31. Connect battery ground cable and check operation of assembly.

Tilt Steering Column (Fig. 57)

Chevrolet, Chevelle and Camaro

1. Disconnect battery ground cable.
2. Disconnect directional switch wiring harness from body harness at multiple connector under instrument panel.
3. Remove steering wheel assembly (refer to Steering, Section 9).
4. Remove preload spring and cancelling cam from end of shaft.
5. Remove shift lever pin and lever from steering column (except floor shift).
6. Remove directional lever screw and lever.
7. Push in hazard warning knob and unscrew knob.
8. On Camaro models equipped with automatic transmission, remove quadrant dial and lamp assembly from column.
9. Remove mast jacket trim cover(s).
10. On Chevrolet and Chevelle models with automatic transmission, loosen set screw and remove quadrant dial pointer.
11. Assemble slide hammer Tool J-6585-1 to turn signal cover remover Tool J-21486. Place cover remover over turn signal cover, tighten clamp, and pull cover from end of column with slide hammer (Refer to Steering, Section 9).
12. Remove three switch mounting screws, noting short length of top screw.
13. Cut multiple connector from switch wiring and slide switch from end of column.
14. To install new switch, feed wiring through the bearing housing, around support, and through shift bowl and shroud.
15. Feed through wiring protector. If clearance is not sufficient loosen mast jacket bracket retaining bolts.
16. Insert switch wiring terminals in multiple connector. Use old connector and wiring for color guide.
17. Position switch and install three mounting screws with short screw in top position.
18. Be sure hazard warning switch is pushed in, then install turn signal cover using special Tool J-21853. On automatic columns align key in cover with keyway in bearing housing.
19. Install turn signal lever, hazard warning knob and tilt lever.
20. Install shift lever and roll pin (where applicable).
21. Install dial pointer on Chevrolet and Chevelle. On Camaro install dial indicator and lamp assembly.
22. Install trim covers and retaining screws.
23. Install cancelling cam and preload spring.
24. Install steering wheel (Refer to Section 9).
25. Connect switch wiring to body harness under instrument panel.
26. Connect battery ground cable and check operation of unit.

Standard and Telescoping Steering Column

Corvette (Fig. 58)

1. Disconnect battery ground cable.
2. Disconnect signal switch harness wiring from chassis wiring harness at multiple connector under instrument panel.
3. Remove steering wheel assembly as outlined in Steering, Section 9.
4. Remove preload spring and cancelling cam.
5. Remove directional signal lever screw and lever.
6. Push in hazard warning knob, unscrew and remove knob.
7. Remove lower trim cover retaining screws and cover.
8. Remove retaining ring, thrust and wave washers from upper end of shaft.
9. Cut wiring above connector.
10. Remove three switch mounting screws, slide switch, cover and upper bearing housing from column, pulling wire through protector and escutcheon.
11. To install replacement switch, assemble upper bearing housing and turn signal switch into switch cover, then feed wiring through escutcheon and protector until switch can be positioned on mast jacket.
12. With switch positioned on mast jacket, install three switch mounting screws.
13. Install thrust and wave washers and snap lock ring in place.
14. Install turn signal lever and hazard warning knob.
15. Install cancelling cam and upper bearing preload spring on steering shaft.
16. Install steering wheel assembly.

    NOTE: Be sure directional signal switch is in neutral position before installing wheel.

17. Install connector on directional signal wiring harness and connect to body harness connector.

WINDSHIELD WIPERS AND WASHERS

INDEX

WIPER TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION (Fig. 59 and 60)

Chevrolet and Camaro

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 ball stud 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.

Chevelle (Fig. 61)

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.
4. Remove transmission retaining screws, lower assembly into plenum chamber, and remove unit from chamber.
5. To install, reverse removal procedure.

Chevy II (Fig. 62)

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

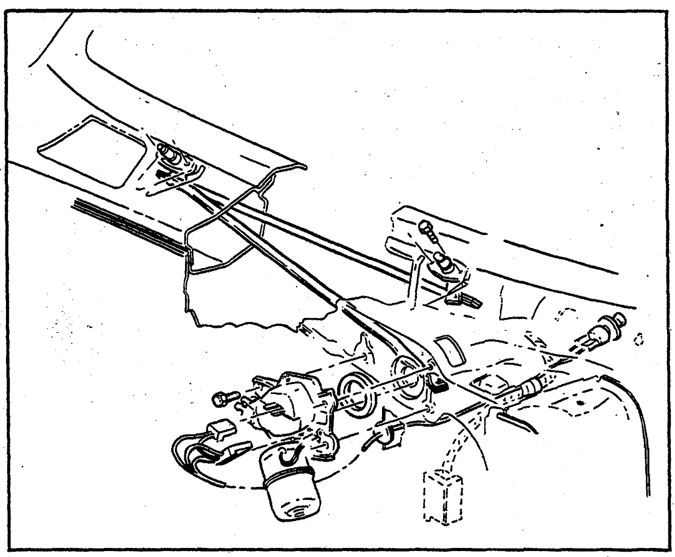


Fig. 59 - Wiper and Motor Linkage--Chevrolet

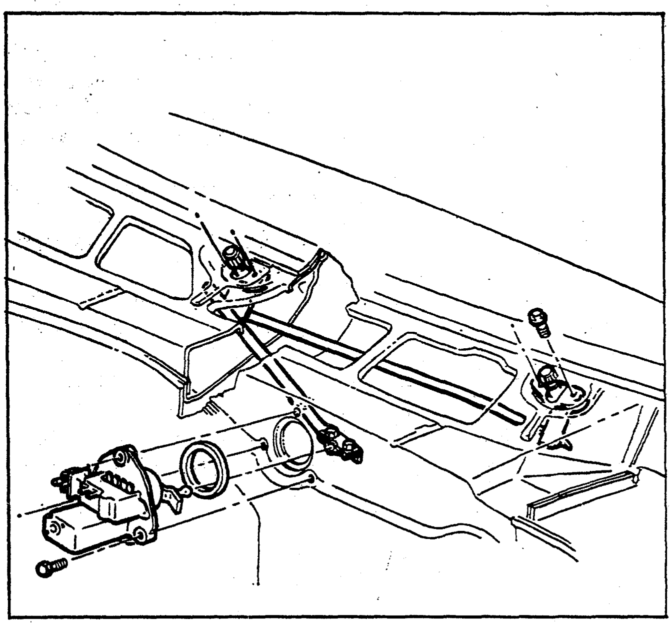


Fig. 60 - Wiper and Motor Linkage--Camaro

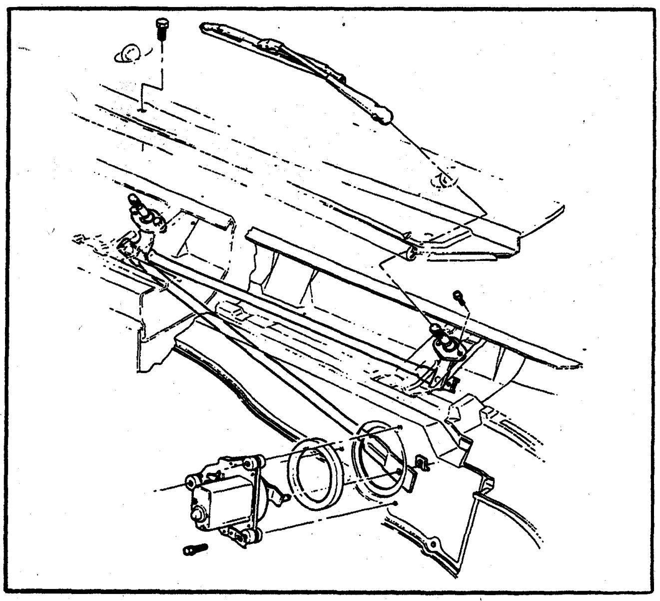


Fig. 61 - Wiper Motor and Linkage -- Chevelle

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

REMOVAL AND INSTALLATION

Chevrolet and Camaro (Fig. 59 and 60)

1. Make certain motor is in park position.
2. Disconnect washer hoses and electrical connectors from assembly.
3. On Chevrolet models, remove plenum chamber side cover and loosen nuts retaining drive rod ball stud to crank arm.
4. Remove three motor retaining bolts and motor. On Camaro models, pull wiper motor assembly from cowl opening and loosen nuts retaining drive rod ball stud to crank arm.
5. Check sealing gaskets at motor and retaining bolts, replace as necessary.
6. Position motor assembly to cowl and install retaining bolts. On Camaro models, attach crank arm to transmission rod.

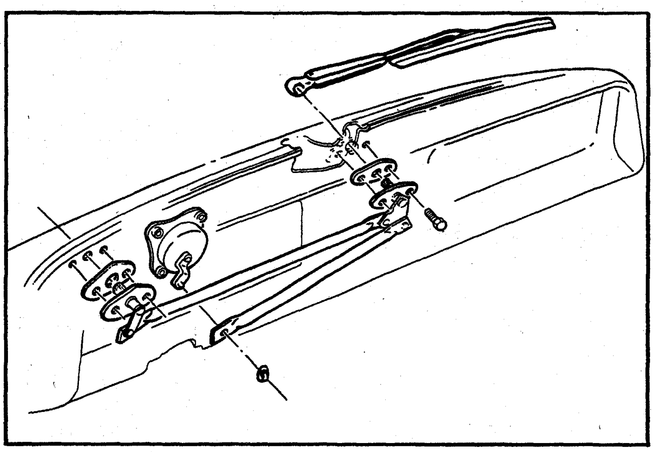


Fig. 62 - Wiper Transmission Removal -- Chevy II

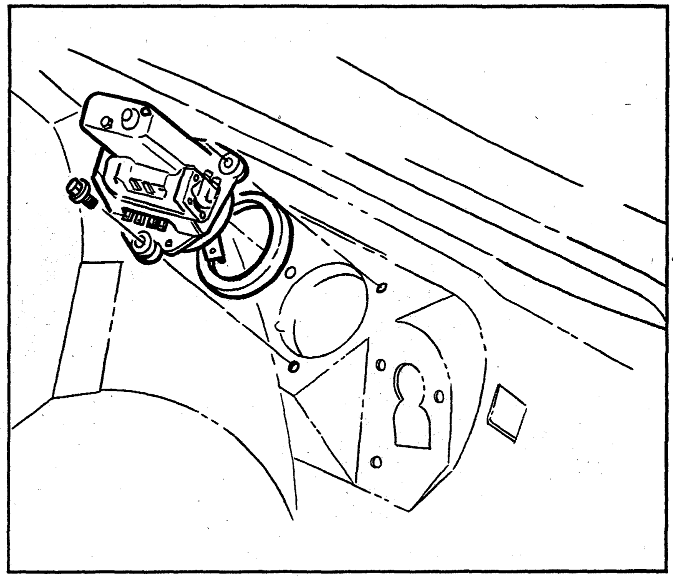


Fig. 63 - Wiper Motor Removal -- Chevy II

CAUTION: Motor assembly must be in the park position prior to installation to cowl. Do

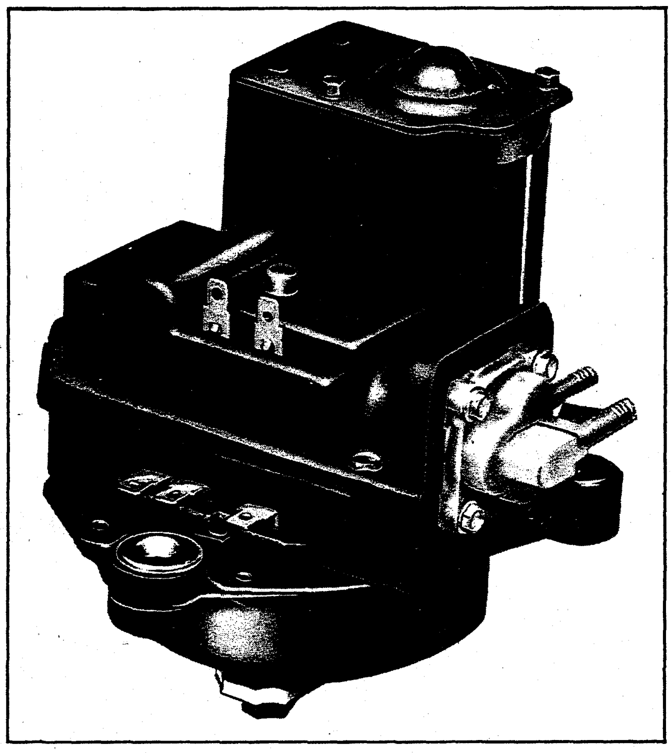


Fig. 64 - Non-Depressed Park Wiper

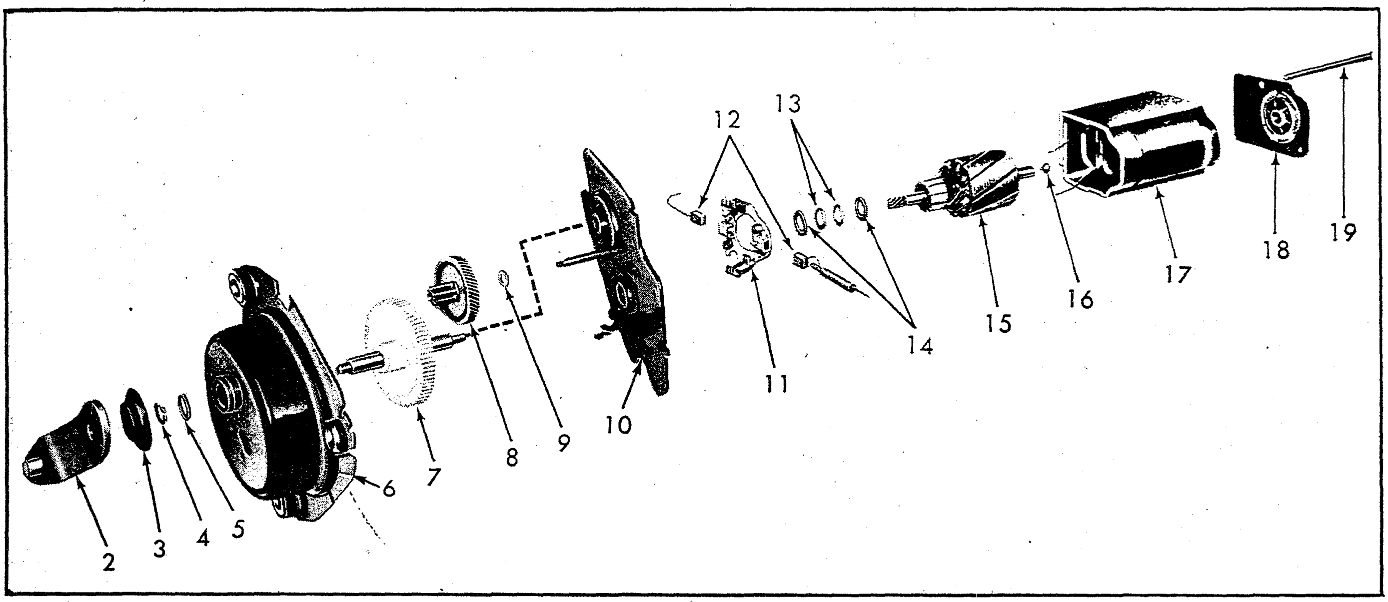


Fig. 65 - Wiper Motor and Gear Box Assembly

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)

not install motor which has dropped or hung from the drive link.

7. Connect wiring and washer hoses to assembly.
8. Install plenum grille side cover (Chevrolet models only).

Chevelle (Fig. 61)

1. Make certain motor is in park position.
2. Disconnect washer hoses 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.

6. Install washer hoses and electrical connections.

Chevy II (Fig. 63)

1. Make certain wiper motor is in park position.
2. Working under instrument panel, remove special retainer clip securing transmission linkage to motor crank arm.
3. Disconnect linkage, electrical connectors and washer hoses.
4. Remove three motor retaining bolts and remove motor from opening cowl.
5. To install, check sealing gaskets at motor and retaining bolts; replace as necessary.
6. Position motor to mounting location 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.

7. Attach crank arm to transmission rod and secure with retaining clip.
8. Connect wiring harness and washer hoses.

NON-DEPRESSED PARK WIPER

CHEVELLE, CHEVY II AND CAMARO

The Type "E" two-speed electric windshield wiper assembly (fig. 64) incorporates a non-depressed type (blades park approximately 2" above windshield molding) motor and gear train. The rectangular, 12 volt, compound 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.

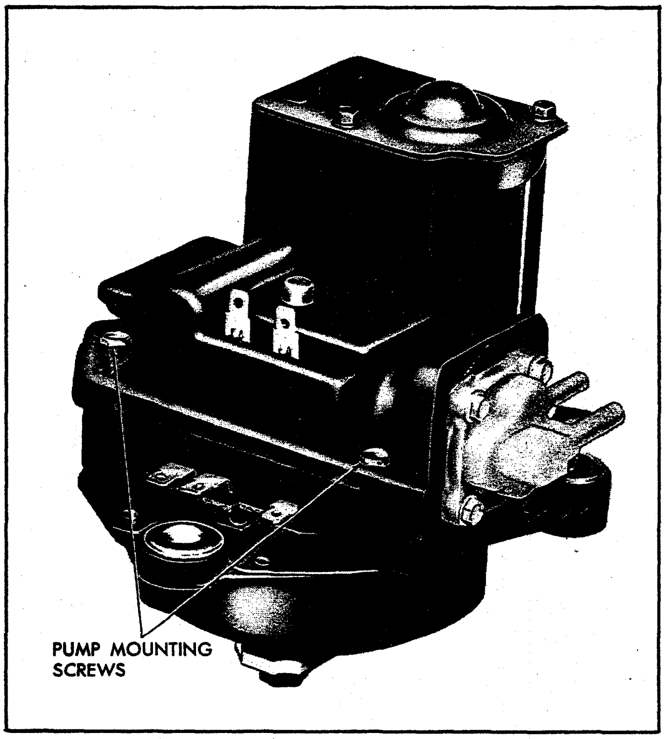


Fig. 66 - Washer Pump - Attach Screws

WIPER MOTOR ASSEMBLY

DISASSEMBLY

Gear Box (Fig. 65)

1. For wipers equipped with a washer pump, remove the two washer pump mounting screws (fig. 66) and lift pump off washer.
2. Remove washer pump drive cam as required (fig. 67). 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.

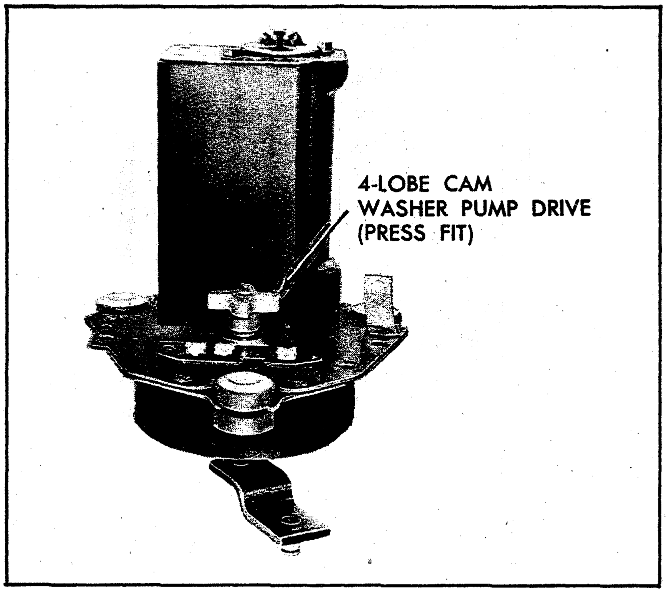


Fig. 67 - Washer Pump Drive Cam

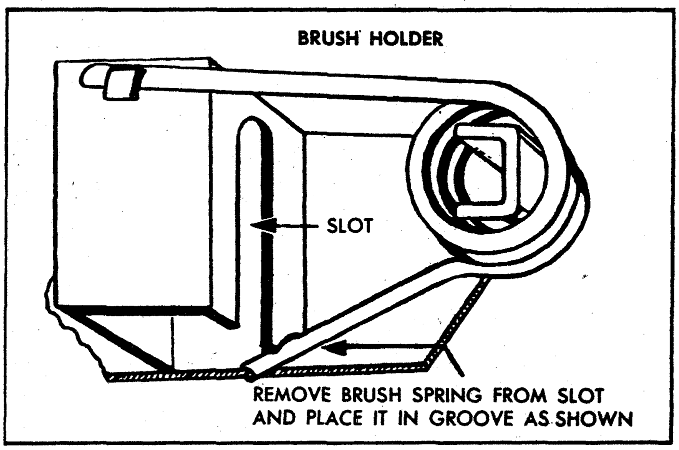


Fig. 68 - Releasing Brush Spring Tension

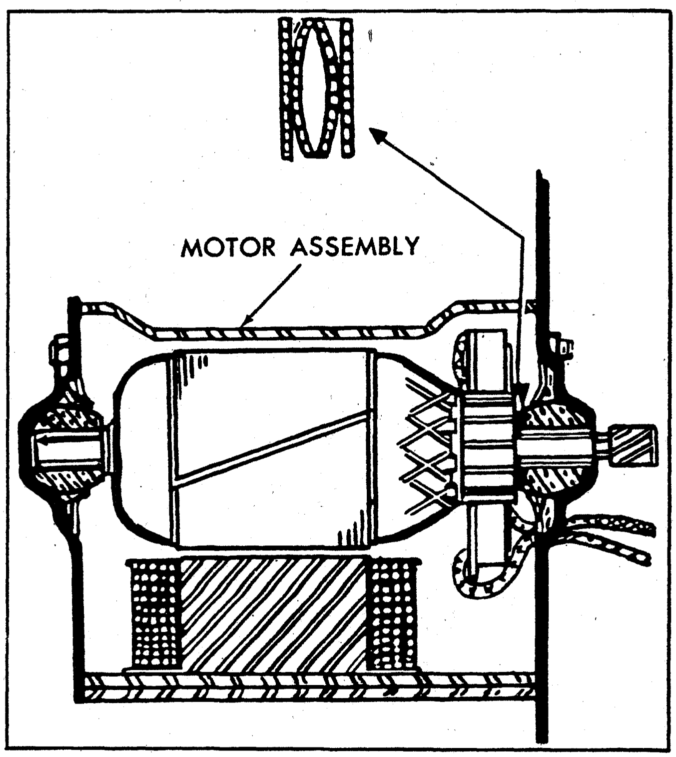


Fig. 69 - End Play Wave Washer Installation

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.

NOTE: Screws, nuts and washers for attaching a replacement terminal board-park switch assembly are included with the replacement assembly.

Motor (Fig. 65)

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. 68), slide armature and end plate from motor frame. Pull end plate from armature.

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 65 for exploded view of motor and gear train.

Motor

Reassemble motor using reverse of disassembly procedures.

NOTE: Armature end play is controlled by end play washers. See Figure 69 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.

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. 70).
3. Replace retaining nut, place crank arm in vise, tighten retaining nut.

WINDSHIELD WASHER PUMP

The windshield washer pump used on the 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. 71). 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.

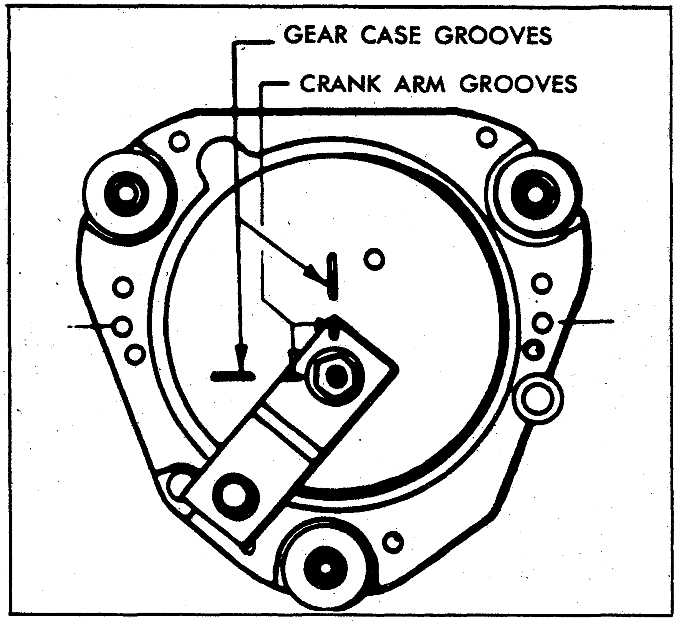


Fig. 70 - Wiper Crank Arm in Park Position

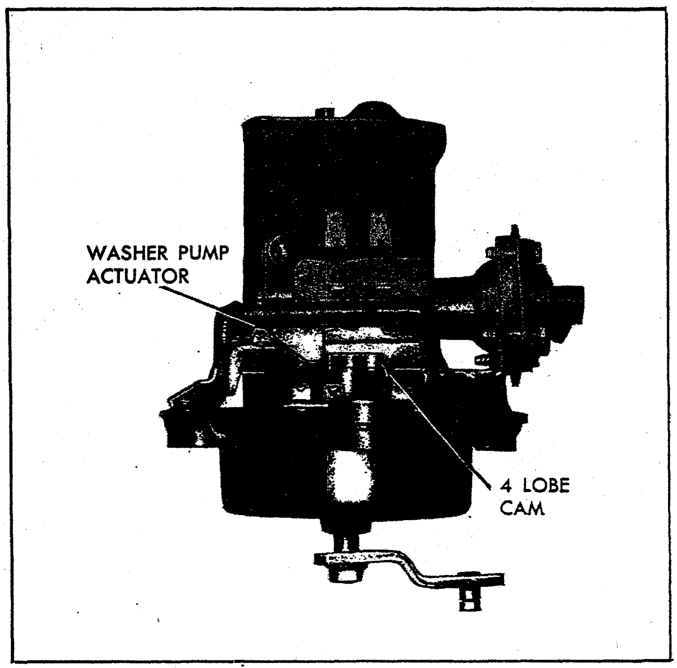


Fig. 71 - Wash Pump Drive Cam and Actuator

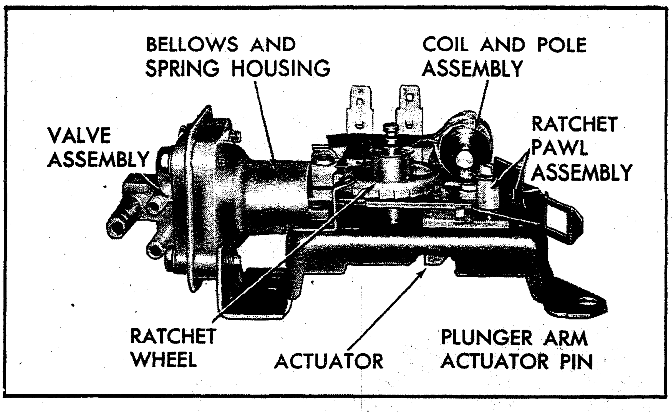


Fig. 72 - Washer Pump Mechanism

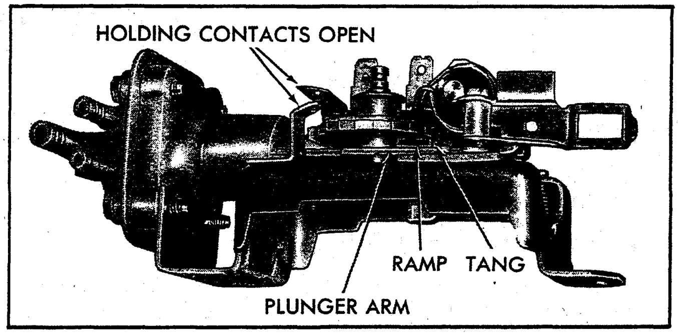


Fig. 73 - Releasing Pump from Lockout Position

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 and remove washer from wiper (fig. 66).
3. Reverse removal procedure to install assembly.

DISASSEMBLY—ASSEMBLY

Refer to Figure

1. Remove washer pump cover.
2. Relay
   a. To remove relay unsolder coil leads from terminals.

   NOTE: No coil polarity is necessary when re-soldering 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. 73).
   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
GENERAL DESCRIPTION

The Type "C" two speed electric wiper assembly (fig. 74) 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. 75).

An electric washer pump is mounted on the gear box section of the wiper and is driven by the wiper unit gear assembly (fig. 75).

The overhaul procedures for the wiper are broken down into three major areas: The motor section, gear box section and washer pump section. Each section may be serviced independently of the other.

SERVICE OPERATIONS

MOTOR SECTION

DISASSEMBLY

NOTE: Motor section may be disassembled independently of the gear box.

Brush Plate and Circuit Breaker Removal

1. Scribe a reference line along the side of the casting and end cap to insure proper re-assembly.
2. Remove the two motor thru bolts.
3. Feed exposed excess length of motor leads thru the casting grommet and carefully back the case and field assembly plus the armature away from the casting (fig. 76).

   NOTE: It may be necessary to remove the armature end play adjusting screw and insert a rod thru the opening in order to apply pressure against the end of the armature.

4. Unsolder the black lead from circuit breaker (fig. 77).
5. Straighten out the 4 tabs that secure the brush plate to the field coil retainers (fig. 77).

   CAUTION: Be careful not to break any of the retainer tabs.

6. Install "U" shaped brush retainer clip over brush holder that has brush lead attached to circuit breaker (fig. 78).
7. Holding the opposite brush from that retained in Step 6, carefully lift the brush holder off the mounting tabs far enough to clear the armature commutator (fig. 78).
8. Allow the brush, held in Step 7, to move out of its holder. Remove the brush spring and lift the brush holder off the armature shaft.

Armature Removal

1. Follow Steps 1 thru 8 under brush plate removal.
2. Lift armature out of case and field assembly.
3. Remove thrust ball from end of armature shaft as required and save for reassembly.

NOTE: Thrust ball may be easily removed with a magnet.

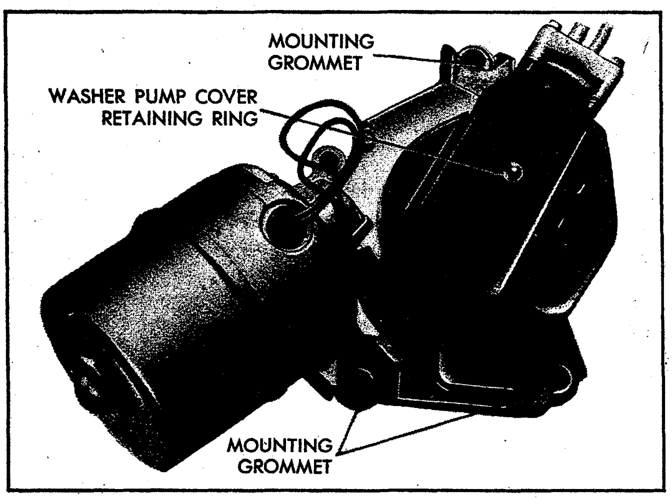


Fig. 74 - Depressed Park 2-Speed Wiper

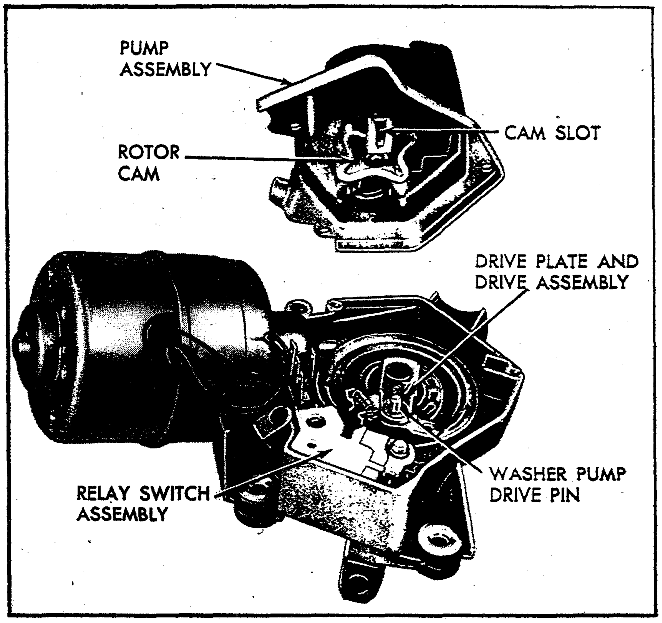


Fig. 75 - Wiper and Washer Pump Mechanism

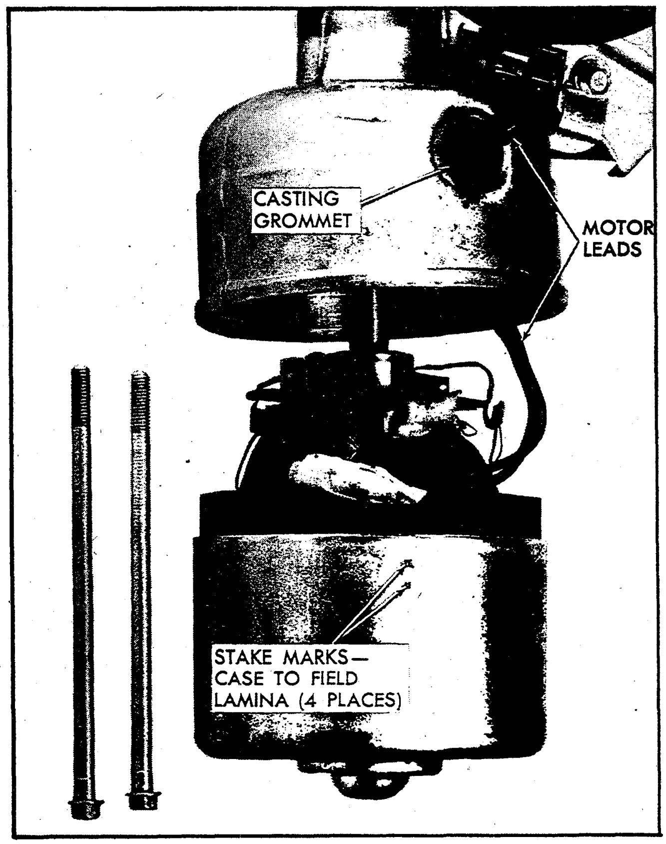


Fig. 76 - Wiper Motor Separation

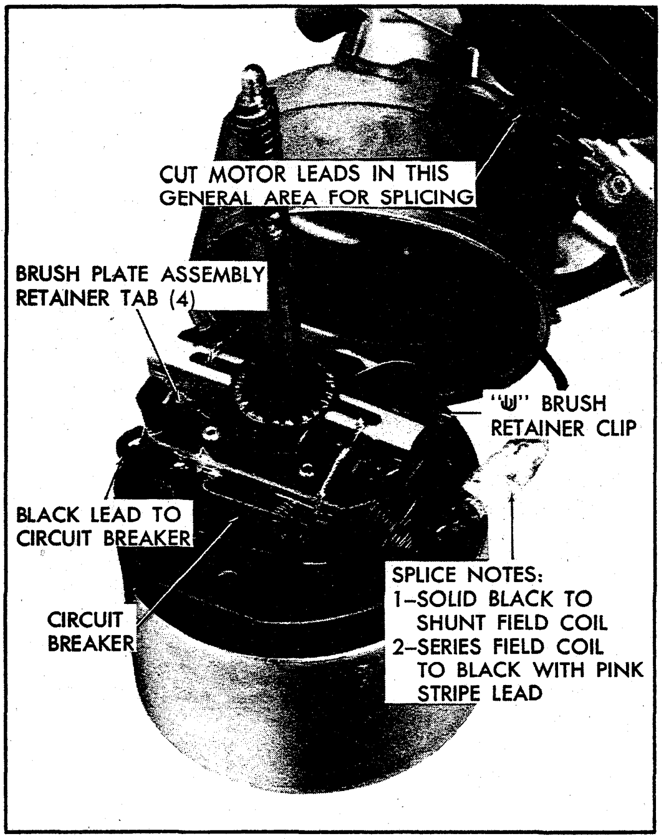


Fig. 77 - Circuit Breaker

Case and Field Assembly Removal

1. Remove brush plate and armature.
2. The end case and field assembly is serviced as a unit. To free the field and case assembly, cut the solid black and black with pink stripe leads in a location convenient for splicing - preferably near the wiper terminal board. Refer to Figure 76.
3. Remove steel thrust plate and rubber disc from case bearing as required.

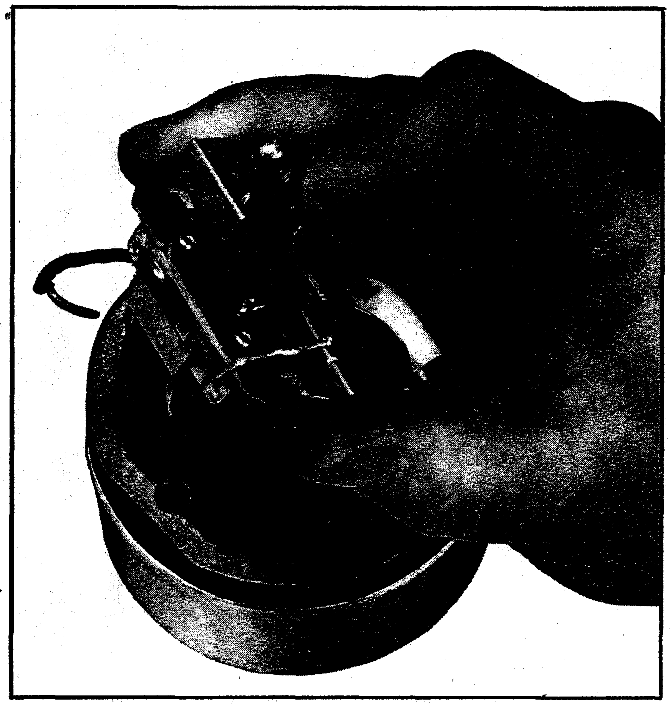


Fig. 78 - Removing Brush Holder

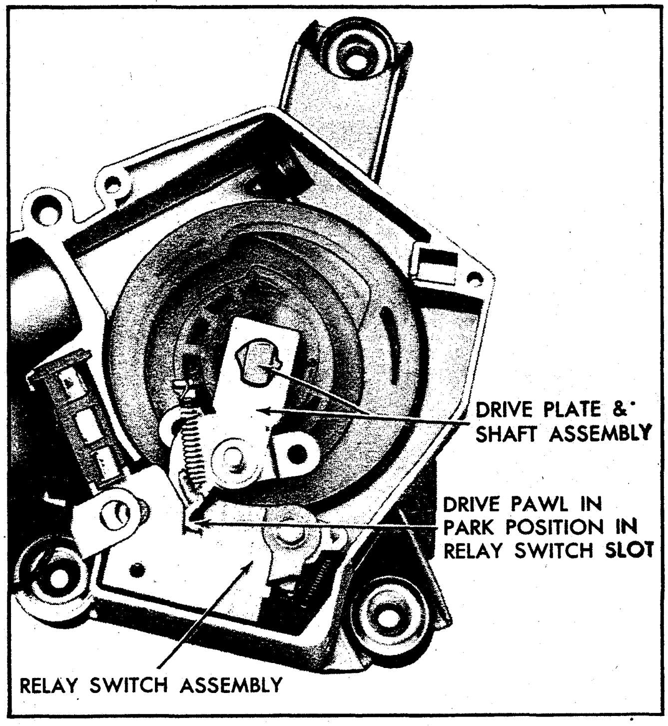


Fig. 79 - Drive Pawl in Full Park Position

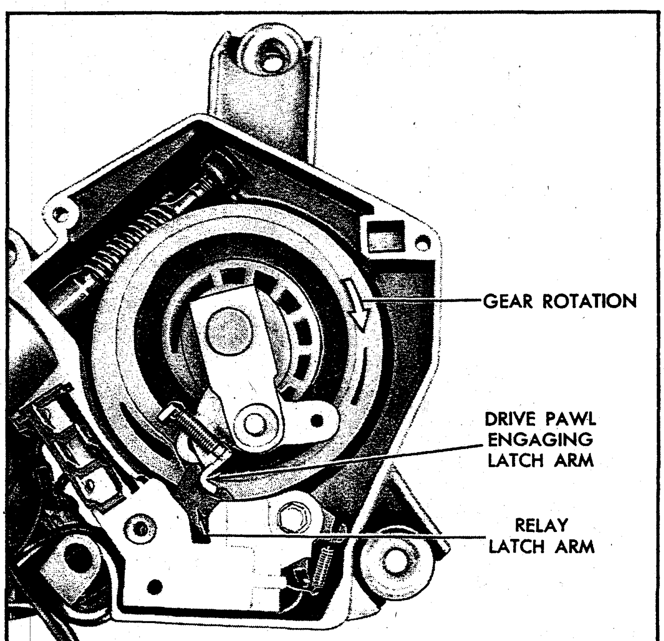


Fig. 80 - Relay Assembly

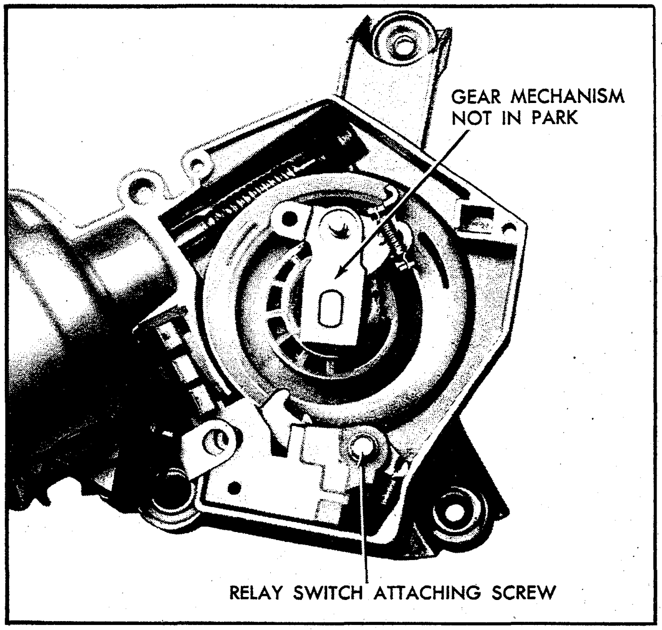


Fig. 81 - Drive Gear not in Park Position

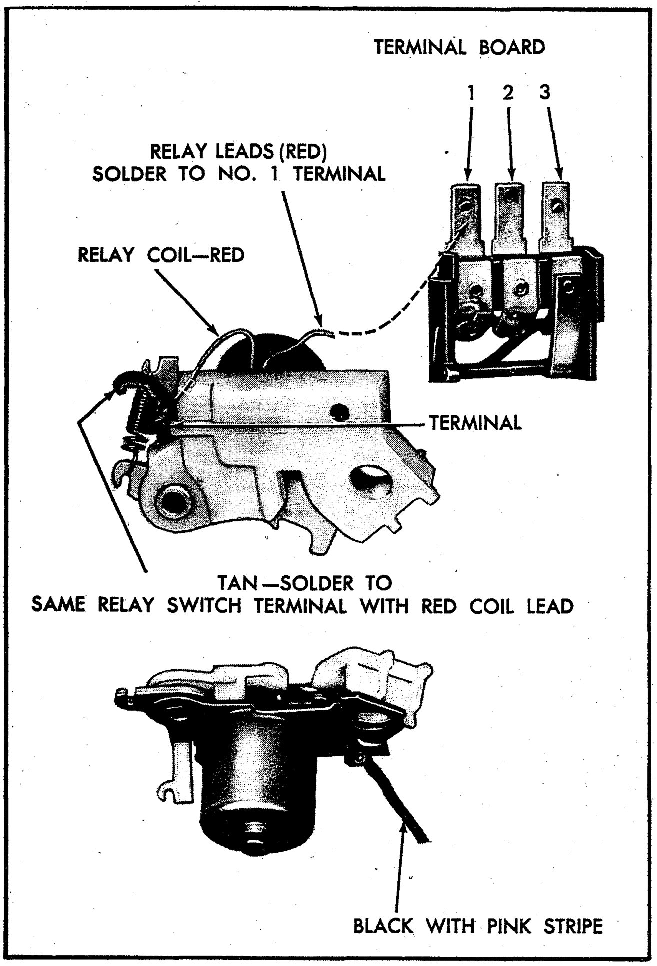


Fig. 82 - Relay Assembly Wiring

ASSEMBLY

1. If new field and case assembly is being installed, splice the black and black with pink stripe leads of the new field with the corresponding leads of the wiper.
2. Install the rubber thrust disc, steel thrust disc and felt lubricating washer in the case assembly bearing in the order indicated.
3. Lubricate end of armature shaft that fits in case bearing. Next, install thrust ball in end of shaft.
4. Assemble armature in the case and field assembly.
5. Position the partially assembled brush plate over the armature shaft far enough to allow re-assembly of the remaining brush in its brush holder; then position the brush plate assembly on the mounting tabs in the position shown in Figure 78.

   NOTE: Circuit breaker ground lead will not reach circuit breaker terminal if brush plate is positioned wrong.
6. Center the brush plate mounting holes over the mounting tabs and bend the tabs toward the brush holders as required to secure the brush plate in position.

   CAUTION: Be sure tabs are centered in brush plate mounting holes.
7. Remove brush retainer clips and resolder circuit breaker ground lead to circuit breaker. Refer to Figure
8. If new case and field assembly is used, scribe a line on it in the same location as the one scribed on the old case. This will insure proper alignment of the new case with the scribed line made on the housing (Step 1 under Brush Plate Removal).
9. Position armature worm shaft inside the housing and, using the scribed reference marks, line up as near

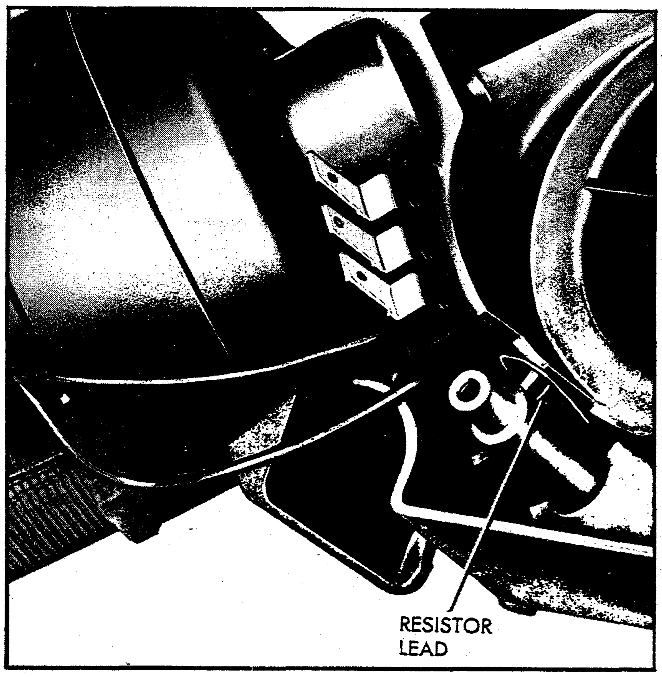


Fig. 83 - Terminal Board Resistor

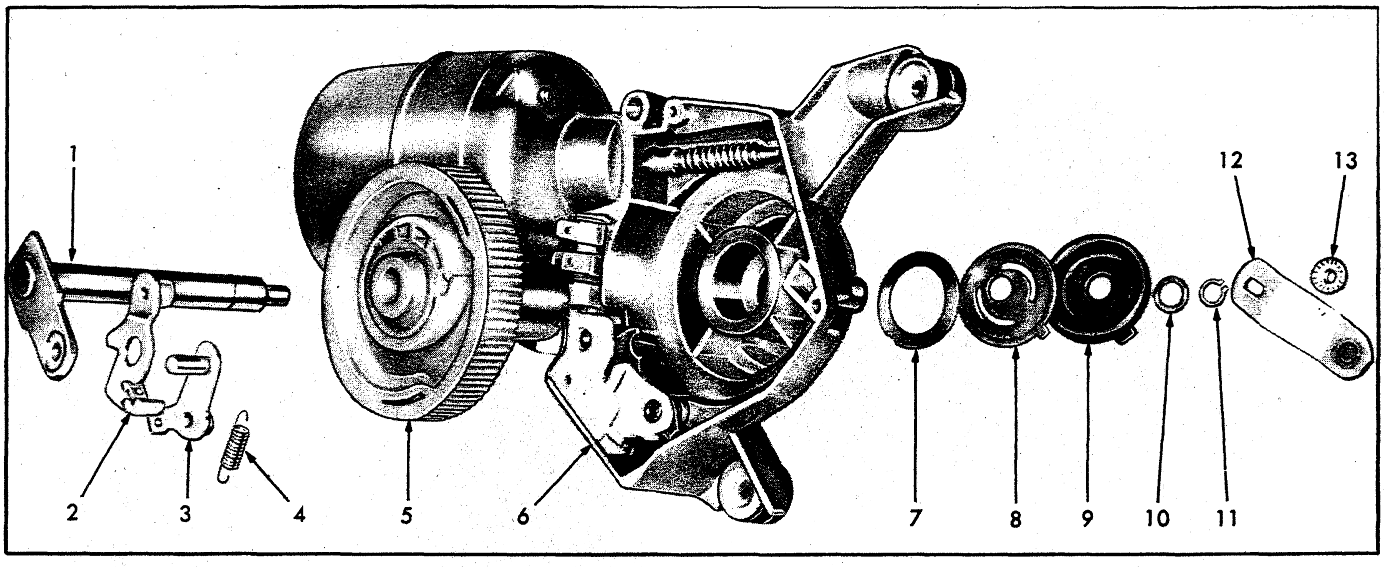


Fig. 84 - Drive Gear Mechanism Assembly

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

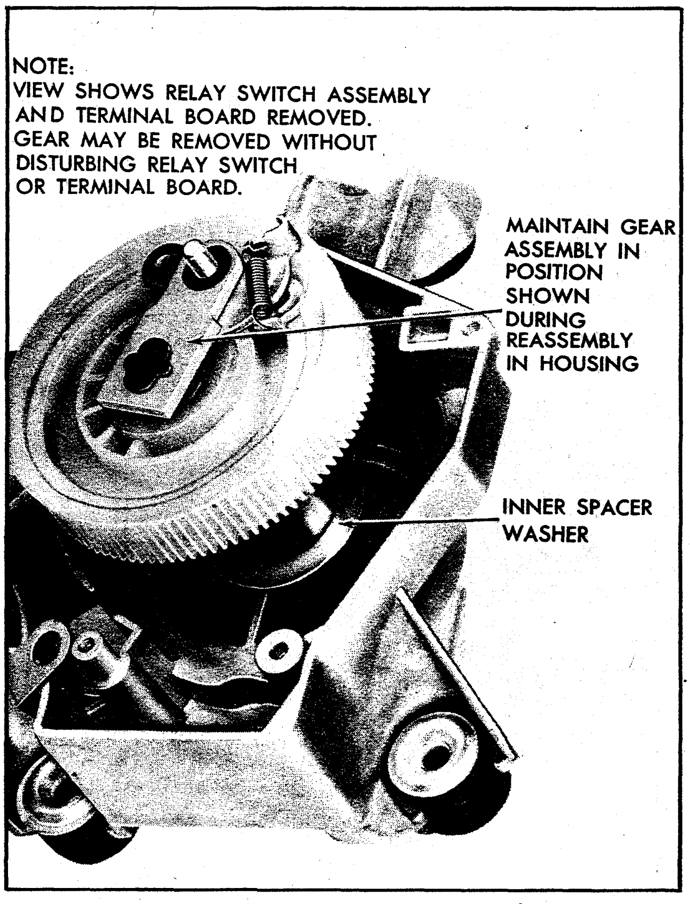


Fig. 85 - Removing Gear Assembly

as possible the case and field assembly with the housing.

10. 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. At the same time carefully pull the excess black and black with pink stripe leads thru the housing grommet.

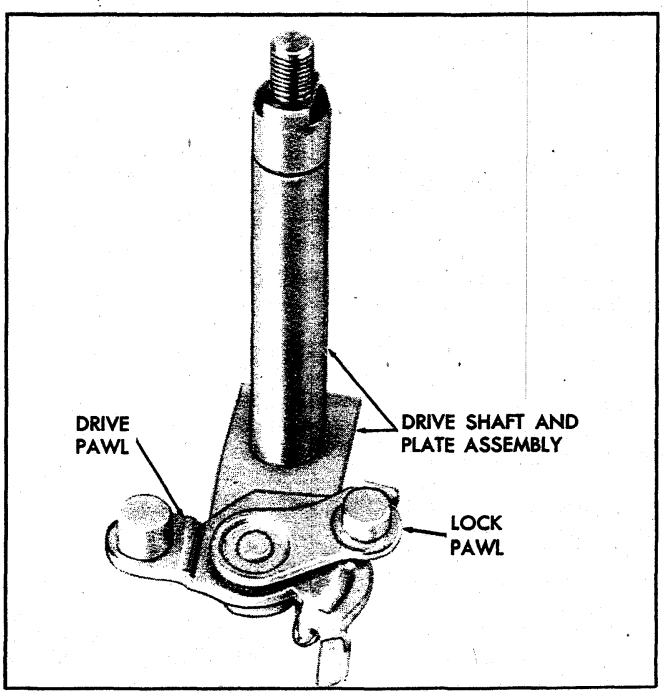


Fig. 86 - Lock and Drive Pawl Assembly

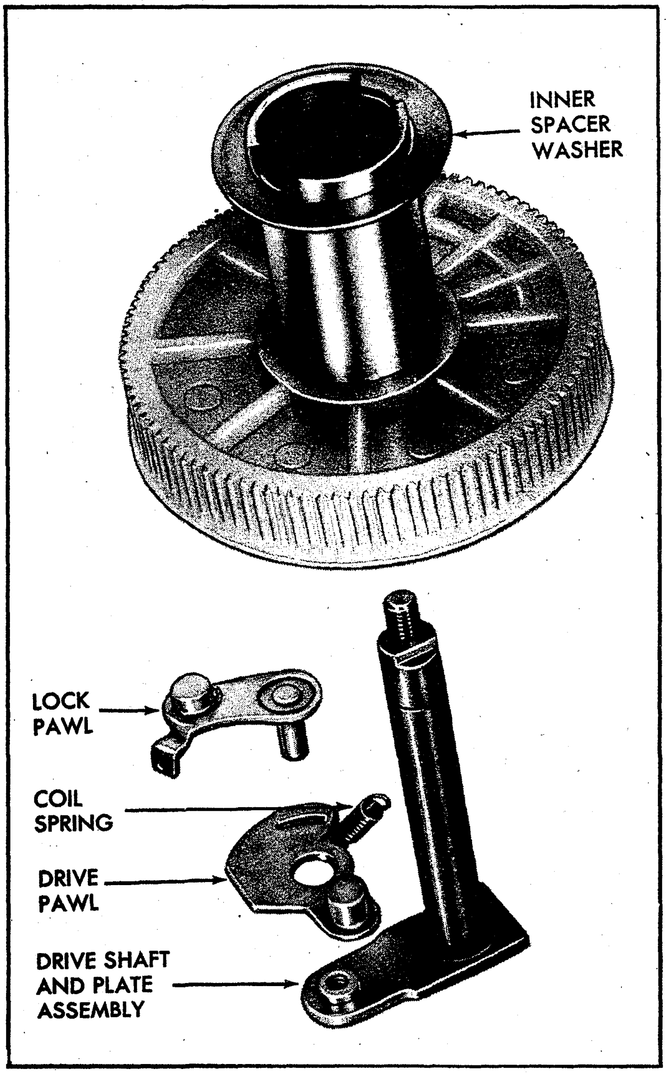


Fig. 87 - Drive Gear and Shaft Assembly

CAUTION: It may be necessary at this point to rotate armature slightly before the armature worm will engage with worm gear teeth.

11. Rotate the case as required to align the bolt holes in the case with those in the housing.
12. Secure the case to the housing with the two tie bolts.

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. 79), it becomes necessary to remove gear assembly **first** (see Gear Assembly Removal).

   If wiper gear mechanism is not in park position

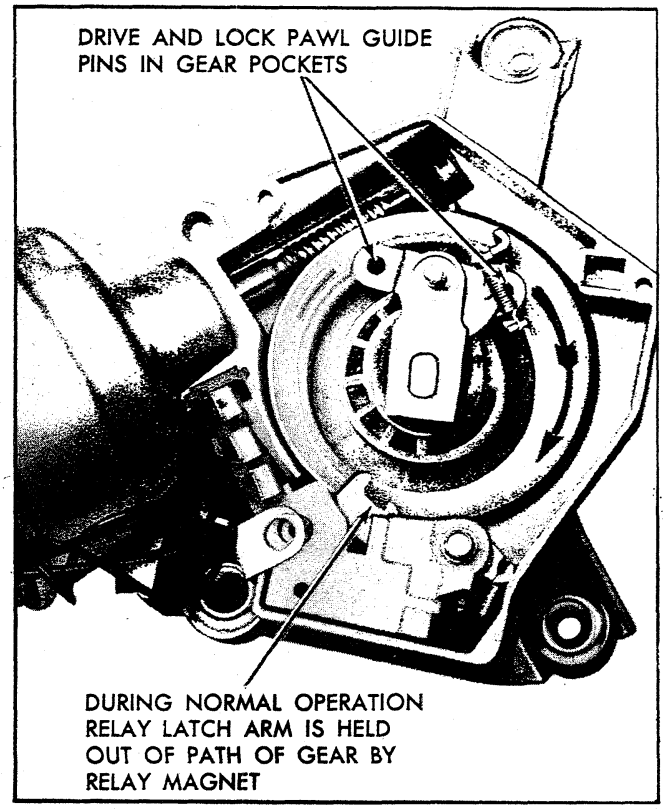


Fig. 88 - Drive and Lock Pawl Guide Pins in Pockets

(drive pawl away from latch arm, fig. 81), proceed to Step 3.

3. Remove relay-switch attaching screw (fig. 80) and carefully lift the relay-switch assembly out of the gear box. Unsolder leads from switch terminals as required. Refer to Figure when resoldering leads.
4. To remove terminal board assembly simply slide it out of housing and unsolder leads as required.

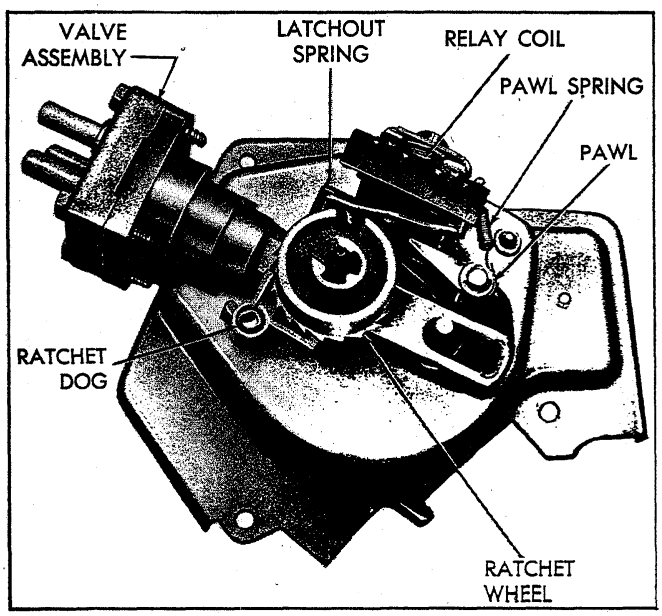


Fig. 89 - Washer Pump Assembly

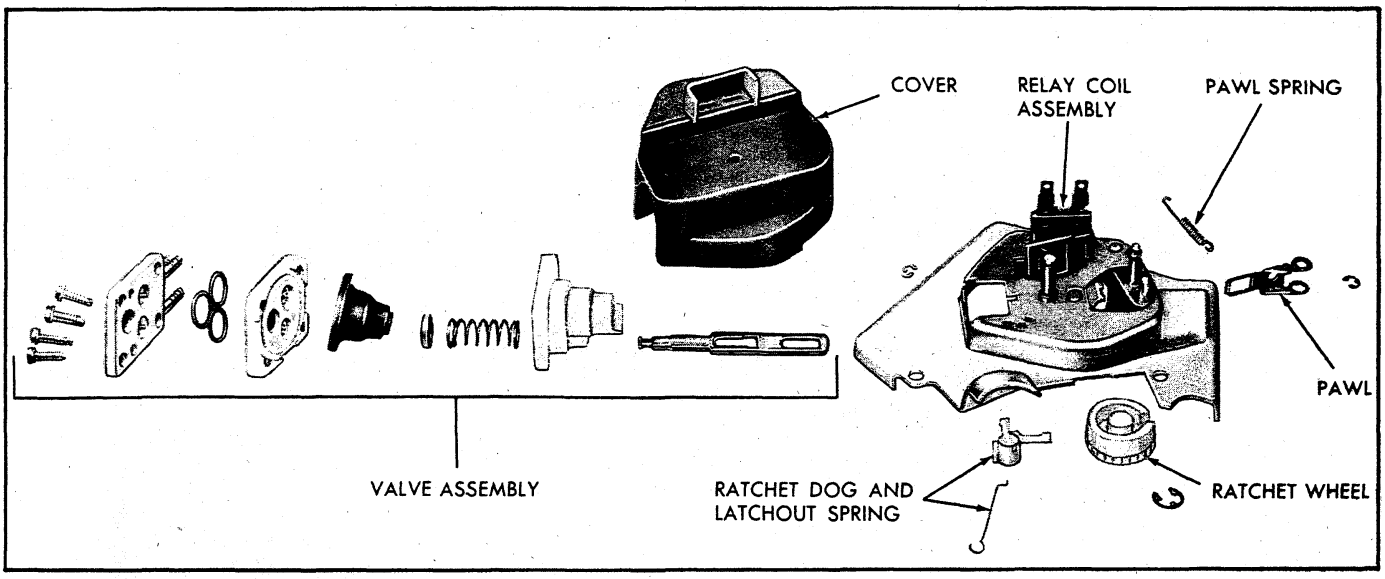


Fig. 90 - Exploded View of Pump

Relay Switch—Latch and Terminal Board Assembly

1. Resolder leads to wiper terminal board as required (fig. 82).
2. Slide terminal board into wiper housing being careful to position the terminal board resistor lead as shown in Figure 83.
3. Resolder leads to relay switch assembly as required (fig. 82).
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 75 for assembly of washer pump to gear housing.

B-Drive Gear Disassembly (Fig. 84)

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. 85).
4. Slide drive plate and shaft out of gear and remove the drive pawl, lock pawl and coil spring as required.

Drive Gear—Assembly

1. Position drive pawl on drive plate as shown in Figure 86.
2. Assemble lock pawl over drive pawl as shown in Figure 86.
3. Slide gear and tube over the drive shaft (fig. 87). (Move drive and lock pawls as required to allow their respective pins to fit in the gear guide channel, fig. 88).
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. 88).
5. Reinstall coil spring between lock and drive pawls (fig. 88).

   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 85.
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 84.
8. Operate wiper to "park" or "off" position and install crank arm.
9. Reassemble washer pump to wiper (fig. 75).

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. 89). An exploded view of the washer pump is shown in Figure 90.

Removal and Installation

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. Position pump and cover assembly to the wiper and install retaining screws.
5. Connect washer hoses to valve assembly and wiring leads to pump and wiper terminals.
6. Check operation of unit.

DEPRESSED PARK 2-SPEED WIPER AND WASHER

CORVETTE

GENERAL DESCRIPTION

The 2-speed windshield wiper (fig. 91) consists of a compound wound 12 volt dc 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. 92).

An electric washer pump is mounted on the gear box section of the wiper and is driven by the wiper unit gear assembly (fig. 93).

SERVICE OPERATIONS

WIPER MOTOR AND WASHER PUMP ASSEMBLY

REMOVAL AND INSTALLATION

1. Raise vehicle hood and disconnect ground lead at battery.
2. Remove engine distributor shielding and left bank spark plug wire vertical shield.
3. Disconnect left bank spark plug wire bracket-to-manifold and position assembly to one side.
4. Disconnect ignition resistor at firewall, then remove washer pump inlet and outlet hose at pump valve assembly.
5. Remove engine distributor cap and position to one side; then disconnect washer pump and motor assembly lead wires.
6. Remove glove box door and compartment. Refer to Section 1 for removal procedure.
7. Make sure wiper arms and wiper motor are both in the parked position; then remove the wiper transmission retaining clip and disconnect both transmission and spacer from crank arm (fig. 93).
8. Remove four wiper motor-to-dash wall mounting bolts and remove wiper motor from vehicle.
9. With the aid of an assistant position the wiper motor to the dash wall and install the four motor mounting bolts, making sure motor assembly is in parked position.

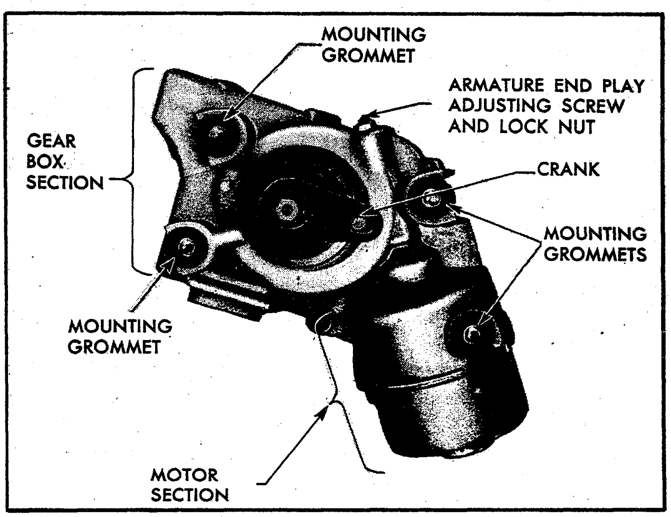


Fig. 91 - Wiper Assembly--Corvette

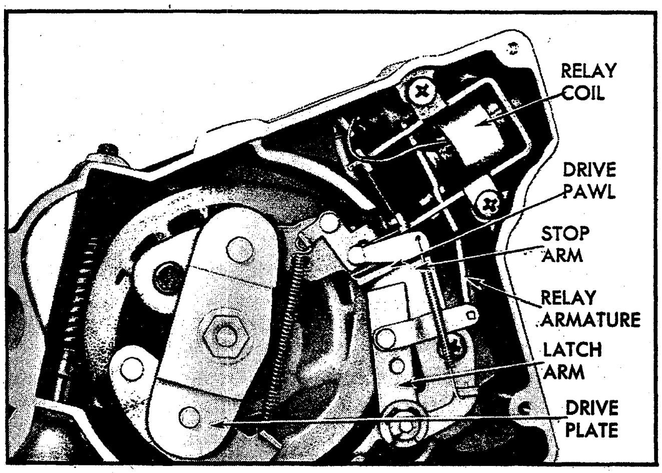


Fig. 92 - Relay Control

10. Position left transmission assembly, spacer and right transmission assembly on crank arm, then install the retaining clip in the groove in the crank arm.
11. Install glove compartment and door assembly. Refer to Section 1 for installation procedure.
12. Install washer pump and motor assembly lead wires; then install engine distributor cap.
13. Install washer pump inlet and outlet hose to pump valve assembly, then install ignition resistor to firewall.
14. Connect left bank spark plug wire bracket-to-manifold, vertical shield and engine distributor shielding.

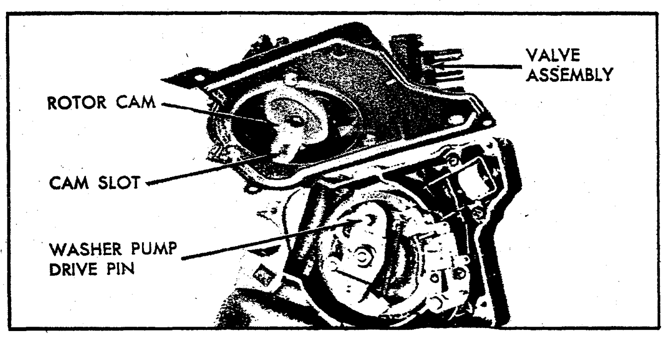


Fig. 93 - Washer Pump

15. Connect positive lead to battery terminal, lower hood and test wiper and washer assembly for proper operation.

WIPER TRANSMISSION

REMOVAL AND INSTALLATION

1. Remove wiper block and arm assembly from transmission.
2. Remove glove box door and compartment assembly. Refer to Section 1 for removal procedures.
3. Remove three transmission-to-cowl retaining screws.
4. Remove wiper transmission retaining clip and remove transmission from crank arm. Then remove transmission through the glove box opening.
5. Reverse removal procedure to install wiper transmission.

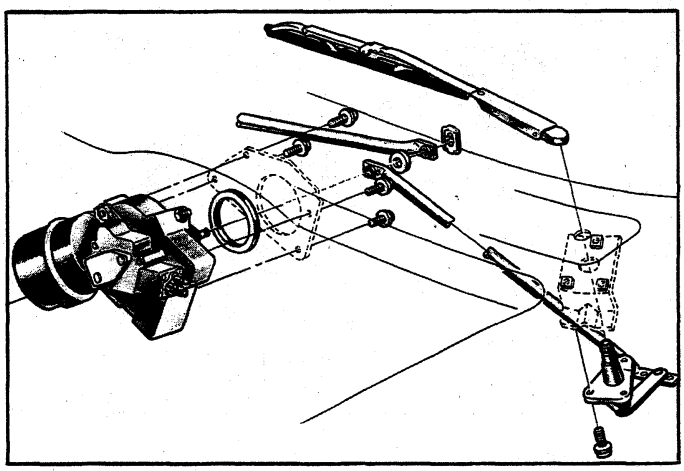


Fig. 94 - Wiper and Trans Installed

WIPER ASSEMBLY REPAIRS

The overhaul procedures for the wiper are broken down into three major areas: The motor section, gear box section and washer pump section. Each section may be serviced independently of the other.

MOTOR SECTION

Disassembly

1. Remove the two motor tie bolts.
2. Remove the armature end-play adjusting screw (fig. 91).
3. Strike the steel case lightly with a mallet to partially loosen it from the die casting 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 separate armature from case while still retaining the brush springs and brushes in place fashion a **spring similar to that shown in Figure 95 and insert** behind the brush leads as shown.

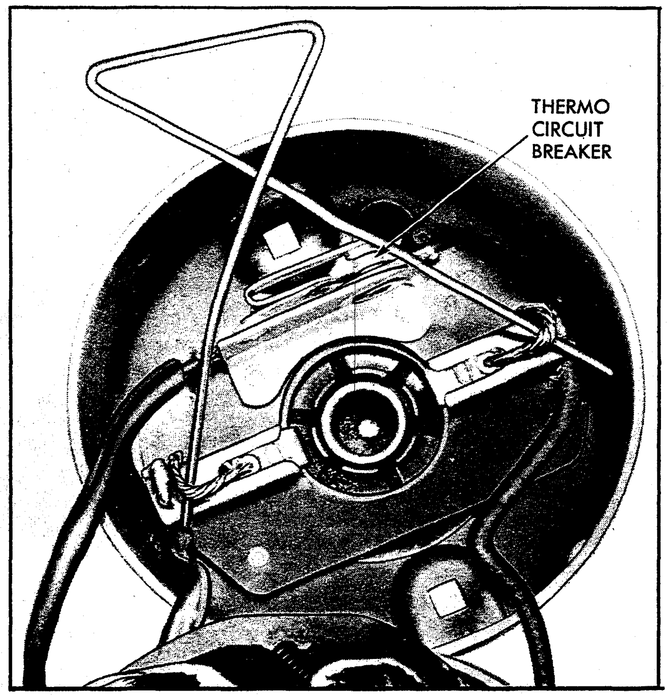


Fig. 95 - Retaining Armature Brushes

6. Pull the armature out of the case and remove the felt washer, thrust plate, and rubber thrust disc from the case assembly bearing as required.
7. The field windings are pressed into the gear housing and further disassembly is not recommended; however, the field leads may be unsoldered from the brush holders to remove the case.
8. 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 95. Clean as required or file lightly to re**move 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 bushes, and **nection 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 the slot in the brush holder. Then push brush into holder with lead upward to project through slot in holder, hold

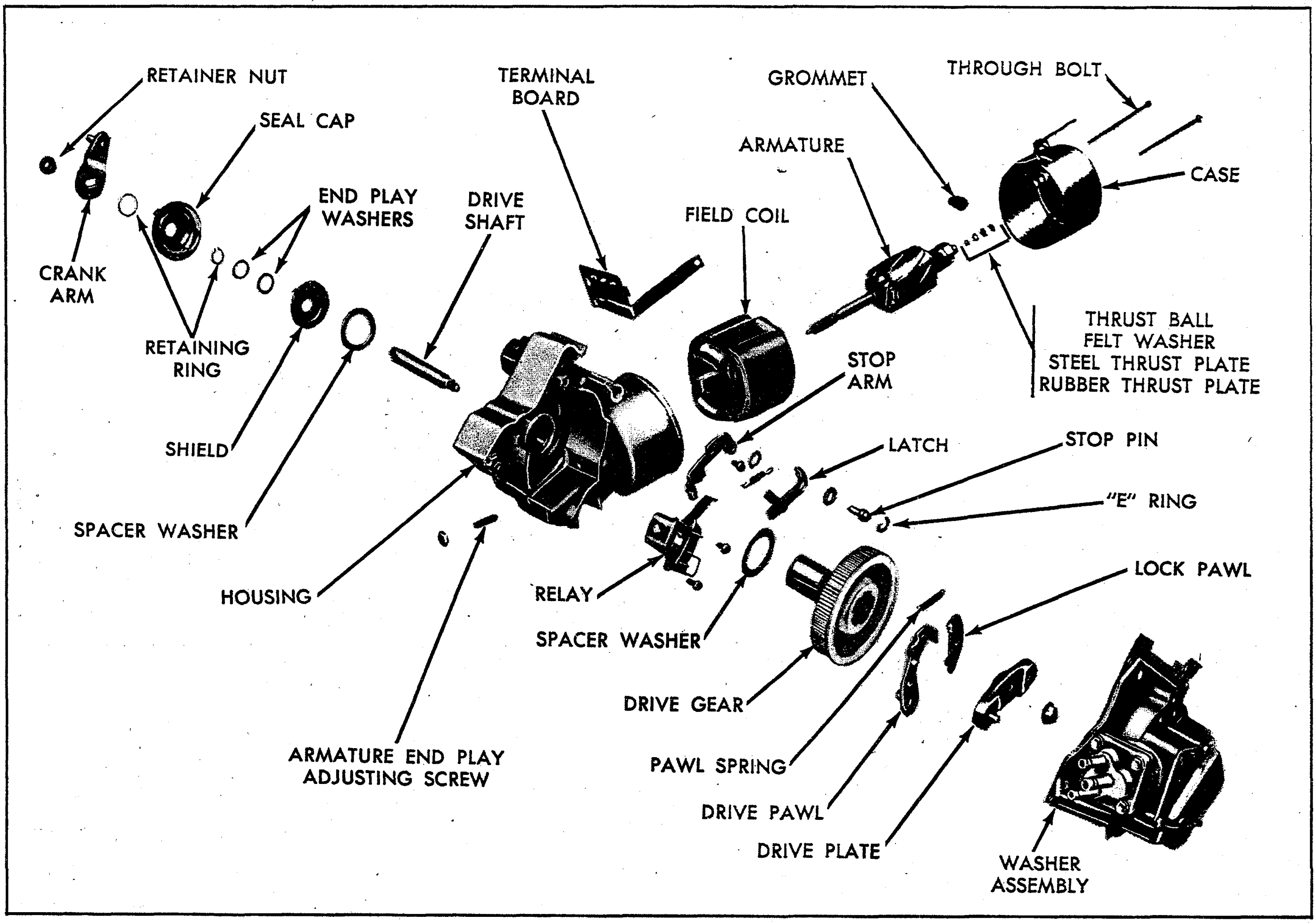


Fig. 96 - Wiper Assembly Exploded View

brush tightly, and remove instrument retaining spring. Hold brush installed with improvised separator as shown in **Figure 95.**

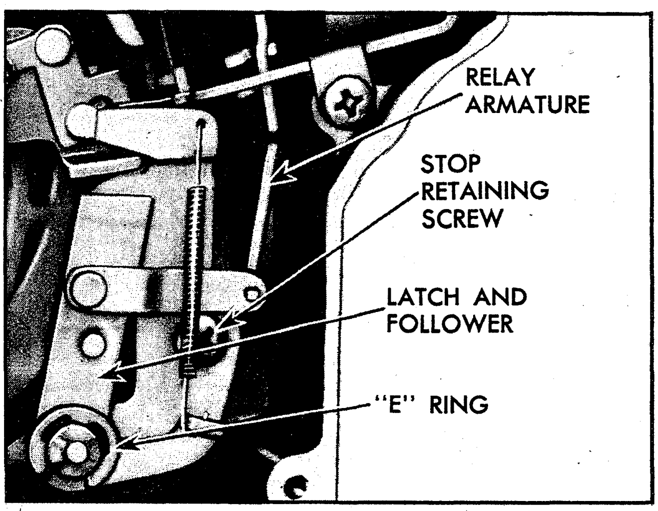


Fig. 97 - Relay Disassembly

Reassembly

1. Assemble rubber thrust disc, steel thrust plate and felt washer in order indicated (fig. 96).
2. 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.
3. Remove the brush retainer spring.
4. 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.

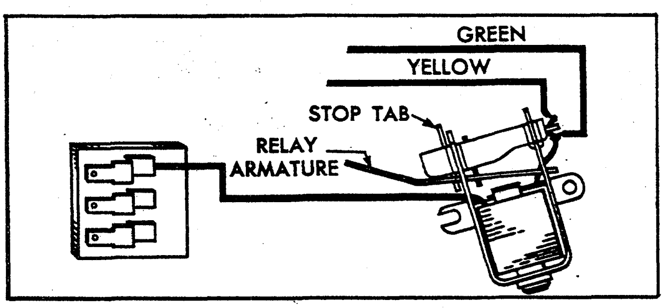


Fig. 98 - Relay Wiring

NOTE: It may be necessary at this point to rotate the armature slightly before the worm will engage with the worm gear.

5. Rotate the case as required to align the holes in the case with those in the housing.
6. 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.
7. Secure case to housing with two tie bolts.
8. Install end-play adjusting screws and locknut and adjust end-play by tightening adjusting screw finger tight; then back off screw 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 Control and Latching Mechanism:

Disassembly

1. Remove four screws which secure the washer pump assembly to gear box.
2. Refer to Figure 97. Disconnect coil spring, remove "E" ring and lift the latch and follower assembly off the pivot pin and relay armature.
3. Remove the stop assembly retaining screw. This will permit the stop assembly to be moved as necessary to allow clearance for removing the relay control assembly.

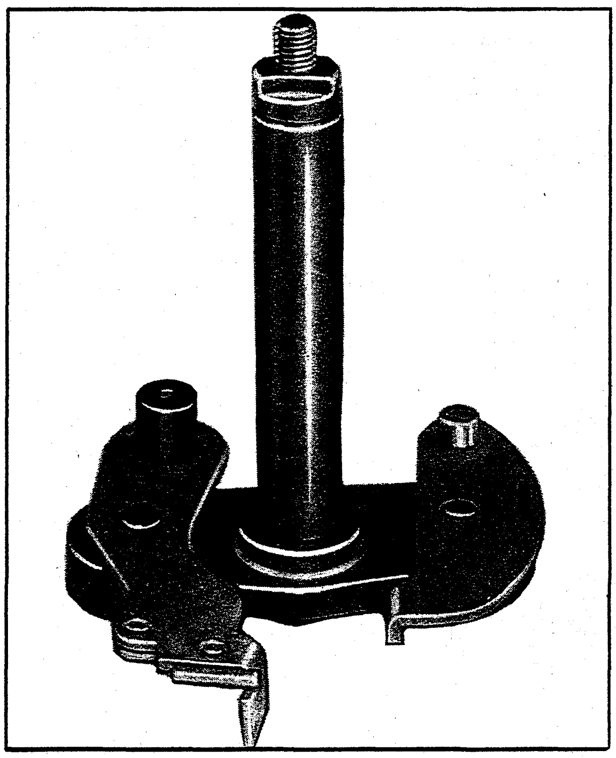


Fig. 99 - Lock and Drive Pawl Mechanism

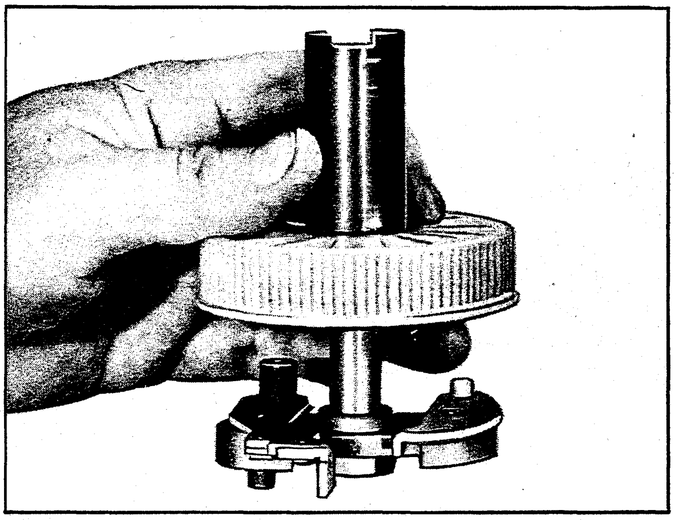


Fig. 100 - Assembly Gear and Eccentric Shaft

4. Remove the two screws that secure the relay control assembly.
5. Lift the relay control assembly out of the gear box and unsolder leads as required.

Reassembly

1. Solder existing green and yellow wiper leads to relay control switch and solder the relay coil lead to the wiper unit terminal board as shown in Figure

B—Drive Gear Mechanism:

Disassembly

Refer to Figure 84 unless other wise specified.

1. Remove the crank arm retaining nut (No. 1).
2. Remove crank arm (No. 2), snap ring (No. 3) and rubber seal (No. 4).
3. Remove the retaining ring (No. 5), end play washers (No. 6), shield (No. 7) and spacer washer (No. 8).
4. Follow Steps 1 through 3 under relay control and latch mechanism disassembly.

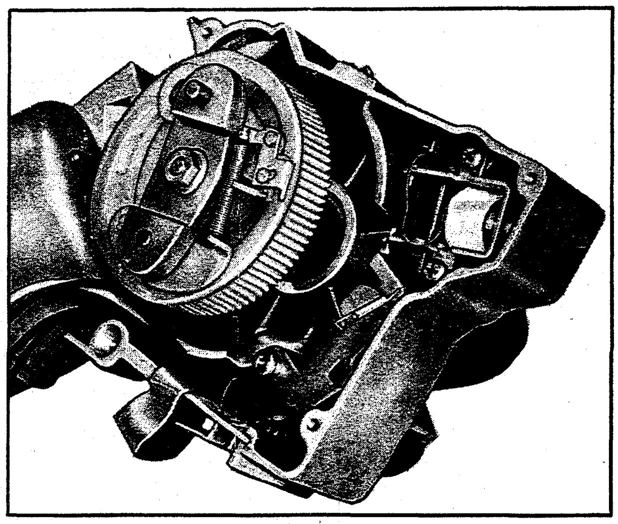


Fig. 101 - Drive Gear Mechanism Installed

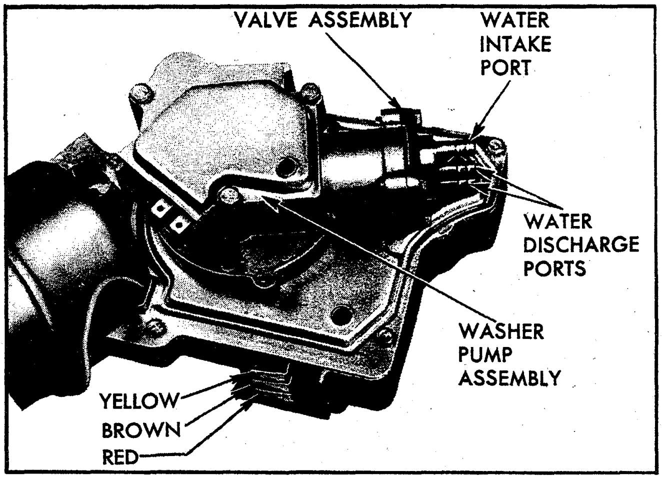


Fig. 102 - Washer Pump Assembly

5. Remove gear mechanism from the gear box and slide spacer washer (No. 9) off the gear assembly eccentric shaft.
6. Slide the drive plate and shaft assembly (No. 11) out of the gear assembly, remove the lock and drive pawls (Nos. 12 and 13) and remove the coil spring (No. 14).

Reassembly

1. Assemble lock and drive pawls to the shaft and drive plate assembly as shown in Figure 99.
2. Install the assembled parts from Step 1 in the gear and eccentric shaft as shown in Figure 100.
3. Connect the coil tension spring between the lock and drive pawls (fig. 100).
4. Reinstall spacer washer on the eccentric shaft of the gear.
5. Reinstall gear mechanism in the housing as shown in Figure 101.
6. Reassemble the parts removed in Steps 1 through 4 under drive gear disassembly.

The washer pump and/or valve assembly (fig. 102) 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 requires service.

WASHER PUMP SECTION

PUMP REPLACEMENT

To replace the washer pump assembly proceed as follows:

1. Raise vehicle hood and remove engine distributor shielding and distributor cap.
2. Remove lead wires from washer pump and disconnect ground wire from screw retained connector; disconnect hoses from valve unit.
3. Remove four screws which secure the washer pump assembly to the gear box.
   a. The water inlet and outlet valve assembly is serviced as a unit if required; also the rotor cam is serviced separately.
4. Install washer pump and cover assembly so that the slot in the washer pump cam fits over the pin on the wiper unit drive plate.
5. Install the four washer pump to gear box retaining screws, position ground lug under lower screw.
6. Connect valve inlet and outlet hoses, attach ground lead and washer pump lead wires.
7. Install engine distributor cap and shielding.
8. Lower hood and check operation of wiper unit.

SPECIAL TOOLS

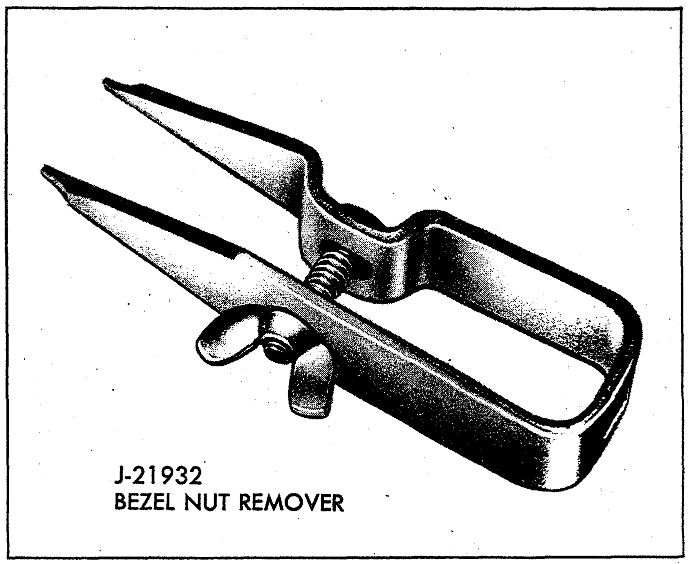


Fig. 103 - Special Tools

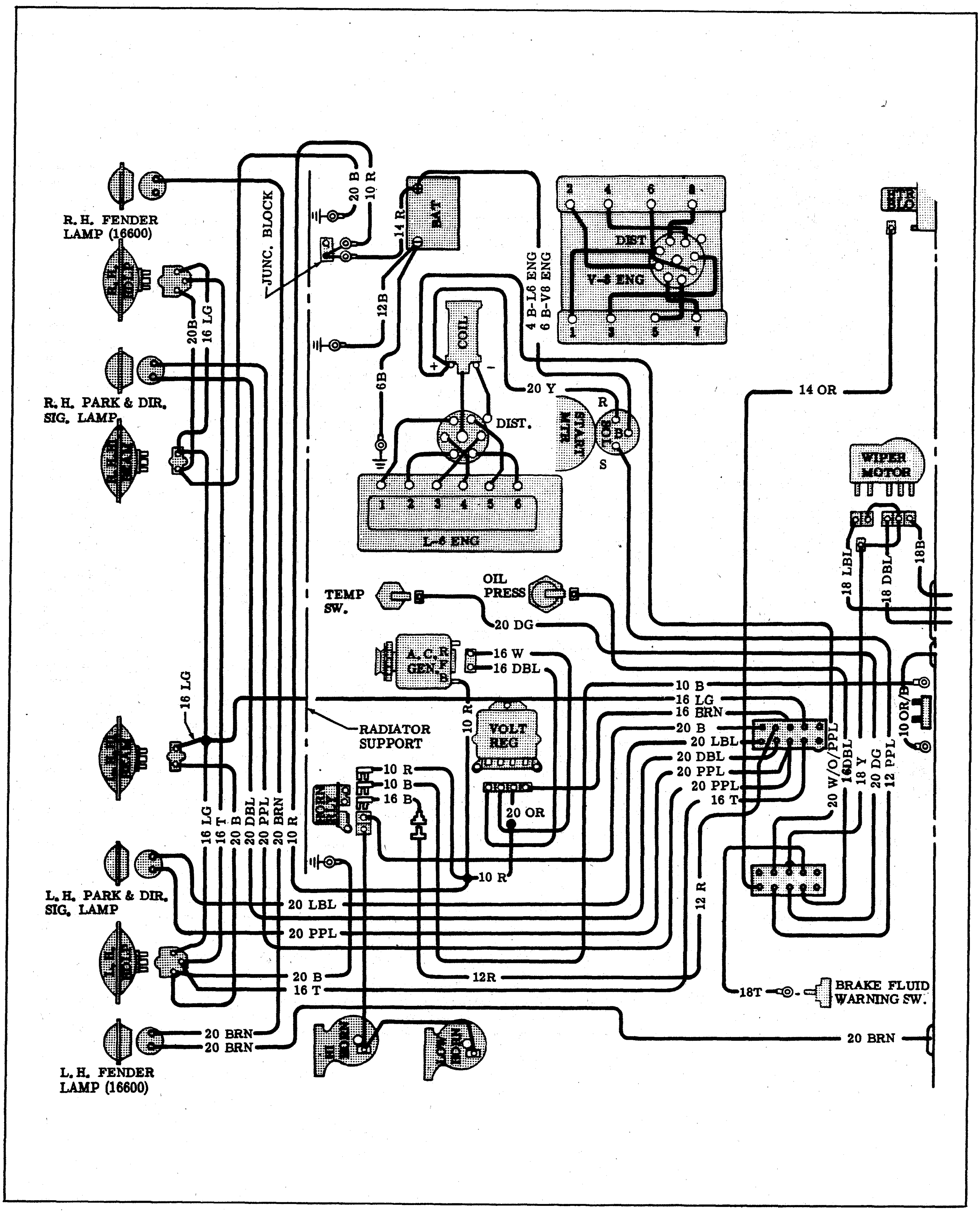


Fig. 104 - Front Lighting & Engine Compartment -- Chevrolet

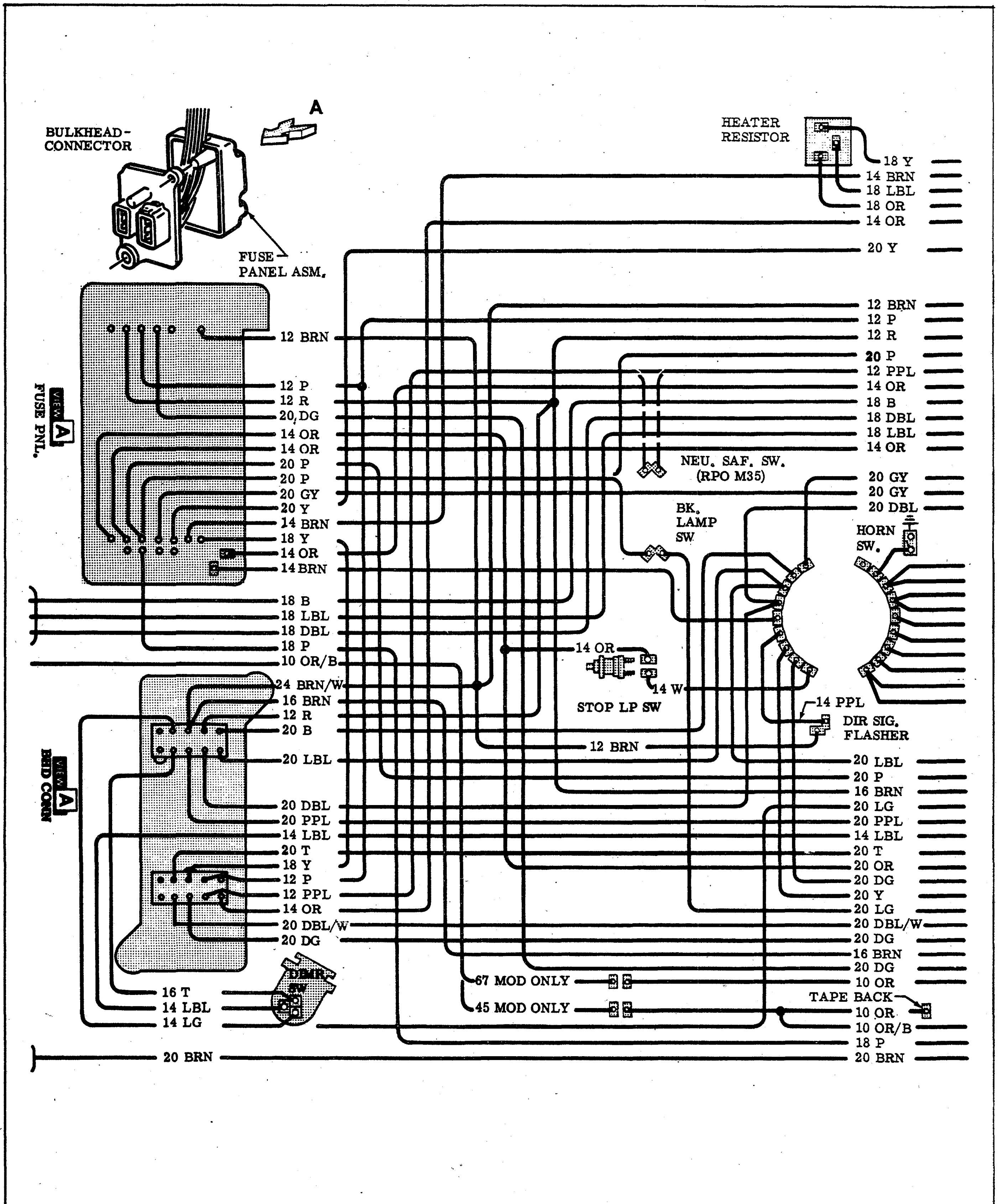


Fig. 105 - Fuse Panel -- Chevrolet

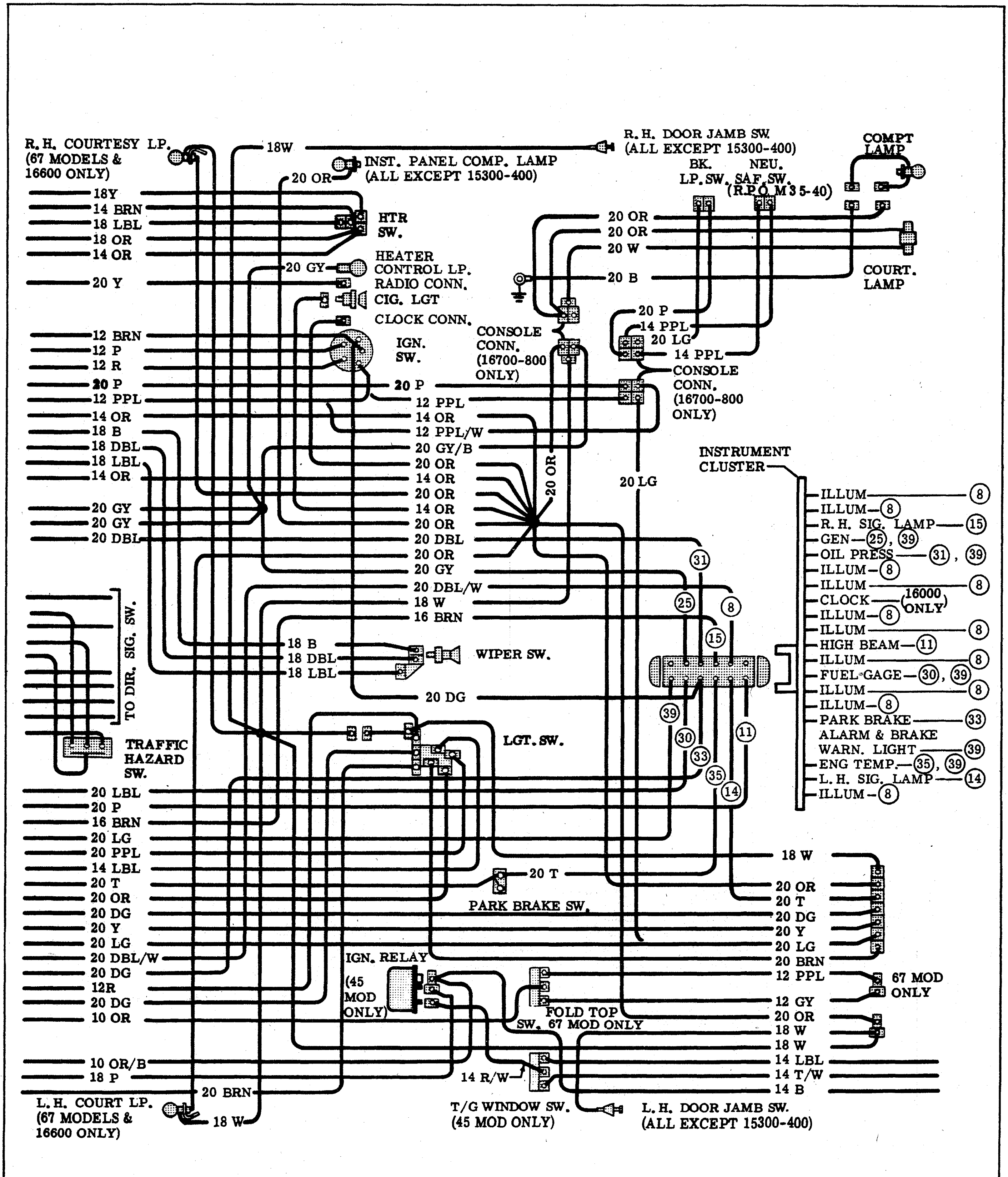


Fig. 106 - Instrument Panel Cluster -- Chevrolet

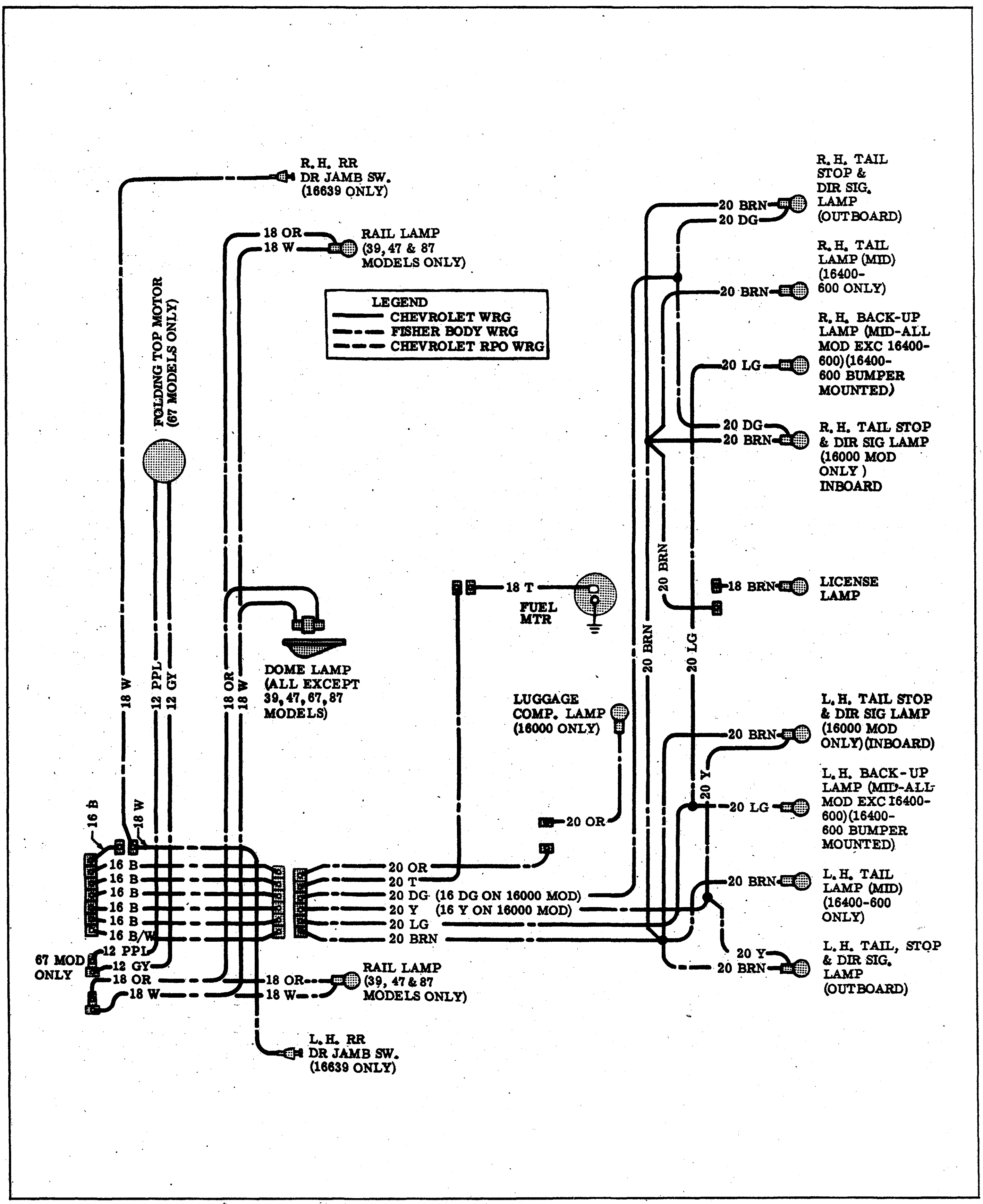


Fig. 107 - Body and Rear End Lighting (Exc Wagon) -- Chevrolet

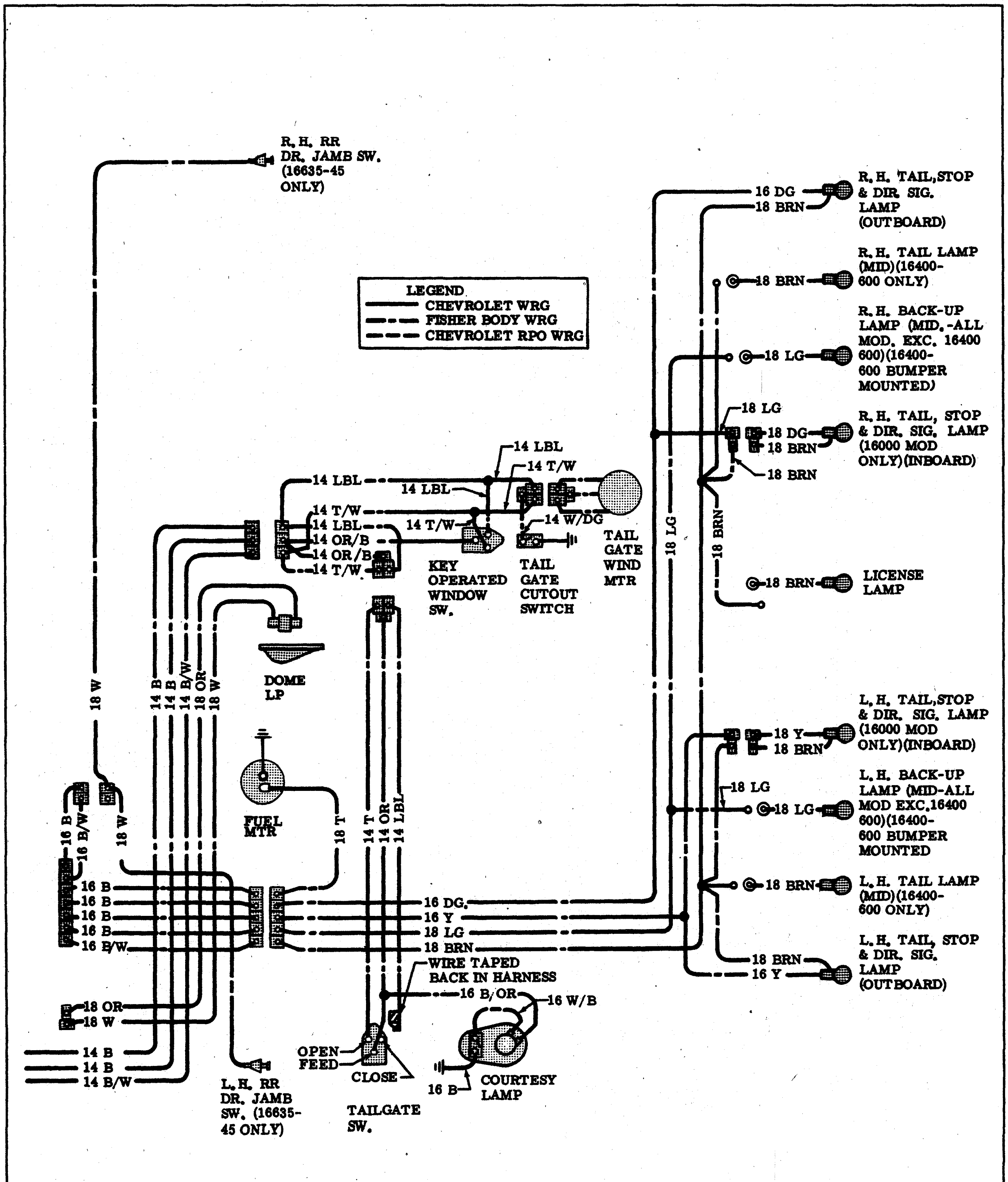


Fig. 108 - Body and Rear End Lighting (Wagon)

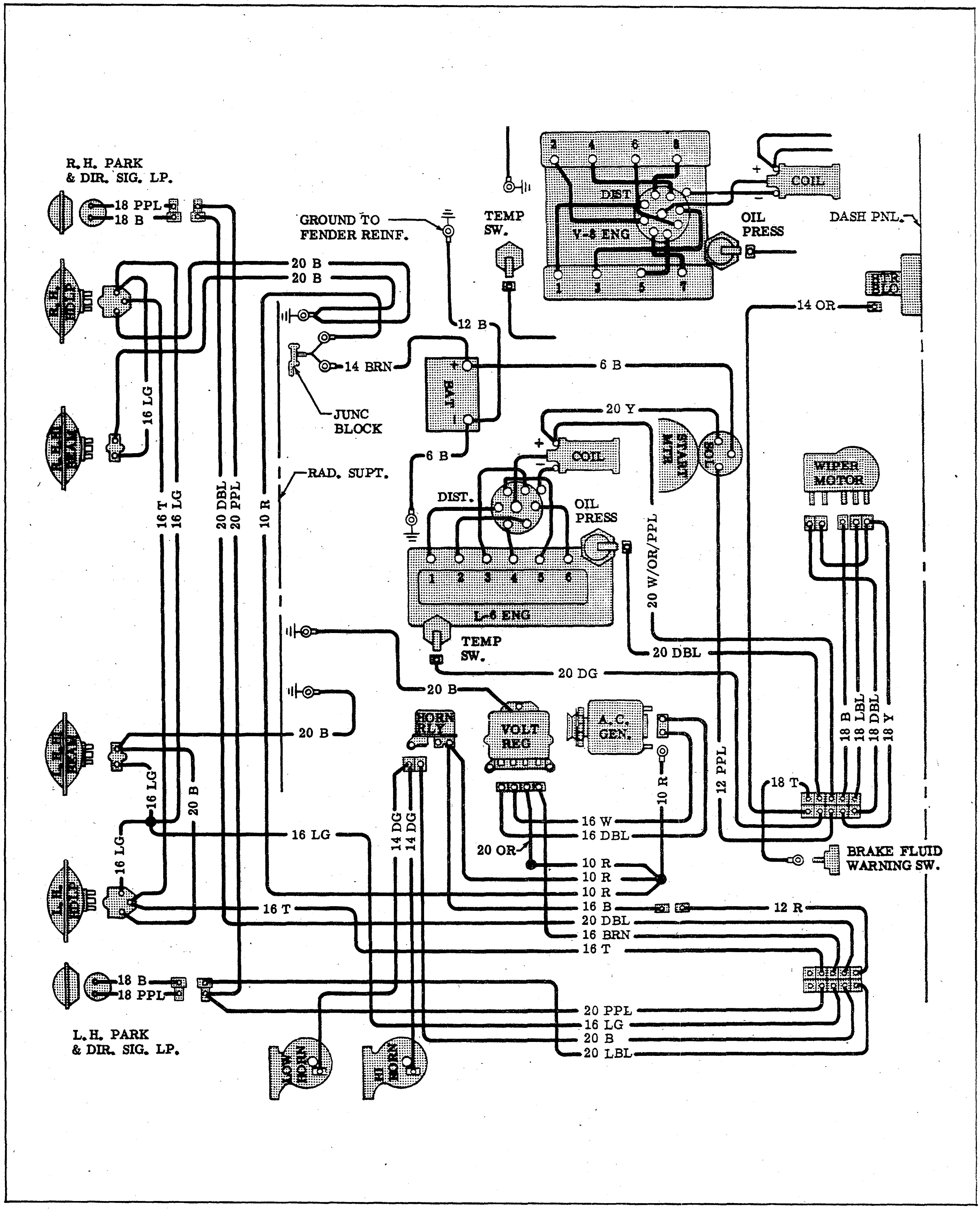


Fig. 109 - Front Lighting and Engine Compartment -- (Chevelle)

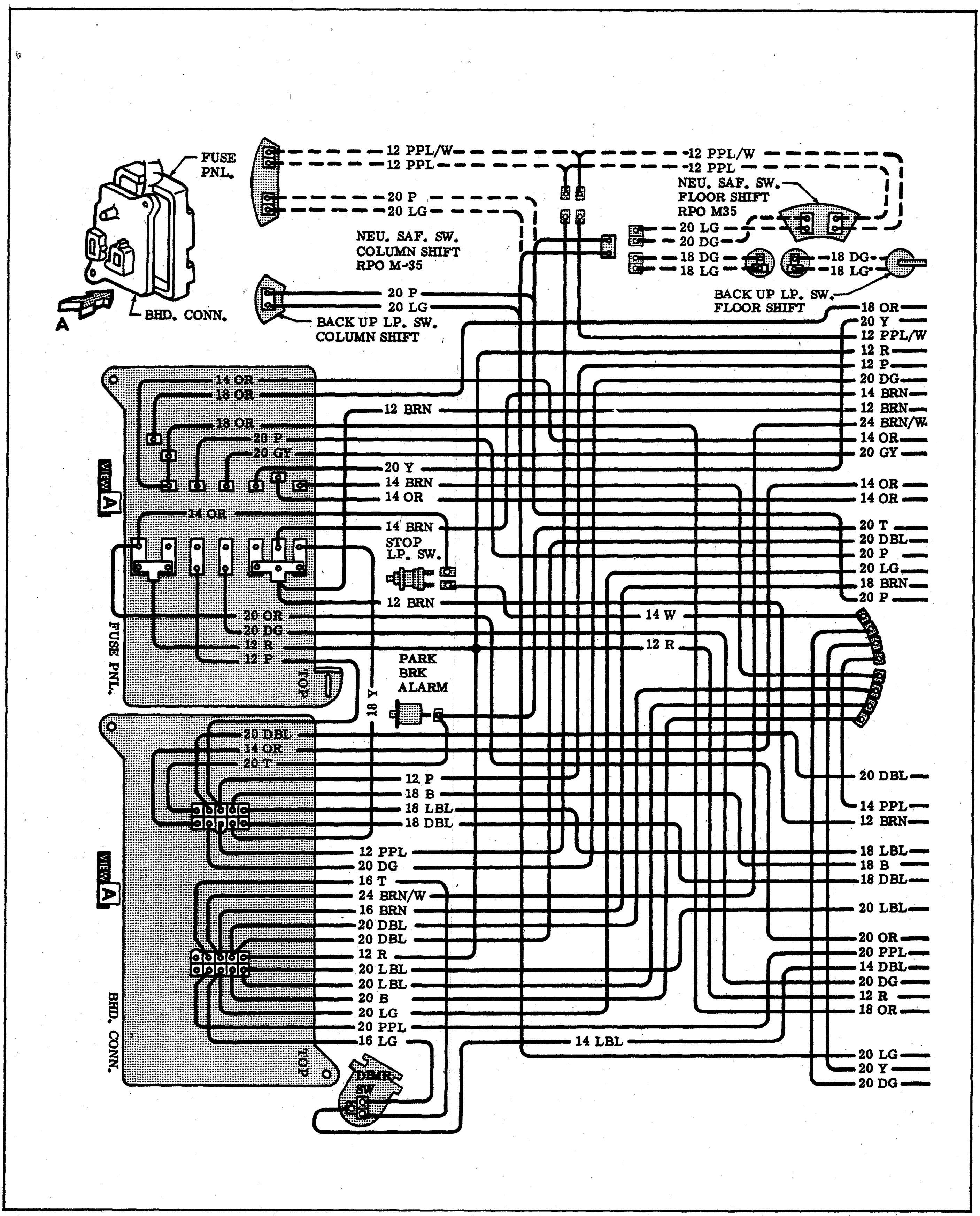


Fig. 110 - Fuse Panel -- Chevelle

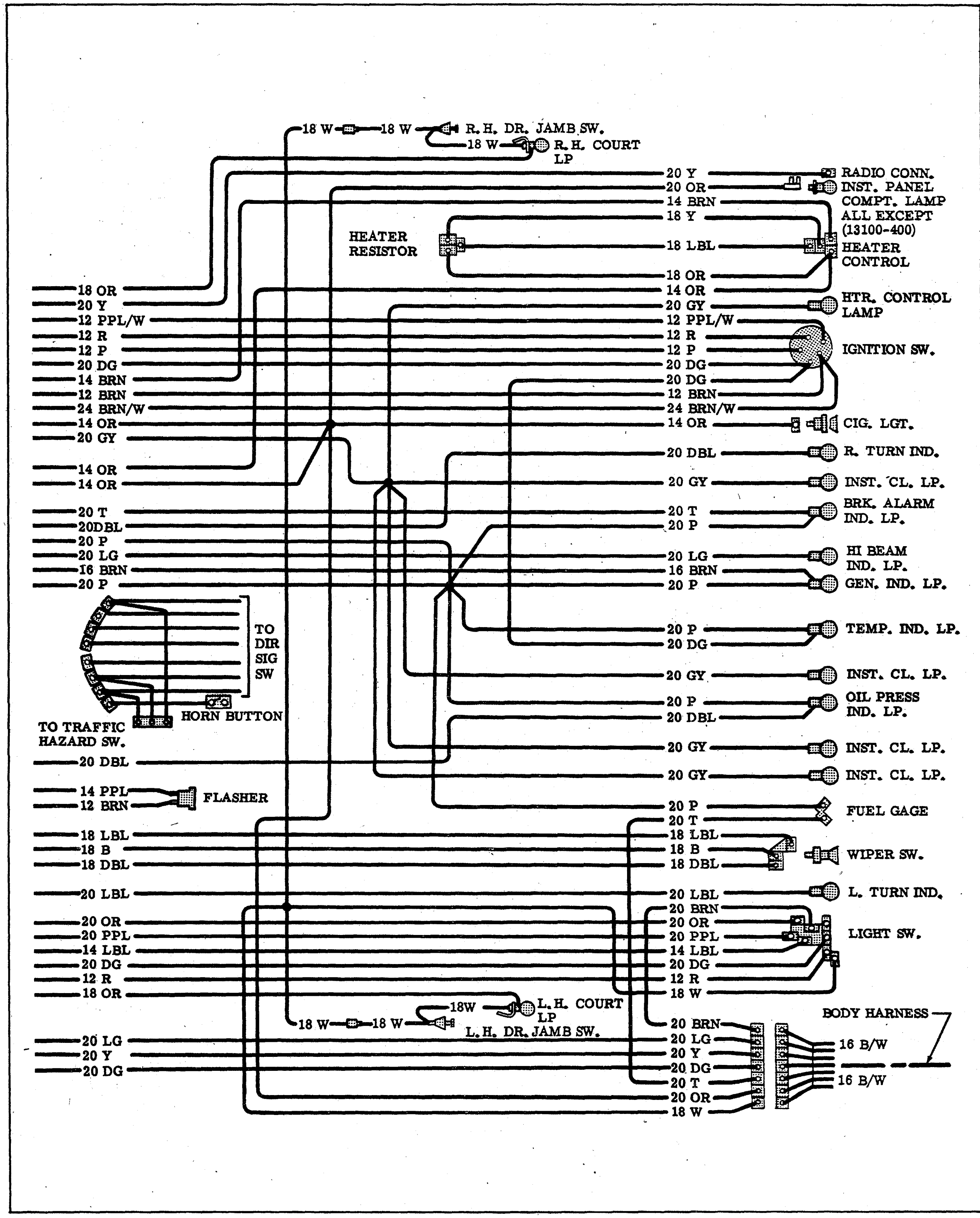


Fig. 111 - Instrument Panel and Cluster -- Chevelle

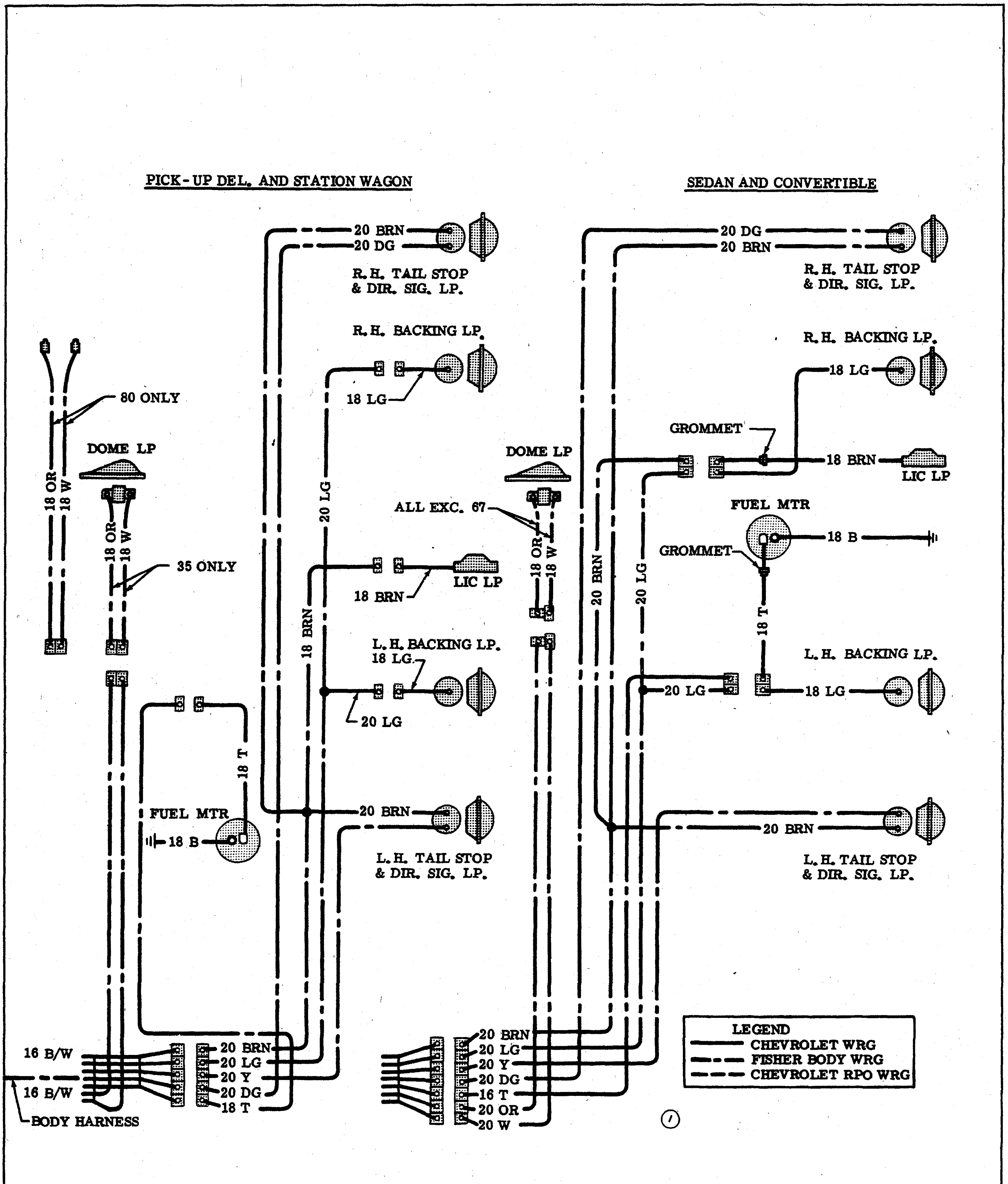


Fig. 112 - Body and Rear Lighting -- Chevelle

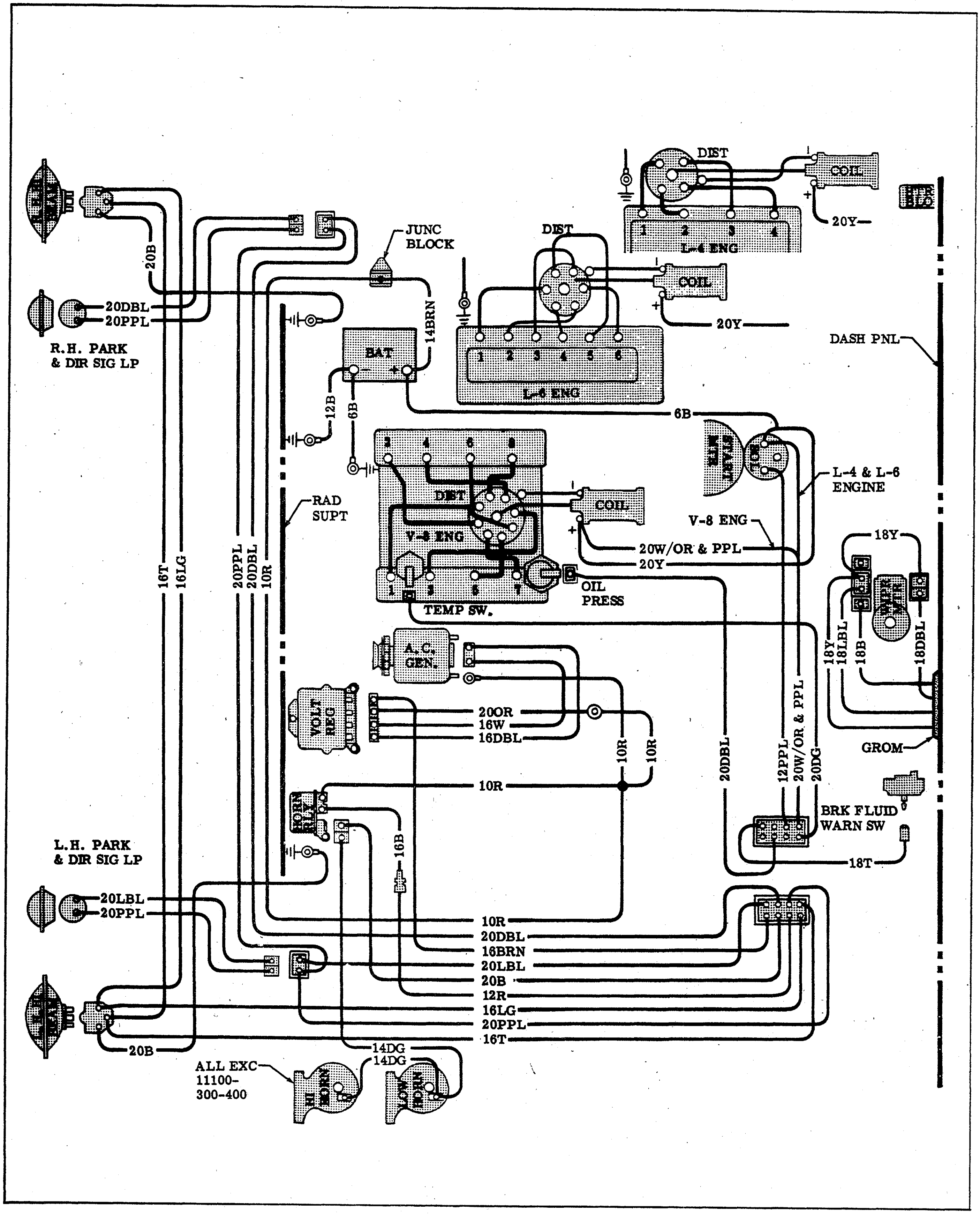


Fig. 113 - Front Lighting & Engine Compartment -- Chevy II

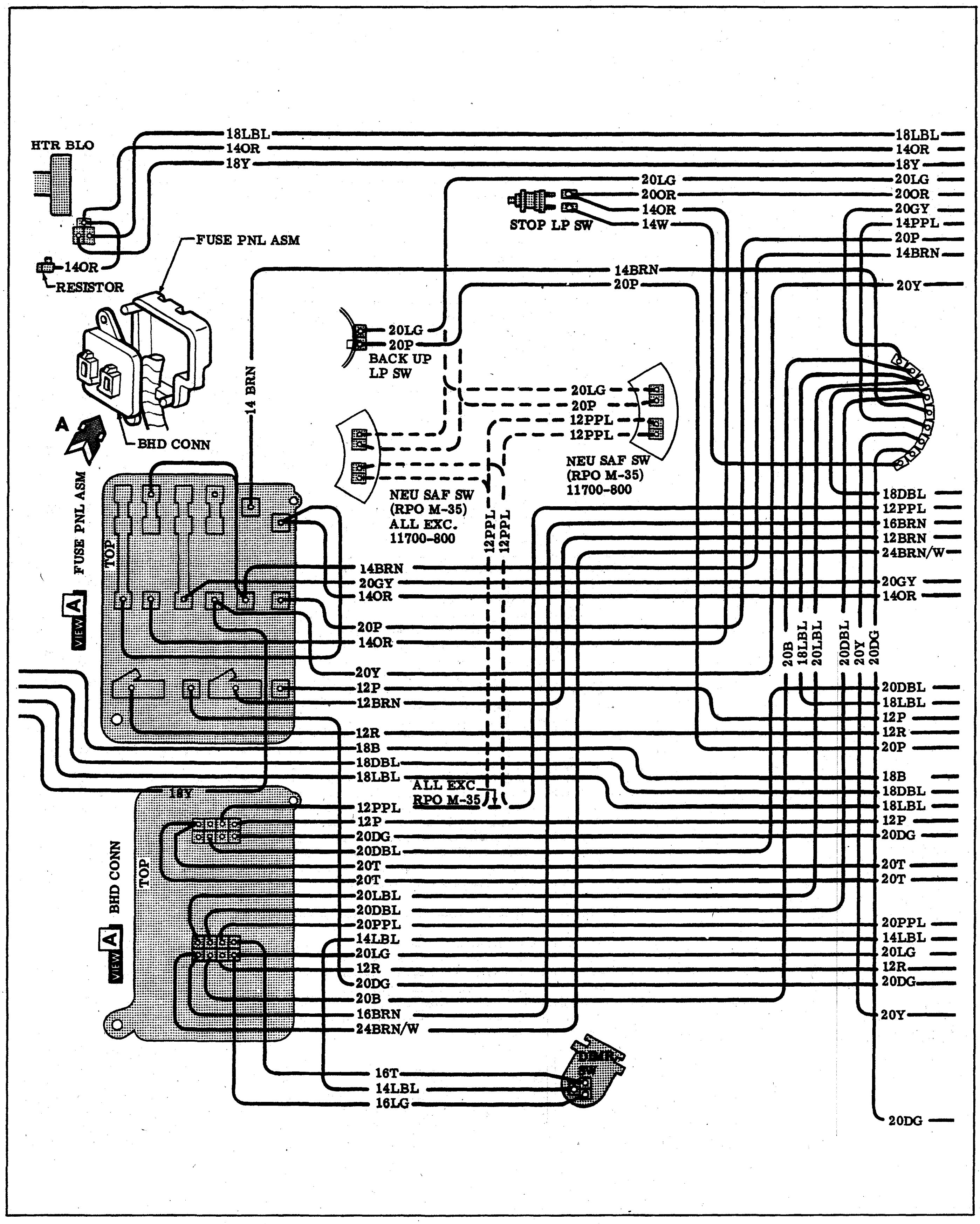


Fig. 114 - Fuse Panel -- Chevy II

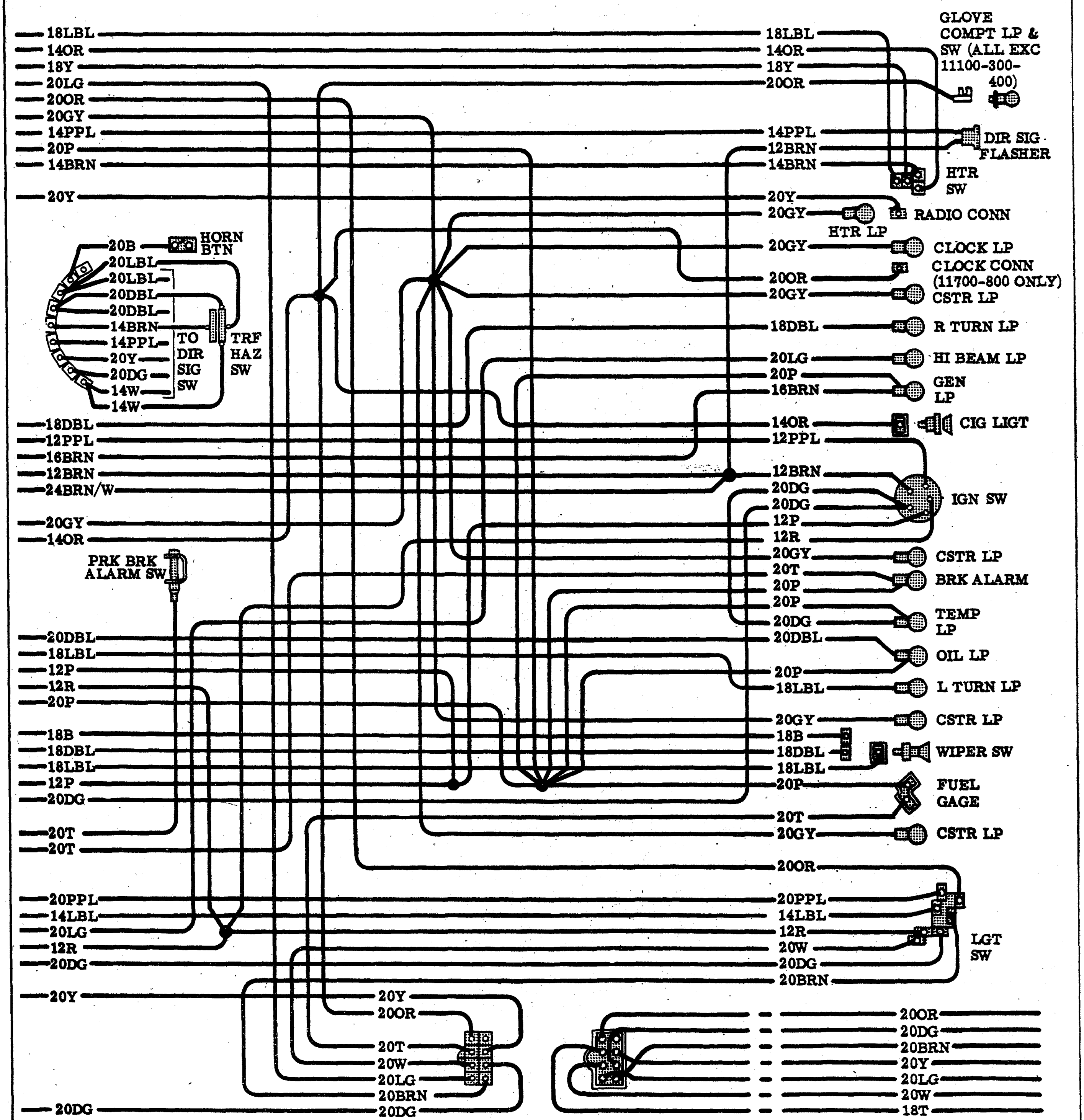


Fig. 115 - Instrument Panel and Cluster -- Chevy II

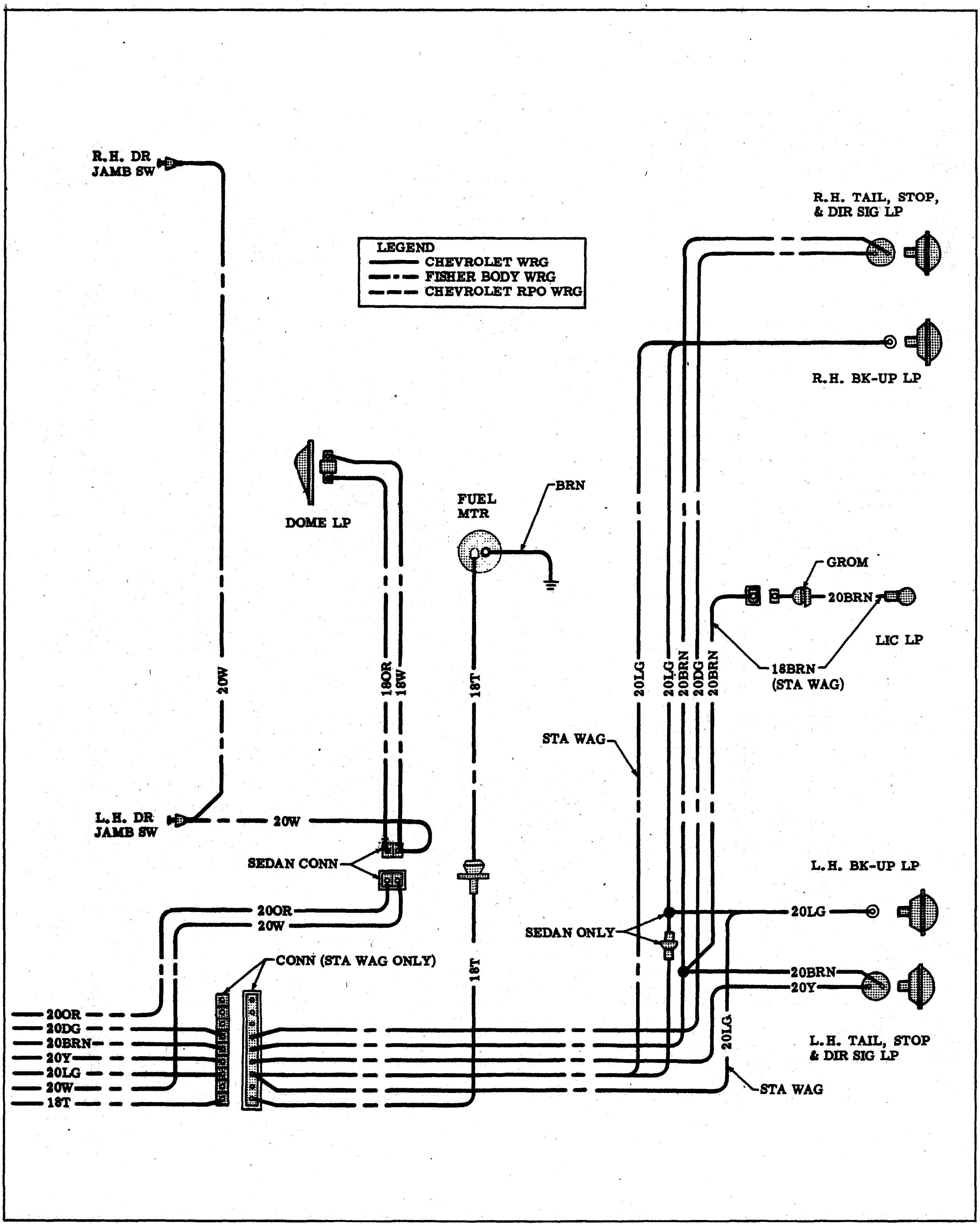


Fig. 116 - Body and Rear Lighting -- Chevy II

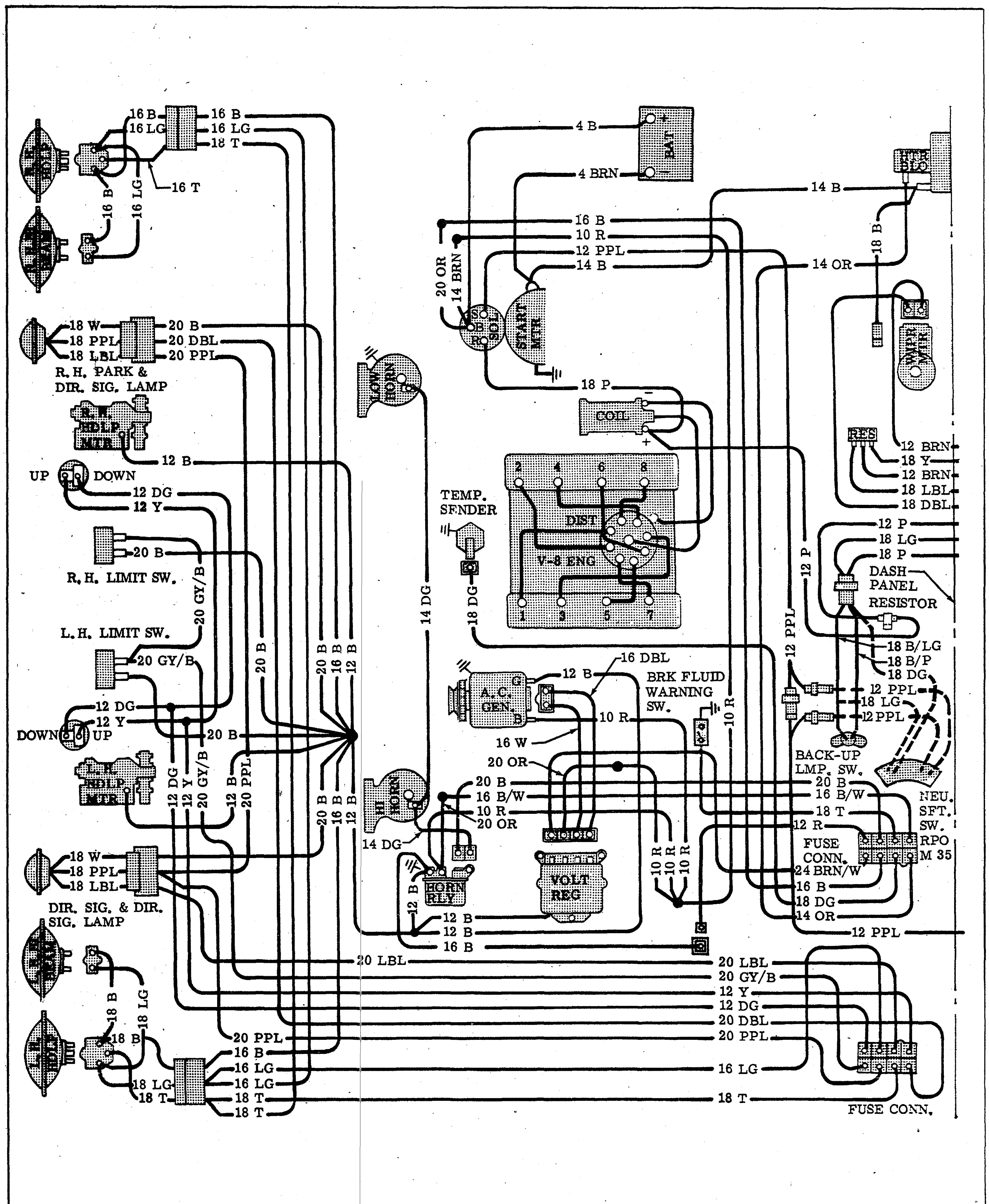


Fig. 117 - Front Lighting & Engine Compt -- Corvette

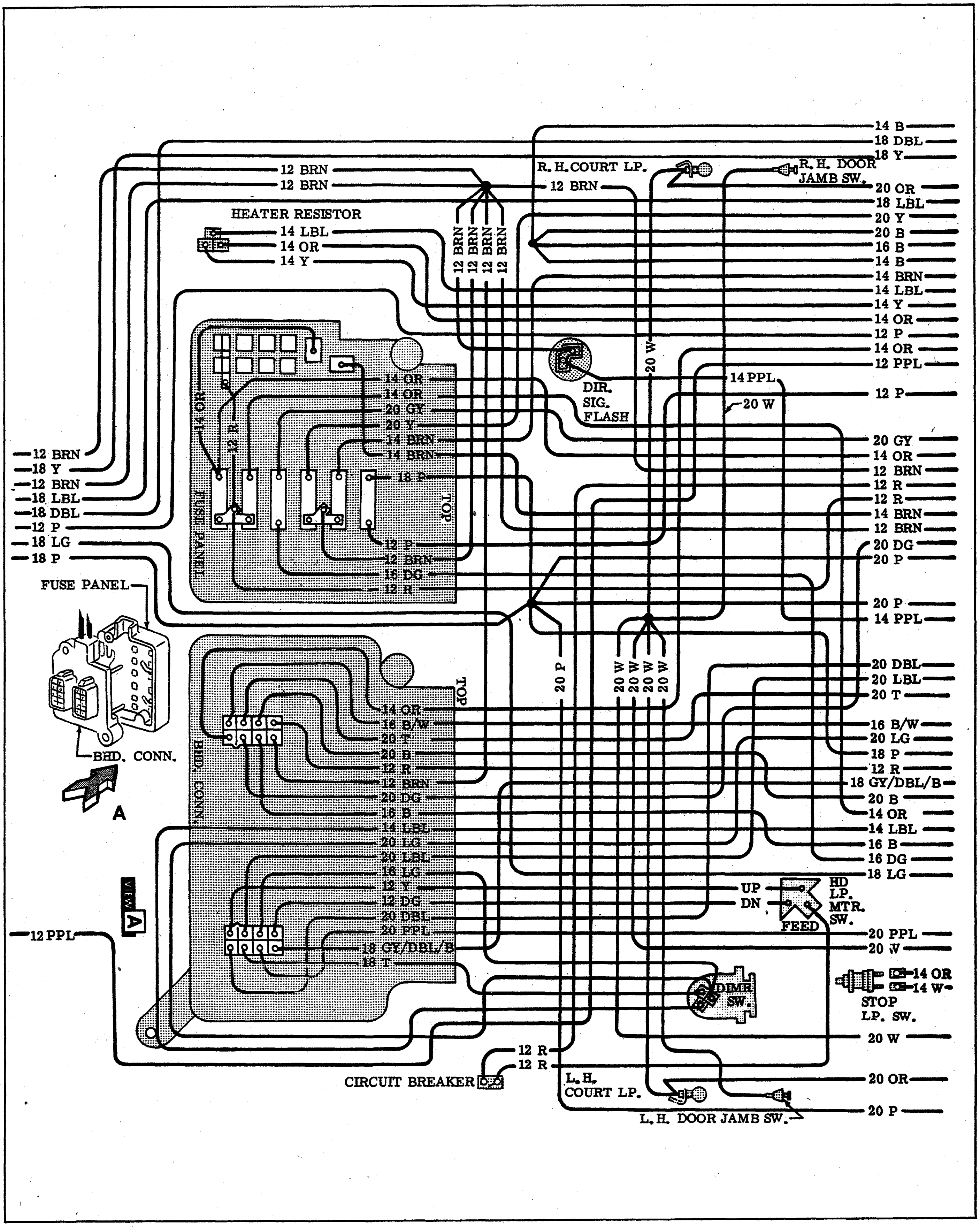


Fig. 118 - Fuse Panel -- Corvette

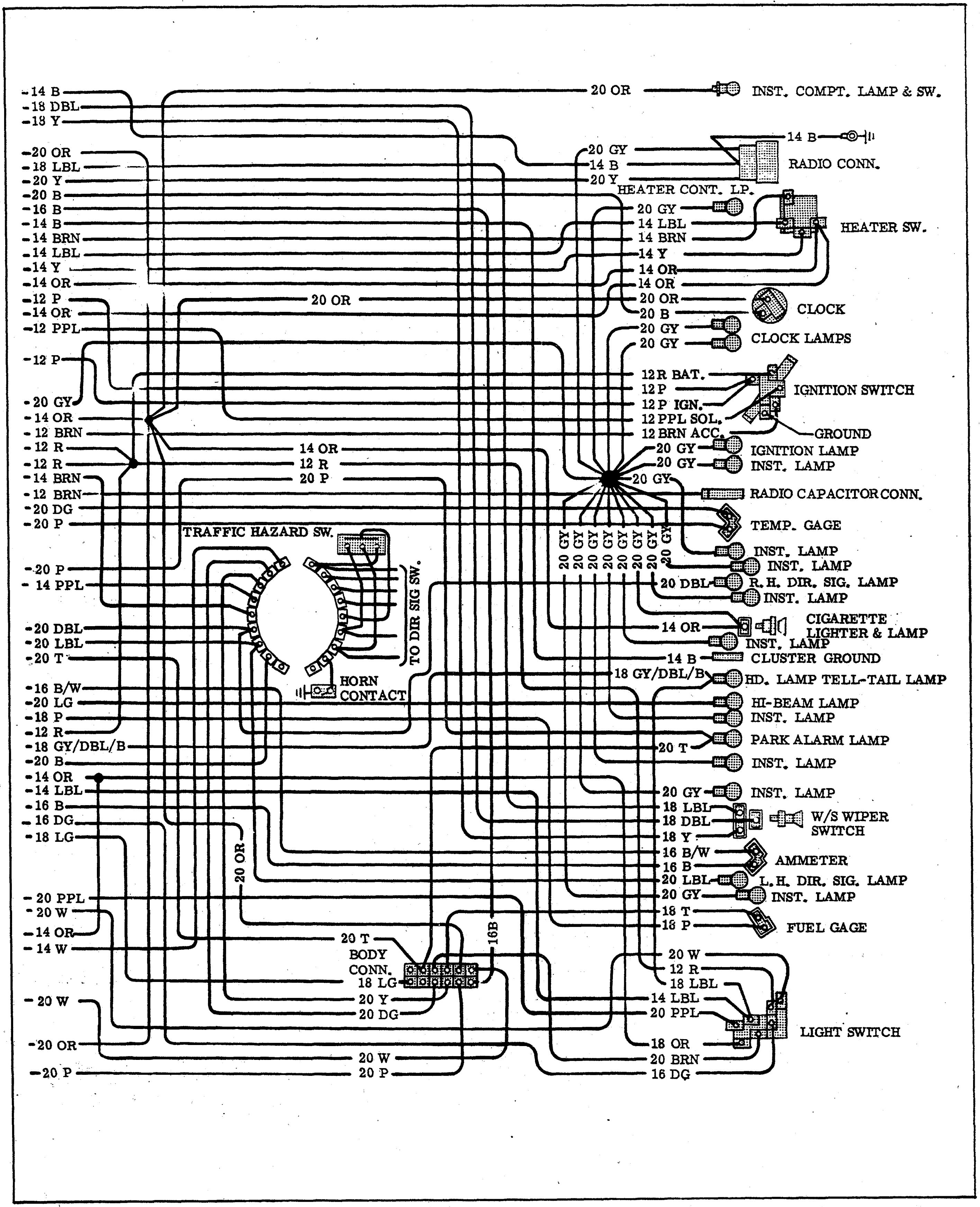


Fig. 119 - Instrument Panel & Cluster -- Corvette

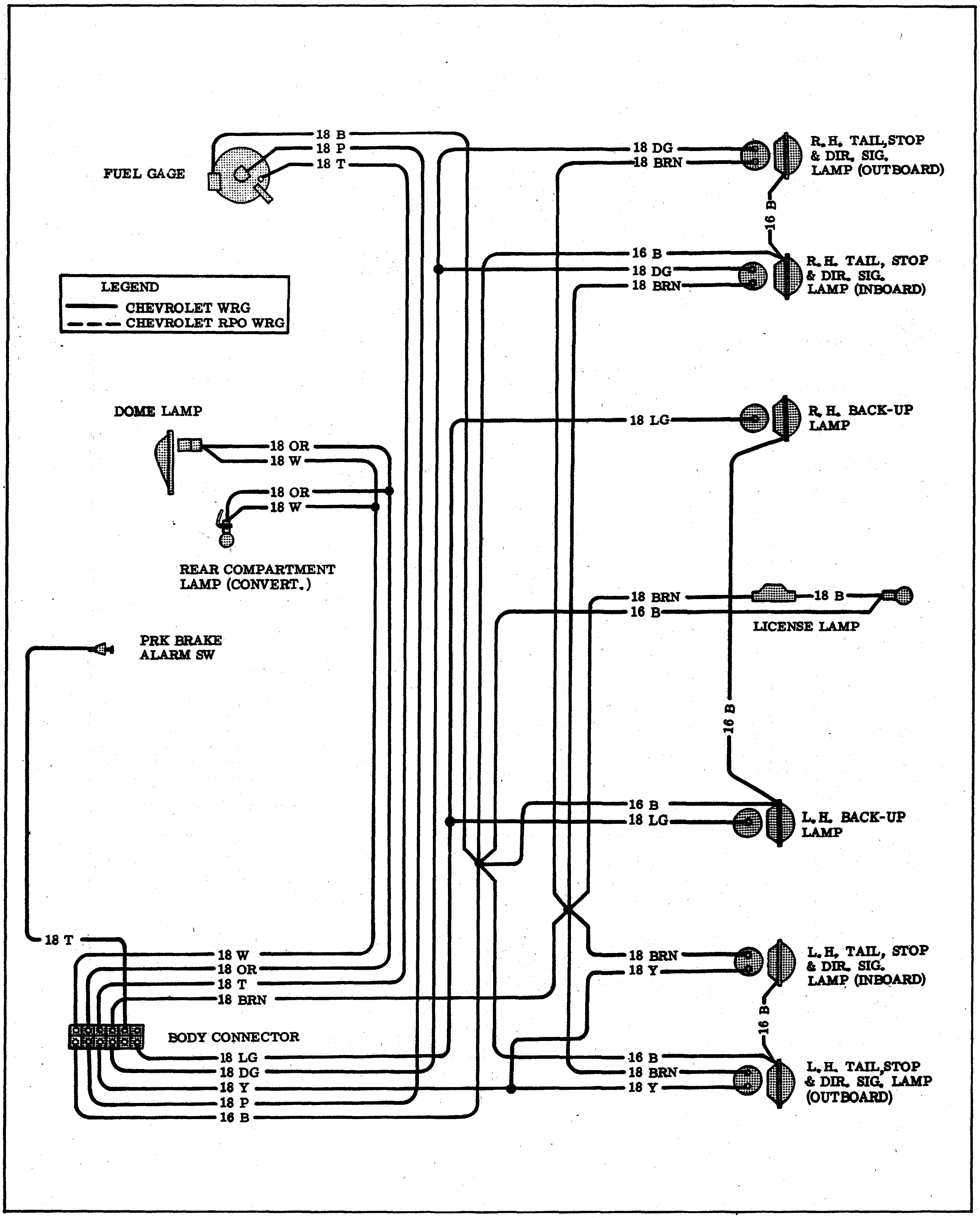


Fig. 120 - Body and Rear Lighting -- Corvette

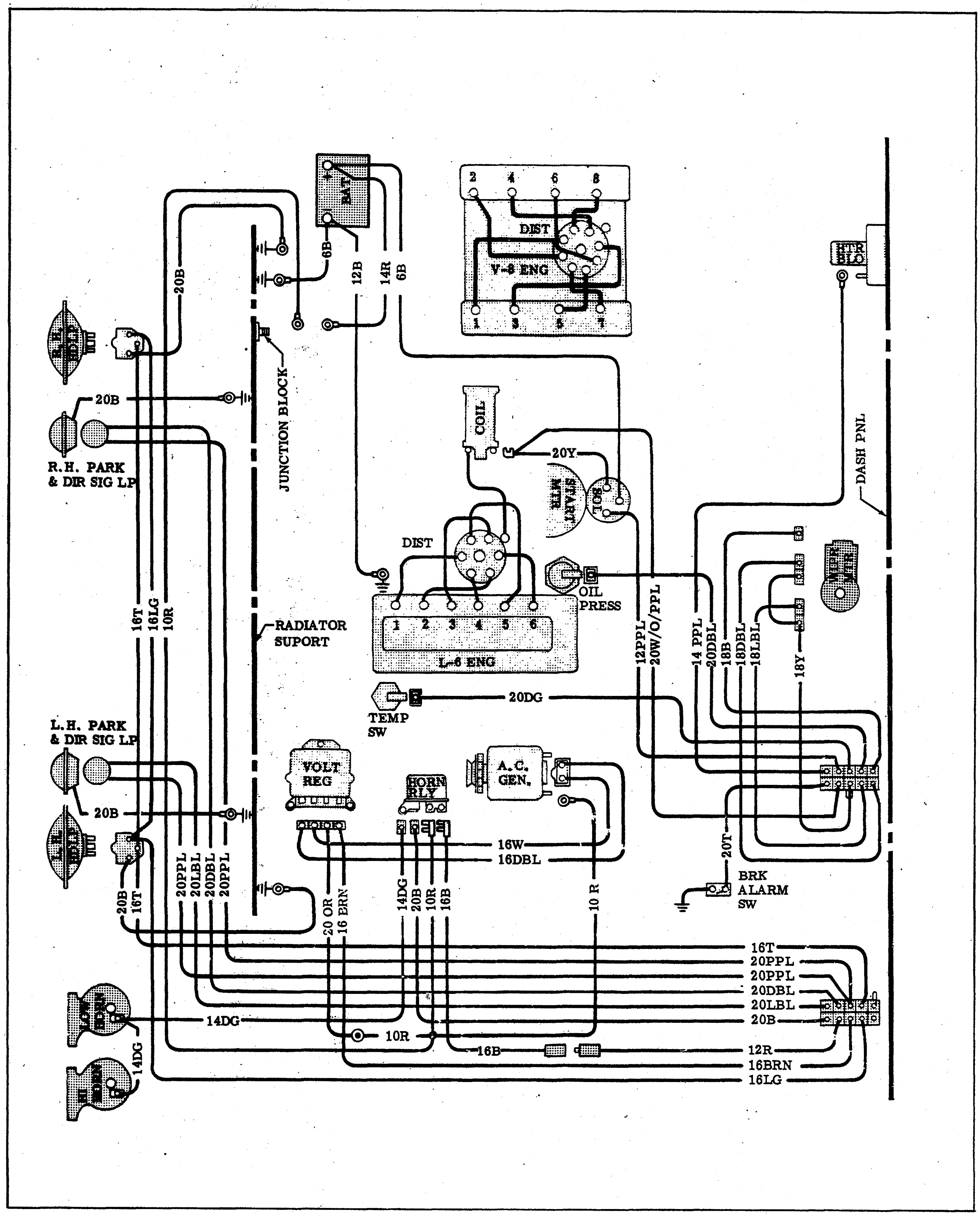


Fig. 121 - Front Lighting & Engine Compt. - Camaro

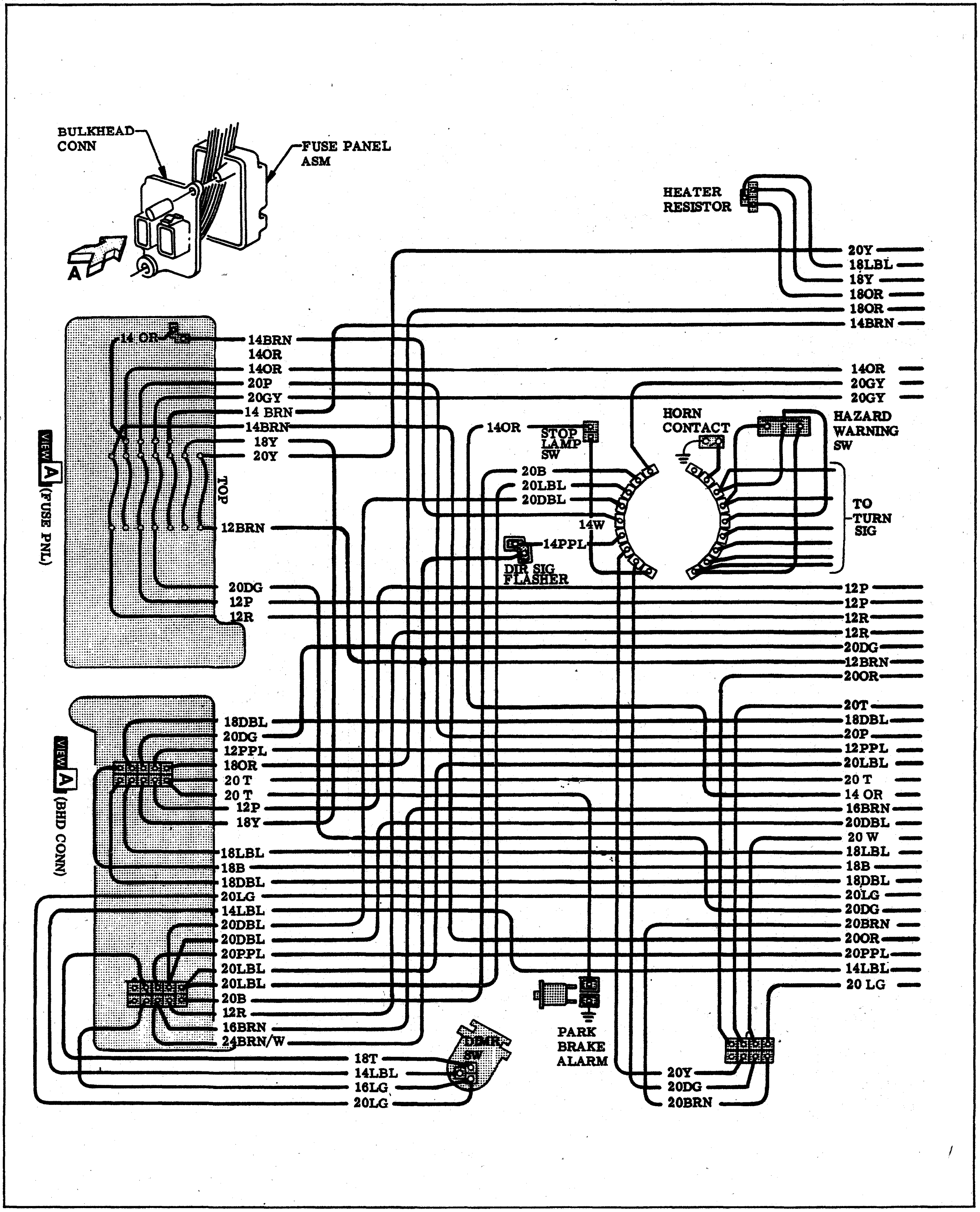


Fig. 122 - Fuse Panel - Camaro

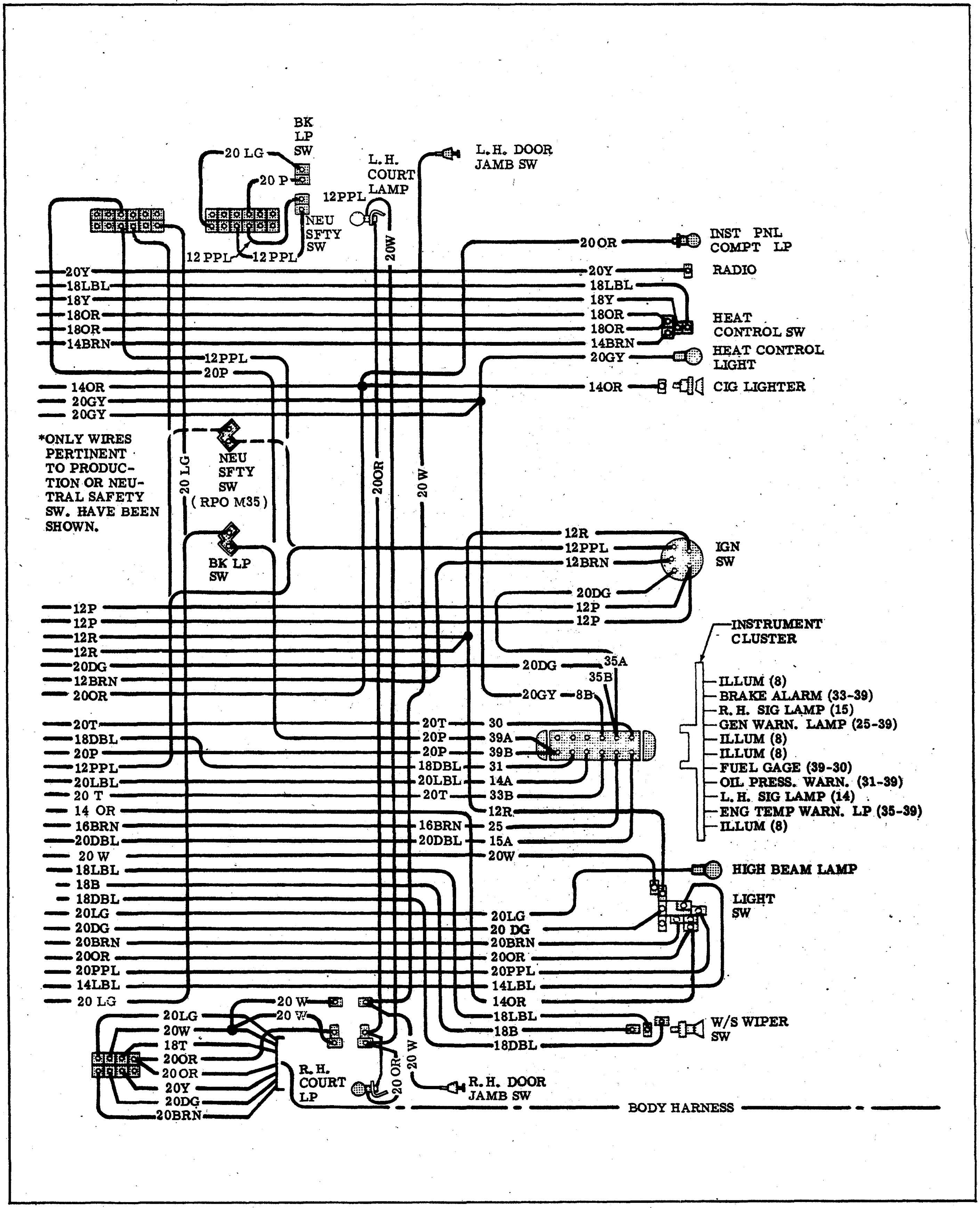


Fig. 123 - Instrument Panel and Cluster - Camaro

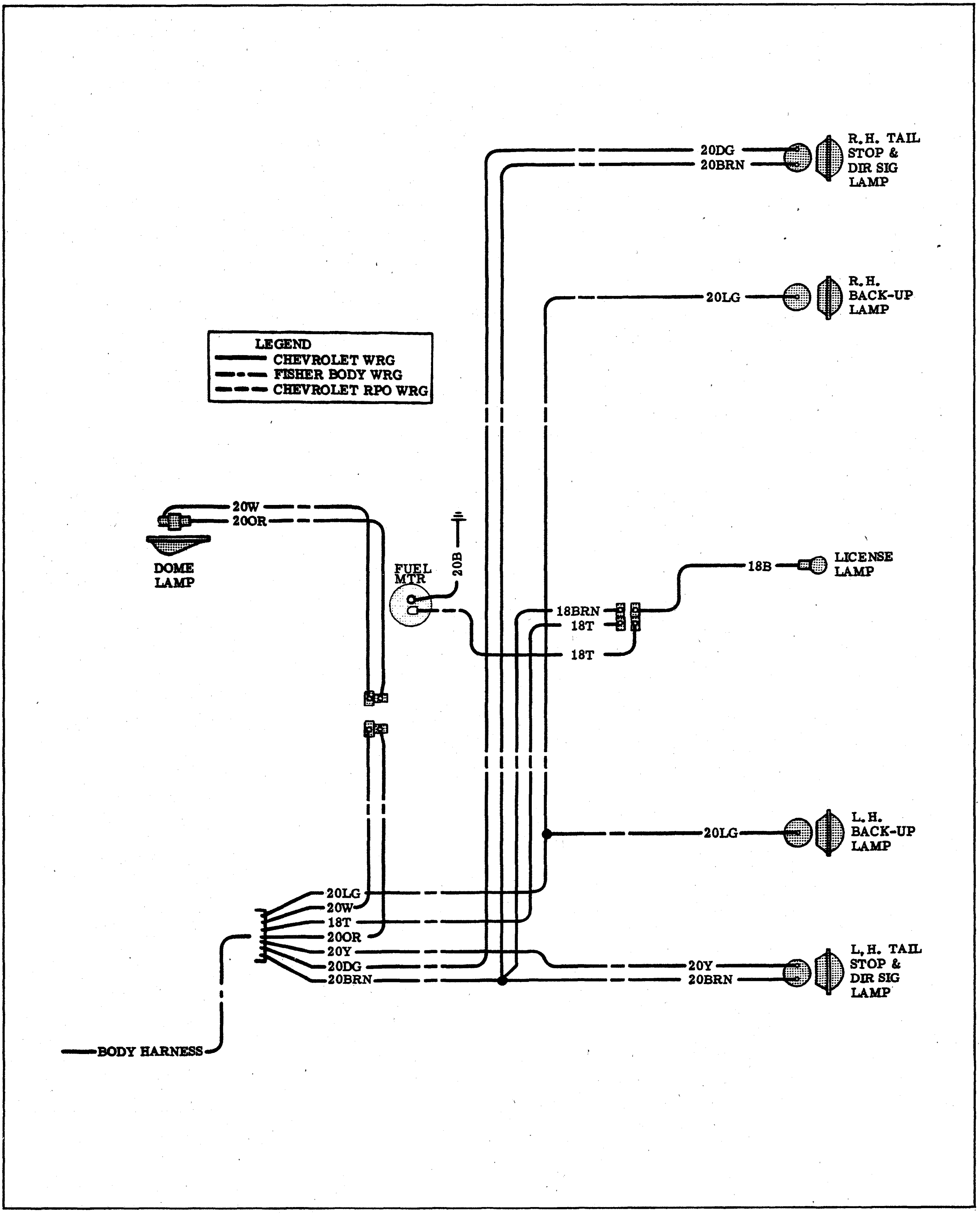


Fig. 124 - Body and Rear Lighting - Camaro

SECTION 13
RADIATOR AND GRILLE

INDEX

GENERAL DESCRIPTION

Radiator assemblies are attached by cap screws either to the radiator support or radiator shroud, depending on the engine installation of each vehicle. The Camaro fan shroud is mounted in two bottom slots and secured by one bolt at the top. Removal and installation procedures for the radiator and shroud are basically the same for each vehicle.

NOTE: Refer to the Fisher Body Service Manual for Body, Section 11 for Sheet Metal, Section 14 for Bumpers, and Section 1A for Air Conditioning information when required.

SERVICE OPERATIONS

RADIATOR AND SHROUD—ALL VEHICLES (EXCEPT CORVETTE)

Removal

1. Drain radiator.
2. Disconnect inlet and outlet radiator hoses, and Powerglide cooler lines if vehicle is so equipped.
3. Remove radiator and shroud attaching screws and lift radiator and shroud out of vehicle.

Installation

NOTE: Refer to Figures 1 through 5 for radiator fan and shroud assembled positions for each vehicle. Reverse removal procedures, fill cooling system and check for leaks.

RADIATOR AND FAN SHROUD—CORVETTE

Fan Shroud Replacement (Fig. 4)

1. Drain radiator and open hood. (Install a bolt in hole of hood support bracket for safety purposes.)
2. Disconnect upper radiator hose and supply tank hose at radiator connection.
3. Remove shroud bolts.

NOTE: Reach upper two shroud bolts from top, between hood and radiator support. Reach lower 4 by reaching around front edge of open hood.

4. Remove shroud carefully (tilt rearward, then lift up to clear fan blades).
5. Reverse procedure to install, fill cooling system and check for leaks.

Aluminum Radiator

Removal and Installation

1. Remove shroud as previously outlined.
2. Disconnect lower radiator hose at either end.
3. Remove radiator upper mount bracket bolts and bracket, then lift radiator from vehicle.
4. Reverse procedure to install.

Copper Radiator

Removal and Installation

1. Remove hood panel assembly after scribing bracket location.
2. Drain radiator and disconnect radiator hoses.

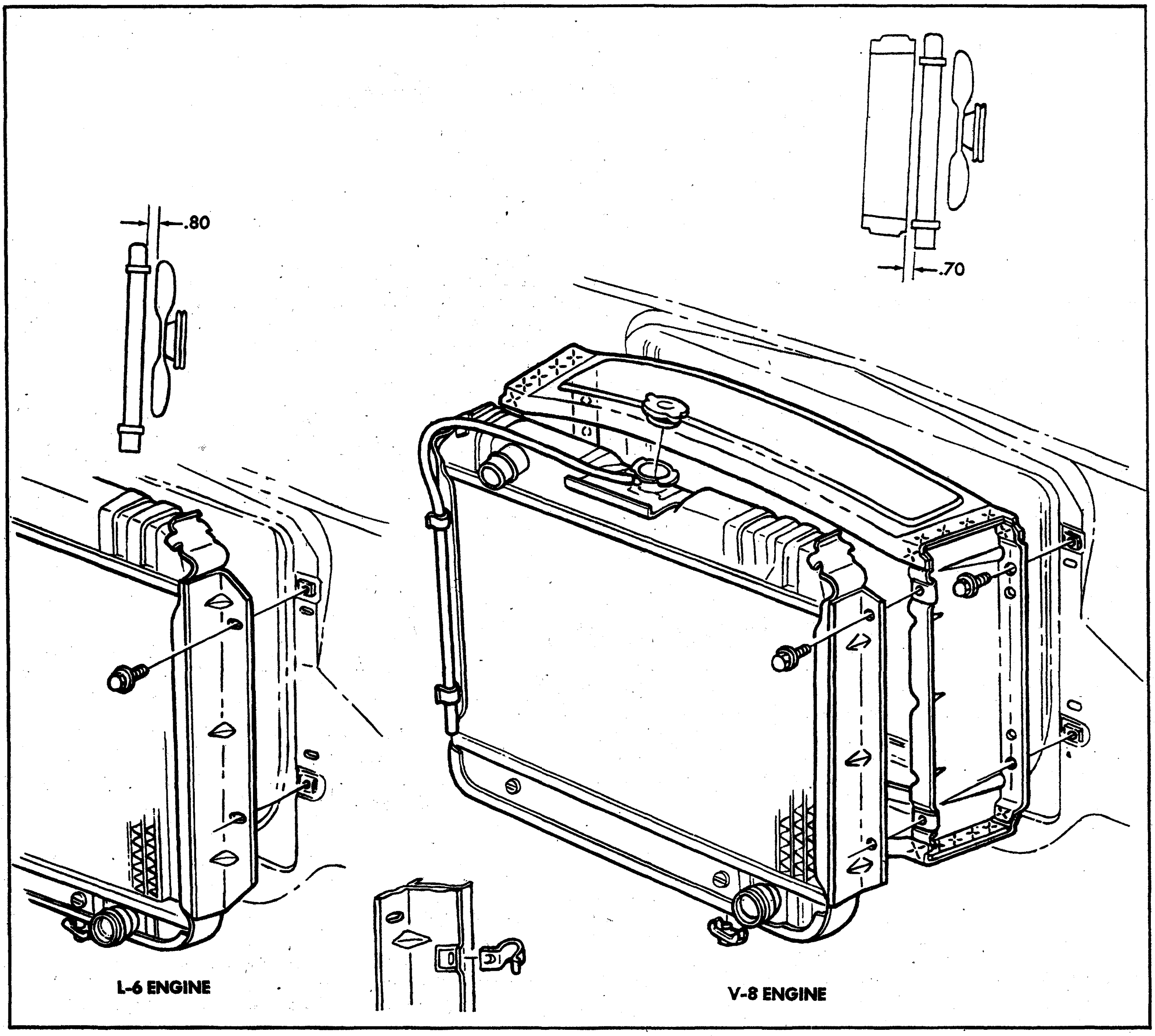


Fig. 1 - Radiator and Shroud - Chevrolet

3. Remove fan.
4. Remove bolts along top of radiator support, right and left radiator hold down clamps, and shroud center bracket.
5. Remove horns and bolts retaining fan shroud to radiator support.
6. With helper, work radiator and fan shroud from vehicle.
7. Reverse procedure to install.

GRILLE ASSEMBLY—CHEVROLET

Removal (Figs. 6 and 7)

1. Raise hood and disconnect battery leads.
2. Remove bumper (Section 14).
3. Remove bolts securing hood catch assembly to radiator support, hood catch support and tie bar, and remove hood catch from vehicle.
4. Remove screws attaching headlamp bezels to grille reinforcements, fenders, and filler panel. Remove bezels and headlamps from vehicle.
5. Remove screws and rivits from each fender trim plate and remove fender trim plates with reinforcements from vehicle. Refer to Figure 6 for attaching hardware locations.
6. Remove rivits securing top of grille to tie bar.
7. Remove screw and rivits securing bottom of grille to filler panel and remove grille. If necessary, remove nuts attaching name plate to grille and replace name plate.
8. Remove screws attaching hood catch support to radiator support and filler panel and remove catch support from vehicle.
9. Remove screws attaching tie bar to fenders, radiator

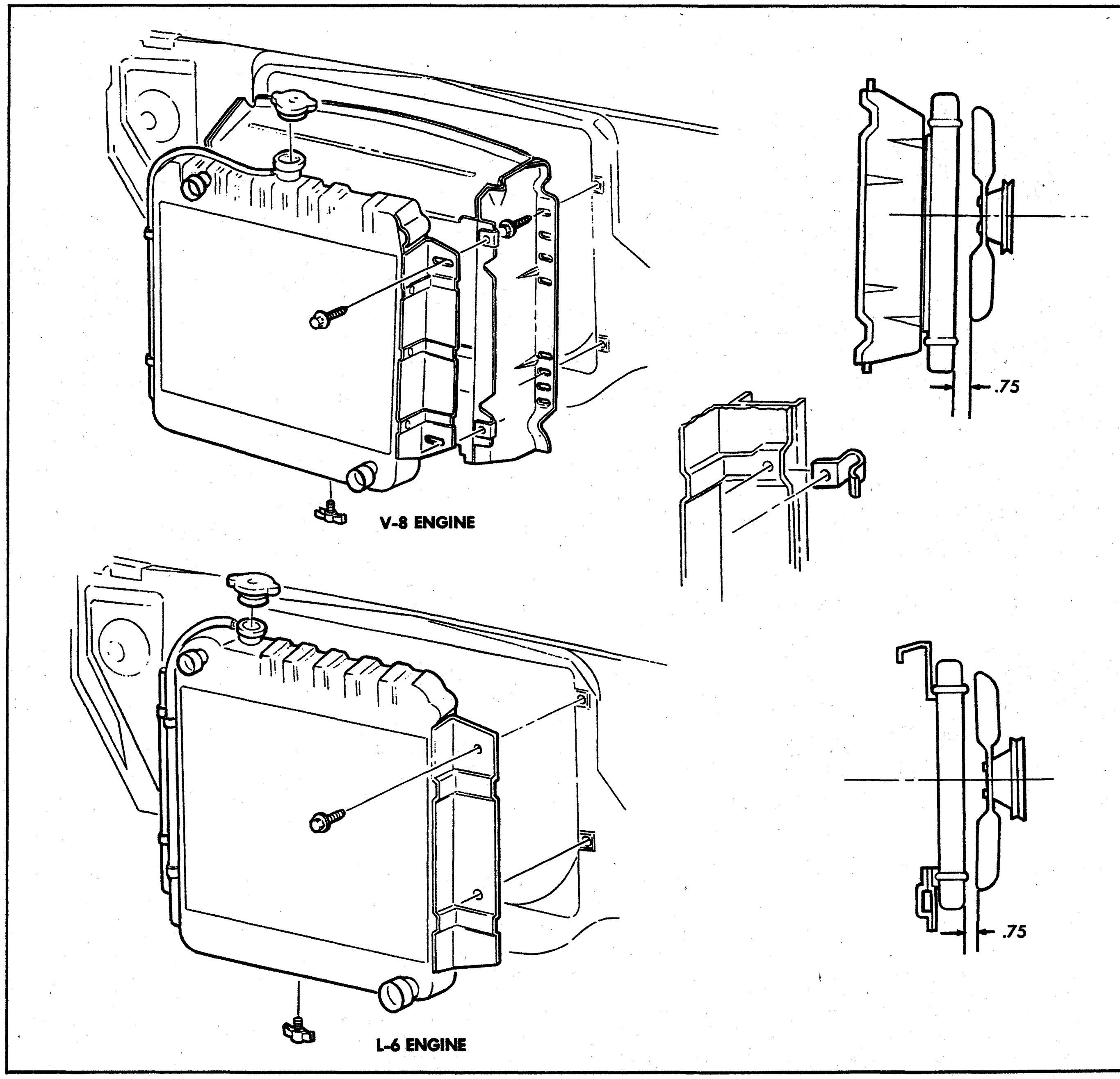


Fig. 2 - Radiator and Shroud - Chevelle

support, and grille reinforcements and remove tie bar.

10. Remove screws securing grille reinforcements to filler panel and remove reinforcements.
11. Remove filler panel attaching hardware and remove filler panel from vehicle.

Repair

If tie bar, filler panel, hood latch support, or any other components removed are undamaged, they may be used for the new grille installation. Where rivets were removed, make new attachments using screws and nuts, patent clips, or rivets.

Installation

Install grille and related components following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

GRILLE ASSEMBLY—CHEVELLE (Fig. 8)

Removal

1. Raise hood and disconnect battery leads.
2. Remove screws from each headlamp bezel and remove headlamp bezels from vehicle. Remove headlamps.

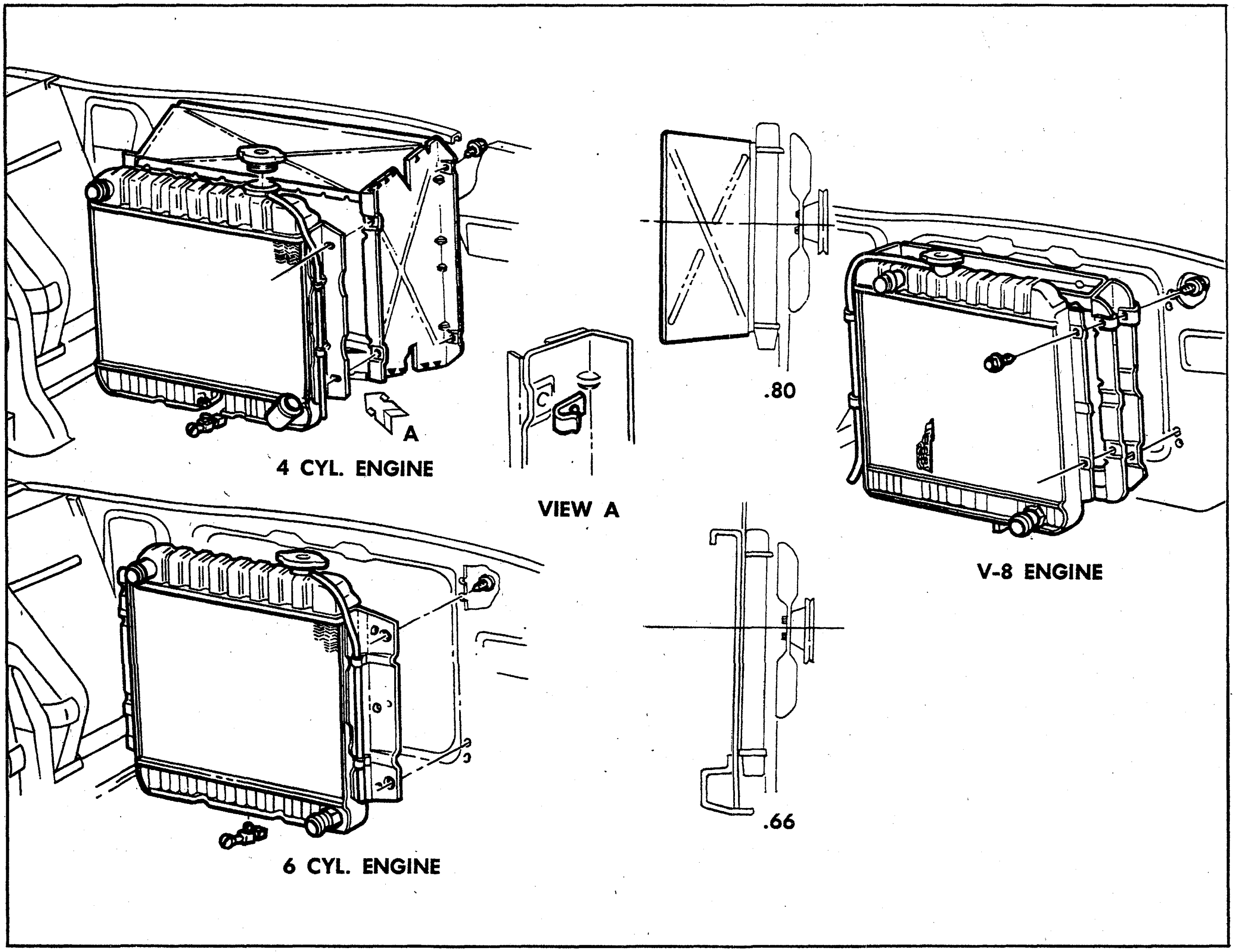


Fig. 3 - Radiator and Shroud - Chevy II

3. Remove screws and nuts attaching grille extensions to fenders and remove grille extensions.
4. Remove rivets attaching top of grille to tie bar.
5. Remove screws attaching hood latch plate to tie bar, catch support bracket, and radiator support and remove latch plate from vehicle.
6. Remove rivets securing grille reinforcements to tie bar and filler panel and remove reinforcements.
7. Remove screws attaching tie bar to fenders, hood catch support, and radiator support and remove tie bar.
8. Remove bumper (Section 14).
9. Remove rivet and screw securing hood catch support to filler panel and radiator support and remove catch support from vehicle.
10. Remove rivets securing bottom of grille to filler panel and remove grille.
11. Remove attaching hardware securing filler panel and filler panel reinforcements to fenders, fender braces, and radiator support, and remove filler panel.
12. If necessary, remove nuts attaching name plate to grille and replace name plate.

Repair

If any components removed are undamaged, they may be used for the new grille installation. Where rivets were removed, make new attachments using screws and nuts, patent clips, or rivets.

Installation

Install grille and related components following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

GRILLE ASSEMBLY--CHEVY II (Fig. 9)

Removal

1. Raise hood and disconnect battery leads.
2. Remove bumper (Section 14).
3. Remove screws and nuts securing hood catch assembly to radiator support, grille, and catch support bracket and remove catch from vehicle.
4. Remove screws from each headlamp bezel and remove bezels from vehicle. Remove headlamps.
5. Remove screws securing hood catch support to filler panel and radiator support and remove catch support.

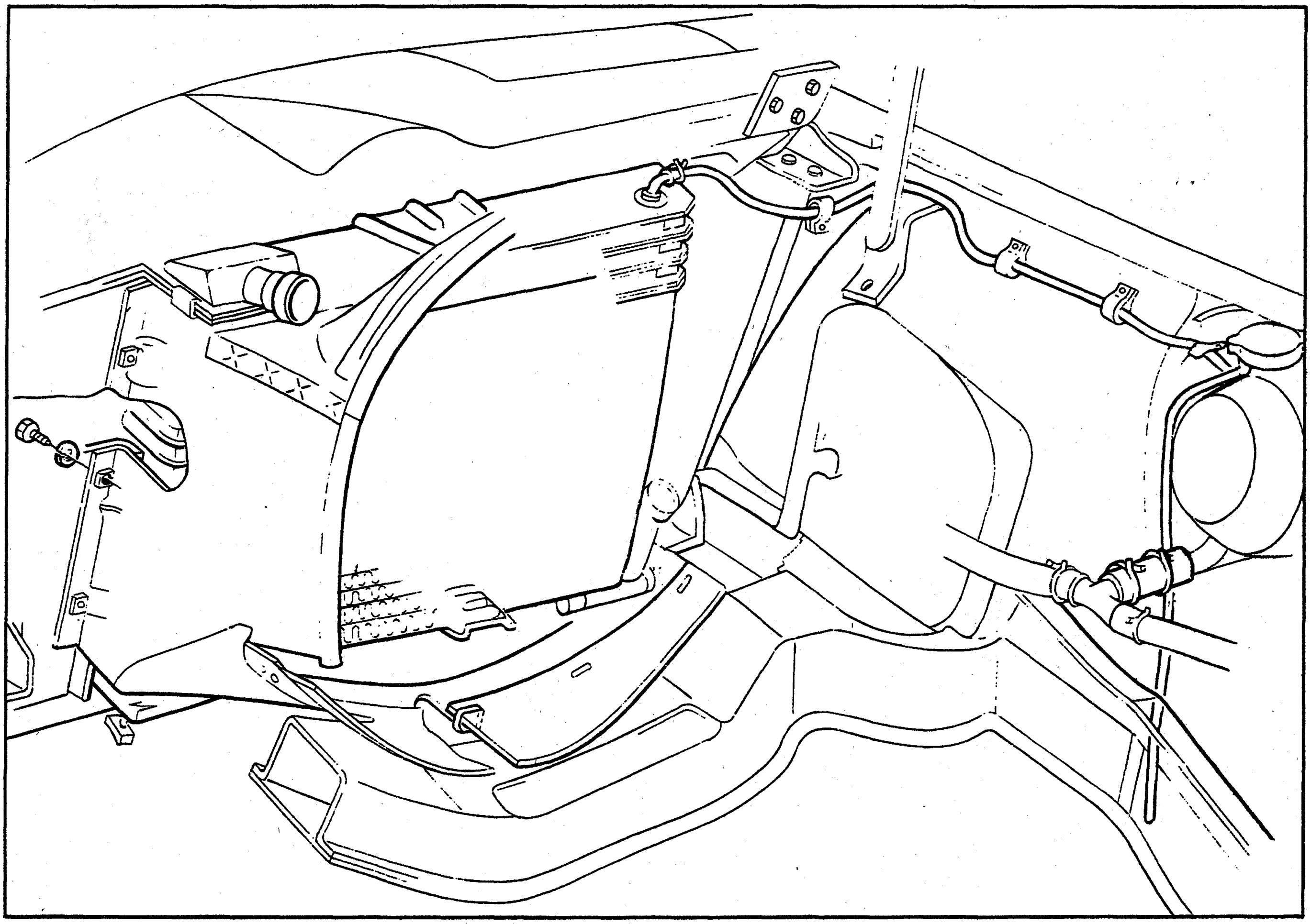


Fig. 4 - Radiator and Shroud - Corvette

6. Remove screws attaching top of grille to left and right supports.
7. Remove rivets securing bottom of grille to filler panel, support assemblies, and reinforcements and remove grille from vehicle.
8. If necessary, remove rivets, screws, and retainers securing reinforcements and name plate to grille and replace reinforcements and name plate.
9. Remove screws attaching left and right supports and remove supports.
10. Remove attaching hardware securing filler panel and remove filler panel from vehicle.

Repair

If any components removed are undamaged, they may be used for the new grille installation. Where rivets were removed, make new attachments using screws and nuts, patent clips, or rivets.

Installation

Install grille and related components following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

GRILLE ASSEMBLY—CORVETTE (Fig. 10)

Removal

1. Raise front of vehicle.
2. Remove front bumper (Section 14).
3. Remove grille retaining screws.
4. Remove grille from vehicle.

Installation

Install grille and related components following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

GRILLE ASSEMBLY—CAMARO (Fig. 11)

NOTE: If necessary to remove retractable headlamp cover only, refer to Section 12.

Removal

1. Raise hood and disconnect battery leads and remove battery.
2. Remove bumper (Section 14).
3. Remove screws securing hood catch assembly to

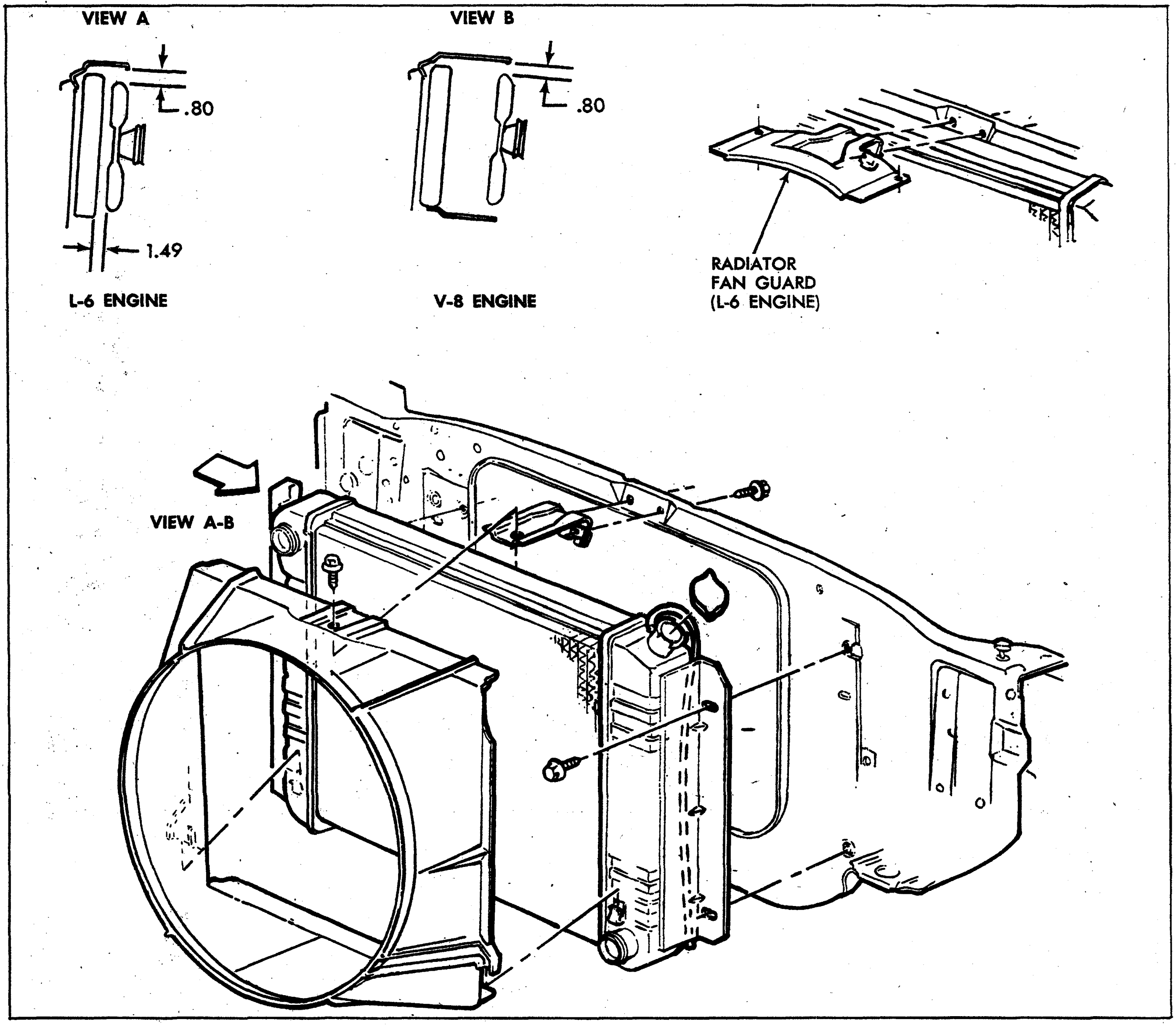


Fig. 5 - Radiator and Shroud - Camaro

grille header panel, catch support bracket, and radiator support and remove hood catch.

4. Remove screws from each headlamp bezel and remove bezels from vehicle. Remove headlamps.
5. Remove hardware attaching hood catch support to radiator support, valance panel, and lower grille and remove catch support from vehicle.
6. Disconnect parking lamps. Remove rivets securing center grille to upper and lower grilles and remove center grille from vehicle. If necessary, replace name plate.
7. Remove screws and rivets securing grille header panel to fenders and upper grille and remove header panel.
8. Remove hardware attaching upper and lower grilles to vehicle and remove upper and lower grilles.
9. Remove screws attaching valance panel to fenders, and fender extensions and retractable headlamp door assemblies if so equipped, and remove valance panel from vehicle.
10. If vehicle is equipped with retractable headlamp covers, disconnect electrical plugs. Remove screws attaching headlamp bracket assemblies to radiator support and remove assemblies from vehicle.

Repairs

If any components removed are undamaged, they may be used for the new grille installation. Where rivets were removed, make new attachments using screws and nuts, patent clips, or rivets.

Installation

Install grille and related components following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

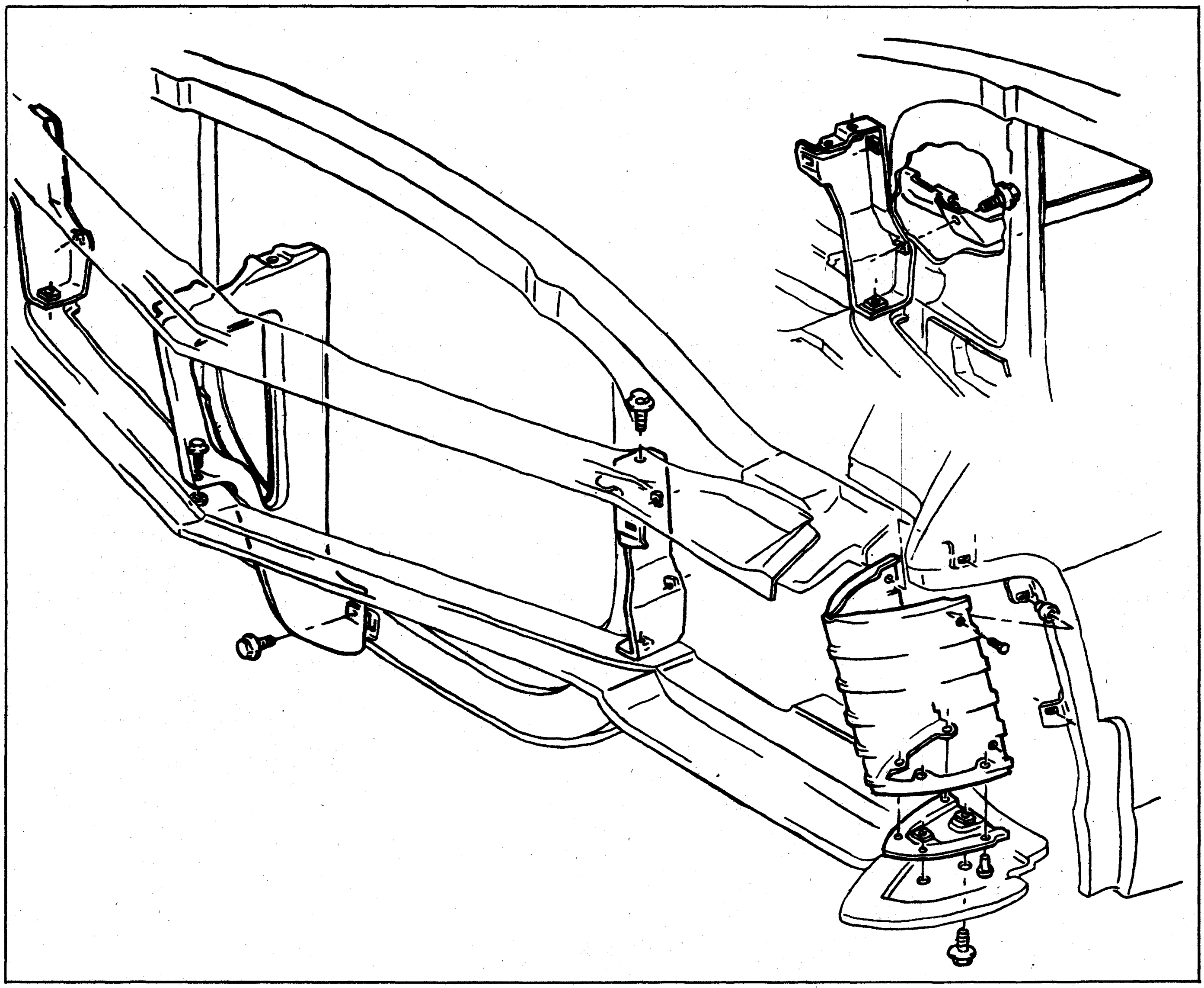


Fig. 6 - Fender Trim Plate - Attaching Hardware

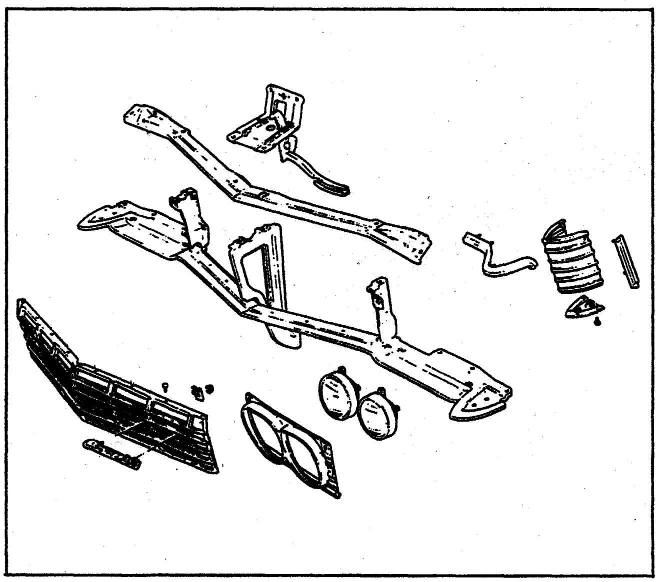


Fig. 7 - Grille Assembly - Chevrolet

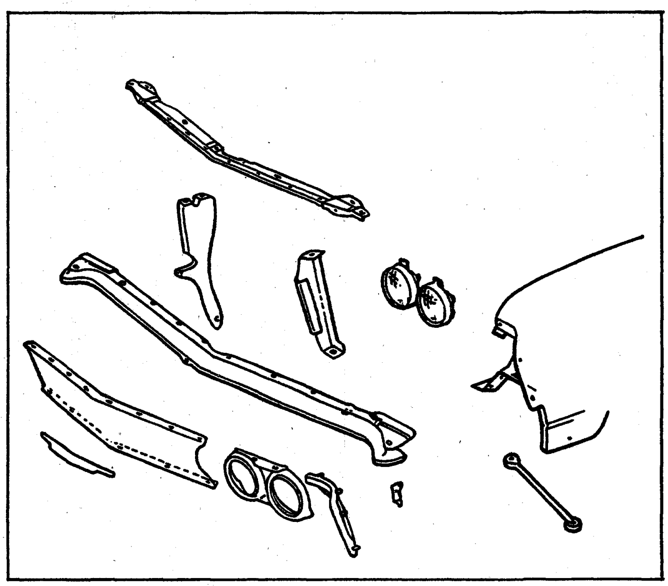


Fig. 8 - Grille Assembly - Chevelle

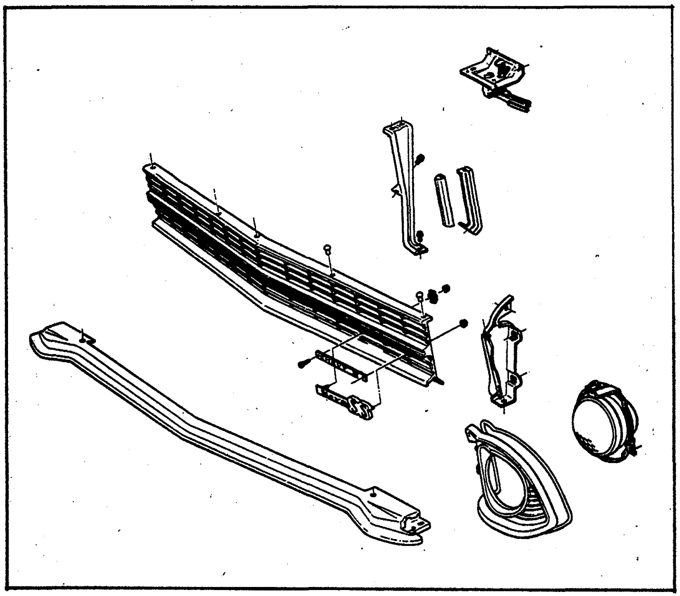


Fig. 9 - Grille Assembly - Chevy II

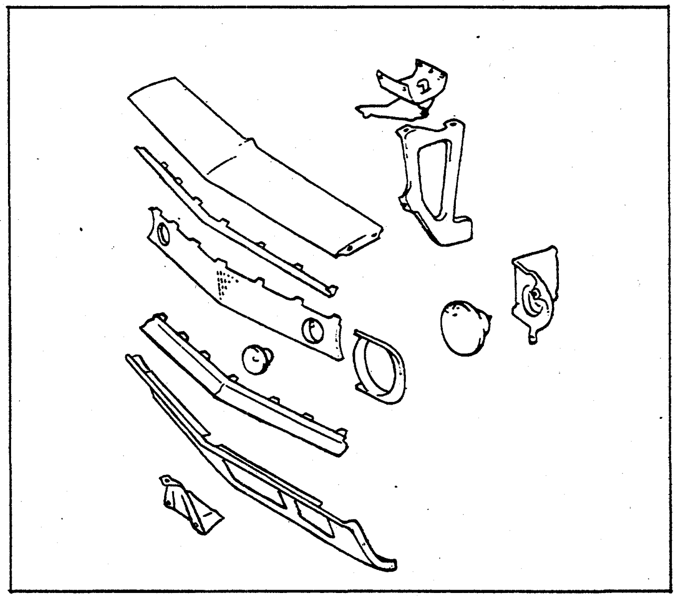


Fig. 11 - Grille Assembly - Camaro

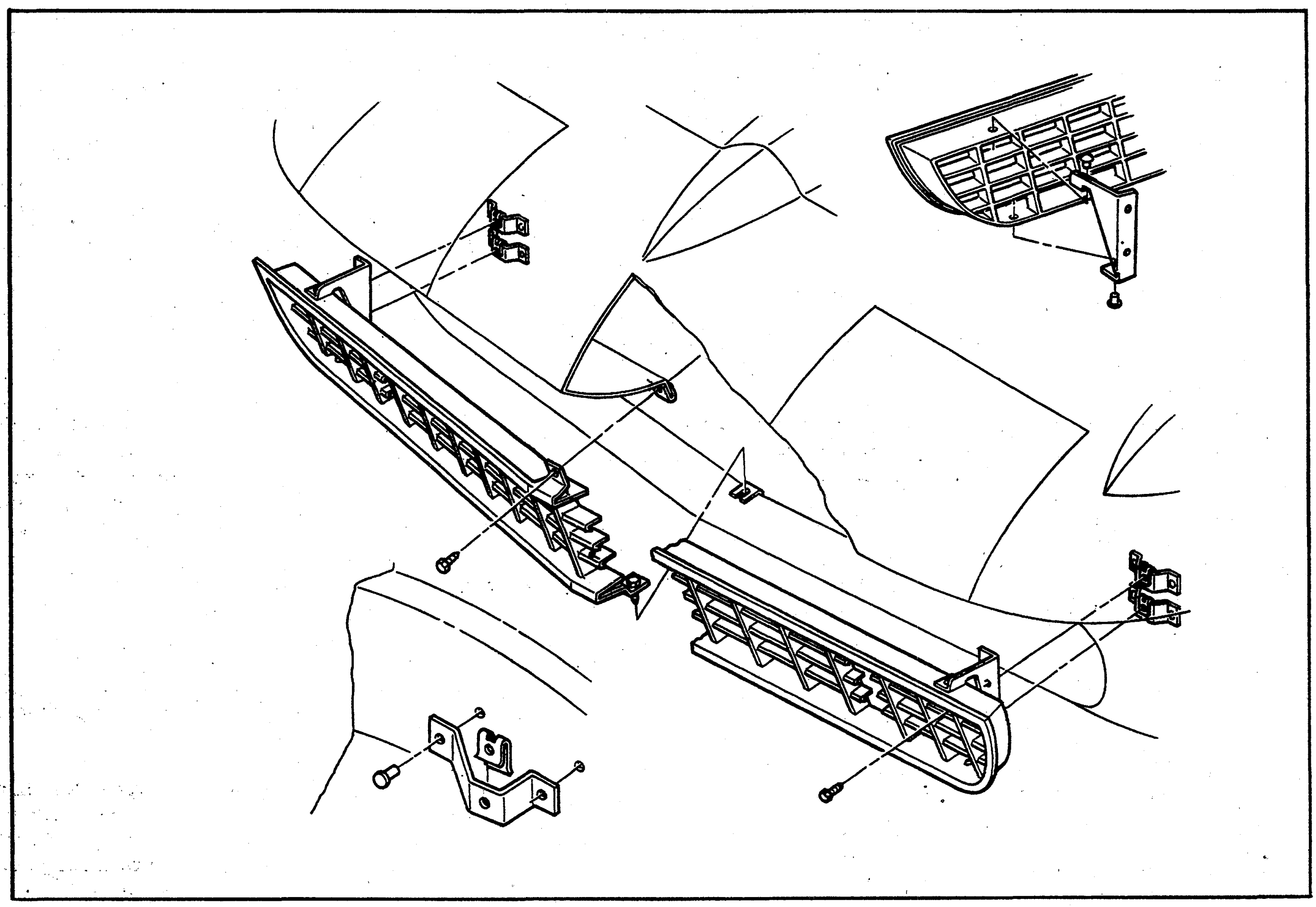


Fig. 10 - Grille Assembly - Corvette

SECTION 14

BUMPERS

INDEX

GENERAL DESCRIPTION—CHEVROLET

The front bumper is a new, full width, three-piece design consisting of a center and two end face bars. Two holes are pierced in the center face bar for the parking lamps. The bumper attaching brackets are lengthened to attach in common with new front bumper diagonal braces.

The rear bumper is a new three-piece design similar in general appearance to the 1966 design. Caprice models have pierced holes in the center portion of the bumper for the back-up lamps with the other models incorporating the back-up lamps with the tail lamps. The fuel tank filler door assembly remains the same as the 1966 models.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY (Fig. 1)

Removal

1. Raise and support front end of vehicle.
2. Disconnect parking lamp wiring.
3. Remove bolts attaching bumper brackets and braces to frame.
4. Remove bumper from vehicle.

Disassembly

1. Remove bolts attaching brackets and braces to bumper.
2. Separate face bar sections by removing two bolts at each joint.
3. Remove screws attaching each parking lamp assembly to center face bar and remove parking lamps.

Assembly

Attach both parking lamps to center face bar and tighten bolts firmly. Assemble the front bumper following the disassembly procedure in reverse order. Except for parking lamp attachments, 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 adjustment washers (fig. 1) are

placed in the tab of each bumper bracket. Dial the adjustment washers in the tabs as required to position the bumper at the correct mounted height.
3. Tighten all bolts securely, connect parking lamp wiring, and lower vehicle.

REAR BUMPER ASSEMBLY (Fig. 2)

Removal

1. Raise and support rear end of vehicle.
2. Disconnect rear license plate lamp wiring.
3. On Caprice models, disconnect back-up lamp wiring.
4. Remove center face bar to frame attaching bolts located behind license plate door.
5. Remove bolts from each side attaching bumper brackets and braces to frame.
6. Remove bumper from vehicle.

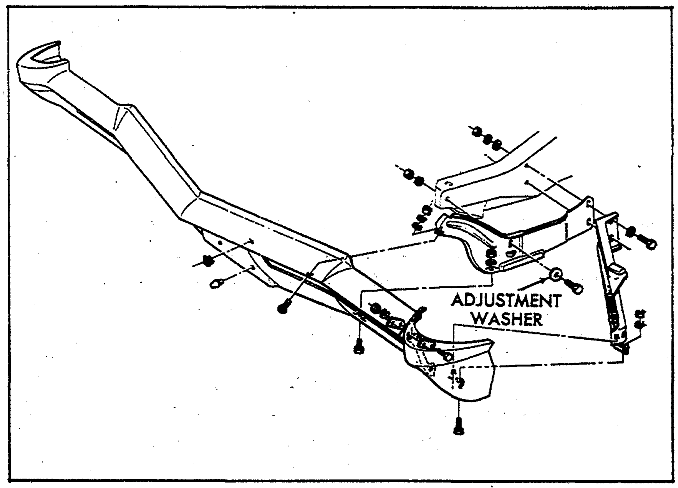


Fig. 1 - Front Bumper Assembly - Chevrolet

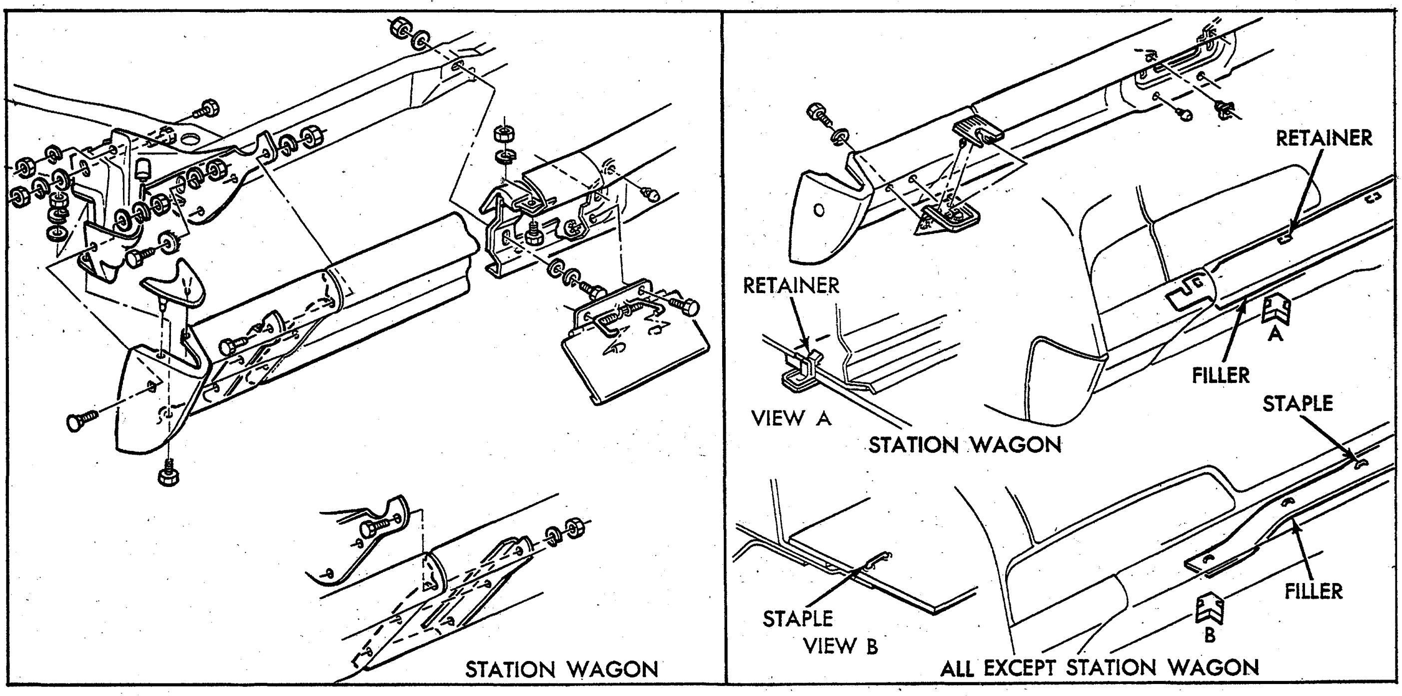


Fig. 2 - Rear Bumper Assembly - Chevrolet

Disassembly

1. Remove license plate lamp.
2. On Caprice models, remove back-up lamp assemblies.
3. Remove bolts retaining each bumper brace to bumper.
4. Remove bolts retaining each bumper bracket to bumper and separate sections of face bar at joints.
5. The license plate door (sedan models) and bumper pads (station wagon models) may be removed by removing the attaching parts shown in Figure 2.

Assembly

On Caprice models, attach both back-up lamps to center face bar and tighten bolts firmly. Assemble the rear bumper following the disassembly procedure in reverse order. Except for back-up lamp attachments on Caprice models, install all bolts loosely; do not tighten any bolts until all bolts are installed.

Installation

1. Position bumper assembly on vehicle aligning holes in braces and mounting brackets with those in frame.
2. Loosely install bolts, lock washers, and nuts including center face bar to frame bolts behind license plate door. Note that eight sided adjustment washers (fig. 2) are placed in the tab of each bumper mounting bracket. Dial the adjustment washers in the tabs as

required to position the bumper at the correct mounted height.
3. Tighten all mounting bolts securely and connect license plate lamp wiring. On Caprice models, connect back-up lamp wiring. 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. The back-up lamp assemblies are attached near the center of the bumper.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY

Removal

1. Raise and support front of vehicle.
2. Disconnect parking lamp wiring.
3. Remove bolts retaining the bumper brackets and braces to the frame.
4. Remove bumper assembly from vehicle.

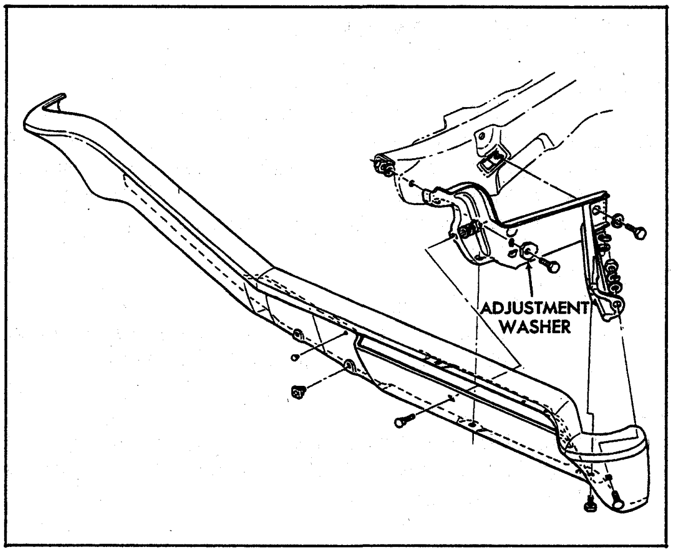


Fig. 3 - Front Bumper Assembly - Chevelle

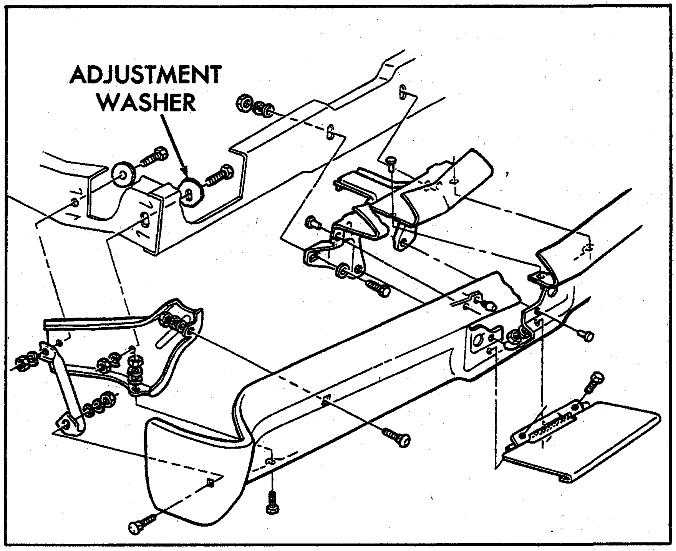


Fig. 4 - Rear Bumper Assembly - Chevelle

Disassembly

1. Remove bolts attaching braces and brackets to bumper.
2. Remove bolts from each parking lamp assembly and remove parking lamps from bumper.

Assembly

Attach both parking brake lamp assemblies to front bumper and tighten bolts firmly. Assemble the front bumper parts by following the disassembly procedure in reverse order. Except for the parking lamp attachments, install all bolts loosely; do not tighten any bolts until all bolts are installed.

Installation

1. Position the front bumper on the frame horns aligning holes in brackets and braces with those in the frame.
2. Loosely install bolts, lock washers, and nuts. Note that eight sided adjustment washer (fig. 3) is placed in the tab of each mounting bracket. Dial the adjustment washers in the tabs as required to position the bumper at the correct mounted height.
3. Tighten all mounting bolts securely, connect the parking lamp wiring, and lower front of vehicle.

REAR BUMPER ASSEMBLY (Fig. 4)

Removal

1. Raise rear end of vehicle.
2. Disconnect rear license plate lamp and back-up lamp wiring.
3. Remove bolts, located behind license plate door, attaching face bar reinforcement to frame.
4. Remove four bolts retaining bumper brackets and braces to frame.
5. Remove bumper from vehicle.

Disassembly

1. Remove license plate lamp and back-up lamps from bumper.
2. Remove brackets and braces at each end of bumper.
3. Remove license plate door.
4. Remove rivets attaching bracket at center of bumper.

Assembly

Attach license plate lamp and back-up lamp assemblies to bumper; tighten bolts firmly. Assemble the bumper parts by following the disassembly procedure in the reverse order. Except for the license plate lamp and back-up lamp attachments, 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. Loosely install bolts, lock washers and nuts. Note that eight sided adjustment washers (fig. 4) are placed at the inside surface of each rear frame channel. Dial washers as required to position bumper at correct height.
3. Tighten all mounting bolts securely, connect back-up lamp and license plate lamp wiring, and lower rear of vehicle.

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 (Fig. 5)

Removal

1. Raise front end of vehicle.
2. Disconnect parking lamp wiring.
3. Remove bolts retaining bumper brackets and braces to frame.
4. Remove bumper assembly from vehicle.

Disassembly

1. Remove bolts securing parking lamp assemblies and remove parking lamps from vehicle.
2. Remove bolts attaching braces and bumper brackets to bumper face bar.

Assembly

Referring to Figure 5, 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.

Installation

1. Position assembled bumper on frame extensions, aligning holes in extension with holes in brackets and braces.
2. Install bolts, lock washers, and nuts; tighten securely.
3. Connect parking lamp wiring and lower front end of vehicle.

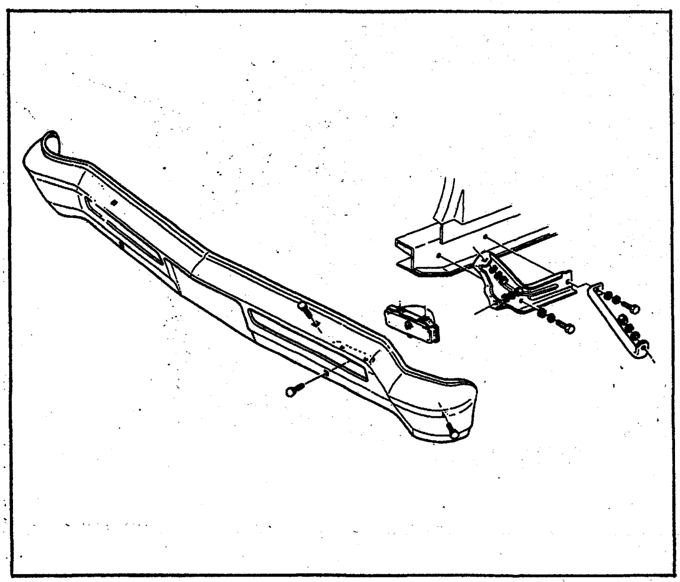


Fig. 5 - Front Bumper Assembly - Chevy II

REAR BUMPER ASSEMBLY (Fig. 6)

Removal

1. Disconnect license plate lamp wire at connector.
2. Raise vehicle from floor. From forward side and underside of rear crossmember, remove mounting bolts retaining the bumper brackets to the vehicle.
3. Remove bumper assembly from vehicle.

Disassembly

1. Remove license plate lamp.
2. Remove bolts attaching each bracket to bumper. Check condition of seal; replace if necessary.

Assembly

1. Position brackets on face bar as shown in Figure 6 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

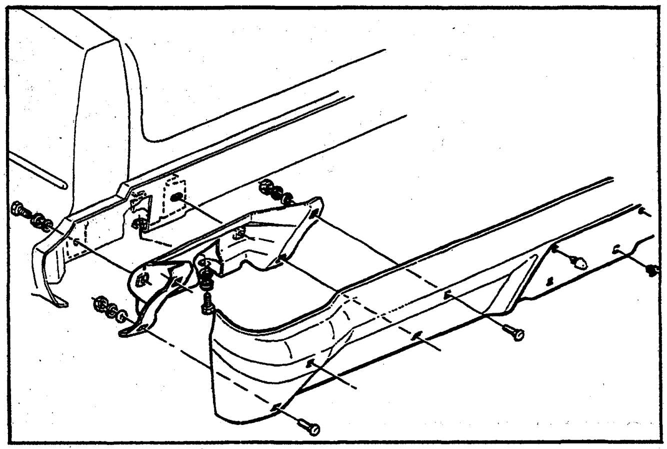


Fig. 6 - Rear Bumper Assembly - Chevy II

from rear fender side panel to the end flange of the bumper is approximately 3/4" on Sedans and 7/8" on station wagons; tighten all bolts. Lower vehicle.

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.

GENERAL DESCRIPTION—CORVETTE

The front and rear Corvette bumpers are of the two piece wrap around type. The front bumpers are connected by a center face bar.

SERVICE OPERATIONS

FRONT BUMPER (Fig. 7)

Figure 7 shows assembly of bumper and installation on vehicle. Removal and installation procedures cover the right hand bumper assembly only, the left hand side is identical. If the bumper is to be removed as an assembly, leave center face bar attached and perform procedure on both sides.

Removal

1. Remove bolts retaining bumper assembly to inner brace.

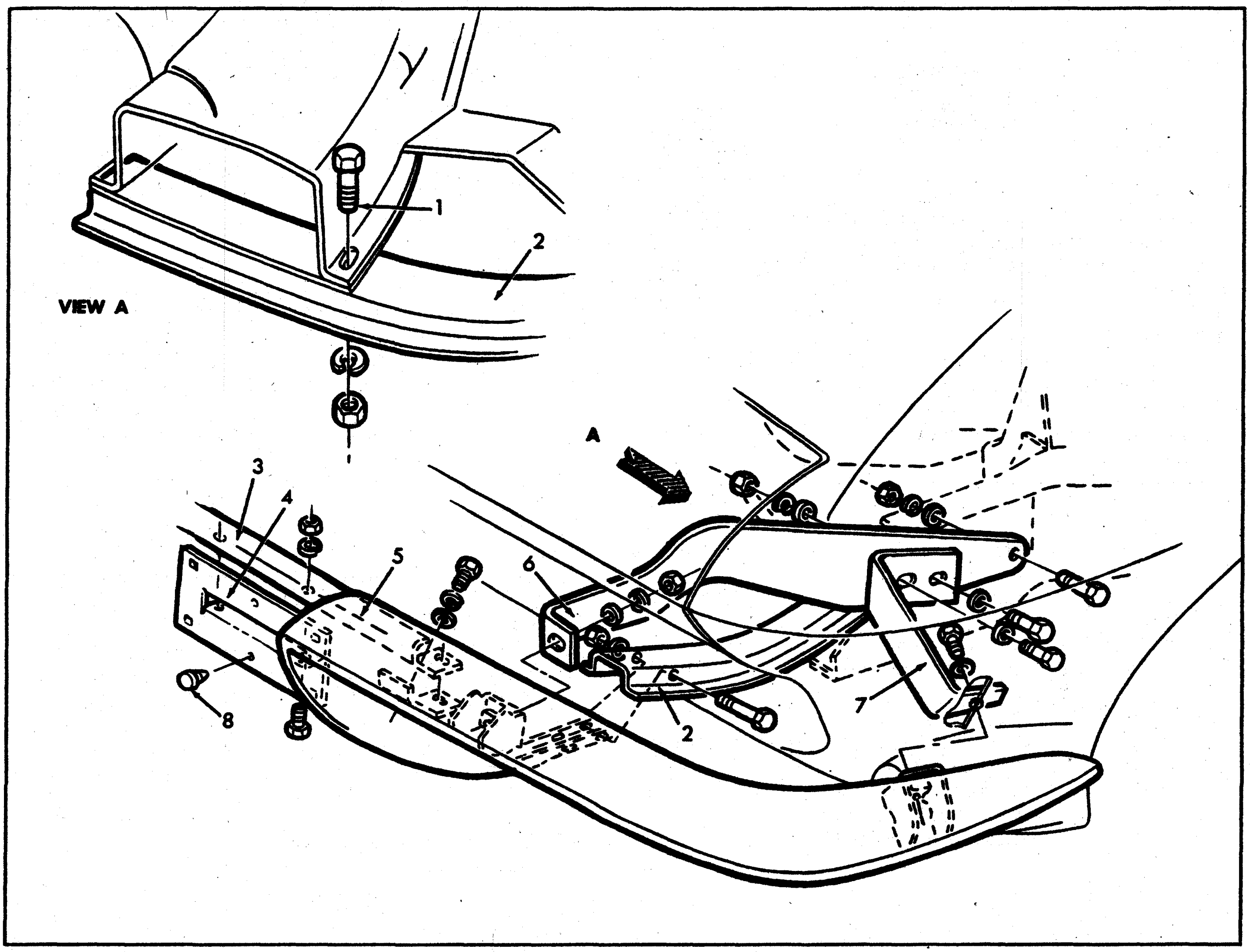


Fig. 7 - Front Bumper - Corvette

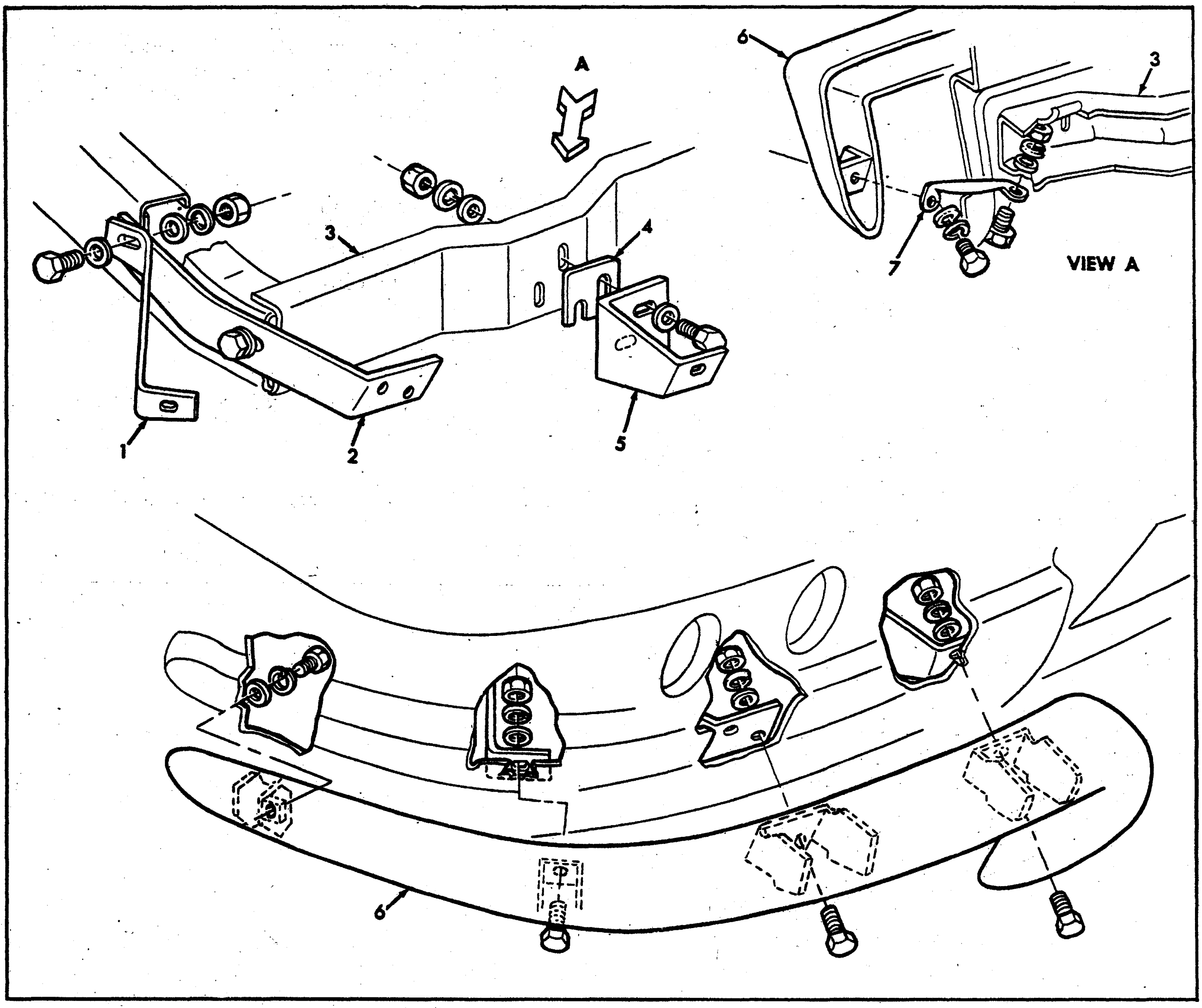


Fig. 8 - Rear Bumper - Corvette

2. Remove bolt retaining bumper assembly to outer brace.
3. Remove bolt retaining bumper assembly to center brace.
4. Remove bolts retaining bumper to center face bar.
5. Remove outer brace, center brace and inner brace.

Installation

Position bumper assembly and align all holes in mating parts with drift punch. Insert all bolts and install nuts and washers. Do not tighten any bolts or nuts until all bolts are inserted and bumper assembly is adjusted to correct installed position on vehicle.

REAR BUMPER (Fig. 8)

Figure 8 shows exploded view of bumper and its installation on vehicle. The following procedure covers left hand bumper assembly only; the right hand side is identical.

Removal

1. Remove bolt retaining bumper assembly to fender (extreme outer end).
2. Remove bolt retaining bumper to outer brace.
3. Remove bolt retaining bumper to inner upper brace.
4. Remove bolt retaining bumper to inner lower brace.
5. Remove bolts retaining bumper to center brace.
6. Outer brace, center brace, inner upper and inner lower braces may be removed at this time. Note and record shimming of upper brace.

Installation

Position bumper assembly and align mating parts with drift punch. Insert all bolts and install nuts and washers. Do not tighten any bolts or nuts until all bolts are inserted and bumper assembly is in correct installed position on vehicle. Note that if inner upper brace shimming has been lost or disturbed, bumper should be installed on all other supports and aligned to correct position on vehicle. Inner upper brace should then be bolted to bumper only and the distance between inner upper brace and frame filled in with shims. Bolts may then be installed to secure brace to frame.

REAR LICENSE PLATE HOUSING

The rear license plate housing may be removed from the vehicle by removing the license plate and removing the retaining screws as shown in Figure 9.

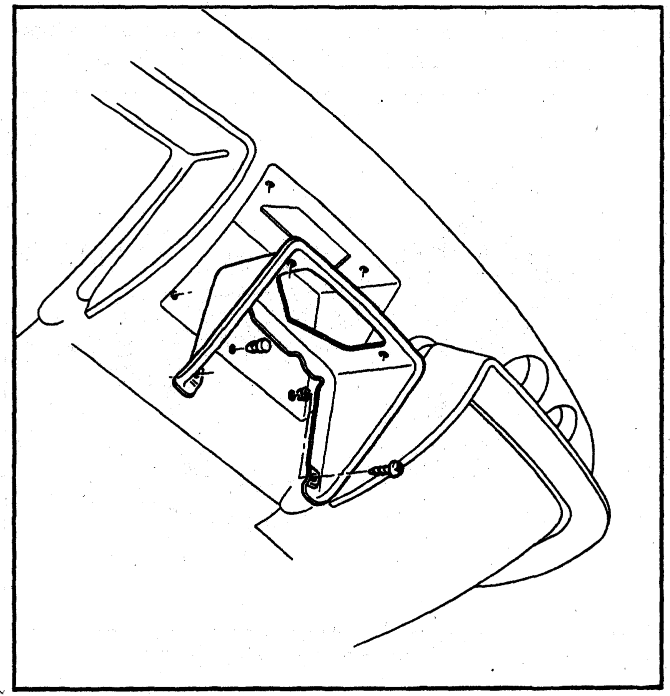


Fig. 9 - Rear License Plate Housing

GENERAL DESCRIPTION—CAMARO

The Camaro front and rear bumpers are of a single piece wrap around design. The front license plate bracket functions as a bumper support between the valance panel and bumper. Holes in the underside of bumpers, slightly inboard of lower bumper bracket bolt, provide for new jack load rest stud for jacking purposes.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY (Fig. 10)

Removal

1. Raise and support front end of vehicle.
2. Remove bolts securing bumper support brackets to frame.
3. Remove bolts, one on each side at fender extension panels, securing bumper to outer bumper bracket.
4. Remove screws and nuts securing license plate bracket to valance panel and remove bumper from vehicle.

Disassembly

1. Remove bolts attaching two support brackets to bumper.
2. Remove screw and nut securing license plate bracket to bumper.

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 with those in frame.
2. Loosely install bolts, lock washers, and nuts. Note the eight sided adjustment washers (fig. 10) are placed in the tab of each bumper bracket. Dial the adjustment washers in the tabs as required to position the bumper at the correct mounted height.
3. Tighten all bolts securely and lower vehicle.

REAR BUMPER ASSEMBLY (Fig. 11)

Removal

1. Raise and support rear end of vehicle.
2. Remove bolts securing bumper brackets to frame and rear fenders.
3. Remove screws securing license plate bracket to body and remove bumper from vehicle.

Disassembly

1. Remove bolts securing four support brackets to bumper.
2. Remove rivets securing license plate bracket to bumper.

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 assembled bumper on frame and body aligning holes in bumper brackets with those in frame.
2. Loosely install all bolts, lock washers and nuts. Insure bumper is in correct mounted position.
3. Tighten all bolts securely and lower vehicle.

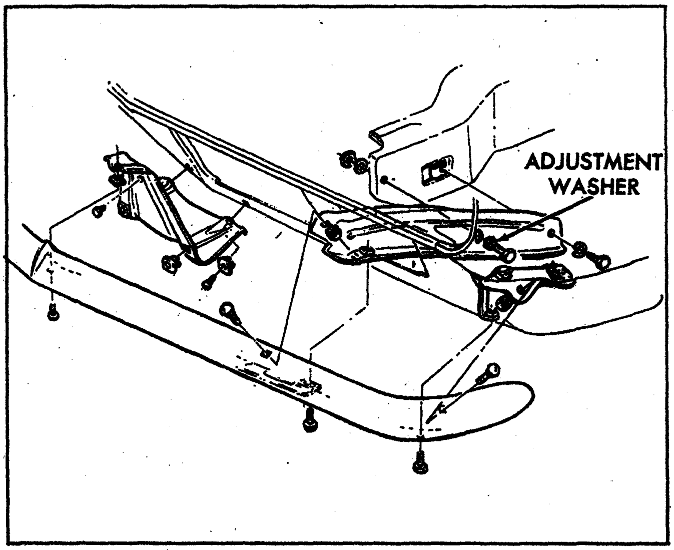


Fig. 10 - Front Bumper Assembly - Camaro

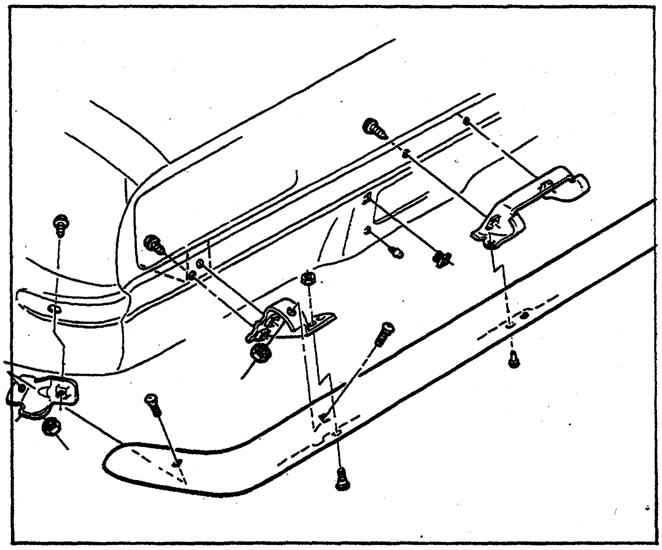


Fig. 11 - Rear Bumper Assembly - Camaro

SECTION 15

ACCESSORIES

CONTENTS OF THIS SECTION

CRUISE-MASTER

INDEX

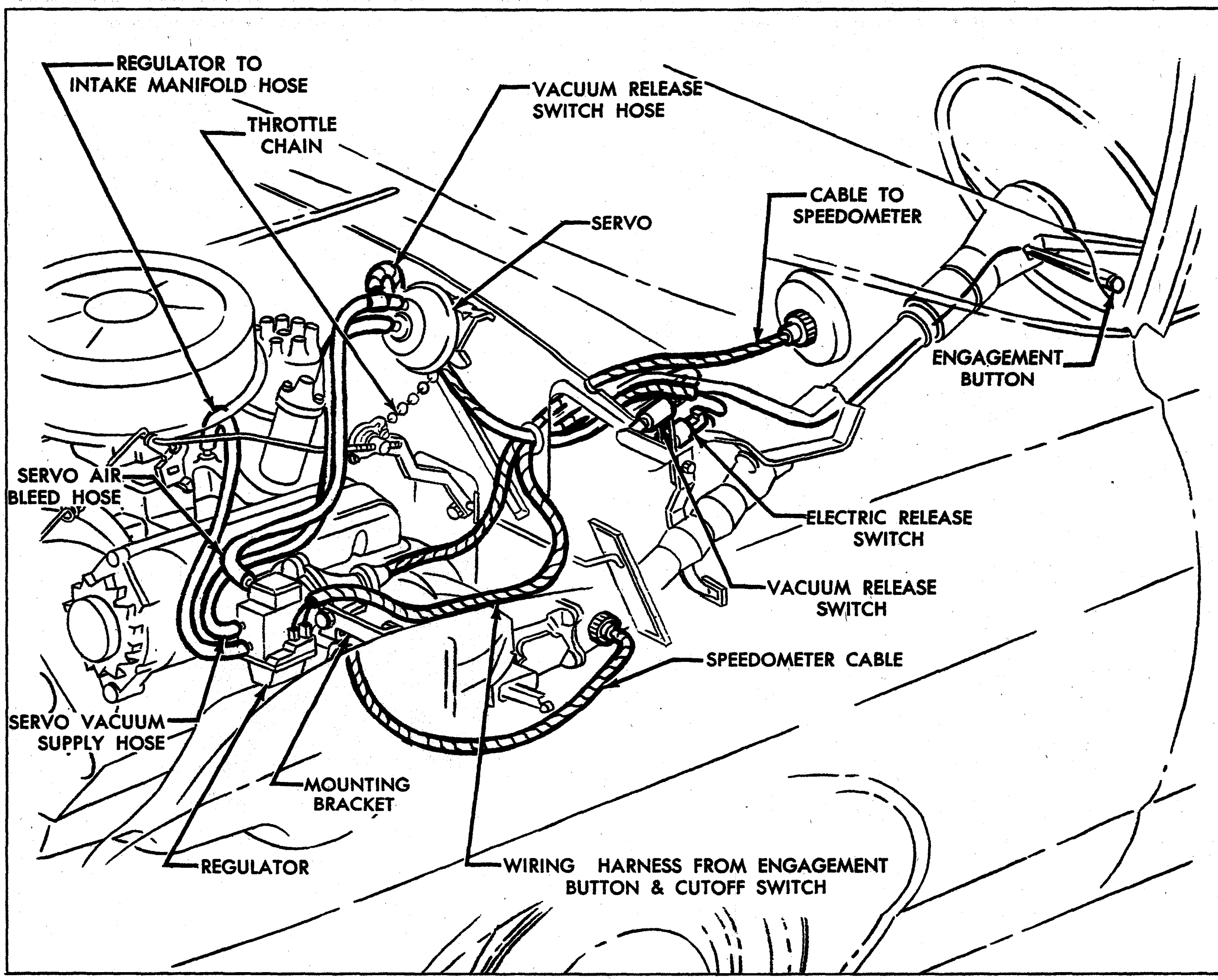


Fig. 1 - Cruise Master System

GENERAL DESCRIPTION

The Cruise Master is a speed control system which employs engine manifold vacuum to power the throttle Servo unit. The Servo moves the throttle when speed adjustment is necessary by receiving a varying amount of bleed air from the Regulator unit. The Regulator varies the amount of bleed air through a valve system which is linked to a speedometer-like mechanism. The speedometer cable from the transmission drives the Regulator, and a cable from the Regulator drives the instrument panel speedometer. The engagement of the Regulator unit is controlled by an Engagement Switch located at the end of the turn signal lever. Two brake release switches are provided: an Electric Switch disengages the Regulator unit and a Vacuum Switch decreases the vacuum in the Servo unit to quickly return the throttle to idle position.

The operation of each unit of the system and the operation of the entire system under various circumstances is described below. Figure 1 shows the location of the system components within the vehicle.

COMPONENT OPERATION

ENGAGEMENT SWITCH

This switch, located within the turn signal knob, has three positions. In the fully released position, the switch passes current through resistance wire to effect a "hold in" magnetic field in the Regulator solenoid. This current is sufficient only to hold the solenoid in place once it has been actuated by the "pull in" circuit. Depressing the button partially allows current to flow to the Regulator solenoid at full voltage which causes the solenoid to pull in. Depressing the button fully opens the circuit to both the resistance and standard solenoid feed wires and the solenoid becomes de-activated.

During vehicle operation the three switch positions have the following functions:

Released

a. System not engaged: No function of the system will occur although a small current is flowing through the solenoid via the resistance wire (at vehicle speeds over 20 mph).

b. System engaged: The small current flowing through the resistance wire is holding the solenoid in the engaged position.

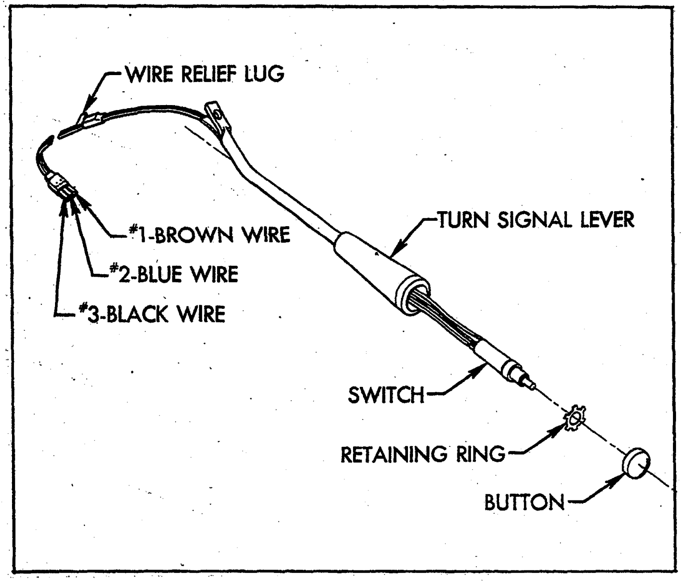


Fig. 2 - Cruise Master Engagement Switch

Partially Depressed

Full voltage is applied to the solenoid (vehicle speed over 20 mph) which sets the Regulator to maintain the vehicle speed at the time of Regulator engagement.

Fully Depressed

No electricity flows to the solenoid and the Regulator is inactive. This position is used by the driver when he desires to raise or lower his controlled speed. He may accelerate to his new speed, press the button fully (Regulator releases previously set speed) and release the button. Upon releasing the button, it passes through the partially depressed position and the solenoid is "pulled in", then into released position which provides "hold in" current. The driver may also press the button fully with no pressure on the accelerator pedal. In this case the regulator releases control of the throttle which returns to idle and the car slows. When the button is released the solenoid is pulled in and held in respectively and the regulator resumes speed control at the speed of the vehicle during the moment of button release (at vehicle speeds over 20 mph).

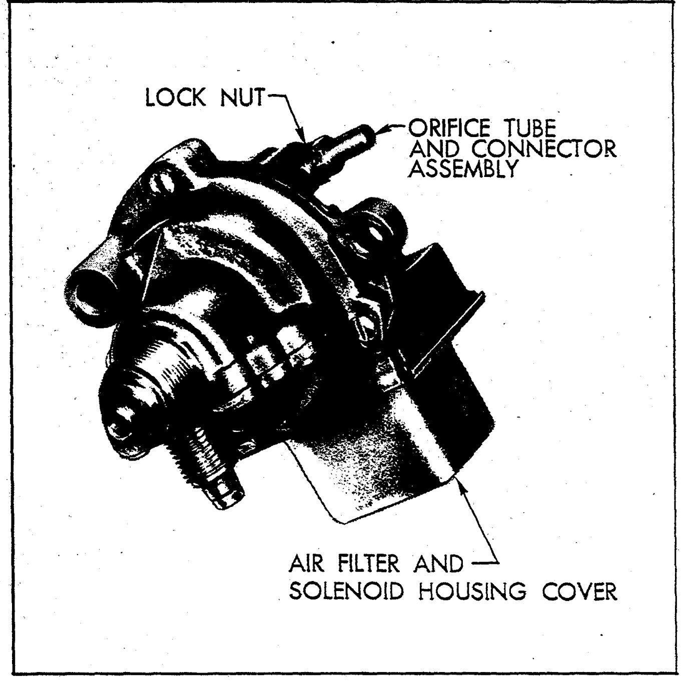


Fig. 3 - Regulator Unit

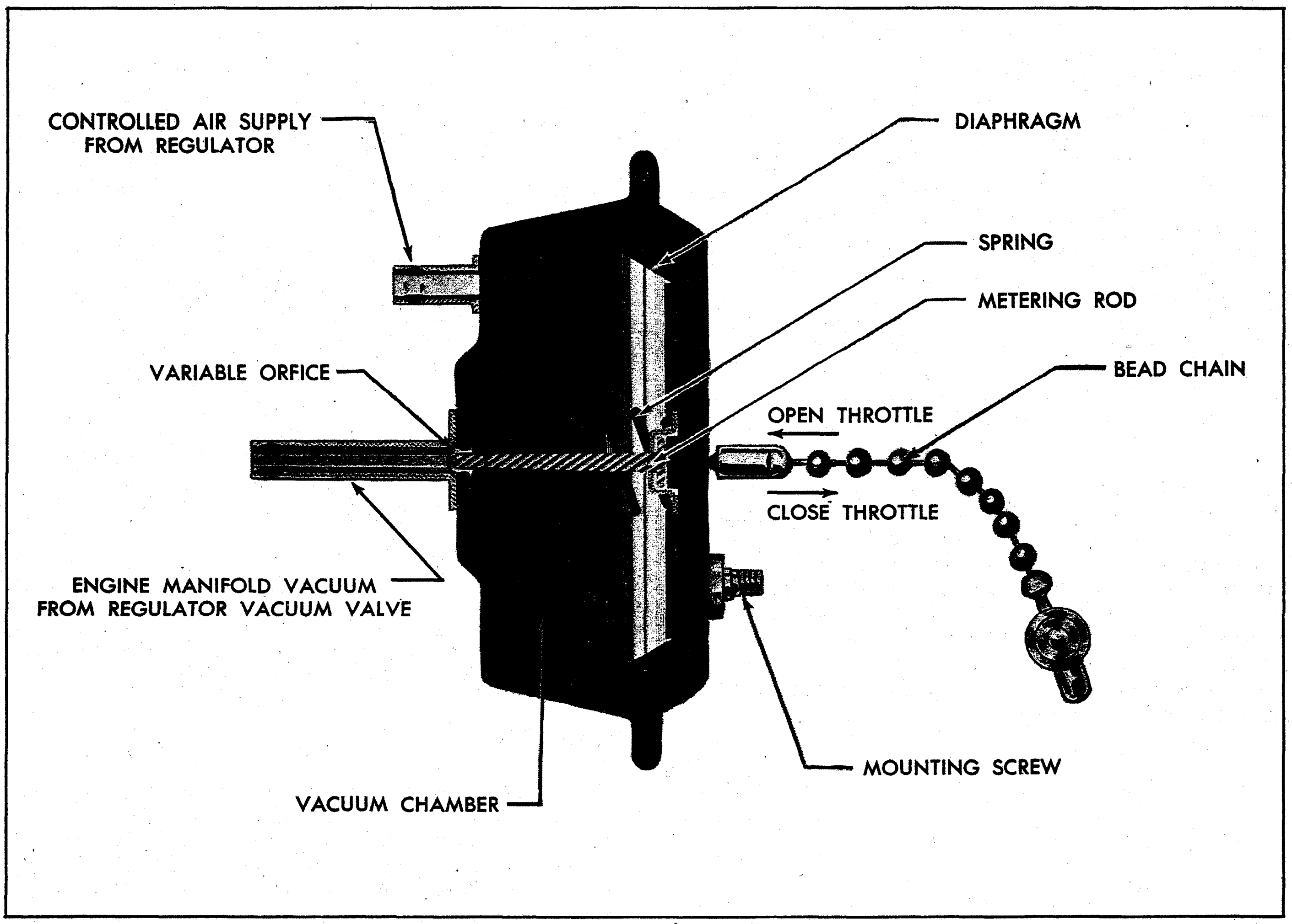


Fig. 4 - Servo Unit

BRAKE RELEASE SWITCHES

Two brake release switches are employed in the Cruise Master System. When the brake pedal is depressed, an Electric Release Switch cuts off the voltage supplied to the engagement switch, hence cuts off power to the Regulator unit. The Regulator is then disengaged and requires Engagement Switch operation to return it to operation. A Vacuum Release Switch operates simultaneously with the electric release switch whenever the brake pedal is depressed. This switch opens a port to atmospheric pressure which rapidly bleeds down the vacuum in the Servo unit thereby returning the throttle to the idle position.

SERVO UNIT

The Servo unit is a vacuum actuated, variable position diaphragm assembly which operates the carburetor throttle when the system is in operation (fig. 4). It is powered by engine intake manifold vacuum and operates the throttle linkage via a bead chain. The Servo has two ports on the sealed side of the diaphragm housing: one is supplied manifold vacuum, and the other is connected to a variable air bleed in the Regulator Unit. The vacuum port is located at the center of the unit and the air bleed port is near the outer wall. When vacuum is applied to the center port, atmospheric pressure moves the diaphragm which pulls on the bead chain opening the carburetor throttle. As the diaphragm moves, it positions a tapered needle within an orifice in the vacuum port so that as the diaphragm moves toward the port, the orifice becomes smaller; and as it moves away from the port, the orifice becomes larger.

The air bleed port serves to supply a variable quantity of air to the diaphragm chamber which causes the diaphragm to attain a balanced state (between the force of the atmospheric pressure to chamber pressure differential and the force of the diaphragm and throttle return springs). In operation then, the following events occur: Vacuum is applied to the center port and the diaphragm moves toward the port. The tapered needle restricts the vacuum port more and more as it moves into the orifice. If no air was allowed to bleed into the chamber, the diaphragm would move until it contacted the housing, however, the Regulator meters bleed air into the chamber and the diaphragm reaches a point at which the air is bled out of the chamber through the vacuum port orifice as fast as it enters the air bleed port. If the Regulator begins to supply less bleed air, (vehicle speed decreasing) the vacuum in the chamber increases and the diaphragm moves toward the vacuum port. In so doing, the tapered needle closes the vacuum port orifice even more

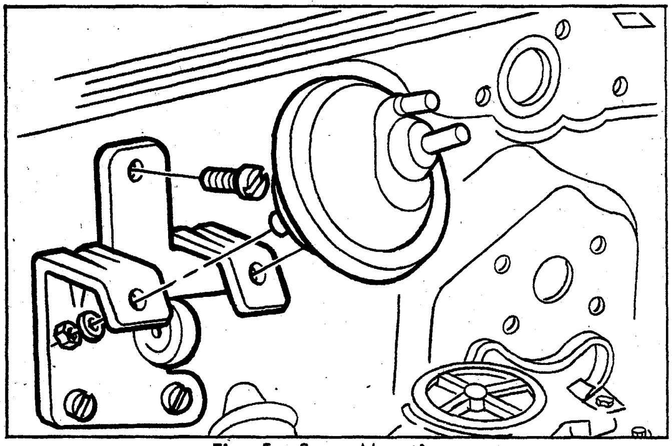


Fig. 5 - Servo Mounting

and the air bled into the chamber again equals the air bled out. A balance occurs again with the diaphragm in a new position. If the Regulator begins to supply more bleed air, (vehicle speed increasing) the vacuum in the chamber drops and the diaphragm moves away from the vacuum port, withdrawing the tapered needle from the orifice and enlarging it. Since the vacuum orifice is now larger, the greater quantity of air being bled into the chamber may be bled out by vacuum and a balance again occurs with the diaphragm in a new position.

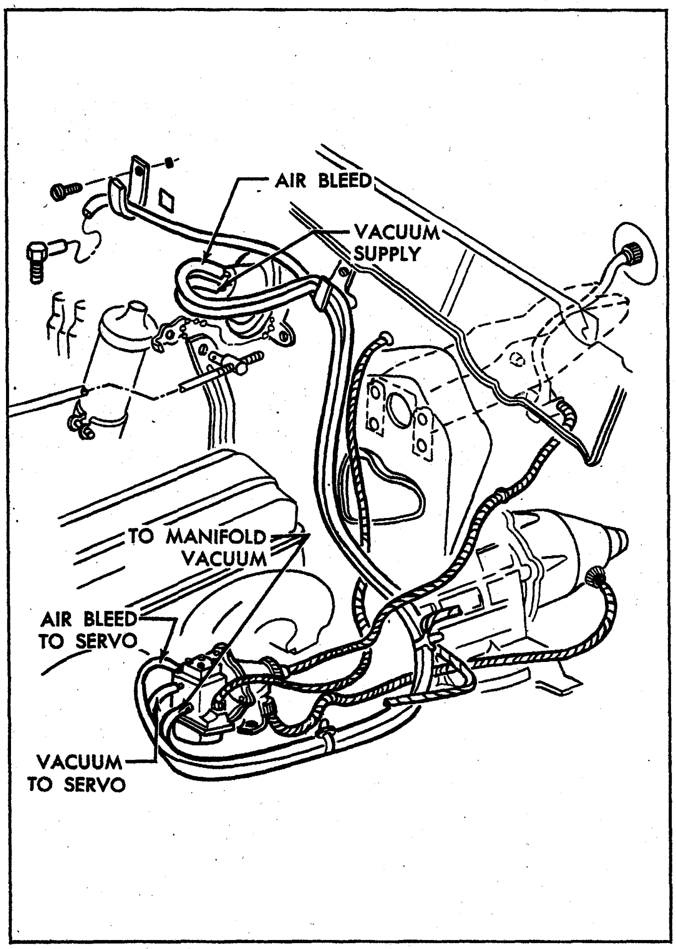


Fig. 6 - Servo, Regulator and Hose

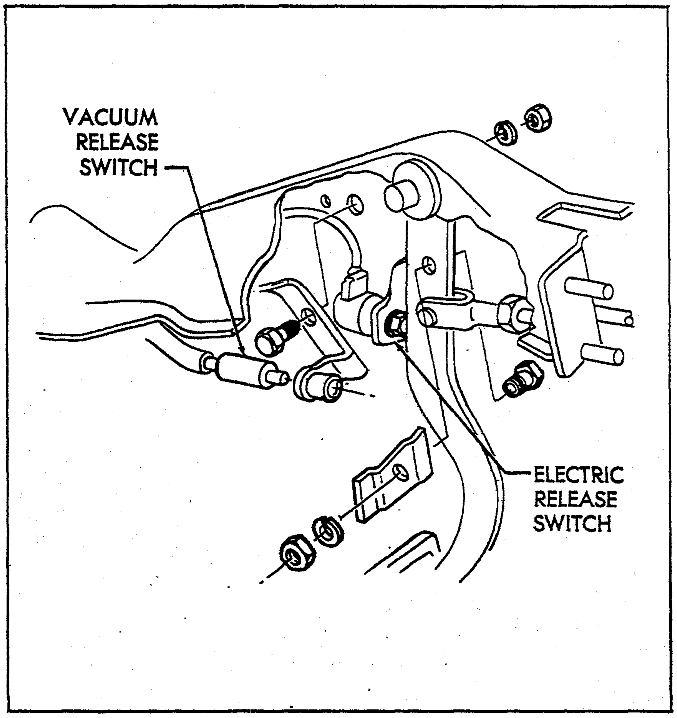


Fig. 7 - Release Switches and Brackets

REGULATOR

The Regulator is a device which has two primary functions: First, it is a vacuum switch which, when engaged by the driver, supplies engine manifold vacuum to the Servo. Second, it meters a small variable quantity of air to the Servo unit in order to change the carburetor throttle opening to effect speed control. A secondary function of the Regulator is to drive the speedometer. Since the car speed is sensed by a speedometer-like mechanism within the unit, the speedometer cable from the transmission drives the Regulator which drives a second cable (at a one to one ratio) to the speedometer.

The Regulator is electrically engaged and disengaged through operation of the Engagement Switch and the Electric Brake Release Switch. It has two sub-assemblies which make up the unit: one being the magnetic speed sensing assembly and the other being the solenoid actuated vacuum switch, air bleed and filter, and low limit speed switch assembly (fig. 8 and 9).

Magnetic Speed Sensing Assembly

The speed sensing assembly operates in the same manner as a speedometer unit except that instead of rotating a needle through an angle proportional to the vehicle speed, it rotates a rubber drum which is clutched to the air bleed valve when the system is in operation. The assembly is driven by the speedometer cable from the transmission which turns a disk shaped ferrite magnet. Facing the magnetic disk is the driven brass disk mounted on a shaft with the rubber drum mounted on the same shaft. A spiral hairspring connects the shaft to the housing and allows it to rotate through an angle which is proportional to car speed. If the car doubled its speed, the shaft would rotate to twice its previous angle as may be seen by noting the operation of a speedometer. The driven disk is sandwiched between the magnetic disk and a field plate. The field plate forms a returning path for the magnetic field from the magnetic disk.

The gear drive for the magnetic disk is a 90 degree nylon gear drive with the driven gear rotating both the magnetic disk and the speedometer drive cable.

Vacuum Switch, Air Bleed and Filter, and Low Limit Speed Switch

The end of the shaft from the speed sensing assembly with the rubber drum extends into the air bleed metering assembly. This rubber drum has a tang extending from its surface which allows a set of points to close at a specific car speed. When the car reaches about 20 mph, the rubber drum has rotated far enough (moved by the brass driven disk in the magnetic field) so that its tang has allowed a spring loaded electrical point to contact another point. These points are in series with the solenoid coil so that under 20 mph, no Regulator operation is possible.

Surrounding the rubber drum is a "U" shaped spring clip which is held spread away from the drum by the nose or cam of the solenoid when the solenoid is in the relaxed position. The rubber drum and this clip comprise the speed clutch of the regulator. When the solenoid is energized, the solenoid nose moves toward the drum and releases the ends of the clip. The clip springs inward and attaches itself by friction to the drum. Now, any change in car speed will rotate the drum and move the "U" clip just as a speedometer moves its needle. The top of the "U" clip is attached to the air bleed valve. The clip moves a sleeve which slides on the orifice tube thereby covering and uncovering air ports in the wall of the tube (the tube inner end is plugged) whenever car speed changes from the speed at which the solenoid was energized. The direction of drum rotation is such that resulting bleed valve operation will cause the Servo to decrease engine power if the car exceeds the preset speed and increase engine power if car speed decreases. The air which passes out the orifice tube enters the Regulator through the openings in the solenoid housing, passes through the oil wetted polyurethane filter, and then enters the orifice tube ports.

When the solenoid is de-energized, the nose retracts and cams the ends of the "U" clip outward so that it releases the rubber drum.

The solenoid also operates a vacuum switch simultaneously with the clutching and declutching of the "U" clip. The vacuum switch supplies the Servo unit with manifold vacuum. The solenoid operated vacuum valve slides over two ports in the Regulator wall. One port is connected to manifold vacuum and the other is connected to the center port of the Servo unit. When the solenoid is de-energized, the valve closes the manifold vacuum port and opens the Servo port to the inside of the regulator case. When the solenoid is energized, the valve connects the Servo port to the manifold vacuum

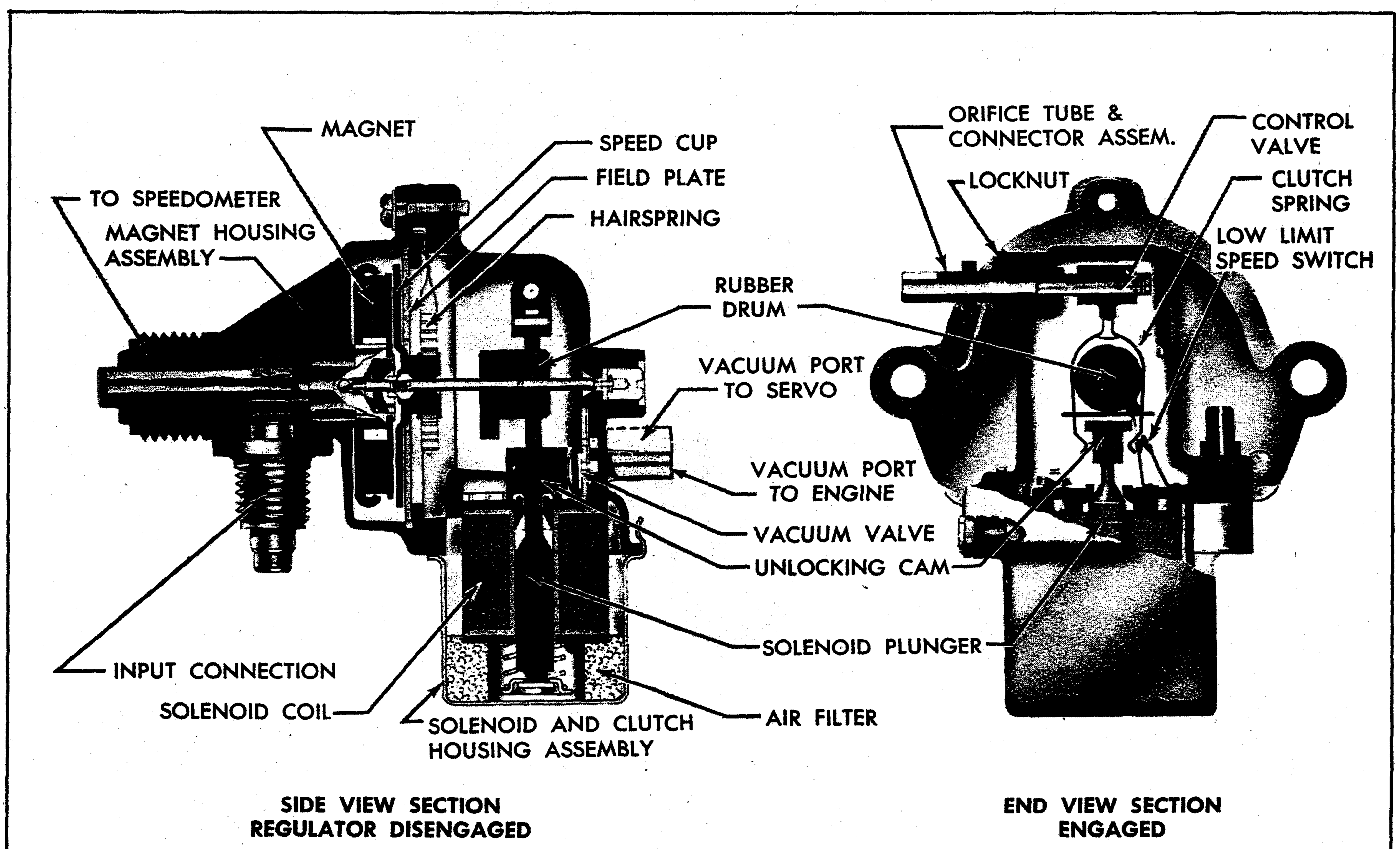
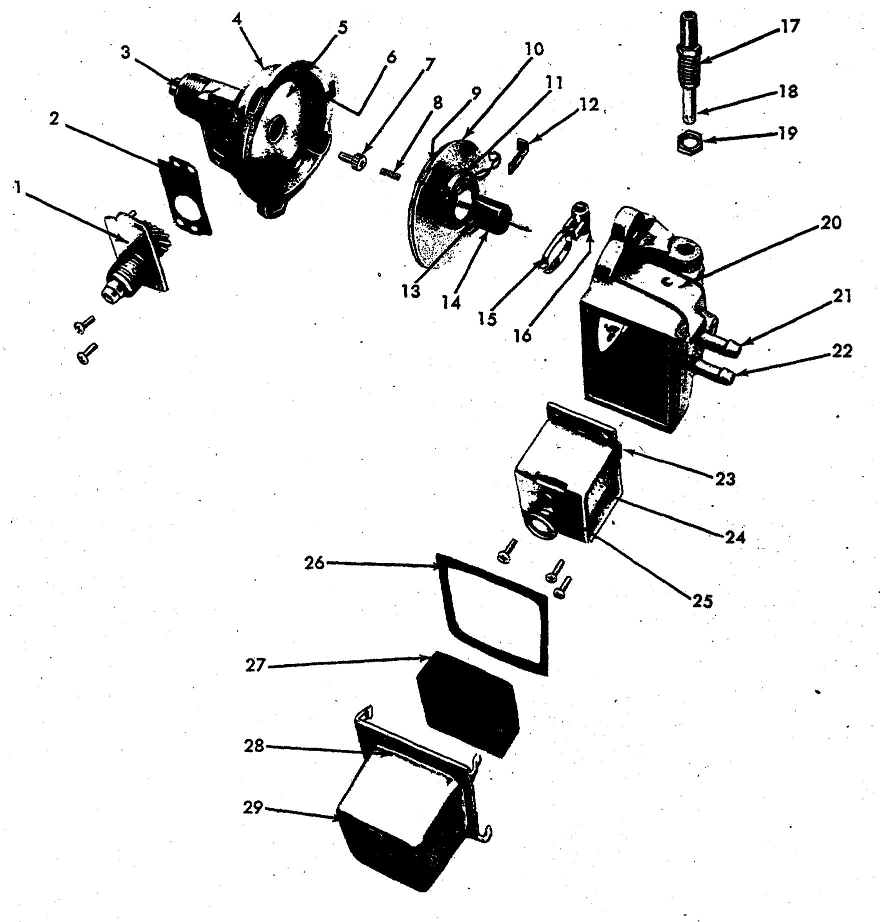


Fig. 8 - Regulator-Cross Section

port thereby supplying vacuum to the Servo unit.

During system operation the following events occur:

1. Car speed below 20 mph--no function of the unit because the rubber drum has not rotated far enough to close the solenoid points. No energizing current can flow through the solenoid coil.
2. Car speed above 20 mph--The tang on the rubber drum has closed the solenoid points and current is flowing through the 40 ohm resistance wire to the solenoid coil. This current is not sufficient to "pull in" the solenoid.
3. Driver partially presses Engagement Switch--full voltage flows through the solenoid to pull it into operation. Solenoid cam tension on the "U" clip is released and the clip grips the rubber drum. Simultaneously the vacuum switch operates; applying manifold vacuum to the Servo unit which tightens the throttle chain. When the driver releases pressure from the accelerator pedal the unit will position the throttle to maintain the speed at the time of solenoid operation.
4. Driver releases the Engagement Switch--current flows to the solenoid through the 40 ohm wire and since the solenoid is "pulled in", the reduced current flow is sufficient to hold it in position.
5. The car begins to ascend a hill--car speed drops slightly (very slightly) and the magnetic force on the driven disk of the speed sensor is decreased. The disk rotates slightly (as would a speedometer shaft because of hairspring tension) turning the rubber drum. Since the "U" clip is gripping the drum, it moves the slide which COVERS the air bleed ports more. With less air bleeding into the Servo, greater vacuum exists in it and the diaphragm moves toward the vacuum port opening the throttle wider. The tapered needle moves into the orifice further and the diaphragm balances in a new position with the wider throttle opening. Car speed has been maintained automatically.



1. Speedometer Cable Adapter (From Transmission)
2. Gasket
3. Speedometer Cable Adapter (To Speedometer)
4. Adapter and Magnet Housing
5. Rotating Magnet
6. Helical Ramp
7. Field Plate Adjusting Pinion
8. Adjusting Pinion Locating Spring
9. Brass Magnetically Driven Disk
10. Field Plate
11. Hair Spring
12. Hair Spring Keeper
13. Rubber Drum Tang
14. Rubber Drum
15. "U" Shaped Clutch Spring
16. Air Bleed Sleeve
17. Orifice Tube
18. Orifice
19. Orifice Tube Locknut
20. Clutch and Solenoid Housing
21. Vacuum Supply Port (To Servo)
22. Vacuum Port (To Intake Manifold)
23. Vacuum Valve Slide
24. Solenoid Coil
25. Solenoid Plunger Return Spring
26. Solenoid Cover Gasket
27. Air Filter
28. Solenoid Cover
29. Air Inlets

Fig. 9 - Regulator - Exploded

6. The car begins to descend a hill--car speed increases slightly and the regulator movements occuring above occur again except in reverse. The rubber drum is turned further against spring tension and the air bleed orifices are uncovered more. This bleeds more air to the Servo reducing the vacuum in the unit. The diaphragm moves away from the vacuum port, closes the throttle slightly, and withdraws the tapered needle from the vacuum orifice. With the orifice enlarged, the increased vacuum counteracts the increased air bleed and the diaphragm finds a balance again at a reduced throttle opening.
7. Driver accelerates by pressing accelerator pedal--car speed increases and the system responds by moving the diaphragm to decrease throttle opening. Since a bead chain is used, the chain merely relaxes and has no effect on throttle operation. After the driver releases pressure from the pedal, the throttle will close until car speed decreases to the pre-set speed. At that point the Regulator bleeds less air to the Servo which opens the throttle enough to maintain the pre-set speed. The system returns to a stable condition.
8. Driver desires higher controlled speed, presses accelerator until new speed is reached, and depresses Engagement Switch fully and releases button--speed sensing assembly tries to turn in a direction that would decrease the throttle opening until the driver fully depresses the Engagement Switch. Then the current is cut off to the solenoid which retracts; the solenoid nose expands the "U" clip releasing its grip on the rubber drum. The drum and disk assembly then rotates to a new position because of the higher car speed. When the solenoid retracts, it also shuts off vacuum to the Servo and opens the vacuum port to atmospheric pressure within the Regulator thereby bleeding down the Servo toward idle throttle position. As the driver releases the Engagement Switch, the contacts cause "pull in" and "hold in" of the solenoid respectively. The system is engaged to maintain the car speed at the time of Engagement Switch release.
9. Driver desires lower cruising speed, presses Engagement Switch fully, waits until car speed decreases to desired speed then releases Switch--when the Engagement switch is fully depressed the solenoid is de-energized causing the vacuum switch to bleed down the Servo to idle throttle position and the "U" clip of the idle bleed valve is released from the rubber drum. The drum and disk assembly is free to rotate to a position which corresponds to vehicle speed as the car slows. When the driver releases the Engagement Switch, the unit "pulls in" and "holds in" in the normal manner. The air bleed valve is clutched to the rubber drum at the car speed during switch release. Vacuum is again applied to the Servo and throttle control is assumed by the Regulator to maintain the car speed at the time of switch release.
10. With system in operation, driver applies brakes--simultaneously the Vacuum Release and Electric Release Switches operate. The Vacuum Switch bleeds air into the Servo through the air bleed line coming from the Regulator. The vacuum is reduced in the Servo and the throttle returns to idle position. The Electric Release Switch cuts off power to the entire system and the solenoid is de-energized. If the driver removes his foot from the brake pedal the Electric Switch again feeds voltage to the Engagement Switch and the Vacuum Switch seals the air bleed line. If the vehicle speed is above 20 mph when this occurs, reduced voltage will flow to the solenoid through the 40 ohm wire which will <u>not</u> be sufficient to "pull in" the unit. If vehicle speed is below 20 mph no current will flow since the tang on the rubber drum has opened the low limit switch points in the Regulator. In either case, after depressing the brake pedal, the system will not control car speed until the driver operates the engagement switch above 20 mph.

SERVICE OPERATIONS

The components of the Cruise Master system are designed to be replaced should they become inoperative. The Regulator is calibrated in such a manner during manufacturing that overhaul operations are impractical. However, one adjustment may be made to the Regulator to correct speed drop or increase at the time of engagement.

BRAKE RELEASE SWITCHES

ELECTRIC

Service – An inoperative switch must be replaced. Switch replacement is identical to standard brake lamp switch replacement.

Adjustment– The brake switch plunger must clear the pedal arm when the arm is moved 1/4 inch measured at the switch (Figure 7).

VACUUM

Service – An inoperative (sticking, plugged, or leaking) switch must be replaced. Switch replacement is similar to brake switch replacement. Be certain that the hose to the switch is connected firmly and is not cracked or deteriorated.

Adjustment– The brake switch plunger must clear the pedal arm when the arm is moved 5/16 inch measured at the switch (Figure 7).

ENGAGEMENT SWITCH

Service The engagement is serviced only by replacement.

Removal

1. Pry the engagement button out of the turn signal knob with a small thin bladed screwdriver (Figure 2).
2. With a small hook or long nosed pliers, remove the switch retaining ring.
3. Pull switch outward utilizing the slack in the wiring harness.
4. With a small soldering iron, unsolder the wires and resolder them to the correct terminals of the replacement switch.

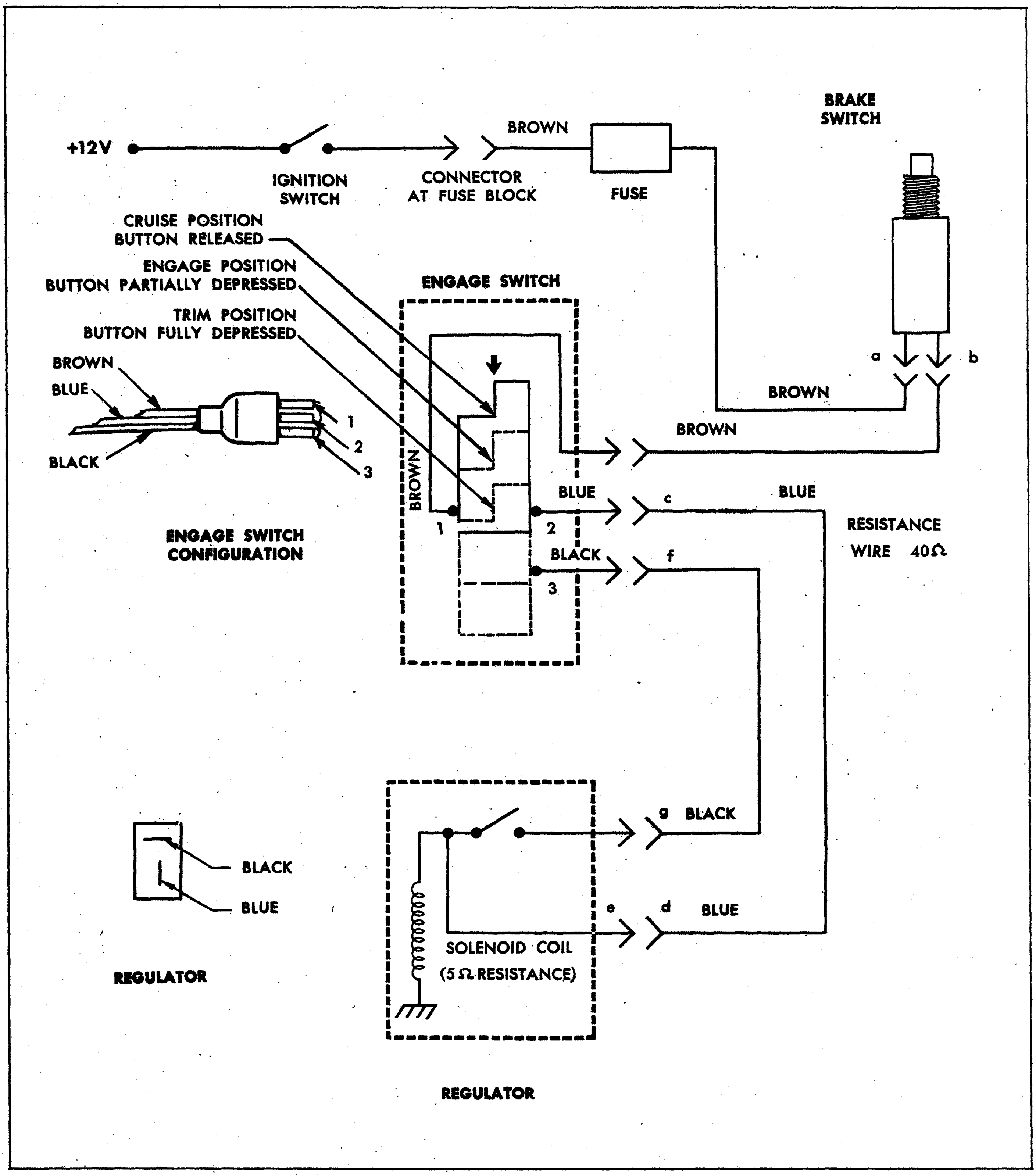


Fig. 10 - Wiring Diagram

Replacement

1. Insert the switch into the turn signal knob, push the retaining ring firmly against the switch, and push the operating button onto the switch plunger.

SERVO

Service — If the Servo unit is found to be defective, replacement is required. Note the condition of the hoses and replace any which are cracked or deteriorated.

Adjustment - Adjust the bead chain so that it is as tight as possible without holding the throttle open when the carburetor is set at its lowest idle throttle position. When connecting the bead chain (engine stopped) manually set the fast idle cam at its lowest step and connect the chain so that it does not hold the idle screw off the cam. If the chain needs to be cut, cut it three beads beyond the bead which pulls the linkage.

REGULATOR

Service - A defective regulator, that is one which is not simply out of adjustment, must be replaced. During replacement, check the hoses which connect to the regulator and replace any which are cracked or deteriorated.

Air Filter

The air filter located in the solenoid cover should be cleaned and re-oiled at engine oil change intervals.

1. Snap the solenoid cover off.
2. Remove the filter and wash it in kerosene or mineral spirits. Squeeze it dry and wet with SAE 10 engine oil. Squeeze out excess oil and reinstall into the cover.
3. Attach the cover with neoprene seal to the solenoid housing. Be certain that the cover fits tightly to the housing.

One regulator adjustment is possible: Engagement-Cruising Speed Zeroing (to remove any difference between engagement and cruising speed).

NOTE: No regulator adjustment should be made, however, until the following items have been checked or serviced:

1. Bead chain properly adjusted.
2. All hoses in good condition, properly attached, not leaking, not pinched or kinked.
3. Regulator air filter clean and properly oiled.
4. Electric and vacuum release switches properly adjusted.

Engagement—Cruising Speed Zeroing

If the cruising speed is lower than the engagement speed, loosen the orifice tube locknut and turn the tube outward; if higher, turn the tube inward. Each 1/8 turn will alter the engagement-cruising speed difference one mph. Tighten the locknut after adjustment and check the system operation at 50 mph.

ELECTRICAL SYSTEM CHECK OUT

1. Check fuse and connector.
2. Check electric brake switch as follows: Unplug connector at brake switch. Connect ohmmeter at points A and B on brake switch. The ohmmeter must indicate infinity when the brake pedal is depressed and continuity when pedal is released. The cruise release brake switch (electric) is adjusted as is the standard stop light brake switch. Replace electric brake switch if needed.
3. Check engagement switch and connecting wiring as follows: Unplug push button control connector (brown, blue, black) at electrical wiring harness connector and perform the following tests. (See Figure 10)

Test #1 — Connect ohmmeter between terminal #1 (brown wire) and terminal #2 (blue wire). Continuity shall be maintained until switch is depressed all the way in.

Test #2 — Connect ohmmeter between terminal #1 (brown wire) and terminal #3 (black). No continuity shall be shown; however, when the button is depressed halfway, continuity shall be indicated. When the button is pressed all the way down, no continuity shall be shown.

Test #3 — Connect ohmmeter between terminal #2 (blue wire) and terminal #3 (black). Button released, no continuity; however, when the button is depressed partially and fully, continuity shall be shown.

4. Check regulator solenoid coil, low-speed switch, and wiring harness as follows:
   a. Disconnect engagement switch wire harness connector from the main wire harness connector (brown, blue, and black wires). Connect ohmmeter between point C (blue wire in main wire harness) and ground. (Make sure the regulator is well grounded to chassis.) The ohmmeter should read 45 ohms ± 2 ohms. If a resistance of greater value is shown, then disconnect the connector from the regulator and measure the resistance of the blue wire from point C to D. It should measure 40 ohms. Check the resistance from point E (vertical bar of terminal forming T) to ground. It should measure 5 ohms ± 1/4 ohm. Replace either the wiring harness or solenoid as needed if greater values are indicated. The black harness wiring from point F to G should also be checked for continuity.

ENGAGEMENT SWITCH TEST

BUTTON POSITION	TERMINALS		
	1 TO 2	1 TO 3	2 TO 3
Cruise (released)	closed	open	open
Engage (partially depressed)	closed	closed	closed
Trim (fully depressed)	open	open	closed

SERVO AND VACUUM SYSTEM CHECK OUT

To determine the condition of the diaphragm, remove hoses from power unit and apply 14 inches of vacuum to either vacuum tube opening (seal the other opening) and hold in for one minute. The vacuum shall not leak down more than 5 inches of vacuum in one minute. If leakage is detected, replace servo. To utilize engine as a vacuum source, proceed as follows:

1. DISCONNECT SERVO BEAD CHAIN and hoses from servo and connect engine vacuum directly to vacuum servo fitting (fitting in middle of servo). Seal the servo unit opening.
2. Note position of servo diaphragm.
3. Start engine - the diaphragm should pull in.
4. Clamp off engine vacuum supply line and check for leakage.

The cruise release brake switch (vacuum) and connecting hoses can likewise be checked using a vacuum pump.

CRUISE MASTER SYSTEM CHECKS

	Cause	Correction
Will not engage	Brake Switch Circuit Open	Check connections - adjust or replace switch. Refer to Electrical Check Out.
	Fuse blown	Replace fuse - if it blows again, check for: 1. Engage Switch stuck in the center of travel - Refer to Electrical Check Out. 2. Incorrect wiring - Refer to Electrical Check Out. 3. Short to ground - Refer to Electrical Check Out. Make necessary corrections.
	Defective Engage Switch	Replace as needed - Refer to Electrical Check Out.
	Vacuum leak in Servo and/or Brake Switch and connecting lines.	Vacuum test and repair or replace as needed. Refer to Servo and Vacuum System Check Out.
	Open in wiring harness	Repair or replace as needed.
	Defective Regulator	Replace Regulator.
Does not cruise at engagement speed	Orifice Tube misadjusted	Adjust as required.
System hunts or pulses	Bead Chain loose	Tighten Bead Chain.
	Kinked or deteriorated hoses	Repair or replace.
	Dirty Air Filter	Service as required.
	Defective and/or improperly positioned Drive Cables and/or Casing Assemblies	Repair or replace as needed.
	Defective Regulator	Replace Regulator.
System does not disengage - with brake pedal	Brake and/or Vacuum Switch misadjusted or defective	Adjust or replace as required. Refer to Servo and Vacuum System Check Out and Electrical Check Out.
System applies full throttle when engaged	Hoses interchanged at Servo	Correct as needed.
	Defective Regulator	Replace Regulator.
Cannot adjust speed downward with Engage Button	Defective Engagement Switch or Wiring	Replace as needed. Refer to Electrical Check Out.
Does not engage or engages lower than limits referred to in "Driver Operation"	Internally Misadjusted Regulator	Replace Regulator

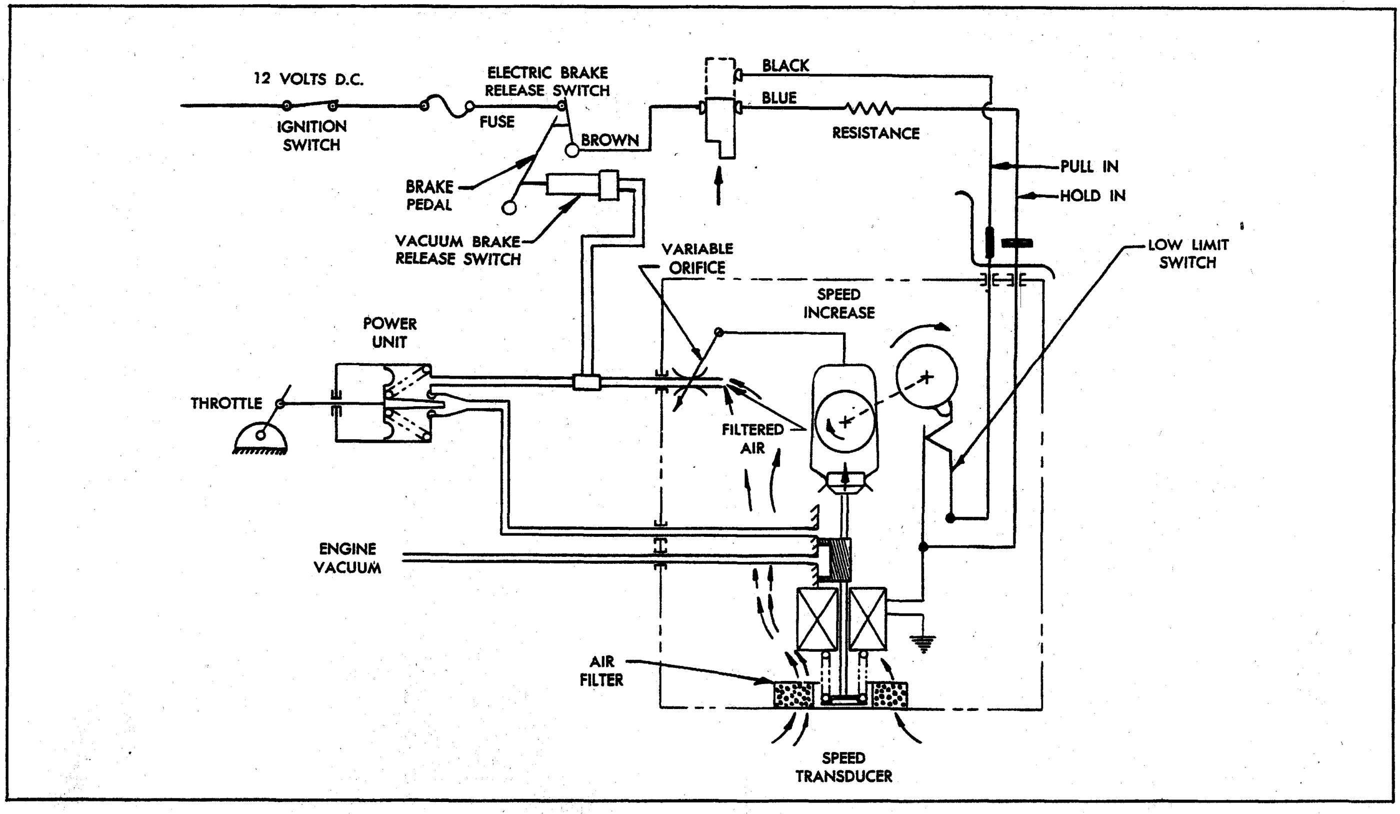


Fig. 11 - Vacuum and Electrical Diagram

AUTOMATIC LEVEL CONTROL

INDEX

GENERAL DESCRIPTION

A pneumatic level control system that automatically maintains correct rear trim height of a car under varying load conditions, the optional automatic level control is used only in conjunction with the Superlift Shock Absorber option.

The Superlift Shock Absorber option alone, consists of the two shock absorbers with pressure lines to a "Tee" where a fill valve is located. The shocks are inflated with (or deflated of) compressed air (at any gas station) to obtain the vehicle level desired with any given load change.

The automatic leveling system is added to the Superlift Shock Absorbers and supplies its own compressed air. The system (fig. 13) consists of a vacuum operated air compressor with pressure regulator and integral storage tank, vacuum line to engine, air intake filter, air lines, and a height control valve.

The COMPRESSOR is a two-stage, vacuum actuated type, requiring no lubrication. Vacuum supply is taken from engine carburetor base. High pressure air is supplied to the reservoir tank by the second stage of the two-stage compressor. The first stage intake stroke draws air at atmospheric pressure through a oneway check valve located in the end of the first stage housing under the first stage housing cover. On the first stage compression stroke, the intake valve is closed and the oneway check valve in the second stage end of the piston is opened. This allows the air from the first stage cylinder to flow through the hollow piston into the second stage cylinder for high pressure compression. The second stage compression stroke closes the check valve in the piston and opens the check valve in the end of the second stage housing.

The intake and compression strokes are controlled by a sliding distributor valve that is actuated through an arm that is tripped by the piston as it nears the end of each stroke. Each time the arm actuates the distributor valve, a different set of holes are covered in the first stage housing. The distributor valve controls the flow of intake manifold vacuum and air under atmospheric pres-

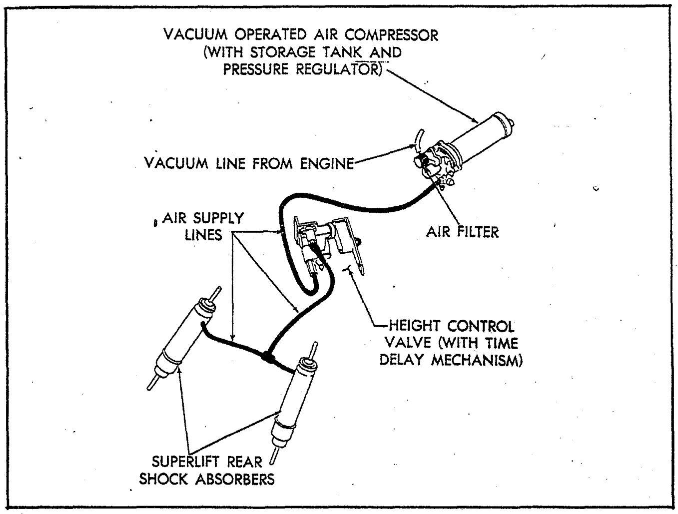


Fig. 12 - Automatic Level Control Schematic

sure, alternatley to opposite sides of the compressor diaphragm.

As the compressor cycles, the reservoir air pressure gradually increases causing a back pressure on the second stage piston until it equals the push of pressure against the diaphragm. At this point, a balanced condition is reached and the unit stops operating. After reservoir pressure drops due to system air usage, the compressor again begins to cycle and replenish the reservoir.

Pressure balance will depend upon the prevailing manifold vacuum and atmospheric pressure. Both are affected by altitude above or below sea level. Balance pressure will vary from approximately 150 to 275 psi.

NOTE: After completion of work on this system or when servicing other parts of the car and the system is deflated, inflate the reservoir to 140 psi or maximum pressure available through the compressor service valve.

The PRESSURE REGULATOR VALVE is preset and limits the reservoir outlet pressure to approximately 125 psi to avoid damage to the height control valve and Superlift shocks.

The HEIGHT CONTROL VALVE, which is mounted on the frame, senses rear car height through a link attached to the right rear upper control arm. When load is added to the car, the overtravel lever is forced up causing an internal lever to open the intake valve. When this valve is open high pressure air is admitted to the Superlift shocks. As the car raises to level, the intake valve shuts off.

When load is removed from the car, the overtravel lever is forced down causing the internal arm to open the exhaust valve. As the car lowers to the level position, the exhaust valve shuts off.

A four to eighteen second time delay mechanism, which is built into the height control valve, prevents air transfer due to normal ride movements. The overtravel lever, which pivots around the control valve shaft, rides off the flat side of the control valve shaft and does not have time to react to the rapid changes or normal ride motions.

During changes due to loading, the time delay mechanism will allow the overtravel shaft to open either the intake or exhaust valve as required, since this is not a rapid movement.

The SUPERLIFT shock absorber is essentially a conventional hydraulic unit with a pliable nylon reinforced neoprene boot acting as an air chamber.

The unit will extend when inflated and retract when deflated by the control valve.

An eight to fifteen psi air pressure is maintained in the Superlift at all times to minimize boot friction. This is accomplished by a check valve in the exhaust fitting on the control valve. Neither shock absorber function nor conventional ride motions thru rear coil springs is impaired in the event of accidental air pressure loss.

A combination of steel tubing and reinforced rubber hose is used for air lines throughout the system.

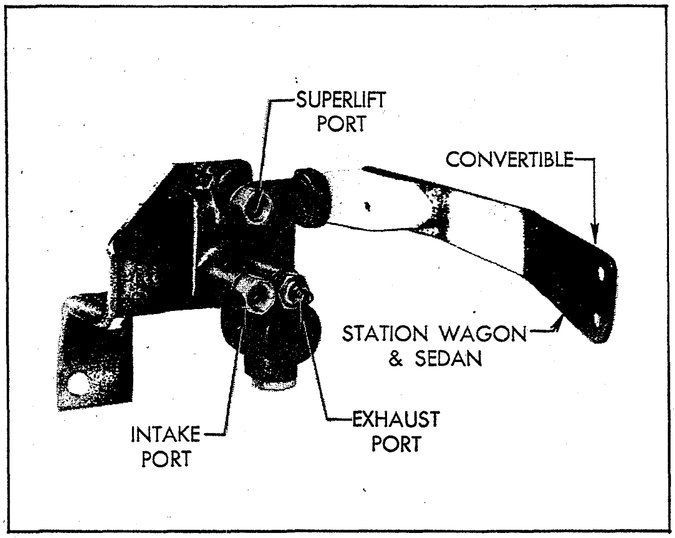


Fig. 13 - Height Control Valve

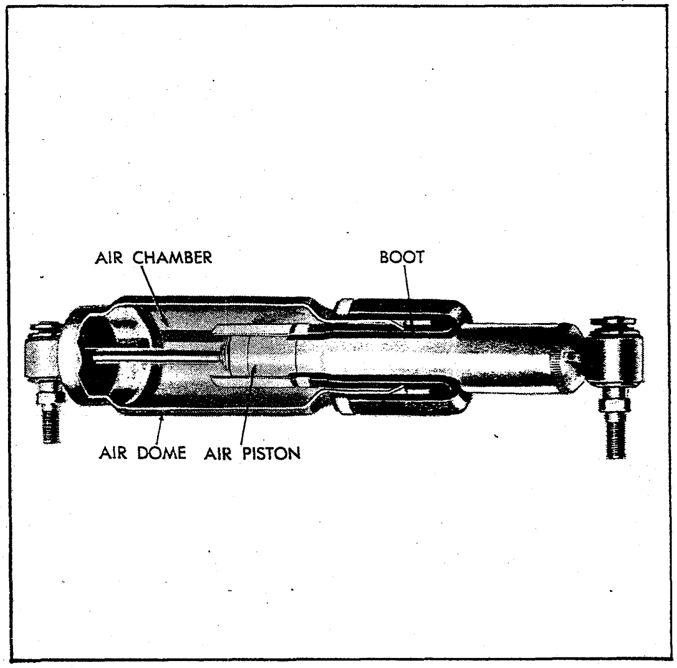


Fig. 14 - Superlift Absorber

CHECKS AND ADJUSTMENTS

SYSTEM TEST

A complete system test includes on and off-the-car component tests.

On the car tests are:

- Quick check of Automatic Level Control System
- Compressor output test
- Regulator test and adjustment
- Control valve test
- Time delay test
- Line and fitting leak test
- Trim adjustment

Off-the-car operations include:

- Control valve replacement
- Compressor repair
- Component leak tests
  - a. Compressor, reservoir, and regulator
  - b. Control valve
  - c. Superlifts

Quick Check-On Car (Reservoir Pressure at 150 PSI)

1. Fill the fuel tank or simulate at the rate of 6 lbs./gal. - otherwise car should be empty.

2. Turn engine off.

3. Add a 2 passenger load to the rear bumper or tailgate. Maintain the load until the car lifts or AT LEAST 20 SECONDS.
4. After car lifts remove the load and observe until the car lowers.

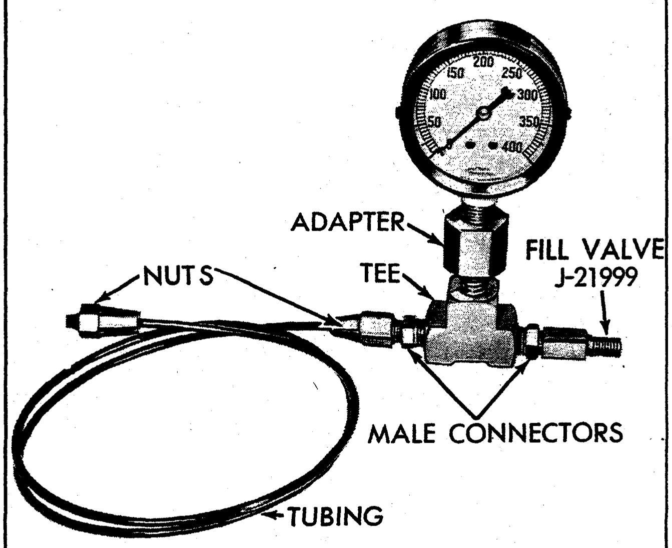


Fig. 15 - Test Gauge Set J-22124

Automatic Level Control Test Gauge (Fig. 15)

NOTE: To service the Automatic Level Control it will be necessary to secure Gauge Set J-22124 or make up the following test gauge. If the connectors indicated are not readily available others may be substituted.

1. Collect the following parts:
   a. Fill Valve, J-21999.
   b. A tee which has three 1/8" female taper pipe threads.
   c. An adapter which has a 1/4" female taper pipe thread on one end and a 1/8" male taper pipe thread on the other end.
   d. Air Pressure Gauge, J-4872.
   e. Two metal sleeves, rubber seals and tube nuts.
   f. A length of 1/8" tubing.
   g. Two male connectors which have a 1/8" male taper pipe thread on one end and a 3/8-24 straight thread male fitting on the other end.
2. Assembly
   a. Connect Fill Valve, J-21999, (female end) at male connector 3/8-24 straight thread fitting.
   b. Connect other end of male connector to tee.
   c. Connect adapter to tee.
   d. Connect pressure regulator to adapter.
   e. Connect second male connector to tee, (1/8 inch male pipe thread fitting).
   f. Install tubing to connector; other end of tubing will go on unit to be checked.

NOTE: Make certain all fittings are air tight.

Compressor Output Test—On Car

1. With all accessories off, run the engine until fast idle screw is off the fast idle cam. Turn off ignition.
2. Deflate system through service valve, then remove high pressure line at regulator adapter and connect test gauge.
3. Inflate reservoir to 70 psi through service valve.
4. Observe test gauge for evidence of compressor air leak.
5. If leaking, proceed to leak test-compressor reservoir, and regulator. If not leaking, continue this test.
6. With engine running at slow idle, observe reservoir build-up for five minutes. Reservoir pressure should build up to a minimum of 90 psi.
7. If compressor fails to cycle, make sure the vacuum and air intake lines are open and unobstructed before removing compressor for repair.
8. If build-up is too slow, proceed to repair compressor.
9. Satisfactory build-up indicates system problem to be in the control section. However, again observe the test gauge for evidence of an air leak and proceed accordingly.

Regulator Test and Adjustment

Performance test the regulator with a known good compressor on the car.

1. Deflate system through service valve and disconnect line at pressure regulator valve. Install test gauge on regulator valve high pressure fitting.
2. Inflate system through service valve to maximum available pressure.

NOTE: If available pressure is less than 140 psi, start engine to build-up reservoir to this pressure.

3. Regulated pressure should build-up to and hold steady at 100-130 psi on test gauge.
4. Check regulated pressure by momentarily (not more than one second) depressing valve core on test gauge and observe gauge reading.
5. If regulated pressure now reads less than 100 psi, replace regulator assembly.
6. If regulated pressure exceeds 130 psi, replace regulator assembly.

Control Valve Test

Exhaust (Superlifts Inflated)

1. Disconnect control valve lever from link.
2. Hold lever down in exhaust position until Superlifts deflate or for a minimum of 18 seconds.
3. If Superlifts deflate, perform Intake Check.
4. If Superlifts do not deflate, remove exhaust adapter from control valve and hold lever down as in Step 2. Replace adapter, O-ring and filter if this deflates Superlifts.
5. Replace control valve if none of the above steps solve problem.

Intake (Reservoir Pressure 125 psi Minimum)

1. Disconnect overtravel lever from link.
2. Hold lever up in intake position until Superlifts inflate or for a minimum of fifteen seconds.
3. If Superlifts inflate and hold, proceed to Time Delay Check.
4. If Superlifts inflate and then leak down, perform leak test on lines and fittings and then on Superlifts and control valve. Repair or replace as indicated.

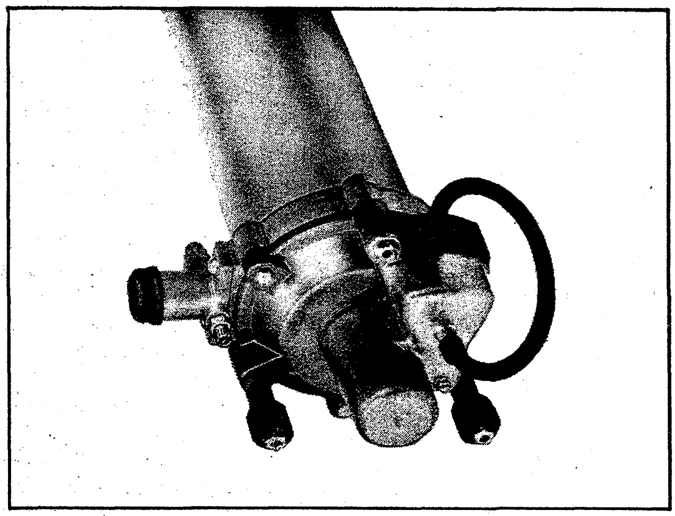


Fig. 16 - Assembly Leak Test Preparation

Time Delay Test (Reservoir Pressure 125 psi Minimum)

1. Record rear trim height of empty car (rear bumper to ground).
2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-18 seconds.
3. Remove weight. After 4-18 seconds car should begin to settle.
4. Replace valve if time delay is not within the 4-18 seconds.

Trim Adjustment—On Car

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of 6 lbs./gallon), but no other load.

Abbreviated Adjustment

1. Fill the compressor at the service valve with the available air line pressure.
2. Disconnect link from height control valve lever. Move the height control valve lever upward until air fills the Superlifts.
3. Move lever downward and hold until air stops escaping from the exhaust port of the height control valve. The Superlifts will now automatically hold 8 to 15 PSI.
4. Let lever go to its neutral position and loosen the lever adjustment nut.
5. Assemble the link to the height control valve lever and tighten the lever adjustment nut.

NOTE: Do not move control valve lever and overtravel body while tightening nut.

Leak Tests

Compressor, Reservoir and Regulator

1. Remove assembly intact.
2. Connect test gauge to regulator. Inflate reservoir through service valve to 80-110 psi.
3. Route an 8" rubber hose between vacuum and vent ports, (fig. 16).
4. Submerge in water and observe for air leaks at:
   Reservoir weld seam.
   Reservoir to compressor O-ring.
   Regulator to compressor O-ring.
   Regulator boot-defective internal O-ring.
   Diaphragm between first and second stage housings. Tightening through bolts may correct the leak.
   Cover gasket and retainer screw. A few bubbles here is not a leak. A continuous stream indicates defective compressor check valves.
   Service valve.
   Test gauge connections.
5. Correct any leaks detected by either tightening screws or replacing parts.

Control Valve

1. Remove control valve unit from car.
2. Clean exterior of control valve thoroughly.
3. Connect test gauge and air pressure source to intake adapter and open air pressure (80-110 psi).
4. Submerge unit in water. No air should escape if overtravel lever is in "neutral" position. If bubbles escape from Superlift port, replace control valve.
5. Shut off air pressure and detach test gauge from air intake port. Plug intake port with Fill Valve, J-21999 (female end).
6. Connect test gauge to Superlift port and open air pressure.
7. With overtravel lever in "neutral" position no air should escape. If bubbles escape from exhaust port, replace control valve.
8. If air escapes around edge of cover plate, tighten screws on replace gasket.
9. Remove control valve from water. Actuate overtravel lever to expel any water from unit.
10. Shut off air pressure and remove line from Superlift port.

Lines and Fittings

1. Disconnect overtravel lever from link.
2. Hold lever up in intake position for maximum Superlift inflation and release.
3. Leak check all connections with a soap and water solution.

Superlifts

1. Disconnect lines and remove unit from car.
2. Inflate individually to 50-60 psi utilizing Fill Valves J-21999. Submerge in water and observe unit for leaks.
3. Install Superlifts.

SERVICE OPERATIONS

CONTROL VALVE

Removal

1. Deflate system using service valve.
2. Disconnect two air lines at leveling valve intake and Superlift ports.
3. Disconnect link from overtravel lever by removing one nut and lock washer.
4. Remove two screws securing leveling valve to frame and remove leveling valve.

Installation

1. Install control valve with two screws, with time delay mechanism down.
2. Secure link to overtravel lever with one nut and lock washer. On all station wagons series the link is secured to the lower hole. On all other series cars with standard springs, the link is secured to the upper hole.
3. Connect air lines at control valve intake and Superlift port.
4. Inflate reservoir to 140 psi or maximum pressure available through service valve.

COMPRESSOR, RESERVOIR AND REGULATOR

Removal and Installation

1. Disconnect air lines (manifold and air cleaner) at compressor end.
2. Disconnect pressure line at compressor head.
3. From wheel side of fender skirt, remove two screws from bracket on compressor end.
4. Remove nut and washer from reservoir stud at bracket and remove assembly from vehicle.
5. Remove compressor end mount bracket.
6. Reverse Steps 1-5 for installation, then leak check fittings.

COMPRESSOR, RESERVOIR AND REGULATOR

Disassembly Into Major Components (Fig. 17)

The compressor is a precision-built mechanism. All parts should be carefully handled and assembled. Take care to prevent entrance of dirt or foreign matter. DO NOT LUBRICATE as unit is designed to run dry.

1. Remove compressor as described above.
2. Remove three flexible mounts and three adapters.
3. Remove reservoir retaining through bolt, cover retaining screw and cover gasket that secure cover and gasket to first stage housing. Remove cover and discard gaskets.
4. Remove two regulator retaining screws, regulator assembly and O-ring from second stage housing. Discard O-ring.
5. Remove three nuts at reservoir flange and two through bolts that enter from flanged side of reservoir. Separate reservoir and O-ring. Discard O-ring.
6. Remove three compressor retaining through bolts that secure second stage housing to first stage housing.
7. Slide second stage (small diameter) housing straight off piston.
8. Disconnect arm tension spring from swivel arm.
9. Remove arm pivot screw and actuating arm.
10. Slide piston assembly straight out of first stage housing.

Disassembly, Inspection and Assembly of Major Components (Fig. 17)

Diaphragm

1. Inspect diaphragm for holes, looseness or other defects and replace if necessary.
2. Remove diaphragm retainer with diagonal pliers and discard.
3. Remove diaphragm plate, diaphragm, second diaphragm plate and corprene washer from piston.
4. Install new corprene washer, old plate, new diaphragm with outer lip toward second stage side, (fig. 17) and second plate. Plates should be installed so that lip on each plate faces away from diaphragm.
5. Use a 13/16 inch deep socket as a pilot for the new diaphragm retainer. Press against the piston shoulder on first stage side, (fig. 18) to position diaphragm retainer. The wood blocks used in the illustration are each 3/4" x 3/4" x 12".

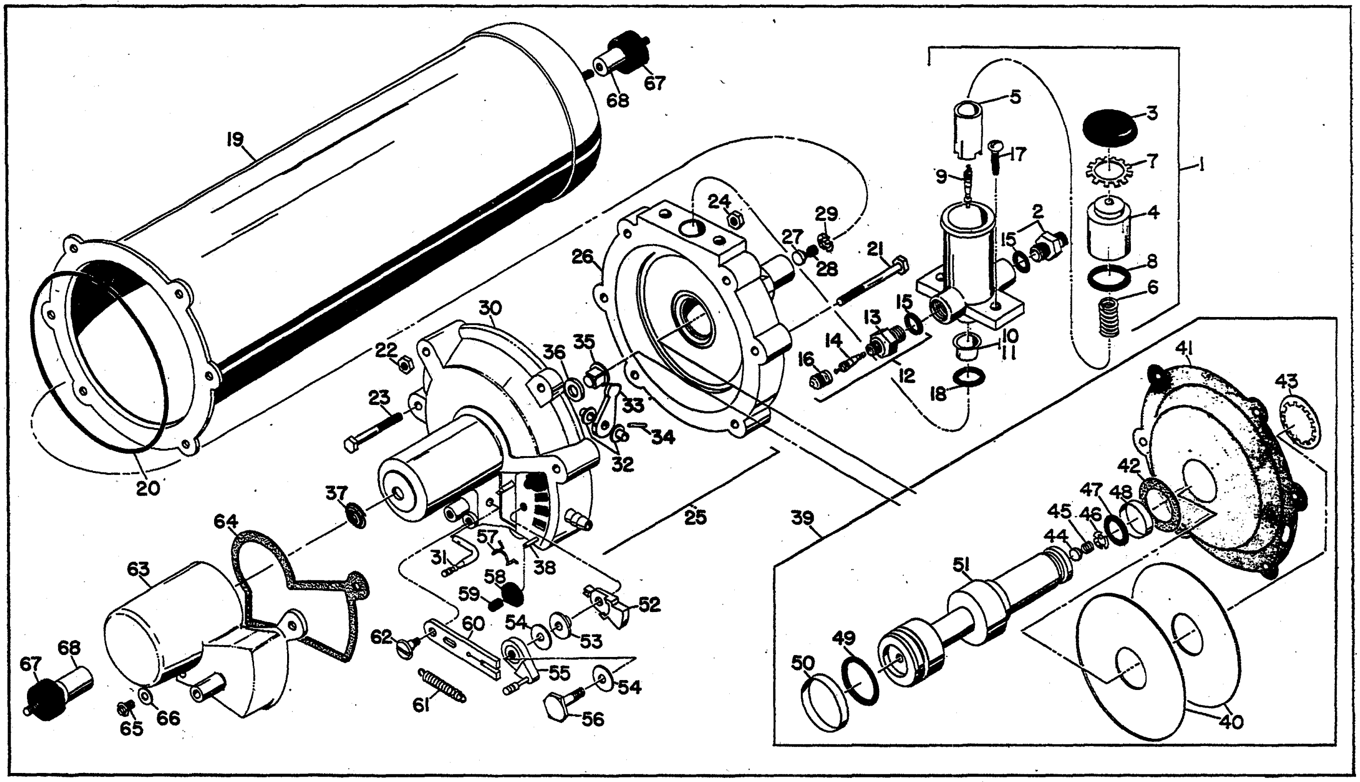


Fig. 17 - Compressor, Regulator and Reservoir - Exploded View

1. Regulator Assembly
2. Adapter Assembly
3. Boot
4. Sleeve
5. Piston
6. Spring
7. Retainer
8. "O" Ring
9. Valve Core
10. Retainer, Screen
11. Screen, Filter
12. Adapter Assembly
13. Adapter
14. Valve Core
15. "O" Ring
16. Cap
17. Screw, Regulator Retaining
18. "O" Ring, Regulator to Compressor
19. Reservoir
20. "O" Ring, Reservoir to Compressor
21. Thru Bolt, Reservoir Retaining
22. Nut, Thru Bolt Reservoir
23. Thru Bolt, Compressor Retaining
24. Nut, Thru Bolt Compressor
25. Compressor Assembly
26. Housing, 2nd Stage
27. Check Valve
28. Spring
29. Expansion Plug Retainer
30. Housing 1st Stage
31. Arm, Swivel
32. Bushing
33. Arm, Rocker
34. Pin, Rocker Arm Retaining
35. Intake Valve
36. Washer
37. Spring, Intake Valve Retaining
38. Pin, Bushing Retaining
39. Piston Assembly
40. Plate, Diaphragm
41. Diaphragm
42. Washer (.760-.765 I.D.)
43. Retainer, Diaphragm
44. Check Valve
45. Spring
46. Expansion Plug Retainer
47. "O" Ring (.357-.367 I.D.)
48. Seal (.569-.571)
49. "O" Ring (.732-.742 I.D.)
50. Seal (.943-.945)
51. Piston
52. Distributor Valve
53. Bushing, Distributor Valve
54. Washer (.160-.163 I.D.)
55. Arm Assembly, Distributor
56. Screw
57. Spring, Valve Tension
58. Bushing, Distributor Valve Stop
59. Bushing, Arm Assembly Stop
60. Arm Actuating
61. Spring, Arm Tension
62. Screw, Arm Pivot
63. Cover
64. Gasket
65. Screw, Cover Retaining
66. Gasket, Cover
67. Mount, Flexible
68. Adapter

NOTE: Position diaphragm retainer securely to effect air tight seal against corprene washer.

Seals

1. Inspect seals for evidence of excessive wear or coring. If necessary replace seals and O-rings.
2. Remove seals and O-rings from piston.
3. Install new O-rings by rolling into groove. Relieve any resulting twist.
4. Install new seals using a piece of .020" shim stock, (fig. 19). Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than necessary to install. Seals should be installed so they are not twisted.

Distributor Valve Mechanism and Intake Valve (First Stage Housing)

NOTE: Actuate distributor valve with finger. Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild using new parts in Distributor Valve and Arm Package. If action is free and positive and upon disassembly there are no damaged parts, parts may be re-used.

Disassembly

1. Remove screw, washer, distributor arm assembly, washer, and distributor valve bushing.
2. Remove two arm assembly stop bushings and two distributor valve stop bushings.
3. Carefully remove distributor valve being careful not to distort valve tension spring.
4. Remove valve tension spring from housing boss, again being careful not to distort valve tension spring.
5. Remove intake valve retaining spring, intake valve and washer using pocket knife.
6. If necessary, remove rocker and swivel arms. Position pin for removal by prying with screw driver, (fig. 20). Grip pin with water pump pliers and remove pin. Remove swivel arm, rocker arm and bushings.

Cleaning and Inspection

1. Clean all parts in clean solvent except distributor arm assembly and blow dry with compressed air.
2. Inspect distributor valve for cracks. Discard if damaged.
3. Inspect all other parts for wear or damage.

Assembly

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align hole in rocker arm with swivel arm and install rocker arm retaining pin, small end first.

   NOTE: If distributor mechanism failed to function properly or one or more parts were found defective, use new parts in distributor valve and arm package during remaining build-up.

2. Install washer on intake valve and install in first stage housing with intake valve retaining spring.
3. Install longer leg of valve tension spring into boss on first stage housing being careful not to distort valve tension spring.

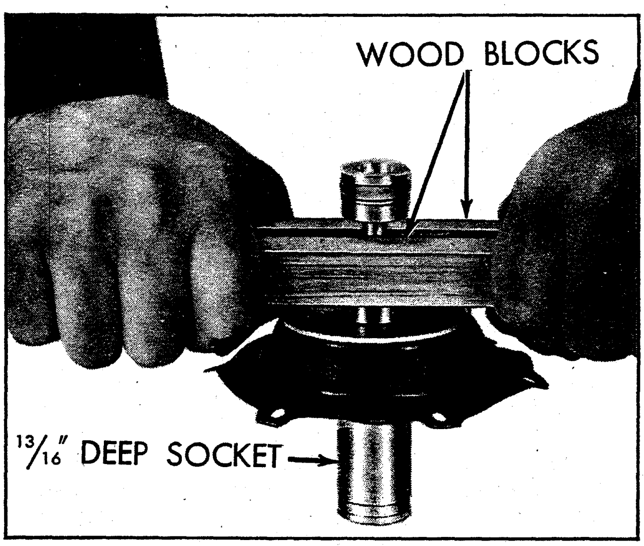


Fig. 18 - Installing Diaphragm Retainer

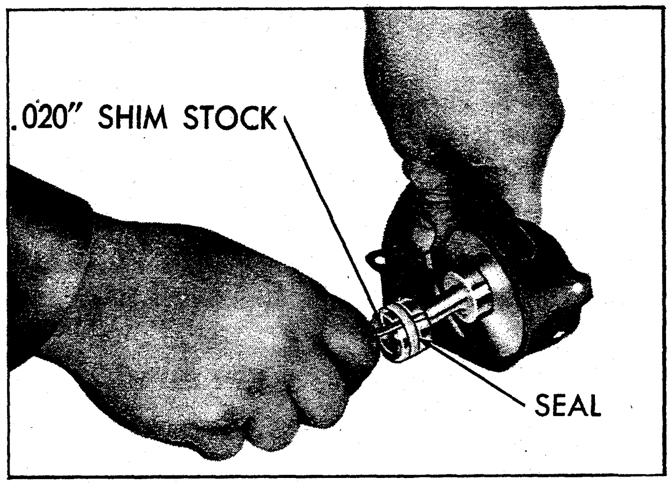


Fig. 19 - Installing Seal

4. Position distributor valve being careful not to distort valve tension spring.
5. Install two distributor valve stop bushings and two arm assembly stop bushings.
6. Install distributor valve bushing, washer, distributor arm assembly, and washer and secure with screw. Tighten to 12 in. lbs.

NOTE: Do not install remaining parts at this time as rocker arm must be free to permit entrance of piston into first stage housing.

Check Valve Replacement (Second Stage Piston)

1. Pry out expansion plug retainer on second stage piston (with pointed tool) and remove spring and check valve.
2. Pour a small amount of clean solvent through bore in piston and blow dry with compressed air. Check valve seat should be smooth and clean.
3. Install new check valve and spring.

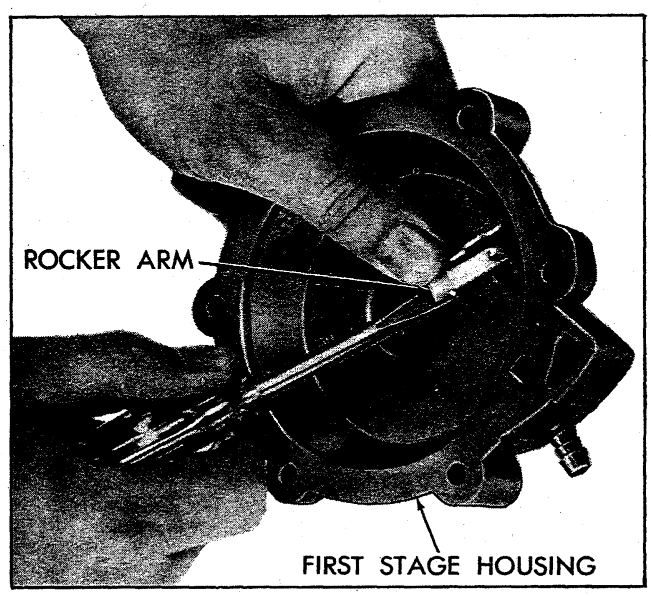


Fig. 20 – Removing Rocker Arm

4. Insert new expansion plug retainer and tap in until it bottoms.

Check Valve Replacement (Second Stage Housing)

1. Pry out expansion plug retainer on second stage housing (with pointed tool) and remove spring and check valve.
2. Clean second stage housing with clean solvent and blow dry with compressed air. Check valve seat should be clean and smooth.
3. Install new check valve and spring.
4. Insert new expansion plug retainer and tap in until it bottoms.

COMPRESSOR, RESERVOIR AND REGULATOR

Assembly From Major Components

1. Slide piston assembly straight into first stage (large diameter) housing.
2. Install actuating arm and secure to first stage housing with arm pivot screw, tightening to 12 in. lbs.
3. Connect arm tension spring to swivel arm.
4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in first stage housing.
5. Install three compressor retaining through bolts that secure second stage housing to first stage housing. Housings will align one way only. Nuts are positioned in counterbores in second stage housing. Tighten to 28 in. lbs.
6. Install new O-ring on second stage housing. Wash inside of reservoir in clean solvent and blow dry with compressed air. Install reservoir on second stage housing with three nuts, tightening to 28 in. lbs. Install two reservoir retaining through bolts, tightening to 28 in. lbs. Through bolt heads should be positioned against reservoir. Leave out through bolt that secures cover.
7. Install new O-ring on regulator and secure regulator with two regulator retaining screws, tighten to 35 in. lbs. Service valve should be on same side as first stage housing.
8. Install new gasket, cover, and secure with cover retaining screw and new cover gasket. Tighten cover retaining screw to 35 in. lbs. Install through bolt so head is positioned against reservoir. Tighten through bolt to 28 in. lbs.
9. Install three adapters and flexible mounts.
10. Proceed to compressor output test on car.

SPECIFICATIONS

HEATING AND AIR CONDITIONING

SECTION 1A

Compressor	
Make	Frigidaire
Type	6 Cylinder Axial
Displacement	
Four-Season	12.6 Cu. In.
Universal and All-Weather	10.8 Cu. In.
Rotation	Clockwise
Compressor Suction and Discharge Connector Bolt Torque	25 ft. lbs.
Compressor Clutch Coil	
Ohms (at 80°F.)	4.18-4.38
Amps (at 80°F.)	2.86 @ 12 Volts
Torques	
Rear Head to Shell Stud Nut	23 lb. ft.
Shaft Mounting Nut	15 lb. ft.
Belt Tension	See Tune-Up Chart

System Capacities	
Refrigerant	R-12
Four-Season and Comfortron Systems	3 lbs., 12 oz.
Universal Systems	
Chevrolet, Chevelle, and Camaro	3 lbs.
Chevy II	2 lbs. 8 oz.
All-Weather System	2 lbs. 8 oz.
Compressor Oil	525 Viscosity
All Systems	11 oz.

Fuses	Fuse Block	In Line
Comfortron Systems	25 amp.	30 amp.
Four-Season Systems	25 amp.	30 amp.
Universal Systems	25 amp.	20 amp.
All-Weather System	25 amp.	20 amp.

FRONT SUSPENSION

SECTION 3

WHEEL ALIGNMENT SPECIFICATIONS (Vehicle at Curb Weight)

	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Caster*	Pos. 3/4° ± 1/2°	(SS and El Camino) Neg. 1/2° ± 1/2° (All others) Neg. 1° ± 1/2°	Pos. 1° ± 1/2°	Pos. 1° ± 1/2°	Pos. 1/2° ± 1/2°
Camber*	Pos. 1/4° ± 1/2°	Pos. 1/2° ± 1/2°	Pos. 1/2° ± 1/2°	Pos. 3/4° ± 1/2°	Pos. 1/4° ± 1/2°
Steering Axis Inclination	7-1/2° ± 1/2°	8-1/4° ± 1/2°	7° ± 1/2°	7° ± 1/2°	8 3/4° ± 1/2°
†Toe-In (Total)	@1/8" to 1/4"	1/8" to 1/4"	1/4" to 3/8"	3/16" to 5/16"	1/8" to 1/4"
Wheel Bearing Adjustment	12 ft. lbs.	12 ft. lbs.	12 ft. lbs.	12 ft. lbs.	12 ft. lbs.
Preload	zero	zero	zero	zero	zero
End Movement	.001" to .008"	.001" to .008"	.000" to .004"	.001" to .008"	.001" to .008"

*Must not vary more than 1/2° from side to side.
@Toe-In (Total) should be 5/16" to 7/16" after rebuild using new bushings and ball joints.
†Adjust Toe-in with steering gear on straight ahead location after camber and caster have been set. Any change in caster and camber settings will affect toe; always recheck and set toe to specifications.

RIDING HEIGHT MEASUREMENT*

Chevrolet	All Biscayne and Bel Air 2 and 4 Doors, All Impala and Caprice 4 Doors and All Station Wagons	5-1/8" ± 1/2"
	All Impala and Caprice 2 Doors	5-3/8" ± 1/2"
Chevelle	All Sedans	1-3/8" ± 1/2"
	SS Coupe and Convertible	1-1/8" ± 1/2"
	El Camino and Station Wagons	2" ± 1/2"
Chevy II	All 4 and 6 Cylinder Standard 2 and 4 Doors, All Station Wagons, and 6 Cylinder Nova 4 Door	3-3/4" ± 1/2"
	All 8 Cylinder Standard 2 and 4 Doors, All Nova 2 Doors and 8 Cylinder Nova 4 Door	3-1/4" ± 1/2"
Corvette	With 327 or 427 Engine	2-1/2" ± 1/2"
	327 Engine with A/C or 427 Engine with A/C, P.S., and P.B.	2" ± 1/2"
	Convertible with 327 Engine, Hardtop, A/C, P.S., P.B., and Powerglide	1-1/2" ± 1/2"
	427 Engine with Optional Suspension	1-1/2" ± 1/2"
Camaro	With 230 Engine	2-3/4" ± 1/2"
	With 250 Engine	2-7/8" ± 1/2"
	With 283 - 327 and 350 Engine	2-5/8" ± 1/2"

*Must be within 1/2" from side to side

BOLT TORQUES

TORQUES	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Spherical Joint					
Upper Stud Nut	50 ft. lbs.	50 ft. lbs.	45 ft. lbs.	45 ft. lbs.	50 ft. lbs.
Lower Stud Nut	80 ft. lbs.	80 ft. lbs.	45 ft. lbs.	20 ft. lbs.	65 ft. lbs.
Stud to Control Arm Nuts (Service)	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	20 ft. lbs.	25 ft. lbs.
Lower Forging Nut	40 ft. lbs.	—	—	—	—
Steering Arm Attaching Nuts	50 ft. lbs.	85 ft. lbs.	65 ft. lbs.	—	85 ft. lbs.
Shock Absorber					
Upper Shaft Nut	8 ft. lbs.	8 ft. lbs.	8 ft. lbs.	20 ft. lbs.	8 ft. lbs.
Lower Attachment	15 ft. lbs.	20 ft. lbs.	9 ft. lbs.	10 ft. lbs.	20 ft. lbs.
Bracket to Spring Tower	—	—	9 ft. lbs.	—	—
Stabilizer Bar					
Frame Bracket Bolts	15 ft. lbs.	15 ft. lbs.	9 ft. lbs.	10 ft. lbs.	15 ft. lbs.
Link Nuts	8 ft. lbs.	8 ft. lbs.	10 ft. lbs.	10 ft. lbs.	8 ft. lbs.
Strut Rod					
Rod to Arm Nut	70 ft. lbs.	—	45 ft. lbs.	—	—
Adjustment Nut	80 ft. lbs.	—	80 ft. lbs.	—	—
Front Spring					
Spring Seat to Control Arm Nuts	—	—	30 ft. lbs.	—	—
Lower Control Arm Inner Pivot Nuts	115 ft. lbs.	80 ft. lbs.	65 ft. lbs.	95 ft. lbs.	85 ft. lbs.
Upper Control Arm					
Attaching Nuts	75 ft. lbs.	50 ft. lbs.	50 ft. lbs.	35 ft. lbs.	50 ft. lbs.
Collar Bolts	45 ft. lbs.	45 ft. lbs.	50 ft. lbs.	40 ft. lbs.	45 ft. lbs.
Brake Anchor Pin Drum Brakes	130 ft. lbs.	130 ft. lbs.	130 ft. lbs.	—	130 ft. lbs.
Brake Anchor Bolt Disk Brakes	—	—	—	75 ft. lbs.	—
Lower Control Arm Cross Shaft Bolts					
Front	—	—	—	70 ft. lbs.	—
Rear	—	—	—	135 ft. lbs.	—
Wheel Stud Nuts	65 ft. lbs.	65 ft. lbs.	65 ft. lbs.	75 ft. lbs.	65 ft. lbs.

REAR SUSPENSION
REAR AXLE

SECTION 4

CHEVROLET, CAMARO, CHEVELLE AND CHEVY II
Gear Backlash . . (.005"-.008" preferred) .003"-.010"
Pinion Bearing Preload (in. lbs.)
New 20-30
Used 5-15
Lubricant Capacity
Large Carrier . . . . 4-1/2 pints
Small Carrier . . . . 3-1/2 pints
Bolt Torques (Ft. Lbs.)
Carrier Cover. 20
Ring Gear 50
Differential Bearing Caps 55
Filler Plug 20
Differential Pinion Lock 20

CORVETTE
Gear Backlash . (.005"-.008" preferred) . . .003"-.010"
Pinion Bearing Preload (in. lbs.)
New 20-25
Used 5-15
Lubricant Capacity . . . . 3-3/4 pints
Bolt Torques (Ft. Lbs.)
Carrier Cover 50
Ring Gear 50
Differential Bearing Caps 55
Filler Plug 20
Differential Pinion Lock 20

	Chevrolet	Chevelle	Chevy II	Camaro·	Corvette
Type Heavy Duty Axle Light Duty Axle	4-Link System 3-Link System	4-Link System	Semi-Elliptic Tapered Single Leaf	Semi-Elliptic Tapered Single Leaf	Independent Three-Link System
Bolt Torque (ft. lbs.) Spring Retainer	25		40	50	65
Control Arm Upper Front Bracket	55				
Upper Bushings	70	80			
Lower Bushings	110	80			
Shock Absorber Upper Nut	15	12	10	8	50
Upper Bracket			10	10	
Lower Nut	65	65	50	45	35
Spring Shackle Front			55	100	
Rear			50	50	
Tie Rod Attaching Nuts	65				
Stud to Axle Bracket	110				
Universal Joint Companion Flange	15	15	15	15	15
Transmission Yoke					15
Wheel Stud Nuts	65	65	65	65	75
Axle Drive Shaft to Spindle					75
to Yoke					15

@ Station Wagon all 4-Link System

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Stabilizer Shaft Bracket to Frame					120
Bracket to Torque Arm					120
Link Bushings					25
Rebound Bumper to Frame					20
Crossmember to Frame					25
Crossmember to Carrier					60
Carrier Front Support to Crossmember					65
Front Bolt					50*
Rear Bolt					50
Drive Spindle Nut					100*
Drive Spindle Support to Torque Arm					30
Strut Rod to Spindle Support					80*
Bracket to Carrier					45
Camber Cam					65
Torque Arm Pivot					50
Spring Link Bolt to Torque Arm				Install nut to expose hole then insert cotter pin.	(Corvette only)
Wheel Alignment # Camber (Degrees)					Neg. 1/2° ± 1/2°
Toe-In (Total)					1/32" to 3/32"

@Station Wagon All 4-Link System
* Plus additional torque necessary to line up cotter pin hole.
\# Camber must not vary more than 1/2 degree from side to side. Toe setting must be made after camber is set.

RIDING HEIGHT

Body Style				
2 Door Sedan	6-1/2" ± 3/8"	5.0" ± 3/8"	6-1/8" ± 3/8"	
4 Door Sedan	6-7/16" ± 3/8"	5.0" ± 3/8"	6-1/16" ± 3/8"	
4 Door Sport Sedan	6-7/16" ± 3/8"	5.0" ± 3/8"		
Sport Coupe	6-1/2" ± 3/8"	4-3/4" ± 3/8"	4-15/16" ± 3/8"	5-1/4" ± 3/8"
Convertible	6-7/16" ± 3/8"	6-1/2" ± 3/8"		5-3/16" ± 3/8"
Station Wagon	6-7/8" ± 3/8"	6-1/4" ± 3/8"	5-13/16" ± 3/8"	
Sedan Pickup		6-3/8" ± 3/8"		
Super Sport Coupe & Convertible		3-3/8" ± 3/8"		

All settings are made at curb weight.

BRAKES

SECTION 5

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Type	Duo Servo Self Adjusting				Disc
Brake Drums Diameter	11"	9-1/2		9-1/2	—
Maximum Out of Round	.008"				—
Maximum Rebore	.060"				—
Brake Shoes Width Front	2-3/4	2-1/2		2-1/2	2-7/32
Rear	2	2		2	
Length Primary	9-1/4	9		9	5-31/32
Secondary	11-41/64	9-3/4		9-3/4	
Wheel Cylinder Diameter Front	1-3/16	1-1/8	1-1/16	1-1/8	1-7/8
Rear	1	15/16	7/8	15/16	1-3/8

TORQUE CHART

APPLICATION	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Brake Pipe Distribution and Switch Assembly Mounting Screws	—	60 lb. in.	150 lb. in.	—	90 lb. in.
Main Cylinder to Firewall Mounting Nuts	24 lb. ft.	24 lb. ft.	24 lb. ft.	24 lb. ft.	24 lb. ft.
Push Rod Clevis Nut	14 lb. ft.	14 lb. ft.	14 lb. ft.	14 lb. ft.	14 lb. ft.
Brake Hydraulic Pipe to Main Cylinder and Switch Connections	100 lb. in. (Front Line) 115 lb. in. (Rear Line)	115 lb. in.	115 lb. in.	115 lb. in.	115 lb. in.
Brake Hose to Brake Assembly Connection	23 lb. ft.	23 lb. ft.	23 lb. ft.	23 lb. ft.	23 lb. ft.
Parking Brake Equalizer Check Nut	85 lb. in.	85 lb. in.	—	85 lb. in.	70 lb. in.
Hydraulic Brake Pipe Connections	110 lb. in.	100 lb. in. (Front) 120 lb. in. (Rear)	100 lb. in.	100 lb. in.	100 lb. in.
Rear Brake Hose to Rear Brake Line "T" Connection	113 lb. in.	113 lb. in.	65 lb. in.	113 lb. in.	113 lb. in.
Caliper Half Retaining Bolts	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.
Caliper to Mounting Bracket Retaining Bolts	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.

ENGINE

SECTION 6

GENERAL DATA:																		
Type	IN LINE				V8													
Displacement	153	194	230	250	283	327					350	396		427				
Horsepower @ rpm	90 @ 4000	120 @ 4400	140 @ 4400	155 @ 4200	195 @ 4600	210 @ 4600	275 @ 4800	300 @ 5000	325 @ 5600	350 @ 5800	295 @ 4800	325 @ 4800	350 @ 5200	385 @ 5200	390 @ 5400	400 @ 5400	425 @ N.A.	435 @ 5800
Torque @ rpm	152 @ 2400	177 @ 2400	220 @ 1600	235 @ 1600	285 @ 2400	320 @ 2400	355 @ 3200	360 @ 3400	355 @ 3600	360 @ 3600	380 @ 3200	410 @ 3200	415 @ 3400	460 @ 3400	460 @ 3600	460 @ 3600	N.A.	460 @ 4000
Bore	3-7/8"	3-9/16"	3-7/8"			4"						4-3/32"		4-1/4"				
Stroke	3.25"			3.53"	3"	3.25"					3.48"	3.76"						
Compression Ratio	8.5:1				9.25:1	8.75:1	10.0:1		11.0:1		10.25:1						N.A.	11.0:1
Firing Order	1-3-4-2	1-5-3-6-2-4			1-8-4-3-6-5-7-2													
CYLINDER BORE:																		
Diameter	3.8745" 3.8775"	3.5620" 3.5650"	3.8745"-3.8775"			3.9995"-4.0025"						4.0925" 4.0995"		4.2495"-4.2525"				
Out of Round — Production	.005" (Max.)				.001" (Max.)													
Out of Round — Service	.002" (Max.)																	
Taper — Production — Thrust Side	.0005" (Max.)																	
Taper — Production — Relief Side	.0005" (Max.)				.001" (Max.)													
Taper — Service	.005" (Max.)																	
PISTON:																		
Clearance — Production	.0005"-.0011"								.0024" .0030"		.0005" .0011"	.0007" .0013"		.0009" .0015"			.0054" .0063"	.0037" .0043"
Clearance — Service	.0025" (Max.)								.0050" (Max.)		.0025 (Max.)						.0085" (Max.)	.0065" (Max.)
PISTON RING:																		
COMPRESSION — Clearance Groove — Production — Top	.0012"-.0027"			.0020" .0035"	.0012"-.0027"				.0012"-.0032"			.0012"-.0032"						
COMPRESSION — Clearance Groove — Production — 2nd	.0012"-.0032"			.0020" .0040"	.0012"-.0032"				.0012"-.0027"			.0012"-.0032"						
COMPRESSION — Clearance Groove — Service	Hi Limit Production .001"																	
COMPRESSION — Gap — Production — Top	.010"-.020"					.013"-.023"			.010"-.020"			.010"-.020"						
COMPRESSION — Gap — Production — 2nd	.010"-.020"					.013"-.025"			.013"-.023"			.010"-.020"						
COMPRESSION — Gap — Service	Hi Limit Production .01"																	
OIL — Groove Clearance — Production	.000"-.005"											.0012"-.0060"						
OIL — Groove Clearance — Service	Hi Limit Production .001"																	
OIL — Gap — Production	.015"-.055"											.010"-.030"						
OIL — Gap — Service	Hi Limit Production .01"																	

<table>
<tr><td colspan="3">Displacement</td><td>153</td><td>194</td><td>230</td><td>250</td><td>283</td><td colspan="5">327</td><td>350</td><td colspan="2">396</td><td colspan="5">427</td></tr>
<tr><td colspan="3">Horsepower</td><td>90</td><td>120</td><td>140</td><td>155</td><td>195</td><td>210</td><td>275</td><td>300</td><td>325</td><td>350</td><td>295</td><td>325</td><td>350</td><td>385</td><td>390</td><td>400</td><td>425</td><td>435</td></tr>
<tr><td colspan="3">PISTON PIN:</td><td colspan="18"></td></tr>
<tr><td colspan="3">Diameter</td><td colspan="11">.9270"-.9273"</td><td colspan="7">.9895"-.9898"</td></tr>
<tr><td colspan="2" rowspan="2">Clearance</td><td>Production</td><td colspan="8">.00015"-.00025"</td><td colspan="2">.00045"
.00055"</td><td>.0015"
.0025"</td><td colspan="5">.00025"-.00035"</td><td colspan="2">.00030"
.00040"</td></tr>
<tr><td>Service</td><td colspan="18">.001" (Max.)</td></tr>
<tr><td colspan="3">Fit In Rod</td><td colspan="18">.0008"-.0016" (Interference)</td></tr>
<tr><td colspan="3">CRANKSHAFT:</td><td colspan="18"></td></tr>
<tr><td rowspan="5">Main Journal</td><td colspan="2">Diameter</td><td colspan="4">All
2.2983"-2.2993"</td><td colspan="6">#1
2.2984"-2.2993"
#2-3-4
2.2983"-2.2993"
#5
2.2978"-2.2988"</td><td>#1-2-3-4
2.4483"-
2.4493"
#5
2.4478"
2.4488"</td><td colspan="7">#1-2
2.7487"-2.7497"
#3-4
2.7482"-2.7492"
#5
2.7478"-2.7488"</td></tr>
<tr><td rowspan="2">Taper</td><td>Production</td><td colspan="18">.0002" (Max.)</td></tr>
<tr><td>Service</td><td colspan="18">.001" (Max.)</td></tr>
<tr><td rowspan="2">Out of Round</td><td>Production</td><td colspan="18">.0002" (Max.)</td></tr>
<tr><td>Service</td><td colspan="18">.001" (Max.)</td></tr>
<tr><td rowspan="4">Main Bearing Clearance</td><td colspan="2" rowspan="3">Production</td><td colspan="4" rowspan="3">All
.0003"-.0029"</td><td colspan="6">#1
.0008"-.0020"</td><td rowspan="2">#1-2-3-4
.0008"-
.0020"</td><td colspan="7">#1-2
.0004"-.0020"</td></tr>
<tr><td colspan="6">#2-3-4
.0018"-.0020"</td><td colspan="7">#3-4
.0009"-.0025"</td></tr>
<tr><td colspan="6">#5
.0010"-.0036"</td><td>#5
.0018"-
.0034"</td><td colspan="7">#5
.0013"-.0029"</td></tr>
<tr><td colspan="2">Service</td><td colspan="18">.004" (Max.)</td></tr>
<tr><td colspan="3">Crankshaft End Play</td><td colspan="4">.002"-.006"</td><td colspan="7">.003"-.011"</td><td colspan="7">.006"-.010"</td></tr>
<tr><td rowspan="5">Crank-</td><td colspan="2">Diameter</td><td colspan="10">1.999"-2.000"</td><td>2.099"-
2.100"</td><td colspan="7">2.199"-2.200"</td></tr>
<tr><td rowspan="2">Taper</td><td>Production</td><td colspan="18">.0003" (Max.)</td></tr>
<tr><td>Service</td><td colspan="18">.001" (Max.)</td></tr>
<tr><td rowspan="2">Out of Round</td><td>Production</td><td colspan="18">.002" (Max.)</td></tr>
<tr><td>Service</td><td colspan="18">.001" (Max.)</td></tr>
<tr><td colspan="2" rowspan="2">Rod Bearing Clearance</td><td>Production</td><td colspan="5">.0007"-.0027"</td><td colspan="13">.0007"-.0028"</td></tr>
<tr><td>Service</td><td colspan="18">.004" (Max.)</td></tr>
<tr><td colspan="3">Rod Side Clearance</td><td colspan="4">.0085"-.0135"</td><td colspan="7">.009"-.013"</td><td colspan="5">.015"-.021"</td><td colspan="2">.019"-.025"</td></tr>
<tr><td colspan="3">CAMSHAFT:</td><td colspan="18"></td></tr>
<tr><td colspan="2" rowspan="2">Lobe Lift ± .002"</td><td>Intake</td><td>.1712"</td><td colspan="2">.1896"</td><td>.2217"</td><td colspan="4">.260"</td><td colspan="2">.2981"</td><td>.260"</td><td colspan="5">.2714"</td><td>.3286"</td><td>.3057"</td></tr>
<tr><td>Exhaust</td><td>.1712"</td><td colspan="2">.1896"</td><td>.2217"</td><td colspan="4">.2733"</td><td colspan="2">.2981"</td><td>.2733"</td><td colspan="5">.2714"</td><td>.3412"</td><td>.3057"</td></tr>
<tr><td colspan="3">Journal Diameter</td><td colspan="10">1.8682"-1.8692"</td><td colspan="8">1.9482"-.1.9492</td></tr>
<tr><td colspan="3">Camshaft Runout</td><td colspan="18">.0015" (Max.)</td></tr>
</table>

<table>
<tr><td colspan="3">Displacement</td><td>153</td><td>194</td><td>230</td><td>250</td><td>283</td><td colspan="5">327</td><td>350</td><td colspan="2">396</td><td colspan="5">427</td></tr>
<tr><td colspan="3">Horsepower</td><td>90</td><td>120</td><td>140</td><td>155</td><td>195</td><td>210</td><td>275</td><td>300</td><td>325</td><td>350</td><td>295</td><td>325</td><td>350</td><td>385</td><td>390</td><td>400</td><td>425</td><td>435</td></tr>
<tr><td colspan="3">VALVE SYSTEM:</td><td colspan="18"></td></tr>
<tr><td colspan="3">Lifter</td><td colspan="16">Hydraulic</td><td colspan="2">Mechanical</td></tr>
<tr><td colspan="3">Rocker Arm Ratio</td><td colspan="4">1.75:1</td><td colspan="7">1.50:1</td><td colspan="7">1.70:1</td></tr>
<tr><td colspan="2" rowspan="2">Valve Lash</td><td>Intake</td><td colspan="16">One Turn Down From Zero Lash</td><td>.022"*</td><td>.024"*</td></tr>
<tr><td>Exhaust</td><td colspan="16">One Turn Down From Zero Lash</td><td>.024"*</td><td>.028"*</td></tr>
<tr><td colspan="3">Face Angle (Int. & Exh.)</td><td colspan="18">45°</td></tr>
<tr><td colspan="3">Seat Angle (Int. & Exh.)</td><td colspan="18">46°**</td></tr>
<tr><td colspan="3">Seat Runout (Int. & Exh.)</td><td colspan="18">.002" (Max.)</td></tr>
<tr><td colspan="2" rowspan="2">Seat Width</td><td>Intake</td><td colspan="18">1/32" - 1/16"</td></tr>
<tr><td>Exhaust</td><td colspan="18">1/16" - 3/32"</td></tr>
<tr><td rowspan="3">Stem Clearance</td><td rowspan="2">Production</td><td>Int.</td><td colspan="11">.0010"-.0027"</td><td colspan="7">.0010"-.0025"</td></tr>
<tr><td>Exh.</td><td colspan="4">.0015"-.0032"</td><td colspan="7">.0010"-.0027"</td><td colspan="7">.0012"-.0027"</td></tr>
<tr><td colspan="2">Service</td><td colspan="18">Hi Limit Production + .001" Intake - .002" Exhaust</td></tr>
<tr><td rowspan="4">Valve Spring (Outer)</td><td colspan="2">Free Length</td><td>2.08"</td><td colspan="2">1.92"</td><td>1.90"</td><td colspan="7">2.03"</td><td>2.11"</td><td colspan="4">2.09"</td><td>2.21"</td><td>2.09"</td></tr>
<tr><td rowspan="2">Pressure lbs. @ in.</td><td>Closed</td><td>78-86 @ 1.66"</td><td colspan="3">54-64 @ 1.66"</td><td colspan="7">N.A.</td><td>84-96 @ 1.88"</td><td colspan="4">94-106 @ 1.88"</td><td>69-81 @ 1.88"</td><td>94-106 @ 1.88"</td></tr>
<tr><td>Open</td><td>170-180 @ 1.26"</td><td colspan="2">170-184 @ 1.33"</td><td>180-192 @ 1.27"</td><td colspan="7">N.A.</td><td>210-230 @ 1.46"</td><td colspan="4">303-327 @ 1.38"</td><td>181-205 @ 1.32"</td><td>303-327 @ 1.38"</td></tr>
<tr><td colspan="2">Installed Height ± 1/32"</td><td colspan="4">1 21/32</td><td colspan="7">1 5/32</td><td colspan="7">1 7/8</td></tr>
<tr><td rowspan="4">Valve Spring (Inner)</td><td colspan="2">Free Length</td><td colspan="16">N.A.</td><td>2.12"</td><td>N.A.</td></tr>
<tr><td rowspan="2">Pressure lbs. @ in.</td><td>Closed</td><td colspan="16">N.A.</td><td>37-45 @ 1.78"</td><td>N.A.</td></tr>
<tr><td>Open</td><td colspan="16">N.A.</td><td>92-110 @ 1.22"</td><td>N.A.</td></tr>
<tr><td colspan="2">Installed Height ± 1/32"</td><td></td><td colspan="15">N.A.</td><td>1 3/4</td><td>N.A.</td></tr>
<tr><td rowspan="2">Damper</td><td colspan="2">Free Length</td><td>1.94"</td><td colspan="3">N.A.</td><td colspan="7">1.94"</td><td colspan="5">1.94"-2.00"</td><td>2.07"-1.95"</td><td>1.94"-2.00"</td></tr>
<tr><td colspan="2">Approx. # of Coils</td><td>4</td><td colspan="3">N.A.</td><td colspan="7">4</td><td colspan="5">3 3/4</td><td>4 1/3</td><td>3 3/4</td></tr>
</table>

*Engine at operating temperature and running.

**Aluminum Heads 45°

	CARTER							HOLLEY													
Carburetor	One Barrel YF							Four Barrel 4150			Four Barrel 4160								Two Barrel 2100		
					①	①	①			①					①		①		Prim.	Sec.	Prim.
Engine Displacement (Horsepower)	153		250		194 230 250	230 250	194	327 (325)	427 (425)	327 (325)	396 (350)		327 (300) 327 (350)	427 (390)	396 (350)		327 (300) 327 (350)	427 (390)	427 (400) 427 (435)	427 (400) 427 (435)	427 (400)
Transmission	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Syn.	Syn.	Syn.	Syn.	Auto.	Syn.	All	Syn.	Auto.	Syn.	All	All	Syn.	All	Auto.
Part Number (Mfg. Number)	3905972 (4374S)	3905971 (4373S)	3905974 (4378S)	3905973 (4377S)	3905976 (4368S)	3905975 (4367S)	3909405 (4387S)	3903389 (R3806A)	3886091 (R3418A)	3903391 (3807)	3908956 (R3836A)	3908957 (R3837A)	3906631 (R3810A)	3906633 (R3811A)	3908958 (R3838A)	3908959 (R3839A)	3906635 (R3814A)	3906637 (R3815A)	3902355 (R3660A)	3902353 (R3659A)	3909872 (R3888A)
Float Level — Mechanical — Primary	7/32"							.170"	.350"	.170"									.350"		
Float Level — Mechanical — Secondary	—							.300"	.450"	.300"											
Float Level — Final	—							Use Sight Plug			—								Use Sight Plug		
Float Drip	1-3/16"							—													
Accelerator Pump	—							.015"													
Idle Vent			.065"					.065"											—		
Fast Idle — Mechanical	—							.025"			.035"								.025"		
Fast Idle — Final	—							2200 RPM					2000 RPM	2200 RPM			2000 RPM	2200 RPM			
Choke Vacuum Break			.220"	.240"	.220"	.240"	.240"	.190"	.350"	.190"	.175"		.190"	.175"			.175"	.175"	.250"	—	.250"
Choke Unloader	.250"							.265"	.350"	.265"									.275"	—	.275"
Thermostat Choke Rod	—		1/2 to 1 Rod Diameter Interference																		
Secondary Stop	—							1/2 Turn After Contact													
Main Metering Jet — Primary	.096	.096	.1015	.1015	.1023	.104	.104	#67	②	#67	#69	#70	#65	#65	#70	#71	#63	#67	#64	.076	#62
Main Metering Jet — Secondary								#74	③	#72	.073	.073	.076	.073	.073	.073	.076	.073	—		
Metering Rod	.0645 .047	.071 .049	.076 .051	.074 .048	.078 .051 .040	.078 .052 .045	.078 .052 .045	—													
Throttle Bore — Primary	1-11/16"							1-9/16	1-3/4	1-9/16									1-1/2	1-3/4	1-1/2
Throttle Bore — Secondary	—							1-9/16	1-3/4	1-9/16									—		

① With Air Injection Reactor System
② #74 - Choke Side, #78 - Throttle Lever Side
③ #82 - Choke Side, #80 - Throttle Lever Side

	ROCHESTER																					
Carburetor	One Barrel BV						Two Barrel 2GV								Quadra-Jet Four Barrel 4MV							
									②	②	①	①	①②	①②					①	①	①	①
Engine Displacement (Horsepower)	194	194	230	230	250	250	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	327 (275) 350 (295)	327 (275) 350 (295)	396 (325) 427 (385)	396 (325) 427 (385)	327 (275) 350 (295)	327 (275) 350 (295)	396 (325) 427 (385)	396 (325) 427 (385)
Transmission	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.
Part Number	7025108	7025105	7025000	7022503	7026028	7026027	7027110	7027101	7027112	7027103	7037110	7037101	7037112	7037103	7027202	7027203	7027200	7027201	7037202	7037203	7037200	7037201
Float Level	1-9/32"						3/4"								9/32"							
Float Drop	1-3/4"						1-3/4"															
Accelerator Pump	—						1-1/8"								13/32" Inner Hole							
Idle Vent	.050"						1"								3/8"							
Fast Idle — Mechanical	—						—								3 Turns After Contact							
Fast Idle — Running	—						—								2200 RPM		2000 RPM		2200 RPM		2200 RPM	
Carburetor Choke Rod	.90"	.100"	.90"	.100"	.90"	.100"	.060"								.100"							
Choke Vacuum Break	.140"	.160"	.140"	.160"	.140"	.160"	.110"	.120"	.110"	.120"	.110"	.130"	.110"	.130"	.160"	.200"	.160"	.240"	.160"	.200"	.160"	.240"
Choke Unloader	.350"						.215"								.260"	.300"			.260"	.300"		
Thermostat Choke Rod	1/2 to 1 Rod Diameter Interference														1/2 to 1 Rod Diameter Interference							
Air Valve Spring	—						—								7/8 Turn							
Air Valve Lockout	—						—								.015" (Auto. Trans. Only)							
Secondary Opening	—						—								75% Min. Contact (Syn. Trans. Only)							
Secondary Lockout	—						—								.010" (Syn. Trans. Only)							
Main Metering Jet — Primary	.059"	.060"	.058"	.059"	.058"	.060"	.052"	.054"	.052"	.054"	.052"	.054"	.052"	.054"	.071"							
Throttle Bore — Primary	1-9/16"						1-7/16"								1-3/8"							
Throttle Bore — Secondary	—						—								2-1/4"							
Air Valve Dashpot	—						—								.015"							

① With Air Injection Reactor System

② With Air Conditioning

ENGINE TORQUES

<table>
<tr><th rowspan="2">SIZE</th><th rowspan="2">USAGE</th><th colspan="4">IN LINE</th><th colspan="5">V-8</th></tr>
<tr><th>153</th><th>194</th><th>230</th><th>250</th><th>283</th><th>327</th><th>350</th><th>396</th><th>427</th></tr>
<tr><td>1/4-20</td><td>Camshaft Thrust Plate</td><td colspan="4">80 in. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Crankcase Front Cover</td><td colspan="9">80 in. lb.</td></tr>
<tr><td></td><td>Flywheel Housing Pans</td><td colspan="9">80 in. lb.</td></tr>
<tr><td></td><td>Oil Filter Bypass Valve</td><td colspan="4"></td><td colspan="5">80 in. lb.</td></tr>
<tr><td></td><td>Oil Pan (To Crankcase)</td><td colspan="7">80 in. lb.</td><td colspan="2"></td></tr>
<tr><td></td><td>Oil Pan (To Front Cover)</td><td colspan="4">55 in. lb.</td><td colspan="3"></td><td colspan="2">80 in. lb.</td></tr>
<tr><td></td><td>Oil Pump Cover</td><td colspan="4">70 in. lb.</td><td colspan="5">80 in. lb.</td></tr>
<tr><td></td><td>Rocker Arm Cover</td><td colspan="7">55 in. lb.</td><td colspan="2">50 in. lb.</td></tr>
<tr><td>11/32-24</td><td>Connecting Rod Cap</td><td colspan="7">35 ft. lb.</td><td colspan="2"></td></tr>
<tr><td>5/16-18</td><td>Camshaft Sprocket</td><td colspan="4"></td><td colspan="5">20 ft. lb.</td></tr>
<tr><td></td><td>Clutch Pressure Plate</td><td colspan="4">20 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Oil Pan (To Crankcase)</td><td colspan="4">125 in. lb.</td><td colspan="3">65 in. lb.</td><td colspan="2">135 in. lb.</td></tr>
<tr><td></td><td>Oil Pump</td><td colspan="4">115 in. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Push Rod Cover</td><td colspan="4">80 in. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Water Pump</td><td colspan="4">15 ft. lb.</td><td colspan="5"></td></tr>
<tr><td>3/8-16</td><td>Clutch Pressure Plate</td><td colspan="4"></td><td colspan="5">35 ft. lb.</td></tr>
<tr><td></td><td>Distributor Clamp</td><td colspan="9">10 ft. lb.</td></tr>
<tr><td></td><td>Flywheel Housing</td><td colspan="9">30 ft. lb.</td></tr>
<tr><td></td><td>Manifold (Exhaust)</td><td colspan="4"></td><td colspan="5">20 ft. lb.</td></tr>
<tr><td></td><td>Manifold (Exhaust to Inlet)</td><td colspan="4">25 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Manifold (Inlet)</td><td colspan="4"></td><td colspan="5">30 ft. lb.</td></tr>
<tr><td></td><td>Manifold Clamp (L6 Outer)</td><td colspan="4">20 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Manifold Clamp (All Others)</td><td colspan="4">30 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Thermostat Housing</td><td colspan="4">30 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Water Outlet</td><td colspan="9">20 ft. lb.</td></tr>
<tr><td></td><td>Water Pump</td><td colspan="4"></td><td colspan="5">30 ft. lb.</td></tr>
<tr><td>3/8-24</td><td>Connecting Rod Cap</td><td colspan="7"></td><td colspan="2">50 ft. lb.</td></tr>
<tr><td>7/16-14</td><td>Cylinder Head</td><td colspan="4"></td><td colspan="3">65 ft. lb.</td><td colspan="2">80 ft. lb.*</td></tr>
<tr><td></td><td>Main Bearing Cap</td><td colspan="4">65 ft. lb.</td><td colspan="3">80 ft. lb.</td><td colspan="2"></td></tr>
<tr><td></td><td>Oil Pump</td><td colspan="4"></td><td colspan="5">65 ft. lb.</td></tr>
<tr><td></td><td>Rocker Arm Stud</td><td colspan="7"></td><td colspan="2">50 ft. lb.*</td></tr>
<tr><td>7/16-20</td><td>Flywheel</td><td colspan="9">60 ft. lb.</td></tr>
<tr><td></td><td>Torsional Damper</td><td colspan="5"></td><td>60 ft. lb.</td><td colspan="3"></td></tr>
<tr><td>1/2-13</td><td>Cylinder Head</td><td colspan="4">95 ft. lb.</td><td colspan="5"></td></tr>
<tr><td></td><td>Main Bearing Cap (2 bolt)</td><td colspan="7"></td><td colspan="2">95 ft. lb.</td></tr>
<tr><td></td><td>Main Bearing Cap (4 bolt)</td><td colspan="8"></td><td>115 ft. lb.</td></tr>
<tr><td>1/2-14</td><td>Temperature Sending Unit</td><td colspan="9">20 ft. lb.</td></tr>
<tr><td>1/2-20</td><td>Torsional Damper</td><td colspan="7"></td><td colspan="2">85 ft. lb.</td></tr>
<tr><td></td><td>Oil Filter</td><td colspan="4">Hand Tight</td><td colspan="5">25 ft. lb.</td></tr>
<tr><td></td><td>Oil Pan Drain Plug</td><td colspan="9">20 ft. lb.</td></tr>
<tr><td>14mm</td><td>Spark Plug</td><td colspan="9">25 ft. lb.</td></tr>
</table>

*RPO L88, L89 - (Aluminum Cylinder Head) - Short Head Bolts 65 ft. lb. - Long Head Bolts 75 ft. lb. Rocker Arm Studs 60 ft. lbs.

ENGINE MOUNT TORQUE CHART

<table>
<tr><th rowspan="2">ATTACHING PARTS</th><th colspan="4">TORQUE IN FT. LBS;</th></tr>
<tr><th>Chevrolet
Chevelle</th><th>Chevy II</th><th>Camaro</th><th>Corvette</th></tr>
<tr><td>Mount Through Bolt</td><td>55</td><td>30</td><td>55</td><td>30</td></tr>
<tr><td>Mount-to-Engine</td><td>25 (V8)</td><td>45 (V8)</td><td>30 (V8)</td><td>25</td></tr>
<tr><td>Mount-to-Bracket</td><td>30 (L6)</td><td>30 (L6)
45 (L4)</td><td>30 (L6)</td><td>—</td></tr>
<tr><td>Bracket-to-Engine</td><td>25 (L6)</td><td>25 (L6)
65 (L4) L/H
45 (L4) R/H</td><td>25 (L6)</td><td>—</td></tr>
<tr><td>Bracket-to-Frame</td><td>25</td><td>25 (L6-V8)
20 (L4)</td><td>30</td><td>—</td></tr>
<tr><td>Mount-to-Transmission</td><td>40</td><td>30 (L6-V8)
45 (L4)</td><td>30</td><td>45</td></tr>
<tr><td>Crossmember-to-Mount</td><td>40</td><td>30</td><td>30</td><td>40</td></tr>
<tr><td>Crossmember-to-Frame</td><td>25</td><td>25</td><td>25</td><td>25</td></tr>
</table>

TUNE UP CHART

Engine	Type		In Line				V8													
Engine	Displacement		153	194	230	250	283	327					350	396		427				
Engine	Horsepower		90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435
Compression ①			130				150	160			150		160						150	
Spark Plug	Make & Number	Standard	AC 46N				AC 45	AC 44						AC 43N						
Spark Plug	Make & Number	Cold	AC 44N				AC 44	AC 43						AC C42N						
Spark Plug	Gap		.035																	
Distributor	Point Dwell		31° - 34°				28° - 32°													
Distributor	Point Gap		.016" (Used) .019" (New)																	
Distributor	Arm Spring Tension		19 - 23 Ounces													28 - 32 oz.			19 - 23 oz.	
Distributor	Condenser		.18 - .23 Microfarad																	
Distributor	Timing ② Exc. A.I.R.	Syn.	4°B	4°B	4°B	4°B	4°B	2°B	8°B	6°B	10°B	10°B	4°B	4°B	4°B	4°B	4°B	4°B	10°B	5°B
Distributor	Timing ② Exc. A.I.R.	Auto.	4°B	4°B	4°B	4°B	4°B	2°B	8°B	6°B			4°B	4°B	4°B	4°B	4°B	4°B		
Distributor	Timing ② A.I.R.	Syn.		2°B	4°B	4°B	0°B	2°B	6°B	6°B	10°B	10°B	4°B	4°B	4°B	4°B	4°B	4°B		5°B
Distributor	Timing ② A.I.R.	Auto.		4°B	4°B	4°B	4°B	2°B	6°B	4°A			4°B	4°B	4°B	4°B	4°B	4°B		
Drive Belts	Fan & P/S		50 lb. Min. 75 ± 5 lbs. (Used) 125 ± 5 lbs. (New) Using Strand Tension Gauge																	
Drive Belts	A/C Compressor		65 lb. Min. 95 ± 5 lbs. (Used) 140 ± 5 lbs. (New) Using Strand Tension Gauge																	
Drive Belts	A.I.R. Pump		35 lb. Min. 55 ± 5 lbs. (Used) 75 ± 5 lbs. (New) Using Strand Tension Gauge																	
Air Cleaner			③																	
Valve Lash	Inlet ④		Hydraulic - One Turn Down From Zero Lash																.022"	.024"
Valve Lash	Exhaust ④		Hydraulic - One Turn Down From Zero Lash																.024"	.028"
Idle RPM ⑤	Exc. A.I.R.	Syn.	500					500	500		700		500	500	550	550	550	550	1000	750
Idle RPM ⑤	Exc. A.I.R.	Auto.	500					600	500				500	500	550	550	550	550		
Idle RPM ⑤	A.I.R.	Syn.		700*	700*		700*				750		700	700	700	700	700	750		750
Idle RPM ⑤	A.I.R.	Auto.		600*	500*		600*						500	500	500	550	550	600		
Fuel Pump	Pressure		3 to 4-1/2				5 to 6-1/2													
Fuel Pump	Volume		One Pint in 30 - 45 Seconds																	
Crankcase Vent			Service at 12,000 Miles																	

① Psi at cranking speed, throttle wide open - Maximum variation, 20 lbs. between cylinders.
② At idle speed with vacuum advance line disconnected and plugged. A = A.T.D.C.; B = B.T.D.C.
③ Paper Element - Service at 12,000 miles initially - Check every 6,000 miles thereafter, until replaced.
Polyurethane - Service every 12,000 miles.
Oil Bath - Change oil at regular engine oil change intervals.
④ Mechanical - Set with engine at operating temperature and running.
⑤ Automatic Transmission - Set idle with transmission in drive.
Air Conditioned Vehicles - Set idle with air conditioning turned "ON" except on specifications indicated by *.

ENGINE ELECTRICAL

SECTION 6Y

BATTERY

Battery Model	1980032*	1980030*	1980036*
Application	153L-4, 194, 230, 250L-6 & 283 V-8	327, 350, 396 & 427 V-8	396 & 427 V-8 w/AC & M-40 Trans.
Ground	Neg.	Neg.	Neg.
Plates	54	66	66
Cranking Power @ 0°F. (Watts)	2300	2900	3150

*65° Side Recess and One Piece Cover Construction

GENERATOR

Generator Model	1100695	1100693	1100696	1100742	1100750	1117754	1117777
Application	Chevy II Exc. V-8, Sta. Wgn. or AC	Chevy II w/V-8, Camaro, Chevelle, Chevrolet and Corvette w/AC	Chevy II w/AC & RPO K-66	Chevrolet w/AC & Turbo-Hydramatic	All A/C except w/RPO M-40 and Chevy II	Optional	Optional
Field Amp. Draw	2.2-2.6	2.2-2.6	2.2-2.6	2.8-3.2	2.2-2.6	3.7-4.4	4.14-4.62
Hot Output — Amps.	32	37	42	63	61	62	62
Cold Output — Volts	14	14	14	14	14	14	14

REGULATOR

Regulator Model	1119515	1119519	1116378
Application	Base All Except with Generator 1117765 and 1100742	Base with Generator 1100742	Base with Generator 1117754
Field Relay: Air Gap	.015	.015	.011-.018
Point Opening	.030	.030	.020-.030
Closing Voltage	1.5-3.2	1.5-3.2	2.5-3.5
Voltage Regulator: Air Gap	.067	.067	–
Point Opening	.014	.014	–
Voltage Setting	13.8-14.8 @ 85°F.	13.8-14.8 @ 85°F.	13.7-14.4 @ 85°F. "O" Position of Adjusting Screw

STARTING MOTOR

Starting Motor Model		1107399	1107400	1107496	1107320	1107372	1107365	1107388
Application		153L-4 194L-6 & 230L-6 w/Manual Trans. 230L-6 w/Auto. Trans. 250L-6 All Trans.	153L-4 & 194L-6 w/Auto. Trans.	283 Cu. In. V-8 All Trans.	327 Cu. In. V-8 Auto. Trans.	250L-6 Hvy. Duty & Taxi Chevrolet	396 & 427 Cu. In. V-8 All Trans. Chevelle, Chevrolet & Corvette w/14" Ring Gear	283 & 327 V-8 w/H.D. Clutch, 350 Cu. In. V-8
Brush Spring Tension, oz.		35	35	35	35	35	35	35
Free Speed	Volts	10.6	10.6	10.6	10.6	10.6	10.6	10.6
	Amperes	49-87*	49-87*	49-87*	65-100*	55-95*	70-99*	65-100*
	RPM	6200-10700	6200-10700	6200-10700	3600-5100	3800-6000	7800-12000	3600-5100
Resistance Test Armature Locked	Volts	4.2	4.2	4.2	3.5	3.5	3.0	3.5
	Amperes	290-425*	290-425*	290-425*	300-360*	300-360	410-480*	300-360

*Includes Solenoid

DISTRIBUTORS

Engine Description and Availability	Ignition Distributor (Product Part No.)	Centrifugal Advance (Crank Degrees @ Engine RPM)	Vacuum Advance (In Crank Degrees)	Point Dwell Setting	Ignition Timing BTDC at Engine Idle	Engine Idle Setting (RPM) Trans.	Prod.	A.I.R. (RPO K-19)	Original Equipment Spark Plug
4 Cyl.-153 Cu. In. Chevy II	1110292	0° @ 600 14° @ 1500 28° @ 3700	0° @ 6" Hg. 23° @ 12" Hg.	31-34°	4°	Manual Auto.	500 500	— —	AC-46N
6 Cyl.-194 Cu. In. Chevy II, with or without RPO K-19	1110388	0° @ 900 20° @ 2000 28° @ 3800	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4° (2° w/K-19 & Man. Tran.)	Manual Auto.	500 500	700 600	AC-46N
6 Cyl.-230 Cu. In. Chevelle & Camaro	1110362	0° @ 900 10° @ 1200 30° @ 3200	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	— —	AC-46N
6 Cyl.-230 Cu. In. Chevelle & Camaro With RPO K-19	1110387	0° @ 950 17° @ 2100 26° @ 4000	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	700 500	AC-46N
6 Cyl.-250 Cu. In. Chevrolet	1110351	0° @ 900 15° @ 1600 23° @ 2300 28° @ 2800	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	700 500	AC-46N
8 Cyl.-283 Cu. In., 195 H.P. Chevy II, Chevelle, Chevrolet Exc. w/Man. Trans. & RPO K-19	1111150	0° @ 900 10° @ 1500 15° @ 2000 28° @ 4200	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	4°	Manual Auto.	500 500	— 600	AC-45
8 Cyl.-283 Cu. In., 195 H.P. Chevy II, Chevelle, Chevrolet, w/Man. Trans. & RPO K-19	1111256	0° @ 900 15.5° @ 1600 30° @ 4100	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	TDC	Manual	—	700	AC-45
8 Cyl.-327 Cu. In. 2 Bbl, (210 H.P.) Camaro	1111101	0° @ 900 32° @ 3950	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	2°	Manual Auto.	500 600	700 600	AC-44
8 Cyl.-327 Cu. In. 4 Bbl. (275 H.P.) Chevy II, Chevelle, Chevrolet, & Camaro Exc. w/RPO K-19	1111249	0° @ 900 11° @ 1500 26° @ 4100	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	8°	Manual Auto.	500 500	— —	AC-44
8 Cyl.-327 Cu. In. 4 Bbl. (275 H.P.) Chevy II, Camaro, Chevelle & Chevrolet w/RPO K-19	1111150	0° @ 900 10° @ 1500 15° @ 2000 28° @ 4200	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	6°	Manual Auto.	— —	700 600	AC-44
8 Cyl.-327 Cu. In. (300 H.P.) Corvette Incl. RPO K-19 w/Man. Trans.	1111194 (Tach. Drive)	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	6°	Manual Auto.	500 500	700	AC-44
8 Cyl.-327 Cu. In. Corvette (300 H.P.) Auto. Trans. w/RPO K-19	1111117	0° @ 900 19° @ 1200 25° @ 1500 40° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	4° ATDC	Auto.	—	600	AC-44
8 Cyl.-327 Cu. In. Chevelle (325 H.P.)	1111195	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	10°	Manual	700	750	AC-44
8 Cyl.-327 Cu. In. Corvette (350 H.P.)	1111196 Tach. Drive	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 4" Hg. 16° @ 7" Hg.	28-32°	10°	Manual	700	750	AC-44
8 Cyl.-350 Cu. In. Camaro	1111168	0° @ 900 9° @ 1300 15° @ 1700 26° @ 4700	0° @ 10" Hg. 15° @ 17" Hg.	28-32°	4°	Manual Auto.	500 500	700 500	AC-44
8 Cyl.-396 Cu. In. Chevrolet, Chevelle, (325 H.P.) RPO L-34 & RPO L-36 w/RPO K-19	1111169	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	4°	Manual Auto. (L-35) Auto. (L-35 & L-36)	500 500	700 500 550	AC-43N
8 Cyl.-396 Cu. In. Chevelle (350 H.P.) 8 Cyl.-427 Cu. In. Chevrolet (385 H.P.) Exc. RPO K-19	1111170	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto.	550 550	— —	AC-43N
8 Cyl.-427 Cu. In. Corvette (390 H.P. RPO L-36, 400 H.P. 3 x 2 RPO L-68)	1111247	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto. Manual Auto.	550 550 — —	700 (L-36) 550 (L-36) 750 (L-68) 600 (L-68)	AC-43N
8 Cyl.-427 Cu. In. RPO L-71 (435 H.P.)	1111258 Tran. Ign. w/Tach. Drive	0° @ 900 30° @ 3800	0° @ 8" Hg. 15° @ 15.5" Hg.	—	5°	Manual	750	750	AC-43N
8 Cyl.-327 Cu. In. Corvette (350 H.P.)	1111157 Tran. Ign. Tach. Drive	0° @ 900 17° @ 1600 28° @ 4600	0° @ 4" Hg. 16° @ 7" Hg.	—	10°	Manual	700	700	AC-44
8 Cyl.-427 Cu. In. RPO L-36 & L-68	1111248 Tach. Drive	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto. Manual Auto.	550 550 — —	700 (L-36) 550 (L-36) 750 (L-68) 600 (L-68)	AC-43N

COIL

Ignition Coil / Application		L-4 & L-6	V-8 (Non-Transistor)	V-8 (Transistor)
Primary Resistance-Ohms		1.45-1.63	1.24-1.46	.38-.51
Secondary Resistance-Ohms		5600-6900	6500-9500	8200-12,400
Ignition Resistor:	Type		Fixed (In Wiring Harness)	
	Ohms	1.8	1.8	.43 & .68

TRANSMISSION AND CLUTCH

SECTION 7

THREE SPEED (SAGINAW)

Clutch Gear Retainer to Case Bolts	22 ft. lbs.
Side Cover to Case Bolts	22 ft. lbs.
Extension to Case Bolts (except overdrive)	45 ft. lbs.
Overdrive Attaching Lower Left Hand Bolt (Marked X)	30 ft. lbs.
Shift Lever to Shifter Shaft Bolts	20 ft. lbs.
Lubrication Filler Plug	15 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount and Mount to Extension Bolts	40 ft. lbs.

THREE SPEED (WARNER)

Clutch Gear Retainer to Case Bolts	20 ft. lbs.
Side Cover to Case Bolts	20 ft. lbs.
Extension to Case Bolts	40 ft. lbs.
Shift Lever to Shifter Shaft Nut	25 ft. lbs.
Lubrication Filler and Drain Plugs	20 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount Bolts	40 ft. lbs.

FOUR SPEED (SAGINAW)

Clutch Gear Retainer to Case Bolts	22 ft. lbs.
Side Cover to Case Bolts	22 ft. lbs.
Extension to Case Bolts (except overdrive)	45 ft. lbs.
Shift Lever to Shifter Shaft Bolts	20 ft. lbs.
Lubrication Filler Plug	15 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount and Mount to Extension Bolts	40 ft. lbs.

FOUR SPEED (MUNCIE)

Clutch Gear Bearing Retainer to Case Bolts	25 ft. lbs.
Cover to Case Bolts	20 ft. lbs.
Extension and Retainer to Case Bolts-(Upper)	20 ft. lbs.
-(Lower)	30 ft. lbs.
Lubrication Filler Plug	30 ft. lbs.
Shift Lever to Shifter Shaft Nut	20 ft. lbs.

POWERGLIDE

Transmission Case to Engine	35 ft. lbs.
Transmission Oil Pan to Case	8 ft. lbs.
Transmission Extension to Case	25 ft. lbs.
Speedometer Driven Gear Fitting Retainer	4 ft. lbs.
Servo Cover to Transmission Case Bolts	20 ft. lbs.
Front Pump to Transmission Case Bolts	15 ft. lbs.
Front Pump Cover to Body Attaching Bolts	20 ft. lbs.
Pinion Shaft Lock Plate Attaching Screws	2-1/2 ft. lbs.
Governor Body to Hub Attaching Bolts	7 ft. lbs.
Governor Hub Drive Screw	8 ft. lbs.
Rear Pump to Transmission Case Bolts	10 ft. lbs.
Valve Body to Transmission Case Bolts	15 ft. lbs.
Valve Body Suction Screen Attaching Screws	2-1/2 ft. lbs.
Upper Valve Body Plate Bolts	5 ft. lbs.
Lower to Upper Valve Body Attaching Bolts	15 ft. lbs.
Inner Control Lever Allen Head Screw	2-1/2 ft. lbs.
Parking Lock Pawl Reaction Bracket Attaching Bolts	10 ft. lbs.
Oil Cooler Plugs at Transmission Case	5 ft. lbs.
Pressure Test Point Plugs	5 ft. lbs.
Low Band Adjustment Locknut	15 ft. lbs.
Converter to Engine Bolts	35 ft. lbs.
Under Pan to Transmission Case	7-1/2 ft. lbs.
Oil Cooler Pipe Connectors to Transmission Case or Radiator	10 ft. lbs.
Oil Cooler Pipe to Connectors	10 ft. lbs.
Vacuum Modulator to Transmission Case	15 ft. lbs.
Oil Pan Drain Plug	20 ft. lbs.
Converter Drain Plug (Taxies)	20 ft. lbs.
Parking Brake Lock & Range Selector Inner Lever Allen Head Screw	2-1/2 ft. lbs.

TURBO-HYDRAMATIC

Pump Cover Bolts	18 lb. ft.
Parking Pawl Bracket Bolts	18 lb. ft.
Case Center Support Bolt	23 lb. ft.
Pump to Case Attaching Bolts	18 lb. ft.
Extension Housing to Case Attaching Bolts	23 lb. ft.
Rear Servo Cover Bolts	18 lb. ft.
Detent Solenoid Bolts	7 lb. ft.
Control Valve Body Bolts	8 lb. ft.
Bottom Pan Attaching Screws	12 lb. ft.
Modulator Retainer Bolt	18 lb. ft.
Governor Cover Bolts	18 lb. ft.
Manual Lever to Manual Shaft Nut	8 lb. ft.
Manual Shaft to Inside Detent Lever	18 lb. ft.
Linkage Swivel Clamp Nut	43 lb. ft.
Converter Dust Shield Screws	93 lb. ft.
Transmission to Engine Mounting Bolts	28 lb. ft.
Converter to Flywheel Bolts	33 lb. ft.
Rear Mount to Transmission Bolts	40 lb. ft.
Rear Mount to Crossmember Bolt	40 lb. ft.
Crossmember Mounting Bolts	25 lb. ft.
Oil Cooler Line	113 lb. In.
Line Pressure Take-Off Plug	13 lb. ft.

STEERING

SECTION 9

STANDARD STEERING

<table>
<tr><td>Item</td><td colspan="2"></td><td>Chevrolet</td><td>Chevelle</td><td>Chevy II</td><td>Camaro</td><td>Corvette</td></tr>
<tr><td rowspan="3">Steering Gear</td><td colspan="2">Type</td><td colspan="5">Recirculating Ball</td></tr>
<tr><td rowspan="2">Ratio</td><td>Gear</td><td>24:1</td><td>24:1</td><td>20:1</td><td rowspan="2">(*)</td><td>16:1</td></tr>
<tr><td>Overall</td><td>31:4.1</td><td>28:1</td><td>25.4:1</td><td>Road 20.2:1
Fast 17.6:1</td></tr>
<tr><td rowspan="3">Linkage</td><td colspan="2">Type</td><td colspan="5">Parallel Relay Rod</td></tr>
<tr><td colspan="2">Location</td><td>Rear</td><td>Front</td><td>Rear</td><td>Rear</td><td>Rear</td></tr>
<tr><td colspan="2"># Tie Rods</td><td colspan="5">2</td></tr>
</table>

(*)

Model and/or Option	Gear Ratio	Overall Ratio
L6- All, 327 V-8 Sed., A/C	28:1	28:1
327 V-8 Cpe	24:1	24:1
350 V-8 All	24:1	24:1
Special Steering	24:1	21.6:1

POWER STEERING

<table>
<tr><td rowspan="2">Pump</td><td colspan="2">Type</td><td colspan="4">Vane Impeller</td><td></td></tr>
<tr><td colspan="2">Pressure</td><td>1000-1100</td><td>870-1000
900-1000</td><td>870-1000</td><td>900-1000</td><td>870-1000</td></tr>
<tr><td rowspan="3">Steering Gear</td><td colspan="2">Type</td><td colspan="2">Integral Recirculating Ball</td><td rowspan="3">Recirculating Ball</td><td>Integ. Recirc. Ball</td><td rowspan="2">Recirculating Ball</td></tr>
<tr><td rowspan="2">Ratio</td><td>Gear</td><td>17.5:1</td><td>17.5:1</td><td>17.5:1</td></tr>
<tr><td>Overall</td><td>21.3:1</td><td>20.4:1</td><td>17.5:1</td><td>17.6:1 Only</td></tr>
</table>

ADJUSTMENT SPECIFICATIONS— STANDARD STEERING

Adjustment	Torque to Turn Worm Shaft
Worm Bearing Preload	5 - 8 Lb. In.
Sector Lash Adjustment	4 - 10 Lb. In. in excess of above
Total Steering Gear Preload	16 Lb. In. Maximum

ADJUSTMENT SPECIFICATIONS—POWER STEERING

<table>
<tr><td></td><td colspan="2">Chevrolet, Chevelle, Camaro</td></tr>
<tr><td>Ball Drag</td><td colspan="2">3 Lb. In. Max.</td></tr>
<tr><td>Thrust Bearing Preload</td><td colspan="2">1/2 - 2 Lb. In. in excess of valve assy. drag</td></tr>
<tr><td>Over Center Preload</td><td colspan="2">3 - 6 Lb. In. in excess of above</td></tr>
<tr><td>Total Steering Gear Preload</td><td colspan="2">14 Lb. In. Max.</td></tr>
<tr><td></td><td>Chevy II</td><td>Corvette</td></tr>
<tr><td>Worm Bearing Preload</td><td>1-1/2 - 5-1/2 Lb. In.</td><td rowspan="3">Same as Standard Steering</td></tr>
<tr><td>Sector Lash Adjustment</td><td>3 - 7 Lb. In. in excess of above</td></tr>
<tr><td>Total Steering Gear Preload</td><td>11 Lb. In. Max.</td></tr>
</table>

TORQUE CHART

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Steering Gear Mounting Bolts	70 lb. ft.	70 lb. ft.	30 lb. ft.	68 lb. ft.	30 lb. ft.
Pitman Shaft Nut	140 lb. ft.				
Steering Wheel Nut	35 lb. ft.				
Steering Wheel Nut-Tilt	1 lb. in.	1 lb. in.	—	1 lb. in.	—
Steering Coupling Nuts	18 lb. ft.		—	18 lb. ft.	
Steering Coupling Clamp Bolts	30 lb. ft.		—	30 lb. ft.	—
Tie Rod End Nut	35 lb. ft.				
Tie Rod Clamp Nut	130 lb. in.				
Idler Arm Mounting Nut	40 lb. ft.				
Steering Wheel to Hub (Wood)	25 lb. in.		—	25 lb. in.	
Steering Damper Bracket Frame Nut	—	—	—	—	18 lb. ft.
Steering Damper Bracket Relay End Nut	—	—	—	—	25 lb. ft.
Steering Damper to Bracket Nut	—	—	—	—	30 lb. ft.
Steering Damper Bracket Relay Rod Bolt	—	—	—	—	25 lb. ft.
Power Steering Pump Pulley	60 lb. ft.				
Power Steering Mounting Bolt	20 lb. ft.				
Power Steering Mounting Nut	25 lb. ft.				
Power Cylinder to Relay Rod Nut	—	—	45 lb. ft.	—	45 lb. ft.
Power Cylinder to Frame Bracket	—	—	30 lb. ft.	—	25 lb. ft.
Control Valve to Pitman Arm	—	—	45 lb. ft.	—	45 lb. ft.
Control Valve Clamp Bolt	—	—	20 lb. ft.	—	20 lb. ft.
Steering Shaft to Gear Clamp Nut	—	—	35 lb. ft.	—	—

WHEELS AND TIRES

SECTION 10

CHEVY II

Tire Usage and Recommended Tire Inflation Pressures
Pounds per Square Inch (PSI) Cool

Models	Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated		Optional Inflation Pressure for Reduced Load	
All Models Except Station Wagon	4 Ply Rating 2 Ply	6.95 x 14	1 to 6 passengers +200 lbs. luggage (1,100 lbs. load)		1 to 5 passengers (750 lbs. load)	
			Front 26**	Rear 26**	Front 24	Rear 24
Station Wagon	8 Ply Rating 4 Ply	6.95 x 14	1 to 6 passengers +300 lbs. cargo (1,200 lbs. load)		1 to 5 passengers (750 lbs. load)	
			Front 24	Rear 40	Front 22	Rear 28

*Optional tires are not available.
**Add 2 psi when vehicle is equipped with V-8 engine.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Station Wagon loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,100# load (1,200# load for station wagons) specified above.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CHEVELLE

Tire Usage

Engine and Body Styles	Standard 14 Inch With A/C*	Standard 14 Inch Without A/C*	Optional 14 Inch With A/C*	Optional 14 Inch Without A/C*
L-6, All styles except Station Wagon; 283 V-8, All styles except Station Wagon, Spt. Sedan and Convertible	7.35	7.35	7.75	7.75
283 V-8, Sport Sedan and Convertible; 327 V-8 Std., except Sport Sedan and Convertible	7.75	7.35	—	7.75
327 V-8 Std., Sport Sedan and Convertible; 327 V-8 H.P., All styles	7.75	7.75	—	—
396 V-8, Pick-Up Delivery	7.75	7.75	—	—
396 V-8, Super Sport Convertible and 2-Door Coupe	F70	F70	—	—
All engines, Station Wagon	7.75	7.75	7.75 (8-Ply Rating, 4-Ply)	7.75 (8-Ply Rating, 4-Ply)

*A/C (Air Conditioning)
All tires listed are 4-ply rating, 2-ply unless otherwise specified.

CHEVELLE (CONT'D)

Recommended Tire Inflation Pressures
Pounds per Square Inch (Cool)

Models	Tire Ply	Standard Inflation for all Loads including Full Rated		Optional Inflation for Reduced Loads	
All Models Except Those Shown Below		1 to 6 passengers +200 lbs. luggage (1,100 lbs. load)		1 to 5 passengers (750 lbs. load)	
		Front	Rear	Front	Rear
	4 Ply Rating—2 Ply	26	26	24	22
Station Wagons		1 to 6 passengers (2 Seat) + 300 lbs. cargo (1,200 lbs. load)		1 to 5 passengers (750 lbs. load)	
		Front	Rear	Front	Rear
	4 Ply Rating—2 Ply	22	30	22	26
	8 Ply Rating—4 Ply	22	30	22	26
El Camino		1 to 3 passengers +800 lbs. cargo (1,250 lbs. load)		1 to 3 passengers + 300 lbs. cargo (750 lbs. load)	
		Front	Rear	Front	Rear
	4 Ply Rating—2 Ply	24	30	24	24

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.

   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Station Wagon and El Camino loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,100# load (1,200# for Station Wagons or 1,250# for El Camino) specified in the Tire Inflation Pressure Table.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CAMARO

Tire Usage and Recommended Tire Inflation Pressures
Pounds per Square Inch (PSI) Cool

Models		Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated	
				Front	Rear
All Except Super Sport	1 to 5 passengers +200 lbs. luggage (950 lbs. load)	4 Ply Rating— 2 Ply*	7.35 x 14	24**	24**
Super Sport			D70—14	26	26

*Optional tires not available.
**Add 2 psi. when vehicle is equipped with 327 V-8 and air conditioning.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Vehicles with luggage racks do not have a load limit greater than the 950 lbs. load specified above.
5. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CORVETTE

Tire Usage and Recommended Tire Inflation Pressures
Pounds per Square Inch (PSI) Cool

Models		Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated	
				Front	Rear
All Models	1 to 2 passengers +150 lbs. luggage (450 lbs. load)	4 Ply Rating— 2 Ply*	7.75-15*	24	24

*Optional tires are not available.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Vehicles with luggage racks do not have a load limit greater than the 450# load specified above.
5. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CHEVROLET

Tire Usage

Engine and Body Styles	STANDARD TIRE		OPTIONAL TIRE
	14 Inch	15 Inch (With Disc Brakes)	14 Inch
All Engines, All Styles except Those Shown Below	8.25	8.15	8.25 (8-Ply Rating, 4-Ply)
427 V-8 Super Sport 2-Door Coupe and Convertible (Z-24 Option)	8.25	G70-15	—
All Engines, Station Wagon	8.55	8.45 (8-Ply Rating, 4-Ply)	8.55 (8-Ply Rating, 4-Ply)

All tires listed are 4-Ply Rating, 2-Ply except where indicated.

Recommended Tire Inflation Pressures—Pounds per Square Inch (Cool)

Models	Tire Ply	Standard Inflation for All Loads Including Full Rated		Optional Inflation for Reduced Loads	
All Models Except Station Wagons		1 to 6 Passengers +200 lbs. luggage (1100 lbs. load)		1 to 5 passengers (750 lbs. load)	
		Front	Rear	Front	Rear
	4 Ply Rating—2 Ply	24	28	24	24
	8 Ply Rating—4 Ply	24	28	24	24
Station Wagons (Without Disc Brakes—14" Wheels		1 to 6 passengers (2 Seat) + 300 lbs. cargo or 1 to 8 pass. (3 Seat) (1200 lbs. load)		1 to 5 passengers (750 lbs. load)	
		Front	Rear	Front	Rear
	4 Ply Raging—2 Ply	22	32	22	26
	8 Ply Rating—4 Ply	22	32	22	26
Station Wagons (With Disc Brakes—15" Wheels)		1 to 6 passengers (2 Seat) + 300 lbs. cargo or 1 to 8 pass. (3 Seat) (1200 lbs. load)		1 to 5 passengers (750 lbs. load)	
		Front	Rear	Front	Rear
	8 Ply Rating—4 Ply	22	34	22	26

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.

   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Station Wagon loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,000# loads (1,200# for Station Wagons) specified in the Tire Inflation Pressure Table.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

BODY AND CHASSIS ELECTRICAL

SECTION 12

LAMP USAGE	CANDLE POWER	BULB NUMBER
Headlamp Unit		
Chevrolet, Chevelle & Corvette		
Outer - High Beam	37 1/2 Watts	4002
Outer - Low Beam	55 Watts	4002
Inner - High Beam only	37 1/2 Watts	4001
Chevy II		
High Beam	55 Watts	6012
Low Beam	45 Watts	
Parking Lamp and Directional Signal		
All Exc. Camaro	4-32	1157
Camaro	4-32	1034-A
Tail, Stop and Directional Signal (Exc. Bel Air)	4-32	1157
Backing Lamp	32	1156
Instrument Illumination Lamps		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Corvette	3	1816
Temperature Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Oil Pressure Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Generator Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Hi-Beam Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Corvette	1	1445
Directional Indicator		
Chevrolet & Camaro	2	194
Chevelle & Chevy II	2	1895
Corvette	3	1816
Cigarette Lighter Lamp		
Corvette	1	1445
Ignition Lock Lamp		
Chevrolet	Special Fiber Optic Wiring	
Corvette	1	1445
Heater or A/C Control Panel		
Chevrolet, Chevelle, Chevy II & Camaro	2	1895
Corvette	3	1893
Glove Box Lamps		
Chevrolet, Chevelle, Chevy II & Camaro	2	1895
Corvette	3	1893
Dome and Courtesy Lamps		
Cartridge Type (All)	12	211
Bayonet Type (Exc. Corvette)	6	89, 212
Corvette	6	90
Convertible	6	631

LAMP USAGE (Cont'd.)	CANDLE POWER	BULB NUMBER
Seat Separator-Compartment Lamp	1	1445
-Courtesy Lamp	6	212
License Plate Lamp	4	67
Radio Dial Lamp		
Chevrolet, Chevelle, Chevy II & Camaro	2	1893
Corvette	3	1816
Brake Alarm Lamp		
Chevrolet & Camaro	2	194
Chevelle & Chevy II	2	1895
Corvette	3	1816
Headlamp Motor Warning Lamp (Flashing)	2	257
Clock Lamp (Corvette)	3	1816
Luggage Compartment Lamp	15	1003
Underhood	15	93

FUSES AND CIRCUIT BREAKER

A circuit breaker in the light control switch protects the headlamp circuit, thus eliminating one fuse. A separate circuit breaker protects the power window, seat and top circuits. On Corvettes the headlamp motor circuit is also protected by a separate circuit breaker. 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 instrument panel are:

Wiper (Chevrolet, Chevelle, and "F" Car) . . . . 3AF/AGC 20 Amp.
Back-up Lamp and Gauges . . . . 3AG/AGC 10 Amp.
Heater - Air Conditioning . . . . 3AG/AGC 25 Amp.
Radio . . . . 3AG/AGC 10 Amp.
Radio - Wiper (Chevy II and Corvette) . . . . 3AG/AGC 20 Amp.
Instrument Lamps . . . . 3AG/AGC 4 Amp.
Stop and Tail Lamps . . . . 3AG/AGC 20 Amp.
Clock, Lighter, Courtesy Lamps, and Hazard Warning . . . . 3AG/AGC 20 Amp.

In-Line Fuses:
Air Conditioning High Blower Speed Fuse located in wire running from horn relay to A/C Relay
Comforton and Four Season . . . . SAE 30 Amp.
Universal & All Weather (Chevy II) . . . . SAE 20 Amp.

Fusible Links:
Pigtail lead at battery positive cable (except Corvette) . . . . 14 gage brown wire
Molded splice at Solenoid "Bat" terminal (Corvette only) . . . . 14 gage brown wire
Molded Splice Located at the horn relay . . . . 16 gage black wire
Molded splice in Voltage Regulator #3 terminal wire . . . . 20 gage orange wire
Molded splice in Ammeter circuit (Both sides of meter) . . . . 20 gage orange wire

WINDSHIELD WIPERS

Non-Depressed Park	Two Speed
Operation	
Test Voltage	12 V.
Crank Arm Rotation	CCW
Current Draw	
No Load	3.6 Max.
Dry W/S	4.5 Max.
Stall	12 Max.
Crank Arm Speed (RPM's)	
Low	34 Min.
Hi	65 Min.

Depressed Park—Chevrolet & Corvette	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

BUMPERS

SECTION 14

TORQUE SPECIFICATIONS

Application	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Front Bumper to Bumper Bracket Nuts	30 lb. ft.	24 lb. ft.	30 lb. ft.	—	25 lb. ft.
Front Bumper to Bumper Brace Nuts	30 lb. ft.	24 lb. ft.	30 lb. ft.	—	25 lb. ft.
Front Bumper to Bumper Brace Lower Nuts	—	39 lb. ft.	—	—	—
Front Bumper to Center Brace Bolts	—	—	—	30 lb. ft.	—
Front Bumper to Outer Brace Bolts	—	—	—	30 lb. ft.	—
Front Bumper to Inner Brace Bolts	—	—	—	43 lb. ft.	—
Front Bumper to License Plate Bracket Nuts	—	—	—	85 lb. ft.	—
Front Bumper Bracket to Frame Bolts	—	—	—	—	50 lb. ft.
Front Bumper Bracket & Brace to Frame Nuts	53 lb. ft.	—	—	—	—
Front Bumper Bracket & Brace to Frame Bolts	—	53 lb. ft.	28 lb. ft.	—	—
Front Inner Brace to Frame Crossmember Nuts	—	—	—	30 lb. ft.	—
Front Bumper Bracket to Frame Nuts	53 lb. ft.	53 lb. ft.	—	—	50 lb. ft.
Front Outer Brace & Center Brace to Frame Bolts	—	—	—	30 lb. ft.	—
Gas Tank Filler Door to Rear Bumper Nuts	43 lb. ft.	43 lb. ft.	—	—	—
Rear Bumper to Frame Crossmember Nuts	30 lb. ft.	—	—	—	—
Rear Bumper to Bumper Bracket Nuts	30 lb. ft.	30 lb. ft. (45 lb. ft. for station wagon & El Camino)	30 lb. ft.	30 lb. ft.	17 lb. ft.
Rear Bumper to Bumper Brace Nuts	—	30 lb. ft.	—	30 lb. ft.	17 lb. ft.

TORQUE SPECIFICATIONS (CONT'D)

Application	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Rear Center Reinforcement to Frame Nuts	—	30 lb. ft. (45 lb. ft. for station wagon & El Camino)	—	—	—
Rear Bumper Bracket to Frame Nuts	50 lb. ft.	53 lb. ft.	28 lb. ft.	—	—
Rear Bumper Braces to Frame Nuts	—	—	—	30 lb. ft.	—
Rear Bumper Bracket & Brace to Frame Nuts	—	53 lb. ft.	—	—	—
Rear Bumper Bracket & Brace to Frame Bolts	—	—	28 lb. ft.	—	—
Rear Bumper Spacer to Bumper Nuts	25 lb. ft.	—	—	—	—
Rear License Plate Bezel to Body Screws	—	—	—	13 lb. in.	—

ACCESSORIES

SECTION 15

CRUISE—MASTER

Solenoid Resistance . . . . 5 ohms 1/4 ohm
Solenoid Wire Resistance . . . . 40 ohms
Maximum allowable Vacuum Leahage Rate for Servo Unit . . . . 5 inches of Vacuum
Operational Test Speed . . . . 50 mph

DECIMAL EQUIVALENTS

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

DRILL SIZES

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

GAGES

GAGE NO.	U. S. STANDARD GAGE* Approx. Thickness—Inches	AMERICAN WIRE or B & S GAGE Thickness—Inches
0000000	0.490	
000000	.460	0.5800
00000	.429	.5165
0000	.398	.4600
000	.368	.4096
00	.337	.3648
0	.306	.3248
1	.2757	.2893
2	.2604	.2576
3	.2451	.2294
4	.2298	.2043
5	.2145	.1819
6	.1991	.1620
7	.1838	.1443
8	.1685	.1285
9	.1532	.1144
10	.1379	.1019
11	.1225	.0907
12	.1072	.0808
13	.0919	.0720
14	.0766	.0641
15	.0689	.0571
16	.0613	.0508
17	.0551	.0453
18	.0490	.0403
19	.0429	.0359
20	.0368	.0320
21	.0337	.0285
22	.0306	.0253
23	.0276	.0226
24	.0245	.0201
25	.0214	.0179
26	.0184	.0159
27	.0169	.0142
28	.0153	.0126
29	.0138	.0113
30	.0123	.0100
31	.0107	.00893
32	.0100	.00795
33	.0092	.00708
34	.0084	.00630
35	.0077	.00561
36	.0069	.00500
37	.0065	.00445
38	.0061	.00397
39	.0057	.00353
40	.0054	.00314
41	.0052	
42	.0050	
43	.0048	
44	.0046	