1972

10-30 SERIES TRUCK

SERVICE MANUAL

CHEVROLET

ST 330-72

1972

SERIES 10 through 30
CHEVROLET TRUCK

CHASSIS SERVICE MANUAL

FOREWORD

This manual includes procedures for maintenance and adjustments, minor service operations, and removal and installation for components of Chevrolet Series 10 through 30 Trucks. Procedures involving disassembly and assembly of major components for these vehicles are contained in the 1972 Chevrolet Passenger Car and Series 10-30 Truck Overhaul 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

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SECTION 0

GENERAL INFORMATION AND LUBRICATION

CONTENTS OF THIS SECTION

GENERAL INFORMATION

INDEX

MODEL LINE UP

The 10 through 30 Series Conventional 2- and 4-Wheel drive and forward control truck model line-up for 1972 consists of the models shown in the "Engine Application" Chart in this section.

TRUCK MODEL DESIGNATION

A five digit number preceded by two letters is used to designate truck models. For example, vehicle CS 10704 would be: Conventional [C], L-6 gasoline engine [S], 3600#-5600# GVW [1], 42"-47" Cab-to-Axle dimension [07], Stepside pickup [04], as listed below.

First Letter—Chassis

[C] - Conventional (Conventional Cab, Suburban)
K - Four-Wheel Drive
P - Forward Control

Second Letter—Engine

A - All
E - V-8 Gasoline
[S] - L-6 Gasoline

First Number—GVW Range

0 - All
[1] - 3900-5800#
2 - 5200-7500#
3 - 6600-14000#

Second and Third Numbers—Cab-To-Axle Dimension

00 - All
05 - 30-35
[07] - 42-47"
08 - 48-53"
09 - 54-59"
10 - 60-65"

Fourth and Fifth Numbers—Body Styles

00 - All
02 - Flat Face Cowl
03 - Cab
[04] - Stepside Pickup
06 - Suburban (Panel Rear Doors)
14 - Utility (Blazer)
16 - Suburban (Tail - Liftgate)
32 - Motor Home Chassis
34 - Fleetside Pickup
35 - Forward Control (Steel Step-Van King)
42 - Forward Control Chassis
55 - Forward Control (Aluminum Step-Van King)

VEHICLE IDENTIFICATION NUMBER AND RATING PLATE

A combination vehicle identification number and rating plate used on all models (fig. 1) is located on the door pillar, except on School Bus, Flat Face Cowl, and some Forward Control models (motor home). On School Bus and Flat Face Cowl models the plate is attached to the air intake plenum panel. On Forward Control models (P10, P20, P30 except P30 Motor Home Chassis) it is attached to the dash and toe panel.

The vehicle identification number stamped on the plate decodes into the information shown in Figure 2.

ENGINE NUMBER

The engine number indicates manufacturing plant, month and day of manufacture, and transmission type. A typical engine number would be F1210TFA, which would breakdown thus:

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

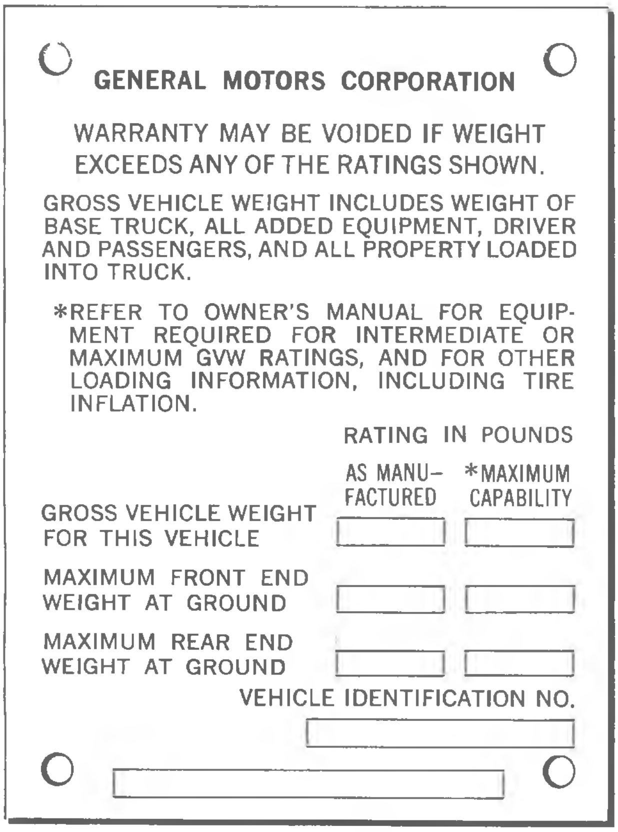


Fig. 1—Vehicle Identification Number and Rating Plate Information

UNIT AND SERIAL NUMBER LOCATIONS

For the convenience of service technicians and engineers when writing up certain business papers such as Warranty Reports, Product Information Reports, or reporting product failures in any way, the location of the various unit numbers have been indicated. These unit numbers and their prefix or suffix are necessary on these papers for various reasons - such as accounting, follow-up on production, etc.

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.

Always include the prefix in the number.

Axles

- Series 10 Rear Axle Serial Number Located at the Bottom Flange of Carrier Housing.
- Series 20-30 Rear Axle Located at the Forward Upper Surface of Carrier.

Transmissions

- 3-Speed Transmission Unit Number Located on Lower Left Side of Case Adjacent to Rear of Cover.
- 4-Speed Transmission Unit Number Stamped on Rear of Case, Above Output.
- Powerglide and Turbo Hydra-Matic 350 Transmission Unit Number Located on Right Rear Vertical Surface of Oil Pan.
- The Turbo Hydra-Matic Transmission 400 Serial Number is Located on the Light Blue Plate on the Right Side of the Transmission.

Engines

- 6-Cylinder Engine Unit Number Located on Pad at Right Hand Side of Cylinder Block at Rear of Distributor.
- 8-Cylinder Engine Unit Number Located on Pad at Front, Right Hand Side of Cylinder Block.

Delcotrons

Delcotron Unit Serial Number--Top of Rear Housing.

Batteries

Battery Code Number Located on Cell Cover Top of Battery.

Starters

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

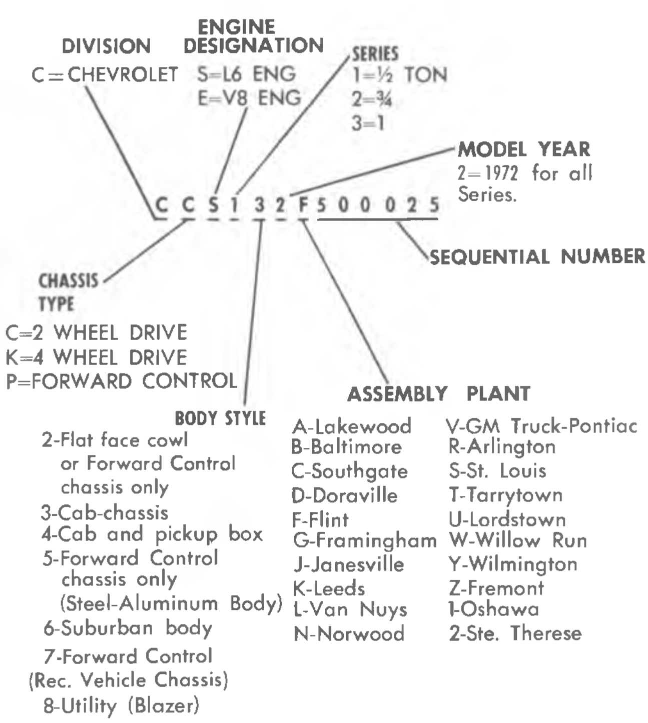


Fig. 2—Vehicle Identification No.

SERVICE PARTS IDENTIFICATION PLATE

The Chevrolet Truck Service Parts Identification Plate (fig. 3) is provided on all Truck models. On most series

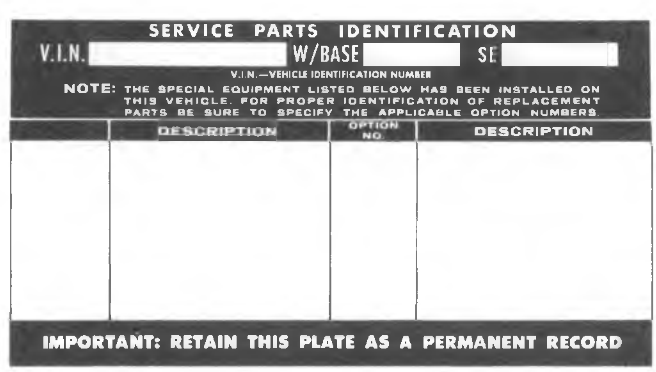


Fig. 3—Service Parts Identification Plate

it will be located on the inside of the glove box door, or, on Forward Control series, it will be located on an inner body panel. The plate lists the vehicle serial number, wheelbase, and all Production options or Special Equipment on the vehicle when it was shipped from the factory including paint information. ALWAYS REFER TO THIS INFORMATION WHEN ORDERING PARTS.

KEYS AND LOCKS

Two keys are provided with each vehicle. The keys operate the ignition switch and door locks.

EMERGENCY STARTING

- Never tow the vehicle to start because the surge forward when the engine starts could cause a collision with the tow vehicle.
- Engines in vehicles with automatic transmissions cannot be started by pushing the vehicle.
- To start the vehicle when the Energizer (battery) is discharged, use a single auxiliary battery or Energizer of the same nominal voltage as the discharged battery, with suitable jumper cables.
- Make connections as set forth below under "Jump Starting With Auxiliary (Booster) Battery" to lessen the chance of personal injury or property damage.

CAUTION: Never expose battery to open flame or electric spark—battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact skin, eyes, fabrics, or painted surfaces—fluid is a sulfuric acid solution which could cause serious personal injury or property damage. Wear eye protection when working with battery.

Jump Starting With Auxiliary (Booster) Battery

Both booster and discharged battery should be treated carefully when using jumper cables. Follow exactly the procedure outlined below, being careful not to cause sparks:

1. Set parking brake and place automatic transmission in "PARK" (neutral for manual transmission). Turn off lights, heater and other electrical loads.
2. Remove vent caps from both the booster and the discharged batteries. Lay a cloth over the open vent wells of each battery. These two actions help reduce the explosion hazard always present in either battery when connecting "live" booster batteries to "dead" batteries.
3. Attach one end of one jumper cable to the positive terminal of the booster battery (identified by a red color, "+" or "P" on the battery case, post or clamp) and the other end of same cable to positive terminal of discharged battery. Do NOT permit vehicles to touch each other, as this could establish a ground connection and counteract the benefits of this procedure.
4. Attach one end of the remaining negative (-) cable to the negative terminal (black color, "-" or "N") of the booster battery, and the other end to the engine lift bracket on 6 cylinder models and the delcotron mounting bracket on V-8 models (see Figure 4) of your 1972 Chevrolet (do not connect directly to negative post of dead battery)—taking care that clamps from one cable do not touch the clamps on the other cable. Do not lean over the battery when making this connection.

Reverse this sequence exactly when removing the jumper cables. Re-install vent caps and throw cloths away as the cloths may have corrosive acid on them.

CAUTION: Any procedure other than the above could result in: (1) personal injury caused by electrolyte squirting out the battery vents, (2) personal injury or property damage due to battery explosion, (3) damage to the charging system of the booster vehicle or of the immobilized vehicle.

Do not attempt to jump start a vehicle having a frozen battery because the battery may rupture or explode. If a frozen battery is suspected, examine all fill vents on the battery. If ice can be seen, or if the electrolyte fluid cannot be seen, do not attempt to start with jumper cables as long as the battery remains frozen.

PUSH STARTING

If your truck is equipped with a manual 3-speed or 4-speed transmission, it can be started in an emergency by pushing. When being pushed to start the engine, turn off all unnecessary electrical loads, turn ignition to "ON," depress the clutch pedal and place the shift lever in high gear. Release the clutch pedal when speed reaches 10 to 15 miles per hour. Bumpers and other parts contacted by the pushing vehicle should be protected from damage during pushing. Never tow the truck to start.

TOWING

All Except Four Wheel Drive Trucks

Normally your vehicle may be towed with all four wheels on the ground for distances up to 50 miles at speeds of less than 35 MPH. The engine should be off and the transmission in neutral.

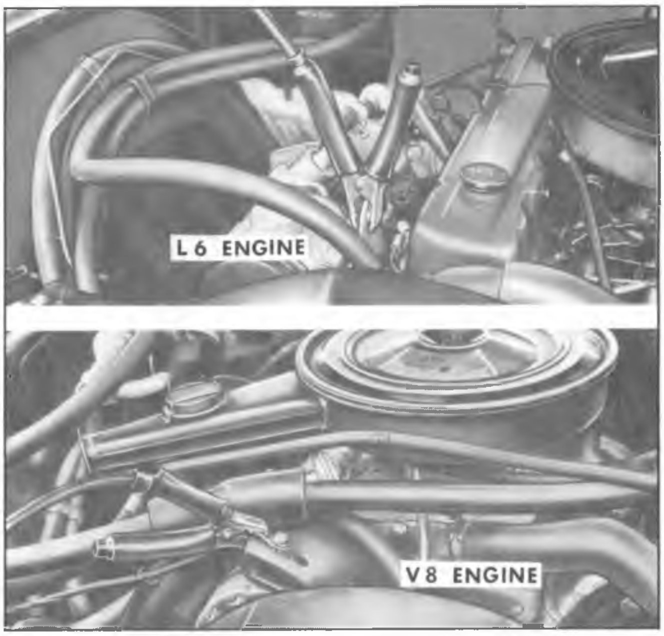


Fig. 4—Booster Battery Cable Ground Connection

However, the rear wheels must be raised off the ground or the drive shaft disconnected when the transmission is not operating properly or when a speed of 35 MPH or distance of 50 miles will be exceeded.

CAUTION: If a truck is towed on its front wheels only, the steering wheel must be secured with the wheels in a straight ahead position.

Four Wheel Drive Trucks

It is recommended that the truck be towed with the front wheels off the ground. The truck can be towed, however, with the rear wheels off the ground if there is damage in the rear wheel area. In this event, the transmission selector lever should be placed in the "N" (neutral) position and the front drive disengaged. Towing speeds should not exceed 35 MPH for distances up to 50 miles. If truck is towed on its front wheels, the steering wheel should be secured to keep the front wheels in a straight-ahead position.

When towing the vehicle at slow speeds (approx. 20 MPH), for a very short distance only, the transmission must be in NEUTRAL and the transfer case MUST be in "TWO WHEEL HIGH."

When towing the vehicle at faster speeds for greater distances, the following steps MUST be taken:

- If front wheels are on the road, disconnect the front drive shaft.
- If rear wheels are on the road, disconnect the rear drive shaft.

ENGINE—VEHICLE AVAILABILITY

See chart on following page.

LOAD CAPACITY CHART

New spring capacities and mandatory equipment options are included in the Load capacity chart on the following pages.

ENGINE APPLICATION

Body	Base Engine	W.B.	Series 10	Series 20	Series 30
Convent. Cab 106" BBC	250 L-6 Gas	115	CS10703		
		127	CS10903	CS20903	
		133			CS31003
		157			CS31403
	307 V-8 Gas	115	CE10703		
		127	CE10903	CE20903	
		133			CE31003
		157			CE31403
Stepside Pickup	250 L-6 Gas	115	CE10704		
		127	CE10904	CS20904	
		133			CS31004
	307 V-8 Gas	115	CE10704		
		127	CE10904	CE20904	
		133			CE31004
Fleetside Pickup	250 L-6 Gas	115	CS10734		
		127	CS10934	CS20934	
		133		CS21034	CS31034
	307 V-8 Gas	115	CE10734		
		127	CE10934	CE20934	
		133		CE21034	CE31034
Suburban Carryall	250 L-6 Gas	127	CS10906	CS20906	
		127	CS10916	CS20916	
	307 V-8 Gas	127	CE10906	CE20906	
		127	CE10916	CE20916	
FF Cowl	250 L-6 Gas	133			CS31002
	307 V-8 Gas	133			CE31002
Utility (K/5 Blazer)	250 L-6 Gas	104	CS10514		
	307 V-8 Gas	104	CE10514		
Convent. Cab 4x4 106" BBC	250 L-6 Gas	127		KS20903	
	307 V-8 Gas	127		KE20903	
Stepside Pickup 4x4	250 L-6 Gas	115	KS10704		
		127	KS10904	KS20904	
	307 V-8 Gas	115	KE10704		
		127	KE10904	KE20904	
Fleetside Pickup 4x4	250 L-6 Gas	115	KS10734		
		127	KS10934	KS20934	
	307 V-8 Gas	115	KE10734		
		127	KE10934	KE20934	
Suburban Carryall 4x4	250 L-6 Gas	127	KS10906	KS20906	
		127	KS10916	KS20916	
	307 V-8 Gas	127	KE10906	KE20906	
		127	KE10916	KE20916	
Utility 4x4 (K/5 Blazer)	250 L-6 Gas	104	KS10514		
	307 V-8 Gas	104	KE10514		

Body	Base Engine	W.B.	Series 10	Series 20	Series 30
Steel Step-Van 7	250 L-6 Gas	102	PS10535		
Steel Step-Van King	250 L-6 Gas	125		PS20835	PS30835
		133		PS21035	PS31035
		157			PS31435
	307 V-8 Gas	125		PE20835	PE30835
		133		PE21035	PE31035
		157			PE31435
Aluminum Step-Van King	250 L-6 Gas	125		PS20855	PS30855
		133		PS21055	PS31055
		157			PS31455
	307 V-8 Gas	125		PE20855	PE30855
		133		PE21055	PE31055
		157			PE31455
Regular Chassis	250 L-6 Gas	102	PS10542		
		129		PS20842	PS30842
		133		PS21042	PS31042
		157			PS31442
	307 V-8 Gas	125		PE20842	PE30842
		133		PE21042	PE31042
		157			PE31442
Motor Home Chassis	350 V-8 Gas	157			PE31132
		157			PE31432

OPTIONAL ENGINES - SERIES AVAILABILITY

292 Cu. In. L-6 Gas	C10, 20, 30 (Except Blazer) K10, 20 (Except Blazer) P20, 30 (Except Motor Home)
350 Cu. In. V-8 Gas	C10, 20, 30 K10, 20 P20, 30
402 Cu. In. V-8 Gas	C10, 20, 30 (Except Blazer)

LOAD CAPACITY CHART INTERPRETATION

The first column of the Load Capacity Chart on the following pages shows the basic model series.

The next column reflects the wheelbases available within each series.

The third column shows the Gross Vehicle Weight (GVW) rating applicable to each series vehicle. GVW means the maximum design weight of the vehicle including the vehicle itself and all equipment added to the vehicle after it has left the factory, the driver weight and occupant weight and everything that is loaded into or onto the vehicle.

Following the GVW columns are the minimum recommended tires to qualify the vehicle for each GVW rating.

The tire pressures listed in the column adjacent to the tire sizes in the chart are the minimum required tire pressures for maximum permissible loads.

The letters "B.E." under the Front and Rear Axle and Spring columns indicate that base equipment is satisfactory to qualify the vehicle for any given GVW rating. When the letters "RPO" denoting Regular Production Option, followed by a number appears in these columns (example RPO G50), the vehicle must be equipped with the extra cost equipment specified by the RPO to qualify the vehicle for the given GVW rating.

The ratings shown under the columns identified "Maximum Front End Weight at Ground", and "Maximum Rear End Weight at Ground", indicates the maximum permissible loading or weight at the ground regardless of spring or axle capacity ratings. These ratings are developed on the basis of the minimum component capability be it axles, springs or tires.

In loading the vehicle, the combined front and rear end weights at the ground must not exceed the GVW specified for the vehicle as manufactured.

In trailer hauling applications, the vehicle rear end weight at the ground with trailer attached must not exceed the "Maximum Rear End Weight at Ground" rating of the vehicle.

A typical example of a Truck in a loaded condition is shown in Figure 5. Note that the axle or GVW capabilities are not exceeded.

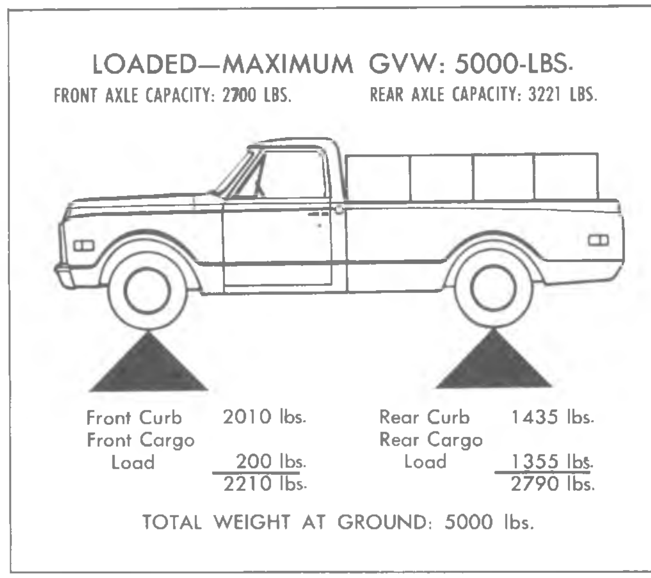


Fig. 5—Typical Vehicle Loaded Condition

LOAD CAPACITY CHART FOR 1972 CHEVROLET SERIES 10 THROUGH 30 TRUCKS

1972 MODELS	WHEEL-BASE	GVW (LBS.)*	MINIMUM MANDATORY EQUIPMENT FOR GVW RATING: FRONT TIRES	FRONT TIRE PRES-SURE	REAR TIRES	REAR TIRE PRES-SURE	FRONT AXLE	FRONT SPRINGS	MAXIMUM FRONT END WEIGHT AT GROUND*	REAR AXLE	REAR SPRINGS	MAXIMUM REAR END WEIGHT AT GROUND*
KS-KE10 Blazer (14 Models)	104	4600	E78-15B	32	E78-15B	32	B.E.	B.E.	2550	B.E.	B.E.	2550
		5000	G78-15B	32	G78-15B	32	B.E.	B.E.	2950	B.E.	B.E.	2950
		5600	H78-15B	28	H78-15B	32	B.E.	B.E.	3000	B.E.	B.E.	3220
KS-KE10 (04, 34 Models)	115	5200	G78-15B	32	G78-15B	32	B.E.	B.E.	2950	B.E.	B.E.	2950
	127	5600	H78-15B	32	H78-15B	32	B.E.	B.E.	3220	B.E.	B.E.	3220
KS-KE10 (06, 16 Models)	127	5400	G78-15B	32	G78-15B	32	B.E.	B.E.	2950	B.E.	B.E.	2950
		6000	H78-15B	32	H78-15B	32	B.E.	B.E.	3220	B.E.	B.E.	3220
		6200 bc	L78-15B	32	L78-15B	32	B.E.	B.E.	3300	B.E.	B.E.	3500
KS-KE20 (03, 04, 34 Models)	127	6400	8.75-16.5C	35	8.75-16.5C	45	B.E.	B.E.	3300	B.E.	B.E.	3980
			or 7.50-16C e	35	or 7.50-16C e	45			3300			4000
		7200	8.75-16.5C	35	8.75-16.5D	60	B.E.	B.E.	3300	B.E.	RPO G50	4700
			or 7.50-16C	35	or 7.50-16D	60			3300			4880
		7500	9.50-16.5D	30	9.50-16.5D	50	B.E.	B.E.	3300	B.E.	RPO G50	5000
			or 7.50-16C	35	or 7.50-16E	65			3300			5000
KS-KE20 (06, 16 Models)	127	6000	8.75-16.5C	35	8.75-16.5C	45	B.E.	B.E.	3300	B.E.	B.E.	3980
		6400 bc	8.75-16.5C	35	8.75-16.5C	45	B.E.	B.E.	3300	B.E.	B.E.	3980
		7200 bc	8.75-16.5C	35	8.75-16.5D	60	B.E.	B.E.	3300	B.E.	RPO G50	4700
		7500 bc	9.50-16.5D	30	9.50-16.5D	50	B.E.	B.E.	3300	B.E.	RPO G50	5000

* Refer to GVW plate on vehicle. Maximum front and rear end loads on this chart are based upon component minimum capacity of axles, springs, or tires.

a RPO J70 Power Brakes required.

b RPO AS3 or RPO A80 seating required for this GVW rating.

c KS-KE10-20 (06, 16) models without RPO AS3 or RPO A80 are restricted to a maximum of 6000 pounds GVW.

e Optional tires available as RPO equipment.

LOAD CAPACITY CHART FOR 1972 CHEVROLET SERIES 10 THROUGH 30 TRUCKS

1972 MODELS	WHEEL-BASE	GVW (LBS.)*	FRONT TIRES	FRONT TIRE PRESSURE	REAR TIRES	REAR TIRE PRESSURE	FRONT AXLE	FRONT SPRINGS	MAXIMUM FRONT END WEIGHT AT GROUND*	REAR AXLE	REAR SPRINGS	MAXIMUM REAR END WEIGHT AT GROUND*
			MINIMUM MANDATORY EQUIPMENT FOR GVW RATING									
CS-CE10 Blazer (14 Models)	104	4400	E78-15B	32	E78 15B	32	B E.	B E	2550	B.E.	B.E.	2550
		4900	G78-15B	32	G78-15B	32	B E.	B E.	2900	B.E.	B.E.	2900
		5300	H78-15B	28	H78 15B	32	B E.	B.E.	2900	B.E.	RPO G50	3220
CS-CE10 (03, 04, 34 Models)	115 127	4600	G78 15B	32	G78 15B	32	B E.	B.E.	2900	B.E.	B.E.	2800
		5000 a	G78 15B	32	G78-15B	32	B E.	B.E.	2900	B.E.	B.E.	2800
		5400 a	H78 15B	30	H78-15B	32	B E.	RPO F60	3100	B.E.	RPO G50	3220
CS-CE10 (06, 16 Models)	127	5200	G78 15B	32	G78 15B	32	B E.	B.E.	2900	B.E.	B.E.	2800
		6000	L78 15B	26	L78 15B	32	B E.	RPO F60	3100	B.E.	RPO G50	3500
CS-CE20 (03, 04, 34 Models)	127 b	6200	8.75-16.5C	40	8 75 16.5C	45	B E.	B.E.	3500	B.E.	B.E.	3980
		6700	8.75-16.5C	40	8.75-16.5D	60	B E.	B.E.	3500	B.E.	RPO G50	4700
		7500	9.50 16.5D	30	9.50-16.5D	55	B E.	B.E.	3500	B.E.	RPO G50	5200
CS-CE20 (06, 16 Models)	127	6000	8.75-16.5C	40	8 75-16 5C	45	B E.	B.E.	3500	B.E.	B.E.	3980
		6200 f	8.75 16.5C	40	8 75-16.5D	45	B E	B.E.	3500	B.E	B.E.	3980
		6700 f	8.75 16.5C	40	8.75-16.5D	60	B E.	B.E.	3500	B.E.	RPO G50	4700
		7500 f	9.50-16.5D	30	9 50 16 5D	55	B E.	B.E.	3500	B.E	RPO G50	5200
CS-CE30 (02, 03, 04, 34 Models, single rear wheels)	133 157 c	6600	8.75-16.5C	40	8 75-16.5C	60	B E	B.E.	3500	B.E.	B.E.	3980
		8000	9.50-16.5D	35	9.50 16 5D	75	B E.	RPO F60	3800	B.E.	RPO G50	5560
		9000	9.50 16.5D	35	9.50 16.5E	75	B E.	RPO F60	3800	B.E.	RPO G60	6340
CS-CE30 (02, 03 Models, dual rear wheels)	133 157 c	6600	6.50 16C	45	6 50-16C	35	B E	B.E.	3220	RPO R05	B.E.	4800
		8000	7.00 16C	45	7 00-16C	45	B E.	RPO F60	3600	RPO R05	RPO G50	6200
		9000	7.00-16C	45	7 00 16C	45	B E.	RPO F60	3600	RPO R05	RPO G60	6320
		10000	7.50-16C	40	7 50-16C	45	B E.	RPO F60	3800	RPO R05	RPO G60	7200
CS30 (03 Models, dual rear wheels)	133	11000	7.00 18D	55	7.00-18D	65	RPO H22	RPO H22	4000	RPO H22	RPO H22	9080
	157 c	14000	8 19.5D	50	8-19.5E	80	RPO H22	RPO H22	4000	RPO H22	RPO H22	11000
CE30 (03 Models, dual rear wheels)	133	11000	7.00-18D	55	7.00 18D	65	RPO H23	RPO H23	4000	RPO H23	RPO H23	9080
	157 c	14000	8 19.5D	50	8-19.5E	80	RPO H23	RPO H23	4000	RPO H23	RPO H23	11000

* Refer to GVW plate on vehicle. Maximum front and rear end loads on this chart are based upon component minimum capacity of axles, springs, or tires.

a RPO J70 Power Brakes required.

b 133 inch wheelbase on 21034 models.

c 157 inch wheelbase is available on -03 models only.

d See Federal Motor Vehicle Safety Standards Certification Label on rear edge of left hand side door of vehicle for GVW, Maximum Front End Weight at Ground, and Maximum Rear End Weight at Ground applicable to that vehicle. GVW, Maximum Front End Weight at Ground, and Maximum Rear End Weight at Ground stated on label reflects calculated weight of vehicle with all options and accessories installed at time of manufacture.

CS-CE20 (06, 16) models without RPO AS3 or RPO A80 are restricted to a maximum of 6000 pounds GVW.

LOAD CAPACITY CHART FOR 1972 CHEVROLET SERIES 10 THROUGH 30 TRUCKS

1972 MODELS	WHEEL-BASE	GVW (LBS.)*	FRONT TIRES	FRONT TIRE PRES-SURE	REAR TIRES	REAR TIRE PRES-SURE	FRONT AXLE	FRONT SPRINGS	MAXIMUM FRONT END WEIGHT AT GROUND*	REAR AXLE	REAR SPRINGS	MAXIMUM REAR END WEIGHT AT GROUND*
			MINIMUM MANDATORY EQUIPMENT FOR GVW RATING									
PS10 (35, 42 Models)	102	4600	G78-15B	32	G78-15B	30	B.E.	B.E.	2900	B.E.	B.E.	2800
		5000 a	G78 15B	32	G78-15B	30	B.E.	B.E.	2900	B.E.	B.E.	2800
		5400 a	H78-15B	30	H78-15B	32	B.E.	B.E.	2900	B.E.	RPO G50	3220
PS-PE20 (35, 42, 55 Models)	125 133	6500	8.75-16.5C	40	8.75 16.5C	45	B.E.	B.E.	3000	B.E.	B.E.	3980
			or 7.50-16C e	35	or 7.50-16C e	45			3000			4120
		7500	9.50-16.5D	30	9.50 16.5D	55	B.E.	B.E.	3000	B.E.	RPO G50	5200
			or 7.50-16C	35	or 7.50-16E	70			3000			5200
PS-PE30 (35, 42, 55 Models) Single rear wheels	125 133 157	7300	8.75-16.5C	45	8.75-16.5D	60	B.E.	B.E.	3500	B.E.	B.E.	4700
			or 7.50-16C e	45	or 7.50-16D e	60			3500			4880
		8000	9.50 16.5D	35	9.50 16.5D	60	B.E.	B.E.	3500	B.E.	B.E.	5560
			or 7.50-16C	45	or 7.50-16E	75			3500			5560
PS-PE30 (35, 42, 55 Models) Dual rear wheels	125 133 157	9000	8.00-16.5D	60	8.00-16.5D	50	B.E.	B.E.	3500	RPO R05	B.E.	6200
			or 7.50-16C	45	or 7.50-16C	35			3500			6200
		10000	8.00-16.5D	60	8.00 16.5D	60	B.E.	B.E.	3500	RPO R05	RPO G60	7200
			or 7.50-16C	45	or 7.50-16C	45			3500			7200
		11000	7.00-18D	55	7.00-18D	65	RPO H22	RPO H22	4000	RPO H22	RPO H22	9080
		14000	8-19.5D	50	8-19.5E	80	RPO H22	RPO H22	4000	RPO H22	RPO H22	11000
PE30 (32 Models) Single rear wheels (Motor Home Chassis)	137 157	7300	8.75-16.5C	45	8.75-16.5D	60	B.E.	B.E.	3980	B.E.	B.E.	4700
			or 7.50-16C e	45	or 7.50-16D e	60			4120			4880
		8000	9.50 16.5D	35	9.50 16.5D	60	B.E.	B.E	4300	B.E.	B.E.	5560
			or 7.50 16D	45	or 7.50-16E	75			4300			5560
PE30 (32 Models) Dual rear wheels (Motor Home Chassis)	137 157	9000	8.00 16.5D	60	8.00 16.5D	50	B.E.	B.E.	4090	RPO R05	B.E.	6200
			or 7.50-16C	45	or 7.50-16C	35			4120			6200
		10000	8.00-16.5D	60	8.00-16.5D	60	B.E.	B.E.	4090	RPO R05	RPO G60	7200
			or 7.50-16C	45	or 7.50 16C	45			4120			7200
		11000	7.50-16D	50	7.50 16C	45	B.E.	B.E.	4300	RPO R05	RPO G60	7200

* Refer to GVW plate on vehicle. Maximum front and rear end loads on this chart are based upon component minimum capacity of axles, springs, or tires.

a RPO J70 Power Brakes required.

b RPO AS3 or RPO A80 seating required for this GVW rating.

c KS-KE10-20 (06, 16) models without RPO AS3 or RPO A80 are restricted to a maximum of 6000 pounds GVW.

e Optional tires available as RPO equipment.

LUBRICATION

INDEX

The time or mileage intervals for lubrication and maintenance services outlined in this section are intended as a general guide for establishing regular maintenance and lubrication periods. Sustained heavy duty and high speed operation or operation under the adverse conditions may require more frequent servicing.

ENGINE

Oil & Filter Recommendations

The letter designation "SE" has been established to correspond with the requirements of GM 6041-M as revised. "SE" engine oils will be better quality and perform better than those identified with "SA" through "SD" designations and are recommended for all Chevrolet light-duty gasoline trucks regardless of model year and previous engine oil quality recommendations.

Oil Change Period

- Use only SE engine oil (SE oils meet quality standard GM 6041-M).
- Change oil each 4 months or 6,000 miles. If more than 6,000 miles are driven in a 4-month period, change oil each 6,000 miles.
- Change oil each 2 months or 3,000 miles, whichever occurs first, under the following conditions;
  - —driving in dusty conditions
  - —trailer pulling
  - —extensive idling
  - —Short-trip operation at freezing temperatures (engine not thoroughly warmed-up).
- Operation in dust storms may require an immediate oil change.
- Replace the oil filter at the first oil change, and every second oil change thereafter. AC oil filters provide maximum engine protection.

The above recommendations apply to the first change as well as subsequent oil changes. The oil change interval for the Chevrolet engine is based on the use of SE oils and quality oil filters. Oil change intervals longer than those listed above will seriously reduce engine life and may affect Chevrolet's obligation under the provisions of the New Vehicle Warranty.

A high quality SE oil was installed in the engine at the factory. It is not necessary to change this factory-installed oil prior to the recommended normal change period. However, check the oil level more frequently during the break-in period since higher oil consumption is normal until the piston rings become seated.

NOTE: Non-detergent and other low quality oils are specifically not recommended.

Oil Filter Type and Capacity

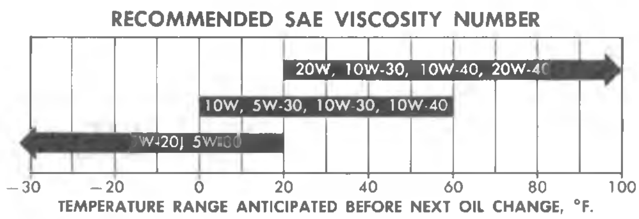
- Throwaway type, 1 quart U.S. measure, .75 quart Imperial measure.
- 250 cu. in., 292 cu. in., AC Type PF-25. 307 cu. in., 402 cu. in., AC Type PF-35.

Crankcase Capacity (Does Not Include Filter)

- 292 L6 Engine; 5 quarts U.S. measure, 4.25 quarts Imperial measure.
- All other engines; 4 quarts U.S. measure, 3.25 quarts Imperial measure.

Recommended Viscosity

Select the proper oil viscosity from the following chart:



> **NOTE:** SAE 5W-20 oils are not recommended for sustained high-speed driving.
>
> SAE 30 oils may be used at temperatures above 40°F.

The proper oil viscosity helps assure good cold and hot starting.

Checking Oil Level

The engine oil should be maintained at proper level. The best time to check it is before operating the engine or as the last step in a fuel stop. This will allow the oil accumulation in the engine to drain back in the crankcase. To check the level, remove the oil gauge rod (dip stick), wipe it clean and reinsert it firmly for an accurate reading. The oil gauge rod is marked "FULL" and "ADD OIL". If the oil is at or below the "ADD" mark on the dipstick, oil should be added as necessary. The oil level should be maintained in the safety margin, neither going above the "FULL" line nor below "ADD OIL" line.

> **NOTE:** The oil gauge rod is also marked either, "Use SE Engine Oil" or, "Use GM 6041-M Quality MS Oil", as a reminder to use only SE oils.

Supplemental Engine Oil Additives

The regular use of supplemental additives is specifically not recommended and will increase operating costs. However, supplemental additives are available that can effectively and economically solve certain specific problems without causing other difficulties. For example, if higher detergency is required to reduce varnish and sludge deposits resulting from some unusual operational difficulty, a thoroughly tested and approved additive—"Engine Oil Supplement"—is available.

Drive Belts

Drive belts should be checked every 6,000 miles or 4 months for proper tension. A loose belt will affect water pump and generator operation.

POSITIVE CRANKCASE VENTILATION VALVE

Every 24,000 miles or 24 months the valve should be replaced. Connecting hoses, fittings and flame arrestor should be cleaned. At every oil change the system should be tested for proper function and serviced, if necessary.

AIR INJECTION REACTOR SYSTEM (A.I.R.) CONTROLLED COMBUSTION SYSTEM (C.C.S.)

The Air Injection Reactor system should have the drive belt inspected for wear and tension every 12 months or 12,000 miles, whichever occurs first. In addition, complete effectiveness of either system, as well as full power and performance, depends upon idle speed, ignition timing, and idle fuel mixture being set according to specification. A quality tune-up which includes these adjustments should be performed periodically to assure normal engine efficiency, operation and performance.

GM EVAPORATION CONTROL SYSTEM

Every 24 months or 24,000 miles (more often under dusty conditions) the filter in the base of the canister must be replaced and the canister inspected.

MANIFOLD HEAT CONTROL VALVE

Every 6,000 miles or 4 months, check valve for freedom of operation. If valve shaft is sticking, free it up with GM Manifold Heat Control Solvent or its equivalent.

AIR CLEANER

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

Oil Wetted Paper Element Type

L-6 engine, replace every 12,000 miles. V-8 engine, every 12,000 miles inspect element for dust leaks, holes or other damage. Replace if necessary. If satisfactory, rotate element 180° from originally installed position. Replace at 24,000 miles. Element must not be washed, oiled, tapped or cleaned with an air hose.

Crankcase Ventilation Filter (Located Within Air Cleaner)

If so equipped, inspect every oil change and replace if necessary. Replace at least every 24,000 miles; more often under dusty driving conditions.

FUEL FILTER

Replace filter element located in carburetor inlet every 12 months or 12,000 miles whichever occurs first, or, if an in-line filter is also used, every 24,000 miles.

Replace in-line filter every 24,000 miles.

DISTRIBUTOR

Replace cam lubricator at 12,000 mile intervals.

GOVERNOR

The attaching bolts should be kept tight, the optionally available governor should be kept clean externally and the filter element should be replaced every 12,000 miles.

ACCELERATOR LINKAGE

Lubricate with engine oil every 12,000 miles as follows:

1. On V8 engine, lubricate the ball stud at the carburetor lever.
2. On L6 engine, lubricate the two ball studs at the carburetor lever and lubricate the lever mounting stud. Do not lubricate the accelerator cable.

AUTOMATIC TRANSMISSION FLUID RECOMMENDATIONS

General Motors DEXRON® Automatic Transmission Fluid, which has been especially formulated and tested for use in the automatic transmission is recommended. Other automatic transmission fluids identified with the mark DEXRON® are also recommended.

Check the fluid level at each engine oil change period. To make an accurate fluid level check:

1. Drive vehicle several miles, making frequent starts and stops, to bring transmission up to normal operating temperature (approximately 180-190°F).
2. Park vehicle on a level surface.
3. Place selector level in "Park" and leave engine running.
4. Remove dipstick and wipe clean.
5. Reinsert dipstick until cap seats.
6. Remove dipstick and note reading.

If oil level is at or below the ADD mark on the dipstick, oil should be added as necessary. One pint raises the level from ADD to FULL. Do not overfill.

Under normal driving conditions, the transmission fluid should be changed every 24,000 miles. If the vehicle is driven extensively in heavy city traffic during hot weather, or is used to pull a trailer, change fluid every 12,000 miles. Likewise, operators of trucks in commercial use where the engine idles for long periods, should change fluid every 12,000 miles.

To Change Turbo Hydra-Matic 400 and Turbo Hydra-Matic 350 fluid, remove fluid from the transmission sump, add approximately 7.5 pints U.S. measure (6.25 pints Imperial measure) for the Turbo Hydra-Matic 400 and 2 1/2 qts. U.S. measure (2 qts. Imperial measure) for the Turbo Hydra-Matic 350 of fresh fluid, to return level to proper mark on the dipstick.

Every 24,000 Miles—the Turbo Hydra-Matic 400 transmission sump filter should be replaced.

MANUAL TRANSMISSION

3-Speed and 4-Speed—every 6,000 miles or 4 months—check at operating temperature and fill as necessary to level of filler plug hole with SAE 80 or SAE 90 GL-5 gear lubricant. Where ambient temperatures below freezing (+32°F.) are expected, use only SAE 80 GL-5 Gear Lubricant. SAE 90 Gear Lubricant should be used only where ambient temperatures are continuously above +32°F.

TRANSMISSION SHIFT LINKAGE (MANUAL AND AUTOMATIC)

Every 6,000 miles or 4 months—lubricate shift linkage and, on Manual transmission floor control, lever contacting faces with water resistant EP chassis lubricant which meets GM Specification GM 6031-M.

CLUTCH

The clutch pedal free travel should be checked at regular intervals.

Lubricate the clutch cross-shaft at fitting (on Series 10 Forward Control models also lubricate the clutch linkage idler lever at fitting) every 6,000 miles or 4 months with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M.

REAR AXLES

STANDARD

Every 4 months or 6,000 miles, whichever occurs first, check lubricant level and add lubricant, if necessary, to fill to level of filler plug hole. Use GL-5 Gear Lubricant as shown in the following table.

Outside Temperature	Viscosity Lubricant To Be Used
BELOW 10°F	SAE 80
UP TO 100°F	SAE 90
ABOVE 100°F CONSISTENTLY	SAE 140

On 20 or 30 Series trucks, drain lubricant every 24,000 miles. If vehicle is operated in exceptionally heavy work or at continuous high speeds, the lubricant should be changed every 12,000 miles. It may be necessary to change lubricant more often if vehicle is used off road in dusty areas.

POSITRACTION

Same intervals as standard axle but use only the special Positraction lubricant available at your authorized dealer.

PROPELLER SHAFT SLIP JOINTS

Propeller shaft slip joints should be lubricated every 6,000 miles or 4 months with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M.

UNIVERSAL JOINTS

All universal joints are the needle bearing type. Lubricate those universal joints (depending on truck model) equipped with lube fittings every 6,000 miles or 4 months with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M. More frequent lubes may be required on heavy duty or "Off the Road" operations.

WHEEL BEARINGS

FRONT

NOTE: Use wheel bearing lubricant GM Part No. 1051344 or equivalent. This is a premium high melting point lubricant which meets all requirements of General Motors Specification GM 6031-M.

Due to the weight of the tire and wheel assembly it is recommended that they be removed from hub before lubricating bearings to prevent damage to oil seal. Then remove the front wheel hub to lubricate the bearings. The bearings should be thoroughly cleaned before repacking with lubricant.

Front wheels are equipped with tapered roller bearings on all trucks. Wheel bearings should be lubricated every 24,000 miles. Do not mix wheel bearing lubricants.

CAUTION: "Long fibre" type greases should not be used on roller bearing front wheels.

REAR

The rear wheel bearings receive their lubrication from the rear axle. When installing bearings which have been cleaned, prelube with wheel bearing grease.

BRAKE MASTER CYLINDER

Check master cylinder fluid level in both reservoirs every 6,000 miles or 4 months. If the fluid is low in the reservoir, it should be filled to a point about 1/4" from the top rear of each reservoir with Delco Supreme No. 11 Hydraulic Brake Fluid.

BRAKE AND CLUTCH PEDAL SPRINGS

Lubricate brake and clutch pedal springs every 6,000 miles or 4 months with engine oil for all models.

PARKING BRAKE

Every 6,000 miles or 4 months clean and lubricate all parking brake pivot points with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M.

STEERING

MANUAL STEERING GEAR

The steering gear is factory-filled with steering gear lubricant. Seasonal change of this lubricant should not be performed and the housing should not be drained—no lubrication is required for the life of the steering gear.

Every 36,000 miles, the gear should be inspected for seal leakage (actual solid grease—not just oily film). If a seal is replaced or the gear is overhauled, the gear housing should be refilled with #1051052 (13 oz. container) Steering Gear Lubricant which meets GM Specification GM 4673-M, or its equivalent.

NOTE: Do not use EP Chassis Lube, which meets GM Specification GM 6031-M, to lubricate the gear. DO NOT OVER-FILL the gear housing.

NOTE: Lubricate intermediate steering shaft with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M every 6,000 miles or 4 months on P-10 models only.

POWER STEERING SYSTEM

Check the fluid level in the pump reservoir at each oil change period. Add GM Power Steering Fluid as necessary to bring level to proper range on filler cap indicator depending upon fluid temperature.

If at operating temperature (approximately 150°F—hot to the touch), fluid should be between "HOT" and "COLD" marks.

If at room temperature (approximately 70°F), fluid should be between "ADD" and "COLD" marks. Use DEXRON® Automatic Transmission Fluid if GM Power Steering Fluid is not available. Fluid does not require periodic changing.

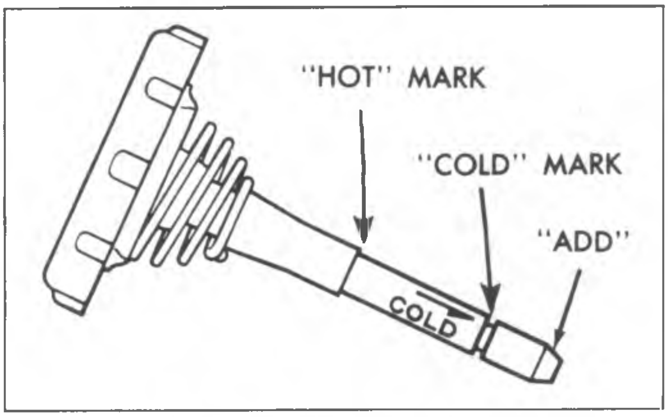


Fig. 6—Power Steering Fluid Level

STEERING LINKAGE AND SUSPENSION

Maintain correct front end alignment to provide easy steering, longer tire life, and driving stability.

Check control arm bushings and ball joints for wear.

Lubricate tie rods, upper and lower control arms, and ball joints at fittings with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M every 6,000 miles or 4 months.

NOTE: Ball joints must be at +10°F. or more before lubricating.

Keep spring to axle U bolts and shackle bolts properly tightened (see Specifications Section for torque recommendations). Check U bolt nuts after the first 1,000 miles of operation if the U bolt or U bolt nuts are changed in service.

HOOD LATCH AND HOOD HINGE

Every 6,000 miles or 4 months, whichever occurs first, lubricate hood latch assembly and hood hinge assembly as follows:

1. Wipe off any accumulation of dirt or contamination on latch parts.
2. Apply Lubriplate or equivalent to latch pilot bolts and latch locking plate.
3. Apply light engine oil to all pivot points in release mechanism, as well as primary and secondary latch mechanisms.
4. Lubricate hood hinges.
5. Make hood hinge and latch mechanism functional check to assure the assembly is working correctly.

BODY LUBRICATION

Normal use of a truck causes metal-to-metal movement at certain points in the cab or body. Noise, wear and improper operation at these points will result when a protective film of lubricant is not provided.

For exposed surfaces, such as door checks, door lock bolts, lock striker plates, dovetail bumper wedges, etc., apply a thin film of light engine oil.

Where oil holes are provided in body parts a dripless oil can be safely used, but any lubricant should be used sparingly, and after application all excess should be carefully wiped off.

The seat adjusters and seat track, ordinarily overlooked, should be lubricated with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M.

There are other points on bodies which may occasionally require lubrication and which are difficult to service. Window regulators and controls are confined in the space between the upholstery and the outside door panel. Easy access to the working parts may be made by removing the trim. Door weatherstrips and rubber hood bumpers should be lightly coated with a rubber lubricant.

FOUR WHEEL DRIVE

Most lubrication recommendations and procedures for 4 wheel drive-equipped trucks are the same for corresponding components of conventional drive trucks.

In addition, the following items require lubrication at the intervals mentioned.

Propeller Shaft Centering Ball

A centering ball at the transfer case end of the front propeller shaft on Four Wheel Drive Models should be lubricated every 24,000 miles with water resistant EP chassis lubricant which meets General Motors Specification GM 6031-M. More frequent lubrication may be required on heavy duty off the road operations.

> **NOTE:** A special needle nose grease gun adapter for flush type grease fitting is required to lubricate the centering ball.

Front Axle

The front axle should be checked every 6,000 miles or 4 months and refilled with SAE 90 GL-5 Gear Lubricant when necessary. With the differential at operating temperature, fill to the level of filler plug hole. If differential is cold, fill to level of 1/2" below the filler plug hole.

Air Vent Hose

Check vent hose for kinks and proper installation every 6,000 miles or 4 months.

Transfer Case

Check the transfer case level every 6,000 miles or 4 months and, if necessary, add lubricant to bring to the level of the filler plug hole. Use SAE 80 or SAE 90 GL-5 Gear Lubricant.

Control Lever and Linkage

Since no grease fitting is provided in the control lever it is necessary to brush or spray engine oil on the lever pivot point and on all exposed control linkage every 6,000 miles or 4 months.

SPEEDOMETER ADAPTER

On vehicles so equipped, lubricate adapter at fitting with water resistant EP chassis grease which meets General Motors Specification GM 6031-M every 6,000 miles.

EXTENDED VEHICLE STORAGE

If you plan to store your truck over an extended period of time, certain steps should be taken to give it maximum protection. It is recommended that you write the Chevrolet Motor Division, General Motors Corporation, Owner Relations Dept., Detroit, Michigan 48202, for detailed instructions on how to prepare your truck for storage.

LUBRICATION DIAGRAMS

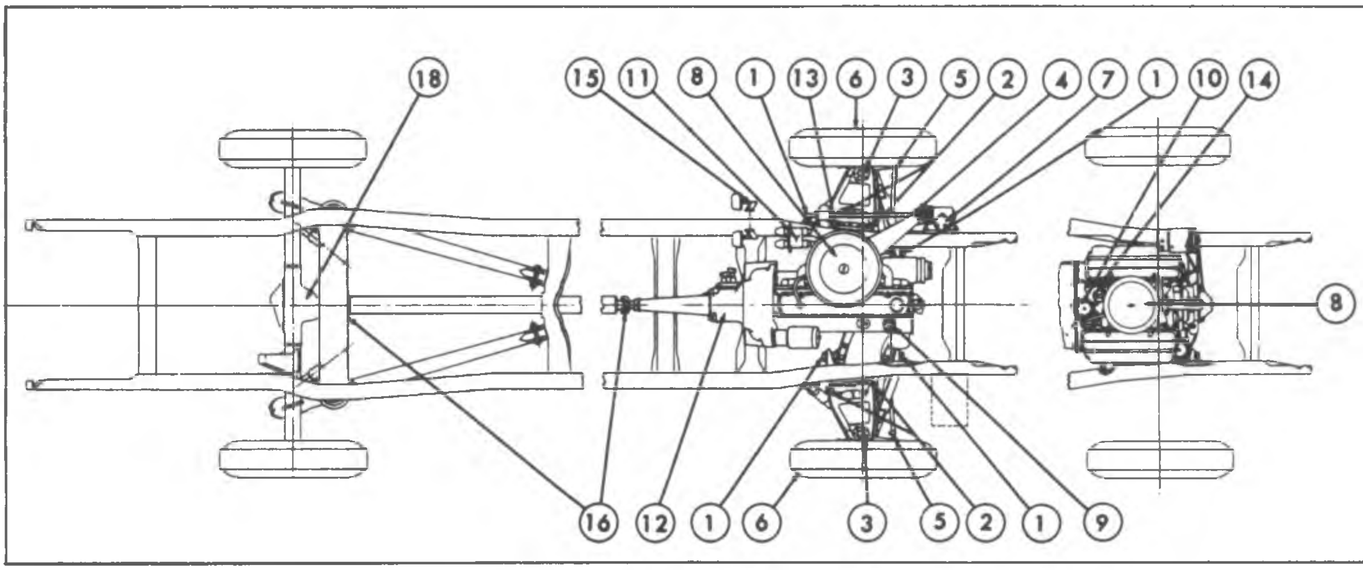


Fig. 7—Lubrication — Conventional Models

No.	Lubrication Points	Lubrication Period	Type of Lubrication	Quantity	Remarks
1	Lower Control Arms	6,000 Miles	Chassis Lubricant	4 places as required	
2	Upper Control Arms	6,000 Miles	Chassis Lubricant	4 places as required	
3	Upper and Lower Control Arm Ball Joints	6,000 Miles	Chassis Lubricant	4 places as required	
4	Intermediate Steering Shaft (PA10)	6,000 Miles	Chassis Lubricant	2 places as required	
5	Tie Rod Ends	6,000 Miles	Chassis Lubricant	4 places as required	
6	Wheel Bearings	30,000 Miles	Whl. Brg. Lubricant	2 places as required	
7	Steering Gear	36,000 Miles			Check for Grease Leak - Do not Lubricate
8	Air Cleaner - Element	12,000 Miles			Replace L-6. Rotate V-8 Replace V-8 at 24,000 miles.
9	Distributor - L-6	12,000 Miles			Replace cam lubricator*
10	Distributor - V-8	12,000 Miles			Replace cam lubricator*
11	Master Cylinder	6,000 Miles	Delco Supreme No. 11 or equivalent	As required	Check - add fluid when necessary
12	Transmission - Manual - Automatic	6,000 Miles 6,000 Miles	GL-5 Dexron® or equivalent	As required As required	Keep even w/filler plug. See Lubrication Section
13	Throttle Bell Crank - L-6	6,000 Miles	Engine Oil	As required	
14	Carburetor Linkage - V-8	6,000 Miles	Engine Oil	As required	
15	Brake and Clutch Pedal Springs	6,000 Miles	Engine Oil	As required	
16	Universal Joints	6,000 Miles	Chassis Lubricant	As required	
17	Propeller Shaft Slip Joint	6,000 Miles	Chassis Lubricant	As required	Not shown
18	Rear Axle	6,000 Miles	GL-5	As required	Check See Lubrication Section

*Replace Cam and Lubricator at 24,000 mile intervals.

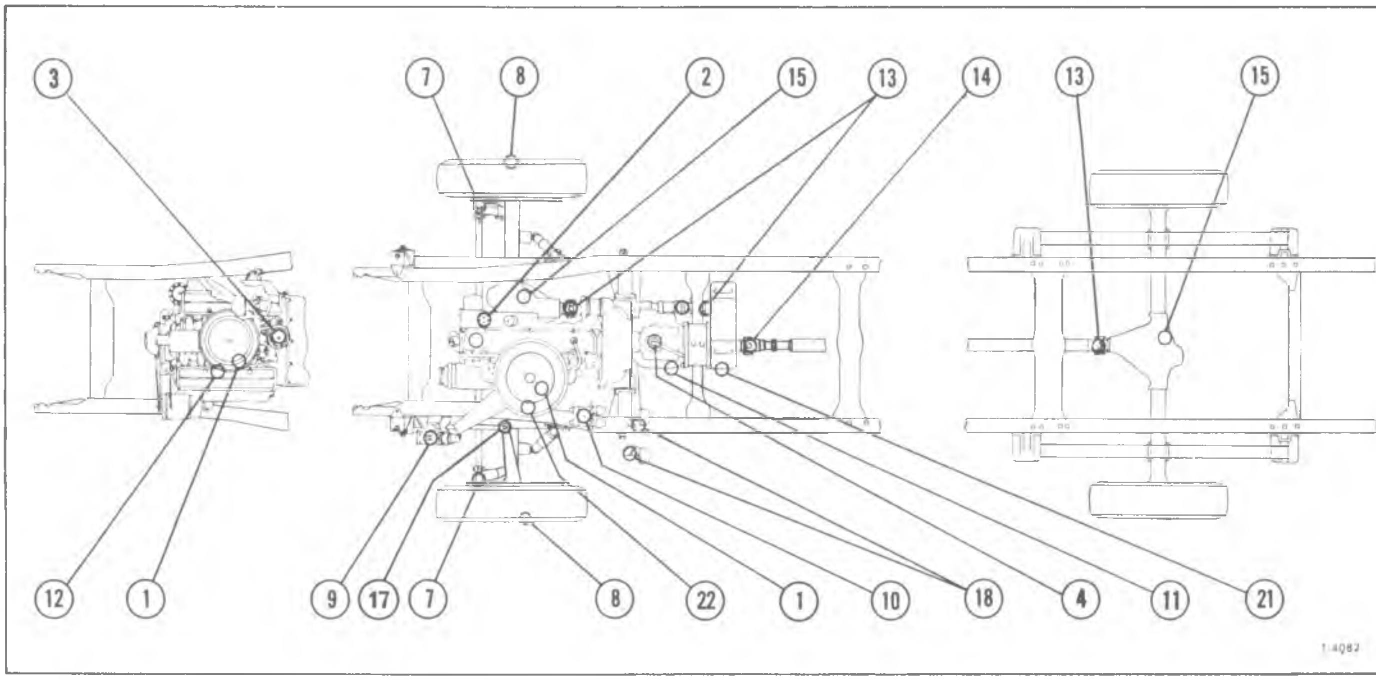


Fig. 8—Lubrication — Four Wheel Drive Models

FOUR WHEEL DRIVE MODELS

No.	Lubrication Points	Lubrication Period	Type of Lubrication	Quantity	Remarks
1	Air Cleaner	12,000 Miles			Replace L-6. Rotate V-8. Replace V-8 at 24,000 miles.
2	Distributor - L-6	12,000 Miles			Replace Cam Lubricator*
3	Distributor - V-8	12,000 Miles			Replace Cam Lubricator*
4	Control Linkage Points	6,000 Miles	Engine Oil	As required	Brush or Spray to apply
7	Tie Rod Ends	6,000 Miles	Chassis Lubricant	2 places as required	
8	Wheel Bearings	30,000 Miles	Wheel Bearing Grease	2 places as required	
9	Steering Gear	36,000 Miles			Check for Grease Leak Do not Lubricate
10	Master Cylinder	6,000 Miles	Delco Supreme No. 11 or equivalent	As required	Check - add fluid when necessary
11	Transmission - Manual - Automatic	6,000 Miles 6,000 Miles	GL-5 Dexron® or equivalent	As required As required	Keep even w/filler plug See Lubrication Section
12	Carburetor Linkage - V-8	6,000 Miles	Engine Oil	As required	
13	Universal Joints	6,000 Miles	Chassis Lubricant	As required	See Lubrication Section
14	Propeller Shaft Slip Joints	6,000 Miles	Chassis Lubricant	3 places as required	
15	Front and Rear Axle	6,000 Miles	GL-5	As required	Check See Lubrication Section
17	Drag Link	6,000 Miles	Chassis Lubricant	2 places as required	
18	Brake and Clutch Pedal Springs	6,000 Miles	Engine Oil	As required	
21	Transfer Case	6,000 Miles	GL-5	As required	Check See Lubrication Section
22	Throttle Bell Crank - L-6	6,000 Miles	Engine Oil	As required	

*Replace Cam and Lubricator at 24,000 mile intervals.

SECTION 1A

HEATER AND AIR CONDITIONING

CONTENTS OF THIS SECTION

HEATER

INDEX

GENERAL DESCRIPTION

Heater components attach to the right side of the dash. The blower motor, heater core, and hose assembly mount on the engine side of the dash panel while the distributor ducting, and controls are under the dash (fig. 1).

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

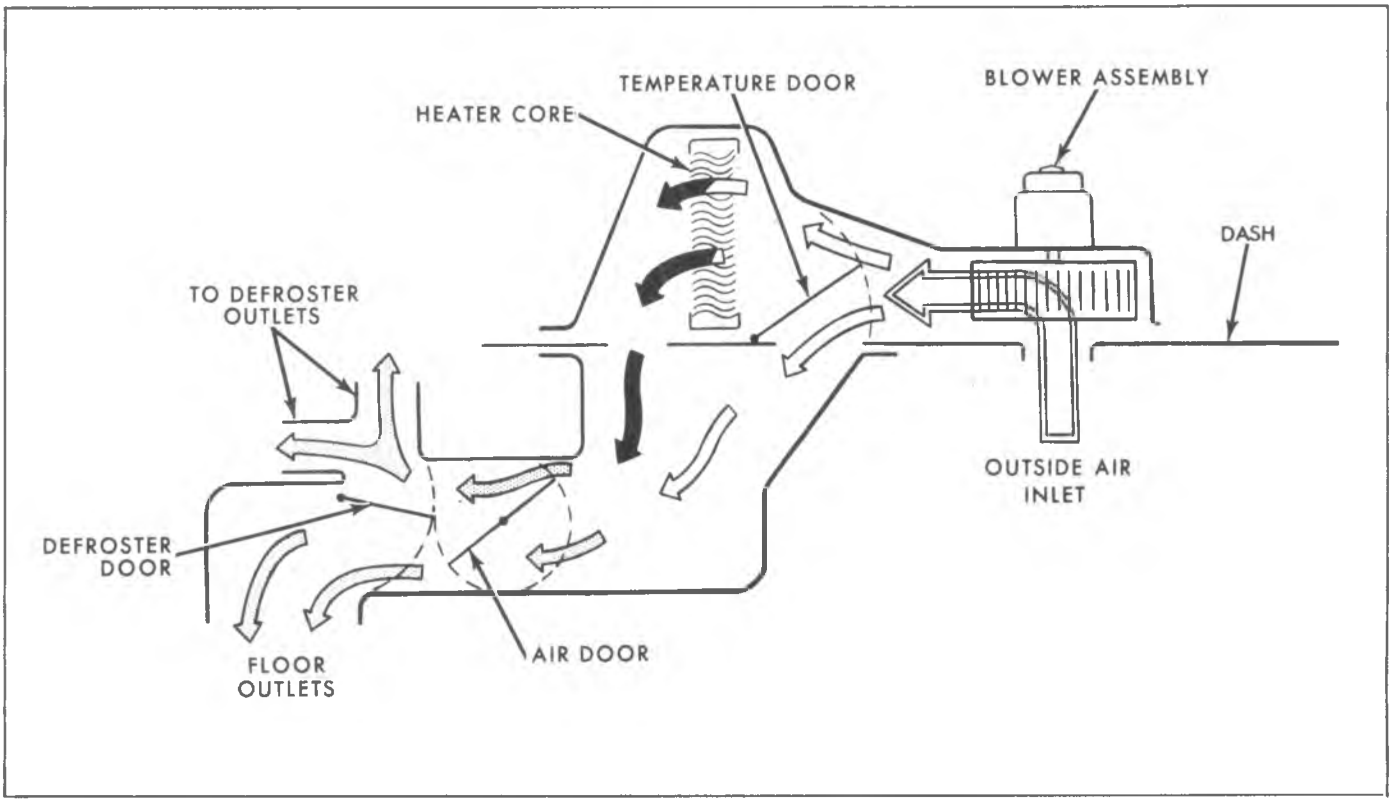


Fig. 1—Heater Airflow Schematic

Engine coolant constantly flows through the heater core during engine operation. Heater output is adjusted by varying the airflow and air temperature through the system. A dash mounted three lever control system is employed. One lever controls the heater-defroster air deflector. The second lever opens the air door and operates the three speed fan switch. The third lever operates a temperature door which passes the airflow either through the heater core, around the core, or partially through and partially around the core.

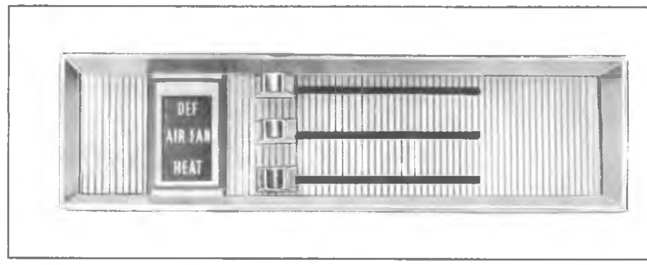


Fig. 2—Heater Control Panel

CONTROLS

The heater controls are located in the center of the dash, below the ash tray. In operation, three levers control all heater operations (fig. 2).

DEF Lever

Moving the DEF (defroster) lever to the right moves an air deflector in the distributor duct which channels the airflow partially or fully to the defroster air outlets.

AIR-FAN Lever

When this lever is fully left, no air passes through the system. Moving the lever to the right about one-third of its travel opens the air door in the air distributor duct. Moving the lever further to the right operates the three speed blower switch.

HEAT Lever

When this lever is fully left, the temperature door in the blower duct causes the airflow to bypass the heater core. Moving the lever to the right moves the temperature door allowing some air to pass through the core and some to bypass the core. With the lever fully right, all air flowing through the system passes through the core.

COMPONENT REPLACEMENT AND REPAIR

BLOWER ASSEMBLY

Removal

1. Disconnect battery ground cable.
2. Support the right front of the hood in the fully raised position.
3. Carefully scribe the hood and fender locations of the right hood hinge and remove the hinge.
4. Unclip the blower wire at the blower flange terminal and note or mark the motor flange position in relation to the blower case.
5. Remove the blower assembly mounting screws.
6. Remove the blower assembly (pry the flange away from the case carefully if the sealer acts as an adhesive).
7. Remove the nut attaching the blower wheel to the motor shaft and separate the assembly.

Installation

1. Assemble the blower wheel to the motor with the open end of the blower away from the motor.
2. Install the assembly to the blower case, connect ground strap, and connect the motor wire.
3. Remount the hood hinge aligning it carefully with the scribed lines. Check hood alignment.
4. Connect battery ground cable.

BLOWER, CORE CASE AND CORE ASSEMBLY

Removal (Fig. 3)

1. Drain radiator.
2. Disconnect battery ground cable.
3. Unclip the blower motor wire at the blower flange terminal.
4. Disconnect heater hoses at the core tubes (fig. 4).
5. In order to gain access to the lower outboard case attachments, the right front fender skirt should be loosened and moved. Remove enough skirt mounting screws and bolts (from the rear forward) to move the skirt a sufficient amount.
6. (Under dash) Remove the seal on the temperature door cable at the distributor duct adapter and disconnect the cable from the temperature door.
7. Remove the case retaining screws and sheet metal nuts. Pull the case away from the mounting studs and inboard to remove it.

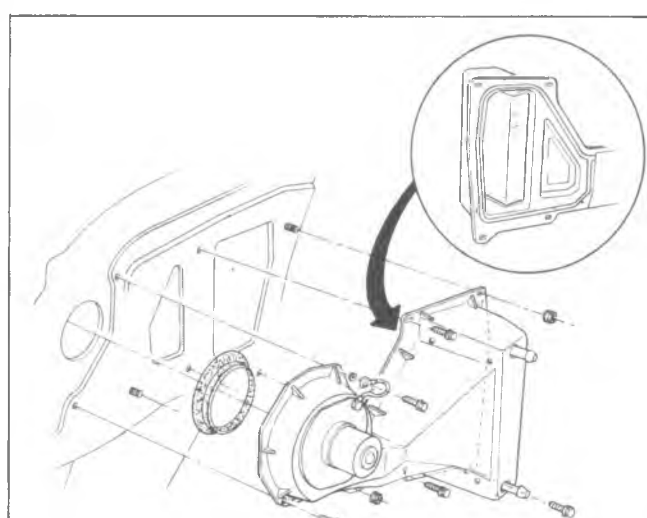


Fig. 3—Heater Assembly

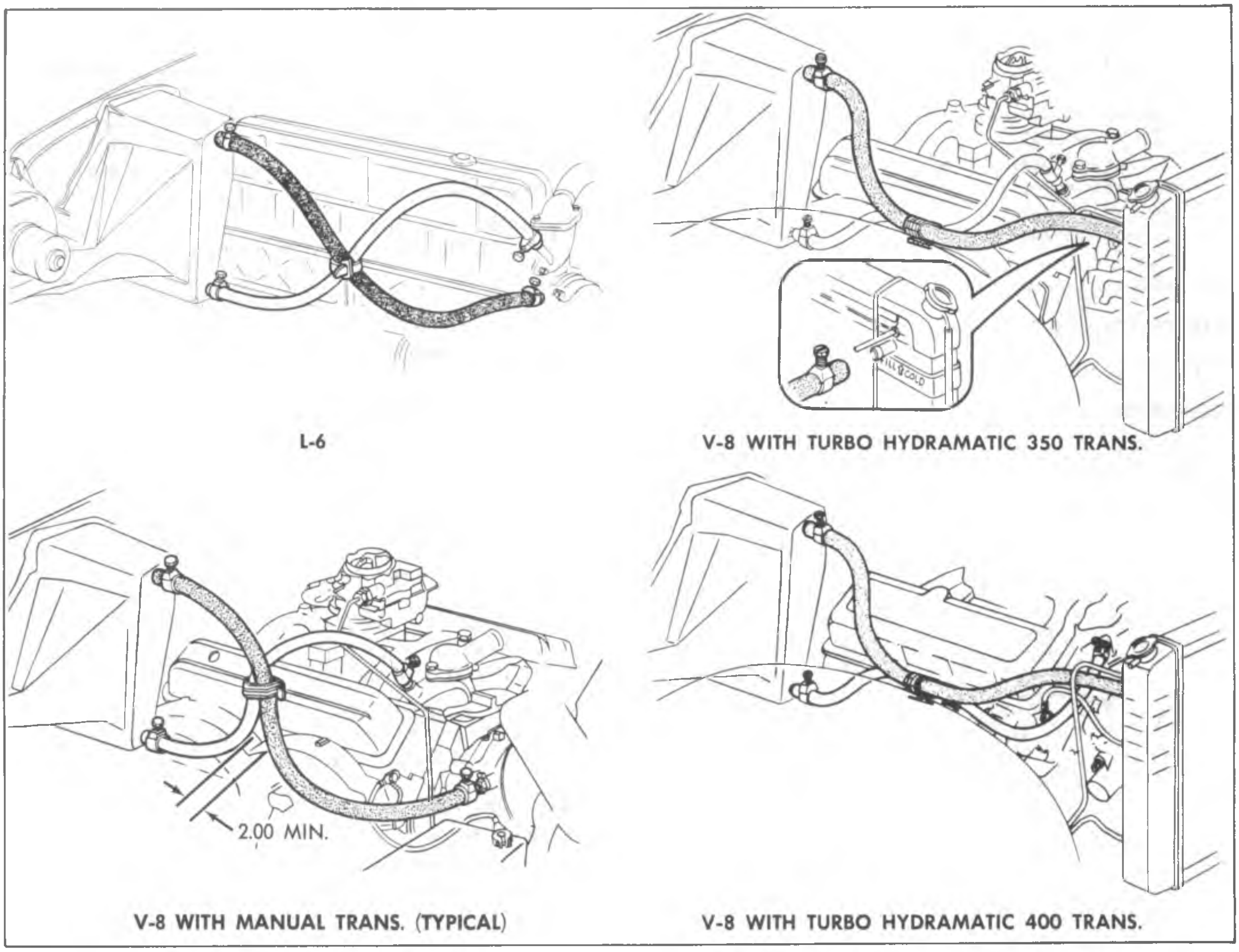


Fig. 4—Heater Hoses

8. Remove the screws attaching the core retainers to the case and remove the core.

Installation

1. Replace the core in the case using non-hardening

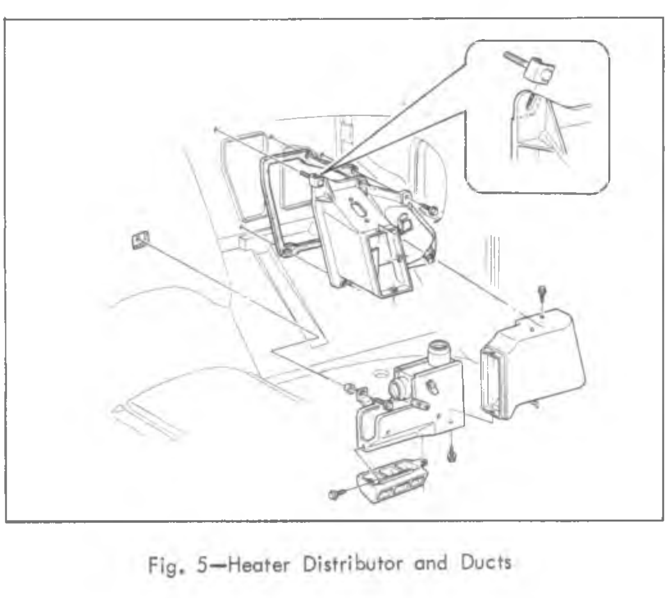


Fig. 5—Heater Distributor and Ducts

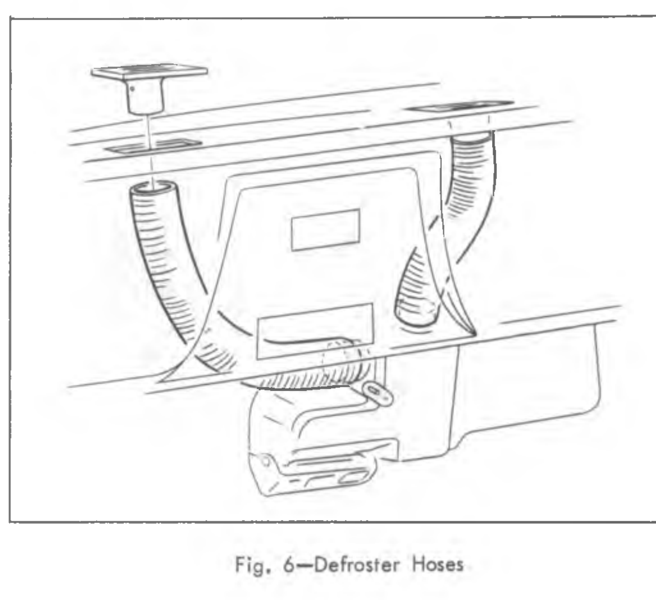


Fig. 6—Defroster Hoses

sealer. Attach the core with the core retainers and screws.
2. Remount the case to the dash panel.
3. Replace and tighten the fender skirt attaching screws and bolts.
4. Connect the temperature door cable to the door and replace the seal.
5. Connect the heater hoses to the core tubes (the hose from the water pump or radiator attaches to the upper core tube).
6. Connect the blower motor wire and battery ground cable.
7. Refill the Cooling System, check for leaks.

AIR DISTRIBUTOR DUCT ASSEMBLY

Figure 5 illustrates air distributor duct installation.

DEFROSTER DUCT

The defroster hose and outlet assemblies are illustrated in Figure 6.

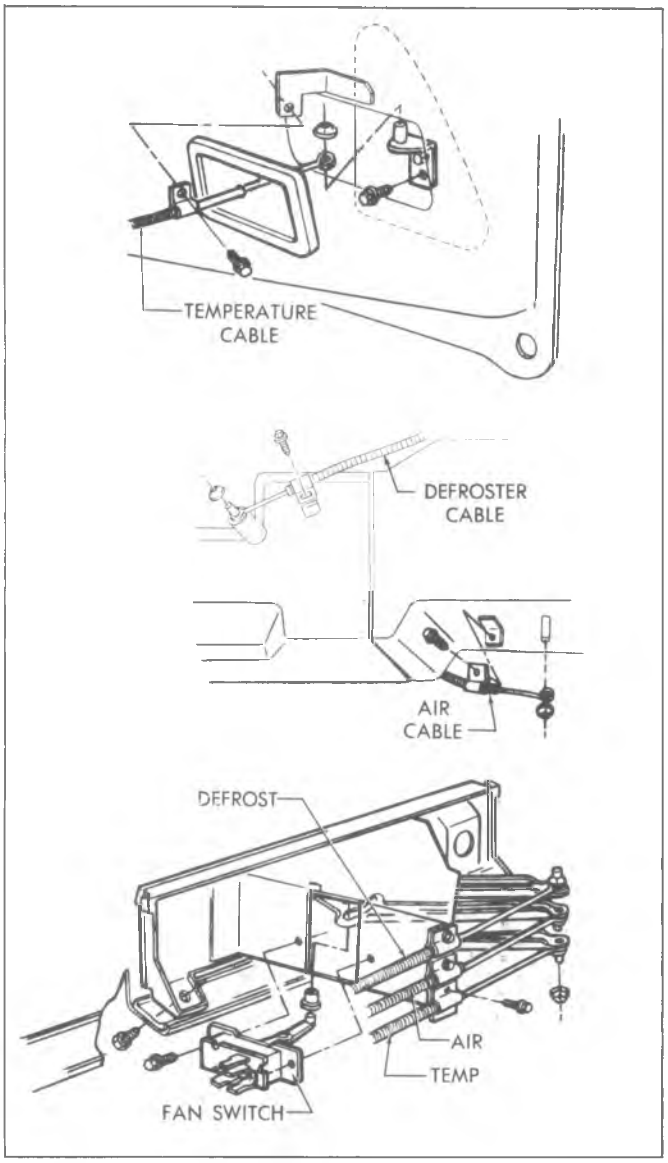


Fig. 7—Heater Control

CONTROL ASSEMBLY

Removal (Fig. 7)

1. Remove the control assembly retaining screws at the lower edge of the dash.
2. Lower the unit and remove the blower switch.
3. Remove the cables from the control unit one by one and mount them in their respective positions on the replacement unit. Check cable adjustment.

Installation

1. Attach the blower switch and wiring to the control unit.
2. Place the unit in position in the dash and replace mounting screws.

CONTROL CABLES

Remove the control assembly as outlined under CONTROL ASSEMBLY and replace the affected cable or cables. Check cable adjustment before installing control.

BLOWER SWITCH

Replacement (Fig. 7)

1. Disconnect the battery ground cable.
2. Disconnect the blower switch wiring harness connector.
3. Remove the blower switch attaching screws and remove the switch.
4. To install, reverse steps 1-3 above.

NOTE: Be sure the switch arm plastic bushing is in place and that the arm is installed in the slot provided in the air-fan lever.

RESISTOR UNIT

Removal (Fig. 8)

1. Remove glove box assembly.
2. Unplug harness connector from resistor unit. Remove the unit attaching screws and remove unit.

Installation

1. Place resistor unit in distributor duct and drive in attaching screws. Connect harness connector to unit.
2. Install glove box assembly.

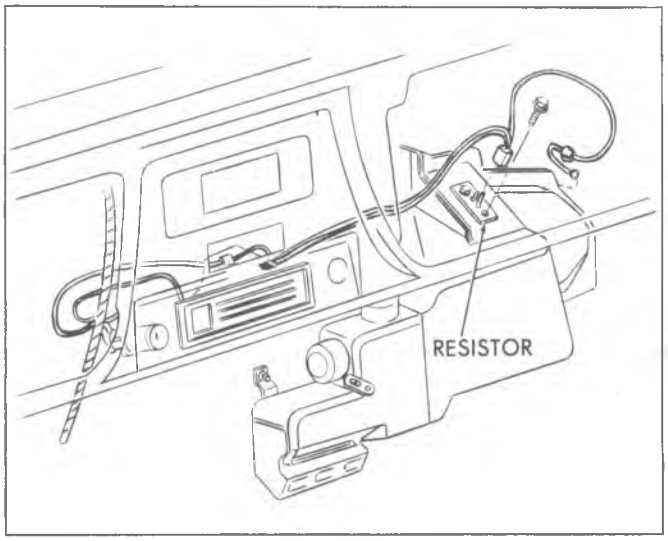


Fig. 8—Heater Wiring

AUXILIARY HEATER

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GENERAL DESCRIPTION

An auxiliary heater is available as a dealer installed accessory to provide additional heating capacity for the rearmost extremities of the panel and suburban models.

This unit operates entirely independent of the standard heater and is regulated through its own controls at the instrument panel.

This system consists of a separate core and fan unit mounted either under the second seat or at the left side of the vehicle (Fig. 9). Heater hoses extend from the unit to the front of the vehicle where they are connected to the standard heater hoses with "tees". An "on-off" water valve is installed in the heater core inlet line in the engine compartment. This valve must be operated manually —"on" for cold weather, "off" in warm weather. The purpose of the valve is to cut off coolant flow to the auxiliary core during warm weather and eliminate the radiant heat that would result.

CONTROLS

Two methods of control are employed with this system:

Water Valve (Fig. 10)

When heat is desired, the water valve must be in the "on" position (valve located in the engine compartment in the core inlet line). During the summer months, this valve should be placed in the "off" position.

Fan Switch (Fig. 11)

The two speed (HI-LOW) fan switch is located below the left side of the instrument cluster. Pulling the switch knob out half-way places the fan on "HI"; at the full out position, the fan is on "LOW".

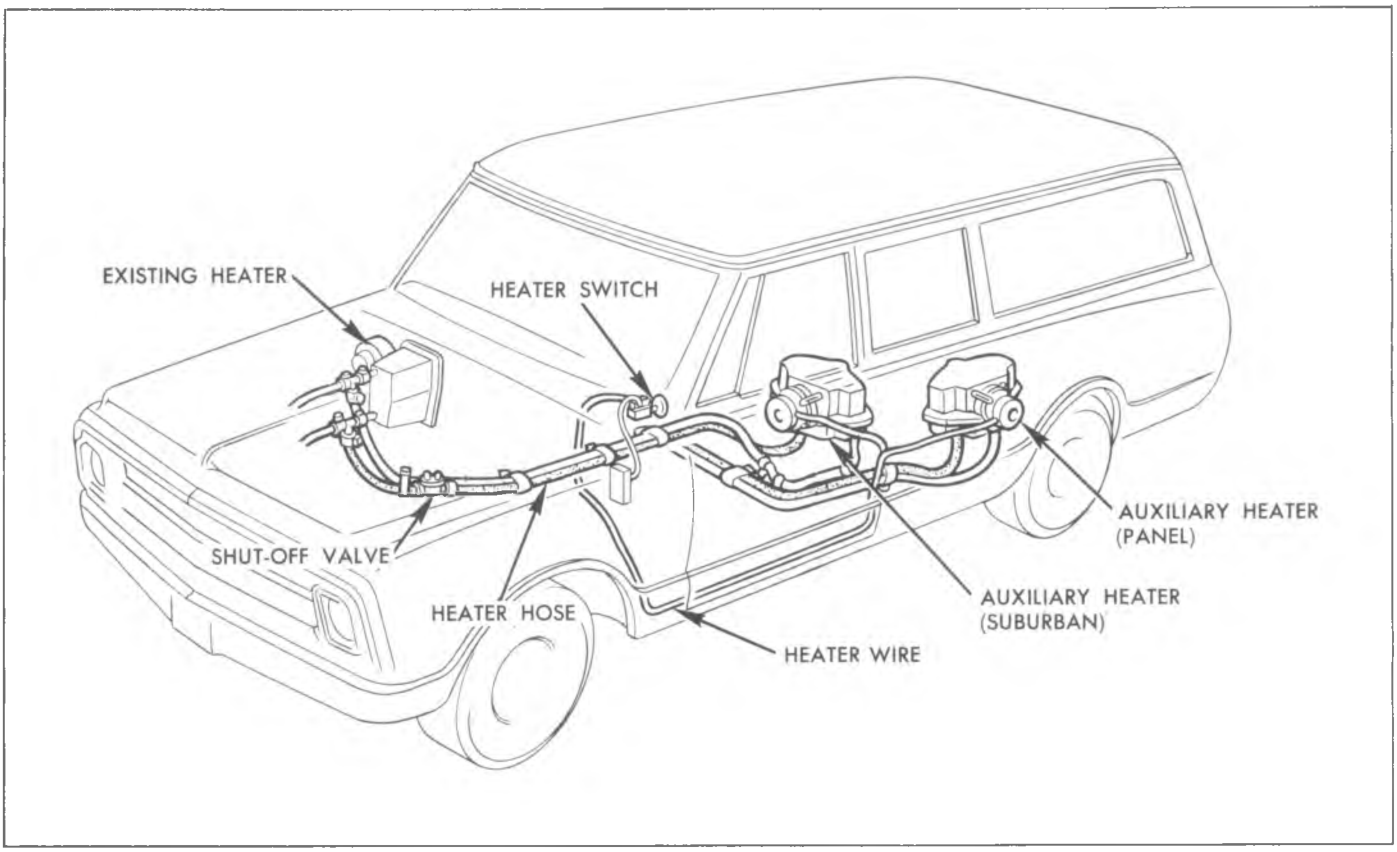


Fig. 9—Auxiliary Heater Installations

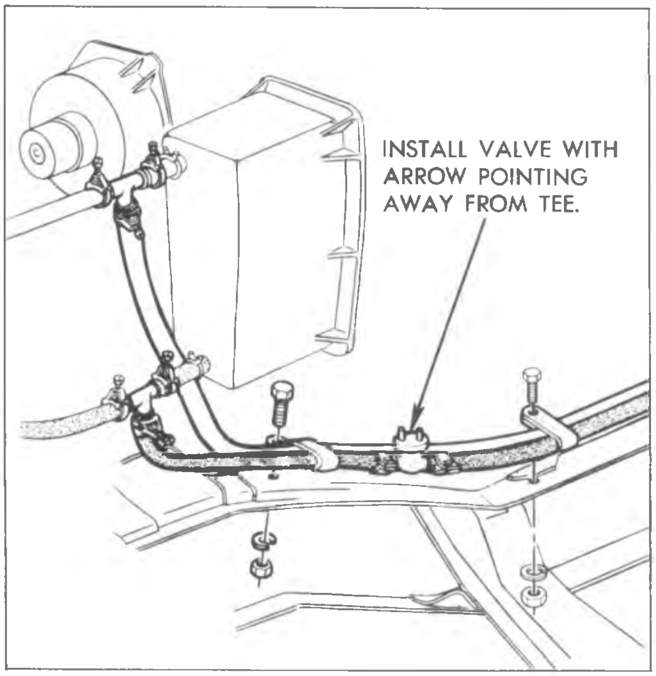


Fig. 10—Auxiliary Heater Water Valve

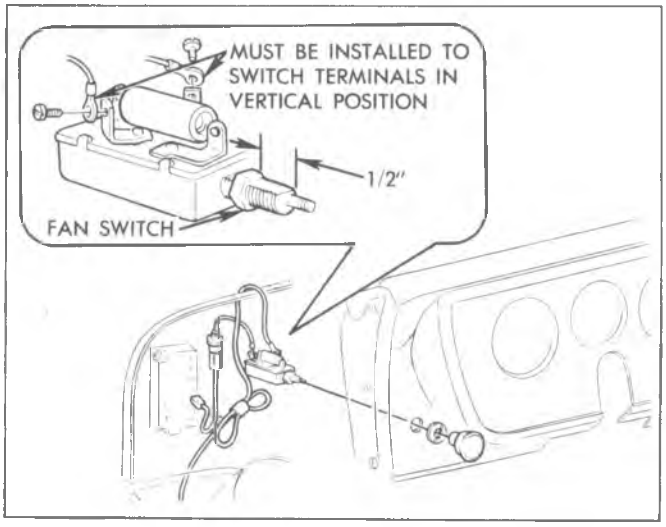


Fig. 11—Auxiliary Heater Control Switch

COMPONENT REPLACEMENT AND REPAIRS

Since a detailed list of installation instructions is included with the auxiliary heater unit, replacement procedures will not be repeated in this section.

CAUTION: All Models—When replacing heater hoses, maintain a 1-1/8" minimum clearance between the auxiliary heater core outlet line and the exhaust pipe (fig. 12). Draw hoses tight to prevent sag or rub against other components.

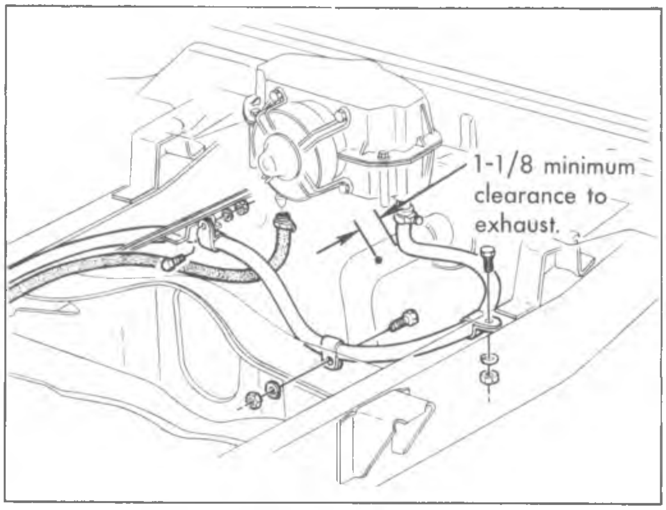


Fig. 12—Auxiliary Heater Hose Routing-Suburban Models

AIR CONDITIONING

INDEX

GENERAL DESCRIPTION

FOUR-SEASON SYSTEM

The Four-Season system uses an evaporator pressure control known as the POA (Pressure Operated Absolute) valve. 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.

Both the heating and cooling functions are performed by this system. Air entering the vehicle must pass either through the cooling unit (evaporator) or through the heating unit, or through both. The system is thus referred to as a parallel system.

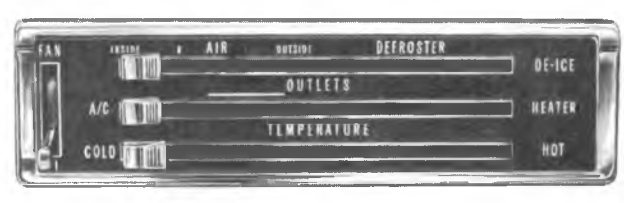


Fig. 13—Four Season System Controls

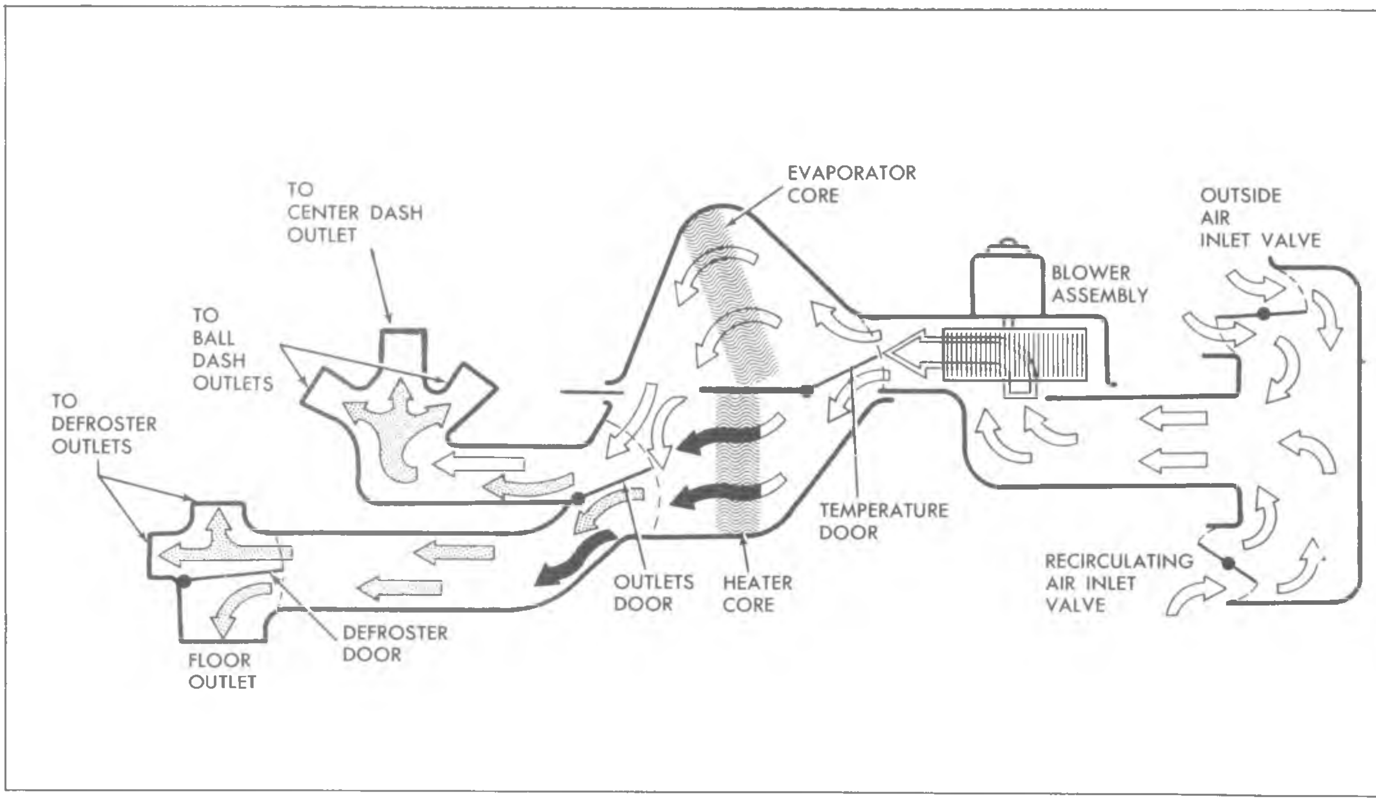


Fig. 14—Airflow Schematic

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.

System operation is as follows (See Figure 14): Air, either outside air or recirculated air enters the system and is forced through the system by the blower.

The air passes by the temperature door and is directed through the heating or cooling cores, or split to flow through both. After flowing through the core or cores, the air passes the outlets door which directs it to the dash or floor outlets or both. Air directed to the dash outlets is finally controlled by the position of the air outlets. Air directed to the floor outlets passes the defroster door which directs the air out the floor outlets, the defroster outlets, or both.

Linkage is so designed that when the system controls are calling for heat, air will enter the vehicle through the floor distributor duct, and when the system controls call for cooling, air will enter through the three dash outlets. The side dash outlets may be rotated to provide either soft, diffused airflow or spot cooling. Rotate half way to shut off airflow. The barrel type outlet in the center of the dash will direct air up or down or, if desired, shut it off.

CONTROLS

Full control of the Four-Season System is obtained through the use of a single control panel (fig. 13). The control levers make use of bowden cables to activate the various doors and switches necessary for system operation. Control adjustment is a matter of properly setting these bowden cables. The following paragraphs explain each control.

"Outlet" Lever

This lever actuates an air diverter door within the duct assembly which routes airflow when fully right (HEATER) to the floor distributor ducts (for heater operation) or when fully left (A/C) to the dash outlets (for cooling operation).

Moving this lever toward the left from the HEATER position will activate the compressor clutch switch and set the cooling portion of the system in operation providing the FAN switch is turned on.

When the lever is moved fully toward the right (heating position) the AIR control lever will automatically move to the outside air position.

Temperature Lever

The "TEMPERATURE" lever, through its bowden cable, actuates the door which controls outlet temperature. This door is necessary to permit mixing of hot and cool air to provide the desired conditioned air outlet temperature, whether during heating or cooling operations.

The temperature door directs the airflow through either the heater core, the evaporator core or through both. When the system is set for full cooling, all air passes through the evaporator core. When warmer outlet air is desired, the temperature door is moved by the temperature lever so that some air passes through the heater core. The warmed air mixes with the cooled air resulting in a higher outlet air temperature. In the full HOT position, all air flows through the heater core. For

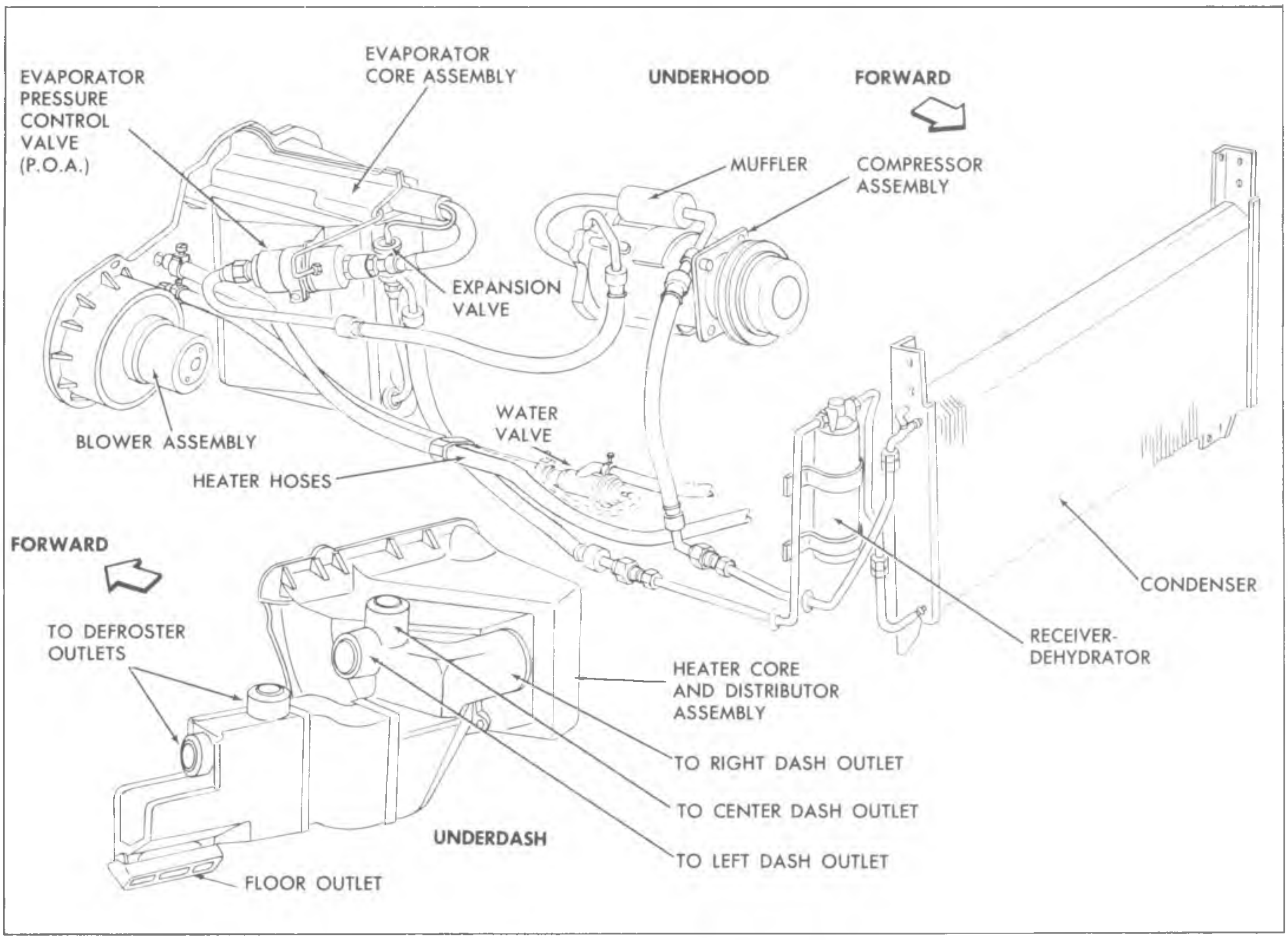


Fig. 15—Four Season System Components

cooler air, moving the lever toward COOL will send some air through the evaporator core (inoperative when the OUTLETS lever is set for heater operation) which in effect bypasses the heater core resulting in less heat output.

Air Control Lever

When the control is properly adjusted, full left position ("INSIDE") will supply 100% recirculated inside air, and moving the lever to the word "OUTSIDE" will supply 100% outside air to the system. Lever movement controls a vacuum switch which in turn actuates an air inlet door in the plenum below the air inlet grille and a recirculating air door in the kick pad. In the full left position, vacuum also closes the Hot Water Shut Off Valve, preventing coolant flow through the heater core.

Defroster

As the Air control knob is moved to the right from the "OUTSIDE" position toward the word DEFROSTER the diverter door within the distributor duct moves to send a portion of the airflow to the defroster ducts. Full "right" position of the AIR knob, as indicated on the panel, is the DE-ICE position which sends the total airflow to the defroster ducts.

Fan Switch

The fan switch controls the operation of the three speed blower motor.

ROOF MOUNTED SYSTEM

The Roof-Mounted System is available for CKE 10-20 series Suburban and Panel Trucks.

This system operates in conjunction with the Four-Season System — it is not available as a separate system. This system operates on recirculated air only.

The blower-evaporator assembly is mounted to the roof panel at the rear of the vehicle. A small shroud covers the unit and houses adjustable outlets. Blower motor operation is controlled by an I.P. mounted three-speed fan switch. Refrigerant is controlled by the Four-Season system. Refrigerant control is provided for the rear unit by an expansion valve. Refrigerant lines "tee" into the Four-Season lines and are routed from the engine compartment to the evaporator as shown in Figure 16.

CONTROLS

The Four-Season controls operate as previously described. The rear unit is controlled by a single three-

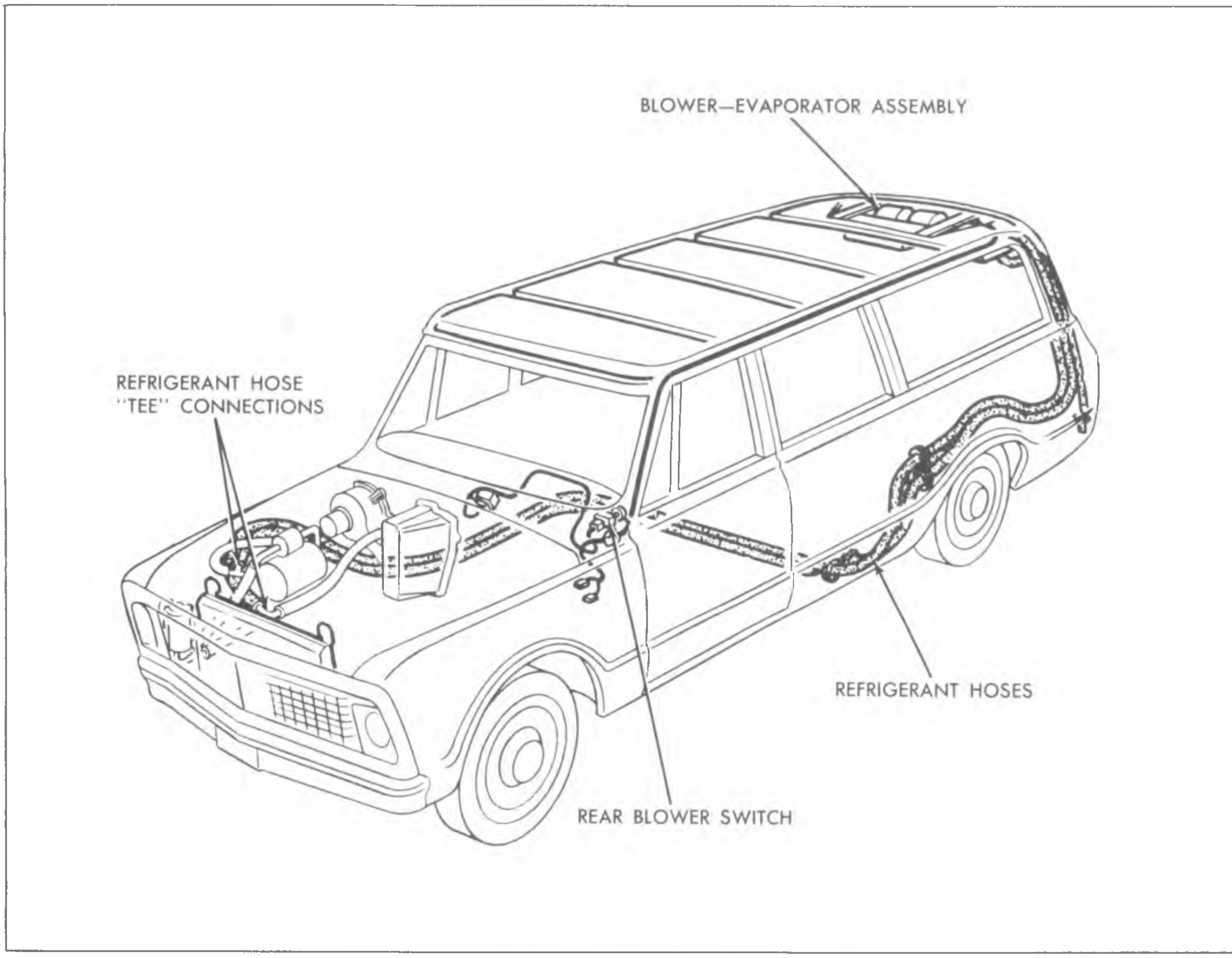


Fig. 16—Roof Mounted System Components

speed fan switch located on the dash, beneath the light switch. In the OFF position, the blower is totally inoperative; however, refrigerant is circulating if the Four-Season System in ON. In any of the three positions (LO, MED, HI) the rear blower motor is operative; providing the Four-Season System is ON.

NOTE: To obtain maximum cooling, the Four-Season System should be on inside with the blower switch on HI and the rear unit blower switch should be on HI.

GM CHEVROLET SYSTEM

The GM Chevrolet System is available as a dealer - installed accessory for C10-30 and K10-20 series trucks.

This system is similar to the Four-Season System in placement of the compressor, condenser and receiver-dehydrator (fig. 18). It differs from the Four-Season System in that it:

1. Operates independently of the heater system.
2. Operates on recirculated (inside) air only.
3. Utilizes a thermostatic switch instead of an evaporator control (POA) valve to control outlet air temperature.

Fig. 17—Roof Mounted System Control

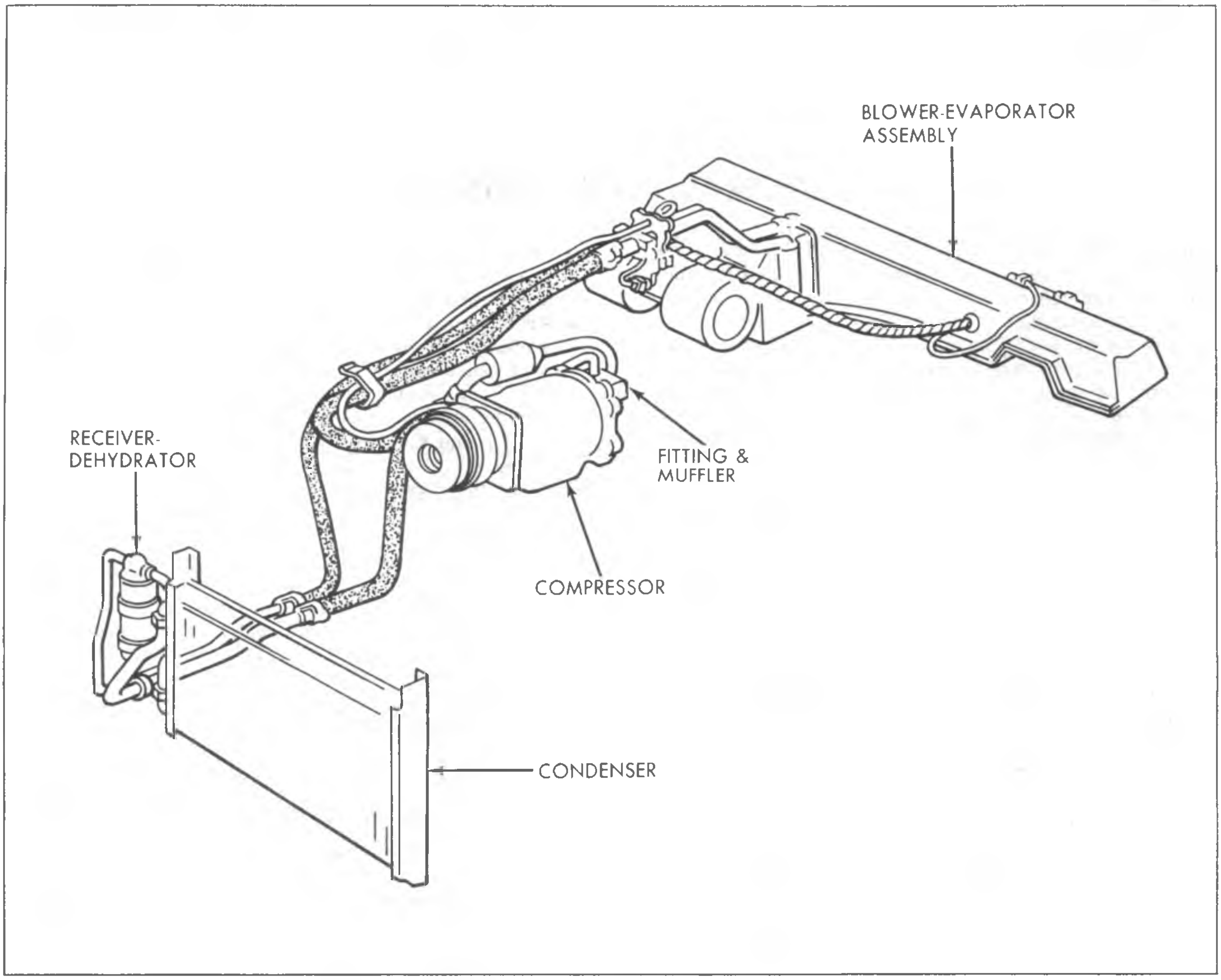


Fig. 18—GM Chevrolet System Components

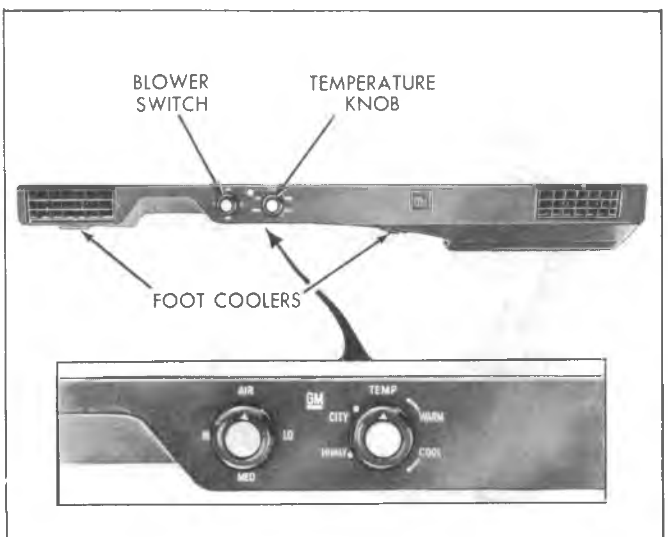


Fig. 19—GM Chevrolet System Controls

The blower-evaporator unit is located under the glove compartment as indicated in Figure 18. An air duct, containing two adjustable outlets and two foot coolers, delivers air to the driver's side of the vehicle. The entire unit is attached to the instrument panel and to the right hand shroud side panel at five locations.

CONTROLS (Fig. 19)

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. When operating this system, the Heater must be fully off for maximum cooling.

Air Knob

Turning the AIR knob clockwise operates the three speed blower motor.

Temp Knob

This knob may be regulated to control the degree of cooling desired. Fully clockwise at CITY provides maximum cooling; however, turning the knob to HIWAY provides adequate cooling for highway operation.

NOTE: Reduced cooling could be encountered when operating at highway speeds with the controls at the "CITY" setting.

GENERAL INFORMATION

In any vocation or trade, there are established procedures and practices that have been developed after many years of experience. In addition, occupation 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).

WARNING: The following precautions in handling R-12 should be observed at all times.

- If it is ever necessary to transport or carry a cylinder 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 since the resulting increase in pressure may cause the safety valve to release or the cylinder or can to burst.
- Cylinders or disposable cans should never be subjected to high temperature when adding refrigerant to the system. In most instances, heating the cylinder 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 cylinder on a gas stove, radiator or use a blow torch while preparing for the charging operation, since a serious accident could result. Don't depend on the safety valve - many cylinders have burst when the safety valve 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.
- 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. If a R-12 liquid should strike the eyes, here is what to do:

1. Keep calm.
2. Do not rub the eyes! Splash the affected area with quantities of cold water to gradually get the temperature above the freezing point. The use of mineral, cod liver or an antiseptic oil is important in providing a protective film to reduce the possibility of infection.
3. As soon as possible, call or consult an eye specialist for immediate and future treatment.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

- All metal tubing lines should be free of kinks, because of the restriction that kinks will offer to the flow of refrigerant. The refrigeration capacity of the entire system can be greatly reduced by a single kink.
- The flexible hose lines should never be bent to a radius of less than 10 times the diameter of the hose.
- The flexible hose lines should never be allowed to come within a distance of 2-1/2" of the exhaust manifold.

Fig. 20—System Contaminants

- 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 new lines that have been sealed during storing.
- 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 as described under "Purging the System" in this section.

WARNING: Always wear safety goggles when opening refrigerant lines.

- In the event any line is opened in 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 swaged 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 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 contaminants may form acids and sludge and eventually cause the breakdown of components within the system. In addition, contaminants may affect the temperature-pressure relationship of R-12, resulting in improper operating temperature and pressures and decreased efficiency of the system.

CAUTION: 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 be capped immediately after use.
- When it is necessary to open a system, have everything you will need ready and handy so that as little time as possible will be required to perform the operation. Don't leave the system open any longer than is necessary.
- Finally, after the operation has been completed and the system sealed again, air and moisture should be evacuated from the system before recharging.

J-8393 CHARGING STATION

The J-8393 Charging Station is a portable assembly of a vacuum pump, refrigerant supply, gauges, valves, and most important, a five (5) pound metering refrigerant charging cylinder. The use of a charging cylinder eliminates the need for scales, hot water pails, etc.

The chief advantage of this unit is savings. A very definite savings in refrigerant and time can be obtained by using this unit. Since the refrigerant is metered into the system by volume, the correct amount may be added to the system. 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.

All evacuation and charging equipment is hooked together in a compact portable unit (fig. 21). It brings air conditioning service down to the basic problem of hooking on two hoses, and manipulating clearly labeled valves.

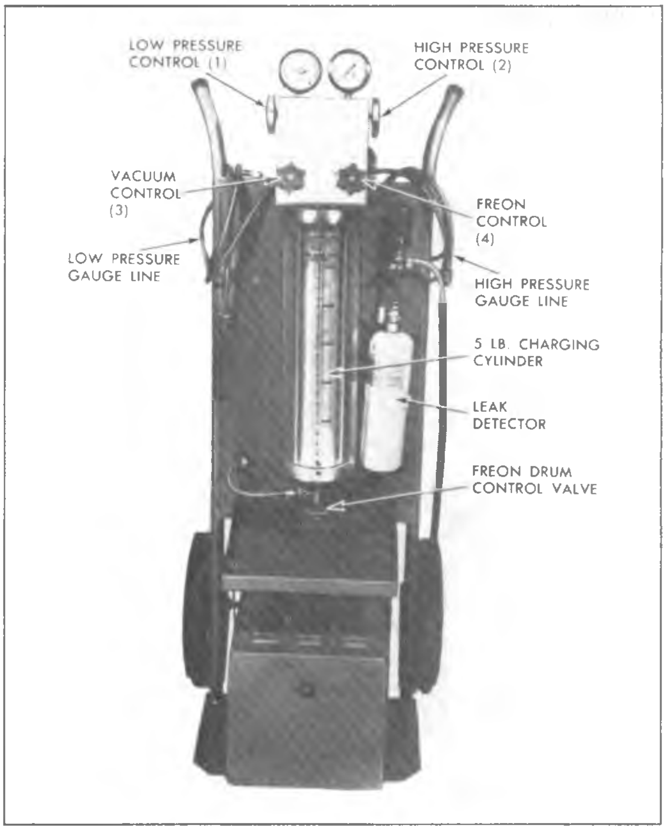


Fig. 21—J-8393 Charging Station

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.

GAUGE SET

The gauge set (fig. 22) is an integral part of the J-8393 Charging Station. It is used when purging, evacuating, charging or diagnosing trouble in the system. The gauge at the left is known as the low pressure gauge. The face is graduated into pounds of pressure and, in the opposite direction, in inches of vacuum. This is the gauge that should always be used in checking pressures on the low pressure side of the system. When all parts of the system are functioning properly the refrigerant pressure on the low pressure side never falls below 0 pounds pressure. However, several abnormal conditions can occur that will cause the low pressure to fall into a partial vacuum. Therefore, a low pressure gauge is required.

The high pressure gauge is used for checking pressures on the high pressure side of the system.

The 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 operations, the valves must be closed. Both valves will be open at the same time during purging, evacuating and charging operations.

The charging station provides two flexible lines for connecting the gauge set to the system components.

VACUUM PUMP

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

The vacuum pump (fig. 23) is a component part of Charging Station J-8393, described previously.

CAUTION: The following precautions should be observed relative to the operation and maintenance of this pump.

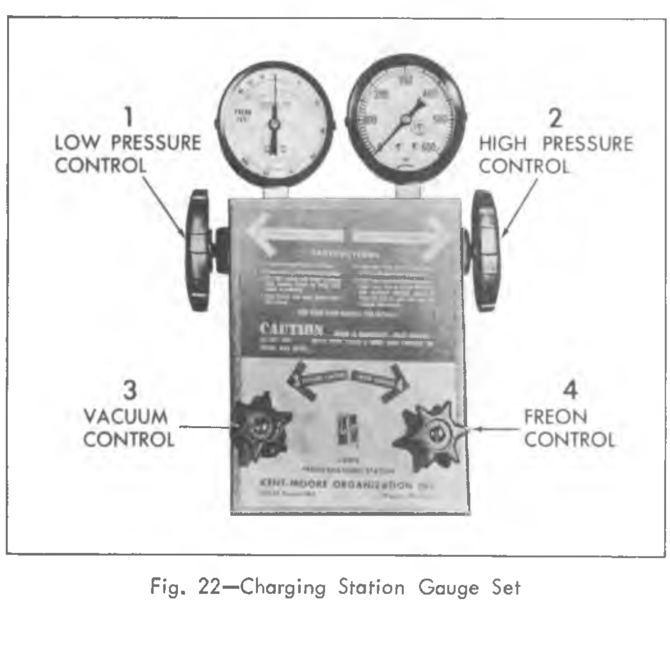


Fig. 22—Charging Station Gauge Set

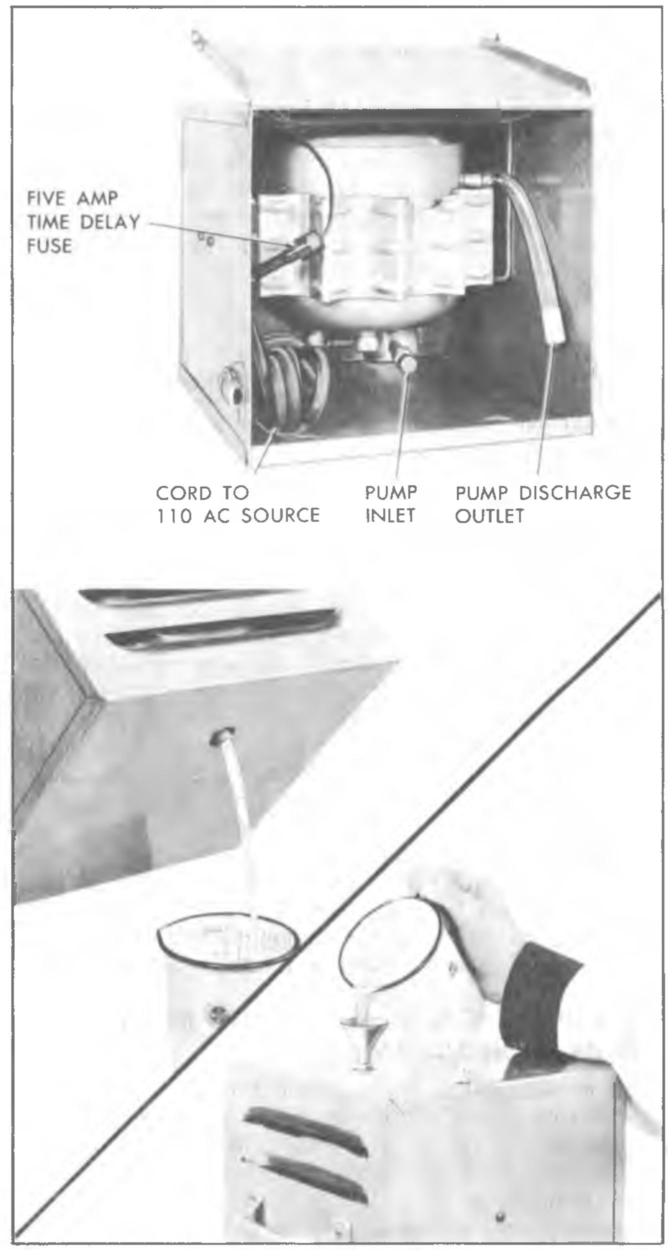


Fig. 23—Vacuum Pump

- 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. 23). Recharge with 8 ounces of vacuum pump oil, Frigidaire 150 or equivalent (fig. 23). If you desire to flush out the pump, use the same type clean oil. Do not use solvent.

NOTE: Improper lubrication will shorten pump life.

- 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.

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.

CAUTION: 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. 24) 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.

WARNING: Do not use lighted detector in any place where combustible or explosive gases, dusts or vapors may be present.

Operating Detector

1. Determine if there is sufficient refrigerant in the system for leak testing.
2. Open control valve only until a low hiss of gas is heard, then light gas at opening in chimney.
3. Adjust flame until desired volume is obtained. This is most satisfactory when blue flame is approximately 3/8" above reactor plate. The reactor plate will quickly heat to a cherry red.
4. 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.

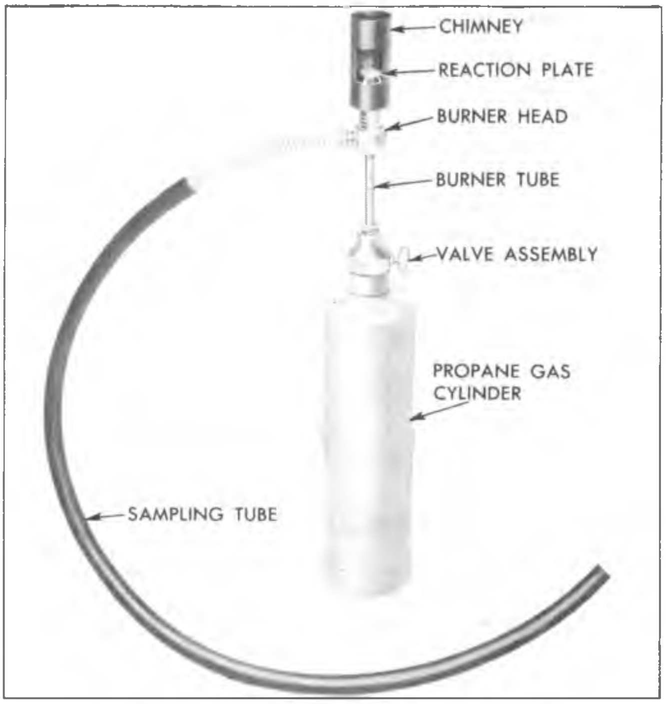


Fig. 24—Leak Detector

WARNING: Do not breathe the fumes that are produced by the burning R-12 gas in the detector flame, since such fumes can be toxic in large concentrations of R-12.

5. Watch for color changes. The color of the flame which passes through the reaction plate will change to green or yellow-green when sampling hose draws in very small leaks of R-12. Large leaks will be indicated by a change in color to a brilliant blue or purple. When the sampling hose passes the leak, the flame will clear to an almost colorless pale blue again. Observations are best made in a semi-darkened area. If the flame remains yellow when unit is removed from leak, insufficient air is being drawn in or the reactor plate is dirty.

NOTE: A refrigerant leak in the high pressure side of the system may be more easily detected if the system is operated for a few minutes, then shut off and checked immediately (before system pressures equalize). A leak on the low pressure side may be more easily detected after the engine has been shut off for several minutes (system pressures equalized); this applies particularly to the front seal.

AVAILABILITY OF REFRIGERANT-12

Refrigerant 12 is available in 30 lb. and in 15 oz. disposable containers.

Normally, air conditioning systems are charged making use of the J-8393 Charging Station which uses the 30 lb-container. Evacuating and Charging Procedures are noted later in this section.

The 15 oz. disposable cans are generally used for miscellaneous operations such as flushing.

COMPRESSOR OIL

Special refrigeration lubricant should be used in the system. This oil is as free from moisture and contaminants as it is possible to attain by human processes. This condition should be preserved by immediately capping the bottle when not in use.

See "Air Conditioning System Capacities" for the total system oil capacity.

Due to the porosity of the refrigerant hoses and connections, the system refrigerant level will show a definite drop after a period of time. Since the compressor oil is carried throughout the entire system mixed with the refrigerant, a low refrigerant level will cause a dangerous lack of lubrication. Therefore the refrigerant charge in the system has a definite tie-in with the amount of oil found in the compressor and an insufficient charge may eventually lead to an oil build-up in the evaporator.

COMPRESSOR SERIAL NUMBER

The compressor serial number is located on the serial number plate on top of the compressor. The serial number consists of a series of numbers and letters. This serial number should be referenced on all forms and correspondence related to the servicing of this part.

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 the 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 and no temperature differential between compressor inlet and outlet lines, indicates no charge.
5. Check refrigerant hose connections:
   "O" ring Connections - Check torque of fittings as charted later in this section under "Refrigerant Line Connections;" retorque if required. Leak test the complete system.
   Hose Clamp Connections - If clamp screw torque is less than 10 in. lb., retighten to 20-25 in. lbs. Do not tighten to new hose specifications or hose leakage may occur. Leak test the complete system.
6. If there is evidence of an oil leak, check the compressor to see that the oil charge is satisfactory.

   NOTE: A slight amount of oil leakage at the compressor front seal is considered normal.
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 for proper oil charge.

   NOTE: A slight amount of oil leakage at the compressor front seal is considered normal.
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 refrigerant hose connections as in Step 5 of "Pre-Delivery Inspection."

PERIODIC SERVICE

- Inspect condenser regularly to be sure that the fins are not plugged with leaves or other foreign material.
- Check evaporator drain tubes regularly for dirt or restrictions.
- At least once a year, check the system for proper refrigerant charge and the flexible hoses for brittleness, wear or leaks.
- Every 6000 miles check sight glass for low refrigerant level.
- Check belt tension regularly.

EVACUATING AND CHARGING PROCEDURES

AIR CONDITIONING SYSTEM CAPACITY

	Refrigerant Charge	Oil Charge
Four-Season System	3 lbs. 4 oz.	10 oz. 525 Viscosity
Roof-Mounted	5 lbs. 8 oz.	13 oz. 525 Viscosity
GM Chevrolet	3 lbs. 4 oz.	10 oz. 525 Viscosity

INSTALLING CHARGING STATION

1. High and low pressure gauge line fittings are provided in the air conditioning system for attaching the Charging Station.

   Four-Season and Roof Mounted Systems—The low pressure fitting is located on the POA valve. The high pressure fitting is located on the muffler (fig. 25).

NOTE: The connector assembly consists of inlet (suction) and outlet (discharge) lines with the freon hoses swaged to the metal lines.

GM Chevrolet Systems—The low pressure fitting is located on the connector block and the high pressure fitting on the muffler (fig. 25).

2. Install Gauge Adapters J-5420 and J-9459 onto the high and low pressure gauge lines.
3. With the engine stopped, remove the caps from the cored valve gauge fittings.
4. Be certain all valves on charging station are closed.
5. Connect high pressure gauge line to high pressure gauge fitting.
6. See Figure 22. 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.
7. System is now ready for purging or performance testing.

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 Charging Station gauge set to the proper high and low pressure gauge fittings. (See "Installing Charging Station")

   CAUTION: Before installing lines, be sure that all four controls on the gauge set are closed.

2. Disconnect vacuum line at Charging Station vacuum pump and put the line in a covered can as shown in Figure 27.

   NOTE: An empty 3 lb. coffee can with a plastic cover which has been cross-slit (X'ed), to allow hose entry, works well for this purpose.

3. Fully open high (2) and low (1) pressure control valves, and allow refrigerant to purge from system at a rapid rate into the covered can.
4. Oil loss will be minimal. It may be added to the system during evacuation as described later.
5. Toward the end of the purge stage, Tool J-24095 should be flushed with refrigerant to eliminate possible contamination.
   a. Disconnect refrigerant line at supply tank.
   b. Flush Tool J-24095 by cracking valve on refrigerant tank. Close valve after flushing for approximately three seconds.
   c. Temporarily refasten the tool.
   d. Reconnect refrigerant line to supply tank.

EVACUATING AND CHARGING THE SYSTEM

GENERAL NOTE: In all evacuating procedures shown below, the specification of 28-29 inches of Mercury vacuum is used. These figures are only attainable at or near Sea Level Elevation.

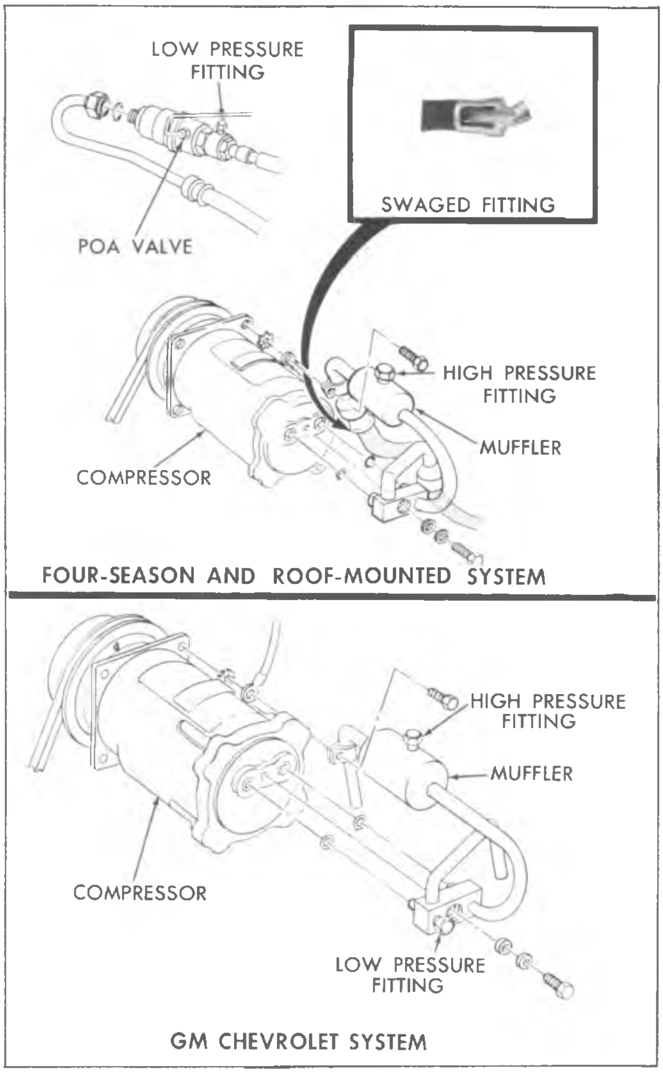


Fig. 25—Compressor Connector Block - Typical

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 23 to 24 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.

Adding Oil

If necessary, refrigerant oil may be added to the system by the following procedure:

1. Install charging station and purge system as previously described.
2. After system has been purged, connect the vacuum line to the vacuum pump.
3. Measure oil loss collected as a result of purging the system.

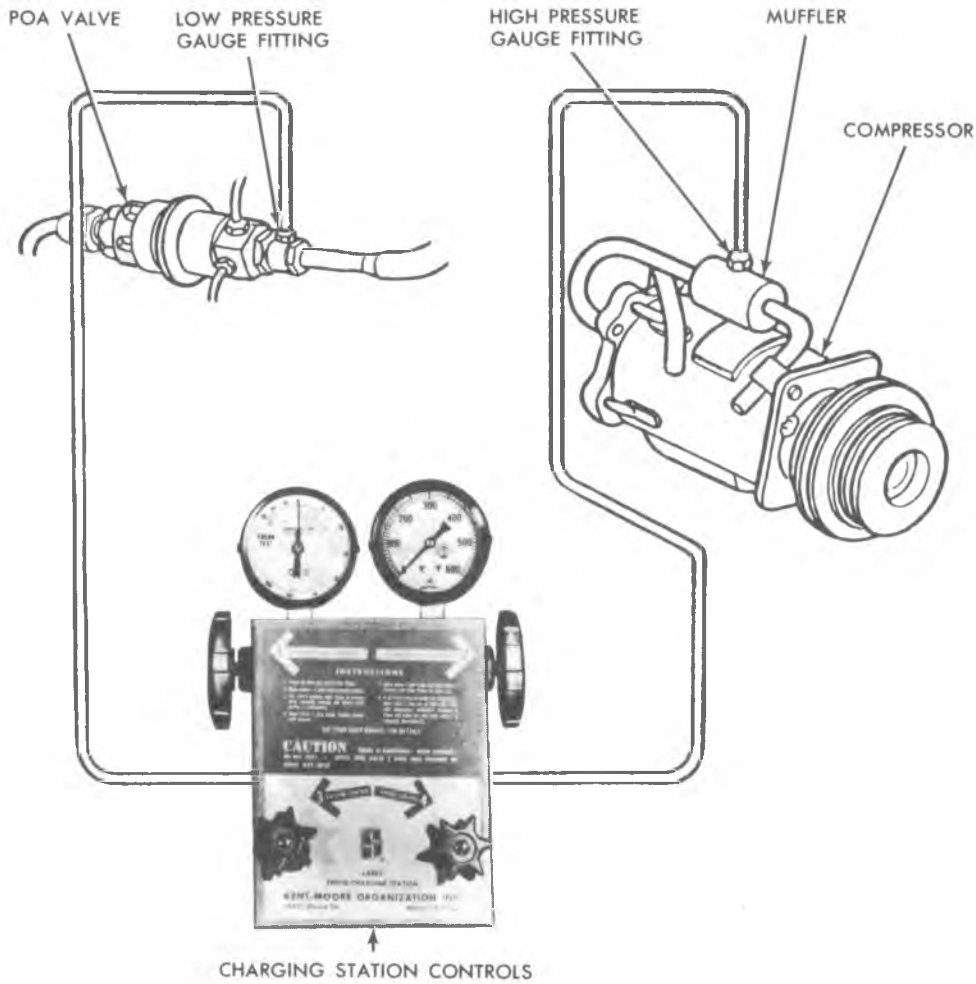


Fig. 26—Charging Schematic (Four Season System Shown)

a. Disconnect low pressure line at POA valve. Install Tool J-24095 (with valve closed) onto suction fitting on POA valve. Insert pick-up tube into graduated container of clean refrigerant oil (Fig. 28).

NOTE: Tool J-24095 will hold 1/2 of an ounce of oil in the tool itself. So if 1 oz. has to be added, the level of the oil in the bottle should decrease 1-1/2 ounces to add 1 oz. to the system.

CAUTION: <u>WHEN REMOVING THE GAUGE LINES FROM THE FITTINGS, BE SURE TO REMOVE THE ADAPTERS FROM THE SYSTEM FITTINGS RATHER THAN THE GAUGE LINES FROM THE ADAPTER.</u>

b. Turn on vacuum pump, and open vacuum control valve (slowly open high pressure side of manifold gauge set to avoid forcing oil out of refrigerant system and pump).

NOTE: When valve on Tool J-24095 is opened, the vacuum applied to the discharge side of the system will suck oil into system from container. Therefore, close observation of oil level in the container is necessry.

c. Note level of oil in container. Open valve on oil adding tool until oil level in container is reduced by an amount equal to that lost during discharge of system + 1/2 ounce, then close valve. <u>Take care not to add more oil than was lost.</u>

d. Disconnect and cap Tool J-24095 and reinstall low pressure line from charging station to POA. Open low pressure valve (1).

Evacuation

After oil has been added to the system (as outlined above), run pump until 28-29 inches vacuum is obtained (See General Note under "Evacuating and Charging the System"). Continue to run pump for 10 minutes after the system reaches 28-29 inches vacuum.

NOTE: 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 sys-

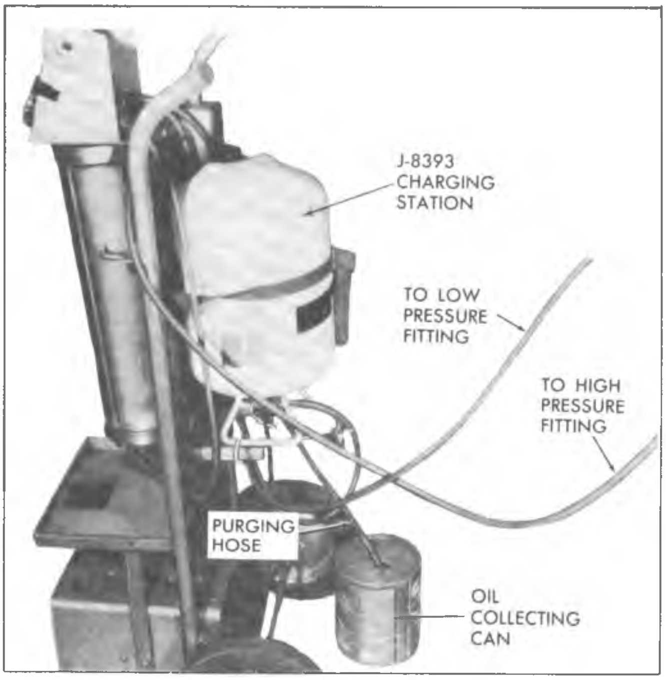


Fig. 27—Collecting Refrigerant Oil During "Purging"

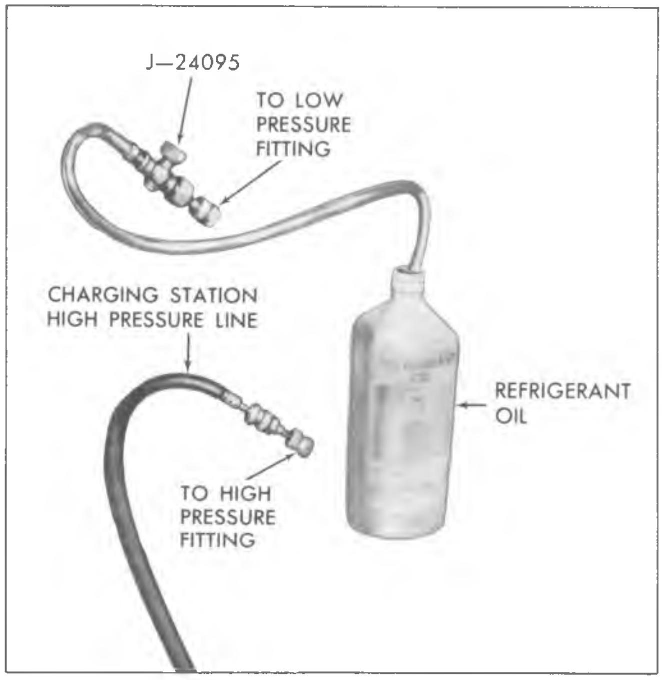


Fig. 28—Adding Refrigerant Oil Using Tool J-24095

tem. Locate and repair all leaks. Purge this 1/2 pound and re-evacuate for 10 minutes.

1. During the ten minute evacuation period, prepare for charging the system by filling the charging cylinder as follows:
   a. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

   NOTE: It will be necessary to close bleed valve periodically to allow boiling to subside to check level in the sight glass of Charging Station cylinder.

   b. Bleed cylinder valve on top (behind control panel) as required to allow refrigerant to enter. When refrigerant reaches desired level (see "System Capacity"), close valve at bottom of cylinder and be certain bleed valve is closed securely.
2. Continue to evacuate for remainder of 10 minute period.
3. Turn hand shut-off valves at low and high pressure gauges of gauge set to full clockwise position with vacuum pump operating, then stop pump. Carefully check low pressure gauge for approximately two minutes to see that vacuum remains constant. If vacuum reduces, it indicates a leak in the system or gauge connections; locate and repair all leaks.

Charging the System

1. Only after evacuating as above, is system ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount of refrigerant for a full charge, fill to the proper level.
2. With High and Low Pressure Valves (1 and 2) open, close Vacuum Control Valve (3), turn off vacuum pump, open refrigerant control valve (4) and allow refrigerant to enter system.

   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 checked as outlined below:

Checking System Operation

1. Operate system for a few minutes at maximum cooling, high blower speed and with engine operating at 2000 RPM (exhaust should be vented if inside).
2. When system is stabilized, the pressure gauges on the charging station should read pressures corresponding to values listed under PERFORMANCE DATA.
3. When correct system pressures are observed, check sight glass to ensure that sight glass is clear (no foam or bubbles can be observed).
4. Feel outlet air distribution to ensure that cold air is being distributed.
5. Disconnect gauge lines and cap fittings.

   CAUTION: When removing gauge lines from fittings, be sure to remove the adapters from the fittings rather than the gauge lines from the adapters.

PERFORMANCE TEST

Under normal circumstances, it will not be necessary to Performance Test a system as outlined below; however, in certain instances, the following procedure may be advantageous in diagnosing system malfunction.

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 control set at "COLD" and all air conditioning outlets open.
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.

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.

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.

Four-Season Air Conditioning

(Refrigerant Charge - 3 Lbs. - 4 Oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	145-155	185-195	200-210	215-225	255-265	285-295
Evaporator Pressure at POA	Dependent Upon Altitude See Chart Under Evaporator Control Valve (POA)					
Discharge Air Temp. at Right Hand Outlet	38-41	38-41	40-43	41-44	43-46	48-51

Roof Mounted Air Conditioning

(Refrigerant Charge - 5 lbs.-8 oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure*	200-210	210-220	225-235	255-265	285-295	330-340
Suction Pressure psi*	-28-	-29.5	29-31	34-36	39-41	43-45
Front Discharge Air Temperature*	34-37	38-43	41-46	47-52	52-57	56-61
Rear Discharge Air Temperature*	41-46	48-53	51-56	58-63	65-70	68-73

GM Chevrolet Air Conditioning

(Refrigerant Charge - 3 lbs.-4 oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure*	110-120	135-145	160-170	190-200	220-230	260-270
Suction Pressure psi*	6	7	9	10	10	13
Discharge Air Temperature*	40-45	41-46	41-46	42-47	44-49	44-49

*When compressor clutch disengages.

REFRIGERANT QUICK-CHECK PROCEDURE

The following procedure can be used to quickly determine whether or not an air conditioning system has a proper charge of refrigerant. This check can be made in a manner of minutes thus facilitating system diagnosis by pinpointing the problem to the amount of charge in the system or by eliminating this possibility from the overall checkout.

Start engine and place on fast idle. Set controls for maximum cold with blower on high.

Bubbles present in sight glass.	No bubbles. Sight glass clear.
System low on charge. Check with leak detector. Correct leak, if any, and fill system to proper charge.	System is either fully charged or empty. Feel high and low pressure pipes at compressor. High pressure pipe should be warm; low pressure pipe should be cold.
No appreciable temperature differential noted at compressor.	Temperature differential noted at compressor.
System empty or nearly empty. Turn off engine and connect charging station. Induce 1/2# of refrigerant in system (if system will not accept charge, start engine and draw 1/2# in through low pressure side). Check system with leak detector.	Even though a differential is noted, there exists a possibility of overcharge. An overfilled system will result in poor cooling during low speed operation (as a result of excessive head pressure). An overfill is easily checked by disconnecting the compressor clutch connector while observing the sight glass.
If refrigerant in sight glass remains clear for more than 45 seconds (before foaming and then settling away from sight glass) an overcharge is indicated. Verify with a performance check.	If refrigerant foams and then settles away from sight glass in less than 45 seconds, it can be assumed that there is a proper charge of refrigerant in system. Continue checking out system using performance checks outlined previously.

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.
- 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.

NOTE: The oil may appear foamy. This is considered normal.

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 as outlined under "Checking Compressor Oil Charge."

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 oz. and the system appears to have lost an excessive amount of oil, add 6 fluid oz. of clean refrigeration oil to replacement compressor, 7 fluid oz. to a repaired compressor.

      If the oil contains chips or other foreign material, replace the receiver-dehydrator and flush or replace all component parts as necessary. Add the full 11 fluid oz. of new refrigeration oil to the replacement compressor.
5. Add additional oil in the following amounts for any system components being replaced.

Evaporator Core	3 fluid oz.
Condenser	1 fluid oz.
Receiver-Dehydrator	1 fluid oz.

CAUTION: 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.

GENERAL REPAIR PROCEDURES

PREPARING SYSTEM FOR REPLACEMENT OF COMPONENT PARTS

Air conditioning, like many other things, is fairly simple to service once it is understood. However, there are certain procedures, practices and precautions that should be followed. For this reason it is strongly recommended that the preceding information in this section be studied thoroughly before attempting to service the system.

Great emphasis must be placed upon keeping the system clean. Use plugs or caps to close system components and hoses when they are opened to the atmosphere. Keep your work area clean.

In removing and replacing any part 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, charge and check the system.

WARNING: 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, charge and check system.

REFRIGERANT LINE CONNECTIONS

"O" Rings

Always replace the "O" ring when a connection has been broken. When replacing the "O" ring, first dip it in clean 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

*Foot Pounds.

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

Hose Clamps

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

Removal

1. Carefully, with a sharp knife, make an angle cut in the hose as shown in Figure 29. This should loosen the hose so that it may be worked off the fitting.
2. Cut off slit end of hose.

NOTE: 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.

Installation

1. Coat tube and hose with clean 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 in. lbs. torque. DO NOT RETORQUE. The clamp screw torque will normally decrease as the hose conforms to the force of the clamp. The screw should be retorqued only if its torque falls below 10 in. lbs. In this case, retorque to 20-25 in. lbs. Further tightening may damage the hose.

REPAIR OF REFRIGERANT LEAKS

Any refrigerant leaks found in the system should be repaired in the manner given below:

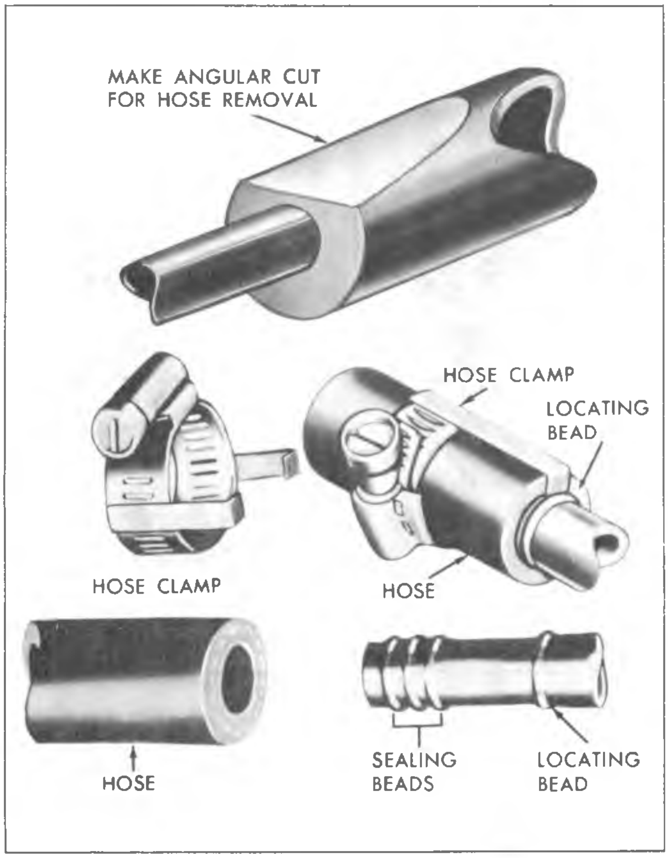


Fig. 29—Hose Clamp Connections

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 with clean refrigeration oil and install carefully.
4. Retorque the fitting, using a backing wrench.
5. Evacuate, charge and check 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 clean refrigeration oil and carefully reinstall over connector. Never push end of hose beyond the locating bead. Properly torque the clamp.
4. Evacuate, charge and check 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.

> **NOTE:** A slight amount of oil leakage past the compressor front seal is considered normal.

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.

Because of the length of the hoses on these systems, hose leaks may be repaired using the following procedure:

1. Locate the leak. This may require removing the body inner side panels to gain access to the hoses (Roof-Mounted System).
2. Discharge the system.
3. Cut out the leaking portion of the hose, making sure that all of the failed portion is removed. If only a very small portion of the hose was removed, it may be possible to splice the two ends together using a special hose connector and two hose clamps. If several inches of hose must be removed, a new piece of hose should be spliced in using two connectors and four hose clamps. Dip the ends of the hoses in clean refrigeration oil before installing the hoses onto the connector. Never push the end of the hose beyond the locating bead of the connector. Torque the clamp to 35-42 in. lbs.

   > **NOTE:** Be sure to replace the hose in the body in the same manner as when removed. If the hose protective grommets are badly mutilated, they should be replaced.

4. Evacuate, charge and check the system.

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.

COLLISION PROCEDURE—ALL SYSTEMS

Whenever a car equipped with an air conditioning unit is involved in a collision or wreck, it should be inspected as soon as possible. The extent of damage to any or all of the component parts and the length of time the system has been exposed to the atmosphere will determine the replacement of parts and processing that will be required. The greater the length of time of exposure to the atmosphere, the greater will have been the chances for air, moisture and dirt to have entered and damaged the system. Every case may be entirely different so it is not possible to establish a hard and fast procedure to follow each time. Good judgment must be used to determine what steps should be taken in each specific case.

The following procedure is presented as a guide for use when inspecting a damaged vehicle equipped with air conditioning.

1. Remove the drive belt.
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 Charging Station.
4. Purge the system.
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 525 Viscosity Oil, or equivalent.

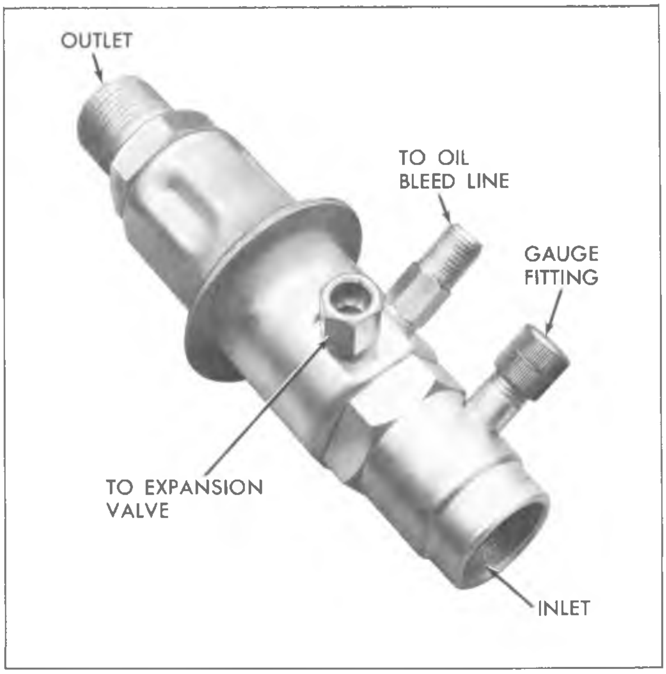


Fig. 30—Evaporator Pressure Control Valve (POA)

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 cylinder or can pressure and leak test the compressor seals prior to installation of compressor.
9. Reinstall the compressor and evacuate the system by following the Evacuating Procedure.
10. Introduce R-12 vapor at cylinder (room) temperature and pressure.
11. Leak test all fittings and connections and give particular attention to a leak test at the compressor shaft seal if compressor has not been leak tested on the bench.
12. Complete system processing and charge system.

MAINTENANCE AND ADJUSTMENTS

EVAPORATOR CONTROL VALVE (POA) (Fig. 30)

The only check for proper POA valve operation is to check the suction pressure at the valve 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

GM Chevrolet System

This system makes use of a thermostatic switch with an air sensing capillary. This capillary controls the switch by sensing the temperature of the air leaving the fins (fig. 31).

Checking for Proper Operation

1. Install the gauge set and set up the vehicle as described under "Performance Test."

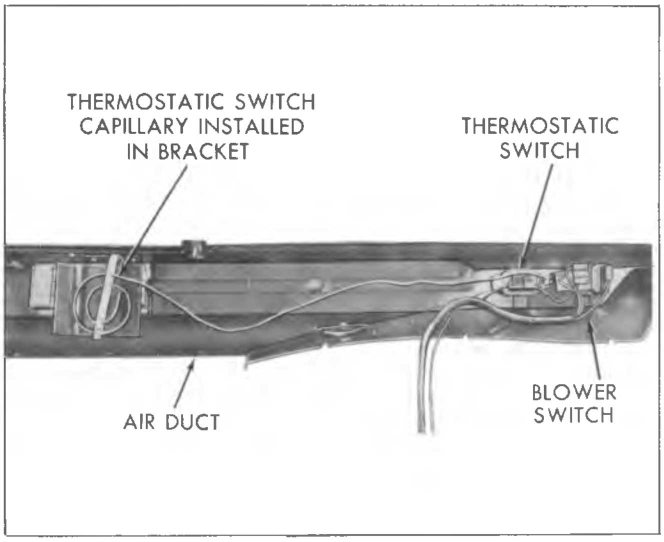


Fig. 31—Thermostatic Switch Installation

2. Movement of the temperature control knob should result in a definite change in suction pressure and cycling of the compressor clutch.
   - If compressor continued to operate regardless of the knob adjustment, it indicates that the switch points are fused which will lead to evaporator freeze-up. Replace the switch.
   - If the compressor does not operate, regardless of the position of the knob, a loss of the power element charge is indicated (provided that it has been established that power is supplied to the switch). This, of course, results in no cooling. Replace the switch.
   - Check the switch adjusting screw for stripped or otherwise damaged threads.

Adjusting Switch

If, after the above checks, the switch seems to be operating properly, adjust for proper setting if necessary, as follows:

1. Vehicle must be set up as described in "Performance Test."
2. The suction side of the system, read on the low pressure gauge, should pull down to the pressure shown in the chart in "Performance Data" under the ambient temperature at the time the switch is being set.
3. Lower the entire unit from its dash mounting, remove the duct assembly from the blower-evaporator unit and then remove the duct rear cover.
4. Disconnect the switch wiring harness, remove the switch attaching screws and remove the switch.

   NOTE: The knob must be pulled off the switch shaft before the switch can be removed.

5. Remove the switch non-metal end plate to gain access to the switch adjusting screw.
6. If the outlet temperature was less than the prescribed temperature at the end of each cooling cycle, turn the adjusting screw a partial turn counterclockwise (fig. 32). If the outlet temperature was more than prescribed temperature, turn the adjusting screw clockwise.

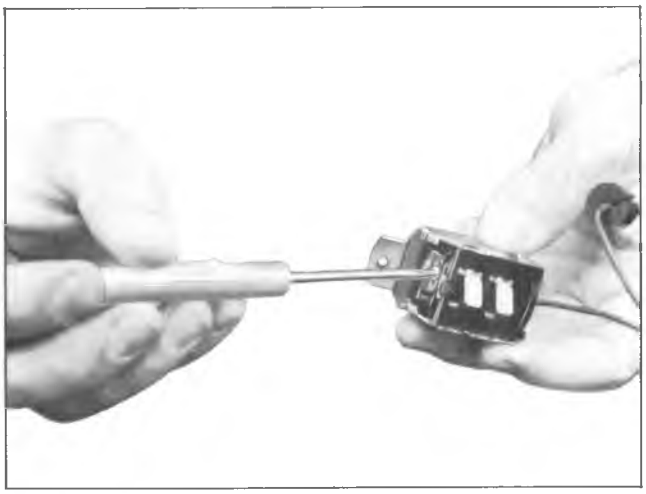


Fig. 32—Thermostatic Switch Adjustment

   NOTE: One turn of the adjusting screw will change the outlet temperature approximately 4 degrees.

7. Reinstall switch end plate and install switch. Reinstall ducts removed in Step 3 above. Be sure that the air sensing capillary has been replaced properly, if removed during disassembly.
8. Check system performance. If further adjustment is needed, repeat Steps 3 through 7 until the prescribed pressure is reached.

   NOTE: Do not attempt to run a Performance Check with the system disassembled since inaccurate readings would be the result. ALWAYS reinstall the duct work before running a performance check.

EXPANSION VALVE (Fig. 33)

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 pipe is very critical. The bulb must be attached tightly to the pipe and must make good contact with the pipe along the entire length of the bulb. A loose bulb will result in high POA pressures and poor cooling. On bulbs located outside the evaporator case, insulation must be properly installed.

Indications of expansion valve trouble provided by the Performance Test are as follows:

VALVE STUCK OPEN
Noisy Compressor.
No Cooling - Freeze Up.

VALVE STUCK CLOSED, PLUGGED SCREEN OR BROKEN POWER ELEMENT
Very Low Suction Pressure.
No Cooling.

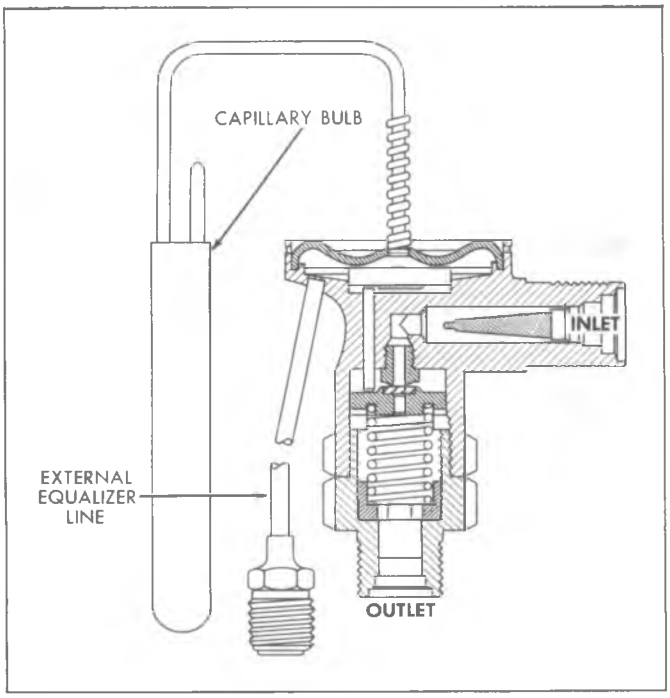


Fig. 33—Expansion Valve

POORLY LOCATED POWER ELEMENT BULB
Normal Pressure.
Poor Cooling.

Check for Defective Valve

The following procedure must be followed to determine if a malfunction is due to a defective expansion valve.

1. Check to determine if the system will meet the performance test as outlined previously. If the expansion valve is defective, the low pressure readings (POA or evaporator pressure) will be above specification.
2. The loss of system performance is not as evident when the compressor head pressure is below 200 PSI. Therefore, it may be necessary to increase the system head pressure by partially blocking the condenser. Disconnect the blower lead wire and repeat the "Peformance Check" to determine if the evaporator pressure can be obtained.
3. The system will also indicate a low refrigerant charge by bubbles occurring in the sight glass.

   Systems equipped with a POA Valve require the following additional test to determine if the deficiency is the expansion valve.
4. Remove the expansion valve bulb from the evaporator outlet pipe, and the connector on the blower resistor. Place the blower on "low." With the engine operating at 2,000 rpm, observe the POA gauge pressure.
5. Insert the expansion valve bulb in a cup of ice. This should result in the POA pressure being reduced to approximately 30 P.S.I. If the pressure does not reduce to this level, the POA valve is defective. If the pressure falls considerably below 30 P.S.I., the expansion valve is defective.

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.

COMPONENT PART REPLACEMENT

ALL SYSTEMS

COMPRESSOR

Removal (Fig. 34)

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.
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 coated with clean refrigeration oil.
4. Connect the electrical lead to the coil and install and adjust compressor belt.
5. Evacuate, charge and check the system.

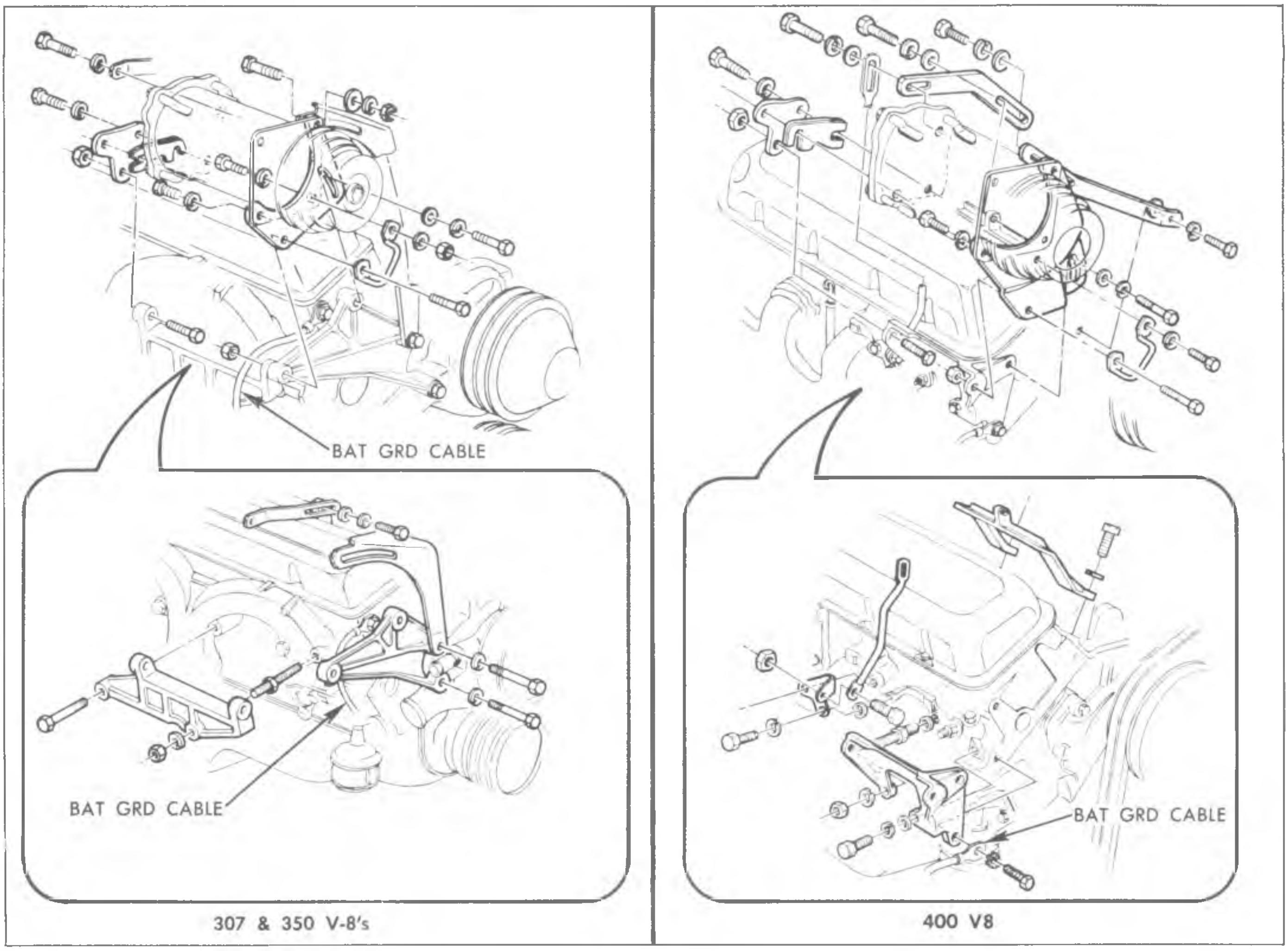


Fig. 34—Compressor Mountings

Compressor Belt Tension Adjustment

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

CONDENSER (Fig. 35)

Replacement

1. Disconnect battery ground cable.
2. Purge the system of refrigerant.
3. Remove the hood catch assembly.
4. Remove the radiator and shroud upper brackets.
5. Disconnect the condenser inlet and outlet lines and cap or tape the open connections at once.
6. Remove the radiator shroud screws and move the radiator rearward far enough to gain access to the condenser mounting screws.
7. Remove the four condenser retaining screws and carefully lift the condenser up out of the vehicle.
8. To install a new condenser, reverse steps 1-7 above. Add one fluid ounce of clean refrigeration oil when installing a new condenser.

   NOTE: Use new "O" rings coated with clean refrigeration oil when connecting all refrigerant lines.

9. Evacuate, charge and check system operation.

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. 35).

CAUTION: If the receiver-dehydrator is to be reused, cap the inlet and outlet connections immediately. When installing a receiver-dehydrator, do not uncap the connections until the last possible moment.

Removal

1. Disconnect battery ground cable.
2. Purge the system.
3. Remove the inlet and outlet connections from the receiver-dehydrator.

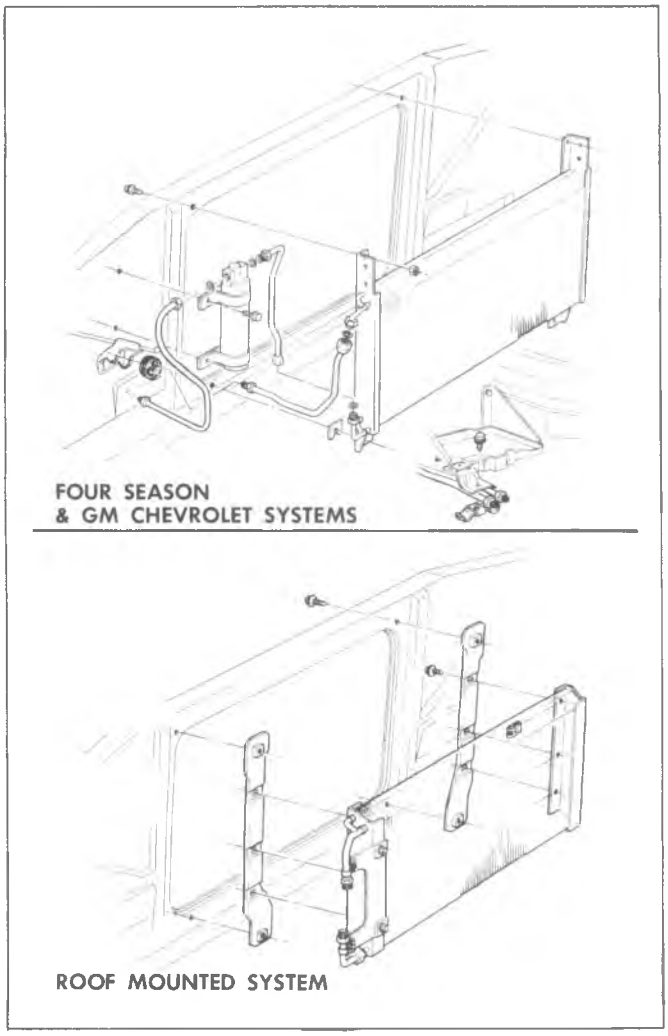


Fig. 35—Condenser and Receiver-Dehydrator

4. Remove the receiver-dehydrator mounting bolts and carefully remove it.
5. Cap the system if the receiver-dehydrator will not be replaced immediately. Cap the receiver if it will be reused.

Installation

1. Place the receiver-dehydrator in position and replace attaching bolts. Do not uncap the unit until immediately before connecting lines.
2. Uncap any previously capped connections and connect the fittings using new "O" ring seals, coated with clean refrigeration oil.
3. Evacuate, charge and check the system. If a new receiver-dehydrator was installed, add one fluid ounce refrigeration oil to the system.

SIGHT GLASS REPLACEMENT

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 36).

1. Purge system.
2. Remove the sight glass retainer nut using a screw driver and remove old glass and "O" ring 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, charge and check the system.

FOUR-SEASON SYSTEM

BLOWER ASSEMBLY

Removal

1. Disconnect battery ground cable.
2. Support the right front of the hood in the fully raised position.
3. Carefully scribe the hood and fender locations of the right hood hinge and remove the hinge.
4. Unclip the blower wire at the blower flange terminal and note or mark the motor flange position in relation to the blower case. Disconnect the rubber cooling tube to the motor.
5. Remove the blower assembly mounting screws.
6. Remove the blower assembly (pry the flange away from the case carefully if the sealer acts as an adhesive).
7. Remove the nut attaching the blower wheel to the motor shaft and separate the assembly.

Installation

1. Assemble the blower wheel to the motor with the open end of the blower away from the motor.
2. Install the assembly to the blower case, connect ground strap, and connect the motor wire. Connect cooling tube to motor.
3. Remount the hood hinge aligning it carefully with the scribed lines. Check hood alignment.
4. Connect battery ground cable.

EVAPORATOR CORE

Removal

1. Disconnect battery ground cable and purge the system.
2. Disconnect the evaporator core inlet line at the expansion valve. Cap the open connections.
3. Disconnect the evaporator oil bleed line at the POA valve. Cap the open connections.
4. Disconnect the evaporator outlet pipe at the POA valve. Cap the open connections. Remove the evaporator outlet pipe clamp.
5. Detach the expansion valve capillary bulb from the evaporator outlet pipe.
6. Disconnect the vacuum lines at the vacuum reservoir.
7. Remove the screws attaching the inboard case half to the outboard case half, back up plate, and dash.
8. Remove inboard case half and evaporator core.

Installation

1. Assemble evaporator core and inboard case half to the outboard case half. Replace case to case, case to back up plate, and case to dash panel mounting screws.
2. Attach the vacuum lines to the vacuum reservoir.
3. Mount the expansion valve capillary bulb to the evaporator core outlet pipe.
4. Connect the evaporator outlet pipe to the POA valve

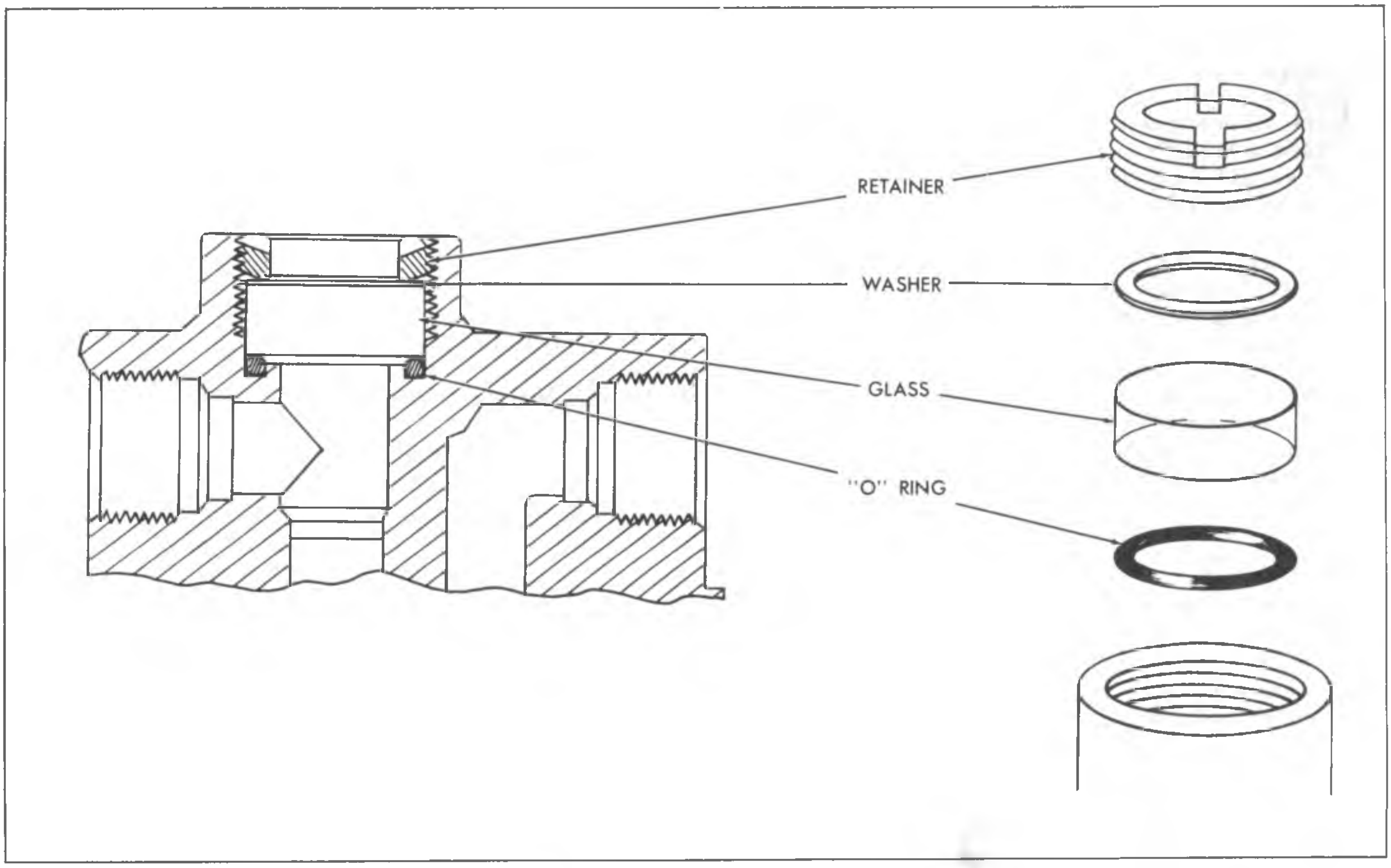


Fig. 36—Sight Glass Replacement

using a new "O" ring, coated with clean refrigeration oil. Install the pipe clamp.

5. Connect the evaporator oil bleed line to the POA valve.
6. Connect the line from the evaporator core to the expansion valve using a new "O" ring, coated with clean refrigeration oil.

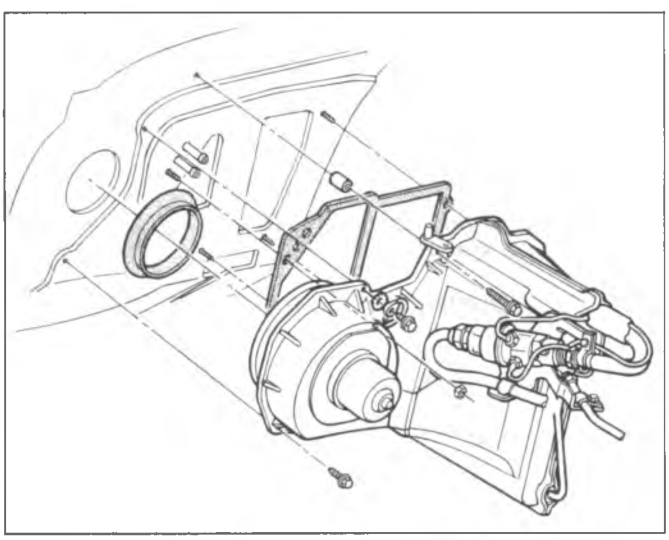


Fig. 37—Evaporator and Blower Assembly

7. If a new evaporator was installed, add three fluid ounces of refrigeration oil to the system. Connect battery ground cable. Evacuate, charge and check the system.

BLOWER AND EVAPORATOR CASE

Removal (Fig. 37)

1. Purge the refrigeration system and drain the radiator.
2. Disconnect battery ground cable.
3. Unclip the blower motor wire at the blower flange terminal.
4. Disconnect heater hoses at the core tubes.
5. Disconnect the refrigerant lines at the POA valve outlet and the expansion valve inlet. Cap all open connections.
6. Remove vacuum hoses to vacuum reservoir and plenum air valve actuator.
7. Disconnect temperature door cable.
8. In order to gain access to the lower outboard case attachments, the right front fender skirt should be loosened and moved. Remove enough skirt mounting screws and bolts (from the rear forward) to move the skirt a sufficient amount.
9. Remove the case retaining screws and sheet metal nuts. Pull the case away from the mounting studs and inboard to remove it.

Installation

1. Check the position of the blower and evaporator case to dash panel seals then position the case over the studs projecting through the dash panel and attach the screws and nuts to retain the case. Connect the blower motor ground strap. Replace spacer between case and dash panel at the screw next to the temperature door lever.
2. Remount the right front fender skirt.
3. Connect temperature door cable and vacuum hoses (hose to engine vacuum source attaches to vacuum tank connection nearest the engine).
4. Connect the refrigerant hoses to the expansion valve inlet and the POA outlet using new "O" ring seals, coated with clean refrigeration oil.
5. Connect the heater hoses to the core tubes (fig. 38).
6. Connect the blower motor wire to the motor flange terminal, and connect the battery ground cable.
7. Refill the cooling system, and evacuate, charge and check the refrigeration system.

HEATER CASE

Removal (Fig. 39)

1. Drain the radiator. Disconnect battery ground strap.
2. Remove the heater hoses from the core tubes.
3. Remove the sheet metal nuts from the heater case studs which project through the dash to the engine side.
4. Remove the glove box.
5. Unplug the relay connector.
6. Remove the right ball outlet hose.
7. Remove the screw attaching the dash outlets air distributor to the heater case and move distributor away from case.
8. Remove the heater case to dash panel retaining screws.
9. Pull the heater case away from the dash panel and reach in and disconnect the resistor connector.
10. Remove the resistor harness grommet and remove the harness from the case. Withdraw the heater case.

Installation

1. Place the heater case under the dash and insert the resistor harness and install the grommet and connect the resistor connector.
2. Position the heater case against the dash panel and push it into place. Check that nothing is pinched between the case and dash panel. Install the heater case to dash retaining screws.
3. Position the dash outlets distributor against the heater case, insert the forward lip into the retaining clip, and install the retaining screw.
4. Install the right dash outlet hose.
5. Connect the relay connector.
6. Install the glove box.
7. Install the sheet metal nuts to the heater case studs which project forward through the dash panel.
8. Attach the heater hoses to the core tubes and connect battery ground strap.
9. Refill the engine cooling system and test system operation.

HEATER CORE

Removal

1. Remove the heater case as outlined under Heater Case.
2. Remove the screws retaining the core mounting straps.
3. Remove core.

Installation

1. Install the core into the case and seal it with non-hardening sealer.
2. Mount the core with the core straps and retaining screws.
3. Replace the heater case in the vehicle as outlined under Heater Case.

WATER VALVE (Fig. 38)

Removal

1. Place a container under the vehicle and then disconnect the shut-off valve inlet and outlet lines. Drain coolant into container.
2. Disconnect the valve vacuum line and remove the valve.

Installation

1. Install the coolant lines onto the new valve, making sure that coolant flows through the valve in the right direction.
2. Install the vacuum line onto the valve.
3. Refill the radiator.

EXPANSION VALVE

Removal

1. Disconnect battery ground cable and purge the system.
2. Loosen the clamp retaining the high pressure line to the bracket next to the expansion valve.
3. Disconnect the capillary bulb from the evaporator outlet pipe. Disconnect the equalizer line from the POA. Cap the POA connector.
4. Disconnect the expansion valve inlet and outlet connections and cap the lines.
5. Remove expansion valve to bracket mounting screw and remove expansion valve.

Installation

1. Mount the expansion valve to the bracket.
2. Connect the inlet and outlet connections. Tighten the inlet pipe clamp.
3. Connect the equalizer line to the POA using new "O" ring coated with clean refrigeration oil and mount the capillary bulb to the evaporator outlet pipe.
4. Connect battery ground cable. Evacuate, charge and check the system.

MUFFLER, CONNECTOR BLOCK & HOSE ASSEMBLY (Fig. 41)

The compressor inlet and outlet hoses are swaged to the connector block and muffler assembly. If the assembly is not repairable (See "Hose Repair"), proceed as follows:

Replacement

1. Purge the system.
2. Disconnect the outlet hose at the condenser inlet pipe and the compressor inlet hose at the POA valve. Cap

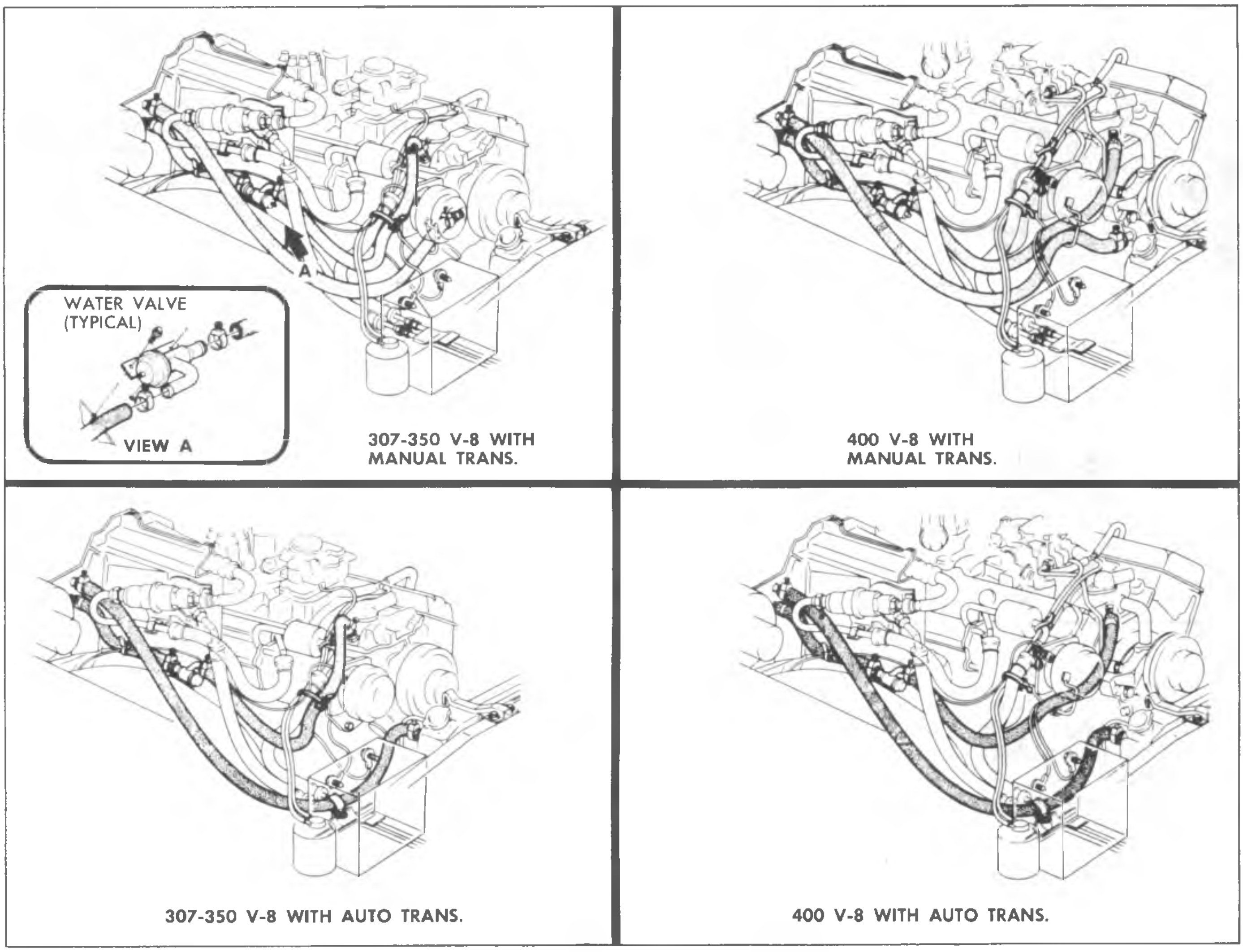


Fig. 38—A/C and Heater Hose Routing-Typical

or tape the open connections at once. Discard the "O" ring seals.

3. Remove the connector block to compressor bolt and remove the muffler, hoses and connector block. Cap or tape the open connections. Discard the "O" ring seals.
4. Assemble the new connector block to the compressor using new "O" ring seals coated with clean refrigeration oil. Tighten the connector block bolt to 25 ft. lbs.
5. Attach the compressor inlet and outlet hoses at the POA valve and condenser inlet pipes using new "O" ring seals coated with clean refrigeration oil.
6. Evacuate, charge and check system operation.

POA VALVE

Removal

1. Disconnect battery ground cable and purge the system.
2. Remove evaporator oil bleed line and expansion valve equalizer line. Cap the connections.
3. Remove retaining clamp screw and loosen POA valve outlet pipe clamp mounting screw.
4. Remove POA valve inlet and outlet connections and remove POA valve. Cap the open tubes.
5. Remove clamp from POA valve.

Installation

1. Assemble clamp on POA valve and connect inlet and outlet connections using new "O" ring seals coated with clean refrigeration oil.
2. Secure POA valve clamp and outlet line clamp.
3. Connect the evaporator oil bleed line and the expansion valve equalizing line to the POA valve using new "O" ring seals coated with clean refrigeration oil.
4. Connect battery ground cable. Evacuate, charge and check the system.

CONTROL ASSEMBLY

Removal (Fig. 42)

1. Disconnect battery ground cable.
2. Remove the screws in the lower lip of the dash which attach the control assembly bracket to the dash.
3. Move the unit toward the front of the vehicle and lower it.

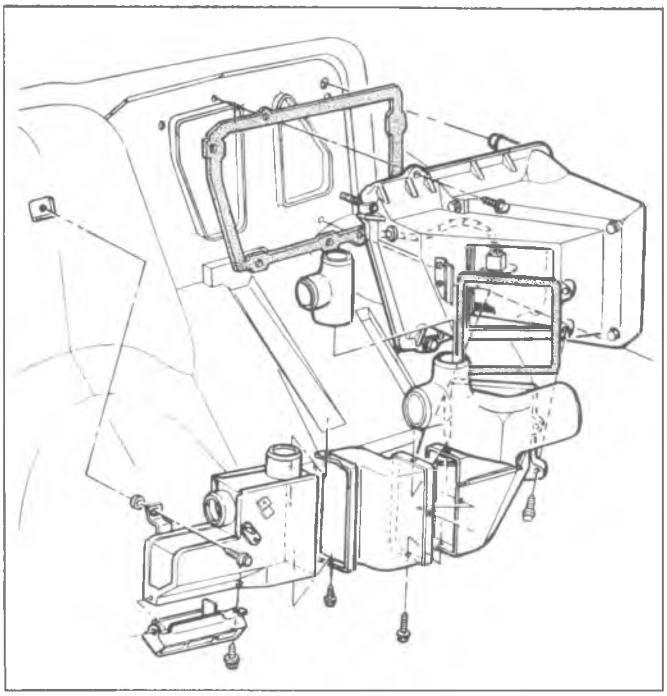


Fig. 39—Heater and Ducts

4. Disconnect the blower harness connector and illuminating lamp sockets. Remove the blower switch and mounting bracket. Remove the vacuum control switch.
5. Remove the control cables and transfer them to the replacement control unit. Check them for adjustment.

Installation

1. Attach the blower switch to the unit. Connect the harness connector and illuminating lamps. Attach the mounting bracket. Install the vacuum switch and hoses.
2. Lift the unit into position and attach it to the dash.
3. Connect the battery ground cable.

BLOWER MOTOR SWITCH (Fig. 43)

Removal

1. Disconnect battery ground cable.
2. Disconnect wiring harness connector at blower switch.
3. Remove blower switch mounting screws and remove switch.

Installation

1. Place blower switch in position and install mounting screws.
2. Connect wiring harness to switch.
3. Connect battery ground cable.

BLOWER MOTOR RELAY (Fig. 43)

Removal

1. Disconnect wiring harness at relay connector.
2. Remove the relay mounting screws and remove relay.

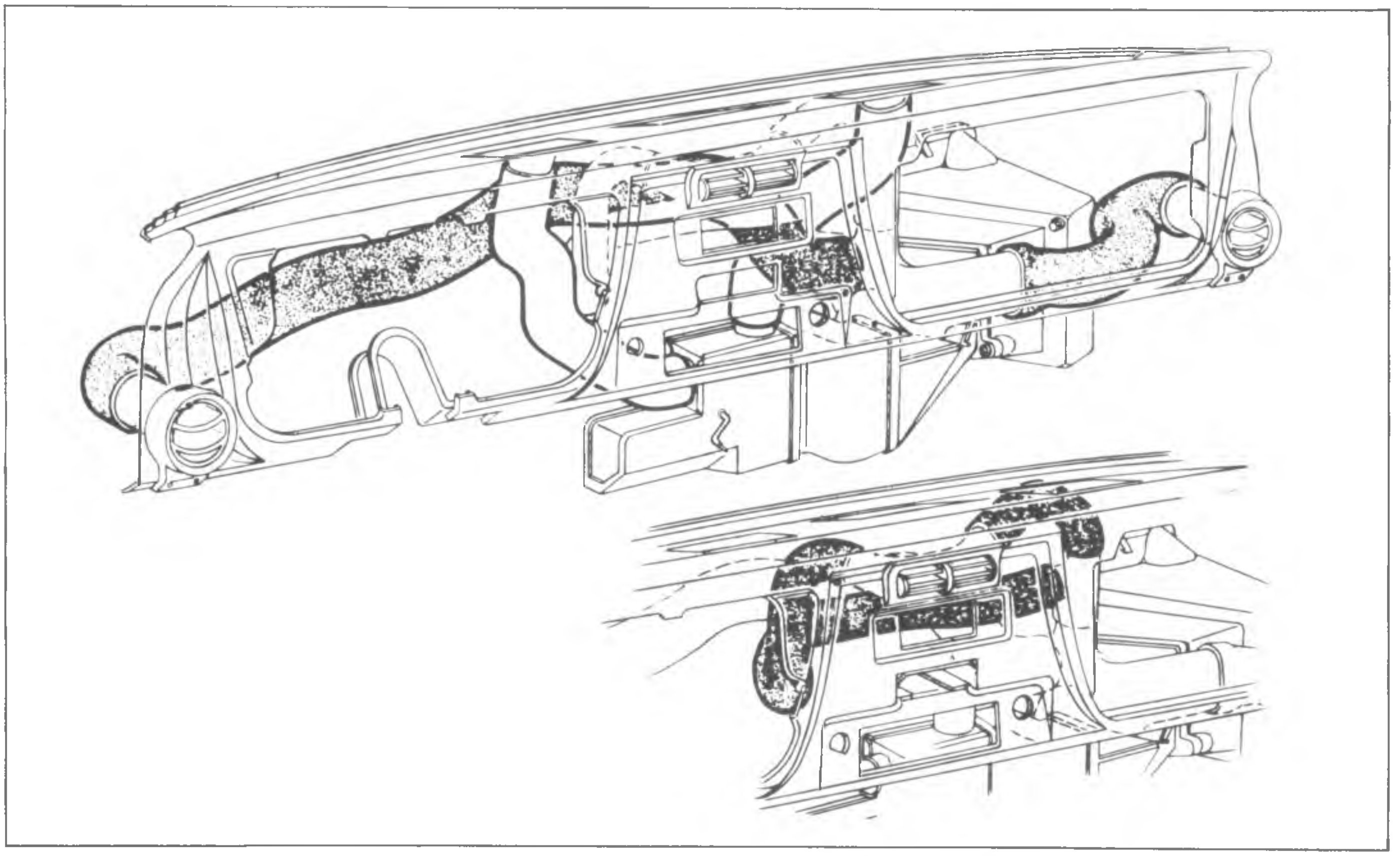


Fig. 40—Air Outlets and Hoses

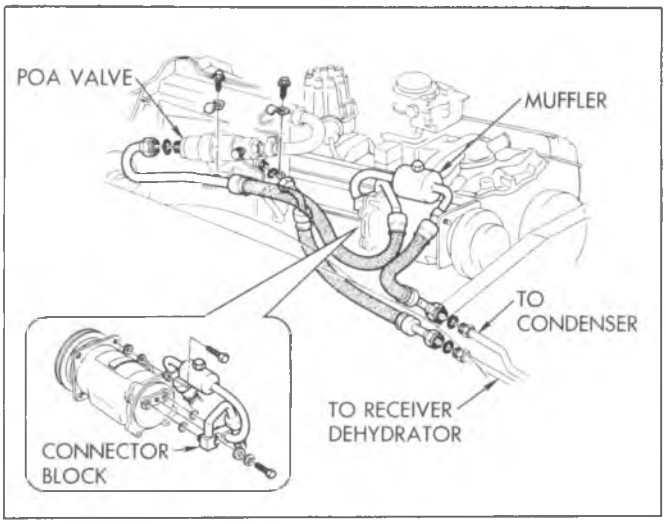


Fig. 41—Muffler, Connector Block and Hose Assy. (Typical)

Installation

1. Place relay in position and drive mounting screws.
2. Connect wiring harness to relay.

COMPRESSOR CLUTCH SWITCH (Fig. 43)

Removal

1. Disconnect wiring harness at compressor clutch switch.
2. Remove two mounting screws and remove switch.

Installation

1. Place switch in position and drive the two mounting screws.
2. Connect wiring harness to switch.

BLOWER RESISTOR UNIT

Removal (Fig. 44)

1. Remove the screw attaching the floor outlet duct (above the heater outlet) to the dash panel.
2. Remove the screws attaching the distributor to the heater case, slide the distributor downward out of rear slide and let it rest on the floor panel.
3. Unplug the resistor unit connector.
4. Remove the resistor unit retaining screws. Remove the unit.

Installation

1. Place the replacement unit in position and install mounting screws.
2. Connect the resistor connector.
3. Position the dash outlet air distributor against the heater case, insert the forward lip into the retaining clip, and install the retaining screws.
4. Mount the floor outlet duct to the dash panel with the attaching screw.

KICK PANEL AIR VALVE

Removal (Fig. 45)

1. Disconnect vacuum hose from actuator.
2. Disconnect valve return spring.
3. Remove actuator bracket mounting screws.

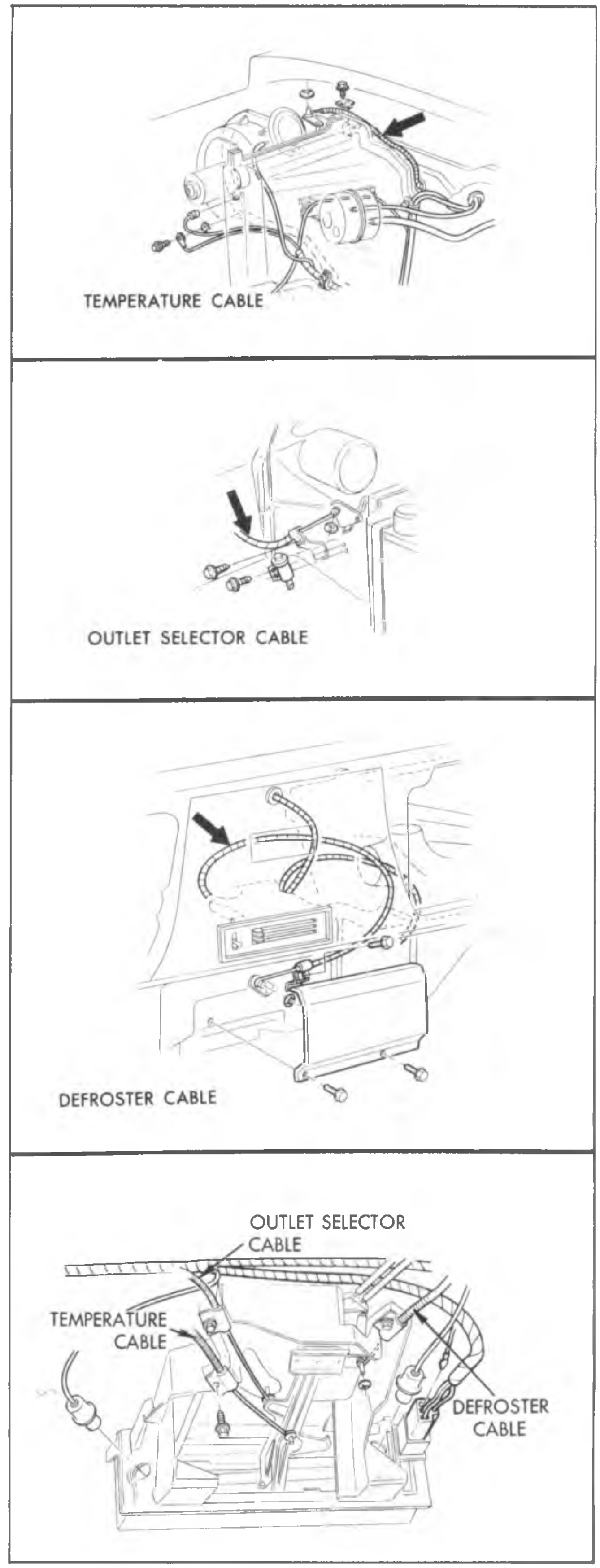


Fig. 42—Air Conditioning Controls

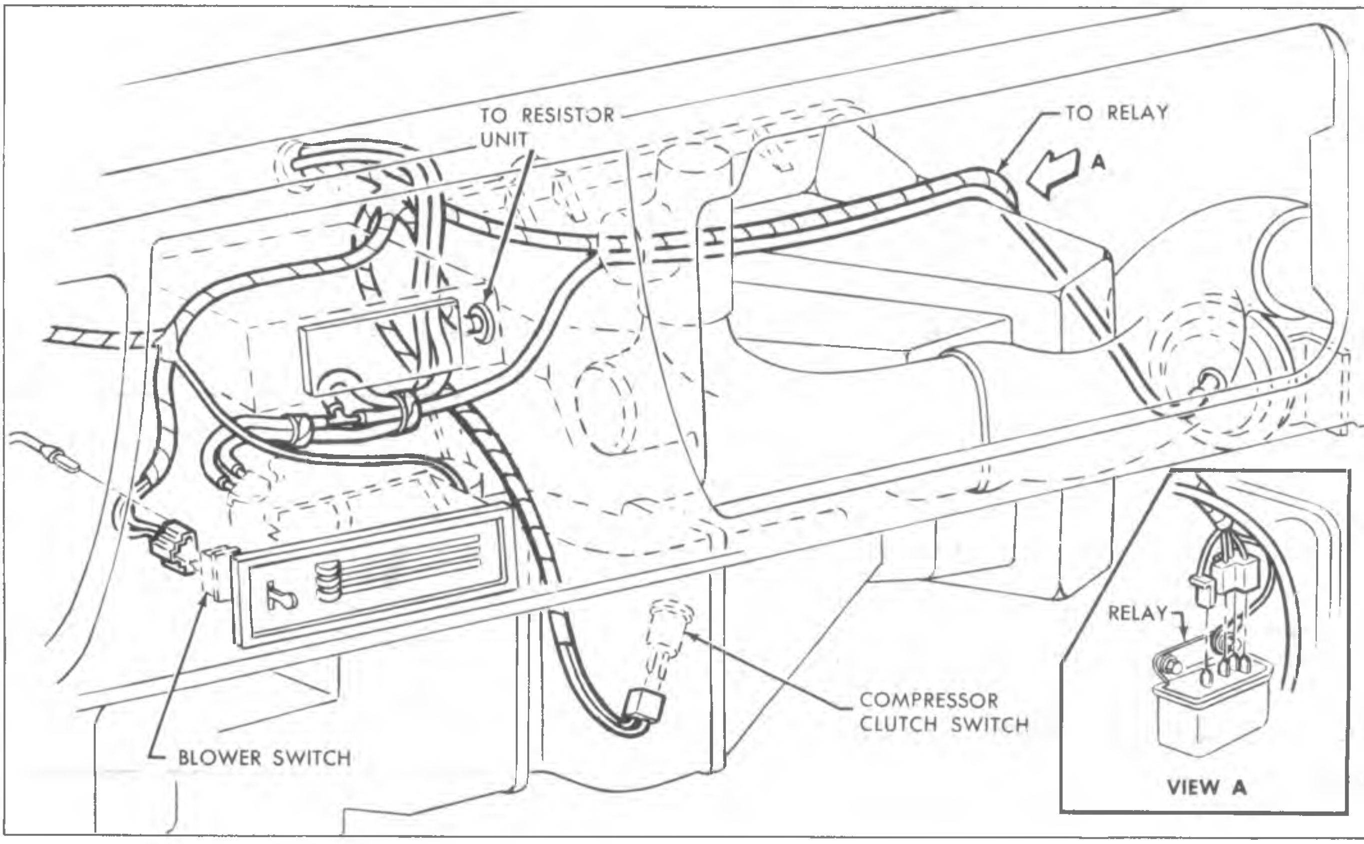


Fig. 43—Wiring and Vacuum Harness-Underdash

4. Remove link retainer at actuator and lift link up out of actuator. Remove actuator assembly.
5. Remove actuator from bracket.

Installation

1. Attach actuator to bracket.
2. Install link in actuator and install retainer on link.
3. Mount the bracket to the kick panel.
4. Connect the valve return spring. Connect the vacuum hose to the actuator.

PLENUM AIR VALVE

Removal (Fig. 46)

1. Remove cowl grille panel. Refer to Section 11.
2. Disconnect the diaphragm link from the connecting shaft arm.

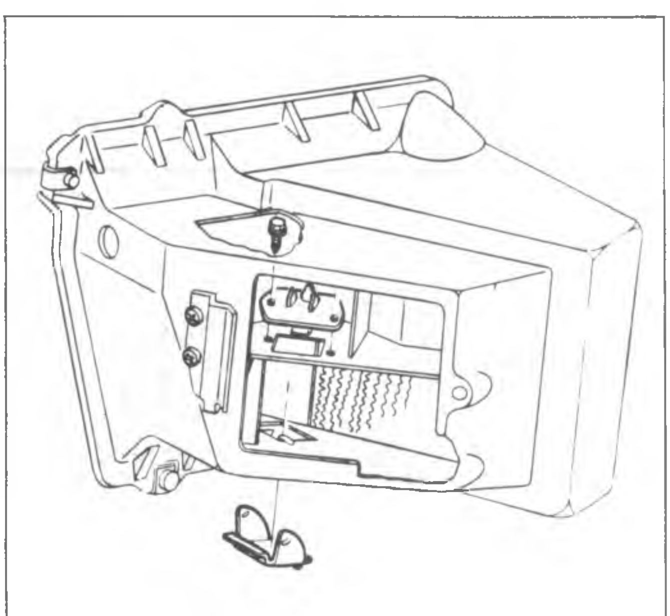


Fig. 44—Resistor Unit

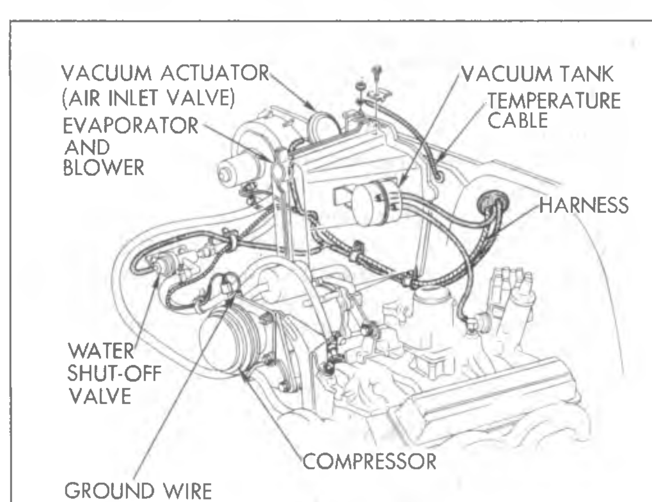


Fig. 45—Electrical and Vacuum Harness-Engine Compartment

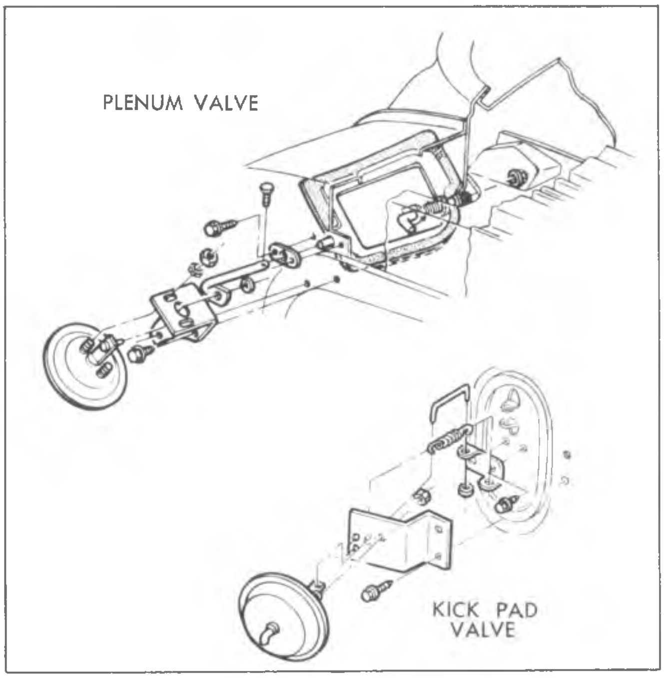


Fig. 46—Air Inlet Valve and Recirculating Air Valve

3. Remove the screw attaching the connecting shaft to the tube extending forward from the valve.
4. Remove the screws attaching the nylon bearing plate to the dash panel and slide it forward.
5. Pull the rear valve pivot pin forward against spring tension until it clears the rear bearing. Lift the valve at the rear and withdraw the valve shaft from the dash panel.

Installation

1. Insert the tube shaft on the valve into the dash panel hole and lower the valve into position with the rear pivot pin retracted. When the rear pin is aligned with its bearing, allow it to extend into position.
2. Attach valve return spring and nylon bushing.

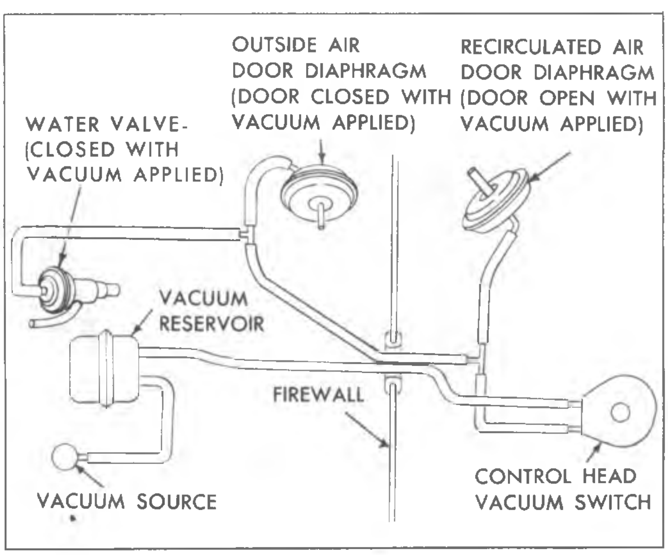


Fig. 47—Vacuum Diagram

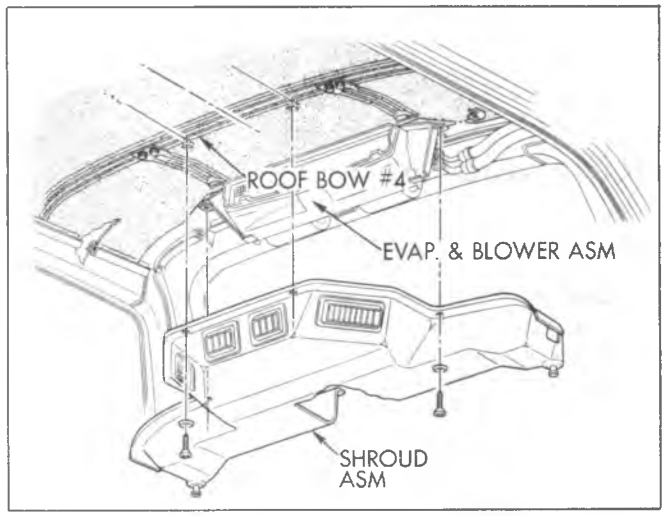


Fig. 48—Blower-Evaporator Duct Installation

3. Assemble the connecting shaft to the valve and actuating diaphragm.
4. Replace the cowl grille panel.

ROOF MOUNTED SYSTEM

The Roof-Mounted System is used in conjunction with the Four-Season System. Since replacement of Four-Season System components has been covered previously, only those components peculiar to the Roof-Mounted System will be covered in this section.

REAR DUCT (Fig. 48)

This duct covers the blower-evaporator assembly, at the rear of the vehicle, and incorporates four adjustable air outlets.

Replacement

1. Disconnect the battery ground cable.
2. Disconnect the drain tubes from the rear duct.

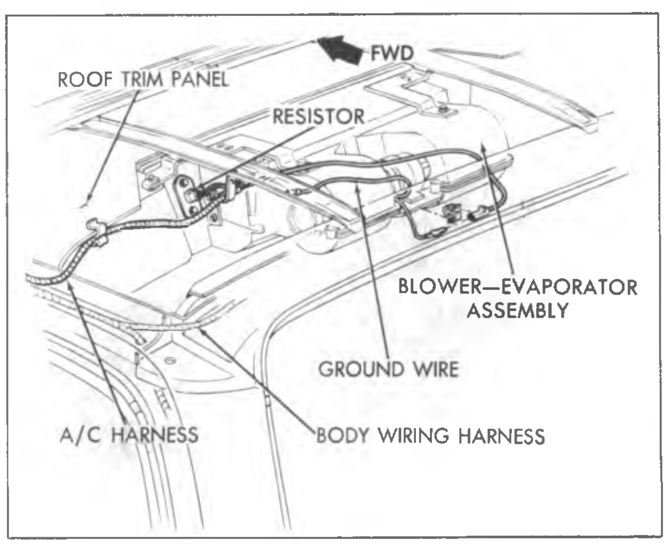


Fig. 49—Blower-Evaporator Installation

3. Remove the four screws securing the duct to the roof panel.
4. Remove the duct from the side and rear retaining flanges and remove the duct.
5. To install, reverse Steps 1-4 above.

BLOWER MOTOR RESISTOR

The blower motor resistor is located on the right side of the blower-evaporator as shown in Figure 49.

Replacement

1. Disconnect battery ground cable.
2. Remove the rear duct as described previously.
3. Disconnect the electrical harness at the resistor.
4. Remove the resistor attaching screws and remove the resistor.
5. To install a new resistor, reverse Steps 1-4 above.

BLOWER MOTOR ASSEMBLY

Removal

1. Disconnect the battery ground cable.
2. Remove the rear duct as outlined previously.
3. Disconnect the blower motor ground strap.
4. Disconnect the blower motor lead wire.
5. Remove the lower to upper blower-evaporator case screws and lower the lower case and motor assembly.

   CAUTION: Before removing the case screws, support the lower case to prevent damage to the case or motor assemblies.

6. Remove the motor retaining strap and remove the motor and wheels. Remove the wheels from the motor shaft.

Installation

1. Place the blower wheels onto the motor shaft and install the set screws; do not tighten the set screws at this time.

   CAUTION: Be sure that the blower wheels are installed as shown in Figure 50.

2. Install the blower motor retaining strap and foam.
3. Place the blower motor and wheel assembly into the lower case. Align the blower wheels so that they do not contact the case and then tighten the wheel set screws.
4. Place the lower case and blower motor assembly in position in the vehicle and install the lower to upper case screws.

   NOTE: Rotate the blower wheels to make sure that they do not rub on the case.

5. Install the center ground wire and connect the blower lead wire.
6. Install the rear duct assembly as described previously.
7. Connect the battery ground cable.

EXPANSION VALVE

This system incorporates an expansion valve which does not utilize an external equalizer line (fig. 51).

Removal

1. Disconnect the battery ground cable.
2. Purge the system of refrigerant.
3. Remove the rear duct as outlined previously.
4. Disconnect the blower motor lead and ground wires.
5. Remove the lower to upper blower-evaporator case screws and lower the lower case and motor assembly.

   CAUTION: Before removing the case screws, support the lower case and motor assemblies.

6. Remove the expansion valve sensing bulb clamps.
7. Disconnect the valve inlet and outlet lines and remove the expansion valve assembly. Cap or tape the open connections at once.

Installation

1. Remove caps or tape from system connections and install the new valve assembly using new "O" rings coated with clean refrigeration oil.
2. Install the sensing bulb, making sure that the bulb makes good contact with the core outlet line.

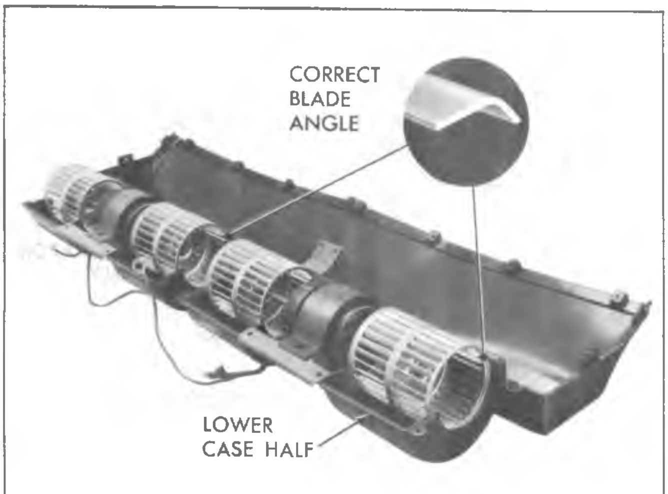


Fig. 50—Blower Motor Installation-Typical

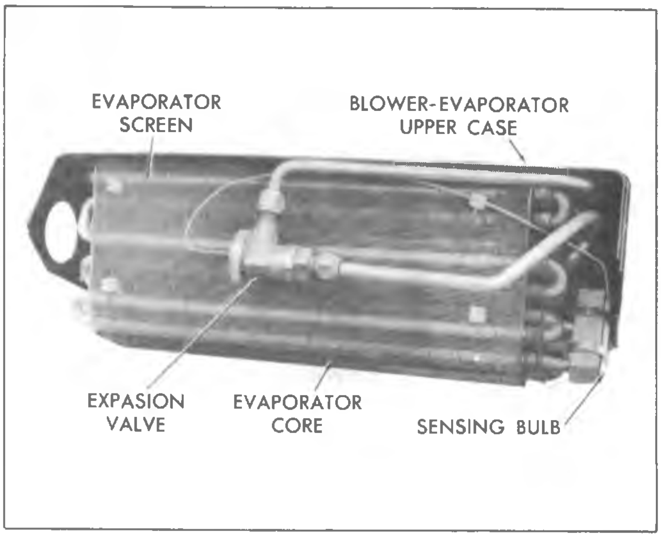


Fig. 51—Evaporator and Expansion Valve

3. Install the lower case and blower motor assemblies. Connect the blower motor lead and ground wires.
4. Install the rear duct as outlined previously.
5. Connect the battery ground cable.
6. Evacuate, charge and check the system.

EVAPORATOR CORE (Fig. 51)

Removal

1. Disconnect the battery ground cable.
2. Purge the system of refrigerant.
3. Remove the rear duct as outlined previously.
4. Disconnect the blower motor lead, ground wire, and resistor connections.
5. Disconnect the refrigerant lines at the rear of the blower-evaporator assembly.
6. Remove the blower-evaporator to roof panel support nuts and washers, lower the blower-evaporator assembly and place it on a work bench upside down.
7. Remove the lower to upper case screws and remove the lower case assembly. Remove the upper case from the evaporator core.
8. Remove the expansion valve inlet and outlet lines and cap or tape the open connections at once. Remove the expansion valve capillary bulb from the evaporator outlet line and remove the valve.
9. Remove the plastic pins holding the screen to the core and remove the screen.

Installation

1. Install the wire screen to the front of the core and insert the plastic pins.
2. Install the expansion valve inlet and outlet lines using new "O" rings coated with clean refrigeration oil. Install the sensing bulb to the evaporator outlet line as shown in Figure 51, make sure the bulbs have good contact with the line.

   NOTE: Add 3 oz. clean refrigeration oil when installing a new core.

3. Install the upper case to the core.
4. Install the lower core case and blower assembly.
5. Install the blower-evaporator to the roof panel support.
6. Connect the refrigerant lines to the blower-evaporator unit using new "O" rings coated with clean refrigeration oil.
7. Connect the blower lead wires, ground strap, and resistor harnesses.
8. Install the rear duct as outlined previously.
9. Connect the battery ground cable.
10. Evacuate, charge and check the system.

BLOWER RELAY (Fig. 52)

The blower relay is attached to the instrument panel reinforcement, just left of the cigarette lighter.

Replacement

1. Disconnect battery ground cable.
2. Disconnect the relay wiring harness at the relay.
3. Remove the relay attaching bolt and remove the relay.
4. To install, reverse Steps 1-3 above.

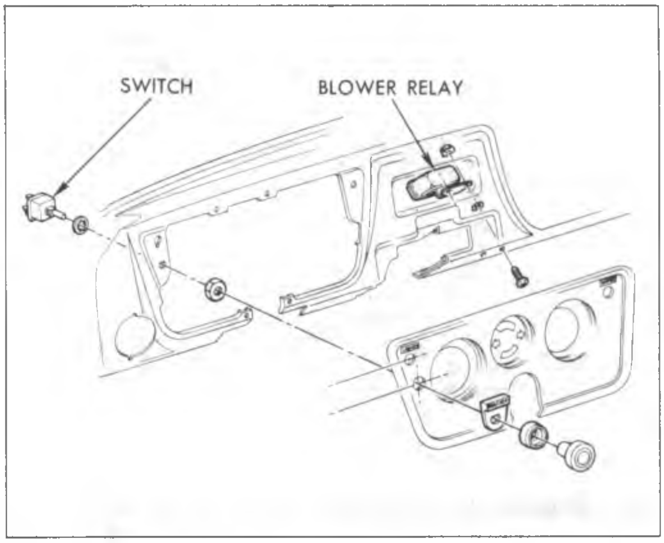


Fig. 52—Blower Motor Switch and Relay

BLOWER MOTOR SWITCH

The three-speed (LO-MED-HI) blower motor switch is located in the instrument panel, just below the light switch (fig. 52).

Replacement

1. Disconnect the battery ground cable.
2. Remove the switch knob, bezel and plate.
3. Remove the switch retaining nut and lockwasher.
4. Disconnect the wiring harness at the switch and remove the switch.
5. To install, reverse Steps 1-4 above.

FUSE

The Four Season portion of this system is protected by a 25 amp fuse in the junction block.

The rear blower high speed circuit is protected by a 25 amp in-line fuse, located between the junction block and the rear blower relay.

GM CHEVROLET SYSTEM

COMPRESSOR, CONDENSER, RECEIVER-DEHYDRATOR AND SIGHT GLASS

Replacement of these components is covered under "ALL SYSTEMS".

BLOWER RESISTOR

Replacement

1. Disconnect the battery ground cable.
2. Remove the glove box and door assemblies.
3. Disconnect the resistor wiring harness.
4. Remove the two resistor mounting screws and remove the resistor as shown in Figure 54.
5. To install, reverse "Removal" Steps 1-4.

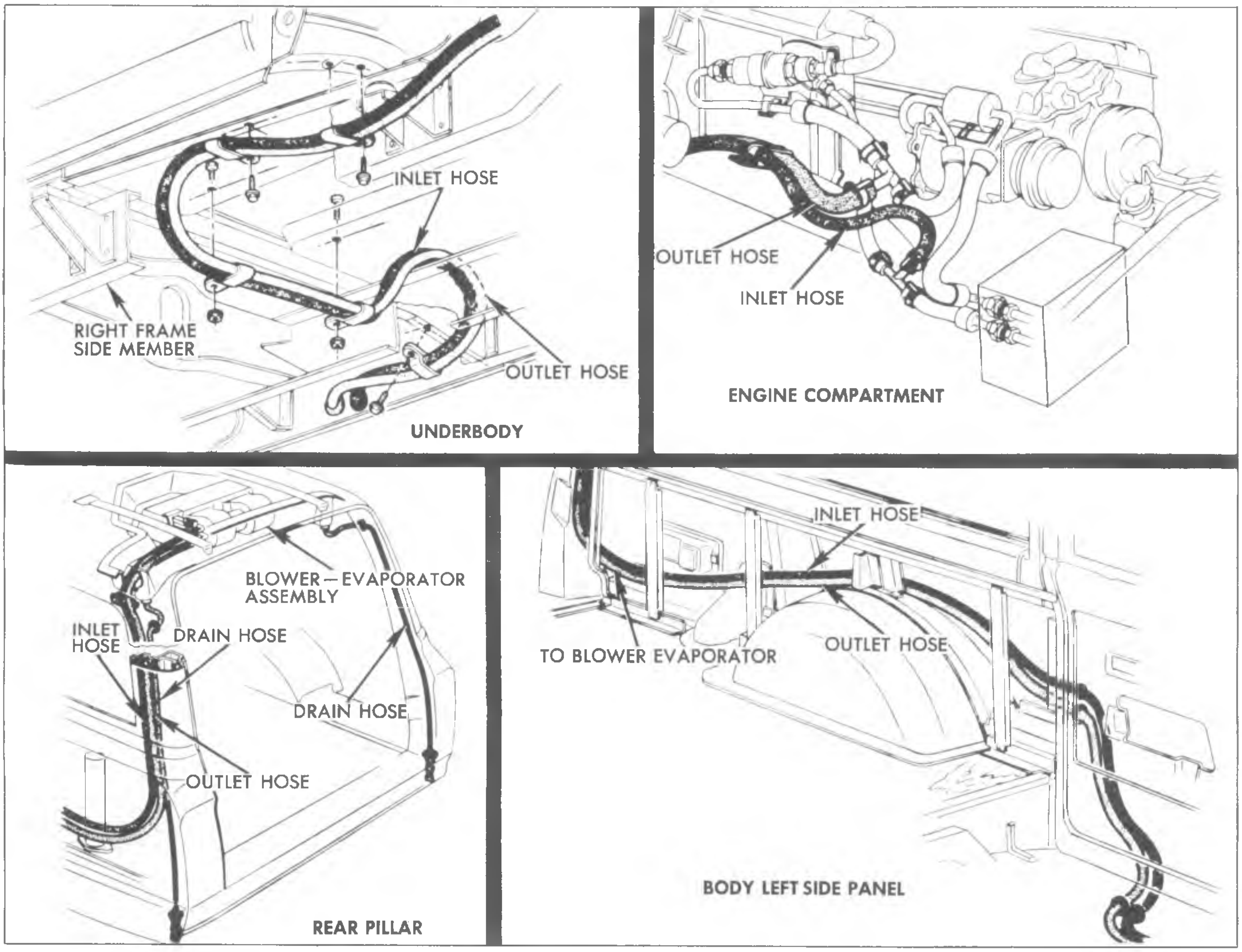


Fig. 53—A/C Hose Routings

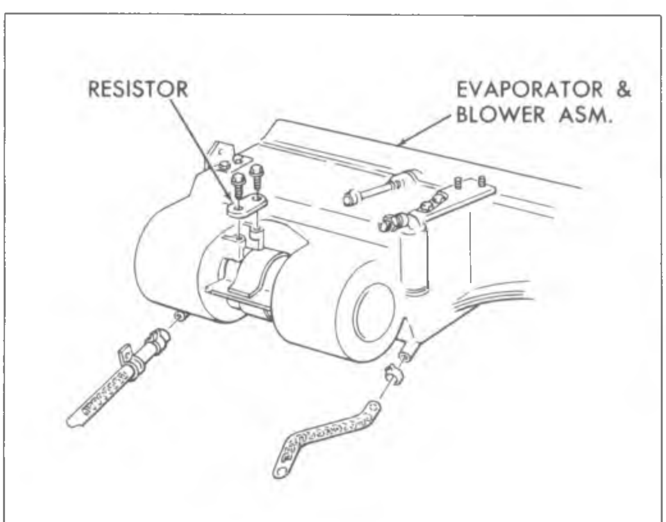


Fig. 54—Blower Motor Resistor

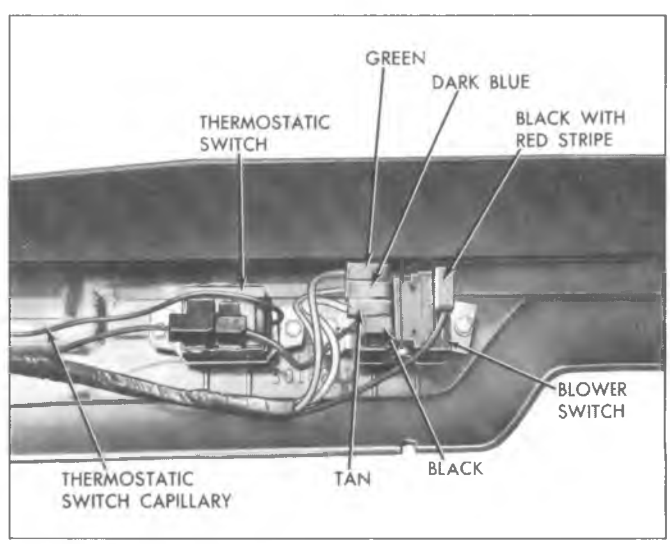


Fig. 55—Thermostatic and Blower Switch Locations

BLOWER AND/OR THERMOSTATIC SWITCHES

The blower and thermostatic switches are located inside the duct assembly as shown in Figure 55. The coolant system need not be opened up to gain access to these switches. However, the entire unit must be lowered from its dash mounting.

Removal

1. Disconnect the battery ground cable.
2. Remove the glove box and door assemblies.
3. Remove the four dash to duct attachments and the bracket to kick pad screw.
4. Lower the entire unit and remove the duct to case screws.
5. Remove the duct from the case being careful not to damage the wiring harness or refrigerant lines.
6. Pull the switch knobs off the shafts.
7. Remove the duct rear cover screws and carefully prying at the cover clips, with a small screw driver, remove the duct cover.
8. Disconnect the electrical connections at the switch being replaced. If the thermostatic switch is being replaced, disconnect the capillary at the bracket in front of the evaporator core.
9. Remove the switch mounting screws and remove the switch.

Installation

1. Install the switch mounting screws.
2. Install the switch electrical connections as noted in Figure 55. If the thermostatic switch was removed, be sure to install the sensing capillary in the bracket as shown in Figure 56.
3. Reverse Steps 1-7 of the "Removal" procedures, being careful not to pinch or otherwise damage the capillary when installing the duct and cover assemblies.

EVAPORATOR CORE, EXPANSION VALVE, BLOWER MOTOR AND WHEELS

To gain access to these components, it is necessary to disconnect the refrigerant lines and remove the entire blower-evaporator unit from the vehicle.

Removal

1. Disconnect the battery ground cable.
2. Purge the system of refrigerant.
3. Remove the glove box and door assemblies.
4. Remove the dash and kick panel attachments.
5. Disconnect the drain tubes at the case.
6. Disconnect the refrigerant lines at the top of the case. Cap or tape the open connections at once.
7. Lower the entire unit to the floor, being careful not to damage the wiring harness.
8. Remove the duct rear cover screws and then with a small screwdriver, carefully unclip the cover.
9. Disconnect the blower motor lead wire. Disconnect the wiring harness from the switches and remove the entire blower-evaporator unit from the vehicle.
10. Blower Motor and Wheels (Fig. 57)—Disconnect the blower ground wire. Remove the lower to upper case screws and separate the case halves. Remove the motor clamp screw and remove the clamp. Loosen the blower wheel set screws and remove the wheels from the motor shaft.

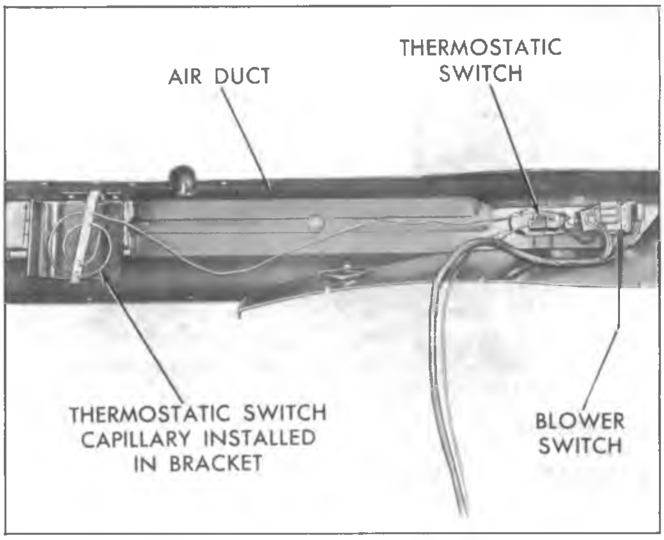


Fig. 56—Thermostatic Switch Capillary Retaining Bracket

Expansion Valve (Fig. 58)—Remove the evaporator core outlet line cover. Remove the expansion valve capillary bulb clamps. Remove the expansion valve clamp screw. Disconnect the valve inlet and outlet lines and remove the expansion valve. Cap or tape the open connections at once.

Evaporator Core (Fig. 58)—Remove the evaporator core outlet line cover. Remove the expansion valve capillary bulb clamps. Remove the (4) upper case to core screws, core outlet line clamp screw and expansion valve inlet line clamp screw. Remove the upper case from the core and expansion valve. Disconnect core at the inlet and outlet line connections and separate the core and expansion valve. Cap or tape the open connections at once.

Installation

1. Blower Motor and Wheels—Install the blower wheels onto the motor shaft as shown in Figure 57. Install motor and wheels into the lower half of case, placing the foam rubber mounting strip around the motor.

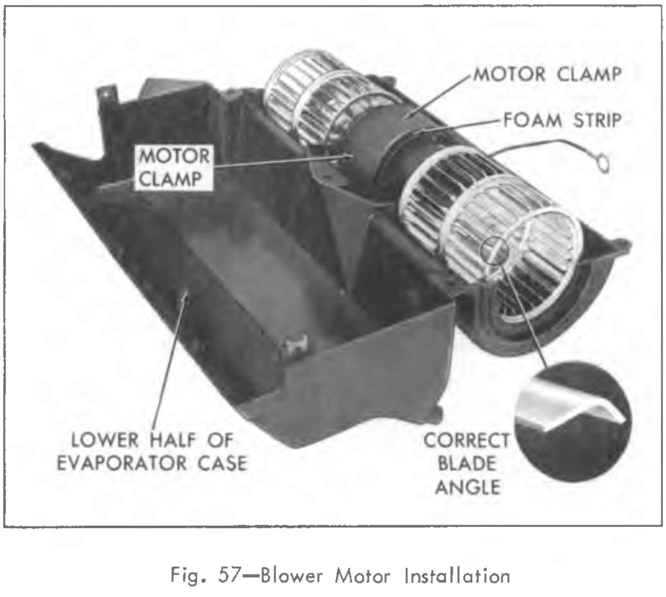


Fig. 57—Blower Motor Installation

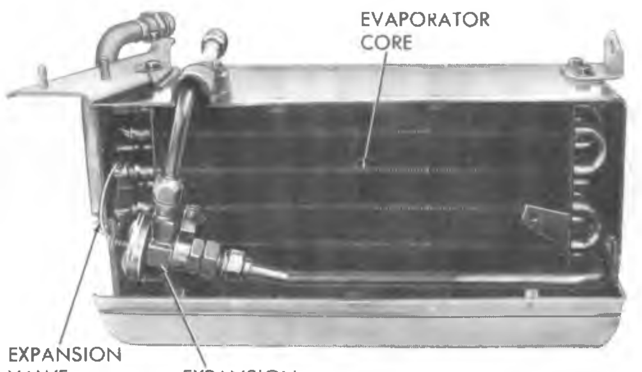


Fig. 58—Evaporate Core and Expansion Valve Location

Install the motor clamp and install the screw. Rotate the blower wheels and determine if interference exists. Interference can be corrected by moving the motor slightly in its mount or by changing the wheel location on the motor shaft. Install the lower case to the upper case and connect the motor ground wire.

Expansion Valve—Install the expansion valve and connect the inlet and outlet lines using new "O" rings coated with clean refrigeration oil. Install the expansion valve clamp and the capillary bulb clamps, making sure that the bulb has good contact with the core outlet line. Install the core outlet line cover, making sure that the foam rubber strip is correctly installed.

Evaporator Core—Add 3 oz. of clean refrigeration oil to the new core and connect the inlet and outlet lines using new "O" rings coated with clean refrigeration oil. Install the upper case half to the core and install the case to core screws. Install the core outlet line and expansion valve clamps. Install the expansion valve capillary bulb clamps making sure that the bulb makes good contact with the core outlet line. Install the core outlet line cover, making sure that the foam rubber seal is positioned correctly.

2. Reverse "Removal" Steps 3-9, using new "O" ring seals coated with clean refrigeration oil, when connecting refrigerant lines.
3. Evacuate, charge and check system.
4. Connect battery ground cable.

WIRING DIAGRAMS

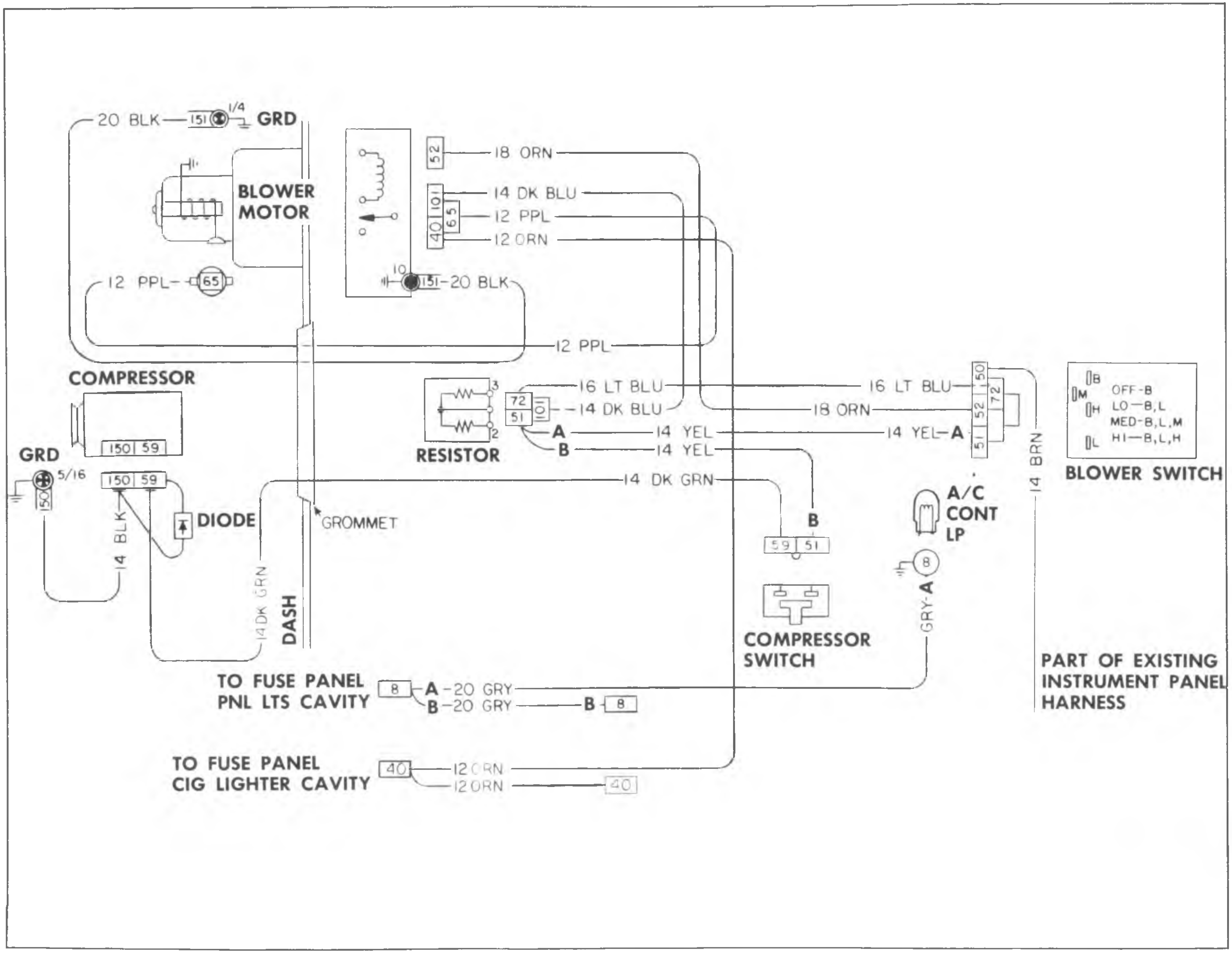


Fig. 59—Four-Season System Wiring Diagram

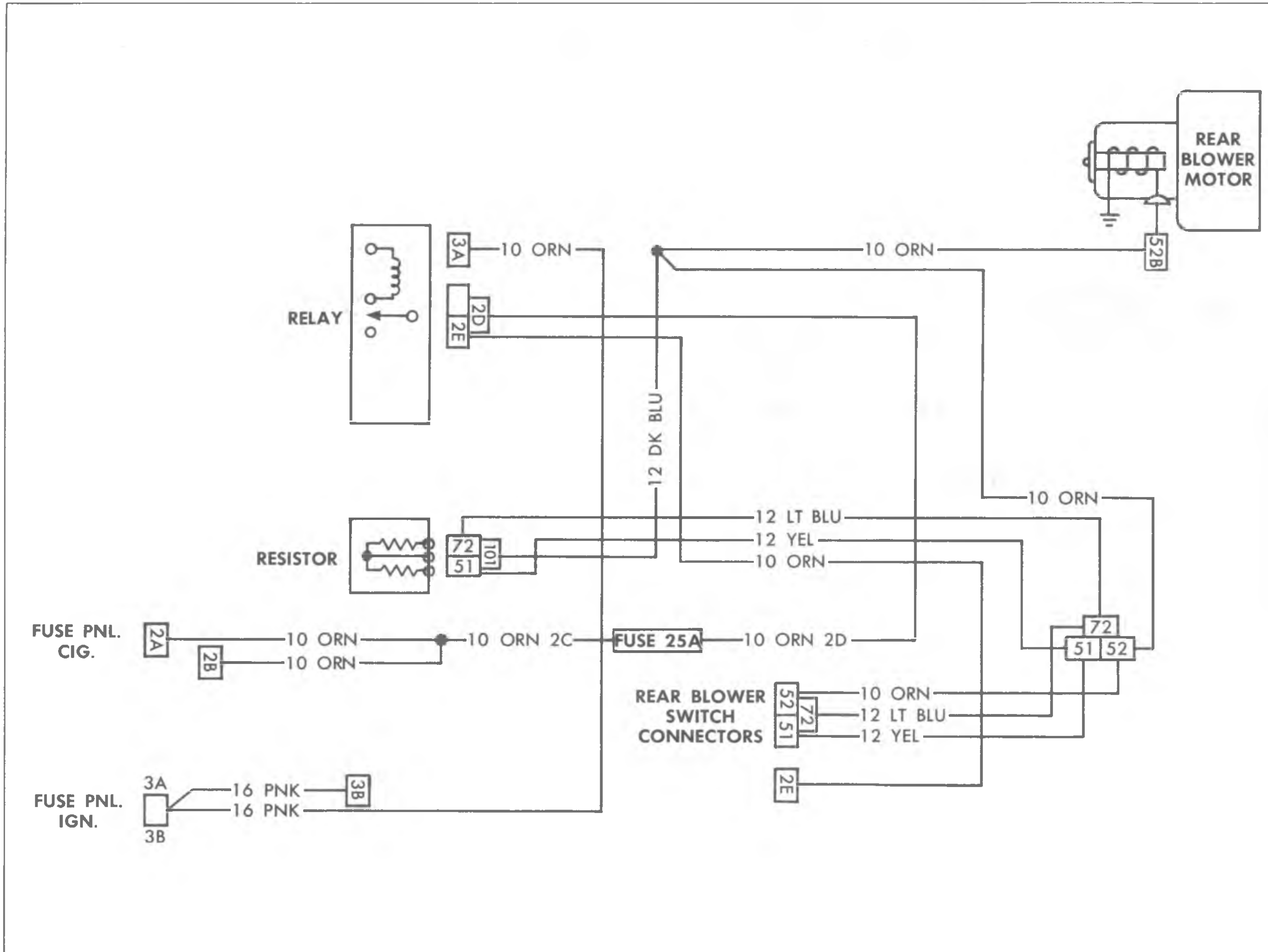


Fig. 60—Roof Mounted System Wiring Diagram

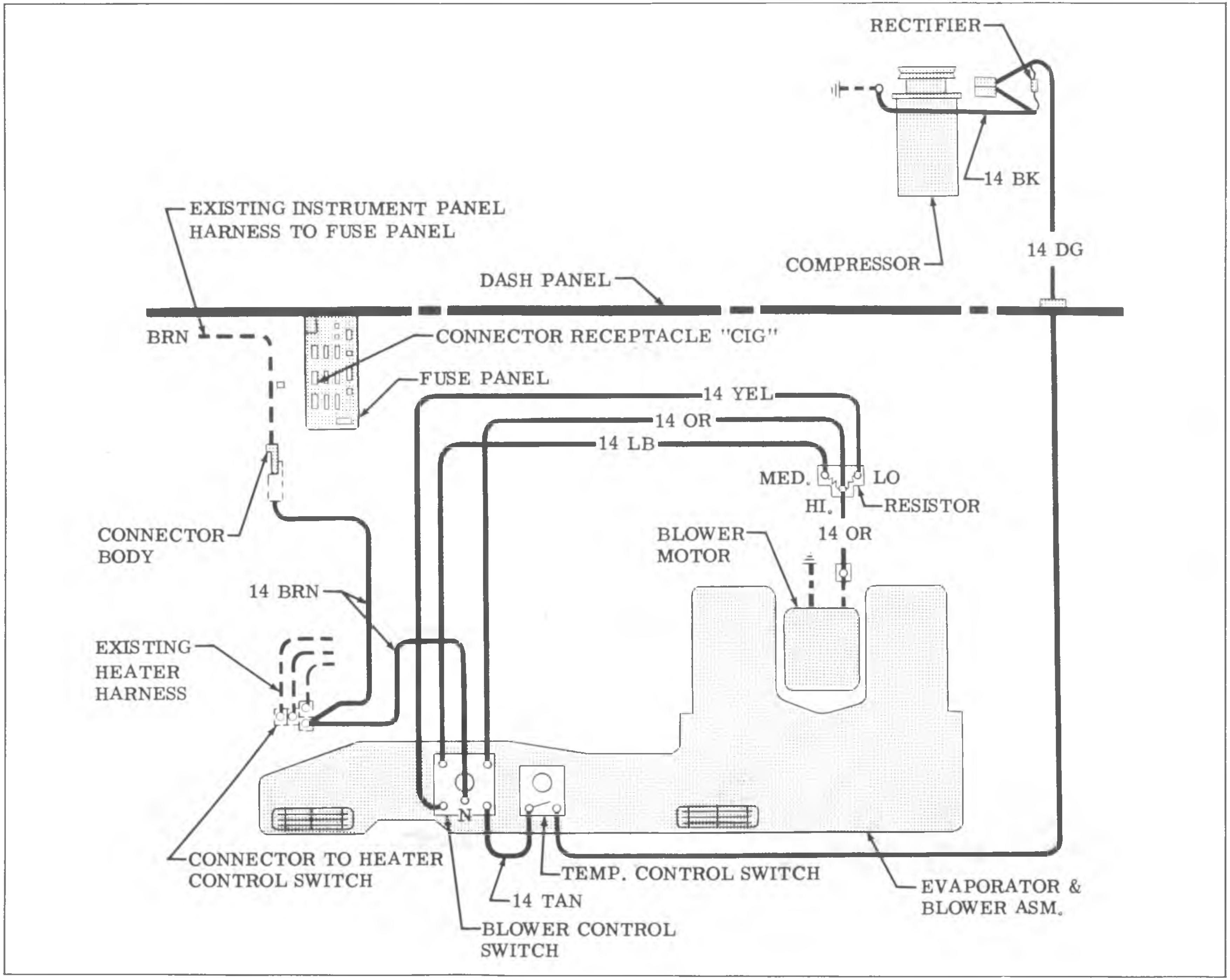
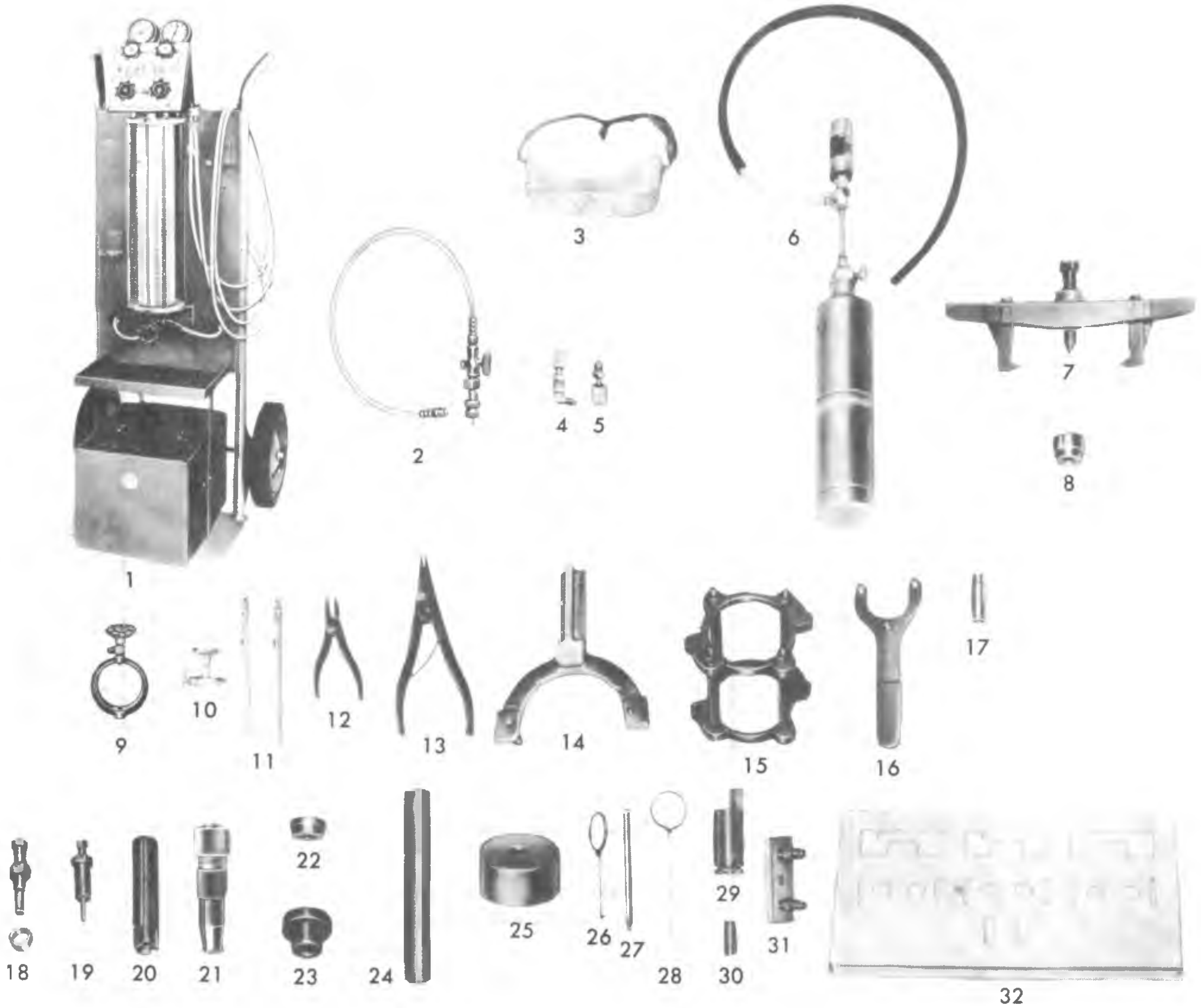


Fig. 61—GM Chevrolet System Wiring Diagram

SPECIAL TOOLS



1. J-8393 Charging Station
2. J-24095 Oil Inducer
3. J-5453 Goggles
4. J-9459 90 Degree Gauge Line Adapter
5. J-5420 Gauge Line Adapter
6. J-6084 Leak Detector
7. J-8433 Puller
8. J-9395 Puller Pilot
9. J-23595 Refrigerant Can Valve (Side-Tap)
10. J-6271 Refrigerant Can Valve (Top-Tap)
11. J-5421 Pocket Thermometers (2)
12. J-5403 No. 21 Snap Ring Pliers
13. J-6453 No. 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-23128 Seal Seat Remover
22. J-9398 Pulley Bearing Remover
23. J-9481 Pulley and Bearing Installer
24. J-8092 Handle
25. J-21352 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-22974 Shaft Seal Protector
31. J-9527 Pressure Test Connector
32. J-9402 Parts Tray

Fig. 62—Air Conditioning Special Tools

SECTION 1B

BODY

CONTENTS OF THIS SECTION

SERIES 10-30 (Except Blazer and Step Van)

INDEX

COMPONENT PARTS REPLACEMENT

BODY MOUNTING

The sequence of mounting attachments is shown in Figures 1 and 2.

BODY SEALING

Cab construction details showing location and application of sealing compound and undercoating are shown in Figures 3, 4 and 5. In servicing complete panels or only a portion of a particular section it must be completely sealed to the panel with which it mates.

Locating Dust and Water Leaks

A quick method for locating many air and water leaks at windshield, backglass, bolt holes, weatherstripping and joints is as follows:

Close all windows and vents, turn air conditioning or heater blower motor to high position and outside air and close doors. Run water over suspected leak area in a small controllable stream and observe area for pressure bubbles.

An alternate method for locating leaks is as follows:

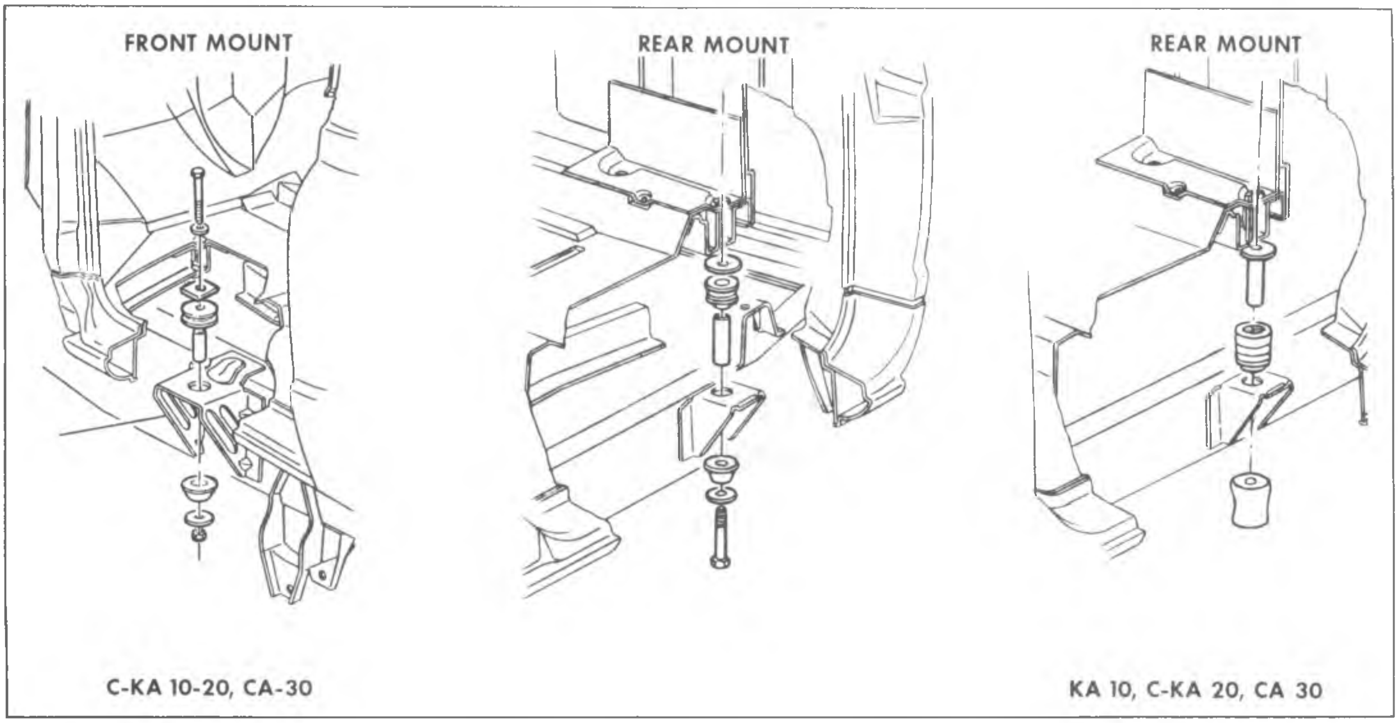


Fig. 1—Body Mounting No. 1

Remove the following trim from inside the cab. Floor mats, dash and toe panel pad and kick pads.

Dust leaks will be evident when these pads and mats are removed. Leaks can be located sometimes by putting a bright light under the cab or body, while checking the interior of the cab or body at joints and weld lines.

All openings that allow dust leaks will also provide water leaks. When checking for water leaks a helper should be used on the inside of the cab or body to locate the entrance of water, while it is applied on the outside.

> **NOTE:** Water does not always enter the cab or body in the location where leaks show up, therefore, back-tracking the path of water will show the true entrance of the leak.

FRONT END

WINDSHIELD GLASS (Fig. 6) AND BODY GLASS (Fig. 7)

The windshield is a one-piece type and is retained in the windshield opening by a moulded rubber weatherstrip. This weatherstrip is sealed in the windshield opening and sealed to the windshield glass.

When replacing a cracked windshield glass, it is very important that the cause of the glass breakage be determined and the condition corrected before a new glass is installed. Otherwise, it is highly possible that a small obstruction or high spot somewhere around the windshield opening will continue to crack or break the newly installed windshield especially when the strain on the glass caused by this obstruction is increased by such conditions as wind pressures, extremes of temperature, motion of the vehicle, etc.

The procedure for removal of the windshield applies to the complete windshield assembly.

Removal

1. Before removing the windshield, mark the location of the break on the windshield rubber channel and the body. Protect the paint finish inside of the cab. Mask around the windshield opening and outside, lay a suitable covering across the hood and fenders.

> **NOTE:** The windshield glass rubber weatherstrip is one piece. The glass is held in a channel within the weatherstrip (fig. 7A).

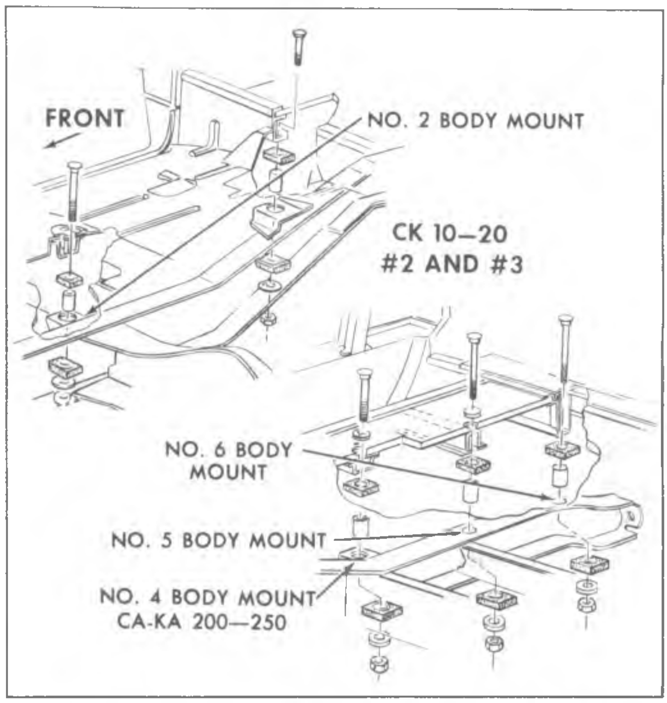


Fig. 2—Panel and Suburban Body Mounts #2, 3, 4, & 5

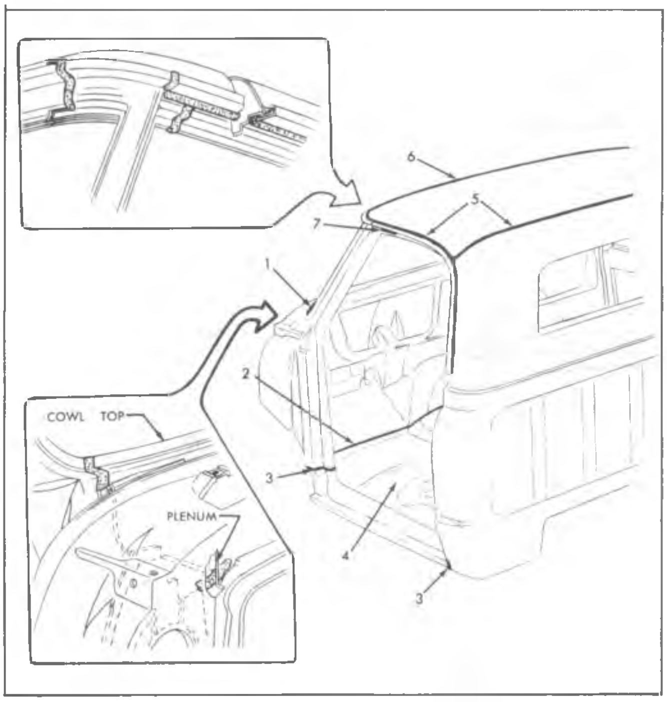


Fig. 3—Cab Sealing Areas (Typical)
1. Hinge Pillar to Cowl Side & Cowl Top to Plenum
2. Dash Panel & Cowl Side Panel to Floor Panel
3. Hinge Pillar & Lock Pillar
4. Undercoating
5. Roof Outer & Back Panel
6. Roof Outer & Back Panel
7. Upper Cab & Drip Molding Cab - Windshield pillar to Windshield Heater to Rocker

2. Do not try to remove reveal mouldings while windshield is in body opening. Remove moldings from weatherstrip retention groove (fig. 7A) after windshield is removed from body opening.
3. To free windshield rubber channel of weatherstrip loosen the lip of the windshield weatherstrip from the pinchweld flange along the top and at the sides by applying pressure with palm of the hand to the edge of the glass. At the same time assist the lip of the rubber weatherstrip channel over the pinchweld flange with a flat bladed tool such as a tongue depressor, or shaped mycarta blade (fig. 8).

Checking Windshield Opening

Due to the expanse and contour of the windshield it is imperative in the event of a strain break that the windshield opening be thoroughly checked before installing a replacement windshield. The replacement glass is used as a template.

1. Check for the following conditions at the previous marked point of fracture.
   a. Chipped edges on glass.
   b. Irregularities in body opening.
   c. Irregularities in rubber channel weatherstrip.
2. Remove all sealer from flange and body around windshield opening.
3. Check flange area for solder, weld high spots, or hardened spot-weld sealer. Remove all high spots.
4. Check windshield glass to opening, by supporting glass with six spacers contained in packet J-22577.

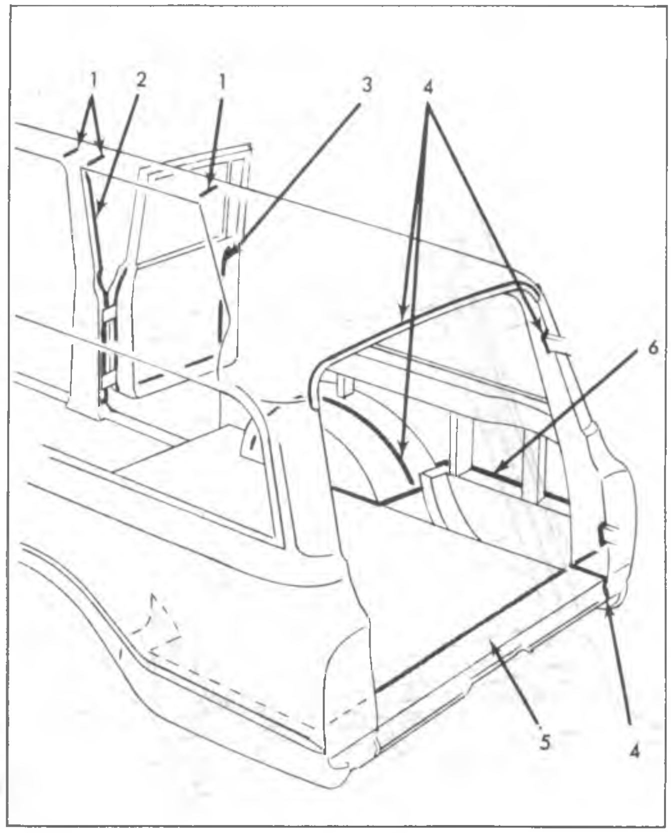


Fig. 4—Panel and Suburban Sealing Areas
1. Side Pillars to Roof Side Heater and Roof Drip Molding
2. Roof, Center Pillar and Rocker
3. Side Front Doors and Cargo Door
4. Rear Drip Mldg., w/House and RR Pillar
5. Undercoating Area
6. Inner and Outer Panel
7. Flooring to Metal

CAUTION: Do not strike glass against body metal. Chipped edges on the glass can lead to future breaks.

5. With the windshield supported and centered in its opening, check the relationship of the glass to the body opening flange around the entire perimeter of the glass.

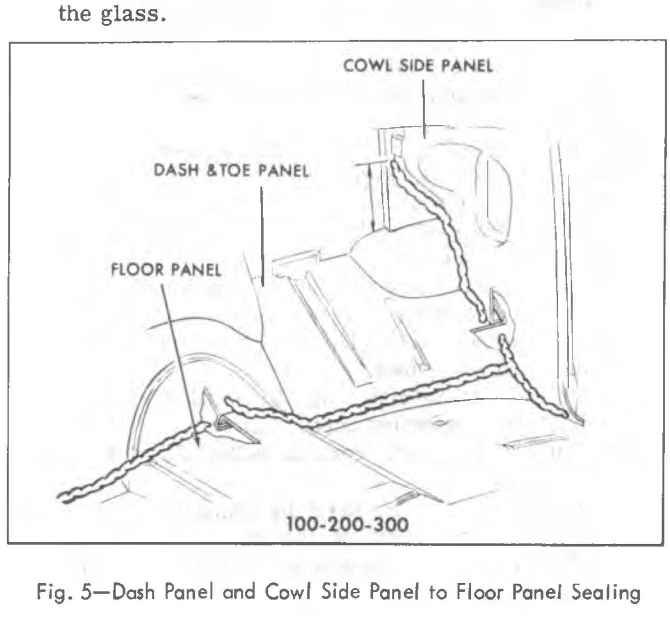


Fig. 5—Dash Panel and Cowl Side Panel to Floor Panel Sealing

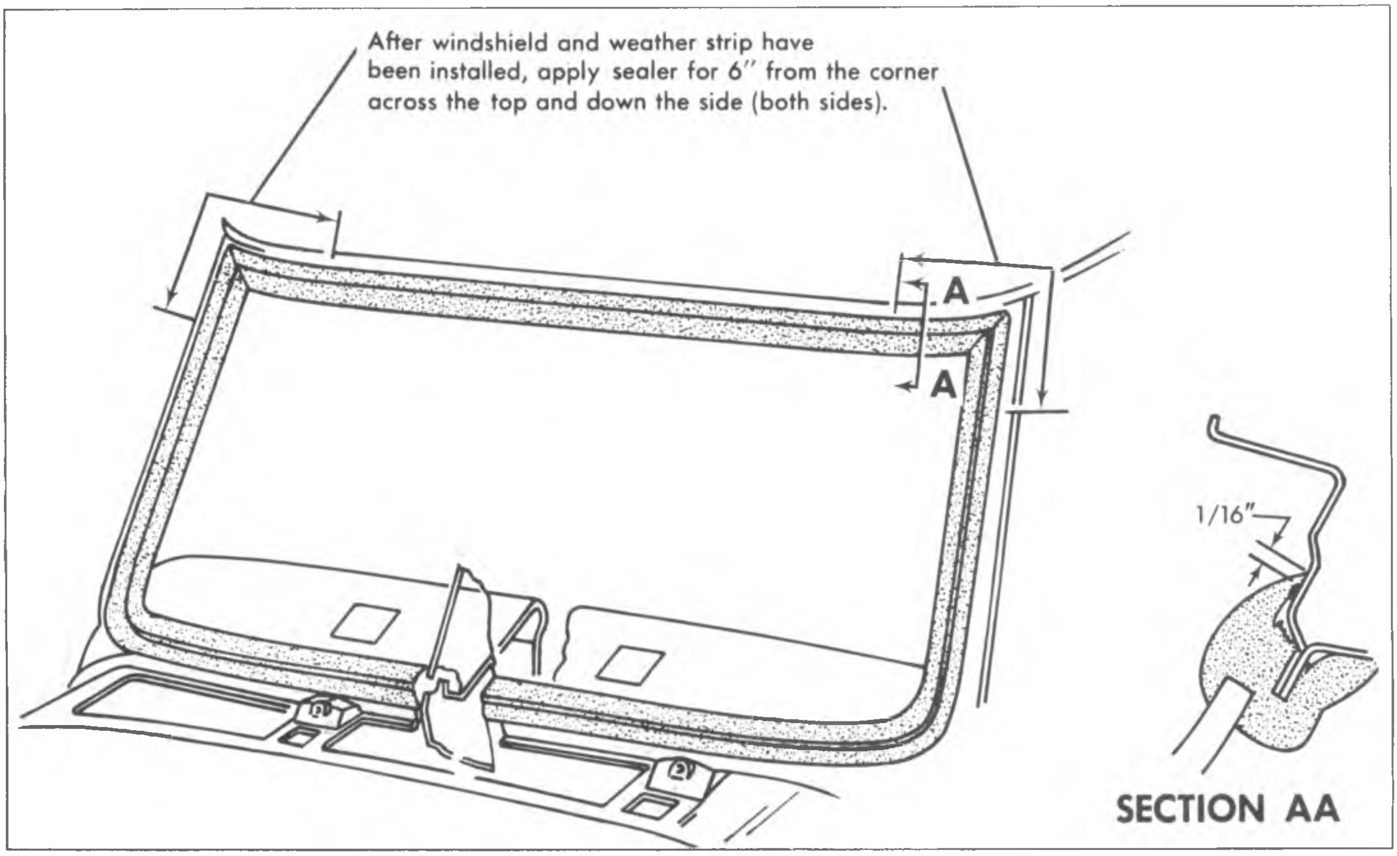


Fig. 6—Windshield Glass, Weatherstrip and Sealing - Conv. Cab

6. Check the relationship of glass to opening as follows:
   a. Inside edge of glass to body flange.
   b. Outer edge of glass to parallel body metal.
7. Mark areas of body metal or flange to be reformed, remove glass and correct as necessary.
8. Recheck windshield in its opening and if satisfactory proceed with installation.

Installation

CAUTION: Always wear gloves when handling glass.

1. Centralize weatherstrip around edge of glass to avoid cocking of square corners during assembly.
2. Install a cord around periphery of weatherstrip, leaving a loop at the top and the loose ends at the bottom as shown in Figure 9.
3. Place protective covering over plenum grille, front fenders and hood. Apply sealer to weatherstrip in areas noted in Figure 7.
4. Place windshield and weatherstrip assembly in opening. With one technician lightly pushing in on windshield, another technician within the cab should pull on the cord as follows:
   a. Pull on loose ends (fig. 10) until each is within 2" of its respective upper corner.
   b. Pull on loop until cord is within 2" of the upper corners.
   c. Finish seating corners by simultaneously pulling on both ends of the cord at each corner. This will insure proper positioning of the critical upper corners.
   d. Apply sealer to upper corners as shown in Figure 6.

OUTSIDE REAR VIEW MIRROR

Rear view mirror installations are shown in Figure 11. Occasional tightening of mounting and assembly bolts and screws will sharply decrease occurrence of failure due to door slamming or road shock.

INSTRUMENT PANEL COMPARTMENT AND LOCK

Replacement (Fig. 12)

Removal of the entire assembly including door may be accomplished by removing ten screws just inside box and compartment lamp wire (if so equipped). The door may be removed, leaving the compartment intact, by removal of four screws and bumper shown in Figure 12. Access to the door stop bumper is gained by reaching up beneath instrument panel.

Also shown in Figure 12 is the lock. Engagement of lock in striker may be adjusted by loosening striker retaining screws and moving the striker to desired position.

INSTRUMENT PANEL COVER ASSEMBLY

The instrument panel cover (fig. 13) is secured to the instrument panel by studs, nuts and screws. The studs are an integral part of the cover assembly.

Removal and Installation

1. Loosen or remove any necessary instrument panel items, glove box, etc.

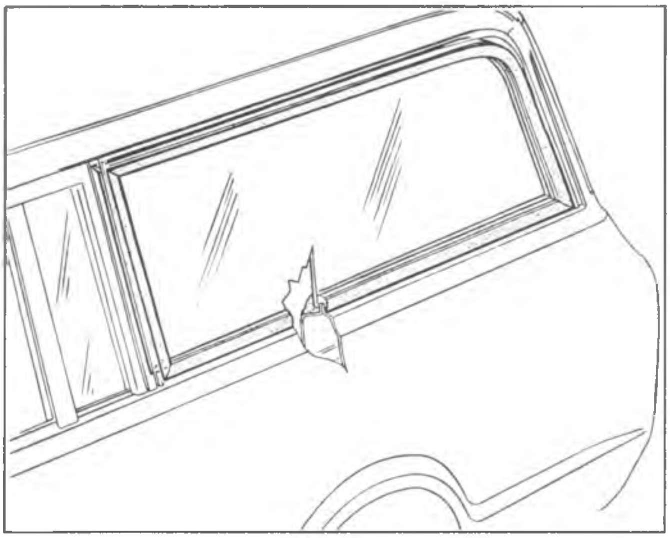


Fig. 7—Rear Stationary Window

2. From underside of instrument panel remove attaching screws and carefully remove cover assembly.
3. To install, reverse removal procedure.

COWL VENTILATOR GRILLE (Fig. 14-15)

The cowl ventilator intake, a louvered opening, extends across the top of the cowl. The opening permits outside air to enter into a plenum chamber which distributes the air to both sides of the cab. Air enters into cab through openings at right and left interior cowl panels near the floor.

Air flow is controlled by valves in the outlet openings. Valves are opened and closed by means of handles.

Replacement

1. Remove windshield wiper arms from wiper pivot shafts.
2. Raise hood and remove screws, retaining cowl ventilator grille and cowl hood ledge seal.
3. Remove four (4) screws from the rear recessed louvers.
4. Remove the six (6) screws retaining the front of the grille to the cowl.
5. Remove the two larger size screws from each end

Fig. 8—Loosening Weatherstrip

of the grille at the forward corners.
6. Remove one (1) screw each side which is exposed when the door is opened.
7. Inspect cowl hood ledge seal for fatigue or cuts and replace if necessary.
8. Secure front edge of grille over lip of hood seal with six retaining screws.
9. Reinstall windshield wiper arms on pivot shafts.
10. Reverse removal procedure to install.

COWL AIR VENTILATOR VALVE ASSEMBLY

Replacement

Entire outlet valve assembly may be removed from the vehicle by removing two screws and depressing the pins. Refer to Figure 16.

WINDSHIELD WIPERS

Windshield wiper units on all models are of the two-speed electric type. A single wiper motor unit, mounted to center of cowl inside cab, power both wiper blades. The wiper blade operating link rods and pivot mountings on these models are located in the outside air inlet plenum chamber.

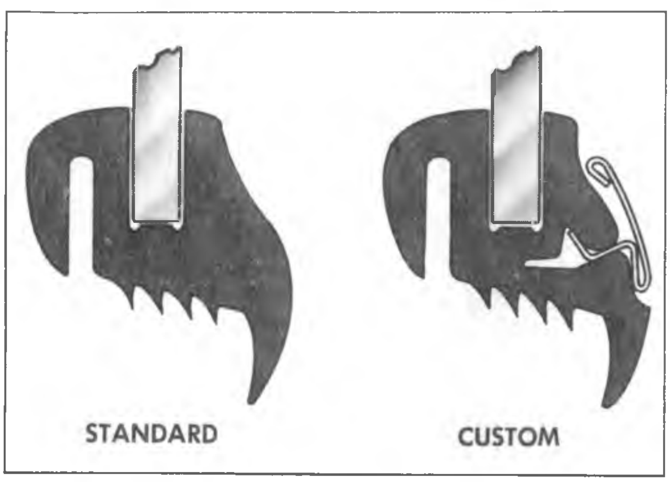


Fig. 7A—Cross Section of Windshield Weatherstrip (Typical)

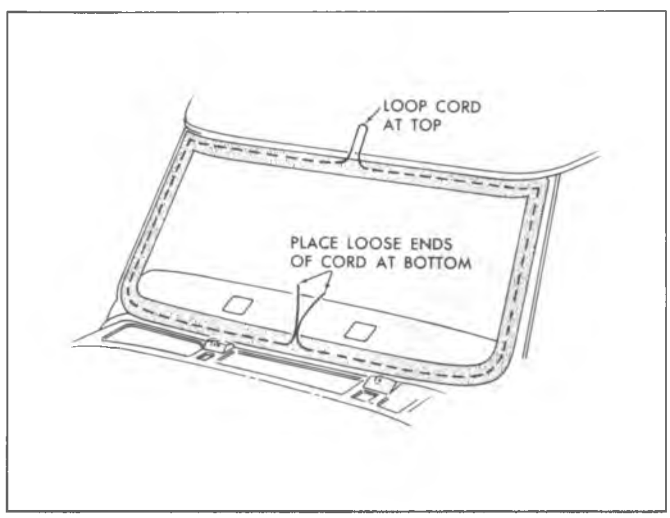


Fig. 9—Cord Installation

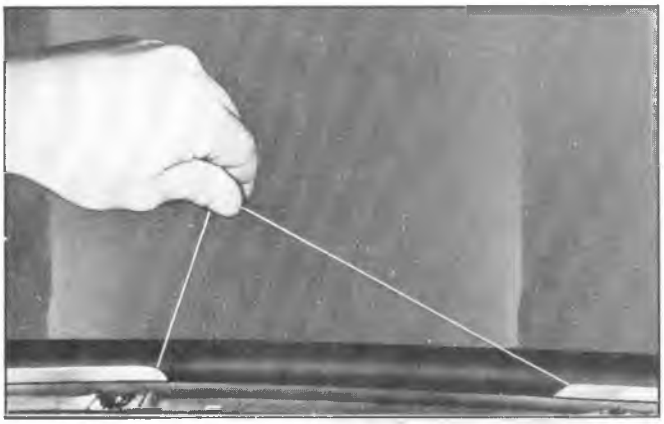


Fig. 10—Pulling String to Seal Rubber Tip

Arm Adjustment

To adjust sweep of blades, turn on wipers and note sweep of arms. If necessary, remove one or both arms as follows: Pull outer end of arm away from glass which will trip lock spring at base of arm and release spring from undercut of pivot shaft. While holding arm in this position, pull outward on cap section at base of arm to remove arm. Arm can be reinstalled in any one of

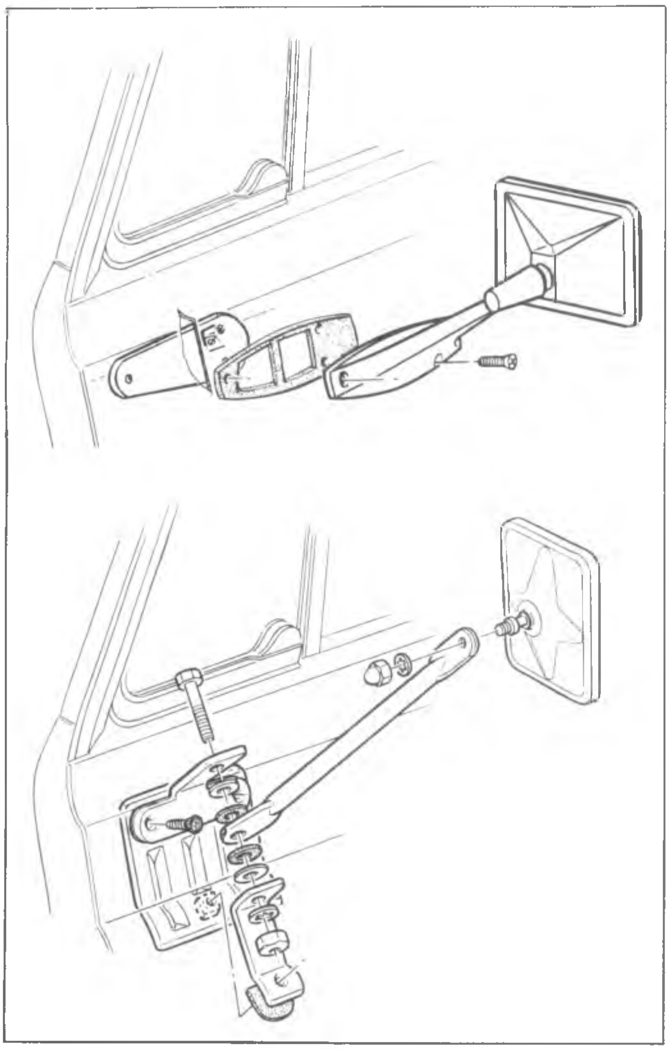


Fig. 11—Rear View Mirrors

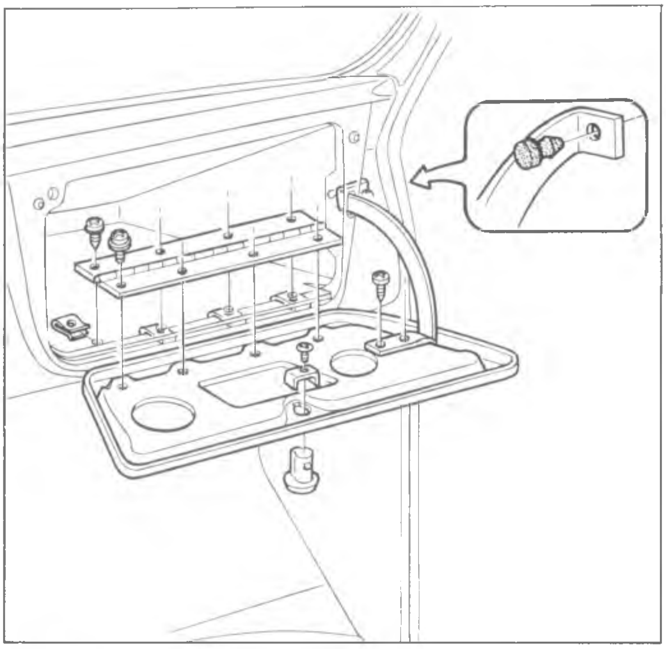


Fig. 12—Instrument Panel Compartment Door (Glove Box)

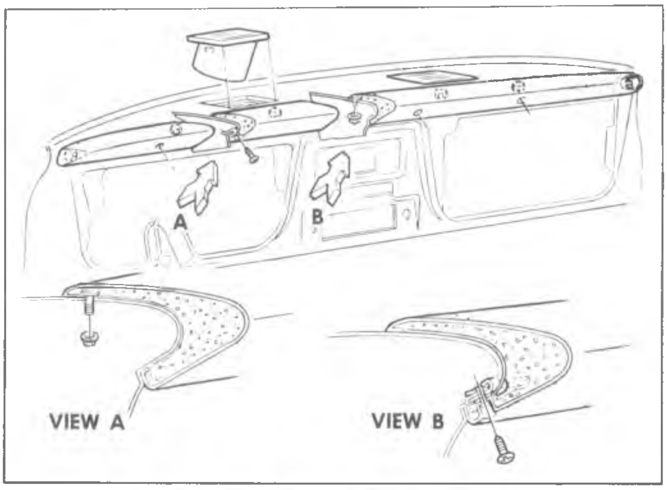


Fig. 13—Instrument Panel Cover

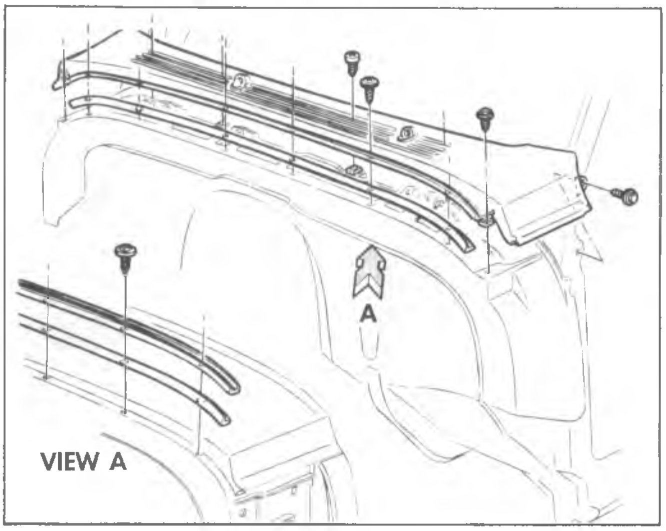


Fig. 14—Cowl Ventilator Grille Intake - Cab Models

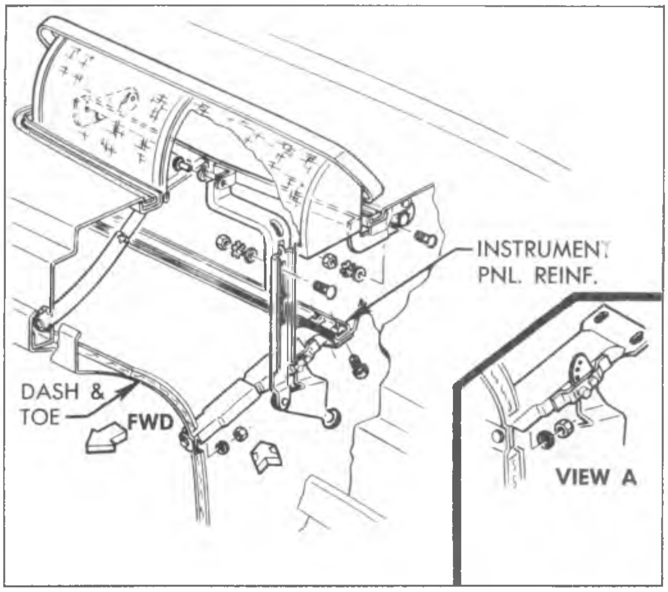


Fig. 15—Cowl Ventilator Grille F/F Cowls

several positions due to serrations on pivot shaft and in arm cap (fig. 17).

Wiper Arm Pivot Shafts and Link Rod (Fig. 17)

Removal

1. Remove windshield wiper arms from pivot shafts. Procedure for removing arms is explained previously under "Arm Adjustments."
2. Remove screws which attach outside air cowl ventilator grille to cowl. Carefully remove grille forward from cowl.
3. At center of cowl, remove retainer (fig. 17) which attaches each link rod to motor drive linkage and arm assembly. Disengage link rods from pins.
4. Remove two screws which attach arm transmission

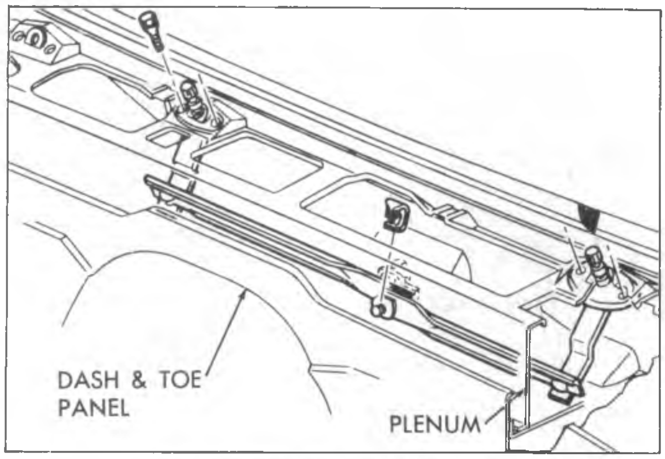


Fig. 17—Windshield Wiper Linkage

pivot shaft assembly to cowl. Remove pivot shaft assembly with link rod from plenum chamber.

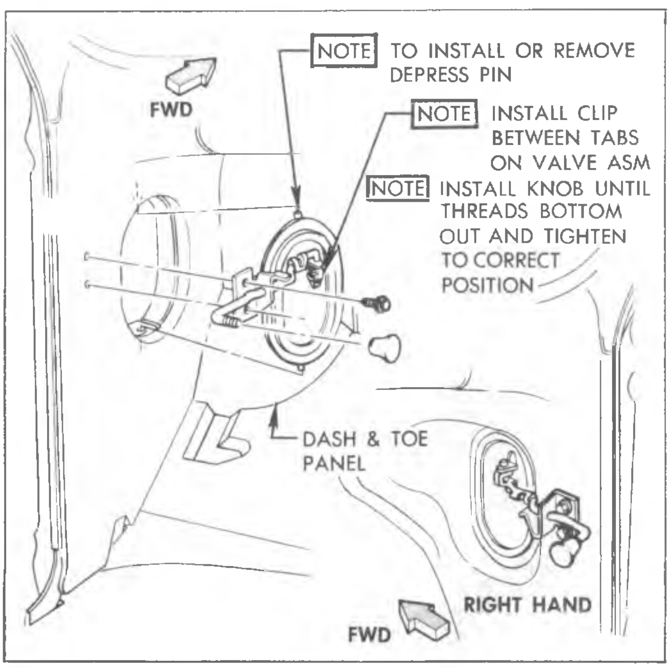


Fig. 16—Cowl Air Ventilator Valve

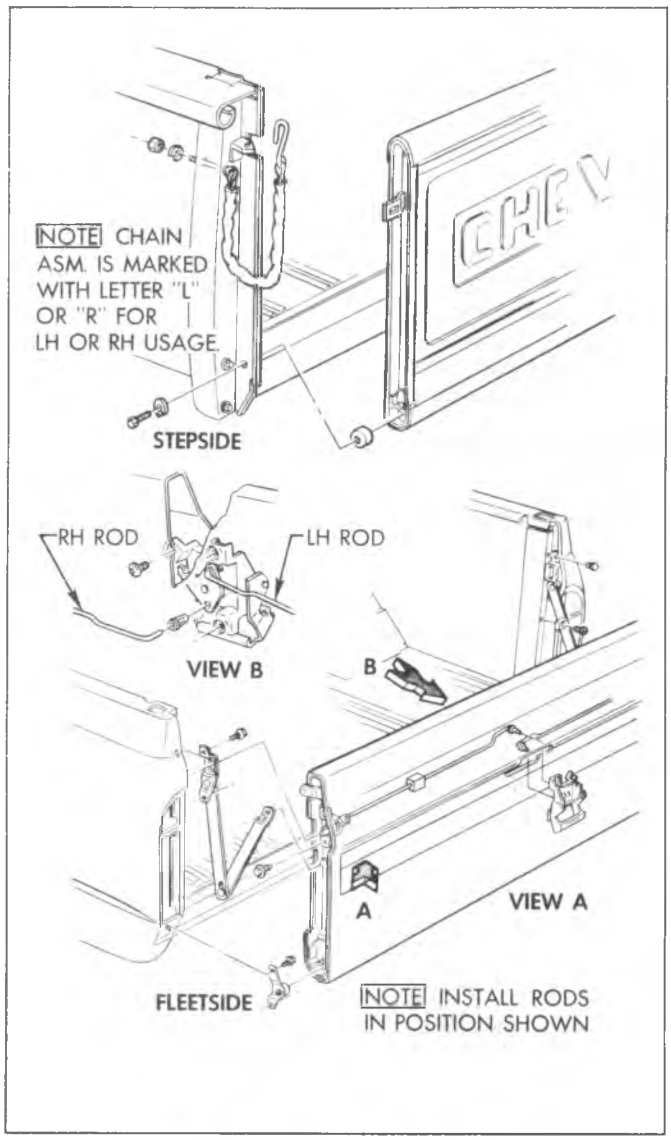


Fig. 18—Endgate - Stepside and Fleetside

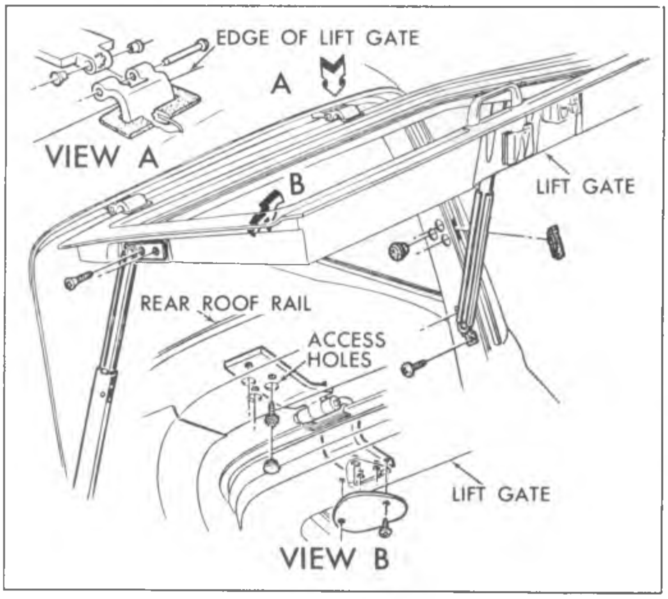


Fig. 19—Suburban - Liftgate Replacement

Installation

1. Place pivot shaft assembly with link rod into position at cowl bracket. Secure assembly to bracket with two screws.
2. Attach end of link rod to linkage of motor drive and arm assembly at center of cowl. Secure rod with retainer. If opposite pivot shaft and link rod was removed, install it at the same time.
3. Install outside air cowl ventilator grille to top of cowl using screws.
4. Before installing wiper arms, operate wiper motor momentarily which should rotate pivot shafts to park position. Install arms and shafts.

TAILGATES (ENDGATES)

Fleetside

Replacement (Fig. 18)

1. Open tailgate.
2. Remove screws attaching handle assembly to inner side of tailgate.
3. Remove clips from handle assembly and remove handle.
4. Remove screws from each latch assembly and lift off, with actuating rods.

Replacement of Trunnion Assembly

1. Lower tailgate half way.
2. Pull center of hinge upward and unlatch from tailgate.
3. Lower tailgate all the way.
4. Remove two screws from trunnion and lift off tailgate.

Stepside

Replacement

1. Unhook endgate chain assembly at each side.
2. Remove bolt and lock washer from each trunnion in carrier box endgate.
3. Remove endgate.
4. Reverse procedure for installation. Align slot in trunnion to coincide with hole in endgate to permit using a tool to hold trunnion while tightening nut view "A" (fig. 18).

Fig. 20—Liftgate Replacement

LIFTGATE ASSEMBLY (Fig. 19)

Removal and Installation

1. Remove one (1) of the two screws securing the liftgate strut supports on each side of the liftgate.
2. Remove two (2) of the three hinge bolts from each hinge on the body side.
3. While supporting the liftgate assembly in the up position, remove the remaining one (1) screw each securing the strut supports to the liftgate.
4. Lower the liftgate to the closed position.
5. Remove the remaining one hinge bolt (each side) from the body.
6. While standing on the endgate, carefully remove the liftgate by slowly guiding straight out and away from the body. (See Figure 20)
7. Reverse above procedure to install.

Hinge Assembly

If necessary to remove hinges, apply the above liftgate steps and proceed as follows:

1. Remove two screws securing each hinge bolt access door on the liftgate.
2. Remove three (3) hinge bolts from each side of liftgate.
3. Remove hinges and rubber grommets.
4. Reverse above procedure to install.

Adjustment (See Fig. 21)

Loosen bolts and adjust at either liftgate hinge location or liftgate latch as shown in Figure 21.

Fig. 21—Liftgate Adjustments

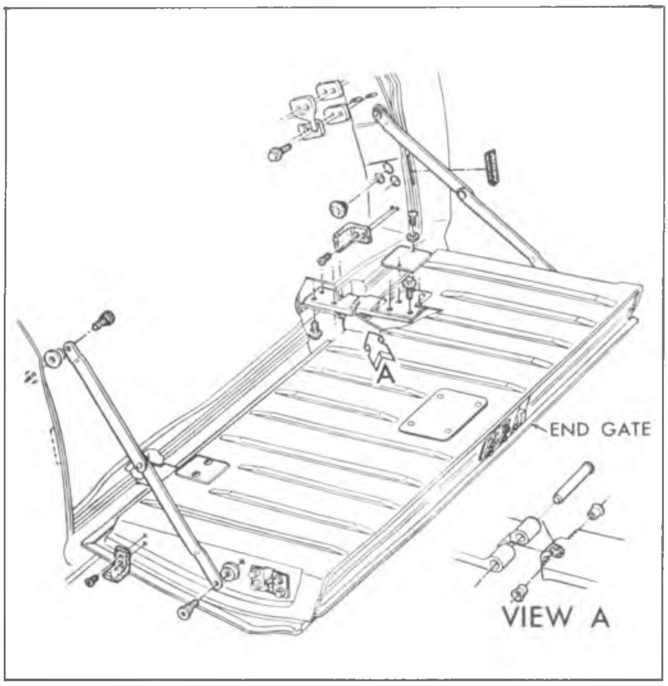


Fig. 22—Suburban Endgate Installation

Outside Handle

Removal and Installation

1. Open liftgate and remove two (2) screws and two internal tooth lockwashers.
2. Remove handle and rubber gasket.
3. Reverse procedure to install.

Supports

A telescoping support, which consists of an inner and outer channel. The end of the inner channel is secured to the rear door while the end of the outer channel is secured to the body pillar. The support is so designed that raising the door to the wide open position and releasing door, support will lock in position.

> **NOTE:** R.H. support has small finger latch to latch the gate in the open position.

To close door, raise door slightly more than open position and lower.

Removal and Installation

1. Support gate in open position and remove screws securing ends of support to gate and body pillar. Remove support.
2. To install, reverse removal procedure.

Window Weatherstrip

Refer to Rear Door Glass in this section.

ENDGATE ASSEMBLY (Fig. 22)

Removal and Installation

> **NOTE:** Scribe or mark hinges before removal.

1. Remove hinge access covers from endgate assembly.
2. Remove three (3) of the four hinge bolts and external tooth lock washers.
3. Lift endgate to almost a closed position.
4. Remove side endgate supports by removing pivot bolts and washers.
5. While supporting the endgate in an up-right position remove the remaining hinge bolt from each side. (See Figure 23)
6. Remove endgate.
7. Reverse procedure to install.

Hinges

If necessary to remove hinges, apply the above steps and proceed as follows:

1. Remove bolts from each of the hinge assemblies on the underside of the body.
2. Remove hinge assemblies. (Note bushing positions if disassembling to remove pin.)
3. Reverse procedure to install.

Adjustments (See Fig. 24)

Loosen bolts and adjust at either endgate hinge position or endgate latch.

Remote and Push Button Control Assembly

Removal and Installation (See Fig. 25)

1. Remove remote and push button control assembly access cover.

Fig. 23—Endgate Replacement

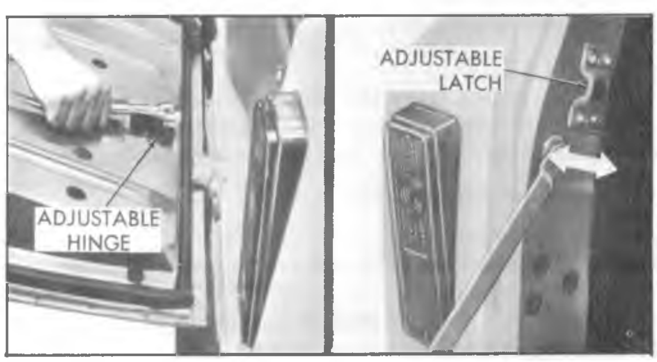


Fig. 24—Endgate Adjustements

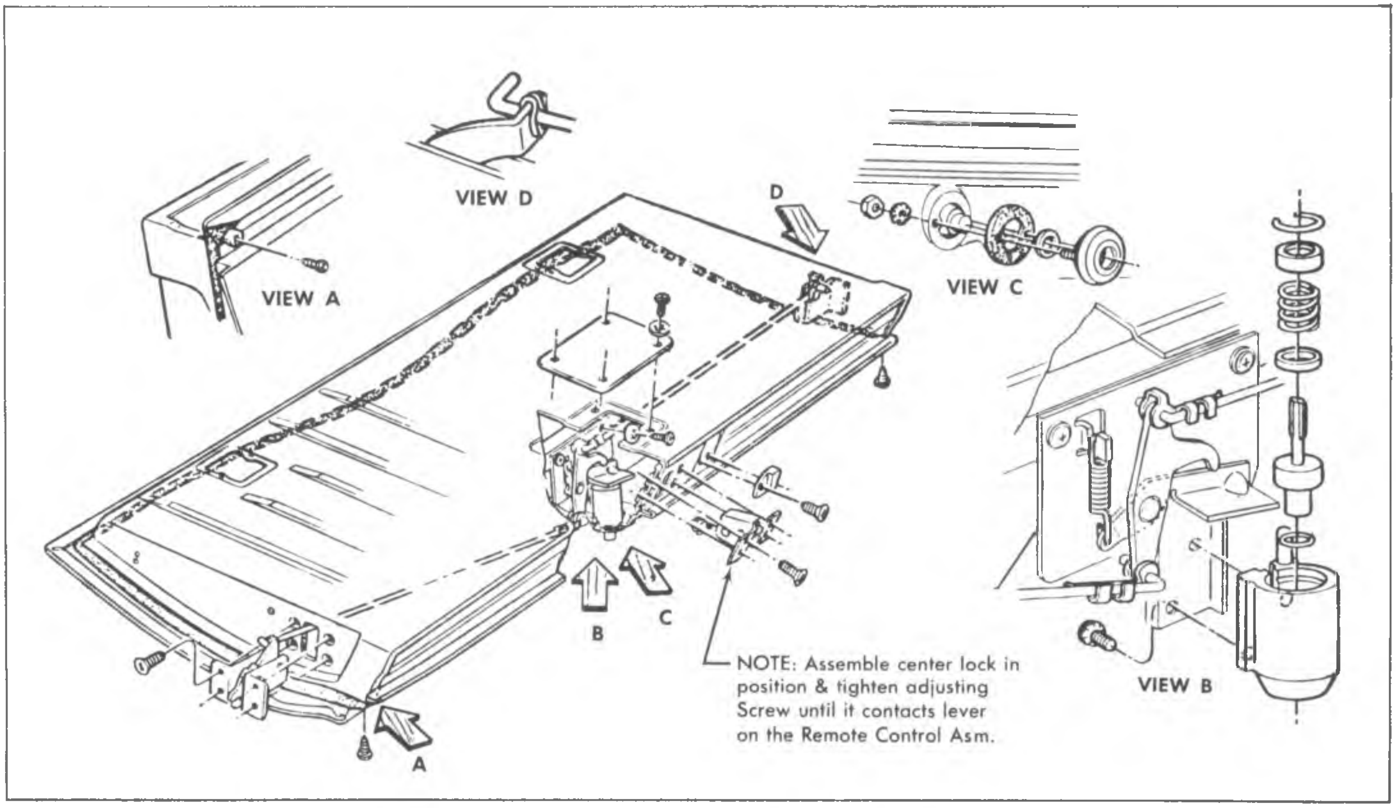


Fig. 25-Suburban Endgate Assembly

2. Remove spring clip securing the right side lock rod to remote assembly. (See Figure 26)
3. Remove screws securing the remote and push button control assembly plate.
4. Pull out the remote and push button control assembly to remove the left side lock rod spring clip: (See Figure 27)
5. Hold the center lock spring lever out of the way and remove the control assembly.
6. Reverse the procedure to install.

Push Button Assembly

If necessary to remove the push button assembly, apply the above Remote and Push Button Control steps and proceed as follows:

1. Secure the Remote and Push Button Control Assembly and remove two screws from the back of the plate.
2. Rotate the push button assembly to release the lock assembly and remove.
3. Reverse procedure to install.

Adjustment

Elongated holes with two large screws and external tooth washers are provided in the remote and push button control assembly plate to provide for needed adjustment.

Lock Cylinder Escutcheon

Removal and Installation

1. Apply above Remote and Push Button Assembly Removal procedures.
2. Remove two nuts securing the escutcheon.
3. Remove escutcheon and gasket.
4. Reverse procedure to install.

Endgate Centerlock

1. Remove screws from endgate end.
2. Remove centerlock assembly.
3. Reverse above procedure to install.

Endgate Side Lock

1. Remove Remote and Push Button Assembly mechanism access hole cover.
2. Remove right or left side lock rod spring clip.
3. Remove four (4) screws and lock washers.
4. Guide rod and side lock from endgate.
5. Reverse procedure to install.

PANEL AND SUBURBAN ENDGATE, LIFTGATE AND REAR DOOR STRIKERS—ADJUSTMENT (Fig. 28)

Locations for striker adjustment are typically shown in Figure 28. Adjust for dimensions shown and add spacers as required. For rear door, adjust wedge as shown in Figure 47.

FRONT DOOR ASSEMBLY (Fig. 29, 30)

Replacement

Remove the door assembly from the body by removing the hinges from the door.

Adjustment

Door adjustment may be accomplished at two places; at the hinge straps-to-door panel and at the hinge cage-to-pillar. Before adjustment is made on any door, however, the striker plate should be removed. The door can be moved fore, aft, up and down at the hinge pillar and the door also can be moved in or out at the hinge-to-door panel. However, in order to adjust the cab front side door assembly at the body hinge pillar it is necessary to use

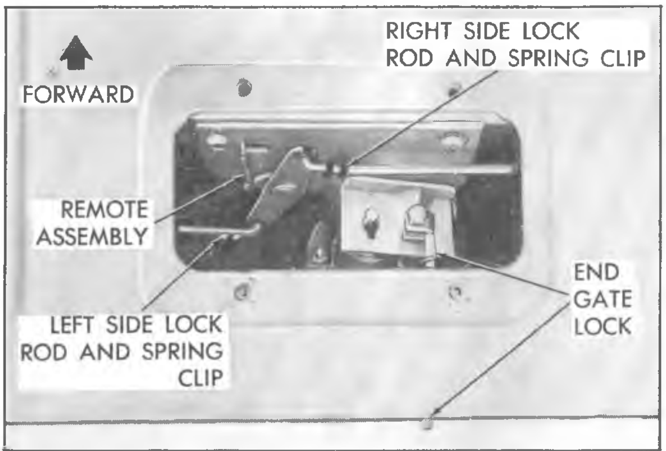


Fig. 26—Endgate Remote and Push Button Control Assembly

special door hinge bolt wrench Tool J-22585 (fig. 29). Move door as required and tighten bolts.

The door should have equal clearance around the entire outer lip of door.

The door should be adjusted in the opening so the edge of the door across the top and also at the lock side is parallel with the body opening as nearly as possible.

Tighten bolts to specifications after adjustment and replace and adjust the door striker plate as outlined under Door Striker Adjust.

DOOR CHECK

The door check is part of the front door upper hinge on all but Step Van models. The front door check hinge combination allows a friction load to hold the door in any position between full open and closed. The front door check-hinge assembly is replaced as a complete unit as follows:

Removal

1. Remove windshield wiper blade assemblies.
2. Remove cowl vent grille screws and lift off grille.
3. Loosen front fender rear bolts.
4. With special Tool J-22585 remove 3 bolts securing front door upper hinge to cowl pillar. Refer to Figure 29.
   a. Remove the door to upper hinge retaining bolts.

Fig. 27—Endgate Remote and Push Button Control Replacement

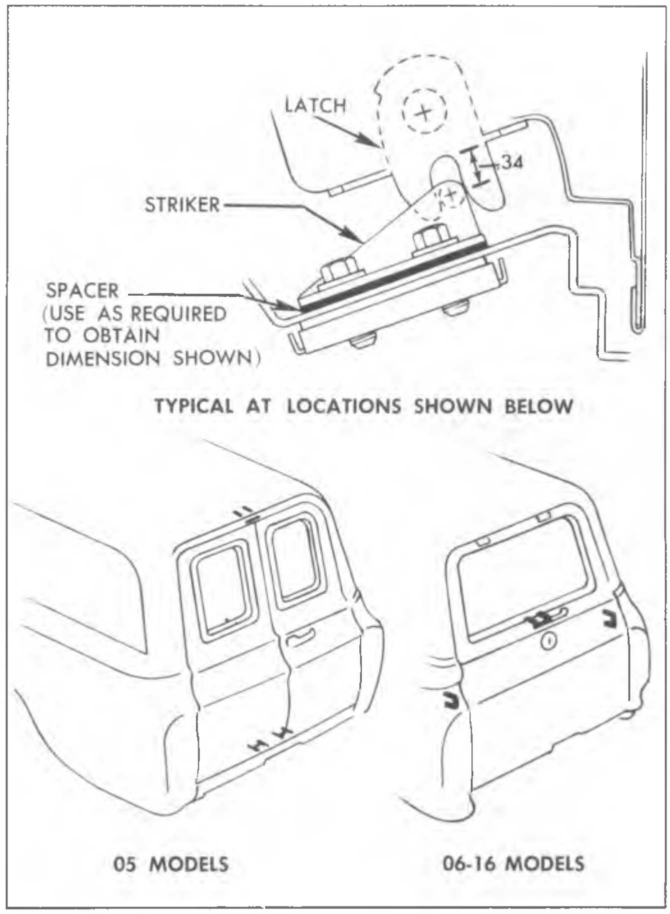


Fig. 28—Panel and Suburban Endgate, Liftgate and Rear Door Striker - Adjustment

   b. With aid of an assistant to support weight of door, remove the door to lower hinge retaining bolts and remove.

Installation

1. Install hinge snugly on pillar in same location as hinge removed.
2. With the aid of an assistant fasten the door to the hinge.
3. Adjustment of the door lock and striker plate should

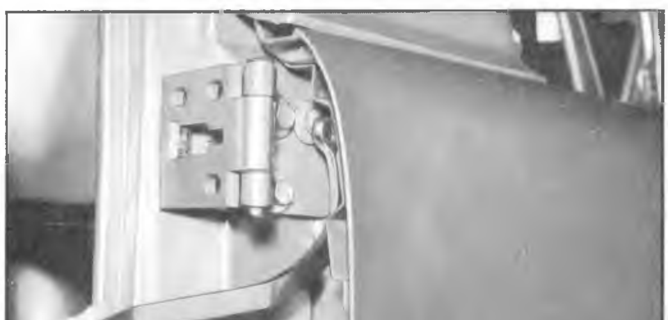


Fig. 29—Door Hinge Bolt Replacement

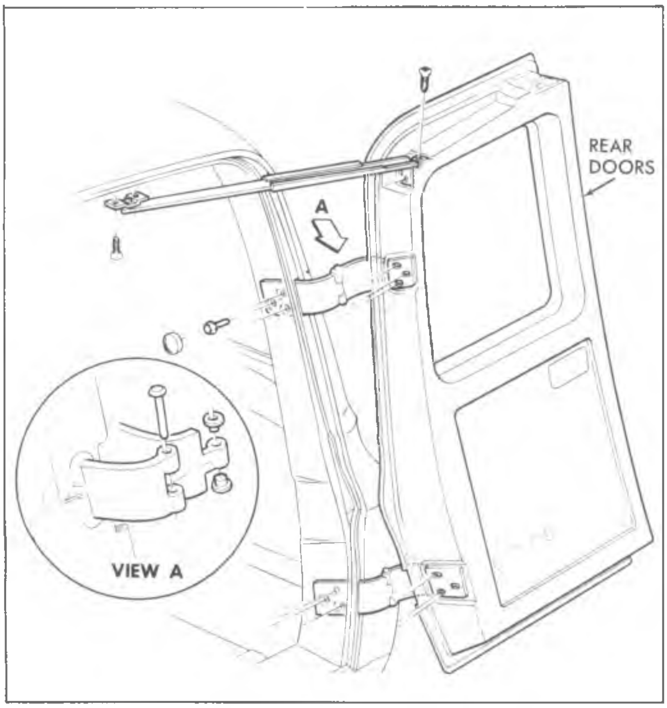


Fig. 30—Rear Door Installation - Panel and Suburban

be made after the door is positioned in the opening.

4. Position striker assembly on body lock pillar so the rotor cover outer face on the door swings into the striker assembly with .10 inch clearance to the lock rotor cover. Use special burred shims as required.

   NOTE: Under usual conditions, shims are not required.

5. As an aid to striker adjustment outline the striker in pencil or crayon for use as a base for adjustment. Horizontal slots are provided in the striker plate to position the striker assembly laterally so that the door outer surface is flush with the pillar surface at the door rear edge within 1/16". Refer to Figure 45.

   NOTE: The striker inner edge must be parallel to the striker mounting depression on the pillar.

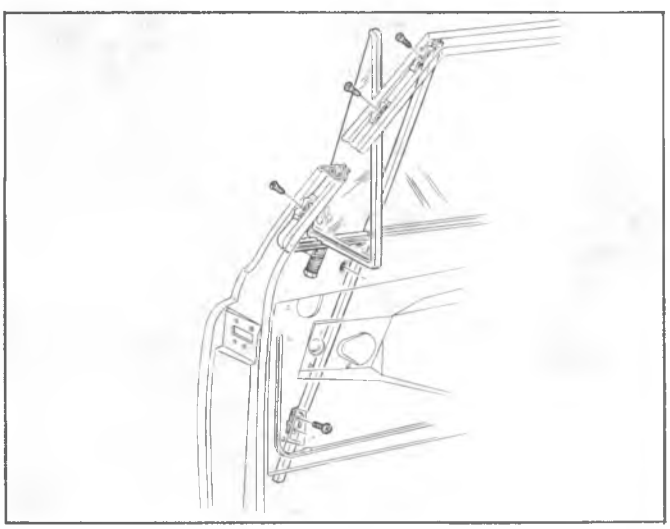


Fig. 31—Ventilator Assembly

Fig. 32—Ventilator Assembly Removal

DOOR VENTILATOR ASSEMBLY

Removal

NOTE: The channel between the door window glass and door vent is removed as part of the vent assembly.

1. Regulate the door window glass to the full down position.
2. Remove one clip each from the door lock handle.
3. Remove two (2) arm rest screws and trim panel.
4. Remove screws shown in fig. 31.
5. Slide door window glass rearward away from ventilator.
6. Remove three sheet metal screws at the upper front of the door, fig. 31.
7. Turn the vent assembly 90° and carefully remove by guiding up and out, fig. 32.

Installation

NOTE: Replace the door window glass and regulate to the full down position before installing the door ventilator assembly.

Fig. 33—Adjusting Ventilator Operating Tension

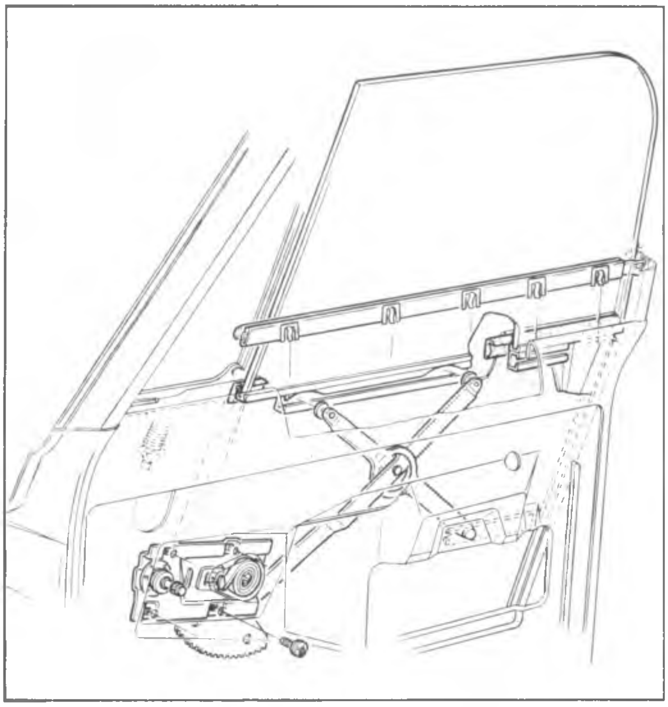


Fig. 34—Regulator Assembly and Glass (Side Door)

1. Lower the ventilator assembly into the door frame-center into position.
2. Make certain the rubber lip is positioned before tightening screws.
3. Slide door glass forward engaging glass in vent channel.
4. Reinstall all screws and tighten.
5. Install and tighten the three screws at the upper front of the door.

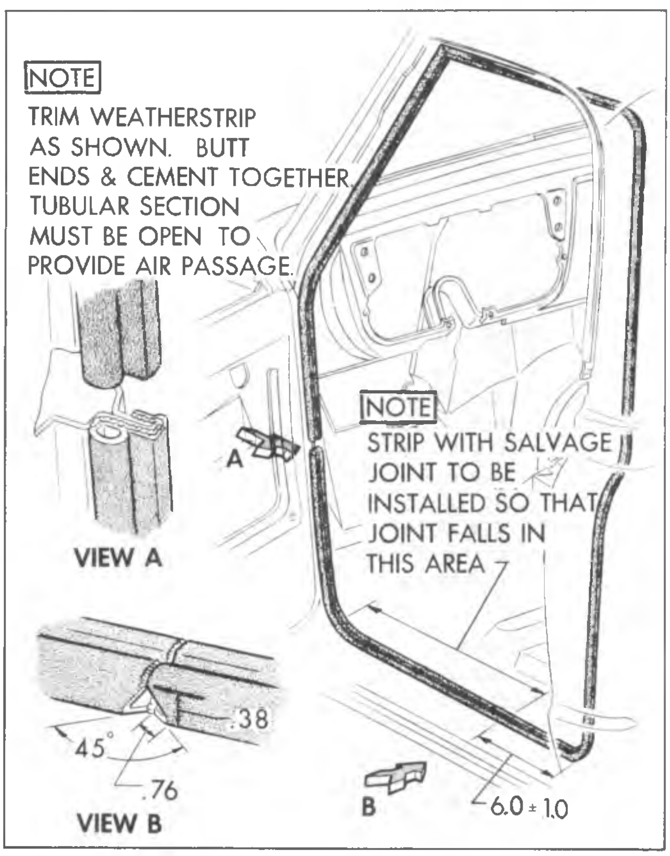


Fig. 35—Door Opening Weatherstrip

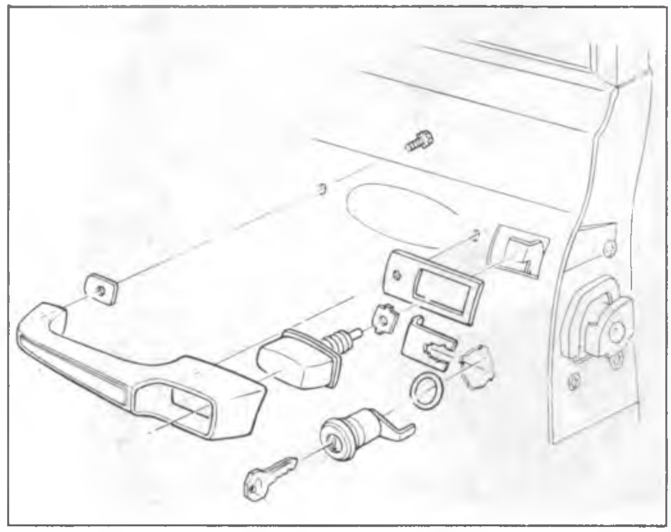


Fig. 36—Handle and Lock (Outside Door)

Adjustment

1. Adjust the ventilator adjusting nut by turning clockwise to increase operating tension (fig. 33).
2. After making adjustment bend tabs over the hex nut.
3. Install two arm rest screws and trim panel.
4. Install door and window regulator handles.

Ventilator Glass Replacement

1. Using an oil can or similar means, squirt prepsol or equivalent on the glass filler all around the glass channel or frame to soften the old seal. When the seal has softened, remove the glass from the channel.
2. Thoroughly clean the inside of the glass channel with sandpaper, removing all rust, etc.
3. Using new glass channel filler, cut the piece to be installed two inches longer than necessary for the channel. Place this piece of filler (soapstoned side of filler away from glass) evenly over the edge of the glass which will fit in the channel. The extra filler extending beyond the rear edge of the glass should be pinched together to hold it in place during glass installation.

   NOTE: One side of this filler (the outside of the roll) is soapstoned. This is the side which goes into the metal channel.

4. Brush the inside of the metal glass channel freely with ordinary engine oil. This will enable the glass and filler to slide freely into the channel. Push the glass with the filler around it into the channel until it is firmly seated. After the glass is firmly in place, the oil softens the filler, causing it to swell, thereby making a perfect, watertight seal. Trim off the excess filler material around the channel and at the ends of the channel.

   NOTE: Glass should be installed so that rear edge is parallel to the division post. Allow full cure before water testing.

Fig. 37—Lock Cylinder Installed

DOOR WINDOW ASSEMBLY

Removal

1. Completely lower glass to bottom of door.
2. Remove inside door and window regulator handles using tool J-7797.
3. Remove door arm rest and trim pad.
4. Mask or cover upper portion of door window frame. Remove ventilator assembly as previously outlined.
5. Slide glass forward until front roller is in line with notch in sash channel. Disengage roller from channel.
6. Push window forward and tilt front portion of window up until rear roller is disengaged.
7. Put window assembly in normal position (level) and raise straight up and out.
8. Reverse above procedure for installation.

WINDOW REGULATOR REPLACEMENT (Fig. 34)

Removal

1. Wind window all the way up.
2. Remove inside door handles with Tool J-7797.
3. Remove door trim pad.
4. Remove 4 screws securing regulator to inner panel.
5. Push regulator out of circular opening while holding rear of assembly, then slide assembly to the notches in the carrier channel and out through the door access hole.

Installation

Install regulator in reverse order of removal, lubricate regulator gears with lubriplate or equivalent.

DOOR OPENING WEATHERSTRIP (Fig. 35)

Side door sealing incorporates an inner seal. The inner seal is mounted on the body opening welding flange and goes completely around the periphery of the opening. The molded weatherstrip material is cemeted in place.

Success of weatherstrip replacement depends entirely upon the quality of the cement used and the care with which it is applied. All rust, road dirt and grease or oil must be completely removed as should all old cement and bits of old weatherstrip. After removing all foreign material from door opening surface, wipe down with prepsol or its equivalent. Use only a good quality cement which is made specially for weatherstrip installation, following the manufacturer's directions. Proceed as follows:

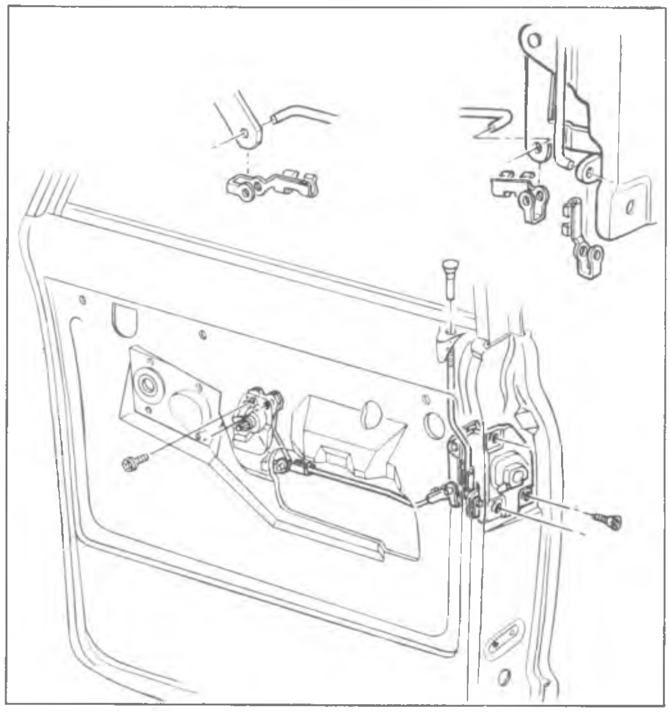


Fig. 38—Remote Control and Side Door Lock

1. Open door and block open.
2. Remove sill plate retaining screws and remove sill plate.
3. Remove side door inner weatherstrip seal.
4. Remove used adhesive from cab door opening with adhesive or cement remover.
5. Apply adhesive to cab opening.
6. Install molded corner of inner weatherstrip, starting where windshield post joins the header panel.
7. Trim inner weatherstrip with a notch as shown in Figure 35 and butt ends together.
8. Reinstall sill plate and sill plate retaining screws.

DOOR LOCKS

(Refer to Figs. 36, 37 and 38)

> **NOTE:** All door lock striker parts, including shims and bolts, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Raise window.
2. Remove inside handles with Tool J-7797.
3. Remove trim panel.
4. Remove remote control sill knob.
5. From outside the door remove screws retaining lock to door edge and lower the lock assembly.
6. Remove screws retaining remote control.
7. Remove lock, push button rod and remote control rod as an assembly.

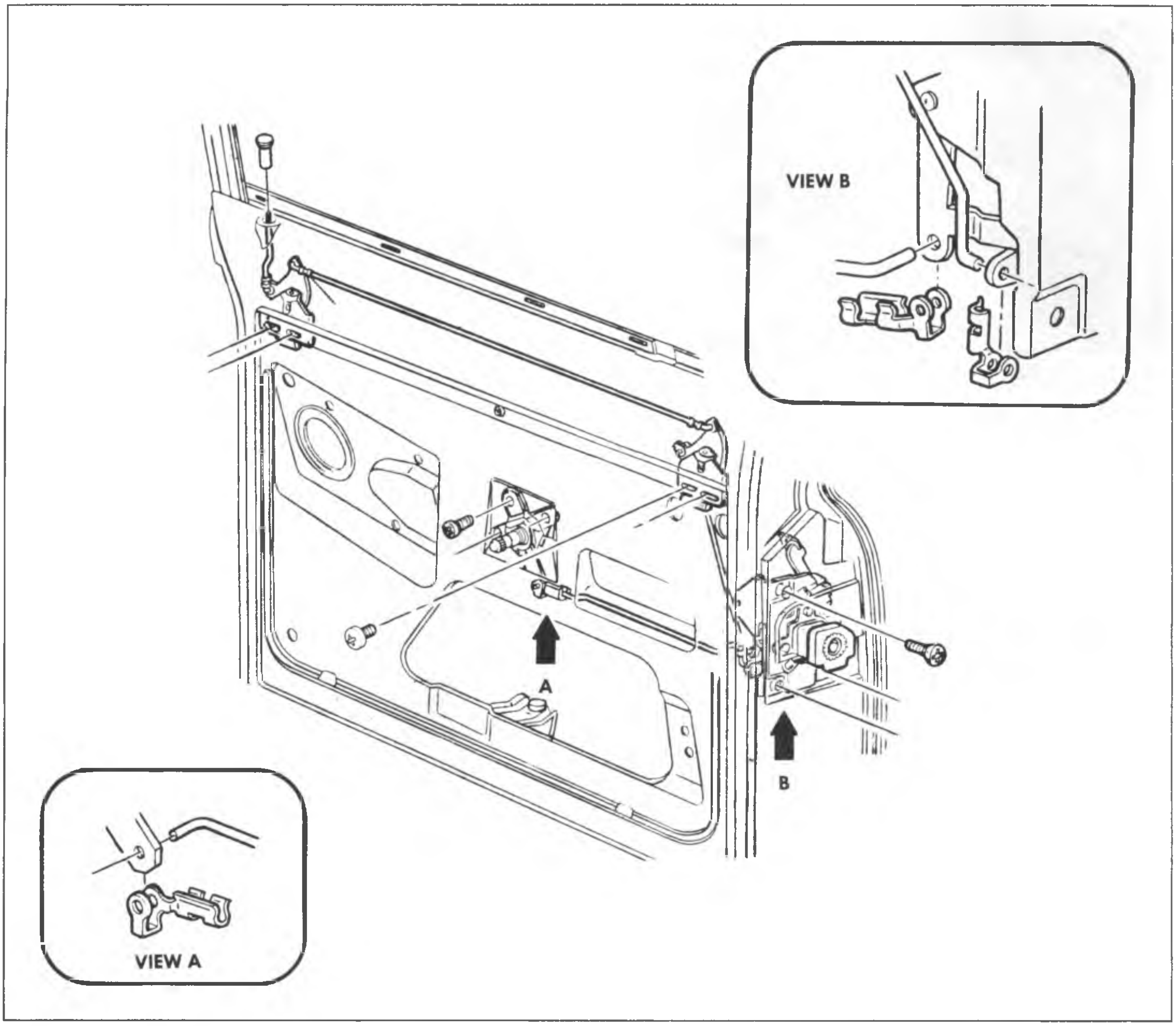


Fig. 39—Remote Control and Side Rear Door Lock.

Installation

1. Transfer remote rod with clip of new lock.
2. Connect remote door handle rod to lock after lock is positioned.
3. Secure lock screws.
4. Secure remote handle.
5. Check all controls for proper operation before reinstalling trim and handles.
6. Install remote control sill knob.
7. Adjust striker as outlined under "Front and Rear Door Lock Striker Adjustment".

Front Door Lock Cylinder Assembly

Removal and Installation

1. Raise door window and remove door trim pad.
2. With a screw driver, or other suitable tool, slide lock cylinder retaining clip (on door outer panel) out of engagement and remove lock cylinder (fig. 37).
3. To install, reverse removal procedure.

Front Door Lock Remote Control and Connecting Rod

The remote control is secured to the door inner panel by the three attaching bolts.

Removal and Installation

1. Raise door window and remove door trim pad.
2. Remove bolts securing remote to door inner panel.
3. Pivot remote inboard slightly, to disengage connecting rod, and remove remote control from door.
4. To install, reverse removal procedure.

NOTE: Connecting rod can be removed at this point by disconnecting spring clip from lock.

REAR SIDE DOOR—PANEL AND SUBURBAN LOCK

Removal and Installation (Fig. 39)

1. Wind window glass to closed position.
2. Remove control knobs and trim assembly.
3. Remove three (3) screws from the door end - at the rotor lock.

Fig. 40—Side Rear Door Center Remote Control Assembly Removal

4. Remove two (2) spring clips from the control rods. (Refer to View "B", fig. 39.)
5. Move the lock assembly inward, rotate around the channel assembly and remove through the door access hole.
6. Reverse procedure to install. Adjust striker as outlined under "Front and Rear Door Lock Striker Adjustment"

REMOTE CONTROLS AND CONNECTING RODS

Removal and Installation

1. Follow above procedure for lock removal.
2. Remove three (3) screws from center remote control mechanism and remove with attaching rod and spring clip. (See Figure 40.)

NOTE: Note position of rod end if disconnecting for proper replacement.

3. Unscrew door lock control button from door assembly.
4. Remove five (5) attaching screws and the upper trim molding: two (2) forward, one (1) center and two (2) rear screws. The forward and rear remote control assemblies are attached by these same screws.
5. Lower the rear remote control assembly far enough for removal of the spring clip attachment through a door access hole. (See Figure 41.)

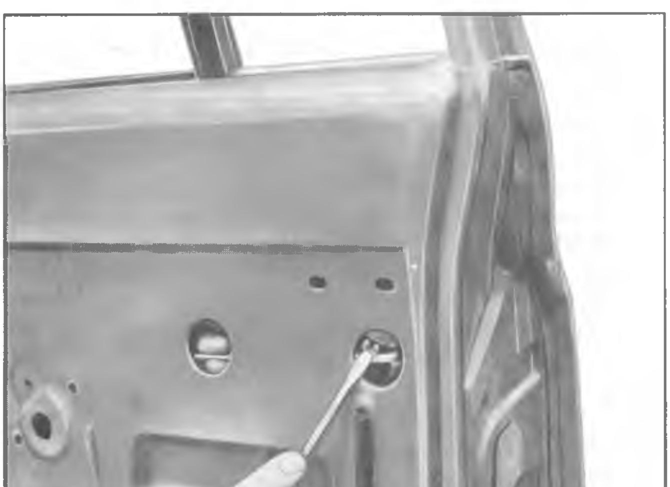


Fig. 41—Side Rear Door Rear Remote Rod Clip Removal

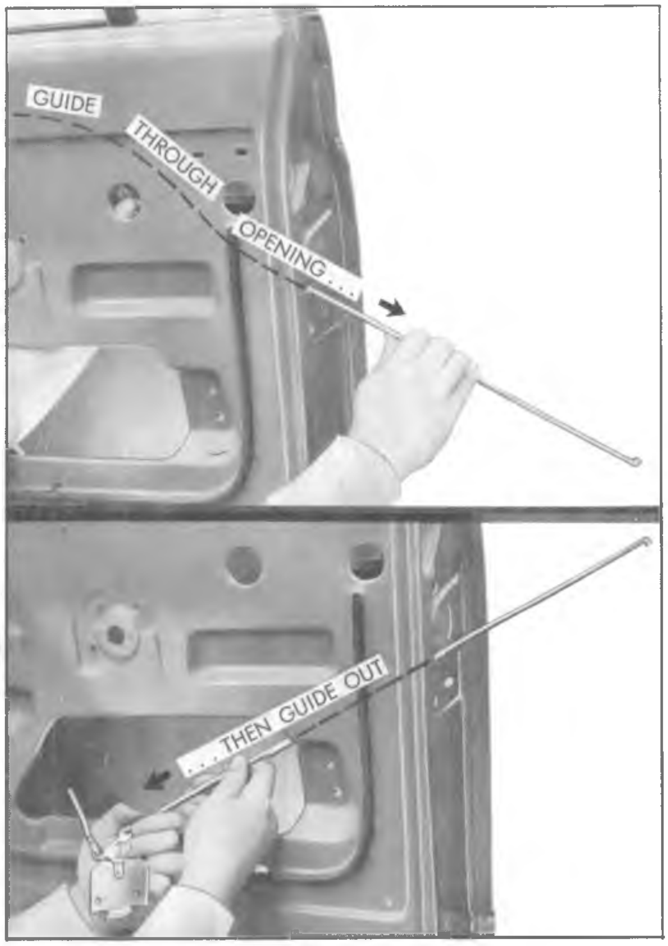


Fig. 42—Side Rear Door Front Remote Control & Rod Removal

6. Remove rear remote control through large door access hole.
7. Guide the attaching rod with the front remote control assembly through the lock hole at the rear of door - tilt upward to clear the regulator assembly and then back out the access hole. (See Figure 42.)
8. Reverse procedure to install.

FRONT AND REAR SIDE DOOR LOCK STRIKER ADJUSTMENT

Adjustment

1. Position striker assembly on body lock pillar so that the rotor cover outer face on the door swings into striker assembly with .10" clearance to the lock rotor cover. Use special burred shims as required (fig. 43).

NOTE: Under usual conditions, shims are not required.

2. Vertical slots are provided in the body lock pillar to vertically position the striker so that the lock rotor and rotor cover assembly swing smoothly into the opening between the teeth and striker wedge block (fig. 44).

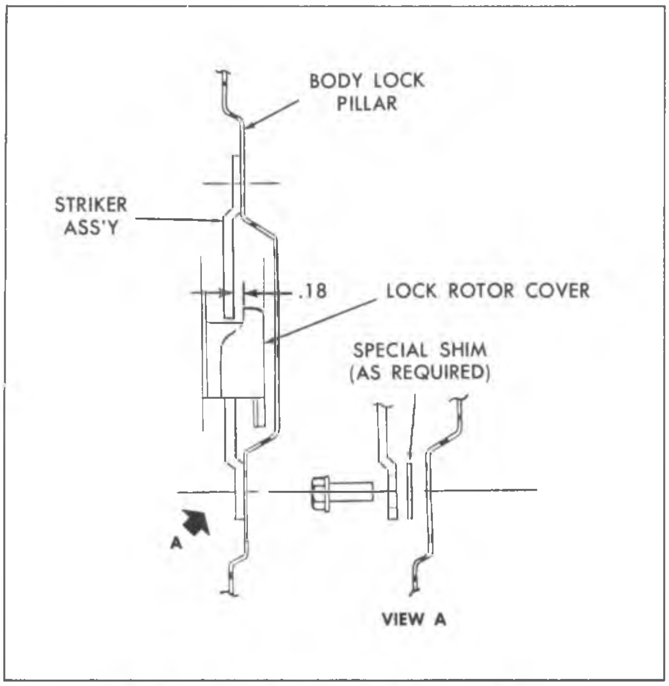


Fig. 43—Striker Assembly on Body Lock Pillar

NOTE: The lock rotor cover assembly must clear the striker plate as the lock enters the striker.

3. As an aid to striker adjustment, outline the striker in pencil or crayon for use as a base for adjustment. Horizontal slots are provided in the striker plate to position the striker assembly laterally so that the door outer surface is flush with the pillar surface at the door rear edge within 1/16" (fig. 45). Torque to specifications.

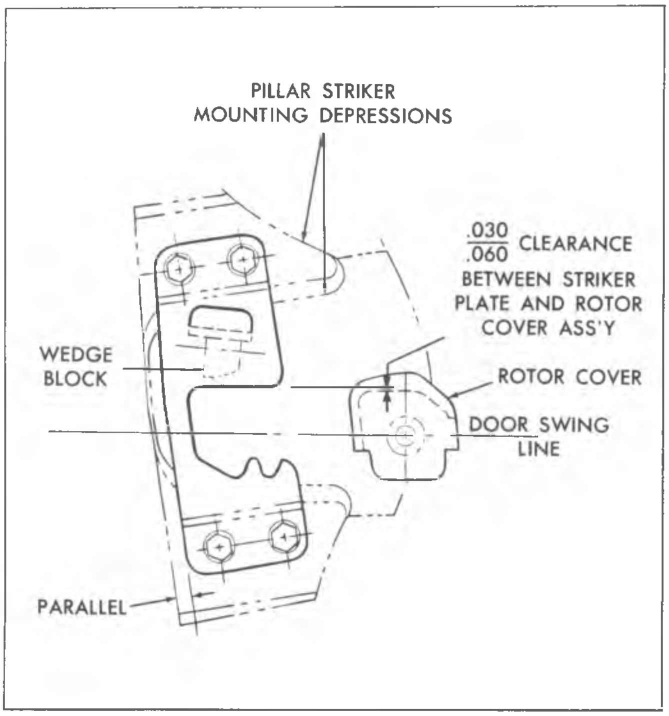


Fig. 44—Lock Rotor Cover Assembly and Striker Plate

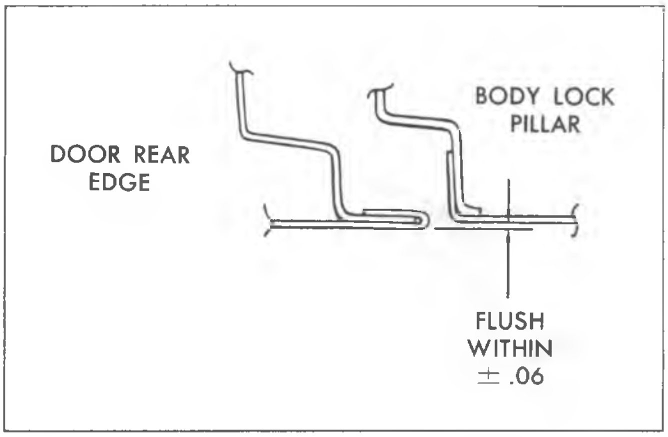


Fig. 45—Door Surface Adjustments (at Striker)

NOTE: The striker inner edge must be parallel to the striker mounting depresson on the pillar.

NOTE: All lock striker attachments, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

REAR DOOR

Removal and Adjustment

Follow procedures outlined for "Front Door Removal and Adjustment".

Rear Doors Latch & Controls (Fig. 46)

Replacement

1. Remove latch access cover.
2. Disconnect rods from latch and remove latch.
3. Reinstall latch, connect rods and adjust as shown in Figure 46.

Rear Door Lock Striker Adjustment

1. Adjust strikers as outlined under "Endgate, Liftgate and Rear Door Strikers - Adjustment" (fig. 28).
2. Adjust wedges as shown in Figure 47.

BODY SIDE WINDOW ASSEMBLY — SUBURBAN (Figs. 48 & 49)

Glass Replacement

1. Wind window to full down position.
2. Remove hand controls and trim panel.
3. Remove cats whiskers and rubber stripping or seal.
4. Remove one upper door attaching screw and two lower securing the window divider run.
5. Pull downward on run and forward.
6. Remove stationary glass with rubber seal attached, and remove run by pulling through a glass opening, if necessary.
7. Reverse above procedures to install.

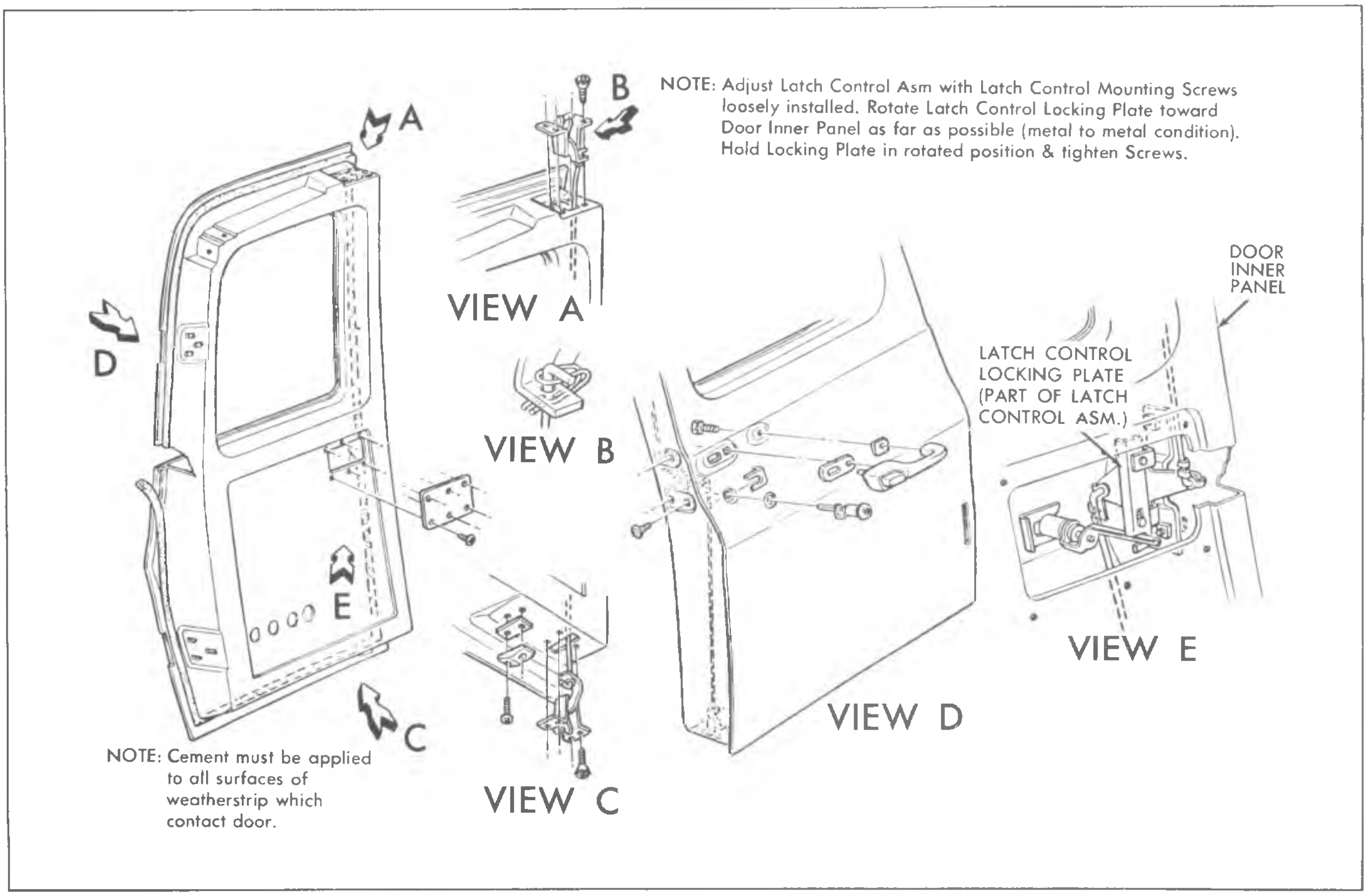


Fig. 46—Rear Doors

REAR WINDOW AND/OR WEATHERSTRIP

Panel and Suburban Trucks

Replacement

1. Using a pointed tool, raise one end of the weatherstrip retainer until it is far enough out to take hold of by hand. Then pull retainer out of its channel all around the window.
2. From inside the cab, carefully push the window glass out through the rear of the opening.

   NOTE: The weatherstrip may remain in the window opening during removal of glass. To remove weatherstrip, merely pull it off the edges of the door panels. On installation of new weatherstrip, clean opening edge thoroughly, then install with butt ends (lightly coated with weatherstrip adhesive) at top center of opening.

3. Inspect the inner and outer flanges making sure they are true and that there are no irregularities around the window opening. Any irregularities must be corrected.
4. Assemble the weatherstrip to the opening making sure the outer channel of weatherstrip is firmly seated on the edges of the panel all around the opening.
5. Start one end of the glass into its channel in the weatherstrip. Using a pointed tool, follow around the rear lip of the glass channel so it bears against the rear surface of the glass (fig. 50).

   NOTE: Care should be used in this operation not to chip the edge of the glass. A pointed wooden tool, if available, should be used.

6. Feed one end of the weatherstrip retainer into the handle of Tool J-2189 and out through the end which spreads the weatherstrip channel (fig. 50).
7. Starting at the bottom center, insert the end of the tool and end of retainer in channel, tapered part of the retainer toward the glass.
8. While holding the tool firmly, with spreading end in channel, follow around the channel spreading it open and feeding retainer into the opening until the full length of the retainer has been fed into the channel.

   NOTE: Care should be used in this operation not to chip the edge of the glass. A pointed wooden tool, if available, should be used.

BACK WINDOW GLASS AND WEATHERSTRIP (Except Panel and Suburban)

The rear window glass rubber weatherstrip is one piece. The glass is held in a channel within the weatherstrip similar to the windshield glass and weatherstrip.

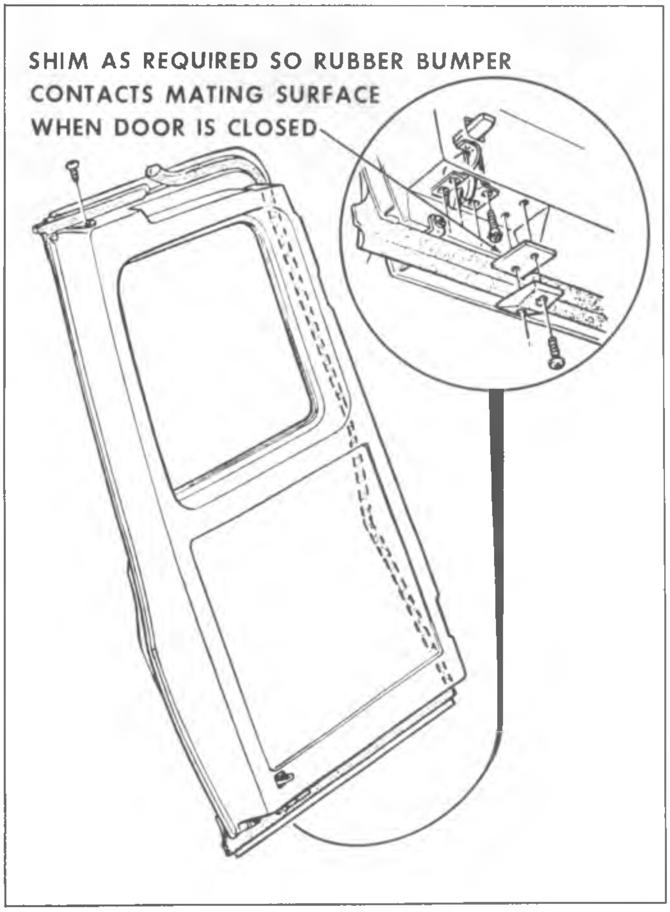


Fig. 47—Rear Door Wedge

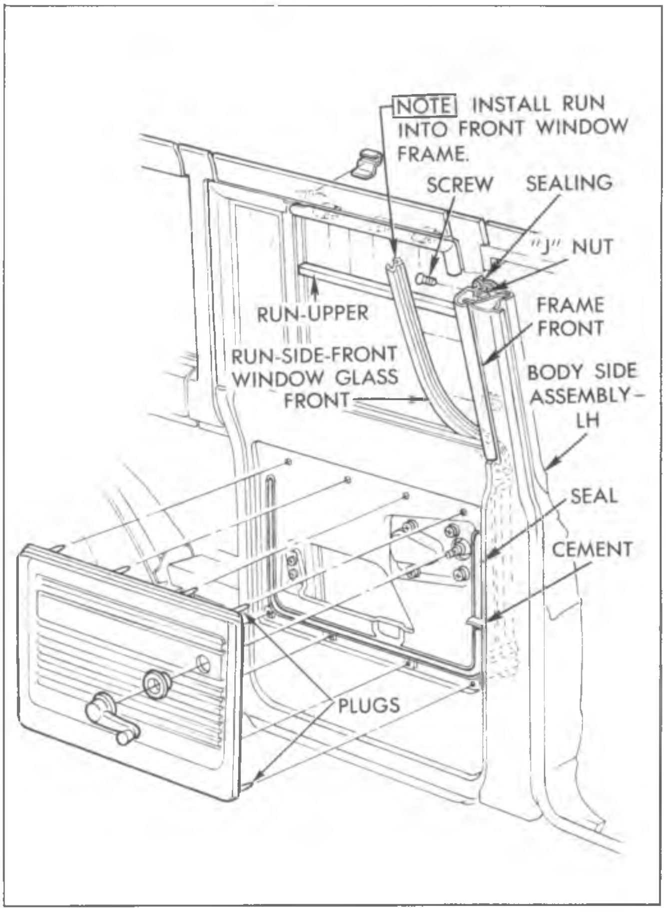


Fig. 48—Suburban Body Side Trim and Window Assembly

Replacement

Refer to Front End windshield glass for typical replacement procedures.

SEATS

CARE AND CLEANING OF INTERIOR SOFT TRIM

Dust and loose dirt that accumulate on interior fabric trim should be removed frequently with a vacuum cleaner, wisk broom or soft brush. Vinyl or leather trim should be wiped clean with a damp cloth. Normal cleanable trim soilage, spots or stains can be cleaned with the proper use of trim cleaners available through General Motors dealers or other reputable supply outlets. Before attempting to remove spots or stains from upholstery, determine as accurately as possible the nature and age of the spot or stain. Some spots or stains can be removed satisfactorily with water or mild soap solution (refer to accompanying "Removal of Specific Stains"). For best results, spots or stains should be removed as soon as possible. Some types of stains or soilage such as lipsticks, some inks, certain types of grease, mustard, etc., are extremely difficult and, in some cases, impossible to completely remove. When cleaning this type of stain or soilage, care must be taken not to enlarge the soiled area. It is sometimes more desirable to have a small stain than an enlarged stain as a result of careless cleaning.

CAUTION: When cleaning interior soft trim such as upholstery or carpeting, do not use volatile cleaning solvents such as: acetone, lacquer thinners, carbon tetrachloride, enamel reducers, nail polish removers; or such cleaning materials as laundry soaps, bleaches or reducing agents (except as noted in the instructions on stain removal). Never use gasoline or naphtha for any cleaning purpose. These materials may be toxic or flammable, or may cause damage to interior trim.

CLEANING FABRICS WITH CLEANING FLUID

This type of cleaner should be used for cleaning stains containing grease, oil or fats. Excess stain should be gently scraped off trim with a clean dull knife or scraper. Use very little cleaner, light pressure, and clean cloths (preferably cheese cloth). Cleaning action with cloth should be from outside of stain towards center and constantly changing to a clean section of cloth. When stain is cleaned from fabric, immediately wipe area briskly with a clean absorbent towel or cheese cloth to help dry area and prevent a cleaning ring. If ring forms, immediately clean entire area or panel section of the trim assembly.

NOTE: Sometimes a difficult spot may require a second application of cleaning fluid followed immediately by a soft brush to completely remove the spot.

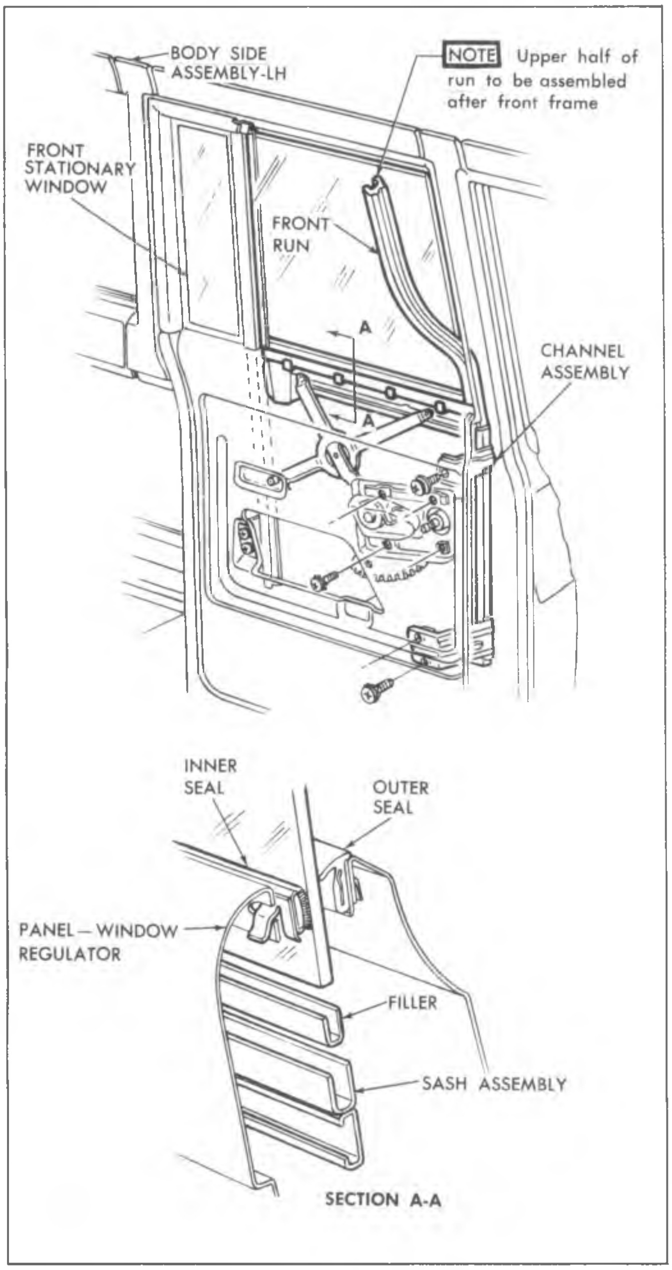


Fig. 49—Body Side Window Run Channel & Front Stationary Window - Suburban

CLEANING FABRICS WITH DETERGENT FOAM CLEANERS

This type of cleaner is excellent for cleaning general soilage from fabrics and for cleaning a panel section where a minor cleaning ring may be left from spot cleaning. Vacuum area to remove excess loose dirt. Always clean at least a full trim panel or section of trim. Mask adjacent trim along stitch or weld lines. Mix detergent type foam cleaners in strict accordance with directions on label of container. Use foam only on a clean sponge or soft bristle brush - Do not wet fabric excessively or rub harshly with brush. Wipe clean with a slightly damp absorbent towel or cloth. Immediately after cleaning fabric, dry fabric, with a dry towel or hair dryer. Rewipe fabric with dry absorbent towel or cloth to restore the luster of the trim and to eliminate any dried residue.

Fig. 50—Installing Weatherstrip Insert with J-2189

REMOVAL OF SPECIFIC STAINS

Candy

Chocolate, use cloth soaked in lukewarm water; other than chocolate, use very hot water. Dry. If necessary, clean lightly with fabric cleaning fluid.

Chewing Gum

Harden gum with ice cube and scrape off with dull knife. Moisten with fabric cleaning fluid and scrape again.

Fruit Stains, Coffee, Soft Drinks, Ice Cream and Milk

Wipe with cloth soaked in cold water. If necessary clean lightly with fabric cleaning fluid. Soap and water is not recommended as it might set the stain.

Catsup

Wipe with cloth soaked in cool water. If further cleaning is necessary, use a detergent foam cleaner.

Grease, Oil, Butter, Margarine and Crayon

Scrape off excess with dull knife. Use fabric cleaning fluid.

Paste or Wax Type Shoe Polish

Light application of fabric cleaning fluid.

Tar

Remove excess with dull knife, moisten with fabric cleaning fluid, scrape again, rub lightly with additional cleaner.

Blood

Wipe with clean cloth moistened with cold water. Use no soap.

Urine

Sponge stain with lukewarm soap suds from mild neutral soap and clean cloth, rinse with cloth soaked in cold water, saturate cloth with one part household ammonia water and 5 parts water, apply for 1 minute, rinse with clean, wet cloth.

Vomitus

Sponge with clean cloth dipped in clean, cold water. Wash lightly with lukewarm water and mild neutral soap. If odor persists, treat area with a water-baking soda solution (1 teaspoon baking soda to one cup of tepid water). Rub again with cloth and cold water. Finally, if necessary, clean lightly with fabric cleaning fluid.

Seat and/or Seat Adjuster

Removal

1. Remove bolts attaching seat to floor and remove seat assembly.

   NOTE: If not immediately reinstalling the seat, reinstall the bolts which attach the seat to the floor.

Disassembly

For Drivers or Front Bench Seat
- a. Remove adjuster and seat belts from seat

For Passenger Bucket Type Seat
- b. Remove seat supports, seat belts and tilting mechanism.

For Second or Third Seats
- c. Remove seat supports and seat belts from seat.

Assembly

1. Reinstall adjusters and/or supports reversing disassembly procedures.
2. Install seat belts

   CAUTION: Shoulder of bolt must bottom on weld nut.

   NOTE: All seat belt attachments, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Installation

1. Reinstall seat assembly. Torque bolts to specifications.
2. For Driver's seats adjust release action by kinking locking rod.

BLAZER

INDEX

GENERAL INFORMATION

Fiber glass repairs can be divided into major and minor repairs. Minor repairs are small surface imperfections, small holes, dents, etc. Major repairs are those which require the use of the fiber glass cloth for its reinforcing qualities.

Minor Repairs

Plastic Solder (or equivalent) or the epoxy and filler (or their equivalent) from the Reinforced Plastic Repair Kit (Epoxy type) (or equivalent) may be used for minor repairs. These provide a quick and lasting repair in the case of small cracks, surface imperfections, dents, etc.

Major Repairs

The Reinforced Plastic Repair Kit (Epoxy type), or its equivalent, should be used for major repairs. Major repairs such as torn panels, separated joints require the reinforcing qualities of the glass fibers.

PREPARATION AND APPLICATION
Plastic Solder or Epoxy and Filler

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. 51).
3. Apply the material, using a putty knife or rubber squeegee, Figure 52. Work the material into the repair and build the material up to the desired 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 53.

REINFORCED PLASTIC REPAIR KIT—EPOXY TYPE
(Preparation and Application)

The following procedure is basic for repairing any fiber glass component or panel.

1. Look for hidden damage. Apply force by hand around the damaged area.

Fig. 51—Mixing Plastic Solder Material

2. 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 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 54.
4. If rear of damage is accessible clean back of area to permit the use of laminate (resin-saturated glass-cloth) on both sides of damaged area.
5. Cut fiber glass cloth to size. Make certain a minimum of five layers is cut for the average repair.
6. Mix resin and hardener per instruction with resin and hardener.

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.

Fig. 52—Applying Plastic Solder

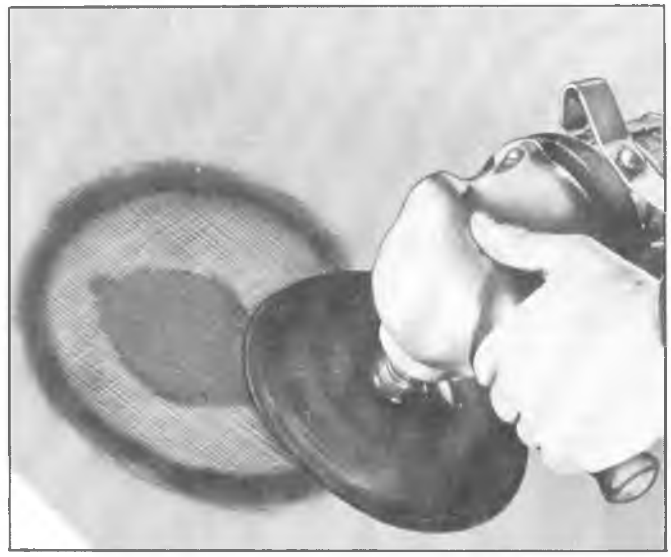


Fig. 53—Finishing Plastic Solder Repair

7. Saturate layers of fiber glass (fig. 55). Place laminate over damage area. Smooth out wrinkles, and make sure general contour of area is maintained, Figure 56.
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 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 57 shows the top of a fender panel which has been scratched through to the plastic.

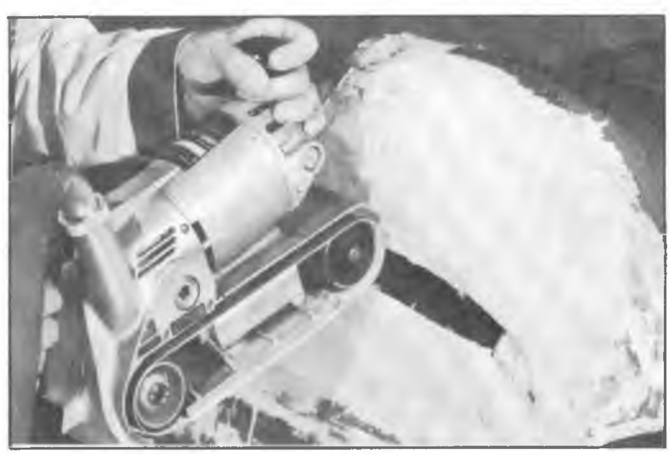


Fig. 54—Grinding "V" at Damaged Areas

Fig. 55—Applying Resin to Fiberglass

1. Remove all paint down to the plastic from the area surrounding the scratch.
2. Featheredge the repair area with No. 220 wet or dry sandpaper and finish block sand with No. 320 wet or dry paper, Figure 58.

   CAUTION: Do not sand too deeply into fiber glass 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 using Prep-Sol or 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.
5. Refinish panel.

Dents or Pits in Panels, Cracks in Glaze Coat

Figure 59 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 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.

Fig. 56—Applying Laminate to Body

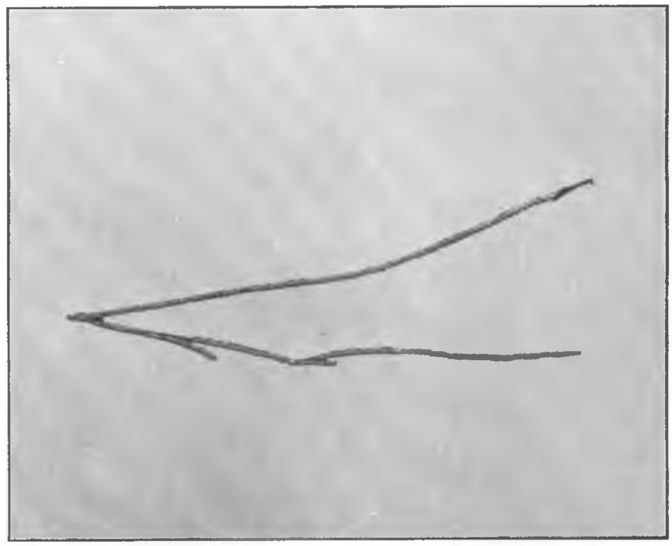


Fig. 57—Typical Scratched Panel

1. Remove paint down to the plastic from area surrounding the damage.
2. Scuff area surrounding damaged area to provide a good bonding surface.
3. Clean up work area with Prep-Sol or equivalent then use tack rag for finish clean-up.
4. Use the Plastic Solder Repair or equivalent (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.

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 60, 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.

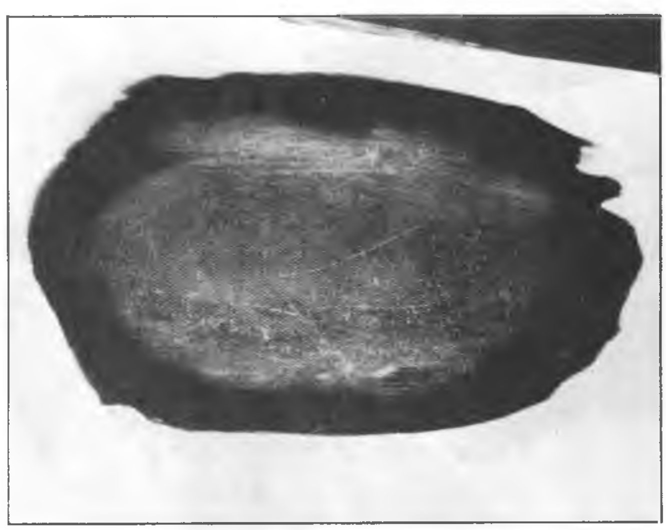


Fig. 58—Repair Area Finish Sanded

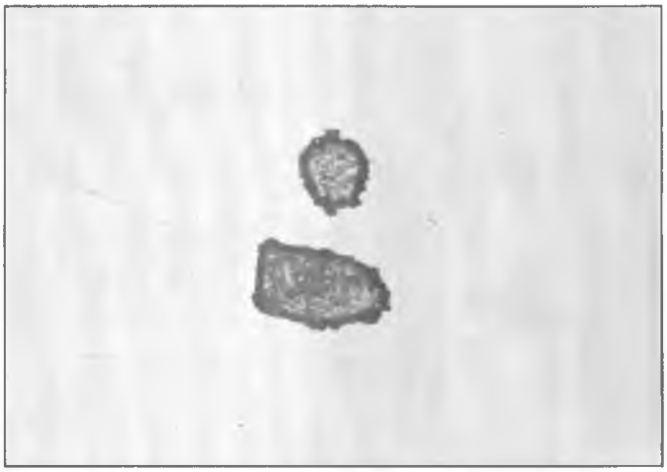


Fig. 59—Typical Pitted Panel

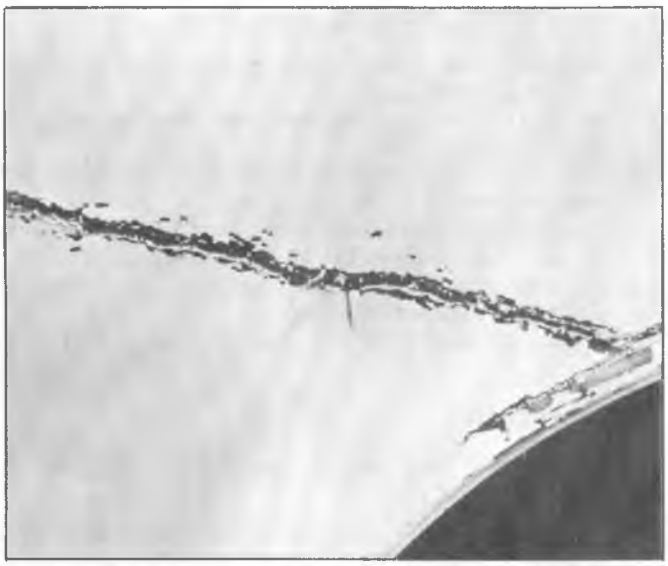


Fig. 60—Typical Cracked Panel

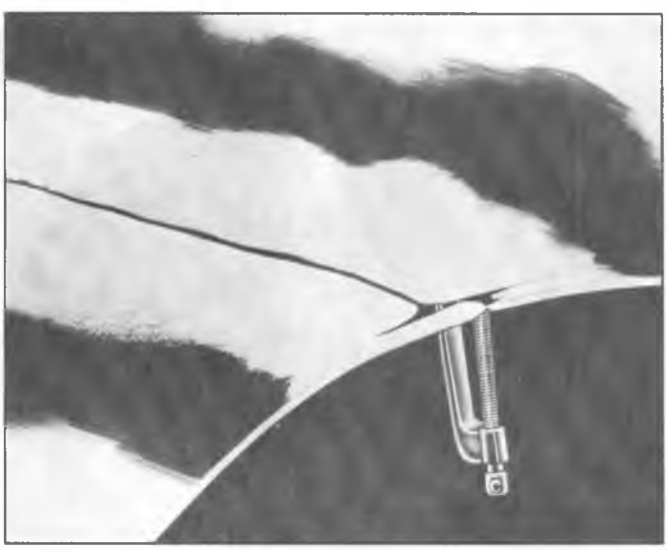


Fig. 61—Cracked Panel Preparation - Typical

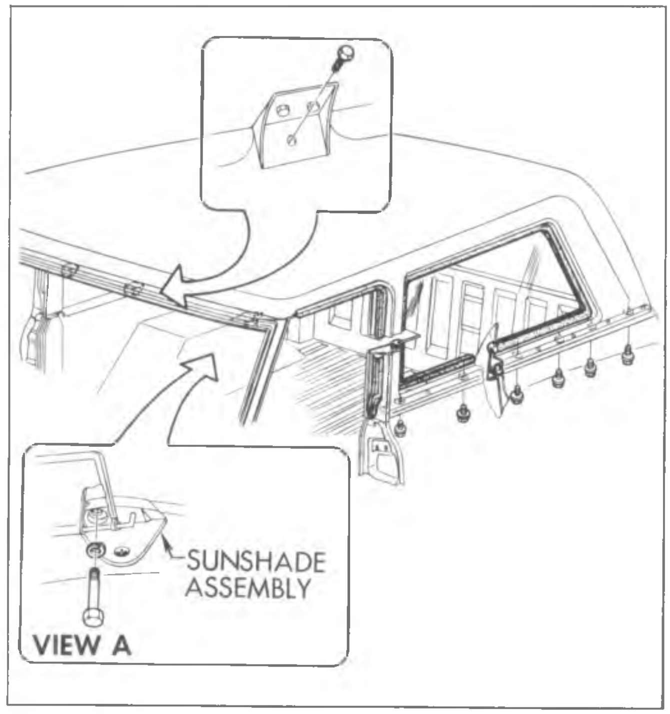


Fig. 62—Top-To-Header Panel Attachments

3. Remove dirt and deadener thoroughly, back approximately 2 to 3 inches from the fracture, on 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.

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

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 61.

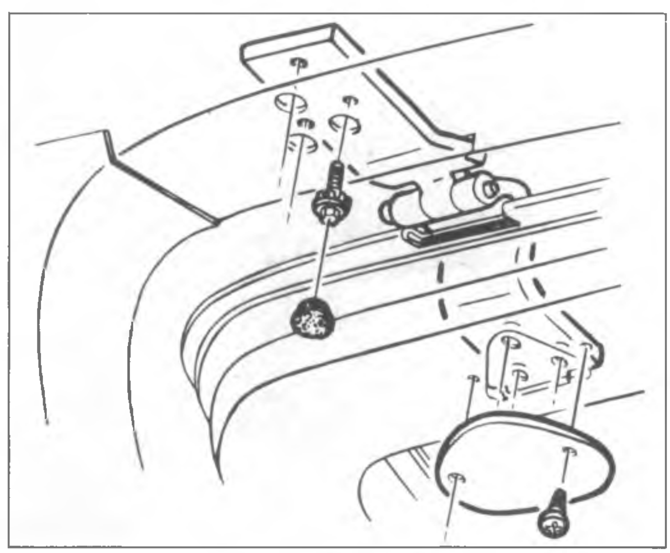


Fig. 63—Liftgate Hinge

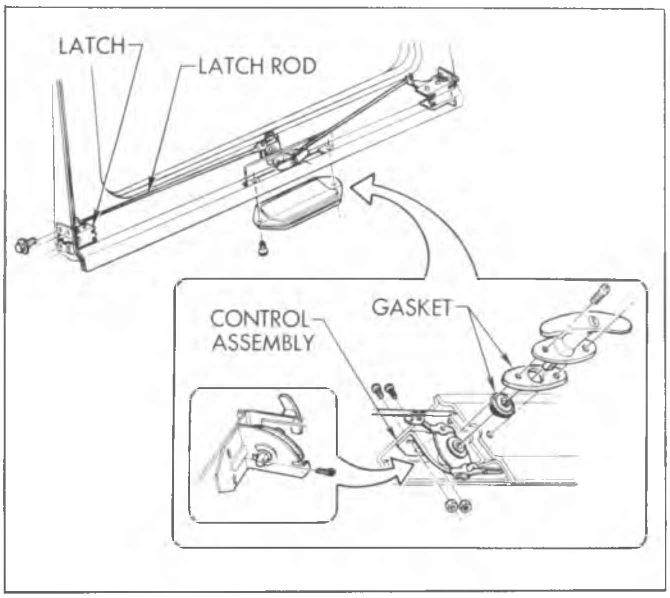


Fig. 64—Liftgate Control Assembly

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 or equivalent then use tack rag for finish cleanup.
8. Use the Repair Procedures previously described.

   NOTE: In some cases it may be advantageous 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.

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 fiber glass cloth. The following repair operations are typical of this type of damage.

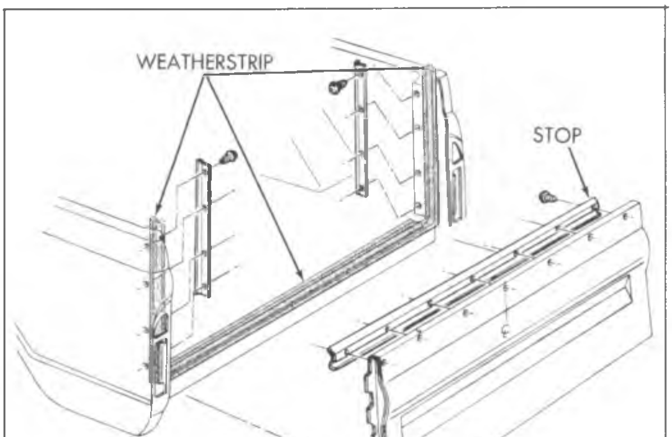


Fig. 65—Tailgate Weatherstrip

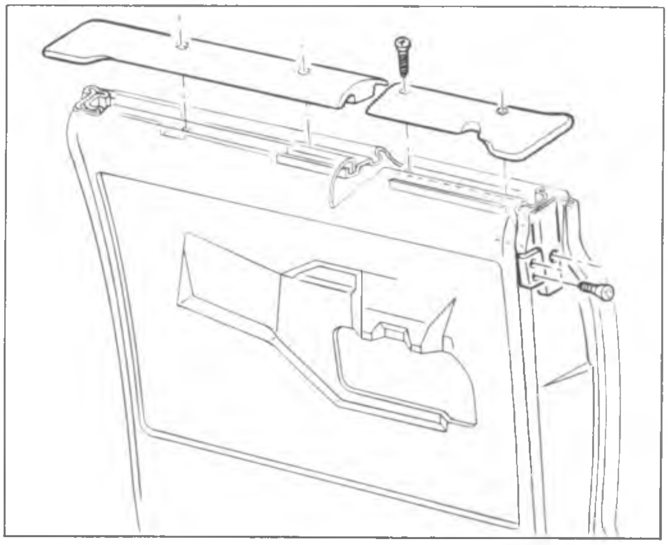


Fig. 66—Door Opening Cover Plate

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.
4. Scuff surface to provide a good bonding surface. Then, clean up area with Prep-Sol or equivalent and wipe dry.
5. Protect adjacent panels by masking, use non-staining masking tape.
6. Cut a strip of fiber glass 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 Reinforced Plastic Repair Kit (Epoxy Type) 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 fiber glass 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 sponging from the center of the break outward.

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

11. Trim excess or loose strands of fiber glass 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.

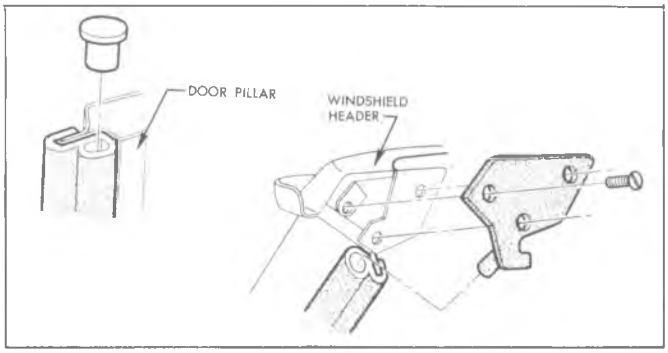


Fig. 67—Door Opening Weatherstrip

14. Allow the patch to harden.
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.

TOP

Removal

1. Remove the lower bolt from each of the top-to-header panel attaching brackets as shown in Figure 62.
2. Remove from each sunshade support the one screw that attaches it to the top.
3. Remove the body side trim panels, if the vehicle is so equipped.
4. Remove the bolts which retain the top to the body side panels.
5. Lower the body tail gate and close the roof liftgate.
6. Lower the door windows.
7. Slide top rearward approximately 18" to expose the bottom rear top-to-pickup box attaching holes.
8. To prevent possible flexing of the sides on removal, connect the sides of the top with support braces as follows.
   a. Fabricate 2 braces 72" long from wood or square aluminum tubing. Drill two (2) 3/8" diameter holes, 63 inches apart in the brace.
   b. Attach one brace to the holes exposed in Step 7.
   c. Slide top forward to expose the front bottom top-to-pickup box attaching holes.
   d. Attach the second brace to these holes.
9. With assistance, lift the top and move it rearward for removal.

Liftgate

The Blazer liftgate is similar in appearance to the liftgate used on the Suburban truck models. The Blazer liftgate, however, is constructed from fiber glass and latches to the side of the opening in the top instead of to the tail gate.

Removal

1. Open liftgate enough to remove the tail gate support screws from the tail gate.
2. Lower the tail gate completely.
3. Remove the access hole plugs from the body to expose body-half of the liftgate hinge as shown in Figure 63.
4. Support the liftgate. Remove the screws which retain the body-half of the tail gate hinge to the body, then remove the liftgate and hinges as an assembly.

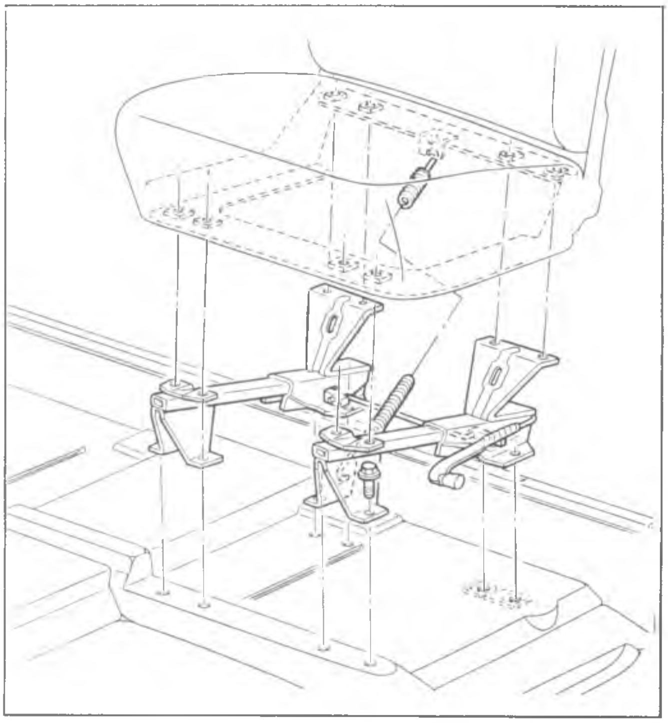


Fig. 68—Driver's Seat Mounting Provisions

Installation

1. Position the liftgate so that the body-half of the hinges enter the top.
2. Install screws into the hinges and torque to specifications.
3. Attach tail gate support and torque the screws to specifications.
4. Reinstall the hinge access hole plugs into the top.

LIFTGATE HINGE

Removal

1. Remove the liftgate and hinge assembly as previously outlined.
2. Remove the hinge screw access cover from the liftgate.
3. Remove the hinge.

Installation

1. Reverse "Removal" procedures, torquing the hinge screws, the access cover screws to specifications.
2. Reinstall the access hole plugs into the top.

LOCK AND HANDLE

Removal and Installation

1. Open the liftgate.
2. Remove the control assembly access hole cover as shown in Figure 64.

3. Remove the cotter pin retaining the handle to the control assembly.
4. Remove the screws retaining the handle to the liftgate and remove the handle and gaskets.
5. Reverse Steps 1-4 to install the lock and handle assembly.

LIFTGATE LATCH CONTROL ASSEMBLY

Removal and Installation

1. Remove the liftgate lock and handle assembly.
2. Remove the screws which retain the control assembly to the liftgate.
3. Remove the control assembly by disconnecting the latch rod clips and latch rods from the control assembly.
4. Reverse Steps 1-3 to install the latch control assembly.

RIGHT-HAND LATCH AND/OR ROD

Removal and Installation

1. Remove the control assembly access hole cover.
2. Disconnect the latch rod from the control assembly.
3. Remove the screws which retain the latch to the liftgate and pull the latch and latch rod out as an assembly.
4. Reverse Steps 1-3 to install the right-hand rod and latch.

LEFT-HAND LATCH AND/OR ROD

Removal and Installation

1. Remove the control assembly access hole cover.
2. Remove the handle assembly.
3. Remove the screws which retain the control assembly to the liftgate, allowing the control assembly to drop down for easier access to the upper latch rod retaining clip.
4. Disconnect the latch rod retaining clip.
5. Remove the screws which retain the latch to the liftgate and pull the latch out as an assembly.
6. Reverse Steps 1-3 to install the left-hand rod and latch.

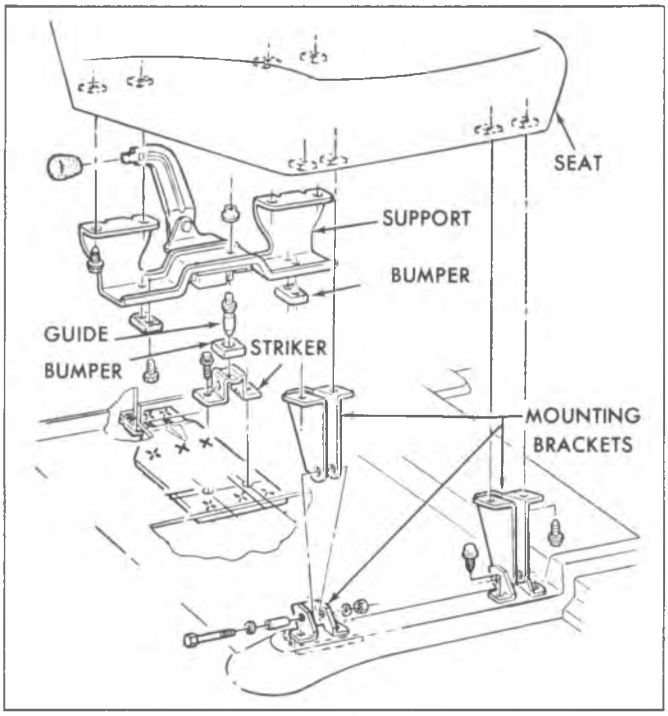


Fig. 69—Auxiliary Seat Mounting Provisions

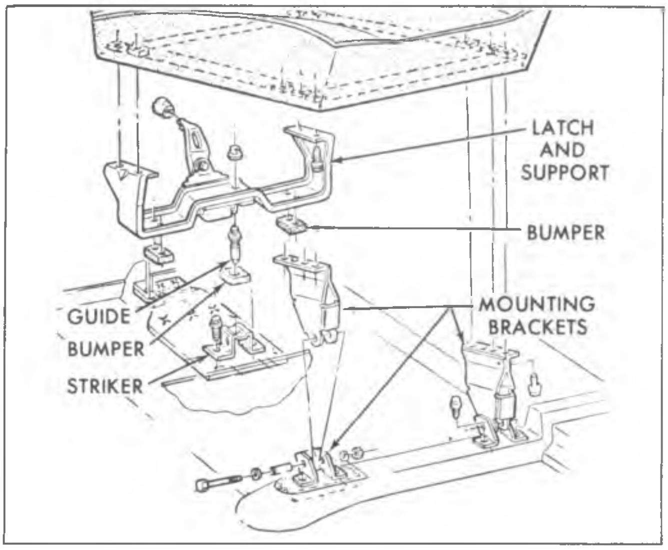


Fig. 70—Passenger's Bucket Seat Mounting Provisions

TAIL GATE

The tail gate on the basic Blazer is identical to that used on the conventional Fleetside pick-up truck models. Refer to the Section on Conventional Models.

When the vehicle is equipped with the optional hard top, the tail gate is sealed in the body opening with weather-

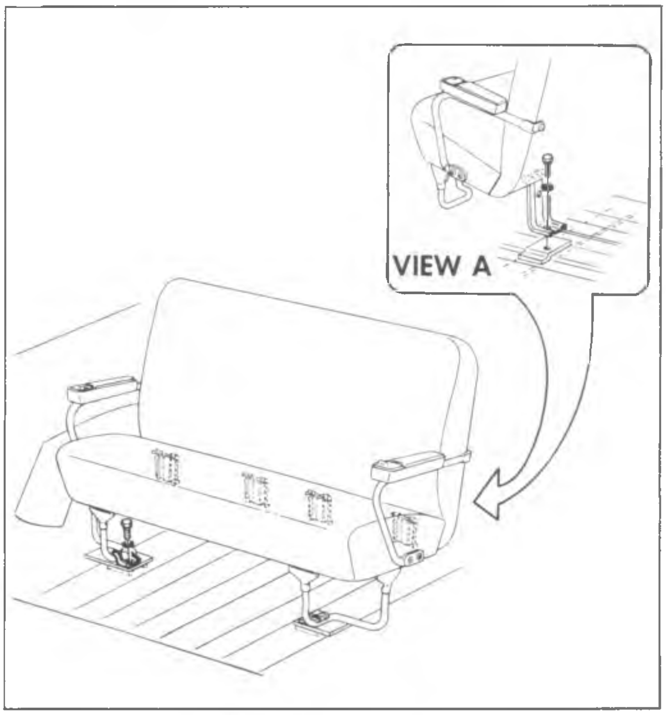


Fig. 71—Optional Rear Seat

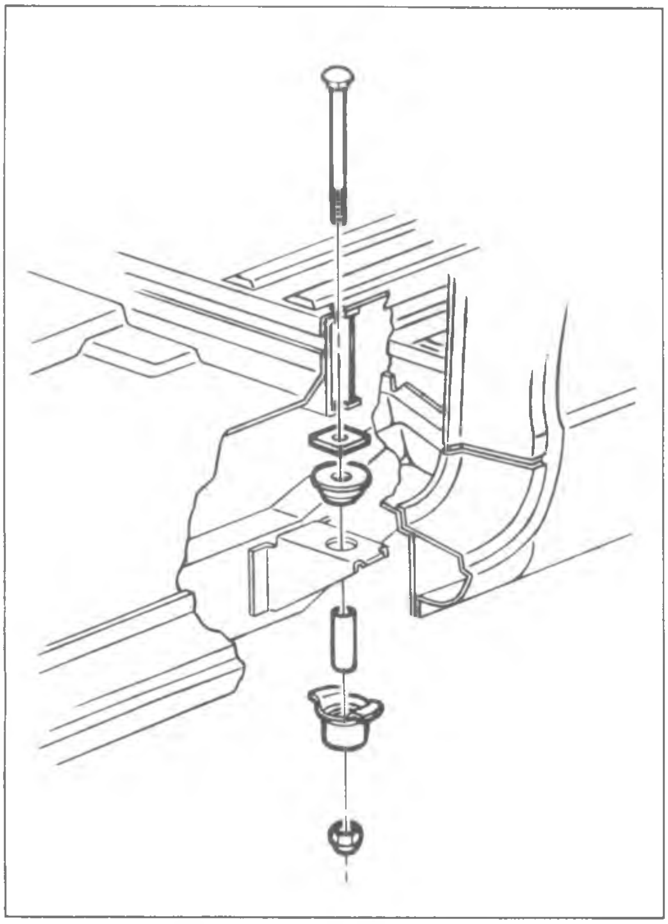


Fig. 72—Body Mount No. 2

stripping. The sides of the tail gate are sealed by a weatherstrip on the inside of the body opening. The bottom of the tail gate is sealed by a weatherstrip which is glued across the bottom of the tail gate itself as shown in Figure 65.

DOORS

Since the front doors on Blazer models do not incorporate door windows or ventipanes, a cover plate is installed over the opening where these components would normally be installed as shown in Figure 66.

On those Blazers which do incorporate door windows and ventipanes, the Service procedures outlined in the section on Conventional Models are applicable.

On either the open or closed Blazer model, the ends of the door opening weatherstrip are sealed at the door pillar and at the windshield header as shown in Figure 67.

SEATS

Driver Seats

Both the standard seat and the optional driver's bucket seat mount as shown in Figure 68. Torque mounts to specifications.

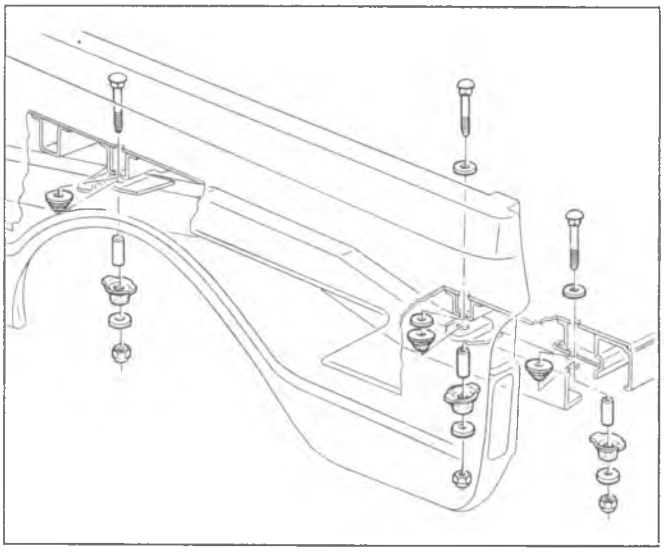


Fig. 73—Body Mounts No. 3, 4 and 5

Front Passenger Seats

The optional auxiliary seat (fig. 69) and the optional passenger bucket seat (fig. 70) are mounted differently due to mounting bracket design differences. Torque all parts to specifications.

Rear Seat

The optional rear seat is shown in Figure 71.

NOTE: After removing the rear seat, reinstall the bolts into the anchor nuts to seal the openings from dirt and foreign matter. When reinstalling the seat, torque all hold-down bolts to specifications.

The rear seat option also includes two seat belts and a rubber rear compartment floor mat. If removing the rear seat temporarily—to haul cargo, for instance—it is not necessary to remove the seat belts from their anchorages as they attach to the rear seat support.

REAR COMPARTMENT FLOOR MAT

Removal and Installation

1. Lower tail gate.
2. Remove the spare tire and its mounting bracket.
3. Remove the rear seat.
4. Remove the front and rear floor mat scuff plates.
5. Remove the floor mat.
6. Reverse Steps 1-5 to reinstall the floor mat.

BODY AND PICK-UP BOX MOUNTING

NOTE: Refer to the section on Conventional Models for Body Mount #1. Mounts two, three, four, and five are as shown in Figures 72 and 73.

STEP-VAN BODY

INDEX

COMPONENT PARTS REPLACEMENT

ENGINE HOUSING

1. Release catch, open engine box lid and lock hinge arm in open position.
2. Remove accelerator pedal by taking out 2 cap screws.
3. Remove metal screws around bottom of box, on vertical sides at right rear corner and left front corner.
4. Remove box.
5. Reverse procedure to install.

WINDSHIELD WIPERS

1. To service windshield wiper motor remove inspection plate in center of front end header panel above windshield.
2. Pivot assemblies service through openings on each side of wiper motor.
3. Wiper switch is mounted in front end header accessible through left side opening.
4. Circuit breaker for wiper motor is located on firewall directly above clutch pedal.

Windshield Wiper Adjustment

1. To adjust position of windshield wiper arms have them in park position. Mark this position on glass with grease pencil.
2. Remove the holding nut and lock washer from the end of drive shaft.
3. Lift off wiper arm and knurled driver. In most cases, the knurled driver remains inside the wiper arm. Tap on arm lightly to remove the driver and place it back on wiper drive shaft.
4. Position the arm above or below the mark on windshield as desired, replace lock washer and tighten holding nut.

Front Door and/or Track Replacement

1. From inside vehicle, remove top track access panel.
2. Remove screws retaining door to upper track.
3. Remove door by disengaging upper track and, tilting door inward, lifting off bottom track.
4. Install by reversing steps 1, 2 and 3.

Drivers' Window Weatherstrip and/or Complete Window Assembly

Removal

Remove glass as outlined under "Driver's Window Sliding Glass Replacement".

Installation

1. Assemble weatherstrip rubber to the opening with weatherstrip retainer groove to inside of body making sure the outer channel of weatherstrip is firmly seated on edge of door panel all around the opening. Watch this carefully on the corner radius. It is important to start the rubber at the top at the point shown in Figure 74, going forward, down and around. Cut off excess rubber about one-half to three-quarters of an inch long. Butt the two ends together and crowd excess rubber on. This makes tight joint and prevents separation at joint after window is in service.
2. Install the glass run channel inside the weatherstrip rubber, starting half way up the rear side of opening, coming down and around the opening to rear. Cut off any excess channel at joint. Leave at least 6 inches of each end of channel out of rubber until rear glass is in place (fig. 75).

   NOTE: The installation of this window is made from the inside of the job with door in closed position. The use of a mixture of liquid soap and water or some other type rubber lubricant applied to the rubber will make the installation of this channel as well as the other filler sections much easier to install.

3. Set lower edge of sliding glass (front section) in run channel with upper edge of glass back of joint in

Fig. 74—Weatherstrip Installed

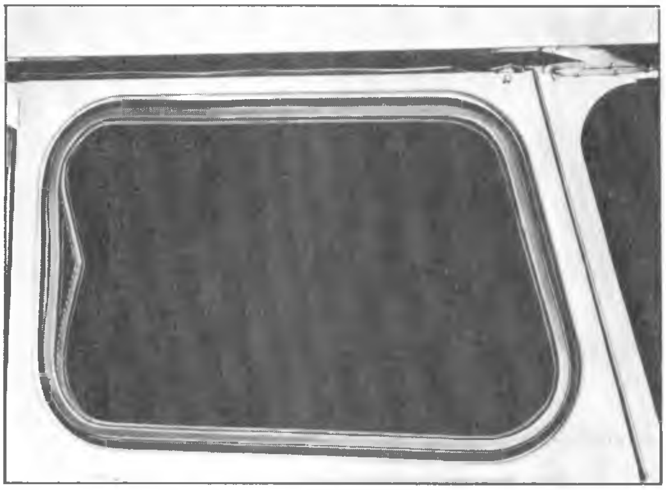


Fig. 75—Driver's Window Weatherstrip

weatherstrip rubber. Place paint scraper or similar object on top of glass and into channel - pry down and push top of glass into channel. Push glass forward as far as possible (fig. 76).

4. Set lower edge of stationary glass in weatherstrip between the run channel and inside edge of rubber. Keep rear edge of glass ahead of weatherstrip at rear of window opening. Using the tool shown in Figure 77 or similar instrument work glass into the weatherstrip channel.

Fig. 76—Installing Sliding Glass

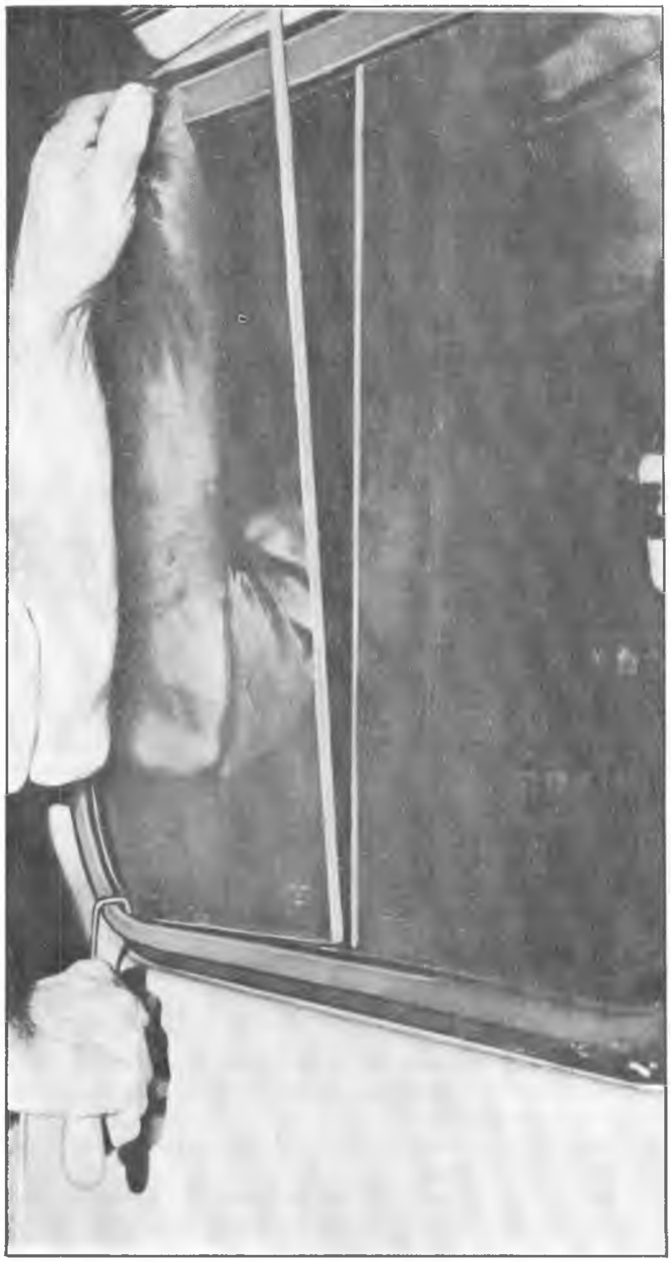


Fig. 77—Installing Stationary Glass

5. Work top of stationary glass into weatherstrip channel in same manner as the bottom.
6. Use rubber mallet to tap glass back to the weatherstrip. Work into weatherstrip channel using paint scraper or similar tool and rubber mallet (fig. 78). Tap glass firmly into weatherstrip.
7. From the outside of the door work the run channel ends into weatherstrip rubber with the paint scraper and mallet handle to tap them back. Channel ends are shown in Figure 75.

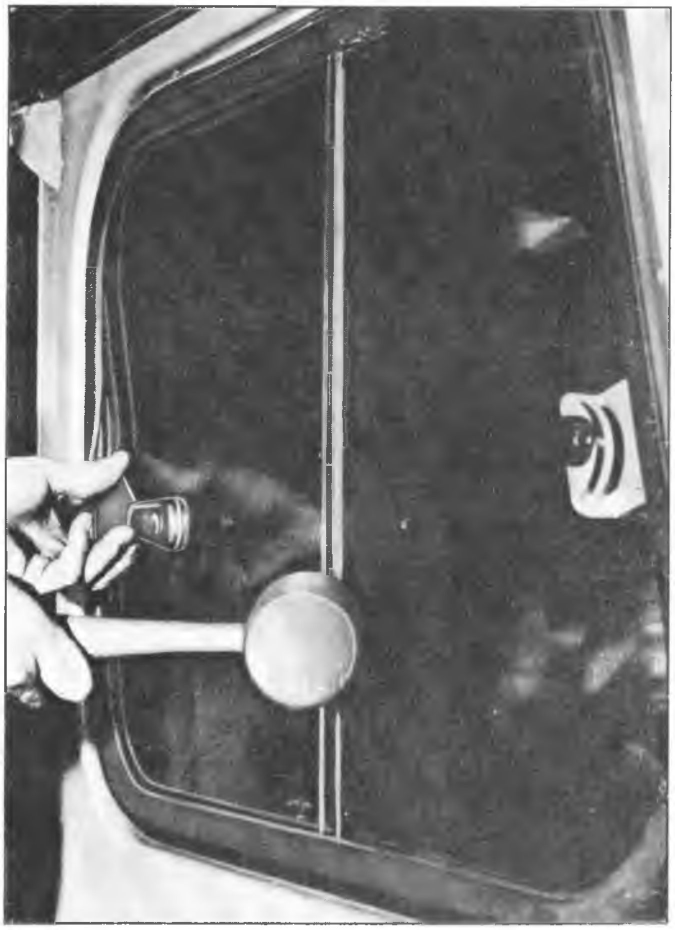


Fig. 78—Tapping Stationary Glass into Weatherstrip

8. Install heavy rubber wedge between run channel and inside edge of weatherstrip from front edge of stationary glass at top around to front edge at bottom. The round edge enters the rubber and the ribbed side goes next to the run channel.
9. Install center weatherstrip on front edge of stationary glass with plush side next to sliding glass. Apply 3-M Weatherstrip Adhesive, or its equivalent, to the inside of this channel before installing. Pushing each end of weatherstrip on before pushing up the center will eliminate the ends catching in the rubber and give it a crowding effect at top and bottom for tighter seal.
10. Feed one end of weatherstrip filler into handle of special Tool J-2189 and out through the end which spreads the weatherstrip channel.
11. Starting at bottom center, insert the end of the tool and end of filler in channel, tapered part of the filler toward the glass.
12. While holding the tool firmly, with spreading end in channel, follow around the channel spreading it open and feeding the filler into the opening around the entire weatherstrip. With the flat side of common screw driver placed against the starting end of the insert filler drive filler back an inch or two. Cut off the other end to make snug joint and work into channel. This prevents separation at joint after window has been in service.
13. The run channel at front of window should be opened up to allow for the extra thickness of the glass thumb pull. Use a block of wood slightly wider than channel and with one edge rounded smooth so as not to damage channel drive it in spreading the area around the thumb pull until glass enters channel with reasonable ease.
14. Install sliding window lock keeper on front edge of door. With window pushed forward in closed position, place keeper behind lock plunger and attach to door with sheet metal screws. To release window pull out on knob and back on glass pull.
15. Locate (3) holes equally spaced across bottom of window rubber on the outside. Keep holes in straight part of rubber. Using 1/4" diameter drill bit start holes 1/2 inch below top edge of rubber and drill up through bottom side of run channel providing holes for water to drain out of channel.
16. Place metal channel over leading edge of weatherstrip with the short leg of channel on the plush side of weatherstrip and tap on with rubber mallet. Install stationary glass retainer clips at top and bottom of center weatherstrip. Please note that there is a difference between top and bottom clips. It is important that they be installed correctly. Without these clips the impact of closing door will drive the stationary glass forward and out of the rubber at rear of window.

DRIVER'S WINDOW SLIDING GLASS

Replacement

1. Using a pointed tool, raise one end of the weatherstrip filler until it is far enough out to take hold of by hand. Then pull filler out of its channel all around the window.
2. Using a pointed tool, raise one end of heavy rubber wedge in front of stationary glass until it can be grasped by hand. Pull entire wedge off its channel.
3. Pull stationary rear glass forward until it is out of rubber at the rear.
4. Using special wire hook, furnished with Body Weatherstripping Tool Set (J-2189) or similar tool, work top of glass out of rubber and lift out of window.
5. If sliding glass is still intact, slide glass back until front edge at top is back of joint in weatherstrip rubber. Using the paint scraper or similar object, slip blade between channel and glass at top. Lift up on scraper to work glass out of channel.
6. If sliding glass is already out and there is no damage to the weatherstrip rubber or the glass run channel then you are ready to install a new sliding glass.
7. To install the sliding glass follow the instructions and illustrations under "Complete Driver's Window Installation." Begin with operation 3 and continue through operation 12. Continue through to operation 15 if new weatherstrip has been used.

DRIVER'S WINDOW STATIONARY GLASS

Replacement

1. Follow operations 1 through 4 under Driver's Window sliding Glass Replacement. If glass is completely gone and there is no further damage to the window, operations 1 and 2 will prepare the window for stationary glass replacement.
2. To install the new glass follow the instruction set forth for "Complete Driver's Window Installation."

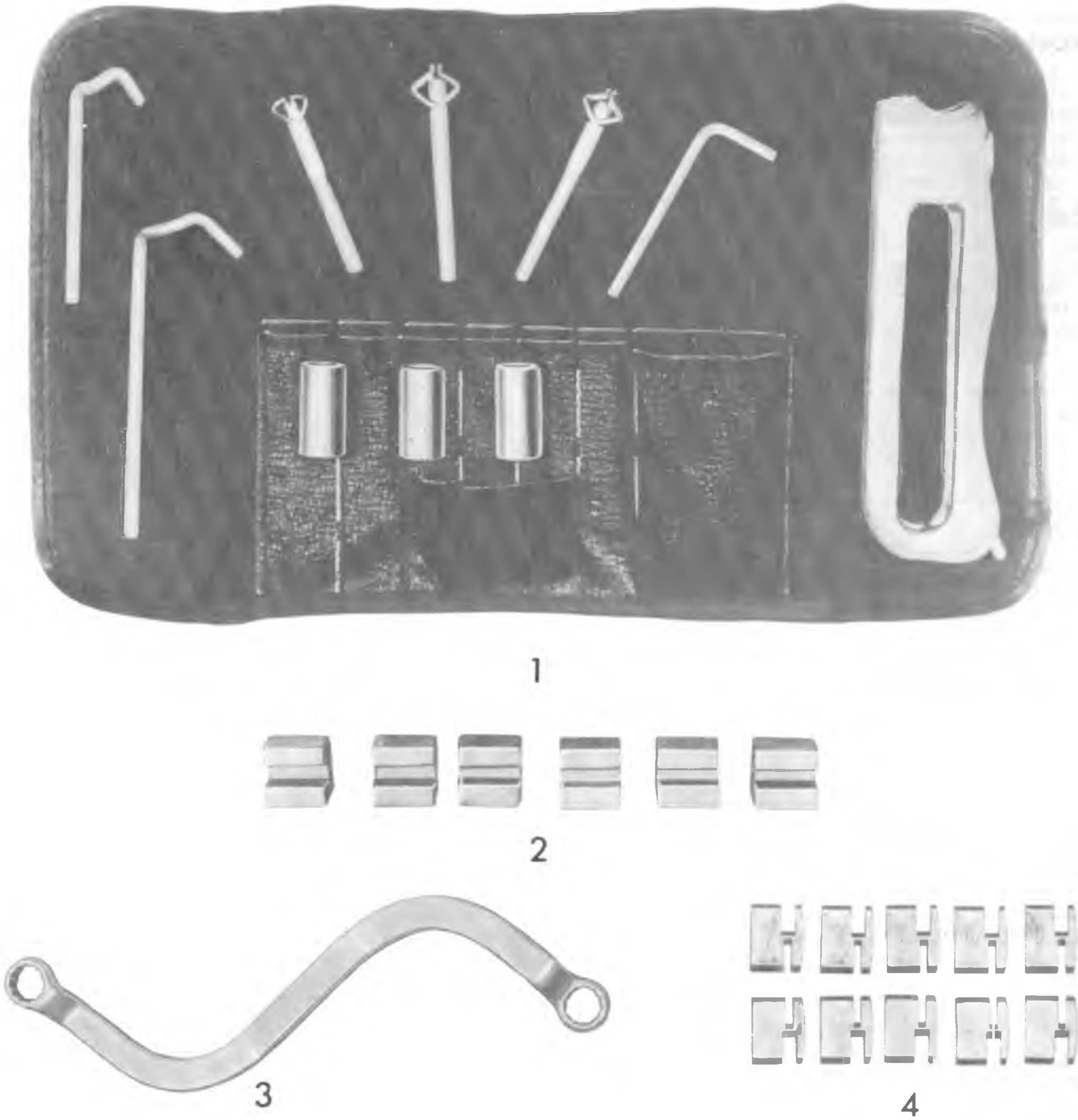
Begin with operation 4 and continue through operation 12.

DRIVER'S WINDOW THUMB PULL AND LOCKING DEVICE

Installation

1. Attach driver's window thumb pull and latch assembly to glass using .040 x 2-1/4" glass glazing strip or its equivalent. Center the latch on leading edge of glass. Fold the glazing strip over edge of glass, apply No. 30 weight motor oil on the outside of the glazing strip and press latch onto the glass. If it is necessary to use mallet or hammer to position latch, tap lightly. Too hard a blow could chip or break glass or cause the clip to open up slightly thus reducing the grip on glass. The glazing strip should be allowed to setup a few hours before too much pressure is applied to it.

SPECIAL TOOLS



1. J-2189—Weatherstrip Tool Set
2. J-5742-01 and J-22577—Windshield Checking Block (Typical)
3. J-22585—Front Door Hinge Bolt Wrench
4. J-9316—Windshield Checking Blocks

Fig. 79—Special Tools

1B BODY

SPECIFICATIONS

MIRRORS AND SUNSHADE

Inside Rear View Mirror	
Mirror to Bracket	45 in. lb.
Sunshade Support to Header Panel	20 in. lb.
Outside Rear View Mirror to Door Panel	
Series 10-20-30 Except (03-04-34 Models)	40 in. lb.
Series 20-30 (03 Models)	120 in. lb.

DOORS

Window Regulator to Door Panel	40 in. lb.
Door Lock to Door Panel	75 in. lb.
Lock Striker to Body Pillar	25 ft. lb.
Rear Door Lock Striker	95 in. lb.
Outside Door Handle	40 in. lb.
Rear Door Arm Check	55 in. lb.
Hinge to Door and Body	
All Except Rear Doors	25 ft. lb.
Rear Doors	30 ft. lb.
Rear Door Bumpers	30 in. lb.
Rear Door Latch Control	85 in. lb.
Rear Door Latch	85 in. lb.

LIFTGATE

Hinge Bolts	25 ft. lb.
Liftgate Support	40 in. lb.
Handle	40 in. lb.
Striker	95 in. lb.

ENDGATE (EXCEPT SUBURBAN)

Handle	95 in. lb.
Tailgate-to-Pickup Box Support	17 ft. lb.
Latch	150 in. lb.
Trunnion	17 ft. lb.

ENDGATE (SUBURBAN)

Latch	85 in. lb.
Latch Remote Control	40 in. lb.
Endgate to Body Support	45 ft. lb.
Striker (Body Mounted)	90 in. lb.
Hinges	30 ft. lb.
Bumpers	10 in. lb.

SEATS

Seat Back-to-Seat Cushion	25 ft. lb.
Front Seat	
Bench Type	
Adjuster-to-Seat	150 in. lb.
Adjuster-to-Floor	150 in. lb.
Bucket Type	
Adjuster-to-Seat	150 in. lb.
Adjuster-to-Floor	18 ft. lb.
Center and Rear Seat (Bench Type)	
Leg-to-Seat	17 ft. lb.
Leg-to-Floor	50 ft. lb.
Rear Mounting Bracket	
to Seat	18 ft. lb.
to Floor	30 ft. lb.
Body Mounts All Except Rear #2	20 ft. lb.
Rear #2	50 ft. lb.
Seat Belt	40 ft. lb.

SECTION 2

FRAME

INDEX

GENERAL DESCRIPTION

Light duty 10-30 Series frames are of the ladder channel section riveted type.

Figure 1 illustrates typical light duty frames with crossmembers, body mounts and suspension attaching brackets. This section also included general instructions for checking frame alignment and recommendations on frame repair.

FRAME ALIGNMENT

Horizontal frame checking can be made with tramming gauges applied directly to the frame or by transferring selected points of measurement from the frame to the floor by means of a plum bob and using the floor layout for measuring. Figure 2 may be used as a general guide in the selection of checking points; however, selection of these points is arbitrary depending on accessibility and convenience. An important point to remember is that for each point selected on one side of the frame, a corresponding point on the opposite side of the frame must be used for vertical checks, opposite and alternate sides for horizontal checks.

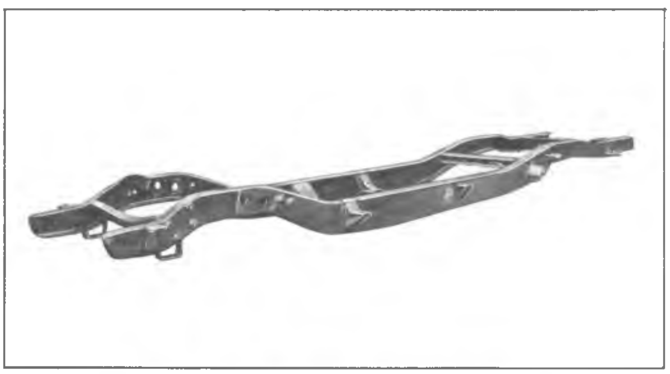


Fig. 1—10-30 Series Frame—Typical

Vehicle Preparation

Points to remember when preparing vehicle for frame checking:

1. Place vehicle on a level surface.
2. Inspect damaged areas for obvious frame misalignment to eliminate unnecessary measuring.
3. Support vehicle so that frame sidemembers are parallel to the ground.

Tramming Sequence

1. Dimensions to bolts and/or holes in frame extend to dead center of the hole or bolt.
2. Dimensions must be within 3/16".
3. If a tram bar is used, for horizontal alignment "X" - check from opposite and alternate reference points AA, BB and CC, as illustrated by the lines in Figure 2. Error will result if a tram bar is not level and centered at the reference points.
4. Obtain vertical dimensions and compare the differences between these dimensions with the dimensions as shown in chart.

Horizontal Check

1. Measure frame width at front and rear. If widths correspond to specifications, draw centerline full length of vehicle halfway between lines indicating front and rear widths. If frame widths are not correct, layout centerline as shown in Step 4.
2. Measure distance from centerline to corresponding points on each side of frame layout over entire length. Opposite side measurements should correspond within 3/16".
3. Measure diagonals marked A, B and C. If the lengths of intersecting diagonals are equal and these diagonals intersect the centerline, frame area included between these points of measurement may be considered in alignment.
4. If front or rear end of frame is damaged and width is no longer within limits, frame centerline may be drawn through the intersection of any two previously drawn pairs of equal, intersecting diagonals.

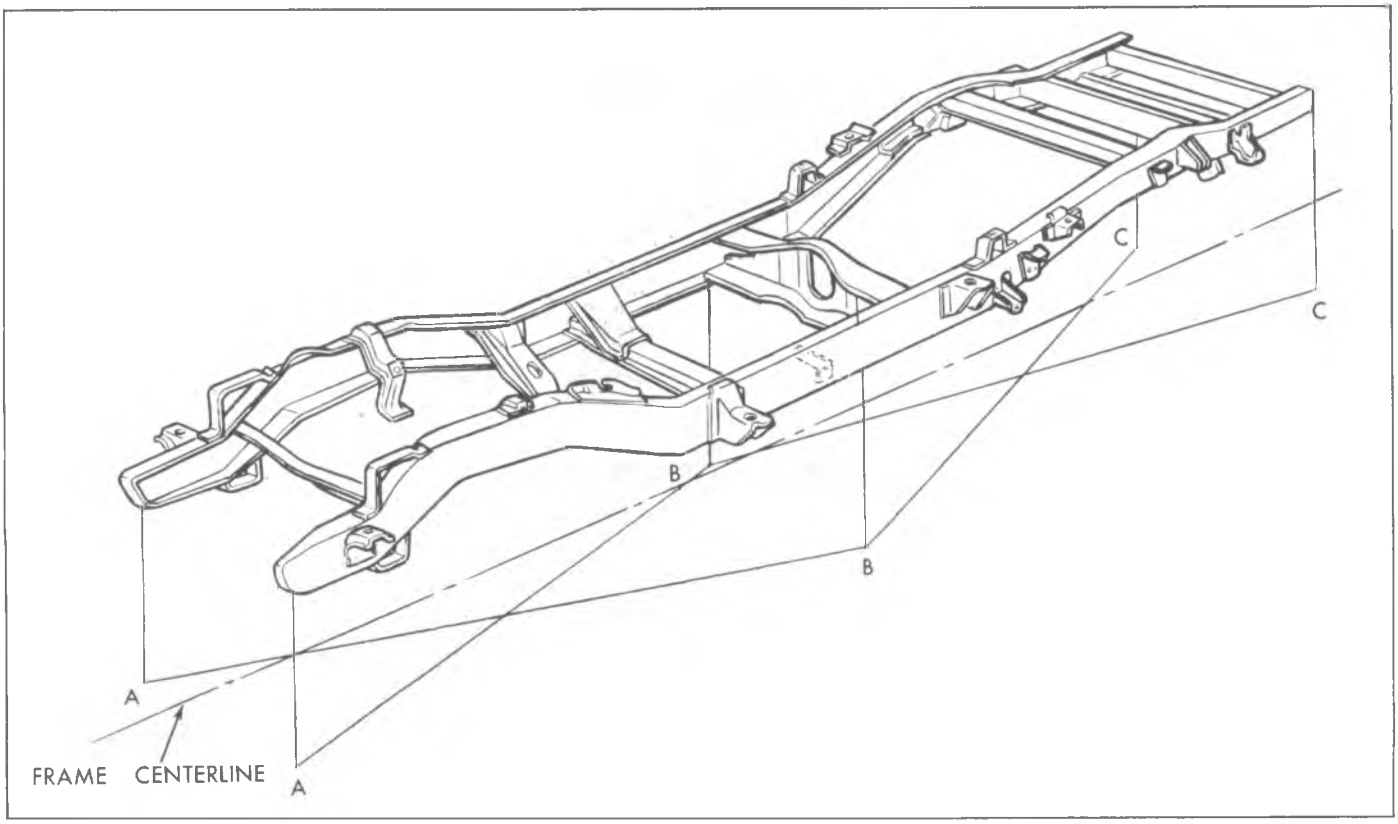


Fig. 2—Frame Horizontal Checking—Typical

Vertical Check

Vertical dimensions are checked with a tramming bar from indicated points on the frame (figs. 3 and 4). For example, if the tram bar is set at point B with a vertical pointer length of 8-1/4 inches, and at point E with a vertical pointer length of 5-1/4 inches (a height difference of 3 inches), the tram bar should be parallel with the frame. If the area is twisted or misaligned in any way, tram bar will not be parallel. Placing the tram bar vertical pointers on opposite sides of the frame side rail is preferable in that frame twist will show up during this vertical check. Figures 3 and 4 show typical checking points, with dimensions for various frames shown in the chart below.

Frame Repair

Welding

Before welding up a crack in frame, a hole should be drilled at the starting point of the crack to prevent spreading. Widen and V groove crack to allow complete weld penetration.

> **NOTE:** Do not weld into corners of frame or along edges of side rail flanges. Welding at these points will tend to weaken the frame and encourage new cracks.

Bolting

Wherever rivets or failed bolts are replaced, bolt hole must be as near the O.D. of the bolt as possible to prevent bolt from working and wearing. Drill out and line ream hole (or holes) to the bolt O.D.

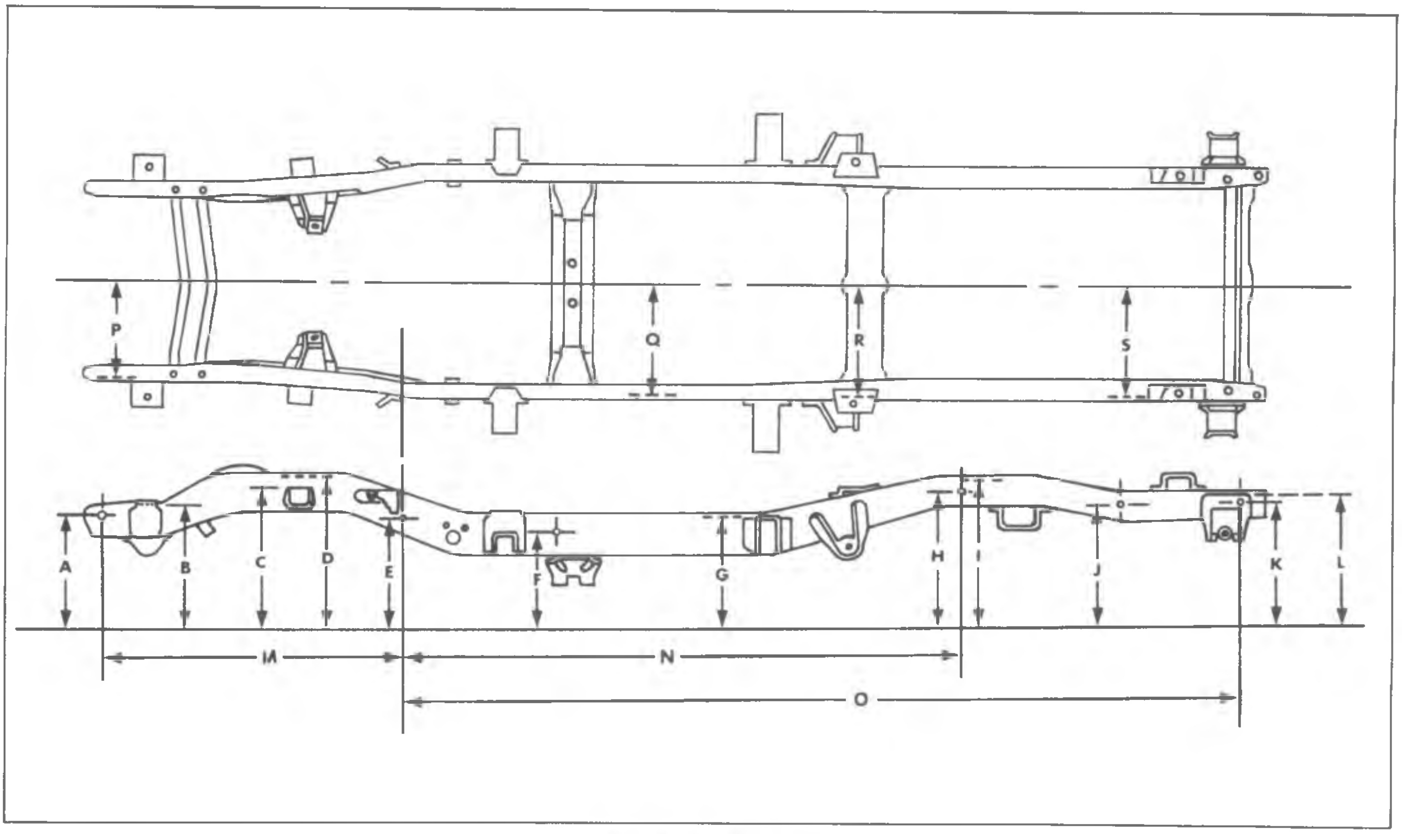


Fig. 3—KA Frame

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
CA107	9-3/8	11-7/8	13-3/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	11-3/8	13-3/8	43	92	127-3/4	14	16-7/8	19-1/8	16-7/8
CA109	9-3/8	11-7/8	13-3/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	11-3/8	13-3/8	43	104	134	14	16-7/8	19-1/8	16-7/8
CA209	9-3/8	11-7/8	13-3/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	11-3/8	13-3/8	43	104	134	14	16-7/8	19-1/8	16-7/8
CA 210/310	9-3/8	11-7/8	12-3/4	16	7-1/2	—	10	10	15-1/8	—	10-1/4	13-3/8	49	90-3/8	158-1/4	14	16-7/8	16-7/8	16-7/8
CA314	9-3/8	11-7/8	12-3/4	16	7-1/2	6-1/8	10	8-3/8	17-1/8	14-1/4	14-1/4	17-1/8	49	90	180-1/2	14	16-7/8	16-7/8	16-7/8
KA107	9-3/8	11-7/8	13-1/8	16	10-1/4	7-1/8	10	13-3/8	14-5/8	12	10-3/4	13-3/8	43	92	127-3/4	14	16-7/8	16-7/8	16-7/8
KA 109/209	9-3/8	11-7/8	13-1/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	10-3/4	13-3/8	43	104	139-3/4	14	16-7/8	16-7/8	16-7/8
PA100	9-3/8	11-7/8	13-3/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	10-3/4	13-3/8	43	79	114-5/8	14	16-7/8	19-1/8	16-7/8
PA 208/308	9-3/8	11-7/8	12-3/4	16	13-1/2	7-1/2	10	10	15-1/8	11-5/8	11-1/4	13-3/8	31-5/8	99-3/4	175-3/4	16-7/8	16-7/8	16-7/8	16-7/8
PA 210/310	9-3/8	11-3/8	12-3/4	16	13-1/2	7-1/2	10	10	15-1/8	11-5/8	11-1/4	13-3/8	31-1/2	107-3/4	183-3/4	16-7/8	16-7/8	16-7/8	16-7/8
PA314	9-3/8	11-7/8	12-3/4	16	13-1/2	7-1/2	10	10	15-1/8	11-5/8	11-1/4	13-3/8	31-1/2	131-3/4	207-3/4	16-7/8	16-7/8	16-7/8	16-7/8
CA105	9-3/8	11-7/8	13-3/8	16	10-1/4	7-1/8	10	13-3/8	15-1/2	12	—	13-3/8	43	81	—	14	16-7/8	19-1/8	16-7/8
KA105	9-3/8	11-7/8	13-1/8	16	10-1/4	7-1/8	10	13-3/8	14-5/8	12	10-3/4	13-3/8	43	81	116-3/4	14	16-7/8	16-7/8	16-7/8
PE 31132 (137)	9-1/4	11-5/8	12-5/8	15-3/4	13-3/8	7-3/8	9-3/4	9-3/4	15	11-1/2	11-1/8	13-1/8	31-1/2	111-3/4	187-3/4	14	16-7/8	16-7/8	16-7/8
PE 31432 (157)	9-1/4	11-5/8	12-5/8	15-3/4	13-3/8	7-3/8	9-3/4	9-3/4	15	11-1/2	11-1/8	13-1/8	31-1/2	131-3/4	207-3/4	14	16-7/8	16-7/8	16-7/8

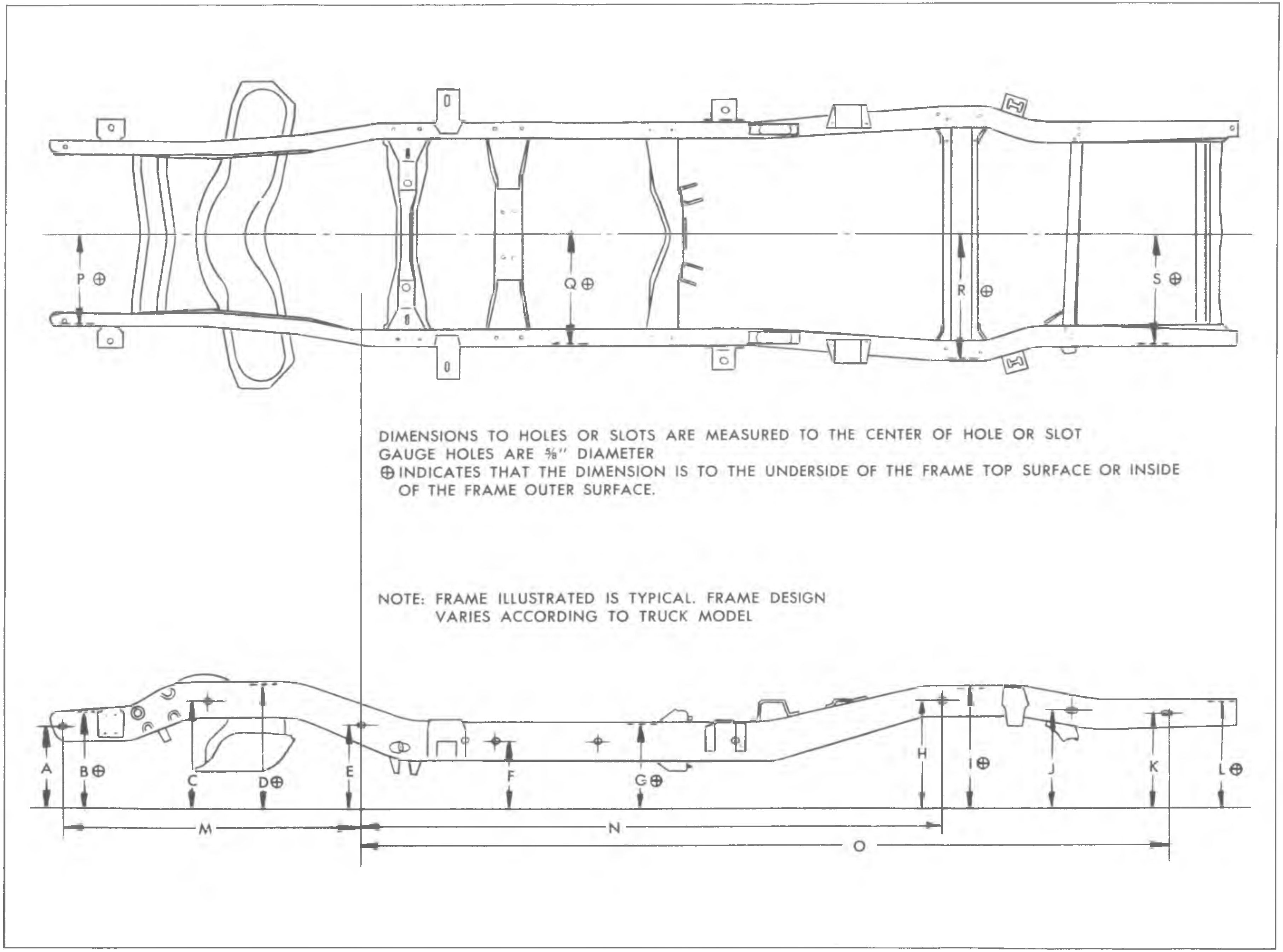


Fig. 4—10-30 Series Truck Frame

SECTION 3

FRONT SUSPENSION

CONTENTS OF THIS SECTION

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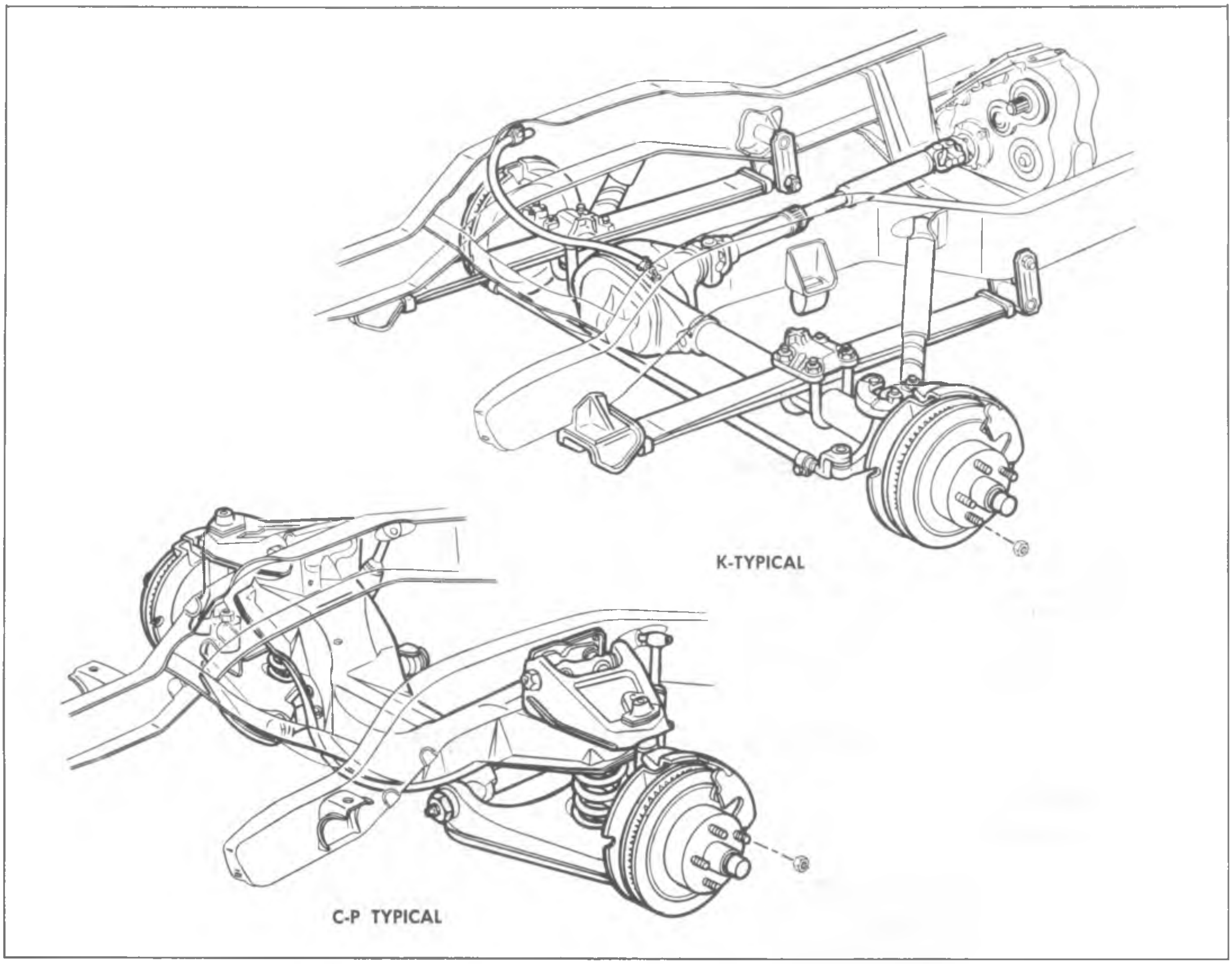


Fig. 1—Front Suspension C-P-K Typical

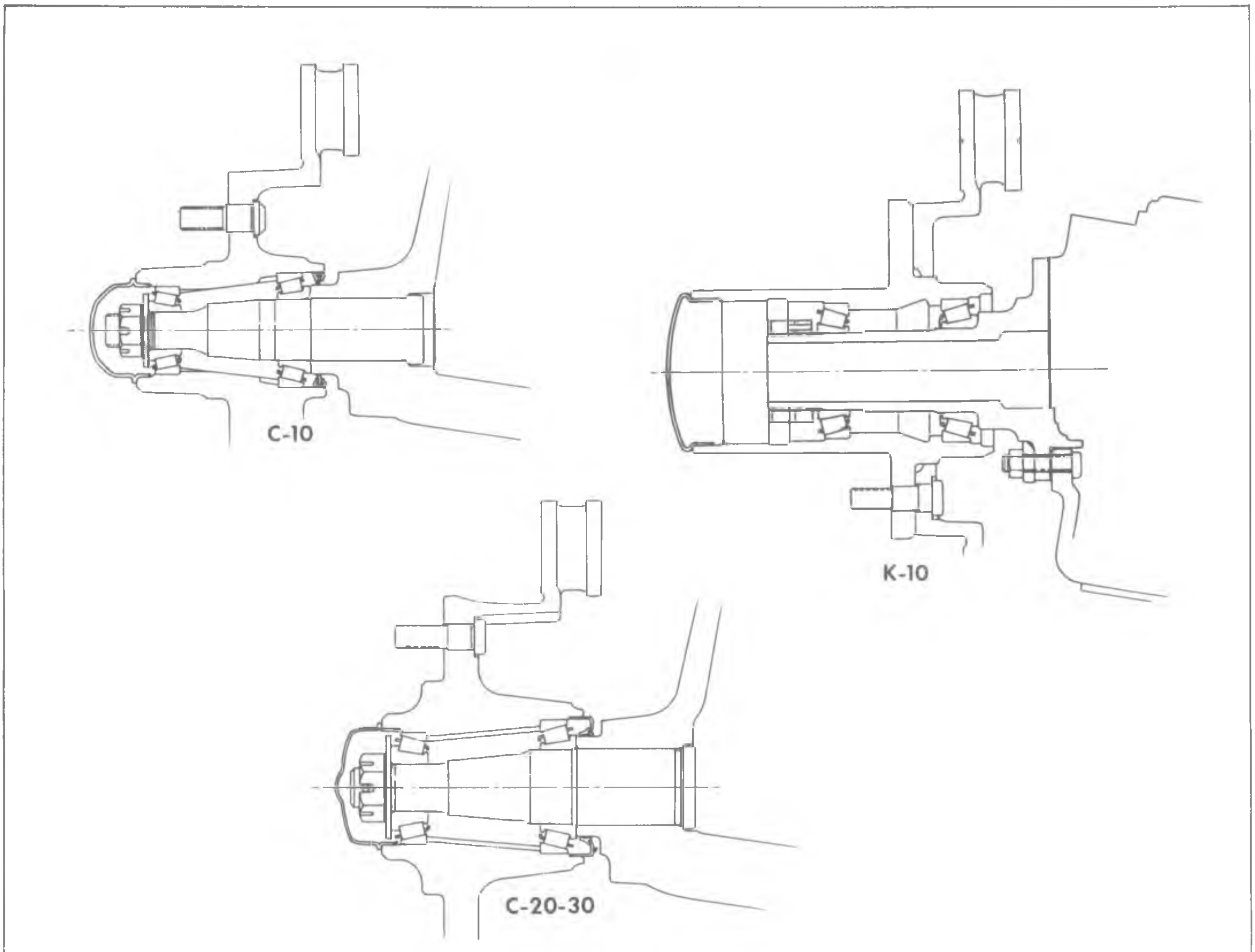


Fig. 2—Wheel Hubs and Bearings

GENERAL DESCRIPTION

Chevrolet 10-30 series truck use an independent wheel front suspension incorporating a coil spring.

This suspension system consists of upper and lower control arms pivoting on steel threaded bushings on upper and lower control arm shafts which are attached to the crossmember. The control arms are attached to the steering knuckle through ball joints. The coil spring is located between the lower control arm and a formed seat in the suspension crossmember.

Double acting shock absorbers are attached to the lower control arm and to the frame at the upper end. Front wheel bearings are the tapered roller type mounted within the hub and brake disc assembly.

MAINTENANCE AND ADJUSTMENTS

WHEEL BEARINGS

Checking Adjustment

CAUTION: Tapered roller bearings are used on all series and they have a slightly loose feel when properly adjusted. This differs from ball bearings which may be pre-load without adverse effect. A design feature of front wheel taper roller bearings is that they must NEVER be pre-loaded. Damage can result by the steady thrust on roller ends which comes from pre-loading.

1. Raise car and support at front lower control arm.
2. Spin wheel to check for unusual noise.
3. If bearings are noisy or excessively loose, they should be cleaned and inspected prior to adjustment.

NOTE: To check for loose bearings, grip the tire at the top and bottom and move the wheel

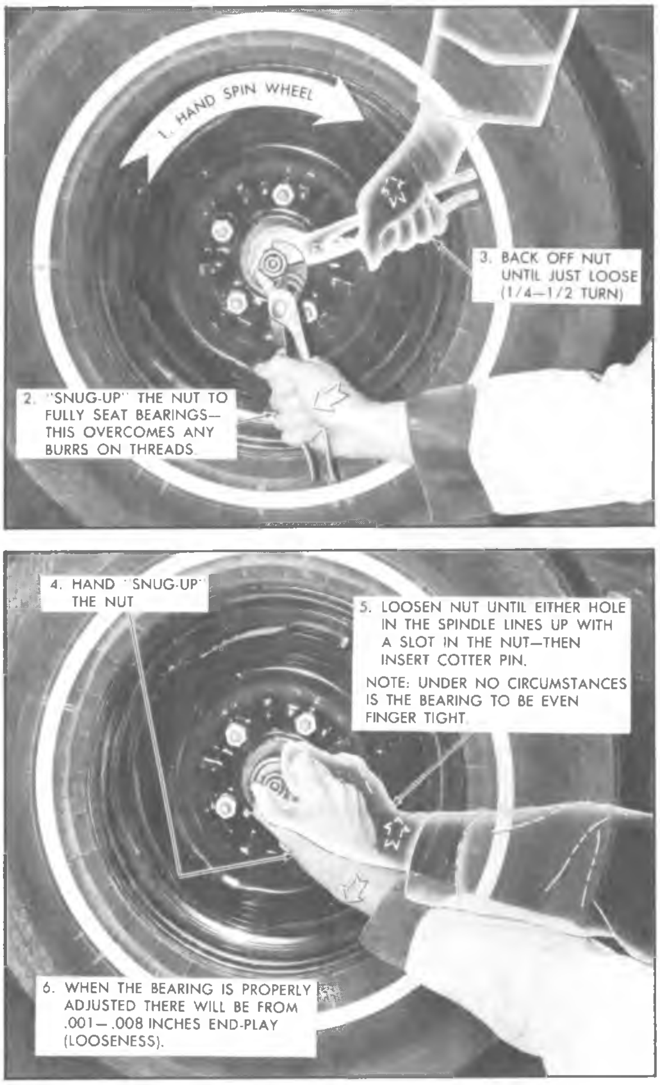


Fig. 3—Wheel Bearing Adjustment

assembly in and out on the spindle. Movement greater than .008" indicates a loose bearing. If necessary to inspect bearings, see Wheel Bearing Replacement.

ADJUSTMENT

1. Raise car and support at front lower control arm.
2. Remove hub cap or wheel disc from wheel.
3. Remove dust cap from hub.
4. Remove cotter pin from spindle and spindle nut.
5. Adjust bearing as shown in Fig. 3.
6. Insert new cotter pin and bend ends against nut, cut off extra length to ensure ends will not interfere with dust cap.
7. Install dust cap on hub.
8. Install hub cap or wheel disc.
9. Lower car to ground.
10. Repeat the same procedure for the other wheel.

FRONT ALIGNMENT (Figs. 4-6)

Satisfactory vehicle operation may occur over a wide range of front end wheel alignment settings. Nevertheless, should settings vary beyond certain tolerances, readjustment of alignment is advisable. The specifications stated in column 1 of the applicable vehicle chart in the specifications section of this manual should be used by owners, dealers and repairmen as guidelines in vehicle diagnosis either for repairs under the new vehicle warranty or for maintenance service at customer's request. These specifications provide an acceptable all-around operating range in that they prevent abnormal tire wear caused by wheel alignment.

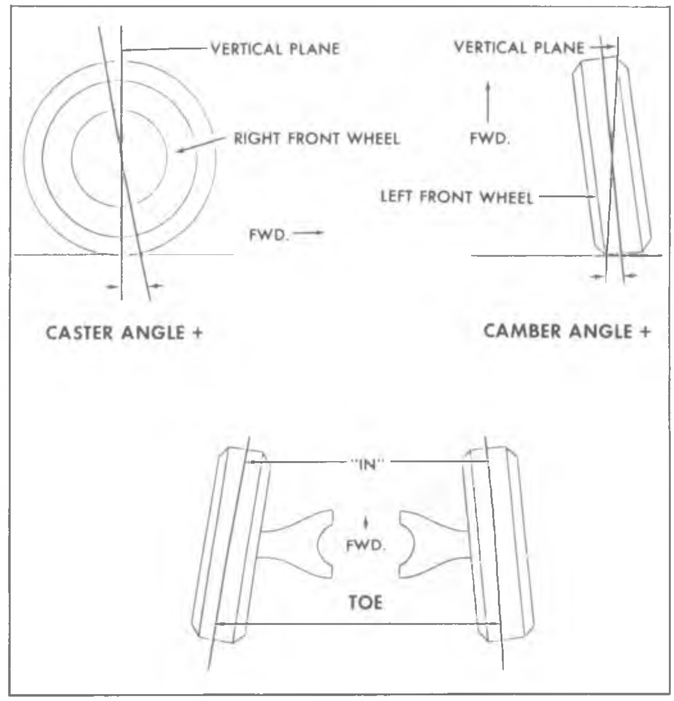


Fig. 4—Front End Alignment

Governmental Periodic Motor Vehicle Inspection programs usually include wheel alignment among items that are inspected. To provide useful information for such inspections, the specifications stated in column 2 of the aforesaid applicable chart are given and these are well within the range of safe vehicle operation.

In the event the actual settings are beyond the specifications set forth in column 1 or 2 (whichever is applicable), or whenever for other reasons the alignment is being reset, Chevrolet recommends that the specifications given in column 3 of the aforesaid applicable chart be used.

Caster and Camber—Figure 4

Positive caster is the amount in degrees of the backward tilt of the steering axis. Positive camber is the amount in degrees that the front wheels are tilted outward at the top from a vertical position. Caster and camber adjustments are made by means of shims located between the upper control arm shaft and the mounting bracket attached to the suspension crossmember.

Measure 10-30 Series caster and camber as follows (refer to Figure 4):

Caster

All caster specifications are given assuming a frame angle of zero. Therefore, it will be necessary to know

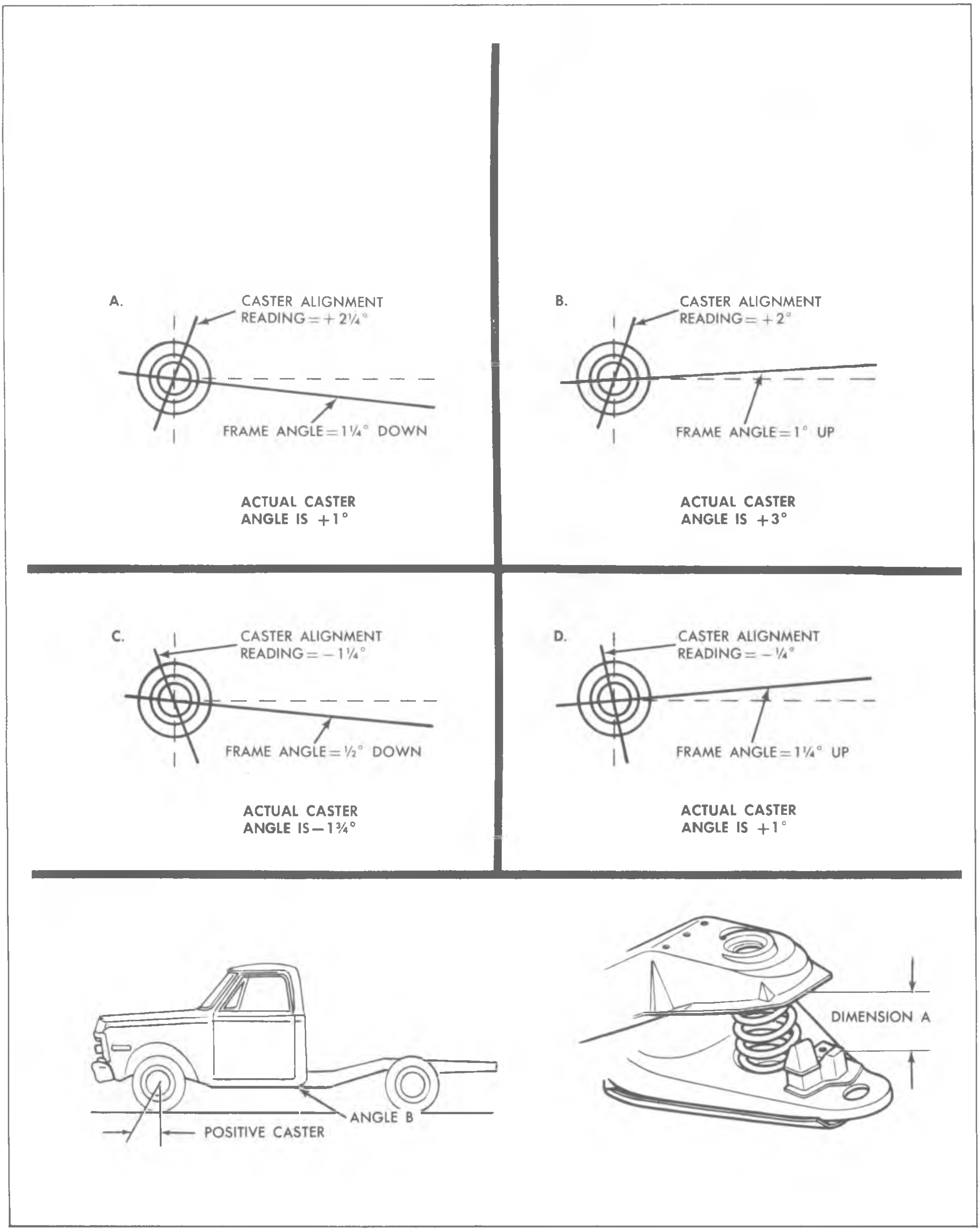


Fig. 5—Caster Adjustment Procedure

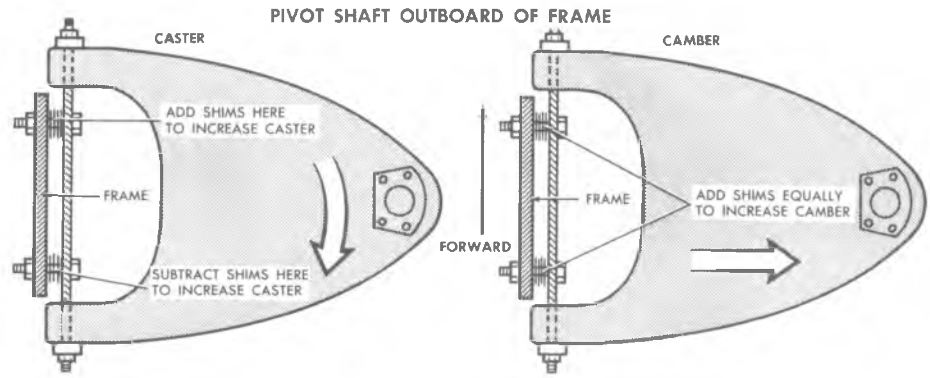


Fig. 6—Camber & Caster Shims

the angle of the frame (whether "up" in rear or "down" in rear) before a corrected caster reading can be determined. Camber and toe can be read "as is" from the alignment equipment.

How to Determine Caster

1. With the vehicle on a level surface, determine the frame angle "B" in Fig. 5, using a bubble protractor or clinometer.
2. Draw yourself a graphic as in Fig. 5 that is representative of the frame angle (either "up" in rear or "down" in rear).
3. Determine the caster angle from the alignment equipment and draw a line that is representative of the caster reading.
4. To determine an "actual (corrected) caster reading" with various frame angles and caster readings one of the following rules applys.
   a. A "down in rear" frame angle must be subtracted from a positive caster reading.
   b. An "up in rear" frame angle must be added to a positive caster reading.
   c. A "down in rear" frame angle must be added to a negative caster reading.
   d. An "up in rear" frame angle must be subtracted from a negative caster reading.
5. Add or subtract as necessary to arrive at the corrected caster angle.
6. Measure dimension "A" (bump stop bracket to frame) and check the specifications for that dimension.
7. Correct the actual caster angle, as arrived at in Step 4, as necessary to keep within the specifications by adding or subtracting shims from the front or rear bolt on the upper control arm shaft.

Camber

1. Determine the camber angle from the alignment equipment.
2. Add or subtract shims from both the front and rear bolts to affect a change.

Toe-In

1. Determine the wheel toe-in from the alignment equipment.
2. Change the length of both tie rod sleeves to affect a toe change. Torque tie rod clamps to specifications.

Cars within these tolerances from the mean specification are safe and not hazardous with respect to alignment effects on operation and handling. Settings outside these limits are not necessarily unsafe, however, customer dissatisfaction, due to steering pull or tire wear may occur or the vehicle may be in a damaged condition.

Definitions

Service Checking

Values within these limits should provide a high level of customer satisfaction and should not require resetting.

Service Reset

Values that the vehicle should be set within if it is observed out of the service checking tolerance, or if it is being aligned due to replacement of components, or for any other reasons.

Vehicle Inspection Tolerances

For government inspection station usage.

COMPONENT PARTS REPLACEMENT

CAUTION: All front suspension attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

WHEEL HUBS, BEARINGS (Fig. 2)

Removal

1. Raise vehicle on hoist and remove wheel and tire assembly. Remove dust cap from end of hub and withdraw cotter pin.
2. Remove the brake caliper and hang by wire to the suspension.
3. Remove hub and disc assembly.
4. Remove outer bearing from hub. The inner bearing will remain in the hub and may be removed by prying out the inner grease seal.
5. Wash all parts in cleaning solvent.

Inspection

1. Check all bearings for cracked bearing cages, worn or pitted rollers.
2. Check bearing races for cracks or scoring, check brake discs for out-of-round or scored conditions and check bearing outer races for looseness in hubs.

Repairs

Replacement of Bearing Cups

If necessary to replace an outer race, drive out old race from the hub with a brass drift inserted behind race in notches in hub. Install new race by driving it into hub with the proper race installer. Remove the inner race in the same manner.

CAUTION: Use care when installing new race to start it squarely into hub, to avoid distortion and possible cracking.

Thoroughly lubricate bearing assemblies with new high melting point wheel-bearing lubricant. Remove any excess lubricant.

NOTE: Be sure bearing parts have been thoroughly cleaned and air-dried.

Wheel Stud Replacement (Fig. 7)

NOTE: Use a piece of water pipe or other similar tool to support the hub while pressing a wheel stud either in or out.

Installation

1. Pack inner and outer wheel bearings with recommended grease (see Seciton 0).
2. Place inner bearing in hub and install new seal assembly, tapping into place with soft hammer.
3. Position hub and disc on spindle and install outer bearing, pressing it firmly into position in hub. Install hub washer nut and new cotter pin.

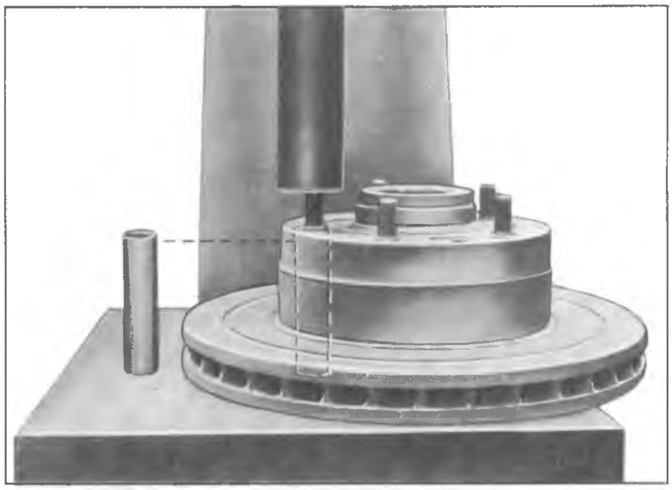


Fig. 7—Pressing Hub Bolt

4. Install brake caliper.
5. Install wheel and tire, and adjust wheel bearings as outlined under Wheel Bearings—Adjust, then lower vehicle to floor.

SHOCK ABSORBER

Removal (Figs. 8 and 9)

1. Raise vehicle on hoist.
2. Remove nuts and eye bolts securing upper and lower shock absorber eyes.
3. Withdraw shock absorber and inspect rubber eye bushings. If defective, replace shock absorber assembly.

Installation

Place shock absorber into position over mounting bolts or into mounting brackets. Install eye bolts and nuts and torque as shown in Specifications Section . Lower vehicle to floor.

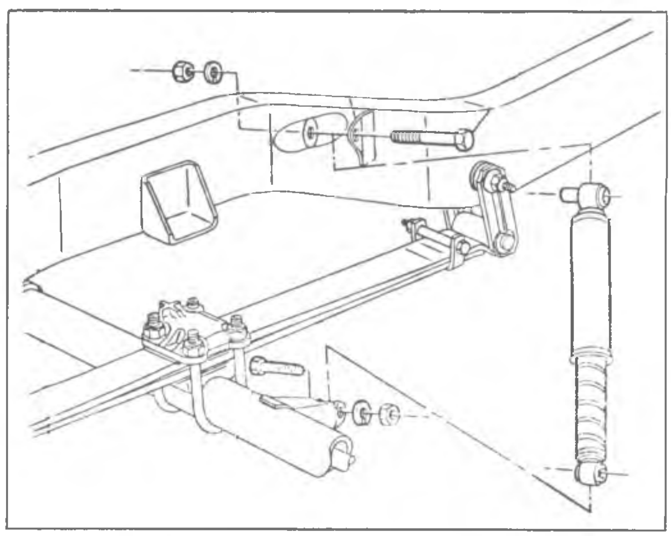


Fig. 8—Shock Absorber — K Series

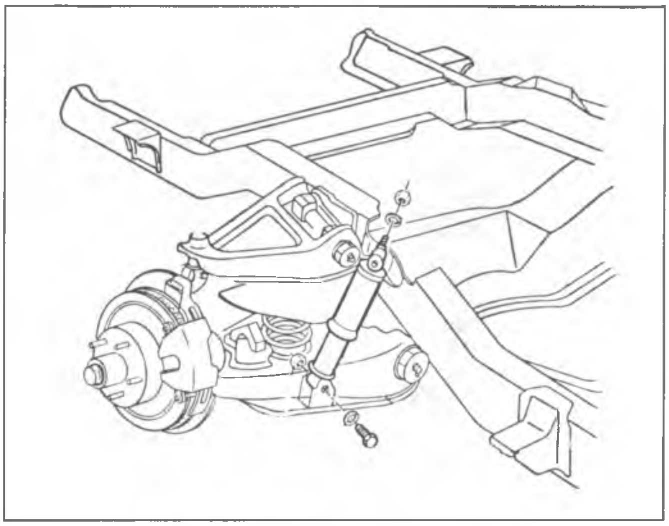


Fig. 9—Shock Absorber — C-P Series

STABILIZER BAR—TYPICAL

Removal (Fig. 10)

1. Raise vehicle on hoist and remove nuts and bolts attaching stabilizer brackets and bushings at frame location.
2. Remove brackets and bushings at lower control arms and remove stabilizer from vehicle.

Inspection

Inspect rubber bushings for excessive wear or aging - replace where necessary.

Installation

1. Place stabilizer in position on frame and install frame brackets over bushings. Install nuts and bolts loosely.
2. Install brackets over bushings at lower control arm location. Be sure brackets are positioned properly over bushings. Tighten all nuts and bolts securely.
3. Lower vehicle to floor.

COIL SPRING

Removal (Fig. 11)

1. Place vehicle on hoist and place jack stands under frame, allowing control arms to hang free.
2. Disconnect shock absorber at lower end.
3. Bolt Tool J-23028 to a suitable jack.
4. Place tool under cross-shaft so that the cross-shaft seats in the grooves of the tool. As a safety precaution install a chain through the spring and lower control arm.
5. Raise the jack to remove tension on the lower control arm cross-shaft and remove the two "U" bolts securing the cross-shaft to crossmember.
6. Lower control arm by slowly releasing the jack until spring can be removed.
7. Remove spring.

Installation

1. Properly position spring on the control arm, and lift control arm.
2. Position control arm cross-shaft to crossmember and install "U" bolts and attaching nuts. Make certain front indexing hole in cross-shaft is lined up with crossmember attaching saddle stud.

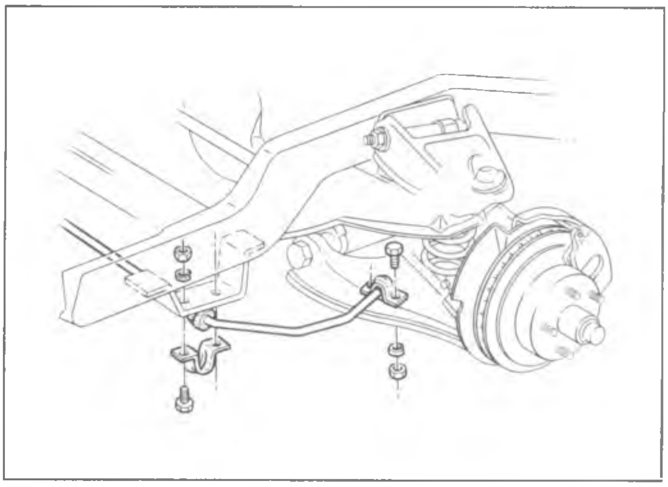


Fig. 10—Stabilizer Bar — Typical

3. Torque nut to specifications.
4. Install shock absorber to lower control arm and install stabilizer bar if so equipped.
5. Remove tool.
6. Remove vehicle from hoist.

Shackle Stop Clearance K-Series

The clearance is to be measured with the vehicle weight on the spring. Shackle stop clearance should be adjusted to 1/8 inch if necessary (See fig. 12).

UPPER AND LOWER CONTROL ARM INNER PIVOT SHAFT REPLACEMENT

10-30 Series Trucks

Upper—Removal

1. Raise vehicle and remove tire.
2. Support the lower control arm with a floor jack.

   NOTE: Position jack under the ball joint assembly or as near as possible and still have good support.

3. Loosen the upper control arm shaft end nuts before loosening the shaft to frame attaching nuts.

Fig. 11—Removing Coil Spring with Tool J-23028

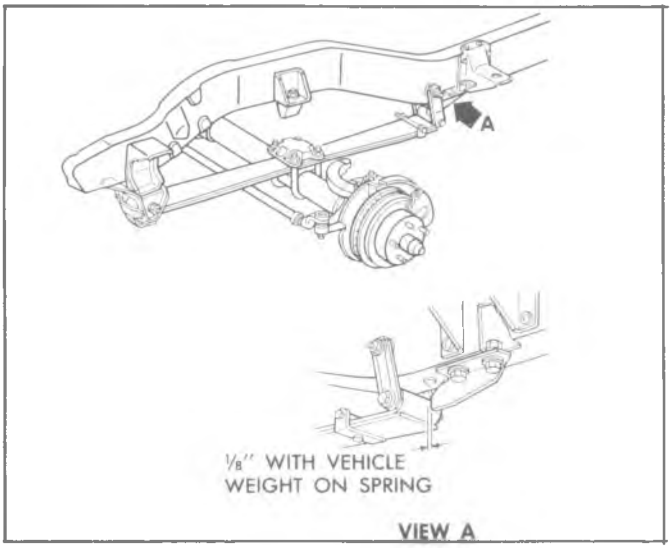


Fig. 12—Shackle Stop Clearance K-Series

4. Loosen the shaft to frame nuts and remove the caster and camber shims.

   NOTE: Tape the shims together as they are removed and mark for position.

5. Remove the pivot shaft to frame nuts but do not allow the arm to swing too far away from the frame.

   NOTE: Use a chain to retain the arm in a close relationship to the frame if necessary.

6. Remove the shaft end nuts and remove shaft from arm.

Bushing Replacement

1. Remove grease fittings from bushing outer ends and unscrew bushings from control arm and shaft.
2. Slide new seal on each end of shaft and insert shaft into control arm.

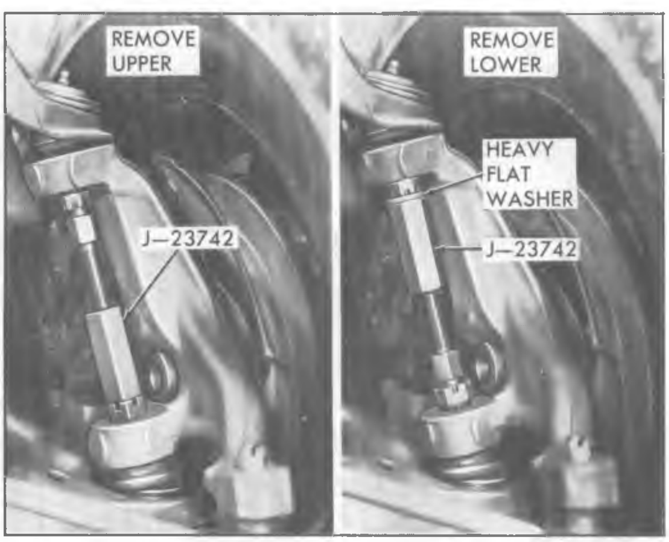


Fig. 13—Loosening Ball Joint Stud — Typical

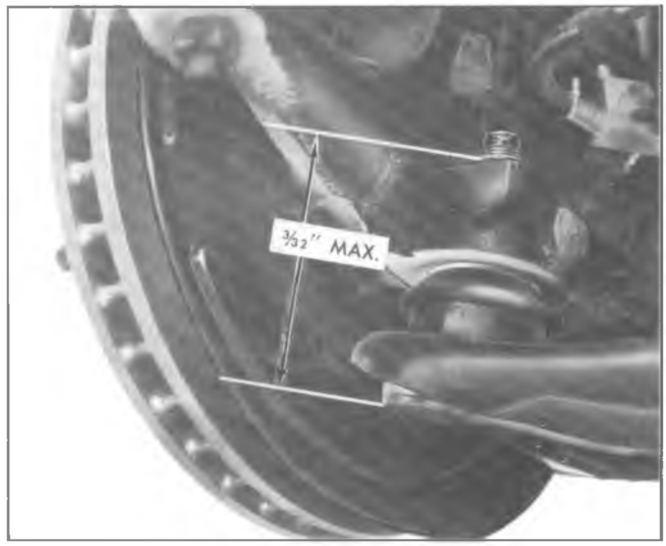


Fig. 14—Checking Lower Ball Joint

3. Start new bushings on shaft and into control arm. Adjust shaft until it is centered in control arm, then turn bushings in and torque to specifications. Figure 17 shows correct final positioning of shaft. Check shaft for free rotation and install grease fittings.

Installation

1. Install the shaft to the control arm and install end nuts. Do not torque nuts at this time.
2. Position cross shaft to frame bolts and start cross shaft nuts.
3. Torque the shaft end nuts. See fig. 17 for spacing.

   NOTE: The shaft should rotate by hand after the nuts are torqued.

Fig. 15—Removing Inner Pivot Shaft

4. Install caster and camber shim in their appropriate places.
5. Torque the cross-shaft to frame nuts.
6. Install the tire.
7. Remove floor jack and lower vehicle to the floor.

Lower—Removal (Fig. 15)

1. Raise vehicle and support the frame so that control arms hang free.
2. Position an adjustable floor jack under the control arm inboard of spring and into depression in lower arm.
3. Install a chain over upper arm. Inboard of stabilizer and outboard of shock absorber as a safety measure.
4. Loosen shaft end nuts.
5. Remove "U" bolts.
6. Lower jack just enough to get at shaft.
7. Remove shaft end nuts and remove shaft.

Bushing Replacement

1. Remove grease fittings from ends of bushings and unscrew bushings from shaft and control arm. Remove shaft and seals.
2. Slide new seal on each end of shaft and insert shaft into control arm.
3. Start new bushings on shaft and into control arm. Adjust shaft until it is centered in control arm, then turn bushings in and torque. Check shaft for free rotating. Figure 16 shows correct final positioning of shaft.

Installation

1. Install shaft to control arm and install end nuts. Do not torque nuts at this time.
2. Raise jack and position shaft into crossmember saddle. Be sure to index hole in shaft to mate with bolt head in saddle.

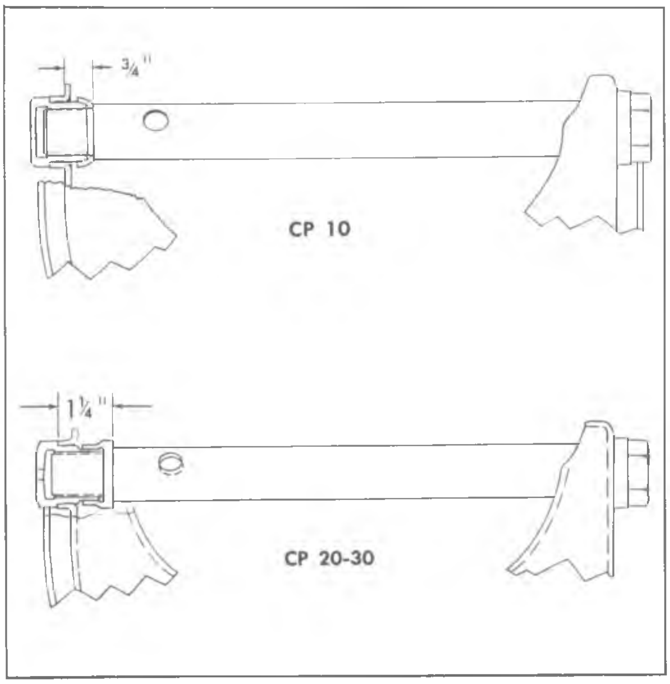


Fig. 16—Positioning Lower Control Arm Shaft

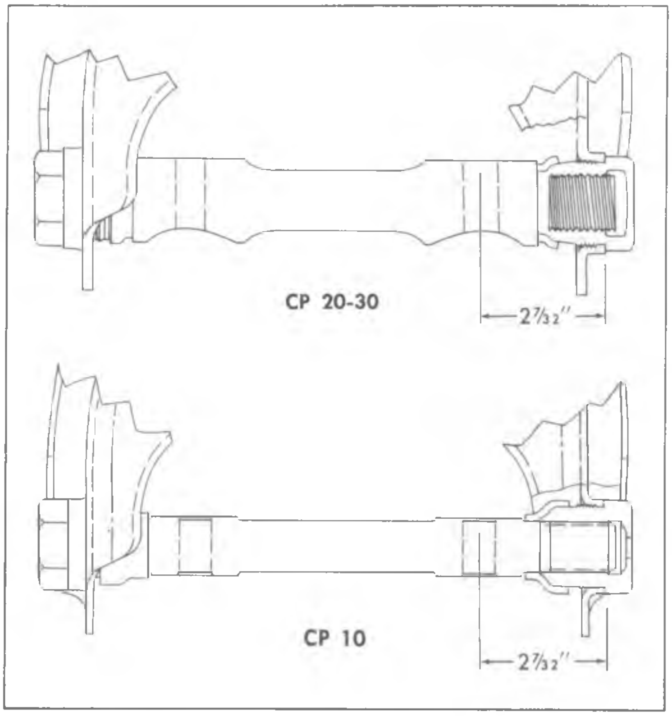


Fig. 17—Positioning Upper Control Arm Shaft

3. Install "U" bolts. Do not torque nuts at this time.
4. Torque cross-shaft end nuts.

NOTE: The shaft should rotate by hand after the nuts are torqued.

5. Torque "U" bolt nuts.
6. Remove chain.
7. Remove floor jack and lower vehicle to floor.

UPPER CONTROL ARM ASSEMBLY

CAUTION: All control arm attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Raise vehicle on hoist, remove wheel and tire assembly and support lower control arm assembly with adjustable jackstand.
2. Remove cotter pin from upper control arm ball stud and loosen stud nut one turn.
3. Loosen upper control arm ball stud in steering knuckle, using Tool J-23742 position as shown in Figure 13. Remove the nut from the ball stud and raise upper arm to clear steering knuckle.
4. Remove nuts securing control arm shaft to frame. Withdraw control arm assembly.

NOTE: Tape shims together and tag for proper relocation when control arm is reinstalled.

Installation

1. Place control arm in position on bracket and install nuts. Before tightening nuts, insert caster and camber shims in the same order as when removed. Torque nuts.

   NOTE: A normal shim pack will leave at least two (2) threads of the bolt exposed beyond the nut. If two (2) threads cannot be obtained: Check for damaged control arms and related parts.

   NOTE: Always tighten the thinner shim packs' nut first for improved shaft to frame clamping force and torque retention.

2. Insert ball joint stud into steering knuckle and install nut. Tighten stud nut.
3. Remove adjustable support from under control arm. Install wheel and tire assembly.
4. Lower vehicle to floor.

LOWER CONTROL ARM ASSEMBLY

Removal

1. Raise vehicle on hoist and remove spring as outlined under spring removal.
2. Remove cotter pin from lower ball stud and loosen stud nut one turn.

   CAUTION: All control arm attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

3. Install Ball Stud Remover J-23742, position - large cup end of the tool over the upper ball stud nut and piloting the threaded end of tool on end of the lower ball stud. Extend bolt from Tool J-23742 to loosen lower ball stud in steering knuckle. When stud is loosened, remove tool and nut from lower stud.
4. Remove control arm.

Installation

1. Install lower ball stud through steering knuckle and tighten nut.
2. Install spring and control arm as outlined under spring installation.
3. Torque lower control arm ball stud to specifications and install cotter pin.
4. Remove vehicle from hoist.

BALL JOINT SERVICE—ON VEHICLE

Ball Joint—Inspection

The upper ball stud is spring loaded in its socket. This minimizes looseness at this point and compensates for normal wear, if the upper stud has any perceptible lateral shake, or if it can be twisted in its socket with the fingers, the upper ball joint should be replaced.

Upper—Removal

1. Raise vehicle on hoist. If a frame hoist is used, it will be necessary to support the lower control arm with a floor jack.
2. Remove cotter pin from upper ball stud and loosen stud nut (two turns) but do not remove nut.
3. Install J-23742 between the ball studs as shown in Figure 13.

   CAUTION: Before proceeding with Step 4, be sure lower control arm is supported as pointed out in Step 1.

4. Extend bolt from Tool J-23742 to loosen ball stud in steering knuckle. When stud is loose, remove tool and stud nut.
5. Center punch rivet heads and drill out rivets.
6. Remove ball joint assembly.

Installation

1. Install new service ball joint, using bolts and nuts supplied with joint, to upper arm. Torque nuts to 45 ft. lbs.
2. Mate ball stud to steering knuckle and install stud nut.
3. Torque the ball stud nut as follows:
   10 Series 40-60 ft. lbs. plus additional torque to align cotter pin not to exceed 90 ft. lbs. Never back off to align cotter pin. 20-30 Series 80-100 ft. lbs. plus additional torque to align cotter pin not to exceed 130 ft. lbs. Never back off to align pin.
4. Install new cotter pin.
5. Install lube fitting and lube new joint.
6. Install tire and wheel.
7. Lower vehicle to floor.

Ball Joint—Inspection

Lower

Lower ball joints are a loose fit when not connected to the steering knuckle. Wear may be checked without disassembling the ball stud, as follows:

1. Support weight of control arms at wheel hub and drum.
2. Measure distance between tip of ball stud and tip of grease fitting below ball joint.
3. Move support to control arm to allow wheel hub and drum to hang free. Measure distance as in Step 2. If the difference in measurements exceeds .094" (3/32") for all models, ball joint is worn and should be replaced (fig. 14).

Lower—Removal

1. Raise vehicle on a hoist. If a frame hoist is used it will be necessary to support the lower control arm with a floor stand.
2. Remove the tire and wheel.
3. Remove the lower stud cotter pin and loosen (two turns) but do not remove the stud nut.
4. Install J-23742 between the ball studs as shown in Figure 13.

   CAUTION: Before proceeding with Step 5, be sure lower control arm is supported as pointed out in Step 1.

5. Extend bolt from Tool J-23742 to loosen ball stud in steering knuckle. When stud is loosened, remove tool and ball stud nut.

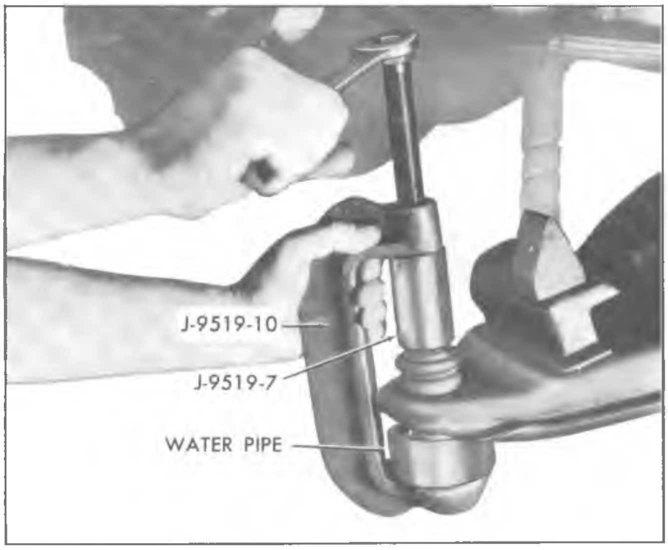


Fig. 18—Ball Joint Removal

6. Pull the brake disc and knuckle assembly up off the ball stud and support the upper arm with a block of wood so that assembly is out of working area.

   CAUTION: Do not put undue stress on the brake line flex hose.

7. Install Tools J-9519-10 and J-9519-7 as shown in Fig. 18.

   NOTE: It will be necessary to alter Tool J-9519-10 as illustrated in Fig. 19 and install a 3" I.D. pipe as shown if working on a 20 or 30 series vehicle.

8. Turn hex head screw until ball joint is free of control arm.
9. Remove tools and ball joint.

Installation (Fig. 20)

1. Start the new ball joint into the control arm and install J-9519 and J-9519-9 as shown.

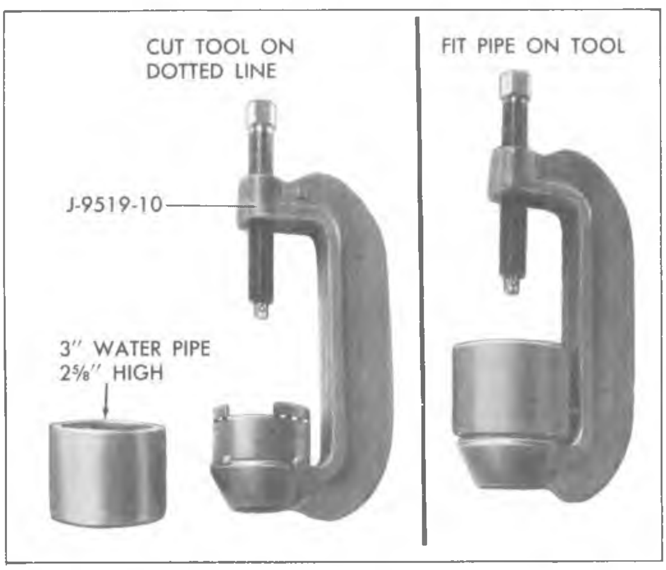


Fig. 19—Alteration to Tool J-9519-10

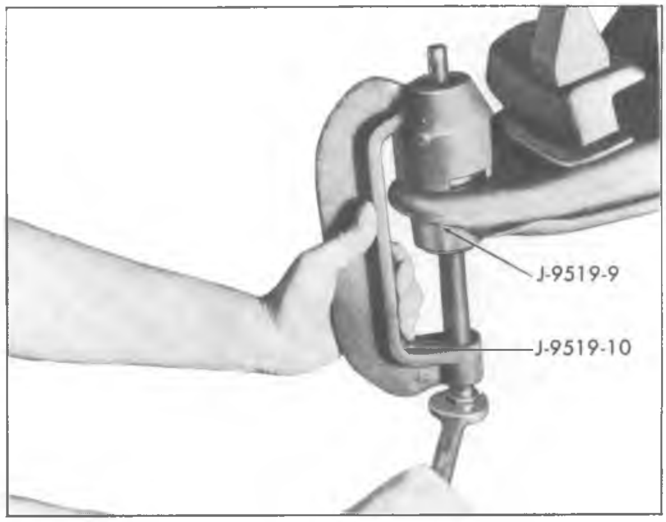


Fig. 20—Installing Ball Joint

NOTE: Position bleed vent in rubber boot facing inward.

2. Turn hex head screw until ball joint is seated in control arm.
3. Lower the upper arm and mate the steering knuckle to the lower ball stud.
4. Install ball stud nut and torque as follows. All Series, 80-100 ft. lbs. plus additional torque to align cotter pin hole not to exceed 130 ft. lbs. maximum. Never back off to align cotter pin.
5. Install a lube fitting and lube the joint.
6. Install tire and wheel and lower vehicle to floor.

STEERING KNUCKLE

It is recommended that vehicle be raised and supported as 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.

Removal

1. Raise vehicle on hoist and support lower control arm as noted above.
2. Remove hub cap wheel cover and wheel nuts.
3. Withdraw wheel and tire, remove caliper as outlined under "Front Wheel Hub" assembly from steering knuckle spindle.
4. Remove disc splash shield bolts securing the shield to the steering knuckle.
5. Refer to Section 9 - Steering Linkage - Tie Rod, for service operations.
6. Remove upper and lower ball studs cotter pins and loosen ball stud nuts. Free steering knuckle from ball studs by installing Special Tool J-23742. Remove ball stud nuts and withdraw steering knuckle.

Installation

1. Place steering knuckle in position and insert upper and lower ball studs into knuckle bosses.

   CAUTION: Steering knuckle hole, ball stud and nut should be free of dirt and grease before tightening nut.

2. Install ball stud nuts and tighten nut to specifications. (See Specification Section.)

CAUTION: These ball stud nuts to knuckle fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must each be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

NOTE: If necessary, tighten one more notch to insert cotter pins. Do not loosen nut to insert cotter pin. Refer to Ball Joint text for proper nut installation.

3. Reverse above removal procedure, and tighten splash shield mounting bolt. Tighten two caliper assembly mounting bolts to 35 ft. lb. torque.
4. Adjust wheel bearings as outlined under Front Wheel Bearing Adjustment.
5. Tighten wheel nuts to 75 ft. lb.

Crossmember and Suspension Unit

Component parts of the front suspension may be serviced separately as outlined in the preceding service. operations. However, if extensive service is to be performed to crossmember, frame, etc., the unit can be removed and installed as follows:

Removal (Fig. 21)

1. Place vehicle on hoist and remove the shock absorber from the lower control arm.
2. Remove idler arm and pitman arm.
3. Support engine and remove front engine mount center bolts.
4. Separate main brake feeder line from crossmember tee.
5. Remove bolts retaining crossmember hangers to frame side rails.

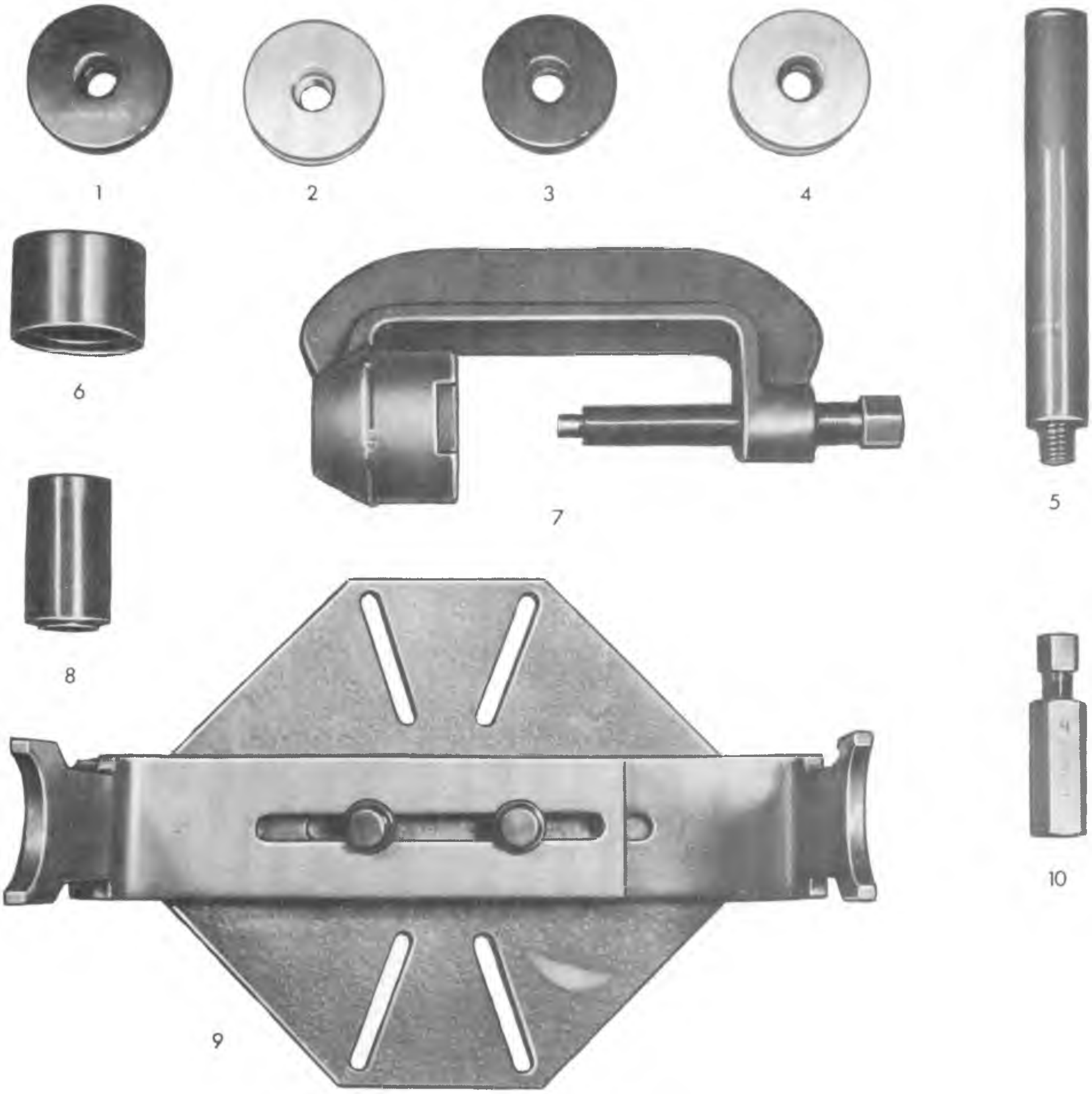
Fig. 21—Suspension Crossmember

6. Remove bolts securing crossmember to frame bottom rail and lower the assembly from vehicle.

Installation

CAUTION: All crossmember to frame attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

1. Jack crossmember into position under frame and install frame bottom rail mounting bolts.
2. Install bolts securing crossmember hanger to frame and torque nuts. See specifications.
3. Position engine on front mount and install mounting bolt and torque.
4. Install the shock absorber.
5. Connect front brake main feeder line and bleed brakes as described in Section 5.
6. Install idler arm and pitman arm.
7. Check and Adjust front end alignment as outlined under "Maintenance and Adjustments" in this section.
8. Remove vehicle from hoist.



1.	J-8457	Bearing Race Installer	6.	J-9519-9	Ball Joint Installer
2.	J-8458	Bearing Race Installer	7.	J-9519-10	"C" Clamp
3.	J-8849	Bearing Race Installer	8.	J-9519-7	Ball Joint Remover
4.	J-9276-2	Bearing Race Installer	9.	J-23028	Spring Remover
5.	J-8092	Driver Handle	10.	J-23742-1	Ball Joint Remover

Fig. 22—Special Tools

FOUR WHEEL DRIVE (SERIES K10 AND K20)

INDEX

GENERAL DESCRIPTION

Primary purpose of four wheel drive is to provide additional tractive effort in off-the-road driving in order to overcome such obstacles as sand, deep mud or snow, hilly terrain with steep grades, etc.

With four wheels capable of driving, all the vehicle and payload weight is utilized to give maximum tire traction.

The power unit is driven through a transmission and consists of an adapter and a two-speed transfer case with a steering and driving front axle. A single control lever is used to shift the transfer case from direct drive to low four wheel drive at a ratio of 1.94 to 1, thus eight forward speeds and two in reverse is provided.

Front wheel drive may be engaged or disengaged at any time without clutching when the transfer case is in direct drive; however, in returning to 2 wheel from 4 wheel the accelerator may have to be varied as steady pressure is applied on lever. This releases gear tooth pressure during shifting.

A yoke and trunnion universal joint permits continuous power flow to each front wheel, regardless of the turning angle.

Provisions for Power Take-off have been incorporated in the transfer case.

FRONT AXLE

The front axle is a hypoid gear axle unit equipped with steering knuckles. Axle assembly number and production date are stamped on left tube of assembly.

Conventional truck service brakes are provided on all 4-wheel drive units.

TRANSFER CASE

Refer to Section 7 for service procedures.

ADAPTER ASSEMBLY

Refer to Section 7 for service procedures.

FREE WHEELING HUBS (Fig. 23)

Free-wheeling hubs are available for the front wheels of four wheel drive vehicles. The purpose of these hubs is to reduce friction and wear by disengaging the front axle shafts, differential and drive line from the front wheels when the vehicle is operated under conditions where front wheel drive is not needed.

The engagement and disengagement of free-wheeling hubs is a manual operation which must be performed at each front wheel. The transfer case control lever must be in 2-wheel drive position when locking or unlocking hubs. Both hubs must be in the fully locked or fully unlocked position. They must not be in the free-wheeling position when low all wheel drive is used as the additional torque output in this position can subject the rear axle to severe strain and rear axle failure may result.

MAINTENANCE AND ADJUSTMENTS

Ball Joint Adjustment

Front axle ball joint adjustment is generally necessary only when there is excessive play in steering, irregular wear on tires or persistent loosening of the tie rod.

1. Raise vehicle on hoist then place jack stands just inside of front springs.
2. Disconnect connecting rod and tie rod to allow independent movement of each steering knuckle.
3. At top of knuckle, apply torque wrench to one of the steering arms attaching stud nuts, then check torque necessary to turn the steering knuckle.
   Maximum torque should be:
   20 ft. lbs. . . . . Axle 44-5B

   NOTE: Knuckle should turn smoothly through turning arc but have no vertical end play.

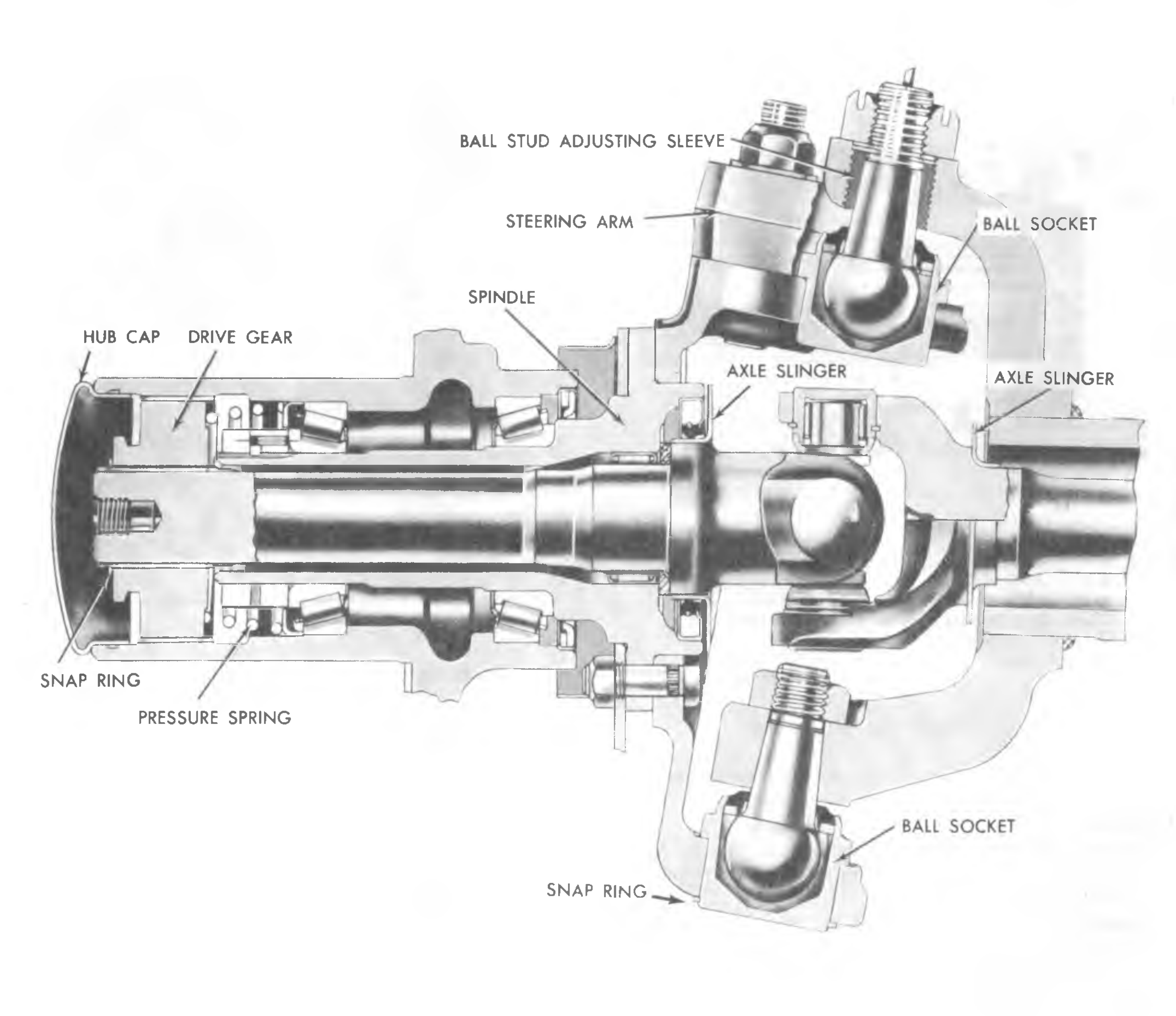


Fig. 23—Steering Knuckle & Hub

COMPONENT PARTS REPLACEMENT

FREE-WHEELING HUB

The free wheeling hub assemblies used on the front wheels are serviceable.

K10 Series

Removal (Fig. 24)

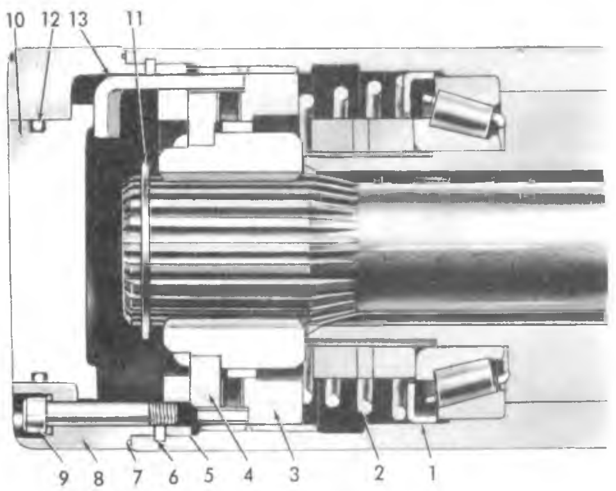
1. Turn actuator lever to set hub to "LOCK" position (fig. 25) and raise vehicle on hoist.
2. Remove six retaining plate bolts and remove retaining plate actuating knob and "O" ring.
3. Remove internal snap ring, outer clutch retaining ring and actuating cam body.
4. Relieve pressure on the axle shaft snap ring and remove snap ring.
5. Remove the axle shaft sleeve and clutch ring assembly and inner clutch ring and bushing assembly.
6. Remove pressure spring and spring retainer plate.

Disassembly

1. Remove actuator knob and "O" ring from retaining plate, discard "O" ring and replace with a new "O" ring during assembly.
2. Slide inner clutch ring and bushing assembly from axle sleeve and clutch ring assembly.

Inspection

1. Wash all parts in solvent and air dry.
2. Inspect all parts for wear, cracks or broken teeth.
3. Replace all "O" rings during assembly.



1. Spring Retainer Plate
2. Pressure Spring
3. Inner Clutch Ring and Bushing Assembly
4. Axle Shaft Sleeve and Clutch Ring Assembly
5. Outer Clutch Retaining Ring
6. Internal Snap Ring
7. "O" Ring
8. Retaining Plate
9. Retaining Plate Bolts and Seals
10. Actuator Knob
11. Axle Shaft Snap Ring
12. "O" Ring
13. Actuating Cam Body

Fig. 24—Hub Assembly — K-10

Assembly

1. Place new "O" ring seal on actuator knob. Apply lubri-plate to "O" ring and place actuator knob in retaining plate.

Installation

All parts should be lubricated during assembly to prevent deterioration before the unit is put into service.

1. Install spring retainer plate (flange side facing bearing) over spindle nuts and seat retainer against bearing outer cup.
2. Install pressure spring into position. Large O.D. seats against spring retaining plate.

   NOTE: Spring is an interference fit. When spring is seated, spring extends past the spindle nuts by approximately 7/8".

3. Place inner clutch ring and bushing assembly into axle shaft sleeve and clutch ring assembly and install as an assembly onto the axle shaft. Press in on assembly and install axle shaft snap ring.

   NOTE: Install 7/16 x 20 bolt in axle shaft end and pull outward on axle shaft to aid in installing snap rings.

4. Install actuating cam body (cams facing outward), outer clutch retaining ring and internal snap ring.
5. Install "O" ring on retaining plate and install actuating knob and retaining plate.

   NOTE: Install actuating knob with knob in "LOCK" position - - grooves in knob must fit into actuator cam body.

Fig. 25—Hub Key Position — Typical

6. Install six cover bolts and seals.
7. Turn knob to "FREE" position to check for proper operation.
8. Lower vehicle to floor.

FREE-WHEELING HUB

K20 Series

Removal

1. Place vehicle on hoist and raise hoist.
2. Turn hub key knob to the "FREE" position.
3. Remove allen head bolts securing the retainer cap assembly to the wheel hub.
4. Pull off the hub cap assembly and gasket; also remove exterior sleeve extension housing and gasket.
   Disassembly of Locking Hub Cap Assembly.
   a. Turn hub key knob to locked position.
   b. Drive out key knob retainer roll pin.
   c. Remove outer clutch gear assembly.
   d. Remove lock ring and remove slotted adjustment sleeve.
   e. Remove spring.
   f. Remove lock ring securing the plastic key knob to the hub retainer cap.
   g. Remove "O" ring from the plastic hub key knob.
5. Remove snap ring from end of axle shaft.
6. Pull internal clutch gear and collar.

Inspection

1. Discard all seals, gaskets and "O" rings.
2. Wash all parts in solvent and air dry.
3. Inspect all parts for wear, cracks for broken teeth and replace as necessary.
4. Replace all seals gaskets and "O" rings.

Installation

1. Install internal clutch gear collar and gear.
2. Install lock ring at end of axle shaft.
3. Assembly of Locking Hub Cap Assembly.

a. Use "O" ring lube and install the new "O" ring in the groove of the plastic hub key knob and insert into retainer cap.
b. Install the lock ring securing the plastic key knob to the hub retainer cap.

NOTE: Check to see that lock ring is fully engaged into slot by pushing outward on the plastic knob.

c. Install the slotted adjustment sleeve with the two tabs facing downward.
d. Install the key knob retaining roll pin with knob in "LOCKED" position.
e. Install spring.
f. Place outer clutch gear assembly on top of spring, compress spring and install lock ring at sleeve end.
g. Turn key knob to "FREE" position.

NOTE: Before continuing to install the extension housing and the assembled cap assembly, remove the head from a 3/8" bolt 5 inches long and use to align the assembly of parts to the hub.

4. Install above noted bolt alignment tool into one of the hub housing bolt holes.
5. Install the new exterior sleeve extension housing gasket and housing and the new hub retainer cap assembly gasket and cap assembly.
6. Install allen head bolts securing the retainer cap assembly to the wheel hub. Torque to specifications.
7. Turn hub key knob to the locked position to assure engagement into position.
8. Install wheel and tire assembly and lower vehicle to floor.

FRONT AXLE ASSEMBLY (Refer to Fig. 26)

Removal

1. Disassemble propeller shaft from front axle differential.
2. Raise front of vehicle on hoist until weight is removed from front springs. Support truck with jack stands behind front springs.
3. Disconnect connecting rod from steering arm.
4. Disconnect brake hoses from frame fittings.
5. Disconnect shock absorbers from axle brackets.
6. Dismount "U" bolts from axle to separate axle from truck springs.
7. Roll front axle out from under the truck.

Installation

CAUTION: <u>All spring attachments, including center bolts, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.</u>

1. Truck should be on jack stands as in Step 2 of removal instructions.
2. Place axle in position under truck.

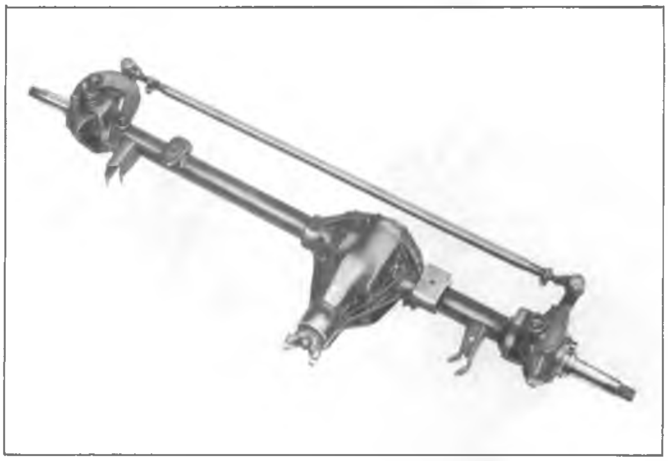


Fig. 26—Front Drive Axle

3. Install "U" bolts attaching axle to front springs.
4. Attach shock absorbers to axle brackets.
5. Connect brake hoses to frame fittings.
6. Attach connecting rod to steering arm.
7. Remove jack stands and lower front of truck.
8. Assemble propeller shaft to front axle differential.
9. Lower vehicle to floor.

Disassembly

NOTE: Refer to K10 or K20 free wheeling hub for removal of 4-wheel drive units with a free wheeling hub assembly, before starting the disassembly of the front axle assembly.

1. Securely mount the axle assembly in a suitable holding fixture.
2. If the vehicle is not equipped with RPO F76 freewheeling hubs, remove the hub cap and snap ring.
3. Remove the drive gear and pressure spring. Place a

Fig. 27—Removing Bearing Cups

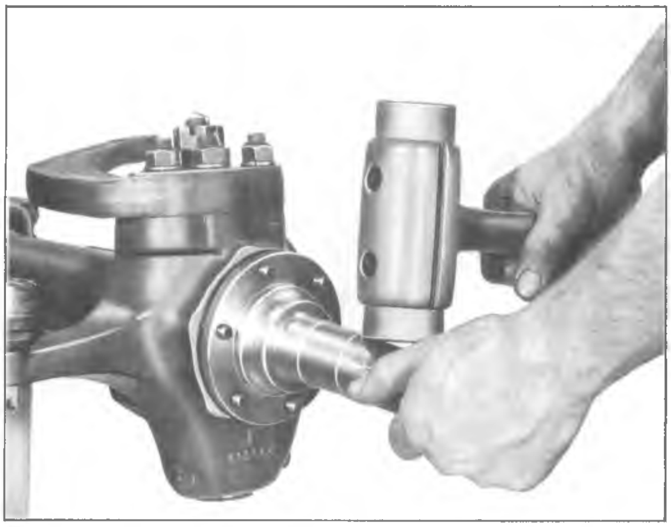


Fig. 28—Removing Spindle and Thrust Washer

hand over the drive gear and use a screwdriver to pry the gear out.

4. Remove the wheel bearing outer lock nut, lock ring, and wheel bearing inner adjusting nut using Tool J-6893 and Adapter J-23446.
5. Remove the disc assembly, outer wheel bearing and the spring retainer plate.

NOTE: If the disc or other brake components require repairs or replacement, refer to Section 5.

Disassemble Wheel Hub Components (Fig. 27)

a. Remove the oil seal and inner bearing cone from the hub using a brass drift and tapping with a hammer. Discard the oil seal.
b. Remove the inner and outer bearing cups using a brass drift and hammer.

6. Remove the spindle retaining bolts.
7. Remove the spindle and bronze thrust washer by tapping the end of the spindle lightly with a soft hammer to break it loose from the knuckle as shown in Figure 28. Discard the thrust washer if any wear has occured.

Disassemble Spindle Components:

a. Secure the spindle in a vise by locating on the high step diameter. Be sure that the machined surface of the spindle will not be damaged by the vise jaws.
b. Remove the oil seal and bearing spacer.
c. Remove the needle roller bearing.

8. Remove the axle shaft and joint assembly.

Repair The Axle Joint Components:

a. Remove the lock rings after removing pressure from the trunnion bearings by squeezing the ends of the bearing in a vise.
b. Support the shaft yoke in a bench vise or on a short length of pipe.
c. Using a brass drift and a soft hammer, drive on end of one trunnion bearing just far enough to drive opposite bearing from yoke.
d. Support the other side of the yoke in the vise and drive the other bearing out by tapping on the end of the trunnion using a brass drift.
e. Remove trunnion.
f. Clean and inspect bearings. Lubricate with a high

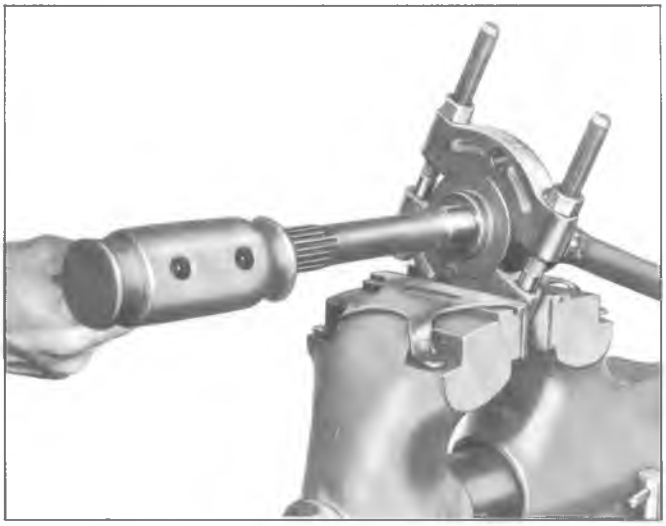


Fig. 29—Removing Axle Slingers

melting point wheel bearing type grease.

g. Replace trunnion and press new or relubricated bearings into yoke and over trunnion hubs far enough to install lock rings.
h. Hold trunnion in one hand and tap yoke lightly to seat bearings against lock rings.

9. Remove axle slingers by placing into a vise and tapping off as shown in Figure 29 or using a press.

NOTE: If spindle seals will be replaced, also replace the axle shaft slingers.

10. To remove the tie rod:
    a. Remove cotter pins.
    b. Loosen tie rod nuts and tap on nut with a soft hammer to break the studs loose from the knuckle arm.
    c. Remove nuts and disconnect the tie rod.

NOTE: If it is necessary to remove the steering arm, discard the three self-locking nuts (fig. 30) and replace with new nuts at assembly.

11. Remove the cotter pin from the upper ball socket nut.
12. Remove the retaining nuts from the upper and lower ball sockets as shown in Figure 31.

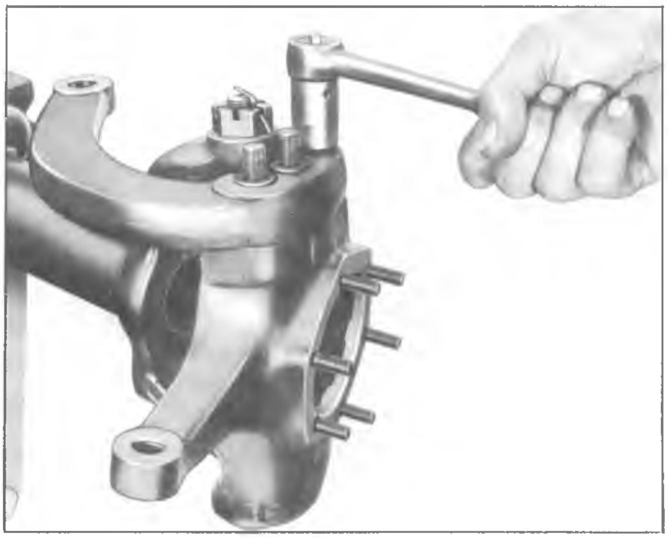


Fig. 30—Removing Steering Arm Nuts

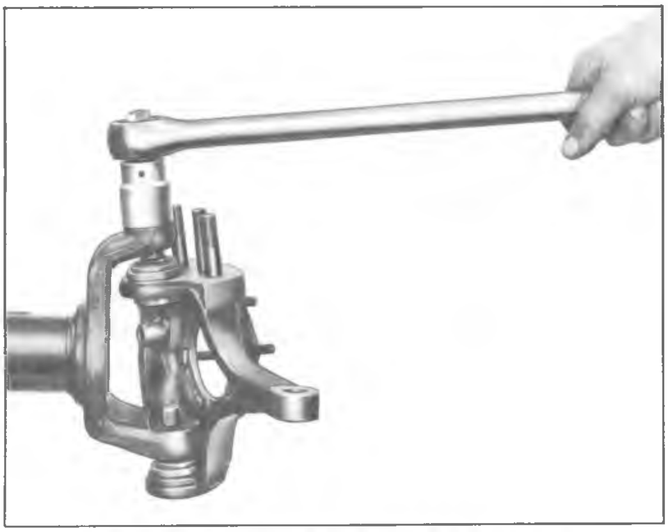


Fig. 31—Removing Ball Socket Retaining Nut

13. Remove the knuckle assembly from the yoke by inserting a suitable wedge-shaped tool between the lower ball stud and the yoke and tapping on the tool to release the knuckle assembly. Repeat as required at the upper ball stud location.

CAUTION: Do not remove the yoke upper ball stud adjusting sleeve unless new ball studs are being installed. If it is necessary to loosen the sleeve to remove the knuckle, do not loosen it more than two threads using Spanner J-23447 as shown in Figure 32. The nonhardened threads in the yoke can be easily damaged by the hardened threads in the adjusting sleeve if caution is not used during knuckle removal.

14. Remove the upper and lower ball sockets from the knuckle using Holder J-9519-10 and Adapter J-23454-1 as a forcing screw.

NOTE: Remove the lower ball joint snap ring before beginning.

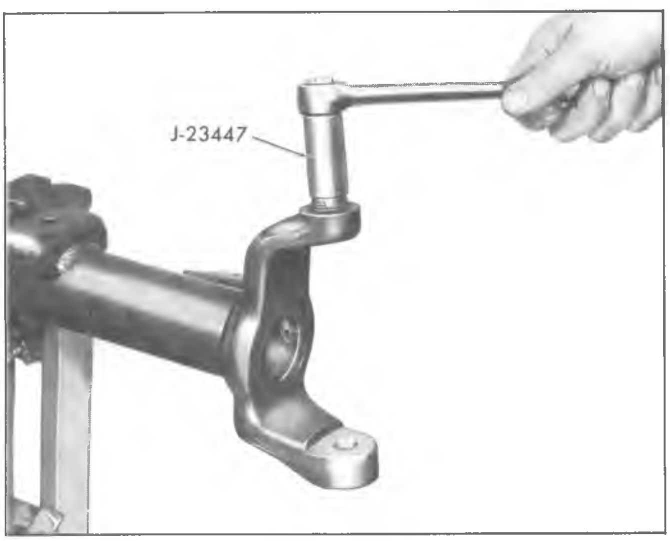


Fig. 32—Loosening Ball Stud Adjusting Sleeve

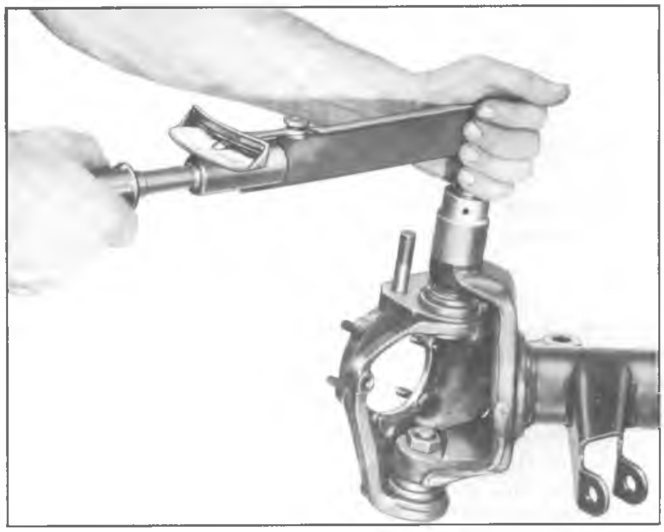


Fig. 33—Torquing Upper Ball Socket Nut

Assembly

1. Install the lower ball socket into the knuckle. Place the knuckle onto holder J-9519-10 in the vise using Adapter J-23454-2. Be sure that the lower socket (the socket without the cotter pin hole in the stud end) is straight. Force knuckle onto ball socket until properly seated. Install the lower ball joint snap ring.

   NOTE: Install new ball stud adjusting sleeves whenever new ball studs are installed.

2. Follow the same procedure as in Step 1 to install the upper ball socket to the knuckle.
3. Position the knuckle and sockets to the yoke. Install new nuts finger tight to the upper (the nut with the cotter pin slot) and lower ball socket studs.
4. Push up on the knuckle (to keep the ball socket from turning in the knuckle) while tightening the lower socket retaining nut. Torque lower nut to 70 ft. lbs.
5. Torque the yoke upper ball stud adjusting sleeve to 50 ft. lbs. using Spanner J-23447.
6. Torque the upper ball socket nut to 100 ft. lbs. as shown in Figure 33. After torquing the nut, do not loosen to install cotter pin, apply additional torque, if necessary, to line up hole in stud with slot in nut.

Replacement of Knuckle Assembly

NOTE: In the event that knuckles are received with the sockets and snap ring assembled, along with the bottom torque prevailing nut, top castilation nut, split sleeve and cotter key, it is recommended that after all of the old parts are removed from the yoke, the steps listed below are to be followed for assembly of the knuckle to the yoke:

1. Assemble knuckle to yoke. Assemble bottom torque prevailing nut. Torque nut to 70-90 ft. lbs.
2. Note: If the stud turns while attempting to torque this nut, assemble the top nut and tighten till it is snug. This will pull the bottom stud into the tapered hole of the yoke and will prevent it from turning while torquing up the nut. After you have applied the 70-90 ft. lbs. Remove the top nut. Only use this method when necessary.

3. Assemble Sleeve. Torque sleeve to 50 ft. lbs. using Spanner J-23447.
4. Assemble top nut. Torque nut to 100 ft. lbs. Tighten nut to line up the hole of the stud to the next castilation on slot of the nut. Note: Do not loosen nut to install cotter pin, apply additional torque, if necessary, to line up hole in stud with slot in nut.
5. Assemble cotter key.
6. Assemble remaining wheel end parts.

If Tie Rod and Steering Arm Were Removed:

a. Assemble the steering arm using the three stud adapters and three new self-locking nuts. Torque the nuts to 90 ft. lbs.
b. Assemble the tie rod to the knuckle arm. Torque the tie rod nuts to 45 ft. lbs. and install cotter pin.

7. Using the outer wheel bearing spindle nut as an installer, assemble the inner axle slinger (yoke side) to the shaft. Place spindle nut in a vise and the slinger over the end of the shaft. Tap on the end of the shaft with a soft hammer until the slinger is fully seated.
8. Assemble the outer axle slinger (spindle side) to the shaft using one of the wheel spindles as a starting guide.

NOTE: Do not use spindle as a pressing or driving tool. Also, use care not to damage spindle seal surface on slinger.

Assemble Spindle Components:

a. Place the spindle in a vise on the high step and install needle roller bearing using Installer J-23445 and Drive Handle J-8092.
b. Install grease seal into spindle using Installer J-23448 and Drive Hammer J-8092.
c. Relubricate the needle bearing and the lip of the oil seal with a high melting point wheel bearing type grease.

9. Assemble axle shaft and joint assembly (see "To repair the axle joint components" on Page 3-16) and install in housing.
10. Install the bronze thrust washer over the axle shaft and install the spindle as shown in Figure 34.
11. Assemble spindle to knuckle.

NOTE: Torque spindle nuts to 45 ft. lbs.

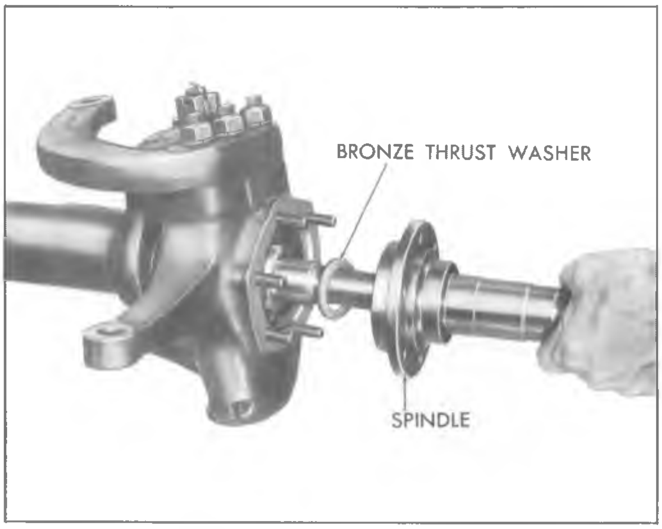


Fig. 34—Installing Spindle and Thrust Washer

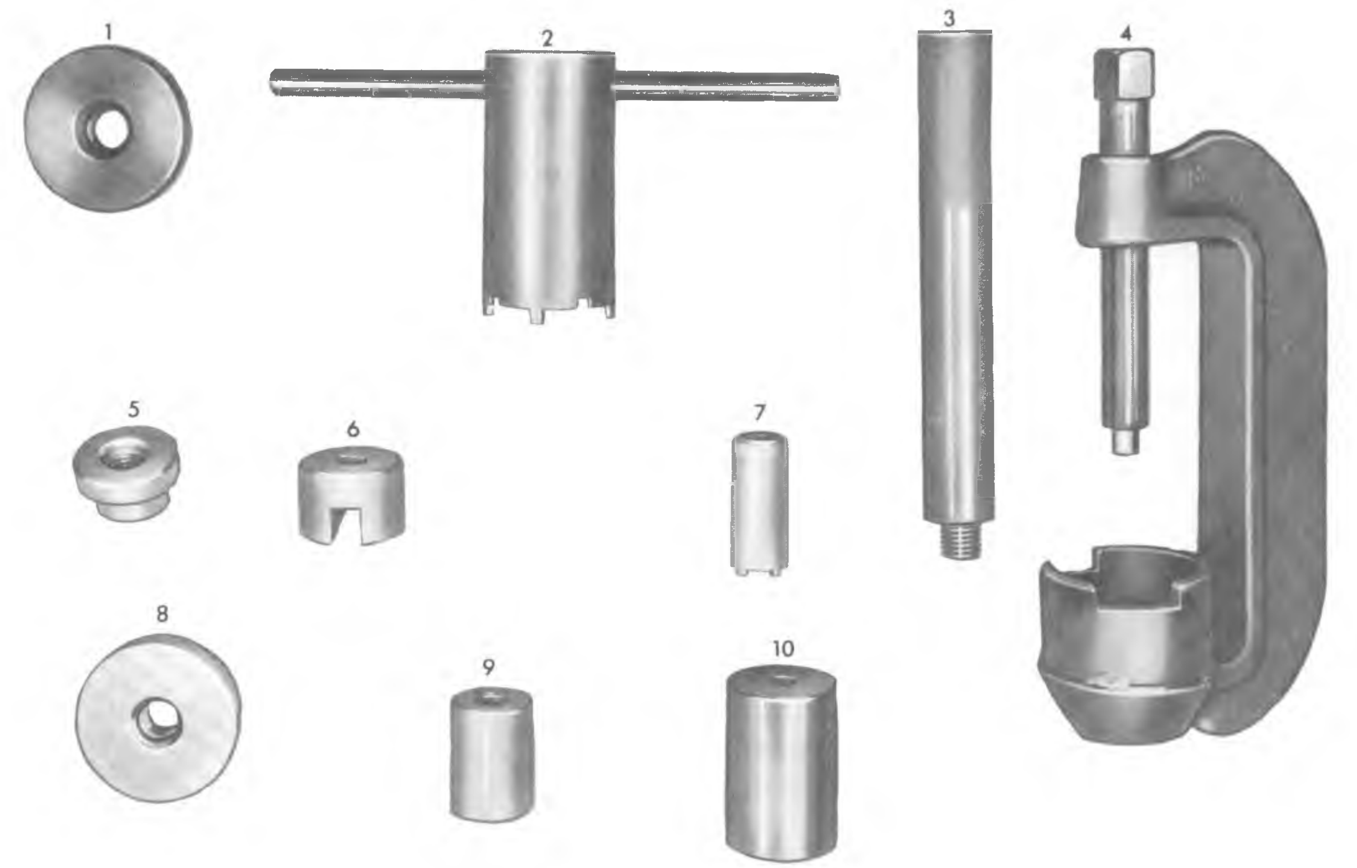
Assemble Wheel Hub Components (Wheel Bearing Adjustment)

a. Assemble the outer wheel bearing cup into the wheel hub using Installer J-6368 and Driver Handle J-8092.
b. Assemble the inner wheel bearing cup into the wheel hub using Installer J-23448 and Driver Handle J-8092.
c. Pack the wheel bearing cone with a high melting point wheel bearing type grease and insert the cone into the cup.

12. Install the disc and the outer wheel bearing cone to the spindle. Torque the inner adjusting nut to 50 ft. lbs. (while rotating hub) to seat the bearings using Tool J-6893 and Adapter J-23446. Back off the inner adjusting nut and retorque to 35 ft. lbs. while the hub is being rotated.
14. Back off the inner adjusting nut again 1/4 turn maximum. Assemble lockwasher by turning nut to nearest hole in lockwasher. Install outer lock nut and torque to 50 ft. lbs. (minimum).

NOTE: Hub assembly should have .001 to .010 inch end play.

15. If vehicle is not equipped with free-wheeling hubs, install the hub cap assembly. If the vehicle is equipped with free-wheeling hubs, refer to free-wheeling hub assembly and installation procedures.



1.	J-6368	Bearing Race Installer	6.	J-23446	Bearing Adjuster Adapter
2.	J-6893	Bearing Installer	7.	J-23447	Adjusting Sleeve Spanner
3.	J-8092	Driver Handle	8.	J-23448	Cup and Seal Installer
4.	J-9519	"C" Clamp	9.	J-23454-1	Ball Joint Remover/Installer
5.	J-23445	Bearing Installer	10.	J-23454-2	Ball Joint Remover/Installer

Fig. 35—Special Tools — 4 Wheel Drive

SECTION 4

REAR SUSPENSION AND DRIVE LINE

CONTENTS OF THIS SECTION

REAR SUSPENSION

INDEX

COMPONENT PARTS REPLACEMENT

SHOCK ABSORBER (Fig. 1 and 2)

Replacement

1. Raise vehicle on hoist.
2. If equipped with airlift shock absorber bleed air out of lines. Disconnect line from shock absorber.
3. Remove shock absorber pivot bolt nuts and washers; pull bolts and remove from vehicle.
4. Position eye at large end of shock absorber in frame bracket or crossmember, install bolt, washer and nut. If equipped with airlift shocks, install shock absorber with the air fitting pointed rearward.
5. Align opposite end of shock absorber with anchor bracket at axle, install bolt, washer and nut.
6. Tighten nuts to specifications.
7. If equipped with airlift shock absorbers, inflate to 10-15 lbs. minimum air pressure.
8. Lower vehicle and remove from hoist.

TIE ROD (SERIES C-P10 and C20) (Fig. 3)

Removal

1. Raise vehicle on hoist.

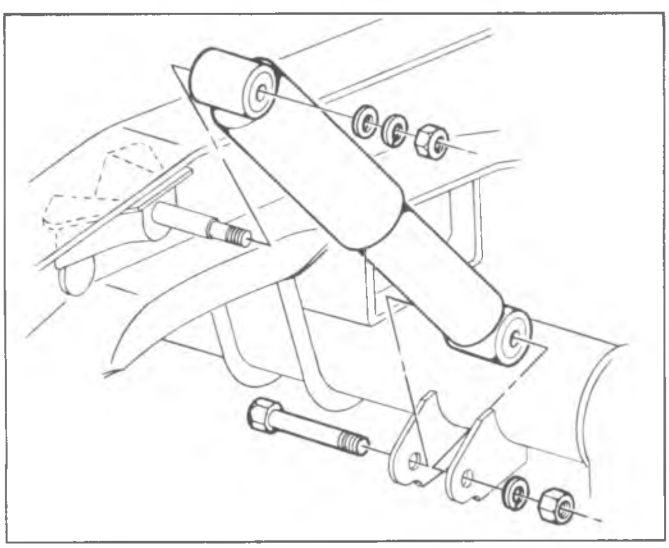


Fig. 1—Shock Absorber Installation—CP20, K10-20 Models

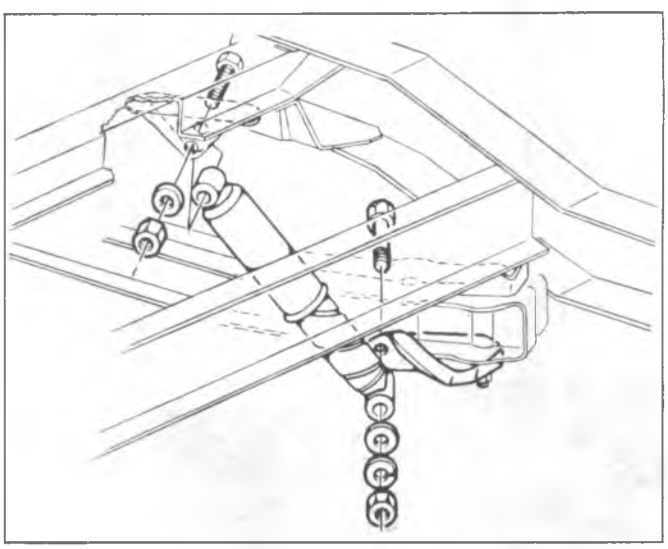


Fig. 2—Shock Absorber Installation—CP10 Models

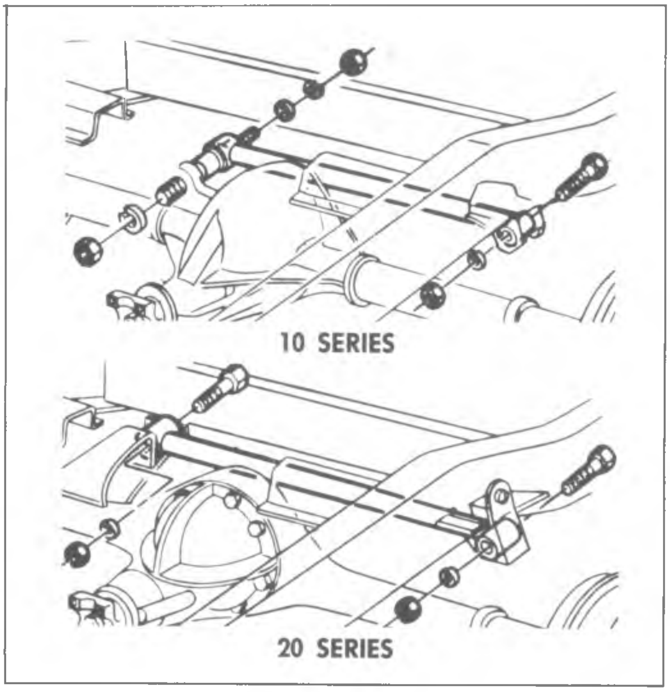


Fig. 3—Tie Rod Installation

2. Remove nuts and bolts from each end of rod and remove rod from vehicle.

Installation

NOTE: All tie rod attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

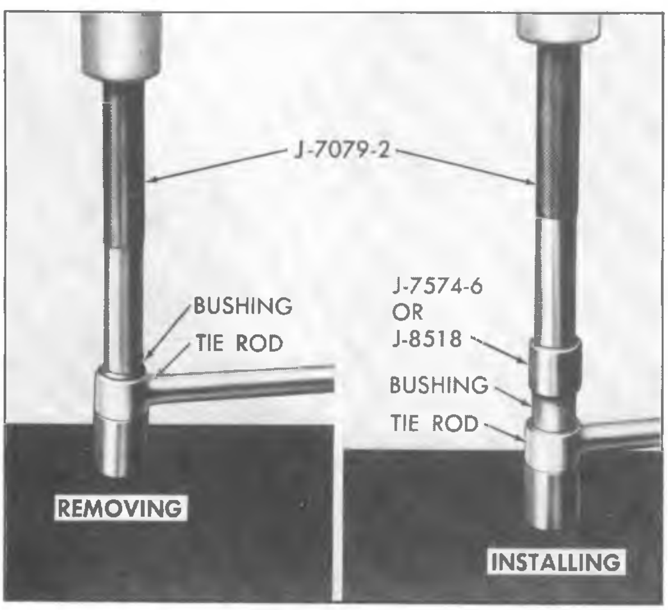


Fig. 4—Tie Rod Bushing Replacement (Series C-P10-C20)

1. Check rod for deformation by sighting down its length or by using straight edge. Minor defects may be removed by bending. A badly bent rod, however, should be replaced.
2. Bushings should be replaced if any abnormal conditions exists, such as looseness, damage to or swelling of rubber parts or general wear.
3. Lower vehicle and remove from hoist.

BUSHING

Replacement

1. Position end of rod on a suitable tube-type support as shown in Figure 4.
2. Press bushing from rod, using Tool J-7079-2.
3. Position new bushing over rod eye.
4. Using Tool J-8518 on Series C-P10 or Tool J-7574-6 on Series C20, place tool on bushing and press bushing into rod eye until tool contacts rod.

Installation

1. Position rod ends in mounting brackets at frame and axle, lining up holes with drift.
2. Insert pivot bolts and install nuts finger tight.
3. Let weight of unloaded vehicle rest on suspension and torque pivot nuts to specifications.

STABILIZER SHAFT (SERIES P30) (Fig. 5)

Removal

NOTE: If vehicle is to be raised during removal procedure, support axle assembly so that weight is not sustained by "U" bolts.

1. Remove the forward "U" bolt retaining nuts, and remove shaft anchors from ends of shaft.
2. Remove the frame-mounted shaft retaining brackets and withdraw shaft from the underside of vehicle.

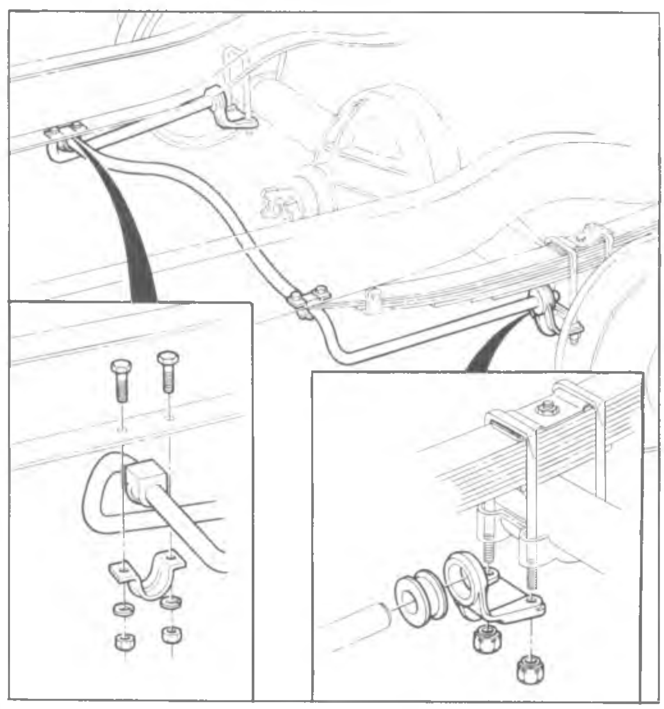


Fig. 5—Rear Stabilizer Shaft (Series P30)

Inspection

1. Position shaft on flat surface and check to see that shaft is parallel from side to side.
2. Inspect bushings for excessive wear and other damage. Replace parts as required.

Installation

1. Position shaft-to-frame bushings on shaft and position shaft to frame. Loosely install the shaft-to-frame retaining brackets.
2. Install bushings in shaft anchors, position shaft in anchors and loosely install anchors to "U" bolts.
3. Relieve tension on rear "U" bolts. Then alternately and evenly tighten nuts to specifications making sure that axle is properly positioned during nut tightening.
4. Align stabilizer shaft so that both ends protrude equally from the anchors. Alternately torque frame bracket retaining nuts to specifications.

CONTROL ARM (SERIES C-P10 and C20)

Removal

1. Raise vehicle on hoist. Allow axle to hang free.
2. Support axle so that load is removed from springs. Place adjustable lifting device under lower control arm.
3. Remove spring clamp bolt from underside of control arm.
4. Remove "U" bolt nuts and separate shock absorber bracket from control arm. Separate control arm from "U" bolts and lower the rear of the arm (fig. 6).

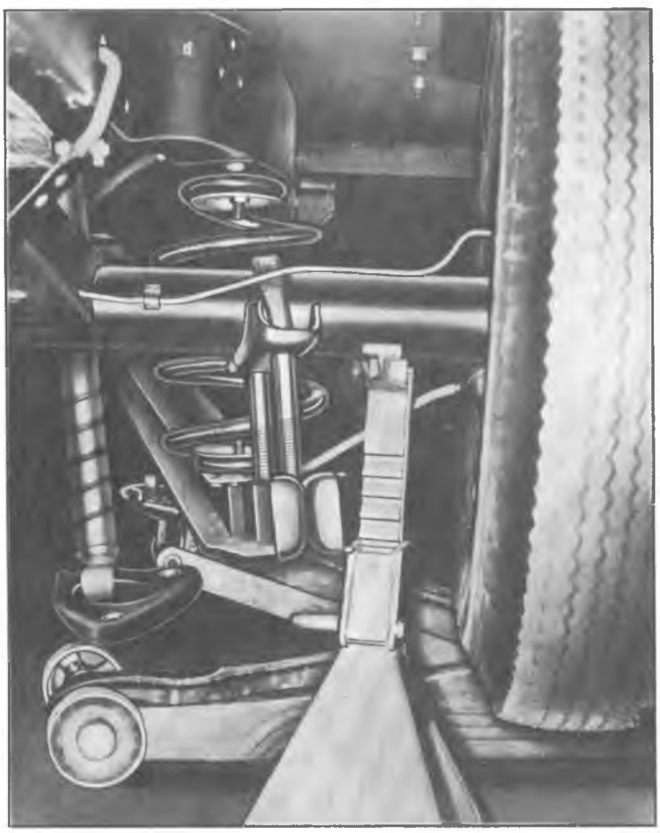


Fig. 6—Removing Control Arm Spring Clamp Bolt (Series C-P10-C20)

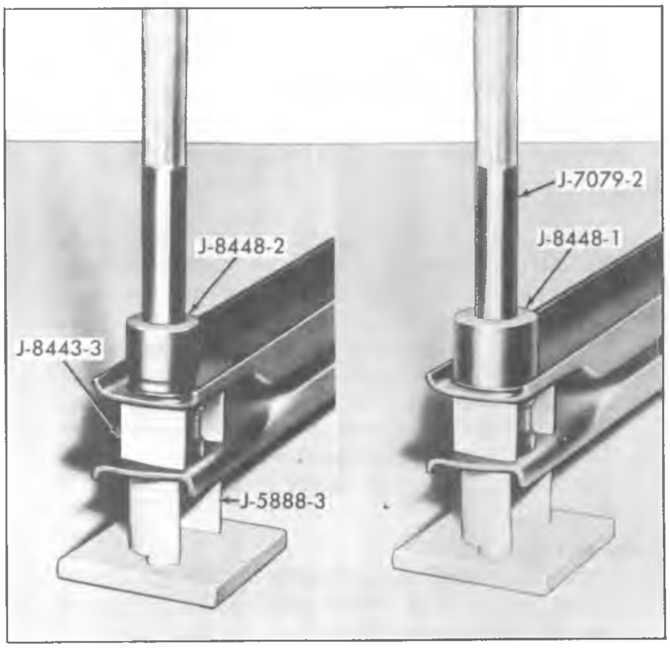


Fig. 7—Control Arm Bushing Replacement (Series C-P10-C20)

5. Disconnect parking brake lever at clip on bracket attachment on control arm.
6. Remove pivot bolt and remove arm from vehicle.

Bushing Replacement

1. Insert Tool J-8448-3 in fork of control arm astride bushing (fig. 7).
2. Rest bushed end of arm on Tool J-5888-3 with bushing flange centered in tool.
3. Place Tool J-8448-2 on top of bushing, indexing pin of tool in center hole of bushing and, using Tool J-7079-2 press bushing from arm.

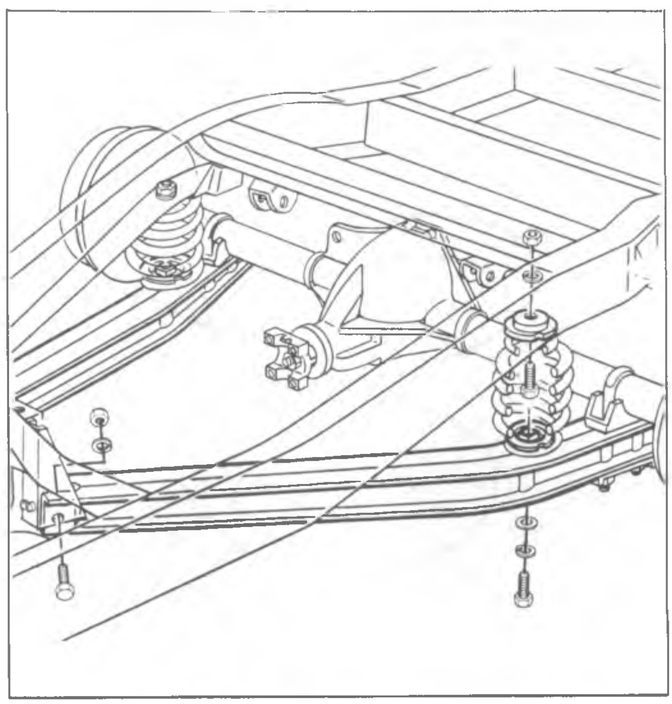


Fig. 8—Control Arm and Spring Details (Series C-P10-C20)

4. Support control arm just as in removing bushing, center new bushing flanged side up over control arm hole.
5. Place Tool J-8448-1 on top of bushing and, after carefully seating bushing in tool, press bushing into arm until flange contacts arm wall.

Installation

NOTE: All control arm attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

(Refer to Figure 8)

1. Position bushed end of control arm in pivot yoke between tunnel and frame, align holes with drift and insert pivot bolt. Place nut on bolt finger tight.
2. Position clamp inside spring as shown in Figure 9 so that it seats freely on spring end without any hang-up. Raise control arm to the spring then pass bolt, with flat washer installed, up through control arm and clamp. Install lock washer and nut. Torque to specifications.
3. Place arm adjacent to axle. Pass "U" bolt over axle and through holes in arm.
4. Place shock absorber bracket on ends of "U" bolt, install nuts and torque to specifications.
5. Put full weight of unloaded vehicle on the front and rear suspension, torque control arm pivot bolts to specifications.
6. Lower vehicle and remove from hoist.

COIL SPRING AND AUXILIARY LEAF SPRING (Series C-P10 and C20)

Removal

Coil Spring

1. Raise vehicle on hoist. Place adjustable lifting device under axle.

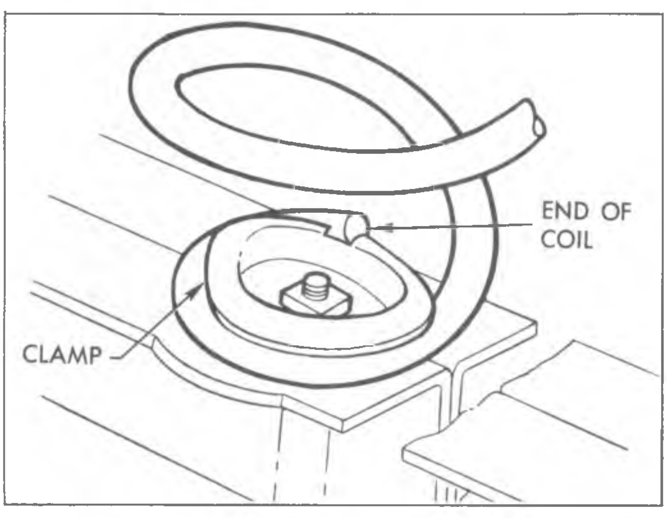


Fig. 9—Spring Clamp Installation (Series C-P10 and C20)

Fig. 10—Spring Removal (Series C-P10 and C20)

2. Remove shock absorber bolt from mounting bracket at control arm.
3. Remove upper and lower clamps from spring by backing out lower bolt from underside of control arm, and upper bolt from inside spring (fig. 10).
4. Lower control arm sufficiently to permit removal of spring.

Auxiliary Spring

1. The auxiliary spring is secured to the frame mounted retaining bracket by one retaining bolt. Before attempting to remove spring, make sure there is no load on spring and that spring leaf does not contact the control arm mounted bumper (fig. 11).
2. Remove cotter pin from spring retaining bolt then remove nut and remove spring from the frame bracket.
3. If auxiliary spring contact bumper is to be removed, support vehicle at rear axle, remove "U" bolts and remove bumper from its position on the control arm.

Installation

Coil Spring

1. Place spring clamp inside spring. Position clamp so that the end of the spring coil is within the area of

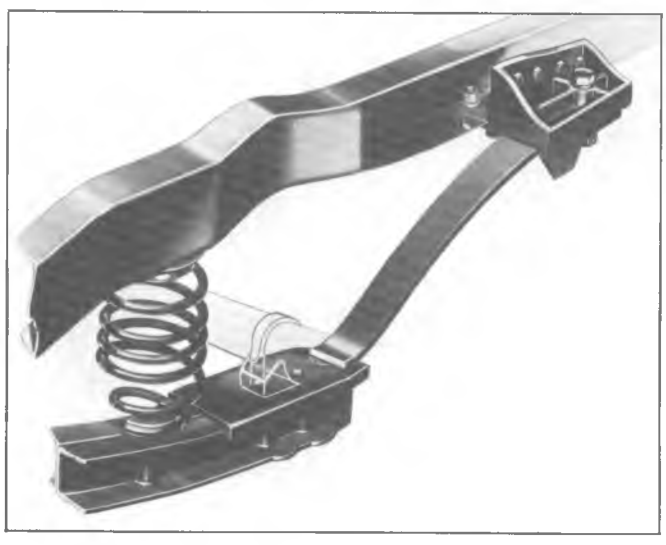


Fig. 11—Auxiliary Rear Spring (Series C10-20)

the notch as shown in Figure 9 so that it seats freely on spring end without any hang-up and locate over bolt hole in control arm.

2. Pass clamp bolt with washer up through hole in control arm and loosely install nut.
3. Position upper clamp inside spring and install bolt and washer. Torque nut to specifications.
4. Connect shock absorber to control arm bracket--torque nut to specifications.
5. Torque spring lower clamp bolt to specifications. Remove jack.
6. Lower vehicle and remove from hoist.

Auxiliary Spring

NOTE: All spring attachments, including center bolts, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

1. Position auxiliary spring bumper between the control arm and the axle housing. Align holes in spring bracket with those in the control arm; position shock absorber bracket to underside of control arm; install "U" bolt over axle and through auxiliary spring bracket control arm and shock absorber bracket; install and alternately torque "U" bolt retaining nuts to specifications.
2. Position auxiliary spring assembly in frame mounted bracket so that free end of spring is positioned above bumper and align spring-to-bracket bolt holes. Install bolt with washer through top side of bracket then install nut and washer to through bolt. Torque nut to 370 ft. lbs. and install cotter pin.

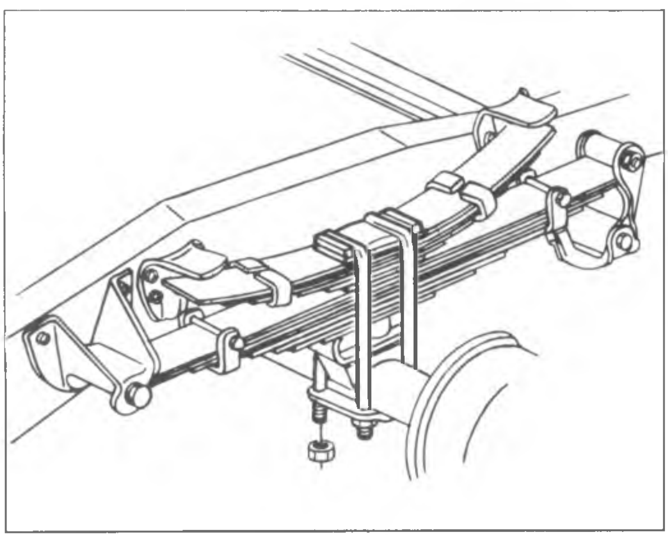


Fig. 12—Leaf Spring Installation—Series 30 11,000 lb. Axle with Auxiliary Spring Shown

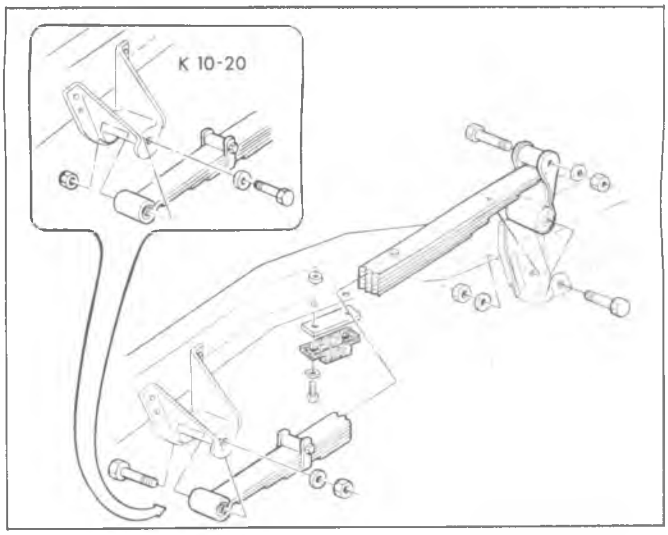


Fig. 13—Leaf Spring Installation (Series 10-20)

LEAF SPRING (Fig. 12, 13)

NOTE: All spring attachments, including center bolts, are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Raise vehicle on hoist so that tension in spring is relieved.
2. Loosen, but do not remove, spring-to-shackle retaining nut.
3. Remove nut and bolt securing shackle to spring hanger.

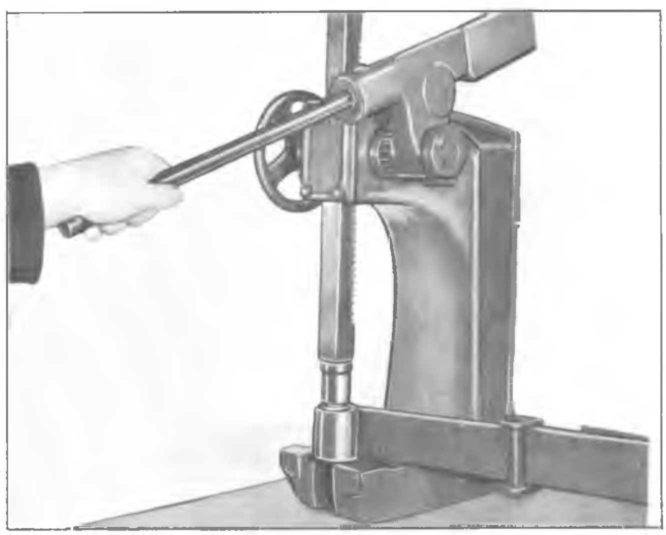


Fig. 14—Pressing Out Bushing

4. Remove nut and bolt securing spring to front hanger.
5. Remove "U" bolt retaining nuts, withdraw "U" bolts and spring plate from spring-to-axle housing attachment.
6. Withdraw spring from vehicle.
7. Inspect spring--replace bushings, repair or replace spring unit as outlined in this section.

BUSHING REPLACEMENT

1. Place spring on press and press out bushing using a suitable rod, pipe or tool (fig. 14).
2. Press in new bushing; assure that tool presses on steel outer shell of bushing.

SPRING LEAF

Replacement

1. Place spring assembly in a bench mounted vise and remove spring clips.
2. Position spring in vise jaws, compressing leaves at center and adjacent to center bolt.
3. File peened end of center bolt and remove nut. Open vise slowly to allow spring assembly to expand.
4. Wire brush and clean spring leaves. Inspect spring leaves to determine if replacement is required; also replace defective spring leaf liners at this time.
5. Align center holes in spring leaves by means of a long drift and compress spring leaves in a vise.
6. Remove drift from center hole and install a new center bolt—peen bolt to retain nut.
7. Align spring leaves by tapping with hammer, then bend spring clips into place or install bolts and spacer if so equipped.

NOTE: Spring clips should be bent sufficiently to maintain alignment, but not tight enough to bind spring action.

Installation

1. Position spring assembly on axle housing. Make sure spring is in position at both spring hangers.

NOTE: The shackle assembly must be attached to the rear spring eye before installing shackle to rear hanger (fig. 13).

2. Install spring retainer plate and "U" bolts--loosely install retaining nuts, but do not torque at this time.
3. Jack frame as required to align spring and shackle with spring hangers.
4. Install shackle bolt and nut and again reposition spring, if necessary to align front eye--install front eye bolt and nut.
5. Lower vehicle so that weight of vehicle is on suspension components and torque affected suspension parts to specifications.
6. Lower vehicle and remove from hoist.

SHACKLE REPLACEMENT

1. Raise vehicle on hoist. Place adjustable lifting device under axle.
2. Remove load from spring by jacking frame.
3. Loosen spring-to-shackle retaining bolt, but do not remove.
4. Remove shackle-to-frame bracket retaining bolt--then remove shackle bolt from spring eye (fig. 13).
5. Position shackle to spring eye and loosely install retaining bolt--do not torque retaining bolt at this time.
6. Position shackle to frame bracket and install retaining bolt.
7. Rest vehicle weight on suspension components and torque both shackle bolt retaining nuts to specifications.
8. Lower vehicle and remove from hoist.

DRIVE LINE

REAR AXLE

INDEX

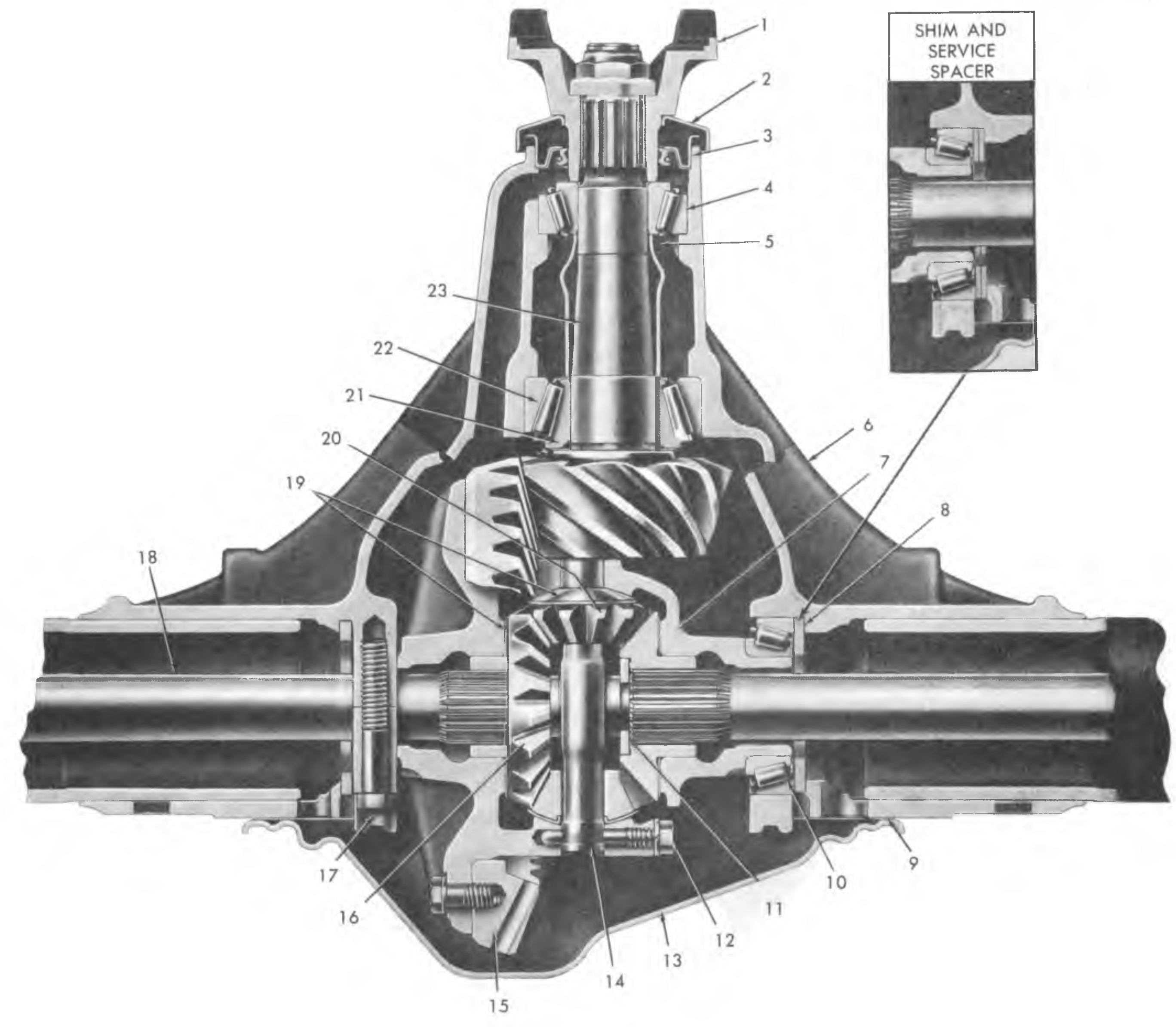
GENERAL DESCRIPTION

SERIES 10 3300 AND 3500 LB. CAPACITY (SALISBURY-TYPE) AXLES

The 3300, and 3500 lb. capacity (Salisbury-Type) axle (fig. 15) is a semifloating, fabricated constructed 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 to the carrier. Welded-on brackets provide attachment points for suspension components such as spring seats, shock absorbers and control arms. A welded flange is provided for brake flange plate attachment.

An 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.



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 (A) with Service 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

Fig. 15—Rear Axle Cross Section—3300, 3500 lb. Capacity—Series 10

The seal is mounted on the pinion 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 a two preloaded tapered roller bearings.

SERIES 20 5500 LB. CAPACITY AXLES (DANA)

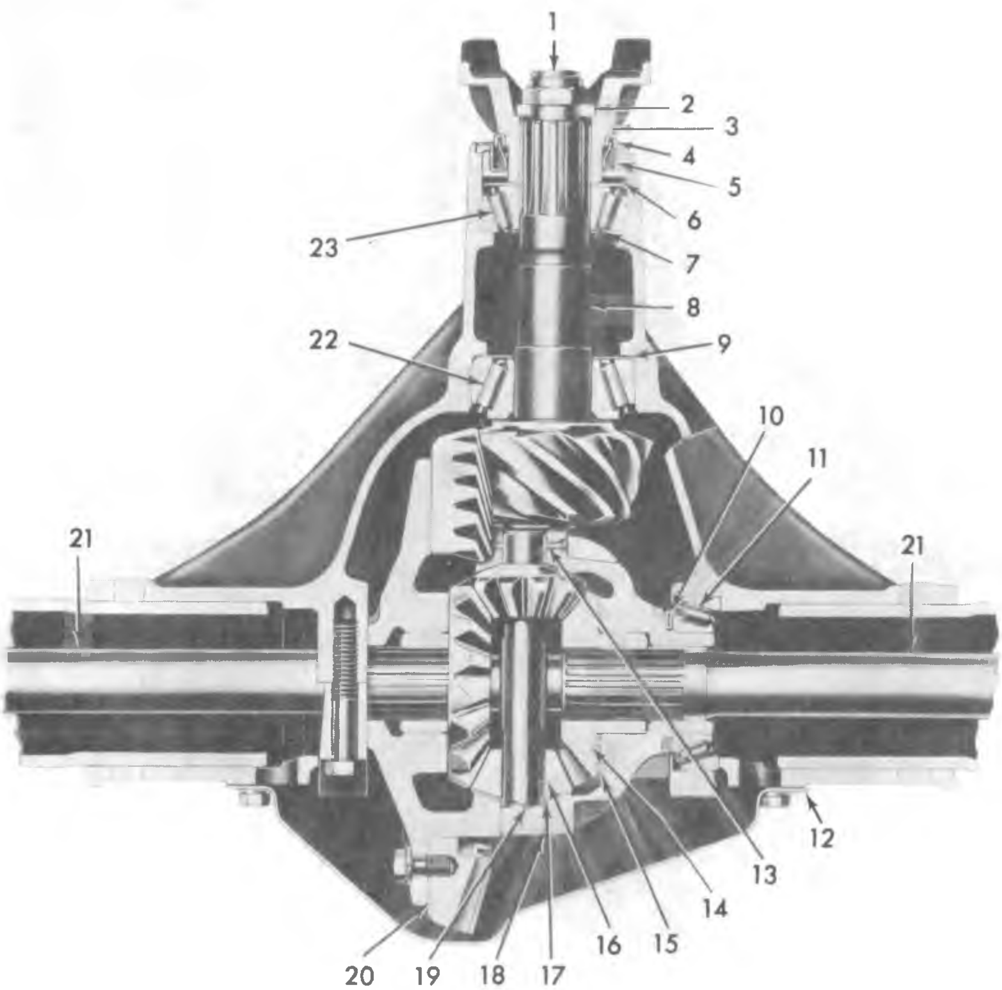
The 5500 lb. capacity axle is a Salisbury Design full floating axle. Their service procedures are a combination of Series 10 Salisbury axle procedures and Series 20-30, 5200, 5500 lb. capacity axle service procedures. Consequently, refer to Series 10, 3300 and 3500 lb. capacity axle service procedures for service on the differential such as pinion shaft oil seal and companion flange and to Series 20-30, 5200 - 7200 lb. capacity axles service procedures for service on wheel hubs, bearings, and axle shafts.

SERIES 20-30 5200 AND 7200 LB. CAPACITY AXLES

The 5200 and 7200 lb. capacity truck rear axles (fig. 16) are of the full floating type with hypoid ring gear and drive pinion. The full floating construction enables easy removal of axle shafts without removing truck load and without jacking up the axle. The differential carrier is heavily ribbed to provide rigid support for the differential assembly--differential caps are doweled to the carrier to assure perfect alignment.

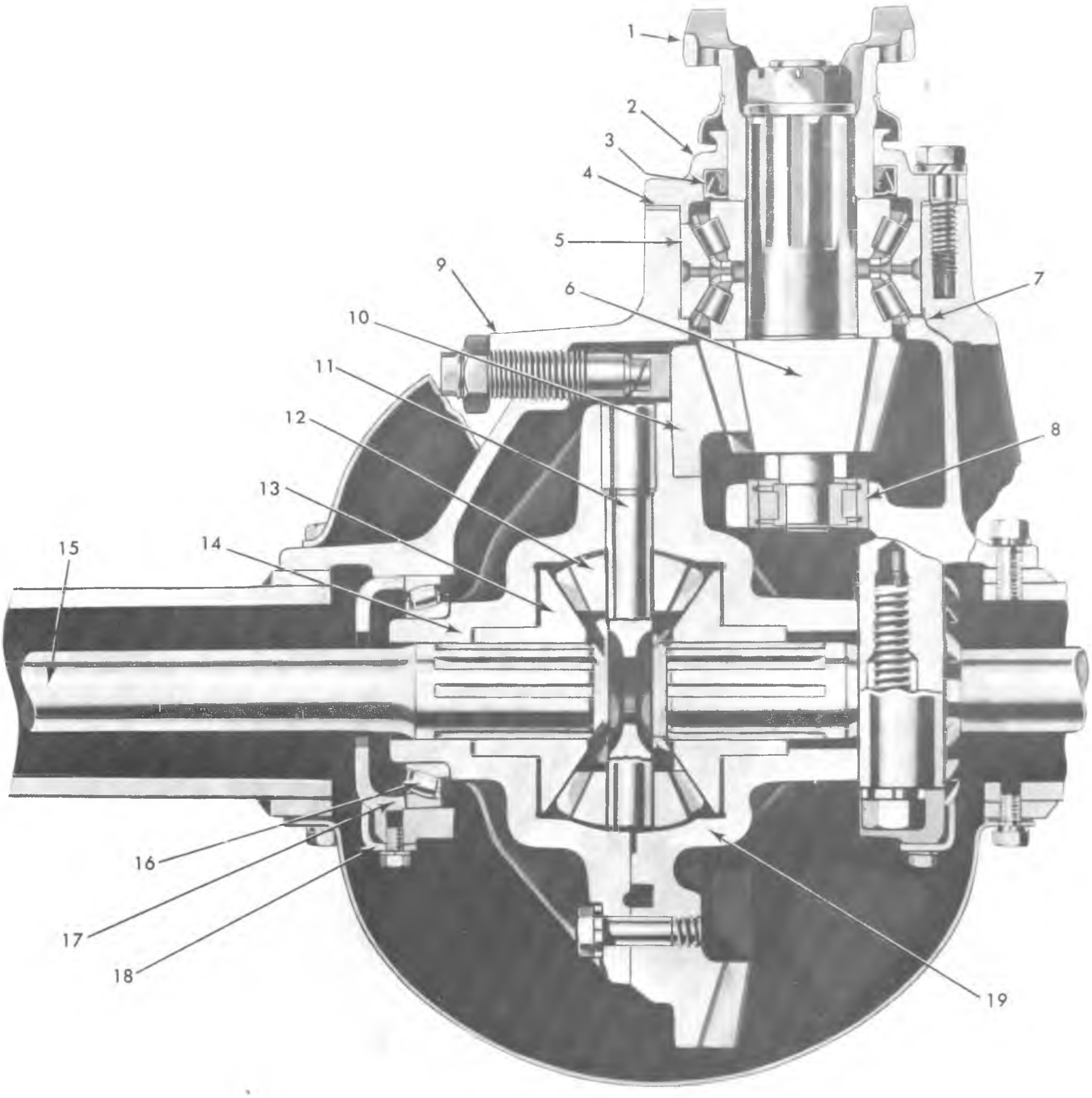
The straddle-mounted drive pinion is supported at the front by two opposed tapered roller bearings. The pinion rear bearing is a roller bearing assembly consisting of an outer race and roller assembly--a precision ground diameter on the pinion pilot functions as an inner race.

A thrust pad mounted on the end of an adjustable screw threaded into the carrier housing limits deflection of the ring gear under high torque conditions.



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

Fig. 15A—Dana 5500 lb. Capacity Axle—Cross Section



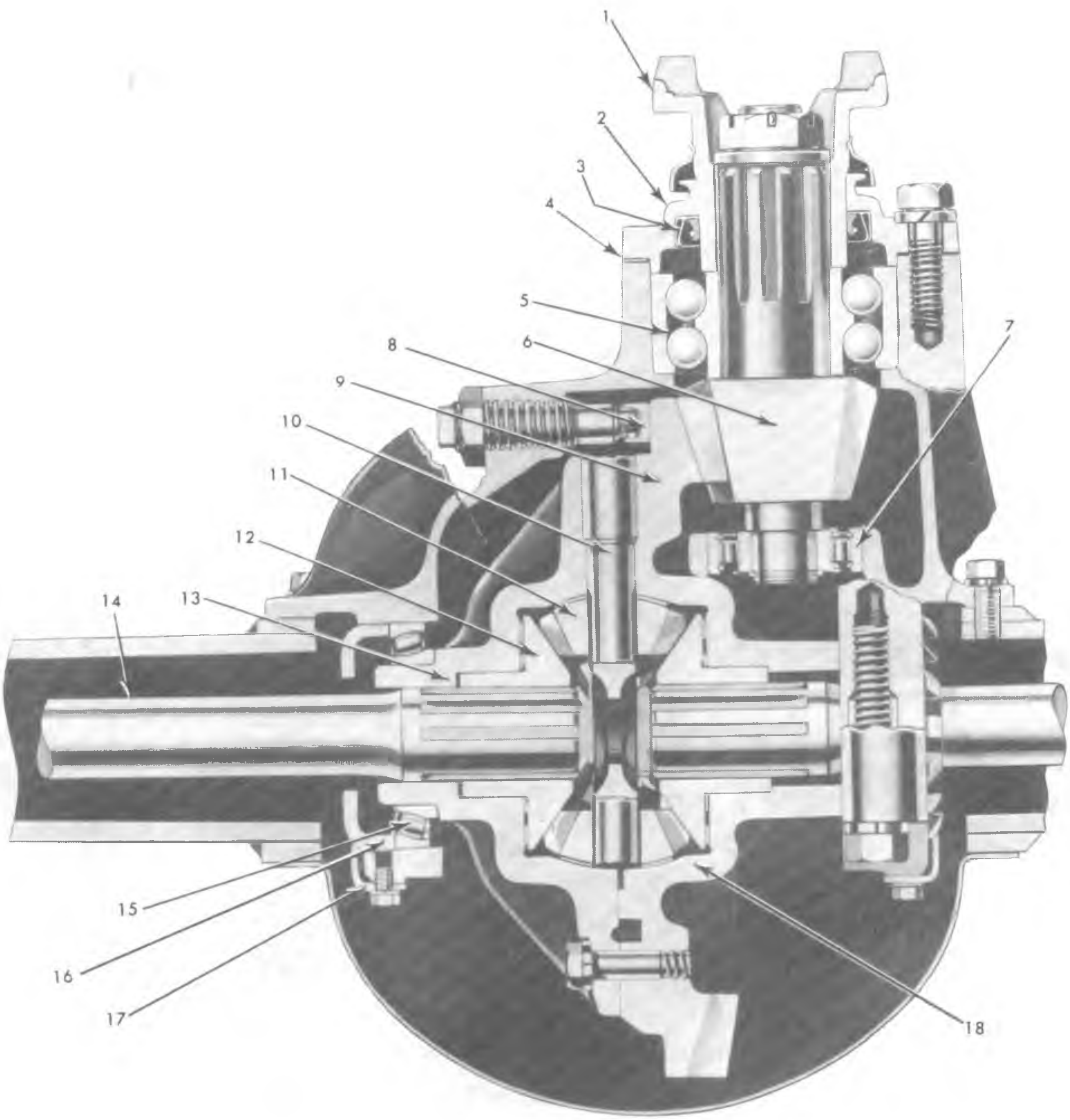
1. Universal Joint Yoke
2. Pinion Bearing and Oil Seal Retainer
3. Oil Seal
4. Gasket
5. Front Pinion Bearing
6. Drive Pinion
7. Pinion Bearing Shim
8. Rear Pinion Bearing
9. Ring Gear Thrust Pad
10. Ring Gear
11. Differential Spider
12. Differential Pinion (Spider) Gear
13. Differential Side Gear
14. Differential Case — Left Half
15. Axle Shaft
16. Differential Bearing
17. Differential Bearing Adjusting Nut
18. Adjusting Nut Lock
19. Differential Case — Right Half

Fig. 16—5200 and 7200 lb. Capacity Axle—Cross Section—Series 20-30

Basically the two axle assemblies are identical with the exception of drive gear ratios and brake assemblies; however, some vehicles utilize a two-pinion differential while others use a four-pinion differential.

11,000 LB. CAPACITY AXLES

The 11,000 lb. capacity, single-speed hypoid axle, illustrated in Figure 17 have a straddle mounted drive



1. Universal Joint Yoke
2. Pinion Bearing Oil Seal and Retainer
3. Oil Seal
4. Oil Seal Gasket
5. Front Pinion Bearing
6. Drive Pinion
7. Rear Pinion Bearing
8. Ring Gear Thrust Pad
9. Ring Gear
10. Differential Spider
11. Differential Pinion (Spider) Gear
12. Differential Side Gear
13. Differential Case - Left Half
14. Axle Shaft
15. Differential Bearing
16. Differential Bearing Adjusting Nut
17. Adjusting Nut Lock
18. Differential Case - Right Half

Fig. 17—11,000 lb. Capacity Axle Cross Section—Series 30

pinion which is supported at the rear by a straight roller bearing. The pinion front bearing consists of a double row ball bearing.

The differential is a conventional four-pinion type. Thrust washers are used between the side gears and case and also between differential pinions and the differential case.

A thrust pad mounted on the end of an adjusting screw threaded into the carrier housing limits deflection of the ring gear under high torque conditions.

Involute splines are incorporated in the axle shaft flange and in the wheel hubs.

This design provides for the driving torque to be transmitted from the axle shaft to the hub through the mating splines.

COMPONENT PARTS REPLACEMENT

SERIES 10 3300, 3500 LB. CAPACITY AXLES AND SERIES 20 5500 LB. CAPACITY AXLES

AXLE ASSEMBLY (EXCEPT 5500 LB. DANA AXLE)

Construction of the axle assembly is such that service operations may be performed with the housing installed in the vehicle or with the housing installed in a holding fixture. The following removal and installation procedure is necessary only when the housing requires replacement.

NOTE: All Axle attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Raise vehicle on hoist.
2. Support rear axle assembly with suitable lifting device, so that tension is relieved in springs, tie rod, and shock absorbers.
3. On vehicles so equipped, disconnect tie rod at axle housing bracket or at differential carrier.
4. Remove trunnion bearing "U" bolts from the axle companion flange, separate trunnion from flange, position propeller shaft to one side and tie it to frame side rail.

   NOTE: Secure trunnion bearings caps to trunnion, using masking tape or a large rubber band, to prevent loss of bearings.

5. Disconnect shock absorbers at lower attachment points and position out of the way.
6. Disconnect axle vent hose from vent connector and position vent hose to one side.
7. Disconnect hydraulic brake hose at connector on axle housing. Remove brake drum, disconnect parking brake cable at actuating levers and at flange plate. Refer to Section 5 for cable removal and brake details.
8. On vehicles so equipped, check coil springs to make sure that they are compressed; then on all vehicles, remove axle "U" bolt nuts, "U" bolts, spacers and clamp plates.
9. Lower axle assembly and remove from vehicle.

Installation

1. Position axle assembly under vehicle and align with springs or control arms as applicable.
2. Install spacer, clamp plate and "U" bolts to axle assembly, loosely install retaining nuts to "U" bolts.
3. Position shock absorbers in lower attachment brackets and loosely install nut to retain shock.
4. Connect axle vent hose to vent connector at carrier.
5. Connect hydraulic brake hose to connector on axle housing, connect parking brake cable to actuating levers. Install brake drum and wheel and tire assembly--bleed brakes and adjust parking brake as outlined in applicable portion of Section 5.
6. Reassemble the propeller shaft to companion flange, making sure that bearing caps are indexed in flange seat. Install the torque bearing cap retaining nuts to specifications.
7. Position vehicle so that weight is placed on suspension components and torque affected parts to specifications.
8. Lower vehicle and remove from hoist.

AXLE VENT

Replacement

The axle vent system consists of the vent connector, vent hose and associated attaching parts. When replacing vent hose make sure that it is routed along original path in such a manner that the hose is free from kinks or binds that would restrict air flow. In replacing the vent connector; pry old connector from carrier, being sure that entire connector is removed. Tap new connector into carrier with a soft-faced hammer, prick punch around edge of hole to insure fit of new connector (fig. 30).

AXLE SHAFT (EXCEPT 5500 LB. DANA AXLE)

Removal

1. Raise vehicle on hoist. Remove wheel and tire assembly and brake drum.
2. Clean all dirt and foreign material from area of carrier cover.
3. Loosen carrier cover-to-carrier bolts slightly to allow lubricant to drain from carrier. Remove carrier cover and gasket.
4. Remove the differential pinion shaft lockscrew and the differential pinion shaft (fig. 18).
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 at end of housing.

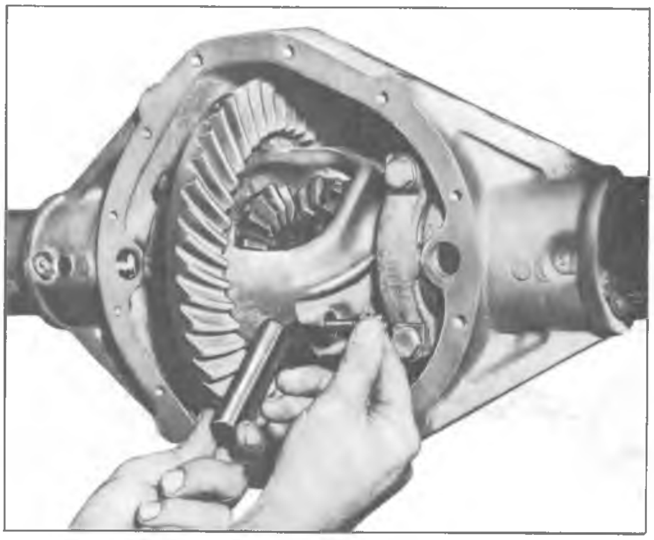


Fig. 18—Differential Pinion Shaft Removal

Oil Seal and/or Bearing (Except 5500 Lb. Dana)

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. Refer to Figure 19 for detail of seal and bearing installation.
2. Using Axle Shaft Bearing Remover J-22813-3 for light duty axles (10 bolt differential cover) or J-23689 for heavy duty axles (12 bolt differential cover) insert into bore so that tool grasps behind bearing (fig. 20). Slide washer against outside of seal (or bearing) and turn nut finger tight against washer. Attach Slide Hammer J-2619 and remove bearing and seal.
3. Back off nut and remove bearing and seal from tool.
4. Pack cavity between seal lips with wheel bearing lubricant and also lubricate new bearing with wheel bearing lubricant.

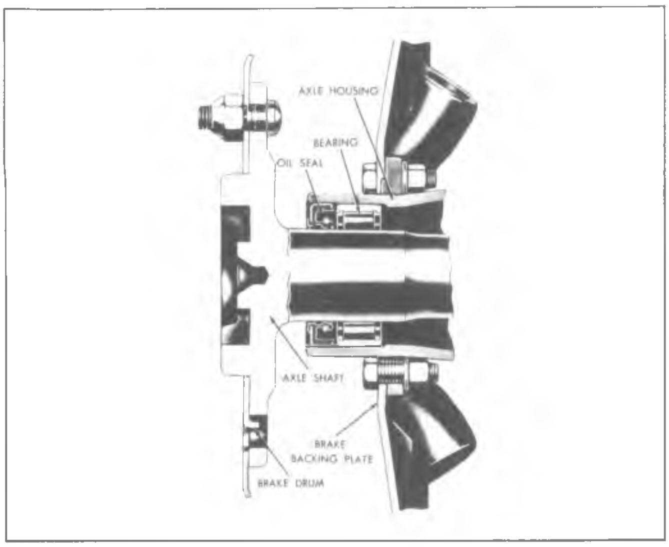


Fig. 19—Sectional View of Housing at Wheel Bearing

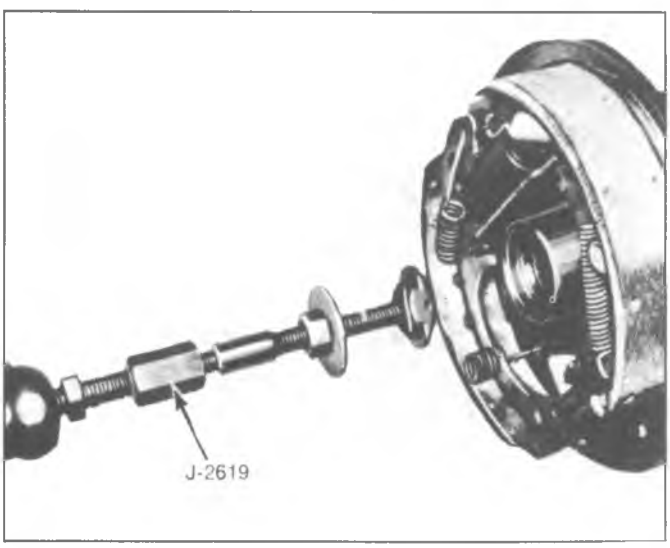


Fig. 20—Axle Shaft Bearing Removal

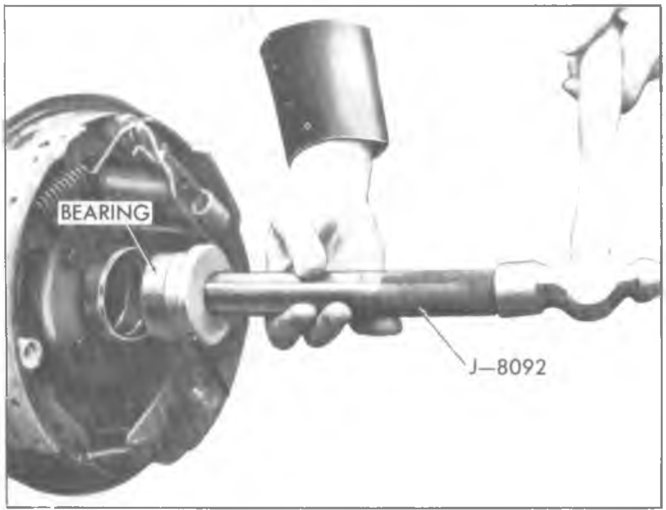


Fig. 21—Axle Shaft Bearing Installation

5. To install bearing, place on Tool J-23690 (heavy duty axle or J-23765 light duty axle), Bearing Installer, and, using J-8092 Drive Handle, drive bearing in bore until tool bottoms against end of tube (fig. 21). This tool installs bearing to a depth of .550" from end of tube.
6. To install seal, place seal on Tool J-21128 (heavy duty axle or J-23771 light duty axle) and drive into bore until tool bottoms against end of tube (fig. 21A). This tool installs the seal flush with end of tube.

Brake Flange Backing Plate (Except 5500 Lb. Dana Axle)

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 four nuts securing flange plate to axle housing (fig. 19).
3. Install new flange plate to axle housing and torque nuts to specifications.

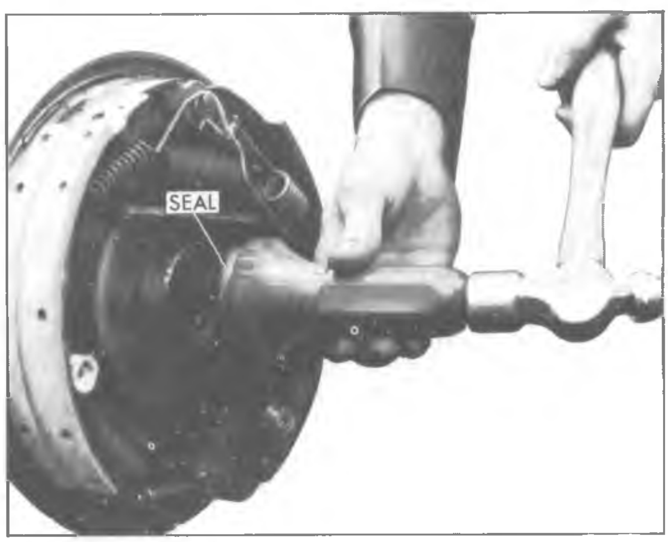


Fig. 21A—Seal Installation

NOTE: This brake backing plate to rear axle fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

4. Install brake components on flange and connect hydraulic line to wheel cylinder inlet. Refer to Section 5 for brake assembly procedure.
5. Bleed and adjust brakes as outlined in Section 5.

Axle Shaft 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 in case.
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 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 remove from hoist.

WHEEL BOLT REPLACEMENT (EXCEPT 5500 LB. DANA AXLE) (Fig. 22)

Removal

1. Raise vehicle on hoist allowing axle to hang freely

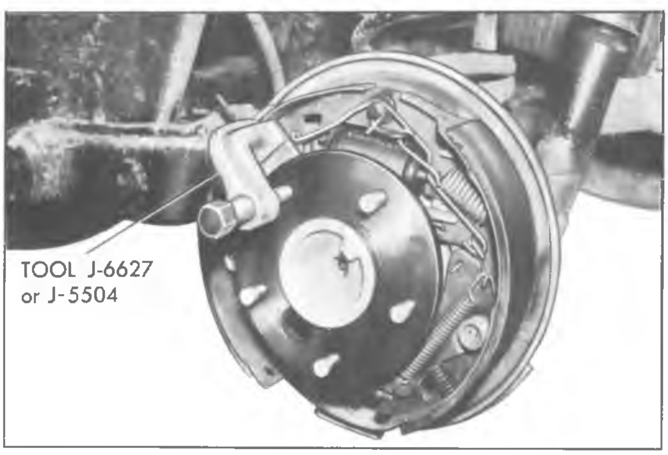


Fig. 22—Pressing Out Wheel Stud

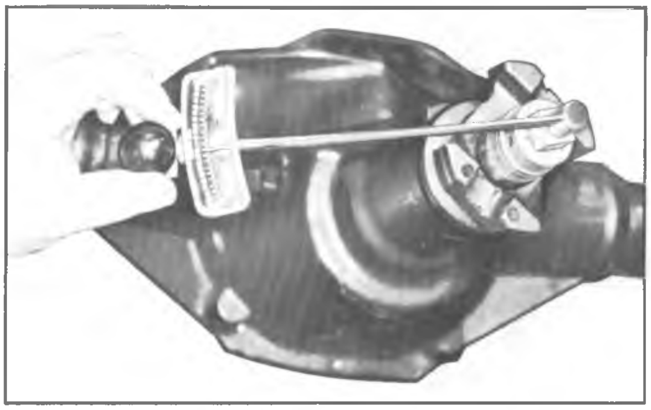


Fig. 23—Measuring Pinion Bearing Preload

2. Remove wheel and tire and brake drum.
3. Using Tool J-5504 or J-6627 press out stud.

Installation

1. Place new stud in axle flange hole. Slightly start stud serrations in hole by firmly pressing back of stud with your hand.
2. Install a lug nut with flat side first (tapered face outboard). Tighten on lug nut drawing stud into flange until stud head is bottomed on back side of flange.
3. Remove lug nut.
4. Reinstall brake drum and wheel and tire.
5. Lower vehicle and remove from hoist.

PINION FLANGE, DUST DEFLECTOR AND/OR OIL SEAL

Replacement

1. Raise vehicle on hoist. Allow axle to hang free.
2. Remove rear wheels and brake drums
3. Mark relationship of propeller shaft to companion flange. 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

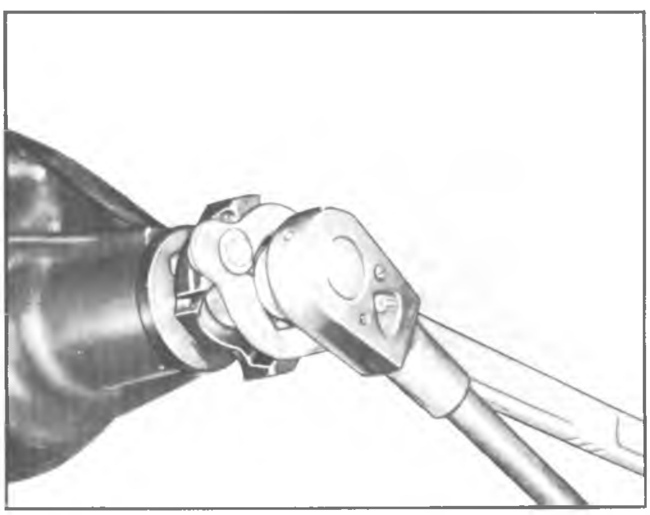


Fig. 24—Drive Pinion Nut Removal

torque required to keep the pinion turning (fig. 23). 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 (fig. 24). (Position J-8614-1 on flange so that the four notches are toward flange.) Discard nut and use a new one upon reassembly.
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. 25).
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 and place gauge plate J-22804-2 (light-duty axle) or J-22804-1 (heavy-duty axle) over seal and against seal flange. Gauge plate insures proper seating of seal in carrier bore.
11. Using Tools J-21468 and J-9458 for light-duty axle (fig. 26) and Tool J-21057 for heavy-duty axle (fig. 27) press and seal into carrier bore until gauge plate is flush with the carrier shoulder and seal flange. Turn gauge plate 180° from installed position; seal must be square in carrier bore to seal properly against pinion flange.
12. 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. 28). Remove J-9458 after flange is seated.

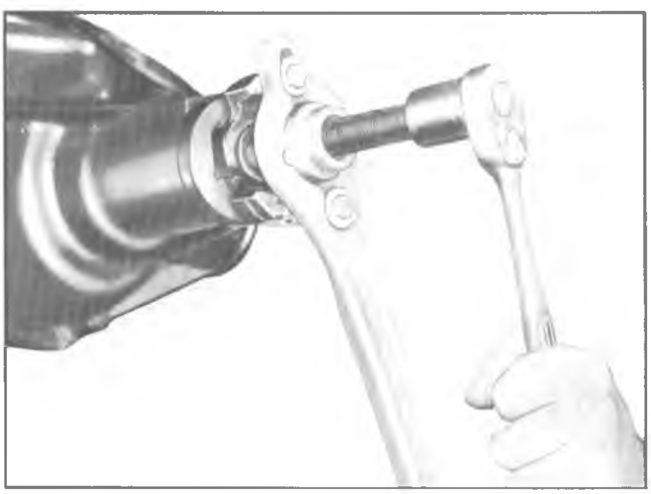


Fig. 25—Drive Pinion Flange Removal

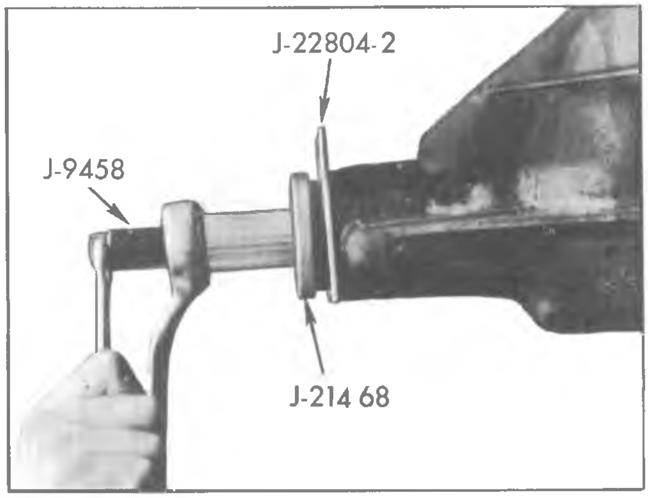


Fig. 26—Drive Pinion Flange Oil Seal Installation (Light Duty)

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.

13. Pack the cavity between end of pinion splines and pinion flange with a non-hardening sealer (such as Permatex Type A or equivalent) prior to installing nut on pinion.
14. Install a new 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.
15. Reinstall propeller shaft to companion flange in same position as marked in Step 3. Reinstall rear brake drums and wheels.

NOTE: This propeller shaft to pinion flange fastener is an important attaching part in that

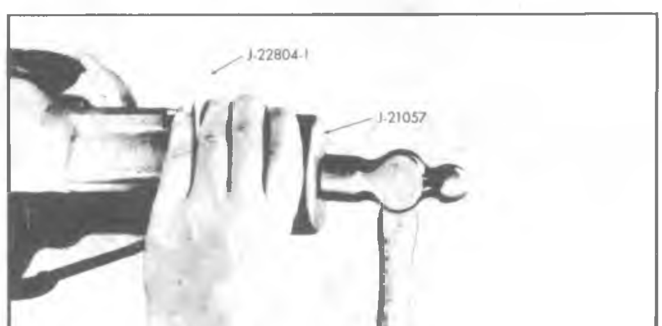


Fig. 27—Drive Pinion Flange Oil Seal Installation (Heavy Duty)

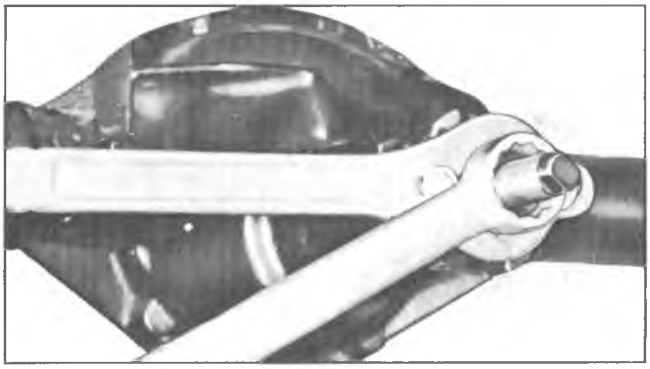


Fig. 28—Pinion Flange Installation

it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

16. Lower vehicle and remove from hoist.

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 "on the vehicle check".

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. 29).
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 lb. torque wrench attached to J-5748. For all except Dana torque should be 70 ft. lbs. minimum new, and no less than 40 ft. lbs. if used. Dana axles torque should be at least 40 ft. lbs. but no more than 200 ft. lbs.

5200, 5500, 7200, 11,000 LB. CAPACITY AXLES

NOTE: Because Series 20, 5500 lb. Capacity Dana Salisbury axles are full floating axles, their service procedures are a combination of Series 10 Salisbury axle procedures and Series 20-30, 5200, 5500 lb. capacity axle service procedures. Consequently, refer to Series 10, 3300 and 3500 lb. capacity axle service procedures for service on the differential such as pinion shaft oil seal and companion flange and to Series 20-30, 5200 - 7200 lb. capacity axles service procedures for service on wheel hubs, bearings, and axle shafts.

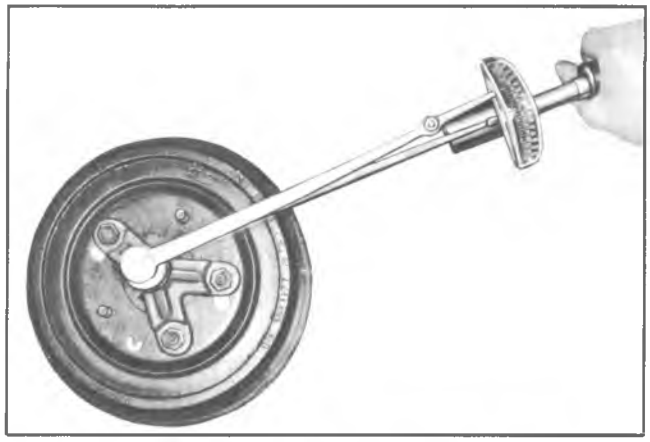


Fig. 29—Measuring Positraction Rotating Torque

Axle Assembly

Service operations on these axle assemblies may be performed with the housing installed in the vehicle or with the housing installed in a holding fixture. There may be occasions, however, when it will be necessary to remove the complete housing assembly. The following axle assembly removal and installation procedure, therefore, is necessary only when housing replacement is required.

NOTE: All axle attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Raise vehicle, place stand jacks under frame side rails, and remove rear wheels.
2. Remove two trunnion bearings "U" bolts from the rear yoke, split rear universal joint, position propeller shaft to one side, and tie it to the frame side rail.

   NOTE: The bearings can be left on the trunnion and held in place with tape.

3. Remove brake drum and disconnect parking brake cable at lever and at flange plate. (See Section 5 for cable removal.)
4. Disconnect hydraulic brake hose at connector on rear axle housing. (Refer to Section 5)
5. Disconnect shock absorbers at axle brackets.
6. Support axle assembly with hydraulic jack, remove spring "U" bolts, and lower axle assembly to the floor.

Installation

1. Place axle assembly under vehicle, raise into position, install spring "U" bolts, anchor plates and nuts, and tighten securely. (On P30 series vehicles make sure that stabilizer anchor plates are properly positioned on forward "U" bolts.)

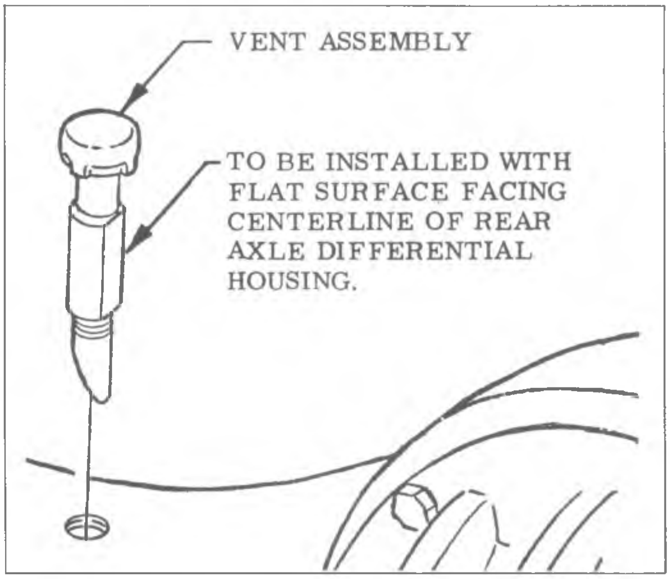


Fig. 30—Axle Vent Installation

2. Connect and secure shock absorbers to axle brackets.
3. Connect hydraulic brake hose to connector on axle housing, and bleed hydraulic system as specified in Section 5. (If vehicle is equipped with air brakes, connect air line at brake chambers--test connections to make sure that there is no leakage.)
4. Connect hand brake cables and adjust parking brakes as specified in Section 5.
5. Reassemble the rear universal joint, making sure that "U" bolts are drawn up tight and locked properly. Caution should be taken not to overtighten "U" bolt nuts and cause bearing cups to become distorted.
6. Install rear wheels, remove stand jacks, and lower vehicle.
7. Test operation of brakes and rear axle.

AXLE VENT

Replacement

Service replacement axle housing assemblies are not equipped with an axle vent; therefore, always make sure that a new vent assembly is installed when replacing the housing. If axle vent requires replacement, pry old vent from housing being sure that entire vent is removed. Prick punch around carrier hole to insure fit of replacement vent. Tap new vent into housing using a soft-faced hammer. Vent should be positioned in housing so that flat surface is toward centerline of differential carrier (fig. 30).

AXLE SHAFT (EXCEPT 11,000 LB. AXLE)

Removal and Installation

1. Remove bolts and lock washers that attach the axle shaft flange to the wheel hub.
2. Install two 1/2"-13 bolts in the threaded holes provided in the axle shaft flange. By turning these bolts alternately the axle shaft may be easily started and then removed from the housing (fig. 31).

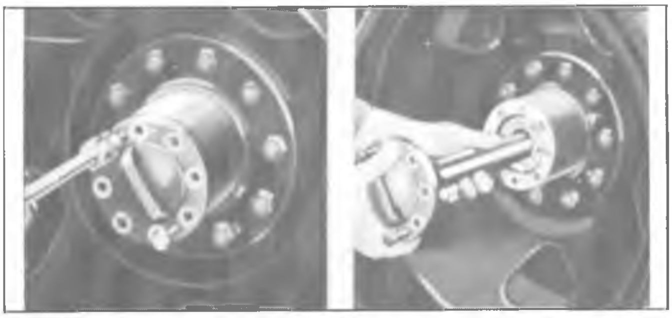


Fig. 31.—Removing Axle Shaft (5200 and 7200 lb. Axle)

3. Thoroughly clean both the axle shaft flange and the end of the wheel hub.

   NOTE: Any lubricant on these surfaces tends to loosen axle shaft flange bolts.

4. Place a new gasket over the axle shaft and position the axle shaft in the housing so that the shaft splines enter the differential side gear. Position gasket so that holes are in alignment and install flange-to-hub attaching bolts--torque bolts to specifications.

   NOTE: To prevent lubricant from leaking through flange holes, apply a non-hardening sealer (such as Permatex Type A or equivalent) to bolt threads. Use care in the amount of sealer applied, as in too heavy an application, the sealer may be forced out as the bolt is installed and may destroy sealing effect of the flange-to-hub gasket.

AXLE SHAFT 11,000 LB. AXLES

Removal and Installation

1. Remove hub cap, and install Tool J-8117 in tapped hole on shaft flange.
2. Install slide hammer (Tool J-2619) and remove axle shaft (fig. 32).
3. Thoroughly remove old gasket material from hub and hub cap. Clean shaft flange and mating surfaces in the wheel hub.
4. Install axle shaft so that the flange splines index into hub splines. Tap shaft into position, using J-8117 and J-2619.
5. Install new hub cap-to-hub gasket, position hub cap to hub and install attaching bolts--torque bolts to specifications.

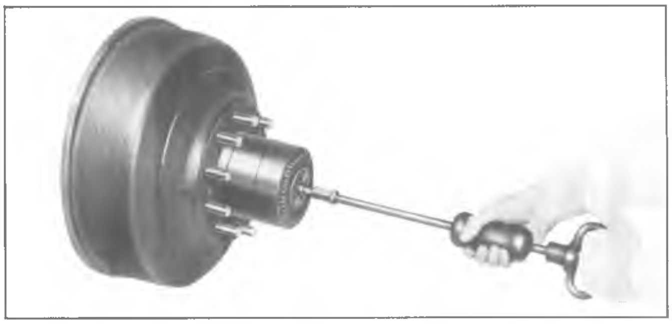


Fig. 32—Removing Axle Shaft (11,000 lb. Axle)

HUB AND DRUM (FIGS. 33, 34)

Removal

1. Remove wheel assembly and axle shaft as specified in applicable "Axle Shaft Removal" procedure of this section.
2. Disengage tang of nut lock from slot or flat of locknut, then remove locknut from housing tube, using appropriate tool (fig. 35).
   a. J-2222--5200, 7200 axles.
   b. J-0870--11,000 lb. axles.
3. Disengage tang of nut lock from slot of flat of adjusting nut and remove nut lock from housing tube.
4. Use appropriate tool as specified in Step 2 to remove adjusting nut from housing tube.

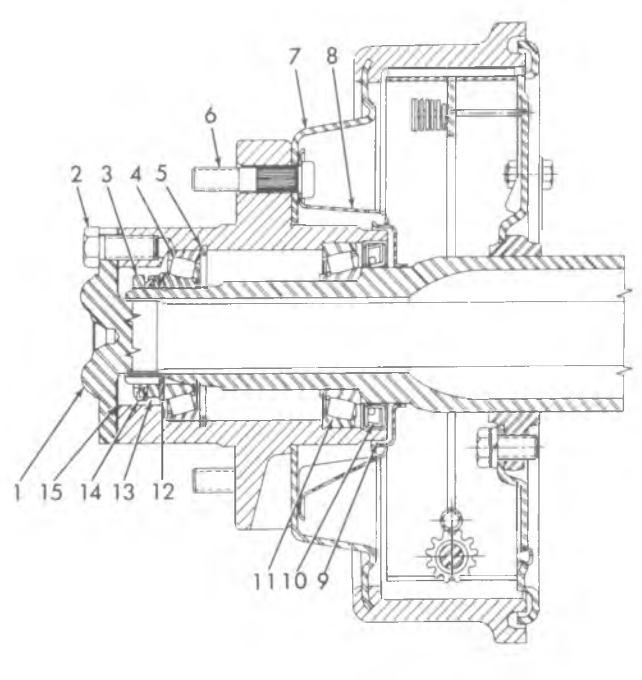
   NOTE: On 5200, 7200 and 11,000 lb. axles, remove thrust washer from housing tube.

5. Pull hub and drum assembly straight off axle housing, using care on the 11,000 lb. axles to avoid dropping outer bearing inner race and roller assembly.
6. Remove oil seal.

Cleaning

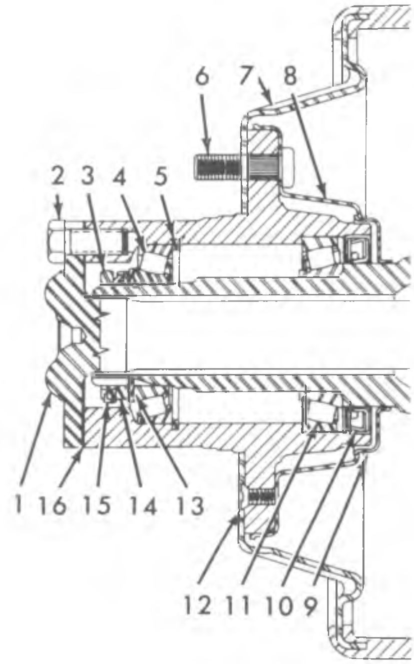
1. Immerse bearing cone and roller assemblies in cleaning solvent. Clean with stiff brush to remove old lubricant. Blow bearings dry with compressed air, directing air stream across bearing. Do not spin bearings while blowing them dry.

NOTE: To remove inner and outer bearings



1. Axle Shaft
2. Axle Shaft-to-Wheel Bolt
3. Adjusting Nut Locknut
4. Hub Outer Bearing Assembly
5. Hub Outer Bearing Retainer
6. Wheel Bolt
7. Drum
8. Oil Deflector
9. Oil Deflector
10. Oil Seal
11. Hub Inner Bearing Assembly
12. Thrust Washer
13. Bearing Adjusting Nut
14. Adjusting Nut Lock
15. Gasket

Fig. 33—Hub and Drum Details (Nondemountable - Type Drum)



1. Axle Shaft
2. Axle Shaft-to-Wheel Hub Retaining Bolt
3. Adjusting Nut Locknut
4. Hub Outer Bearing Assembly
5. Hub Outer Bearing Retainer
6. Wheel Bolt
7. Drum
8. Oil Deflector
9. Oil Deflector
10. Oil Seal
11. Hub Inner Bearing Assembly
12. Drum-to-Hub Retaining Screw
13. Thrust Washer
14. Bearing Adjusting Nut
15. Adjusting Nut Lock
16. Gasket

Fig. 34—Hub and Drum Details (Demountable - Type Drum)

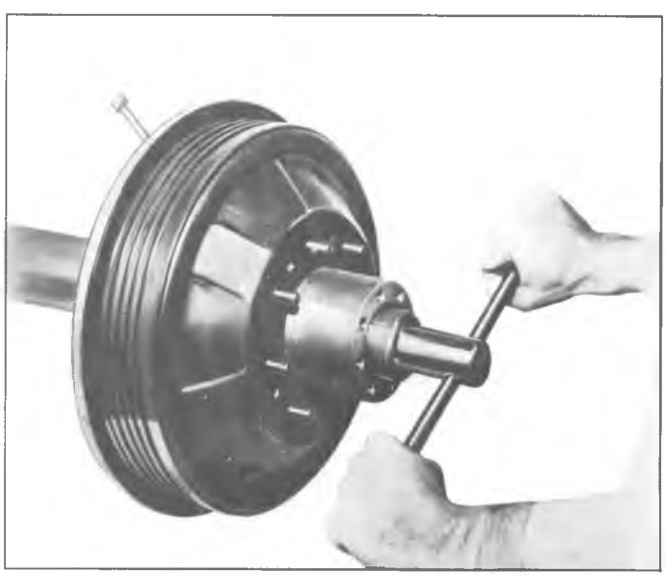


Fig. 35—Bearing Adjustment Nut Removal (Typical)

and cups see "Bearing Cup Replacement" for various axles.

2. Thoroughly clean all lubricant off axle housing tube and out of inside the hub, wipe dry. Make sure all particles of gasket are removed from outer end of hub, axle shaft, and hub cap.
3. Scrape old sealing compound out of oil seal bore in the hub.

Inspection

1. Inspect bearing rollers for excessive wear, chipped edges, and other damage. Slowly move rollers around cone to detect any flat or rough spots on rollers or cone.
2. Examine bearing cups in hub for pits, cracks, and other damage.
3. Examine axle shaft flange studs, wheel studs, hub splines, hub bore, and tapped holes for evidence of damage--clean up threads or replace parts where required.
4. Examine oil seal sleeve for evidence of wear or roughness, check axle housing oil deflector and brake drum oil deflector for evidence of damage--replace parts where required.
5. Examine brake drum for excessive scoring and other damage. To replace brake drum refer to "Brake Drum Replacement."

BEARING CUP

Replacement

Replace inner cup (all axles) as follows:

1. Cut a suitable length of 1/2 inch steel bar stock for press-out tool as shown in Figure 36.
2. Place appropriate press-out tool behind bearing cup, index tool in provided notches, and press out cup with an arbor press.
3. Position bearing cup in hub--thick edge of cup toward shoulder in hub--then, using applicable cup installer

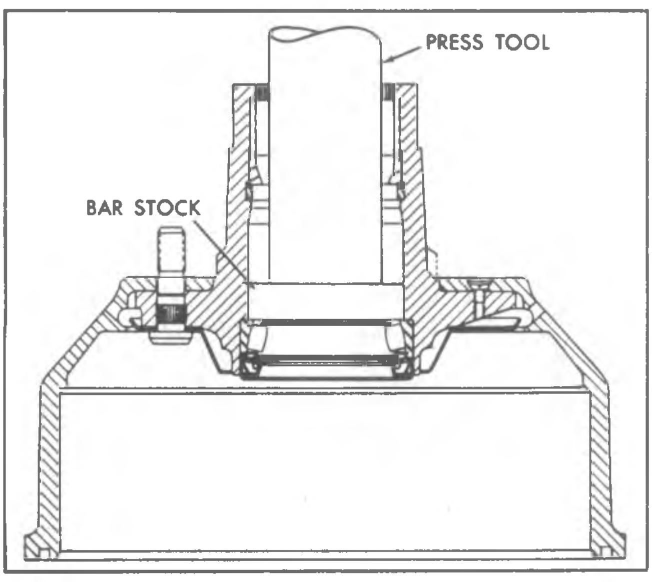


Fig. 36—Removing Hub Inner Bearing Cup

Fig. 37—Installing Hub Inner Bearing Cup (Typical)

as specified, press cup into hub until it seats on hub shoulder (fig. 37). Make certain that cup is not cocked and that it is fully seated against shoulder.

a. J-8114 (Use with J-8092 driver handle)--5200, 5500 and 7200 lb. axles.
b. J-8093 (Use with J-8092 driver handle)--11,000 lb. axle.

Replace outer bearing assembly as follows:

NOTE: Inner bearing assembly must be removed before attempting to replace outer bearing assembly.

1. Using a punch of suitable length, tap bearing outer race away from bearing retaining ring (fig. 38). Then remove retaining ring from hub--using pliers for removal of ring on 5200 and 7200 lb. axle (fig. 38).
2. Press bearing assembly from hub:
   a. 5200, 5500 lb. Dana and 7200 lb. axles--Drive out bearing using a brass drift.
   b. 11,000 lb. axle--Remove the bearings by driving on the axle shaft spacer, using the splined flange cut from an old axle shaft (fig. 39).
3. On 11,000 lb. axle place axle shaft spacer in hub first. Place inner race and roller assembly in hub--larger O.D. of roller assembly towards outer end of hub--then position bearing cup in hub--thin edge of cup toward outer end of hub--press cup into hub, using Tool J-2223 for 5200, 7200 axles; Tool J-8114 with J-8092 drive handle for 11,000 lb. axle.

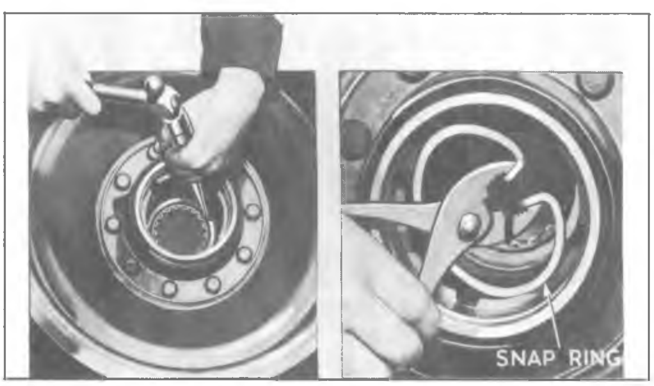


Fig. 38—Bearing Retainer Ring Removal (5200 and 7200 lb. Axle)

Fig. 39—Removing Hub Outer Bearing (11,000 lb. Axle)

4. Withdraw cup installer and install retainer ring using pliers for 5200 and 7200 lb. axles (fig. 38) or Tool J-22380 for 11,000 (fig. 40).

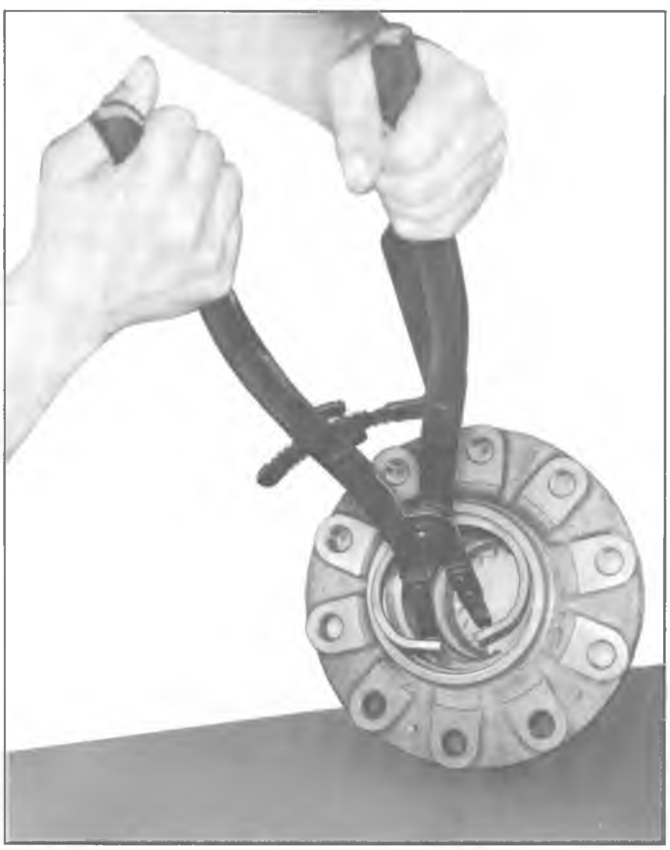


Fig. 40—Removing Wheel Hub Outer Bearing Retainer Ring

5. Press the bearing cup into positive contact with retainer ring using a splined axle shaft flange for 11,000 lb. axles shown in Figure 39.

NOTE: The bearing cup-to-retainer ring seating procedure is essential to assure that an accurate wheel bearing adjustment will be obtained, and that the adjustment will not loosen during vehicle operation.

DRUM DEMOUNTABLE-TYPE (Fig. 34)

Replacement

The demountable-type drum may be separated from the hub and removed from the vehicle without disturbing the axle shaft and hub. The drum is held to the hub by countersunk, slotted screws, which are easily removed with a screw driver.

DRUM NON-DEMOUNTABLE-TYPE (Fig. 33)

Replacement

Construction of the nondemountable-type hub and drum assembly is such that replacement cannot be accomplished with the hub assembly installed on the vehicle.

1. Separate the drum and hub by removing the drum-to-hub retaining bolts, hub stud nuts, or by pressing out the wheel studs, as applicable.
2. Position brake drum to hub assembly, making certain that all drain holes are in alignment.
3. Apply a light, even coating of sealing compound to the hub oil deflector contact surface, and position deflector to drum.
4. Install drum-to-hub retaining bolts, hub stud nuts, or press wheel studs into drum, as applicable.

WHEEL BOLT

Replacement

Wheel bolts are serrated and may also be swaged in place; however, replacement procedure remains the same for both types of installation.

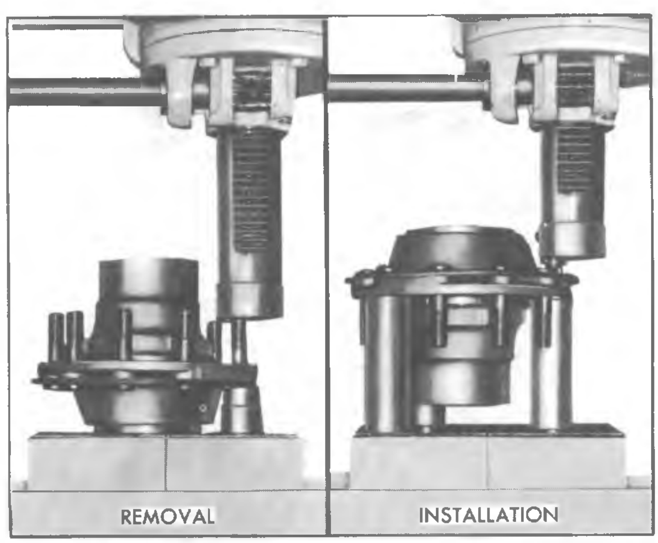


Fig. 41—Wheel Bolt Replacement

Press bolts out of hub flange (as illustrated in Figure 54) and press new bolts into place, making sure they are a tight fit. If all bolts were removed, be sure that hub oil deflector is in position under bolt heads.

HUB STUD

Replacement

Hub studs can be removed and replaced by using a conventional stud remover and replacer. Make sure that studs are firmly bottomed in holes and that threads are not damaged during installation.

OIL SEAL SLEEVE AND BEARING THRUST SPACER

Replacement

The hub inner bearing spacer and sleeve assembly should be inspected when the hub and bearing assembly is removed from the axle housing (figs. 33, 34).

If inspection dictates the need for replacement, pry the sleeve and spacer assembly from the housing, being careful not to damage machined surface of axle housing.

Press a new bearing spacer into the I.D. of a new sleeve - spacer should seat against bottom of sleeve.

CAUTION: The O.D. of the sleeve is the running surface for the hub oil seal. Use extreme care to prevent damage to this surface when installing the bearing spacer.

Tap the sleeve assembly onto the axle housing until the bearing spacer contacts shoulder on housing.

WHEEL HUB OIL SEAL

Replacement

Pry old seal from its location in the hub bore, using care so as not to damage bore surface. Thoroughly clean all oil and foreign matter from seal contact area in hub bore. Pack the cavity between the seal lips with a high-melting point wheel bearing lubricant, and position seal in hub bore. Carefully press the seal into the hub bore, using appropriate tool until seal is properly seated (fig. 42).

1. J-22351 5200 and 7200 lb. axles - Seal should be installed flush with end of hub.
2. J-22354 11,000 lb. axle - Seal should be installed flush with end of hub.

Installation

1. Using a high melting point EP bearing lubricant, liberally pack bearings and apply a light coat on I.D. of hub bearing contact surface and O.D. of axle housing tube.
2. Make sure inner bearing, oil seal, oil seal sleeve, axle housing oil deflector, and inner bearing race and oil seal are properly positioned.
3. Install hub and drum assembly on axle housing, exercising care so as not to damage oil seal or dislocate other internal components.
4. On the 11,000 axles, place outer bearing cone and roller assembly on axle housing and press firmly into hub with hand.
5. On 5200 through 11,000 lb. install thrust washer so that tang on I.D. of washer is in keyway on axle housing.
6. Install adjusting nut and complete the installation as directed under "Bearing Adjustment."

Bearing Adjustment

Before checking bearing adjustment, make sure brakes are fully released and do not drag.

Check bearing play by grasping tire at top and pulling back and forth, or by using a pry bar under tire. If bearings are properly adjusted, movement of brake drum in relation to brake flange plate will be barely noticeable and wheel will turn freely. If movement is excessive, adjust bearing as follows:

1. Remove axle shaft and raise vehicle until wheel is free to rotate.
2. Disengage tang of nut lock from locknut and remove them from axle housing tube.
3. Use appropriate tool as listed for the specified axle:
   a. J-2222 for 5200, 7200 axles.
   b. J-0870 for 11,000 lb. axles.

Adjust wheel bearings according to the following procedure.

Fig. 42—Installing Wheel Hub Oil Seal

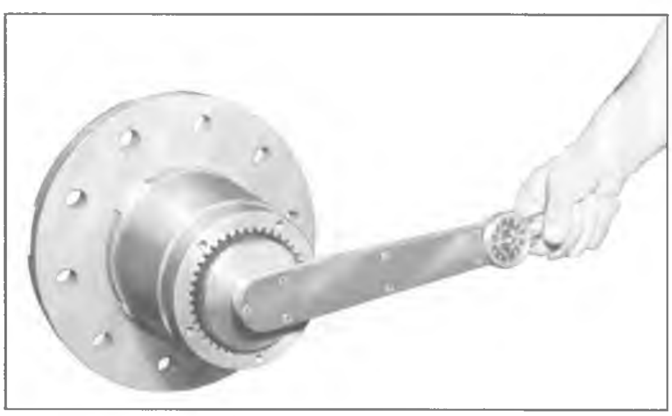


Fig. 43—Tightening Wheel Hub Bearing Adjustment Nut (Typical)

4. Tighten inner adjusting nut to specified torque at the same time rotating hub to make sure all bearing surfaces are in contact. Then back off inner nut to specified amount of turn-back (fig. 43). Refer to Specifications Section.
5. Install tanged nut lock against the inner adjusting nut. Align inner adjusting nut so short tang of nut lock will engage nearest slot on inner adjusting nut. If it is necessary to rotate the adjusting nut to make tang align correctly, rotate the nut slightly clockwise for barrel roller type bearings and counter-clockwise for tapered roller bearings. Bend tang over into position of adjusting nut slot. Refer to Specifications Section.
6. Install outer locknut and tighten to correct specified torque. Then bend long tang of nut lock over into slot of outer nut. This method of adjustment will result in the proper bearing loading, and wheel should turn freely.

DRIVE PINION OIL SEAL (EXCEPT 5500 LB. DANA AXLE) (Fig. 44)

Replacement

NOTE: The pinion oil seal may be replaced with the carrier assembly installed in the vehicle.

1. Mark relationship between propeller shaft and companion flange.
2. Disconnect propeller shaft and remove pinion flange and deflector.
3. Remove bolts retaining the oil seal retainer to carrier, and withdraw retainer from pinion.
4. Pry old seal from bore, using care so as not to damage machined surface of retainer.
5. Thoroughly clean all foreign matter from seal contact area in retainer.
6. Pack the cavity between the seal lips with a high-melting point bearing lubricant, position seal on installer Tool J-22281 so that seal shoulders against installer drive surface.
7. Press seal into retainer until it bottoms against shoulder.
8. Carefully position seal retainer over pinion to prevent damage to seal, and torque retaining bolts to specifications.
9. Reinstall pinion flange and propeller shaft as marked in step #1.

NOTE: This propeller shaft to pinion flange fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

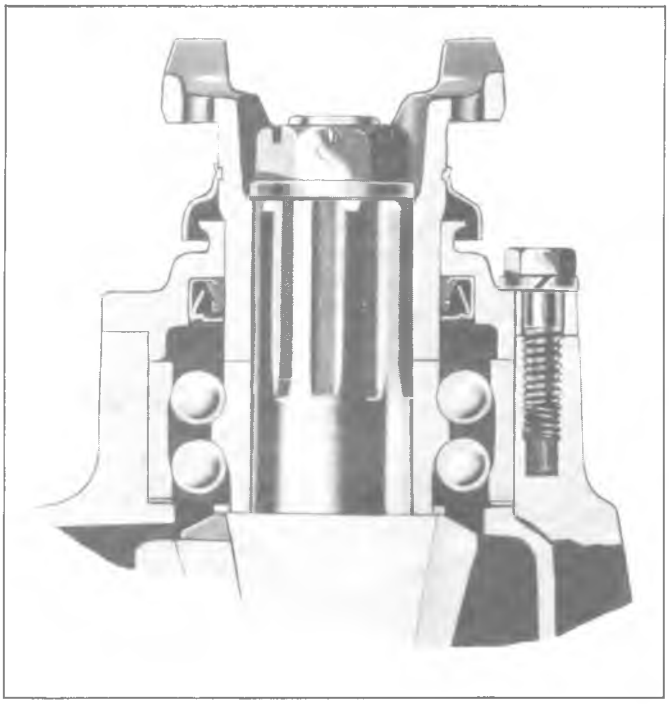


Fig. 44—5200 through 11,000 lb. Axle Pinion Oil Seal (Typical)

NO-SPIN DIFFERENTIAL UNIT

The optionally available No-Spin differential unit is installed in a conventional 5200 or 7200 lb. rear axle housing. Service procedures are the same as for conventional axles.

On-the-Vehicle-Check

1. Raise rear of vehicle until both rear wheels are off the floor.
2. Shift transmission into gear.
3. Rotate both rear wheels as far forward as possible.
4. With assistant holding left wheel forward, rotate the right wheel to the rear, checking for free rotation.
5. Rotate both wheels as far to the rear as possible.
6. While holding the left wheel rearward, rotate the right wheel forward, again checking for free rotation.
7. Repeat Steps 3-6, holding the right wheel and rotating the left wheel for left side forward and rearward operation check.
8. If wheels cannot be rotated freely as described above, remove and inspect the No-Spin.

PROPELLER SHAFT AND UNIVERSAL JOINTS

INDEX

SERVICE INFORMATION

Both one piece and two piece propeller shafts are used depending on the model. All are tubular and use needle bearing type universal joints.

On models that use a two piece shaft, the shaft is supported near its splined end in a rubber cushioned ball bearing which is mounted in a bracket attached to a frame crossmember. The ball bearing is permanently lubricated and sealed.

Four wheel drive models use a front propeller shaft incorporating a constant velocity joint (fig. 53).

COMPONENT PART REPLACEMENT

PROPELLER SHAFT

Two methods are used to retain the propeller shaft to the differential pinion flange. One method utilizes "U" bolts (fig. 45) and the other is a strap attachment (fig. 46).

Removal

1. Raise vehicle on hoist. Mark relationship of shaft to companion flange and disconnect the rear universal joint by removing trunnion bearing "U" bolts or straps. Tape bearing cups to trunnion to prevent dropping and loss of bearing rollers.
2. For models with two-piece shafts remove bolts retaining bearing support to frame crossmember.
3. Slide propeller shaft forward disengaging trunnion from axle flange, then slide assembly rearward disengaging from transmission.

Repairs (Universal Joints)

NOTE: The universal joints are of the extended-life design and do not require periodic inspection or lubrication; however, when 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.

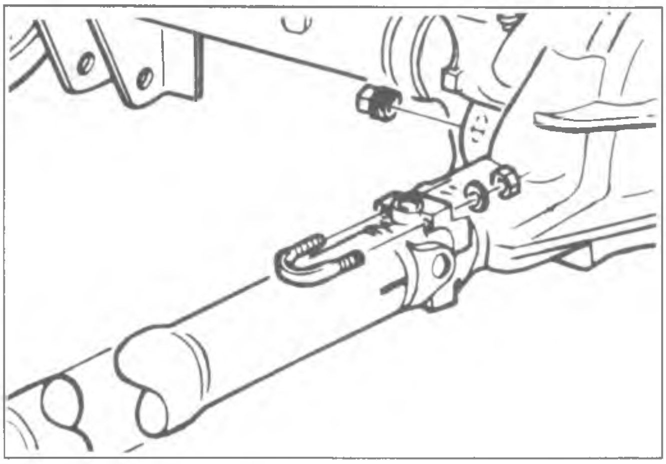


Fig. 45—"U" Bolt Attachment

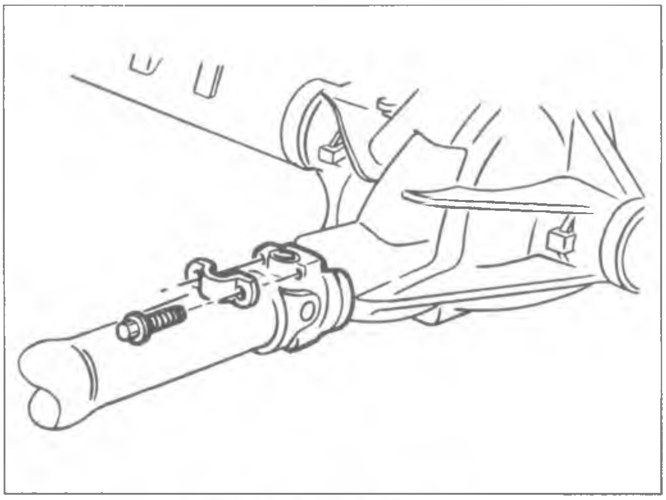


Fig. 46—Strap Attachment

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 on trunnion until bearing cup is almost out (fig. 47). Grasp cup in vise and work cup out of yoke.

   NOTE: The bearing cup cannot be fully pressed out.

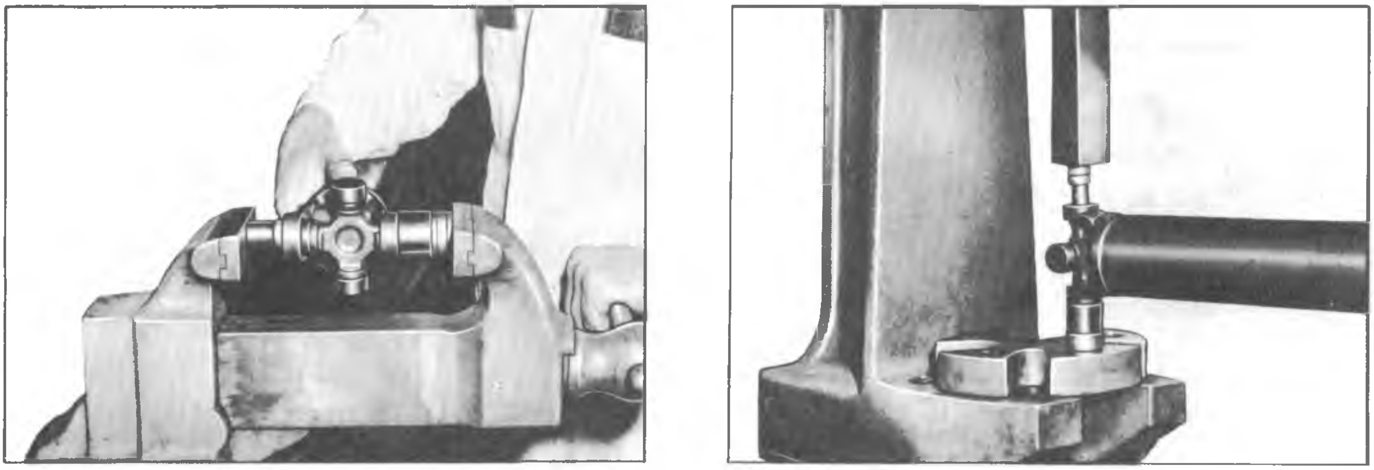


Fig. 47—Bearing Cup Removal

4. Press trunnion in opposite direction and remove other cup as in Step #3.
5. Clean and inspection dust seals, bearing rollers, and trunnion. Relubricate bearings as indicated in Section 0.

   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 (use of squeeze bottle is recommended). This will prevent air pockets and ensure an adequate supply of lubricant.

6. If not installing a "U" joint service kit Figure 48, place dust seals on trunnions--cavity of seal toward end of trunnion. Press seal onto trunnion exercising caution during installation to prevent seal distortion and to assure proper seating of seal on trunnion.

   NOTE: If installing seal on small size trunnion, seal installer J-21548 should be used (fig. 49).

7. Position trunnion into yoke. Partially install one bearing cup into yoke. Start trunnion into bearing cup. Partially install other cup. Align trunnion into cup, and press cups into yoke.
8. Install lock rings.

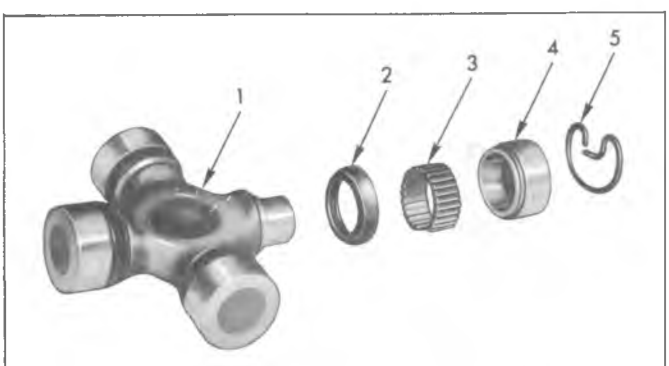


Fig. 48—Universal Joint Repair Kit

Center Support Bearing (Fig. 50)

a. Remove dust shield.
b. Remove strap retaining rubber cushion from bearing support.
c. Pull support bracket from rubber cushion and pull cushion from bearing.
d. Pull bearing assembly from shaft.

1. Assemble bearing support as follows:
   a. Install inner deflector on propeller shaft, if removed, and prick punch deflector at two opposite points to make sure it is tight on shaft.
   b. Fill space between inner dust shield and bearing with lithium soap grease.
   c. Start bearing and slinger assembly straight on shaft journal. Support propeller shaft and, using suitable length of pipe over splined end of shaft, press bearing and inner slinger against shoulder on shaft.
   d. Install dust shield over shaft, small diameter first and press into position against outer slinger.
   e. Install rubber cushion onto bearing.
   f. Install bracket onto cushion.
   g. Install retaining strap.

Installation

1. For models with one piece propeller shafts, slide shaft into transmission and attach rear U-joint axle. Torque bolts to specifications.

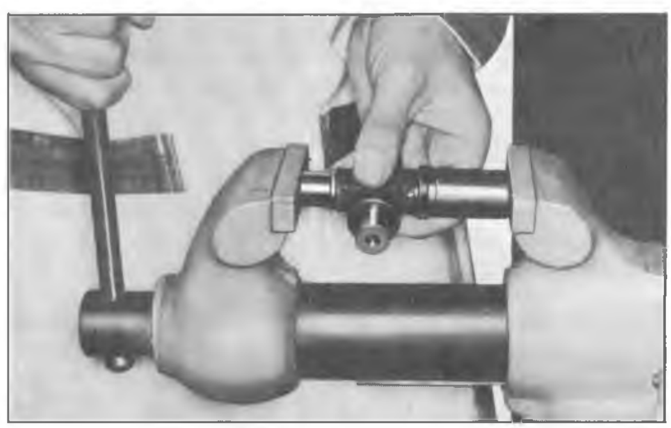


Fig. 49—"U" Joint Trunnion Seal Installer

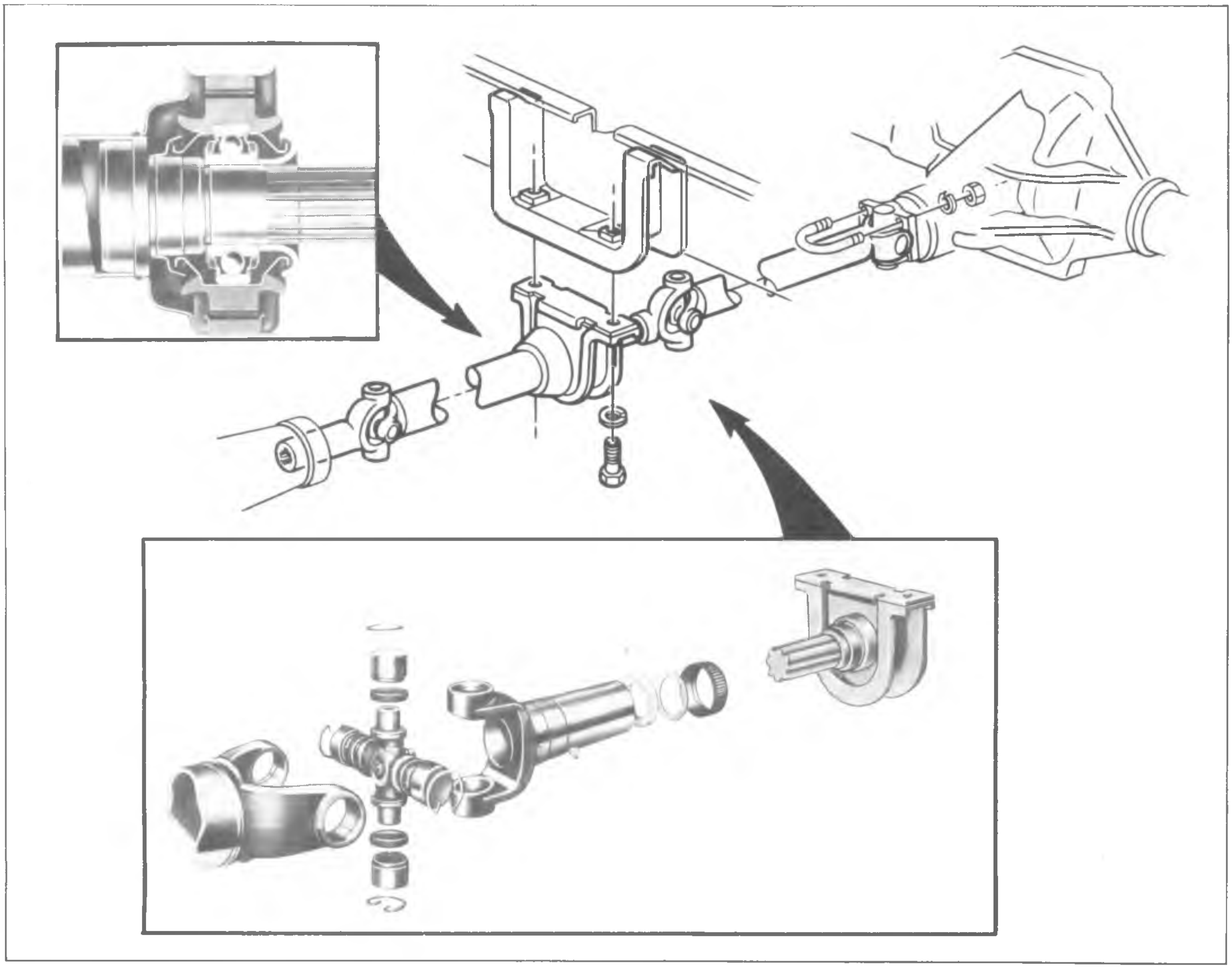


Fig. 50—Propeller Shaft, Universal Joint and Bearing Support

NOTE: This propeller shaft to pinion flange fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

2. For models with two piece shafts, install front half into transmission and bolt support to crossmember.
   a. Slide grease cap and gasket onto rear splines.
   b. Rotate shaft so front U-joint trunnion is in a vertical position.
   c. Take rear propeller shaft and before installing align U-joint trunnions in same vertical position as in step b (at this point all U-joint trunnions should be vertical). (fig. 51). Then, note relationship of front shaft and rear shaft spline position. For all models except model CE31403 (157" W.B. 307 C10, V-8 Engine) Rotate rear shaft four splines toward left side of vehicle (fig. 42) and install rear shaft to front shaft. For Model CE31403 rotate 2 splines. Attach rear U-joint to axle. Tighten grease cap.
   d. Torque bearing support to crossmember and U-joint to axle attachments to specifications.

CONSTANT VELOCITY UNIVERSAL JOINT

Disassembly

1. Remove front propeller shaft from vehicle.
2. Remove rear trunnion snap rings from center yoke. Remove grease fitting.
3. Place prop shaft in vice as shown in Figure 52. Drive one rear trunnion bearing cap from center yoke as shown in Figure 52 until it protrudes approximately 3/8".

   NOTE: Keep rear portion of propeller shaft up to avoid interference of rear yoke half with center yoke.

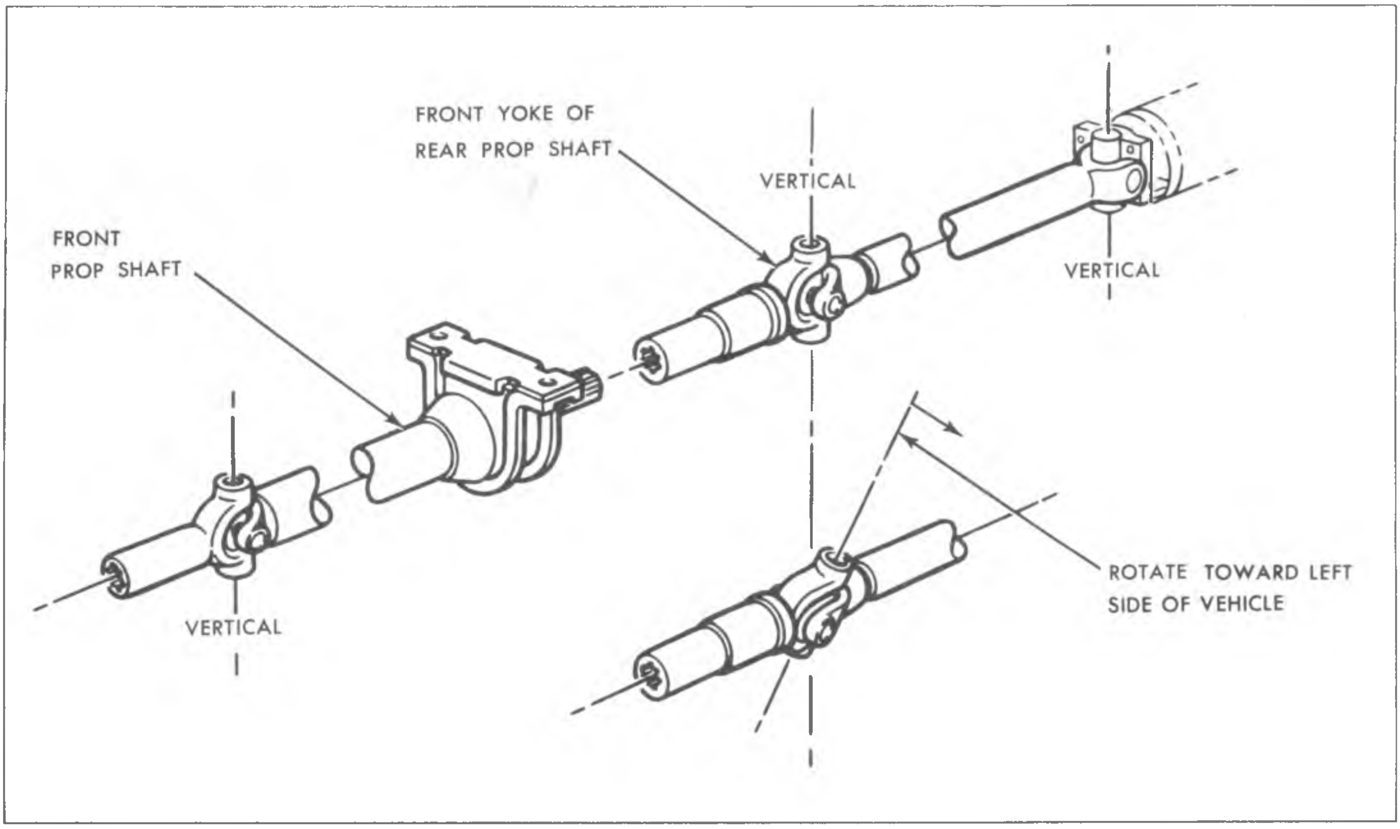


Fig. 51—Aligning U-Joints

4. Once the bearing cup protrudes 3/8", release vice. Grasp protruding portion of cup in vice and drive on center yoke as shown in Figure 53 until cup is removed. Remove cup seal by prying off with a thin screwdriver.
5. Repeat steps 3 and 4 for remaining bearing cup.
6. Once the center yoke cups have been removed, remove rear yoke half bearing cups. Remove rear trunnion.
7. Gently pull rear yoke half from prop shaft. Remove all loose needle bearings. Remove spring seal.
8. Remove front trunnion from center and front yoke in same manner as described in Steps 2, 3 & 4.

NOTE: Before front trunnion can be removed all four (4) bearing caps must be removed.

Assembly

1. Clean and inspect all needle bearings, cups, seals, fittings, trunnions and yokes. Assemble all needle bearings in caps (27 per cap); assemble needle bearings in front yoke (28 total). Retain bearings with a heavy grease. Assemble seals to bearing cups.

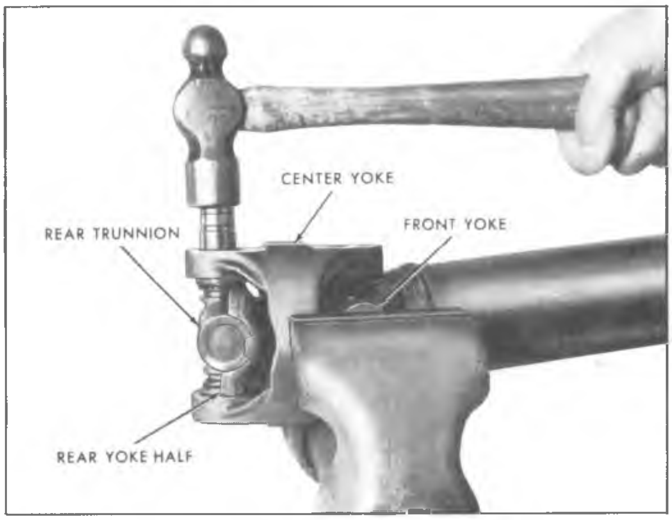


Fig. 52—Driving Out Bearing Cups

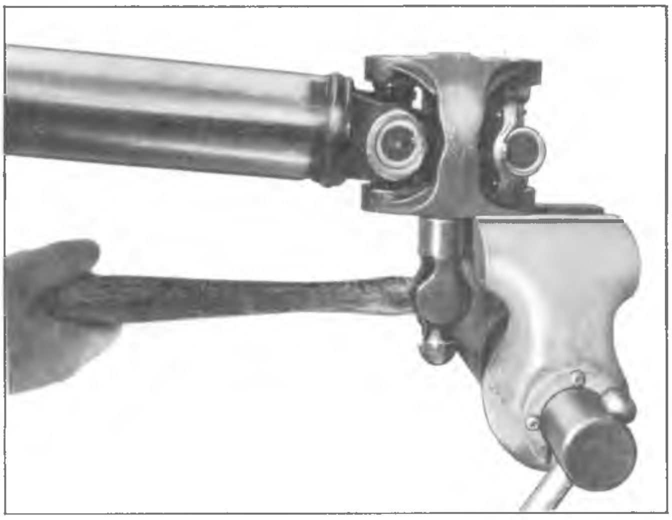
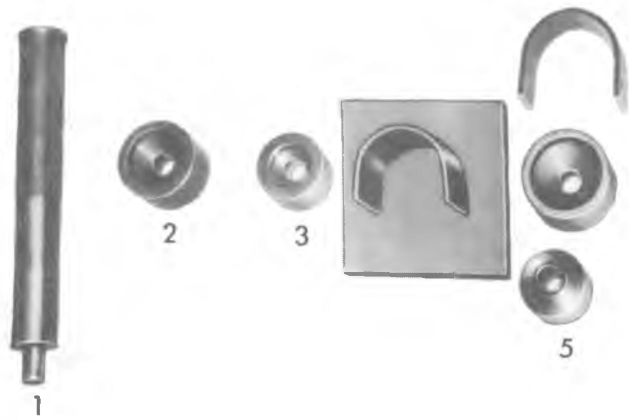


Fig. 53—Bearing Cup Removal

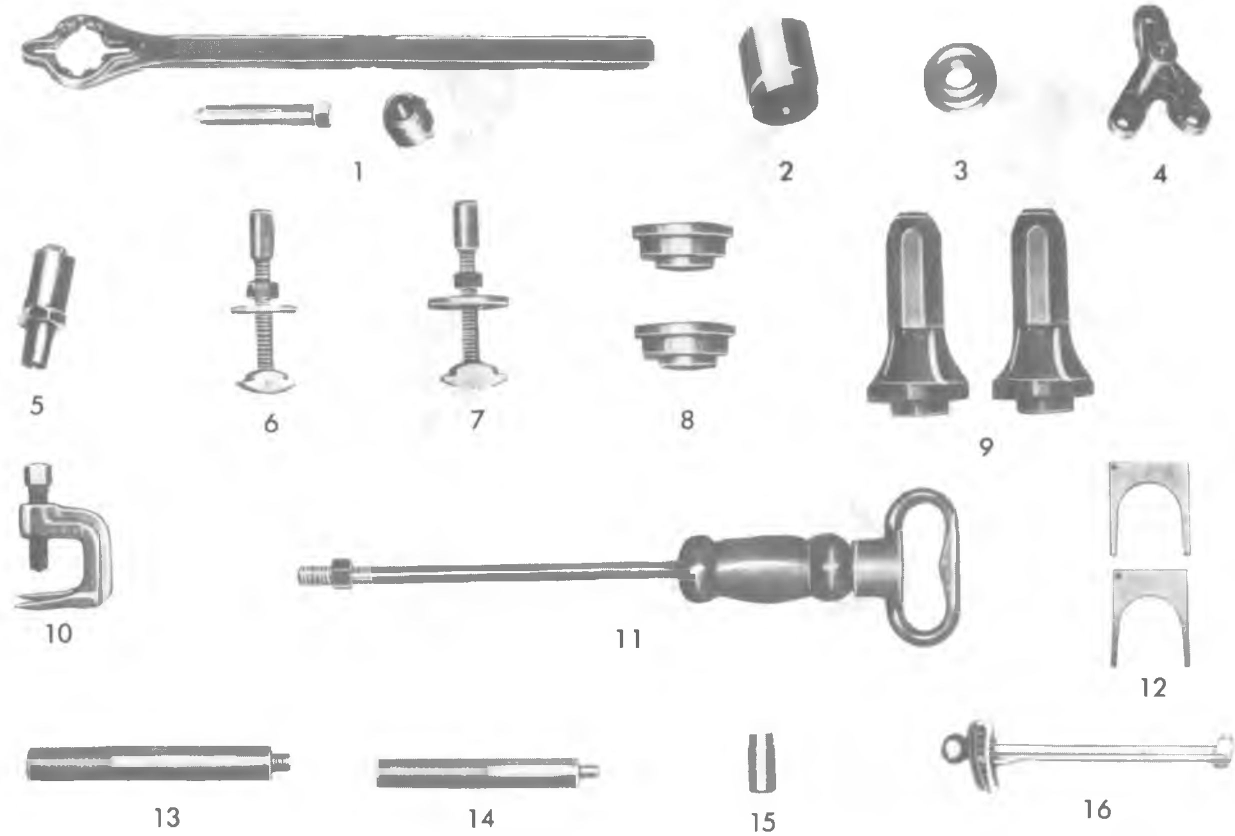
2. Place front trunnion in drive shaft. Place center yoke on front trunnion. Install one bearing cup and seal assembly in front yoke. Drive in to a depth that the snap ring can be installed. Install snap ring. Install remaining cup and seal in front yoke. Install snap ring.
3. Install front trunnion bearing cups in center yoke in same manner.
4. With front trunnion completely installed, install seal on prop shaft (large face first). Gently slip rear yoke half on prop shaft using care not to upset rollers. Insert rear trunnion in center yoke. Install rear yoke half bearing caps on rear trunnion. Install one rear trunnion bearing cap in center yoke and press into yoke until snap ring can be installed. Install remaining cap and snap ring.
5. Grease universal as outlined in Section 0 at all three (3) fittings (2 conventional type and one (in rear yoke half)) that requires a needle nose grease gun adapter).
6. Install propeller shaft with constant velocity joint next to transfer case. Torque U-bolts to specifications.



1. J-7079-2 Driver Handle
2. J-7574-6 Series C20 Tie Rod Bushing Installer
3. J-8518 Series C-P10 Tie Rod Bushing Installer
4. J-5888-3 Support
5. J-8448 Series C-P10 and C-30 Control Arm Bushing Installer

Fig. 54—Rear Suspension Special Tools

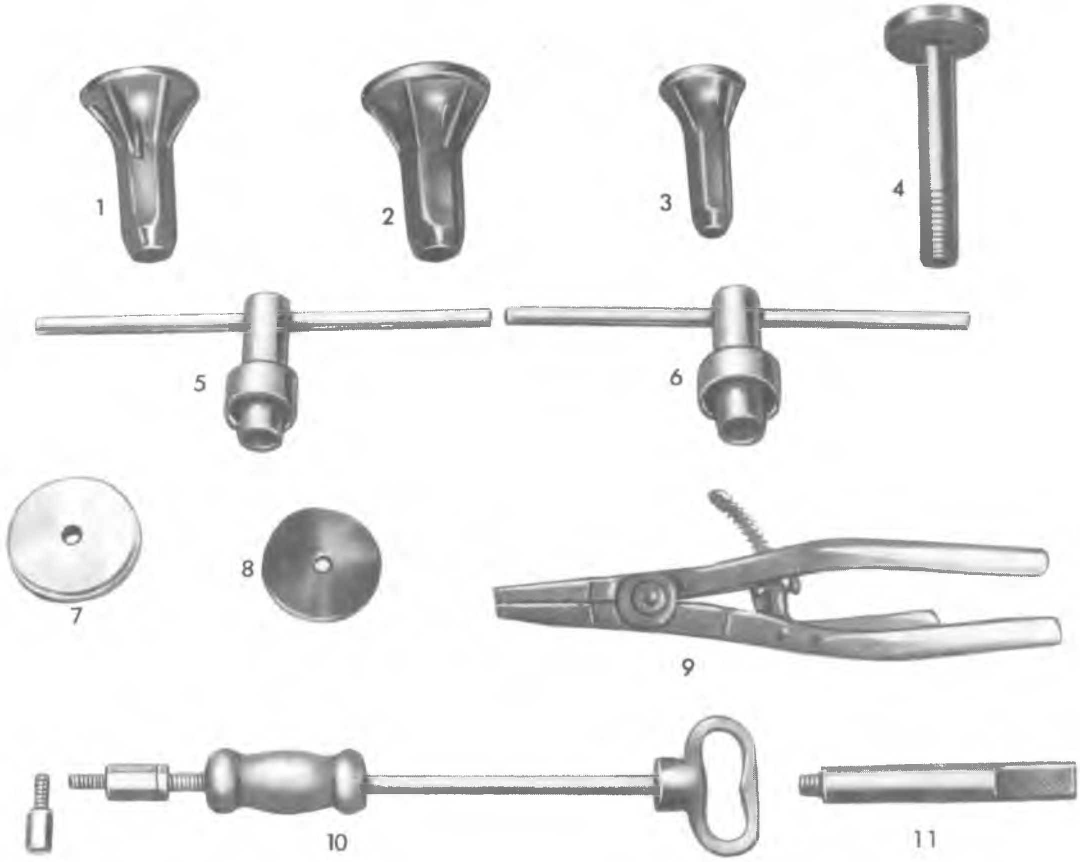
SPECIAL TOOLS



1.	J-8614	Companion Flange Remover—Consisting 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-9458	Drive Pinion Oil Seal Installer—Light Duty Axle—Used with J-21468	
6.	J-22813-3	Axle Shaft Bearing Remover—Light Duty Axle	
7.	J-23689	Axle Shaft Bearing Remover—Heavy Duty Axle	
8.	J-23690	Axle Shaft Bearing Installer—Heavy Duty Axle	
	J-23765	Axle Shaft Bearing Installer—Light Duty Axle	
9.	J-21128	Axle Shaft Seal Installer—Heavy Duty Axle	
	J-23771	Axle Shaft Seal Installer—Light Duty Axle	
10.	J-6627 or 5504	Wheel Bolt Remover	
11.	J-2619	Rear Wheel Bearing and Oil Seal Remover (Slide Hammer)	
12.	J-22804	Pinion Seal Gauge Plates -1 Heavy Duty -2 Light Duty	
13.	J-8092	Drive Handle—Threaded Type	
14.	J-7079-2	Drive Handle—Insert Type	
15.	J-21548	Propeller Shaft "U" Joint Trunnion Seal Installer	
16.	J-5853	Torque Wrench-in. lbs.	

Fig. 55—3300, Through 3500 lb. Capacity Drive Line Special Tools

SPECIAL TOOLS



1. J-22351 Wheel Oil Seal Installer
2. J-22354 Wheel Oil Seal Installer
3. J-22281 Pinion Flange Oil Seal Installer
4. J-2223 Wheel Bearing Installer
5. J-2222 Wheel Bearing Nut Wrench
6. J-0870 Wheel Bearing Nut Wrench
7. J-8093 Wheel Bearing Installer
8. J-8114 Wheel Bearing Installer
9. J-22380 Tru-Arc Pliers
10. J-2619 Slide Hammer with Adapter J-8117
11. J-8092 Drive Handle—Threaded Type

Fig. 56—5200, 5500, 7200 lb. Axles Special Tools

SECTION 5

BRAKES

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology "See Caution on page 1 of this section."

CAUTION: THIS FASTENER IS AN IMPORTANT ATTACHING PART IN THAT IT COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. IT MUST BE REPLACED WITH ONE OF THE SAME PART NUMBER OR WITH AN EQUIVALENT PART IF REPLACEMENT BECOMES NECESSARY. DO NOT USE A REPLACEMENT PART OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THIS PART.

INDEX

GENERAL DESCRIPTION

All 10 through 30 series trucks are equipped with a dual hydraulic brake system.

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, its piston will bottom against the front piston. When the front system loses fluid, its piston will bottom on the end of the master cylinder body. The pressure differential in one of the systems causes an uneven hydraulic pressure balance between the front and rear systems. The combination valve, near the master cylinder, (except RPO H22 vehicles) 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.

RPO H22 vehicles (with frame mounted vacuum over hydraulic boosters) have an electrical switch that senses pedal travel. This switch will illuminate the lamp on the instrument panel whenever the brake pedal travel is in excess of 5.10 inches.

If a vehicle displays these symptoms, it is a good indication that one of the systems contains air or has failed, and it is necessary to bleed or repair the brakes.

MASTER CYLINDER (Fig. 1)

The system is designed with a separate hydraulic system for the front and rear brakes using a dual master cylinder. The cylinder has two separate reservoirs and outlets in a common body casting. On 10 series vehicles the front reservoir controls the front brake system and the rear reservoir controls the rear system. On 20-30 series vehicles the front reservoir controls the rear brake system and the rear reservoir

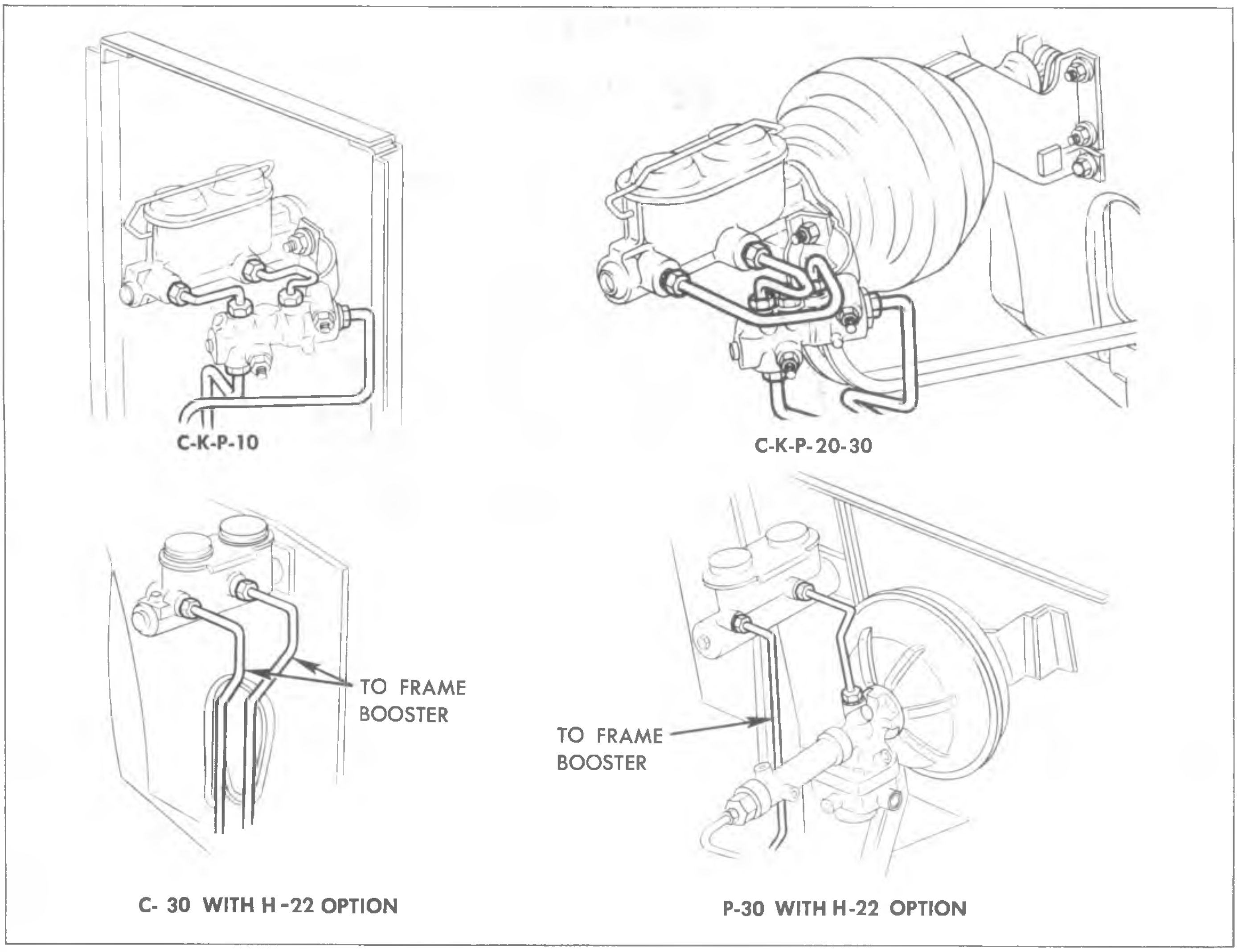


Fig. 1—Master Cylinder—Typical

controls the front system (except on CA 30 with vacuum over hydraulic boosters where the front is controlled by the front booster and rear by the rear booster).

VALVE

All models (except models with vacuum over hydraulic boosters) have a combination valve located below the master cylinder. The front and rear hydraulic lines are routed through this combination "metering" and "brake failure warning switch" to their appropriate wheel cylinders or caliper.

The metering portion of the combination valve tends to "hold off" front hydraulic pressure until the rear brake system overcomes their pull back springs; then pressure is allowed to flow with the result being a good distribution of braking effort.

The brake failure warning switch portion of the combination valve "senses" a loss of hydraulic pressure, if a failure should occur and turns "on" a red light in the dash to warn the operator of the failure.

DISC BRAKES FRONT—(Fig. 2)

All models have disc brakes on the front. The one piece caliper mounts on the steering knuckle/steering arm, which is also a one piece casting, and astride the brake disc. The caliper is the single piston design which is said to be a sliding caliper sliding piston. No front brake adjustment is necessary once the system is in operation and the pedal has been stroked to "seat" the shoes to the caliper.

DRUM BRAKES REAR—(Fig. 3)

The rear brakes are duo servo (except R.P.O. H-22) which are self adjusting. Brake adjustment takes place when the brakes are applied with a firm pedal effort while the vehicle is backing up. Applying the brakes moves the actuator which turns the star wheel and lengthens the adjuster screw assembly. This action moves the shoes outward until clearance between the lining and drum is within proper limits.

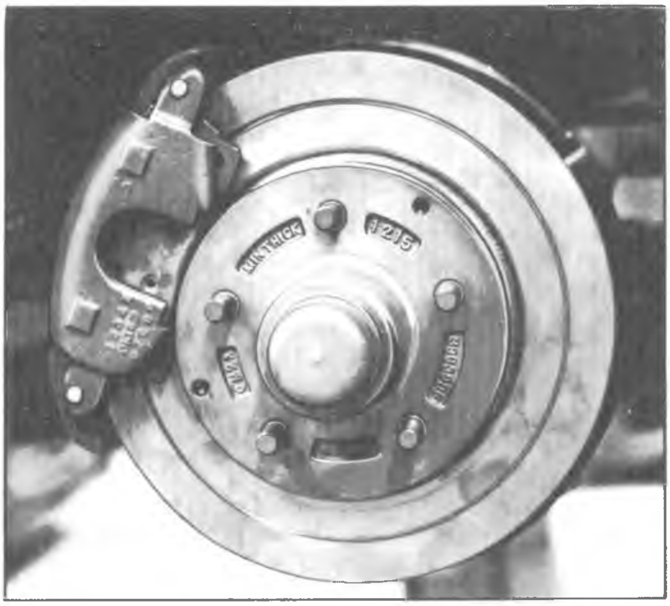


Fig. 2—Front Disc Brake

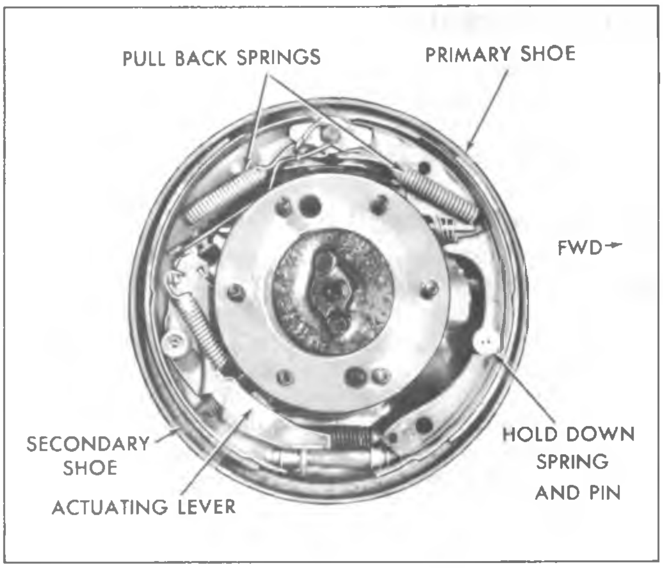


Fig. 3—Rear Drum Brake

MAINTENANCE AND ADJUSTMENTS

BRAKE INSPECTION

Every 12 months or 12,000 miles—whichever occurs first:

Inspect drum brake linings or disc brake pads, as well as the other internal brake components at each wheel (drums, rotors, wheel cylinders, etc.). For convenience, it is recommended that disc brake pads be checked whenever tires are rotated (at 6000 mile intervals). More frequent checks should be made if driving conditions and habits result in frequent brake application. Parking brake adjustment should also be checked whenever brake linings are checked.

NOTE: During any inspection period, the remaining lining life expectancy should be determined. This determination should dictate the next inspection period.

Lining Inspection

Drum Brake

Replace whenever the thickness of any part of any lining is worn to within 1/32" of the shoe table or rivet head whichever is applicable.

Another important point to remember, always replace brake shoes in axle sets (right and left side).

Disc Brakes

Check both ends of the outboard shoe by looking in at each end of the caliper. These are the points at which the highest rate of wear normally occurs. However, at the same time, check the lining thickness on the inboard shoe to make sure that it has not worn prematurely.

Replace whenever the thickness of any part of any lining is worn to within 1/32" of the shoe or rivet whichever is applicable.

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 brake fluid.

   CAUTION: Use only brake fluid when flushing a system.

3. Replace all rubber parts of the system, including brake hoses.
4. Refill the system.
5. Bleed the system.

Flushing Brake Hydraulic System

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system.

Flushing is also recommended if there is any doubt as to the grade of fluid in the system or if fluid has been used which contains the slightest trace of mineral oil.

Flushing is performed at each wheel cylinder in turn, and in the same manner as the bleeding operation except that bleeder valve is opened 1-1/2 turns and the fluid is forced through the pipes and wheel cylinder until it emerges clear in color. Approximately one quart of fluid is required to flush the hydraulic system thoroughly.

When flushing is completed at all wheel cylinders, make certain the master cylinder reservoir is filled to proper level.

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. Bleeding of brake system may be performed by one of two methods - either pressure or manual.

Sequence for Bleeding Wheel Cylinders

It is advisable to bleed one wheel cylinder at a time to avoid allowing fluid level in reservoir to become dangerously low. The correct sequence of bleeding is to bleed wheel cylinder, either front or rear system, nearest master cylinder first. This sequence expels air from lines and wheel cylinders nearest the master cylinder first and eliminates the possibility that air in a line close to the master cylinder may enter a line farther away after it has been bled.

CAUTION: Do not perform bleeding operation while any brake drum is removed.

Pressure Bleeding (Figs. 4 and 5)

NOTE: Pressure bleeding equipment must be of the diaphragm type. That is, it must have a rubber diaphragm between the air supply and the brake fluid to prevent air, moisture, oil and other contaminates from entering the hydraulic system.

1. Clean all dirt from top of master cylinder and remove cylinder cover and rubber diaphragm.

   NOTE: Make sure brake fluid in bleeder equipment is at operating level and that the equipment is capable of exerting 20 to 30 lbs. hydraulic pressure on the brake system.

2. Install Brake Bleeder Adapter J-23518 (J-23339 for frame mounted boosters) on master cylinder. Connect hose from bleeder equipment to bleeder adapter and open release valve on bleeder equipment.

   NOTE: The combination valve, located near the master cylinder, must be held in the open position while bleeding. This can be accomplished by installing Tool J-23709 with the open slot under the mounting bolt and pushing in on the pin in the end of the valve (fig. 4). Be sure to re-torque the mounting bolt after removing Tool J-23709.

3. Install Brake Bleeder Wrench J-21472 on bleeder valve at wheel cylinder nearest the master cylinder and install one end of bleeder hose on bleeder valve.

   NOTE: If the master cylinder is equipped with bleeder valves, bleed these valves first, proceed to the wheel cylinder nearest the master cylinder, then the next nearest and so on until all cylinders have been bled and there is no evidence of air in the system.

4. Pour a sufficient amount of brake fluid into a transparent container to ensure 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.
5. Open wheel cylinder bleeder valve by turning Tool J-21472 counter-clockwise approximately 3/4 of a turn and observe flow of fluid at end of bleeder hose.

   NOTE: To assist the bleeding operation a raw-hide mallet may be used to tap the caliper while fluid is flowing.

6. Close bleeder valve tight as soon as bubbles stop and brake fluid flows in a solid stream from the bleeder hose.
7. Remove brake bleeder wrench and bleeder hose from wheel cylinder bleeder valve.
8. Repeat Steps 3 through 7 on the remaining wheel cylinders.
9. Disconnect bleeder equipment from brake bleeder adapter.

   NOTE: The master cylinder on certain models is tilted. When removing the bleeder adapter on these models, place a clean dry cloth below the

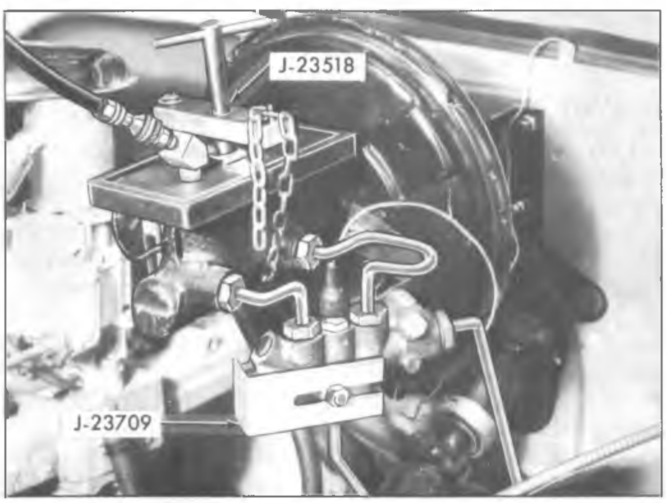


Fig. 4—Brake Bleeder J-23518 and J-23709—Typical

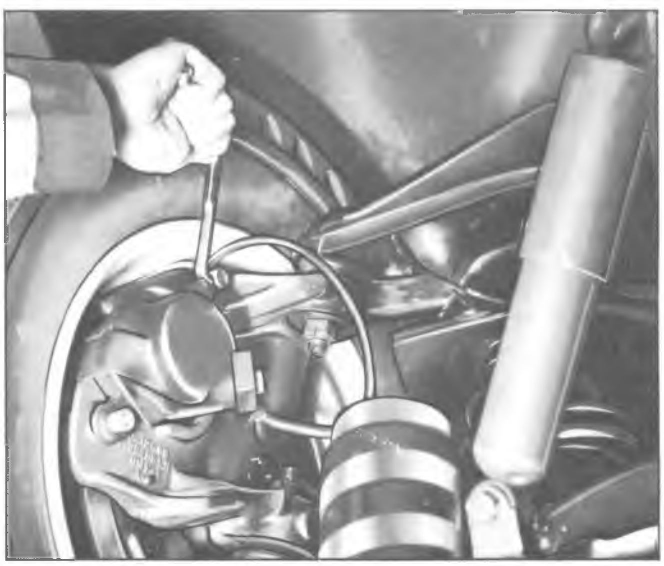


Fig. 5—Bleeding Brakes with Tool J-21472

cylinder to absorb any fluid spillage as the cover is removed.

10. Remove bleeder adapter. Wipe all areas dry if fluid was spilled during adapter removal.
11. Fill master cylinder reservoirs to within 1/4" of reservoir rims as shown in Figure 6.
12. Install master cylinder diaphragm and cover.
13. Test operation of brake pedal before moving the vehicle.

Manual Bleeding

1. Clean all dirt from the top of the master cylinder and remove the cylinder cover and rubber diaphragm.
2. Fill master cylinder (if necessary) and reinstall the cover.
3. Install Brake Bleeder Wrench J-21472 on a bleeder valve at a wheel cylinder and install a bleeder hose on the bleeder valve (fig. 5).

NOTE: The combination valve, located near the master cylinder, must be held in the open position while bleeding. This can be accomplished by installing Tool J-23709 with the open slot under the mounting bolt and pushing in on the pin in the end of the valve (fig. 4). Be sure to re-torque the mounting bolt after removing Tool J-23709.

NOTE: If the master cylinder is equipped with bleeder valves, bleed these valves first, then proceed to the wheel cylinder nearest the master cylinder then, the next nearest and so on until all cylinders have been bled and there is no evidence of air.

4. Pour a sufficient amount of brake fluid into a transparent container to ensure that the end of the bleeder hose will remain submerged during bleeding. Place the loose end of the bleeder hose into the container.

NOTE: Carefully monitor the fluid level at the master cylinder during bleeding. Do not bleed enough fluid at one time to drain the reservoir. Replenish as needed to ensure a sufficient amount of fluid is in the master cylinder at all times.

5. Open wheel cylinder bleeder valve by turning Tool J-21472 counter-clockwise approximately 3/4 of a turn. Have helper depress the brake pedal. Just before the brake pedal reaches the end of its travel, close the bleeder valve and allow the brake pedal to return slowly to the released position. Repeat Step 5 until expelled brake fluid flows in a solid stream without the presence of air bubbles, then close the bleeder valve tightly.

NOTE: To assist the bleeding operation a rawhide mallet may be used to tap the caliper while fluid is flowing.

6. Remove brake bleeder wrench and hose from the bleeder valve and repeat Steps 2 through 6 on the remaining wheel cylinders.
7. Fill the master cylinder to the level shown in Figure 6.
8. Install the master cylinder diaphragm and cover.

NOTE: In order to have a good surge of fluid at the bleeder valve, the brake pedal should be pumped up and pressure held before each opening of the valve.

HYDRAULIC BRAKE LINES AND TUBING (Figs. 7 and 8)

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.

These 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.

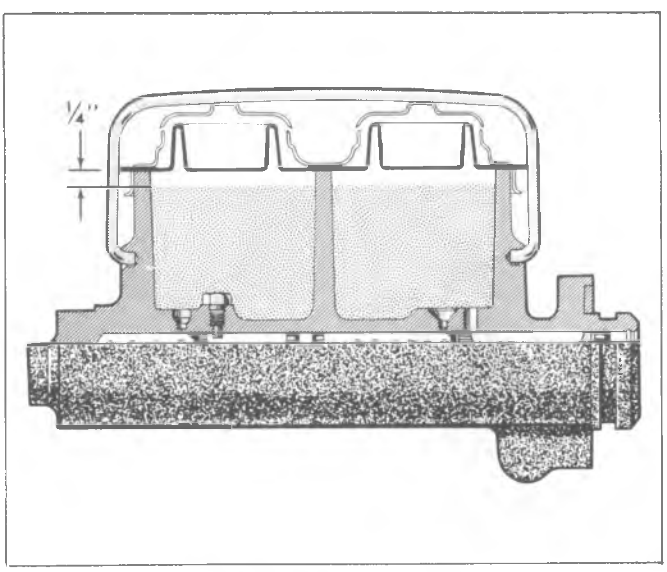


Fig. 6—Correct Fluid Level

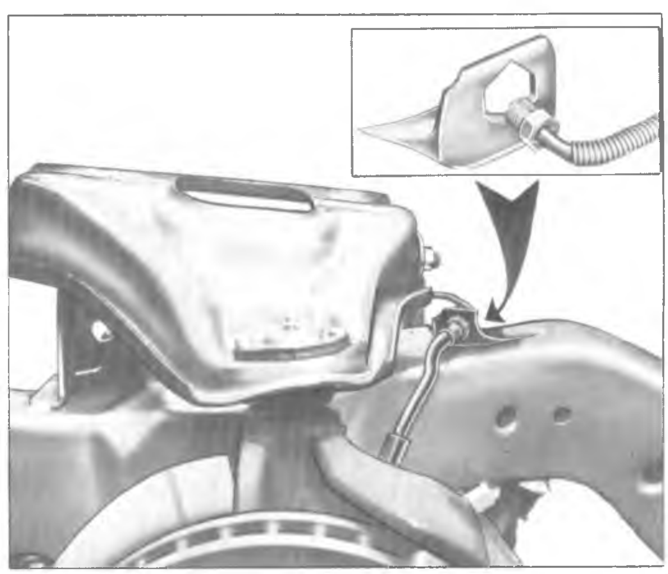


Fig. 7—Brake Tube Support—Typical

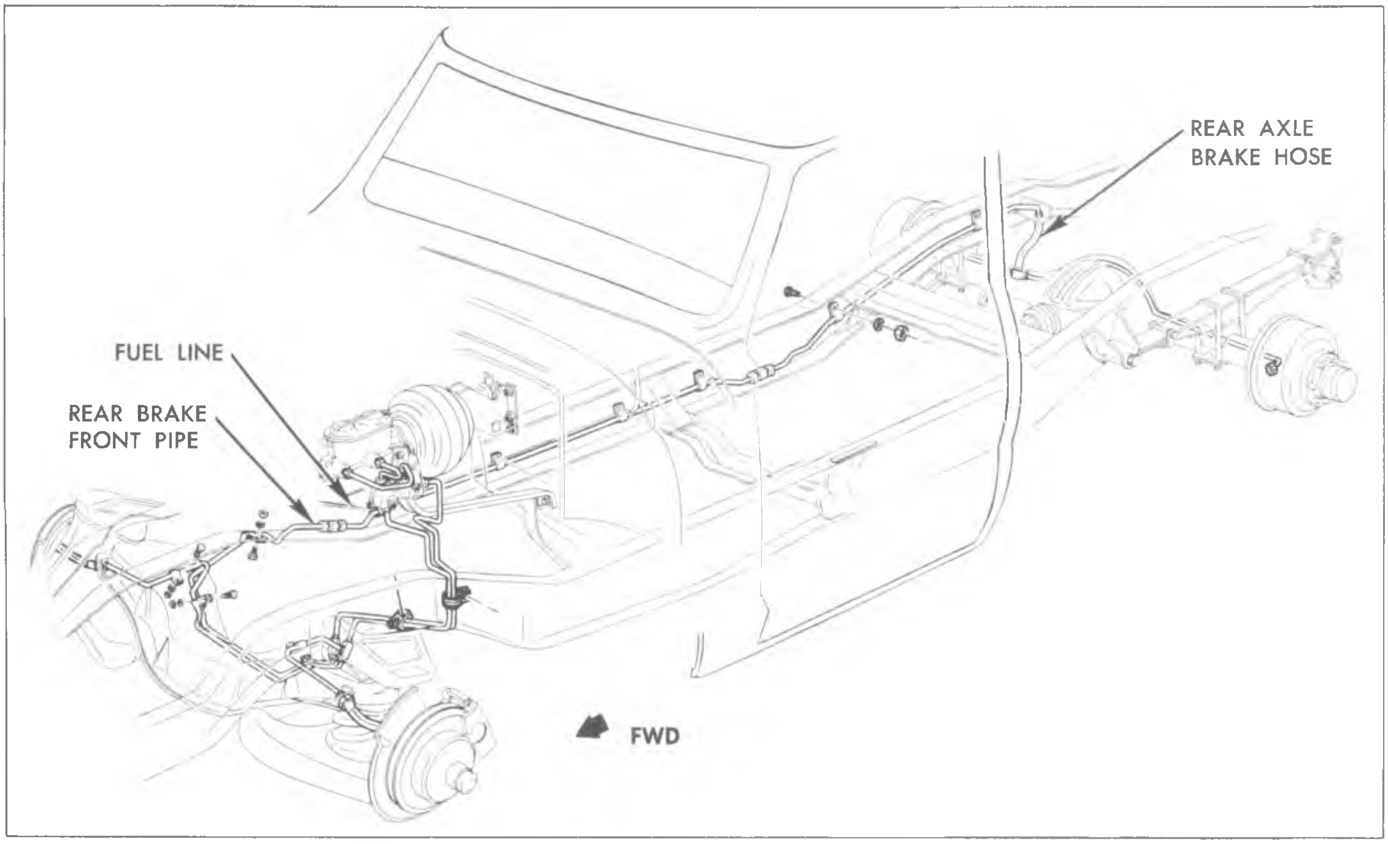


Fig. 8—Brake Line Retainers—Typical

Removal

1. Separate steel line from flex hose. Use back up wrench on the hose fitting.
2. Remove clip retainer from frame bracket.
3. Remove hose to caliper bolt and remove hose.

Installation (Fig. 7)

1. Install the hose to the caliper using new gaskets. Torque the mounting bolt.

   CAUTION: See Caution on Page 1 of this section.

2. Insert hose into frame bracket or crossmember—This end of hose will properly mate to the bracket or crossmember in one direction only.
3. Install the clip retainer.
4. Install the steel line to the flex line using a back up wrench on the hose fitting.

   CAUTION: See Caution on Page 1 of this section.

5. Bleed brakes as outlined in this section.

Hydraulic Brake Tubing (Figs. 9 thru 13)

Hydraulic brake tubing used on all trucks is a double layer flexible steel, copper coated and tin plated tubing which resists corrosion and also stands up under the pressures which are developed when applying the brakes. In making up hydraulic brake pipes, it is important that the ends of the tubing be flared properly for the compression couplings.

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 Tool J-2185 must be equipped with the proper size die block and upset flare punch for each size tubing to form the double-lap flare (fig. 9).

The proper size die blocks and upset flare punches are as follows:

Fig. 9—Tubing Flaring Tool J-2185

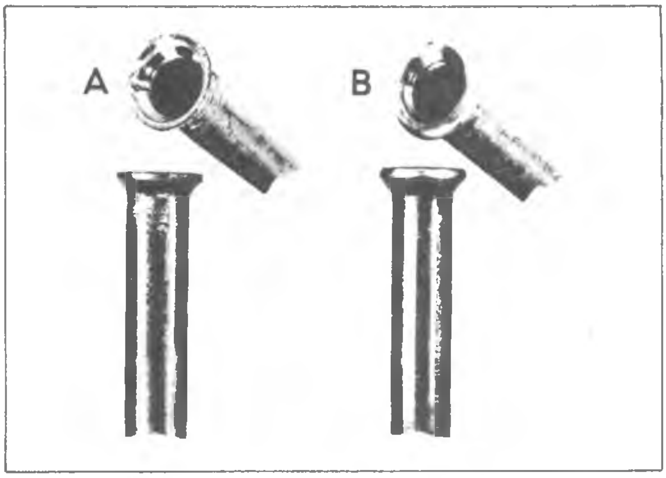


Fig. 10—Single and Double Lap Flare

Tubing Size	Die Block	Upset Flare Punch	Finish Flare Punch
3/16"	J-2185-27	J-2185-3	J-2185-26
1/4"	J-2185-28	J-2185-37	J-2185-26
5/16"	J-2185-29	J-2185-4	J-2185-26

Figure 10 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. Cut the tubing to the desired length, using Tool J-8000. Square off ends of tube and ream sharp edges with reamer tool provided on the tube cutter.
2. Install compression couplings on tubing and dip end of tubing to be flared in hydraulic brake fluid. This lubrication results in better formation of the flare.
3. Place one-half of the die blocks in the tool body with the counterbored ends toward the ram guide. Now lay the tubing in the block with approximately 1/4" 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."
4. Select the correct size upset flare punch. One end of this punch is hollowed out to gauge the amount of

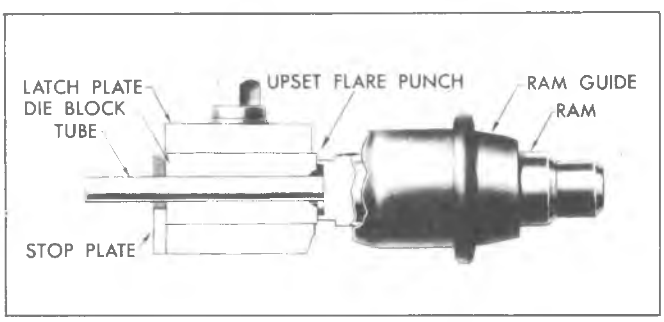


Fig. 11—Positioning Tube

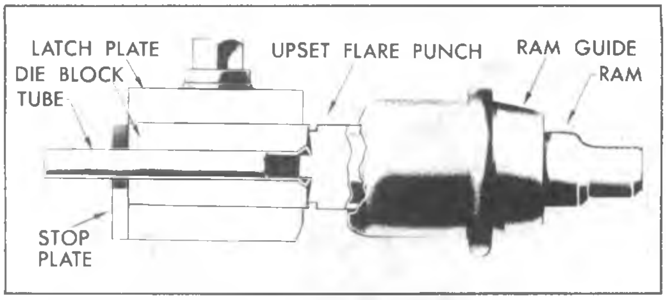


Fig. 12—Flaring Operation

tubing necessary to form a double-lap flare.

5. Slip the punch into the tool body with the gauge end toward the die blocks, install the ram and tap lightly until the punch meets the die blocks and they are forced securely against the stop plate (fig. 11).
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 until the upset flare is complete (fig. 12). 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. 13).

   NOTE: The seat should be inspected at intervals during the finishing operation to avoid over-seating.
8. Blow tubing out with compressed air to remove any foreign objects.

DRUM BRAKE ADJUSTMENT

Service Brake

Although the brakes are self adjusting a preliminary

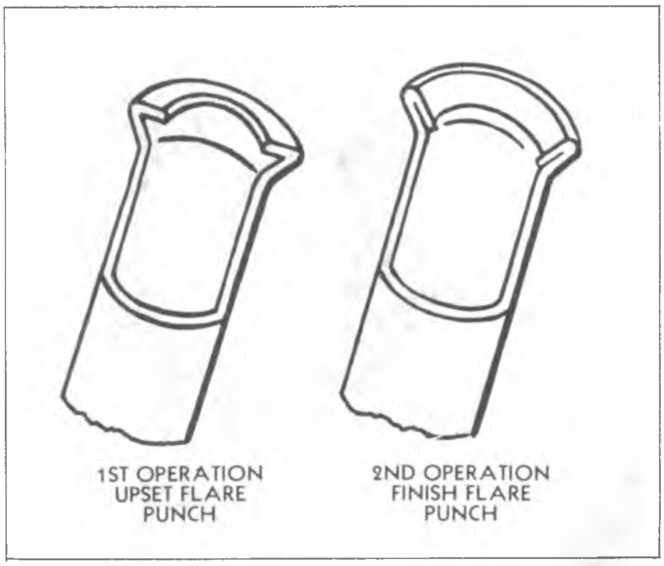


Fig. 13—First and Second Flare

Fig. 14—Using Drum-to-Brake Gauge J-21177

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.

Recommended Method of Adjustment (Fig. 14)

a. Use Drum to Brake Shoe Clearance Gauge J-21177 to check the diameter of the drum clearance surface (fig. 14).
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. 15).
c. Rotate the gauge around the brake shoe lining surface to assure proper clearance.

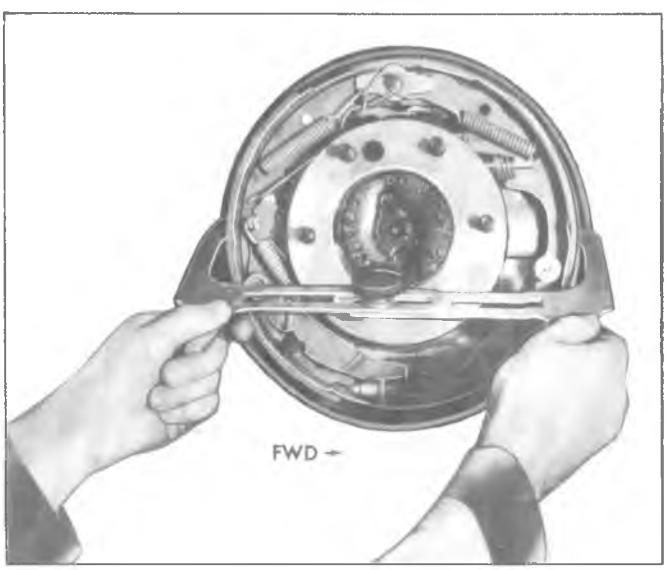


Fig. 15—Setting Lining Clearance with J-21177

Alternate Method of Adjustment

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 3.

2. Install the drum and wheel and remove the vehicle from the jack stands or hoist.

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

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.

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

CAUTION: 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.

Brake Pedal & Push Rod Travel Adjustment

A definite pedal push rod-to-master cylinder piston clearance must be maintained on the dash mounted master cylinder units. This clearance is adjusted as follows:

Threaded Rod Type Adjustment (Fig. 16)

1. After the brake pedal and pedal bumper have been

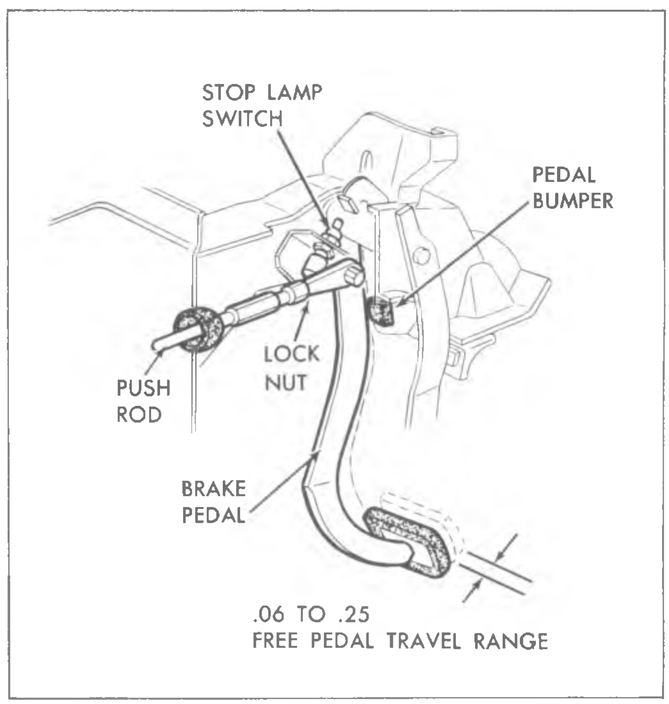


Fig. 16—Brake Pedal Adjustment—Typical

assembled, install the push rod and its attaching parts. Tighten nut to 30 ft. lbs. torque. Then to obtain the correct clearance between the push rod and the master cylinder, adjust the push rod so that the free pedal travel measured at the center of the pedal pad is approximately 1/8 inch (fig. 17).

2. After tightening the locknut on the adjustable push rod, recheck free travel.

CAUTION: See "Caution" on Page 1 of this section.

3. Stop light switch should be adjusted if necessary, so that electrical contact is made when pedal travel measures .38" to .64".

Brake Travel Warning Switch Adjustment

Refer to "Brake Travel Warning Switch" under Component Replacement in this section.

Parking Brake—Rear Wheel

The rear brake assemblies (except RPO H22—where parking brake is mounted on the propeller shaft) 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.

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.

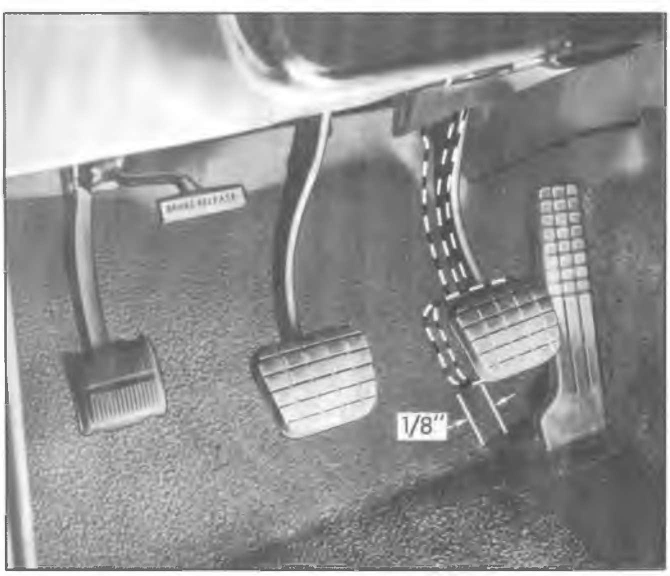


Fig. 17—Brake Pedal Free Movement

Adjustment—Foot Pedal Type

1. Raise vehicle on hoist.
2. Apply parking brake 1 notch from fully released position.
3. Loosen equalizer check nut and tighten the adjusting nut until a moderate drag is felt when the rear wheels are rotated.
4. Tighten the check nut to specifications.

CAUTION: See Caution on Page 1 of this section.

5. Fully release parking brake and rotate the rear wheels. No drag should be present.
6. Remove vehicle from hoist.

Adjustment—Orscheln Lever Type

1. Turn adjusting knob on parking brake lever counterclockwise to stop.
2. Apply parking brake.
3. Raise vehicle on a hoist.
4. Loosen lock nut at intermediate cable equalizer and adjust front nut to give light drag at rear wheels. Tighten the check nut to specifications.

CAUTION: See Caution on Page 1 of this section.

5. Re-adjust parking brake lever knob to give a definite snap-over-center feel.
6. Fully release parking brake and rotate rear wheels. No drag should be present.
7. Remove vehicle from hoist.

Parking Brake (Propeller Shaft)—Internal Expanding

Adjustment—Drum On

1. Jack up at least one rear wheel. Block wheels and release hand brake.
2. Remove cotter pin and clevis pin connecting pull rod and relay lever. This will assure freedom for full shoe release.

CAUTION: It may be necessary to knock out lanced area in brake drum with punch and hammer to gain entry into adjusting screw through brake drum. Be sure all metal has been removed from parking brake compartment.

3. Rotate brake drum to bring one of access holes into line with adjusting screw at bottom of shoes.
4. Expand shoes by rotating adjusting screw with screw driver inserted through hole in drum. Move outer end of screw driver away from drive shaft. Continue adjustment until shoes are tight against drum and drum cannot be rotated by hand. Back off adjustment ten notches and check drum for free rotation.
5. Place parking brake lever in fully released position. Take up slack in brake linkage by pulling back on cable just enough to overcome spring tension. Adjust clevis of pull rod or front cable to line up with hole in relay levers.
   a. Insert clevis pin and cotter pin, then tighten clevis locknut.
   b. Install new hole cover in drum to prevent contamination of brake.
   c. Lower rear wheels. Remove jack and wheel blocks.

CAUTION: See "Caution" on Page 1 of this section.

Adjustment—Drum Off

1. With parking brake drum off, use special Tool J-21177 or J-22364, Drum to Brake Shoe Clearance Gauge, to check diameter of drum clearance surface.
2. Turn the tool to the opposite side and fit over brake shoes by turning the star wheel until the gauge just slides over the linings.
3. Rotate the gauge around the brake shoe lining surface to insure proper clearance.
4. Install propeller shaft flange at mainshaft as outlined in transmission section.
5. Lower rear wheels. Remove jack and wheel blocks.

COMPONENT REPLACEMENT AND REPAIRS

DRUMS, SHOES AND LININGS—REAR DRUM BRAKES (Fig. 18)

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 brake drum or backing plate using a chisel or similar tool. Release the actuator from the star wheel with a small screw driver on models with access hole in backing plate or with a wire hook on models with hole in drum. Back off the star wheel with a second screw driver (as shown in Figures 19 and 20.)

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 metal hole cover must be installed when drum is reinstalled.

Drum brake lining can be inspected through slots in the flange plate. The portion of lining visible through the slot will not necessarily be the area of maximum wear and extra caution is necessary to make sure lining is replaced prior to the point where the remaining thickness, as viewed through the inspection slot, is as follows:

Series 10 (bonded lining), 1/16"
Series 20, 30 (riveted lining), 3/16"

NOTE: Riveted linings should be replaced when worn within 1/32" of rivet heads.

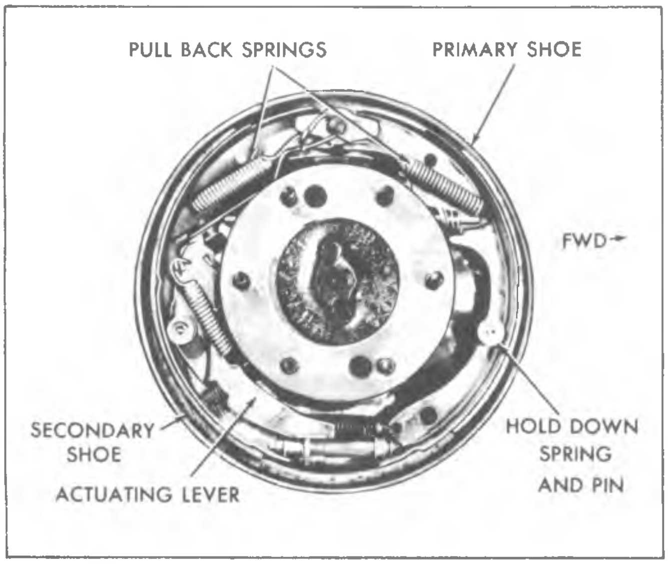


Fig. 18—Rear Brakes

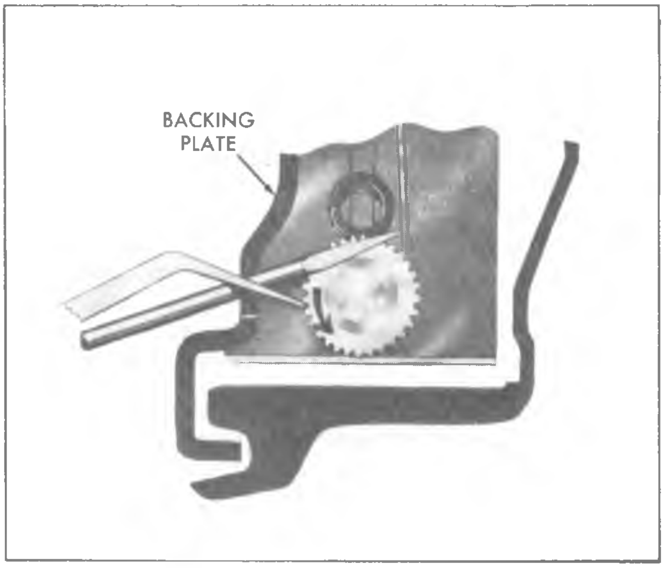


Fig. 19—Backing Plate Access Hole

Removal

1. Raise the vehicle on hoist.
2. Loosen check nuts at forward end of parking brake equalizer sufficiently to remove all tension from brake cable.
3. Remove brake drums.

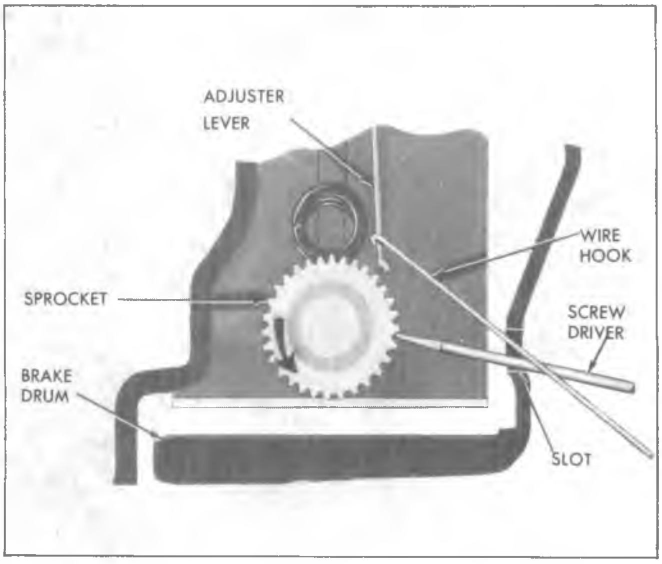


Fig. 20—Brake Drum Access Hole

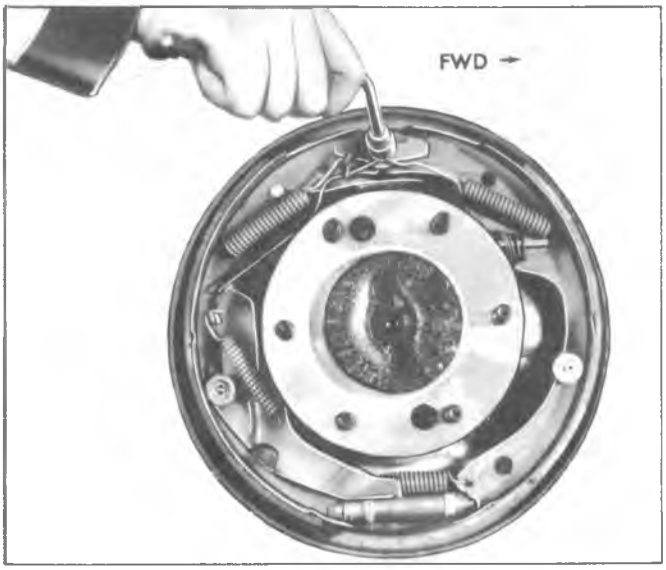


Fig. 21—Unhooking Pull Back Spring

CAUTION: The 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. 21).
5. Remove the actuator return spring.
6. Disengage the link end from the anchor pin and then from the secondary shoe.
7. Remove hold-down pins and springs using any suitable tool (fig. 22).
8. 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.

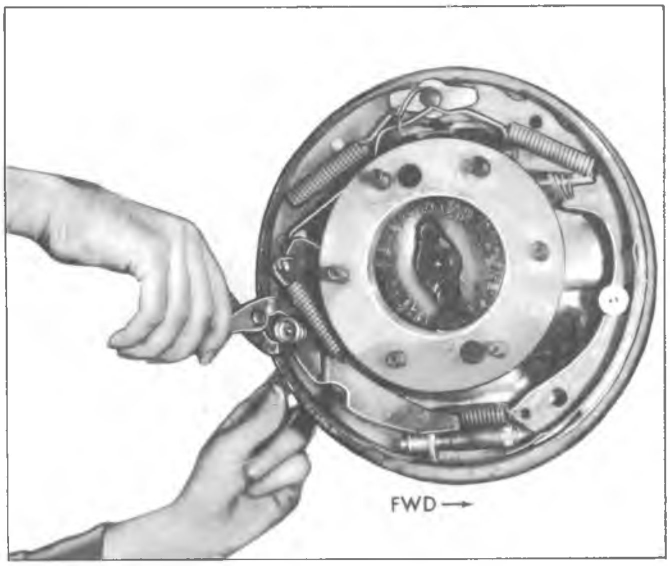


Fig. 22—Removing Hold Down Spring and Pin

9. Separate the brake shoes by removing adjusting screw and spring.

CAUTION: Mark shoe and lining positions if they are to be reinstalled.

10. Remove parking brake lever from secondary brake shoe.

Inspection

1. Clean dirt out of brake drum. Inspect drums for roughness, scoring or out of round. Replace or recondition drums as necessary.
2. 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 requiring overhaul of wheel cylinder.

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

3. Inspect backing plate for oil leakage past axle shaft oil seals. Install new seals if necessary.
4. Check all brake flange plate attaching bolts to make sure they are tight. Clean all rust and dirt from shoe contact faces on flange plate (fig. 23), using fine emery cloth.

Installation

CAUTION: Make certain to install recommended shoe and lining assemblies.

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

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

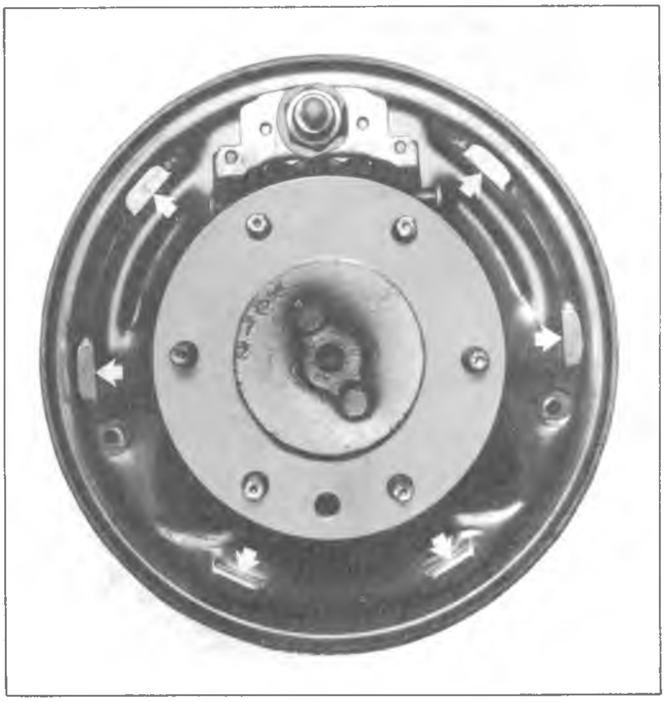


Fig. 23—Backing Plate Contact Surfaces

2. Lubricate parking brake cable.
3. 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.

CAUTION: Loose adjustment may occur from an adjusting screw that is not properly operating. If the lubrication in the adjusting screw of 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 (left hand or right hand). 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. Make sure right hand thread adjusting screw is on left side of car and left hand thread adjusting screw is on right side of car. Make certain starwheel lines up with adjusting hole in backing plate.

If original shoe and lining assemblies are being reinstalled, they must be installed in original positions (as marked at removal).

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

CAUTION: Do not hook the wire link over the anchor pin stud with the regular spring hook tool. Fasten the wire link to the actuator assembly first, and then place over the anchor pin stud by hand while holding the adjuster assembly in full down position.

11. Install actuator return spring.

CAUTION: 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 the spring from the secondary shoe over the wire link end (fig. 24).
14. Pry shoes away from the backing plate and lubricate shoe contact surfaces with a thin coating of brake lube.

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. 25).
16. Follow the above procedure for all brakes.
17. Adjust the service brakes and parking brake as outlined under "Maintenance and Adjustments" in this section.

Relining Brake Shoes

If old brake shoes are to be relined, inspect shoes for distortion and for looseness between the rim and web; these are causes for discarding any shoe. If shoes are serviceable, be governed by the following points in installing new linings:

1. Remove old linings by drilling out rivets. Punching rivets out will distort shoe rim. Thoroughly clean

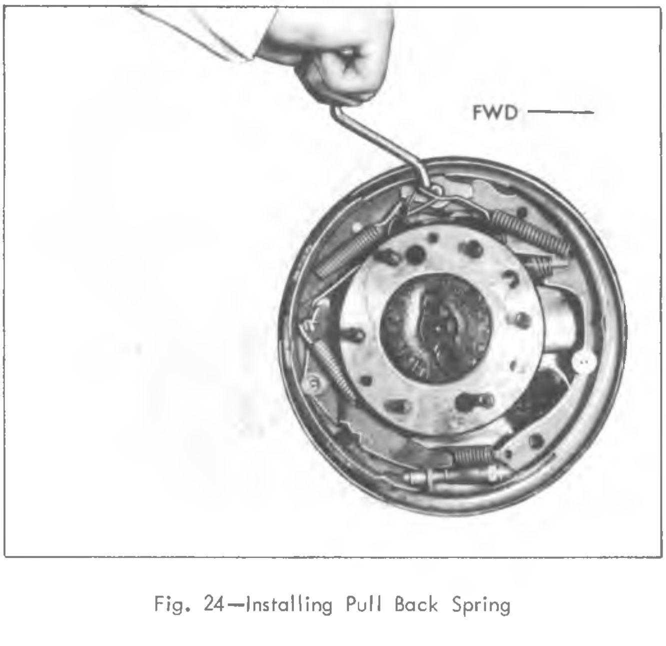


Fig. 24—Installing Pull Back Spring

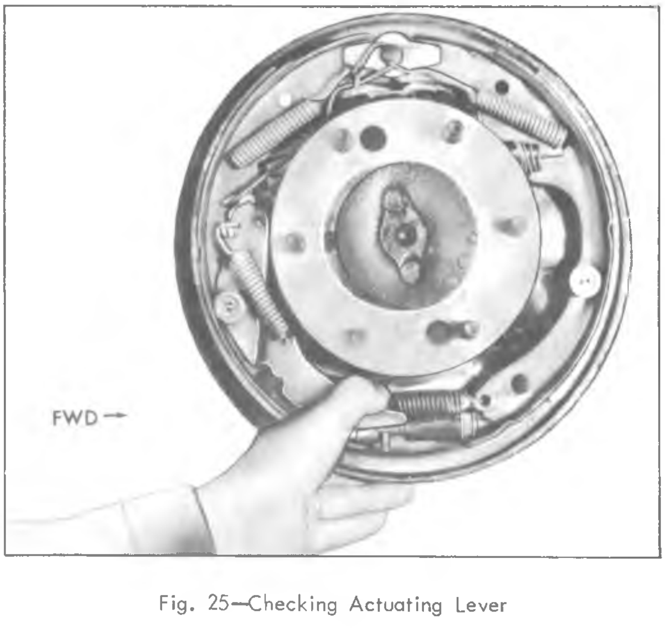


Fig. 25—Checking Actuating Lever

surface of shoe rim and file off any burrs or high spots.

2. Use Chevrolet brake lining or equivalent and the rivets included in lining package which are of the correct size. The rivets must fit the holes with the solid body of rivet extending through the shoe rim, but no farther.

CAUTION: Keep hands clean while handling brake lining. Do not permit oil or grease to come in contact with lining.

3. Start riveting at center of shoe and lining and work toward the ends. Use a roll set for riveting; a star set might split the tubular end and then the rivet would not fill the hole. The primary lining is shorter than secondary lining, therefore, the rivet holes at each end of the shoe rim are not used.
4. After riveting is completed, lining must seat snugly against shoe with no more than .005" separation midway between rivets. Check with a .004" (Go) and a .006" (No Go) feeler gage.

ANCHOR PIN REPLACEMENT

Removal

1. Raise vehicle on a hoist.
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 pin from flange plate. (Threaded type.)

Installation

1. Position anchor pin to flange plate, install lock washer and torque pin. Lock by peening over washer tabs.

CAUTION: See Caution on page 1 of this section.

2. Install brake shoe guide plate, link and pull back springs.
3. Adjust brakes, install drum and wheel as outlined previously in this section.
4. Lower vehicle and test brake operation.

WHEEL CYLINDER

CAUTION: Always use denatured alcohol or brake fluid to clean wheel cylinder parts. Never use mineral-base cleaning solvent such as gasoline, kerosene, carbon-tetrachloride, acetone, paint thinner or units of like nature as these solvents deteriorate rubber parts, causing them to become soft and swollen in an extremely short time.

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.

Wheel Cylinder Repair

Wheel cylinders should not be disassembled unless they are leaking or unless new cups and boots are to be installed. It is not necessary to remove the brake cylinder from the backing plate to disassemble, inspect, and overhaul the cylinder. Removal is necessary only when the cylinder is damaged or scored beyond repair.

Removal

1. Place vehicle on hoist.
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.

Disassembly (Fig. 26)

1. Remove boots from cylinder ends.
2. Remove pistons and cups.

Inspection and Cleaning

NOTE: Staining is not to be confused with corrosion. Corrosion can be identified with 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.

CAUTION: 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 denatured alcohol.
4. Remove 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. 26)

1. Lubricate the cylinder bore with clean brake fluid and insert spring-expander assembly.
2. Install new cups with flat surface toward outer ends of cylinder. Be sure cups are lint and dirt free be-

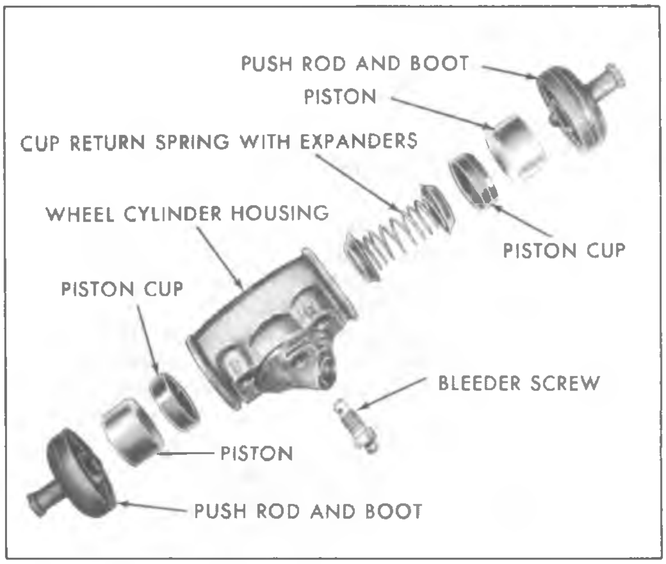


Fig. 26—Wheel Cylinder—Explode

fore insertion. Do not lubricate cups prior to assembly.

3. Install new pistons into cylinder with flat surfaces toward center of cylinder. Do not lubricate pistons before installation.
4. Press new boots onto cylinder by hand. Do not lubricate boots prior to installation.

Installation

1. Position wheel cylinder to brake flange plate. Install screws and tighten securely.

   CAUTION: See Caution on Page 1 of this section.

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

   CAUTION: See Caution on Page 1 of this section.

4. Bleed system as outlined in this section.
5. Install all parts removed for accessability and remove vehicle from hoist.

BRAKE DRUMS

A lanced "knock out" area is provided in the brake backing plate or 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.

Inspecting and Reconditioning

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

WARNING: A CRACKED DRUM IS UNSAFE FOR FURTHER SERVICE AND MUST BE REPLACED. DO NOT ATTEMPT TO WELD A CRACKED DRUM.

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 refinish in order to true up the braking surface.

If the brake linings are slightly worn and the drum is grooved, the drum should be turned just enough to remove grooves. The ridges in the lining should be lightly removed with a lining grinder.

If brake linings are more than half worn but do not need replacement, the drum should be polished with fine emery cloth but should not be turned. At this stage, eliminating all grooves in drum and smoothing the ridges on lining would necessitate removal of too much metal and lining, while if left alone, the grooves and ridges match and satisfactory service can be obtained.

If drum is to be refinished 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.

A brake drum must not be refinished more than .060" over the maximum standard diameter.

Out-Of-Round Or Tapered Drum

A drum that is more than .006 out-of-round on the diameter will result in rough brake application and should be refinished. Out-of-round and the diameter can only be accurately measured with an inside micrometer fitted with proper extension rods.

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. An out-of-round drum can also cause severe and irregular tire tread wear as well as a pulsating brake pedal. When the braking surface of a brake drum exceeds the factory specification limits in taper (and/or) being out-of-round, the drum should be turned to true up the braking surface. Out-of-round as well as taper and wear can be accurately measured with an inside micrometer fitted with proper extension rods.

When measuring a drum for out-of-round, taper and wear, take measurements at the open and closed edges of machined surface and at right angles to each other.

Micrometer Method (Fig. 27)

1. Place the brake drum on a smooth surface.
2. Using micrometers, place the tips at the center of the drum face.
3. While sweeping horizontally and vertically, slowly adjust the micrometer until maximum contact is made. Record this reading.
4. Rotate the drum 45 degrees and repeat Step 3. Continue until 4 readings have been made. The difference between these 4 readings must not exceed .006.

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

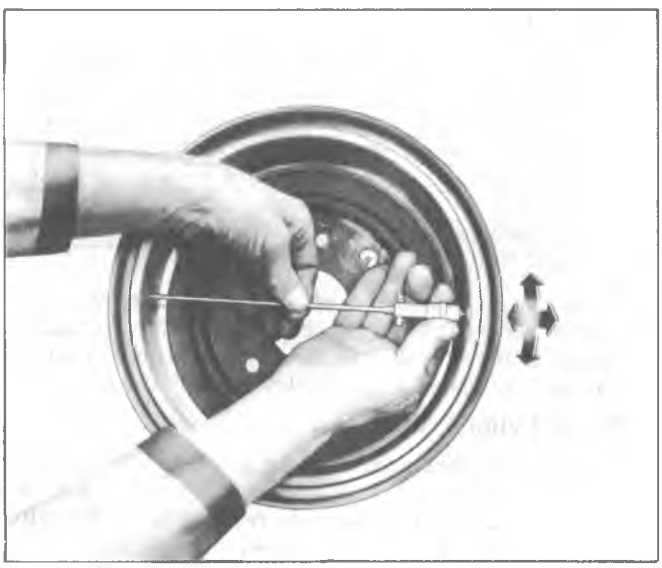


Fig. 27—Measuring Drum Diameter

before the drum is placed in service to prevent any of this oil from getting on the brake shoe facings.

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.

NOTE: All brake drums have a maximum diameter cast into them. This diameter is the maximum wear diameter and not a refinish diameter. Do not refinish a brake drum that will not meet the specifications as shown below after refinishing.

ORIGINAL DIAMETER	MAXIMUM REFINISH DIAMETER	REPLACEMENT (DISCARD) DIAMETER
11.000	11.060	11.090
12.000	12.060	12.090
13.000	13.060	13.090

SHOE AND LININGS—Front Disc Brake

The brake linings should be inspected any time that the wheels are removed. Check both ends of the outboard shoe by looking in at each end of the caliper. This is the point at which the highest rate of wear normally occurs. At the same time, check the lining thickness on the inboard shoe by looking down through the inspection hole in the top of the caliper—See "Brake Inspection".

The outboard shoes have ears near the outer edge which are bent over at right angles to the shoe. The top ends of the shoe have looped ears with holes in them which the caliper retaining bolts fit through. The large tab at the bottom of the shoe is bent over at a right angle and fits in the cut-out in the outboard section of the caliper.

The inboard shoe and lining has ears on the top ends which fit over the caliper retaining bolts. A special spring inside the hollow piston supports the bottom edge of the inboard shoe.

NOTE: Outboard shoes (with formed ears) are designed for original installation only and are fitted to the caliper. The shoes should never be relined or reconditioned for installation on Chevrolet vehicles.

Removal

1. Remove master cylinder cover and observe brake fluid level in front reservoir. If reservoir is more than 1/3 full, siphon the necessary amount out to bring the level to 1/3 full. (This step is taken to avoid reservoir overflow when the caliper piston is pushed back into its bore.) Discard the brake fluid removed. Never reuse brake fluid.
2. Raise the vehicle and remove the front wheels.
3. Push the piston back into its bore. This can be accomplished by using a "C" clamp as shown in Figure 28.
4. Remove the two mounting bolts which attach the caliper to the support (fig. 29).
5. Lift the caliper off the disc.
6. Remove the inboard shoe. Dislodge the outboard shoe and position the caliper on the front suspension arm so that the brake hose will not support the weight of the caliper.

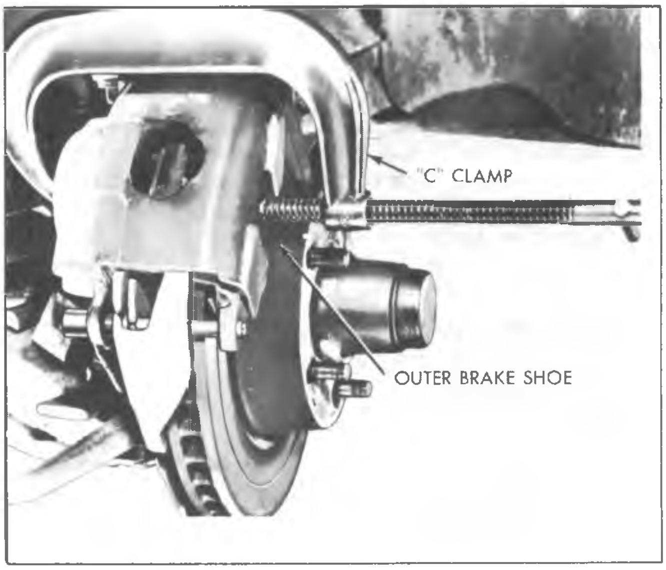


Fig. 28—"C" Clamp for Removal Aid

CAUTION: Mark shoe positions if they are to be reinstalled.

7. Remove the shoe support spring from the piston.
8. Remove the two sleeves from the inboard ears of the caliper.
9. Remove the four rubber bushings from the grooves in each of the caliper ears.

Cleaning and Inspection

NOTE: The shoes should be replaced when the lining is worn to approximately 1/32" over the rivet heads. Replace shoes in axle sets.

1. Thoroughly clean the holes and the bushing grooves in the caliper ears and wipe any dirt from the mounting bolts.

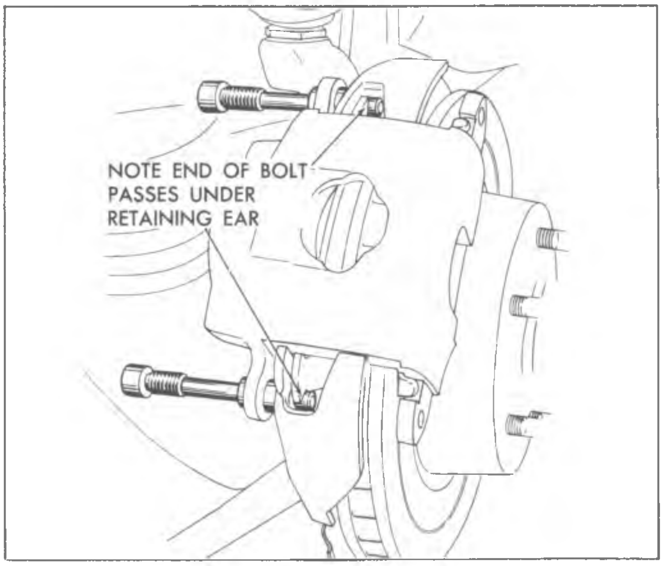


Fig. 29—Caliper Removal and Installation

CAUTION: Do not use abrasives on the bolts since this may damage the plating. If the bolts are damaged or corroded, they should be replaced.

2. Examine the inside of the caliper for evidence of fluid leakage. If leakage is noted, the caliper should be overhauled.
3. Wipe the inside of the caliper clean, including the exterior of the dust boot. Check the boot for cuts, cracks or other damage.

CAUTION: Do not use compressed air to clean the inside of the caliper. This may cause the dust boot to become unseated.

Installation

CAUTION: If original shoes are being reinstalled, they must be installed in original positions (as marked at removal).

1. Lubricate new sleeves, new rubber bushings, the bushing grooves and the end of the mounting bolts using Delco Moraine Silicone Lube or equivalent (fig. 30).

   It is essential that new sleeves and rubber bushings be used and that lubrication instructions be followed in order to ensure the proper functioning of the sliding caliper design.
2. Install the new rubber bushings in the caliper ears.
3. Install the new sleeves to the inboard ears of the caliper.

NOTE: Position the sleeve so that the end toward the shoe and lining assembly is flush with the machined surface of the ear.

4. Install the shoe support spring and the "old" shoe in the center of the piston cavity (as shown in Figure 31).

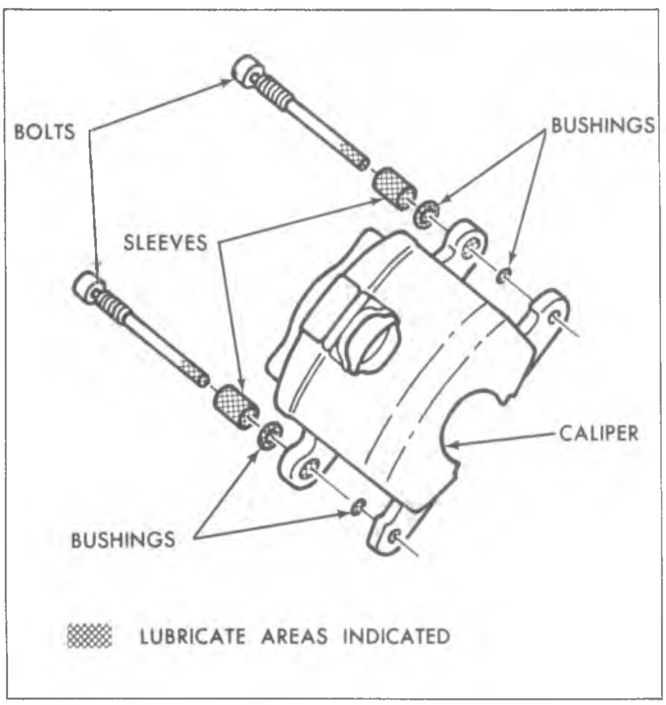


Fig. 30—Lubrication Points

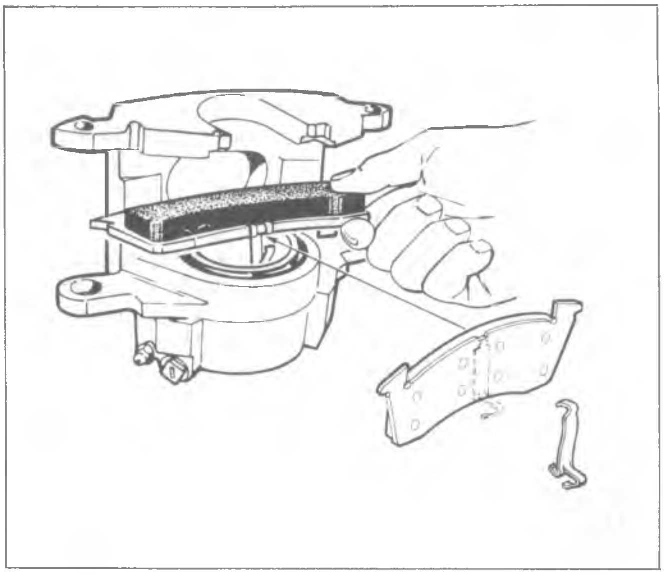


Fig. 31—Installing Support Spring

5. Push down until the shoe lays flat against the caliper (fig. 32).
6. Position the outboard shoe in the caliper with the ears at the top of the shoe over the caliper ears and the tab at the bottom of the shoe engaged in the caliper cutout.
7. With both shoes installed, lift the caliper up and rest the bottom edge of the outboard lining on the outer edge of the brake ~~disc~~ to make sure there is no clearance between the tab at the bottom of the outboard shoe and the caliper abutment.
8. Using a 1/4 x 1 x 2-1/2 inch metal bar, supported on the "old" inboard shoe and the lower flange of the outboard shoe (fig. 33), clamp with moderate pressure using a clean "C" clamp.

CAUTION: Use a clean "C" clamp to avoid contamination of the brake lining and do not use excessive force which could deform the lining face.

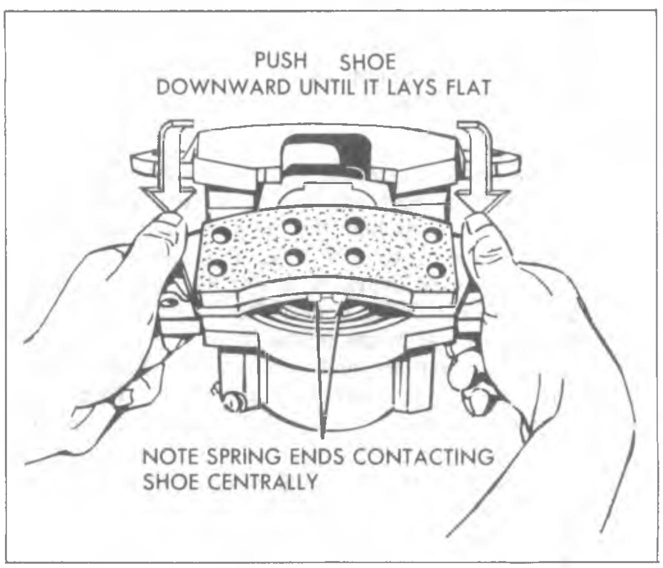


Fig. 32—Installing Shoe to Caliper

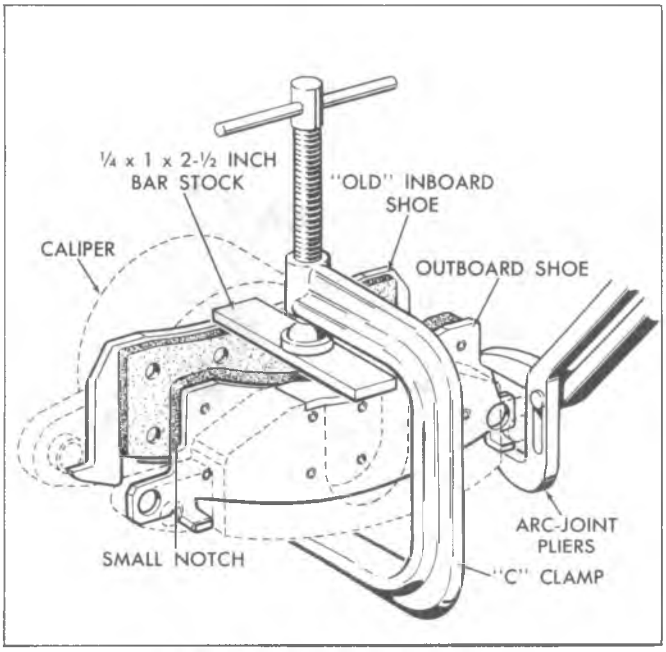


Fig. 33—Fitting Shoe to Caliper

9. Using arc joint pliers, as shown in Figure 33, bend both upper ears of the outboard shoe over the caliper until the clearance between the shoe ear and the caliper (measured at both the edge and side of the caliper) is 0.005 inch or less. Locate pliers on small notches opposite ears.

   NOTE: Outboard shoes (With formed ears) are designed for original installation only and are fitted to the caliper. The shoes should never be relined or reconditioned for installation on Chevrolet vehicles.

10. After clinching, remove the "C" clamp. Remove the "old" inboard shoe and insert the "new" inboard shoe.
11. Position the caliper over the brake disc, lining up the hole in the caliper ears with the holes in the mounting bracket.

    CAUTION: Make sure that the brake hose is not twisted or kinked.

12. Start the caliper to mounting bracket bolts through the sleeves in the inboard caliper ears and the mounting bracket, making sure that the ends of the

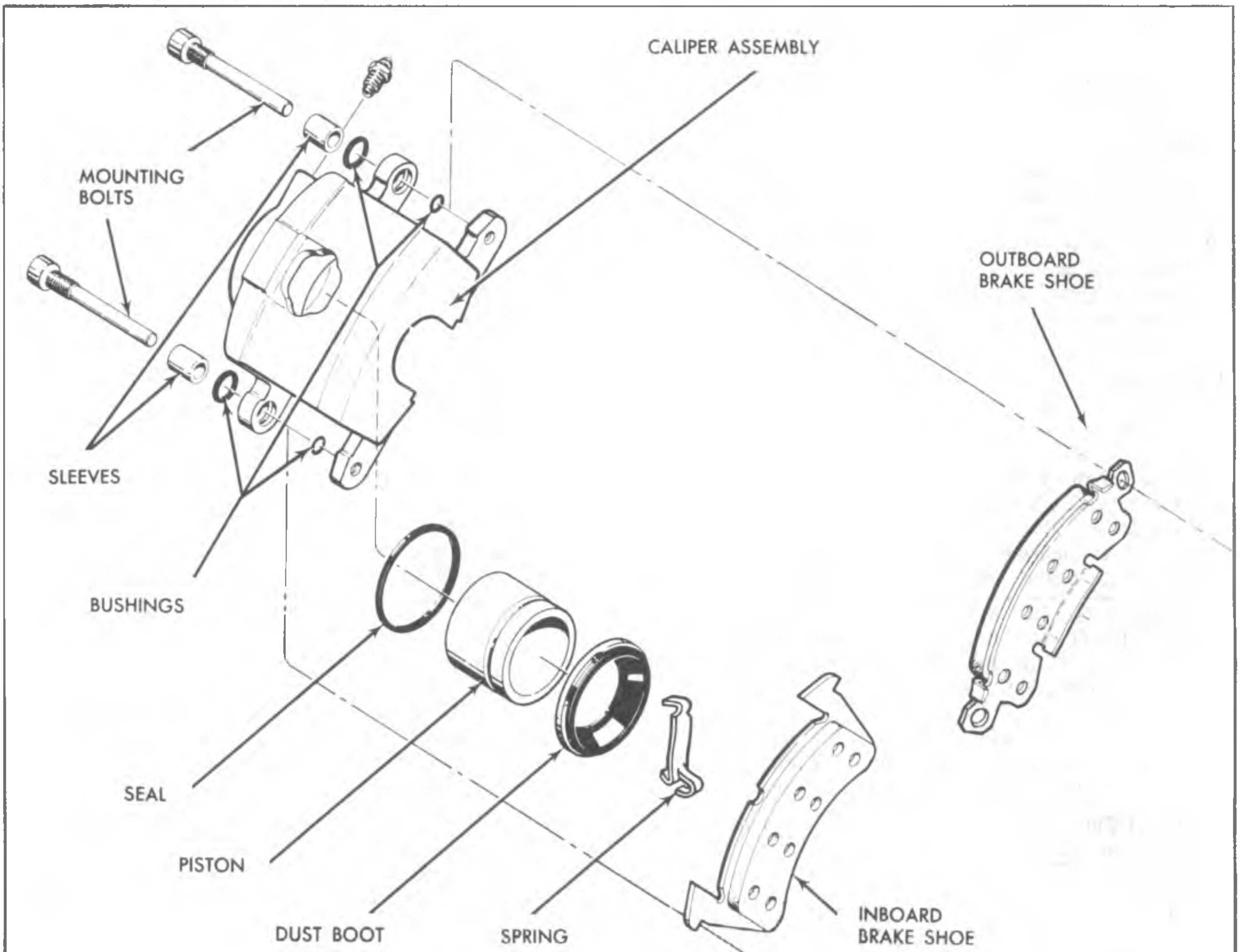


Fig. 34—Caliper Explode

bolts pass under the retaining ears on the inboard shoe (fig. 29).
13. Push the mounting bolts through to engage the holes in the outboard shoes and outboard caliper ears. Then thread the mounting bolts into the mounting bracket.
14. Torque the mounting bolts to 35 ft. lbs.

CAUTION: See "Caution" on Page 1 of this section.

15. Reinstall the front wheel and lower the vehicle.
16. Add brake fluid to the master cylinder reservoir to bring the fluid level up to within 1/4 inch of the top.

CAUTION: Before moving the vehicle, pump the brake pedal several times to make sure that it is firm (Do not move vehicle until a firm pedal is obtained). Check master cylinder fluid level again after pumping the pedal.

CALIPER OVERHAUL

CAUTION: Always use denatured alcohol or brake fluid to clean any caliper parts.

Never use mineral-base cleaning solvent such as gasoline, kerosene, carbon-tetrachloride, acetone, paint thinner or units of like nature as these solvents deteriorate rubber parts, causing them to become soft and swollen in an extremely short time.

Removal

1. Disconnect the hose from the steel brake line and cap or tape the fittings to prevent dirt from entering the line or hoses.
2. Remove the U-shaped retainer from the hose fitting.
3. Withdraw the hose from the frame support bracket and remove the caliper with the hose attached. Mark shoe location and remove the shoes from the caliper.

Disassembly

1. Clean the exterior of the caliper using denatured alcohol or equivalent and place on a clean work surface.
2. Remove the brake hose from the caliper and discard the copper gasket. Check the hose for worn spots, cracks or other signs of deterioration. Discard the hose, if damaged, and replace with a new hose.
3. Drain the brake fluid from the caliper.

WARNING: DO NOT PLACE THE FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR.

4. Using clean shop towels, pad the interior of the caliper and remove the piston by directing compressed air into the caliper inlet hole (fig. 35).

CAUTION: Use just enough air pressure to ease the piston out of the bore. Do not blow piston out of the bore.

NOTE: Another method of removing the piston is to stroke the brake pedal (gently) while the hydraulic lines are still connected. This will push the piston out of the caliper bore.

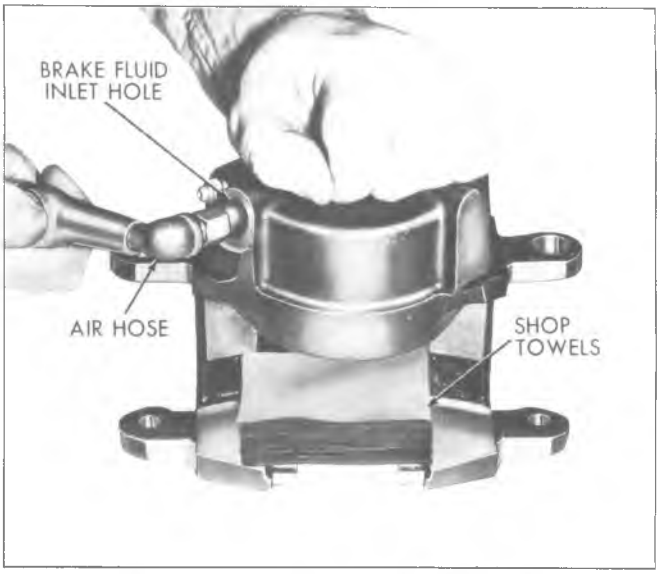


Fig. 35—Removing Piston From Caliper

5. Using a screw driver and caution so as not to scratch the piston bore, pry the dust boot out of the caliper piston bore.
6. Using a small piece of wood or plastic remove the piston seal from its groove in the caliper piston bore.

CAUTION: Do not use a metal tool of any kind for this operation.

7. Remove the bleeder valve from the caliper.

Cleaning and Inspection

NOTE: The dust boot, piston seal, rubber bushings and sleeves are to be replaced each time that the caliper is over-hauled. Discard these parts - do not bother to clean and inspect them.

1. Clean all parts (other than those mentioned above) in denatured alcohol. Use dry, filtered, compressed air to dry parts and blow out all passages in the caliper and bleeder valve.

CAUTION: The use of lubricated shop air will leave a film of mineral oil on the metal parts. This may damage rubber parts when they come in contact after reassembly.

2. Check the mounting bolts for corrosion or other damage. Do not attempt to clean up the bolts. If they appear corroded - replace them.
3. Carefully examine the outside surface of the piston for scoring, nicks, corrosion and worn or damaged chrome plating. If any surface defects are detected, replace the piston.

CAUTION: The piston outside diameter is the primary sealing surface in the caliper assembly. It is manufactured and plated to close tolerances. Refinishing by any means or the use of any abrasive is not an acceptable practice.

4. Check the bore in the caliper for the same defects as the piston. The piston bore, however, is not

plated and stains or minor corrosion can be polished with crocus cloth.

CAUTION: Do not use emery cloth or any other form of abrasive. Thoroughly clean the caliper after the use of crocus cloth. If the bore cannot be cleaned up in this manner, replace the caliper.

Reassembly

1. Lubricate the caliper piston bore and the new piston seal with clean brake fluid. Position the seal in the caliper bore groove.
2. Lubricate the piston with clean brake fluid and assemble a new boot into the groove in the piston so that the fold faces the open end of the piston (fig. 36).
3. Insert the piston into the caliper bore using care not to unseat the seal and force (50 to 100 pounds force required) the piston to the bottom of the bore.
4. Position the dust boot in the caliper counterbore and seat using Boot Installer Tool J-22904 (fig. 37).

CAUTION: Check the boot installation to make sure that the retaining ring moulded into the boot is not bent and that the boot is installed below the caliper face and evenly all around.

5. Install the brake hose in the caliper inlet using a new copper gasket.

CAUTION: See "Caution" on Page 1 of this section.

Hose must be positioned in the caliper locating gate (between locating beads) to assure proper positioning to caliper.

Installation

NOTE: Installation of the caliper and mounting parts (rubber bushings, sleeves, bolts, and shoe and lining assemblies) is the same as for: Brake Shoes and Linings - except for the steps given below.

1. Connect the brake hose to the brake line at the frame bracket.

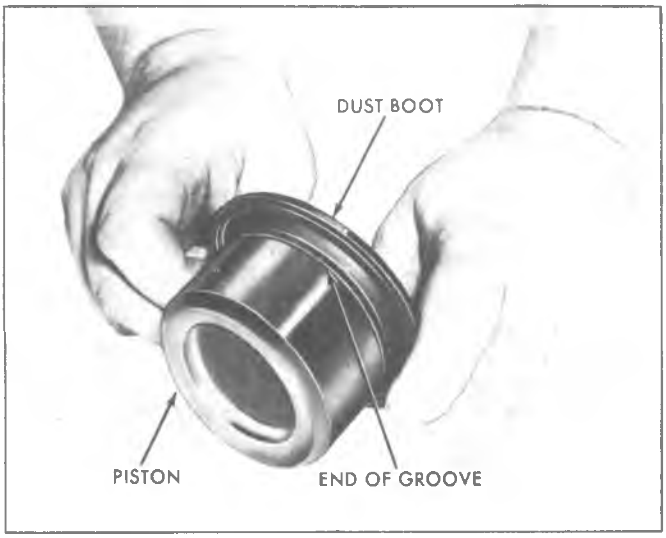


Fig. 36—Installing Boot to Piston

CAUTION: See "Caution" on Page 1 of this section.

2. Bleed the calipers using the method outlined in the beginning of this section.

DISC REFINISHING

Servicing of the brake disc is extremely critical since accurate control of the disc tolerances is necessary to ensure proper brake operation.

NOTE: All brake disc have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. Do not refinish a brake disc that will not meet the specifications as shown below after refinishing.

MINIMUM THICKNESS AFTER REFINISHING	REPLACEMENT (DISCARD) THICKNESS
1.230	1.215

Minimum Requirements

The disc brake surfaces must meet the following specifications.

1. Must be flat radially within .002 T.I.R.
2. Must be parallel with each other within .003 T.I.R. when checked radially.
3. Total circumferential thickness variation at any radius must not exceed .0005 in 360°.
4. When mounted on bearing cups, lateral run-out must not exceed .005 T.I.R. and maximum rate of change must not exceed .001 in 30°.
5. Both surfaces must be free of scratch marks and porosity.

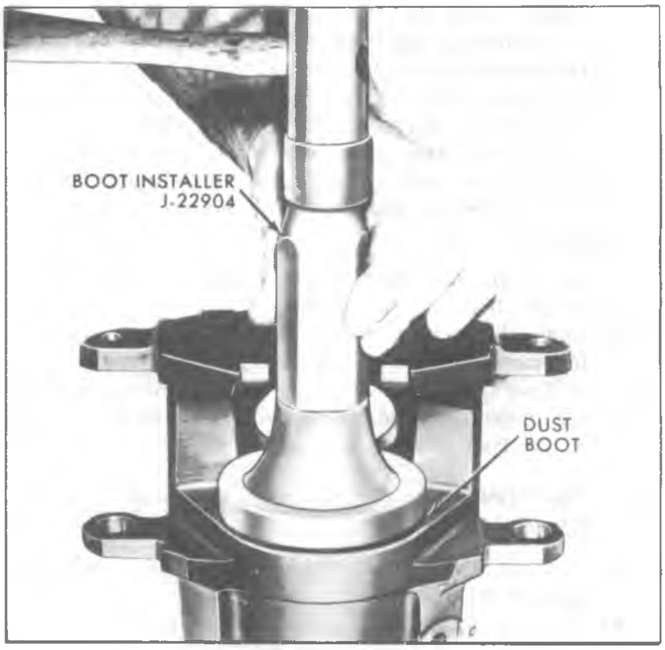


Fig. 37—Installing Boot to Caliper

6. Finish is to be 20-60 micro inches and must not be circumferential (directional).
7. Both surfaces must be square with bearing cup centerline within .003 T.I.R.

Light Scoring

Light scoring of the disc surfaces not exceeding .015 inch in depth, which may result from normal use, is not detrimental to brake operation.

Checking Lateral Runout

Tighten the wheel bearing adjusting nut until all of the play is out of the bearing. It should be just loose enough to allow the wheel to turn. Fasten a dial indicator to some portion of the suspension so that the point of the stylus contacts the rotor face approximately one inch from the rotor edge. Set the dial at zero and move the rotor one complete rotation, checking the indicator as the rotor moves. After checking the runout, readjust the wheel bearing (See Section 3.)

Checking Parallelism

To check for parallelism, measure the thickness of the rotor at four or more points around the circumference of the rotor (use micrometers). All measurements must be made at the same distance in from the edge of the rotor.

MASTER CYLINDER

CAUTION: Always use denatured alcohol or brake fluid to clean any master cylinder parts. Never use mineral-base cleaning solvent such as gasoline, kerosene, carbon-tetrachloride, acetone, paint thinner or units of like nature as these solvents deteriorate rubber parts, causing them to become soft and swollen in an extremely short time.

Removal

1. Wipe master cylinder and lines clean with a clean cloth. Place dry cloths below master cylinder area to absorb any fluid spillage.
2. Disconnect hydraulic lines at master 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 master cylinder from the dash panel (or power brake booster).

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 master cylinder. Assemble new boot over push rod and press it down over the push rod retainer. Slide new mounting gasket into position. Secure the master cylinder to the dash panel with mounting bolts.

CAUTION: See "Caution" on Page 1 of this section.

3. Connect the push rod clevis to the brake pedal with pin and retainer.
4. Connect the brake lines to the master cylinder.

CAUTION: See "Caution" on Page 1 of this section.

5. Fill the master cylinder reservoirs to the levels shown in Figure 6. Bleed the brake system as outlined in this section.
6. If necessary, adjust the brake pedal free play as outlined in this section.

MASTER CYLINDER OVERHAUL (Fig. 38)

Disassembly

1. Remove the small secondary piston stop screw from the bottom of the front fluid reservoir of the master cylinder.
2. Place the master cylinder in the vise so that the lock ring can be removed from the small groove in the I.D. of the bore. Remove the lock ring and primary piston assembly. Remove the secondary piston, secondary piston spring and retainer by blowing air through the stop screw hole. If air is not available, a piece of wire may be used. Bend approximately 1/4" of one end of the wire into a right angle. Hook this end under the edge of the secondary piston and pull the secondary piston from the bore.

CAUTION: Do not tighten vise too tightly as damage to the master cylinder could result.

NOTE: The brass tube-fitting insert should not be removed unless visual inspection indicates the insert is damaged.

3. To replace a defective insert the following procedure should be practiced:
   a. Place the master cylinder in a vise, so that the outlet holes are up. Enlarge the outlet holes in the tube seats using a 13/64" drill. Tap a 1/4" - 20 thread in these holes. Place a heavy washer over the outlet on the master cylinder and thread a 1/4" - 20 x 3/4" hex head bolt into the tube seat. Tighten the bolt until the tube seat is unseated.
   b. A more preferable way to remove a defective insert involves use of a self-tapping screw and a claw hammer. With a box-end or socket wrench,

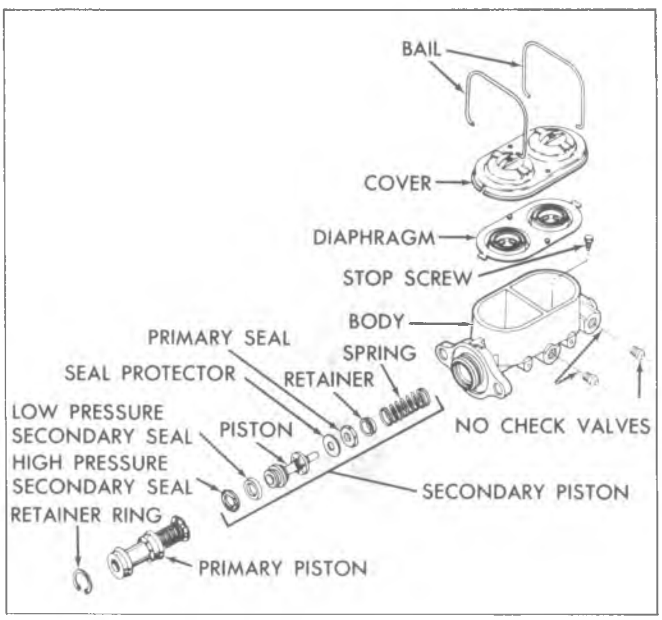


Fig. 38—Master Cylinder—Explode

thread a #6 - 32 x 5/8" long self-tapping screw into the tube-fitting insert. Using the claw end of the hammer, remove the screw and insert.

4. Remove the casting from the vise and inspect the bore for corrosion, pits and foreign matter. Be sure the outlet ports are clean. Inspect the fluid reservoirs for foreign matter. Check the bypass and compensating ports to the master cylinder bore to determine if they are unrestricted.
5. Remove the primary seal, primary seal protector and secondary seals from the secondary piston.

Cleaning

Use denatured alcohol or clean brake fluid to thoroughly clean all reusable brake parts. Immerse in the cleaning fluid and brush metal parts with hair brush to remove foreign matter. Blow out all passages, orifices and valve holes. Air dry and place cleaned parts on clean paper or lintfree clean cloth. If slight rust is found inside either the front or rear half housing assemblies, polish clean with crocus cloth or fine emery paper, washing clean afterwards.

CAUTION: Be sure to keep parts clean until re-assembly. Re-wash at re-assembly if there is any occasion to doubt cleanliness - such as parts dropped or left exposed for eight hours or longer.

If there is any suspicion of contamination or any evidence of corrosion, completely flush the vehicle hydraulic brake system in accordance with this shop manual. Failure to clean the hydraulic brake system can result in early repetition of trouble. Use of gasoline, kerosene, anti-freeze, alcohol or any other cleaner, with even a trace of mineral oil, will damage rubber parts.

Rubber Parts

Wipe fluid from the rubber parts and carefully inspect each rubber part for cuts, nicks or other damage. These parts are the key to the control of fluid flow. If the unit is in for overhaul, or if there is any question as to the serviceability of rubber parts, REPLACE them!

Badly damaged items, or those which would take extensive work or time to repair, should be replaced. In case of doubt, install new parts. Do not rely on the brake unit being overhauled at an early or proper interval. New parts will provide more satisfactory service, even if the brake unit is allowed to go beyond the desired overhaul period.

Assembly

If the brass tube inserts were removed, place the master cylinder in a vise so that the outlet holes are up. Position the new brass tube inserts in the outlet holes, making sure they are not cocked. The recommended method of seating these inserts is to thread a spare brake line tube nut into each outlet hole and turn the nuts down until the insert bottoms. (Remove the tube nut and check the outlet hole for loose brass burrs, which might have been turned up when the insert was pressed into position.)

Each vehicle application of these cylinders is designed to produce the correct displacement of fluid from both the front and rear chambers under normal, failed and partially failed conditions. Cylinders are designed so that this variable displacement requirement is controlled within each bore size by the secondary piston.

Because the pistons vary in length, it is necessary to mark them with identification rings. It is imperative that exact replacements be made when servicing the master cylinders.

With all of the variables to be found in master cylinders, which look similar externally, it is important that the complete assemblies be properly identified. For this purpose a two-letter metal stamp will be found on the end of each master cylinder. This two-letter stamp indicates the displacement capabilities of particular master cylinder. It is, therefore, mandatory that when master cylinders are replaced, they are replaced with cylinders bearing the same two-letter stamp.

1. Place new secondary seals in the two grooves in the flat end of the secondary piston assembly. The seal which is nearest the flat end will have its lips facing toward this flat end. On Delco units, the seal in the second groove should have its lips facing toward the end of the secondary piston which contains the small compensating holes. On Bendix units, the seal in the second groove is an "O" ring seal.
2. Assemble a new primary seal and primary seal protector over the end of the secondary piston opposite the secondary seals, so that the flat side of the seal seats against the flange of the piston which contains the small compensating holes.
3. In order to ensure a correct assembly of the primary piston assembly, a complete primary piston assembly is included in the repair kits.
4. 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 so that the retainer locates inside the lips of the primary seal.
5. Holding the master cylinder with the open end of the bore so that the spring will seat in against the closed end of the bore. Use a small wooden rod to push the secondary piston to seat.
6. Place the master cylinder in a vise with the open end of the bore up. Coat the primary and secondary seals on the primary piston with clean brake fluid. Push the primary piston, secondary piston stop 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.

CAUTION: Do not tighten vise too tightly as damage to the master cylinder could result.

7. Continue to hold the primary piston down. This will also move the secondary piston forward and will ensure that the secondary piston will be forward far enough to clear the stop screw hole, which is in the bottom of the front fluid reservoir. The stop screw is now positioned in its hole and tightened to a torque of 25-40 pound inches.

CAUTION: See "Caution" on Page 1 of this section.

8. Install the reservoir diaphragm in the reservoir cover and install the cover on the master cylinder. Assemble the bail wires into position to retain

the reservoir cover. The master cylinder is now ready for "Bench Bleeding".

MASTER CYLINDER—(With Frame Mounted Booster)

Removal (Fig. 39)

1. Wipe master cylinder and lines clean with a clean cloth. Place dry cloths below master cylinder to absorb any fluid spillage.
2. Disconnect hydraulic lines at master cylinder. Cover line ends with clean, lint-free material to prevent foreign matter from entering system.
3. Disconnect battery ground strap or stop light wires and brake warning switch wire.
4. Remove nuts, bolts, and washers which fasten master cylinder to dash. Pull master cylinder straight off push rod and remove from engine compartment.
5. Remove and discard master cylinder push rod boot.
6. Remove master cylinder cover and pour out fluid from reservoirs. Pump the remaining fluid out by depressing piston.

Disassembly

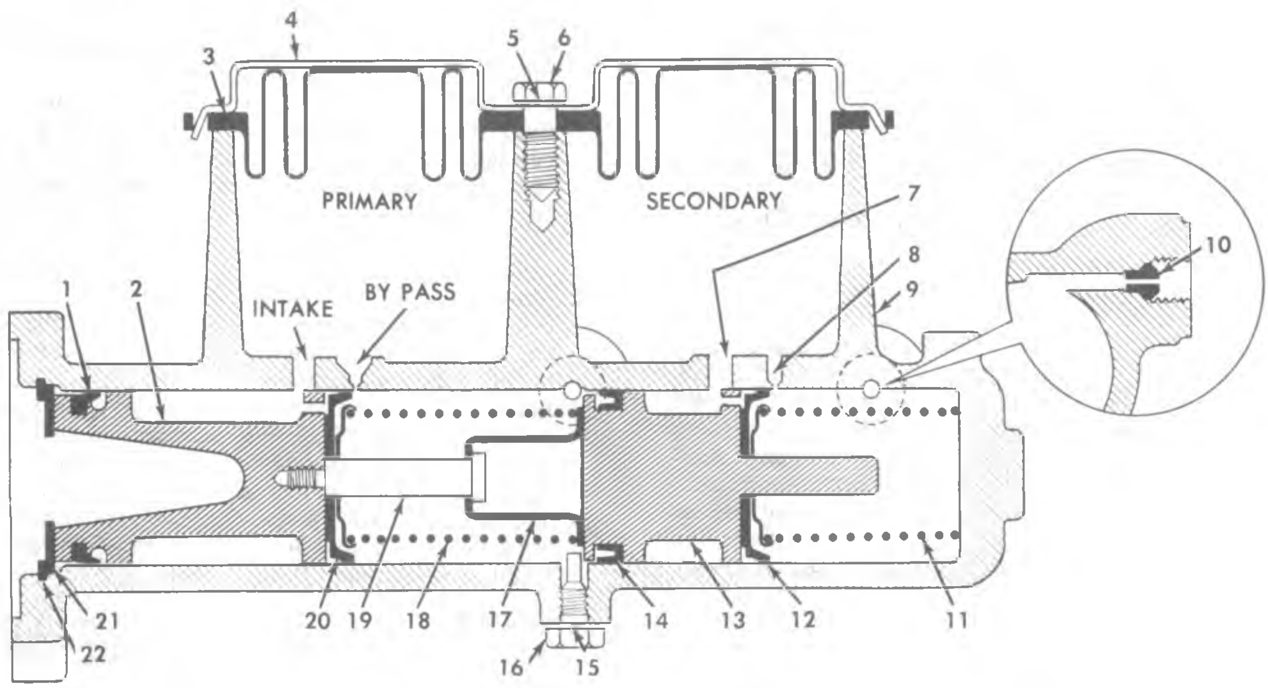
1. Remove cylinder cover bolt and gasket.
2. Lift off reservoir cover and cover seal. Pour out any excess fluid and stroke piston to force fluid through outlet ports.
3. Remove piston stop bolt and gasket from bottom of reservoir housing.
4. Use snap ring pliers and remove retainer ring from groove in end of cylinder bore.
5. Remove stop plate.
6. All internal parts should slide easily out of cylinder bore. If they do not, apply compressed air carefully at front outlet port. If parts do not remove easily, examine bore carefully for extensive damage which may eliminate the possibility of reconditioning the master cylinder.

Cleaning and Inspection

Clean all parts in denatured alcohol or brake fluid. If reservoir housing is degreased, finish clean to remove all trace of other solvents. Inspect cylinder bore for scratches or corrosion. Minor blemishes can be removed with crocus cloth or a clean-up hone.

Check by-pass ports in both reservoirs to make sure they are open and free of burrs.

Remove and discard all rubber parts. All rubber parts



1 Primary Piston Seal Cup
2 Primary Piston
3 Cover Seal
4 Reservoir Cover
5 Gasket
6 Cover Bolt
7 Intake Port
8 By-Pass Port
9 Reservoir Housing
10 Tube Seat
11 Secondary Piston Return Spring
12 Secondary Piston Pressure Cup
13 Floating Secondary Piston
14 Secondary Piston Seal Cup
15 Gasket
16 Stop Bolt
17 Primary Return Spring Retainer
18 Primary Return Spring
19 Primary Piston Stop Pin
20 Primary Piston Pressure Cup
21 Stop Plate
22 Retainer Ring

Fig. 39—Frame Mounted Booster Master Cylinder

are included in repair kit which is available from regular service parts sources.

Assembly

1. Coat all parts with a liberal amount of brake fluid.
2. Install rubber seal cup on secondary piston with cup lip facing rear (open end of cylinder).

   NOTE: All other cup lips face opposite direction (closed end of cylinder).

3. Stack and install secondary piston spring, pressure cup and piston in cylinder bore.
4. Install piston stop bolt and gasket, making sure screw enters cylinder bore behind rear of piston.
5. Assemble and install primary piston parts in cylinder bore.
6. Install stop plate in cylinder bore.
7. Compress all parts in cylinder bore and install retainer ring in groove.
8. Install reservoir cover and seal.

Installation

1. Assemble new boot on brake pedal push rod.
2. Place master cylinder in position in engine compartment. Make certain that push rod and boot are in proper position.
3. Fasten master cylinder to dash with nuts, bolts, and washers.

   CAUTION: See "Caution" on Page 1 of this section.

4. Connect brake lines to master cylinder.

   CAUTION: See "Caution" on Page 1 of this section.

5. Fill the reservoirs with recommended brake fluid to level shown in Figure 6.
6. Follow instructions under heading of "Bleeding Brakes".
7. If necessary, adjust the brake pedal free play as directed.
8. Connect battery ground strap or stop light wires and brake warning switch wire (whichever was disconnected at removal).
9. Test brakes and make any necessary adjustments if operation is not satisfactory.

Bleeding Tool (Fig. 40)

A special tool for bleeding the frame mounted booster master cylinder is shown in Figure 40.

It will be necessary for the service man to install his own bleeder adapter fitting to this tool. When bleeding the system, always bleed the frame mounted boosters before bleeding any wheel cylinders.

BENCH BLEEDING MASTER CYLINDER

1. Install plugs in both outlet ports.

   NOTE: Plastic plugs that come with a replacement cylinder are recommended for this operation.

2. Clamp the master cylinder in a bench vise with the front end tilted slightly down.

   CAUTION: Do not tighten vise too tight as damage to the master cylinder could result.

3. Fill both reservoirs with clean brake fluid.

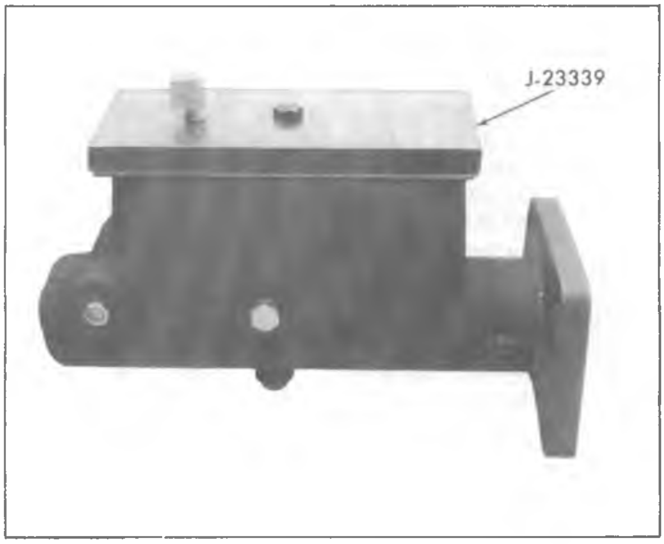


Fig. 40—Tool J-23339 Installed

4. Insert a rod with a smooth round end to the primary piston and press in to compress the piston return spring.
5. Release pressure on rod. Watch for air bubbles in the reservoir fluid.
6. Repeat step 5 as long as bubbles appear.
7. Reposition master cylinder in vise so that the front end is tilted slightly up.
8. Repeat Steps 4-5-6.
9. Install diaphragm and cover on reservoir.

BRAKE COMBINATION VALVE

Metering, Warning and Proportioning (Fig. 41)

NOTE: The brake combination valve is a non-adjustable, non-serviceable valve. If defective it must be replaced.

Function

Metering Valve

This section of the valve operates to "hold-off" hydraulic flow to the front disc brakes until a predetermined pressure is reached. This "hold-off" action allows the rear drum brakes to build up sufficient hydraulic pressure to overcome the force of their re-

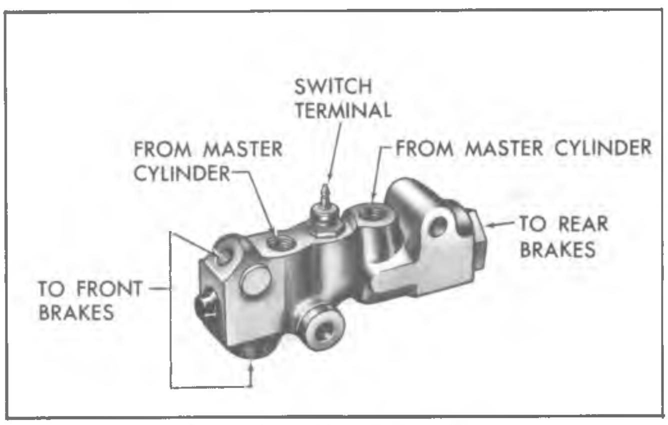


Fig. 41—Combination Valve

tracting springs. This metering or hold off valve then provides for balanced braking.

NOTE: When bleeding the brakes; the pin in the end of the metering portion of the combination valve must be held in the open position (not allowed to close). This can be accomplished by installing Tool J-23709 under the mounting bolt and depressing the pin a slight amount. Be sure to re-torque the mounting bolt after removing Tool J-23709 (fig. 4).

Warning Switch

The warning switch is the pressure differential type. It is wired electrically to the warning lamp on the instrument panel to warn the vehicle operator of a pressure differential between the front and rear hydraulic systems. Once the switch is activated "on", it will not "reset" until the defect in the hydraulic system has been repaired. Hydraulic reset to the "off" position occurs with the application of equal front and rear pressures.

Proportioning Valve

The function of this valve is to prevent premature rear wheel slide. Line pressure is allowed to increase normally up to a certain point (determined by vehicle weight and braking distribution). When the predetermined pressure is reached, the valve begins to function and limit the amount of increase in hydraulic pressure passed to the rear brakes. This prevents the rear brakes from locking up before the full effective braking effort is produced by the front disc brakes.

NOTE: In the event of "front hydraulic system failure" the proportioning valve has a "by-pass" feature that assures full system pressure to the rear brakes.

Removal

1. Disconnect electrical lead.
2. Place dry rags below valve to absorb any fluid spillage.
3. Wipe off any dirt and disconnect hydraulic lines from valve - cover open lines to prevent foreign matter from entering the system.
4. Remove mounting screws and remove valve.

Installation

1. Make sure new switch is clean and free of lint. If any doubt exists, wash the switch in denatured alcohol or brake fluid and allow to dry.
2. Place new switch in position and secure with screws.

   CAUTION: See "Caution" on Page 1 of this section.

3. Connect hydraulic lines to valve.

   CAUTION: See "Caution" on Page 1 of this section.

4. Connect switch electrical lead.
5. Bleed the brake system.

Brake Warning Light Checking

1. Set parking brake and turn the ignition key to "ON".
2. Warning lamp should light.
3. If lamp does not light: bulb is burned out or electrical circuit is defective.
4. Turn ignition key off.
5. Replace bulb or repair circuit as necessary.

Testing Warning Switch

1. Raise vehicle on a hoist and attach a bleeder hose to a rear brake bleed screw and immerse the other end of hose in a container partially filled with clean brake fluid. Be sure master cylinder reservoirs are full.

   NOTE: When bleeding the brakes; the pin in the end of the metering portion of the combination valve must be held in the open position (not allowed to close). This can be accomplished by installing Tool J-23709 under the mounting bolt and depressing the pin a slight amount. Be sure to re-torque the mounting bolt after removing Tool J-23709 (fig. 4).

   CAUTION: See "Caution" on Page 1 of this section.

2. Turn ignition key "ON". Open bleed screw while helper applies heavy pressure to brake pedal. Warning lamp should light. Close bleed screw before helper releases pedal.

   NOTE: To "reset" switch, apply heavy pedal force. This force will apply hydraulic pressure which re-centers the switch contact.

3. Attach bleeder hose to front brake bleed screw and repeat Step 2.
4. Turn ignition key off. See Note under Step 2.
5. Lower vehicle to floor.

   NOTE: If warning lamp does not light during Steps 2 and 3 but does light when the parking brake is set, warning light switch is defective. Do not attempt to repair switch. A defective switch must be replaced with a new combination valve assembly.

   CAUTION: Caution should be taken to prevent air from entering system during checks on switch.

The recommended checking interval should be 24 months or 24,000 miles, any time major brake work is done or any time a customer complains of excessive pedal travel.

Brake Travel Warning Switch—(Fig. 42)

Vehicles with frame mounted vacuum over hydraulic boosters have an electrical switch that senses pedal travel. This switch will illuminate the lamp on the instrument panel whenever the brake pedal travel is in excess of 5.10 inches.

Removal

1. Loosen the nut (at the switch) on the failure warning switch push rod and drop the push rod out of the way.
2. Remove the switch electrical lead.
3. Remove the two switch mounting screws and remove switch.

Installation

1. Install the switch to the brake pedal bracket with two screws and install the electrical lead.

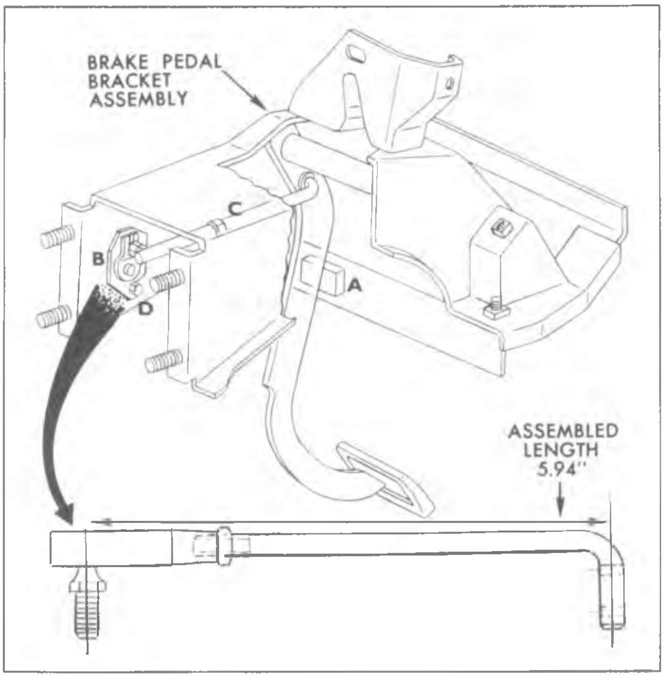


Fig. 42—Travel Switch Adjustment

2. Check the length of the failure switch push rod to see that it is as described in Figure 42.
3. Adjust the switch so that the warning light will be on after 5.10" pedal pad travel in the following manner.

   NOTE: The brake pedal to master cylinder push rod will have to be removed to make test to determine if the switch is properly set. Adjust the brake pedal push rod travel as described in this section upon completion of installation.

4. With brake pedal hard against rubber bumper (A), rotate brake failure warning switch lever (B) forward and insert the preassembled push rod (C) in the switch and brake pedal and lock in place.

If Switch Circuit Is Closed

a. Rotate switch bracket rearward until switch "just opens" (light off).
b. Hold switch bracket in this position and tighten bolt (D). Switch should close (light on) at 5.10" brake pedal pad movement from full back.

If Switch Circuit Is Open

a. Rotate switch bracket forward until switch "just closes" (light on).
b. Hold switch bracket in this position and tighten bolt (D).

BRAKE PEDAL—SERVICE BRAKE (Fig. 43)

NOTE: The brake pedal is an integral design with the clutch pedal (except automatic transmission), necessitating the removal of the clutch pedal before removing the brake pedal.

Removal

1. Remove the clutch pedal as outlined under "Clutch Pedal" in Section 7.
2. Remove the pull back spring from the body bracket.
3. Remove the sleeve assembly screw attachment and remove sleeve.
4. Disengage the push rod from the master cylinder and drop the pedal to check for worn parts - inspect the return spring, bracket attachment, and bushings for needed repairs.

Installation

Reverse the above procedure and make certain the brake pedal is secure and adjusted properly before operating the vehicle.

CAUTION: See "Caution" on Page 1 of this section.

PARKING BRAKE PEDAL OR HANDLE

Removal (Figs. 44, 45 and 46)

1. Place parking brake pedal or handle in the released position.

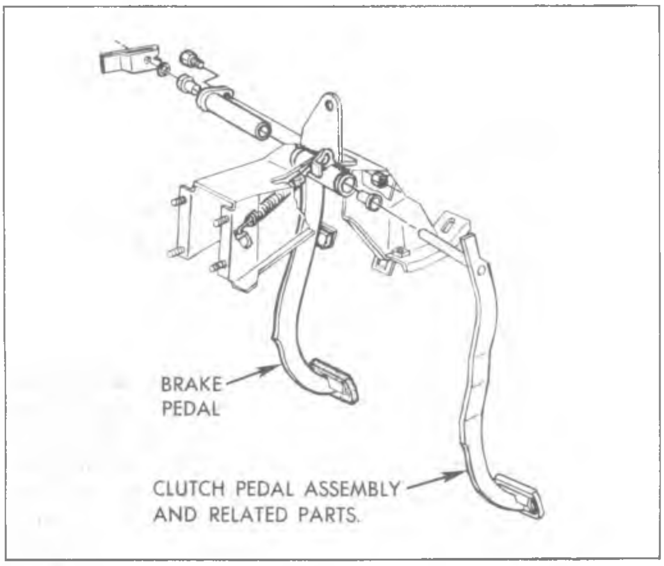


Fig. 43—Brake Pedal Mounting

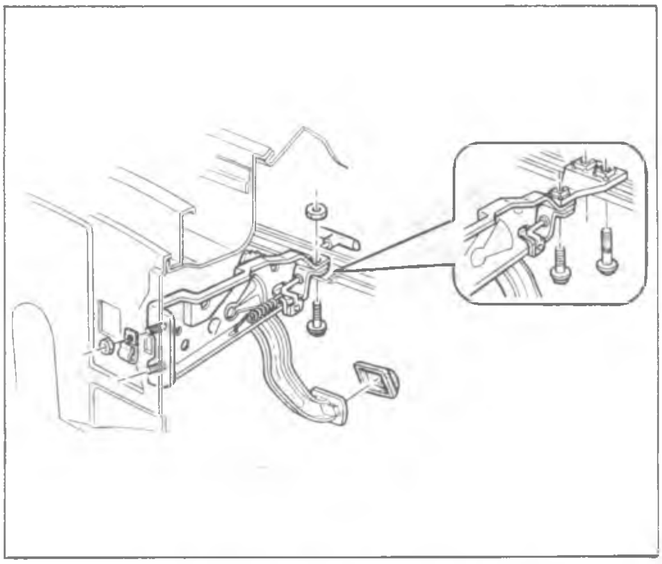


Fig. 44—Parking Brake Pedal—C-K Series

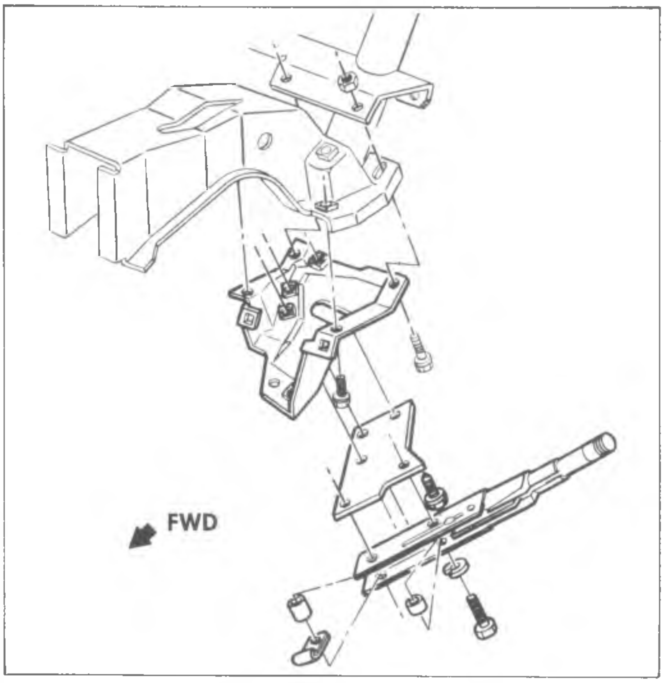


Fig. 45—Parking Brake Handle—P-10 Series

2. Remove nuts from engine compartment on C and K series or bolts from mounting bracket on P series.
3. Remove the bolt from the underside of the dash and lower the brake assembly.

NOTE: Take notice of the spacers on P models for reinstallation.

4. Remove the clevis pin to remove the cable from the brake assembly.

Installation

Reverse the removal procedure. Torque all bolts and nuts. After installing the clevis pin, use a new cotter pin to secure the clevis pin. Adjust the cable if necessary as outlined under "Maintenance and Adjustments".

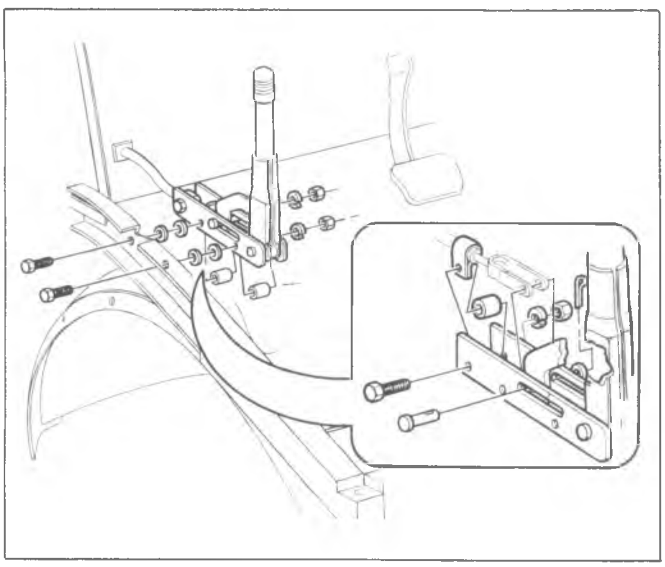


Fig. 46—Parking Brake Handle—P-20-30 Series

CAUTION: See "Caution" on Page 1 of this section.

PARKING BRAKE CABLES

Refer to Figure 47 for routing of cables and guides.

PARKING BRAKE—PROPELLER SHAFT—(Internal Expanding)

Removal (Fig. 48)

1. Remove the propeller shaft. See Section 4.
2. Remove the brake drum.

NOTE: It may be necessary to back off the shoe adjustment before removing the drum.

3. Remove the two pull back springs.
4. Remove the guide plate from anchor pin.
5. Remove shoe hold down cups, springs, and washers from hold down pins - remove pins.
6. Pull brake shoe and lining assemblies away from anchor pin and remove the strut and spring.
7. Lift the brake shoes and linings with the adjusting nut and bolt and connecting spring off the backing plate.
8. Move the shoes toward each other until the adjusting bolt and connecting spring drop off.
9. Remove the clip holding the brake lever to the primary shoe (shoe with short lining).
10. Compress the spring on the brake cable and remove the cable from the lever.
11. If necessary to remove the anchor pin, straighten the washer from pin hex and reinforcement. Remove reinforcement and washer with anchor pin.
12. If necessary to remove the cable, compress tangs on cable and pull assembly out of the hole in the backing plate.
13. If necessary to remove the backing plate, remove the transmission flange nut and transmission output flange. Remove bolts holding the backing plate to bearing retainer and remove the backing plate.

Inspection

Replace any worn or broken parts.

Installation

1. Place the backing plate in position on the rear bearing retainer and fasten with four bolts. Torque bolts to 24 foot-pounds.

CAUTION: See "Caution" on Page 1 of this section.

2. Install transmission output flange on spline of mainshaft and fasten with flange nut. Torque nut to 100 foot pounds.

CAUTION: See "Caution" on Page 1 of this section.

3. Install cable assembly from back of backing plate. Push retainer through hole in backing plate until tangs securely grip the inner side of the plate.
4. Place washer and reinforcement over the threaded end of anchor pin. Hold anchor pin nut (flat side against flange on backing plate) in position behind backing plate and insert threaded end of anchor pin from front side. Thread the anchor pin into nut and tighten securely. (140 foot pounds torque). Bend tang

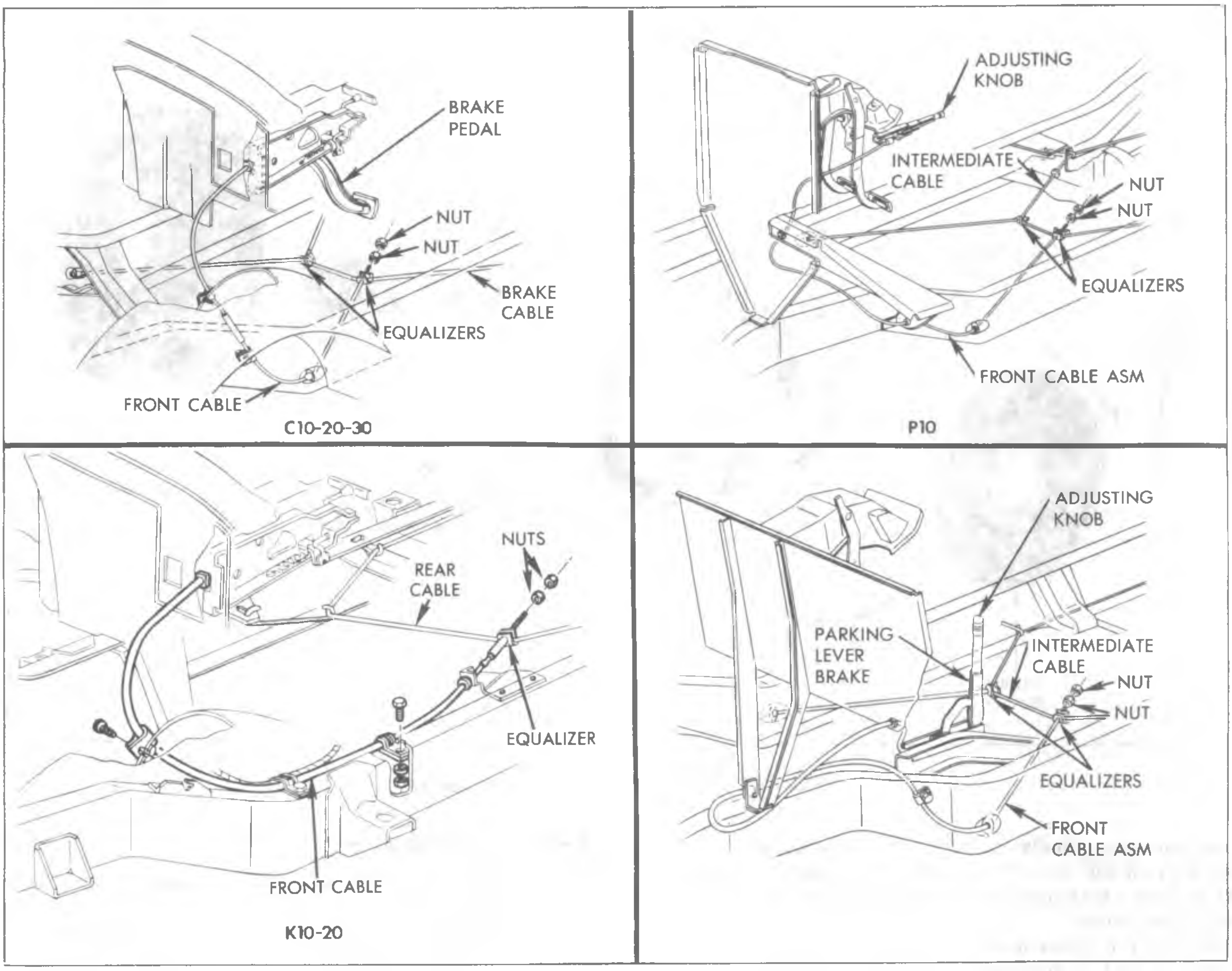


Fig. 47—Parking Brake Systems

of washer over reinforcement and side of washer over hex of anchor pin.

CAUTION: See "Caution" on Page 1 of this section.

5. Install lever on cable by compressing the spring and inserting cable in channel of lever. Release spring.
6. Install primary shoe (short lining) to lever as follows: place pin in lever, place washer on pin and push pin through hole in primary shoe. Fasten parts together by installing the clip in groove of pin.

CAUTION: See "Caution" on Page 1 of this section.

7. Fasten two brake shoes and linings together by installing connecting spring. Move the shoes toward each other and install adjusting screw.
8. Lubricate the backing plate contact surfaces. (Very light coat of lube).
9. Place shoe and linings in position on backing plate.

NOTE: When facing the brake assembly, the shoe with the short lining should be to the left with the lever assembled to it.

10. Pull brake shoes apart and install strut lever and spring between them. The loop on the strut spring should be in the "up" position.
11. Install hold down pins, washers, springs and cups from backing plate to shoes.
12. Place guide plate on anchor pin.
13. Install pull back springs.
14. Remove the "knock out" plug (if necessary) and install a rubber plug in the brake drum adjusting hole.
15. Install the brake drum.
16. Install the propeller shaft.

REAR BRAKES—RPO H-22—(Fig. 49)

Brake shoe adjustment takes place when brakes are applied with a firm pedal effort while the vehicle is backing up. Applying the brakes moves actuators which

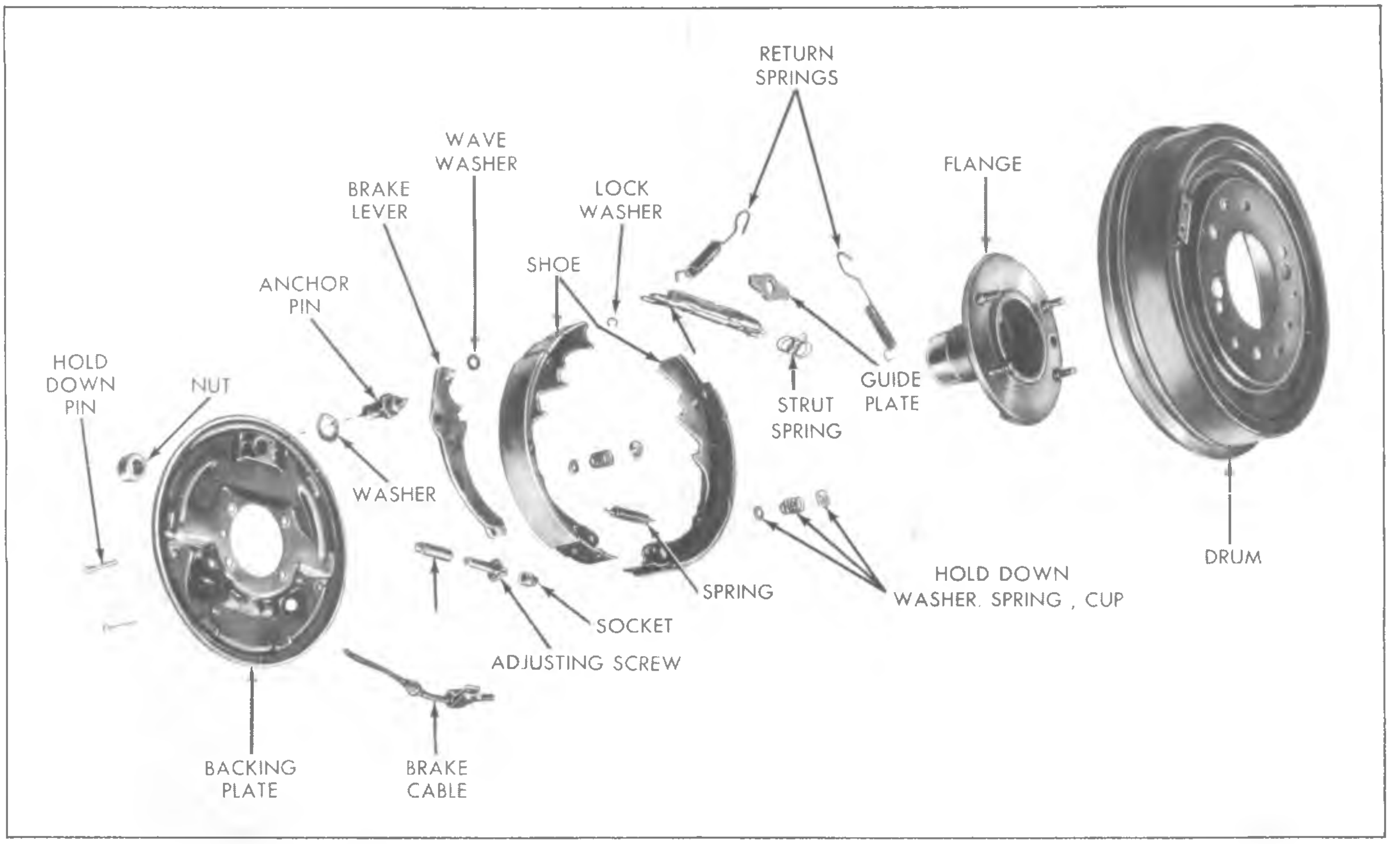


Fig. 48—Internal Expanding Brake Components

turn the star wheels and rotate the adjusting screws outward from the anchor brackets. This action adjusts the shoe until clearance between the lining and drum is within proper limits.

Should low pedal heights be encountered, it is recommended that numerous forward and reverse stops be performed with a firm pedal effort until a satisfactory pedal height results.

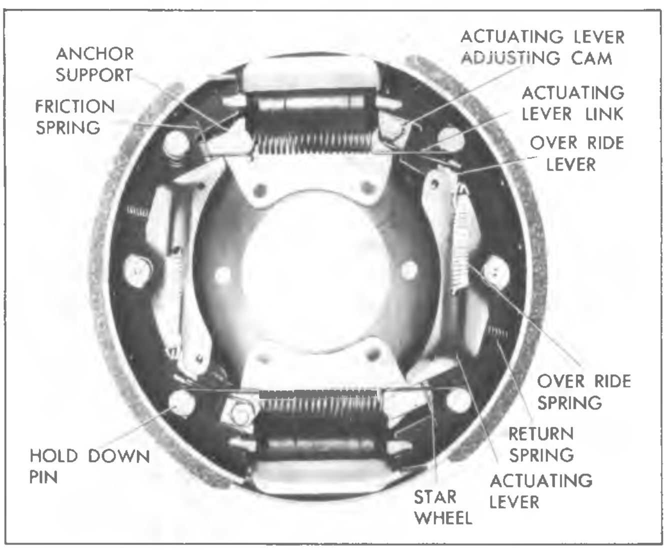


Fig. 49—Rear Brake—Used with RPO H-22

Retracting Self Adjusters

Access holes are located in the flange plate. These holes are for service purposes in the event retracting of the brake shoes is required to remove the drum. In order to back off the adjuster, insert a screw driver index a corner of the screw driver blade with the hole in the actuating lever and hold the lever away from the star wheel. Using a brake adjusting tool, back off the star wheel.

Brake Drums, Shoes and Linings

Removal

1. Raise the vehicle on a hoist.
2. Retract self adjusters if necessary and remove brake drums.
3. Using Tool J-22348 remove the brake shoe pull back springs (fig. 50).
4. Loosen the actuating lever cam cap screw and while holding the star wheel end of the actuating lever past the star wheel, remove the cap screw and cam.
5. Remove the brake shoe hold down springs and pins by compressing the spring with Tool J-22348 and, at the same time, pushing the pin back through the flange plate toward the tool. Then, keeping the spring compressed, remove the lock from the pin with a magnet (fig. 51).
6. Lift off the brake shoe and self adjuster as an assembly.
7. The self adjuster can now be removed from the brake shoe by removing the hold down spring and pin.

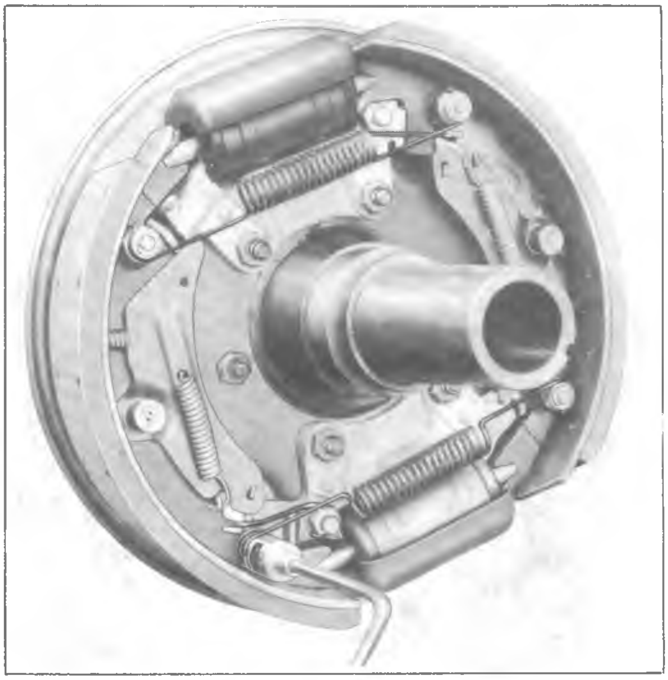


Fig. 50—Removing Pull Pack Spring with Tool J-22348

NOTE: The actuating lever, override lever and spring are an assembly. It is recommended that they not be disassembled for service purposes unless they are broken. It is much easier to assemble and disassemble the brakes leaving them intact.

8. Thread the adjusting screw out of the anchor support and remove and discard the friction spring.
9. Clean all dirt out of brake drum. Inspect drums for roughness, scoring or out of round. Replace or recondition drums as necessary.

NOTE: See Section on "BRAKE DRUMS".

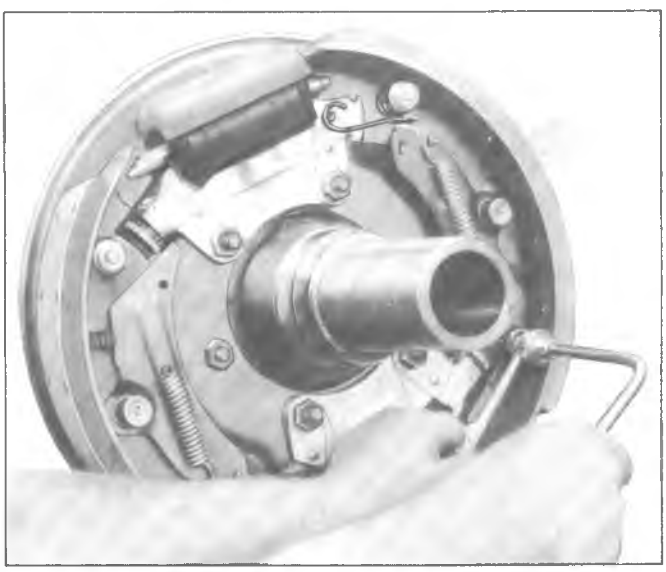


Fig. 51—Removing Hold Down Pins Using J-22348

10. Carefully pull lower edges of wheel cylinder boots away from cylinders. If brake fluid flows out, overhaul of the wheel cylinders is necessary.

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

11. Inspect flange plate for oil leakage past axle shaft oil seals. Install seals if necessary.
12. Check all flange plate attaching bolts to make sure they are tight (150 lb. ft. torque). Clean all dirt and rust from shoe contact faces on flange plate using emery cloth.
13. Thoroughly clean adjusting screws and threads in the anchor brackets.

Installation

1. Put a light film of Lubriplate, or equivalent, on shoe bearing surfaces of brake flange plate and on threads of adjusting screw.
2. Thread adjusting screw completely into anchor bracket without friction spring to be sure threads are clean and screw turns easily. Then remove screw, position a new friction spring on screw and reinstall in anchor bracket.

    CAUTION: See "Caution" on Page 1 of this section.

3. Assemble self adjuster assembly to brake shoe and position actuating lever link on override lever.
4. Position hold down pins in flange plate.
5. Install brake shoe and self adjuster assemblies onto hold down pins, indexing ends of shoes with wheel cylinder push rods and legs of friction springs.

    NOTE: Make sure the toe of the shoe is against the adjusting screw (fig. 52).

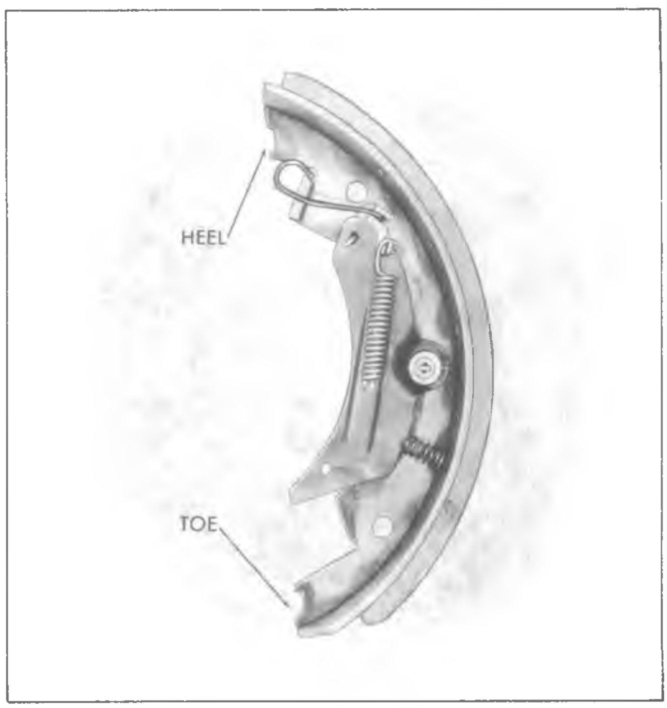


Fig. 52—Brake Shoe and Self Adjuster Assembly

6. Install cup, spring and retainer on end of hold down pin. Using Tool J-22348 compress the spring. With spring compressed, push the hold down pin back through the flange plate toward the tool and install the lock on the pin.
7. Using Tool J-22348 install brake shoe return springs.
8. Holding the star wheel end of the actuating lever as far as possible past the star wheel, position the adjusting lever cam into the actuating lever link and assemble with cap screw.
9. Check the brake shoes for being centered by measuring the distance from the lining surface to the edge of the flange plate at the points shown in Figure 53. To center the shoes, tap the upper or lower end of the shoes with a plastic mallet until the distances at each end become equal.
10. Locate the adjusting lever .020" to .039" above the outside diameter of the adjusting screw thread by loosening the cap screw and turning the adjusting cam.

    NOTE: To determine .020" to .039", turn the adjusting screw 2 full turns out from the fully retracted position. Hold a .060" plug gauge (from J-9789-01 Universal Carburetor Gauge Set) at a 90° angle with the star wheel edge of the actuating lever. Turn the adjusting cam until the actuating lever and threaded area on the adjusting screw just touch the gauge (figs. 54 and 55).

11. Secure the adjusting cam cap screw and retract the adjusting screw.
12. Install brake drums and wheels and remove vehicle from jack stands.
13. Adjust the brakes by making several forward and reverse stops until a satisfactory brake pedal height results.

Fig. 53—Measuring Points for Shoe Centering

Fig. 54—Positioning Actuator Lever

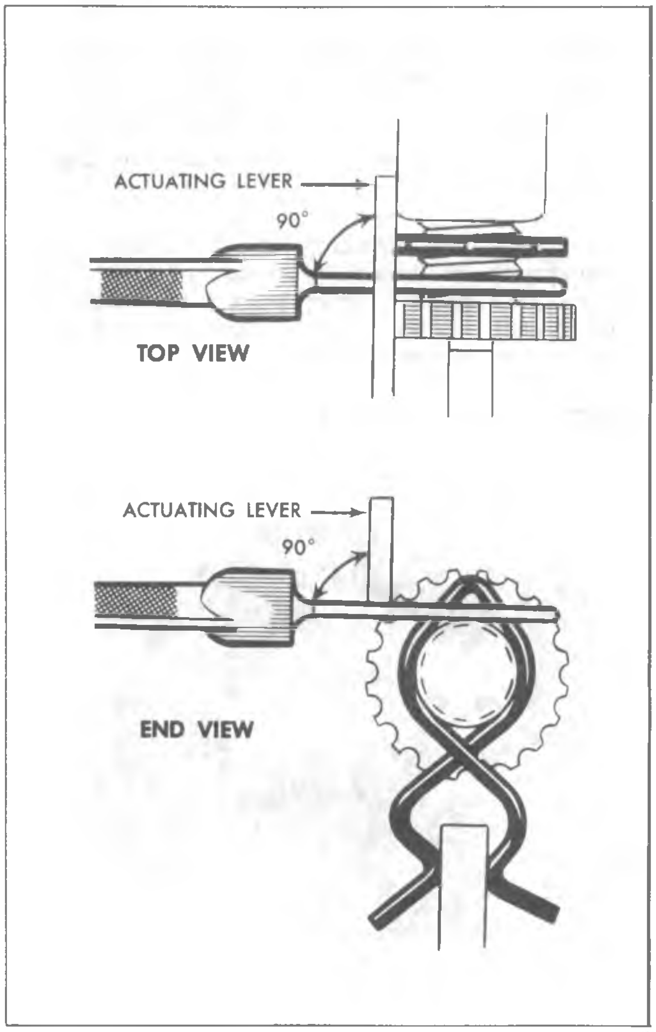


Fig. 55—Pull Gage Positioning for Correct Actuator Lever Adjustment

POWER BRAKES

GENERAL DESCRIPTION

The Power Brake Unit is a self-contained hydraulic and vacuum unit, utilizing manifold vacuum and atmospheric 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. The unit is mounted on the engine side of the dash panel 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 master 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 6.
5. Check for loose mounting bolts at master 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

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 PARTS REPLACEMENT

POWER BRAKE UNIT

Removal

1. Disconnect the brake lines from the two master cylinder hydraulic outlets. Cover brake line fittings to prevent dust and dirt from entering brake lines.
2. Disconnect the vacuum hose from the vacuum check valve on the front housing of the power head. Plug vacuum hose to prevent dust and dirt from entering hose.
3. Disconnect the power brake push rod from the brake pedal.
4. Remove the four nuts (inside vehicle) from the mounting studs which hold the power brake to the dash panel.
5. Carry the power brake to a clean work area and clean the exterior of the power brake prior to disassembly.

Installation

1. Mount power brake assembly to dash.

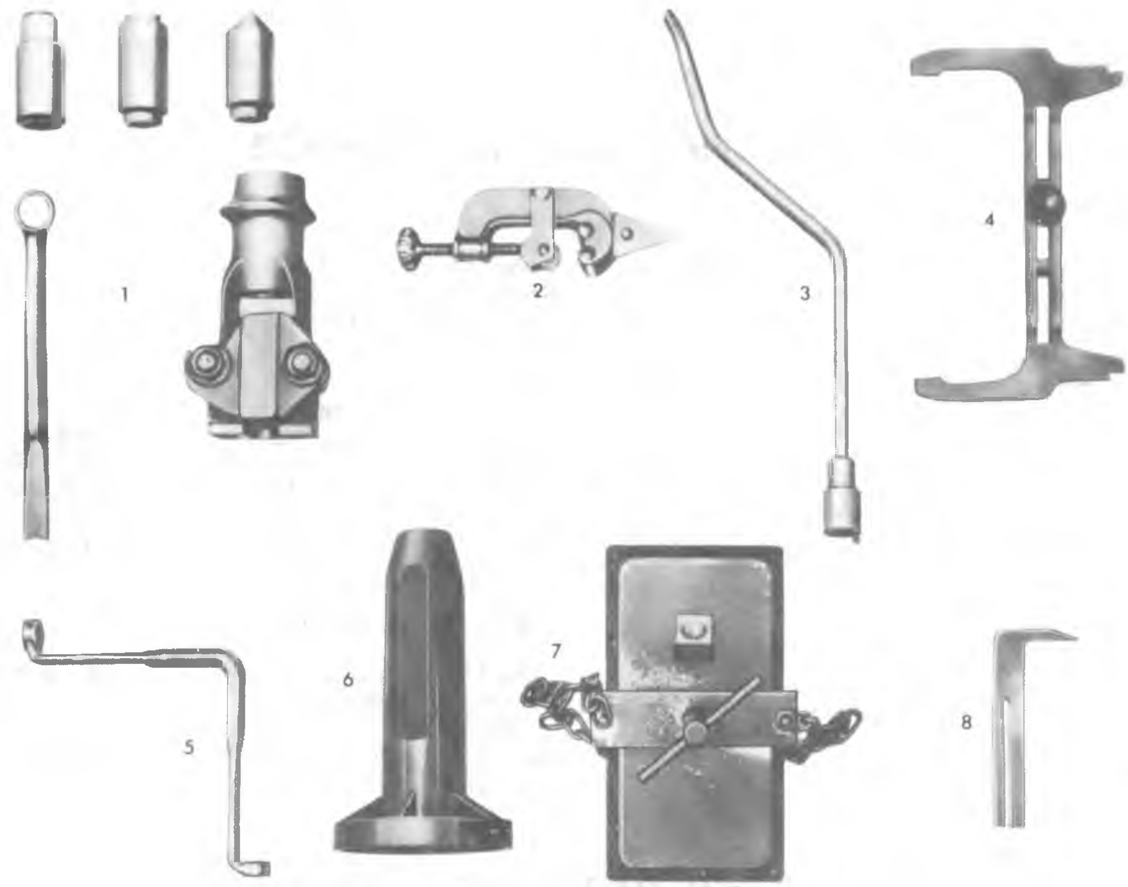
   CAUTION: See "Caution" on Page 1 of this section.

2. Connect power brake push rod to brake pedal.
3. Connect vacuum hose to vacuum check valve.
4. Connect brake lines to master cylinder outlets.

   CAUTION: See "Caution" on Page 1 of this section.

5. Bleed brakes as necessary and fill fluid reservoirs to within 1/4" of top of the reservoirs.

SPECIAL TOOLS



1. J-2185 Flaring Tool
2. J-8000 Tubing Cutter
3. J-8049 or J-22348 Spring Remover
4. J-21177 Drum/Shoe Gage
5. J-21472 Bleeder Wrench
6. J-22904 Dust Boot Installer
7. J-23518 Bleeder Adapter
8. J-23709 Combination Valve Pin Retainer

Fig. 56—Special Tools

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. Emission system requirements, interrelated system functions, improved electrical systems and other advances in design, make today's engines more senstive 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 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 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. To disconnect wire at spark plug, grasp the boot portion of the wire and apply only enough force to remove the boot. Do not pull on plug wire.

Test Compression (Fig. 1)

The compression check is important because an engine with low or uneven compression cannot be tuned success-

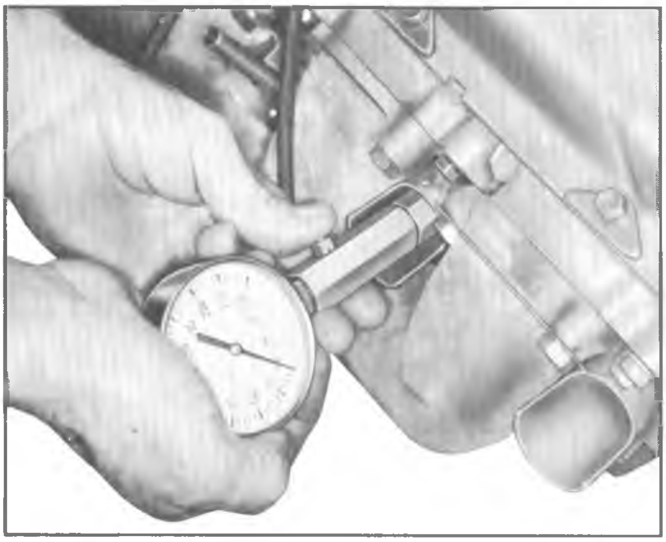


Fig. 1—Checking Compression

fully. 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 distributor primary lead must be disconnected from the negative post on the coil.

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 burned, 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 & Install Spark Plugs (Fig. 2)

1. Inspect each plug individually for badly worn electrodes, glazed, broken or blistered porcelains and replace plugs where necessary.
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.

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.)

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 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.
- Installation of the plugs using excessive torque which changes gap settings.
- Installation of plugs on dirty seat.
- Installation of plugs to 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 (fig. 3).

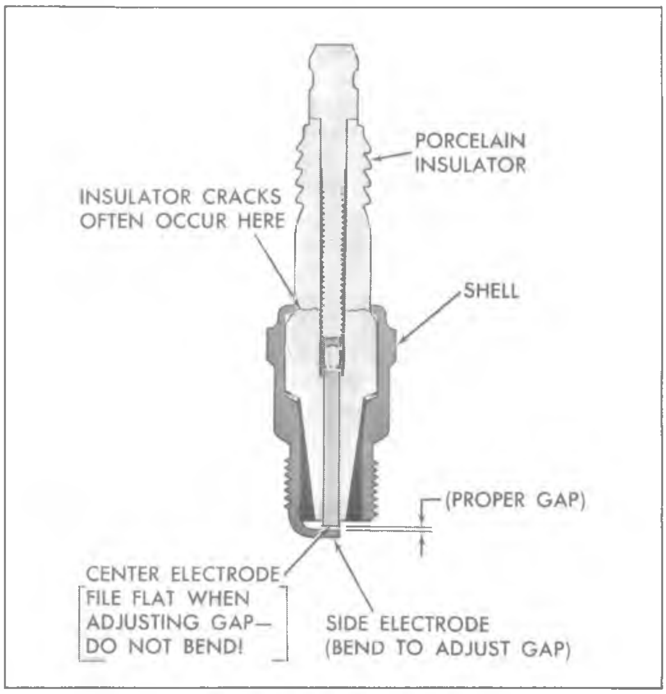


Fig. 2—Spark Plug Detail

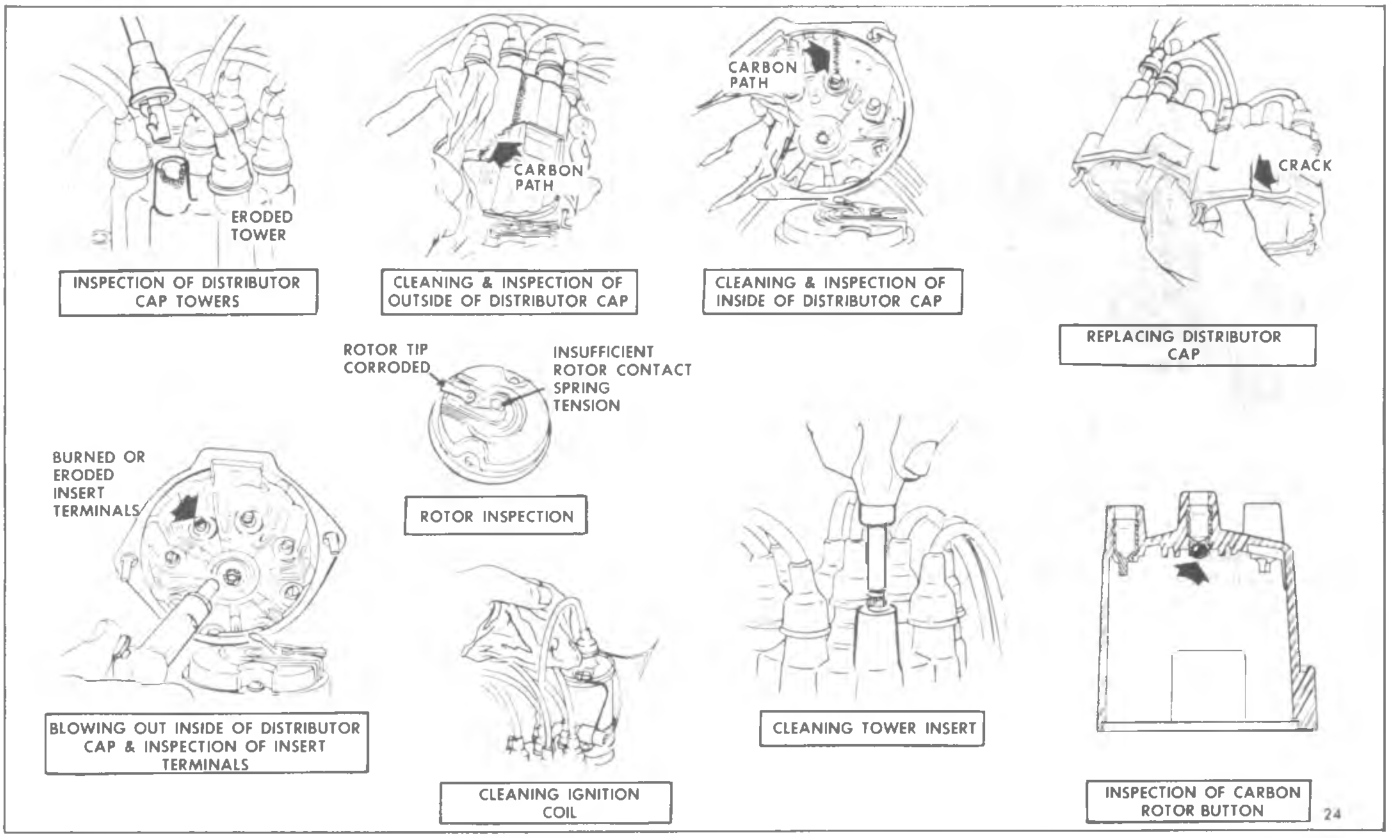


Fig. 3—Cleaning and Inspecting Distributor Cap, Rotor & Coil

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.

Distributor (Figs. 4 or 5)

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 their 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 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 vacuum control will affect the ignition timing. Correct any interference or binding condition noted.
3. Examine distributor points and clean or replace if necessary.
   - Contact points with an overall gray color and only slight roughness or pitting need not be replaced.

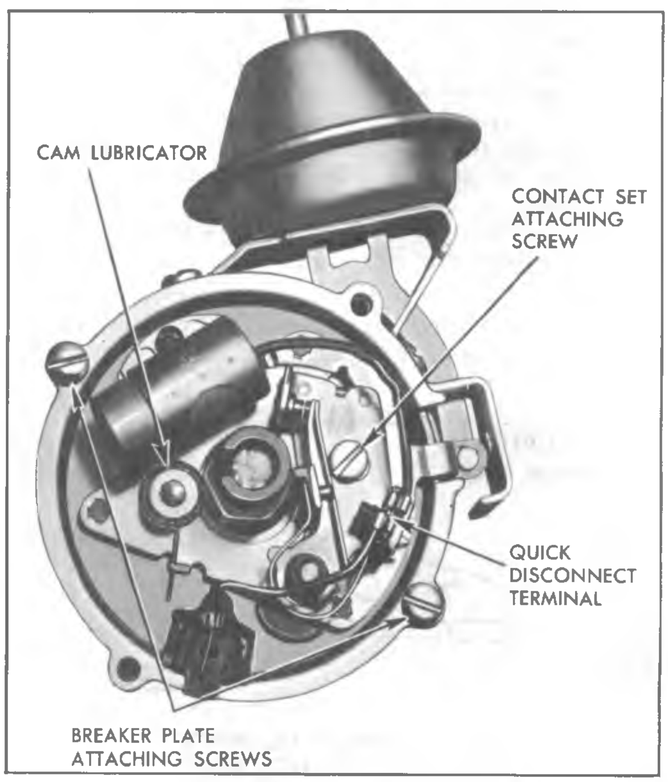


Fig. 4—Distributor (In Line)

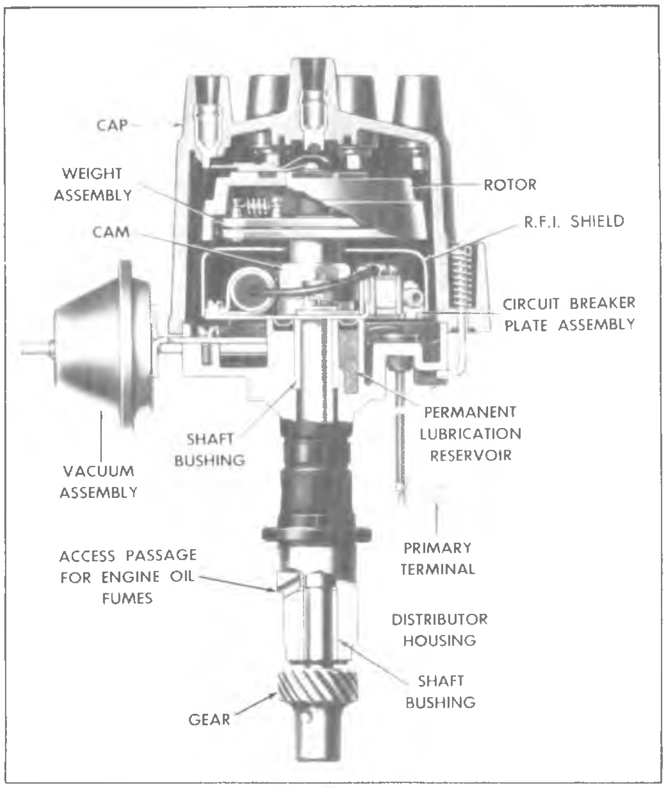


Fig. 5—Distributor (V8)

- 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 and rotate cam lubricator wick 180°.

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 that 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. 6) 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 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. If not within limits, replace.

  Excessive point pressure will cause excessive wear on the points, cam and rubbing block. Weak point pressure permits bouncing or clattering, 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.

Service Battery and Battery Cables

1. Measure the specific gravity of the electrolyte in each cell (fig. 7). If it is below 1.230 (corrected to 80°F.) recharge with a slow rate charger, or if desired, further check battery.
2. Connect a voltmeter across the battery terminals and measure the terminal voltage of the battery during cranking (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.

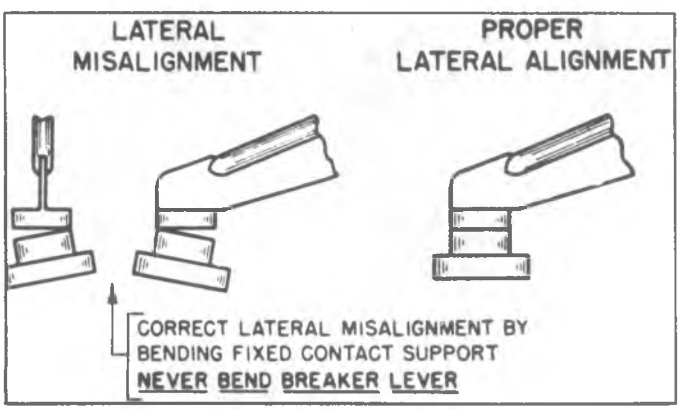


Fig. 6—Point Alignment

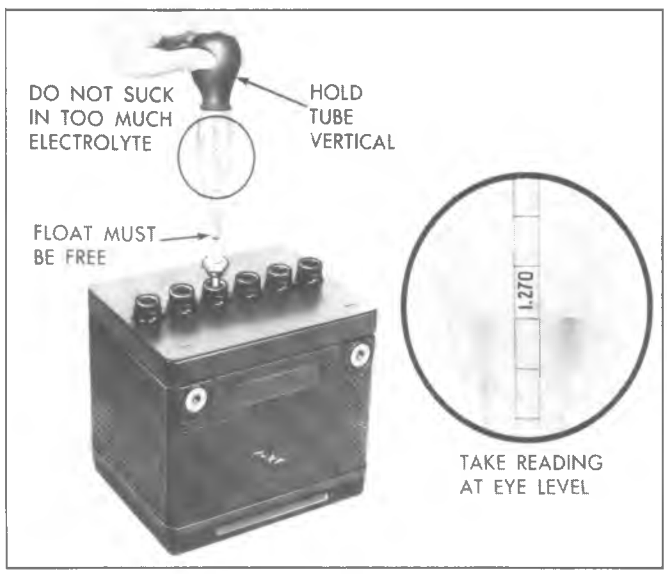


Fig. 7—Testing Specific Gravity of Battery

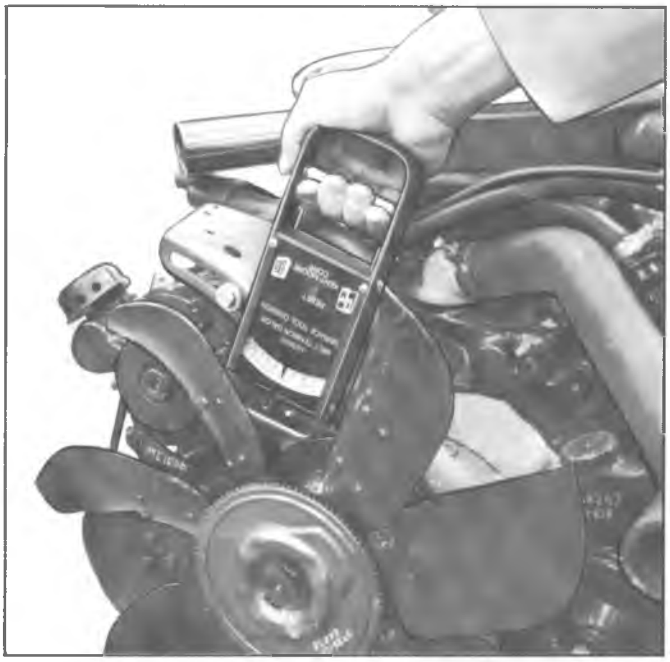


Fig. 8—Checking Fan Belt Tension

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 colorless, odorles, drinking water.

The top of the battery should be clean and the battery hold-down bolts properly tightened. Particular care should be taken to see that the 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. If the battery cable terminals are corroded, the cables should be cleaned separately with a soda solution and wire brush.

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 will indicate the need for further tests and adjustments as outlined in Section 6Y.

Service Belts (Fig. 8)

Inspect belt condition.

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

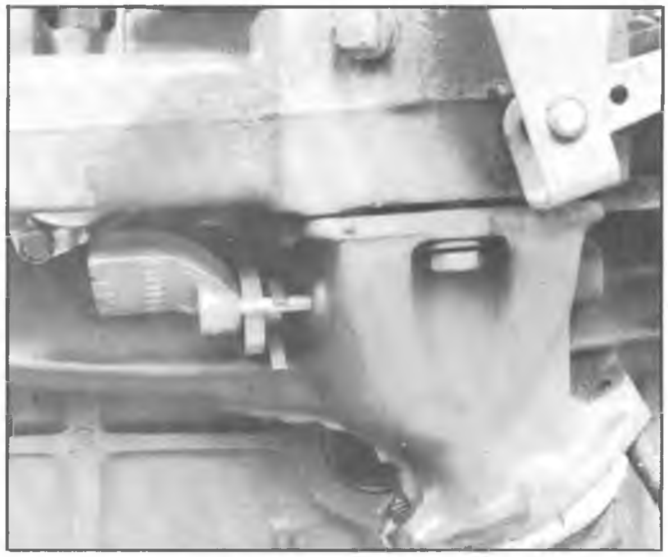


Fig. 9—Manifold Heat Control Valve (In Line)

- Using a strand tension gauge, check the belt tension.
- If belt is below the minimum, adjust until the specified tension, is reached. (See Tune Up Chart in Specification section.)

Service Manifold Heat Valve (Fig. 9 or 10)

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 specificatiins in the sequence outlined on Torque Sequence Chart located at end of Engine Mechanical section. A slight leak at the

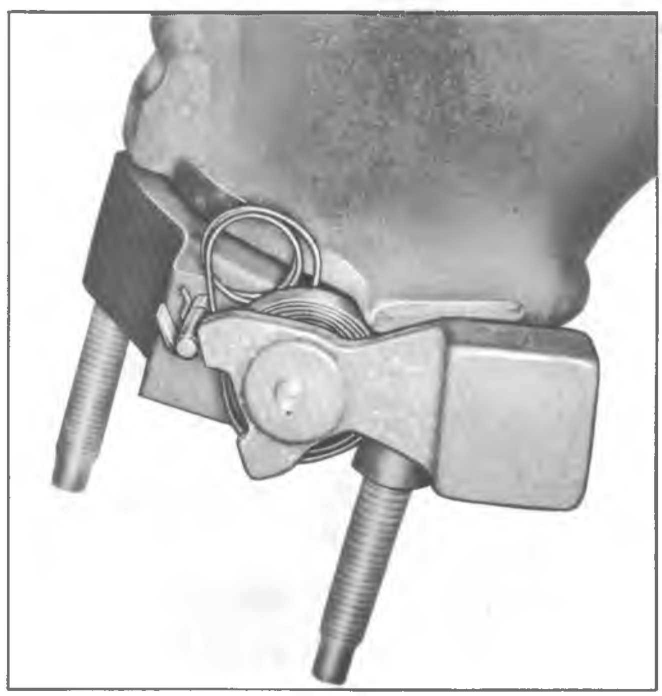


Fig. 10—Manifold Heat Control Valve (Typical V8)

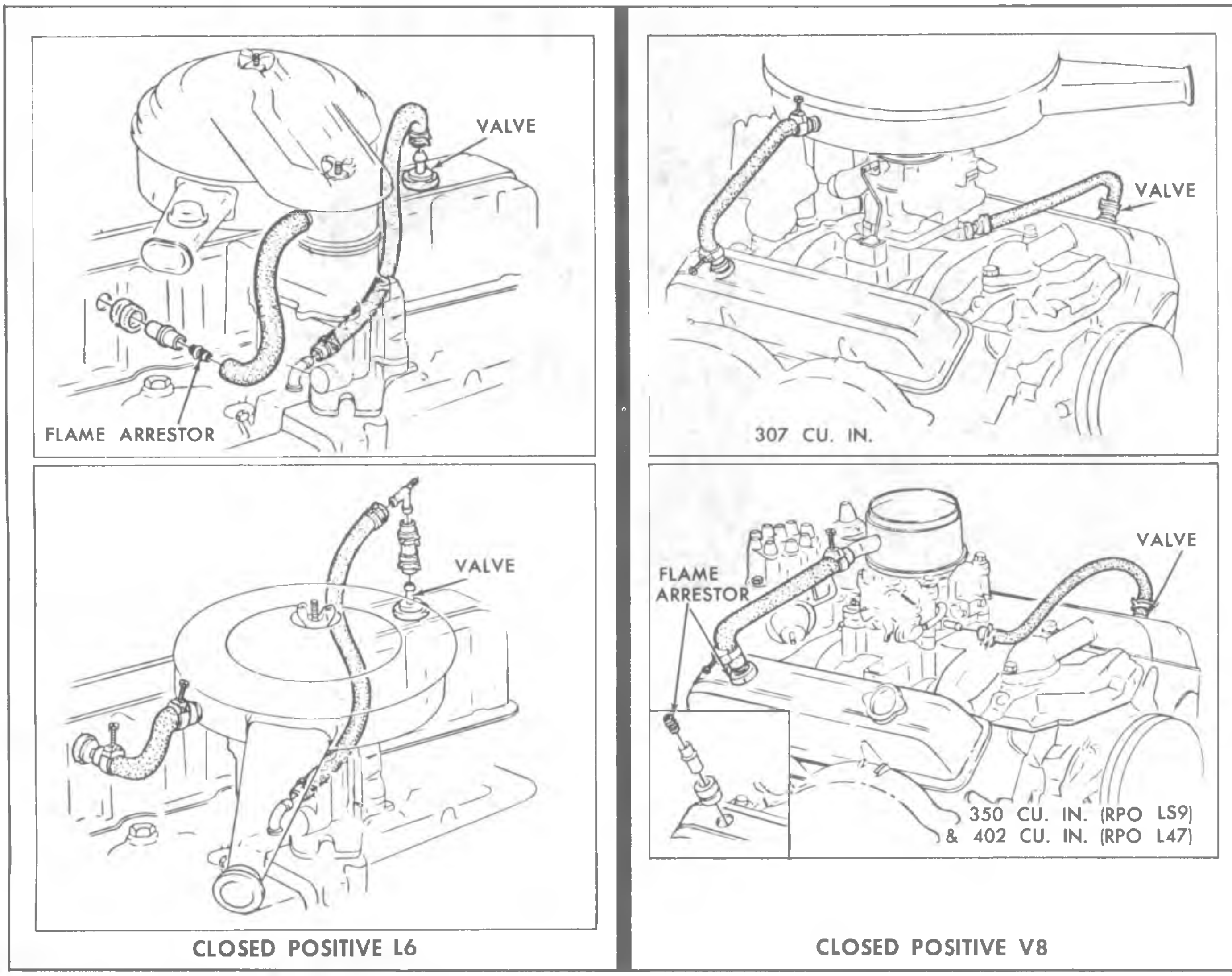


Fig. 11—Crankcase Ventilation Systems

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. Refer to Section 8 for the correct fabrication and replacement procedures for fuel lines.
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.

Service Crankcase Ventilation (Fig. 11)

All engines have a "Closed Positive" ventilation system 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 a "Closed Positive" ventilation system, air is drawn through the engine crankcase (through a regulating valve) (fig. 12) into the manifold, drawing crankcase vapors and fumes with it to be burned. The "Closed

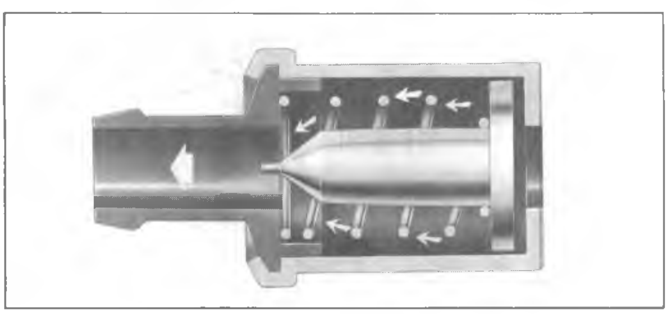


Fig. 12—Crankcase Ventilation Valve

Fig. 13—Crankcase Ventilation Filter

Positive" ventilation system draws clean air from the carburetor air cleaner and has a nonvented oil filler cap.

1. Ventilation valve should be replaced at intervals specified in Section 0.
2. Inspect for deteriorated or plugged hoses.
3. Inspect all hose connections.
4. Remove flame arrestor and wash in solvent, then dry with compressed air.
5. Inspect ventilation filter (fig. 13) and replace if necessary.

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 and Controlled Combustion System are designed, particularly, for these engines; therefore, they must not be interchanged with or replaced by a carburetor or distributor designed for different applications.

Choke Adjustment

Inspect choke valve, choke rod, choke coil and housing for proper alignment, bends and binding — make necessary corrections to assure proper choke operation; then adjust choke as outlined in Section 6M.

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 ENGINE
   - With engine running at idle, raise the adjustment screw window and insert an Allen wrench in the socket of the adjusting screw (fig. 14).
   - Turn the adjusting screw as required until the specified dwell reading is obtained.
   - Close access cover fully to prevent the entry of dirt into the distributor.

   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 1750 rpm and note dwell reading. Return engine to idle and note dwell reading. If dwell variation exceeds specifications, check for worn distributor shaft, worn distributor shaft bushing or loose breaker plate.

Check and Adjust Ignition Timing (Fig. 15)

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 in Specification section.)
3. Aim timing light at timing tab.

   NOTE: The markings on the tabs are in 2° increments (the greatest number of markings on the

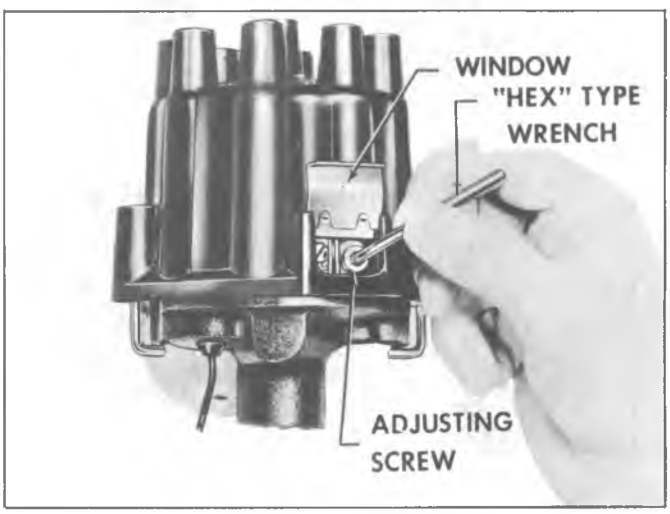


Fig. 14—Setting Point Dwell (Typical V8)

Fig. 15—Ignition Timing Marks

"Before" side of the "O"). The "O" marking is TDC and all BTDC settings fall on the "Before" (advance) side of "O".

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

Adjust Idle Speed (Fig. 16)

1. With engine running at operating temperature, choke valve in fully open position, parking brake on and drive wheels blocked — adjust idle speed as follows (See "Tune-Up" Decal Figure 17):

   NOTE: All carburetors are equipped with idle mixture limiter caps (fig. 16), the idle mixture is preset and "locked in" by these caps — no attempt should be made to adjust mixture. Do not remove mixture screw caps.

- 250 and 292 Cu. In. (Single-Barrel Carburetor) —

  On 250 cu. in. engines disconnect "Fuel Tank" line from Evaporation Emission vapor canister.

  Disconnect the distributor spark advance hose and plug the vacuum source opening.

  Adjust Idle Stop Solenoid screw to obtain 700 rpm with manual transmission in neutral; 600 rpm with automatic transmission in drive. DO NOT ADJUST CEC SOLENOID SCREW.

CAUTION: If the CEC solenoid screw (fig. 16) is used to set engine idle or if the solenoid is adjusted out of limits as specified in Section 6M, a decrease in engine braking may result.

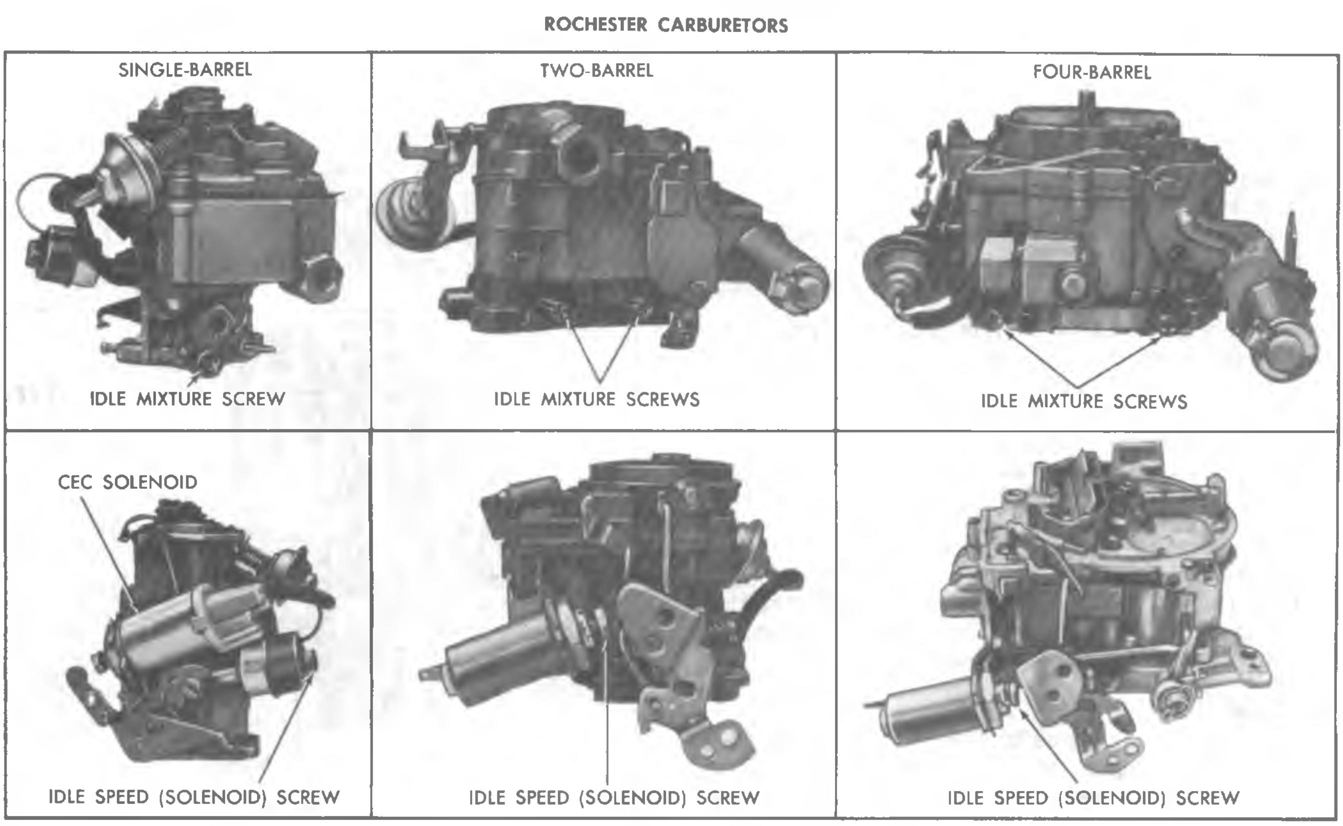
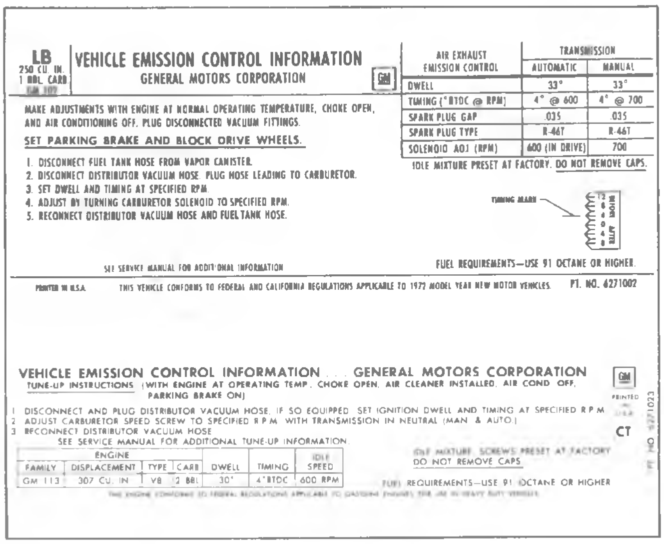


Fig. 16—Idle Speed and Mixture Screws



LB
250 CU. IN.
1 BBL. CARB.

VEHICLE EMISSION CONTROL INFORMATION
GENERAL MOTORS CORPORATION

MAKE ADJUSTMENTS WITH ENGINE AT NORMAL OPERATING TEMPERATURE, CHOKE OPEN, AND AIR CONDITIONING OFF. PLUG DISCONNECTED VACUUM FITTINGS.

SET PARKING BRAKE AND BLOCK DRIVE WHEELS.

1. DISCONNECT FUEL TANK HOSE FROM VAPOR CANISTER.
2. DISCONNECT DISTRIBUTOR VACUUM HOSE. PLUG HOSE LEADING TO CARBURETOR.
3. SET DWELL AND TIMING AT SPECIFIED RPM.
4. ADJUST BY TURNING CARBURETOR SOLENOID TO SPECIFIED RPM.
5. RECONNECT DISTRIBUTOR VACUUM HOSE AND FUEL TANK HOSE.

AIR EXHAUST EMISSION CONTROL	TRANSMISSION AUTOMATIC	MANUAL
DWELL	33°	33°
TIMING (°BTDC @ RPM)	4° @ 600	4° @ 700
SPARK PLUG GAP	.035	.035
SPARK PLUG TYPE	R-46T	R-46T
SOLENOID ADJ (RPM)	600 (IN DRIVE)	700

IDLE MIXTURE PRESET AT FACTORY. DO NOT REMOVE CAPS.

TIMING MARK

SEE SERVICE MANUAL FOR ADDITIONAL INFORMATION

FUEL REQUIREMENTS—USE 91 OCTANE OR HIGHER.

PRINTED IN U.S.A. THIS VEHICLE CONFORMS TO FEDERAL AND CALIFORNIA REGULATIONS APPLICABLE TO 1972 MODEL YEAR NEW MOTOR VEHICLES. PT. NO. 6271002

VEHICLE EMISSION CONTROL INFORMATION . . . GENERAL MOTORS CORPORATION

TUNE-UP INSTRUCTIONS (WITH ENGINE AT OPERATING TEMP., CHOKE OPEN, AIR CLEANER INSTALLED, AIR COND OFF, PARKING BRAKE ON)

1. DISCONNECT AND PLUG DISTRIBUTOR VACUUM HOSE, IF SO EQUIPPED. SET IGNITION DWELL AND TIMING AT SPECIFIED R.P.M.
2. ADJUST CARBURETOR SPEED SCREW TO SPECIFIED R.P.M. WITH TRANSMISSION IN NEUTRAL (MAN. & AUTO.)
3. RECONNECT DISTRIBUTOR VACUUM HOSE

SEE SERVICE MANUAL FOR ADDITIONAL TUNE-UP INFORMATION.

ENGINE FAMILY	DISPLACEMENT	TYPE	CARB	DWELL	TIMING	IDLE SPEED
GM 113	307 CU. IN.	V8	2 BBL	30°	4° BTDC	600 RPM

IDLE MIXTURE SCREWS PRESET AT FACTORY
DO NOT REMOVE CAPS

CT

FUEL REQUIREMENTS—USE 91 OCTANE OR HIGHER

PT. NO. 6271023

Fig. 17—Tune-Up Decal

Reconnect "Fuel Tank" line to vapor canister and reconnect distributor spark advance hose.

- 307 Cubic Inch (Two-Barrel Carburetor)

On vehicles so equipped, disconnect "Fuel Tank" line from Evaporation Emission vapor canister.

Disconnect the distributor spark advance hose and plug the vacuum source opening.

On vehicles equipped with T.C.S. system, turn air conditioning off, adjust Idle Stop Solenoid screw to obtain 900 rpm (950 rpm on C & K series for California) with manual transmission in neutral; 600 rpm with automatic transmission in drive.

On vehicles without T.C.S. system, adjust carburetor speed screw to obtain 600 rpm with transmission in neutral.

Place transmission in park or neutral and adjust carburetor fast idle cam screw to obtain 1850 rpm.

Reconnect "Fuel Tank" line to vapor canister and reconnect distributor spark advance hose.

- 350 Cubic Inch (Four-Barrel Carburetor)

On vehicles so equipped, disconnect "Fuel Tank" line from Evaporation Emission vapor canister.

Disconnect the distributor spark advance hose and plug the vacuum source opening.

On vehicles equipped with T.C.S. system, turn air conditioning off, adjust Idle Stop Solenoid screw to obtain 800 rpm with manual transmission in neutral; 600 rpm with automatic transmission in drive.

On vehicles without T.C.S. system, adjust carburetor speed screw to obtain 600 rpm with transmission in neutral.

Place fast idle cam follower on second step of fast idle cam, turn air conditioning "off" and adjust fast idle to 1350 rpm with manual transmission in neutral; 1500 rpm with automatic transmission in "Park".

Reconnect "Fuel Tank" line to vapor canister and reconnect distributor spark advance hose.

- 402 Cubic Inch (Four-Barrel Carburetor)

On vehicles so equipped, disconnect "Fuel Tank" line from Evaporation Emission vapor canister.

Disconnect the distributor spark advance hose and plug the vacuum source opening.

On vehicles equipped with T.C.S. system, turn air conditioning off, adjust Idle Stop Solenoid screw to obtain 750 rpm with manual transmission in neutral; 600 rpm with automatic transmission in drive.

On vehicles without T.C.S. system, adjust carburetor speed screw to obtain 600 rpm with transmission in neutral.

Place fast idle cam follower on second step of fast idle cam, turn air conditioning "off" and adjust fast idle to 1350 rpm with manual transmission in neutral; 1500 rpm with automatic transmission in "Park".

Reconnect "Fuel Tank" line to vapor canister and reconnect distributor spark advance hose.

ADDITIONAL CHECKS AND ADJUSTMENTS

Cylinder Balance Test (Fig. 18)

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.

L6 Firing Order

$$1\text{-}5\text{-}3\text{-}6\text{-}2\text{-}4 = \frac{1\text{-}5\text{-}3}{6\text{-}2\text{-}4} = 1\text{-}6,\ 5\text{-}2,\ 3\text{-}4$$

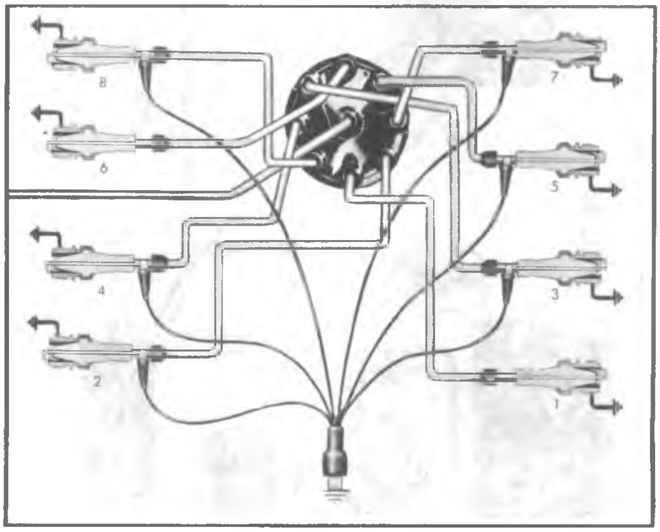


Fig. 18—Cylinder Balance Test

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. 19)

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.

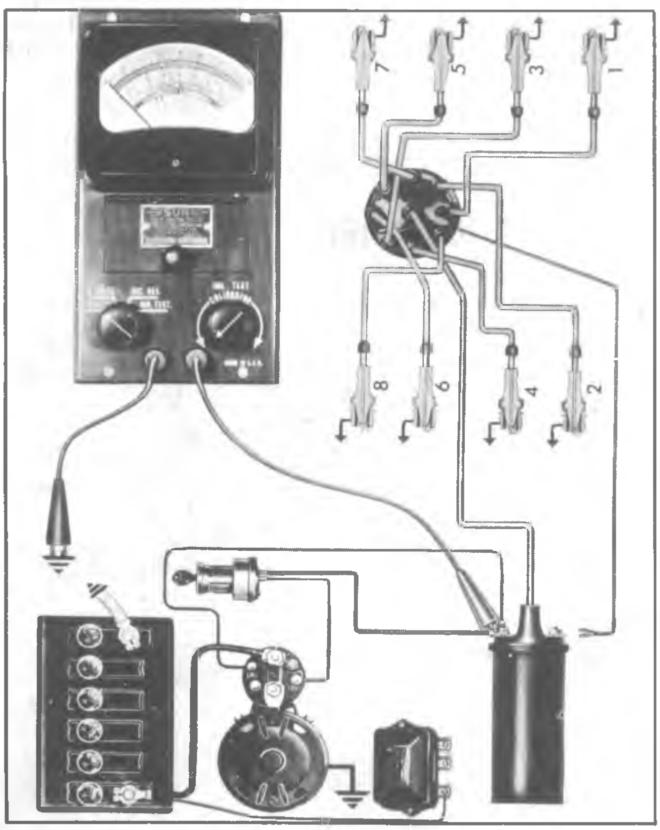


Fig. 19—Testing Cranking Voltage

3. Operate starting motor.
   a. If voltage is 9 volts or more and cranking speed is satisfactory, the battery, starter, cables, starter switch and ignition circuit to coil (by-passing resistance wire) are in good condition.
   b. If below 9 volts, check circuit until difficulty is located.

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

   <u>Cranking speed below normal</u>—Excessive resistance in cables or starting motor; excessive mechanical drag in engine.

   <u>Uneven cranking speed</u>—Uneven compression, defective starter to 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 by-pass the ignition resistance wire or the ignition circuit is incorrectly wired.

> **NOTE:** The voltage drop (12 to 5-7 volts) will only take place when the points are closed. If the points are open, the path through the resistance wire will not be completed.

Distributor Resistance

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

Fig. 20—Cooling System Pressure Check

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.

Carburetor

Refer to Section 6M to perform adjustments such as float level, pump rod and vacuum break.

Fuel Pump

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

Cooling System

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

1. Remove radiator cap.
2. Apply a test pressure of 3 pounds higher than the radiator cap (fig. 21), 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.

Hydraulic Valve Adjustment

1. Remove rocker arm cover(s) and gasket(s).

   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. Adjust valves on L-6 engines as follows:
   a. Mark distributor housing, with chalk, at number one and number six positions (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. The following valves can be adjusted with engine in number one firing position:

      L6 Engine - Number one cylinder-Exhaust and Intake
      Number two cylinder-Intake
      Number three cylinder-Exhaust
      Number four cylinder-Intake
      Number five cylinder-Exhaust

   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 end play while turning adjusting nut (fig. 21). When play has been removed, turn adjusting nut in one full additional turn (to center lifter plunger).
   d. Crank engine until distributor rotor points to number six position and breaker points are open. The following valves can be adjusted with engine in number six firing position:

      L6 Engine - Number two cylinder-Exhaust
      Number three cylinder-Intake
      Number four cylinder-Exhaust
      Number five cylinder-Intake
      Number six cylinder-Intake and Exhaust

3. Adjust valves on V-8 engines using the following procedures:
   a. Crank engine until mark on torsional damper lines up with center or "0" mark on the timing

Fig. 21—Valve Adjustment (L6 Engine)

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. 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. 22). 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.

   Exhaust - 2, 5, 6, 7
   Intake - 3, 4, 6, 8

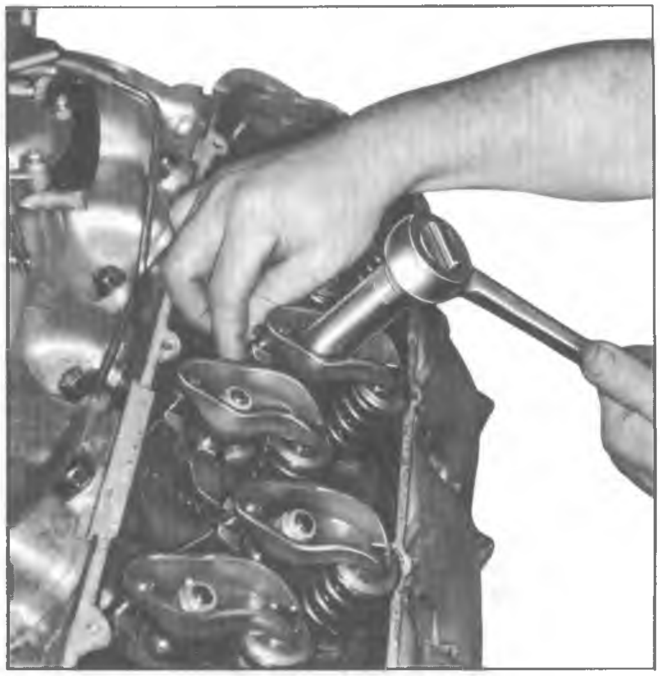


Fig. 22—Valve Adjustment (V8 Engine)

4. Clean gasket surfaces on cylinder head(s) and rocker arm cover(s) with degreaser, then install rocker arm cover(s), using new gasket(s), and torque bolts to specifications.
5. Install distributor cap and spark plug wire assembly.
6. Install rocker arm cover as outlined.
7. Adjust carburetor idle speed.

ENGINE MECHANICAL

IN-LINE ENGINES

INDEX

GENERAL DESCRIPTION

The In-Line engines covered in this section are the 250 and 292 cu. in. L6 engines used in 10-30 Series truck vehicles (fig. 1L).

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 parts, regardless of which truck 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. Disconnect battery cables and drain cooling system.
2. Remove the air cleaner.
3. Perform the following preliminary operations.

   ON CS 10-20-30, KS 10-20 SERIES:
   - Remove the hood as outlined in Section 11.
   - Remove the radiator and shroud as outlined in Section 13.

   ON PS 10-20-30 SERIES:
   - Remove the engine box and hood as outlined in Section 11.
   - Remove the battery.
   - Remove the radiator and shroud as outlined in Section 13.
4. Disconnect wires at:
   - Starter Solenoid.
   - Delcotron.
   - Temperature Switch.
   - Oil Pressure Switch.
   - Coil.
   - CEC Solenoid.
5. Disconnect:
   - Accelerator linkage at manifold bellcrank.
   - Fuel line (from tank) at fuel pump.
   - Heater hoses at engine connection.
   - Oil pressure gauge line (if so equipped).
   - Vacuum lines at engine (as required)
   - Power steering pump at engine bracket and lay aside (if so equipped).
   - Ground straps at engine.
   - Exhaust pipe at manifold.

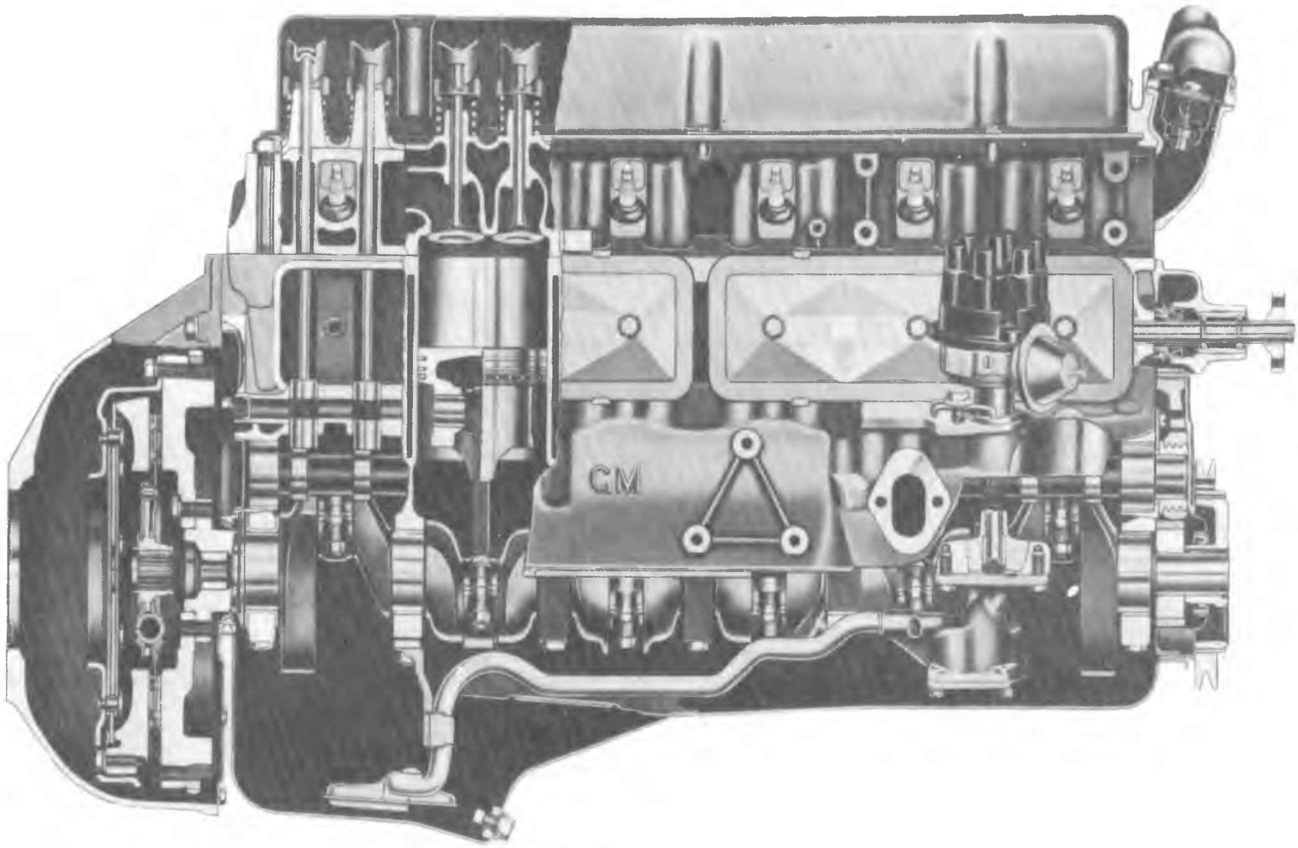


Fig. 1L—In Line Engine

NOTE: Hang exhaust pipe at frame with wire.

6. Remove fan and pulley as outlined in Section 6K.
7. Remove clutch cross-shaft (if so equipped).
8. Perform the following operations:
   - Remove the rocker arm cover as outlined.
   - Attach lifting device or chain to engine lifting brackets and take engine weight off mounts.

   ON ALL SERIES EXCEPT CS 10-20-30:
   - Support transmission and disconnect from engine.
   - Refer to Section 7.
   - Remove engine mount bolts.

   ON CS 10-20-30:
   - Remove propeller shaft as outlined in Section 4.

   NOTE: If plug for propeller shaft opening in transmission is not available, drain transmission.

   - Disconnect TCS Switch at Transmission
   - Disconnect speedometer cable at transmission.
   - Disconnect shift linkage at transmission.
   - Disconnect clutch linkage (as required).
   - Remove engine mount bolts.
   - Transmission cooler lines (if so equipped).

9. Remove engine from vehicle as follows:

   CAUTION: Check often during engine removal to be sure all necessary disconnects have been made.

   ON CS 10-20-30 SERIES:
   - On vehicles with automatic or four speed transmission, remove rear mount crossmember.
   - Raise engine and transmission assembly and pull forward until removed.

   ON KS 10-20 SERIES:
   - Raise engine and pull forward until disconnected from transmission.
   - Continue to raise engine until removed from vehicle.

   ON PS 10-20-30 SERIES:
   - Raise engine and push forward to clear crossmember and disconnect from transmission.
   - Remove engine from vehicle.

10. If engine is to be mounted in an engine stand perform the following:

    ON CS 10-20-30:
    - Remove synchromesh transmission and clutch (if so equipped).

    a. Remove clutch housing rear cover bolts.
    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.

- Remove automatic transmission (if so equipped).
  a. Lower engine, secured by the hoist, and support engine on blocks.
  b. Remove starter and converter housing under pan.
  c. Remove flywheel-to-converter attaching bolts.
  d. Support transmission on blocks.
  e. Disconnect throttle linkage and vacuum modulator line.
  f. Remove transmission-to-engine mounting bolts.
  g. With the hoist attached, remove blocks from the engine only and slowly guide the engine from the transmission.

ON ALL SERIES EXCEPT CS 10-20-30:
- Remove clutch housing.
- 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.

11. Mount engine in engine stand and remove lifting device and lifting adapter.

Installation

1. If engine was mounted in an engine stand, attach lifting adapter to engine lift brackets then using lifting device, remove engine from stand and perform the following:

ON CS 10-20-30:
- Install synchromesh transmission and clutch (if so equipped).
  a. Install the clutch assembly on flywheel as outlined in Section 7.
  b. Install clutch housing rear cover and starter
  c. Install the transmission and clutch housing as outlined in Section 7.
  d. Install clutch housing rear cover bolts and torque to specifications.
- Install automatic transmission (if so equipped).
  a. Position engine adjacent to the transmission and align the convertor with the flywheel.
  b. Bolt transmission to engine then raise engine and transmission assembly and install flywheel to convertor bolts.
  c. Install convertor housing underpan and starter.
  d. Connect throttle linkage and vacuum modulator line.

ON ALL SERIES EXCEPT CS 10-20-30:
- Install clutch assembly and clutch housing as outlined in Section 7.

2. Install engine in vehicle as follows:

ON ALL SERIES EXCEPT CS 10-20-30:
- Install engine and lower until transmission shaft lines up with clutch.
- Push engine rearward and rotate crankshaft until transmission shaft and clutch engage.
- Install the engine mount bolts and torque to specifications.
- Connect transmission to engine.

ON CS 10-20-30 SERIES:
- Lower engine and transmission assembly and push rearward until engine mounts line up.
- On vehicles with automatic or four speed transmissions, install rear mount crossmember.
- Install the engine mount bolts and torque to specifications.
- Install the propeller shaft as outlined in Section 4.

ON ALL SERIES:
- Remove the lifting device and lifting adapter from cylinder head bolt location then torque cylinder head bolts to specifications.
- Install rocker arm cover as outlined.

3. Connect transmission linkage (as required).
4. Install clutch cross-shaft (as required).
5. Install fan and pulley as outlined in Section 6K.
6. Connect:
   - Transmission cooler lines (if so equipped)
   - Exhaust pipe at manifold.
   - Power steering pump (as required).
   - Vacuum lines at engine (as required).
   - Oil pressure gauge line (as required).
   - Heater hoses at engine connnection.
   - Fuel line at fuel pump.
   - Accelerator linkage at manifold bellcrank.
   - TCS switch at transmission.
7. Connect wires at:
   - Coil
   - Oil Pressure Switch
   - Temperature Switch
   - Delcotron
   - Starter Solenoid
   - CEC Solenoid
8. Complete installation as follows:

ON PS 10-20-30 SERIES:
- Install the radiator and shroud as outlined in Section 13.
- Install the battery.
- Install the floor panel and engine box as outlined in Section 1B.

ON CS 10-20-30, KS 10-20 SERIES:
- Install the radiator and shroud as outlined in Section 13.
- Install the hood as outlined in Section 11.

9. Install the air cleaner, connect battery cables, fill cooling system and crankcase then start engine and check for leaks.

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 and choke cable at carburetor.
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. Separate manifolds by removing one bolt and two nuts at center of assembly.

Installation

1. Clean gasket surfaces on cylinder head and manifolds. man
2. Lay a straight edge along the full length of the exhaust port faces and measure any gaps between the straight edge and the port faces. If at any point a gap of .030 or more exists, it is likely the manifold has distorted to a point where it will not seat properly. If a good exhaust seal is to be expected, the exhaust manifold must be replaced.
3. Reinstall the one bolt and two nuts at the center of the manifold to finger tight.
4. Position new gasket over manifold end studs on the cylinder head.
5. Install manifold assembly bolts and clamps while holding manifold assembly in place by hand.
6. Clean, oil and torque all manifold assembly-to-cylinder head bolts and nuts to specifications.
7. Complete torqueing the inlet to exhaust manifold bolt and two nuts at the center of the manifold to specifications.
8. Connect exhaust pipe to manifold using a new packing.
9. Connect crankcase ventilation hose at rocker arm cover.
10. Connect fuel and vacuum lines at carburetor.
11. Connect throttle rods at bellcrank and install throttle return spring.
12. Install air cleaner, start engine, check for leaks and adjust carburetor idle speed.

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.

Installation

1. Clean gasket surfaces on cylinder head and rocker gasket, install rocker arm cover and torque 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 re-installed 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 number one and number six cylinder positions (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. The following valves can be adjusted with engine in number one firing position.

      Number one cylinder--Exhaust and Intake
      Number two cylinder—Intake
      Number three cylinder—Exhaust
      Number four cylinder—Intake
      Number five cylinder—Exhaust

   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. Crank engine until distributor rotor points to number six position and breaker points are open. The following valves can be adjusted with engine in number six firing position:

      Number two cylinder—Exhaust
      Number three cylinder—Intake
      Number four cylinder—Exhaust
      Number five cylinder—Intake
      Number six cylinder—Intake and Exhaust

Fig. 2L—Valve Adjustment

4. Install distributor cap and spark plug wire assembly.
5. Install rocker arm cover as outlined.
6. Adjust carburetor idle speed.

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 most cases, be caused by either insufficient oil supply or improper adjustment.
4. Intermittent Clicking - Probable causes are:
   a. A microscopic piece of dirt momentarily caught between ball seat and check valve ball.
   b. In rare cases, the ball itself may be out-of-round or have a flat spot.
   c. Improper adjustment.

In most cases, where noise exists in one or more lifters, all lifter units should be removed, disassembled, cleaned in a solvent, reassembled, and reinstalled in the engine. If dirt, varnish, carbon, etc. is shown to exist in one unit, it more than likely exists in all the units, thus it would only be a matter of time before all lifters caused trouble.

Removal

1. Remove valve mechanism as outlined.
2. Mark distributor housing, with chalk, at number one and number six 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, polish lifter feet with #600 wet/dry emery paper and coat foot of valve lifters with "Molykote" or its equivalent.

2. Install push rod covers, using new gaskets, and torque 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.

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. Install air line adapter Tool J-23590 to spark plug port and apply compressed air to hold the valves in place.
4. Using Tool J-5892 to compress the valve spring, remove the valve locks, valve cap, valve shield and valve spring and damper (fig. 3L).
5. Remove the valve stem oil seal.
6. To replace, set the valve spring and damper, valve shield and valve cap in place. 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.

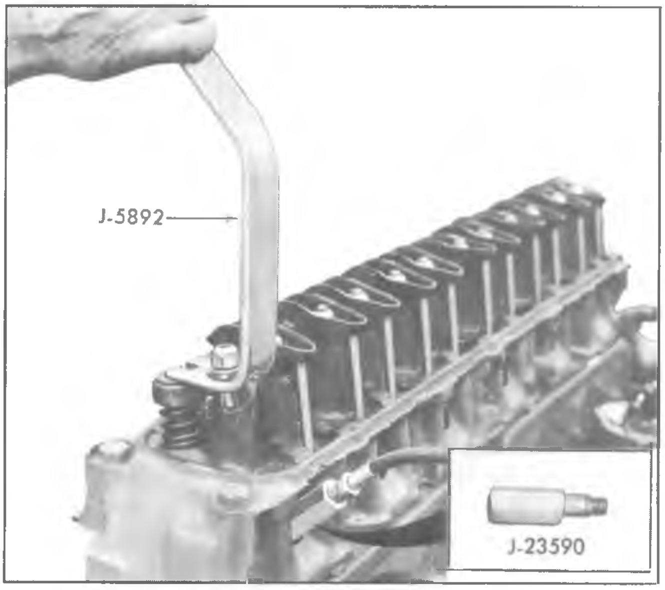


Fig. 3L—Compressing Valve Spring

NOTE: Grease may be used to hold the locks in place while releasing the compressor tool.

8. Install spark plug and torque to specifications.
9. Install and adjust valve mechanism as outlined.

Cylinder Head Assemblies

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 radiator upper hose at water outlet housing and battery ground strap at cylinder head.
6. Remove coil.
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 gaskets.

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.
6. Connect radiator upper 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.
11. Install and torque rocker arm cover.

Oil Pan

Removal

1. Disconnect battery ground cable then remove starter.
2. On CS 10-20-30.
   a. Remove engine front mount bolts (frame bracket-to-mount).
   b. Using a suitable jack with a flat piece of wood (to prevent damaging oil pan), raise engine enough to insert 2" x 4" wood blocks between the engine mounts and frame brackets.
3. Drain engine oil.
4. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.
2. Install new rear seal in rear main bearing cap.
3. Install new front seal on crankcase front cover pressing tips into holes provided in cover.
4. Install new side gaskets on cylinder block (fig. 4L).

   NOTE: DO NOT USE SEALER.

5. Install oil pan and torque bolts to specifications.
6. Complete installation as follows on CS 10-20-30:
   a. Using a suitable jack with a flat piece of wood (to prevent damaging oil pan), raise engine enough to remove 2" x 4" wood blocks from between the engine mounts and frame brackets.
   b. Lower engine, install front mount bolts and torque to specifications.
   c. Install starter and connect battery cable.
7. Fill with engine oil then 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 as outlined.

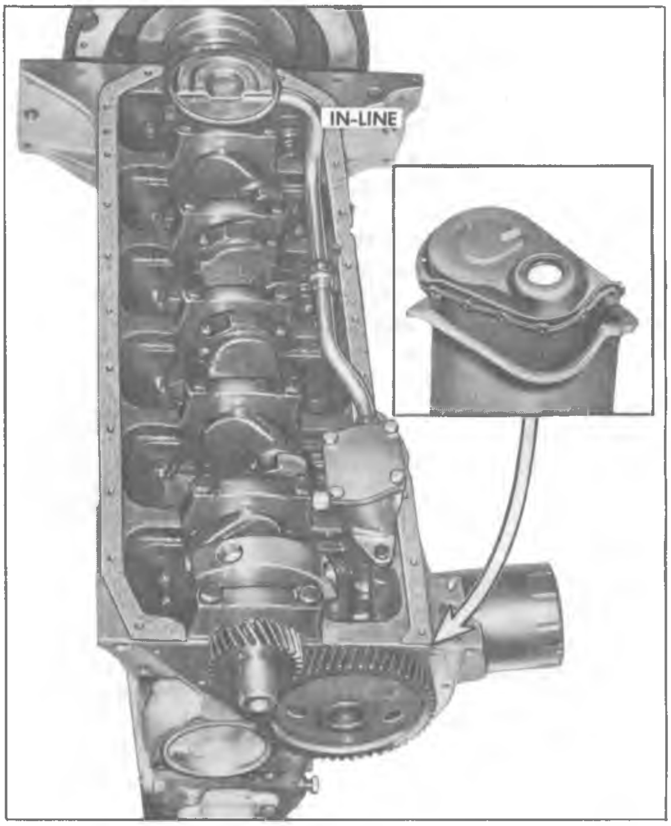


Fig. 4L—Oil Pan Gasket and Seal Location

Oil Seal (Rear Main)

Replacement

NOTE: Always replace the upper and lower seal as a unit. Install seal with lip facing front of engine.

The rear main bearing oil seal can be replaced (both halves) without removal of the crankshaft. Extreme care should be exercised when installing this seal to protect the sealing bead located in the channel on the outside diameter of the seal. An installation tool (fig. 5L) can be used to protect the seal bead when positioning upper half of seal between crankshaft and block as follows:

1. With the oil pan and oil pump removed, remove the rear main bearing cap.
2. Remove oil seal from the bearing cap by prying from the bottom with a small screw driver (fig. 6L).
3. 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. 7L).
4. Clean all sealant and foreign material from cylinder case bearing cap and crankshaft, using a non-abrasive cleaner.
5. Inspect components for nicks, scratches, burrs and machining defects at all sealing surfaces, case assembly and crankshaft.
6. Coat seal lips and seal bead with light engine oil - keep oil off seal mating ends.
7. Position tip of tool between crankshaft and seal seat in cylinder case.
8. Position seal between crankshaft and tip of tool so that seal bead contacts tip of tool.

   NOTE: Make sure that oil-seal lip is positioned toward front of engine.

9. Roll seal around crankshaft using tool as a "shoe-horn" to protect seal bead from sharp corner of seal seat surface in cylinder case.

   CAUTION: Installation tool must remain in position until seal is properly positioned with both ends flush with block.

10. Remove tool, being careful not to withdraw seal.
11. Install seal half in bearing cap, again using tool as a "shoe-horn", feeding seal into cap using light pressure with thumb and finger.
12. Install bearing cap to case with sealant applied to the cap-to-case interface being careful to keep sealant off the seal split line (fig. 8L).

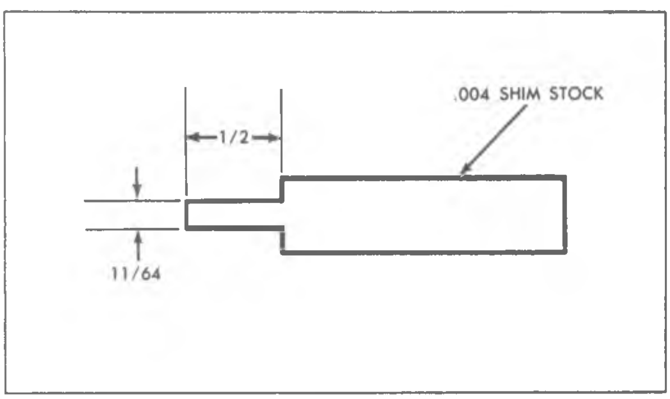


Fig. 5L—Oil Seal Installation Tool

Fig. 6L—Removing Oil Seal (Lower Half) Typical

13. Install the rear main bearing cap (with new seal) and torque to specifications.

Torsional Damper

Removal

1. Drain radiator and disconnect radiator hoses at radiator.
2. Remove radiator core, as outlined in Section 13.
3. Remove fan belt and (if so equipped) accessory drive pulley and belt. If so equipped, remove retaining bolt.
4. Install Tool J-23523 to damper and turn puller screw to remove damper (fig. 9L). Remove tool from damper.

Installation

CAUTION: The inertia weight section of the torsional damper is assembled to the hub with a rubber type material. The installation procedures (with proper tool) must be followed or movement of the inertia weight section on the hub will destroy the tuning of the torsional damper.

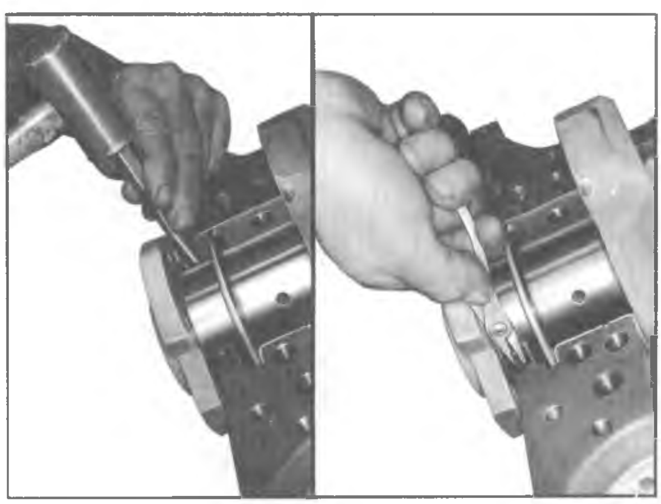


Fig. 7L—Removing Oil Seal (Upper Half) Typical

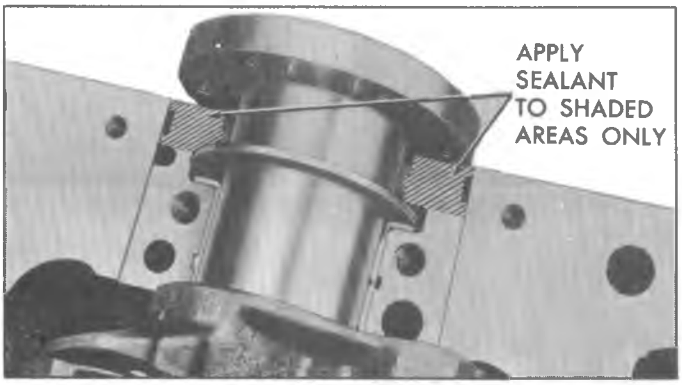


Fig. 8L—Sealing Bearing Cap

1. Coat front seal contact area (on damper) with engine oil.
2. Install torsional damper as follows:
   DRIVE ON TYPE (Without retaining bolt)
   a. Attach damper installer Tool J-22197 to damper. Tighten fingers of tool to prevent inertia weight from moving (fig. 10L).
   b. Position damper on crankshaft and drive into position, using J-5590, until it bottoms against crankshaft gear (fig. 10L). Remove installer tool.

   PULL ON TYPE (With retaining bolt)
   a. Install 7/16 threaded end of Tool J-23523 into crankshaft.

   CAUTION: Install tool in crankshaft so that at least 1/2" of thread engagement is obtained.

   b. Position damper on crankshaft, aligning damper with key on crankshaft.
   c. Install plate, thrust bearing and nut to complete tool installation.
   d. Pull damper into position as shown in Figure 11L.
   e. Remove tool from crankshaft.
3. Install fan belt and adjust using strand tension gauge.
4. If so equipped, install accessory drive pulley and belt.
5. Install radiator core as outlined in Section 13.
6. Connect radiator hoses.
7. Fill cooling system and check for leaks.

Crankcase Front Cover

Removal

1. Remove oil pan as outlined.

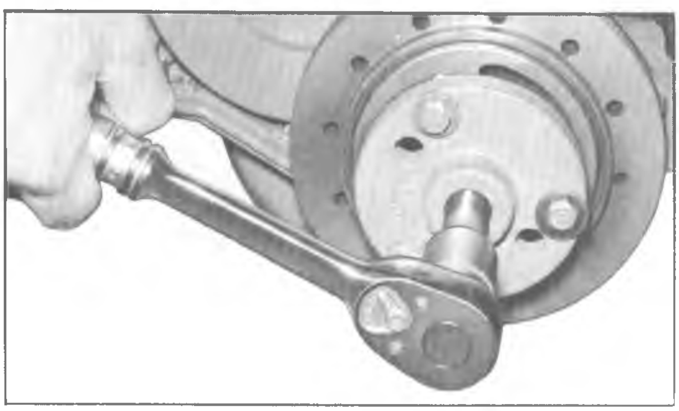


Fig. 9L—Removing Torsional Damper

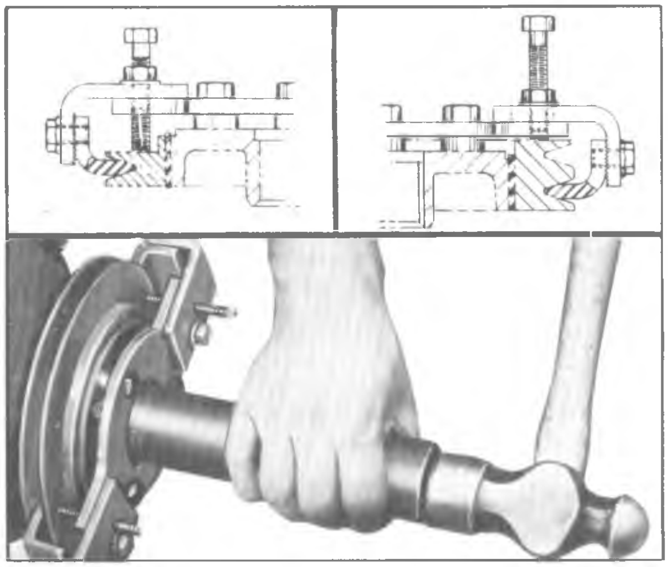


Fig. 10L—Installing Torsional Damper (Drive on Type)

2. Remove crankshaft pulley and hub or torsional damper as outlined.
3. Remove crankshaft front cover attaching screws, remove cover and gasket.

Installation

1. Clean gasket surfaces on block and crankcase front cover.
2. Install centering Tool J-23042 in crankcase front cover seal (fig. 12L).
3. Coat the gasket with gasket sealer and place in position on cover, then install crankcase front cover to block and torque to specifications.
4. Remove centering tool.

NOTE: It is important that centering tool be used to align crankcase front cover so that crankshaft hub or damper installation will not

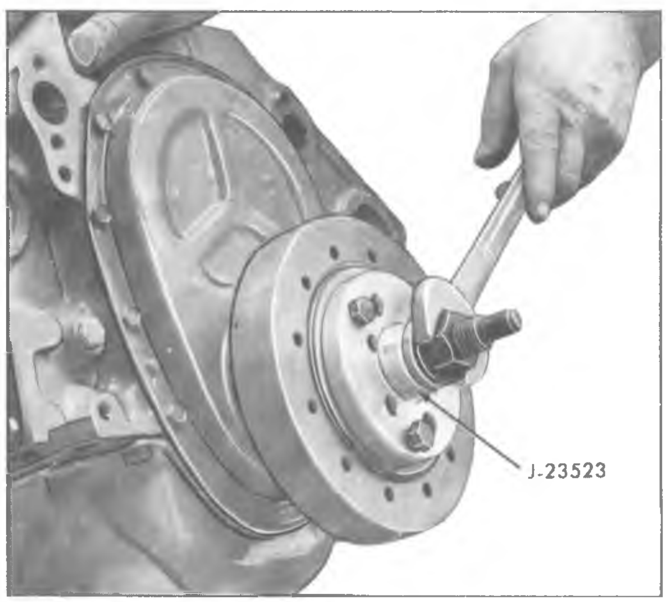


Fig. 11L—Installing Torsional Damper (Pull on Type)

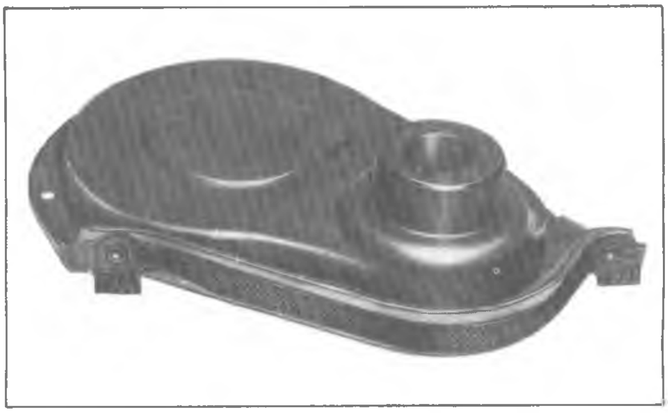


Fig. 12L—Centering Tool (J-23042) In Cover

damage seal and to position seal to seal evenly around the damper or hub surface.

5. Install crankshaft hub and/or damper as outlined.
6. Install oil pan as outlined.

Oil Seal (Front Cover)

Replacement

With Cover Removed

1. With cover removed, pry old seal out of cover from the front with a large 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-23042 (fig. 13L).

CAUTION: Support cover at sealing area. (Tool J-971 may be used as support).

Without Cover Removed

1. With crankshaft pulley and hub or 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 crankshaft.

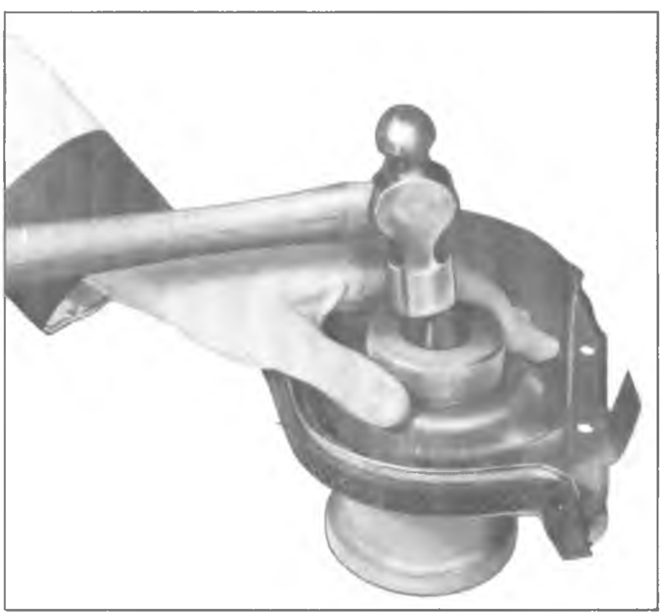


Fig. 13L—Installing Oil Seal (Cover Removed)

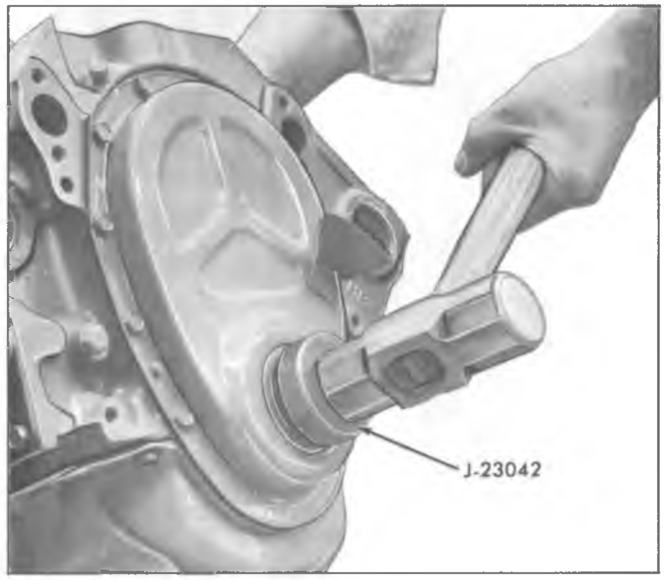


Fig. 14L—Installing Oil Seal (Cover Installed) (Typical)

2. Install new seal so that open end of seal is toward the inside of cover and drive it into position with Tool J-23042 (fig. 14L).

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 (Tool J-8520) on push rod (fig. 15L).

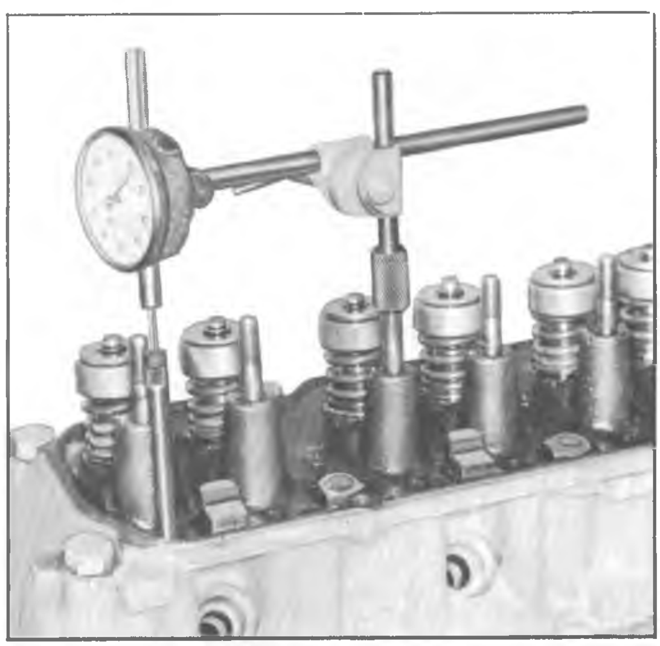


Fig. 15L—Measuring Camshaft Lobe Lift

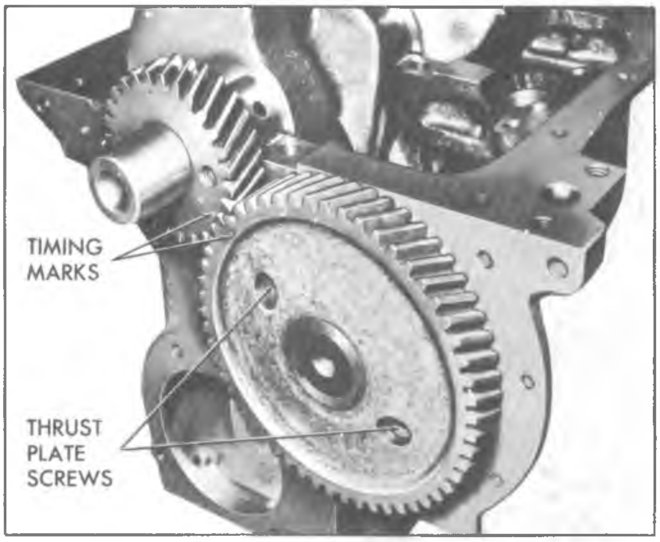


Fig. 16L—Timing Gear Alignment Marks

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 distributor primary lead must be disconnected from the negative post on the coil.

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.

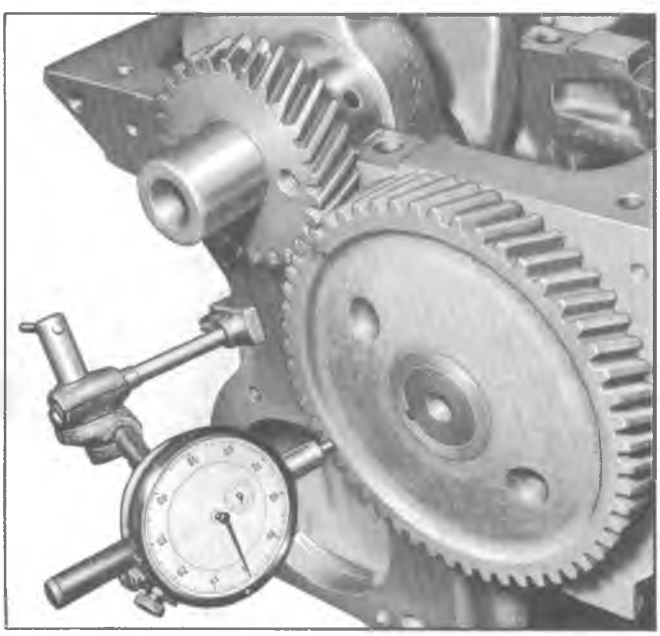


Fig. 17L—Checking Camshaft Gear Runout

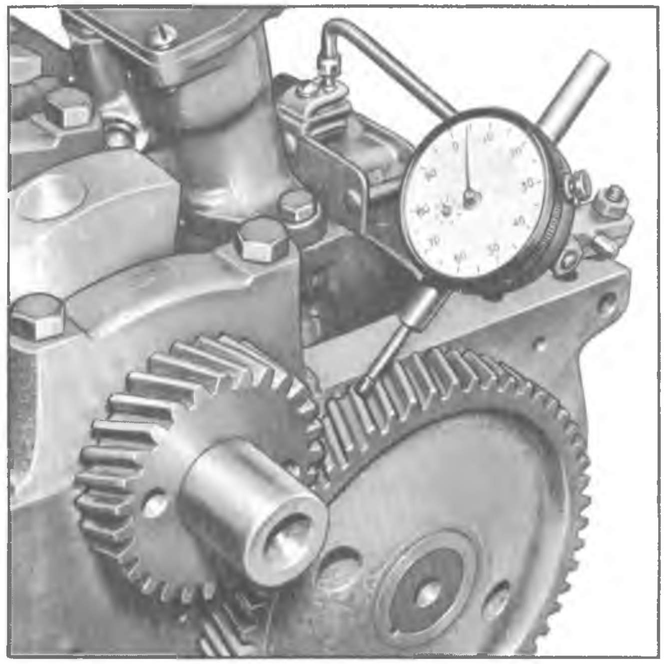


Fig. 18L—Checking Timing Gear Backlash

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 grille as outlined in Section 13.
4. Remove fuel pump as outlined in Section 6M.
5. Align timing gear marks then remove the two camshaft thrust plates screws by working through holes in the camshaft gear (fig. 16L).
6. 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. 16L).

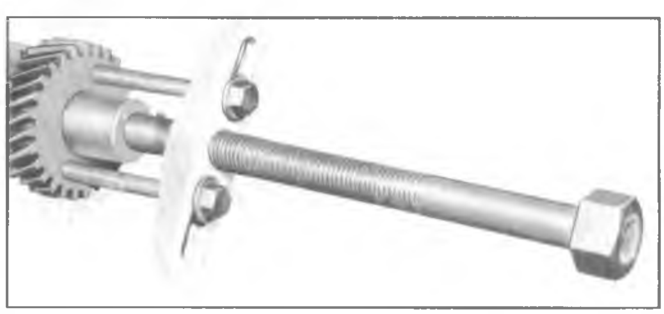


Fig. 19L—Removing Crankshaft Gear

Fig. 20L—Installing Crankshaft Gear

Push camshaft into position. Install camshaft thrust plate to block screws and torque to specifications.

3. Check camshaft and crankshaft gear run out with a dial indicator (fig. 17L). 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. 18L). The backlash should be not 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 valve lifters as outlined.

Timing Gears

Replacement

With camshaft removed, crankshaft gear may be removed using Tool J-8105 (fig. 19L). To install crankshaft gear use Tool J-5590 (fig. 20L). For camshaft gear replacement, refer to "Camshaft Disassembly" in the Chassis Overhaul Manual.

Flywheel

Removal

(All Except 292 cu. in. Engines)

1. Remove transmission and/or clutch housing and clutch from engine.

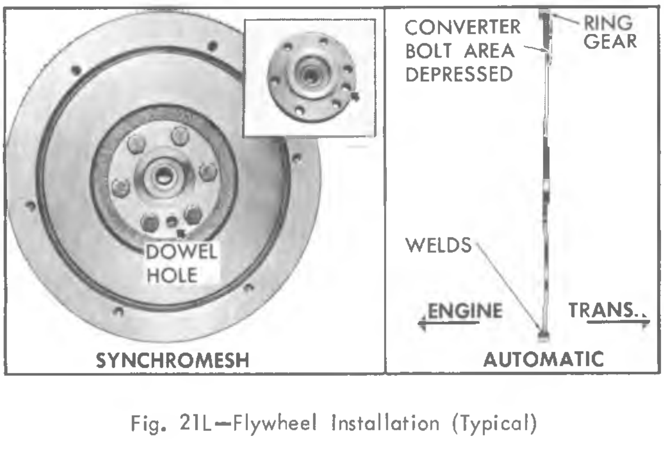


Fig. 21L—Flywheel Installation (Typical)

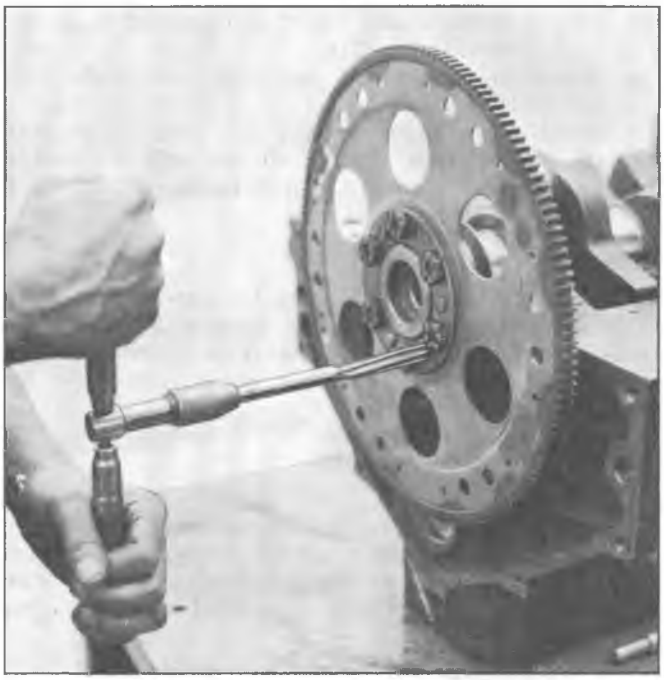


Fig. 22L—Reaming Flywheel Dowel Pin Holes

2. Remove flywheel retaining bolts and remove flywheel.

(292 cu. in. Engines)

1. Remove transmission and/or clutch housing and clutch from engine.
2. Mark relationship of flywheel and crankshaft so that dowel holes can be aligned in their original positions on assembly.
3. Remove engine oil pan and rear main bearing cap.
4. Remove flywheel retaining bolts and drive crankshaft dowels out of flywheel and crankshaft. Rotate crankshaft as necessary so dowels clear cylinder block.
5. Remove flywheel and discard used dowel pins.

Installation

(All Except 292 cu. in. Engines)

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. 21L).
3. Install flywheel retaining bolts and torque to specifications.

(292 cu. in. Engine)

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 holes of crankshaft flange and flywheel.
3. Install flywheel retaining bolts and torque to specifications.

NOTE: The interference fit dowel pins used on 292 cu. in. engines must be replaced with an oversize dowel pin when installing the flywheel.

4. When installing the original flywheel, ream the dowel pin holes with Tool J-22808-2. When installing a new flywheel, first ream the dowel pin holes with

Tool J-22808-2 and then finish reaming them with Tool J-22808-1 (fig. 22L).
5. Install oversize dowel pins flush with flywheel retaining bolt surface.
6. Install rear main bearing cap and torque bolts to specifications. Install oil pan with new gaskets and seals. Torque oil pan retaining screws to specifications.

Engine Mounts

Engine mounts (fig. 23L) 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.

Checking Engine Mounts

Front Mount

Raise the engine to remove weight from the mounts and to place a slight tension in the rubber. Observe both mounts while raising engine. If an engine mount exhibits:

a. Hard rubber surface covered with heat check cracks;
b. Rubber separated from a metal plate of the mount; or
c. Rubber split through center.

Replace the mount. If there is relative movement between a metal plate of the mount and its attaching points, lower the engine on the mounts and tighten the screws or nuts attaching the mount to the engine, frame, or bracket.

Rear Mount

Raise the car on a hoist. Push up and pull down on the transmission tailshaft while observing the transmission mount. If the rubber separates from the metal plate of the mount or if the tailshaft moves up but not down (mount bottomed out) replace the mount. If there is relative movement between a metal plate of the mount and its attaching point, tighten the screws or nuts attaching the mount to the transmission or crossmember.

Front Mount Replacement

1. Remove frame bracket to mount bolt.
2. Raise engine enough to clear mount.
3. Remove mount and install new mount.
4. Install new mount and torque bolts to specifications.
5. Lower engine then install frame bracket to mount bolt and torque to specifications.

Rear Mount Replacement

1. Raise and support vehicle.
2. Bend mount bolt french lock tabs away from bolt head, then remove mount bolts, lower mount and spacer.
3. Raise engine enough to clear upper mount assembly and remove upper mount from frame member.

   NOTE: On models using a propeller shaft brake of any type, it is necessary to remove screws from transmission hole cover to allow the engine to raise because of the limited clearance between the brake and transmission hole cover.

4. Place new upper mount in place on frame member, then lower engine to within 1/4 inch of mount.
5. Align mount so that guide dowel enters hole in mount, install bolt through french lock, lower mount and spacer, then install bolt up through frame, upper mount and thread into engine bell housing loosely.
6. Lower engine completely and tighten mount bolt, then bend tabs of french lock to lock the bolt in place.

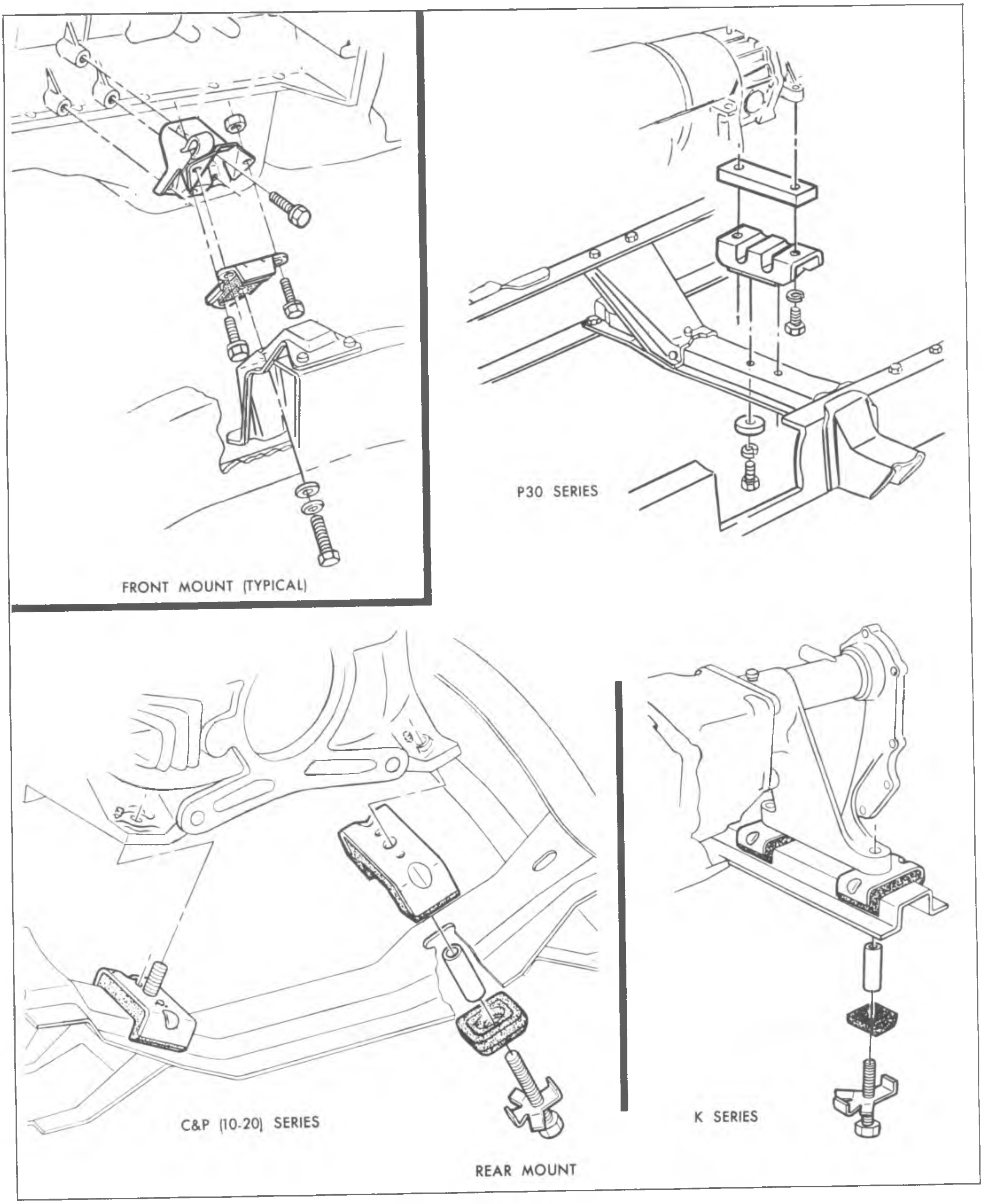


Fig. 23L—Engine Mounts

ENGINE MECHANICAL

V-8 ENGINES

INDEX

GENERAL DESCRIPTION

The V8 engines covered in this section are the 307, 350, and 402 cu. in. engines used in 10-30 Series truck vehicles. In order to avoid repetition and to identify the engines involved in a particular procedure, the 307 and 250 cu. in. V8 engines are identified as "Small V8's". The 402 cu. in. engine is identified as "Mark IV V8".

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 engines, engine sub-assemblies and parts regardless of which truck 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. Disconnect battery cables and drain cooling system.
2. Remove the air cleaner.
3. Perform the following preliminary operations:
   - Remove the hood as outlined in Section 11.
   - Remove the radiator and shroud as outlined in Section 13.
4. Disconnect wires at:
   - TCS Solenoid
   - Starter Solenoid
   - Delcotron
   - Temperature Switch
   - Oil Pressure Switch
   - Coil
5. Disconnect:
   - Accelerator linkage at manifold bellcrank
   - Fuel line (from tank) at fuel pump.
   - Heater hoses at engine connection.

- Oil pressure gauge line (if so equipped).
- Vacuum or air lines at engine (as required).
- Power steering pump with hoses attached and lay aside (if so equipped).
- Ground straps at engine.
- Exhaust pipe at manifold.
- TCS switch at transmission.

NOTE: Hang exhaust pipe at frame with wire.

6. Remove fan and pulley as outlined in Section 6K.
7. Remove clutch cross-shaft.
8. Perform the following operations:
9. Attach lifting device to engine lift brackets and take weight off engine mounts.

ON ALL SERIES EXCEPT CE 10-20-30:
- Support transmission and disconnect from engine.
- Disconnect speedometer cable at transmission.
- Disconnect shift linkage at transmission.
- Disconnect clutch linkage (as required).
- Remove engine mount bolts.

10. Remove engine from vehicle as follows:

CAUTION: Check often during engine removal to be sure all necessary disconnects have been made.

ON CE 10-20-30 SERIES:
- On vehicles with automatic or four speed transmissions, remove rear mount crossmember.
- Raise engine and transmission assembly and pull forward until removed.

ON KE 10-20 SERIES:
- Raise engine and pull forward until disconnected from transmission.
- Continue to raise engine until removed from vehicle.

11. If engine is to be mounted in an engine stand perform the following:

ON CE 10-20-30 SERIES:
- Remove synchromesh transmission and clutch (if so equipped).
  a. Remove clutch housing rear cover bolts.
  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.
- Remove automatic transmission (if so equipped).
  a. Lower engine, secured by the hoist, and support engine on blocks.
  b. Remove starter and converter housing under pan.
  c. Remove flywheel-to-converter attaching bolts.
  d. Support transmission on blocks.
  e. Disconnect throttle linkage and vacuum modulator line.
  f. Remove transmission-to-engine mounting bolts.
  g. With the hoist attached, remove blocks from the engine only and slowly guide the engine from the transmission.

ON ALL SERIES EXCEPT CE 10-20-30:
- Remove clutch housing.
- 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.

12. Mount engine in engine stand and remove lifting device and lifting adapter.

Installation

1. If engine was mounted in an engine stand, attach lifting adapter to engine then using lifting device, remove engine from stand and perform the following:

ON CE 10-20-30:
- Install synchromesh transmission and clutch (if so equipped).
  a. Install the clutch assembly on flywheel as outlined in Section 7.
  b. Install clutch housing rear cover and starter.
  c. Install the transmission and clutch housing as outlined in Section 7.
  d. Install clutch housing rear cover bolts and torque to specifications.
- Install automatic transmission (if so equipped).
  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 bolts.
  c. Install converter housing underpan and starter.
  d. Connect throttle linkage and vacuum modulator line.

ON ALL SERIES EXCEPT CE 10-20-30:
- Install clutch assembly and clutch housing as outlined in Section 7.

2. Install engine in vehicle as follows:

ON ALL SERIES EXCEPT CE 10-20-30:
- Install engine and lower until transmission lines up with clutch.
- Push engine rearward and rotate crankshaft until transmission shaft and clutch engage.
- Install the engine mount bolts and torque to specifications.
- Connect transmission to engine.

ON CE 10-20-30 SERIES:
- Lower engine and transmission assembly and push rearward until engine mounts line up.
- On vehicles with automatic or four speed transmissions, install rear mount crossmember.
- Install the engine mount bolts and torque to specifications.
- Install the propeller shaft as outlined in Section 4.

ON ALL SERIES:
- Remove the lifting device from engine lift brackets.

3. Connect transmission linkage (as required).
4. Install clutch cross-shaft.
5. Install fan and pulley as outlined in Section 6K.
6. Connect:
   - Exhaust pipe at manifold.
   - Power steering pump (as required).
   - Vacuum lines at engine (as required).

- Oil pressure gauge line (as required).
- Heater hoses at engine connection.
- Fuel line at fuel pump.
- Choke cable at carburetor.
- Accelerator linkage at manifold bellcrank.
- TCS switch at transmission.

7. Connect wires at:
   - Coil
   - Oil Pressure Switch
   - Temperature Switch
   - Delcotron
   - Starter Solenoid
   - CEC Solenoid
8. Complete installations as follows:
   - Install the radiator and shroud as outlined in Section 13.
   - Install the hood as outlined in Section 11.
9. Install the air cleaner, connect battery cables, fill coolling system and crankcase then start engine and check for leaks.

Intake Manifold

Removal

1. Drain radiator and remove air cleaner.
2. Disconnect:
   - Battery cables at battery.
   - Upper radiator hose and heater hose at manifold.
   - Water pump by-pass at water pump.
   - Accelerator linkage at pedal lever.
   - Fuel line and choke cable at carburetor.
   - Crankcase ventilation lines (as required).
   - Spark advance hose and governor line (if so equipped) at distributor.
3. Remove distributor cap and mark rotor position with chalk, then remove distributor.
4. Remove (as required) oil filler bracket, air cleaner bracket, air compressor and bracket, coil, accelerator return spring and bracket, and accelerator bellcrank.
5. Remove manifold attaching bolts, then remove manifold and carburetor as an assembly. Discard gaskets and seals.
6. If manifold is to be replaced, transfer:
   Carburetor and carburetor mounting studs.
   - Temperature sending unit.
   - Water outlet and thermostat (use new gasket).
   - Heater hose and water pump by-pass adapters.

Installation

1. Clean gasket and seal surfaces on manifold, block, and cylinder heads.
2. Install manifold seals on block and gaskets on cylinder heads (fig. 1V). Use sealer at water passages and where seals butt to gaskets.
3. Install manifold and torque bolts to specifications in the sequence outlined on the torque sequence chart.
4. Install (if removed) oil filler bracket, air cleaner bracket, air compressor and bracket, coil, accelerator return spring and bracket and accelerator bellcrank.
5. Install distributor, positioning rotor at chalk mark, then install distributor cap.
6. Connect:
   - Spark advance hose and governor line (if so equipped) at distributor.
   - Crankcase ventilation lines (as required).
   - Fuel line and choke cable at carburetor.
   - Accelerator linkage at pedal lever.
   - Water pump by-pass at water pump (use new gasket).
   - Battery cables at battery.
7. Adjust choke cable and accelerator linkage as outlined.
8. Install air cleaner.
9. Fill with coolant, start engine, adjust ignition timing and carburetor idle speed (and mixture on 20-30 series) and check for leaks.

Exhaust Manifold

Removal

1. On vehicles so equipped, remove carburetor heater.
2. On left exhaust manifold, disconnect and remove Delcotron.
3. On "Mark IV V8" engines, remove spark plugs.
4. Disconnect exhaust pipe from manifold and hang exhaust pipe from frame with wire.
5. Remove end bolts then remove center bolts and remove manifold.

Installation

1. Clean mating surfaces on manifold and head, then install manifold in position and install bolts (finger-tight).
2. Torque manifold bolts to specifications.
3. Connect exhaust pipe to manifold. Use new gasket or packing.
4. On "Mark IV V8" engines, install spark plugs. Torque plugs to specifications.
5. On left exhaust manifold, install and connect Delcotron. Adjust belt as outlined in Engine Tune Up.
6. On vehicles so equipped, install carburetor heater.
7. Start engine and check for leaks.

Rocker Arm Cover

Removal

1. Remove air cleaner.
2. Disconnect crankcase ventilation hoses at rocker arm covers.
3. Disconnect temperature wire from left rocker arm clips.
4. On vehicles so equipped, remove carburetor heater from left exhaust manifold.
5. 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 to specifications.
2. Install carburetor heater (if removed).
3. Connect temperature wire at clips on left rocker arm cover.
4. Connect crankcase ventilation hoses (as required).
5. Install air cleaner, start engine and check for leaks.

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 re-installed in the same locations.

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. Crank engine until mark on torsional damper lines up with center or "O" mark on the timing tab fastened to the crankcase front cover and the engine is in the number 1 firing position. This may be determined by placing fingers on the number 1 valve as the mark on the damper comes near the "O" mark on the crankcase 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 should be turned over one more time to reach the number 1 position.

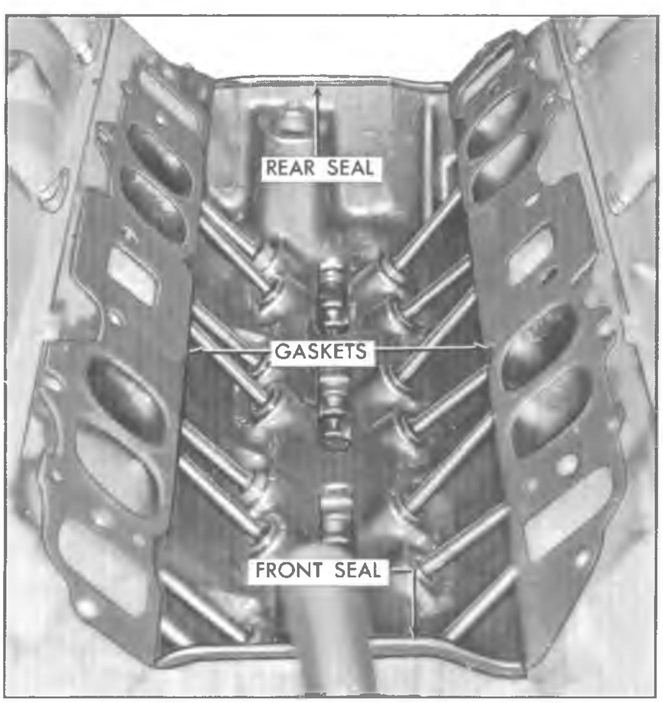


Fig. 1V-Intake Manifold Gasket and Seal Location

   b. 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

   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. 2V). When play has been removed, turn adjusting nut in one full additional turn (to center lifter plunger).
   d. Crank the engine on revolution until the pointer "O" mark and torsional damper mark are again in alignment. This is number 6 firing position. With the engine in this position the following valves may be adjusted.

      Exhaust - 2, 5, 6, 7
      Intake - 3, 4, 6, 8

4. Install rocker arm covers as outlined.
5. Adjust carburetor idle speed.

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 "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 most cases, be caused by either 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 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, polish lifter first with #600 wet/dry emery paper and 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 as outlined.
2. Remove spark plug, rocker arm and push rod on the cylinder(s) to be serviced.
3. Install air line adapter Tool J-23590 to spark plug port and apply compressed air to hold the valves in place.
4. Using Tool J-5892 to compress the valve spring, remove the valve locks, valve cap and valve spring and damper (fig. 3V).
5. Remove the valve stem oil seal.

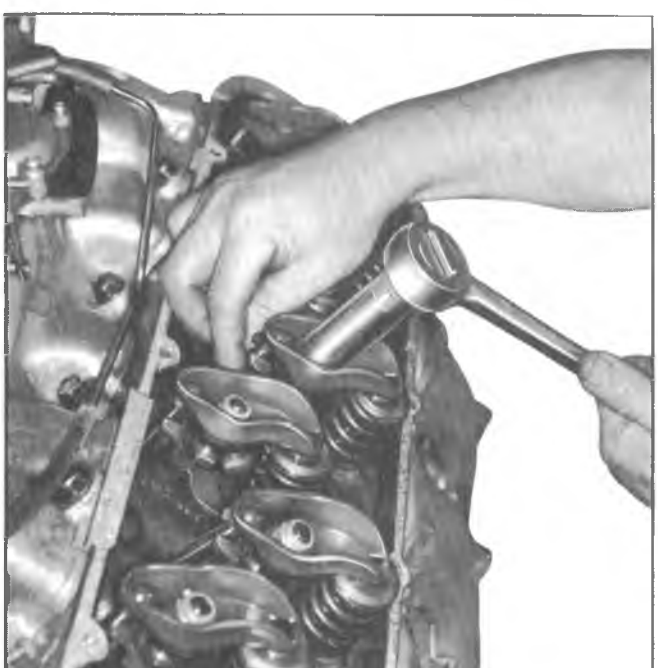


Fig. 2V-Valve Adjustment

6. Assemble as follows:

Small V8 Engines

a. Set the valve spring and damper, valve shield and valve cap in place. 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.

b. 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.

Mark IV V8 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 and torque to specifications.
8. Install and adjust valve mechanism as outlined.

Cylinder Head Assembly

Removal

1. Remove intake manifold as outlined.

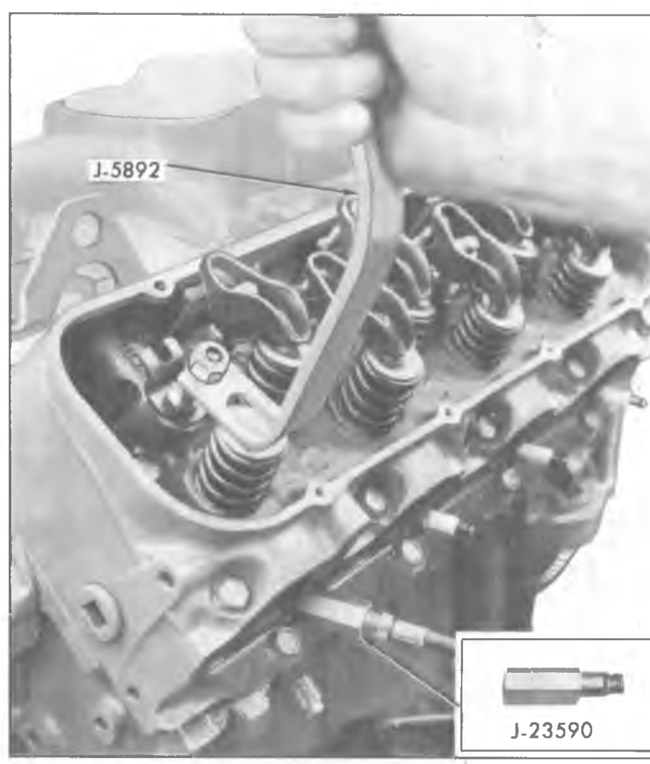


Fig. 3V—Compressing Valve Spring

2. Remove exhaust manifolds as outlined.
3. Remove valve mechanism as outlined.
4. Drain cylinder block of coolant.
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 bolts must be clean. (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 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.

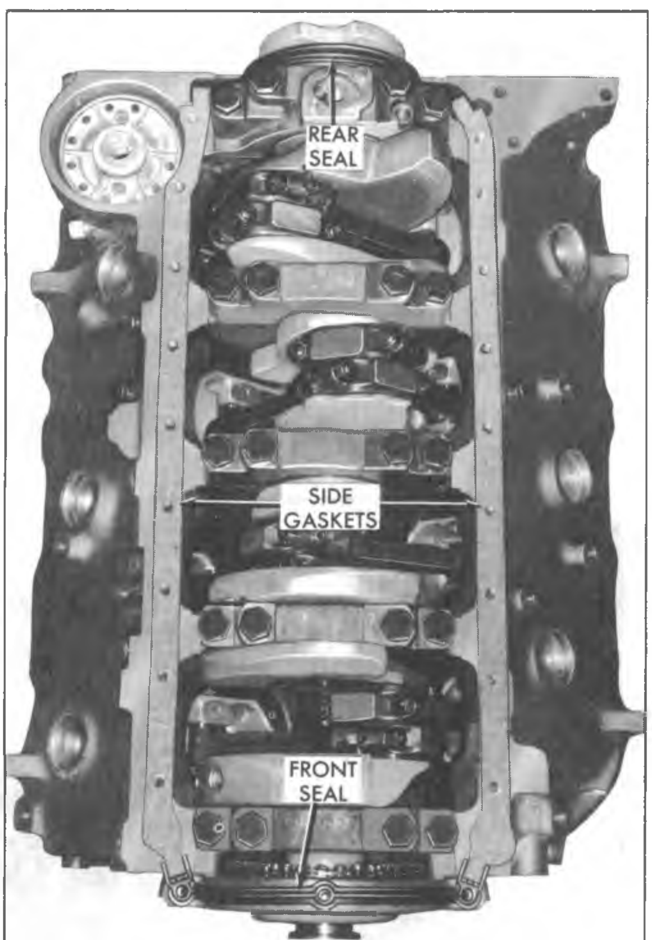


Fig. 4V—Oil Pan Gasket and Seal Location

3. Carefully guide the cylinder head into place over the dowel pins and gasket.
4. Coat threads of cylinder head bolts with sealing compound and install bolts finger tight.
5. Tighten each cylinder head bolt a little at a time in the sequence shown in the torque sequence chart until the specified torque is reached.
6. Install exhaust manifolds as outlined.
7. Install intake manifold as outlined.
8. Install and adjust valve mechanism as outlined.

Oil Pan

Removal

1. Drain engine oil.
2. Remove oil dip stick and tube.
3. On vehicles so equipped remove exhaust crossover pipe.
4. On vehicles equipped with automatic transmission remove converter housing under pan.
5. Remove starter brace and inboard bolt, swing starter aside.
6. On CE 10-20-30.
   a. Remove engine front mount bolts (frame bracket-to-mount).
   b. Using a suitable jack with a flat piece of wood (to prevent damaging oil pan), raise engine enough to insert 2" x 4" wood blocks between the engine mounts and frame brackets.
7. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket and seal surfaces on oil pan, cylinder block, crankcase front cover and rear main bearing cap.
2. Install new oil pan side gaskets on cylinder block using gasket sealer as a retainer. Install new oil pan rear seal in rear main bearing cap groove, with ends butting side gaskets. Install new oil pan front seal in groove in crankcase front cover with ends butting side gaskets (fig. 4V).
3. Install oil pan and torque bolts to specifications.
4. Install starter brace and attaching bolts. Torque bolts to specifications.
5. On CE 10-20-30.
   a. Lower engine and install front mount through bolts.

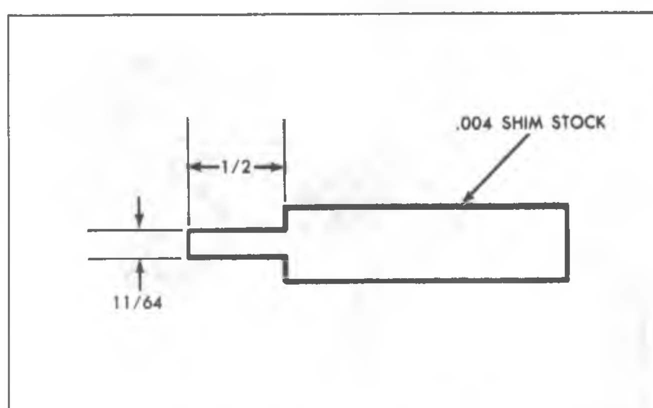


Fig. 5V—Oil Seal Installation Tool

b. Torque bolts to specifications.
6. Install converter housing under pan (if removed).
7. Install exhaust crossover pipe (if removed).
8. Install oil dip stick tube and dip stick.
9. Fill with oil, 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 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

NOTE: Always replace the upper and lower seal as a unit. Install seal with lip facing front of engine.

The rear main bearing oil seal can be replaced (both halves) without removal of the crankshaft. Extreme care should be exercised when installing this seal to protect the sealing bead located in the channel on the outside diameter of the seal. An installation tool (fig. 5V) can be used to protect the seal bead when positioning upper half of seal between crankshaft and block as follows:

1. With the oil pan and oil pump removed, remove the rear main bearing cap.
2. Remove oil seal from the bearing cap by prying from the bottom with a small screw driver (fig. 6V).
3. 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. 7V).
4. Clean all sealant and foreign material from cylinder case bearing cap and crankshaft, using a non-abrasive cleaner.
5. Inspect components for nicks, scraches burrs and machining defects at all sealing surfaces, case assembly and crankshaft.
6. Coat seal lips and seal bead with light engine oil - keep oil off seal mating ends.
7. Position tip of tool between crankshaft and seal seat in cylinder case.
8. Position seal between crankshaft and tip of tool so that seal bead contacts tip of tool.

NOTE: Make sure that oil-seal lip is positioned toward front of engine.

9. Roll seal around crankshaft using tool as a "shoe-horn" to protect seal bead from sharp corner of seal seat surface in cylinder case.

CAUTION: Installation tool must remain in position until seal is properly positioned with both ends flush with block.

10. Remove tool, being careful not to withdraw seal.
11. Install seal half in bearing cap, again using tool as a "shoe-horn", feeding seal into cap using light pressure with thumb and finger.
12. Install bearing cap to case with sealant applied to the cap-to-case interface being careful to keep sealant off the seal split line (fig. 8V).
13. Install the rear main bearing cap (with new seal) and torque to specifications.

Torsional Damper

Removal

1. Remove fan belt, fan and pulley
2. Remove the radiator shroud assembly as outlined in Section 13.

NOTE: If additional operations (such as camshaft removal) are not being performed, the radiator removal will not be necessary.

3. Remove accessory drive pulley then remove damper retaining bolt.

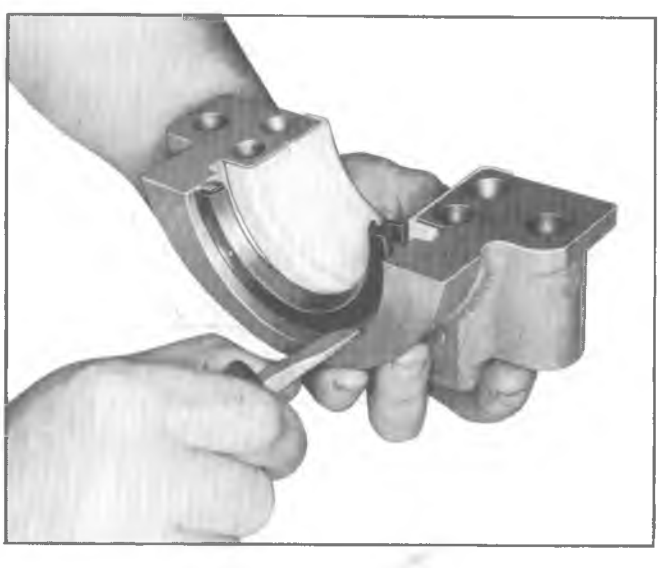


Fig. 6V—Removing Oil Seal (Lower Half)

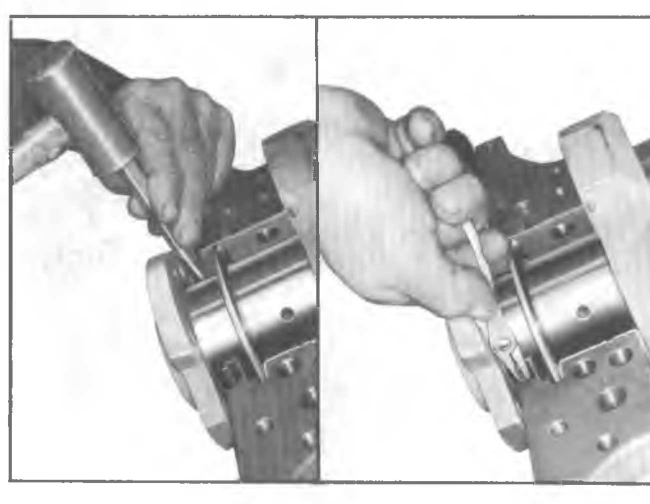


Fig. 7V—Removing Oil Seal (Upper Half)

4. Install Tool J-23523 on damper then, turning puller screw, remove damper (fig. 9V).

NOTE: Tool J-23523 has holes forming two patterns. A two bolt and a three bolt pattern. The holes for the two bolt pattern must be elongated for use on the Mark IV V8 engines.

Installation

CAUTION: The inertia weight section of the torsional damper is assembled to the hub with a rubber type material. The installation procedures (with proper tool) must be followed or movement of the inertia weight section on the hub will destroy the tuning of the torsional damper.

1. Coat front cover seal contact area (on damper) with engine oil.
2. Place damper in position over key on crankshaft.
3. Pull damper onto crankshaft as follows:
   a. Install appropriate threaded end of Tool J-23523 into crankshaft.

   CAUTION: Install tool in crankshaft so that at least 1/2" of thread engagement is obtained.

   b. Install plate, thrust bearing and nut to complete tool installation.
   c. Pull damper into position as shown in Figure 10V.
   d. Remove tool from crankshaft then install damper retaining bolt and torque to specifications.
4. Install accessory drive pulley.
5. Install radiator shroud as outlined in Section 13.
6. Install fan and pulley to water pump hub and tighten securely.
7. Install fan belt and adjust to specifications using strand tension gauge.
8. Fill cooling system, start engine and check for leaks.

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 screws and remove front cover and gasket, then discard gasket.

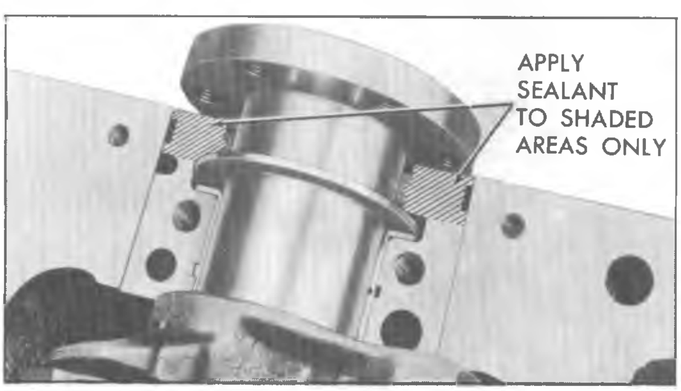


Fig. 8V—Sealing Bearing Cap

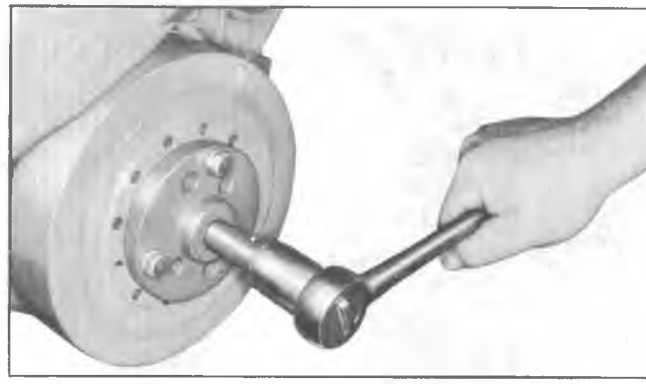


Fig. 9V—Removing Torsional Damper

Installation

1. Make certain that cover mounting face and cylinder block front end face are clean and flat.
2. Coat the oil seal with engine oil and using a new cover gasket, coated with gasket sealer install cover and gasket over dowel pins and cylinder block.
3. Install cover screws and torque to specifications.
4. Install water pump as outlined in Section 6K.
5. Install torsional damper as outlined.
6. Install oil pan as outlined.

Oil Seal (Front Cover)

Replacement

With Cover Removed

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-23042 on Small V8 engines or Tool J-22102 on Mark IV V8 engines (fig. 11V).

CAUTION: Support cover at seal area. (Tool J-971 may be used as support).

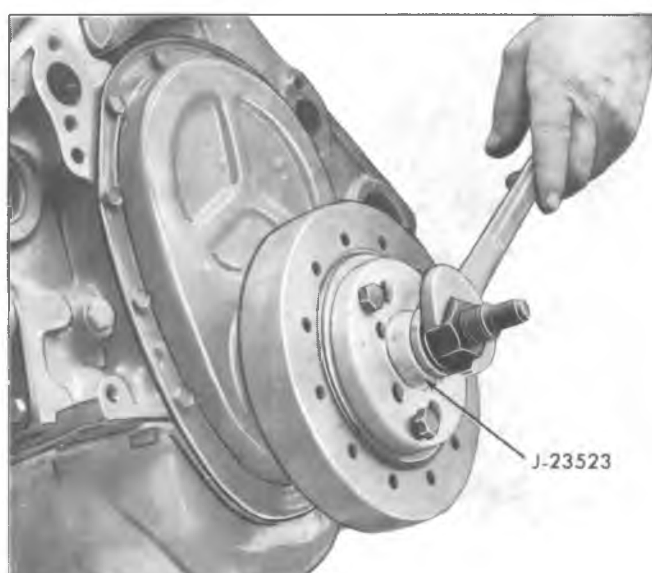


Fig. 10V—Installing Torsional Damper

Fig. 11V—Installing Oil Seal (Cover Removed)

Without Cover Removed

1. With torsional damper removed, pry 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-23042 on Small V8 engines or Tool J-22102 on "Mark IV V8" engines (fig. 12V).

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. 13V).
3. Remove camshaft sprocket to camshaft bolts.
4. Remove camshaft sprocket and timing chain together.

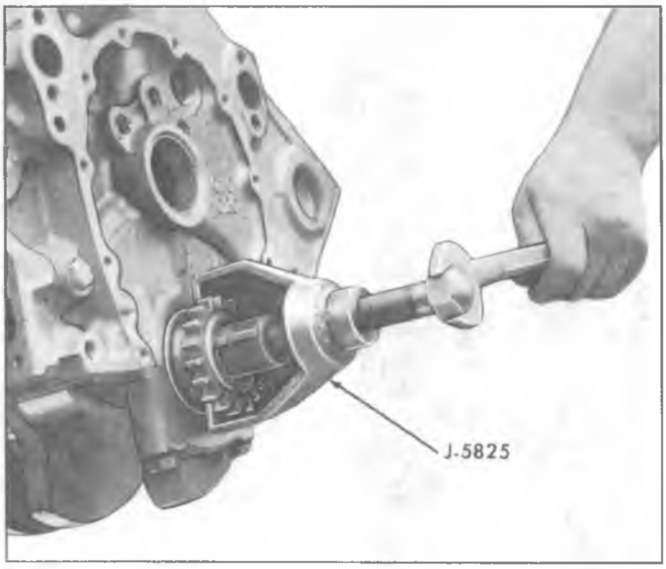


Fig. 12V—Installing Oil Seal (Cover Installed)

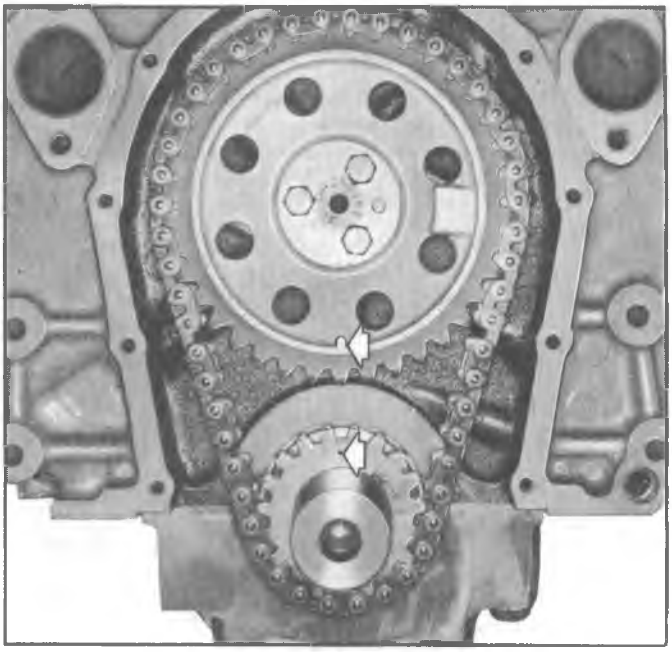


Fig. 13V—Timing Sprocket Alignment Marks

Sprocket is a light press 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.

5. If crankshaft sprocket is to be replaced on Small V8 engines remove sprocket using Tool J-5825 (fig. 14V). Install new sprocket using bolt and nut from J-23523 (fig. 15V). On Mark IV V8 engines remove sprocket using Tool J-1619 (fig. 16V). install new sprocket using bolt and nut from Tool J-23523 (fig. 15V).
6. Install timing chain on camshaft sprocket. Hold the sprocket vertically with the chain hanging down and align marks on camshaft and crankshaft sprockets (fig. 17V).

NOTE: Do not attempt to drive sprocket on camshaft as welsh plug at rear of engine can be dislodged.

7. Draw camshaft sprocket onto camshaft, using the three mounting bolts. Torque to specifications.

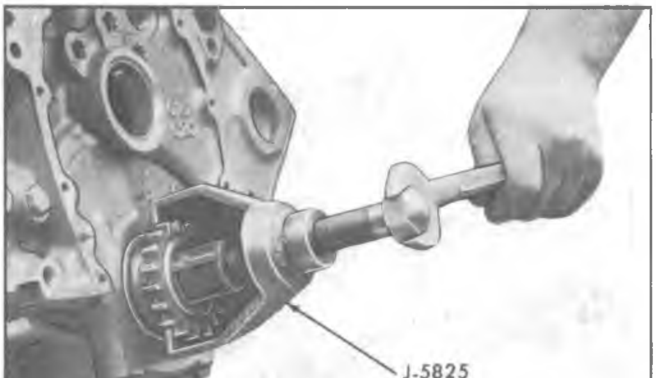


Fig. 14V—Removing Crankshaft Sprocket (Small V8)

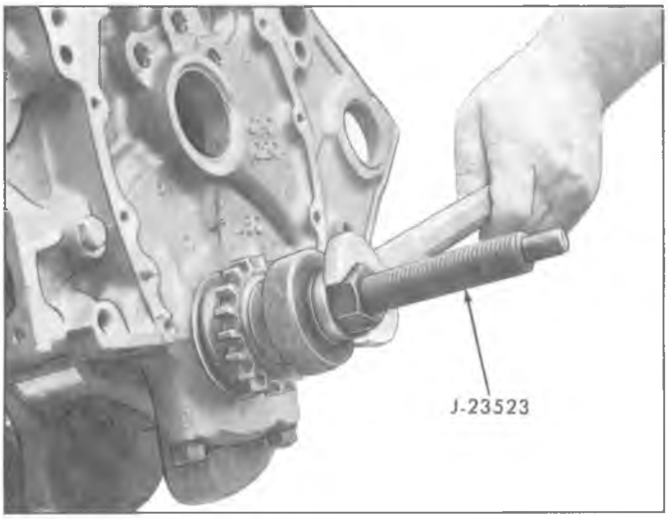


Fig. 15V—Installing Crankshaft Sprocket

8. Lubricate timing chain with engine oil.
9. 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 the valve mechanism as outlined.
2. Position indicator with ball socket adapter (Tool J-8520) on push rod (fig. 18V).

   NOTE: Make sure push rod is in the lifter socket.

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

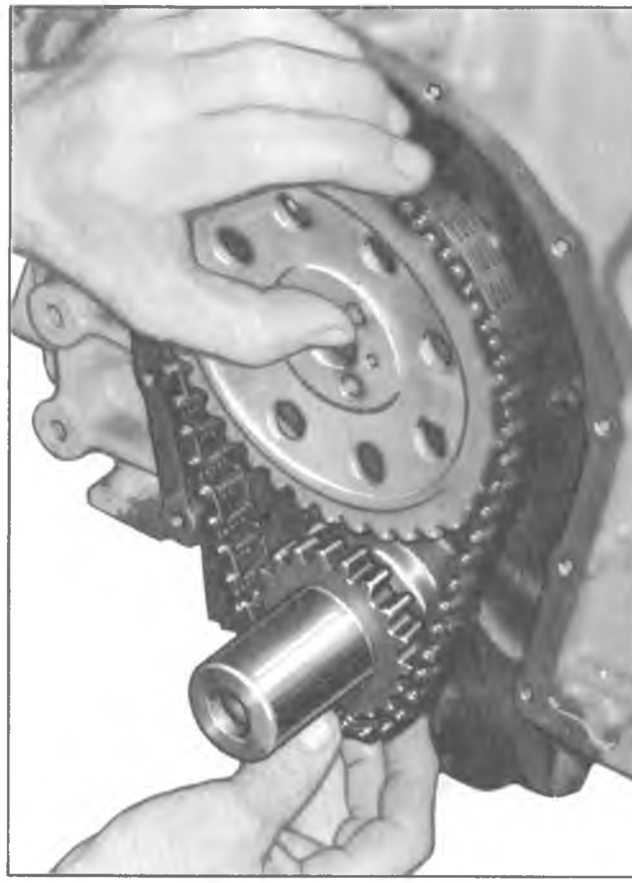


Fig. 17V—Installing Timing Chain

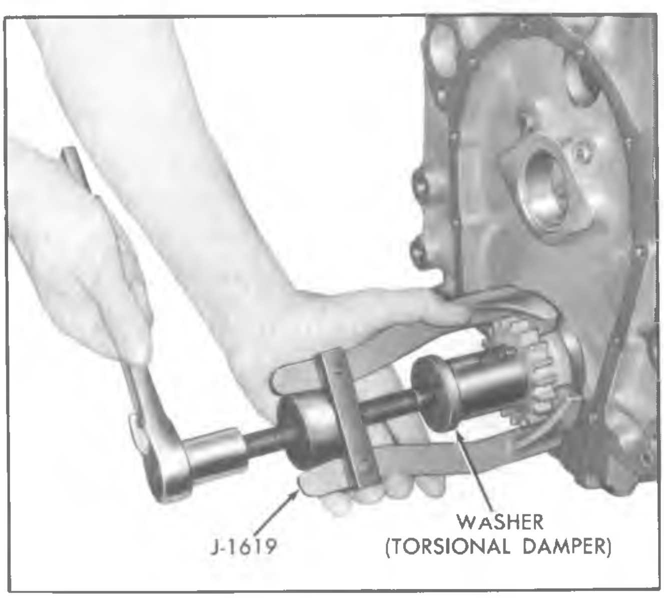


Fig. 16V—Removing Crankshaft Sprocket (Mark IV V8)

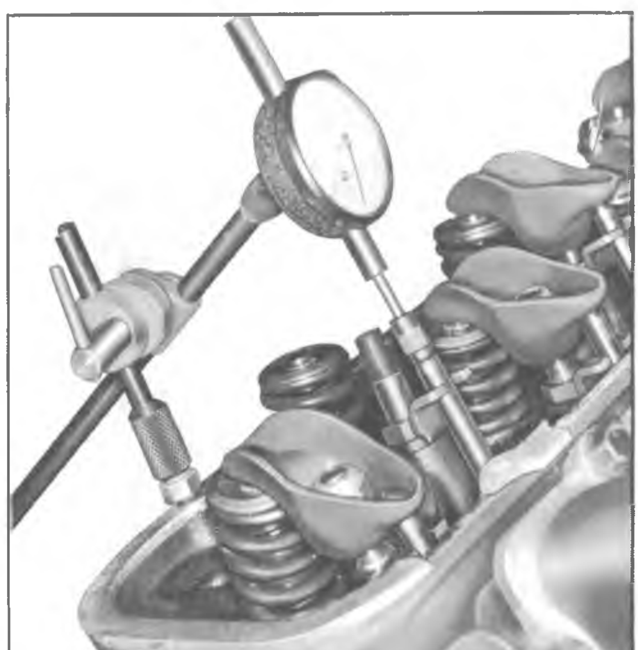


Fig. 18V—Measuring Camshaft Lobe Lift

slowly, or attach an auxiliary starter switch and "bump" the engine over, until the push rod is in fully raised position.

CAUTION: The distributor primary lead must be disconnected from the negative post on the coil.

5. Compare the total lift recorded from the dial indicator with specifications.
6. Continue to rotate the engine 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 grille (if necessary) as outlined in Section 13.
4. Remove fuel pump push rod as outlined in Section 6M.
5. Complete camshaft removal as follows:

NOTE: 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.

6. Install two 5/16" x 18 x 4" bolts in camshaft bolt holes then remove camshaft (fig. 19V).

CAUTION: All camshaft journals are the same diameter and care must be used in removing camshaft to avoid damage to bearings.

Installation

NOTE: Whenever a new camshaft is installed coat camshaft lobes with "Molykote" or its equivalent.

1. Lubricate camshaft journals with engine oil and install camshaft.
2. Install timing chain on camshaft sprocket. Hold the sprocket vertically with the chain hanging down, and align marks on camshaft and crankshaft sprockets. (Refer to fig. 13V and 17V).
3. Align dowel in camshaft with dowel hole in camshaft sprocket then install sprocket on camshaft.
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. 20V).

NOTE: On Automatic Transmission equipped engines, the flywheel must be installed with the flange collar to transmission side (fig. 20V).

Coat thread end of bolts with sealer then install bolts and torque to specifications.

Engine Mounts

Engine mounts (fig. 21V) 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.

Checking Engine Mounts

Front Mount

Raise the engine to remove weight from the mounts and to place a slight tension in the rubber. Observe both mounts while raising engine. If an engine mount exhibits:

a. Hard rubber surface covered with heat check cracks;
b. Rubber separated from a metal plate of the mount; or
c. Rubber split through center.

Replace the mount. If there is relative movement be-

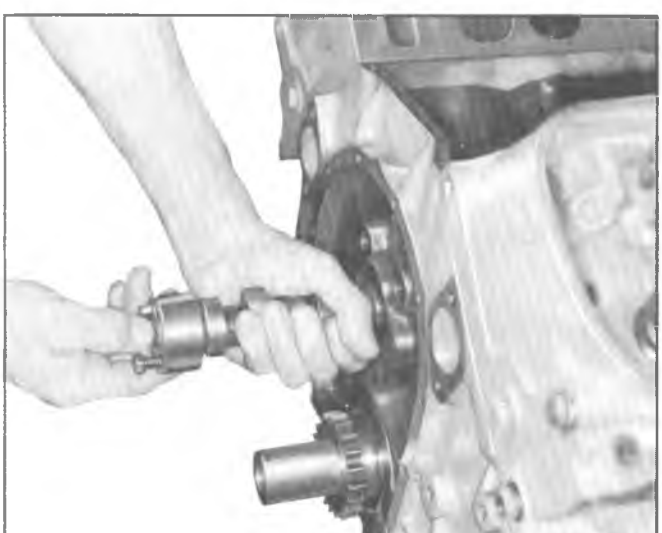


Fig. 19V—Removing Camshaft

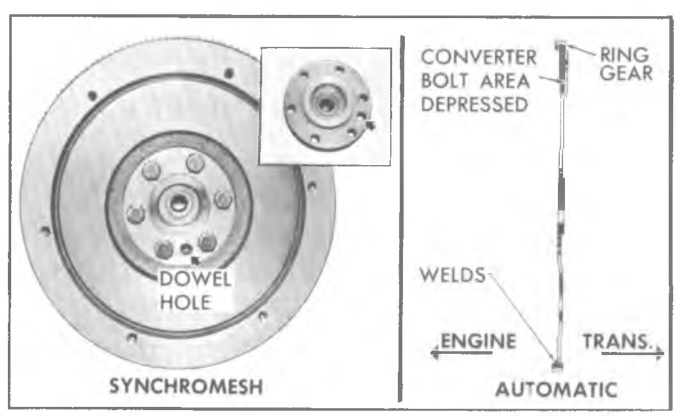


Fig. 20V—Flywheel Installation (Typical) tween a metal plate of the mount and its attaching points, lower the engine on the mounts and tighten the screws or nuts attaching the mount to the engine, frame, or bracket.

Rear Mount

Raise the car on a hoist. Push up and pull down on the transmission tailshaft while observing the transmission mount. If the rubber separates from the metal plate of the mount or if the tailshaft moves up but not down (mount bottomed out) replace the mount. If there is relative movement between a metal plate of the mount and its attaching point, tighten the screws or nuts attaching the mount to the transmission or crossmember.

Front Mount Replacement
With Small V8 Engines

1. Remove distributor cap.
2. Remove mount retaining bolt from below frame mounting bracket.
3. Raise front of engine and remove mount-to-engine bolts and remove mount.

CAUTION: Raise engine only enough for sufficient clearance. Check for interference between rear of engine and cowl panel.

4. Replace mount to engine and lower engine into place.
5. Install retaining bolt and torque all bolts to specifications.

With Mark IV V8 Engine

1. Remove cotter keys then loosen front mount bolt.
2. Raise engine enough to remove weight from cushions.
3. Remove nut, bolt, spacer and cushions and reinstall with new cushions.
4. Lower engine and torque bolt to specifications.
5. Install cotter key.

Rear Mount Replacement

1. Support engine weight to relieve rear mounts.
2. Remove mount attaching bolts from frame outrigger and clutch housing and remove rear mounting cushions.
3. Install new mounting cushions and bolts.
4. Lower engine onto mounts.
5. Torque bolts to specifications then bend lock tabs to bolt head.

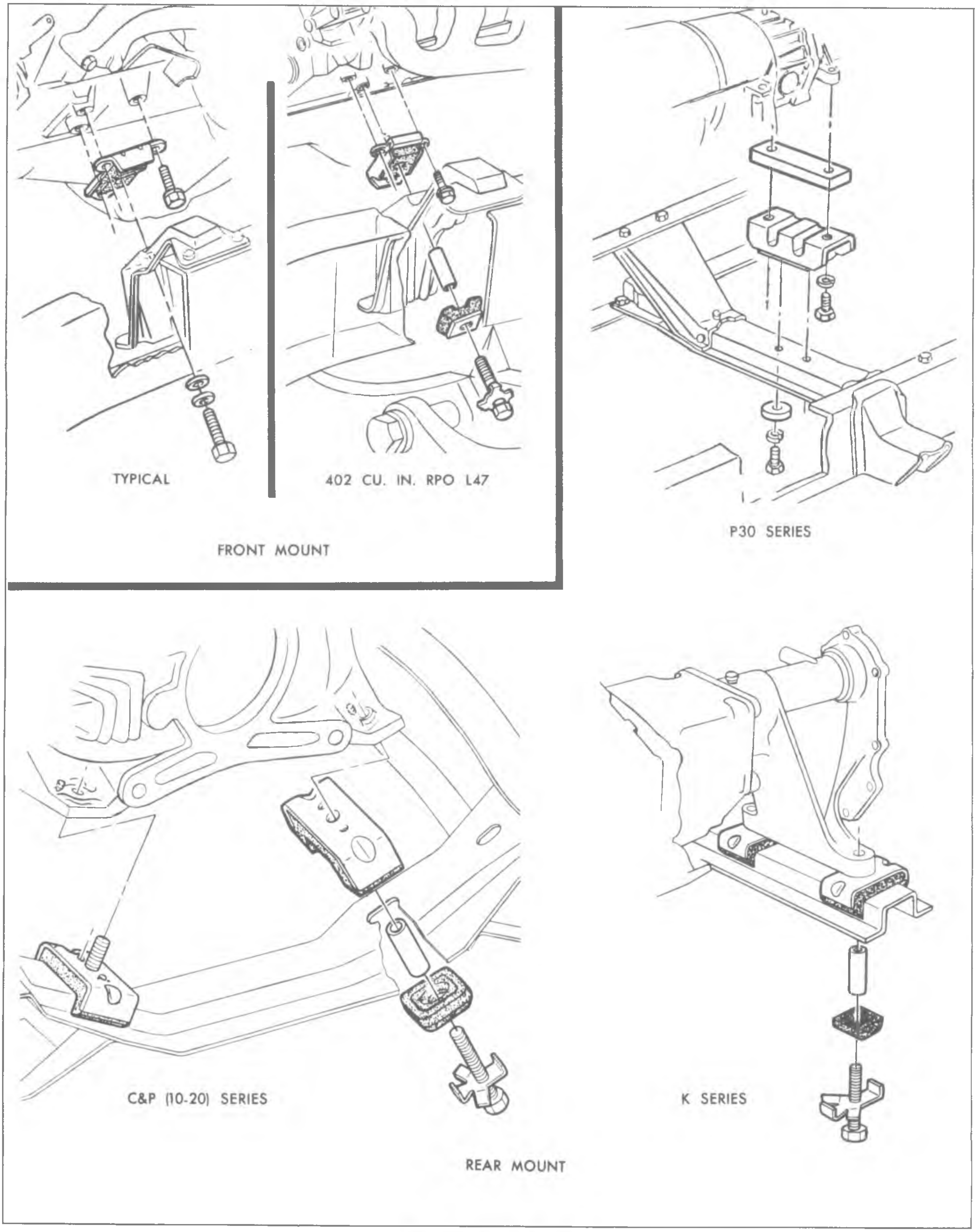


Fig. 21V—Engine Mounts

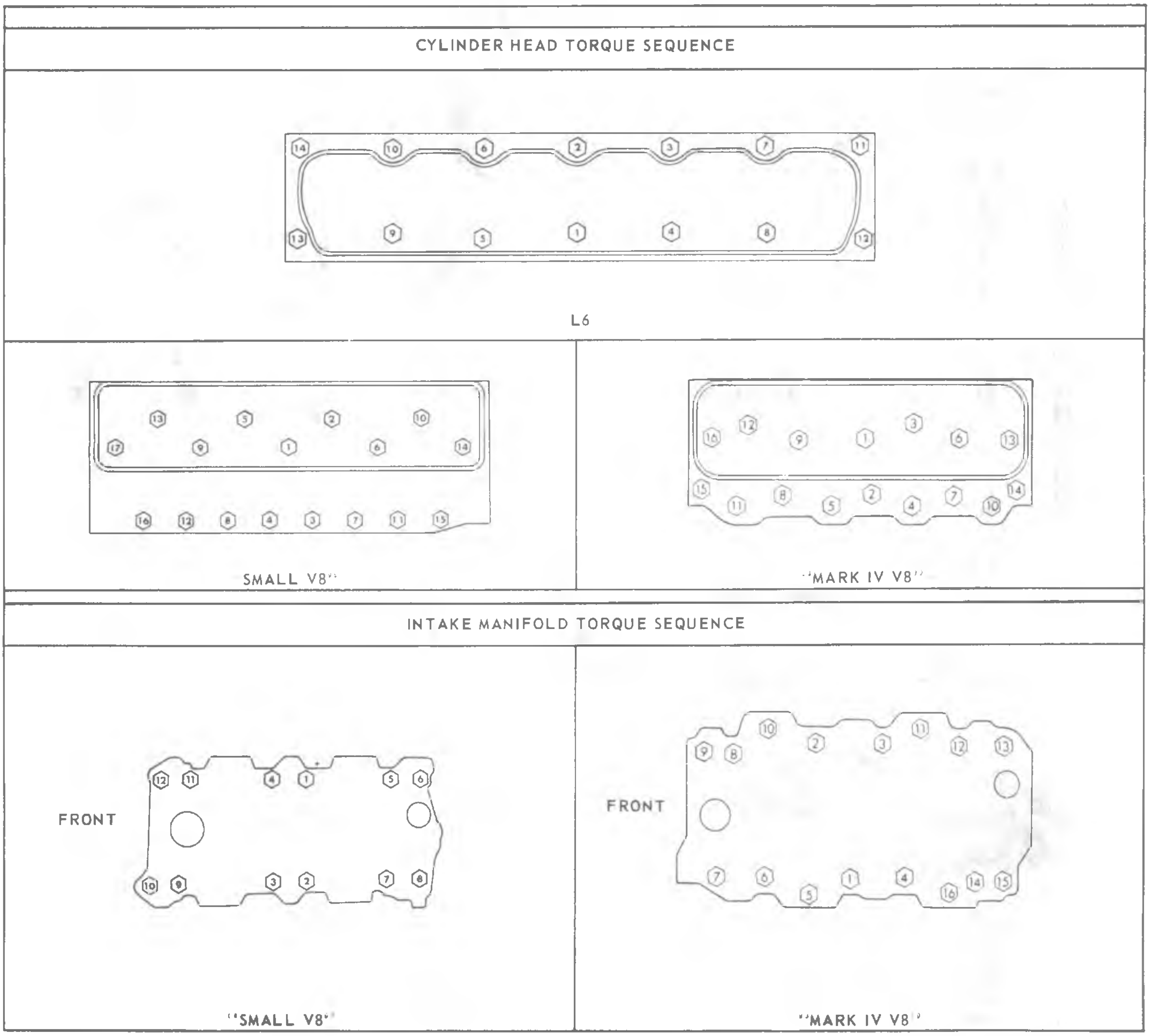
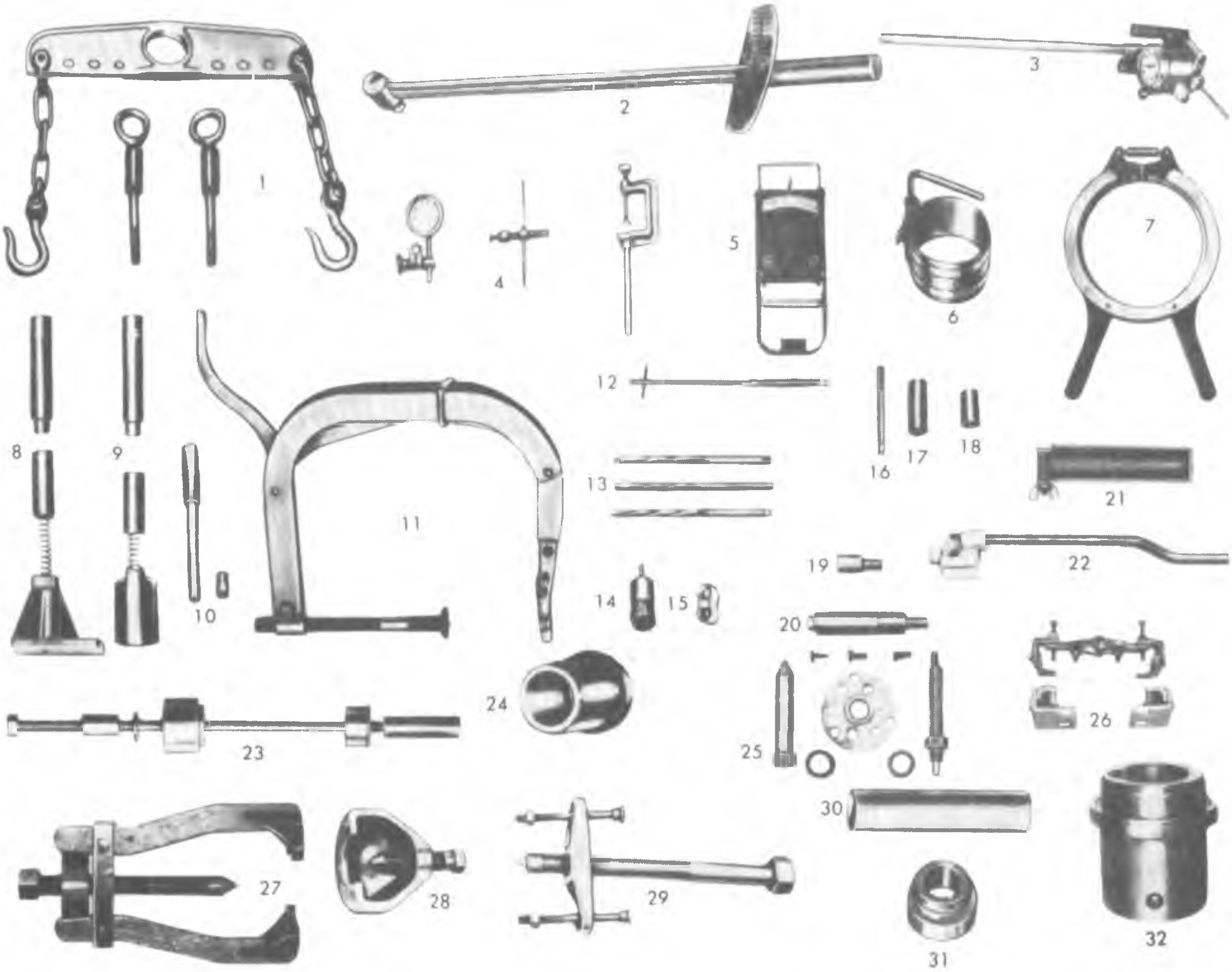


Fig. 1T—Torque Sequence

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-23600	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
17.	J-6036	(.013")
	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-23523	Torsional Damper Puller
26	J-22197	Torsional Damper Installer
27	J-1619	Crankshaft Sprocket Puller
28	J-5825	Crankshaft Sprocket Puller
29	J-8105	Crankshaft Gear Puller
30	J-5590	Crankshaft Sprocket or Gear Installer
31	J-23042	Crankcase Cover Centering Gauge
32	J-22102	Crankcase Cover and Seal Installer

Fig. 2T—Special Tools

SECTION 6K
ENGINE COOLING

INDEX

GENERAL DESCRIPTION

All Chevrolet trucks have pressure type engine cooling systems with thermostatic control of coolant circulation. The cooling system is sealed by a pressure type radiator filler cap.

The pressure type radiator filler cap (fig. 1) is designed to operate the cooling system at higher than atmospheric pressure. The higher pressure raises the boiling point of the coolant which increases the efficiency of the radiator.

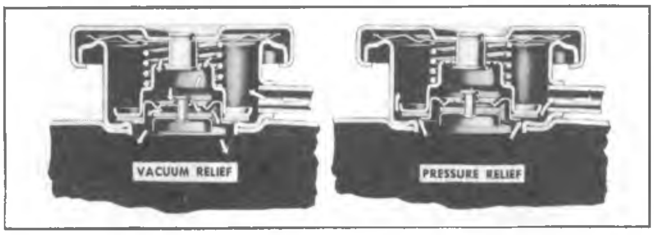


Fig. 1—Radiator Pressure Cap

The radiator filler cap contains a pressure relief valve and a vacuum relief valve. The pressure relief valve is held against its seat by a spring which when compressed, allows excessive pressure to be relieved out the radiator overflow.

The vacuum valve is also held against its seat by a spring which when compressed, opens the valve relieving the vacuum created when the system cools off.

The cooling system's water pump is of the centrifugal vane impeller type (figs. 2 and 3). The bearings are permanently lubricated during manufacture and are sealed to prevent the loss of lubricant or the entry of dirt and water. The pump 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.

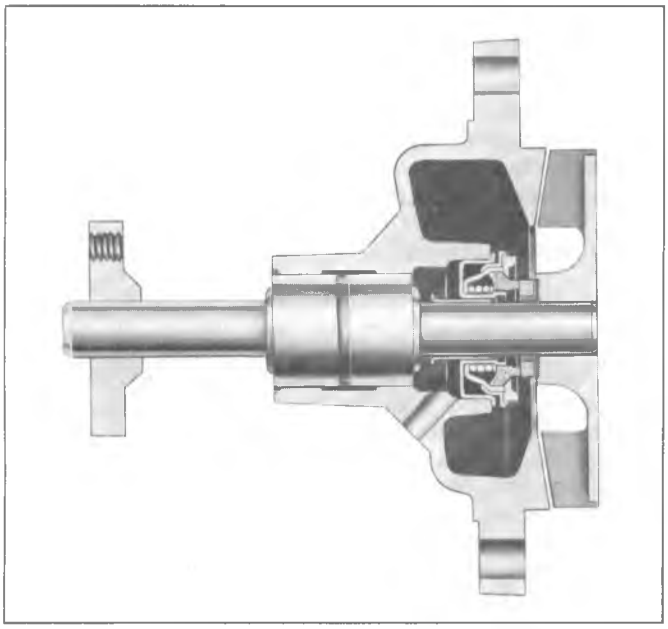


Fig. 2—Water Pump—Typical L-6

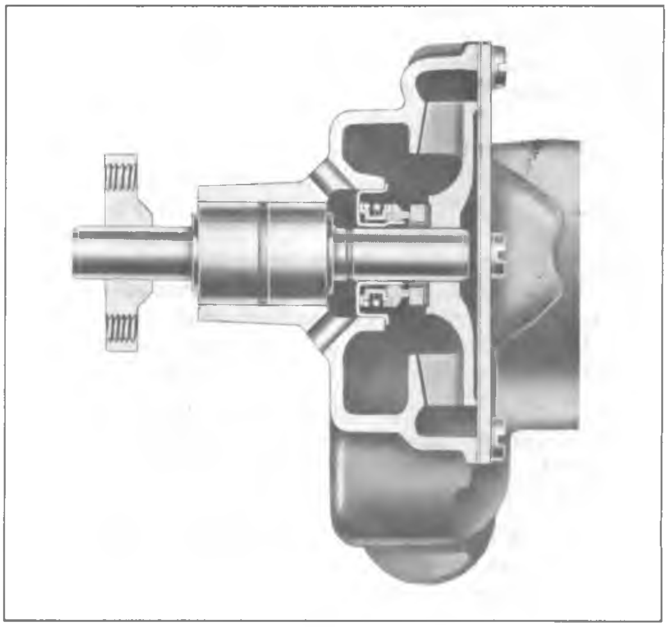


Fig. 3—Water Pump—Typical V-8

Water pump components are not serviced separately; therefore, in the event of water pump failure, it will be necessary to replace the complete assembly - removal and installation procedures are covered in this section.

For radiator service refer to Section 13 of this manual. Radiator fan shroud replacement is covered in Section 11 of this manual.

MAINTENANCE AND ADJUSTMENTS

Coolant Level

The radiator coolant level should only be checked when the engine is cool, particularly on trucks 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 in downflow radiator should be maintained one inch below the bottom of the filler neck of the radiator when cooling system is cold. Coolant level in crossflow radiators should be maintained three inches below the bottom of the filler neck when the system is cold to allow for expansion of coolant when heated. (Note coolant level arrow on rear of radiator outlet tank.) It is very important that the correct fluid level be maintained, as too high a level will overflow from expansion and too low a level will reduce cooling performance.

All truck cooling systems are pressurized with a 15 lb. pressure cap which permits safe engine operation at cooling temperatures of up to 256°F. with a 33% glycol solution.

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 (along the left side on crossflow radiators) and warm at the bottom (along the right side on crossflow radiators), with an even temperature rise from bottom to top (right to left on crossflow radiators). 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 harmful to both 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

It is the owner's responsibility to keep the freeze protection at a level commensurate with the area in which the vehicle will be operated. Regardless of climate, system protection should be maintained at least to 0°F., to provide adequate corrosion protection. When adding solution due to loss of coolant for any reason or in areas where temperatures lower than -20°F. may occur, a sufficient amount of an ethylene glycol base coolant that meets GM Specification 1899-M should be used.

Every two years the cooling system should be serviced by flushing with plain water, then completely refilled with a fresh solution of water and high-quality inhibited (permanent-type) glycol base coolant meeting GM Specification 1899-M, and providing freezing protection at least to 0°F. At this time, also add GM Cooling System Inhibitor and Sealer or equivalent. In addition, Cooling System Inhibitor and Sealer should be added every fall thereafter. GM Cooling System Inhibitor retards the formation of rust or scale and is compatible with aluminum components.

NOTE: Alcohol or methanol base coolants or plain water are not recommended for your cooling system at any time.

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 or its equivalent. 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 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.

WARNING: BE CAREFUL NOT TO SCALD YOUR HANDS.

8. At the end of this time, stop the engine, wait a few minutes and then open the drain cocks. Also, remove lower hose connection.

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. Do not bend radiator fins.

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 radiator upper and lower 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 and cap connections at engine 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.

Heater Core

1. Remove water outlet hose from heater core pipe.
2. Remove inlet hose from engine connection.

Fig. 4—Pressure Checking Radiator Cap

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 mounting.
2. Pull Delcotron away from engine until desired tension reading is obtained with a strand tension gauge. Refer to "Engine Tune Up Specifications".
3. Tighten all Delcotron bolts securely.

Radiator Cap

The radiator cap should be washed with clean water and pressure checked at regular tune-up intervals. Inspect rubber seal on cap for tears or cracks. Install radiator cap on tester (fig. 4). If the pressure cap will not hold pressure or does not release at the proper pressure, replace the cap.

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. 5).
3. Inspect thermostat valve to make sure it is in good condition.
4. Place thermostat in a 33% glycol solution 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 a 33% glycol solution 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. 5—Replacing Thermostat

THERMOSTATIC FAN CLUTCH

Replacement

All mating surfaces (water pump hub and fan clutch hub) should be inspected for smooth mating surfaces and reworked as necessary to eliminate burrs or other imperfections. Except for the fan belt, components should be assembled to the engine (See Water Pump Removal and Installation Procedures). Radial run-out should be checked as follows:

1. Secure the fan blade to prevent rotation. (See Figure 6).
2. Mount a dial indicator (.001 graduations) to the engine and place the indicator pointer on the fan blade spider. Preferably on the longest band or space on the spider. (See Figure 7).

Fig. 6—Securing Fan Blade

Fig. 7—Checking Run-Out

3. Rotate the water pump pulley in one direction and note the total amount of indicator needle movement. This represents the total radial run-out. Mark the point on the pulley at which the highest reading is obtained.
4. If the total indicator reading is less than .006 inch, the assembly is within specification. Install fan belt and adjust.
   If the total indicator run-out exceeds .006 inch, proceed to Step 5.
5. Divide the total indicator reading in half and obtain this thickness from shim stock (1/2 x 3/4) and rework per Figure 8. Place this shim pack between the water pump pulley and fan clutch hub at the bolt closest to the point marked on the pulley in Step 3. If the mark on the pulley is between two bolts so that it is difficult to determine which bolt is closest, place two shim packs; one under each bolt on either side of the mark. (See Figure 9).

Bolt Torque Sequence

a. When one shim pack is used, first, torque the bolt

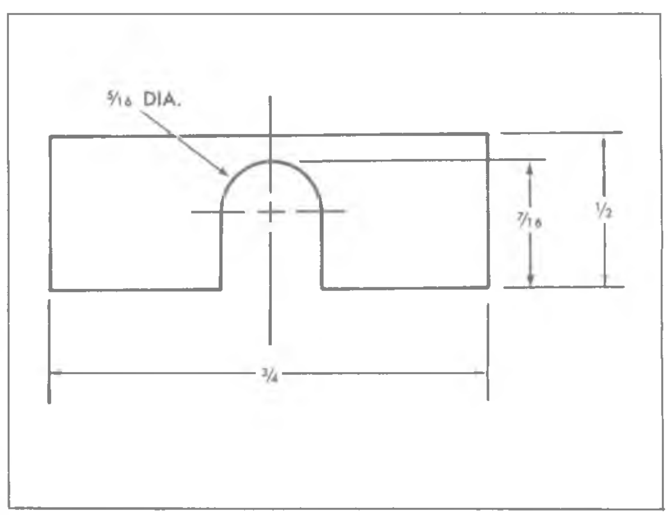


Fig. 8—Shim Fabrication Dimensions

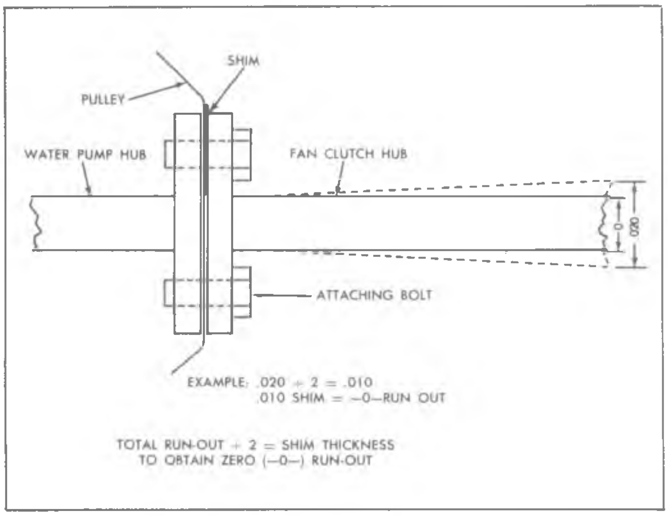


Fig. 9—Determining Shim Placement

over which the shim pack has been placed; second, the bolt opposite the first; and finally, the other two. Recommended torque is 25 lbs. ft.

b. When two shim packs are used, each bolt must be torqued partially; then to full torque alternating between opposite bolts; then the other two bolts in the same manner. Recommended torque is 25 lbs. ft.

NOTE: Excessive run-out may result if the above sequence and recommended torque is not used.

6. Recheck total indicator run-out to verify that run-out is within .006 inch. Install fan belt and adjust.

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.

CAUTION: If a fan blade is bent or damaged in any way, no attempt should be made to repair and reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new fan assembly.

It is essential that fan assemblies remain in proper balance and proper balance cannot be assured once a fan assembly has been bent or damaged. A fan assembly that is not in proper balance could fail and fly apart during subsequent use creating an extremely dangerous condition.

NOTE: Thermostatic fan clutches must be kept in an "in-car" position. When removed from the car the assembly should be supported so that the clutch disc remains in a vertical plane to prevent silicone fluid leakage.

4. Remove pump to cylinder block bolts and remove pump and old gasket 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 then, using a new sealer coated pump-to-block gasket tighten bolts securely.
2. Install pump pulley and fan on pump hub and tighten bolts securely.

NOTE: A guide stud (5/16"-24 x 1" bolt with the head removed) installed in one hole of the fan 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

INTRODUCTION

Carburetors used with Chevrolet Trucks are designed to meet the particular requirements of engine, transmission and vehicles. Carburetors that look alike are not always interchangeable. (Refer to carburetor part number and/or specifications.) Service procedures for the various carburetors are similar, therefore, typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation.

This section covers carburetor removal and installation and external adjustments for all 10-30 Series Trucks. Also covered in this section are maintenance procedures for choke coils, throttle linkage, accelerator and choke controls, air cleaners and fuel filters. For carburetor identification, overhaul procedures, assembly and disassembly of components, and internal carburetor adjustments, refer to Section 6M, of the Overhaul Manual, under the carburetor being serviced. In addition to carburetor adjustment specifications, also refer to Specifications at the end of the manual for carburetor application and type.

CARBURETORS

INDEX

MAINTENANCE AND SERVICE PROCEDURES

Note: Also refer to the "Emission Control Systems" Booklet for required maintenance and warranty information.

CHOKE—Choke mechanism should be checked for free operation. A binding condition may have developed from petroleum gum formation on the choke shaft or from damage. Choke shafts can usually be cleaned without disassembly by using United Delco X-66 Carburetor and Combustion Chamber Conditioner or equivalent.

BOLTS, CARBURETOR TO MANIFOLD—Carburetor attaching bolts and/or nuts should be carefully adjusted to correct torque to compensate for compression of gasket at first 4 months of 6,000 miles of vehicle operation only.

FILTER—CARBURETOR AND/OR FUEL PUMP—A clogged carburetor or fuel pump filter may restrict fuel flow or bypass foreign material into carburetor depending upon type used. Replace clogged filters. Also replace filters each 12,000 miles or 12 months, whichever occurs first.

CEC VALVE, OR VACUUM ADVANCE SOLENOID, AND HOSES—The vacuum portion of either of these valves should be checked, with the transmission in neutral, by using a vacuum gauge attached to the valve (or solenoid) distributor connector. With the engine at fast idle, the vacuum gauge should read zero. The electrical portion of the solenoid or valve may be checked by applying 12 volts across its electrical terminals, which should result in a vacuum reading on the gauge — a vacuum reading should be obtained only while the solenoid or valve is not energized). An inoperative or leaking solenoid or valve should be replaced.

All hoses and wires should be carefully inspected for correct routing and to make certain that they are intact.

IDLE STOP SOLENOID—The idle stop solenoid should be checked to assure that it permits the throttle plate to close further when the ignition switch is turned "off." An inoperative solenoid should be replaced.

PRELIMINARY CHECKS (ALL CARBURETORS)

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.
4. Check and adjust choke as required, using procedures specified in this section.
5. Adjust idle speed and idle mixture as outlined in Section 6, "Engine Tune-up" and at the end of the carburetor group in this section under, "Additional External Settings and Adjustments."

EXTERNAL ADJUSTMENTS (ALL CARBURETORS)

ROCHESTER MV, 2GV AND 4M ADJUSTMENTS

FAST IDLE ADJUSTMENTS (Figs. 1C, 2C and 3C) ROCHESTER MV AND 4MV

NOTE: The fast idle adjustment must be set with transmission in "Neutral."

1. Position fast idle lever on high step of fast idle cam. (Second step on 4MV)
2. Be sure choke is properly adjusted and in wide open position - engine warm.
3. Set fast idle to specified rpm as follows:
   a. Adjust fast idle screw on Rochester 4MV (Fig. 2C).
   b. Bend fast idle lever as required on Rochester MV to specified speed (Fig. 1C).

FAST IDLE ADJUSTMENT—ALL 2 BBL.

NOTE: The two barrel carburetors are preset to the approximate fast idle RPM noted in specifications, listed under "Fast Idle (Running) RPM adjustment", when low step idle is set. (Also note Low Idle RPM in specifications).

Manual Choke

1. Use same procedure as above except in Step 1 rotate the fast idle cam clockwise to its highest position.

CHOKE ROD (FAST IDLE CAM) ADJUSTMENTS MV (Fig. 4C)

Automatic choke models with steps on fast idle cam. With fast idle adjustment made:

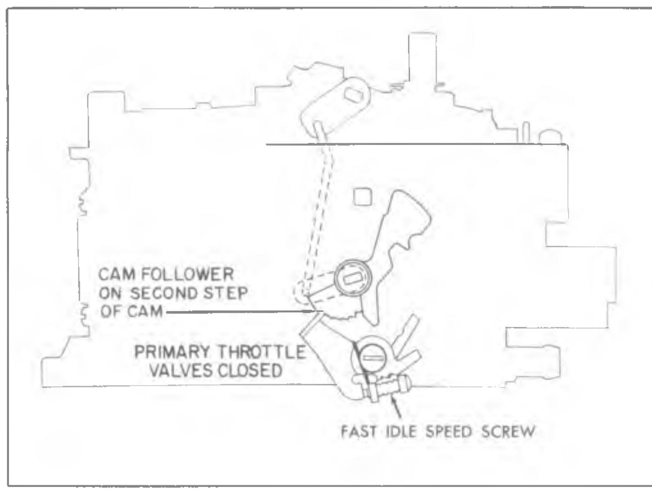


Fig. 2C—Fast Idle Adjustment (Rochester 4MV)

1. Place fast idle cam follower on second step of the fast idle cam and hold firmly against the rise to the high step.
2. Rotate choke valve toward direction of closed choke by applying force to choke coil lever.
3. Bend choke rod at point shown to give specified opening between the lower edge of choke valve (at center of valve) and inside air horn wall.

Manual choke models with smooth contour cam. Use the same procedure as above except for Step 1.

As there are no steps on manual choke cam, the index line on side of cam should be lined up with contact point of the fast idle cam follower tang.

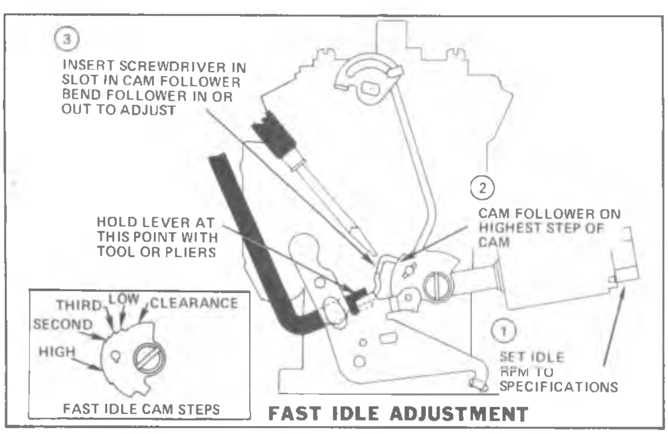


Fig. 1C—Fast Idle Adjustment (Rochester MV)

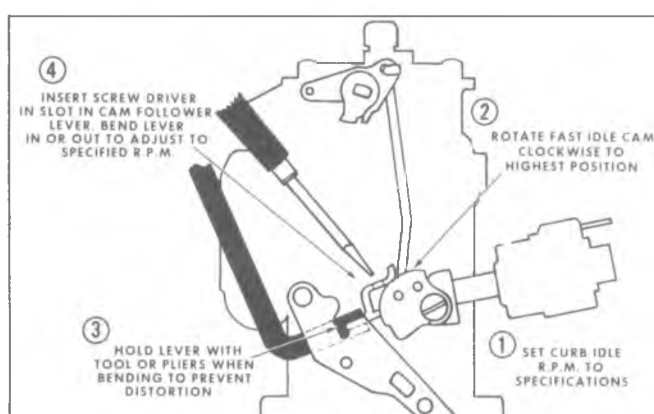


Fig. 3C—Fast Idle Adjustment (Manual Choke)

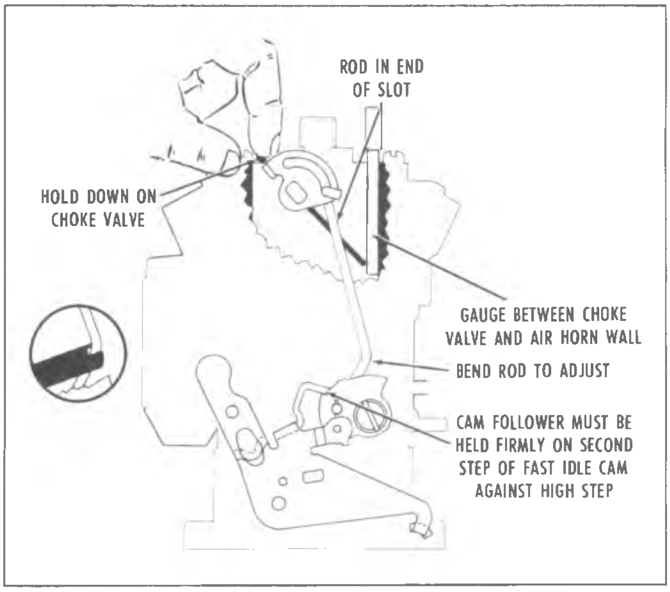


Fig. 4C—Choke Rod (Fast Idle Cam) Adjustment (MV)

2GV (Fig. 5C)

Turn stop screw in until it just contacts bottom step of fast idle cam. Then turn screw in one full turn. Place idle screw on second step of fast idle cam against shoulder of high step. With screw in this position, hold choke valve toward closed position with a rubber band and check clearance between upper edge of choke valve and air horn wall. Adjust to specified dimension by bending tang on choke lever and collar assembly.

4MV (Fig. 6C)

With the cam follower on second step of fast idle cam and against the high step, rotate the choke valve toward the closed position by turning the external choke lever counterclockwise. Dimension between the lower edge of choke valve, at choke lever end, should be as specified. Bend choke rod to adjust (Fig. 6C).

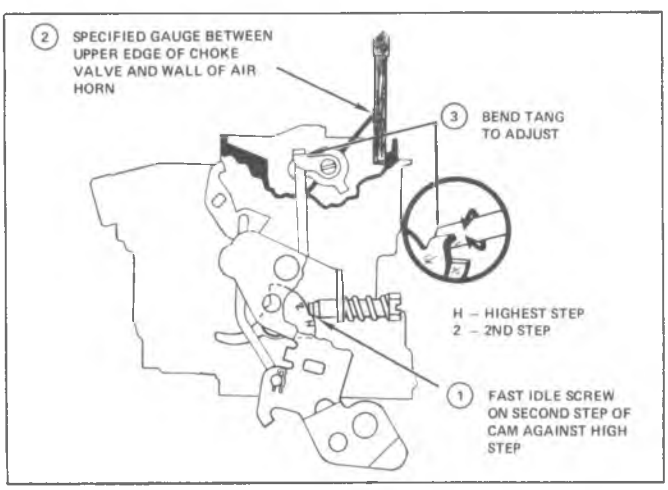


Fig. 5C—Choke Rod (Fast Idle Cam) Adjustment (2GV)

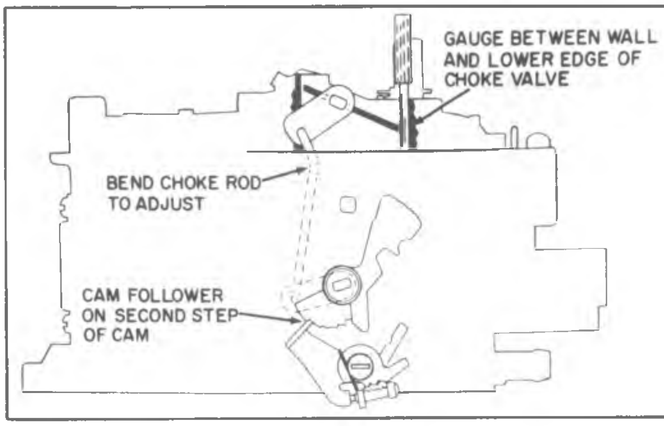


Fig. 6C—Choke Rod (Fast Idle Cam) Adjustment (4MV)

CHOKE VACUUM BREAK ADJUSTMENTS MV (Fig. 7C)

The following procedure for adjusting the vacuum break diaphragm unit is used to insure correct initial choke valve opening after engine starting:

1. Remove air cleaner assembly from vehicle. On vehicles with "Therm AC" air cleaner, plug the sensor's vacuum take-off port.
2. Using an outside vacuum source, apply vacuum to the vacuum break diaphragm until the plunger is fully seated.
3. With the vacuum break diaphragm in the fully seated position, push the choke valve toward the closed position.
4. With the choke valve held in this position, place specified gauge between the lower edge of the choke valve and air horn wall.
5. Dimension should be as specified; if not, bend the vacuum break rod at point shown, to adjust.

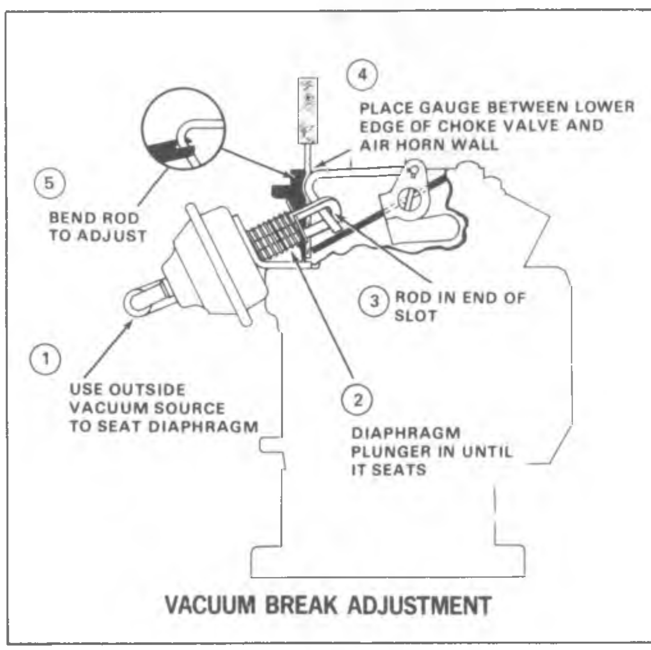


Fig. 7C—Vacuum Break Adjustment (MV)

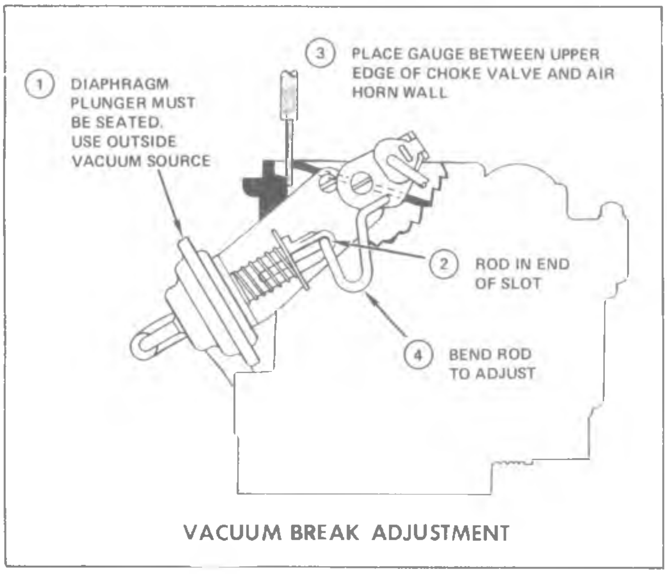


Fig. 8C—Vacuum Break Adjustment (2GV)

2GV (Fig. 8C)

Refer to Figure 8C and follow steps under MV.

4MV (Fig. 9C)

1. Seat choke vacuum break diaphragm using outside vacuum source.
2. Open throttle valve slightly so cam follower will clear steps of fast idle cam. Then rotate vacuum break lever counterclockwise (towards direction of closed choke). A rubber band may be used to hold in place. The end of vacuum break rod should also be in outer end of slot in vacuum break diaphragm plunger.
3. Measure the distance between lower edge of choke valve and inside air horn wall.
4. To adjust to specified dimension, bend vacuum break link at point shown.

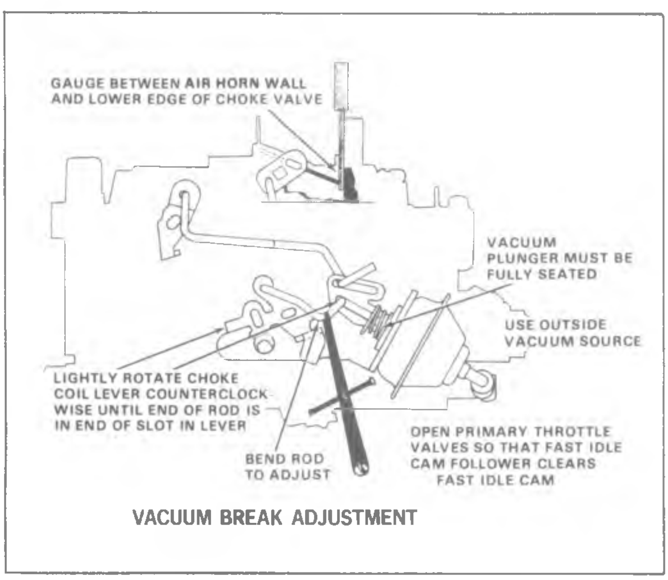


Fig. 9C—Vacuum Break Adjustment (4MV)

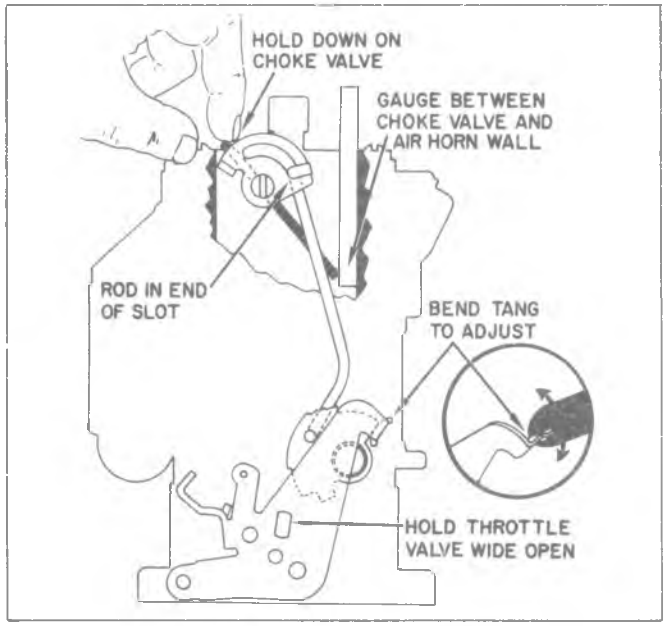


Fig. 10C—Unloader Adjustment (MV)

CHOKE UNLOADER ADJUSTMENT

1. Hold choke valve in closed position by applying a light force to the choke operating lever.
2. Rotate throttle lever to wide open throttle valve position.
3. Bend unloader tang on throttle lever to obtain specified dimension between lower edge of choke plate (at center) and air horn wall.

2GV (Fig. 11C)

With the throttle valves held wide open and the choke

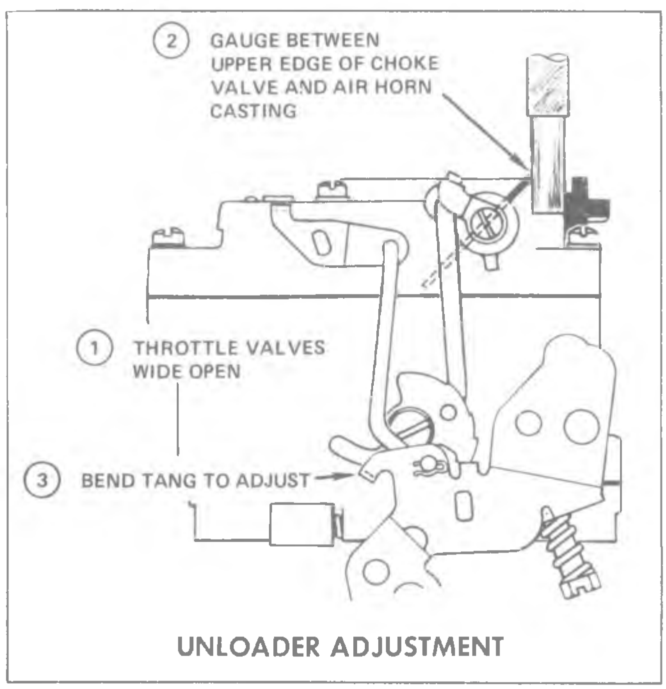


Fig. 11C—Choke Unloader (2GV)

valve held toward the closed position with a rubber band, bend the unloader tang on the throttle lever to obtain specified clearance between the upper edge of the choke valve and air horn wall.

CHOKE COIL ROD ADJUSTMENT

MV (Fig. 12C)

1. Disconnect thermostatic coil rod from upper choke lever and hold choke valve completely closed.
2. With thermostatic coil rod disconnected, push downward on rod to end of travel.
3. With rod held in this position, the top of rod should be even with bottom of hole in choke lever.
4. To adjust, bend rod at point shown.

2GV (Fig. 13C)

1. Hold choke valve completely open.
2. With the thermostatic coil rod disconnected from upper lever, push downward on rod to end of travel.
3. With the rod in the fully downward position, bottom of rod should be even with the bottom of slotted hole in lever as shown.
4. To adjust, bend lever at point shown with screwdriver end.

4MV (Fig. 14C)

1. Hold choke valve completely closed by rotating choke coil lever counterclockwise.
2. With the thermostatic coil rod disconnected, with cover removed, push downward on coil rod so that the rod contacts bracket surface.

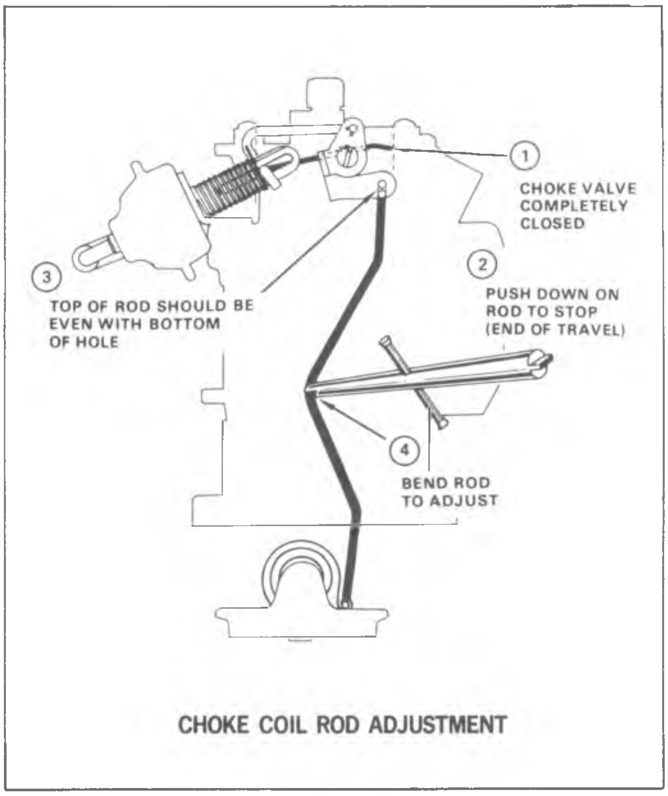


Fig. 12C—Choke Coil Rod Adjustment (MV)

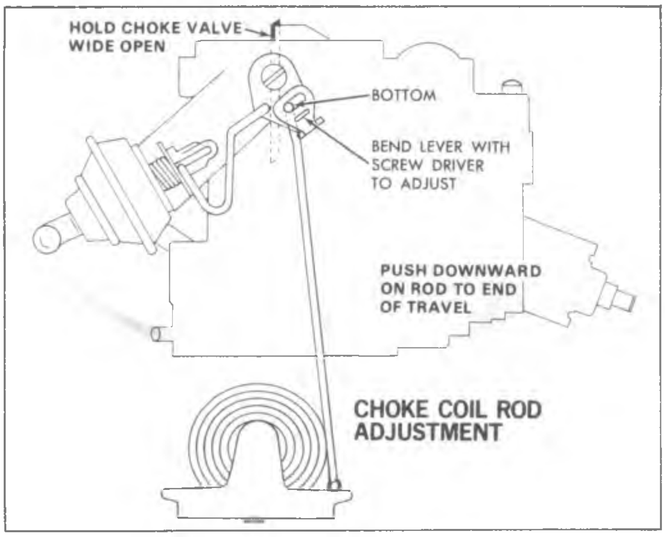


Fig. 13C—Choke Coil Rod Adjustment (2GV)

3. The coil rod must fit in choke lever notch, as shown.
4. Bend choke coil rod at point shown to adjust.
5. Install choke coil spring cover.
6. Insert coil rod into choke coil lever slot and install retaining clip.
7. Make sure that the choke valve operates freely and coil rod does not bind on choke cover from the full open to full closed position.

C.E.C. VALVE ADJUSTMENT (L-6 ENGINES—EXCEPT H/D VEHICLES)

IMPORTANT: Do not set CEC Valve adjustment to idle R.P.M. The CEC (Solenoid) Valve has a specified R.P.M. See Section 6M, Specifications, under "Other Adjustments."

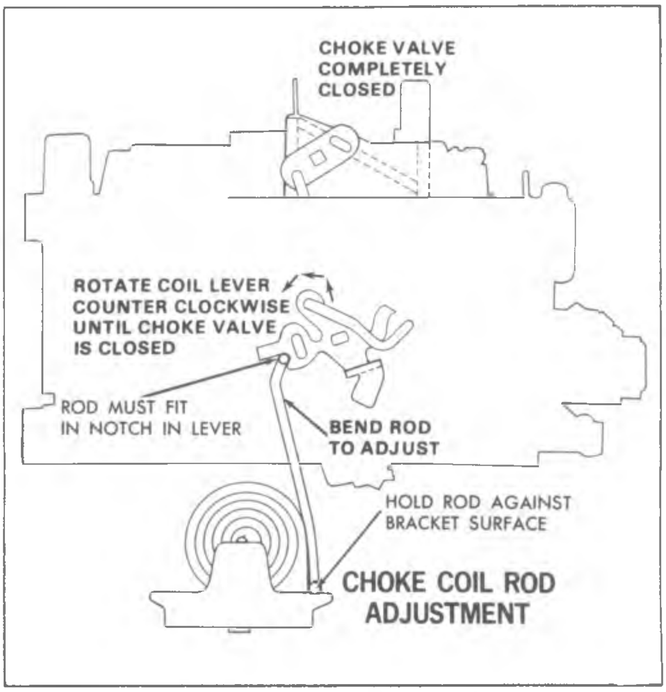


Fig. 14C—Choke Coil Rod Adjustment (4MV)

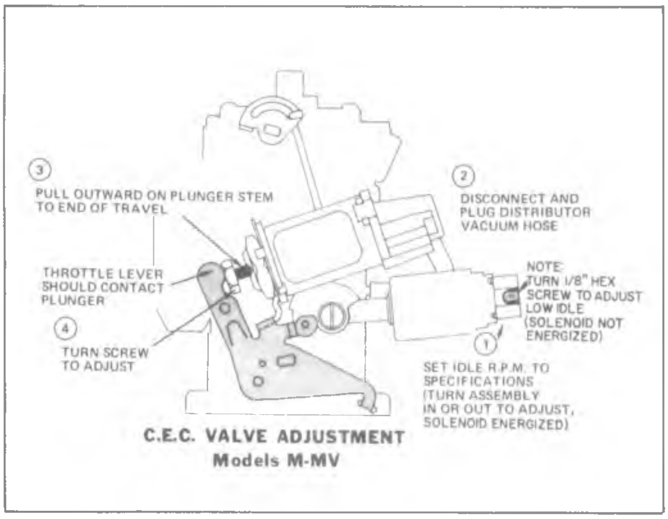


Fig. 15C—C.E.C. Valve Adjustment (MV) Typical

CAUTION: If the CEC solenoid on the carburetor is used to set the engine idle or is adjusted out of limits specified in the Service Manual, decrease in engine braking may result.

This adjustment is to be made only after, (1) replacement of the solenoid, (2) major overhaul of the carburetor is performed, or (3) after the throttle body is removed and replaced.

The C.E.C. valve setting is made only after completing instruction on tune-up sticker.

With engine running and transmission in "Neutral" for manual, and in "Drive" for automatics, with air conditioning off, distributor vacuum hose removed and plugged, and fuel tank hose from vapor canister disconnected, perform the following:

1. Manually extend the C.E.C. valve plunger to contact throttle lever.
2. Adjust plunger length to obtain C.E.C. valve R.P.M. (see "Other Adjustments" in Specifications at end of this manual - Column No. 3).
3. Reconnect fuel tank vapor hoses to the canister and distributor vacuum hoses.

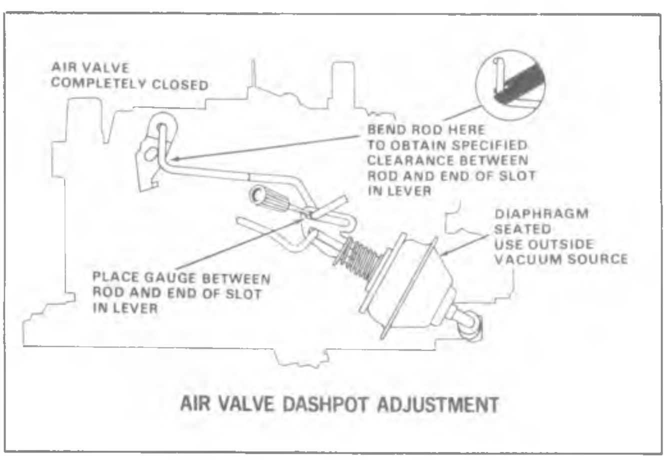


Fig. 16C—Air Valve Dashpot Adjustment (4MV)

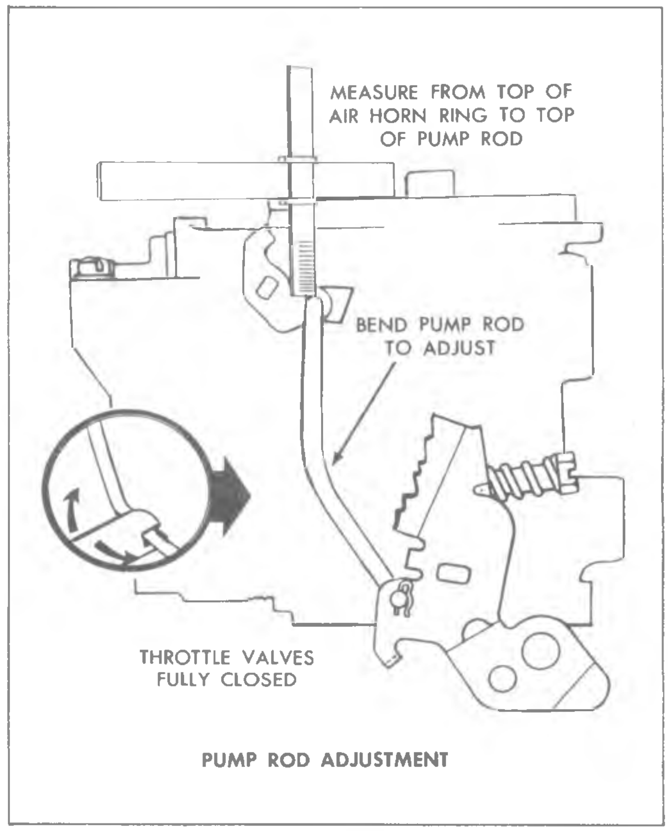


Fig. 17C—Accelerator Pump Rod Adjustment (2GV)

AIR VALVE DASHPOT ADJUSTMENT 4MV (Fig. 16C)

1. Completely seat choke vacuum break diaphragm using an outside vacuum source.
2. With choke diaphragm seated and air valve fully closed, measure the distance between the end of slot in vacuum break plunger lever and air valve.
3. Adjust to specifications by bending rod as shown.

ACCELERATOR PUMP ROD ADJUSTMENT 2GV (Fig. 17C)

Back out idle stop screw and completely close throttle valves in bore. Place gauge on top of air horn ring. Bend the pump rod at lower angle to obtain specified dimension, to top of pump rod.

ALL CARBURETORS

REMOVAL (Figs. K1, K2 and K3)

Flooding, stumble on acceleration and other performance complaints are, in many instances, caused by the presence of dirt, water, gum and varnish caused by stale fuel from prolonged vehicle storage, 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. Check filter.

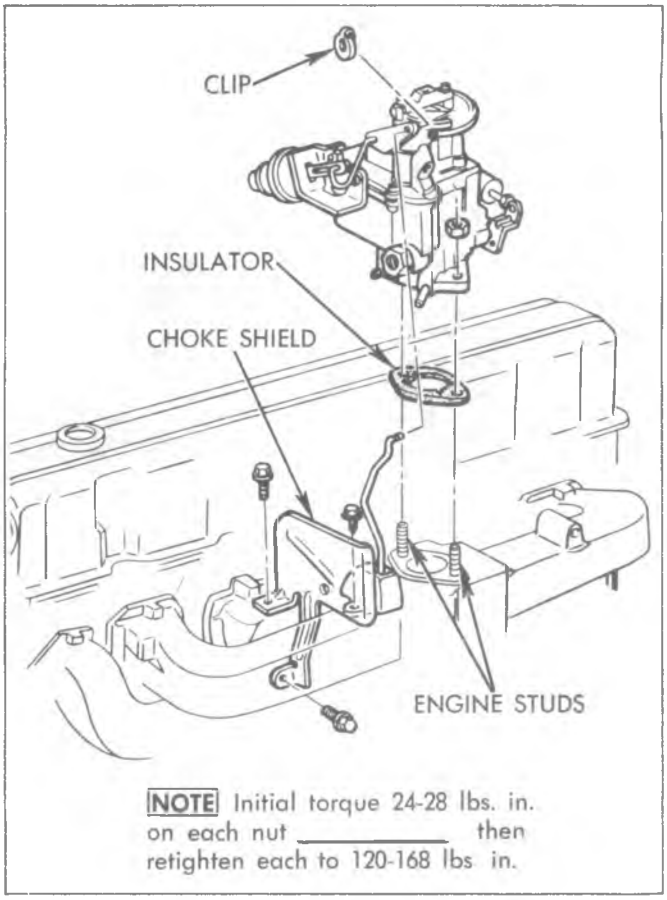


Fig. K1—Choke Coil Rod, L-6

1. Remove air cleaner and gasket.
2. Disconnect fuel and vacuum lines from carburetor.
3. Disconnect choke coil rod.
4. Disconnect accelerator linkage.
5. If equipped with automatic transmission, disconnect TV linkage.
6. Remove C.E.C. valve (if so equipped) vacuum hose and electrical connector.
7. Remove idle stop electrical wiring from solenoid (if so equipped).
8. Remove carburetor attaching nut and/or bolts, gasket or insulator 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 lever 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.

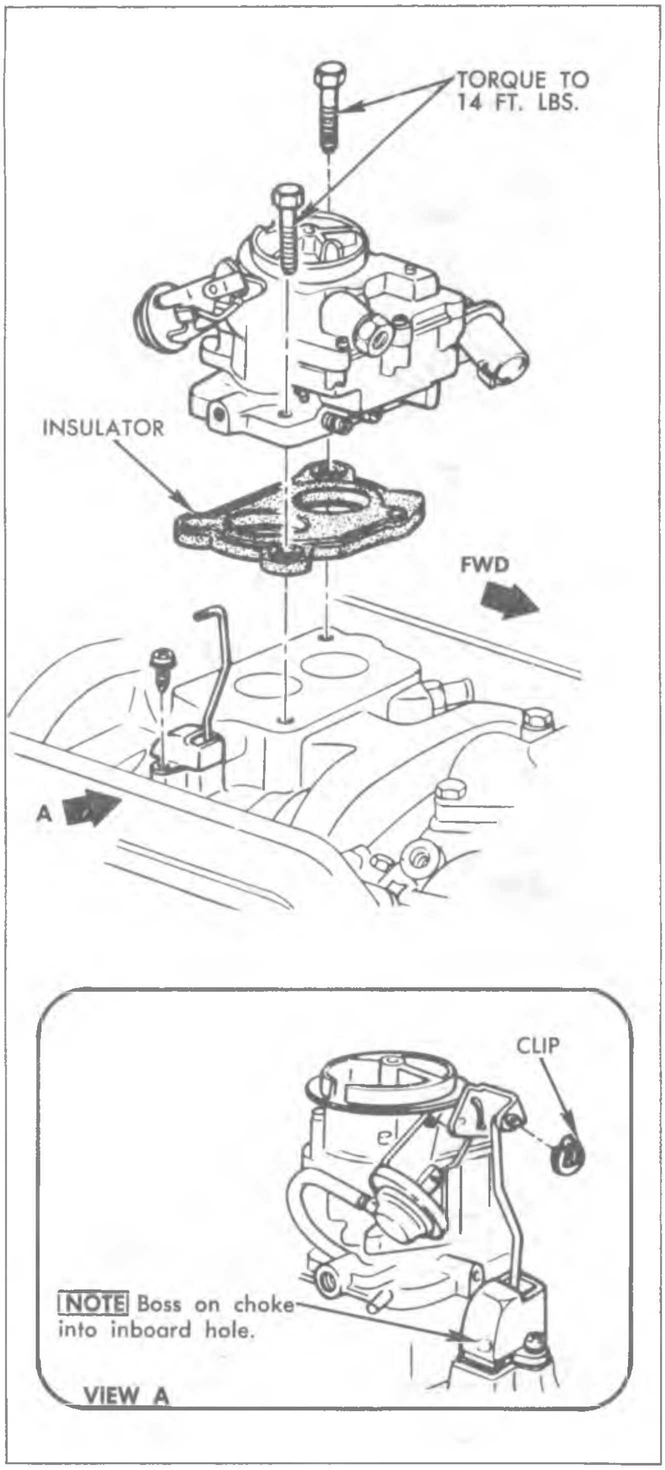


Fig. K2—Choke Coil Rod, 2 Bbl. Carb. V-8

2. Install new carburetor to manifold flange gasket or insulator (as required).
3. Install carburetor over manifold studs or holes.
4. Start vacuum and fuel lines at carburetor.
5. Install attaching nuts and/or bolts and tighten to specified torque shown.
6. Tighten fuel lines and install vacuum lines securely.
7. Connect and adjust accelerator and TV linkage.
8. Connect C.E.C. Valve (L-6) electrical wiring and attach vacuum lines.

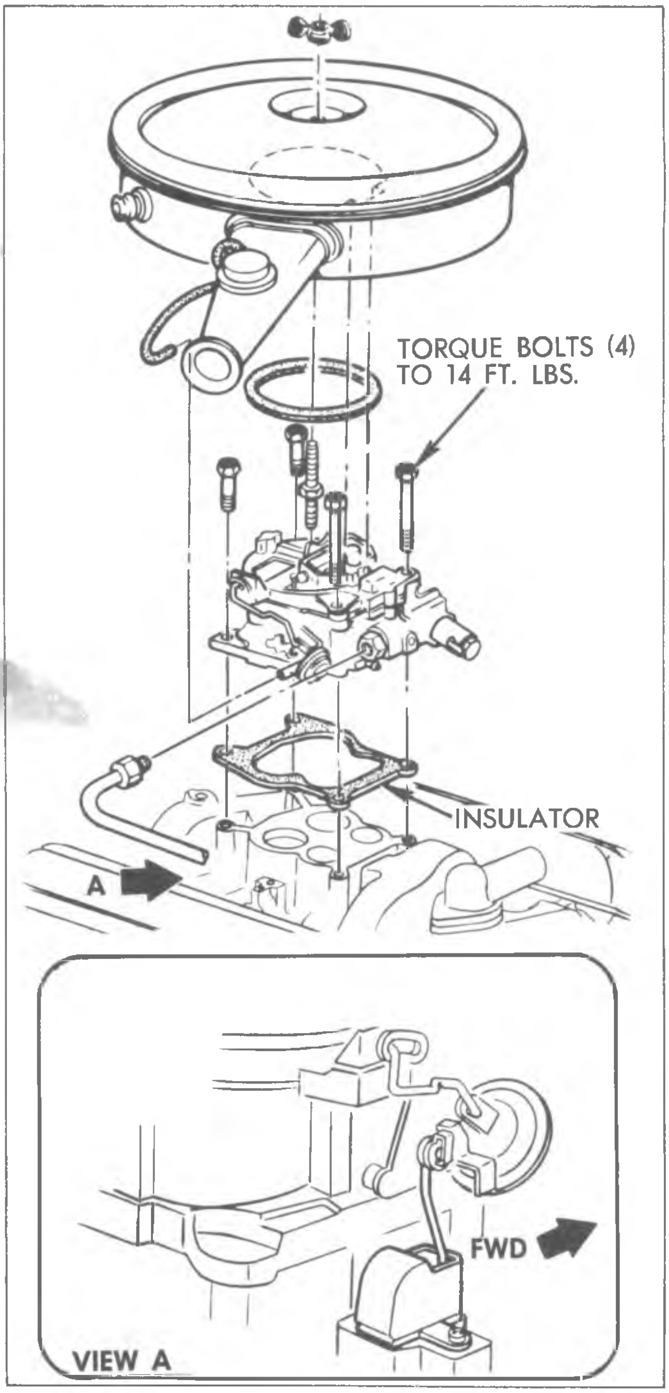


Fig. K3—Choke Coil Rod, 4 MV Rochester

9. Connect idle stop wiring connector to solenoid.
10. Connect choke coil rod.
11. Install air cleaner, adjust curb idle and low idle speeds per decal. (See specifications for C.E.C. valve adjustment, idle stop solenoid adjustment and idle mixture adjustment; also, "Additional external settings and adjustments".)

FUEL FILTER MAINTENANCE

1. Disconnect fuel line connection at inlet fuel filter nut.
2. Remove inlet fuel filter nut from carburetor with a box wrench or socket.

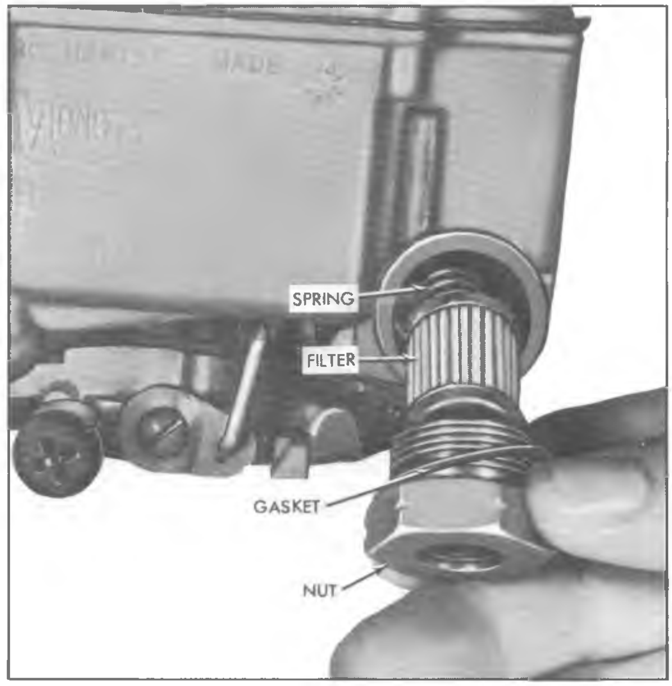


Fig. K4—Fuel Filter (Paper-Type) (Typical)

3. Remove filter element and spring (fig. K4).
4. Check paper element by blowing on fuel inlet end. If filter does not allow air to pass freely, replace element. No attempt should be made to clean filters.

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.

5. Install element spring, and install element in carburetor. Bronze filters must have small section of cone facing out.
6. Install new gasket on inlet fitting nut and install nut in carburetor and tighten securely.
7. Install fuel line and tighten connector.

AUTOMATIC CHOKE COIL ASSEMBLIES

Refer to "External Adjustments" for choke coil adjustment procedures and typical installed views.

Choke Coil Replacement

In-Line Engines (Fig. K1)

NOTE: The following procedures refer to all IN-LINE engines.

1. Remove air cleaner and disconnect choke rod upper clip.
2. Remove bolt attaching choke coil to manifold, and 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 bolt 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 (Figs. K2-K3)

1. Remove air cleaner and disconnect choke rod upper clip.
2. Remove choke coil as follows:
   WITH ROCHESTER 4MV AND 2GV CARBURETORS
   Remove the choke coil shield by prying with a screw driver on the small tangs at base of shield, 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 locator is in the hole of the intake manifold and install mounting screw.
4. Complete installation as follows:
   WITH ROCHESTER 4MV AND 2GV 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.
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.

ON-THE-VEHICLE ADJUSTMENTS

Final curb idle and fast idle settings should be made on the vehicle using a tachometer. All idle speeds in 1972 are to be set with the air conditioning in the OFF position unless otherwise indicated. Idle speed and mixture settings must be made with the air cleaner installed. Warm engine to normal operating temperature, choke valve and thermostatic air cleaner valve must be in full open positions. Idle settings must follow procedure shown on decal.

ADDITIONAL EXTERNAL SETTINGS AND ADJUSTMENTS

All Vehicles

After carburetor overhaul, throttle body part replacement, mixture needle part replacement, or limiter cap and needle removal, the below procedures must be followed:

1. Follow instructions on vehicle tune-up sticker (refer to Section 6, Tune Up) before proceeding.
2. Turn mixture screw in until it lightly contacts seat, then back screws out four (4) full turns.
3. Adjust idle stop solenoid or carburetor speed screw for H/D to obtain, "initial curb idle speed", see "Other Adjustments" Specifications chart in back of this Manual - Column No. 1.
4. Then adjust mixture screws equally in (Leaner) or to 1/4 turn rich from lean roll, when specified, to obtain "final curb idie speed," as specified. See "Other Adjustments" Specifications chart in back of this Section - Column No. 2.
5. Install service "Mixture Needle Limiter Caps" on mixture screws.
6. Reconnect distributor vacuum hose and fuel tank vapor hose.

IDLE STOP SOLENOID (CURB IDLE—LOW IDLE) ADJUSTMENT

With engine at normal operating temperature, air cleaner installed, choke open, and air conditioning off, if so equipped.

CAUTION: Set parking brakes and block the drive wheels.

1. Disconnect fuel tank hose vapor canister.
2. Disconnect distributor vacuum hose at the distributor. Plug hose lead-to carburetor.
3. With engine running;

One Barrel Carburetors

CAUTION: During adjustment, do not turn the solenoid more than one complete turn without first disconnecting the electrical wiring.

a. Turn the solenoid clockwise to increase RPM, counterclockwise to decrease RPM. Refer to Specifications, Section 6M, under "Other Adjustments", column No. 2, for curb idle speed (Idle Stop Solenoid-Energized).
b. Set low idle speed (with solenoid de-energized) to 450 RPM by using an allen head wrench (located at the end of this solenoid). Turn to adjust.

Two Barrel and Four Barrel Carburetors

a. Disconnect electrical connection at the end of the idle stop solenoid.
b. Adjust carburetors low idle (Adjustment screw on low step of cam) to Specifications in Column No. 2, Note (3).
c. Set dwell and timing and recheck low idle speed.
d. Reconnect electrical connector to the solenoid. Open the throttle momentarily and adjust the solenoid plunger screw to the specified curb idle speed (RPM). See Specifications, Section 6M, under "Other Adjustments".

ACCELERATOR AND CHOKE CONTROLS

THROTTLE LINKAGE (Fig. K5 thru K9)

The throttle control system is of the cable type. There are no throttle linkage adjustments, a reference between the bottom of the accelerator pedal roller and floor pan should be used only as a check for bent bracket assemblies. Check torque references in Figures K4 thru K12. Check for correct opening and closing positions by operating accelerator pedal in car. Cable routing attachment, carburetor positioning for proper assembly should be noted by some of the following illustrations.

NOTE: If any binding is present, check for correct routing of cable or pedal interference with carpets.

THROTTLE ROD KICKDOWN LINKAGE ADJUSTMENT

1. Disconnect throttle rod swivel at throttle lever on carburetor or at dash lever.

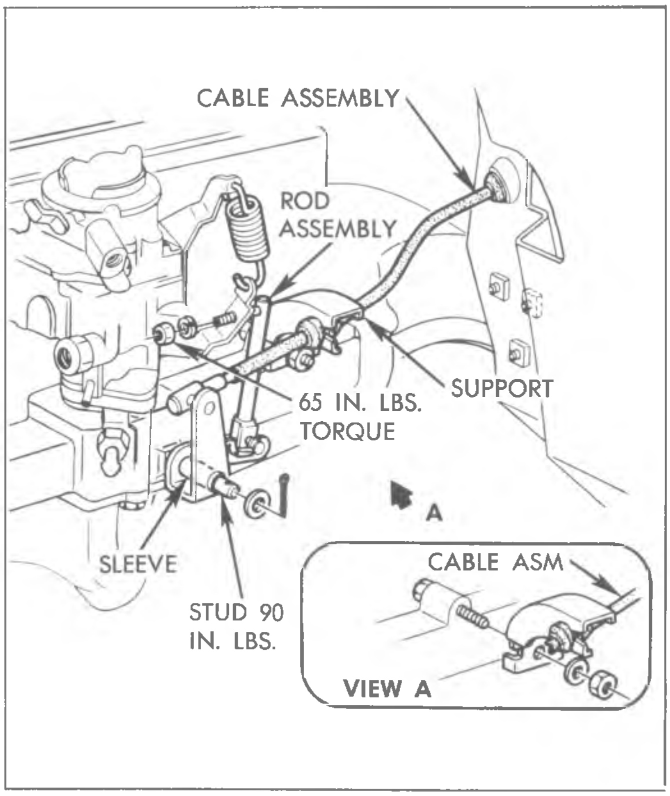


Fig. K5—Accelerator Controls, CS and KS 10 thru 30 Series

NOTE: Cable controls do not require adjustment.

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.

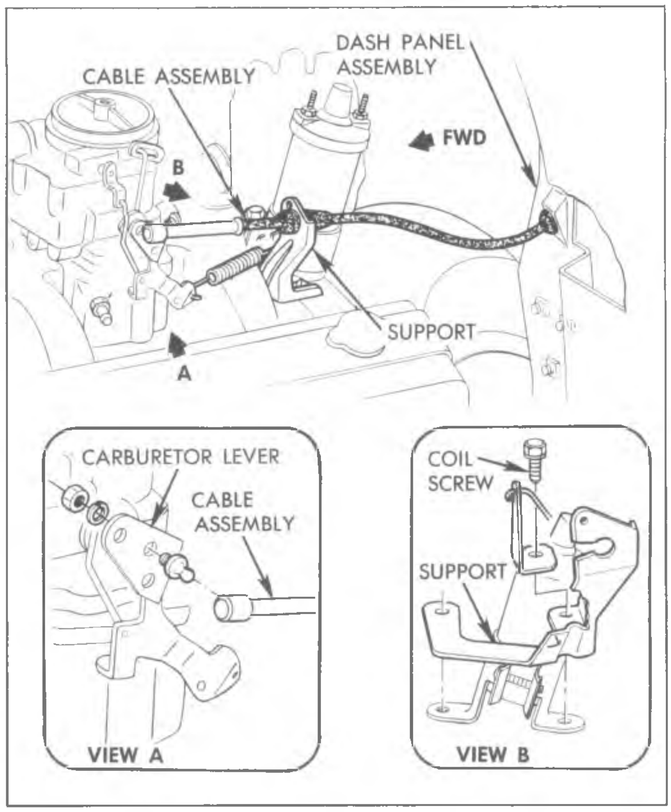


Fig. K6—Accelerator Controls, CE and KE (Refer to Fig. K7 Below)

5. On vehicles equipped with automatic transmission hold throttle lever in full open position, pull TV rod to full detent position and adjust TV rod to just enter hole on throttle lever, and connect TV rod at throttle lever.

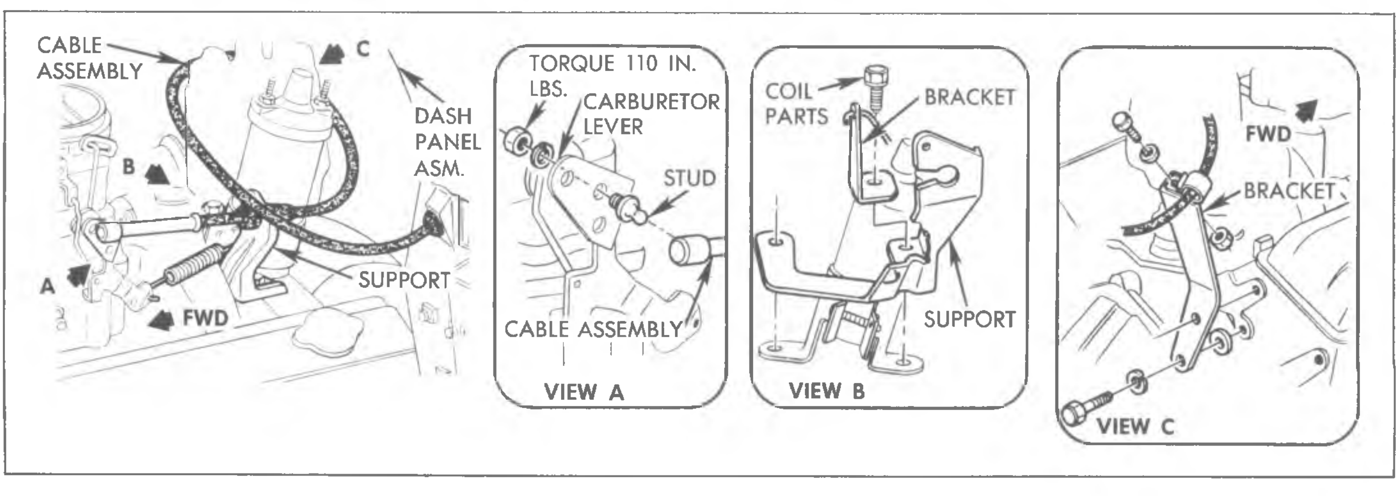


Fig. K7—Accelerator Controls CE-KE 10 and 20 & CE-30 Series

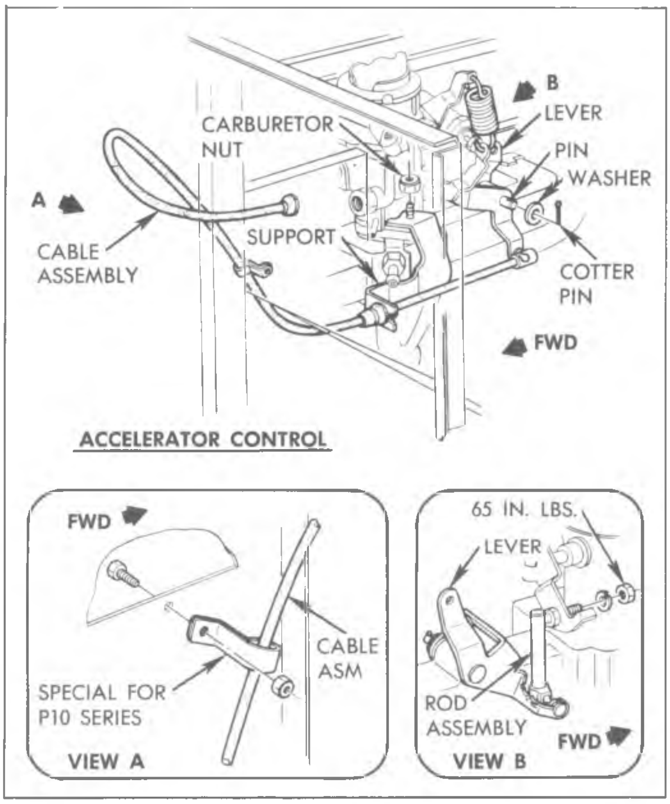


Fig. K8—Accelerator Controls, P Series (Typical)

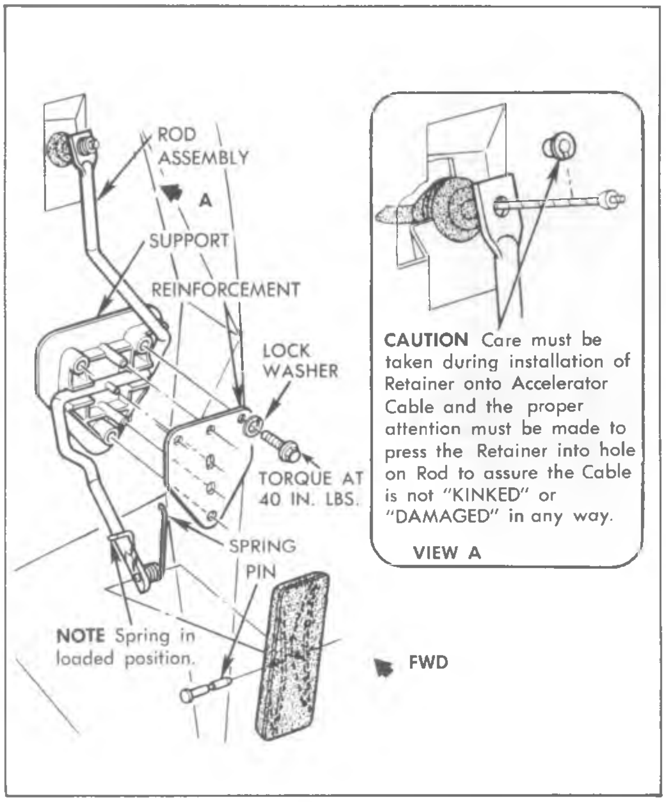


Fig. K9—Accelerator Pedal and Controls C, K and P 10 thru 30 Series

2G ENGINE GOVERNOR (VACUUM SPINNER TYPE)

INDEX

GENERAL DESCRIPTION

The Model 2G Carburetor Governor (fig. 2G) provided with 350 V-8 engines is a mechanically driven vacuum actuated mechanism set to govern engine speed at 4000 rpm maximum under full load conditions. With this limit, full advantage of engine horsepower is allowed without danger of excessive wear due to overspeeding. This 4000 rpm limit establishes an excellent pattern for shift control for automatic type transmissions.

The governor is comprised of two basic units; the centrifugal control valve housed in the distributor (See Engine Distributors in Section 6Y), and a carburetor actuator which is mounted on the carburetor throttle body (fig. 2G). These two components are inter-connected by tubing.

An engine overspeed warning device is incorporated into the governor as shown in Figure 2G. A description of the overspeed warning system will be found in Section 6Y.

Operation

The function of the 2G governor is to limit engine speed and yet allow a wider throttle opening when power is required. The throttle lever is connected to the throttle shaft in such a manner that turning the throttle lever does not actually force the throttle valve open but rather allows them to follow the throttle lever because of the governor spring tension. Thus when the throttle lever is moved to wide open position, the position of the throttle valve will be determined by vacuum on the diaphragm and the tension of the governor or spring acting on the governor lever.

Vacuum is applied to the diaphragm through a system

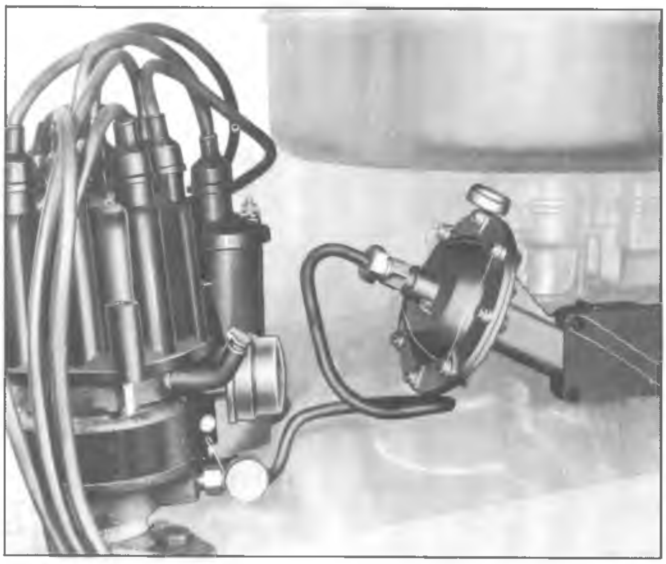


Fig. 1G—Distributor and Governor Mounting

of vacuum passages and restrictions in the throttle body and governor housing. A speed sensitive centrifugal valve in the distributor acts as a vacuum break so that there is no vacuum applied to the diaphragm until the desired governed speed is reached. When the governed speed is reached the valve is closed and vacuum is applied to the diaphragm which acts to close the throttle valves in opposition to the governor spring tension. When power is required as load is increased, engine rpm will drop causing distributor valve to open and allow the governor spring to open the throttle valves further.

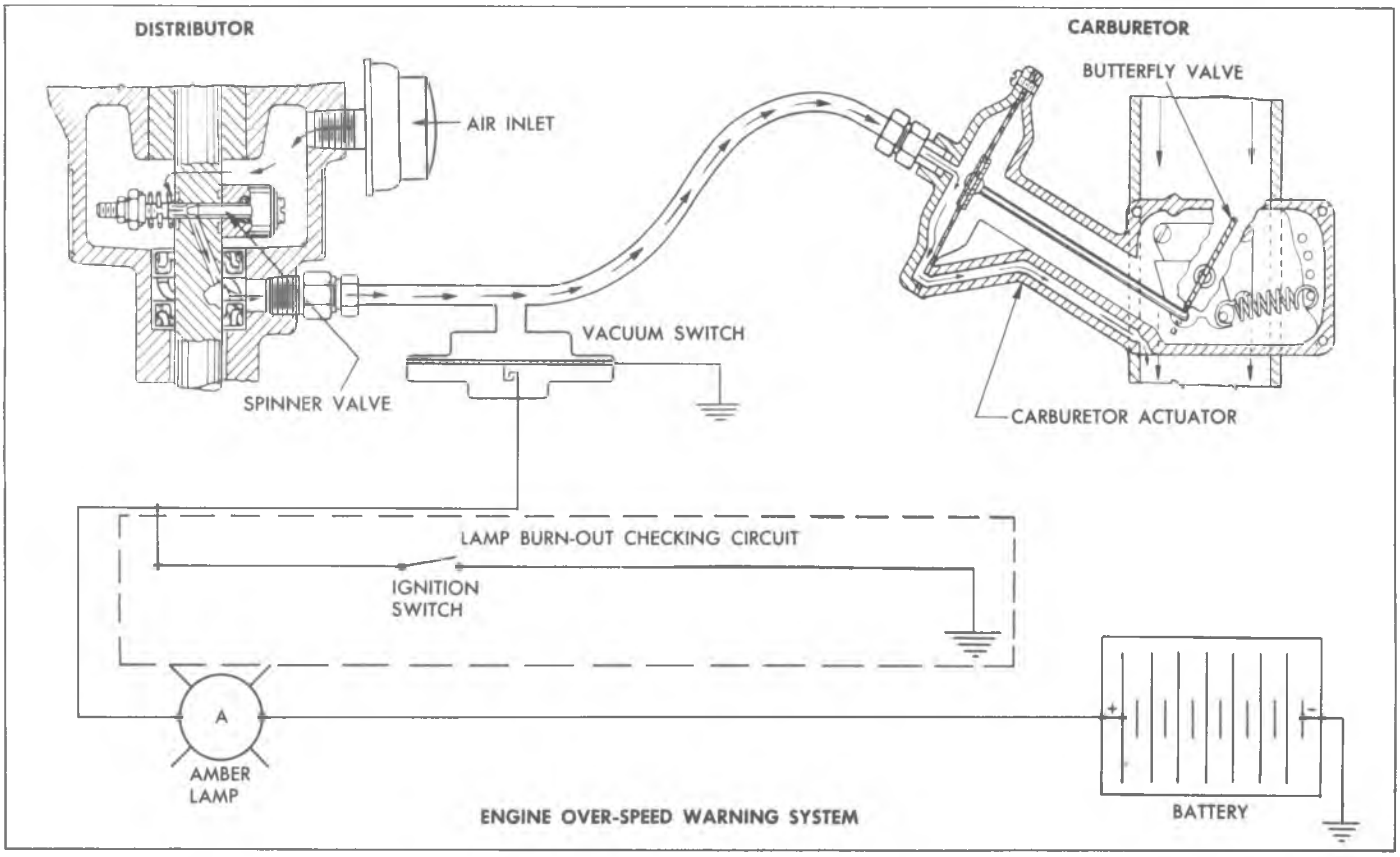


Fig. 2G—Governor and Overspeed Warning Light - Schematic

MAJOR SERVICE OPERATIONS

CONTROL VALVE

Whenever the distributor is removed for overhaul, the governor control valve mechanism should be disassembled and cleaned (See Engine Distributors in Section 6Y).

GOVERNOR HOUSING

Removal

1. Remove the four governor cover attaching screws and then the governor cover and gasket if used (fig. 3G).

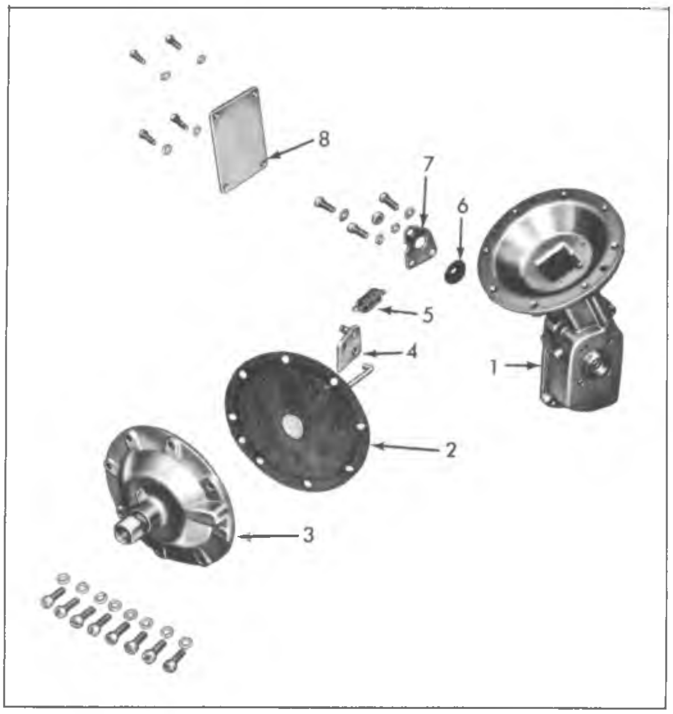


Fig. 3G—Governor - Explode

1. Governor Housing
2. Diaphragm Assembly
3. Diaphragm Cover
4. Governor Lever
5. Governor Spring
6. Leather Seal
7. Leather Seal Retainer
8. Governor Cover

2. Detach and remove the governor spring.
3. Remove the eight diaphragm cover attaching screws and then the diaphragm cover. Hold the throttle lever to avoid damage to the throttle valves and loosen the nut attaching the governor lever and pin assembly to the throttle shaft. Remove the governor lever from the throttle shaft, then detach it from the diaphragm rod by rotating the lever until the tang on the rod clears the slot in the lever.
4. Remove the diaphragm assembly from the housing and inspect for cracks or holes. If the diaphragm is damaged in any way, it must be replaced.
5. Remove the three governor attaching screws, then remove the leather seal retainer and leather seal.
6. Detach the governor housing from the throttle body.
7. The throttle lever and bearing assembly can be removed by detaching the fast idle cam and pump rod and removing the four attaching screws. No attempt should be made to service the throttle lever bearing. If the action indicates excessive friction to the point that the throttle return spring cannot overcome the binding, the throttle lever assembly should be replaced.

CAUTION: Since the idle ports in the throttle body were drilled after the throttle body was assembled, the throttle valves were nicked during the drilling operation. No attempt should be made to remove the throttle valve or to further disassemble the throttle body, since any slight change in positioning of the throttle valves with relation to the idle ports would seriously disrupt carburetor operation.

Cleaning and Inspection

The throttle lever and bearing assembly should not be immersed in any carburetor cleaner, since it might cause damage to the neophrene seal protecting the ball bearings. If the throttle body itself is immersed in solvent, great care must be taken that the throttle shaft bearings are blown completely dry with compressed air. They may then be lubricated with very light machine oil. Since the calibration of vacuum versus spring tension is of extreme importance in governor operation, it can readily be seen that there should be no excessive friction in throttle shaft rotation. If excessive friction is noted, the throttle body assembly must be replaced.

Installation

1. Position the gasket carefully on the throttle body and assemble the throttle lever and bearing assembly to the throttle body with the four screws provided. To be certain that the throttle lever and throttle shaft are in proper relation hold the throttle valve closed while attaching the throttle lever assembly. Position the throttle lever during assembly so that it fits easily onto the throttle body. If this procedure is followed the assembly will operate freely and correctly.
2. Place the governor housing to throttle body gasket in place, noting that the narrower edge goes toward the top of the carburetor. Then put the housing in place over the gasket.
3. Slide the leather seal and retainer over the throttle shaft, position the screw holes in correct relation and install the housing to throttle body screws loosely.
4. Check the throttle shaft for free rotation in the seal, then tighten the housing screws. The throttle valves must be held in a closed position while tightening the screws. Recheck for free rotation and repeat assembly procedure if necessary.
5. Install the diaphragm in the governor housing with the end of the diaphragm rod pointing inward. With the diaphragm in this position the hole for the vacuum passage in the diaphragm should line up with the vacuum passage in the housing. Assemble the governor lever and pin assembly to the diaphragm rod and position the lever on the throttle shaft. Install the nut and lockwasher, holding one of the throttle valves between thumb and forefinger while tightening, to avoid damage to the throttle valves.
6. Position the diaphragm carefully over the screw holes in the housing. Position the cover so that cover restriction pilots through the gasket and into the vacuum passage in the body. Install the eight screws finger tight. Open the throttle valves wide to provide maximum travel of the diaphragm and tighten the eight cover screws to 25 to 28 inch pounds of torque while holding the diaphragm in this position. Install lockwire on screws (shown in Figure 1). Install the governor spring over the lever pin and the stationary post in the housing.
7. Check again for free operation of the throttle shafts, then install the governor, cover and four attaching screws, and install lockwire (shown in Figure 1G).
8. Attach the pump rod and fast idle cam to the throttle lever assembly.
9. Install vacuum tube to diaphragm cover and distributor and install lockwire in attaching nuts.

TROUBLE SHOOTING

(2G VACUUM SPINNER TYPE)

1. Loss of speed control:
Check for vacuum leaks and operation of bleed valves in distributor. Also for proper seal of diaphragm cover and condition of diaphragm itself. Vacuum in the governor housing can be checked by removing the connection to the distributor and attaching a vacuum line. If there is no vacuum reading check the diaphragm for holes and be sure the vacuum passage is clear.
2. Erratic operation under load:
Check for excessive friction in throttle shaft and throttle lever.

NOTE: Vacuum and free operation are two keys to correct operation of the Rochester governor. If all parts are free to move as intended and there are no vacuum leaks, the unit will operate correctly.

Governing systems generally malfunction in one of two ways:

1. They do not govern at all. This could result from:
   a. A vacuum leak in the units or tubing.
   b. "Spinner" unit stuck due to dirt, oil, or some other material depositing in the mechanism.
   c. Orifices in the carburetor clogging so no vacuum could be developed in the governing system.
2. The system "over governs": governs when it should not, causes loss of power, etc. This could result if the vacuum passages were to become clogged with dirt, oil, or other foreign materials. Areas most likely to "clog" are the orifices in the actuator, and the area where air bleeds through the distributor "spinner" valve.

Either type of malfunctioning could be caused by: improper spinner setting; spring post out of position in the carburetor actuator; bent or stretched spring in actuator.

SUGGESTED PROCEDURE FOR FINDING CAUSES OF IMPROPER GOVERNING

1. Localize the trouble on the vehicle. With the vacuum tube disconnected at the distributor, run the engine at about 3,000 rpm and place a finger over the end of the tube. If there is no noticeable change in engine operation, the trouble is probably in the actuator or tubing. If the engine speed is noticeably affected by this, the distributor "spinner" can be suspected.
2. If distributor trouble is indicated perform the following operation (refer "Ignition System, Servicing units off the Vehicle" in Section 6Y for detailed operation).
   a. Remove distributor from engine, remove spinner valve and clean and visually inspect the parts and passages for possible faults.
   b. Check the seals. Do this by connecting the lower vacuum connector to a vacuum pump, and "plugging" the valve hole in the shaft either with the fingers or other suitable means. Slight "seepage" around the seals is not abnormal; however, a vacuum gauge reading within 2" hg. of the maximum that can be obtained with the vacuum hose "squeezed" should be possible if the seals are in satisfactory condition. If the seals leak excessively they should be replaced.
   c. When the spinner parts are reassembled, they should be wiped with a rag saturated with light oil to provide slight, but not excessive lubrication.
3. If actuator or tubing trouble is indicated:
   a. Remove the vacuum tube at the actuator, run the engine at about 3000 rpm and place a finger over the end of the actuator. If there is no change in engine operation, probably the actuator is at fault. A significant change in engine rpm would indicate tube leakage and tube should be replaced.
   b. If the tubing is not defective, check the actuator for leakage. With the orifices "stopped up" with the fingers, or other means, no leakage should occur. Also check for proper seal of diaphragm cover and condition of diaphragm itself. Vacuum in the governor housing can be checked by removing the connection to the distributor and attaching a vacuum line. If there is no vacuum reading check the diaphragm for holes and be sure the vacuum passage is clear.
   c. If no leakage is found, clean all of the component parts.
   d. If tampering is suspected, visually check parts with the governing parts of an engine that is governing properly.

AIR CLEANERS

INDEX

GENERAL DESCRIPTION

Air cleaners on all models operate primarily to remove dust and dirt from air before it is drawn into the carburetor and engine. The air cleaner also helps to reduce engine noise and quenches any flame that may be caused by engine backfiring through the carburetor.

Two types of air cleaners are used on trucks. They

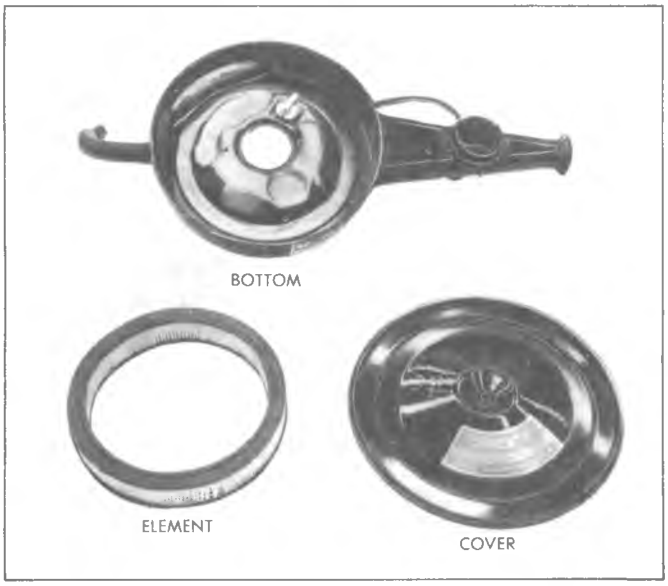


Fig. 1A—Paper Element Air Cleaner

are the oil wetted paper element air cleaner, and the poly-wrap element air cleaner.

The oil wetted paper element air cleaner (fig. 1A) consists of an accordian pleated oiled paper filter supported

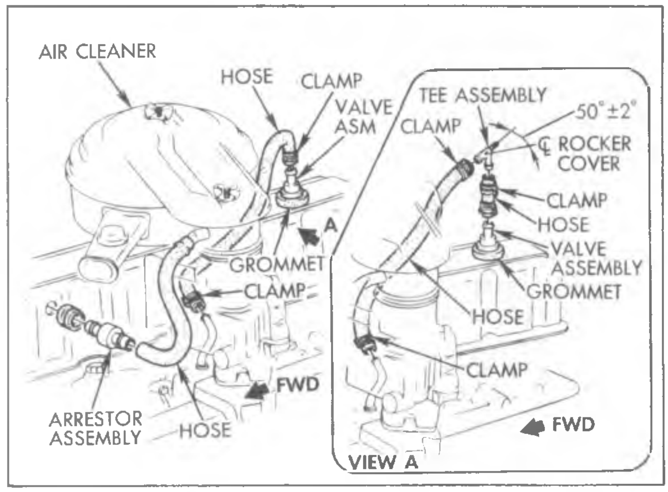


Fig. 2A—Engine Ventilation, C-K (L-6)

by wire mesh with a plastisol seal on both top and bottom.

The engine ventilation (fig. 2A) circulates through the air cleaner bottom and the element.

Air temperature is automatically controlled by a thermostatic valve which selects warmed air from the heat stove and/or cooler air from the engine compartment or from outside the vehicle.

MAINTENANCE AND SERVICE

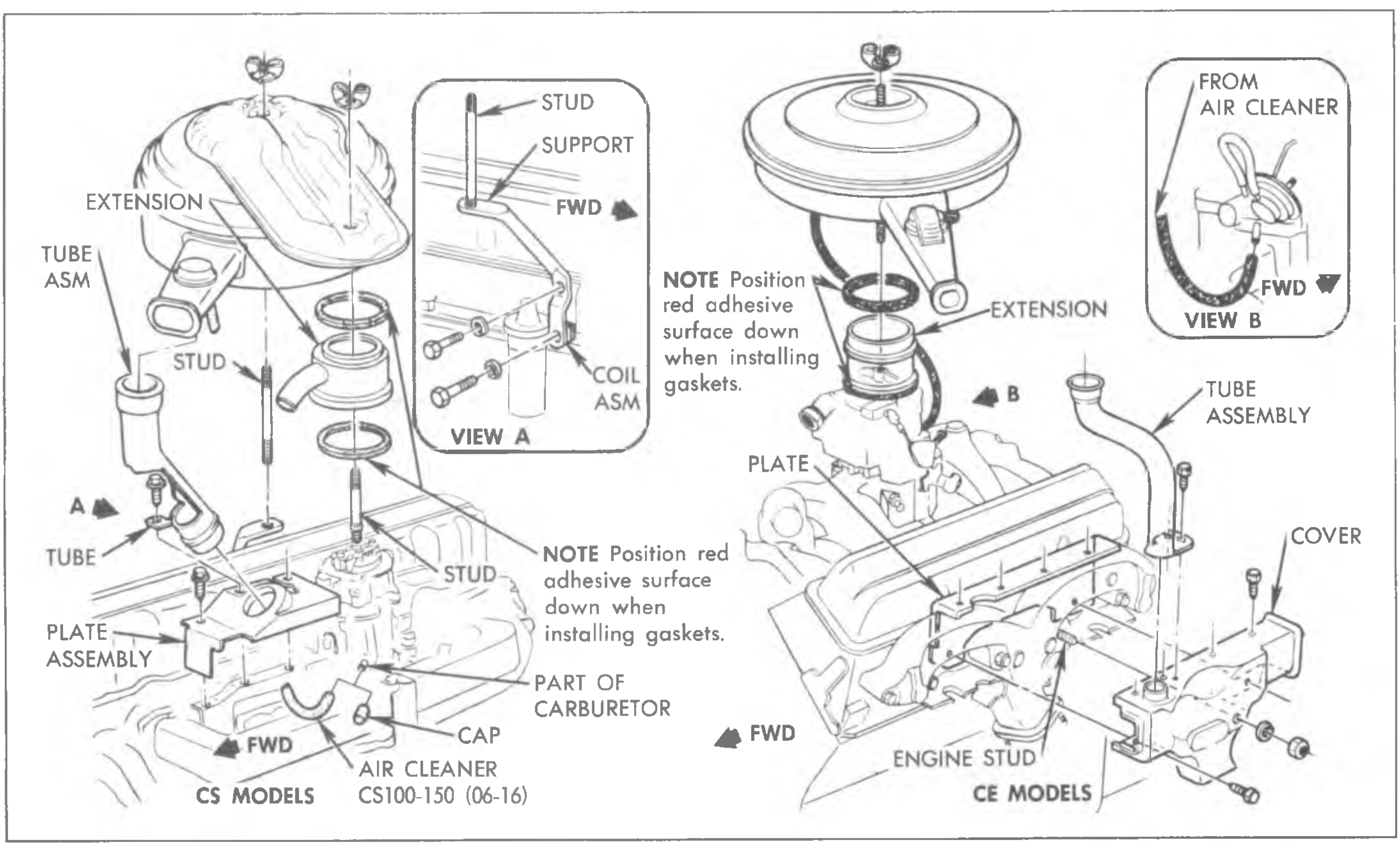


Fig. 3A—Air Cleaner and Heat Stove, CS and CE Series

CARBURETOR AIR CLEANER ELEMENT—Under normal operating conditions, the carburetor air cleaner should be replaced every 24,000 miles on V-8 engines and 12,000 miles on L-6 engines. Operation of vehicle in dusty areas will cause rapid clogging of element and enrichment of carburetor mixture. Under these conditions, the element must be replaced more frequently.

THERMOSTATICALLY CONTROLLED AIR CLEANER —The air cleaner should be inspected to make certain that all hoses and ducts are intact and correctly installed. Operational function should be checked by inspecting position of valve in air intake. With engine stopped, valve should be open. At underhood temperature below 100°F, with engine running, valve should be partially or fully closed. As engine underhood temperature rises, the valve should open.

ELEMENT REPLACEMENT

1. Remove air cleaner cover.
2. Remove element.
3. Remove bottom section of air cleaner and remove and discard air cleaner gasket.
4. Clean bottom section of air cleaner and air cleaner cover thoroughly.

   NOTE: Check air cleaner cover seal for tears or cracks.

5. Install bottom section of air cleaner with a new air cleaner gasket.
6. Install new paper element on bottom section of air cleaner with either end up.
7. Install air cleaner cover.

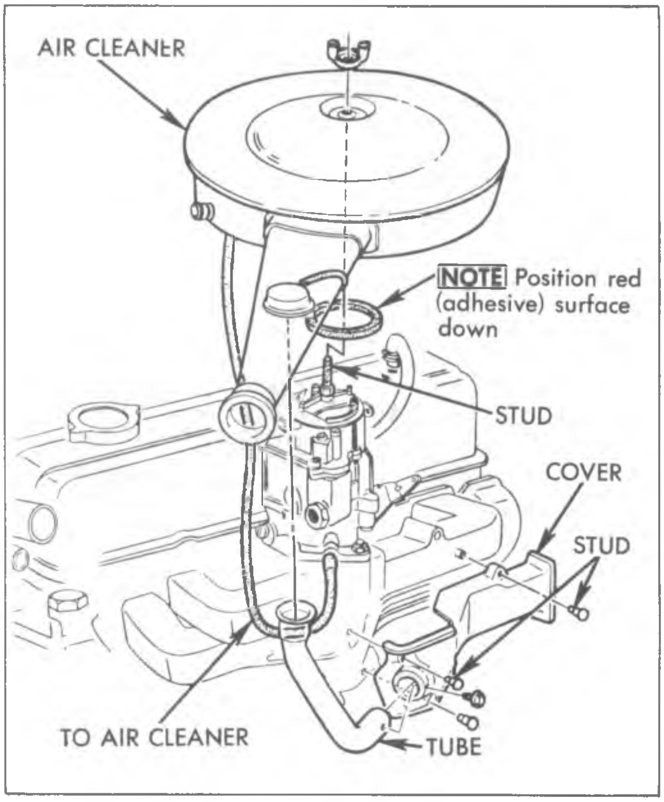


Fig. 5A—Air Cleaner, Heat Stove & Tube—CS 10 (03-04-34)

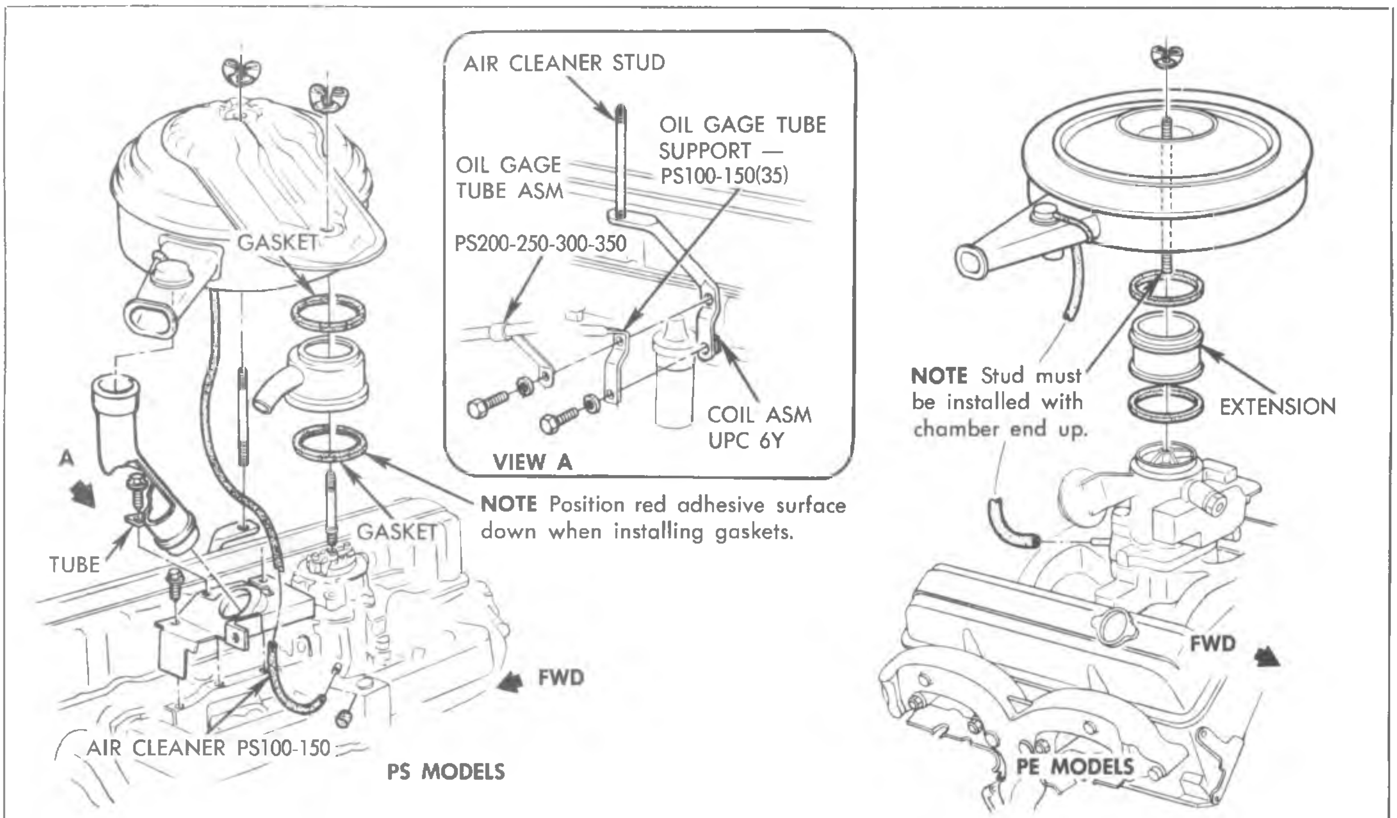


Fig. 4A—Air Cleaner and Heat Stove, P Series

INSPECTING PAPER ELEMENT (Fig. 3A, 4A & 5A)

1. Remove air cleaner element as previously outlined.
2. Inspect top and bottom seals for deformation or cracking. These surfaces must be smooth and uniform.
3. Inspect element for punctures or splits by looking through the element towards a light source.
4. Internal portions of air cleaner cover and bottom should be clean. If washed with solvent surfaces should be dried thoroughly.
5. Install air cleaner element as previously outlined.

THERMOSTATICALLY CONTROLLED AIR CLEANER

This system (fig. 6A and 7A) is designed to improve carburetor operation and engine warm-up characteristics. It achieves this by keeping the air entering the carburetor at a temperature of at least 100°F or more.

The thermostatic air cleaner system includes a temperature sensor, a vacuum motor, and control damper assembly mounted in the air cleaner, vacuum control hoses, manifold heat stove and connecting pipes. The vacuum motor is controlled by the temperature sensor. The vacuum motor operates the air control damper assembly to regulate the flow of hot air and under hood air to carburetor. The hot air is obtained from the heat stove on the exhaust manifold.

Inspection

Visual

1. Check for proper and secure connections of heat pipe and hoses.
2. Check for kinked or deteriorated hoses. Repair or replace as required.

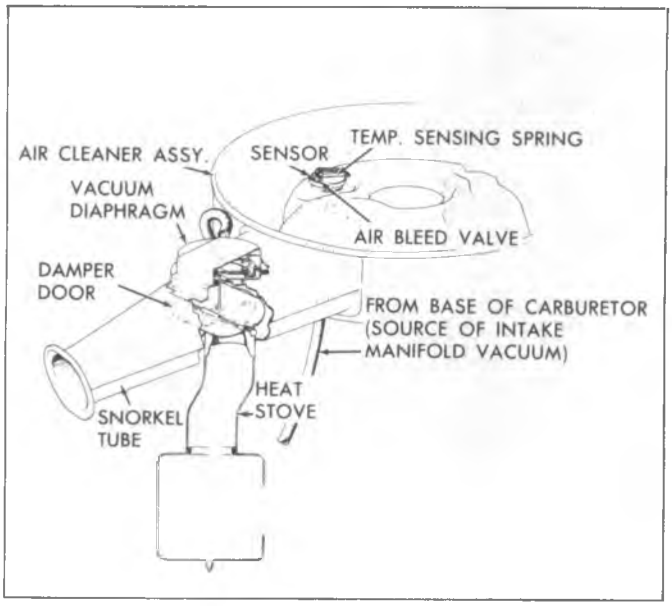


Fig. 6A—Thermostatically Controlled Air Cleaner

Operational

1. Remove air cleaner cover and install temperature gauge (Tool J-22973) as close as possible to sensor (fig. 8A).

   Reinstall cover without wing nut. (Temperature must be below 85°F before proceeding.)
2. With the engine "Off", observe damper door position through snorkel opening. Snorkel passage should be open. Fig. 7A, View A. If not, check for binds in linkage.
3. Start and idle engine. With air temperature below 85°F, snorkel passage should be closed. Fig. 7A, View B. When damper door begins to open snorkel

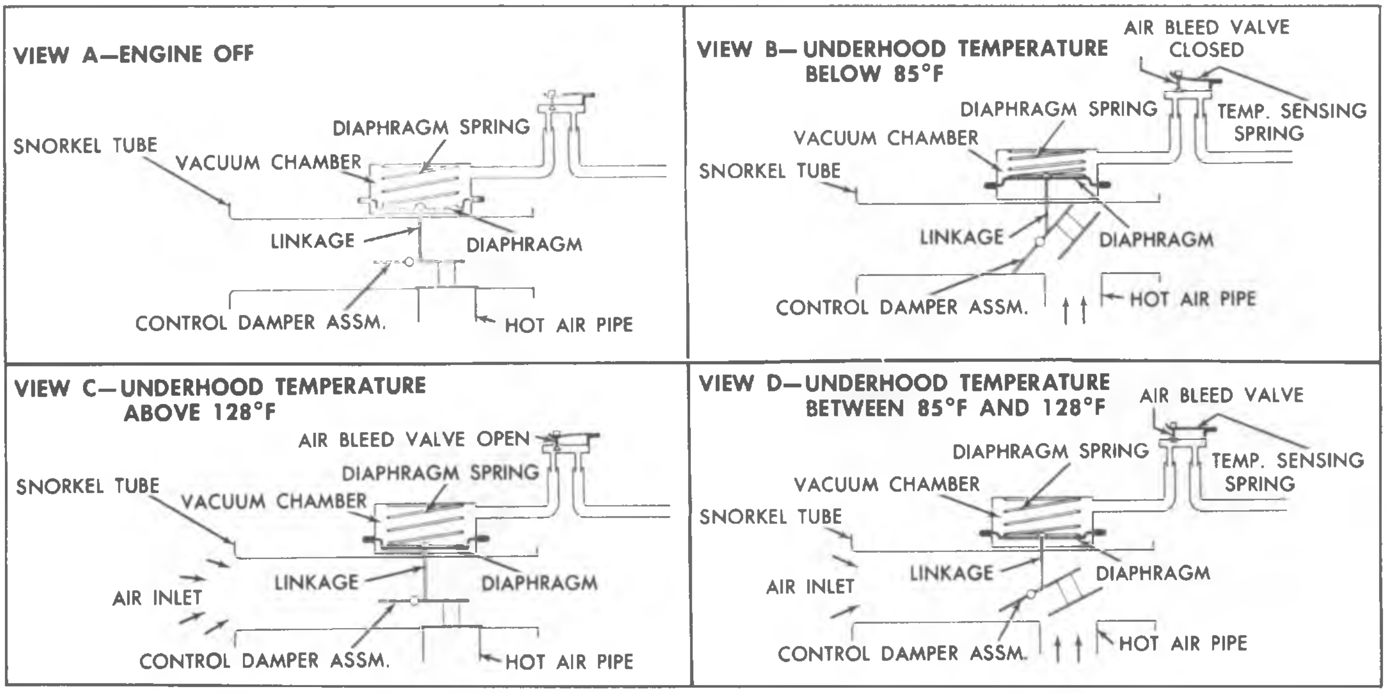


Fig. 7A—Air Cleaner Operation

Fig. 8A—Temperature Gauge Installation

passage, remove air cleaner cover and observe thermometer reading. It should be between 85°F and 115°F.

4. If damper door does not close completely or does not open at correct temperature, continue with the following vacuum motor check:
   a. Turn off engine. Disconnect diaphragm assembly vacuum hose at sensor unit.
   b. Apply at least 9 in. Hg. of vacuum to diaphragm assembly through the hose. This can be done by mouth. Damper door should completely close snorkel passage when vacuum is applied. If not check to see if linkage is hooked up correctly and for a vacuum leak.
   c. With vacuum applied, bend or clamp hose to trap vacuum in diaphragm assembly (fig. 9a).

      Damper door should remain in position (closed snorkel passage). If it does not, there is a vacuum leak in diaphragm assembly. Replace diaphragm assembly.

Fig. 9A—Checking Vacuum Diaphragm

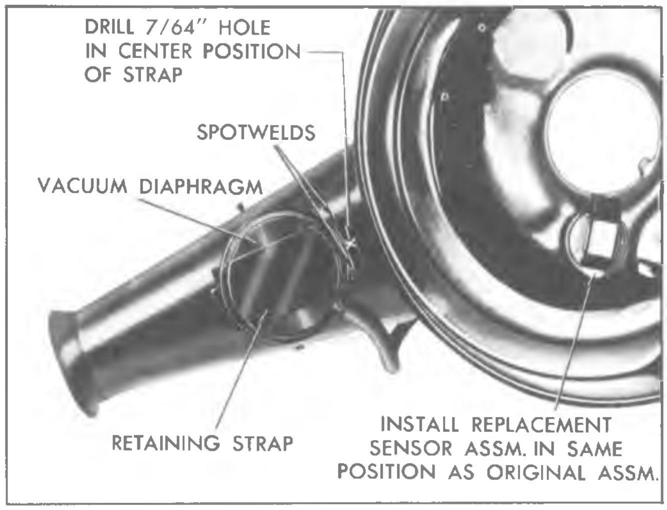


Fig. 10A—Vacuum Diaphragm Replacement

5. If vacuum motor check is found satisfactory, replace sensor unit.

VACUUM MOTOR REPLACEMENT

Removal

1. Remove air cleaner from engine.
2. Drill out spot welds fastening vacuum motor retaining strap to snorkel tube.
3. Remove vacuum motor by lifting and unhooking linkage rod from damper door.

Replacement

1. Drill 7/64" hole in snorkel tube at center of vacuum motor retaining strap (fig. 10a).
2. Connect vacuum motor linkage to damper door. Fasten retaining strap to air cleaner with sheet metal screw.
3. Replace air cleaner on engine and check operation of vacuum motor and control damper assembly.

Fig. 11A—Removing Sensor Unit

TEMPERATURE SENSOR REPLACEMENT

Removal

1. Remove air cleaner from engine and disconnect vacuum hoses at sensor.
2. Pry up tabs of sensor retaining clip (fig. 11a).

   NOTE: Observe position of sensor, new sensor must be installed in this same position.

3. Remove clip and sensor from air cleaner.

Replacement

1. Install sensor and gasket assembly in air cleaner in position as noted above.
2. Press retaining clip on sensor. Support the sensor on its side to prevent damage to the control mechanism in the center.
3. Install air cleaner on engine and connect vacuum hoses.

FUEL PUMP

INDEX

GENERAL DESCRIPTION

The fuel pump (fig. 1P and 2P) used on all Chevrolet vehicles covered in this manual is the diaphragm type. The pump is actuated by an eccentric located on the engine camshaft. On in-line engine, 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.

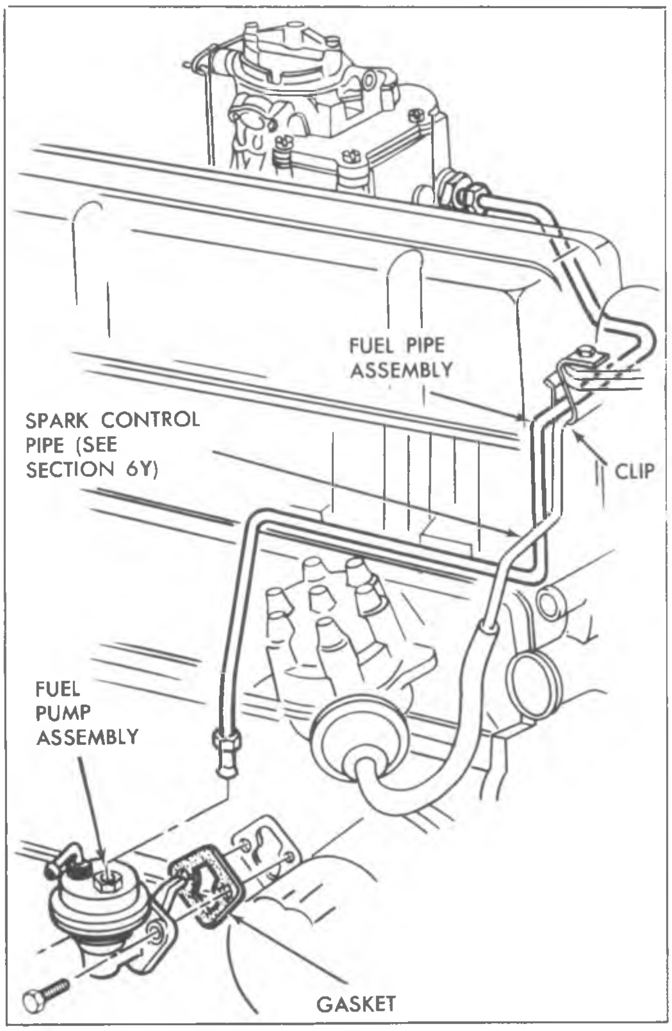


Fig. 1P—Fuel Pump and Pipe, L-6

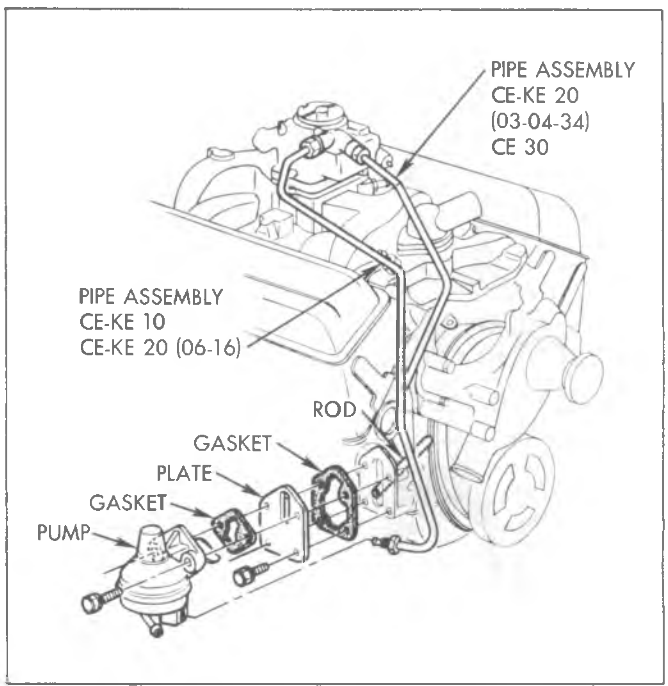


Fig. 2P—Fuel Pump and Pipe, V-8

SERVICE PROCEDURES

INSPECTION

The fuel pump (fig. 3P) 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 distributor primary 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.

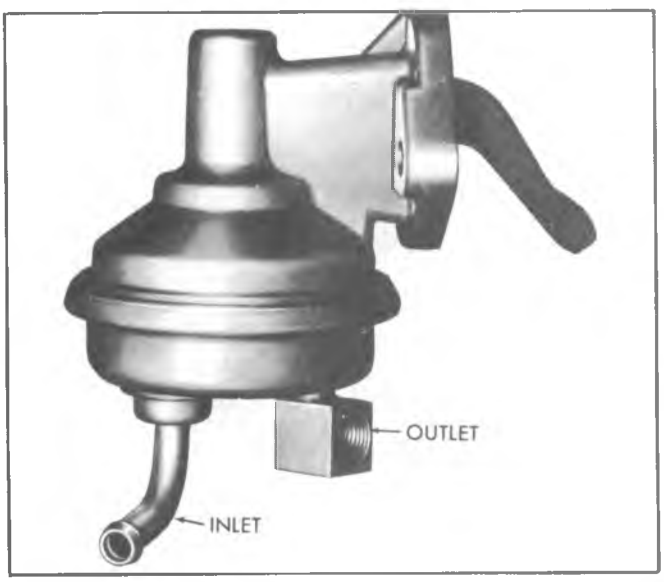


Fig. 3P—Fuel Pump (Non-Serviceable)

3. If fuel flows from pump in good volume from pipe at carburetor, check fuel delivery pressure to be certain that pump is operating within specified limits as follows:
   a. Attach a fuel pump pressure test gauge to disconnected end of 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 significantly at different speeds, the pump should be replaced.

REMOVAL

NOTE: When connecting or disconnecting fuel pump outlet pipe fitting always double wrench to avoid possible damage of pump.

1. Disconnect fuel inlet and outlet pipes at 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 and push rod (402 cu. in. engines), and fuel pump adapter and gasket and push rod 307, 350 and 402 cu. in. engines).

INSTALLATION

1. On V8 engines, if fuel pump push rod has been removed, install push rod and pipe fitting or fuel pump adapter using 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 or heavy grease may be used to hold fuel pump push rod up while installing fuel pump (fig. 4P).

3. Connect fuel pipes to pump.
4. Start engine and check for leaks.

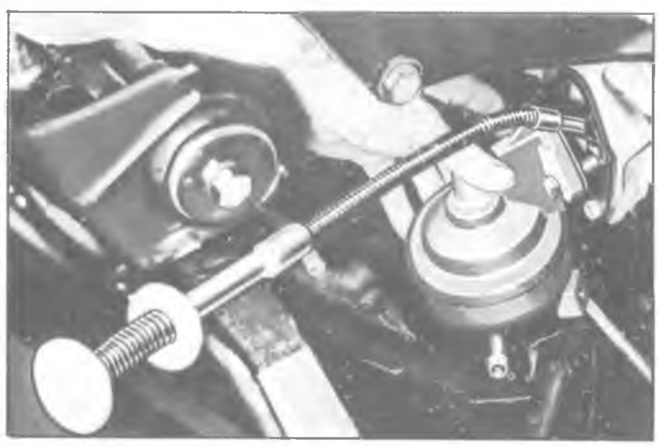
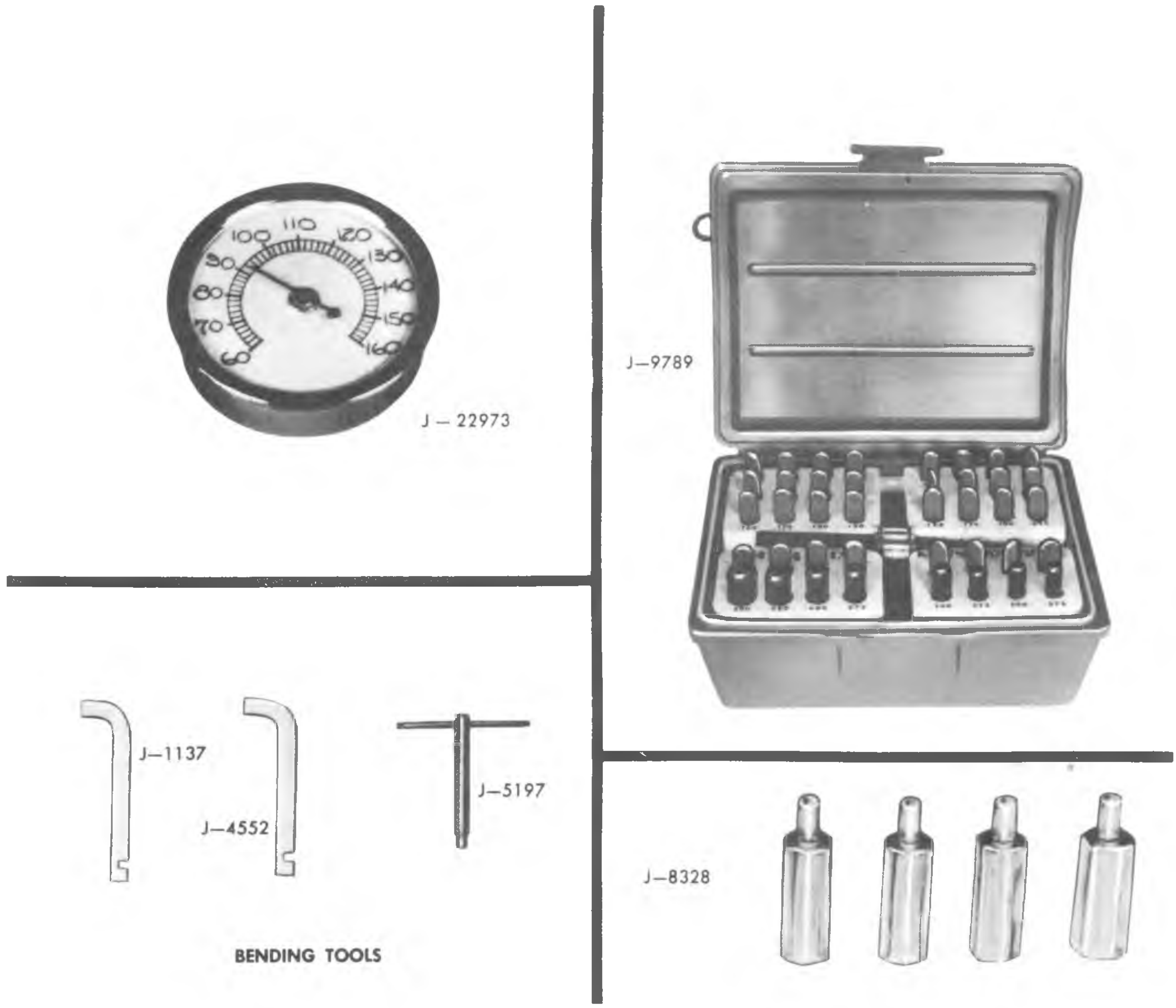


Fig. 4P—Installing V-8 Engine Fuel Pump

SPECIAL TOOLS



J-1137 Choke Rod Bending
J-4552 Choke Rod Bending (1 and 2 bbl.)
J-5197 Unloader Bending
J-8328 Carburetor Holding Tool
J-9789 Universal Carburetor Kit

Fig. 5P—Engine Fuel – Special Tools

SECTION 6T

EMISSION CONTROL SYSTEMS

CONTENTS OF THIS SECTION

POSITIVE CRANKCASE VENTILATION

This system removes engine crankcase vapors which result from normal engine combustion. They are removed by utilizing the manifold vacuum to draw off the vapors through a metered P.C.V. valve and ultimately to the intake system for engine reburn. Refer to Section 0 for service requirement of this valve.

CONTROLLED COMBUSTION SYSTEM

This system increases combustion efficiency through leaner carburetor adjustments and revised distributor calibration. In addition, on the majority of installations, special thermostatically controlled air cleaners are used to maintain hotter intake air (100°F or above) to lean the carburetor. Refer to Section 0 for air cleaner care recommendations.

EVAPORATION EMISSION CONTROL

This system is designed to reduce fuel vapor emission that normally vents to the atmosphere from the gasoline tank and carburetor fuel bowl. The air cleaner filter mounted at the bottom of the canister requires replacement at intervals specified in Section 0. All other parts are serviced as a complete replacement as outlined in Section 8.

TRANSMISSION CONTROLLED SPARK SYSTEM SIX-CYLINDER ENGINE

GENERAL DESCRIPTION

Control of exhaust emission emitted by vehicles using the six-cylinder engine, is accomplished by preventing ignition vacuum advance when the vehicle is operating in low forward gears.

Vacuum advance is controlled by a solenoid-operated valve, which is energized by grounding a normally open switch at the transmission. When the solenoid is in the non-energized position, vacuum to the distributor advance unit is shut off and the distributor is vented to atmosphere through a filter at the opposite end of the solenoid — venting the distributor advance unit prevents it from becoming locked at an advanced position. When the solenoid is energized, the vacuum port is uncovered and the plunger is seated at the opposite end, shutting off the clean air vent. High gear deceleration throttle blade setting is performed with the solenoid de-energized.

The CEC solenoid is controlled by two switches and a time relay. The solenoid is energized in the high forward gear and in reverse on Hydra-matic by a transmission operated switch. A thermostatic coolant temperature switch is used to provide thermal override below 82°F. The time relay is incorporated in the circuit to energize the CEC valve for 20 seconds after the ignition key is turned on. The relay 20 second delay begins when the ignition key is turned on, but the solenoid will remain energized as long as coolant temperature is below 82°F.

Wider throttle blade openings at idle are required to compensate for the retarded spark condition produced by the design of the emission reduction system. To prevent engine dieseling at engine shut down, an idle stop solenoid is provided. The ignition activated idle stop solenoid eliminates dieseling tendencies by allowing the throttle valve to close beyond the normal idle position when the ignition is turned off.

SYSTEM THEORY

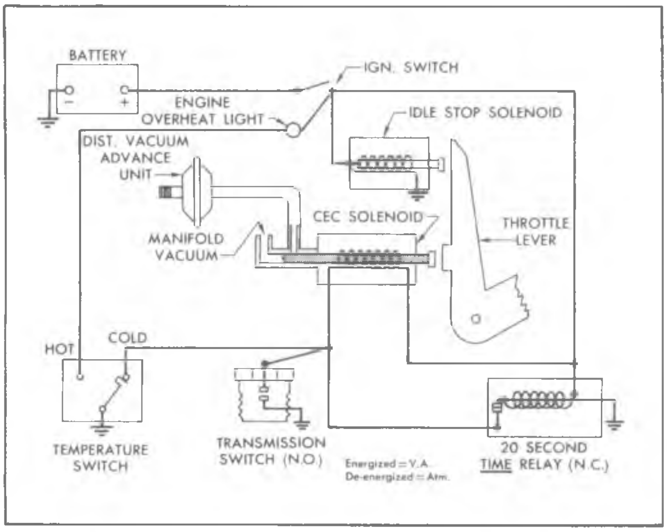


Fig. 6T-1—L-6 TCS System (Engine Off)

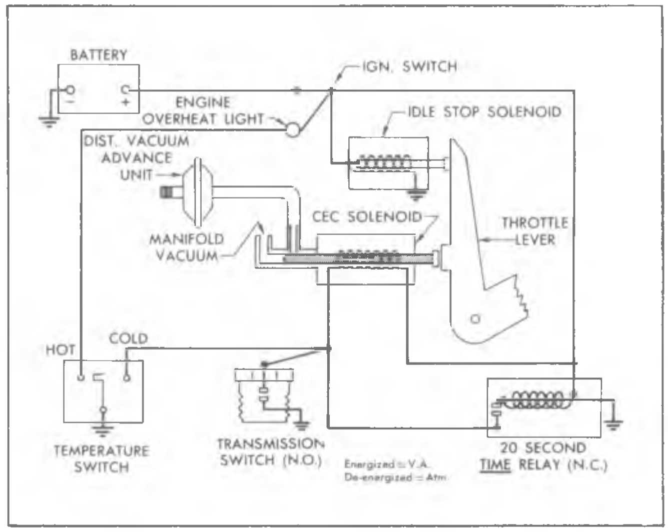


Fig. 6T-3—L-6 TCS System (Low Gear Operation)

The TCS system components are shown in their normal at rest position with the engine off and cold (fig. 6T-1). The temperature switch points are closed, making contact with the cold terminal; the time relay points are closed, transmission switch points are open; CEC solenoid is de-energized, plunger retracted and blocking distributor vacuum advance and opening distributor vacuum advance unit to atmosphere; idle stop solenoid is de-energized with plunger retracted.

When the ignition switch is turned on the idle stop solenoid is energized, extending the plunger to contact the throttle lever. A circuit is completed from the ignition switch through the CEC solenoid and through the temperature switch cold terminal to ground. At the same time another circuit is energized — this is from the ignition switch through the time relay coil and to ground, also as long as the relay points are closed it provides a path to ground for the CEC solenoid (fig. 6T-2). With either one or both of the above circuits complete, the CEC solenoid is energized; permitting vacuum advance to distributor and, additionally, the CEC solenoid plunger extends, contacting the throttle lever to provide deceleration control at a preset value.

In low gear operation, with engine temperature above 82 degrees, the temperature switch cold override points open (fig. 6T-3). If 20 seconds have elapsed the time relay points are open also. This breaks the circuit(s) de-energizing the CEC solenoid, allowing the plunger to block vacuum and open advance unit to atmosphere — deceleration control is no longer effective, leaving throttle control to be performed by the idle stop solenoid.

When the transmission is shifted into high forward gear, the transmission switch points are closed by shift action or by oil pressure as applicable (fig. 6T-4). This completes the circuit from the ignition switch through the

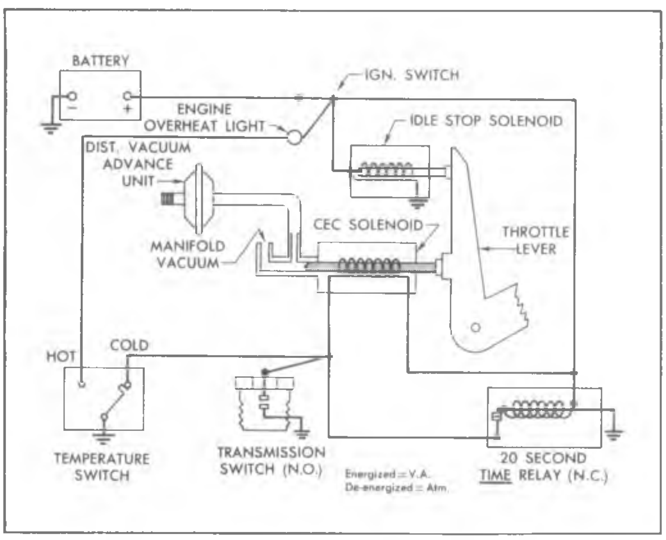


Fig. 6T-2—L-6 TCS System (Cold Override & Time Relay Energized)

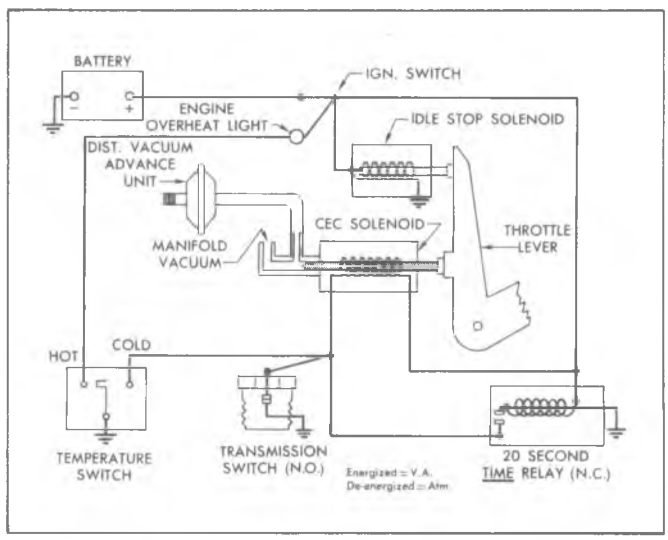


Fig. 6T-4—TCS System (High Gear Operation)

CEC solenoid and through the closed transmission switch points to ground. The CEC solenoid plunger is extended to provide deceleration control and to open the vacuum port to the advance unit.

COMPONENT DESCRIPTION

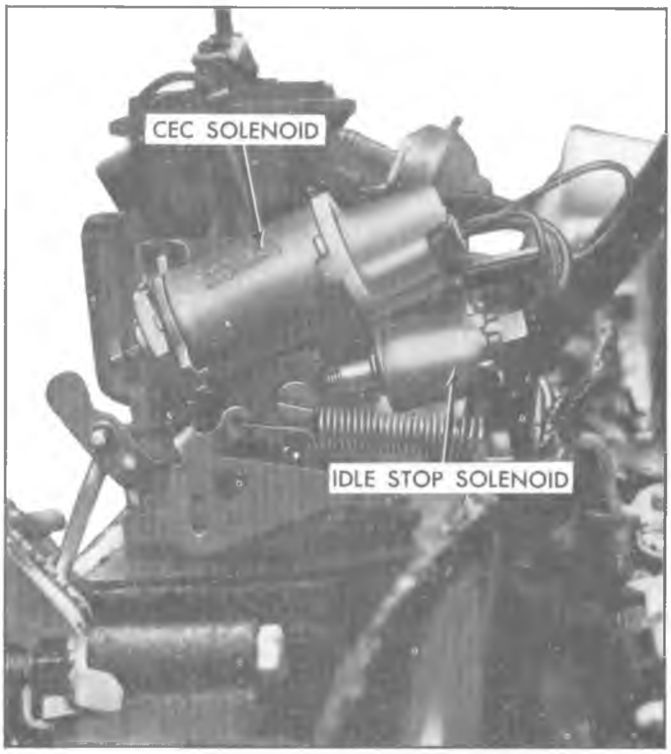


Fig. 6T-5—L-6 Idle Stop and CEC Solenoids

IDLE STOP SOLENOID

The idle stop solenoid is a two position electrically operated control, used to provide a predetermined throttle setting (fig. 6T-5). In the energized position (plunger extended) the plunger contacts the carburetor throttle lever and prevents full closing of the carburetor throttle plates. This fast idle control when de-energized (plunger retracted) allows throttle plates to close beyond the normal idle position; thereby shutting off air supply and in essence starving the engine so that it will shut down without dieseling. The idle stop solenoid is bracket-attached to the carburetor so that the plunger, when extended, contacts the throttle lever.

CEC SOLENOID

The CEC solenoid (fig. 6T-5) is a two-position electrically operated control, which serves a dual function in the TCS system. In the de-energized position the spring loaded plunger closes the vacuum supply port to the distributor advance unit and opens the air vent to the advance unit. In the energized position the plunger is extended to contact the carburetor throttle lever and to open the vacuum port to the distributor and to shut off the air vent. The solenoid is bracket-attached to the carburetor so that the plunger, when extended, contacts the throttle lever to maintain a predetermined engine RPM.

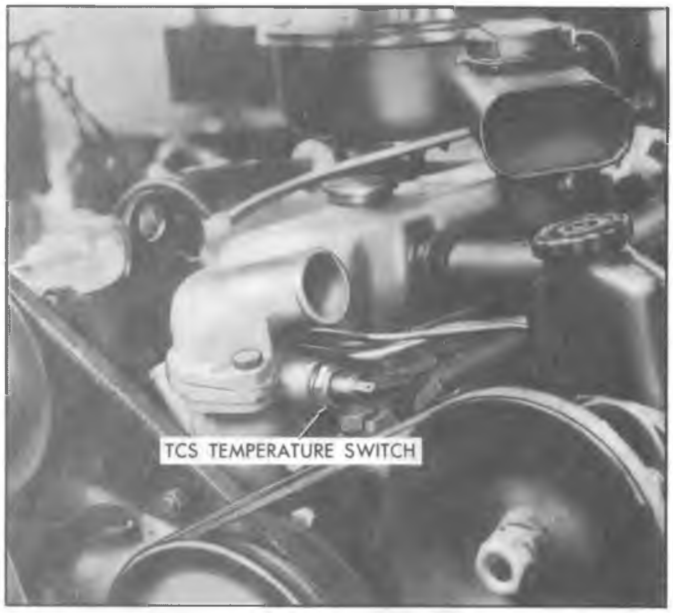


Fig. 6T-6—L-6 Temperature Cold Override Switch

TIME RELAY

The time relay is an electrically operated on-off type switch. When the coil is energized it begins to heat the bi-metal strip to open the normally closed relay points in approximately 20 seconds. A ground path is provided for through the relay housing and mounting bracket. Two self-tapping screws attach the relay to the vertical wall of the cowl and below the brake main cylinder.

TEMPERATURE COLD OVERRIDE SWITCH

The cold override switch, located in the thermostat housing (fig. 6T-6) serves to activate the CEC solenoid. At coolant temperatures below 82 (±7) degrees, the cold

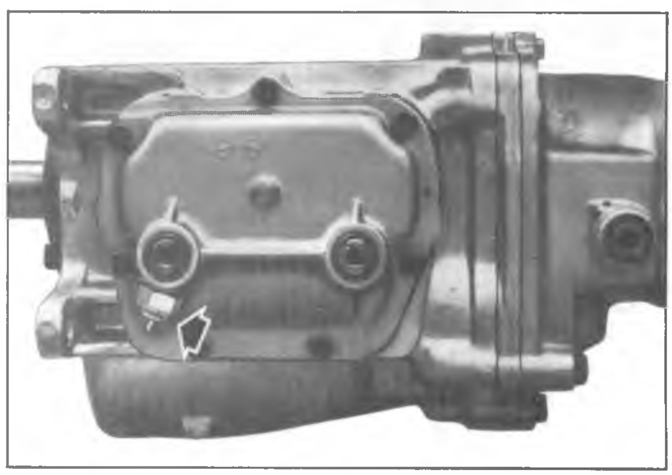


Fig. 6T-7—Transmission Switch Location (Manual)

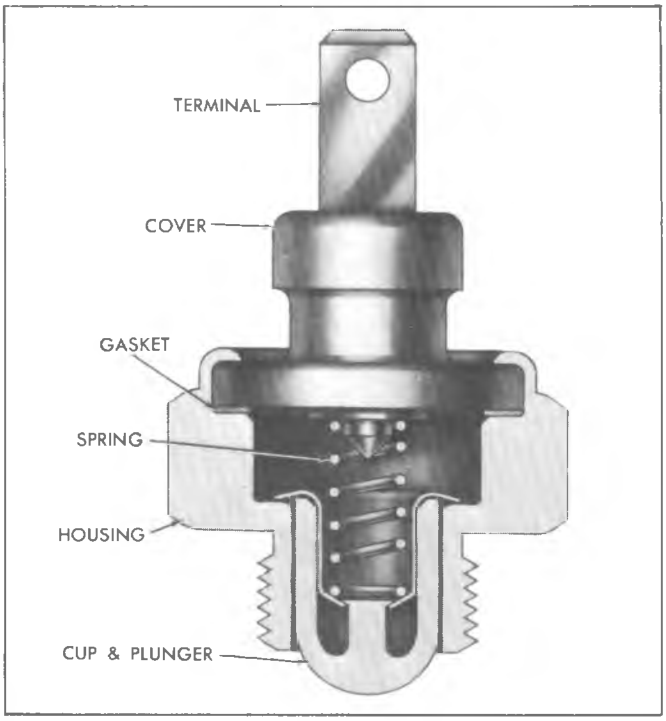


Fig. 6T-8—Manual Transmission Switch (Sectional View)

terminal is contacted by the bi-metallic strip to ground and completes the circuit to the CEC solenoid. In the neutral position, no contact is made; therefore the circuit is broken.

TRANSMISSION SWITCH

On manual shift synchromesh transmissions, both 3- and 4-speed, the switch is located on the outside of the transmission case in an area adjacent to the 2-3 or 3-4 shifter shaft, as applicable (fig. 6T-7). The mechanically

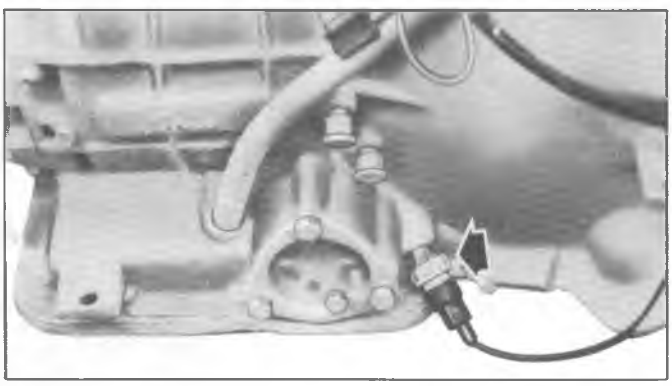


Fig. 6T-9—Powerglide Transmission Switch Location

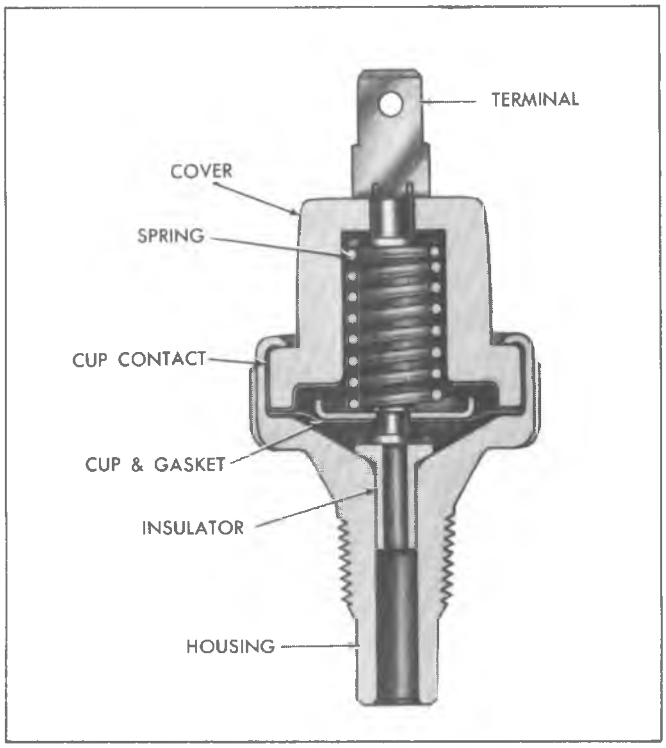


Fig. 6T-10—Powerglide Transmission Switch (Sectional View)

operated switch is spring loaded to provide continuity between the switch terminal and the switch housing (fig. 6T-8). The molded top and the plunger are non-conductors and therefore insulate the cup contact and switch terminal when the plunger is depressed. When installed in the transmission, the plunger contacts the shifter shaft, which causes the plunger to retract in low forward gears. When the transmission is shifted into high forward gear, the plunger drops into a recess or flat on the shifter shaft, causing the plunger to rest on the switch housing. A circuit is completed to ground, from the transmission through the switch housing to the cup contact and through the spring to the electrical terminal.

The Powerglide transmission uses a pressure sensitive switch, which is activated by transmission fluid pressure. The Powerglide switch (fig. 6T-9) is located externally in a boss adjacent to the low servo and activated by high clutch pressure. At rest, in or out of the installed position, the switch is in a normally open position (fig. 6T-10). Construction of the switch is such that a spring loaded diaphragm that contains a metallic contact, is held away from a cup contact, which in turn, is in contact with the switch housing. Transmission fluid pressure, against the insulated plug, forces the diaphragm upward so that the diaphragm contact closes the circuit through the spring to the electrical terminal.

COMPLAINT

Excessive Creep at Idle
High Hole Speeds
Dieseling

COMPLAINT

Poor High Gear Performance
Stumble–Stall–Cold or Hot Start
Excessive Fuel Consumption
Deceleration Exhaust "Pop"

CAUSE

Malfunction in TCS System Component. Check for: Blown fuse–Loose connections–Broken Wire–Broken or Disconnected hoses Proper ground at all components–Proper routing of hoses.

CAUSE

Idle Stop Solenoid Inoperative

CAUSE

C E C Solenoid Energized at all Times

CAUSE

Inoperative C E C Solenoid

Step 1
Inoperative Idle Stop Solenoid

1. Check for free movement of plunger.
2. Check for incorrectly adjusted plunger (out too far).
3. With ignition off-solenoid should de-energize.
4. If solenoid de-energizes–proceed to Step 2.

Step 2
Inoperative C E C Solenoid

1. Check for free movement of plunger.
2. Check for incorrectly adjusted plunger.
3. Remove connector from solenoid and apply 12 volts across terminals. If solenoid does not energize it is defective.
4. Turn ignition on and remove black lead from connector, solenoid should de-energize.
5. If solenoid was not at fault proceed to Step 3.

Step 3
Inoperative Time Relay

1. Remove temperature switch connector.
2. Check relay to make sure that it is cool, then turn ignition on.
3. Solenoid should energize for 20 seconds and then de-energize. If it does not de-energize, remove blue lead from time relay. Solenoid will de-energize if relay is at fault. Proceed to Step 4 if relay is not at fault.

Step 4
Inoperative Transmission Switch

1. Start engine and put transmission in reverse on Hydramatic or high on manuals and Powerglide. (Powerglide equipped vehicles must have rear wheels off floor and upshifted into high.)
2. When transmission is placed in position required for test. the CEC Solenoid should energize. If it does not energize, remove connector at switch and ground the terminal if solenoid energizes the switch is faulty.
3. If the switch is not at fault proceed to Step 5.

Step 5
Temperature Switch Malfunction

1. Cold engine–Turn the ignition switch on. If the CEC Solenoid plunger does not energize or if it energizes and retracts after 20 seconds, remove the switch connector and ground the cold terminal lead. This will activate the solenoid plunger, indicating a defective switch.
2. Warm engine–Allow temperature switch to cool. Then with the wires connected and switch grounded, the solenoid should energize and remain energized. If it does not the switch is defective.

Fig. 6T-10A–Trouble Shooting Guide (Six-Cylinder Engine)

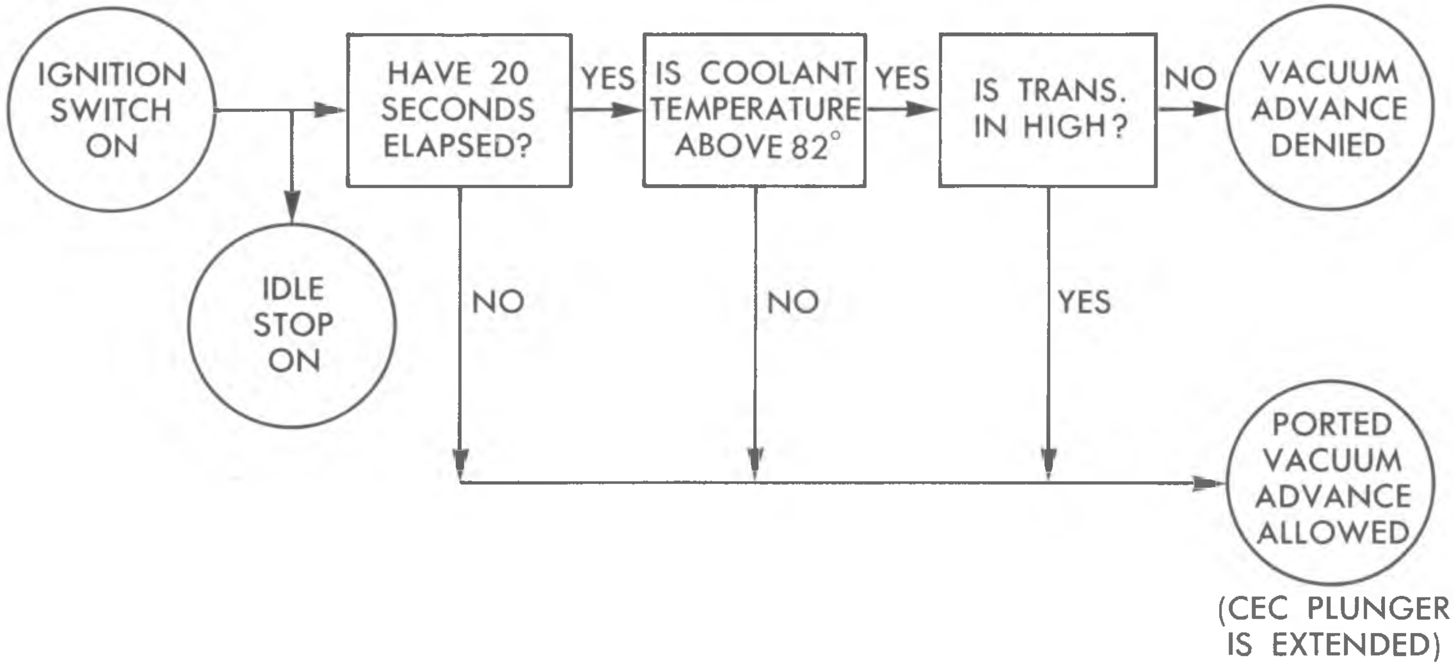


Fig. 6T-10B—Vacuum Advance Diagram (Six-Cylinder Engine)

TRANSMISSION CONTROLLED SPARK SYSTEM SMALL BLOCK V8 ENGINE

GENERAL DESCRIPTION

Control of exhaust emissions emitted by vehicles using the small block V8 engine, is accomplished by eliminating ignition vacuum advance when the vehicle is operating in low forward gears.

Vacuum advance is controlled by a solenoid-operated switch, which is energized by grounding a normally open switch at the transmission. When the solenoid is in the non-energized position, vacuum to the distributor advance unit is denied and the distributor is vented to atmosphere through a filter at the opposite end of the solenoid — venting the distributor advance unit prevents it from becoming locked at an advanced position. When the solenoid is energized, the vacuum port is uncovered and the plunger is seated at the opposite end, shutting off the clean air vent.

The vacuum advance solenoid is controlled by two switches and a delay relay. The solenoid is energized in the high forward gear (and in reverse on Hydra-matic) by a transmission operated switch. A thermostatic coolant temperature switch is used to provide thermal override below 82°F.

Wider throttle blade openings at idle are required to compensate for the retarded spark condition produced by the design of the emission reduction system. To prevent engine dieseling at engine shut down, an idle stop solenoid is provided. The ignition activated idle stop solenoid eliminates dieseling tendencies by allowing the throttle valve to close beyond the normal idle position when the ignition is turned off.

SYSTEM THEORY

The system components are shown in their normal at rest position with the engine off and cold (fig. 6T-11). The temperature switch points are closed, making contact with the cold terminal; the delay relay points are open; transmission switch points are open; idle stop solenoid is de-energized and plunger retracted; vacuum advance solenoid is de-energized with plunger shutting off the port to vacuum advance unit.

When the ignition switch is turned on, the idle stop solenoid is energized, extending the plunger to contact the throttle lever. A circuit is completed from the ignition switch through the vacuum advance solenoid and to ground through the temperature switch (fig. 6T-12). The solenoid plunger moves to open the vacuum port and block the fresh air vent. The vacuum advance solenoid remains energized as long as the temperature switch cold contact remains closed.

In low gear operation, with engine temperature above 82 degrees, the temperature switch cold override points

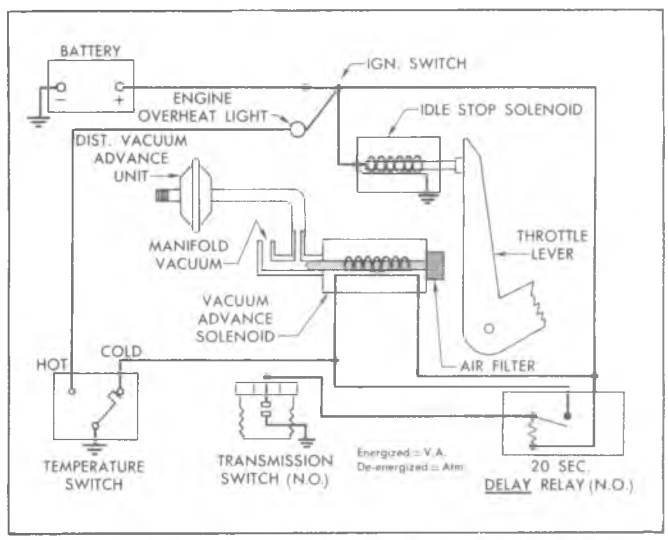


Fig. 6T-12—Small V8 TCS System (Cold Override Energized)

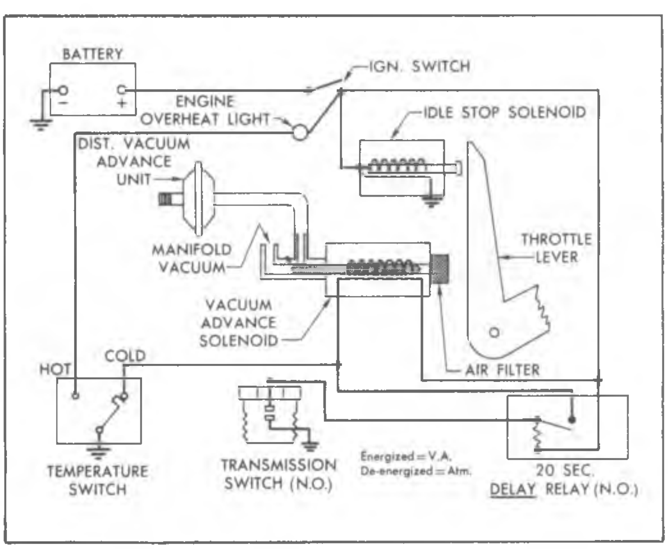


Fig. 6T-11—Small V8 TCS System (Engine Off)

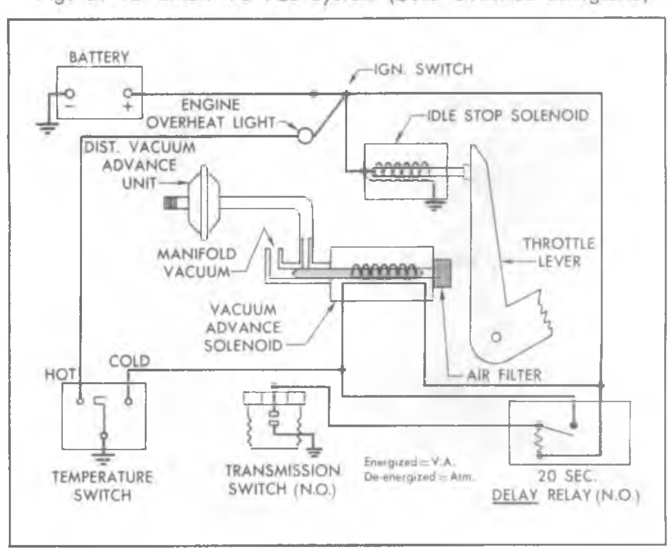


Fig. 6T-13—Small V8 TCS System (Low Gear Operation)

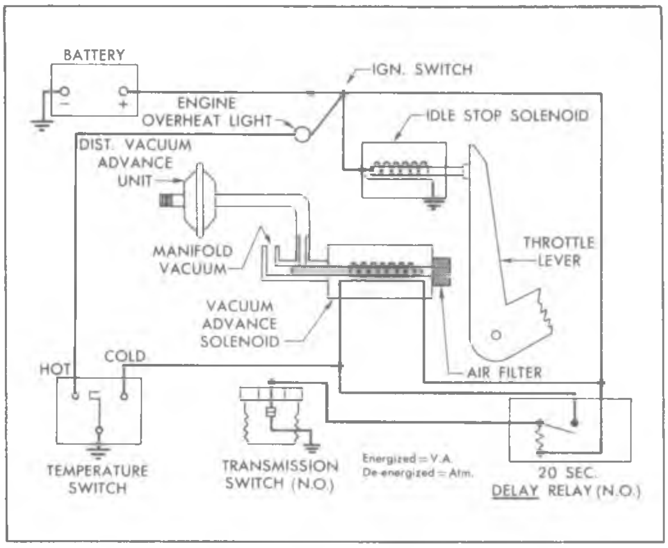


Fig. 6T-14—Small V8 TCS System (High Gear Delay Relay)

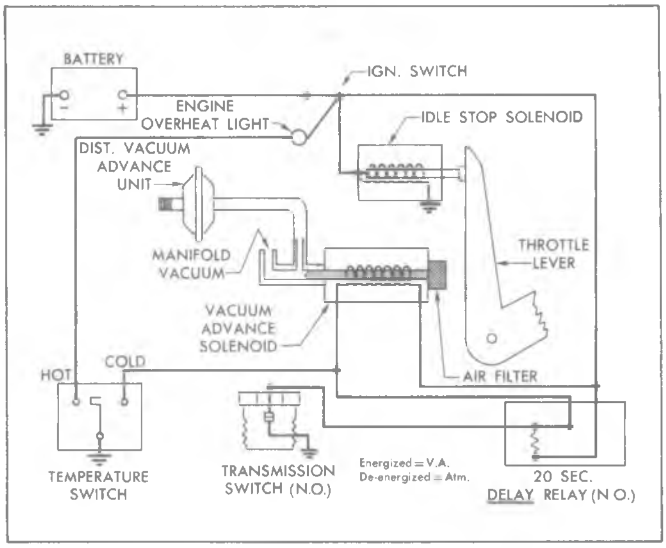


Fig. 6T-15—Small V8 TCS System (High Gear Operation)

open (fig. 6T-13). This breaks the circuit from the vacuum solenoid, allowing the plunger to block vacuum and open the advance unit to atmosphere.

When the transmission is shifted into high forward gear, the transmission switch points are closed by shift action or by oil pressure as applicable. This completes the circuit from the ignition switch through the delay relay timing circuit and through the transmission switch to ground (fig. 6T-14). Vacuum advance solenoid is not energized.

After a delay of 23 seconds (in high gear) the delay relay points close, completing the circuit through the vacuum advance solenoid to ground (fig. 6T-15). Vacuum advance to the distributor is permitted by energizing the solenoid. Subsequent interruption of the high gear position will result in a 23 second delay before the vacuum advance solenoid is energized again.

COMPONENT DESCRIPTION

IDLE STOP SOLENOID

The idle stop solenoid (fig. 6T-16) is a two position electrically operated control, used to provide a predetermined throttle setting. In the energized position (plunger extended) the plunger contacts the carburetor throttle lever and prevents full closing of the carburetor throttle plates. This fast idle control when de-energized

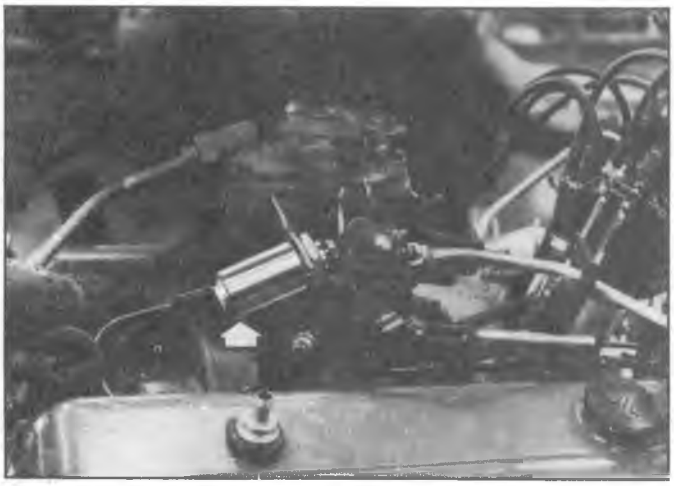


Fig. 6T-16—Small V8 Idle Stop Solenoid

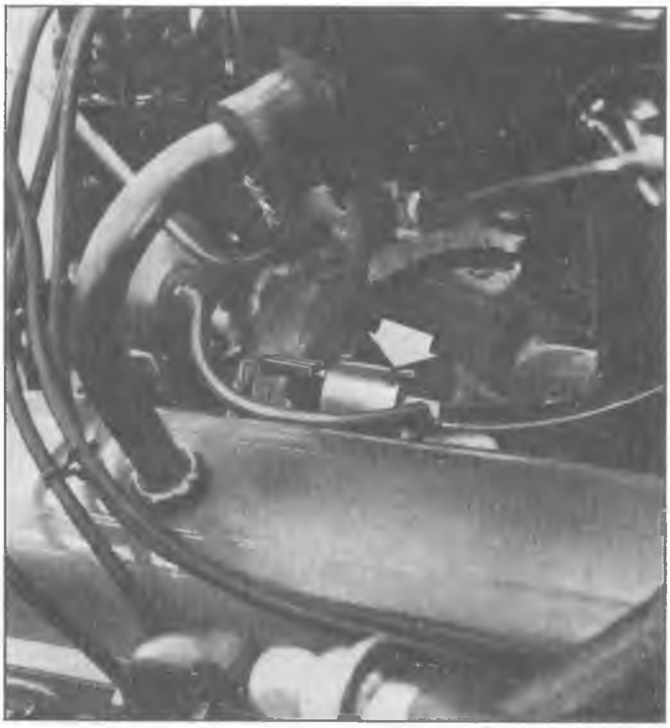


Fig. 6T-17—Small V8 Vacuum Advance Solenoid

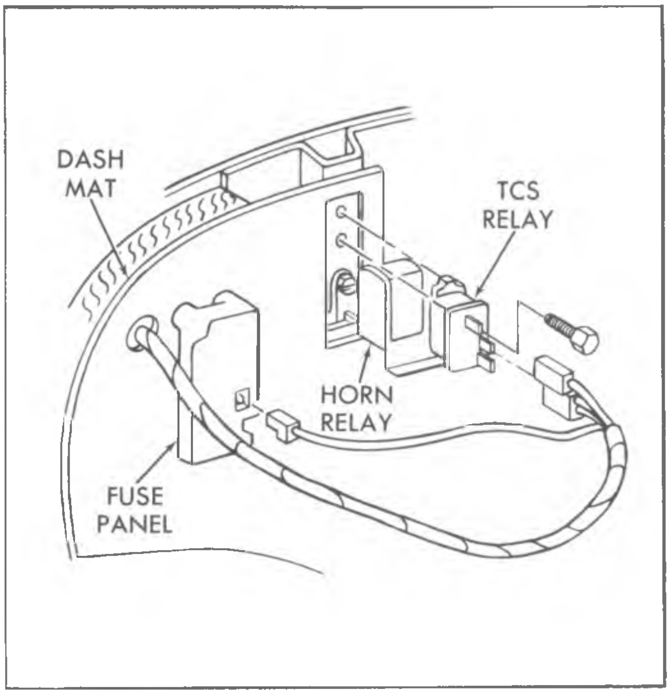


Fig. 6T-18—Small V8 Time Delay Relay

(plunger retracted) allows throttle plates to close beyond the normal idle position; thereby shutting off air supply and in essence starving the engine so that it will shut down without dieseling. The idle stop solenoid is bracket-attached to the carburetor so that the plunger, when extended, contacts the throttle lever.

VACUUM ADVANCE SOLENOID

The vacuum advance solenoid is located on the right rear portion of the inlet manifold (fig. 6T-17). This electrically operated two-position plunger controlled valve serves to supply or deny vacuum to the distributor vacuum advance unit. In the energized position, the plunger opens the vacuum port from the carburetor to the vacuum advance unit. In opening the vacuum port the plunger simultaneously closes the clean air port at the

Fig. 6T-19—Small V8 Temperature Switch (Right Head)

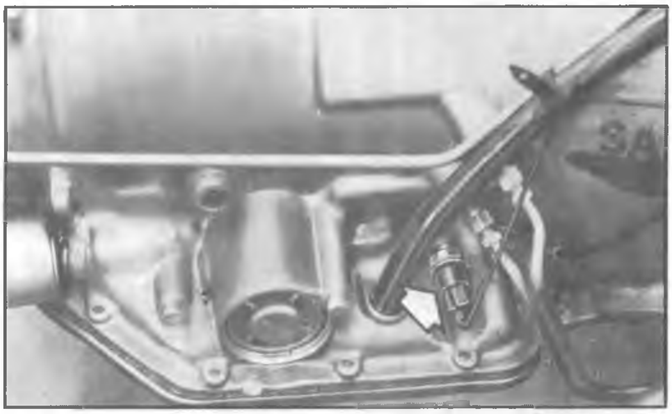


Fig. 6T-20—Turbo Hydra-matic 350 Transmission Switch

opposite end. In the de-energized position the spring loaded plunger seats against the vacuum inlet and opens the distributor advance unit to the clean air vent.

TIME RELAY

The time relay is a solid state timing device designed to delay circuit continuity for a minimum of 20 seconds, after the transmission has been shifted into high forward gear. Delaying circuit completion delays vacuum advance. Any opening of the transmission switch contacts (downshift) of more than one or two seconds, causes the relay to recycle and deny vacuum advance for another 20 seconds. A transmission switch interruption of less than one second will disable the time relay and prevent vacuum advance until the next upshift cycle.

The time relay is located in the passenger compartment on the dash and toe panel between the fuse block and the steering column (fig. 6T-18).

TEMPERATURE SWITCH

The TCS system temperature switch is located in the right cylinder head between the number 6 and number 8 exhaust port (fig. 6T-19).

The switch is a two-position single terminal control which provides a path to ground, for the cold override feature, when engine coolant temperatures are below 82 degrees. The "off" or "neutral" position is maintained at engine coolant temperatures above 82 degrees.

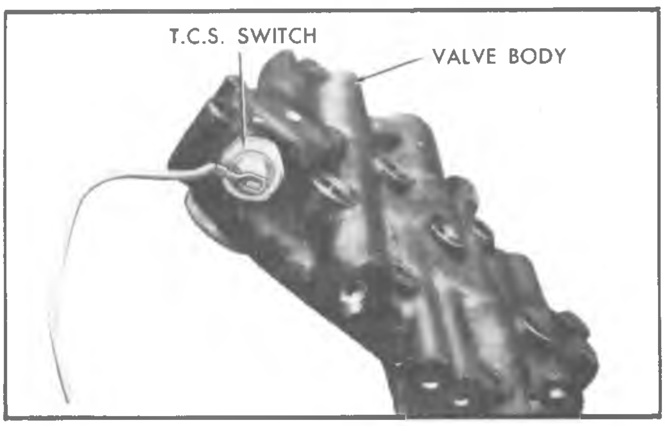


Fig. 6T-21—Turbo Hydra-matic 400 TCS Switch Location

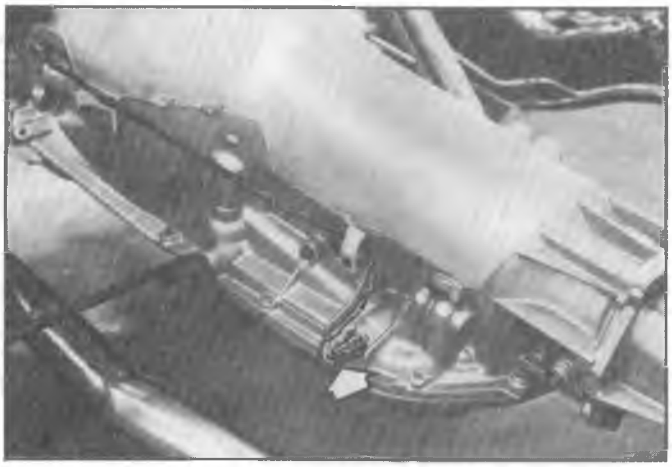


Fig. 6T-22—Turbo Hydra-matic 400 TCS Connection

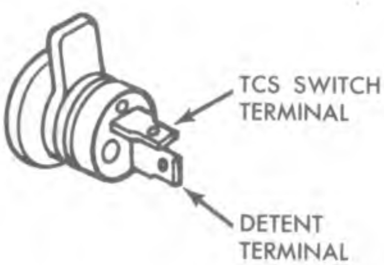


Fig. 6T-23—Turbo Hydra-matic 400 TCS Connection Terminal Identification

TRANSMISSION SWITCH

On manual shift synchromesh transmissions, both 3- and 4-speed, the switch is located on the outside of the transmission case in an area adjacent to the 2-3 or 3-4 shifter shaft, as applicable (fig. 6T-7). The mechanically operated switch is spring loaded to provide continuity between the switch terminal and the switch housing. The molded top and the plunger are non-conductors and therefore insulate the cup contact and switch terminal when the plunger is depressed. When installed in the transmission, the plunger contacts the shifter shaft, which causes the plunger to retract in low forward gears.

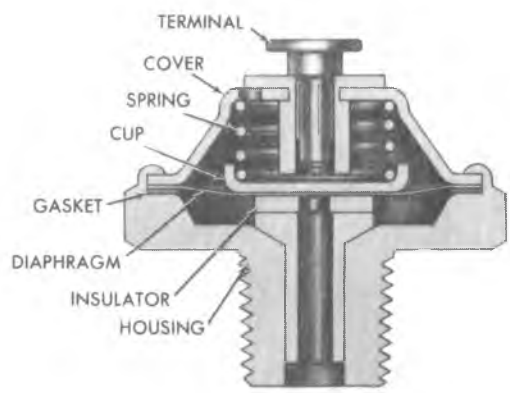


Fig. 6T-24—Turbo Hydra-matic 400 TCS Switch (Sectional View)

When the transmission is shifted into high forward gear, the plunger drops into a recess or flat on the shifter shaft, causing the plunger to extend and allow the cup contact to rest on the switch housing (fig. 6T-8). A circuit is completed to ground, from the transmission through the switch housing to the cup contact and through the spring to the electrical terminal.

The Turbo Hydra-matic 350 transmissions use a pressure sensitive switch, which is activated by transmission fluid pressure. The switch for Turbo Hydra-matic is installed externally in the 2-3 direct clutch pressure tap (fig. 6T-20). At rest, in or out of the installed position, the switch is in a normally open position. Construction of the switch is such that a spring loaded diaphragm that contains a metallic contact, is held away from a cup contact, which in turn, is in contact with the switch housing (fig. 6T-10). Transmission fluid pressure, against the insulated plug, forces the diaphragm upward so that the diaphragm contact closes the circuit through the spring to the electrical terminal.

The Turbo Hydra-matic 400 transmission also uses a pressure sensitive switch which is activated by transmission fluid pressure. However, the TCS switch is located internally in the transmission (fig. 6T-21). From its location in the valve body the switch is connected to the externally located, combination detent solenoid and TCS connector (figs. 6T-22 and 6T-23). The normally open switch is constructed so that a spring loaded metallic diaphragm is held away from the terminal in the switch. Transmission fluid pressure forces the diaphragm upward so that the spring seat contacts the electrical terminal to provide continuity through the grounded housing (fig. 6T-24).

COMPLAINT

Engine Stalls at Idle
Excessive Creep at Idle
High Idle Speed
Dieseling

CAUSE:

Malfunction in Idle Stop Solenoid

Check for free movement of plunger.
Check for incorrectly adjusted plunger (out too far).
Solenoid should de-energize with ignition off.

COMPLAINT

Vacuum at all Times

COMPLAINT

Poor High Gear Performance
Stumble Stall on Cold Start
Excessive Fuel Consumption
Deceleration Exhaust "Pop"

Transmission Switch Malfunction

With engine warm and running, put transmission in low forward gear, the advance solenoid should be de-energized. If solenoid energizes, remove switch connection—replace transmission switch if solenoid de-energizes.

CAUSE:

Malfunction in TCS System Component
Check for: Blown fuse- Loose connections- Broken wire Broken or disconnected hoses—Proper ground at all components Proper routing of hoses.

Step 1 Inoperative Vacuum Advance Solenoid

Check vacuum at source, then connect vacuum gauge to advance unit port. With 12 volts applied to solenoid, solenoid should be energized (vacuum to distributor). Proceed to Step 2 if solenoid is not at fault.

Step 2 Inoperative Delay Relay

With the ignition on, check for 12 volts at tan lead to relay. With 12 volts applied at terminal with tan lead, ground the relay terminal with the black lead, if after 26 seconds the advance solenoid does not energize—replace the relay. Proceed to Step 3 if relay is not at fault.

Step 3 Inoperative Temperature Switch

On a cold engine the vacuum advance solenoid should be energized, if not - ground the wire from the cold terminal of the temperature switch. If solenoid energizes, replace the temperature sending unit. Proceed to Step 4 if unit is not at fault.

Step 4 Inoperative Transmission Switch

With engine warm and running, put transmission in reverse on Hydra-matic or high on manuals and Powerglide. (Powerglide equipped vehicles must have rear wheels off floor and shifted into high gear.), solenoid should be energized. If not remove and ground connector at switch - replace switch if solenoid energizes.

Fig. 6T-24A—Trouble Shooting Guide (Small V8)

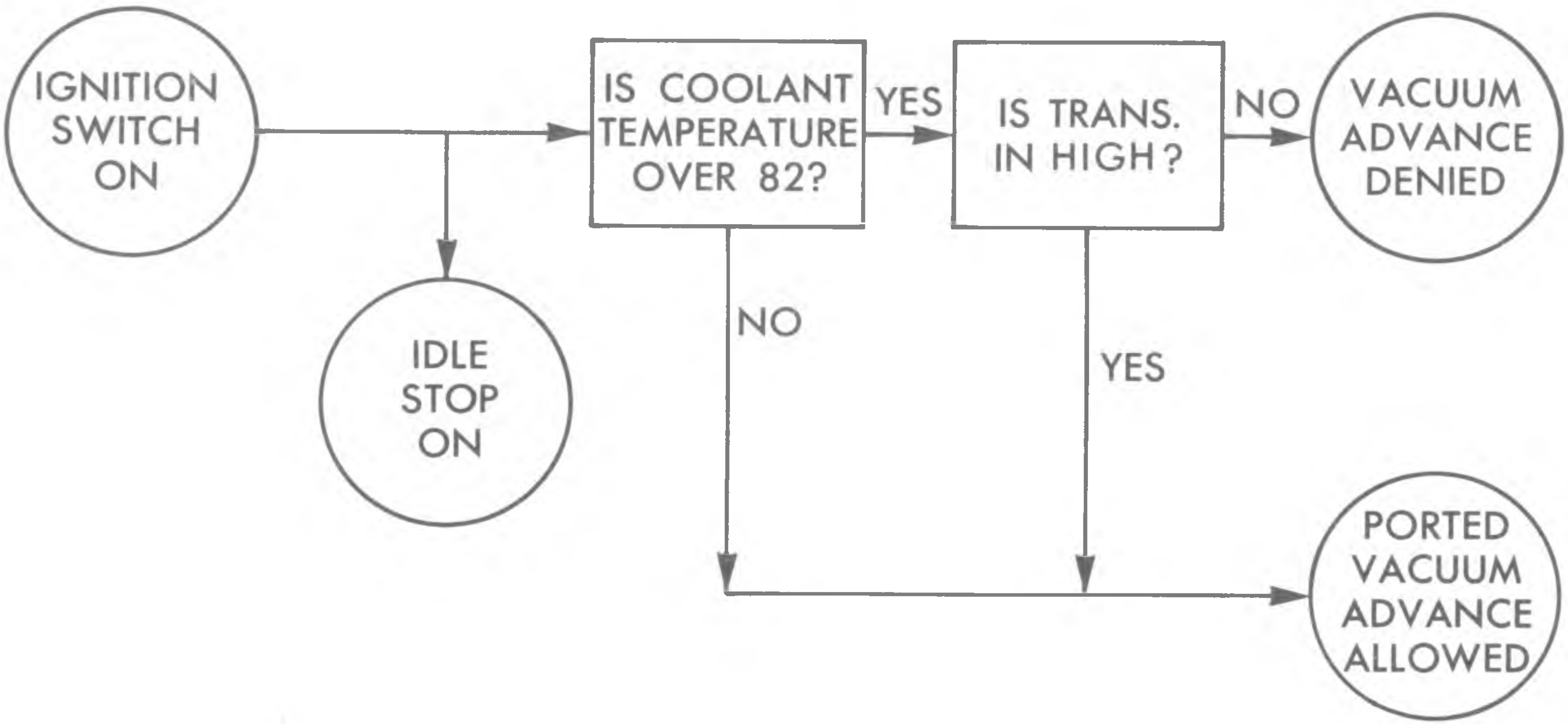


Fig. 6T-24B—Vacuum Advance Diagram (Small V8)

TRANSMISSION CONTROLLED SPARK SYSTEM

MARK IV V8 ENGINE

GENERAL DESCRIPTION

Control of exhaust emissions emitted by vehicles using the Mark IV V8 engine, is accomplished by eliminating ignition vacuum advance when the vehicle is operating in low forward gears.

Vacuum advance is controlled by a solenoid-operated switch, which is energized by grounding a normally open switch at the transmission. When the solenoid is in the non-energized position, vacuum to the distributor advance unit is denied and the distributor is vented to atmosphere through a filter at the opposite end of the solenoid — venting the distributor advance unit prevents it from becoming locked at an advanced position. When the solenoid is energized, the vacuum port is uncovered and the plunger is seated at the opposite end, shutting of the clean air vent.

The vacuum advance solenoid is controlled by two switches. The solenoid is energized in the high forward gear (and in reverse on Hydra-matic) by a transmission operated switch. A thermostatic coolant temperature switch is used to provide thermal override below 82°F.

All Corvette vehicles are equipped with a dual temperature override switch. In addition to the cold override provisions provided with other vehicles, a hot override terminal is added. When coolant temperatures exceed 232°F. the thermostatic switch contacts provide a ground to energize the vacuum solenoid.

Wider throttle blade openings at idle are required to compensate for the retarded spark condition produced by the design of the emission reduction system. To prevent engine dieseling at engine shut down, an idle stop solenoid is provided. The ignition activated idle stop solenoid eliminates dieseling tendencies by allowing the throttle valve to close beyond the normal idle position when the ignition is turned off.

SYSTEM THEORY

The TCS system components are shown in their normal at rest position with the engine off and cold (fig. 6T-25). The temperature switch points are closed, making contact with the cold terminal; transmission switch points are open; idle stop solenoid is de-energized and plunger retracted vacuum advance solenoid is de-energized with plunger shutting off the port to vacuum advance unit.

When the ignition switch is turned on, the idle stop solenoid is energized, extending the plunger to contact the throttle lever. A circuit is completed from the ignition switch through the vacuum advance solenoid and to ground through the temperature switch (fig. 6T-26). The solenoid plunger moves to open the vacuum port and block the fresh air vent. The vacuum advance solenoid remains energized as long as the temperature switch cold contact remains closed.

In low gear operation, with engine temperature above 82 degrees, the temperature switch cold override points open (fig. 6T-27). This breaks the circuit from the vacuum solenoid, allowing the plunger to block vacuum and open advance unit to atmosphere.

When the transmission is shifted into high forward gear, the transmission switch points are closed by shift action or by oil pressure as applicable. This completes the circuit from the ignition switch through the vacuum advance solenoid and through the closed transmission switch points to ground (fig. 6T-28).

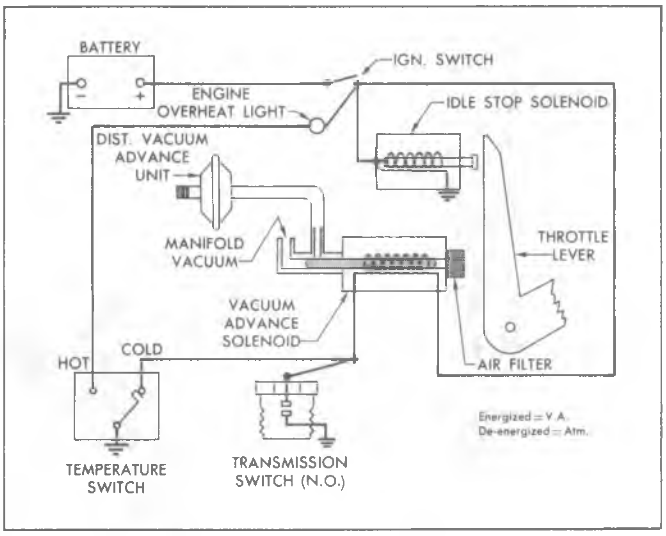


Fig. 6T-25—Mark IV V8 TCS System (Engine Off)

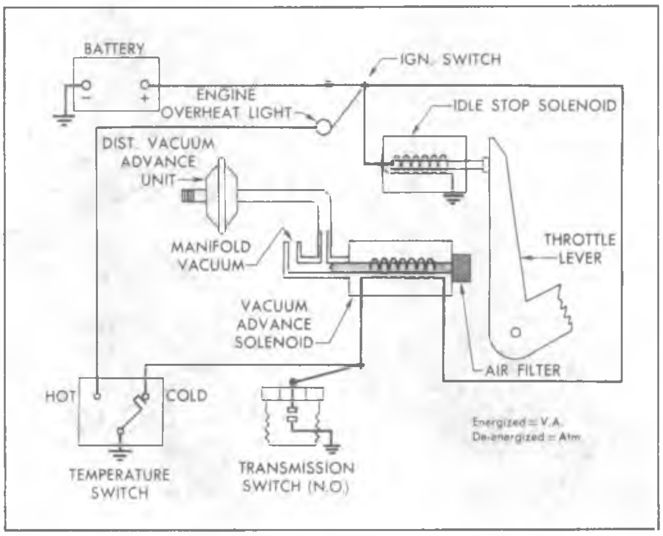


Fig. 6T-26—Mark IV V8 TCS System (Cold Override Energized)

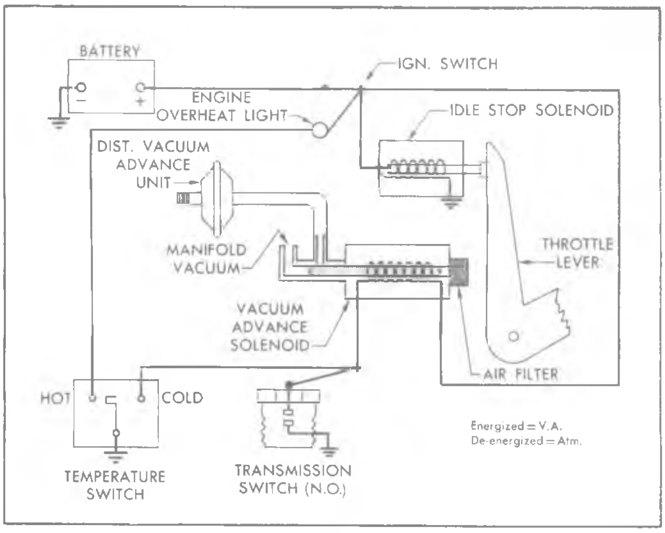


Fig. 6T-27—Mark IV V8 TCS System (Low Gear Operation)

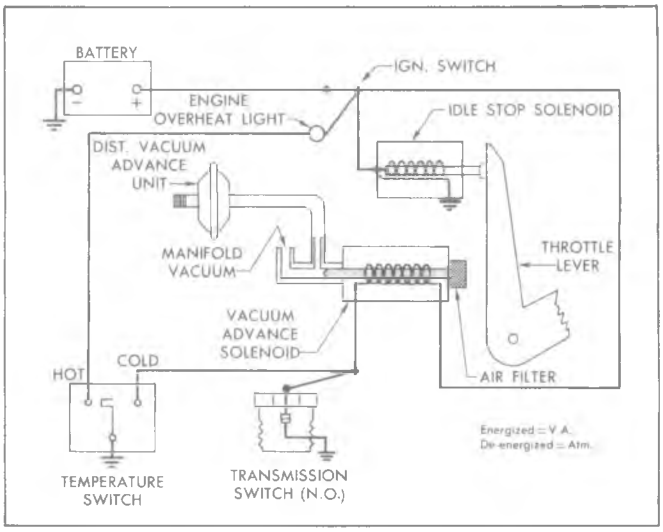


Fig. 6T-28—Mark IV V8 TCS System (High Gear Operation)

COMPONENT DESCRIPTION

IDLE STOP SOLENOID

The idle stop solenoid is a two position electrically operated control, used to provide a predetermined throttle setting. In the energized position (plunger extended) the plunger contacts the carburetor throttle lever and prevents full closing of the carburetor throttle plates. This fast idle control when de-energized (plunger retracted) allows throttle plates to close beyond the normal idle position; thereby shutting off air supply and in essence starving the engine so that it will shut down without dieseling. The idle stop solenoid is bracket-attached to the carburetor so that the plunger, when extended, contacts the throttle lever (fig. 6T-29).

Fig. 6T-29—Mark IV V8 Idle Stop Solenoid

VACUUM ADVANCE SOLENOID

The vacuum advance solenoid is located at the rear center of the inlet manifold, between the ignition distributor and the carburetor (fig. 6T-30). This electrically operated two-position plunger controlled switch serves to supply or deny vacuum to the distributor vacuum advance unit. In the energized position, the plunger opens the vacuum port from the carburetor to the vacuum advance unit. In opening the vacuum port, the plunger

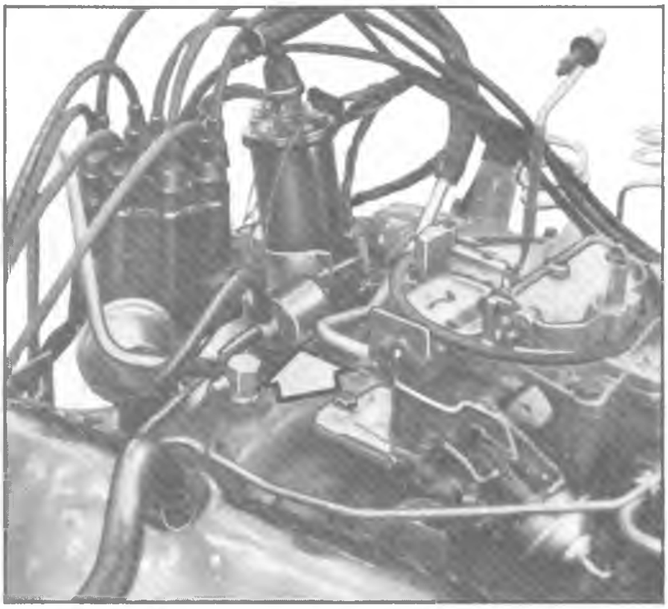


Fig. 6T-30—Mark IV V8 Vacuum Advance Solenoid simultaneously closes the clean air port at the opposite end. In the de-energized position, the spring loaded plunger seats against the vacuum inlet and opens the distributor vacuum advance unit to the clean air vent.

TEMPERATURE SWITCH

The TCS system temperature switch is located in the right cylinder head between the number 6 and number 8 exhaust port (fig. 6T-31).

The switch is a two-position single terminal control which provides a path to ground for the cold override feature, when engine coolant temperatures are below 82 degrees. The "off" or "neutral" position is maintained at engine coolant temperatures above 82 degrees.

TRANSMISSION SWITCH

On manual shift synchromesh transmissions, both 3- and 4-speed, the switch is located on the outside of the transmission case in an area adjacent to the 2-3 or 3-4 shifter shaft, as applicable (fig. 6T-7). The mechanically operated switch is spring loaded to provide continuity between the switch terminal and the switch housing. The molded top and the plunger are non-conductors and therefore insulate the cup contact and switch terminal when the plunger is depressed. When installed in the transmission, the plunger contacts the shifter shaft, which causes the plunger to retract in low forward gears. When the transmission is shifted into high forward gear, the plunger drops into a recess or flat on the shifter shaft, causing the plunger to extend and allow the cup contact to rest on the switch housing (fig. 6T-8). A circuit is completed to ground, from the transmission through the switch housing to the cup contact and through the spring to the electrical terminal.

The Turbo Hydra-matic 350 transmission uses a pressure sensitive switch, which is activated by transmission fluid pressure. The switch is installed in the 2-3 direct clutch pressure tap (fig. 6T-20). At rest in or out of the installed position the switch is in a normally open position. Construction of the switch is such that a spring loaded diaphragm that contains a metallic contact, is held away from a cup contact, which in turn, is in contact with the switch housing (fig. 6T-10). Transmission fluid pressure, against the insulated plug, forces the diaphragm upward so that the diaphragm contact closes the circuit through the spring to the electrical terminal.

Fig. 6T-31—Mark IV V8 Temperature Switch

The Turbo Hydra-matic 400 transmission also uses a pressure sensitive switch which is activated by transmission fluid pressure. However, the TCS switch is located internally in the transmission (fig. 6T-21). From its location in the valve body the switch is connected to the externally located, combination detent solenoid and TCS connector (figs. 6T-22 and 6T-23). The normally open switch is constructed so that a spring loaded metallic diaphragm is held away from the terminal in the switch. Transmission fluid pressure forces the diaphragm upward so that the spring seat contacts the electrical terminal to provide continuity through the grounded housing (fig. 6T-24).

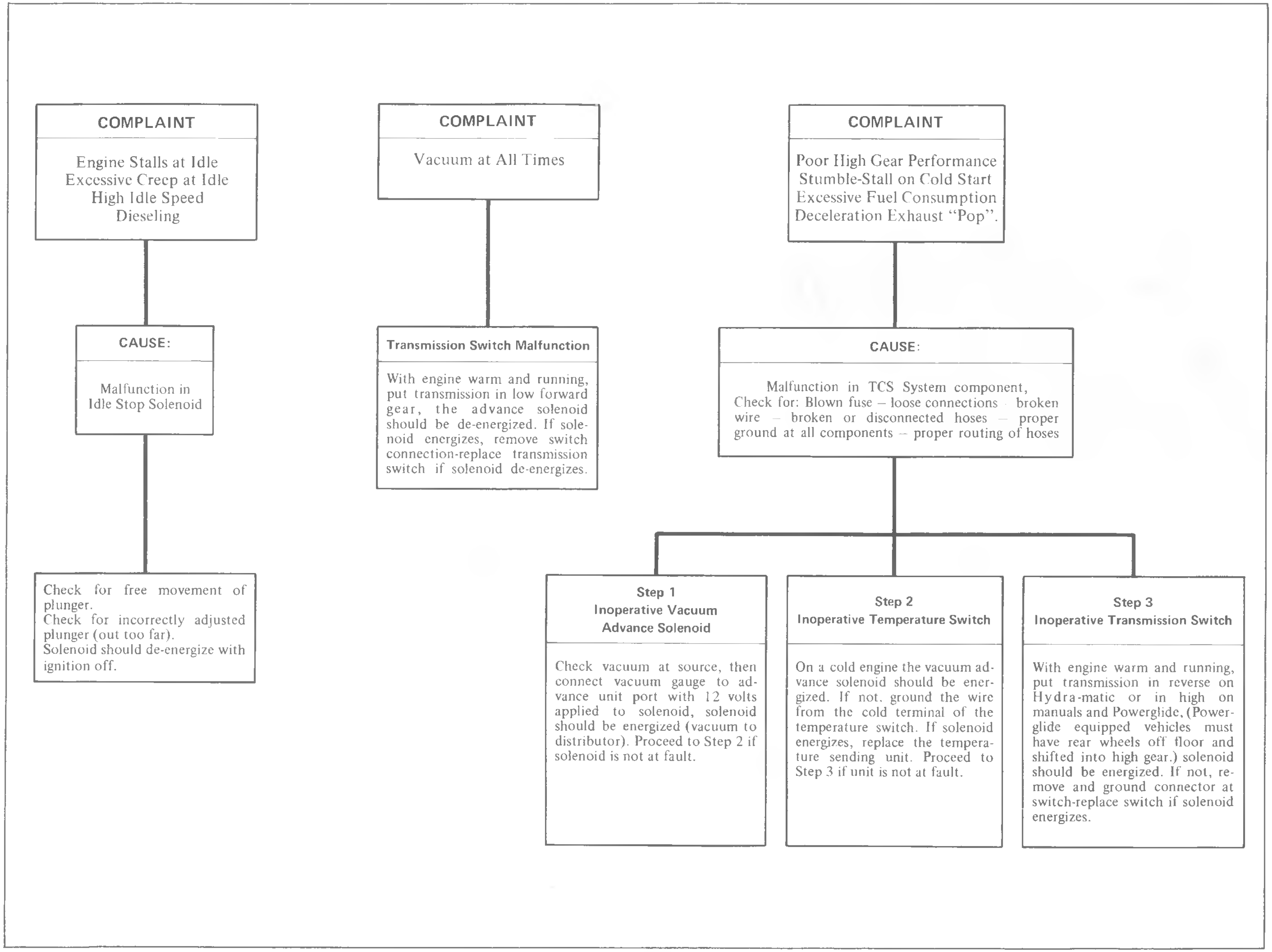


Fig. 6T-31A—Trouble Shooting Diagram (Mark IV Engine)

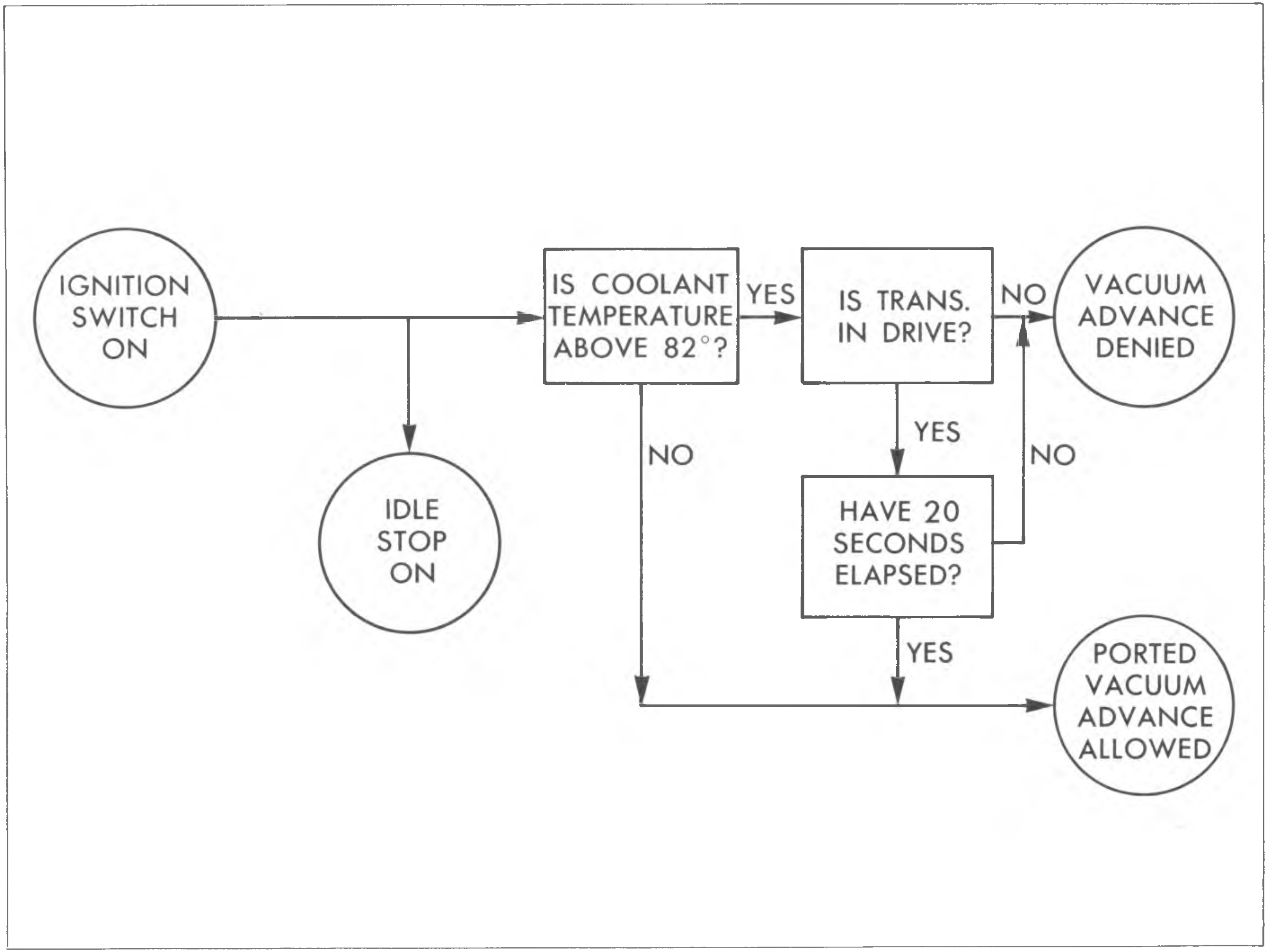


Fig. 6T-31B—Vacuum Advance Diagram (Mark IV Engine)

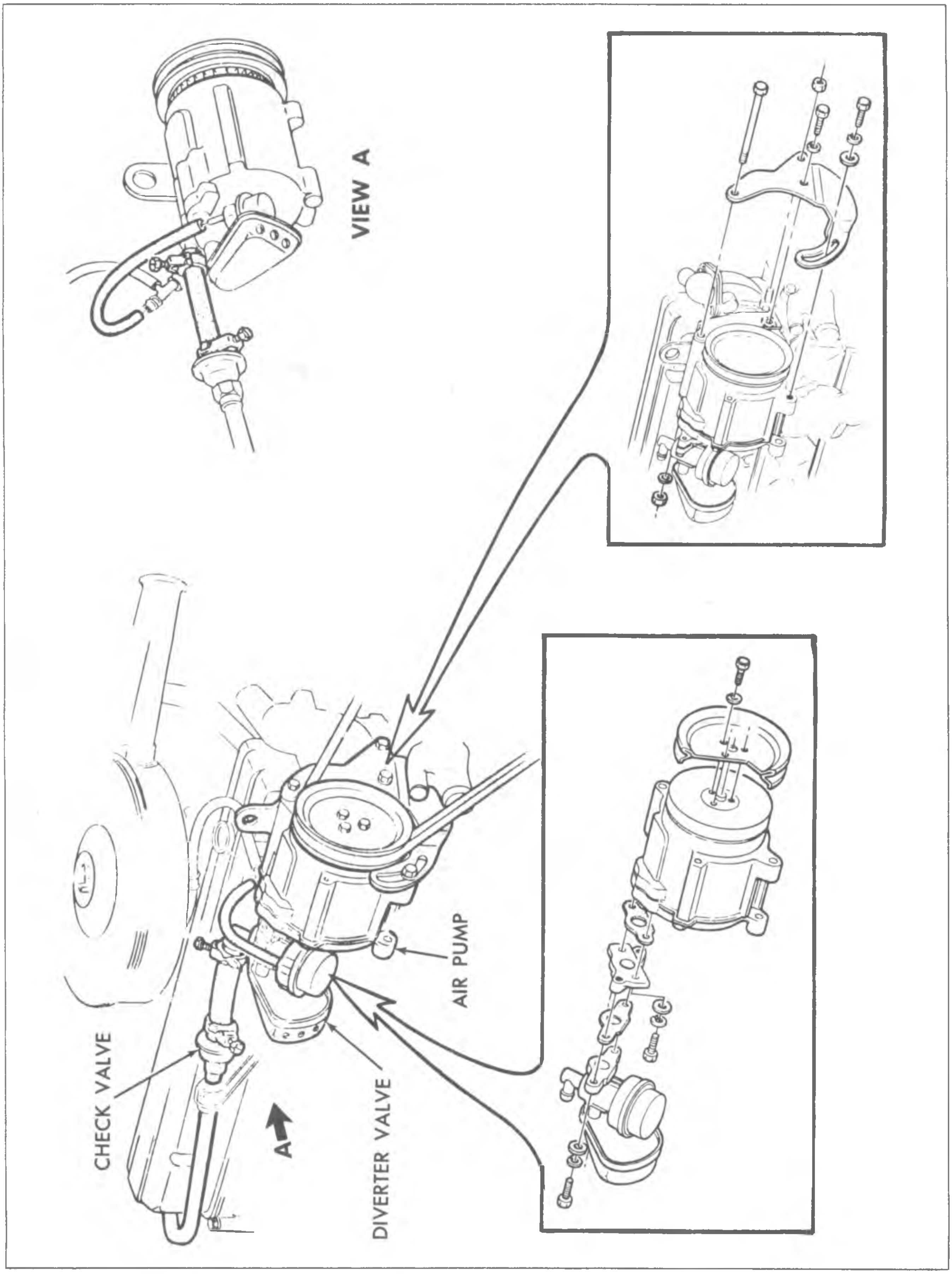


Fig. 6T-32—Six-Cylinder A.I.R. System

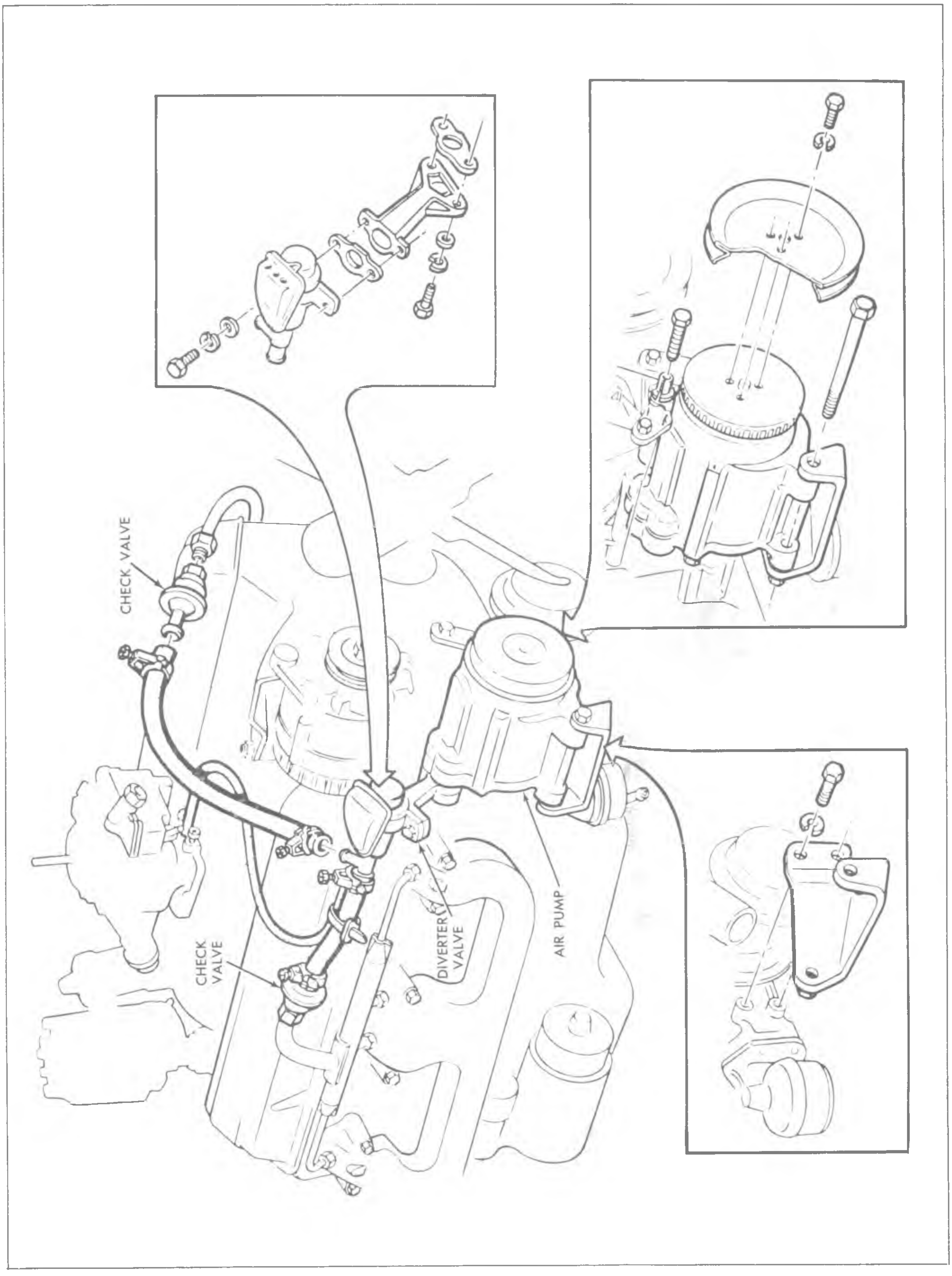


Fig. 6T-33—Eight-Cylinder A.I.R. System

AIR INJECTION REACTOR SYSTEM

GENERAL DESCRIPTION

The Air Injection Reactor (A.I.R.) System (figs. 6T-32 and 33), used on Chevrolet truck engines consists of: the air injection pump (with necessary brackets and drive attachments), air injection tubes (one for each cylinder), an air diverter valve, check valves (one for in-line engines, two for V8 engines) and air manifold assemblies, 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 engines without the A.I.R. System.

The air injection pump (fig. 6T-34) with an integral filter, 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 (fig. 6T-35) The fresh air helps burn the unburned portion of the exhaust gases in the exhaust system, thus minimizing exhaust contaminations.

The diverter valve (fig. 6T-36), when triggered by a

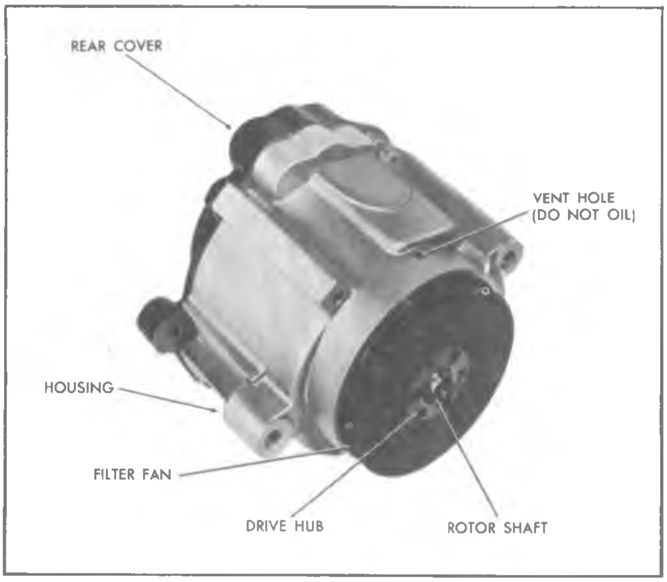


Fig. 6T-34—Air Injection Pump

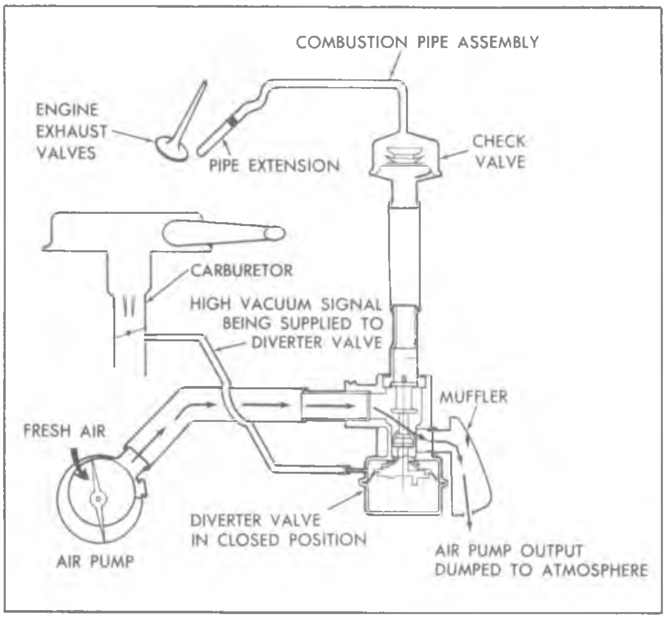


Fig. 6T-35—Schematic of A.I.R. System

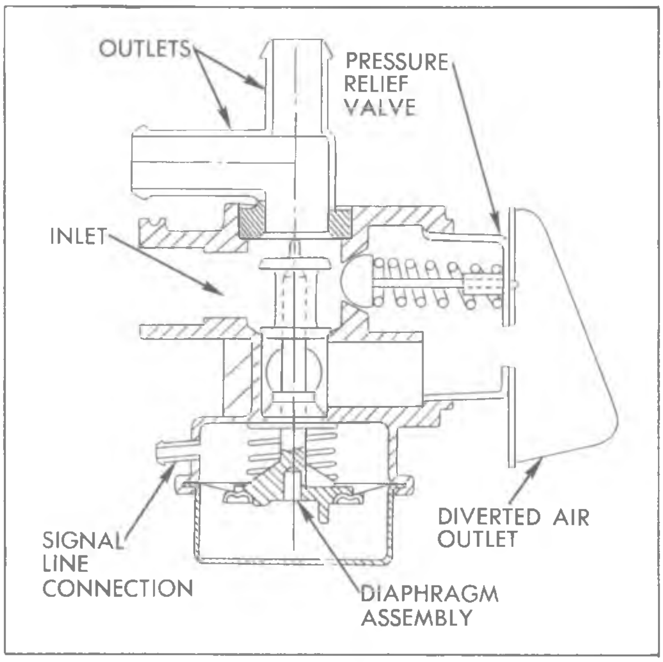


Fig. 6T-36—Diverter Valve (Typical)

sharp increase in manifold vacuum (overrun), temporarily shuts off the injected air to the exhaust port areas and prevents backfiring during this richer period.

At high engine speeds excess air is dumped through the pressure relief valve which is incorporated in the diverter valve.

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 effectively reduce exhaust emissions. 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 the 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.

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 lbs. using a strand tension gauge.

Adjustment

- Loosen pump mounting bolt and pump adjustment bracket bolt or Delcotron mounting bolt and adjustment bracket as applicable.
- Move pump or Delcotron until belt is properly tensioned then tighten adjustment bracket bolt and mounting bolt. Use a strand tension gauge to check adjustment (fig. 6T-37).

CAUTION: Do not pry on the pump housing. Distortion of the housing will result in extensive damage to the Air Injection Pump.

Fig. 6T-37—Checking A.I.R. Pump Belt Tension

Replacement

- Loosen pump mounting bolt and pump adjustment bracket bolt or Delcotron as applicable, then swing pump until drive belt may be removed.
- Install a new drive belt and adjust 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.
- 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. (fig. 6T-38).
- Recheck drive belt tension and adjust if required.

Fig. 6T-38—Tightening Pump Pulley Bolts

Fig. 6T-39—Removing Centrifugal Filter

Fig. 6T-40—Installing Centrifugal Filter

PUMP FILTER

Replacement

- Remove drive belt and pump pulley as previously outlined.
- Pry loose outer disc of filter fan.
- Pull remaining portion of filter off with pliers (fig. 6T-39).

NOTE: Care should be taken to prevent fragments from entering the air intake hole.

- Install the new filter by drawing it on with the pulley and pulley bolts (fig. 6T-40). Do not attempt to install a filter by hammering it on or pressing it on.
- Draw the filter down evenly by alternately torquing the bolts. Make certain that the outer edge of the filter slips into the housing. The slight amount of interference with the housing bore is normal.

NOTE: A new filter may squeal upon initial operation until its O.D. sealing lip has worn in.

AIR MANIFOLD, HOSE AND TUBE

Inspection

- Inspect all hoses for deterioration or holes.
- Inspect all tubes for cracks or holes.
- Check all hose and tube connections.
- Check all tube and hose routing. Interference may cause wear.
- If 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 (fig. 6T-41).

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 on L-6 or the exhaust manifolds on V8 are a straight pipe thread. Do not use a 1/4" tapered pipe tap. The hoses of the A.I.R. 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.

Fig. 6T-41—Checking for Leaks With a Soapy Water Solution

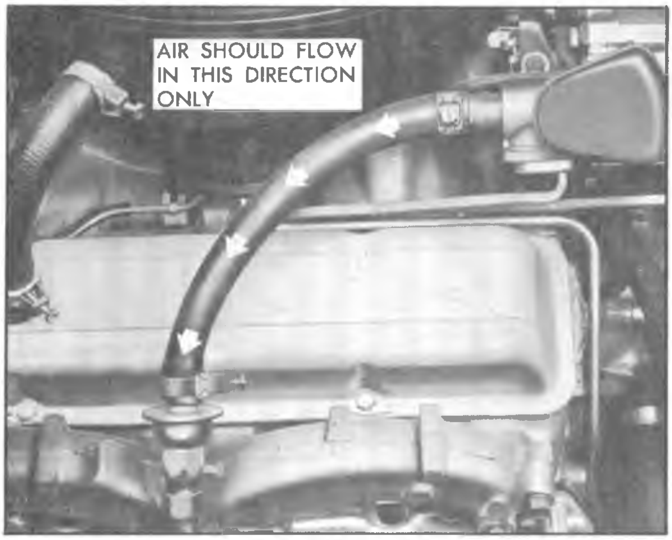


Fig. 6T-42—Air Flow Through Check Valve

- Tighten all connections.

NOTE: Use anti seize compound on threads of the air manifold to exhaust manifold or cylinder connections.

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) (fig. 6T-42).

Replacement

- Disconnect pump outlet hose at check valve. Remove check valve from air manifold, being careful not to bend or twist air manifold (fig. 6T-43).

DIVERTER VALVE

Inspection

- Check condition and routing of all lines especially the signal line. All lines must be secure, without crimps and not leaking.
- Disconnect signal line at valve. A vacuum signal must be available with engine running (fig. 6T-33).
- With engine stabilized at idle speed, no air should be escaping through the muffler. Manually open and quickly close the throttle, a momentary blast of air should discharge through muffler for at least one second (fig. 6T-45).
- Defective valves should be replaced.

CAUTION: Diverter valves although sometimes similar in appearance are designed to meet particular requirements of various engines, therefore, be sure to install the correct valve.

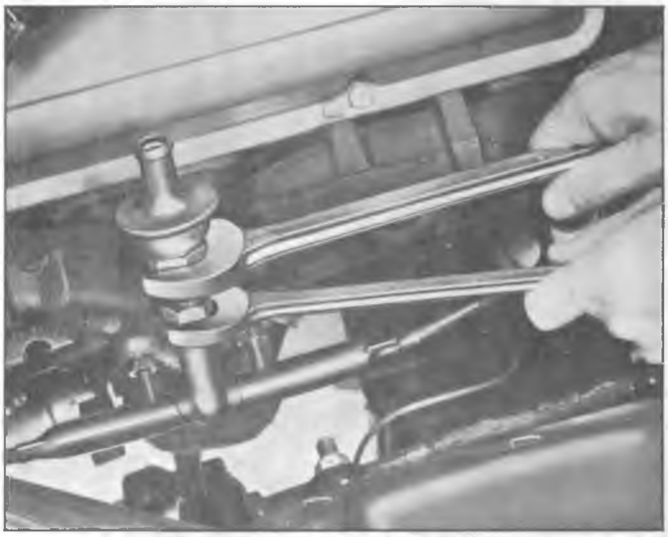


Fig. 6T-43—Removing Check Valve

Replacement

- Disconnect vacuum signal line. Disconnect valve exhaust hose(s).
- Remove diverter valve from pump or elbow.
- Install diverter valve to pump or elbow with new gasket. Torque valve attaching screws to 85 in. lbs.
- Install outlet and vacuum signal lines and check system for leaks.

AIR INJECTION TUBE

Inspection (Fig. 6T-46)

- 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 burned tubes.
- Remove any carbon build up with a wire brush.
- Warped or burned tubes must be replaced.

Fig. 6T-44—Checking for Vacuum Signal at Diverter Valve

Fig. 6T-45—Momentary Blast of Air Through Diverter Valve During Engine Over Run

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.

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 A.I.R. 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. If excessive noise does not exist with the belt removed proceed as follows:

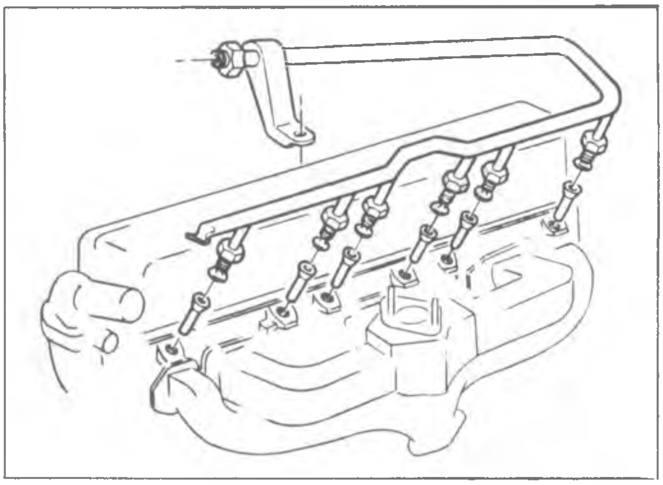


Fig. 6T-46—Air Injection Tubes (In-Line Engine)

- Check for a seized Air Injection Pump.
- Check hoses, tubes, air manifolds and all connections for leaks and proper routing.
- Check air injection pump for proper mounting.
- If none of the above conditions exist and the air injection pump has excessive noise remove and replace pump unit.

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.
- Tighten mounting bolts securely.

Pressure Relief Valve

NOTE: The pressure relief valve is incorporated in the diverter valve. The complete unit must be replaced to correct a malfunction of the relief valve.

SECTION 6Y

ENGINE ELECTRICAL

CONTENT

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 top is a one piece cover. 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, practicularly during engine cranking at low temperatures.

Protection for the Battery charging circuit (10 gauge wire) is provided by a pigtail lead which is a fusible link off the battery positive cable (14 gauge wire).

A battery generally has two classifications of ratings: (1) a 20 hour rating at 80°F and, (2) a cold rating at 0°F which indicates the cranking load capacity. The Ampere-Hour rating found on batteries was based on the 20 hour rating. That is, a battery capable of furnishing three (3) amperes for 20 hours while maintaining a specified average individual cell voltage would be classified as a 60

Fig. 1b—Battery

ampere hour battery (e.g. 3 amperes X 20 hours =60. A.H.). A PWR (Peak Watt Rating) has been developed as a measure of the Energizer's cold cranking ability. The numerical rating is embossed on each case at the base of the Energizer. This value is determined by multiplying the max. current by the max. voltage. The PWR should not be confused with the ampere hour rating since two batteries with the same ampere hour rating can have quite different watt ratings. For battery replacement, a unit of a least equal power rating must be selected.

PERIODIC SERVICING

COMMON CAUSES OF FAILURE

Since the Battery is a perishable item which requires periodic servicing, a good maintenance program will insure the longest possible lift. If the unit 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 ends 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. 3b). When the electrolyte is at the proper level, the lopwer 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. 4b).

The Level Indicator is used in only on cell (second cell cap from positive terminal) 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. 5b).

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

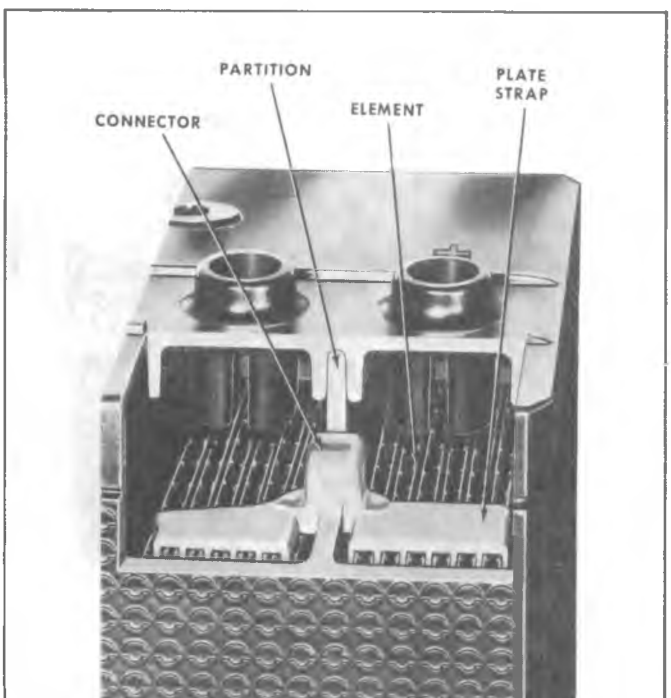


Fig. 2b—Internal View of Cells

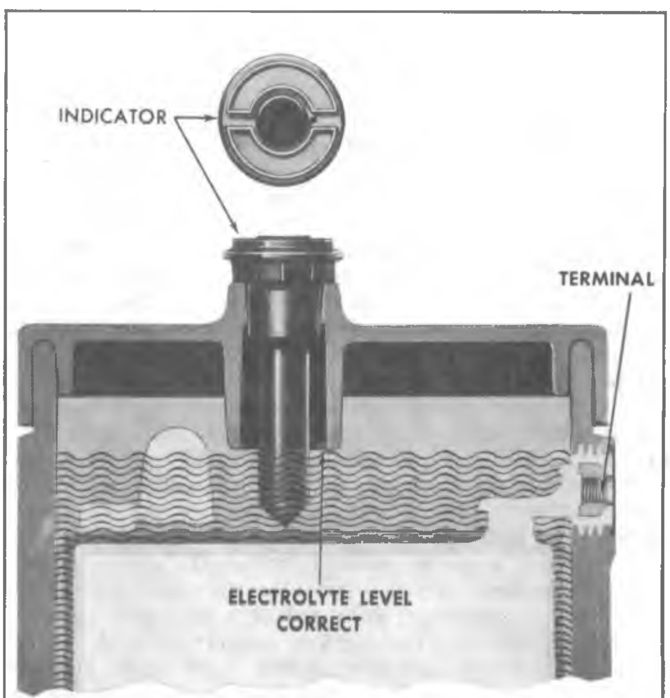


Fig. 3b—Electrolyte at Proper Level

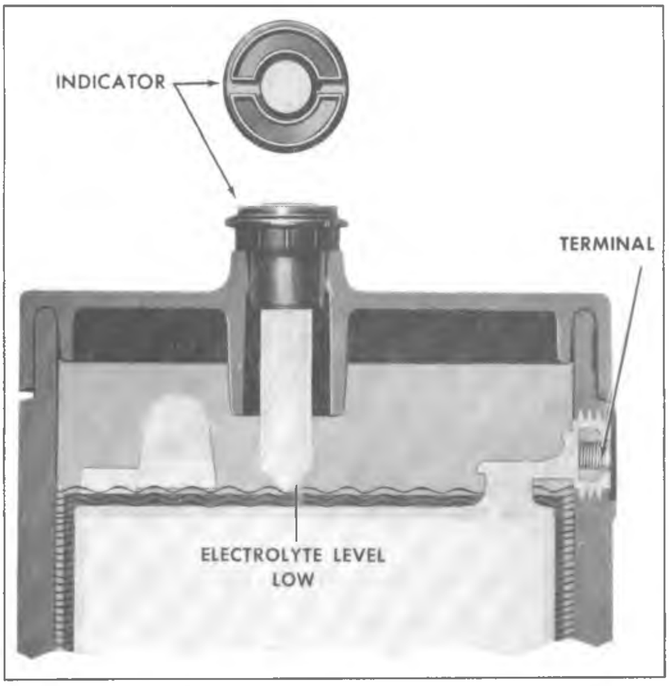


Fig. 4b—Electrolyte at Low Level

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.

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 or poor regulator ground wire connection. Normal Battery water usage is approximately one to two ounces per month per battery.

CLEANING

The external condition of the Battery should be checked periodically for damage or for the presence of dirt and corrosion. 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 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.

CARRIER AND HOLD-DOWN

The 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.

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.

CHARGING PROCEDURES

Before charging a battery, the electrolyte level must be checked and adjusted if needed.

Battery charging consists of applying a charge rate in amperes for a period of time in hours. Thus, a 10-ampere charge rate for seven hours would be a 70 ampere-hour (A.H.) charging input to the battery.

Charging rates in the three to 50 ampere range are generally satisfactory. No particular charge rate or time can be specified for a battery due to the following factors:

1. The size, or electrical capacity in ampere-hours (A.H.), of the battery.
   Example: A completely discharged 70 A.H. battery requires almost twice the recharging as a 40 A.H. battery.

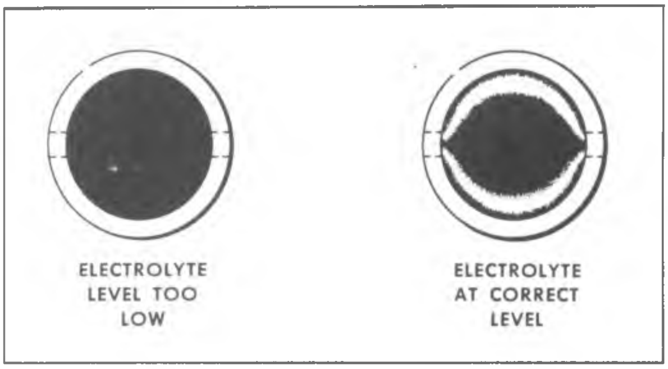


Fig. 5b—View Inside Vent Well

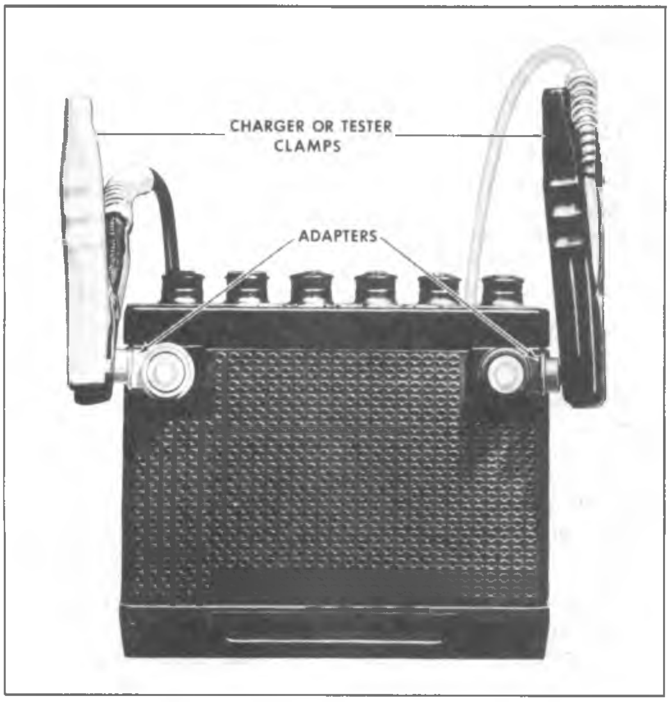


Fig. 6b—Charging Lead Adapters

2. Temperature of the battery electrolyte
   Example: About two hours longer will be needed to charge a 0°F battery than an 80°F battery.
3. Battery state-of-charge at the start of the charging period.
   Example: A completely discharged battery requires twice as much charge in ampere-hours as a one-half charged battery.
4. Battery age and condition.
   Example: A battery that has been subjected to severe service will require up to 50% more ampere-hour charging input than a relatively new battery.

The following basic rule applies to any battery charging situation:

"Any battery may be charged at any rate in amperes for as long as spewing of electrolyte due to violent gassing does not occur, and for as long as electrolyte temperature does not exceed 125 F. If spewing of electrolyte occurs, or if electrolyte temperature exceeds 125 F., the charging rate in amperes must be reduced or temporarily halted to avoid damage to the battery.

The battery is fully charged when over a two-hour period at a low charging rate in amperes all cells are gassing freely (not spewing liquid electrolyte), and no change in specific gravity occurs. The full charge specific gravity is 1.260-1.280, corrected for electrolyte temperature with the electrolyte level at the split ring, unless electrolyte loss has occurred due to age or overfilling in which case the specific gravity reading will be lower. For the most satisfactory charging, the lower charging rates in amperes are recommended.

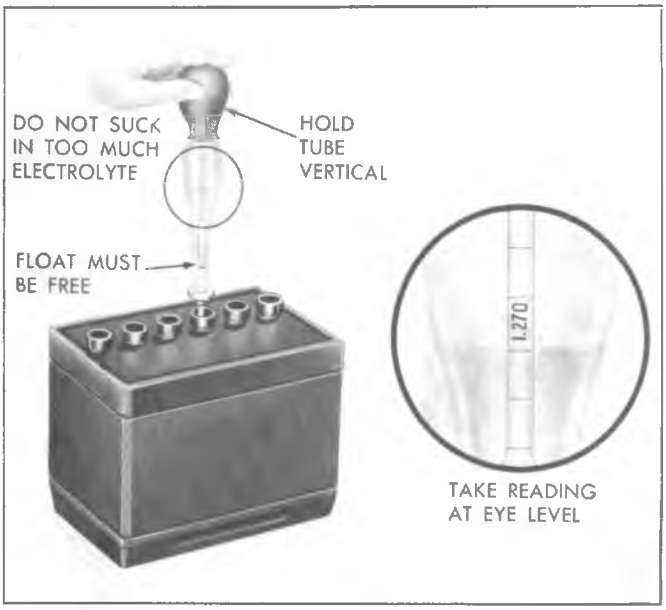


Fig. 7b—Testing Specific Gravity

If after prolonged charging a specific gravity of at least 1.230 on all cells cannot be reached, the battery is not in an optimum condition and will not provide optimum performance; however, it may continue to provide additional service if it has performed satisfactorily in the past.

An "emergency boost charge", consisting of a high charging rate for a short period of time, may be applied as a temporary expedient in order to crank an engine. However, this procedure usually supplies insufficient battery reserve to crank a second and third time. Therefore, the "emergency boost charge" must be followed by a subsequent charging period of sufficient duration to restore the battery to a satisfactory state of charge. Refer to the charging guide in this section.

When out of the vehicle, the sealed side terminal battery will require adapters for the terminals to provide a place for attachment of the charging leads. Adapters are available through local parts service.

When the sealed terminal battery is in the vehicle, the studs provided in the wiring harness are suitable for attachment of the charger's leads.

> **CAUTION:** Exercise care when attaching charger leads to side terminal studs to avoid contact with vehicle metal components which would result in damage to the battery.

CHARGING GUIDE

Recommended Rate* and Time for Fully Discharged Condition

Watt Rating	5 Amperes	10 Amperes	20 Amperes	30 Amperes	40 Amperes	50 Amperes
Below 2450	10 Hours	5 Hours	2-1/2 Hours	2 Hours		
2450-2950	12 Hours	6 Hours	3 Hours	2 Hours	1-1/2 Hours	
Above 2950	15 Hours	7-1/2 Hours	3-1/4 Hours	2 Hours	1-3/4 Hours	1-1/2 Hours

*Initial rate for constant voltage taper rate charger.
To avoid damage, charging rate must be reduced or temporarily halted if:
1. Electrolyte temperature exceeds 125°F.
2. Violent gassing or spewing of electrolyte occurs.

Battery is fully charged when over a two hour period at a low charging rate in amperes all cells are gassing freely and no change in specific gravity occurs. For the most satisfactory charging, the lower charging rates in amperes are recommended.
Full charge specific gravity is 1.260-1.280 corrected for temperature with electrolyte level at split ring.

ENERGIZER TESTS

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, Specific Gravity Test, Instrument Test and Load Test. Refer to test procedures chart at the end of this section.

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 "Perodic Servicing". Correct as required before proceeding with tests.

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 or 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.

> **NOTE:** New energizers which have become completely discharged over a relatively long period of time, such as during vehicle storage, should be tested by the hydrometer method. Energizers discharged to this degree cannot be accurately tested using equipment requiring load capability comparison tests.

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 "Charging Procedures".
- 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 from 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.

LOAD TEST

In addition to the instrument test and full charge hydrometer test, the following load test may also be performed to check the condition of the battery.

> **NOTE:** Equipment to perform the test may be procured for local suppliers of testing equipment.

To begin, charge the battery, if necessary, until all cells are at least 1.200 specific gravity.

1. If unable to obtain specific gravity 1.200 @ 80°F. in all cells, replace battery.
2. If able to obtain a specific gravity of 1.200 or more @ 80°F. in all cells, remove the vent caps and connect a 300 amp. load for 15 seconds.

CHART NO. 1 ENERGIZER LOAD TEST VALUES

MODEL NO.	AMP LOAD
Y86A	130
Y86	130
Y87	130
Y88	160
Y89	160
R88	180
R89	180
R88ST	180
R88WT	230
R88W	230
R89W	230

CHART NO.2 VOLTAGE AND TEMPERATURE CHART

Electrolyte Temperature	Minimum Voltages*
Down to 80°	9.6
70°	9.6
60°	9.5
50°	9.4
40°	9.3
30°	9.1
20°	8.9
10°	8.7
0	8.5

*Voltage must not drop below minimum listed at given temperature when battery is subjected to the proper load for 15 seconds and is 1.200 specific gravity @ 80° F. or more.

a. If smoke occurs in one or more cells, replace the battery.
b. If smoke does not occur proceed to step 3.

3. Place a thermometer in one cell and apply a specified load from chart No. 1. Read the voltage at 15 seconds with load connected, then remove load and read electrolyte temperature. Compare temperature and voltage readings with chart No. 2.
   a. If reading is less than voltage on chart No. 2, replace battery.
   b. If reading is same as or greater than voltage on chart No. 2, fully charge, clean and return battery to service.

SPECIFIC GRAVITY READINGS

A hydrometer can be used to measure the specific gravity of the electrolyte in each cell (fig. 7b).

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 (.002) 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 an 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

Battery installation varies depending on the truck model and series. To install properly, it is important to observe the following precautions:

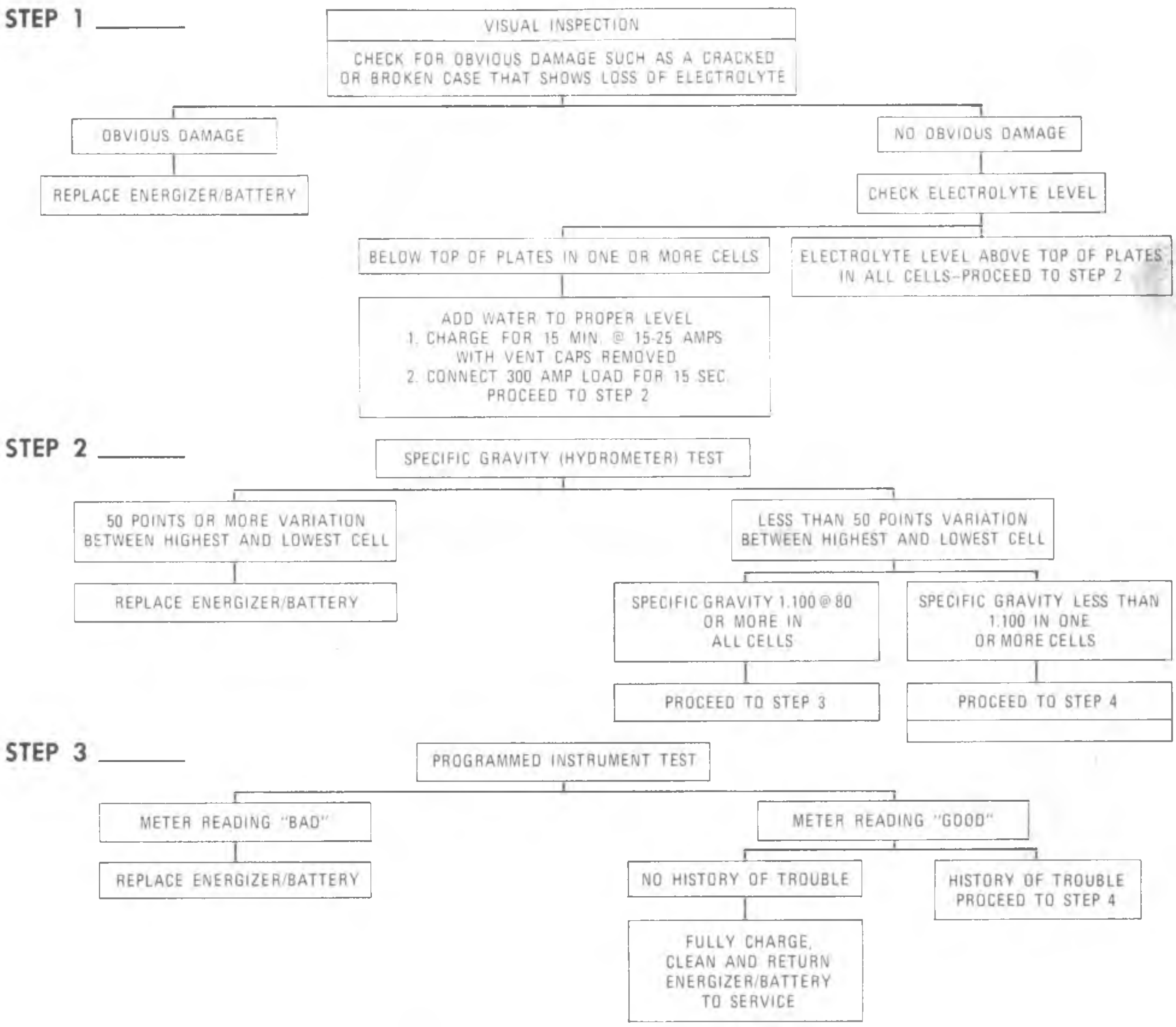
- Connect grounded terminal of Battery last to avoid short circuits which may damage the electrical system.
- Be sure there are not foreign objects in the carrier, so that the new Battery will rest properly in the bottom of the carrier.
- Tighten the hold-down evenly until snug (60-80 in. lbs.). Do not draw down tight enough to distort or crack the case or cover.
- Be sure the cables are in good condition and the terminal studs 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.

ENERGIZER/BATTERY TEST PROCEDURE

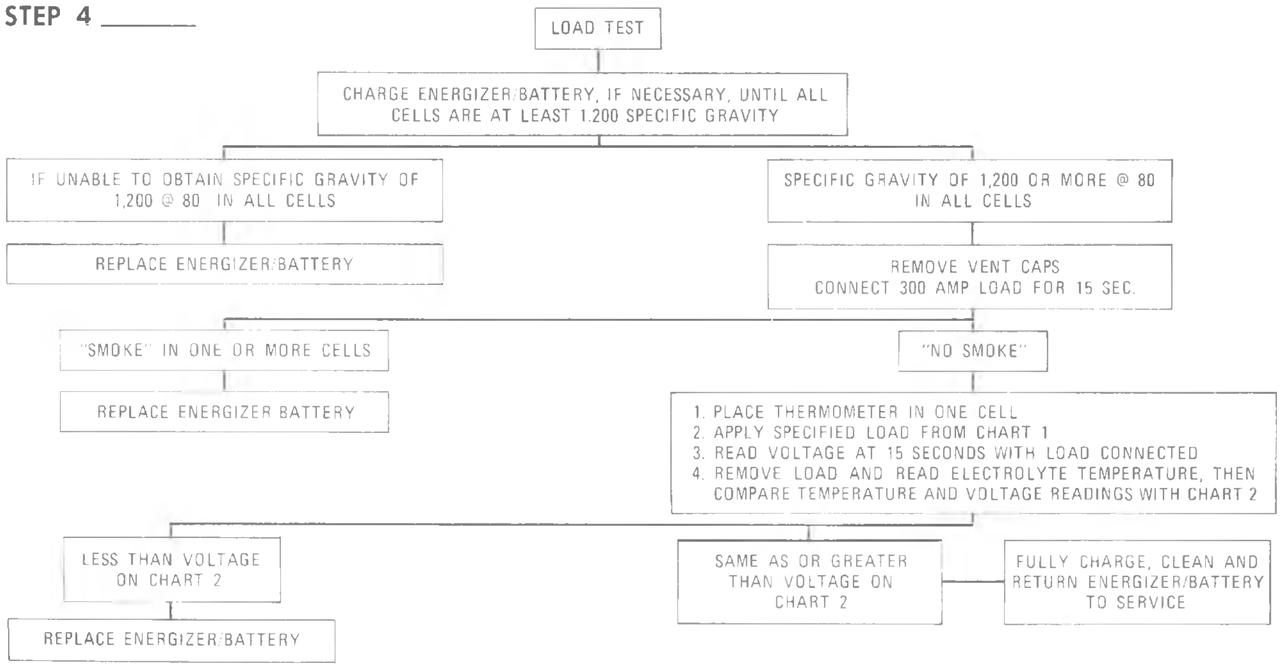
To determine the ability of an Energizer or battery to function properly requires testing. The accuracy of the testing changes with temperature, specific gravity, age of the battery, etc. Therefore, an accurate test has more than one step:

Step 1: Visual inspection
Step 2: Specific gravity check (hydrometer)
Step 3: Programmed Instrument Test
Step 4: Load Test.

CAUTION: Wear safety glasses. Do not break live circuits at Energizer/battery terminals. When testing, be certain to remove gases at Energizer/battery cover caused by charging.



STEP 4



CHARGING SYSTEMS

10 DN SERIES 100B TYPE DELCOTRON

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 throught the two slip rings to the field coils wound concentric with the shaft of the rotor. Six rectifier diodes, contained in a rectifier bridge, are mounted in the slip ring end frame and are joined to the stator windings.

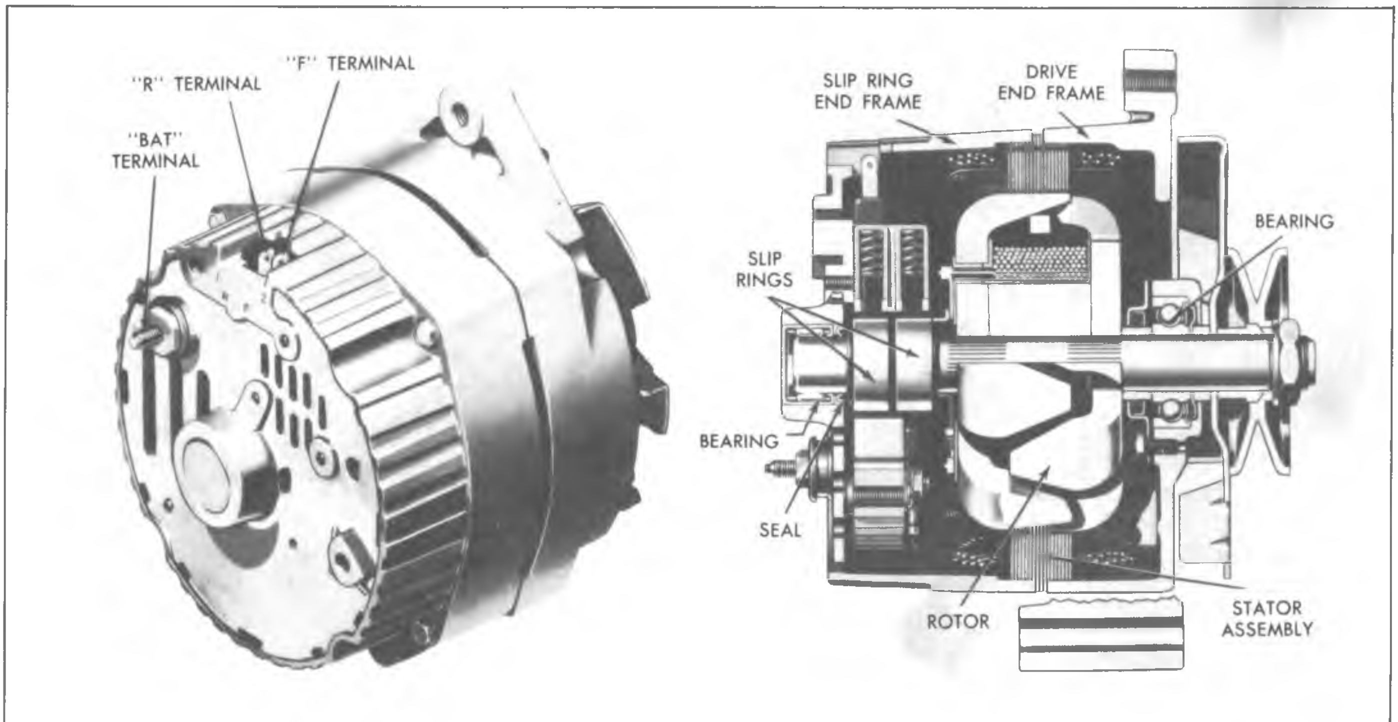


Fig. 1c—10 DN Series 100 B Type Delcotron

The diodes change the Delcotron A.C. current to D.C. current.

The function of the voltage regulator in the charging system is to limit the generator voltage to a pre-set value by controlling the generator field current. The two unit double contact unit uses the field relay to turn out the indicator lamp. The relay unit allows the lamp to light (as a bulb check) with the ignition key on and engine not running. When the engine is started and the generator begins to charge, the indicator light goes out indicating that the system is operating normally.

The double contact regulator assembly (fig. 2c) consists of a double-contact voltage regulator unit and a field relay unit. This unit uses two sets of contact points on the voltage regulator unit to obtain desired field excitation under variable conditions. A wiring diagram of the regulator internal circuit is illustrated in Fig. 2c.

Wiring harnesses are protected by fusible links. A fusible link is a length of special wire, normally four gauges smaller than the circuit it is protecting, used in 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 located in the engine compartment wiring harnesses and eack link will be identified with its gauge size. Wiring diagrams showing the location of the various fusible links are included in Section 12, Chassis Electrical of this manual.

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 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).

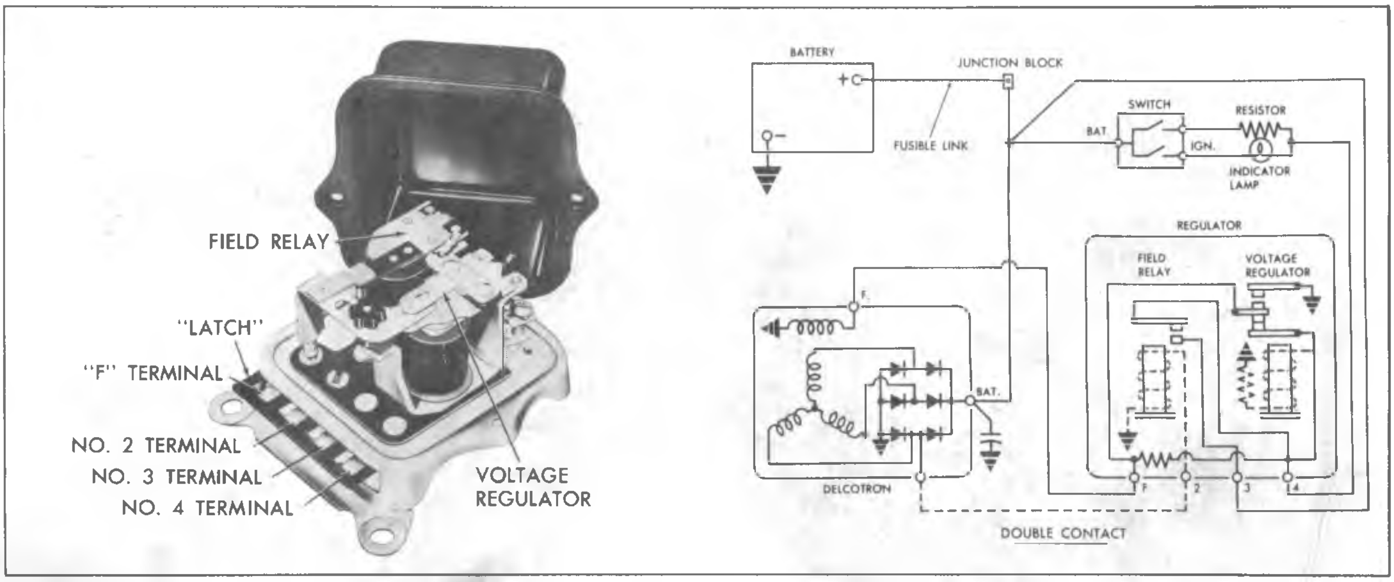


Fig. 2c—Double Contact Regulator

4. Excessive generator noise or vibration.

The following series of on-the-vehicle quick checks 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 Overhaul Manual" and should be referred to as necessary.

STATIC CHECKS

Before making any electrical checks, perform the following static checks:

1. Check for loose fan belt.
2. Check for defective battery. (Refer to Battery.)
3. Inspect all connections, including the slip-on connectors at the regulator and Delcotron.

NOTE: Do not short field to ground to check if generator is charging since this will seriously damage the charging system.

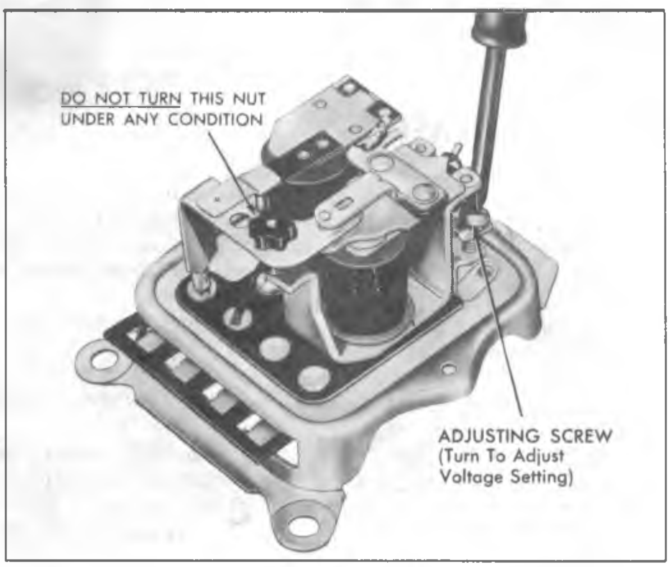


Fig. 3c—Adjust Voltage Setting

SYSTEM CONDITION TEST

This test is used to indicate the overall condition of the charging system (both good and defective) and to isolate the malfunctioning unit if the system is defective.

1. With ignition off, perform the prescribed Static Checks outlined in this section. Then set hand brake and shift transmission into neutral.
2. Connect a voltmeter from junction block on horn relay to ground at regulator base.

   CAUTION: Be sure meter clip does not touch a resistor or terminal extension under regulator.

3. Connect a tachometer on engine.
4. Models equipped with Indicator Lamp: Turn ignition switch to "ON" position and check indicator lamp. If lamp fails to glow, perform appropriate tests and corrections (Indicator Lamp Circuit Tests) before continuing.

   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 ammeter 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.

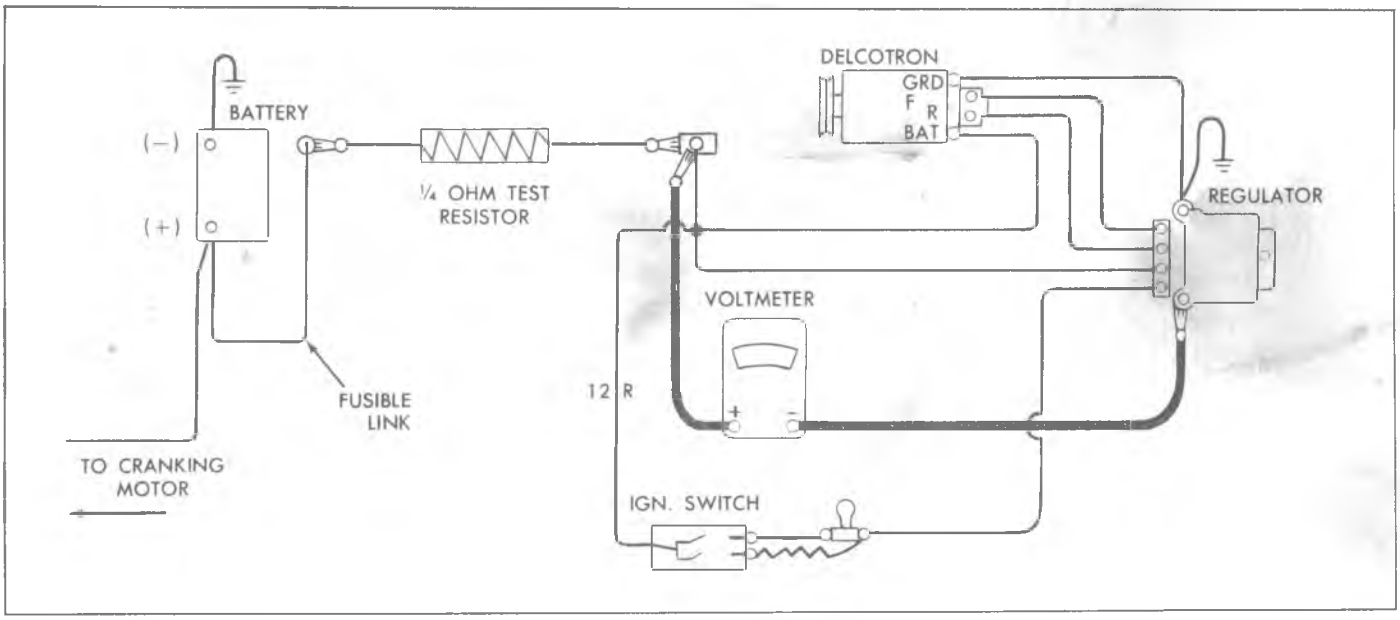


Fig. 4c—Voltage Setting Test Connection

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 - Ammeter Method".
   (1) Delcotron tests bad - refer to "The Overhaul Manual" and repair Delcotron, then repeat Step 6.
   (2) Delcotron tests good - disconnect regulator connector, remove regulator cover and re-connect the connector. Then repeat Step 6 and turn voltage adjusting screw (fig. 3c) to raise setting to 12-1/2 volts. 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 1/2 ohm-25 watt fixed resistor (purchased commercially) into the charging circuit at the junction block as shown in Figure 4c.

   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.

   a. Disconnect four terminal connector and reinstall regulator cover. Then re-connect four terminal connector and adjust voltage to 14.2 and 14.6 (Refer to Step 6 and fig. 3c).
   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.

SYSTEM COMPONENT TESTS

Delcotron Output Test—Ammeter Method (Fig. 5c)

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.

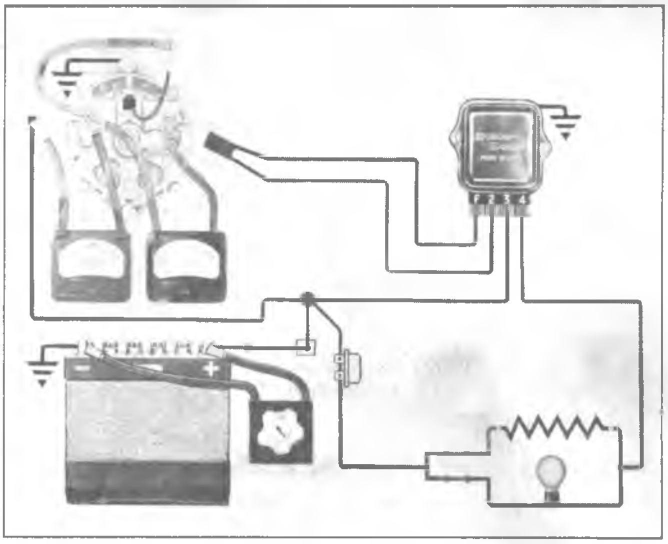


Fig. 5c—Ammeter Method Output Test Connector

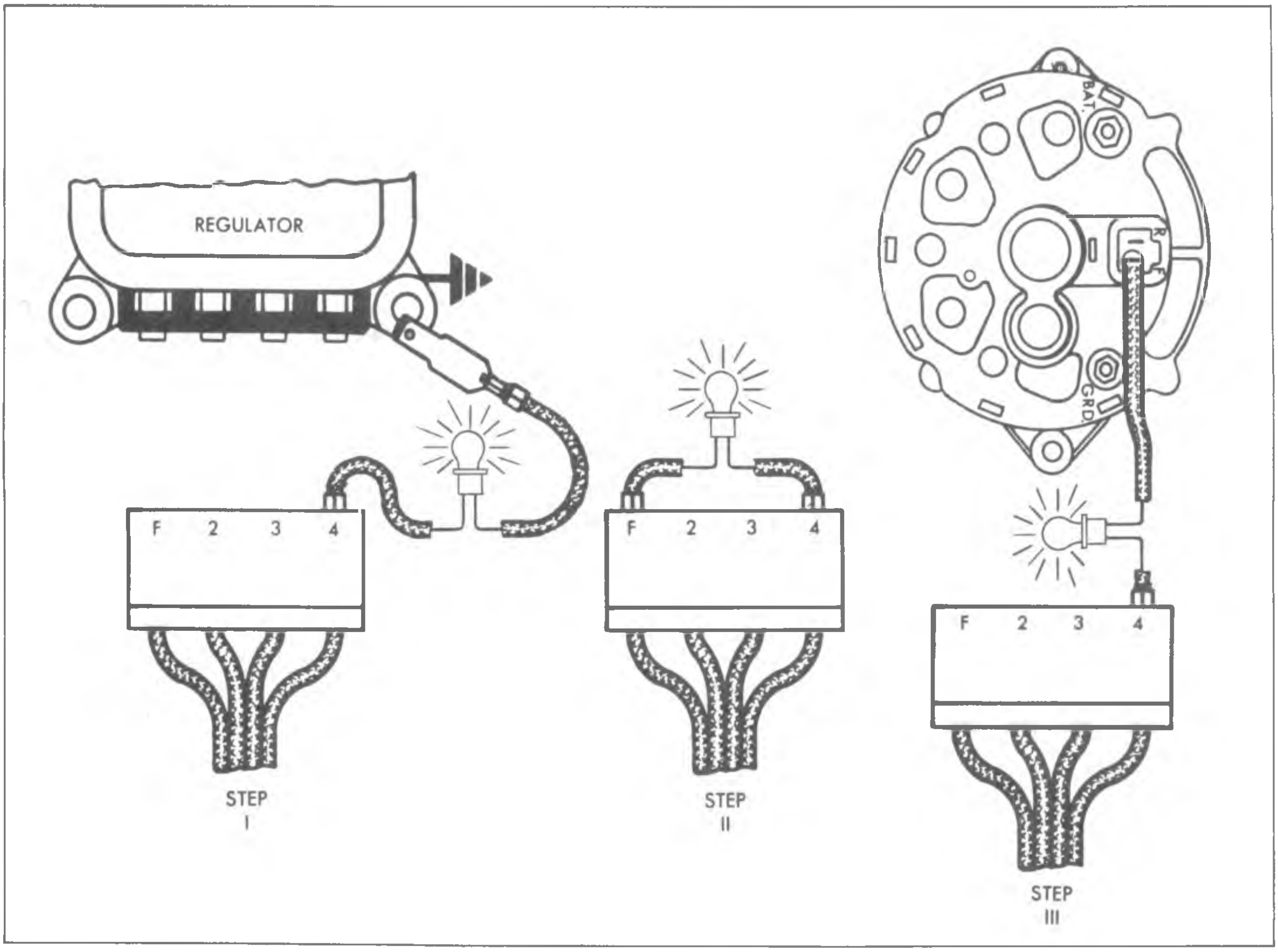


Fig. 6c—Initial Field Excitation Circuit Tests

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.
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 repairs needed.

Indicator Lamp/Initial Field Excitation Circuit Tests

On standard models the indicator lamp circuit provides initial field excitation (causing lamp to glow). The light is cancelled by closing the field relay which applies battery voltage to both sides of bulb (bulb goes out). The indicator light should glow when ignition switch is "ON" and go out almost immediately when engine starts.

Ammeter equipped vehicles use the same initial field excitation and control circuits as the indicator lamp except the lamp is omitted. The continuity tests on both type vehicles can be made as follows:

If Lamp Fails to Glow or Ammeter Fails to Function the Possible Causes are:

1. Faulty bulb or bulb socket.
2. Faulty ammeter.
3. An open circuit in wiring, regulator, or field.
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. 6c, Step 1) and note 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 "FF" and "4" terminals (fig. 6c, Step 2), and note lamp:

a. Test lamp glows - problem is in regulator. An open circuit in regulator or relay is stuck closed. Replace regulator.
b. Fails to glow - problem is in wire between "F" terminals on generator and regulator or in field windings. Go to Step 3.

3. Disconnect test lamp at connector "F" terminal and connect to "F" terminal on Delcotron (fig. 6c, 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.

NOTE: This test lamp procedure may be used on lamp type circuits and on ammeter circuis.

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). 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 "A" terminal) is as follows:

1. Connect a test lamp from the wiring harness connector terminal "4" to ground as shown in Figure 6c (Step 1).
2. Turn the ignition switch to the "ACC" 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.

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. 7c).
2. Operate the engine at fast idle (1500 to 2000 rpm) and observe voltmeter reading.
3. If voltmeter shows zero voltage at regulator, check circuit between No. 2 terminal on regulator to "R" terminal on Delcotron.
4. If voltage at regulator exceeds closing voltage specification and light remains on, regulator field relay is faulty (Refer to specifications). Check and adjust regulator as follows:

Closing Voltage Adjustment

1. Make connections as shown in Figure 8c using a 50 ohm variable resistor.

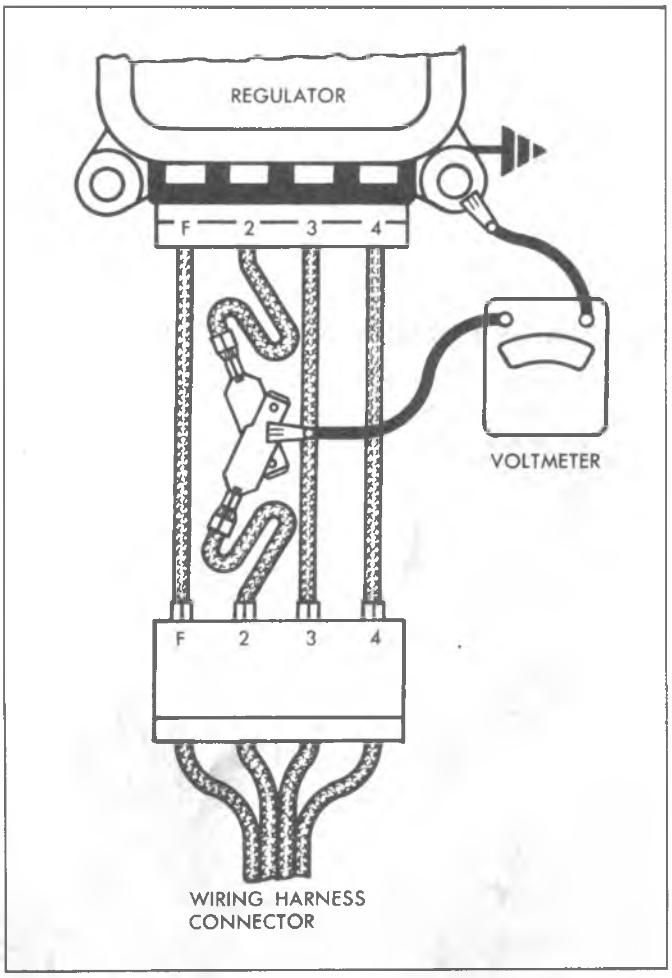


Fig. 7c—Testing Field Relay

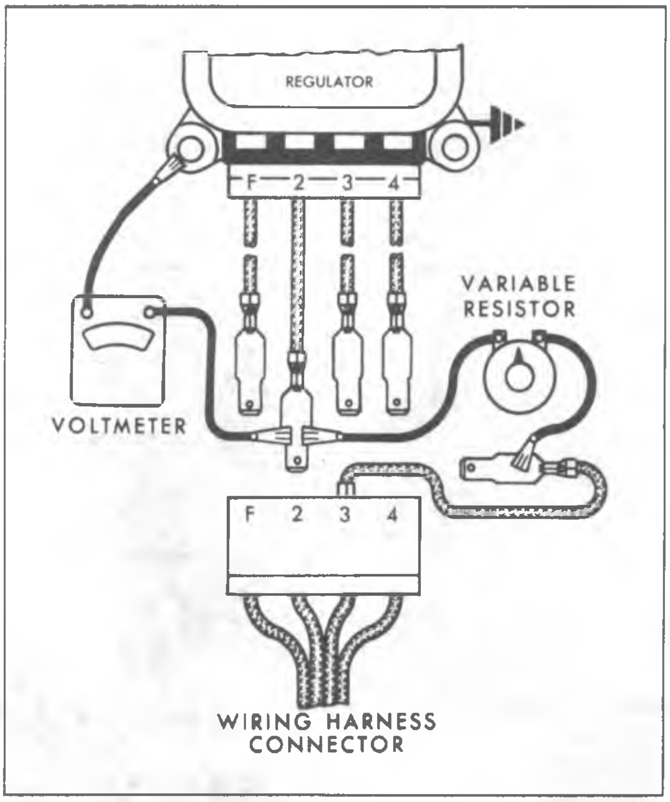


Fig. 8c—Field Relay Closing Voltage Test

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 9c.

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 lamp so the wire in question is in series in the test circuit.

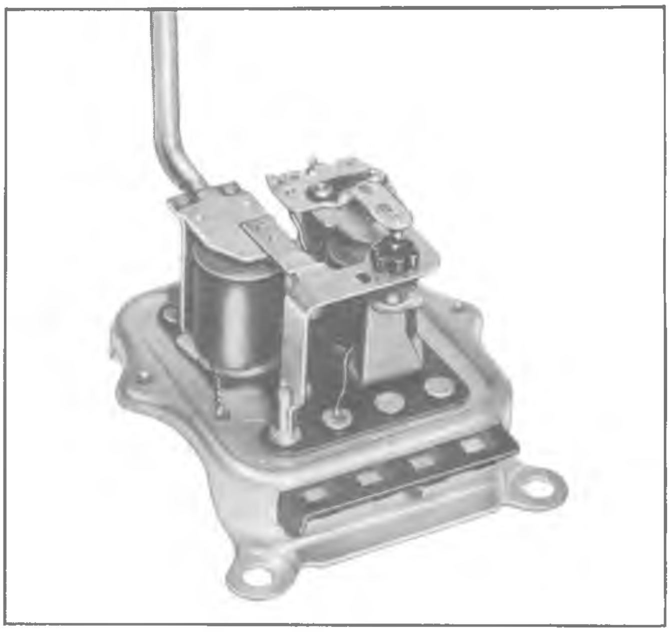


Fig. 9c—Adjusting Field Relay Closing Voltage

COMPONENT PART REPLACEMENT

GENERATOR PULLEY REPLACEMENT

Single Groove Pulley

1. Place 15/16" box wrench on retaining nut and insert 5/16" allen wrench into shaft to hold shaft while removing nut (fig. 10c).
2. Remove washer and slide pulley fan and spacer from shaft.
3. Reverse Steps 1 and 2 to install, use a torque wrench with a craw-foot adapter (instead of box wrench) and torque the nut to 50 ft. lbs. (fig. 11c).

Double Groove Pulley

1. Place a 15/16" socket (with wrench flats on the drive end or use Adapter J-21501 and a box wrench) on retaining nut, insert a 5/16" allen wrench through socket and adapter into hex on shaft to hold the shaft while removing the nut.
2. Remove washer and slide pulley fan and spacer from shaft.
3. To install, slide fan, spacer, 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.

GENERATOR REPLACEMENT (Fig. 12c)

1. Disconnect battery ground strap at battery to prevent damaging wiring harnesses.

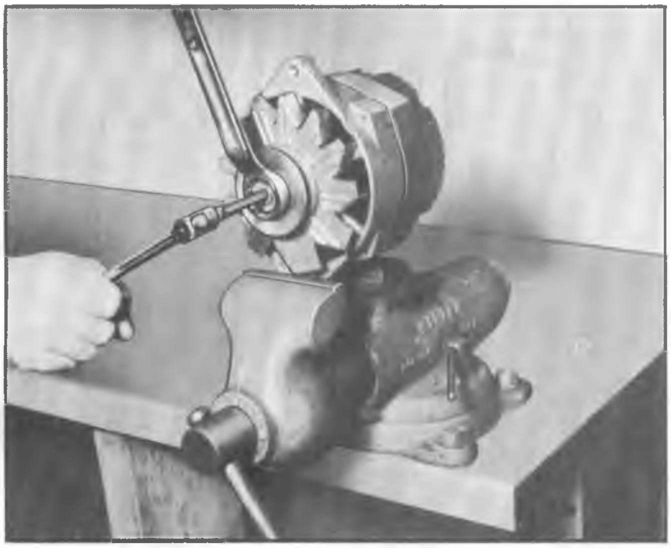


Fig. 10c—Pulley Removal

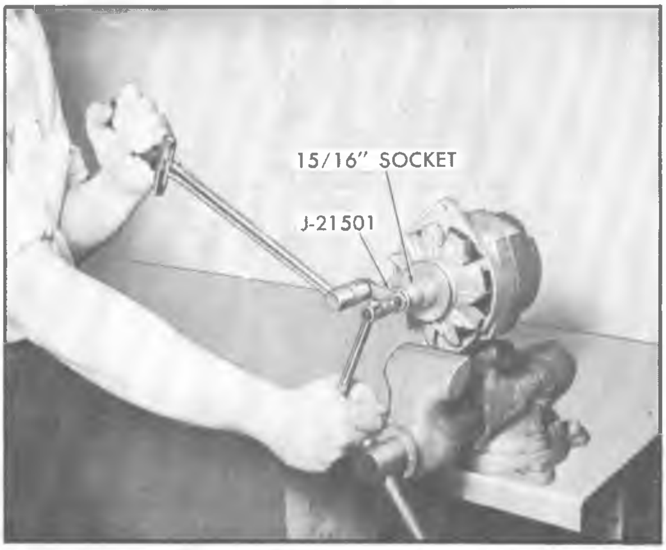


Fig. 11c—Torquing Pulley Nut

2. Disconnect wiring leads at Delcotron.
3. Remove generator brace bolt and detach drive belt.
4. Support generator and remove generator mount bolt and remove from vehicle.
5. Reverse removal procedure to install, then adjust drive belt as described under Tune-up, Section 6.

DOUBLE CONTACT REGULATOR REPLACEMENT

NOTE: Voltage regulating contacts should never be cleaned as they are made of special material that may be destroyed by cleaning with any abrasive material. A sooty or discolored condition of the contacts is normal after a relatively short period of operation.

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.

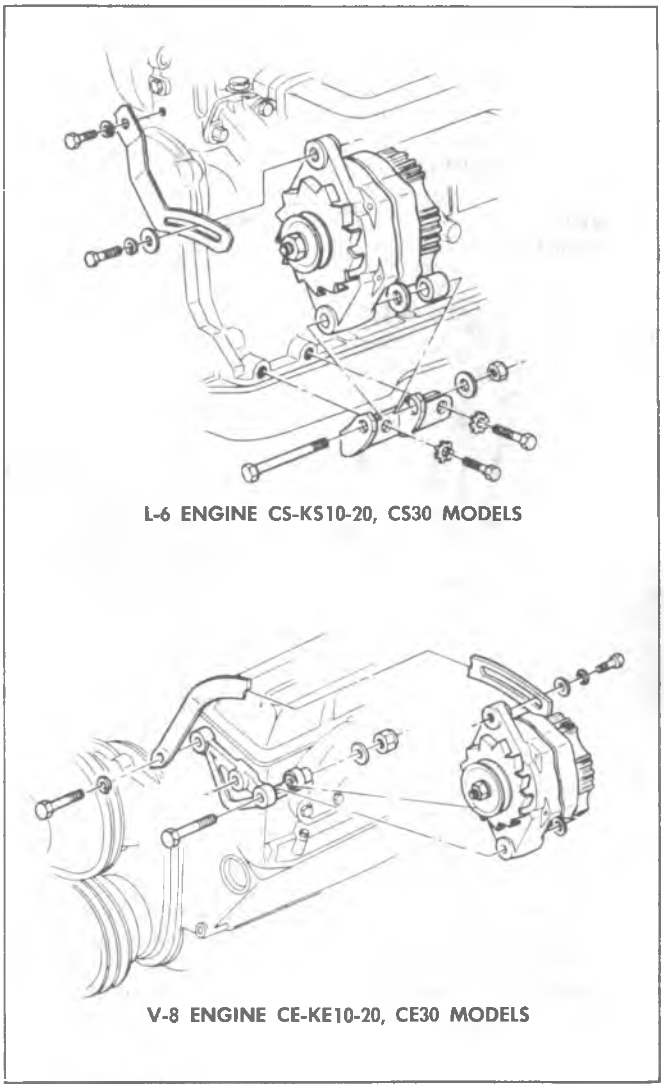


Fig. 12c—Delcotron Installation

10-SI SERIES DELCOTRON SYSTEM

INDEX

GENERAL DESCRIPTION

The 10-SI Series Delcotron generator illustrated in Figure 1D features a solid state regulator that is mounted inside the generator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

No periodic adjustments or maintenance of any kind are required on the entire generator assembly. The generator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

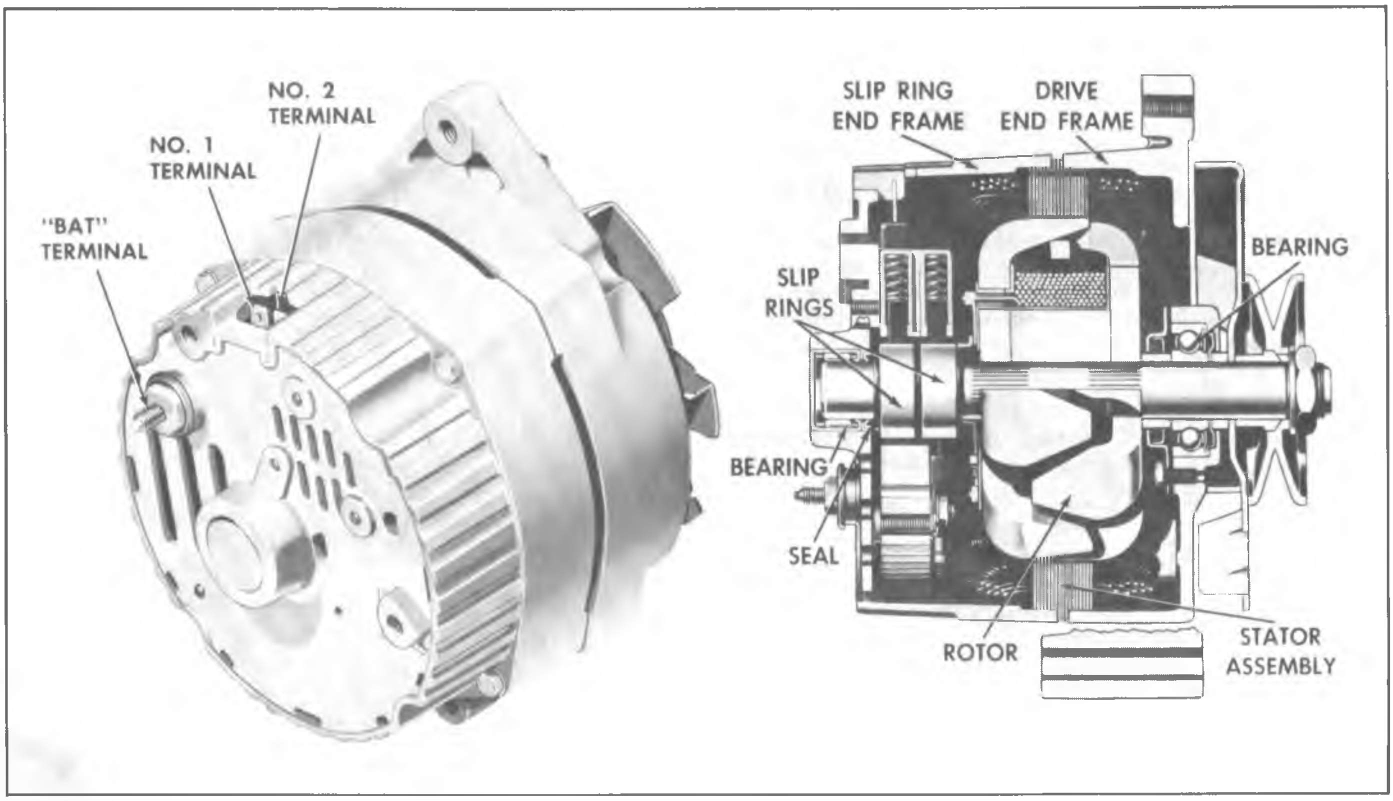


Fig. 1d—10-SI Series Delcotron

The stator windings are assembled on the inside of a laminated core that forms part of the generator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the generator output terminal. Generator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noise.

OPERATING PRINCIPLES

A typical wiring diagram is illustrated in Figure 2D. The basic operating principles are explained as follows.

When the switch is closed, current from the energizer flows to the generator No. 1 terminal, through resistor R1, diode D1, and the base-emitter of transistor TR1 to ground, and then back to the battery. This turns on transistor TR1, and current flows through the generator field coil and TR1 back to the energizer.

With the generator operating, a.c. voltage is generated in the stator windings, and the stator supplies d.c. field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the generator "BAT" terminal. As generator speed increases, current is provided for charging the energizer and operating electrical accessories.

The No. 2 terminal on the generator is always connected to the energizer, but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the generator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the generator voltage to a pre-set value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D3 prevents high-induced-voltages in the field windings when TR1 turns off.

CHARGING CIRCUIT CHECKS

Most charging system troubles show up as an undercharged or overcharged battery. Since the battery itself may be defective, it should be checked first to determine its condition. Also, in the case of an undercharged battery, check for battery drain caused by grounds or by accessories being left on.

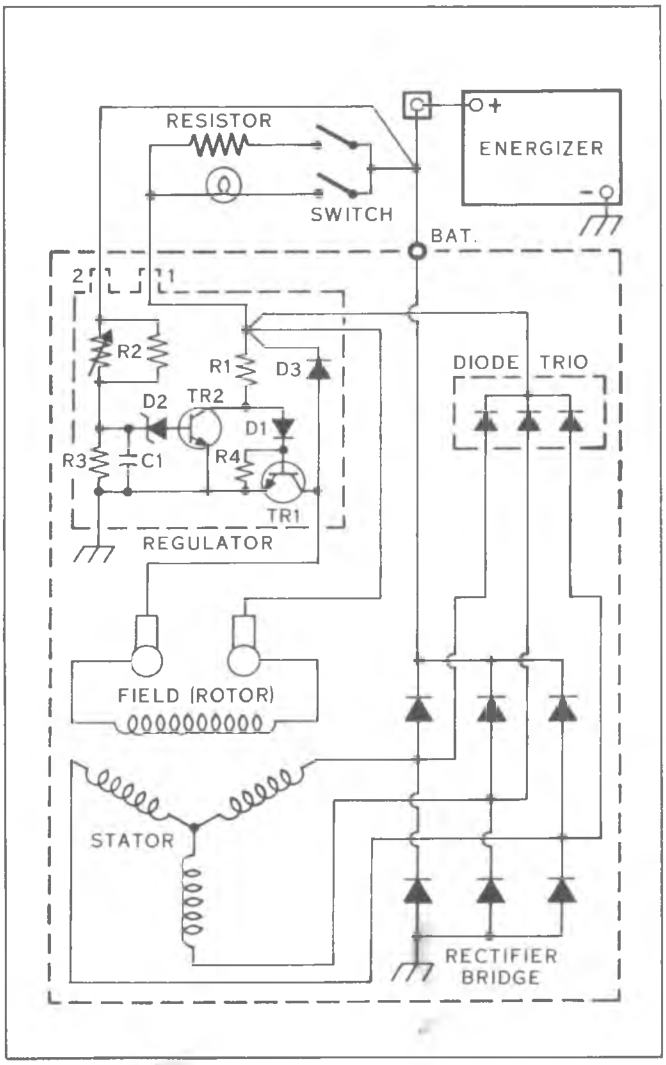


Fig. 2d—Integral Charging System Circuitry

A basic wiring diagram showing lead connections is presented in Figure 3D. The following precautions must be observed when working on the charging circuit. Failure to observe these precautions will result in serious damage to the electrical equipment.

- Do not polarize the generator.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed in these procedures.
- Never operate the generator with the output terminal open circuited.
- Make sure the generator and Energizer are of the same ground polarity.
- When connecting a charger or a booster Energizer to the vehicle Energizer, connect negative to negative and positive to positive.

STATIC CHECK

Before making any electrical checks, visually inspect all connections, including slip-on connectors, to make sure they are clean and tight. Inspect all wiring for cracked, frayed or broken insulation. Be sure generator

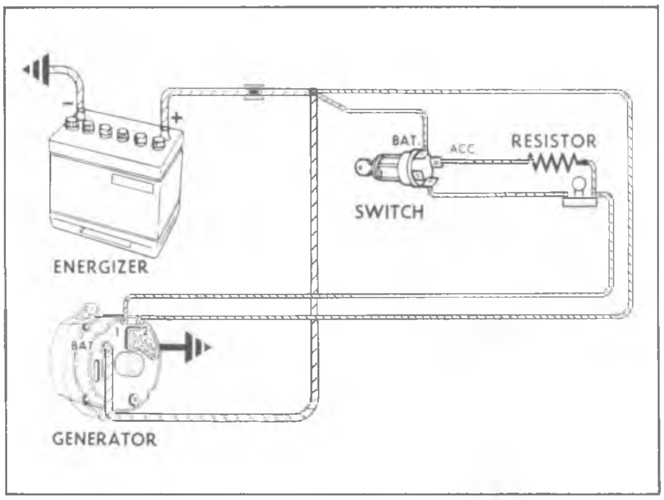


Fig. 3d—Basic Wiring Diagram

mounting bolts are tight and unit is properly grounded. Check for loose fan belt.

UNDERCHARGED ENERGIZER CONDITION CHECK

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions even though the ammeter may be operating normally.

1. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.
2. Check the drive belt for proper tension.
3. Check energizer. Test is not valid unless energizer is good and fully charged.
4. Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the generator and firewall, and the cable clamps and battery posts.
5. With ignition switch "on" connect a voltmeter from generator "BAT" terminal to ground, generator No. 1 terminal to ground and generator No. 2 terminal to ground. A zero reading indicates an open between voltmeter connection and Energizer.

   NOTE: An open No. 2 lead circuit on generators will cause uncontrolled voltage, Enerizer overcharge and possible damage to Energizer and accessories. Generators supplied for current applications have a built-in feature which avoids overcharge and accessory damage by preventing the generator from turning on if there is an open in the wiring harness connected to the No. 2 generator terminal. Opens in the wiring harness connected between the No. 2 generator terminal and Energizer may be between the terminals, at the crimp between the harness wire and terminal, or in the wire.

6. If previous Steps 1 through 5 check satsifactorily, check Delcotron generator as follows:
   a. Disconnect Battery ground cable.

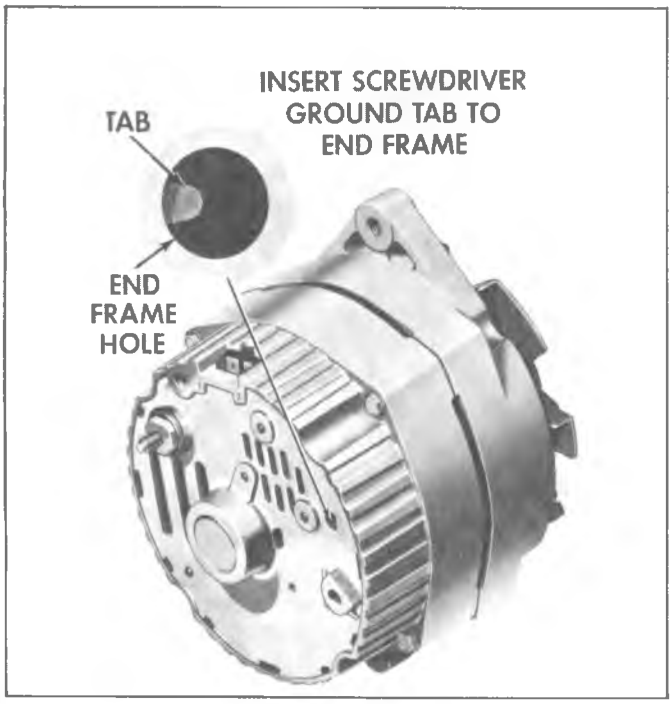


Fig. 4d—Delcotron End View

b. Connect an ammeter in the circuit at the "BAT" terminal of the generator.
c. Reconnect Battery ground cable.
d. Turn on radio, windshield wipers, lights high beam and blower motor high speed. Connect a carbon pile across the Battery.
e. Operate engine at moderate speed as required, and adjust carbon pile as required, to obtain maximum current output.
f. If ampere output is within 10 percent of rated output as stamped on generator frame, generator is not defective; recheck Steps 1 through 5.
g. If ampere output is not within 10 percent of rated output, ground the field winding by inserting a screwdriver into the test hole (Fig. 5).

CAUTION: Tab is within 3/4 inch of casting surface. Do not force screwdriver deeper than one inch into end frame.

h. Operate engine at moderate speed as required, and adjust carbon pile as required to obtain maximum current output.
i. If output is within 10 percent of rated output, replace regulator as covered in the Chassis Overhaul Manual and check field winding.
j. If output is not withing 10 percent of rated output, check the field winding, diode trio, rectifier bridge, and stator as covered in the Chassis Overhaul Manual.
k. Remove ammeter from generator and turn accessories off.

OVERCHARGED ENERGIZER CONDITION CHECK

1. Determine Energizer condition. Test is not valid if Energizer is not good and fully charged.
2. Connect a voltmeter from generator No. 2 terminal to ground. If reading is zero, No. 2 lead circuit is open.
3. If Energizer and No. 2 lead circuit check good, but an obvious overcharge condition exists as evidenced by excessive Energizer water usage, proceed as follows:
   a. Separate end frames as covered in Delcotron "Disassembly" section in the Chassis Overhaul Manual. Check field winding for shorts. If shorted replace rotor and regulator.
   b. Connect ohmmeter using lowest range scale from brush lead clip to end frame as shown in Step 1, Figure 5D, then reverse lead connections.
   c. If both readings are zero, either the brush lead clip is grounded, or regulator is defective.
   d. A grounded brush lead clip can result from omission of insulating washer (Fig. 5), omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as covered in the Chassis Overhaul Manual.

GENERATOR OUTPUT TEST

To Check the generator in a test stand, proceed as follows:

1. Make connections as shown in Figure 6D, except leave the carbon pile disconnected. Use a fully charged Energizer or battery, and a 10 ohm resistor

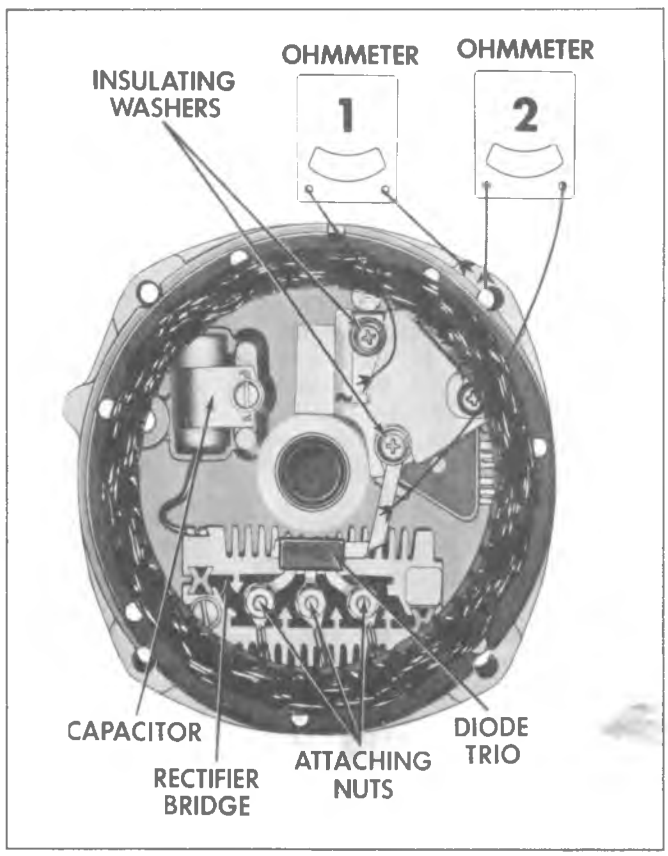


Fig. 5d—Slip Ring End Frame

rated at six watts or more between the generator No. 1 terminal and the Energizer.

2. Slowly increase the generator speed and observe the voltage.
3. If the voltage is uncontrolled with speed and increases above 16 volts, check for a grounded brush lead clip as covered under heading of "OVERCHARGED ENERGIZER", Step 3. If not grounded, replace the regulator.

NOTE: The Energizer must be fully charged when making this check.

4. Connect the carbon pile as shown.
5. Operate the generator at moderate speed as required and adjust the carbon pile as required to obtain maximum current output.
6. If output is within ten percent of rated output as stamped on generator frame, generator is good.
7. If output is not within ten percent of rated output, ground generator field (Fig. 4D).
8. Operate generator at moderate speed and adjust carbon pile as required to obtain maximum output.
9. If output is within ten percent of rated output, replace regulator as covered in "Regulator Replacement" section.
10. If output is not within ten percent of rated output, check the field winding, diode trio, rectifier bridge and stator as previously covered.

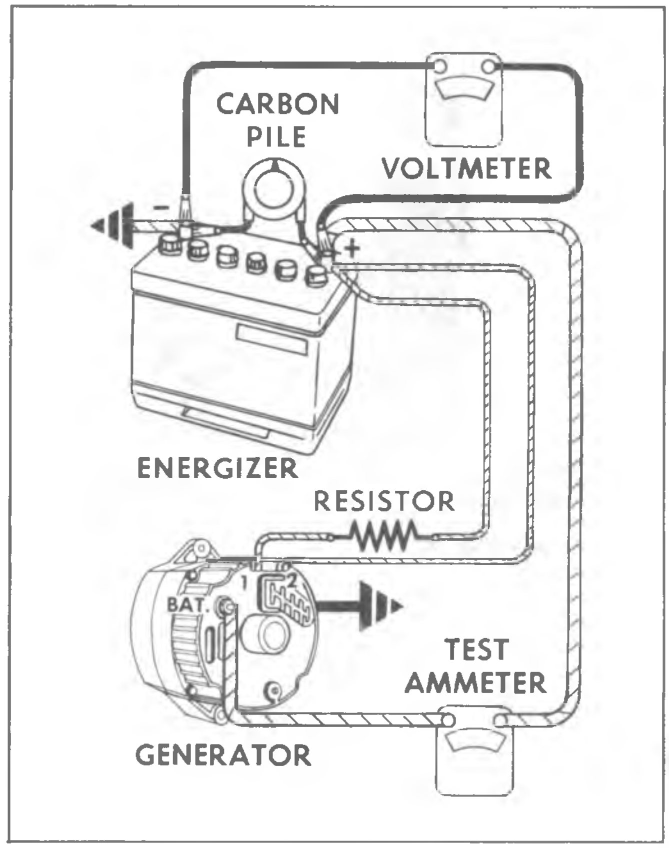


Fig. 6d—Generator Output Test

IGNITION SYSTEMS

INDEX

GENERAL DESCRIPTION

The ignition system used on all models is the standard breaker point type consisting of a coil, condenser, distributor, switch, wiring, spark plugs and a source of electrical energy. The distributor contact points and spark plugs are the only system components that required periodic service. The remainder of the ignition system requires only periodic inspection to check the operation of the components, tightness of electrical connections, and condition of the wiring.

Two types of distributors are used: an internal adjustment distributor on 6 cylinder engines (fig. 1i) and an external adjustment distributor on 8 cylinder engines (fig. 2i). Both function in much the same manner to - (1) cause a high voltage surge from coil, (2) time these surges with regard to engine requirements through use of centrifugal and vacuum advance mechanisms, and (3) direct high voltage surges through distributor rotor, cap, and high tension wiring to the spark plugs.

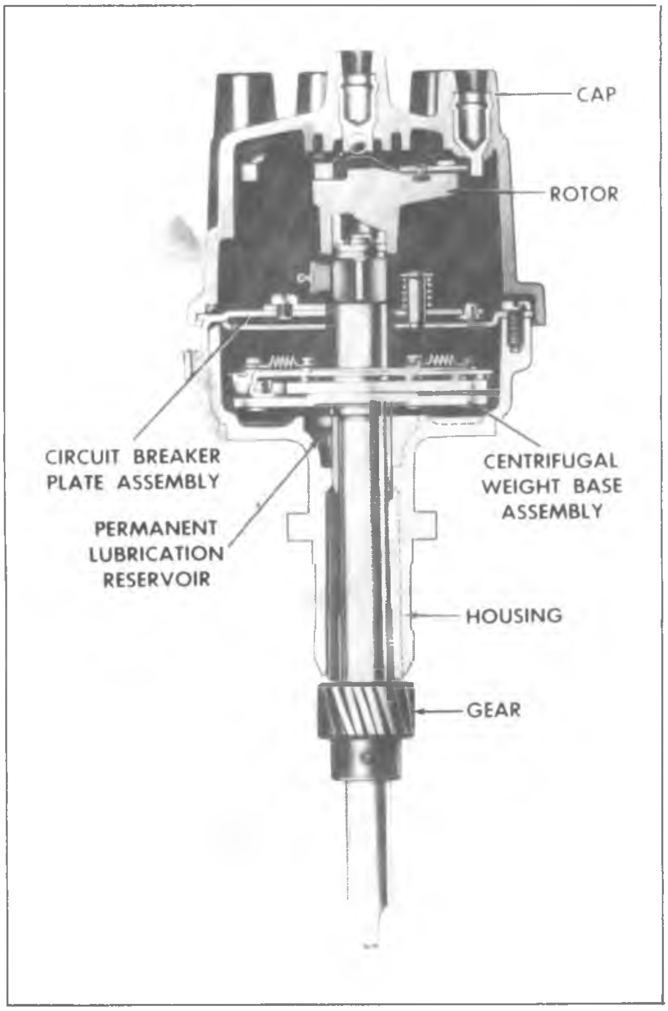


Fig. 1i—L-6 Distributor

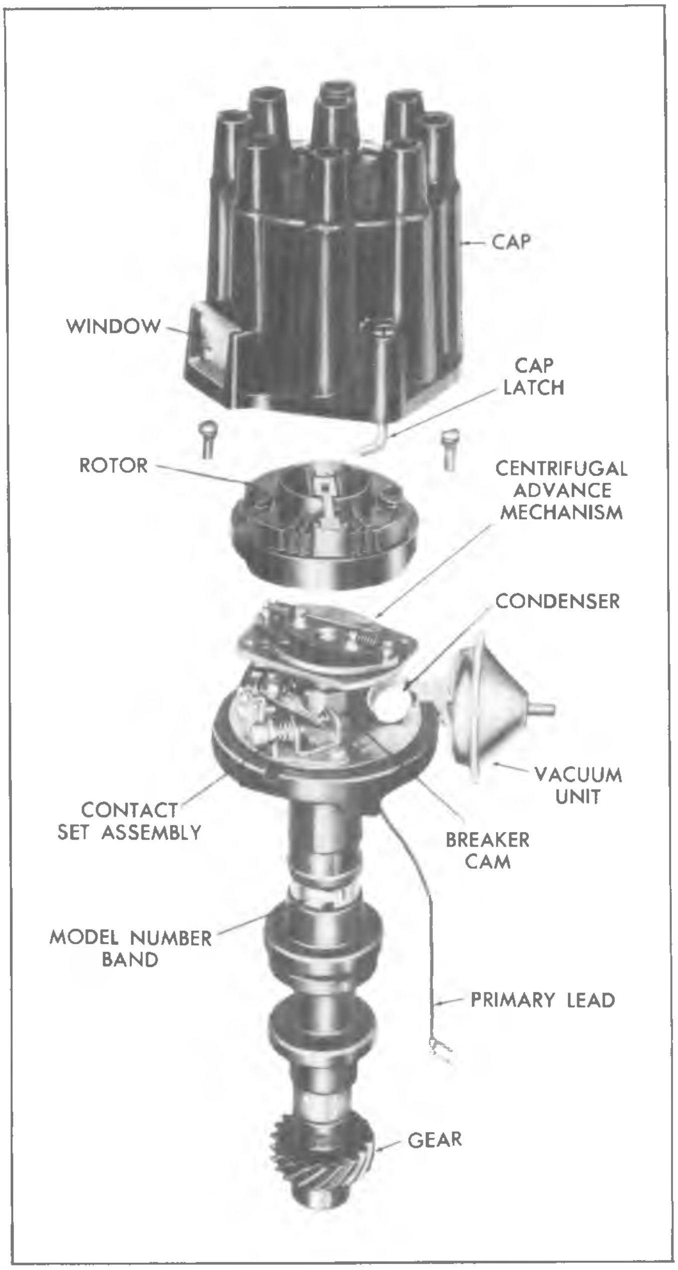


Fig. 2i—V-8 Distributor

The distributor houses the contact points that make and break the primary circuit, and also directs high voltage and current in proper sequence to the spark plugs. The contact point set is replaced as a complete assembly. The breaker lever spring tension and point alignment on the replacement set are factory adjusted, leaving only the dwell angle to be adjusted after installation.

The distributors are equipped with a cam lubricator, which should be rotated 180° every 12,000 miles and replaced every 24,000 miles. Do not attempt to lubricate the element, but replace when necessary. Distributor shaft lubrication is accomplished by a reservoir of lube around the mainshaft in the distributor bowl.

The rotor located above the breaker plate assembly serves as a cover for the centrifugal advance mechanism, and distributes high voltage and current to fire the spark plugs. When the rotor is removed, the centrifugal advance mechanism should be inspected for lubricant. If necessary, a small amount of cam and bearing lubricant should be applied to the advance weights.

The ignition coil (fig. 3i) is an oil filled, hermetically sealed unit designed specifically for use with an external resistance. The number of turns in the primary winding results in a higher inductance in this winding, which makes it possible for the coil to provide a higher secondary voltage output throughout the speed range. The primary current from the ignition switch passes through a resistance wire which lowers the voltage to approximately 8 volts. This lower voltage provides for longer contact life.

For optimum starting performance, the resistance is bypassed during cranking, thereby connecting the ignition coil directly to the battery. This provides full battery voltage at the coil and keeps ignition voltage as high as possible during cranking. The resistance is bypassed automatically through the ignition and starting switch when the switch is in the "Start" position.

The secondary ignition cables in the secondary or high tension system (coil to distributor and distributor to plugs) are resistant to action of oil, grease, battery acid and road salt, and offers resistance to corona breakdown.

Ignition cables have a multiple cloth thread core impregnated with a graphite solution to give the correct conductivity.

The spark plugs used are a resistor type, tapered seat plug. The plugs have a type number on the insulator which designates thread size as well as relative position of the plug in the heat range. Type numbers starting with 4 are 14 mm. thread size. The last digit of the type number indicates the heat range position of the plug. The higher the number, the hotter the plug. Use of leaded fuels results in lead deposits on spark plugs and can cause misfiring at mileages less than 12,000 miles. Spark plugs must be replaced at 6,000 miles when operating with leaded fuels. Where misfiring occurs prior to 6,000 miles, spark plugs in good condition can often be cleaned, tested and reinstalled in an engine with acceptable results.

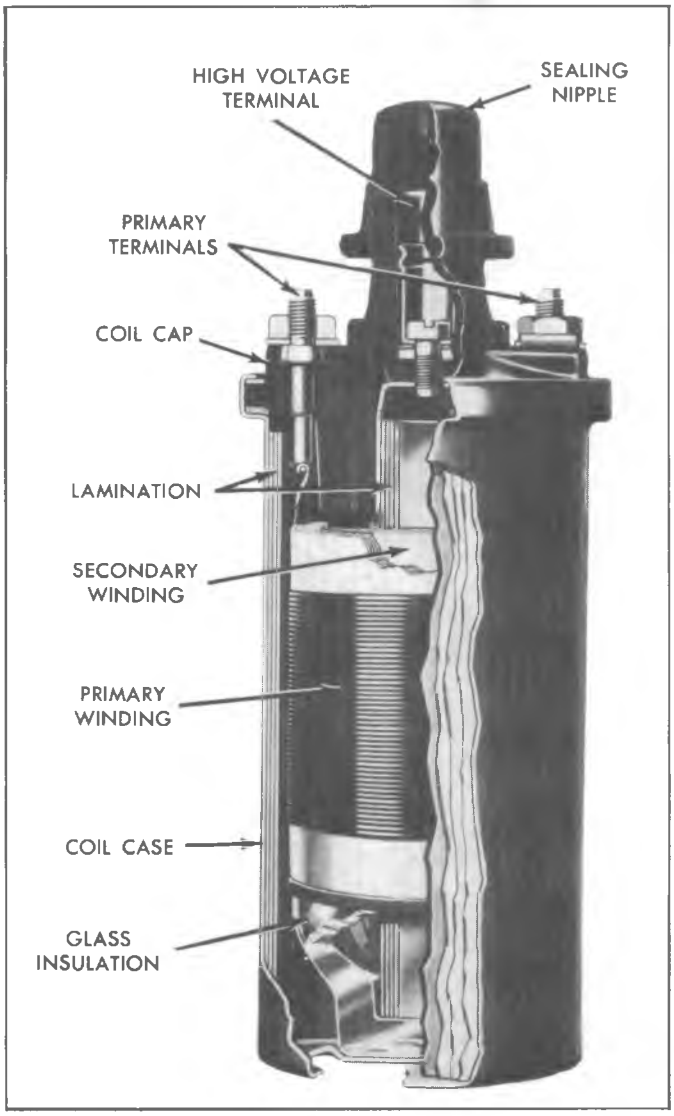


Fig. 3i—Ignition Coil

ADJUSTMENTS AND REPAIRS

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

Six Cylinder Engine Distributor

1. Release distributor cap hold-down screws, remove cap and place it out of work area.
2. Remove rotor and dust shield.
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.

NOTE: Pilot on contact set must engage matching hole in breaker plate.

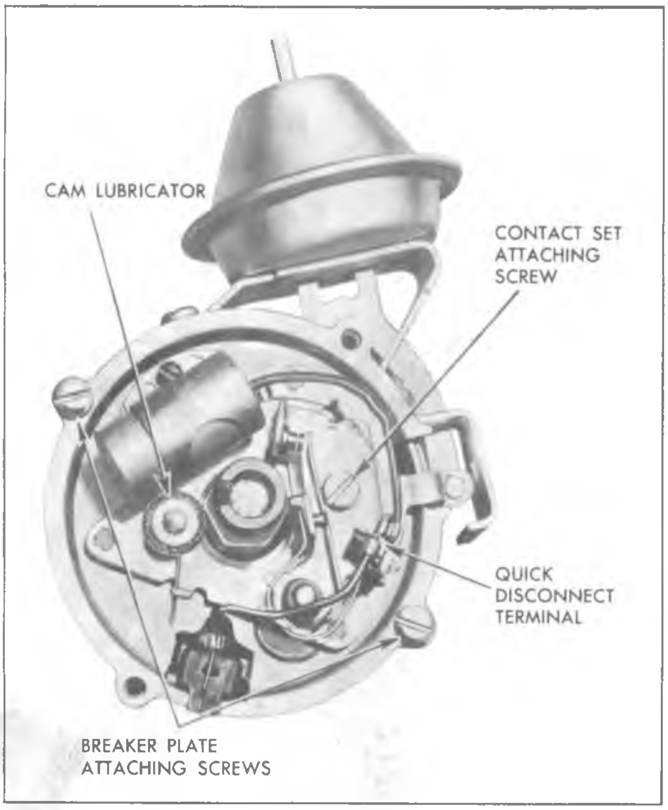


Fig. 4i—Breaker Plate and Attaching Parts

7. Connect primary and condenser lead wires to quick disconnect terminal on contact point set.
8. Set point opening (.019" for new points.)
9. Rotate cam lubricator 180° at 12,000 miles intervals. Replace every 24,000 miles.
10. Reinstall dust shield, rotor, position and lock distributor cap to housing.
11. Start engine and test dwell and ignition timing.

Eight Cylinder Engine Distributor (Fig. 2i)

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 attaching screws and rotor.
4. Loosen the two attaching screws which hold the base of the contact set assembly in place and slide set from breaker plate.
5. Remove the primary and condenser leads from their nylon insulated connection (fig. 5i) in contact set.
6. Reverse Steps 2, 3 and 4 to install new contact set.

CAUTION: Install the primary and condenser leads as shown in Figure 5i. Improper installation will cause lead interference between the cap, weight base and breaker advance plate.

7. Rotate cam lubricator. The lubricator should be rotated at 12,000 mile intervals and replaced at 24,000 mile intervals.

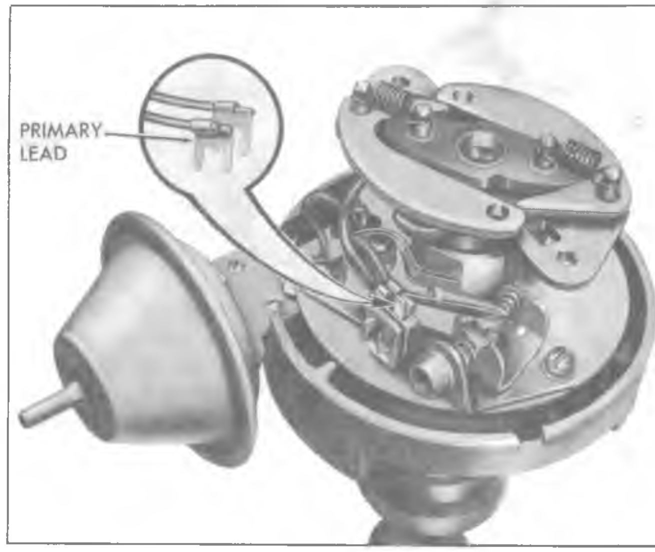


Fig. 5i—Distributor Lead Arrangements

8. Start engine and check point dwell and ignition timing.

Setting Dwell Angle

Six Cylinder Engine Distributor

The point opening of new points can be checked with a feeeler 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 6i).

Contacts 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:

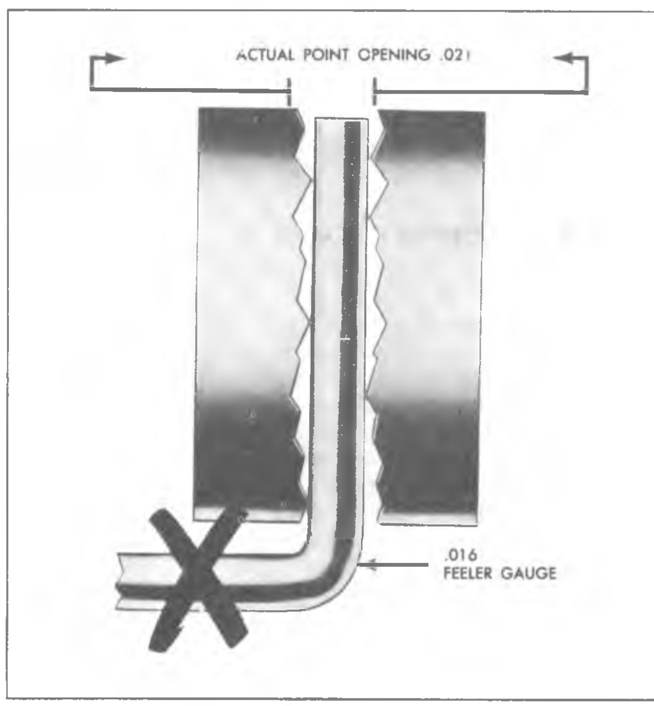


Fig. 6i—Inaccurate Gauge of Rough Points

.019" for new points
.016" for used points

New points must be set to the larger opening as the rubbing block will wear down slightly while seating to the cam. Contact points should be cleaned before adjusting if they have been in service.

To adjust the contact point opening:

1. 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.
2. Loosen the contact support lock screw.
3. Use a screw driver (fig. 7i) to move the point support to obtain a .019" opening for new points and a .016" opening for used points.
4. Tighten the contact support lock screw and recheck the point opening.
5. 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 (Fig. 8) 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. 9i).

1. Preferred Method - Turn the adjusting screw until the specified dwell angle is obtained as measured in degrees (29° to 31°, 30° preferred) by a dwell angle meter.
2. Alternate Method - Turn adjusting screw in (clockwise) until the engine begins to misfire, then turn screw 1/2 turn in the opposite direction (counterclockwise). This will give the approximate dwell angle required. (Use only when meter is not available.

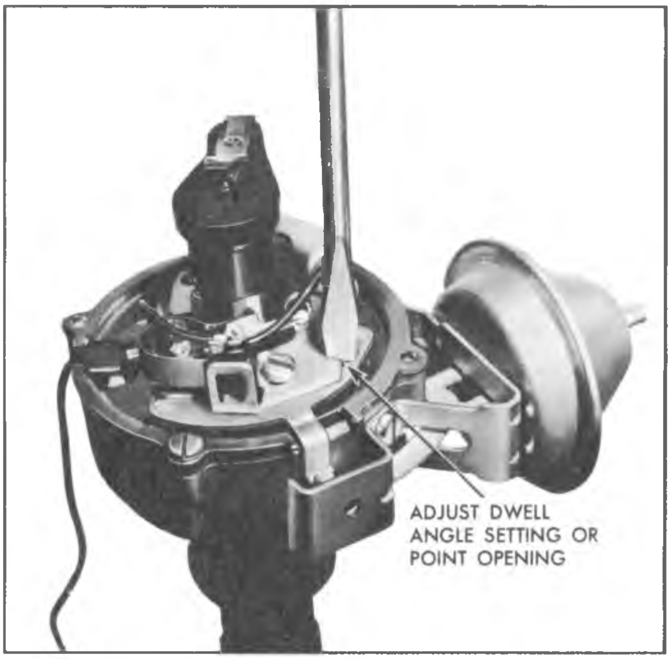


Fig. 7i—Setting Points Opening

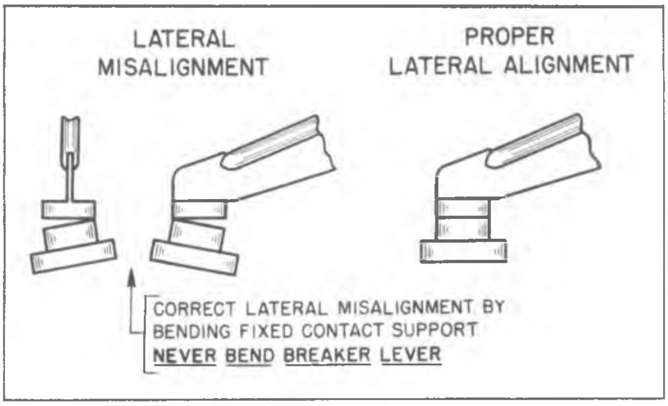


Fig. 8i—Alignment of Points

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. 9i) 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. 9i) until the lamp lights, then give the wrench 1/2 turn in the opposite direction (counterclockwise) to obtain the proper dwell angle.

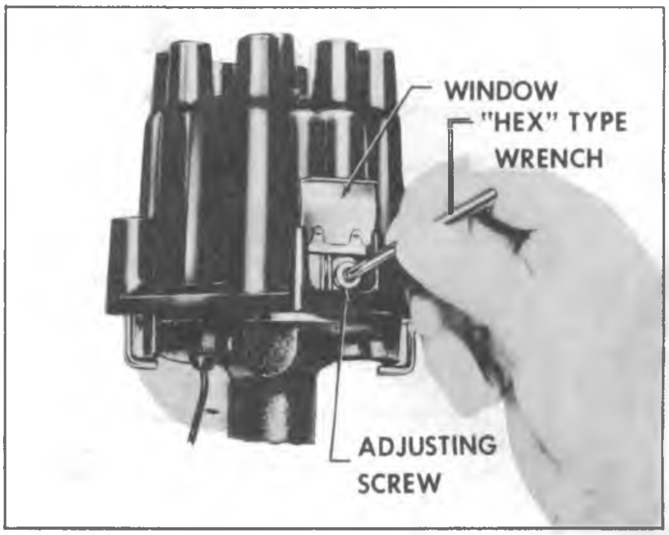


Fig. 9i—Adjusting Dwell Angle

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 lead 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

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 and rotor.
2. Disconnect condenser lead (fig. 5i) from terminal.
3. Remove screw holding condenser bracket to breaker plate and slide condenser from bracket.
4. To replace condenser reverse the above procedure.

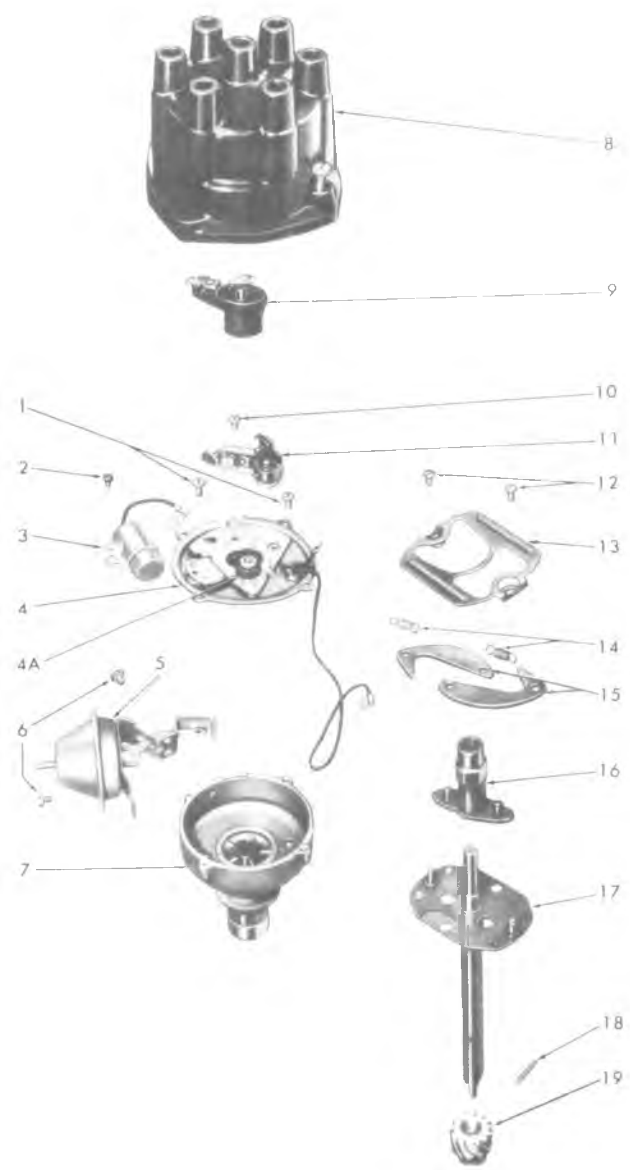
   NOTE: Make sure that new condenser lead is installed in proper position (fig. 5i).

DISTRIBUTOR—Removal

1. Release the distributor cap hold-down screws, remove the cap and place it clear of the work area.

   NOTE: If necessary, remove secondary leads from the distributor cap after first marking the cap tower for the lead to No. 1 cylinder. This will aid in the reinstallation of leads in the cap.

2. Disconnect the distributor primary lead from the coil terminal.
3. Scribe a realignment mark on the distributor bowl and engine in line with the rotor segment.
4. Disconnect external connections (vacuum line, drive cables, etc.) remove the distributor hold-down bolt and clamp, remove the distributor from the engine.



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

Fig. 10i—L-6 Distributor Exploded View

Note position of vacuum advance mechanism relative to the engine.

CAUTION: Avoid rotating the engine with the distributor removed as the ignition timing will be upset.

Disassembly

It is advisable to place the distributor in a distributor testing machine or synchroscope prior to disassembly. When mounting distributors for tests, first secure the gear in the test drive mechanism, then push the distributor housing downward toward the gear to take up any end play between the gear and the housing.

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.

Six Cylinder Engines

Refer to Figure 10i.

1. Remove the rotor and dust shield.
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. 10i).

   NOTE: Do not disassembly 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 11i.

1. Remove the rotor.
2. Remove both weight springs and advance weights.
3. Remove roll pin retaining driven gear to the distributor shaft, slide the gear and spacers from the shaft.
4. Before sliding the distributor shaft from the housing, check for and remove any burrs on the shaft. This will prevent damage to the seals and bushing still positioned in the housing.
5. Slide the distributor mainshaft and cam-weight base assembly from the housing.
6. Remove vacuum advance mechanism retaining screws, remove the vacuum advance assembly.
7. Remove the spring retainer, remove the breaker plate assembly from the distributor housing. Remove the contact point and condenser from the breaker plate. Remove the felt washer and plastic seal located beneath the breaker plate.

Cleaning and Inspection

1. Wash all parts in cleaning solvent except cap, rotor, condenser, breaker plate assembly and vacuum control unit. Degreasing compounds may damage insulation of these parts or saturate the lubricating felt in the case of the breaker plate assembly.
2. Inspect the breaker plate assembly for damage or wear and replace if necessary.
3. Inspect the shaft for wear and check its fit in the bushings in the distributor body. If the shaft or bushings are worn, the parts should be replaced.
4. Mount the shaft in "V" blocks and check the shaft alignment with a dial gauge. The run-out should not exceed .002".
5. Inspect the advance weights for wear or burrs and free fit on their pivot pins.
6. Inspect the cam for wear or roughness. Then check its fit on the end of the shaft. It should be absolutely free without any roughness.
7. Inspect the condition of the distributor points. Dirty points should be cleaned and badly pitted points should be replaced. (See Distributor Contact Points.)
8. Test the condenser for series resistance, microfarad capacity (.18 to .23) and leakage or breakdown, following the instructions given by the manufacturer of the test equipment used.
9. Inspect the distributor cap and spark plug wires for damage and replace if necessary.

Assembly

Six Cylinder Engine (Fig. 10i)

1. Replace cam assembly to mainshaft.

   NOTE: Lubricate top end of shaft with Delco cam and ball bearing grease or equivalent prior to replacing.

2. Install governor weights on their pivot pins, replace weight springs. Install weight cover and stop plate.
3. Lubricate mainshaft and install it in distributor housing.
4. Install distributor driven gear to mainshaft and insert retaining roll pin. Check to see that shaft turns freely.
5. Install breaker plate assembly in the distributor body and attach retaining screws.
6. Attach condenser and contact point set in proper location with appropriate attaching screws.

   NOTE: Contact point set pilot must engage matching hole in breaker plate. Connect primary and condenser leads to contact set quick-disconnect terminal.

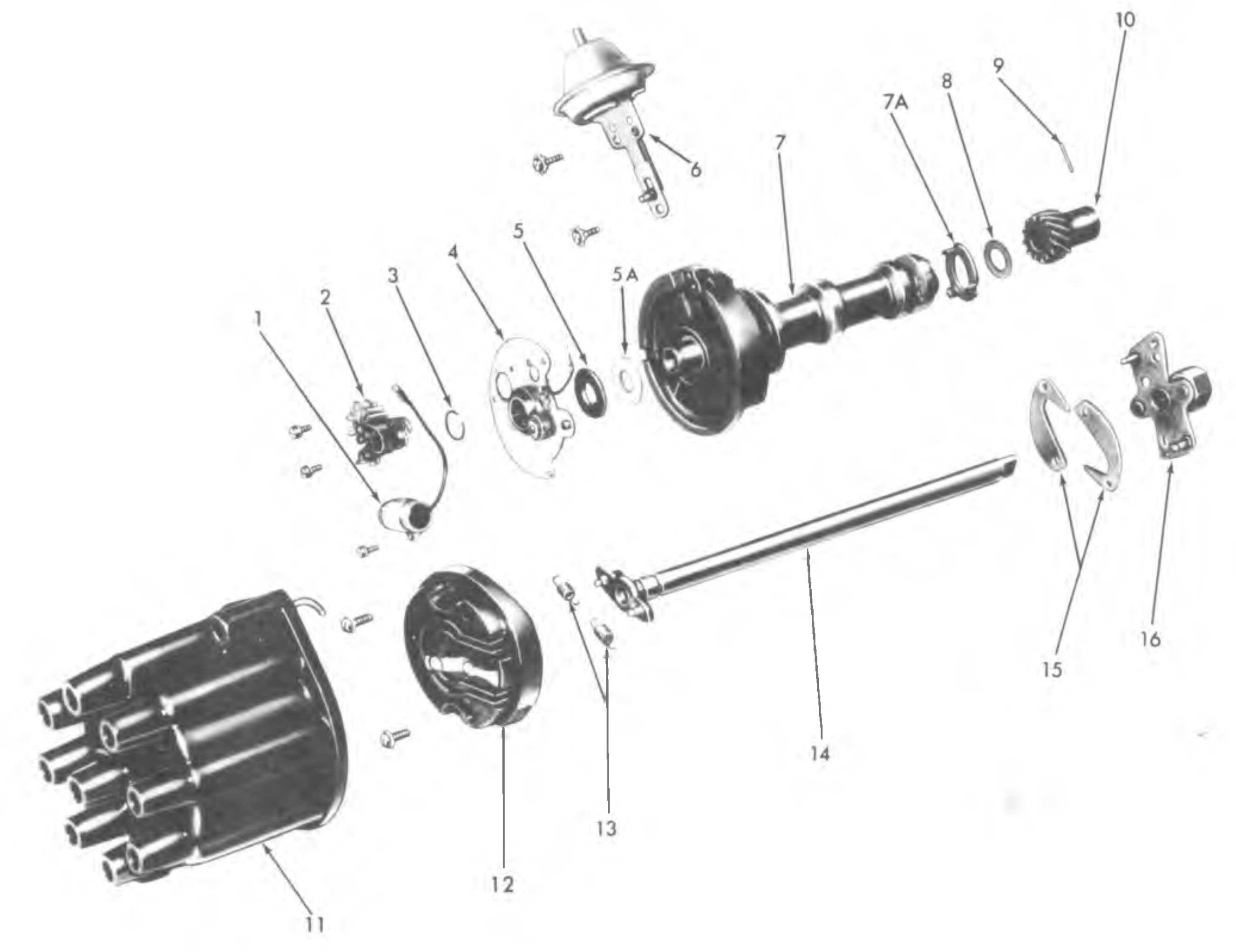
7. Attach vacuum control assembly to distributor housing.
8. Check and adjust contact point opening.
9. Install rotor.

V-8 Engines—(Fig. 11i)

1. a. Fill housing lubricating cavity with proper compound, press in new plastic seal and install felt washer.
   b. Replace the vacuum advance unit.
   c. Install the breaker plate in housing and the spring retainer on the upper bushing.

   NOTE: Spring should seat on the "flat" machined on one side of the mainshaft.

2. Lubricate and slide weight cam over mainshaft and install weights and spring (fig. 12i).



1. Condenser
2. Contact Point Assembly
3. Retaining Ring
4. Breaker Plate
5. Felt Washer
5a. Plastic Seal
6. Vacuum Advance Unit
7. Housing
7a. Tanged Washer
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

Fig. 11i—V-8 Distributor Exploded View

3. Insert mainshaft into housing, indexing it with drive gear and washers.
4. Slide distributor drive gear shims and gear over shaft and install new pin. Tap new pin through gear mainshaft. Check shaft for free rotation.
5. Install contact point set and condenser to breaker plate. Connect leads as shown in Figure 5i.
6. Install rotor to cam assembly, indexing round and square pilot holes.

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 and push the distributor down into position in the block.

   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.
2. 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 (figs. 13i and 14i).
3. 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

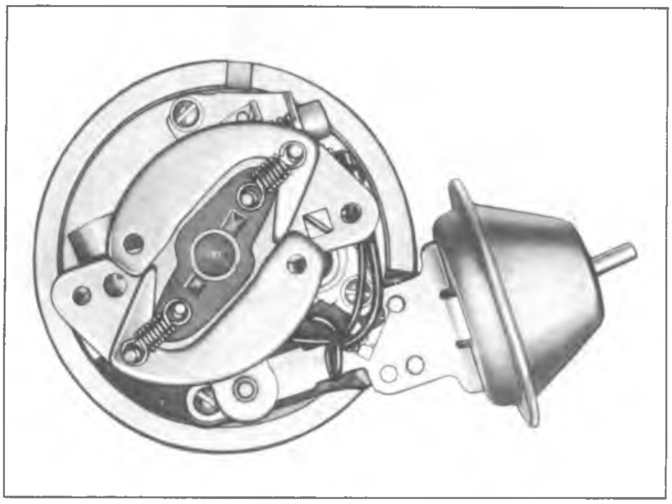


Fig. 12i—Advance Weights Installed

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 V-8 engines) and crank engine until No. 1 intake valve closes and continue to cranks slowly about 1/3 turn until timing mark on pulley lines up with timing tab.

2. Position distributor to opening block in normal installed attitude (figs. 13i and 14i), 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 Tune-Up in Section 6.

SPARK PLUG AND WIRE SERVICE

Removal and Inspection

1. To disconnect wires, pull only on the boot. Pulling on the wire might cause separation of the core of the wire. Remove spark plugs using a 5/8" deep socket on the 5/8" hex tapered plugs. Use care in this operation to avoid cracking spark plug insulators.
2. Carefully inspect the insulator and electrodes of all spark plugs. Replace any spark plug which has a cracked or broken insulator. If the insulator is worn away around the center electrode, or the electrodes are burned or worn, the spark plug is worn out and should be discarded. Spark plugs which are in good condition except for carbon or oxide deposits should be thoroughly cleaned and adjusted.
3. The spark plug wires are a special resistance type. The core is carbon-impregnated linen. This wire is designed to eliminate radio and television interference radiation, but is also superior in resistance to cross fire. The resistance type wire, however, is more easily damaged than copper core wire. For this reason care must be taken that the spark plug wires are removed by pulling on the spark plug boots rather than on the wire insulation. Also, when it is necessary to replace a spark plug boot, the old boot should be carefully cut from the wire and a small amount of silicone lubricant used to aid in installing the new boot. If the wire is stretched, the core may broken with no evidence of damage on the outer insulation. The terminal may also pull off the wire. If the core is broken, it will cause missing. In the case of wire damage, it is necessary to replace the complete wire assembly as a satisfactory repair cannot be made.
4. Wipe ignition wires and cloth moistened with kerosene, and wipe dry. Carefully bend wires to check for brittle, cracked, or loose insulation. Defective insulation will permit missing or cross-firing of engine, therefore defective wires should be replaced.
5. If the wires are in good condition, clean any terminals that are corroded and replace any terminals that are broken or distorted. Replace any borken or deteriorated cable nipples or spark plug boots.

Spark Plug Cleaning

Spark plugs which have carbon or oxide deposits should be cleaned in a blast type spark plug cleaner. Scraping with a pointed tool will not properly remove the deposits and may damage the insulator. If spark plugs have a wet or oily deposit dip them in a degreasing solvent and then

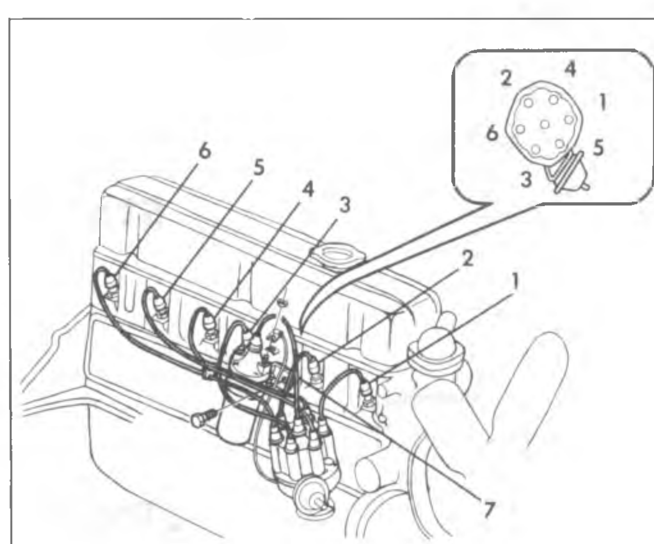


Fig. 13i—L-6 Spark Plug Wire Installation

dry thoroughly with dry compressed air. Oily plugs will cause the cleaning compound to pack in the shell. Carefully follow the instructions of the manufacturer of the cleaner being used, cleaning each plug until the interior of the shell and the entire insulator are clean; however, avoid excessive blasting.

Examine interior of plug in good light. Remove any cleaning compound with compressed air. If traces of carbon oxide remain in plug, finish the cleaning with a light blasting operation. Clean firing surfaces of center and side electrodes with several strokes of a fine file.

When spark plugs have been thoroughly cleaned, carefully inspect for cracks or other defects which may not have been visible before cleaning.

Adjusting Spark Plug Gap

Use round wire feeler gages to check the gap between spark plug electrodes of used plugs (fig. 15i). Flat feeler gages will not give a correct measurement if the electrodes are worn. Adjust gap by bending the side electrodes only; bending the center electrode will crack the insulator. Adjust gaps to specification. Setting spark plug gap to other than specification to effect changes in engine performance is not recommeded.

Fig. 15i—Setting Spark Plug Gap

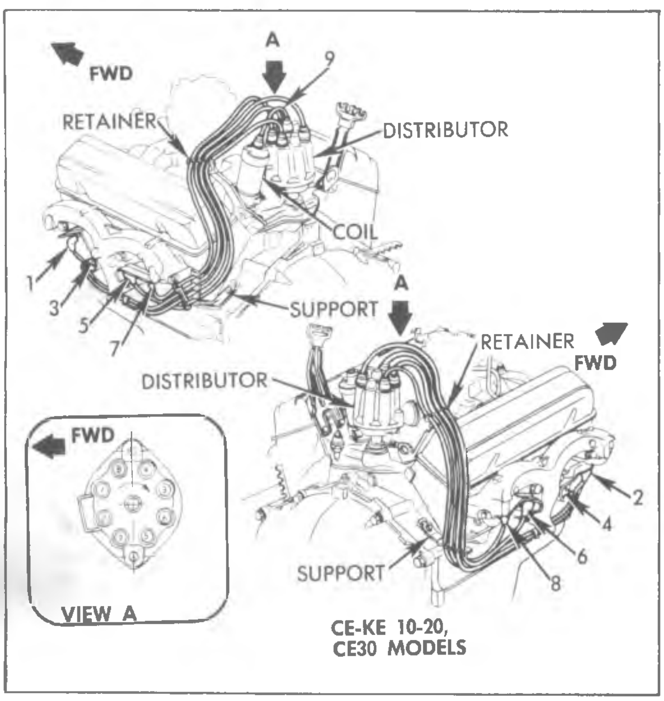


Fig. 14i—V-8 Spark Plug Wire Installation

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 of Spark Plugs

When installing spark plugs, make sure that all surfaces on plugs and in cylinder heads are clean. When installing the 5/8" hex tapered seat spark plugs, tighten to 15 lb. ft., using a 5/8" deep socket, an extension and a torque wrench.

CAUTION: If tapered seat spark plugs are over-tightened, they may crack or be more difficult to remove at the next tune-up.

Installation of Spark Plug Wires

No. 1 spark plug wire is installed in the first distributor cap tower after the adjusting window, moving in the direction of rotation (V-8), or in the foremost tower (L-6). The other wires are then installed in a clockwise direction according to the firing order (figs. 13i and 14i).

STARTING SYSTEM

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

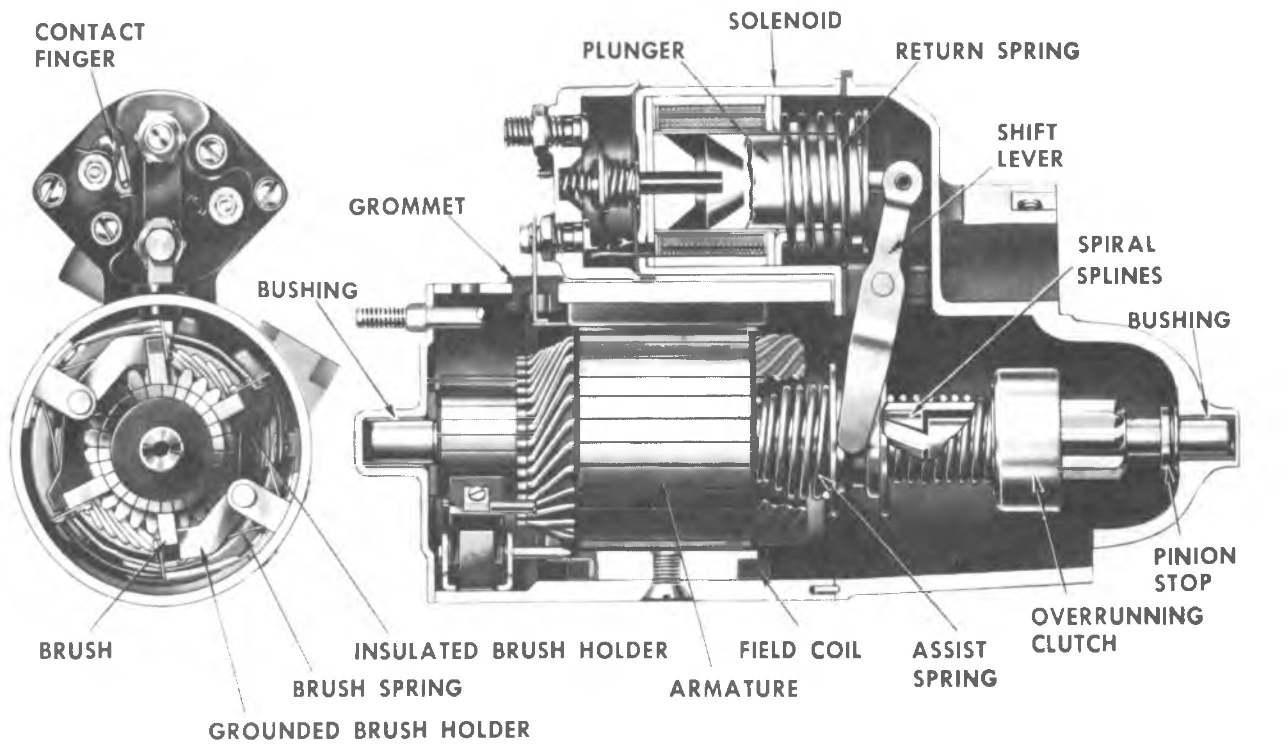


Fig. 1s—Starting Motor Cross Section—Light Duty

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 12-volt extruded frame type, having four pole shoes and four fields, connected with the armature. The aluminum drive end housing is extended to enclose the entire shift lever and plunger mechanism, protecting them from dirt, splash, and icing. The flange mounted solenoid switch operates the overrunning clutch drive by means of a linkage to the shift lever.

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

The gasoline engine type starting motors have graphite and oil impregnated bronze bearings and therefore require no periodic lubrication between major overhauls.

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.
2. From battery negative post to starting motor housing.
3. From solenoid battery terminal to solenoid motor terminal.

If voltage drop is 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 could 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.

COMPONENT PART REPLACEMENT

STARTER MOTOR

Removal and Installation (Fig. 2s)

The following procedure ia a general guide for all vehicles and will vary slightly depending on the truck series and model.

1. Disconnect battery ground cable at the battery.
2. Disconnect engine wiring harness and battery leads at solenoid terminals.

   NOTE: On some V-8 Engine Models, it may be necessary to remove mounting bolts before disconnecting wiring connections.
3. Remove starter mounting bolts and retaining nuts and disengage starter assembly from the flywheel housing.
4. Position starter motor assembly to the flywheel housing and install the mounting bolts and retaining nuts. Torque the mounting bolts 25-35 ft. lbs.
5. Connect all wiring leads at the solenoid terminals.
6. Connect the battery ground cable and check operation of the unit.

SPECIAL TOOLS

Fig. 2s—Special Tool

SECTION 7

CLUTCHES & TRANSMISSIONS

CONTENTS OF THIS SECTION

CLUTCH CONTROLS

INDEX

GENERAL DESCRIPTION

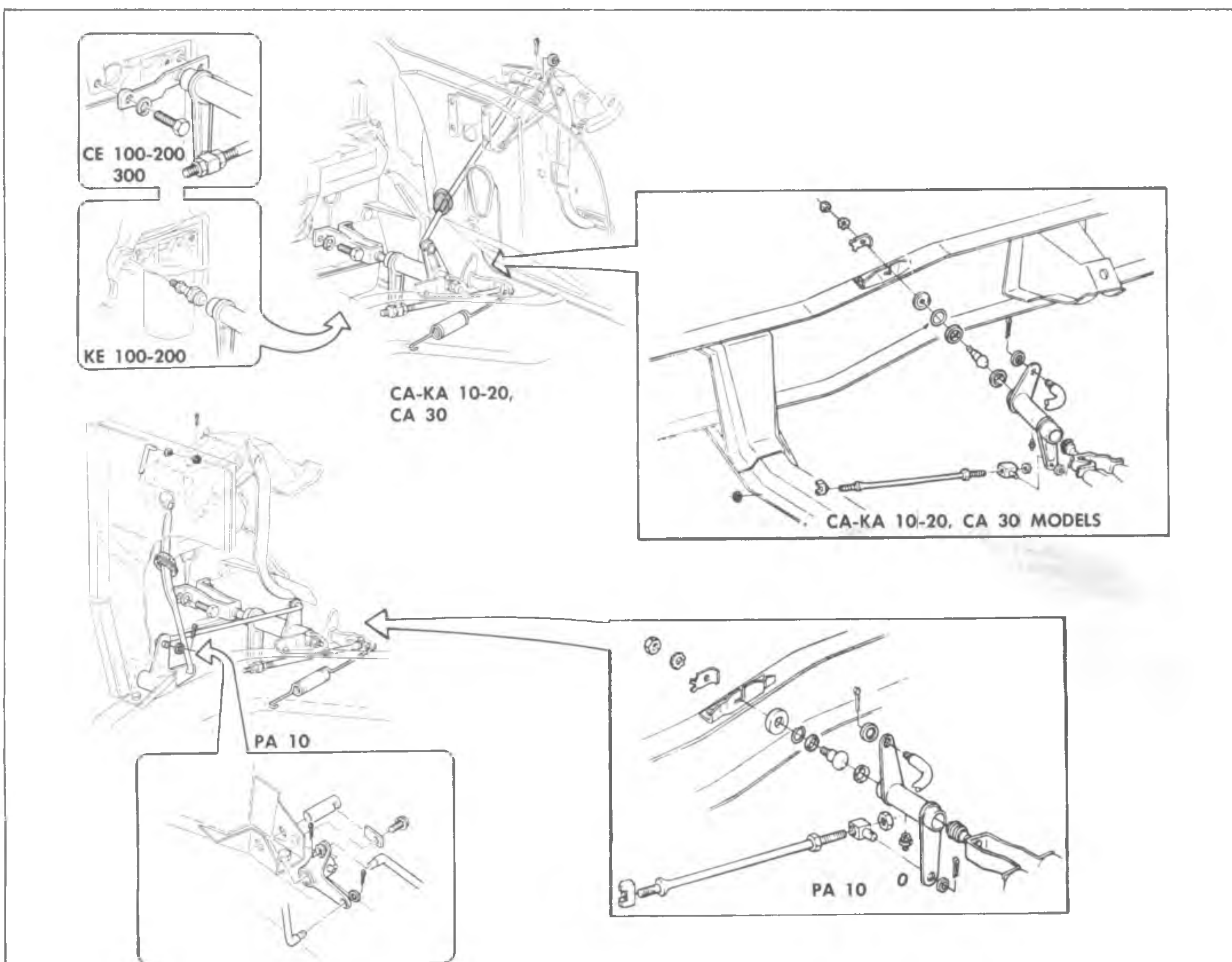


Fig. 1—Clutch Pedal and Linkage Assy. (Exc. P20–30)

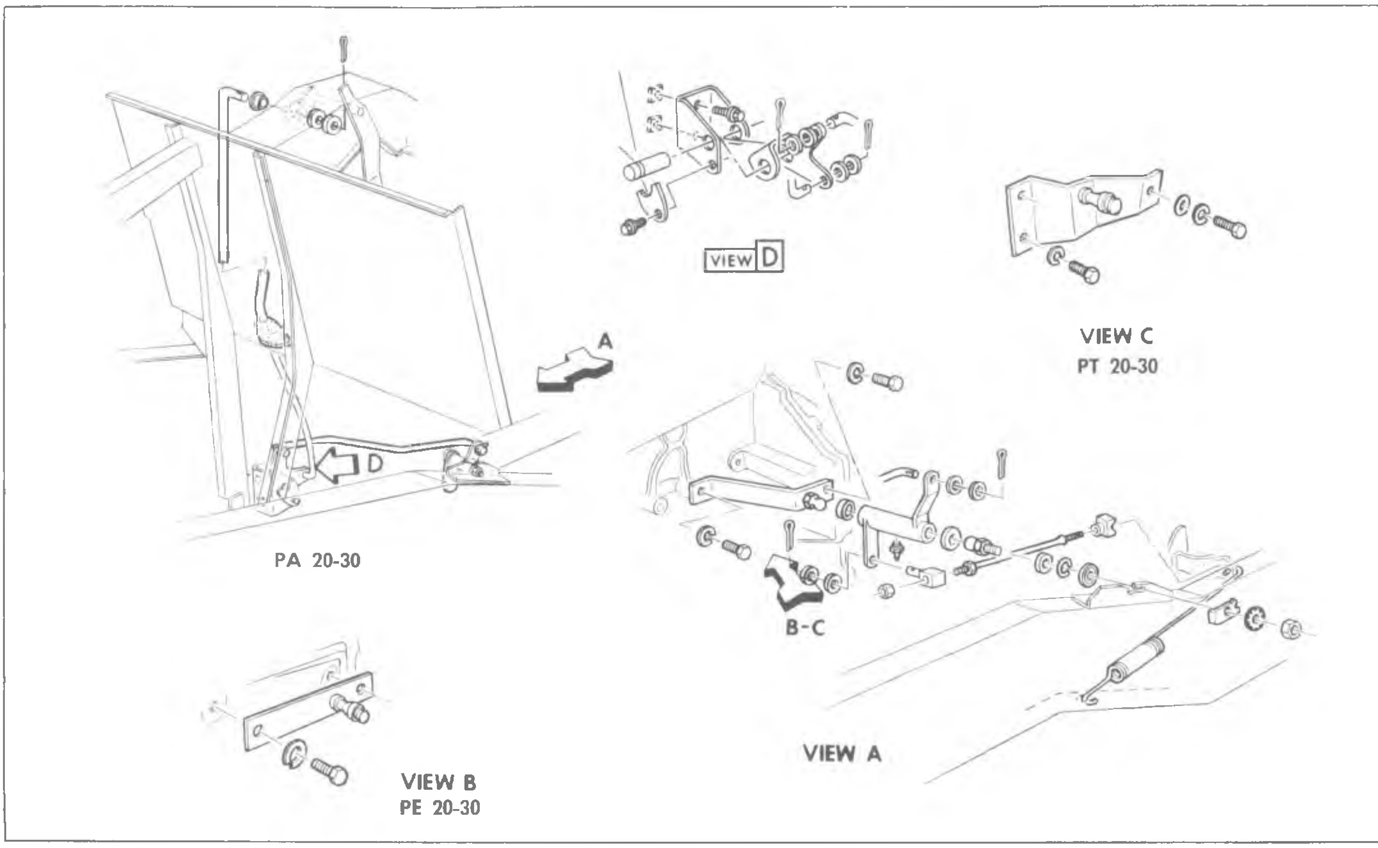


Fig. 2—Clutch Pedal and Linkage Assy. (P20-30)

The clutch operating controls (figs. 1 and 2) for trucks are a mechanical type consisting of a pendant type pedal, return spring, pedal pull rod, cross-shaft, fork push rod, clutch fork and throwout bearing (fig. 1). The pedal pull rod is routed vertically, inside the cab, from the pedal lever down through a seal boot on the toe pan, to the cross-shaft lever. When the clutch pedal is depressed, the pedal pull rod moves rotating the cross-shaft, pushing the fork push rod rearward, and pivoting the clutch fork to move the throwout bearing against the clutch release fingers and releasing the clutch.

MAINTENANCE AND ADJUSTMENTS

CLUTCH FREE PEDAL TRAVEL ADJUSTMENT

Only one simple adjustment is necessary to maintain clutch efficiency and assure long life. This adjustment is for the amount of free clutch pedal travel before the throwout bearing contacts the clutch fingers. As clutch facings wear, the amount of free pedal travel is reduced and in time this will result in clutch slippage. Therefore, it is necessary to adjust pedal at periodic intervals to provide sufficient free pedal travel (fig. 4) to permit full engagement of the clutch.

1. Disconnect clutch fork return spring at fork.
2. Loosen nut "A" (fig. 3) and back off from swivel approximately 1/2 inch.
3. Hold clutch fork push rod against fork to move throwout bearing against clutch fingers (push rod will slide through swivel at cross-shaft).
4. Adjust nut "B" to obtain approximately 3/16" to 1/4" clearance between nut "B" and swivel.
5. Release push rod, connect return spring and tighten nut "A" to lock swivel against nut "B".
6. Check free pedal clearance at pedal (3/4" to 1" is proper clearance). Readjust if necessary.

INSUFFICIENT CLUTCH RELEASE

Where complaints of first or reverse gear clash due to insufficient clutch release are encountered, the following may be helpful. Cut off the existing clutch pedal stop bumper to a height of 3/8". Since shortening the bumper increases the lash and not the usable stroke, the lash must be reduced to specifications in order to gain the additional stroke benefit.

CLUTCH PEDAL REPLACEMENT (Fig. 5)

Removal

1. Pull parking brake lever to applied position.
2. Remove bolt at clutch pedal push rod lever, then remove lever from pedal shaft.
3. Hold pedal pad with one hand and slide clutch pedal and shaft assembly outboard enough to clear pedal stop. Insert a dummy shaft or rod through support and brake pedal assembly to hold components in

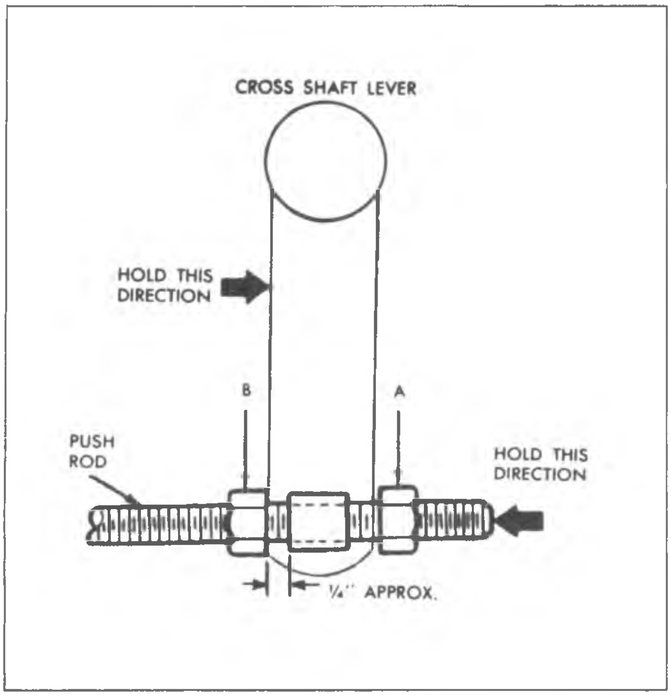


Fig. 3—Free Travel Adjustment

place while removing clutch pedal shaft. Allow return spring (or center spring) to pull pedal up high enough to unhook spring from pedal arm.

4. Remove pedal and shaft assembly from support bracket.

Inspection

1. Check clutch pedal bushings for excessive wear and replace if necessary.
2. Check clutch pedal shaft for wear and alignment and straighten or replace if necessary.

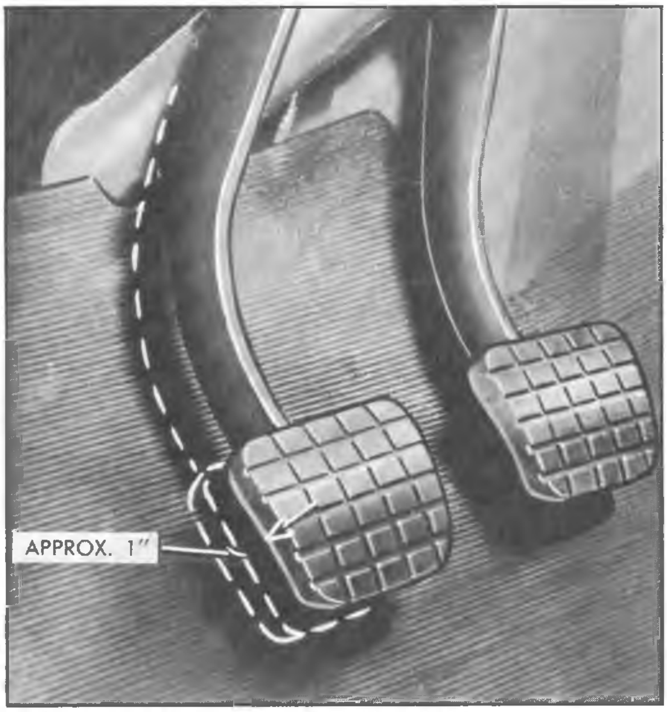


Fig. 4—Clutch Pedal Free Travel

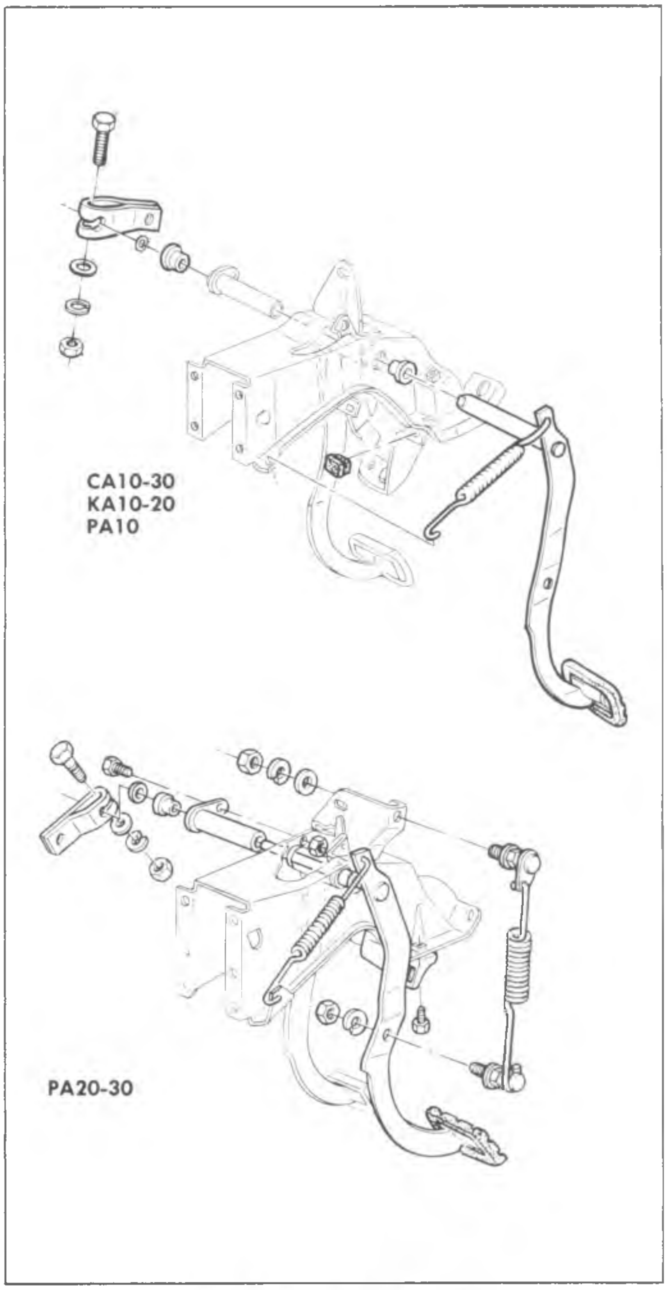


Fig. 5—Clutch Pedal Assy.

Installation

NOTE: Use new shaft bushing if needed and lubricate with Lubriplate or petrolatum.

1. Slide one pedal shaft bushing over shaft, install shaft in support enough to still clear pedal bumper stop, hook pedal return (or overcenter) spring to pedal, then rotate pedal forward of bumper stop; slide shaft into position in support and release pedal against bumper stop.
2. Install clutch pedal shaft bushing over pedal shaft end and into place in sleeve.
3. Assemble pedal push rod lever over pedal shaft and install bolts, washers, and nut. Torque to 25 ft. lbs.
4. Adjust clutch pedal free travel as needed.

CLUTCH CROSS-SHAFT REPLACEMENT (Figs. 1 and 2)

Removal

1. Disconnect clutch fork return spring at fork.
2. Disconnect pedal push rod at cross-shaft lever and allow clutch fork push rod to hang free from lower lever.
3. Loosen ball stud nut and slide stud out of bracket slot, then lift cross-shaft off engine ball stud and out of vehicle.
4. Remove clutch fork push rod from cross-shaft lever if necessary.
5. Reverse removal procedure to install.

CLUTCHES
DIAPHRAGM SPRING CLUTCH

INDEX

MAINTENANCE AND ADJUSTMENTS

PRELIMINARY INSPECTION

There are many things which affect good clutch operation. Therefore, it is necessary, before performing any major clutch operations, to make a preliminary inspection to determine whether or not the trouble is actually in the clutch.

1. Check the clutch pedal and make sure that the pedal has at least 3/4"-1" free travel.
2. Check the clutch pedal bushing for wear and for sticking on the shaft or loose mountings.
3. Lubricate the pedal linkage.
4. Tighten all front and rear engine mounting bolts. Should the mountings be oil soaked, it will be necessary to replace them.

CLUTCH RETRACTING SPRING REPLACEMENT

A rattle in the clutch assembly at idling speeds with the clutch released or failure of the clutch to release properly may be caused by insufficient tension on the pressure plate retracting springs. These troubles can easily be checked by replacing the springs, as follows:

1. Remove the clutch housing underpan.
2. Hand crank the engine until one retracting spring attaching bolt is at the bottom. Remove the bolt and retracting spring and install a new spring.
3. Replace the other retracting springs in the same manner.
4. Replace clutch housing underpan.

DIAPHRAGM CLUTCH ADJUSTMENT

If clutch fails to release:

1. Check pedal for proper travel and linkage for looseness, adjustments, lost motion, etc.
2. Check clutch retracting springs for proper retention of pressure plate to diaphragm spring, replace if necessary. This can be done without removing clutch from vehicle.
3. If Steps 1 and 2 do not cure trouble, check pressure plate lift with dial indicator (fig. 7) as follows:
   a. With proper linkage adjustment (and lash), zero indicator with clutch fully engaged (pedal up).
   b. Measure pressure plate lift at 3 strap bolt positions with full pedal travel.

Fig. 6—Checking Pressure Plate Lift w/dial Indicator

Fig. 7—Gauging Shim Requirement

NOTE: Use 5/8" thick board in place of floor mat to give a positive stop.

All three readings should be within .010" and within total lift readings. If more than .010" check retracting springs per step 2. If trouble still exists, loosen clutch-to-flywheel mounting bolt at position of lowest reading (leave other bolts tight), pry cover, away from flywheel, and insert feeler gauge (fig. 7) to determine thickness of shim required to bring reading within .010".

Total lift readings should be as follows:

L-6 250	.065 to .075
HD 11"	.065 to .085

Make sure proper pedal lash adjustment is made before checking.

NOTE: Excessively high readings indicate that the diaphragm spring is being over stressed which may eventually cause loss of load and result in slippage.

If above measures fail to correct the trouble, check driven disc with clutch pedal depressed (it should spin freely with transmission in neutral). If it does not, trouble may be:

1. Misalignment between pilot bushing in crankshaft and clutch housing.
2. Faulty clutch pilot bushing.
3. Faulty driven disc.

SERVICE OPERATIONS

CLUTCH ASSEMBLY

Removal From Vehicle

1. Remove transmission as outlined in "Transmission Section."
2. Remove clutch throwout bearing from the fork.
3. Remove clutch fork by pressing it away from its ball mounting with a screwdriver, until the fork snaps loose from the ball or remove ball stud from rear of clutch housing.

NOTE: The retainer may be removed from the fork by prying out with a small screwdriver.

4. Install Tool J-5824 or a used clutch drive gear to support the clutch assembly during removal.
5. Loosen the clutch attaching bolts one turn at a time to prevent distortion of clutch cover until diaphragm spring is released.
6. Remove clutch pilot tool and remove clutch assembly from vehicle.

Installation to Vehicle

1. Install the pressure plate in the cover assembly lining up the notch mark on pressure plate with notch mark on flange of cover.
2. Install pressure plate retracting springs, lockwashers and drive strap to pressure plate bolts and lockwashers and tighten to 11 ft. lbs. torque. The clutch is now ready to be installed.
3. Hand crank the engine until "X" mark on flywheel is at the bottom.
4. Install clutch disc, pressure plate and cover assembly and support them with Tool J-5824 or a used clutch drive gear.
5. Turn clutch assembly until "X" mark or painted white letter on clutch cover flange lines up with "X" mark on flywheel.
6. Install attaching bolts and tighten each one a turn at a time to prevent distorting the cover as the spring pressure is taken up.
7. Remove clutch pilot Tool.
8. Pack clutch fork ball seat with a small amount of high melting point grease and install a new retainer in the groove of the clutch fork if the old retainer is worn or damaged.

NOTE: Install retainer with high side up, away from bottom of the ball socket and with open end of retainer on the horizontal.

CAUTION: Be careful not to use too much lubricant.

9. Replace clutch fork ball if removed from the clutch housing and snap clutch fork onto the ball.
10. Pack lubricant in the recess on the inside of the throwout bearing collar and coat the throwout fork groove with a small amount of graphite grease (fig. 8).
11. Install throwout bearing assembly to the throwout fork.

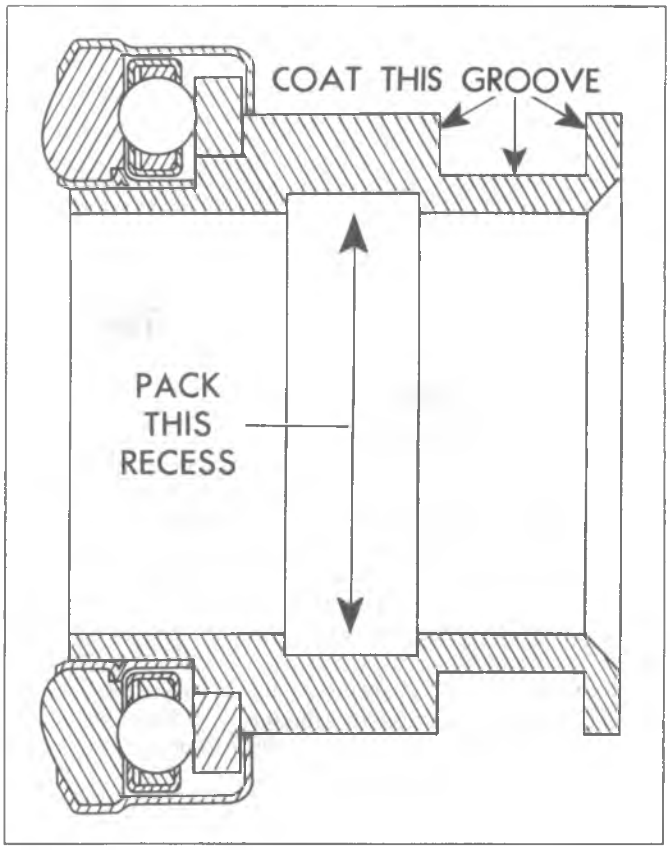


Fig. 8—Lubrication Points on Clutch Throwout Rearing

12. Assemble transmission as outlined in Transmission Section, and install flywheel underpan.
13. Align push rod to clutch fork and attach return spring to clutch fork.
14. Adjust clutch linkage (See adjustments in this section).

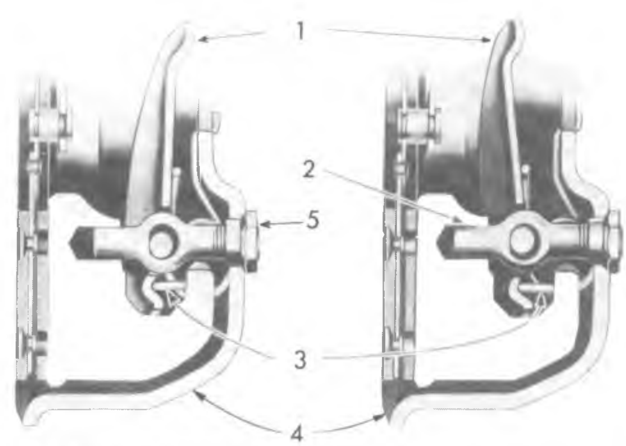
COIL SPRING CLUTCH

INDEX

GENERAL DESCRIPTION

The coil spring single plate clutch is a dry disc type and no adjustment for wear is provided in the clutch itself. An individual adjustment is provided for locating each lever in manufacturing but the adjusting nut is locked in place and should never be disturbed, unless the clutch is dismantled for replacement of parts.

When the clutch pedal is depressed the release bearing is moved toward the flywheel and contacts the inner ends of the release levers, (1) (fig. 9). Each release lever is pivoted on a floating pin which remains stationary in the lever and rolls across a short flat portion of the enlarged hole in the eyebolt (2). The outer end of each release lever engages the pressure plate lug by means of a strut (3), which provides knife-edge contact between the outer end of the lever and the lug. The outer ends of the eyebolts extend through holes in the stamped cover (4), and are fitted with adjusting nuts (5) to correctly position the levers.



1. Release Lever
2. Eyebolt
3. Strut
4. Cover
5. Adjusting Nut

Fig. 9—Release Lever

SERVICE OPERATIONS

CLUTCH ASSEMBLY

Removal From Vehicle

Before removing clutch from flywheel, mark with a punch the flywheel, clutch cover and one pressure plate lug, so that these parts may be assembled in their same relative positions, as they were balanced as an assembly. Loosen the holding screws a turn or two at a time to avoid bending rim of cover. When removing driven plate be sure to mark flywheel side.

> **NOTE:** It is advantageous to place wood or metal spacers (approximately 3/8 thick) between the clutch levers and the cover to hold the levers down as the holding screws are removed or when clutch is removed from engine.

Installation To Vehicle

1. Assemble driven plate and clutch cover assembly to flywheel in accordance with marking on driven plate for flywheel side.
2. Line up the driven plate assembly and pilot bearing with a dummy shaft (used clutch drive gear) before tightening cover holding screws. Tighten holding screws before removing dummy shaft.
3. After transmission has been assembled, adjust pedal as described under "Clutch Pedal Adjustments".

MANUAL TRANSMISSIONS

INDEX

TRANSMISSION LINKAGE ADJUSTMENT

3-Speed Column Shift (Fig. 10)

In cases where gearshift linkage has been disconnected or removed, proper adjustment sequence is important.

1. Install control rods to both second and third shifter lever and first and reverse shifter lever. Set both shifter levers in neutral position.
2. Align both shifter tube levers on mast jacket in the neutral position. Install gauge in holes of levers to hold levers in alignment. Position relay levers so that gearshift control lever is in neutral position.
3. Connect control rods to tube levers making sure clamps are properly adjusted so that tube levers and transmission shifter levers remain in their neutral positions while tightening.
4. Remove gauge and move selector lever through all positions to check adjustment and insure over-travel in all positions.

NOTE: If mast jacket lower dash clamp has been disturbed at its mounting on dash, its adjustment to the steering mainshaft should be checked as outlined in the procedure in Section 9 of this manual.

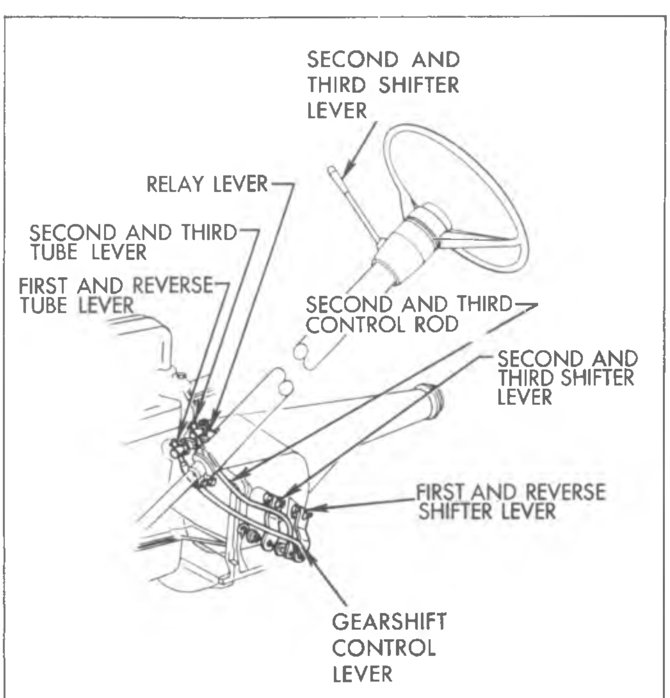


Fig. 10—3 Speed Column Gearshift Controls

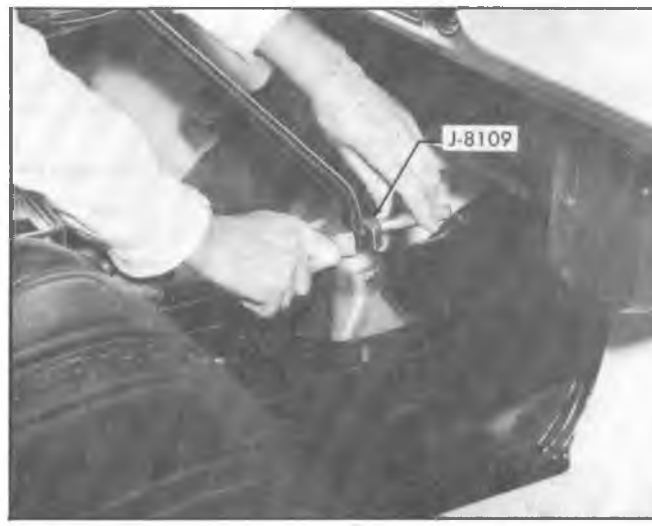


Fig. 11—Removing Transmission Gearshift Lever

TRANSMISSION SHIFT CONTROL LEVER REPLACEMENT (FLOOR SHIFT)

1. On K-Series models remove transfer case shift lever boot retainer attaching screws and retainer from compartment floor.
2. Remove floor covering from vehicle.
3. Remove transmission shift lever boot retainer attaching screws.
4. Slide boot and retainer up on shift lever and remove the transmission shift lever using Tool J-8109 as shown in Figure 11.
5. To install, reverse removal procedure Steps 1-4.

TRANSMISSION REPLACEMENT

Removal—Except "K" Series Models

1. Raise vehicle on suitable hoist and drain lubricant from transmission.
2. Disconnect speedometer cable, back-up lamp and TCS switch at transmission.
3. Remove shift controls from transmission.

NOTE: On vehicle equipped with Muncie 4-Speed transmission, remove the gearshift lever using Tool J-8109 as shown in Figure 11. Press down firmly and rotate counter-clockwise to release gearshift lever.

4. Place clean lint-free cloth or other suitable covering over opening on transmission to prevent entry of dirt or foreign material (applies to 4-speed transmissions).
5. Disconnect parking brake lever and controls (when used) and back up lamp switch wire.
6. If vehicle is equipped with power take-off, remove unit and controls from transmission. Place protective covering over opening.
7. Disconnect propeller shaft from transmission as described in "PROPELLER SHAFTS" (SEC. 4) of this manual.
8. Position a suitable dolly or jack under the vehicle and adjust to carry the weight of the transmission.
9. Visually inspect to determine if other equipment, lines or brackets must be removed to permit removal of the transmission.
10. Remove flywheel housing underpan and transmission-to-flywheel housing mounting bolts.

    IMPORTANT: Be sure to support the clutch release bearing and support assembly during removal of the transmission main drive gear from the flywheel housing. This will prevent the release bearing from falling out of the flywheel housing when the transmission is removed.

11. Move the transmission assembly straight away from the engine, using care to keep the transmission main drive gear shaft in alignment with the clutch disc hub.

    IMPORTANT: When removing the transmission, do not allow the weight of the transmission to hang on the clutch disc hub, as the disc will become distorted, seriously affecting clutch operation.

12. When the transmission is free from the engine, lower the transmission and move from under the vehicle.
13. If desired, a careful check of clutch components should be made after the transmission has been removed. If the clutch requires repair, refer to "CLUTCHES" (Section 7) before transmission is reinstalled in the vehicle.

Installation—Except "K" Series Models

1. Apply a light coating of High Temperature Grease to the main drive gear bearing retainer and splined portion of transmission main drive gear shaft to assure free movement of clutch and transmission components during assembly.

    CAUTION: Do not apply an excessive amount of grease in the above areas, as under normal operation this grease would be thrown onto clutch facings resulting in clutch failure.

2. Shift the transmission into high gear.
3. Mount transmission on dolly or jack and move into position under the vehicle.
4. Align the transmission main drive gear shaft with the clutch disc hub by rotating the transmission companion flange or output yoke. Move the transmission forward, guiding the main drive gear shaft into the clutch disc splines.

    IMPORTANT: Avoid springing the clutch when the transmission is being installed to the engine. Do not force the transmission into the clutch disc hub. Do not let the transmission hang unsupported in the splined portion of the clutch disc.

    Install flywheel housing-to-transmission mounting bolts and washers. Tighten bolts to 40-50 ft.lbs. torque.

5. If vehicle is equipped with power take-off, reinstall unit and controls on transmission.
6. Connect propeller shaft to transmission as described in "PROPELLER SHAFTS" (Section 4) of this manual. Remove transmission jack.
7. Connect parking brake lever and controls (if used). Adjust brakes as outlined in "PARKING BRAKE" (Section 5) of this manual.
8. Install flywheel housing underpan. Tighten cap screws firmly.
9. Reconnect speedometer cable to adapter at transmission, Connect back-up lamp switch wire and TCS switch.
10. Reinstall shift controls on transmission.

    NOTE: On vehicle equipped with 3-speed transmission, reconnect shift levers to transmission side cover.

    On vehicle equipped with Muncie 4-Speed transmission, install gearshift lever using Tool J-8109 as shown in Figure 11. Press down firmly and rotate clockwise to install gearshift lever. Install transmission floor pan cover and floor mat.

11. If other equipment (exhaust pipe, support brackets, etc.) was removed, reinstall these parts.
12. Refill transmission with lubricant recommended in LUBRICATION (Section 0) of this manual.
13. If necessary, adjust clutch or transmission control linkage to achieve proper transmission operation.

Replacement—"K" Series

3-Speed Transmission

1. Raise vehicle
2. Drain transfer case and transmission. Disconnect the speedometer cable from speedometer driven gear fitting, and TCS switch connections.
3. Disconnect propeller shafts from U-joint yoke at case, and tie up out of way.
4. Remove bolt holding the shift lever control assembly to the adapter assembly. Push assembly to one side and tie up out of way.
5. Support transfer case in a suitable cradle. Remove bolts attaching transfer case to adapter.
6. Remove bolts attaching transfer case to frame bracket at right side of case and remove case from adapter.
7. Disconnect shift control rods from the shifter levers at the transmission.
8. Support rear portion of engine. Remove two (2) adapter mount bolts.

9. Remove the 2 top transmission to clutch housing cap screws and insert 2 transmission guide pins, Tool J-1126 in these holes.
10. Remove flywheel under pan. Remove the 2 lower transmission-to-clutch housing cap screws.
11. Slide the transmission and adapter assembly straight back on guide pins until the clutch gear is free of splines in the clutch disc.

NOTE: The use of the 2 guide pins during this operation will support the transmission and prevent damage to the clutch disc through springing.

12. Remove the transmission and adapter as an assembly from under the body.
13. Remove adapter from transmission.
14. To install, reverse removal procedure.

4-Speed Transmission—Removal

1. Remove attaching screws from transfer case shift lever boot retainer and remove retainer.
2. Remove floor mat or carpeting from compartment.
3. Remove attaching screws from transmission shift lever boot retainer. Slide boot and retainer up lever and remove transmission shift lever using Tool J-8109 as shown in Figure 11.
4. On Blazer models remove center floor outlet from heater distributor duct.

NOTE: On Blazer models equipped with a center console, remove console before proceeding to next step.

5. Remove transmission floor cover attaching screws and cover. Rotate cover approximately 90° to clear transfer case shift lever while lifting cover from vehicle.
6. Disconnect shift lever link assembly from transfer case shift rail connecting rod. Remove shift lever attaching bolt and shift lever control from adapter.
7. Disconnect back-up lamp wiring from switch and remove attaching clamp from top cover bolt.
8. Raise and support vehicle on hoist. Support engine with suitable floor stand. Drain transfer case and transmission assemblies.
9. Disconnect speedometer cable from transfer case. Disconnect back-up lamp switch wiring and TCS switch.
10. Disconnect prop shaft at rear of transfer case and tie up away from work area.
11. Disconnect front prop shaft from transfer case and tie up away from work area.
12. Open lock tabs and remove transmission mount-to-frame crossmember bolts. Also remove transfer case-to-frame bracket attaching bolts.
13. Support transmission and transfer case assembly with suitable floor stand.
14. Remove frame to crossmember bolts and remove crossmember from vehicle. Rotate crossmember to clear frame rails.
15. Remove flywheel housing cover. On V-8 engine models, remove exhaust crossover pipe.
16. Remove transmission to flywheel housing attaching bolts.

NOTE: Remove upper bolts first and install transmission guide pins J-1126. Use of the guide pins will prevent damage to the clutch assembly.

17. Slide transmission rearward until main drive gear clears the clutch assembly and lower assembly from vehicle.

4-Speed Transmission—Installation

1. Position transmission, with transfer case attached to the flywheel housing. Install bolts attaching transmission to flywheel housing.
2. Install flywheel housing cover and attaching bolts. On V-8 models, install exhaust crossover pipe.
3. Position frame crossmember and install retaining bolts. Install bolts retaining adapter assembly to crossmember and transfer case to frame rail bracket. Torque all bolts to specification.
4. Torque front and rear transfer case yoke lock nuts to 250 ft. lbs.
5. Install front and rear propshafts to transfer case output yokes.
6. Connect the speedometer cable, back-up lamp wiring and TCS switches.
7. Fill transmission and transfer case to proper level with lubricant specified in the lubricant section, Truck Chassis Service Manual.
8. Install transfer case shift lever assembly and attaching bolt. Connect shift lever link to shift rail bar.
9. Install transmission floor cover and attaching bolts.
10. Install heater distributor duct center outlet.

NOTE: On models with center console, install console and retaining bolts.

11. Install floor mat, transfer case shift lever retainer and attaching screws.
12. Install transmission shift lever.

TRANSMISSION ALIGNMENT

In some instances where "excessive" gear whine or high gear hop out, particularly at 50 MPH and up, are encountered; and after all other probable causes have been checked, an alignment check of the transmission and clutch housing may be helpful.

A special tool, on which a dial indicator is mounted, is necessary to check the transmission case rear bore alignment. This tool may be made from a new or good used clutch gear which has a good bearing surface on the crankshaft pilot end and at the front main bearing location.

The splines on the clutch gear shaft and the teeth on the clutch gear should be ground off so the shaft may be rotated in a clutch disc hub without interference when assembled in the car. Weld a piece of 1/4" rod in the mainshaft pilot bore long enough to extend out the case rear bore. Assemble a good bearing on the clutch gear shaft and secure it with the clutch gear bearing snap ring. Attach a suitable dial indicator to the rod.

Procedure

1. Remove the transmission from the vehicle and completely disassemble, except for the reverse idler gear.

NOTE: In any case where the clutch gear pilot or pilot bearing is excessively loose or worn, the pilot bearing should be replaced before checking the transmission case rear bore alignment by the dial indicator method.

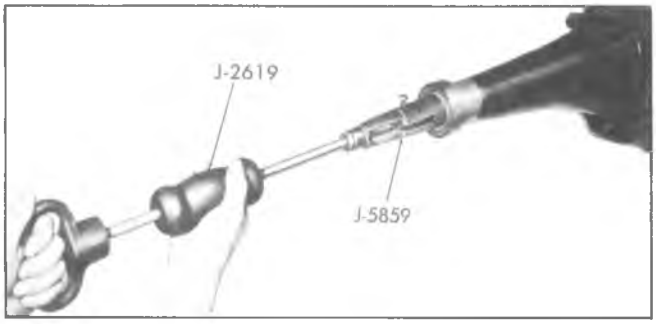


Fig. 12—Removing Mainshaft Rear Oil Seal

2. Carefully install the special tool with the dial indicator in the transmission case with the face of the indicator to the rear of the case and with the tracing finger contacting the I.D. of the case rear bore. Secure in place with a clutch gear bearing retainer.
3. Assemble the transmission case to the clutch housing and tighten the four transmission mounting bolts securely.

   NOTE: Be sure to clean off any paint or other foreign material on the mating faces of the clutch housing and transmission as any foreign material on these faces will change alignment; also, check carefully for dings or burrs on these mating surfaces and remove carefully as necessary.

4. Dial indicate the transmission case rear bore and record the indicator readings in the 12, 3, 6 and 9 o'clock positions.

   NOTE: It is best to start the reading at the 3, 6, 9 or 12 o'clock position closest to the point where the indicator plunger reaches its maximum outward travel. Set the dial indicator at "0" at this location and then record the 3, 6, 9 and 12 o'clock readings in rotation.

5. Install temporary slotted shims between the transmission case and the clutch housing in the quantities and at the bolt locations as necessary to bring misalignment at the transmission case rear bore to a maximum of .005" indicator reading in either the vertical or horizontal direction.

   EXAMPLE: If the maximum indicator reading is at the 12 o'clock position, put shims on the two bottom bolts.

6. After the position and quantity of shims has been determined and recorded the transmission case may be removed.

   NOTE: The clutch housing should then be stamped, showing the position where shims are to be installed and the thickness of shims at each location.

7. Inspect the external clutching teeth of the clutch gear and second speed gear. Inspect the second and third speed clutch internal clutching teeth. If the teeth are worn or tapered, even slightly, the gears should be replaced. Reassemble the transmission.
8. Install the transmission assembly to the clutch housing, using the correct number of shims at the proper locations as previously determined. Shims are available by unit part number with each unit consisting of the following shims:

   4--.002" shims Identification--two corners cut off.
   2--.005" shims Identification--one corner cut off.
   1--.010" shims Identification--all corners square.

   NOTE: These special shims have a tab on one end for ease of installation. Do not slot the shims for the permanent installation.

REAR OIL SEAL REPLACEMENT

1. Drain lubricant from transmission.
2. Disconnect propeller shaft from transmission as described in "PROPELLER SHAFTS" (Section 4) of this manual.
3. On 3-speed transmissions, perform the following replacement procedures:
   a. Remove slip joint yoke from rear of transmission mainshaft.
   b. Pry seal out of extension housing or remove oil seal using oil seal remover (J-5859) and slide hammer (J-2619) as shown in Figure 12.
   c. Coat outer diameter of new oil seal with sealing cement. Install new oil seal using extension housing oil seal installer (J-5154).
   d. Install slip joint yoke on rear of transmission mainshaft.
4. On Muncie and New Process 4-speed transmissions, perform the following:
   a. Remove parking brake from rear of transmission as described in "PARKING BRAKE" (Section 5), when used.
   b. Disconnect speedometer cable and remove speedometer driven gear from mainshaft rear bearing cap.
   c. Using flange or yoke holding tool, remove the output yoke or companion flange nut. Pull output yoke or companion flange nut off the mainshaft.
   d. Remove mainshaft rear bearing cap and gasket. Discard gasket.
   e. Remove oil seal from rear bearing cap. Discard oil seal.

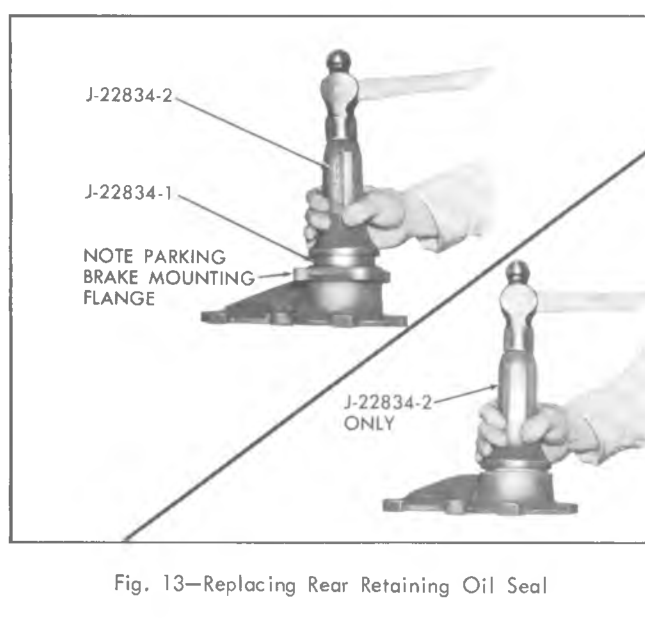


Fig. 13—Replacing Rear Retaining Oil Seal

f. Coat outer diameter of new oil seal with sealing cement. Install oil seal in rear bearing cup using a suitable installer. Drive seal flush with outside of rear bearing cap, being careful not to damage seal as shown in Figure 13.

NOTE: On Muncie 4-speed use Installer J-22834 with Adapter J-22834-1 as required.

g. Clean all gasket surfaces, then install the rear bearing cap with a new gasket on the transmission. Tighten cap screws firmly.
h. Install output yoke or companion flange or mainshaft. Using a flange or yoke holding tool install retaining nut. Torque the retaining nut as follows:

Transmission	Retaining Nut-Torque
Muncie	95-120 ft.-lbs.
NP435	90-130 ft.-lbs.

NOTE: On some models with SM420 transmission, install flange or yoke retaining bolt. Torque bolt to 60-65 ft. lbs.

i. Install speedometer driven gear, then connect speedometer cable.

5. Reconnect propeller shaft to transmission as described in "PROPELLER SHAFTS" (Section 4) of this manual.
6. Refill transmission with lubricant recommended in LUBRICATION (Section 0) of this manual.

SPEEDOMETER DRIVEN GEAR REPLACEMENT

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 fitting.

Install new "O" ring in groove in fitting, coat "O" ring and driven gear shaft with transmission lubricant and insert shaft.

Hold the assembly so slot in fitting is toward lock plate boss on housing and install in housing. Push fitting into housing until lock plate can be inserted in groove and attached to housing.

TRANSMISSION SIDE COVER REPLACEMENT/REPAIR

Saginaw and Muncie 3-Speed (Fig. 14)

1. Disconnect control rods from levers, back-up lamp wiring and TCS switch.
2. Shift transmission into neutral detent positions before removing cover. Remove cover assembly from transmission case carefully and allow oil to drain.
3. Remove the outer shifter levers.
4. Remove both shift forks from shifter shaft assemblies. Remove both shifter shaft assemblies from cover. Seals around shifter shaft may now be pried out if replacement is required because of damage.
5. Remove detent cam spring and pivot retainer "C" ring. Remove both detent cams.
6. 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.

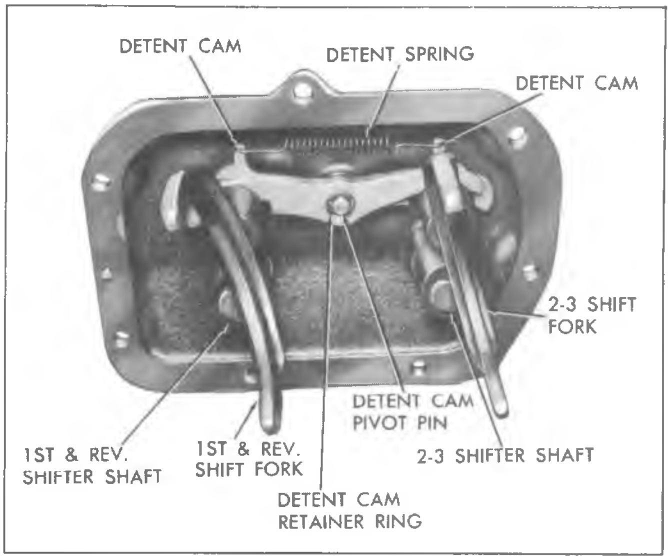


Fig. 14—Transmission Side Cover Assy. (3-Speed Saginaw)

7. Install detent cam retaining "C" ring to pivot shaft, and hook spring into detent cam notches.
8. 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.
9. Install outer shifter levers, flat washers, lock washers and bolts.
10. Shift shifter levers into neutral detent (center) position and slide cover into place making sure the shift

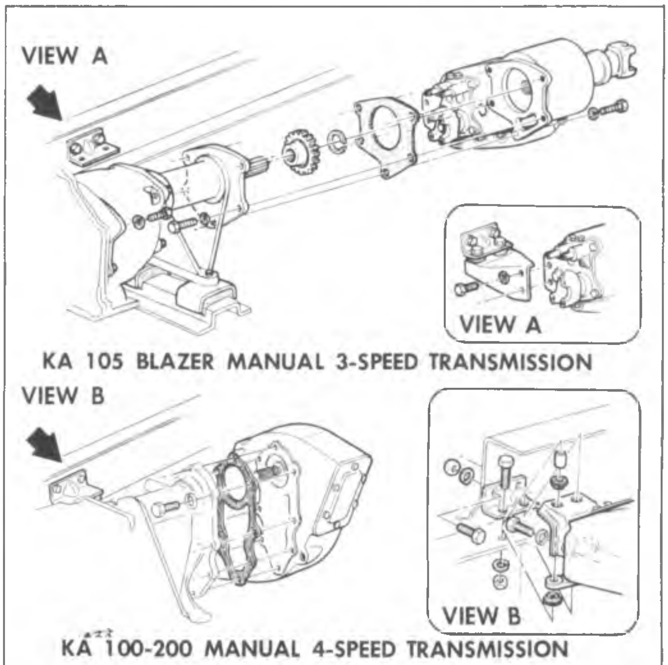


Fig. 15—Transfer Case Mounting

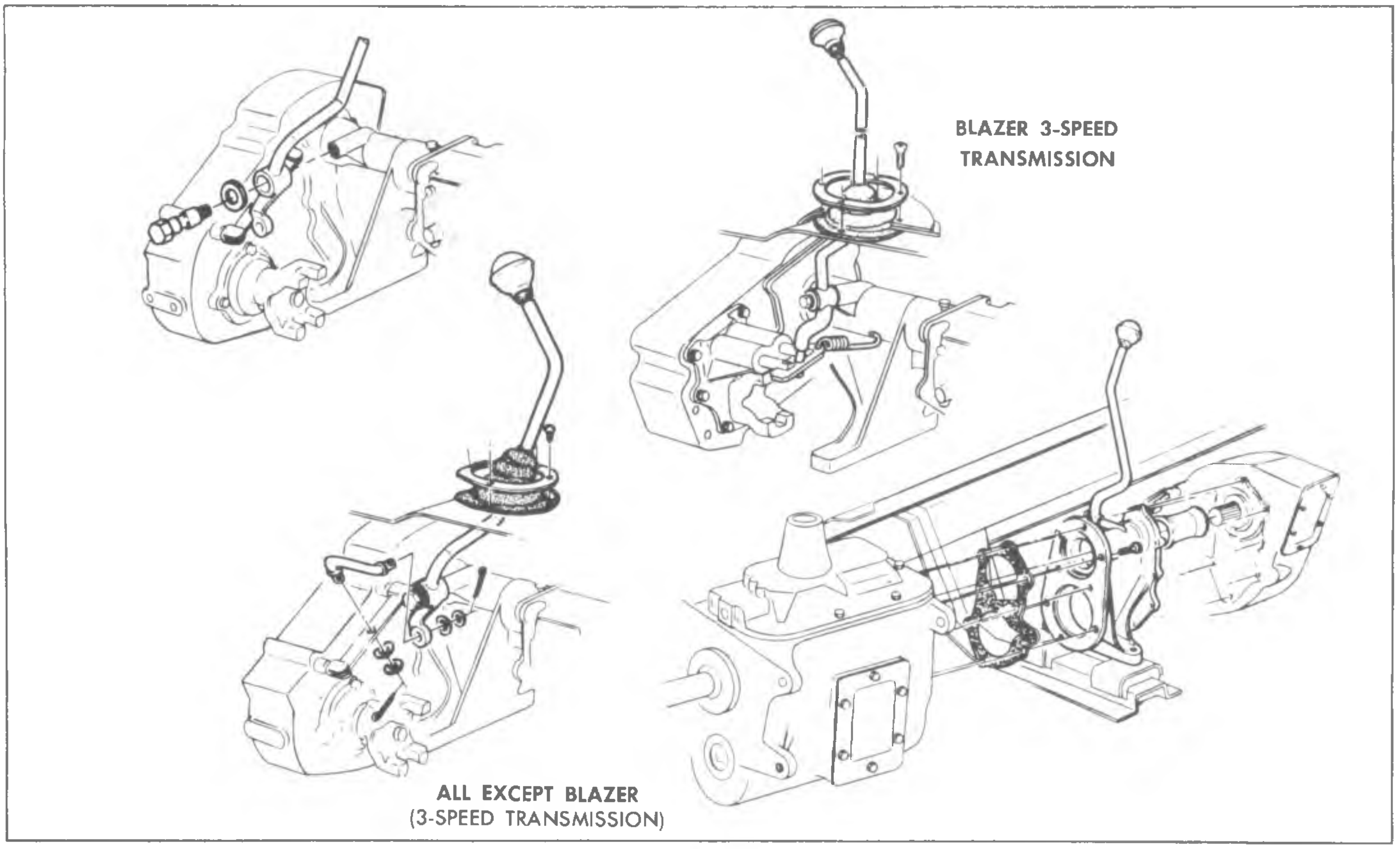


Fig. 16—Transfer Case Controls

forks are aligned with their respective mainshaft clutch sliding sleeves.

11. Install cover attaching bolts and tighten evenly to specified torque. Install TCS switch and connect wiring.
12. Remove filler plug and add lubricant specified in Section 0, to level of filler plug hole.

TRANSFER CASE REPLACEMENT (Figs. 14 and 15)

Removal

1. Raise and support vehicle on hoist. Drain transfer case.
2. Disconnect speedometer cable, back-up lamp and TCS switch.
3. Disconnect rear prop shaft from transfer case and tie up away from work area.
4. Disconnect front prop shaft from transfer case and tie up shaft away from work area.
5. Disconnect shift lever rod from shift rail link.
6. Remove transfer case to frame mounting bracket bolts.
7. Support transfer case and remove bolts attaching transfer case to transmission adapter.
8. Move transfer case to rear until input shaft clears adapter and lower assembly from vehicle.

Installation

1. Support transfer case in suitable stand and position case to transmission adapter. Install bolts attaching case to adapter and torque to 45 ft. lbs.
2. Remove stand as required and install bolts attaching transfer case to frame rail. Bend tabs after assembly.
3. Install connecting rod to shift rail link.
4. Connect front prop shaft to transfer case front output shaft. Torque bolts 17 ft. lbs.
5. Connect rear prop shaft to transfer case rear output shaft. Torque bolts 17 ft. lbs.
6. Connect speedometer cable, back-up lamp and TCS switch.
7. Fill transfer case to proper level with lubricant specified in the lubricant section of the Truck Chassis Service Manual.
8. Lower and remove vehicle from hoist.

CAUTION: Check and tighten all bolts to specified torques.

NOTE: Before connecting prop shafts to companion flanges be sure locknuts are torqued 250 ft. lbs.

TURBO HYDRA-MATIC 350 TRANSMISSION

INDEX

GENERAL DESCRIPTION

The purpose of a transmission is to provide suitable gear ratios between the engine and rear wheels for all driving conditions. The Turbo Hydra-Matic 350 is a fully automatic 3-speed transmission encased in a two-piece aluminum casting (main housing and extension). The transmission consists primarily of a hydraulic torque converter and compound planetary gear set. Four multiple-disc clutches, two roller clutch assemblies, and one band provide the friction elements required to obtain the desired function of the planetary gear set.

The torque converter is a simple transmission that 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 hydraulic system, pressurized by a gear type pump, provides the working pressure required to operate the friction elements and automatic controls.

The vacuum modulator is of the aneriod type and is used to automatically sense any change in torque input to the transmission. It transmits this signal to the pressure regulator, to the intermediate clutch accumulator valve, and to the shift valves so that all torques and shift speed requirements of the transmission are met and smooth shifts are obtained at all throttle openings and altitude conditions.

The cable operated detent system is designed to ensure positive part throttle or full throttle downshifting depending on throttle position.

External control connections to transmission are:

Manual Linkage - To select the desired operating range.

Engine Vacuum - To operate the vacuum modulator.

Detent Cable - To operate Detent System.

The Turbo Hydra-Matic 350 transmission features three forward driving ranges, which can be selected with the shift lever.

Approximate gear ratios of the transmission are as follows:

FIRST - 2.5:1
INTERMEDIATE - 1.5:1
DIRECT - 1.00:1
REVERSE - 2.00:1

The selector quadrant has six selector positions - P, R, N, D, L_2, L_1.

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. This position should be selected whenever the driver leaves the vehicle. 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 moving the vehicle.

D - DRIVE RANGE, used for all normal driving conditions and maximum economy, has three gear ratios. Detent downshifts are available for safe passing, by depressing the accelerator to the floor.

L_1 - L_1 RANGE can be selected at any vehicle speed. When selected at speeds over 50 mph, the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 50 mph (depending on axle ratio) before shifting to first gear.

L_1 Range position prevents the transmission from shifting out of first gear. This is particularly beneficial for maintaining maximum engine braking when continuous first gear operation is desirable.

L_2 - L_2 RANGE for congested traffic or hilly terrain. L_2 Range has the same starting ratio as Drive Range, but prevents the transmission from shifting above second gear. This retains second speed acceleration when extra performance is desired, and can also be used for engine braking.

L_2 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 opening is changed to obtain first gear operation, in the same manner as in Drive Range.

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 might 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 and one half 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. 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 2.5 qts. (U.S. measure 2 qts. Imperial measure)

MANUAL SHIFT LINKAGE CHECK & ADJUST (Figs. 1 and 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.

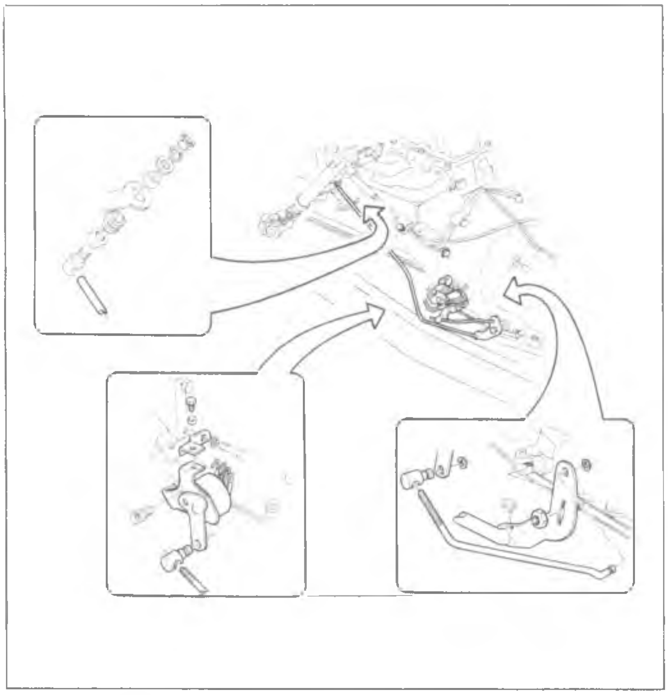


Fig. 1—Turbo Hydra-Matic 350 Control Rod Link
P-Models

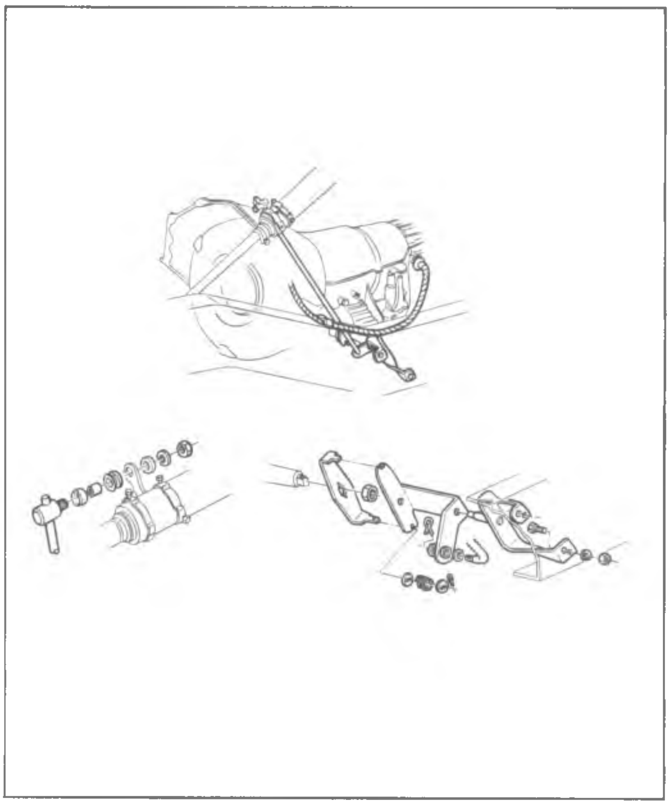


Fig. 2—Turbo Hydra-Matic 350 Control Rod Link
C-Models

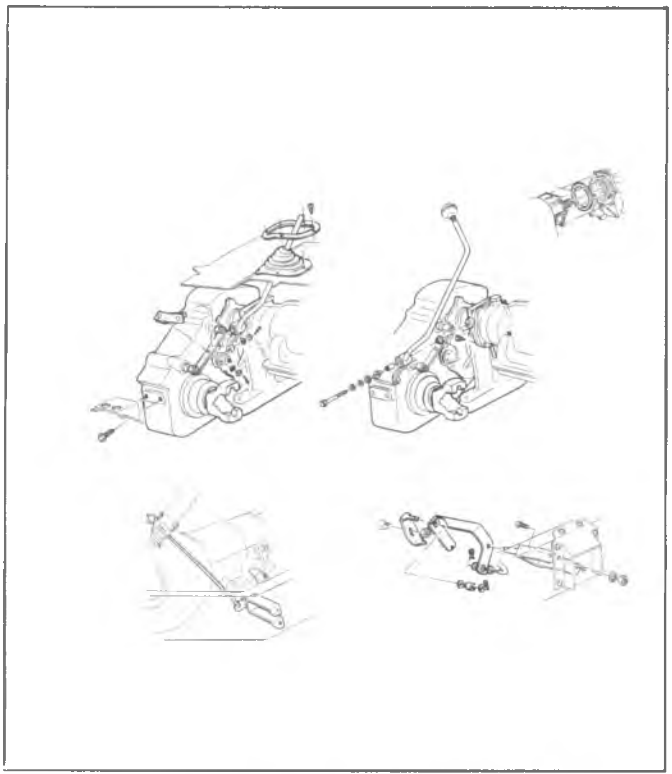


Fig. 3—Transfer Case Shift Lever & Control Link K-Models

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 mast jacket lever, 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.

DETENT CABLE ADJUSTMENT

Refer to Figure 4

L-6 Engines

1. Remove air cleaner.
2. Insert screwdriver on each side of snap lock and pry up to release lock.
3. Compress locking tabs and disconnect snap lock assembly from bracket.
4. Attach snap lock assembly to accelerator control lever and install retaining ring "E".
5. Pull carburetor lever to W.O.T. position (check W.O.T. stop on carburetor).

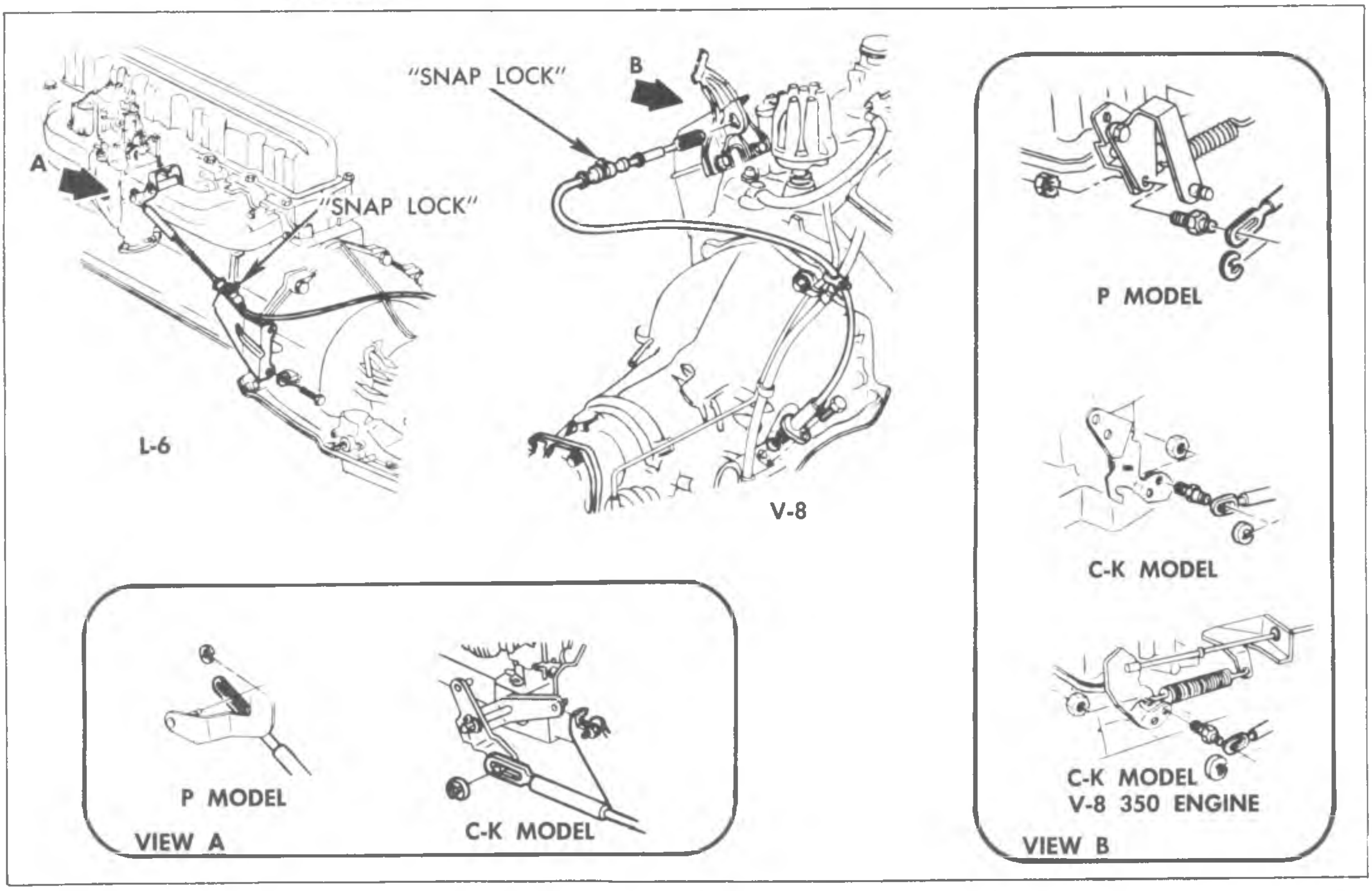


Fig. 4—Detent Cable Adjustment

6. With carburetor lever fixed in the W.O.T. position, grasp cable casing and pull rearward until W.O.T. stop in transmission is felt.

   NOTE: Do not mistake detent which must be traveled through in order to reach W.O.T. for W.O.T. stop.

7. Holding lever and cable in above position, push snap lock on cable downward until top is flush with cable.

   NOTE: Do not lubricate cable.

8. Install air cleaner.

V-8 Engines

1. Remove air cleaner.
2. Disengage plastic snap lock on detent cable by inserting a screwdriver on each side of snap lock and pry up to release lock and compressing locking tabs.
3. Place carburetor lever in wide open throttle (W.O.T.) position (make sure carburetor lever is against W.O.T. stop).

   NOTE: (DETENT cable must be through detent)

4. With carburetor lever in W.O.T. position push snap lock on detent cable back into housing until top is flush with cable retainer housing.
5. Check linkage for proper operation.

   NOTE: Do not lubricate cable.

6. Install air cleaner.

COMPONENT PART REPLACEMENT

TRANSMISSION REPLACEMENT— (All Except K Models)

Removal

1. Raise truck on hoist and remove oil pan drain plug to drain oil.

   NOTE: If desired, the oil may be drained after transmission removal.

2. Disconnect the vacuum modulator line and the speedometer drive cable fitting at the transmission. Tie lines out of the way.
3. Disconnect manual control lever rod and detent cable from transmission.
4. Disconnect prop 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 remove the transmission support crossmember.
7. Remove converter underpan, scribe flywheel-converter relationship for assembly, then remove the flywheel-to-converter attaching bolts.
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: It is best to have an assistant observe clearance of 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 vehicle and transfer to a work bench.

    NOTE: Observe converter when moving the transmission rearward. If it does not move with transmission, pry it free of flywheel before proceeding.

    CAUTION: Keep front of transmission upward to prevent the converter from falling out. Install suitable converter holding tool after removal from the engine.

Installation

1. Mount transmission on transmission lifting equipment installed on jack or other lifting device.
2. Remove converter holding tool.

   CAUTION: Do not permit converter to move forward after removal of holding tool.

3. Raise transmission into place at rear of engine and install transmission case to engine upper mounting bolts, then install remainder of the mounting bolts. Torque bolts to 25-30 ft. lbs.
4. Remove support from beneath engine, then raise rear of transmission to final position.
5. If scribed during removal, align scribe marks on flywheel and converter cover. Install converter to flywheel attaching bolts. Torque bolts to 30-35 ft. lbs.
6. Install flywheel cover.
7. Reinstall transmission support crossmember to transmission and frame.
8. Remove transmission lift equipment.
9. Connect propeller shaft to transmission.
10. Connect manual control lever rod and detent cable to transmission.
11. Connect vacuum modulator line, and speedometer drive cable to transmission.
12. Refill transmission through filler tube, 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.
14. Remove truck from hoist.

Removal K-Models (See Fig. 3)

1. Raise vehicle on hoist and remove oil pan drain plug to drain oil.

   NOTE: If desired, the oil may be drained after transmission removal.

2. Remove transfer case shift lever and rod.
3. Disconnect the vacuum modulator line and the speedometer drive cable at the transmission. Tie lines out of the way.

4. Disconnect manual control lever rod and detent cable from transmission.
5. a. Disconnect front and rear axle prop shafts at transfer case.
   b. Remove transmission to adapter case attaching bolts and place suitable support under transfer case.
   c. Install suitable transmission lift equipment to lifting device and attach to transmission.
6. Remove transfer case to frame bracket attaching bolts and remove transfer case.
7. Remove exhaust system crossover pipe on vehicles with V-8 engine.
8. Remove the transmission support rear crossmember.
9. Remove converter under pan (scribe flywheel to converter relationship for assembly), then remove flywheel to converter attaching bolts.
10. 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.
11. Lower rear of the transmission slightly so that the upper transmission housing-to-engine attaching bolts can be reached using a universal socket with a long extension. Remove upper bolts.

    CAUTION: It is best to have an assistant observe clearance of upper engine components while the transmission rear end is being lowered.

12. Remove remainder of transmission housing-to-engine attaching bolts.
13. Remove transmission by moving it slightly to the rear and downward, then remove from beneath vehicle and transfer to 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 suitable converter holding tool after removal from engine.

Installation

1. Mount transmission on transmission lifting equipment installed on jack or other lifting device.
2. Remove converter holding tool.

   CAUTION: Do not permit converter to move forward after removal of holding tool.

3. Raise transmission into place at rear of engine and install transmission case to engine upper mounting bolts, then install remainder of the mounting bolts. Torque bolts to 25-30 ft. lbs.
4. Remove support from beneath engine, then raise rear of transmission to final position.
5. If scribed during removal, align scribe marks on flywheel and converter cover. Install converter to flywheel attaching bolts. Torque bolts to 30-35 ft. lbs.
6. Install flywheel cover.
7. Place transfer case and adapter assembly at rear of transmission on suitable lift equipment and install transfer case to frame bracket attaching bolts. Torque to 110 to 150 ft. lbs.
8. Reinstall transmission support crossmember to adapter and frame.
9. Install transmission to transfer case adapter attaching bolts (torque to 21 to 29 ft. lbs.) and remove lift equipment.
10. Connect front and rear axle prop shafts to transfer case.
11. Install exhaust system crossover pipe.
12. Connect manual control lever rod and detent cable to transmission.
13. Connect vacuum modulator line and speedometer drive cable to transmission.
14. Assemble rod on transfer case shift lever before installing rod to transfer case shift linkage. Torque shift lever attaching bolt to 40-45 ft. lbs.
15. Lower vehicle and remove from hoist.
16. Refill transmission through filler tube following the recommended procedure outlined in this Section.
17. Check transmission for proper operation and for leakage. Check, and if necessary, adjust linkage.

OTHER SERVICE OPERATIONS

Although certain operations, such as oil pan gasket or manual levers and oil seal replacement, detent cable, governor, filler pipe "O" ring, speedometer drive gear, case extension "O" ring and rear oil seal, vacuum modulator, and intermediate clutch accumulator cover service may be performed from underneath the vehicle without removing the Turbo Hydra-Matic 350; their service procedure is covered in the Overhaul Manual and is not repeated here. Refer to the Turbo Hydra-Matic 350 Section of the Overhaul Manual for all other service operations not covered here.

TURBO HYDRA-MATIC 350 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 specific customer complaints. 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

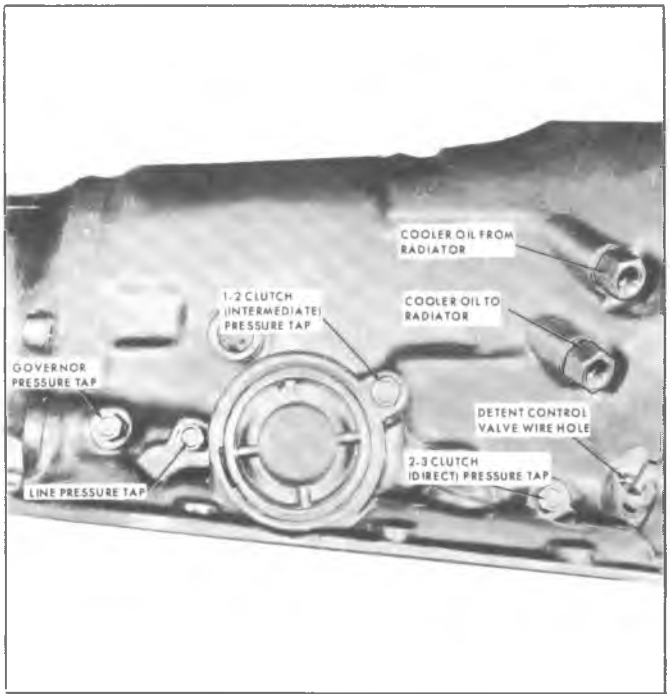


Fig. 5—Pressure Tap Locations

removal of the transmission. Details of the items listed in this sequence are covered further in the text.

SEQUENCE FOR TURBO HYDRA-MATIC 350 DIAGNOSIS PROCEDURE

1. Check oil level and condition.
2. Check and correct detent cable adjustment.
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 1/4 inch 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 band 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, and "O" ring seal - 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).
   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 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 (PSI) 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	L-6 and V-8	Reverse
		L1 or L2	
0	168	166	254
2000	158	159	240
4000	149	153	227
6000	141	147	214
8000	133	141	202
10000	126	135	191
12000	119	130	181
14000	113	126	171

2. Pressures (PSI) indicated below are at 0 output speed with the vacuum modulator tube connected, and with sufficient engine speed to maintain 16 inches Hg absolute manifold pressure.

Approximate Altitude of Check (Ft. Above Sea Level)	Absolute Manifold Pressure ("Hg)	Drive Neutral Park	L-6 and V-8	Reverse
			L1 or L2	
0	16	86	106	130
2000	16	89	108	134
4000	16	91	110	139
6000	16	94	112	143
8000	16	97	114	147
10000	16	99	116	150
12000	16	101	117	154
14000	16	103	119	157

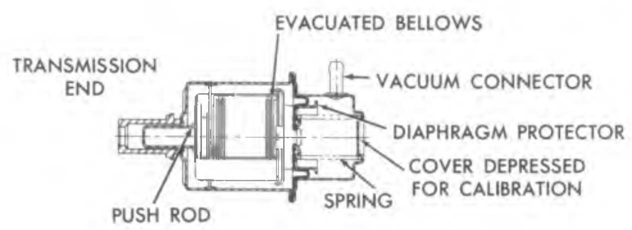


Fig. 6—Vacuum Modulator Assembly

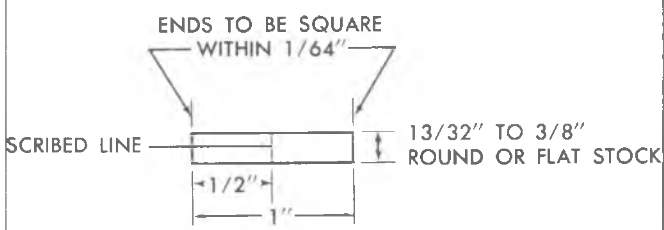


Fig. 7—Bellows Comparison Gauge

VACUUM MODULATOR ASSEMBLY

1. Vacuum Diaphragm Leak Check

Insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

NOTE: Gasoline or water vapor may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric Leak Check

Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam, the crimped upper to lower housing seam (Fig. 6). Using a short piece of rubber tubing, apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

NOTE: Do not use any method other than human lung power for applying air pressure, as pressures over 6 psi may damage the modulator.

3. Bellows Comparison Check

Using a comparison gauge, as shown in Fig. 7, compare the load of a know good Turbo Hydra-Matic 350 modulator with the assembly in question.

A. Install the modulator that is known to be acceptable on either end of the gauge

B. Install the modulator in question on the opposite end of the gauge.

C. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the gauge. The gap between the opposite modulator sleeve end and the gauge line should then be 1/16" or less. If the distance is greater than this amount, the modulator in question should be replaced.

4. Sleeve Alignment Check

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the cam. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

Once the modulator assembly passes all of the above tests, it is an acceptable part and should be re-used.

TURBO HYDRA-MATIC 350 SHIFT POINTS

CK100-150

Engine	L-6 (250) Base 3.07 Axle G78-15 Tire				L-6 (250) Base 3.07 Axle 6.50-16 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
Closed Throttle	7-11	12-6	19-25	24-18	7-11	12-6	20-26	25-18
Detent Touch	26-40	9-1	56-66	46-33	27-41	9-1	57-68	47-34
Wide Open Throttle	32-44	37-24	66-76	74-63	32-45	37-25	67-77	76-65
Engine	L-6 (250) Base 3.07 Axle H78-15 Tire				L-6 (250) Base 3.73 Axle G78-15 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
Closed Throttle	6-11	11-6	19-24	23-17	6-9	10-5	17-28	26-16
Detent Touch	26-39	9-1	54-64	45-32	29-38	7-1	49-57	44-35
Wide Open Throttle	31-43	35-23	63-73	71-61	29-38	32-20	54-62	61-53
Engine	L-6 (250) Base 3.73 Axle 6.50-16 Tire				L-6 (250) Base 3.73 Axle H78-15 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
Closed Throttle	6-9	10-5	18-29	27-16	5-9	9-5	17-27	25-15
Detent Touch	29-39	8-1	50-59	45-35	28-37	7-1	47-55	42-33
Wide Open Throttle	30-39	33-21	56-64	63-54	28-37	31-20	53-60	59-51
Engine	L-6 (250 Base) 4.11 Axle G78-15 Tire				L-6 (250) Base 4.11 Axle 6.50-16 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
Closed Throttle	5-8	9-4	16-26	24-14	5-8	9-4	16-26	24-14
Detent Touch	26-34	7-1	45-52	40-31	27-35	7-1	46-53	41-32
Wide Open Throttle	26-35	29-18	49-57	56-48	27-36	30-19	51-58	57-49
Engine	L-6 (250) Base 4.11 Axle H78-15 Tire				V-8 (307) Base 3.07 Axle G78-15 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
Closed Throttle	5-8	8-4	15-25	23-14	7-11	11-6	19-25	24-18
Detent Touch	25-33	7-1	43-50	38-30	26-40	9-1	56-66	46-33
Wide Open Throttle	25-34	28-18	48-55	54-46	37-48	40-26	69-79	77-67
Engine	V-8 (307) Base 3.07 Axle 6.50-16 Tire				V-8 (307) Base 3.07 Axle H78-15 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
Closed Throttle	7-11	12-6	20-26	24-18	6-11	11-5	19-24	23-17
Detent Touch	27-41	9-1	57-68	47-34	26-39	9-1	54-64	44-32
Wide Open Throttle	38-49	41-27	71-81	79-69	36-46	39-25	67-76	74-65
Engine	V-8 (307) Base 3.73 Axle G78-15 Tire				V-8 (307) Base 3.73 Axle 6.50-16 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
Closed Throttle	6-9	9-5	17-28	26-15	6-9	10-5	18-29	27-16
Detent Touch	29-38	7-1	49-57	44-34	29-39	8-1	50-59	45-35
Wide Open Throttle	33-42	36-26	58-65	64-56	34-43	37-26	60-67	66-58
Engine	V-8 (307) Base 3.73 Axle H78-15 Tire				V-8 (307) Base 4.11 Axle G78-15 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
Closed Throttle	5-9	9-4	17-27	25-15	5-8	9-4	16-26	24-14
Detent Touch	28-37	7-1	47-55	42-33	26-34	7-1	45-52	40-31
Wide Open Throttle	32-40	35-25	56-63	62-55	30-38	33-23	53-59	58-51
Engine	V-8 (307) Base 4.11 Axle 6.50-16 Tire				V-8 (307) Base 4.11 Axle H78-15 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
Closed Throttle	5-8	9-4	16-26	24-14	5-8	8-4	15-25	23-15
Detent Touch	27-35	7-1	46-53	41-32	25-33	6-1	43-50	38-30
Wide Open Throttle	31-39	34-24	54-61	60-52	29-37	32-23	51-57	56-49
Engine	V-8 (350) LS9 3.07 Axle G78-15 Tire				V-8 (350) LS9 3.07 Axle 6.50-16 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
Closed Throttle	7-11	11-6	19-25	24-18	7-11	12-6	20-26	24-18
Detent Touch	26-40	9-1	56-66	46-33	27-41	9-1	57-68	47-34
Wide Open Throttle	37-48	40-26	69-79	77-67	38-49	41-27	71-81	79-69

TURBO HYDRA-MATIC 350 SHIFT POINTS

CK100-150 (Cont.)

Engine	V-8 (350) LS9 3.07 Axle H78-15 Tire				V-8 (350) LS9 3.73 Axle G78-15 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
Closed Throttle	6-11	11-5	19-24	23-17	6-9	9-5	17-28	26-15
Detent Touch	26-39	9-1	54-64	44-32	29-38	7-1	49-57	44-34
Wide Open Throttle	36-46	39-25	67-76	74-65	33-42	36-26	58-65	64-56
Engine	V-8 (350) LS9 3.73 Axle 6.50-16 Tire				V-8 (350) LS9 3.73 Axle H78-15 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
Closed Throttle	6-9	10-5	18-29	27-16	5-9	9-4	17-27	25-15
Detent Touch	29-39	8-1	50-59	45-35	28-37	7-1	47-55	42-33
Wide Open Throttle	34-43	37-26	60-67	66-58	32-40	35-25	56-63	62-55
Engine	V-8 (350) LS9 4.11 Axle G78-15 Tire				V-8 (350) LS9 4.11 Axle 6.50-16 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
Closed Throttle	5-8	9-4	16-26	24-14	5-8	9-4	16-26	24-14
Detent Touch	26-34	7-1	45-52	40-31	27-35	7-1	46-53	41-32
Wide Open Throttle	30-38	33-23	53-59	58-51	31-39	34-24	54-61	60-52
Engine	V-8 (350) LS9 4.11 Axle H78-15 Tire							
Throttle Position	1-2 up	2-1 dn	2-3 up	3-2 dn				
Closed Throttle	5-8	8-4	15-25	23-14				
Detent Touch	25-33	6-1	43-50	38-30				
Wide Open Throttle	29-37	32-23	51-57	56-49				

BLAZER

Engine	V-8 (350) LS9 3.07 Axle H78-15 Tire				V-8 (350) LS9 3.07 Axle E78-15 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
Closed Throttle	7-11	12-6	20-26	24-18	6-11	11-5	19-24	23-17
Detent Touch	27-41	9-1	57-68	47-34	26-39	9-1	54-64	44-32
Wide Open Throttle	38-49	41-27	71-81	79-69	36-46	39-25	67-76	74-65
Engine	V-8 (350) LS9 3.07 Axle 6.50-16 Tire				V-8 (350) LS9 3.73 Axle H78-15 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
Closed Throttle	7-12	12-6	20-26	25-19	6-9	10-5	18-29	27-16
Detent Touch	28-42	9-1	58-69	48-35	29-39	8-1	50-59	45-35
Wide Open Throttle	39-50	42-27	73-82	81-70	34-43	37-26	60-67	66-58
Engine	V-8 (350) LS9 3.73 Axle E78-15 Tire				V-8 (350) LS9 3.73 Axle 6.50-16 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
Closed Throttle	5-9	9-4	17-27	25-15	6-9	10-5	18-30	27-16
Detent Touch	28-37	7-1	47-55	42-33	30-40	8-1	52-60	46-36
Wide Open Throttle	32-40	35-25	56-63	62-55	35-44	38-27	61-69	67-59
Engine	V-8 (350) LS9 4.11 Axle H78-15 Tire				V-8 (350) LS9 4.11 Axle E78-15 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
Closed Throttle	5-8	9-4	16-26	24-14	5-8	8-4	15-25	23-14
Detent Touch	27-35	7-1	46-53	41-32	25-33	6-1	43-50	38-30
Wide Open Throttle	31-39	34-24	54-61	60-52	29-37	32-23	51-57	56-49
Engine	V-8 (350) LS9 4.11 Axle 6.50-16 Tire							
Throttle Position	1-2 up	2-1 dn	2-3 up	3-2 dn				
Closed Throttle	5-9	9-4	16-27	25-15				
Detent Touch	27-36	7-1	47-54	42-33				
Wide Open Throttle	32-40	34-25	55-62	61-54				

TURBO HYDRA-MATIC 350 SHIFT POINTS

CK200-250

Engine	L-6 (250) 4.10 Axle 8.75-16.5 Tire				L-6 (250) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-5	17-28	26-15	6-9	10-5	17-29	27-16
Detent Touch	28-37	7-1	48-56	43-34	29-38	8-1	50-58	44-35
Wide Open Throttle	28-37	31-20	53-61	60-52	29-39	33-20	55-63	62-53
Engine	L-6 (250) 4.56 Axle 8.75-16.5 Tire				L-6 (250) 4.56 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	7-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	25-33	28-18	48-55	54-46	26-35	29-18	49-57	56-48
Engine	L-6 (292) 4.10 Axle 8.75-16.5 Tire				L-6 (292) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-5	17-28	26-15	6-9	10-5	17-29	27-16
Detent Touch	28-37	7-1	48-56	43-34	29-38	8-1	50-58	44-35
Wide Open Throttle	28-37	31-20	53-61	60-52	29-38	33-20	55-63	62-53
Engine	L-6 (292) 4.57 Axle 8.75-16.5 Tire				L-6 (292) 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	7-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	25-33	28-18	48-54	54-46	26-35	29-18	49-56	55-48
Engine	V-8 (307) 4.10 Axle 8.75-16.5 Tire				V-8 (307) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-4	17-28	25-15	6-9	9-5	17-29	26-16
Detent Touch	28-37	7-1	48-56	42-33	29-38	7-1	50-58	44-35
Wide Open Throttle	33-41	35-25	57-64	63-55	34-42	36-26	59-66	65-57
Engine	V-8 (307) 4.57 Axle 8.75-16.5 Tire				V-8 (307) 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	6-1	43-50	38-40	26-34	7-1	45-52	40-31
Wide Open Throttle	29-36	32-23	51-57	56-49	30-38	33-23	53-59	58-51
Engine	V-8 (350) LS9 4.10 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-4	17-28	25-15	6-9	9-5	17-29	26-16
Detent Touch	28-37	7-1	48-56	42-33	29-38	7-1	50-58	44-35
Wide Open Throttle	33-41	35-25	57-64	63-55	34-42	36-26	59-66	65-57
Engine	V-8 (350) LS9 4.57 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	6-1	43-50	38-40	26-34	7-1	45-52	40-31
Wide Open Throttle	29-36	32-23	51-57	56-49	30-38	33-23	53-59	58-51

P100-150

Engine	L-6 (250) 3.73 Axle G78-15 Tire				L-6 (250) 3.73 Axle H78-15 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
Closed Throttle	6-9	10-5	17-28	26-16	6-9	10-5	18-29	27-16
Detent Touch	29-38	7-1	49-57	44-35	29-39	8-1	50-59	45-35
Wide Open Throttle	29-38	32-20	54-62	61-53	30-39	33-21	56-64	63-54
Engine	L-6 (250) 4.11 Axle G78-15 Tire				L-6 (250) 4.11 Axle H78-15 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
Closed Throttle	5-8	9-4	16-26	24-14	5-8	9-4	16-26	24-14
Detent Touch	26-34	7-1	45-52	40-31	27-35	7-1	46-53	41-32
Wide Open Throttle	26-35	29-18	49-57	56-48	27-36	30-19	51-58	57-49

TURBO HYDRA-MATIC 350 SHIFT POINTS

P200-250

Engine	L-6 (250) 3.73 Axle 8.75-16.5 Tire				L-6 (250) 3.73 Axle 9.50-16.5 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
Closed Throttle	6-10	10-5	18-30	28-17	6-10	11-5	19-31	29-17
Detent Touch	31-41	8-1	53-61	47-37	32-42	8-1	55-63	49-38
Wide Open Throttle	31-41	34-22	58-67	66-57	32-42	36-22	61-69	68-59
Engine	L-6 (250) 4.11 Axle 8.75-16.5 Tire				L-6 (250) 4.11 Axle 9.50-16.5 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
Closed Throttle	5-9	9-5	17-28	26-15	6-9	10-5	17-29	26-16
Detent Touch	28-37	7-1	48-55	43-34	29-38	8-1	50-58	44-35
Wide Open Throttle	28-37	31-20	53-61	60-51	29-38	32-20	55-63	62-53
Engine	L-6 (250) 4.10 Axle 8.75-16.5 Tire				L-6 (250) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-5	17-28	26-15	6-9	10-5	17-29	27-16
Detent Touch	28-37	7-1	48-56	43-34	29-38	8-1	50-58	44-35
Wide Open Throttle	28-37	31-20	53-61	60-52	29-39	33-20	55-63	62-53
Engine	L-6 (250) 4.54 Axle 8.75-16.5 Tire				L-6 (250) 4.54 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	7-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	25-33	28-18	48-54	54-46	26-35	29-18	49-56	55-48
Engine	L-6 (292) 4.10 Axle 8.75-16.5 Tire				L-6 (292) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-5	17-28	26-15	6-9	10-5	17-29	27-16
Detent Touch	28-37	7-1	48-56	43-34	29-38	8-1	50-58	44-35
Wide Open Throttle	28-37	31-20	53-61	60-52	29-39	33-20	55-63	62-53
Engine	L-6 (292) 4.57 Axle 8.75-16.5 Tire				L-6 (292) 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	7-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	25-33	28-18	48-54	54-46	26-35	29-18	49-56	55-48
Engine	V-8 (307) 4.10 Axle 8.75-16.5 Tire				V-8 (307) 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-4	17-28	25-15	6-9	9-5	17-29	26-16
Detent Touch	28-37	7-1	48-56	42-33	29-38	7-1	50-58	44-35
Wide Open Throttle	33-41	35-25	57-64	63-55	34-42	36-26	59-66	65-57
Engine	V-8 (307) 4.57 Axle 8.75-16.5 Tire				V-8 (307) 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	6-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	29-36	32-23	51-57	56-49	30-38	33-23	53-59	58-51
Engine	V-8 (350) LS9 4.10 Axle 8.75-16 Tire				V-8 (350) LS9 4.10 Axle 9.50-16.5 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
Closed Throttle	5-9	9-4	17-28	25-15	6-9	9-5	17-29	26-16
Detent Touch	28-37	7-1	48-56	42-33	29-38	7-1	50-58	44-35
Wide Open Throttle	33-41	35-25	57-64	63-55	34-42	36-26	59-66	65-57
Engine	V-8 (350) LS9 4.57 Axle 8.75-16 Tire				V-8 (350) LS9 4.57 Axle 9.50-16.5 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
Closed Throttle	5-8	8-4	15-25	23-14	5-8	9-4	16-26	24-14
Detent Touch	25-33	6-1	43-50	38-30	26-34	7-1	45-52	40-31
Wide Open Throttle	29-36	32-23	51-57	56-49	30-38	33-23	53-59	58-51

TURBO HYDRA-MATIC 400 TRANSMISSION

INDEX

GENERAL DESCRIPTION

The Turbo Hydra-Matic 400 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 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	-	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 for passing speeds.

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 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 400 always contain the transmission serial and vehicle identification 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 400 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 Checking Procedure

Transmission at Operating Temperature

With the transmission hot (after vehicle has been driven at least 15 miles), the fluid level should be between the "FULL" mark and 1/4 inch below FULL. The vehicle should be level with the engine idling and the transmission in PARK.

Transmission at Room Temperature (80°F)

If the vehicle has not been driven sufficiently to bring the transmission up to operating temperature, the fluid level should be checked as follows:

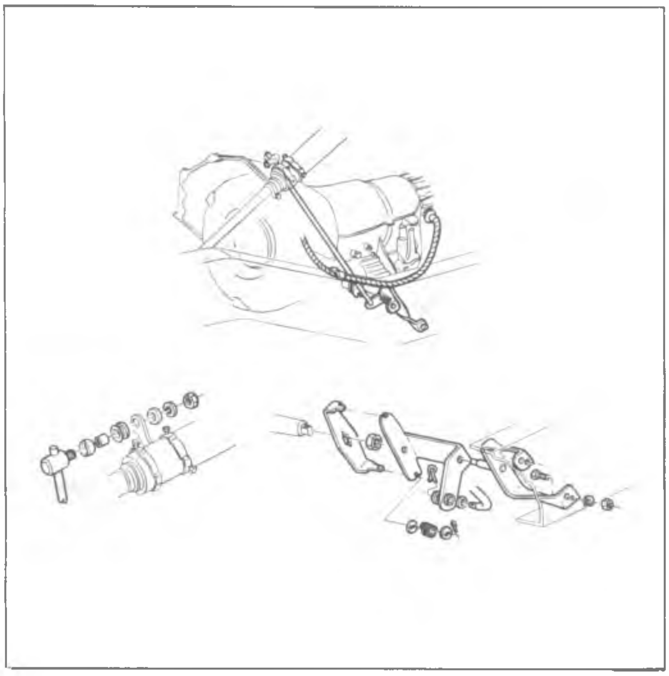


Fig. 1T—Control Linkage (CA 10-20, CA30 Models)

1. Apply the parking brake, put the selector lever in PARK, and start the engine.

   NOTE: Do Not Race the Engine. Move the selector lever through each range.

2. Immediately check the fluid level with the selector lever in the PARK position. The engine should be running at a slow idle and the vehicle should be level. The fluid level on the dipstick should be between the "ADD" mark and 1/4 inch below.
3. If additional fluid is required, add sufficient fluid to to bring the level to 1/4 inch below the "ADD" mark on the dipstick.

If the transmission fluid level can be correctly established at room temperature (80°F) as described, when the transmission reaches normal operating temperature, the fluid level will appear at the "FULL" mark. The fluid level is set at 1/4 inch below the "ADD" mark on the dipstick to allow for expansion of the fluid which occurs as the transmission temperature rises to its normal operating point of 180°F. DO NOT OVERFILL.

CAUTION: Do Not Overfill, as foaming and loss of fluid through the vent pipe might occur as fluid heats up. If fluid is too low, especially when Cold, complete loss of drive may result which can cause transmission failure.

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 1/4 inch below the add mark.

SHIFT CONTROL LINKAGE ADJUSTMENT

Adjust linkage as described below:

COLUMN SHIFT

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 indicator pointer as a reference to position the selector lever. When performing linkage adjustment, pointer is adjusted last.

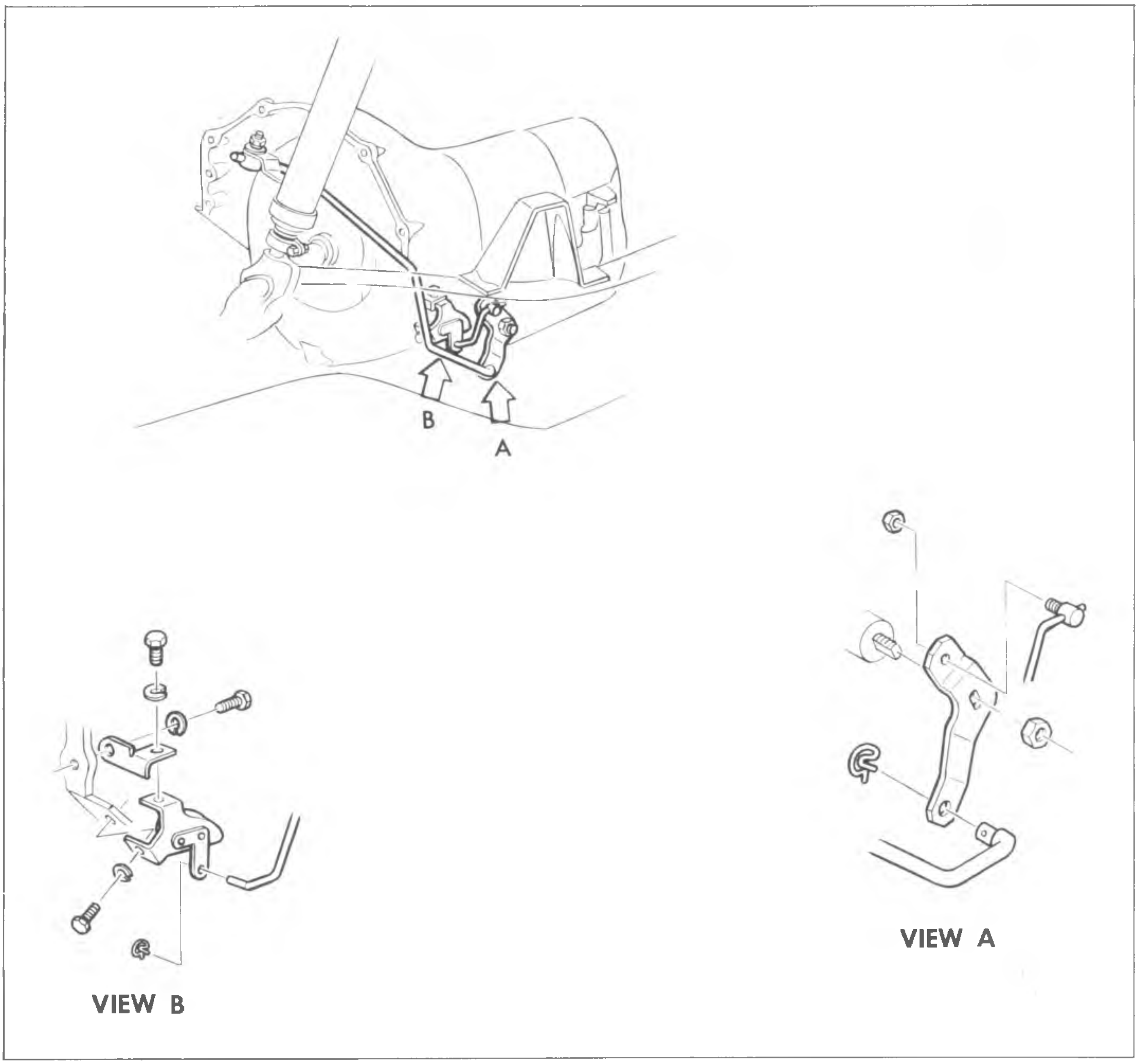


Fig. 2T—Lower Control Linkage (PS-PE-20-30 Models)

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 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 mast jacket, 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.

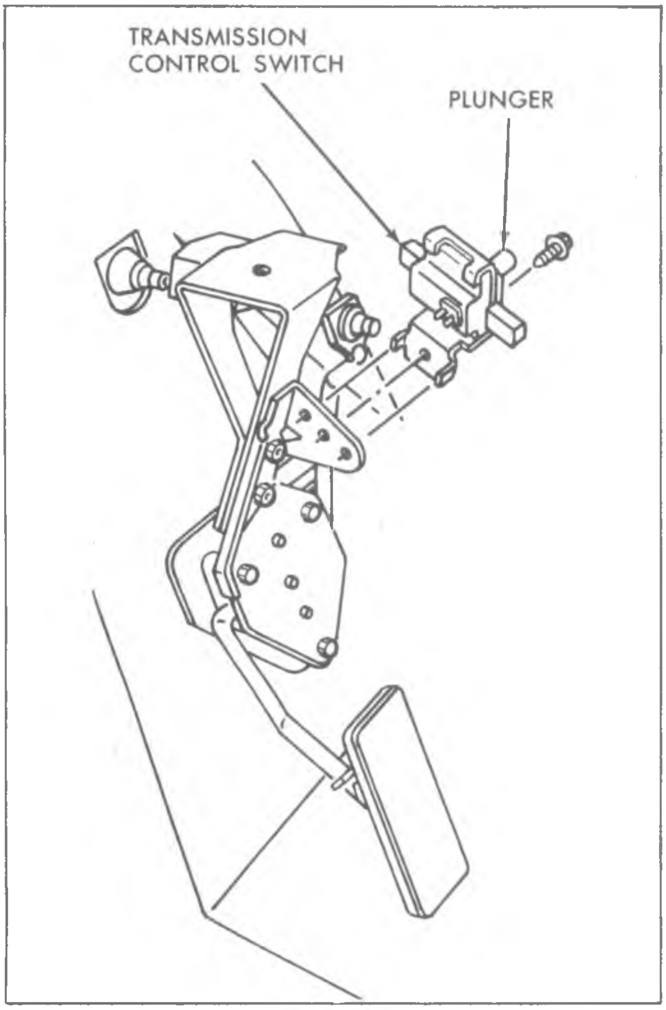


Fig. 3T—Detent Switch Adjustment

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.

DETENT SWITCH ADJUSTMENT

1. Install detent switch as shown in Figure 3T.
2. After installing the switch, press the switch plunger as far forward as possible. This presets the switch for adjustment. The switch will then adjust itself with the first wide open throttle application of the accelerator pedal.

NEUTRAL START SWITCH ADJUSTMENT

The neutral start 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 filter retainer bolt, oil filter, intake pipe assembly and intake pipe to case "O" ring. Discard the oil filter and pipe to case "O" ring.
3. Install new "O" ring seal on intake pipe and place pipe assembly into grommet on new filter assembly.
4. With "O" ring on intake pipe, install pipe and filter assembly into case, attaching filter to control valve assembly with the retainer bolt.
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 (U.S. measure, 6-1/4 pints Imperial measure) of fluid into the transmission. If the valve body has also been removed use 9-1/2 pints (U.S. measure, 8 pints Imperial measure). After a complete overhaul approximately 19 pints (U.S. measure, 15-3/4 pints Imperial measure) 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 180°F.), add fluid to bring level to full mark on indicator.

With transmission at room temperature (approx. 70°F.) add fluid to bring level to 1/4 inch below add mark.

CAUTION: Do not overfill. Foaming will result.

PRESSURE REGULATOR VALVE

NOTE: A solid type pressure regulator valve must only be used in a pump cover with a squared-off pressure regulator boss (See figure 4T). A pressure regulator valve with oil holes and orifice cup plug may be used to service either type pump.

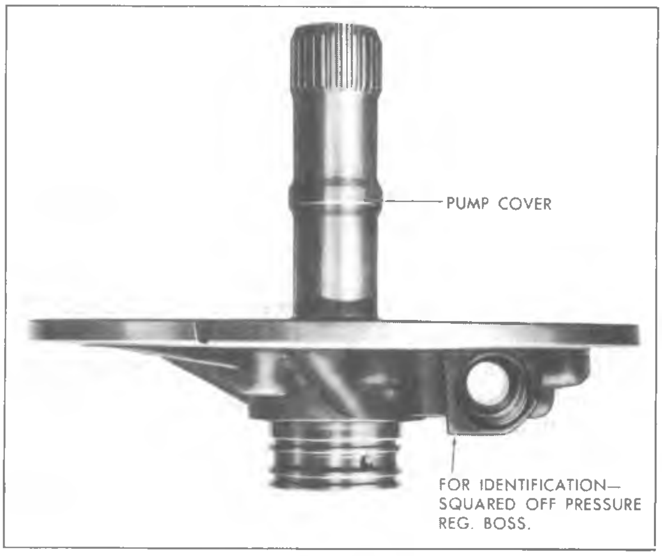


Fig. 4T—Pressure Regulator Valve

Removal

1. Remove bottom pan and filter.
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.

Installation

Installation of the pressure regulator valve is the reverse of the removal.

Adjust oil level.

CONTROL VALVE BODY

Removal

1. Remove bottom pan and filter.
2. Disconnect lead wire from pressure switch assembly.
3. Remove control valve body attaching screws and detent roller spring assembly.

NOTE: Do not remove solenoid attaching screws.

CAUTION: If the transmission is in the vehicle, the front servo parts may drop out as the control valve assembly is removed.

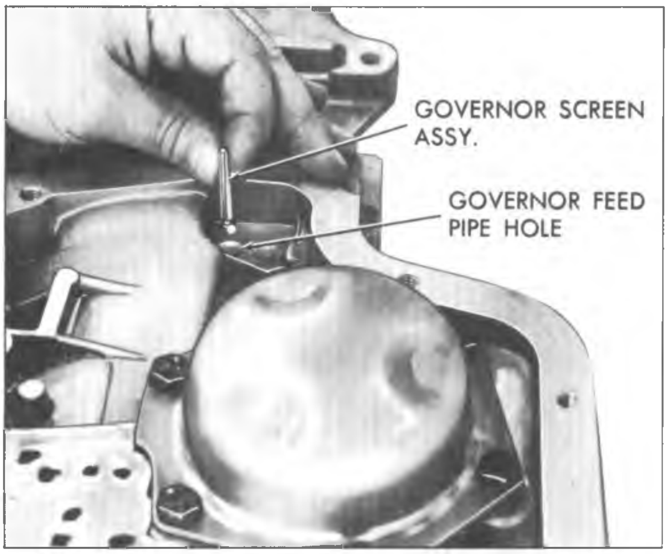


Fig. 5T—Governor Screen Position

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.
5. Remove the governor screen assembly from end of governor feed pipe or from the governor feed pipe hole in the case (fig. 5T). Clean governor screen in clean solvent and air dry.

CAUTION: Do not drop manual valve.

6. Remove the governor pipes and manual valve from control valve body.

Installation

For Installation see Overhaul Manual.

GOVERNOR

Removal

1. Remove governor cover attaching screws, cover, and gasket.
2. Discard gasket.
3. Withdraw governor assembly from case.

Installation

Installation of the governor assembly is the reverse of the removal. Use a new gasket under the governor cover.

Adjust oil level.

MODULATOR AND MODULATOR VALVE

Removal

1. Remove modulator assembly attaching screw and retainer.
2. Remove modulator assembly from case. Discard "O" ring seal.
3. Remove modulator valve from case.

Installation

Installation of the modulator assembly and modulator valve is the reverse of the removal. Use a new "O" ring seal on the modulator assembly.

Adjust oil level.

PARKING LINKAGE—10, 20 SERIES

Removal

1. Remove bottom pan and oil filter.
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

All Models Except CM

1. a. Use a non-hardening sealer on outside of seal body; and using Tool J-21359, drive seal in place.

Model CM

b. Use a non-hardening sealer on outside of seal body; and using Tool J-21464, drive seal in place.

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. Filter and "O" ring.
l. Pressure switch assembly.

TRANSMISSION REPLACEMENT

Before raising the truck, disconnect the battery and release the parking brake.

1. Raise truck on hoist.
2. Remove propeller shaft.
3. Disconnect speedometer cable, electrical lead to case connector, vacuum line at modulator, and oil cooler pipes.
4. Disconnect shift control linkage.
5. Support transmission with suitable transmission jack.
6. Disconnect rear mount from frame crossmember.
7. Remove two bolts at each end of frame crossmember and remove crossmember.
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 with the following additional steps.

Before installing the flex plate to converter bolts, make certain that the weld nuts on the converter are flush with the flex plate and the converter rotates freely by hand in this position. Then, hand start all bolts and tighten finger tight before torquing to specification. This will insure proper converter alignment.

NOTE: After installation of transmission check linkage for proper adjustment.

13. Remove truck from hoist.

TURBO HYDRA-MATIC 400 DIAGNOSIS PROCEDURE

CAUTION: In the event of a major transmission failure, replace filter assembly, and flush oil cooler and cooler lines.

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 satisfactiion.

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 400 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) or (N) Neutral for 30 Series Trucks position, engine running, and the vehicle on level pavement.

Fluid level should be to the FULL mark with the transmission at normal operating temperature (180°F.). With warm fluid (room temperature 80°F.), the level should be at or 1/4 inch below the ADD mark. (See checking procedure)

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 truck 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.

POSSIBLE POINTS OF OIL LEAKS

1. TRANSMISSIION 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.

*A "black light" testing unit may be obtained from several different tool supplies.

   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 pack 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.

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.

While road testing with the transmission oil pressure gauge attached and the vacuum modulator tube connected, the transmission pressures should check approximately as shown on chart.

OIL PRESSURE CHECK

With Vehicle Stationary

1. Oil Pressure Check - Road or Normal Operating Conditions

Transmission oil pressure gauge and engine tachometer should be connected and the oil pressures should check as follows:

Approximate Altitude of Check (Ft. above seal 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

		Minimum	Maximum
L_2-2nd Gear	- Steady road load at approximately 25 mph	145 psi	155 psi
Gear	Selector Lever Position	Minimum	Maximum
1st	Drive		
2nd 3rd	("Zero" throttle to full throttle)	60	150
3rd	Drive Range, Zero Throttle at 30 mph	60	
Reverse	Rev. (Zero to full throttle)	95	260

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.

2. Pressures indicated below are 0 output speed with the vacuum modulator tube disconnected and with engine at 1200 rpm.

NOTE: Pressures are not significantly affected by altitude or barometric pressure when the vacuum tube is connected.

3. Pressures indicated below are with the vacuum tube connected for normal modulator operation, and with sufficient engine speed to stabilize pump pressure (approx. 1000 rpm).

Drive, Neutral, Park	L1 or L2	Reverse
60	150	107

TURBO HYDRA-MATIC 400 MODULATOR ASSEMBLY DIAGNOSIS

After thorough investigation of field returned modulator assemblies, it has been found that over 50% of the parts returned as defective were good. For this reason, the following procedure is recommended for checking Turbo Hydra-Matic 400 modulator assemblies in the field before replacement is accomplished.

1. Vacuum Diaphragm Leak Check

Insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

NOTE: Gasoline or water vapor may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric Leak Check

Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam, the crimped upper to lower housing seam, and the threaded screw seal (Fig. 4T). Using a short piece of rubber tubing apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

NOTE: Do not use any method other than human lung power for applying air pressure, as pressures over 6 psi may damage the modulator.

3. Bellows Comparison Check

Using a comparison gauge, as shown in Figure 5T, compare the load of a known good Hydra-Matic modulator with the assembly in question.

a. Install the modulator that is known to be acceptable on either end of the gauge.
b. Install the modulator in question on the opposite end of the gauge.
c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the gauge. The gap between the opposite modulator sleeve end and the gauge line should then be 1/16" or less. If the distance is greater than this amount, the modulator in question should be replaced.

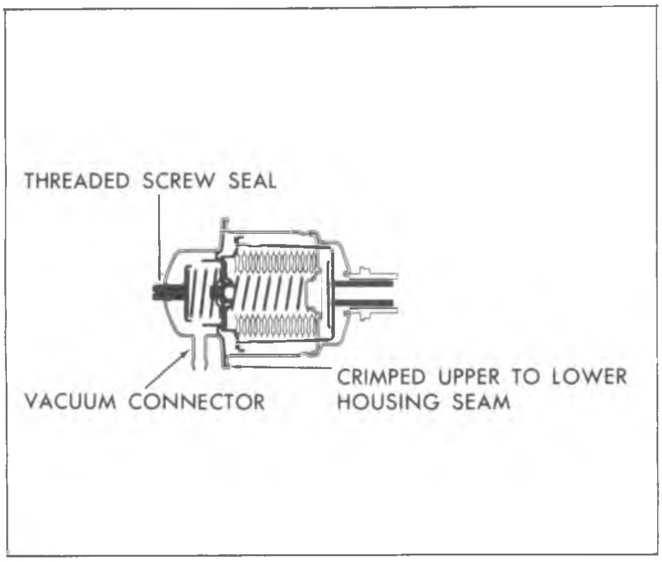


Fig. 6T—Vacuum Modulator

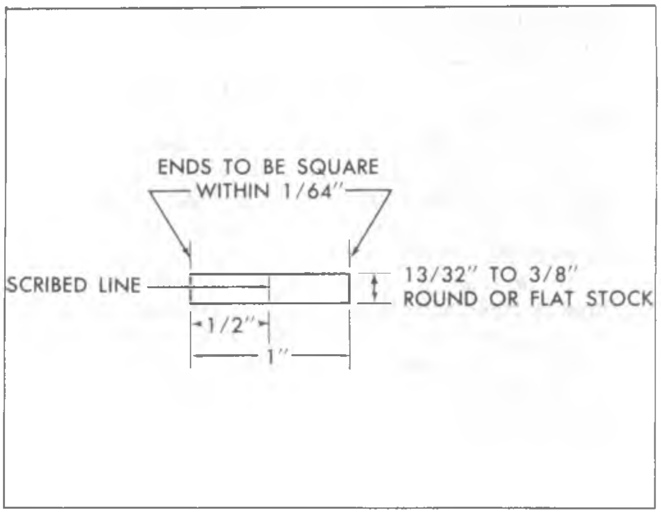


Fig. 7T—Bellows Comparison Gauge

4. Sleeve Alignment Check

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the can. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

Once the modulator assembly passes all of the above tests, it is an acceptable part and should be re-used.

PRESSURE SWITCH CHECK

Pressure switch in the Turbo Hydra-matic 400 transmission may be easily checked with a continuity tester which uses either the vehicle's battery or a separate source to power the test lamp or meter.

CAUTION: To prevent damaging the pressure switch, the tester used must have sufficient resistance that it does not supply the switch with more than .8 amp of current at 12 volts.

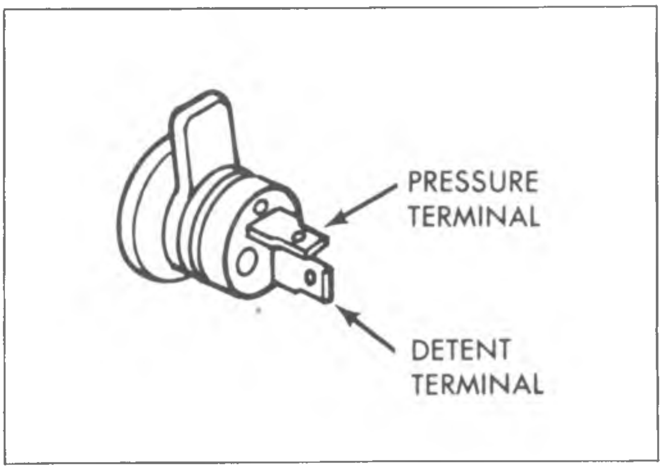


Fig. 8T—Electrical Connector for TCS (Two Term)
CM Model Has Detent Terminal Only

Test lamps which use size 1893 or smaller bulb, will not damage the switch.

1. Disconnect electrical wire harness from transmission electrical connector. If using a continuity tester which has a self contained power source, connect one tester lead to pressure switch terminal of transmission connector (see Fig. 8T), and connect other lead to ground. Tester should show current flowing through the switch (switch closed).

   If the truck's battery is to be used to power a simple light bulb type tester, connect one lamp lead to pressure switch terminal of transmission connector and connect other lead to a "Hot" terminal of the truck's wiring harness. Check that truck's battery cables are connected.
2. Set parking brake, apply service brakes, start engine and let it idle. Move transmission selector to "Drive" and tester should show current flowing through switch to ground (switch closed).
3. With brakes still applied, move transmission selector to "Reverse" (which supplies transmission oil pressure to pressure switch) and tester should show no current flowing through switch to ground (switch open).
4. If above test indicates a defective pressure switch circuit, the transmission bottom pan must be removed to service the pressure switch or lead wire assembly.

TURBO HYDRA-MATIC 400 SHIFT POINTS

C100—150								
Engine	V-8 (402) L47 3.07 Axle G78-15 Tire				V-8 (402) L47 3.07 Axle H78-15 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
Closed	7-13	13-7	20-30	27-16	7-14	13-7	20-30	28-16
Thru Detent (W.O.T.)	33-48	41-25	62-77	70-54	34-49	42-25	63-79	72-56
Engine	V-8 (402) L47 3.07 Axle 6.50-16 Tire							
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn				
Closed	7-14	13-7	21-31	28-17				
Thru Detent (W.O.T.)	35-50	43-26	65-80	74-57				
C200—250								
Engine	V-8 (402) L47 3.54 Axle 8.75-16.5 Tire				V-8 (402) L47 3.54 Axle 9.50-16.5 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
Closed	6-12	12-6	19-27	25-15	7-13	12-6	19-28	26-15
Thru Detent (W.O.T.)	31-44	38-23	57-71	65-50	32-46	40-24	60-74	68-52
Engine	V-8 (402) L47 4.10 Axle 8.75-16.5 Tire				V-8 (402) L47 4.10 Axle 9.50-16.5 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
Closed	6-11	10-5	16-24	22-13	6-11	11-6	17-25	22-13
Thru Detent (W.O.T.)	27-38	33-20	50-61	56-44	28-40	34-21	51-64	59-45
C300—350								
Engine	L-6 (250) 4.10 Axle 8.75-16.5 Tire				L-6 (250) 4.10 Axle 9.50-16.5 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	15-23	21-12
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	28-40	29-19	51-64	59-45
Engine	L-6 (250) 4.10 Axle 8.75-16.5 Tire				L-6 (250) 4.57 Axle 9.50-16.5 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	25-36	26-17	46-57	53-41
Engine	L-6 (250) 4.57 Axle 6.50-16 Tire				L-6 (250) 4.57 Axle 7.00-16 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	24-16	44-54	50-38	25-36	26-17	46-57	52-40
Engine	L-6 (250) 5.14 Axle 8.75-16.5 Tire				L-6 (250) 5.14 Axle 9.50-16.5 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
Closed	4-8	8-4	12-18	16-9	5-9	8-4	12-19	17-10
Thru Detent (W.O.T.)	21-31	22-14	40-49	45-35	22-32	23-15	41-51	47-36
Engine	V-8 (307) 4.10 Axle 8.75-16.5 Tire				V-8 (307) 4.10 Axle 9.50-16.5 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	15-23	21-12
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	28-40	29-19	51-64	59-45

TURBO HYDRA-MATIC 400 SHIFT POINTS (Cont.)

C-300–350 (Cont.)								
Engine	V-8 (307) 4.57 Axle 8.75-16.5 Tire				V-8 (307) 4.57 Axle 9.50-16.5 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	25-36	26-17	46-57	53-41
Engine	V-8 (307) 4.57 Axle 6.50-16 Tire				V-8 (307) 4.57 Axle 7.00-16 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	24-16	44-54	50-38	25-36	26-17	45-57	52-40
Engine	V-8 (307) 5.14 Axle 8.75-16.5 Tire				V-8 (307) 5.14 Axle 9.50-16.5 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
Closed	4-8	8-4	12-18	16-9	5-9	8-4	12-19	17-10
Thru Detent (W.O.T.)	21-31	22-14	40-49	45-35	22-32	23-15	41-51	47-36
Engine	V-8 (350) LS9 4.10 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.10 Axle 9.50-16.5 Tire			
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn	1-2 Up	2-3 Dn	2-3 Up	3-2 Dn
Closed	6-11	10-5	15-23	20-12	6-11	11-6	15-23	21-12
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	28-40	29-19	51-64	59-45
Engine	V-8 (350) LS9 4.57 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.57 Axle 9.50-16.5 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	25-36	26-17	46-57	53-41
Engine	V-8 (350) LS9 4.57 Axle 6.50-16 Tire				V-8 (350) LS9 4.57 Axle 7.00-16 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
Closed	5-9	9-5	13-20	18-10	5-10	9-5	14-21	19-11
Thru Detent (W.O.T.)	24-34	24-16	44-54	50-38	25-36	26-17	46-57	52-40
Engine	V-8 (350) LS9 4.57 Axle 7.50-16 Tire				V-8 (402) L47 4.10 Axle 8.75-16.5 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
Closed	6-11	11-6	15-23	21-12	6-11	10-5	16-24	22-13
Thru Detent (W.O.T.)	18-40	29-19	51-64	59-45	27-38	33-20	50-61	56-44
Engine	V-8 (402) 4.10 Axle 9.50-16.5 Tire				V-8 (402) L47 4.10 Axle 6.50-16 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
Closed	6-11	11-6	17-25	22-13	5-10	10-5	16-23	21-13
Thru Detent (W.O.T.)	28-40	34-21	51-64	59-45	26-38	32-20	49-60	55-43
Engine	V-8 (402) L47 4.10 Axle 7.00-16 Tire				V-8 (402) H47 4.10 Axle 7.50-16 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
Closed	6-11	11-6	17-24	22-13	6-11	11-6	17-26	23-14
Thru Detent (W.O.T.)	28-40	34-21	51-64	58-45	29-42	36-22	54-67	61-47
Engine	V-8 (402) L47 4.10 Axle 8-19.5 Tire							
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn				
Closed	7-12	12-6	19-28	25-15				
Thru Detent (W.O.T.)	31-45	39-23	58-72	66-51				

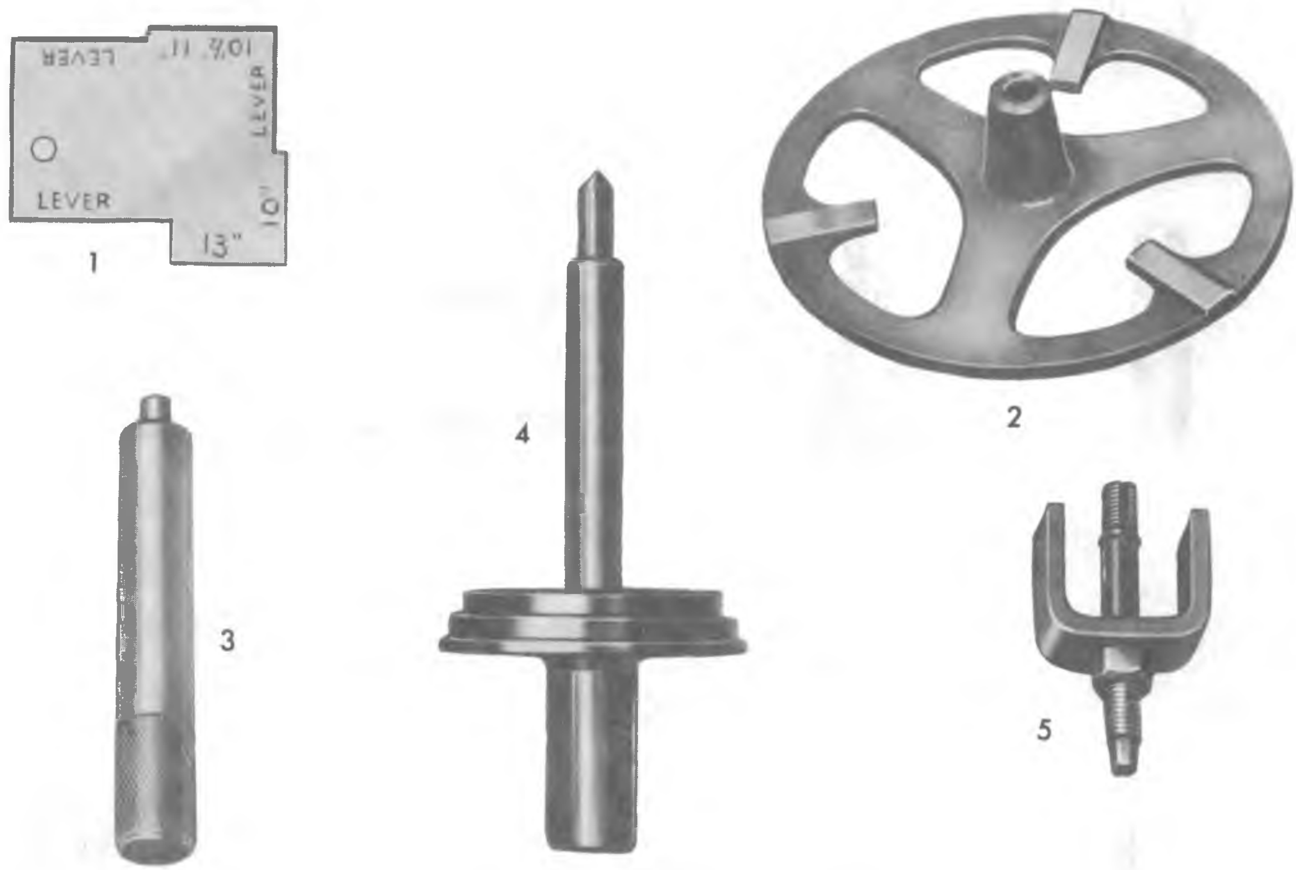
TURBO HYDRA-MATIC 400 SHIFT POINTS (Cont.)

P300–350								
Engine	L-6 (250) 4.10 Axle 8.75-16.5 Tires				L-6 (250) 4.10 Axle 7.50-16 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	16-25	22-13
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	29-42	30-20	54-67	61-47
Engine	L-6 (250) 4.57 Axle 8.75-16 Tire				L-6 (250) 4.57 Axle 7.50-16 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
Closed	5-9	9-5	13-20	18-10	5-10	10-5	15-22	20-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	26-37	27-18	48-60	55-42
Engine	L-6 (292) 4.10 Axle 8.75-16.5 Tire				L-6 (292) 4.10 Axle 7.50-16 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	16-25	22-13
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	29-42	30-20	54-67	61-47
Engine	L-6 (292) 4.57 Axle 8.75-16.5 Tire				L-6 (292) 4.57 Axle 7.50-16 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
Closed	5-9	9-5	13-20	18-10	5-10	10-5	15-22	20-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	26-37	27-18	48-60	55-42
Engine	V-8 (307) 4.10 Axle 8.75-16.5 Tire				V-8 (307) 4.10 Axle 7.50-16 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	16-25	22-13
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	29-42	30-20	54-67	61-47
Engine	V-8 (307) 4.57 Axle 8.75-16.5 Tire				V-8 (307) 4.57 Axle 7.50-16 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
Closed	5-9	9-5	13-20	18-10	5-10	10-5	15-22	20-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	26-37	27-18	48-60	55-42
Engine	V-8 (307) 5.14 Axle 8.75-16.5 Tire				V-8 (307) 5.14 Axle 7.50-16 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
Closed	4-8	8-4	12-18	16-9	5-9	9-5	13-20	17-10
Thru Detent (W.O.T.)	21-31	22-14	40-49	45-35	23-33	24-16	43-53	49-38
Engine	V-8 (350) LS9 4.10 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.10 Axle 7.50-16 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	16-25	22-13
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	29-42	30-20	54-67	61-47
Engine	V-8 (350) LS9 4.57 Axle 8.75-16.5 Tire				V-8 (350) LS9 4.57 Axle 7.50-16 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
Closed	5-9	9-5	13-20	18-10	5-10	10-5	15-22	20-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	26-37	27-18	48-60	55-42
Engine	V-8 (350) LS9 4.57 Axle 7.00-18 Tire				V-8 (350) LS9 4.57 Axle 8-19.5 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
Closed	6-11	11-6	15-23	21-12	6-11	11-6	16-24	21-12
Thru Detent (W.O.T.)	28-40	29-19	51-64	58-45	28-40	29-19	52-64	59-46

TURBO HYDRA-MATIC 400 SHIFT POINTS (Cont.)

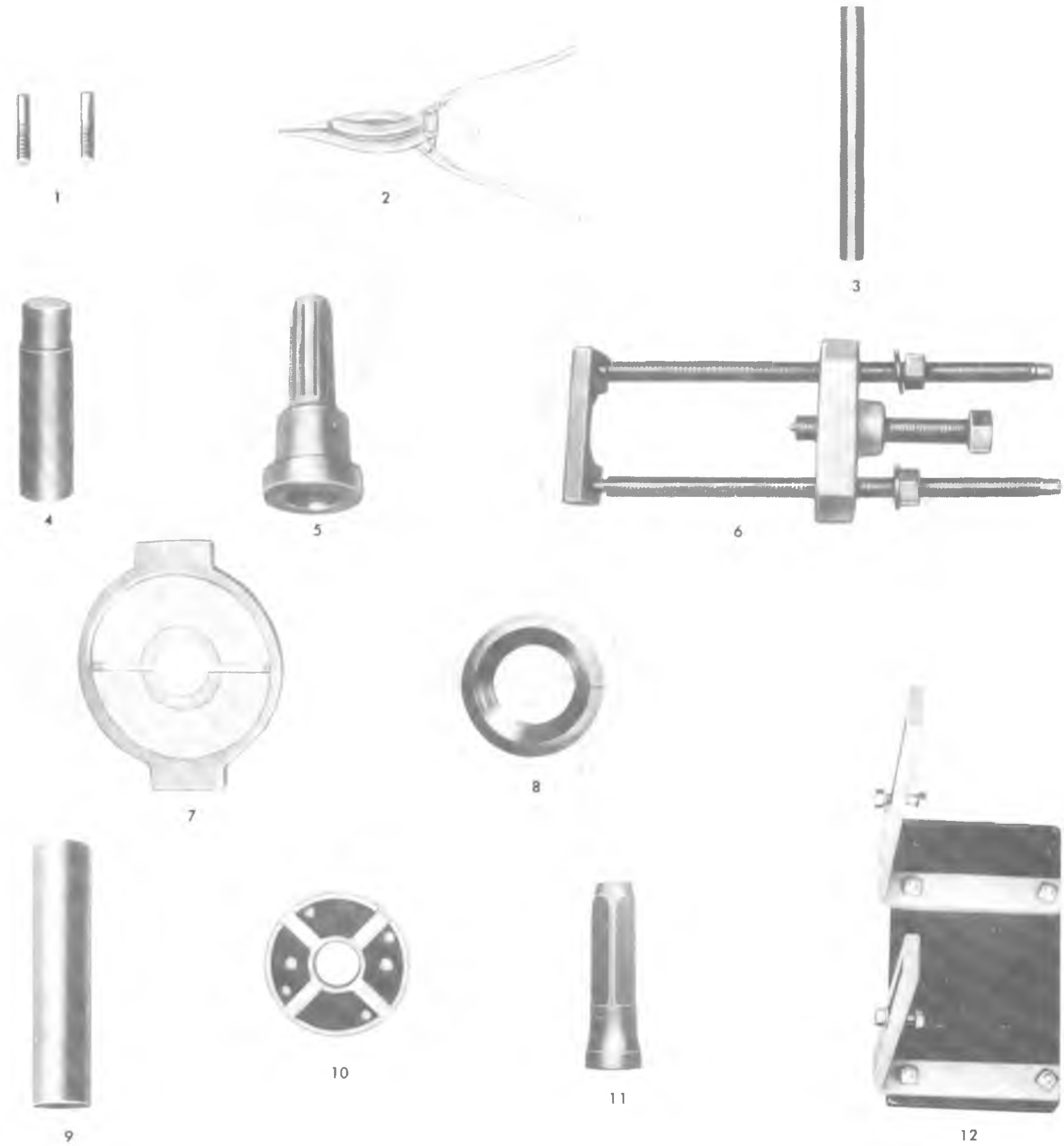
P300—350 (Cont.)								
Engine	V-8 (402) L47 4.10 Axle 8.75-16.5 Tire				V-8 (407) L47 4.10 Axle 7.00-16 Tire			
Throttle Position	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn	1-2 Up	2-1 Dn	2-3 Up	3-2 Dn
Closed	6-11	10-5	16-24	22-13	6-11	11-6	17-24	22-13
Thru Detent (W.O.T.)	27-38	33-20	50-61	56-44	28-40	34-21	51-64	58-45
Engine	V-8 (402) L47 4.57 Axle 8.75-16.5 Tire				V-8 (402) L47 4.57 Axle 7.00-16 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
Closed	5-9	9-5	14-21	19-12	5-10	10-5	16-23	21-13
Thru Detent (W.O.T.)	24-34	30-18	45-55	51-39	26-37	32-19	48-60	55-42
PE300-350 (MOTOR HOME)								
Engine	V-8 (350) L59 4.10 Axle 8.75-16.5 Tire				V-8 (350) L59 4.10 Axle 7.00-16 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
Closed	6-11	10-5	15-23	20-12	6-11	11-6	16-25	22-13
Thru Detent (W.O.T.)	27-38	28-18	50-61	56-44	29-42	30-20	54-67	61-47
Engine	V-8 (350) L59 4.57 Axle 8.75-16.5 Tire				V-8 (350) L59 4.57 Axle 7.00-16 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
Closed	5-9	9-5	13-20	18-20	5-10	10-5	15-22	20-11
Thru Detent (W.O.T.)	24-34	25-16	45-55	51-39	26-37	27-18	48-60	55-42
Engine	V-8 (402) L47 4.10 Axle 8.75-16.5 Tire				V-8 (407) L47 4.10 Axle 7.00-16 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
Closed	6-11	10-5	16-24	22-13	6-11	11-6	17-26	23-14
Thru Detent (W.O.T.)	27-38	33-20	50-61	56-44	29-42	36-22	54-67	61-47
Engine	V-8 (402) L47 4.57 Axle 8.75-16.5 Tire				V-8 (402) L47 4.57 Axle 7.00-16 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
Closed	5-9	9-5	14-21	19-12	5-10	10-5	16-23	21-13
Thru Detent (W.O.T.)	24-34	30-18	45-55	51-39	26-37	32-19	48-60	55-42

SPECIAL TOOLS



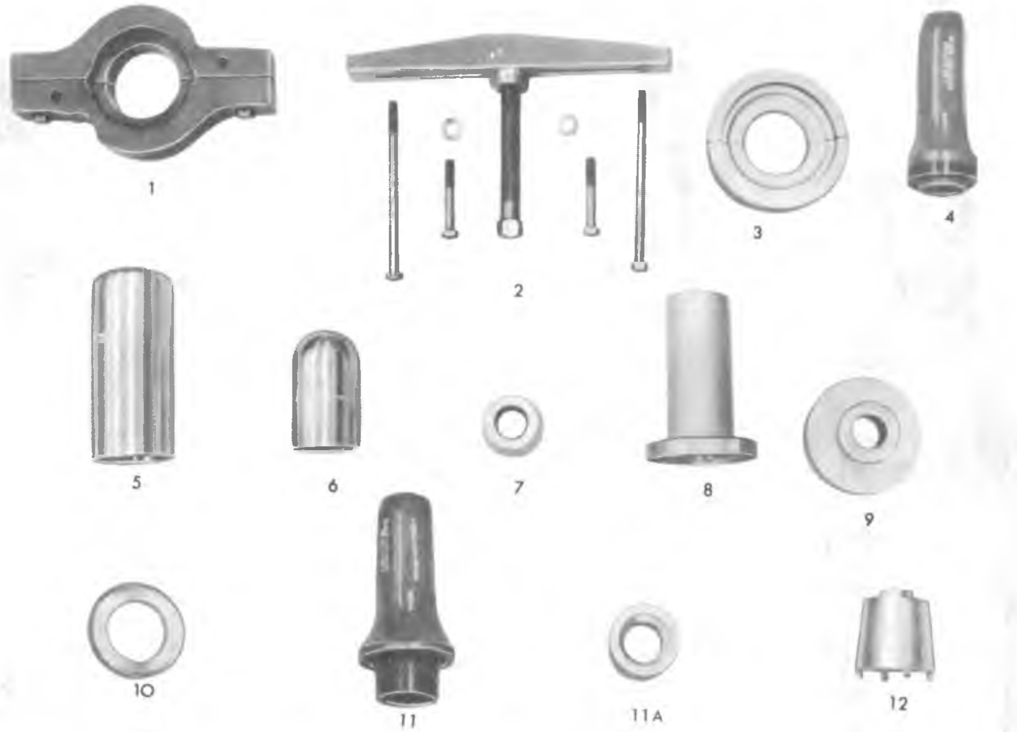
1. J-6456 Height Gauge
2. J-1048 Gauge Plate
3. J-1522 Pilot Bearing Driver
4. J-5824 Clutch Pilot Tool
5. J-1448 Pilot Bearing Puller

Fig. 1ST—Clutch Special Tools



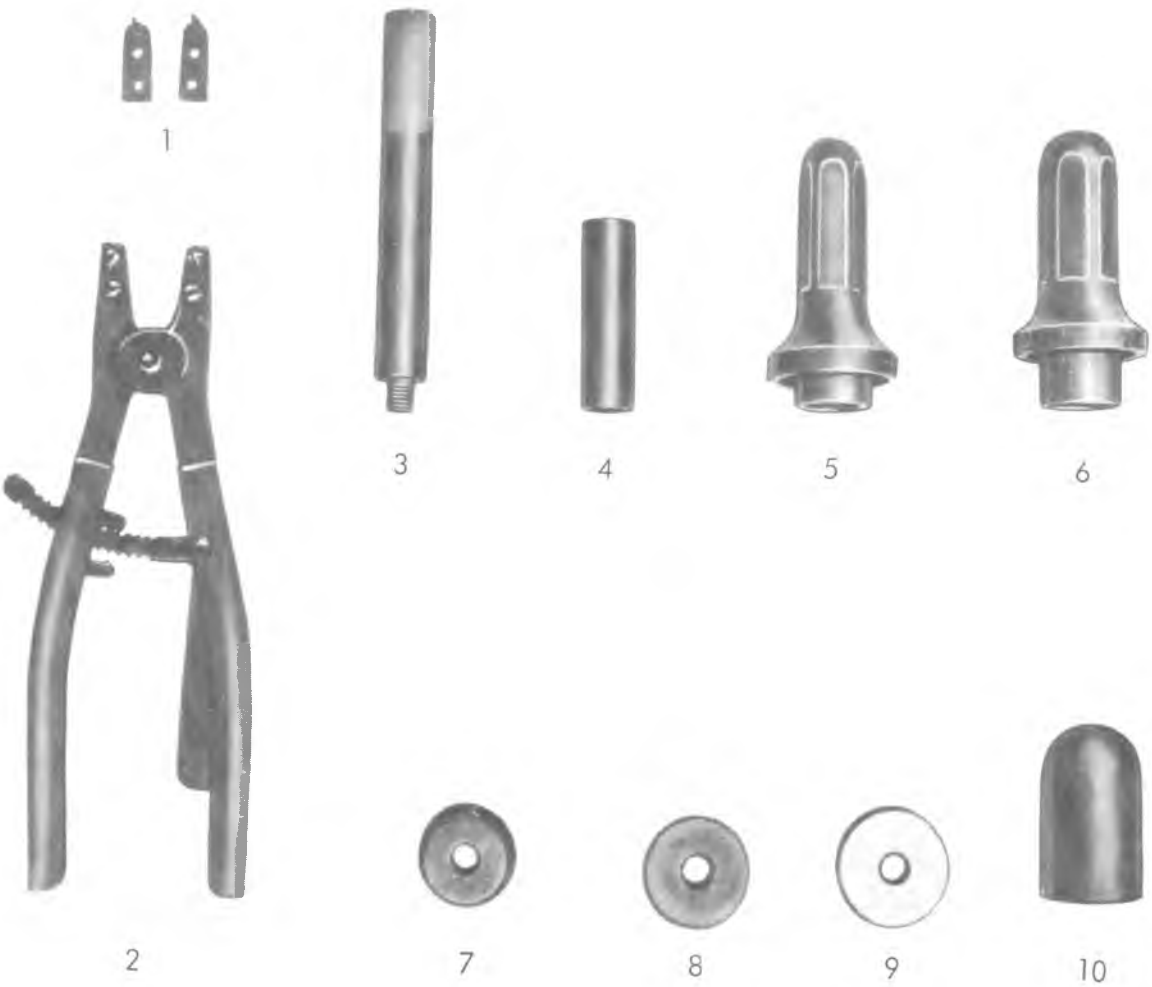
1. J-1126 Transmission Guide Pins
2. J-8059 Retainer Snap Ring Pliers
3. J-22246 Countergear Loading Tool
4. J-5778 Extension Bushing Remover and Installer
5. J-5154 Extension Seal Installer
6. J-5814-01 Speedometer Drive Gear Remover and Adapter J-5814-15
7. J-1453-01 Speedometer Drive Gear Press Plates and Press Plate Holder J-358-1
8. J-2228 Rear Bearing Press Plates
9. J-5590 Clutch Gear Bearing Installer
10. J-9772 Clutch Gear Bearing Installer
11. J-23096 Clutch Gear Retainer Seal Installer
12. J-5752 Transmission Holding Fixture

Fig. 2ST—Transmission Special Tools



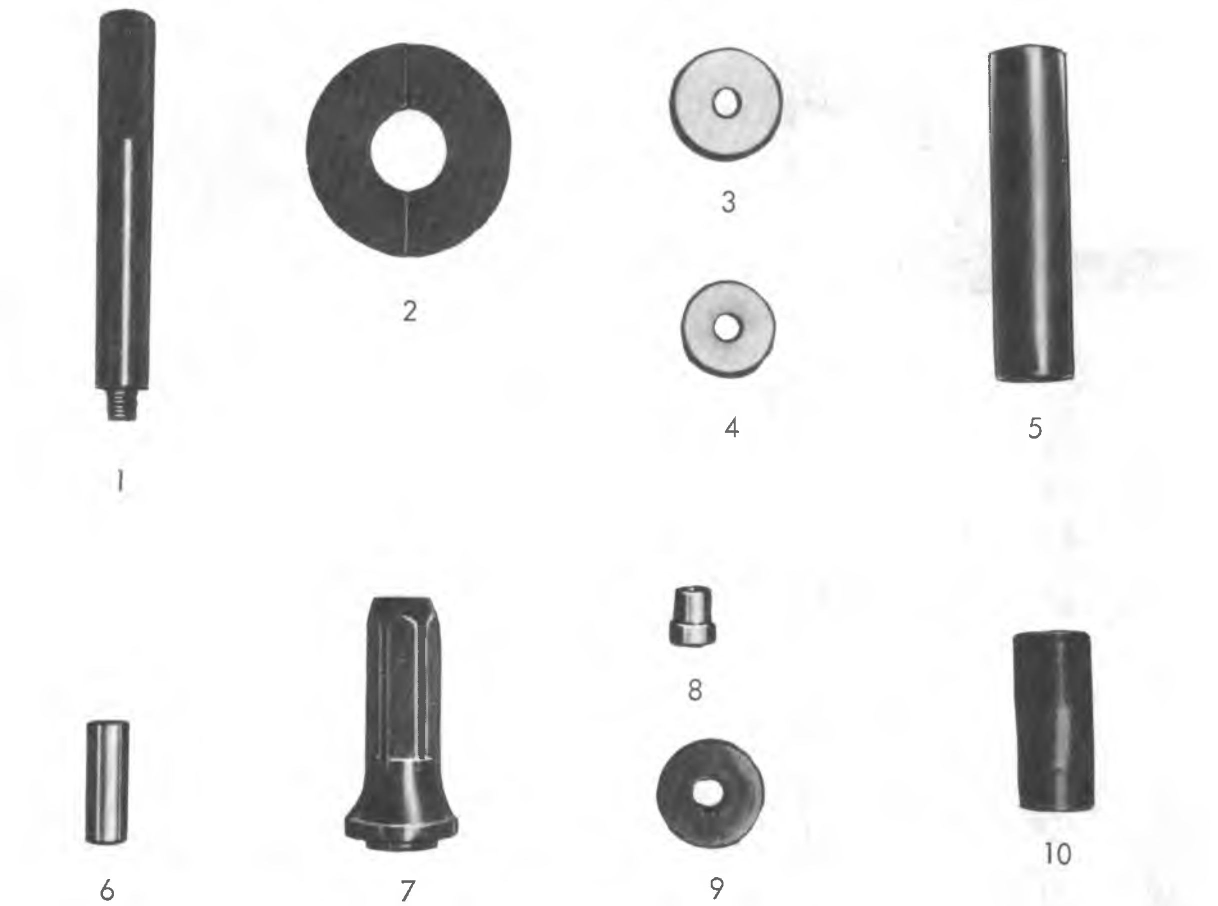
1.	J-22832	Countergear Rear Bearing Remover
2.	J-8433-1	Bearing Puller
3.	J-22872	Clutch Gear Bearing Remover and Installer
4.	J-22833	Front Bearing Retainer Seal Installer
5.	J-22873	d Speed Bushing Installer
		Speed Bushing Installer
		ɔ Ring Installer
8.	J-22874-1	Bearing Installer
9.	J-22874-5	Mainshaft Support Tool
10.	J-22874-2	Countershaft Support Tool
11.	J-22834-2	Rear Bearing Retainer Seal Installer
11a.	J-22834-1	Adapter for Seal Installer
12.	J-23070	Mainshaft Rear Bearing Lock Nut Installer

Fig. 3ST—4-Speed Muncie Special Tools



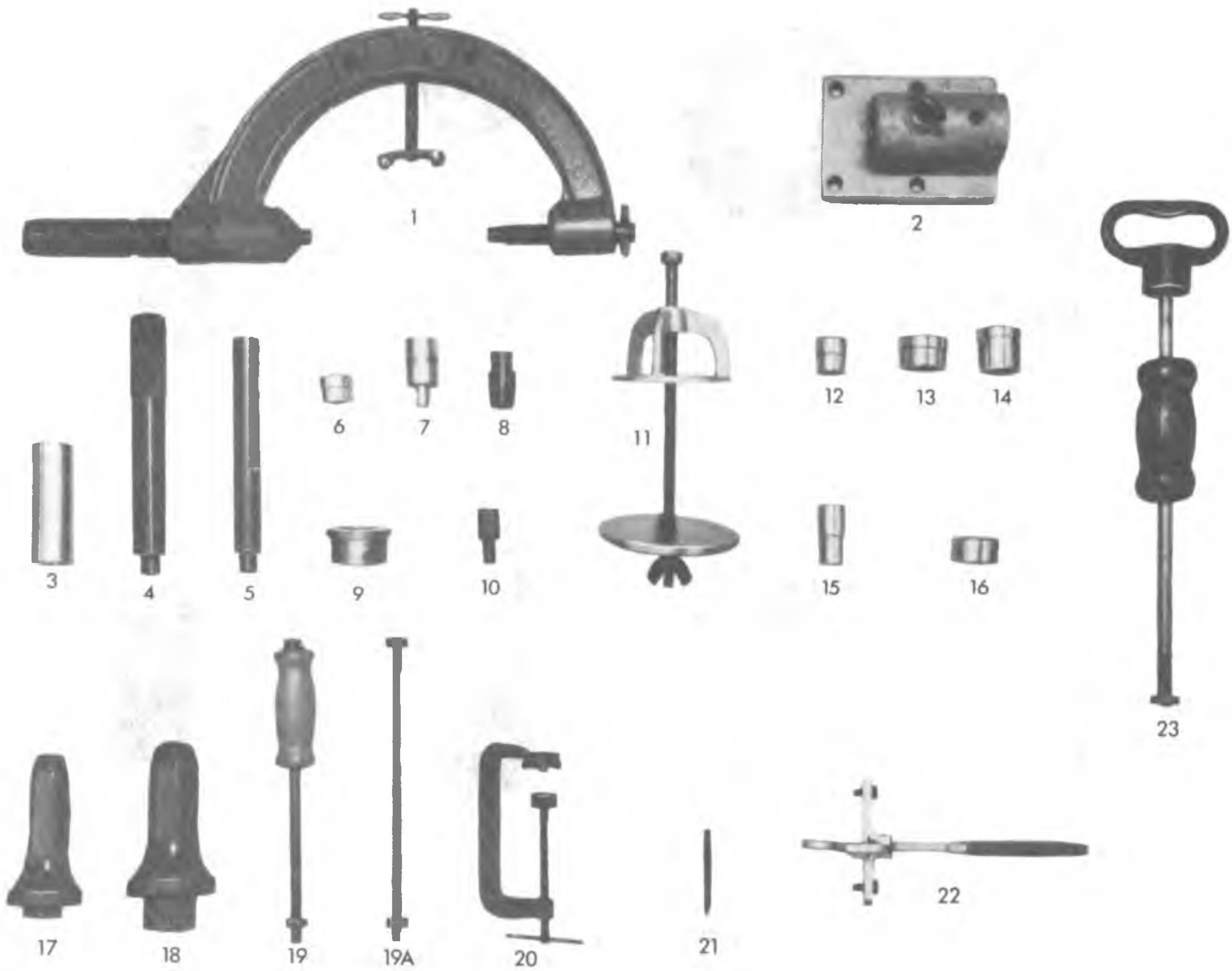
1. J-23432-1 Snap Ring Picks
2. J-23432 Snap Ring Pliers
3. J-8092 Handle
4. J-23429 Intermediate Shaft Remover and Installer
5. J-22836 Front Output Shaft Bearing Retainer Seal Installer
6. J-21359 Rear Output Shaft Bearing Retainer Seal Installer
7. J-23431 Rear Output Shaft Housing Bearing Remover and Installer
8. J-7137 Adapter Seal Installer
9. J-9276-2 Intermediate Gear Bearing Cup Installer
10. J-22875 Rear Output Shaft Rear Bearing Installer

Fig. 4ST—New Process Transfer Case Special Tools



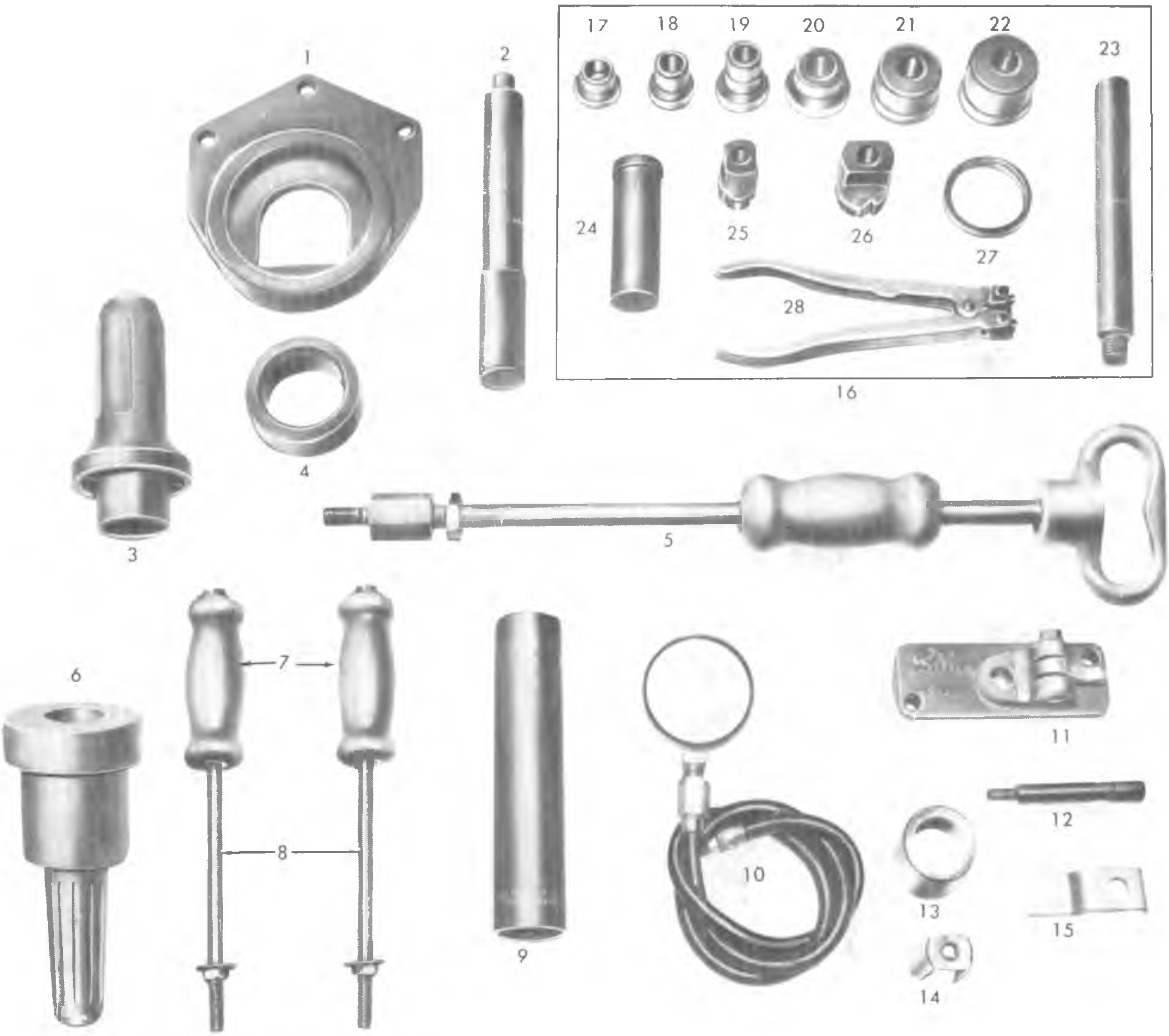
1.	J-8092	Handle.
2.	J-8331	Rear Output Shaft Front Bearing Remover.
3.	J-23422	Rear Output Shaft Front Bearing Cup Installer.
4.	J-23423	Rear Output Shaft Rear Bearing Cup Installer.
5.	J-5590	Bearing Installer.
6.	J-23419	Intermediate Shaft Remove and Installer.
7.	J-22833	Output Shaft Housing Seal Installer.
8.	J-23420	Pilot Bearing Installer.
9.	J-7137	Adapter Seal Installer.
10.	J-6219	Front Output Shaft Bearing Installer.

Fig. 5ST—Dana Transfer Case Special Tools



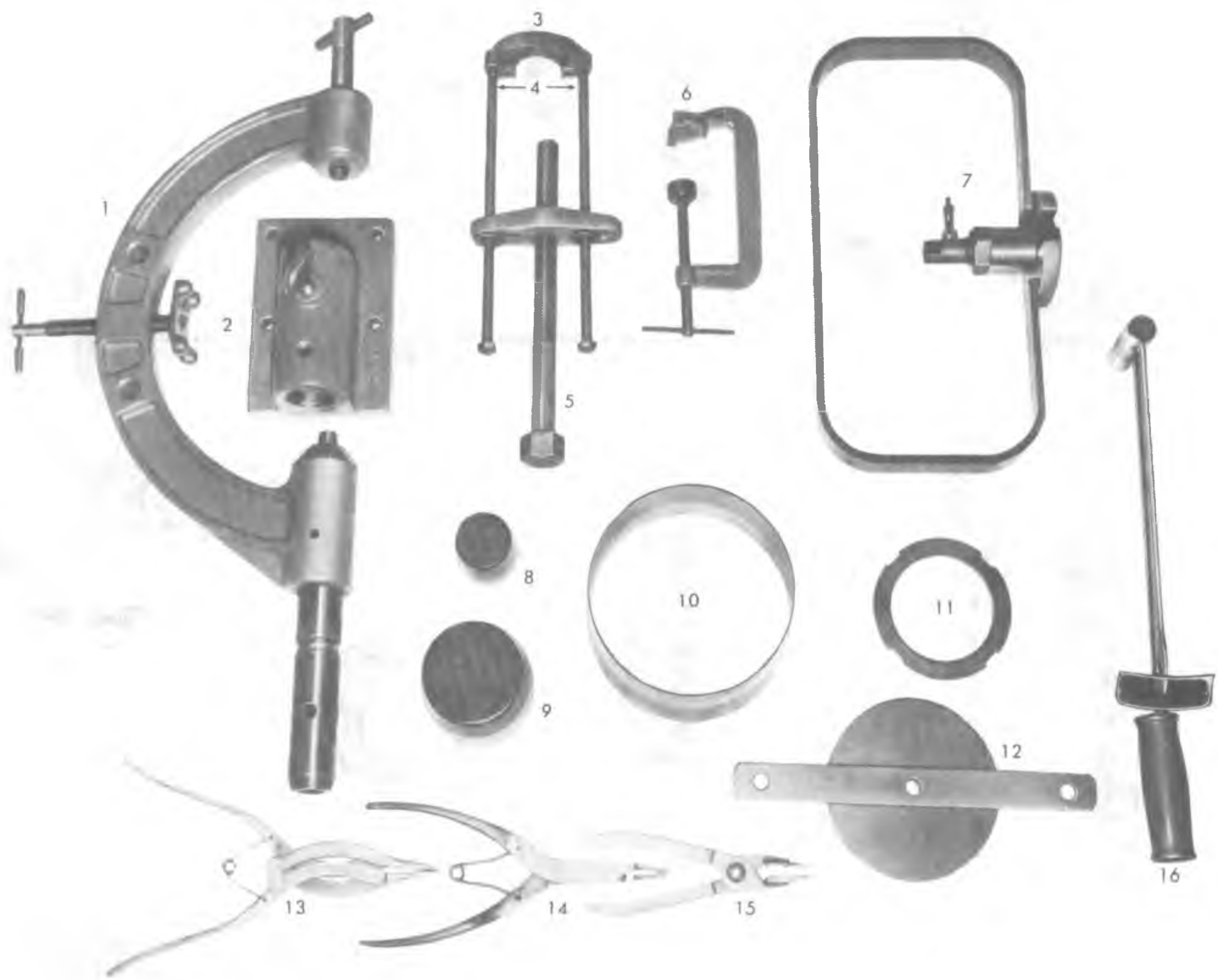
1.	J-8763	Transmission Holding Fixture (Modified for THM 350)
2.	J-3289-14	Transmission Holding Fixture Base
3.	J-23103	Propeller Shaft Yoke Seal Remover and Installer
4.	J-8092	Driver Handle
5.	J-21465-13	Driver Handle Extension
6.	J-23062-3	Sun Gear and Reaction Carrier Bushing
7.	J-23062-7	Output Shaft Bushing Installer
8.	J-21465-15	Stator Shaft Front Bushing Remover
9.	J-23329	Direct Clutch Bushing Installer
10.	J-9534-01	Output Shaft Bushing Remover
11.	J-23327	Clutch Spring Compressor
12.	J-23062-2	Stator Shaft Rear Bushing Installer
13.	J-23062-1	Case Bushing Installer
14.	J-21424-9	Extension Housing Bushing Installer
15.	J-21424-7	Stator Shaft Front Bushing Installer
16.	J-23062-5	Input Ring Gear Bushing Installer
17.	J-5154 or J 21426	Extension Housing Seal Installer
18.	J-21359	Pump Seal Installer
19.	J-6585	Slide Hammer Weights
19a.	J-9539	Slide Hammer Screw
20.	J-21885	2-3 Accumulator Piston Compressing Tool
21.	J-23071	Intermediate Band Apply Pin Gauge
22.	J-23069	1-2 Accumulator Cover Remover and Installer
23.	J-2619	Slide Hammer (Used with J-2619-4 Adapter and J-21465-15 Stator Shaft Front Bushing Remover

Fig. 6ST—Turbo Hydra-Matic 350 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	Ext. Bushing Rem. and Inst. (Not Illustrated)

Fig. 7ST—Turbo Hydra-Matic 400 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 and 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.

Fig. 8ST—Turbo Hydra-Matic 400 Special Tools

SECTION 8

FUEL TANK AND EXHAUST

CONTENTS OF THIS SECTION

FUEL TANKS AND ATTACHMENTS

FUEL CAP, FUEL LINES & FUEL TANK—The fuel tank, cap and lines should be inspected for road damage which could cause leakage. Inspect fuel cap for correct sealing ability and indications of physical damage. Replace any damaged or malfunctioning parts.

INDEX

GENERAL DESCRIPTION

All cab model truck have fuel tanks mounted behind the seat within the cab. The tank is constructed of two steel sections, seam welded, together. The filler neck extends through the left side of the cab, at a convenient height from the ground. Exceptional stiffness is secured by the combination of the welded flanges and depressed ribs in both the front and rear halves. The tank is bolted to the rear of the cab and to the floor panel.

On 1 ton forward control models and cowl models, the tank is mounted on the outside of the left frame side rail. A strong mounting of two metal straps anchor these tanks to mounting brackets which are bolted to the frame side member.

On 1/2 and 3/4 ton conventional and 4-wheel drive models, Suburban and Blazer, the tank is located to the rear of the axle and between the side rails and envelopes the forward edge of the spare tire. These tanks are supported by one or two steel straps which are held at either end by a hook into the side rail. Metal to metal contact between tank and brackets or straps is prevented by the use of anti-squeak material.

Upper and lower filler necks vary as to size, length and shape, depending on model requirements. These necks are treated so that rust will not form and get into the fuel system. Lower filler necks are first bolted or riveted to the tank, except on cab models, and then sweat soldered in place to eliminate any possibility of leakage at this point.

The fuel pickup pipe is built integrally with the tank gauge unit, located at the top of the tank. A large area, fine-mesh screen is located on the bottom of the fuel pickup pipe. This screen is designed to prevent the entrance of dirt or water into the fuel system, and operates with a self-cleaning action.

Frame mounted tanks consist of an upper and lower half, each with a wide flange. The two tank sections are seam welded at the flange around the entire tank to assure leakproof construction. Exceptional stiffness is secured by the combination of the welded flanges and depressed ribs in both upper and lower tank sections.

Evaporation Control System (ECS)

The Evaporation Control System (ECS) is standard equipment under federal regulations for all truck series rated under 6,000 pounds maximum obtainable GVW and all people carrying vehicles. Important changes have been made to improve performance and increase reliability. The most noteworthy being in the area of fuel fill. Past versions used partial inner tanks as fuel fill limiter devices. Current designs use filler necks extended further into the fuel tank and a revised fill vent tube.

Tank Filler Neck Gas Cap—10 Series and Trucks Classed As People Carriers

The truck fuel tank filler cap has a pressure-vacuum safety relief valve.

NOTE: The gas cap requires replacement, only a cap identified on the inside of the cap with "pressure-vacuum" should be used. Failure to use the correct cap can result in a serious malfunction of the system.

COMPONENT PART REPLACEMENT

(Refer to Illustrations)

DRAINING FUEL TANK

If the fuel tank does not incorporate a drain plug, it will be necessary to siphon fuel from the tank when draining is needed. The following procedure is recommended.

1. Obtain approximately 10 feet of 3/8" I.D. hose and cut a flap-type slit 18" from one end. Make this cut in the direction of the shorter end of hose (See Figure 1).
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 siphon hose into the fuel tank filler neck with the natural curl of the hose pointed down. Insert until the hose is heard to strike the bottom of the tank.
4. With the opposite end of the hose in a suitable container, insert an air hose in the downward direction in the flap-type slit and trigger the flow of fuel.

CAUTION: Before draining be sure that the fuel tank gauge unit wire or battery negative cable is disconnected.

Always drain gasoline from complete fuel system including carburetor, fuel pump, 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.

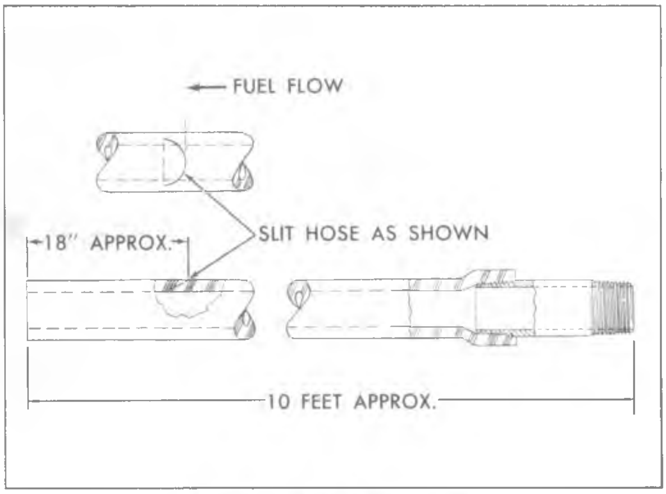


Fig. 1—Siphon Construction

GAUGE UNIT OR STRAINER

Replacement

The following procedure is intended as a general guide only and will vary according to truck series and model.

1. Drain tank to a level below gauge unit mounting location or if unit is inaccessible remove fuel tank.

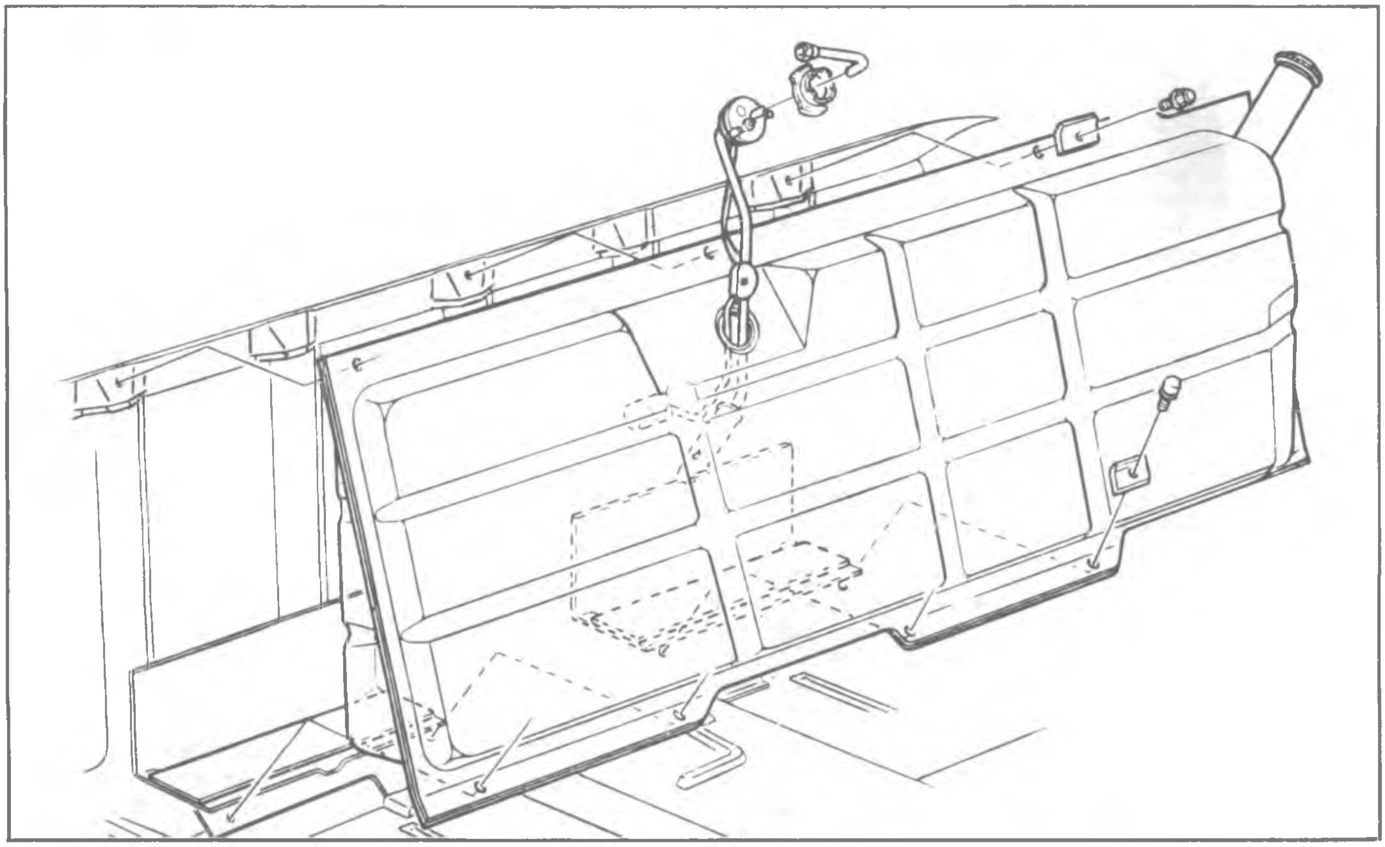


Fig. 2—Cab Mounted Fuel Tank

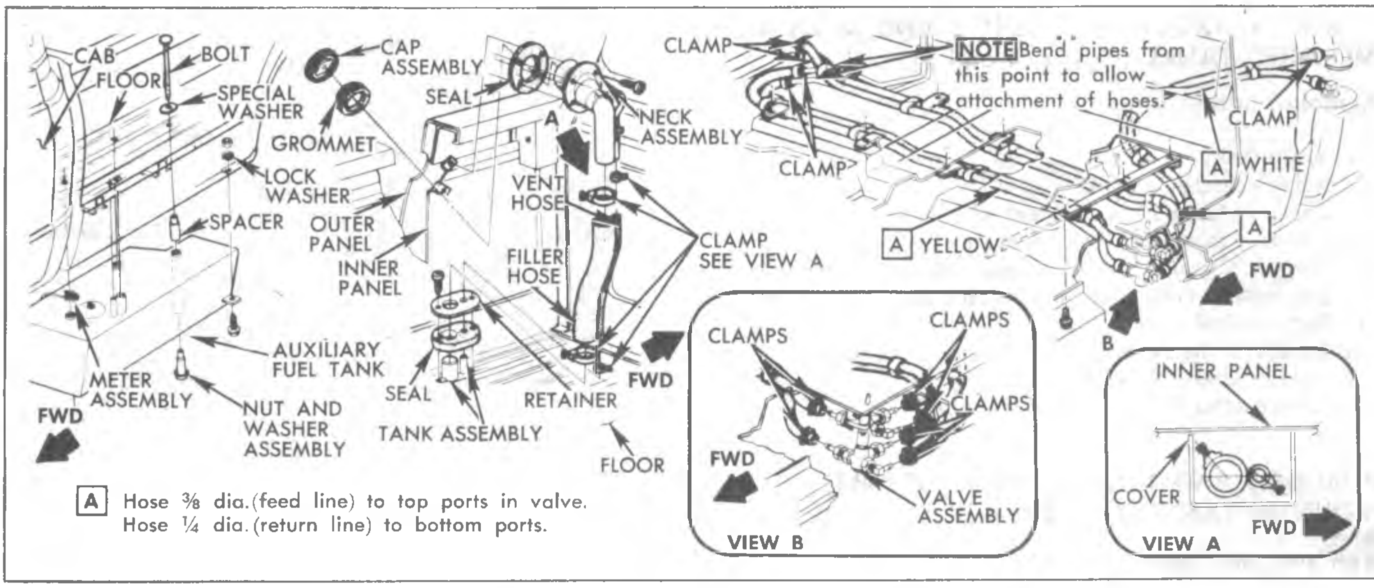


Fig. 3—Auxiliary Fuel Tank Installation

2. Disconnect fuel feed line and wiring from gauge unit.
3. Unlock gauge cam ring using Tool J-23346 and remove gauge unit from tank.

NOTE: On some chassis mounted tanks, remove gauge attaching screws and then disengage unit from tank.

4. Replace or clean strainer with compressed air as required.
5. Install gauge unit using reverse of removal procedure.

GAS CAP IDENTIFICATION

The easiest way to identify the correct filler neck gas cap for trucks with the Evaporation Control System (ECS), is to check for the words "pressure-vacuum" on the inside of the cap. Also check for proper gas cap fit.

If gas cap replacement is required, always check vehicle identification and order by part number.

FUEL TANKS

NOTE: The optional auxiliary fuel tank installs in the same manner as center mounted tanks. It is connected to the cab mounted tank as shown in Figure 3.

CAB MOUNTED TANKS (Fig. 2)

Removal and Installation

1. Remove seat back hold-down bolts and tilt seat back forward.
2. Remove tank cover if so equipped.
3. Drain tank.
4. Disconnect fuel line, meter wire and ground lead.
5. Remove lug wrench and lug wrench mount.
6. Remove seven bolts and fasteners securing tank to cab.
7. Remove tank from cab simultaneously disengaging filler neck from the rubber grommet in the cab opening.
8. Remove meter assembly from fuel tank using Tool J-23346.
9. To install, reverse removal procedure.

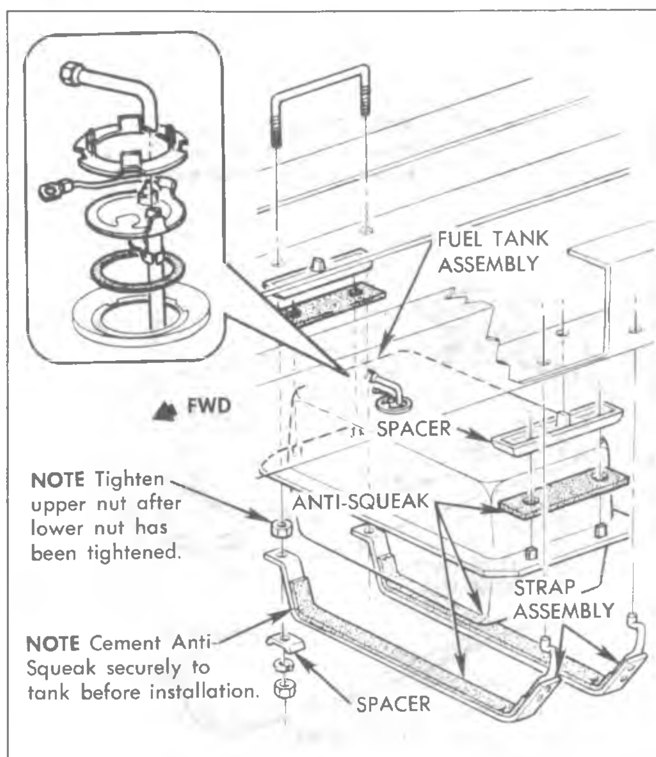


Fig. 4—Fuel Tank Mounting, CA, KA 10 Series

½ AND ¾ TON CHASSIS CENTER AND AUXILIARY MOUNTED TANKS (Figs. 3, 4 and 5)

Removal and Installation

1. Drain tank.
2. Raise vehicle on hoist.
3. Unclamp filler neck and vent tube hose.
4. Unclamp gauge unit hose at frame end.
5. Support tank and remove support strap(s).
6. Lower tank until gauge unit wiring can be removed.
7. Remove fuel tank.
8. Install in the reverse order, being sure that the anti-squeak material is replaced.
9. Lower vehicle and remove from hoist.

P MODELS AND 1 TON CHASSIS (FRAME) MOUNTED TANKS (Figs. 6 and 7)

Removal and Installation

1. Drain tank.
2. Remove filler neck.
3. Disconnect gauge unit fuel line and wiring. Ignition switch must be in OFF position.
4. Remove bolts attaching tank supports to frame.
5. Remove tank complete with mounting brackets and support straps.
6. Remove tank from brackets and support straps, if necessary.
7. To install, reverse the removal procedures. Replace all anti-squeak material.

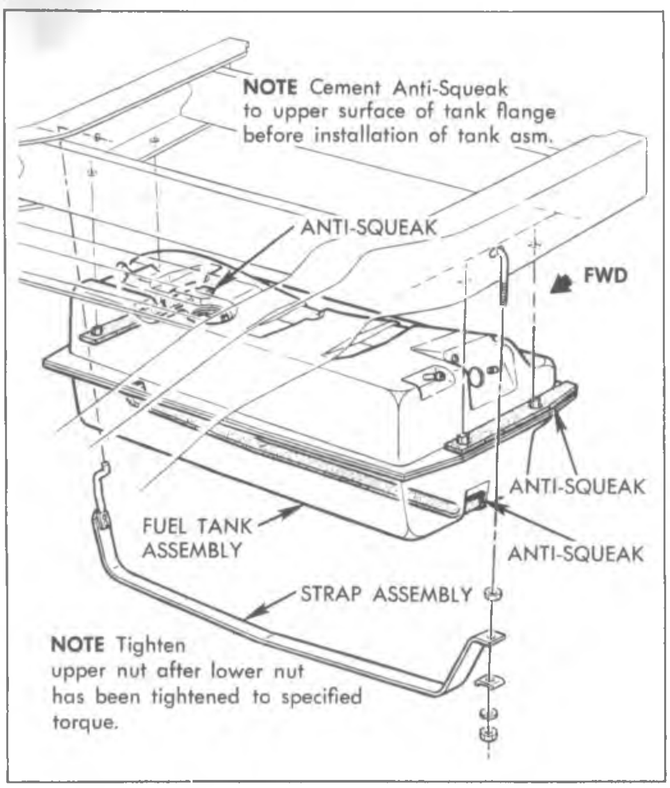


Fig. 5—Fuel Tank, P 10 Series

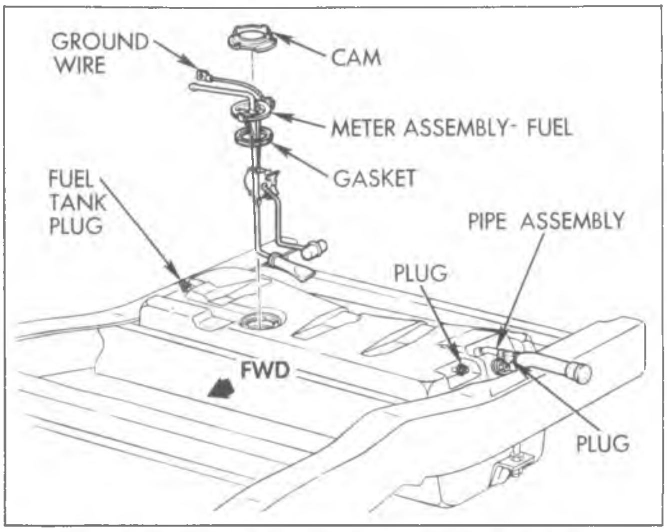


Fig. 6—Fuel Tank Lower Neck and Meter, P 10 Series

CLEANING FUEL SYSTEMS

If trouble is due to contaminated fuel or foreign material that has been put into the tank, it can usually be cleaned. If tank is rusted internally, it should be replaced.

1. Disconnect battery and ignition coil primary wire (+ wire on ignition coil).
2. Drain fuel tank. (See DRAINING FUEL TANK.)
3. Remove fuel tank. (See REMOVAL OF TANK.)
4. Remove fuel inlet filter at carburetor and inspect for contamination. If filter is plugged, replace. (Leave fuel line disconnected.)
5. Locate tank away from heat, flame or other source of ignition. Remove fuel gauge tank unit and inspect

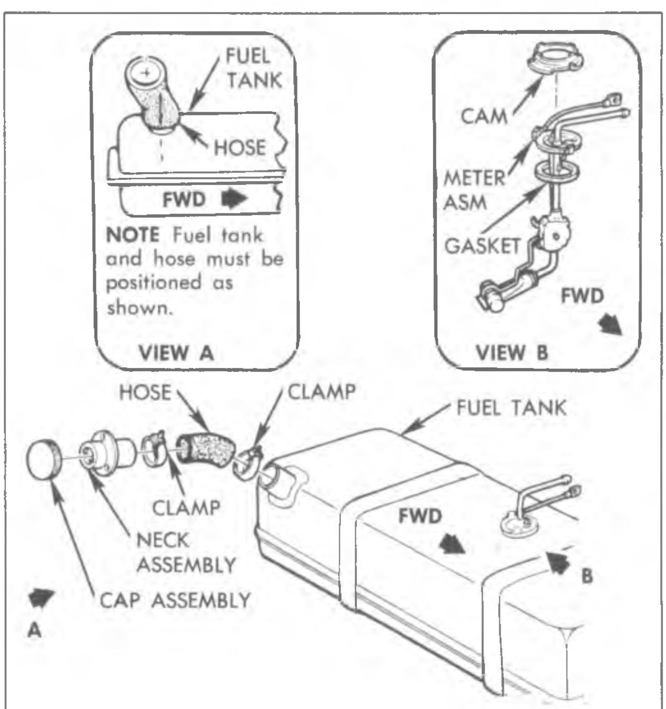


Fig. 7—Fuel Tank Neck and Meter

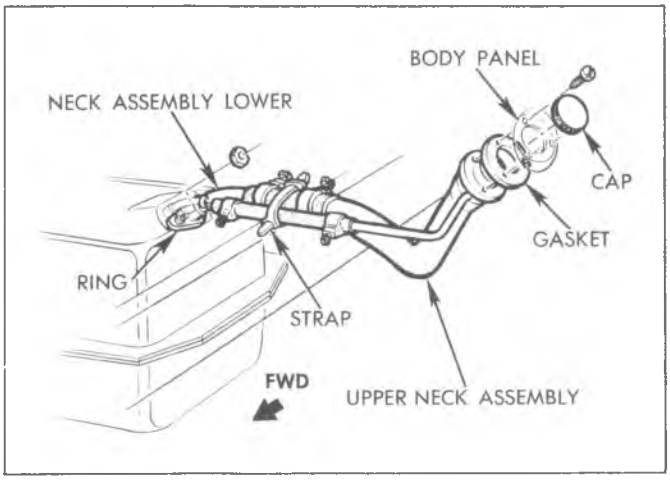


Fig. 8—Fuel Tank Filler Neck, C-K 10-20 (06-16)

condition of filter. If filter is contaminated, a new filter should be installed upon reassembly.

6. Complete draining of tank by rocking it and allowing fuel to run out of tank unit hole.
7. Purge fuel tank with steam or running hot water for at least five minutes. Pour water out of tank unit hole. (Rock tank to assure complete removal of water.)

IMPORTANT: This procedure will not remove fuel vapor. Do not attempt any repair on tank or filler neck where heat or flame is required.

8. Disconnect inlet fuel line at pump and use air pressure to clean fuel line and fuel return line (if equipped). Apply air pressure in the direction fuel normally flows through line.
9. Use low air pressure to clean pipes on tank unit.
10. Install new filter on fuel tank unit if required. Install fuel tank unit with new gasket into tank and install tank. Connect tank unit wires and all fuel lines except pump to carburetor line. (See REMOVAL OF TANK for proper procedure).
11. Connect a hose to fuel line at carburetor; insert other end of hose into a one gallon fuel can.
12. Connect battery cable. MAKE SURE IGNITION COIL PRIMARY WIRE (+ TERMINAL) IS DISCONNECTED.
13. Put six gallons of clean fuel in tank and operate starter to pump two quarts of fuel into fuel can. This will purge fuel pump.
14. Remove hose and connect fuel line to carburetor.
15. Connect coil primary wire.

FUEL LINES

(Refer to Illustrations Figs. 9 thru 14)

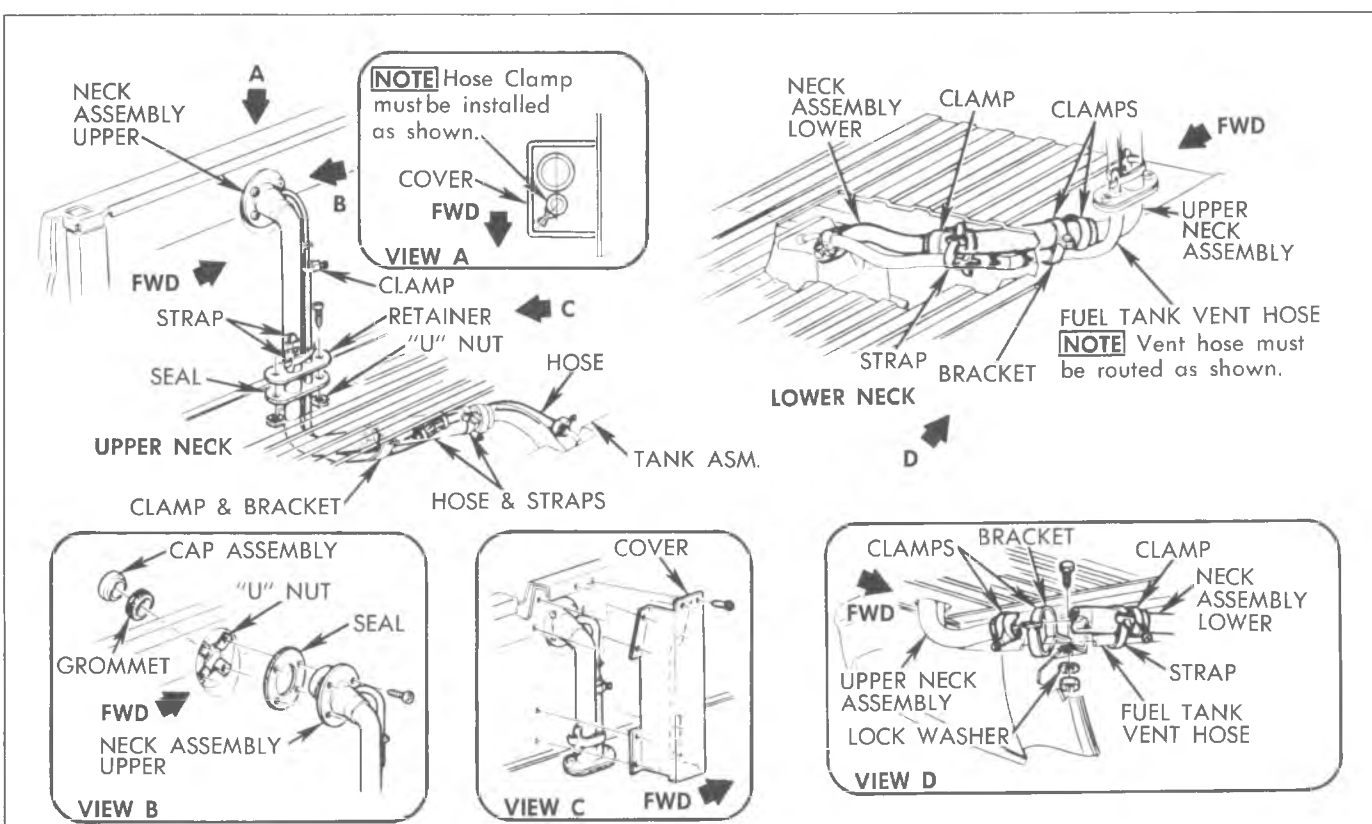


Fig. 9—Fuel Tank Upper & Lower Filler Neck—Blazer

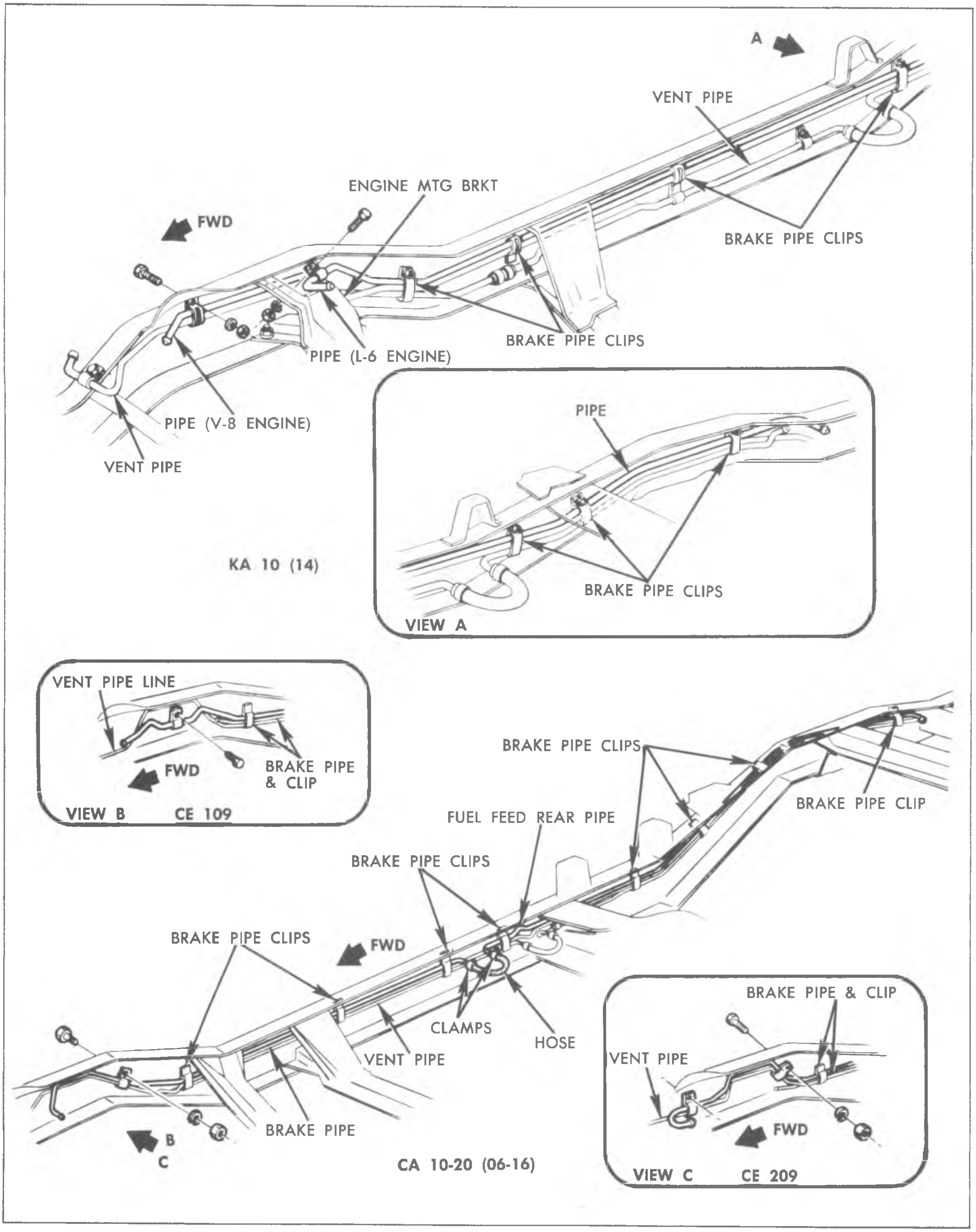


Fig. 10—Fuel Lines, C 10-20 (06-16) & KA 10 (14)

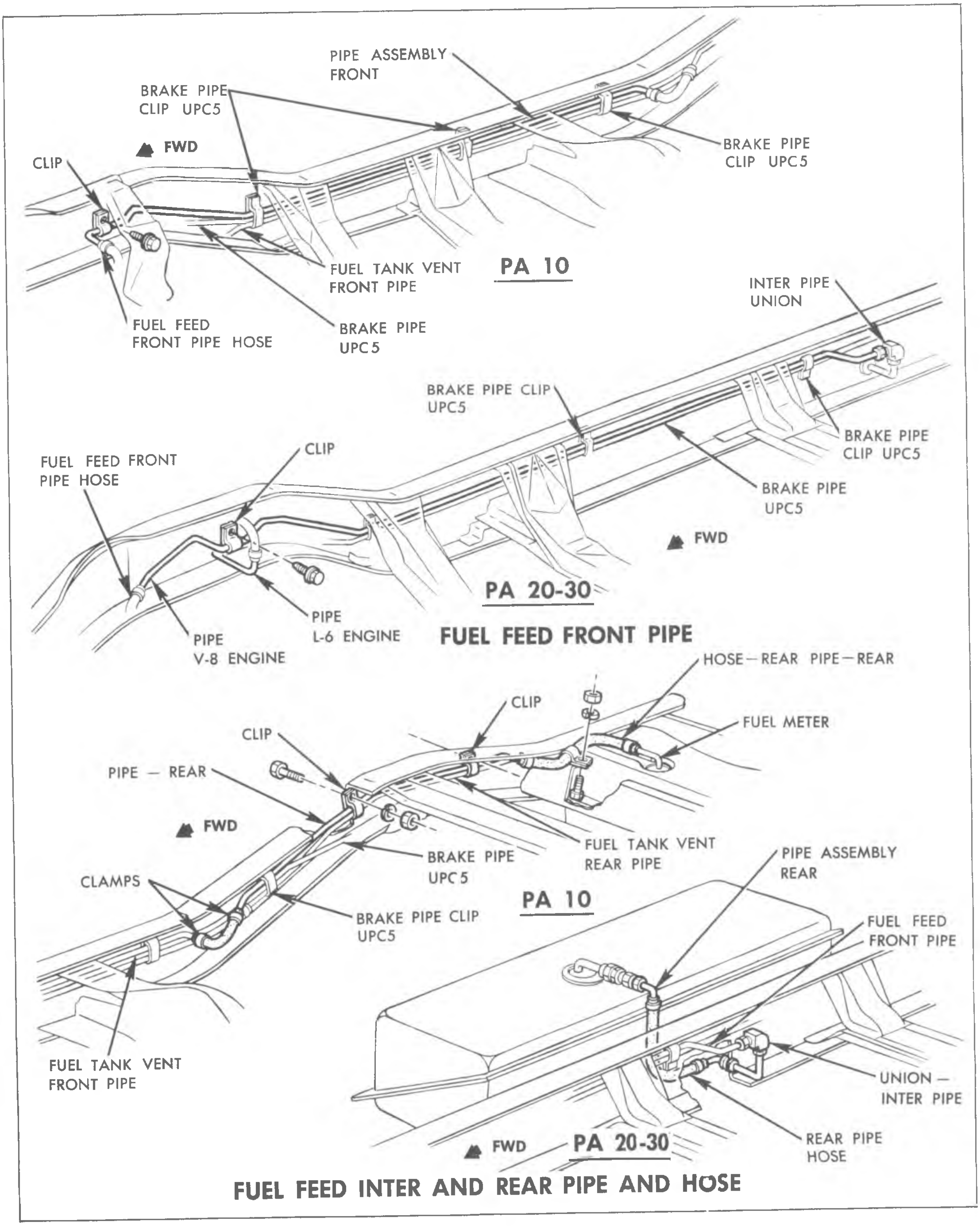


Fig. 11—Fuel Lines, P 10-30 Series

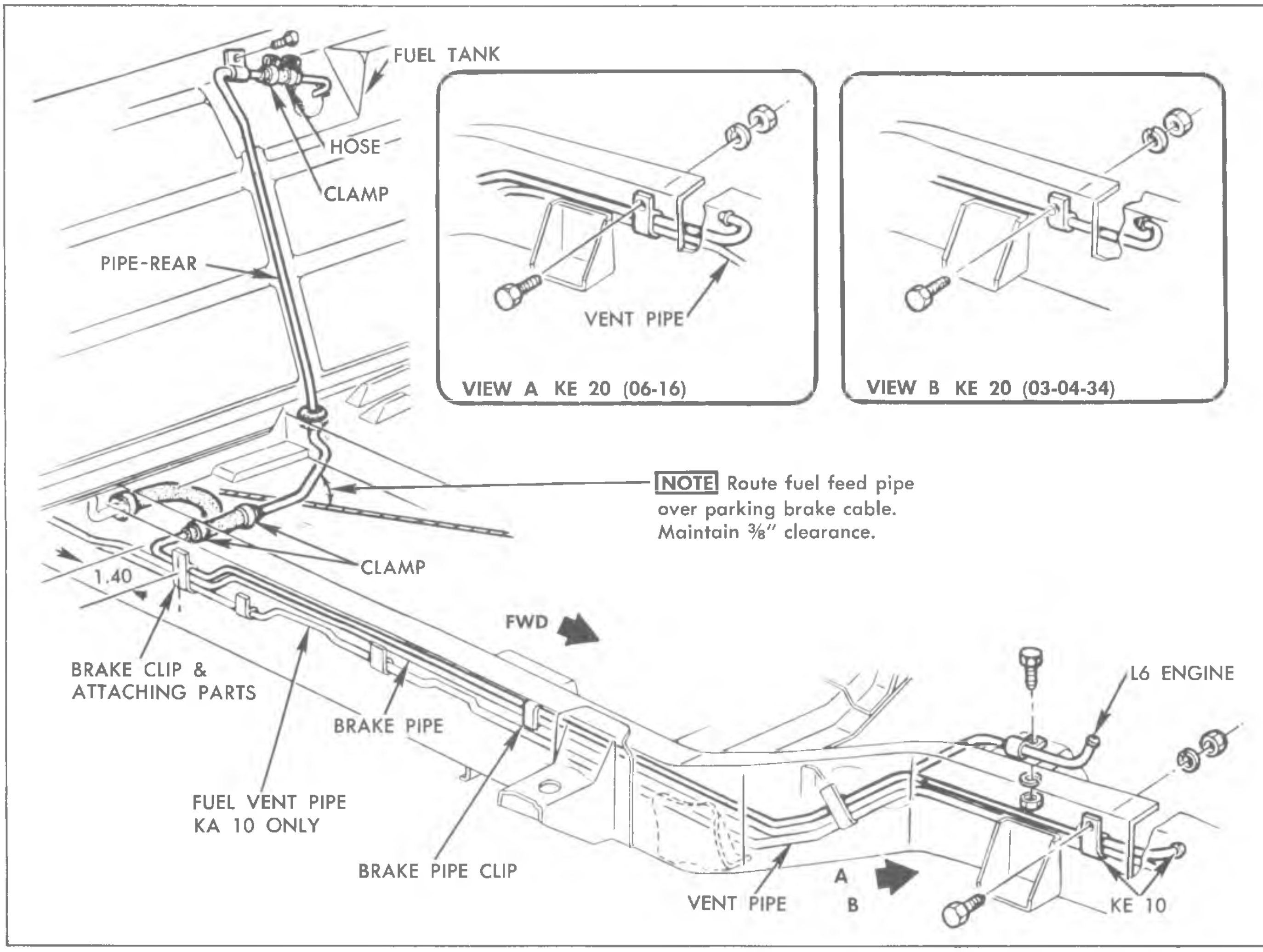


Fig. 12—Fuel Lines KA 10-20 (Except 14)

The fuel lines should be inspected occasionally for leaks, kinks or dents. If evidence of dirt is found in the carburetor, fuel pump or on a disassembly, the lines should be disconnected and blown out. Check the fuel strainer in the tank for damage or omission.

When replacing a fuel line, only seamless steel tubing is to be used. Also, the ends of the tubing must be double-flared using commercially available double flaring tools. All fuel lines must be properly routed and retained.

FRAME MOUNTED FUEL FILTER

Frame mounted fuel filters are standard equipment on P20-30, series vehicles. The fuel filter element should be replaced at the recommended mileage intervals outlined in Section 0, this manual.

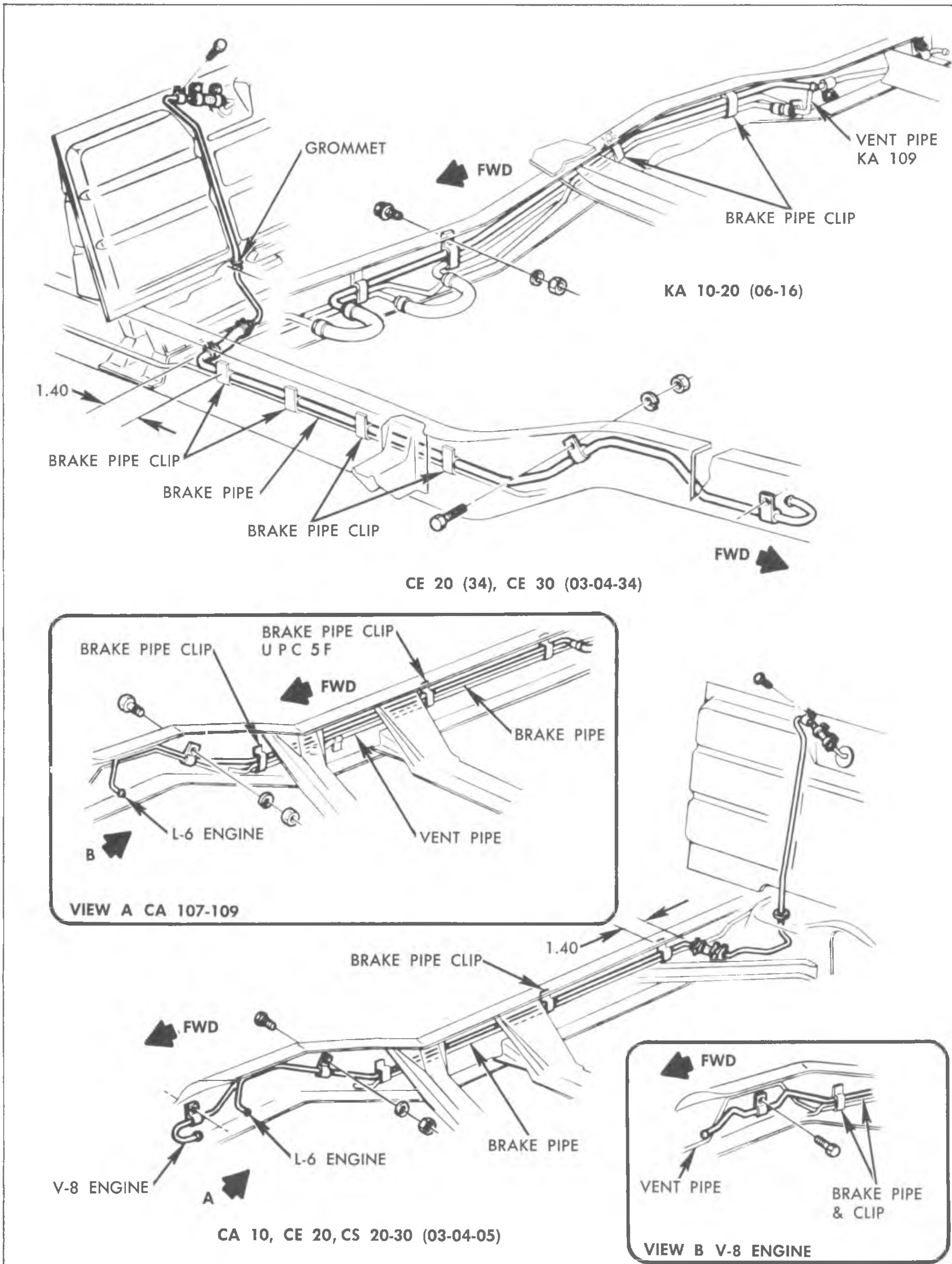


Fig. 13—Fuel Lines, Front & Rear CA 30 (02)

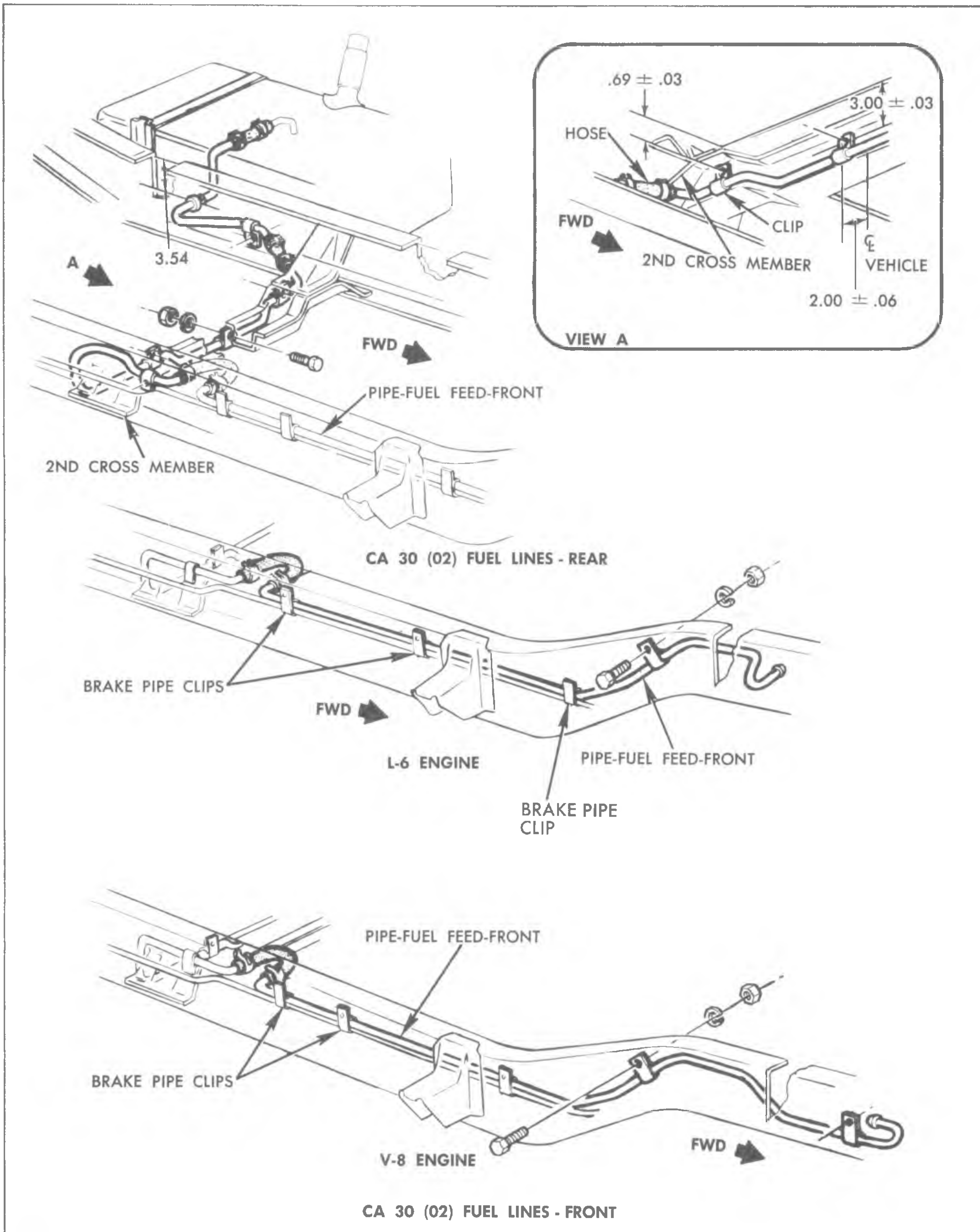


Fig. 14—Fuel Lines—Rear & Front CA 30 (02)

EVAPORATION CONTROL SYSTEM

NOTE: Also refer to the "Emission Control Systems" Booklet for required maintenance and warranty information.

INDEX

EVAPORATION CONTROL SYSTEM FUEL & VAPOR LINES—All fuel and vapor lines and hoses must be in good condition with no signs of leakage. Any damaged or deteriorated lines or hoses must be replaced. All lines should be inspected for proper connections and correct routing.

EVAPORATION CONTROL SYSTEM CANISTER—Check canister for cracks or damage when replacing the canister filter. Replace parts as necessary.

FILTER—ECS CANISTER—Remove canister and replace filter every 24,000 miles in lower section of canister.

SERVICE INFORMATION

The Components of this System are:

FUEL TANK FILLER NECK GAS CAP

The fuel tank filler cap has a new two-step removal and installation procedure plus a pressure-vacuum relief valve.

It is equipped with a double set of locking tangs. To remove:

- Rotate cap one-half turn counterclockwise to clear the first set of tangs from the slots inside the filler neck.
- This will allow any residual pressure to escape.
- Pull the cap outward and rotate one-quarter turn counterclockwise to clear second set of tangs. Then remove the cap.
- To install, reverse this procedure.

NOTE: If this cap requires a replacement, only a cap with these same features should be used. Failure to use the correct cap can result in a serious malfunction of the system. Correct replacement caps may be obtained from your Chevrolet dealer.

GASOLINE TANK

The gasoline tanks incorporate special extended filler necks and vents and also external hose connections.

LIQUID VAPOR SEPARATOR

The separator mounts to the right or left hand side of the gasoline tank. If service is necessary, the entire assembly must be replaced.

CANISTER FILTER

The canister is mounted on the left side of the engine compartment. A filter is mounted in the bottom of the canister. It is to be replaced according to the recommended maintenance schedule.

HOSES

When replacing any evaporative emission hose, use only replacement hose marked "EVAP". No other type of hose is to be used.

COMPONENT PART REPLACEMENT (Fig. 16-25)

(Refer to Illustrations)

CANISTER WITH CANISTER FILTER

Removal

1. Raise vehicle on hoist.
2. Note installed position of hoses on canister.
3. Disconnect hoses from top of canister.
4. Loosen clamps and remove canister.
   If replacing filter, pull out filter from bottom of canister.

Inspection

1. Check hose connection openings. Assure that they are open.
2. Check operation of purge valve by applying vacuum to the valve. A good valve will hold vacuum.

Installation

1. Install new filter.
2. Assemble bottom of canister to canister body.
3. Install canister and tighten clamp bolts.

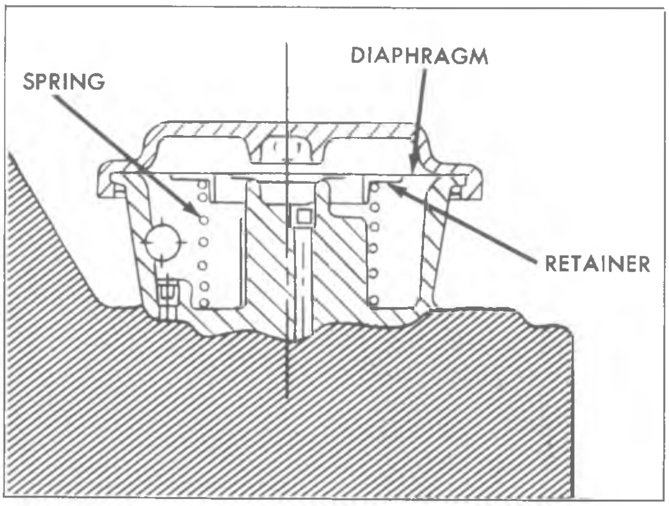


Fig. 15—Purge Valve

4. Connect hoses to top of canister in same position as in Step 3 above.

CANISTER PURGE VALVE (Fig. 10)

Disassembly

1. Disconnect lines at valve.
2. Snap off valve cap (slowly remove cap as diaphragm is under spring tension). Remove diaphragm, spring retainer and spring.
3. Replace parts as necessary. Check orifice openings.

Assembly

1. Install spring, spring retainer, diaphragm and cap.
2. Reinstall canister as previously outlined, connect lines to valve.

SEPARATOR

Removal

1. Raise vehicle on hoist.
2. Disconnect lines from separator.
3. Remove retaining screw and remove separator.

Installation

1. Install separator and its retaining screw.
2. Connect lines to separator.
3. Lower vehicle and remove from hoist.

FUEL TANK

Removal and installation procedures are the same as outlined for other models with exception of disconnecting and connecting fuel tank-to-separator vent lines. Refer to Fuel Tank Section.

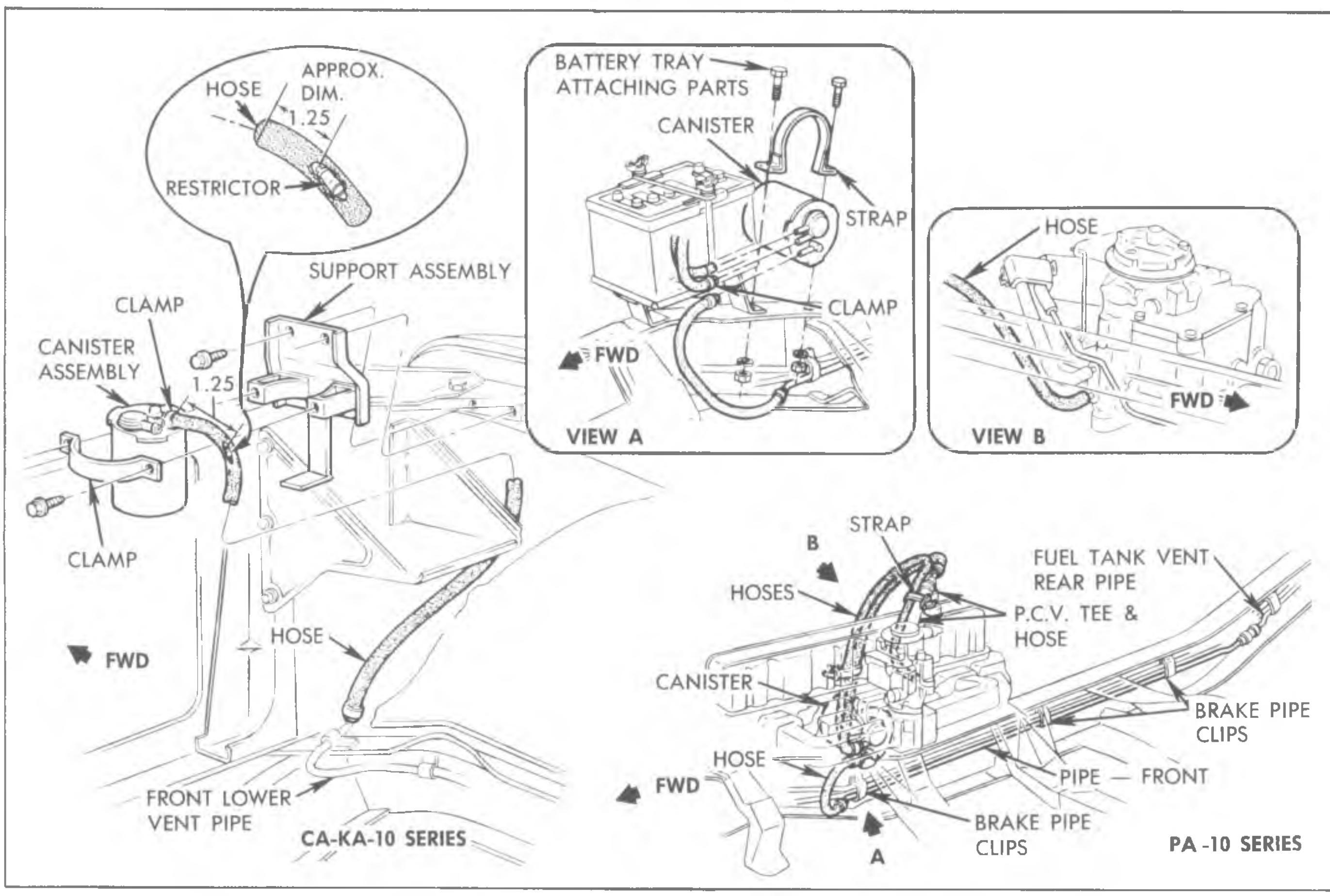


Fig. 16—Canister, Hoses & Front Vent Pipes C, K and P 10 Series

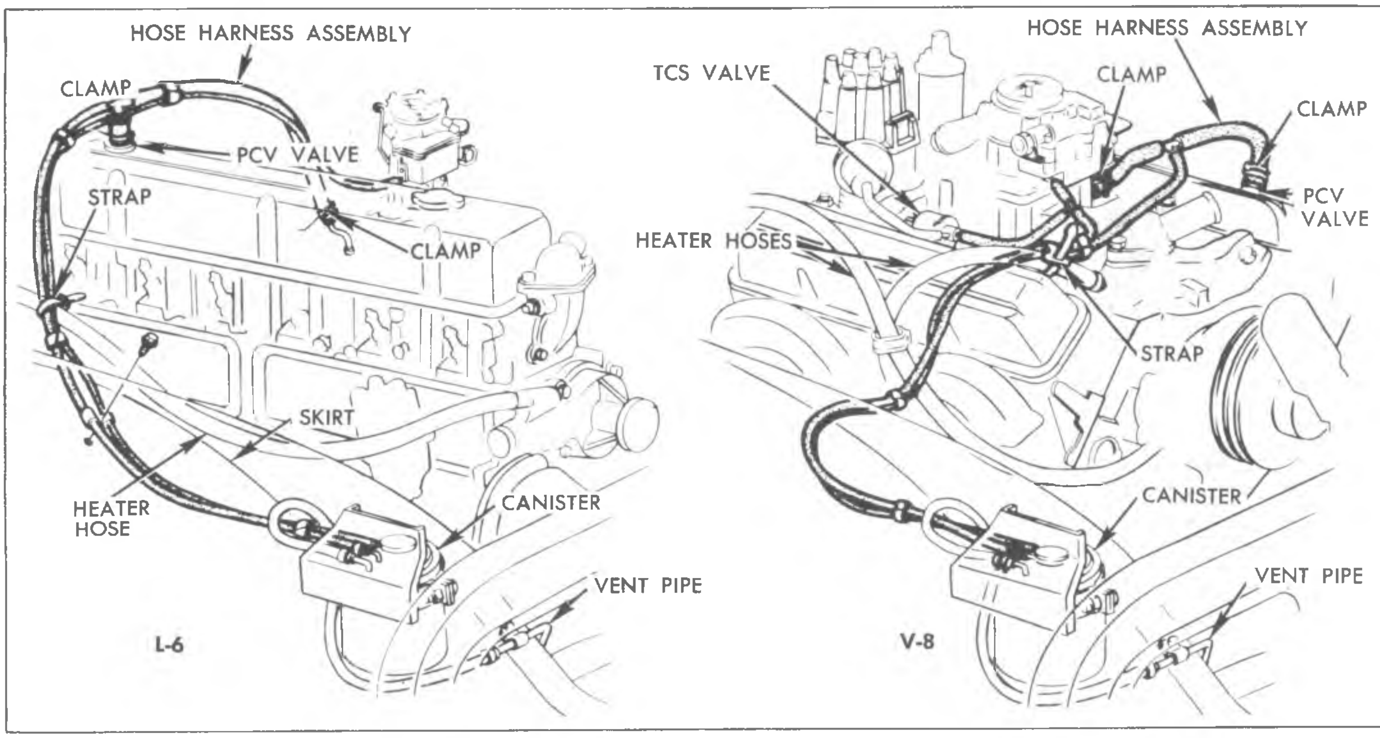


Fig. 17—Canister Hose Routing C-K 10-20 (L6 & V8)

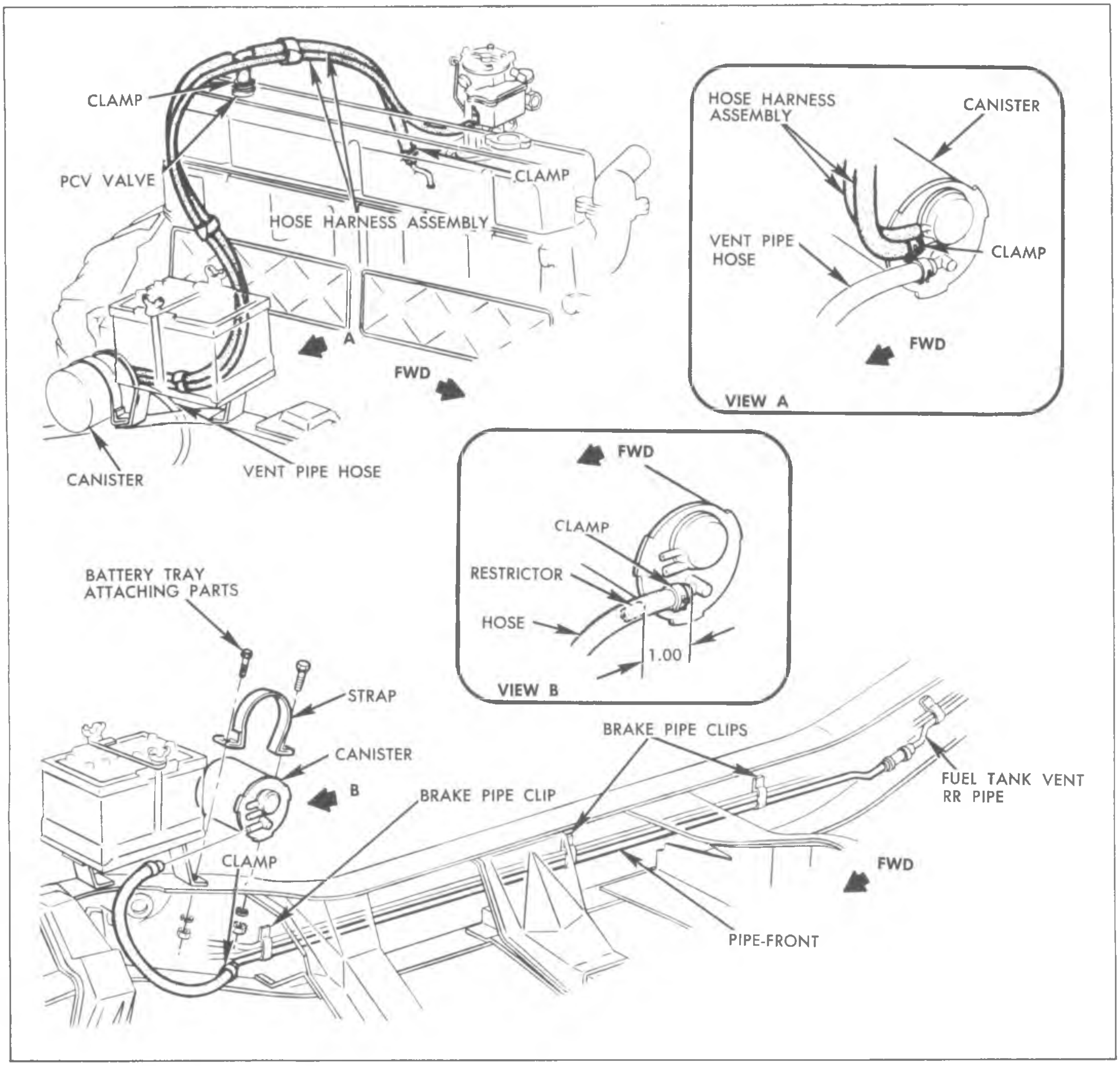


Fig. 18—Fuel Vapor Canister Routing & Front Vent Pipe P-10

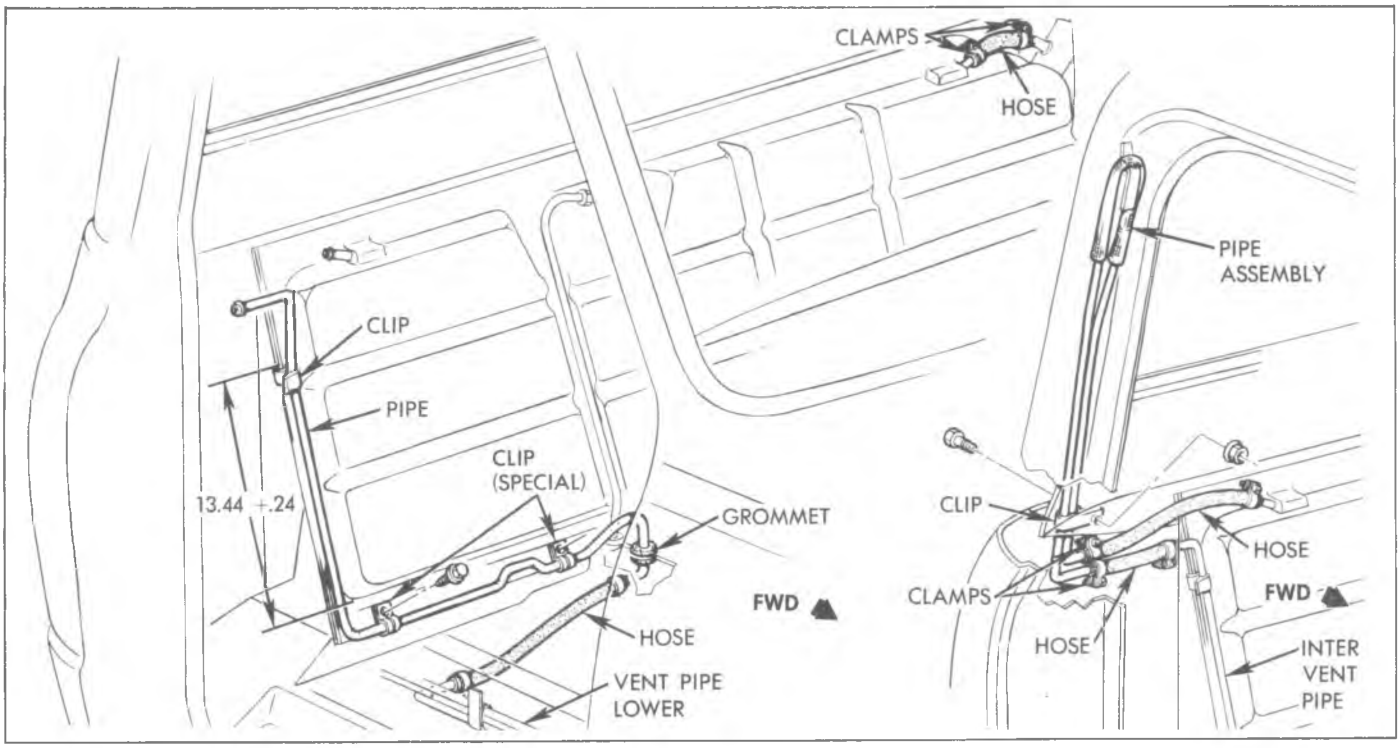


Fig. 19—Upper Vent and Intermediate Hoses and Pipe C, K 10 Series

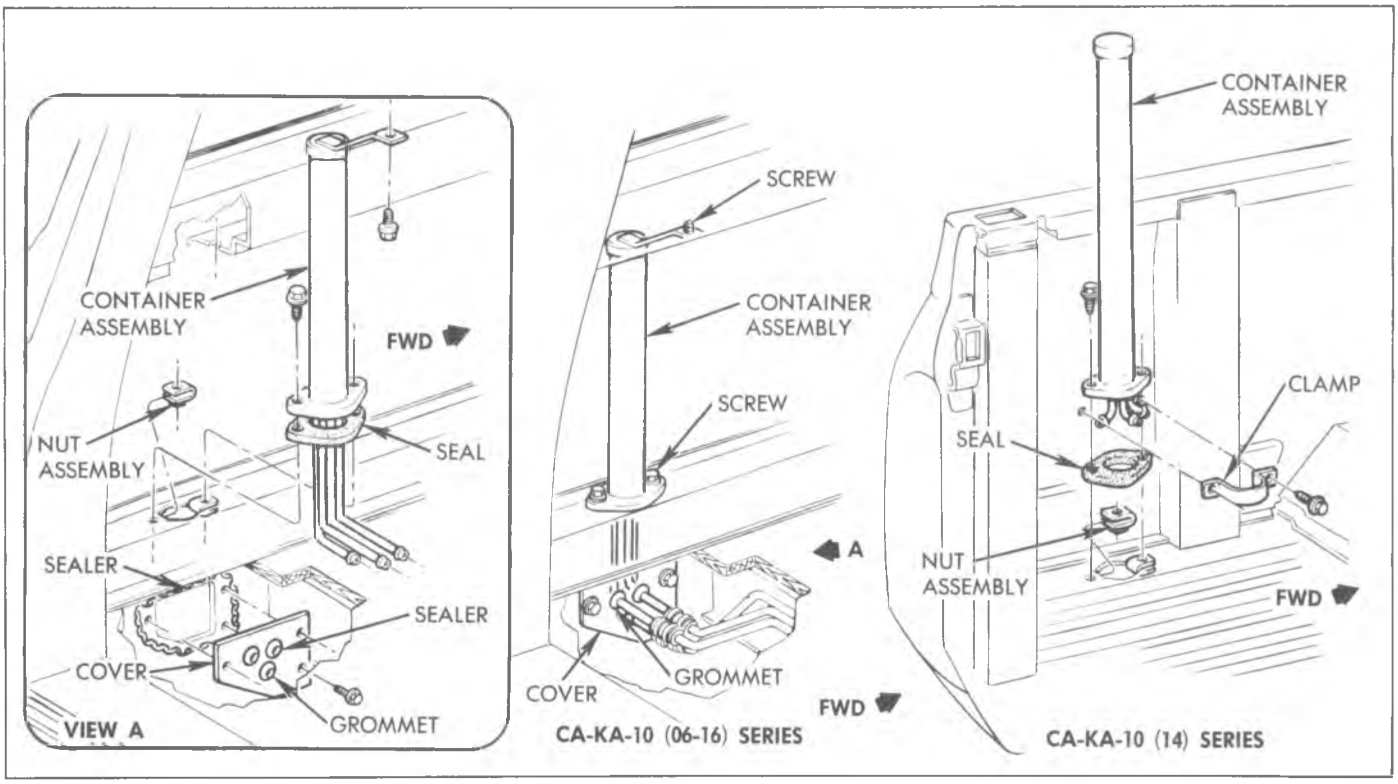


Fig. 20—Containers—Evaporative C, K 10 Series

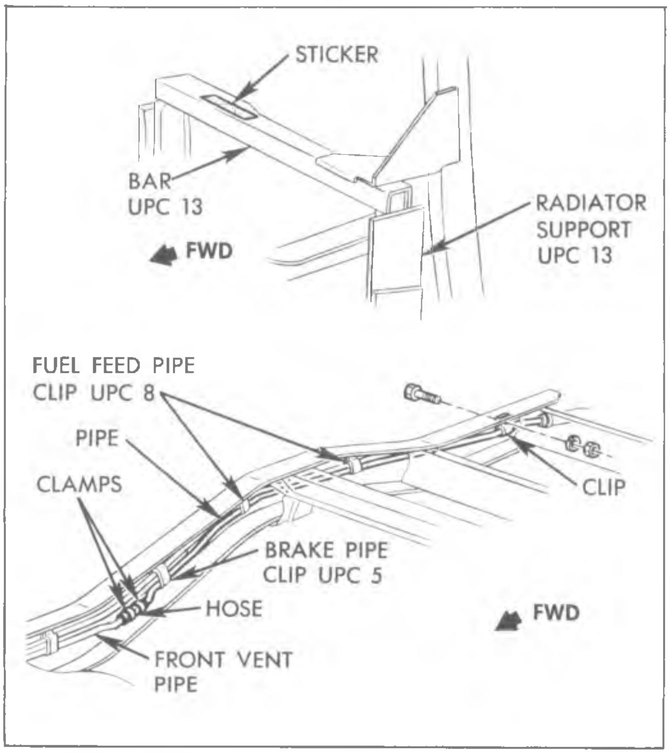


Fig. 21—Fuel Vapor Sticker and Rear Vent Pipe (P-10)

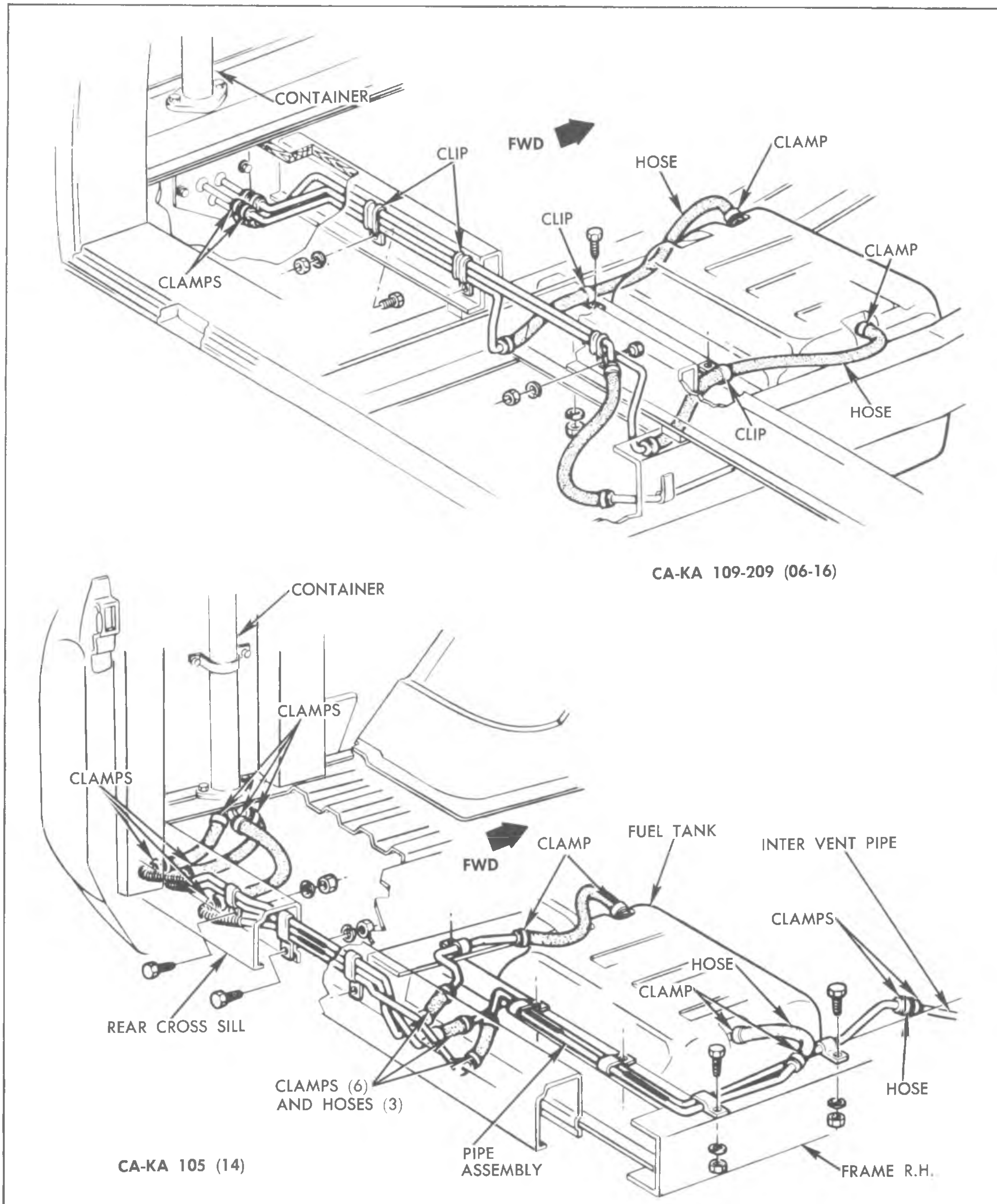


Fig. 22—Fuel Vent Pipes—Rear C-K 10 (14)(06)(16), C-K 20 (06-16)

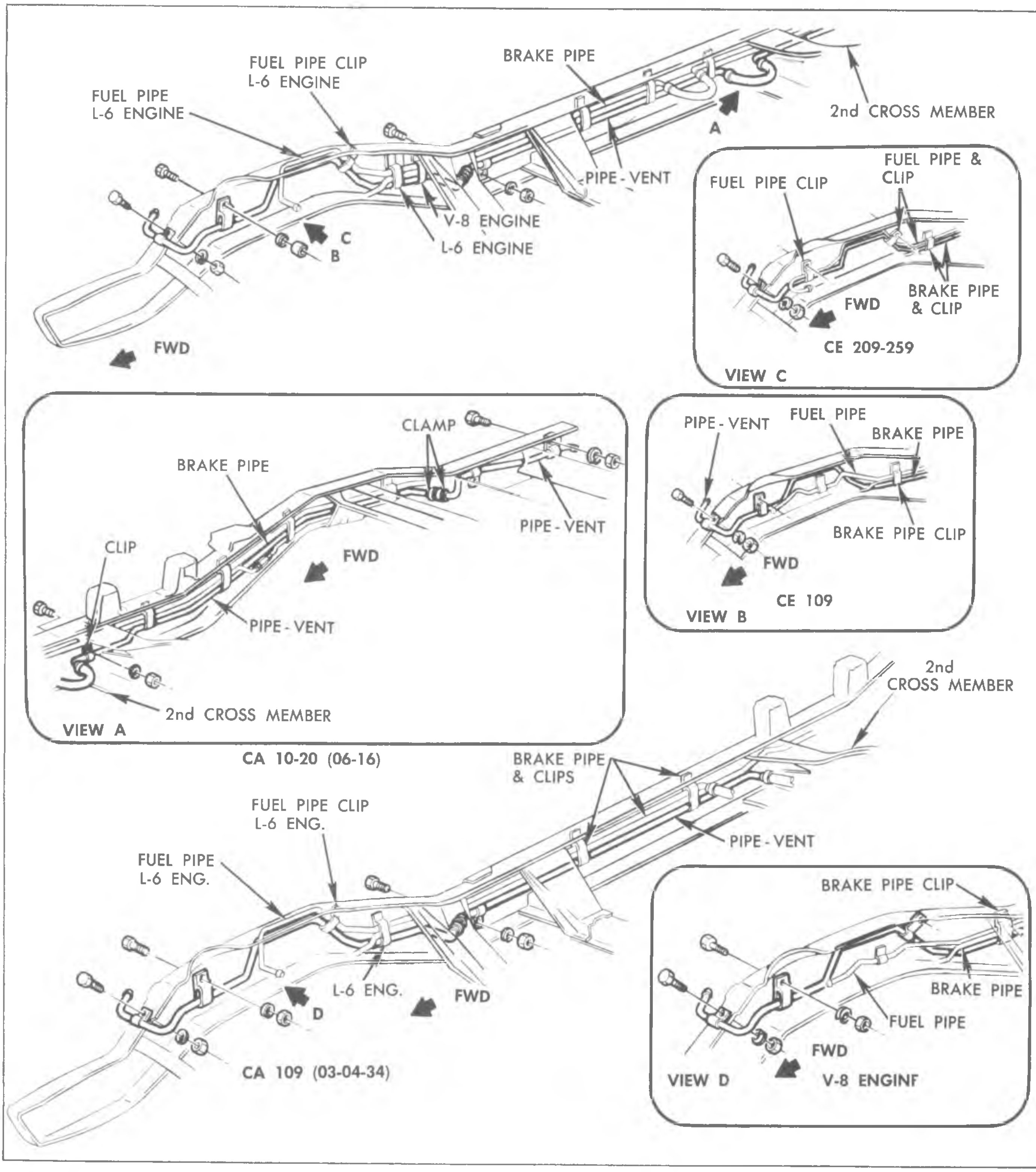


Fig. 23—Fuel Tank Vent Pipes—Lower CA 10-20

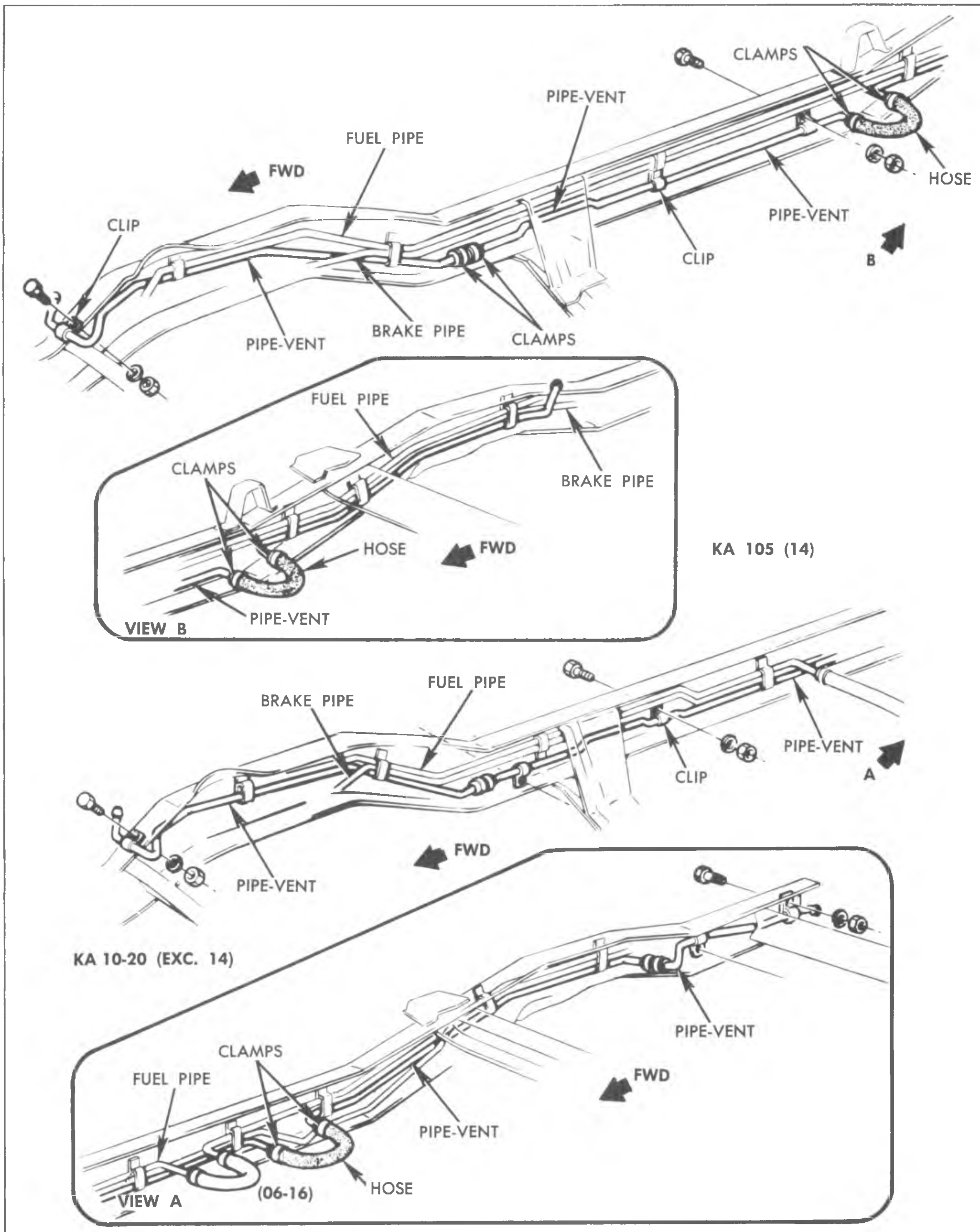


Fig. 24—Fuel Tank Vent Pipes—Lower KA-10-20

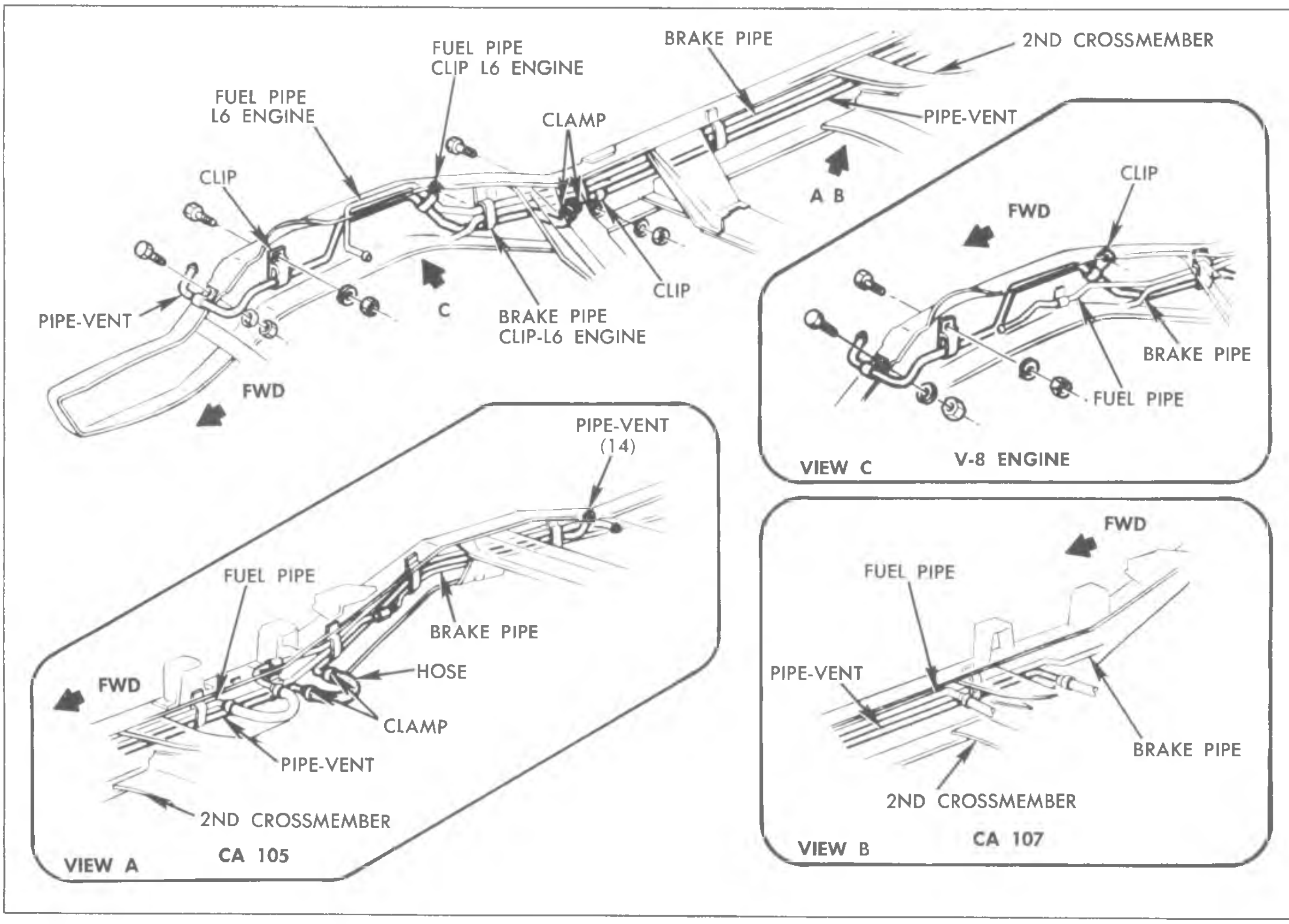


Fig. 25—Fuel Tank Vent Pipes—Lower

EXHAUST SYSTEM
COMPONENT PART REPLACEMENT

Exhaust System Pipes and Resonators Rearward of The Mufflers Must Be Replaced Whenever A New Muffler Is Installed.

(Refer to Illustrations Figs. 26-35)

Truck exhaust systems vary according to series and model designation. Series 10-30 trucks use a split-joint design system in which the exhaust pipe-to-muffler are clamped together and muffler-to-tailpipe connections are welded together. All mufflers and tailpipes are welded assemblies (no clamps) in 1972.

NOTE: All 10-20-30 Series exhaust have been aluminized. Always use the correct replacement parts when servicing these systems.

When installing a new exhaust pipe or muffler and tailpipe, on any model, care should be taken to have the correct alignment and relationship of the components to each other. Particular care should be given to the installation of the exhaust pipe and crossover pipe assembly on V-8 engine single exhaust systems. Incorrectly assembled parts of the exhaust system are frequently the cause of annoying noises and rattles due to improper clearances or obstructions to the normal flow of gases. Leave all clamp bolts and muffler strapbolts loose until all parts are properly aligned and then tighten, working from front to rear.

NOTE: When reinstalling exhaust pipe to manifold, always use new packings and nuts. Be sure to clean manifold stud threads with a wire brush when installing the new nuts.

IMPORTANT: Make sure that exhaust system components have at least 3/4 inch clearance from the floor pan to avoid possible overheating of the floor pan and possible damage to the passenger compartment carpets.

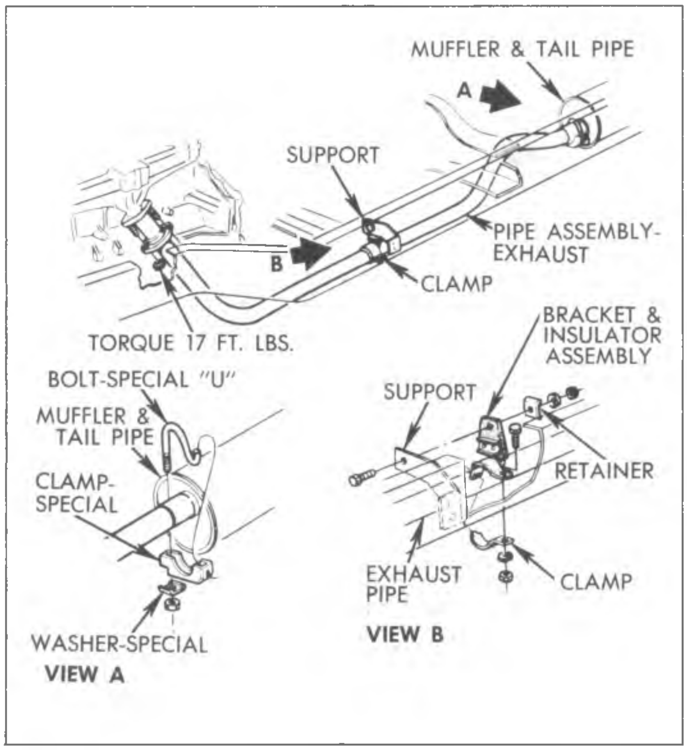


Fig. 26—Exhaust Pipe CS-PS 10 (05)

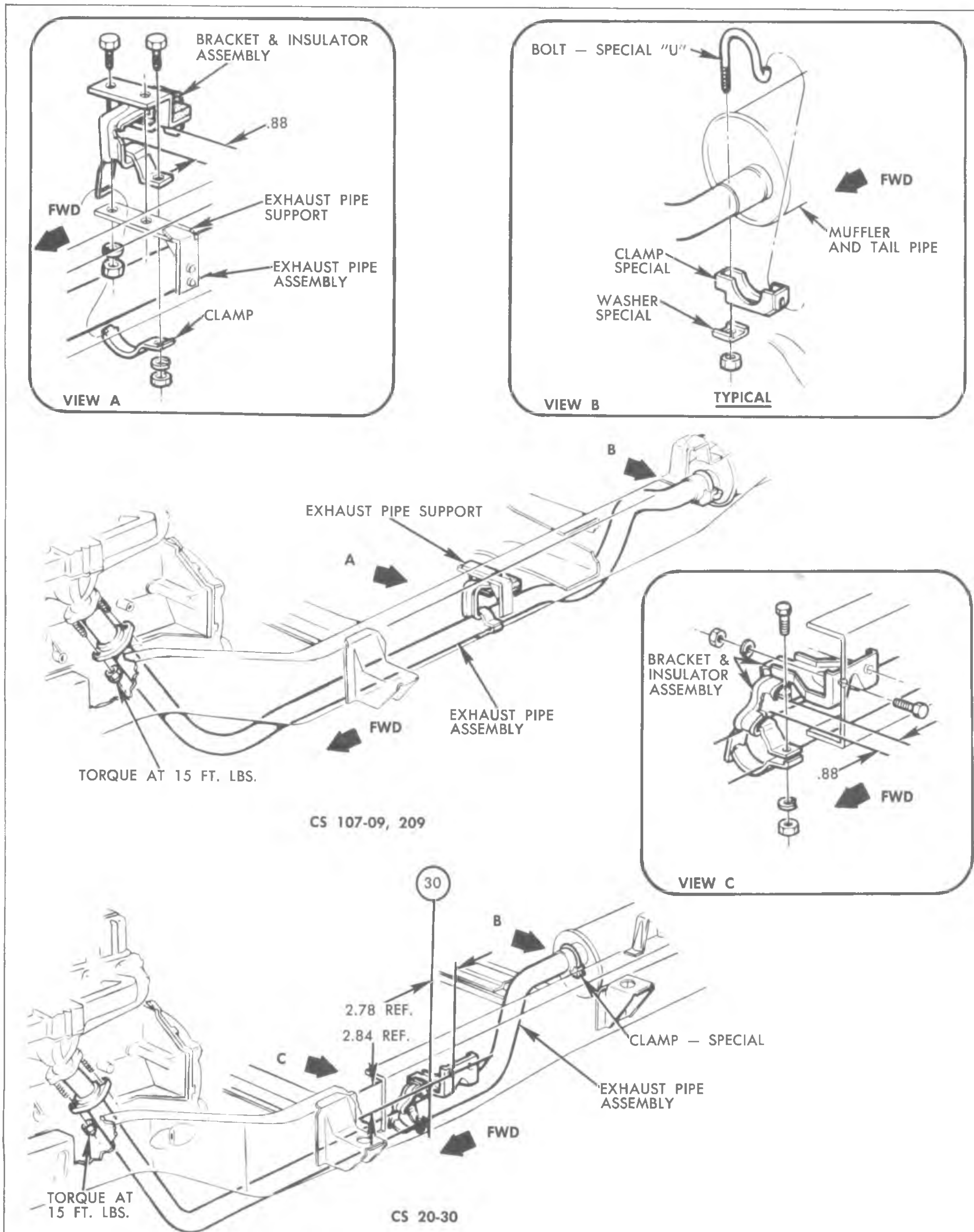


Fig. 27—Exhaust Pipe CS 10-30

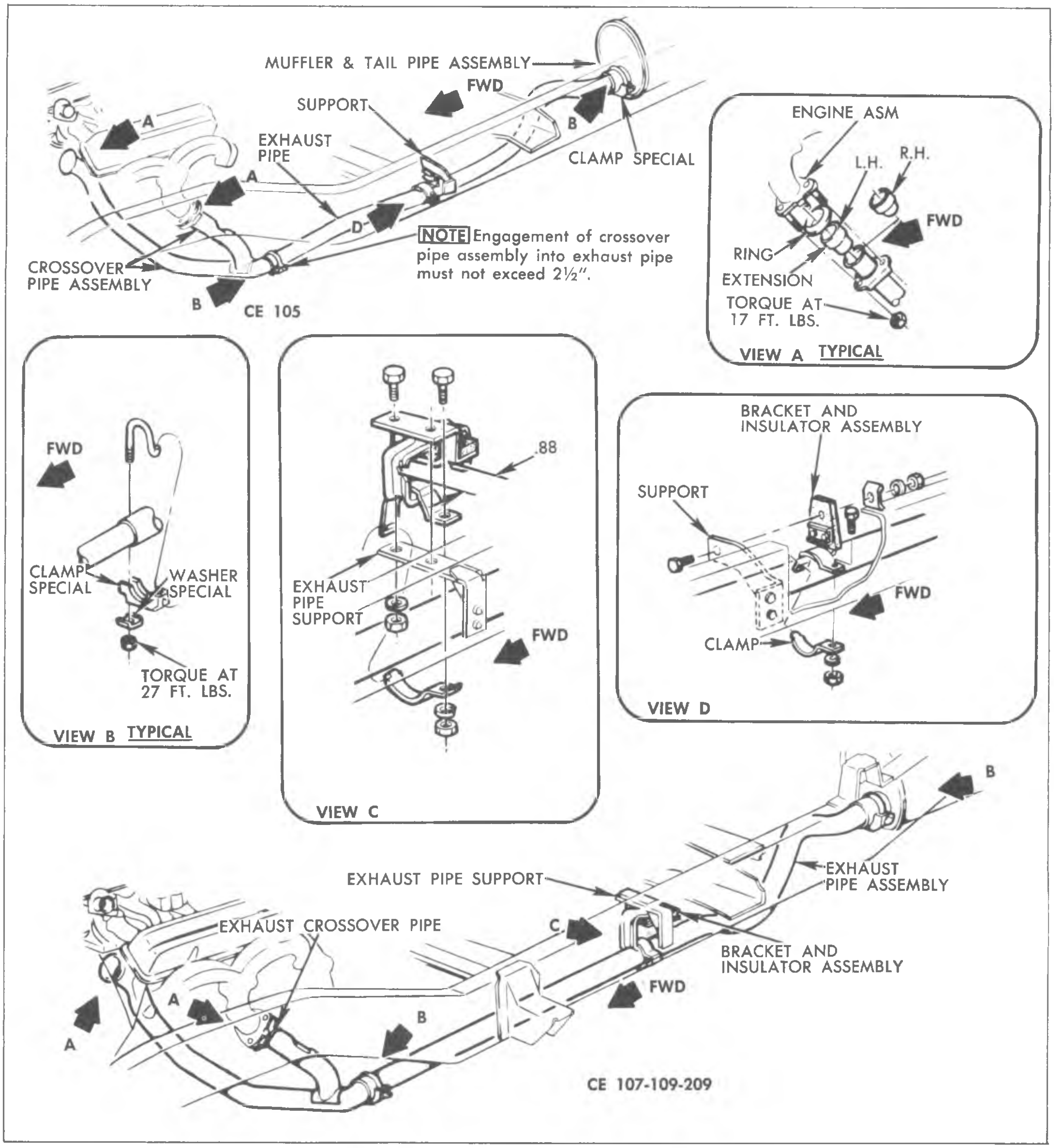


Fig. 28—Exhaust Pipe CE 10-20

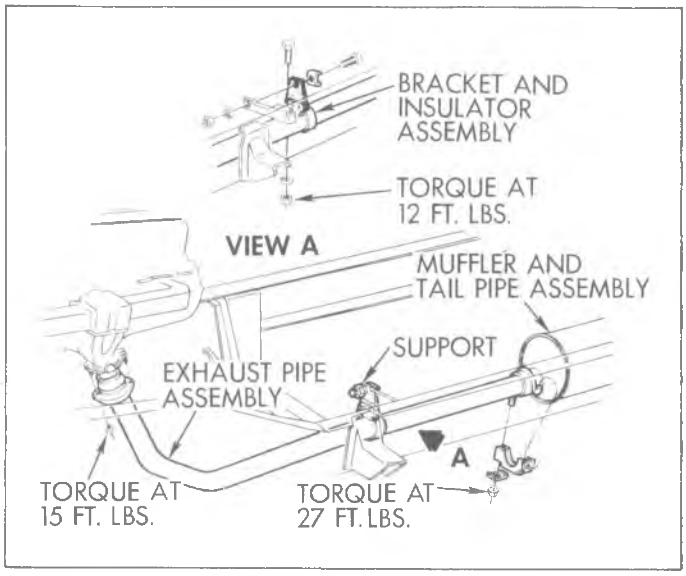


Fig. 29—Exhaust Pipe KS 100-209

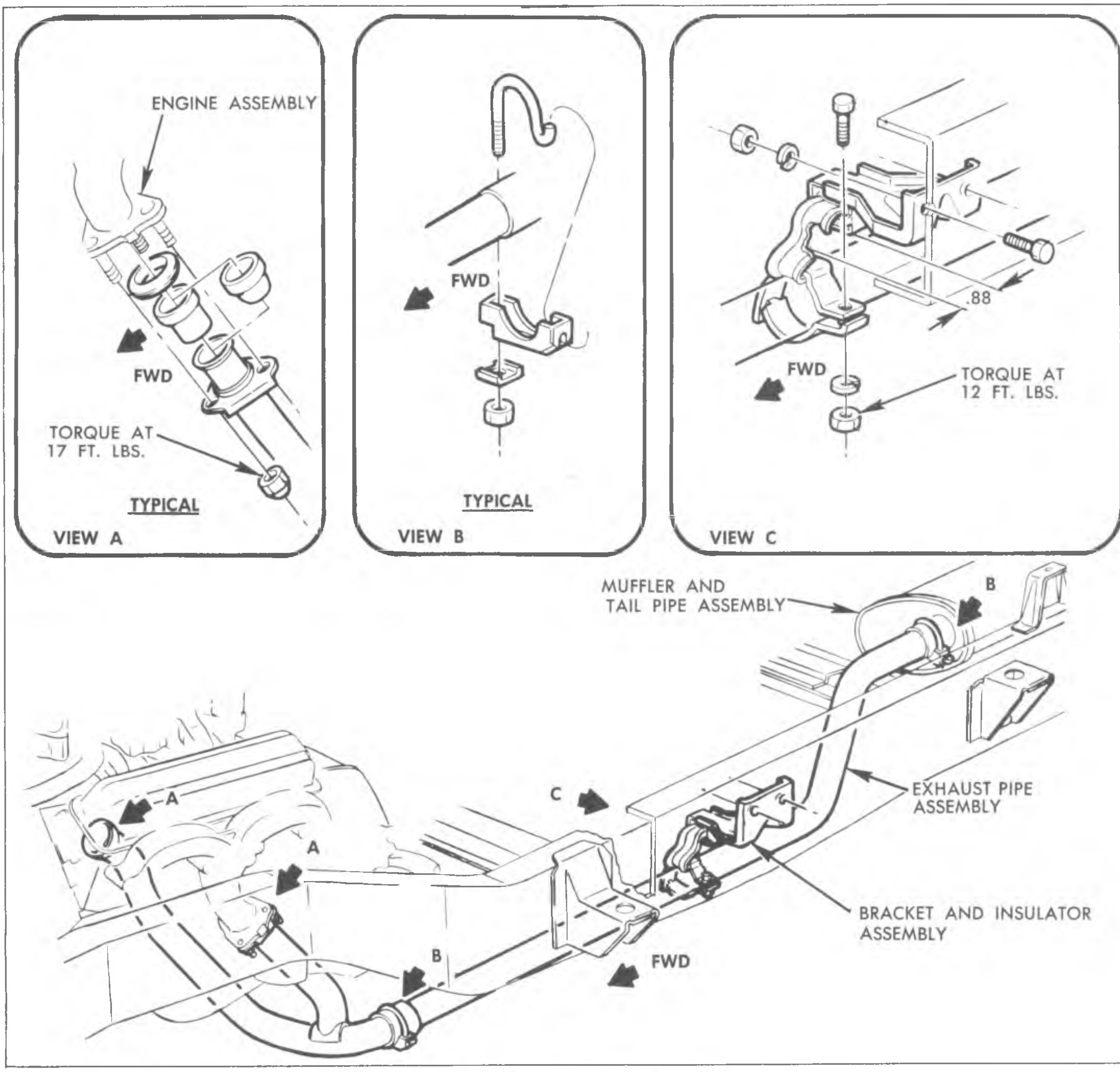


Fig. 29a—Exhaust Pipe CE 210-300

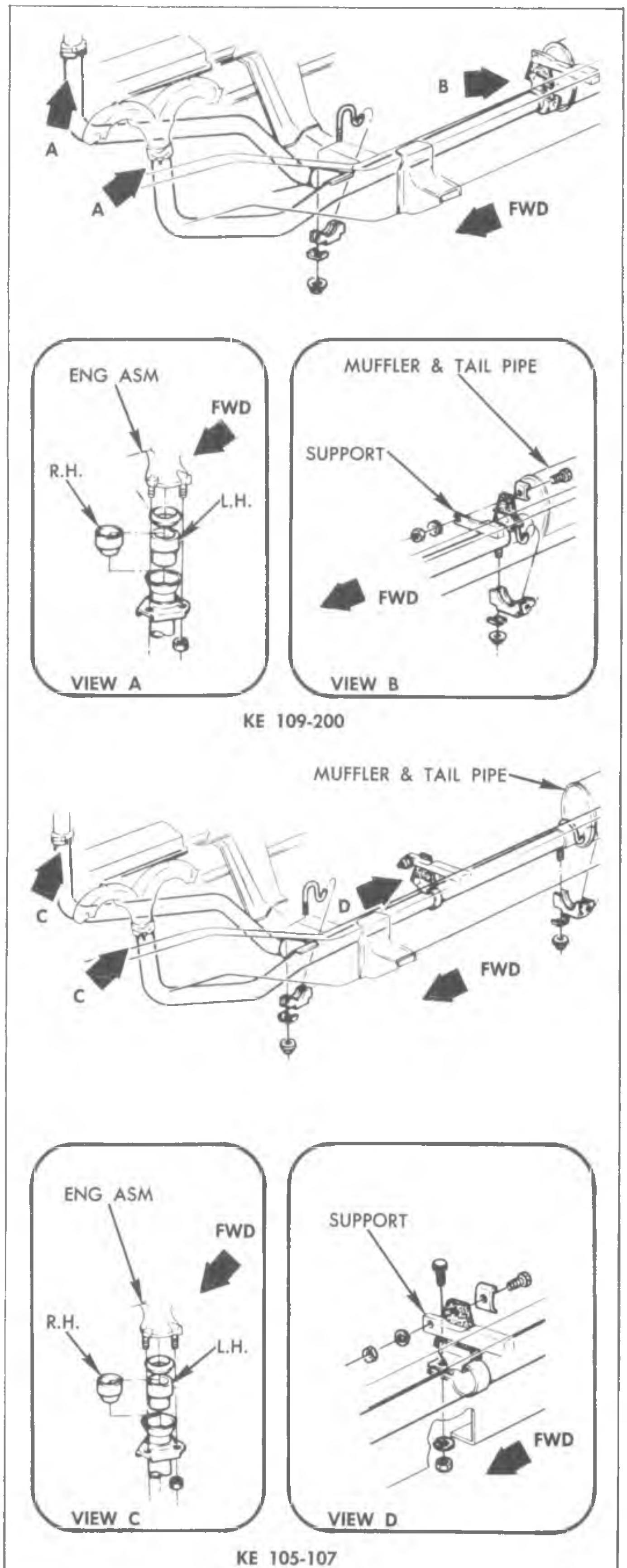


Fig. 30—Exhaust Pipe KE 105-107-109-200

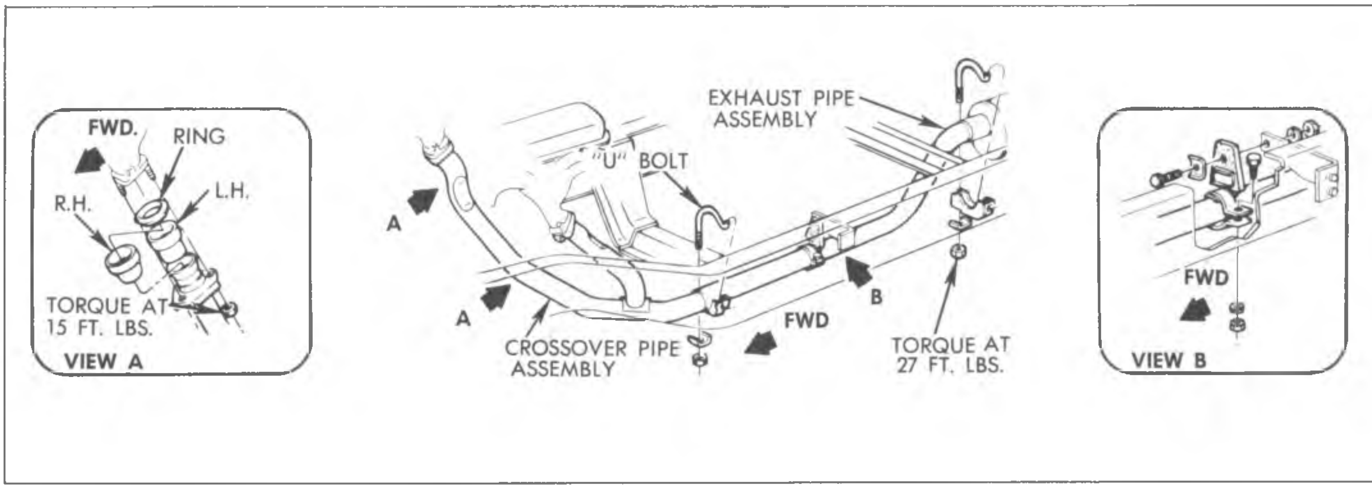


Fig. 31—Exhaust Pipe PE 20-30

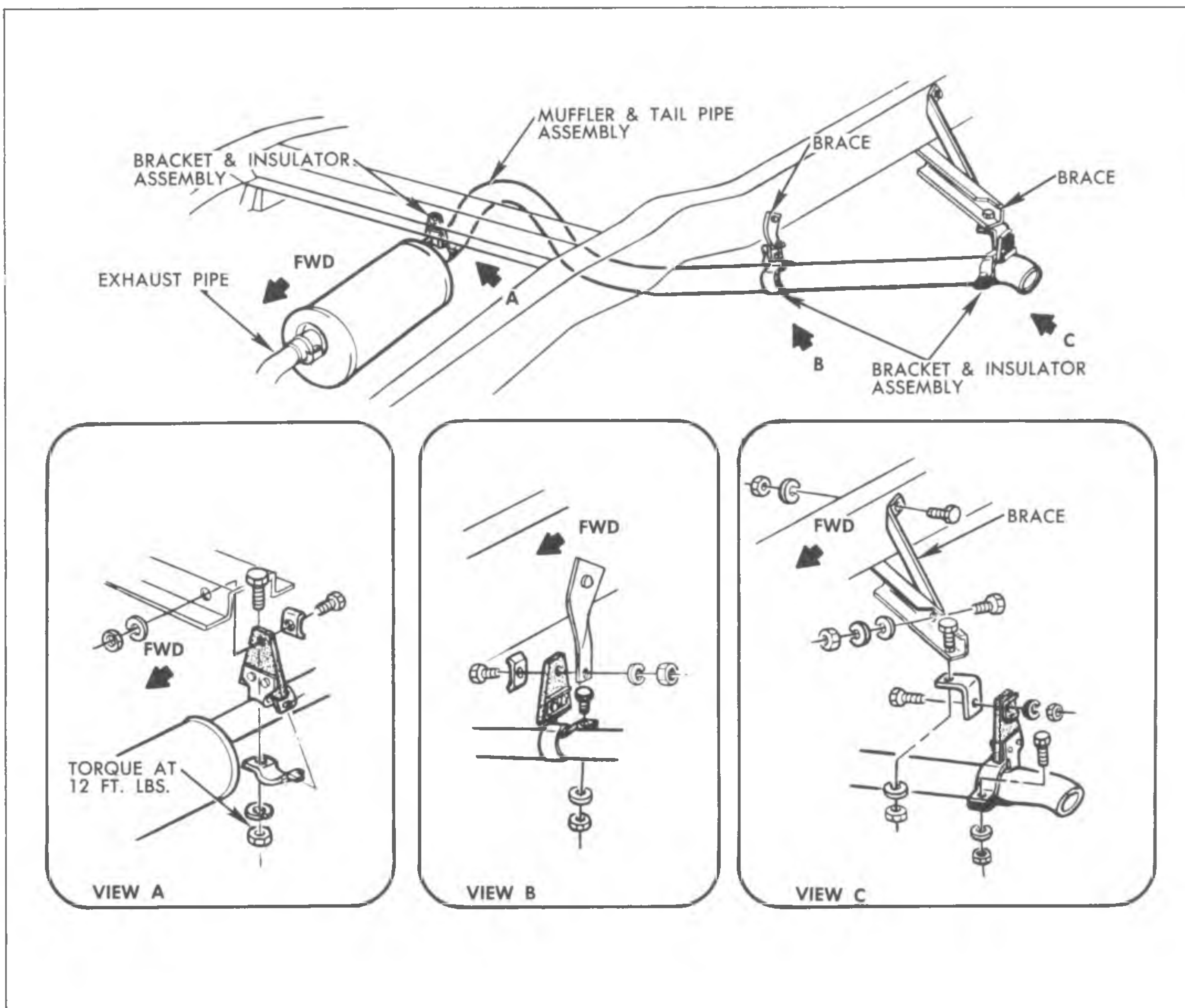


Fig. 32—Muffer & Tail Pipes PA-10-30

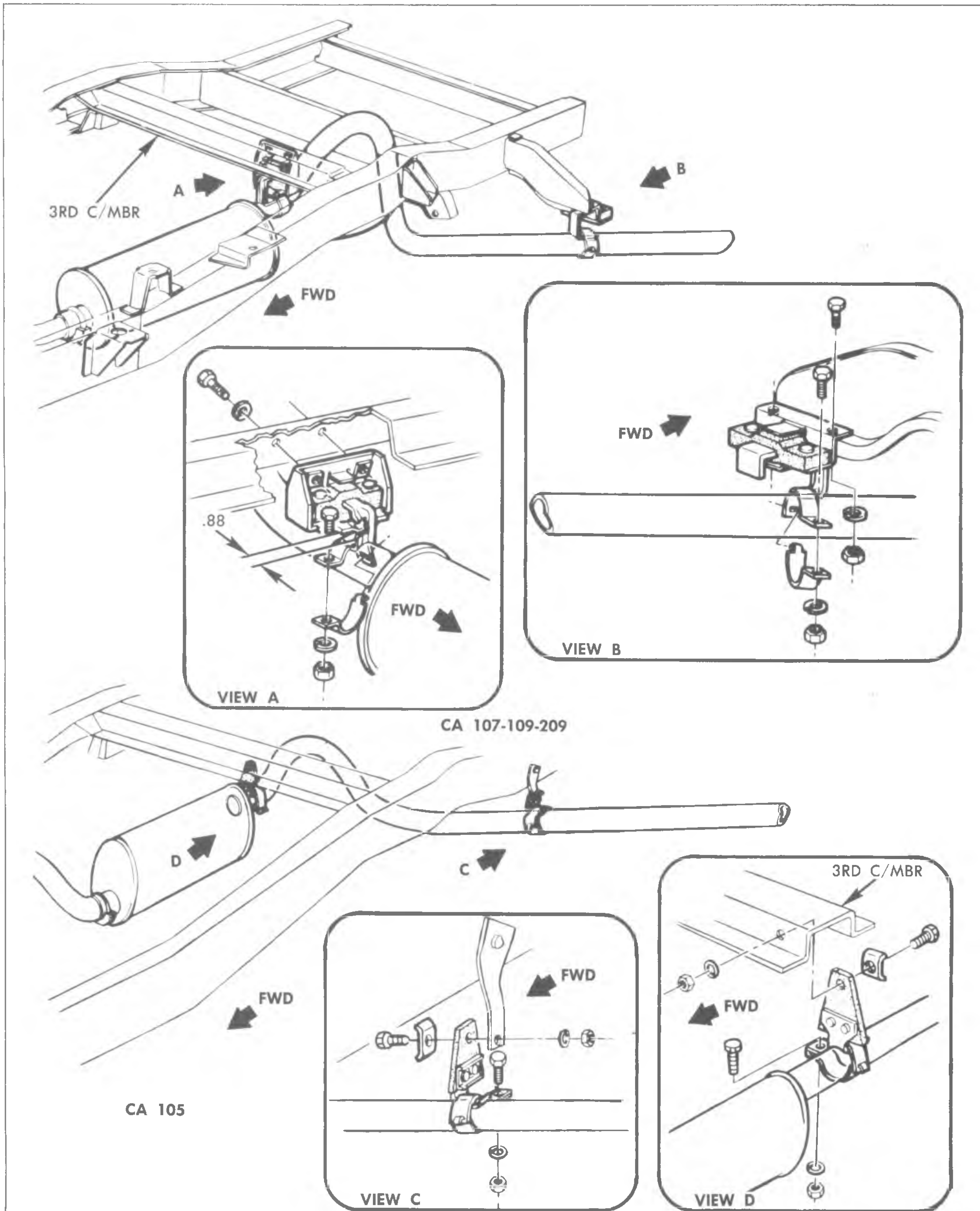


Fig. 33—Muffler & Tail Pipe CA 105-107-109 and 209

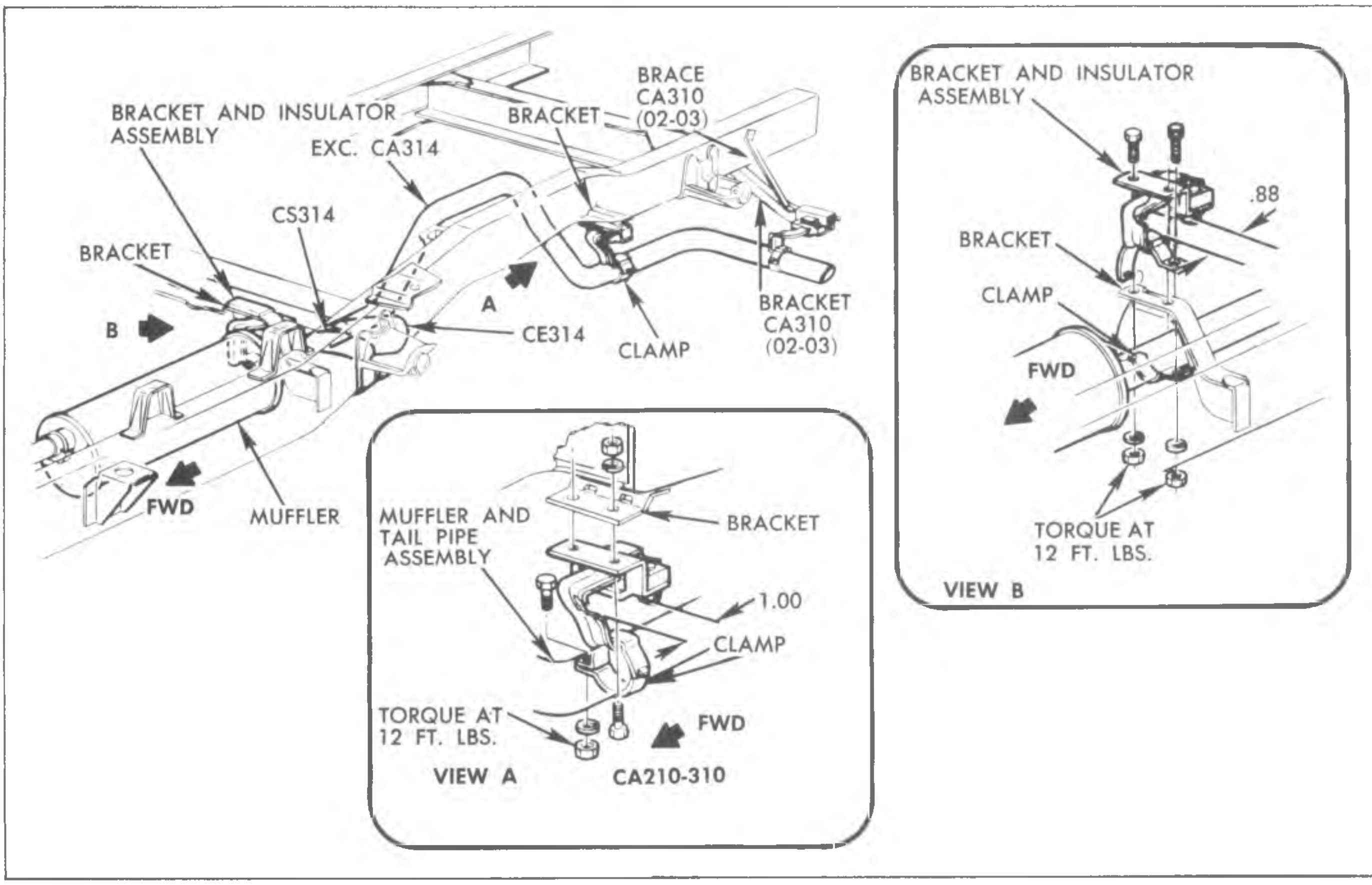


Fig. 34—Muffler & Tailpipe CA 210–300

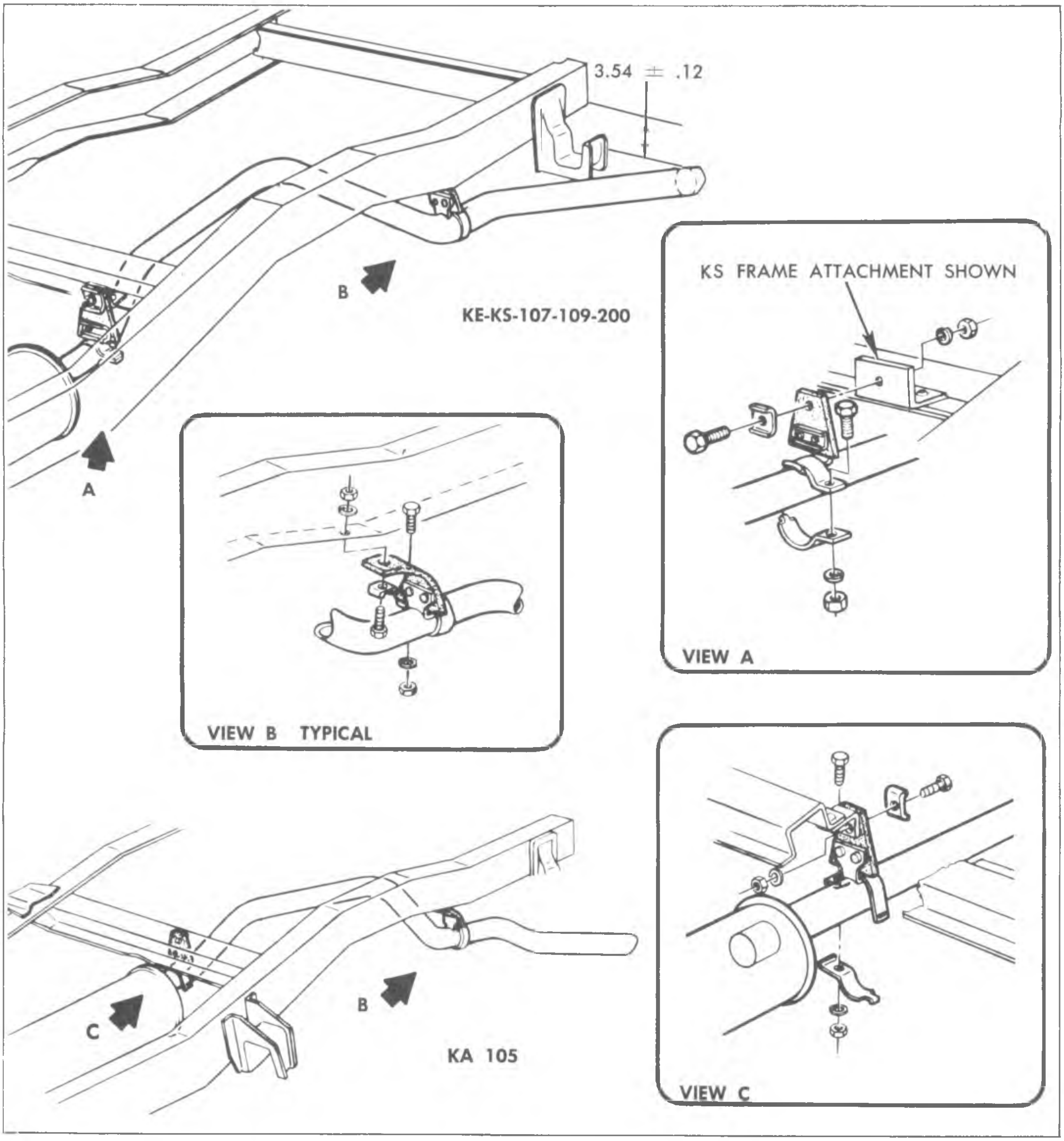


Fig. 35—Muffler & Tailipe KA-105-107-109-200

SPECIAL TOOLS

Fig. 36—Special Tool J-23346

1. J-23346 Fuel Tank Gauge Remover and Installer

SECTION 9

STEERING

CONTENTS OF THIS SECTION

STANDARD STEERING

INDEX

GENERAL DESCRIPTION

The steering gear used on all truck models is of the recirculating ball type and the service procedures are basically the same for all units.

Two types of steering linkages are used. C-P10-20-30 series units have an adjustable tie rod connected to the steering arm at each wheel. Steering effort is transmitted to the tie rods through a relay rod connected to the pitman arm on the left and an idler arm on the right. K10-20 models use a single adjustable tie rod, connecting the left and right steering arms. Steering effort is relayed to the left steering arm, from the pitman arm, by a non-adjustable connecting rod.

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

The steering gear is factory-filled with steering gear lubricant. Seasonal change of this lubricant should not be performed and the housing should not be drained - no lubrication is required for the life of the steering gear.

Every 36,000 miles, the gear should be inspected for seal leakage (actual solid grease - not just oily film). If a seal is replaced or the gear is overhauled, the gear housing should be refilled with #1051052 (13 oz. container) Steering Gear Lubricant which meets GM Specification GM 4673M, or its equivalent.

NOTE: Do not use EP Chassis Lube, which meets GM Specification GM 6031M, to lubricate the gear. DO NOT OVER-FILL the gear housing.

ADJUSTMENTS

CAUTION: All pitman arm to steering gear, steering wheel to steering shaft and all steering linkage fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

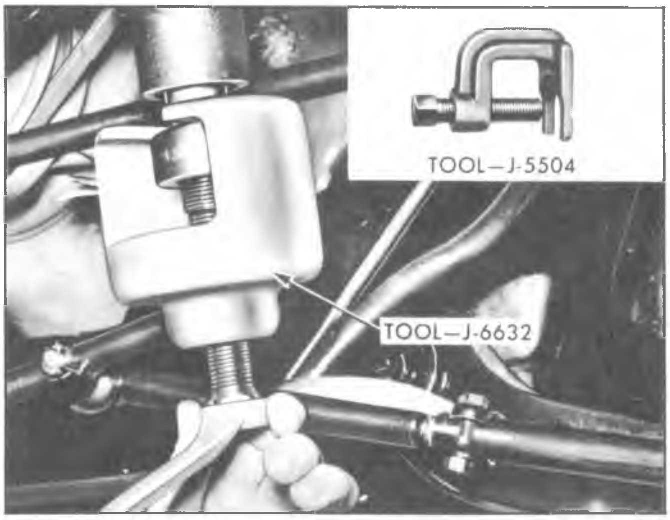


Fig. 1—Removing Pitman Arm — Typical

Steering Gear

Before any adjustments are made to the steering gear attempt to correct complaints of loose or hard steering, or other wheel disturbances, a careful check should be made of front end alignment, shock absorbers, wheel balance and tire pressure for possible cause.

Correct adjustment of steering gear is very important. While there are but two adjustments to be made, the following procedure must be followed step-by-step in the order given.

1. Disconnect the battery ground cable.
2. Remove the pitman arm nut. Mark the relationship of the pitman arm to the pitman shaft. Remove the pitman arm with Tool J-6632 or J-5504 as shown in Figure 1.

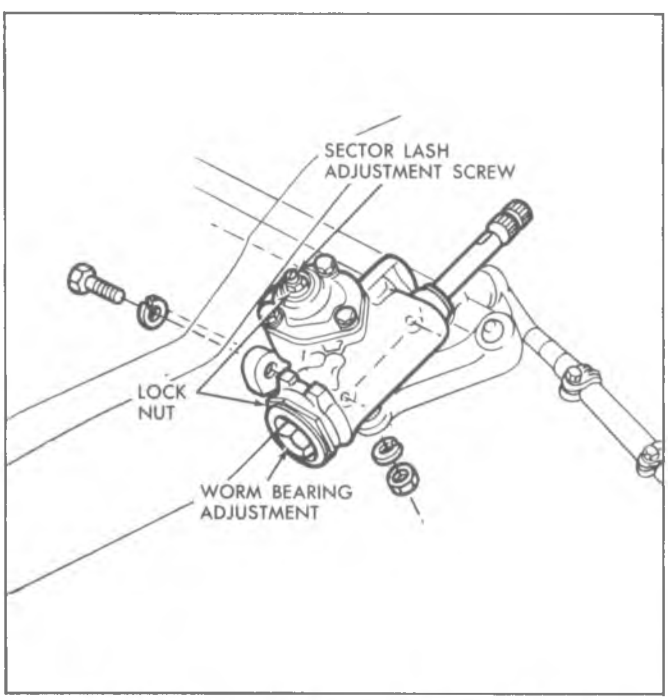


Fig. 2—Steering Gear Adjustment Points — Typical

3. Loosen the steering gear adjuster plug locknut and back the adjuster plug off 1/4 turn (fig. 2).
4. Remove the horn button cap.
5. Turn the steering wheel gently in one direction until stopped by the gear; then turn back one-half turn.

   CAUTION: Do not turn the steering wheel hard against the stops when the steering linkage is disconnected from the gear as damage to the ball guides could result.

6. Measure and record "bearing drag" by applying a torque wrench with a 3/4 inch socket on the steering wheel nut and rotating through a 90° arc (fig. 3).

   NOTE: Do not use a torque wrench having a maximum torque reading of more than 50 inch pounds.

7. Adjust "thrust bearing preload" by tightening the adjuster plug until the proper "thrust loading preload" is obtained (See specifications section at rear of this manual). When the proper preload has been obtained, tighten the adjuster plug locknut to specifications and recheck torque. If the gear feels "lumpy" after adjustment, there is probably damage in the bearings due to severe impact or improper adjustment; the gear must be disassembled for replacement of damaged parts.
8. Adjust "over-center preload" as follows:
   a. Turn the steering wheel gently from one stop all the way to the other carefully counting the total number of turns. Turn the wheel back exactly half-way, to center position.
   b. Turn the lash adjuster screw clockwise to take out all lash between the ball nut and pitman shaft sector teeth and then tighten the locknut.
   c. Check the torque at the steering wheel, taking the highest reading as the wheel is turned through center position. See the Specifications Section for proper over-center preload.
   d. If necessary, loosen locknut and readjust lash adjuster screw to obtain proper torque. Tighten the locknut to specifications and again check torque reading through center of travel.

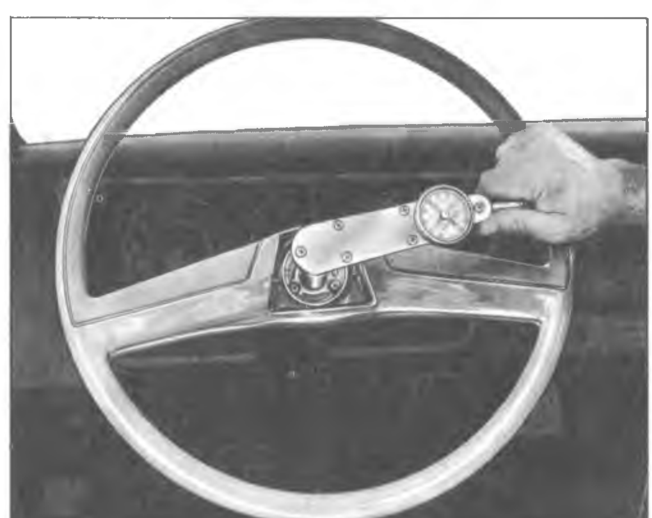


Fig. 3—Checking Torque at Steering Wheel

NOTE: If maximum specification is exceeded, turn lash adjuster screw counter-clockwise, then come up on adjustment by turning the adjuster in a clockwise motion.

9. Reassemble the pitman arm to the pitman shaft, lining up the marks made during disassembly. Tighten the pitman shaft nut to specifications.

   CAUTION: If a clamp type pitman arm is used, spread the pitman arm just enough, with a wedge, to slip the arm onto the pitman shaft. Do not spread the clamp more than required to slip over pitman shaft with hand pressure. Do not hammer the pitman arm onto the pitman shaft. Be sure to install the hardened steel washer before installing the nut.

10. Install the horn button cap and connect the battery ground cable.

Steering Gear High Point Centering—C-P 10, C 20-30

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.

   NOTE: Turning the sleeves an unequal number of turns or in different directions will disturb the toe-in setting of the wheels.

4. Readjust toe-in as outlined in Section 3 (if necessary).

Steering Wheel Alignment

NOTE: On C-P10-20-30 series units check steering gear for high point centering before checking steering wheel alignment.

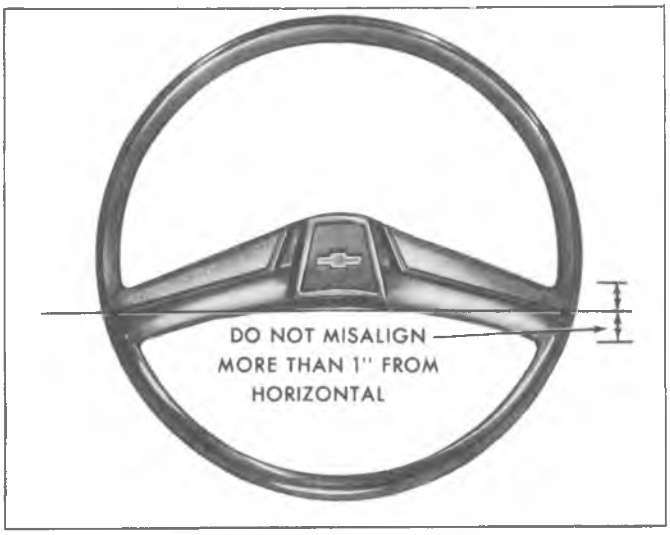


Fig. 4—Steering Wheel Alignment

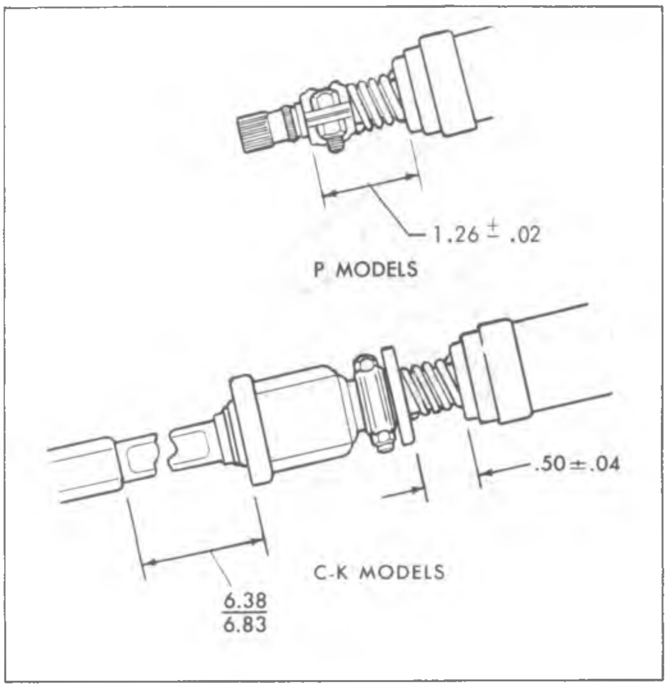


Fig. 5—Steering Column Lower Bearing Adjustment

1. Set wheels in straight ahead position by driving vehicle a short distance.
2. Note steering wheel position. If off more than 1 inch from center (fig. 4), remove steering wheel as outlined under "Steering Wheel - Removal"; center high point on gear, reposition and reinstall the wheel.

Steering Column Lower Bearing Adjustment

1. Loosen clamp on steering shaft.
2. Applying 50 lb. force to the steering wheel end of the steering shaft, adjust clamp to obtain clearances indicated in Figure 5.
3. Tighten clamp bolt to specified torque.

Shifter Tube Adjustment

3-Speed Transmission

1. Loosen adjusting ring attaching screws and clamp bolt.

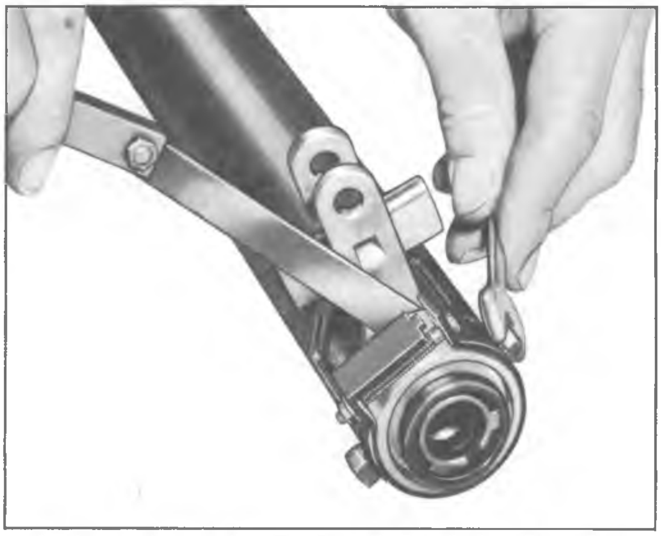


Fig. 6—Shift Tube Adjustment — 3 Speed Man. Transmission

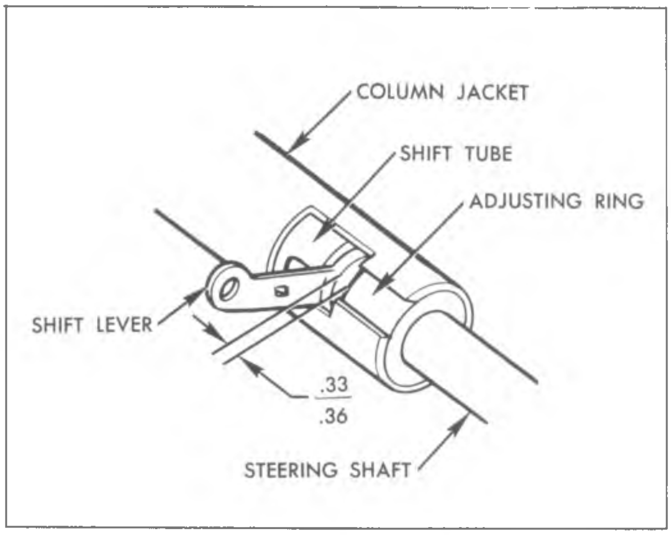


Fig. 7—Shift Tube Adjustment — Automatic Transmission

2. Rotate adjusting ring to give .005" end play between adjusting ring and first and reverse shifter lever (fig. 6).
3. Tighten attaching screws and clamp bolt.

Automatic Transmission

1. Place the shift tube lever in "Neutral" or "Drive".
2. Loosen adjusting ring clamp screws and rotate the shift tube adjusting ring to obtain .33" to .36" clearance between the shift tube lever and adjusting ring (fig. 7).
3. Tighten the adjusting ring clamp screws to 70 in. lbs.

COMPONENT REPLACEMENT AND REPAIRS

STEERING WHEEL

Removal

1. Disconnect battery ground cable.
2. Remove horn button, receiving cup, belleville spring and bushing and mark steering wheel to steering shaft relationship.
3. Remove steering shaft nut and washer.
4. Use Tool J-2927 to remove wheel (fig. 8).

Installation

CAUTION: Directional signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

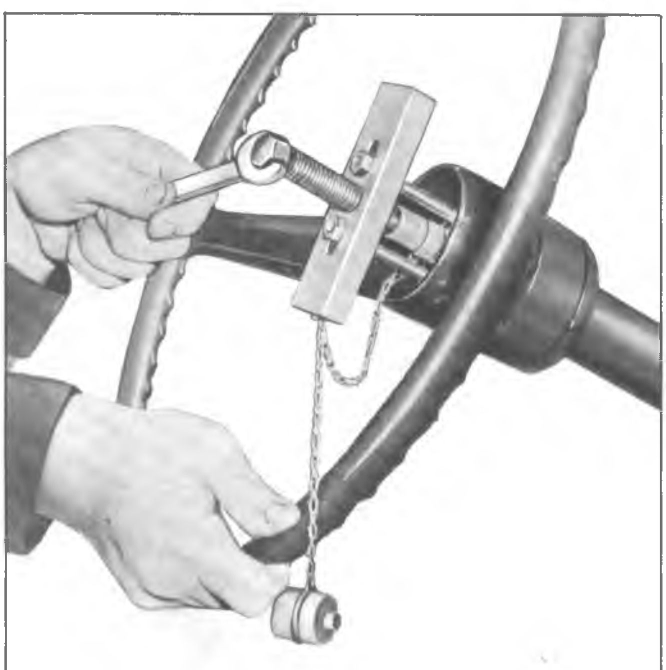


Fig. 8—Steering Wheel Removal

1. Place the steering wheel onto the steering shaft, aligning the marks made at removal.
2. Position into place and secure to proper torque with washer and nut.

CAUTION: The steering wheel to steering shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

3. Install belleville spring, receiving cup, bushing and attaching screws.
4. Install horn button assembly.
5. Connect battery ground cable.

STEERING COUPLING

Flexible Type (Fig. 9)

Removal

1. Remove the coupling to steering shaft flange bolt nuts.
2. Remove the coupling clamp bolt.

   NOTE: This is a special bolt and will require a 12 pt. socket or box wrench.

3. Remove the steering gear to frame bolts and lower the steering gear far enough to remove the flexible coupling.

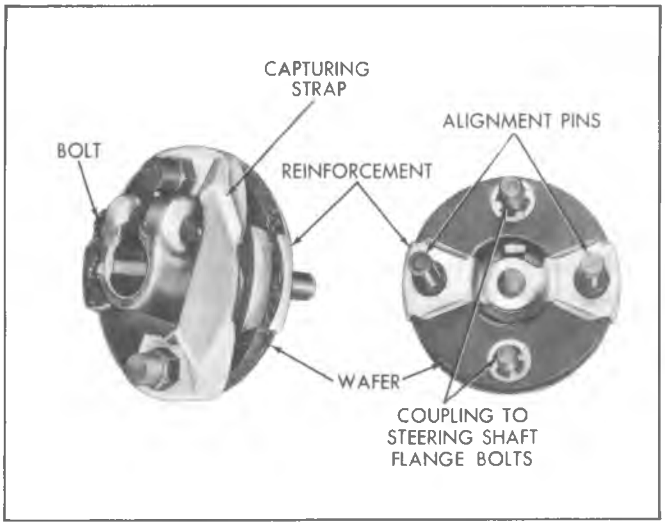


Fig. 9—Flexible Type Steering Coupling—Manual

NOTE: It is not necessary to disconnect the pitman arm from the pitman shaft.

4. Tap lightly on the flexible coupling with a soft mallet to remove the coupling from the steering gear wormshaft.

Installation

CAUTION: All steering coupling and steering gear to frame fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Install the flexible coupling onto the steering gear wormshaft, aligning the flat on the shaft with the flat in the coupling. Install and torque the coupling clamp bolt.

   NOTE: Push the coupling onto the wormshaft until the coupling reinforcement bottoms against the end of the worm.

2. Install the special bolt into the split clamp and torque to specifications.

   NOTE: The bolt must pass through the shaft undercut.

3. Place the steering gear into position, guiding the flexible coupling bolts into the proper holes in the steering shaft flange.
4. Install and tighten the steering gear to frame bolts.
5. Install the coupling to flange bolt nuts and washers and torque to specifications. Be sure to maintain a coupling to flange dimension of .250" to .375". The coupling alignment pins should be centered in the flange slots.

Intermediate Steering Shafts With Pot Joint Couplings

Removal (Fig. 10)

1. Remove the lower shaft flange to flexible coupling bolts.
2. Remove upper shaft to intermediate coupling bolt.
3. Remove the steering gear to frame bolts and lower the steering gear far enough to remove the intermediate shaft assembly.

   NOTE: It is not necessary to remove the pitman arm from the pitman shaft.

Disassembly

1. Mark cover to shaft relationship. Pry off snap ring and slide cover from shaft.
2. Remove bearing blocks and tension spring from pivot pin.
3. Clean grease off pin and end of shaft. Scribe location mark on pin on same side as chamfer in shaft.
4. Supporting shaft assembly securely, with chamfer up, press pin out of shaft with arbor press.

   CAUTION: Do not drive pin out with hammer. This will cause sticky or binding bearings when reassembled.

5. Remove seal clamp and slide seal off end of shaft.

Assembly

1. Be sure all parts are free of dirt. Slide seal onto steering shaft. With lip of seal against step in shaft clamp seal.
2. Press pin back into shaft from chamfered side. Locate pin in shaft using scribe mark as reference.

   CAUTION: Pin must be centered within .012 in. or binding in the coupling will result.

3. Check centering of pin (fig. 11).
   a. Place just enough 3/8" flat washers on pin to prevent bearing block from bottoming when installed.
   b. Measure distance from end of pin to top of bearing with micrometer.
   c. Remove bearing and washers and place same

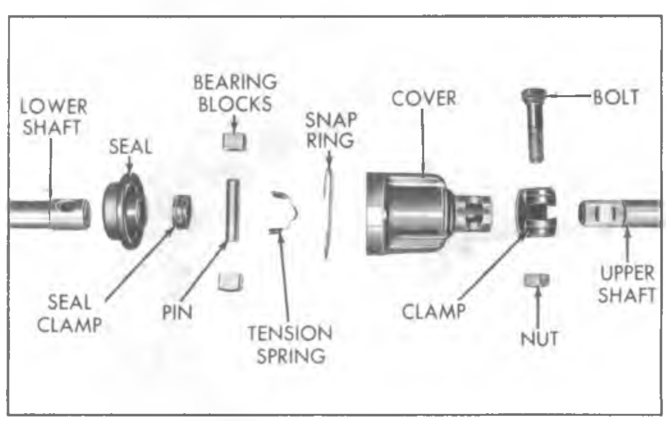


Fig. 10—Steering Shaft Intermediate Coupling (C-K 10-20-30)

bearing and washers on other end of pin. Measure distance from end of pin to top of bearing. If micrometer readings in Steps b and c differ more than .012, repeat last part of Step 2 and recheck.

4. Apply a liberal amount of wheel bearing grease to inside and outside of bearing blocks and inside of cover.
5. Position tension spring and bearing blocks on pin.
6. Slide cover over bearing blocks aligning reference mark on cover with mark on shaft. Install seal into end of cover and secure with snap ring retainer.

Installation

CAUTION: All steering gear to frame and all steering coupling fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Install the intermediate shaft assembly onto the steering shaft, aligning the flat on the shaft with the flat in the coupling. Install the pot joint clamp bolt and torque to specifications.
2. Lift the steering gear into position, guiding the flexible coupling bolts into the shaft flange holes.
3. Install the steering gear to frame bolts and torque to specifications.
4. Install the flexible coupling to steering shaft flange bolt lockwashers and nuts. Check that the coupling alignment pins are centered in the flange slots and then torque the coupling bolts to specifications.

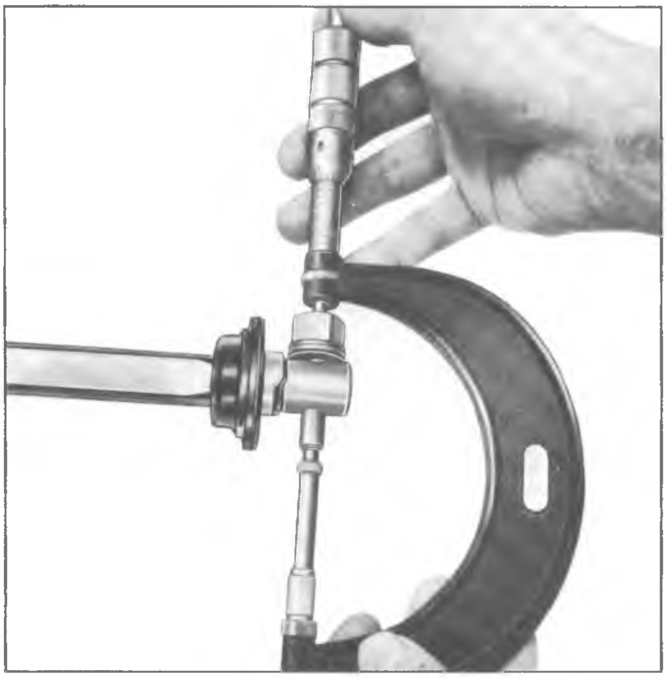


Fig. 11—Checking Coupling Pin Centering

Intermediate Steering Shaft with Universal Joint Couplings

Removal (Fig. 12)

1. Set front wheels in straight ahead position. This can be done by driving the vehicle a short distance on a flat surface.
2. Mark upper universal joint yoke to steering shaft relationship and lower yoke to steering gear wormshaft relationship.
3. Remove both upper and lower universal yoke pinch bolts.
4. Remove steering gear to frame bolts and lower the gear.

   NOTE: It is not necessary to disconnect the pitman arm from the steering gear pitman shaft.

5. Remove the intermediate steering shaft and universal joint assembly.

Disassembly

1. If the upper or lower half of the intermediate steering shaft is to be replaced, proceed as follows:
   a. With the shaft assembly on a bench, straighten the tangs on the dust cap. Separate the upper and lower portions of the shaft assembly.
   b. Remove the felt washer, plastic washer and dust cap. Discard the felt washer.
2. If the trunnion assemblies are to be replaced, proceed as follows:
   a. Remove the snap rings retaining the trunnion bushings in one of the yokes.
   b. Support the yoke on a bench vise and drive out one bushing by tapping on the opposite bushing using a soft drift and hammer.
   c. Support the other side of the yoke and drive out the remaining bushing as in Step b above.
   d. Move the yoke on the trunnion as necessary to separate the upper and lower yokes.
   e. Remove the trunnion from the lower yoke as outlined in Steps a through d above. Remove and discard the seals.

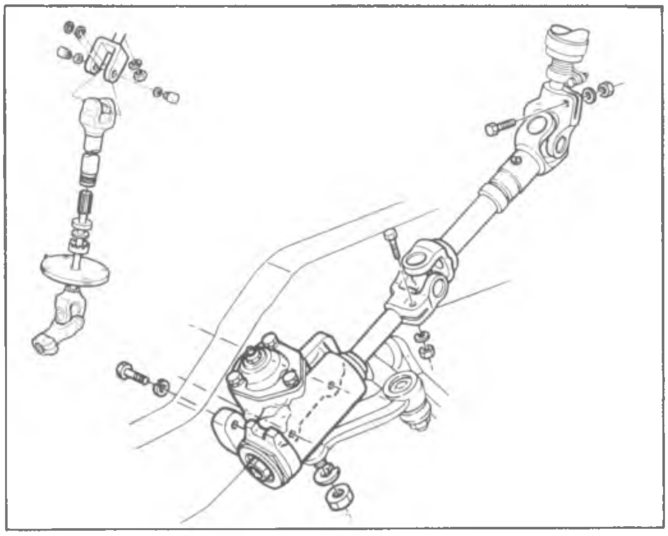


Fig. 12—Intermediate Steering Shaft — P Series

Assembly

1. If the yoke trunnions were removed, reassemble as follows:
   a. Place the new trunnion into the lower yoke.
   b. Place new seals onto the trunnion and then press the new bushings into the yoke and over the trunnion hubs far enough to install the snap rings.
   c. Install the snap rings.
   d. Repeat Steps a through c to attach the upper yoke to the trunnion.

2. Reassemble the intermediate shaft assembly as follows:
   a. Place the dust cap, plastic washer and a new felt seal over the shaft on the lower yoke assembly.
   b. Align the arrow on the lower yoke assembly shaft with the arrow on the upper yoke assembly tube and push the two assemblies together.
   c. Push the dust cap, plastic washer and felt washer into position on the lower end of the upper yoke assembly and bend the tangs of the dust cap down against the yoke tube.

Installation

CAUTION: The steering gear to frame and all intermediate steering shaft yoke fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Align the marks made at removal and assemble the intermediate shaft lower yoke onto the steering gear wormshaft. Install the pinch bolt and torque to specifications.

NOTE: The pinch bolt must pass through the shaft undercut. If a new yoke was installed, the slit in the yoke should be up (12 o'clock position).

2. Raise the steering gear into position while guiding the upper yoke assembly onto the steering shaft.

NOTE: The marks on the coupling and steering shaft must align. If a new yoke was installed, assemble the upper yoke to the steering shaft with the steering wheel in straight ahead position (gear must be on high point).

3. Install the steering gear to frame bolts and torque to specifications.
4. Install the upper yoke to steering shaft pinch bolt and torque to specifications.

NOTE: The pinch bolt must pass through the shaft undercut.

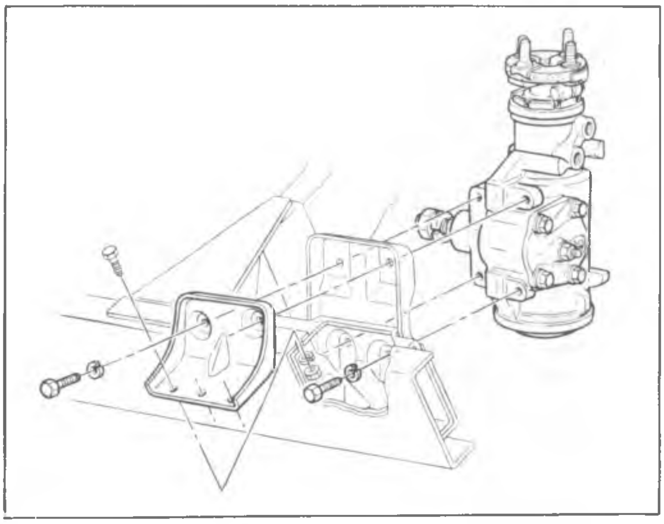


Fig. 13—Steering Gear Mounting—P Series

STEERING GEAR

Removal

1. Set the front wheels in straight ahead position by driving vehicle a short distance on a flat surface.
2. Remove the flexible coupling to steering shaft flange bolts (C-K models) or the lower universal joint pinch bolt (P models). Mark the relationship of the universal yoke to the wormshaft.
3. Mark the relationship of the pitman arm to the pitman shaft. Remove the pitman shaft nut or pitman arm pinch bolt and then remove the pitman arm from the pitman shaft using Puller J-6632 (fig. 1).
4. Remove the steering gear to frame bolts and remove the gear assembly.
5. C-K Models - Remove the flexible coupling pinch bolt and remove the coupling from the steering gear wormshaft.

Installation

CAUTION: All steering gear to frame, pitman arm to pitman shaft and steering coupling fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. C-K Models
   a. Install the flexible coupling onto the steering gear wormshaft, aligning the flat in the coupling with the flat on the shaft. Push the coupling onto the shaft until the wormshaft bottoms on the coupling reinforcement. Install the pinch bolt and torque to specifications.

NOTE: The coupling bolt must pass through the shaft undercut.

b. Place the steering gear in position, guiding the coupling bolt into the steering shaft flange.
c. Install the steering gear to frame bolts and torque to specifications.
d. If flexible coupling alignment pin plastic spacers were used, make sure they are bottomed on the pins, tighten the flange bolt nuts to specifications and then remove the plastic spacers (fig. 10).
e. If flexible coupling alignment pin plastic spacers were not used, center the pins in the slots in the steering shaft flange and then install and torque the flange bolt nuts to specifications.

2. P Models
   a. Place the steering gear in position, guiding the wormshaft into the universal joint assembly and lining up the marks made at removal.

NOTE: If a new gear was installed, line up the mark on the wormshaft with the slit in the universal joint yoke.

   b. Install the steering gear to frame bolts and torque to specifications.
   c. Install the universal joint pinch bolt and torque to specification.

NOTE: The pinch bolt must pass through the shaft undercut.

3. Install the pitman arm onto the pitman shaft, lining up the marks made at removal. Install the pitman shaft nut or pitman arm pinch bolt and torque to specifications.

CAUTION: If a clamp type pitman arm is used, spread the pitman arm just enough, with a wedge, to slip the arm onto the pitman shaft. Do not spread the clamp more than required to slip over pitman shaft with hand pressure. Do not hammer the pitman arm onto the pitman shaft. Be sure to install the hardened steel washer before installing the nut.

PITMAN SHAFT OIL SEAL REPLACEMENT

It is recommended that the steering gear be removed from the vehicle as outlined above and the pitman shaft oil seal replaced as outlined in the 1972 Overhaul Manual, Section 9, Manual Steering Gear.

STEERING COLUMN UPPER BEARING

Standard Column

Removal

1. Remove steering wheel as outlined in this section.
2. Remove directional signal cancelling cam.
3. Pry out upper bearing.

Installation

1. Replace all component parts in reverse order of removal making sure that directional signal switch is in neutral position before installing steering wheel.

CAUTION: The steering wheel to steering shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

Tilt Column

The upper bearings on the tilt column are spun into the bearing housing assembly. If the bearings indicate need of replacement, the entire bearing housing must be replaced. See "Tilt Steering Column - Disassembly and Assembly" for the correct replacement procedure.

STEERING COLUMN LOWER BEARING

Standard Columns

Removal

1. C-K Models - Remove the intermediate shaft and pot joint assembly as outlined earlier in this section. Remove the preload spring washer and spring from the end of the steering shaft.
2. P Models - Remove the intermediate steering shaft and universal joint assembly as outlined earlier in this section. Remove the preload spring clamp and spring from the end of the steering shaft.
3. Pry out the lower bearing assembly.

Installation

1. Place the new bearing over the end of the steering shaft and press into position in the column.
2. P Models - Install the preload spring and clamp and torque the clamp bolt nut to specifications while maintaining the dimension shown in Figure 5. Reinstall the intermediate shaft and universal joint assembly as outlined under "Intermediate Steering Shaft with Universal Joint Couplings - Installation".
3. C-K Models - Place the preload spring and washer over the end of the steering shaft and then install the intermediate steering shaft and pot joint coupling assembly as outlined under "Intermediate Steering Shaft with Pot Joint Coupling - Installation". Be sure to maintain the dimensions outlined in Figure 5.

Tilt Columns

Removal

1. Remove the intermediate steering shaft assembly as outlined earlier in this section.
2. Pry off the lower bearing reinforcement clip and remove the clip and reinforcement.
3. Remove the lower bearing and adapter as an assembly. Press the bearing out of the adapter.

Installation

1. Press the new bearing into the adapter and install the lower bearing and adapter onto the lower end of the steering shaft and place in position in the lower

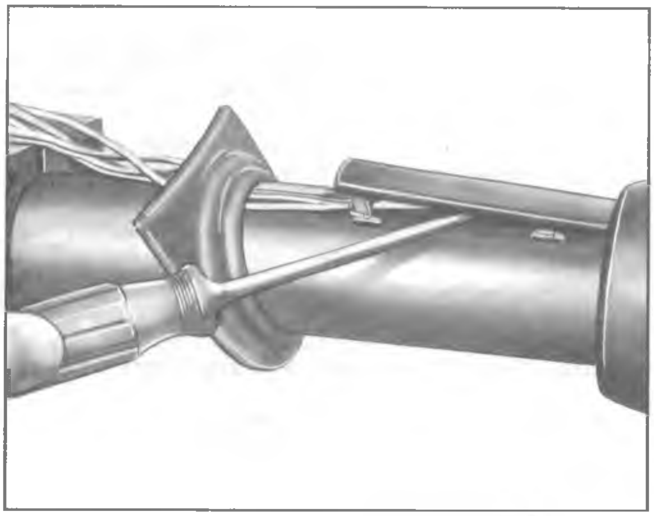


Fig. 14—Removing Wiring Harness Protector

end of the column, aligning the wide tab of the adapter with the open slot in the column.

2. Place the lower bearing reinforcement over the end of the column (open position of reinforcement to open slot in column) and install the reinforcement clip. Make sure all three tabs of the clip are fully engaged with the slots in the reinforcement and column.
3. Reinstall the intermediate steering shaft assembly as outlined under "Intermediate Steering Shaft with Pot Joint Coupling - Installation".

DIRECTIONAL SIGNAL SWITCH—ALL COLUMNS

If the directional signal switch must be replaced, the steering columm does not have to be removed from the vehicle.

Removal

1. Remove the steering wheel as outlined under "Steering Wheel - Removal".
2. Remove the directional signal switch cancelling cam and spring.
3. Remove the column to instrument panel trim plate (if so equipped).
4. Disconnect the directional signal switch wiring harness at the half-moon connector.
5. Pry the wiring harness protector out of the column retaining slots as shown in Figure 14.
6. Mark the location of each wire in the half-moon connector and then remove each individual wire from the connector using Tool J-22727 (fig. 15). Insert the tool into the lower end of the connector and push in until the tool bottoms on the connector. Remove the tool and then pull the wire from the connector.
7. Remove the directional signal lever screw and remove the lever.
8. Push in on the hazard warning light knob and then unscrew and remove the knob.
9. *Tilt Columns Only—*
   a. Automatic Transmission Models - Remove the PRNDL dial screws and remove the dial and indicator needle. Remove the cap and dial illumination bulb from the housing cover.
   b. Unscrew and remove the tilt release lever.
   c. Assemble Tool J-22708 inside the directional signal housing cover; push in until the tangs lock inside the cover flange (fig. 16). Turn the tool center screw clockwise to pull the cover from the housing.
10. Remove the three directional signal switch mounting screws and then carefully remove the switch assembly from the column while guiding the wiring harness through the opening in the shift lever housing.

Installation

1. Wrap the ends of the directional signal switch wires with tape and then guide them through the opening at the lower left hand side of the bearing housing (tilt columns) out the lower end of the shift lever housing and under the dash seal.
2. Place the directional signal switch in position and install the three mounting screws; torque to 25 in. lbs. after screw head has been firmly seated.

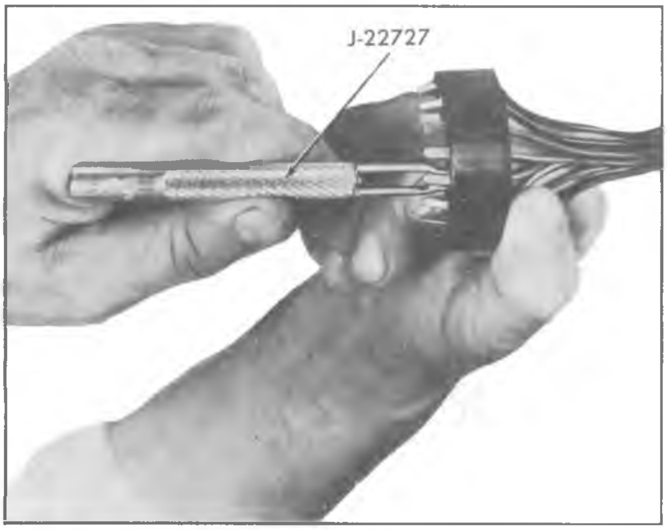


Fig. 15—Removing Wires from Connector

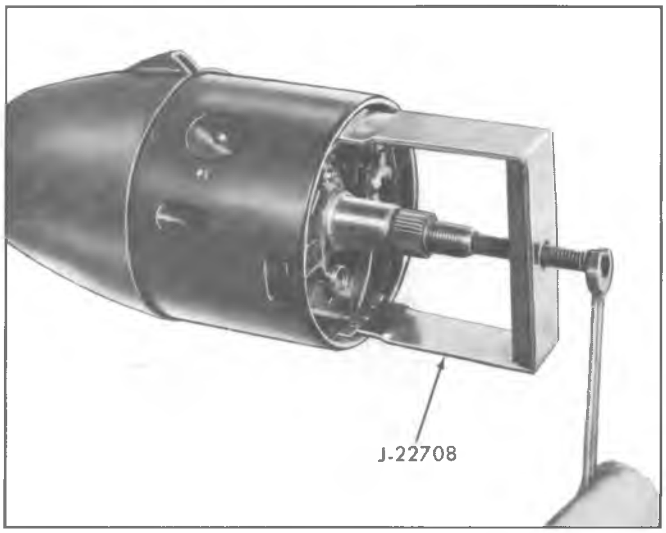


Fig. 16—Removing Directional Signal Housing Cover

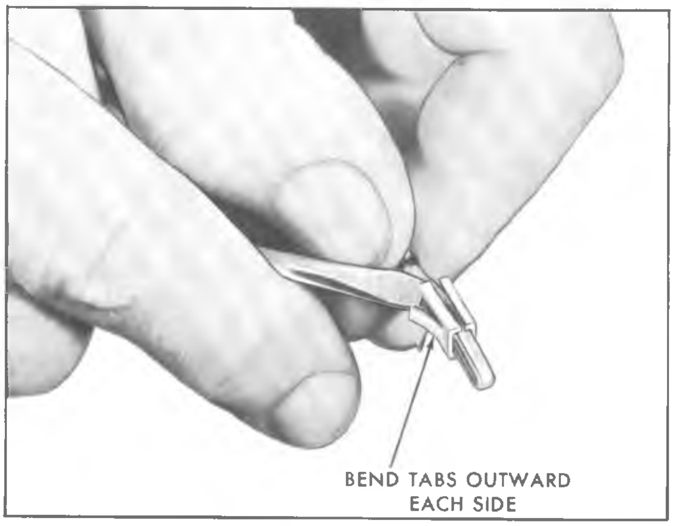


Fig. 17—Preparing Wire Retaining Tabs for Installation

3. *Tilt Columns Only—*
   a. Align the openings in the directional signal switch cover with the proper lever positions and tap the cover into place using a plastic hammer.
   b. Install the tilt release lever.
   c. Automatic Transmission Models - Install the PRNDL dial, pointer, dial illumination bulb and cap.
4. Install the directional signal switch lever and hazard warning knob.
5. Bend the wire retaining tabs slightly outward on each wire in the wiring harness as shown in Figure 17; this will provide proper retention of the wire in the half-moon connector.
6. Install each wire in its marked location in the half-moon connector. Push in until square part of clip is flush with the bottom side of the connector. Connect the directional signal switch wiring harness.
7. Snap the wiring harness protector into the column retaining slots.
8. Install the directional signal cancelling cam and spring.
9. Install the steering wheel as outlined under "Steering Wheel - Installation".
10. Install the column to instrument panel trim plate (if so equipped).

Tilt Column Bearing Housing Assembly Removal (Column in Vehicle)

1. Disconnect the battery ground cable.
2. Remove the steering wheel as outlined on Page 9-4.
3. Remove the directional signal switch as outlined on Page 9-9.
4. ***Column Shift Models—*** Using a suitable size punch, drive out the shift lever pivot pin and remove the shift lever.
5. Install the tilt release lever and place the column in the full "up" position. Remove the tilt lever spring and retainer using a screwdriver that just fits into the slot opening. Insert the screwdriver into the slot, push in approximately 3/16", rotate clockwise approximately 1/8 turn until the retainer

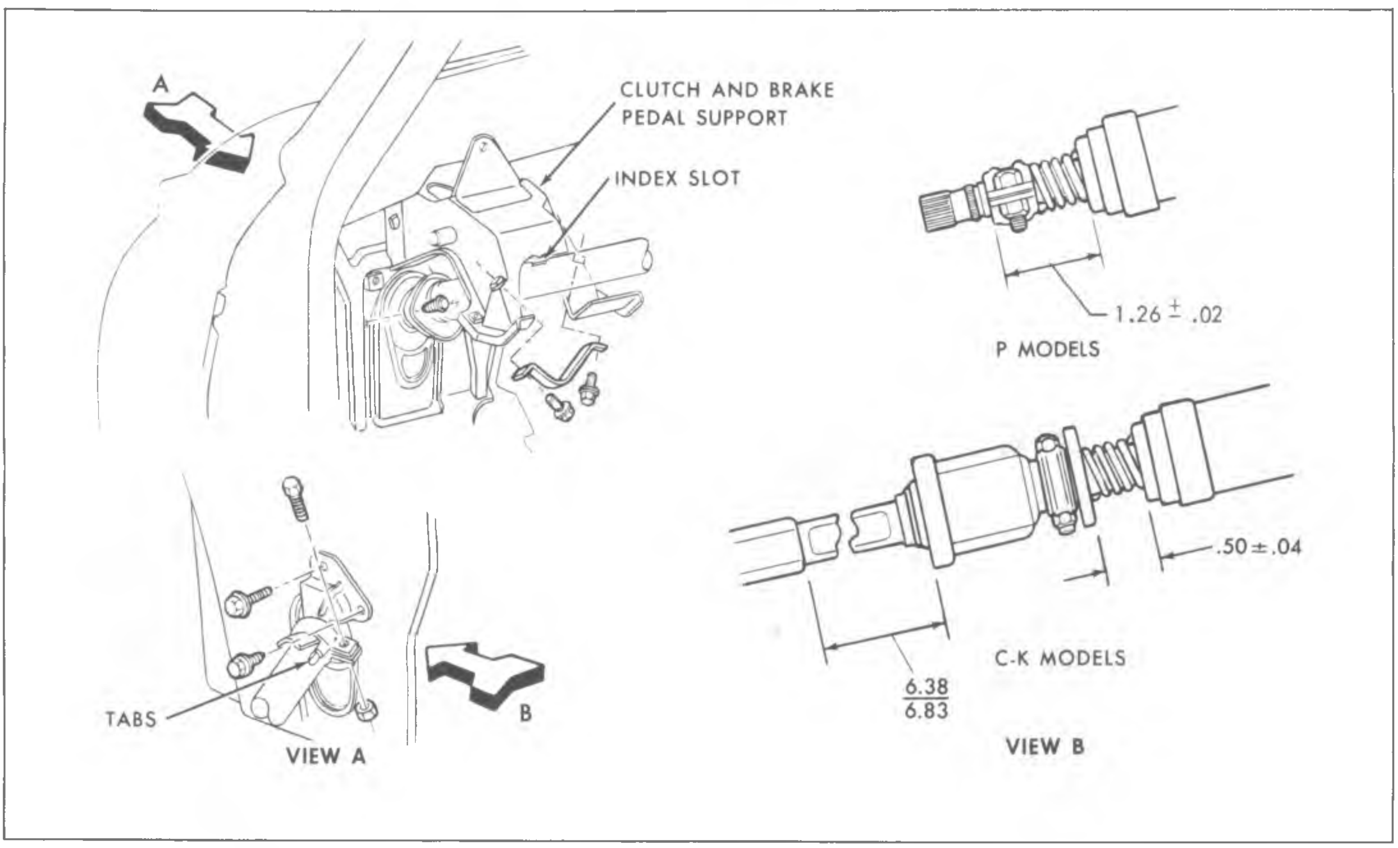


Fig. 18—Steering Column Installation

ears align with the grooves in the housing and remove the retainer and spring.

6. Remove the steering shaft bearing locknut using Socket J-22599. Remove the upper bearing race seat and race.

7. Remove the two bearing housing pivot pins using Tool J-21854.

8. Pull up on the tilt release lever (to disengage the lock shoes) and remove the bearing housing.

If the bearing housing is being replaced or it is necessary to disassemble the bearing housing, proceed as follows:

a. Press the upper and lower bearings out of the housing.
b. Using Puller J-5822 and Slide Hammer J-2619, pull the bearing races from the housing.
c. Remove the tilt release lever.
d. Drive out the shoe release pivot pin using Tool J-22635 or a suitable punch. Remove the lever spring and remove the wedge.
e. Using a suitable size punch, drive out the lock shoe retaining pin. Remove the shoes and shoe springs.

If the upper steering shaft, lower steering shaft, or centering spheres are being removed, proceed as follows:

9. To remove the steering shaft assembly through the upper end of the column. If it is necessary to disassemble the shaft, proceed as follows:

a. To remove the lower steering shaft first disconnect the shaft at the pot joint coupling clamp.
b. Turn the upper shaft 90° to the lower shaft and slide the upper shaft and centering spheres from the lower shaft.
c. Rotate the centering spheres 90° and remove the centering spheres and preload spring from the upper shaft.

If the bearing housing support is being replaced, proceed as follows:

10. Remove the four bearing housing support screws and remove the support.

Assembly

1. Assemble the steering shaft as follows:

a. Lubricate and assemble the centering spheres and preload spring.
b. Install the spheres into the upper (short) shaft and rotate 90°.
c. Install the lower shaft 90° to the upper shaft and over the centering spheres. Slowly straighten the shafts while compressing the preload spring.

2. Install the shaft assembly into the housing from the upper end.

3. Install the lower shaft to the pot joint coupling clamp. Install the coupling clamp bolt and torque to specifications.

NOTE: The coupling bolt must pass through the shaft undercut.

4. Assemble the bearing housing as follows:

a. Press the new upper and lower bearing races into the bearing housing.
b. Lubricate and install the bearings into the bearing races.
c. Place the lock shoe springs in position in the housing. Install each shoe in place and compress the spring until a suitable size straight punch can be used to hold the shoe in position (it may be necessary to acquire assistance to install the shoes. Once the shoes are in place, drive in the shoe retaining pin.
d. Install the shoe release lever and drive in the pivot pin.
e. Install the tilt release lever.
f. Lubricate the shoes and release lever.

5. Install the bearing housing assembly to the support. Hold the tilt release lever in the "up" position until the shoes have fully engaged the support. Lubricate and install the bearing housing pivot pins. Press the pins in flush with the housing.

6. Place the housing in the full "up" position and then install tilt spring and retainer (tapered end of spring first). Push into the housing approximately 3/16" and rotate counterclockwise 1/8 turn.

7. Lubricate and install the upper bearing race, race seat and locknut. Tighten the locknut (using Socket J-22599) to remove the lash and then carefully further tighten 1/16 to 1/8 of a turn (column must be in straight ahead position).

8. Remove the tilt release lever.

9. Install the directional signal switch as outlined on Pages 9-9 and 9-10.

10. Column Shift Models—Install the shift lever and pivot pin.

11. Install the steering wheel as outlined on Page 9-4.

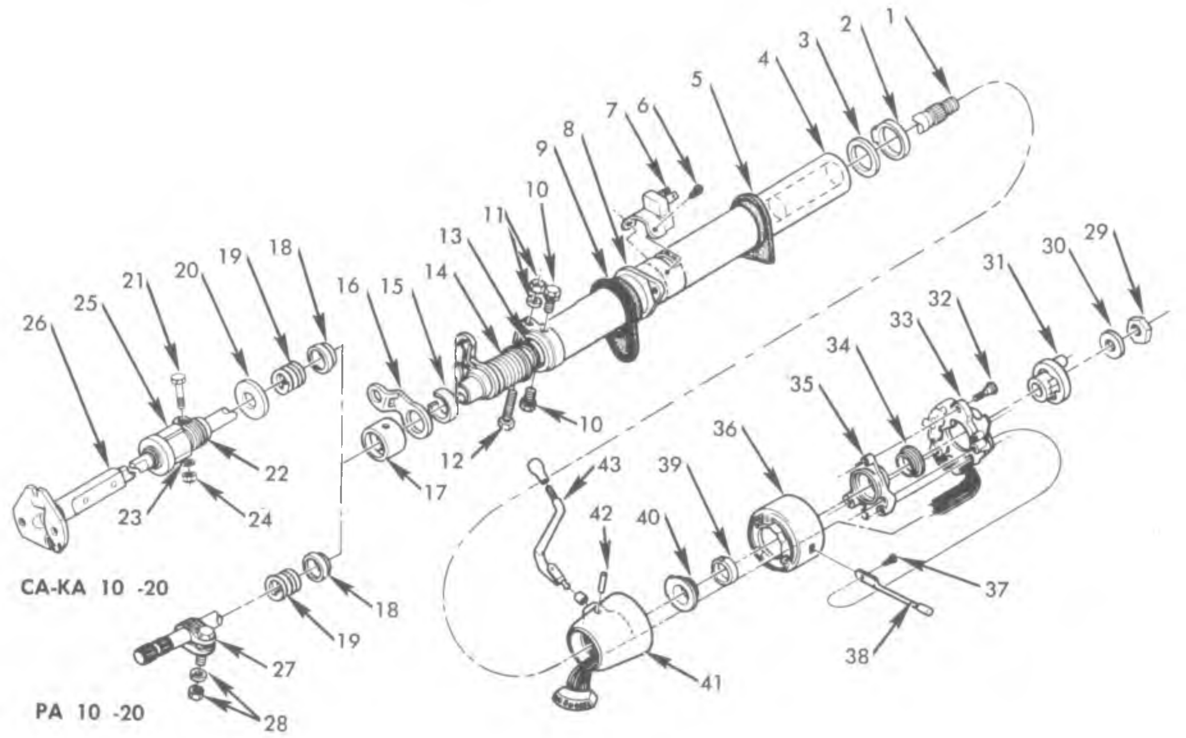
12. Check electrical and mechanical functioning of column.

NOTE: Torque values must be used as specified during reassembly, see Specifications Section.

STEERING COLUMN

Removal (Fig. 18)

1. Disconnect the battery ground cable.
2. Column Shift Models - Disconnect transmission shifter rods at the lower end of the column.
3. C-K Models - Remove the intermediate steering shaft flange to flexible coupling bolts.
   P Models - Remove the intermediate steering shaft upper universal yoke to steering shaft pinch bolt. Mark the coupling to shaft relationship.
4. Remove column clamp screw(s) on engine side of firewall and remove or slide the clamp down the column.
5. From inside the vehicle, remove the screws from the



1. Upper Steering Shaft
2. Shift Housing Bushing
3. Bushing Seat
4. Mast Jacket
5. Column Cover
6. Back-Up Lamp Switch Screw
7. Back-Up Lamp Switch
8. Toe Pan Seal Retainer
9. Toe Pan Seal
10. Adjusting Ring Clamp Screws
11. Nut and Lockwasher
12. Adjusting Ring Clamp Bolt
13. Shift Tube Felt Washer
14. Shift Tube Assembly
15. Shift Lever Spacer
16. 1st-Reverse Shift Lever
17. Adjusting Ring
18. Shaft Lower Bearing
19. Lower Bearing Preload Spring
20. Preload Spring Washer
21. Coupling Clamp Bolt
22. Coupling Clamp
23. Lockwasher
24. Nut
25. Intermediate Coupling
26. Lower Steering Shaft
27. Preload Spring Clamp
28. Nut and Lockwasher
29. Steering Shaft Nut
30. Lockwasher
31. Turn Signal Cancelling Cam
32. Turn Signal Switch Screw
33. Turn Signal Switch
34. Steering Shaft Upper Bearing
35. Switch Contact Support
36. Turn Signal Housing
37. Turn Signal Switch Lever Screw
38. Turn Signal Switch Lever
39. Rubber Ring
40. Plastic Thrust Washer
41. Shift Lever Housing
42. Shift Lever Pin
43. Shift Lever

Fig. 19—Standard Column w/Manual Transmission
10-20 Series — Exploded (Typical)

toe pan cover and slide the cover and seal up the column.

6. Remove the steering wheel as outlined under "Steering Wheel-Removal," and reinstall the shaft nut and washer.

7. All Columns - Disconnect the directional signal wiring harness.

   Standard Column with Automatic Transmission - Disconnect the conductor tube (for transmission indicator) at the instrument panel.

   Tilt Column with Automatic Transmission - Disconnect the single wire at the fuse block and unclip it from the parking brake bracket.

8. Remove the cap screws from the column support bracket at the dash panel.

9. Carefully lower and then withdraw the column assembly, rotating so that the shift levers clear the toe pan opening.

Disassembly—Standard Column (Fig. 19)

NOTE: For floor shift transmission models, omit Steps 4, 14, 15 and 16.

1. Remove the steering wheel nut and lock washer and then slide the steering shaft assembly from the lower end of the column.

2. C and K Models - Remove the intermediate coupling clamp bolt and separate the upper and lower steering shafts. Remove the lower bearing preload spring and washer.

   P Models - Remove the lower bearing preload spring and clamp.

3. Remove the back-up lamp switch.
4. Drive out the shift lever pivot pin and remove the shift lever.
5. Remove the directional signal cancelling cam. Remove the directional signal switch lever.
6. Remove the column wiring harness cover.
7. Remove the directional signal switch screws.
8. Rotate the directional signal switch housing counterclockwise and remove the housing from the column.

NOTE: The housing and switch cannot be fully removed from the column until the shift lever housing is removed.

9. Remove the plastic thrust washer assembly and then remove the shift lever housing (or extension housing) from the column.
10. Separate the directional signal switch, switch control support assembly, directional signal housing and shift lever housing (or housing extension) assemblies.
11. Press the steering shaft upper bearing out of the switch contact support.
12. Remove the shift lever housing (or extension housing) seat and bushing from the upper end of the column.
13. Remove the bolt and screws from the adjusting ring clamp and remove the clamp, adjusting ring and lower bearing. Press the lower bearing out of the adjusting ring.
14. 3-Speed Columns - Remove 1st-reverse shift lever and lever spacer.

    Automatic Columns - Remove the selector plate clamping ring screws (3).
15. Place the column upright on the floor, supporting it with two pieces of wood. Place a block of wood on the upper end of the shift tube. Press down on the shift lever with foot while tapping on the wood block to withdraw the tube from the column jacket.

NOTE: In some tolerance stack-up cases it may be necessary to use a press. Be careful not to damage the tube or jacket.

16. Remove the felt seal from the shift tube.
17. Remove firewall clamp, toe pan seal and dash panel seals from the jacket.

Assembly—Standard Column

NOTE: For floor shift models, omit Steps 2, 3, 4, 5 and 13.

1. Install the dash panel seal, toe panel and firewall clamps over the end of the jacket.
2. Lubricate all bearing surfaces on the shift tube.
3. Place the felt seal onto the shift tube (next to spring) and then place the shift tube in the jacket.
4. 3-Speed Columns - Temporarily install spacer, 1st-reverse shift lever and lower adjusting ring. Place a block of wood on top of the adjusting ring and tap until the shift tube bottoms. Remove adjusting ring, shift lever and spacer.

   NOTE: The shift tube spring retainer must be bottomed against the jacket stops.

   Automatic Columns - Align the three holes in the selector plate with the three holes in the jacket, position the clamping ring and install the three screws.
5. 3-Speed Columns - Lubricate and install the spacer and 1st-reverse shift lever (tang of lever towards top of column).
6. Install lower bearing in the adjusting ring and then install the adjusting ring, clamp and screws.
7. Install the shift lever housing (or extension housing) seat and bushing to upper end of housing.
8. Thread directional signal switch wiring harness through the switch and shift lever (or extension) housings, lubricate the inner diameter of the shift housing, and then place the shift lever (or extension) housing onto the upper end of the column.
9. Install the switch housing plastic washer assembly. Press the upper bearing into the switch contact support.
10. Install the directional signal switch housing, contact support, bearing and switch and torque the switch screws to 25 in. lbs.
11. Install the column wiring harness cover and back-up lamp switch.
12. Install the directional signal and gearshift levers.
13. Adjust the shift tube as outlined under "Shifter Tube Adjustment."
14. P Models - Loosely install the lower bearing preload spring and clamp.

    C and K Models - Loosely install the lower bearing preload spring and washer. Install the lower steering shaft and coupling to the upper steering shaft and torque the coupling clamp bolt to 120 in. lbs.
15. Slide the steering shaft assembly up through the column assembly. Install the directional signal cancelling cam, steering shaft nut and lock washer.

Disassembly—Tilt Column (Fig. 20)

1. If the column is removed from the vehicle, place the column in a bench vise using Holding Fixtures J-22573 (fig. 21).

   CAUTION: Clamping the column directly in a vise, could result in a damaged column.
2. Remove the directional signal switch as outlined under "Directional Signal Switch-Removal".
3. Remove the lower steering shaft and pot joint assembly and lower bearing and adapter assembly as outlined under "Lower Bearing and Adapter-Removal".
4. Column Shift Models - Using a suitable size punch, drive out the shift lever pivot pin and remove the shift lever.
5. Install the tilt release lever and place the column in

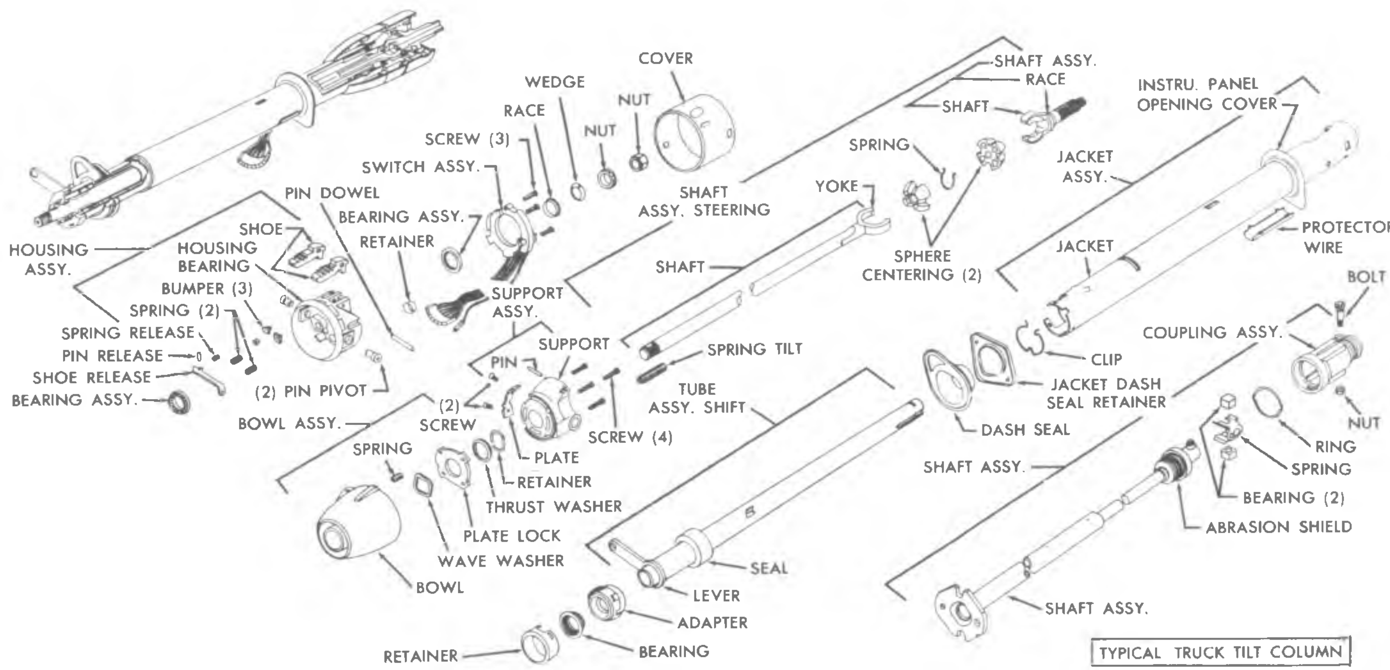


Fig. 20—Tilt Steering Column - Explode

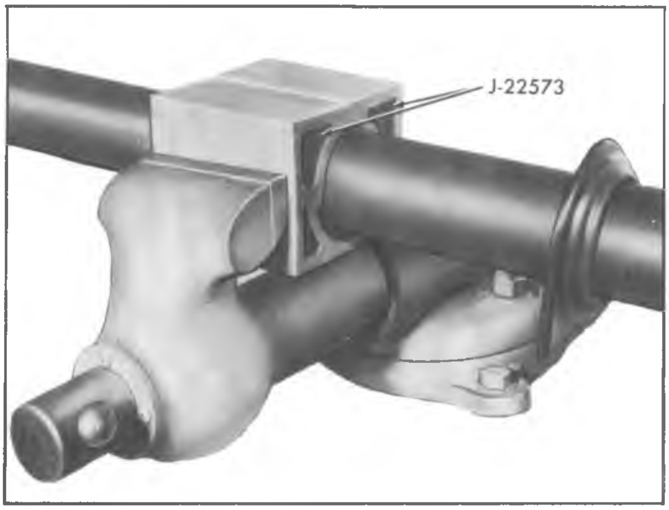


Fig. 21—Securing Column with J-22573

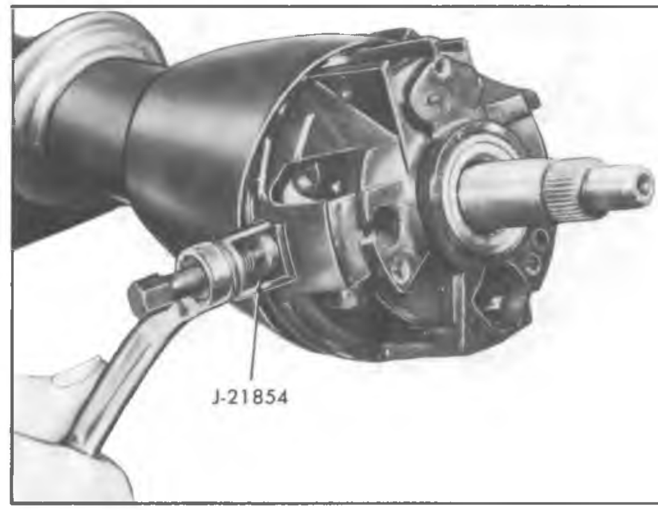


Fig. 23—Removing Bearing Housing Pivot Pin

the full "up" position. Remove the tilt lever spring and retainer using a screw driver that just fits into the slot opening (fig. 22). Insert the screw driver into the slot, push in approximately 3/16", rotate clockwise approximately 1/8 turn until the retainer ears align with the grooves in the housing and remove the retainer and spring.

6. Remove the steering shaft bearing locknut using socket J-22599. Remove the upper bearing race seat and race.
7. Remove the two bearing housing pivot pins using Tool J-21854 (fig. 23).
8. Pull up on the tilt release lever (to disengage the lock shoes) and remove the bearing housing. If it is necessary to disassemble the bearing housing, proceed as follows:
   a. Press the upper and lower bearings out of the housing.
   b. Using Puller J-5822 and Slide Hammer J-2619 pull the bearing races from the housing (fig. 24).
   c. Remove the tilt release lever.
   d. Drive out the shoe release lever pivot pin using Tool J-22635 or a suitable punch (fig. 25). Remove the lever spring and remove the wedge.
   e. Using a suitable size punch, drive out the lock shoe retaining pin. Remove the shoes and shoe springs.
9. Remove the steering shaft assembly through the upper end of the column. If it is necessary to disassemble the shaft proceed as follows:
   a. Turn the upper shaft 90° to the lower shaft and slide the upper shaft and centering spheres from the lower shaft.
   b. Rotate the centering spheres 90° and remove the centering spheres and preload spring from the upper shaft.
10. Remove the four bearing housing support screws and remove the support.
    Column Shift Models - If the shift tube index plate must be removed, remove the two retaining screws and remove the plate.
11. Remove the shift tube retaining ring with a screw driver (fig. 26). Remove the thrust washer.
12. Remove the neutral-safety or back-up lamp switch

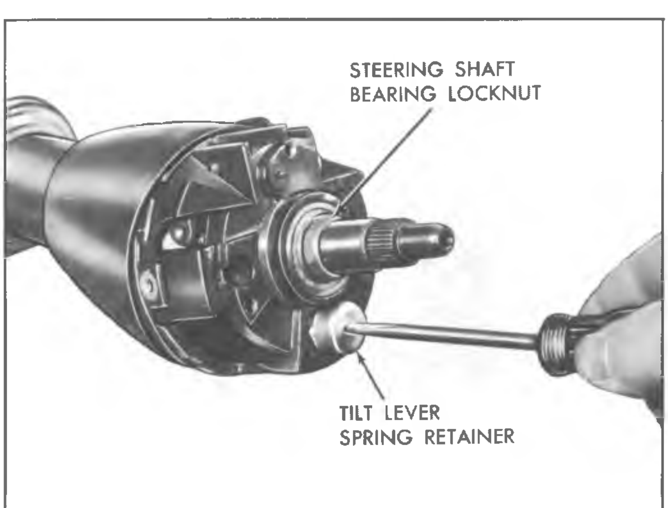


Fig. 22—Removing Tilt Spring and Retainer

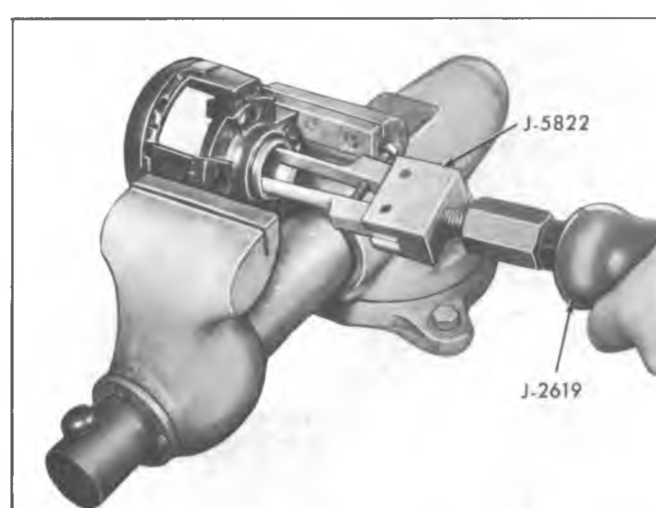


Fig. 24—Removing Bearing Race

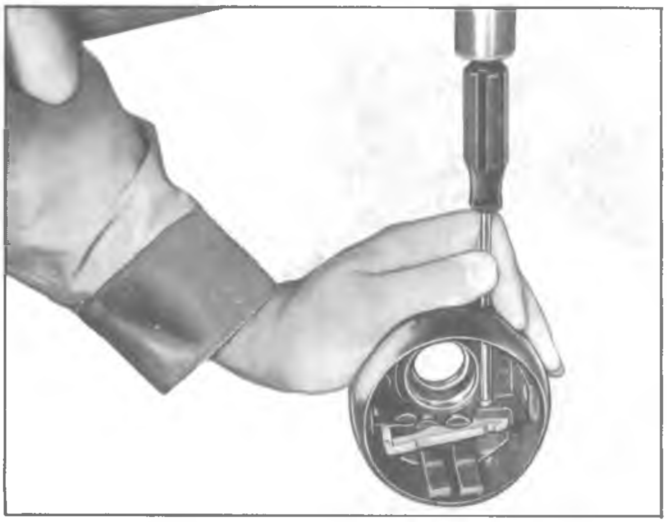


Fig. 25—Removing Release Lever Pivot Pin

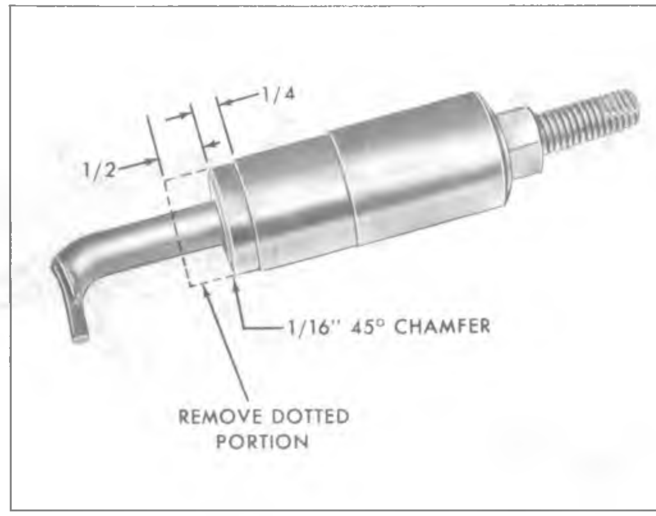


Fig. 27—Revised Shift Tube Removing Tool J-22551

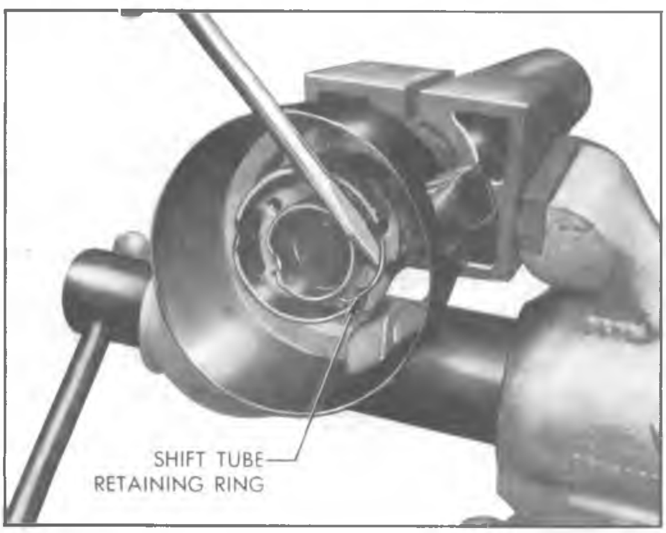


Fig. 26—Removing Shift Tube Retaining Ring

screws and remove the switch.

13. Rework Shift Tube Removing Tool J-22551 by removing 1/2" from the pilot end of the tool (fig. 27). This allows the shift tube to be pushed further out of the housing and will not affect the use of the tool on passenger car columns.
14. Remove the shift tube assembly using Tool J-22551 (fig. 28). Insert the hooked end of the tool into the notch in the shift tube just below the shift lever housing key. Pilot the sleeve over the threaded end of the tool and into the upper end of the shift tube. Force the shift tube out of the housing by turning the nut onto the tool. If the shift tube is not completely free when the nut is bottomed on the threads, complete the removal by hand.

CAUTION: Do Not hammer or pull on the shift tube during removal. On column shift models, guide the lower shift lever through the slotted opening in the column to prevent damage to the tube or column.

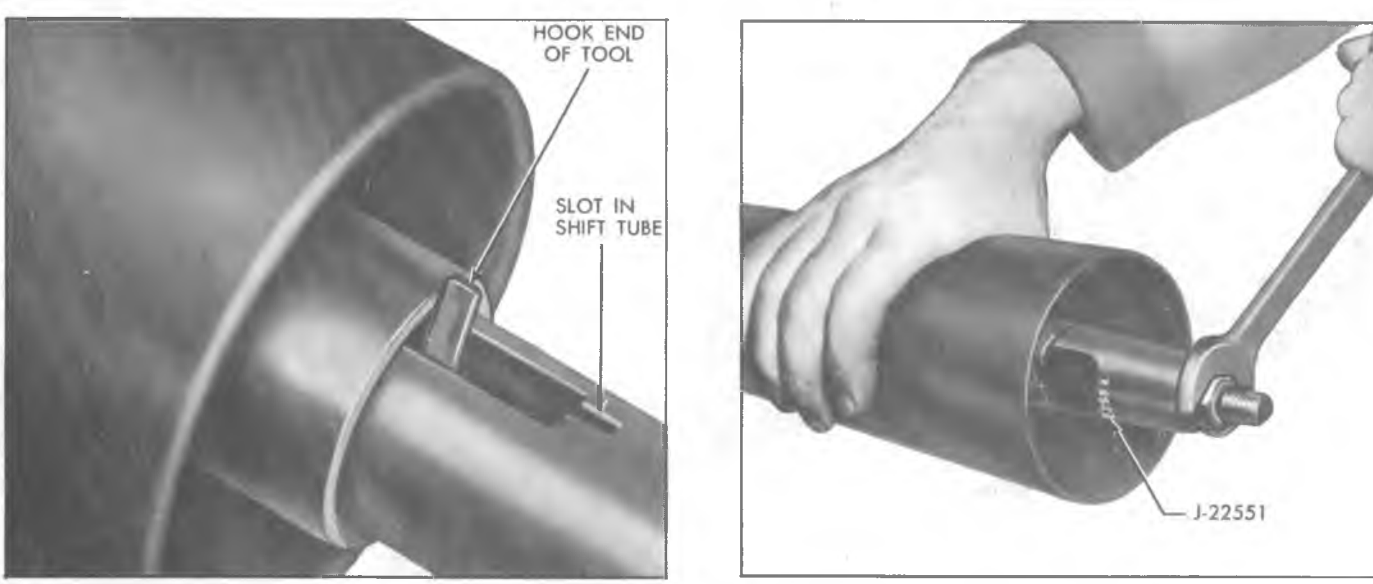


Fig. 28—Removing Shift Tube Assembly

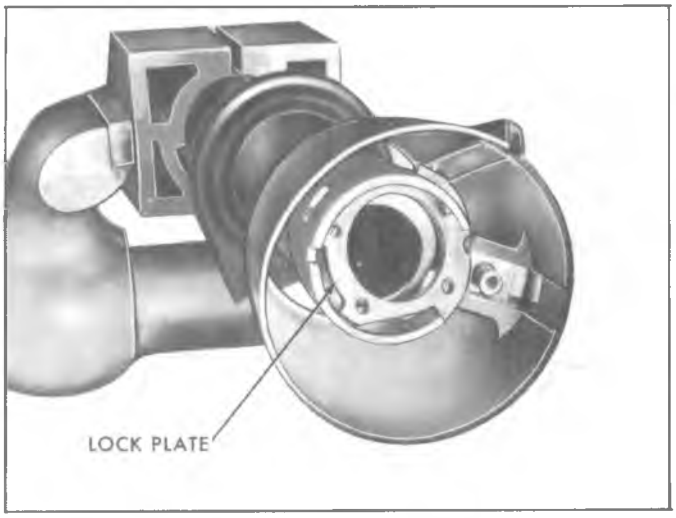


Fig. 29—Removing Lock Plate Assembly

15. Remove the lock plate by sliding out of the column notches, tipping the plate downward toward the housing (to compress the wave washer) and then removing as shown in Figure 29. Remove the wave washer.
16. Remove the shift lever housing.
17. Column Shift Models - Remove the shift lever spring by winding the spring up with pliers.
18. If necessary, remove the dash panel seal, mounting plate and the instrument panel seal from the column jacket.

Assembly—Tilt Columns

NOTE: When lubricating components during the following installation sequence, use a general purpose lithium soap grease.

1. Install the dash panel seal, mounting plate and the instrument panel seal on the column.
2. Column Shift Models - Press a new shift lever spring into the shift lever housing.
3. Slide the shift lever housing over the upper end of the column.
4. Place the wave washer and lock plate in position. Work the lock plate into the notches by tipping the plate toward the housing (compressing the wave washer) at the open side of the column. Lubricate the lock plate and upper end of the shift tube.
5. Carefully install the shift tube into the lower end of the column (make sure the foam seal is at the lower end of the shift tube). Align the keyway in the tube with the key in the shift lever housing and complete installation of the shift tube using Tool J-22549 (fig. 30). The shift lever housing key must bottom in the shift tube slot to be fully installed. Remove Tool J-22549 from the column. Lubricate and push foam seal in flush with column housing.

CAUTION: Do Not hammer or force the tube when installing in the column.

6. Pull up on the shift lever housing (to compress the wave washer) and install the thrust washer and retaining ring. Be sure the ring is seated in both slots of the shift tube.

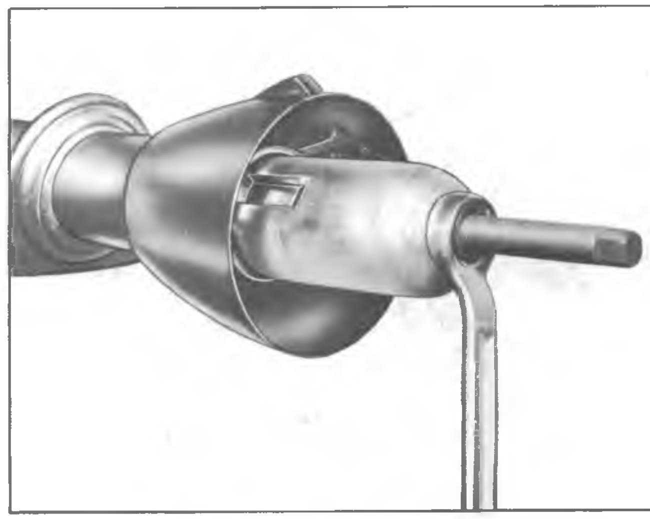


Fig. 30—Installing Shift Pin Tube

7. Lubricate the I.D. of the bearing housing support and install the support, aligning the bolt holes in the support with the bolt holes in the lock plate. Install the four support screws and torque to 45 in. lbs.
8. Assemble the steering shaft as follows:
   a. Lubricate and assemble the centering spheres and preload spring.
   b. Install the spheres into the upper (short) shaft and rotate 90°.
   c. Install the lower shaft 90° to the upper shaft and over the centering spheres. Slowly straighten the shafts while compressing the preload spring.
9. Install the shaft assembly into the housing from the upper end.
10. Install the lower bearing and adapter, bearing reinforcement, wire clip, pot joint coupling and lower shaft as described under "Lower Bearing Installation".
11. Assemble the bearing housing as follows:
   a. Press the new upper and lower bearing races into the bearing housing.
   b. Lubricate and install the bearings into the bearing races.
   c. Place the lock shoe springs in position in the housing. Install each shoe in place and compress the spring until a suitable size straight punch can be used to hold the shoes in position (it may be necessary to acquire assistance to install the shoes). Once the shoes are in place, drive in the shoe retaining pin.
   d. Install the shoe release lever and drive in the pivot pin.
   e. Install the tilt release lever.
   f. Lubricate the shoes and release lever.
12. Install the bearing housing assembly to the support. Hold the tilt release lever in the "up" position until the shoes have fully engaged the support. Lubricate and install the bearing housing pivot pins. Press the pins in flush with the housing.
13. Place the housing in the full "up" position and then install tilt spring and retainer (tapered end of spring first). Push into the housing approximately 3/16" and rotate counter clockwise 1/8 turn.
14. Lubricate and install the upper bearing upper race,

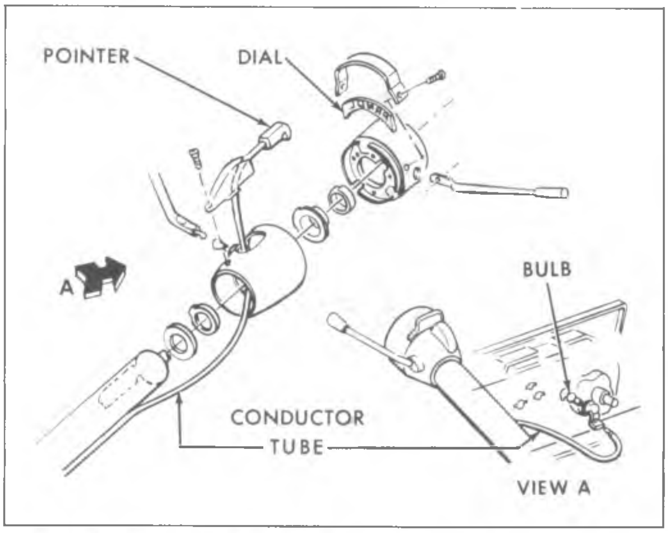


Fig. 31—Conductor Tube for Automatic Transmission Indicator

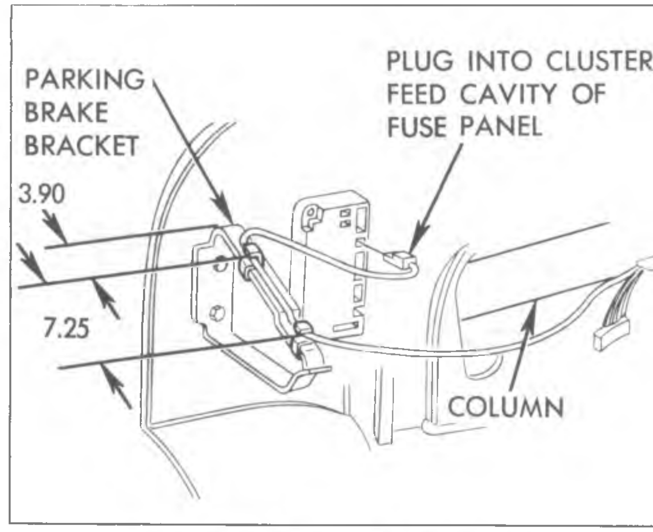


Fig. 32—Tilt Column Shift Indicator Light

race seat and locknut. Tighten the locknut (using Socket J-22599) to remove the lash and then further tighten 1/16 to 1/8 of a turn (column must be in straight ahead position).

15. Remove the tilt release lever.
16. Install the directional signal switch as outlined under "Directional Signal Switch-Installation".
17. Column Shift Models - Install the shift lever and pivot pin.
18. Install the neutral-safety or back-up lamp switch.
19. Remove the column from the bench vise.

Column Installation—Mandatory Sequence (Fig. 18)

1. Applying 50 lbs. force on the steering wheel end of the steering shaft, adjust the lower bearing preload to allow steering shaft end play as indicated in Figure 5. Tighten the shaft clamp on pot joint bolt to specifications.
2. From the passenger side of the dash panel, carefully insert the lower end of the steering column through the toe panel opening.
   C-K Models - Install flange onto bolts and secure to torque specification.
   P Models - Guide the steering shaft into the universal yoke, lining up the marks made at removal. Install the yoke pinch bolt and torque to specifications. The pinch bolt must pass through the shaft undercut.
3. Position and attach the lower clamp mounting bracket to the firewall. Locate the steering column protrusions against the toe pan bracket while at the same time, aligning protrusion in brake and clutch pedal support with index slot in the steering column, as shown in Figure 18. Install the column to bracket clamp and torque the clamp bolt to specifications.

   NOTE: The toe pan bracket must not override the protrusions on the steering column.

4. Position the steering column to dash panel bracket, install the attaching bolts and torque to specifications.
5. C-K Models - After the assembly is completed, and all bolts are properly torqued, the dimension between the steering shaft lower tube and intermediate coupling must be maintained at 6.38 to 6.78 inches.

   NOTE: If plastic spacers were used on the flexible coupling alignment pins (fig. 10), remove the spacers after all bolts have been properly torqued.

   CAUTION: All steering coupling fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

6. Install the seal at the toe pan and then install the toe pan bracket screws; torque to specifications.
7. Install the dash panel trim plate (if so equipped).
8. Connect the transmission shift linkage on column shift models.
9. All Columns - Connect the directional signal wiring harness.
   Standard Column with Automatic Transmission - Connect the conductor tube (for transmission indicator) at the instrument panel (fig. 31).
   Tilt Column with Automatic Transmission - Clip the single wire to the parking brake bracket and plug into the cluster feed cavity of the fuse block (fig. 32).
10. Install steering wheel as outlined under "Steering Wheel-Installation."
11. Connect battery ground cable.

STEERING LINKAGE (Figs. 33 and 34)

CAUTION: All steering linkage fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts

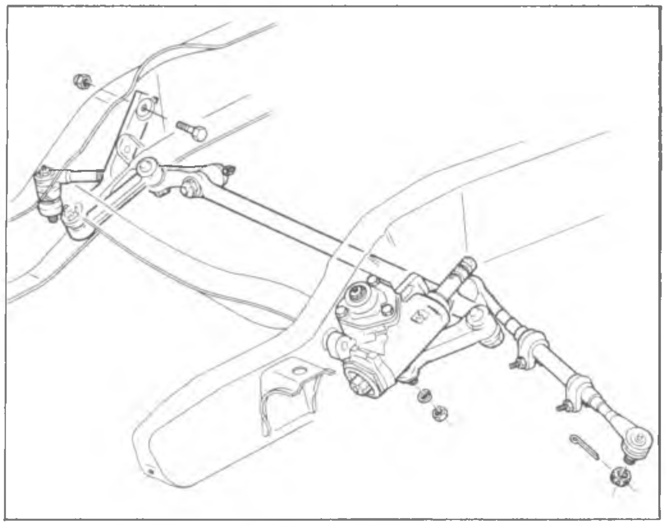


Fig. 33—C-10-30, P-10-20 Series Steering Linkage

if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Tie Rod

Removal

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts.
3. 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. 37).
4. Remove inner ball stud from relay rod using same procedure as described in Step 3.
5. To remove tie rod ends from tie rod, loosen clamp bolts and unscrew end assemblies.

Installation

1. If the tie rod ends were removed, lubricate the tie rod threads with EP Chassis lube and install ends on tie

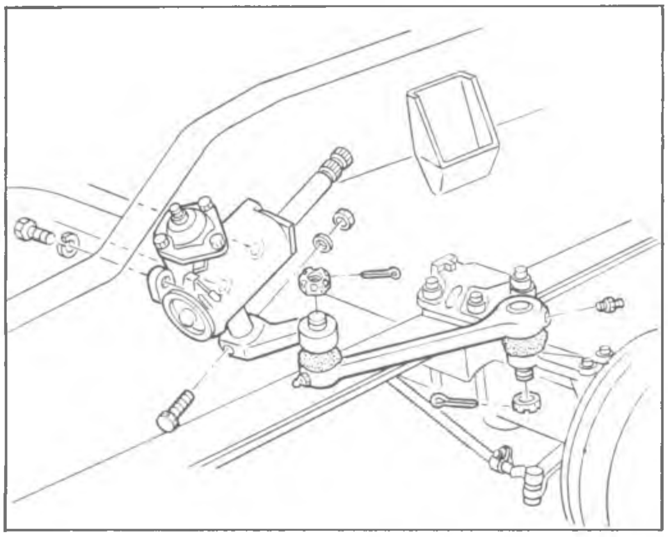


Fig. 34—K10-20 Series Steering Linkage

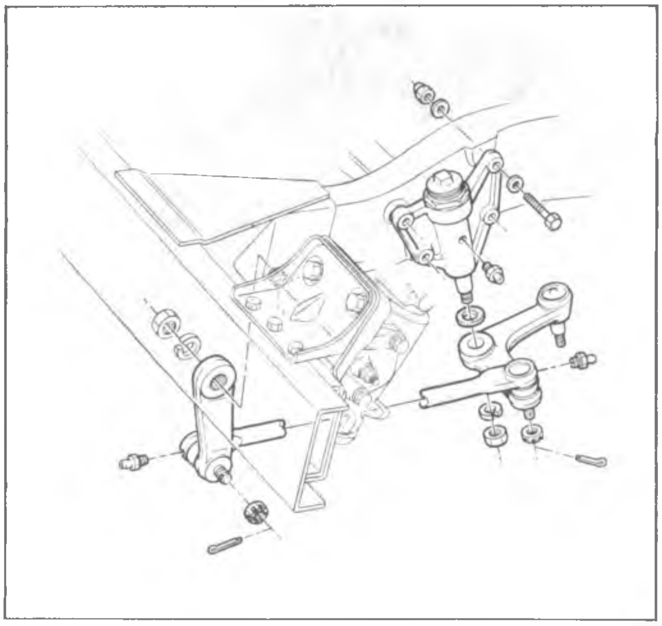


Fig. 35—P-30 Series Steering Linkage Relay Arm, Pitman Arm & Connecting Rod

rod making sure both ends are threaded an equal distance from the tie rod.

2. Make sure that threads on ball studs and in ball stud nuts are perfectly clean and smooth. Check condition of ball stud seals; replace if necessary.

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, tighten and install new cotter pins; see Specifications Section at rear of manual. Lubricate tie rod ends.
5. Remove vehicle from hoist.
6. Adjust toe-in as described in Section 3.

CAUTION: Before tightening the tie rod adjusting sleeve clamp bolts, be sure that the following conditions have been met:

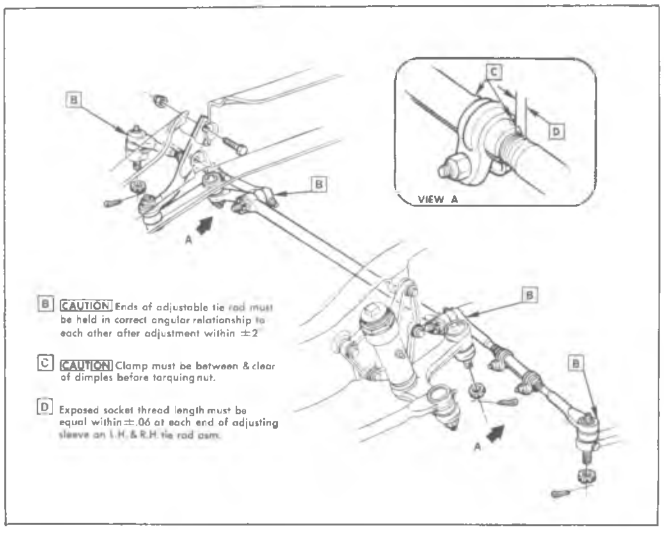


Fig. 36—P-30 Series Steering Linkage

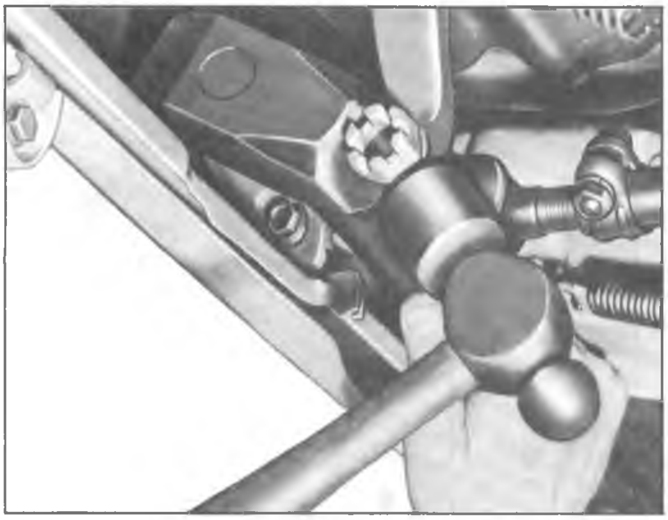


Fig. 37—Ball Stud Removal — Typical

a. The sleeve clamps must be positioned between the locating dimples at either end of the sleeve.
b. The clamps must be positioned within the angular travel indicated in Figure 36.
c. The relationship of the clamp slot with the slit in the sleeve should be maintained as shown in Figure 36.
d. Both inner and outer tie rod ends must rotate for full travel in the same direction. The position of each tie rod end must be maintained as the clamps are tightened to ensure free movement of each joint.
e. All procedures for alignment, adjustment and assembly of tie rods applies to each side.

Relay Rod—C-P10-20-30

Removal

1. Place vehicle on hoist.
2. Remove inner ends of the tie rods from relay rod as described under "Tie Rod—Removal."
3. Remove the cotter pins from the pitman and idler arm ball studs at the relay rod. Remove the castellated nuts.
4. Remove the relay rod from the pitman and idler arms by tapping on the relay rod ball stud bosses with a hammer, while using a heavy hammer as a backing (fig. 37).
5. Remove the relay rod from the vehicle.

Installation

1. Make sure that threads on the ball studs and in the ball stud nuts are perfectly clean and smooth. Check condition of ball stud seals; replace if necessary.

   NOTE: If threads are not clean and smooth, ball studs may turn in sockets when attempting to tighten nut.

2. Install the relay rod to the idler arm and pitman arm ball studs, making certain the seals are in place. Install and torque the nut and then install the cotter pin (see Specifications Section for specific instructions).
3. Install the tie rods to the relay rod as previously described under "Tie Rod—Installation." Lubricate the tie rod ends.
4. Remove the vehicle from the hoist.
5. Adjust toe-in (see Section 3) and align steering wheel as described previously in this section under Steer-Wheel Alignment and High Point Centering.

Idler Arm—C-P10-20-30

Removal

1. Place vehicle on a hoist.
2. Remove the cotter pin and castellated nut from ball stud at the relay rod. Remove the ball stud from the relay rod by tapping on the relay rod boss with a hammer, while using a heavy hammer as a backing (fig. 37).
3. Remove the idler arm to frame bolt and remove the idler arm assembly.

Installation

1. Position the idler arm on the frame and install the mounting bolts (special plain washers under bolt heads); torque the nuts to specifications.
2. Make sure that the threads on the ball stud and in the ball stud nut are perfectly clean and smooth. Check condition of ball stud seal; replace if necessary.

   NOTE: If threads are not clean and smooth, ball stud may turn in the socket when attempting to tighten nut.

3. Install the idler arm ball stud in the relay rod, making certain the seal is positioned properly; install the nut and cotter pin as outlined in the Specifications section at the rear of this manual.
4. Remove the vehicle from the hoist.

Pitman Arm

Removal

1. Place vehicle on hoist.
2. Remove cotter pin from pitman arm ball stud and remove nut.

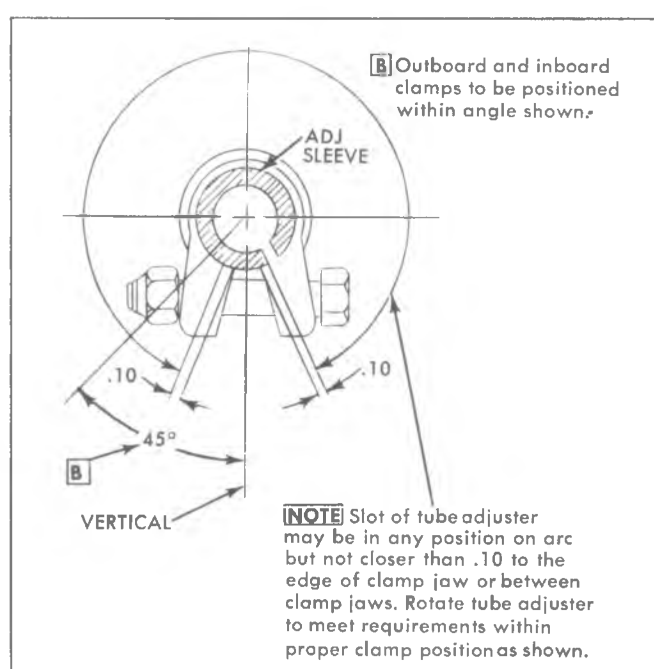


Fig. 38—Tie Rod Clamp Relationships

3. Remove pitman arm or relay rod from ball stud 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 (fig. 37). Pull on linkage to remove from stud.
4. Remove pitman arm nut from pitman shaft or clamp bolt from pitman arm, and mark relation of arm position to shaft.
5. Remove pitman arm, using Tool J-6632 or J-5504.

Installation

1. Install pitman arm on pitman shaft, lining up the marks made upon removal.

   CAUTION: If a clamp type pitman arm is used, spread the pitman arm just enough, with a wedge, to slip arm onto pitman shaft. Do not spread pitman arm more than required to slip over pitman shaft with hand pressure. Do not hammer or damage to steering gear may result. Be sure to install the hardened steel washer before installing the nut.

2. Make sure that threads on ball studs and in ball stud nuts are clean and smooth. Check condition of ball stud seals; replace if necessary.

   NOTE: If threads are not clean and smooth, ball studs may turn in sockets when attempting to tighten nut.

3. Install pitman shaft nut or pitman arm clamp bolt and torque to specifications.
4. Position ball stud onto pitman arm or relay rod. Install nut and torque to specifications. Continue to tighten nut enough to align castellation with hole in stud and install cotter pin.
5. Lubricate ball studs.
6. Remove vehicle from hoist.

Steering Connecting Rod

Removal

1. Remove cotter pins from ball studs and remove castellated nuts.
2. Remove ball studs from steering arm and pitman arm boss with a heavy hammer and striking other side of boss with lighter hammer (fig. 37).

Installation

1. Make sure that threads on ball studs and in ball stud nuts are clean and smooth. Check condition of ball stud seals - replace if necessary.

   NOTE: If threads are not clean and smooth, ball studs may turn in connecting rod when attempting to tighten nut.

2. Install ball studs in steering arm and pitman arm.
3. Install ball stud nuts and torque to specifications. Continue to tighten nuts enough to align castellations with holes in studs.
4. Install cotter pins and lubricate.

POWER STEERING

INDEX

GENERAL DESCRIPTION

Two variations of integral power steering are used in the 10-30 series trucks; "constant ratio" ("P" Models) and "Variable Ratio" ("C-K" Models).

The power steering gears are of the same general design and are overhauled in a like manner. Both gears incorporate the recirculating ball system in which steel balls act as a rolling thread between the steering wormshaft and rack-piston. The rack-piston nut is geared to the sector of the pitman shaft. The valve is contained in the gear housing thus eliminating the need for separately mounted valve and cylinder assemblies.

Variable ratio steering is faster when cornering, requiring fewer turns of the steering wheel to move the front wheels from stop to stop, while steering effort is not increased. It also provides more precise control and better response in maneuvering, particularly in sharp rapid turns and in parking.

Variable ratio steering is accomplished by a pitman shaft sector incorporating a short tooth on either side of a long center tooth, rather than a sector with three teeth of equal length as in the constant ratio gear (fig. 39). Companion changes are also made in the rack-piston teeth.

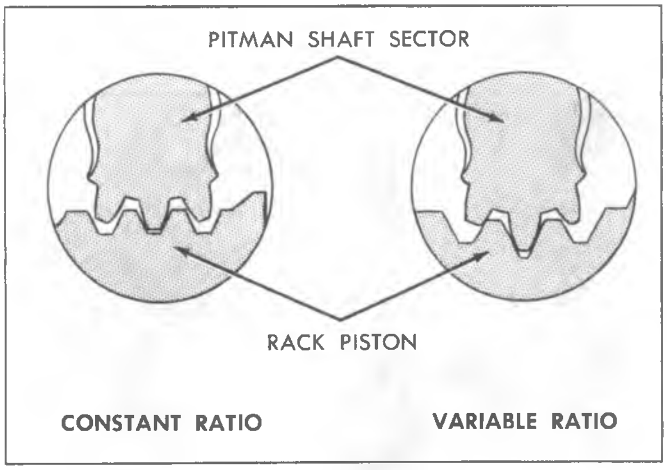


Fig. 39—Pitman Shaft Sector Teeth

Hydraulic pressure is provided by an engine-driven vane-type pump which is bracket mounted to the left side of the engine. Pressure is delivered from the pump through two hoses to the variable ratio steering gear.

MAINTENANCE AND ADJUSTMENTS

ADJUSTMENTS

Power Steering Gear

The over-center adjustment (fig. 40) is the only power steering gear adjustment which can be made on the vehicle. However, in order to make this adjustment, it is also necessary to check the combined ball and thrust bearing preload.

1. Remove the pitman shaft nut. Mark the relation of the pitman arm to the pitman shaft. Disconnect the pitman arm from the pitman shaft using Puller Tool J-6632 (fig. 1).
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 the battery ground cable.
4. Remove the 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 and connect the battery ground cable.
9. Connect the pitman arm to the pitman shaft, lining up the marks made at removal.

CAUTION: The pitman arm to pitman shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

Pump Belt Tension

1. Loosen pivot bolt and pump brace adjusting nuts.

   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-23600 (Fig. 41).
3. Tighten pump brace adjusting nut. Then tighten pivot bolt nut.

FLUID LEVEL

1. Check oil level in the reservoir by checking the dip stick when oil is at operating temperature. On models equipped with remote reservoir, the oil level should be maintained approximately 1/2 to 1 inch from top with wheels in full left turn position.
2. Fill, if necessary, to proper level with GM Power Steering Fluid or equivalent. If this is not available, automatic transmission fluid bearing the mark Dexron ® may be used.

BLEEDING HYDRAULIC SYSTEM

1. Fill oil reservoir to proper level and let oil remain undisturbed for at least two minutes.
2. Start engine and run only for about two seconds.
3. Add oil if necessary.
4. Repeat above procedure until oil level remains constant after running engine.
5. Raise front end of vehicle so that wheels are off the ground.
6. Increase engine speed to approximately 1500 rpm.
7. Turn the wheels (off ground) right and left, lightly contacting the wheel stops.

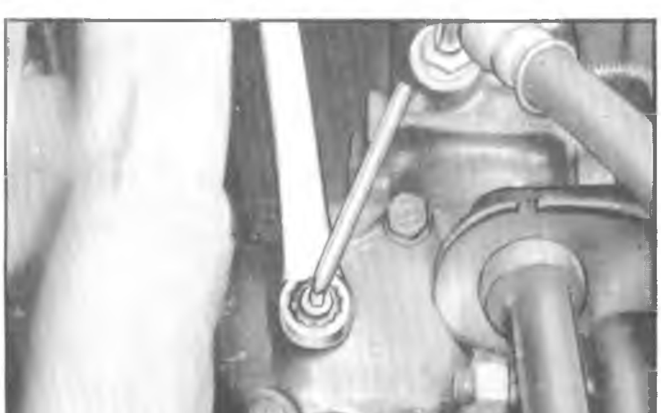


Fig. 40—Over-Center Adjustment

Fig. 41—Checking Belt Tension with J-23600

8. Add oil if necessary.
9. Lower the vehicle 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 truck, 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 objectional pump noise.
    d. Check the presence of air in the oil. Air will show up as a milky appearing oil. If air is present, attempt to bleed system as described in operations 1 through 10. If it becomes obvious that the pump will not bleed after a few trials, proceed as outlined under Hydraulic System Checks.

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.

Test Number One—Oil Circuit Open

Engine must be at normal operating temperature. Inflate front tires to correct pressure. All tests are made with engine idling, so adjust engine idle speed to correct specifications listed in Section 6 and proceed as follows:

a. With engine not running, disconnect flexible pressure line from pump and install Tool J-5176 as shown in Figure 42. Gauge must be between shut-off valve and pump. Shut-off valve must be open.
b. Remove filler cap from pump reservoir and check fluid level. Fill pump reservoir to full mark on dip stick. Start engine and, holding steering wheel against stop, check connections at Tool J-5176 for leakage. Bleed system as outlined under Maintenance and Adjustments. Insert thermometer (Tool J-5421) in reservoir filler opening. Move steering wheel from stop to stop several times until thermometer indicates that hydraulic fluid in reservoir has reached temperature of 150° to 170°.

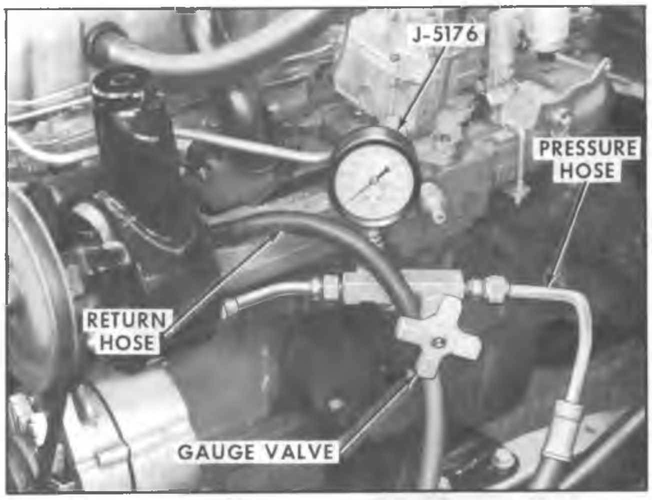


Fig. 42—Checking Power Steering Pressures

CAUTION: <u>To prevent scrubbing flat spots on tires, do not turn steering wheel more than five times without rolling vehicle to change tire-to-floor contact area.</u>

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 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, which may also be faulty.

COMPONENT REPLACEMENT AND REPAIRS

POWER STEERING GEAR

Removal

1. Disconnect hoses at gear. When hoses are disconnected, secure ends in raised position to prevent drainage of oil. Cap or tape the ends of the hoses to prevent entrance of dirt.
2. Install two plugs in gear fittings to prevent entrance of dirt.
3. Remove the flexible coupling to steering shaft flange bolts (C-K models) or the lower universal joint pinch bolt (P models). Mark the relationship of the universal yoke to the stub shaft.
4. Mark the relationship of the pitman arm to the pitman shaft. Remove the pitman shaft nut or pitman arm pinch bolt and then remove the pitman arm from the pitman shaft using Puller J-6632 (fig. 1).
5. Remove the steering gear to frame bolts and remove the gear assembly.
6. C-K Models — Remove the flexible coupling pinch bolt and remove the coupling from the steering gear stub shaft.

Installation

CAUTION: All steering gear to frame, pitman arm to pitman shaft and steering coupling fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. C-K Models
   a. Install the flexible coupling onto the steering gear stub shaft, aligning the flat in the coupling with the flat on the shaft. Push the coupling onto the shaft until the stub shaft bottoms on the coupling reinforcement. Install the pinch bolt and torque to specifications.

   NOTE: The coupling bolt must pass through the shaft undercut.

   b. Place the steering gear in position, guiding the coupling bolt into the steering shaft flange.
   c. Install the steering gear to frame bolts and torque to specifications.
   d. If flexible coupling alignment pin plastic spacers were used, make sure they are bottomed on the pins, tighten the flange bolt nuts to specifications and then remove the plastic spacers (fig. 10).
   e. If flexible coupling alignment pin plastic spacers were not used, center the pins in the slots in the steering shaft flange and then install and torque the flange bolt nuts to specifications.
2. P Models
   a. Place the steering gear in position, guiding the stub shaft into the universal joint assembly and lining up the marks made at removal.

   NOTE: If a new gear was installed, line up the mark on the stub shaft with the slit in the universal yoke.

   b. Install the steering gear to frame bolts and torque to specifications.
   c. Install the universal joint pinch bolt and torque to specification.

   NOTE: The pinch bolt must pass through the shaft undercut.
3. Install the pitman arm onto the pitman shaft, lining up the marks made at removal. Install the pitman shaft nut or pitman arm pinch bolt and torque to specifications.
4. Remove the plugs and caps from the steering gear and hoses and connect the hoses to the gear. Tighten the hose fittings to specified torque.

POWER STEERING PUMP

Removal (Fig. 43)

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.
   C10-20-30 Models with 400 V-8 Engine — Disconnect reservoir hose at pump and secure in raised position. Cap hose pump fittings.
2. Install two caps at pump fittings to prevent drainage of oil from pump.
3. Loosen bracket-to-pump mounting nuts.
4. Remove pump belt.
5. Remove bracket-to-pump bolts and remove pump from vehicle.
6. Remove drive pulley attaching nut.
7. Remove pulley from shaft. Do not hammer pulley off shaft as this will damage pump. Use Tool J-21239-1 for pulling stamped pulleys or Tool J-8433-1 with Adapter J-8433-2 for cast pulleys.

Installation

1. Install pump pulley.

   CAUTION: Do not hammer on pump shaft. Use pulley nut to pull pulley onto shaft.
2. Position pump assembly on vehicle and install attaching parts loosely.
3. Connect and tighten hose fittings.
4. Fill reservoir. Bleed pump by turning pulley backward (counter-clockwise as viewed from front) until air bubbles cease to appear.
5. Install pump belt over pulley.
6. Tension belt as outlined under "Pump Belt Tension—Adjustment" in this section.
7. Bleed as outlined under "Maintenance and Adjustments."

POWER STEERING HOSES

When servicing power steering hoses, avoid twisting the hoses unnecessarily. Install hoses with the wheels in the straight ahead position, then turn the wheels to the right and left, while observing movement of the hoses.

Note and correct any hose contact with other parts of the vehicle that could cause chafing or wear.

Any maintenance operation, on the power steering equipment, should include a thorough inspection of the hydraulic line system.

Figure 44 illustrates typical installations.

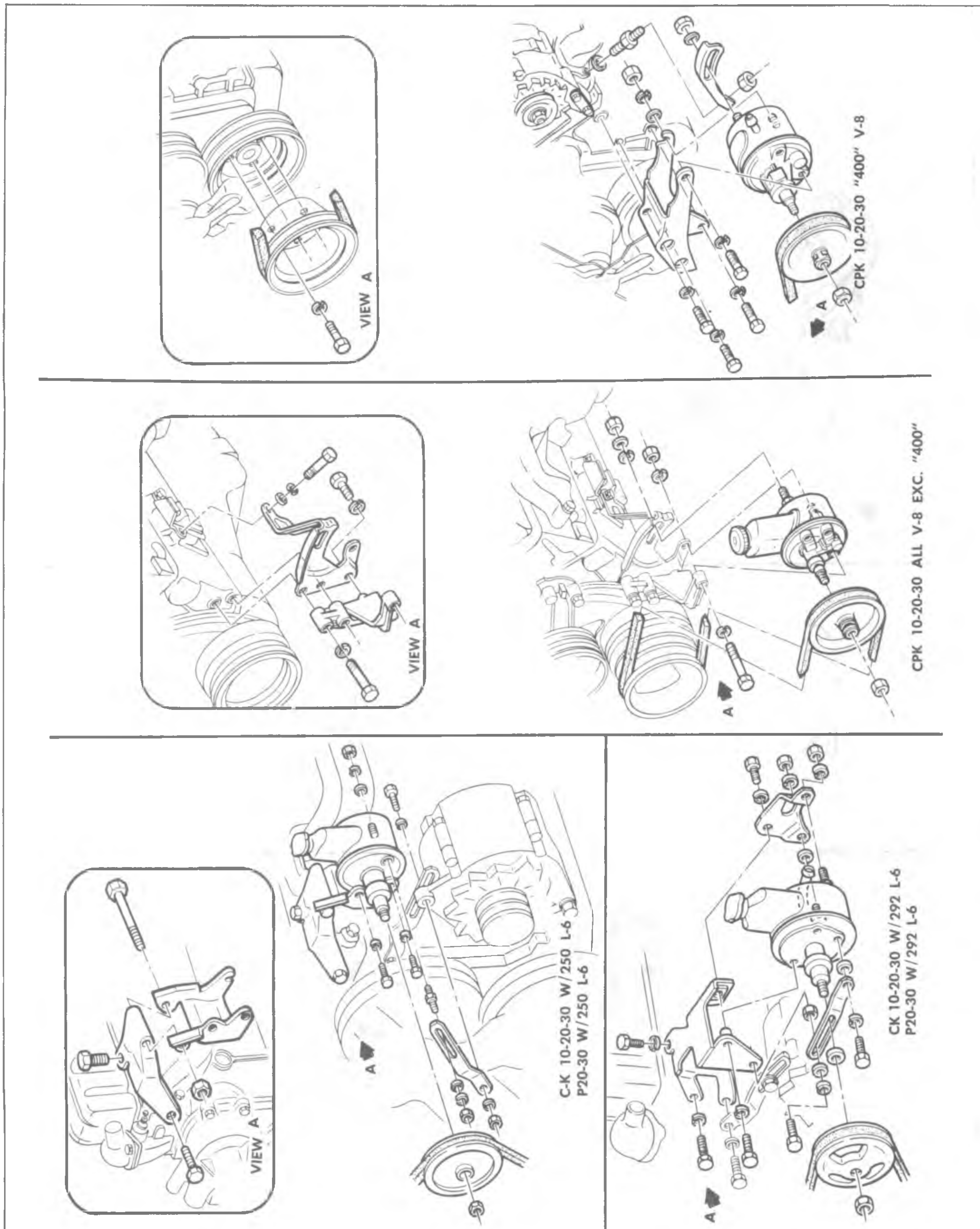


Fig. 43—Power Steering Pump Mounting

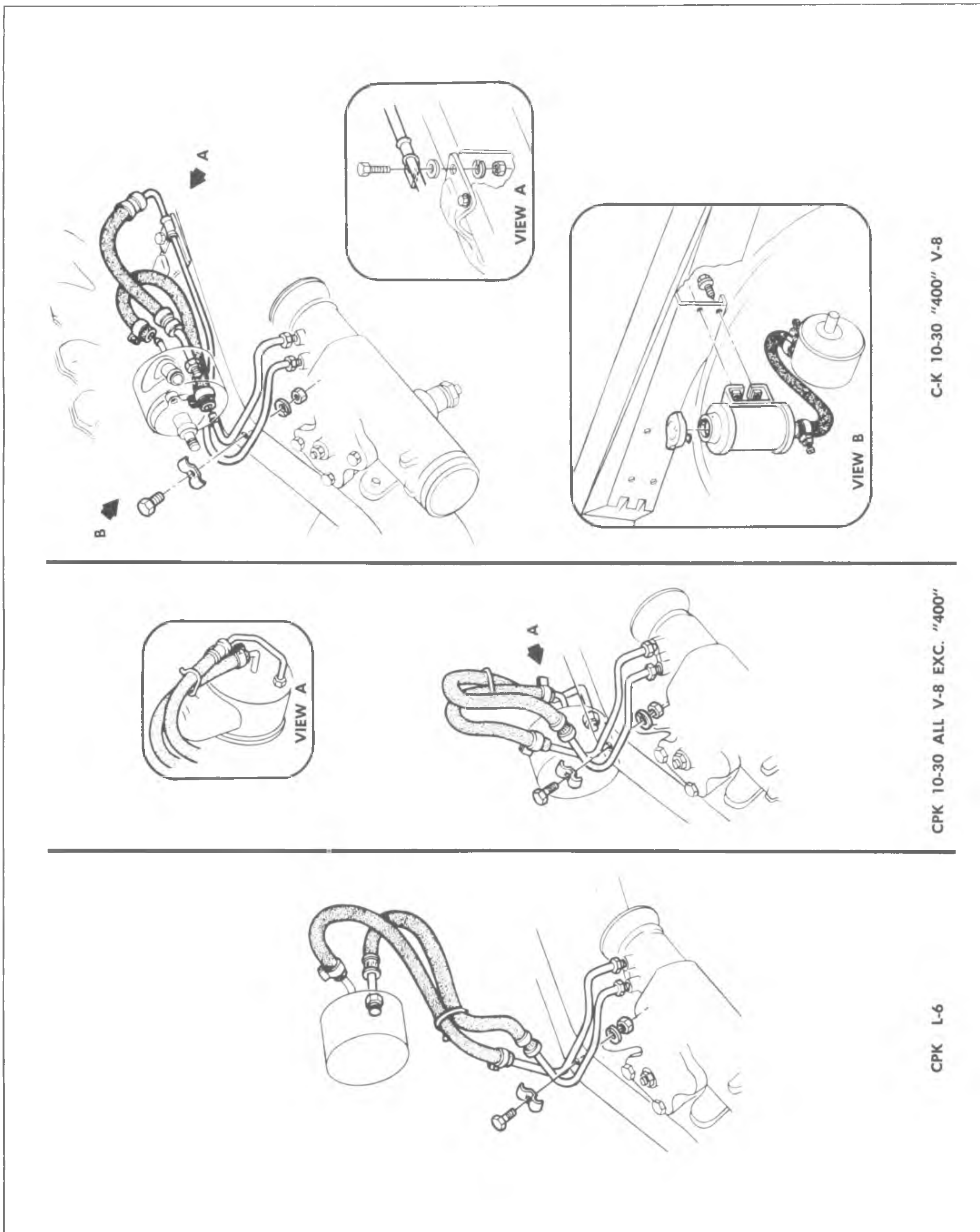
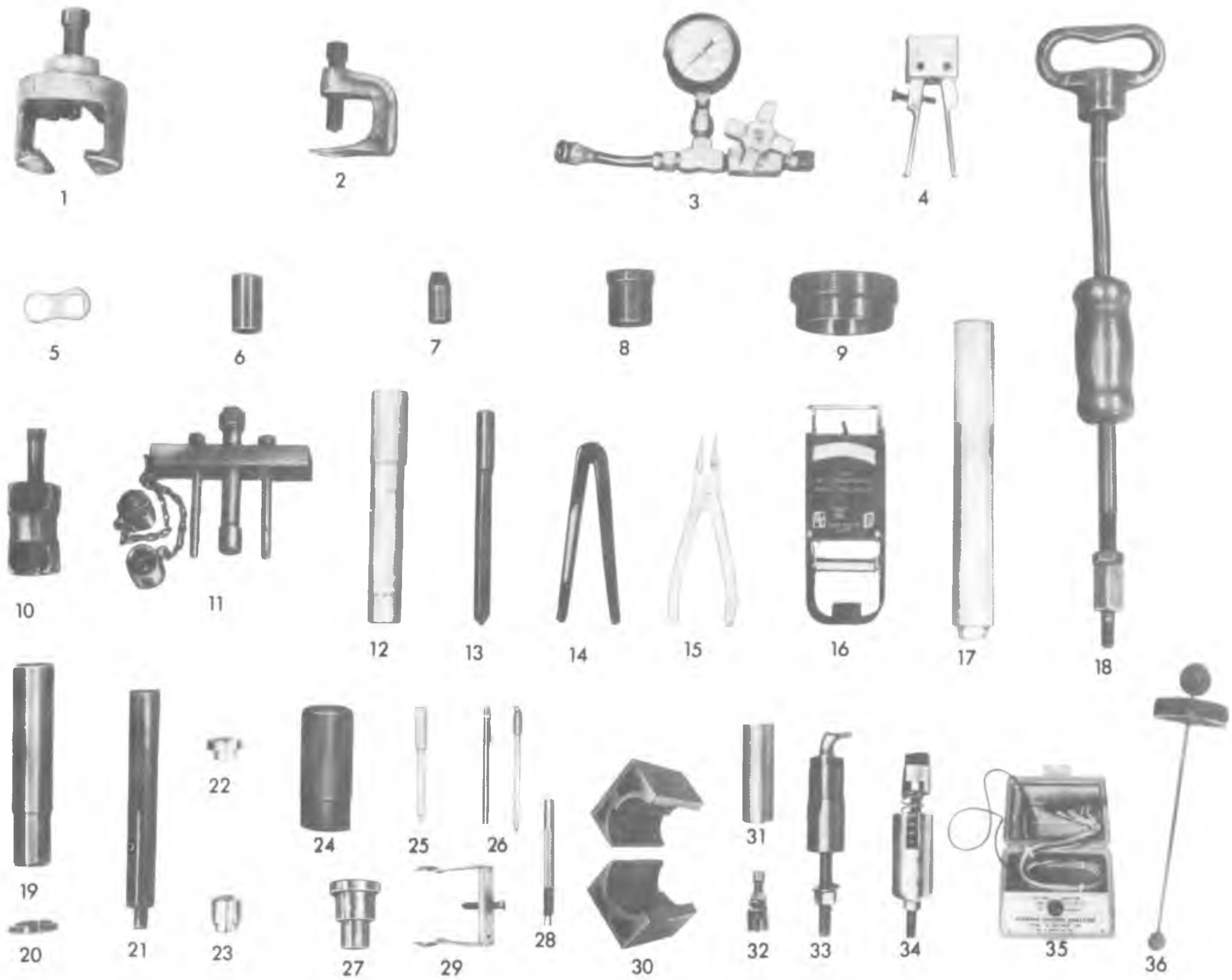


Fig. 44—Power Steering Hose Routing — Typical

SPECIAL TOOLS



1. J-6632 Pitman Arm Puller
2. J-5504 Pitman Arm Puller
3. J-5176 Pressure Gauge
4. J-5822 Wormshaft Bearing Cup Puller
5. J-5860 Torque Wrench Adapter
6. J-22670 Pump Shaft Seal Installer
7. J-6222 Shaft Seal Protector
8. J-9226 Pitman Shaft Bushing Replacer
9. J-7576 Rack-Piston Seal Compressor
10. J-21239 Pump Pulley Remover
11. J-2927 Steering Wheel Puller
12. J-1614 Sector Shaft Bushing Remover
13. J-7539 Ball Retainer
14. J-7624 Spanner Wrench
15. J-4245 #23 Internal Pliers
16. J-23600 Belt Tension Gauge
17. J-5755 Wormshaft Bearing Cup Installer
18. J-2619 Slide Hammer
19. J-6278 Pitman Shaft Bearing Remover
20. J-6278-2 Pitman Shaft Bearing Installer
21. J-7079-2 Drive Handle
22. J-8524-1 Adjuster Plug Bearing Installer
23. J-8524-2 Adjuster Plug Bearing Remover
24. J-6219 Pitman Shaft Seal Installer
25. J-6217 Connector Seat Installer
26. J-5421 Thermometer
27. J-22407 Pitman Shaft Bearing Installer
28. J-22727 Terminal Remover
29. J-22708 Turn Signal Cover Remover
30. J-22573 Steering Column Holding Fixture
31. J-22599 Lock Nut Socket
32. J-21854 Pivot Pin Remover
33. J-22551 Shift Tube Remover
34. J-22549 Shift Tube Installer
35. J-23980 Steering Column Electrical Analyzer
36. ---- Torque Wrenches

Fig. 45—Special Tools

SECTION 10

WHEELS AND TIRES

INDEX

GENERAL DESCRIPTION

The 1972 truck is equipped with a wide range of tube or tubeless type tires and wheels selected according to the truck GVW rating and type of service. The dual rear wheel option is available on Series 30 trucks.

The factory installed tires on Chevrolet trucks are selected to provide the best all around tire performance for all normal operation.

Only those tires of the size shown on the "Load Capacity Chart" in the General Information section of this manual are recommended for use on Chevrolet vehicles. Use of any other size of tire may seriously affect ride, handling, ground clearance, tire clearance, and speedometer calibration. To achieve best all around vehicle handling performance, belted tires and bias ply tires should not be mixed on the same truck. Because of possible adverse effects on vehicle handling, do not mix radial ply tires with other type tires on the same vehicle.

NOTE: On four-wheel drive vehicles all tires must be of equal size and of same tread configuration.

TUBELESS TIRES

These tires have an inner liner which, if punctured, tends to cling to the penetrating object forming a partial seal until the object is removed from the tire. It is essential to conduct a periodic pressure check according to the tire inflation tables on the following pages plus a visual tire inspection to detect imbedded objects which might otherwise go unnoticed and cause serious casing damage.

TUBE TIRES

Some commercial vehicles are equipped (at customer option) with synthetic rubber tires and tubes.

TIRE TRACTION

A decrease in driving, cornering, and braking traction occurs when water, snow, ice, gravel, or other material is on the road surface. Driving practices and truck speed should be adjusted to the road conditions.

When driving on wet or slushy roads, it is possible for a wedge of water to build up between the tire and road surface. This phenomenon, known as hydroplaning, may cause partial or complete loss of traction, which adversely affects vehicle control and stopping ability. To reduce the possibility of traction loss, the following precautions should be observed.

1. Slow down during rainstorms or when roads are slushy.
2. Slow down if road has standing water or puddles.
3. Replace tires when tread depth becomes 1/16".
4. Keep tires properly inflated.

Puncture Inspection and Repair

At each lubrication, tires should be checked for foreign objects in the tread or breaks in the tread or sidewall. If tire is punctured or otherwise damaged, it should be repaired using one of several repair kits available through tire manufacturers' outlets.

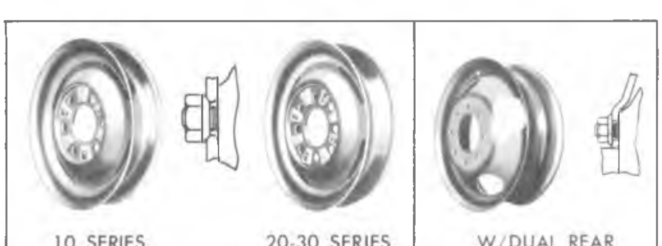


Fig. 1—Front Wheels and Attachments

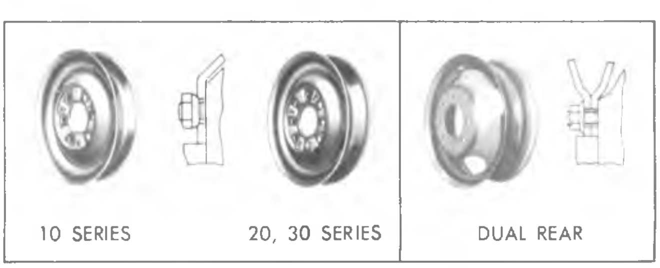


Fig. 2—Rear Wheels and Attachments

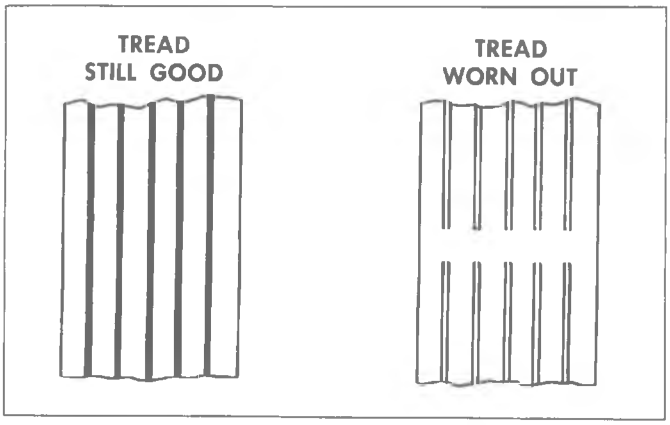


Fig. 3—Passenger Type Tire Tread Wear

Tread Wear

When the depth of tread becomes 1/16-inch or less, there is a significant decrease in traction and anti-skid properties, also, the majority of tire troubles will occur in the last 10% of tire life.

The original equipment passenger type tires on Series 10 trucks incorporate built in tread indicators to assist in judging when tires are worn out and should be replaced.

These indicators are molded into the bottom of the tread groove and will appear as bands across the tread as a visual reminder that the tire should be replaced (see fig. 3).

MAINTENANCE

WHEEL NUT TORQUES

On a new vehicle or after the wheel has been changed, the wheel nut torque must be checked at 100, 1,000 and 6,000 miles and every 6,000 miles thereafter.

TIRE ROTATION

The rotation of truck tires will minimize tire trouble and produce longer tire life. With rotation, accelerated and irregular tire wear on any one particular tire will be spread out over the entire set, and replacement frequency will be reduced. Tire wear may also contribute to such trouble as poor handling and shimmy.

No definite tire rotation formula is applicable to all trucks because of the wide range of usage. However, certain fundamentals, mixed with experience and observation, will assist the trucker in reducing tire costs.

A rotation sequence that moves the front tires to the rear is a general recommendation. Due to different loading conditions on the wheels, new tires which are broken in on the front wheels usually produce the greatest overall tire life.

The outer tire on a dual wheel will skid or drag on a turn because of the difference in the turning radii of the inner and outer tires. This results in faster wear of the outer tire. In general, the tire with the largest diameter or least wear should be at the outside of each dual wheel. In addition, certain truckers have found when trucks are operated continuously on high crown roads an increase in air pressure of from 5 to 10 pounds in the outside tire of each dual produces maximum tire life.

To equalize wear it is recommended that the tires be rotated every 6,000 miles. Upon rotation, tire pressure must be adjusted (front and rear) in accordance with the recommendations for inflation pressure.

Inflation Pressure

Standard inflation pressures for tires are listed in the "Load Capacity Chart" in Section 0 of this manual. These are the minimum required tire pressures and tire sizes for maximum permissible loads. Minimum tire pressures for tires other than those listed in the "Load Capacity Chart" can be determined from the "Tire Load and Inflation Pressure Chart" on the following page, using the weights shown on the vehicle GVW plate.

The use of improper tire inflation pressures can affect tire life and load carrying capacity, and may affect vehicle handling. Inflation pressures should be checked at least once a month (and preferably more often) to insure that the right amount of air is contained in the tires. With regard to tire life, too little air pressure allows abnormal deflection of the tire causing excessive operating temperatures, while too much air pressure prevents normal deflection, making the cord body more vulnerable to road impacts.

Use of optional inflations is allowable only with a reduced load as shown in the "Tire Load and Inflation Pressure Chart."

When operating at loads greater than the optional reduced load, the inflation pressure must be increased to the standard inflation for full rated loads.

TIRE LOAD AND INFLATION PRESSURE
TIRES FOR LIGHT TRUCKS USED IN HIGHWAY SERVICE

TIRES USED AS SINGLES

Tire Size	Load Range	Ply Rating	Tire Load Limits at Various Inflation Pressures									
			30	35	40	45	50	55	60	65	70	75
TUBE TYPE TIRES MOUNTED ON 5° TAPERED BEAD SEAT RIMS												
6.50-16	C	6	1270	1390	1500	1610						
7.00-16	C	6	1430	1560	1680	1800						
7.00-16	D	8	1430	1560	1680	1800	1910	2030	2130			
7.00-18	D	8	—	—	—	—	1950	2090	2220	2350	2470	2590
7.50-16	C	6	1620	1770	1930	2060						
7.50-16	D	8	1620	1770	1930	2060	2190	2310	2440			
7.50-16	E	10	1620	1770	1930	2060	2190	2310	2410	2560	2670	2780
TUBELESS TIRES MOUNTED ON 15° TAPERED BEAD SEAT DROP CENTER RIMS												
8-19.5	D	8	—	—	—	—	2110	2270	2410	2540	2680	2800
8-19.5	E	10	—	—	—	—	2110	2270	2410	2540	2680	2800*

*With 6" Rims—2930 at 80 3060 at 85 3170 at 90.

TIRES USED AS DUALS

Tire Size	Load Range	Ply Rating	Tire Load Limits at Various Inflation Pressures									
			30	35	40	45	50	55	60	65	70	75
TUBE TYPE TIRES MOUNTED ON 5° TAPERED BEAD SEAT RIMS												
6.50-16	C	6	1120	1225	1320	1420						
7.00-16	C	6	1260	1365	1475	1580						
7.00-16	D	8	1260	1365	1475	1580	1685	1780	1870			
7.00-18	D	8	—	—	1710	1830	1950	2060	2170	2270		
7.50-16	C	6	1430	1565	1690	1815						
7.50-16	D	8	1430	1565	1690	1815	1930	2040	2140			
7.50-16	E	10	1430	1565	1690	1815	1930	2040	2140	2245	2345	2440
TUBELESS TIRES MOUNTED ON 15° TAPERED BEAD SEAT DROP CENTER RIMS												
8-19.5	D	8	—	—	1850	1990	2110	2230	2350	2460		
8-19.5	E	10	—	—	1850	1990	2110	2230	2350	2460	2570	2680(#)

(#) 2780 lbs. at 80 lbs. pressure.

WIDE BASE TUBELESS TIRES USED AS SINGLES

Tire Size	Load Range	Ply Rating	Tire Load Limits at Various Inflation Pressures									
			30	35	40	45	50	55	60	65	70	75
8.00-16.5	C	6	1360	1490	1610	1730						
8.00-16.5	D	8	1360	1490	1610	1730	1840	1945	2045			
8.75-16.5	C	6	1570	1720	1850	1990						
8.75-16.5	D	8	1570	1720	1850	1990	2110	2240	2350			
9.50-16.5	C	6	1860	2030	2190	2350						
9.50-16.5	D	8	1860	2030	2190	2350	2500	2650	2780			
9.50-16.5	E	10	1860	2030	2190	2350	2500	2650	2780	3010	3140	3270
10-16.5	C	6	1840	2010	2170	2330						

WIDE BASE TUBELESS TIRES USED AS DUALS

Tire Size	Load Range	Ply Rating	Tire Load Limits at Various Inflation Pressures									
			30	35	40	45	50	55	60	65	70	75
8.00-16.5	C	6	1195	1310	1415	1520						
8.00-16.5	D	8	1195	1310	1415	1520	1620	1710	1800			
8.75-16.5	C	6	1380	1515	1630	1750						
8.75-16.5	D	8	1380	1515	1630	1750	1855	1970	2070			
8.75-16.5	E	10	1380	1515	1630	1750	1855	1970	2070	2175	2260	2360

Tire Load and Inflation Pressure Notes

1. Tire inflation pressure may increase as much as 6 pounds per square inch (psi) when hot.
2. For continuous high speed operation, (over 75 mph) with passenger car type tires increase tire inflation pressure 4 pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cold for load range B tires, or 36 pounds per square inch cold for load range C tires. Sustained speeds above 75 mph are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximum stated above.
3. For sustained high speed driving over 65 MPH, with truck type tires cold inflation pressures must be increased 10 PSI. For special operating conditions... such as campers or other high center of gravity loading vehicles... cold inflation pressures may be increased up to 10 PSI. The total increase in cold inflation pressures shall not exceed 10 PSI above those specified in the above table for the load being carried.
4. Cold tire inflation pressure: after vehicle has been inoperative for 3 hours or more, or driven less than 1 mile. Hot tire inflation pressure: after vehicle has been driven 10 miles or at speeds of more than 60 miles per hour.
5. Loads should be distributed as evenly as possible in the cargo area.
6. Vehicles with luggage racks do not have a vehicle load limit greater than specified.
7. When towing trailers, the additional load on the axle induced by the trailer tongue load must not cause the axle load to exceed the limits stamped on the GVW plate. Tire inflation pressures must be adjusted accordingly.
8. Maximum load must not exceed the maximum tire load limit as indicated by the underscoring in the table. Minimum recommended cold inflation pressures for various loads must conform to the table.

SERVICE OPERATIONS

CAUTION: Servicing of tires mounted on multi-piece rims requires proper tools, safety equipment and specialized training. Severe injuries can result from improper servicing techniques. It is recommended that tires on multi-piece rims be serviced only by competent personnel with proper equipment or by competent truck tire repair shops.

CORRECTING IRREGULAR TIRE WEAR

Heel and Toe Wear--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 to cautioning the owner on his driving habits, is to interchange tires regularly.

Side Wear--This may be caused by incorrect wheel camber, underinflation, high cambered roads or by 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. Camber wear requires correction of the camber first and then interchanging tires.

There is, of course, no correction for high cambered roads. Cornering wear is discussed further on.

Misalignment Wear--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; 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. The remedy is readjusting toe-in, or rechecking the entire front end alignment if necessary.

Uneven Wear--Uneven or spotty wear is due to such irregularities as unequal caster or camber, bent front suspension parts, out-of-balance wheels, brake drums out of round, brakes out of adjustment or other mechanical conditions. The remedy in each case consists of locating the mechanical defect and correcting it.

Cornering Wear--When a truck makes an extremely fast turn, the weight is shifted from an even loading on all 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 the 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 overload 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 operators. Driving more slowly on curves and turns will avoid grinding rubber off tires. To offset normal cornering wear as much as possible, tires should be interchanged at regular intervals.

Wheel and Tire Balancing

It is desirable from the standpoints of tire wear and vehicle handling ease to maintain proper balance of front wheel and tire assemblies on all models. All wheels intended for use on front of vehicle, such as those switched during periodic tire rotation and those installed as new or repaired replacement equipment should be accurately balanced. This may be accomplished by either of the two types of balancing systems in current use which balance wheels either on the vehicle or off. The "on the vehicle" type, however, is the more desirable in that all rolling components (brake drums, bearings, seals, etc.) are included in the balancing procedure and thereby have any existing unbalance corrected.

Truck Wheel Balance Weights

All 1972 truck wheels equipped with a tubular side ring (rolled flange rim) on the outboard side of the wheel rims require special design weights to fit. Dynamic balancing can be accomplished through use of these special balance weights which are designed only for installations on the outboard side of these wheels. Conventional weights fit only the inboard side of these wheels.

Static Balance

Static balance (sometimes called still balance) is the equal distribution of weight of the wheel and tire assembly about the axis of rotation in such a manner that the assembly has no tendency to rotate by itself, regardless of its position. For example: A wheel with a chunk of dirt on the rim will always rotate by itself until the heavy side is at the bottom. Any wheel with a heavy side like this is statically out of balance. Static unbalance of a wheel causes a hopping or pounding action (up and down) which frequently leads to wheel "flutter" and quite often to wheel "tramp."

Dynamic Balance

Dynamic balance (sometimes called running balance) means that the wheel must be in static balance, and also run smoothly at all speeds.

To insure successful, accurate balancing, the following precautions must be observed:

- Wheel and tire must be clean and free from all foreign matter.
- The tires should be in good condition and properly mounted with the balance mark on the tire, if any, lined up with the valve.
- Bent wheels that have runout over 1/16" should either be replaced or straightened before being balanced.
- Inspect tire and wheel assembly to determine if an eccentric or out-of-round condition exists. Note that this condition, if severe, cannot be "balanced out." An assembly which has an out-of-round condition exceeding 3/16" on tire sizes through 19.5" is not suitable for use on the front of the vehicle. Its use on the rear should be governed by its general condition and whether the roundness defect seriously detracts from overall ride quality.
- When balancing wheels and tires, it is recommended that the instructions covering the operation of the wheel balancer being used be closely followed.

WHEEL REMOVAL AND INSTALLATION

Jacking Instructions

The chart will assist in performing wheel and tire changes using vehicle jacks supplied with or recommended for use on Chevrolet Trucks.

Model	Jacking Point on Vehicle	
	Front	Rear
CP10, 20, 30	Lower Control Arm Pivot	Axle Housing
K10-20	Under Front Axle Near Spring Seat	Axle Housing

Dual and Single Wheels

When installing the tire and wheel on the vehicle, the following procedure should be followed:

After wheel nuts are put on loosely, turn the wheel until one nut is at the top of the bolt circle; tighten the nut just snug. Snug up the remaining nuts criss-cross to minimize runout, then tighten the nuts to the recommended torque alternately and evenly to avoid excessive runout.

Lateral runout should not exceed 1/8" on front wheel or 3/16" on rear wheel.

Matching Side and Lock Rings

Side and lock rings of different rim types are not interchangeable. Some may appear to be, but they do not fit properly on the rim base. Serious accidents have resulted from the use of mismatched rings. Rim base and rings must be matched according to manufacturer, size and type. This information is stamped on each part.

Installing Synthetic Tubes

1. Before installing tube in tire, clean inside of casing thoroughly.
2. Insert tube in tire and inflate until it is nearly rounded out.
3. Inspect rim for rust scale and bent flanges--clean rust scale and straighten flanges where necessary.
4. Using a brush or cloth swab, apply a solution of neutral vegetable oil soap to the inside and outside of tire beads and also to the rim side of the tube. Do not allow soap solution to run down into tire.
5. When mounting tire and tube on a drop center rim, follow the standard procedure. Be sure tire is centered on rim so that beads are out of rim well before inflating. Do not allow tire to hang loosely on wheel while inflating.
6. Center valve and pull it firmly against the rim. Hold in this position and inflate until tire beads are firmly seated on rim against flanges.
7. Completely deflate tire by removing valve core.
8. Reinflate tire to recommended pressure.

CAUTION: When tube and flap are not properly lubricated and mounted, they will stretch thin in the tire bead and rim region. This will cause premature failure.

TUBELESS TIRES

Tubeless tires mounted on one piece full drop center rims are standard on some Chevrolet trucks. These tires have a safety inner liner which if punctured, tends to cling to the penetrating object forming a partial seal until the object is removed from the tire.

The mounting and demounting of tubeless truck tires will present no problem when a rubber lubricant, such as Ru-Glyde or equivalent is applied to tire beads and rim flanges. Ru-Glyde or equivalent in addition to materially assisting in mounting and demounting also prevents rusting at the tire sealing area and thus prevents tires from adhering to the wheel.

All tubeless tires used on Chevrolet trucks with the exception of the 6.50-16 size should be demounted and mounted as described in this section. The 6.50-16 size may be demounted using present tire machines or standard tire irons following the same procedure employed in servicing tube type tires.

CAUTION: A hammer, or tools with sharp edges, should never be used to demount or mount tubeless tires as damage to rim flange or tire sealing bead may result.

Inspection for Leaks

1. With wheel assembly removed from vehicle, inflate the tire to recommended operating pressure.
2. Check for leaks at rim bead by placing wheel and tire horizontal and allowing water to stand in groove between rim and tire. Check for large leads by lowering assembly into water tank or running water over tire.

Demounting (all except 6.50-16 tires)

1. Remove valve core to completely deflate tire. With tire lying flat on floor, loosen beads from rim seats by walking around on tire with heels at points close

Fig. 4—Inserting Tire Iron to Lift Bead

to rim. With wide side of rim down, apply tire lubricant to top bead. With stops toward rim, insert spoon ends of two tire irons about 10" apart. While standing on tire to hold bead in gutter, pull one tool toward center of rim (fig. 4).

2. Hold one iron in position with foot and pull second iron toward center of rim. Progressively work bead off rim, taking additional bites if necessary (fig. 5).
3. Stand assembly in vertical position. Lubricate second bead. At top of assembly insert straight end of tire iron between bead and back flange of rim at about a 45 degree angle (fig. 6).
4. Turn iron so that it is perpendicular to rim. Pry second bead off (fig. 7).

Mounting (all except 6.50-16 tires)

All tubeless tires except the 6.50-16 size will be mounted as follows:

Fig. 5—Lifting Bead Over Rim

Fig. 6—Inserting Tire Iron in Second Bead

1. Inspect rim to insure bead seats are clean and smooth. Then place rim on floor with wide side down and lubricate first bead of tire and upper bead seat of rim (fig. 8).
2. Push first bead into well of rim and onto rim as far as possible. Using straight end of tire iron and with stop resting on rim flange, work remaining section of first bead over rim (fig. 9).
3. Hold second bead in well by standing on tire. When necessary, push section of bead into rim well and anchor with vise-grip pliers by pinching pliers on rim flange. Using spoon end of tire iron with stop toward rim, work progressively around bead using small bites until bead slips over flange onto rim base. If necessary, insert second tire iron and lubricate last 6" of bead before completing mounting (fig. 10).
4. Check valve to be certain that hex nut at the valve base is tight. Inflate tire to recommended operating pressure. Check assembly for air leaks.

Fig. 7—Prying Second Bead from Rim

Fig. 8—Lubricating Tire Bead

Fig. 10—Working Second Bead onto Rim

Mounting (6.50-16 tires)

1. Use present tire machines or standard tire irons following the same procedure used in mounting tube type tires, however, extreme care must be exercised to prevent injury to the sealing bead when forcing tire over the rim. A slight application of rubber lubricant on the last 1/2" of each bead circle to be mounted will ease mounting.
2. With tire beads still unseated, rotate tire on wheel so that balance mark on tire lines up with the valve stem.
3. Start tire beads into the rim bead seats as follows:

If a tire mounting machine is being used, lift the tire high in the rim forcing the top tire bead against the top rim flange seating the top bead. The lower bead will be seated by the tire weight.

When a tire mounting machine is not being used, beads may be seated by holding the tire and wheel assembly in a vertical position and bouncing on the floor at various points about the tire circumference.

4. Install valve core and inflate tire with quick "shots" of air to firmly seat the sealing beads.
5. Insure that air pressure build-up during the bead seating process is not allowed to exceed 30 pounds pressure.
   If beads have not seated by the time pressure reaches 30 pounds, assembly should be deflated, re-positioned on rim, re-lubricated and re-inflated.

Fig. 9—Working Bead onto Rim

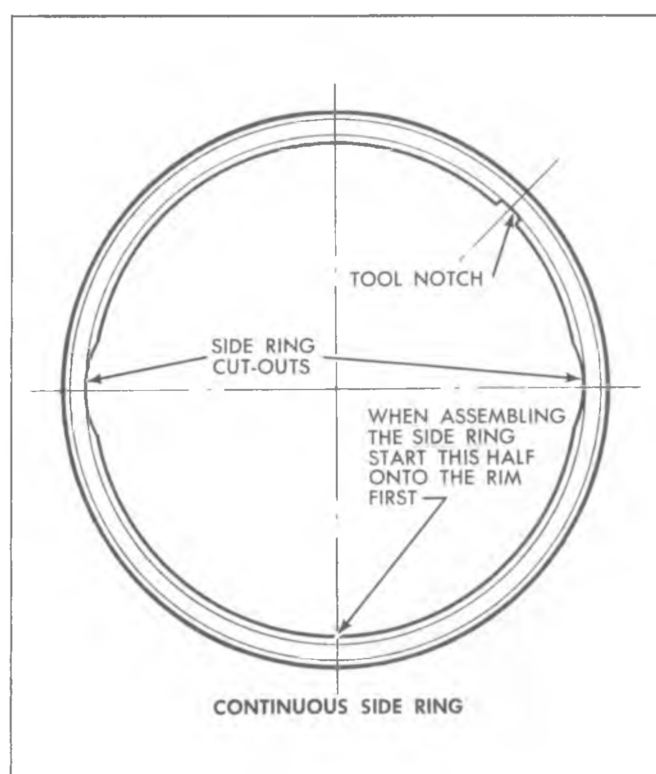


Fig. 11—RHP Continuous Side Ring

Fig. 12—Loosening First Bead

Fig. 13—Removing Ring

6. Check assembly for air leaks, then inflate tire to pressure recommended for vehicle operation.

   NOTE: If a seal cannot be effected in the foregoing manner with the rush of air, it can be accomplished by applying a mounting band or heavy sash cord to the circumference of the tire and then tightening with a tire iron.

RHP RIMS

The RHP rim uses a continuous side ring which has two cutouts directly opposite each other and a single tool notch located approximately 45 degrees from one cutout, (fig. 11). The cutouts enable the continuous side ring to be buttoned on to the rim base without deforming either the ring or rim.

RHP Rim—Tire Replacement

Safety Precautions

- Use only parts free from damage or heavy rust.
- Insure that side ring is completely seated before inflating tire.
- Inflate tire in safety cage or use clip-on type air chuck so that operator may stand aside during inflation.
- Insure that tire is completely deflated prior to removal of rings.

Demounting

1. First remove valve core to completely deflate tire.
2. Place tire and wheel on floor with side ring up.
3. To loosen first bead, drive hooked end of rim tool between tire and rim flange and press downward on bead (fig. 12). Progress around rim, using 2 tools, as shown.
4. The side ring is ready to demount if it is loose and turns easily in the rim gutter.
5. Locate the tool notch in the side ring and insert the rim tool or a long, husky screwdriver and pry up (fig. 13), making sure the opposite side of the ring is fitting into the rim gutter. Do not bend the ring.
6. Now a second tool can be inserted (see fig. 14) and used with the first to walk the tools in a counter-clockwise direction from the tool notch (work toward the cutout that is farthest from the tool notch).
7. When the tools reach the cutout the ring will usually spring off. If necessary, a light tap with the mallet will free the last half of the ring after it has been pried up so both cutouts are visible.
8. Force upper tire bead into well opposite the valve slot and with tire tool pry opposite portion of bead over edge of rim (fig. 15).
9. Turn tire over and by means of rim tools, loosen bead on opposite bead seat. This can be further aided by using foot pressure.
10. Make sure one portion of second bead is still in the rim well, then pry opposite portion of bead over edge of rim (fig. 16). This will free the tire from the rim.

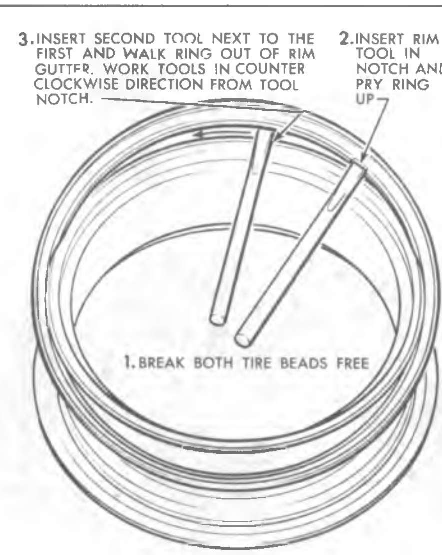


Fig. 14—Removal of Side Ring

Fig. 15—Prying Bead over Edge of Rim

Fig. 17—Mounting First Bead

Mounting

1. Place tire on rim so that valve is in line with valve hole and insert valve through valve hole.
2. Force first bead down into well of rim just to side of valve with foot.
3. Mount first bead over rim gutter with rim tool progressing from each side of foot to point approximately opposite foot (fig. 17).
4. To apply second bead, start at point opposite valve and press bead toe over rim gutter and into rim well with foot pressure (fig. 18).
5. Mount remainder of bead over rim gutter by means of thin tire tool, being careful not to pinch tube.
6. Place half of side ring in rim gutter and push until the ring is half on and the crescent shaped cutouts straddle the rim gutter per illustration (fig. 19).
7. Insert rim tool or large screwdriver in the tool notch and pull the ring on and down toward the rim gutter.
8. While pulling on the rim tool or screwdriver, hit the side ring a sharp blow with a mallet in the area between the tool notch and the nearest cutout. The second half of the ring will now be started over the rim gutter (fig. 20).
9. Remove the rim tool and continue the mallet blows starting at the tool notch and progress counterclockwise until the entire ring is in the rim gutter.
10. Check to make sure the side ring is properly assembled before inflating the tire. The ring will turn easily on the rim base after it is fully assembled.

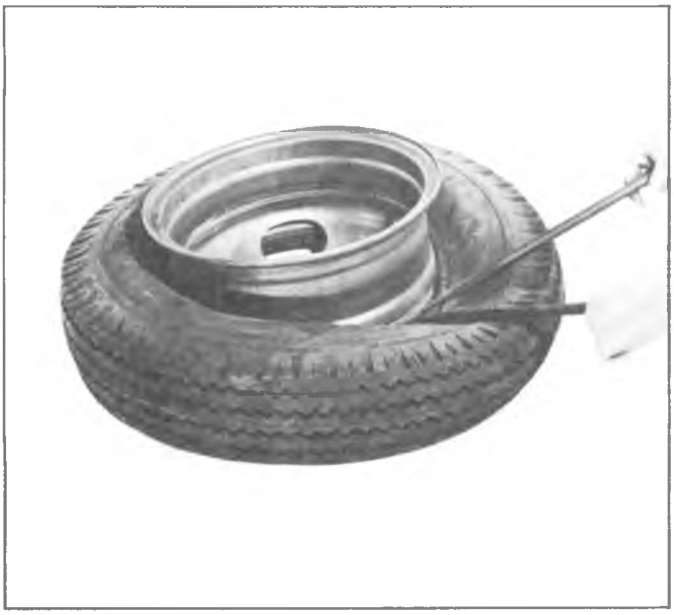
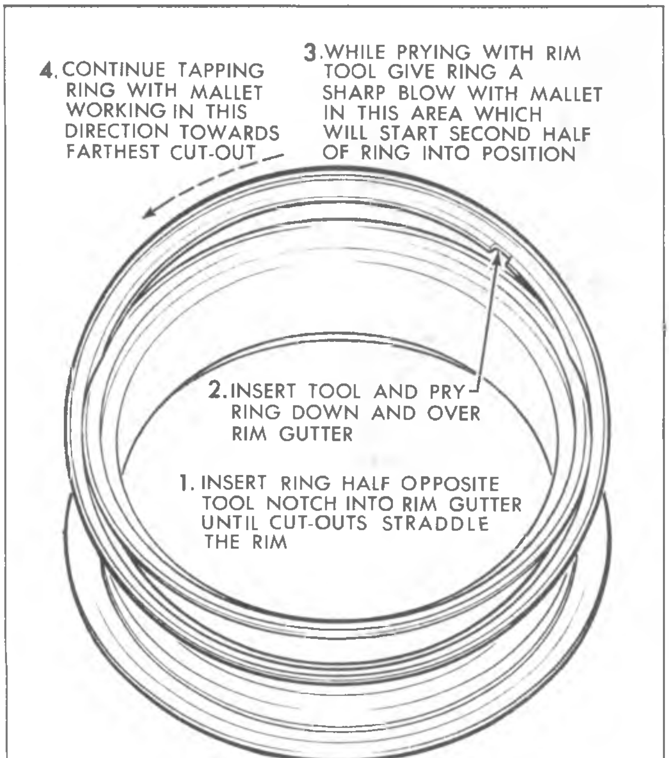


Fig. 16—Prying Second Bead From Rim

Fig. 18—Applying Second Bead



ASSEMBLING SIDE RING

Fig. 19—Assembling Side Ring

Fig. 20—Forcing Ring into Gutter

SECTION 11

CHASSIS SHEET METAL

10-30 SERIES TRUCK

INDEX

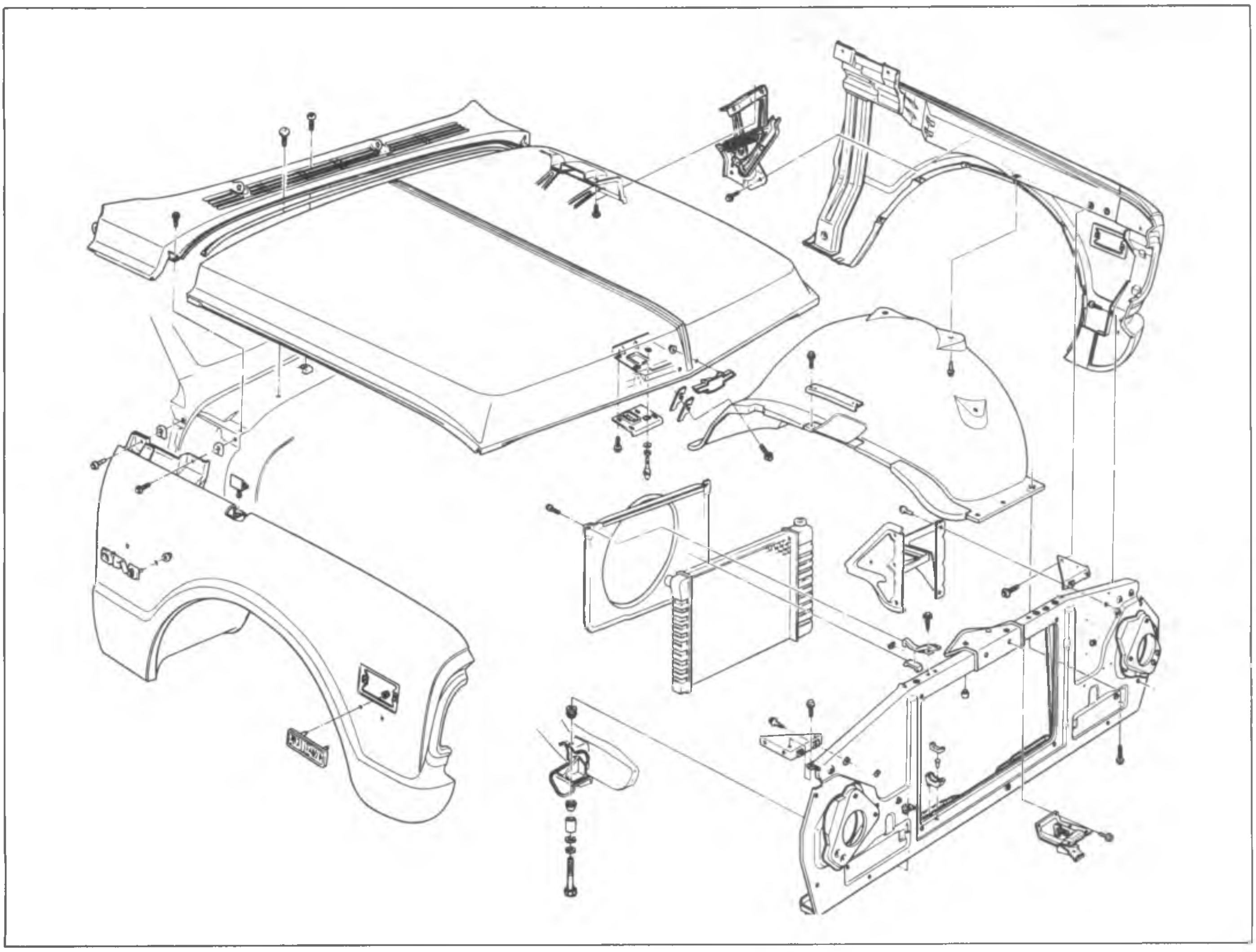


Fig. 1—Front End Sheet Metal—10-30 Series

SERVICE PROCEDURES

Fig. 2—Removing/Installing Hood Hinge Spring

HOOD ASSEMBLY

HOOD HINGE SPRING REPLACEMENT

NOTE: For Hinge Spring Replacement, a tool can be made to dimensions shown in Figure 12 for this purpose.

1. Raise and safely support the hood in full open position.
2. As shown in Figure 2, engage hooked end of tool to spring, then carefully pull forward to engage or disengage spring from hinge assembly.

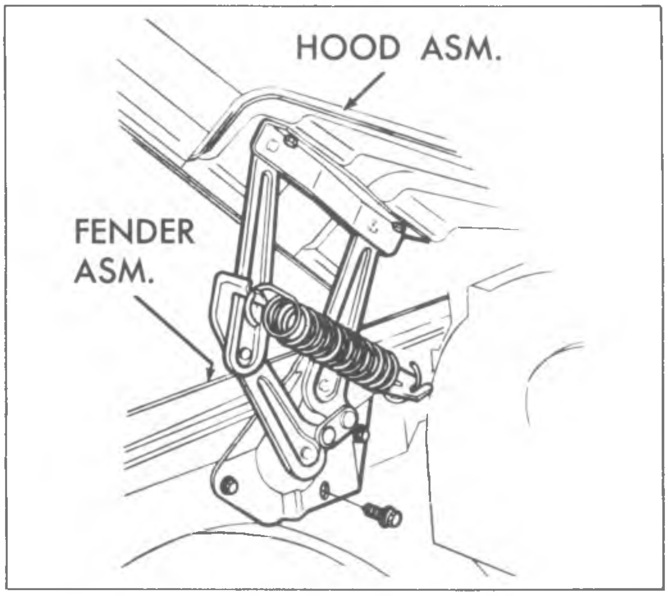


Fig. 3—Hood Hinge & Spring

OOD HINGE (FIG. 3)

Removal

1. Prop the hood in the extreme open position and place protective covering over the cowl and fenders.
2. Scribe position of hinge attachment on hood rear reinforcement and remove two bolts.
3. Remove hood hinge spring as explained in preceding write-up.
4. Scribe position of hinge attachment on fender assembly and remove bolts.
5. Remove hinge.

Installation

1. Install hinge assembly to fender and align within scribe marks. Install bolts.
2. Install hood hinge spring.
3. Install bolts and align hood. See Hood Alignment in this section.

HOOD LOCK ASSEMBLY

A bolt-type hood lock is used as shown in Figure 4. The lock bolt, located on the hood dovetails with the mounted striker plate, preventing upward or downward movement of the hood while the vehicle is in motion. Integral with the striker plate is the combination lock release lever and safety catch.

Replacement

1. Open hood and remove the four bolts holding the combination lock catch and lock bolt.

   NOTE: If original hood lock assembly is to be replaced, scribe a line around lock for alignment on installation.

2. Place hood lock assembly in position.
3. Adjust as outlined under Adjustments.

Adjustment (Fig. 6)

1. Open hood and adjust tightness of lock bolt support so that they are just "snug" enough to hold lock bolt in position.
2. Close hood in a normal manner.
3. Raise hood again; lock bolt assembly will have

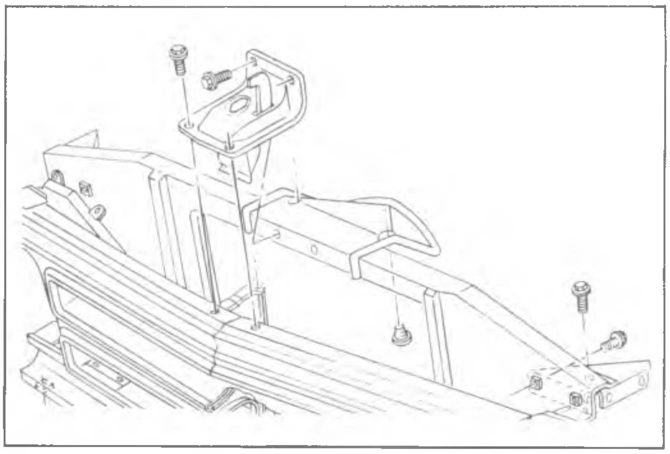


Fig. 4—Hood Striker and Safety Catch

shifted to operating position. Tighten bolts fully. Further adjustment may be made at lock bolt support, if necessary.

NOTE: This Hood Lock Catch Assembly to radiator support and grille support fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

4. Adjust lock bolt to obtain a secure hood closure and reasonable lock release effort.

NOTE: The Hood Lock Plate to hood fastener is also an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

HOOD ASSEMBLY

Removal

1. Lay a fender cover along cowl top to prevent hood from scratching cowl top.
2. Open hood and prop in full open position.

NOTE: If hood is to be reinstalled and present alignment is satisfactory, mark each hinge in relation to hood, to assure original alignment.

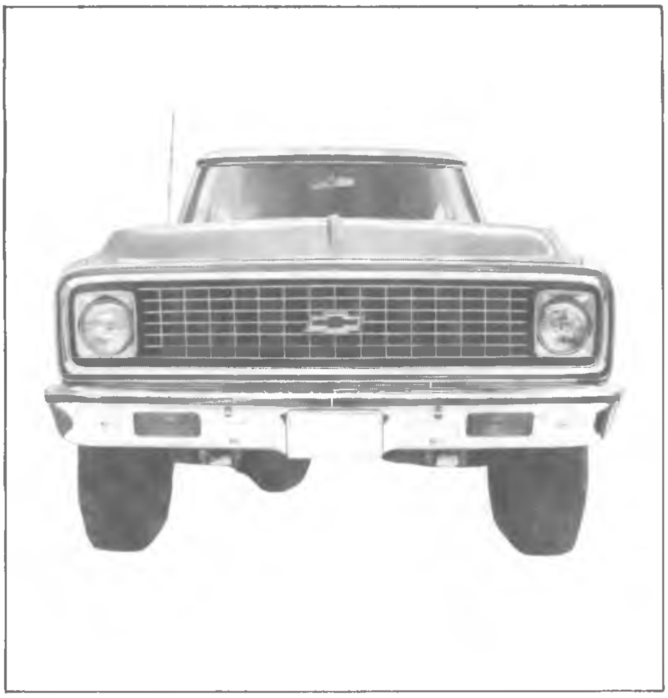


Fig. 5—10-30 Series—Typical

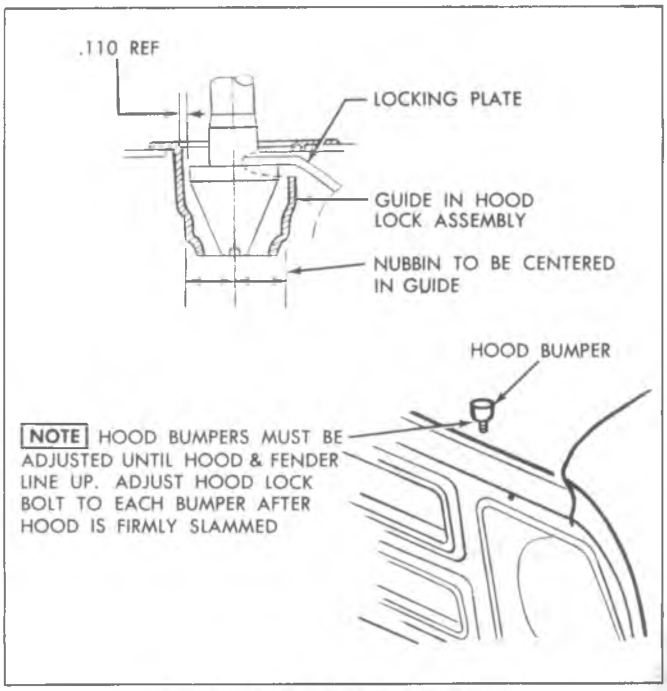


Fig. 6—Hood and Lock Adjustment

3. Remove two cap screws which attach each hinge to hood; then with a helper remove hood from vehicle.

Installation

1. If original hood is to be installed, position hood to hinges and install four cap screws snug which attach hinges to hood.

NOTE: If a new hood is to be installed, perform procedures as outlined under Alignment, directly below.

2. Shift hood on hinges to location marks made before removal of hood, then tighten attaching cap screws at hinges firmly. Close hood and check fit. If necessary to align hood perform procedure as outlined under "Alignment" which follows.

Alignment (Fig. 6)

1. Loosen hood hinge bolts. Note that rear most bolt hole in hinge is slotted to allow hood trailing edge to move up and down.
2. Adjust hood rear bumper so that hood and cowl surfaces are flush.
3. Perform hood lock adjustment as outlined in this section if necessary.

NOTE: Hood Lock Assembly to be adjusted fore and aft until nubbin (part of Hood Lock Bolt Support Assembly) enters center of elongated guide (Socket). Bending nubbin to accomplish this adjustment may seriously effect lock operation and safety catch engagement and is, therefore, NOT RECOMMENDED.

FRONT SHEET METAL ASSEMBLY

Removal of entire front sheet metal assembly including radiator is a relatively simple operation involving, basically, disassembly of mounts, disconnecting radiator hoses and removal of front bumper. Vehicles equipped with air conditioning and/or power steering will require special handling.

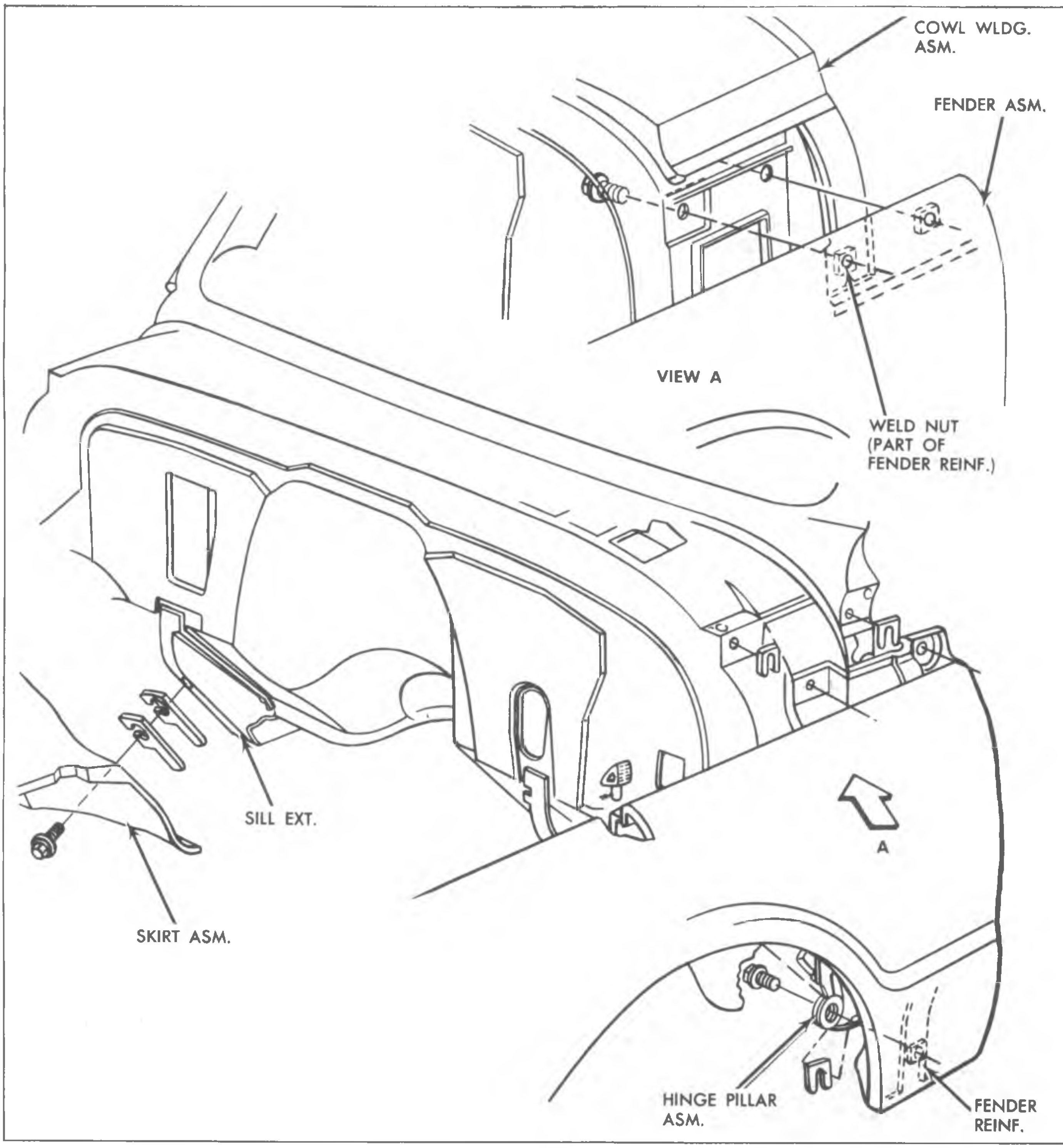


Fig. 7—Fender to Body Attachments

Refer to appropriate sections of this manual for instructions.

Shims which are found at various locations should be recorded to ease installation of sheet metal assembly. Proceed as follows:

10 THROUGH 30 SERIES (Except Step Vans)

Removal

1. Drain radiator and remove radiator hoses. Disconnect oil cooler lines if so equipped.
2. Disconnect wire connectors at the dash and toe panel and wire connector to horn and voltage regulator.
3. Disconnect battery and generator wires.
4. Remove reinforcement on left fender skirt at steering column.
5. Remove front bumper bolts and remove bumper.
6. Remove wiper arm assemblies and cowl grille.

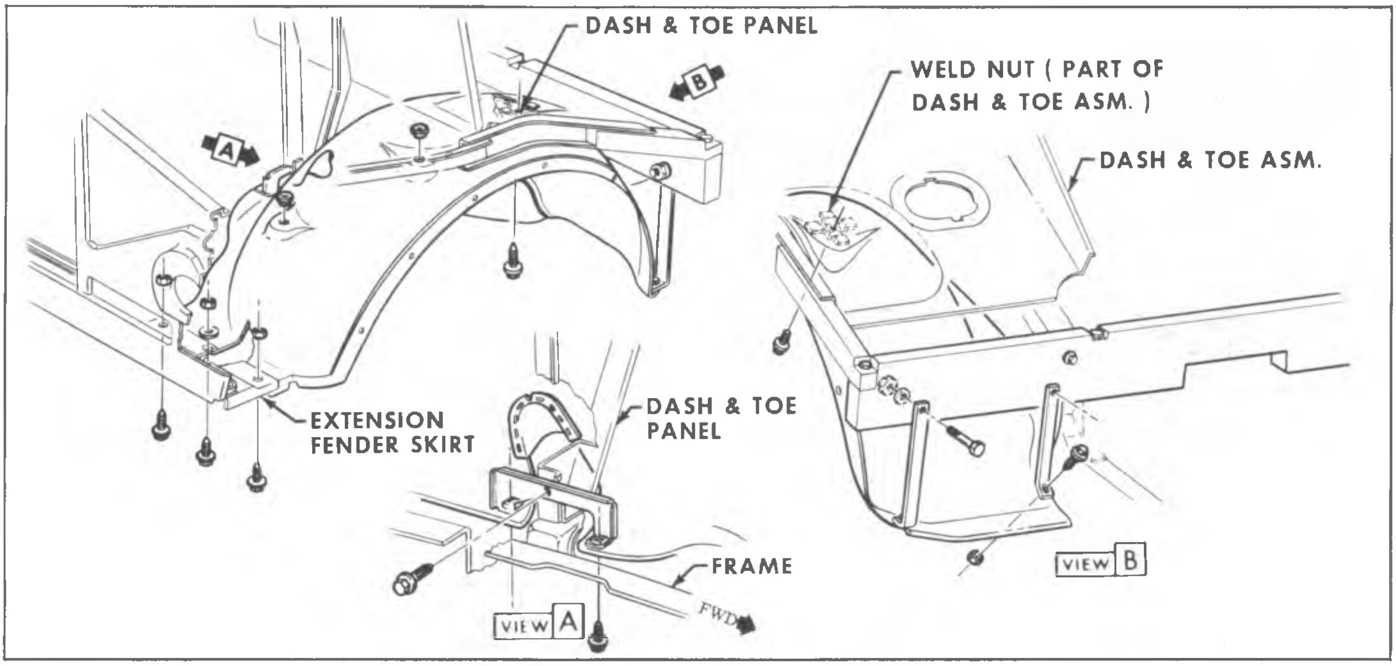


Fig. 8—Fender Skirt, Dash and Toe Pan—P20-30 Models

7. Remove bolts attaching fender upper edge to plenum and hinge pillar.
8. Remove fan shroud.
9. Working from underneath rear of fender, remove attachment from each fender at the hinge pillar.
10. Remove bolt from each radiator support mounting.
11. Remove bolts at each fender skirt to cab sill extension mounting.
12. With a helper, remove front sheet metal assembly, with radiator, battery, horn and voltage regulator attached.

Installation

1. With a helper place sheet metal assembly in position.

   NOTE: Install all bolts loosely to facilitate aligning after complete installation.

2. Install fender bolts at cowl.
3. Install combination bolt and flat washer assembly into each fender reinforcement while inserting shims required between fender reinforcement and body. (See Figure 9.)
4. Install two bolts and shims required at each fender rear lower edge to hinge pillar.
5. Install bolt in each fender skirt to sill extension.
6. Install bolts at steering column skirt reinforcement, final torque 25 ft. lbs.
7. a. Tighten each radiator support mounting bolt 33 ft. lbs.
   b. Torque bolts at fender to cowl 25 ft. lbs.
8. Install front bumper.
9. Connect wire connectors at dash and toe panel. Attach generator and regulator wires.
10. Connect upper and lower radiator hoses. Connect oil cooler lines to the radiator on models so equipped.
11. Install cowl grille and wiper arms.
12. Connect battery and fill radiator. Start engine and check for leaks.

RADIATOR SUPPORT

Removal

1. Remove hood as described in this section.
2. Drain radiator, saving coolant, loosen attachments and remove.
3. Remove right front fender as described in this section.
4. Disconnect battery and remove.
5. Remove battery tray, 1 bolt under skirt.
6. Remove wiring from radiator support.

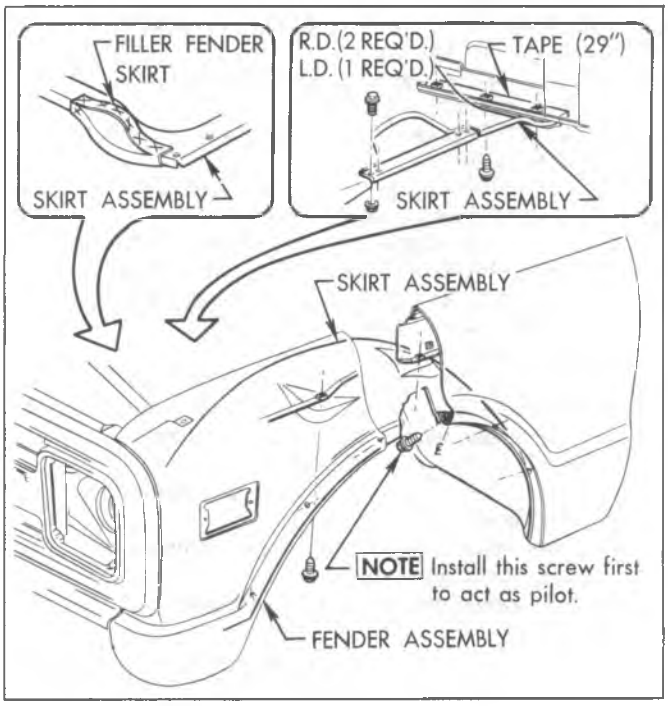


Fig. 9—Fender and Skirt Assembly—10-30 Series

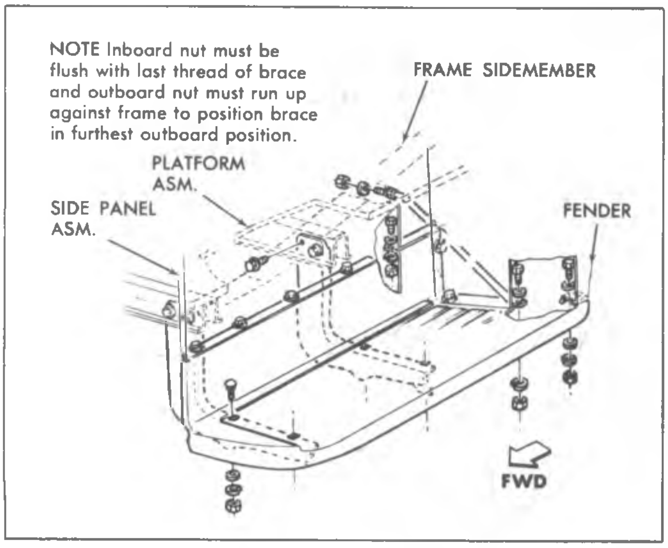


Fig. 10—Running Board—CA310-360 (04) Models

7. Disconnect fan shroud and lay back on engine.
8. Remove both head lamp assemblies. Complete.
9. Remove left fender gusset (5 screws).
10. Remove screws securing fender skirts to radiator support bottom.
11. Remove bolt securing center grille support to radiator support.
12. Remove bolts securing hood catch assembly to radiator support.
13. Remove radiator support bolts secured to frame--Note and record stackup.
14. Tilt radiator support rearward and lift up and off.

Installation

1. Rotate radiator support into position and loosely install attachments to frame.
2. Connect center grille support to radiator support.
3. Connect hood latch plate.
4. Connect left radiator support gusset to left fender.
5. Connect support to left fender.
6. Connect (3) screws from underside of left skirt to support bottom.
7. Place right fender in position and loosely install bolts and shims at fender top to cowl.
8. Attach grille upper to right fender bolts loosely.
9. Attach bolts from inside of grille lower to right fender lower (limited access between radiator support outer face and grille inner face).
10. Install radiator support to fender.
11. Using drift line up right fender skirt rearmost bottom screw with fender flange and attach loosely.
12. Attach right fender skirt inner top bolts to fender underside.
13. Install screw from underside of skirt to center of fender flange.
14. Tighten rearmost bottom screw of fender skirt previously installed loosely.
15. Install remainder of skirt to right fender screws snugly.
16. Tighten right fender skirt front 3 bolts from underside to radiator support.
17. Place battery tray in position and fasten to radiator support.
18. From beneath skirt fasten screw to battery tray bottom.
19. Install bolt and shim at bottom of front fender rear to hinge pillar loosely.
20. Tighten (6) grille filler panel screws previously attached to radiator support.
21. Install radiator, hoses and shroud.
22. Connect removed wiring to radiator support.
23. Install both head lamp assemblies.
24. Tighten all previously installed bolts and screws.

27. Install hood on previously marked outline.
28. Install and secure cowl grille.
25. Install battery and connect leads and wires.
26. Fill radiator with coolant as specified in Section 13.

FRONT FENDER

Removal

1. Remove windshield wiper arms, cowl grille and attaching screws.
2. Remove hood and hinge assembly.
3. Remove head lamp bezel, wiring and attachments from fender.
4. Remove screws attaching fender wheel opening flange to skirt.
5. Remove (2) skirt to fender bolts, located inboard on underside of skirt.
6. Remove two screws attaching gusset to fender.

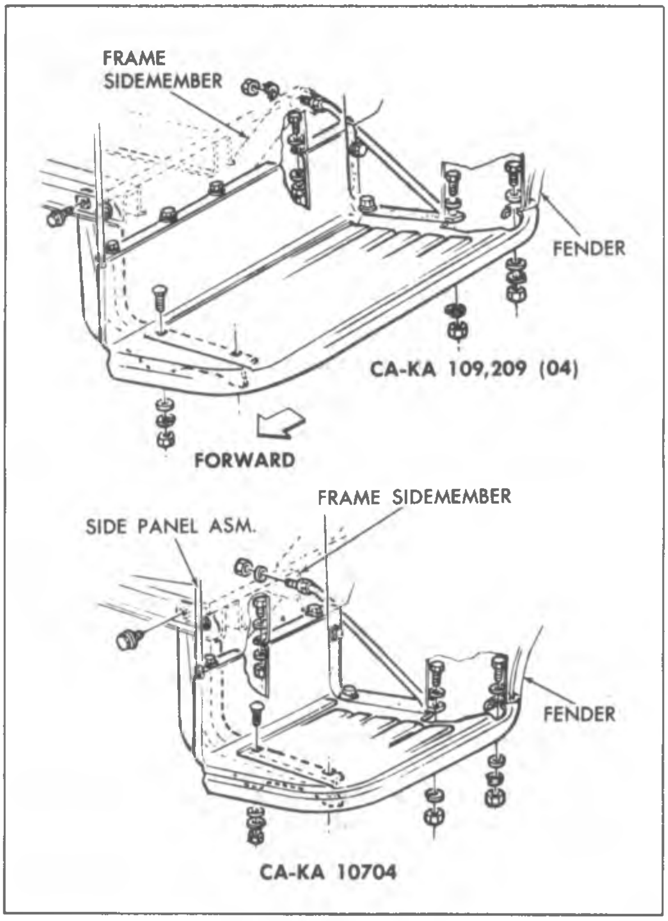


Fig. 11—Running Board and Braces

7. Remove two screws attaching radiator support to front fender.
8. Remove four bolts attaching radiator grille to fender.
9. Remove bolt and shim attaching trailing edge of fender to hinge pillar.
10. Remove two bolts and shims at top rear of fender attaching to cowl.

Installation

To install, reverse the removal procedure using sealing tape between filler panel and fender. Check sheet metal alignment.

FRONT FENDER AND SKIRT (FIGS. 9, 10, and 11)

Removal

1. Remove windshield wiper arms.
2. Remove cowl grille and attaching screws.
3. Remove hood and hood hinge assembly.
4. Disconnect battery and remove (right side only) or remove skirt reinforcement at steering column (left skirt only).
5. Remove (2) top rear fender bolts and shims.
6. Remove bolt and shims at bottom of fender.
7. Remove bolt and shim(s) attaching skirt to sill extension.
8. Remove (4) screws attaching head light door to fender and grille.
9. Remove screws attaching gusset to radiator support.
10. Remove (3) screws attaching skirt to radiator support.
11. Remove (2) screws securing fender to radiator support.
12. Remove (4) screws securing fender to grille.
13. Lift fender and skirt assembly from truck.

Installation

1. Replace fender and skirt assembly.

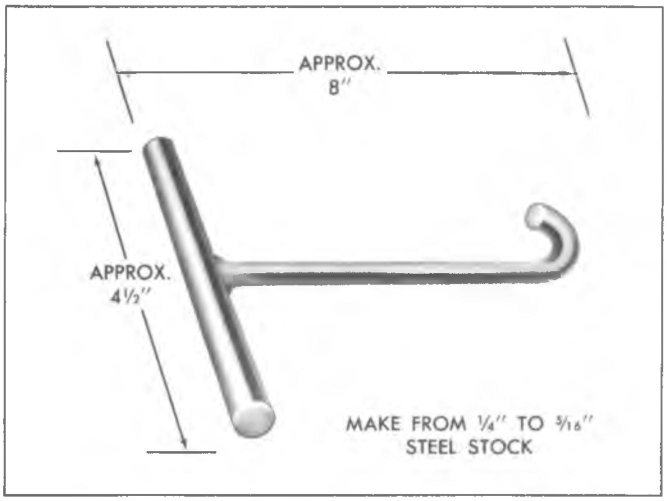


Fig. 12—Hood Hinge Spring Remover/Installer

2. Install bolts loosely.
3. Install shims and secure all parts in reverse order of removal.
4. Tighten shimmed bolts.

FRONT FENDER SKIRT (FIGS. 10 and 11)

Replacement

To replace the skirt alone, remove required screws and rotate over tire. Reverse procedure to install.

RUNNING BOARDS

Refer to Figures 10 and 11.

SECTION 12

ELECTRICAL—BODY AND CHASSIS

CONTENTS OF THIS SECTION

LIGHTING SYSTEM

INDEX

GENERAL DESCRIPTION

The lighting system includes the main light switch; stop light, dimmer and backing lamp switches; head and parking lamps; stop, tail, side marker, clearance and identification lamps; instrument illumination, directional signal and indicator lamps and the necessary wiring to complete the various circuits.

A bulkhead fuse panel (fig. 1) provides convenient power taps and fuse clips for the appropriate curcuits. The engine wiring harness and forward lamp harness connectors are bolted to the fuse panel.

All wiring systems not protected by fuses incorporate a fusible link which provides increased overload protection. The starting motor circuit is the exception.

Composite wiring diagrams are included at the end of this section. The standardized color code is common to all wiring harnesses. The wire covering color designates a particular circuit usage.

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 by used. Never replace a wire with one of a smaller size. 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.

Each harness and wire must be held securely in place by clips or other holding devices to prevent chafing or 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 HEADLAMP (Fig. 2)

Headlamp Aiming

The headlamps must be properly aimed to obtain maximum road illumination.

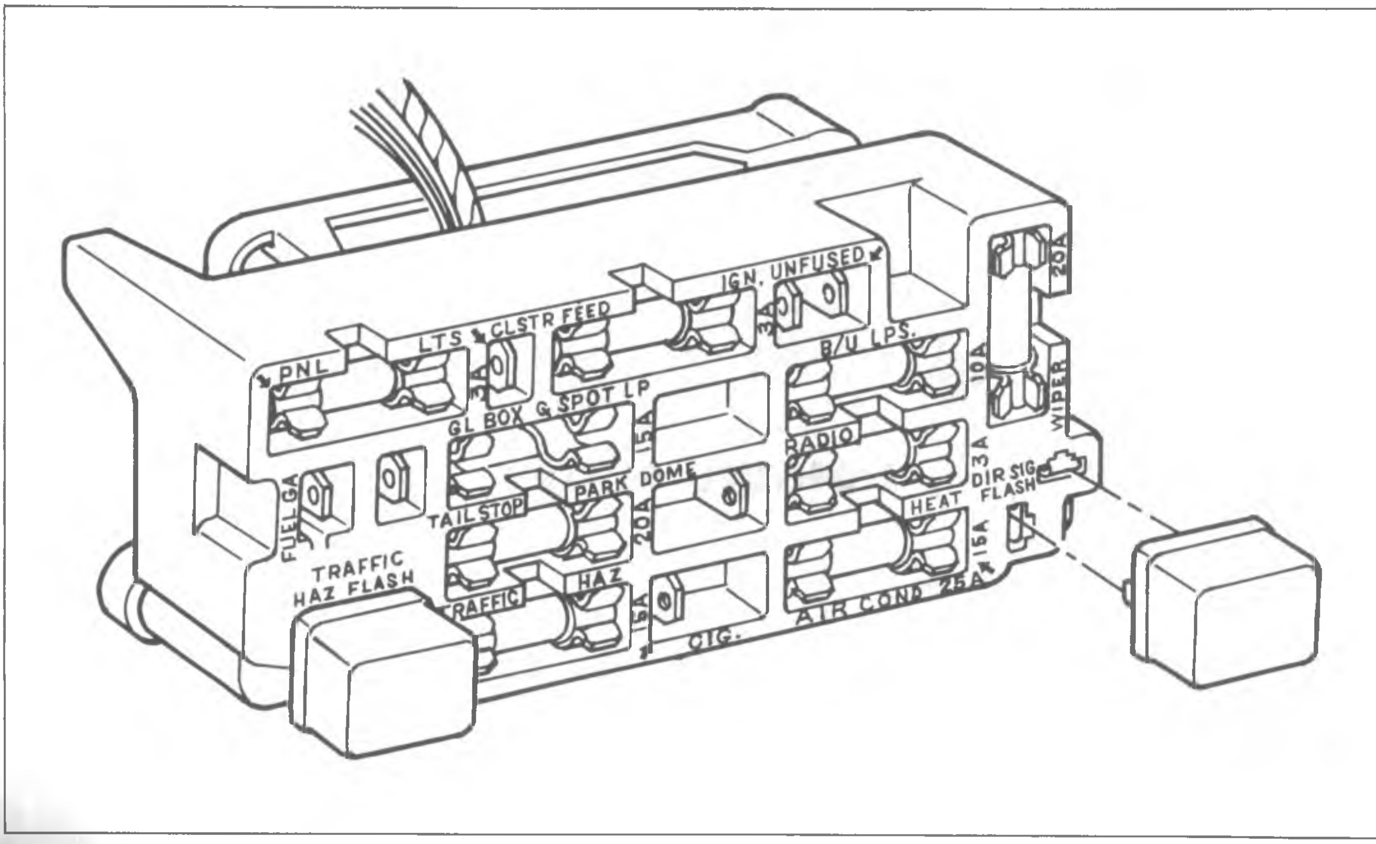


Fig. 1—Fuse Panel

aiming is even more important because the increased range and power of this lamp make even slight variations from recommended aiming hazardous to approaching motorists.

The headlamps must be checked for proper aim whenever a sealed beam unit is replaced and after repairs of the front end sheet metal assembly.

Regardless of the method used for checking headlamp aim, the truck must be at normal weight, that is with gas, oil, water and spare tire. Tires must be inflated to the specified pressures.

Some states have special requirements for headlamp aiming adjustment and these requirements must be known and followed.

Horizontal and vertical aiming of each sealed beam is provided by two adjusting screws visible through the bezel which move the mounting ring against the tension of the coil spring.

There is no adjustment for focus since the sealed beam unit is set for focus during manufacturing assembly.

SERVICE OPERATIONS

SEALED BEAM UNIT REPLACEMENT (Fig. 3)

1. Remove bezel retaining screws and bezel.
2. Disengage spring from retaining ring.
3. Turn headlamp unit to disen9age assembly from headlamp adjusting screws.
4. Disconnect wiring harness connector located at rear of unit in engine compartment.

   NOTE: Do not disturb adjusting screw setting.

5. Remove retaining ring and headlamp from mounting ring.
6. Position new sealed beam unit in mounting ring and install retaining ring.

   NOTE: The number molded into lens face must be at top.

7. Attach wiring harness connector to unit.
8. Install headlamp assembly in panel opening, twisting slightly to engage mounting ring tabs with adjusting screws.
9. Install retaining ring spring then check operation of unit and install bezel.

PARKING, CLEARANCE AND IDENTIFICATION BULB REPLACEMENT

1. Remove retaining screw(s) and lens from housing.
2. Replace bulb and check operation of unit.
3. Install lens and retaining screws.

PARKING LAMP HOUSING REPLACEMENT (Fig. 3)

1. Remove headlamp bezel on P series trucks.

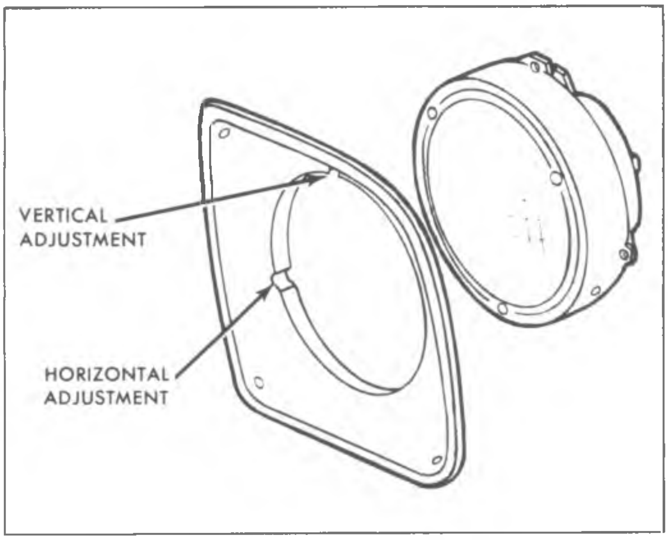


Fig. 2—Headlamp Adjustments

2. Remove lamp housing retaining nuts, and disengage assembly from grille or panel opening.
3. Disconnect parking lamp wiring from forward wiring harness.
4. Connect wiring of new unit to vehicle harness.
5. Position lamp housing in grille or panel opening, as appropriate and install retaining nuts.
6. Install bulb, lens and bezel as required.

CLEARANCE AND IDENTIFICATION LAMP HOUSING REPLACEMENT (See Fig. 4)

REAR LIGHTING (Fig. 5)

Exploded views of the different rear lighting arrangements are shown in Figure 5. The bulbs may be replaced by removing the lamp lens attaching screws and lamp lens. The lamp housings may be replaced by removing the housing attaching nuts or screws, or by removing the nuts and bolts from the bracket.

MARKER LAMPS (Fig. 5)

1. Remove screws retaining marker lamp assembly to sheet metal or housing.

   NOTE: Lamp assembly lens does not separate from back.

2. Rotate marker lamp assembly over and turn plug connector 1/4 turn counter-clockwise to remove and replace bulb inset in plug connector.

DIRECTIONAL SIGNAL LAMPS

Directional Signal lights are an integral part of the parking and taillight assemblies.

NOTE: On vehicles using parking and taillight assemblies for directional signals, refer to applicable light assemblies for bulb replacement.

Bulb Replacement (Cab Mounted Directional Lamps)

1. Remove three screws which retain rear lens to lamp assembly and remove lens.
2. Replace bulb and check operation of lamp.
3. Position lens and install attaching screws.

WIPER SWITCH REPLACEMENT (Fig. 8)

1. Disconnect battery ground cable.
2. Loosen set screw and remove wiper knob.
3. Remove bezel and retaining nut.
4. Push switch from panel opening and remove from behind instrument cluster.
5. Disconnect wiring at switch terminals.
6. To install, reverse removal procedure and check operation of unit.

LIGHT SWITCH REPLACEMENT (Fig. 8)

1. Disconnect battery ground cable.
2. Reaching up behind instrument cluster, depress shaft retaining button and remove switch knob and rod.
3. Remove bezel and retaining nut.
4. Push switch from panel opening and remove from behind instrument panel.
5. Disconnect multiple wiring connectors at switch terminals.
6. To install, reverse removal procedure.

STOPLIGHT SWITCH REPLACEMENT

Conventional Cab Models (Fig. 6)

1. Disconnect wiring harness connector from switch and remove switch retaining nut.
2. Depress brake pedal and place new switch into bracket and install retaining nut.
3. Check switch for proper operation. Electrical contact should be made when pedal is depressed 3/8" to 5/8" from fully released position.

DIMMER SWITCH REPLACEMENT

1. Fold back upper left corner of the floor mat and remove two screws retaining switch to the toe pan.
2. Disconnect wiring connector from switch terminals.
3. Connect wiring to replacement switch and check operation.
4. Position switch to toe pan and install retaining screws.
5. Replace floor mat.

NEUTRAL SAFETY SWITCH REPLACEMENT

Column Shift—Switch Located on Mast Jacket

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 terminals and check operation of switch.

Column Shift—Switch Located on Transmission (Fig. 7)

1. Raise and support vehicle.

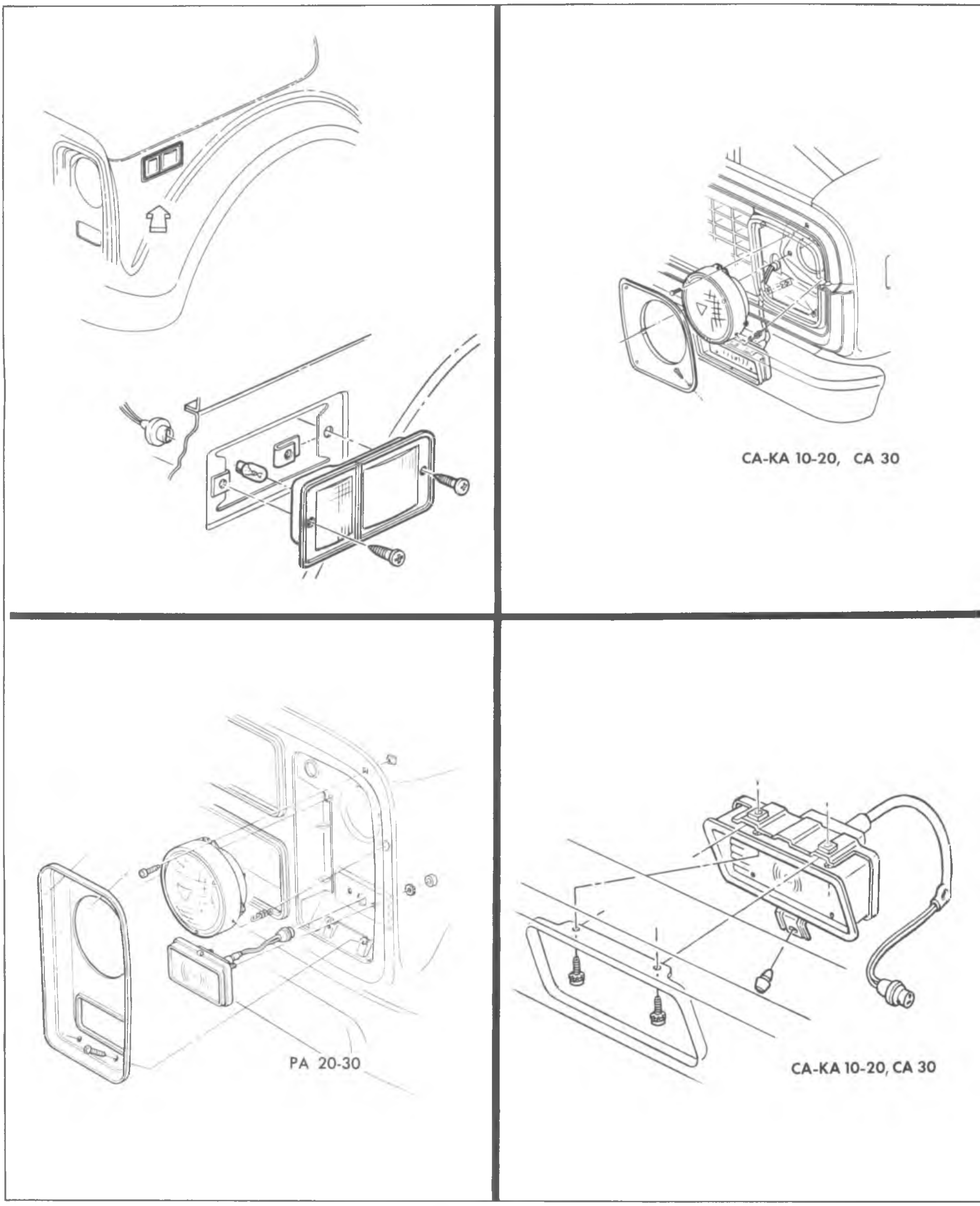


Fig. 3—Front Lighting Assemblies

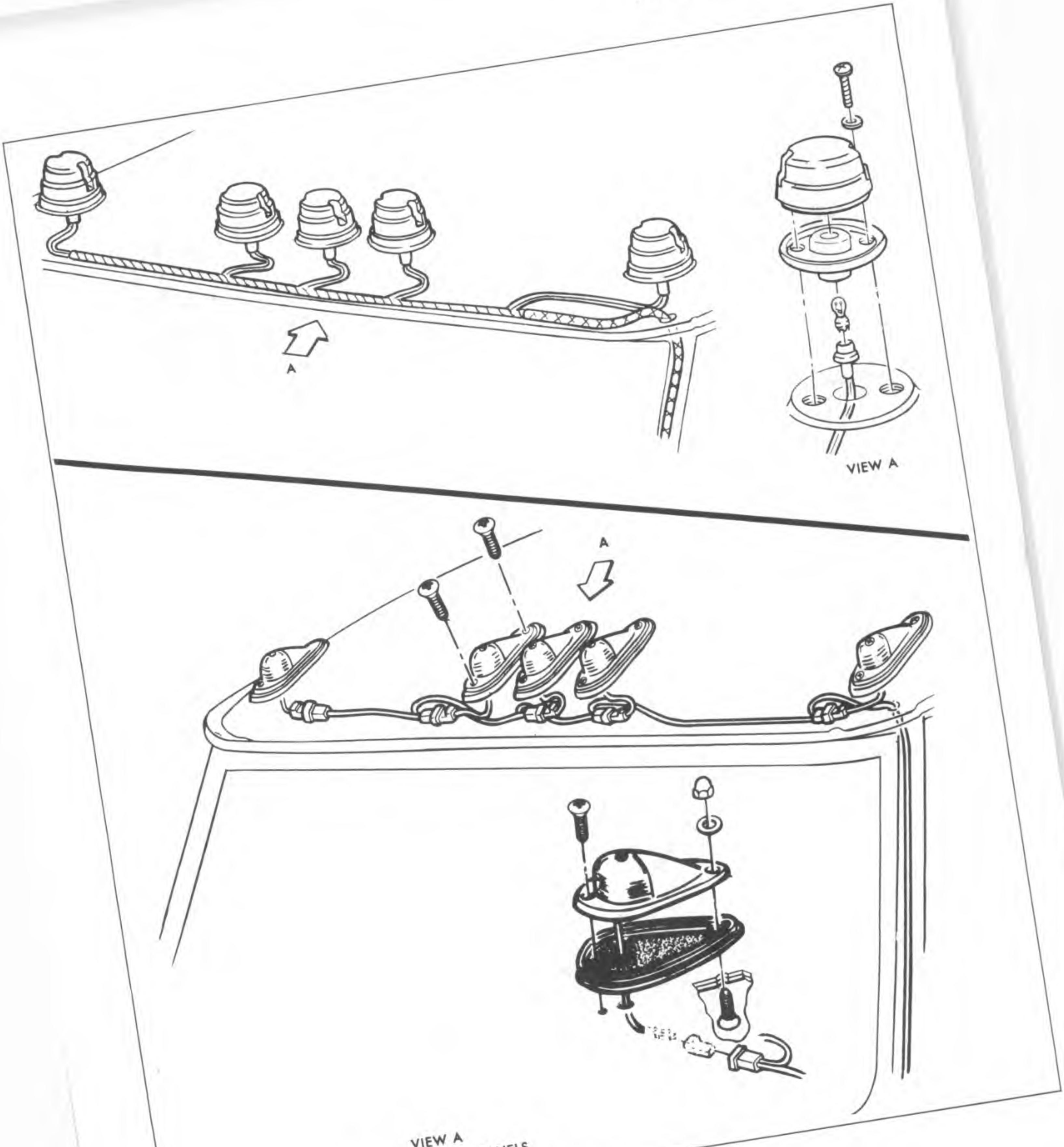


Fig. 4—Clearance and Idntification Lamps

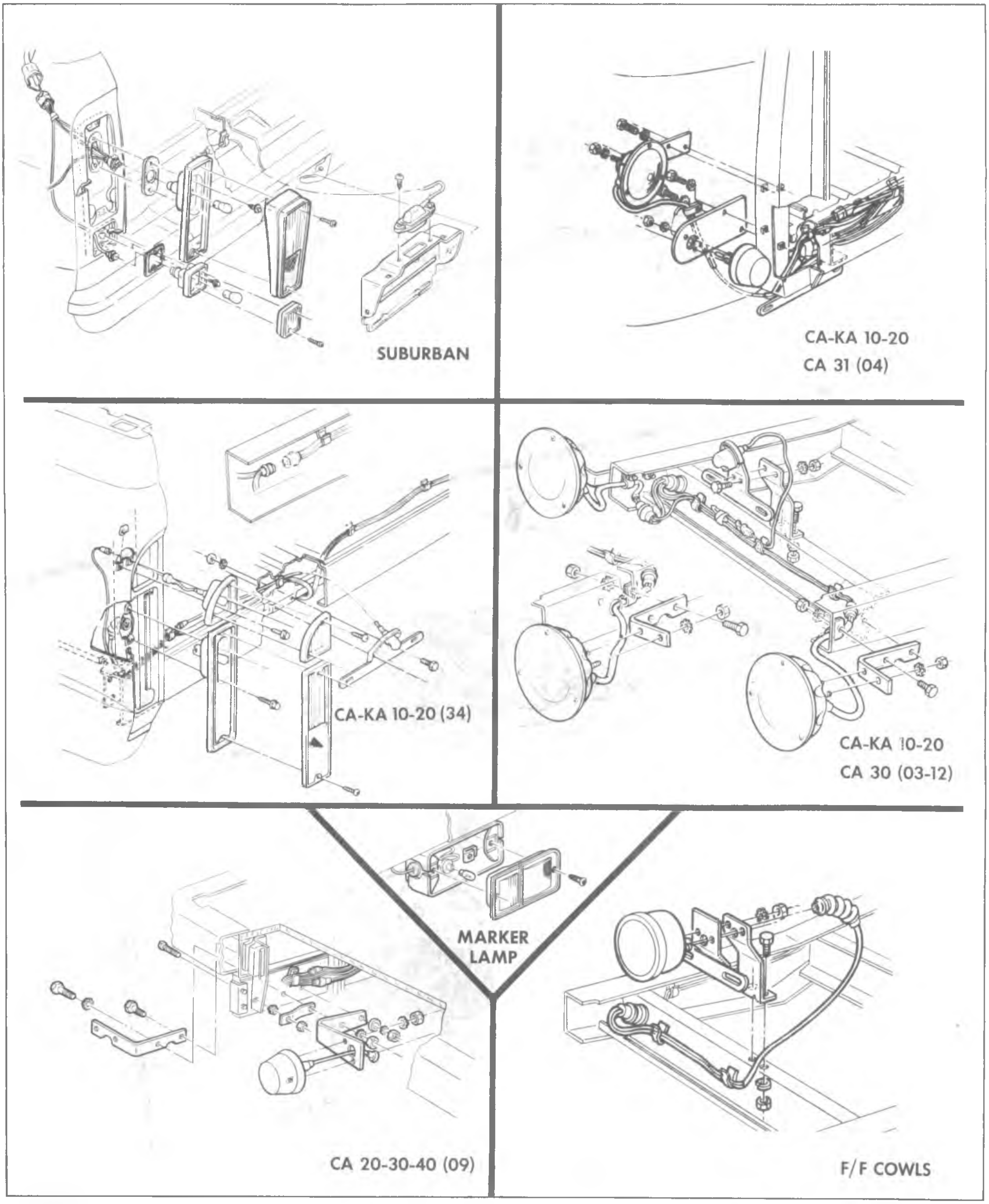


Fig. 5—Rear Lighting Composite

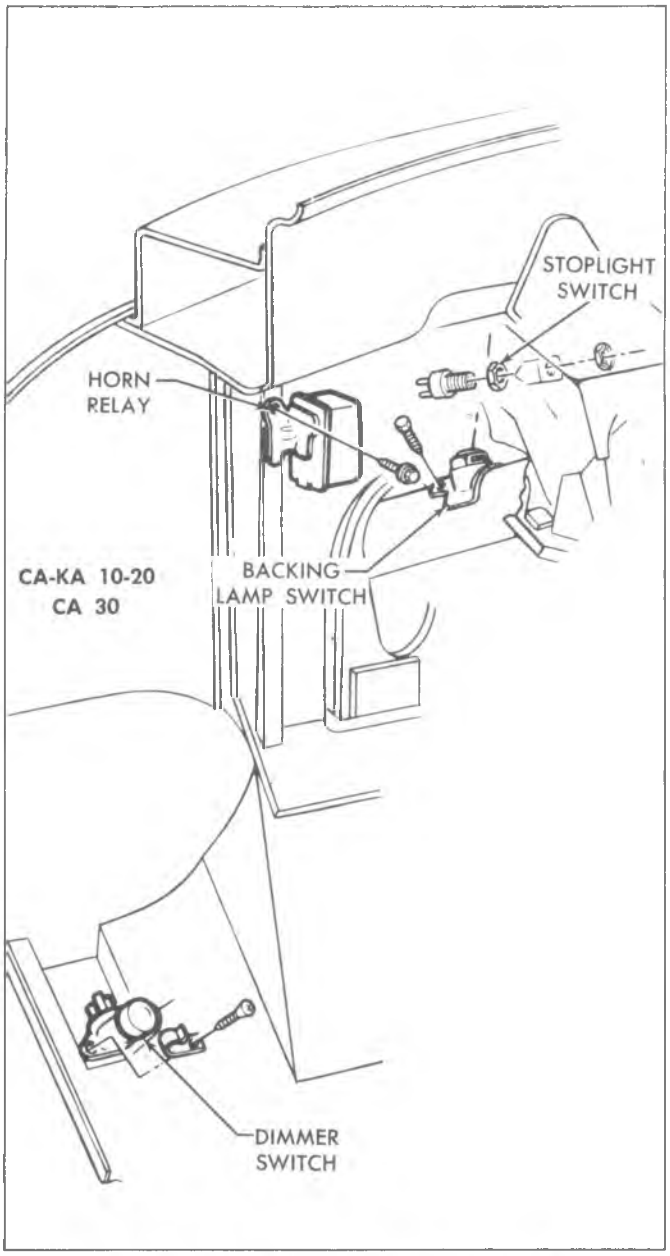


Fig. 6—Electrical Components - Conventional Cab

2. Disconnect switch wiring from engine wiring harness and remove bolt attaching the switch wiring retaining clip to the transmission.

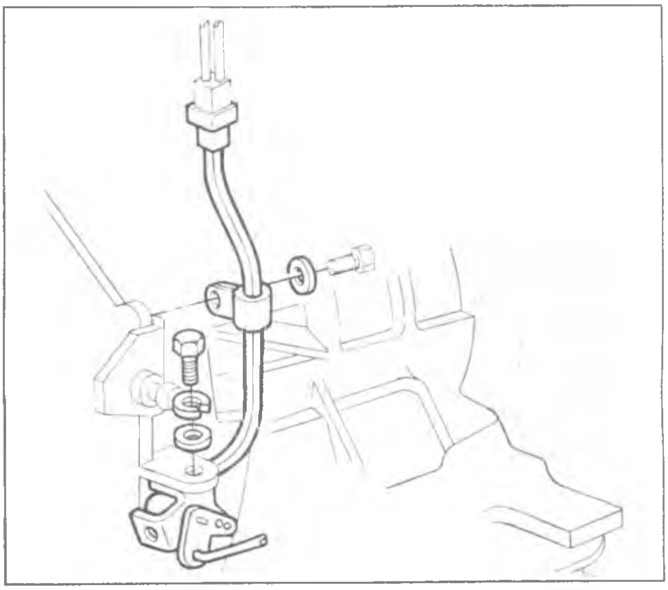


Fig. 7—Neutral Safety Switch - P-Models

3. Remove the bolt attaching the switch to the transmission and disengage switch from shift lever rod.
4. Position new switch to transmission and install switch attaching bolt.
5. Loosen transmission lever extension bolt and with transmission in neutral position and the switch pinned in neutral position attach switch rod to switch.
6. Tighten transmission lever extension bolt to 12-16 ft. lbs. torque and remove pin.
7. Connect switch wiring to engine wiring harness and install wiring retaining clip bolt.
8. Check operation of switch and lower vehicle.

BACKING LAMP SWITCH REPLACEMENT

Switch Located on Mast Jacket

1. Disconnect wiring at switch terminals.
2. Remove switch attaching screws and switch from mast jacket.
3. Position replacement switch to mast jacket, install retaining screws and connect wiring to switch terminals.

   NOTE: Position gear shift in neutral before assembling switch to mast jacket.

4. Check operation of switch.

INSTRUMENTS AND GAUGES

INDEX

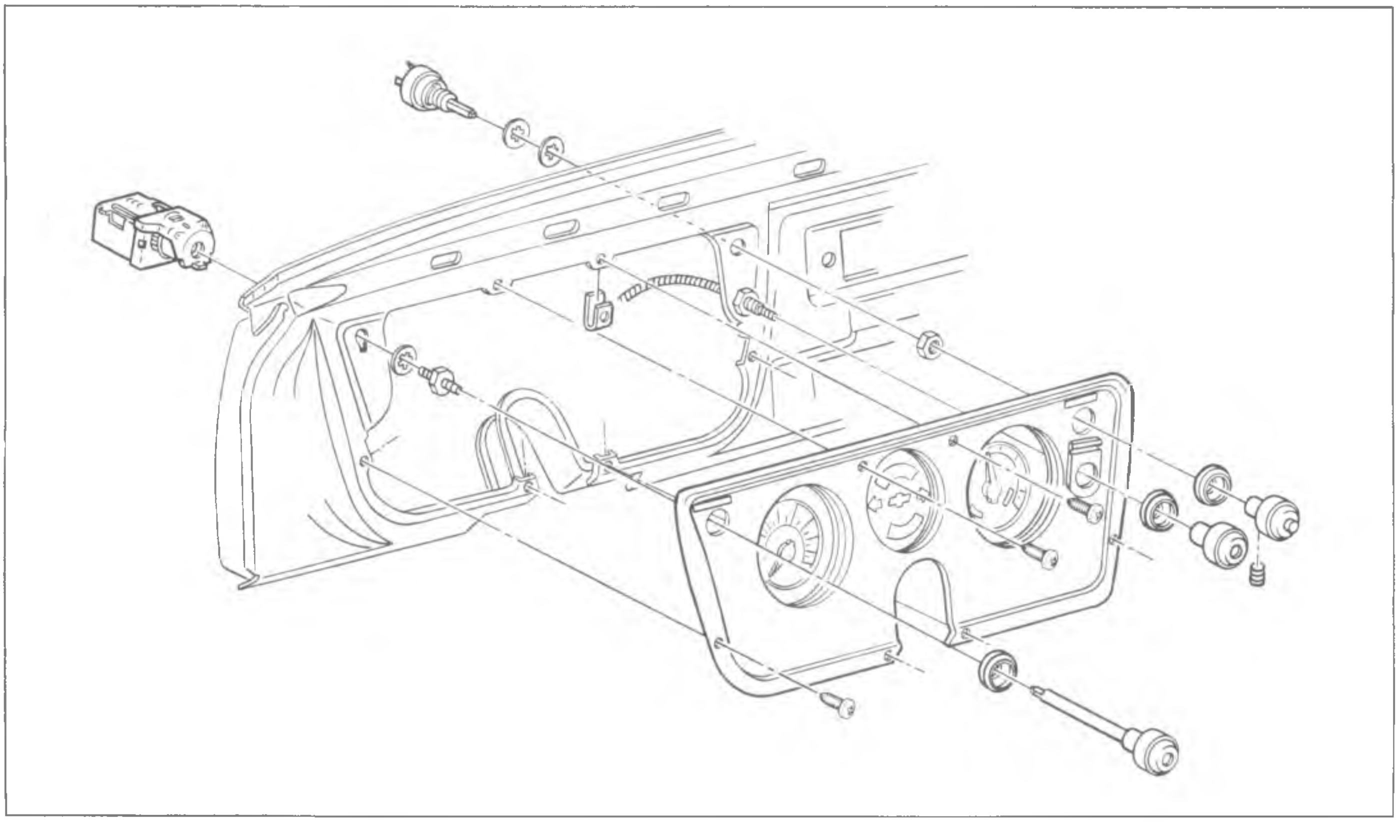


Fig. 8—Instrument Cluster Assembly - Conventional Cab

GENERAL DESCRIPTION

All instruments and gauges are installed in the instrument cluster. The entire cluster may be removed from vehicle for servicing of the instruments and gauges. Illuminating and indicator lamps may be replaced without removing the cluster from the vehicle. On models with a laminated die cut circuit the bulbs are installed in plastic holders which lock into the cluster housing, on all other models the lamp sockets are clip retained and can be quickly snapped in or out of position.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean, tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

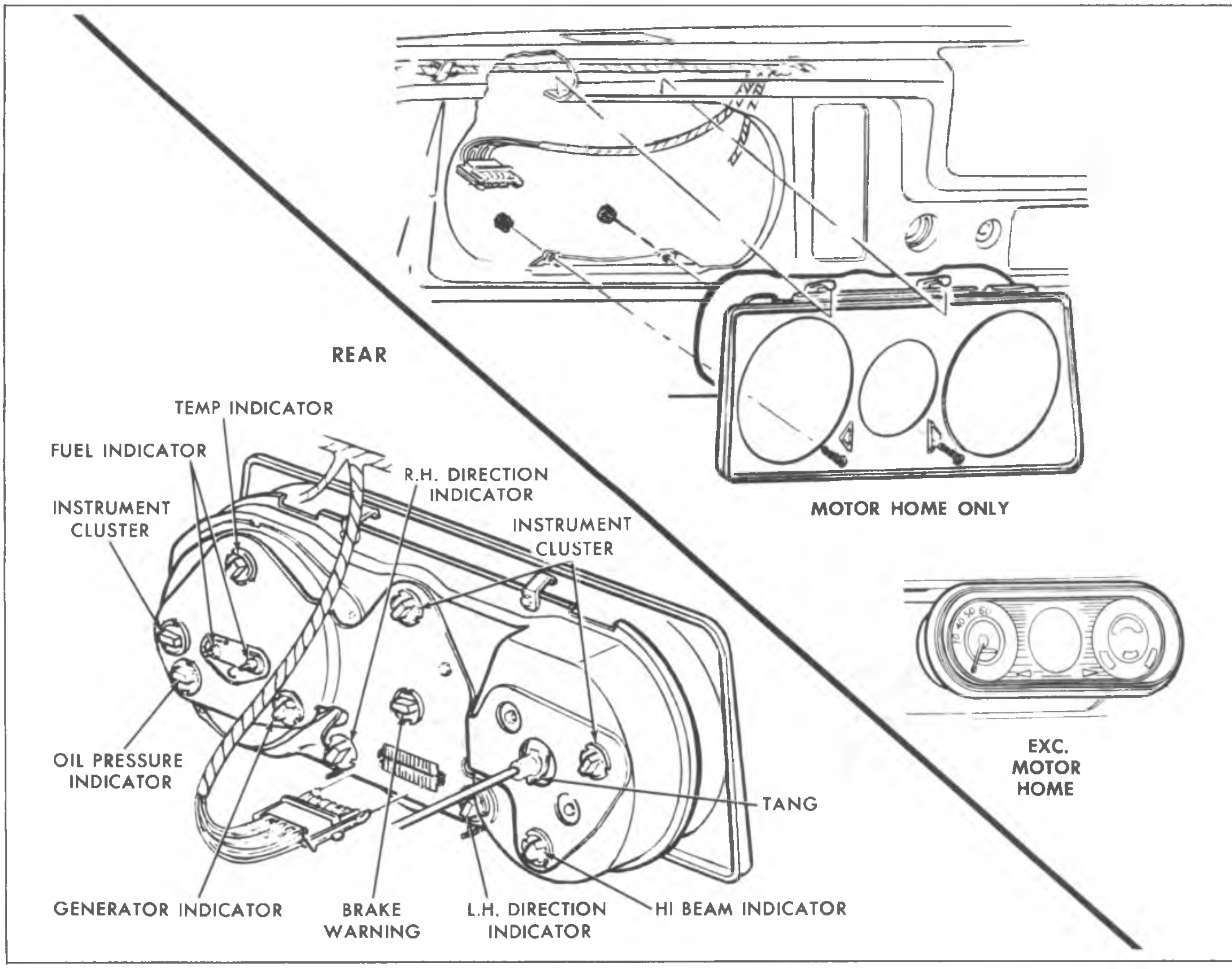


Fig. 9—Instrument Cluster Assembly - P-Models

SERVICE OPERATIONS

IGNITION SWITCH REPLACEMENT

1. Raise hood and disconnect battery ground cable from battery.
2. Remove lock cylinder by positioning switch in "ACC" 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.
4. Pull the ignition switch out from under the dash and remove the wiring connector.
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. 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.

INSTRUMENT CLUSTER REMOVAL AND INSTALLATION

10-30 Conventional Cab Models (Fig. 8)

1. Disconnect battery ground cable.
2. Remove throttle control knob.
3. Remove windshield wiper knob and bezel nut.
4. Remove light switch rod and bezel.
5. Disconnect speedometer cable and chassis wiring harness connector at rear of instrument panel.
6. Protect mast jacket with suitable covering.
7. Remove cluster retaining screws from face of assembly and remove cluster assembly from console.
8. To install, reverse removal procedure.

INSTRUMENT CLUSTER REPLACEMENT P-MODELS (Fig. 9)

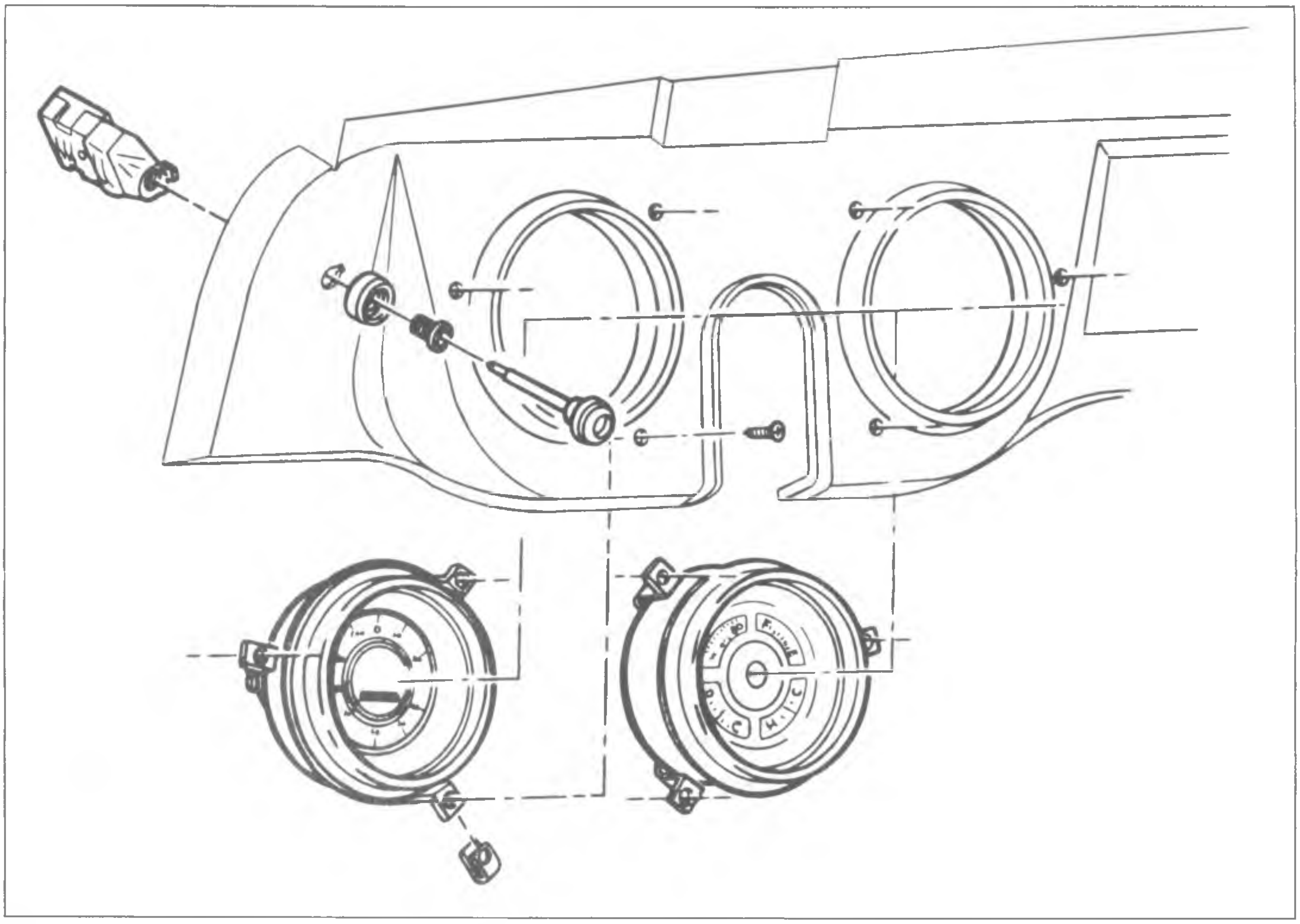


Fig. 10—Instrument Cluster Assembly - F/F Cowl

1. Open hood and remove ground cable from battery.
2. Standing outside vehicle reach up under instrument cluster and disconnect speedometer cable by first depressing tang on rear of speedometer head, pushing then pulling cable free from head as tang is depressed.
3. Unplug instrument panel harness connector from printed circuit.
4. Disconnect oil pressure line from gauge if so equipped. Place cloths beneath line connector to catch drips.
5. Remove (2) two nuts attaching instrument cluster studs to lower opening in instrument panel.
6. Pull top of cluster away from instrument panel and lift out bottom of cluster.
7. Remove cluster to bench for futher disassembly (laminated printed circuit, speedometer head, gauges).

Flatface Cowl Models (Fig. 10)

1. Disconnect battery ground cable.
2. Disconnect electrical connectors and oil pressure pipe.

   NOTE: Oil pressure line connector may leak oil when opened; wrap with cloth.

3. Remove three screws attaching cluster housing to dash panel.
4. Pull cluster from opening in dash panel.
5. To install, reverse removal procedure.

INDICATOR AND ILLUMINATING BULB REPLACEMENT

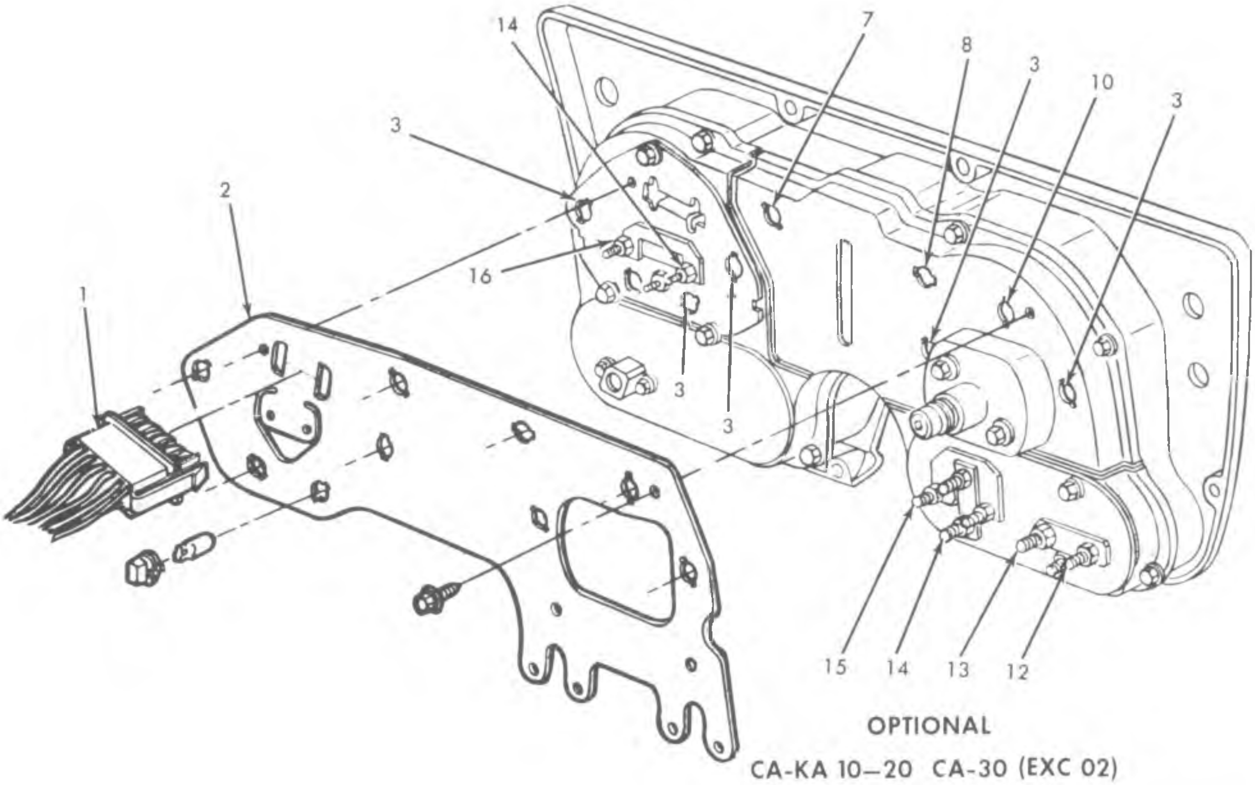
10-30 Conventional Cab and P Models

1. Turn bulb holder counter-clockwise to remove from the cluster housing.
2. Pull bulb straight out to remove from holder.
3. Install replacement bulb in holder, press inward to lock in place.
4. Insert holder into housing, with lugs on holder entering notches in case, and turn clockwise to lock in place.

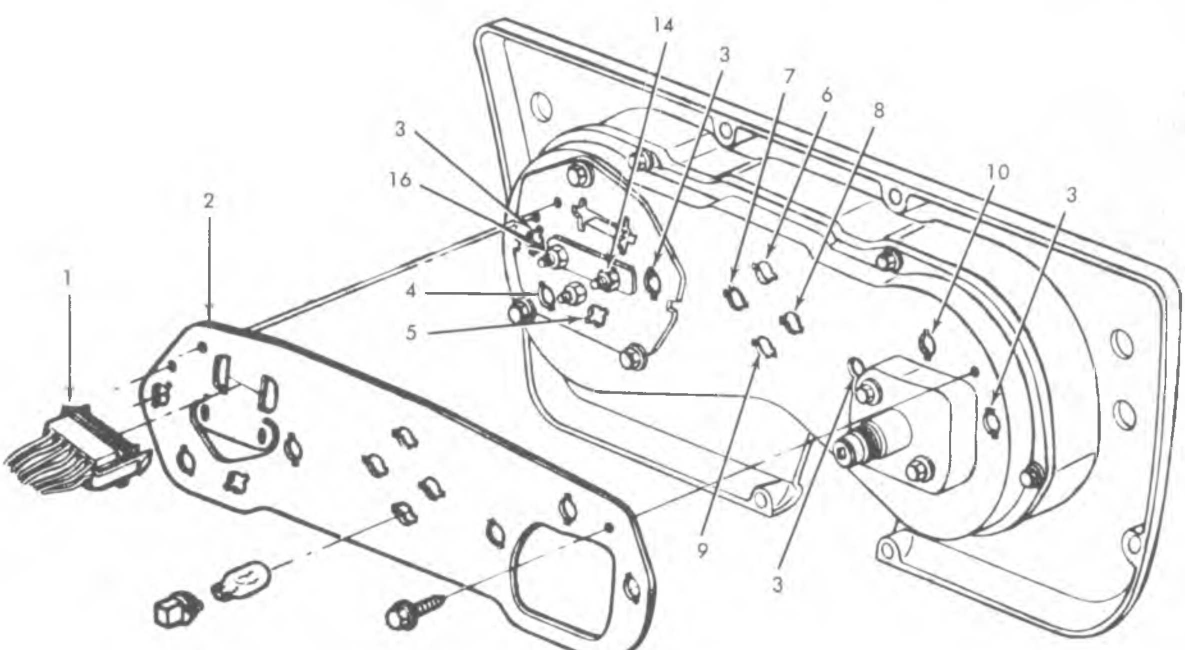
LAMINATED CIRCUIT REPLACEMENT

10-30 Conventional Cab Models (Fig. 11 & 12)

1. Remove instrument cluster assembly as previously described in this section.
2. Remove all instrument cluster lamp assemblies.
3. Remove laminated circuit retaining screws.



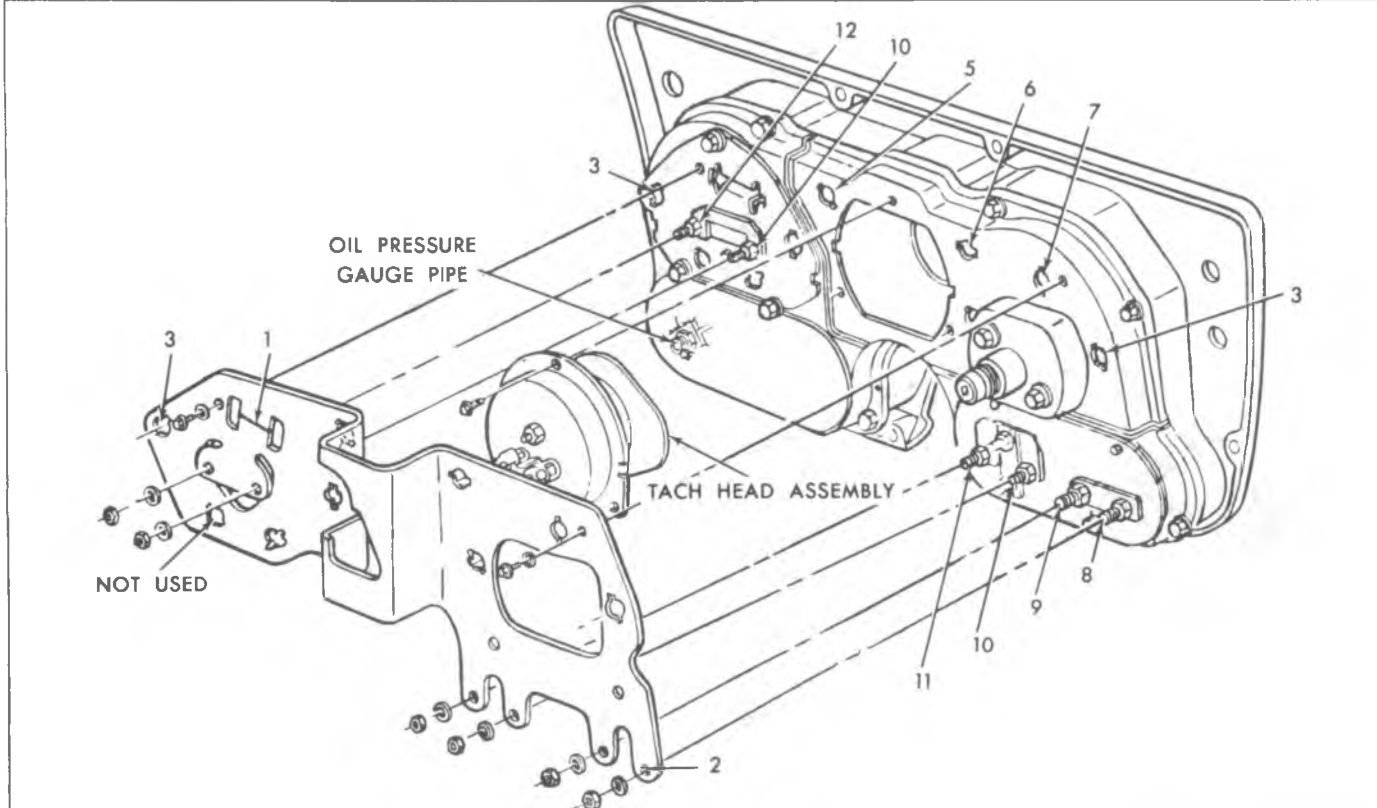
OPTIONAL
CA-KA 10—20 CA-30 (EXC 02)



CA-KA 10-20, CA 30 (EXC 02)

1. Instr. Cluster Conn.
2. Laminated Circuit
3. Instr. Cluster Lamp
4. Temperature Ind.
5. Brake Warning Ind.
6. Generator Ind.
7. R.H. Directional
8. L.H. Directional
9. Oil Pressure Ind.
10. "High" Beam Ind.
12. Generator (Ammeter)
13. Battery (Ammeter)
14. Ignition Terminal
15. Temperature Gauge
16. Fuel Gauge

Fig. 11—Instrument Cluster Connections - Conventional Cab



1. Instr. Cluster Conn.	4. Brake Warning Ind.	7. "High" Beam Ind.	10. Ignition Terminal
2. Laminated Circuit	5. R.H. Directional	8. Generator (Ammeter)	11. Temperature Gauge
3. Instr. Cluster Lamp	6. L.H. Directional	9. Battery (Ammeter)	12. Fuel Gauge

Fig. 12—Optional Instrument Cluster with Tachometer

NOTE: These screws serve as a ground for the circuit and must be reinstalled to provide the proper ground connections for the laminated circuit.

4. Remove fuel, temperature and ammeter terminal nuts retaining laminated circuit to cluster cover.
5. Remove laminated circuit from rear of instrument cluster.
6. To install, reverse removal procedure and check operation of unit.

SPEEDOMETER REPLACEMENT

NOTE: Servicing of the speedometer assembly should be performed by an authorized AC speedometer Service Station.

Conventional Cab Models

1. Remove instrument cluster assembly and laminated circuit as previously described in this section.
2. Remove retaining screws and cluster rear cover.
3. Remove front cover from face of cluster.
4. Remove two retaining screws and speedometer from cluster.
5. To install, reverse removal procedure and check operation of unit. DO NOT KINK CABLE CASING.

Flatface Cowl Models

1. Disconnect battery ground cable.
2. Disconnect speedometer cable and all indicator and illuminating sockets.
3. Remove three screws attaching speedometer housing to dash panel.
4. Pull speedometer from opening in dash panel.
5. To install, reverse removal procedure and check operation of unit. DO NOT KINK CABLE CASING.

P Models

1. Remove instrument cluster assembly as previously described in this section.
2. Remove four screws securing cluster back panel to bezel assembly.
3. Remove two screws securing speedometer head to cluster back panel; carefully remove speedometer head.
4. To install, reverse removal procedure and check operation of unit. DO NOT KINK CABLE CASING.

SPEEDOMETER CABLE CORE REPLACEMENT OR LUBRICATION; ALL MODELS

1. Disconnect speedometer cable casing from the speedometer head.
2. Remove old cable core by pulling it out from speedometer end of casing.

   NOTE: If old cable core is broken it will be necessary to remove lower piece from transmission end of casing.

3. Lubricate the entire length of cable core with speedometer cable core lubricant such as FISK BROS. #700 or equivalent and feed the cable into the conduit. DO NOT KINK SPEEDO CABLE CASING.

4. Connect the upper end of cable to the speedometer head, and road test the truck for proper speedometer-odometer operation.

FUEL GAUGE REPLACEMENT (Fig. 8, 11, 12)

All Except (02) Flat Face Cowl

1. Remove instrument cluster assembly as previously described.
2. Remove instrument cluster bulb holders, ground screws, nuts and washers retaining laminated circuit to fuel gauge rear cover.
3. Remove (3) screws retaining fuel gauge rear cluster cover.
4. Lift gauge away from laminated circuit and rear cluster cover.
5. To install, reverse removal steps 1-4 and check operation of fuel gauge.

 NOTE: Mount insulator strip on fuel gauge studs first, then resistor, then a nut on each stud, next the laminated circuit, then a plain washer on each of two studs holding laminated circuit and finally a nut on back of the studs that have a washer and laminated circuit.

Flatface Cowl Models (Fig. 10)

1. Remove instrument cluster assembly as previously described in this section.
2. Uncrimp bezel (7 places) and remove bezel.
3. Remove nuts securing fuel gauge to cluster case and remove gauge.
4. To install, reverse removal procedure and check operation of unit.

TEMPERATURE INDICATOR LIGHT

10-30 Conventional Cab Models

The temperature indicator circuit consists of two re-remotely located units, indicator light and sender unit. The lamp unit is a single red light which indicates an overheated engine condition.

TEMPERATURE GAUGE REPLACEMENT

Conventional Cab Models (Figs. 8, 11, 12)

1. Remove instrument cluster assembly as previously described in this section.
2. Remove terminal nuts retaining laminated circuit to gauge unit.
3. Remove three attaching screws, cover and gauge assembly from cluster housing.
4. Remove terminal attaching nuts and gauge unit from cover plate.
5. To install, reverse removal procedure and check operation of unit.

Flatface Cowl Models (Fig. 10)

1. Remove instrument cluster assembly as previously described in this section.
2. Uncrimp bezel (7 places) and remove bezel.
3. Remove 2 nuts securing temperature gauge to cluster case and remove gauge.
4. To install, reverse removal procedure and check operation of unit.

TEMPERATURE SENDER UNIT REPLACEMENT

All Models

1. Relieve coolant system pressure by loosening radiator cap.
2. Remove sender unit (located in the left cylinder head on V8 engines, and in the cylinder head rear exhaust port on L-6 engines). Replace with new unit.
3. Check coolant system level and operation of unit.

 NOTE: Coolant must have at least 0° F. freeze protection for temperature sending unit to function properly.

OIL PRESSURE INDICATOR LIGHT

10-30 Conventional Cab Models

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 sender unit
Defective bulb
High engine temperature

OIL GAUGE REPLACEMENT

Conventional Cab Models (Figs. 11, 12)

1. Disconnect battery ground cable.
2. Disconnect oil pressure and air pressure (if so equipped) gauge feed pipes.

 NOTE: Oil pressure line conn. may leak oil when opened; wrap with cloth.

3. Remove three (3) rear cover retaining screws. Tip cover and gauge assembly and remove from instrument cluster housing.
4. Remove pipe fitting and retaining nut from gauge being relaced and remove gauge from cover.

Installation

1. Install gauge to cover with retaining nut and pipe fitting.
2. Reinstall gauge in instrument cluster housing. Install retaining screws.

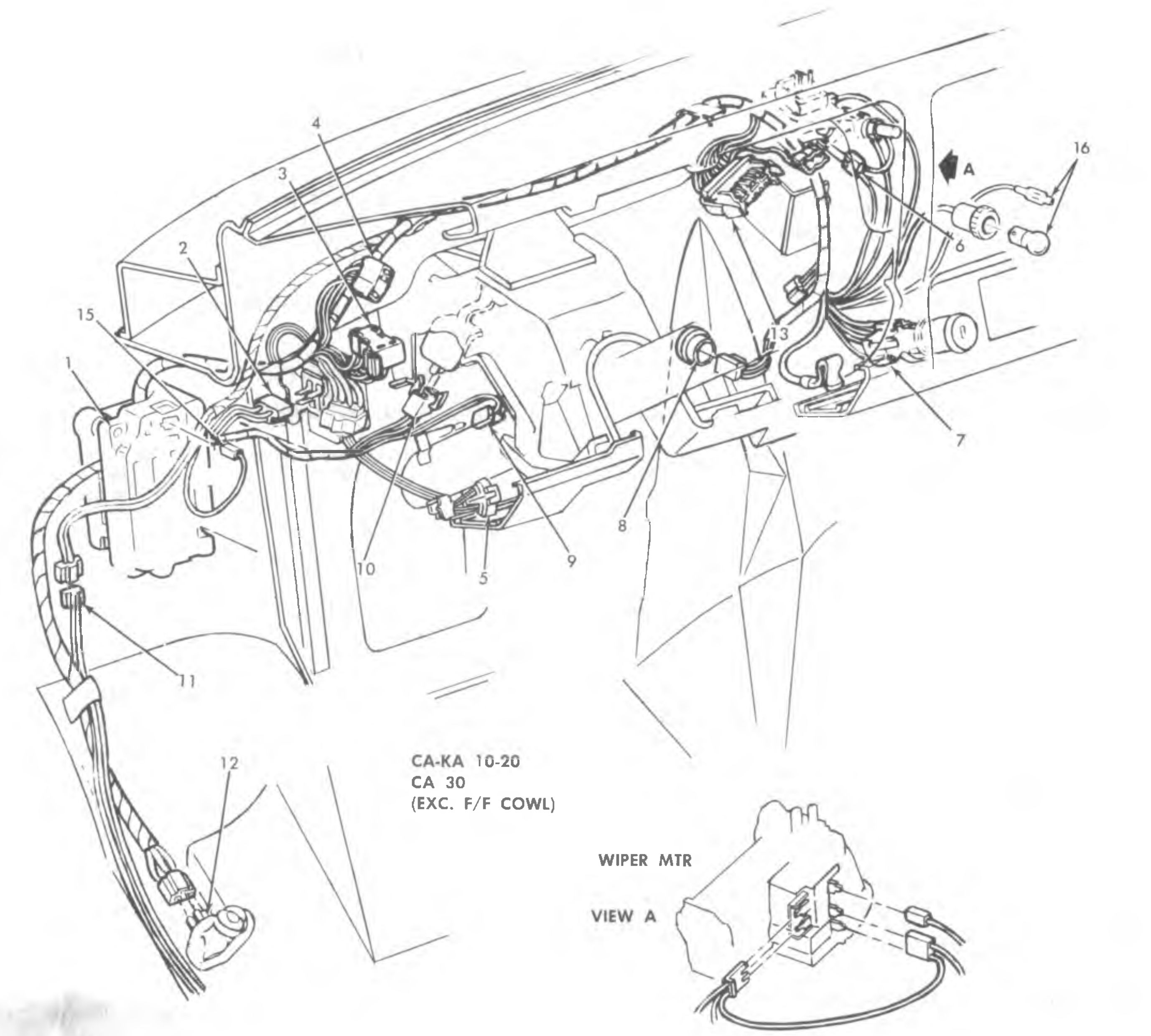
 NOTE: Make sure printed circuit edge is not pinched between cover and cluster housing.

3. Reconnect feed lines to gauge(s). Connect battery ground cable.

Flatface Cowl Models

1. Remove instrument cluster assembly as previously described in this section.
2. Uncrimp bezel (7 places) and remove bezel.
3. Remove nut securing oil pressure gauge to cluster case and remove gauge.
4. To install, reverse removal procedure and check operation of unit.

OIL PRESSURE SENDER UNIT REPLACEMENT



1. Fuse Panel
2. Horn Relay
3. To Light Switch
4. To Wiper Switch
5. To Directional Switch
6. To Wiper Motor
7. Ignition Switch
8. Bulkhead Conn.
9. To Backing Lamp Switch
10. To Stop Lamp Switch
11. To Dome Lamp Conn.
12. Dimmer Switch
13. To Instrument Cluster Conn.
14. Ground Wire, Cluster Conn.
15. Fuel Tank Meter
16. Heater Control

Fig. 13—Instrument Panel Wiring (Conv. Cab 10-30)

All Models

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

10-30 Conventional Cab Models

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.

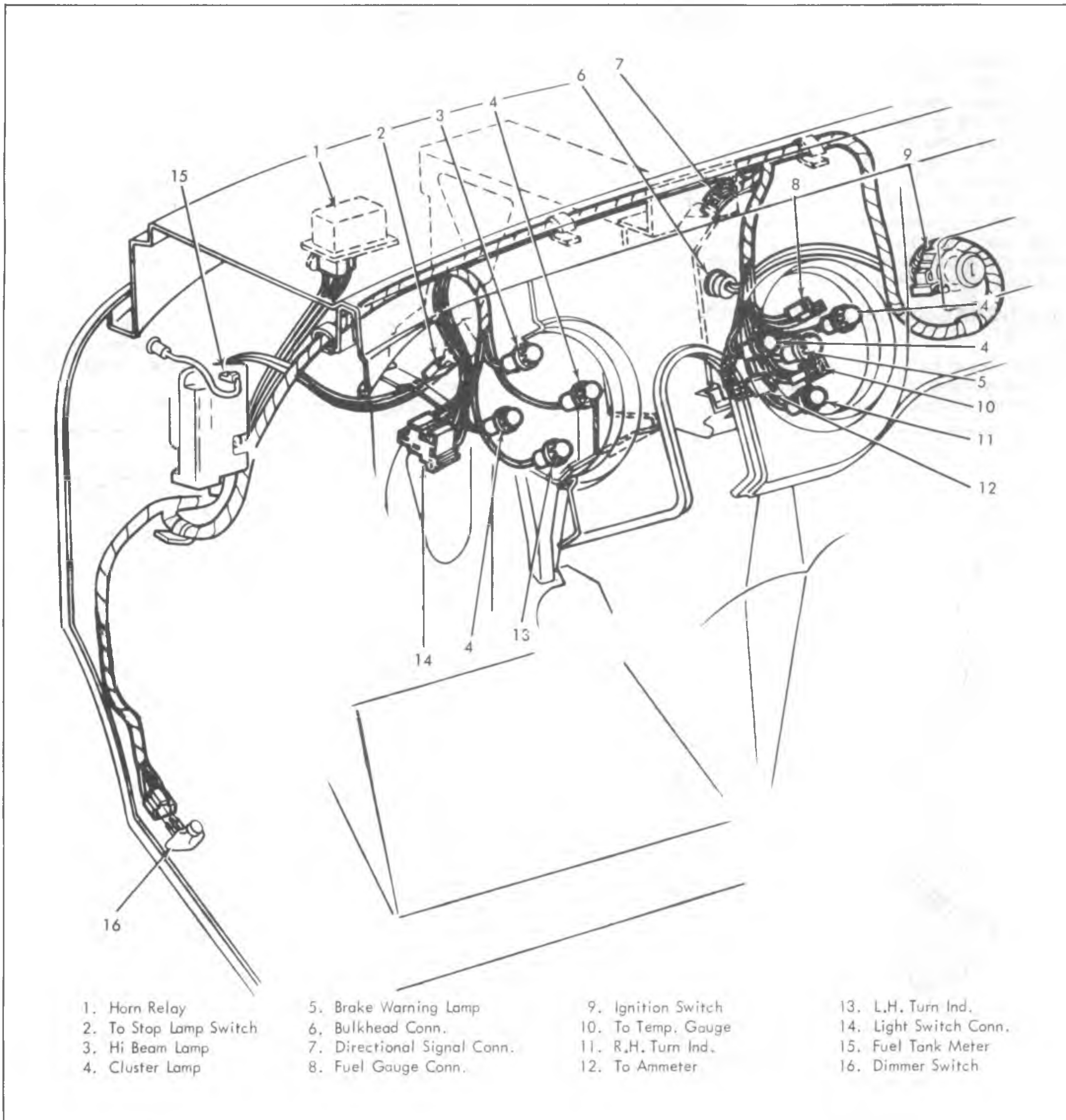


Fig. 14—Instrument Panel Wiring - F/F Cowl

Telltale light stays on after engine is started; refer to Charging Systems under Engine Electrical, Section 6Y.

AMMETER GAUGE REPLACEMENT (Figs. 8,11,12,13)

Conventional Cab Models

1. Remove instrument cluster assembly and laminated circuit as previously described in this section.
2. Remove terminal nuts retaining printed circuit to gauge unit.
3. Remove three attaching screws, cover and gauge assembly from cluster housing.
4. Remove terminal attaching nuts and gauge unit from cover plate.
5. To install, reverse removal procedure and check operation of unit.

DIRECTIONAL SIGNAL CONTROL

The directional signal switch is a self-contained unit which incorporates the hazard warning switch and the lane changing signal. The switch is one complete plastic assembly and is serviced as a unit except for the spring detent, yoke assembly and cancelling springs.

The hazard warning circuit is activated by a push-pull switch which is located on the right side of the mast jacket, opposite the directional signal lever. The switch knob must be pulled to cancel circuit.

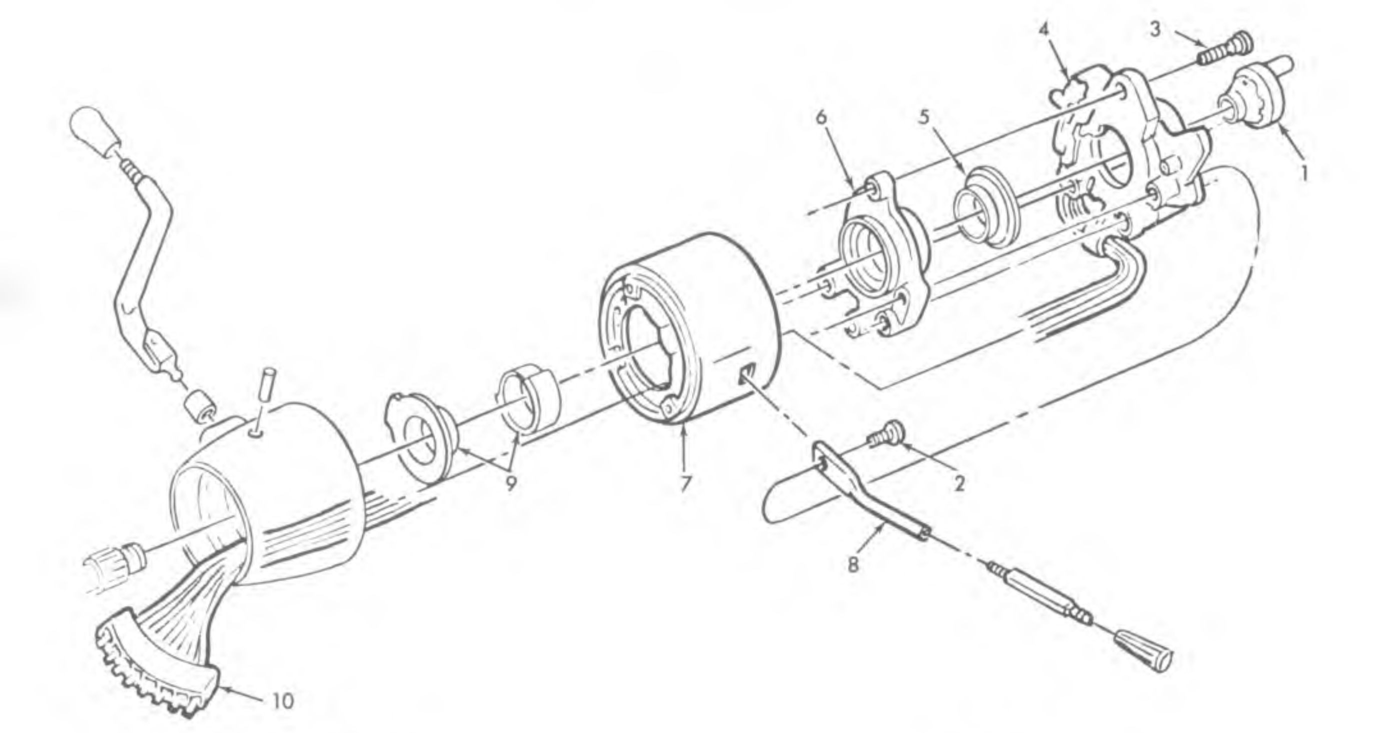
The lane changing circuit is activated by holding the directional signal lever in the first detent position; there is no lock in or cancelling device in this position.

DIRECTIONAL SIGNAL SWITCH REPLACEMENT (Fig. 15)

1. Disconnect battery ground cable.
2. Remove steering wheel assembly (Refer to Steering Section 9), preload spring and cancelling cam.
3. Remove shift lever roll pin and shift lever (if applicable).
4. Remove directional signal lever retaining screw and lever.
5. Push in hazard warning knob.

   NOTE: Hazard switch knob must be pushed in to prevent damage to switch when removing from switch cover.

6. Disconnect switch wiring from chassis harness at multiple connector under instrument panel.
7. Remove mast jacket upper bracket.
8. Remove switch wiring cover from column.
9. Remove switch mounting screws and remove switch, bearing housing, switch cover and shift housing from column.
10. To install, reverse removal procedure.



1. Cancelling Cam
2. Directional Lever Retaining Screw
3. Switch Mounting Screw
4. Switch
5. Upper Bearing
6. Bearing Support
7. Switch Cover
8. Lever Arm
9. Washer
10. Wiring Connector

Fig. 15—Directional Signal Assembly

WINDSHIELD WIPER AND WASHER

INDEX

GENERAL DESCRIPTION

The type "E" two-speed electric windshield wiper assembly 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. Depending on the wiring harness of the different trucks, the wiper motors are equipped with three or four terminals. For service replacement a four terminal assembly is used, servicing both, the three terminal and the four terminal models.

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.

SERVICE OPERATIONS

WIPER MOTOR

REMOVAL AND INSTALLATION

10-30 Conventional Cab Models (Figs. 16, 17)

1. Disconnect battery ground cable.
2. Disconnect wiper drive rods from crank arm by reaching through plenum grille with a cotter pin removal tool.
3. Working under instrument console, disconnect wiper motor and washer wiring connectors.

   NOTE: If vehicle is equipped with a parking brake assembly located on the vertical surface of the cowl front panel (directly below the wiper motor) remove the parking brake assembly attaching bolts (4) to allow shifting of the assembly rearwards in order to provide access for removal and installation of the wiper motor assembly. Also remove blazer under dashboard mounted radio speaker for access.

Disconnect and remove left-hand defroster hose.

4. Disconnect washer hoses from washer pump.
5. Remove motor attaching screws and motor from cowl mounting position.
6. To install, reverse removal procedures.

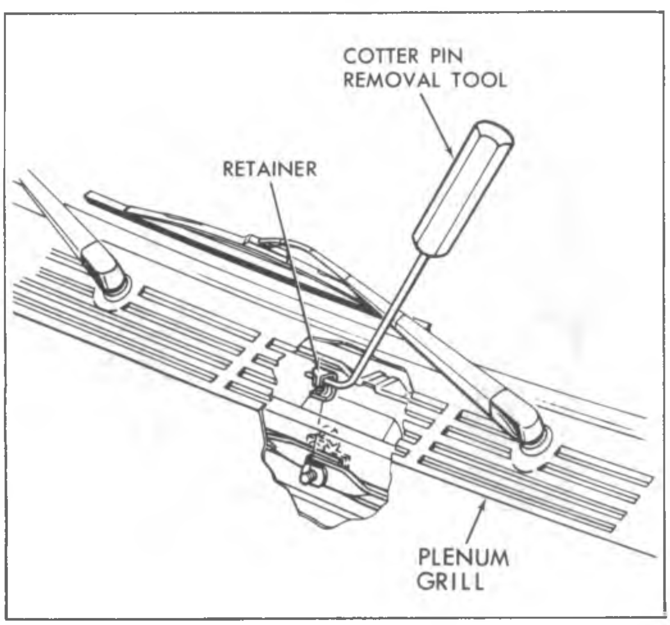


Fig. 16—Removing Wiper Motor Drive Rod Retainer

NOTE: Make certain wiper motor and blades are in the "Park" position.

WIPER MOTOR DISASSEMBLY (Fig. 18)

Gear Box

1. Remove the two washer pump mounting screws and lift pump off washer.
2. Remove washer pump drive cam as required (fig. 21, 22). 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 grease before reassembly.

5. Drill out gear box cover retaining rivets, remove cover from gear train.

   NOTE: Screws, nuts and lock washers for reassembling cover to wiper are contained in a service repair package.

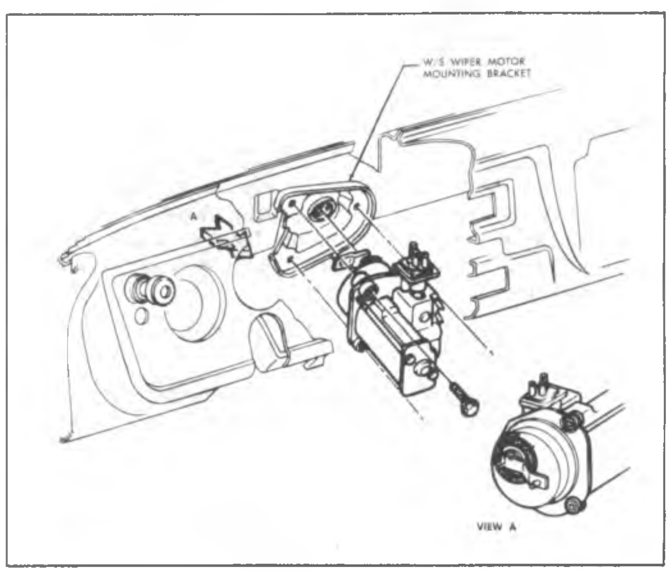
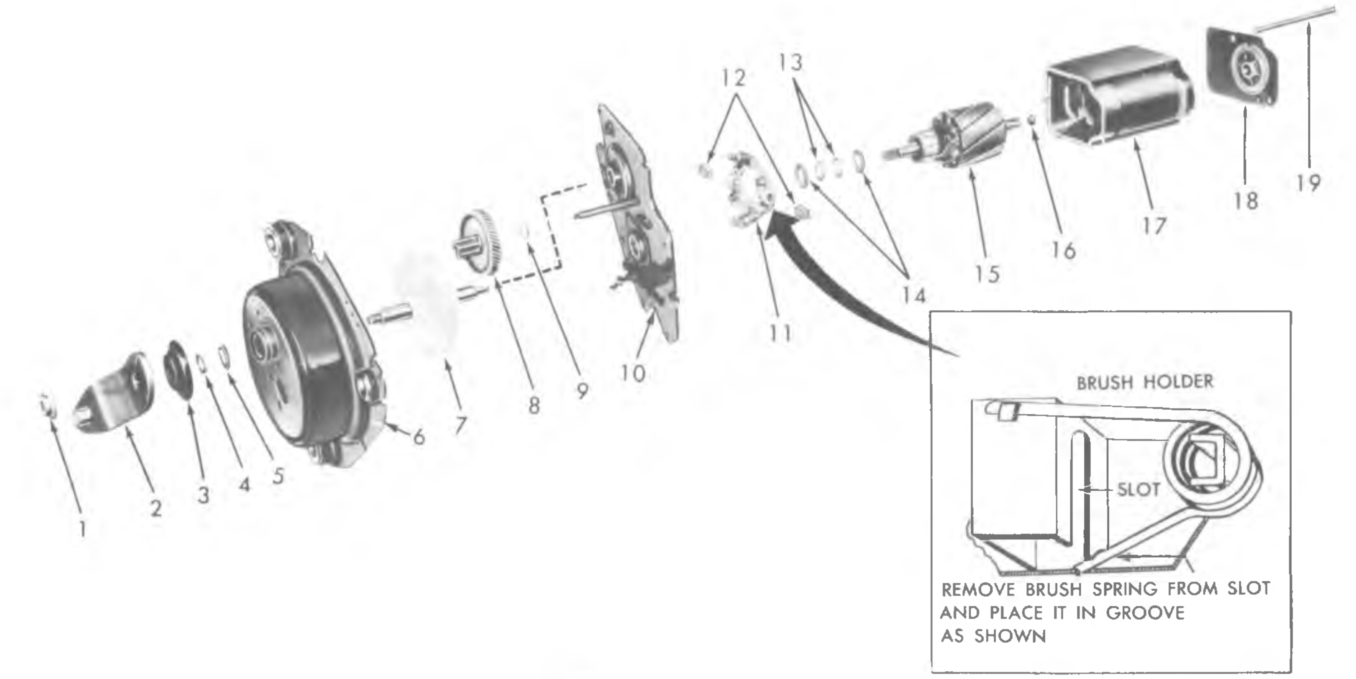


Fig. 17—Wiper Motor Installation



1. Nut
2. Crank Arm
3. Seal Cap
4. Retaining Cap
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)

Fig. 18—Wiper Motor & Gear Box Assembly

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. Code motor leads.
   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 boardpark switch assembly are included with the replacement assembly.

Motor

1. Follow Steps 1 through 7b under gear box disasembly
2. Remove motor through bolts, tap motor frame lightly, and remove motor from mounting plate.
3. Remove brush spring tension (fig. 18), 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.

WIPER MOTOR INSPECTION

Check and inspect all parts for wear, 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.

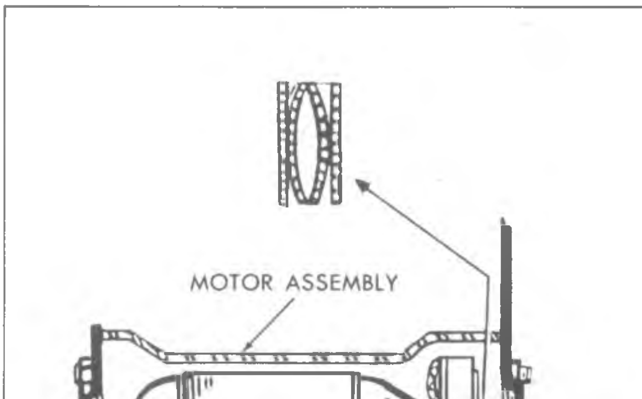


Fig. 19—End Play Wave Washer Installation

WIPER MOTOR ASSEMBLY

Refer to Figure 18 for exploded view of motor and gear train.

Motor

Reassembly motor using reverse of disassembly procedure.

NOTE: Armature end play is controlled by end play washers. See Figure 19 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. 20).
3. Replace retaining nut, place crank arm in vise, tighten retaining nut.

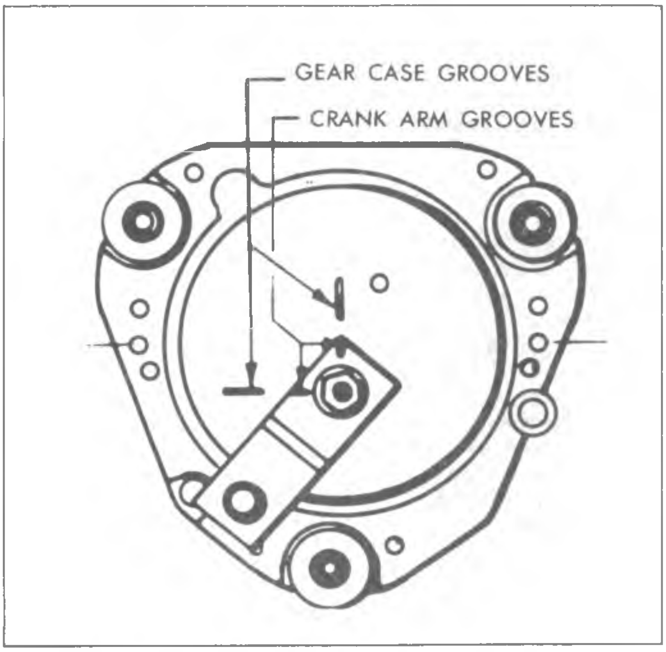


Fig. 20—Wiper Motor Crank Arm in Park Position

WINDSHIELD WASHER

GENERAL DESCRIPTION

The positive displacement washer pumps used on the two-speed non-depressed park wipers (fig. 21) use a pump mechanism consisting of a piston, piston spring and valve arrangement driven by a 4 lobe cam, and follower assembly (fig. 23). The cam is attached to one shaft of the wiper motor output gear (fig. 22). Programming is accomplished electrically and mechanically by a relay assembly and ratchet wheel arrangement.

Fig. 21—Washer Pump Attaching Screws

Fig. 22—Washer Pump Drive Cam

SERVICE OPERATIONS

Removal and Installation

Removal of the washer pump from the wiper motor consists of:

1. Disconnect battery ground cable.
2. Disconnect defroster hose and move to one side.
3. Remove ignition switch from instrument panel as follows:
   a. Remove lock cylinder by positioning switch in "ACC" position and inserting a wire in the small hole in the cylinder face. Puch in on wire to depress plunger and continue to turn key counterclockwise until lock cylinder can be removed.
   b. Remove ignition switch bezel.
   c. Push ignition switch through dash and let hand.
4. Disconnect electrical connector and hoses from pump.

   NOTE: Mark washer hoses for correct reinstallation.

5. Remove two (2) pump mounting bolts.

   NOTE: Access upper right bolt through ignition switch opening using suitable extension.

6. Remove washer pump assembly.
7. To install reverse Steps 1-6.

   CAUTION: Install washer multiplug harness connector with battery lead on terminal with no tang (fig. 21). Incorrect installation of connector will result in direct ground and destroy wiper motor fuse.

Fig. 23—Washer Pump Drive Cam and Actuator

Disassembly—Assembly (Figures 24 thru 27)

1. Remove washer pump cover by squeezing.
2. Solenoid assembly - ratchet dog.
   a. Remove the ratchet dog retaining screw. Hold the spring loaded solenoid plunger in position and carefully lift the solenoid assembly and ratchet dog off the frame of the pump.
   b. Separate the ratchet dog from solenoid mounting plate as required.
3. Ratchet pawl.
   a. Disconnect ratchet pawl spring.
   b. Remove ratchet pawl retaining ring and slide ratchet pawl off cam follower shaft.
4. Ratchet wheel.
   a. Follow step 1 under solenoid - ratchet dog disassembly.
   b. Move ratchet wheel spring out of shaft groove and slide ratchet wheel off its shaft.
5. Pump and actuator plate assembly.
   a. Remove solenoid assembly - ratchet dog, ratchet pawl and ratchet wheel as outlined in their respective procedures.
   b. To separate the pump and pump actuator plate from the frame, pull the pump housing in the direction of the arrow until the grooves in the housing clear the frame. Then remove the actuator plate from the ratchet wheel and cam follower shafts.
6. Valve assembly.
   a. Remove the four (4) screws that attach the valve assembly to the pump housing.

   CAUTION: During re-assembly be sure gasket between housing and valve plate is properly positioned in the housing and valve plate grooves. Also be sure triple "O" ring is properly installed between valve body and pipe assembly.

7. To assemble washer unit, reverse above procedures.

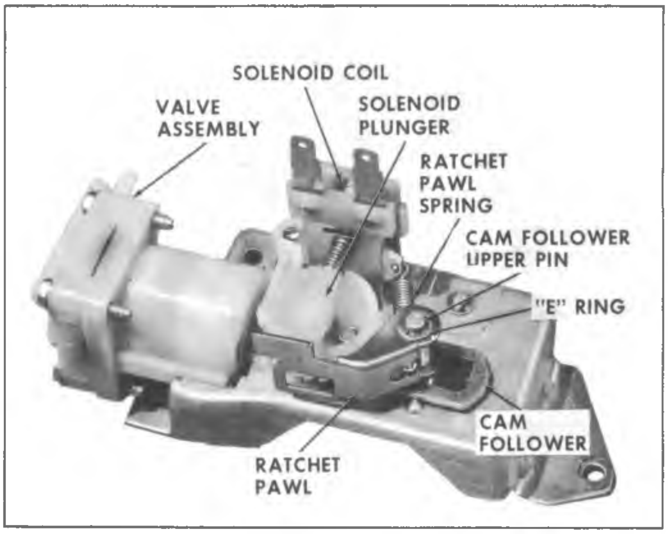


Fig. 24—Washer Pump Mechanism

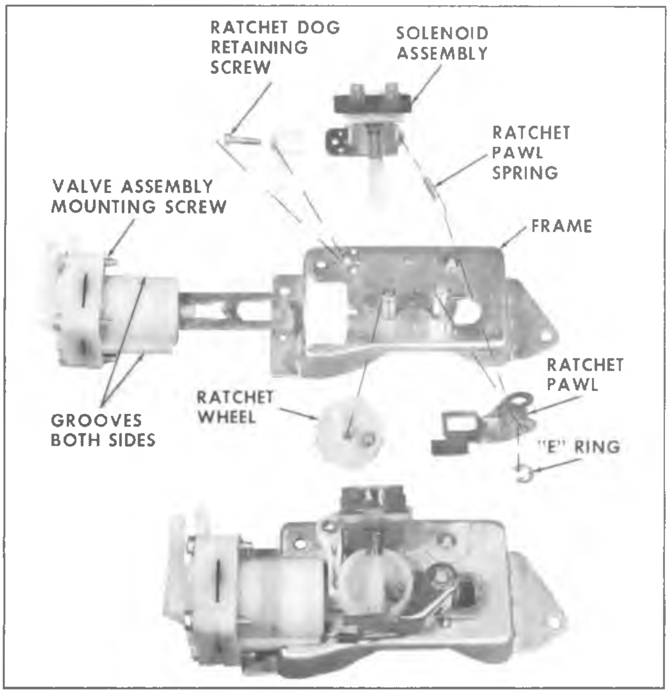


Fig. 25—Washer Pump — Exploded View

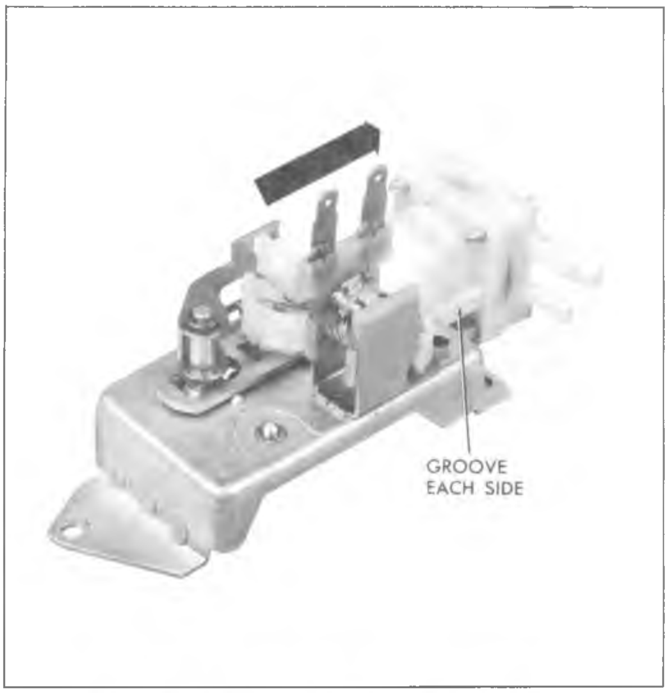


Fig. 26—Releasing Pump From Lockout Position

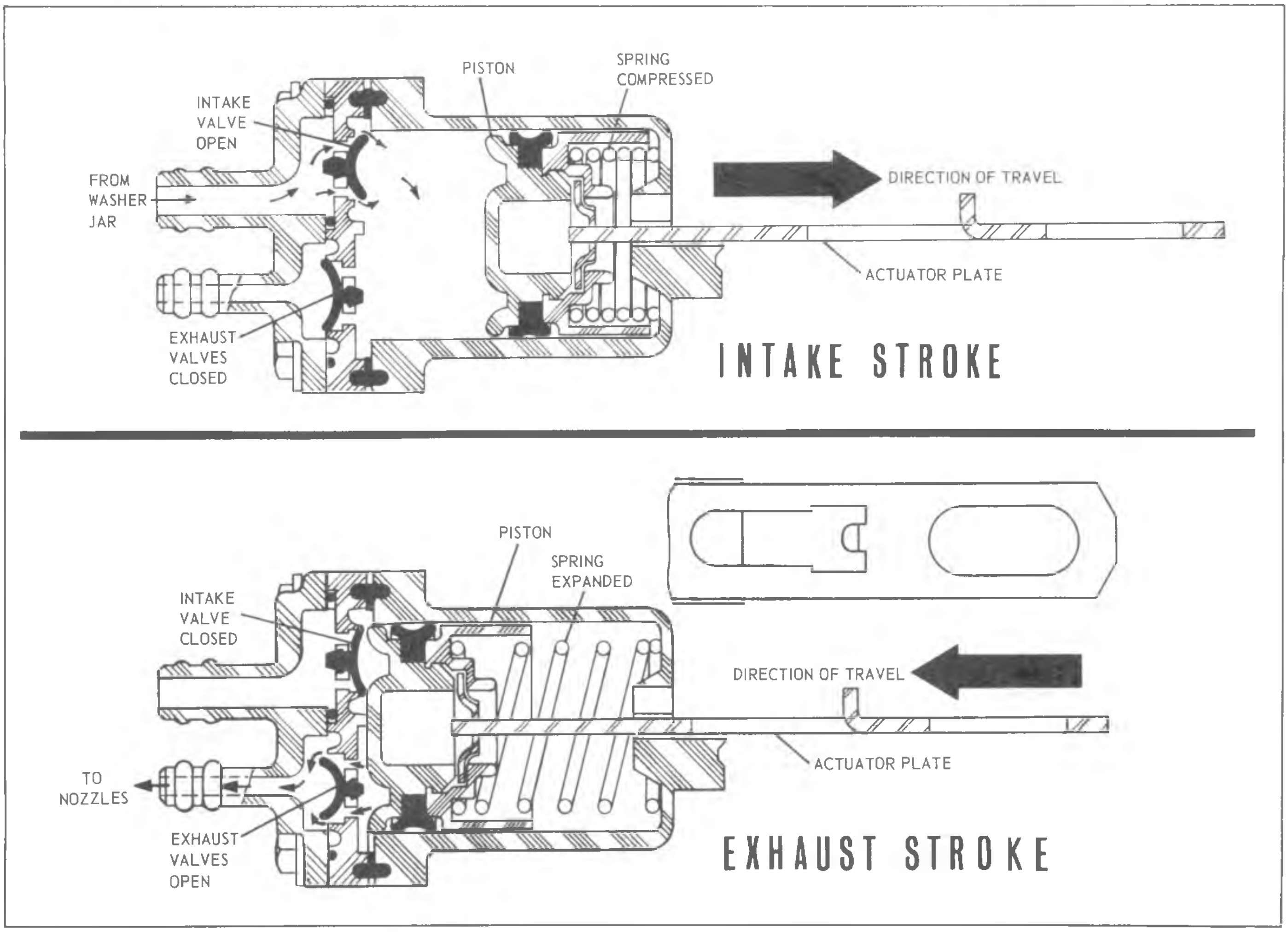


Fig. 27—Cross Section of Windshield Washer Pump Valve

ELECTRICAL CIRCUIT IDENTIFICATION

Circuit Number	Circuit Color	Circuit Name
2	Red	Feed, Battery - Unfused
3	Pink	Feed, Ign. Sw. "On" Controlled - Unfused
3	White,-Purple & Orange	Primary Ignition Voltage - Dropping Resistor. .38 ohm/ft.
3	White-Red & Black	Primary Ignition Voltage - Dropping Resistor 30 ohm./ft.
4	Brown	Feed. Ign. Sw. Accy. Controlled - Unfused
5	Purple	Neutral Safety Switch Feed or Neutral Safety Switch to Relay (Truck) or Relay to Ignition Switch (Truck) (Auto. Trans.)
6	Purple	Starter Solenoid Feed
7	Yellow	Primary Ignition Resistance Bypass
8	Gray	Instrument and Panel Lights, (Fused No. 44 Circuit)
9	Brown	Tail and License Lamp, Forward Side Marker Lamps Tail, Clearance and Marker Lamps (Trailers)
10	Light Blue	Dimmer Switch Feed
11	Light Green	Headlamp, High Beam
12	Tan	Headlamp, Low Beam
13	Purple	Front Parking Lamps
14	Light Blue	L.H. Indicator and Front Direction Light
15	Dark Blue	R.H. Indicator and Front Direction Light
16	Purple	Direction Signal Switch, Feed from Flasher
17	White	Direction Signal Switch, Feed from Stop Switch
18	Yellow	Stop and Direction Lamp or Direction Lamp Only-Rear L.H.
19	Dark Green	Stop and Direction Lamp, or Direction Lamp Only - Rear R.H.
20	Red	Stop Lamp (Trailer)
22	White	Ground - Direct (Trailer Wiring)
24	Light Green	Back-Up Lamp
25	Brown	Generator or Generator Armature to Voltage Regulator "A" (Includes Generator Telltale Circuit) or Regulator to Ignition Switch (Truck)
26	Dark Blue	Field Circuit (F) (Gen. Reg.)
27	Brown	Traffic Hazard Switch, Feed from Flasher
28	Black	Horn Switch
29	Dark Green	Horn Feed
30	Tan	Fuel Gauge to Tank Unit
31	Dark Blue	Oil Pressure - Engine
32	Yellow	Map Light
33	Tan	Warning Light - Brake Alarm
34	Purple	Fog or Drive Lamp
35	Dark Green	Telltale Temp. Gauge (Hot), or Std. Temp. - Readable Gauge.
38	Dark Blue	Flasher, Fuse Feed
39	Pink-Black	Feed, Ign.Sw. "On" Controlled Fused

Circuit Number	Circuit Color	Circuit Name
40	Orange	Feed, Battery - Fused
41	Brown-White	Feed, Ign. Sw. Accsy. Controlled - Fused
43	Yellow	Radio Feed
44	Dark Green	Instrument and Panel Lights, Feed (Usually Light Switch to Fuse)
45	Black	Marker and Clearance Lamps (Trailers - ICC Requirement)
46	Dark Blue	Rear Seat Speaker Feed from Radio Single or Rt., Stereo
47	Dark Blue	Auxiliary Circuits (Trailer)
49	Gray	Mod. Assembly to Control
50	Brown	Blower Switch - Feed
51	Yellow	Blower Feed - Low
52	Orange	Blower Feed - High
55	Orange	Kick-Down on Automatic Transmission
56	Tan	Amplifier to Heatsink (Radio)
59	Dark Green	Compressor to Air Conditioning Switch
60	Orange-Black	Feed, Battery - Circuit Breaker Protected
63	Tan	Blower-Switch Control - Low and Feed
65	Purple	Blower Motor to Relay
70	Red-White	Feed, Relay Controlled Circuit Breaker Protected
72	Light Blue	Blower Switch Medium to Blower Resistor
75	Dark Green	Back-Up Switch or Parking Brake Alarm Feed
80	Pink-Black	Feed-Key Warning Buzzer
90	Pink-Black	Feed, Cutout Sw. Controlled Circuit Breaker Protected
91	Black	Windshield Wiper - Low
92	Light Blue	Windshield Wiper - High
93	Yellow	Windshield Wiper Motor Feed
94	Dark Blue	Windshield Washer Switch to Windshield Washer
101	Dark Blue	Resistor Output to Blower Relay
102	White	SI Alternotor Regulator Sensing Circuit
105	Black	Ammeter - Generator
106	Black-White	Ammeter - Battery
107	Dark Blue	Over-Speed Warning Light
111	Black	Buzzer to Low Air Pressure or Vacuum Switch
112	Dark Green White	Telltale Temperature Gauge (Hot)
119	White	Generator (Alternator) to Regulator
120	Black	Power Trans. Relay to Thermo Switch (Truck)
121	Brown	Tachometer to Coil
124	Black	Switch on Shift Lever to Adapter, or to Motor on Rear Axle (Low), or to Adaptor (Low) (Truck)
125	Light Green	Switch to Diff. Lock-Out Valve (Truck)
126	Brown	Diesel Ignition - Buzzer to No. 4 "L" on Voltage Regulator (Truck)

ELECTRICAL CIRCUIT IDENTIFICATION (Cont'd.)

Circuit Number	Circuit Color	Circuit Name
127	Dark Green	Two-Speed Axle - Switch on Shift Lever to Motor on Rear Axle (High) (Truck)
130	Color depends on Resonator	Generator (Alternator) External Resistance
	Brown-White	2 ohms per foot
	Black-Pink	1 ohm per foot
131	Brown	Low Vacuum to Air Pressure Warning Light to Switch (Truck)
139	Pink-Black	Feed, Ign. Sw. "On" Controlled - Fused
140	Orange	Feed, Battery - Fused
141	Brown-White	Feed Ign. Sw. Accsy. Controlled Fused
150	Black	Ground Circuit - Direct
151	Black	Ground Circuit - Direct
152	Black	Ground Circuit - Direct
153	Black	Ground Circuit - Direct
154	Black	Ground Circuit - Direct
155	Black	Ground Circuit - Direct
156	White	
157	White Black	Ground Circuit - Sw. Controlled - Body Interior Lamps - such as
158	White-Dark Green	Dome, Courtesy, Map, Warning, etc.
159	Black-Purple	Ground - Key Warning Buzzer
162	Gray	Power Top-Up
163	Purple	Power Top-Down
164	Dark Blue	Window Control-L.F. - Up
165	Brown	Window Control-L.F. - Down
166	Dark Blue White	Window Control-R.F. - Up
167	Tan	Window Control-R.F. - Down
168	Dark Green	Window Control-L.R. - Up
169	Purple	Window Control - L.R. - Down
170	Light Green	Window Control - R.R. - Up
171	Purple-White	Window Control - R.R. - Down
178	Dark Green	Power Seat - 6-W - Fore and Aft
179	Tan	Power Seat - 6-W - Solenoid - Rear - Up and Down
180	Light Green	Power Seat - 6-W - Solenoid - Frt. - Up and Down
181	Light Blue	Power Seat - Solenoid - Fore and Aft
182	Yellow	Power Seat - 6-W - Aft and Down
183	Light Blue	Tailgate - Window - Up
184	Tan-White	Tailgate - Window - Down
189	Dark Green	Power Seat - 4-W - Fore and Down
190	Yellow	Power Seat - 4-W - Aft and Up
191	Light Green	Power Seat - 4-W - Solenoid - Up and Down
192	Purple	Defogger - High or Single Speed
193	White-Purple & Orange	Defogger - Low Speed - .38 ohm/ft.
198	Light Green	In-Car Sensor to Control
199	Brown	Rear Seat Speaker - Feed from Radio Left Stereo
200	Light Green	Front Speaker - Feed from Radio - Single or Right Stereo
201	Tan	Front Speaker - Feed from Radio - Left Stereo
202	Black	Compressor Overheat Switch to Thermal Limiter
203	Red/White	Rear Air Conditioning Potentiometer Feed
204	Brown	Ambient Temperature Switch to Thermal Limiter (Feed)
205	White/Black	Seat Belt Seat Sensor to Belt Retractor (Grd.)
206	Black	Neutral Start Switch to Buzzer and Lamp
207	Yellow/Black	Seat Sensor to Neutral Start Switch
208	Black	Switch Controlled Ground (TCS)
209	Purple	Parking Brake Warning Lamp
239	Pink-Black	Feed, Ign. Sw. "On" Controlled - Fused
240	Orange	Feed, Battery - Fused
241	Brown-White	Feed Ign. Sw. Accsy. Controlled - Fused
252	Gray	Electric Door Lock (Unlock)
253	Light Green	Electric Door Lock (Lock)
340	Orange	Feed, Battery - Fused

NOTE: Ground circuit numbers used in the order as listed, depending on the number of circuits at any one time.
* When No. 35 circuit does not apply (normally on Vehicles with both Telltale Light and Standard Temperature Gauge.)

DIRECTIONS FOR INTERPRETING THE NEW ADDRESSING CONCEPT

THIS DOCUMENT INCORPORATES A NEW MAPPING CONCEPT TO REPLACE LINES REPRESENTING WIRES. IT READS IDENTICAL TO MOST ROAD MAPS IN THAT NUMERIC STATIONS ARE ASSIGNED HORIZONTALLY AND ALPHABETIC STATIONS ARE ASSIGNED VERTICALLY. THEREFORE ANY COMBINATION OF NUMERIC AND ALPHABETIC CHARACTERS DESIGNATES A PRECISE LOCATION.

TO ILLUSTRATE THE USE OF THIS CONCEPT LETS USE THE HORN CIRCUIT, LOCATED IN THE UPPER LEFT HAND CORNER, AS AN EXAMPLE. THE NUMBER 29 CONTAINED IN THE RECTANGLE $\boxed{29}$ REPRESENTS THE CIRCUIT NUMBER. IMMEDIATELY TO THE RIGHT APPEARS 12 DG. THE NUMBER 12 SPECIFIES THE GAUGE OF THE WIRE AND DG IS THE ABBREVIATION FOR THE WIRE COLOR, DARK GREEN. SHOWN IN PARENTHESIS IS (24C) THIS IS THE ADDRESS IDENTIFYING THE LOCATION OF THE OTHER END OF THE WIRE. TO FIND THIS LOCATION, SIMPLY SCAN THE BOTTOM OF THE SHEET TO THE NUMBER 24 AND THEN SCAN VERTICALLY TO THE APPROXIMATE LOCATION OF C. THE CIRCUIT #29 SHOULD POP INTO VIEW.

TO FOLLOW THE CIRCUIT IN REVERSE, SIMPLY REVERSE THE PROCEDURE. FOLLOW THE LEAD IN WIRE OUT OF THE RECTANGLE $\boxed{29}$ AT THE END OF THIS WIRE APPEARS (4S) 12 DG AGAIN. THE NUMBER 12 REPRESENTS WIRE GAUGE AND DG THE WIRE COLOR, DARK GREEN. (4S) IS THE ADDRESS. TO FIND THIS LOCATION, SCAN THE BOTTOM OF THE SHEET TO STATION 4 AND SCAN VERTICALLY TO THE APPROXIMATE LOCATION OF "S" THE CIRCUIT #29 SHOULD BE IMMEDIATELY APPARENT.

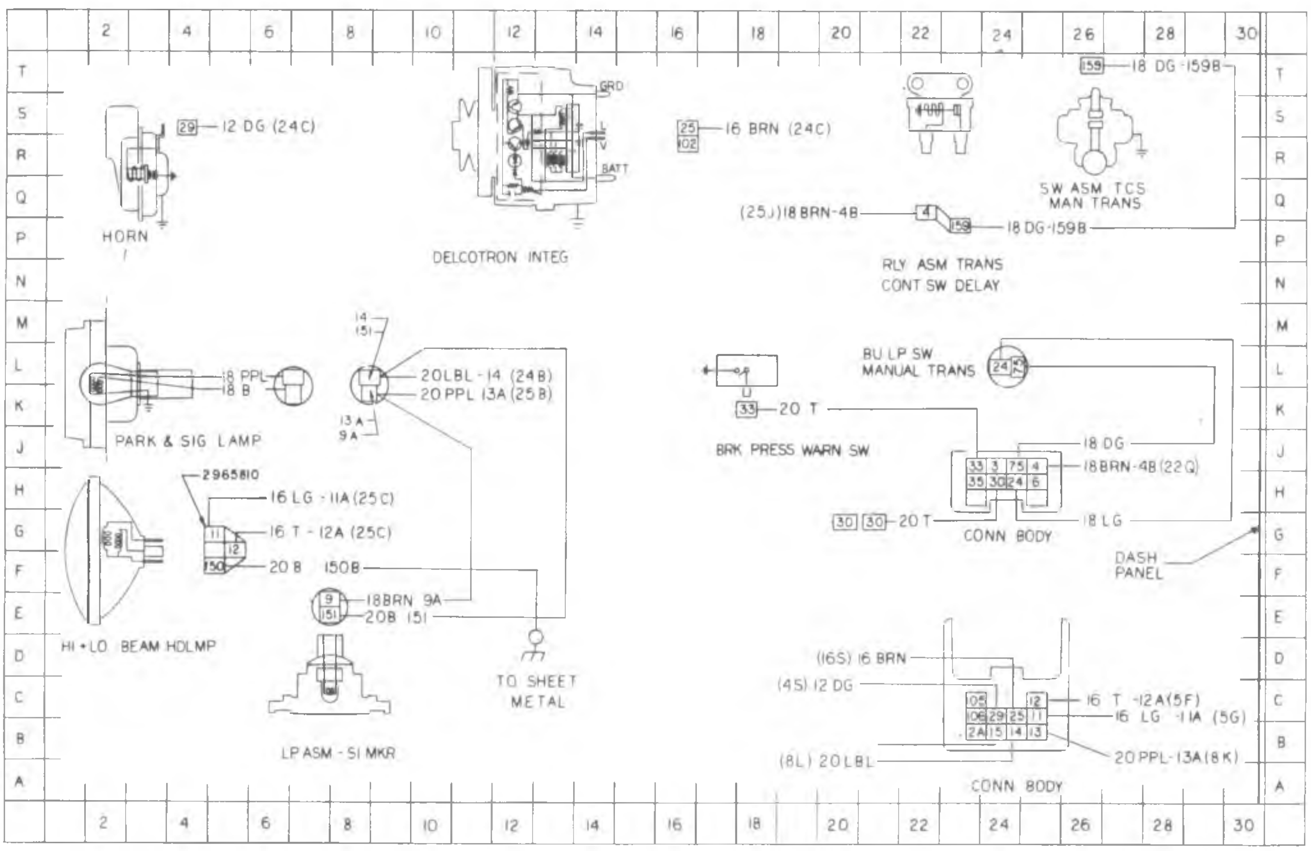


Fig. 28—Instruction Sheet P 10-30 Truck Wiring

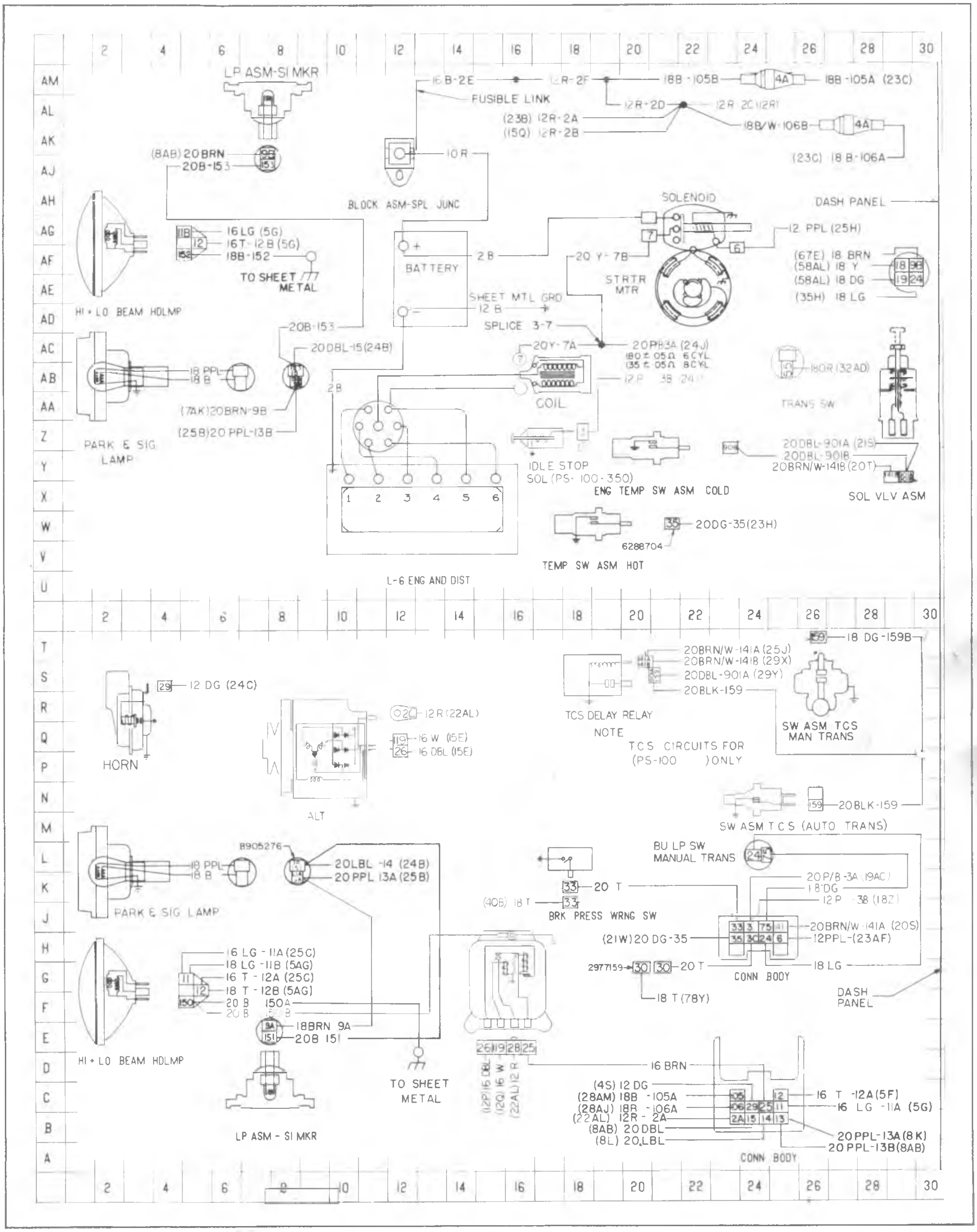


Fig. 29—Engine Compartment P 10-30

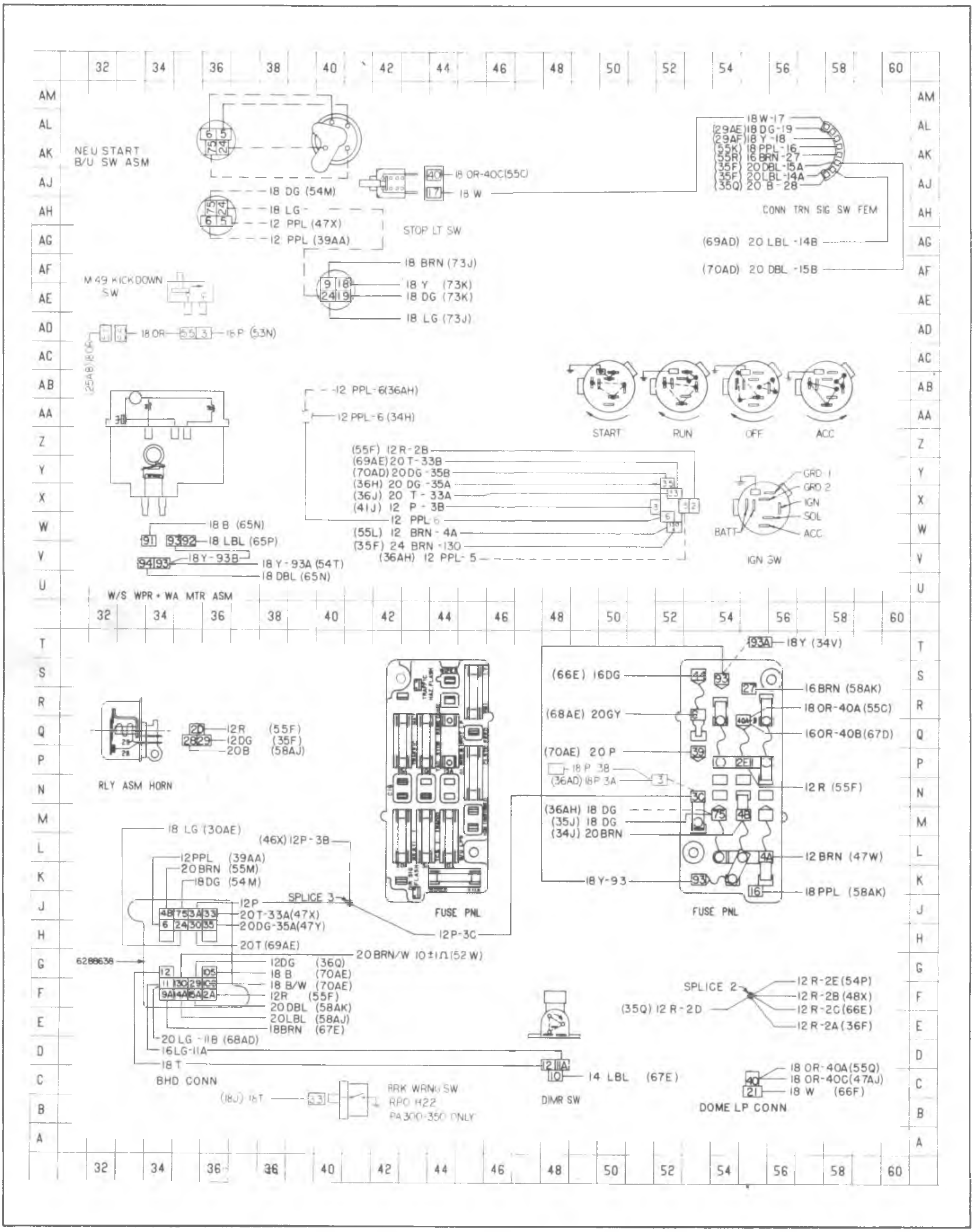


Fig. 30—Instrument Panel P 10-30

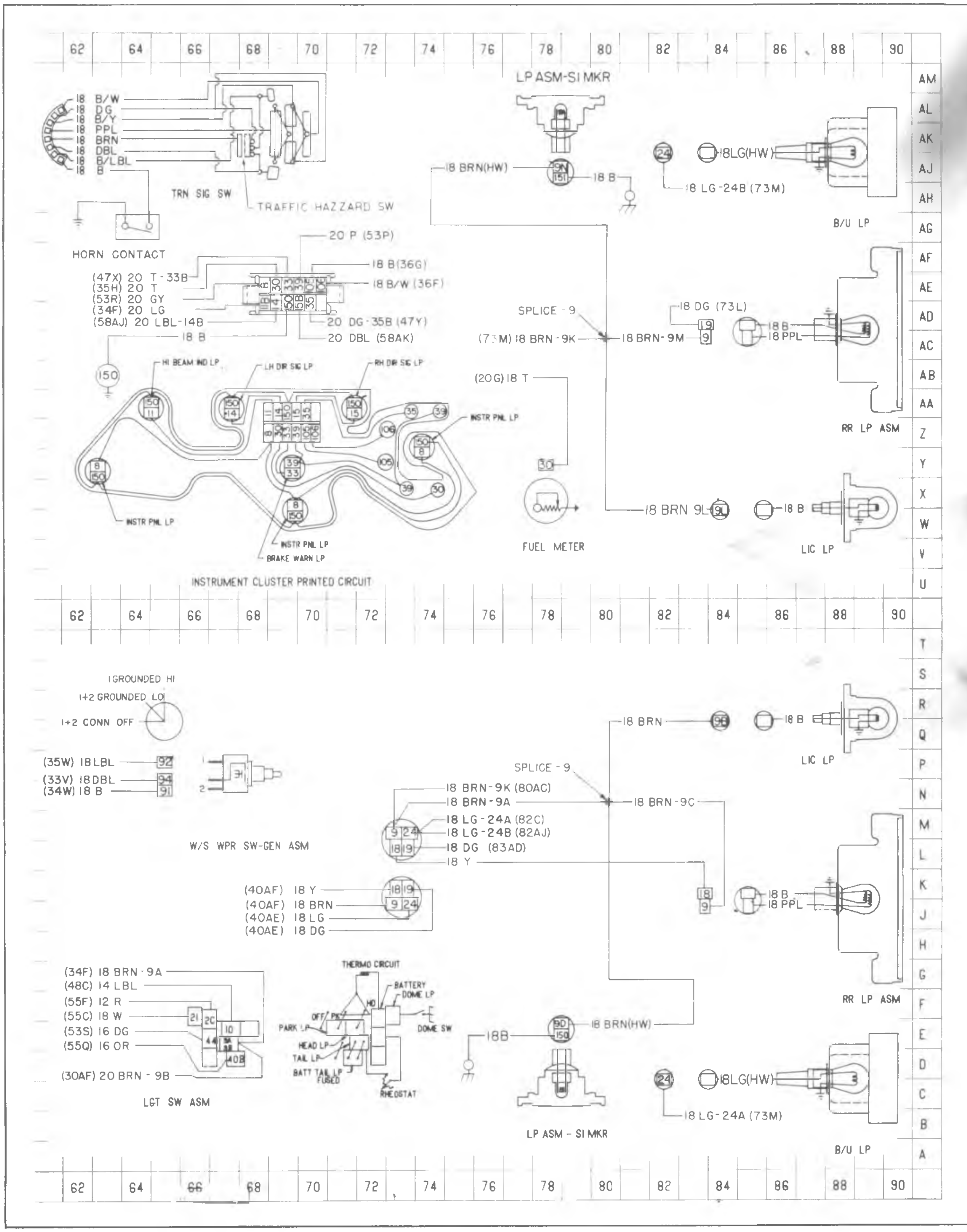


Fig. 31—Instrument Cluster & Rear P 10-30

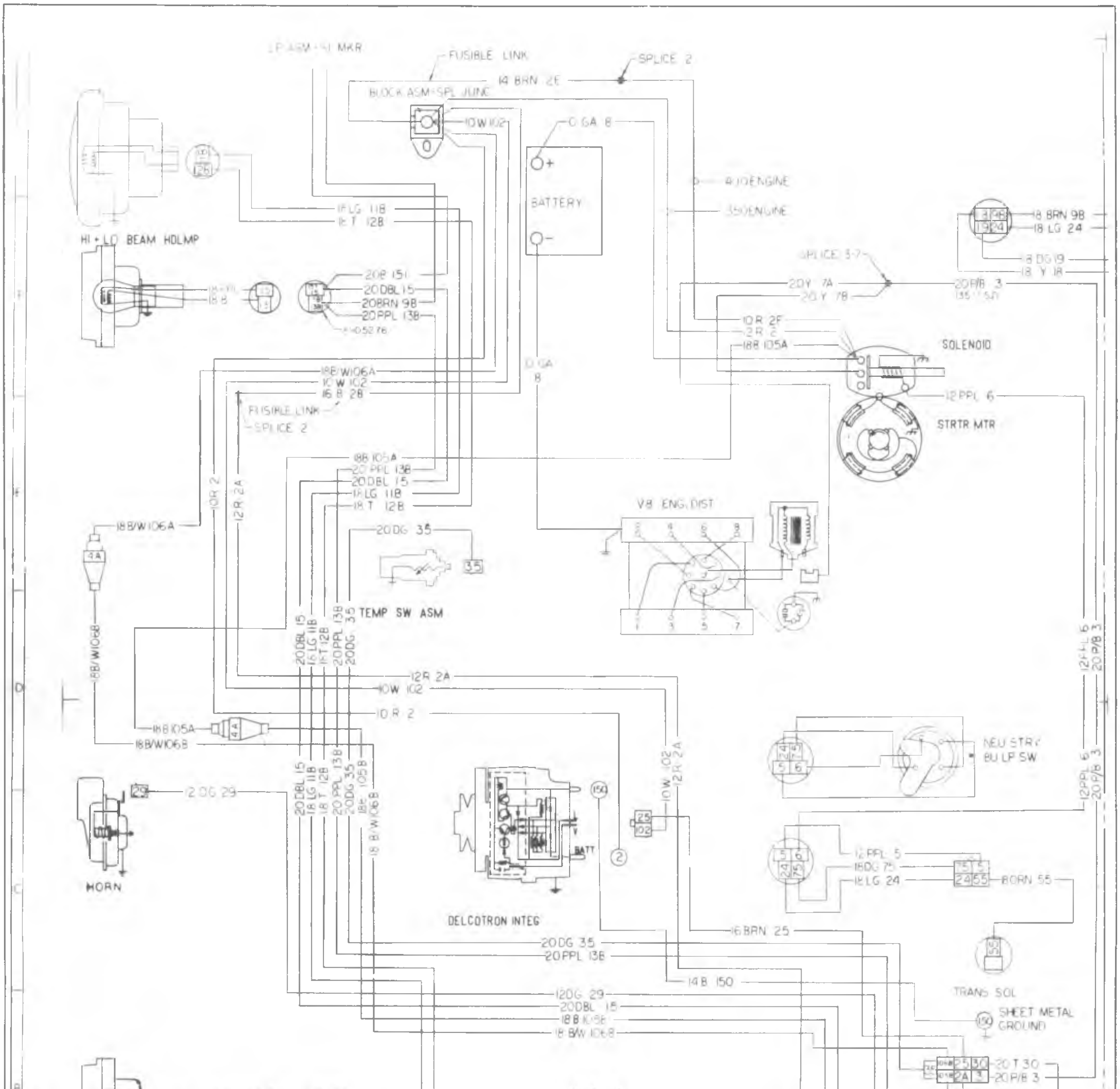


Fig. 32—Mobile Home Engine Compartment PE 31

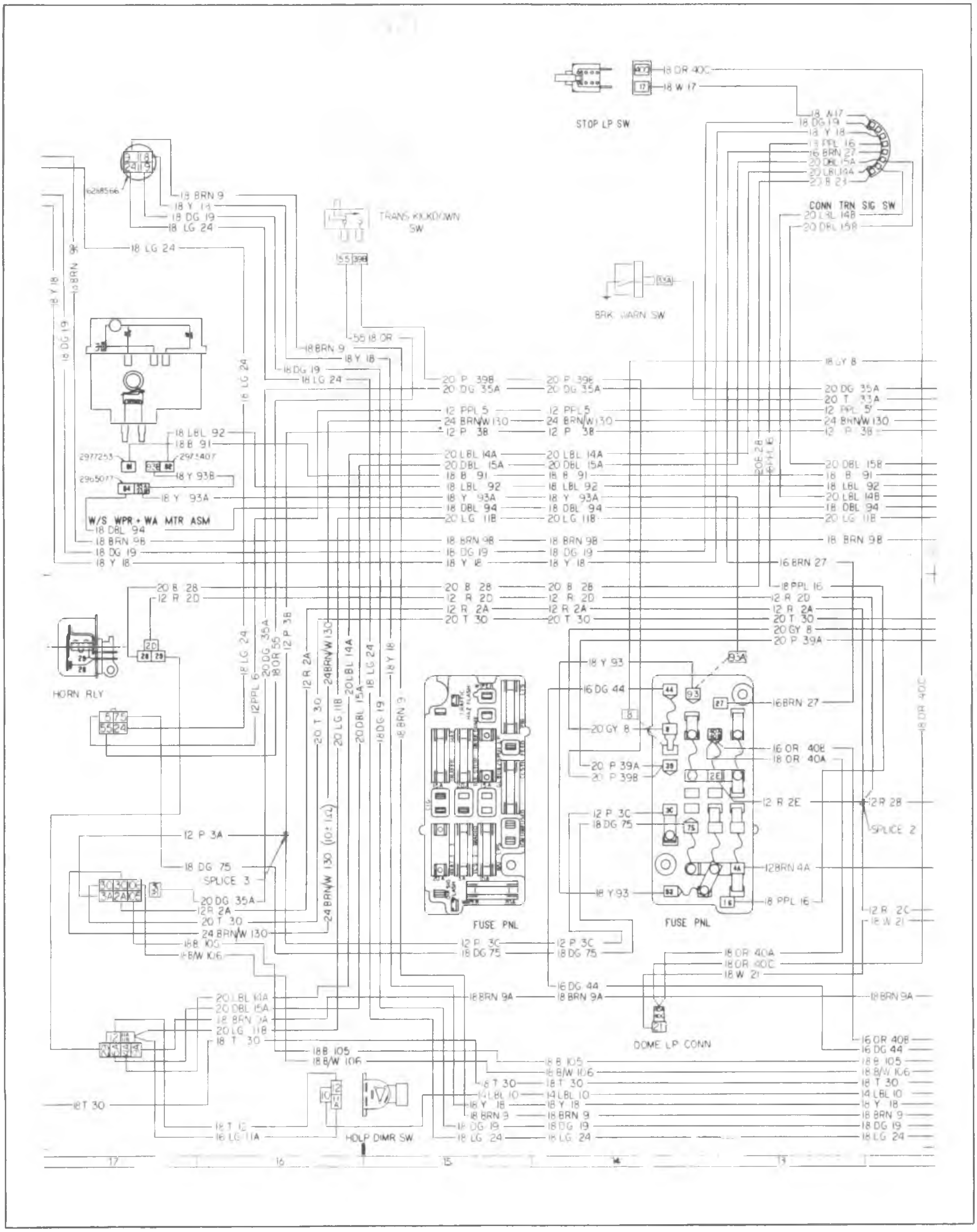


Fig. 33—Mobile Home Instrument Panel PE 31

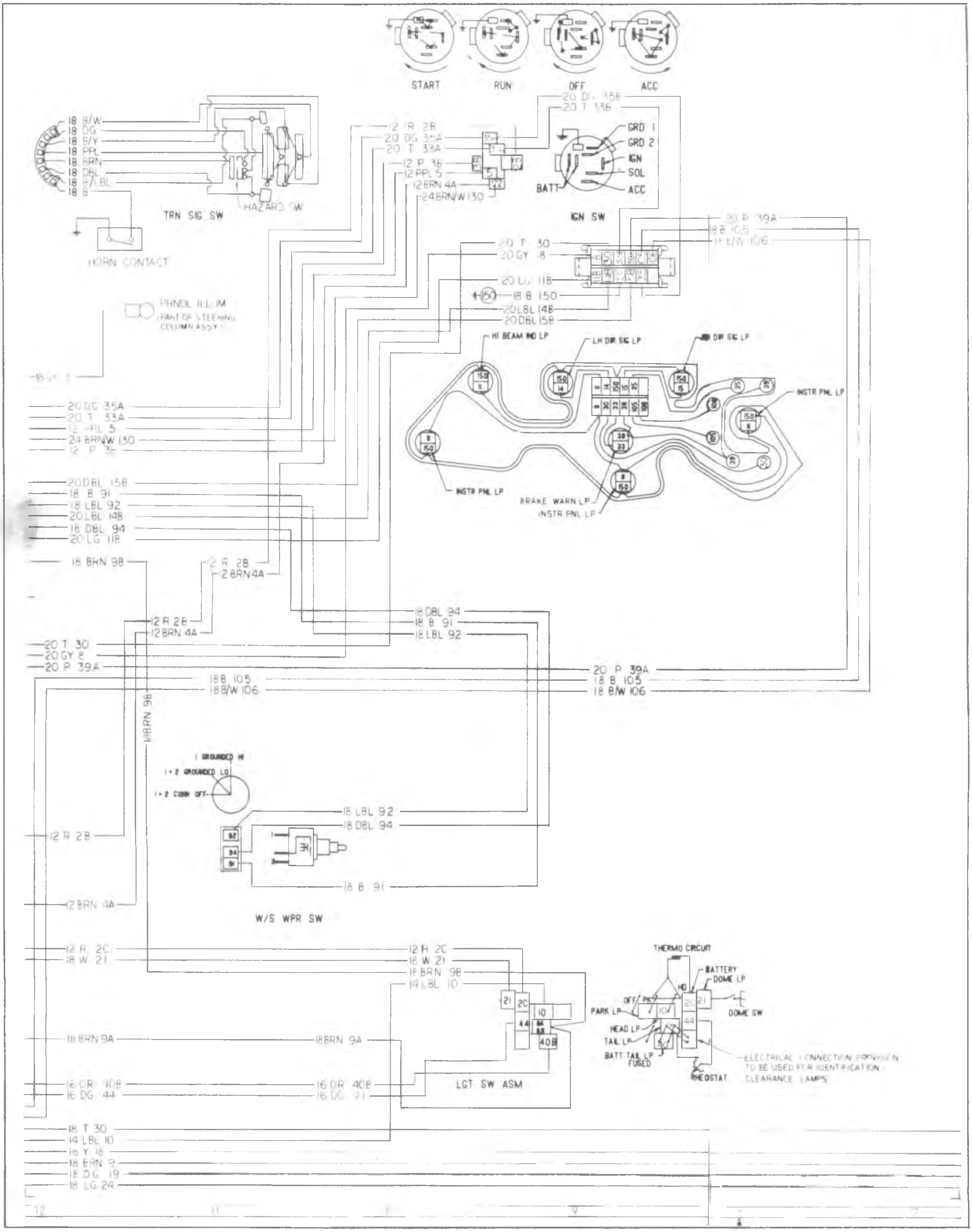


Fig. 34—Mobile Home Instrument Cluster PE 31

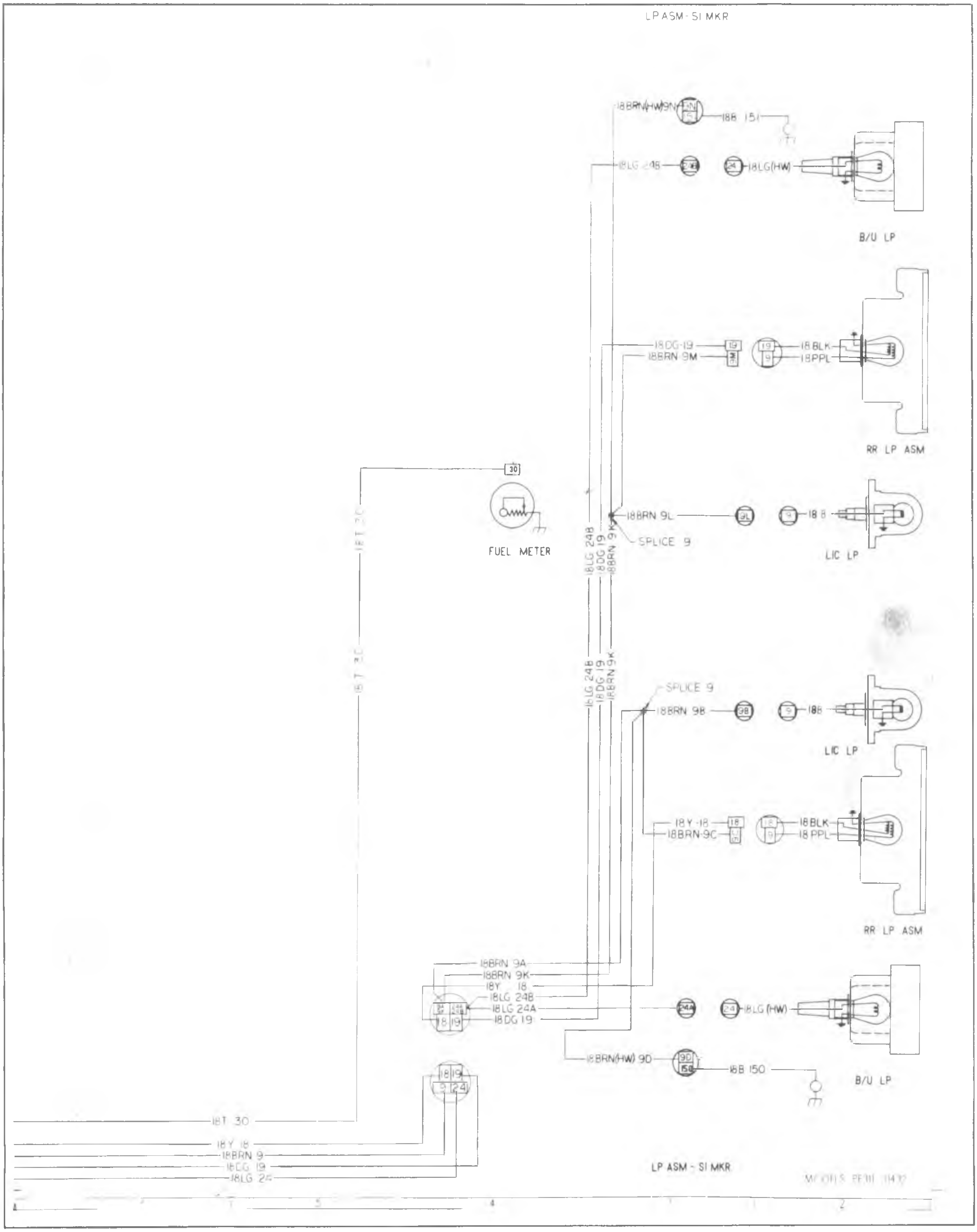


Fig. 35—Mobile Home Rear Lighting PE 31

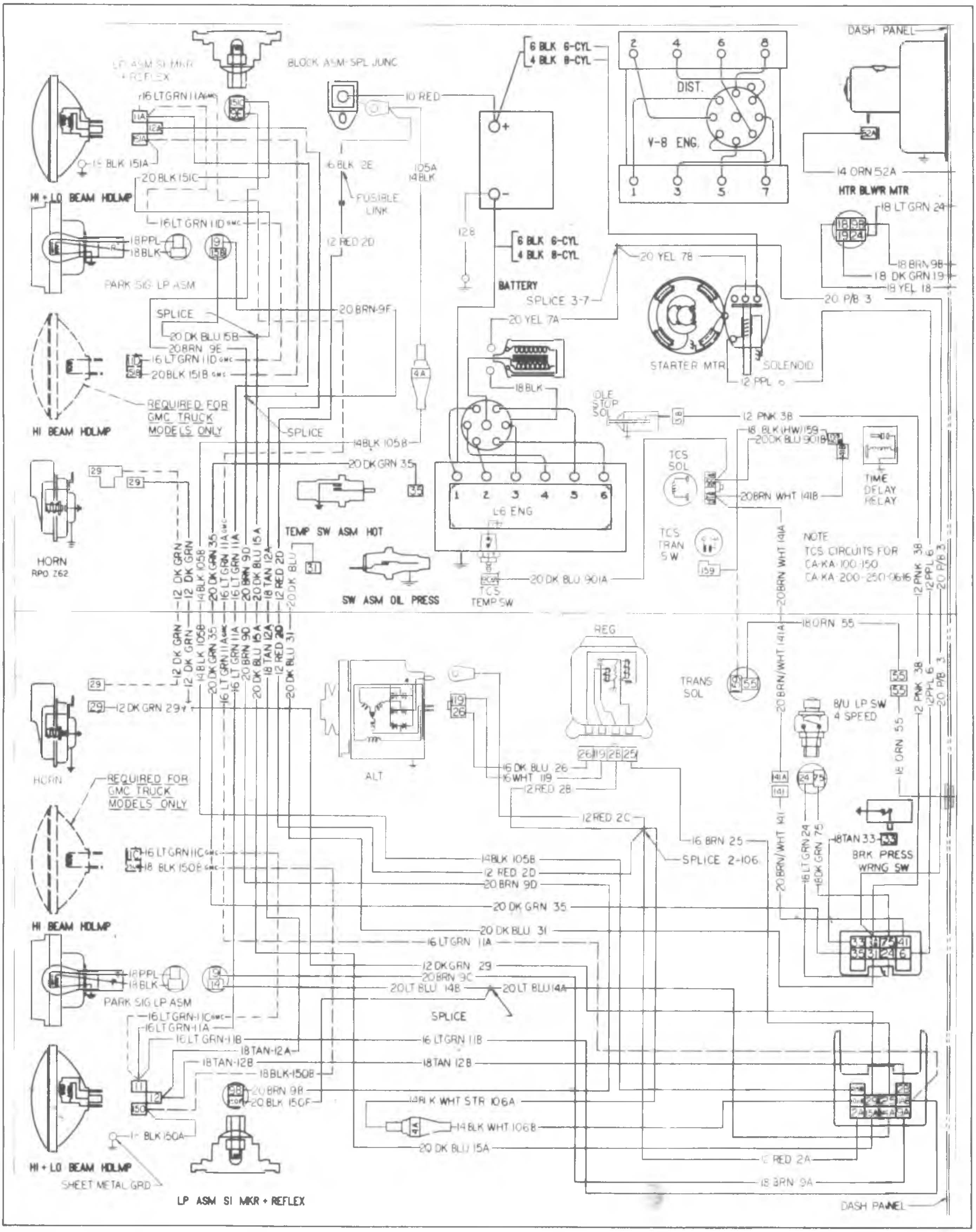


Fig. 36—Engine Compartment CA-KA 10-30

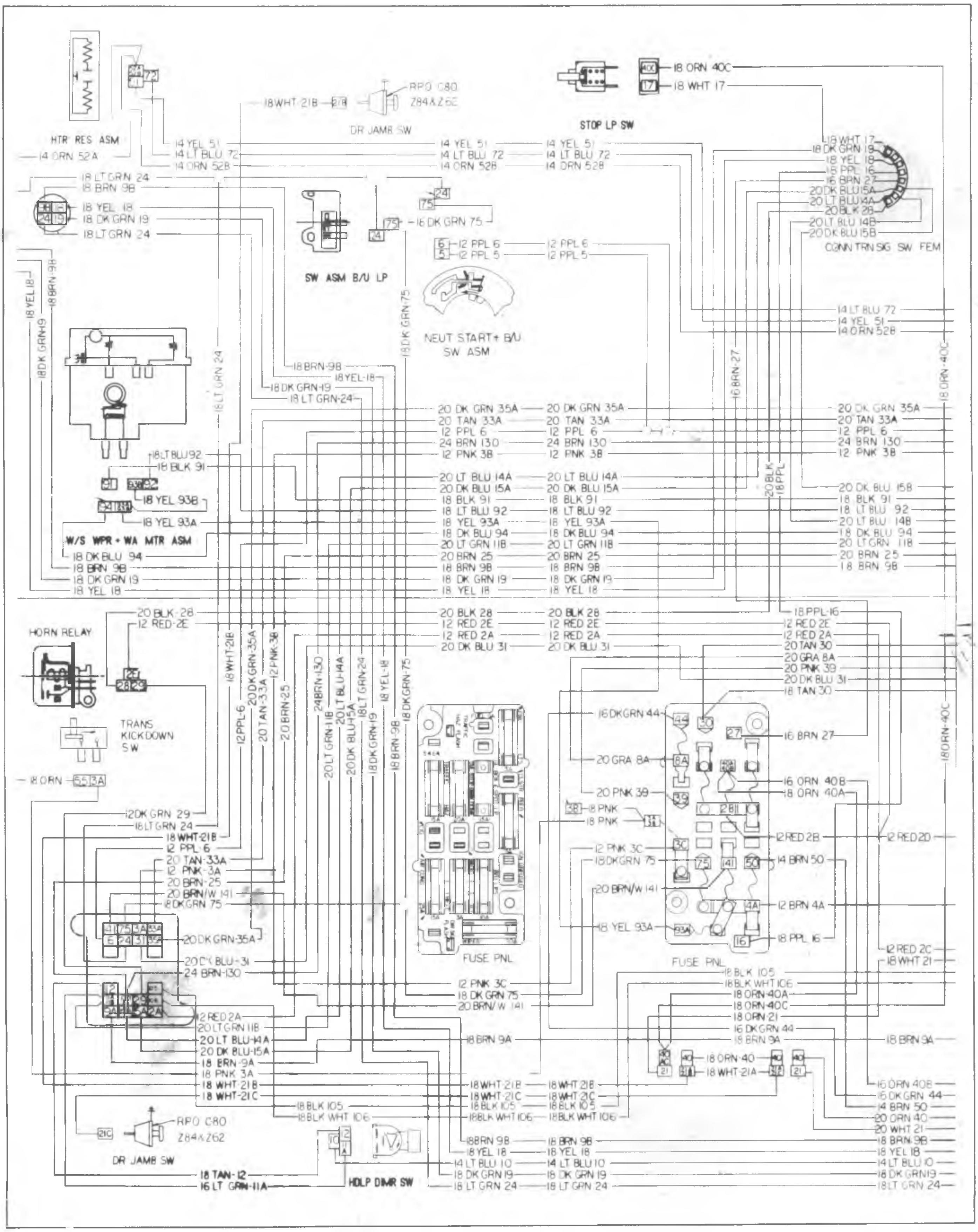


Fig. 37—Instrument Panel CA-KA 10-30

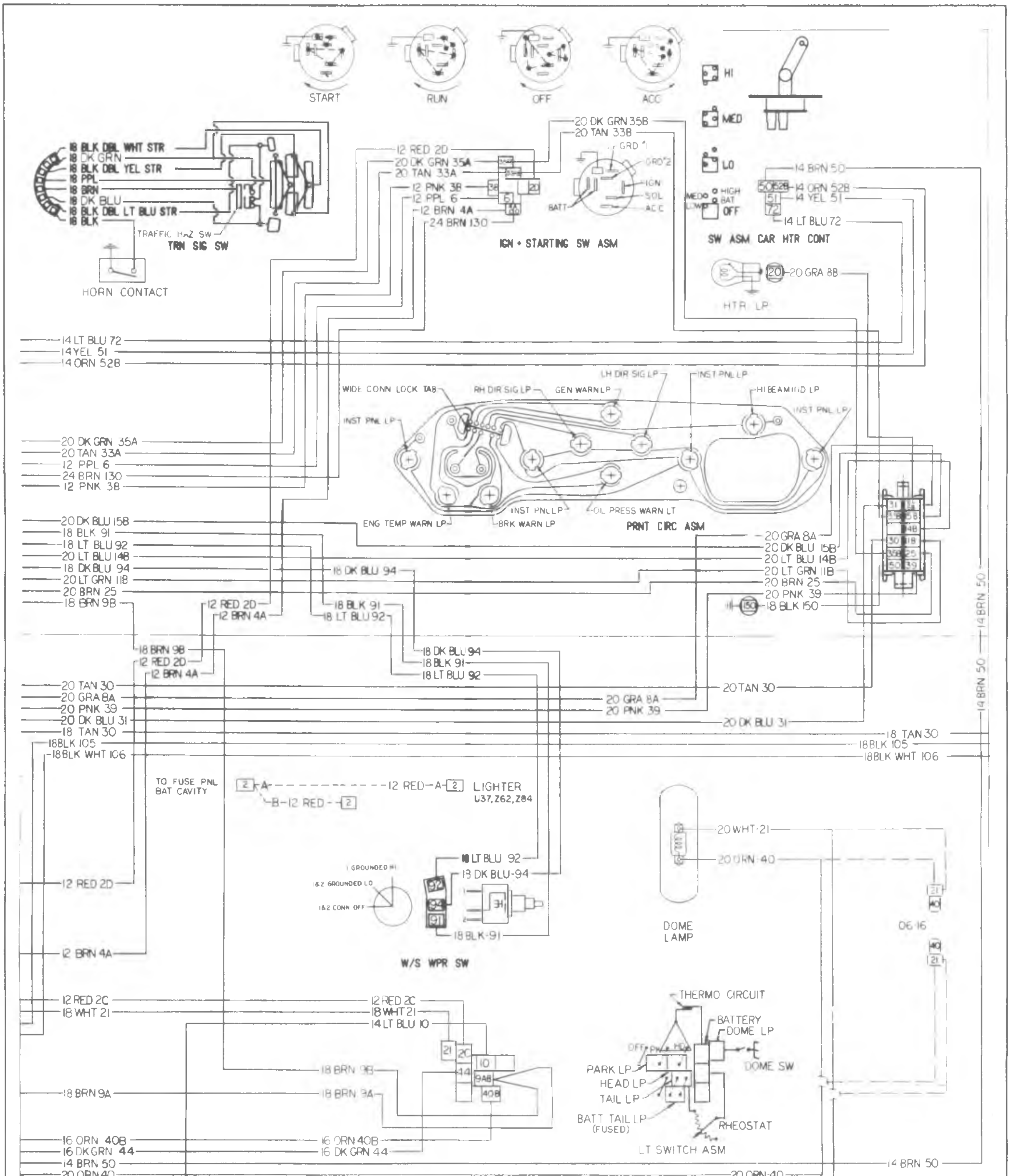


Fig. 38—Instrument Cluster CA-KA 10-30

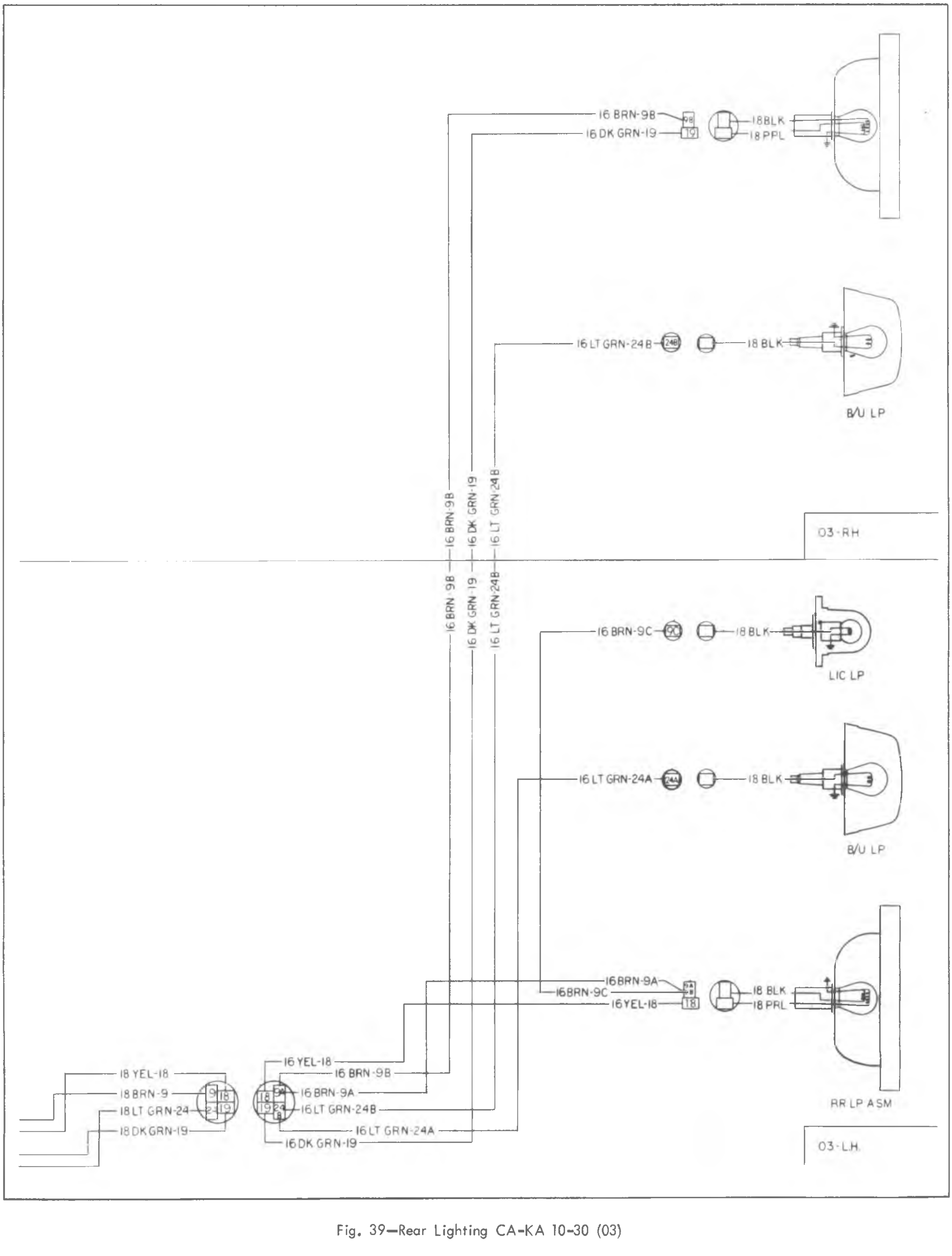


Fig. 39—Rear Lighting CA-KA 10-30 (03)

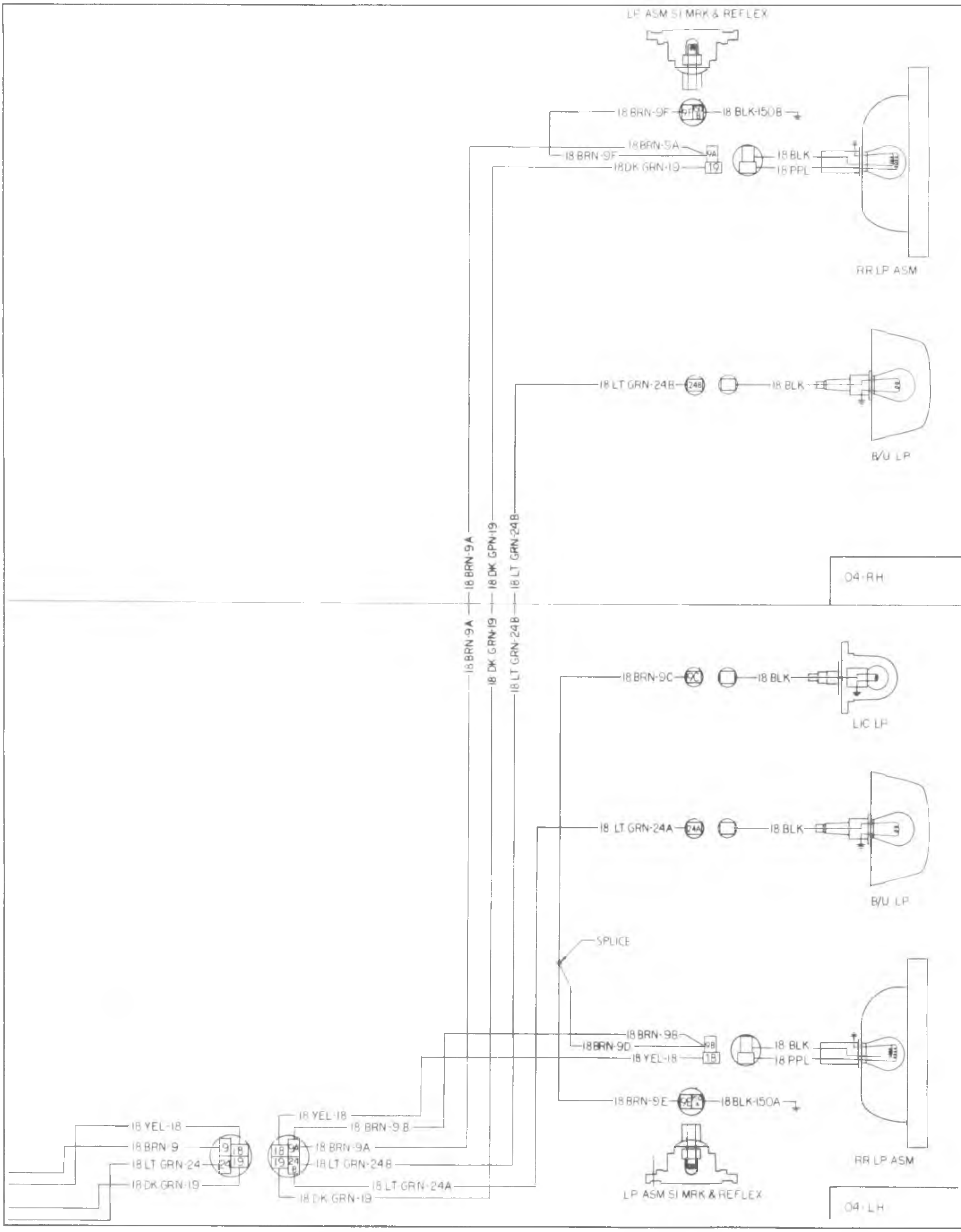


Fig. 40—Rear Lighting CA-KA 10-30 (04)

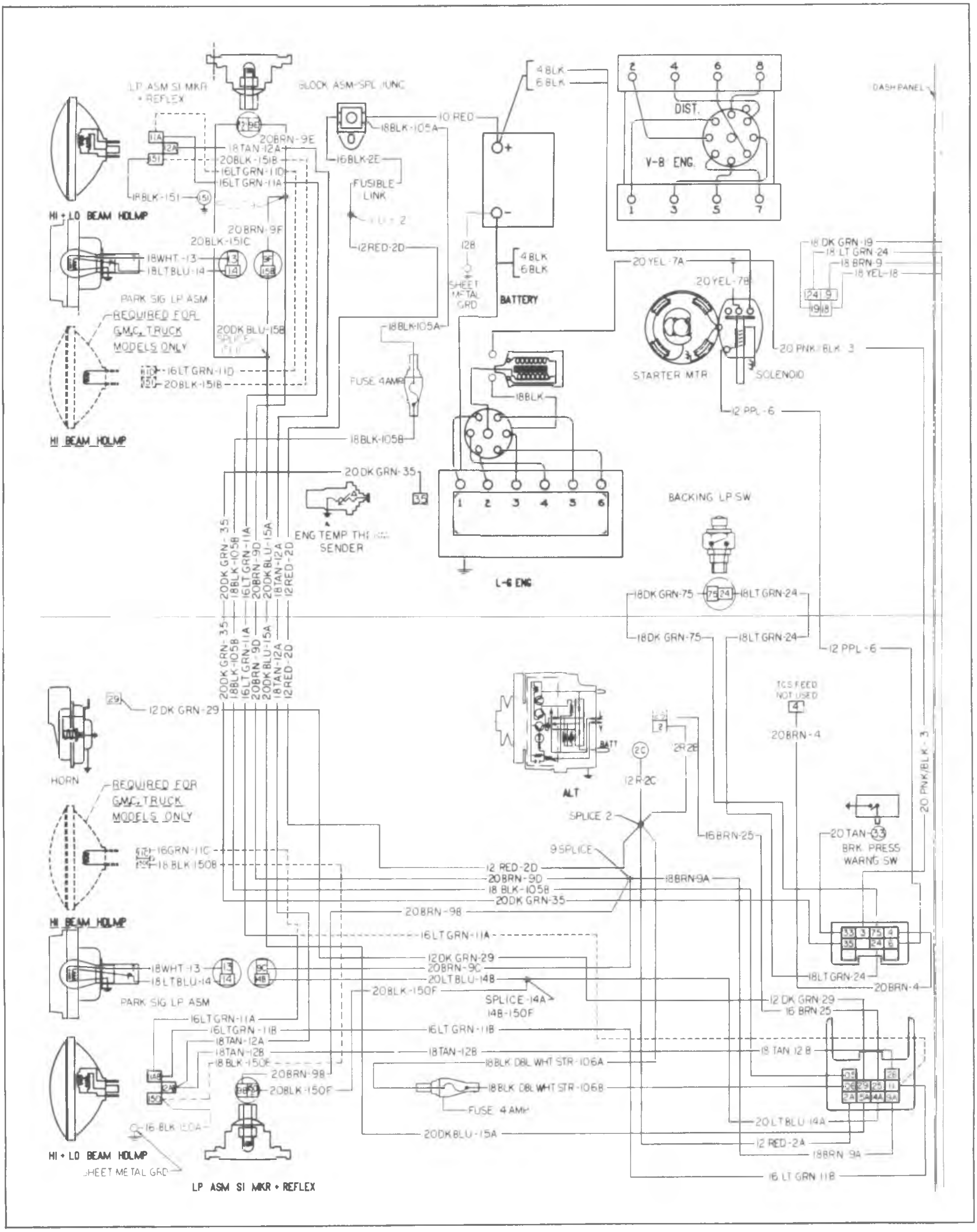


Fig. 41—Rear Lighting CA-KA 10-30 (06-16)

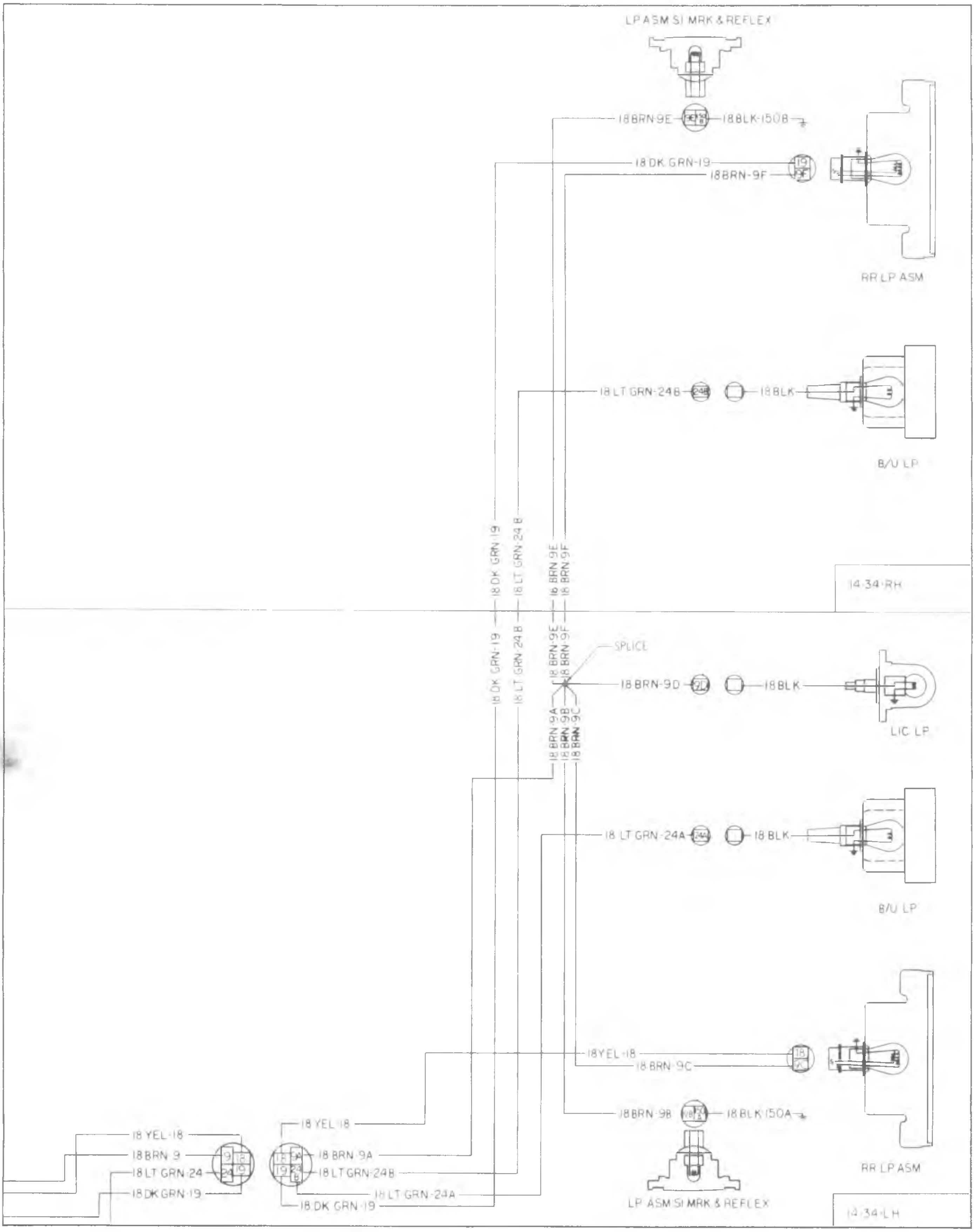


Fig. 42—Rear Lighting CA-KA 10-30 (14-34)

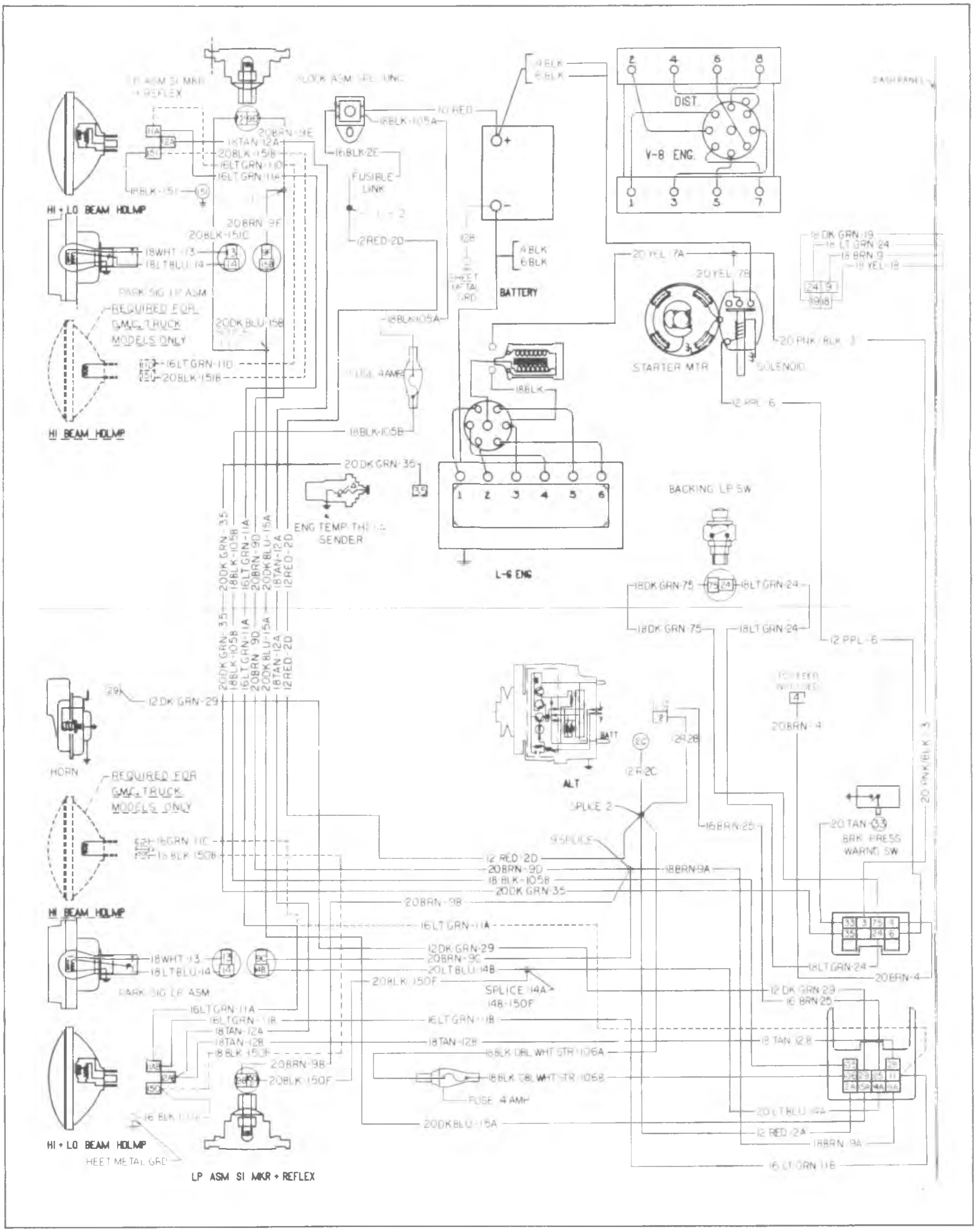


Fig. 43—Engine Compartment CA 30 (02)

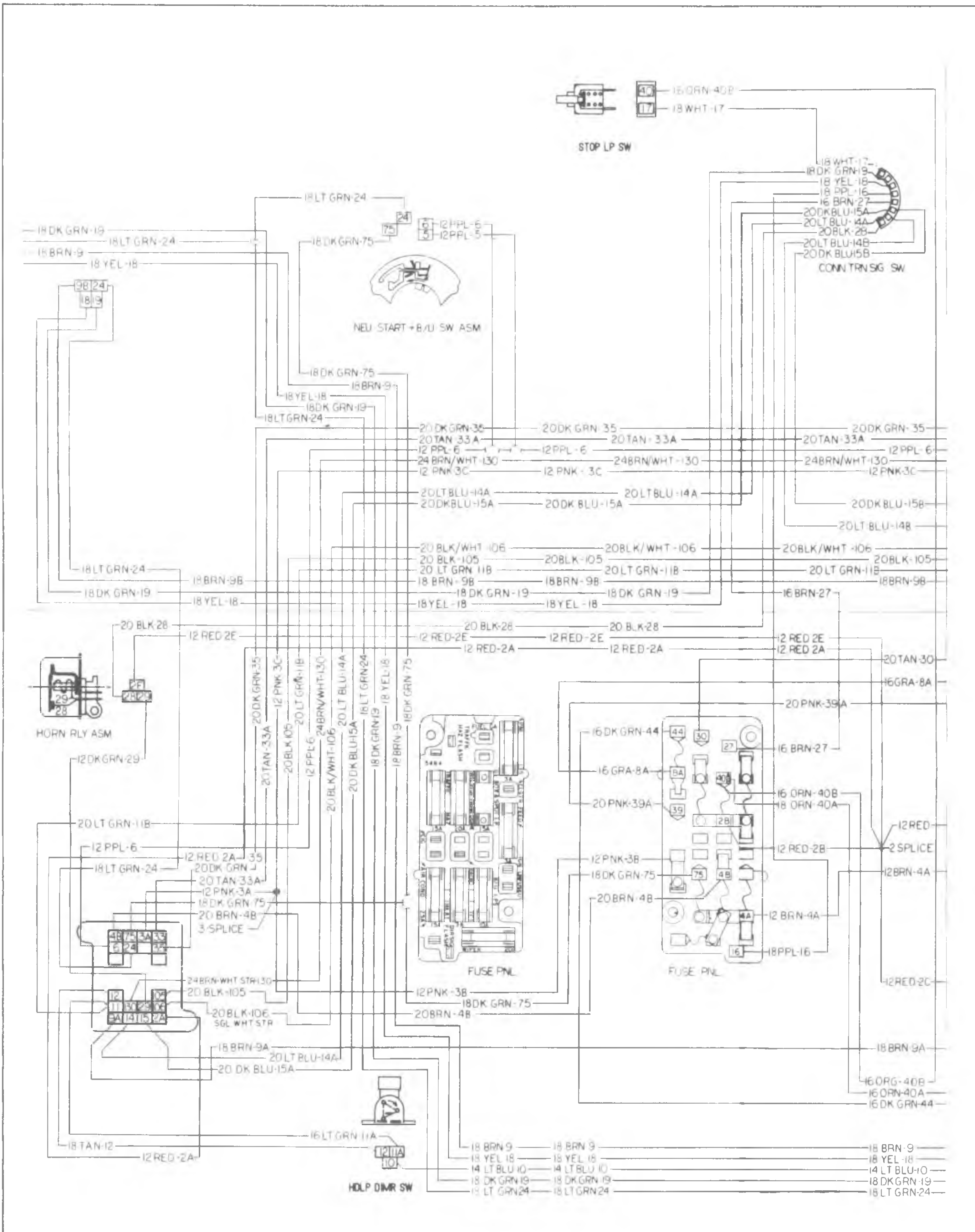


Fig. 44—Instrument Panel CA 30 (02)

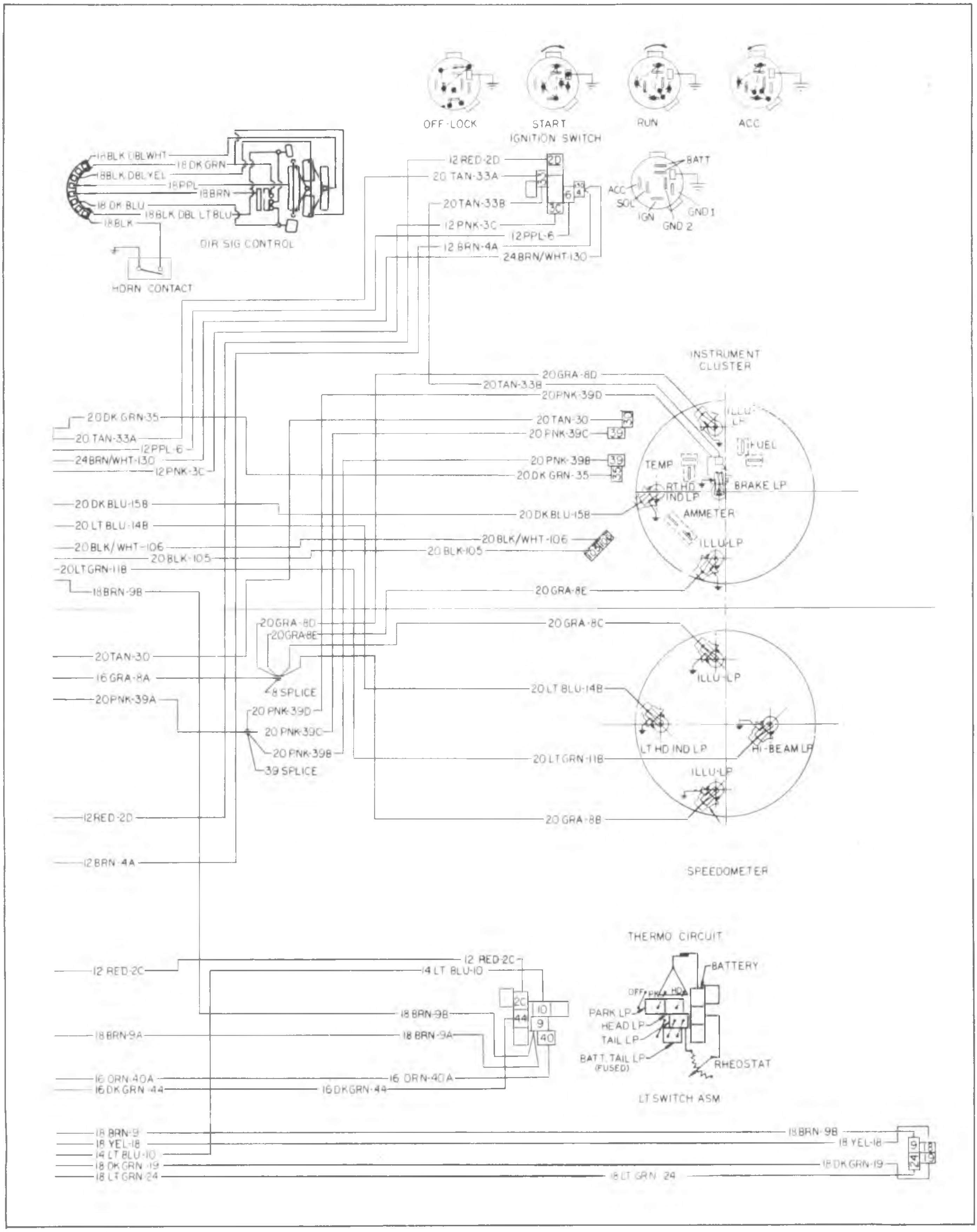


Fig. 45—Instrument Cluster CA 30 (02)

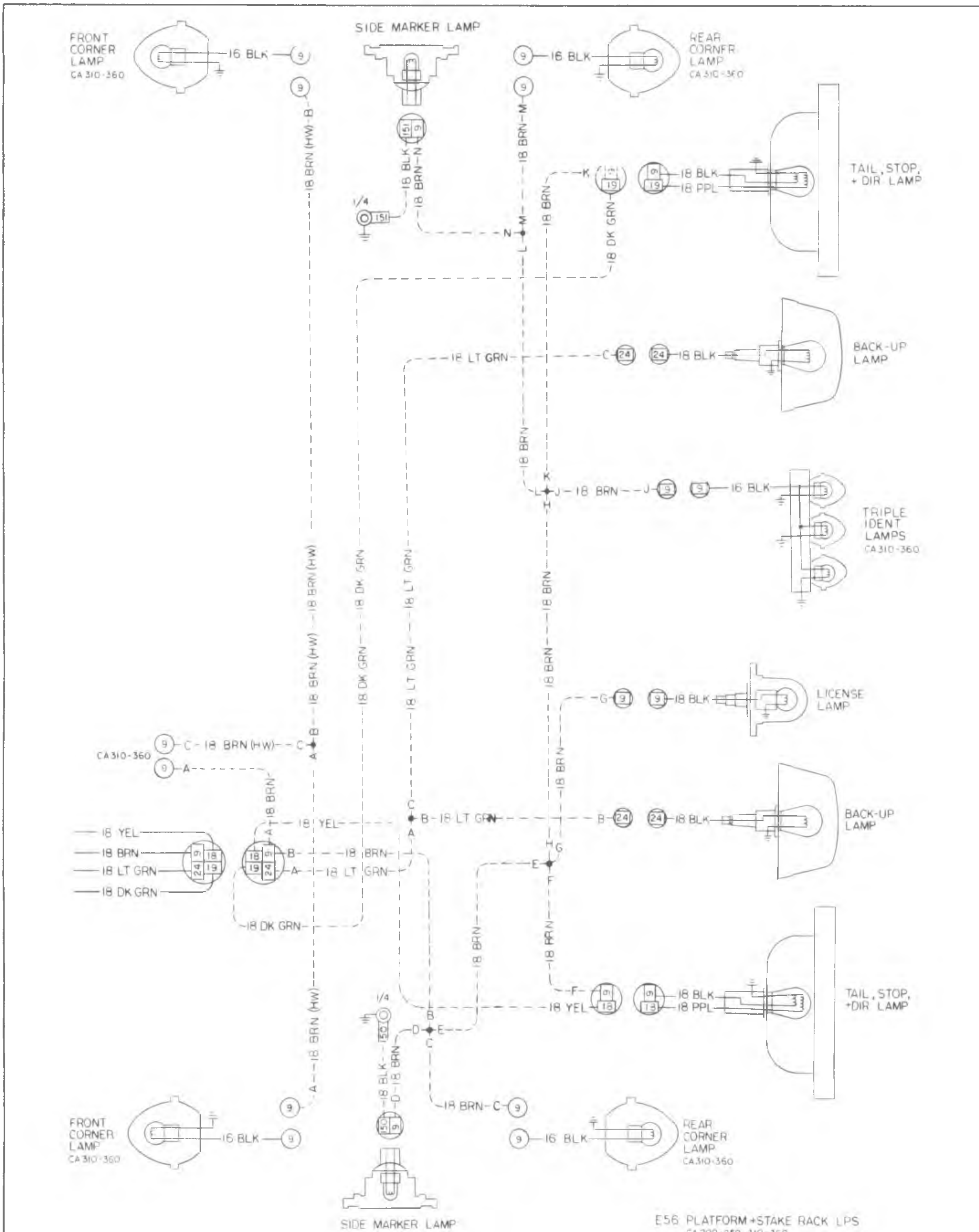


Fig. 46—Rear Lighting—Platform CA 20-30

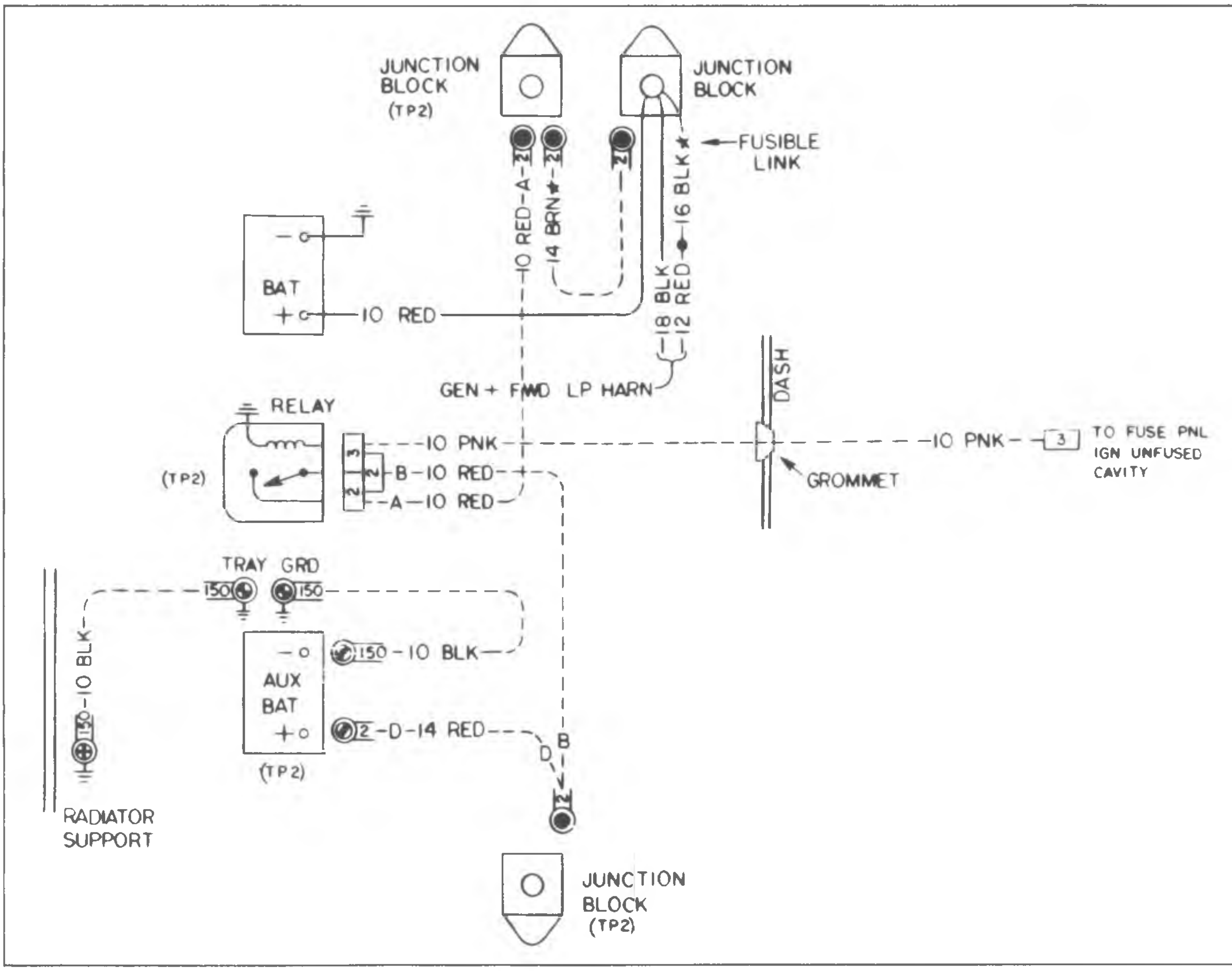


Fig. 47—Auxiliary Battery Circuit — Option TP 2

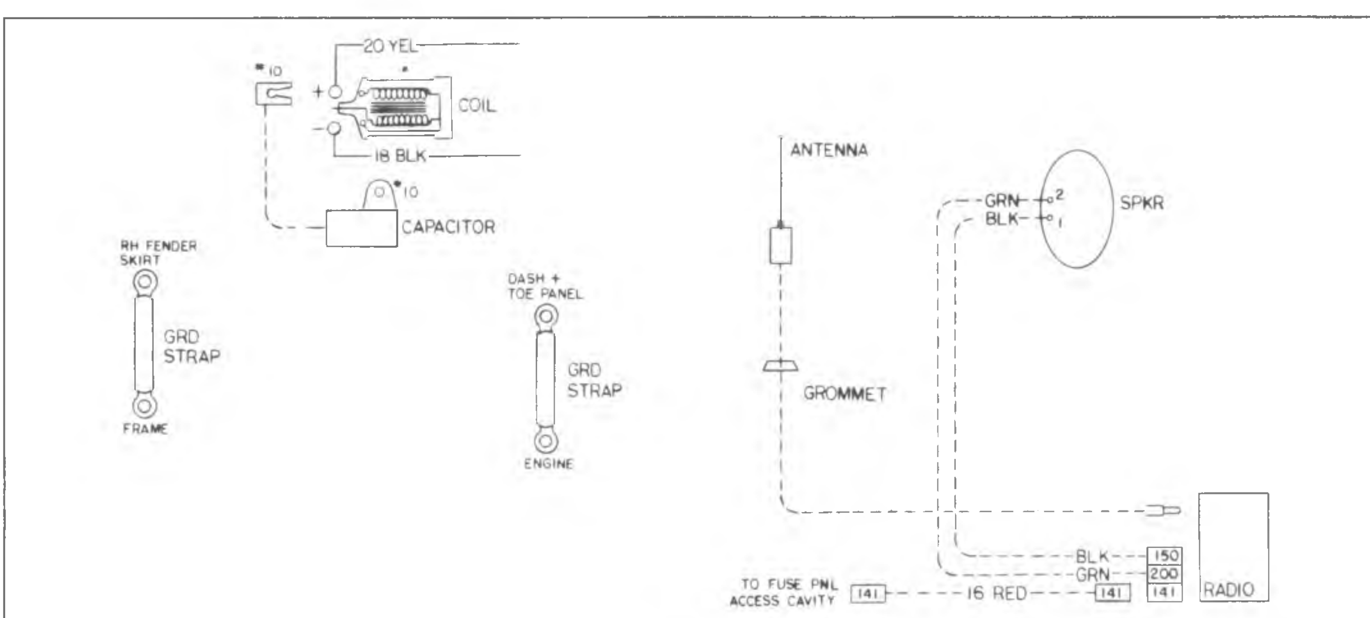


Fig. 48—Radio Circuit — Option 63

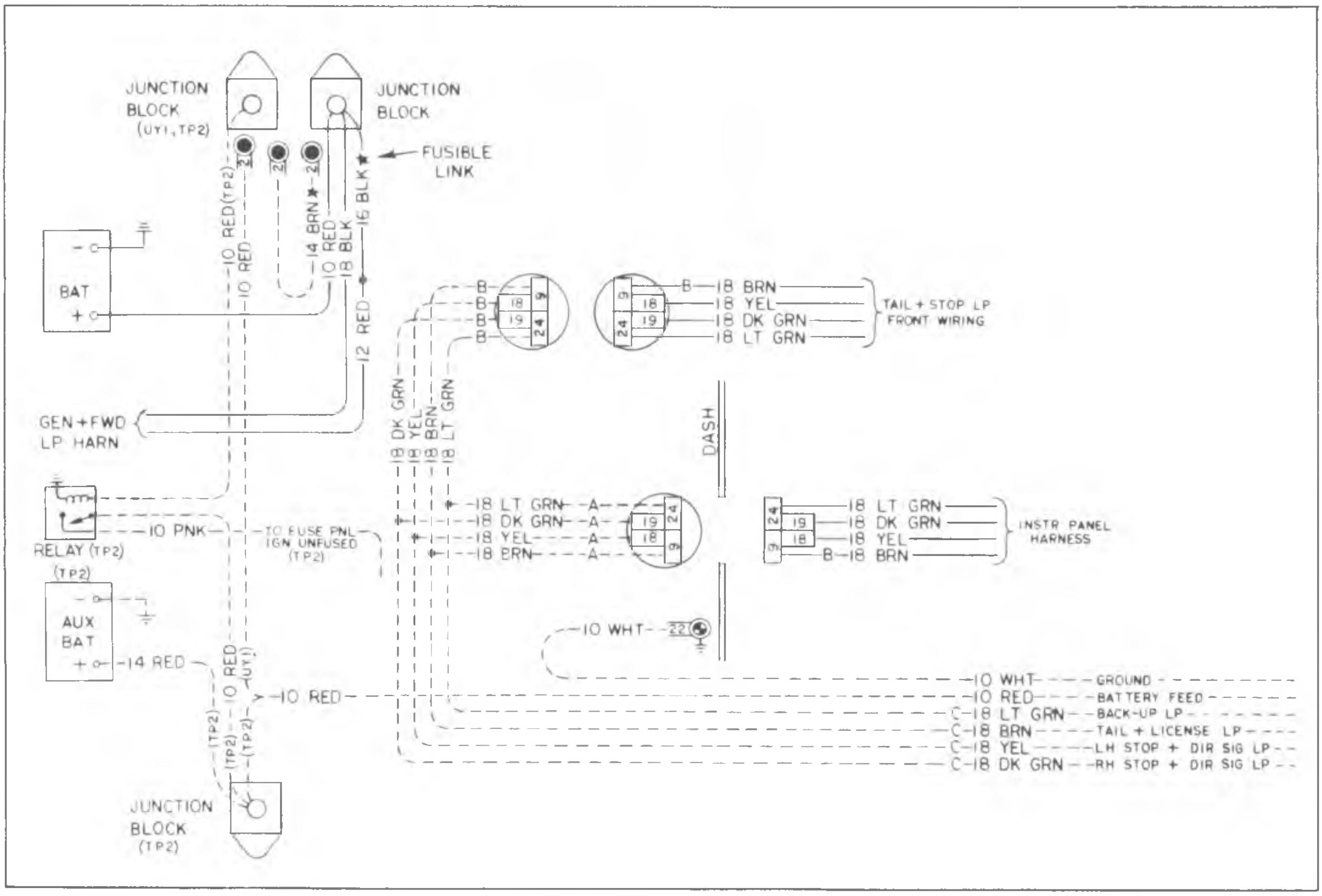


Fig. 49—Camper Wiring — Option UY1

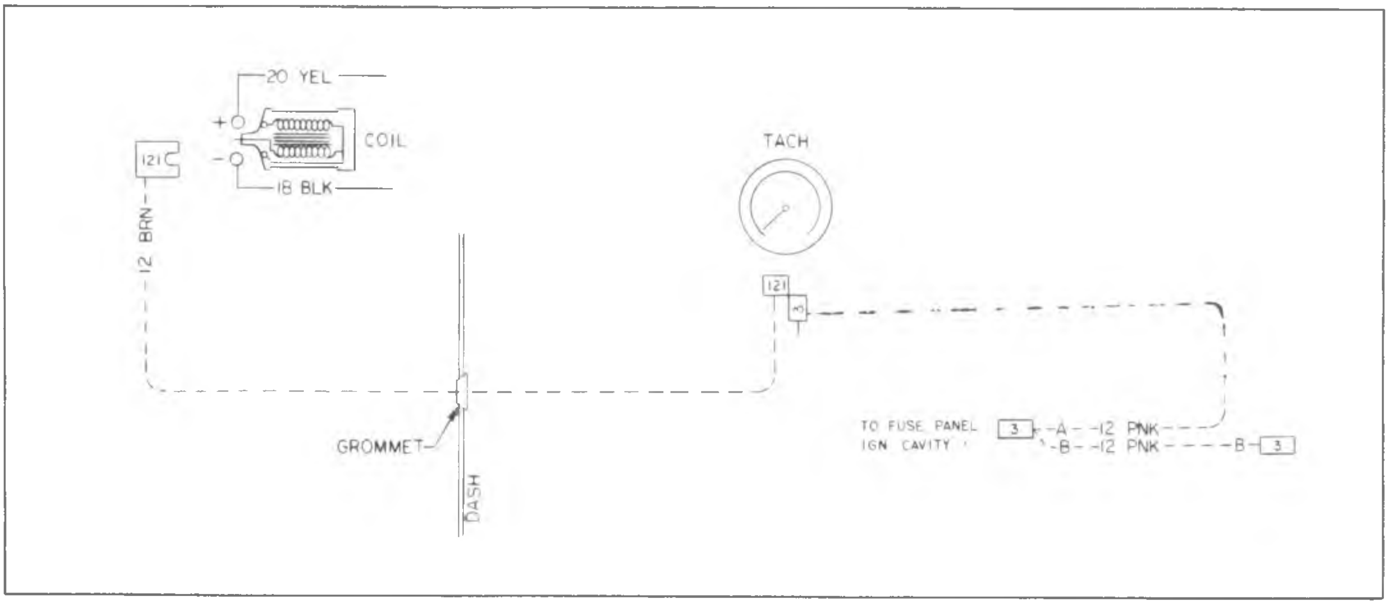


Fig. 50—Tachometer Circuit—Option U 16

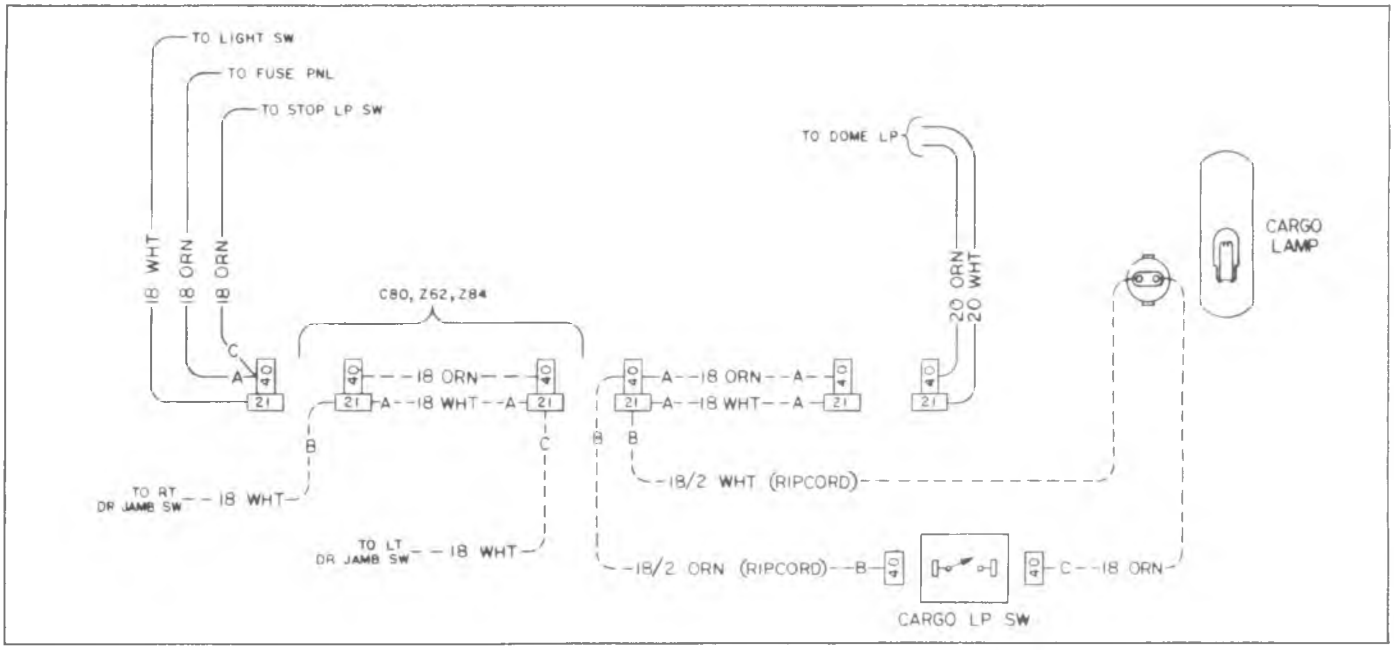


Fig. 51—Cargo Lamp Circuit — Option UF2

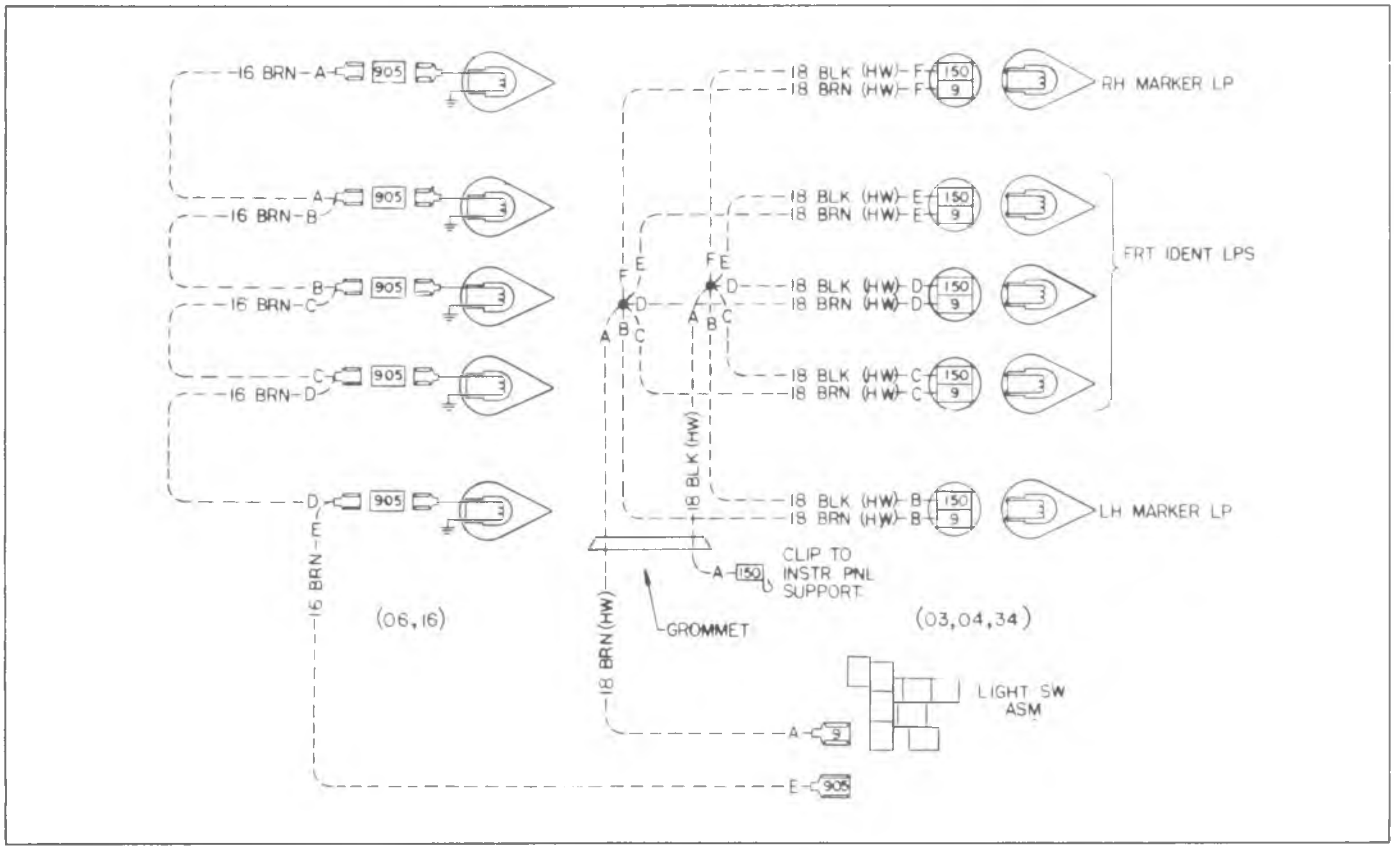


Fig. 52—Roof Marker Lamps — Option UO1

SECTION 13

RADIATOR AND GRILLE

CONTENTS OF THIS SECTION

RADIATOR—10 THRU 30 SERIES

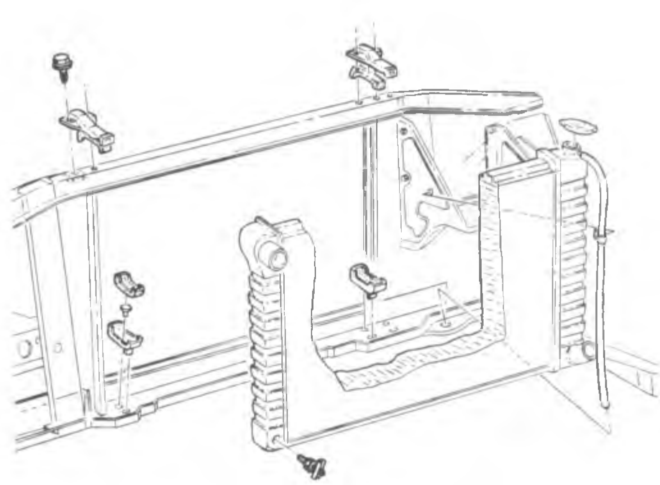
INDEX

GENERAL DESCRIPTION

P10 trucks are equipped with down-flow type radiators. All other models are equipped with cross-flow type radiators. The cross-flow radiator is similar to the conventional down-flow radiator except it is mounted sideways in the vehicle and attached in the conventional manner. Two retainers, one on each side at the top, secure the radiator in position.

The radiators are of copper-brass construction. All radiators (except P10 models) incorporate drain cocks.

SERVICE PROCEDURES



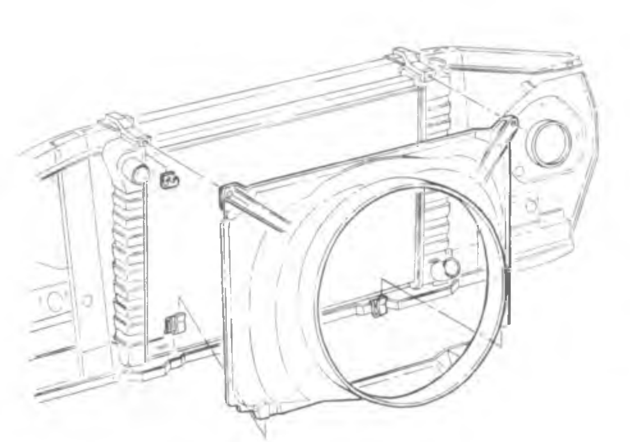


Fig. 1—Radiator and Shroud Mount

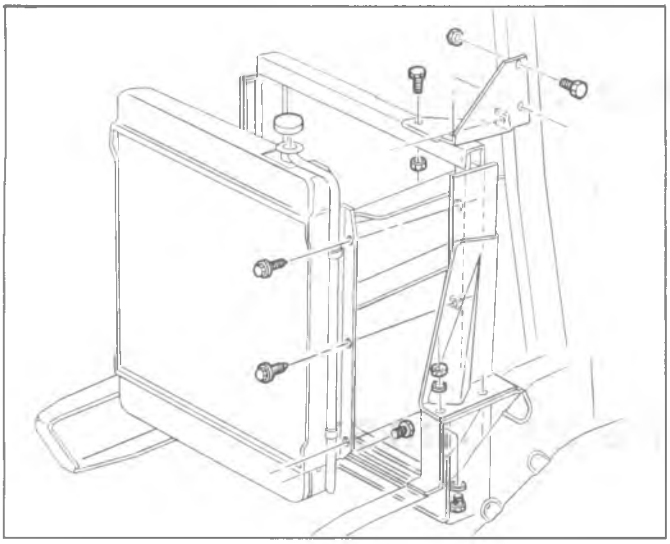


Fig. 2—Radiator Mounting—PA 10 Models

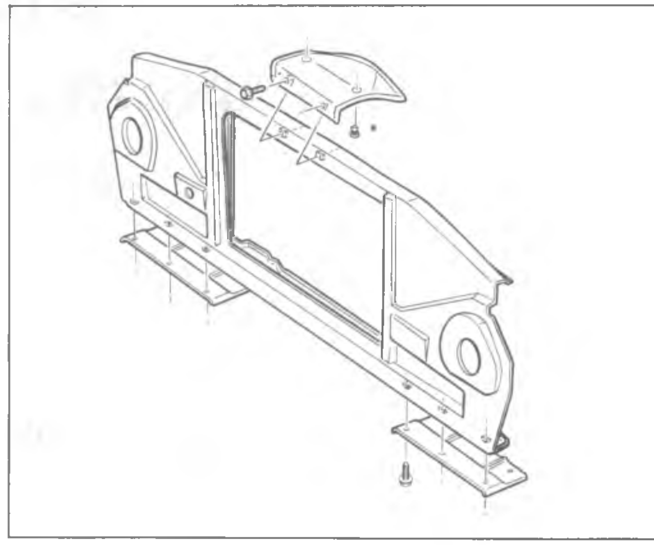


Fig. 3—Finger Guard Mounting

NOTE: When radiator repairs require draining and saving of the anti-freeze, the following procedure may be used to facilitate draining past lower parts:

1. Cut a 1 foot (or longer if desired) piece of 3/8 inch I.D. hose.
2. Slip hose onto drain cock spout and route hose past lower parts.
3. Open cock and drain coolant into a clean container -- save for later refill.

CA, KA AND PS-PE20-30 MODELS (Fig. 1)

Radiator Replacement

1. Drain radiator and disconnect water hoses and Powerglide coolant line if so equipped.
2. Remove finger guard, if so equipped (fig. 3).
3. If vehicle is equipped with a fan shroud, remove shroud attaching screws and carefully hang shroud over engine fan assembly to provide clearance for radiator removal.
4. Remove screws attaching two retainers to radiator and support and remove retainers.
5. Lift radiator up out of lower mounts. Lift shroud out of vehicle if applicable.
6. Inspect lower pads and retainers and replace if necessary.
7. Lower shroud and radiator into position and secure shroud with two lower screws.
8. Install two retainers at top of radiator and shroud with six screws.
9. Connect radiator hoses and transmission coolant line, fill cooling system and check for leaks.
10. Refer to torque specifications in rear of manual for correct torque values.

PA10 MODELS (Fig. 2)

Radiator Replacement

1. Drain radiator and disconnect water hoses and Powerglide coolant line if applicable.
2. Remove mounting screws attaching radiator to support and remove radiator from vehicle.
3. Replace radiator mounting components if necessary.
4. Install radiator following removal procedure in reverse order. Connect radiator hoses and transmission coolant line, fill cooling system and check for leaks.
5. Refer to torque specifications in rear of manual for correct torque values.

GRILLE—10 THRU 30 SERIES

INDEX

SERVICE PROCEDURES

CAUTION: CERTAIN PARTS OF THE GRILLE ARE MADE OF PLASTIC.

DO NOT USE EXCESSIVE HEAT IN THESE AREAS AS DISTORTION COULD RESULT.

DO NOT USE HARSH CHEMICALS TO CLEAN THE GRILLE AREA AS DISTORTION AND OR PAINT PEEL COULD RESULT.

CA-KA 10-20, CA 30 MODELS GRILLE REPLACEMENT (Fig. 4)

Removal

1. Disconnect battery.
2. Remove bolts at fender outer upper and lower edge.
3. Remove bolts at center brace and hood lock from radiator mounting.

4. Remove headlamp bezels.
5. Remove headlamps and retainer springs.
6. Disconnect parking lamps and remove grille assembly.

Disassembly

1. Remove headlamp bezels.
2. Remove center brace and hood lock plate from grille.
3. Remove inner grille.

NOTE: Inner grille can be removed separately if need be by removing center brace and hood lock plate. Disconnect parking lamps and lift inner grille free.

Assembly

Assemble parts removed in the disassembly procedure --tighten all screws and bolts.

Installation

1. Position grille and install bolts at fender.
2. Install bolts at center brace and lock plate.
3. Connect parking lamps.
4. Connect battery.

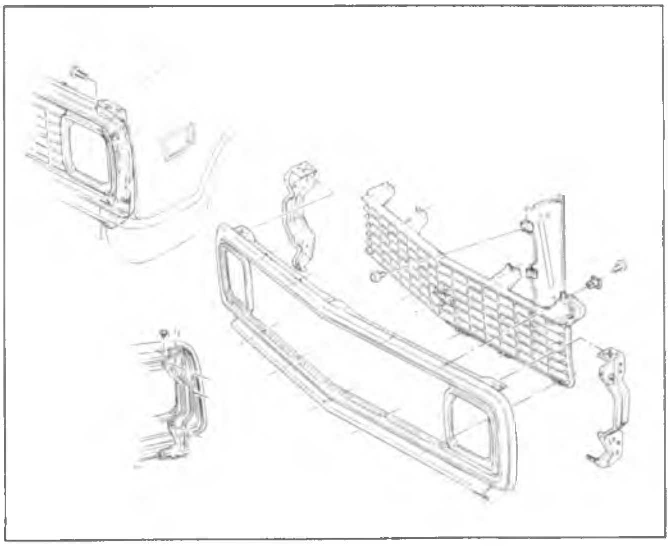


Fig. 4—Grille Mounting

SECTION 14

BUMPERS

INDEX

GENERAL DESCRIPTION

All 1972 truck front and rear bumpers are of a single piece design. Bumper attachments are the standard bracket and brace to frame mountings. This section contains procedures for the removal and installation of face bars, brackets, braces and license plate brackets.

SERVICE PROCEDURES—10 THRU 30 SERIES

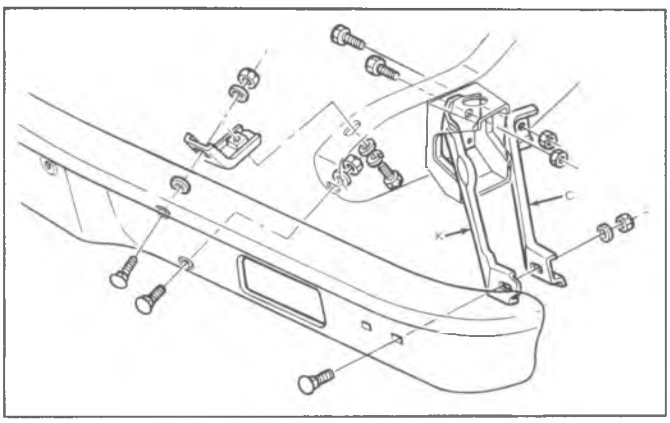


Fig. 1—Front Bumper—C-K 10 Models

FRONT BUMPER—C AND K MODELS (Fig. 1)

Removal

1. Remove parking lamp assemblies. (See Section 12).

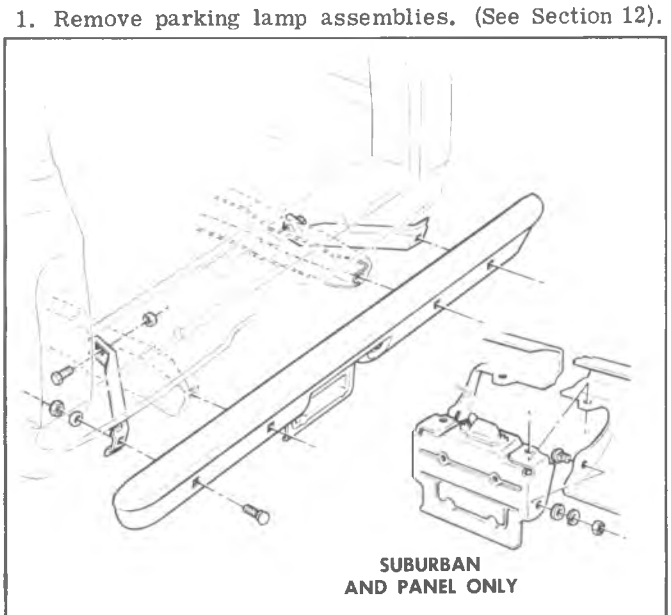


Fig. 2—Rear Bumper—C-K Models

2. Remove bolts securing left and right bumper braces to frame.
3. Remove bolts securing two bumper brackets to frame.
4. Remove bolts securing bumper face bar to frame, and remove bumper from vehicle.
5. If necessary, disassemble bumper by removing bolts attaching brackets and braces to bumper face bar.

Installation

Assemble and install front bumper following the removal procedure in reverse order. Refer to torque specifications in rear of manual for correct torque values.

REAR BUMPER—C AND K MODELS (Fig. 2)

Removal

1. Remove bolts attaching bumper to each bumper brace. Disconnect license lamp wiring on suburban and panels and pickup.
2. Remove bolts attaching bumper to frame.

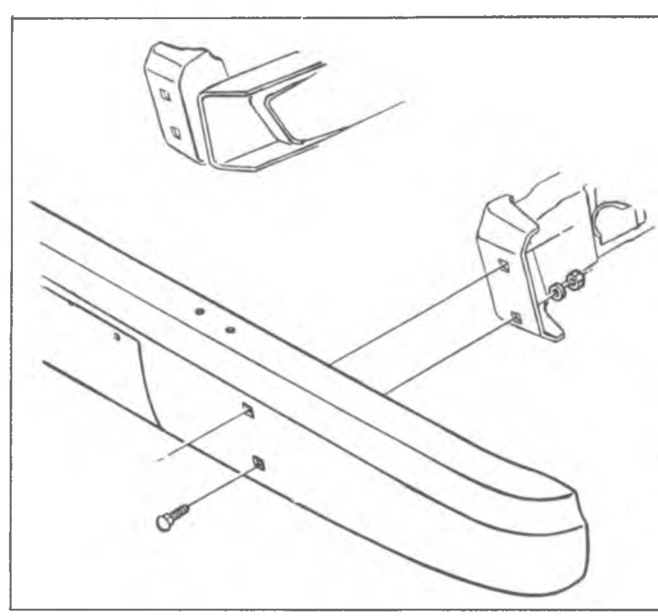


Fig. 3—Front Bumper—P20-30 Models

3. Remove bumper from vehicle.
4. If necessary, replace body dirt seal.

Installation

Install rear bumper following removal procedure in reverse order. Connect license lamp wiring on suburban, panel, and pickup models.

FRONT BUMPER—P20 AND P30 MODELS (Fig. 3)

Removal

Remove nuts, washers, and bolts securing front bumper to forward frame horns and remove bumper from vehicle.

Installation

Place bumper in mounted position and secure to frame with bolts, washers, and nuts.

SECTION 15

ACCESSORIES

RADIO REPLACEMENT (Fig. 1)

CAUTION: Failure to have the speaker hooked up before turning on the radio could cause the destruction of an output transistor.

1. Remove ground cable from the battery.
2. Remove flex hoses from heater distributor.
3. Remove heater (A/C) control head by taking out (2) screws pushing control back, then pulling down beneath dash for access.
4. Remove ash tray and ash tray retainer, secured by 4 screws.
5. Remove electrical plugs from rear of radio, then knobs, spacers and nuts from the front of the receiver.
6. Remove (1) mounting screw on side of radio chassis then push radio back and up before slipping down and out under instrument panel.
7. After necessary radio receiver repair, reverse Steps 1-6, for installation making sure the speaker is hooked up before power is applied to the radio receiver.

NOTE: The radio dial illumination bulb is located in the top cover of the AM/FM receiver. The AM radio dial bulb is replaced through the right rear of the radio.

SPEAKER REPLACEMENT

Blazer Models Only

The speaker is mounted to the underside of the instrument panel with (2) screws.

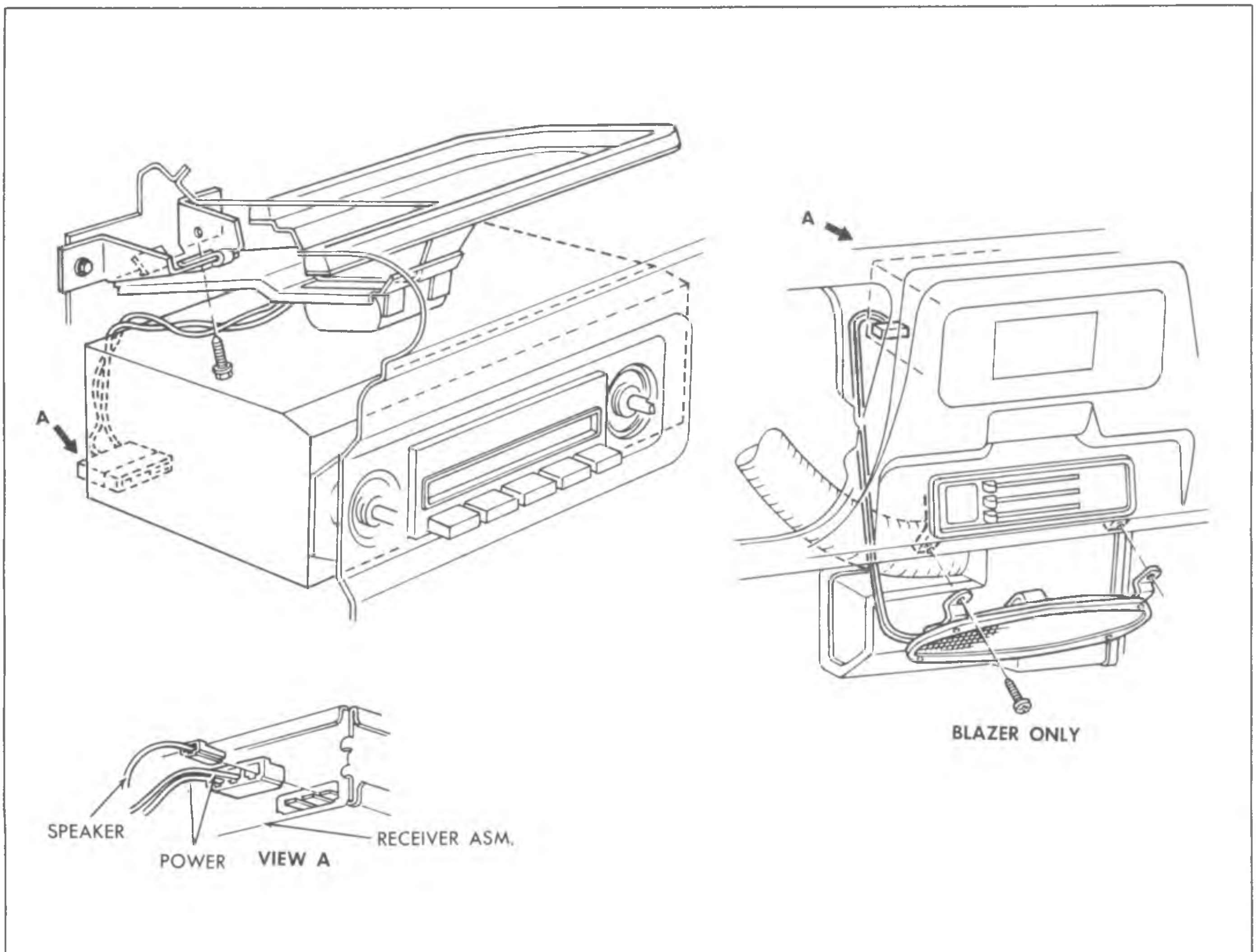


Fig. 1—Radio Speaker Installations

All (Except Blazer Models)

1. Remove radio receiver as previously described, then remove dash mounted speaker bracket screws.
2. Unclip speaker from bracket.
3. Replace speaker in bracket and install speaker mounting bracket.
4. Reinstall radio, making sure speaker is hooked up.
5. Check radio for proper operation before reinstalling ash tray assembly, heater—AC control head and duct hoses.

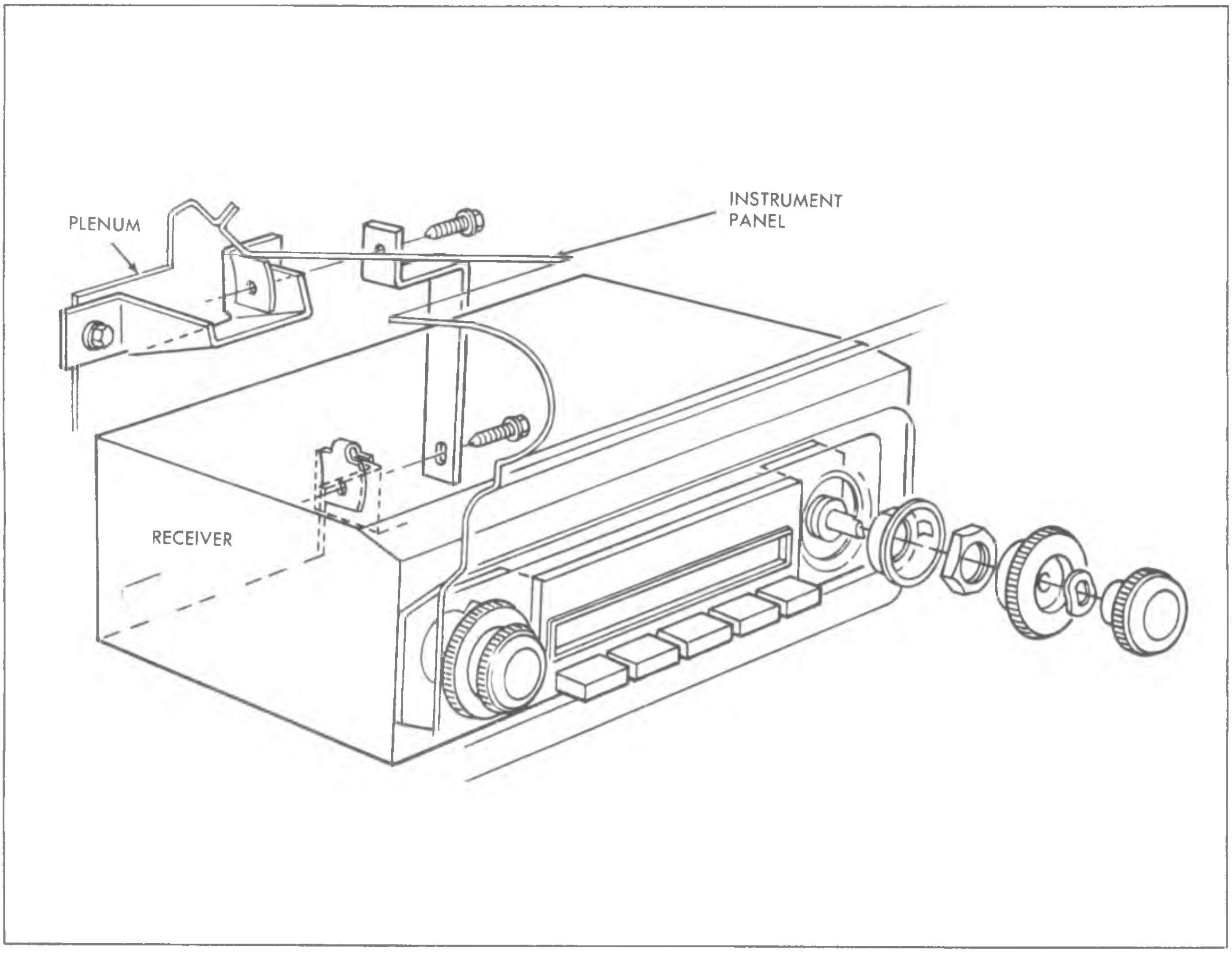


Fig. 2—Radio Receiver

SPECIFICATIONS

HEATING AND AIR CONDITIONING

SECTION 1A

HEATER

	Volts	Amps. (Cold)	RPM (Cold)
Blower Motor			
Deluxe Air	13.5	6.25 Max.	2550 Min. 2950 Max.

Fuses

Deluxe Heater . . . . 10 Amp.

AIR CONDITIONING

Compressor

Make . . . . Frigidaire
Type . . . . 6 Cylinder Axial
Displacement . . . . 12.6 Cu. In.
Rotation . . . . Clockwise

	Volts	Amps. (Cold)	RPM (Cold)
Blower Motor			
Four-Season	12	16.5 Max.	3700 Min.
GM Chevrolet and Roof-Mounted	12	13.7 Max.	3400 Min.

Compressor Clutch Coil

Ohms (at 80°F). 3.70
Amps. (at 80°F) . . . . 3.33 @ 12 volts

System Capacities

Refrigerant 12
Four-Season and GM Chevrolet . . . . . . 3 lbs. 4 oz.
Roof-Mounted . . . . 5 lbs. 8 oz.
525 Viscosity Compressor Oil
Four-Season and GM Chevrolet . . . . . . 10 fluid oz.
Roof-Mounted . . . . 13 fluid oz.

Torque Specifications

Compressor Suction and Discharge
Connector Bolt . . . . 25 ft. lbs.
Rear Head to Shell Stud Nuts . . . . 23 ft. lbs.
Shaft Mounting Nut . . . . 15 ft. lbs.
Belt Tension. . . . . See Tune Up Chart

Fuses

Fuse Block—
Four-Season and Roof-Mounted Systems . . . . . 25 Amp.
GM Chevrolet Systems . . . . 10 Amp.
In-Line—
Roof-Mounted System . . . . 25 Amp.

BODY
SECTION 1B

MIRRORS AND SUNSHADE

Inside Rear View Mirror	
Mirror to Bracket	45 in. lb.
Bracket to Header Panel	15 in. lb.
Sunshade Support to Header Panel	20 in. lb.
Outside Rear View Mirror to Door Panel	
Series 10-20-30 Except (03-04-34 Models)	40 in. lb.
Series 20-30 (03 Models)	120 in. lb.

DOORS

Window Regulator to Door Panel	40 in. lb.
Door Lock to Door Panel	75 in. lb.
Lock Striker to Body Pillar	25 ft. lb.
Rear Door Lock Striker	95 in. lb.
Outside Door Handle	40 in. lb.
Rear Door Arm Check	55 in. lb.
Hinge to Door and Body	
All Except Rear Doors	25 ft. lb.
Rear Doors	30 ft. lb.
Rear Door Bumpers	30 in. lb.
Rear Door Latch Control	85 in. lb.
Rear Door Latch	85 in. lb.

LIFTGATE

Hinge Bolts	25 ft. lb.
Liftgate Support	40 in. lb.
Handle	40 in. lb.
Striker	95 in. lb.

ENDGATE (EXCEPT SUBURBAN)

Handle	95 in. lb.
Tailgate-to-Pickup Box Support	17 ft. lb.
Latch	150 in. lb.
Trunnion	17 ft. lb.

ENDGATE (SUBURBAN)

Latch	85 in. lb.
Latch Remote Control	40 in. lb.
Endgate to Body Support	45 ft. lb.
Striker (Body Mounted)	90 in. lb.
Hinges	30 ft. lb.
Bumpers	10 in. lb.

SEATS

Seat Back-to-Seat Cushion	25 ft. lb.
Front Seat	
Bench Type	
Adjuster-to-Seat	150 in. lb.
Adjuster-to-Floor	150 in. lb.
Bucket Type	
Adjuster-to-Seat	150 in. lb.
Adjuster-to-Floor	18 ft. lb.
Center and Rear Seat (Bench Type)	
Leg-to-Seat	17 ft. lb.
Leg-to-Floor	50 ft. lb.
Rear Mounting Bracket	
to Seat	18 ft. lb.
to Floor	30 ft. lb.
Body Mounts All Except Rear #2	20 ft. lb.
Rear #2	50 ft. lb.
Seat Belt	40 ft. lb.

FRONT SUSPENSION

SECTION 3

*WHEEL ALIGNMENT SPECIFICATIONS

	CASTER										
Dimension "A" in inches	2 1/2"	2 1/4"	3"	3 1/4"	3 1/2"	3 1/4"	4"	4 1/4"	4 1/2"	4 1/4"	5"
CA PA 10			+ 2°	+ 1 3/4°	+ 1 1/2°	+ 1 1/4°	+ 1°	+ 3/4°	+ 1/2°	+ 1/4°	0°
CA PA 20 - 30	+ 2 3/4°	+ 2 1/2°	+ 2°	+ 1 3/4°	+ 1 1/2°	+ 1 1/4°	+ 1°	+ 3/4°	+ 1/2°	+ 1/4°	0°
K - 10 - 20	+ 4°	no provision for resetting									

CAMBER	
CA PA - 10 - 20 - 30	+ 1/4°
K 10 - 20 . . . . No provision for resetting	+ 1 1/2°
TOE-IN (TOTAL)	
CA PA 10 - 20 - 30 KA 10 - 20	3/16"

*See column 1, 2 or 3 under Vehicle Alignment Tolerances for applicable tolerances.

VEHICLE ALIGNMENT TOLERANCES††

	Field Usage	
	Column 1 *Service Checking	Column 3 @ Service Reset
Camber	± 3/4°	± 1/2°
Caster	± 1°	± 1/2°
$ Toe-in	± 1/8"	± 1/16"
Camber (Side to Side)	1°	1/2°
Caster (Side to Side)	1°	1/2°

VEHICLE INSPECTION TOLERANCES

	Column 2
Caster	± 2°
Camber	± 1 1/2°
Toe	± 3/8"

* Caster and Camber must not vary more than 1° from side to side.
@ Caster and Camber must not vary more than 1/2° from side to side.
$ Toe setting must always be made after caster and camber.
†† See explanatory copy in front suspension section 3.

FRONT SUSPENSION BOLT TORQUE (Ft. Lbs.)

	CP-10	CP-20-30	K-All
Lower Control Arm Shaft U-Bolt	45	110	-
Upper Control Arm Shaft Nuts	70	120	-
Lower Control Arm Bushing	New 160 Replace 95	New 190 Replace 115	-
Lower Control Arm Bushing	New 280 Replace 130	New 280 Replace 130	-
Upper Ball Joint Nut	*50	**90	**100
Lower Ball Joint Nut	**90	**90	*** 80
Crossmember to Side Rail	65	65	-
Crossmember to Bottom Rail	100	100	-
Stabilizer Bar to Control Arm	25	25	-
Stabilizer Bar to Frame	25	25	-
Shock Absorber Upper End	140	140	65
Shock Absorber Lower End	75	75	65
Brake Splash Shield to Knuckle	140 In. Lbs.	140 In. Lbs.	—
Wheel Bearing Adjustment	#15	#40	Inner#-35 Outer -50
Wheel Bearing Preload	Zero	Zero	Zero
Wheel Bearing End Movement	.001-.008	.001-.010	.001-.010
Caliper Mounting Bolt	35	35	35
Spring-Front Eye Bolt	-	-	90
Spring-Rear Eye Bolt	-	-	50
Spring-To Rear Shackle Bolt	-	-	50
Spring-To Axle U-Bolt	-	-	120
Spring-Front Hanger to Frame	-	-	30
Suspension Bumper	15	15	15
Shackle Stop Bracket Bolts	-	-	40

* Plus additional torque to align cotter pin. Not to exceed 90 ft. lbs. maximum.
** Plus additional torque to align cotter pin. Not to exceed 130 ft. lbs. maximum.
***Plus additional torque to align cotter pin.
\# Back nut off to align cotter pin at nearest slot.

REAR SUSPENSION

SECTION 4

TORQUE SPECIFICATIONS (FT. LBS.)

WHEEL BEARING ADJUSTMENT SPECIFICATIONS

Rear Axle Capacity	Bearing Adjusting Nut Torque*	Adjusting Nut Back-off*	Outer Locknut Torque	Resulting Bearing Adjustment	Type of Bearing
5,200# and 7,200#	50-60 Ft. Lbs.	1/8 *	175 Ft. Lbs.	Slight Preloaded	Barrel Roller
11,000#	75-100 Ft. Lbs.	1/8 *	250 Ft. Lbs.	Slight Preloaded	Barrel Roller
5,500#	50 Ft. Lbs.	**	65 Ft. Lbs.	.001 to .010 End Play	Tapered Roller

** Back-off nut and retighten to 35 Ft. Lbs. then, back-off nut 1/4 turn.
* With wheel rotating.

UNIVERSAL JOINT ATTACHMENT TORQUE SPECIFICATIONS

Strap Attachments	15 Ft. Lbs.
"U" Bolt Attachment	20 Ft. Lbs.

DIFFERENTIAL SPECIFICATIONS

	3300-3600 Lb. Capacity	5500# (Dana)	5200-7200 Lb. Capacity	11,000 Lb. Capacity
Gear Backlash Preferred	.005"-.008"	.004"-.009"	.005"-.008"	.005"-.008"
Min. and Max.	.003"-.010"	.004"-.009"	.003"-.012"	.003"-.012"
Pinion Bearing Preload (In. Lbs.)				
New	20-25	20-40		
Used	5-10	10-20		

Bolt Torques (Ft. Lbs.)

Carrier Cover	23	35	18	—
Ring Gear	50	110	110	105
Differential Bearing Caps	55	85	100	205

	3300-3600 Lb. Capacity	5500# (Dana)	5200-7200 Lb. Capacity	11,000 Lb. Capacity
Filler Plugs	18	10	18	10
Differential Pinion Lock	20	—	—	—
Drive Pinion Nut	—	255	220	220
Differential Carrier to Axle Housing	—	—	45	85
Differential Bearing Adjusting Lock	—	—	15	15
Pinion Bearing Cage To Carrier	—	—	95	165
Trust Pad Lock Nut	—	—	135	135
Brake - Backing Plate	35	35	105	155
Axle Shaft To Hub Bolts	—	60	90	15

TORQUE SPECIFICATIONS (FT. LBS.) (CONT'D)

	CA-PA10	CA20	K10-20	PA20-30	CA30
Tie Rod Attaching Bolts - Stud to Axle - Tie Rod to Stud - Frame	 * 135 135	 ** 135 135	 - - -	 - - -	 - - -
Axle to Control Arm U Bolts	145	145	-	-	-
Spring to Axle U Bolts Nuts	-	120	120	150	120
Control Arm Front Attaching Bolts	145	145	-	-	-
Coil Spring Attaching Bolt Lower	55	55	-	-	-
Coil Spring Attaching Bolt Upper	50	50	-	-	-
Spring Front Bushing Bolt	-	90	90	90	90
Spring Rear Shackle Bolts	-	90	90	90	90
Shock Absorber Attaching Bolts	75	75	65	65	-
Propshaft Bearing Support Hanger	20	#	-	35	35
Rear Stabilizer	-	-	-	25	-

* C-P10 Models - 135 Ft. Lbs.
** Models CE-CS 25903-04-34 - 250 Ft. Lbs.
All others - 135 Ft. Lbs.
C20 Except 133" W.B. Models - 20 Ft. Lbs.
C20 133" W.B. Models - 35 Ft. Lbs.

BRAKES

SECTION 5

TORQUE SPECIFICATIONS

Master Cylinder to Dash or Booster	25 Ft. Lbs.
Vacuum Booster to Frame	25 Ft. Lbs.
Brake Line to Master Cylinder	150 In. Lbs.
Brake Line to Combination Valve	150 In. Lbs.
Brake Line From Combination Valve	150 In. Lbs.
Brake Line to Frame	150 In. Lbs.
Combination Valve Mounting Nuts	17 Ft. Lbs.
Combination Valve Master Cylinder Brace/Dash	150 In. Lbs.
Flex Hose to Caliper	22 Ft. Lbs.
Flex Hose to Tubing	100 In. Lbs.
Rear Pipe to Wneel Cylinder	150 In. Lbs.
Rear Pipe to Connector	115 In. Lbs.
Flex Hose to Connector	115 In. Lbs.
Flex Hose to Pipe	115 In. Lbs.
Front Brake Hose to Frame Nut	58 In. Lbs.
Brake Line to Front Crossmember Bolt	100 In. Lbs.
Brake Line Bracket to Axle Housing Nut	18 Ft. Lbs.
Brake Line to Bracket Bolt at Axle Housing	90 In. Lbs.
Push Rod to Pedal	27 Ft. Lbs.
Push Rod to Clevis Nut	25 Ft. Lbs.
Brake Pedal Bolt Nut	95 In. Lbs.
Pedal Bracket to Dash	25 Ft. Lbs.
Pedal Support to Bracket	150 In. Lbs.
Parking Brake Assembly to Dash	100 In. Lbs.
Parking Brake Assembly to Instrument Panel	100 In. Lbs.
Parking Brake Cable to Assembly Clip	18 Ft. Lbs.
Cable Clips to Frame	18 Ft. Lbs.
Equalizer Nuts	17 Ft. Lbs.
Rear Brake Anchor Pin	140 Ft. Lbs.
Caliper Mounting Bolt	35 Ft. Lbs.
Support Plate to Knuckle	140 In. Lbs.

ENGINE

SECTION 6

TUNE-UP CHART

ENGINE	Type		In Line		V8			
ENGINE	Displacement		250	292	307		350	402
ENGINE	Horsepower		110	125	135	215	175	210
COMPRESSION ①			130 psi		150 psi			
SPARK PLUG	Make & Number	Standard	AC-R46T	AC-R44T	AC-R44T			
SPARK PLUG	Make & Number	Cold	AC-R45T	AC-R43T				
Gap			.035"					
DISTRIBUTOR ②	Point Dwell		31°-34°		29°-31°			
DISTRIBUTOR ②	Point Gap		.016" (Used) .019" (New)					
DISTRIBUTOR ②	Arm Spring Tension		19-23 ounces					
DISTRIBUTOR ②	Condenser		.18-.23 microfarad					
DISTRIBUTOR ②	Timing ③	Syn.	4°B a	4°B	4°B		4°B	8°B
DISTRIBUTOR ②	Timing ③	Auto.	4°B a	4°B	8°B b		8°B	8°B
DRIVE BELT ④	Fan P/S and Air Pump		50 lb. Min. 75 ± 5 lbs. (Used) 125 ± 5 lbs. (New) Using Strand Tension Gauge					
DRIVE BELT ④	A/C Compressor		65 lb. Min. 95 ± 5 lbs. (Used) 140 ± 5 lbs. (New) Using Strand Tension Gauge					
AIR CLEANER			See Note ⑤					
VALVE LASH			Hydraulic - 1 turn down from zero lash					
IDLE RPM ⑥	Syn.		700	700	900 c		800	750
IDLE RPM ⑥	Auto.		600	700	600		600	600
FUEL PUMP ⑦	Pressure in lbs.		3-1/2 to 4-1/2		5 to 6-1/2	7 to 8-1/2		
FUEL PUMP ⑦	Volume		1 pint in 30-45 seconds @ cranking speed					
CRANKCASE VENTILATION			Replace at 24,000 miles					

① PSI at Cranking Speed, throttle wide open - Maximum variation, 20 PSI between cylinders.

② Rotate cam lubricator 180° at 12,000 mile intervals — Replace at 24,000 mile intervals.

③ At idle speed with vacuum advance line disconnected and plugged. On Step Van vehicles, use number two cylinder and timing tab on bottom of cover. B - B.T.D.C.

④ Do not pry against A.I.R. pump housing.

⑤ **CAUTION:** In addition to its function of filtering air drawn into the engine through the carburetor, the air cleaner also acts as a flame arrestor in the event the engine backfires. Because backfiring may cause fire in the engine compartment, the air cleaner should be installed at all times unless its removal is necessary for repair or maintenance services.

Paper Element Type - First 12,000 miles, inspect element for dust leaks, holes, or other damage and replace if necessary. If satisfactory, rotate element 180° from original installation position. Replace element at 24,000 miles. Element must not be washed, oiled, tapped, or cleaned with an air hose. If so equipped, replace P.C.V. breather filter every 24,000 miles (do not attempt to clean). If so equipped, clean wire mesh frame arrestor every 12,000 miles

Oil Bath Type - The oil level in the oil bath air cleaner reservoir should be checked every 12,000 miles and sufficient S.A.E. 50 oil added when temperature is above freezing or S.A.E. 20 oil added when temperature is below freezing. Adding oil and servicing the cleaner will vary greatly, depending upon operating conditions.

Oil Wetted Paper Element With Polyurethane Wrap - This dual element air cleaner has extremely long life and will not require replacement for 50,000 to 100,000 miles under normal operating conditions. Cleaning and oiling of the polyurethane wrap should be done at 24,000 miles under normal highway or city-type operation. Service under off-the-road or extremely dusty operations should be performed at 12,000 miles or less depending upon severity of operating conditions

⑥ See "TUNE-UP" section.

⑦ Replace filter element located in carburetor inlet every 12 months or 12,000 miles, whichever occurs first.

a 0°-K20 suburban models for California only.

b 4°B - 20 & 30 series.

c 950 - C&K series for California only.

Item			250	292	307	350	402
GENERAL DATA:							
Type			In Line		V8		
Displacement (cu. in.)			250	292	307	350	402
Horsepower @ rpm			110 @ 3800	125 @ 3600	135 @ 4000	175 @ 4000	210 @ 4000
Torque @ rpm			185 @ 1600	225 @ 2400	230 @ 2400	290 @ 2400	320 @ 2800
Bore			3-7/8		3-7/8	4	4-1/8
Stroke			3.53	4.12	3.25	3.48	3.76
Compression Ratio			8.5:1	8.0:1	8.5:1	8.5:1	8.5:1
Firing Order			1 - 5 - 3 - 6 - 2 - 4		1 - 8 - 4 - 3 - 6 - 5 - 7 - 2		
CYLINDER BORE:							
Diameter			3.8745 - 3.8775		3.8745 - 3.8775	3.9995 - 4.0025	4.1246 - 4.1274
Out of Round	Production		.0005 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 -.0015	.0025 - .0031	.0012 - .0018	.0007 - .0013	.0018 - .0026
Clearance	Service		.0025 Max.	.0045 Max.	.0032 Max.	.0027 Max.	.0045 Max.
PISTON RING:							
COMPRESSION Clearance Groove	Production	Top	.0012 - .0027	.0020 - .0040	.0012 - .0027	.0012 - .0032	.0017 - .0032
COMPRESSION Clearance Groove	Production	2nd	.0012 - .0032		.0012 - .0032		
COMPRESSION Clearance Groove	Service		Hi Limit Production + .001				
COMPRESSION Gap	Production	Top	.010 - .020				
COMPRESSION Gap	Production	2nd	.010 - .020			.013 - .025	.010 - .020
COMPRESSION Gap	Service		Hi Limit Production + .01				
OIL Groove Clearance	Production		.005 Max.	.005 - .0055	.005 Max.	.002 - .007	.0005 - .0065
OIL Groove Clearance	Service		Hi Limit Production +.001				
OIL Gap	Production		.015 - .055				.010 - .030
OIL Gap	Service		Hi Limit Production + .01				
PISTON PIN:							
Diameter			.9270 - .9273				.9895 - .9898
Clearance	Production		.00015 - .00025				.00025 - .00035
Clearance	Service		.001 (Max.)				
Fit in Rod			.0008"-.0016 Interference				
CRANKSHAFT:							
Main Journal	Diameter		All 2.2983 - 2.2993		#1-2-3-4 2.4484 - 2.4493; #5 2.4479 - 2.4488		#1-2 2.7487 - 2.7496; #3-4 2.7481 - 2.7490; #5 2.7473 - 2.7483
Main Journal	Taper	Production	.0002 (Max.)				
Main Journal	Taper	Service	.001 (Max.)				
Main Journal	Out of Round	Production	.0002 (Max.)				
Main Journal	Out of Round	Service	.001 (Max.)				
Main Bearing Clearance	Production		All .0003 – .0029	All .0008 – .0034	#1 .0008 - .0020; #2-3-4 .0011 - .0023; #5 .0017 - .0033		#1 .0007 - .0019; #2-3-4 .0013 - .0025; #5 .0019 - .0033
Main Bearing Clearance	Service		#1 - .002 (Max.) All Others .0035 (Max.)				
Crankshaft End Play			.002 - .006				.006 - .010
Crankpin	Diameter		1.999 - 1.2000	2.099 - 2.100	2.199 - 2.200		2.1985 - 2.1995
Crankpin	Taper	Production	.0003 (Max.)				
Crankpin	Taper	Service	.001 (Max.)				
Crankpin	Out of Round	Production	.0002 (Max.)				
Crankpin	Out of Round	Service	.001 (Max.)				
Rod Bearing Clearance	Production		.0007 - .0027		.0013 - .0035		.0009 - .0025
Rod Bearing Clearance	Service		.0035 (Max.)				
Rod Side Clearance			.0009 - .0014		.008 - .014		.013 - .023
CAMSHAFT:							
Lobe Lift ± .002" (X)	Intake		.2217	.2315	.2600		.2343
Lobe Lift ± .002" (X)	Exhaust		.2217	.2315	.2733		.2343
Journal Diameter			1.8682 - 1.8692				1.9482 - 1.9492
Camshaft Runout			.0015 Max.				
VALVE SYSTEM:							
Lifter			Hydraulic				
Rocker Arm Ratio			1.75:1		1.50:1		1.70:1
Valve Lash	Intake / Exhaust		One Turn Down From Zero Lash				
Face Angle (Int. & Exh.)			45°				
Seat Angle (Int. & Exh.)			46°				
Seat Runout (Int. & Exh.)			.002 (Max.)				
Seat Width	Intake		1/32 -1/16				
Seat Width	Exhaust		1/16 -3/32				
Stem Clearance	Production	Int.	.0010 - .0027				
Stem Clearance	Production	Exh.	.0015 - .0032		.0010 - .0027		.0012 - .0029
Stem Clearance	Service		Hi Limit Production +.001 Intake - + .002 Exhaust				
Valve Spring (Outer)	Free Length		1.90		2.03		2.12
Valve Spring (Outer)	Pressure lbs. @ in.	Closed	55-64 @ 1.66	85-93 @ 1.69	76-84 @ 1.70		69-81 @ 1.88
Valve Spring (Outer)	Pressure lbs. @ in.	Open	180-192 @ 1.27	174-184 @ 1.30	194-206 @ 1.25		228-252 @ 1.38
Valve Spring (Outer)	Installed Height ± 1/32"		1-21/32	1-5/8	1-23/32		1-7/8
Valve Spring (Inner)	Free Length		—				2.06
Valve Spring (Inner)	Pressure lbs. @ in.	Closed	—				26-34 @ 1.78
Valve Spring (Inner)	Pressure lbs. @ in.	Open	—				81-99 @ 1.28
Valve Spring (Inner)	Installed Height ± 1/32"		—				1-25/32
Damper	Free Length		—	1.94			—
Damper	Approx. # of Coils		—	4			—

(X) California Camshafts: #6262810(L6) Inlet 0.2217 - Exhaust 0.2315
#6262944 (Small V8) Inlet 0.2671 - Exhaust 0.2733
#3864896(L6) Inlet 0.2217 - Exhaust 0.2217

ENGINE TORQUES

<table>
<tr><th rowspan="2">Size</th><th rowspan="2">Usage</th><th colspan="2">In Line</th><th colspan="2">Small V-8</th><th>Mark IV V-8</th></tr>
<tr><th>250</th><th>292</th><th>307</th><th>350</th><th>402</th></tr>
<tr><td rowspan="8">1/4-20</td><td>Camshaft Thrust Plate</td><td colspan="2">80 lb. in.</td><td colspan="3"></td></tr>
<tr><td>Crankcase Front Cover</td><td colspan="5">80 lb. in.</td></tr>
<tr><td>Flywheel Housing Pans</td><td colspan="5">80 lb. in.</td></tr>
<tr><td>Oil Filler Bypass Valve</td><td colspan="2"></td><td colspan="3">80 lb. in.</td></tr>
<tr><td>Oil Pan (To Crankcase)</td><td colspan="4">80 lb. in.</td><td></td></tr>
<tr><td>Oil Pan (To Front Cover)</td><td colspan="2">50 lb. in.</td><td colspan="2"></td><td>80 lb. in.</td></tr>
<tr><td>Oil Pump Cover</td><td colspan="2">70 lb. in.</td><td colspan="3">80 lb. in.</td></tr>
<tr><td>Rocker Arm Cover</td><td colspan="4">45 lb. in.</td><td>50 lb. in.</td></tr>
<tr><td>11/32-24</td><td>Connecting Rod Cap</td><td>35 lb. ft.</td><td colspan="4"></td></tr>
<tr><td rowspan="6">5/16-18</td><td>Camshaft Sprocket</td><td colspan="2"></td><td colspan="3">20 lb. ft.</td></tr>
<tr><td>Clutch Pressure Plate</td><td>20 lb. ft.</td><td colspan="4"></td></tr>
<tr><td>Oil Pan (To Crankcase)</td><td colspan="2">75 lb. in.</td><td colspan="2">65 lb. in.</td><td>135 lb. in.</td></tr>
<tr><td>Oil Pump</td><td colspan="2">115 lb. in.</td><td colspan="3"></td></tr>
<tr><td>Push Rod Cover</td><td colspan="2">50 lb. in.</td><td colspan="3"></td></tr>
<tr><td>Water Pump</td><td colspan="2">15 lb. in.</td><td colspan="3"></td></tr>
<tr><td rowspan="10">3/8-16</td><td>Clutch Pressure Plate</td><td></td><td colspan="4">35 lb. ft.</td></tr>
<tr><td>Distributor Clamp</td><td colspan="5">20 lb. ft.</td></tr>
<tr><td>Flywheel Housing</td><td colspan="5">30 lb. ft.</td></tr>
<tr><td>Manifold (Exhaust)</td><td colspan="2"></td><td colspan="3">20 lb. ft.①</td></tr>
<tr><td>Manifold (Exhaust to Inlet)</td><td colspan="2">25 lb. ft.</td><td colspan="3"></td></tr>
<tr><td>Manifold (Inlet)</td><td colspan="2"></td><td colspan="3">30 lb. ft.</td></tr>
<tr><td>Manifold-to-head</td><td colspan="2">30 lb. ft.</td><td colspan="3"></td></tr>
<tr><td>Thermostat Housing</td><td colspan="2">30 lb. ft.</td><td colspan="3"></td></tr>
<tr><td>Water Outlet</td><td colspan="5">30 lb. ft.</td></tr>
<tr><td>Water Pump</td><td colspan="2"></td><td colspan="3">30 lb. ft.</td></tr>
<tr><td>3/8-24</td><td>Connecting Rod Cap</td><td></td><td>40 lb. ft.</td><td colspan="2">45 lb. ft.</td><td>50 lb. ft.</td></tr>
<tr><td rowspan="4">7/16-14</td><td>Cylinder Head</td><td colspan="2"></td><td colspan="2">65 lb. ft.</td><td>80 lb. ft.</td></tr>
<tr><td>Main Bearing Cap</td><td colspan="2">65 lb. ft.</td><td colspan="2">70 lb. ft.</td><td></td></tr>
<tr><td>Oil Pump</td><td colspan="2"></td><td colspan="3">65 lb. ft.</td></tr>
<tr><td>Rocker Arm Stud</td><td colspan="4"></td><td>50 lb. ft.</td></tr>
<tr><td rowspan="2">7/16-20</td><td>Flywheel</td><td>60 lb. ft.</td><td></td><td colspan="2">60 lb. ft.</td><td>65 lb. ft.</td></tr>
<tr><td>Torsional Damper</td><td></td><td>60 lb. ft.</td><td colspan="3"></td></tr>
<tr><td rowspan="2">1/2-13</td><td>Cylinder Head</td><td colspan="2">95 lb. ft.</td><td colspan="3"></td></tr>
<tr><td>Main Bearing Cap</td><td colspan="4"></td><td>110 lb. ft.</td></tr>
<tr><td>1/2-14</td><td>Temperature Sending Unit</td><td colspan="5">20 lb. ft.</td></tr>
<tr><td rowspan="4">1/2-20</td><td>Torsional Damper</td><td colspan="4"></td><td>85 lb. ft.</td></tr>
<tr><td>Oil Filter</td><td colspan="2">Hand Tight</td><td colspan="3">25 lb. ft.</td></tr>
<tr><td>Oil Pan Drain Plug</td><td colspan="5">20 lb. ft.</td></tr>
<tr><td>Flywheel</td><td></td><td>110 lb. ft.</td><td colspan="3"></td></tr>
<tr><td>14mm 5/8</td><td>Spark Plug</td><td colspan="5">15 lb. ft.</td></tr>
</table>

① Inside bolts on 307-350 engines 30 lb. ft.

CARBURETOR

SECTION 6M

IDENTIFICATION

Also refer to Rochester Carburetor Identification Illustration in the Overhaul Shop Manual.

VEHICLES						ENGINES		TRUCK CARBURETORS				
Type						Displacement and Type	RPO	BBL.	All (Except Calif.)		California	
C	K	P	G	M	S				Manual	Auto.	Manual	Auto.
10	10	10	10-20			250 L-6	Base	1	7042021	7042022	7042991	7042992
20-30	20	20-30	30			250 L-6	Base	1	7042025	7042025	7042025	7042025
20	20		30			250 L-6	Base	1	7042021	7042022	7042991	7042992
40					40	250 L-6	Base	1	7042011	7042011	7042011	7042011
20-30	20	20-30				292 L-6	L-25	1	7042026	7042026	7042026	7042026
40-50				50	50	292 L-6	L-25	1	7042012	7042012	7042012	7042012
			10			307 V-8	Base	2	7042103	7042102	7042823	7042822
10	10					307 V-8	Base	2	7042105	7042104	7042825	7042824
40						350 V-8	Base	2	7042123	7042123	7042123	7042123
50				50	50	350 V-8	Base	2	7042124	7042124	7042124	7042124
			20-30			350 V-8	Base	4QJ	7042211	7042210	7042911	7042910
10	10		10			350 V-8	LS-9	4QJ	7042211	7042210	7042911	7042910
20-30	20-30	20-30	30			350 V-8	LS-9	4QJ	7042208	7042208	7042208	7042208
20-30	20-30	20-30				307 V-8	Base	2	7042108	7042108	N/A	N/A
60				60		366 M-4	Base	4H	685981	685981	685981	685981
50					50	366 M-4	L-86	4H	685981	685981	685981	685981
10-20						402 M-4	L-47	4QJ	7042219	7042218	N/A	N/A
20-30		30%				402 M-4	L-47	4QJ	7042207	7042206	7042207	7042206
60					60	427 M-4	L-43	4H	685982	N/A	685982	N/A

(%) Auto transmission only.

HEAVY DUTY: (Emissions Definition) All C, K, P & G over 6,000 GVW except 06 & 16 C & K (Suburbans) and 06 & 36 G (Sportvans) which are "People Carriers". Refer to GVW plate for gross vehicle weight specified on a permanent plate attached to the cab or vehicle body.

ADJUSTMENTS

Rochester Carburetors

MODEL	Number (A) Automatic Trans. (M) Manual Trans.	Float Level	Float Drop	Metering Rod	Pump Rod	Choke Rod (Fast Idle Cam 2nd Step)	Air Valve Dashpot	Choke Vacuum Break	Choke Unloader
MV	7042011 (A) (M)	1/4		.070		.150			
MV	7042012 (A) (M) H/D	1/4		.070		.150			
MV	7042021 (M)	1/4		.078		.150		.225	.500
MV	7042991 (M)	1/4		.076		.150		.225	.500
MV	7042022 (A)	1/4		.079		.125		.190	.500
MV	7042992 (A)	1/4		.078		.125		.190	.500
MV	7042025 (A) (M) H/D	1/4		.070		.180		.260	.500
MV	7042026 (A) (M) H/D	1/4		.070		.275		.350	.500
2GV	7042102 (A)	21/32	1-9/32		1-5/16	.040		.080	.210
2GV	7042104 (A)	21/32	1-9/32		1-5/16	.040		.080	.210
2GV	7042822 (A)	21/32	1-9/32		1-5/16	.040		.080	.210
2GV	7042824 (A)	21/32	1-9/32		1-5/16	.040		.080	.210
2GV	7042103 (M)	21/32	1-9/32		1-5/16	.075		.110	.210
2GV	7042105 (M)	21/32	1-9/32		1-5/16	.075		.110	.210
2GV	7042823 (M)	21/32	1-9/32		1-5/16	.075		.110	.210
2GV	7042825 (M)	21/32	1-9/32		1-5/16	.075		.110	.210
2GV	7042108 (A) (M) H/D	25/32	1-9/32		1-1/2	.100		.170	.325
2G	7042123 (A) (M) H/D	23/32	1-9/32		1-1/2				
2G	7042124 (A) (M) H/D	23/32	1-9/32		1-1/2				
4MV	7042206 (A) H/D	1/4			13/32	.100	.020	.250	.450
4MV	7042207 (M) H/D	11/32			13/32	.100	.020	.250	.450
4MV	7042208 (A) (M) H/D	3/16			3/8	.100	.020	.215	.450
4MV	7042219 (M)	11/32			3/8	.100	.020	.250	.450
4MV	7042210 (A) H/D	3/16			3/8	.100	.020	.215	.450
4MV	7042218 (A)	1/4			3/8	.100	.020	.250	.450
4MV	7042211 (M) H/D	3/16			3/8	.100	.020	.215	.450
4MV	7042910 (A) H/D	3/16			3/8	.100	.020	.215	.450
4MV	7042911 (M) H/D	3/16			3/8	.100	.020	.215	.450

L/D Light Duty, H/D Heavy Duty — See Identification Chart

FAST IDLE (RUNNING) RPM ADJUSTMENT

Carburetors—Rochester

Vehicles	MV		4QJ		2GV
	Auto.	Man.	Auto.	Man.	Auto. and Manual
All Trucks	2400† a.		* 1500 b.	* 1350 b.	*1850 (1-1/4 S.A.E.) *2200 (1-1/2 S.A.E.) a. These settings are approximate with low idle at 450 RPM — with viscous clutch fans disengaged.

† With vacuum advance
* Without vacuum advance
a. On high step
b. On second step

NOTE: For vacuum advance for 1 bbl. carburetors — pull lead off of cold override switch and ground it — this will energize the C.E.C. valve.

OTHER ADJUSTMENTS

NOTE: Refer to "Additional External Settings and Adjustments" or "Idle Stop Solenoid adjustment and "C.E.C. Valve Adjustment", as applicable, in Section 6M (Service Manual), under carburetors before using the following charts.

NOTE: All Idle Speeds listed are to be set with Air Conditioning OFF.

Equipment		(See Note Above) Column No. 1	(See Note Above) Column No. 2	(See Note Above) Column No. 3
Transmission	Engine	Initial Curb Idle Speed (RPM)	Final Curb Idle Speed (RPM)	CEC Valve Engine Speed (RPM)
		Use Lean Drop Method - Except with A.I.R.		(4)
Manual (Neutral)	L-6 250 C.I.D.	800 (1) L/D 775 (3) H/D	700 (3)	1000
	L-6 292 C.I.D. (L-25)	775 (3)	700	—
	V-8 307 C.I.D.	1000 (1) L/D 700 (1) H/D	900 (3) L/D 600 (3) H/D	—
	V-8 350 C.I.D. (LS-9)	1000 (1)	900 (3)	—
	MK IV 402 C.I.D. (L-47)	675 (1) H/D	750 (3) (1) L/D 600 (3) H/D	—
Automatic (In Drive) Neutral for H/D	L-6 250 C.I.D.	630 (1) L/D 775 (3) H/D	600 (3) 700	650
	L-6 292 C.I.D. (L-25)	775 (3)	700	
	V-8 307 C.I.D.	650 (1) L/D 700 (1) H/D	600 (3) (1)	—
	V-8 350 C.I.D. (LS-9)	630 (1)		
	MK IV 402 C.I.D. (L-47)	675 (1) H/D		—

(1) Idle adjustment for vehicles equipped with A.I.R. is: 1/4 turn rich from lean roll (mixture screw).
(2) With A.I.R. operating (if so equipped).
(3) Set low idle, using idle speed screw or solenoid allen head screw adjustment (with solenoid de-energized), at 450 RPM.
(4) **CAUTION:** If the C.E.C. valve (solenoid) on the carburetor is used to set engine idle or is adjusted out of limits specified in the Service Manual, decrease in engine braking may result.
L/D Light Duty, H/D Heavy Duty - See truck identification.

ENGINE ELECTRICAL

SECTION 6Y

BATTERY

Model No.	Application	No. of Plates Per Cell	Cranking Power @ 0° F. (Watts)	Capacity @ 20 Hour Rate (Amp. Hr.)
1980141 (Y86)	250 L-6	54	2300	45
1980145 (R88)	292 L-6, 307 V-8, 350 V-8 & 402 V-8	66	2900	61
1980182 (R88X)	T60 Option	90	3750	76

GENERATORS

Model No.	Applications	Delco Remy Spec. No.	Field Current Amps. (80° F.)	Cold Output*			Rated Hot Output** Amps.
				Spec. Volts	Amps. @ 2000 RPM	Amps. @ 5000 RPM	
1102452	CA, KZ, GS and PS 10-30 Models	3395	2.2-2.6	14	25	35	37
1102440	GE and PE 10-30 Models	3395	2.2-2.6	14	25	35	37
1102453	CS, KS and GS 10-30 w/N40 (or) K19, PS 10 w/N40	3395	2.2-2.6	14	25	35	37
1102456	CS, KS 10-30 w/ N40/K19, PS 10-30 w/N40 & K19 GS10-20 w/N40/K19/L25/ E56/RO5/K79	3395	2.2-2.6	14	25	35	37
1102458	CA-KA 10-30/w/N40 K19, GS 10-30 w/K79 PS 20-30 w/L25/ K79/N40	3396	2.2-2.6	14	28	40	42
1102459	GE 10-30 w/K79/C62 PE 10-30/ w/K79	3396	2.2-2.6	14	28	40	42
1102455	GS, PS 10-30 w/K76, CA, KA 10-30 w/K76/C60	4500	2.2-2.6	14	33	58	61
1102463	GE 10-30 w/K76/C60 PE 10-30 w/K76	4500	2.2-2.6	14	33	58	61
1100487 (10SI)	PE30 (Motor Home)	4500	2.2-2.6	14	33	33	61

*Generator temperature approximately 80° F. **Ambient temperature 80° F.

VOLTAGE REGULATOR

MODEL NO.	APPLICATION	FIELD RELAY			VOLTAGE REGULATOR		
		AIR GAP	POINT OPENING	CLOSING VOLTAGE	AIR GAP	POINT OPENING	VOLTAGE SETTING
1119515	All except 1100487	.015	.030	1.5 - 3.2	.067	.014	13.5 - 14.4 @ 125°F.

STARTING MOTOR

Model No.	Application	Spec. No.	Free Speed		
			Volts	Amperes	RPM
1108365	GS 10-20	3573	9	50-80*	5500-10,500
1108367	PS, CS, KS w/250 L-6 & A.T., GE w/307 V-8				
1108368	PS, CS, KS w/250 L-6 & M.T., PE, CE, KE 307 V-8 M.T.				
1108338	GE w/350 V-8, PE, CE, KE w/350 V-8 & A.T.	2438	9	55-80*	3500-6000
1108360	PS, CS, KS w/292 L-6 & M.T., PE, CE, KE, 350 V-8 & M.T.				
1108385	CE w/402 V-8 & M.T.	3563	9	65-95*	7500-10,500
1108425	GS 30 w/250 L-6 & M.T. CS 30 w/250 L-6 & A.T., PS, CS, KS w/292 L-6 & A.T.	3533	9	40-105*	3500-6500
1108418	CE w/402 V-8 & A.T.	3563	9	65-95*	7500-10,500

*Includes Solenoid

DISTRIBUTORS

Engine Description and Available	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*	Transmission	Original Equipment Spark Plug
250 Cu. In. L-6 Except "G" Series	1110489	C-4797 0 @ 930 RPM 2° @ 1270 RPM 14° @ 2300 RPM 24° @ 4100 RPM	C-3990 0 @ 8" Hg 23° @ 16" Hg	31°-34°	4°	All	AC-R46T
250 Cu. In. L-6 "G" Series	1110493						
250 Cu. In. L-6 20-30 Series w/RPO NB2	1110498		C-3997 0 @ 8" Hg 16° @ 13" Hg				
292 Cu. In. L-6 RPO L25	1110486	C-4809 0 @ 860 RPM 2° @ 1140 RPM 17° @ 2150 RPM 20° @ 4000 RPM	C-3991 0 @ 8" Hg 18° @ 16" Hg	31°-34°	4°	All	AC-R44T
307 Cu. In. V-8 10 Series	1112040	C-4815 0 @ 680 RPM 2° @ 1320 RPM 20° @ 4200 RPM	C-3954 0 @ 8" Hg 20° @ 17" Hg	29°-31°	8°	Automatic	AC-R44T
307 Cu. In. V-8 10 Series	1112041	C-4753 0 @ 800 RPM 2° @ 1200 RPM 12° @ 2200 RPM 24° @ 4300 RPM	C-3954 0 @ 8" Hg 20° @ 17" Hg	29°-31°	4°	Manual	AC-R44T
307 Cu. In. V-8 20-30 Series	1112043	C-4824 0 @ 800 RPM 2° @ 1200 RPM 11° @ 2100 RPM 20° @ 4200 RPM	C-3036 0 @ 8" Hg 15° @ 15.5" Hg	29°-31°	4°	All	AC-R44T
350 Cu. In. V-8 RPO LS9	1112047	C-4818 0 @ 865 RPM 2° @ 1335 RPM 11° @ 2400 RPM 18° @ 4200 RPM	C-3036 0 @ 8" Hg 15° @ 15.5" Hg	29°-31°	8°	Automatic	AC-R44T
350 Cu. In. V-8 RPO LS9	1112046	C-4753 0 @ 800 RPM 2° @ 1200 RPM 12° @ 2200 RPM 24° @ 4300 RPM	C-3036 0 @ 8" Hg 15° @ 15.5" Hg	29°-31°	4°	Manual	AC-R44T
402 Cu. In. V-8 RPO L-47	1112064	C-4830 0 @ 930 RPM 2° @ 1260 RPM 16° @ 2400 RPM 30° @ 4400 RPM	C-3954 0 @ 8" Hg 20° @ 17" Hg	29°-31°	8°	All	AC-R44T

*Refer to Vehicle Emission Control Information Sticker.

IGNITION COIL

APPLICATION	PRIMARY RESISTANCE @ 75°F.	SECONDARY RESISTANCE	IGNITION RESISTOR	
	- OHMS -	- OHMS -	TYPE	OHMS
L-6 Engines	1.41 - 1.65	3,000 - 20,000	In Wiring Harness	1.8
V-8 Engines	1.77 - 2.01	3,000 - 20,000	In Wiring Harness	1.8

TRANSMISSION AND CLUTCH

SECTION 7

THREE SPEED SAGINAW

Clutch Gear Retainer to Case Bolts	15 ft. lbs.
Side Cover to Case Bolts	15 ft. lbs.
Extension to Case Bolts	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.

THREE SPEED MUNCIE

Clutch Gear Retainer to Case Bolts	15 ft. lbs.
Side Cover to Case Bolts	15 ft. lbs.
Extension to Case Bolts	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.
Transmission Drain Plug	30 ft. lbs.

FOUR SPEED MUNCIE

Rear Bearing Retainer	18 ft. lbs.
Cover Bolts	25 ft. lbs.
Filler Plug	35 ft. lbs.
Drain Plug	35 ft. lbs.
Clutch Gear Bearing Retainer Bolts	18 ft. lbs.
Universal Joint Front Flange Nut	95 ft. lbs.
Power Take Off Cover Bolts	18 ft. lbs.
Parking Brake	22 ft. lbs.
Countergear Front Cover Screws	25 in. lbs.
Rear Mainshaft Lock Nut (4 Wheel Drive Models)	95 ft. lbs.

NEW PROCESS TRANSFER CASE MODEL 205

Idler Shaft Lock Nut	200 ft. lbs.
Idler Shaft Cover Bolts	18 ft. lbs.
Front Output Shaft Front Bearing Retainer Bolts	30 ft. lbs.
Front Output Shaft Yoke Lock Nut	200 ft. lbs.
Rear Output Shaft Bearing Retainer Bolts	30 ft. lbs.
Rear Output Shaft Housing Bolts	30 ft. lbs.
Rear Output Shaft Yoke Lock Nut	200 ft. lbs.
P. T. O. Cover Bolts	15 ft. lbs.
Front Output Shaft Rear Bearing Retainer Bolts	30 ft. lbs.
Drain and Filler Plugs	30 ft. lbs.
Transfer Case to Frame Bolts	130 ft. lbs.
Transfer Case to Adapter Bolts	35 ft. lbs.
Adapter Mount Bolts	75 ft. lbs.
Transfer Case Bracket to Frame Nuts (Upper)	30 ft. lbs.
Transfer Case Bracket to Frame Nuts (Lower)	65 ft. lbs.
Adapter to Transmission Bolts - (Manual Transmission)	22 ft. lbs.
- (Automatic Transmission)	35 ft. lbs.

DANA TRANSFER CASE MODEL 20

Shift Rail Set Screws	15 ft. lbs.
Front Output Shaft Rear Cover Bolts	30 ft. lbs.
Front Output Shaft Front Bearing Retainer	30 ft. lbs.
Front Output Shaft Yoke Lock Nut	200 ft. lbs.
Intermediate Shaft Lock Plate Bolt	15 ft. lbs.
Rear Output Shaft Housing Bolts	30 ft. lbs.
Rear Output Shaft Yoke Lock Nut	200 ft. lbs.
Case Bottom Cover Bolts	15 ft. lbs.
Transfer Case to Adapter Bolts	45 ft. lbs.
Transfer Case to Frame Bolts	45 ft. lbs.
Adapter Mount Bolts	75 ft. lbs.
Adapter to Transmission Bolts	45 ft. lbs.

STEERING

SECTION 9

Components	C-P10	C20 - 30	K10 - 20	P20 - 30
Tie Rod Ball Joint Nut Outer and Inner	35 lbs. ft.**	45 lbs. ft.***	45 lbs. ft.	45 lbs. ft.***
Tie Rod Clamp Bolt	22 lbs. ft.		35 lbs. ft.	22 lbs. ft.
Idler Arm Mounting Bolts	30 lbs. ft.		-	30 lbs. ft.
Idler Arm to Relay Rod Nut	60 lbs. ft.		-	60 lbs ft.
Pitman Arm to Relay Rod Nut	60 lbs. ft.		-	60 lbs. ft.
Steering Connecting Rod Nuts	-	-	50 lbs. ft. Plus next slot for cotter pin.	-
Pitman Arm to Pitman Shaft Nut	180 lbs. ft. power 140 lbs. ft. manual		90 lbs. ft.	180 lbs. ft. power 140 lbs. ft. manual
Steering Gear Mounting Bolts	65 lbs. ft.			
Steering Wheel Nut	40 lbs. ft.			
Lower Mast Jacket Bearing Adjustment	P10-1.26 +.02 C10- .50 +.02	.50 + .02		1.26 +.02
Power Steering Belt Tension	125 lbs. New - 75 lbs. Used			
Pump Pulley Nut	58 lbs. ft.			
Pump Pressure	900 - 1000 psi.			
Pump Bracket and Support	25 lbs. ft.			
Power Steering Hose Clamp Screws	15 lbs. in.			
Power Steering Gear Hose Fittings	25 lbs. ft.			
Flexible Coupling Bolt & Studs	18 lbs. in.			
Lower Mast Jacket Bearing Clamp or Coupling Bolt	32 lbs. ft.			
Lower Coupling to Wormshaft Clamp Bolt	C10-30 lbs. ft. P10-75 lbs. ft.	30 lbs. ft.		75 lbs. ft.*
Column to Dash Panel Clamp Screws	125 lbs. in.			120 lbs. in.
Toe Panel Cover Screws	30 lbs. in. C10 24 lbs. in. P10	30 lbs. in.		24 lbs. in.
Firewall Bracket Clamp Bolt	90 lbs. in. C10 98 lbs. in. P10	90 lbs. in.		98 lbs. in.
Lower Bearing Adjusting Ring Bolt	70 lbs. in.			

* Upper and Lower Universal Joint Clamp
** Plus Torque Required to Align Cotter Pin, Max. 50 lbs. ft.
***Plus Torque Required to Align Cotter Pin, Max. 60 lbs. ft.

SECTION 9 (CONT'D)

MANUAL STEERING GEAR

Components	C-P10	C20 - 30	K10 - 20	P20 - 30
Worm Bearing Preload	4 to 6 lbs. in.			9 to 12 lbs. in.
Worm Bearing Lock Nut	85 lbs. ft.			
Over Center Adjustment	4 to 10 lbs. in.*			9 to 13 lbs. in.*
Over Center Lock Nut	30 lbs. ft.			
Total Steering Gear Preload	14 lbs. in. Max.			25 lbs. in. Max.

* In excess of worn bearing preload.

POWER STEERING GEAR

Components	All
Steering Gear Ball Drag	3 lbs. in. Max.
Thrust Bearing Preload	1/2 to 2 lbs. in.*
Adjuster Plug Locknut	80 lbs. ft.
Over-Center Preload	3 — 6** lbs. in.
Over-Center Adjusting Screw Locknut	25 lbs. ft.
Total Steering Gear Preload	14 lbs. in. Max.

* In excess of ball drag.
** In excess of ball drag and thrust bearing preload.

WHEELS AND TIRES

SECTION 10

WHEELS

Wheel Nut Torques - 10-30 Series

SERIES	DESCRIPTION	TORQUE
K10	7/16" Bolts (6)	55-75 ft. lbs.
C, P10	1/2" Bolts (5)	65-90 ft. lbs.
C, P20, 30	9/16" Bolts (8)	90-120 ft. lbs.
C30	Heavy Duty Wheels 5/8" Bolts (10)	200-250 ft. lbs.

TIRES

See "Load Capacity Charts" in Section 0 and "Tire Load and Inflation Pressure" tables in Section 10 of this manual.

SHEET METAL

SECTION 11

Hood Safety Plate	20 ft. lbs.
Hood Lock Bolt	30 ft. lbs.
Hood Lock Bolt Plate	150 in. lbs.
Hood Hinge	25 ft. lbs.
Hood Bumper	85 in. lbs.

BODY AND CHASSIS ELECTRICAL

SECTION 12

LAMP USAGE

Application	Trade No.	Rating*
Instrument Cluster		
Conventional Cab	194	2CP
F/F Cowl	1895	2CP
Temperature Indicator		
Conventional Cab	194	2CP
Brake Warning Indicator		
Conventional Cab	194	2CP
F/F Cowl	1895	2CP
Generator Indicator		
Conventional Cab	194	2CP
Directional Indicator		
P-Models	194	2CP
Conventional Cab	168	3CP
F/F Cowl	1445	1CP
Oil Pressure Indicator		
Conventional Cab	194	2CP
High Beam Indicator		
Conventional Cab	194	2CP
F/F Cowl	1445	1CP

Use	Trade No.	Rating*
Oil Pressure Gauge	1895	2CP
Tachometer	194	2CP
Heater Control	1895	2CP
Dome Lamp	211	12CP
License Lamp	67	4CP
Back-Up Lamps	1156	32CP
Parking and Directional Signal	1157	4-32CP
Tail, Stop and Rear Directional Signal	1157	4-32CP
Headlamp	6014	60W-High Beam 50W-Low Beam
Side Marker Lamps	194	2CP
Roof Clearance and Identification Lamps		
All Exc. P & Suburban	194	2CP
Suburbans	1155	4CP
P-Models	67	4CP

* CP - Candle Power
W - Watts

WINDSHIELD WIPERS

TWO-SPEED WIPER	
Crank Arm Speed (RPM's) (No Load)	
Lo	34 Min.
Hi	65 Min.
Current Draw, AMPS	
No Load (Lo Speed - No Linkage)	3.6
Stall (Lo Speed)	12
WASHER	
Number of "squirts" at full pressure	10
Pressure (PSI)	11-15
Coil Resistance (ohms)	6 ± 1

FUSE AND CIRCUIT BREAKER USAGE

Applicablity	Location	Amps	Type
Instrument Cluster Feed	Fuse block in driver's compartment	3	3AG/AGC
Panel Lights		3	3AG/AGC
Wiper Motor		20	SFE/SAE
Air Conditioning		25	3AG/AGC
Heater Motor		15	3AG/AGC
Backup Lamps		10	3AG/AGC
Tail, Stop, Dome License Lamps Marker Lights Spotlamp, Park Lamps		20	SAE/SFE
Radio - TCS		3	3AG/AGC
Hazard Flash		15	3AG/AGC
Headlamps	Light Switch	15	Circuit breaker
Ammeter	In-Line Part of Gen. & fwd. lamp harness (2 reqd.)	4	3AG/AGC

RADIATOR AND GRILLE

SECTION 13

TORQUE SPECIFICATIONS

Grille	150 in. lbs. outer 10 ft. lbs. inner
Grille Bracket	20 ft. lbs.
Fan Shroud	45 in. lbs.

BUMPERS

SECTION 14

TORQUE SPECIFICATIONS

Front Bumper	35 ft. lbs.
Front Bumper Bracket and Brace	40 ft. lbs.
Rear Bumper to Outer Bracket	35 ft. lbs.
Rear Bumper Outer Bracket and Brace	45 ft. lbs.

ACCESSORIES

SECTION 15

CRUISE—MASTER

Solenoid Resistance	5 ohms ± 1/4 ohm
Solenoid Wire Resistance	40 ohms
Maximum allowable Vacuum Leakage rate for Servo unit	5 inches of Vacuum Per Minute Not Greater than 1 inch of Vacuum per 10 seconds
Operational Test Speed	60 MPH

WEIGHTS AND MEASURES

LINEAR MEASURE

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

AREA MEASURE

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

LIQUID MEASURE

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

DRY MEASURE

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

CUBIC MEASURE

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

COMMON WEIGHT

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

COMMON U.S.A. EQUIVALENTS

LENGTH

1 inch	=25.4001 millimeters
1 millimeter	=0.03937 inches
1 foot	=0.304801 meters
1 meter	=3.28083 feet
1 yard	=9.914402 meters
1 meter	=1.093611 yards
1 mile	=1.609347 kilometers
1 kilometer	=0.621370 miles

LIQUID CAPACITY

1 quart	=0.94633 liters
1 liter	=1.05671 quarts
1 gallon	=3.78533 liters
1 liter	=0.26418 gallons

DRY CAPACITY

1 quart	=1.1012 liters
1 liter	=0.9081 quarts
1 peck	=8.810 liters
1 liter	=0.11351 pecks

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	

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	

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		

CHEVROLET

SERVICE