1976 JEEP TECHNICAL SERVICE MANUAL

Jeep®

FOREWORD

This manual contains the latest service information for all 1976 Jeep vehicles. Adjustment, diagnosis, disassembly, repair, assembly, and installation procedures along with specifications and torque references are included in each section.

The Section Index on the opposite page allows you to locate any desired section quickly. At the beginning of each section is an index which gives the page number on which major subjects begin. An alphabetical index is included in the back of this manual.

All information and specifications in this manual are based on the latest data available at the time of publication. Jeep Corporation reserves the right to discontinue models and change specifications or design without notice or incurring obligation.

Brand names mentioned in this manual are for convenience only and are not intended as a recommendation to use a specific brand of product. They are indicative of a class or type and may be substituted by their equivalent.

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1976 Technical Service Manual

CJ-5/CJ-7 Cherokee Wagoneer Truck

Jeep Corporation

World's Largest and Most Experienced
Manufacturer of 4-Wheel Drive Vehicles

Service Publications

Section Index

GENERAL INFORMATION—VEHICLE IDENTIFICATION

GENERAL

A new model—the CJ-7—with optional one-piece removable hard-top, automatic transmision, and Quadra-Trac joins the Jeep line of 4-wheel drive vehicles for 1976. The CJ-6 will no longer be available domestically or in Canada, but will remain available for export markets.

In all, Jeep offers nine models for 1976 in four series—the open-body CJ-5 and CJ-7 models, the 2-door sports/utility Cherokee, the 4-door Wagoneer station wagon, and the Jeep pickup truck. Complete service instructions for these vehicles are contained in this manual.

CJ-5 AND CJ-7 MODELS

Two models are available: the 83.5-inch wheelbase CJ-5 (Model 83) and the 93.5-inch wheelbase CJ-7 (Model 93). See figures A-1 and A-2.

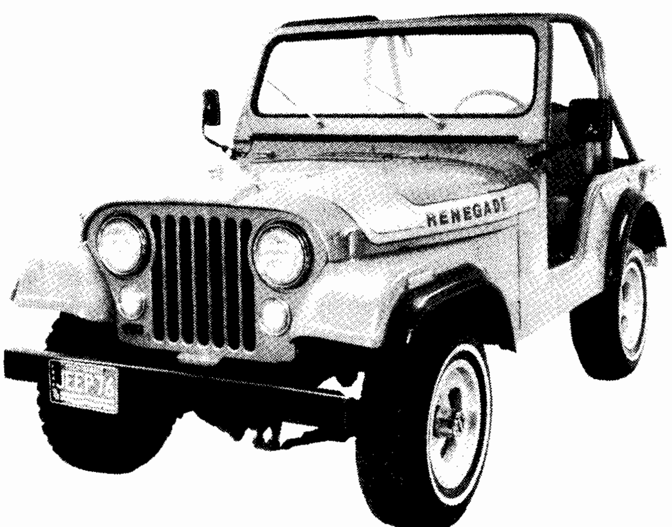

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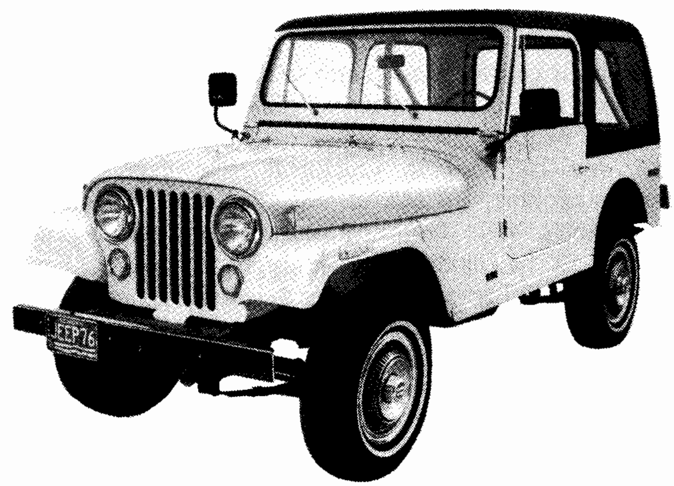
Fig. A-1 1976 CJ-5 Renegade

The 1976 CJ-7 offers automatic transmission teamed with Quadra-Trac full-time 4-wheel drive to provide "go anywhere" highway or back-trail versatility and performance. A molded (structural polycarbonate) hard-top with steel side doors, roll-down windows, and liftgate is also available.



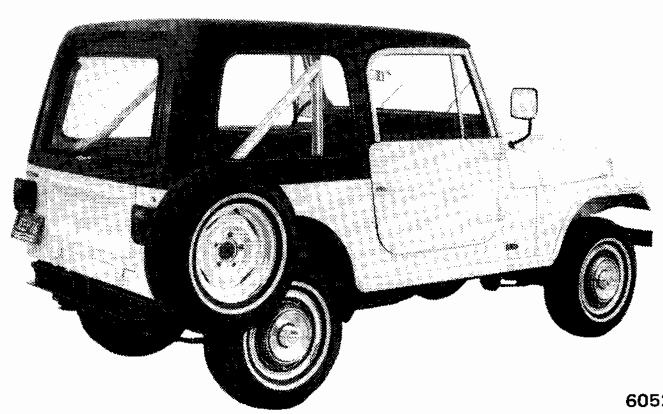


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Fig. A-2 1976 CJ-7

Both models have new, stronger frames with deeper side rails and a full-width skid plate for better engine-transmission-transfer case protection. Body holddowns have been improved to minimize noise and vibration, and fuel tank skid plates are now standard equipment.

Suspension systems feature longer, wider-spaced, multi-leaf front and rear springs and shock absorbers for better ride and handling. An optional suspension package includes heavy-duty springs and shocks and a front frame tie-bar. A front sway bar is also optional.

A new three-speed, fully synchronized, standard manual transmission is capable of handling higher engine torque loads and provides smoother and easier operation.

Six-cylinder engines now have an electric-assist choke, an exhaust gas recirculation system, and a new fuel-return line (also incorporated in V-8 engines) for improved hot starts.

Other new items include an energy-absorbing steering column which offers anti-theft protection, new steering wheels, taillamps, windshields, and instrument panels. Parking and service brake systems have been improved for 1976.

A single catalytic converter is used on all CJ models equipped with V-8 engines. CJ models with six-cylinder engines do not use a catalytic converter (except vehicles sold in California); however, all CJ models require the use of unleaded fuel. To ensure compliance with federally mandated fuel requirements, all CJ models are equipped with fuel filler necks containing a built-in restrictor. The restrictor prevents the insertion of the larger filler nozzle used on pumps delivering leaded gas.

CHEROKEE MODELS

Two models are available: a standard 2-door Model 16 and a custom 2-door "S" Model 17. Both models have a 109-inch wheelbase. See figure A-3.

The Cherokee Chief package features extra-wide track with wider front and rear axles, five special slot-style eight-inch-wide steel wheels, and a 3.54 axle ratio. Large front and rear wheel openings with steel lip extensions accommodate the extra-large tires on the wider wheels. Standard on the Chief are power disc brakes, power steering, and fuel tank skid plate.

Engines used in Cherokee models have electronic ignition as standard equipment and will operate on regular grade leaded or unleaded fuel. A catalytic converter is not used on either model in any state.

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Fig. A-3 1976 Cherokee

All Cherokees for 1976 have a new, more rugged frame with box-section construction that includes deeper side rails and improved welding and riveting. Suspension systems feature increased travel for front springs to minimize "bottoming out" in rough terrain, and new standard rear springs (asymetrical design) that provide a softer ride without compromising ruggedness or vehicle handling.

The standard 3-speed transmission is upgraded for six-cylinder models from the T-14A to the T-15A. The T-15A was previously used on V-8's only and has a torque input capacity of 325 foot-pounds as opposed to 230 foot-pounds for the T-14A.

The Quadra-Trac lockout device has been renamed "Emergency Drive" and has a new control knob and instruction panel, again located in the glove box. The Quadra-Trac Low Range Unit control lever has been relocated to the left side of the floorpan hump for improved efficiency of operation.

Other design changes include new front springs for V-8 models, new dual nozzle windshield washer system (replacing single nozzle type), and a new forward-pivoting seat back design for front bucket seats that provides easier access to rear seats.

WAGONEER MODELS

Two models are available: a standard 4-door Station Wagon Model 14 and a custom 4-door Station Wagon Model 15. Both models have a 109-inch wheelbase.

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Fig. A-4 1976 Wagoneer

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Fig. A-5 1976 Townside Pickup Truck

Standard equipment on Wagoneers includes a 360 CID two-barrel V-8 engine, Turbo-Hydramatic transmission, Quädra-Trac 4-wheel drive system, power steering, and power front disc brakes.

To improve Wagoneer ruggedness and durability, an all-new frame has been developed for 1976 models. It features extensive use of box-section side rail construction for increased strength. Front springs have also been improved to provide increased travel for a smoother ride and prevent "bottoming out" on rough terrain. New standard rear springs of asymmetrical design contribute to the softer ride with no sacrifice of strength or durability.

The Quadra-Trac lockout device has been renamed "Emergency Drive" and has a new control knob and instruction panel, again located in the glove box. The Quadra-Trac Low Range Unit control lever has been relocated to the left side of the floorpan hump for improved efficiency of operation.

Optional engines are listed on a chart in this section. All engines used in Wagoneer models operate on regular grade leaded or unleaded fuel. A catalytic converter is not used on any model in any state.

TRUCK MODELS

Three Truck models are available:

- Series J-10, Model 45, 119-inch wheelbase;
- Series J-10, Model 45, 131-inch wheelbase;
- Series J-20, Model 46, 131-inch wheelbase.

Truck models are aligned by Gross Vehicle Weight Rating (GVWR) to conform to industry practice. Two optional GVW ratings are available on J-20 Series Trucks only.

Numerous mechanical improvements and refinements have been incorporated in the 1976 Jeep pickup trucks, with new choices in options, trim, and body colors.

Gross Vehicle Weight Ratings

Series	Model Number	Wheelbase (Inches)	Gross Vehicle Weight Rating		
			Standard	Option 1	Option 2
J-10	25	119	6025	–	–
J-10	45	131	6025	–	–
J-20	46	131	6500	7200	8000

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A new, more rugged frame, improved in beam strength and torsional rigidity, makes direct steering gear mounting possible plus use of box-section side rail construction. Improved body mounts reduce vibration.

Standard engine in the J-10 truck series is the 258 CID six, with a 3-speed floor-shift transmission and Model 20 manual-shift 4-wheel drive system. Standard in the J-20 Series is the 360 CID V-8 with two-barrel carburetor, a 3-speed floor-shift transmission, and Model 20 manual 4-wheel drive system. The wide range of optional engines, axle ratios, and transmissions available on 1976 Jeep trucks is shown in the Power Train Combinations chart.

The Quadra-Trac lockout device has been renamed "Emergency Drive" and has a new control knob and instruction panel. The Quadra-Trac Low Range Unit control lever has been relocated to the left side of the floorpan hump for improved efficiency of operation.

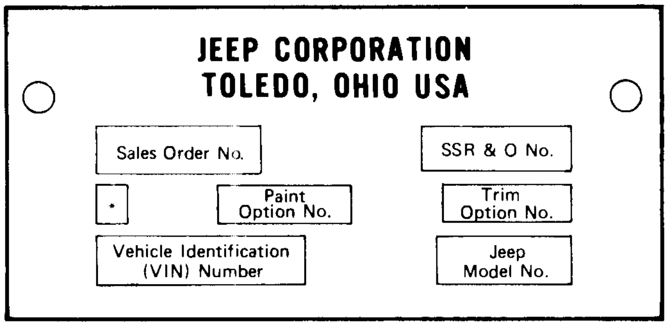
Other mechanical and functional improvements include new front springs for J-10 models; a dual-nozzle windshield washer system; a new optional front stabilizer bar; new, more attractive 15-inch wheel covers for J-10 models equipped with Quadra-Trac.

All engines used in Truck models are designed to operate on regular grade leaded or unleaded fuel. Catalytic converters are not used on any model in any state.

VEHICLE IDENTIFICATION

Vehicle Identification Plate

A metal vehicle identification plate is affixed to the left-hand side of the firewall under the hood (fig. A-6). The plate shows the Sales Order Number; the Vehicle Identification Number (VIN); Special Sales Request & Order (SSR&O) Number; Paint Option Number; Trim Option Number; and the Jeep Model Number.



*Disregard – for factory use only

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Fig. A-6 Vehicle Identification Plate

Special Sales Request and Order (SSR&O) Number

Certain Jeep vehicles are built to special order with other than standard parts or equipment. To assist the dealer in ordering correct replacement parts, an SSR&O number is assigned and a permanent record of the deviation is maintained by the factory. The SSR&O number is embossed on the Vehicle Identification Plate as shown in figure A-6.

Parts ordering procedure for SSR&O parts is detailed in the Jeep Parts Catalog.

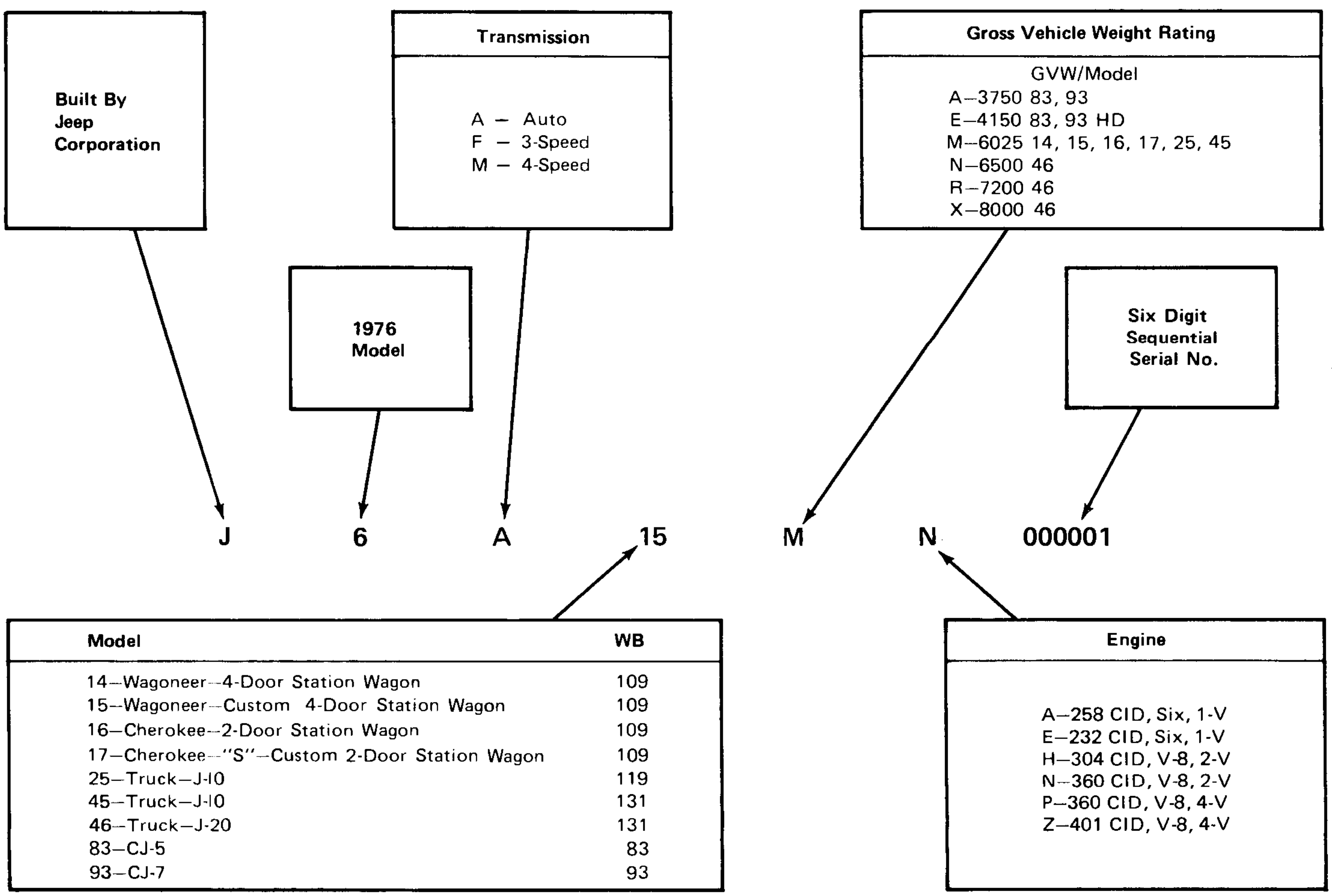
Vehicle Identification Number (VIN)

All VIN numbers contain 13 characters, a combination of letters and numbers that provide specific information about the vehicle. VIN's for all Jeep vehicles can be decoded using the VIN Decoding Chart.

Paint Option Number

The Paint Option Number is embossed on the Vehicle Identification Plate in the location shown in figure A-6.

VIN Decoding Chart



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Paint is not available from the factory. All colors shown below are available from Ditzler or duPont paint jobbers by requesting the paint intermix formula. Option No. 999 indicates special paint. To obtain information on special paint, contact your Jeep Parts Distribution Center, and provide the Vehicle Identification Number (VIN).

Paint Option Numbers

Paint Option Number	Color	Paint Option Number	Color
G6	Renegade Orange	P1	Classic Black
G7	Alpine White	6D	Sand Tan
G9	Medium Blue Metallic	6P	Firecracker Red
H2	Reef Green Metallic	6R	Brilliant Blue
H4	Dark Cocoa Metallic	6T	Nautical Blue Metallic
J1	Pewter Gray Metallic	6V	Sunshine Yellow
Fleet Only		Fleet Only	
FA	Transport Yellow	FE	Forest Green
FB	Omaha Orange	FH	Olive Drab
FC	Federal Gray		

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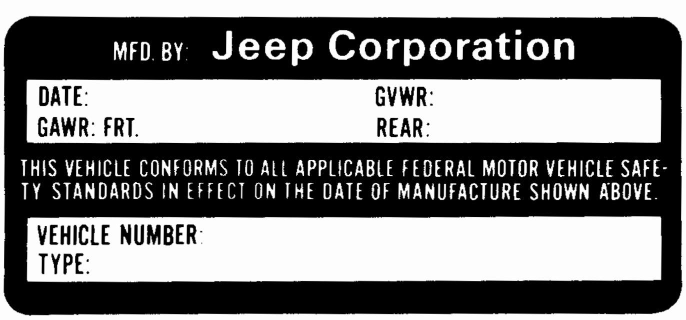
Trim Option Number

The Trim Option Number is embossed on the Vehicle Identification Plate as shown in figure A-6. Consult your Jeep Parts Catalogs for trim ordering procedure. Special trim is indicated by trim option number 999. To obtain information on special trim, contact your National Parts Distribution Center and provide the Vehicle Identification Number (VIN).

Safety Certification Sticker

Placed on all vehicles to show that they meet federal motor vehicle safety certification standards. It lists the VIN, month and year built, Gross Vehicle Weight Rating (GVWR), and Gross Axle Weight Rating (GAWR).


MFD. BY: Jeep Corporation

DATE: GVWR:

GAWR: FRT. REAR:

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VEHICLE NUMBER:

TYPE:

Fig. A-7 Safety Sticker

The sticker is placed on the instrument panel on CJ-5 and CJ-7 models. On Cherokee, Wagoneer, and Truck models it is on the door lock pillar on the driver's side.

KEYS AND LOCKS

Two square-headed and two oval-headed keys are provided, as applicable, with each vehicle. The square-headed (code D) key operates the ignition switch, front door locks, and Wagoneer and Cherokee tailgates. The oval-headed (code E) key operates the glove box lock. Each key has a code number stamped on the knock-out plug. In the event a key is lost, a new key can be made by converting the key code number to a key bitting number. Key bitting numbers can be obtained from a key cutting machine manufacturer's cross-reference list or by contacting your Zone office.

If a key is lost and the key code number is unknown, the correct number can be identified by the Zone office from the vehicle identification number.

If the ignition key is lost and the key code number is not available, a new key can be made by removing a door lock and taking it to a locksmith (for CJ Models, remove ignition switch). The locksmith can determine the key bitting by inserting a blank key into the lock cylinder and cutting the blank to match the tumblers.

If a glove box key is lost, the lock cylinder can be removed and the tumblers rearranged to match the ignition key. Refer to the procedures outlined in Section 14 of this manual for installing new tumblers.

If the ignition switch lock is defective and the key is available, the cylinder and individual tumblers can be ordered and matched to the existing key. To determine the tumbler arrangement, place the key over the template (fig. A-8). Starting from the left, read across the horizontal lines and record first digit (number 1 position) of the key code. Continue this process for subsequent numbers 2 through 5.

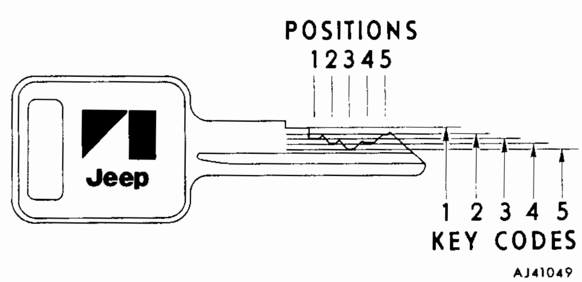


Fig. A-8 Key Coding Template

SERVICE MANUAL IMPROVEMENTS

You are encouraged to report errors, omissions, or recommendations for improving this publication. A form provided for this purpose is included at the end of this section.

SPECIAL TOOLS

Special tools are required for some service operations. When such tools are required, reference is made in the service procedure to the tool name and number. In addition, all special tools are illustrated throughout the text, where possible, or at the end of the section in which they are referenced.

WARNING: *Use of tools or procedures other than those recommended in this service manual could be detrimental to the safe operation of the vehicle being serviced, as well as to the safety of the person or persons servicing the vehicle.*

CONVERSION OF ENGLISH AND METRIC MEASURES

Cubic Centimetres to Inches: To change cubic centimetres to cubic inches, multiply cubic centimetres by 0.061 (cc x 0.061 equals cubic inch).

Cubic Inches to Centimetres: To change cubic inches to cubic centimetres, multiply cubic inches by 16.39 (cubic inch x 16.39 equals cc).

Litres to Cubic Inches: To change litres to cubic inches, multiply litres by 61.02 (litre x 61.02 equals cubic inches).

Cubic Inches to Litres: To change cubic inches to litres, multiply cubic inches by 0.01639 (cubic inches x 0.01639 equals litres).

Cubic Centimetres to Litres: To change centimetres to litres, divide by 1000 (simply move the decimal point three figures to the left).

Litres to Centimetres: To change litres to cubic centimetres, move the decimal point three figures to the right.

Miles to Kilometres: To change miles to kilometres, multiply miles by 1.609 (miles x 1.609 equals kilometres).

Kilometres to Miles: To change kilometres to miles, multiply kilometres by 0.6214 (kilometres x 0.6214 equals miles).

Pounds to Kilograms: 1 pound equals 0.04536 kg.

Kilograms to Pounds: 1 kg equals 2.2046 pounds.

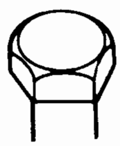
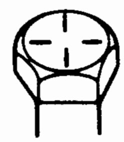
STANDARD TORQUE SPECIFICATIONS AND CAPSCREW MARKINGS

Torque specifications will be found at the end of each section where appropriate. All critical torque specifications are listed. Where no torque reference is given, refer to the chart below (Standard Torque Specifications and Capscrew Markings). Note that torque specifications given in the chart are based on use of clean and dry threads. Reduce torque by 10 percent when threads are lubricated with engine oil and by 20 percent if new plated capscrews are used.

TORX-HEAD FASTENERS

Various sizes of internal and external hex-lobular (Torx) head fasteners are used as attaching hardware on numerous components and assemblies in the 1976 model Jeep vehicles. Due to the ever-changing usage and application of automotive fasteners, Torx-head fasteners may not be identified as such throughout the text. However, these fasteners may be removed and installed using Tool Set J-25359.

Standard Torque Specifications and Capscrew Markings

SAE Grade Number	1 or 2		5		6 or 7		8	
Capscrew Head Markings Manufacturer's marks may vary. Three-line markings on heads shown below, for example, indicate SAE Grade 5. 								
Usage	**Used Frequently**		**Used Frequently**		**Used at Times**		**Used at Times**	
Capscrew Diameter and Minimum Tensile Strength psi (Kg/sq cm)	To 1/2 - 69,000 (4850.7) To 3/4 - 64,000 (4499.2) To 1 - 55,000 (3866.5)		To 3/4 - 120,000 (8436.0) To 1 - 115,000 (8084.5)		To 5/8 - 140,000 (9842.0) To 3/4 - 133,000 (9349.9)		150,000 (10545.0)	
Quality of Material	**Indeterminate**		**Minimum Commercial**		**Medium Commercial**		**Best Commercial**	
Capscrew Body Size (Inches) - Thread	**Torque**		**Torque**		**Torque**		**Torque**	
	Ft-Lb	**kg m**	**Ft-Lb**	**kg m**	**Ft-Lb**	**kg m**	**Ft-Lb**	**kg m**
1/4-20 -28	5 6	0.6915 0.8298	8 10	1.1064 1.3830	10	1.3830	12 14	1.6596 1.9362
5/16-18 -24	11 13	1.5213 1.7979	17 19	2.3511 2.6277	19	2.6277	24 27	3.3192 3.7341
3/8-16 -24	18 20	2.4894 2.7660	31 35	4.2873 4.8405	34	4.7022	44 49	6.0852 6.7767
7/16-14 -20	28 30	3.8132 4.1490	49 55	6.7767 7.6065	55	7.6065	70 78	9.6810 10.7874
1/2-13 -20	39 41	5.3937 5.6703	75 85	10.3725 11.7555	85	11.7555	105 120	14.5215 16.5960
9/16-12 -18	51 55	7.0533 7.6065	110 120	15.2130 16.5960	120	16.5960	155 170	21.4365 23.5110
5/8-11 -18	83 95	11.4789 13.1385	150 170	20.7450 23.5110	167	23.0961	210 240	29.0430 33.1920
3/4-10 -16	105 115	14.5215 15.9045	270 295	37.3410 40.7985	280	38.7240	375 420	51.8625 58.0860
7/8- 9 -14	160 175	22.1280 24.2025	395 435	54.6285 60.1605	440	60.8520	605 675	83.6715 93.3525
1- 8 -14	235 250	32.5005 34.5750	590 660	81.5970 91.2780	660	91.2780	910 990	125.8530 136.9170

AJ41029

METRIC SYSTEM-SI

The International System of Units (Systeme International) officially abbreviated "SI" in all languages - the modern metric system

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL
LENGTH	Dimensions Tire rolling circumference Turning circle/radius Braking distance	metre	m
	Greater than 999 metre Dimensions Depth of surface finish	kilometre millimetre micrometre	km mm µm
Area	Glass & Fabrics Brake & Clutch linings Radiator area etc.	square centimetre	cm2
	Small areas	square millimetre	mm 2
Volume	Car Luggage Capacity	cubic metre	m3
	Engine capacity Vehicle fluid capacity	litre cubic centimetre	l cm 3
Volume Flow	Gas & Liquid	litre per second	l/s
Time Interval	Measurement of elapsed time	second minute hour day	s min h d
Velocity	General use Road speed	metre per second kilometre per hour	m/s km/h
Acceleration & Deceleration	General use	metre per second squared	m/s2
Frequency	Electronics	hertz kilohertz megahertz	Hz kHz mHz
Rotational Speed	General use	revolution per minute revolution per second	rpm rps
Mass	Vehicle mass Legal load rating	megagram	t
	General use Small masses	kilogram gram milligram	kg g mg
Density	General use	kilogram per cubic metre gram per cubic centimetre kilogram per litre	kg/m3 g/cm3 kg/l
Force	Pedal effort Clutch spring force Handbrake lever effort etc.	newton	N
Moment of Force (Torque)	Torque	newton metre	N-m
Power, Heat Flow Rate	General use Bulbs Alternator output Engine performance Starter performance	watt kilowatt	W kW

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL
Celsuis Temperature	General use	degree Celsius	°C
Thermodynamic Temperature	General use	kelvin	K
Electric Current	General use	ampere milliampere microampere	A mA µA
Potential Difference (Electromotive Force)	General use	kilovolt volt millivolt microvolt	kV V mV µV
Electric Resistance	General use	megohm kilohm ohm	MΩ kΩ Ω
Electric Capacitance	General use	farad microfarad picofarad	F µF pF
Fuel Consumption	Vehicle performance	litre per 100 kilometre	l/100 km
Oil Consumption	Vehicle performance	litre per 1000 kilometre	l/1000 km
Stiffness	Linear stiffness	kilonewton per metre	kN/m
Tire Revolutions	Tire Data	revolution per kilometre	rev/km
Pressure	Tire Coolant Lubricating oil Fuel pump delivery Engine compression Manifold Brake line (hydraulic) Car heating & ventilation Barometric pressure	kilopascal	kPa
Luminous Intensity	Bulbs	candela	cd
Accumulator Storage Rating	Battery	ampere hour	A-h

U.S.A./METRIC COMPARISON

Quantity	USA	Metric- Symbol	
Length	Inch-Foot-Mile	Metre	m
Weight(mass)	Ounce-Pound	Kilogram	Kg
Area	Square inch/Foot	Square Metre	m2
Volume-Dry	Cubic inch/Foot	Cubic Metre	m3
-Liquid	Ounce-Pint-Quart-Gallon	Litre	l
Velocity	Feet Per Second	Metre per Second	m/s
Road Speed	Miles Per Hour	Kilometre per Hour	km/h
Force	Pound-Force	Newton	N
Torque	Foot-Pounds	Newton metre	N-m
Power	Horsepower	Kilowatt	kW
Pressure	Pounds Per Square Inch	Kilopascal	kPa
Temperature	Degrees Fahrenheit	Degrees Kelvin and Celsius	K °C

General Dimensions (Inches)

	CJ Models		Cherokee Models			Wagoneer Models		Truck Models			
								J-10 Series			J-20 Series
								Model 25		Model 45	Model 46
	CJ-5	CJ-7	"S"	Std.	Chief	Custom	Std.	Base	Honcho		
Wheelbase	83.5	93.5	108.7	108.7	108.7	108.7	108.7	118.7	118.7	130.7	130.7
Overall Length	138.4	147.9	183.5	183.5	183.5	183.5	183.5	192.5	192.5	204.5	204.5
Overhang—Front	23.5	23.5	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
—Rear	31.4	30.9	44.9	44.9	44.9	44.9	44.9	43.9	43.9	43.9	43.9
Overall Width	68.6*	68.6*	75.6	75.6	78.9	75.6	75.6	78.9	78.9	78.9	78.9
Overall Height	—	—	66.9	66.9	67.6	66.7	66.7	69.3	69.9	69.1	70.7
Open Body	67.6	67.6	—	—	—	—	—	—	—	—	—
Soft Top	71.4	71.3	—	—	—	—	—	—	—	—	—
Hard Top	71.3	70.5	—	—	—	—	—	—	—	—	—
Step Height—Front	27.0	26.1	19.9	19.9	20.7	20.7	20.7	20.7	21.3	20.5	22.1
—Rear	—	—	—	—	—	20.8	20.8	—	—	—	—
Front Tread	51.5	51.5	59.9	59.2	65.4	59.4	59.4	63.3	64.5	63.3	64.6
Rear Tread	50.0	50.0	58.5	57.8	62.3	57.8	57.8	63.8	64.9	63.8	65.9
Minimum Ground Clearance	6.9	6.9	7.7	7.7	8.6	7.7	7.7	7.7	8.6	7.7	8.1
Minimum Turning Diameter	33.5	35.9	37.7	37.7	39.4	37.7	37.7	40.6	41.2	44.5	44.5
Effective Leg Room—Front (Accelerator)	37.9	39.1	39.4	39.4	39.4	38.8	38.8	38.8	38.8	38.8	38.8
—Rear (Minimum)	—	—	37.0	37.0	37.0	37.0	37.0	—	—	—	—
Hip Room—Front	55.4	53.8	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5
—Rear	—	—	60.9	60.9	60.9	60.9	60.9	—	—	—	—
Shoulder Room—Front	55.4	53.8	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3
—Rear	—	—	58.3	58.3	58.3	58.3	58.3	—	—	—	—
Effective Head Room—Front	—	—	38.0	38.0	38.0	38.0	38.0	40.2	40.2	40.2	40.2
Soft Top	39.8	40.6	—	—	—	—	—	—	—	—	—
Hard Top	40.8	39.9	—	—	—	—	—	—	—	—	—
—Rear	—	—	37.3	37.2	37.2	37.2	37.2	—	—	—	—
Cargo Floor Height	25.2	25.1	24.9	24.9	25.6	24.7	24.7	—	—	—	—
Cargo Capacity (Cubic Feet)	—	—	95.1**	95.1**	95.1**	95.1**	95.1**	—	—	—	—
Cargo Space (Townside Truck Models)											
Overall Length	—	—	—	—	—	—	—	86.5	86.5	98.5	98.5
Length at Floor	—	—	—	—	—	—	—	83.6	83.6	95.6	95.6
Width at Wheelhouse	—	—	—	—	—	—	—	50.0	50.0	50.0	50.0
Width at Floor	—	—	—	—	—	—	—	68.0	68.0	68.0	68.0
Width of Tailgate Opening	—	—	—	—	—	—	—	57.2	57.2	57.2	57.2
Height of Sides and Tailgate	—	—	—	—	—	—	—	20.5	20.5	20.5	20.5
Area (Volume Index—Cubic Feet)	—	—	—	—	—	—	—	67.0	67.0	76.6	76.6

***With side mounted spare tire. **With rear seat removed.**

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Power Train Combinations—1976 CJ Models

Series	GVWR	Engine	LHD	RHD (9)	Transmission					Transfer Case		Clutch (Inches)	Axle Ratio		Trac-Lok (8)	Axle Model		Brakes (Inches) (3)		Wheels	Tires
					3	4	A	T-150	T-18	20	QT.		3.54	4.09		Front	Rear	Front	Rear		
CJ-5 Model 83 83.4-Inch Wheelbase	3750 (1)	6-232 (6) (7)	X	X	S			X		S		10.5	S	O (2)	O	Dana 30 Open End	AMC/ Jeep	Bendix 11 x 2 Drum	Bendix 11 x 2 Drum	15 x 6 5 Bolt 5.50 B.C.	F78x15 (B)
						O			X												
		6-258 (5)	X	X	S			X		S		10.5									
						O			X												
		304-2V (4)	X		S			X		S		10.5									
CJ-7 Model 93 93.4-Inch Wheelbase	3750 (1)	6-232 (7)	X		S			X		S		10.5	S	O	O	Dana 30 Open End	AMC/ Jeep	Bendix 11 x 2 Drum	Bendix 11 x 2 Drum	15 x 6 5 Bolt 5.50 B.C.	F78x15 (B)
				X										S							
		6-258	X	X	S			X		S		10.5	S	O (2)							
						O			X												
							O				S		S	O							
		304-2V	X		S			X (4)		S		10.5	S	O							
							O				S		S	O							
CJ-6 Model 84 103.4-Inch Wheelbase (10)	3750 (1)	6-232 (7) 6-258	X	X (KD)	S			X		S		10.5	S	O (2)	O	Dana 30 Open End	AMC/ Jeep	Bendix 11 x 2 Drum	Bendix 11 x 2 Drum	15 x 6 5 Bolt 5.50 B.C.	F78x15 (B)

Notes:

(1) 4150 GVW Optional with Specific Suspension components-Mandatory GVW with full enclosures.
(2) 4.09 Ratio Std. RHD.
(3) Power Drum Optional.
(4) Available California with catalytic converter.
(5) 4-Speed-not available California.
(6) 232-4-Speed-Export Only
(7) Not available California.
(8) Not available with Q.T.
(9) Not Emission & Safety Certified.
(10) Export Only-Not Emission Certified.

Abbreviations:

B - Load Range "B" Tires
B.C. - Bolt Circle
GVWR - Gross Vehicle Weight Rating
KD - Knock-Down
LHD - Left-Hand Drive
O - Optional Equipment
QT - Quadra-Trac
RHD - Right-Hand Drive
S - Standard Equipment

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Power Train Combinations—1976 Cherokee-Wagoneer-Truck Models

Series	Engine	LHD	RHD	Transmission					Transfer Case		Clutch (Inches)	Axle Ratio					Trac-Lok (5)	Axle Model		Brakes (6)		Wheels	Tires
				3	4	A	T15A	T18	20	QT		3.07	3.54	3.73	4.09	4.88		Front	Rear	Front	Rear		
Cherokee Models 16 & 17 109 - Inch Wheelbase 6025 GVWR	6-258 (1)	X		S			X		S		10.5		S		O		N.A.4.09 O	Dana 44 Open End	Dana 44	Delco 11x2 Drum Std. 12-Inch Disc Opt.	Delco 11x2 Drum	15 x 6.00 6 Bolt 5.50 B.C.	H78x15 (B)
						O				S(4)													
			X(KD)	S			X		S		10.5				S								
	360-2V (1)	X		S			X		S		11.0												
					O			X	S														
						O				S		S	O				O						
	360-4V				S			X	S		11.0												
						O				S													
	401-4V	X				S				S													
Wagoneer Models 14 & 15 109 - Inch Wheelbase 6025 GVWR	6-258 (2)	X		S			X		S		10.5		S		O		N.A.4.09 O	Dana 44 Open End	Dana 44	Delco 12-Inch Disc	Delco 11x2 Drum	15 x 6.00 6 Bolt 5.50 B.C.	H78x15 (B)
			X(KD)	S			X		S						S								
	360-2V (1) 360-4V 401-4V	X				S				S		S	O				O						
	360-2V (2)				O			X	S		11.0												
J - 10 Truck Model 25 119 - Inch Wheelbase Model 45 131 - Inch Wheelbase 6025 GVWR	6-258 (1)	X		S			X		S		10.5							Dana 44 Open End	Dana 44	Delco 11x2 Drum Std. 12-Inch Disc Opt.	Delco 11x2 Drum	15 x 6.00 6 Bolt 5.50 B.C.	H78x15 (B)
					O			X	S						S		O						
						O	X			S													
	360-2V (1)	X		S			X		S		11.0												
					O			X	S														
						O				S			S		O		O						
	360-4V	X			S			X	S		11.0												
						O				S													
	401-4V	X				S				S			S										
J - 20 Truck Model 26 119 - Inch Wheelbase 6500 GVWR Export Only	6-259	X	X(KD)		S			X	S		10.5					S (3)		Dana 44 Open End	Dana 60FF	Delco 12.5 Inch Disc	Delco 12x 2.5 Drum	16 x 6.50 8 Bolt 6.50 B.C.	7.50x16 (C)
J - 20 Truck Model 46 131 - Inch Wheelbase 6500 GVWR 7200 Opt. 8000 Opt.	6-258 (2)	X	X(KD)		S			X	S		10.5					S (3)		Dana 44 Open End	Dana 60FF	Delco 12.5 Inch Disc	Delco 12x 2.50 Drum	16.5 x 6 8 Bolt 6.50 B.C. (7)	8.00x16.5 (D) (8)
	360-2V (1)	X		S			X		S		11.0												
					O			X	S														
						O				S				S	O		O						
	401-4V	X				S				S				S									
	360-4V					O				S				S	O								
					S			X	S		11.0												

Notes:
(1) N. A. California
(2) N. A. Domestic Market
(3) Available Trac-Lok Only 4.88 Ratio
(4) Low Range N. A.
(5) N. A. with Quadra - Trac
(6) Power Std. with Front Disc Brake
(7) Wheel Standard 7200 GVW & 8000 GVW } 16.5 x 6.75 8 Bolt 6.50 B. C.
(8) Tire Standard 7200 GVW & 8000 GVW } 9.50 x 16.5 (D)

Abbreviations:
B - Load Range "B" Tires
B. C. - Bolt Circle
C - Load Range "C" Tires
D - Load Range "D" Tires
GVWR - Gross Vehicle Weight Rating
KD - Knock-Down
LHD - Left-Hand Drive
O - Optional Equipment
QT - Quadra-Trac
RHD - Right-Hand Drive
S - Standard Equipment

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DECIMAL EQUIVALENTS

FRACTIONS		DECIMALS		FRACTIONS		DECIMALS	
64ths	32nds	Two Place	Three Place	64ths	32nds	Two Place	Three Place
1		.02	.016	33		.52	.516
	1	.03	.031		17	.53	.531
3		.05	.047	35		.55	.547
1/16		.06	.062	9/16		.56	.562
5		.08	.078	37		.58	.578
	3	.09	.094		19	.59	.594
7		.11	.109	39		.61	.609
1/8		.12	.125	5/8		.62	.625
9		.14	.141	41		.64	.641
	5	.16	.156		21	.66	.656
11		.17	.172	43		.67	.672
3/16		.19	.188	11/16		.69	.688
13		.20	.203	45		.70	.703
	7	.22	.219		23	.72	.719
15		.23	.234	47		.73	.734
1/4		.25	.250	3/4		.75	.750
17		.27	.266	49		.77	.766
	9	.28	.281		25	.78	.781
19		.30	.297	51		.80	.797
5/16		.31	.312	13/16		.81	.812
21		.33	.328	53		.83	.828
	11	.34	.344		27	.84	.844
23		.36	.359	55		.86	.859
3/8		.38	.375	7/8		.88	.875
25		.39	.391	57		.89	.891
	13	.41	.406		29	.91	.906
27		.42	.422	59		.92	.922
7/16		.44	.438	15/16		.94	.938
29		.45	.453	61		.95	.953
	15	.47	.469		31	.97	.969
31		.48	.484	63		.98	.984
1/2		.50	.500	1		1.00	1.000

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ATTENTION: SERVICE PUBLICATIONS

MAINTENANCE

GENERAL

Scheduled and unscheduled maintenance services required to keep Jeep vehicles in good running condition are detailed in this section. Services that must be performed at periodic intervals are listed in the Mechanical Maintenance Schedule. These services are scheduled on the basis of mileage as accumulated on the odometer or a specified time interval—whichever comes first—or they are scheduled by accumulated mileage only. This Maintenance section is therefore subdivided into three parts: (1) Services Scheduled by Mileage or Time Intervals, (2) Services Scheduled by Accumulated Mileage, and (3) Unscheduled Maintenance. Unscheduled maintenance services are those services which need not be performed regularly, but only as the occasion arises.

Mechanical Maintenance Schedule

The services listed in the Schedule are those which experience and testing have indicated are the most likely needed at the mileage or time interval shown. They are shown on the schedule as "R," "HD," or "E" services.

"R" services are those maintenance services that are required to keep vehicles in normal service functioning properly.

"HD" services are those services required only if the vehicle is operated in heavy-duty service. Heavy-duty service includes any of the following uses:

- Off-road operation or operation under dusty conditions for over 30% of use.
- Extended idling during normal operation.
- Towing of trailers over 2,000 pounds.
- Short-run usage—that is, most trips average under 6 miles.

Vehicles in heavy-duty use require service at more frequent intervals, as specified by "HD" in the Mechanical Maintenance Schedule. These services must be performed in addition to the services required for vehicles in normal service, as specified by "R".

"E" services are services required at the interval shown in the schedule to help assure continued compliance with U. S. National Emission Control Standards.

Fuel Requirements

CJ models required unleaded fuel to meet Federal emission standards. The fuel filler tube on these models contains a restrictor which prevents insertion of a nozzle from a gas pump delivering leaded fuel. Reminder labels reading "Unleaded Fuel Only" are affixed to the instrument panel and sheet metal next to the filler tube. Leaded fuel must not be used in CJ models with V-8 engines. These models are equipped with a catalytic converter which—if leaded fuel is used— could be contaminated and require replacement of the alumina catalyst beads.

Cherokee, Wagoneer, and Truck models can use either leaded or unleaded fuel as long as it has an octane rating (research method) of 91 or higher.

SERVICES SCHEDULED BY MILEAGE OR TIME INTERVALS

AT START OF WINTER

Perform the following maintenance services at the start of every winter season:

Battery Cables

Inspect the cables for condition and clean the terminals. Coat connections with light mineral grease or petroleum jelly. Replace cables if required.

1976 Jeep Mechanical Maintenance Schedule

Engine Oil and Oil Filter	Engine Coolant	Tires
Change required (R) every 5,000 miles or 5 months, whichever comes first. If most vehicle uses involve trips under 6-8 miles, change oil once in between the oil and filter changes. Change Heavy-Duty (HD) every 3,000 miles or 3 months, whichever comes first. Check engine oil level every 500-600 miles.	Change required (R) at 25,000 miles or 25 months and then at the start of every winter season. **Wheel Nuts** Tighten to specified torque (R) after first 200 miles.	Tires and tire services are excluded from both the New Vehicle Warranty and the Maintenance Schedule. Tire adjustments are handled directly by the tire manufacturer. Normal maintenance recommendations appear as guides under "Tires".

SERVICES SCHEDULED by ACCUMULATED MILEAGE

HD—If you operate your Jeep vehicle under heavy-duty conditions such as off-road or dusty driving conditions for over 30% of use; extended idling during normal uses; towing heavy trailers (over 2,000 lbs.); or short run uses (most trips under 6-8 miles); more frequent servicing intervals are required. HD service intervals are in addition to others indicated.

R —Required for function and durability. E —Required to help assure compliance with U.S. National Emission Control standards.

ODOMETER READING 000000 IN THOUSANDS		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Fluids (including battery)—inspect/correct level Chart 1		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
COMPLETE BODY LUBRICATION AND BRAKE INSPECTION * Chart 2		HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD
Front Suspension—inspect/correct caster and toe		HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD
Manual Transmission Clutch—inspect/correct adjustment				R			R			R			R			R			R		
Automatic Transmission—adjust linkage				R			R			R			R			R			R		
COMPLETE CHASSIS LUBRICATION (Chart 3)	CJ	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
	Cherokee, Wagoneer, Truck	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD
Shock Absorber Mountings and Bushings—inspect		HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD
Spring Bushings—inspect		HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD	R	HD	HD
Exhaust System—inspect		R	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD
U.S. EMISSION CONTROL SERVICES CHEROKEE, WAGONEER, TRUCK (Chart 4)	Scheduled routine service	E	E		E	E		E	E		E	E		E	E		E	E		E	E
	Complete precision tune-up			E			E			E			E			E			E		
U.S. EMISSION CONTROL SERVICES CJ (Chart 5)	Scheduled routine service			E						E						E					E
	Complete precision tune-up						E						E						E		
	Idle speed (curb and fast)—check and inspect. Drive belts—inspect condition and tension and correct as required.	E																			

* Immediately after operating in sand, mud, water, etc., inspect the brake assemblies and clean if necessary.

CHART 1 FLUIDS

INSPECT AND CORRECT LEVELS:

NORMAL SERVICE Every 5,000 Miles*

HEAVY-DUTY SERVICE Every 3,000 Miles*

- Transmission
- Transfer Case—Model 20 only**
- Differentials—Front and Rear
- Steering Gear Housing
- Power Steering Reservoir
- Brake Master Cylinder
- Engine Oil Level
- Radiator Coolant, Windshield Washer Solvent, Battery — at each fuel tank fill

DRAIN AND REFILL:

At Mileage indicated

Transmission	
Automatic	
Normal Service	25,000
Heavy Duty Service	10,000
Manual	30,000
Transfer Case—Model 20 only**	30,000
Differentials—Front and Rear	30,000

*Except as otherwise indicated

**Quadra-Trac transfer case does not require scheduled lubricant level check or drain and refill

CHART 2 COMPLETE BODY LUBRICATION AND BRAKE INSPECTION

NORMAL SERVICE: Every 15,000 miles
HEAVY DUTY SERVICE: Every 5,000 miles

Inspection, and correction as needed, of brake linings and other parts
Hood latch and hinges
Door latches, lock cylinders and door hinges*
Tailgate and liftgate hinges and latches*
Front seal tracks
Ash tray slides
Glove box door latch and hinge
Courtesy light switch buttons*
Apply silicone lubricant to all door, window, tailgate and liftgate rubber weather seals

*Where applicable

CHART 4 U. S. EMISSION CONTROL SERVICES CHEROKEE, WAGONEER, TRUCK MODELS

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-ups.

SCHEDULED ROUTINE SERVICES
At 5-10-20-25-35-40-50-65-70-80-85-95-100,000 miles
Drive belts—inspect condition and tension and correct as required
Heat Valve (exhaust manifold)—inspect and lubricate

COMPLETE PRECISION TUNE-UP
At 15-30-45-60-75-90,000 miles
Air-Guard System Hoses—inspect and correct as required
Carburetor Air Cleaner Element—replace paper cartridge, clean polyurethane element, unless plugged or damaged, then replace
Choke Linkage—inspect for free movement (correct as required)
Coil and Spark Plug Wires—inspect and replace as required
Distributor Advance Mechanisms—check and correct as required
Distributor Cap and Rotor—inspect and replace as required
Drive Belts—inspect condition and tension and correct as required
Engine Oil Filler Cap (filter type)—clean
Exhaust Gas Recirculation Discharge Port (six-cylinder)—inspect and clean as required*
Exhaust Gas Recirculation Valve—inspect and clean*
Fuel Filter—replace
Fuel System: Cap, Tank, Lines, Check Valves and Connections—inspect for integrity and correct as required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Heat Valve (exhaust manifold)—inspect and lubricate
Idle Speed and Mixture—check and reset as required
Ignition Timing—check and set as required
PCV Filter (six cylinder)—clean
PCV Hoses—inspect and replace as required
PCV Valve—replace
Spark Plugs—replace
TAC System—inspect and correct as required
Vacuum Fittings, Hoses and Connections—inspect and correct as required

***Service every 15,000 miles if leaded fuel is used. Service every 30,000 miles if lead-free fuel is used.**

CHART 3 COMPLETE CHASSIS LUBRICATION

	CJ Models	Cherokee, Wagoneer, Truck
NORMAL SERVICE:	Every 5,000 miles	Every 15,000 miles
HEAVY-DUTY SERVICE:	Every 3,000 miles	Every 5,000 miles

Inspection and or lubrication of . . .

Steering linkage (with replacement of suspension and steering system seals and components as necessary)
Steering shaft U-joint (Cherokee, Wagoneer, Truck)
Clutch Linkage—CJ Models

Lubricate every 25,000 miles:
Front wheel bearings—All Models
Transfer case shift linkage—CJ Models
Transfer case shift control lever assembly—Cherokee, Wagoneer & Truck

NORMAL SERVICE: Every 10,000 miles
HEAVY-DUTY SERVICE: Every 5,000 miles
Front and Rear Propeller Shafts—All Models

NOTE: Rear wheel bearings do not require periodic or scheduled lubrication; only at time of overhaul or other service.

CHART 5 U. S. EMISSION CONTROL SERVICES CJ MODELS

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-ups.

SCHEDULED ROUTINE SERVICES At 15-45-75-100,000 miles
Drive belts—inspect condition and tension and correct as required.
Fuel Filter—replace.

COMPLETE PRECISION TUNE-UP AT 30-60-90,000 MILES
Air-Guard System Hoses—inspect and correct as required
Carburetor Air Cleaner Element—replace
Choke Linkage—inspect for free movement (correct as required)
Coil and Spark Plug Wires—inspect and replace as required
Distributor Advance Mechanisms—check and correct as required
Distributor Cap and Rotor—inspect and replace as required
Drive Belts—inspect condition and tension and correct as required*
Engine Oil Filler Cap (filter type)—clean
Fuel Filter—replace
Fuel System: Cap Tank, Lines, Check Valves and Connections—inspect for integrity and correct as required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Heat Valve (exhaust manifold)—inspect and lubricate
Idle Speed (curb and fast) and mixture—check and reset as required
Ignition Timing—check and set as required
PCV Filter (six-cylinder)—clean
PCV Hoses—inspect and replace as required
PCV Valve—replace
Spark Plugs—replace
TAC System Hoses—inspect and correct as required
Transmission Controlled Spark Systems—inspect and correct as required
Vacuum Fittings, Hoses and Connections—inspect and correct as required

Engine Coolant

Change engine coolant *after* the first 25,000 miles or 25 months, whichever comes first, and then at the start of every winter season. Refer to Cooling section for draining and refilling procedures.

EVERY 5,000 MILES/MONTHS

Engine Oil Change

Engine oil should be changed after the first 5,000 miles and every 5,000 miles thereafter. As periods for subsequent oil changes are affected by a variety of conditions, no single mileage figure can apply for all types of driving. Five-thousand miles is therefore the maximum amount of miles that should elapse between changes; more frequent changes are beneficial, and for this reason, oil should be changed every 5 months even though 5,000 miles may not have elapsed on the vehicle odometer.

Drain crankcase only after engine has reached normal operating temperature to ensure complete drainage of used oil.

For maximum engine protection under all driving conditions, fill crankcase only with engine oil meeting API Engine Oil Service Classification "SE". These letters must appear on the oil container singly or in combination with other letters. SE engine oils provide protection against oil oxidation, high-temperature engine deposits, rust, and corrosion.

Single viscosity or multi-viscosity oils are equally acceptable. Oil viscosity number, however, should be determined by the lowest anticipated temperature before the next oil change.

Crankcase capacity is 5 quarts for six-cylinder engines, 4 quarts for V-8's. Add 1 quart with filter change. Do not fill past FULL mark on engine oil dipstick.

Engine Oil Viscosity

Lowest Temperature Anticipated	Recommended Single Viscosity	Recommended Multi-Viscosity
Above +40°F	SAE 30 or 40	SAE 10W-30, 20W-40, or 10W-40
Above 0°F	SAE 20W-20	SAE 10W-30 or 10W-40
Below 0°F	SAE 10W*	SAE 5W-20 or 5W-30

*Sustained high speeds (above 55 mph) should be avoided when using SAE 10W engine oil since oil consumption may be greater under this condition.

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Oil Filter Change

A full-flow oil filter is mounted on the lower front right side on V-8 engines and on the lower center right side of six-cylinder engines.

The throwaway filter unit can be removed from the adapter by using Oil Filter Removal Tool J-22700. To install, turn the replacement unit by hand until the gasket contacts the seat and then tighten an additional half turn.

The oil filter should be changed every 5,000 miles or every 5 months, whichever comes first.

EVERY 25,000 MILES/MONTHS

Engine Coolant

Change the engine coolant at 25,000 miles or 25 months, whichever comes first, and then at the start of every winter season. Refer to Cooling section for draining and refilling procedures.

SERVICES SCHEDULED BY ACCUMULATED MILEAGE

AFTER FIRST 200 MILES

Wheel-to-Hub Nuts

After the first 200 miles of operation, tighten the wheel-to-hub nuts to the specified torque value.

Wheel-to-Hub Nuts (Foot-Pounds)

Model	OK Range	Preferred
CJ Models	65 to 90	78
Cherokee, Wagoneer, Truck (except 8000 GVW Truck)	65 to 80	73
Truck 8000 GVW	110 to 125	118

AFTER FIRST 5,000 MILES

Exhaust System Inspection—All Models

Check the exhaust system after 5,000 miles of vehicle operation and inspect for the following conditions. Correct as required.

- Exhaust system leaks, damage, misalignment.
- Grounding against body sheet metal or frame.
- Exhaust manifold heat valve stuck.
- Catalytic converter (CJ models only) "bulged" or damaged by excessive heat.

Emission Control Services—CJ Models

Drive Belts

Check belts driving fan, air pump, alternator, power steering pump, and air conditioning compressor for cracks, fraying, wear, and general condition. Use Tension Gauge J-23600 to check drive belt tension. Compare reading obtained against the tension specified for used belts in the following chart. If installing a new belt, use the initial tension setting shown in the chart.

If drive belt must be replaced or tension must be adjusted, refer to Cooling section for procedure.

Drive Belt Tension (Pounds)

Drive Belt	New Belt*	Used Belt
Air Conditioner	125 to 155	90 to 115
Air Pump (except six-cylinder with power steering)	125 to 155	90 to 115
Air Pump (with power steering — 3/8 inch belt)	65 to 75	60 to 70
Fan/Alternator	125 to 155	90 to 115
Power Steering Pump	125 to 155	90 to 115

*New belt specifications apply only to replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.

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Engine Idle Speeds

Check curb and fast idle speeds using equipment known to be accurate. For curb idle speed, refer to Tune-Up Specifications (On Car) chart in the Emission Controls section. For fast idle speed, refer to Carburetor Service Specifications chart in the Fuel—Carburetion section.

EVERY 5,000 MILES

Fluid Level Checks—All Models

Battery

Check electrolyte level and add distilled water, if necessary, to bring level to bottom of ring in filler wells. Check specific gravity with a reliable hydrometer. Coat connections with light mineral grease or petroleum jelly. Refer to Electrical section for detailed maintenance information.

Engine Coolant

Coolant level should be checked when the engine is cold. If coolant should be needed, fill radiator to approximately 1/2 inch to 1 inch below the filler neck when hot or 1-1/2 inch to 2 inches when cold. Add a mixture of equal parts of ethylene glycol antifreeze and pure water. In an emergency, plain water may be used. Check the freeze protection at the earliest opportunity, as the addition of plain water will reduce the antifreeze and corrosion protection afforded by the coolant. Do not overfill, as loss of coolant—due to expansion—will result.

Automatic Transmission

Check the fluid level at each engine oil change. 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.

(2) Place vehicle on level surface.

(3) Have engine running at hot idle speed.

(4) Apply parking brake.

(5) Move gearshift lever through all gears, leaving it in Park.

(6) Remove dipstick, located in fill tube at right rear of engine near firewall, and wipe clean.

(7) Insert dipstick until cap seats.

(8) Remove dipstick and note reading. The fluid level should be between the ADD and FULL marks. If at or below the ADD mark, add sufficient fluid to raise level to FULL mark.

Use AM Automatic Transmission Fluid, Dexron, or Dexron II or equivalent.

CAUTION: *Do not overfill. Overfilling can cause foaming which in turn can lead to overheating, fluid oxidation, or varnish formation. These conditions can cause interference with normal valve, clutch, and servo operation. Foaming can also cause fluid to escape from the transmission vent where it may be mistaken for a leak.*

When checking fluid level, also check fluid condition. If fluid smells burned or is full of metal or friction material particles, a complete transmission overhaul is needed. Examine the fluid closely. If doubtful about its condition, drain out a sample for a doublecheck.

Manual Transmission and Model 20 Transfer Case

Fluid levels in the Model 20 transfer case and manual transmission (T-15A, 150-T, or T-18) must be checked at the same time. Fill plugs for all units are located on the right side of the assembly.

To check lubricant level, remove the transmission and transfer case fill plugs. Lubricant should be level with each fill plug hole. If not, bring up to level with make-up lubricant and replace fill plug. Use SAE 80W Gear Lubricant of API-GL-4 quality.

Quadra-Trac Transfer Case and Low Range Reduction Unit

Fluid levels in the Quadra-Trac transfer case and the low range reduction unit (if equipped) must be checked at the same time. Fill plugs are shown in figure B-1. Lubricant should be level with each fill plug hole. If not, bring up to level with a blend of AMC/Jeep Lubricant Concentrate, Jeep Part No. 8123004 (or equivalent), and SAE 30W non-detergent motor oil.

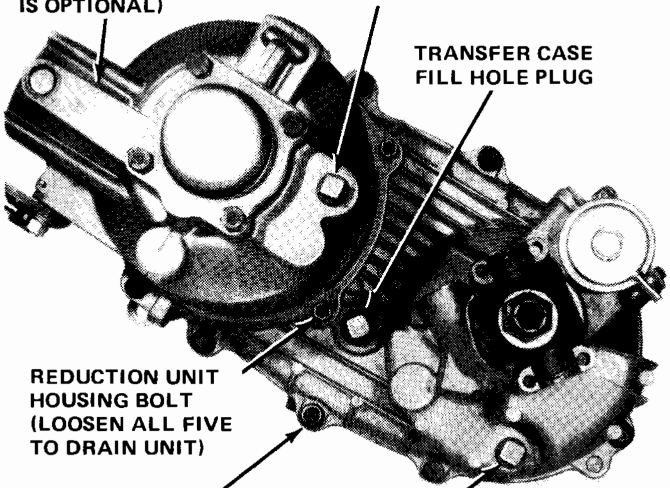
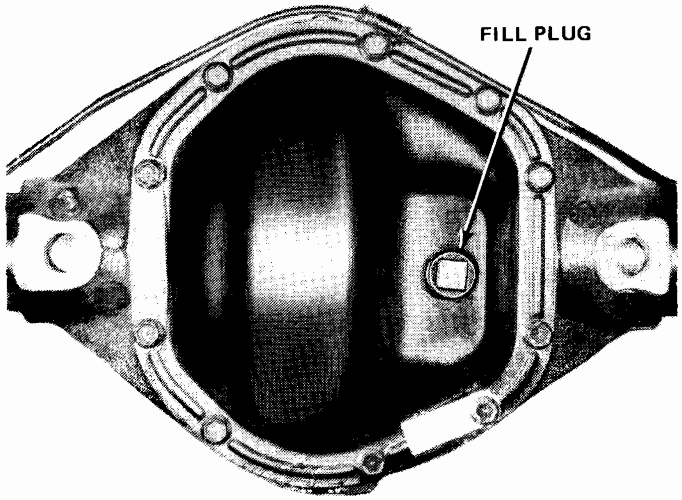


Fig. B-1 Quadra-Trac Transfer Case and Low Range Reduction Unit Fill Plugs

Axle Differentials—Front and Rear

Check the lube level every 5,000 miles or at each oil change. The lubricant level of all differentials should be at the level of the fill hole (fig. B-2). If not, bring to level by adding lubricant. Use AM Rear Axle Lubricant or equivalent of SAE 80W-90 (API-GL-5) quality. For Trac-Lok axles, use Limited-Slip Gear Lubricant of SAE 80W-90 (API-GL-5) quality.



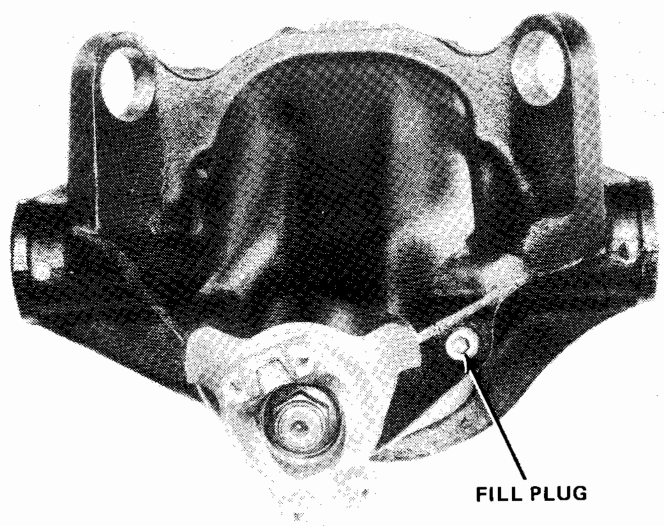


Fig. B-2 Axle Fill Plug Locations

Manual Steering Gear

Check by removing the side cover bolt opposite the adjuster screw (fig. B-3). Lubricant should be to level of bolt hole. If not, add make-up fluid such as AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (Lithium Base).

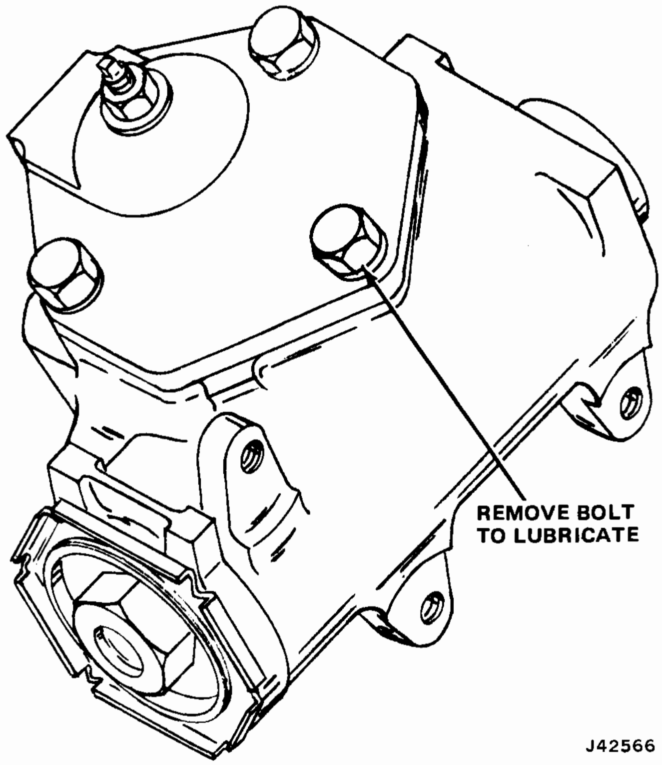


Fig. B-3 Manual Steering Gear Fill Hole Location

Power Steering Gear Pump

Lubricant level can be checked with fluid either hot or cold. If below the FULL HOT or FULL COLD marking on the dipstick attached to the reservoir cap (fig. B-4), add make-up fluid such as AM Automatic Transmission Fluid or equivalent brand labeled Dexron.

Windshield Washer Solution

Replenish windshield washer solution with a quality washer solvent to avoid system freeze-up during cold weather. For warmer weather, use plain water. Do not use anti-freeze or other solutions that can damage the paint.

Chassis Lubrication—CJ Models

Lubricate the following components every 5,000 miles for vehicles in normal service. For vehicles in heavy-duty service, lubricate every 3,000 miles.

Clutch Linkage

Apply AM All-Purpose Lubricant (or equivalent) or multi-purpose chassis lubricant (lithium base) at the clutch bellcrank. There are two lube fittings on the bellcrank.

Fig. B-4 Power Steering Gear Pump Dipstick Location

Steering Linkage

Lubricate tie-rod ends and connecting rod ends using AM All-Purpose Lubricant (or equivalent) or multi-purpose chassis lubricant (lithium base).

Emission Control Services—Cherokee-Wagoneer-Truck

Drive Belts

Check belts driving fan, air pump, alternator, power steering pump, and air conditioning compressor for cracks, fraying, wear, and general condition. Use Tension Gauge J-23600 to check drive belt tension. Compare reading obtained against the tension specified for used belts shown in the following chart. If installing a new belt, use the initial tension setting shown in the chart.

Drive Belt Tension (Pounds)

Drive Belt	New Belt*	Used Belt
Air Conditioner	125 to 155	90 to 115
Air Pump (except six-cylinder with power steering).	125 to 155	90 to 115
Air Pump (with power steering – 3/8 inch belt)	65 to 75	60 to 70
Fan/Alternator.	125 to 155	90 to 115
Power Steering Pump	125 to 155	90 to 115

***New belt specifications apply only to replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.**

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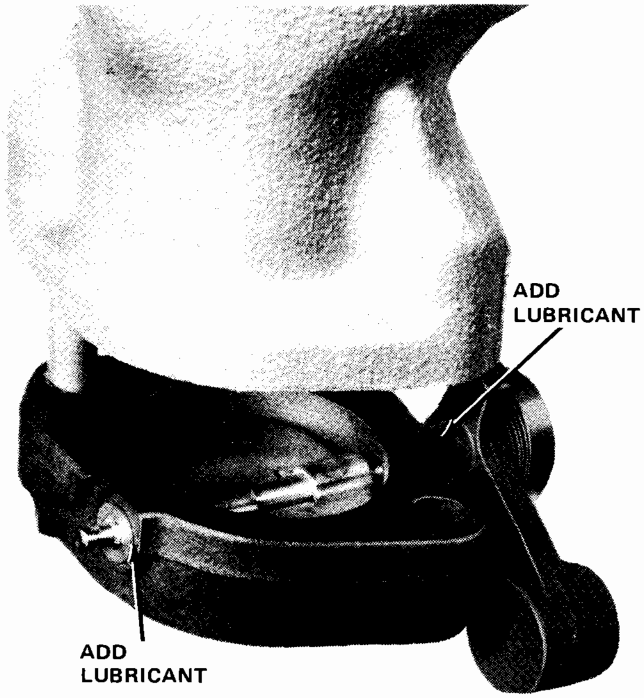

V-8 ENGINE 41699

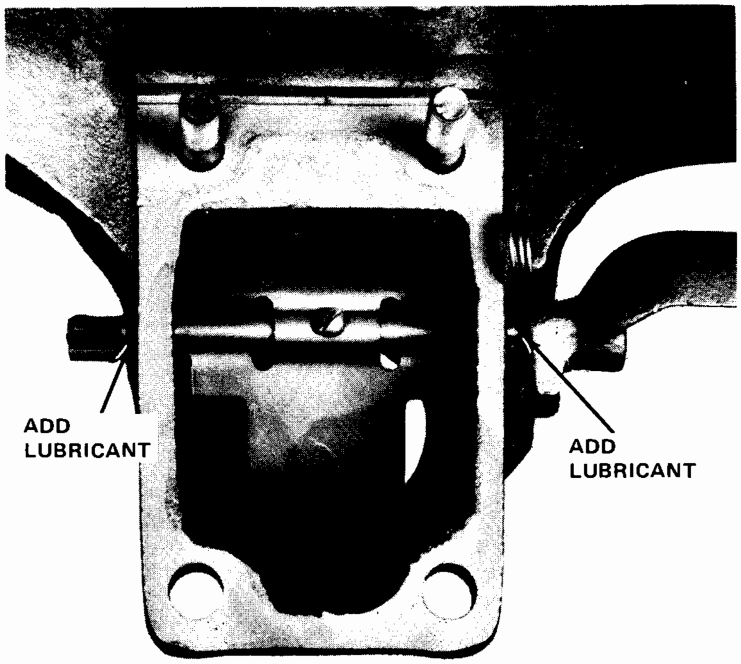

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Fig. B-5 Heat Valve Shaft Lubrication Points

Exhaust Manifold Heat Valve

Check for proper operation and lubricate the shaft using AM heat Valve Lubricant, Part No. 8891632, or equivalent.

On V-8 engines the valve is at the end of the right-side exhaust manifold. On six-cylinder engines, the valve is in the lower portion of the exhaust manifold on the left side of the engine.

EVERY 10,000 MILES

Propeller Shafts—All Models

Lubricate the following propeller shaft components every 10,000 miles for vehicles in normal service and every 5,000 miles for vehicles in heavy-duty service. Use AM All-Purpose or Multi-Purpose Chassis Lubricant (lithium base) or equivalent.

Sleeve Yokes (Splines)

Apply grease gun pressure to sleeve yoke grease fitting until lubricant appears at pressure relief hole in expansion plug at sleeve yoke end of spline. At this point, cover pessure relief hole with finger and continue to apply pressure until grease appears at sleeve yoke seal. This will ensure complete lubrication of spline.

Single Cardan Joint

The single cardan joint is "permanently" lubricated. It should not be disassembled in an attempt to lubricate it (seals could be damaged). If diagnosis indicates looseness or severe wear, replace the assembly.

Double Cardan Joint

Lubricate the constant velocity center bearing at the transfer case end of the front propeller shaft as follows:

(1) Mark propeller shaft and pinion yoke to ensure proper alignment upon assembly.

(2) Disconnect front universal joint from rear axle. Move front end of shaft to right as far as possible.

(3) Rotate shaft until lube hole plug in center bearing can be seen.

(4) Lube joint using an extended point lubrication adapter such as Alemite Adapter No. 6783.

(5) Align marks on propeller shaft and pinion yoke.

(6) Connect front universal joint to front axle.

NOTE: *Undercoating or rustproofing compounds could cause the propeller shafts to become unbalanced and cause drive train vibrations. Remove any such compounds using the special solvent available from local undercoating shops.*

EVERY 15,000 MILES

Perform all the services scheduled to be performed at 5,000-mile intervals in addition to the following maintenance tasks:

Body Lubrication—All Models

Lubricate all models every 15,000 miles for vehicles in normal service and every 5,000 miles for vehicles in heavy-duty service. Refer to Recommended Lubricants chart at end of this section for items to be lubricated and lubricants to use.

Brake Inspection—All Models

Examine brake linings for wear. If vehicle has drum-type brakes, check the self-adjusting mechanism for proper function. Inspect hydraulic system for leaks and condition at each wheel cylinder and at master cylinder. Check condition of all lines, fittings, and hoses. Correct as required. Adjust parking brake using procedure in Brakes section.

Steering and Front Suspension—All Models

Refer to Front Wheel Alignment procedure in Steering section and inspect caster and toe. Correct as required. Camber is preset at the time of manufacture and does not require adjustment. Inspect spring bushings and shock absorber mountings and bushings and correct as required.

Automatic Transmission Linkage Adjustment—All Models

Adjust the linkage every 15,000 miles. The following procedure applies for all vehicles with automatic transmission.

(1) Place steering column gearshift lever in Neutral (N) position.

(2) Raise vehicle on hoist.

(3) Loosen locknut on gearshift rod trunnion just enough to permit movement of gearshift rod in trunnion.

(4) Place outer range selector lever fully into neutral detent position and tighten locknut at trunnion to 9 foot-pounds torque.

(5) Lower car and operate steering column gearshift lever in all ranges. Vehicle should start only in Park or Neutral and column gearshift lever should engage properly in all detent positions. Readjust linkage if operation is not satisfactory.

Manual Transmission Clutch Inspection and Adjustment

Inspect clutch by driving vehicle and checking for clutch chatter, grabbing, slippage, and incomplete release. Correct as required. Use following procedure for adjustment, if required.

(1) Adjust bellcrank outer support bracket to provide approximately 1/8-inch bellcrank end play.

(2) Lift clutch pedal up against pedal stop.

(3) On clutch push rod (pedal-to-bellcrank), adjust lower ball pivot assembly on or off of rod as required to position bellcrank inner lever parallel to front face of clutch housing (slightly forward from vertical).

(4) Adjust clutch for release rod (bellcrank-to-release fork) to obtain maximum specified clutch pedal free play.

Emission Control Routine Services—CJ Models

Drive Belts

Inspect drive belts for condition and tension as described under "AFTER FIRST 5,000 MILES." Replace or adjust as required.

Fuel Filter

Replace the fuel filter at the carburetor every 15,000 miles or whenever a complete precision tune-up (Chart 5) is performed.

Chassis Lubrication—Cherokee-Wagoneer-Truck

Lubricate the steering linkage and steering shaft universal joint at 15,000-mile intervals using AM All-Purpose Lubricant or Multi-Purpose Lubricant (lithium base) or equivalent.

Complete Precision Tune-Up—Cherokee-Wagoneer-Truck

A complete precision tune-up should be performed on Cherokee, Wagoneer, and Truck models at 15,000-mile intervals and a precision electronic diagnosis purchased whenever questionable engine performance occurs between scheduled precision tune-ups.

Refer to Chart 4 of the 1976 Mechanical Maintenance Schedule for a complete listing of items requiring attention during the tune-up. Refer to Emission Controls section for detailed procedures and specifications. Procedures for air cleaner servicing and fuel filter replacement can be found in the Fuel—Carburetion section.

EVERY 25,000 MILES

Chassis Lubrication

Lubricate the front wheel bearings every 25,000 miles using a high quality wheel bearing lubricant. Clean, inspect, and repack front wheel bearings when they are removed for servicing.

Adjust wheel bearings after lubrication in accordance with procedures in Brakes—Wheels section.

Transfer Case Shift Linkage—CJ Models

Lubricate every 25,000 miles using AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (lithium base) or equivalent.

Transfer Case Shift Control Lever — Cherokee-Wagoneer-Truck

Lubricate every 25,000 miles using AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (lithium base) or equivalent.

Automatic Transmission Fluid Change

Drain and refill the automatic transmission at 25,000 miles for vehicles in normal service and every 10,000 miles for vehicles in heavy-duty service. Change fluid immediately after vehicle operation, before it cools.

(1) Remove transmission pan screws, pan, and gasket.
(2) Remove and discard oil strainer.
(3) Remove and discard O-ring seal from the pick-up pipe.
(4) Install new oil strainer.
(5) Install new O-ring seal on pick-up pipe and install strainer and pipe assembly.
(6) Clean pan thoroughly and position new gasket on pan. Use petroleum jelly to hold gasket.
(7) Install pan. Secure with attaching screws and tighten to 10 to 13 foot-pounds torque.
(8) Pour approximately 5 quarts of Dexron or Dexron II automatic transmission fluid (or equivalent) down filler pipe. Be sure container, spout, funnel, or other items in contact with fluid are clean.
(9) Start engine—allow to idle a few minutes.
(10) Place gearshift lever in Park (P) position and apply parking brake.
(11) With transmission warm, check fluid level. Add fluid, if necessary, to bring level to FULL mark.

EVERY 30,000 MILES

At every 30,000-mile interval, perform all of the services listed under "EVERY 5,000 MILES," "EVERY 10,000 MILES," and "EVERY 15,000 MILES" in addition to the following scheduled maintenance.

Manual Transmission and Model 20 Transfer Case Fluid Change

Manual transmission (3- or 4-speed) and Model 20 transfer case lubricating fluid must be changed at the same time. Change every 30,000 miles. Use SAE 80W Gear Lubricant of API-GL-4 quality — see Fluid Capacities chart at the end of this section for quantity. To change fluid:

(1) Remove fill plugs and drain plugs.
(2) Allow units to drain completely.
(3) Replace drain plugs.
(4) Fill to level of fill holes.
(5) Replace fill plugs.

Axle Differentials (Front and Rear) Fluid Change

Change every 30,000 miles using AM Rear Axle Lubricant or Limited-Slip Gear Lubricant of SAE 80W-90 (API-GL-5) quality or equivalent. For Trac-Lok differentials, use Jeep Differential Oil, Part Number 8991018 or equivalent. Quantity required is listed in the Fluid Capacities chart at the end of this section by axle model. To change fluid:

(1) Remove axle differential housing cover.
(2) Allow lubricant to drain out completely.
(3) On all differentials (except Trac-Lok), flush the differential with a flushing oil or light engine oil to clean out the housing (do not use water, steam, kerosene, or gasoline for flushing). Trac-Lok differentials may be cleaned only by disassembling the unit and wiping with clean rags. Do not flush the unit.
(4) Check condition of differential housing cover gasket. Replace if necessary.
(5) Install gasket and differential housing cover.
(6) Tighten cover bolts to 15 to 25 foot-pounds torque.
(7) Remove filler plug (fig. B-2) and add new lubricant to fill-hole level.

Complete Precision Tune-Up—CJ Models

A complete precision tune-up should be performed on CJ models at 30,000-mile intervals and a precision electronic diagnosis purchased whenever questionable engine performance occurs between the scheduled precision tune-ups.

Refer to Chart 5 of the 1976 Mechanical Maintenance Schedule for a complete listing of items requiring attention during the tune-up. Refer to Emission Controls section for detailed procedures and specifications. Procedures for air cleaner servicing and fuel filter replacement can be found in the Fuel—Carburetion section.

UNSCHEDULED MAINTENANCE

GENERAL

Services detailed in this subsection are not listed in the Mechanical Maintenance Schedule for performance at a specified interval. They are to be performed as the occasion arises. Owners, users, and service mechanics should be alert for indications that service or replacement is needed.

CATALYTIC CONVERTER

The catalytic converter used on all CJ models with V-8 engine and those manufactured for sale in California could become contaminated if leaded gas is used or if the engine or emission controls are not maintained as scheduled. If this occurs, the catalyst—the alumina-coated beads in the converter—must be replaced. Refer to the catalyst replacement procedure in the Emission Control section.

QUADRA-TRAC TRANSFER CASE

Stick-Slip Condition

The Quadra-Trac transfer case does not require periodic or scheduled lubrication. However, should a stick-slip condition occur in the transfer case, a torque wind-up condition results as in a conventional transfer case. Sudden release of the clutch brake cones under this condition results in a constant, pulsating, grunt-like noise that, if it occurs, is evident to the driver at slow or "crawl" speeds—such as when slowly turning a corner, or when maneuvering to park.

NOTE: *Stick-slip can occur after extended high-speed highway driving or driving after the vehicle has been sitting idle for a week or more. This is considered normal, and should be of no concern, as the noise will disappear with continued driving.*

If this condition occurs, a full eight fluid ounces of Concentrate, Jeep Part Number 8123004, or Lubrizol 762 or equivalent should be added (this applies to the Quadra-Trac transfer case with or without the reduction unit). It may be necessary to drain a slight amount of lubricant at the transfer case drain plug (fig. B-1) to permit addition of the full amount of concentrate through the transfer case fill plug.

If the addition of the concentrate does not correct the stick-slip condition, the unit should be drained, refilled, and then driven in tight circles to distribute lubricant.

CAUTION: *When driving in tight circles, do not turn the wheels to the stop position—keep the wheel about half a turn off the stop position.*

Fluid Change

Without Reduction Unit

Use a lubricant blend consisting of eight ounces of Concentrate, Jeep Part Number 8123004, or Lubrizol 762 and SAE-30 good quality nondetergent motor oil. Requirement is 3.5 pints (2.9 Imperial pints or 1.7 liters). **Detergent and heavy-duty (10W-30) type motor oils are not recommended.**

Remove fill plug and drain plug (fig. B-1) and allow the transfer case to drain completely. Replace drain plug. Install concentrate, then fill to fill-hole level with motor oil, as specified above. Replace fill plug.

With Reduction Unit

Use a lubricant blend of eight ounces of Concentrate, Jeep Part Number 8123004, or Lubrizol 762 and good quality SAE 30 nondetergent motor oil. Requirement is 4.5 pints (3.7 Imperial pints or 2.1 liters).

Remove the fill plugs from the transfer case and reduction unit. Remove the transfer case drain plug. After it has drained *completely*, replace the drain plug.

Loosen the five bolts on the reduction unit housing (no drain plug), so that the unit can be pulled back far enough to permit the unit to drain. After it has drained completely, move the housing back into position and tighten the bolts.

First, install the concentrate in the reduction unit and then fill to fill-hole level with motor oil as specified above. Replace the fill plug. Next, fill the transfer case to fill-hole level with the specified motor oil. Replace fill plug.

CAUTION: *Fill plugs, drain plugs, and reduction housing bolts should not be overtightened. Tighten plugs and 3/8-16 bolts to 15 to 25 foot-pounds and 5/16-18 bolts to 10 to 20 foot-pounds torque. Overtightening may result in thread stripping or breakage of the aluminum unit.*

After draining and refilling, it may be necessary to drive the vehicle in circles (in an open area) both clockwise and counterclockwise for about 15 minutes to allow the fresh lubricant to enter the differential unit and to force the clutches to operate.

CAUTION: *When driving in tight circles, do not turn the wheels to the stop position—keep the wheel about half a turn off the stop position.*

TIRES

Tires and tire services are excluded from the New Vehicle Warranty and Mechanical Maintenance Schedule. Tire adjustments are handled directly by their manufacturers. Their normal maintenance recommendations appear as guides under Tire Condition in this manual.

Recommended Lubricants

Component	Lubricant
Manual Transmission* Model 20 Transfer Case*	SAE 80W Gear Lubricant API-GL-4
Automatic Transmission*	AM Automatic Transmission Fluid or equivalent brand labelled Dexron® or Dexron II®
Power Steering Gear Pump*	AM Automatic Transmission Fluid or equivalent brand labelled Dexron®
Quadra-Trac Transfer Case* Low Range Reduction Unit*	Use a blend of AMC/Jeep Lubricant Concentrate, Jeep Part. No. 8123004 and SAE 30W non-detergent motor oil
Manual Steering Gear*	AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (Lithium Base)
Brake Master Cylinder* (Drum or Disc Brakes)	AMC/Jeep Brake Fluid, Part No. 8992757 or equivalent conforming to SAE Standard J1703 and FMVSS No. 116, DOT 3 Brake Fluid
Axle Differentials—Front & Rear* Trac-Lok Axle Differential*	AM Rear Axle Lubricant or Limited-Slip Gear Lubricant of SAE 80W-90 (API-GL5) quality.
Propeller Shaft Double Cardan Joint; Propeller Shaft Single Cardan Joint; Propeller Shaft Sleeve Yokes; Model 20 Transfer Case Shift Lever; Model 20 Transfer Case Shift Linkage; Steering Linkage Ball Joints; Steering Shaft Universal Joint; Clutch Linkage Bellcrank	AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (Lithium Base)
Front Wheel Bearings	Wheel Bearing Lubricant
Exhaust Manifold Heat Valve	AM Heat Valve Lubricant, Part No. 8891632 or equivalent
Ash Tray Slides Door, Hood, Liftgate, and Tailgate Lock Mechanisms Glove Box Latch and Hinges Parking Brake	AM Lubriplate or equivalent
Accelerator Linkage Door, Hood, Tailgate, and Liftgate Pivot Points	AM Motor Oil or equivalent brand
Weatherstripping	AM Silicone Lubricant Spray, Part No. 8992881 or equivalent
Key Lock Cylinders	Apply AM Silicone Lubricant Spray or light oil to key and insert in lock cylinder. Repeat several times
Air Cleaner Polyurethane Element	SAE 10W-30 engine oil

*No drain or refill required except when overhauled or serviced. See *Fluid Capacities* chart for refill quantities
Fluids specified are to be used for maintaining recommended levels as well as service refills.

Fluid Capacities

Capacities, Approximate Refill	U.S. Measure	Imperial Measure	Metric Measure - Liters
Engine Oil (Includes 1 quart for filter change)			
232 CID & 258 CID engines	6.0 quarts	5.0 quarts	5.7
304 CID, 360 CID & 401 CID engines	5.0 quarts	4.2 quarts	4.7
Cooling System (Includes 1 quart for heater)			
232 CID & 258 CID engines	10.5 quarts	8.7 quarts	10.0
304 CID engine	14.0 quarts	11.6 quarts	13.2
360 CID & 401 CID engines	13.0 quarts	10.8 quarts	12.3
Transfer Case			
Model 20	3.2 pints	2.7 pints	1.5
(a) Quadra-Trac	3.5 pints	2.9 pints	1.7
(a) Quadra-Trac with Reduction Unit	4.5 pints	3.7 pints	2.1
Transmission			
Manual 3-Speed—CJ Models	3.0 pints	2.1 pints	1.2
Manual 3-Speed—Cherokee, Wagoneer, & Truck	2.7 pints	2.2 pints	1.3
Manual 4-Speed—All Models	6.5 pints	5.5 pints	3.1
Automatic—Change Only	5.0 quarts	4.2 quarts	4.7
Automatic—At Overhaul	11.0 quarts	9.2 quarts	10.4
Axles			
AMC Model Rear Axle—CJ Models	4.0 pints	4.2 pints	1.9
Model 30—Front Axle—CJ Models	2.5 pints	2.1 pints	1.2
(b) Model 44—Front or Rear Axle—All but CJ Models	3.0 pints	2.5 pints	1.4
(b) Model 60-3 (FF) Rear Axle—Trucks over 6500 GVW	6.0 pints	5.0 pints	2.8
Gas Tank (Approximate Gallons)			
CJ Models	15.5 gallons	12.9 gallons	58.7
Cherokee & Wagoneer	22.0 gallons	18.3 gallons	83.3
Truck	19.0 gallons	15.8 gallons	71.9

(a) Quantities listed are for SAE 30 (good quality) Non-Detergent Motor Oil. Add eight ounces of Concentrate, Jeep Part Number 8123004.
(b) Capacities of conventional and Trac-Lok rear axles are identical.

SIX-CYLINDER ENGINE

GENERAL

The 232 and 258 CID are six-cylinder, in-line, overhead valve engines. Both engines operate only on unleaded fuel when installed in CJ Models. All Cherokee and Truck Models equipped with six-cylinder engines may use leaded or unleaded fuel. Cylinders are numbered from front to rear. Firing order is 1-5-3-6-2-4. Crankshaft rotation is counterclockwise, viewed from the rear. The crankshaft is supported by seven (two-piece) bearings. The camshaft is supported by four one-piece (line bored) bearings. Due to the similarity of the 232 and 258 CID engines, service procedures have been consolidated and typical illustrations are used, except where specific procedures and illustrations are needed to clarify the operation (fig. 1A-1 and 1A-2).

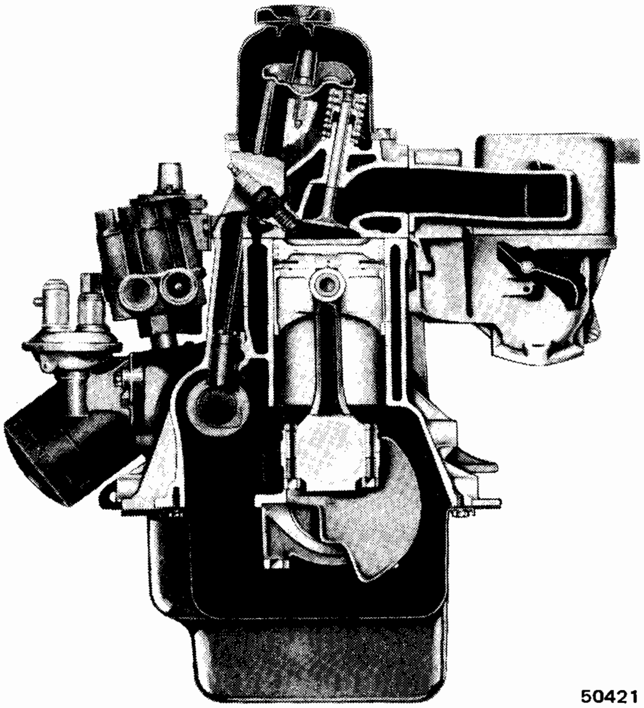

Fig. 1A-1 Engine Assembly—Sectional View

Identification

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the block between the No. 2 and No. 3 cylinders (fig. 1A-3).

The numbers of the code identify the year, month, and day that the engine was built.

The code letter identifies the cubic inch displacement, carburetor type and compression ratio. The letters are decoded as follows:

Engine Build Date Code

Letter Code	CID	Carburetor	Comp. Ratio
A	258	1V	8.0:1
E	232	1V	8.0:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
8 - 1975 9 - 1976	01 - 12	A or E	01 - 31

EXAMPLE: 9 03 A 18

60257

The example code identifies a 258 CID with 1V carburetor and 8.00:1 compression ratio built on March 18, 1976.

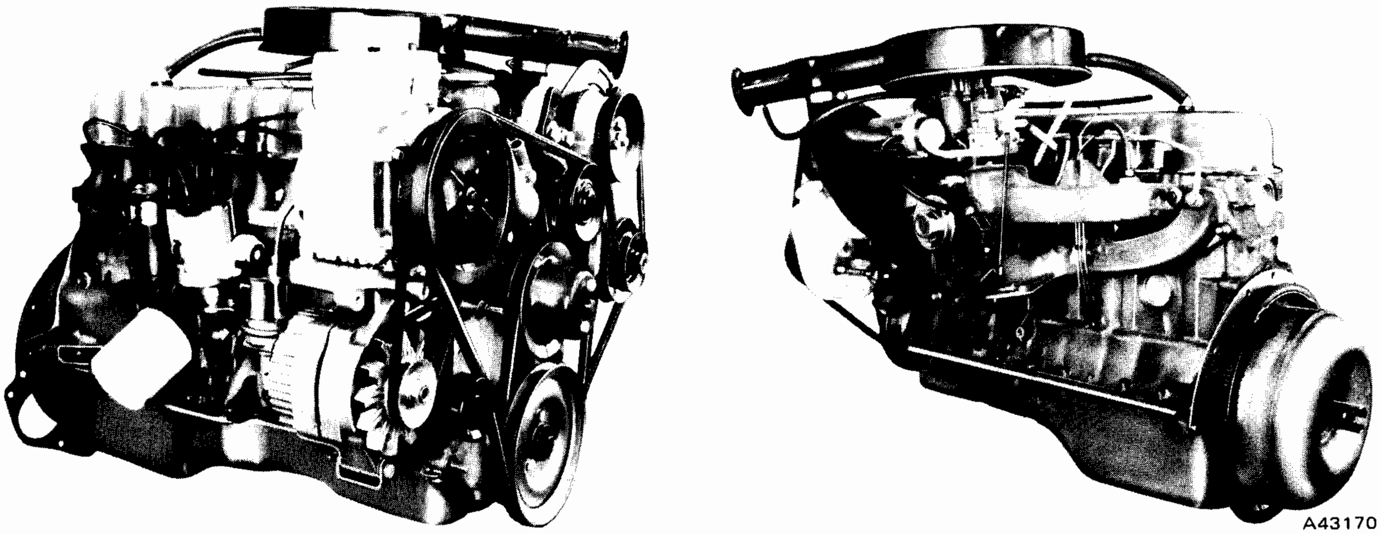

Fig. 1A-2 Engine Assembly

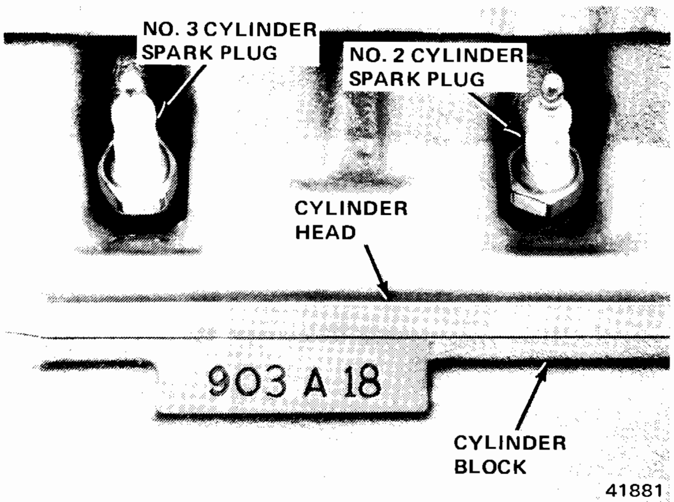

Fig. 1A-3 Build Date Code Location

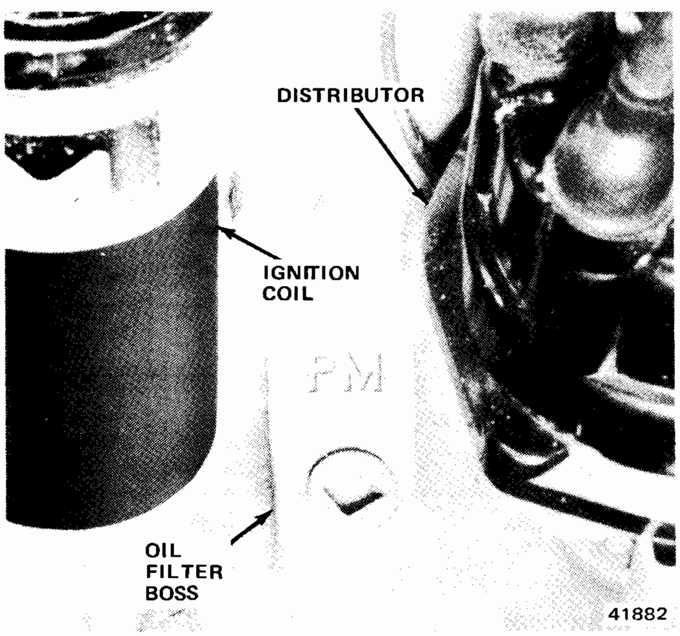

Fig. 1A-4 Oversize or Undersize Letter Code

Oversize or Undersize Components

Some engines may be built with oversize or undersize components such as oversize cylinder bores, undersize crankshaft main bearing journals, undersize connecting rod journals, or oversize camshaft bearing bores (inside diameter of camshaft bearing is always standard). These engines are identified by a letter code stamped on a boss on the cylinder block between the ignition coil and distributor (fig. 1A-4). The letters are decoded as follows:

Code Letter	Definition	
B	All cylinder bores	-0.010-inch oversize
M	All crankshaft main bearing journals	-0.010-inch undersize
P	All connecting rod bearing journals	-0.010-inch undersize
C	All camshaft bearing bores	-0.010-inch oversize

EXAMPLE: The code letters PM mean that the crankshaft main bearing journals and connecting rod journals are 0.010-inch undersize.

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LUBRICATION SYSTEM

A gear-type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing. The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and the pump body, then is forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main oil gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals except number 4 main bearing journal) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole; oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. Oil is provided to the camshaft bearings through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Rotation of the sprocket lubricates the crankshaft sprocket and chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan (fig. 1A-5).

CYLINDER LEAKAGE TEST

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance or rough idle is caused by combustion chamber leakage. A compression test alone may not show this fault. The cylinder leakage test provides an accurate means of testing engine condition. Cylinder leakage testing will point out exhaust and intake valve leaks, leaks between cylinders or into the water jacket, or other causes of compression loss.

(1) Check coolant level and fill as required. Do not install radiator cap.

(2) Start and run engine until it reaches normal operating temperature.

(3) Remove spark plugs.

(4) Remove oil filler cap.

(5) Remove air cleaner.

(6) Set carburetor fast idle speed screw on top step of fast idle cam.

NOTE: *Shop air source for testing should maintain 70 psi minimum and 200 psi maximum (80 psi recommended).*

(7) Perform test procedure on each cylinder according to tester manufacturer's instructions.

NOTE: *While testing, listen for air escaping through carburetor, tailpipe, or oil filler cap opening. Check for bubbles in radiator coolant.*

(8) All gauge indications should be even with no more than 25% leakage. For example; at 80 psi input pressure, a minimum of 60 psi should be maintained in the cylinder. Refer to the following leakage diagnosis chart.

Cylinder Leakage Test Diagnosis

Condition	Possible Cause	Correction
AIR ESCAPES THROUGH CARBURETOR	(1) Intake Valve leaks.	(1) Refer to Valve Reconditioning under Cylinder Head.
AIR ESCAPES THROUGH TAILPIPE	(2) Exhaust Valve leaks.	(2) Refer to Valve Reconditioning under Cylinder Head.
AIR ESCAPES THROUGH RADIATOR	(3) Head Gasket leaks or crack in cylinder block.	(3) Remove cylinder head and inspect.
MORE THAN 25% LEAKAGE ON ADJACENT CYLINDER	(4) Head gasket leaks or crack in cylinder block or head between adjacent cylinders.	(4) Remove cylinder head and inspect.
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	(5) Stuck or broken piston ring(s); cracked piston; worn rings and/or cylinder wall.	(5) Inspect for broken ring(s) or piston. Measure ring gap and cylinder diameter, taper, and out-of-round.

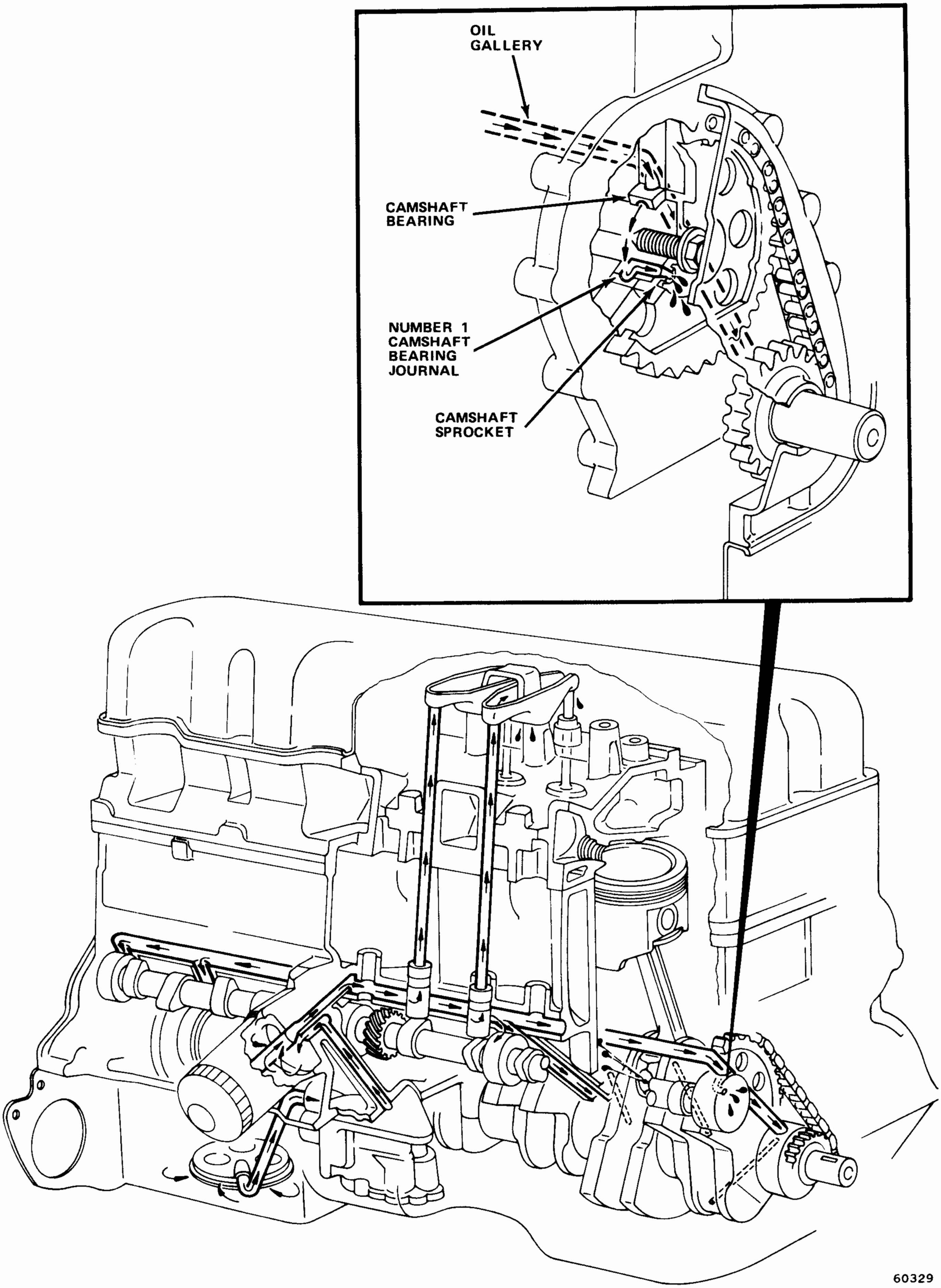

Fig. 1A-5 Lubrication System

Service Diagnosis

Condition	Possible Cause	Correction
EXTERNAL OIL LEAK	(1) Fuel pump gasket broken or improperly seated.	(1) Replace gasket.
	(2) Cylinder head cover gasket broken or improperly seated.	(2) Replace gasket; check cylinder head cover gasket flange and cylinder head gasket surface for distortion.
	(3) Oil filter gasket broken or improperly seated.	(3) Replace oil filter.
	(4) Oil pan side gasket broken or improperly seated.	(4) Replace gasket; check oil pan gasket flange for distortion.
	(5) Oil pan front oil seal broken or improperly seated.	(5) Replace seal; check timing chain cover and oil pan seal flange for distortion.
	(6) Oil pan rear oil seal broken or improperly seated.	(6) Replace seal; check oil pan rear oil seal flange; check rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove.
	(7) Timing chain cover oil seal broken or improperly seated.	(7) Replace seal.
	(8) Oil pan drain plug loose or has stripped threads.	(8) Repair as necessary and tighten.
	(9) Rear oil gallery plug loose.	(9) Use appropriate sealant on gallery plug and tighten.
	(10) Rear camshaft plug loose or improperly seated.	(10) Seat camshaft or replace and seal, as necessary.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high.	(1) Lower oil level to specifications.
	(2) Oil too thin.	(2) Replace with specified oil.
	(3) Valve stem oil seals are damaged, missing, or incorrect type.	(3) Replace valve stem oil seals.
	(4) Valve stems or valve guides worn.	(4) Check stem-to-guide clearance and repair as necessary.
	(5) Piston rings broken, missing.	(5) Replace missing or broken rings.
	(6) Piston rings incorrect size.	(6) Check ring gap, repair as necessary.
	(7) Piston rings sticking or excessively loose in grooves.	(7) Check ring side clearance, repair as necessary.
	(8) Compression rings installed upside down.	(8) Repair as necessary.
	(9) Cylinder walls worn, scored, or glazed.	(9) Repair as necessary.
	(10) Piston ring gaps not properly staggered.	(10) Repair as necessary.
	(11) Excessive main or connecting rod bearing clearance.	(11) Check bearing clearance, repair as necessary.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Section 3, Oil Pressure Warning Light and Sending Unit Test.
	(3) Oil pump malfunction.	(3) Refer to Oil Pump in this section.
	(4) Oil pressure relief valve sticking.	(4) Remove and inspect oil pressure relief valve assembly.
	(5) Oil passages on pressure side of pump obstructed.	(5) Inspect oil passages for obstructions.
	(6) Oil pickup screen or tube obstructed.	(6) Inspect oil pickup for obstructions.
LOW OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil excessively thin due to dilution, poor quality, or improper grade.	(2) Drain and refill crankcase with recommended oil.
	(3) Oil pressure relief spring weak or sticking.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Oil pickup tube and screen assembly has restriction or air leak.	(4) Remove and inspect oil inlet tube and screen assembly. (Fill pickup with lacquer thinner to find leaks.)
	(5) Excessive oil pump clearance.	(5) Check clearances; refer to Oil Pump in this section.
	(6) Excessive main, rod, or camshaft bearing clearance.	(6) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper grade oil.	(1) Drain and refill crankcase with correct grade oil.
	(2) Oil pressure gauge or sending unit inacurrate.	(2) Refer to Section 3, Oil Pressure Warning Light and Sending Unit Test.
	(3) Oil pressure relief valve sticking closed.	(3) Remove and inspect oil pressure relief valve assembly.
MAIN BEARING NOISE	(1) Insufficient oil supply.	(1) Check for oil low level or low oil pressure.
	(2) Main bearing clearance excessive.	(2) Check main bearing clearance, repair as necessary.
	(3) Crankshaft end play excessive.	(3) Check end play, repair as necessary.
	(4) Loose flywheel or torque conveter.	(4) Tighten flywheel or converter attaching bolts.
	(5) Loose or damaged vibration damaged.	(5) Repair as necessary.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Bearing clearance excessive or bearing missing.	(2) Check clearance, repair as necessary.
	(3) Crankshaft connecting rod journal out-of-round.	(3) Check journal measurements, repair or replace as necessary.
	(4) Misaligned connecting rod.	(4) Repair as necessary.
	(5) Connecting rod bolts tightened improperly.	(5) Tighten bolts to specified torque.
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive.	(1) Check clearance, repair as necessary.
	(2) Cylinder walls excessively tapered or out-of-round.	(2) Check cylinder wall measurements, repair as necessary.
	(3) Piston ring broken.	(3) Replace ring.
	(4) Loose or seized piston pin.	(4) Check piston-to-pin clearance, repair as necessary.
	(5) Connecting rods misaligned.	(5) Check rod alignment, repair as necessary.
	(6) Piston ring side clearance excessively loose or tight.	(6) Check ring side clearance, repair as necessary.
	(7) Carbon build-up on piston is excessive.	(7) Clean carbon from piston.
VALVE TRAIN NOISE *NOTE: A clicking noise, upon starting the engine, reducing in level and disappearing after a short period of time is normal. This noise is due to a slight oil leak-down condition caused by valve spring pressure exerted on the tappets.*	(1) Insufficient oil supply.	(1) Check for: (a) Low oil level. (b) Low oil pressure. (c) Plugged pushrods. (d) Wrong hydraulic tappets. (e) Plugged oil gallery in block.
	(2) Push rods worn or bent.	(2) Replace worn or bent push rods.
	(3) Rocker arms worn.	(3) Replace worn rocker arms.
	(4) Dirt or chips in hydraulic tappets.	(4) Clean tappets.
	(5) Excessive tappet leak-down.	(5) Replace valve tappet.
	(6) Tappet face worn.	(6) Replace tappet; check corresponding cam lobe for wear.
	(7) Broken or cocked valve springs.	(7) Properly seat cocked springs; replace broken springs.
	(8) Stem-to-guide clearance excessive.	(8) Check stem-to-guide clearance, repair as necessary.
	(9) Valve bent.	(9) Replace valve.
	(10) Loose rocker arms.	(10) Tighten bolts to specified torque.
	(11) Valve seat runout excessive.	(11) Regrind valve seat/valves.
	(12) Worn rocker arm pivot(s).	(12) Replace rocker arm pivot(s).
	(13) Push rod rubbing or contacting cylinder head.	(13) Remove cylinder head and remove obstruction in head.

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ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine and at the rear of the engine between the transmission extension housing and the rear support crossmember. Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion (fig. 1A-6).

If it is necessary to remove the front engine mounts, an engine holding fixture may be fabricated as illustrated in figure 1A-7.

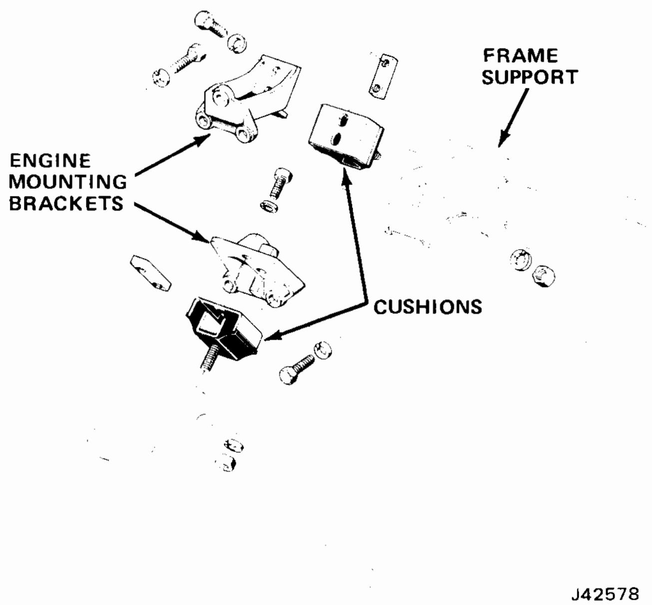

Fig. 1A-6 Engine Mounting—Typical

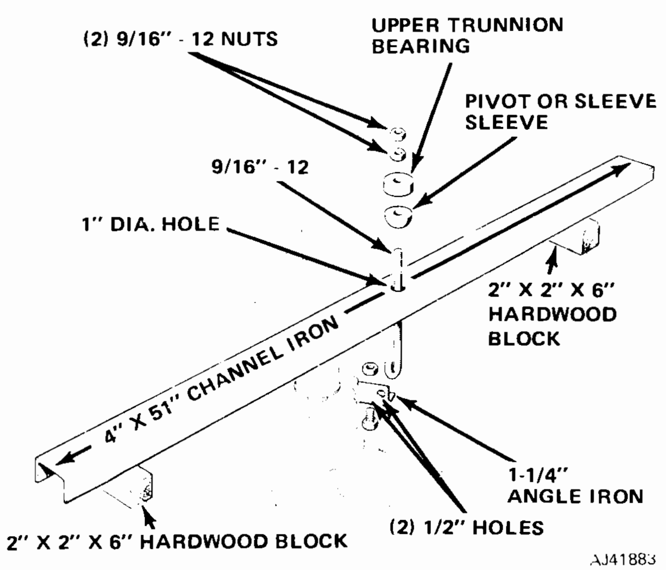

Fig. 1A-7 Engine Holding Fixture—Typical

ENGINE REMOVAL

The engine is removed without the transmission and bell housing.

(1) On the Cherokee and Truck, the hood must be removed. Mark hinge locations at hood panel for alignment during installation. Remove hood from hinges.

(2) Remove air cleaner assembly.

(3) Drain cooling system.

(4) Disconnect upper and lower radiator hoses.

(5) If equipped with automatic transmission, disconnect cooler lines from radiator.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate the shroud from the radiator to faciliate removal of the radiator and engine fan.*

(6) Remove radiator.

(7) Remove radiator fan.

(8) If equipped, remove power steering pump and drive belt from the engine and place aside. Do not disconnect the power steering hoses.

(9) If equipped with air conditioning:

(a) Turn both service valves clockwise to the front seated position.

(b) Bleed refrigerant charge from compressor by slowly loosening service valve fittings.

(10) Disconnect condenser and evaporator lines from compressor.

(11) Disconnect receiver outlet at disconnect coupling.

(12) Remove condenser and receiver assembly.

(13) Disconnect the following wires (if equipped):

- Starter motor
- Coil terminals
- Alternator
- Temperature gauge sending unit
- Oil pressure gauge sending unit
- Solenoid vacuum valve
- Solenoid control switch
- Throttle stop solenoid

(14) Disconnect the following lines (if equipped):

- Fuel line from tank at fuel pump
- Vacuum line for power brake unit at intake manifold
- Vacuum line for fuel vapor storage canister at air cleaner snorkel
- Fuel bowl pressure vent line at air horn.
- Vacuum line for heater damper doors at intake manifold

(15) Disconnect accelerator linkage at engine.

(16) Disconnect transmission linkage.

(17) Disconnect exhaust pipe at support bracket and exhaust manifold.

(18) Remove oil filter.

(19) Remove both engine front support cushion-to-frame retaining nuts.

(20) Support the weight of the engine with a lifting device.

(21) Remove front support cushion and bracket assemblies from engine.

(22) Remove transfer case shift lever boot, floormat (if equipped) and transmission access cover.

(23) If equipped with automatic transmission, remove upper bolts securing transmission bell housing to engine.

If equipped with manual transmission, remove upper bolts securing clutch housing to engine.

(24) Remove starter motor.

(25) If equipped with automatic transmission:

- Remove engine adapter plate inspection covers.
- Mark assembled position of converter and flex plate and remove converter-to-flex plate capscrews.
- Remove remaining bolts securing transmission bell housing to engine.

If equipped with manual transmission:

- Remove clutch housing lower cover and remaining bolts securing the clutch housing to engine.

(26) Support transmission with a floor jack.

(27) Remove engine by pulling forward and upward.

ENGINE INSTALLATION

(1) Lower engine slowly into engine compartment and align with the transmission bell housing (automatic transmission) or clutch housing (manual transmission).

NOTE: *On manual transmissions, make certain the clutch shaft is aligned properly with the splines of the clutch driven plate.*

(2) Install transmission bell housing-to-engine (automatic transmission) or clutch housing-to-engine bolts (manual transmission). Tighten the bolts to specified torque (automatic transmission—28 foot-pounds; manual transmission: top, 17; bottom, 43 foot-pounds).

(3) Remove floor jack which was used to support transmission.

(4) If equipped with automatic transmission, align marks previously made on converter and flex plate, install converter to flex plate capscrews and tighten to 33 foot-pounds torque.

(5) Install inspection covers (automatic transmission) or the clutch housing lower cover (manual transmission).

(6) Install starter motor.

(7) Install front support cushion and bracket assemblies to engine; tighten retaining bolts to 28 foot-pounds torque.

(8) Lower engine onto frame supports, remove lifting device and install front support cushion retaining nuts. Tighten nuts to 33 foot-pounds torque.

(9) Connect exhaust pipe to support bracket and exhaust manifold using a new seal, if required.

(10) Install oil filter.

(11) Connect all wires, lines, linkage and hoses which were previously disconnected from engine.

(12) If removed, install air conditioning condenser and receiver assembly. Connect receiver outlet to the disconnect coupling. Connect condenser and evaporator lines to compressor. Purge compressor of air as outlined in Air Conditioning section.

CAUTION: *Both service valves must be open before the air conditioning system is operated.*

(13) If removed, install power steering pump and drive belt; tighten belt to specified tension.

(14) Install radiator fan and tighten retaining bolts to 18 foot-pounds torque.

(15) Install radiator and connect upper and lower hoses. If equipped with automatic transmission, connect the cooler lines.

(16) Fill cooling system to specified level.

(17) Inspect engine oil level and add oil as required.

(18) Install air cleaner assembly.

(19) Start engine. Check hose connections for leaks. Stop engine.

(20) If removed, install and align hood assembly.

(21) Install the transmission access cover, floormat, and transfer case shift lever boot.

CYLINDER HEAD COVER AND GASKET

Removal

(1) Remove air cleaner and PCV molded hose.

(2) Disconnect distributor vacuum advance line at spark CTO tube and fuel line at fuel pump; rotate fuel line to allow removal of the cylinder head cover.

(3) Disconnect PCV valve from grommet in cylinder head cover.

(4) Remove cylinder head cover screws, cover, and gasket from engine.

Installation

(1) Inspect cylinder head cover for cracks.

(2) Position gasket on cylinder head cover flange. Gasket tabs are to be positioned in cutout openings in flange of cover.

(3) Position cylinder head cover and gasket on engine and install screws. Tighten to 50 inch-pounds torque.

CAUTION: *Do not overtighten screws as this may crack cover and split the cover gasket.*

(4) Connect fuel and distributor vacuum advance lines.

(5) Connect PCV valve to grommet in cylinder head cover.

(6) Install air cleaner and connect PCV hose.

ROCKER ARM ASSEMBLY

The intake and exhaust rocker arms of each cylinder pivot on a bridged pivot which is secured with two capscrews as shown in figure 1A-8. The bridged pivots maintain correct rocker arm-to-valve tip alignment. The rocker arm assembly is actuated by hollow steel push rods with hardened steel balls at both ends. The push rods pass oil to rocker arm assemblies.

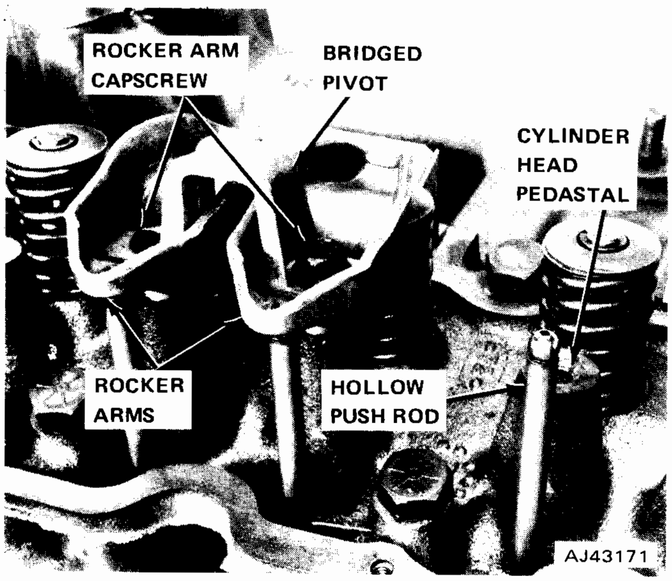

Fig. 1A-8 Rocker Arm Assembly

Removal

(1) Remove cylinder head cover and gasket.

(2) Remove two capscrews at each bridged pivot backing off each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove each bridged pivot and corresponding pair of rocker arms and place on bench in same order as removed.

Cleaning and Inspection

Clean all parts with a cleaning solvent and use compressed air to blow out oil passages in the rocker arms and push rods.

Inspect the pivot surface of each rocker arm and bridged pivot, replace any parts which are scuffed, pitted, or excessively worn. Inspect valve stem tip contact surface of each rocker arm and replace any rocker arm which is deeply pitted. Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn due to lack of oil, the push rod must be replaced and the corresponding lifter inspected.

It is not normal to find a wear pattern along the length of the push rod. Inspect the cylinder head for obstruction if this condition exists.

Installation

(1) Install rocker arms and bridged pivots in the same order as removed.

(2) Install capscrews and tighten to 21 foot-pounds torque, tightening each of the two capscrews for each bridge a turn at a time time to avoid breaking the bridge.

(3) Install cylinder head cover and gasket.

VALVE SPRING/VALVE STEM OIL DEFLECTOR

Nylon valve stem oil deflectors are installed on each valve stem to prevent oil used for rocker arm lubrication from entering the combustion chamber through the valve guides. The oil deflectors should be replaced whenever valve service is performed or if the deflectors have deteriorated.

The valve spring is held in place on the valve stem by a retainer or an exhaust valve rotator and a set of conical-type valve locks. The locks can be removed only by compressing the valve spring.

NOTE: *Exhaust valve springs used with rotators are shorter than standard valve springs. Also these springs use a removable spring seat that fits under the spring on the cylinder head. Refer to Specifications at the end of this section.*

Exhaust Valve Rotator

258 CID engines installed in Cherokee and Truck models use exhaust valve rotators. Exhaust valve rotators perform two functions. Like ordinary valve spring retainers, they hold the valve spring in place. However, the second function is to positively induce rotation of the exhaust valve to increase durability of the valve seat and face.

The outer housing of the rotator rides on the exhaust valve spring and remains stationary. The inner retainer with valve locks retains the exhaust valve and outer housing. In addition, the inner retainer rotates slightly when the exhaust valve is off its seat. This rotation is caused by the inner spring being crushed between the retainer and the inner washer when pressure is applied to the assembly during exhaust valve opening (fig. 1A-9).

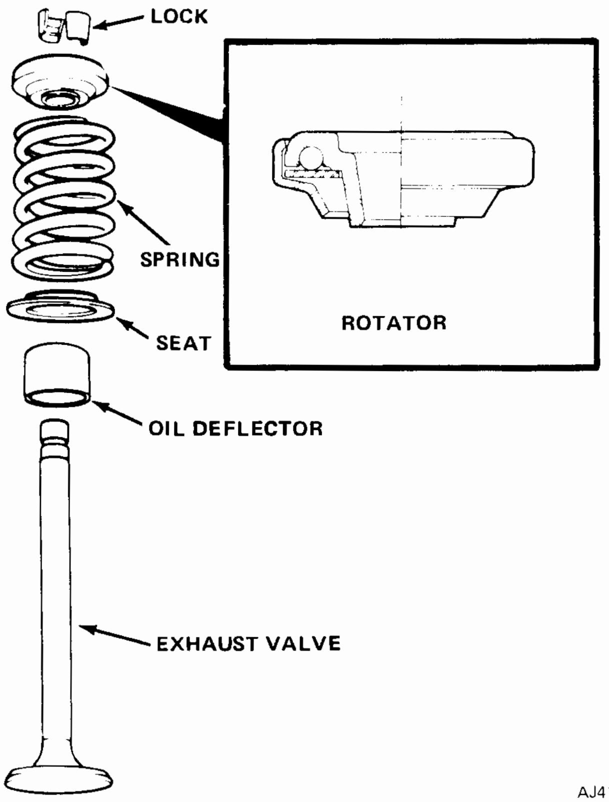

Fig. 1A-9 Exhaust Valve Rotator

Fig. 1A-10 Valve Spring Removal

Valve Spring Removal/Oil Deflector Replacement

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assembly, backing off each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove push rods.

NOTE: *Retain push rods, bridged pivots, and rocker arms in same order and position as removed.*

(4) Remove spark plug from cylinder.

(5) Install a 14-mm (thread size) air adapter in spark plug hole.

NOTE: *An adapter can be made by attaching an air hose connection to a spark plug from which the porcelain has been removed.*

(6) Connect an air hose to adapter and maintain at least 90 psi in cylinder to hold the two valves against their seats.

NOTE: *On vehicles equipped with air conditioning, it will be necessary to use a flexible air adapter when servicing No. 1 cylinder.*

(7) Use Valve Spring Remover and Installer Tools J-22534-1, J-22534-4, and J-22534-5 to compress valve spring and remove valve locks. (fig. 1A-10).

(8) Remove valve spring and retainer or rotator.

(9) Remove valve stem oil deflector (if necessary).

(10) Remove exhaust valve spring seat (if equipped with rotators).

Valve Spring Tension Test

Use Valve Spring Tester J-8056 to test each valve spring for the specified tension value (fig. 1A-11). Replace valve springs that are not within specifications.

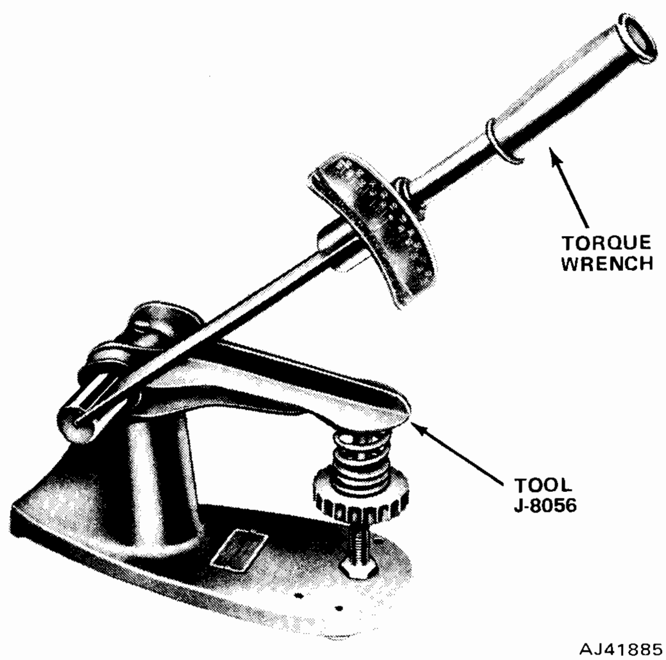

Fig. 1A-11 Valve Spring Tester

Installation

(1) Using a 7/16-inch deep socket and small hammer, gently tap oil deflector onto valve stem.

CAUTION: *Deflector must be tapped carefully to avoid damage caused by sharp edges of valve lock grooves.*

(2) Install exhaust valve spring seat (if equipped).
(3) Install valve spring and retainer or rotator.
(4) Compress valve spring with Tool J-22534-1, J-22534-4, and J-22534-5 and insert valve locks. Release spring tension and remove tool.

NOTE: *Tap spring from side-to-side to be certain spring is seated properly at cylinder head.*

(5) Disconnect air hose, remove adapter from spark plug hole, and install spark plug.
(6) Install rocker arms and bridged assembly, tightening each of the two capscrews for each bridge a turn at a time to avoid breaking the bridge.
(7) Install cylinder head cover and gasket.

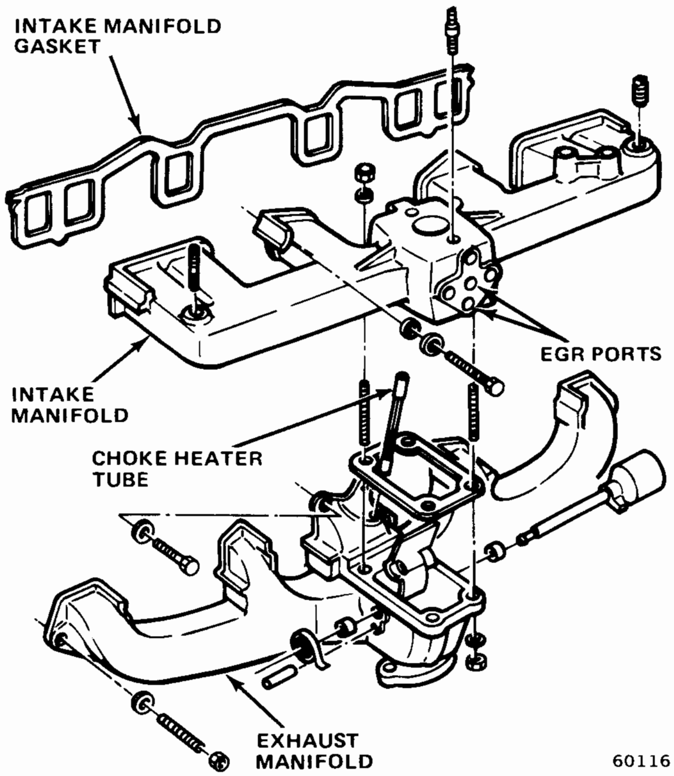

Fig. 1A-12 Intake and Exhaust Manifold Assembly

INTAKE AND EXHAUST MANIFOLDS

The intake and exhaust manifolds are attached to the cylinder head on the left side of the engine. A gasket is used between the intake manifold and the cylinder head; none is used between the exhaust manifold and cylinder head. An asbestos gasket is used at the mating surfaces of the intake manifold to exhaust manifold and also between the exhaust manifold and exhaust pipe (fig. 1A-12).

The exhaust gas recirculation valve and back-pressure sensor (if equipped) are mounted on the side of the intake manifold. All intake manifolds have a metal plate incorporated into the area above the exhaust manifold heat valve. This creates a hot spot that improves fuel vaporization during warmup and shortens choke operation time.

Removal and Cleaning

(1) Remove air cleaner and carburetor.
(2) Disconnect accelerator cable from accelerator bellcrank.
(3) Disconnect PCV vacuum hose from intake manifold.
(4) Remove spark CTO vacuum tubes and disconnect TCS solenoid vacuum valve wiring (if equipped).
(5) Disconnect vacuum hose from EGR valve or back-pressure sensor (if equipped).
(6) Remove power steering mounting bracket (if equipped).
(7) Detach power steering pump and set aside (if equipped). Do not remove hoses.
(8) Remove air conditioning drive belt idler assembly from cylinder head (if equipped).
(9) Remove EGR valve and back-pressure sensor (if equipped).
(10) Disconnect exhaust pipe from manifold flange.
(11) Remove manifold attaching bolts, nuts, and clamps and remove intake and exhaust manifold as an assembly. Discard gasket.
(12) Separate manifolds at riser area.
(13) Clean mating surfaces of manifolds and cylinder head.

Installation

(1) Assemble manifolds and finger-tighten heat riser retaining nuts.
(2) Position new intake manifold gasket on cylinder head and install manifold assembly. Tighten heat riser nuts to 5 foot-pounds torque. Tighten manifold attaching bolts and nuts in sequence (fig. 1A-13) to 23 foot-pounds torque.
(3) Install flange gasket and connect exhaust pipe to manifold flange.
(4) Install carburetor.
(5) Install power steering pump (if equipped).
(6) Install AC drive belt idler assembly (if equipped).
(7) Install power steering pump mounting bracket (if equipped).
(8) Install EGR valve and back-pressure sensor (if removed).

(9) Install drive belt(s) and tighten to specified tension (refer to Section 2—Cooling).

(10) Install spark CTO vacuum tubes. Connect TCS wiring (if equipped).

(11) Connect vacuum hose to the EGR valve and back-pressure sensor (if equipped).

(12) Connect accelerator cable and PCV hose.

(13) Install air cleaner.

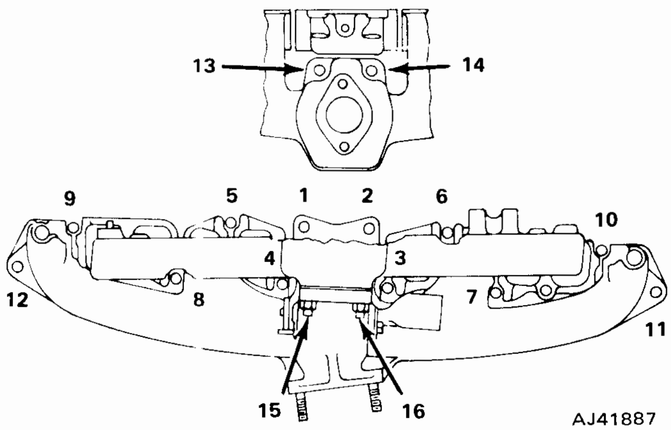

Fig. 1A-13 Intake Manifold Torque Sequence

CYLINDER HEAD ASSEMBLY

Cylinder heads for either 232 or 258 CID engines are interchangeable. All incorporate hardened exhaust valve seats and exhaust valves with flash chrome stems.

NOTE: *If equipped with exhaust valve rotators it is necessary to change exhaust valve assemblies when replacing cylinder heads.*

Removal

(1) Drain cooling and disconnect hoses at thermostat housing.

(2) Remove cylinder head cover and gasket.

(3) Remove rocker arms and bridged pivot assembly, backing off each screw a turn at a time to avoid breaking the bridge.

(4) Remove push rods.

NOTE: *Retain push rods, bridged pivots and rocker arm in the same order and position as removed.*

(5) Remove intake and exhaust manifold assembly from cylinder head.

(6) If equipped with air conditioning, perform the following:

(a) Remove air conditioning drive belt idler bracket from cylinder head.

(b) Loosen alternator drive belt.

(c) Remove bolts from air conditioning compressor mounting bracket and set compressor aside.

(7) Disconnect ignition wires and remove spark plugs.

(8) Disconnect temperature sending unit wire and battery ground cable.

(9) Remove ignition coil and bracket assembly.

(10) Remove cylinder head bolts, cylinder head, and gasket.

Cleaning and Inspection

(1) Thoroughly clean machined surface of cylinder head and block. Remove all dirt and gasket cement.

(2) Remove carbon deposits from combustion chambers and top of pistons.

(3) Use a straightedge and feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to Specifications at the rear of this section.

NOTE: *Due to emission control regulations, cylinder heads which exceed specifications for flatness must be replaced. Milling is not recommended.*

Installation

(1) If cylinder head is to be replaced and the original valves re-used, remove valves and measure stem diameter. Replace valves if oversize, as only standard size valves are to be used with a service replacement head. If original valves are standard size, remove all carbon buildup and reface as outlined under Valve Refacing.

(2) Install valves in cylinder head using new valve stem oil deflectors.

(3) Transfer all attached components from the original head which are not included with replacement head.

CAUTION: *Do not apply sealing compound on head and block surfaces. Do not allow sealer to enter cylinder bore.*

(4) Apply an even coat of Perfect Seal sealing compound or equivalent to both sides of new head gasket and position gasket on block with the word TOP facing upward.

(5) Install cylinder head. Tighten bolts (in sequence) to 105 foot-pounds torque (fig. 1A-14).

(6) Connect temperature sending unit wire and battery negative cable.

(7) Install ignition coil and bracket assembly.

(8) Install spark plugs and connect ignition wires.

(9) Attach air conditioning compressor mounting bracket to cylinder head (if equipped).

(10) Install intake and exhaust manifold assembly. (Refer to Intake and Exhaust Manifold Installation for the correct torque tightening sequence.)

(11) Install push rods in the order removed.

(12) Install rocker arms and bridged pivot assemblies in order removed, tightening each of the two capscrews for each bridge a turn at a time to avoid breaking the bridge. Tighten screws to 21 foot-pounds torque. Install cylinder head cover and gasket.

(13) Connect hoses to thermostat housing and fill cooling system to specified level (refer to Section 2—Cooling).

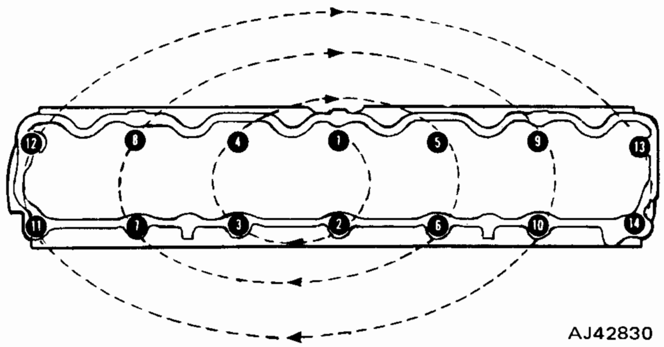

Fig. 1A-14 Cylinder Head Torque Sequence

CYLINDER HEAD RECONDITIONING

NOTE: *The following procedures apply after the cylinder head has been removed from the engine.*

Disassembly

(1) Compress each valve spring with Spring Compressor Tool J-22534 and remove valve locks, retainers, rotators (if equipped), springs, valve stem oil deflectors and exhaust valve spring seats (if equipped).

(2) Remove valves.

NOTE: *Place valves in a rack in the same order as removed from cylinder head.*

Cleaning and Inspection

(1) Clean all carbon buildup from the combustion chambers, valve ports, valve stems and head.

(2) Clean all dirt and gasket cement from cylinder head machined surface.

(3) Inspect for cracks in combustion chambers and valve ports.

(4) Inspect for cracks in gasket surface at each coolant passage.

(5) Inspect valves for burned or warped or cracked heads. Inspect for scuffed or bent valve stems. Replace scuffed, bent or warped valves.

Valve Reconditioning

Use a valve refacing machine to reface the intake and the exhaust valves to the specified angle. After refacing, at least 1/32-inch margin must remain or the valve must be replaced. Examples of correct and incorrect valve refacing are shown in figure 1A-15.

The valve stem tip can be resurfaced and rechamfered when worn. Do not remove more than 0.010 inch.

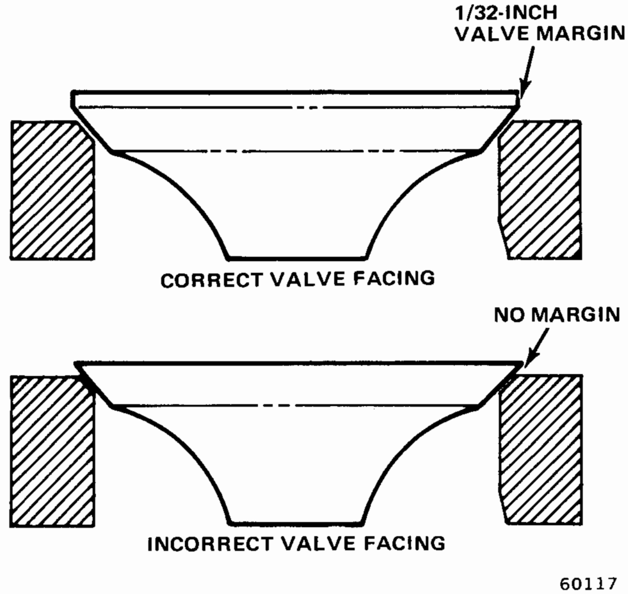

Fig. 1A-15 Valve Refacing

Valve Seat Refacing

Install a pilot of the correct size in the valve guide and reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish. This is especially important when refacing the hardened exhaust valve seats.

Tapered stones of 15° and 60° should be used to obtain the specified seat widths when required.

Control seat runout to a maximum of 0.0025 inch (fig. 1A-16).

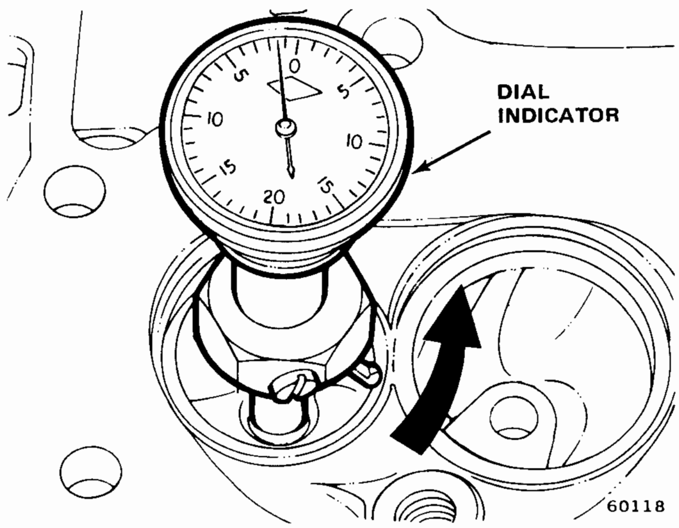

Fig. 1A-16 Checking Valve Seat Runout

Valve Guides

The valve guides are an integral part of the cylinder head and are not replaceable. When the stem-to-guide clearance is excessive, the valve guides must be reamed to the next larger size to obtain proper clearance. Oversize service valves are available in 0.003-inch, 0.015-inch, and 0.030-inch sizes.

Reamer	Size
J-6042-1	0.003-inch
J-6042-5	0.015 inch
J-6042-4	0.030 inch

NOTE: *Valve guides must be reamed in steps, starting with the 0.003-inch oversize reamer and progressing to the size required.*

Valve Stem-to-Guide Clearance

Valve stem-to-guide clearance may be checked by either of the following two methods.

Preferred Method

- Use a dial indicator to measure the lateral movement of the valve stem with the valve installed in its guide and just off the valve seat (fig. 1A-17). Correct clearance is 0.001 to 0.003 inch.

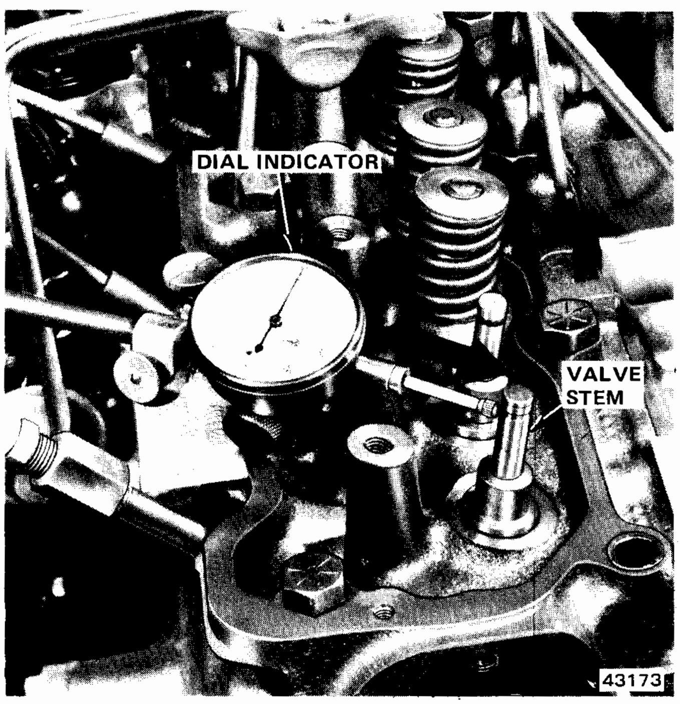

Fig. 1A-17 Checking Stem-to-Guide Clearance

Alternate Method

- Measure the valve stem diameter with a caliper micrometer midway between the valve head and tip. Select a pilot from a valve refacing kit which fits snugly in the valve guide bore.

NOTE: *Make certain the valve stem and guide bore are thoroughly cleaned before measuring. The valve stem-to-guide clearance can be determined by subtracting the diameter of the valve stem from the size of the pilot selected.*

Assembly

(1) Thoroughly clean valve stems and valve guide bores.

(2) Lightly lubricate stem and install valve in same valve guide from which it was removed.

(3) Install exhaust valve spring seat (if equipped).

(4) Install new valve stem oil deflector on valve stem.

(5) Position valve spring and retainer or rotator (if equipped) on the cylinder head and compress valve spring with compressor tool. Install valve locks and release tool.

(6) Tap valve spring from side-to-side with a hammer to be certain the spring is properly seated at cylinder head.

HYDRAULIC VALVE TAPPETS

The hydraulic valve tappet consists of a tappet body, plunger, plunger return spring, check valve assembly metering disc, plunger cap, and lockring (fig. 1A-18).

The tappet operates in a guide bore which intersects with the main oil gallery.

When the tappet is on the heel of the cam lobe, the groove in the tappet body indexes with the main oil gallery and oil under pressure passes into the tappet through a hole. Oil flows into the plunger and through the check valve assembly, maintaining the tappet fully charged (fig. 1A-19).

The leak-down cycle occurs when the tappet leaks oil during normal valve opening. Lift from the cam lobe causes tappet body movement which closes the check valve and transmits movement to the push rod to open the intake or exhaust valve.

In addition, oil under pressure in the plunger also flows through the metering disc, plunger cap, and hollow push rod to the rocker arm assembly.

Removal and Disassembly

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assemblies, backing off each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove push rods.

NOTE: *Retain push rods, bridged pivots, and rocker arms in the same order and position as removed.*

(4) Remove cylinder head and gasket.

(5) Remove tappets through push rod openings of block with Hydraulic Valve Tappet Remover and Installer Tool J-21884 as shown in figure 1A-20.

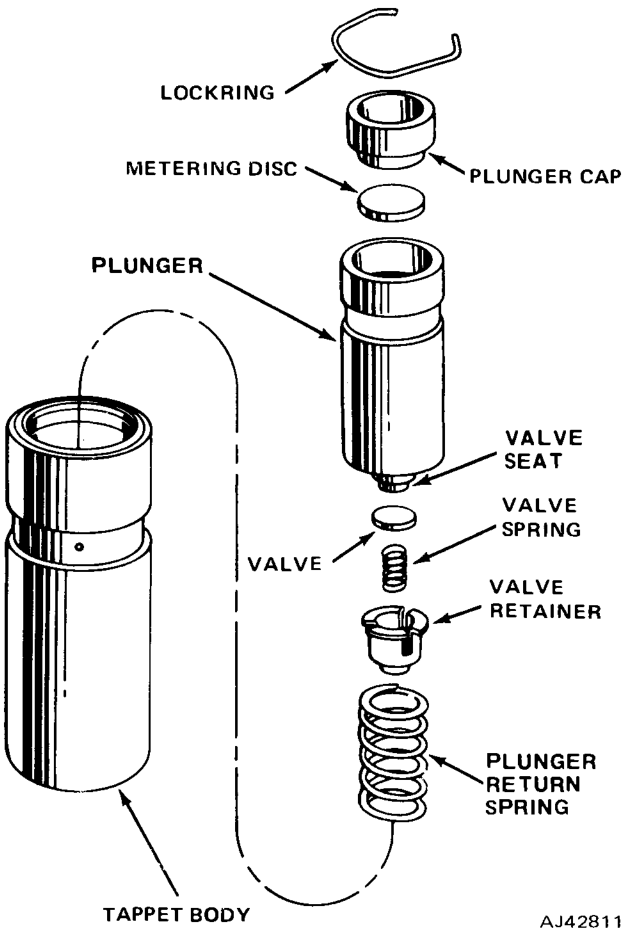

Fig. 1A-18 Hydraulic Tappet Assembly

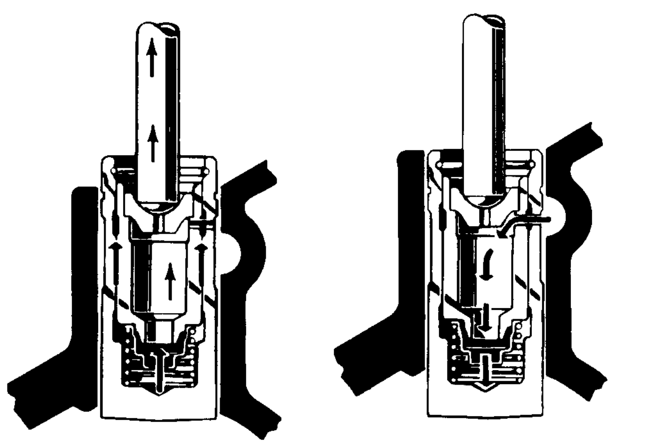

Fig. 1A-19 Hydraulic Tappet Operation

Cleaning and Inspection

NOTE: *Tappet components must be retained in the same order as removed.*

Release lockring and remove plunger cap, metering disc, plunger, and plunger return spring from tappet body.

Clean components of the hydraulic tappet assembly in a good cleaning solvent to remove all varnish or gum deposits.

Check for signs of scuffing on the side and face of the tappet body.

Inspect tappet face for concave wear by laying a straightedge across the face. If the face is concave, the corresponding lobe on the camshaft is worn, and replacement of camshaft and tappets is necessary.

Install plunger return spring, plunger, metering disc, and plunger cap in tappet body.

Using a push rod on plunger cap, compress plunger assembly and install lockring.

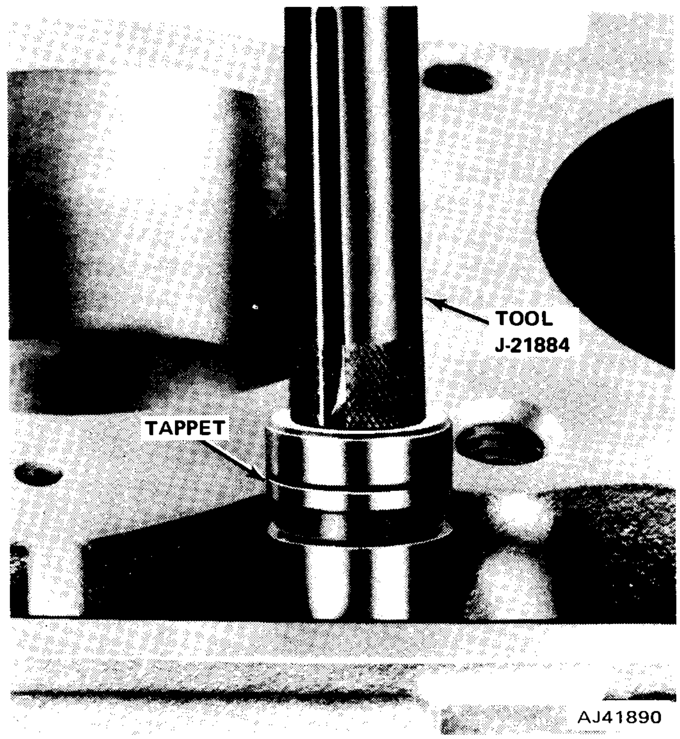

Fig. 1A-20 Hydraulic Tappet Removal

Hydraulic Tappet Leak-Down Test

After cleaning and inspection, the tappet must be leak-down tested to ensure its zero-lash operating ability. Figure 1A-21 illustrates Tool J-5790 used to test tappet leak-down accurately.

(1) Swing weighted arm of tester away from ram of tester.

(2) Place 0.312 to 0.313 diameter ball bearing on plunger cap of tappet.

(3) Lift ram and place tappet with ball bearing inside tester cup.

(4) Lower ram, then adjust nose of ram until it contacts ball bearing. Do not tighten hex nut on ram.

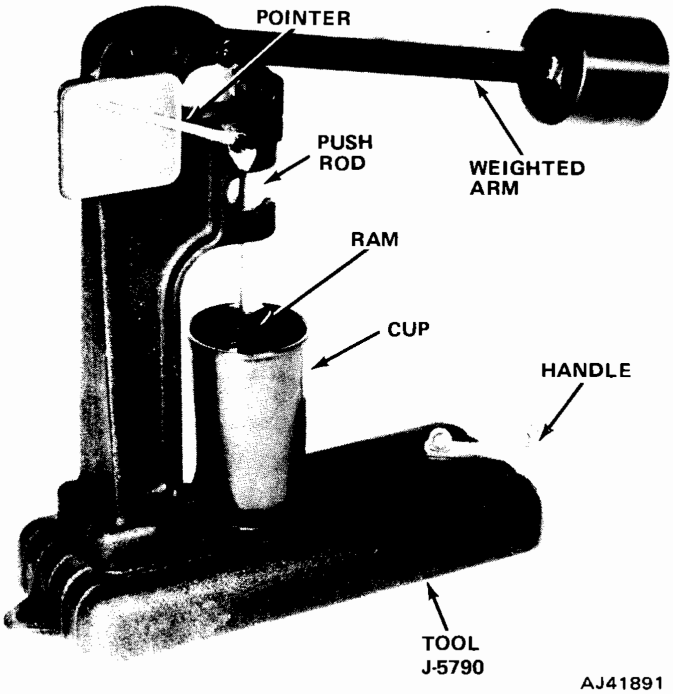

Fig. 1A-21 Hydraulic Tappet Leak-Down Test

(5) Fill tester cup with Valve Tappet Test Oil J-5268 until tappet is completely covered.

(6) Swing weighted arm onto ram and pump up and down on tappet to remove air. When air bubbles cease, swing weighted arm away and allow plunger to rise to normal position.

(7) Adjust nose of ram to align pointer with SET mark on scale of tester and tighten hex nut.

(8) Slowly swing weighted arm onto ram and push rod assembly. Rotate cup by turning handle at base of tester clockwise one revolution every two seconds.

(9) Time leak-down from instant pointer aligns with START mark on scale until pointer aligns with 0.125 mark.

(10) A good tappet will take 20 to 110 seconds to leak-down. Discard tappets outside this range.

NOTE: *Do not charge the tappet assemblies with engine oil. They will charge themselves within 3 to 8 minutes of engine operation.*

Installation

(1) Dip tappet assembly in Jeep Engine Oil Supplement (EOS) or equivalent.

(2) Use Hydraulic Valve Tappet Remover and Installer Tool J-21884 and install tappets in the same bores from which they were removed.

(3) Install push rods in same order as removed.

(4) Install rocker arms and bridged pivot assemblies and tighten retaining screws to 21 foot-pounds torque, tightening each of the two capscrews for each bridge a turn at a time to avoid breaking the bridge.

(5) Pour remaining EOS over entire valve train.

NOTE: *The EOS must remain in the engine for at leas 1,000 miles but need not be drained until the next scheduled oil change.*

(6) Install cylinder head and gasket and tighten bolts to torque (see Cylinder Head Torque Sequence, fig. 1A-14).

(7) Install cylinder head cover and gasket.

VIBRATION DAMPER

The vibration damper is balanced independently and then rebalanced as part of the complete crankshaft assembly.

Do not attempt to duplicate the damper balance holes when installing a service replacement. The vibration damper is not repairable and is serviced only as a complete assembly.

Removal

(1) Remove drive belt(s).

(2) Remove three retaining capscrews and separate vibration damper pulley from vibration damper (if equipped).

(3) Remove vibration damper retaining bolt and washer.

(4) Use Vibration Damper Remover Tool J-21791 to remove damper from crankshaft as shown in figure 1A-22.

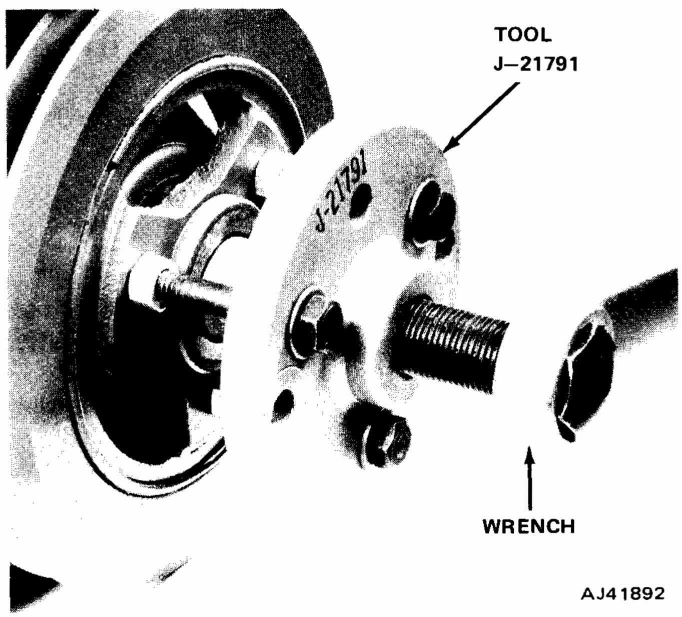

Fig. 1A-22 Vibration Damper Removal

Installation

(1) Align key slot of the vibration damper with crankshaft key and tap damper onto crankshaft.

(2) Install vibration damper retaining bolt and washer; tighten to 55 foot-pounds torque.

(3) If removed, install damper pulley and retaining capscrews; tighten the screws to 23 foot-pounds torque.

(4) Install drive belt(s) and tighten to specified tension (refer to Section 2—Cooling).

TIMING CASE COVER

The timing case cover is provided with a seal and oil slinger to prevent oil leakage at the vibration damper hub. A hole is provided in the cover for the use of a magnetic timing probe. A graduated degree scale cast into the cover is used for ignition timing (fig. 1A-23). Refer to Section 4A for magnetic timing probe usage and ignition timing procedure.

It is important that the timing case cover be properly aligned with the crankshaft to prevent eventual damage to the oil seal. The oil seal may be replaced without removing the timing case cover.

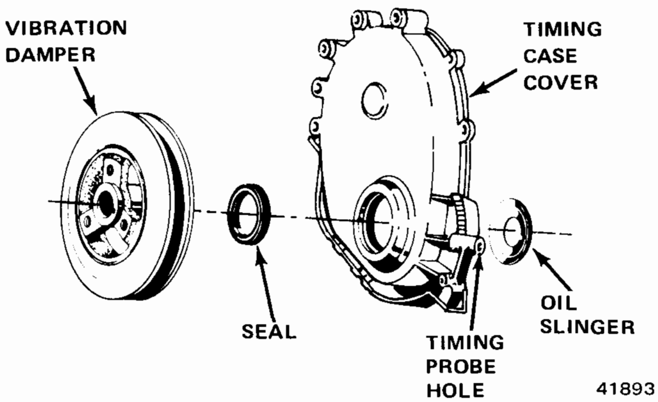

Fig. 1A-23 Timing Case Cover

Removal

(1) Remove drive belt(s), radiator fan and hub assembly, damper pulley (if equipped) and vibration damper.

(2) Remove oil pan-to-timing case cover screws and cover-to-block screws.

(3) Raise timing case cover enough to detach retaining nibs of oil pan seal from bottom side of cover (this must be done to prevent pulling the seal end tabs away from the tongues of the oil pan gasket which would cause an oil leak and necessitate removal of the oil pan to correct).

(4) Remove timing case cover and gasket from engine.

(5) Cut off oil pan seal end tabs flush with front face of cylinder block and remove seal.

(6) Clean timing case cover, oil pan, and cylinder block gasket surfaces.

(7) Remove crankshaft oil seal from timing case cover.

Installation

(1) Apply seal compound, Perfect Seal or equivalent, to both sides of new timing cover gasket and position gasket on cylinder block.

(2) Cut end tabs of a new oil pan seal same as was cut off original seal.

(3) Coat seal end tabs generously with Permatex No. 2 (or equivalent) and position seal on timing case cover (fig. 1A-24).

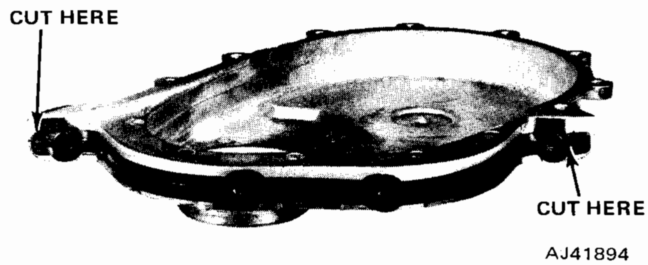

Fig. 1A-24 Oil Pan Front Seal Installation

(4) Position timing case cover on engine. Place Timing Case Cover Alignment Tool and Seal Installer J-22248 on crankshaft and seal opening of cover (fig. 1A-25).

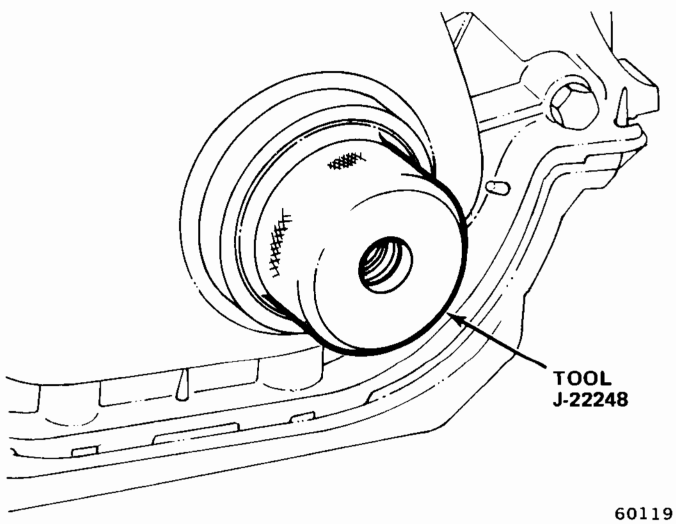

Fig. 1A-25 Timing Case Cover Alignment

(5) Install cover-to-block screws and oil pan-to-cover screws. Tighten cover-to-block screws to 5 foot-pounds torque and oil pan-to-cover screws to 11 foot-pounds torque.

(6) Remove cover aligning tool and place a new oil seal on tool with seal lip facing inward. Apply a light film of Perfect Seal or equivalent on outside diameter of seal.

(7) Insert draw screw from Tool J-9163 into seal installing tool and press seal into cover until bottomed in cover opening (fig. 1A-26).

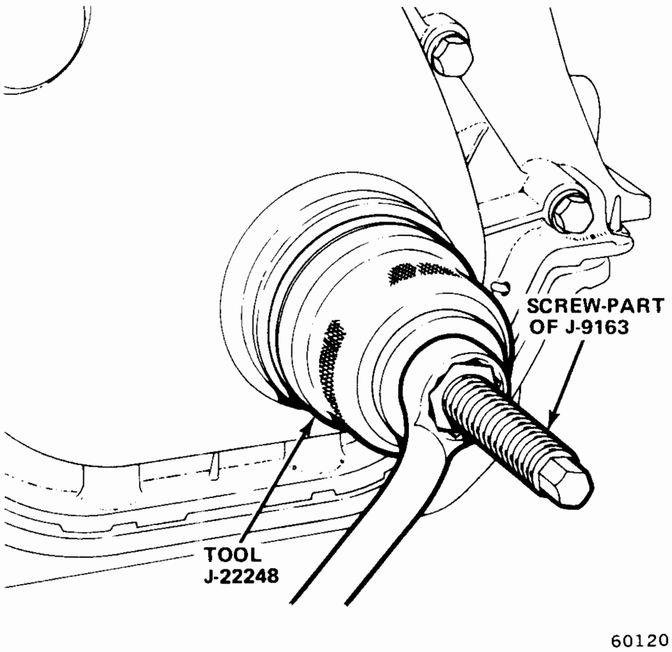

Fig. 1A-26 Timing Case Cover Oil Seal Installation

(8) Remove tools, and apply a light film of engine oil on seal lip.

(9) Install vibration damper and tighten retaining bolt to 55 foot-pounds torque.

(10) Install damper pulley (if equipped).

(11) Install radiator fan and hub assembly.

(12) Install drive belt(s) and tighten to specified tension (refer to Section 2—Cooling).

Timing Case Cover Oil Seal Replacement (Cover not Removed)

(1) Remove drive belts.

(2) Remove vibration damper pulley (if equipped).

(3) Remove vibration damper.

(4) Remove oil seal with Tool J-9256 as shown in figure 1A-27.

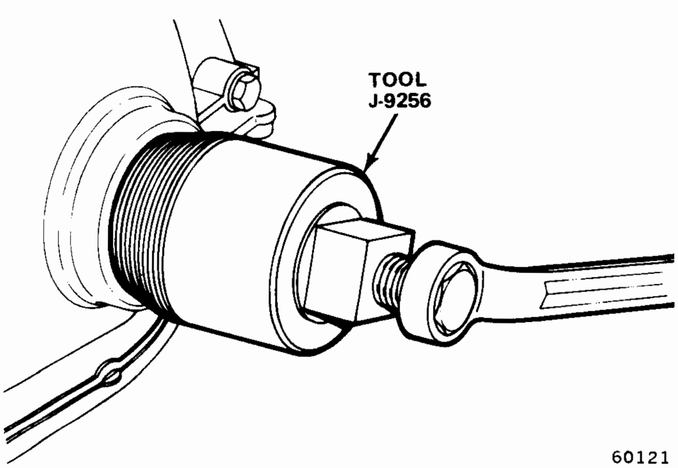

Fig. 1A-27 Timing Case Cover Oil Seal Removal

(5) Place new oil seal on Timing Case Cover Alignment Tool and Seal Installer J-22248 with seal lip facing inward. Apply a light film of Perfect Seal or equivalent on outside diameter of seal and apply light film of engine oil on seal lip.

(6) Insert draw screw from Tool J-9163 into seal installing tool and press the seal into cover until bottomed in cover opening.

(7) Remove tools.

(8) Install vibration damper and tighten retaining bolt to 55 foot-pounds torque.

(9) Install damper pulley (if equipped).

(10) Install drive belt(s) and tighten to specified tension (refer to Section 2—Cooling).

TIMING CHAIN

Installation of the timing chain with the timing marks of the crankshaft and camshaft sprockets properly aligned assures correct valve timing. A worn timing chain will adversely affect valve timing. If the timing chain deflects more than 1/2 inch, it should be replaced.

Checking Valve Timing

(1) Disconnect ignition wires and remove spark plugs.

(2) Remove cylinder head cover and gasket.

(3) Remove rocker arms and bridged pivot from No. 1 cylinder.

(4) Rotate crankshaft until No. 6 piston is at TDC on compression stroke.

(5) Rotate crankshaft counterclockwise (viewed from front of engine) 90 degrees.

(6) Install dial indicator with end of push rod touching No. 1 cylinder intake valve push rod end. Set dial indicator to zero.

(7) Rotate crankshaft clockwise (viewed from front of engine) until dial indicator shows 0.016-inch lift.

(8) Timing mark on vibration damper should index with TDC mark on timing case cover. If timing mark is more than 1/2 inch off TDC in either direction, valve timing is incorrect.

Removal

(1) Remove drive belt(s).

(2) Remove radiator fan and hub assembly.

(3) Remove vibration damper pulley (if equipped).

(4) Remove vibration damper.

(5) Remove timing case cover.

(6) Remove oil seal from timing case cover.

(7) Remove camshaft sprocket retaining bolt and washer.

(8) Rotate crankshaft until 0 timing mark on the crankshaft sprocket is closest to and in a centerline with timing pointer of camshaft sprocket (fig. 1A-28).

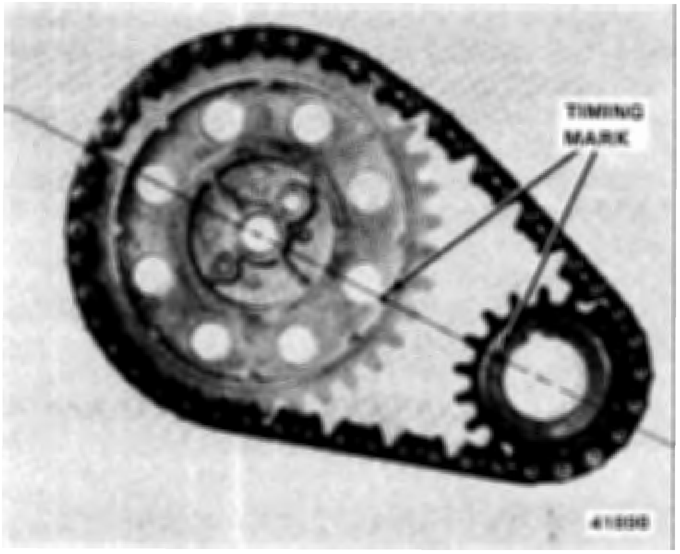

Fig. 1A-28 Sprocket Alignment

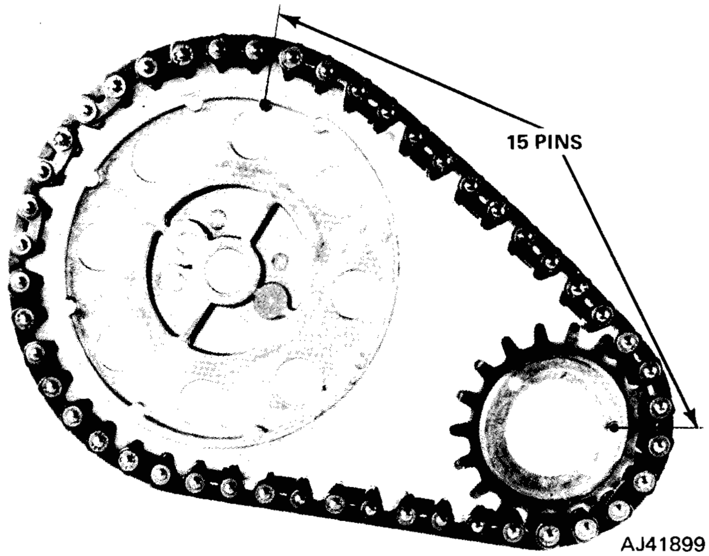

Fig. 1A-29 Timing Chain Installation

(9) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly. Disassemble chain and sprockets.

Installation

(1) Assemble timing chain, crankshaft sprocket, and camshaft sprocket with timing marks aligned as shown in figure 1A-28.

(2) Install assembly to the crankshaft and camshaft.

(3) Install camshaft sprocket retaining bolt and washer and tighten to 50 foot-pounds torque.

NOTE: *To assure correct installation of the timing chain, locate timing mark of the camshaft sprocket at approximately one o'clock position. This should place timing mark of crankshaft sprocket where it meshes with chain (fig. 1A-29). Count number of chain pins between timing mark of both sprockets. There should be 15 pins.*

(4) Install timing case cover and new oil seal.

(5) Install vibration damper.

(6) Install damper pulley (if equipped).

(7) Install engine fan and hub assembly.

(8) Install drive belt(s) and tighten to specified tension (refer to Section 2- Cooling).

CAMSHAFT AND BEARINGS

All 232 and 258 engines use the same camshaft. The camshaft is supported by four steel-shelled, babbitt-lined bearings pressed into the block and line reamed. Camshaft bearing bores are step-bored, being larger at the front bearing than at the rear, to permit easy removal and installation of the camshaft. Camshaft bearings are lubricated under pressure.

NOTE: *It is not advisable to replace camshaft bearings unless equipped with special removing, installing, and reaming tools.*

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear. The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face. Therefore, camshaft end play is zero during engine operation.

Measuring Cam Lobe Lift

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assemblies.

(3) Remove spark plugs.

(4) Install a dial indicator on end of push rod (use piece of rubber tubing between dial indicator plunger to push rod) (fig. 1A-30).

(5) Rotate crankshaft until cam lobe base circle (push rod down) is under valve tappet. Set dial indicator to zero.

(6) Rotate crankshaft until push rod reaches its maximum upward travel. Read travel at dial indicator. Correct cam lobe lift is 0.226 to 0.238 inch.

Removal

(1) Drain cooling system.

(2) Remove radiator.

(3) Remove air conditioning condenser and receiver assembly as a charged unit (if equipped) (refer to Section 13A—Air Conditioning).

(4) Remove cylinder head cover and gasket.

(5) Remove rocker arms and bridged pivot assemblies, backing off each capscrew a turn at a time to avoid breaking the bridge.

(6) Remove push rods.

NOTE: *Keep push rods and tappets in the same order as removed.*

(7) Remove cylinder head and gasket.
(8) Remove hydraulic tappets.
(9) Remove drive belt(s).
(10) Remove radiator fan and hub assembly.
(11) Remove damper pulley (if equipped).
(12) Remove vibration damper.
(13) Remove timing case cover.
(14) Remove timing case cover oil seal.
(15) Remove fuel pump.
(16) Remove distributor and ignition wires.
(17) Rotate crankshaft until 0 timing mark of crankshaft sprocket is closest to and in a centerline with timing pointer of camshaft sprocket (fig. 1A-28).
(18) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly.
(19) Remove front bumper or grille as required and remove camshaft.

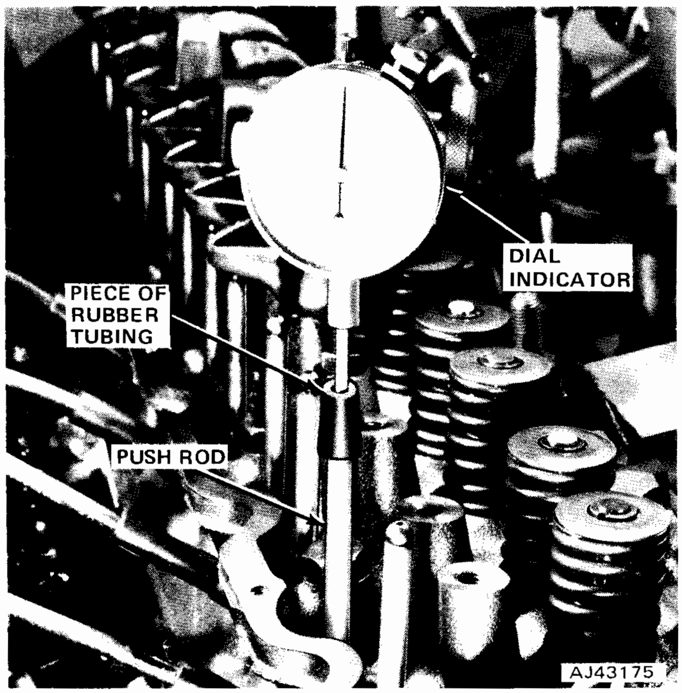

Fig. 1A-30 Cam Lobe Lift Measurement

Inspection

Inspect the camshaft bearing journals for an uneven wear pattern or rough finish. Replace if either condition exists.

Inspect the distributor drive gear for damage or excessive wear. Replace if necessary.

Inspect each cam lobe and the matching hydraulic valve tappet for wear. If the face of the tappet(s) is worn concave, the matching camshaft lobe(s) is also worn, both the camshaft and all tappets must be replaced.

Installation

(1) Lubricate camshaft with Jeep Engine Oil Supplement or equivalent.
(2) Install camshaft carefully to prevent damaging camshaft bearing.
(3) Install timing chain, crankshaft sprocket and camshaft sprocket with timing marks aligned (fig. 1A-28).
(4) Install camshaft sprocket retaining bolt and tighten to 50 foot-pounds.
(5) Install timing case cover with new oil seal.
(6) Install vibration damper.
(7) Install damper pulley (if equipped).
(8) Install radiator fan and hub assembly.
(9) Install drive belt(s) and tighten to specified tension (refer to Section 2—Cooling).
(10) Install fuel pump.
(11) Rotate crankshaft until No. 1 piston is at TDC position on compression stroke.
(12) Install distributor cap and ignition wires.

NOTE: *Install distributor so that the rotor is aligned with the No. 1 terminal of the cap when distributor housing is fully seated on block.*

(13) Install hydraulic tappets.
(14) Install cylinder head and gasket.
(15) Install push rods.
(16) Install rocker arms and bridged pivot assemblies, tightening each of the two capscrews for each bridge a turn at a time to avoid breaking the bridge.
(17) Install cylinder head cover and gasket.

NOTE: *The hydraulic valve tappets and all valve train components should be lubricated with Jeep Engine Oil Supplement (EOS), or equivalent, during installation.*

NOTE: *The EOS must remain in the engine for at least 1,000 miles but need not be drained until the next scheduled oil change.*

(18) Install air conditioning condenser and receiver assembly (if equipped) (refer to Section 13A—Air Conditioning).

CAUTION: *Both service valves must be opened before the air conditioning system is operated.*

(19) Install radiator, connect hoses, and fill cooling system to specified level (refer to Section 2—Cooling).
(20) Install front bumper or grille (if removed).

OIL PAN

Removal

(1) Raise vehicle and drain engine oil.
(2) Remove the starter motor.
(3) On CJ Models:

- Place a jack under the transmission bell housing.
- Disconnect engine right support cushion bracket from block and raise the engine to allow sufficient clearance for oil pan removal.

(4) Remove oil pan.

(5) Remove oil pan front and rear neoprene oil seals and side gaskets.

(6) Thoroughly clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan sump.

Installation

(1) Install a new oil pan front seal to timing chain cover and apply a generous amount of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to the end tabs.

(2) Cement new oil pan side gaskets into position on engine block and apply a generous amount of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to the gasket ends.

(3) Coat inside curved surface of a new oil pan rear seal with soap and apply a generous amount of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to side gasket contacting surface of seal end tabs.

(4) Install seal in recess of the rear main bearing cap making certain it is fully seated.

(5) Apply engine oil to oil pan contacting surface of the front and rear oil pan seals.

(6) Install oil pan and tighten drain plug securely.

(7) If disconnected, lower engine and connect right support cushion bracket to block. Remove the jack.

(8) Install starter motor.

(9) Lower vehicle and fill the crankcase with new oil.

OIL FILTER

A full flow oil filter, mounted on the lower right hand side of the engine, is accessible through the hood opening. A bypass valve incorporated in the filter mounting boss on the cylinder block provides a safety factor if the filter becomes clogged as a result of dirt or sludge accumulation (fig. 1A-31).

Tool J-22700 will facilitate removal of the oil filter. Before installation apply a thin film of oil to the new filter gasket. Install filter until gasket contacts the seat of the adapter, then tighten securely, by hand only. Operate engine at fast idle and check for leaks.

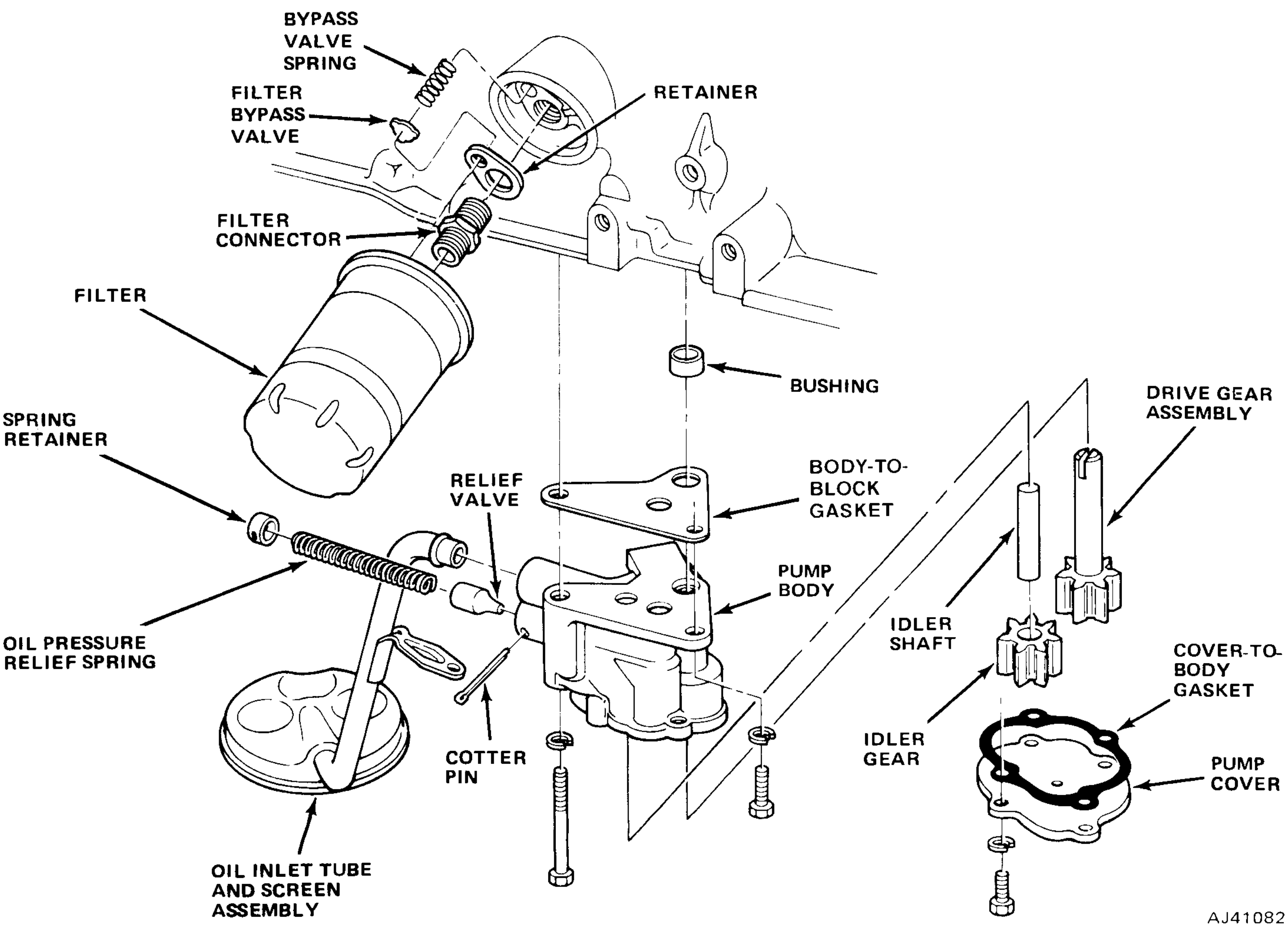

Fig. 1A-31 Oil Filter and Oil Pump Assembly

OIL PUMP

A positive displacement gear type oil pump is used and is driven by the distributor shaft, which in turn is driven by a gear on the camshaft. Crankcase oil enters the pump through an inlet tube and screen assembly which is a press fit in the pump body (fig. 1A-31). The pump incorporates a pressure relief valve to regulate maximum pressure. It is not adjustable. A setting of 75 pounds maximum pressure is built into the tension of the spring. In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

NOTE: *Oil pump removal or replacement will not affect distributor timing as the distributor drive gear remains in mesh with the camshaft gear.*

Removal

(1) Drain engine oil.

(2) Remove oil pan (refer to Oil Pan Removal in this section).

(3) Remove oil pump retaining screws, oil pump, and gasket.

CAUTION: *Do not disturb position of oil inlet tube and screen assembly in pump body. If tube is moved within pump body, a new tube and screen assembly must be installed to assure an airtight seal.*

Disassembly and Inspection

(1) Remove cover retaining screws, cover, and gasket from pump body.

(2) Measure gear end clearance by placing a straightedge across ends of gears while pushing gears up into pump body. Select a feeler gauge which will fit snugly but freely between straightedge and pump body (fig. 1A-32). Correct clearance is 0.002 to 0.006 inch (0.006 desired).

If gear end clearance is not within specifications, replace the oil pump assembly.

NOTE: *If clearance is less than specifications, a thinner oil pump cover gakset may correct the clearance. The standard gasket is 0.010 inch thick.*

(3) Measure gear-to-body clearance by inserting a feeler gauge between gear tooth and pump body inner wall directly opposite the point of gear mesh. Select a feeler gauge which fits snugly but freely (fig. 1A-33). Rotate gears to check each tooth in this manner. Correct clearance is 0.0005 to 0.0025 (0.0005 desired).

If gear-to-body clearance is more than specified, replace idler gear, idler shaft, and drive gear assembly.

(4) Remove cotter pin and slide spring retainer, spring, and oil pressure relief valve out of pump body. Check for sticking condition during disassembly. Clean or replace as necessary.

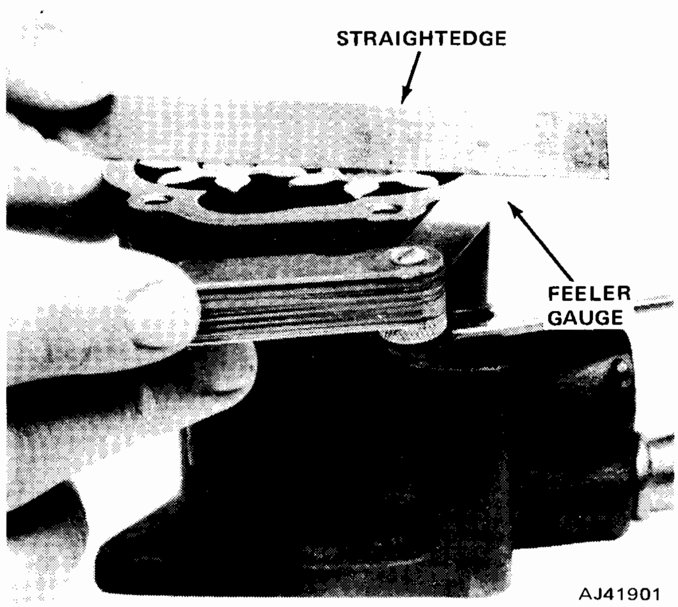

Fig. 1A-32 Oil Pump Gear End Clearance Measurement

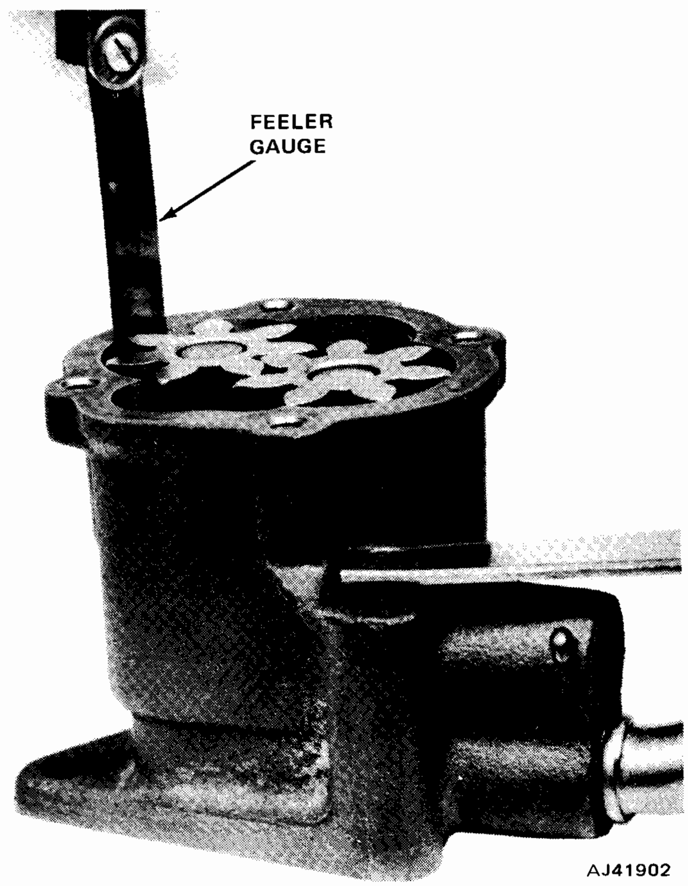

Fig. 1A-33 Oil Pump Gear-to-Body Clearance Measurement

NOTE: *The oil inlet tube must be moved to allow removal of the relief valve; therefore, the pickup tube assembly must be replaced upon installation.*

Assembly and Installation

(1) Install oil pressure relief valve, spring, retainer, and cotter pin.

(2) If position of the inlet tube in the pump body has been disturbed, install new tube and screen assembly. Apply a light film of Permatex No. 2, or equivalent, around end of tube. Using Tool J-21882 (fig. 1A-34) drive tube into body making sure support bracket is properly aligned.

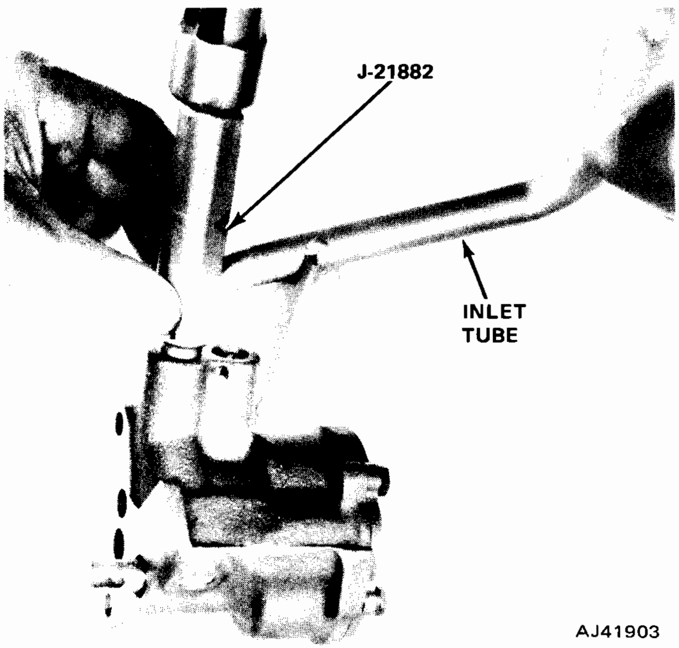

Fig. 1A-34 Oil Pump Inlet Tube Installation

(3) Install idler shaft, idler gear, and drive gear assembly.

NOTE: *To ensure self-priming of the oil pump, the pump must be filled with petroleum jelly prior to the installation of the oil pump cover. Do not use grease.*

(4) Install pump cover and new gasket. Tighten cover screws to 70 inch-pounds torque.

NOTE: *Check operation prior to installing the oil pump.*

(5) Install oil pump and a new gasket. Tighten short screws to 10 foot-pounds torque, and long screws to 17 foot-pounds torque.

(6) Install oil pan using new gaskets and seals (refer to Oil Pan Installation in this section). Fill crankcase with new oil to specified level.

REAR MAIN BEARING OIL SEAL

The rear main bearing crankshaft oil seal consists of two pieces of neoprene with a single lip that effectively seals the rear of the crankshaft. To ensure leak-free operation, the upper and lower seal halves must be replaced in pairs.

Removal

(1) Drain engine oil.

(2) Remove oil pan (refer to Oil Pan Removal in this section).

(3) Remove rear main bearing cap and discard lower seal.

(4) Loosen all remaining bearing capscrews.

(5) With a brass drift and hammer, tap upper seal until sufficient seal is protruding to permit pulling it out completely.

Installation

(1) Remove oil pan front and rear neoprene oil seals and oil pan side gaskets.

(2) Clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from the oil pan sump.

(3) Clean main bearing cap thoroughly to remove all sealer.

(4) Wipe seal surface of crankshaft clean and lightly coat with engine oil.

(5) Coat lip of seal with engine oil.

(6) Install upper seal into engine block.

NOTE: *Lip of seal must face toward front of engine.*

(7) Coat both sides of lower seal end tabs with Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, being careful not to apply sealer to lip of seal.

(8) Coat outer curved surface of lower seal with soap and lip of seal with engine oil.

(9) Install seal into cap recess and seat it firmly.

(10) Coat with Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, on both chamfered edges of rear main bearing cap (fig. 1A-35).

NOTE: *Do not apply sealer to cylinder block mating surface of rear main cap as bearing clearance could be reduced.*

(11) Install rear main bearing cap.

(12) Tighten all main bearing capscrews to 80 foot-pounds torque.

(13) Install oil pan using new gaskets and seals. Tighten drain plug securely.

(14) Fill crankcase with new oil to specified dipstick level.

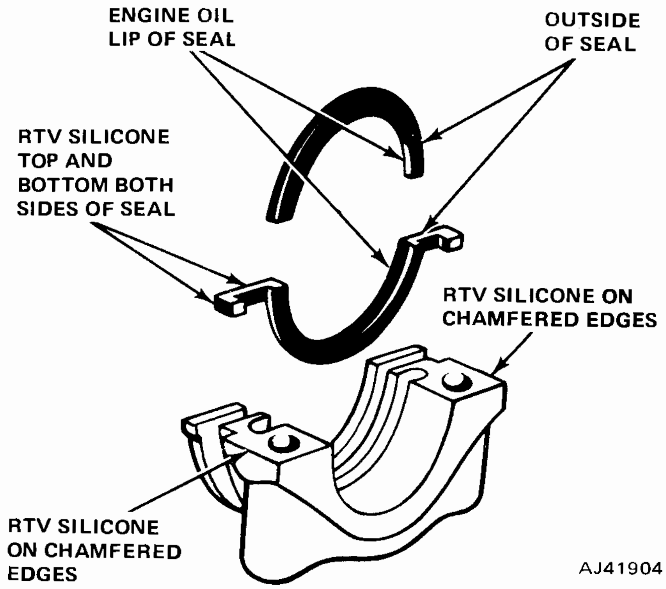

Fig. 1A-35 Rear Main Oil Seal and Cap Installation

CYLINDER BLOCK

Disassembly

(1) Remove engine as outlined under Engine Removal.

(2) Separate transmission from engine assembly (refer to appropriate Transmission Section).

(3) Place engine assembly on engine stand.

(4) Remove intake and exhaust manifolds.

(5) Remove cylinder head cover and gasket.

(6) Remove rocker arms and bridged pivot assemblies, backing off each capscrew a turn at a time to avoid breaking the bridge.

(7) Remove push rods.

(8) Remove cylinder head and gasket.

(9) Remove valve tappets.

(10) Remove drive pulley and vibration damper.

(11) Removing timing case cover.

(12) Remove timing chain and sprockets.

(13) Remove camshaft.

(14) Position pistons (one at a time) near bottom of stroke and use a ridge reamer to remove any ridge from top end of cylinder walls.

(15) Remove oil pan and gaskets.

(16) Remove oil pump.

(17) Remove connecting rod bearing caps and inserts and retain in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(18) Remove piston and connecting rod assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod bolts do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose can be slipped over the rod bolts to prevent damage to the cylinder bores or crankshaft.*

(19) Remove main bearing caps and inserts.

(20) Remove crankshaft.

Cylinder Bore Reconditioning

(1) Check cylinders for taper with an inside micrometer (from top to bottom).

(2) Check for an out-of-round condition by measuring across cylinder bores at two points parallel to crankshaft and perpendicular to crankshaft.

(3) If cylinder taper does not exceed 0.005 inch and out-of-round does not exceed 0.003 inch, cylinder bore may be trued by honing. If cylinder taper or out-of-round condition exceeds these limits, cylinder must be bored and then honed for an oversize piston.

NOTE: *When finish-honing the cylinder bores, move the hone up and down at sufficient speed to produce a uniform cross hatch pattern on the cylinder walls.*

(4) Removal of glaze from the cylinder wall for faster ring seating can be accomplished by various methods. When an expanding type hone is used, do not use more than ten strokes to recondition a cylinder wall (a stroke is one down and up movement). The engine bearings and lubrication system must be protected from abrasives.

(5) Rigid type hones are not to be used to remove cylinder glaze since a slight amount of taper always exists in cylinder walls after engine has been in service.

(6) Prior to fitting pistons, cylinder bores should be scrubbed clean with a hot water and detergent solution. Immediately after cleaning, apply light engine oil to the cylinder walls and then wipe with a clean, lint-free cloth.

Assembly

(1) Install upper main bearing inserts in cylinder block.

(2) Install crankshaft.

(3) Install main bearing caps and inserts. Tighten bolts to 80 foot-pounds torque.

(4) After thoroughly cleaning cylinder bores, apply a light film of clean, engine oil to bores with a clean, lint-free cloth.

(5) Position piston rings on piston as follows:

(a) Oil spacer gap is on centerline (±20°) of piston skirt.

(b) Oil rail gaps are 180° apart and on centerline (±20°) of piston pin.

(c) No. 2 compression ring gap is 180°(±20°) from top oil rail gap.

(d) No. 1 compression ring gap is 180°(±20°) from No. 2 compression ring gap with at least 30 degrees between each ring gap.

(6) Lubricate piston and rings with clean engine oil.

(7) Use Piston Ring Compressor Tool J-5601 to install connecting rod and piston assemblies through the top of the cylinder bores (fig. 1A-36).

NOTE: *Be careful that connecting rod bolts do not scratch the connecting rod journals or cylinder walls.*

NOTE: *Lengths of rubber hose over the connecting rod bolts will provide protection during installation.*

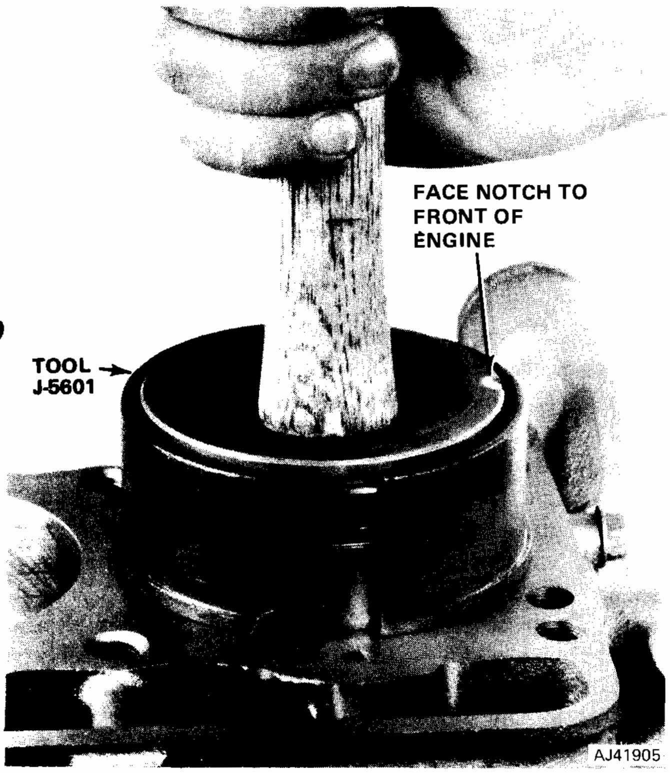

Fig. 1A-36 Piston-to-Bore Installation

(8) Install connecting rod bearing caps and inserts in the same order as removed. Tighten retaining nuts to 28 foot-pounds torque.

(9) Install oil pump.

(10) Install engine oil pan using new gaskets and seals. Tighten drain plug securely.

(11) Install camshaft.

(12) Install timing case cover.

(13) Install vibration damper and drive pulley.

(14) Install valve tappets.

(15) Install gasket and cylinder head.

(16) Install push rods.

(17) Install rocker arms and bridged pivot assemblies, tightening each of the two capscrews for each bridge a turn at a time to avoid breaking the bridge.

(18) Install cylinder head cover and gasket.

(19) Install intake and exhaust manifolds.

(20) Remove engine from engine stand.

(21) Install transmission to engine assembly (refer to appropriate Transmission section).

(22) Install engine assembly as outlined under Engine Installation.

CONNECTING ROD AND PISTON ASSEMBLIES

NOTE: *The following procedures may be used to service connecting rod and piston assemblies with engine in the vehicle.*

Removal

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assembly, backing off each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove push rods.

(4) Remove cylinder head and gasket.

(5) Position pistons one at a time near bottom of stroke and use a ridge reamer to remove any ridge from top end of cylinder walls.

(6) Drain engine oil.

(7) Remove oil pan and gaskets.

(8) Remove connecting rod bearing caps and inserts and retain in same order as removed.

NOTE: *Connecting rods and caps are stamped with the corresponding cylinder number.*

(9) Remove connecting rod and piston assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod bolts do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose can be slipped over the rod bolts to prevent damage to the cylinder bores or crankshaft.*

Installation

(1) After thoroughly cleaning cylinder bores, apply a light film of clean, engine oil to bores with a clean, lint-free cloth.

(2) Position piston rings on pistons as follows:

(a) Oil spacer gap is on centerline (±20°) of piston skirt.

(b) Oil rail gaps are 180° apart and on centerline (±20°) of piston pin.

(c) No. 2 compression ring gap is 180°(±20°) from top oil rail gap.

(d) No. 1 compression ring gap is 180°(±20°) from No. 2 compression ring gap with at least 30° between each ring gap.

(3) Lubricate piston and rings with clean engine oil.

(4) Use Piston Ring Compressor Tool J-5601 to install connecting rod and piston assemblies through the top of the cylinder bores (fig. 1A-36).

NOTE: *Be careful that connecting rod bolts do not scratch the connecting rod journals or cylinder walls. Lengths of rubber hose over the connecting rod bolts will provide protection during installation.*

(5) Install connecting rod bearing caps and inserts in the same order as removed. Tighten retaining nuts to 28 foot-pounds torque.

(6) Install oil pan using new gaskets and seals. Tighten drain plug securely.

(7) Install gasket and cylinder head.

(8) Install push rods.

(9) Install rocker arms and bridged pivot assemblies, tightening each of the capscrews a turn at a time to avoid breaking the bridge.

(10) Install cylinder head cover and gasket.

(11) Fill the crankcase with new oil to specified dipstick level.

CONNECTING RODS

The connecting rods are nodular iron, balanced assemblies with bearing inserts at the crankshaft journal end. A squirt hole in the crankshaft end provides lubrication for the camshaft lobes, distributor drive gear, cylinder walls, and piston pins. The squirt hole must face the camshaft when the connecting rod is installed.

The piston pin is a 2,000 pound press-fit. Replace any rod that requires little effort to install piston pins.

Misaligned or bent connecting rods will cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearing, or crankshaft connecting rod journals. If wear patterns or damage to any of the above mentioned components indicate the probability of a misaligned connecting rod, check rod alignment. Misaligned or bent rods must be replaced.

Side Clearance Measurement

(1) Slide snug-fitting feeler gauge between connecting rod and crankshaft rod journal flange. Correct clearance is 0.005 to 0.014 inch. Replace connecting rod if side clearance is not to specifications.

Connecting Rod Bearings

The connecting rod bearings are steel-backed, aluminum-alloy, precision type.

Each bearing is selectively fitted to its respective journal to obtain the desired operating clearance. **In production**, the select fit is obtained by using various sized, color coded bearing inserts as shown in the bearing fitting chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on inserts used in production.*

The rod journal size is identified **in production** by a color coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal size are shown in the bearing fitting chart.

When required, different sized upper and lower bearing inserts may be used as a pair; therefore, a standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance 0.0005 inch.

NOTE: *Never use a pair of bearing inserts with more than 0.001-inch difference in size.*

Example:

Correct	Incorrect
Upper—Standard	Standard
Lower—0.001-inch undersize	0.002-inch undersize

Connecting Rod Bearing Fitting Chart

Crankshaft Connecting Rod Journal Color and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow — 2.0955 to 2.0948(Standard)	Yellow — Standard	Yellow — Standard
Orange — 2.0948 to 2.0941(0.0007 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black — 2.0941 to 2.0934(0.0014 Undersize)	Black — .001-Inch Undersize	Black — .001-inch Undersize
Red — 2.0855 to 2.0848(0.010 Undersize)	Red — .010-Inch Undersize	Red — .010-inch Undersize

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Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-, 0.002-, 0.010-, and 0.012-inch undersize. Bearing size is stamped on the back of service replacement inserts.

NOTE: *The 0.002- and 0.012-inch undersize inserts are not used in production.*

Removal

(1) Drain engine oil.

(2) Remove oil pan and gaskets.

(3) Rotate crankshaft as required to position two connecting rods at a time at bottom of stroke.

(4) Remove connecting rod bearing caps and then remove lower bearing insert.

(5) Remove upper bearing insert by rotating it out of connecting rod.

NOTE: *Do not mix bearing caps. Each connecting rod and its matching cap is stamped with the cylinder number on a machined surface which faces the camshaft side of the engine block.*

(6) Inspect bearing inserts for abnormal wear or damage. Bearing inserts with either condition should be replaced.

Measuring Bearing Clearance with Plastigage

(1) Wipe journal clean.

(2) Place a strip of Plastigage across full width of lower insert at the center of bearing cap.

(3) Install bearing cap to connecting rod and tighten retaining nuts to 28 foot-pounds torque.

(4) Remove bearing cap and determine amount of clearance by measuring the width of the compressed Plastigage with the scale furnished (fig. 1A-37).

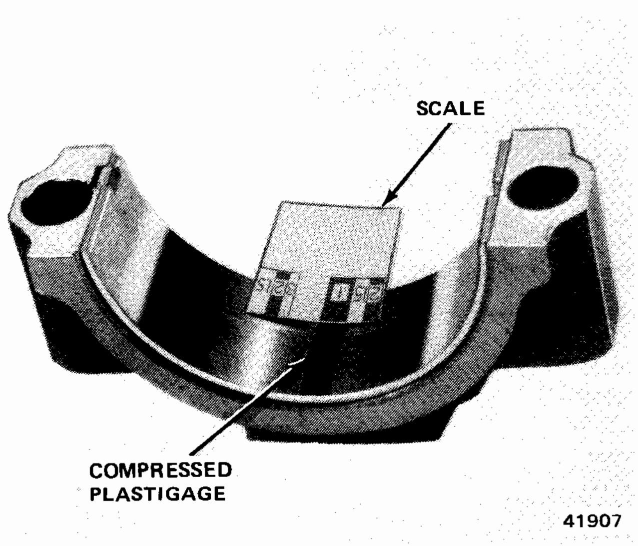

Fig. 1A-37 Bearing Clearance Measurement with Plastigage

Measuring Bearing Clearance with Micrometer

(1) Wipe connecting rod journal clean.

(2) Use a micrometer to check for taper and out-of-round conditions. Correct tolerance for both taper and out-of-round is 0.0005-inch maximum. If any rod journal is not within specifications, the crankshaft must be replaced or reconditioned and fitted with new undersize bearing inserts.

(3) Use micrometer to measure maximum diameter of rod journal.

(4) Compare reading obtained with journal diameters listed in Connecting Rod Bearing Fitting Chart and select inserts required to obtain specified bearing clearance.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Install bearing inserts, cap, and retaining nuts. Tighten to 28 foot-pounds torque.

CAUTION: *Care must be exercised when rotating the crankshaft with bearing caps removed. Be sure the connecting rod bolts do not accidentally come in contact with the rod journals and scratch the finish. Bearing failure would result. Rubber hoses installed over the connecting rod bolts will help prevent damage to crank journals.*

(3) Install oil pan using new gaskets and seals. Tighten drain plug securely.

(4) Fill crankcase with new oil to specified level.

PISTONS

Aluminum alloy Autothermic pistons, steel reinforced for strength and controlled expansion, are used. The ring belt area above the piston pin provides for three piston rings: two compression and one oil control ring.

The piston pin boss is offset from the centerline of the piston to place it nearer the thrust side of the piston.

A notch in the top perimeter of the piston ensures correct installation in the bore. Notch must face front of engine when installed (fig. 1A-38).

Fitting Pistons

Pistons are fitted to their respective bores by measuring the inside diameter of the cylinder bore at a point 2-5/16 inches below the top of bore, and the outside diameter of the piston. Pistons are cam ground and must be measured at right angles to piston pin at centerline of pin (fig. 1A-39). The difference between cylinder bore diameter and piston diameter is piston-to-bore clearance.

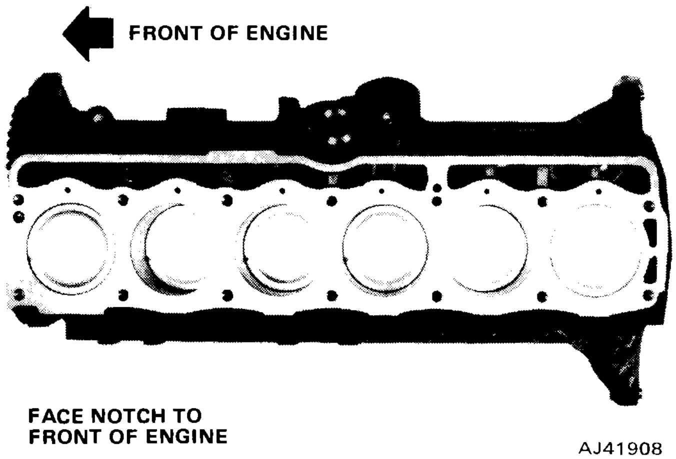

Fig. 1A-38 Pistons Correctly Positioned in Bores

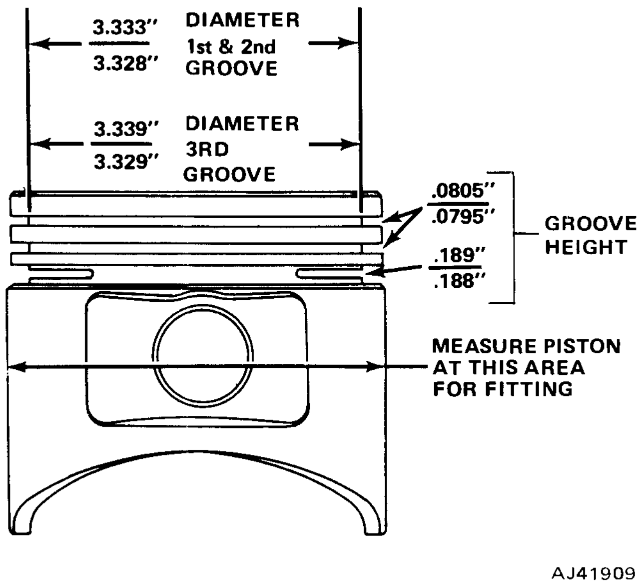

Fig. 1A-39 Piston Measurements

Piston Rings

The compression rings (two) are made of cast iron. The oil control ring is a three-piece steel design.

Ring Fitting

(1) Clean carbon from all ring grooves. The oil drain openings in the oil ring grooves and pin boss must be open. Be careful not to remove metal from the grooves or lands since this will change the ring groove clearances and destroy ring-to-land seating.

(2) Check ring side clearance with a feeler gauge fitted snugly between ring land and ring. Rotate ring in groove; it must move freely at all points (fig. 1A-40). Correct side clearance between land and rings should be as listed in Specifications.

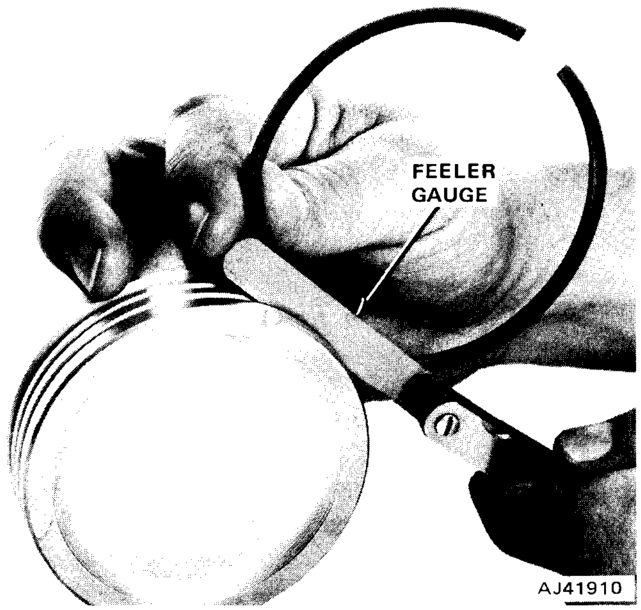

Fig. 1A-40 Ring Side Clearance

(3) Place ring in bore and push down with an inverted piston to a position near lower end of ring travel. Measure ring gap (joint clearance) with feeler gauge fitting snugly in ring opening (fig. 1A-41).

NOTE: *When other than standard ring sizes are used, rings should be individually fitted to their respective bores.*

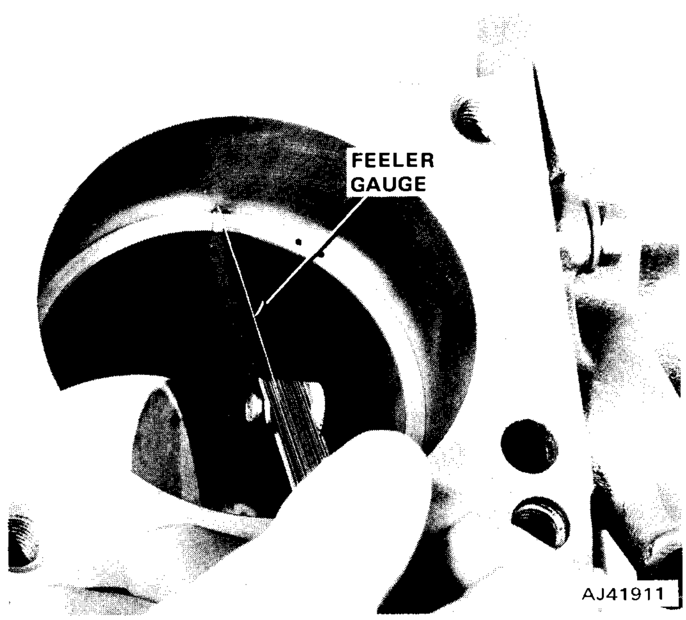

Fig. 1A-41 Ring Gap Clearance

Installation

(1) Install oil control rings as indicated by instructions in package. It is not necessary to use a tool to install upper and lower rails (fig. 1A-42).

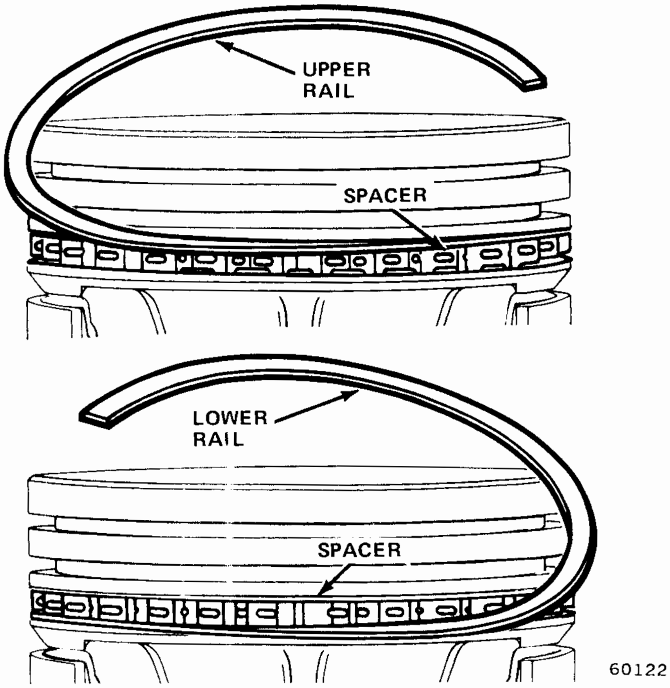

Fig. 1A-42 Oil Control Ring Rail Installation

(2) Install lower compression ring using ring installer to expand ring around piston (fig. 1A-43).

NOTE: *Make certain upper and lower compression rings are installed properly. Figure 1A-44 shows typical ring markings indicating the top side of the ring.*

(3) Install upper compression ring using ring installer to expand ring around piston (fig. 1A-43).

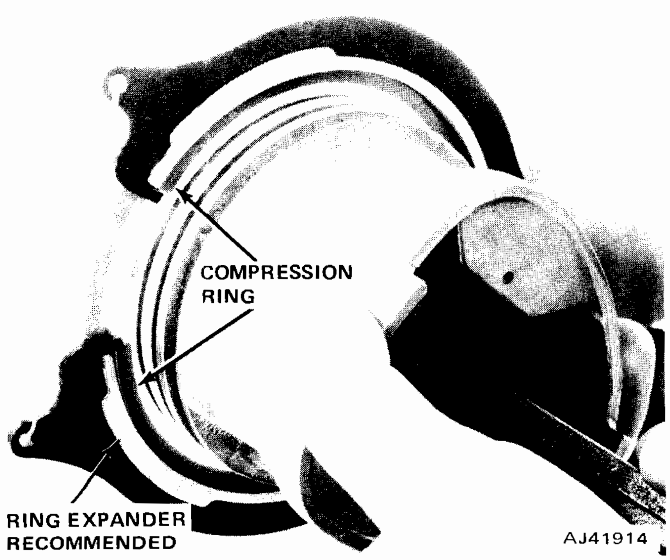

Fig. 1A-43 Compression Ring Installation

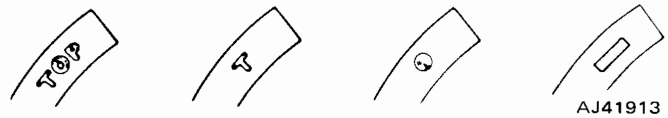

Fig. 1A-44 Typical Piston Ring Markings

Piston Pins

Piston pins are press fit into the connecting rod and require no locking device.

Removal

(1) Using Piston Pin Remover J-21872 and arbor press, place piston on Remover Support J-21872-1 (fig. 1A-45).

(2) Using Piloted Driver J-21872-3, press pin completely out of piston. Note position of pin through gauge window of remover support.

Pin Fitting

(1) Inspect pin and pin bore for nicks and burrs; remove as necessary.

NOTE: *Never re-use piston pin after it has been installed and removed from a connecting rod.*

(2) With pin removed from piston, clean and dry piston pin bore and new piston pin.

(3) Position piston so that pin bore is in a vertical position. Insert pin in bore. At room temperature, pin should slide completely through pin bore without pushing it.

(4) Replace piston and pin if pin jams in pin bore.

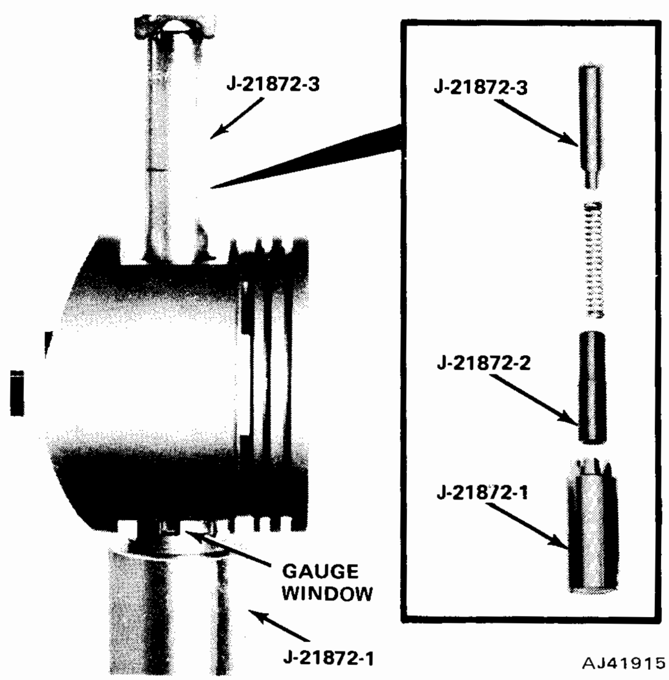

Fig. 1A-45 Piston Pin Removal or Installation

Installation

(1) Insert Pin Pilot J-21872-2, through piston and connecting rod pin bores (fig. 1A-45).

(2) Position pin pilot, piston, and connecting rod on Support J-21872-1.

(3) Insert piston pin through upper piston pin bore and into connecting rod pin bore.

(4) Position Piloted Driver J-21872-3 inside piston pin.

(5) Using arbor press, press piston pin through connecting rod and piston until pin pilot indexes with mark on support.

NOTE: *The piston pin is a 2,000 pound press-fit. If little effort is required to install piston pin in connecting rod, or if rod moves along pin, a new connecting rod is required.*

(6) Remove piston and connecting rod assembly from press. Pin should be centered in rod, plus or minus 0.0312 inch.

CRANKSHAFT

The crankshaft is nodular-iron and is counterweighted and balanced. The 232 CID engine crankshaft has eight counterweights, and the 258 CID engine crankshaft has twelve counterweights. Both have seven main bearing journals and six connecting rod journals.

An oil slinger is provided at the rear main journal, inboard of the rear oil seal. The component parts and crankshaft are individually balanced; then the complete assembly is balanced as a unit.

NOTE: *On engines equipped with automatic transmissions, the torque converter and converter flexplate must be marked prior to removal and installed in the same position.*

Service replacement dampers, crankshafts, flywheels, torque converters, and clutch components are balanced individually and may be replaced as required without rebalancing the complete assembly.

Removal or Replacement

If the crankshaft is damaged to the extent that reconditioning is not feasible, it must be replaced. Removal and installation involves following the procedures outlined under Cylinder Block.

Crankshaft End Play Measurement

The crankshaft end play is controlled at the No. 3 main bearing insert which is flanged for this purpose.

(1) Attach a dial indicator to cylinder block adjacent to No. 3 main bearing.

(2) Pry shaft forward with a flat-bladed screwdriver, set dial indicator, push rod on face of crankshaft counterweight, and set to zero.

(3) Pry shaft fore and aft. Read dial indicator (fig. 1A-46). The end play is the difference between the high and low readings.

(4) The correct crankshaft end play is 0.0015 to 0.0065 inch (0.002 to 0.0025 desired).

(5) If end play is incorrect according to specifications, inspect crankshaft thrust faces for wear. If no wear is apparent, replace thrust bearing and recheck end play. If end play is still outside specifications, the crankshaft must be replaced.

NOTE: *When replacing the thrust bearings, it is recommended to pry the crankshaft fore and aft to align the faces of the thrust bearing.*

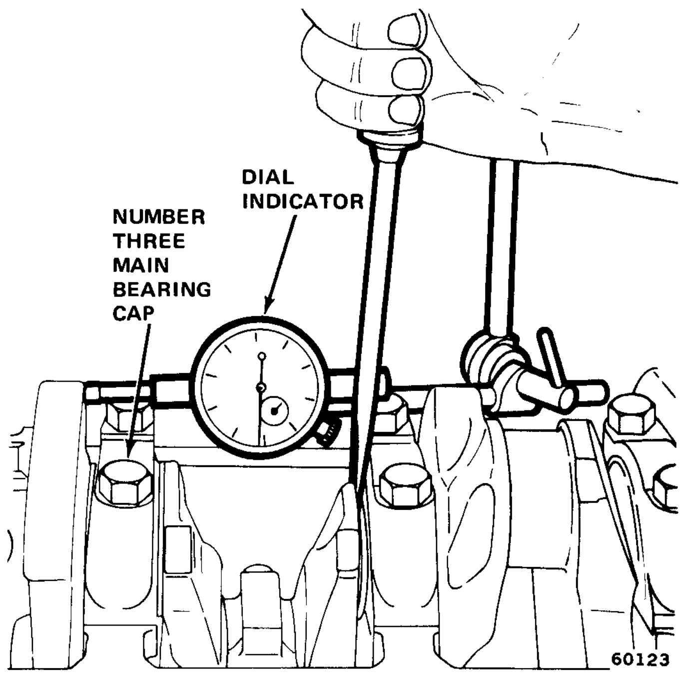

Fig. 1A-46 Measuring Crankshaft End Play

Measuring Main Bearing Journal with a Micrometer (Crankshaft Removed)

(1) Clean main bearing journal.

(2) Measure maximum diameter of journal with a micrometer.

(3) Compare reading obtained with journal diameters listed in Main Bearing Fitting Chart and select inserts required to obtain specified bearing clearance.

Crankshaft Main Bearings

The main bearings are steel-backed, micro-babbitt, precision type. Each bearing is selectively fitted to its respective journal to obtain the desired operating clearance. **In production,** the select fit is obtained by using various sized color coded bearing inserts as shown in Main Bearing Fitting Chart. The bearing code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on inserts used in production.*

The main bearing journal size is identified **in production** by a color coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft, except for the rear main journal which is on the crankshaft rear flange.

When required, different sized upper and lower bearing inserts may be used as a pair. A standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance by 0.0005 inch.

Example:

Correct	Incorrect
Upper—Standard	Standard
Lower—0.001-inch undersize	0.002-inch undersize

CAUTION: *Never use bearing inserts in pairs with greater than 0.001-inch difference in size. When replacing inserts, all the odd size inserts must be either on the top (in block) or the bottom (in main cap).*

Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-, 0.002-, 0.010-, and 0.012-inch undersize. The size is stamped on the back of the service replacement inserts.

NOTE: *The 0.012-inch undersize insert is not used in production.*

Removal and Inspection

(1) Drain engine oil.
(2) Remove oil pan.
(3) Remove main bearing cap and insert.
(4) Inspect bearing insert for abnormal wear or damage. If either condition exists, both upper and lower inserts must be replaced. Refer to Measuring Bearing Clearance with Plastigage to select bearing inserts required to obtain the specified bearing clearance.
(5) Inspect crankshaft main journal. If damaged, it must be either reconditoned or replaced.
(6) Remove upper insert by loosening all of other bearing caps and inserting small cotter pin in crankshaft oil hole (head of pin should be large enough that it will not fall into oil hole, yet thinner than the thickness of the bearing).
(7) With pin in place, rotate crankshaft so that upper bearing insert will rotate in the direction of its locating tongue.
(8) Remove and inspect remaining bearings one at a time in the same manner.

Measuring Bearing Clearance with Plastigage (Crankshaft Installed)

NOTE: *Check clearance one bearing at a time. All other bearings must remain tightened.*

(1) Support weight of crankshaft with a jack or stand placed under counterweight adjacent to main bearing being checked.

NOTE: *When checking number 1 main bearing, support crankshaft at the vibration damper.*

(2) Remove main bearing cap and insert.
(3) Clean insert and exposed portion of crankshaft journal.
(4) Place strip of Plastigage across full width of bearing insert.
(5) Install bearing cap and tighten bolts to 80 foot-pounds torque.
(6) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with furnished scale (fig. 1A-47).

Main Bearing Fitting Chart

Crankshaft Main Bearing Journal Color Code and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow — 2.5001 to 2.4996 (Standard)	Yellow — Standard	Yellow -- Standard
Orange — 2.4996 to 2.4991 (0.0005 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black — 2.4991 to 2.4986 (0.001 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Green — 2.4986 to 2.4981(0.0015 Undersize)	Black — .001-inch Undersize	Green — .002-inch Undersize
Red — 2.4901 to 2.4896(0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize

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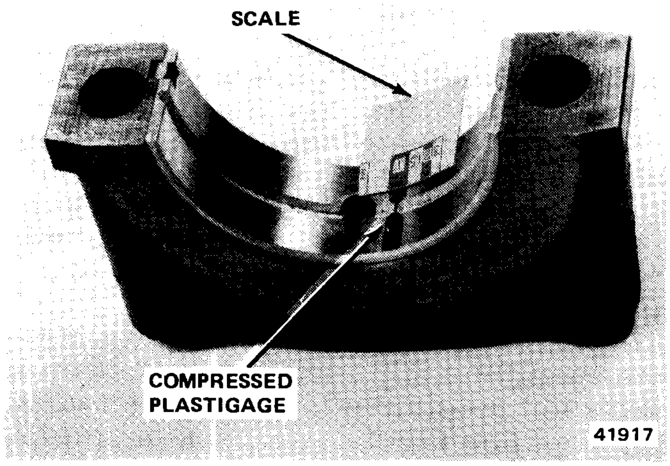

Fig. 1A-47 Checking Main Bearing Clearance with Plastigage

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Loosen all main bearing caps and install main bearing upper insert(s).

(3) Install main bearing cap(s) and lower insert(s). Tighten bolts to 80 foot-pounds torque in 20 pound increments from 40 foot-pounds rotating crank after tightening each main cap to make sure crankshaft rotates freely.

(4) Install oil pan (using new gaskets and seals). Tighten drain plug securely.

(5) Fill crankcase with new oil to dipstick level.

FLYWHEEL AND STARTER RING GEAR ASSEMBLY

The starter ring gear can be replaced only on vehicles with manual transmission. The starter ring gear is welded to and balanced as part of the converter drive plate on vehicles with automatic transmissions. The entire drive plate/ring assembly must be replaced on automatic transmission equipped vehicles.

Ring Gear Replacement—Manual Transmission

(1) Position flywheel on arbor press with steel blocks equally spaced under gear.

(2) Press flywheel through ring gear.

NOTE: *Ring gear can also be removed by breaking it with a chisel.*

(3) Apply heat to expand inside diameter of replacement ring gear.

(4) Press flywheel onto replacement ring gear.

NOTE: *On manual transmission equipped cars, the flywheel is balanced as an individual component and also as part of the crankshaft assembly.*

Do not attempt to duplicate original flywheel balance holes when installing a service replacement. Service flywheels are balanced during manufacture.

SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly (short block) may be installed whenever the original engine block is worn or damaged beyond repair. It consists of engine block, piston and rod assemblies, crankshaft, camshaft, oil pump inlet tube and screen, timing gears, and chain.

NOTE: *Short engine assemblies have an S stamped on the same surface as the build date code for identification.*

Installation includes transfer of component parts from the worn or damaged original engine. Follow the appropriate procedures for cleaning, inspection, and torque tightening as outlined in this section.

Specifications

Type	In Line, OHV, Six-cylinder
Bore	3.75 inches
Stroke	
232	3.50 inches
258	3.895 inches
Displacement	
232	232 cubic inches
258	258 cubic inches
Compression Ratio	8.0:1
Compression Pressure	
232	140 psi
258	150 psi
Maximum Variation Between Cylinders	20 psi
Firing Order	1-5-3-6-2-4
Taxable Horsepower	33.75
Fuel	Regular, Low Lead, or No Lead

Camshaft

Fuel Pump Eccentric Diameter	1.615 to 1.625 inches
Tappet Clearance	Zero Lash (Hydraulic tappets)
End Play	Zero (engine operating)
Bearing Clearance	0.001 to 0.003 inch

Specifications (Continued)

Camshaft (Continued)

Bearing Journal Diameter
- No. 1 .... 2.029 to 2.030 inches
- No. 2 .... 2.019 to 2.020 inches
- No. 3 .... 2.009 to 2.010 inches
- No. 4 .... 1.999 to 2.000 inches

Base Circle Runout .... 0.001 inch (max)
Cam Lobe Lift .... 0.232 inch
Intake Valve Timing
- Opens .... 12.12° BTDC
- Closes .... 64.80° ABDC

Exhaust Valve Timing
- Opens .... 53.12° BBDC
- Closes .... 23.80° ATDC

Valve Overlap .... 35.92°
Intake Duration .... 256.92°
Exhaust Duration .... 256.92°

Connecting Rods

Total Weight (Less Bearings)
- 232 .... 557 to 665 grams
- 258 .... 695 to 703 grams

Total Length (Center-to-Center)
- 232 .... 6.123 to 6.127 inches
- 258 .... 5.873 to 5.877 inches

Piston Pin Bore Diameter .... 0.9288 to 0.9298 inches
Bearing Clearance .... 0.001 to 0.0025 inch (0.0015-0.002 inch preferred)
Side Clearance .... 0.005 to 0.014 inch
Maximum Twist .... 0.001 per inch
Maximum Bend .... 0.0005 per inch

Crankshaft

End Play .... 0.0015 to 0.0065 inch
Main Bearing Journal Diameter .... 2.4986 to 2.5001 inches
Main Bearing Journal Width
- No. 1 .... 1.086 to 1.098 inches
- No. 3 .... 1.271 to 1.273 inches
- No. 2-4-5-6-7 .... 1.182 to 1.188 inches

Main Bearing Clearance .... 0.001 to 0.003 inch (0.0025 inch preferred)
Connecting Rod Journal Diameter .... 2.0934 to 2.0955 inches
Connecting Rod Journal Width .... 1.070 to 1.076 inches
Connecting Rod Bearing Clearance .... 0.001 to 0.0025 inch (0.0015-0.002 inch preferred)
Maximum Out-of-Round (All Journals) .... 0.0005 inch
Maximum Taper (All Journals) .... 0.0005 inch

Cylinder Block

Deck Height .... 9.528 to 9.534 inch
Deck Clearance
- 232 .... 0.0575 inch (below block)
- 258 .... 0.110 inch (below block)

Cylinder Block (Continued)

Cylinder Bore (standard) .... 3.7501 to 3.7533 inches
- Maximum Cylinder Taper .... 0.005 inch
- Maximum Cylinder Out-of-Round .... 0.003 inch

Tappet Bore Diameter .... 0.905 to 0.906 inch
Cylinder Block Flatness .... 0.001/1 inch, 0.002/6 inch; 0.008 inch (max)

Cylinder Head

Combustion Chamber Volume .... 62.5 to 65.5 cc
Valve Arrangement .... EI-IE-IE-EI-EI-IE
Valve Guide ID (Integral) .... 0.3735 to 0.3745 inch
Valve Stem-to-Guide Clearance .... 0.001 to 0.003 inch
Intake Valve Seat Angle .... 30°
Exhaust Valve Seat Angle .... 44.5°
Valve Seat Width .... 0.040 to 0.060 inch
Valve Seat Runout .... 0.0025 inch
Cylinder Head Flatness .... 0.001/1 inch; 0.002/6 inch; 0.008 inch (max)

Lubrication System

Engine Oil Capacity .... 5 quarts (Add 1 quart with filter change)
Normal Operating Pressure .... 13 psi at 600 rpm; 37 to 75 psi (max) at 1600 rpm+
Oil Pressure Relief .... 75 psi (max)
Gear-to-Body Clearance .... 0.0025 to 0.0005 inch (0.0005 inch preferred)
Gear End Clearance .... 0.002 to 0.006 inch (0.006 inch preferred)

Pistons

Weight (less pin) .... 481 to 485 grams
Piston Pin Bore Centerline-to-Piston
- Top .... 1.599 to 1.603 inches

Piston-to-Bore Clearance .... 0.0009 to 0.0017 inch (0.0012 to 0.0013 inch preferred)
Piston Ring Gap Clearance –
- Compression (Both) .... 0.010 to 0.020 inch

Piston Ring Gap Clearance–
- Oil Control Steel Rails .... 0.010 to 0.025 inch

Piston Ring Side Clearance
- No. 1 Compression .... 0.0015 to 0.003 inch (0.0015 preferred)
- No. 2 Compression .... 0.0015 to 0.003 inch (0.0015 preferred)
- Oil Control .... 0.001 to 0.008 inch (0.003 preferred)

Piston Ring Groove Height
- Compression (both) .... 0.0795 to 0.0805 inch
- Oil Control .... 0.188 to 0.189 inch

Piston Ring Groove Diameter
- No. 1 and No. 2 .... 3.328 to 3.333 inches
- Oil Control .... 3.329 to 3.339 inches

Piston Pin Bore Diameter .... 0.9308 to 0.9313 inch

Specifications (Continued)

Pistons (Continued)

Piston Pin Diameter . . . . 0.9304 to 0.9309 inch
Piston-to-Pin Clearance . . . . 0.0003 to 0.0005 inch loose
(0.0005 inch preferred)
Piston Pin-to-Connecting Rod . . . . 2000 lb. press-fit

Rocker Arms, Push Rods and Tappets

Rocker Arm Ratio 1.6:1
Push Rod Length . . . . 9.615 to 9.595 inches
Push Rod Diameter .313 to .312 inch
Hydraulic Tappet Diameter . . . . 0.904 to 0.9045 inch
Tappet-to-Bore Clearance . . . . 0.001 to 0.002 inch

Valves

Valve Length
(Tip-to-Gauge Dim. Line) . . . . 4.7895 to 4.8045 inches
With Rotator . . . . 4.8095 to 4.8245 inches
Valve Stem Diameter . . . . 0.3715 to 0.3725 inch
Stem-to-Guide Clearance . . . . 0.001 to 0.003 inch

Valves (Continued)

Intake Valve Head Diameter . . . . 1.782 to 1.792 inches
Intake Valve Face Angle . . . . 29°
Exhaust Valve Head Diameter . . . . 1.401 to 1.411 inches
Exhaust Valve Face Angle . . . . 44°
Maximum Allowable Removed for
Tip Refinishing . . . . 0.010 inch

Valve Springs

Free Length . . . . 2.234 inches approx.
With Rotators . . . . 2.00 inches approx.

Spring Tension
Valve Closed . . . . 95 to 105 lbs at 1-13/16 inches
With Rotators . . . . 80-88 lbs at 1-5/8 inches
Valve Open . . . . 188 to 202 lbs at 1-7/16 inches
With Rotators . . . . 210 to 226 lbs at 1-3/16 inches
Inside Diameter . . . . 0.948 to 0.968 inch
With Rotators . . . . 1.000 to 1.020 inches

Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torque	Service In-Use Recheck Torque
Accessory Drive Pulley Screws	18	12 to 25
Air Injection Tube-to-Manifold	20	15 to 20
Air Pump-to-Bracket	20	15 to 22
Air Pump Brackets-to-Engine (A. Compressor or Pedestals)	25	18 to 28
Air Pump Adjusting Strap-to-Pump	20	15 to 22
Alternator Pivot Bolt or Nut	28	20 to 35
Alternator Adjusting Bolt	18	15 to 20
Alternator Mounting Bracket-to-Engine	28	23 to 30
Alternator Pivot Mounting Bolt to Head	33	30 to 35
Block Heater Nut	20 in-lb	17 to 25 in-lb
Camshaft Sprocket Screw	50	45 to 55
Carburetor Hold-Down Nuts	14	12 to 15
Coil Bracket-to-Cylinder Head	14	10 to 18
Connecting Rod Bolt Nuts	28	26 to 30
Cylinder Head Capscrews	105	95 to 115
Cylinder Head Cover Screws	50 in-lb	42 to 58 in-lb
Crankshaft Pulley-to-Damper	23	18 to 28
Clutch Housing Spacer to Block Screws	12	9 to 15
Clutch Housing-to-Block Screws (top)	27	22 to 30
Clutch Housing-to-Block Screws (bottom)	43	37 to 47

	Service Set-To Torque	Service In-Use Recheck Torque
Distributor Clamp Bracket Screw	13	10 to 18
EGR Valve	13	9 to 18
Exhaust Manifold Bolts	23	18 to 28
Exhaust Pipe-to-Manifold	23	18 to 28
Fan and Hub Assembly Bolts	18	12 to 25
Drive Plate-to-Converter Screw	22	20 to 25
Flywheel or Drive Plate-to-Crankshaft	105	95 to 120
Front Crossmember-to-Sill	65	55 min.
Front Support Bracket-to-Block	28	22 to 38
Front Support Cushion-to-Bracket	33	27 to 38
Front Support Cushion-to-Crossmember	37	30 to 45
Fuel Pump Screws	16	13 to 19
Idler Arm Bracket-to-Sill	50	35 to 60
Idler Pulley Bracket to Front Cover Nut	7	4 to 9
Idler Pulley Bearing Shaft-to-Bracket Nut	33	28 to 38
Intake Manifold Screws	23	18 to 28
Main Bearing Capscrews	80	75 to 85
Oil Filter Adapter	48	42 to 55
Oil Pump Cover Screws	70 in-lb	60 to 80 in-lb
Oil Pump Attaching Screws (Short)	10	8 to 13
Oil Pump Attaching Screws (Long)	17	12 to 20
Oil Pan Screws—1/4 inch—20	7	5 to 9
Oil Pan Screws—5/16-inch—18	11	9 to 13
Power Steering Pump Adapter Screw	23	18 to 28
Power Steering Pump Bracket Screw	43	37 to 47
Power Steering Pump Mounting Screw	28	25 to 35

Torque Specifications (Continued)

	Service Set-To Torques	Service In-Use Recheck Torques
Power Steering Pump Pressure Line Nut	38	30 to 45
Power Steering Pump Pulley Nut	58	40 to 65
Rear Crossmember-to-Side Sill Nut	30	20 to 35
Rear Support Cushion-to-Bracket	48	40 to 55
Rear Support Bracket-to-Transmission	33	27 to 38
Rear Support Cushion-to-Crossmember	18	12 to 25
Rocker Arm Assembly-to-Cylinder Head	21	18 to 26
Spark Plugs	28	22 to 33
Timing Case Cover-to-Block Screws	5	4 to 8
Timing Case Cover-to-Block Studs	16	13 to 19
Thermostat Housing Screw	13	10 to 18
Vibration Damper Screw	55	48 to 64
Water Pump Screws	13	9 to 18

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

Fig. 1A-47 Six-Cylinder Engine Tools

V-8 ENGINE

GENERAL

The 304, 360, and 401 CID engines are 90-degree V-8 designs incorporating overhead valves. The 304 CID engines (CJ Model only) operate ONLY on unleaded gasoline. The cylinders are numbered from front to rear: 1-3-5-7 on the left bank and 2-4-6-8 on the right bank with cylinder firing order 1-8-4-3-6-5-7-2.

The crankshaft, supported by five two-piece main bearings, rotates in a counterclockwise direction as viewed from the rear. The camshaft is supported by five one-piece, line-bored bearings.

Bridged pivot assemblies control movement of intake and exhaust rocker arms that are paired by cylinders (fig. 1B-1 and 1B-2).

Service procedures for all V-8 engines are essentially the same.

Identification

The cubic-inch displacement of all V-8 engines is cast into each side of the cylinder block. These numbers are located between the engine mounting bracket bosses.

Build Date Code

The engine Build Date Code is located on a tag attached to the right bank cylinder head cover (fig. 1B-3).

The code numbers identify the year, month, and day that the engine was built. The code letter identifies the cubic inch displacement, carburetor type, and compression ratio.

Example: 9 05 H 14

The example code identifies a 304 CID with 2V carburetor and 8.4:1 compression ratio built on May 14, 1976.

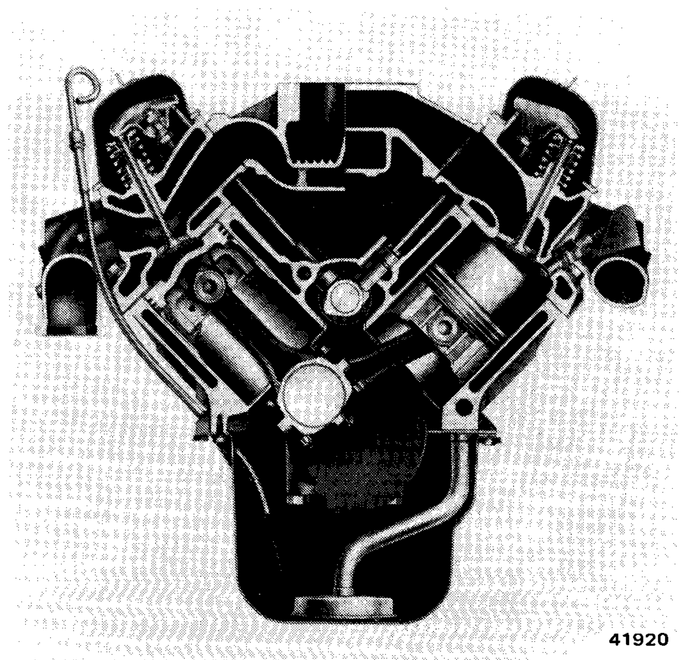

Fig. 1B-1 Sectional View of V-8 Engine Assembly

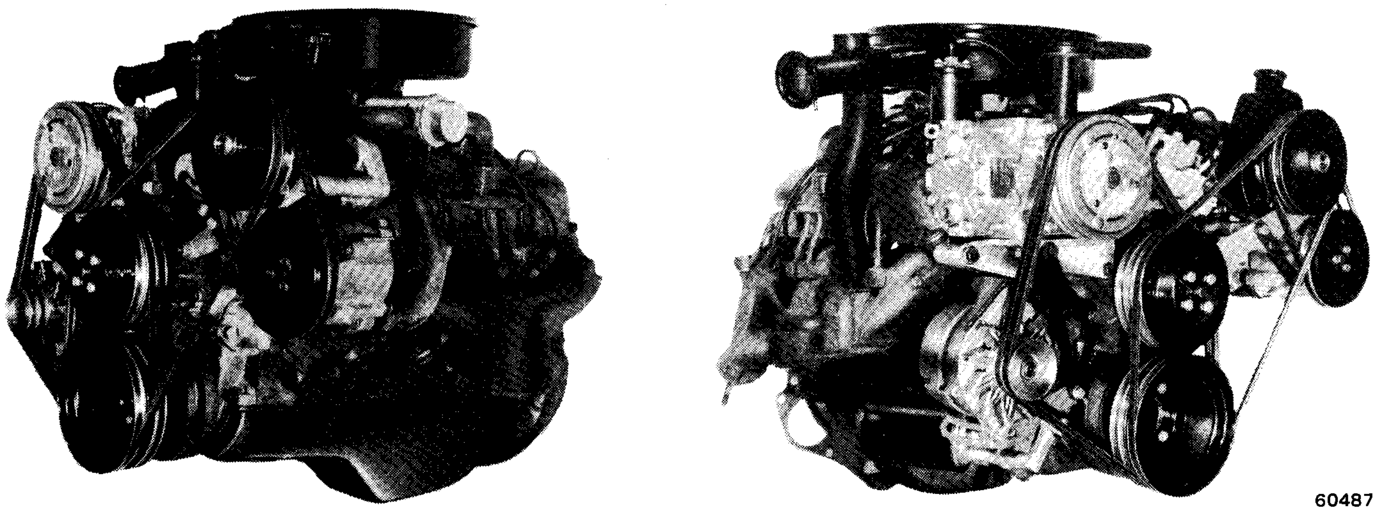

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Fig. 1B-2 Typical V-8 Engine Assembly

Engine Build Date Code Explanation

Letter Code	CID	Carburetor	Compression Ratio
H	304	2V	8.4:1
N	360	2V	8.25:1
P	360	4V	8.25:1
Z	401	4V	8.25:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
8 – 1975 9 – 1976	01 – 12	H, N, P, or Z	01 – 31

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Fig. 1B-3 Build Date Code Location V-8

Oversize or Undersize Components

On vehicles with odd-sized engines, it is sometimes necessary to machine all cylinder bores to 0.010-inch oversize, all crankshaft main bearing journals, all connecting rod journals to 0.010-inch undersize, or all camshaft bearing bores 0.010-inch oversize. These engines have a single or double letter code stamped adjacent to the Build Date Code on the tag attached to the right bank cylinder head cover. The letters are coded as follows:

Single letter B.	cylinder bore 0.010-inch oversize
Single letter M.	main bearings 0.010-undersize
Single letter P.	connecting rod bearings 0.010-inch undersize
Double letters PM.	main and connecting rod bearings 0.010-inch undersize
Single letter C.	camshaft bearing bores 0.010-inch oversize

LUBRICATION SYSTEM

A gear-type, positive displacement oil pump is incorporated in the timing case cover. A cavity in the cover forms the body of the pump while drive and idler gears rotate within the cavity. The drive gear shaft is driven by the distributor.

The oil pump cover seals the end of the oil pump cavity and also serves as a mount for the oil filter. The oil pressure relief valve assembly is located in the oil pump cover (fig. 1B-4).

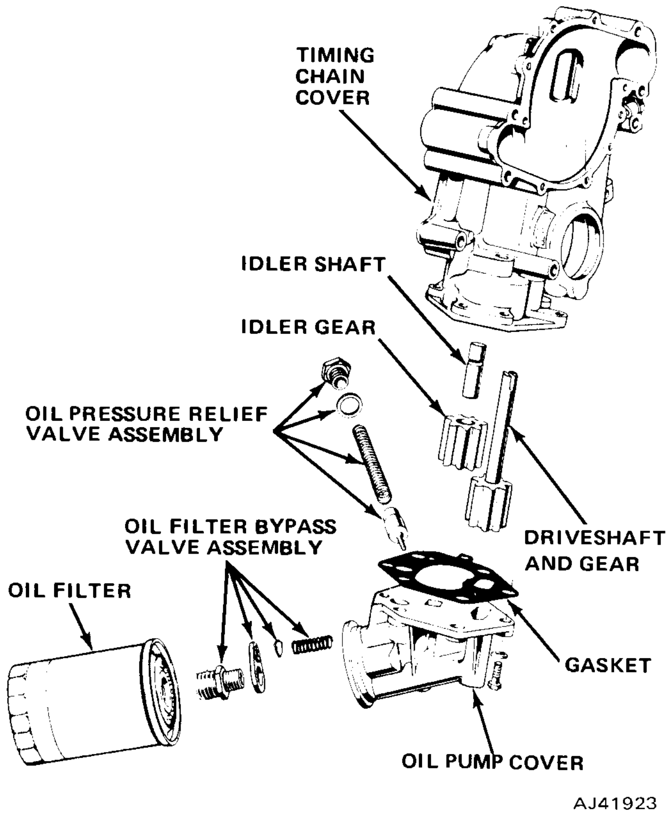

Fig. 1B-4 Oil Pump and Filter Assembly

Oil is drawn from the sump area of the oil pan through a tube and screen assembly to a horizontal oil gallery located at the lower right side of the engine block. A passage in the timing case cover channels oil into the oil pump. Pressure is developed when oil is driven between the gears and pump body.

The oil is forced from the pump through a passage in the oil pump cover to the oil filter (fig. 1B-5).

The oil passes through the filtering elements and to an outlet passage in the oil pump cover. From the oil pump cover passage, the oil enters an adjoining passage in the timing case cover and then is channeled into a gallery which extends up the left front of the cylinder block. This gallery channels oil directly to the right main oil gallery which intersects with a short passage that channels oil to the left main oil gallery.

The left and right main oil galleries extend the length of the cylinder block. The left oil gallery channels oil to each hydraulic tappet on the left bank. The right oil gallery channels oil to each hydraulic tappet on the right bank. In addition, five passages extend down from the right oil gallery to each camshaft bearing and on to each upper main bearing insert. The crankshaft is drilled to allow oil to flow from each main journal to adjacent connecting rod journals. A squirt hole in each connecting rod bearing cap distributes oil to the cylinder walls, pistons and piston pins as the crankshaft rotates.

A small passage within the front camshaft bearing journal channels oil through the camshaft sprocket to the timing chain cover area where the chain and sprockets throw off oil to lubricate the distributor gears and fuel pump eccentric. This oil returns to the oil pan by passing under the front main bearing cap.

The oil supply for the rocker arm assemblies is metered through the hydraulic valve tappets and routed through hollow push rods to a hole in the push rod end of the corresponding rocker arm. This oil lubricates the valve train, then returns to the oil pan through channels at both ends of the cylinder head (fig. 1B-6).

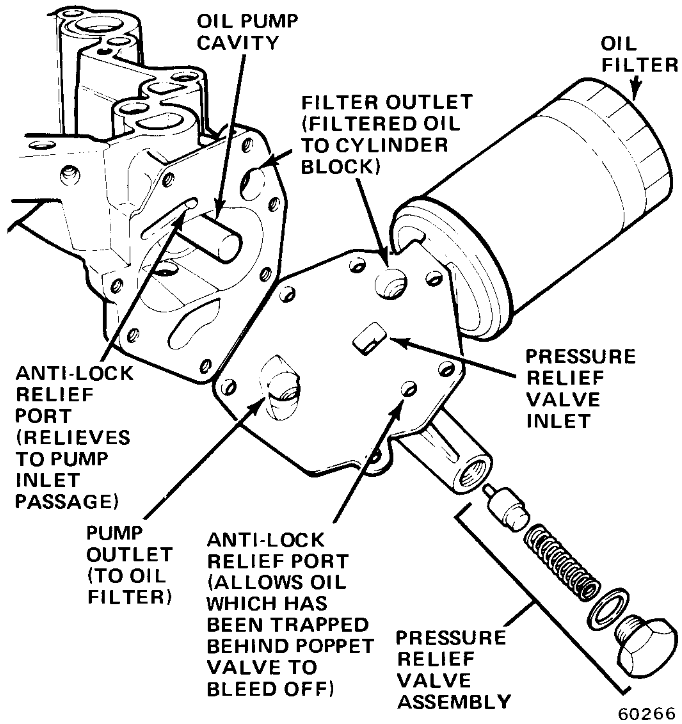

Fig. 1B-5 Oil Pump Passages

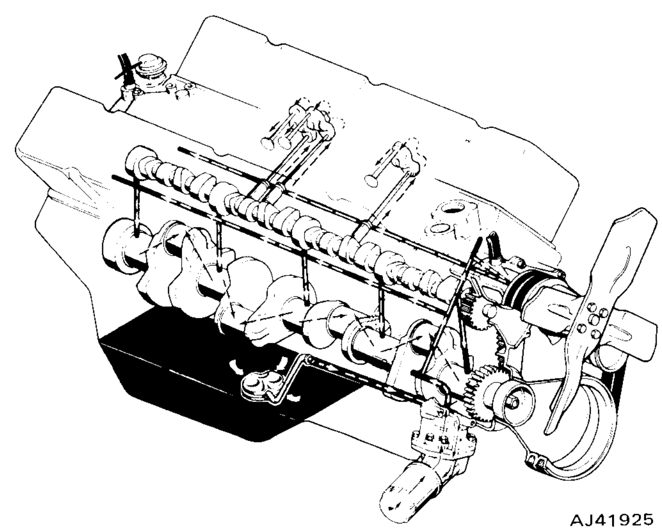

Fig. 1B-6 Lubrication System

ENGINE MOUNTING

Resilient rubber mounting cushions support the engine and transmission at three points. A cushion is located at each side on the centerline of the engine with the rear supported by a cushion between the transmission extension housing and the rear support crossmember (fig. 1B-7).

Removal or replacement of any cushion may be accomplished by supporting the weight of the engine or transmission in the area of the cushion.

If necessary to remove the front engine mounts, an engine holding fixture may be fabricated as illustrated in figure 1B-8.

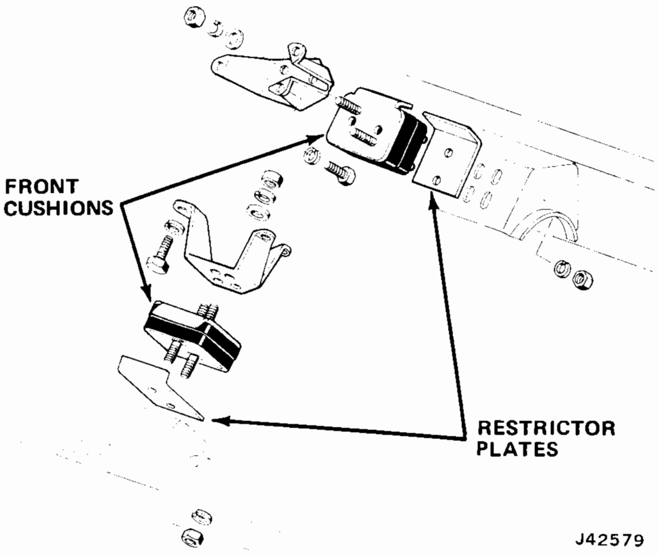

Fig. 1B-7 Typical Engine Mounting—V-8 Engine

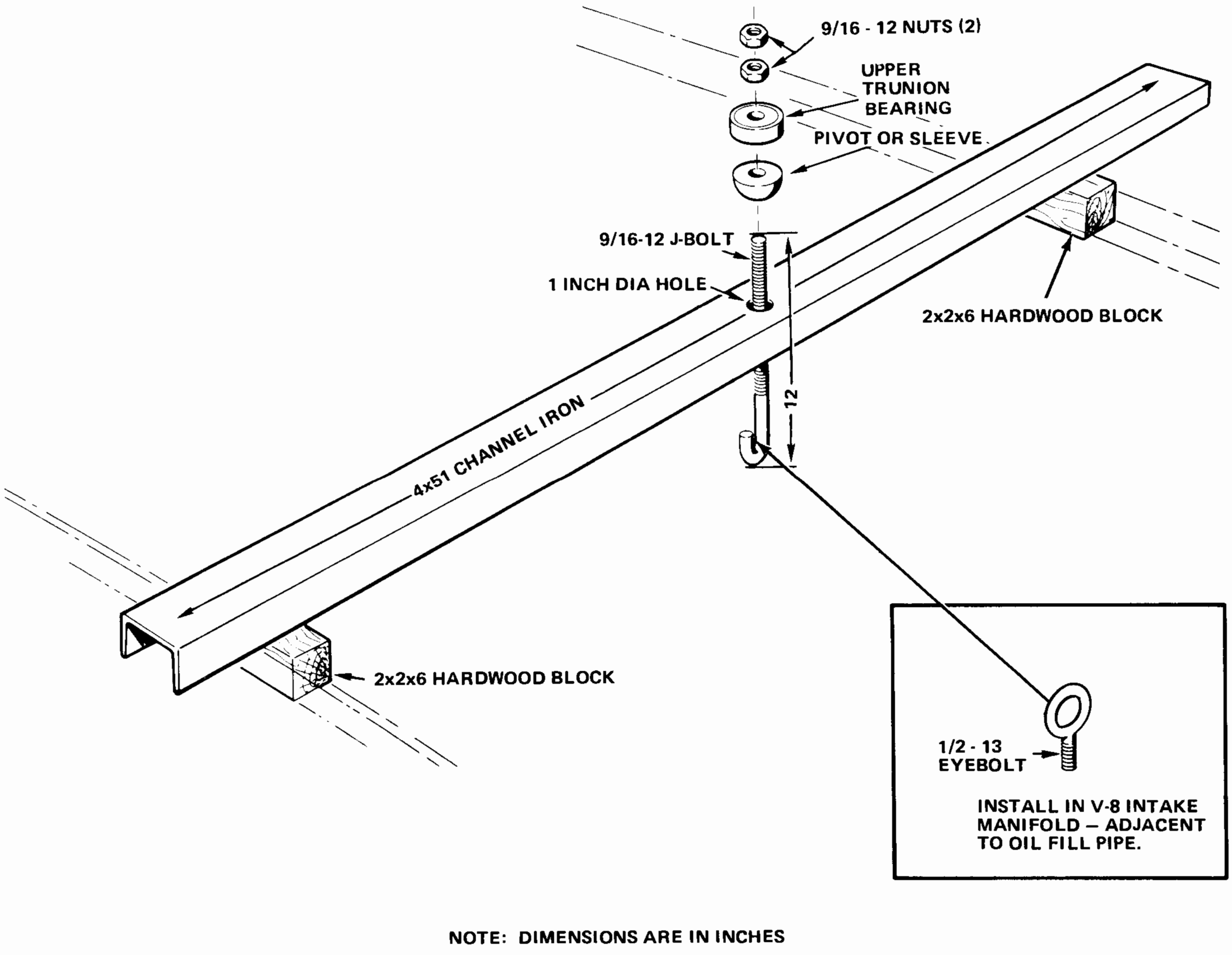

Fig. 1B-8 Engine Holding Fixture

Service Diagnosis

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS	(1) Fuel pump gasket broken or improperly seated.	(1) Replace gasket.
	(2) Cylinder head cover gasket broken or improperly seated.	(2) Replace gasket; check cylinder head cover gasket flange and cylinder head gasket surface for distortion.
	(3) Oil filter gasket broken or improperly seated.	(3) Replace oil filter.
	(4) Oil pan side gasket broken or improperly seated.	(4) Replace gasket; check oil pan gasket flange for distortion.
	(5) Oil pan front oil seal broken or improperly seated.	(5) Replace seal; check timing case cover and oil pan seal flange for distortion.
	(6) Oil pan rear oil seal broken or improperly seated.	(6) Replace seal; check oil pan rear oil seal flange; check rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove.
	(7) Timing case cover oil seal broken or improperly seated.	(7) Replace seal.
	(8) Oil pan drain plug loose or stripped threads.	(8) Repair as necessary and tighten.
	(9) Rear oil gallery plug loose.	(9) Use appropriate sealant on gallery plug and tighten.
	(10) Rear camshaft plug loose or improperly seated.	(10) Seat camshaft plug or replace and seal, as necessary.
	(11) Porosity in crankshaft pilot bushing hole.	(11) Seal with RTV Silicone and core plug or replace crankshaft as necessary.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high.	(1) Lower oil level to specifications.
	(2) Oil too thin.	(2) Replace with specified oil.
	(3) Valve stem oil deflectors are damaged, missing, or incorrect type.	(3) Replace valve stem oil deflectors.
	(4) Valve stems or valve guides worn.	(4) Check stem-to-guide clearance and repair as necessary.
	(5) Piston rings broken, missing.	(5) Replace missing or broken rings.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
EXCESSIVE OIL CONSUMPTION (Continued)	(6) Incorrect piston ring gap.	(6) Check ring gap, repair as necessary.
	(7) Piston rings sticking or excessively loose in grooves.	(7) Check ring side clearance, repair as necessary.
	(8) Compression rings installed upside down.	(8) Remove glaze from cylinder wall and replace rings.
	(9) Cylinder walls worn, scored, or glazed.	(9) Remove glaze or rebore cylinders as necessary.
	(10) Piston ring gaps not staggered.	(10) Remove glaze, replace rings, and stagger ring gaps.
	(11) Blocked or restricted PCV valve or hose.	(11) Inspect hose, flow test PCV, and repair or replace as necessary.
	(12) Excessive main or connecting rod bearing clearance.	(12) Check bearing clearance, repair as necessary.
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Section 3, Oil Pressure Gauge and Sending Unit Test.
	(3) Oil pump malfunction.	(3) Refer to Oil Pump.
	(4) Oil pressure relief valve sticking.	(4) Remove and inspect oil pressure relief valve assembly.
	(5) Oil passages on pressure side of pump obstructed.	(5) Inspect oil passages for obstructions.
	(6) Oil pickup screen or tube obstructed.	(6) Inspect oil pickup for obstructions.
	(7) Loose oil pickup tube.	(7) Seal and tighten.
LOW OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Section 3, Oil Pressure Gauge and Sending Unit Test.
	(3) Oil excessively thin due to dilution, poor quality, or improper grade.	(3) Drain and refill crankcase with recommended oil.
	(4) Oil pressure relief spring weak or sticking.	(4) Remove and inspect oil pressure relief valve assembly.

60547B

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
LOW OIL PRESSURE (Continued)	(5) Oil pickup tube and screen assembly has restriction or air leak.	(5) Remove and inspect oil pickup tube and screen assembly. (Fill pickup with lacquer thinner to find leaks.)
	(6) Oil pump malfunctioning.	(6) Inspect and check clearances. Refer to Oil Pump.
	(7) Excessive main, rod, or camshaft bearing clearance.	(7) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper grade oil.	(1) Drain and refill crankcase with correct grade oil.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Section 3, Oil Pressure Gauge and Sending Unit Test.
	(3) Oil pressure relief valve sticking closed.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Pressure relief passage or anti-lock port restricted.	(4) Check for restriction in anti-lock port and repair as necessary.
MAIN BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Main bearing clearance excessive.	(2) Check main bearing clearance, repair as necessary. Make certain all upper inserts are installed.
	(3) Crankshaft end play excessive.	(3) Check end play, repair as necessary.
	(4) Loose flywheel or torque converter.	(4) Tighten flywheel or converter attaching bolts.
	(5) Loose or damaged vibration damper.	(5) Repair as necessary.
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Bearing clearance excessive or bearing missing.	(2) Check clearance, repair as necessary.
	(3) Crankshaft connecting rod journal out-of-round.	(3) Check journal measurements, repair or replace as necessary.
	(4) Misaligned connecting rod.	(4) Repair as necessary.
	(5) Connecting rod bolts not tightened to proper torque.	(5) Tighten bolts to specified torque.

60547C

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive.	(1) Check clearance, repair as necessary.
	(2) Cylinder walls excessively tapered or out-of-round.	(2) Check cylinder wall measurements, repair as necessary.
	(3) Piston ring broken.	(3) Replace ring.
	(4) Loose or seized piston pin.	(4) Check piston-to-pin clearance, repair as necessary.
	(5) Connecting rods misaligned.	(5) Check rod alignment, repair as necessary.
	(6) Piston ring side clearance excessively loose or tight.	(6) Check ring side clearance, repair as necessary.
	(7) Carbon build-up on piston is excessive.	(7) Clean carbon from piston.
VALVE TRAIN NOISE NOTE: A clicking noise, upon starting the engine, reducing in level and disappearing after a short period of time is normal. This noise is due to a slight oil leak-down condition caused by valve spring pressure exerted on the tappets.	(1) Insufficient oil supply.	(1) Check for: (a) Low oil level. (b) Low oil pressure. (c) Wrong hydraulic tappet. (d) Plugged oil gallery in block. (e) Plugged pushrod.
	(2) Push rods worn, bent or rubbing against cylinder head.	(2) Replace worn or bent push rods. Repair cylinder head as necessary.
	(3) Rocker arms or bridged pivots worn.	(3) Replace worn rocker arms or pivots.
	(4) Dirt or chips in hydraulic tappets.	(4) Clean tappets.
	(5) Excessive tappet leak-down.	(5) Replace valve tappet.
	(6) Tappet face worn.	(6) Replace tappet; check corresponding cam lobe for wear.
	(7) Broken or cocked valve springs.	(7) Properly seat cocked springs; replace broken springs.
	(8) Stem-to-guide clearance excessive	(8) Check stem-to-guide clearance, repair as necessary.
	(9) Valve bent.	(9) Replace valve.
	(10) Loose rocker arms.	(10) Tighten capscrews to specified torque.
	(11) Valve seat runout excessive.	(11) Regrind valve seat/valve.

60547D

Cylinder Leakage Test Diagnosis

Condition	Possible Cause	Correction
AIR ESCAPES THROUGH CARBURETOR	(1) Intake Valve leaks.	(1) Refer to Valve Reconditioning under Cylinder Head Reconditioning.
AIR ESCAPES THROUGH TAILPIPE	(2) Exhaust Valve leaks.	(2) Refer to Valve Reconditioning under Cylinder Head Reconditioning.
AIR ESCAPES THROUGH RADIATOR	(3) Head Gasket leaks or crack in cylinder block.	(3) Remove cylinder head and inspect.
MORE THAN 25% LEAKAGE ON ADJACENT CYLINDER	(4) Head gasket leaks or crack in cylinder block or head between adjacent cylinders.	(4) Remove cylinder head and inspect.
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	(5) Stuck or broken piston ring(s); cracked piston; worn rings and/or cylinder wall.	(5) Inspect for broken ring(s) or piston. Measure ring gap and cylinder diameter, taper and out-of-round.

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CYLINDER LEAKAGE TEST

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance or rough idle is caused by combustion chamber leakage. A compression test alone may not show this fault. The cylinder leakage test provides an accurate means of testing engine condition. Cylinder leakage testing will point out exhaust and intake valve leaks, leaks between cylinders or into the water jacket, or other causes of compression loss.

(1) Check coolant level and fill as required. Do not install radiator cap.

(2) Start and run engine until it reaches normal operating temperature.

(3) Remove spark plugs.

(4) Remove oil filler cap.

(5) Remove air cleaner.

(6) Set carburetor fast idle speed screw on top of fast idle cam.

(7) Calibrate tester according to instructions of manufacturer.

NOTE: *Shop air source for testing should maintain 70 psi minimum and 200 psi maximum (80 psi recommended).*

(8) Perform test procedure on each cylinder according to tester manufacturer's instructions.

NOTE: *While testing, listen for air escaping through carburetor, tailpipe, or oil filler cap opening. Check for bubbles in radiator coolant.*

(9) All gauge indications should be even with no more than 25% leakage. For example: at 80 psi input pressure, a minimum of 60 psi should be maintained in the cylinder. Refer to the following leakage diagnosis chart.

ENGINE REMOVAL

The engine is removed without the transmission and bell housing.

(1) On Cherokee, Wagoneer, and Truck models, the hood must be removed. Mark hinge locations at hood panel for alignment during installation. Remove hood from hinges.

(2) Remove air cleaner assembly.

(3) Drain cooling system and disconnect upper and lower radiator hoses.

(4) If equipped with automatic transmission, disconnect cooler lines from radiator and engine assembly.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate the shroud from the radiator to facilitate removal and installation of the radiator and engine fan.*

(5) Remove radiator.

(6) Remove radiator fan. If equipped with power steering, remove fluid from pump reservoir and disconnect hoses.

(7) If equipped with air conditioning, turn both service valves clockwise to the front seated position. Bleed compressor refrigerant charge by slowly loosening service valve fittings.

(8) Disconnect condenser and evaporator lines from compressor.

(9) Disconnect receiver outlet at the disconnect coupling.

(10) Remove condenser and receiver assembly.

(11) Remove Cruise Command vacuum servo bellows and mounting bracket as an assembly (if equipped).

(12) On Cherokee, Wagoneer, and Truck models remove battery.

(13) Disconnect the following wires (if equipped):

- Starter motor
- Coil positive terminal
- Temperature gauge sending unit
- Alternator
- Oil pressure gauge sending unit
- Solenoid vacuum valve
- Throttle stop solenoid

(14) Disconnect the following lines (if equipped):

- Fuel line from tank at fuel pump
- Vacuum line at power brake unit.
- Vacuum line for heater damper doors at intake manifold

(15) If equipped with automatic transmission, disconnect

- Fuel return line at fuel filter
- Fuel bowl pressure vent line at carburetor the transmission filler tube bracket from right cylinder head. Do not remove filler tube from the transmission.

(16) Remove both engine front support cushion-to-frame retaining nuts.

(17) Support weight of engine with a lifting device.

(18) On CJ models, remove left front support cushion and bracket from cylinder block.

(19) On CJ models equipped with manual transmission, remove transfer case shift lever boot, floormat (if equipped) and transmission access cover.

(20) On vehicles equipped with automatic transmissions, remove upper bolts securing the transmission bell housing to engine.
If equipped with manual transmission, remove upper bolts securing clutch housing to engine.

(21) Disconnect exhaust pipes at exhaust manifolds and support bracket.

(22) Remove starter motor.

(23) Support transmission with a floor jack.

(24) If equipped with automatic transmission, remove engine adapter plate inspection cover. Mark assembled position of converter and flex plate and remove the converter-to-flex plate capscrews.

(25) Remove remaining bolts securing transmission bell housing to engine.
If equipped with manual transmission, remove clutch housing lower cover and remaining bolts securing clutch housing to engine.

(26) Remove engine by pulling upward and forward.

CAUTION: *If equipped with power brakes, care must be taken to avoid damaging the power unit while removing the system.*

ENGINE INSTALLATION

(1) Lower engine slowly into engine compartment and align with transmission bell housing (automatic transmission) or clutch housing (manual transmission). On manual transmissions, make certain clutch shaft is aligned properly with splines of clutch driven plate.

(2) Install the transmission bell housing-to-engine bolts (automatic transmission) or clutch housing (manual transmission). Tighten bolts to specified torque (automatic transmission: 28 foot-pounds; manual transmission: 27 foot-pounds).

(3) Remove floor jack which was used to support transmission.

(4) If equipped with automatic transmission, align marks previously made on converter and flex plate, install converter-to-flex plate capscrews and tighten to specified torque.

(5) Install inspection cover (automatic transmission) or the clutch housing lower cover (manual transmission).

(6) Install starter motor.

(7) On CJ models, install left front support cushion and bracket to cylinder block. Tighten bolts to 28 foot-pounds torque.

(8) Lower engine onto frame supports, and remove the lifting device.

(9) Install front support cushion retaining nuts. Tighten nuts to 33 foot-pounds torque.

(10) Connect exhaust pipes at exhaust manifolds and support bracket.

(11) If equipped with automatic transmission, connect transmission filler tube bracket to right cylinder head.

(12) Install battery if removed.

(13) Install Cruise Command vacuum servo bellows and mounting bracket, if removed.

(14) Connect all wires, lines, linkage, and hoses previously disconnected from engine.

(15) If removed, install air conditioning condenser and receiver assembly.

(16) Connect receiver outlet to the disconnect coupling. Connect condenser and evaporator lines to compressor.

(17) Purge compressor of air as outlined in Section 13A—Air Conditioning.

CAUTION: *Both service valves must be open before the air conditioning system is operated.*

(18) If equipped with power steering, connect hoses and fill pump reservoir to specified level.

(19) Install radiator fan and tighten the retaining bolts to 18 foot-pounds torque.

(20) Install radiator and connect upper and lower hoses. If equipped with automatic transmission, connect cooler lines.

(21) Fill cooling system to specified level.

(22) Install air cleaner assembly.

(23) Start engine. Check all connections for leaks. Stop engine.

(24) If removed, install and align hood assembly.

(25) If removed, install transmission access cover, floormat, and transfer case shift lever boot.

CYLINDER HEAD COVER

All V-8 engines use a formed-in-place RTV (room temperature vulcanizing) silicone cylinder head cover gasket.

Removal

(1) Remove air cleaner assembly.

(2) Disconnect air delivery hose at air injection manifold (if equipped).

(3) Left Side:

(a) Disconnect power brake vacuum hose at intake manifold.

(b) Disconnect throttle stop solenoid wire (if equipped).

(4) Right side:

(a) Remove Thermostatically Controlled Air Cleaner (TAC) hot air hose.

(b) Remove heater hose from choke cover clamp.

(5) Disconnect spark plug wires and remove plastic wire separator from cyinder head cover bracket.

(6) Remove retaining screws and washers, separate cylinder head cover from cylinder head.

Installation

(1) Inspection for bent or cracked cover and repair as required.

(2) Clean cylinder head cover and cylinder head gasket surface of old gasket material.

(3) Apply a bead of Jeep Gasket-in-a-Tube, or equivalent, to cylinder head and cylinder head cover gasket surface.

NOTE: *If silicone gasket has not been badly damaged during removal, it is not necessary to clean and reseal cover completely. Use Jeep Gasket-in-a-Tube or equivalent, to repair small gaps in silicone gasket.*

(4) Position cylinder head cover on engine.

(5) Install retaining screws and tighten to 50 inch-pounds torque.

NOTE: *Do not overtighten screws as this will crack cylinder head covers and form gaps in sealer.*

(6) Connect spark plug wires and install plastic wire separator to cylinder head cover bracket.

(7) Right Side:

(a) Install heater hose to choke cover clamp.

(b) Install TAC hot air hose.

(8) Left Side:

(a) Connect power brake vacuum hose at intake manifold.

(b) Connect throttle stop solenoid wire (if equipped).

(9) Connect air delivery hose to air injection manifold.

(10) Install air cleaner assembly.

ROCKER ARM ASSEMBLY

The intake and exhaust rocker arms of each cylinder pivot on a bridged pivot assembly which is secured to the cylinder head by two capscrews as shown in figure 1B-9. The bridged pivot maintains correct rocker arm-to-valve tip alignment.

The push rods are hollow and serve as oil galleries to lubricate the rocker arm assemblies.

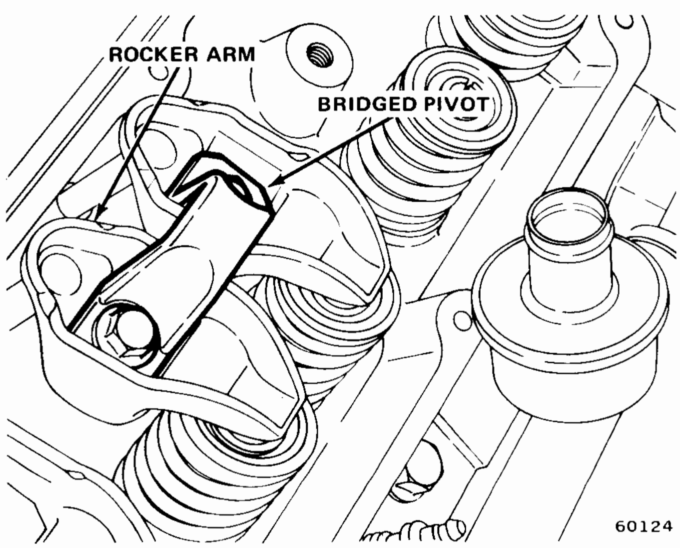

Fig. 1B-9 Rocker Arm Assembly—V-8 Engine

Removal

(1) Remove cylinder head cover.

NOTE: *Keep all parts in the same order and position as removed from engine.*

(2) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.
(3) Remove push rods.

Cleaning and Inspection

Clean all parts with a good cleaning solvent and use compressed air to clean the oil passages in the rocker arms and push rods.

Inspect the pivot surface of each rocker and pivot assembly, replace any part which is scuffed, pitted, or excessively worn. Inspect the valve stem contact surface of each rocker arm and replace any rocker arm which is deeply pitted.

Inspect each push rod end for scuffing or excessive wear and replace as required. It is not normal to find a wear pattern along the length of the push rod. Check the cylinder head for obstruction if this condition exists.

NOTE: *If a push rod is excessively worn due to lack of oil, the push rod as well as the matching hydraulic valve tappet and rocker arm must be replaced.*

Installation

(1) Install push rods. **Make certain the bottom end of each rod is centered in the plunger cap of hydraulic valve tappet.**
(2) Install rocker arms and bridge pivot assemblies.
(3) Install capscrews, tightening each capscrew for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.
(4) Reseal and install cylinder head cover.
(5) Install retaining screws and washers. Tighten screws to 50 inch-pounds torque.

VALVE SPRING/VALVE STEM OIL DEFLECTOR

Nylon valve stem oil deflectors are installed on each valve stem to prevent the oil used for rocker arm lubrication from entering the combustion chamber through the valve guides. Replace oil deflectors whenever valve service is performed or if the deflectors become deteriorated.

Each valve spring is held in place on the valve stem by a retainer and a set of valve locks. Remove valve locks by compressing the valve spring.

Valve springs and oil deflectors can be removed without removing the cylinder head. Refer to Cylinder Head Reconditioning for removal procedure with the cylinder head removed.

Removal

(1) Remove cylinder head cover.
(2) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.

NOTE: *Keep rocker arm assemblies and push rods in the same order and position as removed.*

(3) Remove spark plug from cylinder which requires valve spring or oil deflector removal.
(4) Install a 14mm (thread size) air adapter in spark plug hole.

NOTE: *An adapter can be fabricated from the body of a spark plug from which the porcelain has been removed and an air hose fitting has been welded.*

(5) Connect air hose to adapter and maintain at least 90 psi in the cylinder to hold valves against their seats.
(6) Use Valve Spring Remover and Installer Tools J-52534-1, J-52534-5, and J22534-5 to compress the valve spring and allow removal of the valve locks (fig. 1B-10).

Fig. 1B-10 Valve Spring Removal

(7) Remove valve spring and retainer from cylinder head.

(8) Remove oil deflector.

Valve Spring Tension Test

Use Valve Spring Tester J-8056 to test each removed valve spring for the specified tension values, if required (fig. 1B-11). Replace all valve springs which are not within specifications. Replace springs which bind due to warpage.

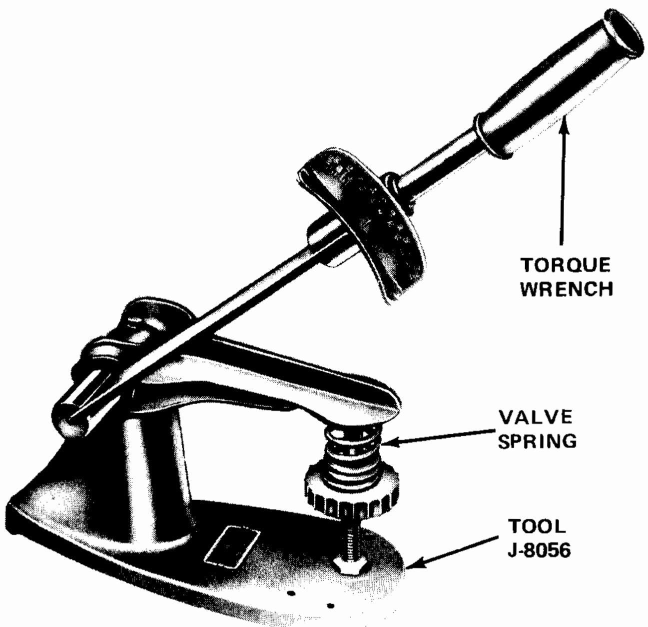

Fig. 1B-11 Valve Spring Tester

Installation

(1) Use 7/16-inch deep socket and hammer to gently tap valve stem oil deflector onto valve stem.

IMPORTANT: *A close-coiled valve spring is used on all valves. The close-coiled end, identified by paint stripes, must face the cylinder head when installing the springs.*

(2) Install valve spring and retainer.

(3) Compress valve spring with Valve Spring Remover and Installer Tools J-22534-1, J22534-4, and J-22534-5.

(4) Insert valve keepers.

(5) Release spring tension and remove tool.

(6) Tap valve spring from side to side with a light hammer to be certain spring is seated properly at cylinder head.

(7) Disconnect air hose and remove air adapter from spark plug hole.

(8) Install spark plug.

(9) Install push rods making certain bottom end of each rod is centered in plunger cap of hydraulic valve tappet.

(10) Install rocker arms and bridged pivot assemblies. Install capscrews, tightening each capscrew for each bridge assembly a turn at a time, to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.

(11) Reseal and install cylinder head cover.

(12) Install retaining screws and washers. Tighten screws to 50 inch-pounds torque.

INTAKE MANIFOLD

The cast iron intake manifold is designed to enclose and seal the tappet area between the two cylinder heads. A one-piece metal gasket, used to seal the intake manifold to the cylinder heads and block, also serves as an oil splash baffle.

The intake manifold contains coolant passages, a crankcase ventilator passage, and an exhaust crossover passage. Passages are also incorporated within the intake manifold for the Exhaust Gas Recirculation (EGR) system.

Induction system passages uniformly distribute the fuel and air mixture to the combustion chamber of each cylinder. The left bore of the carburetor supplies a fuel-air mixture through passages in the intake manifold to the No. 1, 7, 4 and 6 cylinder intake ports and the right bore supplies the No. 3, 5, 2, and 8 ports.

Removal

(1) Drain coolant from radiator and cylinder block into suitable, clean container.

(2) Remove air cleaner assembly.

(3) Disconnect ignition wires.

(4) Remove ignition wire plastic separators from cylinder head cover brackets.

(5) Disconnect radiator upper hose and bypass hose from intake manifold.

(6) Disconnect and lay aside wire from temperature gauge sending unit.

(7) Disconnect ignition coil bracket and lay coil and bracket assembly aside.

(8) Remove TCS solenoid vacuum valve and solenoid control switch (if equipped) from right side cylinder head cover.

(9) Disconnect heater hose from rear of manifold.

(10) Disconnect all hoses, lines, and wires from the carburetor.

(11) Disconnect accelerator linkage and throttle valve linkage (if equipped) from carburetor and intake manifold.

(12) Disconnect air delivery hoses at the air injection manifold.

(13) Disconnect diverter valve from air pump output hose and lay valve and delivery hoses aside.

(14) Remove carburetor.

(15) Remove intake manifold, metal gasket and end seals.

(16) Clean mating surfaces of engine block and intake manifold.

Installation

NOTE: *When replacing intake manifold, transfer all components such as EGR valve, EGR CTO, thermostat/housing and temperature gauge sending unit from previous manifold. Clean and tighten as required.*

(1) Apply Perfect Seal compound, or equivalent, to both sides of new manifold gasket.

(2) Position gasket by aligning two rear locators at the rear of the cylinder head; then, while holding the rear locators in place, align the two front locators.

(3) Install the two end seals and apply Permatex No. 2, or equivalent, to seal ends.

(4) Install intake manifold and retaining bolts, making sure all bolts are started before tightening. Tighten bolts to 43 foot-pounds torque.

(5) Install carburetor.Tighten nuts to 15 foot-pounds torque.

(6) Install diverter valve and connect air pump output hose.

(7) Connect air delivery hoses to air injection manifolds.

(8) Connect all previously disconnected hoses, lines, linkages, and wires to intake manifold and carburetor.

(9) Install TCS solenoid vacuum valve and solenoid control switch (if equipped) to right side cylinder head cover.

(10) Install ignition coil and bracket assembly.

(11) Connect radiator upper hose and bypass hose.

(12) Install ignition wire plastic separators to cylinder head cover brackets.

(13) Connect ignition wires.

(14) Refill radiator and check coolant level.

(15) Install air cleaner assembly.

EXHAUST MANIFOLD

The swept-flow design of the cast iron manifold provides efficient removal of exhaust gases and minimizes cylinder back-pressure. The mating surfaces of the exhaust manifold and the cylinder head are machined smooth to eliminate the need for a gasket.

All V-8 engines are equipped with Air Guard Systems and have air injection manifolds attached at the No. 1, 3, and 5 exhaust ports of the left exhaust manifold and the No. 2, 4, 6, and 8 of the right exhaust manifold. Refer to the Emission Control Section for description of the entire Air Guard System.

Removal

(1) Disconnect ignition wires.

(2) Disconnect air delivery hose at the injection manifold.

(3) Remove air injection manifold and injection tubes.

(4) Disconnect exhaust pipe at exhaust manifold.

(5) Remove exhaust manifold retaining bolts.

(6) Separate exhaust manifold from cylinder head.

Installation

(1) Place new gaskets on each air injection tube and install air injection manifold and injection tubes.

CAUTION: *Do not nick or scratch mating surfaces.*

(2) Clean mating surfaces of exhaust manifold and cylinder head.

(3) Install exhaust manifold and retaining bolts. Tighten bolts to 25 foot-pounds torque.

(4) Connect exhaust pipe using a new seal if required. Tighten nuts to 23 foot-pounds torque.

(5) Connect air delivery hose to air injection manifold.

(6) Connect ignition wires.

CYLINDER HEAD AND GASKET

Removal

(1) Drain cooling system and cylinder block.

(2) Remove cylinder head cover.

(3) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.

(4) Remove push rods.

NOTE: *Keep rocker arm assemblies and push rods in same order and position as removed.*

(5) Remove ignition wire and spark plugs.

(6) Remove intake manifold.

(7) Remove exhaust manifolds.

(8) Loosen all drive belts.

(9) Right side:

(a) If equipped with air conditioning, remove compressor mount bracket and battery negative cable from cylinder head.

(b) Disconnect alternator mounting bracket from cylinder head.

(10) Left side: Disconnect air pump and power steering mount bracket (if equipped) from cylinder head.

(11) Remove cylinder head retaining bolts.

(12) Remove cylinder head and gasket.

Cleaning and Inspection

Thoroughly clean the gasket surface of the cylinder head and block to remove all dirt and gasket cement.

Remove the carbon deposits from the combustion chambers and the top of each piston.

Use a straightedge and feeler gauge to check the flatness of the cylinder head and block mating surfaces.

Refer to Specifications for flatness tolerances.

NOTE: *Due to emission control requirements, cylinder heads or blocks which exceed specifications for flatness must be replaced. Milling is not recommended.*

If the cylinder head is to be replaced and the original valves reused, remove the valves and measure the stem diameter. Replace oversize valves. **Only standard size valves may be used with a service replacement head.**

If the original valves are standard size, remove all carbon buildup and reface the valves as outlined under Valve Refacing. Install the valves in the cylinder head using new valve stem oil deflectors. Transfer all attached components from the original head which are not included with the replacement head.

Installation

NOTE: *The 304 CID engine utilizes an aluminum coated embossed steel gasket and the 360 and 401 CID engines utilize an aluminum coated laminated steel and asbestos gasket. Retightening is not necessary with either gasket.*

(1) Apply an even coat of Perfect Seal sealing compound or equivalent to both sides of new head gasket.

NOTE: *Do not apply sealing compound on head and block surfaces or allow sealer to enter cylinder bores.*

(2) Position gasket on block with stamped word TOP facing upward.

(3) Install cylinder head and gaskets.

NOTE: *Wire brush the threads of bolts prior to installation as dirt will affect the torque readings.*

(4) Cylinder head capscrews must be tightened evenly to 80 foot-pounds torque following the sequence outlined in figure 1B-12; then, follow the sequence again and tighten screws to 110 foot-pounds torque.

(5) Left side: connect air pump mount bracket to cylinder head and power steering pump (if equipped).

(6) Right side:

(a) Connect alternator mounting bracket to cylinder head.

(b) Install air conditioning compressor mounting bracket (if equipped) and battery negative cable to cylinder head.

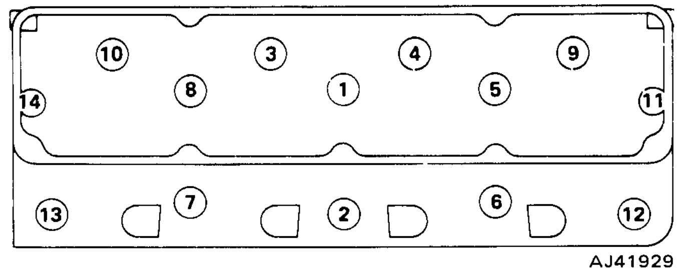

Fig. 1B-12 Cylinder Head Torque Sequence—V-8

(7) Adjust all drive belts to specified tension.

(8) Install exhaust manifold and tighten retaining bolts to 25 foot-pounds torque.

(9) Install intake manifold. Tighten manifold retaining bolts to 43 foot-pounds torque.

(10) Install all lines, hoses, linkage, and wires previously disconnected.

(11) Install push rods and rocker arm assemblies in the same order and position as removed.

(12) Install rocker arms and bridged pivot assemblies. Install capscrews, tightening each capscrew for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.

(13) Reseal and install cylinder head cover. Tighten retaining screws to 50 inch-pounds torque.

(14) Install spark plugs and connect ignition wires.

(15) Fill cooling system to specified level.

CYLINDER HEAD RECONDITIONING

The following procedures apply after the rocker arm has been removed from the engine.

Disassembly

(1) Compress each valve spring with C-clamp type spring compressor tool and remove valve locks and retainers.

(2) Release compressor and remove valve spring.

(3) Remove valve stem oil deflectors.

(4) Remove valves one at a time and place them in a rack in the same order as in cylinder head.

Cleaning and Inspection

Clean all carbon buildup from the combustion chambers, valve ports, valve stems, and heads.

Remove all dirt and gasket cement from the cylinder head gasket mating surface.

Inspect for cracks in the combustion chanbers and valve ports and in the gasket surface at each coolant passage.

Inspect for burned or cracked valve heads and scuffed valve stems. Replace any valve which is bent or scuffed along stem.

Reconditioning

Use a valve refacing machine to reface intake and exhaust valves to specified angle. After refacing, at least 1/32-inch margin must remain or the valve must be replaced. Examples of correct and incorrect valve refacing are shown in figure 1B-13.

Resurface and rechamfer the valve stem tip when worn. **Never remove more than 0.010 inch.**

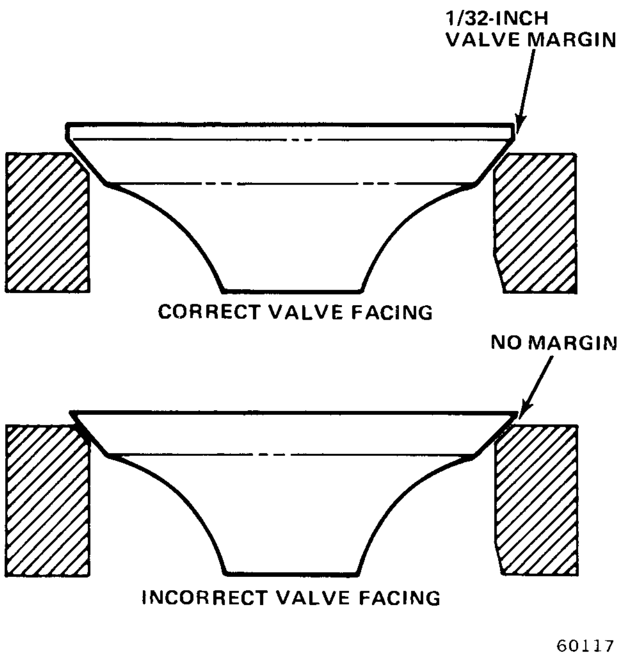

Fig. 1B-13 Valve Refacing

Valve Seat Refacing

Install a pilot of the correct size in the valve guide and reface the valve seat to the specified angle with a good dressed stone. Remove only enough metal to provide a smooth finish. This is especially important on the hardened exhaust valve seats. Use 15° and 60° tapered stones to obtain the specified seat widths when required. Maximum seat runout is 0.0025 inch (fig. 1B-14).

Valve Guides

The valve guides are an integral part of the cylinder head and are not replaceable. Therefore, when the stem-to-guide clearance is excessive, ream the valve guides to the next larger size so that proper clearance can be obtained. Oversize service valves are available in 0.003 inch, 0.015 inch and 0.030 inch.

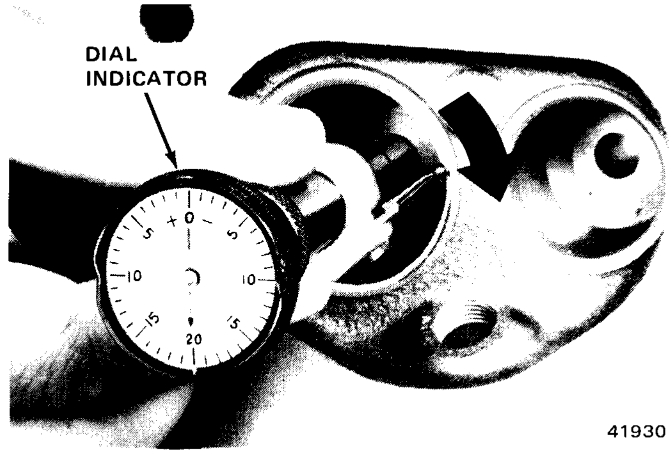

Fig. 1B-14 Valve Seat Runout

The following oversize valve guide reamers may be used:

Valve Guide Reamers

Reamer Tool Number	Size
J-6042-1	0.003 inch
J-6042-5	0.015 inch
J-6042-4	0.030 inch

60268

NOTE: *Ream guides in steps. Start with the 0.003-inch oversize reamer and progress to the size required.*

Valve-Stem-to-Guide Clearance

Valve-stem-to-guide clearance may be checked by either of two methods:

Preferred Method

(1) Mount a dial indicator adjacent to valve guide to be checked.

(2) Position valve slightly off its seat with valve stem pushed laterally away from dial indicator.

(3) Set dial indicator push rod on stem of valve near tip and set gauge to zero (fig. 1B-15).

(4) Read dial indicator while moving valve stem laterally toward dial indicator. Stem-to-guide clearance is indicated on gauge.

Alternate Method

NOTE: *Make certain the valve stem and guide bore are thoroughly cleaned before measuring.*

(1) Measure valve stem diameter with a caliper micrometer midway between valve head and tip.

(2) Select a pilot from a valve refacing kit which fits snugly in valve guide bore.

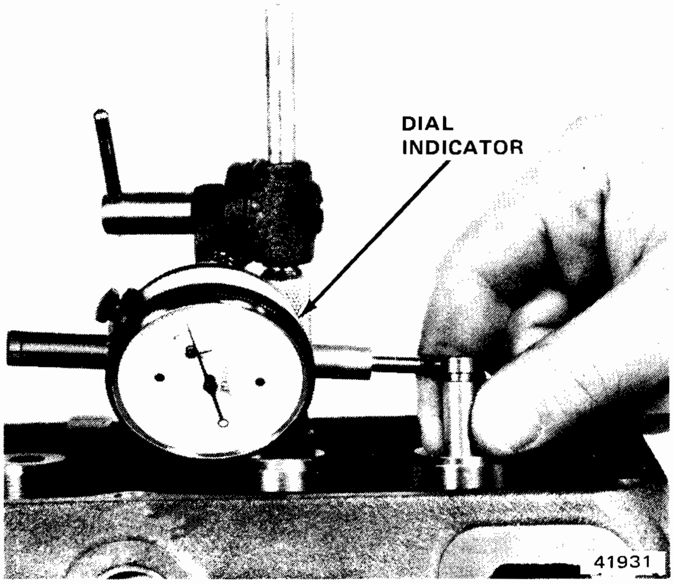

Fig. 1B-15 Valve-Stem-to-Guide Clearance Measurement

(3) Determine valve-stem-to-guide clearance by subtracting diameter of valve stem from size of the pilot selected.

Assembly

(1) Thoroughly clean valve stems and valve guide bores.
(2) Install each valve in the same valve guide from which it was removed.
(3) Install new valve stem oil deflector on each valve stem.
(4) Position each valve spring and retainer on cylinder head and compress the valve spring with compressor tool.
(5) Install valve locks and release tool.
(6) Tap each valve spring from side to side with a light hammer to set the spring properly at cylinder head.

HYDRAULIC VALVE TAPPETS

The hydraulic valve tappet consists of a body, plunger, metering disc, plunger cap, and lockring (fig. 1B-16).

The tappet operates in a guide bore which has an oil passage drilled into the adjoining oil gallery.

When the tappet is on the heel of the cam lobe, oil under pressure at the main oil gallery is admitted into the tappet through a hole in grooved portion of the tappet body. Oil flows into the plunger and through the check valve assembly maintaining the tappet fully charged (fig. 1B-17).

During the normal valve opening events the tappet leaks off oil. Contact with the cam lobe causes tappet body movement, closing the check valve and transmitting zero-lash movement of the push rod to open the intake or exhaust valve.

In addition, oil under pressure in the plunger also flows through the metering disc, plunger cap, and hollow push rod to the rocker arm assembly.

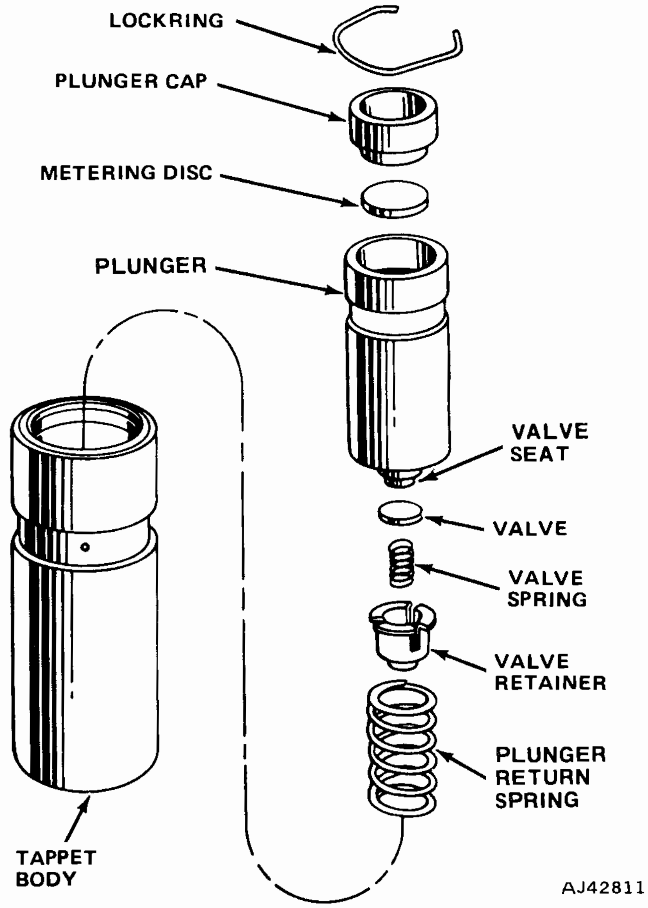

Fig. 1B-16 Typical Hydraulic Tappet Assembly

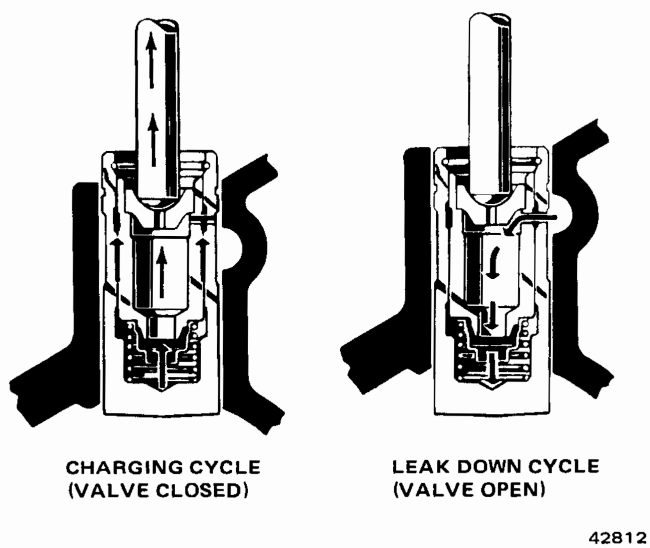

Fig. 1B-17 Hydraulic Tappet Operation Cycles

Removal

(1) Remove cylinder head cover.
(2) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.
(3) Remove push rods.

NOTE: *Keep rocker arm assemblies and push rods in the same order as removed.*

(4) Remove intake manifold.
(5) Remove tappet from guide bore in engine block.

Cleaning and Inspection

Release lockring.
Remove plunger cap, metering disc, plunger assembly, and plunger return spring from tappet body.

NOTE: *Keep the tappets and all components in the same order as removed.*

Clean all components of the hydraulic tappet assembly in a good cleaning solvent to remove all varnish or gum deposits.

A visual inspection of each tappet assembly is required.

The inspection should include checking for signs of scuffing on the barrel and face of the tappet. Inspect tappet face for wear using a straightedge across the tappet face. If the tappet face is concave, the corresponding lobe on the camshaft is worn and the replacement of the camshaft and tappets is necessary.

If any components of a tappet assembly are noticeably worn or damaged, replace the entire assembly.

Install plunger return spring, plunger, metering disc, and plunger cap in tappet body.

Using a push rod on plunger cap, compress plunger assembly and install lockring.

Hydraulic Tappet Leak-Down Test

After cleaning and inspection, the tappet must be leak-down tested to ensure its zero-lash operating ability. Use Tool J-5790 to test tappet leak-down accurately (fig. 1B-18).

(1) Swing weighted arm of tester away from ram of tester.
(2) Place 0.312 to 0.313 inch diameter ball bearing on plunger cap of tappet.
(3) Lift ram and place tappet with ball bearing inside tester cup.
(4) Lower ram, then adjust nose of ram until it contacts ball bearing.

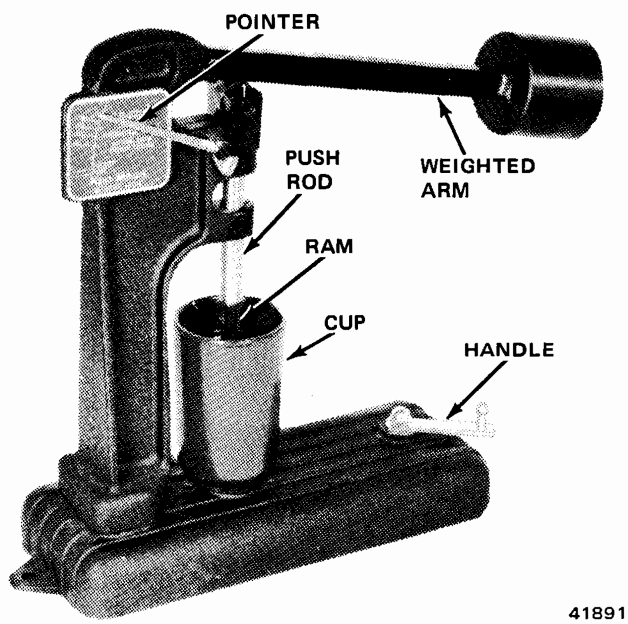

Fig. 1B-18 Hydraulic Tappet Leak-Down Tester J-5790

(5) Fill tester cup with Valve Tappet Test Oil J-5268 until tappet is completely covered.
(6) Swing weighted arm onto ram and pump up and down on tappet to remove air. When air bubbles cease, swing weighted arm away and allow plunger to rise to normal position.
(7) Adjust nose of ram to align pointer with SET mark on scale of tester and tighten hex nut.
(8) Slowly swing weighted arm onto ram. Rotate cup by turning handle at base of tester clockwise one revolution every two seconds.
(9) Time leak-down from instant pointer aligns with START mark on scale until pointer aligns with 0.125 inch mark.
(10) A good tappet will take 20 to 110 seconds to leak-down. Discard tappets outside this range.

NOTE: *Do not charge the tappet assemblies with engine oil as they will charge themselves within three to eight minutes of engine operation.*

Installation

(1) Dip each tappet assembly in Jeep Engine Oil Supplement (EOS), or equivalent, and install tappet in same bore from which it was removed.
(2) Install push rods in the same order as removed.
(3) Install rocker arm and bridged pivot assemblies. Install capscrews, tightening each capscrew for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.
(4) Pour remaining EOS over entire valve train mechanism.

NOTE: *Do not drain the EOS from the engine for at least 1,000 miles or until the next scheduled oil change.*

(5) Install cylinder head cover and gasket. Tighten retaining screws to 50 inch-pounds torque.

(6) Install intake manifold and new gasket and end seals. Tighten manifold retaining bolts to 43 foot-pounds torque.

(7) Install all lines, hoses, linkage, and wires previously disconnected from intake manifold.

VIBRATION DAMPER

The vibration damper is balanced independently and then rebalanced as part of the complete crankshaft assembly.

Do not attempt to duplicate original damper balance holes when installing a service replacement. The vibration damper is not repairable and is serviced only as a complete assembly.

Removal

(1) Loosen alternator drive belt.

(2) Loosen air conditioning drive belt (if equipped) and move aside.

(3) Loosen power steering drive belt (if equipped) and move aside.

(4) Remove damper drive pulley retaining bolts and damper pulley from vibration damper.

(5) Remove damper retaining bolt.

(6) Use Vibration Damper Removal Tool J-21791 to remove damper from crankshaft as shown in figure 1B-19.

Installation

(1) Apply a light film of engine oil to seal contacting surface of vibration damper.

(2) Align key slot of vibration damper with crankshaft.

(3) Tap damper onto crankshaft with hammer.

(4) Install damper retaining bolt and tighten to 55 foot-pounds torque.

(5) Install damper pulley and retaining bolts and **lockwashers**. Tighten bolts to 23 foot-pounds torque.

(6) Install drive belts and tighten to specified tension.

TIMING CASE COVER

The timing case cover is die-cast aluminum with a crankshaft oil seal to prevent oil leakage at the vibration damper hub (fig. 1B-20). The oil seal is installed from the back side of the timing case cover; therefore, it is necessary to remove the cover whenever oil seal replacement is required.

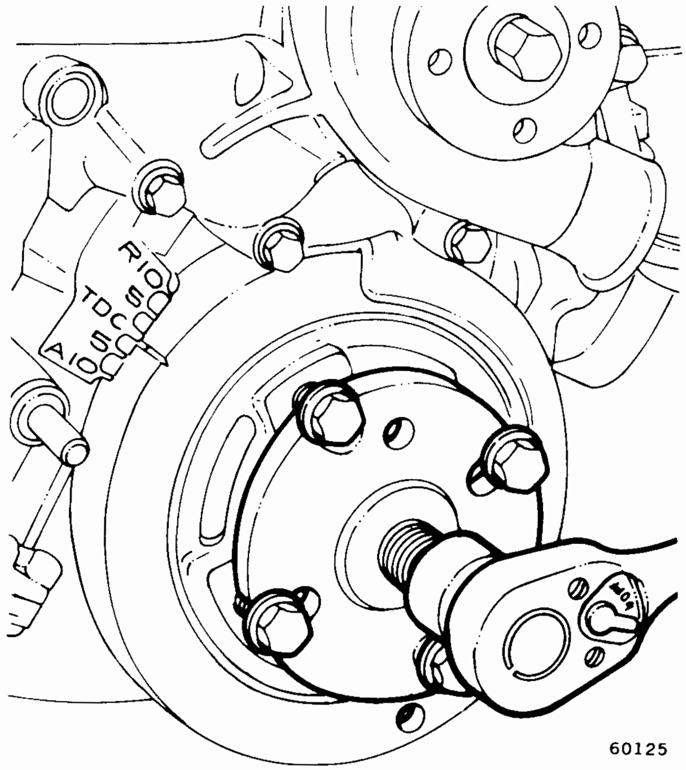

Fig. 1B-19 Vibration Damper Removal

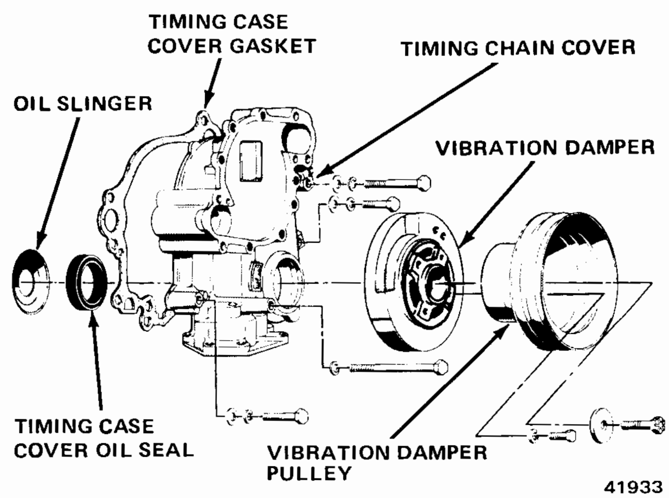

Fig. 1B-20 Timing Case Cover Assembly

A graduated scale cast into the cover is used for ignition timing. A hole is provided for checking ignition timing with a magnetic timing probe. Refer to Section 4A for ignition timing procedure and magnetic timing probe description.

The engine oil pump, oil passages and coolant passages are incorporated within the timing case cover casting. The timing case cover casting is also used to mount the fuel pump, distributor, and water pump.

Removal

(1) Drain cooling system and cylinder block.

(2) Disconnect radiator hoses and bypass hose.

(3) Remove all drive belts.

(4) Remove fan and spacer assembly.

(5) If equipped with air conditioning, remove compressor and bracket assembly from engine and move aside. **Do not disconnect the air conditioning hoses.**

(6) Remove alternator, alternator mounting bracket and back idler pulley as an assembly from engine.

(7) Disconnect heater hose at water pump.

(8) Remove power steering pump (if equipped) and air pump and mounting bracket as an assembly. **Do not disconnect power steering hoses.**

(9) Remove distributor cap and mark rotor and housing position.

(10) Remove distributor.

(11) Remove fuel pump.

(12) Remove vibration damper pulley and retaining bolts and lockwashers.

(13) Remove vibration damper.

(14) Remove two front oil pan bolts.

(15) Remove bolts which secure timing case cover to engine block.

NOTE: *The cover retaining bolts vary in length and must be installed in the same location as removed.*

(16) Remove cover by pulling forward until free of the locating dowel pins.

(17) Clean gasket surface of cover.

(18) Remove oil seal.

NOTE: *The oil seal always should be replaced whenever the timing case cover is removed. Refer to Oil Seal Replacement in this section.*

Installation

(1) Remove lower locating dowel pin from engine block.

NOTE: *The dowel pin is required for correct cover alignment and either must be reused or a replacement dowel installed after the cover is in position.*

(2) Use a sharp knife or razor blade to cut both sides of oil pan gasket flush with engine block.

(3) Using old gasket as a guide, trim a new gasket to correspond to the amount cut off at oil pan (fig. 1B-21).

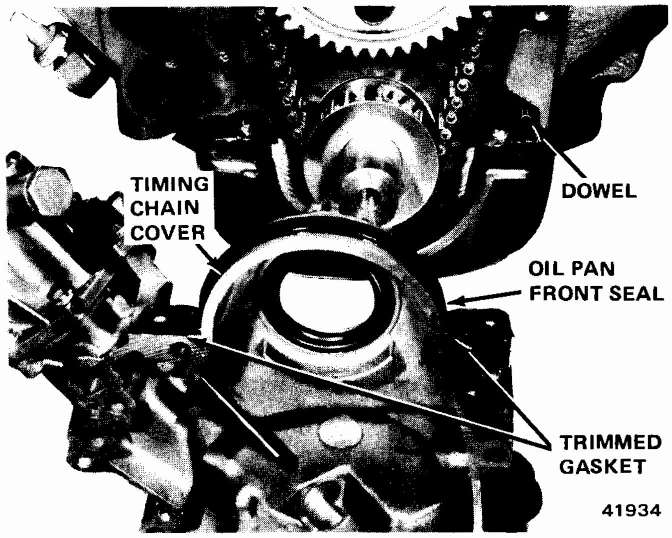

Fig. 1B-21 Oil Pan Front Seal Installation

(4) Apply sealer to both sides of new gasket and install gasket on timing case cover.

(5) Install new front oil pan seal.

(6) Align tongues of new oil pan gasket pieces with oil pan seal and cement into place on cover (fig. 1B-21).

(7) Apply a bead of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to cutoff edges of original oil pan gaskets.

(8) Place timing case cover into position and install front oil pan bolts.

(9) Tighten bolts slowly and evenly until cover aligns with upper locating dowel.

(10) Install lower dowel through cover and drive into corresponding hole in engine block.

(11) Install cover retaining bolts in the same location as removed. Tighten to 25 foot-pounds torque.

(12) Install vibration damper. Tighten retaining bolt to 55 foot-pounds torque.

(13) Install damper pulley and retaining bolts.

(14) Install fuel pump.

(15) Install distributor with the rotor and housing in the same position as it was prior to removal.

(16) Install distributor cap and connect heater hose.

(17) Install power steering pump and air pump and mount bracket (if equipped).

(18) Install alternator and alternator mount bracket.

(19) Install air conditioning compressor and bracket assembly (if equipped).

(20) Install fan and spacer assembly.

(21) Install all drive belts and tighten to the specified tension.

(22) Connect radiator hoses and bypass hose.

(23) Fill cooling system to specified level.

(24) Start engine and check for oil or coolant leaks.

(25) Adjust initial ignition timing to specified setting.

Oil Seal Replacement

Timing case cover must be removed to replace seal.

(1) Pry out original seal from inside timing case cover and clean seal bore.

(2) Apply a light coat of Perfect Seal compound, or equivalent, to outer surface of a new seal.

(3) Drive seal into place from inside the cover with Seal Installer Tool J-22533 until it contacts the outer flange of the cover (fig. 1B-22).

(4) Apply a light film of engine oil to lips of neoprene seal.

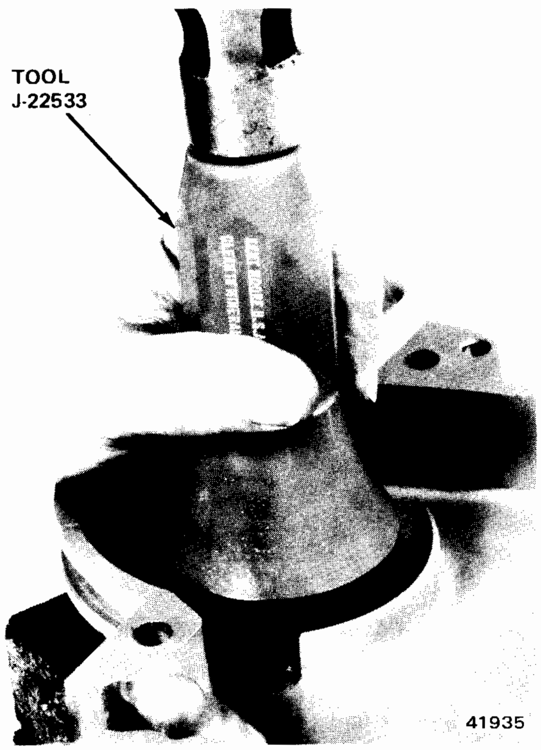

Fig. 1B-22 Timing Case Cover Oil Seal Replacement

TIMING CHAIN

To ensure correct valve timing, install the timing chain with the timing marks of the crankshaft and camshaft sprockets properly aligned. A worn timing chain will adversely affect valve timing. If the timing chain deflects more than 1/2 inch, it should be replaced.

Checking Valve Timing

(1) Remove spark plugs.

(2) Remove cylinder head covers and gaskets.

(3) Remove rocker arms and bridged pivot assemblies from No. 1 cylinder.

(4) Rotate crankshaft until No. 6 piston is at Top Dead Center (TDC) on compression stroke (this places No. 1 piston at TDC on the exhaust stroke in valve overlap position).

(5) Rotate crankshaft counterclockwise 90 degrees as viewed from front.

(6) Install dial indicator on No. 1 intake valve push rod end.

(7) Set dial indicator to zero.

(8) Crank engine slowly in direction of rotation (clockwise viewed from front) until dial indicator indicates 0.020 inch for 304 and 360 CID engines and 0.025 inch for 401 CID engines.

(9) At this point, milled timing mark on vibration damper should be in line with TDC marking on timing case cover.

If more than 1/2-inch variation in either direction exists, remove timing chain cover and inspect timing chain installation.

Check for incorrect camshaft sprocket indexing. The sprocket keyway should align with the centerline of the first lobe on the camshaft.

Removal

(1) Remove timing case cover.

(2) Remove crankshaft oil slinger.

(3) Remove camshaft sprocket retaining bolt and washer.

(4) Remove distributor drive gear and fuel pump eccentric.

(5) Rotate crankshaft until the zero timing mark on the crankshaft sprocket is closest to and in a centerline with the zero timing mark on the camshaft sprocket (fig. 1B-23).

(6) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

Installation

(1) Assemble timing chain, crankshaft sprocket, and camshaft sprocket with timing marks aligned (fig. 1B-23).

(2) Install assembly to crankshaft and camshaft.

(3) Install fuel pump eccentric and distributor drive gear.

(4) Install camshaft sprocket, washer, and retaining bolt. Tighten bolt to 30 foot-pounds torque.

NOTE: *The fuel pump eccentric must be installed with the stamped word REAR facing the camshaft sprocket.*

(5) To ensure correct installation of timing chain:

(a) Rotate crankshaft until timing mark on camshaft sprocket is on a horizontal line at 3 o'clock position.

(b) Beginning with pin directly adjacent to camshaft sprocket timing mark, count number of pins downward to timing mark on crankshaft sprocket.

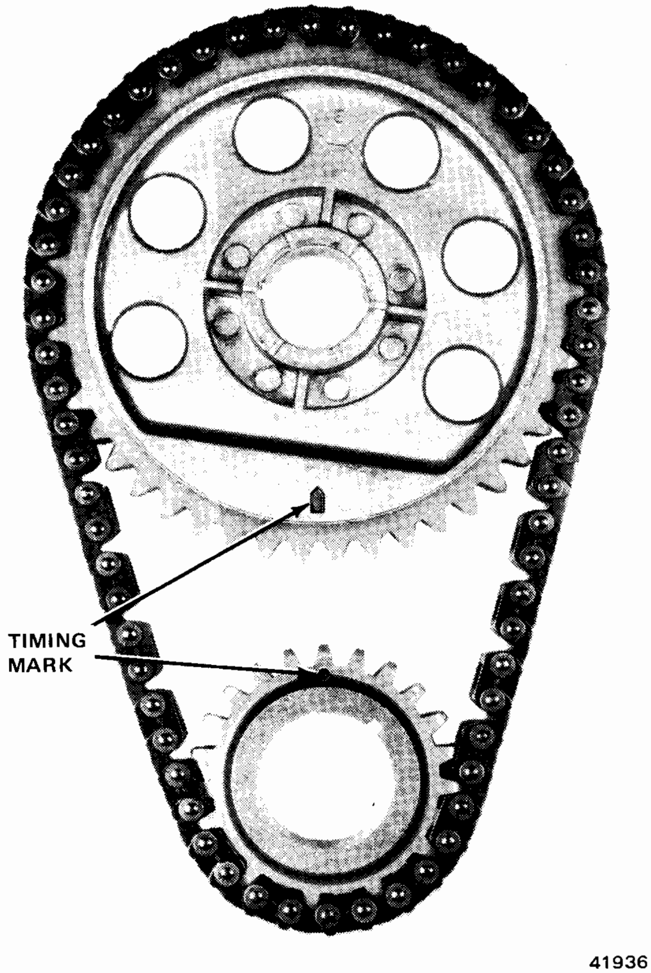

Fig. 1B-23 Sprocket Alignment

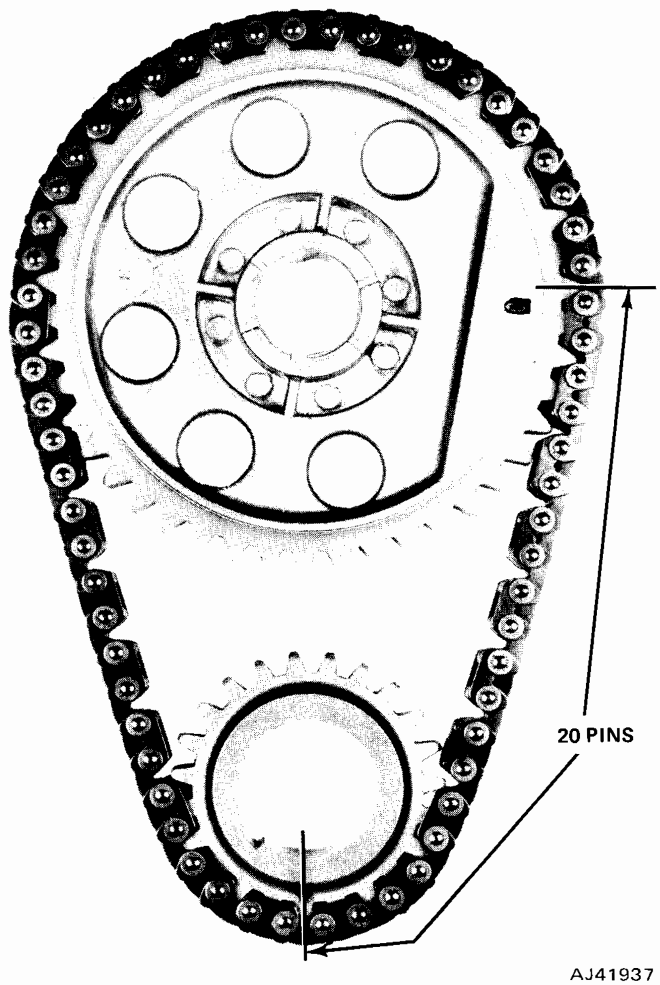

Fig. 1B-24 Correct Timing Chain Installation

(c) There should be 20 pins between these two points. **The crankshaft sprocket timing mark must be between pins 20 and 21 (fig. 1B-24).**

(6) Install crankshaft oil slinger.

(7) Install timing case cover using a new gasket, tighten retaining bolts to 25 foot-pounds torque.

CAMSHAFT AND BEARINGS

The camshaft is supported by five steel-shelled, babbitt-lined bearings which have been pressed into the block and line reamed. The camshaft journals are step bored, being larger at the front bearing than at the rear, to permit easy removal and installation of the camshaft. All camshaft bearings are lubricated under pressure.

NOTE: *Do not replace camshaft bearings unless required special tools for removing, installing, and reaming are available.*

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear.

The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face to hold camshaft end play to zero during engine operation.

Camshaft Identification

The 401 CID engine camshaft is identified by white marks between the No. 3 and 4 camshaft bearings.

The 304 and 360 CID engine camshafts, which are the same, have no identifying paint marks.

Cam Lobe Lift Measurement

Cam lift may be checked with a dial indicator.

(1) Remove rocker arm cover and gasket.

(2) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove spark plugs.

(4) Install a dial indicator on end of push rod (fig. 1B-25).

NOTE: *A piece of rubber tubing may be used to secure dial indicator plunger to push rod.*

(5) Rotate crankshaft until cam lobe base circle (push rod down) is under valve tappet.

(6) Set dial indicator to zero.

(7) Rotate crankshaft until point of maximum push rod upward movement occurs.

(8) Read travel at dial indicator. (Correct lift is 0.260 to 0.270 inch for 304 and 360 CID engines and 0.0280 to 0.0290 inch for 401 CID engine).

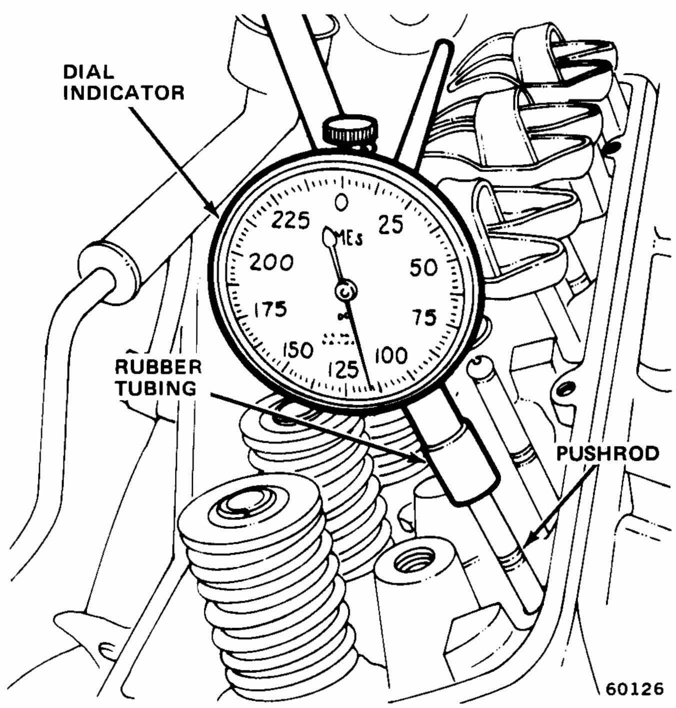

Fig. 1B-25 Cam Lobe Lift Measurement

Removal

(1) Drain cooling system and cylinder block.

(2) Remove radiator assembly.

(3) If equipped with air conditioning, remove condenser and receiver assembly as charged unit. Refer to Section 13A—Air Conditioning for detailed procedure.

(4) Remove cylinder head covers and gaskets.

(5) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.

(6) Remove push rods.

NOTE: *Keep push rods, rocker arm assemblies, and tappets in the same order as removed.*

(7) Remove intake manifold assembly.

(8) Remove drive belts.

(9) Remove fan and hub assembly.

(10) Remove distributor.

(11) Remove damper pulley.

(12) Remove vibration damper.

(13) Remove timing case cover.

(14) Remove timing case cover oil seal.

(15) Rotate crankshaft until zero timing mark on crankshaft sprocket is closest to and in a centerline with zero timing mark on camshaft sprocket.

(16) Remove retaining bolt from camshaft.

(17) Remove distributor drive gear and fuel pump eccentric from the camshaft.

(18) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

(19) Remove hood latch support bracket upper retaining screws and move bracket, as required, to allow removal of camshaft.

(20) Remove front bumper or grille, as required, and remove camshaft.

Inspection

Inspect the camshaft bearing journals for an uneven wear pattern or rough finish. Either condition will necessitate camshaft replacement.

Inspect the distributor drive gear for damage or excessive wear.

Inspect fuel pump eccentric for excessive wear.

Inspect each cam lobe and the matching hydraulic valve tappet for wear. If the face of the tappet is worn concave and the matching camshaft lobe is worn, both the camshaft and tappets must be replaced.

Installation

(1) Lubricate entire camshaft generously with Jeep Engine Oil Supplement (EOS), or equivalent.

(2) Carefully install camshaft into engine block.

(3) Assemble timing chain, crankshaft sprocket, and camshaft sprocket with the zero timing marks aligned as at time of removal.

(4) Install chain and sprockets assembly to engine. Recheck installation as shown in figure 1B-23.

(5) Install fuel pump eccentric and distributor drive gear to camshaft.

(6) Install new timing case cover gasket; refer to Timing Case Cover in this section. Install a new oil seal and apply light film of engine oil to lips of seal.

(7) Install timing case cover.

(8) Install vibration damper.

(9) Install damper pulley and retaining bolts, tighten bolts to 23 foot-pounds torque.

(10) Install hydraulic valve tappets lubricated with Jeep Engine Oil Supplement, or equivalent, during installation.

NOTE: *Do not drain the EOS from the engine for at least 1,000 miles or until the next scheduled oil change.*

(11) Install intake manifold assembly.
(12) Install push rods.
(13) Install rocker arms and bridged pivot assemblies. Install capscrews, tightening each caps screw for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.
(14) Install cylinder head covers and gaskets.
(15) Install fuel pump.
(16) Rotate crankshaft until No. 1 piston is at TDC position on compression stroke.

NOTE: *After No. 1 intake valve has closed, TDC can be reached by rotating the crankshaft clockwise as viewed from the front until the timing mark or the damper aligns with TDC on the timing case cover.*

(17) Install distributor so that rotor is aligned with No. 1 terminal of the cap when fully seated on block.
(18) Install distributor cap.
(19) Install ignition wires.
(20) If removed, install air conditioning condenser and receiver assembly. Refer to Section 13A—Air Conditioning for procedure to purge compressor air.

CAUTION: *Both service valves must be open before the air conditioning system is operated.*

(21) Install hood latch support bracket retaining screws and tighten securely.
(22) If removed, install front bumper or grille.
(23) Install radiator.
(24) Fill cooling system to specified level.

OIL PAN

Removal

(1) Drain engine oil.
(2) Remove starter.
(3) Remove oil pan.
(4) Remove oil pan front and rear neoprene oil seals. Thoroughly clean the gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan sump.

Installation

(1) Install the oil pan front seal to timing case cover and apply a generous amount of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to end tabs.
(2) Cement new oil pan side gaskets into position on engine block and apply a generous amount of Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, to side gasket contacting surface of seal end tabs.
(3) Install seal in the recess of rear main bearing cap making certain it is fully seated.
(4) Apply engine oil to oil pan contacting surface of front and rear oil pan seals.
(5) Install oil pan and tighten drain plug securely.

NOTE: *Tighten 1/4-20 oil pan screws to 7 foot-pounds torque and 5/16-18 oil pan screws to 4 foot-pounds torque.*

(6) Install starter.
(7) Fill crankcase to specified level with new oil.

OIL FILTER

A full flow oil filter mounted on the lower right-hand side of the engine is accessible from below the chassis.

A bypass valve, incorporated in the filter mounting base, provides a safety factor in the event the filter becomes inoperative as a result of dirt or sluge accumulation. Oil Filter Remover Tool J-22700 will facilitate removal.

Before installation, apply a thin film of oil to the filter gasket. **Do not use grease.** Install filter until gasket contacts the seat of the adapter. Tighten by hand only, following instructions on replacement filter. Operate engine at fast idle and check for leaks.

OIL PUMP

A positive displacement gear type oil pump is used and is driven by the distributor shaft, which in turn is driven by a gear on the camshaft (fig. 1B-4). The pump, which is part of the timing chain cover, incorporates a pressure relief valve to regulate maximum pressure.

Crankcase oil enters the pump after being drawn through the pickup tube and screen assembly, the horizontal main oil gallery, and the connecting passage in the timing chain cover.

Oil pump removal or replacement will not affect distributor timing as the distributor drive gear remains in mesh with the camshaft gear.

Oil Pressure Relief Valve

The oil pressure relief valve is not adjustable. A setting of 75 pounds maximum pressure is built into the tension of the spring.

In the relieved position, the valve permits oil to bypass through a passage in the pump cover to the inlet side of the pump.

Removal

(1) Remove retaining screws and separate the oil pump cover, gasket, and oil filter as an assembly from pump body (timing cover).

(2) Remove drive gear and shaft and driven or idler gear by sliding them out of body.

(3) Remove the oil pressure relief valve from pump cover for cleaning by removing the retaining cap and spring.

Clean cover thoroughly. Check operation of relief valve by inserting release valve and checking to see that it slides back and forth freely. If not, replace pump cover and release valve.

Gear End Clearance Measurement

(1) Place straightedge across gears and pump body.

(2) Select a feeler gauge which will fit snugly but freely between straightedge and pump body (fig. 1B-26).

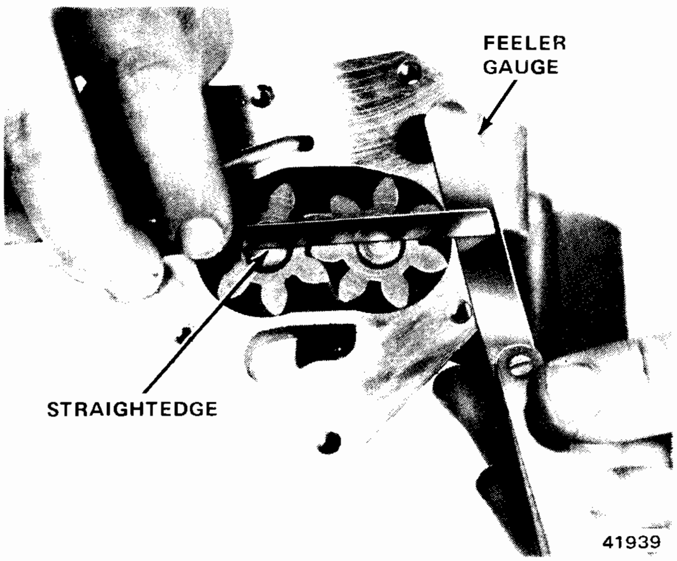

Fig. 1B-26 Gear End Clearance Measurement

NOTE: *Make certain gears are up as far as possbile into body. Correct clearance is 0.002 to 0.006 clearance inch (0.006 clearance clearance desired).*

If clearance is not within specification, measure gear length. If gear length is incorrect, replace gears. If gear length is correct, replace timing case cover.

NOTE: *If clearance is less than specified, a thinner oil pump cover gasket may correct the clearance. Standard gaskets are 0.010-inch thick.*

Gear-to-Body Clearance

(1) Insert a feeler gauge between gear tooth and pump body inner wall directly opposite the point of gear mesh. Select a feeler gauge which fits snugly but freely (fig. 1B-27).

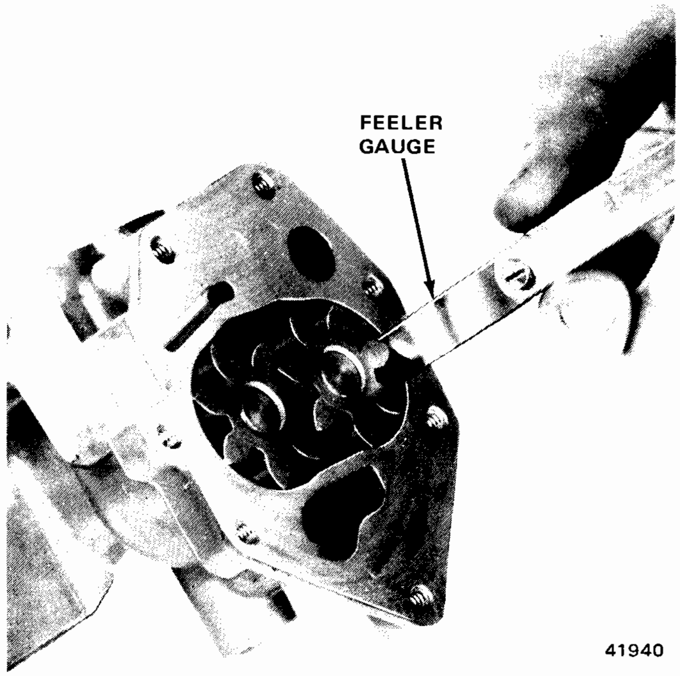

Fig. 1B-27 Gear-to-Body Clearance Measurement

(2) Rotate gears to check each tooth in this manner. Correct clearance is 0.0005 to 0.0025 inch (0.0005 desired).

(3) If gear-to-body clearance is more than specified, measure gear diameter. If diameter is incorrect, replace gears. If diameter is correct, replace timing case cover.

Installation

(1) If removed, install oil pressure relief valve in pump cover with spring and retaining cap.

(2) Install idler shaft, idler gear, and drive gear assembly.

NOTE: *To ensure self-priming of the oil pump, the pump must be filled with petroleum jelly prior to the installation of the oil pump cover.* **Do not use grease of any type.**

(3) Install pump cover and oil filter assembly with a new gasket. Tighten retaining screws to 55 inch-pounds torque.

REAR MAIN BEARING OIL SEAL

The rear main bearing oil seal consists of a two-piece, neoprene, single-lip seal to seal the rear of the crankshaft. Correct installation of the seal will ensure leak-free engine operation (fig. 1B-28).

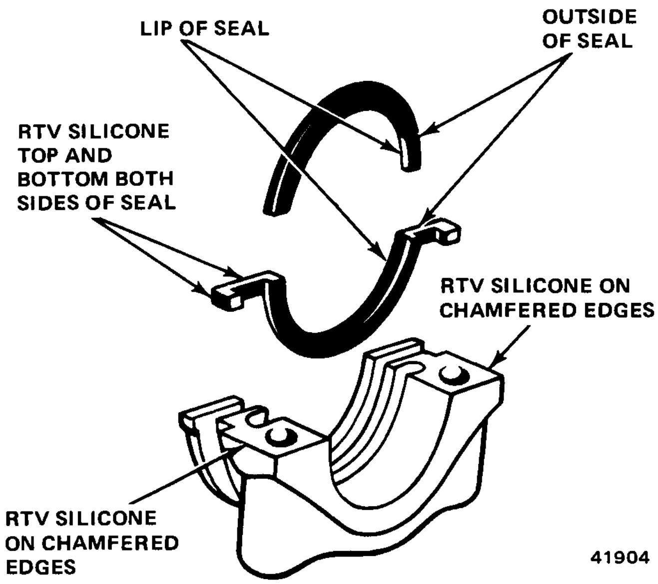

Fig. 1B-28 Rear Main Oil Seal Installation

Removal

(1) Drain engine oil.
(2) Remove oil pan.
(3) Remove oil pan front and rear neoprene oil seals.
(4) Remove oil pan side gaskets.
(5) Thoroughly clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan.
(6) Remove rear main bearing cap.
(7) Remove and discard lower seal.

NOTE: *To ensure leak-free operation, the upper and lower seal halves must be replaced in pairs.*

(8) Clean main bearing cap thoroughly to remove all sealer.
(9) Loosen all remining main bearing capscrews.
(10) With a brass drift and hammer, tap the upper seal until sufficient seal is protruding to permit pulling seal out completely.

Installation

(1) Wipe seal surface of the crankshaft clean and then oil lightly.
(2) Coat block contacting surface of the new upper seal with soap, and lip of seal with engine oil (fig. 1B-28).
(3) Install upper seal into engine block.

NOTE: *The lip of the seal must face to the front of the engine.*

(4) Coat both sides of new lower seal end tabs with Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, being careful not to apply sealer to lip of seal.
(5) Coat outer curved surface of lower seal with soap and lip of seal with engine oil.
(6) Install seal into cap recess and seat firmly.
(7) Place Jeep Gasket-in-a-Tube (RTV silicone), or equivalent, on both chamfered edges of rear main bearing cap.

CAUTION: *Do not apply sealer to cylinder block mating surface of rear main cap as bearing clearance could be reduced.*

(8) Install rear main bearing inserts.
(9) Install rear main bearing cap.
(10) Tighten all main bearing capscrews to 100 foot-pounds torque.
(11) Install oil pan using new gaskets and seals. Tighten drain plug securely.
(12) Fill crankcase to specified level with new oil.

CYLINDER BLOCK

Disassembly

(1) Remove engine assembly as outlined earlier in this section.
(2) Separate transmission from engine.
(3) Use engine stand to support engine assembly.
(4) Remove cylinder head covers.
(5) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.
(6) Remove push rods.
(7) Remove intake manifold assembly.
(8) Remove valve tappets.
(9) Remove cylinder heads and gaskets.
(10) Position pistons, one at a time, near bottom of their stroke and use ridge reamer to remove any ridge from top end of cylinder walls.
(11) Remove damper pulley and vibration damper.
(12) Remove timing case cover.
(13) Remove engine oil and remove oil pan.
(14) Remove camshaft.
(15) Remove connecting rod bearing caps and inserts and keep in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(16) Remove connecting rod and piston assemblies through top of cylinder bores. **Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls.**

NOTE: *Pieces of rubber hose can be pushed over the rod bolts to prevent damage to the rod journals.*

(17) Remove oil pickup tube and screen assembly.
(18) Remove main bearing caps and inserts.
(19) Remove crankshaft.

Cylinder Bore Reconditioning

Inspect the cylinder bores for scoring, taper, and out-of-round. Check with an inside micrometer or telescope gauge from the top to the bottom of the cylinders for taper. Check for an out-of-round condition by measuring across the cylinder bores at two points: parallel to the crankshaft and perpendicular to the crankshaft.

If cylinder taper does not exceed 0.005 inch and out-of-round does not exceed 0.003 inch, the cylinder bore may be corrected by honing.

If the cylinder taper or out-of-round condition exceeds these limits, the cylinder must be bored and then honed for an oversize piston.

After honing the cylinder bores, move the hone up and down at a sufficient speed to produce a uniform crosshatch pattern on the cylinder walls.

Removal of glaze from the cylinder wall for quicker ring seating can be accomplished by various methods. When an expanding type hone is used, do not use more than ten strokes (each stroke down and return) to recondition a cylinder wall.

Successful ring installation depends upon cleanliness during the honing operation and careful handling of parts. The engine bearings and lubrication system must be protected from abrasives.

Rigid type hones are not be be used to remove cylinder glaze as there is always a slight amount of taper in cylinder walls after the engine has been in service.

Prior to fitting pistons, the cylinder bores should be scrubbed clean with a hot water and detergent solution. After cleaning, apply light engine oil to cylinder walls and then wipe with a clean, lint-free cloth.

NOTE: *If crankshaft remains in block, cover the connecting rod journals with clean cloths during honing and cleaning operation.*

Assembly

(1) Install upper main bearing inserts.

(2) Install crankshaft.

(3) Install main bearing caps and inserts.

(4) Install new oil pickup tube and screen assembly.

(5) Install camshaft.

(6) Prior to installing the connecting rod and piston assemblies into cylinder block, arrange piston ring gaps so that:

(a) Oil spacer gap is on centerline (±20°) of either skirt face.

(b) Oil rail gaps are 180° apart and inline with piston pin centerline (±20°).

(c) Number 2 compression ring gap is 180°(±20°) from top oil rail gap.

(d) Number 1 compression ring gap is 180°(±20°) from the number 2 compression ring gap.

(7) Lubricate piston and ring surfaces with clean engine oil.

NOTE: *Be sure piston notch faces forward and oil squirt hole faces camshaft (fig. 1B-29).*

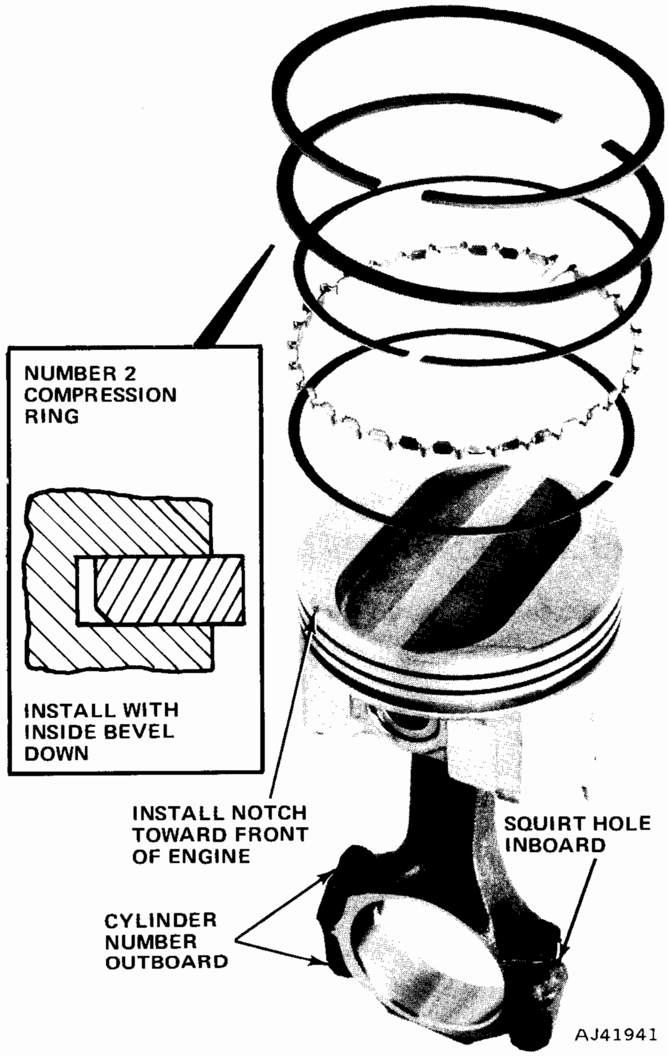

Fig. 1B-29 Piston Ring Sequence

(8) Use a piston ring compressor tool to install connecting rod and piston assemblies through top of cylinder bores. **Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls.**

NOTE: *Place length of rubber hose over the connecting rod bolts for protection during installation.*

(9) Install connecting rod bearing caps and inserts in same order as removed. Tighten nuts on 304 and 360 CID engines to 28 foot-pounds torque. Tighten nuts on 401 CID engines to 39 foot-pounds torque.

(10) Install engine oil pan using new gaskets and seals. Tighten drain plug securely.

(11) Install timing case cover and gaskets; refer to Timing Case Cover earlier in this section.

(12) Install vibration damper and damper pulley.

(13) Install cylinder head and gaskets.

(14) Install valve tappets.

(15) Install intake manifold and new gaskets.

(16) Install push rods.

(17) Install rocker arms and bridged pivot assemblies. Install capscrews, tightening each capscrew for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.

NOTE: *Install valve train components in same order as removed.*

(18) Reseal and install cylinder covers.

(19) Install transmission to engine.

(20) Remove engine from stand.

(21) Install engine assembly as outlined earlier in this section.

CONNECTING ROD AND PISTON ASSEMBLIES

Use these procedures to service connecting rods and pistons with the engine in the car.

Removal

(1) Remove cylinder head covers.

(2) Remove rocker arms and bridged pivot assemblies, loosening each capscrew a turn at a time to avoid breaking the bridge.

(3) Remove push rods.

(4) Remove intake manifold assembly.

(5) Remove cylinder head and gasket.

(6) Position pistons, one at a time, near bottom of their stroke and use a ridge reamer to remove any ridge from top end of cylinder walls.

(7) Drain engine oil.

(8) Remove oil pan.

(9) Remove connecting rod bearing caps and inserts. Keep in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(10) Remove connecting rod and piston assemblies through the top of cylinder bores. **Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls.**

NOTE: *A piece of rubber hose can be pushed on over the rod bolts to avoid damage to the rod journals.*

Installation

(1) After thoroughly cleaning cylinder bores, apply a light film of clean engine oil to bores with a clean, lint-free cloth.

(2) Prior to installing connecting rod and piston assemblies into engine, arrange piston ring gaps so that:

(a) Oil spacer gap is on centerline (±20°) of either skirt face.

(b) Oil rail gaps are 180° apart and in line with piston pin centerline (±20°).

(c) Number 2 compression ring gap is 180°(±20°) from top oil rail gap.

(d) Number 1 compression ring gap is 180°(±20°) from the number 2 compression ring gap.

(3) Lubricate piston and ring surfaces with clean engine oil.

NOTE: *Be sure piston notch faces foward and oil squirt hole faces camshaft (fig. 1B-29).*

(4) Use piston ring compressor tool to install connecting rod and piston assemblies through top of cylinder bores. **Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls.**

NOTE: *Place lengths of rubber hose over the connecting rod bolts for protection during installation.*

(5) Install connecting rod bearing caps and inserts in same order as removed. Tighten retaining nuts to 33 foot-pounds torque on 304 and 360 CID engines. Tighten retaining nut on 401 CID engines to 39 foot-pounds torque.

(6) Install engine oil pan using new gaskets and seals. Tighten drain plug securely.

(7) Install cylinder heads and gaskets.

(8) Install push rods.

(9) Install rocker arms and bridged pivot assemblies. Install capscrews, tightening each capscrew for each bridge assembly a turn at a time to avoid breaking the bridge. Tighten capscrews to 19 foot-pounds torque.

(10) Install intake manifold assembly.

(11) Reseal and install cylinder head covers.

(12) Fill crankcase with new oil to specified level.

CONNECTING ROD

The connecting rods for 304 and 360 CID engines are nodular-iron and 401 CID engines are forged steel. Both types are independently balanced. The crankshaft end of the connecting rods incorporates a two-piece bearing insert. A squirt hole at the crankshaft

Connecting Rod Bearing Fitting Chart

Crankshaft Connecting Rod Journal Color Code and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
304 - 360 CID Engines		
Yellow — 2.0955 to 2.0948 (Standard)	Yellow — Standard	Yellow — Standard
Orange — 2.0948 to 2.0941 (0.0007 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black — 2.0941 to 2.0934 (0.0014 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Red — 2.0855 to 2.0848 (0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize
401 CID Engine		
Yellow — 2.2485 to 2.2478 (Standard)	Yellow — Standard	Yellow — Standard
Orange — 2.2478 to 2.2471 (0.0007 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black — 2.2471 to 2.2464 (0.0014 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Red — 2.2385 to 2.2378 (0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize

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end provides lubrication for the cylinder walls, pistons, and piston pins. If must face inward when the connecting rod is installed (fig. 1B-29). The removable bearing cap has a number from 1 through 8 stamped on it and the adjacent machined surface of the rod to identify the cylinder in which the rod was assembled. The piston end of the rod is a 2000-pound press-fit to the piston pin.

Have the connecting rod alignment checked by a competent machine shop whenever engine wear patterns or damage indicates probable rod misalignment. Always replace bent connecting rods.

Connecting Rod Bearings

The connecting rod bearings for all V-8 engines are steel-backed, aluminum-alloy, precision type.

The connecting rod bearings are select fit to their respective journals to obtain the desired operating clearance. **In production**, the select fit is obtained by using various sized color coded bearing inserts as shown in the bearing fitting chart. The bearing color code appears on the edge of the insert. Bearing size is not stamped on inserts used in production.

The rod journal size is identified **in production** by a color coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. Use color codes shown in the bearing fitting chart to identify journal size and select the correct bearing inserts to obtain proper clearances.

When required, different sized upper and lower bearing inserts may be used as a pair; therefore, a standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance by 0.0005 inch (1/2 thousandth of an inch).

CAUTION: *Never use bearing inserts with greater than 0.001-inch difference in size in pairs.*

Example:

Correct	Incorrect
Upper - Standard	Standard
Lower - 0.001-inch undersize	0.002-inch

Service replacement bearing inserts are available in pairs in the following sizes: standard, 0.001-inch undersize, 0.002-inch undersize, 0.010-inch undersize, and 0.012-inch undersize. The size is stamped on the back of the service replacement inserts.

NOTE: *The 0.002- and 0.012-inch undersize inserts are not used in production.*

Removal

Use this procedure to service connecting rod bearing with the engine in the vehicle.

(1) Drain engine oil.

(2) Remove oil pan.

(3) Rotate crankshaft as required to position connecting rod journal at bottom of stroke.

(4) Remove bearing caps and lower inserts.

(5) Remove upper insert by rotating insert out of connecting rod.

NOTE: Do not mix bearing caps. *Each connecting rod and matching cap is stamped with the cylinder number on a machined surface which faces the camshaft side of the engine block. The numbers are located on a machined surface opposite the squirt holes (fig. 1B-30).*

(6) Inspect bearing inserts and replace if worn or damaged.

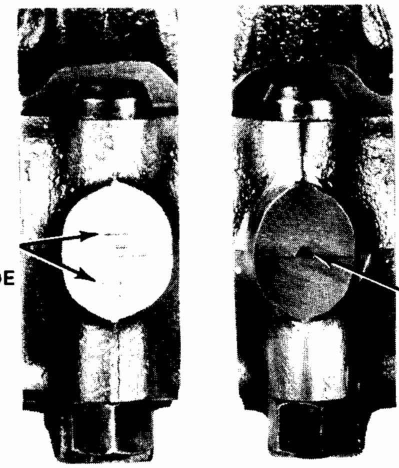

Fig. 1B-30 Rod Number and Squirt Hole Location

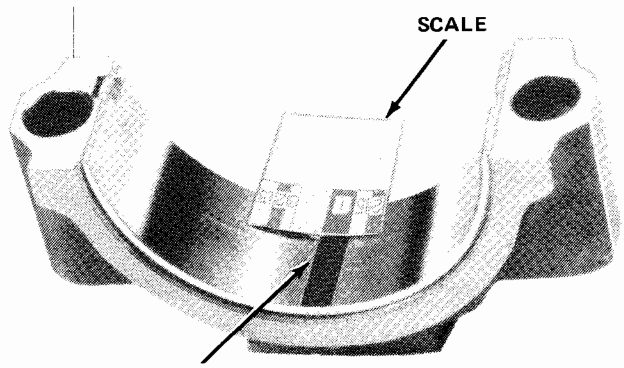

Fig. 1B-31 Connecting Rod Bearing Clearance Measurement with Plastigage

Measuring Journal Size with Micrometer

(1) Wipe connecting rod journals clean.

(2) Using a micrometer, measure journal diameter at a number of points. Note difference between maximum and minimum diameters.

(3) Refer to Specifications for maximum allowable taper and out-of-round. If any rod journal is beyond specifications, the crankshaft must be replaced or reconditioned and fitted with new undersize bearing inserts.

(4) Compare maximum reading obtained with journal diameters listed in bearing fitting chart.

(5) Select inserts required to obtain 0.002 to 0.0025 inch bearing clearance.

Measuring Bearing Clearance with Plastigage

(1) Wipe bearing inserts and rod journal clean.

(2) Place a strip of Plastigage across full width of lower insert at center of bearing cap.

(3) Install bearing cap to connecting rod and tighten retaining nuts to 33 foot-pounds torque on 304 and 360 CID engines and 39 foot-pounds torque on 401 CID engines.

(4) Remove bearing cap and determine amount of clearance by measuring width of the compressed Plastigage with scale furnished (fig. 1B-31).

Connecting Rod Side Clearance Measurement

(1) Rotate crankshaft to position connecting rod journalat bottom of stroke.

(2) Insert snug fitting feeler gauge between connecting rods (fig. 1B-32).

(3) Compare feeler gauge measurement to clearance specified. Replace rods not to Specifications.

Installation

(1) Rotate crankshaft to position connecting rod journal at bottom of stroke.

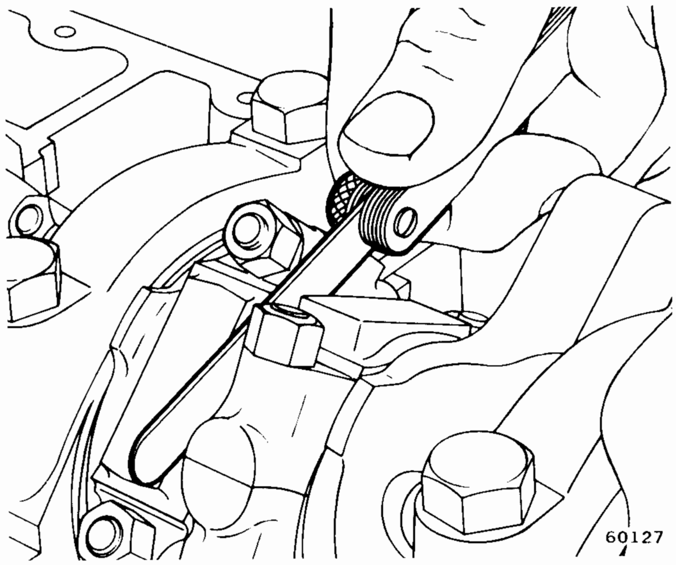

Fig. 1B-32 Connecting Rod Side Clearance Measurement

(2) Lubricate bearing surface of each insert with clean engine oil.

(3) Install bearing inserts, cap and retaining nuts. Tighten to 33 foot-pounds torque on 304 and 360 CID engines and 39 foot-pounds torque on 401 CID engines.

CAUTION: *Exercise care when rotating the crankshaft with bearing caps removed. Be sure the connecting rod bolts do not accidentally come in contact with the rod journals and scratch the finish, which can cause bearing failure. Use of rubber hose on rod bolts is recommended to prevent damage to rod journals.*

(4) Install oil pan using new gaskets and seals. Tighten drain plug securely.

(5) Fill crankcase to specified level with new oil.

PISTONS

Aluminum alloy Autothermic pistons, steel reinforced for strength and controlled expansion are used.

The pistons are cam-ground and are not perfectly round. The ring belt area contains three piston rings, two compression and one oil control ring above the piston pin.

The piston pin boss is offset from the piston centerline to place it nearer the thrust side of the piston.

To ensure correct installation of the pistons in the bore, two notches are cast in the top perimeter of the piston on 304 and 360 CID engines and one notch on 401 CID engines. The notches must face forward (fig. 1B-33).

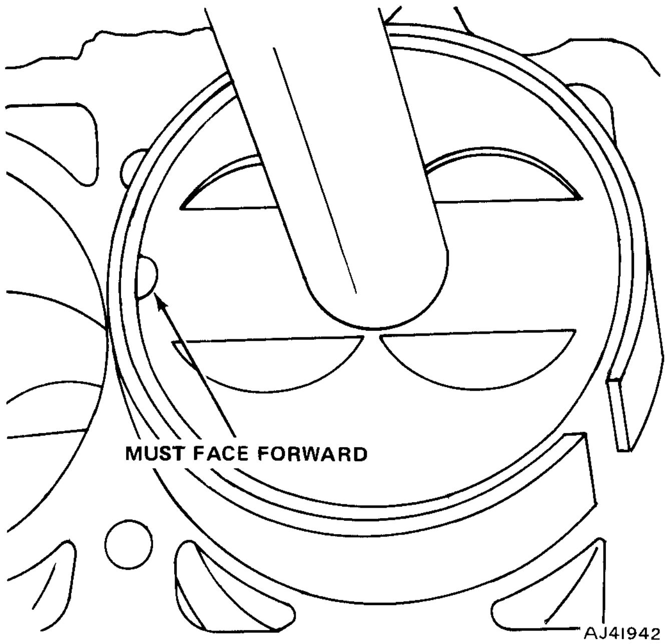

Fig. 1B-33 Installing Piston Assembly into Bore

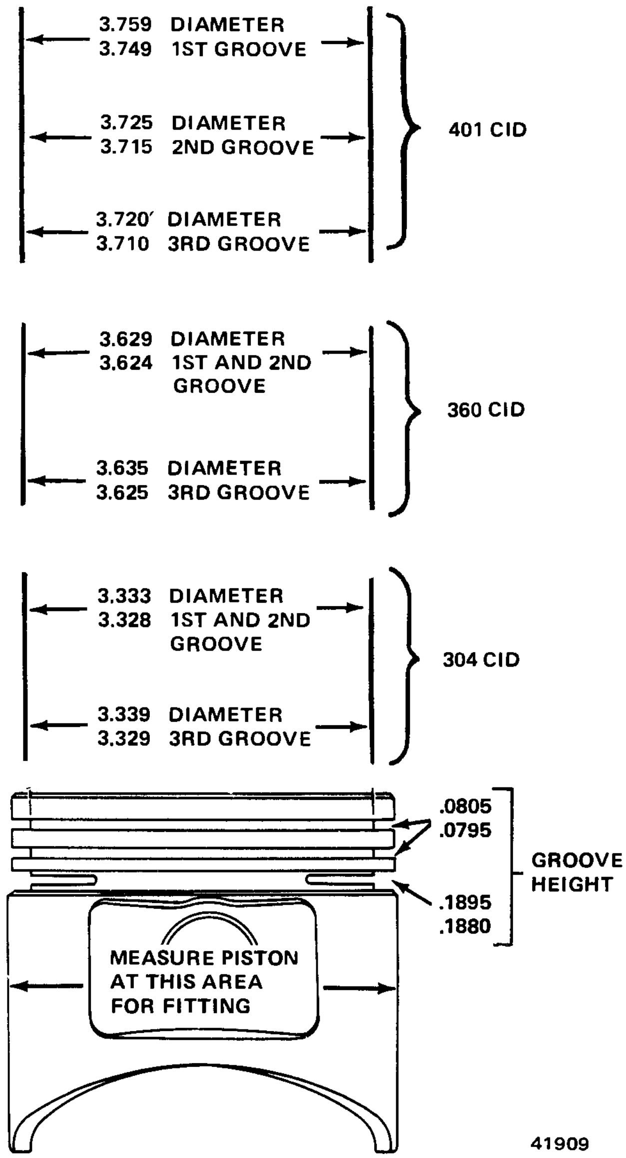

Fig. 1B-34 Piston Measurements (Inches)

Piston Fitting

(1) Using an inside micrometer, measure cylinder bore inside diameter at a point 2-5/16 inch below top of bore.

(2) Using an outside micrometer, measure diameter of piston at right angles to piston pin at centerline of pin (fig. 1B-34).

(3) The difference between cylinder bore diameter and piston diameter dimension is the piston-to-bore clearance.

Piston Pins

The piston pins are press-fit into the rods at 2000 pounds pressure and require no locking device. The piston pins for 304 and 360 CID engines are of the same diameter, while the piston pin for 401 CID engine is larger in diameter.

NOTE: *Two different tools are required to service piston pins: J-21872 is used on 304 and 360 CID engines and J-23194 is used on 401 CID engines.*

Removal

(1) Using Piston Pin Remover (J-21872 or J-23194) and an arbor press, place piston on remover Support (J-21872-1 or J-23194-1) (fig. 1B-35).

(2) Using Piloted Driver (J-21872-3 or J-23194-3), press pin completely out of piston. Note position of pin through gauge window of remover support.

Pin Fitting

(1) Inspect pin and pin bore for nicks and burrs; replace as necessary.

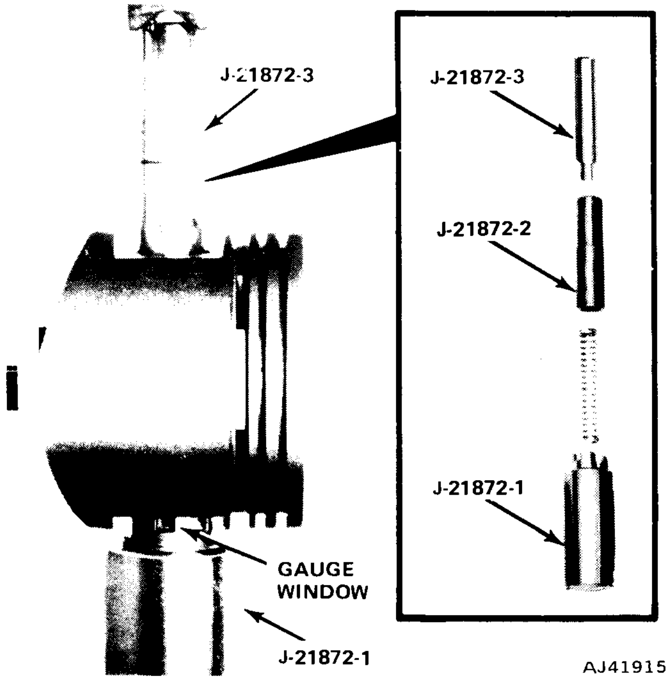

Fig. 1B-35 Piston Pin Removal and Installation

(2) With pin removed from piston, clean and dry piston pin bore and piston pin.

(3) Position piston so that pin bore is in a vertical position. Insert pin in bore. At room temperature, pin should slide completely through pin bore without pushing.

(4) Replace piston and pin if pin jams in bore.

Installation

(1) Assemble piston and connectint so that piston notch will face forward and oil squirt hole will face inward when installed.

(2) Place Pin Pilot (J-21872-2 or J-23194-2) through piston and connecting rod pin bores (fig. 1B-36).

(3) Place pin pilot, piston, and connecting rod on Support (J-21872-1 or J-23194-1).

(4) Place piston pin through upper piston pin bore and into connecting rod pin bore (fig. 1B-36).

(5) Place Pilot Driver (J-21872-3 or J-23194-3) inside piston pin.

(6) Using arbor press, press piston pin through connecting rod and piston until pin pilot indexes with mark on support.

NOTE: *The piston is press-fit at 2000 pounds pressure. If little effort is required to install piston pin in connecting rod, or if rod moves along pin, a new connecting rod is required.*

(7) Remove piston and connecting rod assembly from press. Pin should be centered in rod ±1/32 inch.

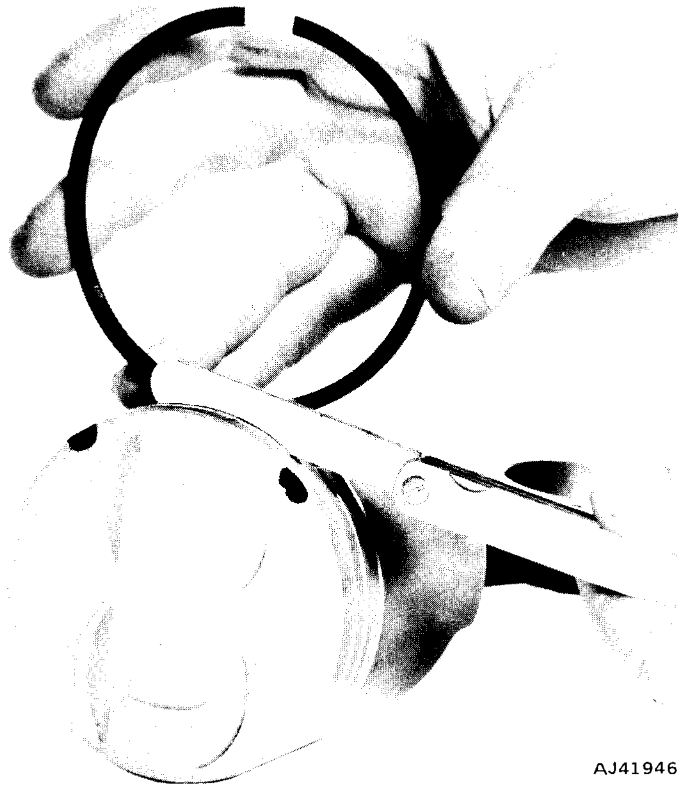

Fig. 1B-36 Ring Side Clearance Measurement

Piston Rings

Both compression rings are made of cast iron while the oil control is a three-piece steel design.

Ring Fitting

(1) Clean carbon from all ring grooves. The oil drain openings in the oil ring grooves and pin boss must be cleared. Be careful not to remove metal from the grooves, or from the lands, since this will change the ring groove clearances and destroy ring-to-land seating.

(2) Check ring side clearance with a feeler gauge fitted snugly between ring land and ring. Roll ring around groove in which it is to operate. It must fit freely at all points (fig. 1B-36). Side clearance between land and rings should be as listed in the Specifications.

(3) Place ring in bore. With an inverted piston, push ring down near lower end of ring travel area. Measure ring gap or joint clearance with feeler gauge fitted snugly in ring opening (fig. 1B-37). End clearance should be as listed in Specifications.

NOTE: *When using other than standard ring sizes, fit rings individually into their respective bores.*

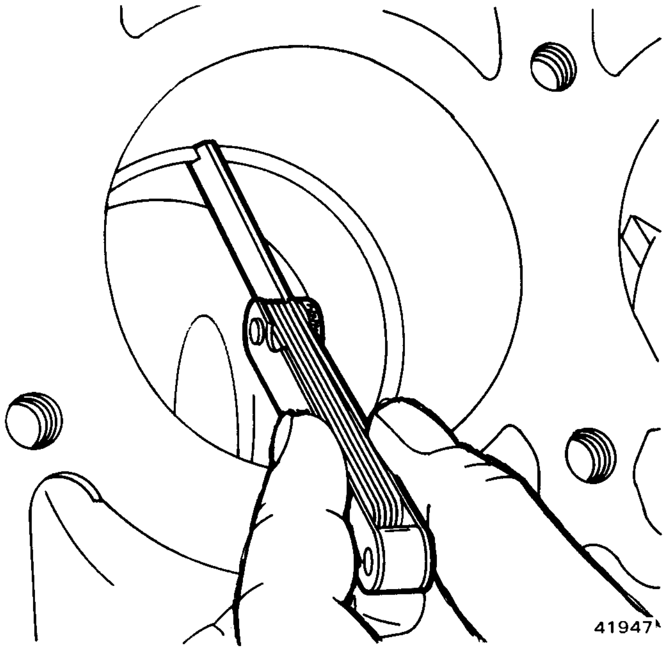

Fig. 1B-37 Ring Gap Measurement

Installation

(1) Install oil control rings as indicated by instructions in package. It is not necessary to use a tool to install upper and lower rails. They are rolled into place (fig. 1B-38).

(2) Install lower compression ring using ring installer to expand ring around piston.

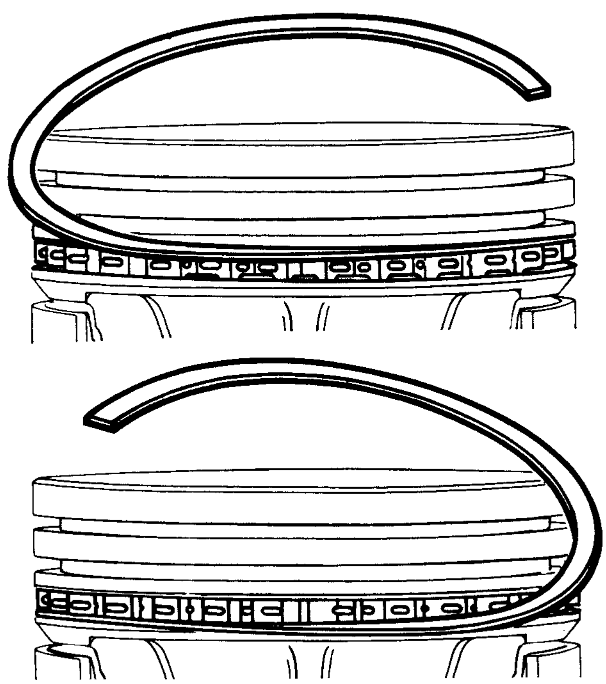

Fig. 1B-38 Installing Upper and Lower Rails

NOTE: *Make certain upper and lower compression rings are not installed upside down. Figure 1B-39 shows typical ring markings to indicate the top side of the ring.*

(3) Install upper compression ring using ring installer to expand ring around piston (fig. 1B-40).

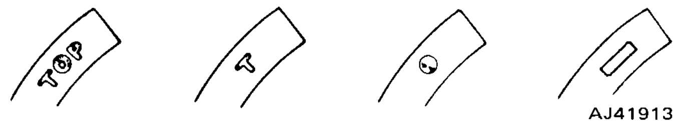

Fig. 1B-39 Typical Piston Ring Markings

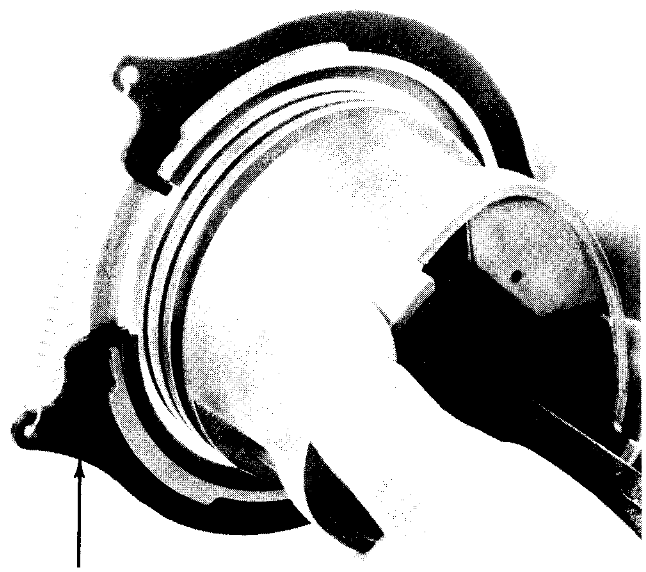

Fig. 1B-40 Compression Ring Installation

CRANKSHAFT

The crankshaft is counterweighted and balanced independently. The component parts of the crankshaft assembly are individually balanced, and then the complete assembly is balanced as a unit; therefore, service replacement dampers, crankshafts, flywheels, torque converters, and clutch components may be replaced without rebalancing the assembly.

There are five main bearings and four connecting rod journals. The end thrust is controlled by No. 3 main bearing.

The rear main bearing oil seal is protected from excessive oil by a slinger which is a machined part of the crankshaft.

NOTE: *On automatic transmission equipped engines, the torque converter and converter flexplate must be marked prior to removal and installed in this position upon assembly.*

Removal or Replacement

If the crankshaft is damaged beyond reconditioning, it must be replaced. Use the procedures outlined under Cylinder Block earlier in this section for removal and installation of the crankshaft.

Checking End Play

The crankshaft end play is controlled at the No. 3 main bearing which is flanged for this purpose.

(1) Attach a dial indicator to crankcase adjacent to No. 3 main bearing.

(2) Set dial indicator push rod on face of an adjacent counterweight (fig. 1B-41).

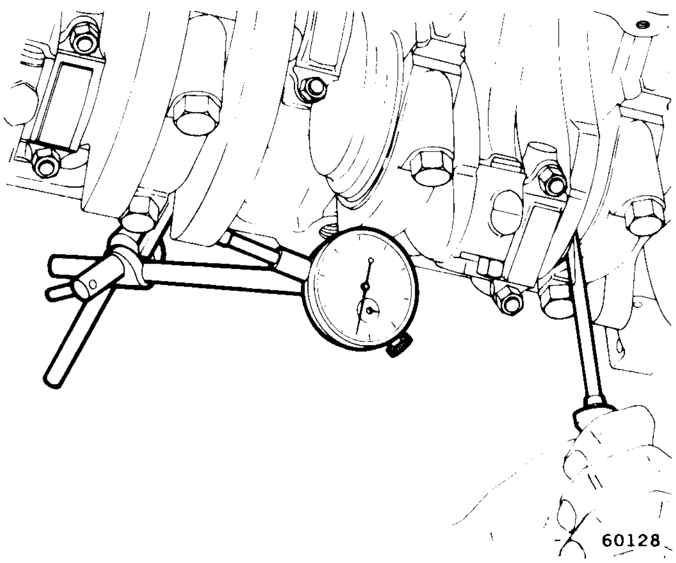

Fig. 1B-41 Crankshaft End Play Measurement

(3) Pry crankshaft fore and aft.

(4) Read dial indicator. End play is the difference of high and low readings.

(5) If end play is incorrect according to Specifications, inspect crankshaft thrust faces for wear. If no end play is apparent, replace thrust bearing and recheck end play. If end play is still outside of specifications, the crankshaft must be replaced.

NOTE: *When replacing the thrust bearings, pry the crankshaft fore and aft to align the thrust faces of the bearings.*

Measuring Main Bearing Journal with Micrometer (Crankshaft Removed)

(1) Wipe main bearing journal clean.

(2) Using a micrometer, measure journal diameter at a number of points. Note difference between maximum and minimum diameters.

(3) Refer to Specifications for maximum allowable taper and out-of-round.

(4) Compare maximum reading obtained with journal diameters listed in bearing fitting chart.

(5) Select inserts required to obtain specified bearing clearance (0.0017 to 0.0020 inch desired on No. 1 through No. 4 main bearings and 0.0025 to 0.003 inch desired for the rear main bearing).

Crankshaft Main Bearings

The main bearing caps are numbered (front to rear) from 1 through 5, with an arrow to indicate forward position. The upper main bearing inserts are grooved while the lower insert surfaces are smooth for the 304-360 CID engines.

NOTE: *The 401 CID engine has a groove in both the upper and lower insert.*

Each bearing is select fit to its respective journal to obtain the desired operating clearance. **In production,** the select fit is obtained by using various sized color coded bearing inserts as shown in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on production inserts.*

The main bearing journal size is identified **in production** by a color coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft except for the rear main journal. The paint mark for the rear main journal is on the crankshaft rear flange.

Use the Bearing Fitting Chart to select proper bearing inserts to obtain the specified bearing clearance (0.0017 to 0. 0020 inch desired on No. 1 through No. 4 main bearings and 0.0025 to 0.003 inch desired for the rear main bearing).

When required, different sized upper and lower bearing inserts may be used as a pair; therefore, a standard size upper insert may be used in combination with a 0.001-inch undersize lower insert to reduce clearance by 0.0005 inch (1/2 thousandth of an inch).

Example:

Correct	Incorrect
Upper - Standard	Standard
Lower - 0.001-inch undersize	0.002-inch

Main Bearing Fitting Chart (Inches)

Crankshaft Main Bearing Journal Color Code and Diameter (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow - 2.7489 to 2.7484 inches (Std.)	Yellow - Standard	Yellow - Standard
Orange - 2.7484 to 2.7479 inches (0.0005US)	Yellow - Standard	Black - .001-inch undersize
Black - 2.7479 to 2.7474 inches (0.001US)	Black - .001-inch undersize	Black - .001-inch undersize
Green - 2.7474 to 2.7469 inches (0.0015US)	Black - .001-inch undersize	Green - .002-inch undersize
Red - 2.7389 to 2.7384 inch (0.010US)	Red - .010-inch undersize	Red - .010-inch undersize

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NOTE: *When servicing upper and lower inserts of different sizes, install all same size inserts together either on the top (upper) or bottom (lower). Never use bearing inserts with greater than 0.001-inch difference in pairs.*

Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-inch undersize, 0.002-inch undersize, 0.010-inch undersize, and 0.012-inch undersize. The size is stamped on back of service replacement inserts.

NOTE: *The 0.012-inch undersize insert is not used in production.*

Removal and Inspection

This procedure may be used to check main bearings with engine in vehicle.

(1) Drain engine oil and remove pan.
(2) Remove main bearing cap and insert.
(3) Inspect bearing insert for abnormal wear or damage.
(4) If either condition exists, both upper and lower inserts must be replaced. (Refer to Measuring Bearing Clearance with Plastigage, as described later in this section, to select bearing inserts required to obtain specified bearing clearance.)
(5) Inspect crankshaft main journal. If damaged, either recondition or replace crankshaft.
(6) Remove upper insert by loosening all of the other bearing caps and inserting a cotter pin about 1/2-inch long in the crankshaft oil hole (head of pins should be large enough so that it will not fall into oil hole, yet thinner than bearing).
(7) With pin in place, rotate shaft so that upper bearing insert will rotate in the direction of its locating tang.
(8) Remove and inspect remaining bearings in same manner.

Measuring Main Bearing Clearance with Plastigage (Crankshaft Installed)

(1) Support weight of the crankshaft with a jack placed under counterweight which is adjacent to main bearing being checked.

NOTE: *Check each bearing clearance one at a time. All other bearings must remain tightened.*

(2) Remove main bearing cap and insert.
(3) Wipe insert and exposed portion of the crankshaft journal clean.
(4) Place a strip of Plastigage across full width of bearing insert.
(5) Install bearing cap and tighten retaining bolts to 100 foot-pounds torque.
(6) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale furnished (0.0017 to 0.0020 inch clearance desired on No. 1 through No. 4 main bearings and 0.0025 to 0.003 inch desired for the rear main bearing) (fig. 1B-42).

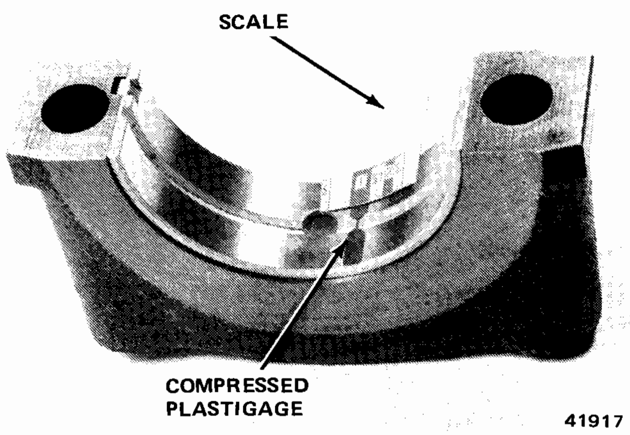

Fig. 1B-42 Main Bearing Clearance Measurement

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Loosen all main bearing caps.

(3) Install main bearing upper insert(s).

(4) Install main bearing cap(s) and lower insert(s). Tighten retaining bolts evenly to 100 foot-pounds torque in steps of 30, 60, 90 and 100 foot-pounds torque increments, turning crankshaft at each step to determine if crank rotates freely. If crank does not rotate freely, check inserts for proper installation and size.

(5) After installation, turn crankshaft to check for free operation.

(6) Install oil pan using new gaskets and seals. Tighten drain plug securely.

(7) Fill crankcase to specified level with new oil.

FLYWHEEL AND STARTER RING GEAR ASSEMBLY

The starter ring gear can be replaced on vehicles with manual transmission only. The starter ring gear is welded to and balanced as part of the converter drive plate on vehicles with automatic transmission.

Ring Gear Replacement—Manual Transmission

(1) Place flywheel on an arbor press with steel blocks equally spaced under gear.

(2) Press flywheel through ring gear.

NOTE: *The ring gear can also be removed by breaking it with a chisel.*

(3) Apply heat to expand inside diameter of replacement ring gear.

(4) Press replacement ring gear onto flywheel.

NOTE: *On manual transmission, the flywheel is balanced as an individual component and also as part of the crankshaft assembly.* **Do not attempt to duplicate original flywheel balance hones when installing a service replacement.**

SHORT ENGINE ASSEMBLY

A service replacement short engine assembly may be installed whenever the original engine block is damaged beyond repair. The short engine assembly consists of engine block, piston, and rod assemblies, crankshaft, camshaft, oil inlet tube and screen, timing gears, and chain. Whenever installing a short engine assembly, always install a new engine oil pump pickup tube and screen assembly.

NOTE: *Short engine assemblies include a replacement engine build date tag. Remove previous tag and attach replacement tag to right rocker arm cover.*

Transfer component parts from the original engine following procedures and clean and tighten as required.

V-8 Engine Specifications

Bore

304	3.75 inches
360	4.08 inches
401	4.165 inches

Stroke

304	3.44 inches
360	3.44 inches
401	3.68 inches

Displacement

304	304 cu. inches
360	360 cu. inches
401	401 cu. inches

Compression Ratio

304	8.40:1
360 (2V or 4V)	8.25:1

Compression Ratio (Continued)

401	8.25:1

Compression Pressure

304	140 psi (min)
360 (2V or 4V)	140 psi (min)
401	140 psi (min)
Maximum Variation Between Cylinders	20 psi (min)

Taxable Horsepower

304	45.00
360	53.27
401	55.51

Camshaft

Fuel Pump Eccentric Diameter	2.182 inch to 2.192 inch
Tappet Clearance	Zero lash (hydraulic tappets)

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V-8 Engine Specifications (Continued)

Camshaft (Continued)

End Play . . . . Zero (engine operating)
Bearing Clearance . . . . 0.001 inch to 0.003 inch (0.0017-0.0020 inch preferred)

Bearing Journal Diameter

No. 1 . . . . 2.1195 inch to 2.1205 inch
No. 2 . . . . 2.0895 inch to 2.0905 inch
No. 3 . . . . 2.0595 inch to 2.0605 inch
No. 4 . . . . 2.0295 inch to 2.0305 inch
No. 5 . . . . 1.9995 inch to 2.0005 inch
Base Circle Runout . . . . 0.001 maximum

Cam Lobe Lift

304/360 . . . . 0.266 inch
401 . . . . 0.286 inch

Intake Valve Timing

Opens 304/360 . . . . 14.75° BTDC
401 . . . . 25.57° BTDC

Closes 304/360 . . . . 68.75° BTDC
401 . . . . 90.75° BTDC

Exhaust Valve Timing

Opens 304/360 . . . . 56.75° BBDC
401 . . . . 80.80° BBDC
Closes 304/360 . . . . 26.75° ATDC
401 . . . . 42.75° ATDC

Valve Overlap

304/360 . . . . 41.50°
401 . . . . 68.32°

Intake Duration

304/360 . . . . 263.50°
401 . . . . 296.32°

Exhaust Duration

304/360 . . . . 263.50°
401 . . . . 303.55°

Connecting Rods

Total Weight (Less Bearings)
304/360 . . . . 681 to 689 grams
401 . . . . 794 to 802 grams
Total Length (Center-to-Center)
304/360 . . . . 5.873 inch to 5.877 inch
401 . . . . 5.856 inch to 5.860 inch
Bearing Clearance . . . . 0.001 inch to 0.003 inch (0.0020-0.0025 inch preferred)
Side Clearance . . . . 0.006 inch to 0.018 inch
Maximum Twist . . . . 0.0005 inch per inch
Maximum Bend . . . . 0.001 inch per inch

Crankshaft

End Play . . . . 0.003 inch to 0.008 inch
Main Bearing Journal Diameter
No. 1, 2, 3, 4 . . . . 2.7474 inch to 2.7489 inch
Rear Main . . . . 2.7464 inch to 2.7479 inch

Main Bearing Journal Width

304/360
No. 1 . . . . 1.2635 inch to 1.2695 inch
No. 2 . . . . 1.246 inch to 1.248 inch
No. 3 . . . . 1.273 inch to 1.275 inch
No. 4 . . . . 1.246 inch to 1.248 inch
No. 5 . . . . 1.215 inch to 1.217 inch
401
No. 1 . . . . 1.244 inch to 1.269 inch
No. 2 . . . . 1.222 inch to 1.232 inch
No. 3 . . . . 1.273 inch to 1.275 inch
No. 4 . . . . 1.222 inch to 1.232 inch
No. 5 . . . . 1.202 inch to 1.217 inch

Main Bearing Clearance

No. 1, 2, 3, 4 . . . . 0.001 inch to 0.003 inch (0.0017-0.0020 inch preferred)

Rear Main

No. 5 . . . . 0.002 inch to 0.004 inch (0.0025-0.003 inch preferred)

Connecting Rod Journal Diameter

304/360 . . . . 2.0934 inch to 2.0955 inch
401 . . . . 2.2464 inch to 2.2485 inch

Connecting Rod Journal Width

304/360 . . . . 1.998 inch to 2.004 inch
401 . . . . 1.846 inch to 1.852 inch

Connecting Rod Bearing

Clearance . . . . 0.001 inch to 0.003 inch (0.0020-0.0025 inch preferred)
Maximum Taper (All Journals) . . . . 0.0005 inch
Maximum Out-of-Round (All Journals) . . . . 0.0005 inch

Cylinder Block

Deck Height . . . . 9.205 inch to 9.211 inch

Deck Clearance

304/360 . . . . 0.0145 inch (below block)
401 . . . . 0.0045 inch (below block)
Maximum Cylinder Taper . . . . 0.051 inch
Maximum Cylinder Out-of-Round . . . . 0.031 inch
Tappet Bore Diameter . . . . 0.9055 inch to 0.9065 inch
Cylinder Block Flatness . . . . 0.001/1 inch; 0.002/6 inch; 0.008 inch maximum

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V-8 Engine Specifications (Continued)

Cylinder Head

Combustion Chamber Volume
- 304 .... 57.42 to 60.42 cc
- 360/401 .... 58.62 to 61.62 cc

Valve Arrangement .... EI-IE-EI-IE
Valve Guide ID (Integral) .... 0.3735 inch to 0.3745 inch
Valve Stem-to-Guide Clearance .... 0.001 inch to 0.003 inch
Intake Valve Seat Angle .... 30°
Exhaust Valve Seat Angle .... 44.5°
Valve Seat Width .... 0.040 inch to 0.060 inch
Valve Seat Runout .... 0.0025 inch maximum
Cylinder Head Flatness .... 0.001/1 inch; 0.002/6 inch; 0.008 inch maximum

Lubrication System

Engine Oil Capacity .... 4 quarts (add 1 quart with filter change)
Normal Operating Pressure .... 13 psi at 600 rpm; 37 to 75 psi at 1600 rpm+
Oil Pressure Relief .... 75 psi maximum
Gear-to-Body Clearance .... 0.0005 inch to 0.0025 inch (0.0005 inch preferred)
Gear End Clearance .... 0.002 inch to 0.006 inch (0.006 inch preferred)
Gear Diameter .... 1.526 inch to 1.578 inch
Gear Length .... 1.485 inch to 1.484 inch

Pistons

Weight (Less Pin)
- 304 .... 506 to 510 grams
- 360 .... 601 to 605 grams
- 401 .... 590 to 594 grams

Piston Pin Bore CL - to Piston Top
- 304/360 .... 1.599 inch to 1.603 inch
- 401 .... 1.506 inch to 1.510 inch

Piston-to-Bore Clearance
- 304/401 .... 0.0010 inch to 0.0018 inch (0.0014 inch preferred)
- 360 .... 0.0012 inch to 0.0020 inch (0.0016 inch preferred)

Piston Ring Gap Clearance
- No. 1 and No. 2 .... 0.010 inch to 0.020 inch (0.010-0.0012 inch preferred)

Oil Control Steel Rail
- 304 .... 0.010 inch to 0.025 inch
- 360 .... 0.015 inch to 0.045 inch
- 401 .... 0.015 inch to 0.055 inch (0.010-0.020 inch preferred)

Piston Ring Side Clearance

304
- No. 1 .... 0.0015 inch to 0.0035 inch (0.0015 inch preferred)
- No. 2 .... 0.0015 inch to 0.003 inch (0.0015 inch preferred)
- Oil Control .... 0.0011 inch to 0.008 inch

360/401
- No. 1 .... 0.0015 inch to 0.003 inch (0.0015 inch preferred)
- No. 2 .... 0.0015 inch to 0.0035 inch (0.0015 inch preferred)
- Oil Control .... 0.000 inch to 0.007 inch

Piston Ring Groove Height
- No. 1 and No. 2 .... 0.0795 inch to 0.0805 inch
- Oil Control .... 0.1880 inch to 0.1895 inch

Piston Ring Groove Diameter

304
- No. 1 and No. 2 .... 3.328 inch to 3.333 inch
- Oil Control .... 3.329 inch to 3.339 inch

360
- No. 1 and No. 2 .... 3.624 inch to 3.629 inch
- Oil Control .... 3.624 inch to 3.635 inch

401
- No. 1 .... 3.749 inch to 3.759 inch
- No. 2 .... 3.715 inch to 3.725 inch
- Oil Control .... 3.710 inch to 3.720 inch

Piston Pin Diameter
- 304/360 .... 0.9308 inch to 0.9313 inch
- 401 .... 1.0009 inch to 1.0012 inch

Piston Pin Bore Diameter
- 304/360 .... 0.9288 inch to 0.9298 inch
- 401 .... 0.9988 inch to 0.9998 inch

Piston-to-Pin Clearance .... 0.0003 inch to 0.0005 inch (0.0005 inch preferred) loose

Rocker Arms, Push Rods, and Tappets

Rocker Arm Ratio 1.6:1
Push Rod Length .... 7.790 inch to 7.810 inch
Push Rod Diameter .... 0.312 inch to 0.315 inch
Hydraulic Tappet Diameter .... 0.9040 inch to 0.9045 inch
Tappet-to-Bore Clearance .... 0.001 inch to 0.0025 inch

Valves

Valve Length (Tip-to-Gauge Dim. Line) .... 4.7895 inch to 4.8045 inch
Valve Stem Diameter .... 0.3715 inch to 0.3725 inch
Stem-to-Guide Clearance .... 0.001 inch to 0.003 inch

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V-8 Engine Specifications (Continued)

Intake Valve Head Diameter
304 . . . . 1.782 inch to 1.792 inch
360/401 . . . . 2.020 inch to 2.030 inch
Intake Valve Face Angle . . . . 29°

Exhaust Valve Head Diameter
304 . . . . 1.401 inch to 1.411 inch
360/401 . . . . 1.675 inch to 1.685 inch

Exhaust Valve Face Angle . . . . 44°

Valve Springs
Free Length . . . . 2.200 inch

Spring Tension
Valve Closed . . . . 80 to 88 pounds at 1-13/16 inch
Valve Open . . . . 210 to 216 pounds at 1-23/64 inch
Inside Diameter (All) . . . . 1.000 inch to 1.020 inch

Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torque	Service In-Use Recheck Torque
Air Injection Tube-to-Manifold	38	30 to 45
Air Pump-to-Bracket	20	15 to 22
Air Pump Brackets-to-Engine—AC Compressor or Pedestals	25	18 to 28
Air Pump Adjusting Strap-to-Pump	20	15 to 22
Alternator Pivot Bolt or Nut	28	20 to 35
Alternator Adjusting Bolt	18	15 to 20
Alternator Mounting Bracket Bolt-to-Engine	28	23 to 30
Alternator Pivot Mounting Bolt-to-Head	33	30 to 35
Automatic Transmission-to-Block	28	22 to 38
Camshaft Gear Retainer Screw	30	25 to 35
Carburetor Adapter-to-Manifold Screws—2V	14	12 to 15
Carburetor Holddown Nuts	14	12 to 15
Clutch Housing Spacer-to-Block Screws	12	9 to 15
Clutch Housing-to-Block Screws	27	22 to 30
Connecting Rod Bolts Nuts	33 (304 & 360) 39 (401)	30 to 35 (304 & 360) 35 to 40 (401)
Crankshaft Pulley-to-Damper	23	18 to 28
Cylinder Head Capscrews	110	100 to 120
Cylinder Head Cover Screws	50 in-lb	42 to 58 in-lb
Distributor Bracket Screw	13	10 to 18
Drive Plate-to-Converter Screw	22	20 to 25
EGR Valve-to-Manifold	13	9 to 18
Exhaust Manifold Bolts	25	20 to 30
Exhaust Pipe-to-Manifold Nuts	20	15 to 25
Fan and Hub Assembly Bolts	18	12 to 25
Flywheel or Drive Plate-to-Crankshaft	105	95 to 120
Front Support Cushion Bracket-to-Block	28	22 to 38
Front Support Cushion-to-Bracket	33	27 to 38
Front Support Cushion-to-Frame	33	27 to 37
Fuel Pump Screws	16	13 to 19
Idler Pulley Bearing Shaft-to-Bracket Nut	33	28 to 38
Idler Pulley Bracket-to-Front Cover Nut	7	4 to 9
Intake Manifold Screws	43	37 to 47
Main Bearing Capscrews	100	90 to 105
Oil Pump Cover Screws	55 in-lb	45 to 65 in-lb
Oil Pan Screws 1/4 Inch - 20	7	5 to 9
Oil Pan Screws 5/16 Inch - 18	11	9 to 13
Oil Relief Valve Cap	28	22 to 35
Power Steering Pump Adapter Screw	23	18 to 28
Power Steering Pump Bracket Screw	43	37 to 47
Power Steering Pump Mounting Screw	28	25 to 35
Rear Insulator Bracket-to-Trans. Stud Nut	33	27 to 38
Rear Support Insulator-to-Bracket Nut	48	40 to 55
Rear Support Cushion-to-Crossmember Screw Nut	18	12 to 25
Rocker Arm Capscrew	19	16 to 26
Spark Plugs	28	22 to 33
Thermostat Housing Screw	13	10 to 18
Timing Case Cover-to-Block	25	18 to 33
Vibration Damper Screw	55	48 to 64
Water Pump Screws	48 in-lb	40 to 55 in-lb

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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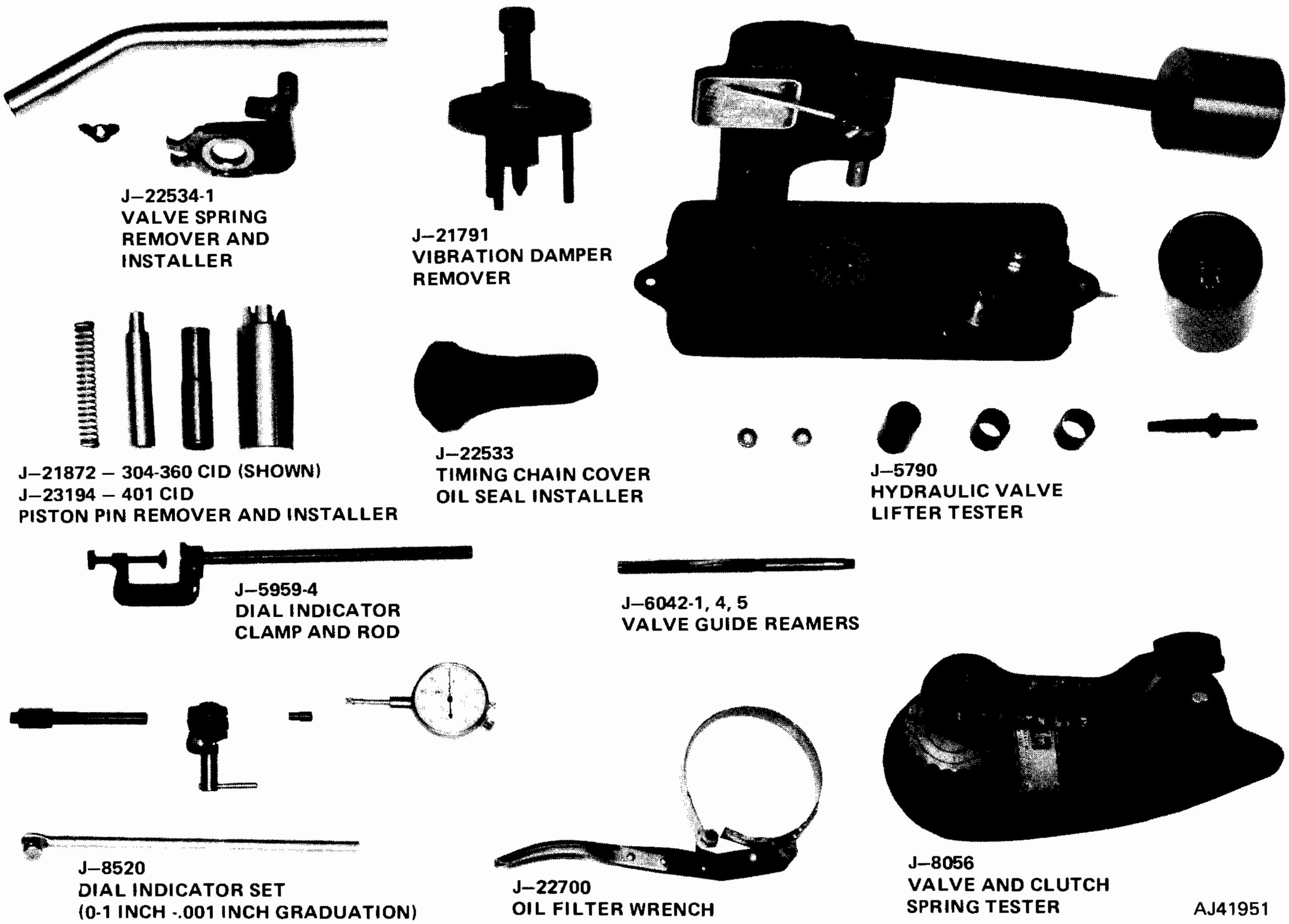


Special Tools

COOLING SYSTEM

GENERAL

The cooling system regulates the engine operating temperature by allowing the engine to reach normal operating temperature as quickly as possible, maintaining normal operating temperature, and preventing overheating (fig. 2-1 and 2-2). The cooling system also provides a means to heat the passenger compartment and to cool the automatic transmission fluid.

The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the engine and heater core.

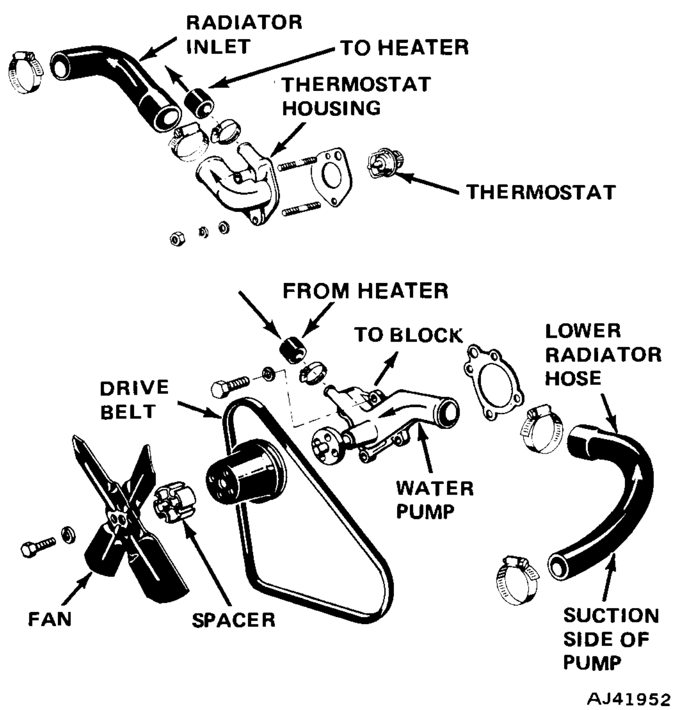


Fig. 2-1 Six-Cylinder Cooling System

The **coolant** is a mixture of low mineral content water and ethylene glycol based antifreeze. The antifreeze lowers the freezing point of the solution to prevent engine damage from freezing. The antifreeze also raises the boiling point to increase efficiency of coolant flow, reduce coolant loss from high heat, and minimize the possibility of cavitation damage.

Cavitation is the formation of a partial vacuum in a liquid caused by a swiftly moving solid body (impeller). The vacuum reduces the boiling point of the liquid and allows vapor bubbles to form, which burst when contacting a hard surface. If enough bubbles do this in a localized area, metal can be eroded and leakage can occur.

A centrifugal **water pump** driven by a V-type drive belt circulates the coolant through the water jackets, passages, and hoses of the system. The drive belt is

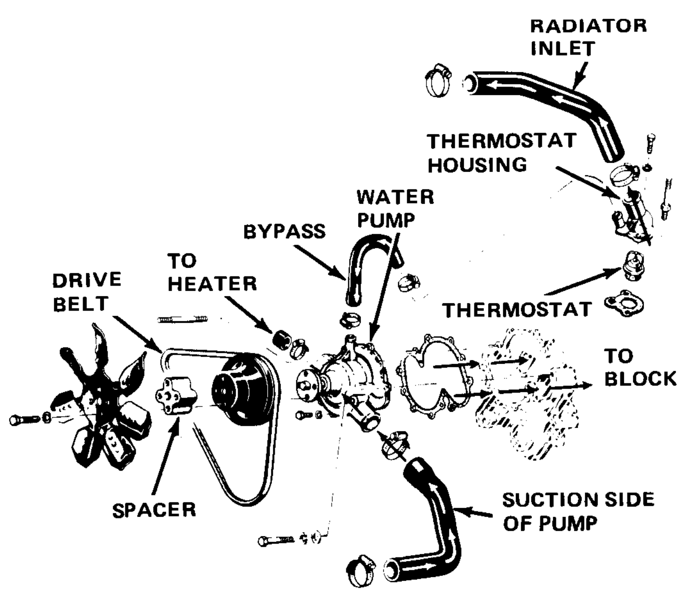


Fig. 2-2 V-8 Cooling System

driven by the vibration damper pulley, as are the belts for the other engine driven accessories (refer to Drive Belt Arrangement diagrams at the end of this section). The steel water pump impeller is pressed on the rear of the shaft which rides in a bushing pressed into the cast iron housing. The housing has a small hole to allow escape of any seepage that may occur. The water pump seals are lubricated by antifreeze; the bearings are sealed and no additional lubrication is necessary.

Rubber **hoses** route coolant to the heater core and radiator. On vehicles with V-8 engines, the heater core return hose is routed through a bracket attached to the carburetor choke housing.

The lower radiator hose on all models is spring reinforced to prevent collapsing caused by suction at the water pump inlet.

NOTE: *Coolant Temperature Override (CTO) switches are installed in the cooling system to control vacuum for emission control equipment. (Refer to Section 4A—Emission Control for description and operation.)*

A pellet-type **thermostat** controls operating temperature of the coolant by controlling coolant flow to the radiator. The temperature-sensitive pellet keeps the water control valve closed below 195°F, causing coolant to be recirculated within the engine, or open above 195°F to allow coolant flow to the radiator. This provides quick warmup and overall temperature control. Stamped on the thermostat are the words UP and TO RAD to indicate the proper installed position. The same thermostat is used winter and summer. Engines should not be operated without a thermostat (except for servicing or testing). Operating without a thermostat causes longer engine warmup time, poor warmup performance, and slower heater warmup.

With the thermostat open, coolant flows into a fin and tube type **radiator**. The radiator is composed of a top and bottom tank soldered to the cooling tubes. On the upper tank is the filler neck which has an overflow tube that routes overboil to the road. The bottom tank contains an **oil cooler** on vehicles equipped with automatic transmissions. The radiator has a drain cock in the lower tank to permit draining of the radiator.

Some radiators have a plastic **shroud** attached to funnel air more directly through the radiator for improved cooling.

Fitted to the radiator filler neck is a **radiator pressure cap** consisting of a pressure valve and a vacuum valve. The cap performs several functions:

- Prevents coolant loss when vehicle is in motion.
- Keeps impurities and air out of the system to minimize corrosion.
- Allows atmospheric pressure to enter the system and equalize. during cool down when a cooling system vacuum occurs.
- Seals the cooling system up to 15 psi pressure, which raises the coolant boiling point approximately 2-1/2°F per pound of pressure.

The **Tempatrol** fan drive is a torque and temperature-sensitive clutch unit which automatically increases or decreases fan speed to provide adequate cooling (fig. 2-3). It is used with heavy-duty or air conditioning cooling systems.

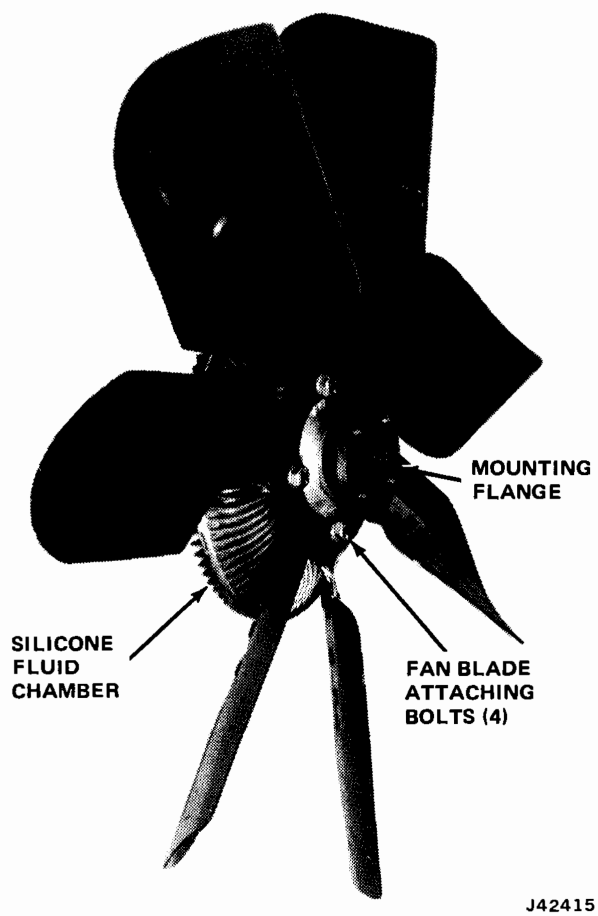


Fig. 2-3 Tempatrol Viscous Fan

A bimetal thermostatic coil at the front of the clutch unit reacts to changing radiator air temperatures and regulates the flow of silicone fluid into the drive chamber. The amount of fluid flowing into the chamber provides automatic fan speed control in proportion to the cooling demands of the engine.

The **temperature gauge** is an electrical instrument that indicates coolant temperature. It responds to electrical resistance changes of the sending unit, which is installed in the intake manifold of V-8 engines, and the cylinder head of six-cylinder engines (refer to Section 3—Electrical).

A factory-installed engine cylinder **block heater** is optional. It consists of a 600W, 120V heater element fitted into a core plug hole in the block, and a power cord and nylon straps which are placed in the glove box for later installation.

OPERATION

With engine running, the belt driven water pump circulates coolant throughout the system. On six-cylinder engines coolant is forced directly into the cylinder block through the water jackets surrounding the cylinders. It travels up through passages in the head gasket and cylinder head, around the combustion chambers and valves, and forward to the front of the cylinder head. Below 195°F, the thermostat is closed and coolant flows through the bypass port in the cylinder head, down through the block and back to the water pump where it is recirculated. A bypass port in the head allows coolant flow to the heater core.

On V-8 engines coolant is forced from the center of the engine timing case cover to each side outlet into each bank of the cylinder block. It flows in the water jackets around all cylinders and up through holes in the block and head gaskets into the cylinder heads to cool the combustion chambers and valves. Coolant then flows through each head to passages at the front of the head and then into the intake manifold to the thermostat. In the right head, coolant is also forced into the intake manifold at the rear corner and out to the heater core, through the heater core, and back to the water pump where it is recirculated.

Below 195°F the thermostat is closed and coolant flows out the bypass port through the hose to the water pump, where it is recirculated.

On all engines the recirculation cycle continues until coolant temperature reaches 195°F and the thermostat begins to open. Coolant then flows to the radiator upper tank, down through the cooling tubes, and into the bottom tank. The radiator fan and vehicle motion cause air to flow past the cooling fins, removing heat from the coolant. As the coolant flows through the lower tank, it passes the automatic transmission oil cooler (if equipped) and cools the automatic transmission fluid. Coolant is then pushed through the lower radiator hose into the water pump inlet to restart the cycle.

The thermostat continues to open allowing more coolant flow to the radiator until it reaches maximum open position (219°F (±3 °)).

The heat causes system pressure to rise, which raises the boiling point of the coolant. The pressure cap maintains pressure between 13.9 and 18 psi. Above 15 psi the relief valve in the cap allows pressurized coolant to vent through the filler neck overflow tube to the road (fig. 2-4).

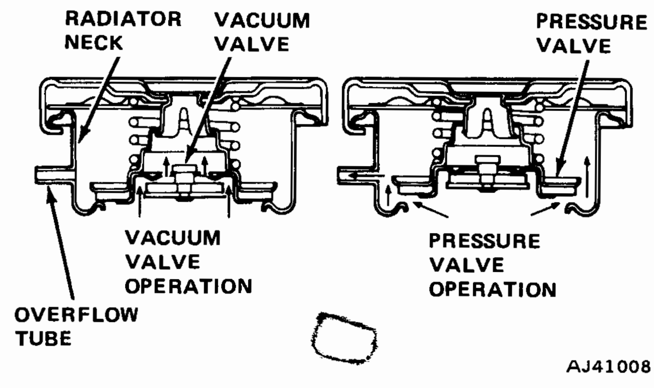


Fig. 2-4 Radiator Cap Operation

Immediately after engine shutdown, temperature rises during heat soak. In some cases, particularly after a hard run, or if coolant level is too high, some coolant may be pushed out the overflow tube. Unless overflow occurs frequently, IT IS NORMAL.

As engine temperature drops, the hot coolant contracts and forms a partial vacuum in the system. The radiator cap vacuum valve allows atmospheric pressure to enter the system where there is a 0.6 psi differential.

During operation, the coolant temperature is monitored by the temperature sending unit. The sending unit electrical resistance varies as temperature changes, which allows the temperature gauge to read accordingly (refer to Section 3—Electrical).

The sender responds to temperature changes, so under high load or on hot days, the coolant will be hotter and the gauge will indicate higher temperatures. Unless the gauge needle is past the high end of the band or coolant loss occurs, THIS IS NORMAL.

COOLING SYSTEM DIAGNOSIS

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

Air may be drawn into the cooling system through leakage at the water pump seal. Combustion gas may be forced into the cooling system through a leak at the cylinder head gasket even though the passage is too small to allow water to enter the combustion chamber.

Cooling System Service Diagnosis

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION — OVERHEATING	(1) Coolant level low	(1) Replenish coolant level
	(2) Fan belt loose	(2) Adjust fan belt
	(3) Radiator hose(s) collapsed	(3) Replace hose(s)
	(4) Radiator blocked to airflow by debris or special equipment	(4) Remove restriction
	(5) Faulty radiator cap	(5) Replace cap
	(6) Vehicle overloaded	(6) Reduce load
	(7) Defective Tempatrol fan	(7) Replace fan
	(8) Ignition timing incorrect	(8) Adjust ignition timing
	(9) Idle speed low	(9) Adjust idle speed
	(10) Air trapped in cooling system	(10) Purge air
	(11) Vehicle in heavy traffic	(11) Operate at fast idle intermittently to cool engine
	(12) Incorrect cooling system component(s) installed	(12) Install proper component
	(13) Faulty thermostat	(13) Replace thermostat
	(14) Water pump shaft broken or impeller loose	(14) Replace water pump
	(15) Radiator tubes clogged	(15) Flush radiator
	(16) Cooling system clogged	(16) Flush system
	(17) Casting flash in cooling passages	(17) Repair or replace as necessary. Flash may be visible by removing cooling system components or removing core plugs.
	(18) Brakes dragging	(18) Repair brakes

Cooling System Service Diagnosis (Continued)

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION—OVERHEATING (Continued)	(19) Excessive engine friction	(19) Repair engine
	(20) Vehicle working beyond cooling system capacity	(20) Install heavy-duty cooling or use special-duty vehicle
	(21) Antifreeze concentration over 68%	(21) Lower antifreeze content
LOW TEMPERATURE INDICATION—UNDERCOOLING	(1) Improper fan being used	(1) Install proper fan
	(2) Improper radiator	(2) Install proper radiator
	(3) Thermostat stuck open	(3) Replace thermostat
	(4) Improper fan pulley (too small)	(4) Install proper pulley
COOLANT LOSS BOILOVER	Refer to Overheating Causes in addition to the following:	
	(1) Overfilled cooling system	(1) Reduce coolant level to proper specification.
	(2) Quick shutdown after hard (hot) run	(2) Allow engine to run at fast idle prior to shutdown

NOTE: *Immediately after shutdown, the engine enters a period known as "heat soak." This occurs when the cooling system is inoperative and engine temperature is still high. If coolant temperature rises about the boiling point, it may push some coolant out of the radiator overflow tube. If this does not occur frequently, it is considered normal.*

Condition	Possible Cause	Correction
	(3) Air in system resulting in occasional burping of coolant	(3) Purge system
	(4) Insufficient antifreeze allowing coolant boiling point to be too low	(4) Add antifreeze to raise boiling point
	(5) Antifreeze deteriorated because of age or contamination	(5) Replace coolant
	(6) Leaks due to loose hose clamps, loose nuts, bolts, drain plugs, faulty hoses, or defective radiator	(6) Pressure test system to locate leak then repair as necessary
	(7) Faulty head gasket	(7) Replace head gasket

Cooling System Service Diagnosis (Continued)

Condition	Possible Cause	Correction
COOLANT LOSS BOILOVER (Continued)	(8) Cracked head, manifold, or block	(8) Replace as necessary
COOLANT ENTRY INTO CRANKCASE OR CYLINDER	(1) Faulty head gasket	(1) Replace head gasket
	(2) Crack in head, manifold or block	(2) Replace as necessary
NOISE	(1) Fan contacting shroud	(1) Reposition shroud and check engine mounts
	(2) Loose water pump	(2) Replace pump
	(3) Dry fan belt	(3) Apply belt dressing or replace belt
	(4) Loose fan belt	(4) Adjust fan belt
	(5) Rough surface on drive pulley	(5) Replace pulley
	(6) Water pump bearing worn	(6) Remove belt to isolate. Replace pump
NO COOLANT FLOW THROUGH HEATER CORE	(1) Plugged return pipe in water pump	(1) Remove obstruction
	(2) Heater hose collapsed or plugged	(2) Remove obstruction or replace hose
	(3) Plugged heater core	(3) Remove obstruction or replace core
	(4) Plugged outlet in thermostat housing	(4) Remove flash or obstruction
	(5) Heater bypass hole in cylinder head plugged (six-cylinder)	(5) Remove obstruction

COOLING SYSTEM TESTS

Water Pump

To test a water pump for a loose impeller, proceed as follows:

(1) Position clean bucket beneath water pump.
(2) Loosen fan belt.
(3) Disconnect lower radiator hose from water pump.
(4) Bend a stiff clothes hanger or welding rod as shown in figure 2-5.
(5) Position rod in water pump inlet and try to turn fan. If impeller is loose and can be held with rod while fan is turning, pump is defective. If impeller turns, pump is OK.
(6) Reconnect hose and replenish coolant, or proceed with further repairs.

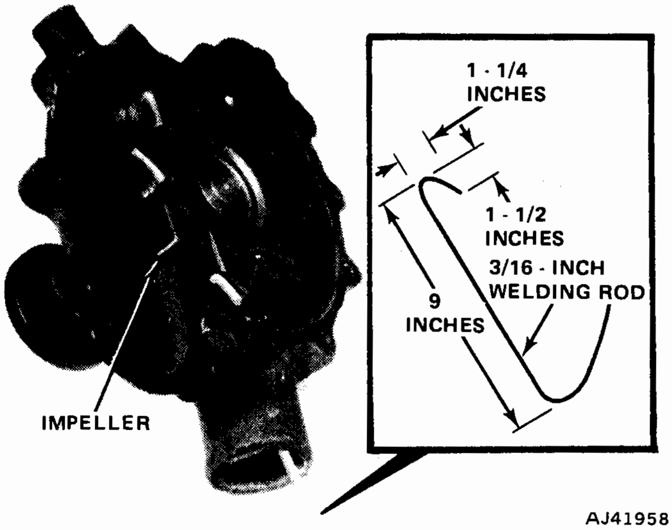


Fig. 2-5 Checking Water Pump for Loose Impeller

Tempatrol Fan Test

Start the engine and allow it to warm up to operating temperature. From under the hood, gradually increase the engine speed until a definite decrease of the audible fan airflow is heard. Maintain this engine speed until a definite increase of the audible fan airflow is heard.

The Tempatrol unit is operating satisfactorily if the time interval between decrease and increase of the audible fan airflow does not exceed three minutes.

NOTE: *The cooling system must be in good condition prior to performing the above test to ensure against excessively high radiator air temperatures.*

Thermostat

(1) Remove thermostat.

(2) Insert 0.003-inch feeler gauge, with wire or string attached, between valve and seat (fig. 2-6).

(3) Submerge thermostat in a container of antifreeze and water solution, suspended so it does not touch sides or bottom of container.

(4) Suspend a thermometer in solution so it does not touch container.

(5) Heat solution.

(6) Apply slight tension on feeler gauge while solution is heated. The moment valve opens 0.003 inch, feeler gauge will slip free from valve. Note temperature at which this occurs. Valve must be open 0.003 inch at 192°F to 199°F. It must be fully open a minimum of 0.360 inch at 219°F (±3°F).

(7) Install thermostat.

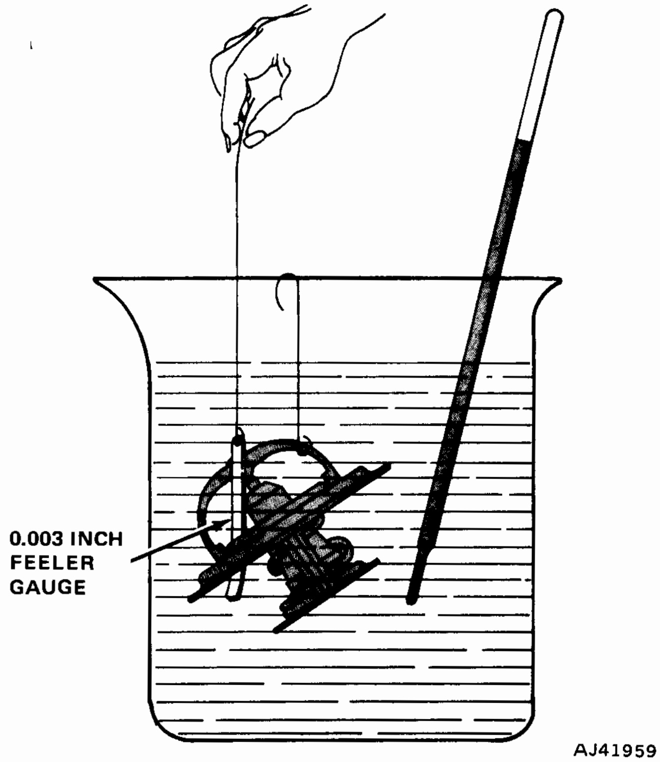


Fig. 2-6 Testing Thermostat

Radiator Cap

(1) Remove cap from radiator.

(2) Make sure seating surfaces are clean.

(3) Wet rubber gasket with water and install cap on tester (fig. 2-7).

(4) Operate tester pump and observe needle at its highest point. Cap release pressure should be 13.9 to 18 pounds.

NOTE: *Cap is okay when pressure holds steady or holds within the 13.9 to 18 pound range for 30 seconds or more. If needle drops quickly, replace cap.*

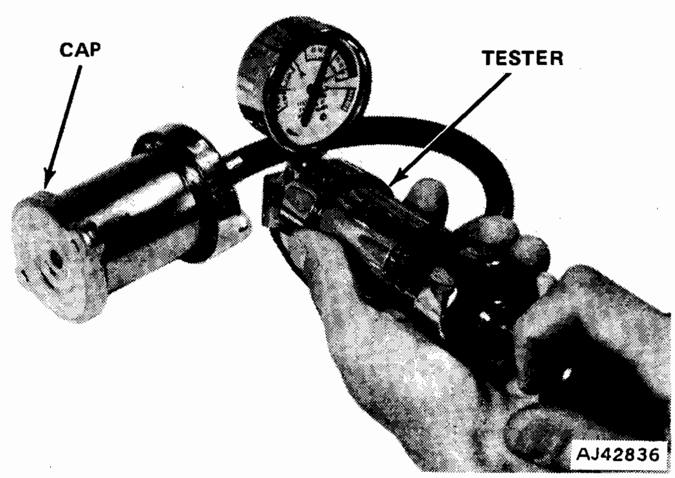


Fig. 2-7 Radiator Pressure Cap Test

Cooling System Pressure Test

NOTE: *Engine must be at normal operating temperature.*

(1) Carefully remove radiator pressure cap from filler neck and check coolant level.

(2) Wipe inside of filler neck and examine lower inside sealing seat for nicks, dirt, and solder bumps.

(3) Inspect overflow tube for dents or internal obstruction. Run a wire through tube to be sure it is clear.

(4) Inspect cams on outside of filler neck. If cams are bent, seating of pressure cap valve and tester seal will be affected. Bent cams can be reformed if done carefully.

(5) Attach pressure tester to filler neck (fig. 2-8). DO NOT FORCE.

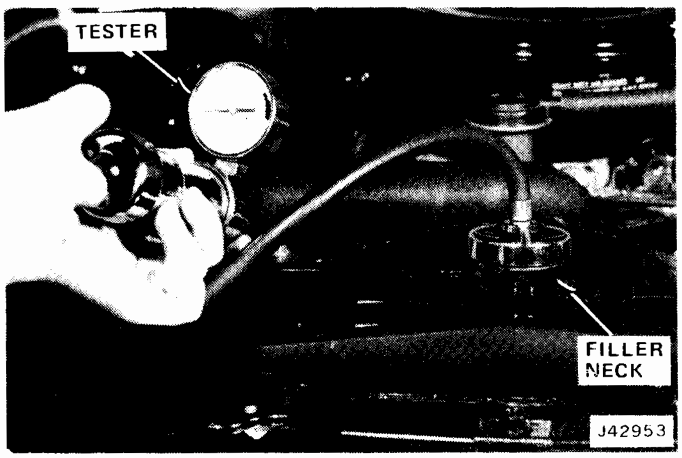


Fig. 2-8 Cooling System Pressure Test

(6) Operate tester pump to apply 15 psi pressure to system. If hoses swell excessively while testing, replace as necessary.

(7) Observe needle:

(a) **Holds Steady:** If needle holds steady for two minutes, there are no serious leaks in the system.

NOTE: *There may be an internal leak that does not show up under normal system pressure. If it is certain that coolant is being lost and no leaks can be found, check for internal leakage or proceed with Combustion Leakage Test (Without Pressure Tester).*

(b) **Drops Slowly:** Indicates presence of small leaks or seepage. Examine all points for seepage or slight leakage with a flashlight. Check radiator, hose, gaskets, and heater. Seal tiny leaks with AMC Sealer Lubricant, or equivalent. Repair leaks and recheck system.

(c) **Drops Quickly:** Indicates that serious leakage is present. Examine system for serious leaks. If none are visible, check for internal leakage.

NOTE: *Large radiator leaks should be repaired by a reputable radiator repair shop.*

Checking for Internal Leakage

(1) Remove oil pan drain plug and drain a small amount of oil (water, being heaviest, should drain first), or run engine to churn oil, then examine dipstick for water gobules.

(2) Check transmission dipstick for water globules.

(3) Check transmission oil cooler for leakage (refer to Oil Cooler Leakage).

(4) Run engine at normal operating temperature without pressure cap on radiator.

(5) Carefully attach Pressure Tester to filler neck. If pressure builds up quickly, a leak exists as a result of a faulty head gasket or crack. Repair as necessary.

CAUTION: *Do not allow pressure buildup over 18 psi. Release pressure by turning engine off and slowly removing tester. If tester does not have a safety catch, rock tester cap from side to side to release pressure.*

(6) If there is no immediate pressure increase, operate Pressure Tester until gauge reads within system range. Gauge hand vibration indicates compression or combustion leakage into cooling system.

Isolate compression leak by shorting each spark plug. Gauge hand should stop or decrease vibration when spark plug of leaking cylinder is shorted.

Combustion Leakage (Without Pressure Tester)

(1) Drain sufficient coolant to allow thermostat removal.

(2) Disconnect water pump drive belt.

(3) Six-Cylinder Engine: Disconnect upper radiator hose from thermostat housing, remove thermostat, and install thermostat housing to cylinder head.

V-8 Engine: Remove thermostat housing from intake manifold and remove thermostat.

(4) Add coolant to engine to bring level within 1/2 inch of top of thermostat housing or intake manifold.

(5) Start engine and accelerate rapidly three times while watching coolant.

CAUTION: *Do not run engine too long to avoid overheating.*

NOTE: *If any internal engine leaks to the cooling system exist, bubbles will appear in the coolant. If bubbles do not appear, there are no internal leaks.*

Oil Cooler Leakage

Should a leak in the oil cooler occur, it can be detected by the presence of transmission fluid in the coolant. If fluid appears in the coolant, check the fluid level of the automatic transmission. If the fluid level is low, check the oil cooler as follows:

(1) Remove transmission-to-cooler lines at radiator.

(2) Plug one fitting in cooler.

(3) Remove radiator cap and fill radiator so bubbles can be seen.

(4) Apply shop line pressure (50 to 200 psi) to other fitting.

Bubbles in coolant at filler neck indicate a leak in oil cooler. Should a leak in the oil cooler occur, radiator must be removed and repaired.

CAUTION: *Because of high oil pressure, conventional soldering must not be used for oil cooler repair.* **All repairs must be silvered soldered or brazed.**

Hose and Belt Inspection

Check hoses at regular intervals by squeezing. If a hose is cracked or feels brittle when squeezed, it should be replaced. If a hose swells excessively when under pressure, it should be replaced. Inspect V-belts frequently for defects such as extreme dryness, fraying, or cracking.

CAUTION: *Do not use any commercial belt dressing or oil-based lubricant on any drive belt. Do not dress the sides of any drive belt with a file or other abrasive. Each belt has 5 to 6 tensile members wrapped around it and, if these members are cut, the belt could fail.*

COOLANT

Maintain coolant level with a mixture of ethylene-glycol-based antifreeze and low mineral content water.

CAUTION: *Freeze protection should always be maintained to meet local requirements. Maximum protection is provided with a 68 percent concentration which prevents freezing to -90°F. A higher percentage will freeze at a higher point. For example, pure antifreeze freezes at -8°F. Antifreeze concentration MUST ALWAYS be at least 44 percent (-20°F freezing point), year-round and in all climates. If concentration is lower, engine parts can be eroded from a condition called cavitation.*

CAUTION: *Coolant additives which claim to improve engine cooling should not be used.*

Coolant level when cold should be 1-1/2 inches to 2 inches below the rear of the radiator filler neck sealing surface, and at normal operating temperature it should be 1/2 inch to 1 inch below this surface. If necessary to check level, idle engine for a few moments to cool it down. If engine is overheated and all coolant has not been lost, operate engine above curb idle speed for a few moments with hood up, then shut engine off and let it cool 15 minutes before removing cap.

WARNING: *Use extreme care when removing the cap from a hot radiator. If possible, wait until the engine has cooled, then wrap a thick cloth around the radiator cap and turn it slowly to the first stop. Step back while the pressure is released from the cooling system. When you are sure all the pressure has been released, press down on the cap (with a cloth), turn, and remove it.*

Draining Coolant

Coolant is drained from the radiator by loosening the drain cock on the bottom tank.

Coolant is drained from the engine block by removing the drain plugs.

- Six-Cylinder—Two located on left side of block, which may be replaced by one or two CTW switches.
- V-8—Centrally located on each side of block.

WARNING: *Do not remove block drains with system under pressure or serious burns from coolant may occur.*

Refilling

Before refilling, install all drain plugs and tighten radiator drain cock. Add the proper mixture of coolant to meet local requirements for freeze protection.

CAUTION: *Antifreeze concentration MUST ALWAYS BE at least 44 percent (-20°F freezing point), year-round and in all climates. If concentration is lower, engine parts can be eroded from cavitation.*

Fill the radiator to the proper coolant level. the radiator cap.

After refilling the system or when air pockets are suspected, the cooling system should be bled of excess air.

Bleeding Air from System

Trapped air will hamper or stop coolant flow or cause "burping" of engine coolant out of the radiator.

Bleed air by operating the engine with a properly filled cooling system with the radiator cap off until coolant has completely circulated throughout the engine, or until normal operating temperature is reached. The heater control must be in the HEAT position, and the heater temperature control must be in the full WARM or HIGH position.

Replenish coolant level, if necessary, and reinstall radiator cap. After coolant has reached normal operating temperature, shut engine off and replenish coolant level as necessary.

ADJUSTMENTS

Fan and Alternator Belt Adjustment

(1) Loosen alternator pivot mount bolt and alternator adjusting bolt.

(2) Adjust belt using pry bar on six-cylinder engines and 1-inch,open-end wrench on V-8 engines.Snug adjusting bolt (fig. 2-9 and 2-10).

(3) Check belt tension using Tension Gauge J-23600 (fig. 2-11).

(4) Tighten adjusting bolt to 18 foot-pounds torque and pivot bolt to 28 foot-pounds torque.

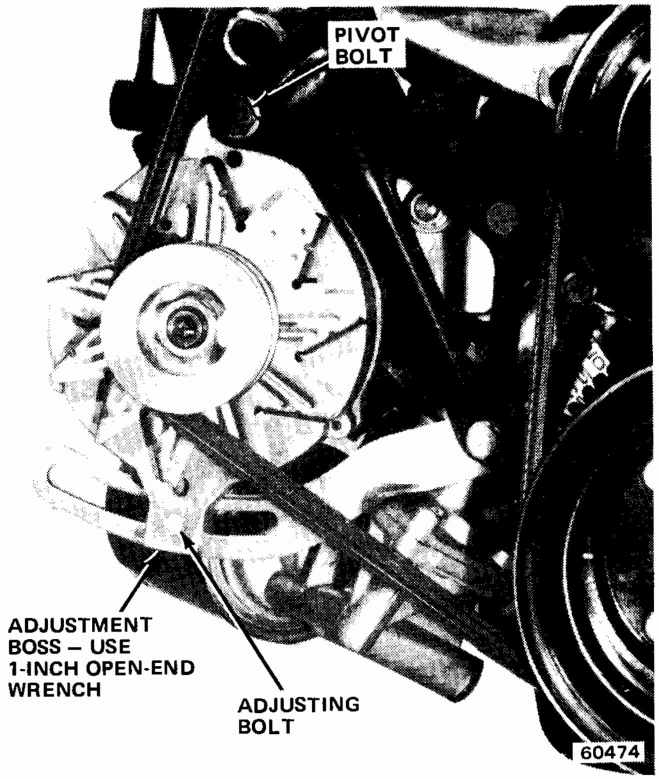


Fig. 2-10 Alternator Adjustment—V-8

Alternator Belt Adjustment Six-Cylinder with Air Conditioning

(1) Loosen alternator lower adjusting bolt.
(2) Loosen alternator bracket adjusting bolt.
(3) Loosen alternator upper pivot bolt.

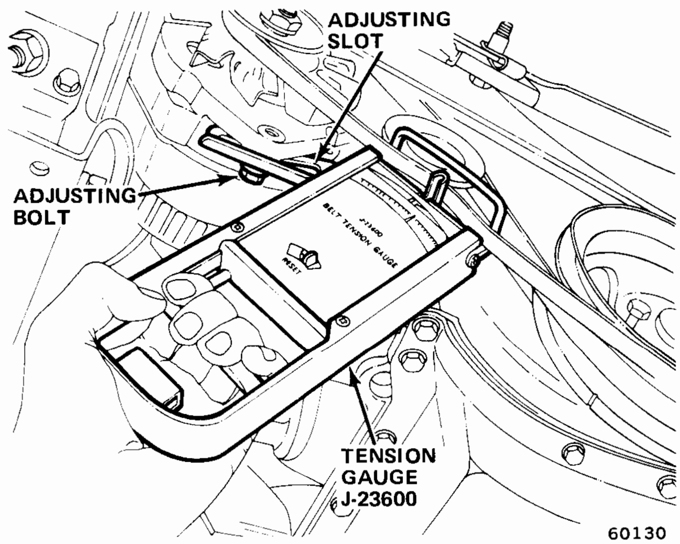


Fig. 2-11 Checking Drive Belt Tension—Typical

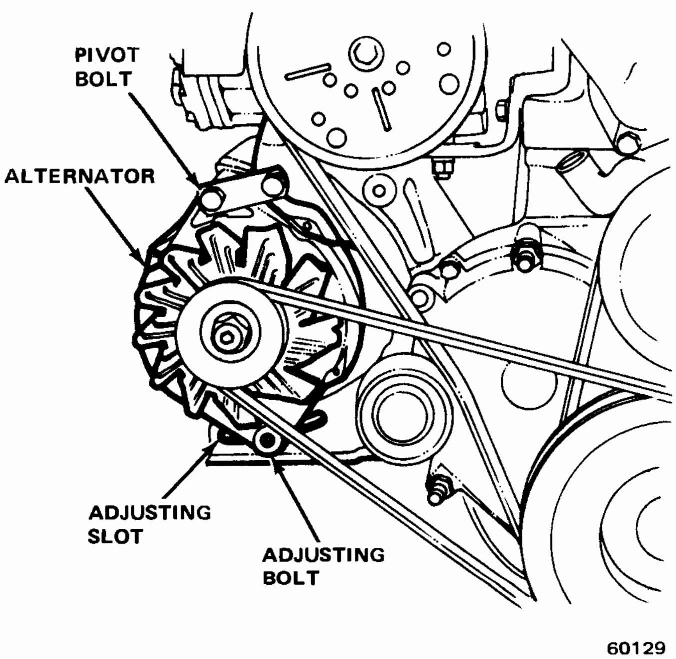


Fig. 2-9 Alternator Adjustment—Six-Cylinder

(4) Adjust alternator using a suitable pry bar. Snug adjust bolt (fig. 2-12).

(5) Check belt tension using Tension Gauge J-23600 (fig. 2-11). Correct if necessary.

(6) Tighten adjusting bolt to 18 foot-pounds torque, and tighten mounting bolts to 28 foot-pounds torque. If equipped with back idler, tighten to 33 foot-pounds torque.

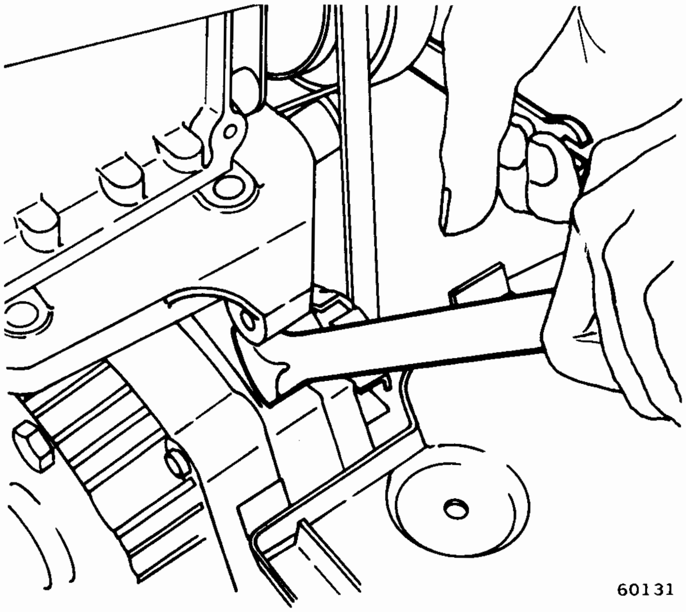


Fig. 2-12 Alternator Adjustment—Six-Cylinder with Air Conditioning

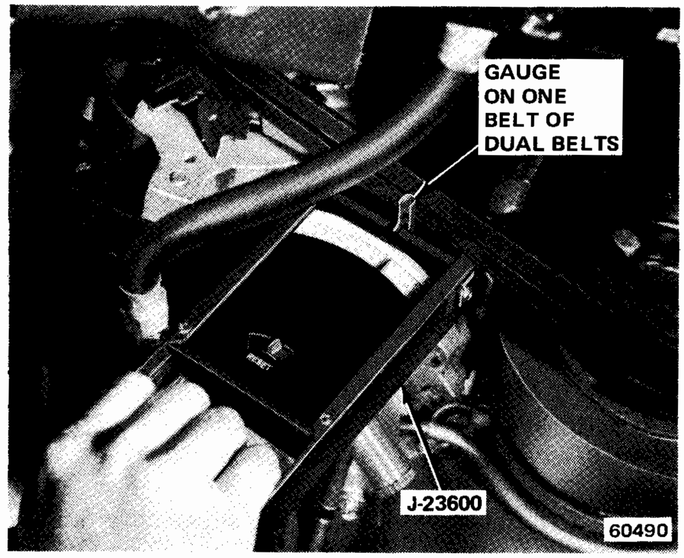


Fig. 2-13 Checking Drive Belt Tension—V-8 Engine with Air Conditioning

Belt Adjustment—V-8 Engine with Air Conditioning

V-8 engines equipped with air conditioning have a matched pair of belts to drive the alternator and AC compressor. The belts must be replaced together as a set; do not replace them individually. When checking belt tension, check one belt, not both, or incorrect indications will result (fig. 2-13).

Hose Position

In places where hoses do not have specific routing clamps, make sure hoses are moved to clear exhaust pipes, fan blades, and drive belts. Otherwise, hoses will be damaged resulting in coolant loss and overheating.

Shroud Position

In some extreme cases, the engine fan may contact the shroud. An examination of proper engine mounting should locate the trouble. If not, examine the shroud position. To compensate for normal engine movement, loosen the shroud mounting screws and relocate shroud to prevent fan-to-shroud contact.

WATER PUMP SERVICE

The water pump is the centrifugal type and is serviced as an assembly only.

Removal—Six-Cylinder Engine

(1) Drain cooling system at radiator.
(2) Disconnect radiator and heater hoses from water pump.
(3) Loosen alternator adjustment strap screw, upper pivot bolt, and remove drive belt.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate shroud from radiator to facilitate removal and installation of engine fan and hub assembly.*

(4) Remove fan and hub assembly.
(5) Remove air conditioning intermediate idler pulley and mounting bracket (if equipped).
(6) Remove power steering pump front mounting bracket (if equipped).
(7) Remove water pump and gasket from engine.
(8) Clean all old gasket material from gasket surface of engine, and remove any foreign material which may have accumulated in impeller cavity.

Installation

(1) Install new water pump and gasket to engine.
(2) Tighten retaining bolts to 13 foot-pounds torque.
(3) Install power steering pump front mounting bracket (if equipped).
(4) Install air conditioning intermediate idler pulley and mounting bracket (if equipped).
(5) Install alternator drive belt and tighten to specified tension.
(6) Connect radiator and heater hoses to water pump.
(7) Tighten air conditioning drive belt to specified tension.
(8) Fill radiator with a mixture of 50 percent Jeep All-Season Coolant (or equivalent) and 50 percent water. Start engine and open heater control valve to

remove air bubbles from heater core. Operate engine long enough for thermostat to open, and recheck coolant level.

Removal—V-8 Engine

(1) Disconnect battery negative cable.
(2) Drain radiator and disconnect upper radiator hose at radiator.
(3) Loosen all drive belts.
(4) Remove fan and hub assembly.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate it from radiator to allow removal of engine fan and hub assembly.*

(5) If equipped with a viscous fan, remove fan assembly (do not unbolt fan blades) and shroud all at the same time. There is sufficient room to move viscous fan assembly toward radiator and clear water pump.

NOTE: *Studs in water pump may back out of water pump while removing nuts, preventing fan assembly from clearing water pump. If this happens, install a double nut on stud(s) and remove stud(s).*

(6) If vehicle is equipped with air conditioning, install a double nut on air conditioning compressor bracket to water pump stud and remove stud (fig. 2-14).

NOTE: *Removal of this stud eliminates removing compressor mounting bracket.*

(7) Remove alternator and mount bracket assembly and place aside. Do not disconnect wires.

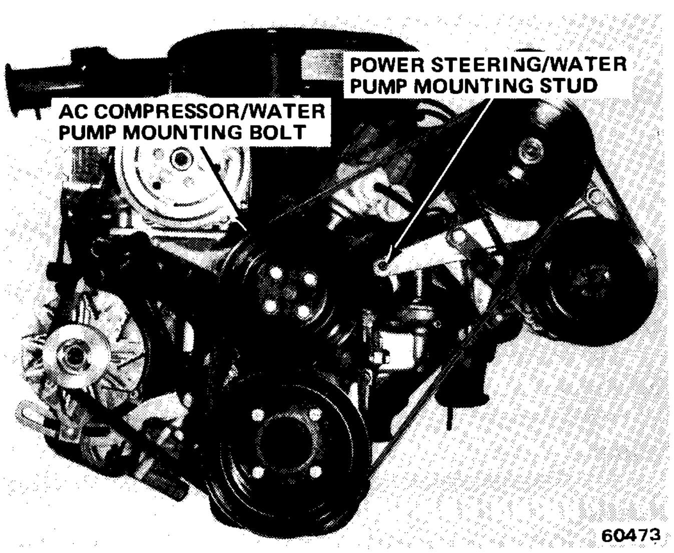


Fig. 2-14 Water Pump Mounting—V-8 Engine

(8) If equipped with power steering, remove two nuts that attach power steering pump to rear half of pump mounting bracket.
(9) Remove two bolts that attach front half of bracket to rear half.
(10) Remove remaining upper bolt from inner air pump support brace, loosen lower bolt and drop brace away from power steering front bracket (fig. 2-14).
(11) Remove front half of power steering bracket from water pump mounting stud.

NOTE: *If vehicle is equipped with a radiator shroud, it is necessary to separate it from radiator to facilitate removal and installation of engine fan and hub assembly.*

(12) Disconnect heater hose, bypass hose, and lower radiator hose at water pump.
(13) Remove water pump and gasket from timing chain cover.
(14) Clean all old gasket material from gasket surface of timing chain cover.

Installation

(1) Install new water pump and gasket to timing case cover.
(2) Tighten retaining bolts to specified torque.
(3) If removed, install front section of power steering mount bracket, power steering pulley and drive belt.
(4) Tighten drive belt to specified tension, then tighten pulley retaining nut to 55 to 60 foot-pounds torque.
(5) Install air pump drive belt (if removed) and tighten to specified tension.
(6) Install alternator and mount bracket assembly.
(7) Connect heater hose, bypass hose, and lower radiator hose to water pump.

NOTE: *Vehicles with a shroud should have radiator removed previously as bolts that attach shroud also retain radiator.*

CAUTION: *Check to be sure the wire coil is installed in the lower radiator hose. Failure to install this coil will result in the hose collapsing during high engine rpm.*

(8) Install engine fan and hub assembly and tighten retaining bolts to specified torque.
(9) If equipped with a viscous fan, install shroud and fan assembly at the same time.
(10) Install alternator drive belt and tighten to specified tension.
(11) Connect upper radiator hose to radiator.
(12) Connect battery negative cable.

(13) Fill cooling system with a 50 percent Jeep All-Season Coolant or equivalent and 50 percent water mixture. Operate engine with heater control valve open until thermostat opens. Shut off engine and recheck coolant level.

THERMOSTAT REPLACEMENT

When installing the thermostat, the pellet, which is encircled by a coil spring, should face the engine. All thermostats are marked on the outer flange to indicate proper installed position.

The thermostat on six-cylinder engines **must be installed with the air bleed hole up** (fig. 2-15). This prevents air from being trapped in the block which could cause a sudden burping over of the coolant when the thermostat opens.

Fig. 2-15 Thermostat Installation—Six-Cylinder

Also during installation, observe the recess on the intake manifold (V-8) or cylinder head (six) and fit the thermostat in that groove (fig. 2-16 and 2-14). Then install the gasket and thermostat housing. Tightening the housing unevenly or with the thermostat out of its recess will result in a cracked housing. Tighten housing to 13 foot-pounds torque.

RADIATOR

Radiators are identified by Jeep part number and the vendor build code number embossed on the upper tank, or on some Cherokees, Wagoneers, or Trucks, the code is on the radiator right side support.

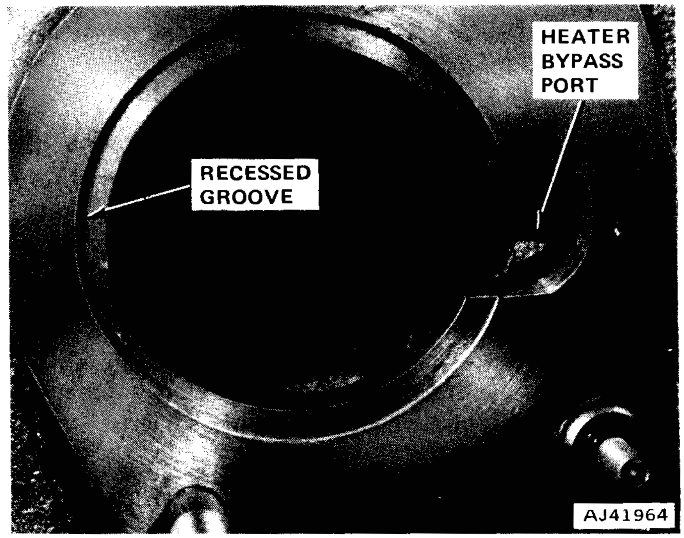


Fig. 2-16 Thermostat Recess—Six-Cylinder

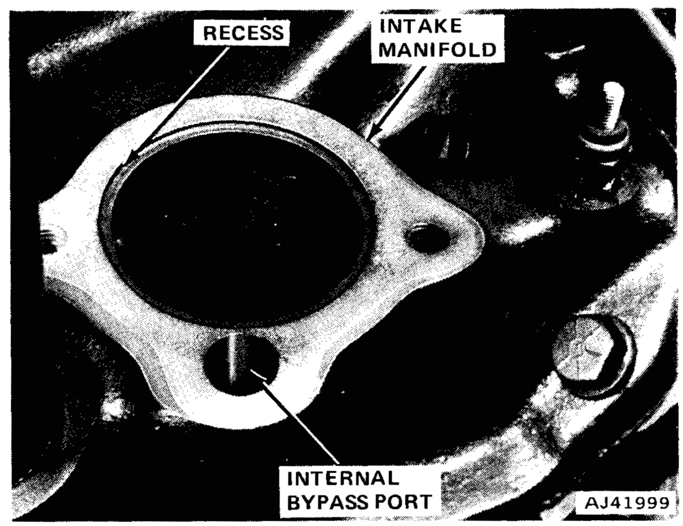


Fig. 2-17 Thermostat Recess—V-8

Radiator Identification

Blackstone or BLK — Vendor: Blackstone

B6 — Month: A—Jan, B—Feb; Year: 5—1975, 6—1976

M 77 P 05 6

Vendor: Modine
Last two digits of Vendor Part Number
Vendor Assembly Plate
Month: 01—Jan, 02—Feb
Year: 5-1975, 6-1976

48 — Week
6 — Year

42901

NOTE: *For testing radiator for leaks or pressure loss, see Cooling System Pressure Test.*

Several conditions may affect radiator operation:

- Bent or damaged tubes.
- Corrosive deposits restricting coolant flow.
- Tubes blocked due to improper soldering.

Damaged tubes which affect proper operation must be repaired. Leaks can be detected by applying 3 to 5 psi air pressure to the radiator while it is submerged in water. Tubes should be repaired with solder.

A clogged radiator usually can be cleared by reverse flushing or by solvent cleaning.

Solvent Cleaning

Use of a radiator cleaner (AMC Radiator Kleen, or equivalent) prior to flushing will soften scale and deposits.

Reverse Flushing Radiator

CAUTION: *The cooling system normally operates at 12 to 15 psi pressure. Excessive pressure may damage the radiator, heater core, or hoses.*

(1) Disconnect radiator hoses.

(2) Attach a piece of radiator hose to radiator bottom outlet and insert flushing gun.

(3) Connect water supply hose and air supply line to flushing gun.

(4) Allow radiator to fill with water.

(5) When radiator is filled, apply air in short blasts, allowing radiator to refill between blasts.

Continue reverse-flushing until clean water flows through top hose. If flushing fails to clear radiator passage, the radiator will have to be cleaned more extensively by a radiator repair shop.

Oil Cooler Repairs

Because of the high pressure in the oil cooler, conventional soldering will not repair leaks. **All repairs must be silver-soldered or brazed.**

FAN REPLACEMENT

Fan blade assemblies are balanced within 0.25 in.-oz. and should not be altered in any way. Refer to the Cooling System Components Chart for fan applications.

CAUTION: *Fans are designed for certain applications only. DO NOT attempt to increase cooling capacity by installing a fan not intended for a given engine. Noise and fan damage may result.*

CYLINDER BLOCK

Removing Coolant from Crankcase

Should coolant mix with engine oil, it will clog the oil lines and cause the pistons to seize. Severe damage to the engine will result. If coolant has leaked into the lubricating system, locate the cause for the coolant leak (such as a faulty head gasket or cracked block) and make the necessary repairs. After repairing the leak, use AMC Crankcase Cleaner, or equivalent, to flush engine.

Engine Flushing

(1) Remove thermostat housing and thermostat. Replace thermostat housing.

(2) Attach flushing gun to upper radiator hose at radiator end.

(3) Attach leadaway hose to water pump inlet.

(4) Connect water supply hose and air supply line to flushing gun.

(5) Allow engine to fill with water.

(6) When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through leadaway hose.

(7) Remove thermostat housing and install thermostat. Install thermostat housing. Tighten bolts to 13 foot-pounds torque.

(8) Connect radiator hoses.

(9) Refill cooling system.

Replacing Core Plugs

Prior to "hot tanking" or "block boiling," remove casting flash causing hot spots or coolant flow blockage. Remove core plugs with hammer, chisel, and prying tool. Apply a sealer to edges of new plug and install with hammer and suitable tool. Refer to the core plug size chart for location and size.

ENGINE BLOCK HEATER

On engines equipped with an engine block heater, the heating element plugs into any standard wall outlet. It heats the coolant which heats the engine parts to provide easier cold starting.

Installation

(1) Drain coolant from engine.

(2) Remove core plug and install block heater (fig. 2-18). Tighten six-cylinder T-bolt to 20 inch-pounds torque. Tighten V-8 compression nut to 10 foot-pounds torque.

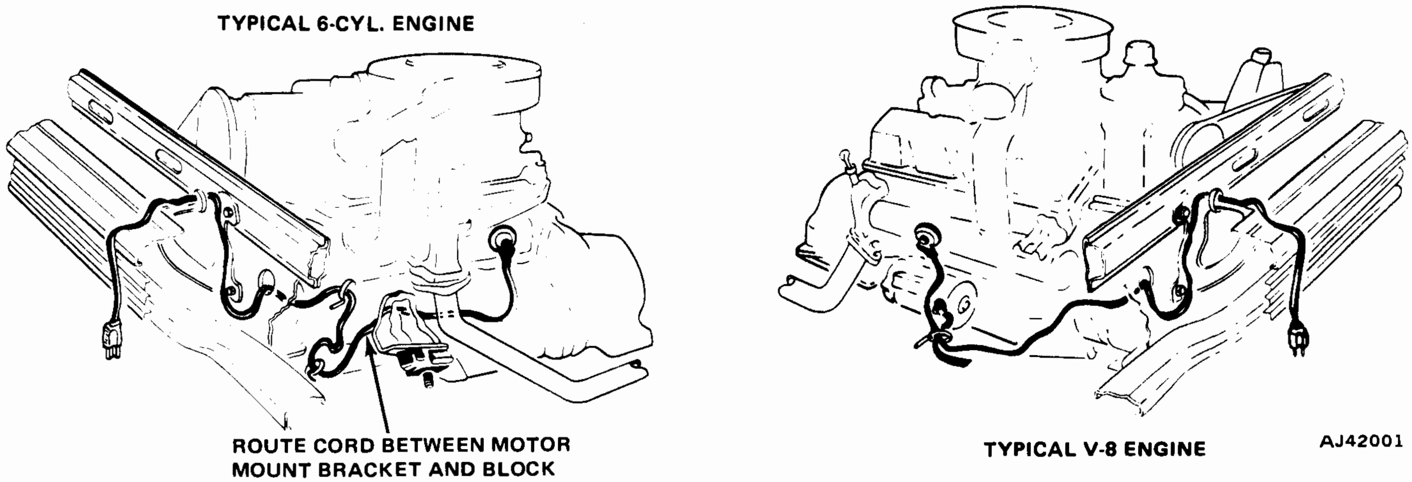


Fig. 2-18 Engine Block Heater Installation

CAUTION: *Be careful when tightening heater mounting bolt. Improper tightening may damage seal or allow heater to loosen, resulting in coolant loss and engine damage.*

(3) From front of vehicle, route heater (female) end of power cord through hole in front panel, along wire harness and connect to block heater.

(4) Using the furnished nylon straps, tie cord to wire harness and to inside of grille, and allow cord to extend outside of grille.

(5) Refill radiator with coolant.

Core Plug Sizes

Location	Diameter (inches)
Six-Cylinder Head — Left Side (3)	7/8
V8 Heads — Outer Sides (2 ea)	1
V8 Cylinder Block (3 ea side)	1 1/2
V8 Heads (1 ea end)	1 1/2
Six-Cylinder Block (3 on left side, 1 at rear)	2
Six-Cylinder Head (1 at rear)	2

60248

Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Accessory Drive Pulley Screws (Six-Cylinder)	18	12-25
Air Conditioning Idler Pulley Bracket to Timing Case Cover Nut	7	4-9
Air Pump-to-Bracket Screws . . .	20	15-22
Air Pump Bracket-to-Engine Screws	25	18-28
Air Pump Adjusting Strap to Pump.	20	15-22
Alternator Adjusting Bolt	18	15-20
Alternator Mounting Bracket-to-Engine Bolt	28	23-30
Alternator Pivot Bolt or Nut . . .	28	20-35
Alternator Pivot Mounting Bolt to Head	33	30-35
Crankshaft Pulley to Damper Screw	23	18-28
Engine Block Heater Nut (V-8) Compression Type	10	8-13
Engine Block Heater Nut Six-Cylinder T-Bolt Type	20 in-lb	17-25 in-lb
Fan Blades and Pulley to Hub Screw	18	12-25
Idler Pulley Bearing Shaft to Bracket Nut	33	28-38
Idler Pulley Bracket to Front Cover Nut	7	4-9
Oil Cooler Line Flared Fitting Nuts	25	15-30

Torque Specifications (Continued)

	Service Set-To Torques	Service In-Use Recheck Torques
Oil Cooler Line Radiator Fitting	15	10-30
Power Steering Pump Adapter Screw	23	18-28
Power Steering Pump Bracket Screw	43	37-47
Power Steering Pump Mounting Screw	28	25-35
Power Steering Pump Pressure Line Nut	30	30-45
Power Steering Pump Pulley Nut	58	40-69
Thermostat Housing	13	10-18
Timing Case Cover to Block (V-8) (through Water Pump)	25	18-33
Water Pump-to-Block Screws (Six-Cylinder)	13	9-18
Water Pump to Engine Block (V-8)	25	18-33
Water Pump-to-Timing Case Cover Screws (V-8)	48 in-lb	40-55 in-lb

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

60250

Cooling System Specifications

	Six-Cylinder	V-8
Radiator Cap		
Relief Pressure	15 psi	15 psi
Thermostat		
Rating	195°F	195°F
Must be open 0.003 inch	+3° of 195°F	+3° of 195°F
Fully open	218°F	218°F
Water Pump		
Type	Centrifugal	Centrifugal
Drive	V-Belt	V-Belt
Radiator		
Type	Tube & Fin	Tube & Fin
Cooling System Capacities (Includes 1 quart for heater)		
232 and 258 CID Engines	10.5 qts. U.S. 8.7 qts. Imp.	
304 CID Engines		13.0 qts. U.S. 11.6 qts. Imp.
360 and 401 CID Engines		14.0 qts. U.S. 10.8 qts. Imp.
Fan		
Number of blades	Refer to Cooling System Component Chart	
Diameter	Refer to Cooling System Component Chart	
Drive Belt		
Angle of V	38°	38°
Width — top of groove	0.391-0.453	0.391-0.453
Type (plain or cogged)	plain	plain

60570

Cooling System Components

Model	Package			Engine				Fan					Shroud
	Std	HD	AC	232 258	304	360(2V)	360(4V) 401	Dia. (Inches)	No. of Blades	Flex	Tempatrol	Spacer Thickness	
CJ	●			●				15.62	4			.52	
		●		●				19.00	7			.52	
	●				●			19.00	4			1.50	
		●			●			18.75	7	●		1.50	
Cherokee-Wagoneer-Truck	●			●				15.62	4			1.77	
		●		●				15.62	7			1.00	
			●	●				15.62	7			1.00	●
	●					●		19.00	4			1.77	
	●						●	19.50	7		●		
		●				●	●	19.50	7		●		
			●			●	●	19.50	7		●		●

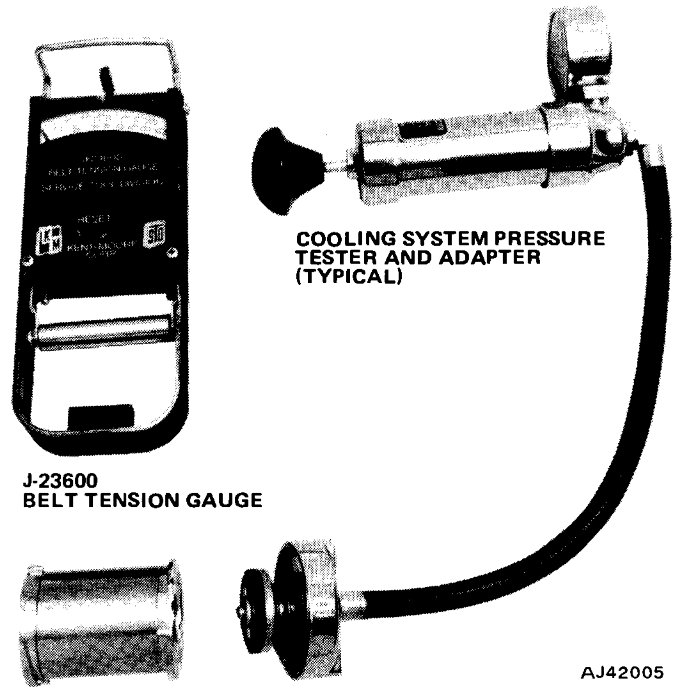
Note: All standard cooling package radiators have two rows of tubes. All other radiators have three rows of tubes. Refer to the parts catalog for application.

60571

Engine Drive Belt Tension Specifications

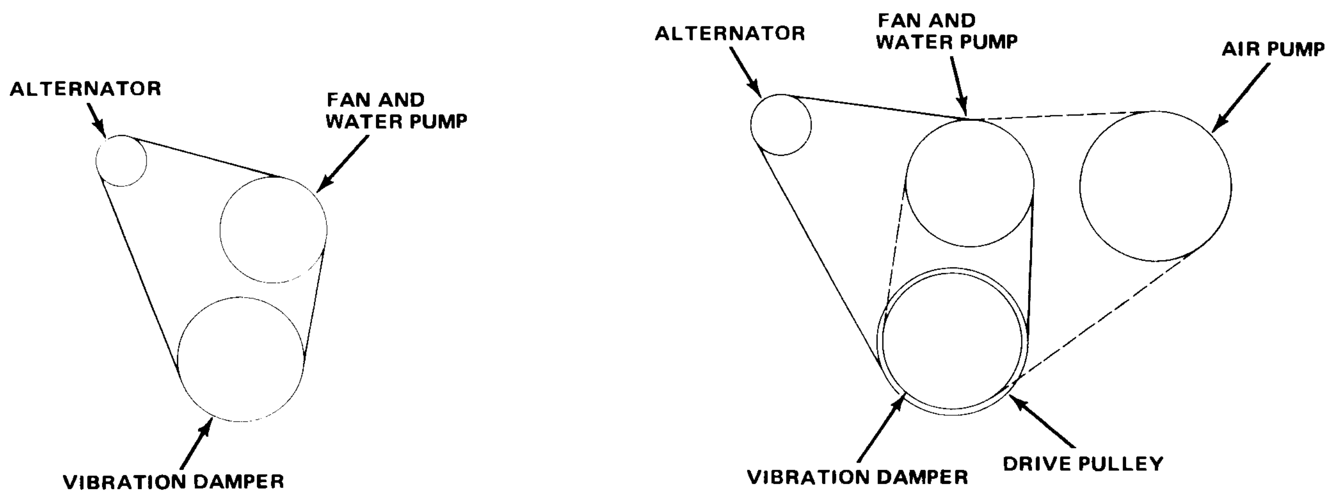
	Initial Pounds New Belt	Reset Pounds Used Belt
Air Conditioner		
Six-Cylinder	125-155	90-115
V-8	125-155	90-115
Air Pump		
All except six-cylinder w/PS	125-155	90-115
Six-Cylinder w/PS (3/8-inch belt)	65-75	60-70
Fan	125-155	90-115
Power Steering Pump	125-155	90-115

60253



Special Tools

LEGEND
FRONT BELT ————————
MIDDLE BELT ——— · ——— · ———
REAR BELT — — — — — — — — —

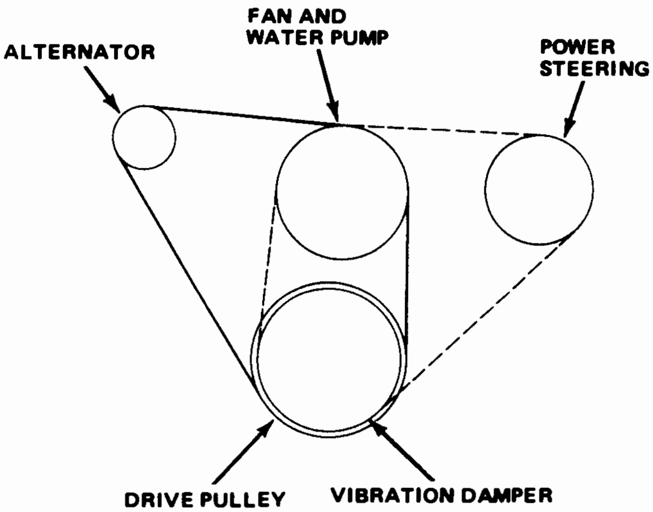


BASIC BELT ARRANGEMENT — SIX-CYLINDER ENGINE

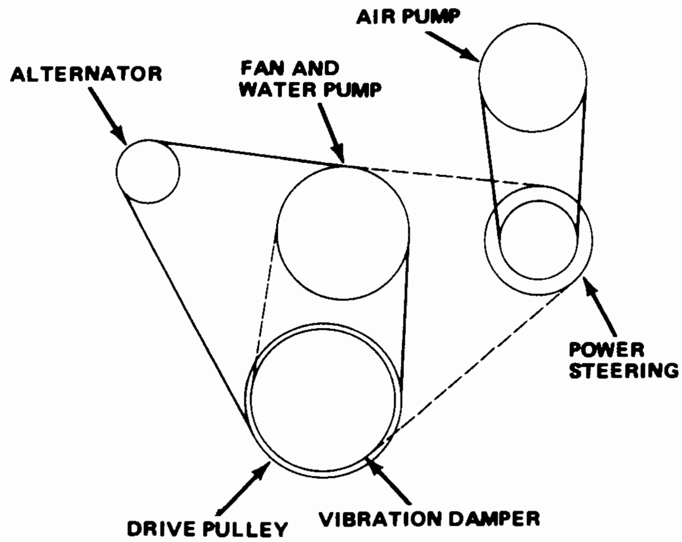
AIR GUARD — SIX-CYLINDER ENGINE

Drive Belt Arrangement (1 of 3)

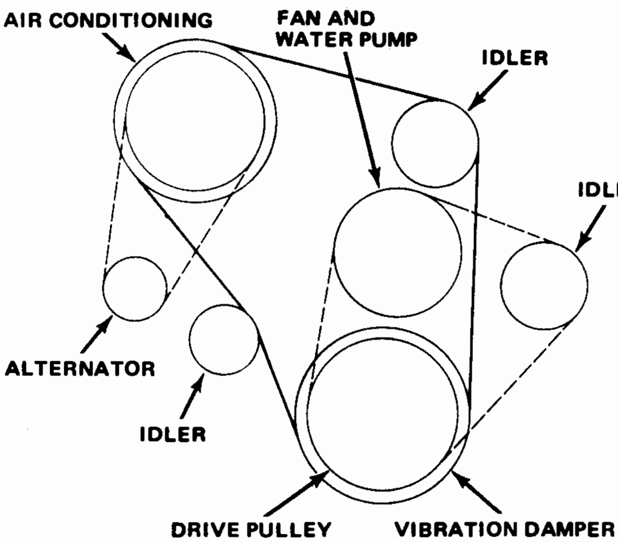
60254A



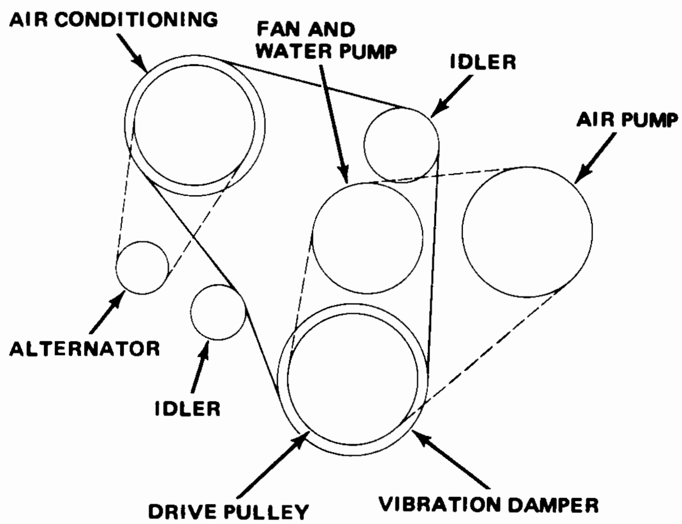
POWER STEERING –
SIX-CYLINDER ENGINE



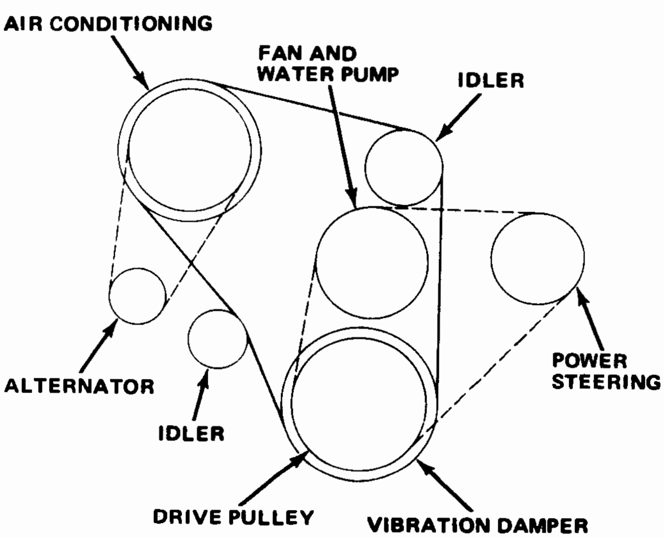
AIR GUARD AND POWER STEERING –
SIX-CYLINDER ENGINE



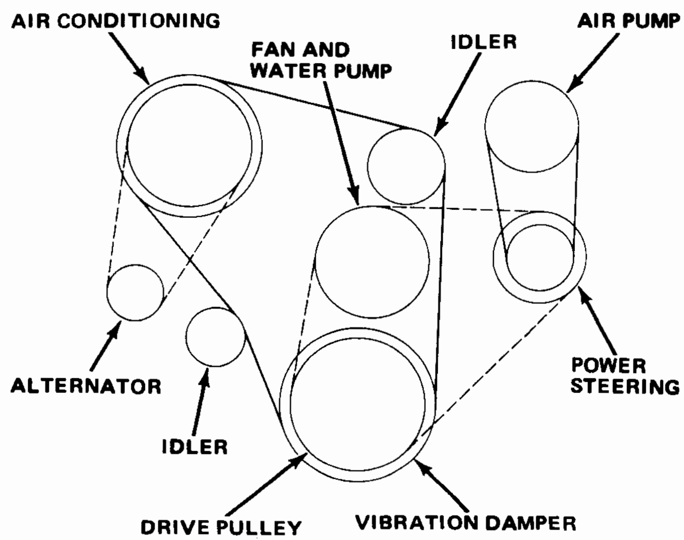
AIR CONDITIONING ONLY –
SIX-CYLINDER ENGINE



AIR GUARD AND AIR CONDITIONING–
SIX-CYLINDER ENGINE



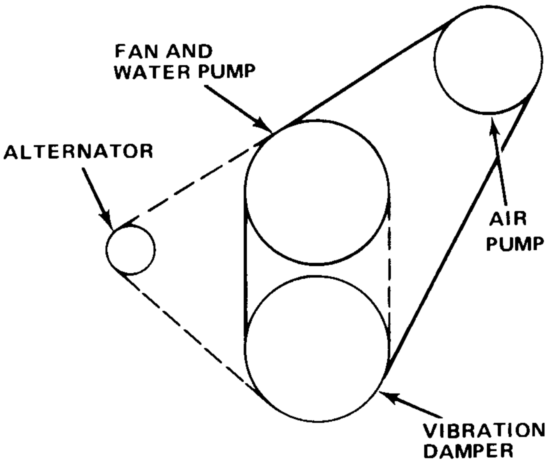
POWER STEERING AND AIR CONDITIONING
– SIX-CYLINDER ENGINE



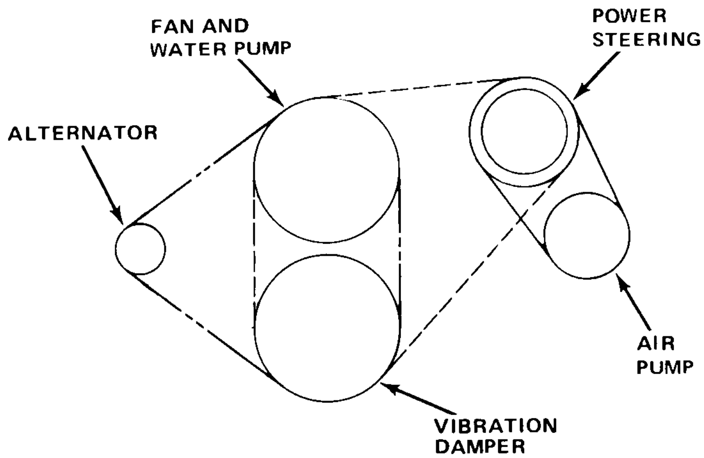
AIR GUARD, POWER STEERING AND AIR
CONDITIONING – SIX-CYLINDER ENGINE

60254B

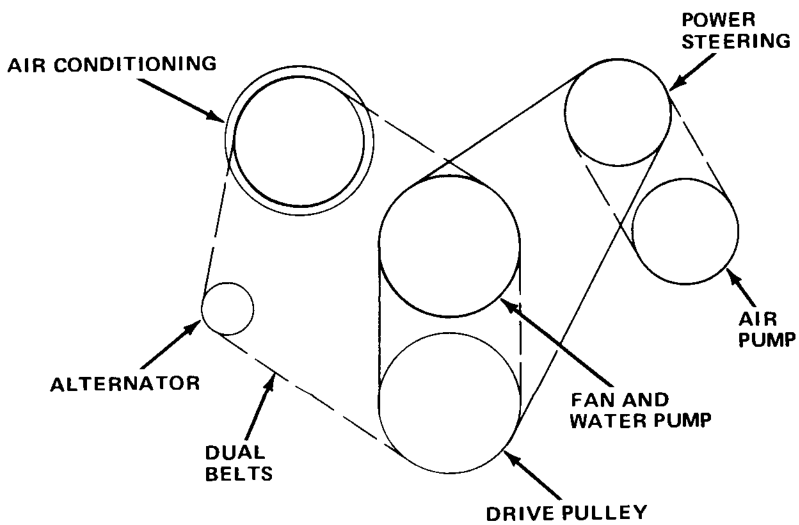
Drive Belt Arrangement (2 of 3)



BASIC BELT ARRANGEMENT WITH
AIR GUARD — V-8 ENGINE



AIR GUARD AND POWER
STEERING - V-8 ENGINE



AIR GUARD, AIR CONDITIONING, AND
POWER STEERING — V-8 ENGINE

60254C

Drive Belt Arrangement (3 of 3)

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

www.cargeek.ir

ELECTRICAL

BATTERIES AND GROUND CONNECTIONS

GENERAL

A 12-volt, negative ground, dc system is used which utilizes the frame and body for the ground return circuit.

CAUTION: *Burns or other damage may be caused by accidentally grounding circuits through careless use of tools or by not tightening connections in energized circuits.*

A 12-volt electrical system can generate an arc that can ignite gasoline that has been spilled or seeped from the fuel system. Disconnect the battery ground cable before removing any electrical component.

GROUND CONNECTIONS

Check for a poor or no-ground condition when servicing electrical malfunctions such as: erratic temperature and fuel gauge readings; directional lamps glowing when headlamps are operated; windshield wiper motor attempting to operate when some other electrical component is operated.

All models have the battery ground cable attached directly to the engine. An additional ground wire connected to the battery negative cable terminal end is attached to the dash panel on CJ models and to the right front fender inner panel on Cherokee-Wagonner-Truck models. To complete the ground return circuit from the load (bulb, gauge, etc.) back to the battery, the ground connections and their locations are as follows:

Instrument Panel—The hi-beam lamp, turn signal indicator lamps, panel lighting lamps and the constant voltage regulator (CVR) for the fuel and temperature gauges ground at the instrument cluster or panel for all models.

Frame-to-Engine Ground—All models utilize a ground strap. The strap is attached to the left motor mount.

CJ Models

The instrument cluster is grounded by the four mounting studs welded to the instrument panel (fig. 3-1)

Note the ground contact for the CVR (fig. 3-2). The regulator is part of the fuel gauge and depends on this ground to regulate voltage to the gauges.

The wiper/washer, lights, and heater control lights are grounded by a wire attached to a screw at the lower lip of the instrument panel.

Cherokee-Wagoneer-Truck

The cluster is grounded from a pin terminal on the cluster to a mounting screw on the lower lip of the instrument panel above the parking brake mechanism.

MAIN HARNESS CONNECTOR

All models have a main wiring harness connector located at the left upper corner of the toeboard (dash panel).

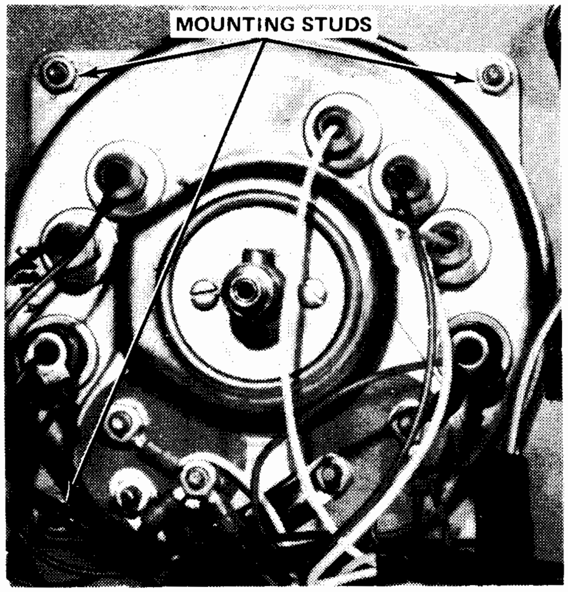


Fig. 3-1 Instrument Cluster Ground—CJ Models

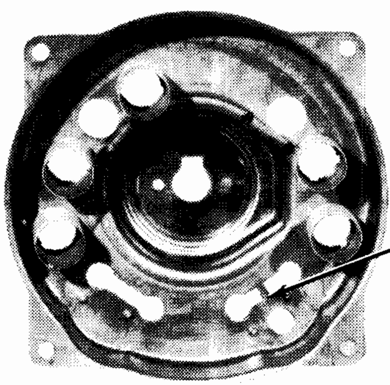


Fig. 3-2 Constant Voltage Regulator Ground—CJ Models

The connector can be removed from the dash panel by removing the center bolt from the engine compartment side and the two fuse block attaching screws from the driver's side. Be careful not to bend the male spade terminals when removing or installing the connector.

If any wires are replaced on the engine compartment side, the terminal opening must be resealed with a durable sealer.

NOTE: *Do not use string-type body caulk as a sealer.*

Located near the left upper corner of the main harness connector is a connector for the frame harness and the electrical tailgate window. On models without the electric tailgate, one of the terminals of the 3-way connector may be used to supply power for other accessories if desired by installing a 30-amp fuse or circuit breaker in the power tailgate position on the fuse block located next to the 4-way flasher.

CAUTION: *This circuit is hot regardless of the ignition switch position.*

BATTERIES

Three models are used, each having a different ampere hour rating to provide the starting power needed for various engine applications. All batteries used are 12-volt, lead-acid units. Batteries with cells anchored in epoxy are used to prevent damage from vibration encountered in off-road use. Replacement batteries should meet utility vehicle specifications. A regular passenger car battery would have a relatively short life if used in a utility vehicle.

The battery part number, reserve capacity rating, and cold cranking rating appear on a label affixed to the top of the battery. Use the Capacity Rating Chart to determine the amp hour rating for testing purposes.

Battery Capacity Rating Chart

Part Number	Amp. Hr. Rating	Reserve Capacity (Minutes)	Cold Cranking at 0° F (Amps)
5457114	50	73	290
5457116	60	93	345
5457115	70	106	370

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Cold Cranking Rating

The cold cranking test rating appears as an amperage rating at 0°F. This rating is the minimum amperage which must be maintained while cranking at 0°F (battery temperature) for 30 seconds with 1.25 volts minimum required per cell.

Reserve Capacity Rating

Reserve capacity is defined as the number of minutes a new, fully charged battery at 80°F (26.7°C) can be discharged at a steady rate of 25 amperes and maintain a voltage of 1.75 volts per cell (10.50 volts total battery voltage) or higher.

Starting Procedure—Discharged Battery

The correct method for starting a car with a discharged battery is with a portable starting unit or a booster battery. **When using either method, it is essential that connections be made correctly or serious damage to the electrical system may occur.**

When using a portable starting unit, **the voltage must not exceed 16 volts or damage to the battery, alternator, or starter may result.** Because of the

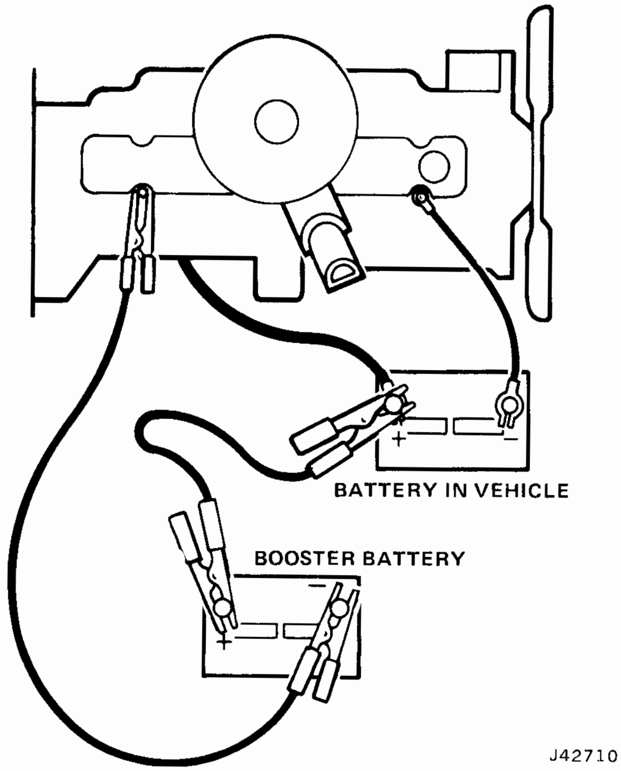

Fig. 3-3 Battery Jumper Cable Connections

accompanying high voltage, **a fast charger must not be used for booster starting.** Before connecting jumper cables to a discharged battery, remove the vent cap and cover the cap openings with a cloth.

CAUTION: *Battery action generates hydrogen gas which is flammable and explosive. Hydrogen gas is present within a battery at all times even when a battery is in a discharged condition. Keep open flames and sparks (including cigarettes, cigars, pipes) away from the battery. Always wear eye protection when working with a battery.*

WARNING: *During cold weather, if fluid is not visible or ice is evident, do not attempt to jump-start as the battery could rupture or explode.*

The battery must be brought up to 40°F and water added (if necessary) before it can be safely jump-started or charged.

Remove the vent caps from the booster battery and cover the cap openings with a cloth.

CAUTION: *If the car is being jump-started by a battery in another car, the cars must not contact each other.*

Connect a jumper cable between the positive posts of the two batteries. The positive post may be identified by the POS embossed on the battery cover in 1/4-inch letters adjacent to the battery post.

Be sure the clamps are making good contact. DO NOT CONNECT THE OTHER END OF THE JUMPER CABLE TO THE NEGATIVE TERMINAL OF THE DISCHARGED BATTERY. **Connect to a bolt or nut on the engine. Do not connect the jumper to the carburetor, air cleaner, or fuel line. Keep the cable clear of belts and pulleys (fig. 3-3).**

When removing the jumper cables, disconnect the clamp on the engine first.

Discard the cloth used to cover the cap openings as they have been exposed to sulfuric acid.

Install the vent caps.

BATTERY CHARGING

Slow Charge

Slow charging is the preferred method of recharging a battery. The slow charge method may be safely used, regardless of charge condition of the battery provided the electrolyte is at the proper level in all cells and is not frozen.

CAUTION: *Do not attempt to charge or use a booster on a battery with frozen electrolyte as it may cause the frozen battery to explode.*

The normal charging rate for a battery is one amp per positive plate per cell. For example, a 54-plate battery has nine plates per cell (54 divided by 6). There is always one more negative plate per cell than positive. The charging rate should be four amps. A 70-amp hour battery has 66 plates or 11 plates per cell.

The charging rate for this battery would be five amps (5 positive and 6 negative plates per cell). A minimum period of 24 hours is required when using this method.

The battery may be fully charged by this method unless it is not capable of accepting a full charge. A battery is in a maximum charged condition when all cells are gassing freely and three corrected specific gravity readings, taken at hourly intervals, indicate no increase in specific gravity.

Fast Charge

Always disconnect one battery cable before using a fast charger.

A battery may be charged at any rate which does not cause the electrolyte temperature of any cell to exceed 125°F and which does not cause excessive gassing and loss of electrolyte.

A fast charger cannot be expected to fully charge a battery within an hour, but will charge the battery sufficiently so that it may be returned to service and then be fully charged by the vehicle charging system, provided the vehicle is operated a sufficient length of time.

Frozen Electrolyte

A 3/4-charged automotive battery is in no danger of damage from freezing. Therefore, **keep the batteries at 3/4 charge or more, especially during winter weather.**

A battery in which the electrolyte is either slushy or frozen should be replaced. Batteries with this condition, depending on the severity of the freeze, may accept and retain a charge and even perform satisfactorily under a load test. However, after 120 to 150 days in service, a reduction in capacity and service life will become apparent as the individual plates lose their active material.

Freezing Temperature Chart

Specific Gravity (Corrected to 80°F)	Freezing Temperature Degrees Fahrenheit
1.270	-84°F
1.250	-62°F
1.200	-16°F
1.150	+05°F
1.100	+19°F

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Discharge Chemical Action

A cell is discharged by completing an external circuit such as cranking a starter motor. Sulfuric acid, acting on both positive and negative plates, forms a new chemical compound called lead sulfate. The sulfate is supplied by the acid solution (electrolyte). The acid becomes weaker in concentration as the discharge continues. The amount of acid consumed is in direct proportion to the amount of electricity removed from the battery. When the acid in the electrolyte is partially used up by combining with the plates and can no longer deliver electricity at a useful voltage, the battery is said to be discharged.

The gradual weakening of the electrolyte in proportion to the electricity delivered is a helpful action in that it allows the use of a hydrometer to measure how much unused acid remains with the water in the electrolyte. This information then can be used to determine approximately how much electrical energy is left in each cell.

Charge Chemical Action

The lead sulfate in the battery is decomposed by passing a current through the battery is a direction opposite to that of the discharge. The sulfate is expelled from the plates and returns to the electrolyte, thereby gradually restoring it to its original strength. Hydrogen and oxygen gasses are given off at the negative and positive plates as the plates approach the fully charged condition. This is caused by an excess of charging current not totally accepted by the plates.

BATTERY MAINTENANCE

CAUTION: *Always observe the correct polarity. Reversed battery connections may damage the alternator diodes.*

The NEGATIVE battery terminal is connected to the engine and to the fender inner panel.

It is very important that the battery be in a fully charged condition when a new car is delivered. The continual operation of a partially charged battery could shorten its life and result in replacement.

Fluid level in the battery should be checked periodically and replenished with distilled water, if possible. However, drinking water free of high mineral content may be used. Add water to each cell until the liquid level reaches the bottom of the vent well. DO NOT OVERFILL.

The engine should be operated immediately after adding water, particularly in cold weather, to assure proper mixing of the water and acid.

The external condition of the battery and the cables should be checked periodically.

The holddown should be kept tight enough to prevent the battery from shaking to prevent damage to the battery case. It should not be tightened to the point where the battery case will be placed under a severe strain.

Particular care should be taken to see that the top of the battery is free of acid film and dirt between the battery terminals. For best results when cleaning the battery, wash with a diluted ammonia or soda solution to neutralize any acid present and then flush with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cells.

To ensure good contact, the battery cables should be tight on the battery posts. **Check to be sure the terminal clamp has not stretched.** This could cause the clamp ends to become butted together without actually being tight on the post. If the battery posts or cable terminals are corroded, the cables should be disconnected by loosening the terminal clamp bolt and removing the clamp with the aid of a puller. **Do not twist or pry on the cable to free it from the battery post.** Clean the terminals and clamps with a soda solution and a wire brush. After the cables are connected to the battery posts, a thin coat of grease should be applied. The battery ground cable and engine-to-crossmember ground strap also should be inspected for a good connection and condition.

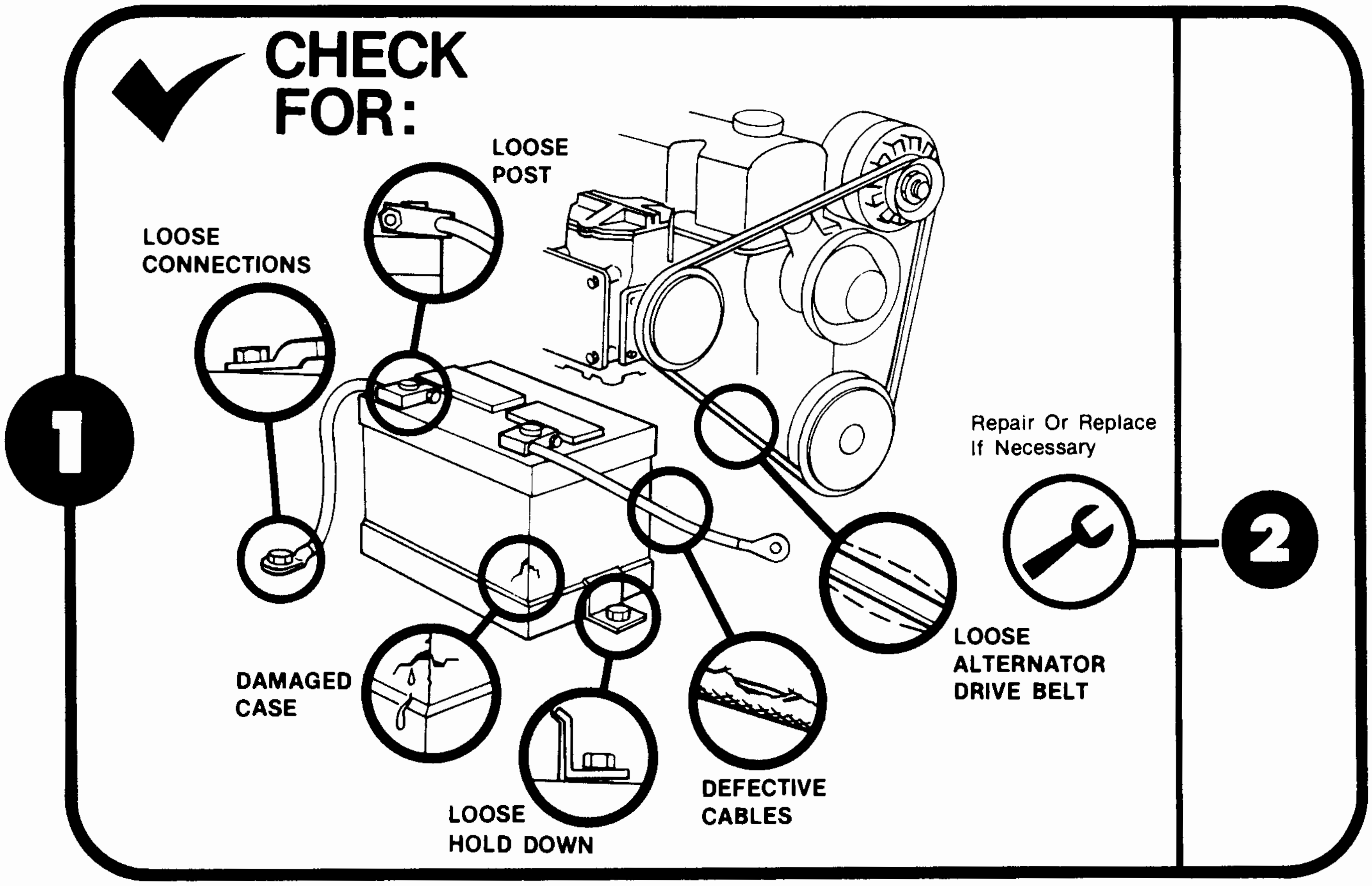
WARNING: *Explosive gases are present within the battery at all times. Avoid open flames and sparks.*

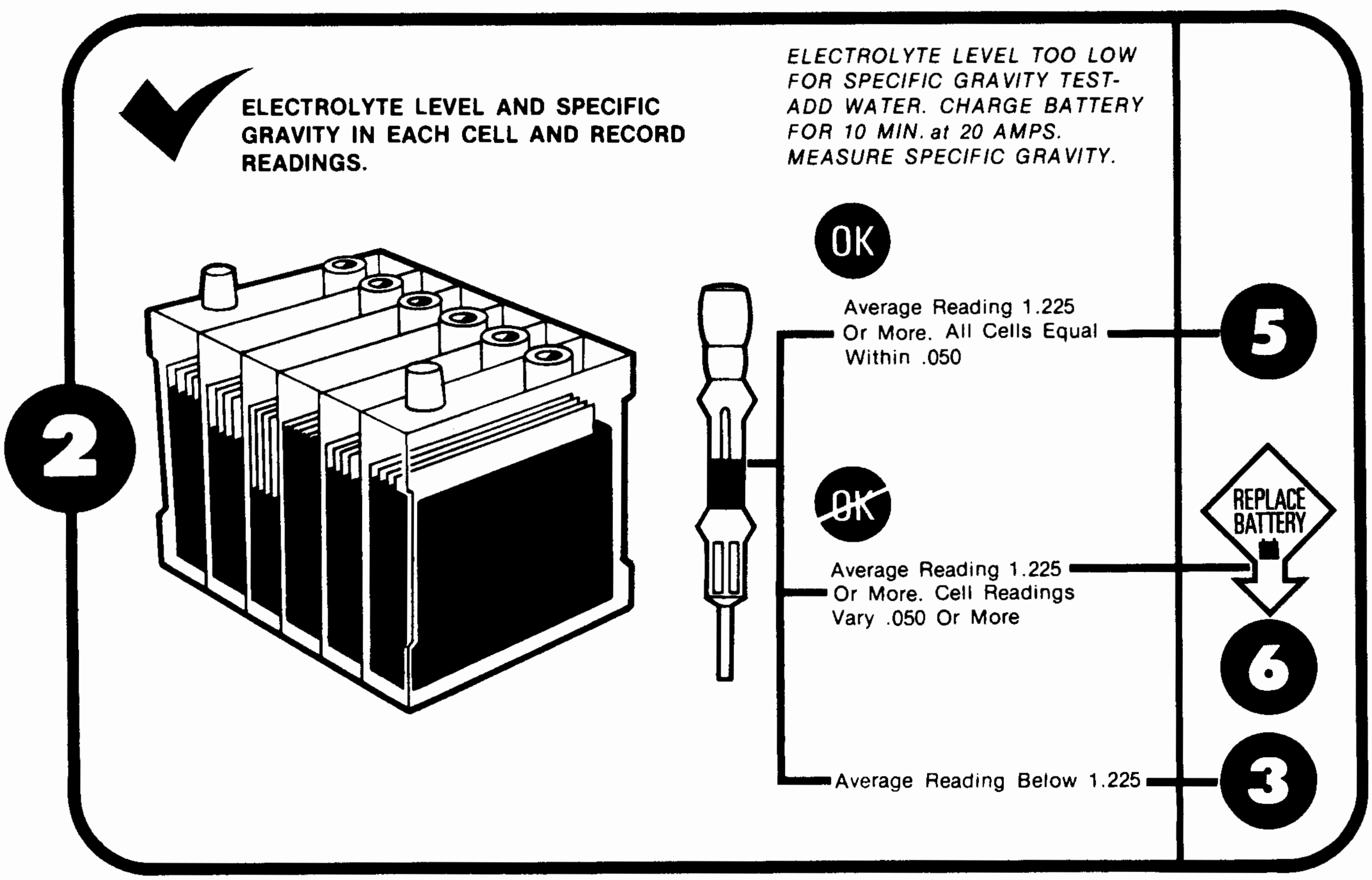
BATTERY TESTING

When testing a battery, perform the steps in the sequence listed in the Battery Test Procedures Chart.

Battery Test Procedures

STEP | SEQUENCE | RESULT





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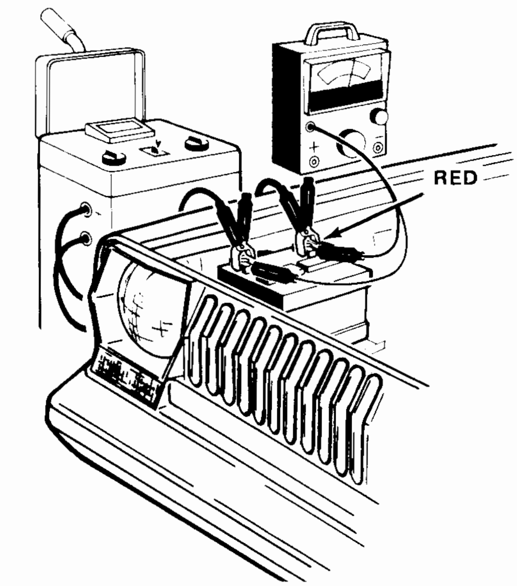
STEP | SEQUENCE | RESULT

3

- CONNECT BATTERY CHARGER AND VOLTMETER
- CHARGE BATTERY FOR 3 MINUTES AT 40 AMPS
- AT THE END OF 3 MINUTES READ VOLTMETER WHILE CHARGER IS STILL CHARGING



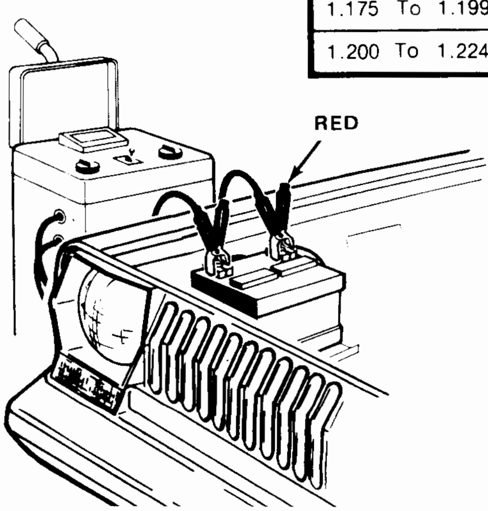
OK — Voltage Is 15.5 Or Less → **4**

~~OK~~ — Voltage Above 15.5 → REPLACE BATTERY → **6**

4

CHARGE BATTERY AS INDICATED IN CHART, AFTER CHARGE IS COMPLETED, RECHECK SPECIFIC GRAVITY.

AVERAGE SPECIFIC GRAVITY	CHARGE RATE (AMPS)	TIME
Less Than 1.125	5	12 Hours
1.125 To 1.149	20	90 Min.
1.150 To 1.174	20	70 Min.
1.175 To 1.199	20	50 Min.
1.200 To 1.224	20	30 Min.



OK — Average Specific Gravity 1.225 Or More. Cell Readings Equal Within .050 → **5**

~~OK~~ — Average Specific Gravity 1.225 Or More, But Cell Readings Vary .050 Or More → REPLACE BATTERY → **6**

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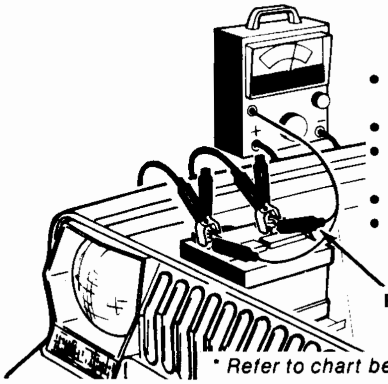
STEP | SEQUENCE | RESULT

5

HEAVY LOAD OUTPUT TEST



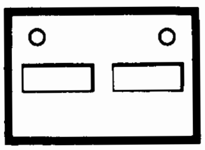
- CLEAN BATTERY POST AND CABLE ENDS
- CONNECT HEAVY LOAD TESTER
- ADJUST LOAD TO 3 TIMES THE BATTERY AMP HR. RATING*
- HOLD LOAD FOR 15 SECONDS
- READ VOLTMETER

Voltage Reading 9.6 Or More — **6**

Voltage Reading Less Than 9.6 — REPLACE BATTERY — **6**

* Refer to chart below to determine AMP HR. RATING

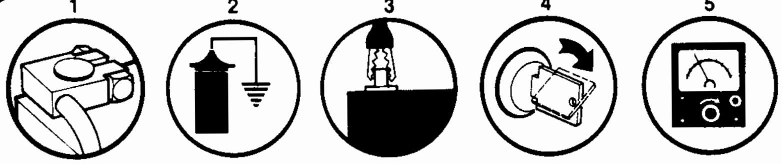
BATTERY AMP. HOUR IDENTIFICATION



Part Number	Amp. Hr. Rating	Reserve Capacity (Minutes)	Cold Cranking at 0° F (Amps)
5457114	50	73	290
5457116	60	93	345
5457115	70	106	370

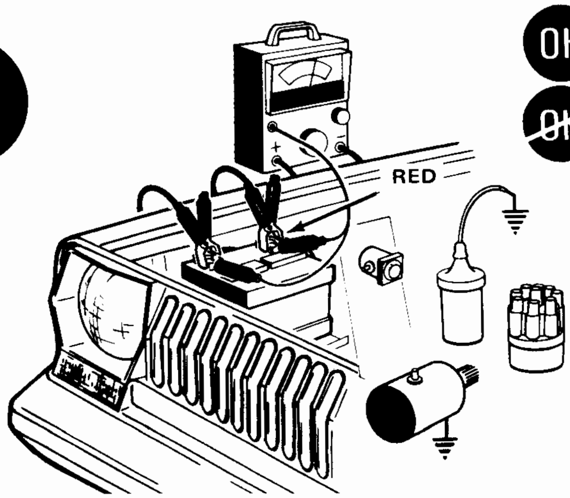
6

STARTER DRAW TEST



1. CLEAN AND CONNECT BATTERY CABLES
2. REMOVE COIL WIRE FROM DISTRIBUTOR. AND CONNECT TO GROUND
3. CONNECT HEAVY LOAD TESTER
4. CRANK ENGINE
5. TURN LOAD CONTROL UNTIL VOLTMETER SHOWS SAME VOLTAGE AS WHEN CRANKING.

READ AMMETER



OK: 6 Cyl. – 150-180 Amps; 8 Cyl. – 160-210 Amps — **8**

~~OK~~: 6 Cyl. – Above 180 Amps; 8 Cyl. – Above 210 Amps

- Battery Cables And Solenoid Not Tested — **7**

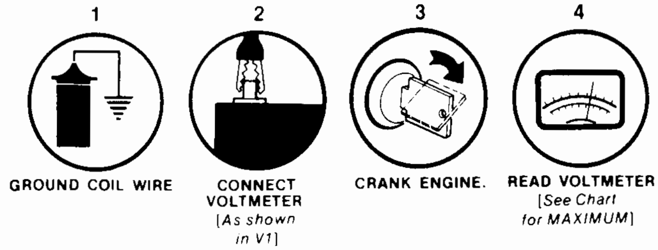
Or

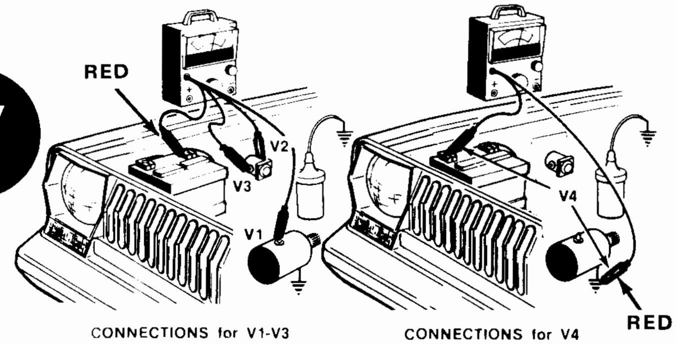
- Battery Cable And Solenoid Repairs Completed — REPAIR STARTER — **8**

60589C

STEP | SEQUENCE | RESULT

7





CONNECTIONS for V1-V3   CONNECTIONS for V4

MAXIMUM VOLTAGE DROP CHART

Test	Voltage Drop By Starter Draw Amperage			
	150-210	215-295	300-420	425-600
V1	0.5V	0.7V	1.0V	1.5V
V2	0.3V	0.5V	0.6V	0.9V
V3	0.2V	0.3V	0.4V	0.5V
V4	0.2V	0.3V	0.4V	0.5V

VOLTAGE DROP TEST

V1 — Reading OK (At Or Below Max.) — Repeat Test Sequence Except Connect Voltmeter As Shown For V4

V1 — Reading ~~OK~~ (Above Max.) — Repeat Test Sequence Except Connect Voltmeter As Shown For V2

V2 — Reading OK (At Or Below Max.) — Repair Solenoid-To-Starter Cable. Repeat Test Sequence Except Connect Voltmeter As Shown For V4

V2 — Reading ~~OK~~ (Above Max.) — Repeat Test Sequence Except Connect Voltmeter As Shown For V3

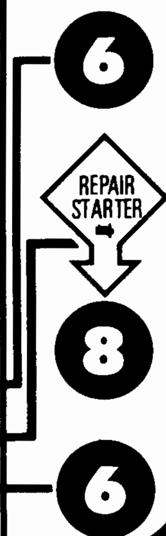
V3 — Reading OK (At Or Below Max.) — Repair Solenoid. Repeat Test Sequence Except Connect Voltmeter As Shown For V4

V3 — Reading ~~OK~~ (Above Max.) — Repair Battery-to-Solenoid Cable. Repeat Test Sequence Except Connect Voltmeter As Shown For V4

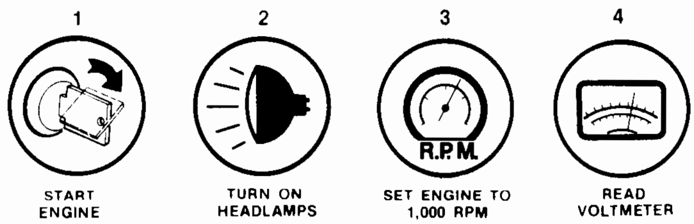
V4 — Reading OK (At Or Below Max.)
- Repairs To Solenoid Or Cables Performed

Or
- Repairs To Solenoid Or Cables Not Required

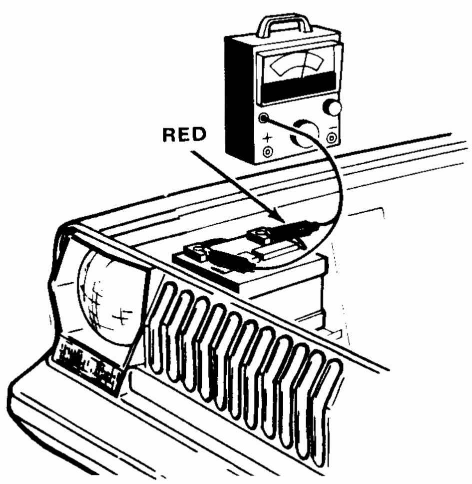
V4 — Reading ~~OK~~ (Above Max.) — Repair Engine-To-Battery Cable



8

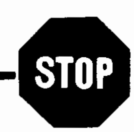


CHARGING SYSTEM QUICK TEST



OK

Voltmeter Indicates 13V. To 15V.



~~OK~~

Voltmeter Indicates More Than 15V
Voltmeter Indicates Less Than 13V.

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Self-Discharge Rate Chart

Temperature	Approximate Allowable Self-Discharge Per Day For First Ten Days
100°F (37.8°C)	0.0025 Specific Gravity
80°F (26.7°C)	0.0010 Specific Gravity
50°F (10°C)	0.0003 Specific Gravity

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In rare cases where a battery goes dead and no apparent cause can be found, the battery should be fully charged and allowed to stand on a shelf for three to seven days to determine if self-discharge is excessive. The Self-Discharge Rate Chart shows allowable self-discharge for the first ten days of standing after a battery has been fully charged. A fully charged battery is a battery which does not increase the electrolyte specific gravity after three continuous hours of charging.

Hydrometer Test

Prior to testing, visually inspect the battery for any damage (broken container, cover, loose post, etc.) that would make the battery unserviceable. The correct method of reading a hydrometer is to have the liquid in the hydrometer at eye level (fig. 3-4). Disregard the curvature of the liquid where the surface rises against the float due to surface tension. Draw only enough liquid in to keep the float off the bottom of the barrel. The hydrometer must be kept vertical while drawing in liquid and taking the reading. **Care should be taken when inserting the tip of the hydrometer into the cell, to avoid damage to separators.** Broken separators could result in premature battery failure.

Hydrometer floats are generally calibrated to indicate correctly only at one fixed temperature—80°F. The temperature correction amounts to approximately 0.004 specific gravity (referred to as 4 points of gravity). For each 10°F above 90°F, subtract 4 points. Always correct the readings for temperature variation. Test the specific gravity of the electrolyte in each battery cell.

Example: A battery is tested at 10°F and has a specific gravity of 1.240. The actual specific gravity is found as follows:

Number of° above or below 80°F equals 70°(80° minus 10 degrees).

70°divided by 10°(each 10-degree difference) equals 7.

7 x 0.004 (temperature correction factor) equals 0.028.

Temperature is below 80°F, so temperaturee correction is subtracted.

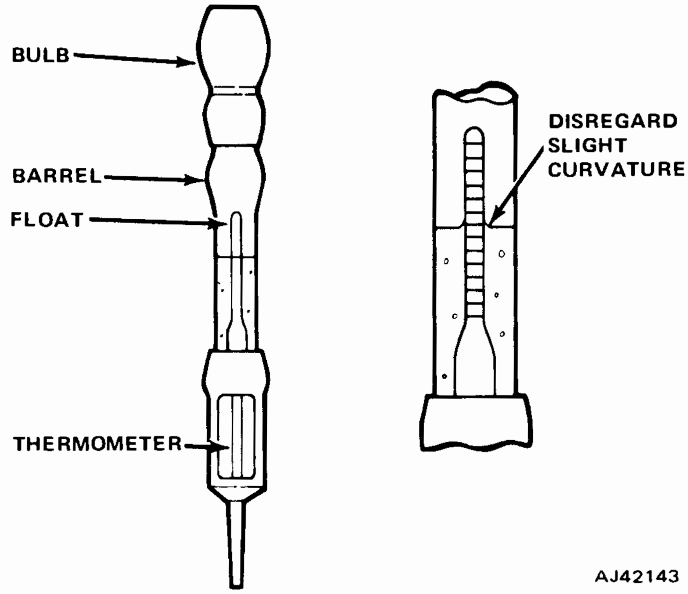

Fig. 3-4 Hydrometer and Proper Method of Reading

Temperature-corrected specific gravity equals 1.240 minus 0.028 equals 1.212.

A fully charged battery should have a specific gravity of 1.250 to 1.265.

If the specific gravity of all cells is above 1.235 (1.196 tropical climate), but the variation between cells is more than 50 points (0.050), it is an indication of an unserviceable battery, and the unit should be removed from the car for further testing.

NOTE: *A fully charged tropical climate battery will have specific gravity of 1.225 at 80°F.*

If the specific gravity of one or more cells is less than 1.235, recharge the battery at approximately 5 amperes until three consecutive hourly readings are constant.

At the end of the charge period, if the cell variation is more than 50 points (0.050), replace the battery.

When the specific gravity of all cells is above 1.235 and variation between cells is less than 50 points, the battery may be tested under load.

Specific Gravity Reading

State of Charge	Specific Gravity As Used in Cold and Temperate Climates
Fully Charged	1.265
75% Charged	1.225
50% Charged	1.190
25% Charged	1.155
Discharged	1.120

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Perform the hydrometer test as follows:

(1) Clean outside of battery with a solution of baking soda and water. Make a visual inspection of container, covers, and terminal posts. Remove vent plugs.

(2) Add water if necessary to bring electrolyte to the proper level and apply a fast boost charge of approximately 35 amperes for 10 minutes. Then take and record **temperature corrected** hydrometer readings. Proceed to step (3).

(3) Apply a fast boost charge of approximately 35 amperes for 30 minutes. Record temperature corrected hydrometer readings. If cells show a slight or no increase in hydrometer reading, proceed to step (4); otherwise, determine replacement as follows:

(a) If the variation in **temperature corrected** hydrometer readings found in step (3) is 50 points or more for the individual cells within a battery, replace battery.

(b) If one cell lags behind in gravity, and its electrolyte when drawn into the hydrometer is discolored with the remaining cells relatively clear, replace battery.

(c) If the electrolyte in one or more cells is discolored, replace battery. A battery in this condition has been damaged in service by heavy cycling or electrolyte has been frozen.

NOTE: *When replacing a battery with damage caused by heavy cycling, the alternator should be checked to determine if it has sufficient output to satisfy the electrical demands of that particular vehicle. Also the next larger size battery should be installed, if possible.*

(d) If all cells show a more than slight increase in **temperature corrected** gravities (with variation **within** 50 points) and have clear electrolyte, battery is probably only discharged and can be returned to service.

(4) Sulfated batteries may be brought back to service condition by a slow charge (3 to 4 amperes) for 48 to 72 hours. After this charge, all cells should read at least 1.250 corrected gravity and have clear electrolyte; if not, the battery is not serviceable. If the variation in hydrometer readings is more than 50 points, replace battery.

Heavy Load Test

NOTE: *The following instructions refer to amserv Battery-Alternator-Regulator Tester, Model 21-307.*

(1) Before performing a heavy load test, battery must be fully charged (refer to Slow Charge).

(2) Turn carbon pile knob of battery tester to OFF position.

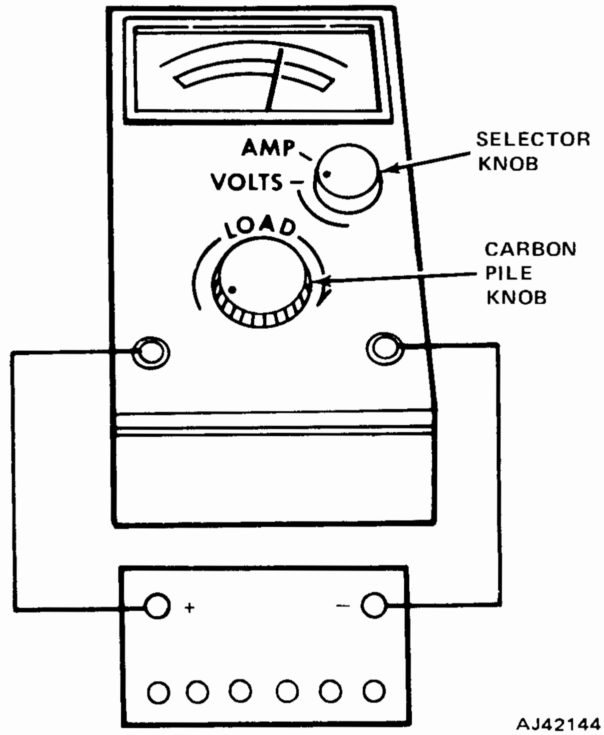

Fig. 3-5 Heavy Load Test

(3) Turn selector knob to AMP position.

(4) Connect test leads as shown in figure 3-5.

(5) Turn carbon pile knob clockwise until ammeter reading is equal to three times the ampere hour rating of the battery:

- 150 amperes for 50 amp hour battery
- 180 amperes for 60 amp hour battery, etc.

(6) Maintain load for 15 seconds, turn selector switch to VOLTS and read the scale.

If the voltmeter reading was 9.6 volts or higher with the battery temperature at a minimum of 70°F, the battery has good output capacity. If less than 9.6 volts, replace the battery.

Battery Storage

All automotive wet batteries will discharge slowly when stored. Batteries discharge faster when warm than when cold. For example: at 100°F (37.8°C), a normal self-discharge of 0.0025 specific gravity per day could be expected. At 50°F (10°C), a discharge of 0.0003 specific gravity would be normal.

Before storage, clean the battery case with a baking soda solution and wipe the case dry. When storing a battery, charge fully (no change in specific gravity after three readings taken one hour apart) and then store in as cool and dry a place as possible (refer to Freezing Temperature Chart).

MOTORCRAFT ALTERNATOR

GENERAL

The Motorcraft charging system is a negative ground system consisting of three main components: an alternator, a regulator, and a battery. **It is used on all V-8 engines.**

The alternator is belt driven by the engine. Its major components are the front and rear housings, the stationary stator windings, the rotating field windings or rotor, and six rectifying diodes. Current is passed to the rotating field through two brushes mounted in the rear housing and two slip rings attached to the rotor.

The regulator is an electro-mechanical device (non-solid state) and nonadjustable. It has two major components: the field relay and the voltage limiter. The field relay connects the voltage limiter into the system. The voltage limiter is a vibrating type which regulates current applied to the field and maintains charging voltage within prescribed limits to keep the battery properly charged.

OPERATION

When the ignition switch is turned to the ON position, current flows through the ignition switch (and ammeter, if equipped) to the regulator S-terminal (fig. 3-6 and 3-7). From the S-terminal, current flows through the field relay coil which closes the field relay contacts. With the field relay contacts closed, current passes from the regulator A-terminal through the field relay contacts and voltage limiter upper contacts to the regulator F-terminal. From the F-terminal, current to the alternator FLD terminal, through the insulated brush and slip ring to the rotor coil, and through the other slip ring to the grounded brush (fig. 3-6 and 3-7).

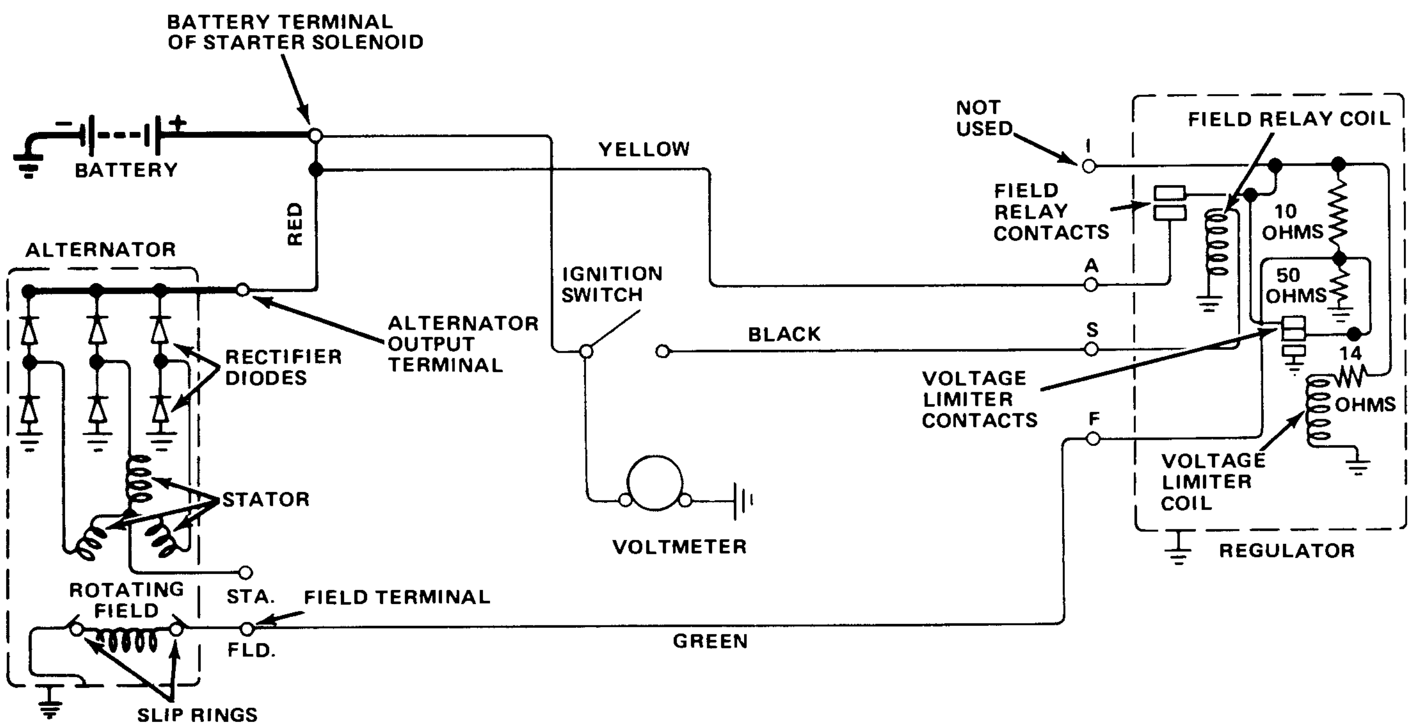

Fig. 3-6 Charging System Schematic—CJ Models with V-8 Engine

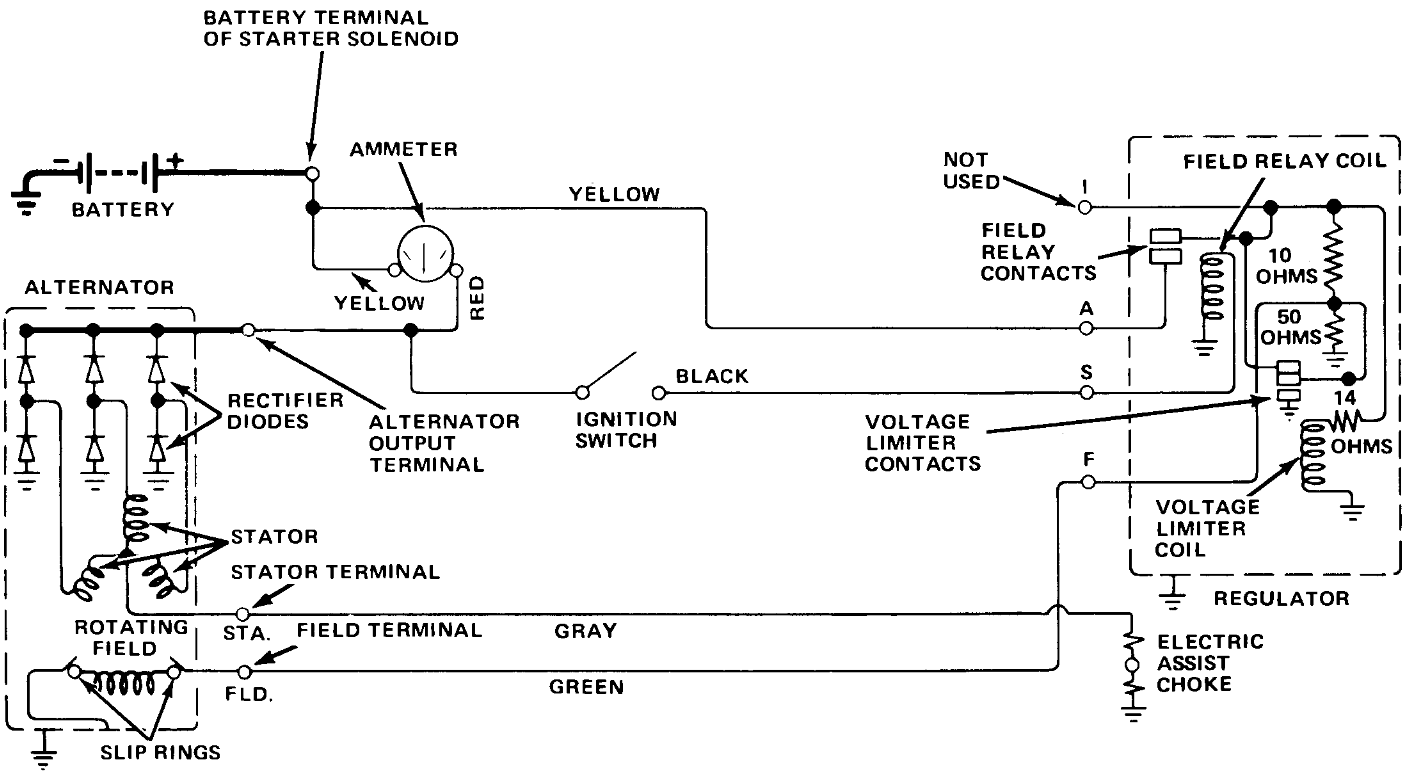

Fig. 3-7 Charging System Schematic— Cherokee-Wagoneer-Truck with V-8 Engine

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This circuit provides current to rotor windings to create a magnetic field. When the engine is started, the rotor is rotated, causing the rotor magnetic field to act on the stator windings which begin producing voltage. The voltage limiter now begins metering current to the rotor field coil to maintain desired output voltage.

The voltage regulator operates through the limiter upper contacts when alternator speed is low or when the system is under a heavy load. Output voltage is controlled through the upper contacts which vibrate open and Closed. When closed, the upper contacts pass the maximum allowable current (about 3 amps) to the field. When open, field current passes through the 10-ohm resistor which produces a decrease in field current and ouptut voltage. When alternator speed is high or the system is under a light load, voltage attempts to increase and the regulator then operates on the voltage limiter lower contacts. The increase in voltage causes current to pass through the 14-ohm resistor to the voltage limiter pull-in coil (fig. 3-6 and 3-7). The pull-in coil is energized and pulls down the limiter armature closing the lower contacts. With the lower contacts closed, field current passes directly to ground which causes the rotor field to collapse and decrease voltage output. The decrease in voltage allows the lower contacts to open which again applies 10 ohms of resistance to the field circuit, but in this case serves to increase voltage produced.

The voltage limiter operates on the upper contacts or lower contacts, but never both. The upper contacts allow maximum field current to pass to the rotor. The lower contacts prevent any field current to pass to the rotor. When neither contacts are closed, field current is reduced by the 10-ohm resistor. The contacts vibrate open and closed many times per second maintaining accurate voltage regulation.

The voltage regulator operates by metering field current to the alternator through the FLD terminal. An insulated brush is connected to the FLD terminal and passes current from the regulator to a slip ring attached to one end of the rotor windings. After passing through the rotor windings, current grounds through a second slip ring which contacts a grounded brush. The field current passing through the rotor field coil produces a magnet field. The strength of this field is determined by the amount of current provided by the regulator.

The rotor magnetic field acts on the windings of the stator to produce alternating current through electromagnetic induction. The stator is wye wound around the stator core. One end of each winding is connected to a common neutral junction. The other end of each winding is connected to a pair of diodes. The diodes serve to change the three-phase alternating current produced in the stator windings into direct current required for the car electrical system. This is accomplished by the characteristic of the diodes to flow current in one direction only. The positive diodes pass current to the alternator BAT terminal while the negative diodes pass alternating current flowing in the opposite direction, directly to ground. In this way, the alternating current is changed to direct current available at the alternator output terminal.

NOTE: *On vehicles equipped with 4V carburetors, current for electric assist choke operation is obtained from the alternator STA terminal. The STA terminal passes approximately 7 volts to the heating element in the choke cover (fig. 3-7).*

TROUBLESHOOTING

Voltage Output Quick Test

(1) Connect positive voltmeter lead to positive battery post and negative lead to negative post.

(2) Start engine. Apply a load by turning on heater or air conditioner blower to high speed, then turn on high-beam headlamps.

(3) Slowly increase speed to approximately 2000 rpm.

(4) Allow voltmeter to stabilize and note indication. Compare it to specifications in Output Voltage Chart.

Output Voltage Chart

Ambient Temperature In Degrees Fahrenheit	Acceptable Voltage Range
0 to 50	14.8 to 14.1
50 to 100	14.5 to 13.7
100 to 150	14.2 to 13.4
150 to 200	13.8 to 13.1

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(5) If voltage output is as specified, charging system is operating properly. If voltage is below specifications, perform Undercharge Troubleshooting Procedure. If voltage is above specifications, perform Overcharge Troubleshooting Procedure.

Voltage Output No-Load Test

This test, together with the Output Load Test, should be performed whenever an overcharging or undercharging condition is suspected. Belt tension, wire connections, and battery condition must be checked before performing these tests.

(1) Connect voltmeter positive lead to battery positive cable and negative lead to negative cable.

(2) Be sure that all electrical accessories are turned off, including the radio and door operated dome lamps and courtesy lamps.

(3) Note battery voltage.

(4) Start engine and slowly increase speed to approximately 1500 rpm.

(5) Note voltmeter reading. Voltage should increase, but not more than 2 volts above voltage noted in step (3).

Test Results

(1) If voltage does not increase, or if increase is within 2-volt limit, proceed to Output Load Test.

(2) If the voltage increase exceeds 2 volts, proceed to Overcharge Troubleshooting Procedure.

Output Load Test

(1) Connect positive voltmeter lead to positive battery post and negative lead to negative post.

(2) Be sure that all electrical accessories are turned off, including radio and door operated dome lamps and courtesy lamps.

(3) Note battery voltage for use later in test.

(4) Start engine. Apply a load by turning on heater or air conditioner blower to high speed and headlamps on high beam.

(5) Slowly increase speed to approximately 2000 rpm.

(6) Note voltmeter reading. It should increase at least 0.5 volt above that noted in step (3).

Test Results

(1) If voltage increase exceeds 0.5 volt, charging system is operating satisfactorily.

(2) If voltage increase is less than 0.5 volt, proceed to Undercharge Troubleshooting Procedure.

Undercharge Troubleshooting Procedure

Perform the Output Load Test to determine if an undercharge condition exists before performing this procedure. A voltmeter, ohmmeter, and jumper wire are required for testing.

(1) Turn ignition on and check for battery voltage at regulator S-terminal. If no voltage is indicated, check for open circuit between ignition switch and regulator. If battery voltage is indicated, proceed to step (2).

(2) Turn ignition off and check for battery voltage at regulator A-terminal. If voltage is not indicated, or it is less than battery voltage, check yellow wire for open or faulty terminal connections at regulator and starter solenoid.

(3) Using an ohmmeter, disconnect regulator connector and check brush and rotor circuit by connecting one ohmmeter lead to regulator connector F-terminal and other ohmmeter lead to a good ground (fig. 3-8). Ohmmeter should indicate 4 to 250 ohms. Less than 4

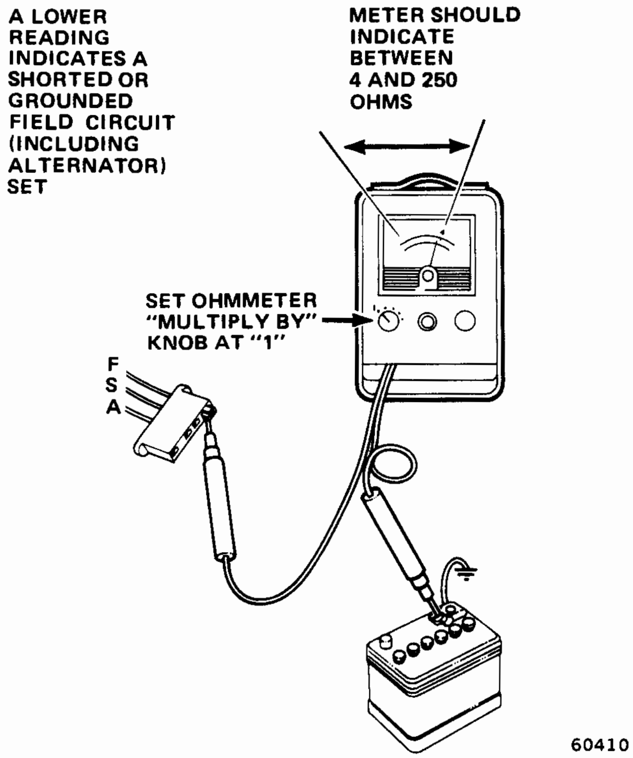


Fig. 3-8 Grounded Field Circuit Test

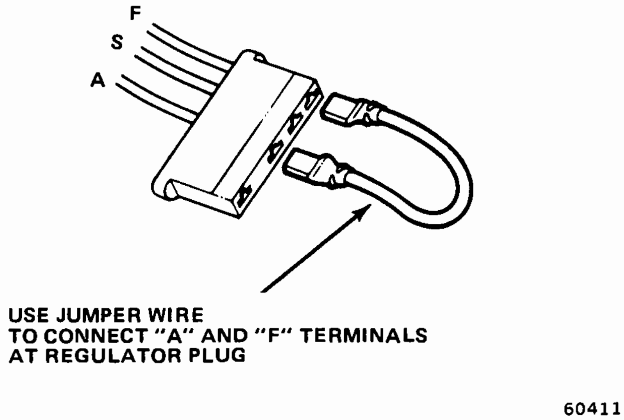


Fig. 3-9 Regulator Connector Jumper Wire Connections (Regulator Bypassed)

ohms indicates a shorted condition. More than 250 ohms indicates an open condition or dirty brushes or slip rings.

NOTE: *Alternator will have to be disassembled to determine if the problem is brushes or rotor. Refer to the Rotor Continuity Test.*

(4) If alternator brush or rotor circuit are within specifications, proceed to step (5). If a shorted condition was indicated in step (3), the voltage regulator may have been damaged and the regulator field circuit must be checked as follows.

(5) Connect an ohmmeter between regulator terminals I and F. Ohmmeter should indicate no resistance. If approximately 10 ohms are indicated, regulator should be replaced.

(6) Connect a jumper wire between A and F terminals of regulator connector (fig. 3-9) and repeat output test. If output voltage is as specified, replace regulator.

(7) Disconnect jumper wire installed in step (5) and leave regulator connector removed. Disconnect wire harness from FLD terminal of alternator and connect jumper wire between BAT and FLD terminals of alternator (fig. 3-10). Repeat output test.

If output is as specified, replace alternator wire harness. If output is still below specification, alternator is faulty and must be tested and repaired.

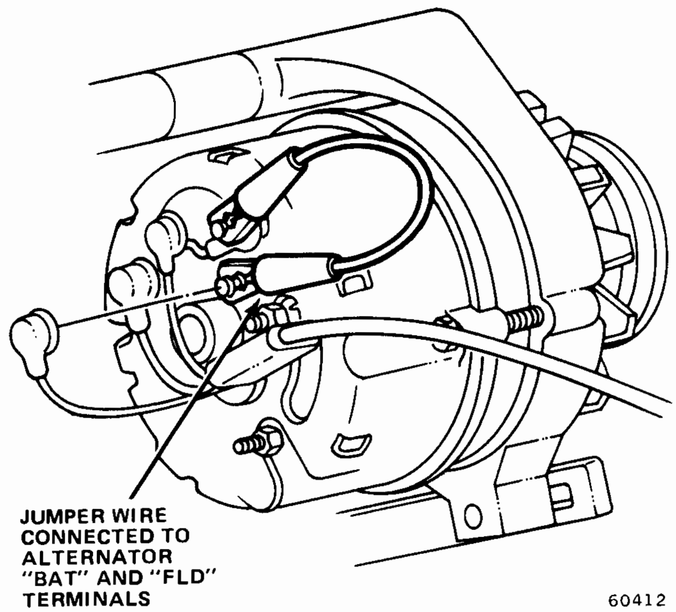


Fig. 3-10 Alternator Jumper Wire Connections

Overcharge Troubleshooting Procedure

Perform Output No-Load Test to determine if an overcharge condition exists before performing this procedure.

(1) Clean and tighten ground connections at alternator and regulator. Repeat Output Test.

(2) Disconnect regulator connector from regulator and repeat Output Test. If voltage is as specified, replace regulator.

(3) If voltage still remains above specifications, alternator wire harness is shorted and must be replaced. Voltage regulator must be replaced also since the shorted condition will damage it.

TESTING

Stator Ground and Negative Diode Test (Alternator Removed)

(1) Set ohmmeter at 10 scale and calibrate meter.

(2) Touch one ohmmeter to lead STA terminal and other lead to GRD terminal.

(3) Check continuity in other direction by reversing leads.

A reading of approximately 60 ohms should be indicated in one direction and infinity (no needle movement) in the other direction.

NOTE: *Ohmmeter must be on 10 scale or incorrect indications will result.*

Test Results

An indication of 60 ohms or less in both directions may be due to:

(a) Defective negative diode

(b) Grounded positive diode plate

(c) Grounded alternator BAT terminal

(d) Grounded STA terminal

(e) Grounded stator winding (laminations grounded or windings grounded to front or rear housing)

Infinity (no needle movement) indication is caused by an open STA terminal connection.

Field Circuit Open or Ground Test (Alternator Removed)

(1) Set ohmmeter at 1 scale and calibrate.

(2) Touch one ohmmeter lead to FLD terminal and other lead to GRD terminal.

(3) Spin drive pulley and note ohmmeter indication. Ohmmeter should indicate between 3.5 and 250 ohms and fluctuate while rotor is turning.

Test Results

An indication lower than 3.5 ohms may be due to:

(a) Grounded positive brush

(b) Grounded field terminal

(c) Defective rotor

An indication of higher than 250 ohms may be due to:

(a) Worn out or hung brushes

(b) Open brush lead

(c) Defective rotor

Rotor Continuity Test

(1) Separate front housing and rotor assembly from rear housing and stator assembly.

(2) Set ohmmeter at 1 scale and calibrate.

(3) Touch one lead to one slip ring and other lead to other slip ring (fig. 3-11). Ohmmeter indication should be 3.5 to 4.5 ohms.

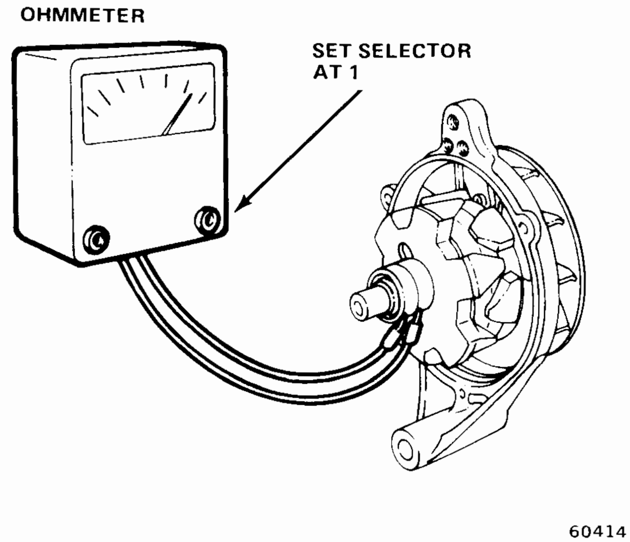


Fig. 3-11 Rotor Continuity Test

Test Results

(1) Indications higher than 4.5 ohms may be due to damaged solder connection at slip rings or broken wire.

(2) Indications lower than 3.5 ohms may be due to a shorted wire or slip ring.

(3) Replace rotor if damaged beyond repair.

Rotor Ground Test

(1) Separate front housing and rotor assembly from rear housing and stator assembly.

(2) Set ohmmeter at 1000 scale and calibrate.

(3) Touch one ohmmeter lead to rotor shaft and other lead to first one slip ring and then the other. Ohmmeter should indicate infinity (no needle movement) in both cases.

Test Results

If ohmmeter indicates other than infinity, a short to ground exists. Check soldered connections at slip rings to make sure they are secure and not grounding out against rotor shaft, or that excess solder is not grounding rotor coil. Replace rotor if damaged.

NOTE: *If the Field Circuit Open or Ground Test showed trouble and both Rotor Tests prove satisfactory, the brushes are the cause.*

Stator Continuity Test

(1) Remove stator and rectifier assembly from rear housing and disconnect stator leads from rectifier.

(2) Set ohmmeter at 1 scale and calibrate.

(3) Touch ohmmeter leads to two of the bare stator lead wires (fig. 3-12).

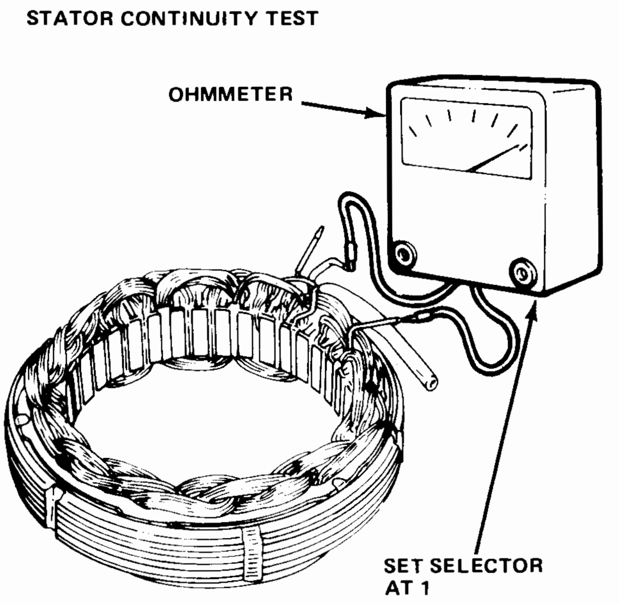


Fig. 3-12 Stator Continuity Test

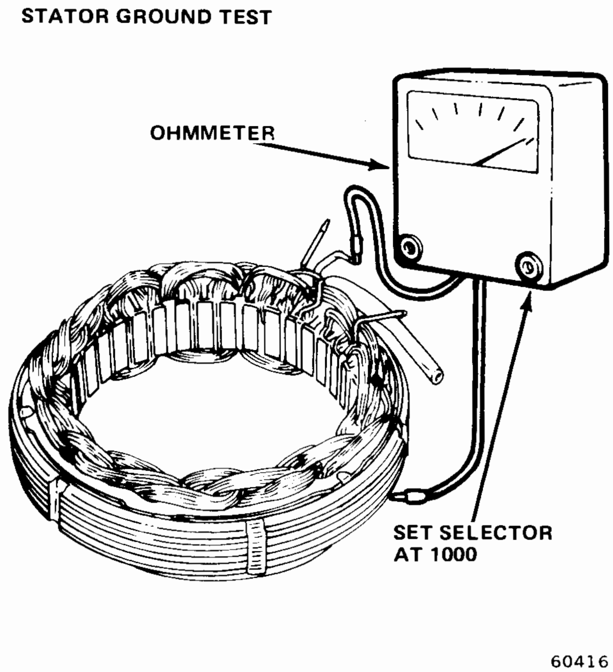


Fig. 3-13 Stator Ground Test

(4) Move one probe to third stator wire. Equal readings should be obtained between each pair of leads.

Test Results

If unequal indications are obtained, stator is open. Check neutral junction splices. If a break is found, make necessary repairs and retest. If unequal readings still exist, replace stator.

Stator Ground Test

(1) Remove stator and rectifier assembly from rear housing and disconnect stator leads from rectifier.

(2) Set ohmmeter at 1000 scale and calibrate.

(3) Touch one ohmmeter lead to bare metal surface of stator core and other lead to a bare stator lead wire (fig. 3-13). Ohmmeter should register infinity (no needle movement). Be sure probe makes good contact with core.

Test Results

If ohmmeter indicates other than infinity, stator is grounded and must be replaced.

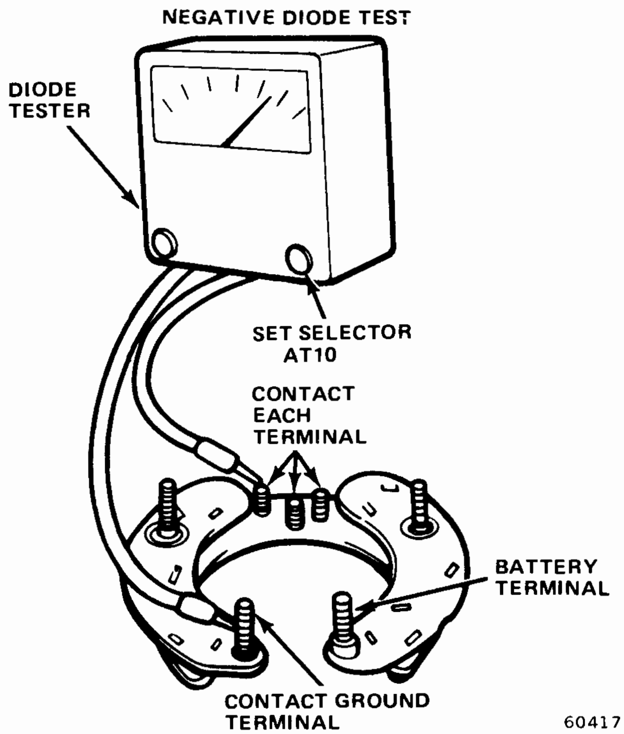


Fig. 3-14 Testing Negative Diodes

Rectifier Diode Testing

(1) Remove rectifier assembly from rear housing.

(2) Set ohmmeter at 10 scale and calibrate.

(3) Test negative diodes by touching one ohmmeter lead to ground terminal and other lead to each stator lead terminals (fig. 3-14).

(4) Test positive didoes by touching one lead to rectifier battery terminal and other lead to each stator lead terminal (fig. 3-15). Reverse leads to check diodes in other direction.

All diodes should show continuity (approximately 60 ohms) in one direction and no continuity (infinity) in the other direction.

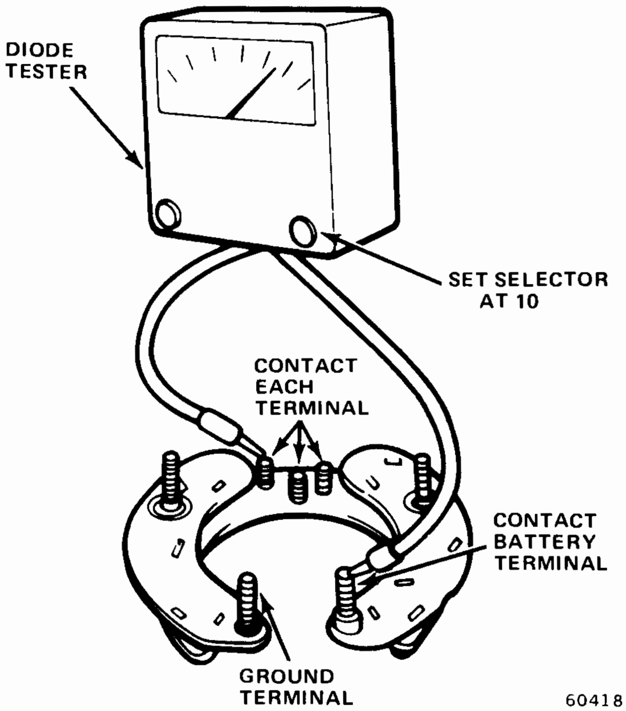


Fig. 3-15 Testing Positive Diodes

Test Results

If continuity is observed in both directions, the diode(s) is shorted. If no continuity is observed in both directions, the diode(s) is open. Replace the rectifier assembly if open or shorted diodes are found.

ALTERNATOR REMOVAL AND INSTALLATION

Removal

(1) Disconnect battery negative cable.
(2) Loosen alternator mounting bracket bolts.
(3) Remove alternator adjustment bolt.
(4) Remove alternator drive belt.
(5) Disconnect wire harness from rear of alternator.
(6) Remove alternator pivot bolt and remove alternator.

Installation

(1) Install alternator and pivot bolt. Do not tighten pivot bolt.
(2) Install adjustment bolt but do not tighten.
(3) Install drive belt.
(4) Tighten mounting bracket bolts to 28 foot-pounds torque.
(5) Tighten drive belt to specified tension.
(6) Tighten pivot bolt to 33 foot-pounds torque and tighten adjusting bolt to 18 foot-pounds torque.
(7) Connect wire harness to alternator.
(8) Connect battery negative cable.

DISASSEMBLY

NOTE: *Refer to figure 3-16 for parts identification.*

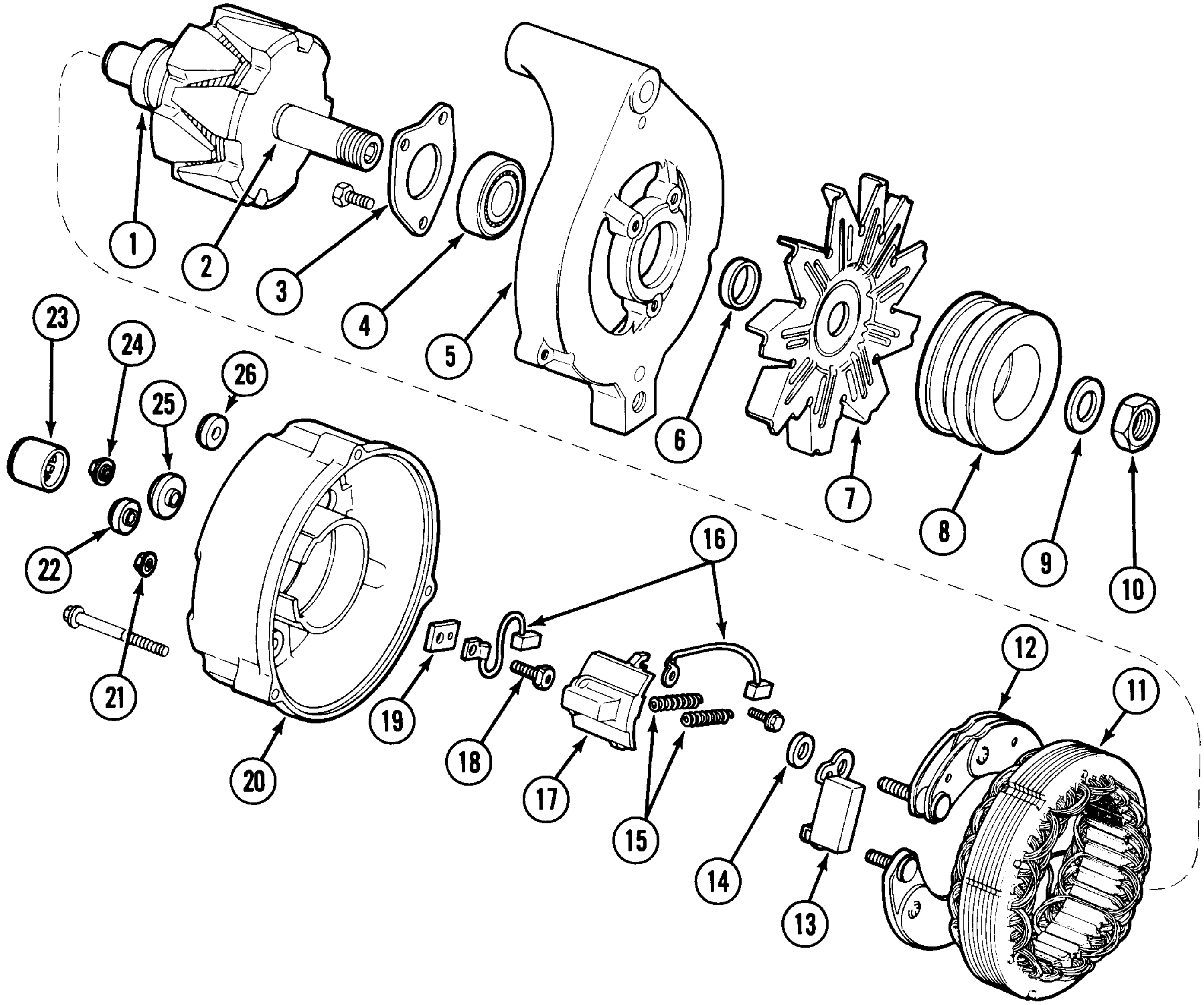
(1) Mark both end housings and stator with a scribe mark for assembly.
(2) Remove three housing through-bolts.
(3) Separate front housing and rotor from stator and rear housing.
(4) Remove all nuts and insulators from rear housing and remove rear housing from stator and rectifier assembly.
(5) Remove brush holder mounting screws and remove brush holder, brushes, brush springs, insulator and terminal.
(6) If replacement is necessary, press rear bearing from rear housing, supporting housing close to bearing boss.
(7) If rectifier assembly or stator is being replaced, unsolder stator leads from rectifier printed circuit board terminals, using a 100-watt soldering iron.

NOTE: *Production alternators have two types of rectifier assemblies. One has a circuit board spaced away from exposed diodes and the other has a circuit board with built-in diodes. These assemblies are interchangeable. Refer to figures 3-17 and 3-18 for parts identification.*

(8) Disconnect stator neutral lead from rectifier assembly with exposed diodes by turning stator terminal clockwise 1/4-turn to unlock.
(9) Disconnect stator neutral lead from rectifier assembly with built-in diodes by pressing stator terminal straight out of rectifier.

CAUTION: *On rectifier assemblies with built-in diodes, do not twist stator terminal during removal as rectifier serrations may be damaged. Do not remove ground terminal screw unless it or insulator must be replaced.*

(10) Separate rectifier assembly from stator.
(11) Clamp front housing in vise and remove drive pulley nut using Tool J-21501 (fig. 3-19).
(12) Remove lockwasher, pulley, fan, fan spacer, front housing, and front bearing spacer from rotor shaft.
(13) Remove front end bearing retainer screws and remove retainer. If bearing is damaged or has lost its lubricant, support housing close to bearing boss and press out bearing.
(14) Test stator, rectifier, and rotor.



1. ROTOR
2. STOP RING
3. FRONT BEARING RETAINER
4. FRONT BEARING
5. FRONT HOUSING
6. FRONT BEARING SPACER
7. FAN
8. PULLEY
9. WASHER
10. NUT
11. STATOR
12. RECTIFIER ASSEMBLY
13. RADIO NOISE SUPPRESSION CAPACITOR
14. INSULATOR CAPACITOR
15. BRUSH SPRING
16. BRUSH SET
17. BRUSH HOLDER
18. BRUSH TERMINAL SCREW
19. BRUSH TERMINAL INSULATOR
20. REAR HOUSING
21. GRD TERMINAL NUT
22. FIELD INSULATOR (ORANGE)
23. REAR BEARING
24. BAT TERMINAL NUT
25. BATTERY INSULATOR (RED)
26. STATOR INSULATOR (BLACK)

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Fig. 3-16 Motorcraft Alternator—Exploded View

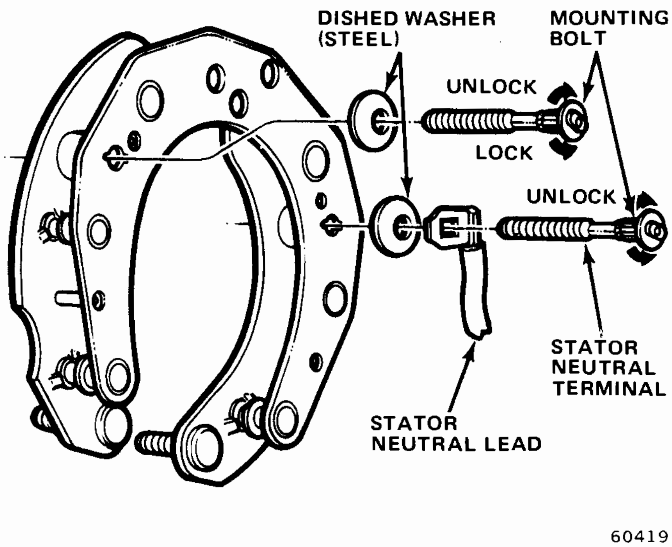

Fig. 3-17 Rectifier Assembly with Exposed Diodes

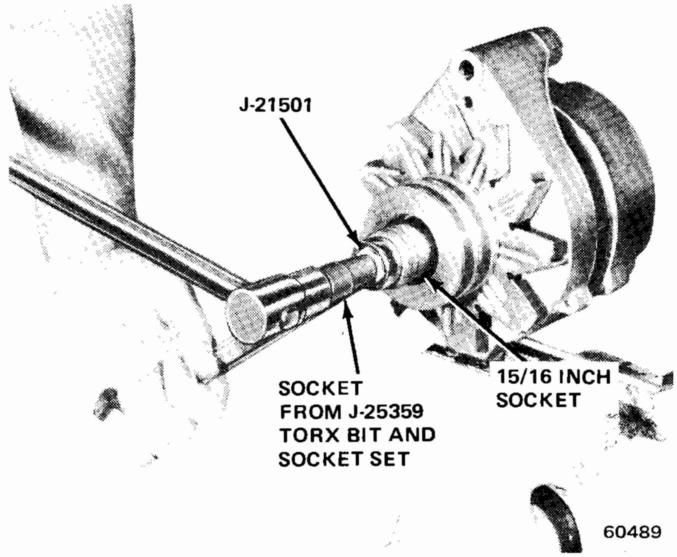

Fig. 3-19 Pulley Removal and Installation

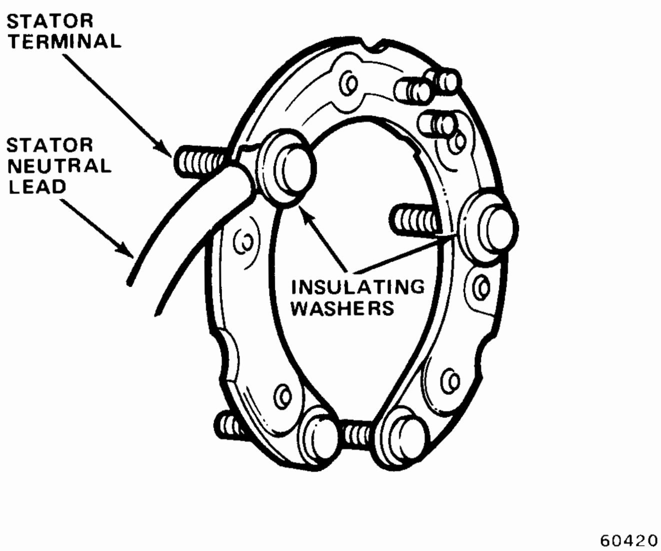

Fig. 3-18 Rectifier Assembly with Built-In Diodes

Cleaning and Inspection

(1) Clean rotor, stator, and bearings with clean cloth. Do not clean with solvent.

(2) Rotate front bearing on drive end of rotor shaft. Check for any scraping noise, looseness, or roughness. Look for excessive lubricant leakage. If any of these conditions exist, replace bearing.

(3) Inspect rotor shaft rear bearing surface for roughness or severe chatter marks. Replace rotor assembly if shaft is not smooth.

(4) Place rear bearing on slip ring end of rotor shaft and rotate bearing. Make same check for noise, looseness, or roughness as was made for front bearing. Inspect bearing rollers and cage for damage. Replace bearing if these conditions exist or if lubricant is lost or contaminated.

(5) Check pulley and fan for excessive looseness on rotor shaft. Replace any pulley or fan that is loose or bent out of shape.

(6) Check both front and rear housings for cracks, particularly the webbed areas and at mounting ear. Replace damaged or cracked housings.

(7) Check all wire leads on both stator and rotor assemblies for loose or broken soldered connections and for burned insulation. Resolder poor connections. Replace parts that show signs of burned insulation.

(8) Check slip rings for nicks and surface roughness. Nicks and scratches may be removed by turning down the slip rings. Do not go beyond minimum diameter of 1.22 inches. If rings are badly damaged, replace rotor assembly.

(9) Replace brushes if worn shorter than 5/16 inch.

ASSEMBLY

(1) Press front bearing in front housing bearing boss (put pressure on outer race only), and install bearing retainer. If stop ring on rotor drive shaft was damaged, install new stop ring. Push new ring on shaft and into groove. Do not open ring with snap ring pliers as permanent damage will result.

(2) Position front bearing spacer on drive shaft with recessed side against stop ring.

NOTE: *Front bearing spacer is black and larger in diameter than fan spacer.*

(3) Position front housing, fan spacer, fan, pulley, and lockwasher on rotor shaft and install drive pulley nut.

(4) Clamp front housing in vise and tighten drive pulley nut to 60 to 100 foot-pounds torque (fig. 3-19).

(5) If rear housing bearing was removed, support housing near bearing boss and press in replacement bearing flush with outer housing.

(6) Place brush springs, brushes, brush terminal and terminal insulator in brush holder and hold brushes in position by inserting a wooden or plastic toothpick in the brush holder (fig. 3-20).

(7) Position brush holder assembly in rear housing and install mounting screws.

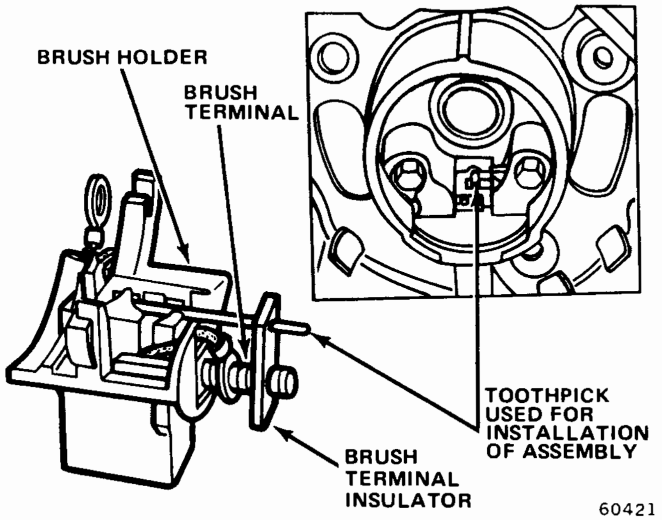

Fig. 3-20 Brush Holder Assembly Installation

(8) Wrap three stator winding leads around circuit board terminals.

(9) Install stator neutral lead on rectifier with exposed diodes by inserting stator terminal through neutral lead, dished washer, and rectifier. Turn stator terminal counterclockwise 1/4-turn to lock.

(10) Install stator neutral lead on rectifier with built-in diodes by inserting stator terminal through neutral lead, insulating washer, and rectifier. Align serrations of stator terminal and rectifier hole and press terminal into rectifier.

(11) Install radio noise suppression capacitor on rectifier terminals (fig. 3-21).

(12) Install BAT terminal insulator and STA terminal insulator (fig. 3-21).

(13) Position stator and rectifier assembly in rear housing.

(14) Position STA (black), BAT (red), and FLD (orange) insulators on terminal bolts, and install retaining nuts.

(15) Position rear housing and stator assembly over rotor and align scribe marks made during disassembly.

(16) Seat machined portion of stator core into step in both end housings.

(17) Install housing through-bolts.

(18) Remove brush retracting toothpick and put a dab of waterproof cement over hole to seal it.

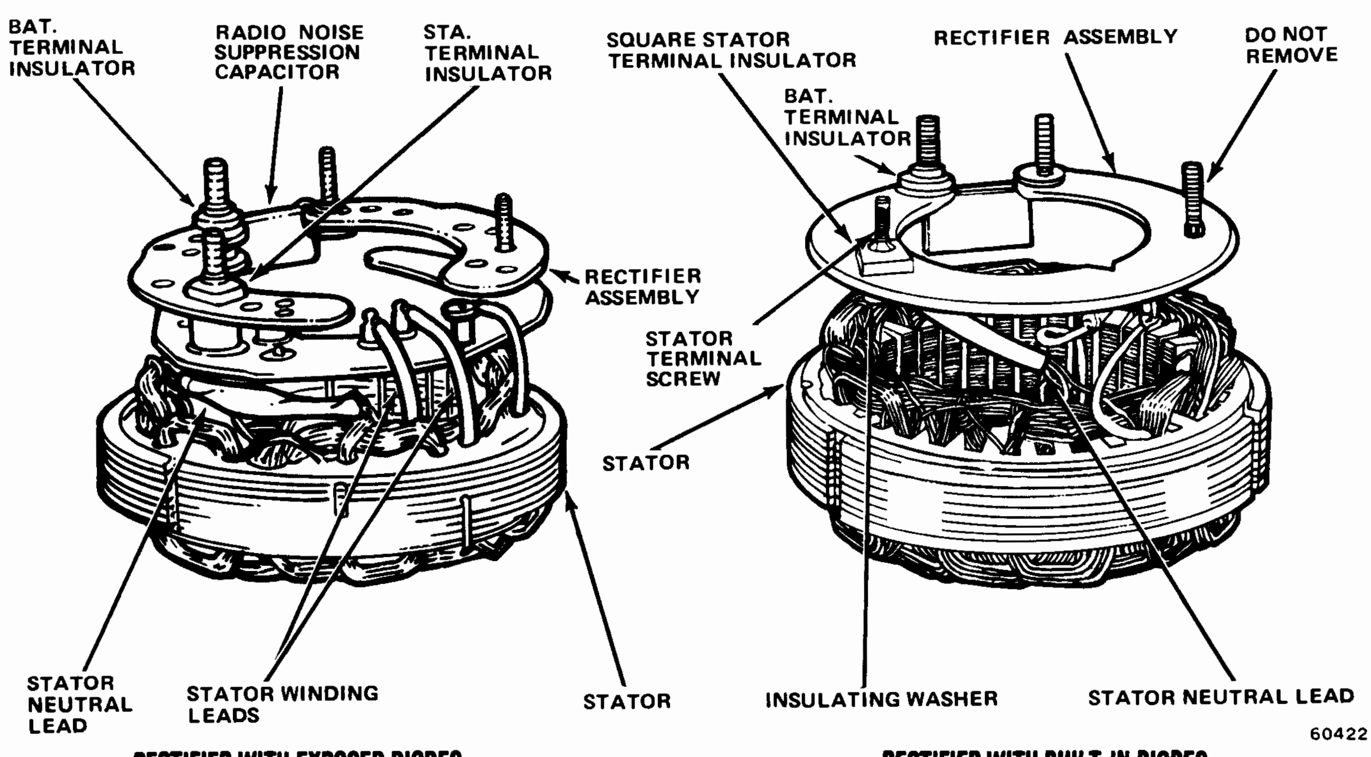

Fig. 3-21 Stator and Rectifier Assemblies

DELCO ALTERNATOR

GENERAL

The 10-SI Series Alternator (fig. 3-22) is typical of a variety of models. **It is used on all six-cylinder engines.** A solid-state regulator having an integrated circuit is built into the end frame. All regulator components are enclosed in 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.

The alternator (fig. 3-22) consists primarily of two end frame assemblies, a rotor assembly, and a stator assembly. The rotor assembly is supported in the drive end frame by a ball bearing and in the slip ring end frame by a roller bearing. These 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 circumstances, will provide long periods of attention-free service. No periodic adjustments or maintenance are required on the alternator assembly.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes (three positive and three negative) molded to an assembly which is connected to the stator windings. This rectifier bridge changes the stator ac voltages to dc voltages which appear at the output terminal. The blocking action of the diodes prevent battery discharge back through the alternator.

Because of this blocking action, the need for a cutout relay in the circuit is eliminated. Alternator field current is supplied through a diode trio which is also 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.

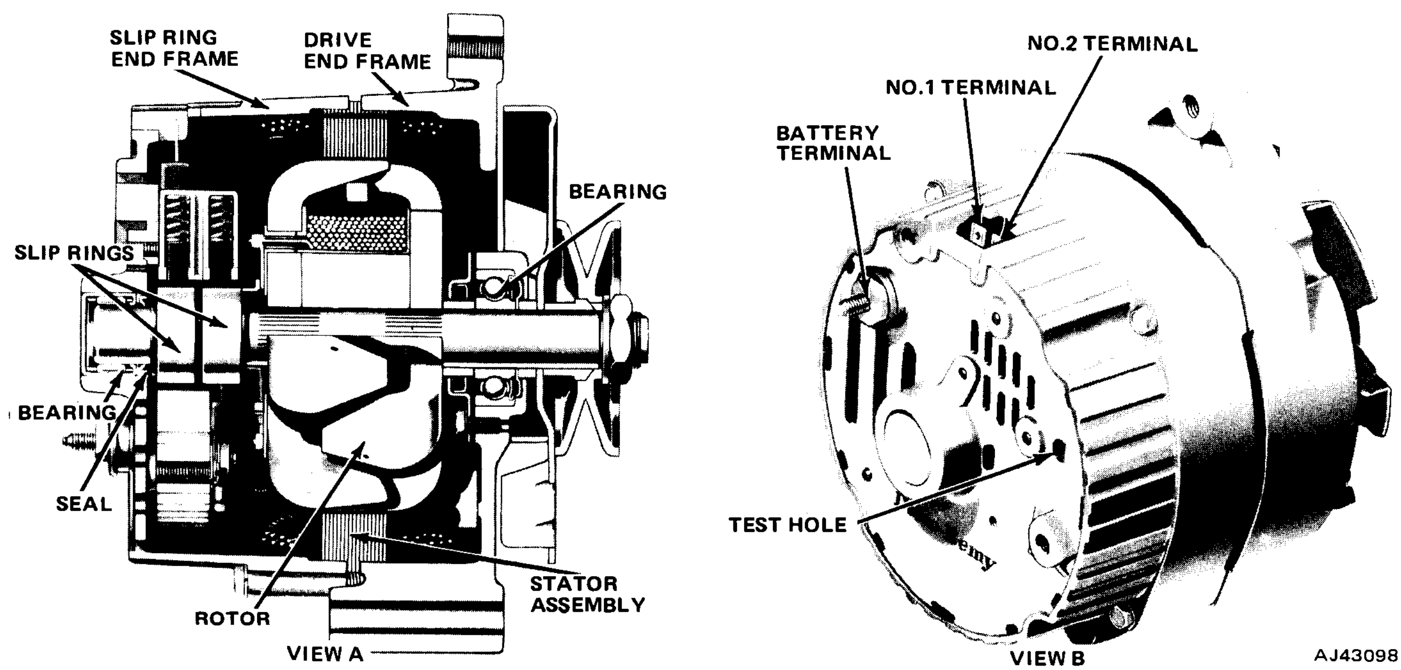

Fig. 3-22 Delco 10-SI Series Alternator

OPERATION

The basic operating principles of the 10-SI Series Alternator (fig. 3-23) are explained as follows:

When the ignition switch is closed, current from the battery flows through the 10-ohm resistor to the alternator 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 alternator field coil and TR1 back to the battery. The indicator lamp then lights.

With the alternator operating, ac voltages are generated in the stator windings, and the stator supplies dc 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 ac voltage to a dc voltage which appears between ground and the alternator BAT terminal. As alternator speed increases, current is provided for charging the battery and operating electrical accessories. Also with the alternator operating, the same voltage appears at the BAT and No. 1 terminals, and the indicator lamp goes out to indicate the alternator is producing voltage.

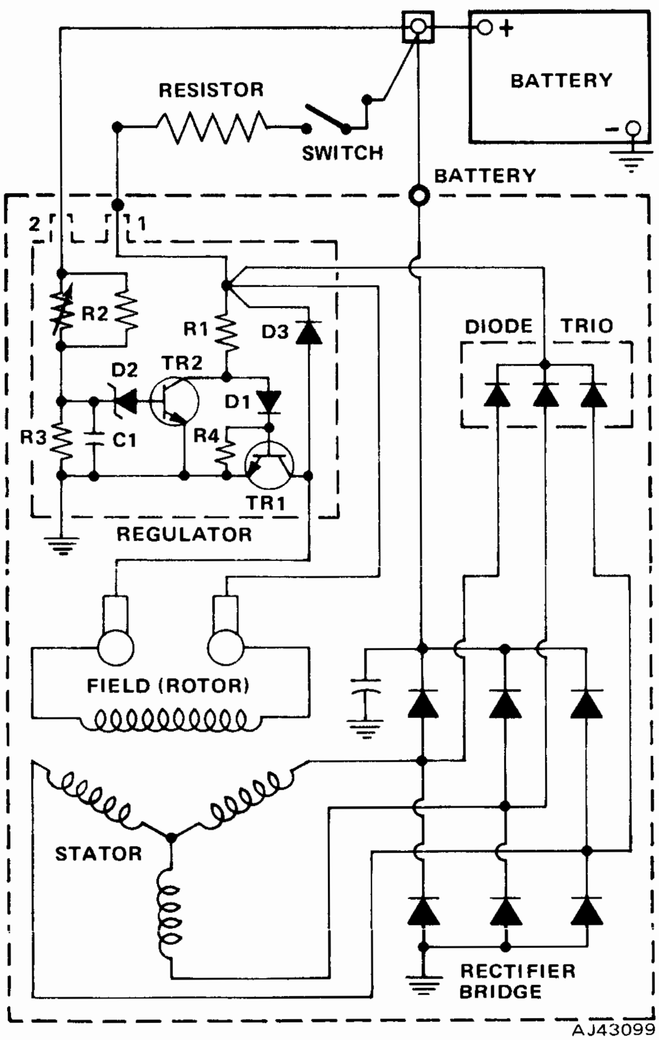

Fig. 3-23 10-SI Alternator Schematic—Typical

The No. 2 terminal on the alternator is always connected to the battery, but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the alternator 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 alternator voltage to a preset value.

Capacitor C1 provides voltage continuity across R3, R4 prevents excessive current through TR1 at high temperatures, and D3 prevents high induced voltages in the field windings when TR1 turns off. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

NOTE: *On vehicles equipped with electric assist choke, a phase tap is used at the alternator to provide current for choke operation. A strap attached to the rectifier bridge provides about 7 volts to an additonal terminal at the rear of the alternator (fig. 3-24).*

TROUBLESHOOTING PROCEDURES

Close adherence to the following procedures in the order presented will lead to the location and correction of charging system defects in the shortest possible time.

Figure 3-25 is a basic wiring diagram showing lead connections.

To avoid damage to the electrical equipment, always observe the following precautions:

- Do not polarize the alternator.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed.
- **NEVER** operate the alternator with the output terminal circuit open and No. 1 and No. 2 terminals connected to the alternator.
- Make sure the alternator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle, connect negative to negative and positive to positive.

NOTE: *For charging rate indication, an ammeter is used for Cherokee, Wagoneer, and Truck. CJ Models use a voltmeter.*

Trouble in the charging system will show up as one or more of the following conditions:

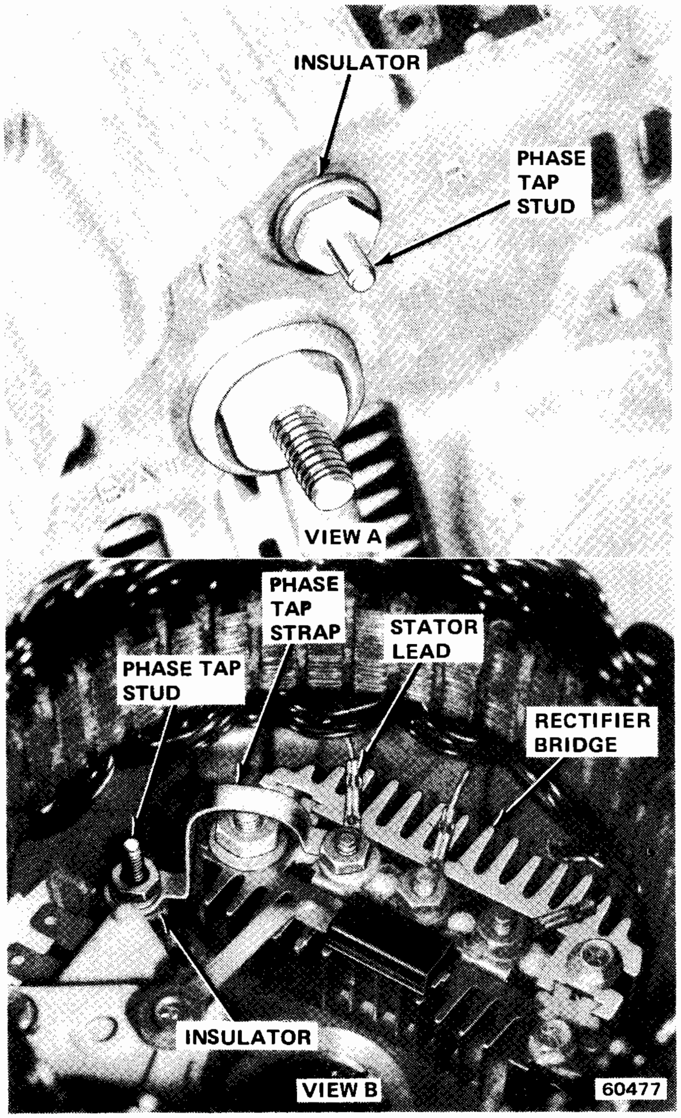

Fig. 3-24 Phase Tap for Electric Assist Choke

A—Faulty voltmeter or ammeter operation.

B—An undercharged battery as evidenced by slow cranking and low specific gravity readings.

C—An overcharged battery as evidenced by excessive water usage.

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 or broken insulation. Be sure alternator mounting bolts are tight and unit is properly grounded. Check for loose fan belt.

Noisy Alternator

Noise from the alternator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, out-of-round or rough slip rings, hardened brushes or defective stator.

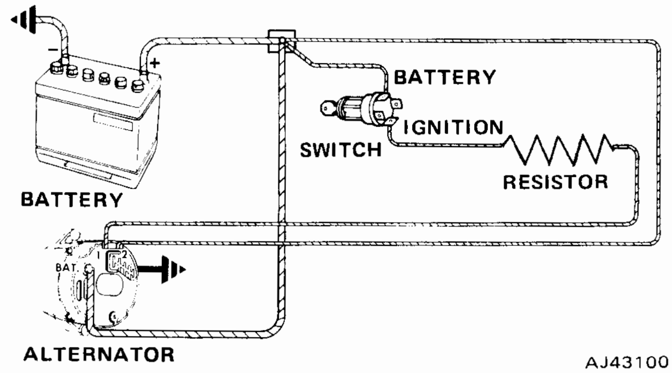

Fig. 3-25 Basic Lead Connections (Negative Ground Shown)

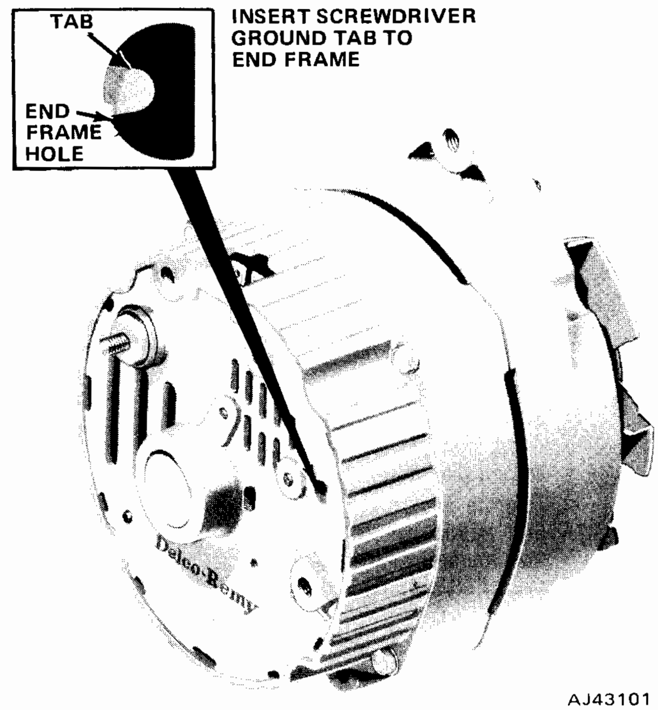

Fig. 3-26 Grounding Alternator Field Windings (Wiring Connections not Shown)

Faulty Ammeter or Voltmeter Operation

Check the ammeter or voltmeter for normal operation. If the meter operates normally, proceed to Overcharged-Undercharged Battery Diagnosis Guide.

Overcharged-Undercharged Battery

For battery overcharged-undercharged diagnosis, refer to the Overcharged-Undercharged Battery Diagnosis Guide.

Overcharged-Undercharged Battery Diagnosis Guide

UNDERCHARGED

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 voltmeter may be operating normally. The following procedure also applies to circuits with an ammeter.

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. If a battery defect is suspected, refer to battery testing in this section.
4. Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the alternator and firewall, and the cable clamps and battery posts.
5. With ignition switch on connect a voltmeter from:
   a. Alternator BAT. terminal to ground
   b. Alternator No. 1 terminal to ground
   c. Alternator No. 2 terminal to ground

   A zero reading indicates an open between lead connection and battery.
6. If previous Steps 1 through 5 check satisfactorily, check the alternator as follows:
   a. Disconnect battery negative cable.
   b. Connect an ammeter in the circuit at the BAT. terminal of the alternator.
   c. Reconnect battery negative 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.

OVERCHARGED

1. To determine battery condition refer to battery testing section.
2. Connect a voltmeter from alternator No. 2 terminal to ground. If reading is zero, No 2 lead circuit is open.
3. If battery and No. 2 lead circuit check good, but an obvious overcharge condition exists as evidenced by excessive battery water usage, proceed as follows:
   a. Separate end frames as covered in "DISASSEMBLY" section under heading of "ALTERNATOR REPAIR." 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, Fig. 3-32, Ohmmeter 1, 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. 3-32)**, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as covered under heading of ALTERNATOR REPAIR AND TESTING.

If ampere output is within 10 amperes of rated output as stamped on alternator frame, alternator is not defective; recheck Steps 1 through 5.

If ampere output is not within 10 amperes of rated output, ground the field winding by inserting a screwdriver into the test hole **(Fig. 3-26)**. CAUTION: Tab is within ¾ inch of casting surface. Do not force screwdriver deeper than one inch into end frame.

Operate engine at moderate speed as required, and adjust carbon pile as required to obtain maximum current output.

- If output is within 10 amperes of rated output, replace regulator as covered in ALTERNATOR REPAIR AND TESTING section, and check field winding.
- If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as covered in ALTERNATOR REPAIR AND TESTING section.

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Alternator Leakage Troubleshooting Procedure

If the alternator is suspected of discharging the battery because of excessive leakage, perform the following procedure. A bulb socket with jumper wires attached and a No. 158 bulb are required.

(1) Disconnect battery lead to alternator.

(2) Connect No. 158 bulb in series with battery lead and alternator output terminal. Bulb should not light. If bulb lights (even dimly), replace rectifier bridge.

(3) Disconnect connector from No. 1 and 2 terminals of alternator.

(4) Connect No. 158 bulb in series with No. 1 terminal at alternator and the battery positive post. Bulb should not light. If bulb lights (even dimly), test diode trio. If diode trio is not defective, replace voltage regulator.

(5) Connect No. 158 bulb in series with No. 2 terminal at alternator and battery positive post. Bulb should not light. If bulb lights (even dimly), replace voltage regulator.

REMOVAL AND INSTALLATION

Removal

WARNING: *Failure to disconnect battery negative cable may result in injury from hot battery lead at the alternator.*

(1) Disconnect battery negative cable.

(2) Remove two-terminal plug and battery lead on back of alternator.

(3) Remove mounting and adjusting bolts and washers.

(4) Remove alternator drive belt from alternator pulley and remove alternator from mounting bracket.

(5) Remove pulley and fan from alternator.

(a) Insert allen wrench into shaft to hold shaft while removing nut (fig. 3-27).

(b) Remove retaining nut and washer.

(c) Slide pulley, fan, and spacer from shaft.

Installation

(1) Install pulley on replacement alternator.

(a) Install spacer, fan, and pulley.

(b) Attach washer and nut.

(c) Tighten nut to 40 to 60 foot-pounds torque (fig. 3-28).

(2) Install alternator to mounting bracket with washers and bolts. Tighten bolts finger-tight only.

(3) Install alternator drive belt.

(4) Tighten belt to the specified belt tension. Refer to Section 2 for proper belt tensioning procedures.

(5) Tighten bolt at sliding slot bracket to 20 foot-pounds torque. Tighten remaining bolts to 30 foot-pounds torque.

(6) Install terminal plug and battery lead to alternator.

(7) Connect battery negative cable.

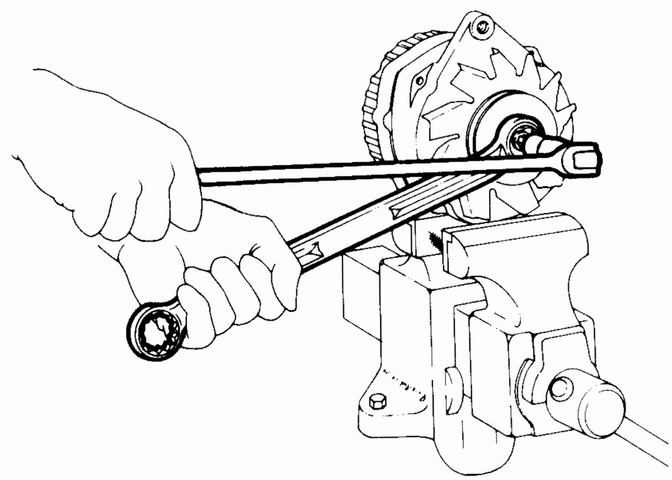


Fig. 3-27 Pulley Removal

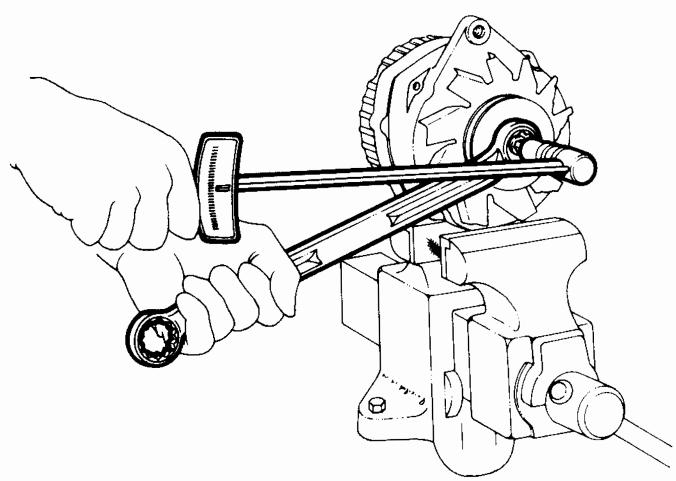


Fig. 3-28 Tightening Pulley Nut

REPAIR AND TESTING

Disassembly, Testing, and Assembly

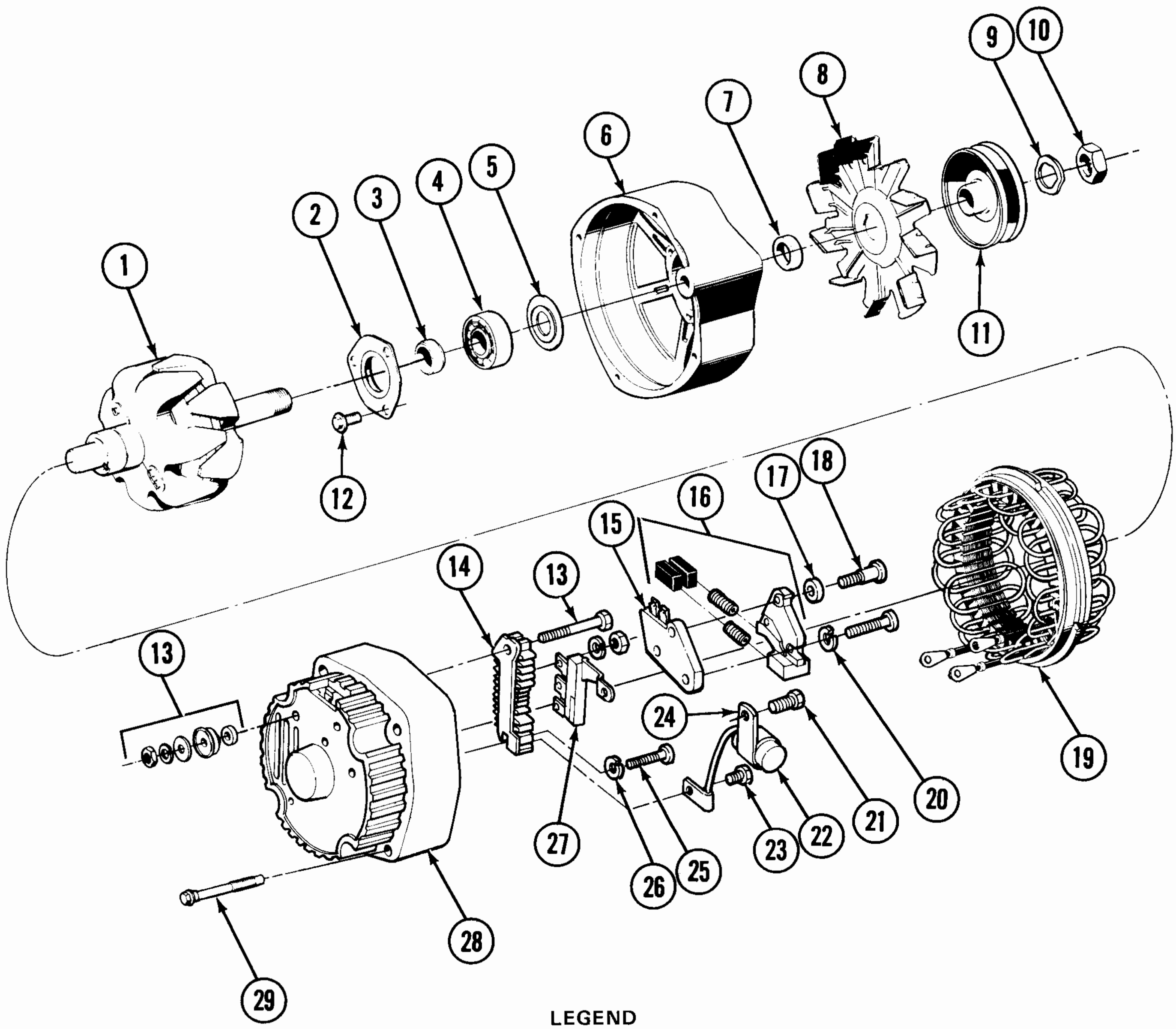
CAUTION: *As rotor and drive end frame assembly is separated from slip ring frame assembly, the brushes will fall down onto the shaft and come in contact with* *lubricant. Brushes which come in contact with shaft should be cleaned immediately to avoid contamination by oil, or they will have to be replaced.*

(1) Scribe marks on alternator case for location reference.

(2) Remove four through-bolts, connecting slip ring and end frame and drive end frame (fig. 3-29).

(3) Separate drive end frame and rotor assembly from the stator assembly by prying apart with a screwdriver placed between stator assembly and drive end frame.

NOTE: *After disassembly, place a piece of tape over the slip ring end frame bearing to prevent entry of dirt and other foreign material, and also place a piece*



LEGEND

1 ROTOR
2 RETAINER
3 COLLAR (INNER)
4 BEARING
5 WASHER
6 HOUSING
7 COLLAR (OUTER)
8 FAN
9 WASHER, LOCK
10 NUT, PULLEY
11 PULLEY
12 SCREW
13 TERMINAL PACKAGE
14 RECTIFIER BRIDGE
15 REGULATOR
16 BRUSH ASSEMBLY PACKAGE
17 WASHER
18 SCREW
19 STATOR
20 WASHER
21 SCREW
22 CAPACITOR
23 SCREW
24 CLAMP
25 SCREW
26 WASHER
27 DIODE TRIO
28 HOUSING
29 THROUGH-BOLT

Fig. 3-29 10-SI Alternator—Exploded View

of tape over the shaft on the slip ring end. Use pressure-sensitive tape and not friction tape which would leave a gummy deposit on the shaft. If brushes are to be reused, clean with a soft, dry cloth.

(4) Place rotor in vise and tighten only enough to permit removal of shaft nut.

CAUTION: *Avoid excessive tightening of the rotor in the vise as this may cause rotor distortion.*

(5) Remove shaft nut, washer, pulley, fan, and collar.

(6) Separate drive end frame from rotor shaft.

Rotor Testing

The rotor may be checked electrically for grounded, open, or short-circuited field coils as follows.

(1) Check for ground by connecting a 110-volt test lamp or ohmmeter from either slip ring to rotor shaft or to rotor poles. If lamp lights or ohmmeter reading is low, the field winding is grounded (fig. 3-30).

(2) Check for opens by connecting the test lamp or ohmmeter to each slip ring. If lamp fails to light, or if the ohmmeter reading is high (infinity), the winding is open (fig. 3-30).

(3) Check winding for short circuits by connecting a battery and ammeter in series with two slip rings. The field current at 12 volts and 80°F should be between 4.0 to 4.5 amperes. Any ammeter reading above 4.5 amperes indicates shorted windings.

NOTE: *The winding resistance and ammeter readings will vary slightly with winding temperature changes. A reading below the specified value indicates excessive resistance. An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings (fig. 3-30). If the resistance reading is below 2.6 ohms at 80°F, the winding is shorted. If resistance is above 3.0 ohms at 80°F, the winding has excessive resistance.*

(4) Replace rotor assemblies which fail the above test.

(5) Clean and inspect rotor as follows:

(a) Clean magnetic poles or rotor by brushing with mineral spirits.

CAUTION: *Do not clean with degreasing solvent.*

(b) Inspect slip rings for dirt and roughness. Clean with solvent if necessary. These may also be cleaned and finished with 400 grain or finer polishing cloth. Do not use sandpaper. Spin rotor in lathe or otherwise spin rotor, and hold polishing cloth against rings until they are clean.

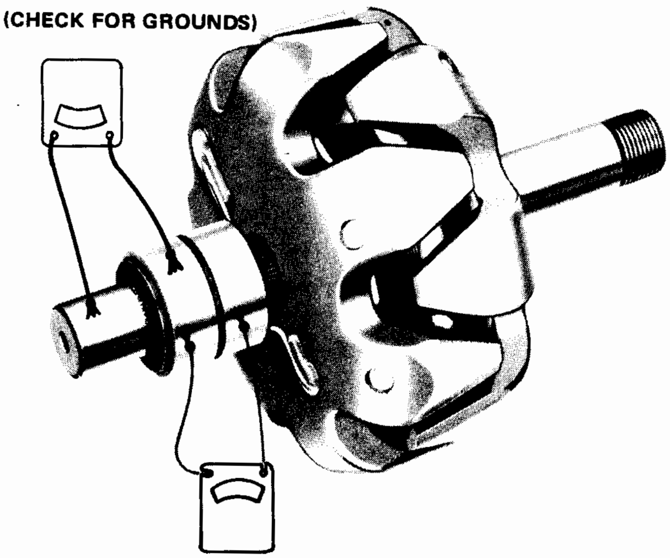


Fig. 3-30 Checking Rotor

CAUTION: *The rotor must be rotated in order that slip rings will be cleaned evenly. Cleaning slip rings by hand, without spinning rotor, may result in flat spots on slip rings, causing brush noise.*

(c) True rough or out-of-round slip rings in lathe to 0.002 inch maximum indicator reading. Remove only enough material to make rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

If the rotor is not defective, but the alternator fails to supply rated output, the defect is in the diode trio, rectifier bridge, or stator.

Stator

Disassembly

(1) Remove three stator lead attaching nuts and washers and remove stator leads from rectifier bridge terminals.

(2) Remove phase tap strap, if equipped.

(3) Separate stator frame from end frame. The fit between the stator frame and end frame is not tight, and the two can be separated easily.

Testing

The stator windings may be checked with a 110-volt test lamp or ohmmeter as follows:

(a) Check for grounded windings by connecting lamp or ohmmeter from any stator lead to frame. If lamp lights or ohmmeter reading is low, the stator is grounded (fig. 3-31).

(b) Test for opens by successively connecting test lamp or ohmmeter between stator leads. If lamp

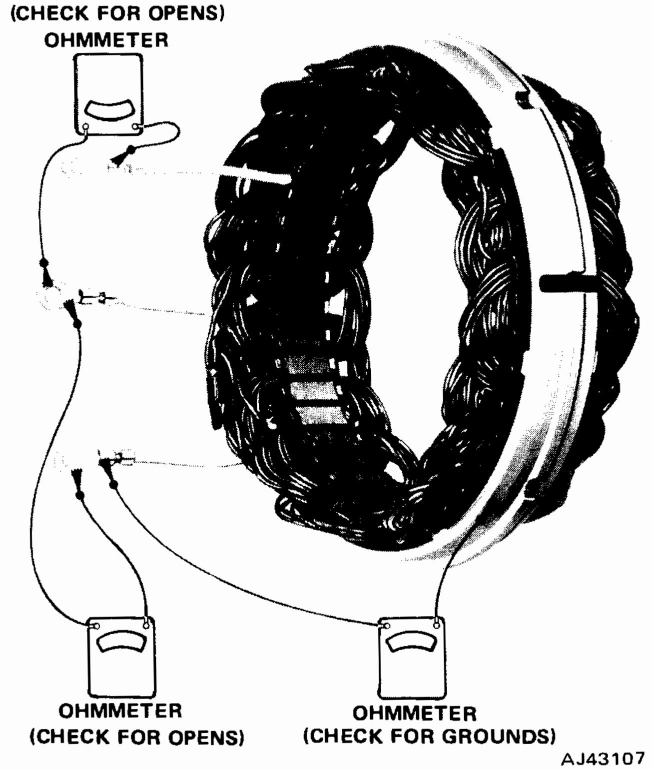


Fig. 3-31 Checking Stator

fails to light or ohmmeter reading is high, there is an open in stator windings (fig. 3-31).

(c) Locate short circuits in stator windings.

NOTE: *A short circuit is difficult to locate without laboratory test equipment, due to low resistance of windings. However, if all other electrical checks are normal and alternator fails to supply rated output, shorted stator windings are indicated.*

(d) Replace stator which fails above test.

CAUTION: *Do not clean in solvent.*

(1) Clean stator, if necessary, by brushing with mineral spirits or equivalent.

Assembly

(1) Position stator frame and end frame together.
(2) Install phase tap strap, if removed.
(3) Attach stator leads to rectifier bridge terminals. Secure with washers and nuts.

Diode Trio

Testing

NOTE: *Testing is performed before further disassembly of the diode trio to isolate malfunctions.*

CAUTION: *Do not use high voltage, such as 110-volt test lamp, to check this unit.*

(1) Before removing the diode trio, connect an ohmmeter, using lowest range scale, from brush lead clip to end frame (fig. 3-32).
(2) Reverse lead connections. If both readings are zero, check for grounded brush lead clip caused by omission of insulating washer, omission of insulating sleeve over screw, or damaged insulation (fig. 3-32).
(3) Remove screw to inspect sleeve.

NOTE: *If screw assembly is correct and both ohmmeter readings are the same, replace voltage regulator.*

Disassembly

(1) Remove three stator attaching screws.
(2) Remove stator leads from rectifier bridge terminals.
(3) Remove phase tap strap, if equipped.
(4) Remove stator.
(5) Remove diode trio lead clip attaching screw and remove diode trio. Note that the insulating washer on the screw is assembled over the top of the diode trio connector.

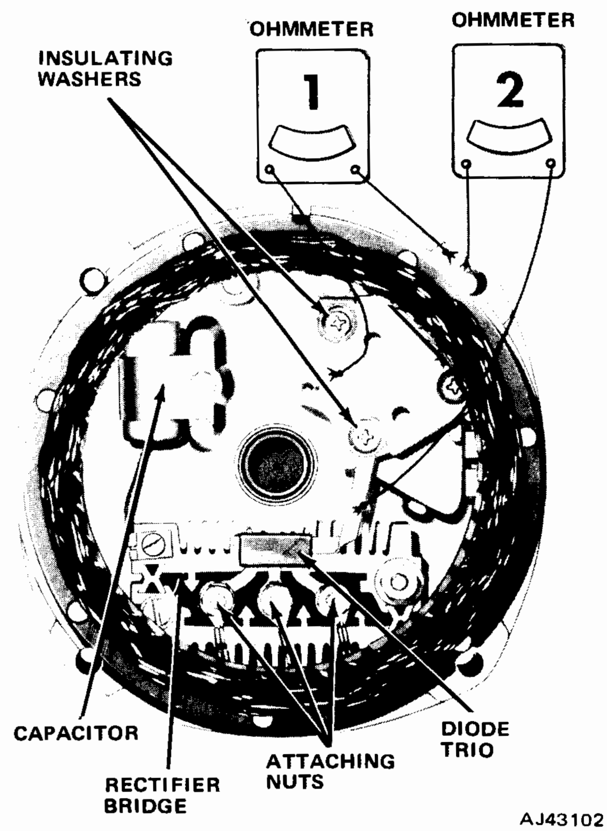


Fig. 3-32 Slip Ring End Frame Assembly

Final Testing

(1) Check diode trio after removing it from end frame assembly.

(a) Connect an ohmmeter having a 1-1/2-volt cell to the single brush connector and one of the stator lead connectors (fig. 3-33). Observe reading on lowest range scale.

(b) Reverse leads to same two connectors.

(2) Replace the diode trio if any or all of the readings when reversing connections are the same. A good diode trio will give one high and one low reading.

(3) Connect ohmmeter to each pair of three connectors. If any reading is zero, replace diode trio.

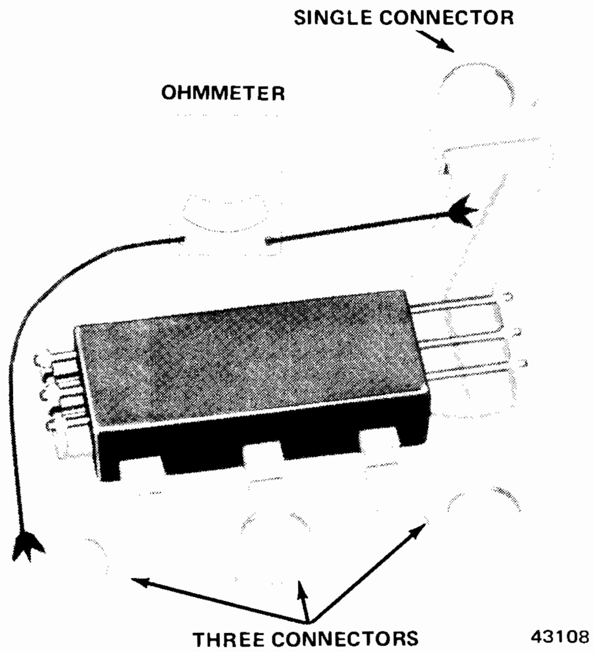


Fig. 3-33 Checking Diode Trio

Assembly

(1) Position diode trio to end frame.

(2) Install diode trio lead clip screw, making sure insulating washer is over the top of diode trio connector.

(3) Install phase tap strap, if removed.

(4) Install stator and attach leads to rectifier bridge terminals. Secure with washers and nuts.

Rectifier Bridge

NOTE: *The rectifier bridge contains all of the diodes found in the heat sink and slip ring end frame. If one diode is defective, the entire rectifier bridge must be replaced.*

Testing

CAUTION: *Do not use high voltage, such as a 110-volt test lamp, to check these units.*

(1) Connect ohmmeter to grounded heat sink and one of three terminal tabs (fig. 3-34). Note reading.

(2) Reverse lead connections to the grounded heat sink and same terminal tab. Note reading.

(3) Replace rectifier bridge if both readings are the same.

NOTE: *A good rectifier bridge will give one high and one low reading. Do not replace either unit unless at least one pair of readings is the same.*

(4) Repeat steps (1) and (2) between the grounded heat sink and the other two terminal tabs, and between the insulated heat sink and each of the three terminal tabs. The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check.

Disassembly

(1) Remove phase tap strap, if equipped.

(2) Remove capacitor lead attaching screw.

(3) Disconnect capacitor lead from rectifier bridge.

(4) Remove rectifier bridge attaching screws and battery terminal screw.

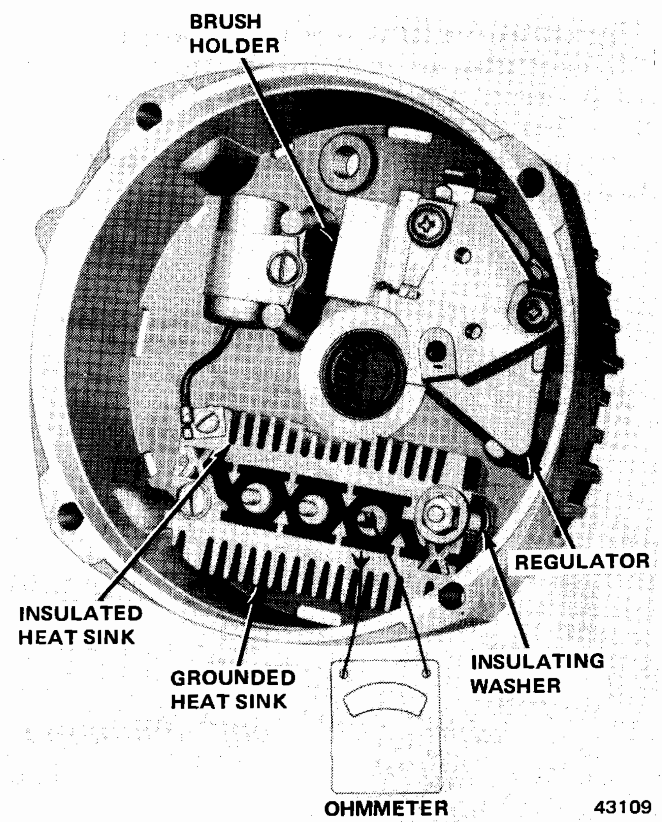


Fig. 3-34 Rectifier Bridge Check

(5) Remove rectifier bridge. Note insulator between insulated heat sink and end frame (fig. 3-34).

Assembly

(1) Position rectifier bridge to end frame with insulator between insulated heat sink and end frame.
(2) Install phase tap strap, if removed.
(3) Install rectifier bridge attaching screw and battery terminal screw.
(4) Connect capacitor lead to rectifier bridge and tighten securely.

Brushes

Disassembly

(1) Remove two brush holder screws and one diode trio lead strap attaching screw. Note position of all insulator washers for assembly (fig. 3-35).
(2) Inspect brush holder screws for broken or cracked insulation.
(3) Remove brush holder and brushes. Carefully note stack-up of parts for assembly.

NOTE: *The voltage regulator may be removed at this time.*

Inspection

Inspect brush springs for evidence of damage or corrosion.

Inspect brushes for wear or contamination.

If old brushes are to be reused, they must be thoroughly cleaned with soft, dry cloth and must be completely free of oil.

Replace brush springs if there is any doubt about their condition.

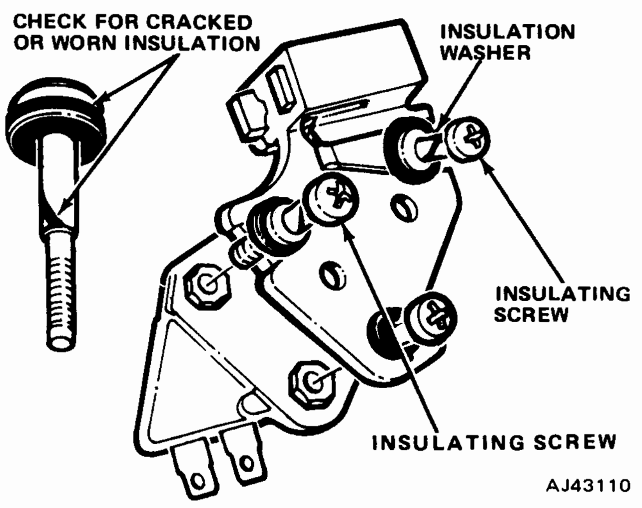


Fig. 3-35 Brush Holders

Assembly

NOTE: *Should any of the brush holder assembly parts require replacement, it will be necessary to replace the entire brush holder assembly. Individual parts are not serviced for this particular assembly.*

(1) Install springs and brushes into brush holder.

NOTE: *Brushes should slide in and out of brush holder without binding.*

(2) Insert a straight wooden or plastic toothpick (to prevent scratching brushes) into hole at bottom of holder to retain brushes.

NOTE: *Install voltage regulator at this time.*

(3) Attach brush holder into end frame, noting carefully stack-up of parts (fig. 3-35). Allow wooden or plastic toothpick to protrude through hole in end frame.
(4) Install diode trio lead strap attaching screw and washer.
(5) Securely tighten remaining two brush holder screws.

Bearing Replacement and Lubrication

Disassembly

Drive End Frame

(1) Remove bearing retaining plate screws.
(2) Press bearing from the end frame with suitable tube or collar.

NOTE: *If the bearing is in satisfactory condition, it may be reused.*

Slip Ring End Frame

(1) Press out bearing using a tube or collar that fits inside the end frame housing.
(2) Press out bearing from the inside of the housing toward the outside.

NOTE: *The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to lubricate and reuse the bearing.*

Assembly

Drive End Frame

NOTE: *Prior to assembly, fill the cavity one quarter full between the retainer plate and bearing with Delco-Remy lubricant No. 1948791, or equivalent.*

CAUTION: *Do not overfill as this may cause the bearing to overheat.*

(1) Assemble bearing and slinger into end frame (fig. 3-36).

(2) Press bearing in with the use of a suitable tube or collar that fits over the outer race.

NOTE: *It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is hardened.*

(3) Install retaining plate and screws.

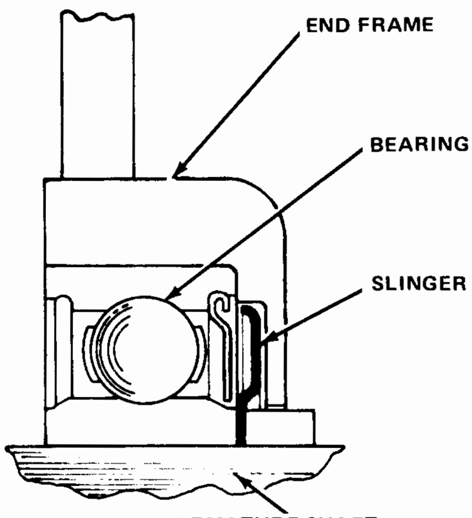


Fig. 3-36 Drive End Bearing Assembly

Slip Ring End Frame

(1) Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame.

CAUTION: *Use extreme care to avoid misalignment or placing undue stress on the bearing.*

(2) Place a flat plate over bearing and press in from the outside toward the inside of the frame until bearing is flush with the outside of the frame.

NOTE: *If the seal is separated from the bearing, it is recommended that a new seal be installed whenever the bearing is replaced. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing. Press the seal in with the lip of the seal toward the rotor when assembled, away from the bearing.*

Alternator Final Assembly

(1) Before assembling rotor and drive end frame to slip ring end frame, be sure that bearing surfaces of shaft are perfectly clean.

(2) Position the slip ring frame and drive ring frame together, aligning the scribe marks.

(3) Install four through-bolts and securely tighten.

(4) Remove wooden or plastic toothpick from brush holder assembly.

STARTING SYSTEM

GENERAL

The starting system includes the starter motor and drive, battery, starter relay, starter switch (ignition switch), and the necessary cables and wiring to connect the components. A starter safety switch, on vehicles equipped with automatic transmissions, prevents operation of the starter in all selector positions except N (neutral) and P (park).

NOTE: *All models equipped with an automatic transmission have a combination neutral-start backup lamp switch mounted on the steering column. When equipped with a manual transmission, the neutral-start wires are connected together, resulting in a direct connection between the ignition switch and the starter motor relay S-terminal.*

A low and high current circuit make up the starting system (fig. 3-37). The low current is the control circuit and includes the connections and wires from the ignition switch to the S-connection at the starter relay. This circuit activates the pull-in winding in the starter solenoid and closes the switch to complete the high current circuit. The high current circuit is from the battery through the starter relay switch to the starter motor to ground.

The Starter Motor Diagnosis Guide may be used to trace the source of the problem when the starter will

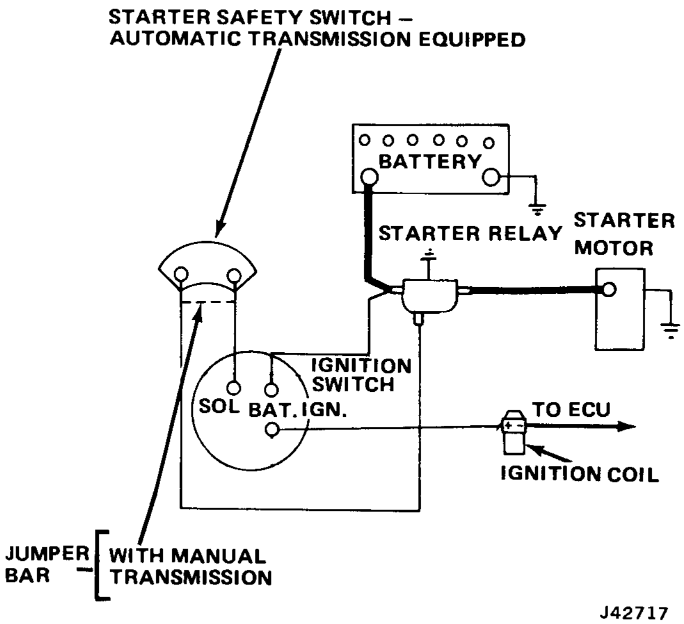


Fig. 3-37 Starting System Wiring Diagram

not crank the engine or cranks slowly.

If the starter motor cranking speed is normal and the engine does not start, the problem usually can be found in the fuel or ignition system.

STARTER MOTOR

The starter has an integral positive engagement drive. When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts (fig. 3-38). When the starter is first engaged, a heavy current flows through the grounded field coil actuating a movable pole shoe. The pole shoe is attached to the starter drive actuating lever, thus the drive is engaged with the flywheel.

When the movable pole shoe is fully seated, it opens the field coil grounding contacts and is connected in parallel with the other pole shoes while the armature is rotating. A holding coil is used to maintain the movable pole shoe in the fully seated position during the time that the starter is cranking the engine.

Identification

The starter motor identification code is stamped on the frame, below the Jeep Part number, at the time of manufacture.

Example:

6	F	C	A
Year	Month	Week	Work
(1976)	(June)	(3rd Week)	Shift

The letter I is never used in starter coding.

Current Draw Test—On Vehicle

(1) Prior to performing a current draw test, battery must be fully charged as described under Hydrometer Tests in this section.

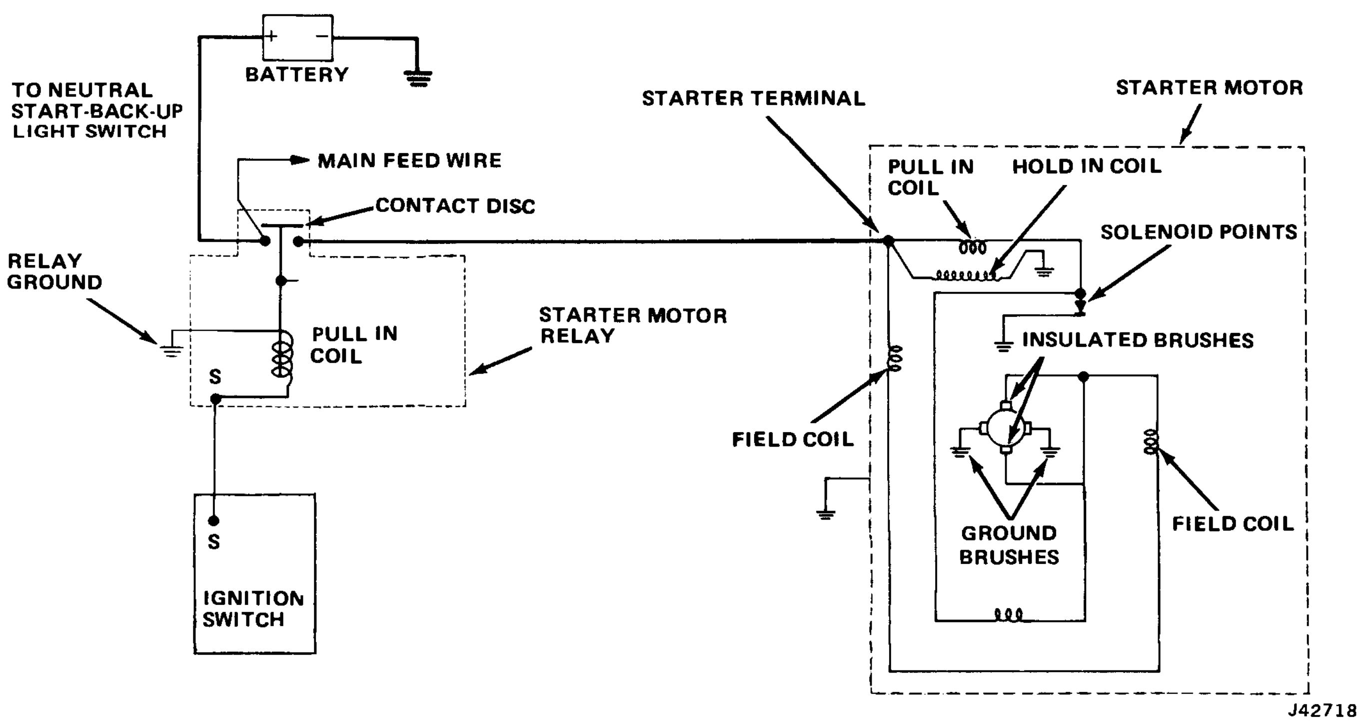


Fig. 3-38 Starter Motor—Wiring Diagram

NOTE: *The lower the voltage, the higher the amperage draw.*

(2) Disconnect and ground ignition coil secondary wire.

(3) Connect a remote control starter switch between positive battery terminal and S-terminal of the starter solenoid.

(4) Connect battery-starter tester leads as shown in figure 3-39. Operate remote control starter switch and read voltage indicated on voltmeter while starter is cranking engine.

CAUTION: *Do not operate for more than 15 seconds.*

(5) Turn remote control starter switch off.

(6) Turn load control knob clockwise or to Increase until the voltmeter reading is exactly the same as it was when the starter was cranking.

Read the current draw on the ammeter scale. This is the current being used by the starter under full load conditions. If the current draw is not 180 to 220 ampperes at room temperature, remove the starter motor from the engine for bench testing.

NOTE: *Do not take ampere draw reading until starter motor has obtained maximum rpm.*

No-Load Test—Out of Vehicle

The starter motor no-load test will indicate such faults as open or shorted windings, worn bushings (rubbing armature), or bent armature shaft. This test is run with the starter on the bench.

NOTE: *The tester load control knob must be in the Decrease or extreme clockwise position.*

(1) Operate starter with test equipment connected as shown in figure 3-40. Note voltage reading.

(2) Determine exact starter rpm using a mechanical tachometer (not shown).

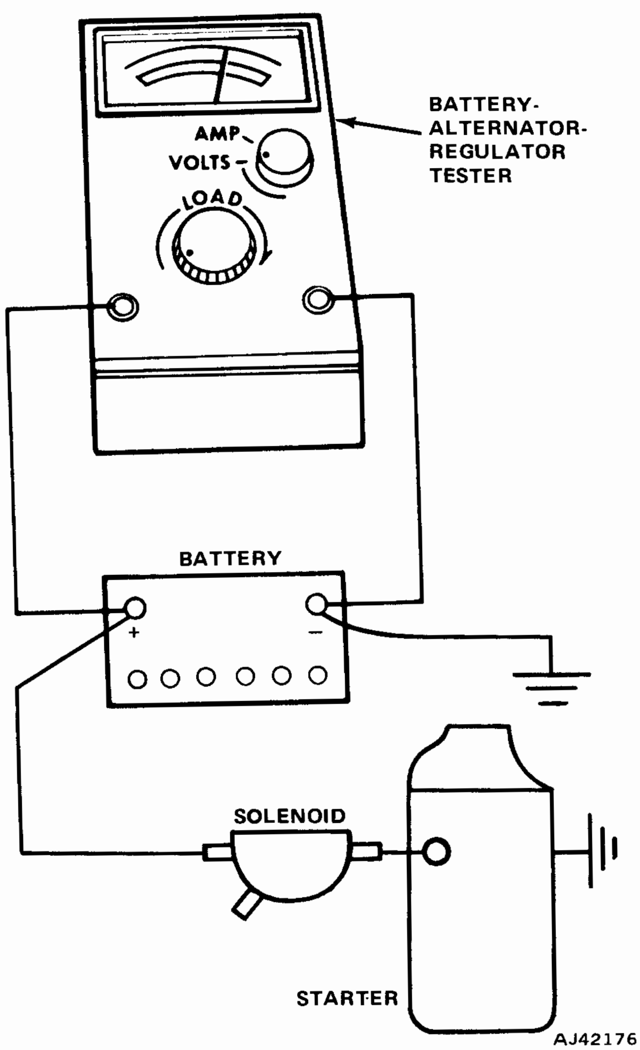


Fig. 3-39 Starter Motor Current Draw Test

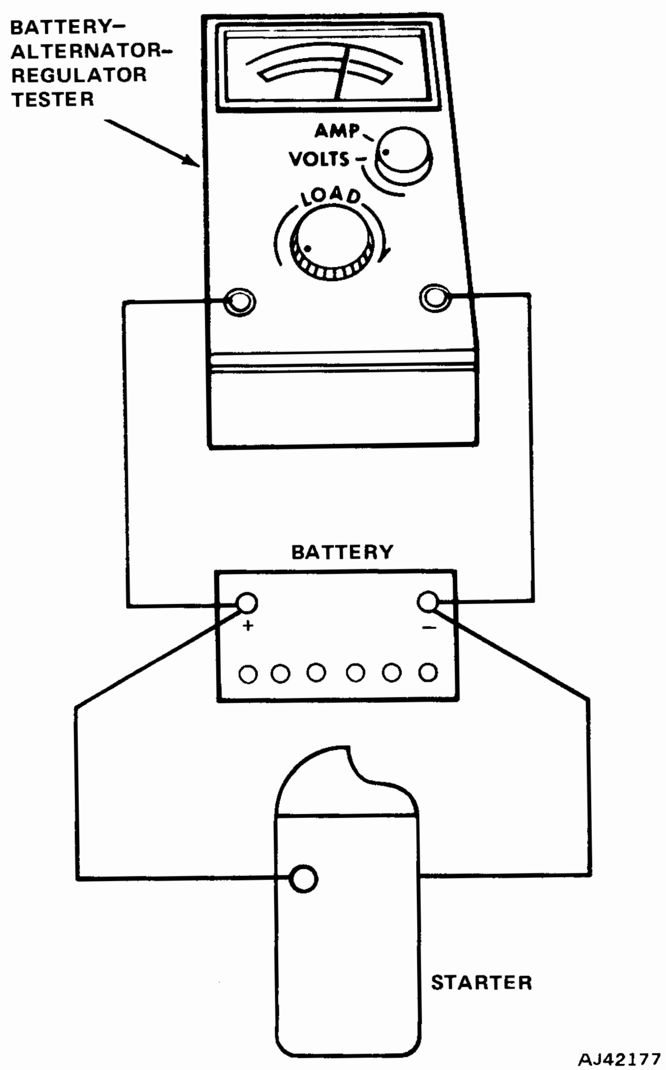


Fig. 3-40 Starter Motor No-Load Test

NOTE: *To use a mechanical tachometer, remove seal from drive end housing and clean grease from end of armature shaft.*

(3) Disconnect starter from battery.

(4) Turn load control knob clockwise (Increase) until voltmeter reading is exactly the same as it was with the starter connected to the battery.

(5) If ammeter reading at no-load speed is below specifications, starter has high electrical resistance and should be repaired or replaced.

(6) If ammeter reading is higher than specifications and starter is running slower than it should, starter should be disassembled, cleaned, inspected, and tested as outlined in the following paragraphs.

Disassembly

Refer to figure 3-41 for parts identification.

(1) Remove brush cover band and protective tape, drive yoke cover and gasket.

(2) Remove brushes from brush holders.

(3) Remove through-bolts, drive end housing, and drive yoke return spring.

(4) Remove pivot pin and starter drive yoke.

(5) Remove armature and drive assembly.

(6) Remove brush end plate.

Cleaning and Inspection

(1) Use a brush or air to clean starter frame, field coils, armature, drive assembly, and drive end housing.

(2) Wash all other parts (except field coils) in solvent and dry parts.

(3) Inspect armature windings for broken or burned insulation and unsoldered connections.

(4) Check armature for open circuits and grounds as outlined in Armature Test Procedure.

(5) If the commutator is dirty, it may be cleaned with No. 400 or No. finer sandpaper.

NOTE: *Never use emery cloth to clean the commutator.*

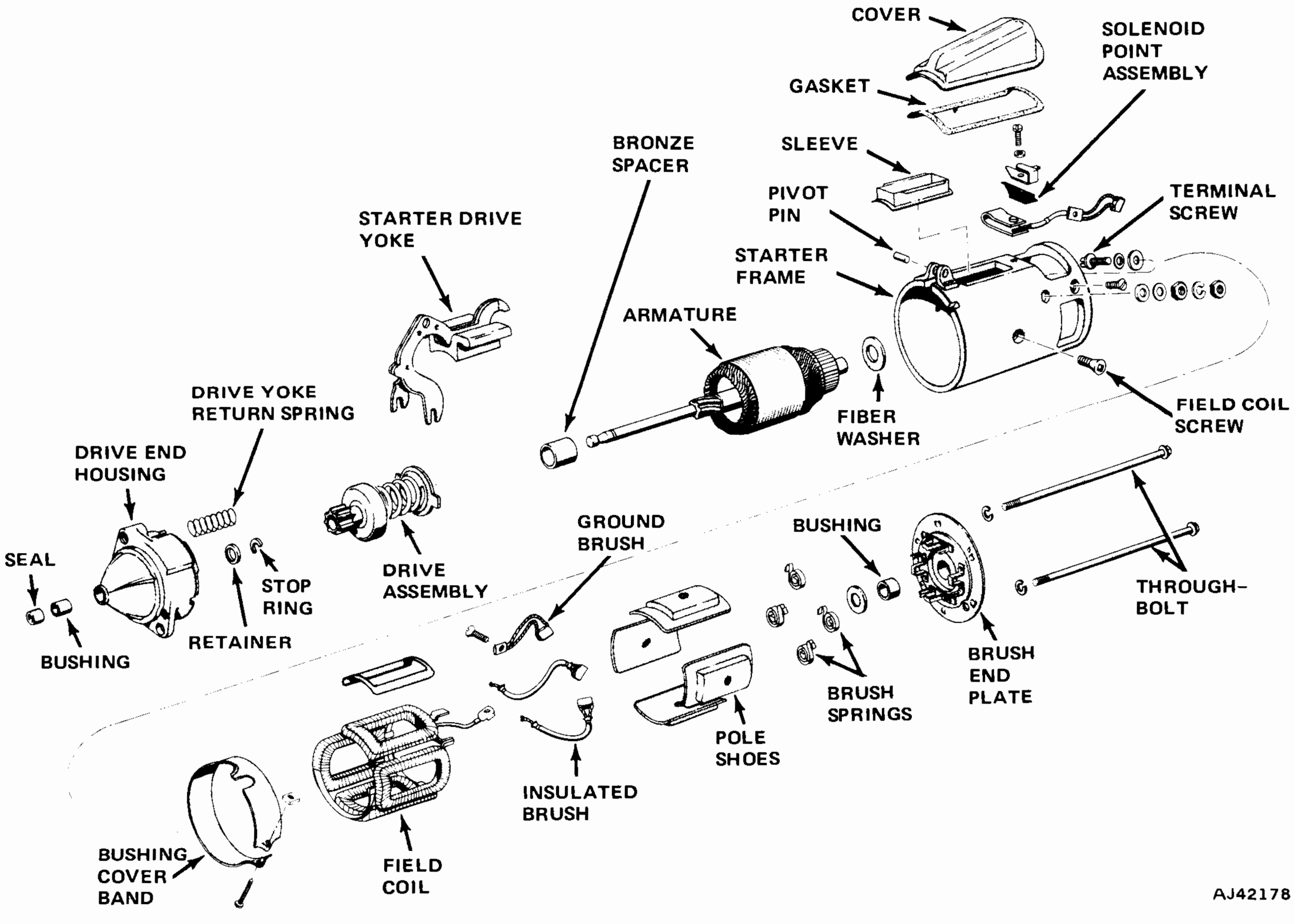


Fig. 3-41 Starter Motor—Disassembled View

(6) If armature commutator is worn, out-of-round (0.005 inch or more), or has high insulation, it should be turned down on a lathe.

(7) Inspect armature shaft and front and rear bushings for scoring and excessive wear.

(8) Inspect drive assembly pinion gear for damage.

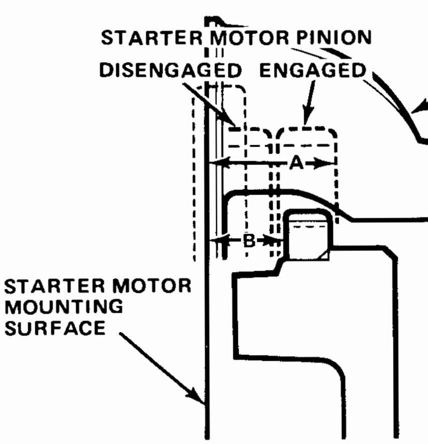
NOTE: *The entire circumference of the ring gear must be inspected for damage when the teeth of the drive assembly pinion gear are damaged.*

NOTE: *An engine that has repeated starter motor pinion failures should be checked for proper ring gear location (fig. 3-42 and 3-43), missing or improper parts or misaligned bell housing. For wobbling ring gear, the maximum allowable runout is 0.030 inch. Check for broken welds or broken flex plate.*

(9) Check drive assembly clutch by grasping and rotating pinion gear. Gear should rotate freely in one direction and lock up in opposite direction.

(10) Check brush holders for broken springs and insulated brush holders for shorts to ground. Tighten any rivets that may be loose. Replace brushes if worn to 1/4 inch or less in length.

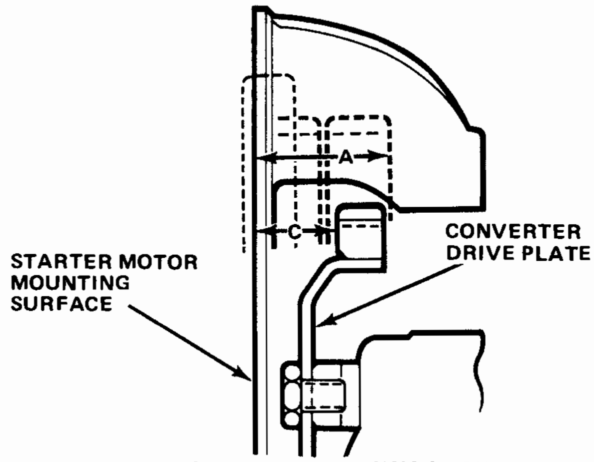
(11) Check brush spring tension. Replace springs if tension is not within specified limits (40 ounces minimum).



ENGINE	FLYWHEEL (INCHES)			
	A		B	
6 CYLINDER	1.2465 TO 1.2060	1 - 1/4 TO 1 - 13/64	0.8365 TO 0.7660	27/32 TO 49/64
V-8	1.2465 TO 1.2035	1 - 1/4 TO 1 - 13/64	0.8365 TO 0.7635	27/32 TO 49/64

60137

Fig. 3-42 Ring Gear Location—Manual Transmission



ENGINE	DRIVE PLATE (INCHES)			
	A		C	
6 CYLINDER	1.2465 TO 1.2060	1 - 1/4 TO 1 - 13/64	0.8305 TO 0.7700	53/64 TO 49/64
V-8	1.2465 TO 1.2035	1 - 1/4 TO 1 - 13/64	0.8305 TO 0.7675	53/64 TO 49/64

60138

Fig. 3-43 Ring Gear Location—Automatic Transmission

(12) Inspect field coils for burned or broken insulation and for broken and loose connections. Check field brush connections and lead insulation.

COMPONENT TESTING AND REPLACEMENT

Field Ground Circuit Test (On Test Bench)

This test will determine if the field winding insulation has failed, permitting a conductor to touch the frame.

(1) Place insulated brushes aside so that brushes do not touch any part of starter.

(2) Remove screw that attaches solenoid point assembly brush lead to frame.

NOTE: *Do not allow ground brush to contact starter.*

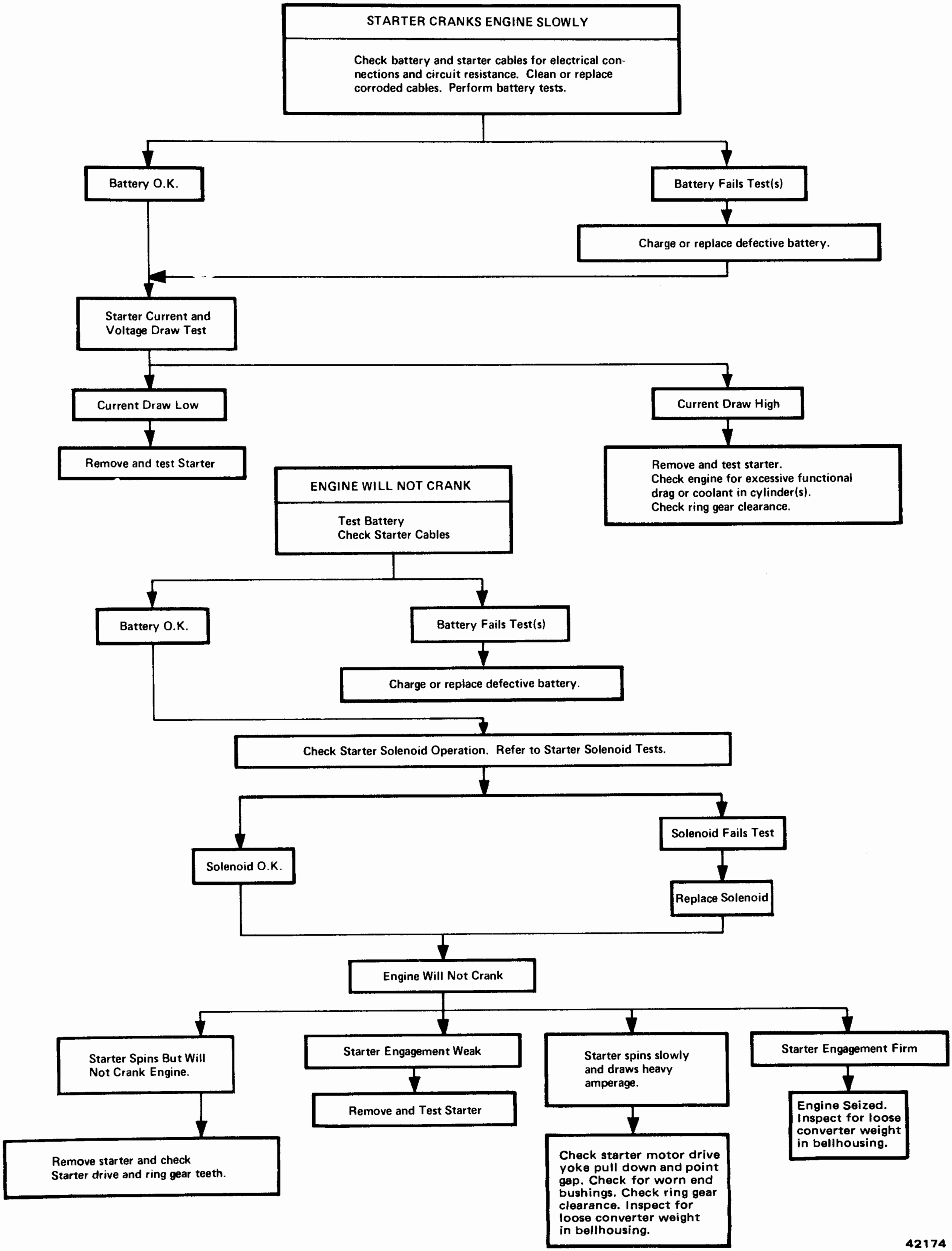
(3) Insert a piece of paper between solenoid points. Starter is now ready for testing (fig. 3-44).

(4) Connect one test prod to terminal screw and the other prod to starter frame. Test lamp should not light. If lamp lights, field windings are shorted and must be replaced.

NOTE: *Check for a loose rivet on solenoid point assembly which could also cause a short to ground.*

(5) Touch one prod to terminal and the other prod to brushes (not single ground brush). Test lamp should light. If lamp does not light, check for poor or broken connections.

Starter Motor Diagnosis Guide



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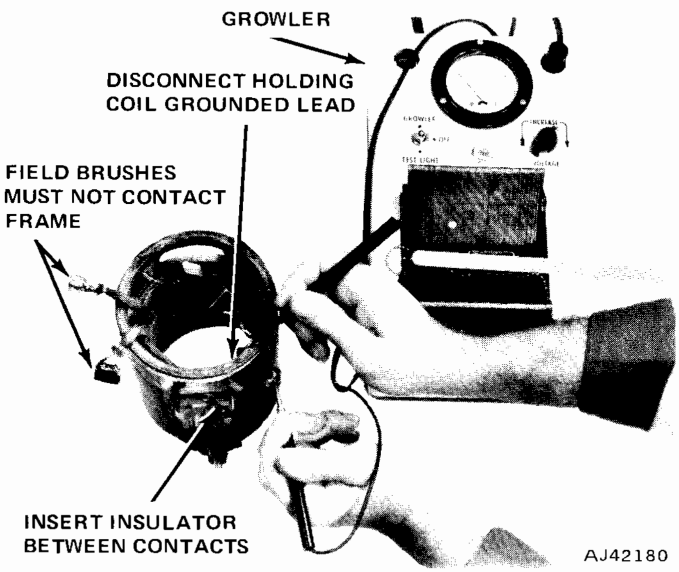

Fig. 3-44 Field Grounded Circuit Test

Field Coil Replacement

(1) Remove retaining screw and ground brushes from starter frame.

(2) Straighten tabs of solenoid coil retaining sleeve and remove sleeve.

(3) Remove three field coil retaining screws using Tool J-22516 and an arbor press.

(4) Unsolder field coil leads at terminal screw and at solenoid connection.

NOTE: *A considerable amount of heat is required to unsolder the leads. A heavy-duty soldering iron or a propane torch with a small flame is recommended.*

(5) Remove field coils and pole shoes from starter frame.

(6) Cut insulated brush leads as close to field coil connection as possible.

NOTE: *The solenoid point assembly need not be removed unless defective.*

(7) Solder new insulated brush lead clip to field coil connecting strap (use rosin core solder).

(8) Position field coils in starter frame, install retaining screws and tighten securely using Tool J-22516 and an arbor press.

(9) Solder field coil leads to starter terminal screw and solenoid connection (use rosin core solder).

(10) Install lower ground brush lead as close to threaded terminal block as possible.

(11) Place unthreaded terminal of replacement ground brush under threaded terminal of solenoid ground lead and install longer retaining screw contained in the brush kit.

(12) Install solenoid coil retaining sleeve and bend tabs to properly secure coil.

Solenoid Contact Assembly Replacement

To replace the contact assembly with the replacement kit, proceed as follows. Refer to figure 3-45 for parts identification.

(1) Unsolder contact post from field coil connecting strap.

NOTE: *A considerable amount of heat is required to unsolder leads. A heavy-duty soldering iron or a propane torch with a small flame is recommended.*

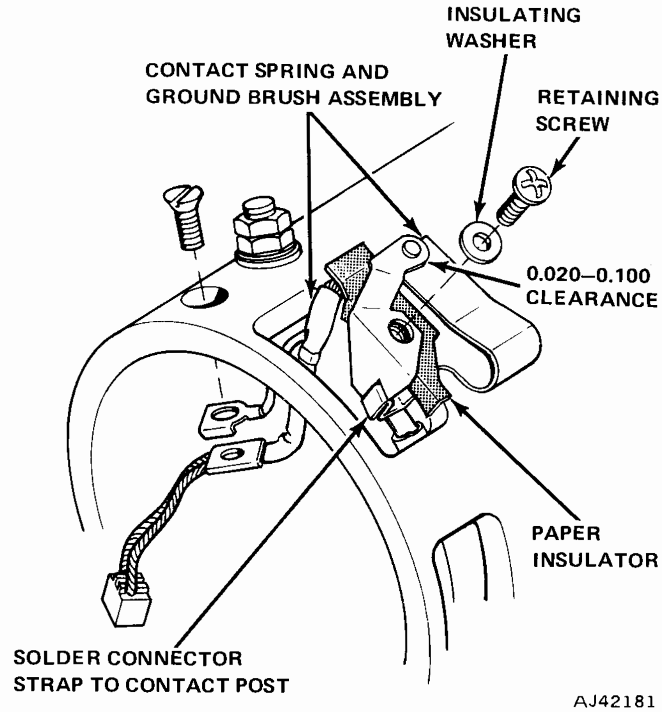

Fig. 3-45 Starter Motor Contact Kit

(2) Cut off head of contact spring retaining rivet with small, sharp chisel and discard contact spring. Use an 8-32 thread tap to cut threads in rivet hole.

(3) Remove contact post retaining screw and insulating washer. Discard contact post and paper insulator.

(4) Place new contact spring and ground brush assembly, paper insulator, and contact post into position on starter frame.

(5) Install insulating washer and retaining screw. Center contact points and tighten retaining screw.

(6) Stake threaded end of screw from inside starter frame.

(7) Clean end of field connecting strap and slotted area of contact post with fine sandpaper to ensure good solder joint.

(8) Insert end of field connector strap through slot of contact post. Bend and crimp end of connector strap against cleaned surface of contact post.

(9) Solder connection using rosin core solder.

(10) Remove upper ground brush retaining screw and discard brush.

(11) Place field ground lead terminal and new ground brush terminal block together and install original retaining screw.

(12) Install armature and drive assembly, drive yoke and drive yoke pivot pin. Apply a few drops of 10W-30 motor oil to both ends of armature.

(13) Slide stop ring retainer into place on armature shaft.

(14) Position drive yoke return spring in drive end housing and install housing to starter frame.

(15) Install end plate.

(16) Install through-bolts and tighten.

(17) Insert brushes into their holders.

(18) Press down firmly on starter drive yoke until movable pole shoe is bottomed and check clearance between new contact points. Bend upper contact post, if required, to obtain a minimum 0.020-inch to a maximum 0.100-inch clearance (0.508 to 2.54mm).

(19) Install a protective tape over brush openings of starter frame.

(20) Install drive yoke cover, gasket, and brush cover band.

(21) Tighten brush cover band retaining screw.

Armature Test Procedure

The armature should be tested for grounds, shorts, and balance whenever the starter motor is overhauled. Follow the test equipment manufacturer's procedure or the following.

Ground Test

(1) Place armature in growler jaws.

(2) Turn power switch to test position.

(3) Touch one test lead to armature core and other lead to each commutator bar one at a time and observe the test lamp. Test lamp should not glow. If test lamp glows on any bar, armature is grounded and must be replaced (fig. 3-46).

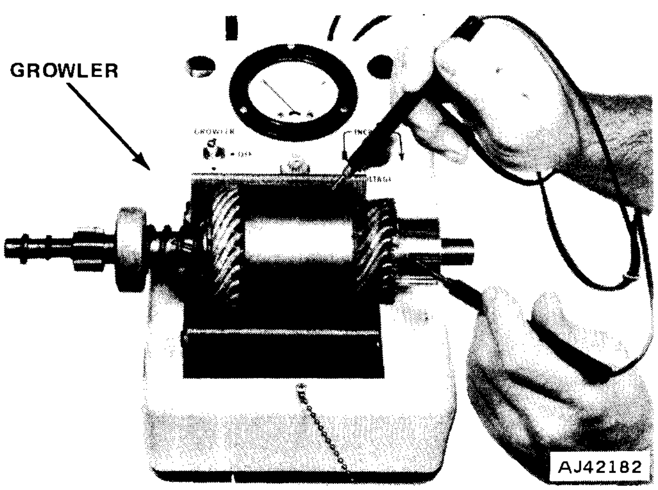

Fig. 3-46 Armature Ground Test

Short Test

CAUTION: *Never operate the growler in the test position without an armature in the jaws.*

(1) Place armature in growler jaws.

(2) Turn power switch to growler position.

(3) Using steel blade, hold blade parallel with and touching armature core. Slowly rotate armature one or more revolutions in growler jaws. If steel blade vibrates on any position of core, area is shorted and armature must be replaced (fig. 3-47).

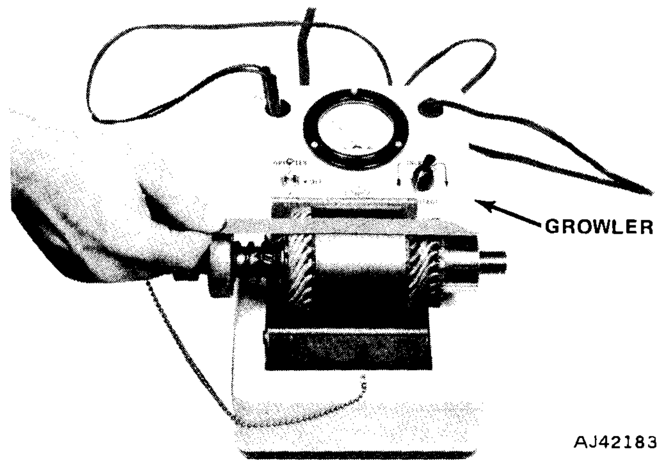

Fig. 3-47 Armature Short Test

Balance Test

(1) Place armature in growler jaws.

(2) Turn power switch to growler position.

(3) Place contact fingers of meter test cable across adjacent commutator bars at side of commutator.

(4) Adjust voltage control until needle is at highest reading on scale.

(5) Test each commutator bar with adjacent bar until all bars have been checked. A reading of zero indicates an open circuit in that particular pair (fig. 3-48).

Assembly

Refer to figure 3-41 for parts identification.

Bushing Replacement

Drive End

(1) Support drive end housing.

(2) Drive out seal from the inside of the housing.

(3) Drive out original bushing from housing after the seal has been removed.

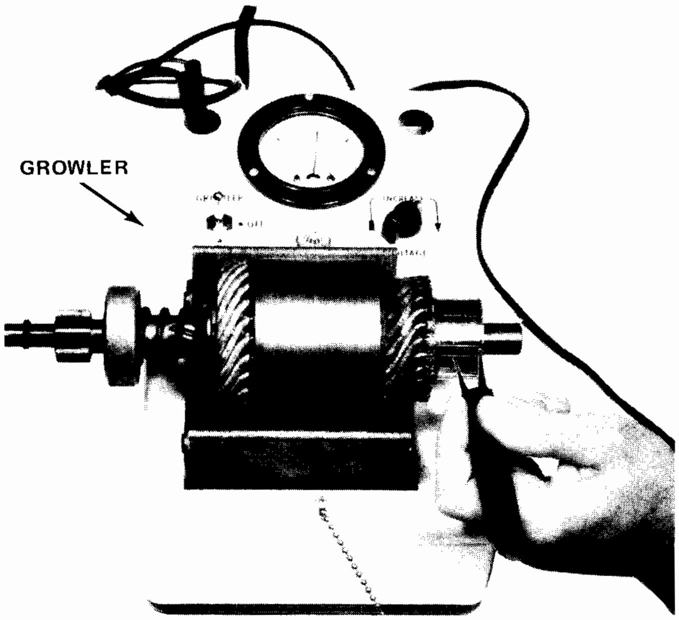

Fig. 3-48 Armature Balance Test

(4) Install new bushing using a suitable tool.

NOTE: *Do not install drive end housing seal at this time.*

Commutator End

(5) Remove old bushing by threading through bushing cavity with suitable size tap.

(6) Secure tap in vise and separate end frame from bushing.

(7) Press new bushing into place using suitable bushing installer.

Drive Assembly Replacement

(1) Pry stop ring off and remove starter drive from armature shaft.

NOTE: *The service replacement drive assembly is prelubricated. Apply a few drops of 10W-30 motor oil to the armature shaft and end bushings.*

(2) Apply thin coating of Dow Corning 33 Silicone Lubricant (or equivalent) on armature shaft splines.

(3) When installing drive assembly, check snap ring for tight fit on shaft. Slide drive assembly over shaft and install stop ring and original retainer.

Drive End, Armature, End Plate Installation

(1) Position fiber thrust washer on commutator end of armature shaft.

(2) Apply a few drops of 10W-30 motor oil to both bearing surfaces of shaft.

(3) Insert armature into starter frame and install starter drive yoke and pivot pin.

NOTE: *The drive yoke must engage the starter drive assembly.*

(4) All brushes should be out of their retainers and hanging outside of the starter frame before installing the armature.

(5) Place starter drive yoke return spring into recess of drive end housing and install housing to starter frame.

(6) Install brush end plate with end plate boss aligned with starter frame slot.

(7) Install through-bolts and tighten.

NOTE: *Be sure snap ring retainer is properly seated in drive end housing.*

(8) Use hook to pull back on brush springs and insert brushes into holders.

(9) Cover brush openings with waterproof tape and install drive yoke cover and gasket.

(10) Install brush cover band and tighten retaining screw.

(11) Apply a generous amount of Lubriplate to drive end of armature shaft and install drive end housing seal using a socket or other suitable tool. Dent seal slightly in center to expand it.

(12) Connect starter to battery and check operation (refer to No-Load Test in this section).

STARTER SOLENOID TEST (ON VEHICLE)

Engine Will Not Crank

(1) Verify battery and cable conditions as outlined under Battery Maintenance to assure correct cranking voltage.

(2) Inspect and tighten battery and starter cable connections at starter relay.

(3) Disconnect wire at solenoid S-terminal.

CAUTION: *Place transmission in Neutral or Park position and apply parking brake prior to conducting solenoid test.*

(4) Connect jumper wire from battery positive post to solenoid S-terminal. If engine cranks, solenoid is not defective.

(5) If engine does not crank, connect another jumper wire from battery negative terminal to solenoid mount bracket. Be sure a good connection is made. If solenoid now can be made to operate, relay was not properly grounded. Remove rust or corrosion and attach solenoid to fender with cadimum-plated screws.

(6) If engine does not crank, remove two jumper wires and connect a heavy jumper cable between battery and starter motor terminals of solenoid. If engine cranks, solenoid is defective and must be replaced.

(7) If engine does not crank, solenoid is not defective. Check starter motor.

STARTER CABLE TEST (VOLTAGE DROP)

General

The starter cable tests will determine if there is excessive resistance in the circuit (fig. 3-49). When performing these tests, it is important that the voltmeter be connected to the terminals that the cables are connected to instead of to just the cables. For example, when checking from the battery to the solenoid, the voltmeter probes must be touching the battery post and the solenoid threaded stud.

Before performing tests:

(1) Remove coil secondary wire from distributor and ground coil wire.

(2) Place transmission in Neutral or Park and apply parking brake.

(3) Be sure battery is fully charged.

Battery to Starter Motor Voltage Drop Tests (V-1, fig. 3-49)

(1) Connect voltmeter positive lead to battery positive post.

(2) Connect voltmeter negative lead to starter motor terminal.

(3) Crank engine and note voltmeter reading while cranking (V-1). Reading should be 0.5 volt or less. If reading is more than 0.5 volt, move test lead to starter cable at the starter and retest. If voltage reading is 0.5 or less, remove cable from starter and clean connections. If reading is more than 0.5 volt, perform tests on each cable and the solenoid to locate problem area.

Battery-to-Solenoid Voltage Drop Tests (V-2, fig. 3-49)

(1) Connect voltmeter positive lead to battery positive post.

(2) Connect voltmeter negative lead to battery terminal (threaded stud) of solenoid.

(3) Crank engine and note voltmeter reading while cranking. Reading should be 0.2 volt or less. If reading is above 0.2 volts, remove cable, clean connections, and retest. If reading is still above 0.2 volt, replace cable.

Solenoid Voltage Drop Test (V-3, fig. 3-49)

(1) Connect voltmeter positive lead to battery positive post.

(2) Connect voltmeter negative lead to starter cable at solenoid.

(3) Crank engine and note voltmeter reading while cranking. Reading should be less than 0.3 volt.

(4) If reading is over 0.3 volt, move voltmeter connections from cable connections to solenoid starter terminal and retest. If voltage drop is now 0.3 or less, remove cables and clean connections. If voltage drop is still in excess of 0.3 volt, replace solenoid.

(5) If battery to starter circuit voltage drop was more than 0.5 volt but battery through solenoid voltage drop is 0.3 volt or less, replace solenoid to starter cable.

Starter Motor Ground Voltage Drop Test (V-4, Fig. 3-49)

(1) Connect voltmeter negative lead to starter motor housing.

(2) Connect voltmeter positive lead to battery negative post.

(3) Crank engine and note voltmeter reading while cranking. Reading should be 0.2 volt or less.

(4) If reading is more than 0.2 volt, move positive voltmeter lead to ground cable attaching bolt at engine and retest.

(5) If voltmeter is less than 0.2 volt when checking at battery ground cable, check starter motor for loose mounting bolts, corrosion, or dirt on the mounting surface.

(6) If voltage drop is more than 0.2 volt when checking at ground cable, connect voltmeter leads to ground cable leads and retest.

(7) If voltage drop is now less than 0.2 volt, clean connections between engine block and cable. If voltage drop is more than 0.2 volt, move voltmeter negative lead to battery negative post clamp and retest. If more than 0.1 volt, clean terminals. If 0.1 volt or less, replace ground cable.

Starter Motor Solenoid Pull-In Winding Test

This test determines if solenoid pull-in winding is shorted or open.

(1) Remove S-terminal wire from solenoid.

(2) Connect one ohmmeter lead to S-terminal.

(3) Connect remaining ohmmeter lead to solenoid case or mounting bracket—ohmmeter should indicate 3 to 5 ohms. If solenoid is not within these limits, replace solenoid.

NOTE: *A poor solenoid ground can be determined by moving one ohmmeter lead to the battery negative terminal. If an increase in resistance is shown, the solenoid has a poor ground.*

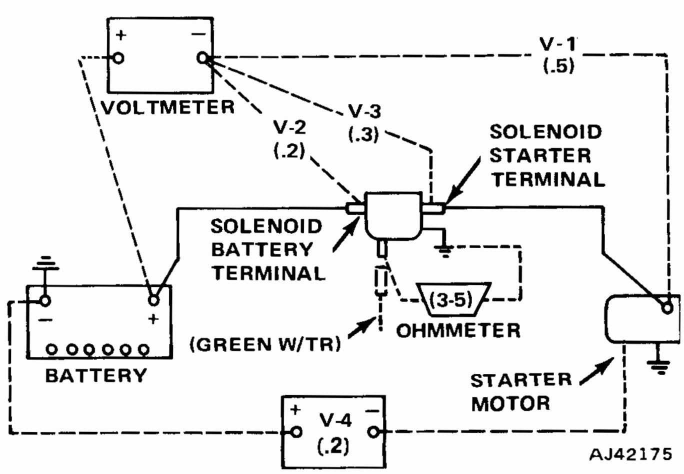

Fig. 3-49 Starter Cranking Circuit Test

IGNITION SYSTEM

GENERAL

The ignition spark must occur at the correct time and with sufficient intensity to ignite the compressed fuel-air mixture. All components of the ignition system must function properly for satisfactory and economical operation.

The coil must be able to transform the low primary voltage to a secondary voltage high enough to supply sufficient spark for all conditions of load and speed. The ignition distributor must perform two functions. It must distribute the high tension secondary voltage to the spark plugs in proper sequence. It must also give the electronic control unit a signal to operate the coil primary so the coil can fire the spark at just the right instant for the engine to develop full power.

At high speeds, the spark must occur at the plug earlier in the compression stroke in order to give the fuel-air mixture ample time to ignite, burn, and apply its power to the piston as it starts down on the power stroke. Spark timing must vary in relation to changes in engine speed. This is accomplished by the centrifugal advance mechanism of the distributor.

During part throttle operation or cruising speed, the fuel mixture is drawn into the cylinder through a restricted opening in the carburetor and is less dense. The less dense mixture will burn slower and additional advance is necessary for maximum economy. This additional advance is furnished by the vacuum advance unit and operates in relation to throttle position and engine load. The vacuum advance unit is controlled by carburetor ported vacuum. The centrifugal advance will advance engine timing with increases in engine speed.

IGNITION SYSTEM DIAGNOSIS

To determine an ignition system fault other than spark knock, refer to Ignition System Diagnosis Guide.

Engine Spark Knock (Ping)

Spark knock in some engines can be attributed to a number of causes. The most common is the intermittent spark knock which is a result of climatic factors such as temperature, air density, and humidity.

- Underhood temperatures are increased by the use of air conditioning (especially during long periods of idling), overloading (trailer pulling, operating in too high a gear), and the installation of accessories that restrict airflow.
- Air density increases as barometric pressure rises and as temperature drops. A dense mixture of air and fuel drawn into the cylinder has the same effect as raising the compression ratio which in turn increases the possibility of spark knock.
- Low humidity also increases the tendency to spark knock. High humidity decreases spark knock.

Other Causes of Spark Knock

- **Fuel Octane Rating**—All engines are designed to operate on unleaded fuels. (The required octane rating varies with each model year vehicle.) Fuels of equivalent research octane rating may vary in their knocking characteristics in a given engine. It may be necessary to reduce initial timing (not more than 2 degrees from specifications) or select an alternate source of fuel.
- **Ignition Timing**—Ignition timing should be checked to be sure it is set within specifications.

NOTE: *The white paint mark on the timing degree scale represents the specified spark setting at idle speed, not TDC (Top Dead Center).*

- **Combustion Chamber Deposits** — An excessive buildup of deposits in the combustion chamber may be caused by not using recommended fuels and lubricants, prolonged engine idling, or continuous low speed operation. The occasional use of Carburetor and Combustion Area Cleaner, Part Number 8992352 or its equivalent (Group 15.410), or operating the car at turnpike speeds will reduce these deposits.
- **Distributor Advance Mechanism**—The centrifugal and vacuum advance units should be checked to be sure they are operating freely.

Ignition System Diagnosis Guide

Condition	Possible Cause	Correction
MOMENTARY INTERRUPTION OF IGNITION	(1) Excessive resistance in ignition feed circuit.	(1) Perform checks outlined in Ignition System Tests. Repair as needed.
	(2) Excessive resistance in coil primary circuit.	(2) Perform checks outlined in Ignition System Tests. Repair as needed.
	(3) Excessive resistance in coil secondary circuit.	(3) Perform checks outlined in Ignition System Tests. Repair as needed.
	(4) Excessive resistance in sensor circuit.	(4) Perform checks outlined in Ignition System Tests. Replace sensor and modify connector terminals as needed.
	(5) Electronic Control Unit Faulty.	(5) Replace ECU and modify connector terminals as outlined in Ignition System Tests.
ENGINE FAILS TO START (NO SPARK AT PLUGS)	(1) No voltage to ignition system.	(1) Check battery, ignition switch and wiring. Repair as needed.
	(2) Electronic Control Unit ground lead open, loose or corroded.	(2) Clean, tighten, or repair as needed.
	(3) Excessive resistance in primary ignition circuit.	(3) Perform checks as outlined in Ignition System Tests. Repair as needed.
	(4) Ignition coil open or shorted.	(4) Test coil. Replace if faulty.
	(5) Electronic Control Unit Faulty.	(5) Replace Electronic Control Unit and modify connector terminals as outlined in Ignition System Tests.
	(6) Control Unit 4-wire connector corroded or loose.	(6) Clean with Jeep fabric cleaner and modify connector terminals as outlined in Ignition System Tests.
	(7) Faulty sensor.	(7) Check resistance of sensor circuit as outlined in Ignition System Tests. Replace if faulty.
ENGINE BACKFIRES BUT FAILS TO START	(1) Incorrect ignition timing.	(1) Check timing. Adjust as needed.
	(2) Moisture in distributor cap.	(2) Dry cap and rotor.

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Ignition System Diagnosis Guide (Continued)

Condition	Possible Cause	Correction
ENGINE BACKFIRES BUT FAILS TO START (Continued)	(3) Distributor cap faulty (shorting out).	(3) Check cap for loose terminals, cracks and dirt. Clean or replace as needed.
	(4) Wires not in correct firing order.	(4) Connect wires in proper firing order.
ENGINE DOES NOT OPERATE SMOOTHLY AND/OR ENGINE MISFIRES AT HIGH SPEED	(1) Spark plugs fouled or faulty.	(1) Clean and regap plugs. Replace if needed.
	(2) Spark plug cables faulty.	(2) Check cables. Replace if needed.
	(3) Spark advances system(s) faulty.	(3) Check operation of advance system(s). Repair as needed.
EXCESSIVE FUEL CONSUMPTION	(1) Incorrect ignition timing.	(1) Check timing. Adjust as needed. Refer to Section 4A.
	(2) Spark advance system(s) faulty.	(2) Check operation of advance system(s). Repair as needed.
ERRATIC TIMING ADVANCE	(1) Faulty vacuum advance assembly.	(1) Check operation of advance diaphragm and replace if needed.
	(2) Misadjusted, weak or damaged mechanical advance springs.	(2) Readjust or replace springs as needed.
BASIC TIMING NOT AFFECTED WHEN VACUUM HOSE IS DISCONNECTED	(1) Vacuum hose(s) leaking.	(1) Inspect hose and replace if needed.
	(2) Improper hose connections at spark CTO switch.	(2) Correct connections at spark CTO. Refer to Section 4A.
	(3) Faulty vacuum advance unit.	(3) Check operation of advance diaphragm and replace if needed.
DISTRIBUTOR CAP BLOWS OFF	(1) Housing not vented.	(1) Open blocked holes in nose of distributor or drill new holes (1/8 inch).

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- **Exhaust Manifold Heat Valve** — The exhaust manifold heat valve should be checked for free operation. If it sticks in the closed position, the intake manifold is heated excessively and ping results.

IGNITION SYSTEM COMPONENTS

The Breakerless Inductive System (BID) Ignition System consists of five major components: an electronic ignition control unit, an ignition coil, a distributor, high tension wires, and spark plugs.

Control Unit

The electronic control unit is a solid-state, moisture-resistant module. The component parts are permanently sealed in a potting material to resist vibration and environmental conditions. All connections are warerproof. The unit has built-in current regulation, reverse polarity protection and transient voltage protection.

Because the control unit has built-in current regulation, there is no resistance wire or ballast resistor used in the primary circuit. Battery voltage is present at the ignition coil positive terminal whenever the ignition key is in the ON or START position; therefore, there is no need for an ignition system bypass during cranking. The primary (low voltage) coil current is electronically regulated by the control unit.

NOTE: *This unit is not repairable and must be serviced as a unit.*

Ignition Coil

The ignition coil is an oil-filled, hermetically-sealed unit (standard construction). Ignition coils do not require special service other than keeping terminals and connections clean and tight. For correct polarity, the coil positive terminal should be connected to the battery ignition feed. The ignition coil has two windings on a soft iron core; the primary winding which consists of a comparatively few turns of heavy wire and the secondary winding which consists of many turns of very fine wire.

The function of the ignition coil in the BID ignition system is to transform battery voltage in the primary winding to a high voltage for the secondary system.

When an ignition coil is suspected of being defective, it should be checked on the car. A coil may break down after it has reached operating temperature; **it is important that the coil be at operating temperature when tests are made.** Perform the tests following the instructions of the Test Equipment Manufacturer.

Distributor

The distributor is conventional except that a sensor and trigger wheel replace the usual contact points, condenser, and distributor cam.

The distributor uses two spark advance systems (mechanical and vacuum) to establish the optimum spark timing setting required for various engine speed and load conditions. The two systems operate independently, yet work together to provide proper spark advance.

The mechanical (centrifugal) advance system is built internally into the distributor and consists of two flyweights which pivot on long-life, low-friction bearings and are controlled by calibrated springs which tend to hold the weights in the no-advance position. The flyweights respond to changes in engine (distributor shaft) speed, and rotate the trigger wheel with respect to the distributor shaft to advance the spark as engine speed increases and retard the spark as engine speed decreases. Mechanical advance characteristics can be adjusted by bending the hardened spring tabs to alter the spring tension.

The vacuum advance system incorporates a vacuum diaphragm unit which moves the distributor sensor in response to the changes in carburetor throttle bore vacuum.

Sensor/Trigger Wheel

The sensor (a component of the distributor) is a small coil, wound of fine wire, which receives an alternating current signal from the electronic control unit.

The sensor develops an electromagnetic field which is used to detect the presence of metal. The sensor detects the edges of the metal in the teeth of the trigger wheel. When a leading edge of a trigger wheel tooth aligns with the center of the sensor coil, a signal is sent to the control unit to open the coil primary circuit.

NOTE: *There are no wearing surfaces between the trigger wheel and sensor, dwell angle remains constant and requires no adjustment. The dwell angle is determined by the control unit and the angle between the trigger wheel teeth.*

OPERATION

With the ignition switch in the START or RUN position, the control unit is activated (fig. 3-50). At this time, an oscillator, contained in the control unit, excites the sensor which is contained in the distributor. When the sensor is excited, it develops an electromagnetic field. As the leading edge of a tooth of the trigger wheel enters the sensor field, the tooth reduces the strength of oscillation in the sensor. As the oscillator strength is reduced to a predetermined level, the demodulator circuit switches. The demodulator switching signal controls a power transistor which is in series with the coil primary circuit. The power transistor switches the coil primary circuit off, thereby inducing the high voltage in the

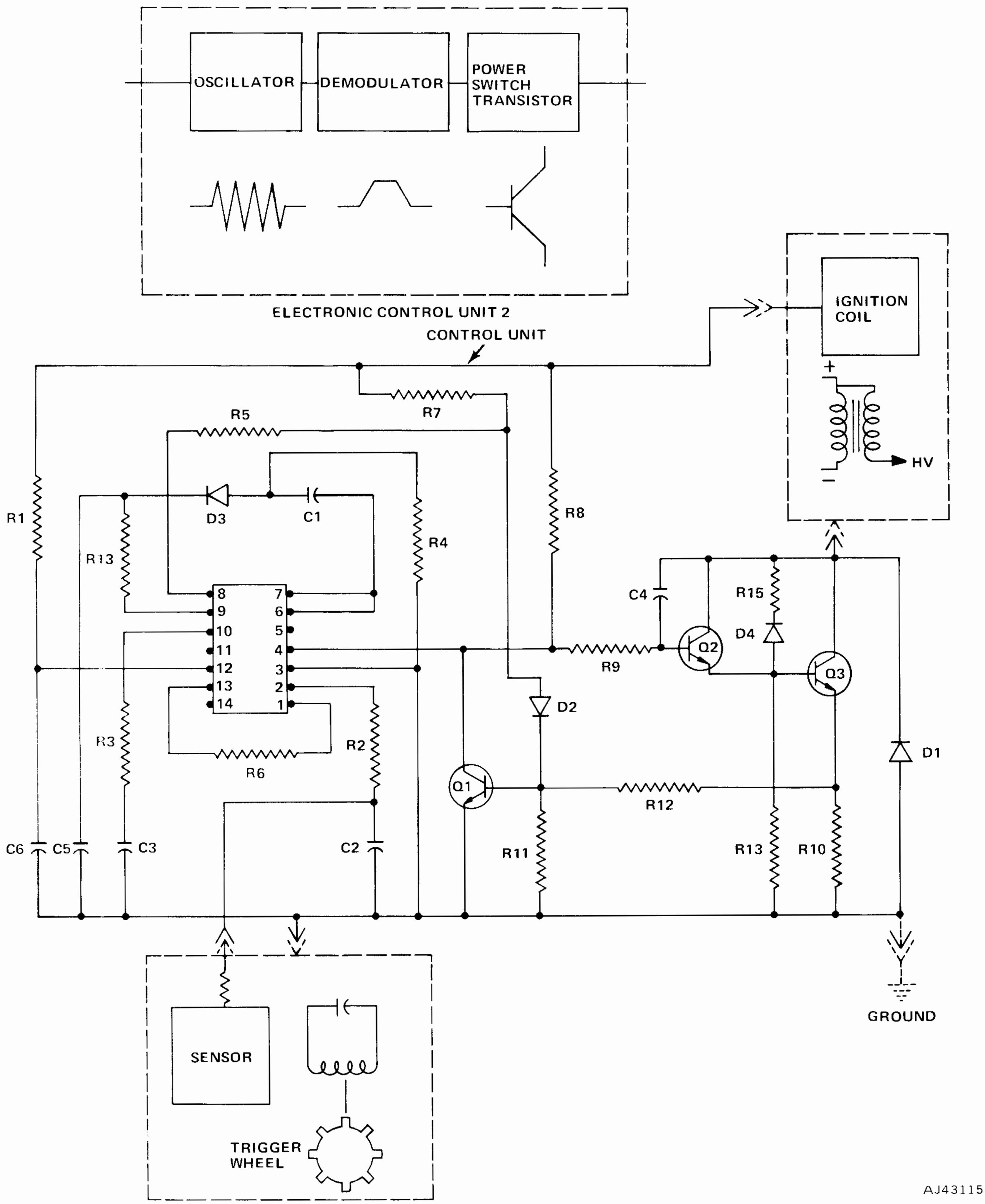

Fig. 3-50 Ignition System Schematic

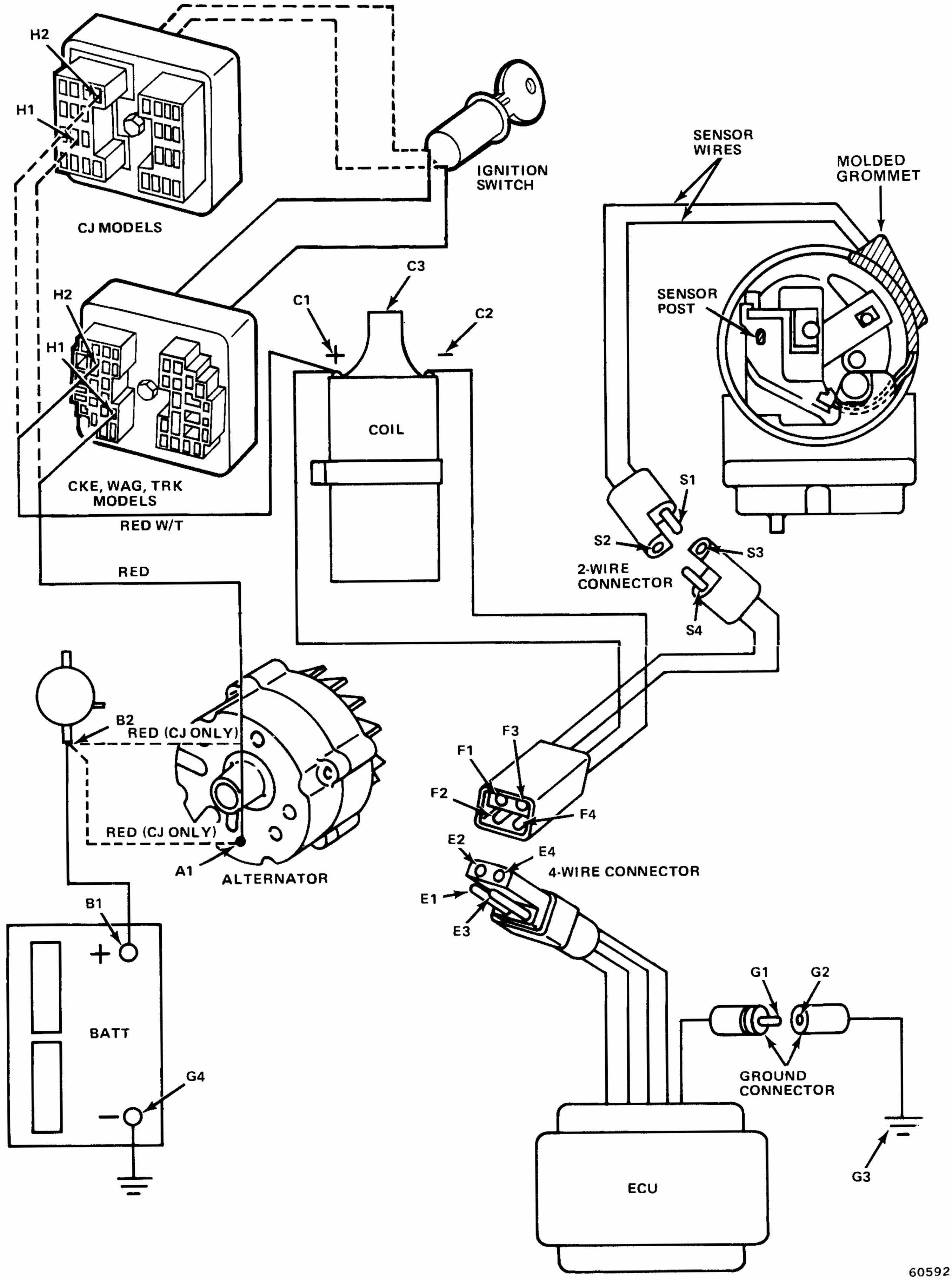

Fig. 3-51 Ignition System Tests

coil secondary winding. High voltage is then distributed to the spark plugs by the distributor cap, rotor, and ignition wires.

TROUBLESHOOTING

Ignition System Test

The following tools and materials are required for testing.

- Electronic Ignition Pulse Simulator J-25331
- Ohmmeter
- Small wire brush
- Jeep Fabric Cleaner, Part Number 8990968
- Petroleum jelly

(1) Disconnect Electronic Control Unit (ECU) ground and 4-wire connectors. Use small wire brush and fabric cleaner to clean and rinse terminals identified E1, E2, E3, E4, F1, F2, F3, F4, G1 and G2 in figure 3-51. Do not connect 4-wire and ground connectors.

(2) Disconnect battery cables from battery (disconnect negative cable first). Move ignition switch to START and hold momentarily before allowing it to return to ON position.

(3) Measure resistance of complete ignition feed circuit by connecting ohmmeter to battery positive cable (B1) and to F3 terminal in 4-wire connector (fig. 3-51).

(a) If resistance is less than 1 ohm, tighten main harness connector attaching screw to fully seat connector.

(b) If resistance is 1 ohm or more, isolate the problem area by connecting the ohmmeter and measuring the resistance of each segment of the ignition feed circuit (fig. 3-51): B1, B2; B2, A1; A1, H1; F3, C1; C1, H2; H1, H2; dash connector. Clean, tighten or reposition circuit connectors if needed. Tighten main harness connector attaching screw to fully seat connector.

(4) Inspect coil primary connections for looseness an proper assembly sequence (fig. 3-52). Wire terminal(s) must be between channel washer and nut. Channel washer tabs must be up. Reposition and tighten if required.

(5) Measure coil primary circuit resistance by connecting ohmmeter to F3 and F4 at 4-wire connector (fig. 3-51).

(a) If resistance is 1 to 2 ohms, proceed to step (6).

(b) If resistance is less than 1 ohm, replace coil and proceed to step (7).

(c) If resistance is more than 2 ohms, isolate problem area by connecting ohmmeter and measuring resistance at each segment (fig. 3-51): C1, C2—1 to 2 ohms; F3, C1—0 ohm; F4, C2—0 ohm. Replace coil or repair segment as needed and proceed to step (6). If coil was replaced, proceed to step (7).

(6) Measure coil secondary resistance by removing coil secondary wire from coil and connecting ohmmeter to coil positive terminal and coil secondary terminal (C1 and C3; fig. 3-51).

NOTE: *Be sure to recalibrate ohmmeter to 1,000 ohm scale before testing secondary resistance.*

(a) If resistance is 9,000 to 15,000 ohms, install coil secondary wire into coil and proceed to step (7).

(b) If resistance is less than 9,000 ohms or more than 15,000 ohms, replace coil, install coil secondary wire into coil, and proceed to step (7).

(7) Remove distributor cap, rotor and dust cover. Measure sensor circuit resistance and integrity by connecting ohmmeter to F1 and F2 at 4-wire connector (fig. 3-51) and observing ohmmeter while:

- Wiggling, flexing, and lightly pulling sensor wires and 2-wire connector.
- Firmly massaging molded sensor wire grommet at distributor (see shaded area in figure 3-51).
- Applying firm side-to-side pressure to sensor post.

Resistance should be 1.6 to 2.4 ohms. Ohmmeter needle should not waver of fluctuate when the wires, connector, grommet and sensor post are wiggled, pulled, flexed, massaged, and pressed.

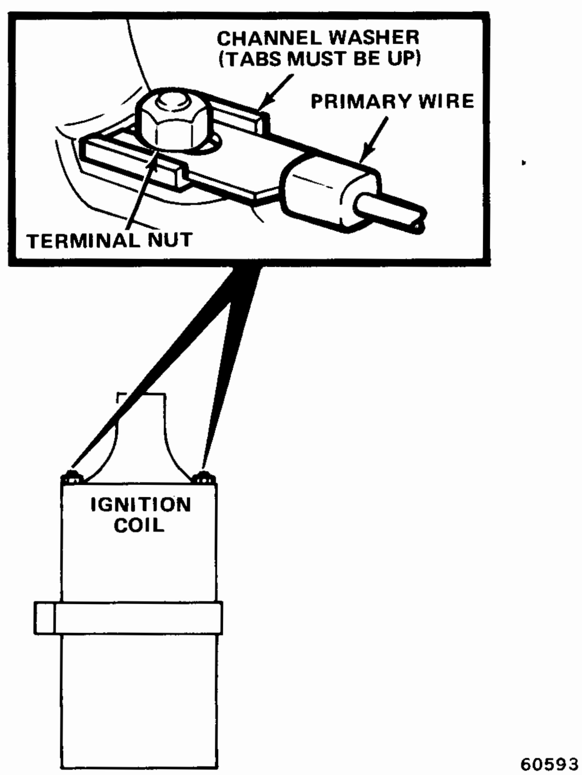

Fig. 3-52 Coil Primary Connections

(a) If resistance is 1.6 to 2.4 ohms and steady, disconnect 2-wire connector and proceed to step (9).

(b) If resistance is too high or too low, or if needle wavers or fluctuates, proceed to step (8).

(8) Disconnect 2-wire connector. Measure sensor resistance and integrity by connecting ohmmeter to S1 and S2 (fig. 3-51) and observing ohmmeter while:

- Wiggling, pulling, and flexing sensor wires.
- Firmly massaging molded sensor wire grommet at distributor (see shaded area in figure 3-51).
- Applying firm side-to-side pressure to sensor post.

Ohmmeter should indicate 1.6 to 2.4 ohms. Ohmmeter needle should not waver or fluctuate when the wires, grommet and sensor post are wiggled, pulled, flexed, massaged, and pressed.

(a) If resistance is 1.6 to 2.4 ohms and steady, proceed to step (9).

(b) If resistance is too high or too low, or if needle wavers or fluctuates, replace sensor and proceed to step (9).

(9) Use small wire brush and fabric cleaner to clean and rinse terminals identified S1, S2, S3, S4 (fig. 3-51). Proceed to step (10).

(10) Measure resistance of ECU ground circuit by connecting ohmmeter to G2 (fig. 3-51) and battery negative cable (G4). Resistance should be 0 ohms. Clean and tighten connections if needed and proceed to step (11).

(11) Before connecting the 4-wire and ground connectors, use pliers to squeeze terminals E1, E2, E3, E4, and G1 until terminals have a distant oval shape. This assures a tight interference fit when connected. Refer to figure 3-53 for desired terminal shape.

(12) Apply a film of petroleum jelly to all male terminals in 4-wire and ground connectors and around outer edge of terminal end of ECU 4-wire connector. Connect 4-wire and ground connectors and proceed to step (13).

(13) Connect Pulse Simulator Tool No. J-25331 to control unit side of 2-wire connector (fig. 3-54). Connect battery cables to battery (connect positive cable first). Remove coil secondary wire from distributor cap, and place wire end 1/2 inch from any good ground (fig. 3-54). With ignition switch ON, operate simulator and observe for spark across 1/2-inch gap.

(a) If spark jumps 1/2-inch gap, proceed to step (15).

(b) If spark does not jump 1/2-inch gap, proceed to step (14).

(14) Disconnect wire from coil negative terminal. Connect one pulse simulator clip to coil negative terminal. Connect remaining clip to ground (fig. 3-55). Place coil secondary wire end 1/2 inch from any good ground. With ignition switch ON, operate pulse simulator and observe for spark across 1/2-inch gap when button is released.

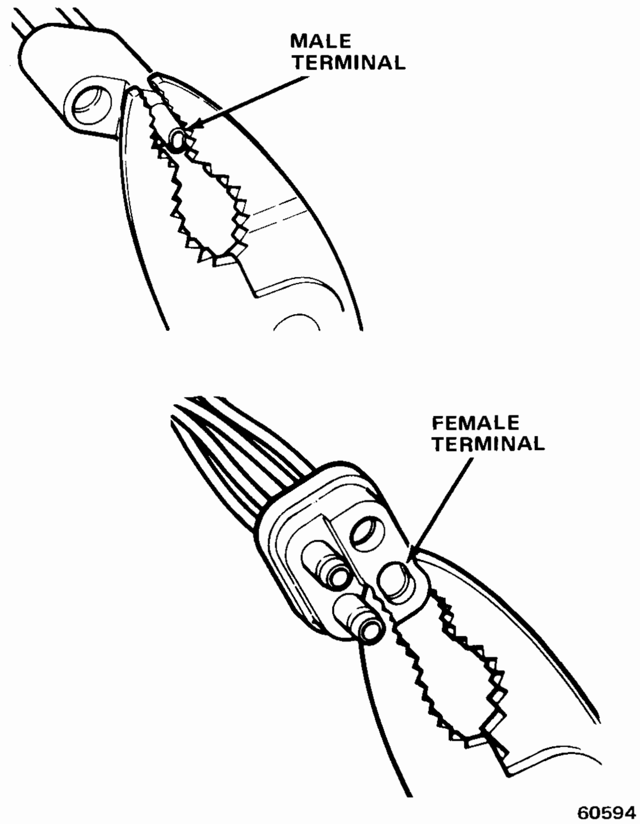

Fig. 3-53 Modifying Connector Terminals

(a) If spark jumps 1/2-inch gap, replace ECU and proceed to step (15).

NOTE: *Be sure to squeeze and lubricate the terminals and connectors of the new ECU as described in steps (11) and (12).*

(b) If spark does not jump 1/2-inch gap, replace coil and proceed to step (15).

(15) Disconnect pulse simulator. Before connecting 2-wire connector, squeeze terminals S1, S2, S3, and S4 until terminals have a distinct oval shape to assure tight interference fit (fig. 3-53). Apply a film of petroleum jelly to male terminals and connect 2-wire connector. Connect coil negative wire. Inspect distributor cap for cracks and carbon tracks and replace if necessary. Install dust cover, rotor, distributor cap and coil secondary wire.

(16) Inspect the catalytic converter for external evidence of overheating (e.g., top and bottom bulged) and replace converter(s) if damaged. Such damage is rare, but can occur as a result of extreme amounts of unburned fuel going into the converter.

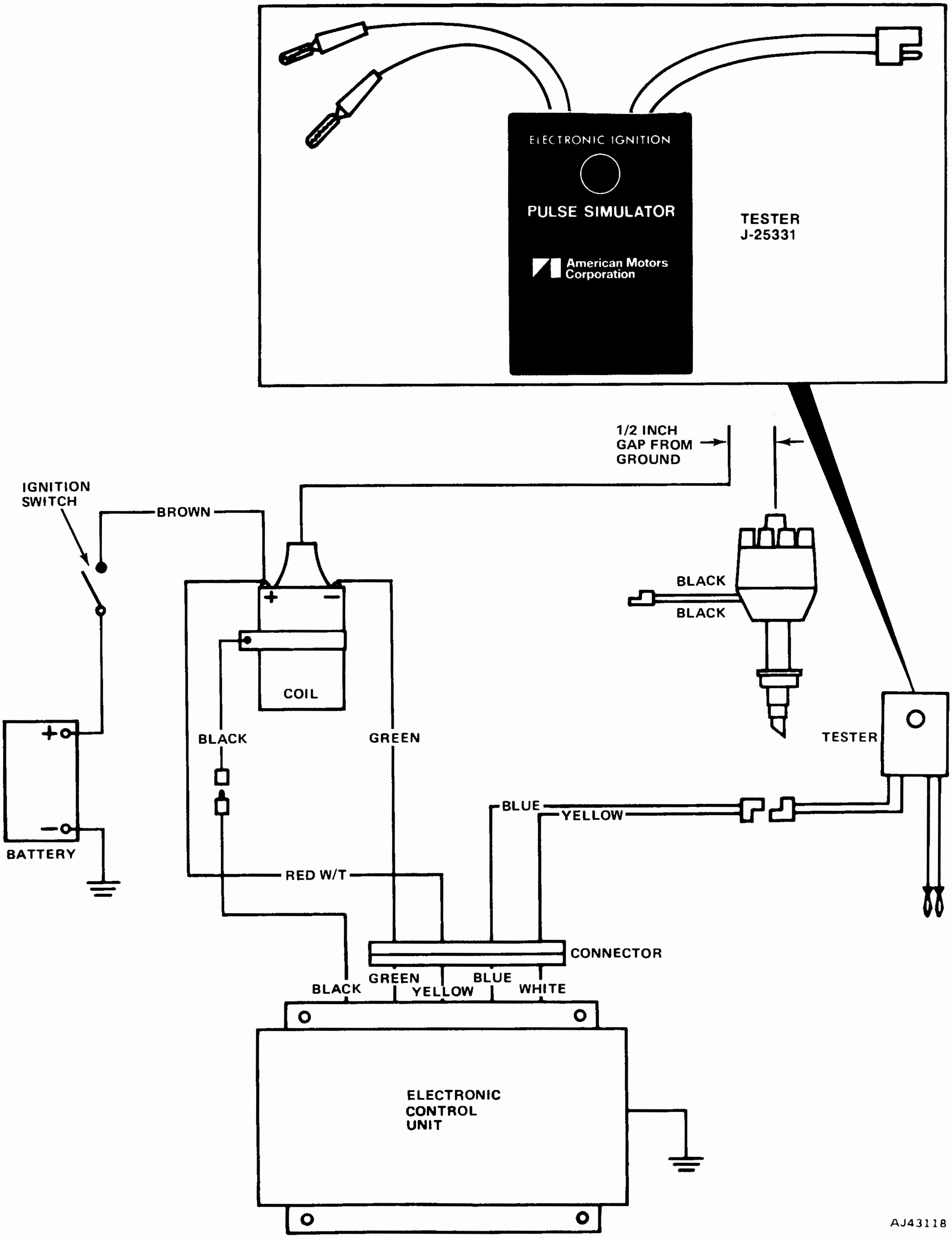

Fig. 3-54 Tester Connected to 2-Wire Connector

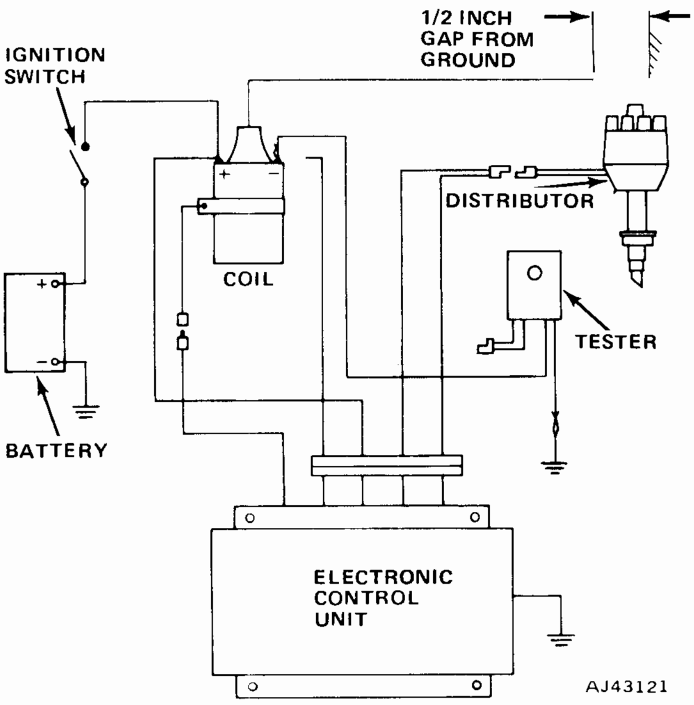

Fig. 3-55 Tester Connected to Coil Negative Terminal

NOTE: *Ignition system should now operate correctly. If an intermittent ignition interruption occurs after this procedure has been performed, disconnect 4-wire connector and measure sensor circuit and integrity (repeat only step (7)). If sensor circuit resistance and integrity are O.K., replace ECU. If sensor circuit resistance is too high or too low, or if needle fluctuates, replace sensor. Be sure to squeeze and lubricate the terminals and connectors of new ECU or sensor as described in steps (11), (12), and (15).*

DISTRIBUTOR SERVICE

General

When replacing the sensor or vacuum chamber on six-cylinder and V-8 engines, the distributor may be removed from the engine or remain installed.

Test Equipment

The following equipment is required to perform proper distributor service:

- Small Gear Puller
- Sensor Locking Screw Removal Tool (Special Driver Bit) J-25097.
- Sensor Positioning Gauge
- 0.050 Gauge Wire.

Removal—Six-Cylinder and V-8

(1) Unfasten distributor cap retaining clips. Remove distributor cap with high tension cables and position it out of the way.

(2) Disconnect vacuum hose from distributor vacuum advance unit.

(3) Disconnect distributor primary wiring connector.

(4) Scribe a mark on distributor housing in line with tip of rotor (fig. 3-56) and note position of rotor and distributor housing in relation to surrounding engine parts as reference points for installing distributor.

(5) Remove distributor holddown bolt and clamp.

(6) Withdraw distributor carefully from engine.

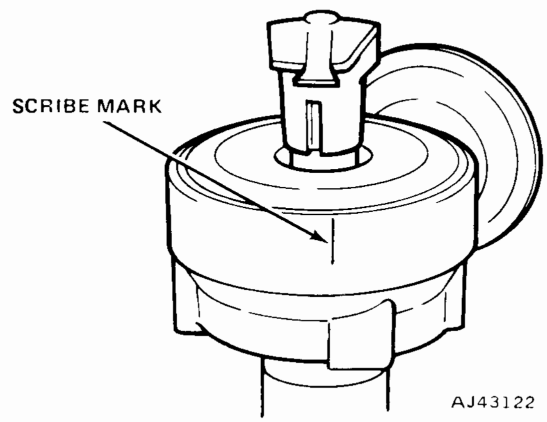

Fig. 3-56 Rotor Position Reference Mark

Component Replacement

(1) Place distributor in suitable holding device.

(2) Remove rotor and dust shield (fig. 3-57).

(3) Remove trigger wheel using a small gear puller (fig. 3-58). Be sure the puller jaws are gripping the inner shoulder of the trigger wheel or the trigger wheel may be damaged during removal. Use a thick flat washer or nut as a spacer. Do not press against the small center shaft.

(4) Loosen sensor locking screw about three turns.

NOTE: *The sensor locking screw has a tamper proof head design which requires Special Driver Bit Tool J-25097. If a driver bit is not available, use small needlenose pliers to remove screw. The service sensor has a standard slotted head screw.*

Lift the sensor lead grommet out of the distributor bowl. Pull sensor leads out of the slot around sensor spring pivot pin (fig. 3-59). Lift and release sensor spring, making sure it clears the leads, then slide the sensor off bracket.

(5) If the vacuum chamber is to be replaced, remove the retaining screw and slide the vacuum chamber out of the distributor. **DO NOT** remove the vacuum chamber unless replacement is required.

(6) Clean dirt or grease off of the vacuum chamber bracket. Clean and dry sensor and bracket. The material used for sensor and vacuum chamber requires no lubrication.

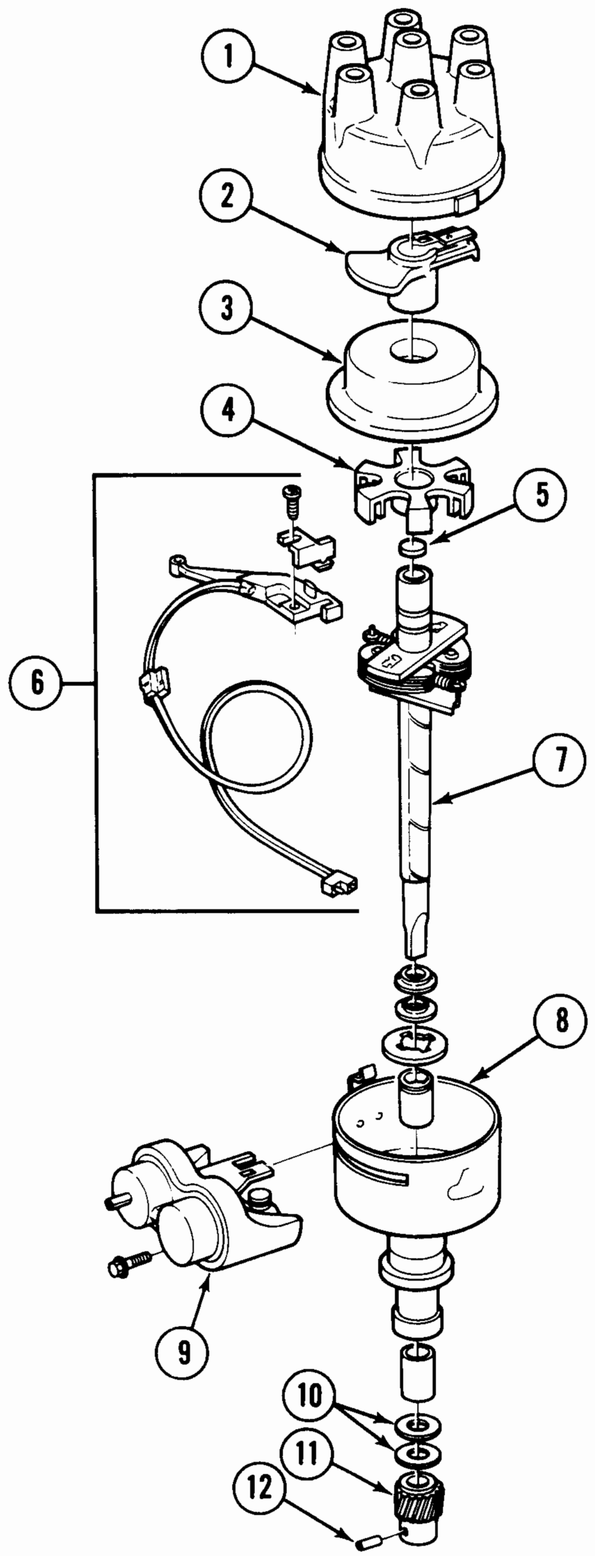

Fig. 3-57 Distributor—Disassembled View

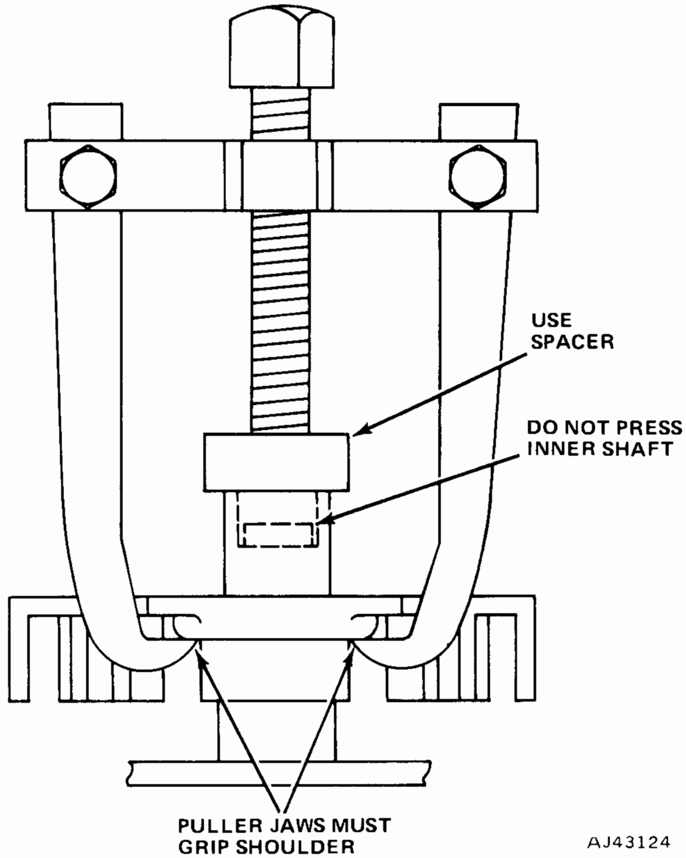

Fig. 3-58 Trigger Wheel Removal

(7) With the vacuum chamber installed, assemble sensor, sensor guide, flat washer, and retaining screw. Install retaining screw only far enough to hold assembly together and be sure it does not project beyond the bottom of sensor.

(8) If the vacuum chamber has been replaced and the original sensor is being used, substitute new screw for original special head screw to facilitate sensor positioning. Use existing flat washer.

(9) Install sensor assembly on vacuum chamber bracket, making certain that the tip of the sensor is located properly in summing bar (fig. 3-59).

(10) Place sensor spring in its proper position on sensor, then route sensor leads around spring pivot pin. Install sensor lead grommet in distributor bowl, then make certain the leads are positioned so they cannot be caught by the trigger wheel.

(11) Place sensor positioning gauge over yoke (be sure gauge is against flat of shaft) and move sensor sideways until the gauge can be positioned (fig. 3-60). With the gauge in place, use a small blade screwdriver to snug down retaining screw. Check sensor position by removing and installing gauge. When properly positioned, it should be possible to remove and replace gauge without any sensor side movement. Tighten the retaining screw to 5 to 10 oz.-in., then recheck the sensor position as before.

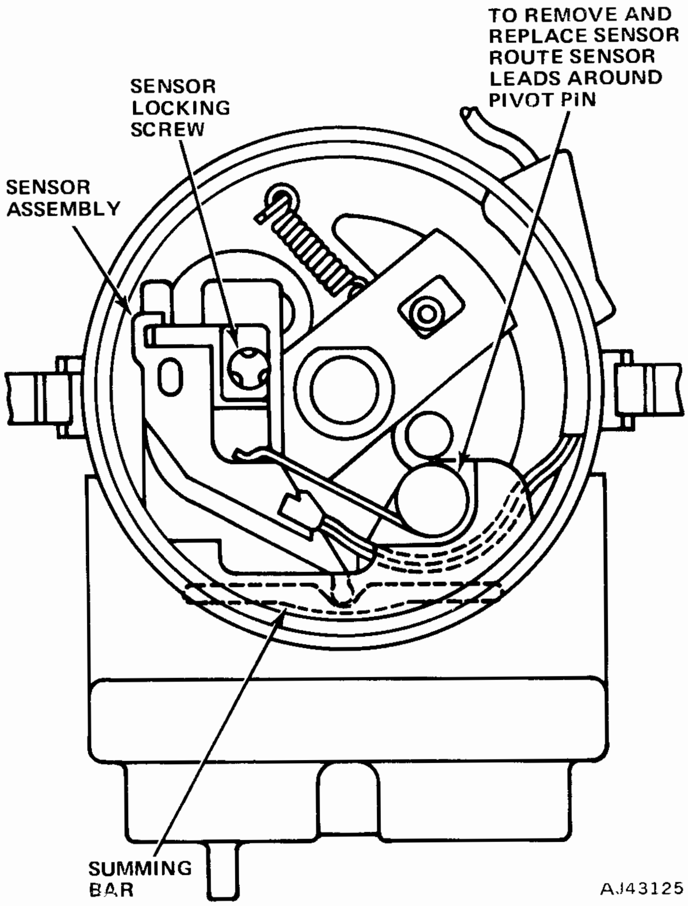

Fig. 3-59 Removal and Installation of Sensor Assembly

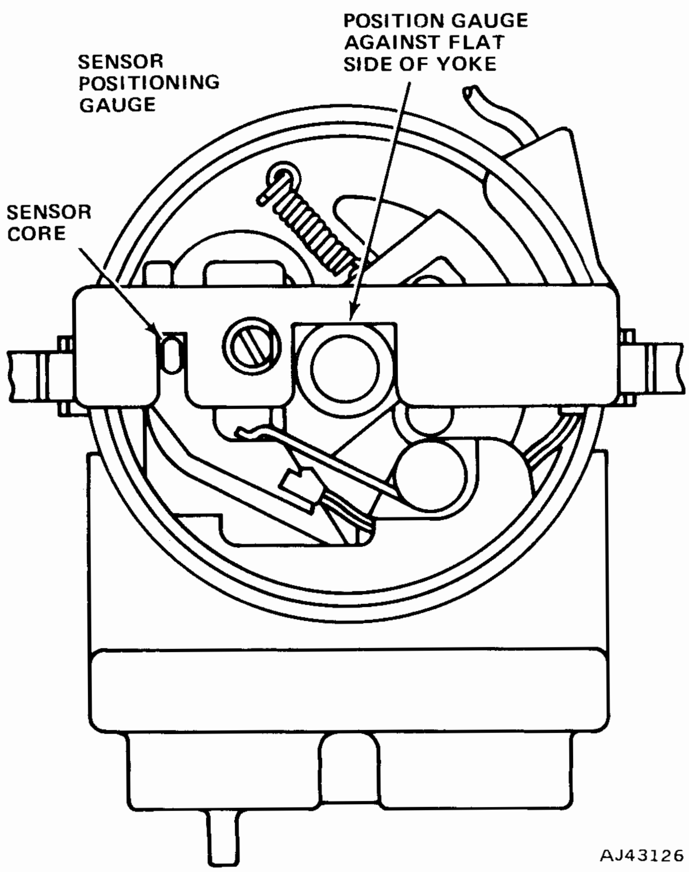

Fig. 3-60 Positioning Sensor

(12) Remove gauge and set trigger wheel in place on yoke. Visually check to make certain the sensor core is positioned approximately in the center of trigger wheel legs and that trigger wheel legs cannot touch sensor core.

(13) Support distributor shaft and press trigger wheel onto yoke. Using 0.050 gauge wire, bend wire gauge to the dimension shown in figure 3-61. Use gauge to measure the distance between trigger wheel legs and the sensor base (fig. 3-61). Install trigger wheel until it just touches the gauge.

(14) Add about 3 to 5 drops of SAE 20 oil to the felt wick in the top of the yoke.

(15) Install dust shield and rotor. Distributor is ready for installation. Install the distributor and time the engine to specification.

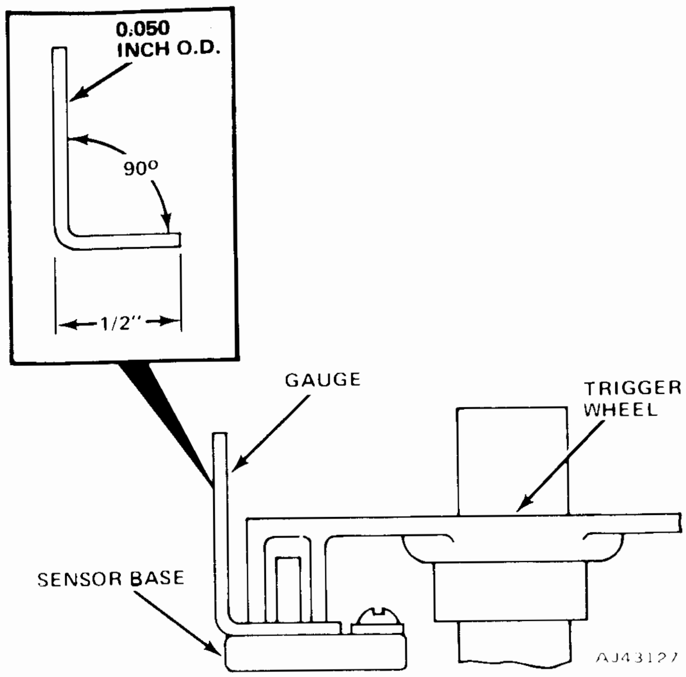

Fig. 3-61 Measuring Distance Between Trigger Wheel and Sensor Base

Installation—Six-Cylinder and V-8

(1) Clean distributor mounting area of engine block.

(2) Install a new distributor mounting gasket in counterbore of engine block.

(3) Position distributor in engine: If engine was not rotated while distributor was removed:

(a) Align rotor tip with mark scribed on distributor housing during removal. Turn rotor approximately 1/8-turn counterclockwise past scribed mark.

(b) Slide distributor down into engine and position distributor vacuum advance housing in approximately the same location (in relation to surrounding engine parts) as when removed.

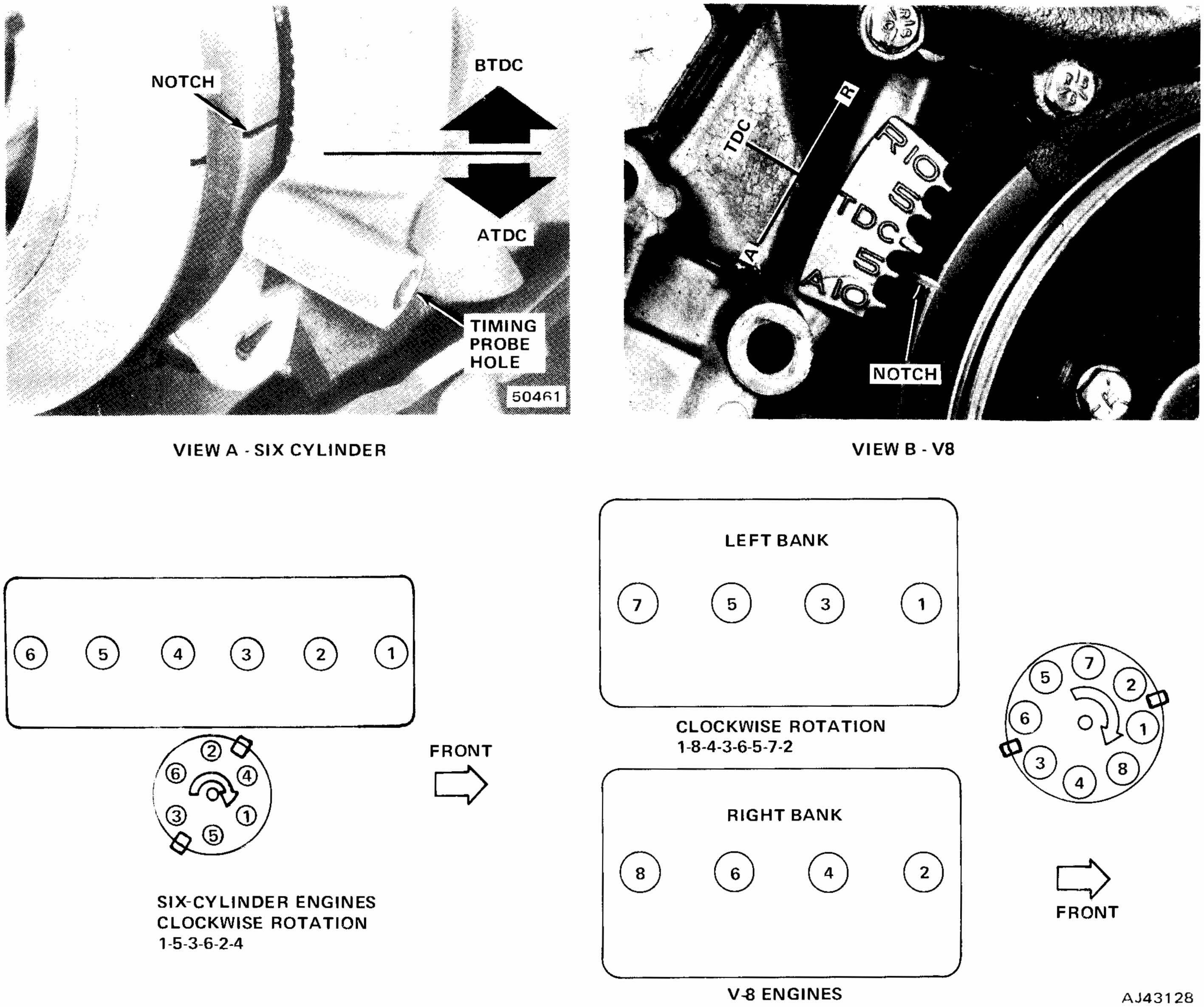

Fig. 3-62 Timing Mark Location and Firing Order

NOTE: *It may be necessary to move rotor and shaft slightly to start gear into mesh with camshaft gear and to engage oil pump drive tang, but rotor should align with scribed mark when distributor is down in place.*

(c) Install distributor holddown clamp, bolt and lockwasher, but do not tighten bolt.

(4) If engine was cranked while distributor was removed, it will be necessary to re-establish timing as follows:

(a) Remove No. 1 spark plug. Hold finger over spark plug hole and rotate engine until compression pressure is felt. Slowly continue to rotate engine until timing mark on crankshaft pulley lines up with top dead center (0) mark on timing quadrant (fig. 3-62). Always rotate engine in direction of normal rotation. Do not back engine to align timing marks.

(b) Turn distributor shaft until rotor tip points in the direction of the No. 1 terminal in the distributor cap. Turn rotor 1/8-turn counterclockwise past the position of the No. 1 terminal.

(c) Slide distributor down into engine and position distributor vacuum advance housing in approximately the same location (in relation to surrounding engine parts) as when removed.

NOTE: *It may be necessary to move rotor and shaft slightly to start gear into mesh with camshaft gear and to engage oil pump drive tang, but rotor should align with the position of No. 1 terminal when distributor is down in place.*

(d) Install distributor holddown clamp, bolt and lockwasher, but do not tighten bolt.

(5) Install distributor cap (with high tension cables) on distributor housing, making sure tang on

distributor housing aligns with slots in distributor cap and that cap fits down snug on distributor housing.

NOTE: *If distributor cap is incorrectly positioned on distributor housing, cap or rotor may be damaged when engine is cranked.*

(6) Connect distributor primary wiring connector.

(7) Connect timing light to No. 1 spark plug.

CAUTION: *Do not puncture high tension cables or boots to make contact. Use proper adapters.*

NOTE: *A hole is provided in the timing case cover for the use of a magnetic timing probe. The probe is inserted through the hole until it contacts the vibration damper. Eccentricity of the damper spaces the probe tip away from the damper while the engine is running. The magnetic probe is calibrated to compensate for the timing case cover hole location which is 9.5° after the TDC mark on damper.*

(8) Operate engine at 500 rpm and observe timing marks with timing light. Rotate distributor housing as needed to align timing mark on crankshaft pulley with mark on timing quadrant. See Specifications. When timing is correct, tighten distributor holddown bolt and recheck timing to be sure it did not change.

(9) Disconnect timing light and connect vacuum hose to distributor advance unit.

INSTRUMENT CLUSTER AND INSTRUMENT PANEL COMPONENTS

INSTRUMENT CLUSTER

CJ Models

The instrument cluster is composed of the speedometer housing, cluster lighting bulbs, hi-beam indicator, turn signal indicators, brake failure/parking brake warning indicator, Emergency Drive indicator, temperature gauge, combination fuel gauge and constant voltage regulator (CVR) (fig. 3-63).

The voltmeter, oil pressure gauge, clock, and tachometer are separate from the instrument cluster. Refer to figure 3-63 for location on the instrument panel.

Removal and Installation

(1) Disconnect battery negative cable.

(2) Separate speedometer cable from speedometer head.

(3) Remove voltmeter as outlined under Voltmeter Replacement.

(4) Remove four attaching nuts and pull cluster off of mounting studs.

(5) Remove gauge wires and cluster lamps and remove cluster assembly.

(6) After installing cluster and voltmeter, connect battery cable and check all lights and gauges for proper operation.

NOTE: *The connector link (fig. 3-64) is not serviced. In the event a connector link has to be replaced, manufacture a connector out of 16 gauge (or larger) insulated wire.*

Cherokee-Wagoneer-Truck

The instrument cluster (fig. 3-65) is composed of the instrument cluster case (speedometer housing), panel lighting bulbs, hi-beam indicator, turn signal indicators, ammeter, oil pressure gauge, temperature and fuel gauges, constant voltage regulator (CVR) (part of the temperature gauge), brake failure warning bulb, Emergency Drive warning bulb (Quadra-Trac), heater control lights, wiper-washer and heater control lights, and the blower motor fan switch.

Removal

(1) Disconnect battery.

(2) Remove six cluster retaining screws.

(3) Disconnect speedometer cable at cluster.

(4) Disconnect cluster pin terminal plug by pulling straight away from cluster.

(5) Disconnect four-terminal plug.

(6) Disconnect fan switch connector plug.

(7) Disconnect vacuum hoses from heater control.

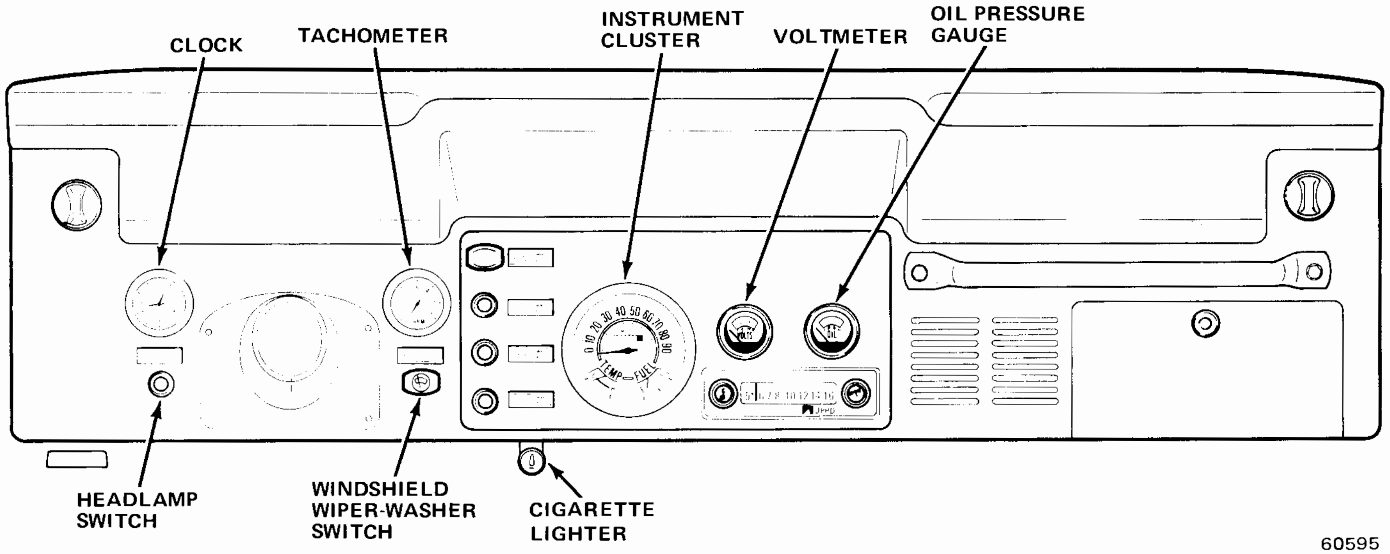

Fig. 3-63 Instrument Panel—CJ Models

NOTE: *Tag each hose according to its numbered location to ensure the proper connection when installing the cluster.*

(8) Remove two heater control panel lights.

(9) Disconnect temperature control wire from lever.

(10) Remove cluster assembly.

Installation

(1) Connect harness plugs and heater control identification bulbs.

(2) Connect temperature control wire to operating lever.

(3) Connect vacuum hoses.

(4) Install cluster.

(5) Connect speedometer cable.

(6) Connect battery cable.

(7) Check all gauges, controls, and lights.

COMPONENT TESTS AND REPLACEMENT

Printed Circuit Test

(1) Remove instrument cluster. Do not disassemble cluster.

(2) Remove all bulbs.

NOTE: *An ohmmeter or Test Lamp J-21008 should be used. When using an ohmmeter, use low scale and adjust meter to 0 reading.*

NOTE: *Refer to figure 3-66 for component identification.*

(3) Connect test lamp or ohmmeter lead to correct pin plug terminal for circuit to be tested. Follow each circuit from pin to each uncoated position up to bulb of indicator in that circuit. Bulb should light or ohmmeter should read 0 resistance at these positions.

(4) Check all uncoated positions on opposite side of bulb or indicator circuit. Circuit must go to either a pin terminal or a grounding screw. Bulb shoulb light or ohmmeter should indicate 0 resistance.

(5) Connect test lamp or ohmmeter lead to ground pin terminal and other lead to cluster metal case.

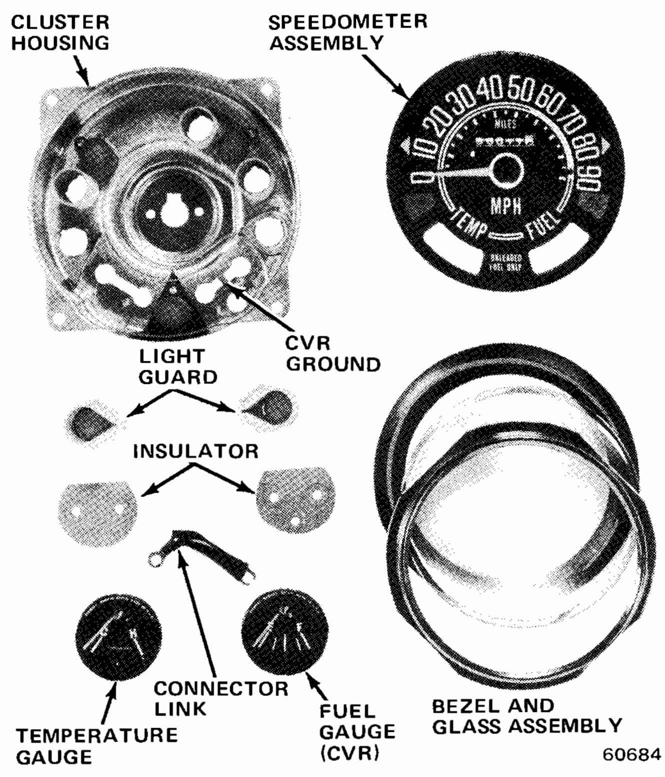

Fig. 3-64 Instrument Cluster Assembly--CJ Models

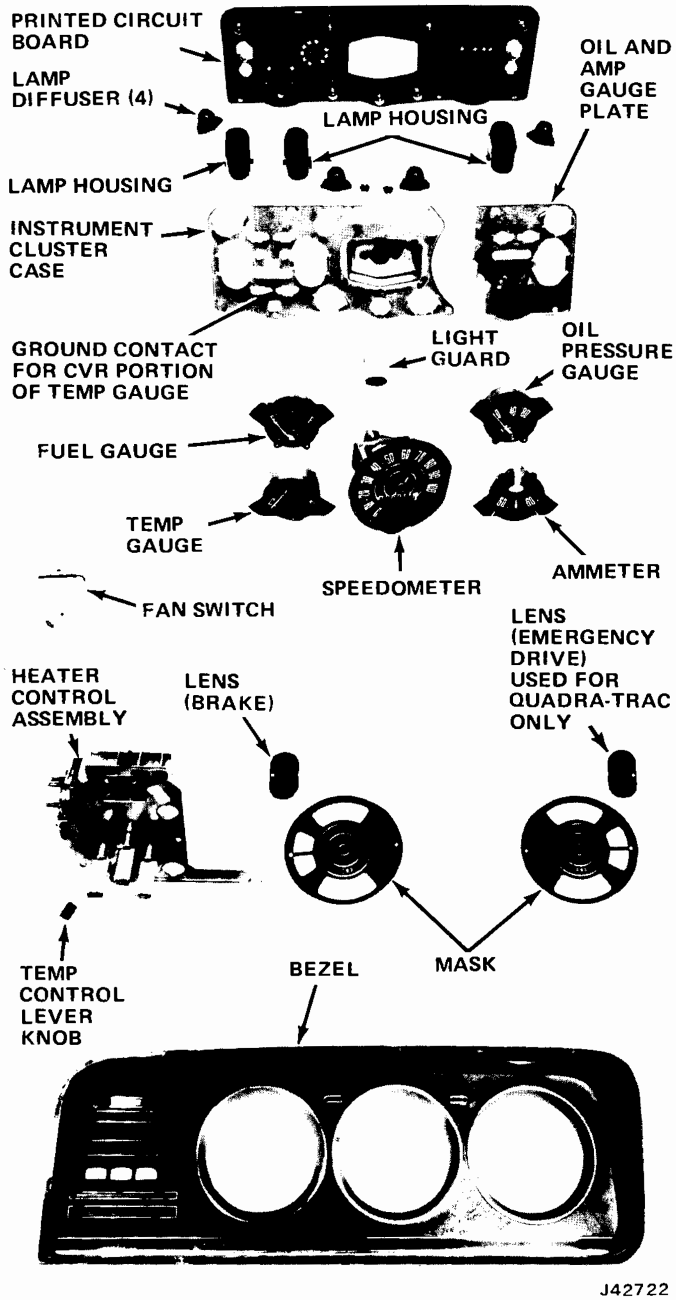

Fig. 3-65 Instrument Cluster—Cherokee-Wagoneer-Truck

Bulb should light or the ohmmeter should indicate 0 resistance. When bulb fails to light or ohmmeter reads resistance on any test, replace printed circuit.

(6) Check for shorting between circuits. With a lead connected to correct pin for circuit to be tested, move other lead to all other pin terminals in cluster. There should be no light or resistance indication between circuits.

Instrument Illumination

CJ Models

Three bulbs in the intrument cluster, six molded lamps in the instrument panel, and one bulb each in the voltmeter and oil gauge provide instrument panel illumination. Protection for the panel bulbs and lamps is provided by the 3-amp fuse located in the fuse panel. The 3-amp fuse is fed from the headlamp switch through a rheostat.

Do not pull on the bulb wires to remove the bulb socket; grasp the socket and pull straight out.

To remove the molded lamps, remove the wire connectors. Squeeze the lamp together at the top and bottom to release the small retaining tabs. Push the lamp through the panel (toward the steering wheel). To install the molded lamps, push into the panel until the retaining tabs snap into place.

Cherokee-Wagoneer-Truck

Four bulbs provide lighting for the instrument cluster and two bulbs illuminate the heater control panel. Panel lights are fed from the fuse panel through an adjustable headlamp switch rheostat. To replace instrument cluster bulbs, reach up behind the cluster, twist the bulb socket counterclockwise (viewed from the rear) and pull out. To replace the heater control panel bulb, pry the bulb socket down until the spring clip which attached the socket to the panel is free.

Voltmeter

The voltmeter (fig. 3-67) registers regulated voltage which provides an indication of the charging systems ability to keep the battery charged. Continuous readings in either the high or low red voltage bands can indicate improper voltage regulation, broken or slipping alternator belt, shorted alternator diode or defective battery. Low readings in the green band are normal with the engine idling or for short periods after long engine cranking. However, continuous readings in the low green area can indicate faulty operation.

The voltmeter gauge needle may indicate voltage when the ignition is turned off after engine operation. This is characteristic of magnetic-type gauges.

NOTE: *When replacing the voltmeter lamp bulb, the radio has to be removed on vehicles so equipped in order to seat the bulb socket.*

Replacement

(1) Disconnect battery negative cable.
(2) Remove radio, if equipped.
(3) Disconnect voltmeter wiring.
(4) Remove voltmeter retaining bracket and remove voltmeter.
(5) Install voltmeter in instrument panel and install retaining bracket.
(6) Connect voltmeter wiring.
(7) Install radio, if removed.
(8) Connect battery negative cable.

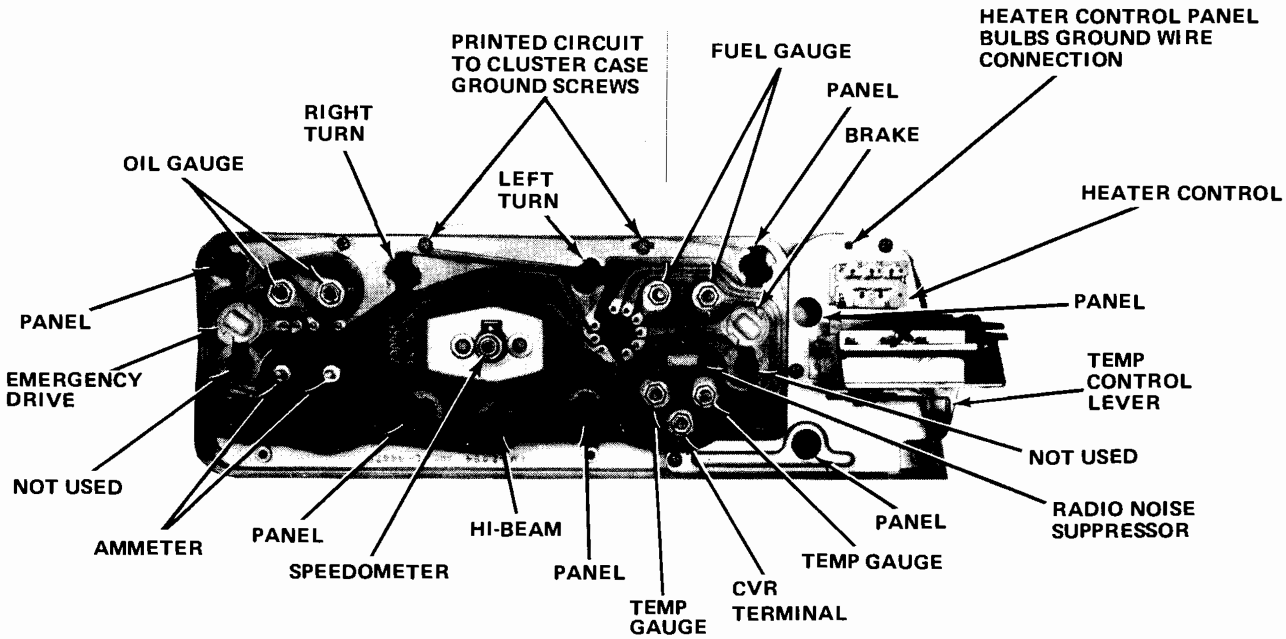

Fig. 3-66 Instrument Cluster—Rear View—Cherokee-Wagoneer-Truck

Oil Pressure Gauge and Sending Unit Test

To test the accuracy of the oil pressure gauge and the sending unit, the following procedure may be used.

Equipment Required: Tester J-24538, direct reading oil gauge and tee fitting (Automatic Transmission Gauge W-320 can be used).

Gauge Test

(1) Disconnect wire from sending unit located on engine.

(2) Turn ignition switch to the on position.

(3) Connect one lead of tester to a good ground and other lead to sending unit wire. Refer to the Oil Pressure Gauge Calibration Chart.

Oil Pressure Gauge Calibrations

Oil Pressure (PSI)	Resistance (Ohms)	
	CJ Models	Cke.—Wag.—Trk.
0	57-63	69-77
10	—	35-38
40	19-21	—
60	—	13-15
80	9.5-10.5	9.5-10.5

60596

Check all circuit connections before replacing the gauge.

NOTE: *On CJ models, the oil pressure gauge needle will indicate operating pressure when the ignition switch is turned off. When the ignition switch is turned on and the engine is stopped, the needle will return to zero.*

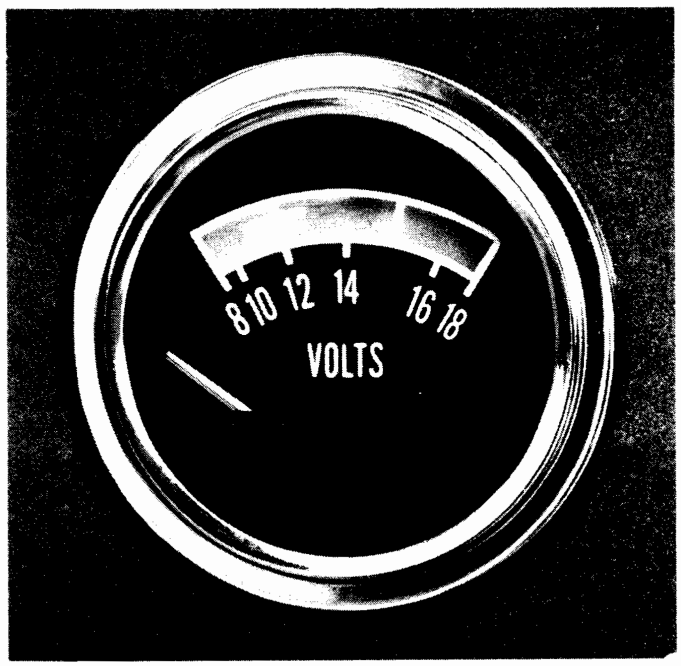

Fig. 3-67 Voltmeter—CJ Models

Sending Unit Test

After verifying a proper operating gauge, remove the oil sending unit and install a tee fitting, between the block and the sender. Connect a direct reading oil pressure gauge to the tee fitting. Connect the sending unit wires; start the engine and compare the readings between the two gauges. Replace sending unit if defective.

Oil Pressure Gauge Replacement

The oil pressure gauge in CJ models can be serviced by removing the two nuts which secure the retaining bracket to the gauge studs. The gauge can be slipped out of the instrument panel opening after removal of the retaining bracket.

The oil pressure gauge on Cherokee—Wagoneer—Truck models can be serviced by following the procedures outlined under Fuel and Temperature Gauge Replacement.

Temperature Gauge and Sending Unit

The temperature gauge circuit is comprised of a sending unit, connecting wiring, and gauge. On the Cherokee, Wagoneer, and Truck, it also includes the instrument cluster printed circuit.

The sending unit is threaded into the cylinder head on six-cylinder engines and into the intake manifold coolant crossover on V-8 engines. The indicator, located in the instrument cluster, is grounded through the variable resistance of the sending unit.

Changes in the coolant temperature vary the resistance of the sending unit, thereby increasing or decreasing the temperature indication.

Fuel Gauge and Sending Unit

The fuel level gauge circuit is comprised of a sending unit, connecting wiring, and gauge. On the Cherokee, Wagoneer, and Truck, it also includes the instrument cluster printed circuit.

The sending unit is located in the fuel tank and the gauge in the instrument cluster. The gauge is grounded through the variable resistance of the sending unit.

A float attached to a slide rheostat follows the level of the fuel. Changes in the fuel level vary the slide rheostat resistance, thereby increasing or decreasing the fuel level indication.

Attitude of the body of the vehicle while parked or making starts and stops will affect the fuel indication.

The fuel gauge on CJ models is a combination gauge and constant voltage regulator (CVR). This CVR provides approximately 5 volts to both the fuel and temperature gauges.

the temperature gauge on the Cherokee, Wagoneer, and Truck is also a combination gauge and CVR. It provides approximately 5 volts to the fuel gauge.

Fuel or Temperature Gauge Tests

The use of Universal Gauge Tester J-24538 is recommended for gauge testing. The tester is to be used on the ground side of a gauge to simulate the operation of a sending unit.

Sending Unit Test—All Models

(1) Disconnect sending wire at sending unit.

(2) Connect one lead of tester to disconnected wire and the other lead to a known good ground.

(3) Turn ignition switch to on position.

(4) Turn tester controls to select each ohm value listed on chart and observe gauge.

(5) If gauge reading is accurate for each ohm value selected, the trouble is in sending unit or sending unit ground circuit (includes sending unit-to-body ground connections).

(6) After verifying a good sending unit ground connection, replace sending unit if gauge is accurate.

(7) If gauge reading is not accurate for each ohm value selected, no gauge reading is obtained or gauge needle reading is pegged above the full or hot position.

(a) Disconnect test leads and connect sending unit wire.

(b) Proceed to Testing at the Instrument Cluster.

Temperature Gauge Calibration—All Models

C (COLD)	130°—73 ohms
Beginning of Band	171°—36 ohms
Top of Band	242°—13 ohms
H (HOT)	270°— 9 ohms

60597

Fuel Gauge Calibration—All Models

Indication	Empty	1/2	Full
Ohms	73	23	10

60598

NOTE: *Fuel and temperature gauges are 5 percent meters; that is, they must be accurate within 5 percent of a specific ohm value.*

Example: 5 percent of 60 ohms is 3 ohms or 60 (±3 ohms).

Testing at the Instrument Cluster—CJ Models

CAUTION: *Be sure tester leads are properly connected before turning ignition switch on.*

Refer to figure 3-68.

(1) Disconnect sender unit wire (output terminal) from terminal.

(2) Connect one tester lead to output terminal of gauge and other lead to a known good ground (T-1).

(3) Turn ignition switch on. Observe gauge reading while selecting ohm values listed in appropriate gauge calibration chart.

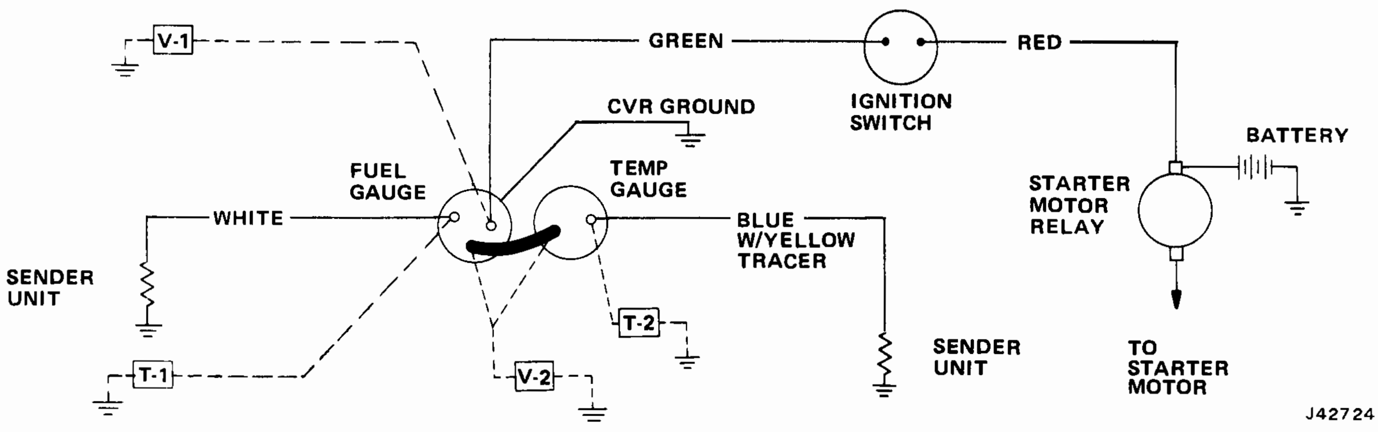

Fig. 3-68 Fuel and Temperature Gauge Circuitry—CJ Models

(4) If gauge reads correctly, wire leading to sender unit or the sender unit is defective. If the gaage reads correctly, disconnect the sender unit wire at the sender unit. Repeat the test from sender unit wire to ground. If the gauge is still inaccurate, replace the sender unit wire. If the gauge is accurate, the sender unit is defective or the fuel tank has a poor ground. A poor ground gives low readings on the gauge.

(5) If no reading is obtained, check input voltage to gauge (I-terminal) with test light or voltmeter (fig. 3-68).

(6) When checking input voltage, check fuel gauge first. The I-terminal of the fuel gauge is fed battery voltage. This terminal voltage can be checked by placing the positive lead of a voltmeter on the I-terminal and contacting a known good ground with the negative lead (V-1).

(7) If no voltage or a drop of more than 0.2 volt (as compared to battery voltage) is indicated, check connections at the ignition switch and red wire back to starter motor relay for loose connections, corrosion, or broken wires.

NOTE: *I-terminal voltage at the fuel gauge is regulated internally to approximately 5 volts.*

(8) To check this voltage, attach voltmeter, V-2, to CVR terminal as shown. The voltmeter should pulsate about one every second or less.

(9) A steady reading of battery voltage indicates that the CVR is defective or does not have a ground.

(10) No reading at all indicates a defective CVR. The CVR and fuel gauge are integral. The entire fuel gauge must be replaced if the CVR is defective.

The fuel gauge CVR terminal feeds the temperature gauge. A defective CVR will cause **both** gauges to read too high, too low, or not at all.

If the fuel gauge operation is satisfactory, check the temperature gauge by connecting the gauge tester (T-2) as shown in figure 3-79.

The gauge now reads correctly, the wire leading to the sender unit is defective.

Refer to the CJ Fuel and Temperature Gauge Diagnosis Guide.

NOTE: *Do not test gauges removed from the instrument cluster unless the fuel gauge is grounded by an extra ground wire attached to the gauge housing.*

Testing at the Instrument Cluster—Cherokee-Wagoneer-Truck

(1) Disconnect battery negative cable.

(2) Remove instrument cluster and disconnect all electrical connections.

(3) Connect a jumper wire from cluster ground terminal to known good ground (fig. 3-69).

CAUTION: *Do not attempt to test gauges with printed circuit removed from the cluster housing, as this would remove the ground for the CVR, resulting in high voltage to the gauges.*

(4) Connect an ignition feed wire, protected by a 3-amp fuse, to E-pin terminal. This applies voltage through radio noise suppressor to I-terminal of temperature gauge.

NOTE: *Be sure there are no open circuits between the E-terminal and the temperature gauge I-terminal.*

(5) Ground one lead of Gauge Tester J-24538 to known good ground.

(6) Connect battery and turn ignition on.

(7) To check fuel gauge, touch remaining lead of Gauge Tester to L-terminal.

(8) To check temperature gauge, touch C-terminal.

(9) Dial resistance required as shown in the appropriate gauge calibration Chart and observe gauge.

(10) Check full range of gauge. If gauge is not correct through entire range, it should be replaced.

NOTE: *Make sure the battery is fully charged.*

(11) If both gauges read too high through entire range, check for good contact between temperature gauge and cluster case.

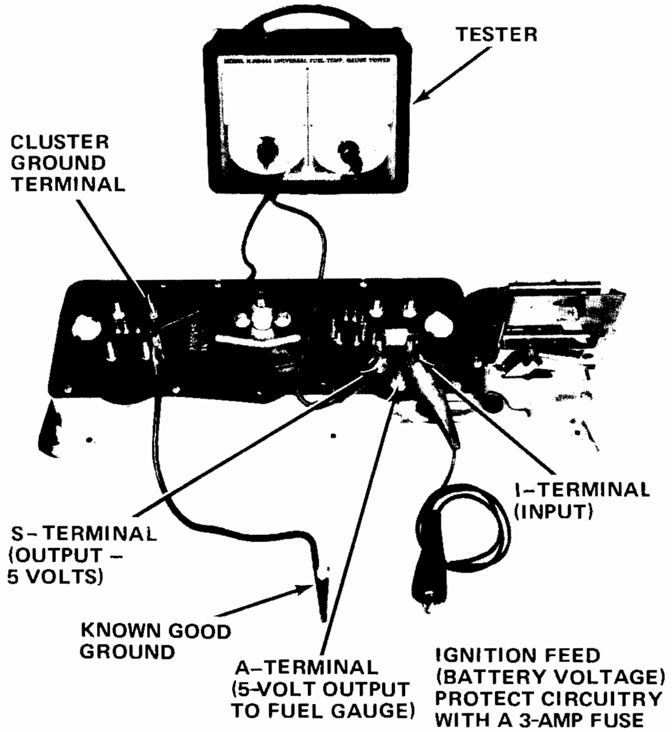

Fig. 3-69 Testing Temperature Gauge—Cherokee-Wagoneer-Truck

TEST RESULTS With Tester Connected as Shown in Figure 3-69	POSSIBLE LOCATION OF TROUBLE
Gauge reading satisfactory at each Ohm value selected (Gauge was defective as installed in vehicle)	Gauge output terminal to printed circuit connection. Printed circuit between gauge output terminal and gauge (indicator pin terminal). Sending wire or wire harness connections. Ignition terminal of instrument harness connector.
No gauge reading	Gauge terminals to printed circuit connections. Printed circuit between gauge input terminal and ignition pin terminal. Gauge.
Gauge reads Full or Hot at all Ohm values selected	Gauge or defective CVR.
Temperature and fuel gauges both read too low or too high	CVR unit. CVR case ground connection.
CAUTION: Upon completing tests, do not disconnect the ground jumper wire until the battery voltage source jumper wire has been disconnected and the ignition switch is in the OFF position.	

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NOTE: *Be sure two printed circuit-to-cluster case ground screws are tight.*

(12) If all ground connections are good and both gauges still read too high or too low, replace the temperature gauge.

(13) If only one gauge reads high or low, replace just that gauge.

Fuel and Temperature Gauge Replacement (Cluster Removed)

All models require the cluster to be removed in order to service the fuel and temperature gauges.

CJ Models

(1) Carefully uncrimp lip of outer bezel and remove outer bezel, glass and glass retaining bezel.

(2) Remove two attaching screws from speedometer housing and remove housing and face plate.

(3) Either gauge can be removed by removing attaching nuts.

(4) When installing gauges, be sure gauges are properly centered in gauge openings in the face plate.

NOTE: *If fuel gauge is being replaced, burnish the metal to remove any corrosion at the contact (CVR) ground area.*

Cherokee-Wagoneer-Truck

NOTE: *This procedure can be used for oil pressure gauge replacement.*

(1) Remove six printed circuit retaining screws and remove instrument cluster case (fig. 3-65).

(2) Remove gauge mask.

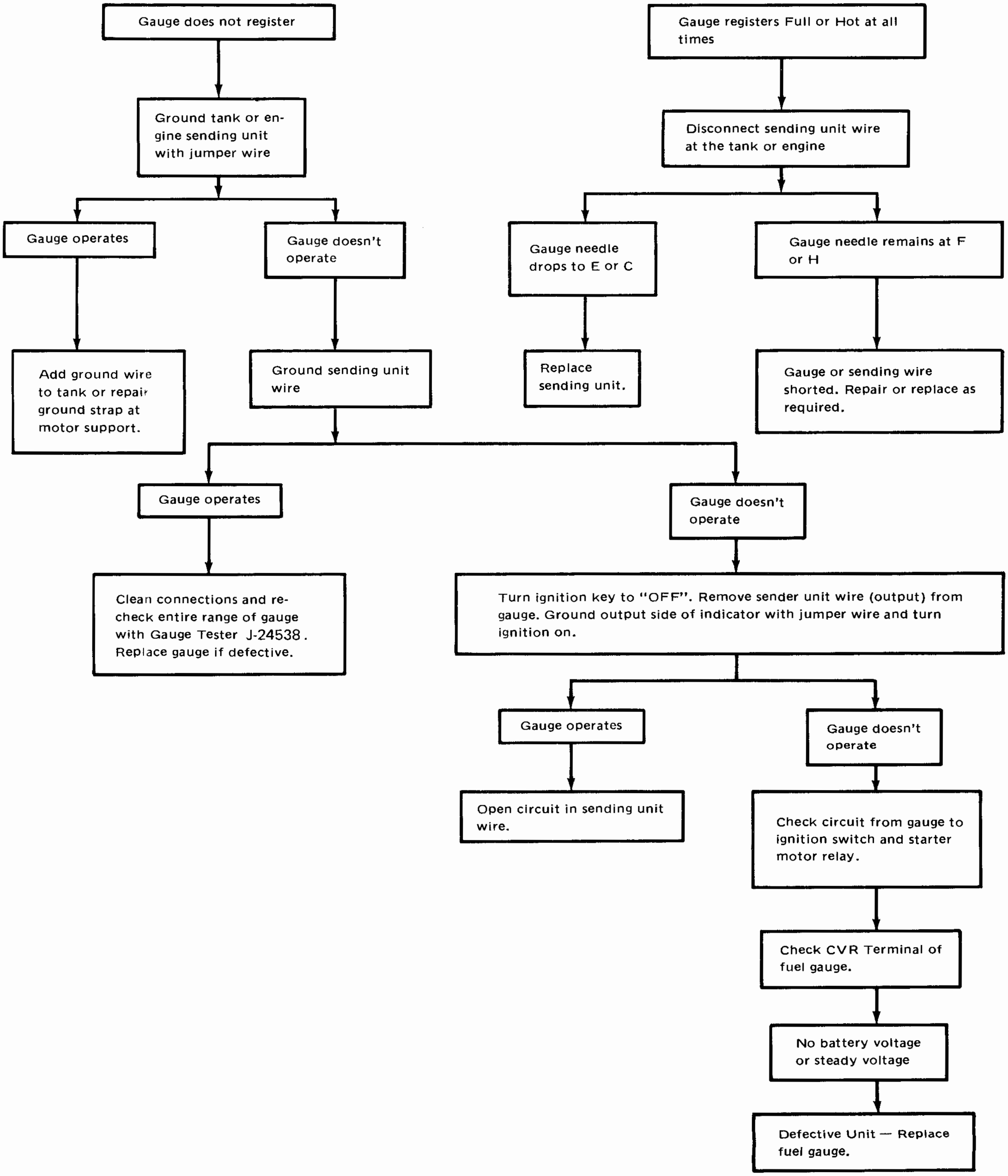
(3) Remove pal nuts (machine nuts on the ammeter) and remove gauge.

(4) When installing gauges, be sure gauges are centered. If installing the temperature gauge, be sure the CVR ground contact area is burnished clean (fig. 3-65). Be sure printed circuit ground screws are tight.

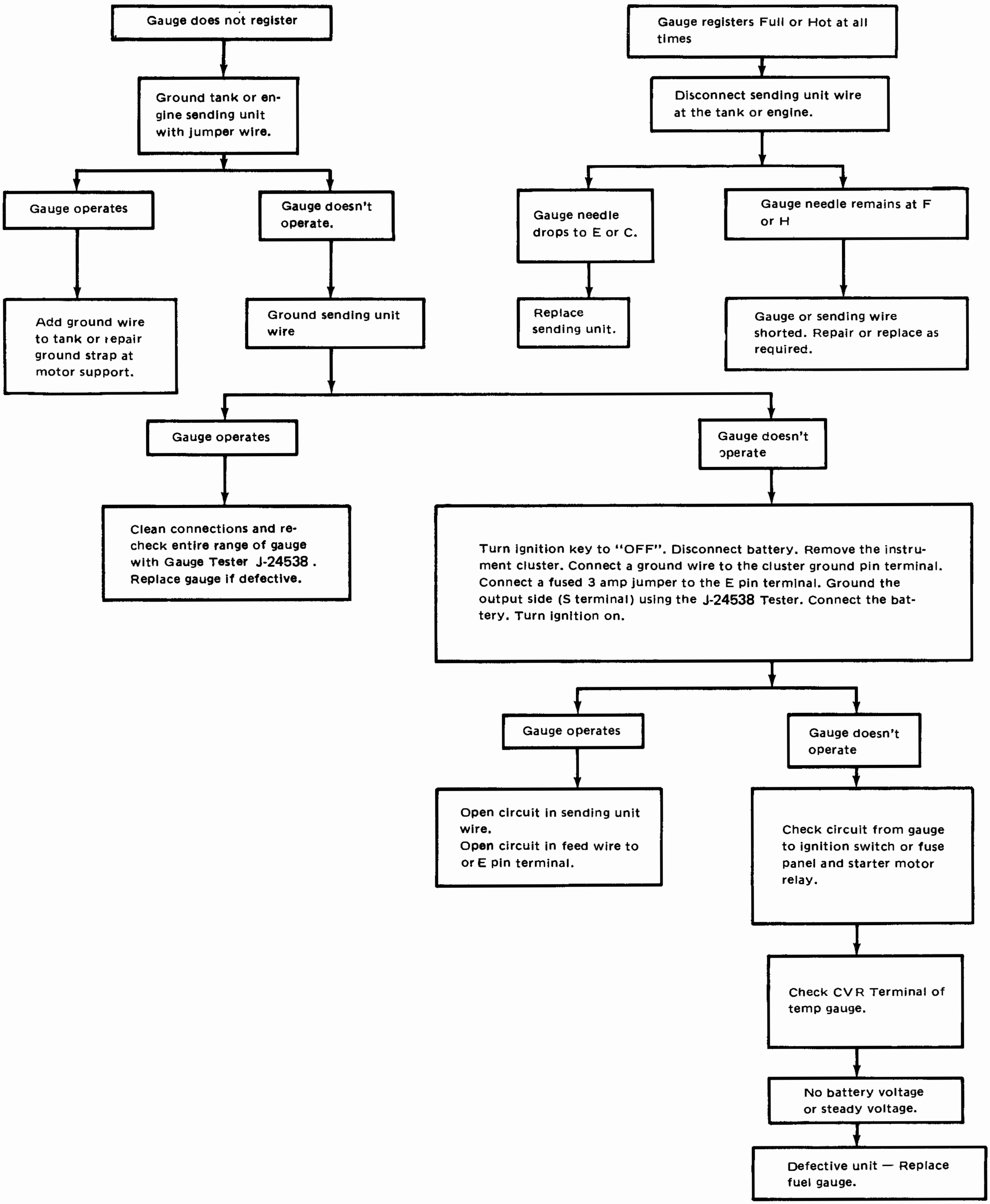
Fuel Tank Sender Unit Replacement

On all models, the fuel tank must be dropped down out of the mounting brackets in order to service the sender unit. Refer to the Fuel-Carburetor-Exhaust Section for fuel tank mounting information.

Fuel and Temperature Gauge Diagnosis Guide—CJ Models



Fuel and Temperature Gauge Diagnosis Guide— Cherokee-Wagoneer-Truck



SPEEDOMETER

A magnetic type speedometer is used on all models.

All speedometers are equipped with a ratchet device to prevent turning the odometer backward.

The following data is supplied for testing and calibrating the speedometer heads.

Speedometer Calibration

Shaft Speed (rpm)	Indication (mph)
167	9 to 11
500	30 to 32.5
1000	60 to 63
1500	90 to 94

60599

Speedometer Head Replacement

Speedometer head replacement includes resetting the replacment odometer to the same mileage as the one removed, unless such setting conflicts with local ordinances.

CJ Models

(1) Carefully uncrimp lip of outer bezel and remove glass and bezel.

(2) Remove two screws and separate speedometer head from housing.

(3) Unhook odometer retaining clip. Twist and push down to disengage clip.

(4) Remove odometer and set to proper mileage. Refer to Odometer Setting Procedures.

(5) Install odometer.

NOTE: *Check anti-backup spring for proper positioning.*

(6) Install retaining spring clip using needlenose pliers. Do not force clip against dial face.

(7) Install speedometer head into speedometer housing.

(8) Install bezel and glass assembly.

Cherokee-Wagoneer-Truck

(1) Remove printed circuit board attaching screws and separate cluster case from bezel.

(2) Remove two speedometer attaching screws and speedometer.

(3) Remove odometer retaining clip.

(4) Remove odometer.

(5) Install odometer assembly.

NOTE: *Check anti-backup spring for proper positioning.*

(6) Install retaining spring clip.

(7) Install speedometer head.

(8) Install printed circuit board.

Odometer Setting Procedure

This procedure applies with the odometer removed from the speedometer head.

Refer to figure 3-70.

Hold the fifth separator and rotate the last five numerals in their normal direction until the desired sixth digit is obtained. When the desired sixth digit is obtained, align the fourth separator in line with the fifth separator. Rotate the last four numerals, repeating the process until the desired total mileage is obtained. When installing the odometer, the separators must straddle a cross bar to maintain proper number alignment.

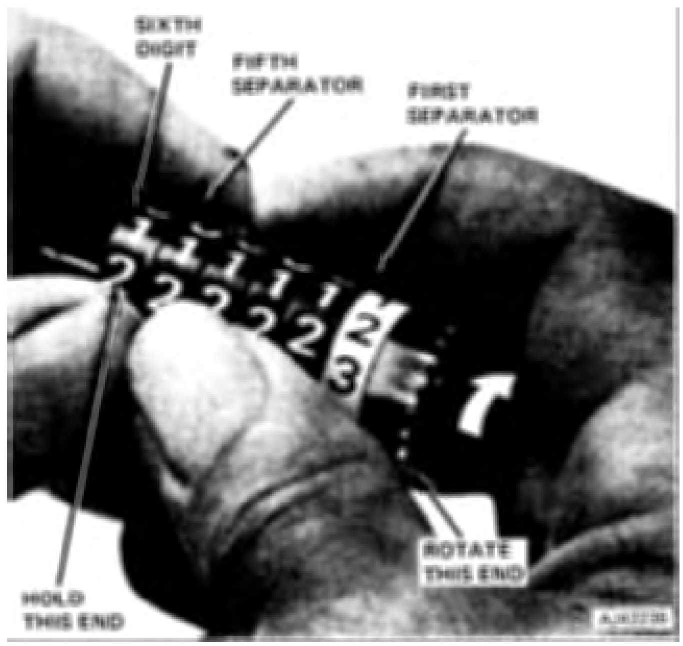


Fig. 3-70 Advancing Odometer Reading (for Replacement Only)

Speedometer Cable Inspection

Always inspect the speedometer cable and core for kinks or sharp bends.

Place the core on a flat surface in the form of an inverted U and then cross the open ends. Hold one end in the left hand, the other in the right hand.

Twist one end, applying light finger pressure to the other end. If the core is satisfactory, the turning action will be smooth.

On a damaged core, the turning action will be jerky and, in a severe case, the core will leap or jump.

The speedometer cable requires a graphite grease lubrication.

CLOCK

CJ Models

The clock is attached to the instrument by a retaining bracket secured with two screws. To reset the clock, pull out the adjustment knob. Hands of *fast running* clocks should be turned *backward*, and *slow running* clocks *forward*. Clock speed will then be corrected automatically after one or two adjustments.

Cherokee-Wagoneer-Truck

The clock is attached to the instrument panel with two nuts.

If the vehicle is not equipped with air conditioning, the clock may be removed by reaching behind the instrument panel and removing the nuts.

If the vehicle is equipped with air conditioning, access to the clock can be obtained by removing the glove box liner attaching screws and pulling down the top portion.

To reset the hands of the clock, pull out the adjustment knob. Hands of a *fast-running* clock should be turned *backward*, *slow-running* clocks *forward*. Clock speed will then be corrected automatically after one or two adjustments.

TACHOMETER—CJ MODELS

The tachometer used in CJ models is an in-line type. Primary current for the ignition coil passes from the ignition switch through the tachometer to the coil positive terminal.

Tachometer Replacement

The tachometer is attached to the instrument panel by a plastic retaining cup secured to the tachometer case by a screw. The tachometer wiring cannot be disconnected at the tachometer. Disconnect the wiring at the fuse panel, ignition switch, and instrument panel ground.

CIGAR LIGHTER

The cigar lighter is mounted to the instrument panel on all models.

The lighter can be removed by removing the battery feed wire (and ground wire on CJ models) and unscrewing the shell that surrounds the lighter.

All models protect the lighter circuit with a 20-amp fuse located at the fuse panel.

IGNITION SWITCH

The ignition switch is mounted on the lower section of the steering column on all models. It is connected to the key lock assembly by a remote lock rod.

The ignition switch has five positions: (1) accessory, (2) off-lock, (3) off, (4) on, and (5) start.

In accessory position, current is available to those loads connected to the accessory terminals on the fuse panel and to the electric tailgate switch mounted on the instrument panel.

In off-LOCK and off position, no current flows through the switch.

In on position, current is available to all accessories, the primary ignition system, and the instrument cluster.

In start position, all accessories are disconnected. The wire connected to the solenoid S-terminal is energized and the brake warning light grounds through the ignition switch ground (bulb check) terminal.

Two different types of ignition switches are used, one for standard columns and one for Adjust-O-Tilt columns (referred to hereafter as Tilt column). The actuator rod moves down on the standard column and up (toward the steering wheel) on the Tilt column when the ignition key is turned to start position.

(1) To make sure that switch is in its correct position, install ignition key in off position. Turn switch body until key is straight up and down.

(2) Remove key an push on main switch body so that notched bezel can be installed freely with notches in line with notch pins.

(3) Turn bezel clockwise to lock in position. The word **Starter** should be on top when correctly assembled.

Removal

(1) Place key in off-lock position and remove two switch mounting screws.

(2) Disconnect switch from remote rod.

(3) Remove harness connector and remove switch.

Installation

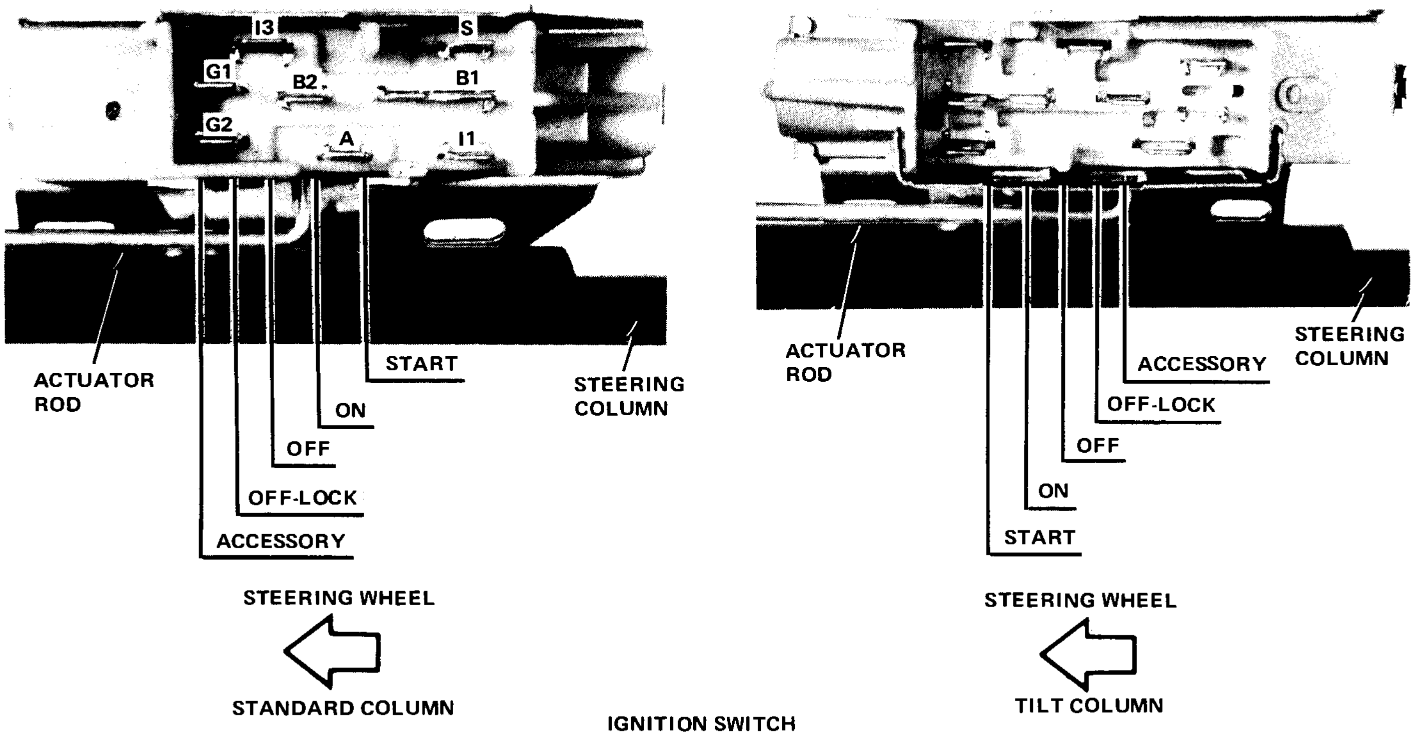
(1) With actuator rod disconnected, position switch as shown in figure 3-71.

(2) Move slider to extreme left (accessory position).

NOTE: *The left side of the ignition switch is toward the steering wheel.*

(3) Position actuator rod in slider hole and install switch to steering column, being careful not to move slider out of detent.

(4) Tighten retaining screws securely.



IGNITION SWITCH

POSITION	CIRCUIT	
START	I-1, B-1 & S G-1, G-2	CONNECTED GROUNDED
ON	I-1 & B-1 A & B-2 1-3 & B-3	CONNECTED CONNECTED CONNECTED
OFF	OPEN	
OFF-LOCK	OPEN	
ACCESSORY	A & B-2	CONNECTED

B-1, B-2 & B-3 (COMMON CONNECTION)

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Fig. 3-71 Ignition Switch Positions

Tilt Column

(1) With actuator rod disconnected, position switch as shown in figure 3-82.

(2) Move slider to extreme left (accessory position).

NOTE: *The right side of the ignition switch is downward from the steering wheel.*

(3) Position actuator rod in slider hole.

(4) Install switch to steering column but do not tighten retaining screws.

(5) Lightly push switch down column (away from steering wheel) to remove lash in actuator rod. Be careful not to move slider out of detent.

(6) Tighten retaining screws securely.

Cylinder Service

For ignition switch cylinder service, refer to Section 11—Steering.

Ignition Switch Test

The ignition switch terminals are shown in figure 3-71.

Although an ohmmeter can be used to check continuity between common connections, a better method is to place a load across the switch (heater, ignition, etc.) which will heat the switch and show it under normal operation. Insert paper clip into the ignition feed wire connector at the back of the switch. Insert another paper clip into any other terminal that is carrying the load. Connect a voltmeter to the two paper clips and note the reading. The maximum voltage drop (the voltage indicated on the voltmeter) is 0.0125 (12.5 millivolts) volt per amp. This means that a 10-amp load would allow 10 x 0.0125 volt to appear on the scale. A reading of 0.2 (two tenths) volt, for example, would mean that the switch is defective.

The ignition switch slide bar positions can be easily identified by first locating the alignment hole in the flat portion of the switch adjacent to the terminals.

LIGHTING SYSTEMS—DIRECTIONAL SIGNAL SWITCH—HORNS

LIGHTING SYSTEMS

The wiring of the lighting systems is shown in the wiring diagrams, which indicate the various units in relation to their positions in the vehicle. The wires in the various circuits are different colors or are marked by tracers.

All models have a 20-amp circuit breaker built into the switch for light system protection.

The upper and lower headlamp beams are controlled by a foot switch located on the toeboard.

HEADLAMPS

All models are equipped with a single headlamp system.

The type 2 headlamp used with the single system is identified by the number 2 embossed on the sealed beam face. The lamp contains two elements: one low beam and one high beam.

Headlamp Aiming Procedure

Lamps must be aimed on the low beam. They may be aimed either with mechanical aimers or by using a screen. If Mechanical Aimers C-3674 are used, follow instructions supplied by the aiming equipment. If a screen is to be used, preparation for aiming is as follows:

(1) Locate vehicle in a darkened area with a level floor and with a screen (wall) having a nonreflecting white surface.

(2) A reference line should be marked on floor 25 feet away from and parallel to the screen.

(3) Position vehicle perpendicular to screen and with front headlamps directly over reference line.

(4) Locate middle tape on screen so it is aligned with centerline of vehicle.

(5) Equalize all tire pressures.

(6) Rock vehicle from side to side to equalize springs and shock absorbers.

(7) Measure distance between vehicle headlamp centers.

(8) Position marker tapes vertically on screen to right and left of middle tape at half this distance.

(9) Measure distance from center of each lamp to surface on which vehicle rests.

(10) Position marker tape horizontally on screen to cross vertical tapes at measured height of each lamp center respectively.

(11) Remove headlamp doors.

(12) Clean headlamps.

(13) Turn headlamps on low beam.

NOTE: *Cover the lamp not being aimed. Be sure to use the horizontal reference line on the screen that is the same dimension as the vehicle lamp height.*

(14) Turn vertical aiming screw counterclockwise until lamp beam is considerably lower than horizontal reference line on screw (fig. 3-72).

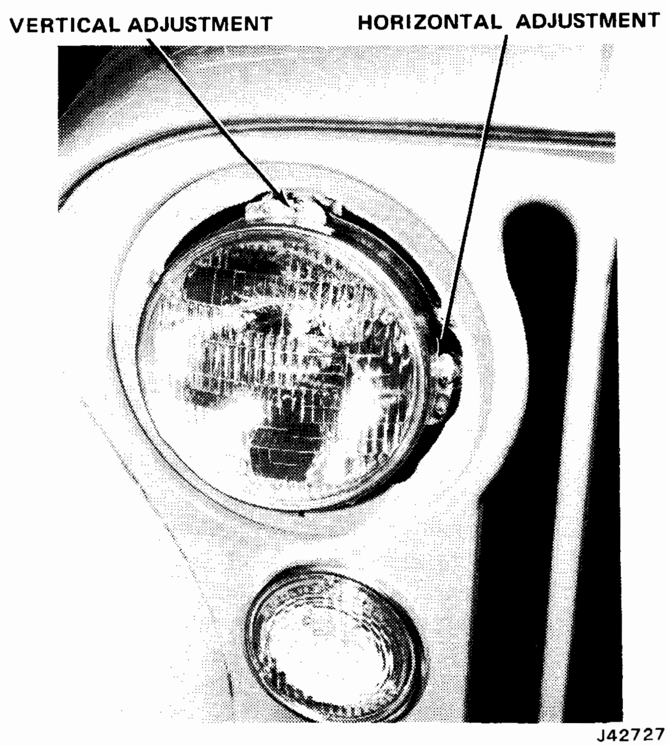

Fig. 3-72 Headlamp Adjustment

(15) Turn screw clockwise until top edge of high intensity area is even with horizontal line.

(16) Turn horizontal aiming screw counterclockwise until beam is off centering tape.

(17) Turn same screw clockwise until left edge of high intensity area is 2 inches to right of lamp centerline (fig. 3-73).

(18) Cover lamp that has been aimed and aim other lamp using same procedure.

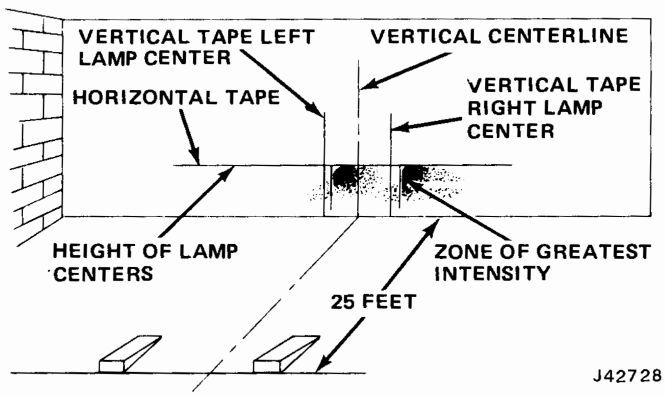

Fig. 3-73 Headlamp Aiming Chart

Headlamp Replacement

Each sealed beam headlamp can be replaced only as a complete unit.

NOTE: *Headlamps have a number 2 molded into the glass at the top of the lens.*

The only difference in the replacement procedure between models is the removal of the headlamp door. The remainder of the headlamp assembly is the same as for all models.

To remove the door on the CJ models, remove the one lower attaching screw. Pull the door out slightly at the bottom and push up to disengage upper retaining tab. Cherokee-Wagoneer-Truck models have three screws retaining headlamp door.

(1) Remove screws and remove door.

(2) Remove three screws in retaining ring.

(3) Pull headlamp out and disconnect wire harness.

(4) Install headlamp with the number 2 at the top of the lamp.

(5) Check lamp aim following procedures under Headlamp Aiming Procedure when replacing headlamps.

Headlamp Switch

The switch is a two-position switch containing a rheostat for controlling instrument panel light brightness (fig. 3-74). Rotating the knob clockwise dims the panel lights. Rotating the knob fully counterclockwise turns on the dome and courtesy lamps.

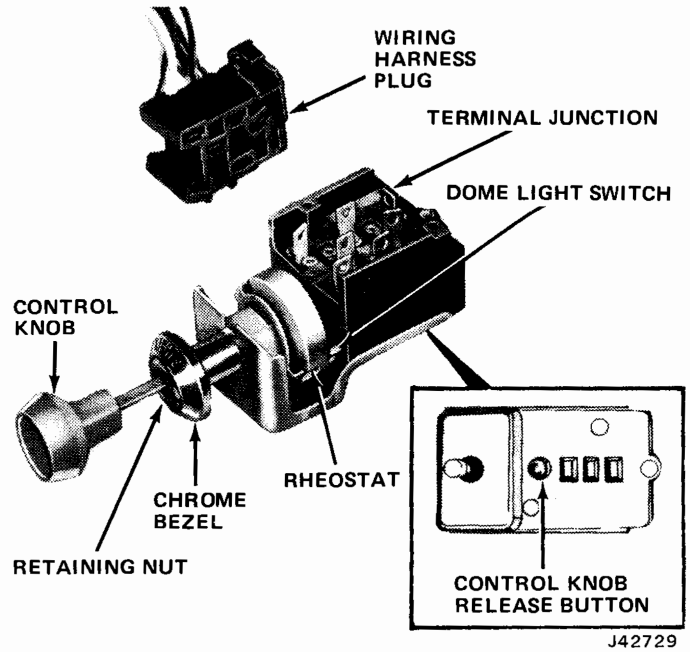

Fig. 3-74 Headlamp Switch

(1) To remove switch, first disconnect wire connector plug from switch.

(2) Pull control knob out to second position.

(3) From behind instrument panel, depress knob release button (as shown in figure 3-74 inset) and pull knob out of switch.

(4) Remove retaining nut and bezel.

(5) Remove switch through rear of instrument panel.

(6) When replacing switch, make sure wire terminal plug on switch is tight on connections.

Dimmer Switch Replacement

Refer to figure 3-75.

(1) Remove wire plug from switch.

(2) Remove two capscrews that hold dimmer switch to floorboard.

(3) Remove plug.

(4) Check operation of dimmer switch with a test lamp. A circuit across two different pairs of contacts (one to headlamps, the other to the high-beam indicator light) should alternately light test lamp when switch is operated.

PARKING, SIDE MARKER, AND DIRECTIONAL LAMPS

CJ Models

The parking lamps are mounted in the radiator guard panel just below the headlamps (fig. 3-76). The lamps are on when headlamp switch knob is pulled out.

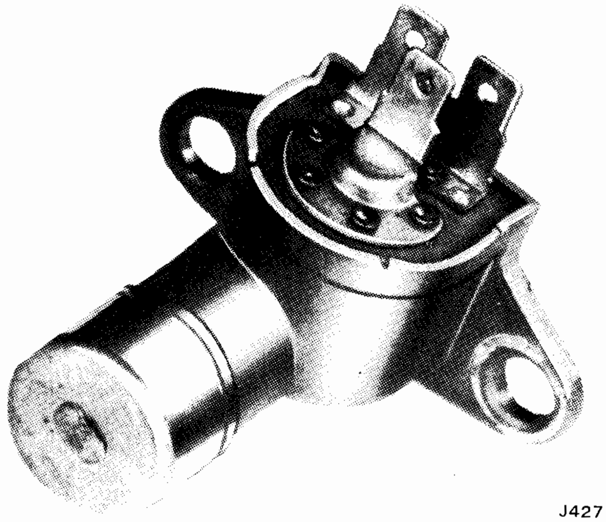

Fig. 3-75 Headlamp Dimmer Switch

(1) Remove three screws, allowing lens to be removed.

(2) Replace lamp.

If the complete parking lamp assembly is to be removed for service or replacement, remove the headlamp assembly to gain access to the rear of the parking lamp.

(1) Disconnect wire connector from harness.

(2) Remove nuts and lockwashers securing parking lamp assembly.

(3) Remove through the front of panel.

To replace front side marker bulbs, reach under the fender and pull down on the socket assembly. To install the bulb and socket assembly, line up the retaining tabs on the socket with the openings on the marker lamp. Push the assembly in and twist the socket 1/4-turn. The bulb is an edge-base type. Pull straight out to remove.

Cherokee-Wagoneer-Truck

The Cherokee and Truck models have the parking lamps mounted in the headlamp panel just above the bumper (fig. 3-77).

The Wagoneer has the parking lamps mounted in the radiator grille panel (fig. 3-78).

The front side marker lamp will flash in unison with the front turn indicator bulb when the headlamps are not on. When the headlamps are on, the side marker flashes alternately with the front turn signal lamp. Side marker and parking lamps come on when the headlamp switch is pulled out to any position.

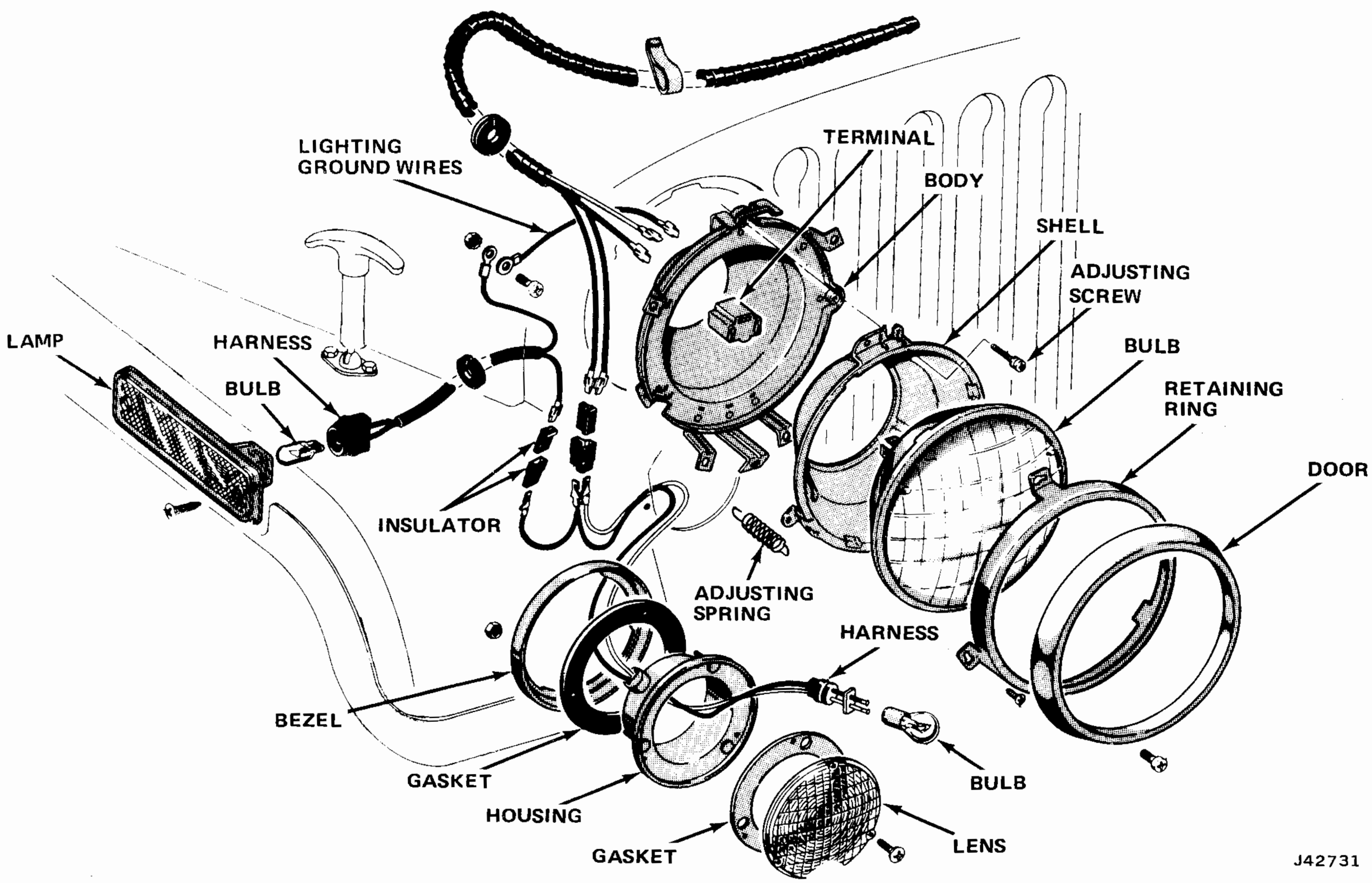

Fig. 3-76 Headlamp, Parking, Directional and Side Marker Lamps—CJ Models

To replace parking lamp bulbs on the Wagoneer, remove the parking lamp lens.

To replace parking lamp bulbs on Cherokee and Truck models, remove the lens and colored relector.

To remove the entire parking lamp assembly, remove the lamp lens. Insert a narrow blade screwdriver or a putty knife between the lamp and the body sheet metal. Pry the sheet metal away from the lamp assembly until the spring clip on the side is disengaged. Pull out the lamp assembly to disconnect the wires. Before installing the lamp assembly, bend the retaining sheet metal lip back to its original position.

To replace side marker lamps, remove the lamp assembly. Twist the socket 1/4-turn to remove. Remove the bulb by pulling it straight out from the socket.

REAR DIRECTIONAL, SIDE MARKER, STOP AND TAIL-LAMPS

CJ Models

Refer to figure 3-79 for parts identification.

Taillamp Bulb Replacement

Remove lens screws, lens, and gasket. Clean lens and reflector before installing.

Taillamp Housing Replacement

Disconnect wiring, remove taillamp lens, and remove the three screws securing taillamp assembly body and remove from rear of body.

Side Marker Bulb Replacement

Turn the bulb socket 1/4-turn counterclockwise and remove the bulb and socket.

Cherokee

Refer to figure 3-80 for parts identification.

Taillamp Bulb Replacement

Remove the taillamp lens and remove the bulb. Clean the lens and housing before installing lens.

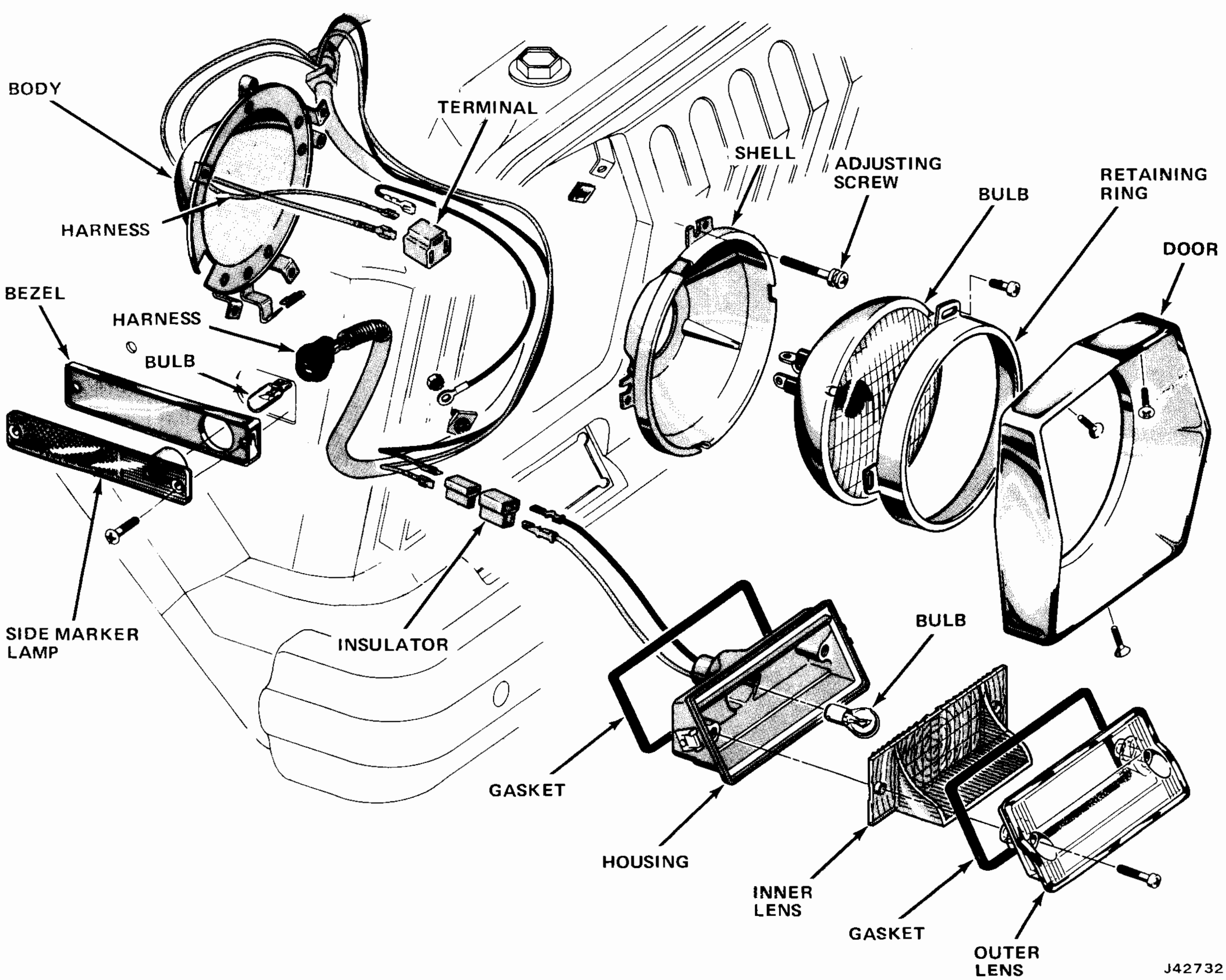

Fig. 3-77 Headlamp, Parking, Directional, and Side Marker Lamps— Cherokee-Truck

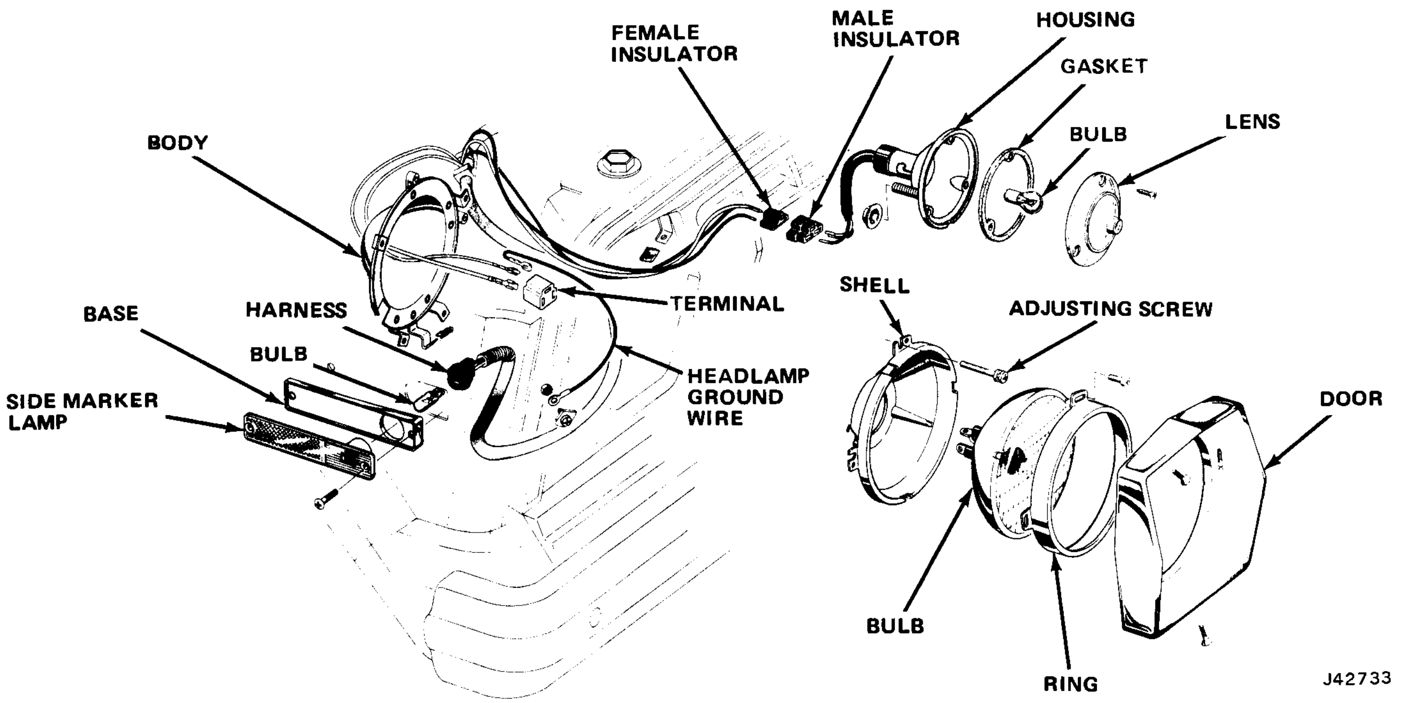

Fig. 3-78 Headlamp, Parking, Directional and Side Marker Lamps—Wagoneer

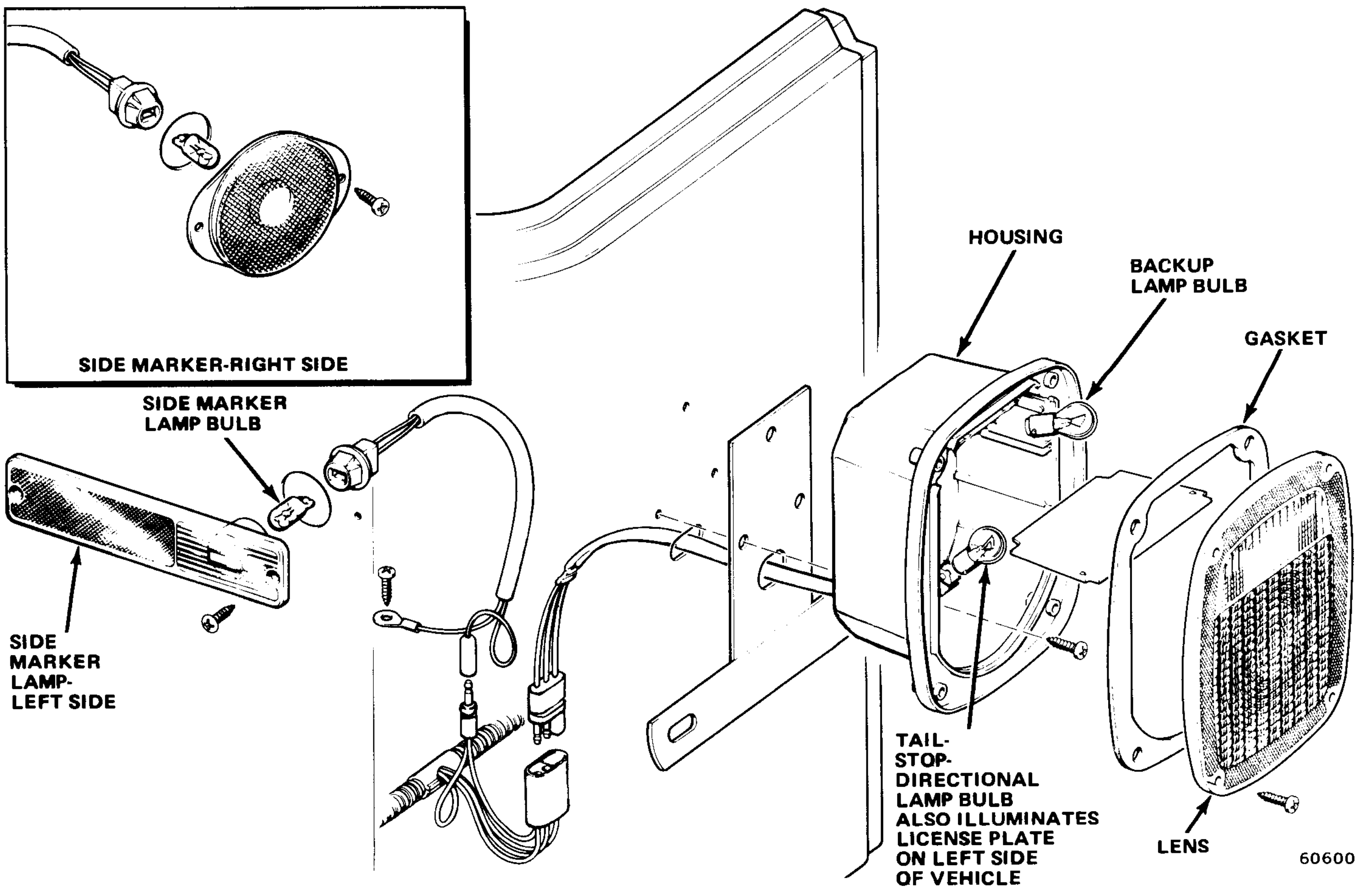

Fig. 3-79 Rear Directional, Stop, Backup, Taillamps and Side Marker Lamps—CJ Models

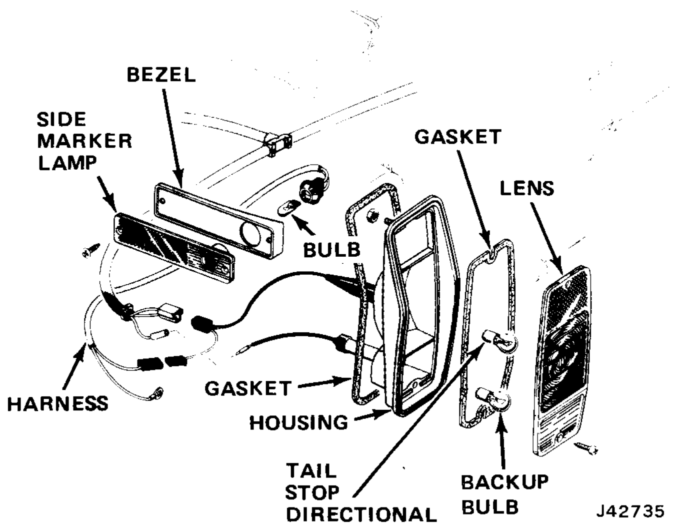

Fig. 3-80 Rear Directional, Stop, Backup and Taillamps—Cherokee

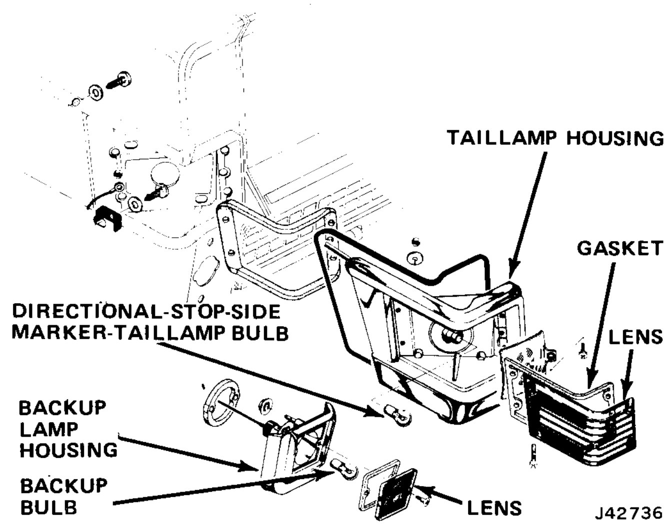

Fig. 3-81 Rear Directional, Stop, Backup and Taillamps—Wagoneer

Taillamp Housing Replacement

(1) Remove interior rear quarter trim panel. On right side, pull panel out at top and remove (this section of body contains jack and tire wrench). On left side, trim panel is held by expandable clips. Use care in prying these clips out of their recesses so panel is not bent or damaged.

(2) Disconnect taillamp harness connections.

(3) Remove four attaching nuts and push housing out from corner posts.

Wagoneer

Refer to figure 3-81 for parts identification.

Taillamp Bulb Replacement

Remove four screws and remove the lens. The white reflector is held in position by one capscrew which, when removed with the reflector, allows the bulb to be removed and replaced. Clean lens and reflector before installing.

Taillamp Housing Replacement

Refer to figure 3-81 and follow the housing replacement procedure as outlined for Cherokee models.

Truck—Except Townside Model

On these vehicles, the lamp is mounted to brackets located on the outside rear of the pickup box side panel .

Taillamp Bulb Replacement

Remove lens and remove the bulb. Clean lens and reflector before installing.

Taillamp Housing Replacement

(1) Disconnect lamp harness.

(2) Remove attaching nuts.

Truck—Townside Model

On these vehilces, the lamp assemblies are mounted in the pickup box end caps (fig. 3-82).

Taillamp Bulb Replacement

Remove lens and remove bulb. Clean lens and reflector before installing.

Taillamp Housing

(1) Remove lens.

(2) Remove two 1/4-20 screws.

(3) Remove housing and disconnect lamp harness.

License Plate Lamp

CJ Models

The left taillamp illuminates the license plate. Refer to figure 3-79.

NOTE: *When installing a rear step bumper on CJ models, the lamp wiring from the step bumper must be spliced into the taillamp harness.*

Cherokee and Wagoneer

The license plate lamp is attached to the tailgate and is a sealed unit. The lamp is removed by removing the lamp attaching screws and disconnecting the attaching wire.

Truck

The license plate lamp is attached to the rear frame crossmember. Bulb replacement is accomplished by removing the bulb lens. The ground for the license plate bulb depends upon metal-to-metal contact between the bulb bracket, license plate bracket, and the frame (fig. 3-82).

When equipped with step bumper, the lamp wiring must be disconnected from the original lamp and connected to the step bumper license lamp extension wire.

Backup Lamps and Switches

To replace a bulb, remove the backup lamp or taillamps lens, as required.

Switch Adjustment and Replacement—Manual Transmission

The backup lamp switch is threaded into the right rear corner of the transmission cover housing. The backup lamp switch is actuated by the reverse shift rail.

The backup lamp switch is not serviceable or adjustable and must be replaced as a unit.

NOTE: *Jumper wires are used at the neutral safety switch connector and the automatic transmission backup lamp switch connector to complete the circuit on vehicles equipped with manual transmission.*

Switch Adjustment and Replacement—Automatic Transmission

A combination backup and neutral safety switch is mounted on the steering column. This switch is adjustable. If defective, the switch must be replaced.

To adjust the backup lamp switch, place the transmission shift lever in the R position. Loosen (do not remove) the two switch attaching screws. Turn the ignition switch to the on position. Rotate the switch one direction or the other until the backup lamps operate. Tighten the attaching screws. Check the switch for an engine start in the N and P positions. The engine must not start in R, D, 2, or 1 position.

As an aid to adjusting the backup lamp switch, install a test lamp to the lamp side of the switch and ground one side of a test lamp. When the test lamp lights, the backup lamps are operating.

Courtesy and Dome Lamps

CJ Models

The courtesy lamps are located beneath each end of the instrument panel and are operated by rotating the headlamp switch knob counterclockwise to the stop.

Current passes from the headlamp switch through the lamp and back to ground at the headlamp switch. No door switches are used.

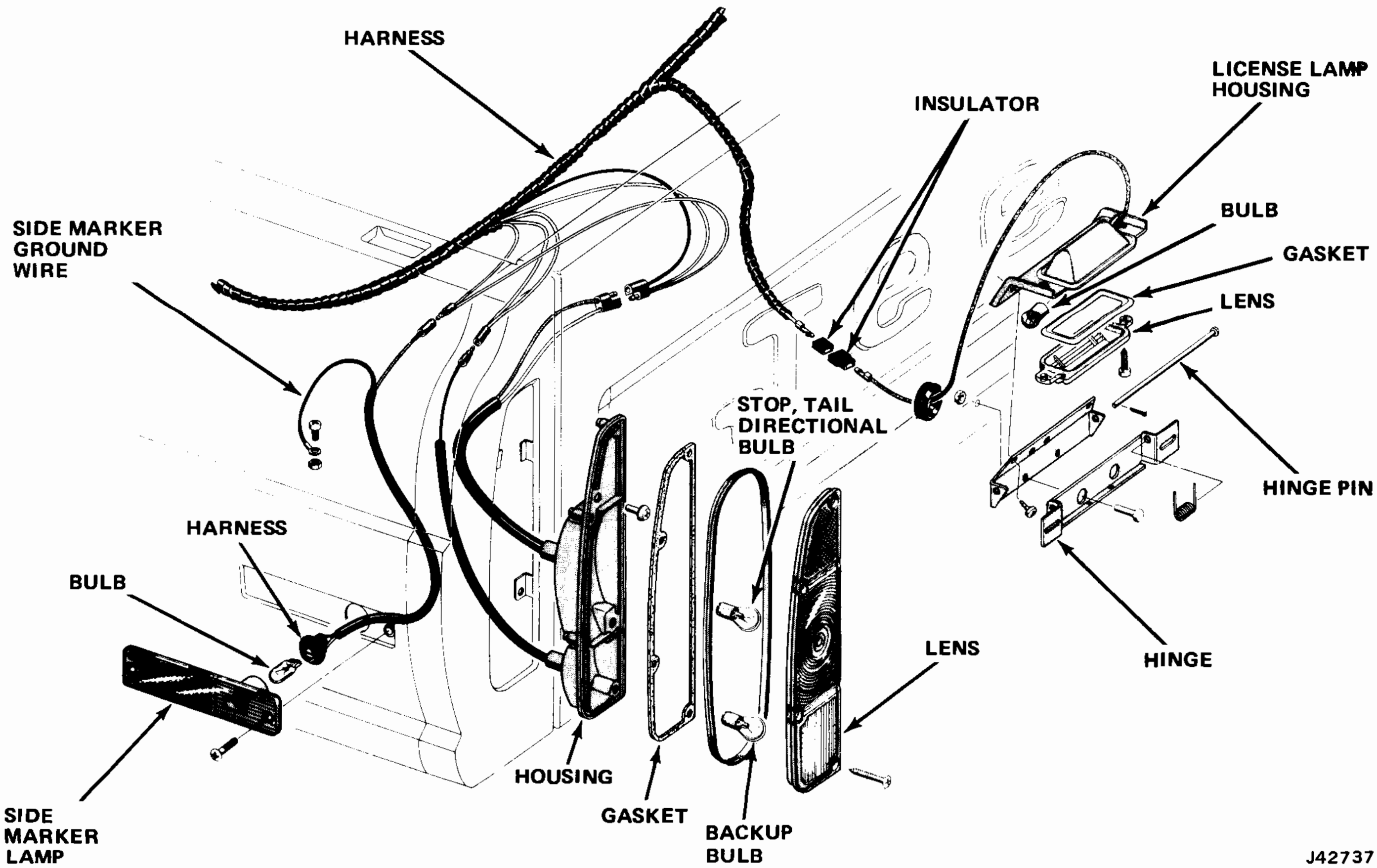

Fig. 3-82 Rear Directional, Stop, Backup, Taillamps and Side Marker—Truck

Cherokee-Wagoneer-Truck

The courtesy and dome lamps operate when the front doors are opened, being actuated by the door pillar switch which provides a ground for the circuit.

Battery feed is from the headlamp switch through a rheostat. When the doors are closed, the dome and courtesy lamps are operated by rotating the headlamp switch knob counterclockwise to the stop. The ground for the lamps is then through the headlamp switch. The dome lamp lens can be removed by squeezing the lens together to disengage the retaining tab (fig. 3-83).

A cargo lamp is offered on some Truck models (fig. 3-84). The cargo lamp bulb is replaced by removing the outer lens.

The lamp assembly can be removed after removing two attaching screws. The dome lamp bracket in the cab of Truck body styles is centrally located above the rear window.

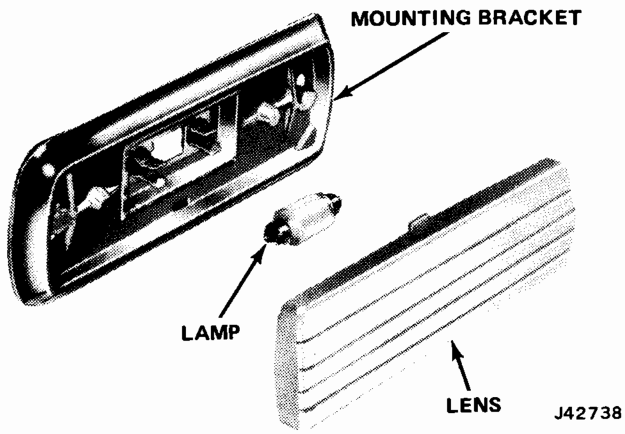

Fig. 3-83 Dome Lamp

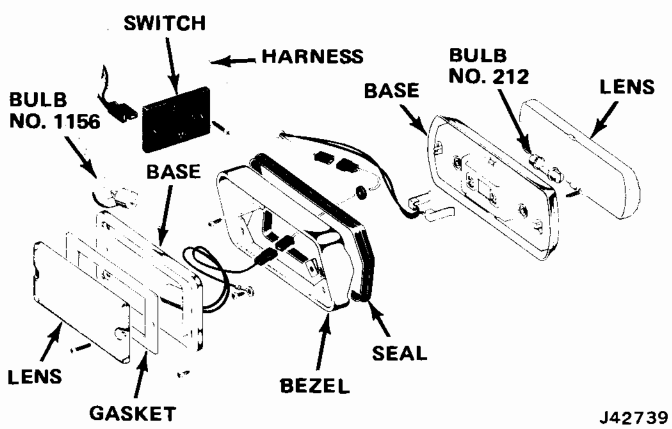

Fig. 3-84 Cargo Lamp—Truck

DIRECTIONAL SIGNAL SWITCH

The most frequent causes of failure in the directional signal system are loose connections and burned out bulbs. A flashing rate approximately twice the normal rate usually indicates a shorted out bulb in the circuit.

If a three-lamp flasher is installed in a vehicle having only two lamp bulbs per side, the lamps will light but will not flash. Conversely, if a two-lamp flasher is used on a vehicle having three lamps, the too-high current draw will cause the lamps to flash too fast.

If there is no signal at any front, rear, or indicator lamp, check the fuse.

If fuse checks okay, next eliminate flasher unit by substituting a known good flasher. If a new flasher does not cure trouble, check signal system wiring connections at fuse and at steering column connector.

NOTE: *If brake stoplamps function properly, rear signal lamp bulbs are okay.*

The directional flasher is mounted directly to the fuse panel. Refer to the wiring diagram at the rear of the manual for circuitry.

Switch Removal

(1) Disconnect battery negative cable.

(2) Remove horn contact trim cover by loosening bottom attaching screws.

(3) Disconnect horn wire from switch in steering wheel cavity by gently pulling quick-disconnect connector.

(4) Remove steering wheel nut. Note alignment of steering wheel to steering shaft index marks for later installation.

(5) Remove steering wheel with Steering Wheel Puller J-21232-01.

(6) Loosen anti-theft cover retaining screws and lift cover from column. It is not necessary to completely remove these screws as they are held on the cover by plastic retainers.

(7) Use Lock Plate Compressor Tool J-23653 to depress lock plate (fig. 3-85).

(8) Once lock plate is depressed, pry round wire snap ring from steering shaft groove.

(9) Remove Lock Plate Compressor Tool, snap ring, lock plate, directional signal canceling cam, upper bearing preload spring and thrust washer from steering shaft.

(10) Place directional signal actuating lever in right turn position and remove lever.

(11) Depress hazard warning light switch, located on right side of column adjacent to the key lock, and remove button by turning in a counterclockwise direction.

(12) Remove directional signal wire harness connector block from its mounting bracket on right side of lower column.

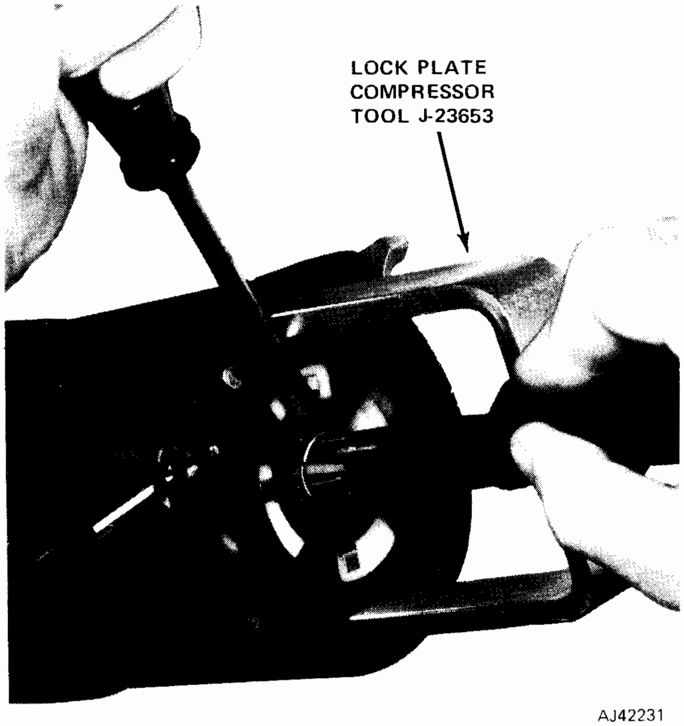

Fig. 3-85 Lock Plate Snap Ring Removal

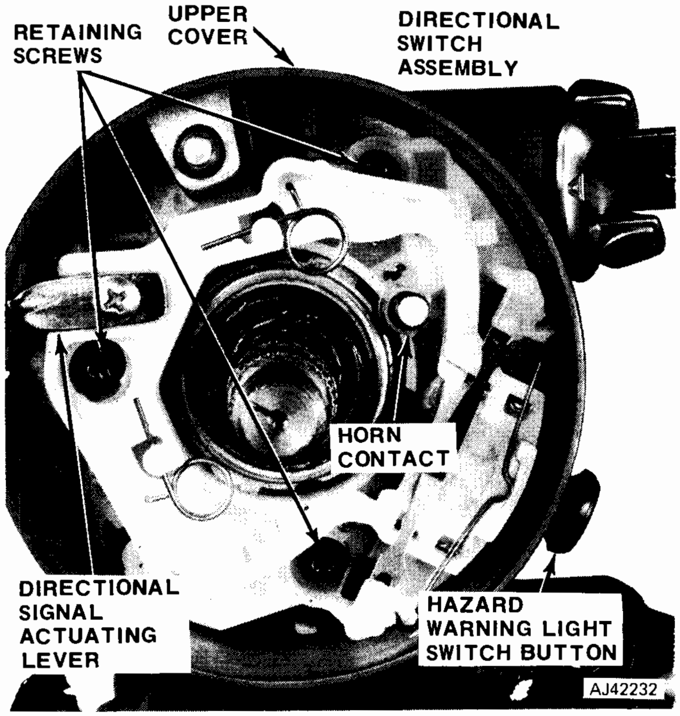

Fig. 3-86 Directional Switch

NOTE: *On vehicles equipped with automatic transmission, use a stiff wire, such as a paper clip, to depress the lock tab which retains the shift quadrant lamp wire in the connector block.*

(13) Remove directional signal switch retaining screws and pull directional signal switch and wire harness from column (fig. 3-86).

Switch Installation

(1) Guide wire harness into position and carefully align switch assembly.

NOTE: *Assure that actuating lever pivot is correctly aligned and seated in the upper housing pivot boss prior to installing the retaining screws.*

(2) Install directional signal lever and actuate directional signal switch to assure correction operation.

(3) Place thrust washer, spring, and directional signal canceling cam on upper end of steering shaft.

(4) Align lock plate splines with steering shaft splines and place lock plate in position with directional signal canceling cam shaft protruding through dogleg opening in lock plate.

(5) Install snap ring.

(6) Install anti-theft cover.

4-WAY EMERGENCY FLASHER (HAZARD WARNING)

All models are equipped with a four-way emergency flasher system. With the switch activated, the two front and two rear turn signal lights flash on and off simultaneously as do both turn signal indicator lights on the instrument clusters.

This system makes use of the regular turn signal wiring and bulbs, but has a separate supply wire, flasher unit, and off-on switch. This makes it possible when leaving a vehicle with the 4-way flasher operating, to lock the ignition switch and car doors. When the 4-way flasher is turned on, the normal directional signal supply is disconnected at the directional signal switch and a new supply circuit is connected into the switch directly from the battery. This 4-way flasher circuit comes through a special heavy-duty flasher. Since the 4-way warning flasher is of the heavy-duty type, it will flash from one to six bulbs at a constant rate. Therefore, flashing indicator lights do not necessarily mean that *all* signal bulbs are flashing.

The 4-way emergency flasher switch is a part of the directional signal switch.

To operate the system, push in the switch button. The 4-way flasher can be canceled by pulling out on the flasher switch.

As the 4-way flasher switch is part of the directional signal switch assembly, refer to Directional Signal Switch for removal or replacement procedure.

The battery feed for the 4-way flasher system is from the fuse panel.

HORNS AND HORN RELAY

The horn circuit for all Jeep vehicles consists of the horn(s), horn relay, horn contacts, and the battery.

The horn relay, located under the instrument panel, obtains current from an unfused battery source. It reduces the amount of current passing through the horn contacts in the steering column and closes the horn feed circuit when the horn contacts are closed by pressing the horn ring. The relay is encased in plastic and hangs freely from the wire harness at the left side of the instrument panel.

Testing

If the horn does not operate, check for battery voltage to the red wire with tracer connected to the horn relay No. 1 terminal. If voltage is not present, refer to the wiring diagram and trace the red wire with tracer back to the voltage source.

If voltage is present at the relay No. 1 terminal, disconnect the wire from the horn and touch the horn terminal with the hot wire. If the horn does not blow, it is defective or has a bad ground.

If the horn blows, connect all the wires and ground the horn button wire (No. 2 terminal). If the horn does not blow, the relay is defective.

If the horn blows, there is an open circuit to the horn button.

Ground the horn wire at the steering column connector. If the horn operates, the open circuit is in the steering column. If the horn does not operate, the open circuit is between the horn relay and the steering column connector.

RADIOS

GENERAL

Jeep radios are transistorized. They operate with the ignition in the ON or ACCESSORY position. All models use nonadjustable, whip-stype antennas.

AM radios are available on all Jeep models. Station selection is controlled manually on CJ models (fig. 3-87) while Cherokee, Wagoneer, and Truck models have pushbutton or manual tuning (fig. 3-88). A single speaker mounted in the instrument panel is used on all models.

AM/FM stereo radios are available on Cherokee, Wagoneer, and Truck models (fig. 3-88). A slide switch, located in the center of the radio, controls AM or FM band selection. A stereo indicator lamp, located at the right end of the station dial, lights when the radio is tuned to an FM stereo broadcast. A left-to-right balance control is located behind the tuning control knob.

Cherokee S and Wagoneer models use four speakers with the stereo radio. A speaker is mounted in each front door and rear quarter trim panel. A front-to-rear speaker fader control is used with the 4-speaker system. It is separate from the radio and mounted on the instrument panel.

Cherokee (except S models) and Truck models use a 2-speaker system with the stereo radio. A speaker is mounted in each front door.

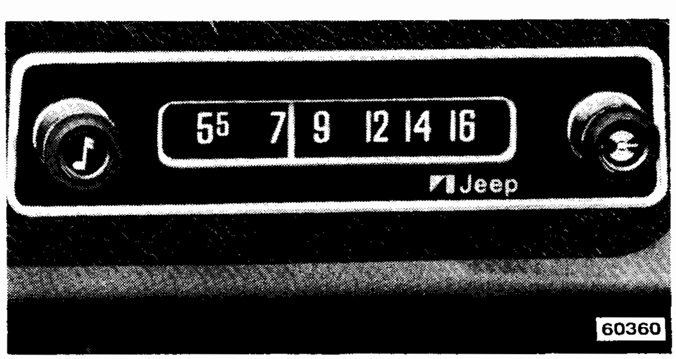

Fig. 3-87 AM Radio—CJ Models

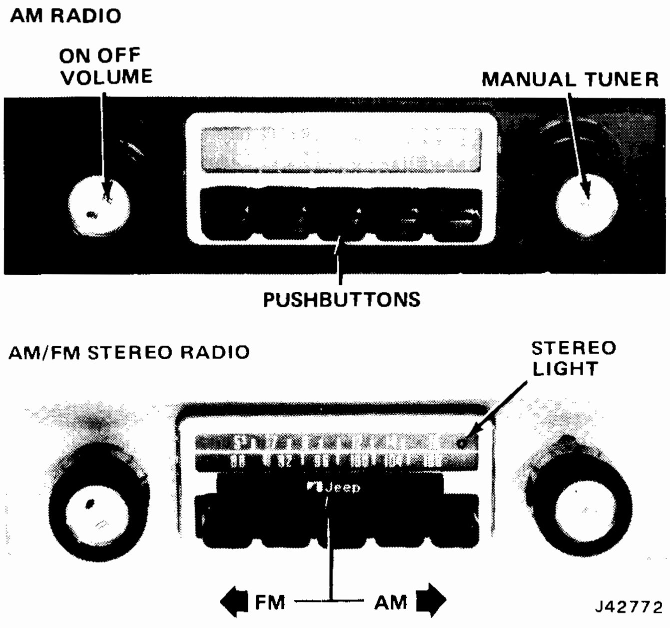

Fig. 3-88 AM and AM-FM Stereo Radio—Cherokee-Wagoneer-Truck

Antenna Trimmer Adjustment

An antenna trimmer adjustment is necessary to match the radio to the antenna. The adjustment always must be made after installation of a radio and antenna, or after any repairs to a radio.

The adjustment should also be checked whenever radio reception is unsatisfactory.

The antenna trimmer adjustment for CJ models is at the upper right corner at the rear of the radio. The trimmer adjustment is located just above the tuning control on radios in Cherokee, Wagoneer, and Truck models.

The trimmer adjustment may be made anywhere. It is not necessary to be able to receive an understandable station. The object is to obtain the most amount of noise possible while the volume control is left in a medium volume setting. Adjust the trimmer as follows:

(1) Remove inner and outer tuning control knobs.

NOTE: *AM/FM stereo radios must be switched to the AM position.*

(2) Turn on radio and allow it to warm up for several seconds.

(3) Turn tuning control knob to 1400 KC range and obtain a signal (a station or just plain static). Turn volume control to medium level.

(4) Insert a common blade screwdriver through small hole above tuning control.

(5) Turn screw left or right until most volume is obtained (*without touching volume control*).

(6) Install inner and outer tuning control knob.

Setting Pushbuttons

(1) Move vehicle outside and away from high tension power lines.

(2) Pull button out (approximately one-half inch) to unlock tuner.

(3) Select station with tuning knob. Tune for clearest reception.

(4) Push button in as far as possible (to lock tuner) and release. This station is now set for automatic tuning.

(5) Follow same procedure for remaining buttons.

Radio Polarity

When servicing the radio, the A (Red) lead must be connected to the positive side of the power source. If connected otherwise, the receiver will not operate and damage will result.

The radio is grounded internally. The ground return circuit is completed by grounding the chassis to the instrument panel. When bench testing, a ground jumper wire must be attached between the radio chassis and the negative terminal of a 12-volt battery to complete the power circuit.

DEFINITIONS OF FREQUENTLY USED TERMS

AM (Amplitude Modulation): Common system of radio broadcasting (520 to 1610 kHz).

Antenna: Device used for transmitting and receiving radio signals.

Circular Polarization: A technique of transmitting radio signals to minimize the affects of fading.

Distortion: False reproduction of the original transmitted signal.

FM (Frequency Modulation): Another system of radio broadcasting (88 to 108 mHz) with the added advantage of wider audio frequency response.

Fading: Variation of intensity of received radio signals.

Flutter: Momentary loss of received radio station; sometimes referred to as picket fencing.

Hertz: Current term of cycles per second.

Ignition Noise: Undesirable radio signals or noise that interfere with the reception of desired radio signal. Examples include the adjacent channel interference, cross-modulation, and intermodulation.

Monaural: A system utilizing a single signal on a single radio frequency (station) as distinquished from a dual channel system (FM stereo).

Multipath Reception: Signal loss or reduction due to a direct signal and a reflected signal arriving at the antenna simultaneously.

Selectivity: The ability of a radio receiver to accept the signal of one station while rejecting signals of undesirable adjacent stations.

Sensitivity: The ability of the radio receiver to receive weak stations.

RADIO RECEPTION CHARACTERISTICS

AM and FM stereo have different reception characteristiscs. The following information will help explain the normal operational characteristics of these radios.

Signal Transmission

The range of a normal hearing is approximately 30 Hz (cycles per second) to 14,000 Hz. AM has a range of 50 to 5000 Hz; FM on the other hand, covers the entire range of normal hearing. Both AM and FM are received on a regular radio as a monaural (single) signal.

FM stereo receivers are capable of receiving both monaural and FM stereophonic broadcasts. These broadcasts are sometimes referred to as multiplex.

Fading

Fading is not usually a problem with AM because of its long distance reception capability (fig. 3-89). FM, on the other hand, is limited to line-of-sight reception (25 to 40 miles) under average conditions of terrain and transmitted power (fig. 3-90). The area of good FM stereo reception may be even slightly less than that of regular FM because of stronger signal requirements. Figure 3-91 illustrates fading of an FM signal due to differences in terrain. Reception behind hills may be noisy (hissing, popping, etc.). This noisy reception is sometimes called "flutter" or "picket fencing."

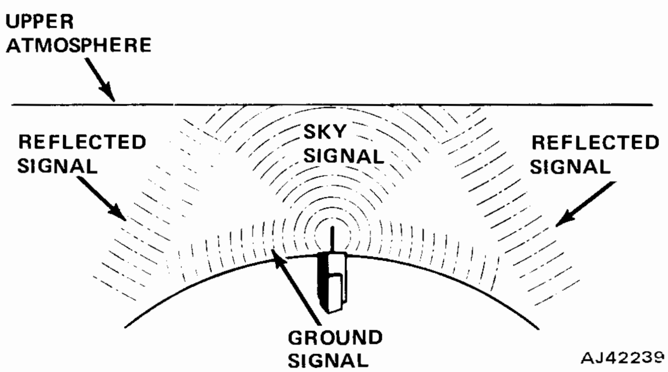

Fig. 3-89 AM Reception—Long Distance, Follows Curvature of Earth and is Reflected by Upper Atmosphere

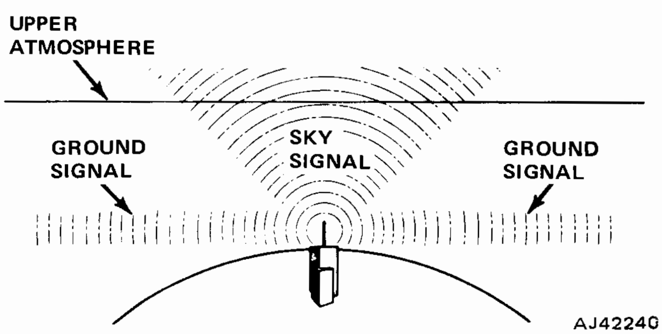

Fig. 3-90 FM Reception—Shorter Distance, Does Not Follow Curvature of Earth and is Not Reflected by Upper Atmosphere

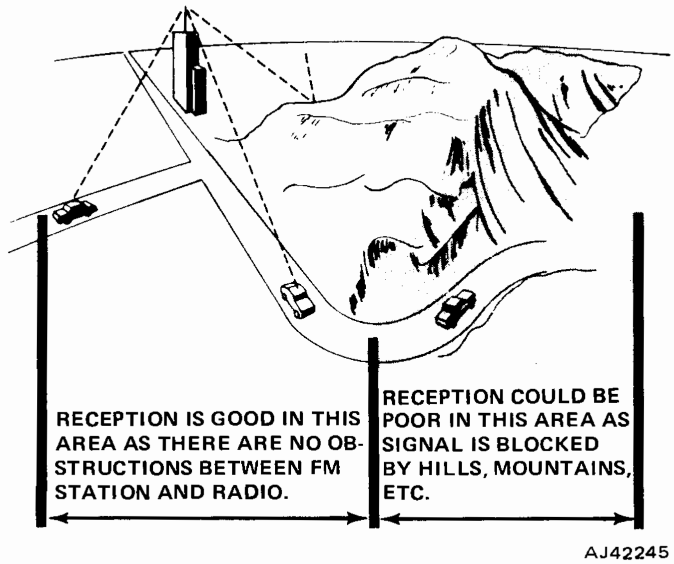

Fig. 3-91 FM Fading

Metropolitan Reception

Transmitted FM signals are easily reflected by solid objects such as buildings. This is why FM can be received under bridges and between tall buildings, whereas AM reception under the same conditions would either be reduced or nonexistent.

Multipath Reception

The fact that FM can be received quite well between tall buildings can unfortunately cause a detrimental side effect, namely multipath reception (fig. 3-92). It is caused by a direct signal and a reflected one arriving at the vehicle's antenna causing distortion, partial or complete loss of the station, or poor FM stereo reception. This type of interference is usually of short duration since the area of interference is usually only a few inches or feet across. It is mostly encountered in downtown areas.

Some FM stations use a technique known as circular or vertical polarization. This technique can improve radio performance in areas encountering multipath reception.

AM Interference

Interference and Ignition Noise

AM reception is susceptible to certain types of electrical interference. These include power lines,

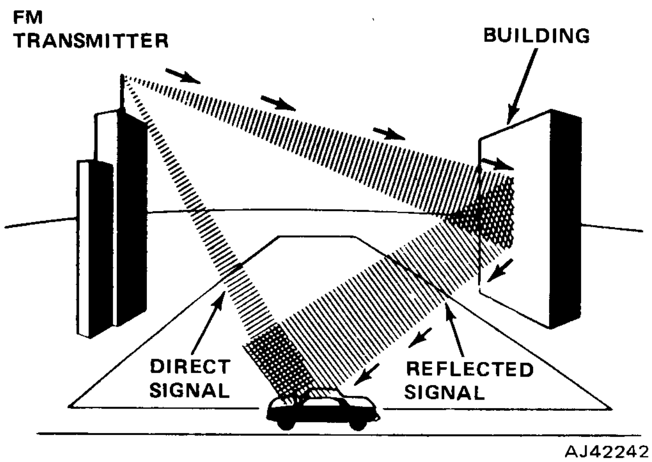

Fig. 3-92 Multipath Reception

thunderstorms, and other situations where electrical charges in the air cause disturbances resulting in buzzing and static. AM, however, does not usually suffer from ignition interference of nearby vehicles, because suppression equipment installed on the vehicle (resistive ignition wire, noise suppression capacitors, etc.) prevents ignition noise in the radio.

FM Interference

Ignition Noise Interference

FM usually does not suffer from the electrical disturbances that affect an AM receiver. FM is slightly sensitive to ignition noise generated by engines of adjacent vehicles, especially those not containing radio suppression equipment. This ignition noise is more prevalent when listening to a weaker station while driving in heavy traffic. The noise will also occur if the radio is tuned off-station slightly. To improve reception, make sure the radio is tuned for minimum noise.

Other FM Interference

Occasionally when listening to a station while driving in the vicinity of another station, especially a strong station, the possibility of receiving both stations simultaneously exists. The phenomenon is called adjacent channel interference or cross-modulation (fig. 3-92).

Using Controls Effectively

Always fine-tune the radio manually for clearest sound and minimum noise.

Weak FM stereo signals are inherently noisier than monaural ones when received on an FM stereo radio. To prevent this type of noise from being heard, the FM stereo radio automatically switches from stereo to the monaural mode. This Stereo-Indicator light will go out, both speakers will still operate, but without the stereo effect. When the signal strength increases to a noise-free level, the receiver will switch back to the stereo mode. This action is automatic and requires no adjustment by the customer.

Occasionally, conditions will be such that noise-free reception simply cannot be attained. If this occurs, set the tone control to the bass (counterclockwise) position to reduce the noise level. Later, when out of the noisy area, set the control back to its normal position.

RADIO INTERFERENCE DIAGNOSIS

The object of this diagnosis is to present a systematic approach to troubleshoot noise problems:

- Determine if the noise is normal (refer to Radio Reception Characteristics)
- Determine point of entry
- Eliminate the noise

Determine Point of Entry

There are five different ways for noise to enter a radio:

1. Antenna
2. A-line (battery feed wire to the radio)
3. Speaker leads (by themselves or from noise radiated from the other car wires)
4. Defective radio
5. Enter directly into the radio

Antenna

Disconnect the antenna. If this causes the noise to stop, the problem is reduced to three possibilities:

- A defective antenna (refer to Radio Antenna Ohmmeter Tests).
- Noise radiated upward from the dash.
- Noise radiated from the engine compartment.

Noise Radiated Upward from Dash: Can be determined by improvising a tool made from a piece of aluminum or copper screen approximately 36 inches by 12 inches (fig. 3-93).

Lay the screen across the top of the dash and attach the clips to good body ground.

To determine exactly where the noise source is, another useful tool can be improvised from an antenna lead-in cable.

To make the tool, cut or remove the lead-in from the antenna at the antenna. Remove approximately 2 inches of the outer plastic covering and the woven shield (fig. 3-94).

(1) Disconnect original antenna lead-in and plug-in test probe.

(2) Turn radio on and use probe to discover the hot spot. Do not touch end of probe with your hand,

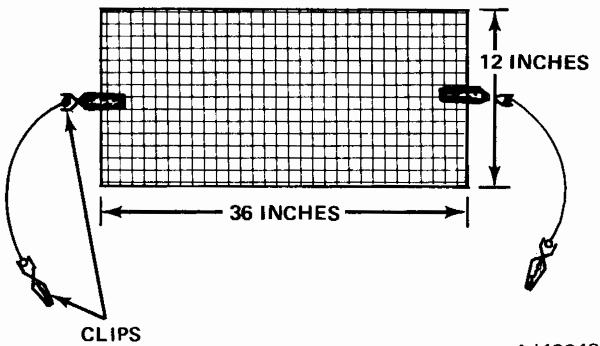

Fig. 3-93 Noise Suppression Tool

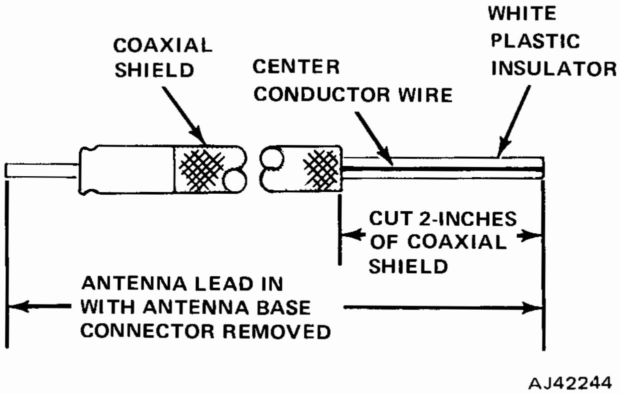

Fig. 3-94 Noise Probe

as this will give a wrong indication. As probe comes closer to noise source, loudness of noise will increase.

(3) If source is found to be a switch, connect a 0.5 mfd capacitor from battery feed side of switch to a good chassis ground.

(4) Gauges and sender units generally can be silenced by installing 0.5 mfd capacitors at their terminals.

(5) If source is found to be a wire, try rerouting wire. If this is not successful, a 0.5 mfd capacitor can be connected from wire to ground or wrap a piece of screen around wire or harness and attach one or more ground leads to screen. It also may be possible to screen off the area found to be radiating noise and ground screen.

(6) If noise is found to be a motor, install a 0.25 mfd coaxial (feed-through) capacitor.

Noise Radiated from the Engine Compartment:

These noises can be separated into three areas:

- Primary Ignition Noise
- Secondary Ignition Noise
- Alternator Whine (Antenna)

Primary Ignition Noise: Generally affects the AM band and usually appears as:

- Frequency varying with rpm
- Loudness varying with rpm

It stops instantly when ignition key is shut off and turned to accessory position.

The first two classifications are usually the result of a poor ground on the control unit or a control unit wire routing problem.

Cleaning of the control unit ground may solve the problem.

An extra long antenna lead-in may be prepared as shown in figure 3- 94 and used as a hot-spot probe.

Remove the ignition coil and its mounting bracket. Clean the paint off the bracket and the engine block, then reassemble tightly (fig. 3-95). In many cases, this helps reduce the amount of interference radiated from the ignition system.

Be sure to check the coil polarity. The distributor must be connected to the negative side of the coil.

Secondary Ignition Noise: Will always affect FM but, if severe, it may also affect AM. Normally one of the following conditions will be found in the radio:

- Motor noise across FM band (and possibly on AM)
- Motor noise (loud) off station but not on a strong station

NOTE: *When these conditions exists in the radio, the problem is more than likely a result of:*

- Distributor cap carbon ball eroded away or cracked, or loose cap
- A rotor with a burned carbon contact spot
- A secondary wire not seated in the coil or distributor
- A defective coil
- An oily film on some of the lead terminals
- Copper core secondary wiring
- Defective or improper spark plugs

If a wire was found not seated, remove the wire and check for a carboned end. It is not advisable to repair an end terminal on carbon core wire, replace the entire cable.

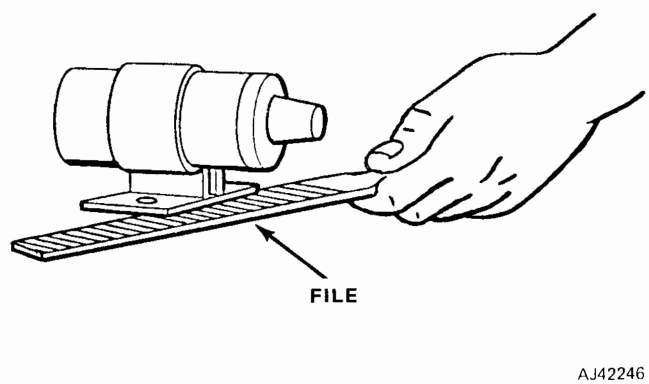

Fig. 3-95 Cleaning Coil Bracket

A tuneup may cure most of the problems.

If the noise in question sounds like one or two cylinders and definitely not all of them, then the problem is after the coil. Once again, use the probe which plugs into the radio. Have someone sit in the vehicle and listen to the radio while going from plug to plug with the probe. The person in the vehicle should notice an appreciable increase in the plug noise when the defective plug is reached.

Install resistor spark plugs when experiencing spark plug noise. The resistor equivalent of the Champion N-12Y plug is the XN-12Y or RN-12Y plug. If the vehicle has copper core secondary wiring, these wires should be replaced with carbon core resistor wire.

Alternator Whine: Can be described as an annoying, high-pitched whistle or squeal that increases and decreases with engine rpm. Methods of getting rid of alternator whine are:

(1) Provide a good fender ground (fig. 3-96).

(2) Install good grounding strap.

(3) Run offending wire through a shielded (grounded) cable.

(4) Clean slip rings and make sure brushes are making good contact.

(5) Align hood to keep fender-to-hood gap as close as possible.

(6) Install a 0.5 mfd coaxial capacitor at the alternator output terminal. Be sure it is rated to handle the maximum alternator current.

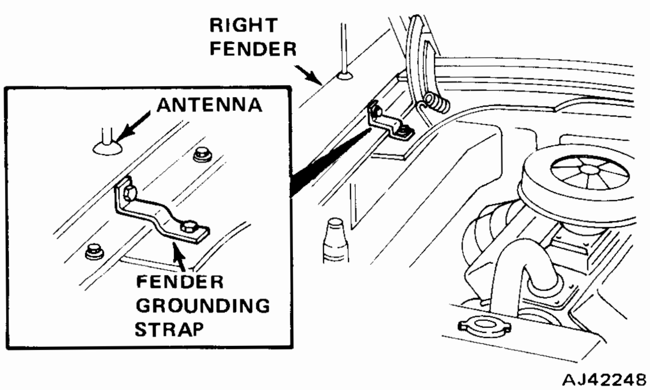

Fig. 3-96 Typical Fender Ground Strap Installation

A-Line (Battery Feed Wire to Radio)

If disconnecting the antenna did not rid the radio of the noise, the noise is probably on the A-line.

Motor noise on the A-line is usually the result of voltage spikes on this line being so large that the input filter circuit in the radio cannot handle them. There are two ways to handle this problem.

- Find out what is causing the noise on the line and eliminate it.
- Add external filters to reduce the spikes to a point where the radio filter can handle the spikes.

A grounded capacitor touched to all hot electrical connections will often identify the offenders (fig. 3-97). The antenna probe (fig. 3-93) also can be used to find hot spots.

In general, any adjacent metal parts which are separated by mastic or paint must be connected together electrically.

Effective bonding requires more than physically clean surfaces and self-tapping screws. Tooth-type lockwasher must be used to cut into the surface layers of metal. Grounding straps must be as short and heavy as possible.

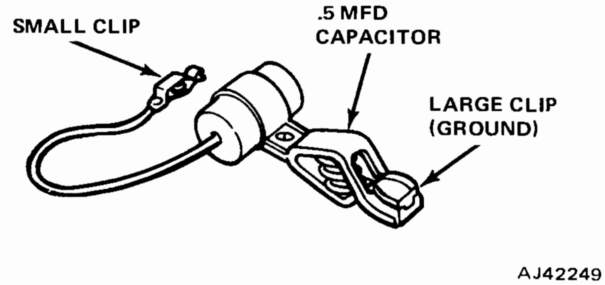

Fig. 3-97 Noise Eliminator Test Device

A-line noise is normally the result of:

- Alternator whine
- Wiring harness too close to ignition wiring
- Radio noise suppressor
- Poor radio ground

Alternator Whine: Does not stop instantly when the key is turned quickly to the accessory position at fast idle. It is a high-pitched whine which increases with rpm. Correct alternator whine as follows:

(1) Install 0.5 to a 2 mfd bypass capacitor from alternator output terminal to ground (fig. 3-98).

(2) Install coaxial capacitor in alternator output wire (fig. 3-98).

(3) Install noise suppressor kit (part no. 8121771).

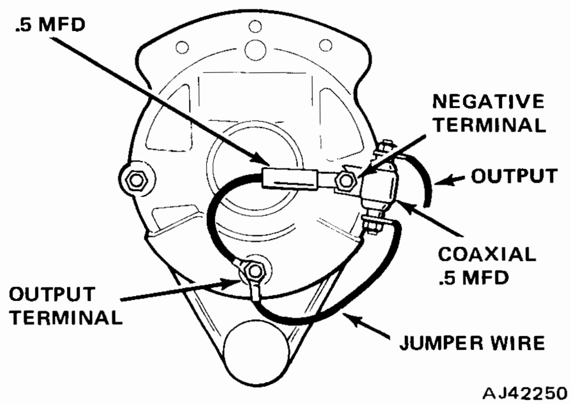

Fig. 3-98 Alternator Noise Suppression

(4) Replace alternator diodes.

(5) Install a 0.5 mfd coaxial capacitor in alternator brush feed wire.

Wiring Harness: Noise normally can be corrected as follows:

(1) Relocate wiring away from ignition wires.

(2) Install 0.5 mfd capacitors on each fuse panel lead. Be sure capacitor is grounded (fig. 3-99).

(3) Relocate wiring away from tachometer and ammeter wiring.

(4) Remove loops from harness wires.

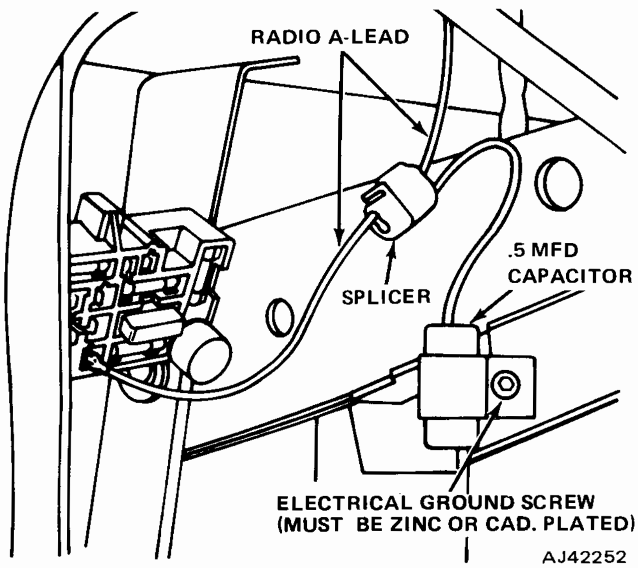

Fig. 3-99 Wiring Harness Noise Suppression

Radio Noise Suppressor: A noise suppressor must be installed on every Cherokee, Wagoneer, or Truck equipped with a radio. This suppressor (choke) is plugged into the back of the printed circuit board. Be sure the choke has not been installed over the copper strip that is installed on the vehicles not originally equipped with a radio.

Tap on the dash with the ignition on and in the accessory position. If noise only occurs in the on position:

(1) Remove radio choke.

(2) Remove plastic covering.

(3) Unsolder one end of coil wire and remove approximately 6-1/2 inches of wire.

(4) Resolder wire end.

(5) Wrap coil with several turns of electrician tape and install choke.

Poor Radio Ground: To check for a poor ground, attach a jumper wire to the radio case and ground to a good chassis ground. If there is no change in radio noise, the radio has a good ground. Check for loose mounting screws.

Speaker Leads

To determine if speaker leads are inducing or picking up noise, perform one or both of the following:

(1) Separate the speaker coil wires by installing a loom over each wire.

(2) Install a 0.002 mfd thumbnail type capacitor across the speaker.

Speaker-induced noise normally will not occur on front mounted one or two speaker systems. It will more likely occur on four speaker systems and when the fader control is in the midposition.

Defective Radio

Exchange with a known good radio to determine if the radio is defective.

Enter Directly into the Radio

(1) Be sure radio has good ground.

(2) Tighten all radio chassis screws.

(3) Center punch cover to make good electrical contact with front of case (fig. 3-100).

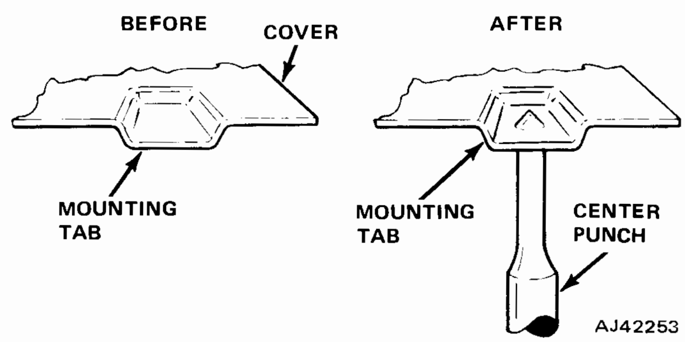

Fig. 3-100 Center Punching Covers

Wheel and Tire Static

Wheel static is another source of interference. This is a running noise most likely to be encountered when the vehicle is in motion, on a hard, dry surface road. The noise will remain when the vehicle is coasting with the engine and all electrical equipment turned off. The static occurs in the front wheels due to insulating film produced by the lubricant in the wheel bearings. The remedy is to install collector springs to dissipate the static (fig. 3-101).

In some instances, static discharges take place between the tire and the road surface, which cannot be eliminated with collector springs. An anti-static powder kit is available from radio supply houses which applies conducting material to the inside surface of the tire to eliminate noise from this source. Tire static can be checked by washing the tire with water. The water provides a conduction path to ground for the discharge. Tire static is most likely to be encountered during hot and dry seasons.

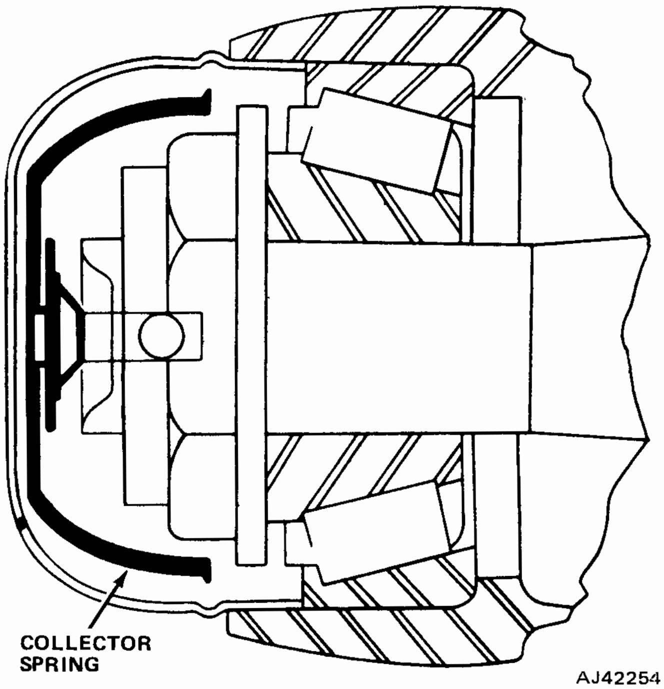

Fig. 3-101 Collector Springs

Turn and Stop Signals

The flasher in the turn signals and the switch in the stop signal may cause popping noises in the radio. In most cases, the noises are interference due to arcing at the contacts. The cure is a 0.5 mfd bypass capacitor installed at the battery connection of the switch or the flasher. It is less likely, but possible, that the low frequency components of the interruptions are reaching the audio stages of the radio. The test is to check if the noise is present with the volume control turned down. If so, install a 1000-mfd capacitor.

Horn Noise

The diagnosis and cure for a growling noise in the radio when the horn is operated is a 0.5 or 0.25 mfd capacitor. Be sure the capacitor case is grounded. The suppressor capacitors are installed at the point where the battery lead feeds the horn relay.

Accessories

Electric windshield wipers, blowers or fans, window openers, or any brush-type motors generally can be suppressed by installing 0.25 mfd capacitors at their terminals.

RADIO REPLACEMENT

CJ Models

(1) Disconnect negative battery cable.
(2) Remove radio control knobs, attaching nuts, and bezel.
(3) Disconnect radio support bracket.
(4) Remove defroster hose.
(5) Remove radio by tilting it downward.
(6) Disconnect antenna lead, speaker wires, and feed wire.
(7) Connect antenna lead, speaker wires, and feed wire to replacement radio.
(8) Install radio in instrument panel.
(9) Connect radio support bracket.
(10) Install radio bezel, attaching nuts, and control knobs.
(11) Install defroster hose.
(12) Connect battery negative cable.

Cherokee—Wagoneer—Truck

(1) Open glove box door and remove glove box liner and lock striker.
(2) Remove antenna lead.
(3) Disconnect feed wire from fuse panel.
(4) Disconnect rear support bracket from radio.
(5) Remove radio control knobs and attaching nuts.
(6) Push radio back to clear instrument panel and remove it through glove box opening.
(7) Install radio in instrument panel.
(8) Install radio attaching nuts and control knobs.
(9) Connect rear support bracket.
(10) Connect feed wire to fuse panel.
(11) Connect antenna lead.
(12) Install glove box liner and lock striker.

RADIO BULB REPLACEMENT

All Models

(1) Remove radio.
(2) Remove radio dial cover retainers and cover.
(3) Rotate manual tuning control to move pointer to extreme left or right.
(4) Remove dial light deflector clips and deflector.
(5) Remove bulb and bulb diffuser.
(6) Install diffuser on bulb and install bulb.
(7) Install dial light deflector.
(8) Install dial cover.
(9) Install radio.

RADIO ANTENNA

All antennas must have good ground to eliminate static noises. The mast of the antenna is not grounded except through the radio. The base of the antenna is grounded to the vehicle sheet metal. The coaxial shield (the wire mesh) surrounding the center conductor wire of the antenna lead-in cable is grounded to the radio and the antenna base.

Tests

There are three antenna tests to be made with the use of an ohmmeter:

- Mast to ground

- Tip of mast to tip of conductor
- Body ground to battery ground

Refer to figure 3-102.

Mast-to-Ground Test

This test verifies that the antenna is making electrical contact with the radio and that the mast is insulated from the base.

(1) Touch one ohmmeter prod to tip of antenna mast and other prod to antenna base (0-1). With antenna installed in radio, there should be continuity (approximately 15 ohms).

(2) Disconnect antenna from radio and repeat step (1). There should not be any continuity with antenna disconnected from radio.

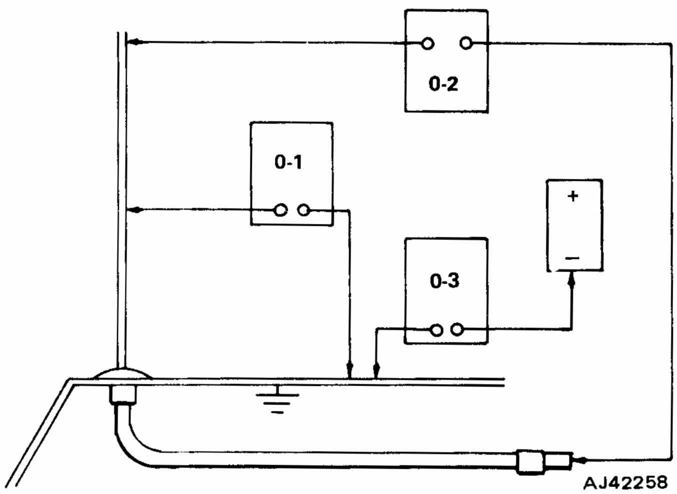

Fig. 3-102 Antenna Ohmmeter Test

Tip of Mast-to-Tip of Conductor Test

This test verifies that the antenna does not have an open circuit.

(1) Disconnect antenna from radio.

(2) Touch one ohmmeter prod to mast tip and other prod to tip of lead-in (part inserted into the radio) (0-2). There should be continuity (fraction of an ohm).

Body Ground-to-Battery Ground Test

This test verifies that the antenna base has a good ground. Touch one ohmmeter lead to the fender and the remaining prod to the battery post (0-3). The resistance should be extremely low (less than one ohm).

RADIO SPEAKERS

Speakers have an impedance of either 3.2 or 8 ohms. A speaker should be replaced with the proper part number speaker. If the exact replacement is not available, select a speaker which matches the ohm value stamped on the radio chassis with a black ink stamp.

AM/FM stereo radios are more critical in the selection of a speaker than are AM radios. A noticeable deterioration in sound will be noticed if the correct speaker is not used.

Stereo speakers are paired together for a truer stereo sound, right front with right rear, left front with left rear.

Speaker Repairs

A speaker, once it has been damaged, is usually not repairable and should be replaced with a new unit. Defective speakers usually have one or more of the following symptoms:

- Loose mounting.
- Screws or other objects stuck to back of magnet.
- Audio distortion, particularly on the low frequency notes and at high volume.
- Rattles and buzzes caused by foreign material hitting or rubbing against the speaker cone.
- Raspy noises caused by foreign matter inside the speaker restricting free movement of the speaker cone.
- Muffled sound caused by speaker opening obstruction.

Use a light to check the speaker opening(s).

If the entire speaker is not visible through the speaker grille openings, remove the obstruction as follows:

Front Door Speakers

(1) Remove door trim panel lower screws.

(2) Carefully lift the door trim panel away from door to expose speaker.

(3) Cut out excess water dam paper around speaker.

(4) Install door trim panel lower screws.

NOTE: *Be sure the speaker mounting screws are tightened securely.*

SPEAKER HARNESS TEST

Ground Condition

(1) Disconnect speaker feed wires at radio connector and each individual speaker.

NOTE: *When reconnecting the speaker harness to the radio, be sure the antenna lead-in cable is fully engaged in the radio socket.*

(2) Connect one lead of an ohmmeter to the speaker feed wire and the other

The speaker is located to the right of the radio. lead to a good ground. An infinity reading should be indicated. Check each individual speaker wire in this manner.

(1) If resistance is indicated on the ohmmeter, the wire being checked is grounded.

NOTE: *Grounded speaker harnesses are generally caused by screws pierced through wire harness.*

Short Condition

(1) Disconnect speaker feed wires at the radio connector and at each individual speaker.

(2) Connect ohmmeter leads to speaker feed wires at the radio connector.

(3) An infinity reading should be indicated.

(4) If resistance is indicated on ohmmeter, the feedwires being checked are shorted.

Speaker Test

Speakers may be isolated for grounds by testing the impedance with an ohmmeter. The specified value should match the ohm value stamped on the radio chassis.

Radio Speaker Replacement

CJ Models

To remove the speaker, remove the four attaching nuts from the mounting studs.

Cherokee-Wagoneer-Truck

The AM speaker is located above the radio. To remove the speaker, remove the radio, then remove the four attaching nuts from the speaker mounting studs.

On vehicles equipped with a stereo radio, interior trim panels must be removed for access to the speaker. Refer to Section 15 for trim panel service procedures.

TAILGATE WINDOW DEFOGGER

GENERAL

The electrically heated tailgate window grid consists of two vertical bus bars and horizontal rows of heating elements of silver bearing, ceramic enamel compound that is fused to the inside surface of the tailgate glass. A controls witch, pilot lamp, timer-relay, and wire harness complete the circuit.

Braided wire, soldered to each bus bar at 2-1/2-inch intervals, serves as the electrical feed and ground for the grid. The grid feed wire is attached to the timer-relay, mounted inside the tailgate. The feed to the relay is supplied by a wire attached to the fuse panel power tailgate terminal (fig. 3-103).

A separate control circuit, connected to the heater control switch, operates the relay and timer in the relay.

When the control switch, located on the instrument panel, is activated (with ignition switch on, the relay contacts will close. The timer in the relay will operate the defogger for about 8 to 12 minutes, depending on the ambient temperature, or until the control switch or ignition switch is turned off. The pilot lamp indicates system operation.

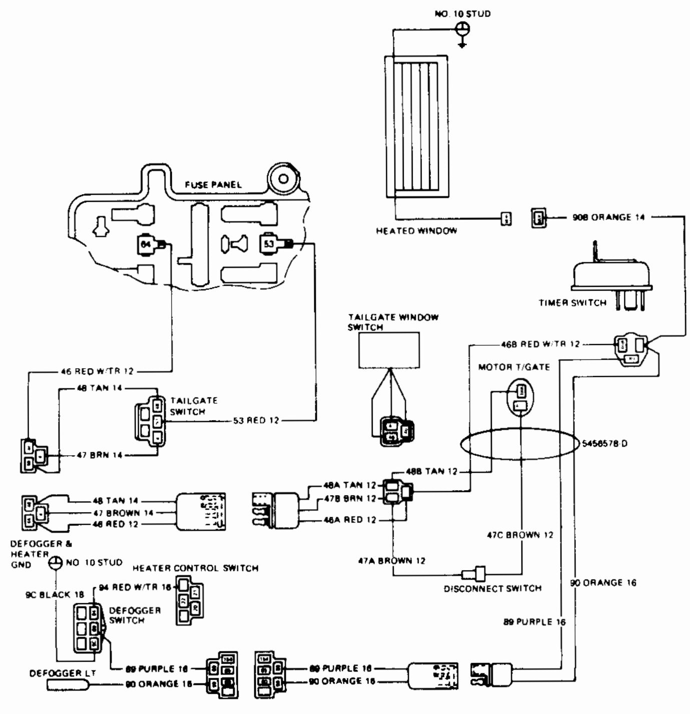

Fig. 3-103 Heated Rear Window Wiring Diagram

NOTE: *If the defogger switch must be replaced, both it and the electric tailgate window switch must be replaced since they are serviced as as an assembly.*

TESTING

Switch Test

(1) Turn ignition switch on and press defogger switch.

(2) Disconnect optional equipment wiring harness at connector under dash. Connect a 12-volt test lamp from purple wire (89) to a good ground (fig. 3-103). Test lamp should light.

(3) Shut off defogger switch and test lamp should not light.

(4) To test indicator light, disconnect orange wire from lamp. Connect a jumper wire from accessory terminal of fuse panel to orange wire. With ignition switch turned to ACC position, the lamp should light.

Relay Test

(1) Remove tailgate trim panel and access hole cover.

(2) Disconnect three-wire connector plug from timer-relay (fig. 3-103).

(3) Connect a jumper wire from fuse panel accessory terminal to X-terminal on timer-relay.

(4) Connect another jumper wire from fuse panel accessory terminal to red wire with tracer terminal of switch.

(5) Connect third jumper wire from purple wire terminal of switch to P-terminal of timer-relay.

(6) Connect a 12-volt test lamp from L-terminal of timer-relay to a good ground.

(7) Turn ignition switch to ACC position. Test lamp should not light.

(8) Press defogger switch. Test lamp should light and remain on for 8 to 12 minutes. This test should be performed with a fully charged battery. If switch or timer-relay does not function as described, replace individual unit. If timer-relay does not shut off when key is turned off, replace switch.

Grid Test (fig. 3-104)

When a grid is inoperable due to an open circuit, the area of glass normally cleared by that grid will remain fogged or iced until adequately warmed by the adjacent grids. Use the following procedure to locate a broken grid.

(1) With the engine running at idle, press the tailgate window defogger switch. The defogger lamp should glow, indicating defogger operation.

NOTE: *The feed wire is connected to the right side (passenger side) of the window and the ground connection is on the left side of the window.*

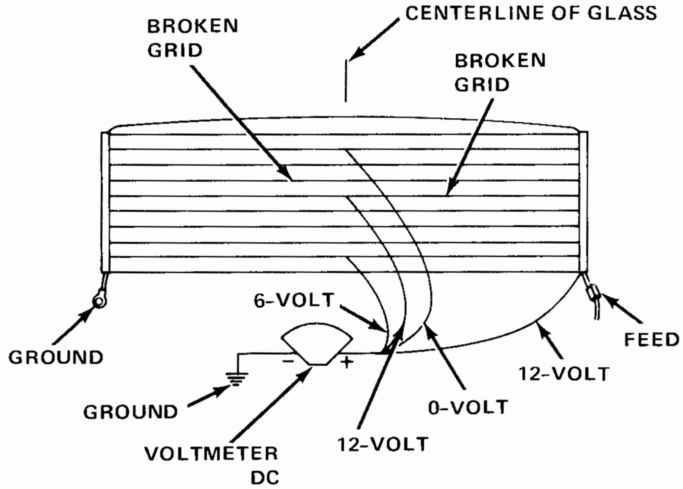

Fig. 3-104 Voltmeter Connections and Voltage Drop for Grid Continuity

(2) Use a 12-vdc voltmeter and contact the positive lead of the voltmeter to the right side (feed) vertical bus element on the inside surface of the glass and contact the negative lead to the left side (ground) bus element. Voltage drop indicated on the meter should be 11 to 13 volts. Connect the negative lead of the voltmeter to a good ground—the meter reading should remain the same.

(3) Keep the negative lead connected to ground. Use the positive lead and carefully contact each grid at approximate centerline of the window.

(4) A voltage drop of one-half the full amount, approximately six volts, indicates a good grid or closed circuit.

(5) A full voltage drop of 12 volts at the centerline indicates a break in the grid between the positive lead and ground.

(6) No voltage drop (0 volts) at the centerline indicates a break in the grid between the centerline and the voltage source or feed.

(7) The exact location of the break can then be pinpointed by moving the positive lead to the left or right along the grid until an abrupt change in the voltage reading is noticed.

GRID REPAIR

Once a broken or open grid is located, repairs can be accomplished using the grid repair kit in accordance with the following procedure.

(1) Using suitable marking pencil, mark location of broken or open grid on exterior surface of glass.

(2) Using fine steel wool, lightly rub area to be repaired (inside of tailgate window). Clean area with isopropyl alcohol (rubbing alcohol).

(3) Attach two strips of cellulose tape (inside of tailgate window) above and below break in grid as shown in figure 3-105.

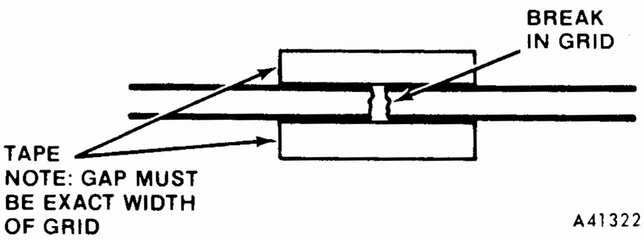

Fig. 3-105 Tailgate Window Defogger Grid Repair

(4) Mix repair coating until uniform in consistency, with silver particles mixed throughout fluid, and apply coating to break in grid with small brush furnished in kit. Apply a heavy coat of mixture, extending approximately 1/4 inch on either side of break.

(5) Start engine and press defogger switch. Run engine for one minute. Turn ignition switch off.

(6) Apply a second heavy coat of mixture to break in grid, extending about 1/4 inch on either side of break.

(7) Start engine and press defogger switch. Run engine until defogger completes cycle (pilot light goes off). Turn ignition switch off.

(8) Remove cellulose tape from inside of tailgate window.

(9) Check repaired area for continuity. Do not touch repaired area.

CAUTION: *Do not clean repaired area for 24 hours. Then clean inside of tailgate window with liquid window cleaner.*

(10) Clean pencil markings from exterior surface of glass.

ELECTRICALLY OPERATED TAILGATE WINDOW

GENERAL

An electrically operated tailgate window is offered on the Cherokee and Wagoneer Models. When checking for tailgate window motor operation, it is necessary to isolate the problem to one of the two operating circuits: (1) tailgate window operation from instrument panel switch and (2) tailgate window operation from tailgate window switch.

Operation

Instrument Panel Switch

Voltage is supplied from the ignition switch through a 30-amp circuit breaker in the fuse panel to instrument panel tailgate window switch (fig. 3-106).

NOTE: *If the vehicle is equipped with a tailgate window defogger, the defogger and tailgate switches are serviced as an assembly. They cannot be replaced separately. Both switches must be replaced when either is defective.*

Tailgate Window Switch

Voltage is supplied directly from the battery through a 30-amp circuit breaker in the fuse panel to the red (No. 46) wire of the tailgate window switch (fig. 3-107).

Testing

Instrument Panel Tailgate Window Switch

(1) Turn ignition switch to on position.

(2) Using a 12-vdc test lamp, connect one end of test lamp to ground and place probe to red (No. 53) wire of switch (fig. 3-106). If lamp lights, voltage is present at switch. If lamp does not light, repair problem in feed circuit before proceeding.

(3) Place test lamp probe to brown (No. 47) wire of switch. Move switch to up position. If lamp lights, proceed to step (4). If lamp does not light, replace switch.

(4) Place test lamp probe to tan (No. 48) wire of switch. Move switch to down position. If lamp lights, proceed to Tailgate Window Switch Test. If lamp does not light, replace switch.

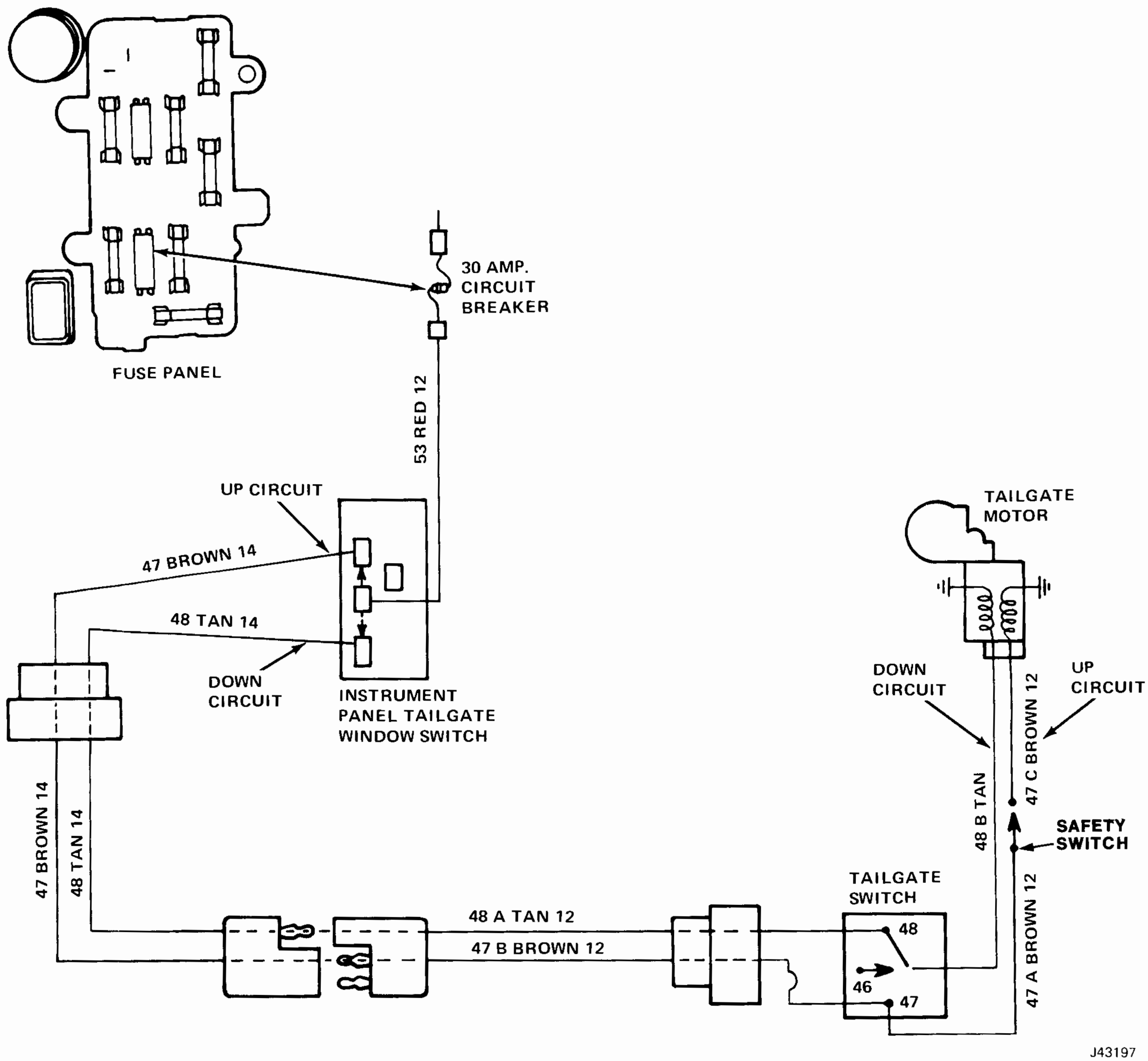

Fig. 3-106 Instrument Panel Tailgate Window Switch Circuitry— Cherokee-Wagoneer

Tailgate Window Switch

(1) Using a 12-vdc test lamp, connect one end of test lamp to ground and place probe to red (No. 46) wire of tailgate window switch (fig. 3-107). If lamp lights, proceed to step (2). If lamp does not light, repair problem in feed circuit before proceeding.

(2) Place test lamp probe to tan (No. 48A) wire of tailgate switch. Turn tailgate window switch key to down position. If lamp lights, proceed to step (3). If lamp does not light, replace switch.

(3) Place test lamp probe to brown (No. 47B) wire of tailgate switch. Turn tailgate window switch key to up position. If lamp lights, proceed to next test. If lamp does not light, replace switch.

Tailgate Window Safety Switch

(1) Using a 12-vdc test lamp, connect one end of test lamp to ground and place probe to brown (No. 47A) wire of safety switch (fig. 3-107). Turn tailgate window switch to up position. If lamp lights, voltage is present at switch. If lamp does not light, repair feed circuits as necessary.

(2) Place test lamp probe to brown (No. 47C) wire at switch. Turn tailgate window switch to up position

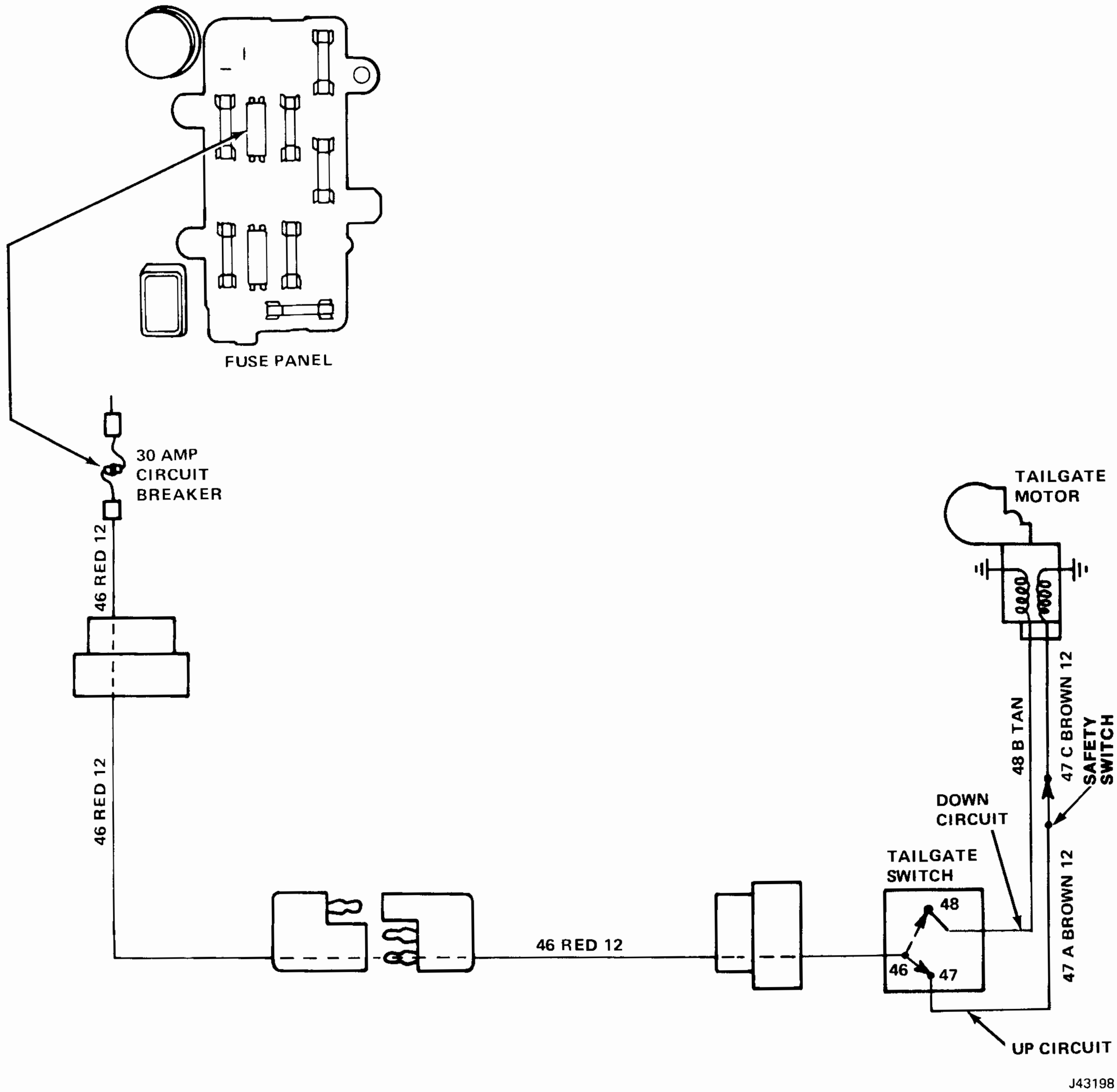

Fig. 3-107 Tailgate Window Switch Circuitry—Cherokee-Wagoneer

and close safety switch. If lamp lights, proceed to next test. If lamp does not light, replace switch.

Tailgate Window Motor

NOTE: *Tailgate window motor must be grounded.*

(1) Using a 12-vdc test lamp, connect one end of test lamp to ground and place probe to tan (No. 48B) wire at electrical motor (fig. 3-107). Turn tailgate window switch to down position. If lamp lights and motor does not operate, replace motor. If lamp does not light, check feed circuit to motor and repair as necessary.

(2) Place test lamp probe to brown (No. 47C) wire at electric motor. Close safety switch. Turn tailgate window switch to up position. If lamp lights and motor does not operate, replace motor. If lamp does not light, check feed to motor and repair as necessary.

Electric Motor Removal and Installation

For electric tailgate removal, refer to Section 16 of this manual.

CRUISE COMMAND

GENERAL

Cruise Command automatic speed control senses car speed through the speedometer cable and uses engine intake manifold vacuum to regulate the accelerator and automatically maintain any preset cruising speed between 30 and 85 mph.

The Cruise Command control is an integral part of the directional switch lever and consists of two separate switches. The first is the OFF-ON and RES (resume) slide switch located on the directional switch lever. The second switch is a pushbutton switch located at the end of the directional switch lever.

To engage the speed control, move the slide switch to the ON position and accelerate to the desired speed. Press the pushbutton on the end of the directional switch lever and release. The speed control system will now maintain the selected speed. The system will automatically disengage when the brake pedal is lightly depressed.

The speed control can be re-engaged automatically to the previously selected speed by accelerating to 30 mph and moving the slide switch to the RES position and releasing the switch. When the RES function is used, the rate of acceleration is regulated by engine intake manifold vacuum; therefore, the rate of acceleration cannot be adjusted. On the large displacement V-8 engines, the acceleration rate will be firm.

WARNING: *Cruise Command should not be used when driving on slippery roads.*

NOTE: *When the ignition or slide switch is moved to the OFF position, the preset speed of the RES function is canceled and must be reset when the system is reactivated.*

The Cruise Command can be set at a higher speed than initially selected by accelerating to the desired speed and then depressing and releasing the pushbutton. A lower controlled speed can be achieved by lightly pressing the brake pedal, momentarily, allowing the car to slow to the desired speed and then pressing and releasing the pushbutton.

COMPONENTS

The system is comprised of five basic components: the regulator, the relay, the vacuum servo, the control switch, and the release switch.

Regulator

The regulator meters vacuum to the servo. It senses speed through the speedometer cable located between the transmission and regulator. The flyweight-type governor reacts to the cable speed and engages the low speed switch at approximately 30 mph. When the low speed switch is closed, the driver may engage the Cruise Command system.

The regulator is serviced as an assembly.

Relay

The relay, located beneath the instrument panel, is energized when the ignition switch is turned on and prevents a battery drain when the ignition is turned off.

Vacuum Servo

The vacuum servo, a neoprene bellows, receives the modulated vacuum and actuates the throttle to control the car speed.

Control Switch

The control switch, which is an integral part of the turn signal lever, when actuated, energizes either the solenoid valve or the coupling coil, or both, thereby controlling speed.

Release Switch

When the brake pedal is depressed slightly, the brake switch de-energizes the solenoid valve disengaging the speed control.

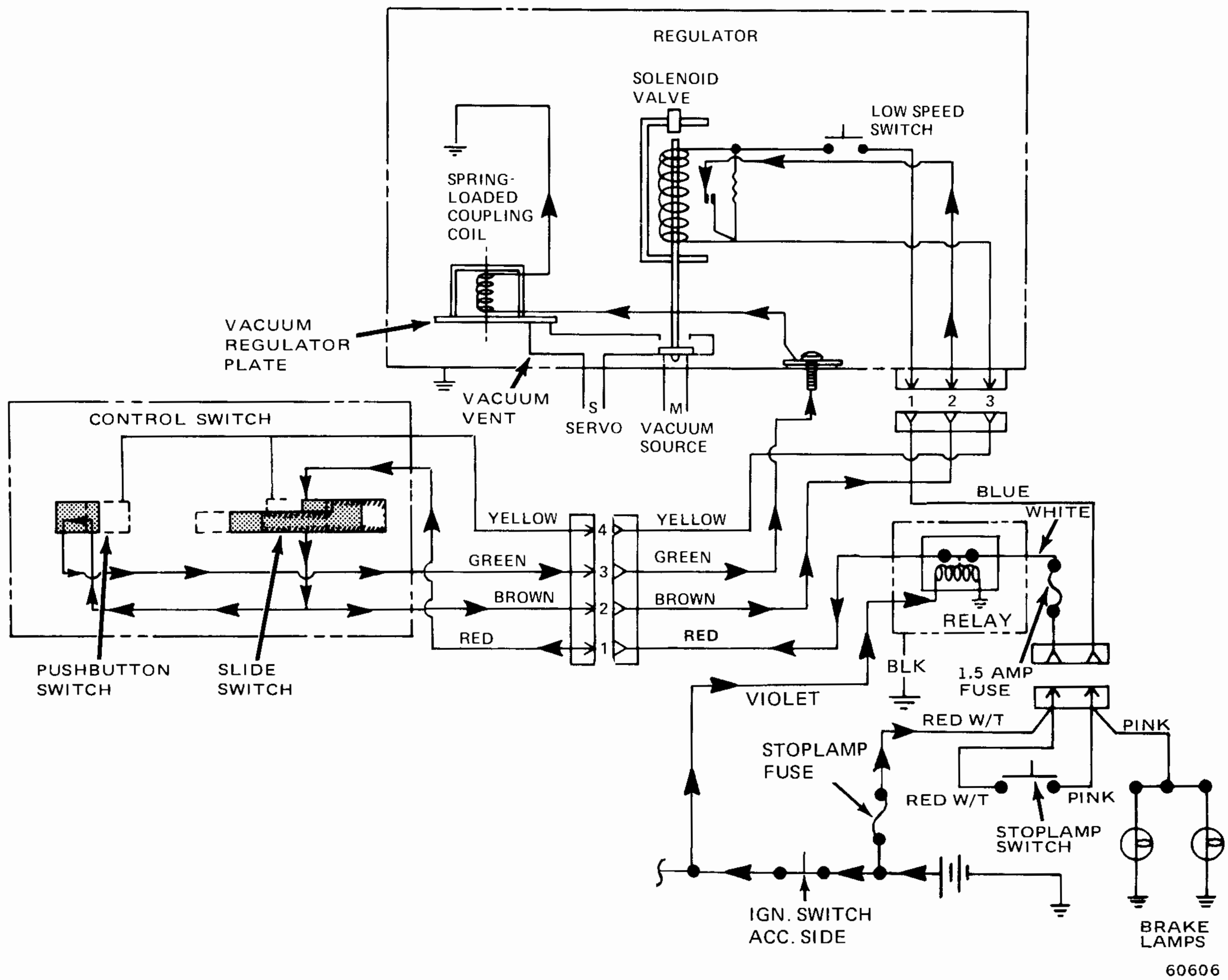

Fig. 3-108 Current Flow with Slide Switch in the ON Position

OPERATION

Once the vehicle has been started and the ignition turned to the ON position, the relay is energized and current is supplied to the control switch. The control switch now can be moved to the ON position, but the Cruise Command system will not operate until vehicle speed reaches about 30 mph (fig. 3-108). At this speed, the flyweights in the regulator have moved out far enough to close the low speed switch contacts. With the low speed switch closed, the current can be supplied to the solenoid valve coil.

The solenoid valve controls vacuum entering the regulator by sealing off the manifold vacuum port until the solenoid valve coil is energized.

With speed about 30 mph and the low speed switch closed, the solenoid valve coil can be energized by pressing the pushbutton. This passes current from the pushbutton switch to the solenoid valve coil. The current passes through the coil and the low speed switch and grounds at the brakelamps.

The current passing through the solenoid valve coil creates a magnetic field which draws a metal plunger in the center of the coil up to the top of the solenoid valve. This plunger opens the manifold vacuum port when it moves up into the solenoid valve and vacuum is applied to regulator passages.

In addition to opening the manifold vacuum port, the plunger completes the solenoid valve coil hold-in circuit. The metal plunger carries current supplied from the control switch when it is in the ON position. However, the current does not flow until the plunger moves up and contacts the solenoid valve metal mounting bracket. Then current flows from the plunger through the solenoid valve mounting bracket which is connected to one end of the solenoid valve coil. Current passes through coil and grounds at the brakelamps (fig. 3-109). In this way, the solenoid valve remains energized and the plunger is held off the manifold vacuum port.

NOTE: *The circuit completed through plunger and solenoid valve mounting bracket is illustrated in the circuitry diagrams as a pair of contacts to the right of the solenoid valve.*

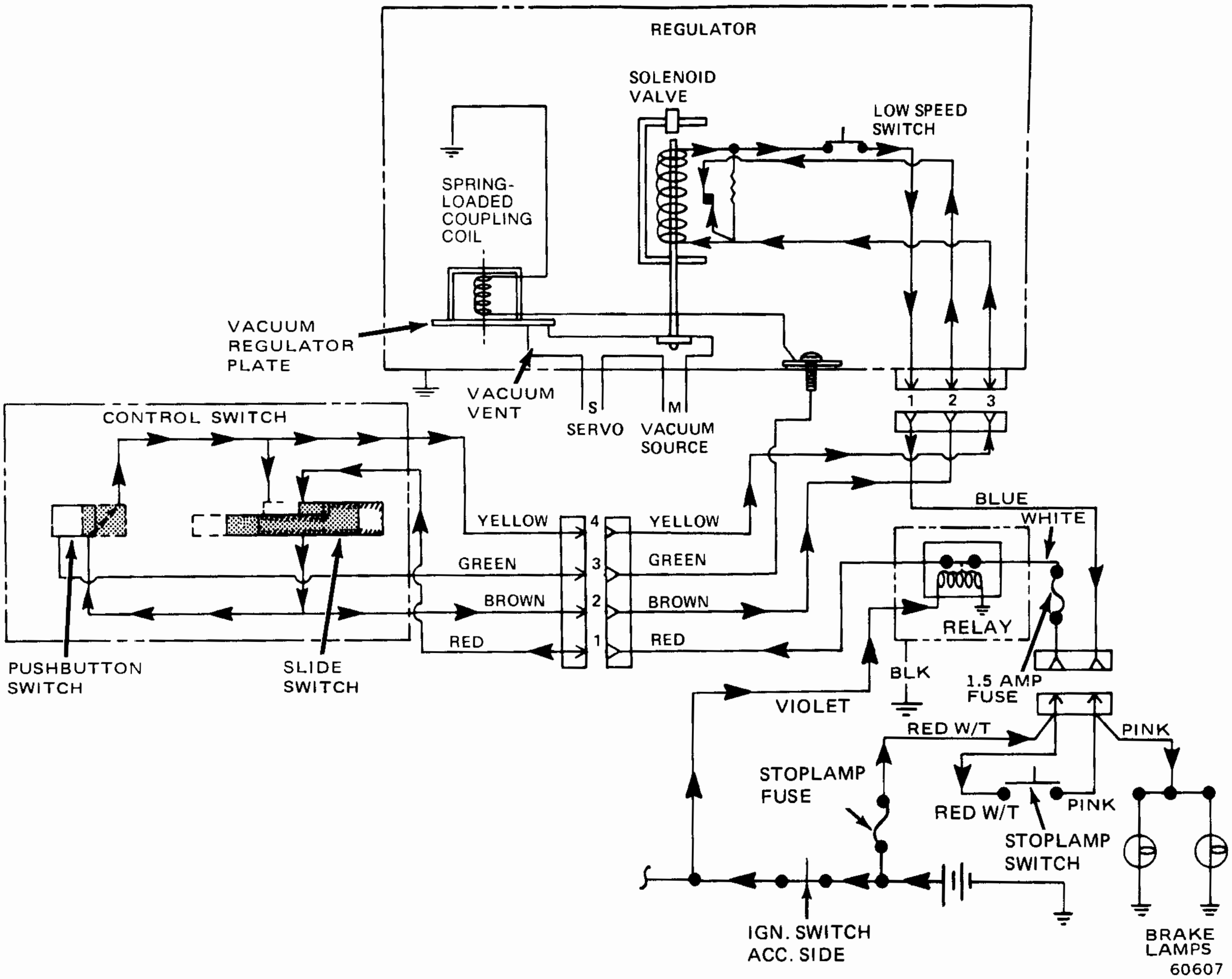

Fig. 3-109 Current Flow with Pushbutton Pressed

Once the pushbutton is released, vehicle speed is controlled by the coupling coil within the regulator. The coupling coil is connected to a pair of flyweights by the flyweight slide. The slide is moved back and forth by the flyweights which are driven by the speedometer cable. The flyweight slide causes the coupling coil to rotate clockwise or counterclockwise dependent upon whether the vehicle is accelerating or decelerating.

Located beneath the coupling coil is a metal flat washer. Attached to the washer is a thin plastic plate. This plate is positioned over a port which is part of the regulator vacuum passages. The port is the vent for vacuum applied to the servo. The plate regulates vacuum bleed-off by covering or uncovering the vacuum vent (fig. 3-109).

The vacuum regulator plate works in combination with the coupling coil to control vacuum supplied to the servo which operates the engine throttle. The coupling coil creates a magnetic field when energized. This field attracts the metal washer of the vacuum regulator plate and locks the plate and washer to the coupling coil.

As mentioned previously, the coupling coil is rotated by the back-and-forth movement of the flyweight slide as the flyweights move outward as the speedometer cable speed increases and inward as cable speed decreases. When speed decreases as in ascending a hill, the coupling coil rotates counterclockwise. This moves the vacuum regulator plate counterclockwise which completely covers the vacuum vent. With the vent sealed, more manifold vacuum is applied to the servo which opens the throttle further causing the car to gain speed. The speed increases until the set speed is attained.

When speed increases as in descending a hill, the coupling coil is rotated clockwise by flyweight movement. This moves the vacuum regulator plate clockwise which opens the vacuum vent and causes more vacuum bleed-off. Less vacuum is applied to the servo, throttle opening is reduced, and speed is lowered.

Two features of the vacuum regulator plate cause the system to maintain the desired, constant cruising speed. The vacuum regulator plate is notched. When

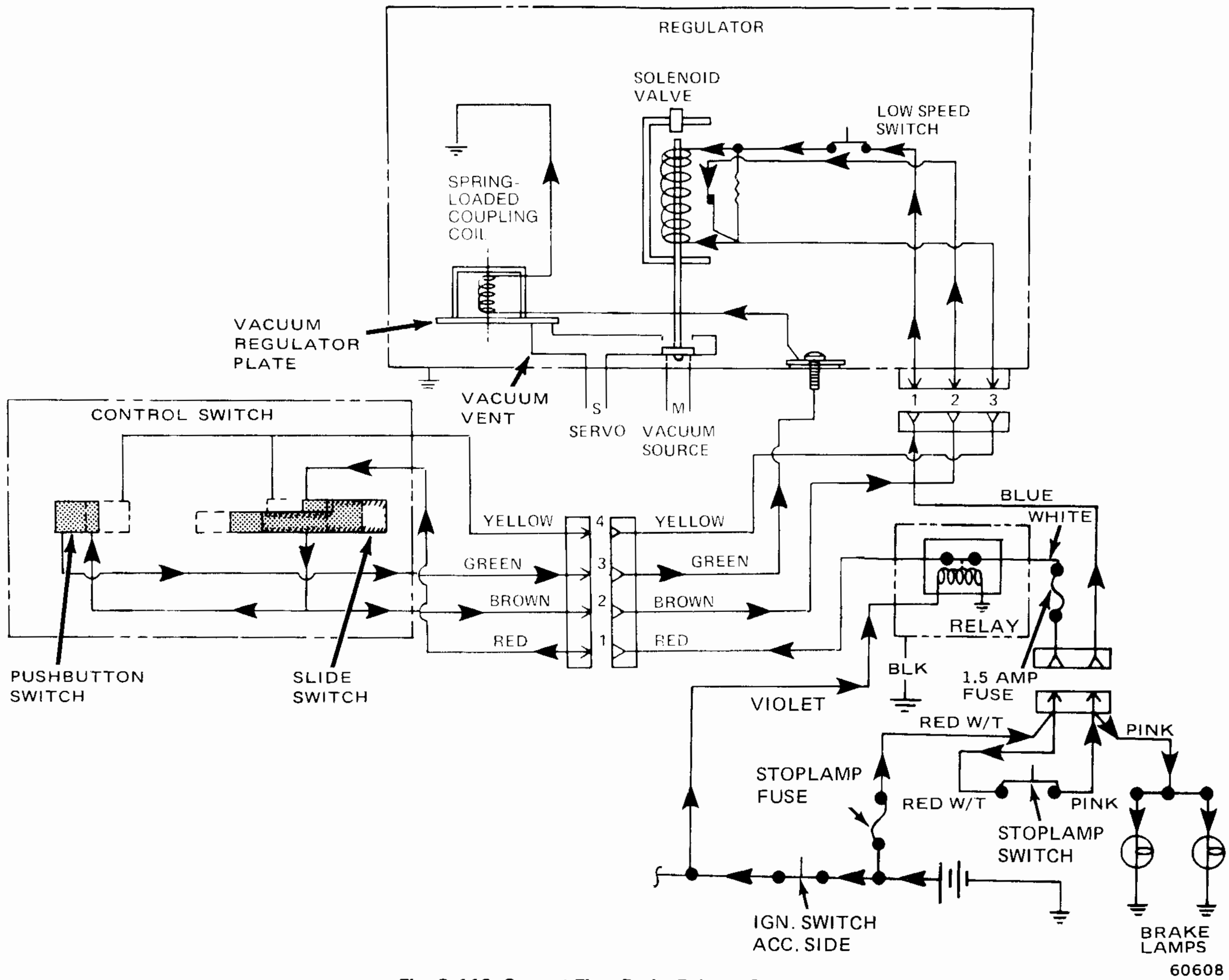

Fig. 3-110 Current Flow Brake Release Circuit

the plate is centered over the vacuum vent, the notch meters vacuum bleed-off.

The vacuum bleed-off is designed to be just enough to maintain a vacuum supply to the servo to overcome the throttle return spring and keep the throttle in a fixed position. The plate notch remains in a centered position due to spring wire attached to the plate. After accelerating or decelerating, the spring wire returns the plate to the centered position.

When the control switch is in the ON position, the coupling coil is energized through the pushbutton switch when it is not pressed. When the pushbutton is pressed (and car speed is above 30 mph), the pushbutton switch stops current flow to the coupling coil circuit and applies current to solenoid valve (fig. 3-109). With no current applied to the coupling coil, the vacuum regulator plate centers over the vacuum vent. Set speed is determined by the relationship of the coupling coil to the flyweight slide. When the pushbutton is released, the coupling coil is energized and the vacuum regulator plate and washer are locked to it. If speed increases, the plate decreases vacuum to the servo. If speed decreases, the plate increases vacuum to the servo. A constant speed is maintained since any change in flyweight speed rotates the coupling coil and vacuum regulator plate which increases or decreases vacuum to the servo.

When the brakes are applied, the solenoid valve is deenergized which seals off the manifold vacuum port and vacuum is lost in the system. The stoplamp switch applies voltage through the low speed switch to one end of the solenoid valve coil. This voltage opposes voltage already applied to the coil by the control switch (fig. 3-110). The opposing voltage causes current to stop flowing and the solenoid field collapses, allowing the plunger to drop and seal the manifold vacuum port.

The stoplamp switch does not affect the coupling coil. For this reason, the vehicle accelerates back to set speed when the control switch is moved to the RES or RESUME position after braking.

When the control switch is moved to the RESUME position, current flows from the control switch through the low speed switch to the solenoid valve coil. The solenoid valve is energized in the same way as when the pushbutton is pressed. The solenoid valve

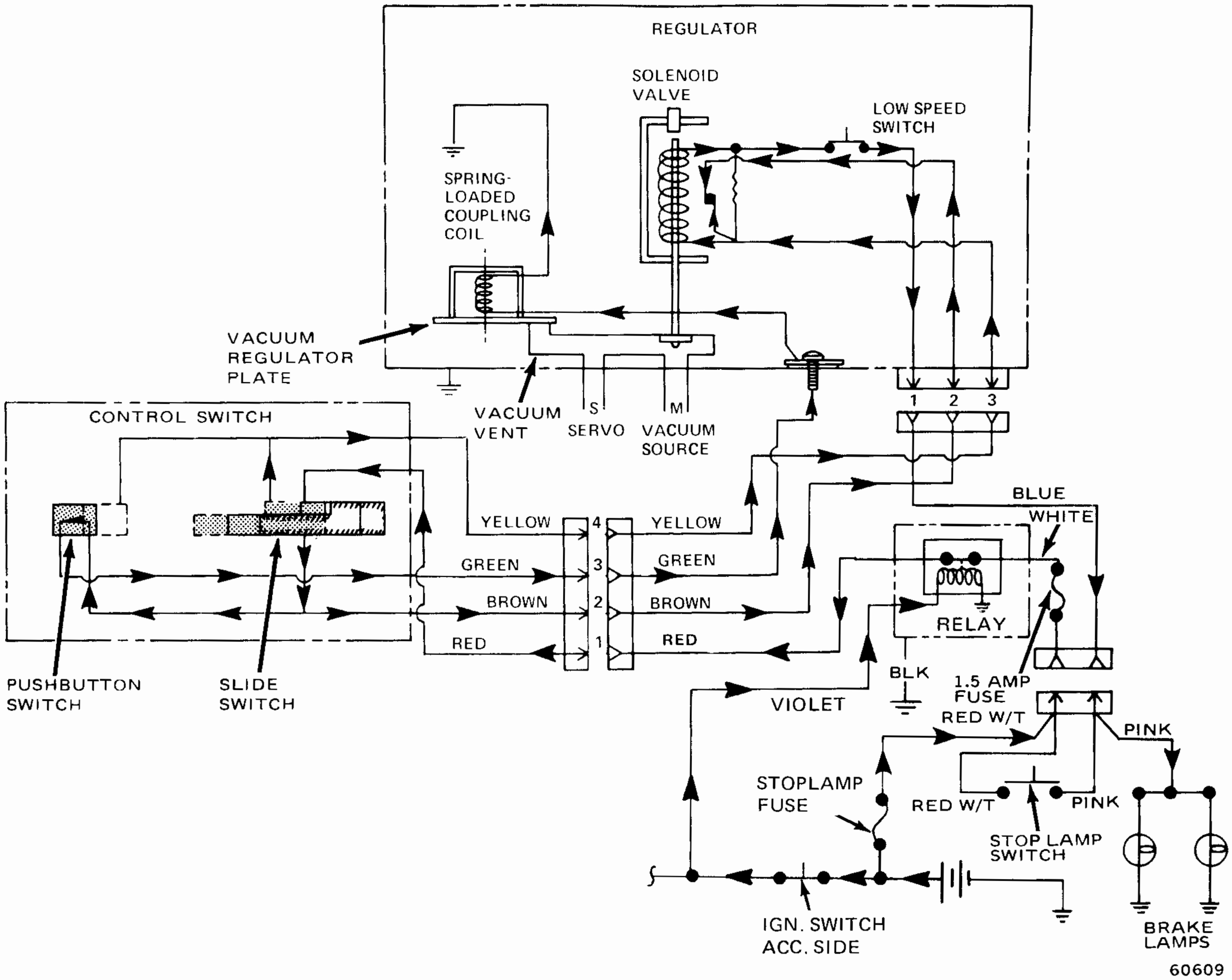

Fig. 3-111 Current Flow with Slide Switch in RESUME Position

lifts the solenoid plunger which completees the hold-in circuit and opens the manifold vacuum port (fig. 3-111).

Since the coupling coil is not de-energized during braking, the vehicle begins to accelerate once the solenoid valve is energized during resume mode. This occurs because of the decrease in speedometer cable speed due to braking, which causes the flyweights to move inward. The flyweight slide moves back and rotates the coupling coil counterclockwise. This moves the vacuum regulator plate over the vacuum vent which applied more vacuum to the servo and produces acceleration until set speed is attained. Then the vacuum regulator plate again maintains the constant set speed.

ADJUSTMENTS

Vacuum Servo Chain Linkage Adjustment

IMPORTANT: Prior to adjusting the servo chain, the carburetor throttle must be at idle position, throttle stop solenoid disconnected, and choke valve fully open.

To install the vacuum servo chain, insert the chain in the vacuum servo hook.

Stretch the chain linkage to the carburetor until the chain is fully extended, the clevis pin hole should align with the hole in the carburetor throttle lever. If it does not, adjust the chain at the servo hook, one ball at a time, until a free pin fit is obtained. When properly adjusted, the chain must be as tight as possible and still allow the throttle to return to an idle with the throttle stop solenoid (if equipped) disconnected.

After the servo chain has been properly adjusted, bend the servo hook tabs together. The chain must be free in the hook after bending the tabs.

Do not use any type of lubrication on the chain guide and pulley assembly.

Damaged Speedometer Cables and Gears

Refer to Speedometer section.

Centering Spring Adjustment

The Cruise Command system is designed to maintain, within 3 mph, the speed selected by the driver.

Check operation of the system at 50 mph. Adjustment is made by turning the centering spring adjustment screw.

If speed control holds speed three or more mph higher than selected speed, turn centering spring adjusting screw, "C" toward "S" 1/32 inch or less; if speed is three or more mph below selected speed, turn centering spring adjusting screw, toward "F", 1/32 inch or less (fig. 3-112).

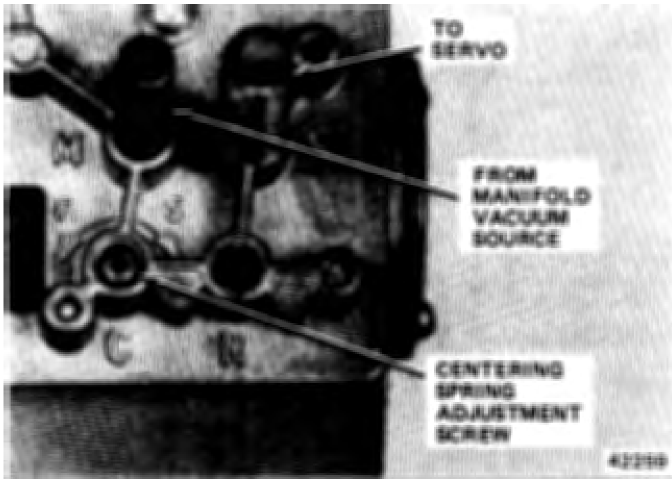

Fig. 3-112 Centering Spring Adjustment

NOTE: *The centering adjustment is extremely sensitive and must never be turned more than one-eight turn in either direction. If the centering adjustment is not correct, the "zero" starting point can be found as follows:*

(1) Remove regulator cover to view adjustment cam.

(2) Insert allen wrench in adjustment screw on outside of housing.

(3) Turn adjustment screw until pin on eccentric faces toward the center of housing.

(4) Install regulator cover.

TROUBLESHOOTING

For troubleshooting of the Cruise Command system, refer to the Cruise Command Diagnosis Guide.

TESTING

The following tests should be performed as part of the diagnosis to determine the cause of the malfunction and the correction required.

NOTE: *Whenever a unit is disconnected for testing, it should be reconnected before the next unit is tested.*

Control Switch Continuity Test

To test control switch operation, connect an ohmmeter or test lamp to the control switch wire harness connector at the steering column. Refer to the Control Switch Continuity Chart for wire connections and switch positions.

Control Switch Circuitry

Switch Wire Continuity	Slide Switch			Pushbutton Depressed Slide Switch On
	Off	On	Resume	
Red/Brown	Open	Closed	Closed	Closed
Red/Green	Open	Closed	Closed	Open
Red/Yellow	Open	Open	Closed	Closed

Note: Pushbutton cannot be depressed with slide switch in resume position.

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Circuitry Tests

It is not always necessary to remove the regulator in case of inoperative Cruise Command. The following checks should be performed as part of the diagnosis to determine the cause and correction of Cruise Command trouble. Refer to figure 3-113.

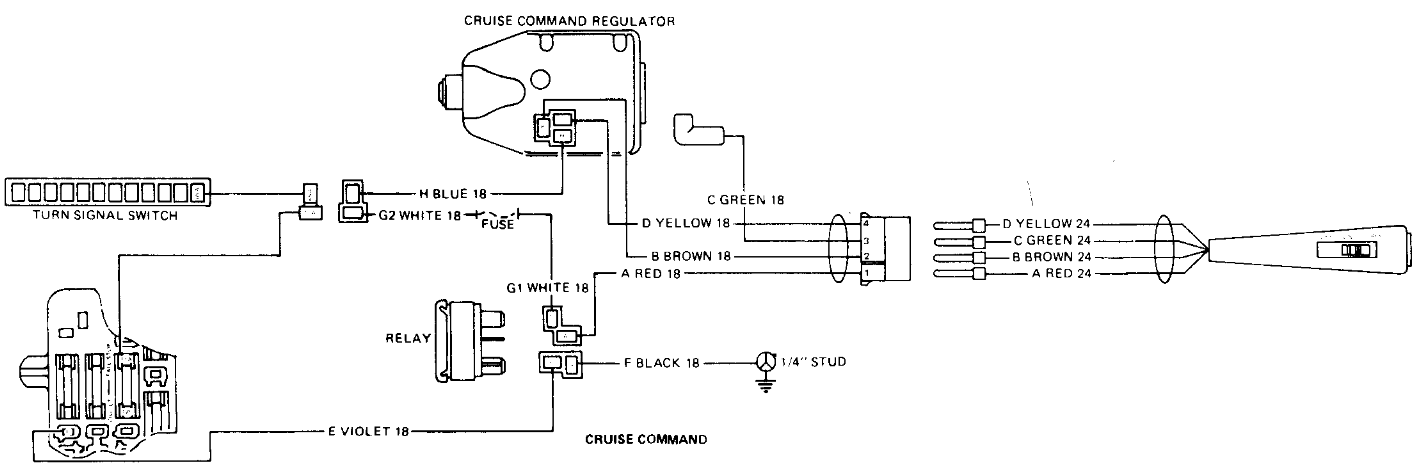

Fig. 3-113 Cruise Command Schematic

Cruise Command Diagnosis Guide

Condition	Possible Cause	Correction
BLOWING FUSES	(1) Short or ground in Cruise Command wiring circuit.	(1) Perform electrical checks.
CRUISE COMMAND DOES NOT ENGAGE	(1) Cruise Command harness fuse burned out.	(1) Check for cause. Replace fuse 1.5 amp only).
	(2) Faulty brake lamp switch.	(2) Replace brake lamp switch.
	(3) No current to brown wire.	(3) Check for loose connection or repair wiring harness.
	(4) Vacuum leak.	(4) Repair leak.
	(5) Bad regulator ground.	(5) Check regulator for ground (use ohmmeter—check from regulator to mounting bracket).
	(6) Faulty connections.	(6) Check connections, repair as necessary.
	(7) Brake lamp fuse burned out.	(7) Check for cause and repair, replace fuse.
	(8) Brake lamp bulb burned out.	(8) Replace bulb.
	(9) Control switch inoperative.	(9) See Circuitry Tests—steps (8) through (15).
	(10) Faulty regulator.	(10) After all electrical checks, replace regulator.
CRUISE COMMAND DOES NOT DISENGAGE WHEN BRAKE IS APPLIED	(1) Defective brake lamp switch (open).	(1) Replace brake lamp switch.
	(2) Collapsed hose from servo to regulator.	(2) Replace hose.
RE-ENGAGES WHEN BRAKE IS RELEASED	(1) Faulty control switch.	(1) Replace control switch.
	(2) Check wiring for proper location in connectors.	(2) Correct wiring location.
CARBURETOR DOES NOT RETURN TO NORMAL IDLE OR PULSATING ACCELERATOR PEDAL	(1) Improper throttle chain linkage adjustment.	(1) Adjust throttle chain linkage.
	(2) Speedometer cable or drive cable kinked or lack of lubrication.	(2) Lubricate cable, including tips, or replace cable if necessary.

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Cruise Command Diagnosis Guide (Continued)

Condition	Possible Cause	Correction
SPEEDOMETER INOPERATIVE AND CRUISE COMMAND OPERATES	(1) Speedometer cable not driving speedometer.	(1) Check for broken cable or loose connections.
	(2) Faulty regulator.	(2) Replace regulator as necessary.
NEITHER SPEEDOMETER NOR CRUISE COMMAND OPERATES	(1) Transmission cable not driving regulator.	(1) Check for broken cable or loose connections.
VEHICLE ACCELERATES OR DECELERATES MORE THAN 3 MPH AFTER PRESSING CONTROL SWITCH PUSHBUTTON	(1) Regulator out of adjustment.	(1) Refer to Centering Spring Adjustment.
	(2) Open in green to regulator.	(2) Check green wire from control switch to regulator.
	(3) Incorrect wiring.	(3) Refer to wiring diagram.
ENGINE ACCELERATES WHEN STARTED	(1) Vacuum hoses reversed at regulator.	(1) Check for proper connections.
SYSTEM DISENGAGES ON LEVEL ROAD WITHOUT APPLYING BRAKE	(1) Loose wiring connections or poor ground.	(1) Tighten connection and check ground.
	(2) Loose hoses.	(2) Check hose connections.
	(3) Servo linkage chain broken or throttle clevis slipped.	(3) Repair chain or install clevis.
ERRATIC OPERATION OF CRUISE COMMAND	(1) Check vacuum servo or vacuum hose.	(1) Replace servo or vacuum hose.
	(2) Faulty wiring.	(2) Perform circuitry tests.
	(3) Faulty regulator.	(3) Replace regulator as necessary.

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(1) Disconnect push-on connectors (single and triple) at regulator.

(2) Turn ignition switch to ACCESSORY position.

(3) Move slide switch to the ON position.

(4) Using a 12-volt test lamp, ground one test lamp lead and touch the other lead to the brown wire and then the green wire at the connectors. Test lamp should light. If test lamp does not light on brown wire, check fuse, automatic speed control relay, engagement switch, and connection at power source. If test lamp does not light on green wire, check engagement switch and connections at power source, automatic speed control relay and brake light switch.

(5) Push SET SPEED button all the way in and hold. Ground one test lamp lead and touch the other lead to each wire connector. Test lamp should light on the brown and yellow wires and should not light on the green or blue wire.

(6) Release SET SPEED switch button.

(7) Move slide switch to RES position and hold. Ground one test lamp lead and touch the other lead to each wire in the connector. Test bulb should light on all wires except the blue wire (blue connects to turn signal side of turn signal switch). To make an independent check of the engagement switch before removal from the car, disconnect switch from wiring

harness, at the multiple connector in passenger compartment, and make the following checks (omit steps (8) through (15) if steps (1) through (7) check out).

(8) Attach a jumper wire from a 12-volt power source to red lead of the engagement switch.

(9) Move slide switch to OFF position.

(10) Using test lamp, ground one test lamp lead and touch the other lead, in turn, to brown wire, green wire, and yellow wire. Test lamp should not light on any of these wires.

(11) Move slide switch to ON position.

(12) Touch test lamp lead to the brown wire and then green wire. Test lamp should light on each of these wires. Touch lead to the yellow wire. Lamp should not light.

(13) Push SET SPEED all the way in and hold. Test lamp should light on brown wire and on yellow wire. Test lamp should not light on green wire.

(14) Release SET SPEED switch button.

(15) Move slide switch to RES position and hold. Touch test lamp lead, in turn, to brown wire, yellow wire, and then to light green wire. Test lamp should light.

NOTE: *If steps (1) through (7) do not check out and steps (8) through (15) do check out, replace Cruise Command wire harness. If steps (8) through (15) do not check out, replace engagement switch.*

Brake Release Test

The brake release switch is part of the stoplamp switch. To test the brake release switch, observe the stoplamps. Stoplamps should light when brake pedal is pressed one-quarter inch or more.

NOTE: *If the Cruise Command is to disengage, when stepping on the brake, the stoplamp circuit must not be grounded. Correct any stoplamp problem before proceeding. Check for burned out bulbs, improper ground connections, open or grounded circuits in the brake release switch or wire harness.*

NOTE: *Use of Hazard Warning lights prevents Cruise Command system from engaging.*

(1) Test brake release switch at regulator.

(2) Check all harness connections for proper fit.

(3) Disconnect three-wire connector at regulator.

(4) Connect one side of test lamp to ground and other to blue wire. Test lamp should not light.

(5) Press brake pedal 1/4 inch. Test lamp should light. If test lamp does not light, check power source fuse, stoplamp switch, and wire harness to regulator to locate problem.

Automatic Speed Control Relay Test

The automatic speed control relay is located next to the steering column and near dash panel.

NOTE: *Check all connections prior to testing.*

(1) Turn ignition switch and slide switch to ON position.

(2) Using a test lamp, ground one lead and touch other lead to each individual connector at relay. Test lamp should light. If test lamp does not light on the red but lights on the white and violet connectors, replace relay. If test lamp does not light on the white and violet wires, check power source, fuse, and wire harness.

CONTROL SWITCH REPLACEMENT

The Cruise Command control switch is part of the turn signal lever. The switch is not repairable. The switch and harness are serviced only as a unit.

Removal

(1) Remove the following:
- Horn button insert
- Steering wheel
- Anti-theft cover
- Locking plate and horn contact

(2) Remove turn signal lever (allow handle to hang loose outside steering column).

(3) Remove four-way flasher knob.

(4) Remove holddown screws and turn signal switch.

(5) Remove trim piece from under steering column.

(6) Disconnect four-wire connector.

(7) *Tilt Column*—Remove harness from plastic connector. Tape two of the four wires back along the harness (to allow a smaller diameter) and tape a string to the harness.

(8) *Standard Column*—Tie or tape a string to the plastic connector.

(9) Remove lever and harness assembly from column.

Installation

(1) Check new Cruise Command control switch by connecting to plastic connector before installing in steering column. Refer to Control Switch and Harness Test.

NOTE: *When installing the harness, be sure to feed the harness through the turn signal lever opening as the handle will not fit through the opening.*

(2) *Tilt-Column*—Tape two of the leads back along the harness and tape the harness to the string that was attached to the original harness before removal.

(3) Pull replacement harness down through the steering column. On the Tilt Column, the harness must pass through the hole on the left side of the steering shaft.

(4) Install turn signal switch and four-way flasher knob.

(5) Install Cruise Command lever.

(6) Install horn contact, locking plate, and lockring anti-theft cover.

(7) Install steering wheel and horn button insert.

(8) Install trim on steering column.

TRAILER TOWING PACKAGES

GENERAL

The schematics for the light and heavy-duty towing packages are shown at the rear of this manual.

CAUTION: *If a trailer is equipped with a fully charged battery and the battery on the towing vehicle is dead, do not attempt to start the towing vehicle unless the trailer connector is disconnected. Attempting to use the trailer battery for starting will damage the trailer connector.*

Class 1 and 2 Package

The trailer connector is connected into the existing frame harness. This type of package requires the use of heavy-duty flashers for both turn and Hazard Warning flashers. The maximum amount of bulbs to be used on the trailer are:

- Four taillamp bulbs
- One license plate lamp bulb
- One set of directional signal lamp bulbs

All bulbs are to be the same size as the towing vehicle. The original equipment flashers must be installed when the trailer is not in use.

Class 3 and 4 Package

This type of package does not require the use of heavy-duty flashers. Three relays, fed through a 10-amp circuit breaker, carry the load to the trailer. The left and right turn and taillamp circuits are used only to trigger the relays and do not carry any of the trailer load.

Electrical Specifications

ALTERNATOR – V-8 ENGINES

Make	Motorcraft
Standard – All except Camper	40 amp
– Camper Truck	60 amp
Optional – Required with Heated Backlight, Air Conditioning, Cold Climate Group	60 amp
Rotation	CW @ Drive End
Field Current	2.5 - 3.0 amp
Pulley Size	2.62 inches

VOLTAGE REGULATOR – V-8 ENGINES

Make	Motorcraft
Type	Electro-mechanical
Adjustment	None

Regulator Temperature	Acceptable Voltage Range
0 - 50°F	14.8 - 14.1
50-100°F	14.5 - 13.7
100 - 150°F	14.2 - 13.4
150 - 200°F	13.8 - 13.1

ALTERNATOR – SIX-CYLINDER ENGINES

Make	Delco-Remy
Rating	
Standard	37 amp
A/C Optional – Required with Heated Backlight and Cold Climate Group	63 amp
Rotation Viewing Drive End	Clockwise
Field Current	4.0 - 4.5 amps at 12V, at 80°F
Pulley Size	2.62 inches

VOLTAGE REGULATOR – SIX-CYLINDER ENGINES

Make	Delco-Remy
Model	1116387
Type	Solid State
Adjustment	None

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Electrical Specifications (Continued)

IGNITION SYSTEM

Sensor

Resistance: 1.6 to 2.4 ohms at 77°F to 200°F. Use accurate ohm-meter and check across sensor lead terminals.

Coil

Primary Resistance	1 to 2 ohms
Secondary Resistance	9,000 to 15,000 ohms
Open Circuit Output	20 kv minimum

STARTER MOTOR

Brush Length	0.50 inch
Wear Limit	0.25 inch
Brush Spring Tension	40 oz
Free Speed (No Load Test)	
Volts	12.0
Amperes	65
RPM	9250 max
Lock Test - pounds (max)	
600 Amperes @ 3.4 Volts	13 foot-pounds min
Minimum Voltage to Seat Pole Shoe and Complete Pinion Engagement	7.2 volts
Contact Point Clearance	0.020 - 0.100 inch (0.060 desired)

FUSE CHART

FUSE CHART	CJ Models	Cherokee-Wagoneer-Truck
Air Conditioner/Heater	25	25 amp
Backup Lamps/Cigar Lighter	15	15 amp
Tail and Stop Lamps/Cruise Control	20 amp	20 amp
Cluster Feed/Brake Failure/Parking Brake Warning	3	3 amp
Directional Signal/Windshield Wiper-Washer	10 amp	10 amp
Electric Tailgate Window/Defogger	—	(2) Circuit Breaker (30 amp)
Headlamps	Circuit Breaker (25 amp)	Circuit Breaker (25 amp)
Panel Lights	3 amp	3 amp
Radio	10 amp (5 amp In Line)	10 amp (5 amp In Line)

BULB CHART

BULB CHART	CJ Models	Cherokee-Wagoneer-Truck
Front Lamps		
Headlamp	6014	6014
Side Marker	194	194
Parking and Directional	1157	1157 (1157 NA-Wag.)
Rear Lamps		
Backup Lamp	1156	1156
License Lamp	—	(97-Truck Only)
Side Marker	194	194
Stop, Tail and Directional	1157	1157
Indicator Lamps		
Brake Failure/Parking Brake Warning	53	158
Directional Signals	53	158
High Beam	53	158
Quadra-Trac Emerg. Drive	53	158
Vehicle Interior		
Ammeter	—	158
Ashtray	—	1445
Clock	1816	1816
Column Light (Auto. Trans.)	1816	1816
Courtesy	89	89
Directional Signal Flasher (Tung Sol or equivalent)	224	224
Dome	—	212
Glove Box	—	1891
Hazard Warning Flasher (Tung Sol or equivalent)	552	552
Headlamps/Wiper-Washer	*	*
Heater Controls	*	1815
Instrument Cluster	53	158
Oil Pressure Gauge	1895	158
Radio	1893	1892
Tachometer	1895	—
Voltmeter	1895	—

*Replaced as unit

60603B

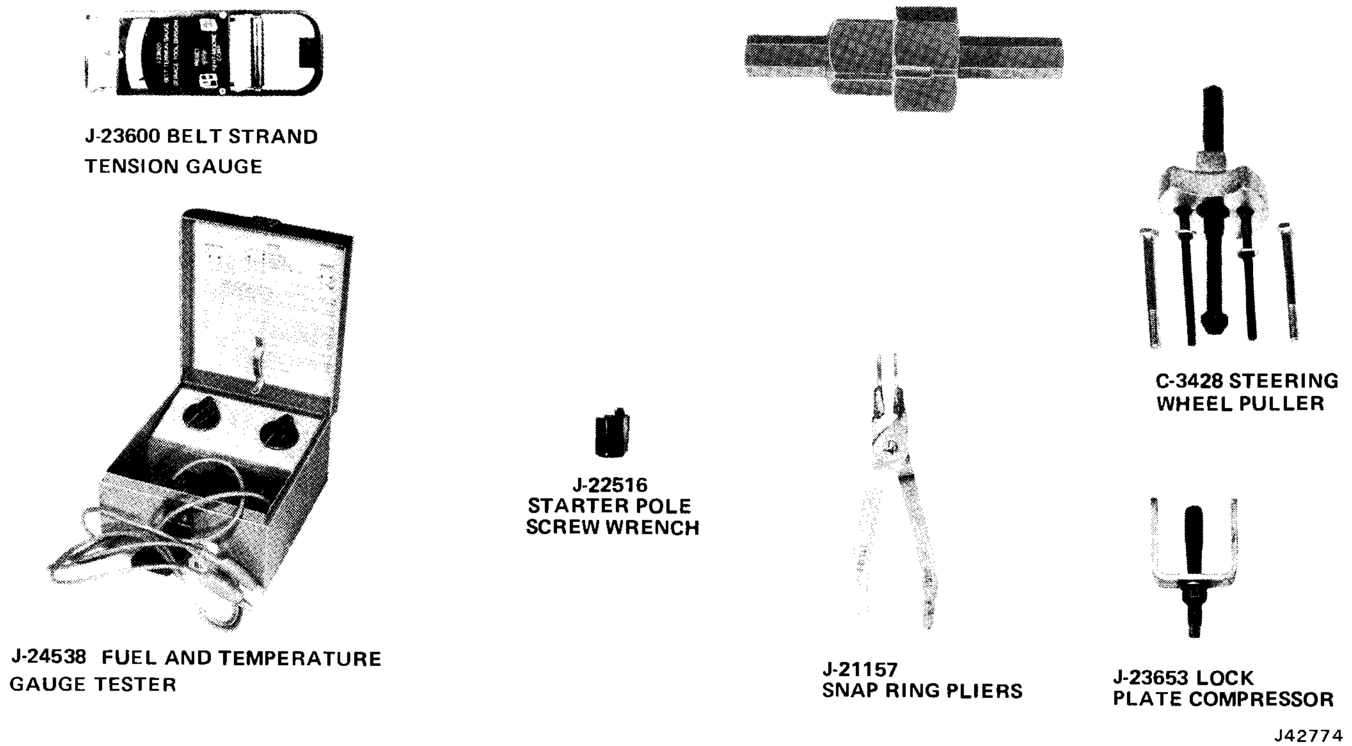
Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Alternator Adjusting Bolt	28	20-35
Alternator Mounting Bracket Bolt to Engine	28	23-30
Alternator Pivot Bolt or Nut	18	15-20
Battery Holddown Bolt	60-70 in-lb	50-90 in-lb
Bolt, Fan (Alternator)	10-15	10-18
Directional Signal Switch Handle Screw	20-30 in-lb 10-15	15-30 in-lb 10-18
Hazard Warning Knob Mounting Screws	2-5 in-lb	2-5 in-lb
Speedometer Cable to TCS Switch	120-130 in-lb	115-175 in-lb
Spark Plug	25-30	22-35
Starter Motor to Clutch or Converter Housing	18	13-25
Starter Motor Through Bolts	65 in-lb	55-75 in-lb
Starter Motor to Bell Housing	18	13-25
Starter Solenoid Terminal Nuts (5/16-inch Stud Nut)	50-60 in-lb	40-70 in-lb
Steering Wheel Nut	15-20	15-25

All torque values given in foot-pounds with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

60604



Special Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

FUEL—CARBURETION

FUEL SYSTEM

GENERAL

New service specifications and applications for all Model YF, Model 2100 and Model 4350 carburetors are presented in this section. The desired adjustment setting is now accompanied by a tolerance which may be used when making adjustments on a carburetor not functioning in an acceptable manner.

AIR CLEANER

The air cleaner element assembly consists of a paper cartridge and a polyurethane element (fig. 4-1).

In order for the air cleaner to function properly, it must be serviced periodically. A dirty element will restrict airflow to the carburetor and create an overly rich mixture. It will also cause excessive fuel consumption and become unable to filter dust and dirt which can lead to abnormal wear of the moving parts of the engine.

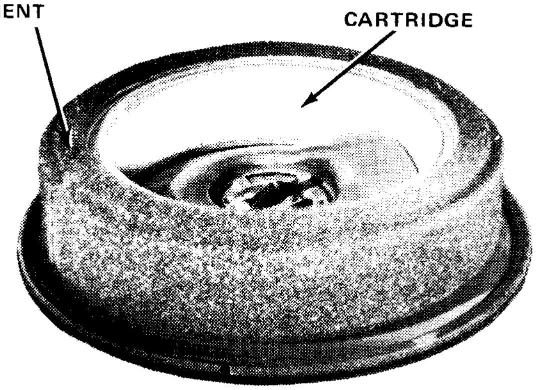


Fig. 4-1 Air Cleaner Element

The air cleaner should be serviced in accordance with the instruction decal attached. However, where no decal is present, service the air cleaner as follows:

Clean the air cleaner element assembly every 5,000 miles on Cherokee, Wagoneer, and Truck models. Replace the element every 15,000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models. If the vehicle is operated under dusty conditions, check the condition of the air cleaner element assembly more frequently and service if dirty.

To clean the polyurethane element, first carefully remove it from the paper cartridge and wash it in solvent. Wrap the element in a clean, dry cloth and squeeze to remove all possible solvent. Do not wring the element as it may tear.

To clean the paper cartridge, first shake out accumulated dirt—DO NOT WASH. Use compressed air and carefully blow through the element in the reverse direction of normal airflow.

After cleaning, oil the polyurethane element liberally with engine oil (SAE 10W 30) and squeeze to evenly distribute the oil through the element and to remove excess oil. The element should be slightly dampened with oil. Install the polyurethane element on the paper cartridge with the edges of the polyurethane element over the plastic end plates of the paper cartridge.

Replace the air cleaner paper cartridge more frequently if there is any apparent damage or evidence of plugging. At the same time, inspect the polyurethane element and replace it if torn or otherwise damaged.

FUEL FILTERS

All carburetors are protected against the entry of dirt and other foreign matter through the fuel inlet by a replaceable 15-micron, pleated paper filter which is located in the carburetor fuel inlet line and is secured by two short rubber hoses and clamps. The filter should be replaced every 15,000 miles.

All models have a fuel return system for 1976 (refer to Fuel Return System section) which requires an extra nipple on the fuel filter to route excess vapor back to the fuel tank.

All vehicles use a woven Saran sleeve-type filter which is attached to the end of the fuel outlet tube inside the fuel tank. This filter is rated at 65 microns and repels water. Under normal conditions it requires no maintenance or service.

FUEL TANK

The fuel tank on Cherokee, Wagoneer, and Truck models is suspended from the frame by a single steel strap and front and rear brackets. On CJ-5 and CJ-7 Models the fuel tank is attached to the frame by brackets and bolts. The brackets are attached to the tank at the seam flange. The various fuel tank and venting arrangements used on California vehicles are illustrated in figures 4-2, 4-3, 4-4, and 4-5. Nationwide vehicles, except California vehicles, use the same tank design without vapor vent lines or liquid check valve.

The fuel tank is an external expansion type. Fuel tank venting for CJ models and all California vehicles is accomplished by vapor lines which lead to a liquid check valve. The vapor lines are located so that during any inclination of the vehicle at least one line will be open. Venting for all other vehicles is through the fuel tank filler cap.

Fuel Tank Sending Unit

This assembly utilizes a float pivoted to an electrical contact that rides on a wire resistance element to electrically signal the fuel gauge, indicating the level of fuel in the fuel tank.

Fuel pickup and fuel return system nipples, and the sending wire connection are mounted on the sending unit mounting cover which is secured to the fuel tank with a locking ring.

To replace the fuel sending unit, the fuel tank must be removed.

Fuel Tank Filler Tube

The filler neck on all CJ models incorporates a restrictor to prevent entry of nozzles used on leaded fuel gasoline station pumps. The restrictor reduces the size of the filler neck to a small opening which is covered by a trap door (fig. 4-6). When a small diameter unleaded fuel pump nozzle is inserted into the filler neck, this nozzle can pass through the restrictor opening, push open the restrictor trap door, and the fuel tank can be refilled. In this way, catalytic converter contamination due to leaded fuel can be prevented.

All CJ models are designed to use unleaded fuel even though only some CJ models have catalytic converters.

The filler tube opening is located at the right rear body panel on CJ-5 and CJ-7 models. On all other vehicles, except Trucks, the filler tube opening is located at the left rear quarter panel. On Truck models it is located at the left side of the pickup box.

The filler tube is connected to the fuel tank inlet by a rubber hose and secured with clamps.

All fuel tanks are equipped with a filler tube vent hose which extends from the filler tube to a fitting at the top of the tank. The purpose of this vent is to provide easier filling by relieving the air displaced as the tank is filled.

Fuel Tank Filler Cap—California Cherokee, Wagoneer, Truck, and all CJ Models

The filler cap incorporates a two-way relief valve which is closed to atmosphere under normal operating conditions. The relief valve is calibrated to open only when a pressure of 0.75 to 1.5 psi or a vacuum of 1.1 to 1.8 inches of Hg occurs within the tank. When the pressure or vacuum is relieved, the valve returns to the normally closed position.

Fuel Tank Filler Cap—Nationwide (Except California)

This filler cap is vented externally since these vehicles do not have a closed fuel tank vent system.

Fuel Tank Vent—California Cherokee, Wagoneer, Truck and All CJ Models

A closed fuel tank vent system prevents raw fuel vapor from entering the atmosphere. Fuel vapor from the tank is routed through the vent lines at the top of the tank to a liquid check valve (fig. 4-7).

The liquid check valve incorporates a float and Viton needle assembly. In the event that liquid fuel enters the check valve, the float will rise and force the needle upward to close the vent passage and prevent fuel flow through the valve.

After passing through the check valve, the fuel vapor is routed forward through a vent line to a charcoal canister in the engine compartment.

The fuel vapors are then drawn into the air cleaner snorkel and burned along with the fuel-air mixture.

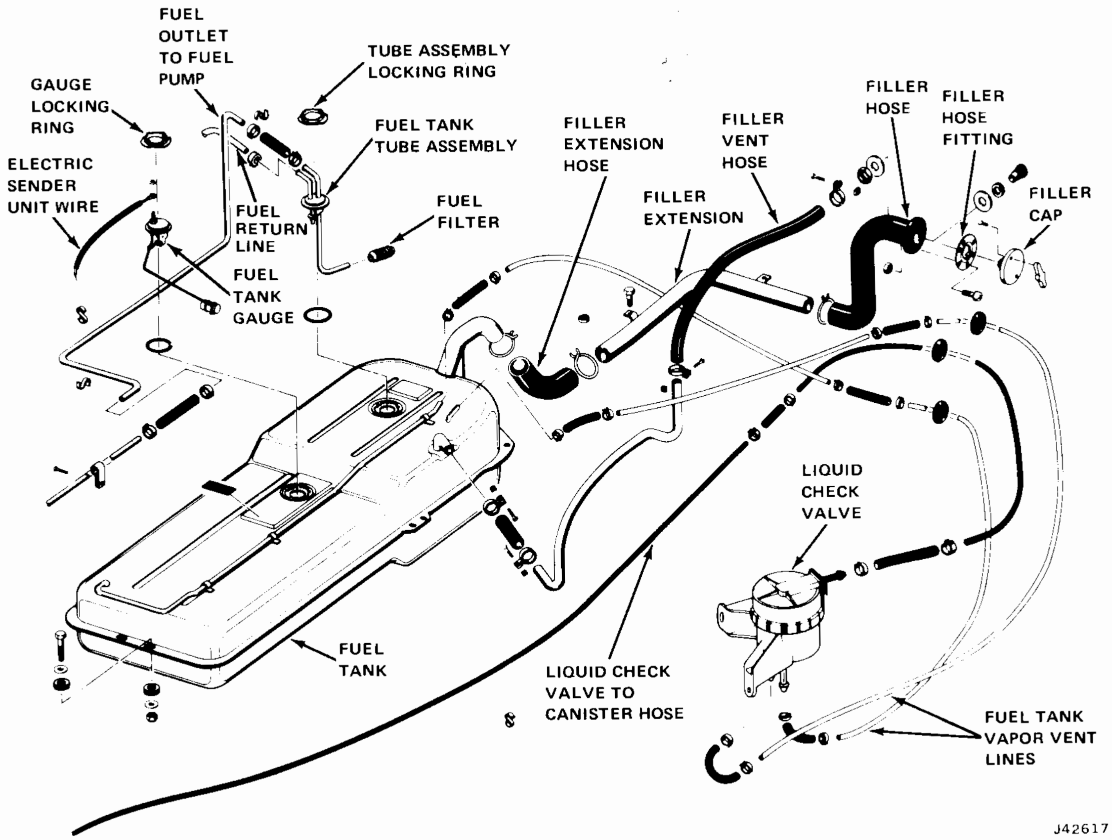


Fig. 4-2 Fuel Tank and Vent Lines—Cherokee and Wagoneer

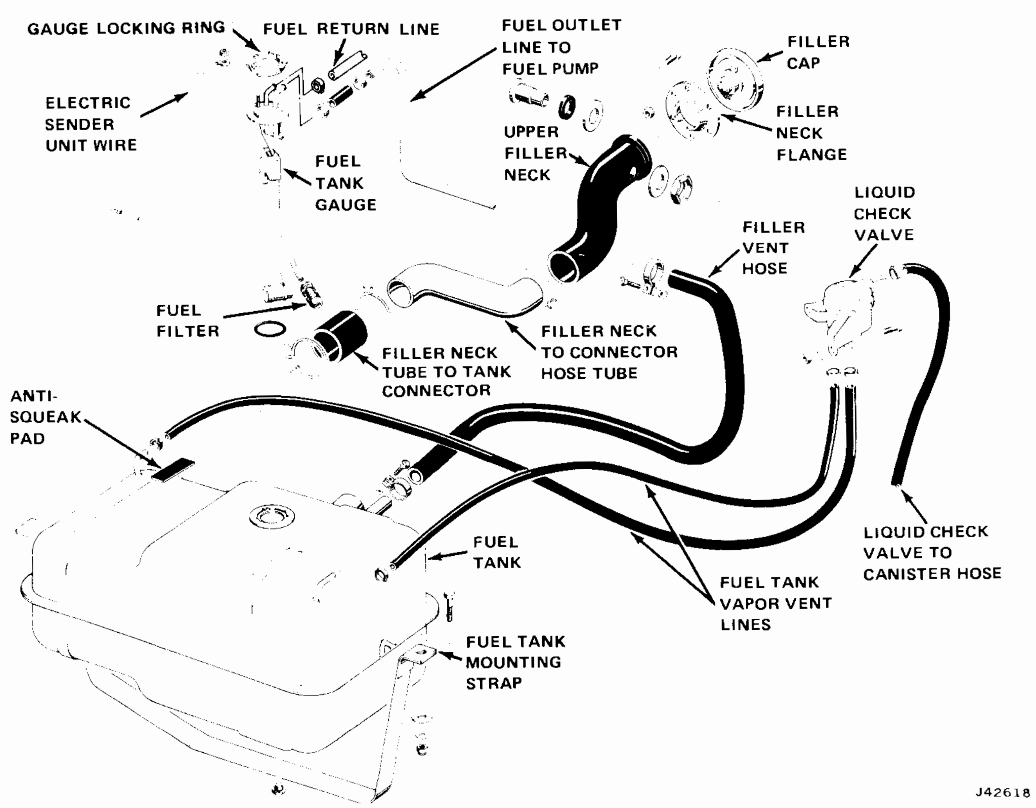


Fig. 4-3 Fuel Tank and Vent Lines—Truck (Townside)

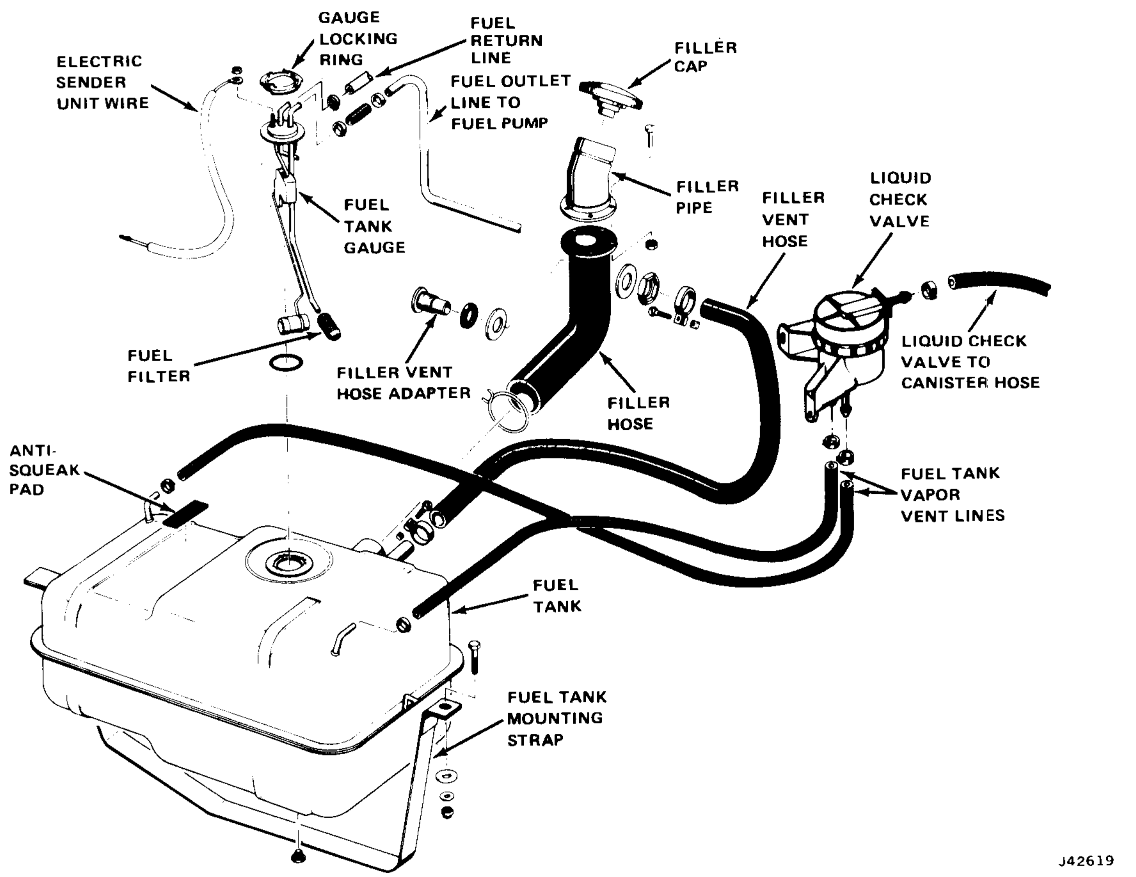


Fig. 4-4 Fuel Tank and Vent Lines—Truck (Thriftside)

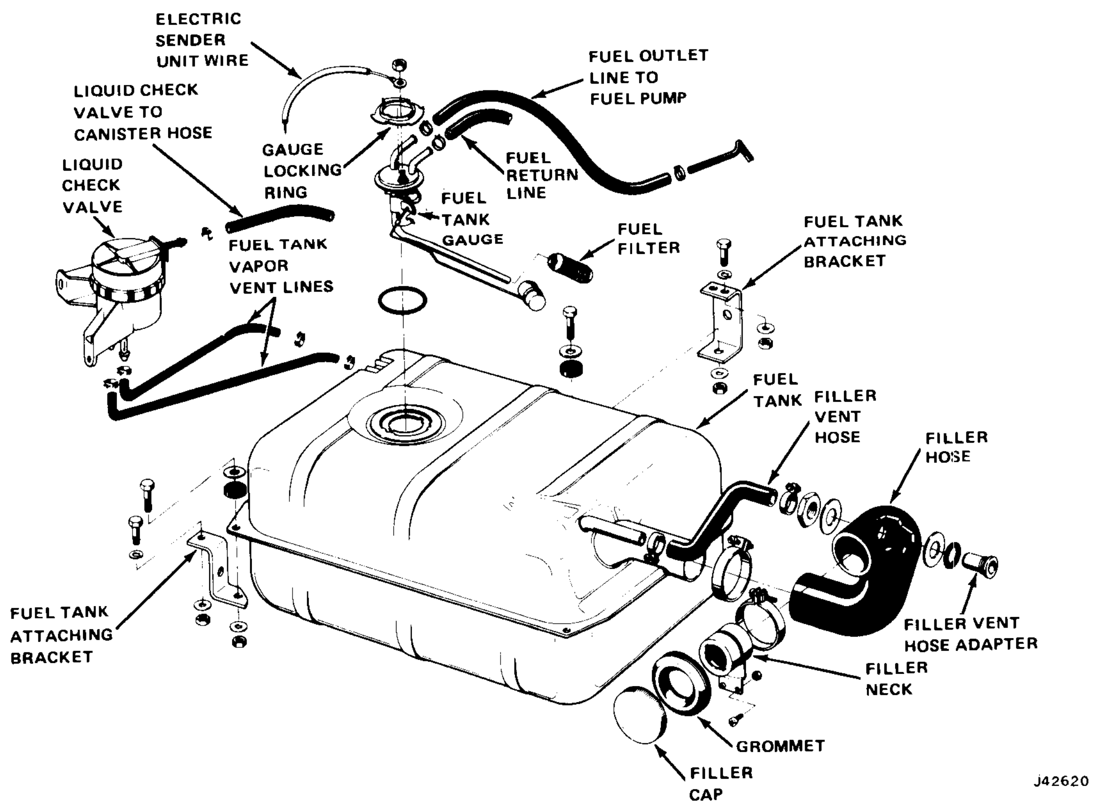


Fig. 4-5 Fuel Tank and Vent Lines—CJ-5 and CJ-7

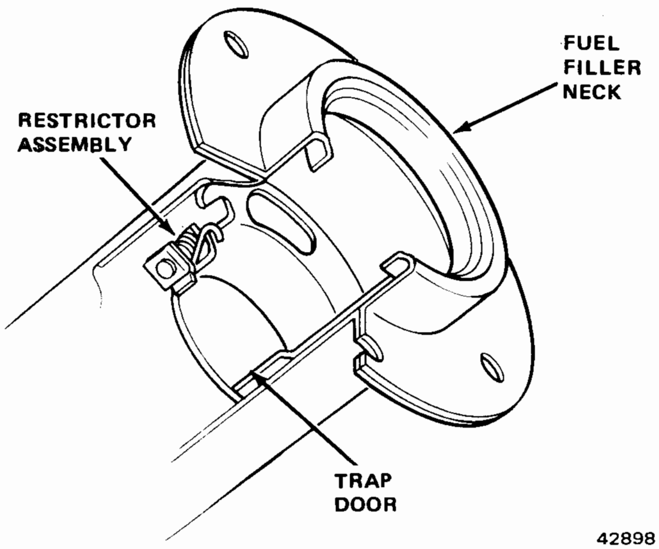


Fig. 4-6 Filler Neck Restrictor

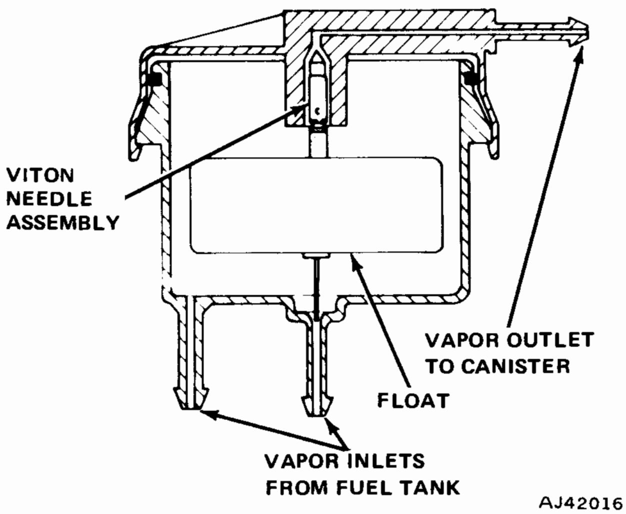


Fig. 4-7 Liquid Check Valve

Fuel Tank Capacities (Gallons)

CJ Models	15.5
Wagoneer, Cherokee	22
Truck	19

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FUEL RETURN SYSTEM

All models use a fuel return system to reduce the possibility of high temperature fuel vapor problems. The fuel return system consists of a special fuel filter and a return line to the fuel tank (fig. 4-8).

The special fuel filter has an extra outlet nipple connected to the fuel return line. The fuel return line is routed back to the fuel tank, where it attaches to an extra nipple on the fuel tank sending unit. During normal operation, a small portion of fuel is returned to the tank. During periods of high underhood temperatures, vaporized fuel is returned to the tank and not passed through the carburetor.

The extra nipple on the special fuel filter should be positioned upward to ensure proper fuel system operation.

FUEL PUMP

A single-action, stamped fuel pump is used for all engine applications.

The fuel pump rocker arm is activated by an eccentric on the engine camshaft and provides a steady supply of fuel at a constant pressure to the carburetor.

When the carburetor fuel inlet needle closes, accumulation of fuel in the pump extends the diaphragm, compressing the diaphragm spring. This action causes the rocker arm linkage to become inoperative until the pressure on the diaphragm and spring is reduced. The fuel pump discharge pressure is thus controlled by the diaphragm spring.

NOTE: *Fuel pumps are not to be overhauled. Prior to replacement of a fuel pump assembly suspected to be defective, test for specific requirements as outlined in the following test procedures.*

Fuel Pump Testing

Be sure the in-line fuel filter is not clogged before making tests. The following tests will determine if the fuel pump requires replacement.

Pressure Test

(1) Remove air cleaner assembly.

(2) Disconnect fuel inlet line or fuel filter at the carburetor.

(3) Disconnect fuel return line at fuel filter and plug nipple on filter.

NOTE: *Use care to prevent combustion due to fuel spillage.*

(4) Connect pressure gauge, restrictor, and flexible hose (fig. 4-9) between fuel filter and carburetor.

(5) Position flexible hose and restrictor so fuel can be discharged into suitable graduated container.

(6) Before taking pressure reading, operate engine at curb idle rpm and vent the system into the container by momentarily opening hose restrictor.

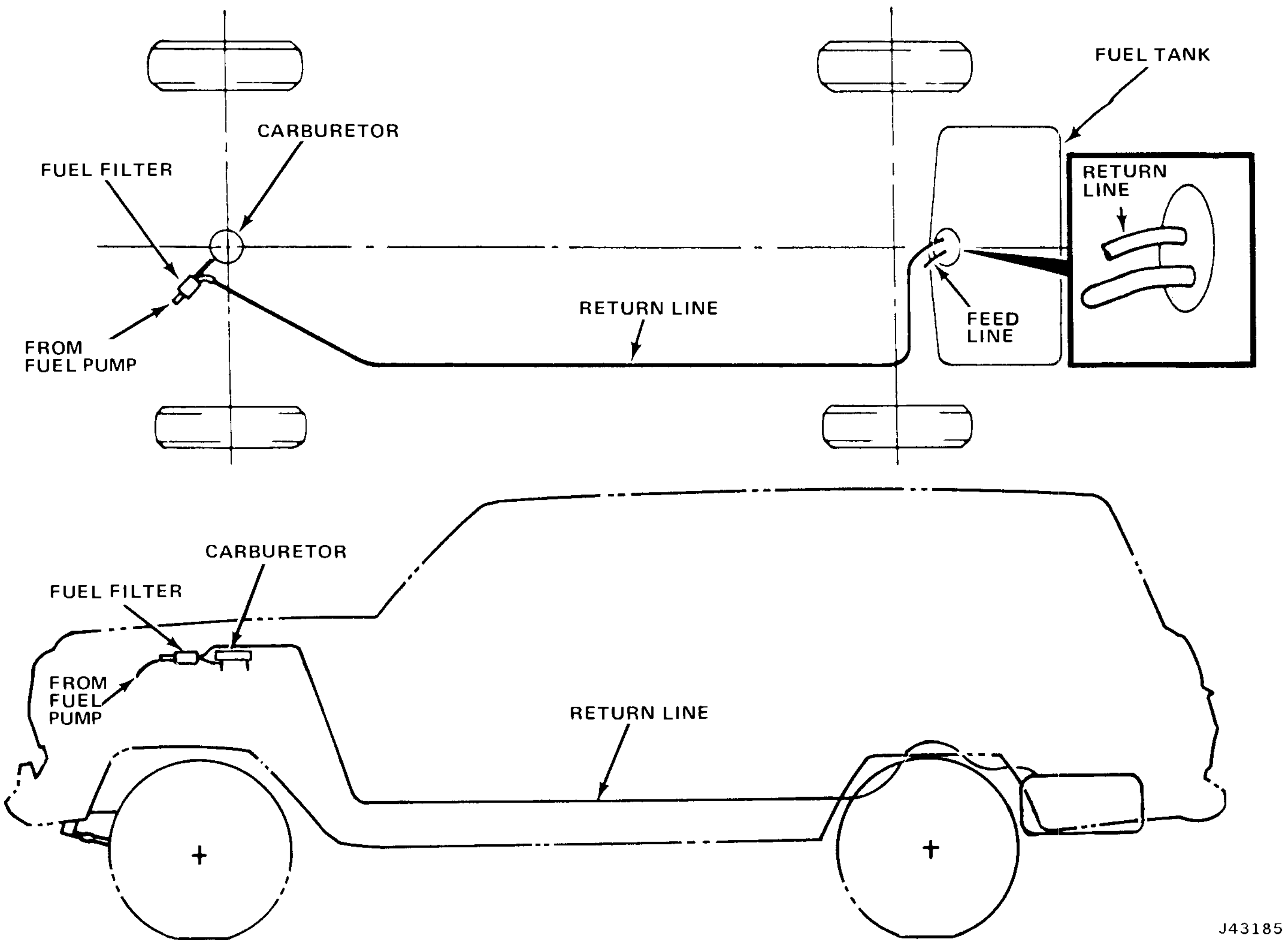

Fig. 4-8 Fuel Vapor Return System—Typical

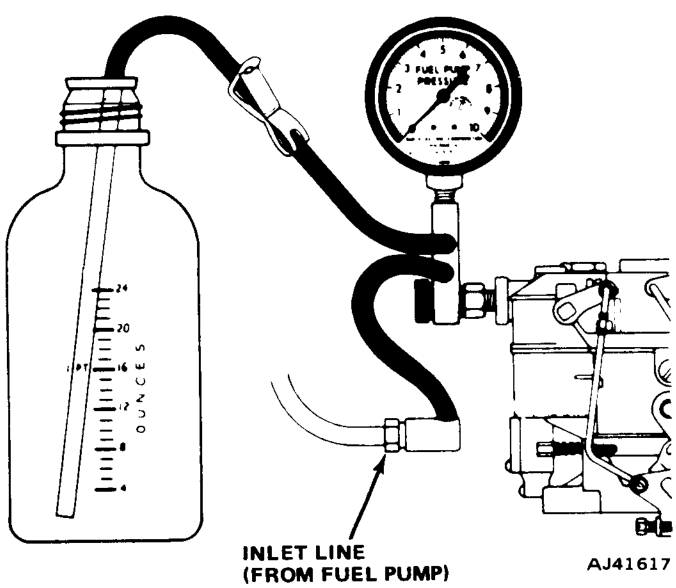

Fig. 4-9 Fuel Pump Testing

(7) Close hose restrictor, allow pressure to stabilize, and note gauge reading. Gauge should indicate 4 to 5 psi for six-cylinder engines, and 5 to 6.5 psi for V-8 engines.

NOTE: *If the pump pressure is not within specification and the fuel lines and filter are in satisfactory condition, the pump is defective and should be replaced. If the pump pressure is within specifications, perform the capacity and vacuum tests.*

Capacity (Volume) Test

If fuel pump pressure is within specification, test the capacity (volume) as follows:

(1) Operate engine at curb idle rpm.

(2) Open hose restrictor and allow fuel to discharge into graduated container for 30 seconds, then close restrictor.

NOTE: *At least one pint of fuel should have been discharged. If pump volume is less than one pint, repeat test using an auxiliary fuel supply and a new fuel filter. If the pump volume meets specification while using the auxiliary fuel supply, check for a restriction in the fuel supply from the tank and for proper tank venting.*

Vacuum Test

(1) Disconnect fuel inlet line at fuel pump.

(2) Connect vacuum gauge to fuel pump inlet.

(3) Operate engine at curb idle rpm and note vacuum gauge reading. Gauge should indicate ten inches of mercury (10 Hg). If the pump vacuum reading is not within specification, the pump is defective and should be replaced.

NOTE: *Vacuum gauge will not register a reading until fuel in carburetor float bowl has been used and pump begins to operate at full capacity.*

Fuel Pump Specifications

Volume	1 quart of fuel in 1 minute or less
Vacuum	10 inches of mercury (min)
Pressure	Six-Cylinder: 4 to 5 psi V-8 : 5 to 6.5 psi

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CARBURETION

CARBURETOR MODEL YF—1 VENTURI

GENERAL

Some Model YF carburetors for 1976 are equipped with an electric assist choke which supplies supplemental heat to the choke bimetallic spring. This speeds choke valve opening after the choke cover interior reaches modulating temperature (refer to Thermostatic Switch chart). This feature reduces emissions of carbon monoxide (CO) and hydrocarbons during warmup.

The electric assist choke is powered from a special ac terminal at the alternator which provides a 7-volt power source for an electric heating element within the choke cover.

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically

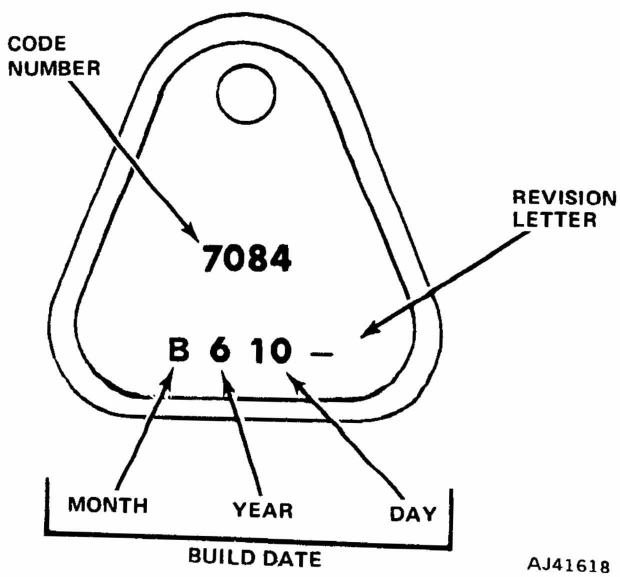


Fig. 4-10 Identification Tag

choke valve, fuel bowl vents, fuel inlet fitting, float assembly, needle and seat assembly, and dashpot or solenoid assembly (if equipped).

The main body assembly contains the metering rod and jet, accelerator pump assembly, pump discharge jet, ball and weight, low speed jet, antiperc bleed, economizer, and main discharge nozzle.

The throttle body assembly contains the throttle shaft and lever assembly with coded return spring, curb idle adjusting screw, idle mixture adjusting screw, idle limiter cap, distributor vacuum fitting, and EGR vacuum fitting.

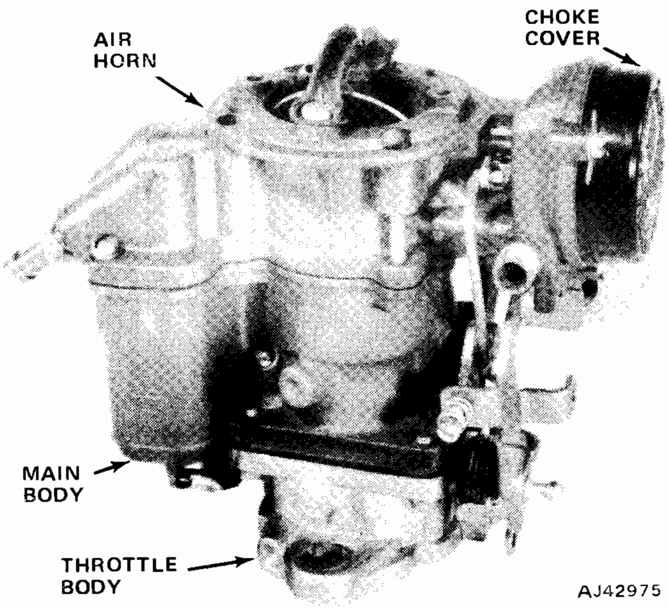


Fig. 4-11 Model YF Carburetor Assembly

CARBURETOR CIRCUITS

Five conventional circuits are used: Float (Fuel Inlet) Circuit, Idle (Low Speed) Circuit, Main Metering (High Speed) Circuit, Pump Circuit, and Choke Circuit.

Float (Fuel Inlet) Circuit

The float circuit maintains the specified fuel level in the bowl to provide an adequate fuel supply to the metering circuits for all engine operating conditions.

A spring-loaded, two-piece needle is used to prevent float vibration from affecting the fuel level. The needle also incorporates a flared tip which is capable of digesting small foreign particles, resulting in minimum fuel leakage or flooding under extreme dirt conditions. The flared tip needle also reduces wear to extend the normal life of the needle and seat assembly. Special precautions must be taken when adjusting the float level (refer to Float Level Adjustment).

Fuel enters the carburetor through the needle and seat assembly. When the fuel in the bowl reaches a specified level, the float lever pushes the needle toward its seat and restricts the incoming fuel flow to admit only enough fuel to replace that being used (fig. 4-12).

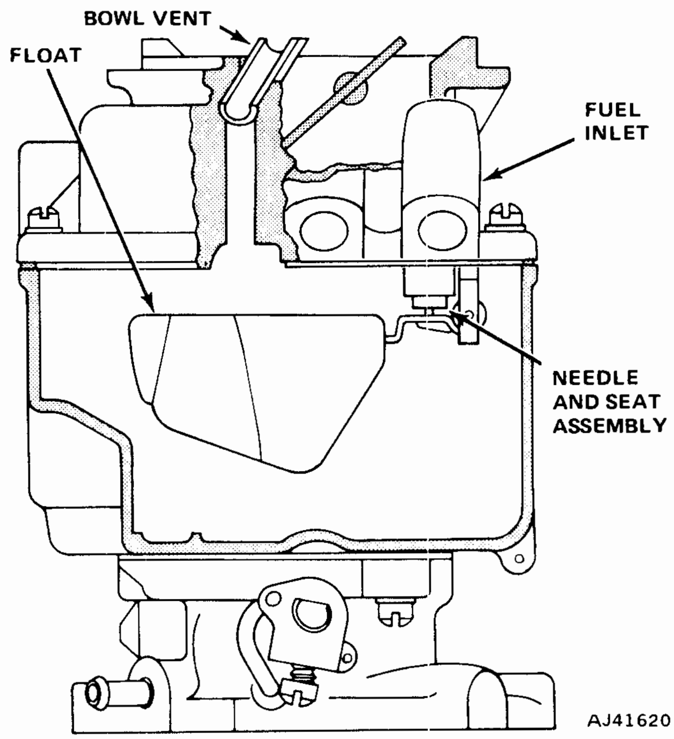


Fig. 4-12 Float Circuit

The bowl is vented internally by a tube and a drilled passage, located inside the air horn, to assure correct air pressure above the fuel for all engine operating conditions. The vent automatically compensates for any air cleaner restriction by balancing pressure between the fuel bowl and the incoming air.

All YF carburetors have an external fuel bowl pressure vent. Excess bowl pressure is vented from the carburetor to the fuel vapor storage canister. An aluminum wafer, located inside the air horn, is normally seated. When pressure within the fuel bowl becomes excessive, the wafer unseats and pressure is vented through a passage in the air horn. A hose connected to the air horn vent passage sends the excess pressure and fuel vapor to the fuel vapor storage canister (fig. 4-13).

Idle (Low Speed) Circuit

Fuel for idle and early part-throttle operation is metered through the idle circuit. The low speed jet is threaded into the low speed well and may be removed for cleaning.

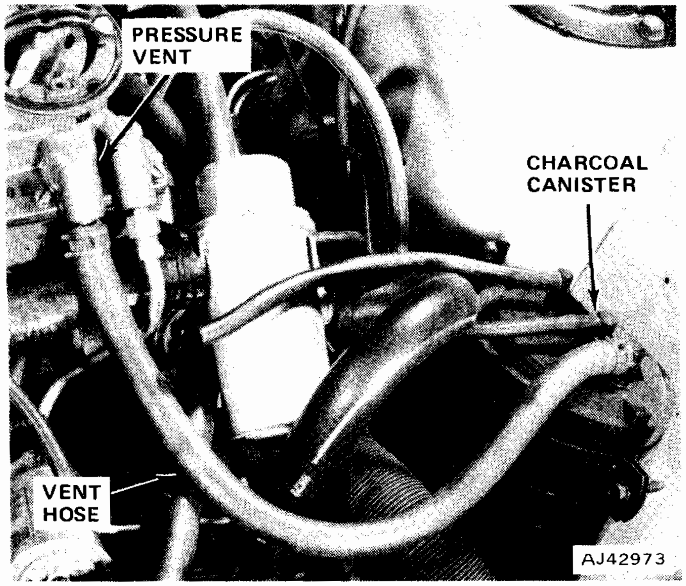


Fig. 4-13 External Fuel Bowl Pressure Vent

Fuel is metered as it enters the lower end of the low speed jet and flows up through the tube. The fuel is then mixed with air which is metered through the bypass. The fuel-air mixture then travels downward through the economizer and past the idle bleed where additional metered air is introduced. The fuel-air mixture continues downward and is discharged below the throttle valve at the idle port opening and the idle mixture adjustment screw port (fig. 4-14).

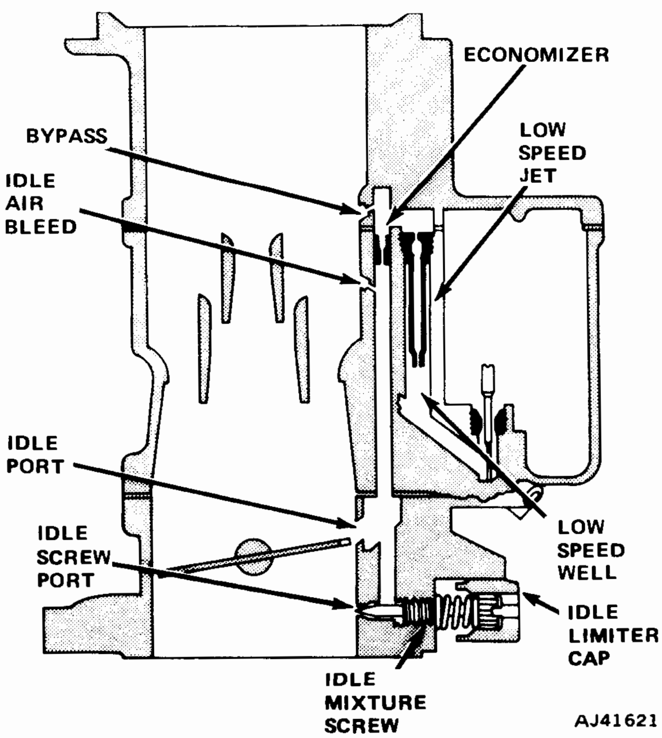


Fig. 4-14 Idle Circuit

The idle mixture adjustment screw controls the amount of mixture discharged into the manifold. Turning the screw inward (clockwise) decreases the amount of fuel-air mixture supplied for idle. The idle limiter cap is designed to regulate the adjustment range of the idle mixture adjusting screw, effectively controlling the exhaust emission level at idle speeds to comply with Federal Motor Vehicle Emission Standards.

The idle port is slotted and, as the throttle valve is opened, more of the port is exposed to manifold vacuum to allow an increased discharge of the fuel-air mixture for early part-throttle operation.

Main Metering (High Speed) Circuit

Fuel for most part-throttle and full-throttle operation is supplied through the main metering circuit (fig. 4-15).

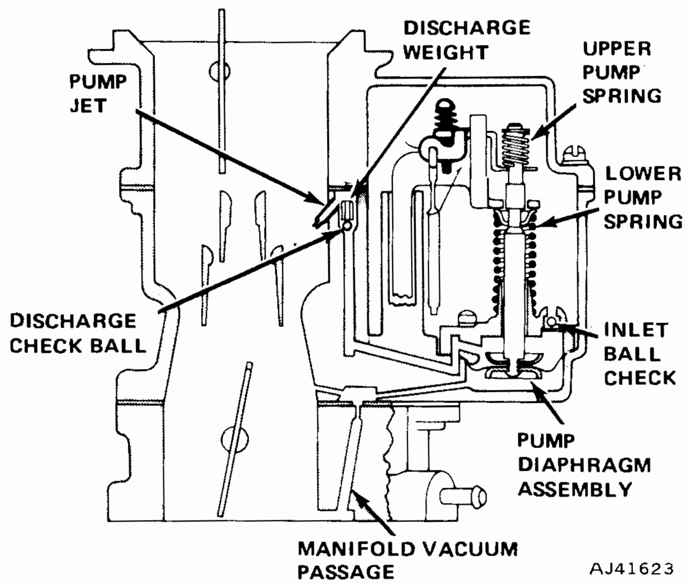


Fig. 4-15 Main Metering Circuit

The position of the metering rod in the metering rod jet regulates the amount of fuel admitted to the main discharge nozzle. The lower end of the metering rod is calibrated in steps to meter accurately the fuel required. As the metering rod is raised or lowered in the jet, the opening is varied in size to provide the correct amount of fuel proportionate to the engine requirements for part-throttle and full-throttle operations. The metering rod is actuated by mechanical linkage and also by changing manifold vacuum.

The restriction and air bleeds within the vacuum passage leading to the pump diaphragm vacuum chamber provide a lower and more uniform vacuum.

To prevent percolation in the low speed well or main discharge nozzle, which may occur during hot engine idle or shutdown, an antiperc passage is used. Its purpose is to vent vapors and relieve pressure to prevent fuel from being forced out of the nozzle and into the intake manifold.

The main discharge nozzle and the antiperc bushing are permanently installed and are not to be removed.

Mechanical Action

During part-throttle operation, manifold vacuum pulls the pump diaphgram assembly downward, holding the metering rod arm against the pump lifter link which is connected by linkage to the throttle shaft. Therefore, the metering rod is mechanically controlled as long as manifold vacuum is strong enough to overcome the tension of the lower pump diaphragm spring. The upper spring assists the lower pump spring on acceleration.

Vacuum Action

Under any engine operating condition in which the tension of the lower pump diaphragm spring is sufficient to overcome the manifold vacuum applied to the pump diaphragm assembly, the metering rod will move upward toward the wide-open or power enrichment position.

Pump Circuit

The pump circuit provides the increased amount of fuel required during acceleration at lower vehicle speeds to assure satisfactory engine performance (fig. 4-16).

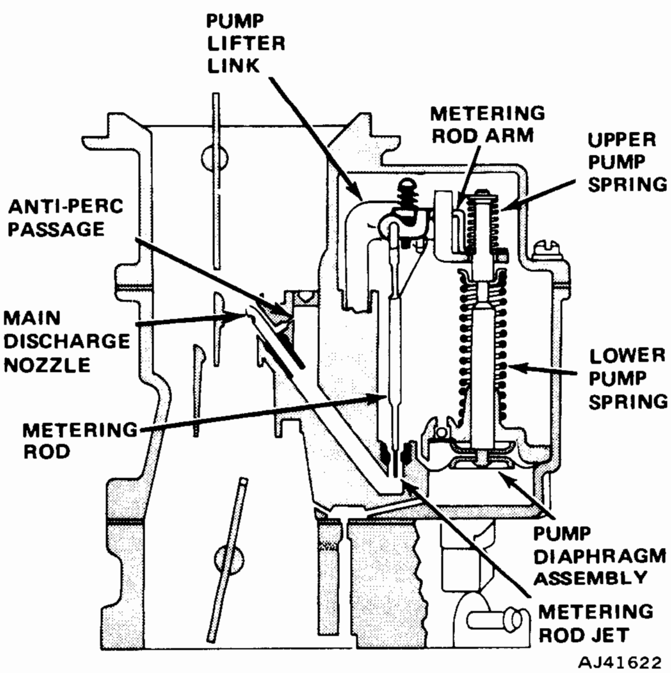


Fig. 4-16 Pump Circuit

The accelerator pump is actuated in the same manner as the metering rod. When the throttle closes, the pump diaphragm moves downward, both by mechanical linkage and by increased manifold vacuum supplied to the underside of the diaphragm. During the downward movement of the diaphragm, fuel is drawn into the chamber above the diaphragm through the inlet check ball. The discharge check ball is seated during the intake stroke to prevent air entering the pump chamber. When the throttle is opened, manifold vacuum decreases at the underside of the diaphragm and tension of the lower pump diaphragm spring moves the diaphragm upward. The upward movement of the diaphragm is mechanically assisted by the pump lifter link which is connected by linkage to the throttle shaft. During the upward movement of the diaphragm, fuel under pressure is forced through the pump discharge passage, unseats the discharge check ball, and is discharged through the pump jet. The inlet check ball is seated during the discharge stroke to prevent fuel leakage back into the bowl. If the throttle is opened suddenly, the upper pump spring is compressed, resulting in a smooth pump discharge.

A pump relief bushing, located near the top of the pump discharge passage, allows fuel bowl air pressure to enter the passage. The pump relief serves two purposes. One is to prevent fuel from being drawn out of the pump circuit during high speed constant throttle operation. The other is to bleed off a calibrated portion of the pump discharge back to the fuel bowl, thereby regulating the amount of discharge through the pump jet.

Choke Circuit

The automatic choke provides a richer mixture that is necessary for quick cold engine starting and proper warmup performance (fig. 4-17). When the engine is cold, thermostatic coil tension holds the choke valve closed. As the engine is cranked, air pressure against the offset choke valve causes the valve to open slightly against the thermostatic coil tension. Intake manifold vacuum, applied to the choke piston, also tends to pull the choke valve open. When the engine starts, the choke valve assumes a partially open position where thermostatic coil tension is balanced by the pull of vacuum on the piston and force of the air stream against the offset choke valve. This choke valve opening is known as the initial choke valve clearance.

As the choke piston moves down in the cylinder, it exposes slots located in the sides of the cylinder. This allows intake manifold vacuum to draw warm air, heated by the exhaust manifold, through the thermostatic coil housing. This warm air causes the thermostatic spring to lose its tension gradually until the choke valve is in a wide-open position.

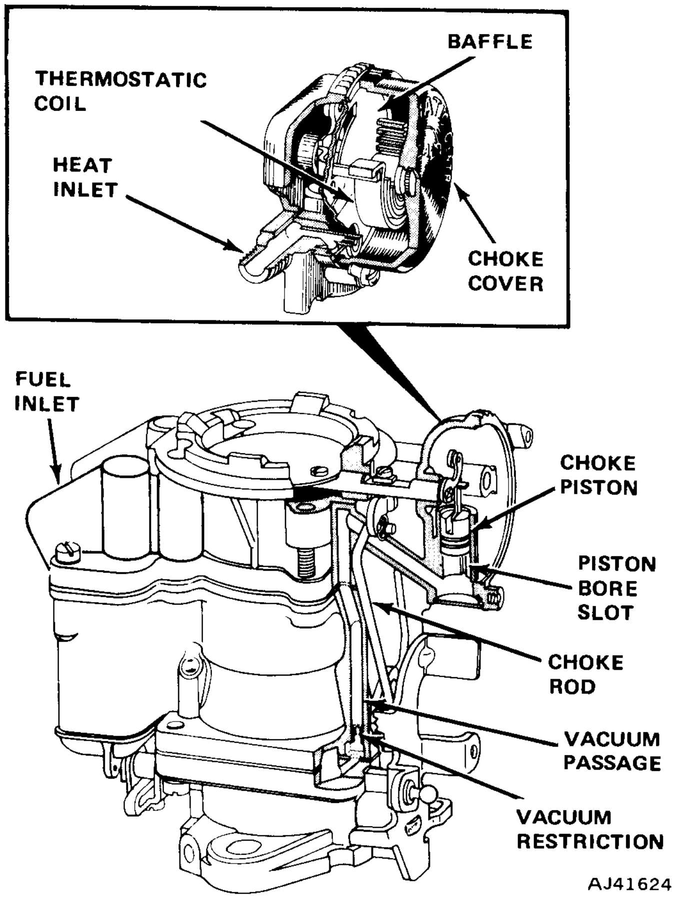


Fig. 4-17 Choke Circuit

If the engine is accelerated during the warmup period, the corresponding drop in manifold vacuum allows the thermostatic coil to momentarily close the choke valve to provide a richer mixture.

To prevent stalling during the warmup period, it is necessary to provide a faster idle speed. The fast idle cam, actuated by the choke shaft through connecting linkage, rotates into position against the fast idle screw. The cam is progressively stepped to provide the correct speed in proportion to the choke valve opening. When the choke valve reaches the fully open position, the fast idle cam rotates free of the fast idle screw, allowing the throttle lever to return to curb idle position.

If the engine floods during starting, the choke valve may be opened manually to clean out excessive fuel in the intake manifold. This is accomplished by depressing the accelerator pedal to the floor and cranking the engine. With the accelerator linkage in this position, a tang on the throttle lever contacts the fast idle cam, causing the choke rod to move upward and open the choke valve a predetermined amount.

All YF carburetors have a choke clean air tube to prevent dust or other contaminants from being brought into the choke housing. The choke clean air tube is fitted through the air horn into the throttle bore above the choke valve. From the air horn, the clean air tube passes under the exhaust manifold where it slips into the choke heater tube (fig. 4-18). In this manner air, filtered by the air cleaner assembly, is pulled into the choke clean air tube, passes through the choke heater tube, and eventually enters the choke housing.

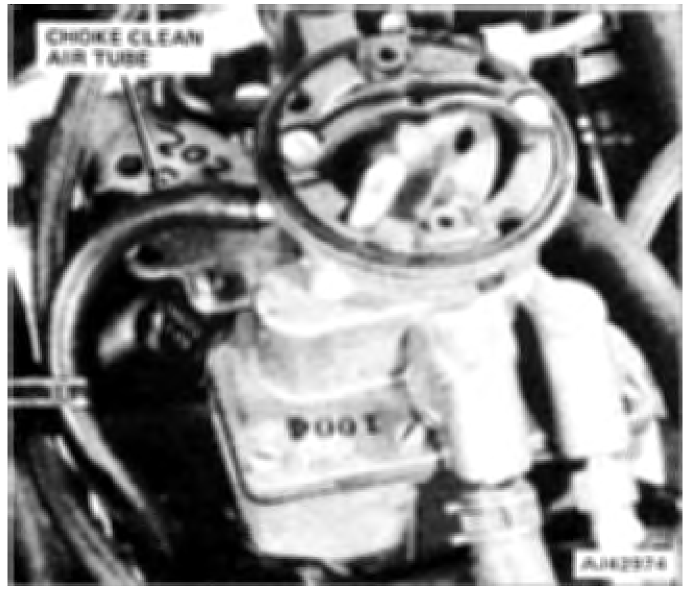


Fig. 4-18 Choke Clean Air Tube

When equipped with an electric heat assist, a thermostatic switch (bimetallic disc) within the choke cover closes when modulating temperature is reached, allowing current to flow to the heating element. When normal engine operating temperature is reached, the thermostatic coil exerts sufficient pressure against the choke piston lever to hold the choke fully open. Since the choke piston is in the full downward position, enough heated air bypasses through the slots of the piston passage to keep the thermostatic coil heated and the choke valve fully open during continued engine operation.

The electric assist is integral with the choke cover and cannot be repaired or adjusted. It can be tested for proper operation in the following manner.

Electric Assist Choke Test

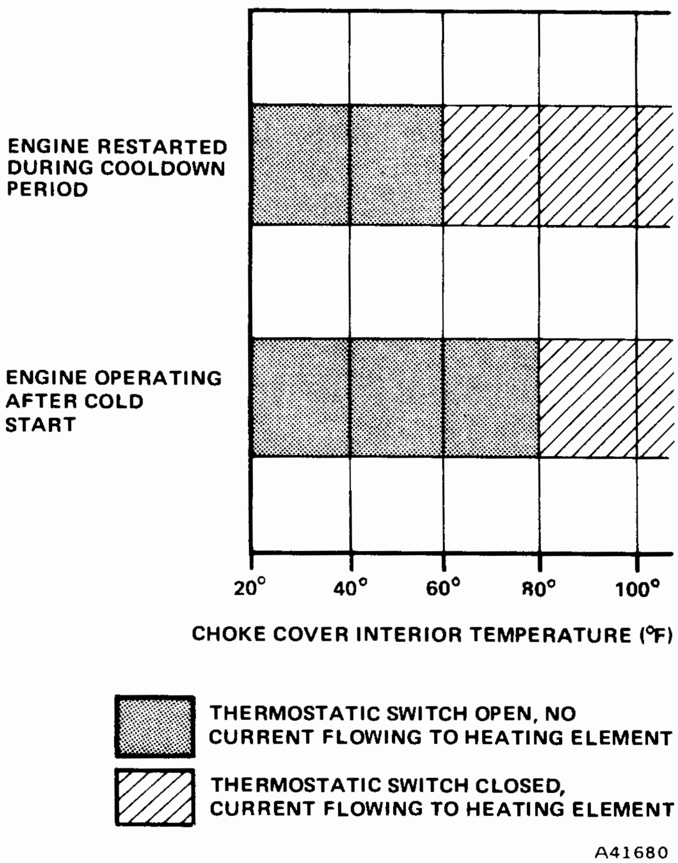
(1) Bring engine to operating temperature.

(2) Turn off ignition, remove choke cover, and start engine.

(3) Hold choke cover so thermostatic coil can be observed and bring ground cover strap on choke cover into contact with any suitable engine ground.

Within a few seconds the coil, warmed by the heating element, will begin to expand. If it does not, discard and replace the choke cover unit.

Thermostatic Switch Choke Modulation Chart



CARBURETOR OVERHAUL

The following procedure applies to complete overhaul, with the carburetor removed from the engine. A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine (refer to Service Adjustment Procedures).

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection and replacement of gaskets and worn or damaged parts. Refer to figure 4-19 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in kit.*

Removal

Flooding, stumble on acceleration, and other performance problems are in many instances caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the problem, the carburetor should be carefully removed from the engine without removing the fuel from the bowl. The bowl contents then may be examined for contamination as the carburetor is disassembled.

(1) Remove air cleaner.

(2) Remove control shaft from throttle lever and disconnect distributor vacuum line, in-line fuel filter, choke clean air tube, vacuum hoses, pullback spring, and the choke heat tube at the carburetor.

(3) Remove carburetor retaining nuts and remove carburetor.

(4) Remove carburetor mounting gasket, spacer (if equipped), and lower gasket from the intake manifold.

Installation

(1) Clean gasket mounting surfaces of spacer and carburetor. Place spacer between two new gaskets and position the spacer and gasket on the intake manifold. Position carburetor on the spacer and gasket and secure it with retaining nuts. To prevent leakage, distortion, or damage to the carburetor body flange, first snug the nuts and then tighten to 12 to 15 foot-pounds torque.

(2) Connect in-line fuel filter, control shaft, choke heat tube, pullback spring, vacuum hoses, choke clean air tube, and distributor vacuum line.

Disassembly

(1) Remove choke cover attaching screws, dashpot or solenoid bracket assembly, air horn assembly, and air horn gasket (fig. 4-19).

(2) Hold air horn assembly bottom side up, and remove float pin, and float lever and lever assembly. Turn the air horn assembly over and catch the needle pin, spring, and needle.

(3) Remove needle seat and gasket (fig. 4-20).

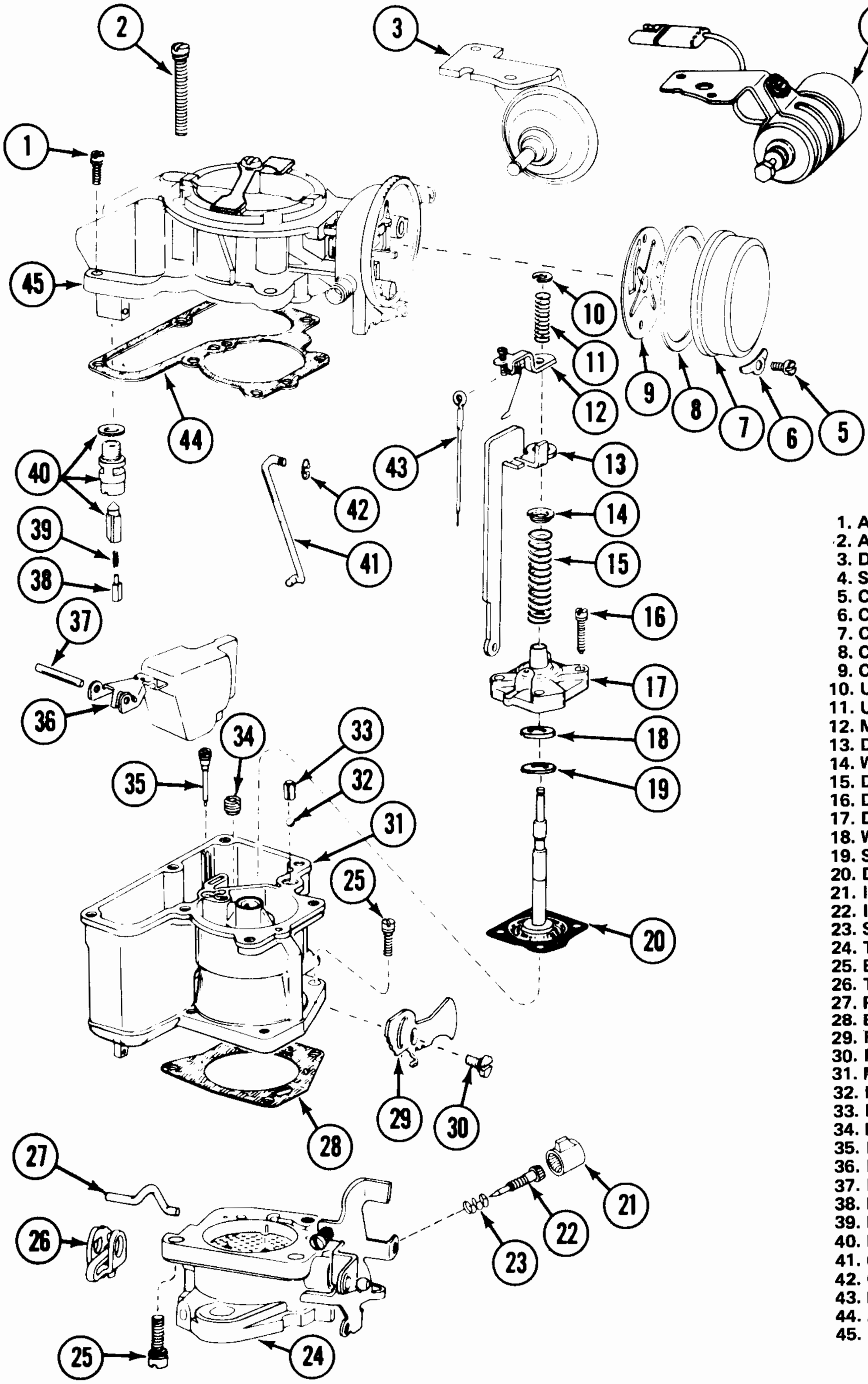
(4) Remove air cleaner bracket. If choke plate attaching screws are staked, file staked ends and remove screws. Use new screws on assembly. Remove choke plate from air horn assembly, choke link lever, and attaching screw. Rotate choke shaft and piston assembly counterclockwise until choke piston is out of choke piston cylinder (fig. 4-21). Remove assembly from air horn. Remove piston pin and piston from choke piston lever and link assembly.

(5) Turn pump main body casting upside down and catch accelerating pump discharge check ball and weight.

(6) Loosen throttle shaft arm screw and remove arm and pump connector link (fig. 4-22).

(7) Remove fast idle cam and shoulder screw.

(8) Remove accelerating pump diaphragm housing screws. Lift out the pump diaphragm assembly, pump lifter link, and metering rod as a unit (fig. 4-23).



1. AIR HORN SCREW (SHORT)
2. AIR HORN SCREW (LONG)
3. DASHPOT AND BRACKET
4. SOLENOID AND BRACKET
5. COIL HOUSING SCREW
6. COIL HOUSING RETAINER
7. CHOKE COVER
8. COIL HOUSING GASKET
9. COIL HOUSING BAFFLE PLATE
10. UPPER PUMP SPRING RETAINER
11. UPPER PUMP SPRING
12. METERING ROD ARM
13. DIAPHRAGM LIFTER LINK
14. WASHER
15. DIAPHRAGM SPRING
16. DIAPHRAGM HOUSING SCREW (4)
17. DIAPHRAGM HOUSING
18. WASHER
19. SPACER
20. DIAPHRAGM
21. IDLE SCREW LIMITER CAP
22. IDLE MIXTURE SCREW
23. SPRING
24. THROTTLE BODY
25. BODY FLANGE SCREW (3)
26. THROTTLE SHAFT ARM
27. PUMP CONNECTOR LINK
28. BODY GASKET
29. FAST IDLE CAM
30. FAST IDLE CAM SCREW
31. MAIN BODY
32. DISCHARGE BALL
33. DISCHARGE BALL WEIGHT
34. METERING JET
35. LOW SPEED JET
36. FLOAT
37. FLOAT PIN
38. NEEDLE PIN
39. NEEDLE SPRING
40. NEEDLE, NEEDLE SEAT, GASKET
41. CHOKE CONNECTOR ROD
42. CHOKE CONNECTOR ROD RETAINER
43. METERING ROD
44. AIR HORN GASKET
45. AIR HORN

AJ41625

Fig. 4-19 Model YF Carburetor—Exploded View

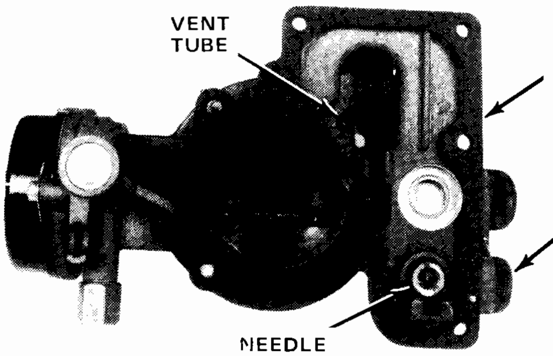


Fig. 4-20 Interior View of Air Horn

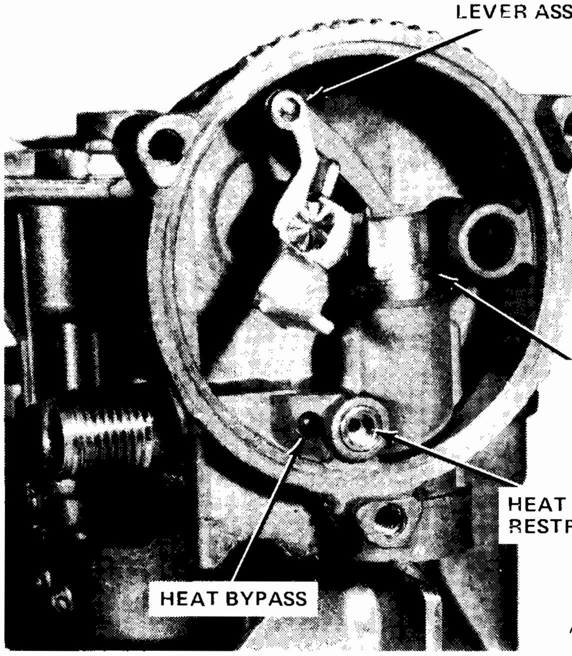


Fig. 4-21 Choke Piston and Lever Assembly

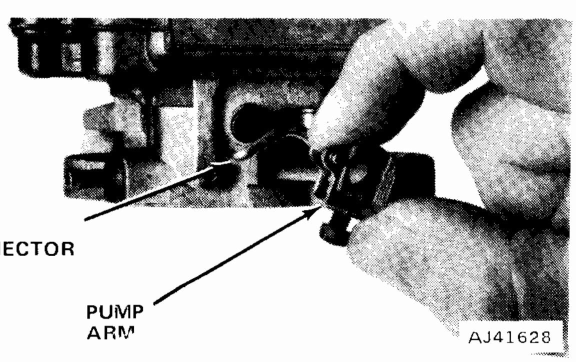


Fig. 4-22 Replacement of Pump Arm and Link

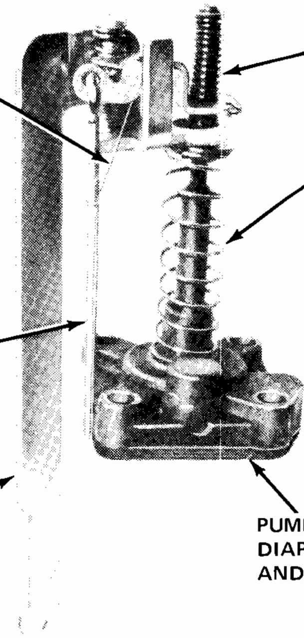


Fig. 4-23 Accelerator Pump and Metering Rod Assembly

(9) Disengage metering rod arm spring from metering rod, and remove metering rod from metering rod arm assembly. Note the location of any washers shimming either spring for proper assembly. Compress upper pump spring and remove spring retainer. Remove upper spring, metering rod arm assembly, and pump lifter link from pump diaphragm shaft. Compress pump diaphragm spring and remove pump diaphragm spring retainer, spring, and pump diaphragm assembly from pump diaphragm housing assembly.

(10) Remove metering rod jet and low speed jet.

(11) Remove retaining screws and separate throttle body flange assembly from main body casting. Remove body flange gasket.

(12) Remove throttle plate retaining screws. File staked ends and use new screws upon assembly. Slide throttle shaft and lever assembly out of throttle body flange assembly. Note the location of the ends of the torsion spring on the throttle shaft for proper assembly. When removing idle mixture limiter cap, be sure to note the position of the tab. After removing the limiter cap, count the number of turns to lightly seat the needle. This information will be used in assembly.

Cleaning and Inspection

Dirt, gum, water or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered here. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all the carburetor parts (except the accelerating pump diaphragm and the anti-stall dashpot assembly) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used.

Rinse the parts in kerosene to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and for ease of operation. Make sure all carbon and foreign material have been removed from the automatic choke housing and the piston. Check the operation of the choke piston in the choke housing to be sure it has free movement. Check the throttle shafts in the bores for excessive looseness or binding and check the throttle plates for burrs which prevent proper closure. Inspect the main body, throttle body, air horn, choke housing, and thermostatic spring housing for cracks.

Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace the float pin if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface. Inspect the rubber boot of the anti-stall dashpot for proper installation in the groove of the stem bushing. Check the stem movement for smooth operation. Do not lubricate the stem. Replace the assembly if it is damaged.

Assembly

(1) Install throttle shaft and lever assembly with torsion throttle return spring and bushing in the throttle body flange.

(2) Position throttle plate on throttle shaft with notch in plate aligned with slotted idle port in the throttle body flange (fig. 4-24).

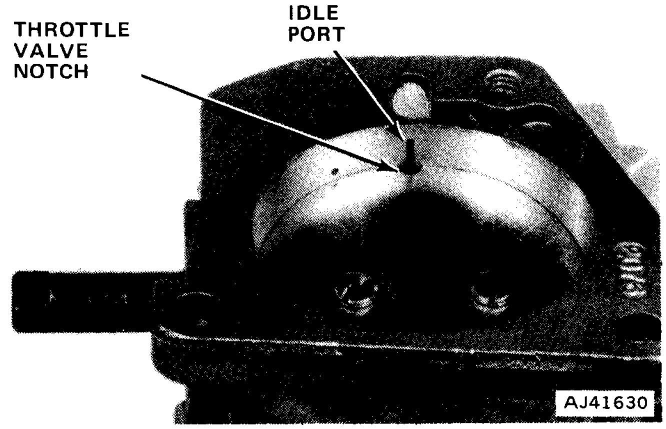


Fig. 4-24 Throttle Valve Alignment

(3) Install throttle plate attaching screws, but do not tighten. Move the shaft back and forth and rotate it to be sure the throttle plate does not bind in the flange bore.

NOTE: *It is necessary that the throttle plate should close tightly in the bore; therefore, idle speed screw should be backed out sufficiently to be sure it does not contact the throttle stop.*

(4) Reposition plate if necessary and tighten and stake (or peen) screws in place.

(5) Place new body flange gasket and main body casting on throttle body flange and install attaching screws and tighten evenly.

(6) Install low speed jet and metering rod jet (fig. 4-25).

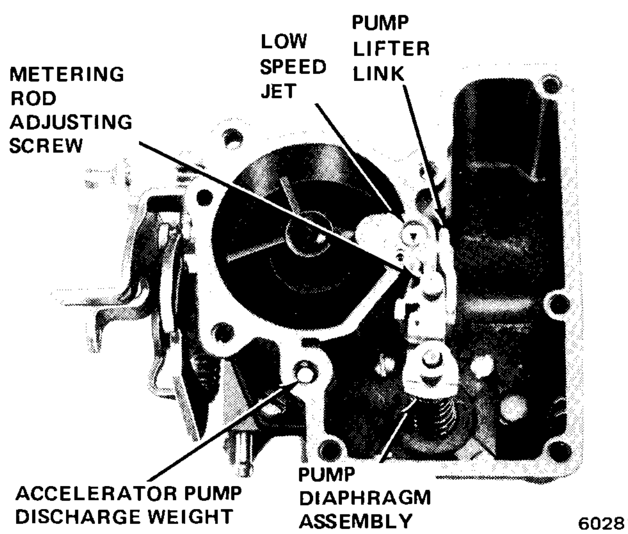


Fig. 4-25 Interior View of Fuel Bowl

(7) Install pump diaphragm in pump diaphragm housing.

(a) Position pump diaphgram spring on diaphragm shaft and housing assembly.

(b) Install spring shim washers.

(c) Install spring retainer, pump lifter link, metering rod arm and spring assembly, and upper pump spring on diaphragm shaft.

(d) Depress spring and install upper pump spring retainer.

(8) Install metering rod on the metering rod arm and place looped end of metering arm spring on metering rod (fig. 4-23).

(9) Align pump diaphragm with diaphragm housing (make sure the holes are aligned) and install housing attaching screws.

(10) Align pump housing, pump lifter link, and metering rod with main body casting.

(11) Install assembly in main body casting, being careful to engage pump lifter link with main body and to insert metering rod in metering rod jet.

(12) Install pump housing attaching screws but do not tighten. Push down on diaphragm shaft to compress diaphragm and tighten attaching screws.

(13) Adjust metering rod, following procedure under Metering Rod Adjustment.

(14) Install fast idle cam and shoulder screw. Install throttle shaft arm and pump connector link or throttle shaft and pump lifter link. Tighten lock screw.

(15) Assemble choke piston and pin to choke piston lever and link assembly. Install choke shaft assembly in the air horn and position piston (fig. 4-21).

(16) Align piston with cylinder and rotate shaft assembly clockwise until piston pin is inside piston cylinder.

(17) Position choke plate on choke shaft and install screws. Do not tighten screws.

(a) Check choke plate movement to be sure it does not bind.

(b) Tighten and stake (or peen) screws to prevent loosening.

(c) Install choke link lever and tighten attaching screw.

(18) Install needle seat and gasket in air horn. With air horn inverted, install needle, pin spring, needle pin, float and lever assembly, and float pin. Adjust float level to specifications.

(19) Place pump check ball and weight in main body casting.

(a) Position new air horn gasket, air horn assembly, and dashpot or solenoid bracket on main body.

(b) Install and tighten attaching screws.

(20) Install thermostatic coil housing, gasket and baffle plate, identification mark facing outward, with gasket between baffle and coil housing.

NOTE: *Be sure thermostatic spring engages choke lever tang.*

(21) Install retainers and housing screws. Set coil housing index to specifications and tighten screws.

(22) Install air cleaner bracket and choke connector rod.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Invert air horn assembly, and check clearance from top of float to bottom of air horn with float level gauge (fig. 4-26). Hold air horn at eye level when gauging float level. The float arm (lever) should be resting on the needle pin.

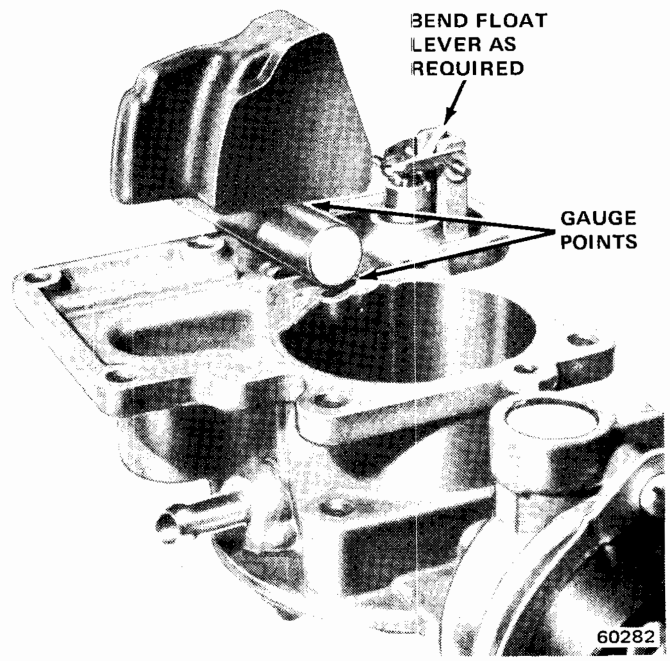


Fig. 4-26 Float Level Adjustment

CAUTION: *Do not load the needle when adjusting the float. Bend float arm as necessary to adjust the float level (refer to Carburetor Service Specifications for proper clearance).*

NOTE: *Do not bend the tab at the end of the float arm. It prevents the float from striking the bottom of the fuel bowl when empty.*

(3) Install carburetor air horn and a new gasket on the carburetor.

Float Drop Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Hold air horn upright and let float hang free. Measure the maximum clearance from top of float to bottom of air horn with float drop gauge. (Refer to Carburetor Service Specifications for proper clearance.) Hold air horn at eye level when gauging dimension (fig. 4-27).

(3) Bend tab at end of float arm to obtain specified setting.

(4) Install carburetor air horn and new gasket on carburetor.

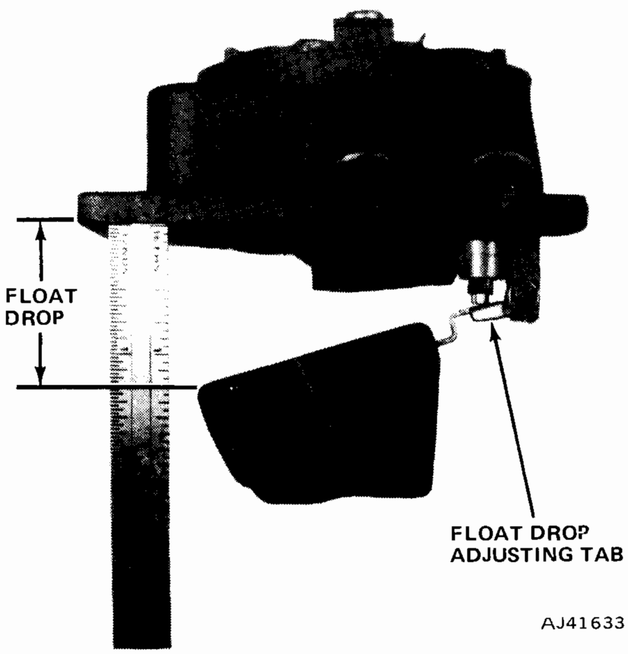


Fig. 4-27 Float Drop Adjustment

Metering Rod Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Back out idle speed adjusting screw until throttle plate is closed tight in throttle bore.

(3) Press down on end of pump diaphragm shaft until assembly bottoms.

(4) To adjust metering rod, hold diaphragm assembly as in step (3), above, then turn rod adjustment screw until metering rod just bottoms in body casting (fig. 4-28).

NOTE: *It may be helpful to scribe a line on the metering rod so that you can accurately determine when the rod is bottomed.*

(5) Turn metering rod adjustment screw clockwise one turn for final adjustment.

(6) Install carburetor air horn and new gasket on carburetor.

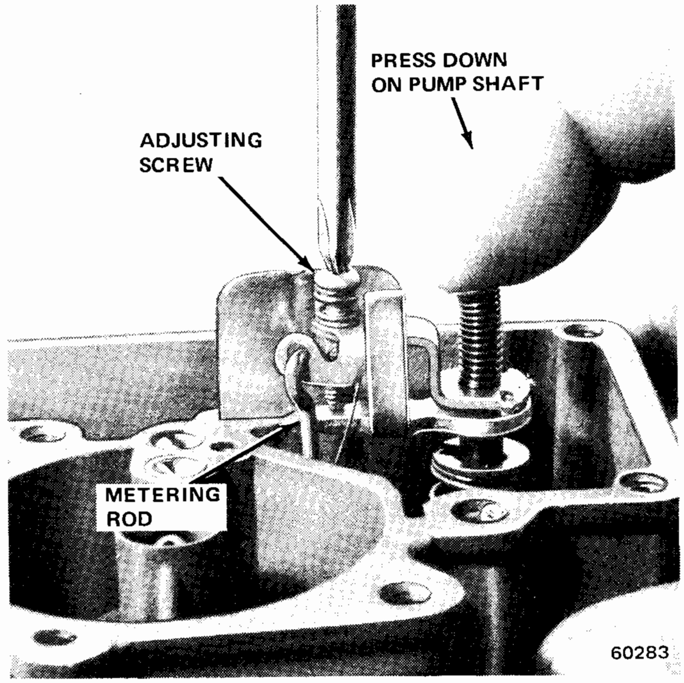


Fig. 4-28 Metering Rod Adjustment

Initial Choke Valve Clearance Adjustment

(1) Bend a 0.025-inch wire gauge at a 90° angle approximately 1/8 inch from end. Partially open throttle and close choke valve to position choke piston at top of its bore.

(2) Holding choke valve fully closed, release throttle and insert wire gauge into piston slot and against outboard side (right side of choke shaft) of piston bore. Push piston downward with gauge until bent end of gauge enters slot in piston bore. With gauge in place, push on choke shaft bimetal lever in counterclockwise direction to move piston upward, locking gauge in place (fig. 4-29).

(3) Measure clearance between lower edge of choke valve and air horn wall (refer to Carburetor Service Specifications for the correct setting).

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall, simply position gauge next to bracket.*

(4) Adjust clearance by carefully bending choke piston lever with a pair of needlenose pliers.

NOTE: *Decrease clearance by bending toward piston and increase clearance by bending away from piston.*

(5) Install choke baffle plate (embossed cross outward), coil housing gasket, and coil housing. Be sure that the thermostatic coil properly engages the bimetal lever.

(6) Install coil housing retainers and retaining screws, but do not tighten. Adjust choke as outlined under Automatic Choke Adjustment.

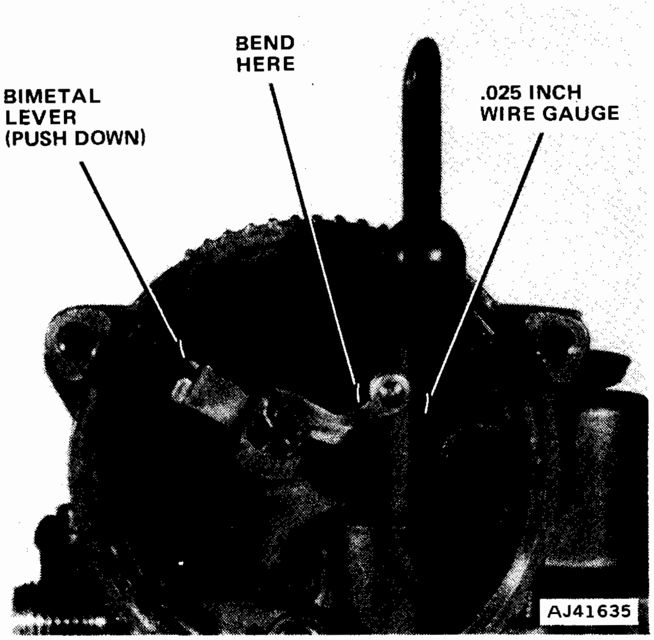


Fig. 4-29 Initial Choke Valve Clearance Adjustment

Fast Idle Cam Linkage Adjustment (On or OFF Vehicle)

(1) Position fast idle screw on second step of fast idle cam against shoulder of high step (fig. 4-30).

(2) Adjust by bending choke plate connecting rod to obtain specified clearance between lower edge of choke plate and air horn wall. (Refer to Carburetor Service Specifications for proper clearance.)

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall, simply position gauge next to bracket.*

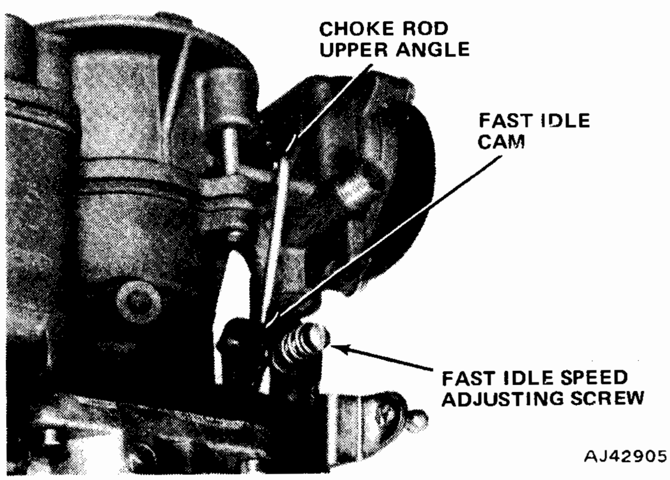


Fig. 4-30 Fast Idle Cam Linkage Adjustment

Choke Unloader Adjustment (On or OFF Vehicle)

(1) Hold throttle fully open and apply pressure on choke valve toward closed position.

(2) Measure clearance between lower edge of choke valve and air horn wall. (Refer to Carburetor Service Specifications for correct setting.)

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall simply position gauge next to bracket.*

(3) Adjust by bending unloader tang which contacts the fast idle cam as shown in figure 4-31.

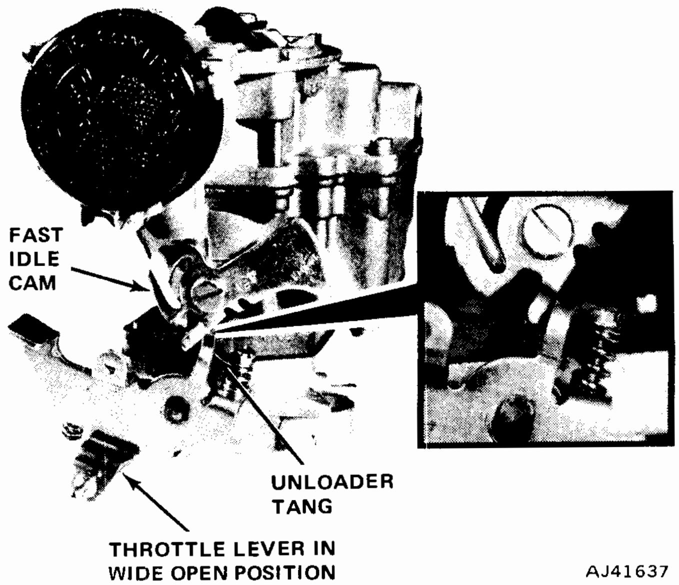


Fig. 4-31 Choke Unloader Adjustment

NOTE: *Bend toward cam to increase clearance and away from cam to decrease clearance.*

CAUTION: *Do not bend the unloader tang downward from a horizontal plane. After making the adjustment, be sure that the unloader tang has at least 0.070-inch clearance from the main body flange when the throttle is fully open (fig. 4-32).*

(4) Operate throttle and check unloader tang to be sure it does not bind, contact, or stick on any part of carburetor casting or linkage. After carburetor installation, check for full throttle opening when throttle is operated from **inside** the vehicle.

NOTE: *If full throttle opening is not obtainable, it may be necessary to remove excess padding under floormat or reposition throttle cable bracket located on the engine.*

the main metering (high speed) circuit provides an economical mixture for normal cruising speeds; the pump circuit provides additional fuel during low speed acceleration; and the power enrichment circuit provides a rich mixture when high power output is needed.

In addition to these four basic metering circuits, the carburetor contains a float (fuel inlet) and choke circuit.

Float (Fuel Inlet) Circuit

Fuel under pressure enters the fuel bowl through the fuel inlet fitting in the main body.

The Viton tipped fuel inlet needle is controlled by the float and lever assembly which is hinged on the float shaft. A wire retainer is hooked over grooves on opposite ends of the float shaft and into a groove behind the fuel inlet needle seat. The retainer holds the float shaft firmly in the fuel bowl guides and also centers the float assembly in the fuel bowl.

An integral retaining clip is hooked over the end of the float lever and attached to the fuel inlet needle. This assures reaction of the fuel inlet needle during downward movement of the float (fig. 4-36).

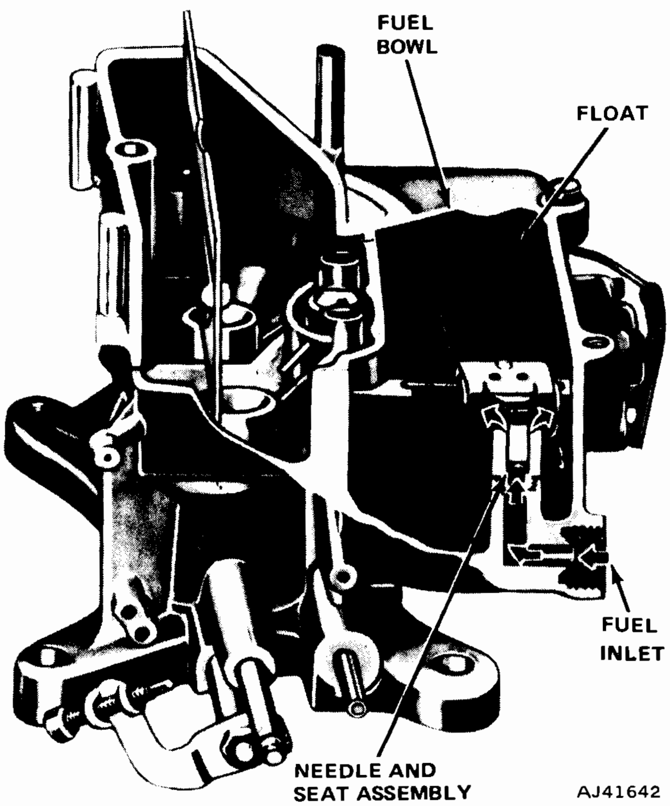


Fig. 4-36 Float Circuit

The float circuit maintains a specified fuel level in the bowl, enabling the basic fuel metering circuits to deliver the proper mixture to the engine. The amount of fuel entering the bowl is regulated by the distance the fuel inlet needle is raised off its seat. The float drops as the fuel level drops and raises the fuel inlet needle off its seat. This permits additional fuel to enter the bowl past the fuel inlet needle. When the fuel reaches a preset level, the fuel inlet needle drops and only enough fuel is admitted to replace that being used.

Idle (Low Speed) Circuit

Fuel for idle and low speed operation flows from the fuel bowl through the main jets into the main wells. From the main wells, the fuel is metered as it passes through calibrated restrictions at the lower end of the idle tubes. After flowing through the idle tubes, the fuel enters diagonal passages above the tubes. The fuel is metered again as it flows downward through restrictions at the lower end of the diagonal passages and then enters the idle passages in the main body (fig. 4-37).

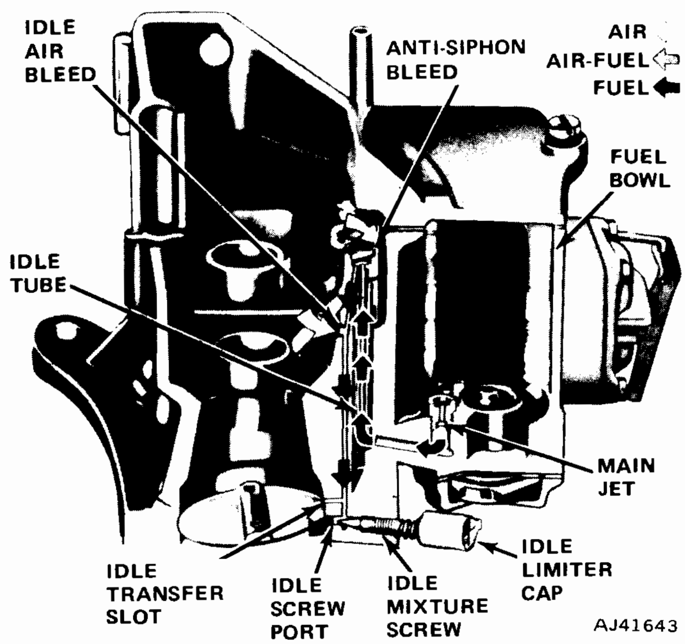


Fig. 4-37 Idle Circuit

Air enters the idle system through air bleeds which are located in the main body directly below the booster venturi. The air bleeds serve as anti-siphon vents during off-idle, high speed operation, and when the engine is stopped.

The fuel-air mixture moves down the idle passages past the idle transfer slots which serve as additional

CARBURETOR MODEL 2100—2 VENTURI

GENERAL

The Model 2100 carburetor is a two-venturi carburetor which incorporates two lightweight aluminum assemblies, the air horn and the main body.

The air horn assembly serves as the main body cover and also contains the choke assembly and fuel bowl vents.

The throttle shaft assembly and all units of the fuel metering systems are contained in the main body assembly. The automatic choke assembly and the dashpot are attached to the main body (fig. 4-34).

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used). The tag is attached to the carburetor and must remain with the carburetor to assure proper identification (fig. 4-35).

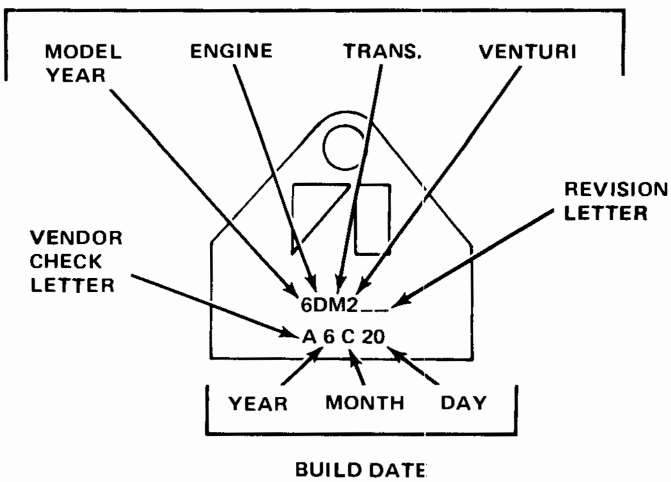


Fig. 4-35 Identification Tag

CARBURETOR CIRCUITS

The Model 2100 carburetor utilizes four basic fuel metering circuits: the idle (low speed) circuit provides a fuel-air mixture for idle and low speed performance;

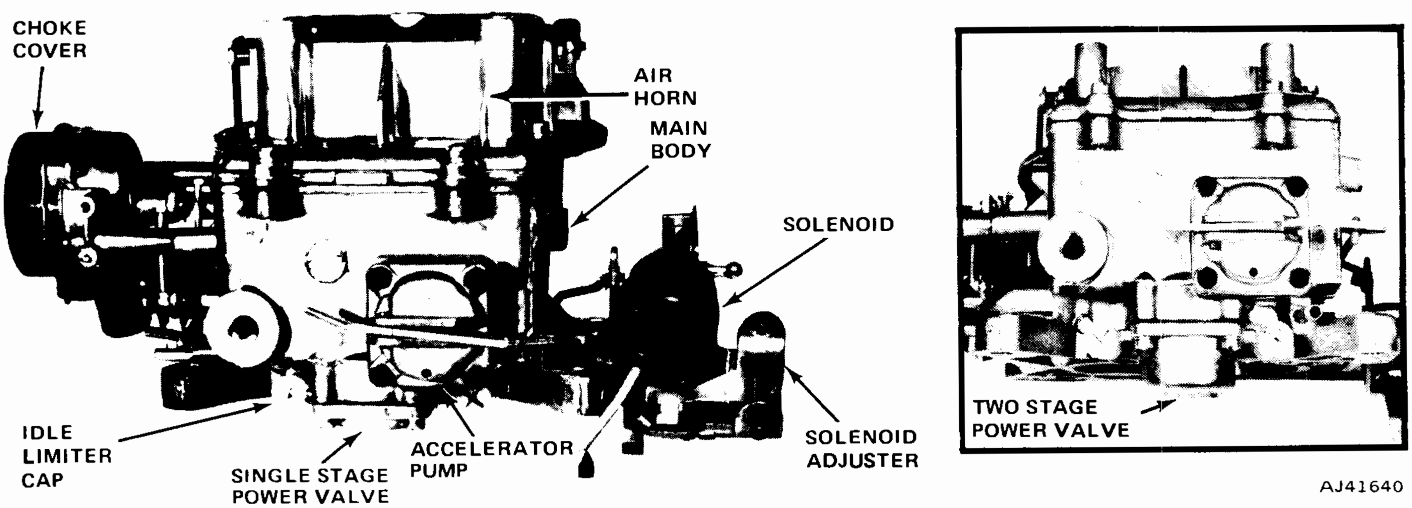


Fig. 4-34 Model 2100 Carburetor Assembly

When the throttle valves are opened, the diaphragm rod is pushed inward forcing fuel from the pump chamber into the discharge passages. The Elastomer valve seals the inlet hole during pump operation preventing fuel from returning to the fuel bowl. Fuel under pressure unseats the discharge check ball and weight and is forced through the pump discharge screw. The fuel is then sprayed into the main venturi through discharge ports.

An air bleed is provided in the pump chamber to prevent vapor accumulation and pressure buildup.

Power Enrichment Circuit

During heavy load conditions or high speed operation, the fuel-air ratio must be increased for higher engine output. The power enrichment circuit supplies extra fuel during this period and is controlled by intake manifold vacuum (fig. 4-40).

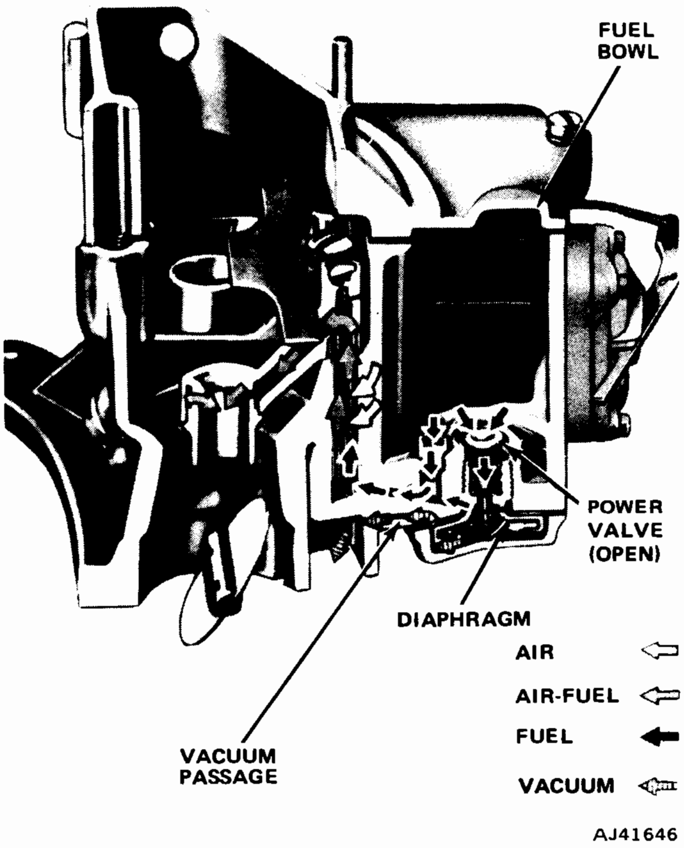


Fig. 4-40 Power Enrichment Circuit

Choke Circuit

The choke valve, located in the air horn assembly, provides a high vacuum above as well as below the throttle valves when closed. During cranking, vacuum above the throttle valves causes fuel to flow from the main metering and idle circuits. This provides the richer fuel-air mixture required for cold engine starting.

Manifold vacuum is applied to the power valve diaphragm from an opening in the base of the main body, through a passage in the main body and power valve chamber to the power valve diaphragm. During idle and normal driving conditions, manifold vacuum is high enough to overcome the power valve spring tension and hold the valve closed. When higher engine output is required, the increased load on the engine results in decreased manifold vacuum. The power valve spring opens the first stage of the power valve when manifold vacuum drops below a predetermined value and a small amount of fuel flows through the valve.

When manifold vacuum drops to a lower value, the power valve spring opens the second stage of the power valve and allows a greater amount of fuel to flow through the valve.

The fuel which flows through the power valve is added to the fuel in the main metering circuit to enrich the mixture. As engine load requirements decrease, manifold vacuum increases and overcomes the tension of the power valve spring, closing the power valve.

The choke shaft is connected by linkage to a thermostatic coil which winds up when cold and unwinds when warm.

The position of the choke valve is controlled by the action of a two-stage vacuum modulator exerting force against the tension of the thermostatic coil (fig. 4-41).

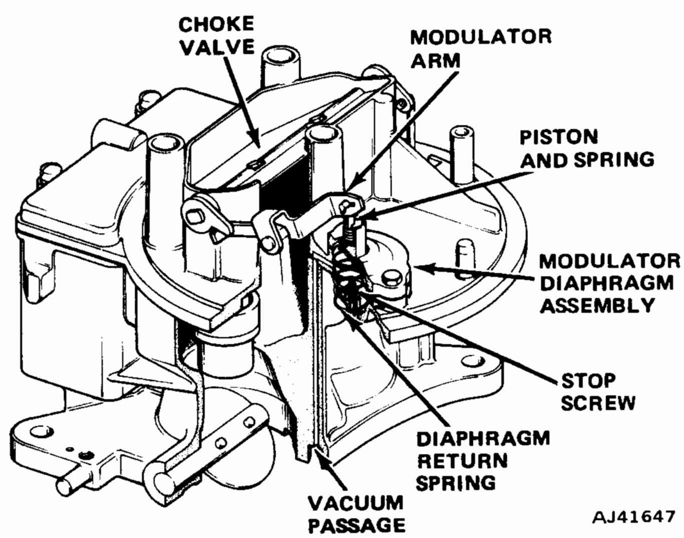


Fig. 4-41 Choke Circuit

Position carburetor on spacer and gasket and install nuts. To prevent leakage, distortion, or damage to the carburetor body flange, snug the nuts; then, alternately tighten each nut in a criss-cross pattern to 13 foot-pounds torque.

(2) Connect in-line fuel filter, throttle cable, choke heat tube, PCV hose, pullback spring, solenoid wire (if equipped), transmission throttle linkage (if equipped), choke clean air tube, vacuum hoses, and distributor vacuum line.

(3) Adjust engine idle speed, idle fuel mixture, and anti-stall dashpot if equipped (refer to Section 4A—Emission Controls—Exhaust Systems).

Disassembly

(1) Remove air cleaner anchor screw (fig. 4-42).

(2) Remove automatic choke rod retainer from thermostatic choke shaft lever.

(3) Remove air horn attaching screws, lockwashers, and carburetor identification tag. Remove air horn and air horn gasket.

(4) Remove choke rod by loosening screw that secures choke shaft lever to choke shaft. Remove rod from air horn. Slide plastic dust seal out of air horn.

(5) Remove choke modulator assembly (fig. 4-43).

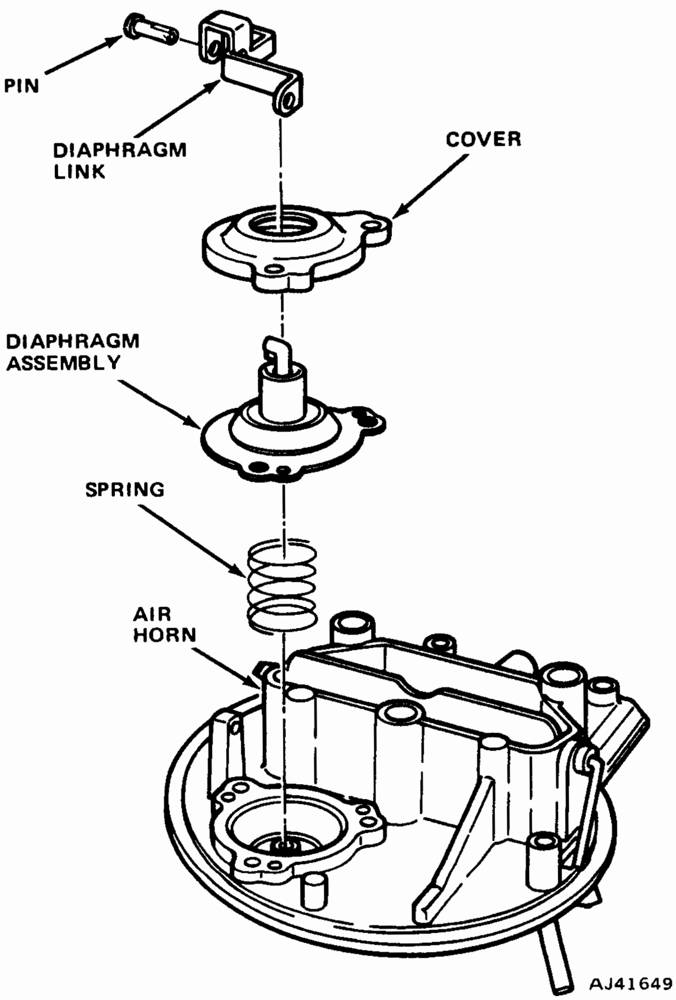


Fig. 4-43 Choke Modulator Assembly

(6) Remove choke plate attaching screws. Remove choke plate by sliding it out of the shaft from top of air horn. Slide choke shaft out of air horn.

NOTE: *File off flared portion of choke plate screws to prevent damage to the threads in the shaft.*

(7) Remove fast idle cam retainer (fig. 4-44).

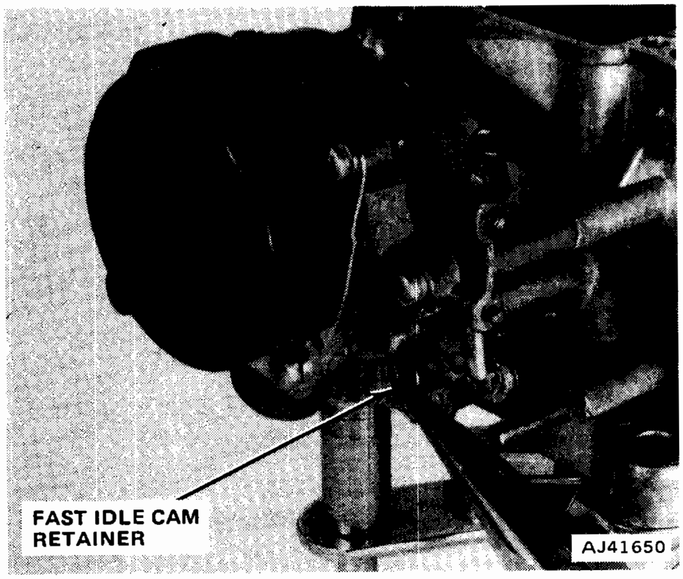


Fig. 4-44 Removing Fast Idle Cam Retainer

(8) Remove choke shield.

(9) Remove thermostatic choke spring housing retaining screws and clamp, housing, and gasket.

(10) Remove fast idle cam rod from fast idle cam lever.

(11) Remove choke housing assembly retaining screws, housing assembly, and gasket.

(12) Remove thermostat lever retaining screw and washer. Remove thermostatic choke shaft and fast idle cam lever from the choke housing.

(13) Pry float shaft retainer from fuel inlet seat (fig. 4-45). Remove float, float shaft retainer, and fuel inlet needle assembly. Remove retainer and float shaft from float lever.

(14) Remove fuel inlet needle seat and gasket. Remove main jets with Main Metering Jet Wrench J-10174-01 (fig. 4-46).

(15) Remove accelerator pump discharge screw, air distribution plate, booster venturi and gasket (fig. 4-47). Invert main body and let accelerating pump discharge weight and ball fall into hand.

(16) Disconnect accelerator pump operating rod from overtravel lever. Remove rod and retainer.

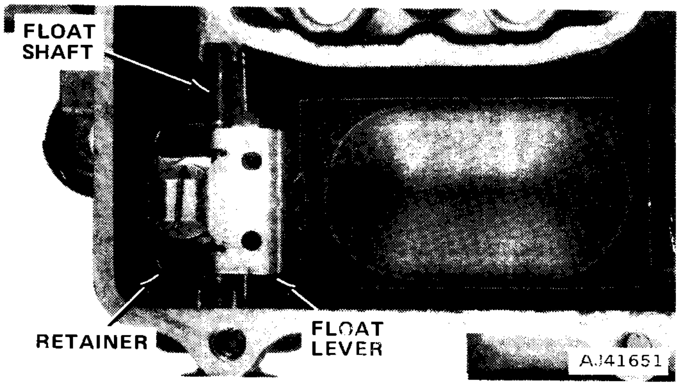


Fig. 4-45 Float Assembly

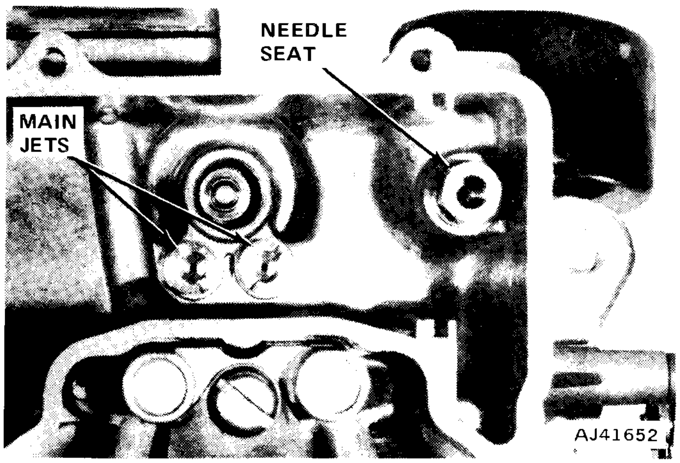


Fig. 4-46 Interior View of Fuel Bowl

(17) Remove accelerating pump cover attaching screws. Remove accelerating pump cover, diaphragm assembly, and spring (fig. 4-48).

(18) Remove Elastomer valve by grasping firmly and pulling out.

NOTE: *If the Elastomer valve tip broke off during removal, be sure to remove the tip from the fuel bowl. Elastomer valve must be replaced whenever it has been removed from the carburetor.*

(19) Invert main body and remove power valve cover, gasket, and power valve with Power Valve Socket Tool J-10175 (fig. 4-49). Remove and discard power valve gasket.

(20) Remove idle mixture adjusting screws and springs. Remove limiter caps from adjusting screws.

(21) Remove nut and washer securing fast idle lever assembly to throttle shaft and remove lever assembly. Remove fast idle speed adjusting screw and spring from fast idle lever.

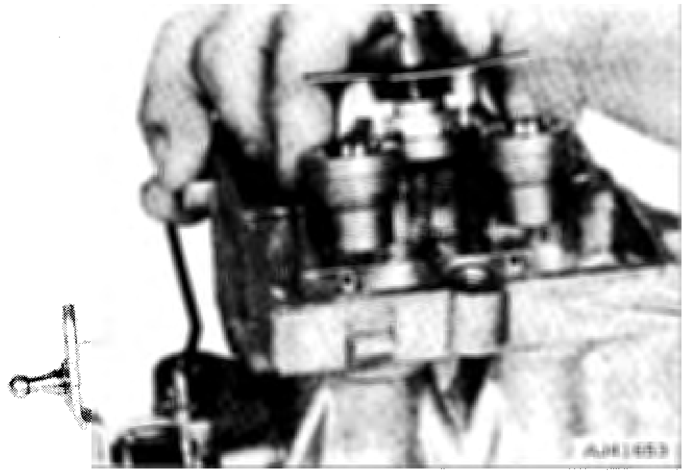


Fig. 4-47 Removing Booster Venturi Assembly

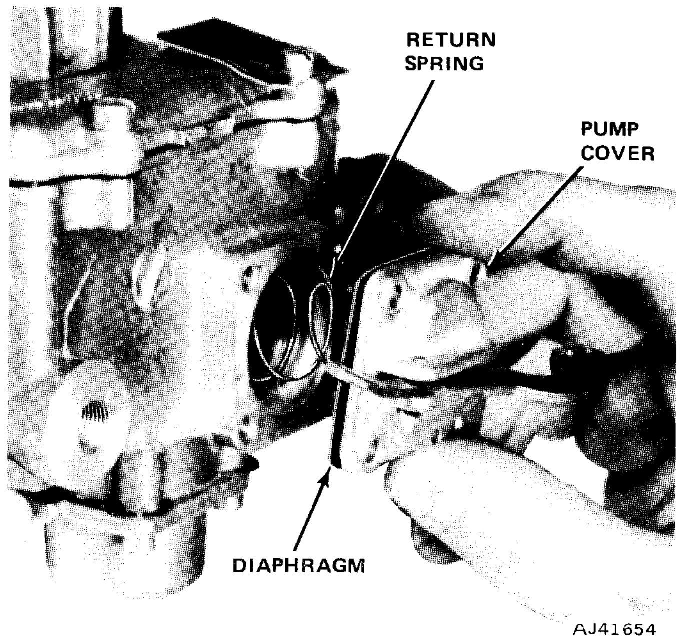


Fig. 4-48 Removing Accelerator Pump Assembly

(22) Remove dashpot or electric solenoid.

(23) If it is necessary to remove the throttle plates, lightly scribe a line on the throttle plates along throttle shaft, and mark each plate and its corresponding bore with a number or letter for proper assembly.

(24) Slide the throttle shaft out of the main body.

Cleaning and Inspection

Dirt, gum, water, or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

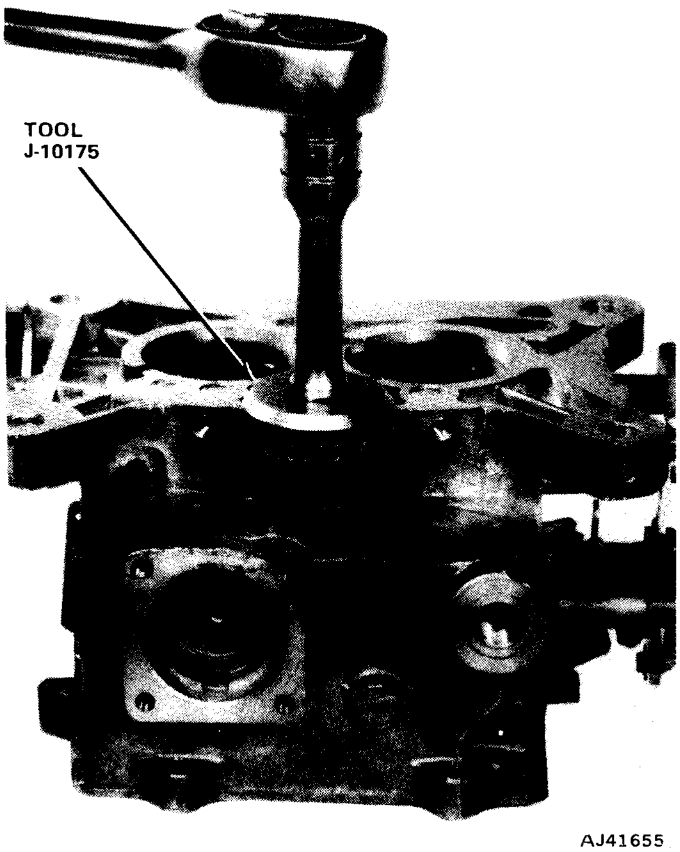


Fig. 4-49 Removing Power Valve

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered here. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all the carburetor parts (except accelerating pump diaphragm, power valve, modulator diaphragm, and the dashpot assembly) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used. Rinse the parts in kerosene to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and for ease of operation and free it if necessary. Be sure all carbon and foreign material has been removed from the automatic choke housing. Check the throttle shafts in the bores for excessive looseness or binding and check the throttle plates for burrs which prevent proper closure. Inspect the main body, air horn, booster venturi assemblies, choke housing and choke cover, power valve cover and accelerating pump cover for cracks. Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace float shaft if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Assembly

Be sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets. Inspect accelerating pump diaphragm for tears or cuts.

(1) Slide throttle shaft assembly into main body.

(2) Refer to lines scribed on throttle plates and install throttle plates in their proper location with the screws snug, but not tightened.

(3) Close throttle plates.

(4) Invert main body and hold it up to the light.

NOTE: *Little or no light should show between the throttle plates and the throttle bores.*

(5) Tap plates lightly with a screwdriver handle to test them. Hold the throttle plates closed and tighten attaching screws.

(6) Install fast idle speed adjusting screw and spring on fast idle lever.

(7) Install dashpot or electric solenoid.

(8) Place fast idle lever assembly on throttle shaft and install retaining washer and nut.

(9) Lubricate tip of new Elastomer valve and insert tip into accelerator pump cavity center hole.

(a) Using a pair of needlenose pliers, reach into fuel bowl and grasp valve tip.

(b) Pull valve in until it seats in pump cavity wall and cut off tip forward of retaining shoulder.

(c) Remove tip from bowl.

(10) Install accelerator pump diaphragm return spring on boss in chamber. Insert the diaphragm assembly in cover, place cover and diaphragm assembly into position on main body and install cover screws.

(11) Insert accelerating pump operating rod into inboard hole of accelerating pump actuating lever.

(12) Position accelerating pump operating rod retainer over correct hole in the overtravel lever. (Refer to Accelerating Pump Stroke Adjustment).

(13) Invert main body and install power valve and new gasket. Tighten valve securely.

(14) Install idle mixture adjusting screws and springs. Turn needles in gently with fingers until they just touch seat, then back them off two turns for a preliminary idle fuel mixture adjustment.

NOTE: *Do not install idle mixture limiters at this time.*

(15) Install power valve cover and new gasket.

NOTE: *The power valve cover must be installed with the limiter stops on the cover in position to provide a positive stop for the tabs on the idle adjusting limiters.*

(16) Install main jets, fuel inlet seat, and new gasket.

NOTE: *Be sure the correct jets are installed.*

(17) Install fuel inlet needle assembly in fuel inlet seat.

NOTE: *Fuel inlet needles and seats are matched assemblies. Be sure the correct needle and seat are assembled together.*

(18) Slide float shaft into float lever. Position float shaft retainer on float shaft.

(19) Install float dampener spring with short wire under float lever (fig. 4-50).

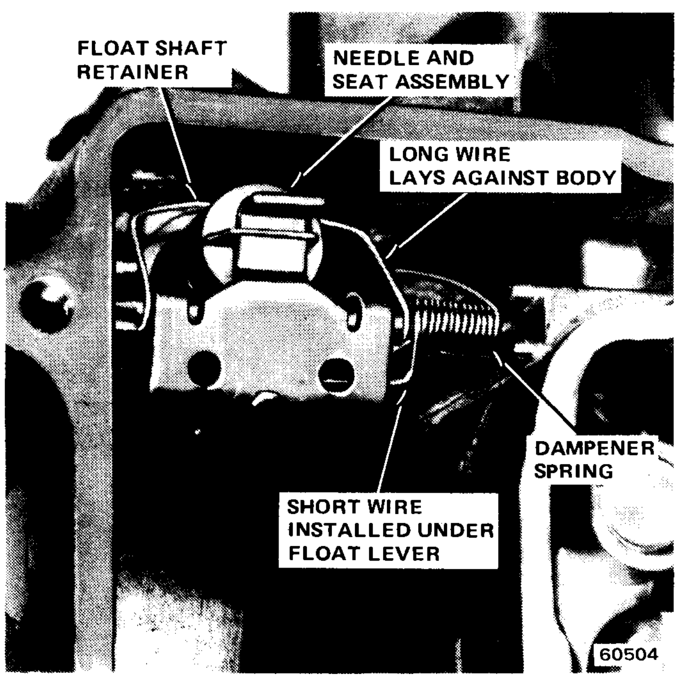


Fig. 4-50 Dampener Spring Installation

(20) Insert float assembly into fuel bowl and hook float lever tab under fuel inlet needle assembly. Insert float shaft into its guides at sides of fuel bowl.

(21) Press float shaft retainer in groove on fuel inlet needle seat and check float setting.

(22) Drop accelerating pump discharge ball into passage in main body.

(a) Drop accelerating pump discharge weight on top of ball.

(b) Position new booster venturi gasket and booster venturi in main body.

(c) Install air distribution plate and accelerator pump discharge screw and tighten screw.

(23) Position fast idle cam lever on thermostatic choke shaft.

NOTE: *The bottom of the fast idle cam lever adjusting screw must rest against the tang on the choke shaft.*

(a) Insert choke shaft into the rear of choke housing.

(b) Position choke shaft so that choke hole in shaft is to left side of choke housing.

(24) Install fast idle cam rod on fast idle cam lever.

(25) Place choke housing vacuum pickup port to main body gasket on choke housing flange.

(26) Position choke housing on main body and at the same time, install the fast idle cam on the hub on main body.

(27) Position gasket and install choke housing attaching screws.

(28) Install thermostat lever.

(29) Install fast idle cam retainer and choke cover.

(30) Install choke shield.

(31) If choke plate shaft was removed, position shaft in air horn, then install choke plate rod on end of choke shaft.

(32) If choke plate was removed, insert choke plate into choke plate shaft.

(a) Install choke plate screws but do not tighten.

(b) Check for proper plate fit, binding in air horn and free rotation of shaft by moving plate from closed to open position. If necessary, remove choke plate and grind or file plate edge where it is binding or scraping on air horn wall. If choke plate and shaft moves freely, tighten choke plate screws while holding choke in fully closed position.

(33) Position main body gasket and choke rod plastic seal on main body.

(34) Position air horn on main body and gasket so that choke plate rod fits through the seal and opening in the main body.

(35) Insert end of choke plate rod into choke plate lever.

(36) Install air horn attaching screws and carburetor identification tag, and tighten attaching screws.

(37) Attach choke plate rod and retainer to thermostatic choke shaft lever.

(38) Install air cleaner anchor screw. Tighten to 9 foot-pounds torque.

(39) Install modulator diaphragm return spring in recess of air horn. Position modulator cover over diaphragm assembly and engage piston rod with keyed slot of modulator arm. Place diaphragm and cover over return spring and install cover retaining screws.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment—Dry

(1) Remove air horn assembly and gasket. Raise float by pressing down on float tab until fuel inlet needle is lightly seated.

(2) Using a T-scale, measure distance from the fuel bowl machined surface to the flat surface of either corner of the float, at the free end (refer to Carburetor Service Specifications for the correct setting).

(3) Bend float tab to adjust and hold fuel inlet needle off its seat while adjusting, to prevent damage to the Viton tipped needle (fig. 4-51).

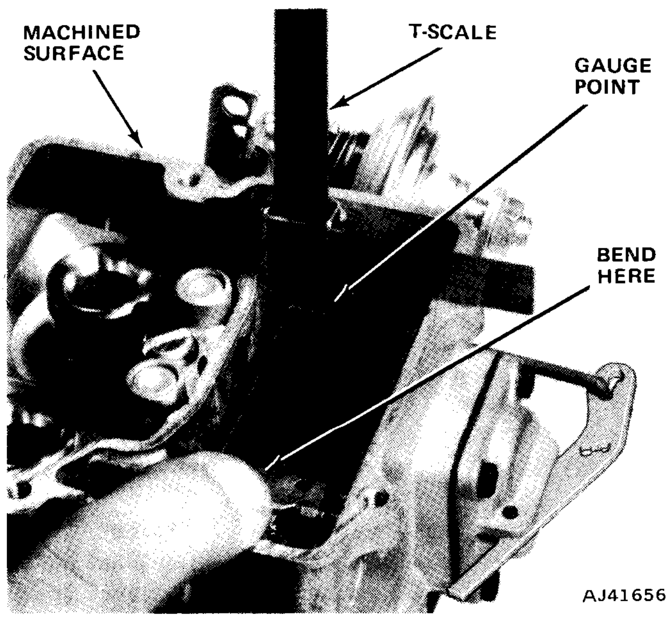


Fig. 4-51 Dry Float Adjustment

Float Level Adjustment—Wet

(1) With vehicle on a flat, level surface and engine at normal operating temperature, remove carburetor air cleaner assembly, and anchor screw.

(2) Remove air horn attaching screws and carburetor identification tag. Temporarily place air horn and gasket in position on carburetor main body and start engine. Let engine idle for a few minutes, then rotate air horn out of way and remove air horn gasket to provide access to the float assembly.

(3) While the engine is idling, use a T-scale to measure the vertical distance from the top machined surface of the carburetor main body to the level of the fuel in the fuel bowl (fig. 4-52). The measurement should be made at least 1/4 inch away from any vertical surface to assure an accurate reading, because the surface of the fuel is concave (higher at the edges than in the center). Care must be exercised to measure the fuel level at the point of contact with the float with the fuel (refer to Carburetor Service Specifications for the correct fuel level (wet) setting).

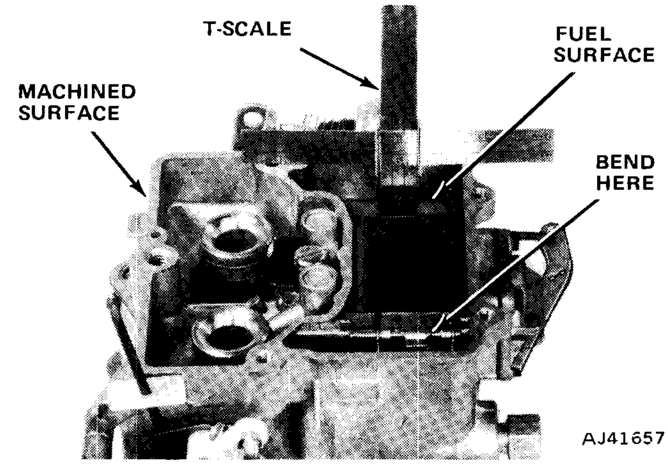


Fig. 4-52 Wet Float Level Adjustment

(4) If any adjustment is required, stop engine to minimize hazard of fire due to fuel spray when float setting is disturbed. To adjust the fuel level, bend the float tab (contacting the fuel inlet valve) upward in relation to the original position to raise the fuel level, and downward to lower it. Each time an adjustment is made to the float tab to alter the fuel level, the engine must be started and permitted to idle for a few minutes to stabilize the fuel level. Check the fuel level after each adjustment until the specified level is obtained.

(5) Install a new air horn gasket, the air horn assembly, carburetor identification tag and the attaching screws. Be sure plastic dust seal on choke operating rod is positioned correctly and does not cause rod to bind. Tighten the screws. Install the air cleaner anchor screw and tighten to 7 to 12 foot-pounds torque.

(6) Check the idle fuel mixture, idle speed adjustments and the carburetor dashpot adjustment (if equipped). Adjust the carburetor as required (refer to Carburetor Service Specifications).

(7) Install air cleaner.

Initial Choke Valve Clearance Adjustment

(1) Loosen choke cover retaining screws to allow movement of cover. Rotate choke cover 1/4-turn counterclockwise (rich) from index and tighten the retaining screws.

(2) Disconnect choke heat inlet tube. Align fast idle speed adjusting screw with the second step (index) of the fast idle cam.

(3) Start engine without moving accelerator linkage. Turn fast idle cam lever adjusting screw out (counterclockwise) three (3) full turns. Measure clearance between the lower edge of choke valve and air horn wall (refer to Carburetor Service Specifications for correct setting).

CAUTION: *Use extreme care while twisting the modulator arm to avoid damaging the nylon piston rod of the modulator assembly.*

(4) Adjust by grasping modulator arm securely with a pair of pliers at point A and twisting the arm at point B with a second pair of pliers. Twist toward the front of the carburetor to increase clearance and toward the rear of the carburetor to decrease clearance (fig. 4-53).

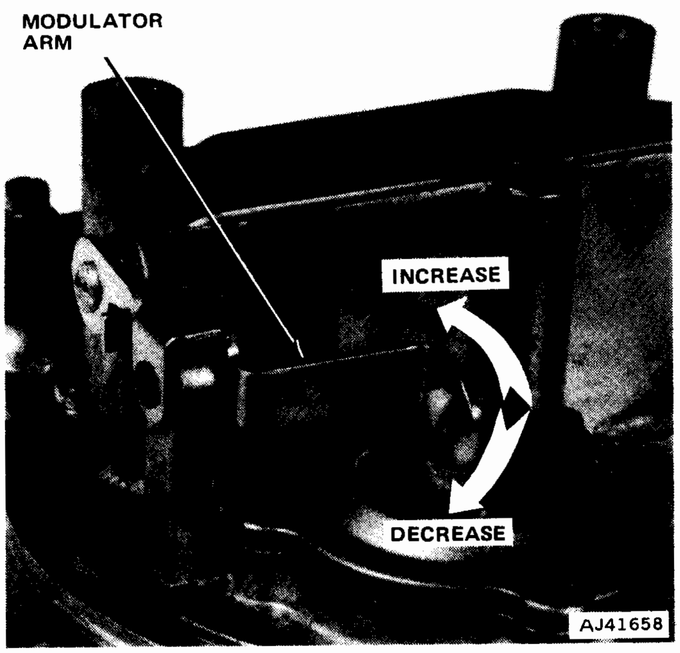


Fig. 4-53 Initial Choke Valve Clearance Adjustment

(5) After completing adjustment, stop engine and connect choke heat tube. Turn the fast idle cam lever adjusting screw in (clockwise) three full turns. Do not reset the choke cover until the fast idle cam linkage adjustment has been performed.

Fast Idle Cam Linkage Adjustment

(1) Push down on fast idle cam lever until fast idle speed adjusting screw is in contact with the second step (index) and against the shoulder of the high step.

(2) Measure clearance between the lower edge of choke valve and air horn wall (fig. 4-54). Refer to Carburetor Service Specifications for the correct setting.

(3) Adjust by turning the fast idle cam lever screw.

(4) Loosen the choke cover retaining screws and adjust the choke as outlined under Automatic Choke Adjustment.

(5) Install choke shield clamp and retaining screws.

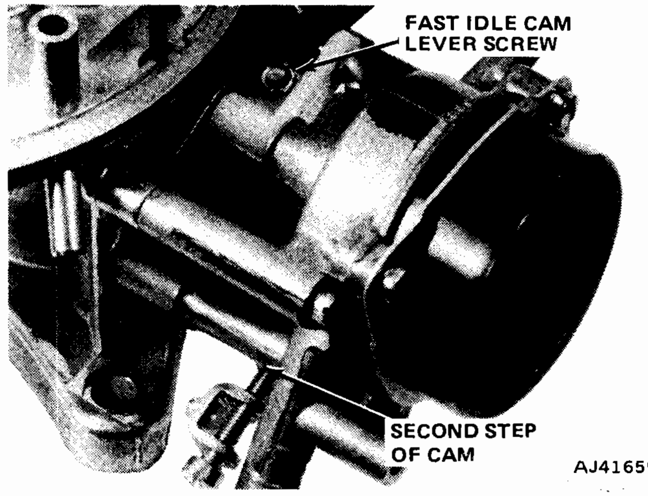


Fig. 4-54 Fast Idle Cam Linkage Adjustment

Choke Unloader Adjustment

(1) Hold throttle fully open and apply pressure on the choke valve toward the closed position.

(2) Measure the clearance between the lower edge of choke valve and air horn wall. Refer to Carburetor Service Specifications for correct setting.

CAUTION: Do not bend *the unloader tang downward from a horizontal plane.*

(3) Adjust by bending the unloader tang which contacts the fast idle cam as shown in figure 4-55. **Bend toward the cam to increase the clearance and away from the cam to decrease the clearance.**

(4) After making the adjustment, open the throttle until the unloader tang is directly below the fast idle cam pivot. **There must be exactly 0.070-inch clearance between the unloader tang and the edge of the fast idle cam (fig. 4-56).**

(5) Operate the throttle and check unloader tang to make sure it does not bind, contact, or stick on any part of carburetor casting or linkage. After carburetor installation, check for full throttle opening when the throttle is operated from inside the vehicle. If full throttle opening is not obtainable, it may be necessary to remove excess padding under the floormat or reposition the throttle cable bracket located on the engine.

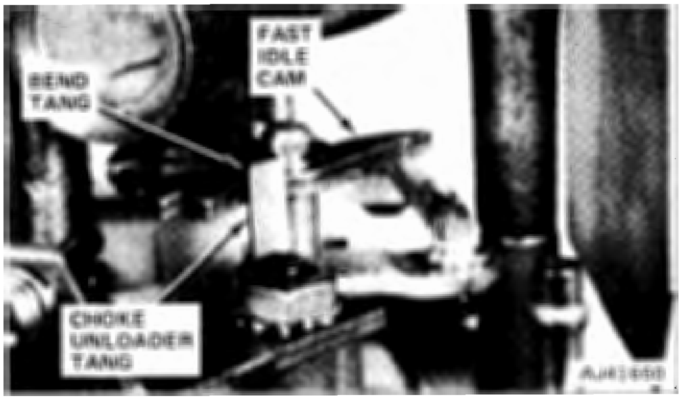


Fig. 4-55 Unloader Adjustment

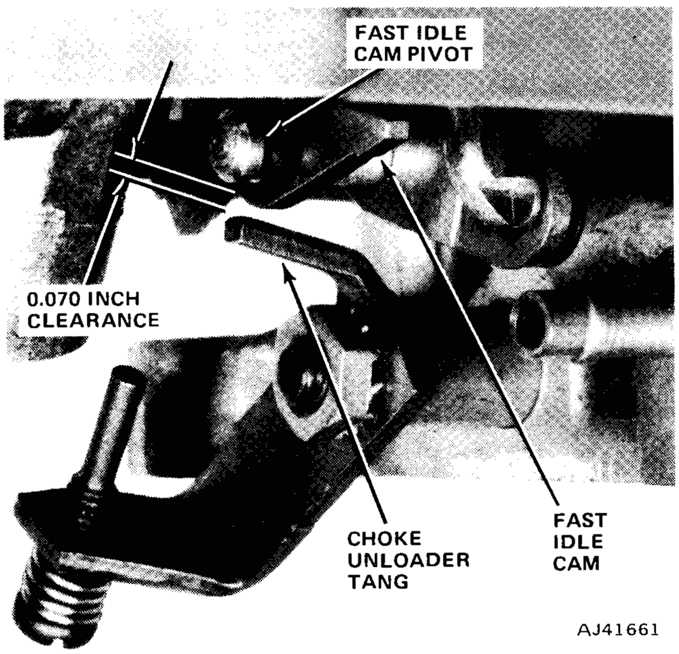


Fig. 4-56 Unloader-to-Fast-Idle-Cam Clearance

Automatic Choke Adjustment

Loosen choke cover retaining screws and rotate cover in the desired direction as indicated by an arrow on the face of the cover (refer to Carburetor Service Specifications for the correct setting). The specified setting will be satisfactory for most driving conditions. However, in the event that stumbles or stalls occur on acceleration during engine warmup, the choke may be set richer or leaner using the tolerance provided to meet individual engine requirements.

Accelerating Pump Stroke Adjustment

The accelerating pump stroke has been set to help keep the exhaust emission level of the engine within the specified limits. The additional holes provided for pump stroke adjustment are for adjusting the stroke for specific engine and climate applications. The primary throttle shaft lever (overtravel lever) has four holes and the accelerating pump link has two holes to control the accelerating pump stroke (fig. 4-57).

For normal operating conditions, the accelerating pump operating rod should be in the third hole in the overtravel lever (for all carburetors except the 6DM2J which should be in the second hole) and the inboard hole (hole closest to the pump plunger) in the accelerating pump link. In extremely hot climate regions, the pump stroke may be shortened to provide smoother acceleration by placing the pump rod in the second hole of the overtravel lever. In extremely cold climates, the pump stroke may be increased to provide smoother acceleration by placing the pump rod in the fourth hole of the overtravel lever.

The accelerating pump operating rod should be in the third hole in the overtravel lever and the inboard hole (hole closest to the pump plunger) in the accelerating pump link.

(1) Remove operating rod from retaining clip.

(2) Position clip over the specified hole in overtravel lever. Insert operating rod through clip and overtravel lever. Snap release clip over rod.

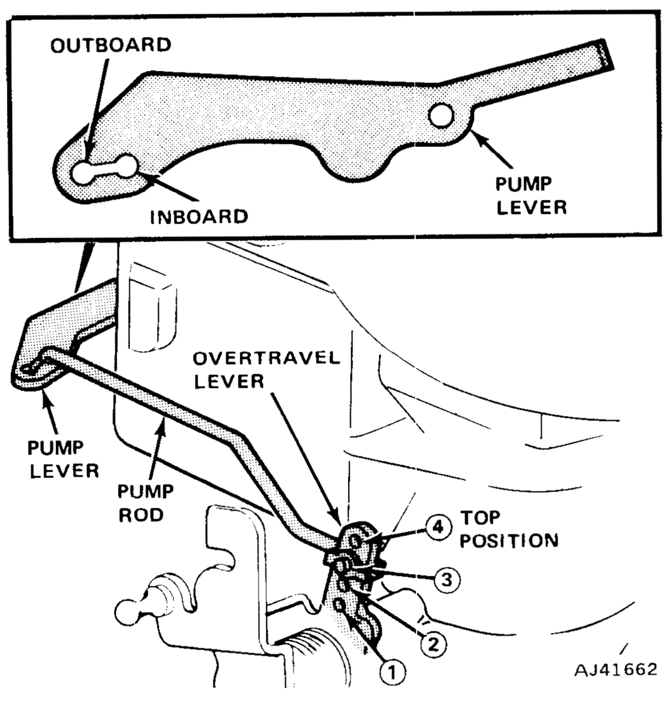


Fig. 4-57 Accelerating Pump Stroke Adjustment

Idle Speed and Mixture Adjustment

Refer to Engine Idle Setting Procedures in Emission Control section.

Dashpot Adjustment (On Vehicle)

With the throttle set at curb idle position, fully depress the dashpot stem and measure the clearance between the stem and the throttle lever (fig. 4-58).

Refer to Carburetor Service Specifications for correct setting. Adjust by loosening the locknut and turning the dashpot.

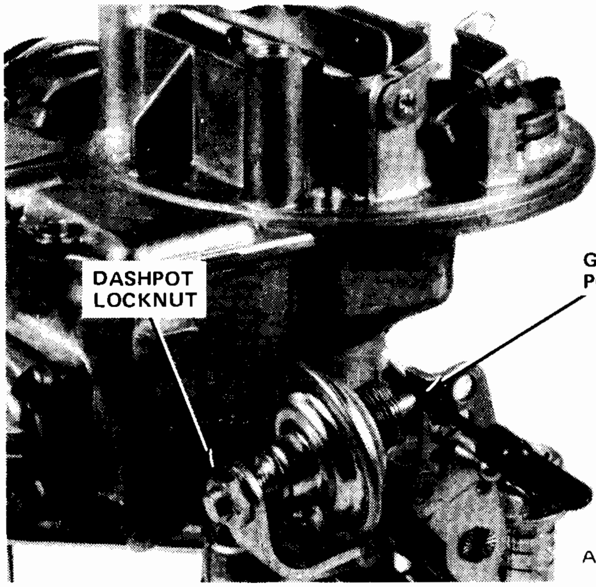


Fig. 4-58 Dashpot Adjustment

Fast Idle Speed Adjustment (On Vehicle)

Set the fast idle speed with the engine at operating temperature and the fast idle speed adjusting screw against the index mark (second step) of the fast idle cam (refer to Carburetor Service Specifications for the correct rpm setting). Adjust by turning the fast idle speed adjusting screw.

NOTE: *When adjusting fast idle speed, plug EGR port and spark port.*

Model 2100 Carburetor Calibrations

	6DM2J	6RHM2	6DA2J	6DM2	6RHA2
Throttle Bore Size	1.562	1.562	1.562	1.562	1.562
Main Venturi Size	1.080	1.080	1.080	1.080	1.080
Fuel Inlet Diameter	0.101	0.101	0.101	0.101	0.101
Low Speed Jet (Tube)	0.028	0.031	0.032	0.031	0.029
Economizer	0.046	0.055	0.043	0.046	0.055
Idle Air Bleed	0.106	0.101	0.101	0.106	0.110
Main Jet Number	47	47	48	47	47
High Speed Bleed	0.052	0.031	0.052	0.052	0.031
Power Valve Timing (Inches of Hg)					
First Stage	10.00	8.00	10.00	10.00	8.00
Second Stage	5.50	3.50	5.50	5.50	3.50
Accelerator Pump Jet	0.028	0.024	0.024	0.032	0.024
Vacuum Spark Port					
Height	0.050	0.050	0.050	0.050	0.050
Width	0.085	0.085	0.085	0.085	0.085
Choke Heat Bypass	0.114	0.114	0.114	0.114	0.114
Choke Heat Inlet Restriction	0.076	0.076	0.076	0.076	0.076
Choke Vacuum Restriction	0.082	0.082	0.089	0.082	0.082

60575

CARBURETOR MODEL 4350—4 VENTURI

GENERAL

The Model 4350 carburetor consists of three main assemblies: air horn, main body, and throttle body (fig. 4-59).

The air horn assembly also serves as the fuel bowl cover and contains the choke valve and shaft, accelerator pump linkage, fuel inlet needle and seat, auxiliary fuel inlet valve, float and lever, secondary air valve, booster venturi, and internal fuel bowl vents.

The main body assembly contains fuel passages for the metering systems, main metering jets, accelerator pump, accelerator pump inlet, discharge check valves, and secondary air valve damper piston.

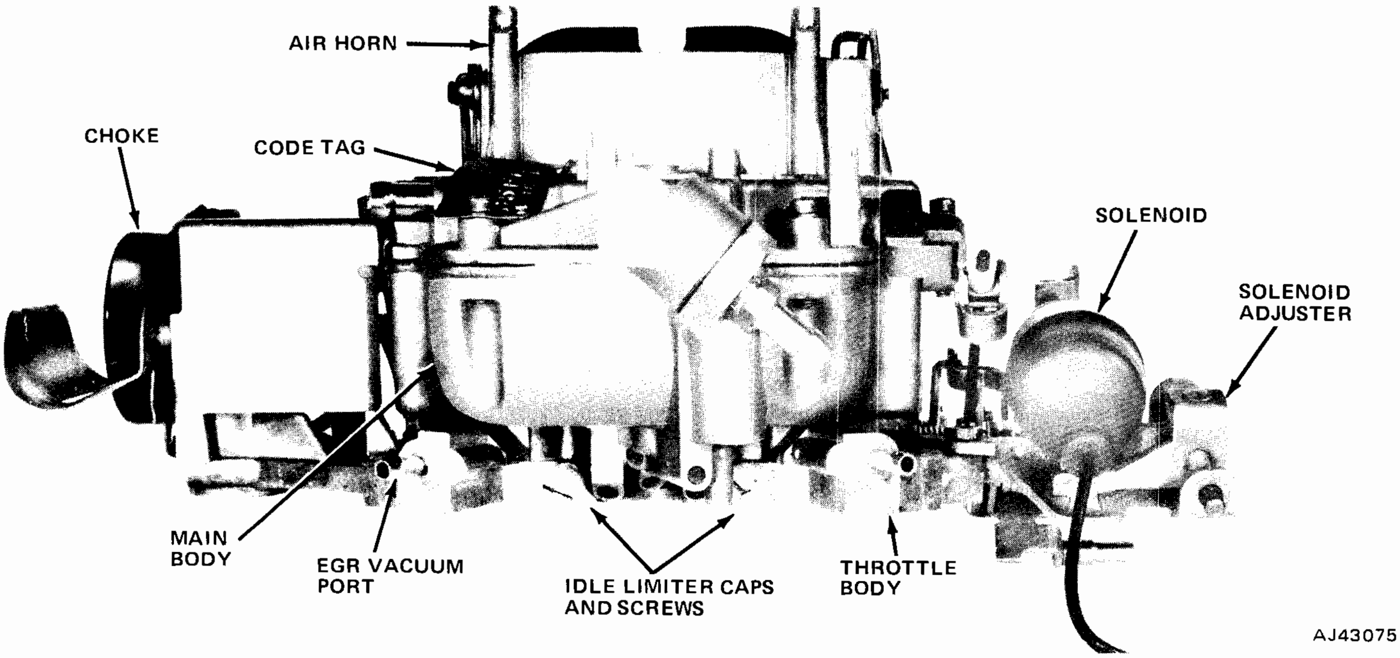


Fig. 4-59 Model 4350 Carburetor Assembly

The throttle body assembly contains the primary and secondary throttle shaft and lever assemblies, curb idle solenoid, fast idle adjusting screw, idle mixture adjusting screws, and the automatic choke assembly.

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used). The tag is attached to the carburetor and must remain with the carburetor to assure proper identification (fig. 4-60).

CARBURETOR CIRCUITS

The Model 4350 carburetor incorporates five basic fuel metering circuits: idle (low speed), primary main metering, secondary main metering, pump, and power enrichment circuit. In addition to the basic fuel metering circuits, the float (fuel inlet) and choke circuits are used.

Float (Fuel Inlet) Circuit

Fuel under pressure enters the carburetor through the fuel inlet passage located in the air horn assembly. The amount of fuel entering the fuel bowl is regulated by the distance the fuel inlet needle is moved off its seat. A dual float and lever assembly controls the movement of the fuel inlet needle and reacts to any change in the fuel level. When the fuel level drops, the fuel inlet needle, which rests against the float lever, drops away from its seat and admits the proper amount of fuel to maintain the specified level (fig. 4-61).

An auxiliary fuel inlet valve is provided to supplement the normal fuel supply during heavy road load or high speed operation. When the float drops to a certain level, the float lever presses against the auxiliary valve plunger and opens the valve to provide an additional fuel supply to the bowl.

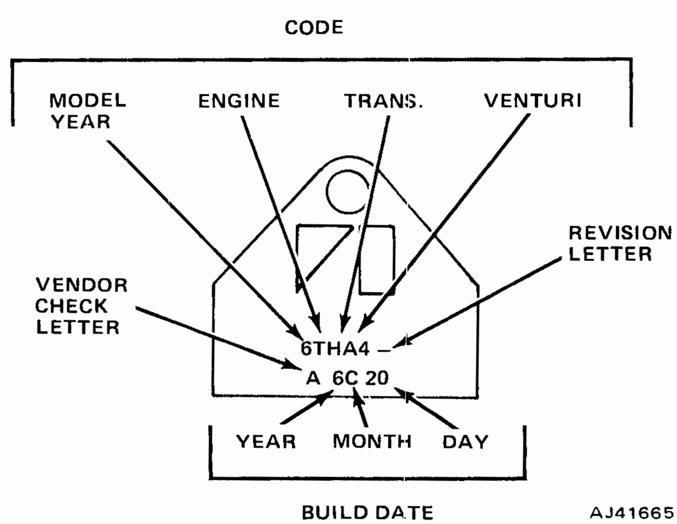


Fig. 4-60 Identification Tag

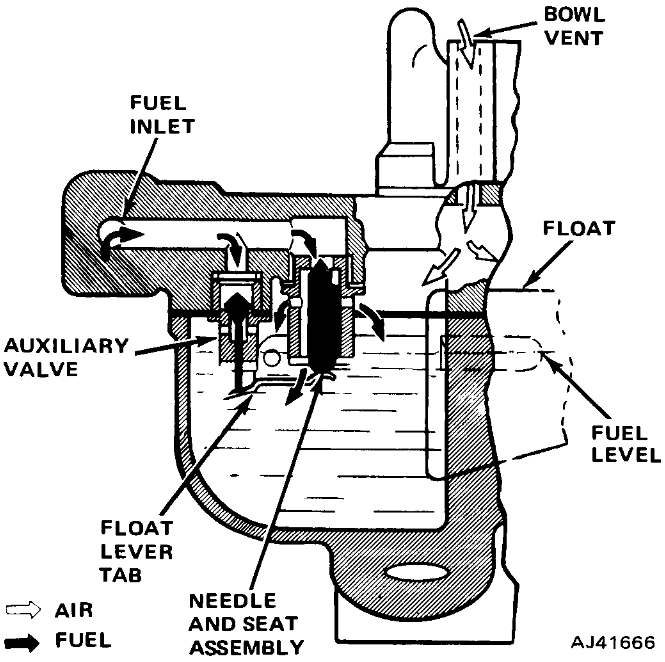


Fig. 4-61 Float Circuit

Idle (Low Speed) Circuit

Fuel for idle and low speed operation is supplied through the idle circuit. When the throttle valves are in the curb idle or early part-throttle position, manifold vacuum, or low pressure, is applied to the idle discharge ports and idle transfer slots. The pressure difference between atmospheric pressure in the fuel bowl and manifold vacuum causes fuel to flow through the idle circuit.

Fuel is forced from the fuel bowl through the main jets into the main wells. From the main wells, the fuel passes through the idle tubes which are located inside of the main well tubes. The fuel is metered as it flows through restrictions at the lower end of the idle tubes. The fuel then flows upward through the idle tubes and is routed through short diagonal passages to the downward idle channels which terminate at the idle transfer slots and idle discharge ports (fig. 4-62).

Filtered air enters through calibrated idle air bleeds and mixes with the fuel as it flows downward through the idle channels. The idle air bleeds also prevent siphoning through the idle system during high speed operation or engine shutdown.

The fuel-air mixture is discharged through the idle discharge ports and the bottom of the idle transfer slots when the throttle valves are in the curb idle position. The top of the idle transfer slots serve as additional air bleeds at this time to further atomize the idle fuel-air mixture. As the throttle valves are opened slightly above the curb idle position, the entire idle transfer slots are exposed to the manifold vacuum. This provides a richer fuel-air mixture and prevents a flat spot during the transition from idle to primary main metering circuit.

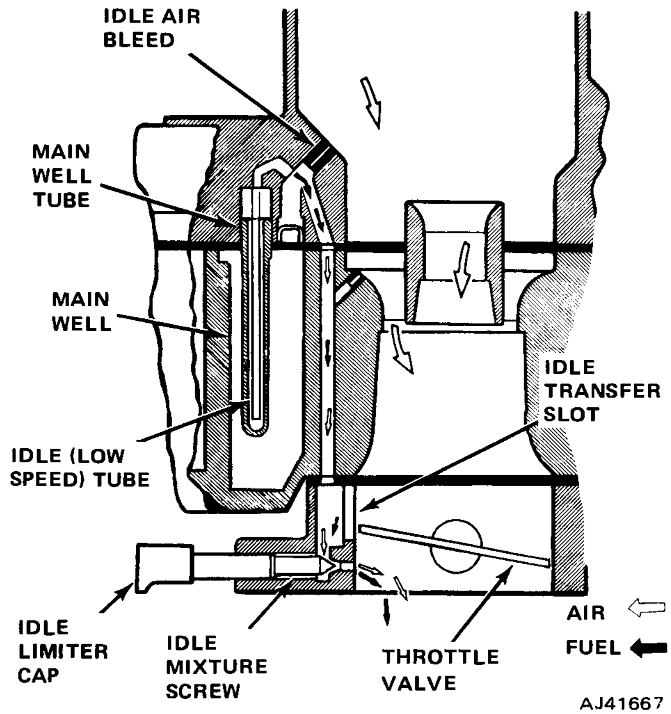


Fig. 4-62 Idle Circuit

Primary Main Metering Circuit

Fuel for part throttle or cruising speeds is provided by the primary main metering circuit in response to the primary throttle opening.

As the primary throttle opening is increased, manifold vacuum decreases at the idle discharge ports and transfer slots causing the idle circuit discharge to diminish. However, the increased throttle opening develops an airflow through the main and booster venturi and creates a vacuum or pressure drop at the main discharge nozzle openings, which are located within the booster venturi. Fuel flows through the main metering circuit due to pressure being higher in the fuel bowl than at the discharge nozzles. The pressure drop at the booster venturi is proportionately greater as the throttle opening is increased, resulting in an increased fuel flow for higher engine speeds.

Fuel is forced from the fuel bowl through the main metering jets and into the main wells. The fuel then flows through the main well tubes. As the fuel flows upward through the main well tubes, it is mixed with air supplied by the high speed air bleeds. The air enters through small holes in the sides of the main well tubes. The fuel-air mixture flows from the main well tubes to the main discharge nozzles and is discharged into the air stream within the booster venturi (fig. 4-63).

The high speed air bleeds meter an increasing amount of air as booster venturi vacuum (pressure drop) increases, thereby maintaining the proper fuel-air ratio. The high speed air bleeds serve as anti-siphon vents at reduced speeds and also act as vents for the main wells to help reduce percolation during a hot engine shutdown.

For 1976, a vacuum-operated throttle kicker assembly is used on some models to reduce hydrocarbon emissions when the throttle is closed rapidly. As the throttle closes, the resulting increase in manifold vacuum causes a vacuum diaphragm to retract linkage to open the primary throttle plate slightly.

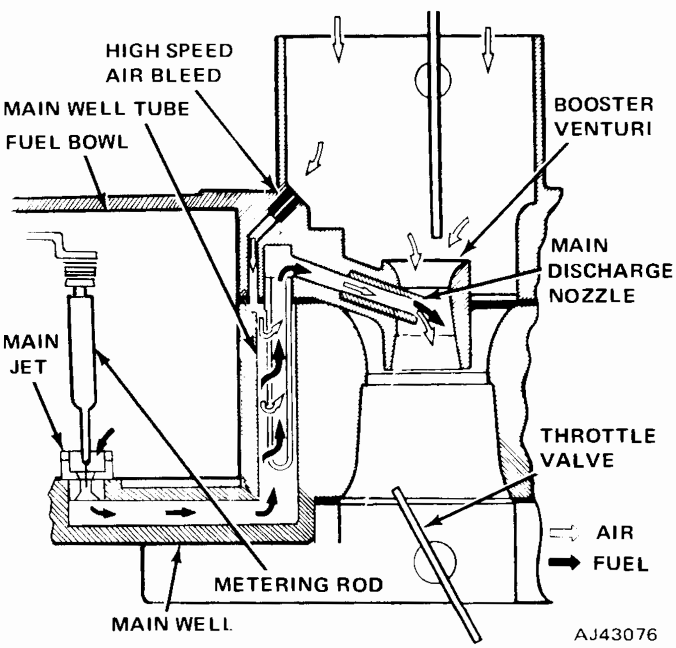


Fig. 4-63 Primary Main Metering Circuit

Secondary Main Metering Circuit

When maximum power demands are made on the engine, an additional volume of fuel-air mixture is supplied by the secondary main metering circuit to supplement the primary main metering circuit discharge.

The secondary throttle is mechanically linked to the primary throttle and begins to open when the primary throttle is 3/4 open. Both throttles reach wide-open position at the same time. During the engine warmup period (choke on), the secondary throttles are prevented from opening by the secondary throttle lockout lever to avoid an excessive load on a cold engine.

A single air valve plate is located in the air horn above the secondary main discharge nozzles and is linked to a damper piston. A spring located on the damper piston is calibrated to hold the air valve closed until air velocity is sufficient to overcome the spring tension. The damper spring also counteracts sudden movements of the air valve to provide smoother engine operation.

When the secondary throttle valves are opened slightly, manifold vacuum is introduced into the secondary openings below the air valve.

Secondary main metering jets located just below the air valve plate sense the pressure drop and fuel begins to flow through the secondary fuel system. The air valve also reacts to the pressure drop and begins to open. The amount of opening is controlled by air flowing through the secondaries and the opposing force of the air valve piston damper spring. The amount of fuel flowing through the secondary metering system is controlled by the secondary metering jets and the secondary metering rods. The secondary metering rods are connected to the air valve so that the size of the main metering jets and the corresponding fuel flow is in direct proportion to the air valve opening and the volume of air required to produce the opening.

Fuel in the secondary main wells is maintained at the same level as the primary main wells by a small constant feed passage located at the rear of the fuel bowl (fig. 4-64). An anti-siphon bleed is located on top of the secondary feed passage. The anti-siphon bleed also acts as a vent for the secondary main wells during curb idle and hot engine shutdown to help reduce percolation. This same bleed becomes a cranking jet during cold weather start-up and helps richen the mixture for fast starts.

When the primary throttle plates began to close on deceleration the secondary throttle plates are closed mechanically. As airflow through the secondaries diminishes, the air valve plate is closed by the force of the damper piston spring. The secondary throttle shaft is made of two shafts coupled loosely in the center to permit some movement. This allows each secondary plate to seat independently of its own bore. There are two secondary return springs, one on each of the two secondary throttle shafts.

Pump Circuit

When accelerating rapidly from low speeds, a momentary fuel lag occurs in the idle and primary main metering circuits. The increased air velocity resulting from the rapid opening of the throttle tends to lean out the fuel-air mixture. To compensate for this lean condition, the pump circuit delivers an additional quantity of fuel which is discharged into the air stream to maintain the proper fuel-air ratio.

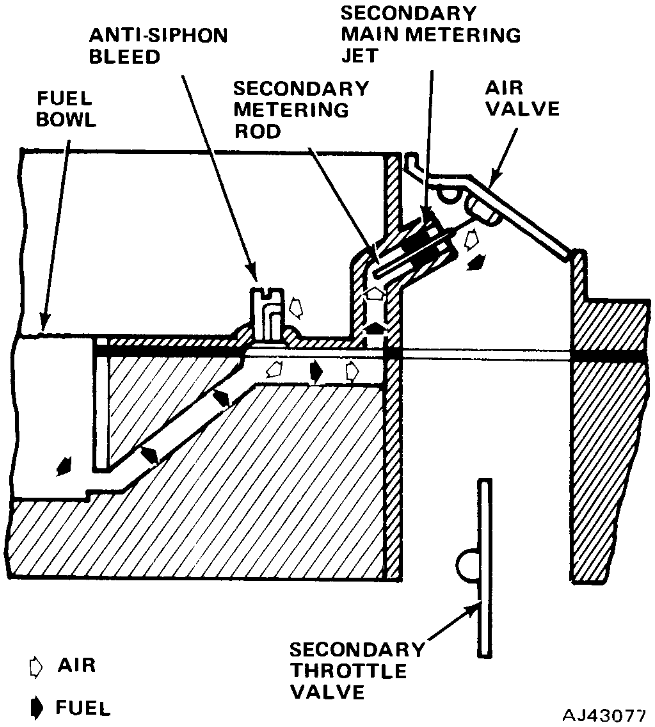


Fig. 4-64 Secondary Main Metering Circuit

When the throttle is closed, the accelerator pump plunger is pulled upward by the pump link and compresses the pump spring. Fuel is drawn from the fuel bowl past the inlet check valve and into the pump chamber. The pump discharge needle is seated at this time to prevent air from entering the pump chamber (fig. 4-65).

When the throttle is opened, the pump plunger is moved downward by spring action, causing the inlet check valve to seat, and forcing fuel into the discharge passage. The seating of the inlet check valve prevents fuel escaping back to the fuel bowl. The pressure of the fuel in the discharge passage lifts the discharge needle off its seat and sprays the fuel out the discharge nozzles. When the pump plunger has completed its travel downward, the discharge needle seats to prevent air entering the discharge passage, assuring a solid fuel supply for the next pump stroke.

At high speeds a vacuum develops at the pump discharge nozzles. The pump air bleed (check ball) provides a vent to the discharge nozzles and prevents siphoning of fuel from the discharge passage. The air bleed is sealed by fuel pressure during the discharge stroke.

Power Enrichment Circuit

During heavy road load or high speed operation, the fuel-air ratio must be richened to provide increased engine power.

Power enrichment is accomplished by means of two calibrated metering rods yoked to a single manifold vacuum actuated piston (fig. 4-66). The metering rod piston rides on a calibrated spring which attempts to keep the piston at the top of its cylinder. This allows the smallest diameter of the tapered metering rods to extend into the main metering jets and permits maximum fuel flow through the jets to the main well cavities.

At idle, part throttle, or cruise conditions when manifold vacuum is high, the piston will be drawn down into the vacuum cylinder, overcome calibrated spring tension, and the larger diameter of the metering rods will extend into the main metering jets, restricting the fuel flow to the main well cavities. An additional control is provided by the vacuum piston limiter lever which is linked to the throttle lever by the accelerator pump rod. This provides a direct relationship between metering rod position and throttle plate opening.

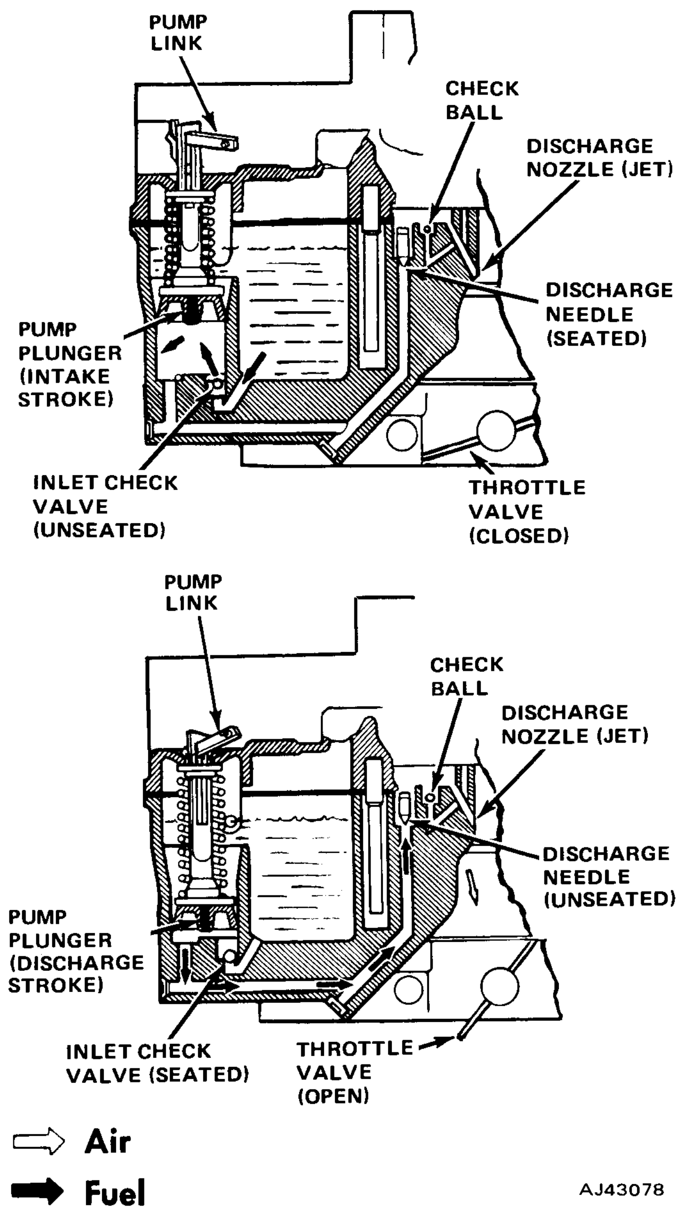


Fig. 4-65 Pump Circuit

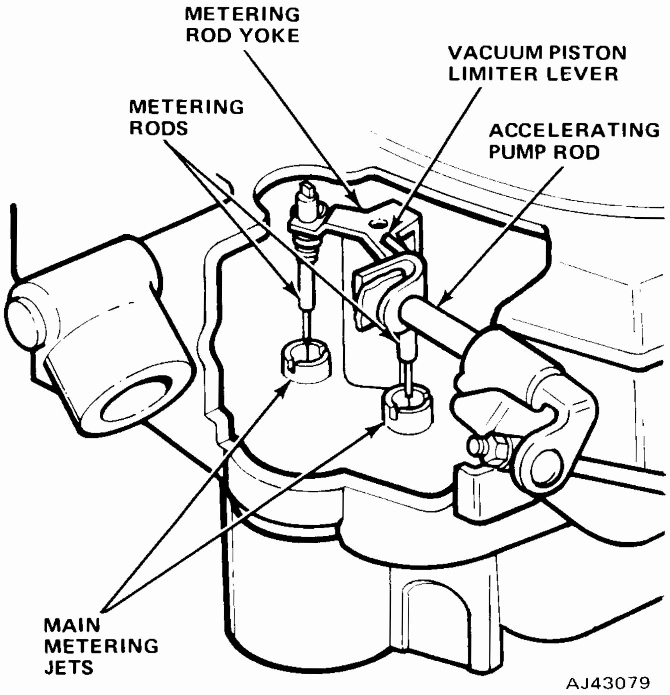


Fig. 4-66 Power Enrichment Circuit

Choke Circuit

A cold engine requires a richer fuel-air mixture for quick starting and satisfactory performance during the warmup period. The choke circuit automatically regulates the position of the choke valve in the air horn to provide the proper mixture throughout the entire cold engine operation.

When the engine is cold, the thermostatic coil in the choke cover exerts force against its lever and rotates the thermostatic choke shaft. This action causes the choke valve to close (fig. 4-67).

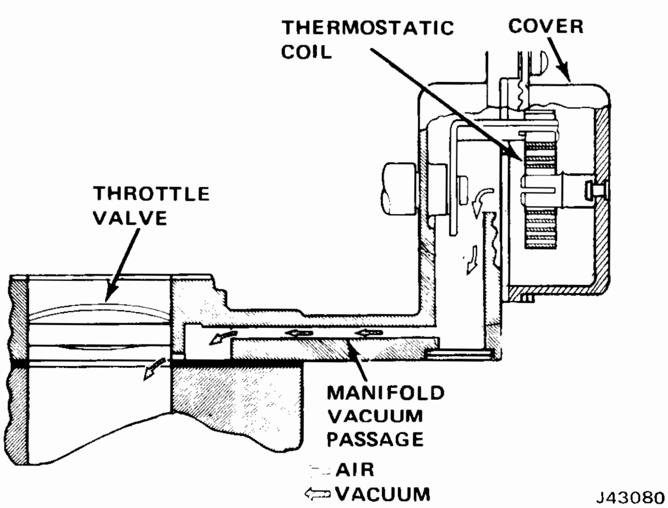


Fig. 4-67 Choke Circuit

During cranking, manifold vacuum is applied to the primary openings below the choke valve and causes fuel to flow through the idle and primary main metering circuits to start the engine. In addition to the fuel flow from the main metering circuit, a cranking jet, located in the air horn assembly between the primary venturi, provides additional fuel for cold engine starts (fig. 4-68). Fuel flows from the secondary feed passage, through the cranking jet, and into the primary throttle bores when the choke valve is closed.

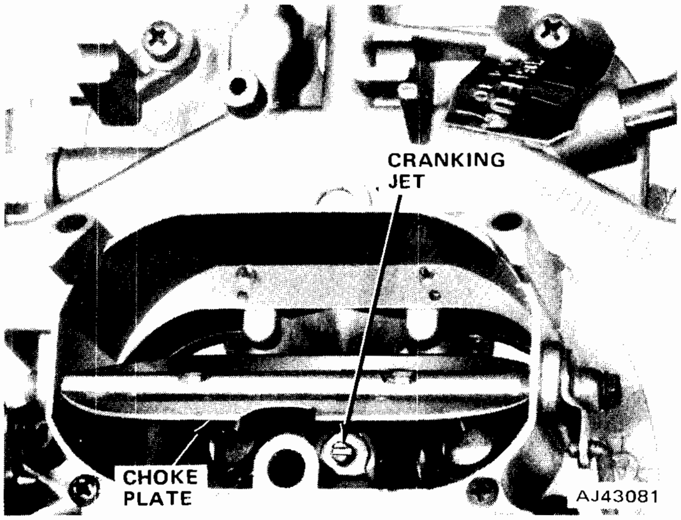


Fig. 4-68 Cranking Jet

When the engine starts, manifold vacuum is channeled to the choke vacuum diaphragm which is attached to the throttle body. As the diaphragm is pulled in, linkage opens the choke plate a specified distance. The action of the diaphragm, combined with atmospheric pressure against the offset choke valve, opposes the tension of the thermostatic coil and causes the choke valve to open slightly to prevent flooding of the engine. This opening of the choke valve is referred to as the initial choke valve clearance.

As the engine warms up, a chamber in the exhaust manifold crossover passage heats filtered air being drawn through the choke heat tube to the choke housing by manifold vacuum. A thermostatic bypass valve, which is integral with the choke heat tube, helps prevent premature choke valve opening during the early part of the warmup period. The valve regulates the temperature of the hot airflow to the choke housing by allowing outside unheated air to enter the heat tube. A thermostatic disc is incorporated in the valve which is calibrated to close the valve at 75°F and open it at 55°F.

The volume of air entering the choke housing is controlled by calibrated restrictions in the carburetor. The heated air entering the choke housing causes the thermostatic coil to gradually lose its tension and unwind.

During the warmup period, a fast idle must be provided to prevent engine stalling. The fast idle cam is rotated into position against the fast idle screw by the thermostatic choke shaft and lever assembly and results in increased engine speed in proportion to the choke valve opening. When the choke valve is fully open, the fast idle cam rotates free of the fast idle screw, allowing the engine to return to curb idle.

If the engine is accelerated during the warmup period, the resulting drop in manifold vacuum decreases the pull of the choke piston against the tension of the thermostatic coil and allows the choke valve to move toward the closed position. This provides the richer mixture required to prevent engine stalling.

Should the engine become flooded during the starting period, the choke can be mechanically opened a specified distance by depressing the accelerator pedal to the floor. A tang on the primary throttle lever will then contact the fast idle cam and partially open the choke valve through connecting linkage. This is referred to as the unloader.

To avoid overloading a cold engine, a secondary lockout lever engages a tang on the secondary throttle stop lever and prevents secondary throttle operation during the warmup period. The lockout lever releases the secondary throttle only after the choke is fully open.

CARBURETOR OVERHAUL

The following procedure applies to complete overhaul with the carburetor removed from the engine.

A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine (refer to Service Adjustment Procedures).

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection and replacement of all gaskets and worn or damaged parts. Refer to figure 4-69 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in kit.*

Carburetor Removal

Flooding, stumble on acceleration, and other performance complaints are, in many instances, caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the cause of complaint, the carburetor should be carefully removed from the engine without removing the fuel from the bowl. The contents of the bowl then may be examined for contamination as the carburetor is disassembled.

(1) Remove air cleaner.

(2) Remove throttle cable from throttle lever. Disconnect distributor vacuum line, PCV hose, EGR vacuum line,, in-line fuel filter and the choke heat tube at the carburetor.

(3) Disconect choke clean air line from air horn.

(4) Remove carburetor retaining nuts and remove carburetor. Remove carburetor mounting gasket, spacer, and lower gasket from intake manifold.

Carburetor Installation

(1) Clean gasket mounting surfaces of spacer and carburetor. Place spacer between two new gaskets and position spacer and gaskets on intake manifold. Position carburetor on spacer and gasket and secure it with retaining nuts. To prevent leakage, distortion or damage to the carburetor body flange, snug the nuts, and then alternately tighten each nut in a criss-cross pattern to 13 foot-pounds torque.

(2) Connect in-line fuel filter throttle cable, choke heat tube, distributor vacuum line, EGR vacuum line, and PCV hose.

(3) Connect choke clean air line to the air horn.

(4) Adjust engine idle speed, idle fuel mixture, and antistall dashpot (if equipped). Install air cleaner.

Disassembly

(1) Remove fuel inlet line from fuel filter.

(2) Remove choke clean-air pickup connecting tube from air horn.

(3) Remove choke control rod retainer from automatic choke lever. Separate rod from lever.

(4) Remove accelerator pump throttle link retainer from throttle lever assembly. Separate link from lever assembly.

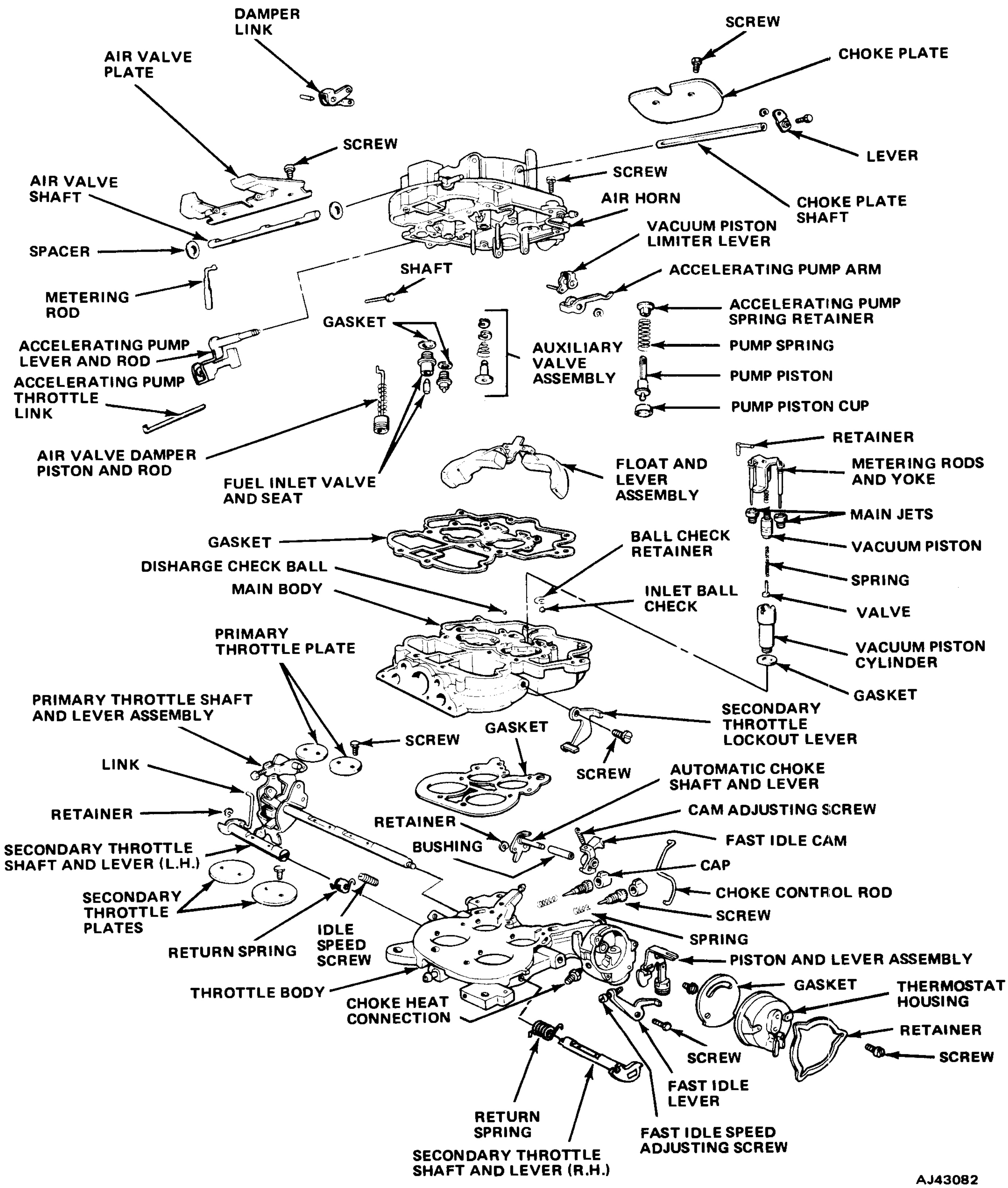


Fig. 4-69 Carburetor Model 4350—Exploded View

(5) Remove air cleaner anchor screw and remove air-horn-to-fuel-bowl attaching screws (fig. 4-70).

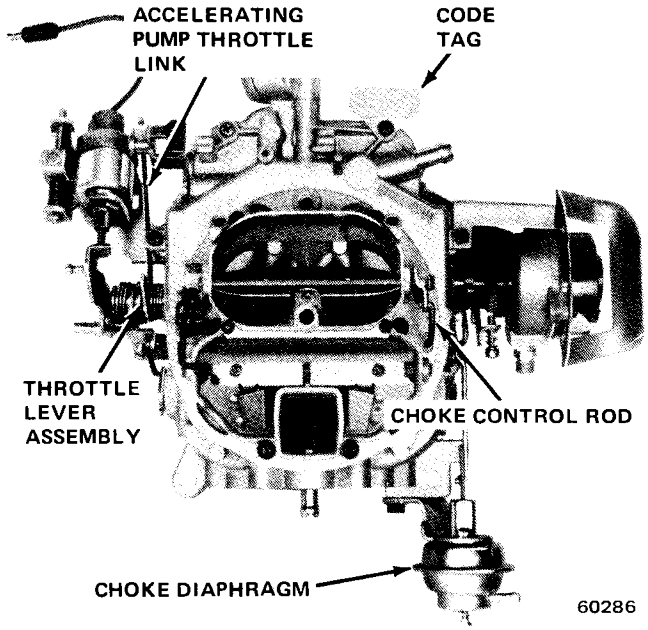


Fig. 4-70 Model 4350 Carburetor—Top View

(6) Lift air horn off main body.

(7) Pull float pivot pin and remove float assembly.

(8) Remove auxiliary fuel inlet valve with Tool J-10185 and fuel inlet needle seat with a 1/2-12 point socket (fig. 4-71).

(9) Remove secondary air valve damper link pivot pin and remove rod from link.

(10) Remove air valve damper piston, rod, and spring.

(11) If it is necessary to remove secondary air valve plate or shaft, remove the air valve plate attaching screws. Remove plate, then slide shaft out of the air horn.

(12) Remove attaching screws if it is necessary to remove choke plate or choke shaft.

(13) Remove choke plate, then slide choke shaft and lever out of air horn.

NOTE: *Choke lever is attached to shaft with a left-hand thread screw.*

(14) Remove accelerating pump arm retainer and slide accelerating pump lever and rod from air horn.

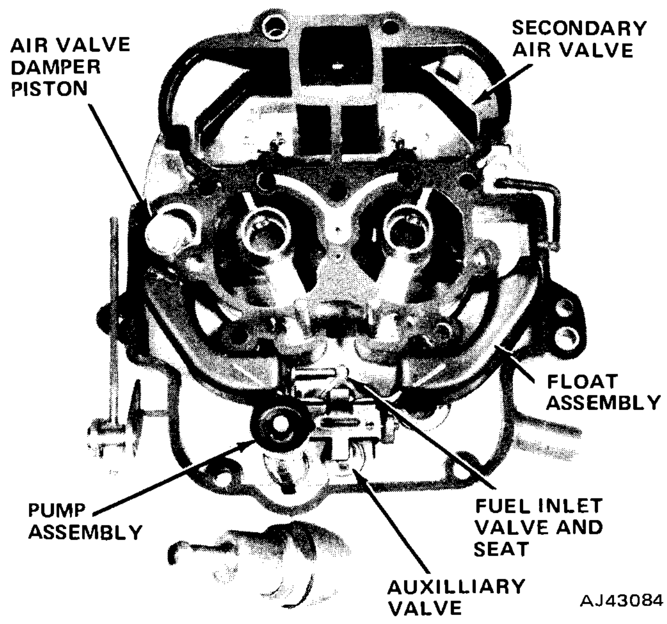


Fig. 4-71 Air Horn—Bottom View

(15) Remove accelerating pump from pump arm.

(16) Turn main body upside down and catch accelerating pump discharge needle and check ball (fig. 4-72).

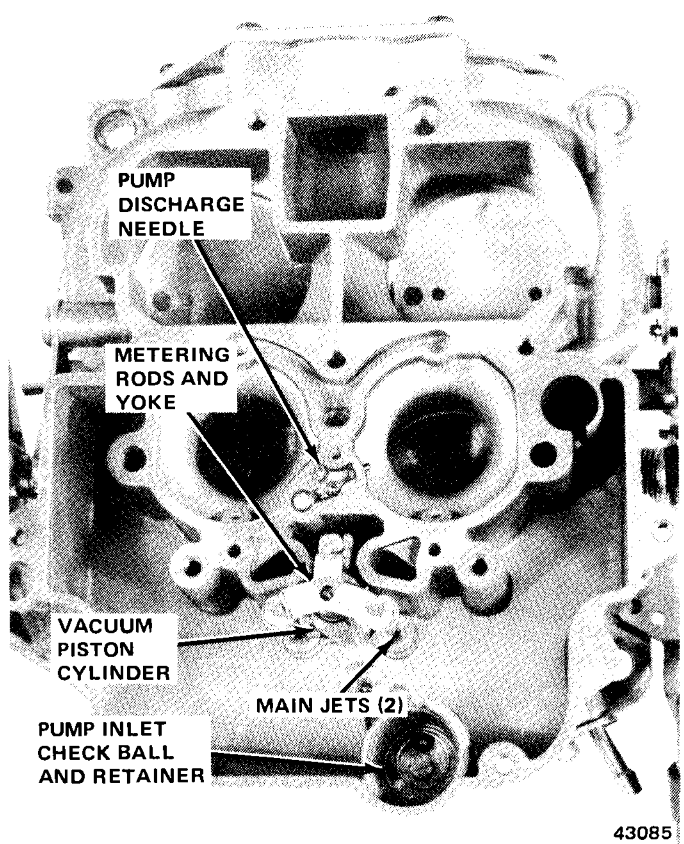


Fig. 4-72 Fuel Bowl Interior

(17) Remove main metering jets.

(18) Remove accelerating pump inlet check ball retainer, then turn main body over and catch ball from pump well.

(19) Remove throttle body to main body screws from bottom of throttle body (fig. 4-73) and separate the two castings.

(20) Remove choke housing cover screws, cover, gasket and thermostatic spring.

(21) Remove choke diaphragm assembly.

(22) Remove retainers from secondary throttle-lever-to-primary-throttle connecting link, remove link.

(23) Remove throttle kicker assembly.

(24) If it is necessary to remove throttle plates or shafts from throttle body, remove throttle plate attaching screws and plates.

(25) Slide secondary throttle shafts and return springs out of throttle body.

(26) Remove screw from primary throttle shaft and remove fast idle lever and adjusting screw. Slide throttle shaft and primary throttle shaft and lever assembly out of throttle plate.

(27) Remove primary throttle lever assembly retainer, then slide lever and springs off shaft.

(28) If it is necessary to remove fast idle cam or bushing, carefully press bushing out of choke housing and bushing column.

NOTE: *The column may bend out of alignment or break without proper support to the column during bushing removal or installation. Make sure all holes in new gaskets have been properly punched and that no foreign material has adhered to gaskets. Gasket surfaces must be clean and flat and free of nicks or burrs.*

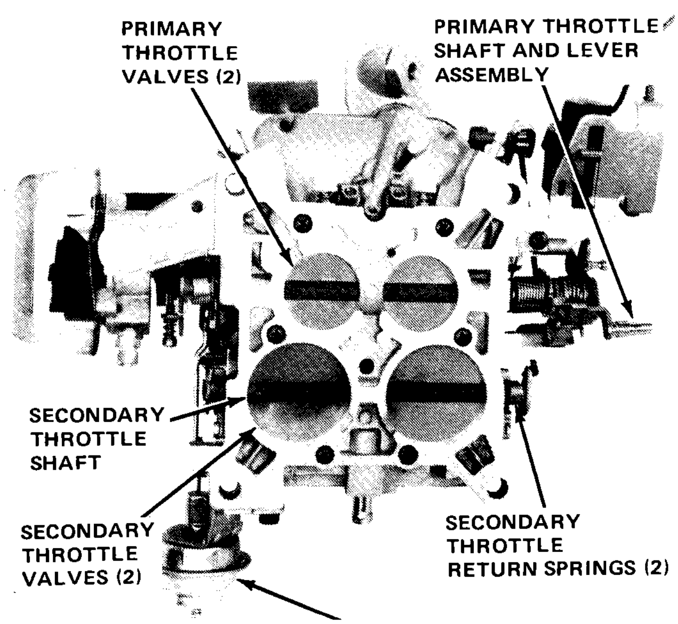


Fig. 4-73 Throttle Body—Bottom View

Cleaning and Inspection

Dirt, gum, water, or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection of only those parts not included in the carburetor overhaul kit are covered here. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all carburetor parts (except accelerating pump piston and dashpot assembly) in clean commercial carburetor cleaning solvent. If a commerical solvent is not available, lacquer thinner or denatured alcohol may be used.

Rinse the parts in kerosene to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and ease of operation and free it if necessary. Make sure all carbon and foreign material have been removed from the automatic choke housing and the piston. Check the throttle shafts in the bores for excessive looseness or binding and check the throttle plates for burrs which prevent proper closure. Inspect the main body, throttle body, air horn, choke housing, and thermostatic spring housing for cracks. Replace the float if the arm needle contact surface is grooved. If the floats are serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace float shafts if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Assembly

(1) If throttle plates and shafts are removed, slide primary throttle return spring (coiled clockwise) on primary throttle shaft (flat milled) and slide shaft into primary shaft holes (mixture needle side of body).

(2) Slide secondary throttle shafts and spring assemblies into secondary shaft holes.

(3) Position secondary throttle plates (larger diameter) in secondary bores with ground flat edges of plates facing up.

(4) Install plate attaching screws snug but not tight.

(5) Position primary throttle plates (smaller diameter) in primary bores with ground flat edge of plates facing up and toward the idle mixture needles. Install plate attaching screws snug but not tight.

(6) Rotate primary and secondary throttle shafts to closed position and tap throttle plates lightly, with screwdriver handle or similar tool, so that plates are properly and fully seated in throttle bores (when viewed with a light behind the plates, little or no light should be observed). Tighten throttle plate screws.

(7) Install secondary throttle lockout lever.

(8) Install fast idle speed lever and adjusting screw.

(9) If the fast idle cam and bushing were removed, insert automatic choke shaft bushing through choke housing. Position fast idle cam between choke housing and bushing column. Slide bushing through fast idle cam. Press bushing in choke housing and into column. Clean bushing with 1/4-inch reamer.

(10) Insert automatic choke shaft and lever in bushing.

(11) Install choke diaphragm assembly.

(12) Insert secondary throttle to primary throttle connecting rod into throttle lever levers and install retainers.

(13) Install throttle kicker assembly.

(14) Position main body on a working surface with fuel bowl down.

(15) Position main body to throttle body gasket on main body.

(16) Position throttle body on main body and install attaching screws.

(17) Invert main body and throttle body so fuel bowl is upward.

(18) Install main jets.

(19) Install vacuum piston cylinder and new gasket.

(20) Adjust metering rods (refer to Metering Rod Adjustment).

(21) Install valve, spring, vacuum piston and metering rods and yoke assembly.

(22) Install choke-to-throttle lockout lever.

(23) Place accelerator pump check ball in pump inlet hole of pump chamber. Install check ball retaining ring.

(24) Place accelerator pump discharge needle into pump discharge cavity.

(25) Install auxiliary fuel inlet valve and gasket using Tool J-10185.

(26) Assemble accelerator pump and insert into air horn.

NOTE: *Accelerator pump diaphragm must be positioned on lower hole of pump plunger stem.*

(27) Compress pump plunger and insert accelerator pump arm into plunger stem.

(28) Place vacuum piston limiter lever over pump arm and install accelerating pump lever and rod assembly.

(29) Install accelerating pump arm retainer.

(30) If choke plate and shaft were removed, slide choke shaft through holes in air horn. Install choke shaft lever on end of shaft on automatic choke side.

NOTE: *The lever and shaft are tapered and the attaching screw has a left-hand thread. Insert choke plate into slot in choke shaft and install plate attaching screws snug but not tight.*

(31) Close choke plate and gently tap the plate to position plate in air horn. Tighten attaching screws.

(32) If air valve plate and shaft were removed, slide shaft through holes on secondary side of air horn

(33) Position air valve plate in air horn opening.

(34) Install plate attaching screws snug but not tight.

(35) Close air valve plate and tap lightly to properly position in air horn. Tighten attaching screws.

NOTE: *Be sure plate and shaft turn freely after assembly.*

(36) Insert fuel inlet needle into fuel inlet seat.

(37) Position float and lever assembly between hinge post and over fuel inlet valves. Insert float hinge pin through the post and float lever.

NOTE: *The pin must be inserted from the pump plunger side for self-retention.*

(38) Insert air valve damper piston, rod and spring assembly through air horn and attach rod end to damper link.

(39) Insert air valve damper rod into hole in air valve plate. Slide other end of rod into damper link.

(40) Position the air valve damper link on the air horn and install pivot pin.

(41) Set float level (refer to Float Adjustment).

(42) Position main body to air horn gasket on main body.

(43) Carefully position air horn assembly over main body. Guide accelerator pump plunger and air valve damper piston into their chambers as air horn is gently lowered into position.

(44) Install other air horn attaching screws.

(45) Install accelerating pump throttle link in lower hole of primary throttle lever assembly. Install link retainer.

(46) Insert choke control rod end into automatic choke lever. With long nose pliers, install retaining clip.

(47) Check choke gasket cover clearance.

(48) Install choke gasket cover and retainer.

SERVICE ADJUSTMENT PROCEDURES

Float Adjustment

(1) Invert air horn assembly and remove gasket.

(2) Measure distance from float pontoons to air horn casting using a T-scale. Position horizontal scale over flat surface of both float pontoons at the free ends, parallel to air horn casting. Hold lower end of the vertical scale in full contact with the smooth area of air horn casting, located midway between the main discharge nozzles (fig. 4-74).

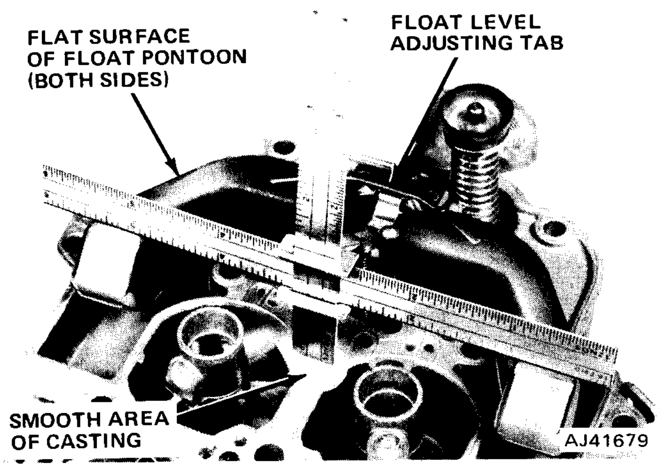


Fig. 4-74 Float Adjustment

IMPORTANT: *Do not allow the end of the vertical scale to come in contact with any gasket sealing ridge while measuring the float setting.*

(3) Refer to Carburetor Service Specifications for correct setting. The free end of each float pontoon should just touch the horizontal scale. If one pontoon is lower than the other, twist the float and lever assembly slightly to align.

(4) Adjust the float level by bending the tab which contacts the fuel inlet needle.

Auxiliary Inlet Valve Adjustment

(1) Turn air horn assembly upright, allowing the float to hang freely. Push up on the float until the primary fuel inlet needle lightly contacts its seat.

(2) While holding float in this position, measure clearance between float level auxiliary tab and auxiliary inlet valve plunger. Bend tab as required (fig. 4-75).

(3) Refer to Carburetor Service Specifications for correct setting.

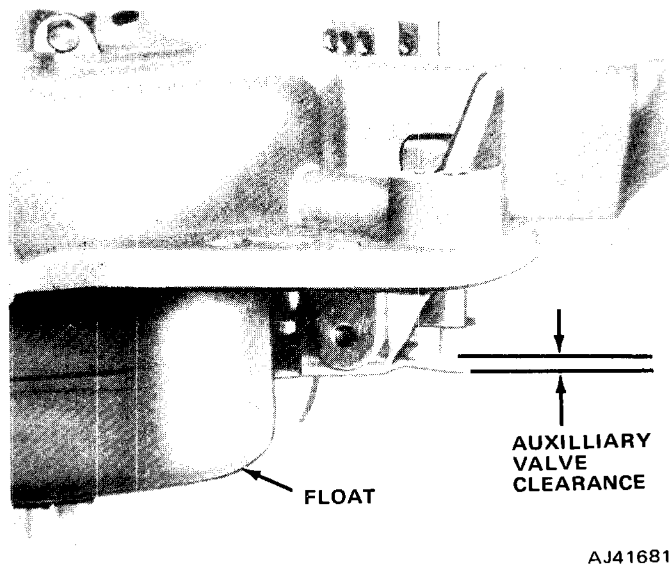


Fig. 4-75 Auxiliary Inlet Valve Adjustment

Metering Rod Adjustment

(1) Depress metering rod yoke. Using a small screwdriver, turn the vacuum piston adjusting screw counterclockwise until yoke is seated against the vacuum piston cylinder (fig. 4-76).

(2) Turn metering rod adjusting screws until large diameter of metering rods contact and seat in the main jets.

(3) Remove plastic yoke retainer.

(4) Remove metering rod and yoke assembly.

(5) Turn vacuum piston adjusting screw clockwise to move vacuum piston away from yoke until 0.120 (± 0.005) inch clearance is obtained (fig. 4-77).

(6) Install metering rod and yoke assembly.

(7) Install plastic yoke retainer.

Initial Choke Valve Clearance (On or Off Vehicle)

(1) Loosen choke cover screws.

(2) Open throttle and rotate choke cover until choke valve is held closed.

(3) Close throttle. Fast idle speed screw should be on top step of cam.

(4) Bottom choke diaphragm against setscrew. Do not press on links.

(5) Measure clearance between lower edge of choke valve and air horn (fig. 4-78).

(6) Adjust clearance by turning screw located at rear of diaphragm housing (fig. 4-79).

(7) Adjust fast idle cam linkage.

(8) Loosen choke cover screw and rotate cover to relieve tension on choke bimetallic coil. Set choke cover to specifications and tighten choke cover screws.

NOTE: *If vacuum is applied to the choke diaphragm with a hand pump, a vacuum leak may be noticed. This is normal.*

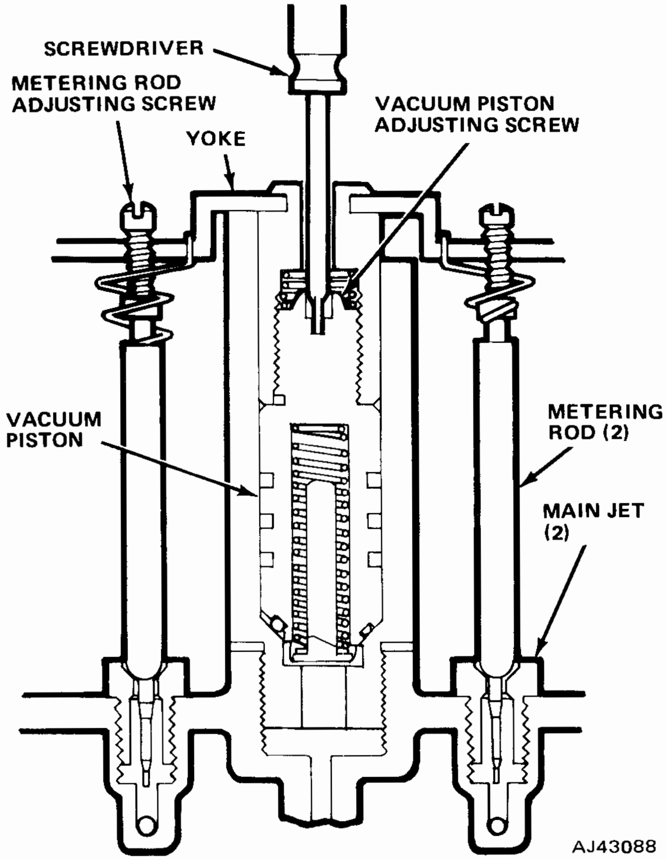


Fig. 4-76 Metering Rod Adjustment

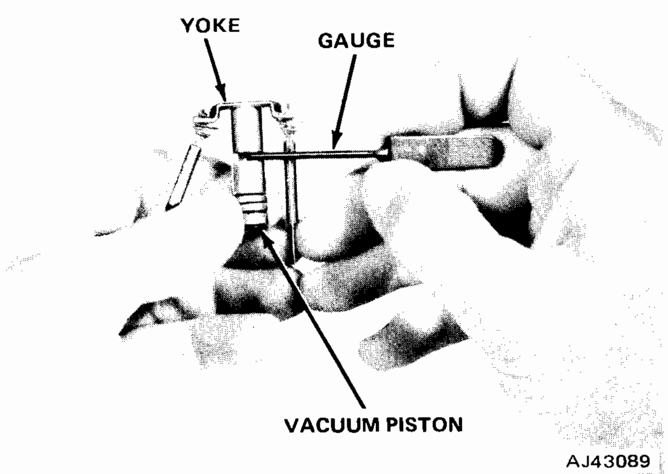


Fig. 4-77 Metering Rod Vacuum Piston Adjustment

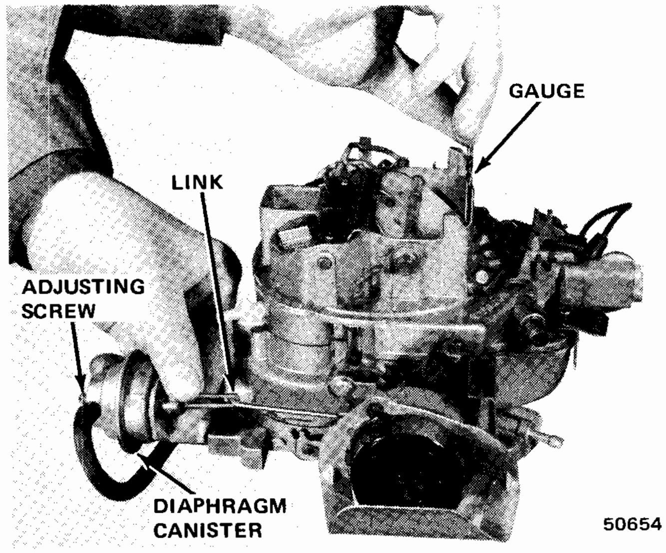


Fig. 4-78 Measuring Initial Choke Valve Clearance

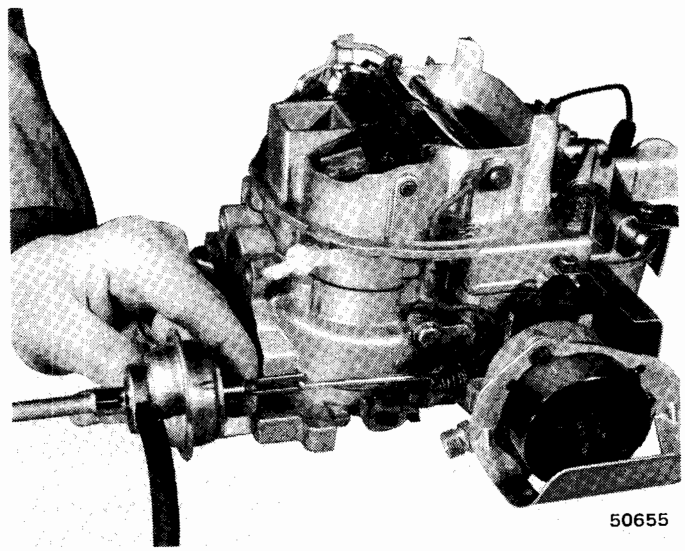


Fig. 4-79 Adjusting Initial Choke Valve Clearance

Choke Plate Indexing

This procedure is only necessary if the choke plate lever attaching screw has been loosened or removed.

(1) Loosen choke lever attaching screw (turn clockwise). Pry lever off choke shaft far enough to allow choke valve to turn.

(2) Back out cam index adjusting screw until screw no longer touches automatic choke shaft lever (fig. 4-80).

(3) Loosen choke cover attaching screws and rotate cover 90 degrees counterclockwise so that automatic choke shaft lever touches fast idle cam. Tighten one choke cover attaching screw.

(4) Turn cam index screw until it just touches the automatic choke shaft lever and then turn an additional 6 to 7 turns.

(5) Manually close choke plate and tighten choke shaft lever attaching screw.

(6) Adjust initial choke valve clearance and fast idle cam linkage.

(7) Set choke cover to specified setting and tighten attaching screws.

Fig. 4-80 Indexing Choke Plate

Fast Idle Cam Linkage Adjustment (On or Off Vehicle)

(1) Rotate choke cover 1/4-turn clockwise (rich) and tighten the retaining screws.

(2) Operate the throttle to allow the choke valve to close completely.

(3) Push down on the fast idle cam counterweight until screw is in contact with the second step (index) and against the shoulder of the high step.

(4) Measure the clearance between the lower edge of the choke valve and the air horn wall (fig. 4-81). Refer to Carburetor Service Specifications for the correct setting.

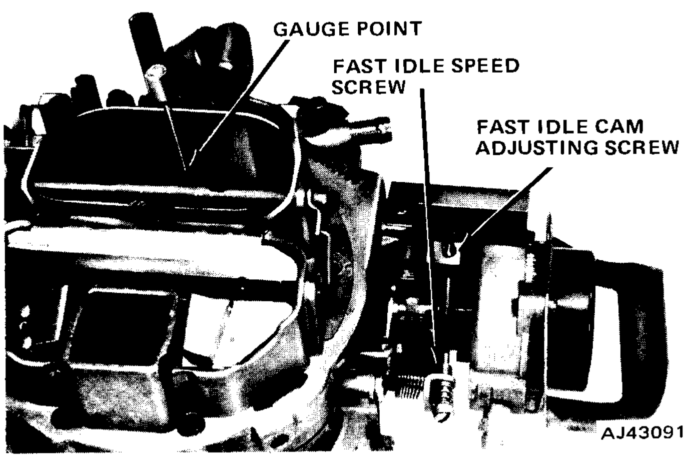


Fig. 4-81 Fast Idle Cam Linkage Adjustment

(5) Adjust by turning the fast idle cam adjusting screw.

(6) Loosen the choke cover retaining screws and adjust the choke as outlined under Automatic Choke Adjustment.

Choke Unloader Adjustment

(1) Hold throttle fully open and apply pressure on the choke valve toward the closed position.

(2) Measure the clearance between the lower edge of choke valve and air horn wall. Refer to Carburetor Service Specifications for correct setting.

CAUTION: *Do not bend the unloader tang downward from a horizontal plane.*

(3) Adjust by bending the unloader tang which contacts the fast idle cam as shown in figure 4-82. Bend toward the cam to increase the clearance and away from the cam to decrease the clearance. After making the adjustment, make certain the unloader tang has at least 0.070-inch clearance from the choke housing when the throttle is fully open (fig. 4-83).

(4) Operate throttle and check unloader tang to make sure it does not bind, contact, or stick on any part of carburetor casting or linkage. After carburetor installation, check for full throttle opening when the throttle is operated from inside the vehicle. If full throttle opening is not obtainable, it may be necessary to remove excess padding under the floormat or reposition the throttle cable bracket located on the engine.

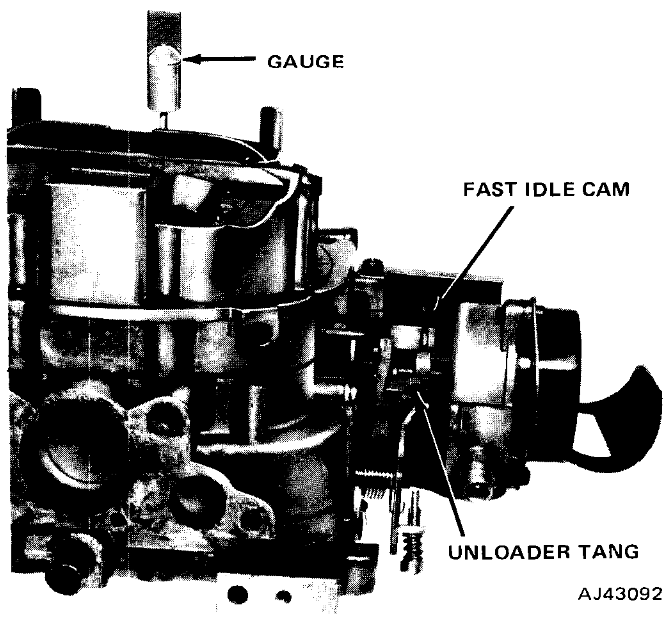


Fig. 4-82 Unloader Adjustment

Fig. 4-83 Unloader-to-Choke Housing Clearance

Throttle Kicker Adjustment

First complete Fast Idle Cam Linkage Adjustment.

(1) Push down on the fast idle cam counterweight until screw is in contact with the second (index) step and aginst the shoulder of the high step.

(2) With a minimum of 15 inches of vacuum applied to diaphragm, turn adjusting screw on diaphragm until high idle cam just falls free of the cam screw.

Automatic Choke Adjustment (On or Off Vehicle)

Loosen the choke cover retaining screws and rotate the cover in the desired direction as indicated by arrow on face of cover. Refer to Carburetor Service Specification for the correct setting. The specified setting will be satisfactory for most driving conditions. However, in the event that stumbles or stalls occur on acceleration during engine warmup period, the choke may be set richer or leaner using the tolerance provided to meet individual engine requirements.

Accelerator Pump Adjustment

NOTE: *The accelerating pump throttle link must be installed in the lower hole of the throttle shaft lever assembly.*

(1) Back out idle speed screw until primary throttle plates seat in bore.

(2) Turn accelerating pump throttle link adjusting nut until the notch in the pump lever is aligned with the index mark on the air horn (fig. 4-84).

(3) Adjust by loosening the locknut and turning the dashpot.

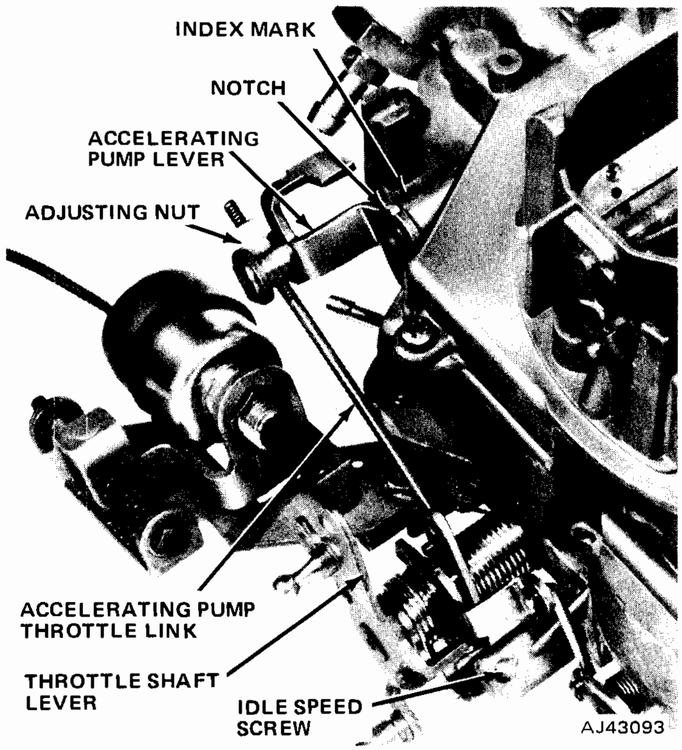


Fig. 4-84 Accelerating Pump Adjustment

Idle Speed and Mixture Adjustment (On Vehicle)

Refer to Engine Idle Setting Procedures in the Emission Control section.

Dashpot Adjustment (On Vehicle)

(1) Set throttle at curb idle position.

(2) Fully press the dashpot stem and measure the clearance between the stem and the throttle lever as shown in figure 4-85. Refer to Carburetor Service Specifications for the correct setting.

Fast Idle Speed Adjustment (On Vehicle)

Set the fast idle speed with the engine at operating temperature and the fast idle screw against the first kickdown step (middle step) of the fast idle cam. Refer to Carburetor Service Specifications for the correct rpm setting. Adjust by turning the fast idle screw.

NOTE: *When adjusting fast idle speed, disconnect and plug vacuum hose at EGR valve and spark port.*

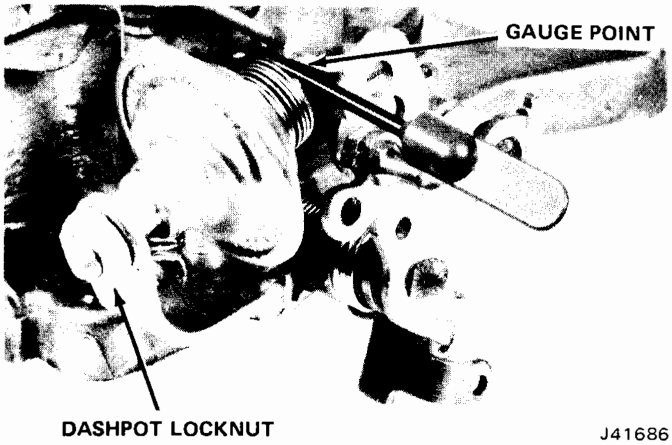


Fig. 4-85 Dashpot Adjustment

Model 4350 Carburetor Calibrations

	6THA4	6THM4	6THA4C
Primary Throttle Bore Size	1.440	1.440	1.440
Main Venturi Size	1.000	1.000	1.000
Secondary Throttle Bore Size	1.960	1.960	1.960
Fuel Inlet Diameter	0.098	0.098	0.098
Low Speed Jet	0.038	0.038	0.038
Idle Air Bleed (First)	0.049	0.049	0.049
Idle Air Bleed (Second)	0.029	0.029	0.029
Primary Metering Jet	0.072	0.072	0.072
Secondary Metering Jet	0.144	0.144	0.144
Cranking Jet	0.040	0.040	0.040
High Speed Bleed	0.063	0.063	0.063
Power Valve Timing (Inches of Hg)	8.000	8.000	8.000
Accelerator Pump Jet	0.026	0.026	0.026
Vacuum Spark Port	0.052	0.052	0.052
Choke Heat Inlet Restriction	0.089	0.089	0.089
Choke Vacuum Restriction	0.076	0.076	0.076

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Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torque	Service In-Use Recheck Torque
Air Cleaner Stud (2100 Carb.)	10	7-12
Air Injection Tubes — V-8	38	30-45
6 Cyl.	15	10-18
Air Pump Mounting Bolts	20	15-22
Carburetor Holddown Nuts	14	12-15
Exhaust Manifold Bolts — V-8	25	20-30
Exhaust-Pipe-to-Manifold Nuts	23	18-28
Fuel Pump Screw	16	13-19
Intake and Exhaust Manifold Bolts and Nuts — 6 Cyl.	23	18-28
Intake Manifold Bolts — V-8	43	37-47

All torque values given in foot-pounds with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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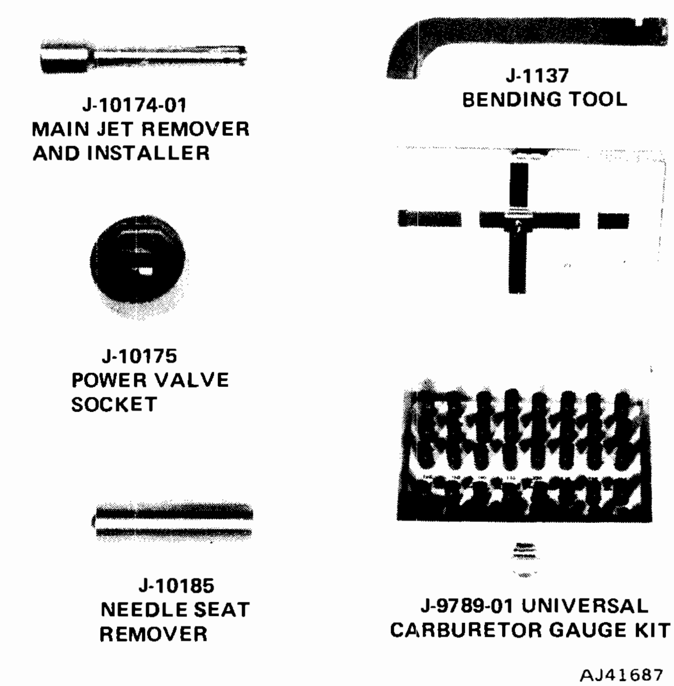

Fig. 4-86 Carburetor Tools

Carburetor Service Specifications

Carburetor Model	Application	Float Level Set-To	Float Level OK Range	Float Drop	Initial Choke Valve Clearance Set-To	Initial Choke Valve Clearance OK Range	Fast Idle Cam Setting Set-To	Fast Idle Cam Setting OK Range	Automatic Choke Cover Setting Set-To	Automatic Choke Cover Setting OK Range	Dashpot Set-To	Dashpot OK Range	Choke Unloader	Fast Idle Speed	Choke Cover ID
Carter YF															
7088	258 J10, J20, CKE, Manual/Automatic	0.476	0.444-0.508	1 3/8	0.215	0.195-0.235	0.195	0.180-0.210	1 Notch Rich	1/2-1 1/2 Notches Rich	–	–	.275 Min.	1600 on 2nd step (hot with TCS Solenoid and EGR discon-nected) OK Range 1550-1650	AA
7084	232/258 (Calif) CJ-5/7 Manual								2 Notches Rich	1 1/2-2 1/2 Notches Rich	0.075	0.043-0.107			EJ*
7109	232/258 CJ-5/7 Manual								2 Notches Rich	1 1/2-2 1/2 Notches Rich					EJ*
7083	258/CJ-7 Automatic								1 Notch Rich	1/2-1 1/2 Notches Rich					AA
7085	258/CJ-7 Automatic (Calif)								1 Notch Rich	1/2-1 1/2 Notches Rich					EK*
Motorcraft 2100		Float Level Set-To	Float Level OK Range												
6RHM2	360 J10, J20, CKE Manual	0.555	0.493-0.617 Dry		0.136	0.113-0.159	0.115	0.100-0.130	2 Notches Rich	1 1/2–2 1/2 Notches Rich	–		.250 Min.	1600 on 2nd step (hot with TCS Solenoid and EGR discon-nected) OK Range 1550-1650	TFA
		0.930	0.868-0.992 Wet												
6RHA2	360 J10,J20,CKE, WAG, Automatic	0.555	0.493-0.617 Dry												
		0.930	0.868-0.992 Wet												
6DM2	304 CJ5/7 Manual	0.555	0.493-0.617 Dry		0.132	0.109-0.155	0.120	0.105-0.135			0.075	0.061-0.125			
		0.930	0.868-0.992 Wet												
6DA2J	304 CJ-7 Automatic	0.555	0.493-0.617 Dry		0.136	0.113-0.159	0.126	0.111-0.141	1 Notch Rich	1/2-1 1/2 Notches Rich					
		0.930	0.868-0.992 Wet												
6DM2J	304 CJ-5/7 (Calif) Manual	0.555	0.493-0.617 Dry						1 Notch Rich	1/2-1 1/2 Notches Rich					
		0.930	0.868-0.992 Wet												
Motorcraft 4350		Float Level Set-To	Float Level OK Range	Auxiliary Inlet											
6THA4	360/401 CKE, WAG, J10, J20 Automatic	0.900	0.850 0.950	.050	0.135	0.109 0.161	0.135	0.120 0.150	2 Notches Rich	1 1/2-2 1/2 Notches Rich	–		.325 Min.	1600 on 2nd step (hot with TCS Solenoid and EGR discon-nected) OK Range 1550-1650	4TY
6THM4	360 CKE, J10, J20 Manual														
6THA4C	360 CKE, WAG, J10, J20, Automatic (California)														

Note: For idle speed refer to Emission Control Section
*Electric Choke

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TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

EMISSION CONTROLS—EXHAUST SYSTEMS

EMISSION CONTROLS

GENERAL

Emission control systems are required to meet existing standards for exhaust, crankcase, and raw fuel vapor emissions. The systems control emission of hydrocarbons, carbon monoxide, and oxides of nitrogen at the levels specified by Federal or California standards.

Nationwide Federal Emission Standards and the standards which apply in California differ. This necessitates a number of differences between emission control systems on vehicles built for sale in California and Nationwide except California.

Emission control system usage varies in relation to engine, transmission, and series application. The Emission Control Systems Application Chart (at the end of this section) may be used to determine the current system usage for any particular vehicle.

This section outlines service procedures for all Jeep Emission Control Systems. Tuneup specifications and procedures as prescribed by the U.S. Emission Control Services Maintenance Chart are also included.

Service Diagnosis

The following table lists causes of service problems in descending order of probability. It is more likely a problem results from the first listed "possible cause" than the tenth, for instance.

However, visual examination often leads directly to the correct solution and all service procedures should begin with a careful look at any suspected part or assembly.

Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY)	(1) Binding linkage, choke valve or choke piston.	(1) Repair as necessary.
	(2) Restricted choke vacuum and hot air passages.	(2) Clean passages.
	(3) Improper fuel level.	(3) Adjust float level.
	(4) Dirty, worn or faulty needle valve and seat.	(4) Repair as necessary.
	(5) Float sticking.	(5) Repair as necessary.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY) (Continued)	(6) Exhaust manifold heat valve stuck.	(6) Repair as necessary.
	(7) Faulty fuel pump.	(7) Replace fuel pump.
	(8) Incorrect choke cover adjustment.	(8) Adjust choke cover.
	(9) Inadequate unloader adjustment.	(9) Adjust unloader.
	(10) Faulty ignition coil.	(10) Test and replace as necessary.
	(11) Improper spark plug gap.	(11) Adjust gap.
	(12) Incorrect initial timing.	(12) Adjust timing.
	(13) Incorrect valve timing	(13) Check valve timing; repair as necessary.
ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed.	(1) Adjust curb or fast idle speed.
	(2) Incorrect initial timing.	(2) Adjust timing to specifications
	(3) Improper idle mixture adjustment.	(3) Adjust idle mixture.
	(4) Damaged tip on idle mixture screw(s).	(4) Replace mixture screw(s).
	(5) Improper fast idle cam adjustment.	(5) Adjust fast idle.
	(6) Faulty EGR valve operation.	(6) Test EGR system and replace as necessary.
	(7) Faulty PCV valve air flow.	(7) Test PCV valve and replace as necessary.
	(8) Exhaust manifold heat valve inoperative.	(8) Lubricate or replace heat valve as necessary.
	(9) Choke binding.	(9) Locate and eliminate binding condition.
	(10) Improper choke setting.	(10) Adjust choke.
	(11) Faulty TAC unit.	(11) Repair as necessary.
	(12) Vacuum leak.	(12) Check manifold vacuum and repair as necessary.
	(13) Improper fuel level.	(13) Adjust fuel level.
	(14) Faulty distributor rotor or cap.	(14) Replace rotor or cap.
	(15) Secondary throttle valves not closing (4350 Model, 4V carburetor).	(15) Locate and eliminate binding condition.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(16) Leaking engine valves.	(16) Check cylinder leakdown rate or compression and repair as necessary.
	(17) Incorrect ignition wiring.	(17) Check wiring and correct as necessary.
	(18) Faulty coil.	(18) Test coil and replace as necessary.
	(19) Clogged air bleed or idle passages.	(19) Clean passages.
	(20) Restricted air cleaner.	(20) Clean or replace air cleaner.
FAULTY LOW-SPEED OPERATION	(1) Clogged idle transfer slots.	(1) Clean transfer slots.
	(2) Restricted idle air bleeds and passages.	(2) Clean air bleeds and passages.
	(3) Restricted air cleaner.	(3) Clean or replace air cleaner.
	(4) Improper fuel level.	(4) Adjust fuel level.
	(5) Faulty spark plugs.	(5) Clean or replace spark plugs.
	(6) Dirty, corroded, or loose secondary circuit connections.	(6) Clean or tighten secondary circuit connections.
	(7) Faulty ignition cable	(7) Replace ignition cable.
	(8) Faulty distributor cap.	(8) Replace cap.
FAULTY ACCELERATION	(1) Improper pump stroke.	(1) Adjust pump stroke.
	(2) Incorrect ignition timing.	(2) Adjust timing.
	(3) Inoperative pump discharge check ball or needle.	(3) Clean or replace as necessary
	(4) Worn or damaged pump diaphragm or piston.	(4) Replace diaphragm or piston
	(5) Leaking main body cover gasket.	(5) Replace gasket.
	(6) Engine cold and choke too lean.	(6) Adjust choke.
	(7) Improper metering rod adjustment (YF Model carburetor or 4350 Model carburetor).	(7) Adjust metering rod.
	(8) Faulty spark plug(s).	(8) Clean or replace spark plug(s).
	(9) Leaking engine valves.	(9) Check cylinder leakdown rate or compression, repair as necessary.
	(10) Faulty coil.	(10) Test coil and replace as necessary.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
FAULTY HIGH SPEED OPERATION	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Defective TCS system.	(2) Test TCS System; repair as necessary.
	(3) Faulty distributor centrifugal advance.	(3) Check centrifugal advance and repair as necessary.
	(4) Faulty distributor vacuum advance.	(4) Check vacuum advance and repair as necessary.
	(5) Low fuel pump volume.	(5) Replace fuel pump.
	(6) Improper spark plug gap.	(6) Adjust gap.
	(7) Faulty choke operation.	(7) Adjust choke.
	(8) Partially restricted exhaust manifold, exhaust pipe, muffler, or tailpipe.	(8) Eliminate restriction
	(9) Clogged vacuum passages.	(9) Clean passages.
	(10) Improper size or obstructed main jets.	(10) Clean or replace as necessary.
	(11) Clogged secondary metering passages (4350 V4 carburetor).	(11) Clean passages.
	(12) Restricted air cleaner.	(12) Clean or replace as necessary.
	(13) Secondary linkage, throttle valves, or shaft binding (4350 4V carburetor).	(13) Locate and eliminate binding condition
	(14) Auxiliary inlet valve not adjusted properly (4350 4V carburetor).	(14) Adjust inlet valve.
	(15) Faulty distributor rotor or cap.	(15) Replace rotor or cap
	(16) Worn distributor shaft.	(16) Replace shaft.
	(17) Faulty coil.	(17) Test coil and replace as necessary.
	(18) Leaking engine valve(s).	(18) Check cylinder leak down or compression and repair as necessary.
	(19) Faulty valve spring(s).	(19) Inspect and test valve spring tension and replace as necessary.
	(20) Incorrect valve timing.	(20) Check valve timing and repair as necessary
	(21) Intake manifold restricted.	(21) Pass chain through passages.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
MISFIRE AT ALL SPEEDS	(1) Faulty spark plug(s).	(1) Clean or replace spark plug(s).
	(2) Faulty spark plug cable(s).	(2) Replace as necessary.
	(3) Faulty distributor cap or rotor.	(3) Replace cap or rotor.
	(4) Faulty coil.	(4) Test coil and replace as necessary.
	(5) Primary circuit shorted or open intermittently.	(5) Trace primary circuit and repair as necessary.
	(6) Leaking engine valve(s).	(6) Check cylinder leakdown rate or compression and repair as necessary.
	(7) Faulty hydraulic tappet(s).	(7) Clean or replace tappet(s).
	(8) Faulty valve spring(s).	(8) Inspect and test valve spring. tension, repair as necessary.
	(9) Worn lobes on camshaft.	(9) Replace camshaft.
	(10) Vacuum leak.	(10) Check manifold vacuum and repair as necessary.
	(11) Improper carburetor settings.	(11) Adjust carburetor.
	(12) Fuel pump volume or pressure low.	(12) Replace fuel pump.
	(13) Blown cylinder head gasket.	(13) Replace gasket.
	(14) Intake or exhaust manifold passage(s) restricted.	(14) Pass chain through passages.
POWER NOT UP TO NORMAL	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor rotor.	(2) Replace rotor.
	(3) Worn distributor shaft.	(3) Replace shaft.
	(4) Incorrect spark plug gap.	(4) Adjust gap.
	(5) Faulty fuel pump.	(5) Replace fuel pump.
	(6) Incorrect valve timing.	(6) Check valve timing and repair as necessary.
	(7) Faulty coil.	(7) Test coil and replace as necessary.
	(8) Faulty ignition.	(8) Test cables and replace as necessary.
	(9) Leaking engine valves.	(9) Check cylinder leakdown rate or compression and repair as necessary.
	(10) Blown cylinder head gasket.	(10) Replace gasket.
	(11) Leaking piston rings.	(11) Check compression and repair as necessary.

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
INTAKE BACKFIRE	(1) Improper ignition timing.	(1) Adjust timing.
	(2) Faulty accelerator pump discharge.	(2) Repair as necessary.
	(3) Improper choke operation.	(3) Repair as necessary.
	(4) Defective EGR CTO	(4) Replace EGR CTO
	(5) Defective TAC unit.	(5) Repair as necessary.
	(6) Lean fuel mixture.	(6) Check float level or manifold vacuum for vacuum leak.
EXHAUST BACKFIRE	(1) Vacuum leak.	(1) Check manifold vacuum and repair as necessary.
	(2) Faulty diverter valve.	(2) Test diverter valve and replace as necessary.
	(3) Faulty choke operation.	(3) Repair as necessary.
	(4) Exhaust leak.	(4) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Distributor centrifugal or vacuum advance malfunction.	(2) Check advance and repair as necessary.
	(3) Excessive combustion chamber deposits.	(3) Use combustion chamber cleaner.
	(4) Carburetor set too lean.	(4) Adjust carburetor.
	(5) Vacuum leak.	(5) Check manifold vacuum and repair as necessary.
	(6) Excessively high compression.	(6) Check compression and repair as necessary.
	(7) Fuel octane rating excessively low.	(7) Try alternate fuel source.
	(8) Heat riser stuck in heat on position.	(8) Free-up or replace heat riser.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	(1) Low fuel level.	(1) Adjust fuel level.
	(2) Low fuel pump pressure or volume.	(2) Replace fuel pump.
	(3) Metering rod(s) not adjusted properly (YF Model Carburetor or 4350 Model Carburetor).	(3) Adjust metering rod(s).
	(4) Improper PCV valve air flow.	(4) Test PCV valve and replace as necessary
	(5) Vacuum leak.	(5) Check manifold vacuum and repair as necessary.
	(6) Clogged main jet(s).	(6) Clean main jet(s).
	(7) Undersize main jets	(7) Replace main jet(s).
	(8) Blocked air bleeds.	(8) Clean air bleeds.
	(9) Clogged fuel filter screen.	(9) Replace fuel filter.
	(10) Restricted air cleaner.	(10) Clean or replace air cleaner.

AIR GUARD SYSTEM

GENERAL

This system incorporates a belt driven air pump, diverter (bypass) valve, air injection manifold(s), air injection tubes and connecting hoses (fig. 4A-1 and 4A-2).

Air is discharged from the air pump to the diverter valve which directs it to the air distribution manifold(s) or dumps it through a bypass port, depending on engine operating conditions. Air pressure in this system is kept to approximately 5 psi by a relief valve incorporated in the diverter valve.

Air is routed through the air injection manifold and through injection tubes into the engine exhaust ports. The air mixes with hot unburned exhaust products and causes a further burning of the mixture, reducing hydrocarbon and carbon monoxide emissions to the atmosphere.

AIR PUMP

The air pump used for V-8 and six-cylinder engines is the same. The major components of the air pump are enclosed in a die-cast aluminum housing. A filter fan assembly, rotor shaft and drive hub are visible on the pump exterior (fig. 4A-3).

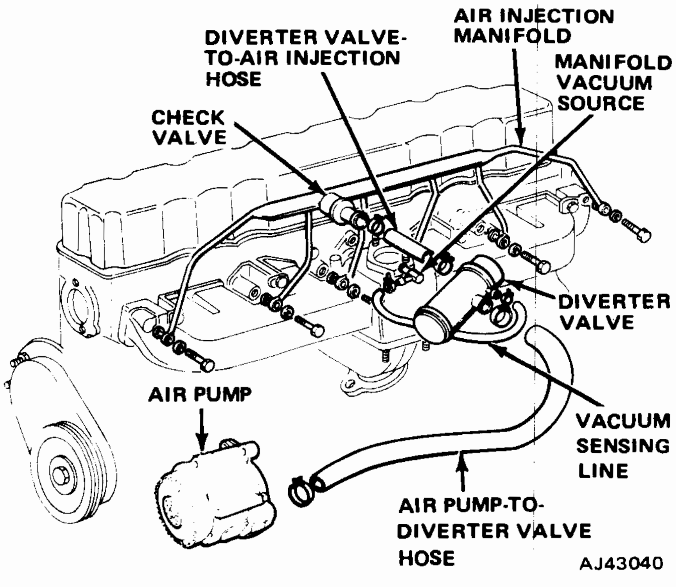


Fig. 4A-1 Air Guard System—Six-Cylinder

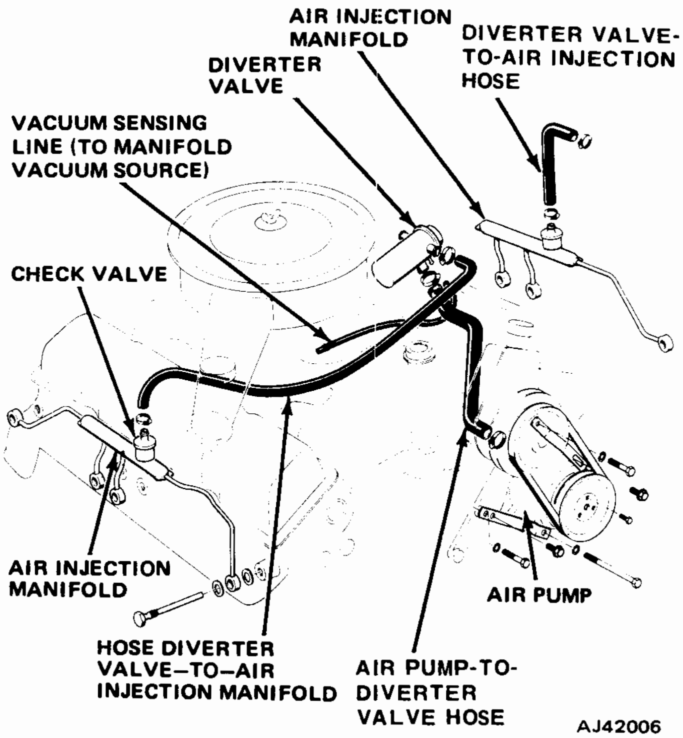


Fig. 4A-2 Air Guard System—V-8

The pump is designed to be relatively service free. The only serviceable item is the filter fan assembly. It is not recommended that the rear housing cover be removed for any reason, since the internal components of the pump are not serviceable.

The aluminum housing has cavities for air intake, compression, and exhaust and a bore for mounting the front bearing. The housing also includes cast metering areas that reduce the noise of intake and compression. Mounting bosses are located on the housing exterior.

NOTE: *The relief valve assembly is incorporated in the diverter valve. If defective, the diverter valve assembly must be replaced.*

The front bearing supports the rotor shaft; the bearing is secured in position by plastic, injected around grooves in the housing and bearing outer race.

The rear cover supports the vane pivot pin, rear bearing race, and exhaust tube. Dowel pins pressed

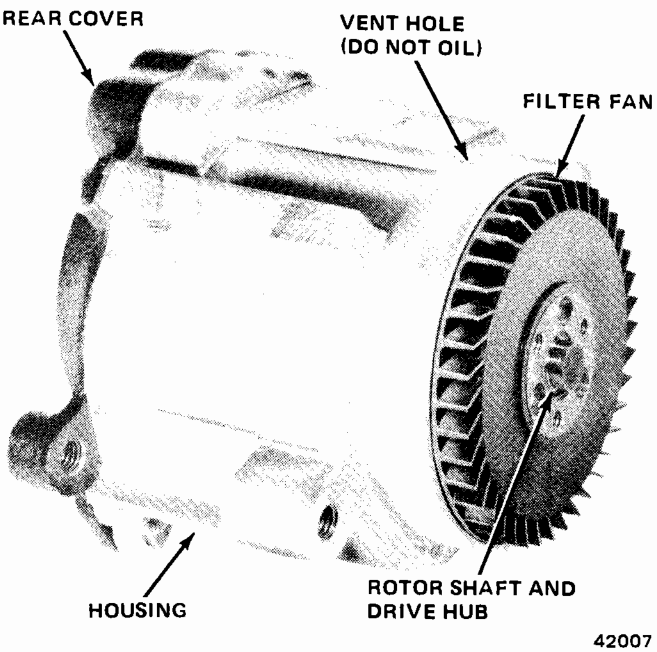


Fig. 4A-3 Air Pump

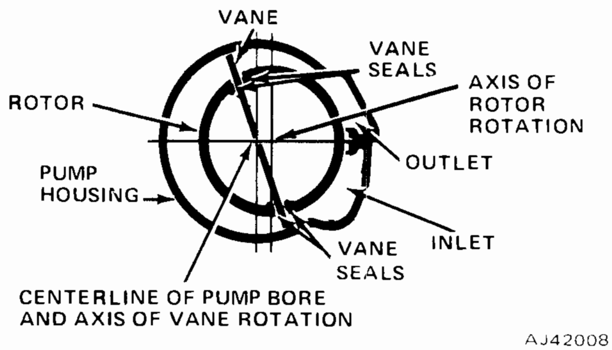


Fig. 4A-4 Air Pump Operation

into the housing correctly position the end cover which is fastened by four bolts.

The rotor positions and drives the two vanes. A stamped steel liner supports carbon shoes and shoe springs which seal the vanes and rotor. The two plastic vanes are molded to hubs which support bearings that rotate on the pivot pin. The pulley drive hub is pressed on the rotor shaft, and bolt holes in the hub provide for attachment of a pulley.

The pump vanes are located 180 degrees apart and rotate around the pivot pin which is located on the centerline of the pump housing. The rotor which drives the vanes rotates off the centerline of the pump housing (fig. 4A-4). This creates changes in the distance between the outside of the rotor and the inner wall of the pump housings during rotor rotation. As the leading vane moves past the intake opening, it is moving from a small area to a large area (defined by the rotor-to-pump housing clearance). This forms a vacuum which draws air into the pump. As the vanes and rotor continue to rotate, the trailing vane passes the intake and traps the air between the vanes. The vanes and rotor move into small area and the entrapped air begins to be compressed. The compression continues until the leading vane passes the exhaust opening where the compressed air passes out of the pump and on to the rest of the Air Guard System.

Air Pump Diagnosis

The air pump is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. Allow for normal break-in wear of the pump prior to replacement for excessive noise.

First check the drive belt tension and tighten as specified. Do not pry on the aluminum housing. Check hoses to be sure they are properly connected and are in good condition and check that the pump mounting bracket is securely fastened.

Air pump noise can be confused with other engine noise. On a noise complaint, first remove the drive belt and check the pump to make sure it is operative. A seized pump will not rotate and the noise could be caused by belt slippage.

A chirping or squeaking noise probably originates from vane rub in the housing bore and is noticeable at low speed intermittantly. Vane chirping is often eliminated at increased pump speeds, or with additional wear-in time.

Bearing noise is easily distinguished from vane chirping; it is a rolling sound noticeable at all speeds. It does not necessarily indicate bearing failure; but if bearing noise reaches an objectionable level at certain speeds, the pump may have to be replaced.

Failure of a rear bearing is identified by a continuous knocking noise and replacement of the pump is required.

If it is determined that the air pump is not delivering air (determine presence of airflow by removing an exhaust hose), the pump must be replaced.

NOTE: *The pump is equipped with a centrifugal fan-type air filter, located behind the drive pulley. In the event that the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the filter should be masked off to prevent liquids from entering the pump.*

Service Precautions

The following is a list of service precautions to prevent damage to the air pump. **DO NOT:**

- Attempt to prevent pulley from rotating by inserting tools into the centrifugal filter fan.
- Operate engine with pump belt removed or disconnected.
- Attempt to lubricate.

- Clean centrifugal filter.
- Replace filter by driving or hammering in position.
- Remove drive hub when replacing filter.
- Disassemble pump or remove rear cover.
- Exceed 20 foot-pounds torque on mounting bolts.
- Pry on aluminum housing to adjust belt tension.
- Clamp pump in vise.

Removal—Six-Cylinder

(1) Disconnect air pump output hose at back of air pump.
(2) Loosen adjustment bolt and remove drive belt.
(3) Remove front mount bracket-to-engine attaching bolts.
(4) Remove rear mount bracket-to-pump attaching bolts.
(5) Loosen rear mount bracket-to-power steering attaching bolts.
(6) Pull pump down and forward to remove.

Installation—Six-Cylinder

(1) Position pump and install rear mount bracket-to-pump attaching bolts.
(2) Install front mount bracket-to-engine attaching bolts.
(3) Tighten attaching bolts to specified torque.
(4) Adjust power steering drive belt to specified tension.
(5) Connect air pump output hose to back of pump.
(6) Adjust air pump drive belt to specified tension.

Removal—V-8

(1) Disconnect air pump output hose at pump.
(2) Loosen mount bracket-to-pump attaching screws and remove drive belt.
(3) Remove mount bracket-to-pump attaching bolts.
(4) Remove pump.

Installation—V-8

(1) Position pump at mounting location and install mount bracket-to-pump attaching bolts (do not tighten).
(2) Install drive belt and adjust to the specified tension.
(3) Tighten mounting bolts and adjusting strap screw to 20 foot-pounds torque.

NOTE: *If air pump is driven by the air conditioning belt, adjust the belt to the tension specified for the air conditioning belt. Pry only against the cast iron cover when adjusting the belt. Do not pry on the aluminum housing.*

Fan Replacement

Pry outer disc loose and remove remaining portion as illustrated in figure 4A-5.

NOTE: *It is almost impossible to remove the fan without destroying it. Be careful to prevent fragments from entering the air intake hole. Do not attempt to remove the metal drive hub.*

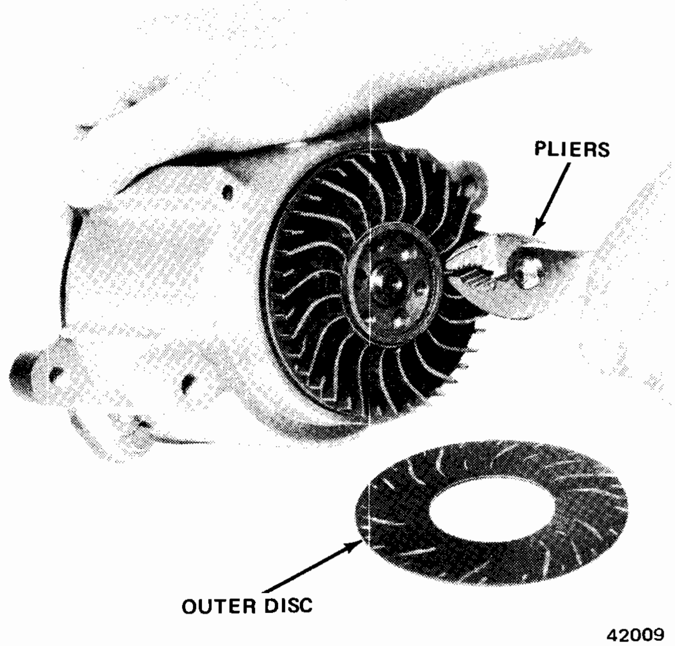


Fig. 4A-5 Centrifugal Filter Fan Removal

Install new filter fan into position by using pulley and bolts as tools.

Draw fan down evenly by alternately tightening bolts. Be sure that outer edge of fan slips into housing. A slight amount of interference with housing bore is normal.

NOTE: *Do not attempt to install a fan by hammering or pressing it on.*

After a new fan is installed, it may squeal upon initial operation until its outside diameter lip has worn in. This may require 20 to 30 miles of operation.

Exhaust Tube Replacement

Grasp exhaust tube in a vise or with suitable pliers and pull out with a twisting motion.

NOTE: *Do not clamp the pump body in a vise.*

Support pump as shown in figure 4A-6.

Insert new exhaust tube into hole and tap into place

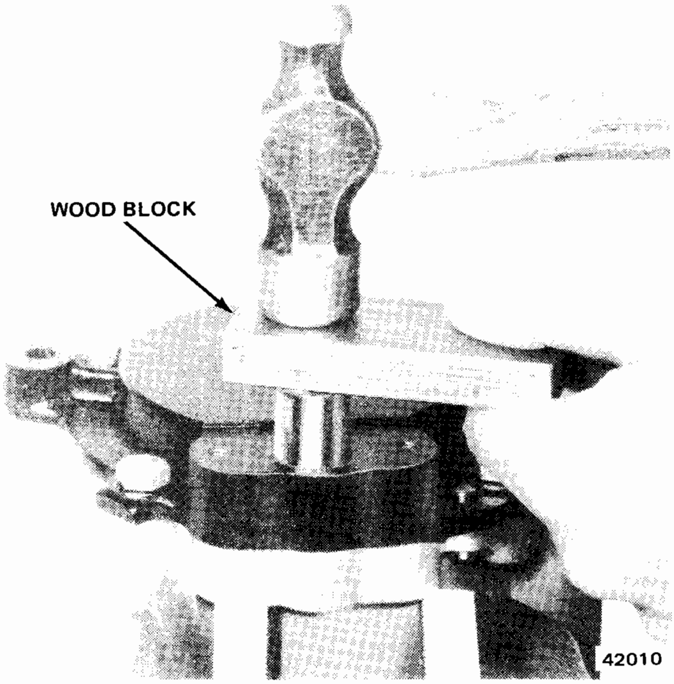


Fig. 4A-6 Exhaust Tube Installation

using a block of wood until approximately 7/8 inch of tube extends above the cover.

DIVERTER (BYPASS) VALVE

A diverter valve is used in all Air Guard applications. The valves for V-8 and six-cylinder engines differ only in the number of outlets. The V-8 diverter valve has two outlets and the six-cylinder diverter valve has only one. The valve momentarily diverts air pump output from reaching the exhaust during rapid deceleration and acts as a pressure release when air pump output is excessive. An internal silencer is incorporated in the diverter housing to muffle the airflow.

In a rapid deceleration condition, high intake manifold vacuum is applied to the diaphragm in the diverter. When the vacuum signal is 20 inches of mercury or more, the spring tension of the diaphragm is overcome. This moves the metering valve down against its upper seat and away from its lower seat, forcing air pump output to vent to atmosphere (fig. 4A-7). Air pump output is diverted only momentarily because of a bleed hole in the diaphragm. This hole allows vacuum to quickly equalize on both sides of the diaphragm and the diaphragm spring returns the metering valve to its normal position.

If the air pump develops excessive output pressure, this pressure will overcome the diaphragm spring tension, pushing the metering valve down and venting pump output pressure to the atmosphere. When pump output pressure returns to normal, the metering valve will move up and away from the upper seat and against the lower seat, returning to its normal open position, allowing air pump pressure to flow to the exhaust manifold(s).

Diverter Test

(1) Start engine and let idle.

(2) Check diverter vents. Little or no air should flow from vents.

(3) Accelerate engine to 2000 to 3000 rpm and rapidly close throttle. A strong flow of air should pass from the diverter vents. If air does not flow or if backfire occurred, make certain vacuum sensing line has vacuum and is not leaking.

NOTE: *The diverter valve diverts air pump output when 20 inches of Hg or more is applied at vacuum sensing line or pump output exceeds 5 psi.*

(4) Slowly accelerate engine. Between 2500 and 3500 rpm, air should begin to flow from diverter vents.

Diverter Replacement

The diverter valve is not serviceable and must be replaced if defective. The valve is suspended by the hoses between the air pump and air injection manifold(s) (fig. 4A-1 and 4A-2). Removal involves disconnecting the hoses and the vacuum sensing line. Installation entails reconnecting the hoses and vacuum line.

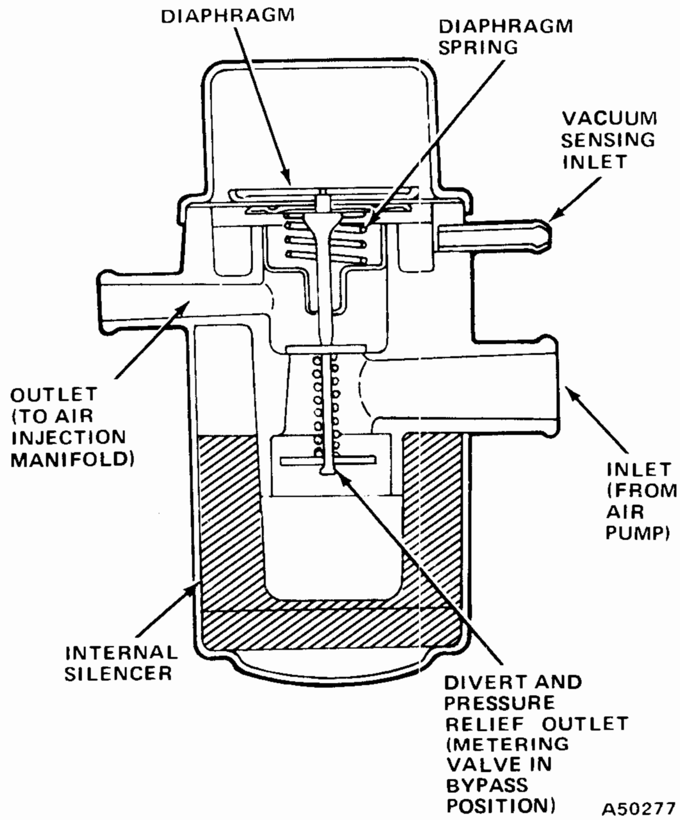


Fig. 4A-7 Diverter Valve (V-8 Shown)

AIR INJECTION MANIFOLDS AND TUBES

The air injection manifold(s) is constructed of cold rolled steel with a zinc plating and distributes air from the pump to each of the injection tubes.

A check valve, incorporating a stainless steel spring plunger and an asbestos seat, is integral with the air injection manifold. Its function is to prevent the reverse flow of exhaust gases to the pump during pump failure or diverter valve bypass operation. Reverse flow would damage the air pump and connecting hoses.

The air injection tubes project into the exhaust ports, directing air into the vicinity of the exhaust valve seats. The injection tubes, which are made of stainless steel, are inserted through the distribution tubes of the air injection manifold and threaded into the exhaust manifold.

Air injection tubes are used for all cylinders except No. 7 on V-8 engines. Two different length injection tubes are used on six-cylinder engines. The shorter tubes are used for No. 3 and No. 4 cylinders.

Removal—Six-Cylinder

NOTE: *Intake and exhaust manifold assembly must be removed to prevent bending or damaging the air distribution manifold during removal.*

(1) Remove intake and exhaust manifold assembly. Refer to Section 1A—Six-Cylinder Engines.

(2) Position manifold in vise and remove injection tubes and sealing gaskets from each cylinder exhaust port.

Installation—Six-Cylinder

(1) Install new sealing gaskets on injection tubes and air injection manifold.

(2) Assemble air injection manifold and injection tubes to exhaust manifold. Tighten tubes to 20 foot-pounds torque.

(3) Position injection tube in exhaust manifold openings.

NOTE: *Two different length injection tubes are used on six-cylinder engines. The shorter length injection tubes must be inserted into cylinders 3 and 4.*

(4) Install intake and exhaust manifold assembly. Refer to Section 1A—Six-Cylinder Engine.

Removal—V-8

(1) Disconnect air delivery hose at check valve.

(2) Loosen injection tubes.

(3) Remove air injection manifold and injection tubes as an assembly.

NOTE: *Some interference to removal may be encountered due to carbon buildup on the tubes.*

(4) Remove injection tubes and sealing gaskets from air injection manifold.

Installation—V-8

(1) Install injection tubes through the air injection manifold openings using a new sealing gasket at either side of each opening.

(2) Assemble air injection manifold and injection tubes to exhaust manifold. Tighten tubes to 38 foot-pounds torque.

(3) Connect air delivery hose.

Check Valve Test

To check the air injection manifold valve for proper operation, disconnect the air supply hose at the injection manifold. With the engine running above idle speed, listen and feel for exhaust leakage at the check valve. A slight leak is normal.

ENGINE MODIFICATIONS

The design of certain engine components is directly related to emission standards. The operation of such items as the camshaft, carburetor, ignition distributor and cylinder head affects the amount of emissions. Therefore, the correct combination of engine components, as prescribed by government certification, must be used in service. Refer to the appropriate sections of this manual for servicing these components.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL

The EGR (Exhaust Gas Recirculation) system used on all vehicles reduces the formation of oxides of nitrogen (NOx) by introducing a metered amount of exhaust gas into the combustion chambers. Exhaust gas is inert, will not burn, and therefore combustion temperatures are reduced. Fewer oxides of nitrogen are produced at lower combustion temperatures.

In 1976 Jeep models, the same EGR system is used by all CJ-5 and -7 models, and all California Cherokees, Wagoneers, and Trucks. It consists of a diaphragm-actuated flow control valve (EGR valve), a coolant temperature override switch (EGR CTO), an exhaust back-pressure sensor and connecting hoses (fig. 4A-8 and 4A-9).

Nationwide (except California) Cherokees, Wagoneers, and Trucks are equipped with the same system but do not use the back-pressure sensor. In those units, the EGR valve bolts directly to the manifold and the outer (E) port of the CTO switch connects directly to the EGR valve.

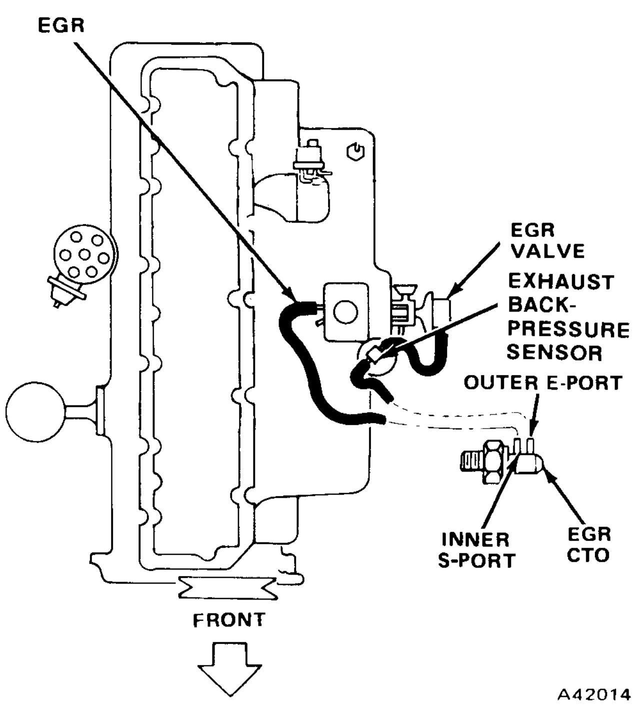


Fig. 4A-8 EGR System—Six-Cylinder

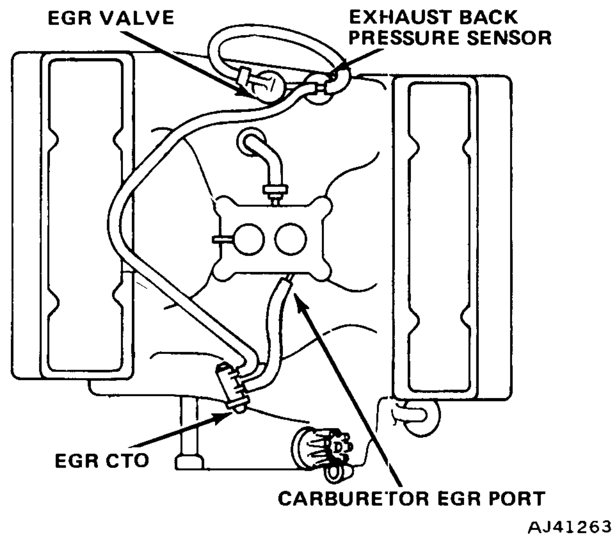


Fig. 4A-9 EGR System—V-8

The EGR CTO switch prevents EGR action until engine temperature reaches a preset level, and the back-pressure sensor permits EGR action only at increased engine loads, thereby improving driveability.

EGR VALVE

The EGR valve mounts on a machined surface at the rear of the intake manifold on V-8 engines and on the side of the intake manifold on six-cylinder engines. When the back-pressure sensor is used, the EGR valve mounts on the spacer which is an integral part of the back-pressure sensor.

EGR valves are calibrated by the use of differently shaped pintles (fig. 4A-10). The valve is normally held closed by a spring located above the diaphragm (fig. 4A-11). The valve opens when sufficient vacuum is applied through hoses connecting the CTO switch and the back-pressure sensor (if used) to the EGR vacuum port at the carburetor.

When vacuum overcomes the diaphragm spring pressure, a pintle within the valve is lifted off its seat and exhaust gas, which reaches the EGR valve through special passages, is metered into the intake manifold. Exhaust gas is drawn from the exhaust crossover passage in V-8 engines, from an area near the heat riser in six-cylinder engines.

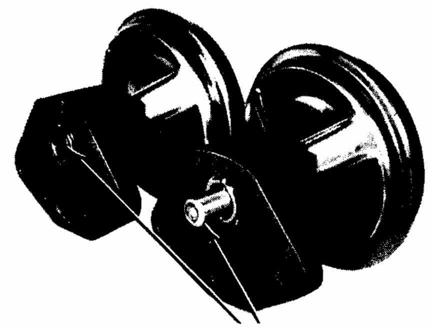


Fig. 4A-10 EGR Valve Pintles

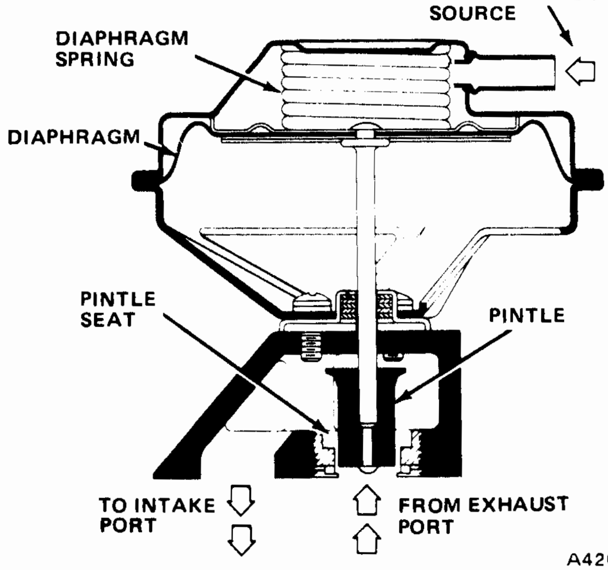


Fig. 4A-11 EGR Valve

EGR Valve Test

With the engine at operating temperature and curb idle, manually depress the EGR valve diaphragm. This should cause an immediate engine speed drop of approximately 200 rpm, indicating that the EGR valve had been properly cutting off the flow of exhaust gas at idle.

If there is no change in engine rpm and the engine is idling properly, exhaust gases do not reach the combustion chambers and the probable difficulty is a plugged passage between the EGR valve and the intake manifold.

If the engine idles poorly and rpm is not affected by compressing the EGR valve diaphragm, the EGR valve is not closing off the flow of exhaust gases at idle and there is a fault in the hoses, hose routings or the valve itself.

(1) Install a tee in the EGR vacuum signal line near EGR valve and connect vacuum gauge to tee.

(2) With engine at operating temperature, place your fingers lightly against EGR valve diaphragm and slowly accelerate the engine.

(3) Note vacuum indicated when the diaphragm first begins to move. Refer to EGR Valve Vacuum Signal Values tables.

(4) Continue accelerating engine and note vacuum required to completely depress diaphragm. If there is evidence of leakage, replace EGR valve.

EGR Valve Vacuum Signal Values

Vendor Part Number (Located on Valve)	AMC Part Number	Vacuum Required (Inches)	
		Open Start	Open (Max.)
7040176	3219052	2.8 to 3.2	7.0
7043589	3225951	1.8 to 2.2	5.0
17050471	3223980	1.8 to 2.2	5.5
17050472	3223981	1.8 to 2.2	5.0
7030881	3218739	2.9 to 3.2	9.0

Removal

(1) On V-8 engines, remove air cleaner assembly.

(2) Disconnect vacuum hoses.

(3) Remove two retaining bolts from manifold.

(4) Remove EGR valve, gasket, spacer and attached exhaust back-pressure sensor assembly (if used), restrictor plate and its gaskets (if used).

(5) Clean EGR pintle if required (refer to EGR Valve Maintenance).

(6) Discard used gaskets and clean all mating surfaces.

Installation

(1) Install restrictor plate (if used) between two gaskets and install spacer (if used), EGR gasket, and EGR valve.

(2) Install retaining bolts and tighten to 13 foot-pounds torque.

(3) Connect vacuum lines and install air cleaner assembly (if removed).

NOTE: *The exhaust back-pressure assembly, if used, should extend toward the left side on V-8 engines, toward the front of the car on six-cylinder engines. The stainless steel restrictor plate is calibrated for the engine and exhaust system found on that vehicle. Always replace the same restrictor plate originally installed.*

EGR Valve Maintenance—Cherokee-Wagoneer-Truck

Remove all lead or carbon deposits from the stainless steel metering pintle of the valve using a wire brush. After cleaning, depress the diaphragm, cap the vacuum inlet, and repeatedly open the EGR valve manually by pressing down on the diaphragm and releasing. Pintle should remain retracted; if it does not, diaphragm has a leak and valve must be replaced.

On six-cylinder engines, lead or carbon deposits will build most rapidly in the exhaust gas discharge passage (upper hole). If the deposits cannot be removed with a spiral-type wire brush, a 9/16-inch drill may be used. Coat the tip of the drill with heavy grease and use pliers to rotate the bit in the discharge passage.

EGR CTO Switch

The EGR CTO switch is located at the coolant passage of the intake manifold adjacent to the oil filler tube on V-8 engines, and at the left side of the cylinder block on six-cylinder engines. The inner port (S) connects by hose to the EGR port at the carburetor, the outer port (E) connects to the exhaust back-pressure sensor, when the vehicle is so equipped, or to the EGR valve.

When coolant temperature is below the rating of the CTO switch there is no vacuum signal to the EGR system. The EGR CTO switch on the Jeep CJ models opens at 115°F and has a black body or a black paint dab. All other Jeep models have an 160°F CTO switch with a yellow body or yellow paint dab.

EGR CTO Test

NOTE: *Engine coolant temperature must be below 100°F.*

(1) Check vacuum lines for leaks and correct routings (fig. 4A-8 and 4A-9).

(2) Disconnect vacuum line at back-pressure sensor (if equipped) or at the EGR valve, and connect line to a vacuum gauge.

(3) Operate engine at 1500 rpm; no vacuum should be indicated on gauge. If vacuum is indicated, replace EGR CTO switch.

(4) Idle engine until coolant temperature exceeds 115°F (black color code) or 160°F (yellow color code). The temperature gauge needle is about halfway between the cold mark and the beginning of the band at 115°F and about at the beginning of the band at 160°F.

(5) Accelerate engine to 1500 rpm; carburetor ported vacuum should be indicated on vacuum gauge. If not, replace EGR CTO switch.

Removal—Six-Cylinder

(1) Drain coolant from radiator.

(2) Disconnect vacuum lines.

WARNING: *Serious burns can result if not coolant is not drained before removing switch from block.*

(3) Using 7/8-inch open-end wrench, remove switch from block.

Installation—Six-Cylinder

(1) Install EGR CTO switch in block.

(2) Connect vacuum lines.

(3) Install coolant and purge air from cooling system.

Removal—V-8 Engine

(1) Drain coolant from radiator.

(2) Remove air cleaner assembly.

(3) Remove coil bracket attaching screw and tip coil away from EGR CTO switch.

(4) Disconnect vacuum hoses from CTO switch.

WARNING: *Serious burns can result if hot coolant is not drained before removing switch from intake manifold.*

(5) Using 7/8-inch open-end wrench, remove switch from intake manifold.

Installation—V-8 Engine

(1) Install EGR CTO switch in intake manifold.

(2) Install coil and bracket with attaching screw.

(3) Connect vacuum hose to switch.

(4) Install air cleaner assembly.

(5) Install coolant and purge cooling system of air.

EXHAUST BACK-PRESSURE SENSOR

Exhaust back-pressure sensors are used on all Jeep CJ models and on all vehicles sold in California. This device monitors exhaust back-pressure and permits EGR operation only when engine operating conditions are favorable for EGR action with a given engine/exhaust combination. Back-pressure sensors are variously calibrated, are not serviceable, and must be replaced when necessary with the same part number.

The exhaust back-pressure sensor consists of a diaphragm valve and a spacer connected by a metal tube which projects into an exhaust port in the spacer body (fig. 4A-12). The EGR valve mounts directly on the spacer.

The metal tube connecting the diaphragm valve to the spacer picks up exhaust back-pressure from the exhaust port into which it projects. When the back-pressure reaches the calibrated level of the sensor the diaphragm valve spring pressure is overcome, permitting a vacuum signal to the EGR valve when the coolant temperature override (CTO) switch is open (refer to EGR CTO Switch section).

This system permits EGR operation only when the engine has warmed up sufficiently and when exhaust pressure is relatively high, as in acceleration and at

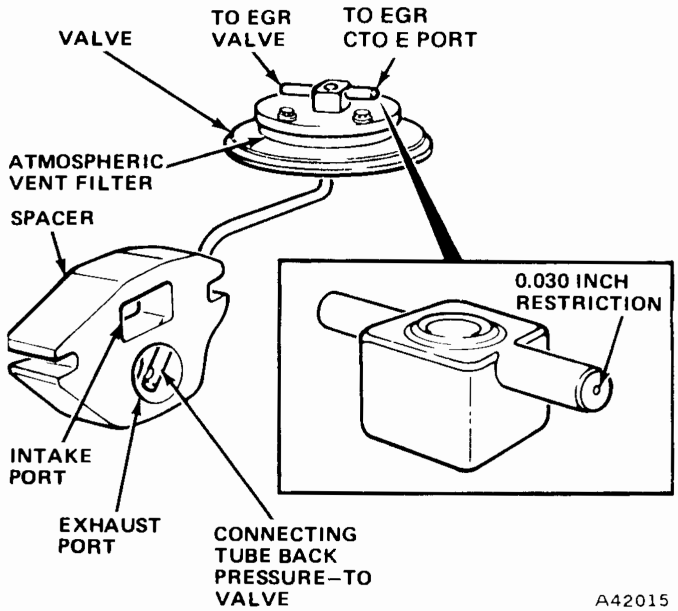


Fig. 4A-12 Exhaust Back-Pressure Sensor Six-Cylinder Shown

some cruising speeds. When back-pressure has not reached calibrated levels, or if the CTO switch has not opened, the carburetor vacuum signal vents to the atmosphere from a vent at the diaphragm valve.

Removal

(1) Remove vacuum lines from exhaust back-pressure sensor valve and EGR valve.
(2) Remove two attaching nuts from EGR valve.
(3) Remove EGR valve and exhaust back-pressure sensor assembly.
(4) Clean all mating surfaces and intake manifold and back-pressure sensor ports.

Installation

(1) Install new gasket on intake manifold and position exhaust back-pressure sensor on top of gasket.

NOTE: *Exhaust back-pressure sensor assembly should extend toward the left side on V-8 engines and toward the front of the vehicle on six-cylinder engines.*

(2) Install new gasket on exhaust back-pressure sensor spacer and install EGR valve.
(3) Install support bracket to valve portion of sensor and tighten screws.
(4) Install two attaching nuts and tighten to 13 foot-pounds torque.
(5) Attach vacuum lines to exhaust back-pressure sensor valve and EGR valve.

NOTE: *Vacuum line from CTO switch must be connected to nipple with 0.030-inch restriction.*

Exhaust Back-Pressure Sensor Test

(1) Inspect all EGR vacuum lines for leaks and correct routing.
(2) Install a tee in vacuum line between EGR valve and exhaust back-pressure sensor.
(3) Attach a vacuum gauge to tee.
(4) Start engine and allow to idle. No vacuum should be indicated.

NOTE: *If vacuum is indicated at idle speed, verify correct line connections. Be sure manifold vacuum is not being used as a source. If carburetor is providing ported vacuum, inspect for partially open throttle plate, which could apply premature ported vacuum to back-pressure sensor.*

(5) Accelerate engine to 2000 rpm and observe vacuum gauge for the following:

- If coolant temperature is below 115°F, no vacuum should be indicated.
- If coolant temperature is above 115°F (black CTO switch) or 160°F (yellow CTO switch), ported vacuum should be indicated.
- If no vacuum was indicated during test, be sure vacuum is being applied to inlet side of back-pressure sensor. Then remove back-pressure sensor and inspect spacer port and tube for restrictions. Restrictions caused by carbon or lead deposits can be removed with spiral wire brush. Otherwise, replace back-pressure sensor.

RESTRICTOR PLATES

The restrictor plate (fig. 4A-13) is located between the exhaust back-pressure sensor spacer and the intake manifold, mounted between gaskets. The stainless steel restrictor plate is calibrated for a particular engine/exhaust system and should never be altered or replaced with a restrictor plate of different calibration.

All heavy-duty California vehicles use the exhaust back-pressure sensor assembly without a restrictor plate.

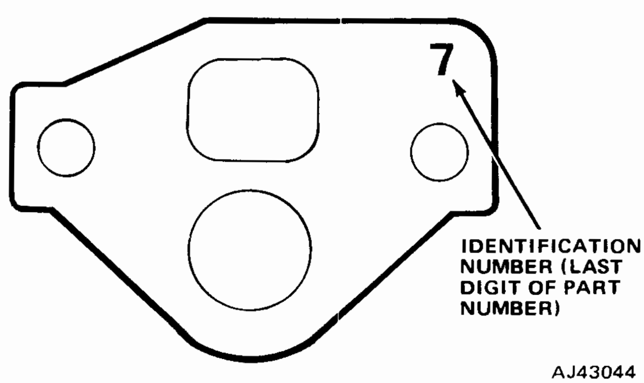


Fig. 4A-13 Restrictor Plate

EGR DELAY VALVE

An EGR delay valve is used on models equipped with 360/401 CID engines and 4V carburetor. The delay valve is installed between the EGR valve and back-pressure sensor (fig. 4A-14) and delays the vacuum signal to the EGR valve to prevent stumble or hesitation on initial acceleration. The delay valve is color coded to prevent improper installation. The red side of the valve connects to the back-pressure sensor and the blue side connects to the EGR valve.

Delay Valve Test

Bypass the back-pressure sensor when performing this test as the sensor has a bleed which may give false readings.

(1) Install a tee in vacuum line between red side of delay valve and vacuum source.

(2) Attach vacuum gauge to tee.

(3) Start engine and, while observing EGR valve operation, increase rpm until 3 to 10 inches of vacuum are indicated on the gauge. It should take from 18 to 32 seconds for the vacuum signal to reach the EGR valve.

(4) Replace delay valve if delay is longer than 32 or less than 18 seconds.

(5) While maintaining a 3- to 10-inch vacuum, disconnect vacuum line from delay valve. EGR valve should close (seat) within 0.5 second or less. If valve does not seat within this time, replace delay valve.

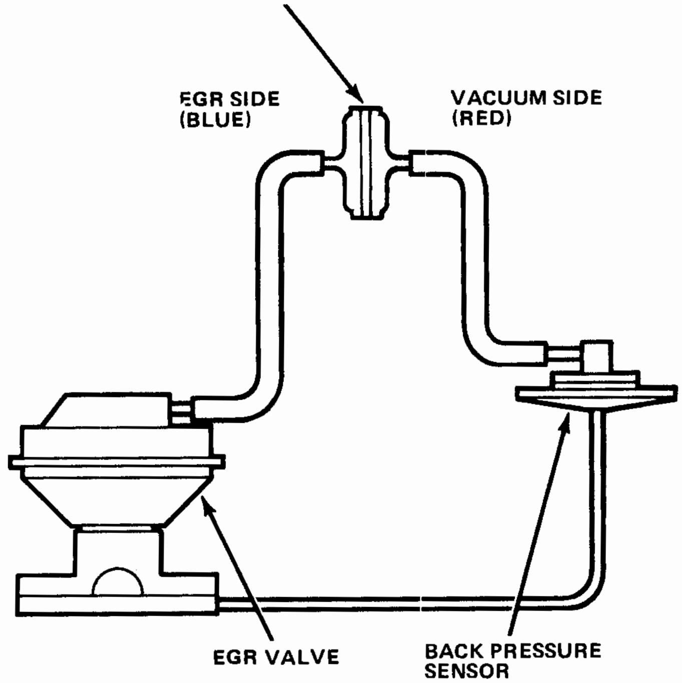


Fig. 4A-14 EGR Delay Valve

CATALYTIC CONVERTER

GENERAL

All CJ models with V-8 engines and all California CJ models have catalytic converters. Leaded fuel poisons the catalytic converter, although use of a few gallons of leaded fuel in an emergency does not seriously impair the converter.

To avoid confusion, all CJ models are fitted with a fuel filler neck restrictor (refer to Fuel—Carburetion section) which admits only the smaller nozzles used for unleaded fuel.

CONVERTER OPERATION

All exhaust gases flow through the catalytic converter where a chemical change takes place which reduces carbon monoxide and hydrocarbons to harmless carbon dioxide and water. The catalysts which produce this action are platinum and palladium, present as a fine coating on beads of alumina.

The temperature of the converter during this chemical reaction is somewhat higher than that of exhaust gases as they leave the engine, but insulation keeps the outside skin of the converter at about the same temperature as the muffler. Due to its solid mass, however, the catalytic converter stays hot much longer than the muffler.

The catalytic converter body is stainless steel which is designed to last the life of the car. Excessive heat can result in bulging or other distortion, but excessive heat is not the fault of the converter—the vehicle has a carburetor or ignition problem permitting unburned fuel to enter the converter, producing excessive heat. If a converter is heat damaged, the ignition or carburetor problem should be corrected at the same time the converter is replaced, and all other components of the exhaust system should also be checked for heat damage.

CATALYST REPLACEMENT PROCEDURE

(1) Raise vehicle.

(2) Place vacuum pump hose on exhaust pipe and tighten clamp (fig. 4A-15).

(3) Connect shop air (80 psi minimum) to fitting on vacuum pump.

(4) Remove plug from bottom of converter.

NOTE: *It may be necessary to apply heat directly to the plug to ease removal.*

(5) Position vibrator on converter and lock in place (fig. 4A-16).

(6) Remove shop air hose from vacuum pump.

(7) Connect shop air hose to fitting on vibrator. Catalyst beads will fall into can for approximately 10 minutes.

(8) When converter is empty, disconnect shop air hose, remove can, and discard beads.

(9) Install refill bead can on vibrator.

(10) Connect shop air hose to vacuum pump and vibrator. Beads will be drawn up and packed into place.

NOTE: *If any beads come out of the tailpipe, the converter is defective and must be replaced.*

(11) When converter is full, remove shop air hose from vibrator and remove vibrator from converter.

NOTE: *Replace plug if damaged during removal. Coat threads of plug with a nickel-based anti-seize compound before installation.*

(12) Install plug on bottom of converter and tighten to 40 foot-pounds torque.

(13) Disconnect shop air from vacuum pump and remove vacuum pump.

(14) Lower vehicle.

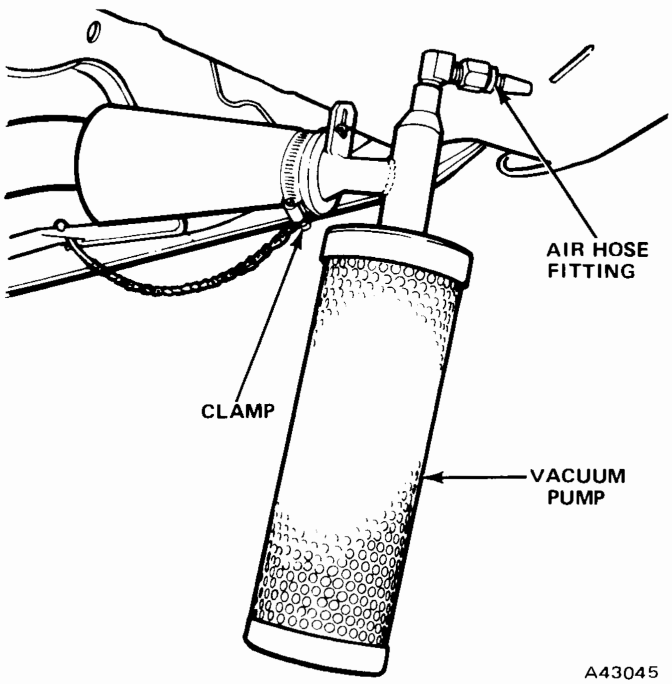


Fig. 4A-15 Vacuum Pump

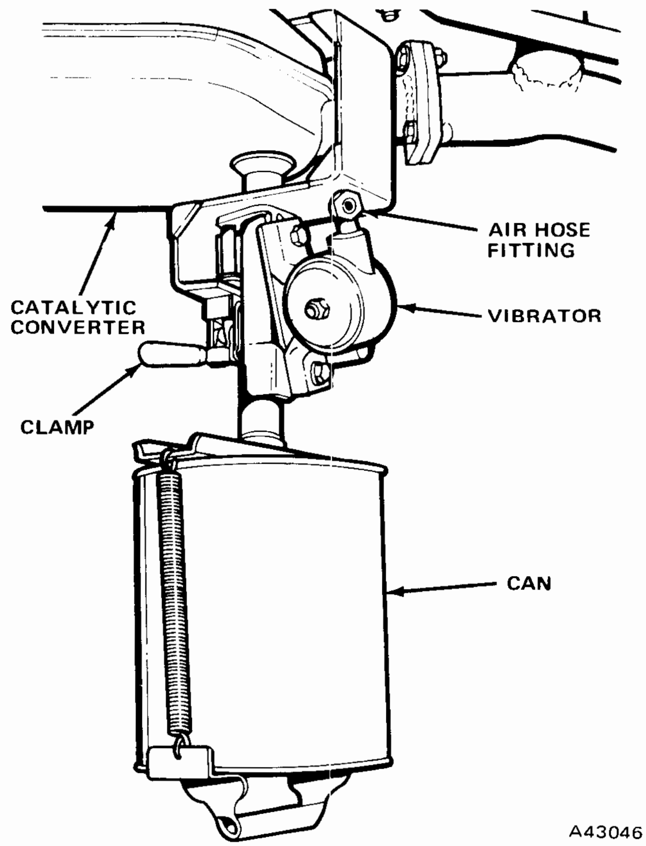


Fig. 4A-16 Vibrator Tool

FUEL TANK VAPOR EMISSION CONTROL SYSTEM

GENERAL

A closed fuel tank vent system is used on all CJ models and California Cherokee, Wagoneer, and Truck models. This system routes raw fuel vapor into the intake system where it is burned along with the fuel-air mixture, preventing fuel vapors from entering the atmosphere (fig. 4A-17). All other Nationwide vehicles do not have vent lines since they do not use a closed vent system.

FUEL TANK FILTER

All vehicles use a woven Saran sleeve-type fuel filter which is attached to the end of the fuel outlet tube inside the fuel tank. This filter is rated at 65 micron and repels water. Under normal conditions it requires no maintenance or service.

FUEL TANK FILLER CAP

The filler cap on California Cherokee, Wagoneer, and Truck models and all CJ models incorporates a two-way relief valve which is closed to atmosphere under normal operating conditions. The relief valve is calibrated to open only when a pressure of 0.75 to 1.5 psi or a vacuum of 15 to 25 inches of water occurs within the tank. When the pressure or vacuum is relieved, the valve returns to the normally closed position. The cap is identified by a black relief valve housing.

NOTE: *It is normal to occasionally encounter an air pressure release when removing the filler cap.*

All other Nationwide vehicles use an externally vented cap.

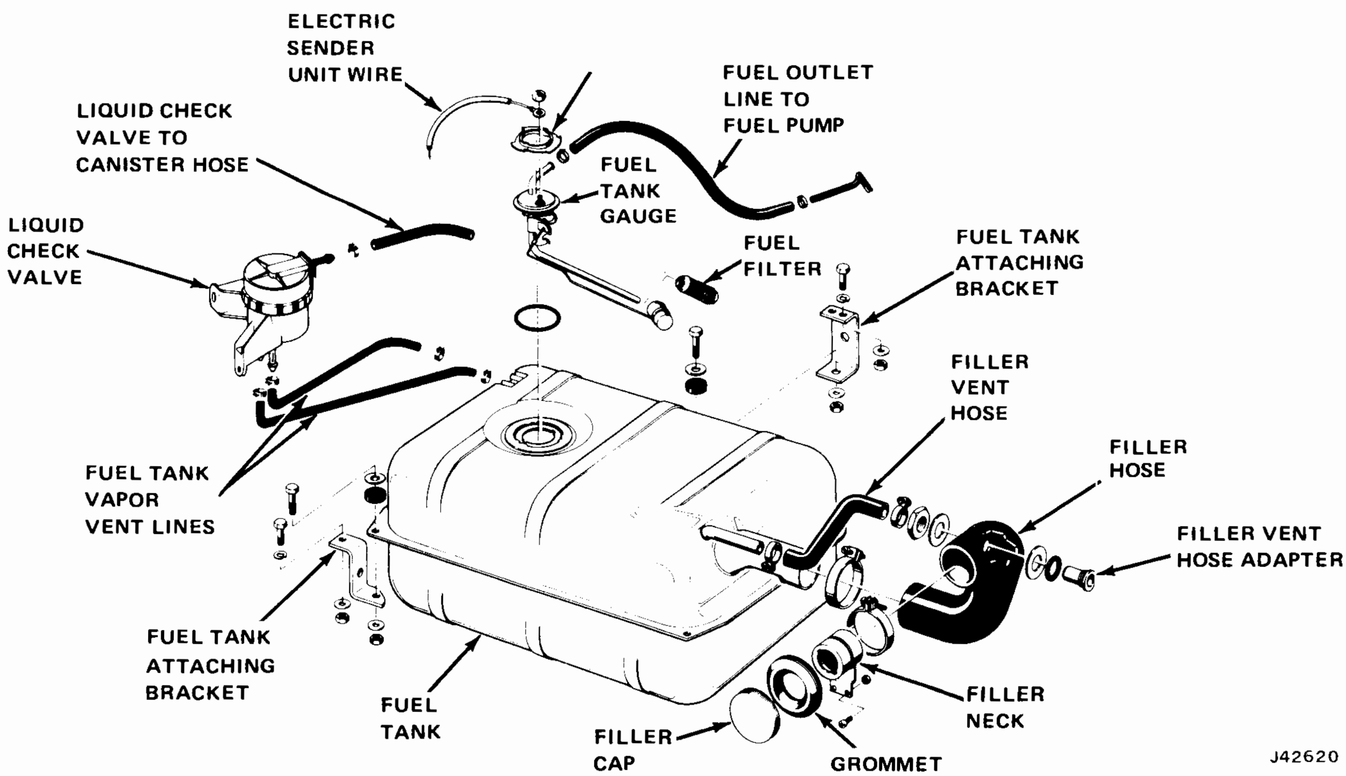


Fig. 4A-17 Fuel Tank Vapor Emission System (Typical)

LIQUID CHECK VALVE

The liquid check valve incorporates a float and Viton needle assembly. In the event that liquid fuel enters the check valve, the float will rise and force the needle upward to close the vent passage; thereby preventing liquid fuel from flowing through the valve (fig. 4A-18).

After passing through the check valve, the fuel vapor is routed through a vent line to the vapor storage canister in the engine compartment.

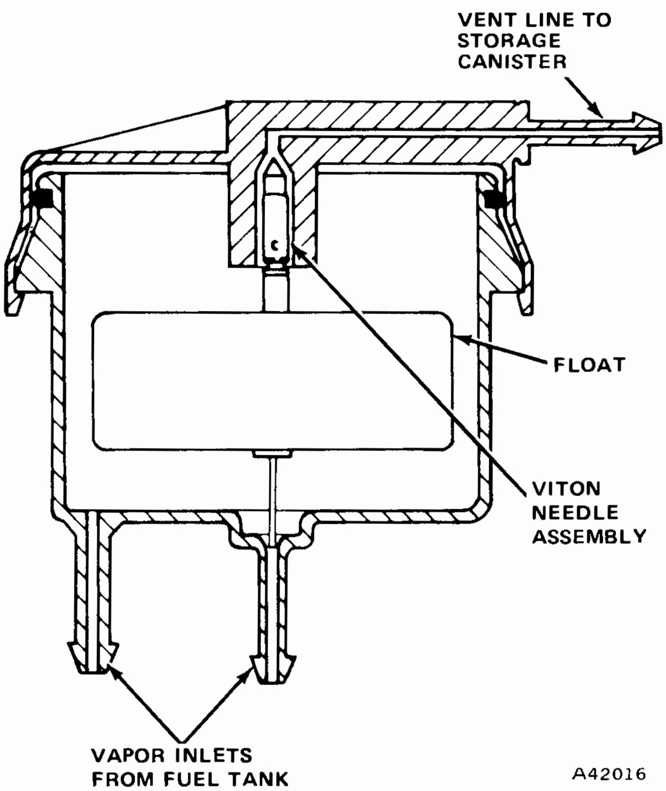


Fig. 4A-18 Liquid Check Valve (Typical)

FUEL VAPOR STORAGE CANISTER

The fuel-resistant nylon body of the canister contains activated charcoal granules which absorb and store the fuel tank vapors until they are drawn into the intake manifold through the carburetor air cleaner (fig. 4A-19).

In 1976, all canisters have three nipple connections, although one connection is plugged when used with the 2V V-8 engine which does not require a connection to the carburetor float bowl.

In all other applications, the canister has connections for the fuel tank vapor line, the carburetor float bowl and to a tube at the underside of the air cleaner snorkel.

The tube at the snorkel projects into the incoming airstream, creating a vacuum that draws fuel vapor from the canister. The amount of vapor drawn is relative to air velocity passing through the air cleaner snorkel. The canister on six-cylinder engines and V-8 engines with 4V carburetors has three hose connections: one for the fuel tank vapor line, one for the carburetor float bowl, and one hose connected to a tube at the underside of the air cleaner snorkel. This tube projects into the incoming stream of the snorkel. Air passing over the tube creates a vacuum that draws fuel vapor from the canister. The amount of vapor drawn from the canister is relative to the air velocity passing through the air cleaner snorkel. Higher air velocity creates higher vacuum and an increase in vapor drawn from the canister.

Outside air is drawn into the canister through a replaceable filter pad which is accessible through the bottom of the canister body. The filter pad should be replaced at the recommended mileage intervals listed in the Mechanical Maintenance Schedule.

MAINTENANCE

The fuel tank, filler cap, fuel lines, and vent lines must be maintained in good condition to prevent raw fuel vapors (hydrocarbons) from entering the atmosphere.

Inspect the filler cap for evidence of fuel leakage (stains) at the filler neck opening. Remove the cap and

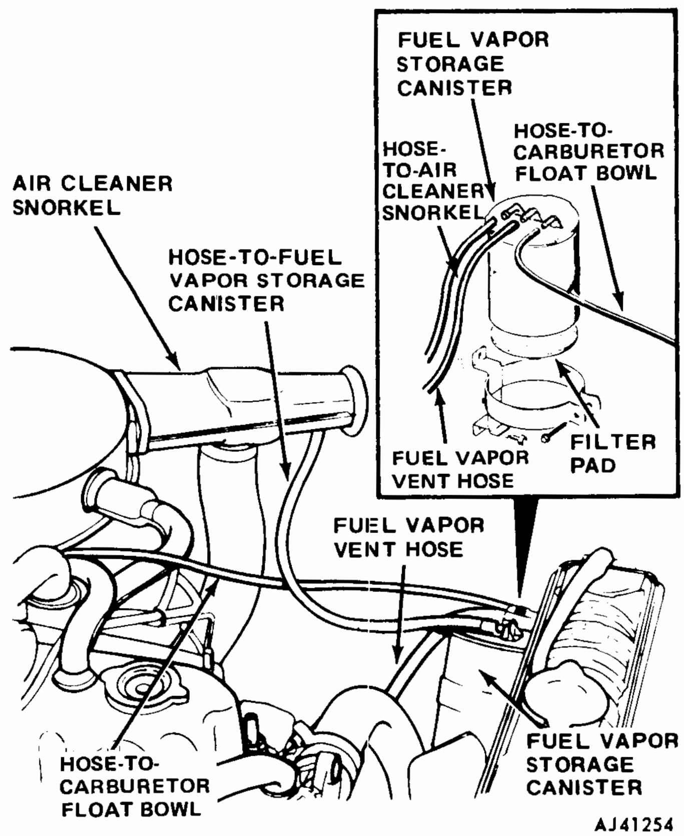


Fig. 4A-19 Fuel Vapor Storage Canister—Six-Cylinder Shown check the condition of the sealing gasket. Replace the filler cap if the gasket is damaged or deteriorated.

Inspect the fuel tank for evidence of fuel leakage (stains). Trace any stain back to its origin and repair or replace the tank as required.

Inspect the fuel and vent lines for leakage or damage, repair or replace as required. Be sure all connections are tight.

If liquid fuel is present at the fuel vapor storage canister, inspect the liquid check valve and replace if necessary.

The filter pad located at the bottom of the canister is the only serviceable item of the canister assembly. It should be replaced at 15,000-mile intervals on Cherokee, Wagoneer, and Truck models and 30,000 miles on CJ models as prescribed in the Mechanical Maintenance Schedule, located in Section B of this manual.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

GENERAL

This system incorporates a calibrated airflow PCV valve connected between an intake manifold vacuum source and the engine. Crankcase vapors are drawn through the PCV valve into the intake manifold where they are burned along with the fuel-air mixture (fig. 4A-20). The oil filler cap is closed in this system to prevent any crankcase vapors from entering the atmosphere.

During periods of relatively high manifold vacuum, such as idle or cruise speeds, outside air is drawn from the air cleaner into the crankcase. On six-cylinder engines, the air passes through a polyurethane foam filter located in the air cleaner (fig. 4A-21). On V-8 engines, the air passes through a polyurethane foam filter located in the oil filler cap. The filler cap is connected by a hose to the air cleaner (fig. 4A-22).

If crankcase vapor pressures (blowby) exceed the flow capacity of the PCV valve, airflow in the system will reverse. Crankcase vapors are drawn through the air cleaner element and carburetor and burned along with the fuel-air mixture.

The positive crankcase ventilation system performs two functions:

- Prevents combustion blowby from entering the atmosphere.
- Ventilates the crankcase with clean air to help prevent the formation of sludge.

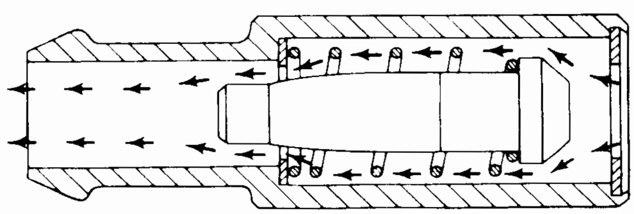


Fig. 4A-20 Positive Crankcase Ventilation Valve Flow

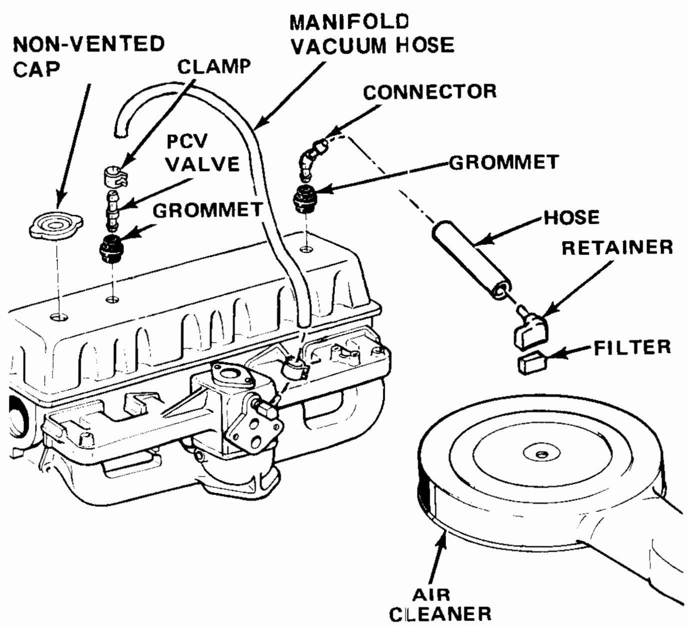


Fig. 4A-21 PCV System—Six-Cylinder

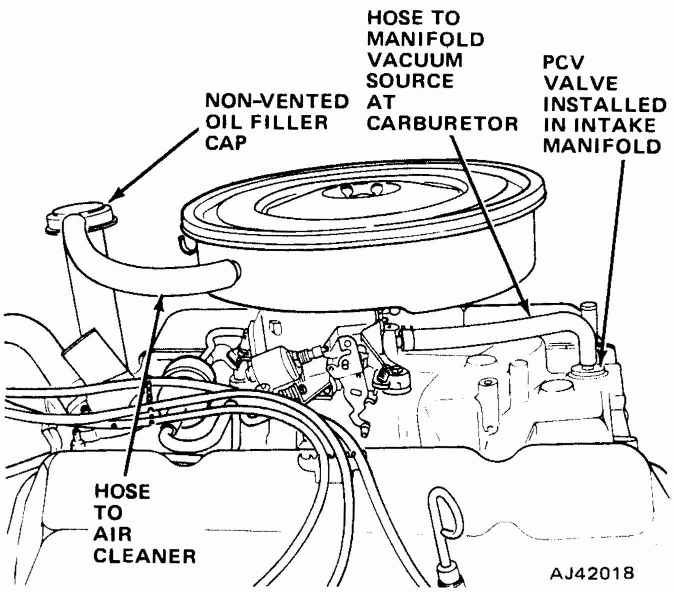


Fig. 4A-22 PCV System—V-8

Positive Crankcase Ventilation (PCV) Valve

Two PCV valves with different flow rates (cfm) are used. The black valve is used on all V-8 engines and the silver valve is used on all six-cylinder engines.

The PCV valve must be replaced at 15,000-mile intervals on Cherokee, Wagoneer, and truck models and 30,000-mile intervals on CJ models as specified in the Mechanical Maintenance Schedule. All hoses in the PCV system should be inspected at this time for leaks or restrictions and cleaned or replaced as required. PCV valve replacement may be required more often under adverse operating conditions.

PCV VALVE TEST

The valve may be tested at idle speed for correct flow rate (cfm) providing the engine manifold vacuum is at least 14 inches Hg. When checking vacuum, connect the gauge to a fitting which is as centrally located as possible on the intake manifold.

Remove the valve from the grommet in the intake manifold (V-8) or cylinder head cover (six-cylinder) and connect the plastic hose of PCV Valve Tester J-23111 to the valve (fig. 4A-23).

NOTE: *The PCV valve must be held in a horizontal position and tapped lightly during the test. Hold the tester in a vertical position.*

Start the engine and allow it to idle and observe the flow rate (cfm). Refer to PCV Valve Flow Chart.

A valve which flows above or below specification must be replaced. The correct PCV valve should be used for replacement.

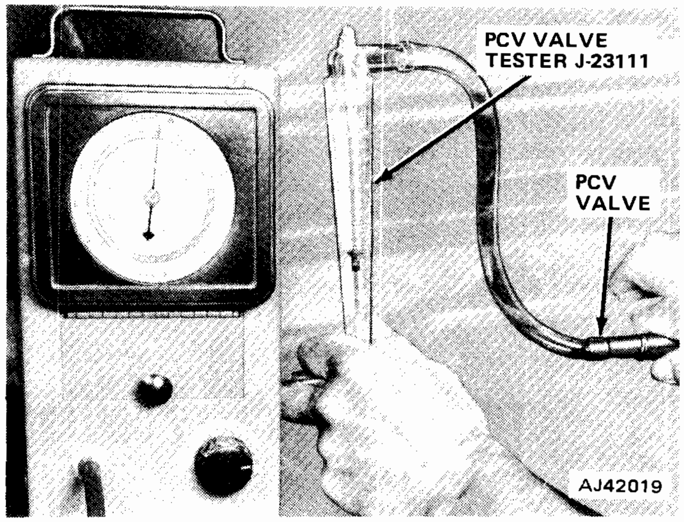


Fig. 4A-23 PCV Valve Test

PCV VALVE FLOW CHART

ENGINE MANIFOLD VACUUM (In. Hg.)	Air Flow (CFM)	
	Black Valve	Silver Valve
20	1.35-1.65	1.3-1.7
18	1.35-1.65	1.3-1.7
16	1.35-1.65	1.3-1.7
14	1.35-1.65	1.3-1.7
12	1.35-2.2	1.3-1.7
10	1.8 -2.9	1.3-1.7
8	2.5 -3.5	1.3-1.7
6	2.9 -4.0	1.3-1.7
3	3.3 -4.4	1.7

PCV AIR INLET FILTER MAINTENANCE

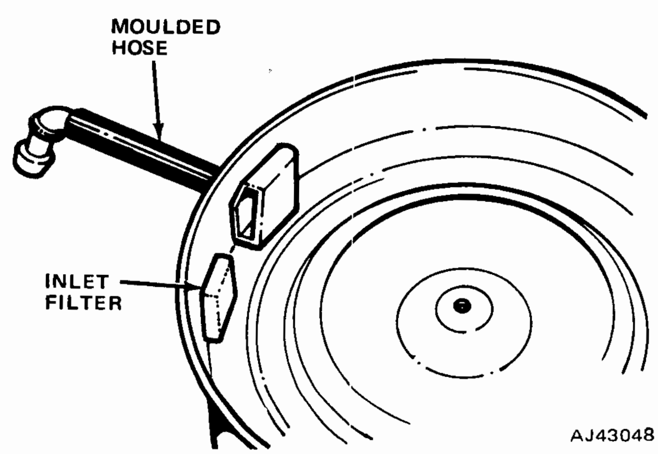


Fig. 4A-24 PCV Air Inlet Filter—Six-Cylinder

Six-Cylinder

A polyurethane foam PCV air inlet filter is located in a filter retainer in the air cleaner. The retainer must be rotated to remove it from the air cleaner (fig. 4A-24). The filter must be cleaned in kerosene at the mileage intervals recommended in the Mechanical Maintenance Schedule. After cleaning, the filter should be lightly oiled with clean engine oil.

V-8

A polyurethane foam PCV air inlet filter is located in the sealed oil filler cap. To clean the filter, apply light air pressure in reverse direction of normal flow; that is, through the filler tube opening of the cap. Lightly oil the filter with clean engine oil. If the filter is deteriorated, the filler cap must be replaced.

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC) SYSTEM

SIX-CYLINDER ENGINE

This system consists of a two-piece heat shroud positioned on the exhaust manifold, a hot air hose, and an air duct and valve assembly which is located in the air cleaner snorkel (fig. 4A-25).

The air duct and valve assembly incorporates an air valve, a thermostat unit, and a spring.

The temperature of the air entering the air cleaner is thermostatically controlled by the air duct and valve assembly. Air from the engine compartment, or heated air from the shrouded exhaust manifold is supplied to the engine.

The thermostat unit in the air duct is exposed to incoming air. The spring-loaded air valve is connected to the thermostat unit through linkage. The spring holds the air valve in the closed position (heat on) until the thermostat unit overcomes the spring tension.

During the engine warmup period when the air temperature entering the air duct is less than 105°F, the thermostat is in the retracted position and the air valve is held in the closed position (heat on) by the spring, thus shutting off the air from the engine compartment. Air is then drawn from the shroud at the exhaust manifold.

As the temperature of the air passing the thermostat unit rises, the thermostat starts to open and pulls the air valve down. This allows cooler air from the engine compartment to enter the air cleaner. When the temperature of the air reaches 130°F, the air valve is in the open position (heat off) so that only engine compartment air is allowed to enter the air cleaner.

TAC Operational Test—Six-Cylinder

(1) Remove air cleaner top half and immerse snorkel in cold water, making certain thermostat unit is covered.

(2) Place a thermometer in water and observe the temperature while heating water slowly.

NOTE: *With water temperature at 105°F or less, air valve must be in closed (heat on) position.*

(3) Heat water until temperature reaches 130°F; air valve must be in fully open (heat off) position.

NOTE: *If air valve does not open and close at temperatures specified, check valve mechanism for a binding condition or a disconnected or defective spring. If valve mechanism is in satisfactory condition, thermostat unit is defective and air cleaner assembly must be replaced.*

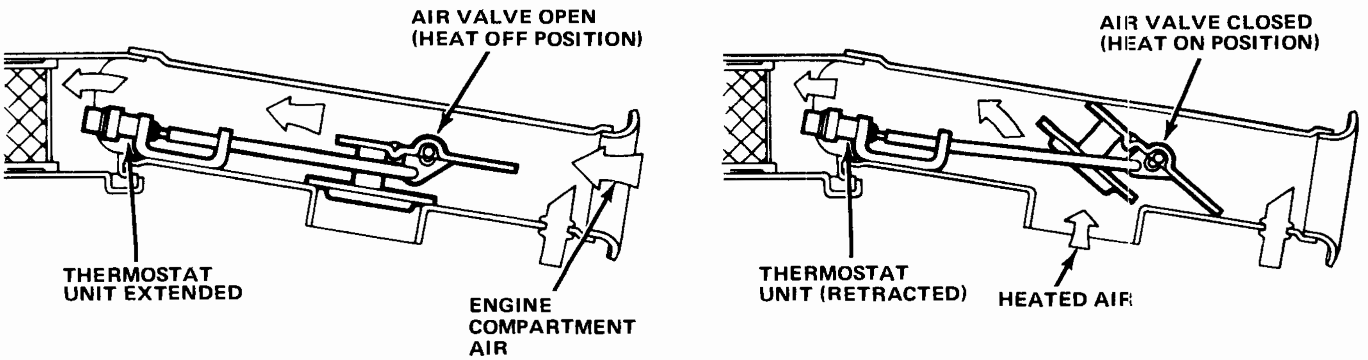


Fig. 4A-25 TAC System—Six-Cylinder

V-8 ENGINE

This system consists of a heat shroud which is integral with the right-hand exhaust manifold, a hot air hose, a special air cleaner assembly (equipped with a thermal sensor), and a vacuum motor and air valve assembly.

The thermal sensor incorporates an air bleed valve which regulates the amount of vacuum applied to the vacuum motor, thereby controlling the air valve position to supply either heated air from the exhaust manifold or air from the engine compartment (fig. 4A-26).

During the warmup period, when underhood air temperatures are low, the air bleed valve is closed and sufficient vacuum is applied to the vacuum motor to hold the air valve in the closed (heat on) position.

As the temperature of the air entering the air cleaner approaches approximately 115°F, the air bleed valve opens to decrease the amount of vacuum applied to the vacuum motor. The diaphragm spring in the vacuum motor then moves the air valve into the open (heat off) position, allowing only underhood air to enter the air cleaner.

The air valve in the air cleaner snorkel will also open, regardless of air temperature, during rapid acceleration to obtain maximum airflow through the air cleaner.

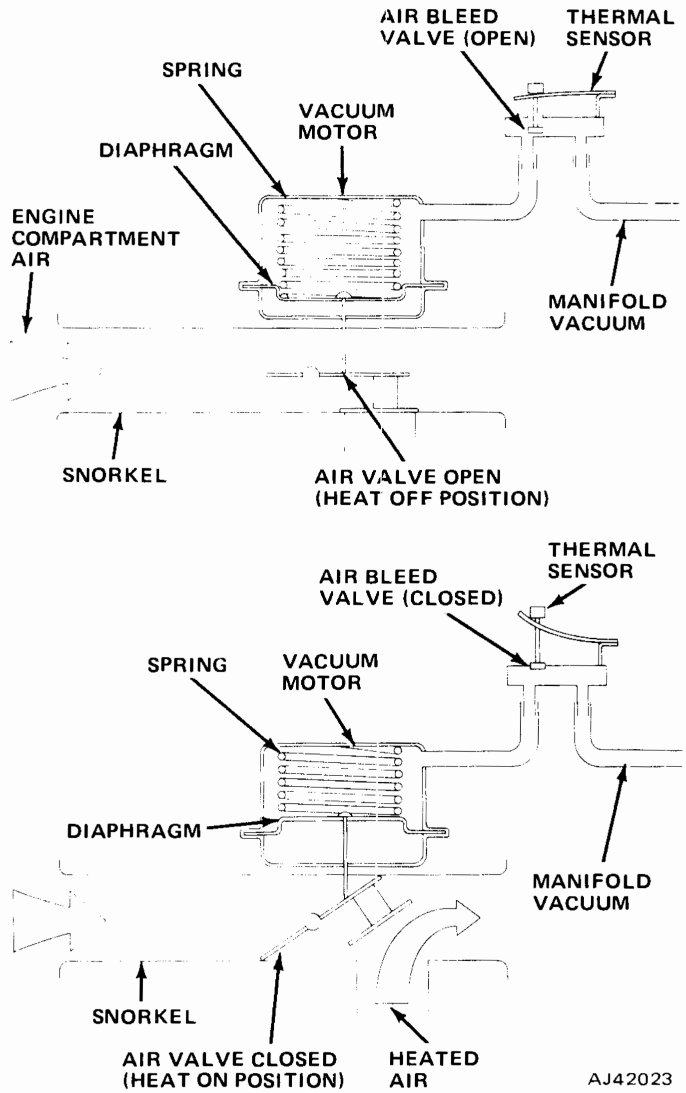


Fig. 4A-26 TAC System—V-8

TAC Operational Test—V-8

(1) Remove air cleaner assembly from engine and allow to cool at room temperature.

(2) After cooling, sight through air cleaner snorkel to observe position of air valve; it should be fully open to outside air.

(3) Install air cleaner assembly to engine and connect hot air tube and manifold vacuum hose.

(4) Start engine and observe position of air valve, it should be fully closed to outside air.

(5) Move the throttle lever rapidly to approximately 1/2 to 3/4 opening and release, air valve should open and then close again.

(6) Allow engine to warm to operating temperature and observe position of air valve; it should be fully open to outside air.

If air valve does not close at room temperature with vacuum applied, check for a mechanical bind in the snorkel, vacuum motor linkage disconnected, vacuum leaks in hoses or connections at the vacuum motor, thermal sensor, and intake manifold.

If air valve mechanism is operating freely and no vacuum leaks are detected, connect a hose from an intake manifold vacuum source directly to vacuum motor.

If air valve now closes, thermal sensor is defective and must be replaced.

If air valve does not close, vacuum motor is defective and must be replaced.

VACUUM THROTTLE MODULATING SYSTEM (VTM)

This system is designed to reduce the emission of hydrocarbons (HC) during rapid throttle closure at high speeds. It is not used on CJ models, but is used on some Nationwide and California Cherokee, Wagoneer, and Truck models with V-8 engine.

The system consists of a deceleration valve located at the right front side of the intake manifold and a throttle modulating diaphragm located at the carburetor base. The deceleration valve is connected by one hose to a manifold vacuum source and by another hose to the throttle modulating diaphragm (fig. 4A-27).

During high speed deceleration, when manifold vacuum reaches approximately 21 to 22 inches, the deceleration valve triggers a vacuum signal to the throttle modulating diaphragm and causes a plunger to move out and open the throttle slightly. The increased throttle opening allows more air to enter the combustion chambers and lean out the overrich mixture, thereby reducing the emission of the hydrocarbons.

The deceleration valve calibration is preset at time of manufacture and normally does not require adjustment. To check and adjust the throttle modulating diaphragm, proceed as follows:

(1) With engine not running and curb idle speed previously set, position throttle lever against curb idle adjusting screw.

(2) Measure clearance between the throttle modulating diaphragm plunger and the throttle lever. It should be 1/16 inch (0.062 inch).

(3) Adjust by loosening the jamnut and turning the diaphragm assembly.

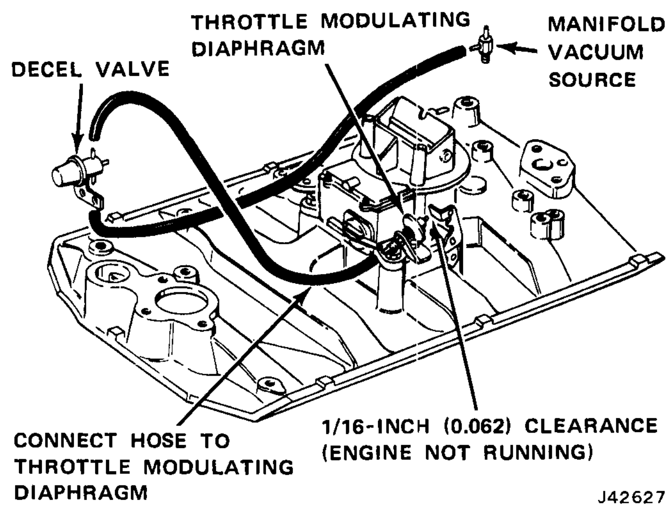


Fig. 4A-27 Vacuum Throttle Modulating System

TRANSMISSION CONTROLLED SPARK (TCS) SYSTEM

GENERAL

The purpose of this system is to reduce the emission of oxides of nitrogen by lowering the peak combustion temperature during the power stroke. The system incorporates a solenoid vacuum valve, a solenoid control switch, and related wiring and vacuum lines (fig. 4A-28 and 4A-29). This system is used only on California CJ models.

SOLENOID VACUUM VALVE

This valve is attached to the intake manifold at the rear right side of the intake manifold (V-8 engines) or to a bracket at the rear of the intake manifold (six-cylinder engines). When the valve is energized (ground circuit complete), carburetor ported vacuum is blocked and the distributor vacuum line is vented to atmosphere through a port in the valve, resulting in no vacuum advance. When the valve is de-energized (ground circuit open), ported vacuum is applied to the distributor resulting in normal vacuum advance.

SOLENOID CONTROL SWITCH

This switch opens or closes in relation to vehicle speed or gear range. At speeds above 32 to 36 mph (automatic transmission) or high gear (manual transmission), the switch opens and breaks the ground circuit to the solenoid vacuum valve.

At speeds under 32 to 36 mph (automatic transmission) or lower gear ranges (manual transmission), the switch is closed and completes the ground circuit to the solenoid vacuum valve.

On manual transmissions, the switch is operated by the shifter shaft, which is screwed into the transmission case.

On automatic transmissions, the switch is located along the speedometer cable on the firewall. The switch is operated by speedometer cable rpm. The cable attaches to both ends of the switch. At 32 to 36 mph (533 to 599 cable rpm), the switch will open the ground circuit.

TCS TEST

A vacuum gauge, probe-type test lamp, and a jumper wire are used to check the operation of the TCS system.

(1) Turn ignition switch on.

(2) Disconnect wire connector from solenoid vacuum valve.

(3) Connect wire lead of test lamp to ground.

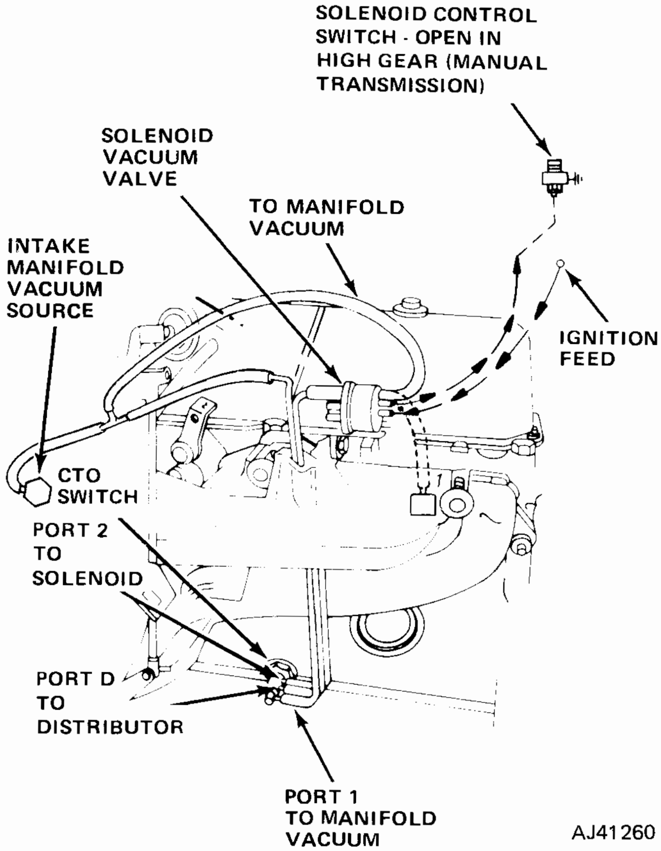


Fig. 4A-28 TCS System—Six-Cylinder

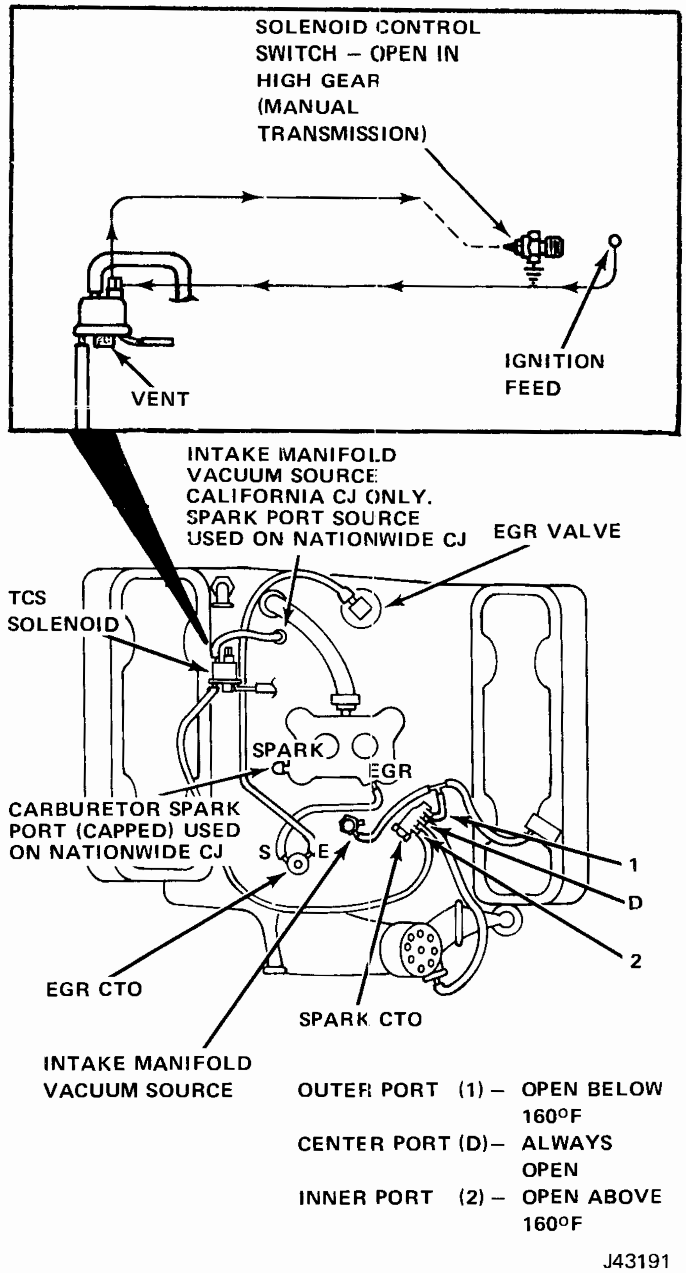


Fig. 4A-29 TCS System—V-8

(4) Touch probe end of test lamp to each terminal of connector. Test lamp should light at one of the terminals; if not, ignition feed portion of TCS system is defective.

(5) Connect wire lead of test lamp to battery positive post.

NOTE: *Manual transmission equipped vehicles must be in neutral to begin step (6).*

(6) Touch probe end of test lamp to solenoid vacuum valve ground wire terminal at connector (opposite the terminal which caused test lamp to light in step (4) (Test No. 1). Test lamp should light; if not, use the following procedure.

(a) Disconnect wire at solenoid control switch.

(b) Using a jumper wire, connect one end to switch wire connector and other end to ground (Test No. 2).

(c) If test lamp lights when solenoid control switch wire is grounded with jumper wire, solenoid control switch is defective. If test lamp does not light, solenoid control switch wire is defective.

(7) Disconnect vacuum line from vent side of solenoid vacuum valve.

(a) Using a vacuum gauge, connect gauge to solenoid vacuum valve where hose was disconnected.

(b) Start engine. With solenoid vacuum valve attached, no vacuum should be indicated; otherwise, replace solenoid vacuum valve.

(c) Disconnect wires from solenoid vacuum valve. Ported vacuum should be indicated; if not, replace solenoid vacuum valve.

(8) Manual transmission equipped:

(a) Place gear selector in high gear.

(b) Test lamp should go out; if not, solenoid control switch is defective.

(9) Automatic transmission equipped:

(a) Raise and support vehicle so that rear wheels are free to rotate.

(b) Disconnect solenoid control switch wire. Connect wire lead of test lamp to solenoid control switch wire male connector. Touch probe end of test lamp to switch wire female connector (Test No. 3).

(c) Start engine. Test lamp should light; if not, solenoid control switch is defective.

(d) Slowly accelerate engine 32 to 36 mph, test lamp should go out. If test lamp goes out at a speed outside of this range, switch should be replaced.

NOTE: *With decreasing speed, the solenoid control switch will close the ground circuit at 22 to 28 mph (366 to 466 cable rpm). Make tests while increasing speed or accelerating engine only.*

(10) Stop engine.

(11) Reconnect wire connector to solenoid control switch and lower vehicle.

SPARK COOLANT TEMPERATURE OVERRIDE SWITCH (SPARK CTO)

This switch is threaded into the thermostat housing on V-8 engines and into the left rear side of the block on six-cylinder engines. Its purpose is to improve driveability during the warmup period by providing full distributor vacuum advance until the engine coolant temperature has reached 160°F. The switch incorporates a thermal unit which reacts to coolant temperatures and moves a check ball inside the switch up or down to open or close the switch ports. Either intake manifold or carburetor ported vacuum is thereby routed to the distributor vacuum advance diaphragm (fig. 4A-31).

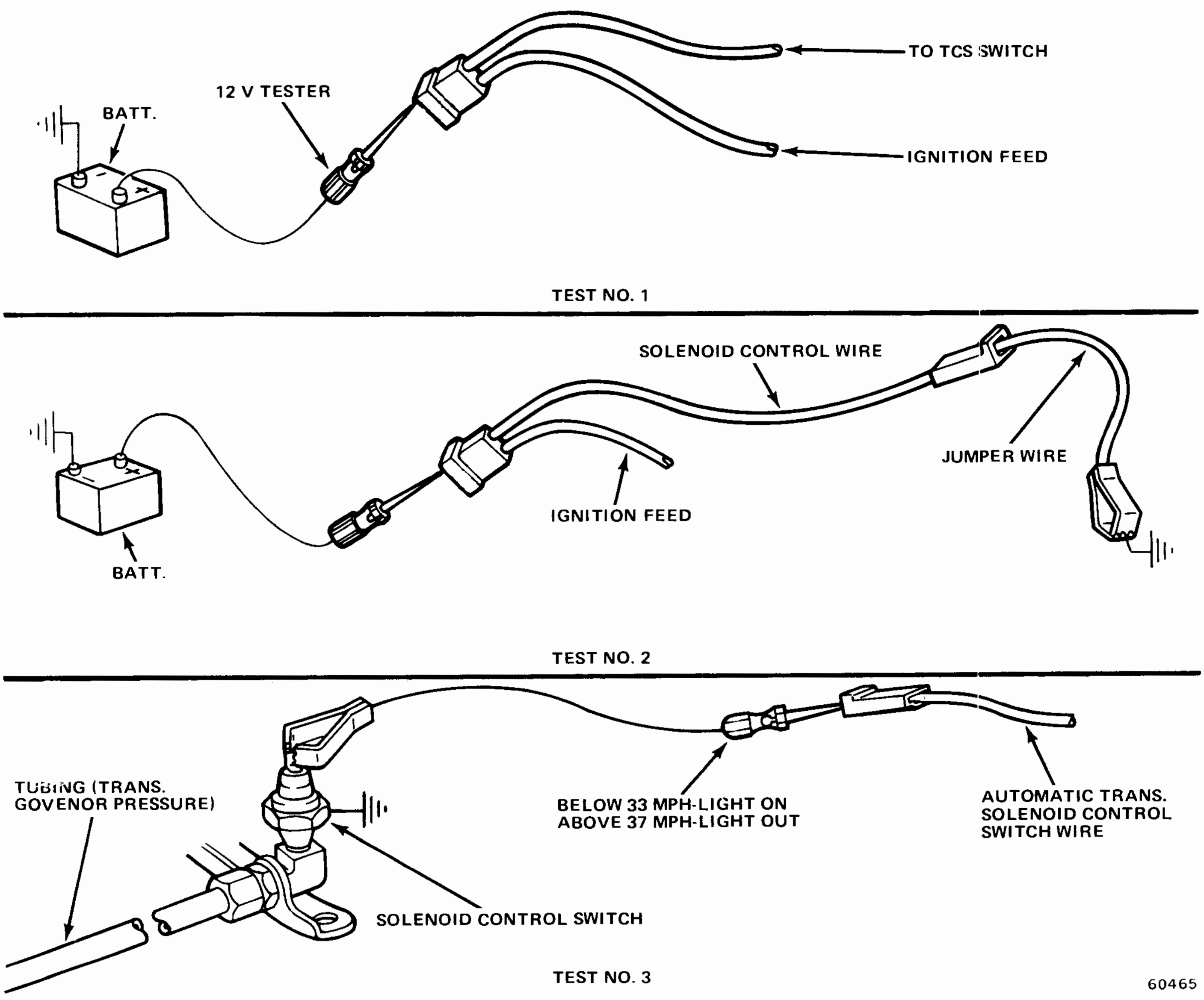


Fig. 4A-30 TCS System Test

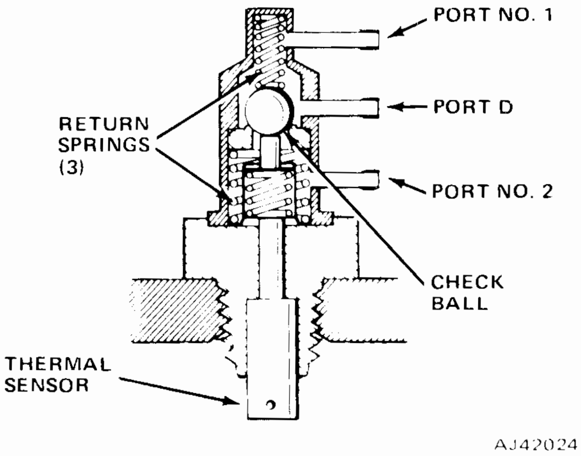


Fig. 4A-31 Spark CTO

When the coolant temperature is below 160°F, ports No. 1 and D are open and port No. 2 is closed. When the coolant temperature reaches 160°F, port No. 1 closes and ports No. 2 and D are open.

SPARK CTO TEST

NOTE: *Begin test with coolant temperature below 160°F.*

(1) Remove all vacuum lines from CTO switch. Plug those lines that will create a vacuum leak.

(2) Connect a vacuum line from a manifold vacuum source to port No. 1 (outer) of the CTO.

(3) Connect a vacuum gauge to port D (center) of CTO.

(4) Start engine. Manifold vacuum should be indicated on vacuum gauge; if not, replace CTO.

(5) With engine still running and coolant temperature **below** 160°F, disconnect vacuum line from port No. 1 (outer) of CTO and connect to port No. 2 (inner).

(6) No manifold vacuum should be indicated on vacuum gauge. Replace CTO if vacuum is indicated.

(7) Keep engine running until coolant temperature exceeds 160°F (approximately the beginning of the temperature gauge band). Manifold vacuum should be indicated; if not, replace CTO.

(8) Disconnect line from port No. 2 and connect it to port No. 1. No vacuum should be indicated; otherwise, replace CTO.

(9) Reconnect vacuum lines to CTO.

Removal—Six-Cylinder

(1) Drain coolant from radiator.

(2) Disconnect vacuum lines from spark CTO switch.

(3) Place a drain pan under the engine below CTO switch.

(4) Using a 7/8-inch open end wrench, remove switch from block.

WARNING: *Be careful of scalding hot water leaking from block when removing the switch.*

Installation—Six-Cylinder

(1) Drain coolant from radiator.

(2) Connect vacuum lines to switch.

(3) Install coolant.

Removal—V-8 Engine

(1) Drain coolant from radiator.

(2) Remove air cleaner assembly.

(3) Disconnect vacuum lines from CTO switch.

(4) Using a 7/8-inch open end wrench, remove switch from thermostat housing.

Installation—V-8 Engine

(1) Install spark CTO switch in thermostat housing.

(2) Install coil and bracket with attaching screw.

(3) Connect vacuum lines to switch.

(4) Install air cleaner assembly.

(5) Install coolant.

(6) Purge cooling system of air.

EMISSION CONTROL MAINTENANCE

GENERAL

Proper emission control depends on overall engine performance as well as special emission control systems. The following procedures cover maintenance services listed in the U. S. Emission Control Services Chart which have not been described earlier in this section.

U.S. Emission Control Service—Cherokee-Wagoneer-Truck Models

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-up.

SCHEDULED ROUTINE SERVICES

At 5-10-20-25-35-40-50-55-65-70-80-85-95-100,000 miles
Heat Valve (exhaust manifold)—inspect and lubricate
Drive Belts—inspect condition and tension and correct if required

COMPLETE PRECISION TUNE-UP

At 15-30-45-60-75-90,000 miles
Engine Oil Filler Cap (filter type)—clean and soak in engine oil
Exhaust Gas Recirculation Valve—inspect and clean
Exhaust Gas Recirculation Discharge Port (six-cylinder)—inspect and clean if required
Drive Belts—inspect condition and tension and correct if required
Carburetor Air Cleaner Element—replace paper cartridge, clean polyurethane element, unless plugged or damaged, then replace
Fuel Filter Element—replace
Heat Valve (exhaust manifold) — inspect and lubricate
PCV Valve—replace
PCV Filter (six-cylinder)—clean
PCV Hoses—inspect and replace if required
Coil and Spark Plug Wires—inspect and replace if required
Spark Plugs—replace
Ignition Timing—check and set if required
Distributor Advance Mechanisms—check and correct if required
Distributor Cap and Rotor—inspect and replace if required
Idle Speed and Mixture—check and reset if required
Choke Linkage—inspect for free movement (correct if required)
Fuel System: Cap, Tank, Lines and Connections—inspect for integrity and correct if required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Air-Guard System Hoses—inspect and correct if required
TAC System—inspect and correct if required
Vacuum Fittings, Hoses and Connections—inspect and correct if required

U.S. Emission Control Service—CJ Models

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-ups.

SCHEDULED ROUTINE SERVICES

At 5-15-45-75,000 miles
Drive Belts—inspect condition and tension
At 15-45-75,000 miles
Fuel Filter Element—replace

COMPLETE PRECISION TUNE-UP

At 30-60-90,000 miles
Air-Guard System Hoses—inspect and correct if required
Carburetor Air Cleaner Element—replace
Choke Linkage—inspect for free movement (correct if required)
Coil and Spark Plug Wires—inspect and replace if required
Distributor Advance Mechanisms—check and correct if required
Distributor Cap and Rotor—inspect and replace if required
Drive Belts—inspect condition and tension and correct if required*
EGR System—inspect hoses and connections
Engine Oil Filler Cap (filter type)—clean and soak in engine oil
Fuel Filter Element—replace
Fuel System: Cap, Tank, Lines and Connections—inspect for integrity and correct if required
Fuel Vapor Inlet Filter at Charcoal Canister—replace
Heat Valve (exhaust manifold)—inspect and lubricate
Idle Speed (curb and fast) and mixture—check and reset if required
Ignition Timing—check and set if required
PCV Filter (6-cylinder)—clean
PCV Hoses—inspect and replace if required
PCV Valve—replace
Spark Plugs—replace
TAC System Hoses—inspect and correct if required
Transmission Controlled Spark Systems—inspect and correct if required
Vacuum Fittings, Hoses and Connections—inspect and correct if required

IGNITION SYSTEM

Spark Plugs

Spark plugs should be removed and examined for burned electrodes and dirty, fouled, cracked or broken porcelains. Plugs should be replaced at mileage intervals recommended in the U. S. Emission Control Services Chart. Plugs with lower mileage may be cleaned under some circumstances (refer to fig. 4A-32). After cleaning, the center electrode should be filed flat with a point file. The gap must be set to 0.033 to 0.037 inch (fig. 4A-33).

Spark Plug Condition

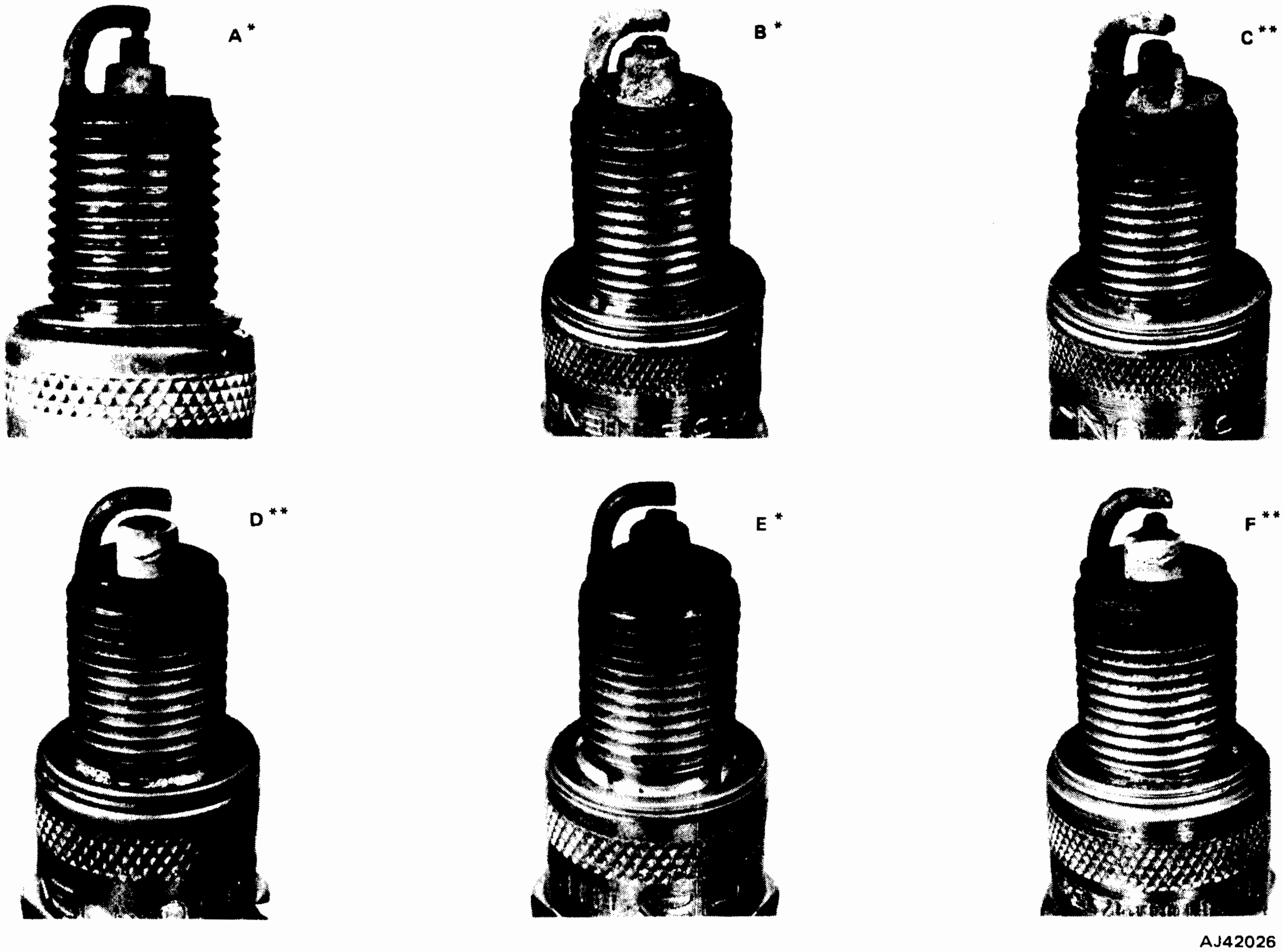
Refer to figure 4A-32.

Gap Bridging—(A)—May be traced to flying deposits in the combustion chamber. In a few cases, fluffy deposits may accumulate on the plugs during in-town driving; when the engine is suddenly put under heavy load, this material can melt and bridge the gap.

Scavenger Deposits—(B)—Fuel scavenger deposits shown may be white or yellow. They may appear to be harmful but this is normal appearance with certain brand fuels. Such materials are designed to change the chemical nature of deposits to lessen misfire tendencies. Notice that accumulation on the ground electrode and shell areas may be unusually heavy, but the material is easily removed. Such plugs can be considered normal in condition, and can be cleaned using standard practices.

Chipped Insulator—(C)—Usually results from bending the center electrode during regapping of the plug. Under certain conditions, severe detonation can also split insulator firing ends.

Pre-ignition Damage—(D)—Caused by excessive temperatures, produces melting of the center electrode and, somewhat later, the ground electrode. Insulators will appear relatively clean of deposits. Check for correct plug heat range, overadvanced ignition timing and similar reasons for overheating.



* LOW MILAGE PLUGS WITH THIS CONDITION MAY BE CLEANED
**REPLACE

Fig. 4A-32 Spark Plug Conditions

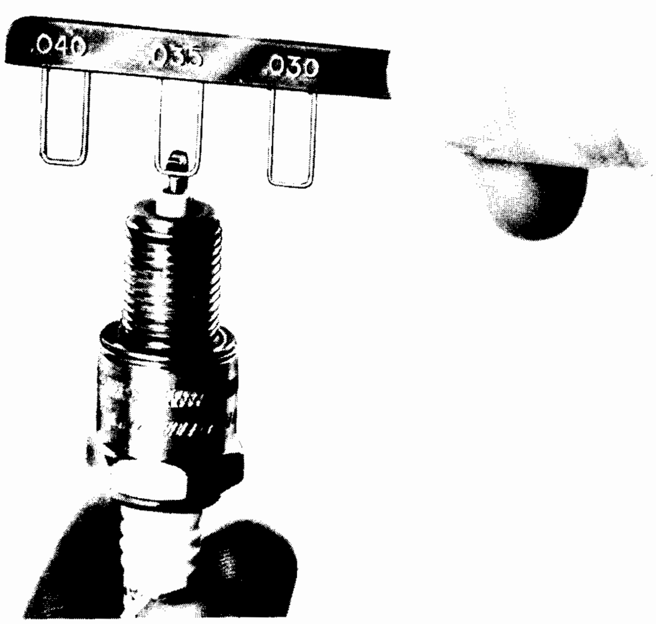


Fig. 4A-33 Spark Plug Gap Check

Cold Fouling (or Carbon Fouled)—(E)—Dry, black appearance of one or two plugs in a set. Check for sticking valves or bad ignition leads. Fouling of the entire set may be caused by a clogged air cleaner, a sticking exhaust manifold heat valve, or a faulty choke.

Overheating—(F)—Indicated by a dead white or gray insulator which appears blistered. Electrode gap wear rate will be considerably in excess of 0.001 inch per 1000 miles. This may suggest that a cooler heat range should be used; however, overadvanced ignition timing, detonation, and cooling system stoppages can also cause overheating.

Spark Plug Wires

To remove wires from spark plugs, twist the boot slightly to break the seal. Grasp the rubber protector boot and lift straight up with a steady, even pull. Do not pull on the wire itself as this will damage the wire.

To remove wires from the distributor cap or coil tower, loosen the boot first, then grasp the upper part of the boot and the wire and gently pull straight up.

Wire Test

Do not puncture the spark plug wires with a probe while performing any test. This may cause a separation in the conductor. The preferred method is to remove the suspected wire(s) and use an ohmmeter to test for resistance according to the length of the particular wire.

Resistance Values

When installing each spark plug wire or the coil high tension wire, be certain a good tight connection is made at the spark plug, distributor cap tower, or coil tower. The protector boots at the spark plugs and distributor cap must fit tightly. A partially seated wire creates an additional gap in the circuit and the resulting spark jump will cause terminal corrosion and wire damage.

Resistance Values

Inches	Ohms
0 to 15	3,000 to 10,000
15 to 25	4,000 to 15,000
25 to 35	6,000 to 20,000
Over 35	8,000 to 25,000

Ignition Coil

When an ignition coil is suspected of being defective, it should be checked on the vehicle. A coil may break down after it has reached operating temperature. It is important that the coil be at operating temperature when tests are made. Perform the tests following the instructions of the test equipment manufacturer.

Distributor

The distributor used on all engines is the breakerless electronic type. There is no scheduled maintenance for this distributor. Refer to Section 3—Electrical for distributor service procedures.

Distributor Rotor

The rotor should be inspected visually for cracks, evidence of burning on the top of the metal strip, or evidence of mechanical interference with the cap. If any of the above conditions are found, the rotor should be replaced. Some burning is normal on the end of the metal strip. **This should never be filed.**

Distributor Cap

The distributor cap should be removed and wiped clean with a dry rag. A visual inspection should be made for cracks, carbon runners, and corroded high tension terminals. If any of these conditions are found, the cap should be replaced. In replacing the cap, be sure that the high tension wires are installed in the same towers from which they were removed and that they are pushed down firmly in place.

If the inserts inside the cap are excesively burned, the cap should be replaced. However the vertical face of the insert will show some evidence of burning through normal operation. The inserts should also be checked for evidence of mechanical interference with the rotor tip.

Initial Ignition Timing

A graduated degree scale located on the timing chain cover is used for timing the ignition system. A milled notch on the vibration damper is used to reference the No. 1 firing position of the crankshaft with the timing marks on the scale as shown in figures 4A-34 and 4A-35.

Timing Procedure

(1) Disconnect distributor vacuum hose.

(2) Connect an ignition timing light and a properly calibrated tachometer.

NOTE: *If a timing light incorporating an advance control feature is used, the control must be in the off position.*

(3) Start engine.

(4) Adjust idle speed to 500 rpm.

(5) Adjust initial ignition timing to setting specified on the Tuneup Specifications (On Vehicle) Chart by loosening the distributor holddown clamp and rotating the distributor.

(6) Verify ignition timing after tightening distributor holddown clamp.

Distributor Advance Test Procedure

NOTE: *Distributor advance may also be tested with the distributor out of the vehicle. Follow testing equipment manufacturer's instructions. Refer to Distributor Specifications (On Distributor Tester).*

Adjustable Advance Control Timing Light Procedure

(1) Disconnect the TCS solenoid vacuum valve wires.

(2) Increase engine speed to 2000 rpm.

(3) Turn advance control of ignition timing light until the ignition timing has returned to the initial setting.

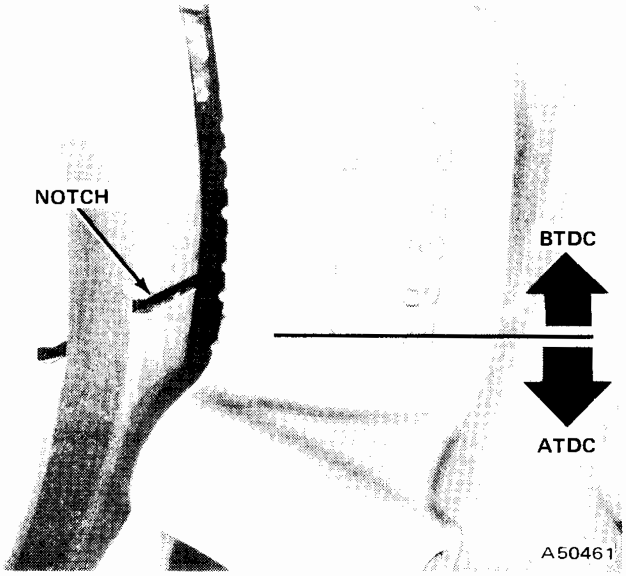


Fig. 4A-34 Timing Mark Location—Six-Cylinder

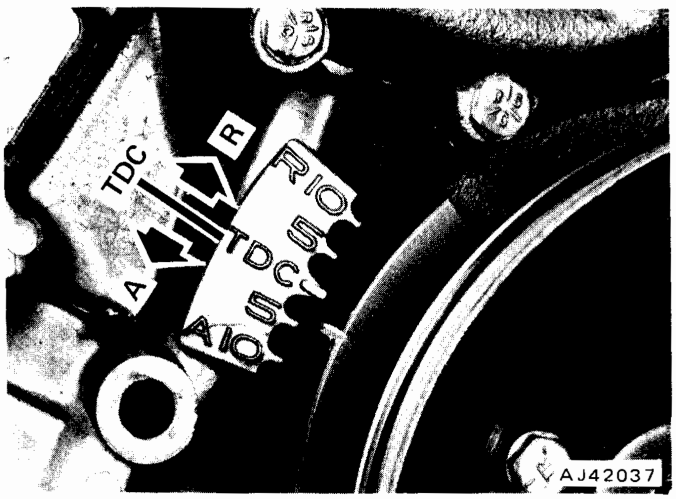


Fig. 4A-35 Timing Mark Location—V-8

NOTE: *The degree reading on the advance meter should be as specified in the Tuneup Specification (On Vehicle) Chart.*

(4) If the total advance at 2000 rpm is less than specified, disconnect vacuum advance hose at distributor.

(5) Check maximum centrifugal degrees advance at engine rpm specified.

If the centrifugal advance degrees are as specified, the vacuum unit must be replaced.

DIAGNOSIS WITH SCOPE ANALYZER

The scope analyzer is an ignition tester that provides quick and accurate diagnosis of ignition system performance. All phases of the ignition cycle are shown graphically on an oscilloscope (cathode ray tube) as they occur in engine operation.

The manufacturers of scope analyzer equipment provide generally excellent descriptions of test procedures possible with their equipment. This section is not intended to cover all uses of scope equipment, but to point out differences in scope pattern between the conventional "point" system and the BID (Breakerless Induction Discharge) system used on Jeep vehicles (refer to Scope Diagnosis Pattern Chart).

Scope Diagnosis Pattern Chart

The upper section of the chart shows a typical scope pattern of the point system from firing line to firing line and areas of the pattern significant to diagnosis.

The scope pattern (waveform) shows time duration horizontally and voltage vertically. Bearing this in mind, note the lower section of the chart which shows the typical pattern of the BID system.

Note the somewhat longer duration of the spark line shown on the BID pattern—this longer spark provides superior combustion with the leaner air-fuel mixtures now used.

The BID waveform pattern is below zero line in the coil section but otherwise is similar to that of the point system in this area.

In the final "dwell" section of the scope pattern, a "worm" appears just above the zero line on the BID pattern. This wiggle is caused by the automatic current regulator built into the ECU (Electronic Control Unit) circuitry and is entirely normal. Since this section of the pattern is under electronic control, it will not vary from cylinder to cylinder as in the point system where this dwell area is controlled mechanically.

Other than the difference described, scope ignition diagnosis procedures for point and BID systems is essentially the same.

CARBURETION

Engine Idle Speed and Mixture Setting Procedures

The engine and related systems must be performing properly prior to marking carburetor idle speed and mixture adjustments. The idle speed and mixture adjustments must be made with the engine at operating temperature and air cleaner in place (fig. 4A-37, -38, and -39).

Plastic idle limiter caps are installed over the idle mixture screw(s) on all carburetors. The limiters are designed to regulate the adjustment range of the idle mixture screw(s), thereby effectively controlling the exhaust emission level at idle speeds to comply with Federal Standards for emission control. The limiter caps must be removed in order to perform the lean drop idle setting using the tachometer procedure. The infrared analyzer procedures do not normally require limiter cap removal.

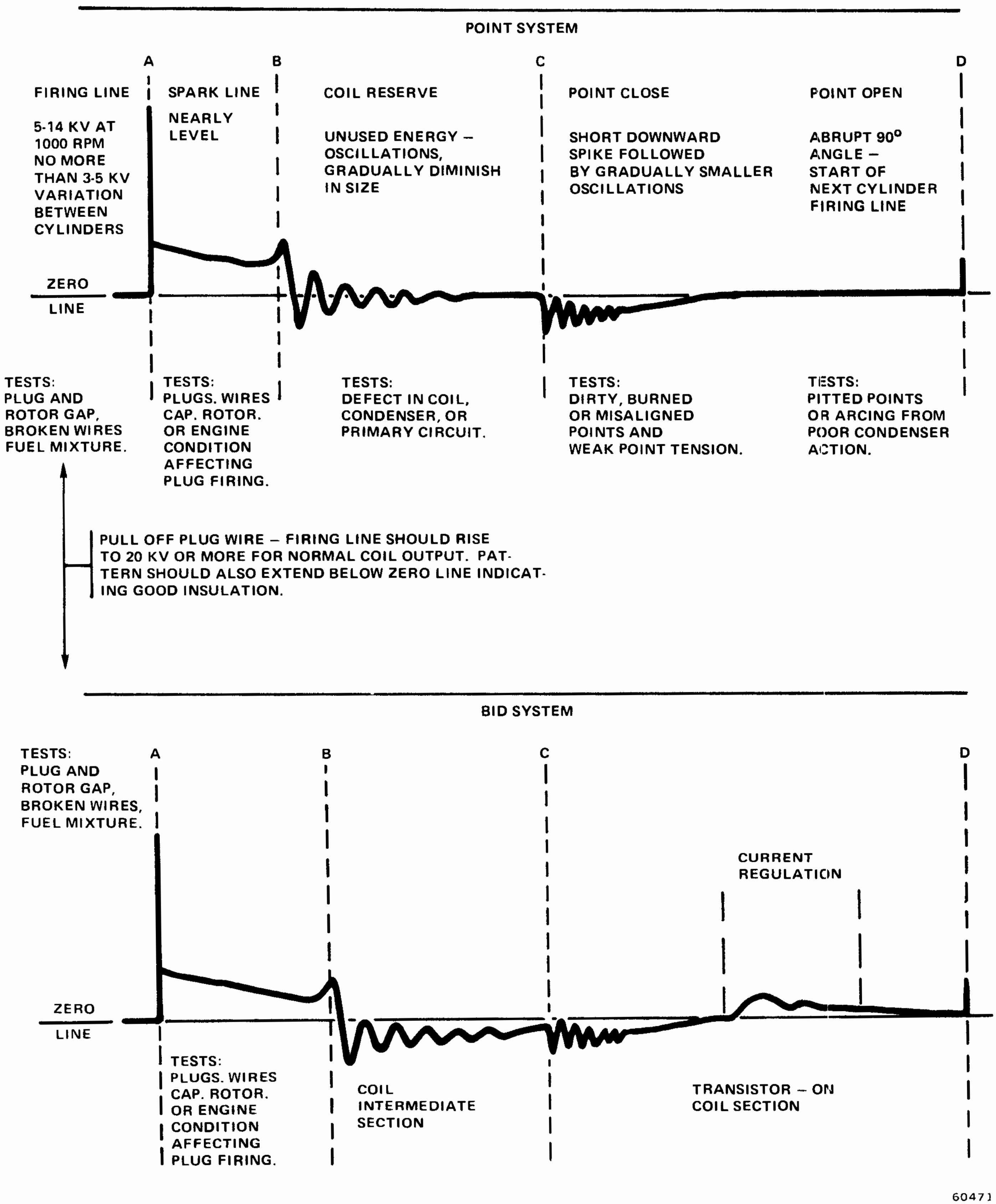


Fig. 4A-36 Diagnosis Pattern Chart

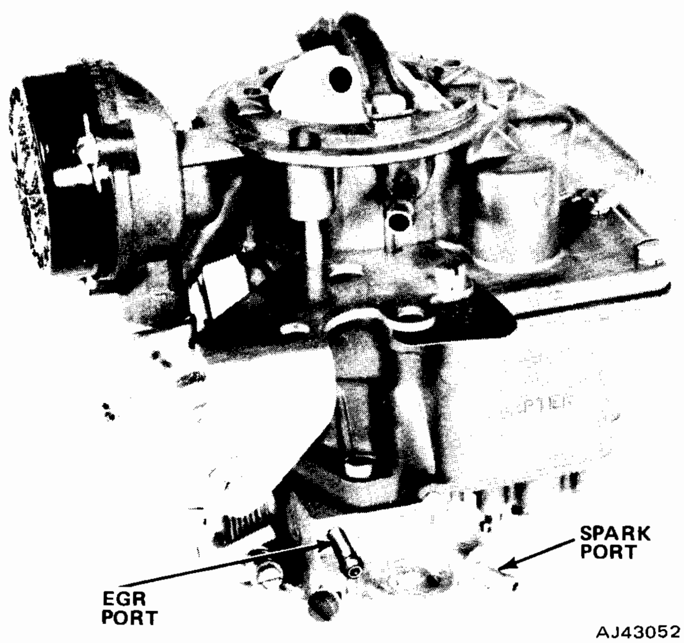


Fig. 4A-37 Model YF Carburetor

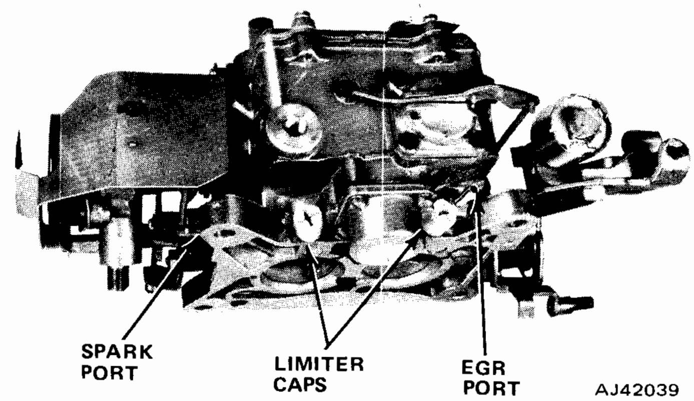


Fig. 4A-38 Model 2100 Carburetor

Proper idle speed and mixture adjustments can be made by following a standard tachometer procedure in which the idle mixture is adjusted to a lean drop idle setting. A infrared (IR) analyzer procedure, in which the idle mixture is adjusted to obtain a specified carbon monoxide level, may be used, but only on vehicles without a catalytic converter. When following the tachometer procedure, adjustments must be made in the exact detailed sequence outlined to obtain lean drop idle settings and satisfactory idle quality.

WARNING: *Set park brake firmly. Do not accelerate.*

Tachometer Procedure

NOTE: *To compensate for fuel and temperature variations while performing the idle mixture adjustment:*

(a) *Do not idle engine over three minutes at a time.*

(b) *If the idle mixture adjustment is not completed within three minutes, run engine at 2000 rpm for one minute.*

Recheck the idle mixture adjustment at the specified rpm and adjust as required. If the idle mixture adjustment is not completed within three minutes, repeat step (b).

(1) Adjust idle screw(s) to the full rich stop(s). Note position of screw head slot inside limiter cap slots.

(2) Carefully remove idle limiter cap(s) by installing a sheet metal screw in center of cap and turning clockwise. Discard the cap(s).

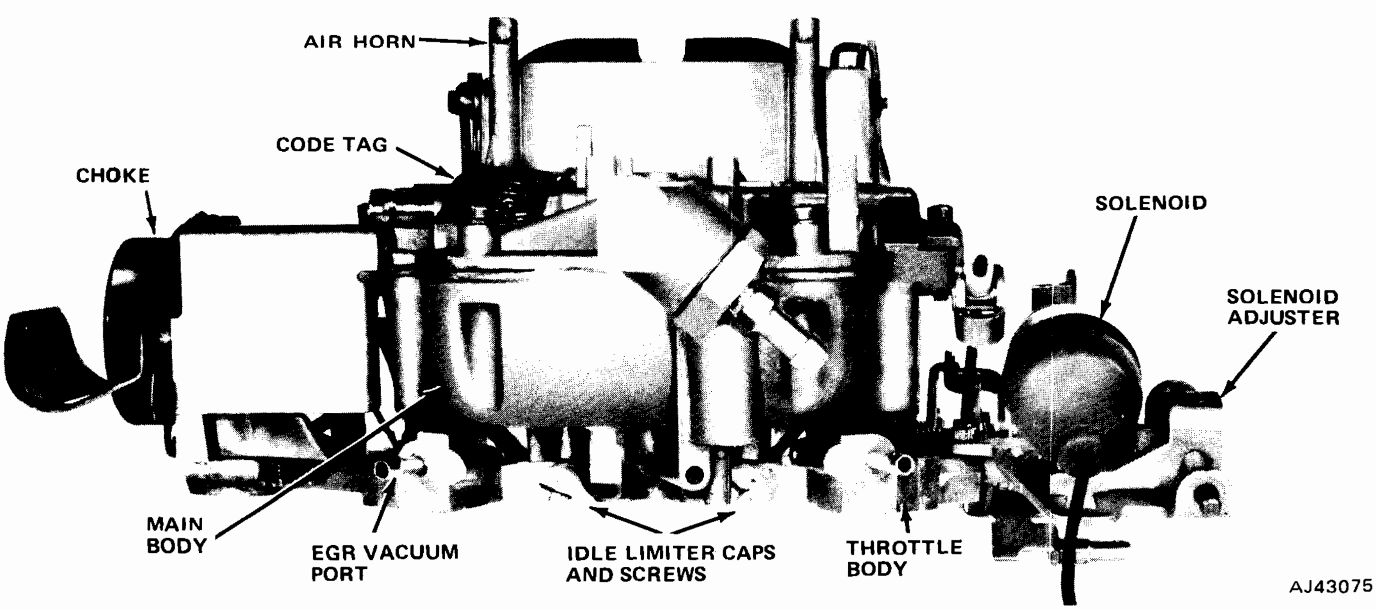


Fig. 4A-39 Model 4350 Carburetor

(3) Reset idle screw(s) to the approximate position noted before the limiter cap(s) was removed (step 2).

NOTE: *The tachometer used should have an expanded scale of 400 to 800 to 0 to 1000 rpm. The instrument should be inspected periodically and calibrated to allow not more than two percent error.*

(4) Start engine and warm to operating temperature.

(5) Adjust idle speed to 30 rpm above the following specified rpm.

- **Six-Cylinder:** Automatic—550 rpm in drive—Nationwide, 700 rpm in Drive (California).
- **Six-Cylinder:** Manual—600 rpm in neutral—CJ Models, 650 rpm in Neutral, Cherokee, Wagoneer, Truck.
- **V-8 Engine:** Automatic—700 rpm in drive
- **V-8 Engine:** Manual—750 rpm in neutral

NOTE: *On all V-8 engines with automatic transmissions, the throttle-stop solenoid is used to adjust curb idle speed. Use the following procedure for idle speed adjustment.*

(a) With solenoid wire connected, loosen solenoid locknut and turn solenoid in or out to obtain specified idle rpm.

(b) Tighten solenoid bracket.

(c) Disconnect solenoid wire and adjust curb idle speed screw to obtain 500 rpm.

(d) Connect solenoid wire.

Engine	Transmission	RPM Drop
232-258	Manual W/Catalytic Converter	50 rpm
258	Automatic W/Catalytic Converter	25 rpm
CJ V-8's	Manual	100 rpm
CJ V-8's	Automatic	20 rpm
Cke, Wag, Trk, V-8 and 6-cylinder	All	Lean best idle

(6) Starting from full rich stop position (as established before limiter(s) was removed), turn mixture screw(s) clockwise (leaner) until a loss of engine rpm is indicated.

(7) Turn mixture screw(s) counterclockwise until the highest rpm reading is obtained at lean best idle setting. On carburetors incorporating two mixture screws, turn both screws equally unless the engine demands otherwise.

NOTE: *If the idle speed changed more than 30 rpm during the mixture adjustment, reset to 30 rpm above the specified rpm and repeat the adjustment.*

(8) As a final adjustment, turn mixture screw(s) clockwise until specified drop in engine rpm is obtained.

(9) Install new (blue) service idle limiter cap(s) over idle mixture screw(s) with limiter cap ear(s) positioned against the full rich stop(s). Be careful not to disturb idle mixture setting while installing the cap(s). Press cap(s) firmly and squarely into place.

Infrared (IR) Analyzer Procedure—CJ Models with Six-Cylinder Engine Without Catalytic Converter

NOTE: *To compensate for fuel and temperature variations while performing the idle mixture adjustment:*

(a) *Do not idle engine over three minutes at a time.*

(b) *If the idle mixture adjustment is not completed within three minutes, run engine at 2000 rpm for one minute.*

(c) *Recheck the idle mixture adjustment at the specified rpm and adjust as required. If the idle mixture adjustment is not completed within three minutes, repeat step (b).*

NOTE: *The IR analyzer to be used must be periodically inspected and calibrated to assure accurate readings.*

(1) Connect IR analyzer by precisely following the instructions of the manufacturer.

(2) Start engine and allow sufficient warmup time for engine and analyzer to stabilize.

(3) Recalibrate IR analyzer before proceeding to adjust carburetor.

(4) Insert probe of analyzer at least 18 inches into tailpipe.

NOTE: *The exhaust system and the test equipment must be free of leaks to prevent erroneous readings.*

(5) Adjust idle speed to 30 rpm above the following specified rpm.

Six-Cylinder: Automatic—550 rpm in Drive
Six-Cylinder: Manual—600 rpm

(6) Observe CO level and compare to following table.

Engine Idle CO Level

Six-Cylinder Automatic	1.0% max
Six-Cylinder Manual	1% to 2%

(7) If less than specified, turn screws counterclockwise 1/16 turn at a time, until specified CO reading is obtained.

(8) If greater than specified, turn screw(s) clockwise until specified CO reading is obtained.

(9) Allow ten seconds for meter to stabilize after each adjustment.

NOTE: *If the idle speed changed more than 30 rpm during the mixture adjustment, reset to the specified rpm and repeat the adjustment until the specified carbon monoxide level is obtained.*

Choke Linkage

All choke linkage including the fast idle cam should be checked for free movement at the mileage intervals specified in the Mechanical Maintenance Schedule.

Free carburetor linkage by applying Jeep Carburetor and Combustion Area Cleaner, or equivalent. Never use oil to lubricate carburetor linkage.

For correct choke system adjustments, refer to Fuel—Carburetion section of this manual.

Dashpot Adjustment

Six-cylinder vehicles without the throttle stop solenoid are equipped with a dashpot assembly. For required adjustment, refer to Section 4—Fuel—Carburetion.

Exhaust Manifold Heat Valve

An often overlooked, but highly important emission related component is the exhaust manifold heat valve. This valve can affect the gas mileage, performance, driveability and especially emission levels.

This valve is to be inspected for correct operation and lubricated with Jeep Heat Valve Lubricant, or equivalent, every 5000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models. Refer to the Exhaust section for service procedures.

EXHAUST SYSTEMS

GENERAL

The basic exhaust system on all vehicles consists of a front exhaust pipe, muffler, and tailpipe. Refer to figures 4A-40, 4A-41, 4A-42, and 4A-43 for exhaust system components.

All CJ models with V-8 engines are equipped with a catalytic converter.

The exhaust system must be properly aligned to prevent stress, leakage, and grounding. If the system grounds on any body panel, it may amplify objectionable noises originating from the engine or the body. When inspecting an exhaust system, check for cracked or loose joints, stripped bolt threads, and corrosion damage. Replace all parts that are badly corroded or damaged; do not attempt to repair.

EXHAUST MANIFOLD HEAT VALVE

Six-Cylinder Engine

A thermostatically controlled heat valve in the exhaust manifold directs exhaust heat to the floor of the intake manifold for rapid fuel vaporization during engine warmup. The valve is closed, directing exhaust heat to the intake manifold when the counterweight is in the extreme counterclockwise position when viewed from the counterweight end (fig. 4A-46). As the engine reaches operating temperature, the thermostatic spring heats up and loses tension, allowing counterweight to open the valve (fig. 4A-47).

The manifold heat valve must operate freely and should be checked and lubricated every 5,000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models with Jeep Heat Valve Lubricant, or equivalent.

Replacement

(1) Remove and separate intake and exhaust manifolds (refer to Section 1A—Six-Cylinder Engine).

(2) Remove manifold heat valve assembly by cutting heat valve shaft on both sides of valve.

(3) Lift valve from manifold and drive out remaining shaft sections and bushings.

(4) Install new bushings using heat valve shaft as a guide pin.

(5) Ream out new bushings with a 5/16-inch drill bit to remove all burrs.

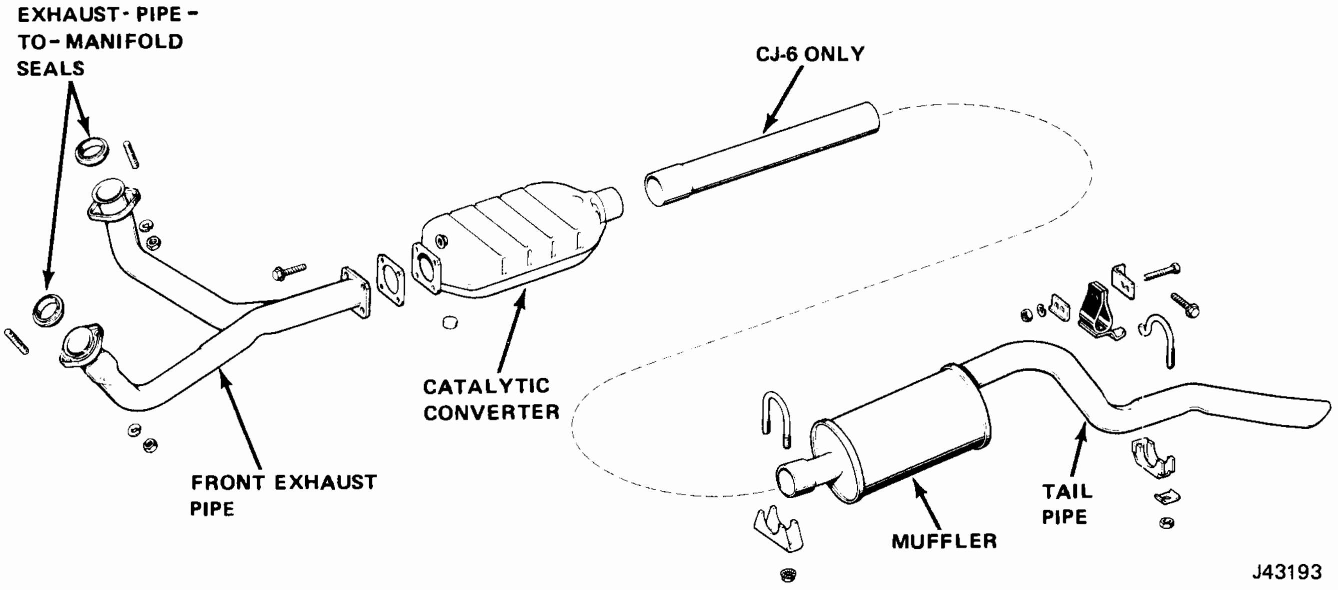


Fig. 4A-40 Exhaust System—CJ-5/CJ-7—V-8 Engine

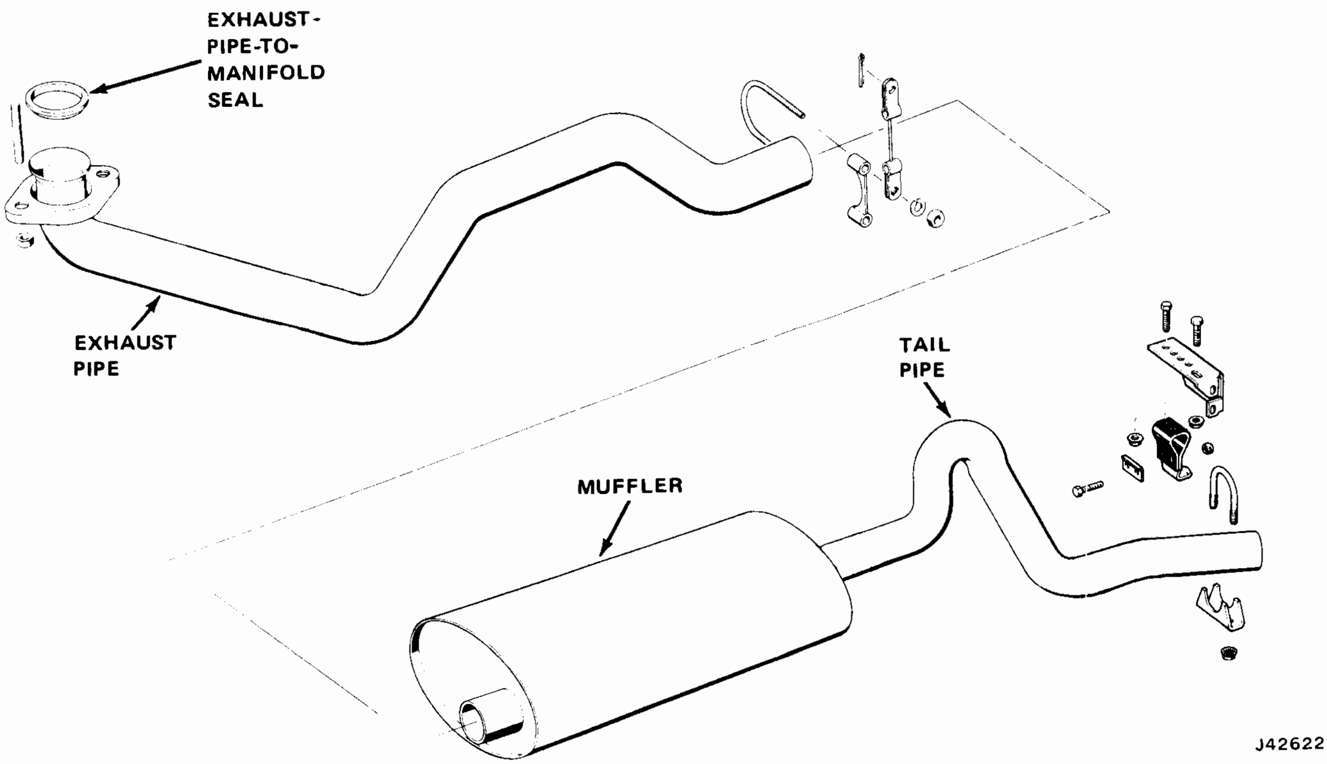


Fig. 4A-41 Exhaust System—CJ-5/CJ-7—Six-Cylinder Engine

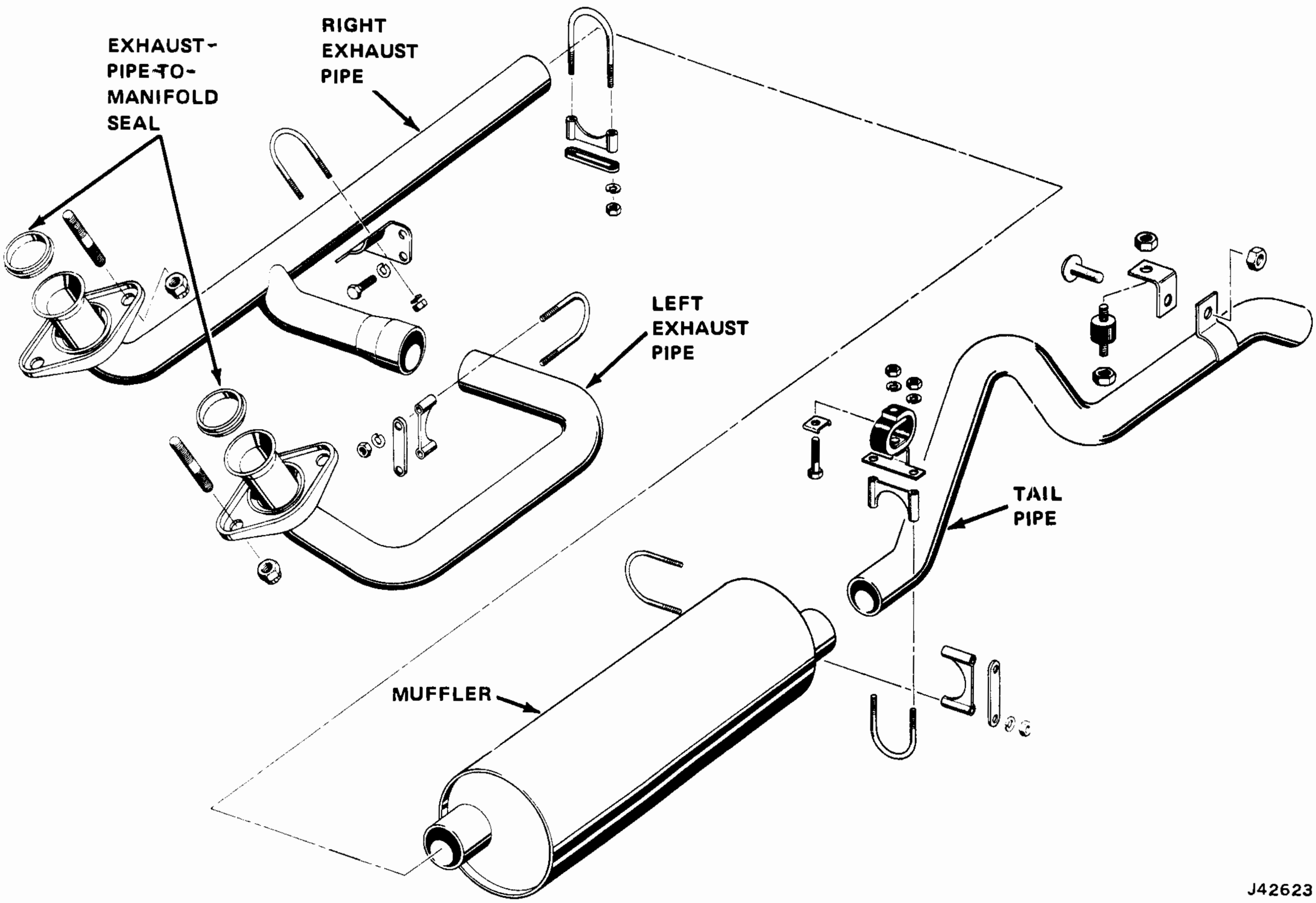


Fig. 4A-42 Exhaust System—Truck—V-8 Engine

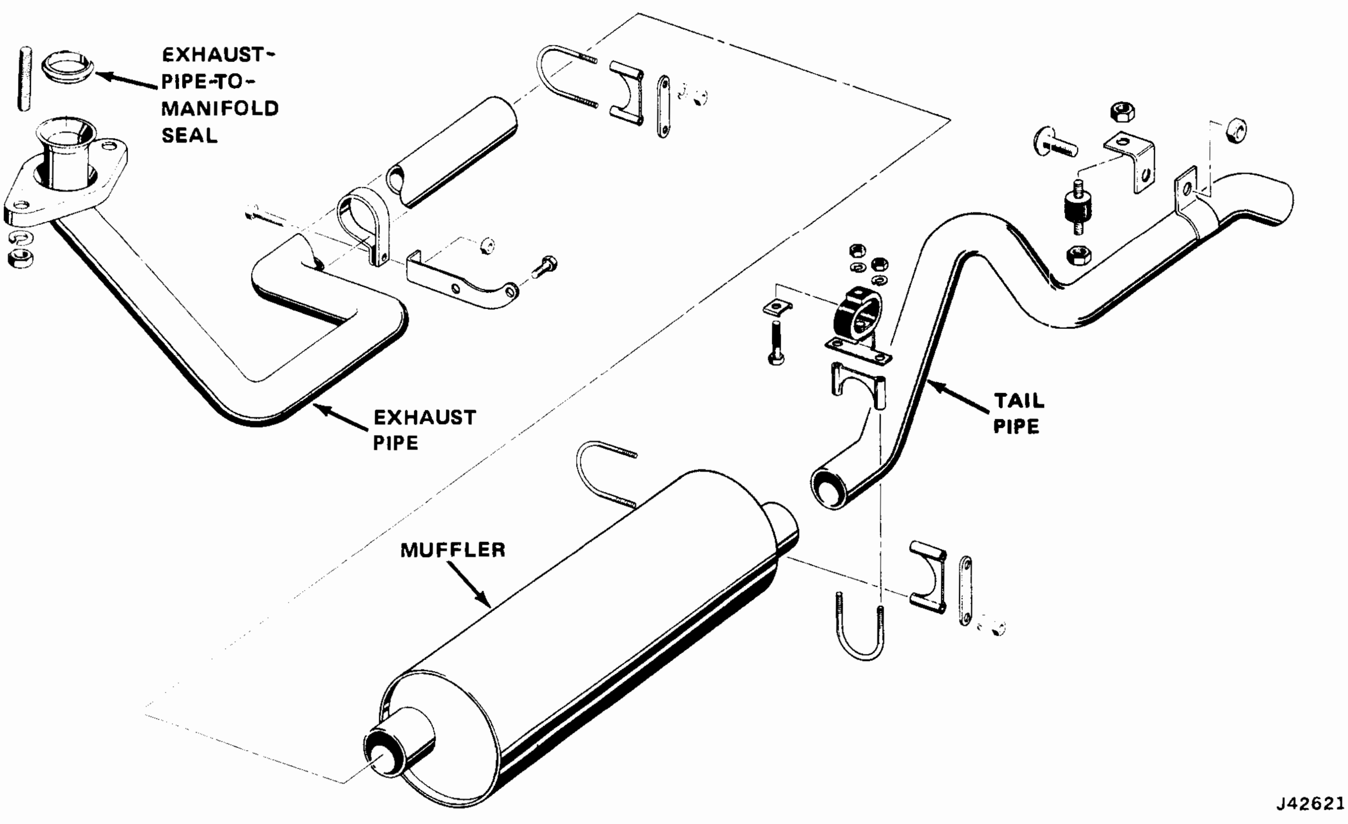


Fig. 4A-43 Exhaust System—Truck—Six-Cylinder Engine

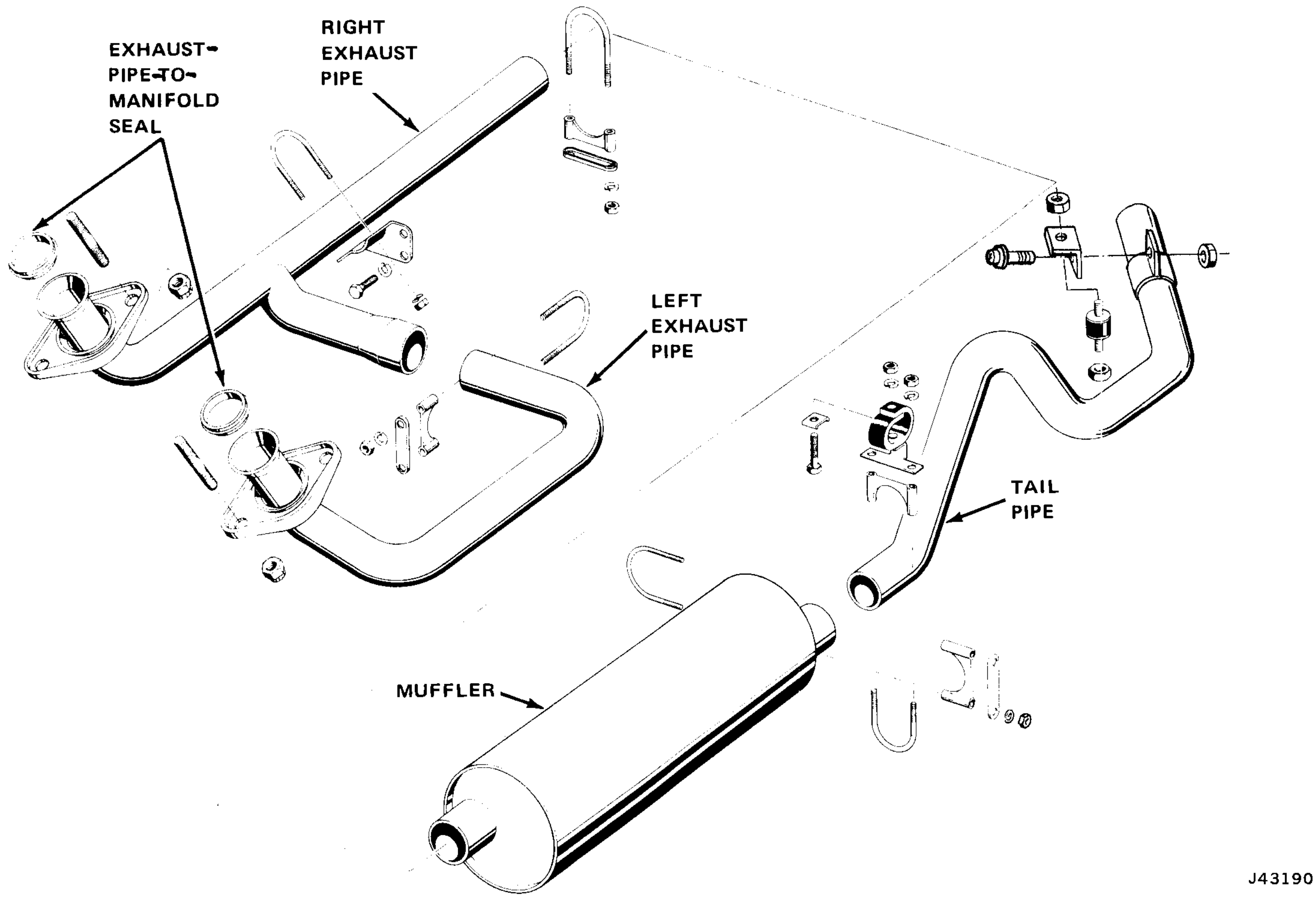


Fig. 4A-44 Exhaust System—Cherokee-Wagoneer—V-8 Engine

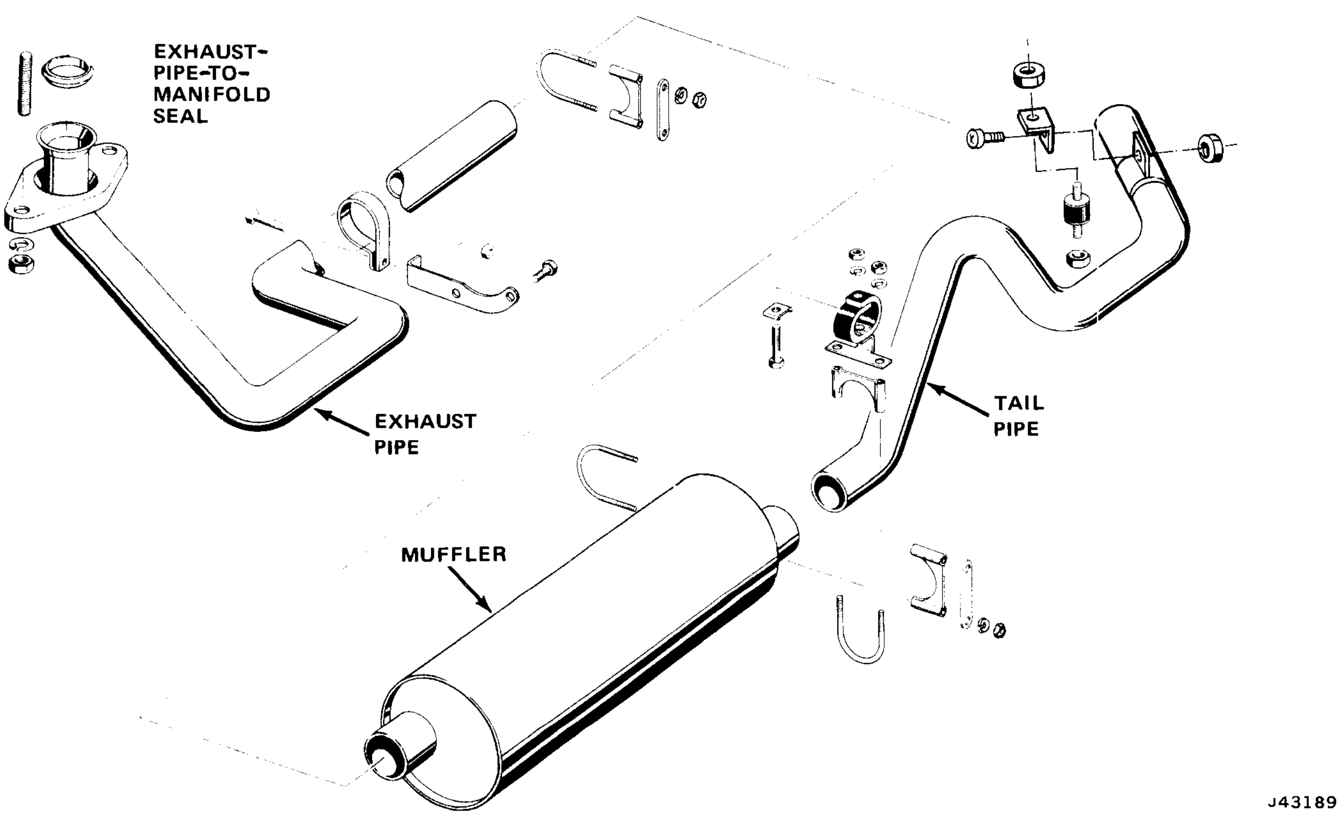


Fig. 4A-45 Exhaust System—Cherokee-Wagoneer—Six-Cylinder Engine

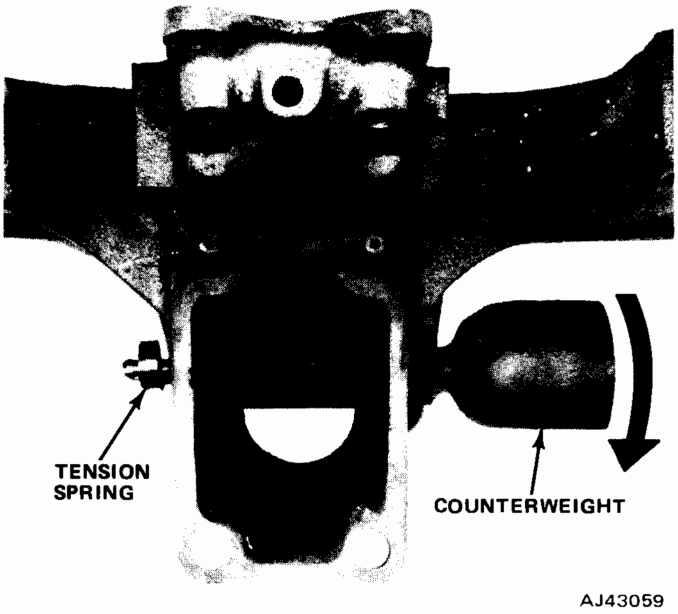


Fig. 4A-46 Heat Valve in Closed Position—Six-Cylinder

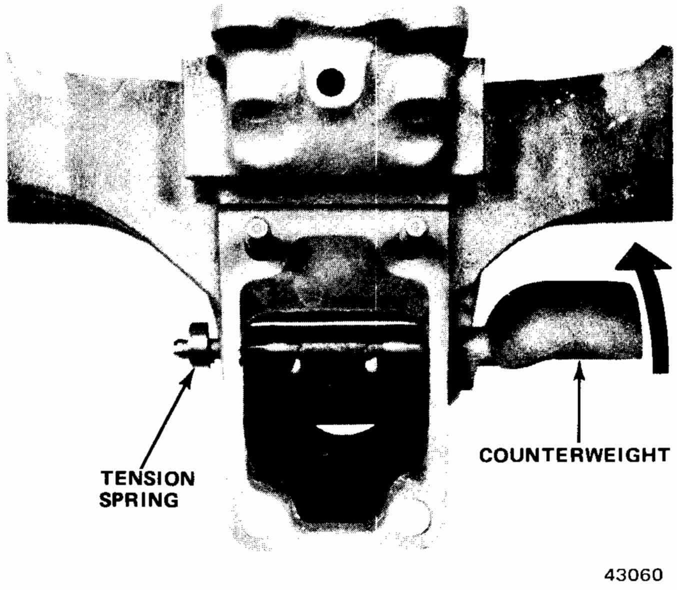


Fig. 4A-47 Heat Valve in Open Position—Six-Cylinder

(6) Position heat valve as shown in figure 4A-46 and install shaft and counterweight assembly.

(7) Rotate counterweight until spring stop contacts bottom of manifold boss.

(8) Align hose in valve with screw threads in shaft and install, but do not tighten retaining screw.

(9) Close heat valve and install tension spring with hook end up and pointing away from manifold. Hook spring under support pin.

(10) Operate heat valve several times to allow shaft to center.

(11) Hold shaft and move valve as far as possible from counterweight. Tighten retaining screw.

(12) Check operation of valve.

(13) Install intake and exhaust manifolds (refer to Section 1A—Six-Cylinder Engine).

V-8 Engine

A thermostatically controlled heat valve mounted between the right exhaust manifold and exhaust pipe directs exhaust heat to the intake manifold for rapid fuel vaporization during engine warmup. The valve is closed, directing exhaust heat through the intake manifold crossover passage when the counterweight is in the horizontal position (fig. 4A-48). The exhaust heat crosses through the intake manifold and discharges into the left exhaust manifold until the engine reaches operating temperature. At this time, the thermostatic spring loses its tension and the counterweight moves downward, opening the valve and allowing the exhaust heat to discharge through the right exhaust pipe.

The manifold heat valve must operate freely and should be checked and lubricated every 5,000 miles on Cherokee, Wagoneer, and Truck models and every 30,000 miles on CJ models with Jeep Heat Valve Lubricant, or equivalent.

Replacement

(1) Disconnect and lower exhaust pipes.

(2) Replace with manifold heat valve and gaskets.

(3) Replace exhaust pipe gaskets.

(4) Position exhaust pipes and connect to exhaust manifold.

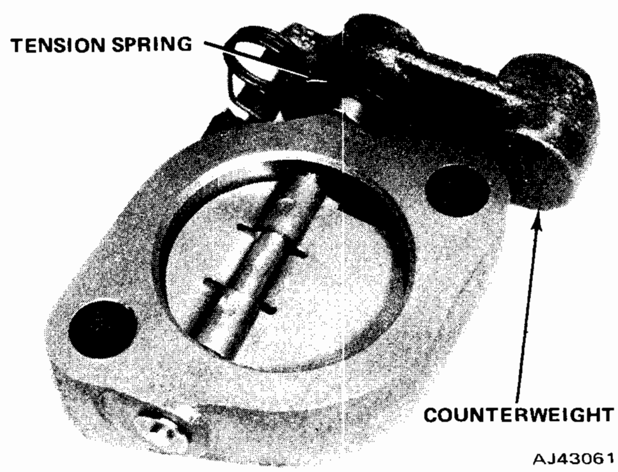


Fig. 4A-48 Exhaust Manifold Heat Valve—V-8

Jeep Tuneup Specifications (On Vehicle)

Engine CID	Transmission	Initial Timing @700 RPM Or Less With Vacuum Hose Disconnected		Curb Idle Speed RPM		Distributor Model Number	Vacuum Unit Number	Total Advance @2000 RPM ②	Centrifugal Advance		Spark Plugs
		Set-To	OK Range	Set-To	OK Range				Degrees	RPM	
232	Manual	8°	6°-10°	600	500-700	3227331	8125438	22°-30°	0 - 0.8 4.0 - 8.0 8.0 - 12.0 9.3 - 13.3	1000 1500 2000 3000	N12Y GAP .033- .037 Inch
258	Auto	8°	6°-10°	550 ① 700 Calif.	450-650 600-800	3227331	8125438	22°-30°	0 - 0.8 4.0 - 8.0 8.0 - 12.0 9.3 - 13.3	1000 1500 2000 3000	
	Manual	6°	4°-8°	600 ③ 600 Calif.	500-700 500-700						
304	Auto	10°	8°-12°	700 ①	600-800	3228263	8125437	21.4°-29.5°	0 - 5.6 5.6 - 9.7 8.4 - 12.5 14.1 - 18.7	1000 1500 2000 3000	
	Manual	5°	3°-7°	750	650-850	3228264	8125436	25.6°-33.6°	0 - 4.8 6.8 - 12.8 12.6 - 16.6 18.6 - 22.6	1000 1500 2000 3000	
304 Calif.	Auto	5°	3°-7°	700 ①	600-800	3228264	8125436	25.6°-33.6°	0 - 4.8 6.8 - 12.8 12.6 - 16.6 18.6 - 22.6	1000 1500 2000 3000	
	Manual			750	650-850						
360/401	Auto	8°	6°-10°	700 ①	600-800	3228265	8125437	19.6°-27.6°	0 - 5.4 4.8 - 8.8 6.6 - 10.6 10.2 - 14.2	1000 1500 2000 3000	
	Manual	5°	3°-7°	750	650-850	3228263	8125437	21.4°-29.5°	0 - 5.6 5.6 - 9.7 8.4 - 12.5 14.1 - 18.7	1000 1500 2000 3000	
360/401 Calif.	Auto	5°	3°-7°	700 ①	600-800	3228265	8125437	19.6°-27.6°	0 - 5.4 4.8 - 8.8 6.6 - 10.6 10.2 - 14.2	1000 1500 2000 3000	
	Manual			750	650-850						

1 Idle to be set with transmission in drive and parking brake applied. Do not accelerate engine.

2 Disconnect TCS wires at Solenoid Vacuum Valve.

NOTE: Air Conditioning must be off for final idle setting.

3 650 with OK Range of 550-750 for Cherokee & Truck.

60706

Specifications

Accelerator Pump — Snap Throttle
From 1000 RPM . . . . 1 to 1-1/2 AFR Enrichment
Belt Tension
Predelivery or Belt With Previous Service . . . . . 90-115 lbs.
New Belt . . . . 125-155 lbs.
Air Pump — Six Cyl. with PS (3/8-inch belt)
Predelivery or Belt With Previous Service. . . . . . . 60-70 lbs.

Air Pump — Six Cyl. with PS (3/8-inch belt)
(Continued)
New Belt . . . . 65-75 lbs.
Cranking Vacuum — This test must have operating battery voltage, completely closed throttle valve(s), PCV valve completely closed . . . . . . 9 inches/min.

60709

Distributor Specification (On Distributor Testor)

Distributor Model Number	Vacuum Unit Number	Distributor Degrees and RPM			
		Centrifugal Advance		Vacuum Advance (Inches of Mercury)	Vacuum Advance Degrees
		Degrees	RPM		
3227331	8125438 (IDJ-4B)	0 - 0.4 2.0 - 4.0 4.0 - 6.0 4.65 - 6.65 5.25 - 7.25	500 750 1000 1500 2200	5.0 - 7.0 Start 10.0 12.6 Max	0 - 2.3 3.4 - 5.7 7.0 - 9.0
3228263	8125437 (IDJ-4)	0 - 2.8 2.8 - 4.85 4.2 - 6.25 7.05 - 9.05 11.0 - 13.0	500 750 1000 1500 2200	4.0 - 6.0 Start 10.0 12.7 Max	0 - 2.2 3.9 - 6.6 6.5 - 8.5
3228264	8125436 (IDJ-4A)	0 - 2.4 3.4 - 6.4 6.3 - 8.3 9.3 - 11.3 13.5 - 15.5	500 750 1000 1500 2200	5.0 - 7.0 Start 10.0 12.5 Max	0 - 2.7 3.5 - 6.7 6.5 - 8.5
3228265	8125437 (IDJ-4)	0 - 2.7 2.4 - 4.4 3.3 - 5.3 5.1 - 7.1 7.5 - 9.5	500 750 1000 1500 2200	4.0 - 6.0 Start 10.0 12.7 Max	0 - 2.2 3.9 - 6.6 6.5 - 8.5

60705

1976 CJ Model Emission Control Systems Application Chart

Jeep Model	CJ 5/7				CJ 7			
Model Code	83 & 93				93			
Engine CID	232/258		304		258		304	
Transmission	Manual				Automatic			
Emission Control System	NW	Cal	NW	Cal	NW	Cal	NW	Cal
Air Guard		●	●	●		●	●	●
BPS	●	●	●	●	●	●	●	●
Catalytic converter		●	●	●		●	●	●
EGR	●	●	●	●	●	●	●	●
EGR CTO	115°	115°	115°	115°	115°	115°	115°	115°
FTVEC	●	●	●	●	●	●	●	●
Fuel Return	●	●	●	●	●	●	●	●
PCV	●	●	●	●	●	●	●	●
Spark CTO				160°		160°		160°
TAC	●	●	●	●	●	●	●	●
TCS				●		●		●
CHBPV			●	●			●	●
Solenoid						●	●	●

Air Guard - **Air Injection System**
BPS - **Back-Pressure Sensor**
CHBPV - **Choke Heat Bypass Valve**
EGR - **Exhaust Gas Recirculation**
EGR CTO - **Exhaust Gas Recirculation Coolant Temperature Override Switch**
Fuel Return - **Fuel Vapor Return System**
FTVEC - **Fuel Tank Vapor Emission System**
PCV - **Positive Crankcase Ventilation System**
Spark CTO - **Spark Coolant Temperature Override Switch**
TAC - **Thermostatically Controlled Air Cleaner**
TCS - **Transmission Controlled Spark System**
NW - **Nationwide Application Except California**
Cal. - **California only**
● - **On all Models Specific**

60707

1976 Cherokee, Wagoneer, Truck, Emission Control Systems Application Chart

Jeep Model	Cherokee										Wagoneer					Truck									
Model Code	16 and 17										14 and 15					25 and 45				25,45,46					
Engine CID	258		360 2V		360 4V				401		360 2V	360 4V		401		258		360 2V		360 4V				401	
Transmission	M	A	M	A	M		A		A		A	A		A		M	A	M	A	M		A		A	
Emission Control System	NW		NW		NW	Cal.	NW	Cal.	NW	Cal.	NW	NW	Cal.	NW	Cal.	NW		NW		NW	Cal.	NW	Cal.	NW	Cal.
Air Guard			•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•
BPS						•		•		•			•		•						•		•		•
EGR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
EGR CTO	←												160°												→
FTVEC						•		•		•			•		•						•		•		•
Fuel Return	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PCV	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Spark CTO	←												160°												→
TAC	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
VTM			•		•	•		•					•					•		•	•		•		
SDV					•	•	•	•	•	•		•	•	•	•					•	•	•	•	•	•
CHBPV			•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•
Solenoid				•			•	•	•	•	•	•	•	•	•				•			•	•	•	•

Air Guard - **Air Injection System**
BPS - **Back-Pressure Sensor**
CHBPV - **Choke Heat Bypass Valve**
EGR - **Exhaust Gas Recirculation**
EGR CTO - **Exhaust Gass Recirculation Coolant Temperature Override.**
FTVEC - **Fuel Tank Vapor Emission Control System**
Fuel Return - **Fuel Vapor Return System**
PCV - **Positive Crankcase Ventilation System**
SDV - **Signal Delay Valve**
Spark CTO - **Spark Coolant Temperature Override Switch**
TAC - **Thermostatically Controlled Air Cleaner**
VTM - **Vacuum Throttle Modulator**
M - **Manual Transmission**
A - **Automatic Transmission**
NW - **Nationwide application Except California**
Cal. - **California only**
• - **On all Models Specified**

60708

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

CLUTCH

GENERAL

A single plate, dry disc-type clutch is used. A steel cover assembly bolted to the flywheel contains the clutch driven plate, release levers and springs.

Two types of clutch covers are used, a 10-1/2-inch diameter direct spring pressure type and an 11-inch diameter semicentrifugal type. The direct spring pressure type and semicentrifugal type are similar. Both apply direct spring pressure to the pressure plate to provide engagement. However, the semicentrifugal cover utilizes six rollers that are forced outward by centrifugal action to apply extra force to the pressure plate and maintain positive clutch action at high engine rpm (fig. 5-1).

Although no internal adjustment is provided for wear of the disc, release lever height should be checked and adjusted.

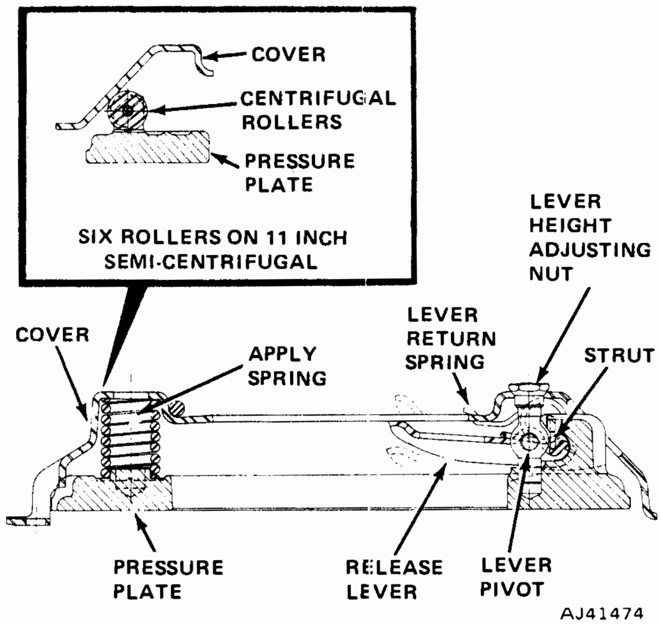


Fig. 5-1 Direct Spring Pressure and Semicentrifugal Type Clutches

SERVICE DIAGNOSIS

GENERAL

Clutch problems can generally be assigned to one of the following categories defined as:

- Clutch chatter
- Clutch slippage or inadequate clutch linkage free play
- Clutch drag or inadequate clutch release

- Clutch pedal pulsation
- Clutch-related vibration
- Clutch area noises

Each category is described in common complaint language and followed by a common-sense approach to repairing the problem.

NOTE: *Before performing any of the diagnosis and repair procedures outlined below, check for complete return of the clutch pedal to its stop and adjust pedal free play.*

CLUTCH CHATTER

Clutch chatter can be described as a shaking or shuddering sensation that is felt throughout the vehicle. Chatter usually develops when the clutch cover pressure plate makes initial contact with the driven plate and ceases when the clutch is fully engaged (clutch pedal released). Check clutch operation as follows:

WARNING: *The following test requires clutch engagement to the point of car movement. Area to front and rear of vehicle must be clear.*

(1) Start engine, depress clutch pedal and shift transmission into first gear.

(2) Increase engine speed to 1200 to 1500 rpm and slowly release clutch pedal. When pressure plate makes initial contact with driven plate, observe clutch operation. Depress clutch pedal and reduce engine speed.

(3) Shift transmission into reverse and repeat the procedure outlined in step (2).

(4) If clutch chatter does not develop, increase engine speed to 1700 to 2200 rpm and repeat steps (2) and (3).

(5) If clutch chatter does not develop after performing tests outlined in steps (1) through (4), problem may be improper operation by owner. If clutch chatter does develop, proceed to step (6).

(6) Raise vehicle on hoist.

(7) Check for loose or broken front or rear engine support cushions. Tighten or replace as necessary. Check for loose clutch-housing-to-engine and clutch-housing or adapter-to-transmission attaching bolts. Tighten as necessary. Refer to torque specifications in this section. Check for binding, worn, bent, or broken clutch linkage components. Lubricate or replace as necessary.

(8) If components inspected were in good condition, proceed to step (9). If one or more problems were discovered and corrected, lower car and repeat step (1). If chatter is still evident, proceed to step (9).

(9) Remove transmission and clutch components as outlined in this section.

NOTE: *Whenever clutch components are removed, also remove pilot bushing lubricating wick and soak wick in engine oil. Install wick before assembly.*

(10) Check for oil or grease contamination of driven plate. If contaminated, correct cause of contamination and replace driven plate.

(11) Check clutch cover for broken or collapsed springs and inspect surface of pressure plate for deep scoring, cracks, heat checking, or warping (check surface with straightedge). Replace clutch cover if it exhibits any of these conditions. If clutch cover is in good condition, do not replace it.

(a) Clean oil and dirt from cover with mineral spirits and allow to air dry.

(b) Lightly sand pressure plate surface with fine emery cloth.

(c) Lubricate release lever pivots and check release lever height. Adjust height if necessary.

CAUTION: *Apply lubricant to pivots sparingly. Excessive lubrication could result in grease contamination of pressure plate and driven plate surfaces.*

(12) Inspect crankshaft pilot bushing. Replace bushing if worn, deeply scored, or discolored.

NOTE: *Soak replacement bushing in engine oil before installation.*

(13) Inspect condition of splines on transmission clutch shaft and in driven plate hub. If splines are worn, galled, chipped, or broken, replace clutch shaft or driven plate. Corrosion, rust, or burrs can be removed from splines with an oilstone or fine-tooth file. Install driven plate on clutch shaft. Driven plate must move freely on shaft.

(14) If all clutch components were in good condition, proceed to step (15). If one or more components were determined to be faulty, repair as outlined and proceed to step (16).

(15) Check clutch housing alignment as outlined in this section. Correct alignment if necessary and proceed to step (16).

(16) Apply thin film of chassis lubricant on splines of transmission clutch shaft. Do not apply lubricant to pilot hub.

(17) Install pilot bushing lubricating wick. Install clutch components and transmission.

NOTE: *Do not replace any release bearing and sleeve unless it is defective or damaged. Refer to Clutch Area Noises.*

CLUTCH SLIPPAGE OR INADEQUATE CLUTCH LINKAGE FREE PLAY

Clutch slippage can be described as a condition in which the engine overspeeds (overrevs) but does not generate any increase in torque supplied to the rear wheels. Clutch slippage occurs when the driven plate is not gripped firmly between the flywheel and clutch cover pressure plate and rotates or slips between them at high torque. Clutch slippage can occur during initial acceleration or during subsequent shifts. Check clutch operation as follows:

(1) Block wheels and set parking brake firmly.

(2) Start engine (engine should be at operating temperature), shift transmission into third gear, and increase engine speed to 2000 rpm.

WARNING: *Do not permit anyone to stand in front of vehicle during test.*

(3) Slowly release clutch pedal until clutch is fully engaged.

CAUTION: *Do not allow clutch to be engaged for more than 5 seconds as clutch components may become damaged.*

(4) If engine stalls within 5 seconds, the clutch is not defective. If engine continues to run, proceed to step (5).

(5) Raise vehicle on hoist. Check clutch linkage for binding, worn, broken, or bent components. Lubricate or replace as necessary. If all components tested are in good operating condition, proceed to step (6).

(6) If one or more problems were discovered during inspection in step (5), repeat steps (1) through (4). If clutch slippage is corrected, stop. If slippage persists, proceed to step (7).

(7) Remove transmission and clutch components as outlined in this section.

NOTE: *Whenever transmission is removed, also remove pilot bushing lubricating wick and soak wick in engine oil. Install wick before assembly.*

(8) Inspect driven plate. If excessively worn (1/16 inch or less friction material remains above rivets), highly glazed, or if plate is contaminated by oil or grease, replace driven plate.

NOTE: *If driven plate is contaminated, determine cause and make correction.*

(9) Inspect clutch cover assembly. If assembly is heat-checked, has broken or collapsed springs, or shows signs of overheating (e.g., has turned blue), replace clutch cover assembly. If assembly does not exhibit any of these conditions, do not replace it.

(a) Clean oil and dirt from assembly using mineral spirits and allow assembly to air dry.

(b) Lightly sand pressure plate surface with fine emery cloth.

(c) Lubricate clutch release lever pivots and check and adjust release lever height if necessary.

CAUTION: *Apply lubricant to pivots sparingly. Excessive lubrication could result in grease contamination of driven plate and pressure plate surfaces.*

(10) Check release bearing mounting surface of transmision front bearing cap for galling, deep scores, or roughness. Install release bearing and sleeve on front bearing cap and check for smooth fore-and-aft movement. Replace release bearing and sleeve or front bearing cap as necessary. Apply chassis lubricant to groove in release bearing sleeve and apply thin coat of lubricant to release bearing mounting surface of front bearing cap.

CAUTION: *Release bearing used with T-150 transmission has retaining springs which position bearing on throwout lever. Check these springs for distortion, loss of tension, or for being bent or broken. Replace bearing if springs are damaged. Also, when installing bearing, be sure retaining projections on throwout lever are properly engaged in retaining holes in bearing.*

NOTE: *Do not replace release bearing and sleeve unless defective or damaged. Refer to Clutch Area Noises.*

(11) Apply thin film of chassis lubricant to splines of transmission clutch shaft. Do not apply lubricant to pilot hub.

(12) Install pilot bushing and lubricating wick. Install clutch components and transmission as outlined in this section.

(13) Lower vehicle.

CLUTCH DRAG OR INADEQUATE RELEASE

Clutch drag can be described as a condition in which the clutch driven plate, and consequently the transmission clutch shaft, does not come to a complete stop after the clutch pedal is depressed (clutch disengaged). Clutch drag can cause gear clash when shifting into reverse or hard or difficult shifting. Check clutch operation as follows.

NOTE: *Occasionally, the clutch driven plate and clutch shaft will require approximately 5 seconds to lose momentum and come to a complete stop after initial clutch disengagement. This is normal and should not be misconstrued as clutch drag.*

(1) Start engine, depress clutch pedal fully, and shift transmission into first gear.

(2) Shift transmission into neutral but DO NOT release clutch pedal.

(3) Wait 5 to 10 seconds and shift transmission into reverse. If shift is smooth with no gear clash, clutch operation is normal. If shifting into reverse produces gear clash, proceed to step (4).

(4) Raise vehicle on hoist. Check clutch linkage for binding, worn, broken or bent components. Lubricate or replace as necessary. If components are in good operating condition, proceed to step (5). If one or more problems were discovered and repaired, lower vehicle and repeat steps(1) through (3). If clutch now operates correctly, stop. If clutch drag persists, proceed to step (5).

(5) Remove transmission and clutch components as outlined in this section.

NOTE: *Whenever transmission is removed, also remove pilot bushing lubricating wick and soak wick in engine oil. Install wick before assembly.*

(6) Observe wear pattern on driven plate. If wear pattern is uneven (e. g., two areas heavily worn on one side, two only partially worn on opposite side), or has opposing wear patterns on front and reverse side, the driven plate is warped and should be replaced.

(7) Inspect clutch cover assembly. If clutch cover assembly has worn, bent, or broken release levers or lever pivots, is heavily scored, or warped, replace clutch cover assembly. If cover assembly does not exhibit any of these conditions, do not replace assembly.

(a) Clean oil and dirt from clutch cover assembly using solvent and allow assembly to air dry.

(b) Lightly sand pressure plate with fine emery cloth.

(c) Lubricate clutch release lever pivots.

NOTE: *Apply lubricant to pivots sparingly. Excessive lubricant could result in grease contamination of pressure plate and driven plate surfaces.*

(8) Check and adjust release lever height as necessary.

NOTE: *If release lever height cannot be adjusted, release lever(s) are bent. Replace clutch cover assembly.*

(9) Inspect crankshaft pilot bushing for heavy scoring, angular wear pattern, or discoloration. Replace as necessary.

NOTE: *If pilot bushing indicates angular wear, proceed to step (12) after completing step (10). Soak replacement bushing in engine oil before installation.*

(10) Inspect condition of splines on transmission clutch shaft and in driven plate hub. If severely worn, galled, or corroded, replace clutch shaft or driven plate. Corrosion, rust, or burrs can be removed from splines with an oilstone or fine-tooth file. Install driven plate on clutch shaft. Driven plate must move freely on shaft.

(11) If components inspected in step (10) are in good condition, proceed to step (12). If one or more problems were discovered in steps (3) through (10), repair as outlined and proceed to step (12).

(12) Check clutch housing alignment as outlined in this section. Correct as necessary and proceed to step (13).

(13) Apply thin film of chassis lubricant to splines of transmission clutch shaft. Do not apply lubricant to pilot hub.

(14) Install pilot bushing lubricating wick. Install transmission and clutch components.

(15) Lower vehicle.

NOTE: *Do not replace clutch release bearing or sleeve unless defective. Refer to Clutch Area Noises.*

CLUTCH PEDAL PULSATION

Clutch pedal pulsation can be described as a rapid up-and-down (pumping-type) movement of the pedal that is not accompanied by any noise. This pedal movement, which is slight, can be felt by the driver. However, on occasion, pedal movement will be great enough to be visually observed and cause a noticeable vibration.

Clutch pedal pulsation occurs when the release bearing makes initial contact with the clutch cover release levers (clutch partially disengaged), or at any time the release bearing is in contact with the release levers. Pulsation is usually caused by incorrect clutch release lever height or clutch housing misalignment. Check clutch operation as follows.

(1) Start engine, slowly depress clutch pedal until release bearing makes initial contact with clutch release levers, and check for pulsation.

NOTE: *Some minor pulsation is normal.*

(2) Continue to depress clutch pedal while checking for pulsation until pedal is fully depressed.

(3) If pulsation is not evident or is minor, stop repair. If pulsation is very rapid and can be felt throughout car, refer to Clutch-Related Vibrations. If car displays pulsation symptoms, proceed to step (4) as outlined in this section.

NOTE: *Whenever transmission is removed, also remove pilot bushing lubricating wick and soak wick in engine oil. Install wick before assembly.*

(4) Inspect clutch cover for excessively worn or bent release levers. If release levers are bent or excessively worn, replace clutch cover and proceed to step (7). If release levers are in good condition, clean oil and dirt from clutch cover assembly using mineral spirits and allow assembly to air dry.

(a) Lightly sand pressure plate with fine emery cloth.

(b) Lubricate clutch release lever pivots.

(c) Check and adjust release lever height as necessary and proceed to step (6).

NOTE: *Apply lubricant to pivots sparingly. Excessive lubrication could result in grease contamination of driven plate and pressure plate surface.*

(5) Check clutch housing alignment as outlined in this section. Correct as necessary and proceed to step (4).

(6) Apply thin film of chassis lubricant on splines of transmission clutch shaft. Do not apply lubricant to pilot hub.

(7) Install pilot bushing lubricating wick. Install clutch components and transmission.

CLUTCH-RELATED VIBRATIONS

Clutch related vibrations differ from pedal pulsations in frequency and magnitude—they can be felt throughout the car. Clutch vibrations usually occur at a relatively high engine speed (over 1500 rpm) regardless of clutch pedal position. However, vibrations related to clutch component imbalance occur infrequently, as the clutch cover and driven plate are balanced as a unit at assembly—the clutch is installed on the crankshaft/flywheel assembly and given a final fine-tune balance. Replacement of clutch components to correct vibrations should be performed only after exhausting all other possibilities. Check clutch operation as follows.

(1) Raise vehicle on hoist and check engine front support cushion interlocks for grounding. Repair as necessary. Check for any other engine component (e.g., exhaust manifold, valve cover, etc.) for grounding on body or frame. If one of these components is grounded, repair and check for vibration. If vibration ceases, stop repair. If vibation continues, lower vehicle and proceed to step (2).

(2) Disconnect accessory drive belts one at a time and check for vibration. If vibration is corrected after removal of a drive belt, cause of vibration is related to the accessory driven by the belt or by the belt itself. Repair as necessary. If vibration continues, check following areas for other possible causes of clutch-related vibrations.

- Loose flywheel mounting bolts.
- Excessive flywheel face runout (over 0.005 inch).
- Damaged crankshaft vibration damper.
- Clutch cover imbalance.

NOTE: *To check for imbalance, engine can be run with clutch components removed if engine is properly supported. If vibration is not evident, replace clutch cover.*

CLUTCH AREA NOISES

Clutch Release Bearing Noise

Clutch release bearing noises can be described as whirring, grating, or grinding noises which occur when the clutch pedal is depressed (clutch disengaged).

These noises usually continue until the clutch pedal is fully released (clutch engaged) and the bearing is no longer in contact with the clutch cover release levers.

Release bearing noise is corrected by replacing the bearing and sleeve as outlined in this section.

NOTE: *The release bearing and sleeve should not be replaced as a matter of course when the clutch cover or driven member are serviced. The bearing and sleeve should be replaced only when actually defective.*

Clutch Shaft or Countershaft Bearing Noise

Clutch shaft or countershaft bearing noises can be described as whirring, grating, or grinding noises which cease when the clutch pedal is depressed (clutch disengaged) or when the transmission is shifted into gear. These noises are most noticeable when the clutch pedal is fully released and the transmission is in neutral. Correction of these noises will require transmission removal and replacement of the problem bearing(s).

Crankshaft Pilot Bushing Noise

Pilot bushing noises can be described as squealing, howling, or elephant-type trumpeting noises which are most noticeable when the engine is cold. These noises occur during the first few inches of clutch pedal travel as the pedal is being released (partial clutch engagement) with the transmission in gear. It can also occur in very cold weather when the pedal is fully depressed (clutch disengaged) and the engine is started with the transmission in neutral. To correct pilot bushing noise, adjust bushing as outlined in this section.

CLUTCH LINKAGE ADJUSTMENT

The operating linkage components are shown in figures 5-2 and 5-3.

(1) Lift clutch pedal up against pedal stop.

(2) On Cherokee and Truck models, adjust clutch push rod lower ball pivot assembly in or out on push

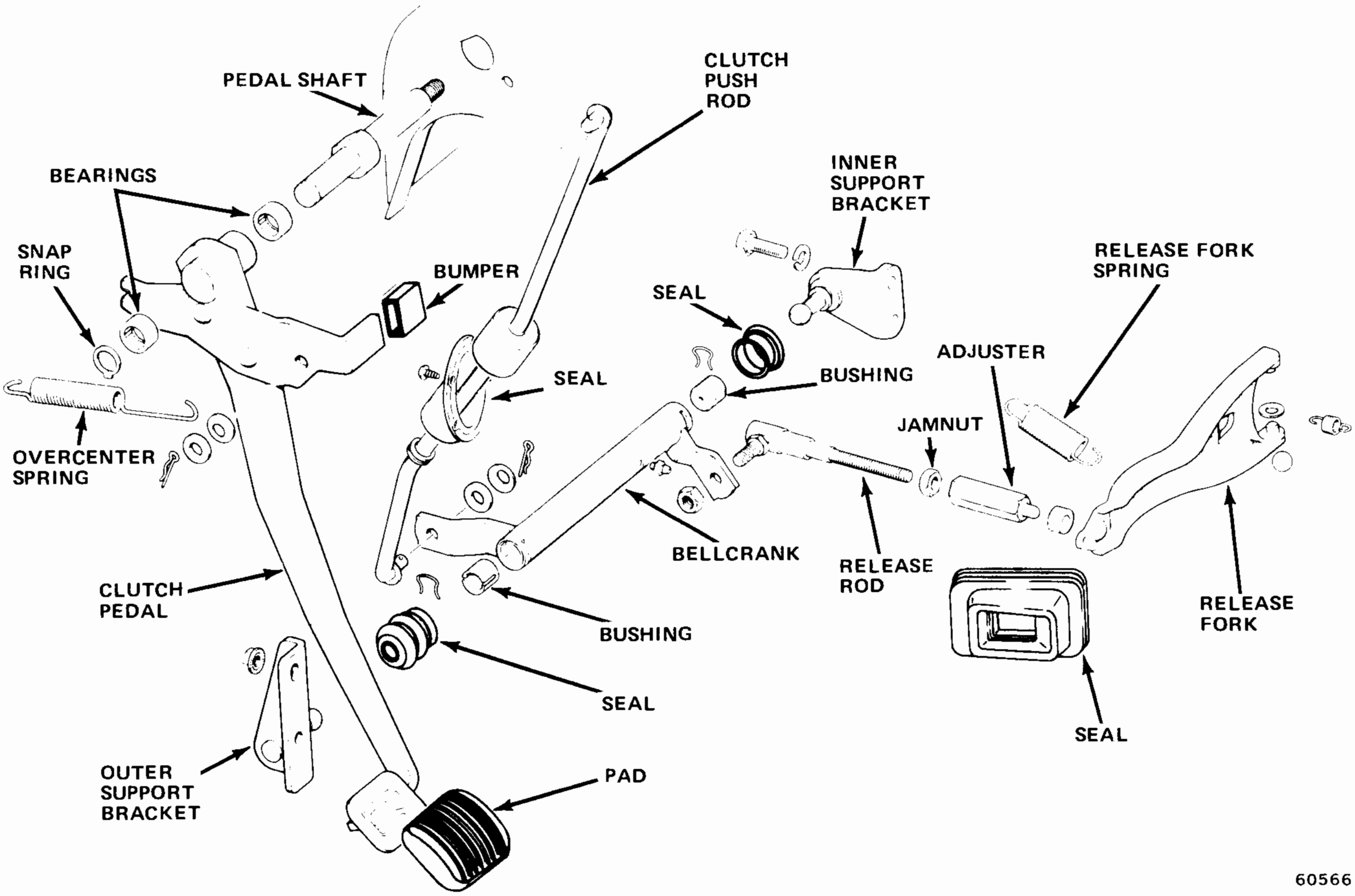


Fig. 5-2 Clutch Linkage—CJ Models

rod as required to position bellcrank inner lever parallel to front face of clutch housing (slightly forward from vertical).

(3) Loosen jamnut and turn release fork adjuster in or out to obtain specified clutch pedal free play and tighten jamnut.

CLUTCH REMOVAL

(1) Remove transmission and transfer case. Refer to Section 6—Manual Transmission.

(2) Remove starter, throwout bearing, and sleeve assembly and clutch housing.

(3) Mark position of clutch cover, pressure plate and flywheel for assembly reference.

CAUTION: *When removing clutch cover from flywheel, loosen attaching screws in rotation, one or two turns at a time, until spring tension on cover is released. The clutch cover is a steel stamping which could be warped by improper removal, causing clutch chatter when installed.*

(4) Inspect crankshaft pilot bushing, flywheel, transmission clutch shaft, throwout bearing and sleeve assembly, driven plate, clutch cover, and clutch housing alignment.

DRIVEN PLATE

Repair of the driven plate is not recommended. If the plate or cushion springs are bent, worn, or damaged, replace the driven plate. Do not replace the plate if the cushion springs only appear loose. This is normal.

THROWOUT BEARING

The clutch release mechanism consists of a forked lever which pivots on a ball and stud threaded into the clutch housing. A clutch fork return spring is anchored to a clip under the ball pivot and holds the lever in contact with the ball pivot. The clutch throwout bearing and sleeve is attached to the forked end of the throwout lever with a wave washer on the lower pin. On CJ models, the throwout bearing is attached to the fork by tension springs. The throwout bearing is permanently lubricated during manufacture.

Do not wash the throwout bearing in solvent as the lubricant may be dissolved.

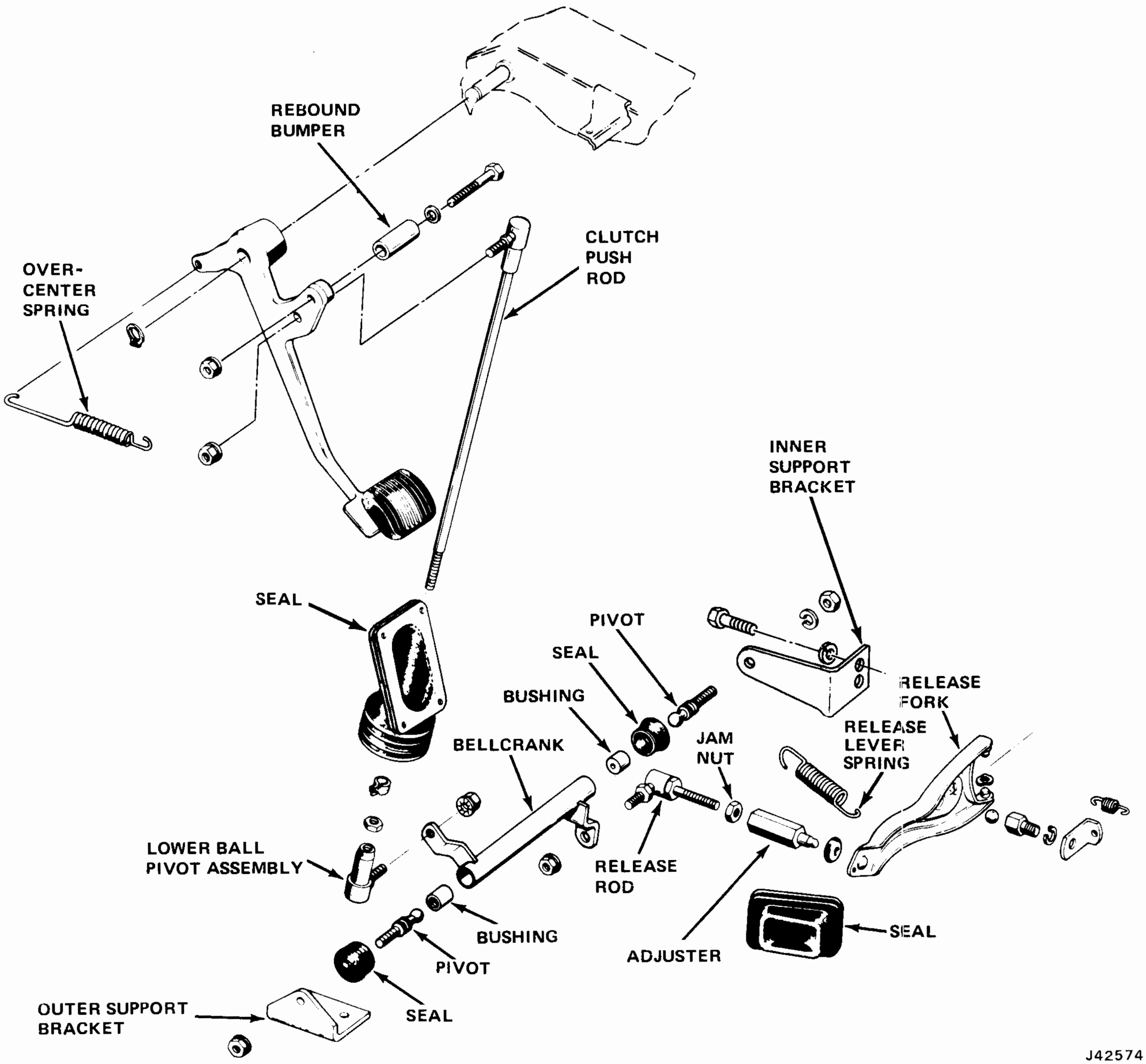


Fig. 5-3 Clutch Linkage—Cherokee and Truck

CRANKSHAFT PILOT BUSHING

When the clutch assembly is removed from the flywheel, inspect the pilot bushing for wear, scoring, cracks, and looseness. Replace bushing if worn or damaged.

Removal

(1) Remove lubrication wick and fill crankshaft bore and pilot bushing with multi-purpose grease.

(2) Insert clutch aligning tool in bushing and tap end of tool with lead hammer. Hydraulic pressure will force bushing out of crankshaft.

Installation

(1) Clean grease from crankshaft bore.

(2) Soak bushing and lubrication wick in engine oil.

(3) Using clutch aligning tool as bushing driver, install bushing in crankshaft bore. Keep bushing straight during installation and be sure it is fully seated.

(4) Install lubrication wick.

FLYWHEEL

Inspect flywheel and pressure plate surfaces for roughness. Check flywheel bolts for proper torque. Tighten bolts to 105 foot-pounds torque if necessary.

TRANSMISSION CLUTCH SHAFT

Install clutch driven plate on transmission clutch shaft. Be sure plate moves freely on splines. If splines on clutch shaft are burred, remove burrs with file or stone. If driven plate is not free to move on splines, incomplete release will result in hard shifting.

CLUTCH HOUSING ALIGNMENT

Clutch housing misalignment, caused by excessive face or bore runout of clutch housing or housing-to-transmission adapter, can cause: improper clutch release, driven plate failure, front transmission bearing failure, premature crankshaft pilot bushing wear, clutch cackle noise, vibration, and in some cases, jumping out of gear on deceleration. If these malfunctions occur, the rear face of the clutch housing or housing-to-transmission adapter should be checked for excessive runout.

Without Transmission Adapter

Use the following procedure to check housing alignment when the vehicle is not equipped with housing-to-transmission adapter.

(1) Remove transmission as outlined in Section 6—Manual Transmission.

(2) Remove clutch housing and clutch assembly.

(3) Remove one flywheel attaching bolt.

(4) Use nine-inch long 1/2-20 bolt and nut for dial indicator support.

(5) Install nut on bolt so that 10 or 12 threads are exposed and thread bolt into crankshaft.

(6) Tighten nut to secure bolt.

(7) Install clutch housing on engine and tighten attaching bolts to specified torque. (Refer to Torque Specifications.)

(8) Mount dial indicator on long bolt. Indicator stylus should contact rear face of clutch housing approximately 1/8 inch from edge of rear opening (fig. 5-4).

(9) Check face runout of housing by turning crankshaft.

(10) Face runout should not exceed 0.010 inch at any point through 360 degrees of rotation.

NOTE: *Crankshaft end play must be held to zero when checking face runout. Move crankshaft forward or backward with pry bar to remove end play.*

(11) Use following procedure to correct face runout of clutch housing.

(a) Install shims between clutch housing and engine to clutch housing spacer (fig. 5-5).

(b) Shims should be installed at points A to correctly align top with bottom of housing. Shims installed at points B and D or C and E will correct runout at either side of clutch housing. Shims installed at points D and E will align housing from bottom to top.

(c) To install shims, loosen clutch housing assembly.

(d) Locate shims where necessary by loosening bolts and inserting shims.

(e) Tighten bolts and recheck face runout.

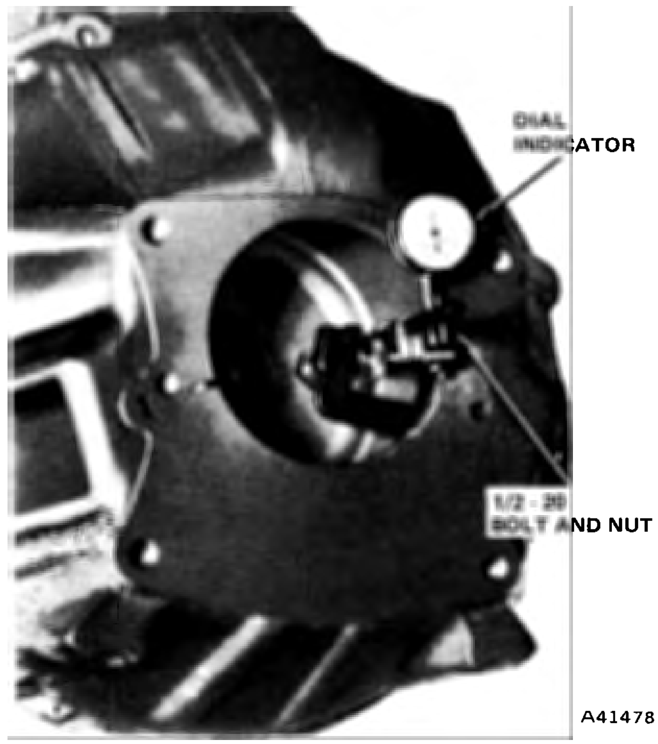


Fig. 5-4 Mounting Dial Indicator

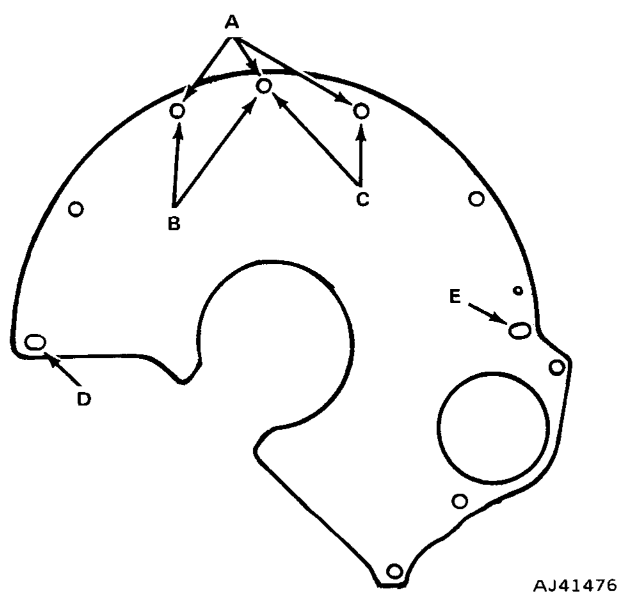


Fig. 5-5 Shim Locations—232 CID Engine Shown

(f) Total face runout of clutch housing should not exceed 0.010 inch. Relocate shims as necessary to correct runout.

(12) Check bore alignment by positioning dial indicator stylus on inside diameter of rear opening of clutch housing.

(13) Rotate crankshaft and note indicator reading at four equally spaced points. Total bore runout must not exceed 0.010 inch.

(14) Any change in face alignment will change bore alignment and may make it possible to correct bore alignment by changing face alignment. Where it is impossible to correct bore alignment to within a maximum of 0.010 inch runout with change of face alignment (not to exceed 0.010 inch), replace housing.

With Transmission Adapter

Use the following procedure to check clutch housing-to-transmission adapter alignment.

(1) Remove transmission as outlined in Section 6—Manual Transmission.

(2) Remove clutch housing, with adapter attached, and remove clutch assembly.

(3) Remove one flywheel attaching bolt.

(4) Obtain a 1/2-20 by 15-inch long bolt and one 1/2-20 nut. Bolt and nut will serve as support for dial indicator.

(5) Thread nut onto bolt so that 10 to 12 threads are exposed. Threaded bolt in flywheel and tighten nut securely.

(6) Install clutch housing, with adapter attached, onto engine. Tighten upper bolts to 35 foot-pounds torque, and lower bolts to 45 foot-pounds torque.

(7) Mount dial indicator on 1/2-20 bolt. Position indicator so stylus contacts transmission mating face of adapter about 1/8 inch in from edge of adapter bore.

(8) Zero dial indicator and rotate crankshaft to check runout at adapter face. Runout should not exceed 0.010 inch at any point through 360 degrees of rotation.

NOTE: *Crankshaft end play must be held to zero while checking face runout.*

(9) Position dial indicator so stylus contacts bore surface of adapter at approximately center of bore.

(10) Zero dial indicator and rotate crankshaft to check runout of adapter bore. Runout should not exceed 0.010 inch at any point through 360 degrees of rotation.

NOTE: *Crankshaft end play must be held to zero while checking bore runout.*

(11) Correct adapter misalignment as follows:

(a) If runout at adapter bore is within acceptable limits but out of tolerance at face, shim clutch housing as required to obtain runout of 0.010 inch or less. Shim housing as described under Clutch Housing Alignment—Without Transmission Adapter.

(b) If runout at adapter face is within acceptable limits but out of tolerance at bore, proceed as follows:

1. Loosen adapter-to-clutch housing bolts one turn.

2. Tap adapter lightly with hammer to reposition. Move adapter up, down, or side to side as required to obtain runout of 0.010 inch or less.

3. When runout is corrected, tighten adapter bolts to 35 foot-pounds torque. Check runout and adjust if necessary.

(c) If runout at adapter face or bore cannot be brought within tolerance, replace adapter and clutch housing.

(12) After correcting alignment, remove dial indicator and remove clutch housing with adapter attached.

NOTE: *If clutch housing was shimmed, mark location of shims for assembly reference.*

(13) Remove 1/2-20 bolt and nut from flywheel and install flywheel bolt removed previously. Tighten bolt to 100 to 110 foot-pounds torque. Install clutch assembly Tighten clutch cover bolts to 40 foot-pounds torque.

(14) Install clutch housing with adapter attached. Tighten upper bolts to 35 foot-pounds torque, and lower bolts to 45 foot-pounds torque.

(15) Install transmission as outlined in Section 6—Manual Transmission.

CLUTCH RELEASE LEVER ADJUSTMENT

NOTE: *Always inspect release lever height adjustment before installing clutch cover assembly.*

(1) Install Clutch Gauge Plate, Tool J-1048, on flywheel in position normally occupied by driven plate (fig. 5-6).

(2) Position cover assembly over gauge plate. Release levers should be directly over machined lands of gauge plate and gauge plate hub should be centered between ends of release levers.

(3) Attach cover assembly to flywheel. Tighten cover attaching screws in rotation, one or two turns at a time, to avoid distortion of cover.

(4) Compress each release lever several times to seat levers in their operating positions (fig. 5-7).

(5) Measure height of each lever relative to gauge hub. Clutch Lever Height Gauge, Tool J-23330, has four different dimensional settings which can be used for measuring above and below hub (fig. 5-8).

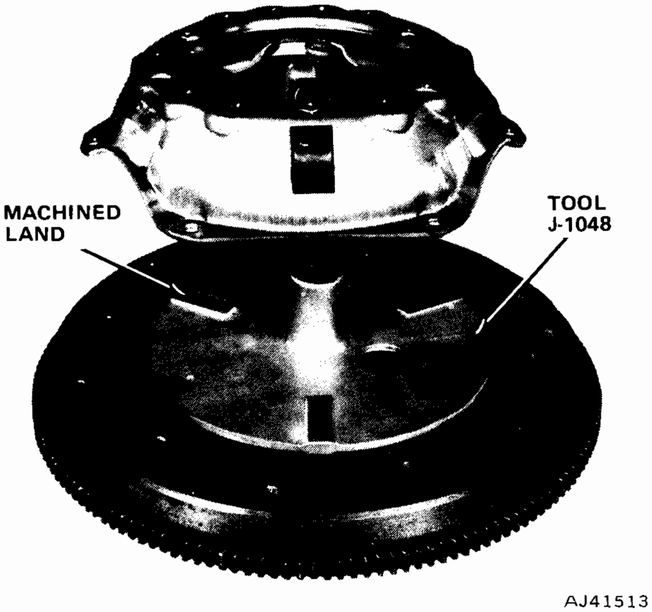


Fig. 5-6 Clutch Gauge Plate J-1048

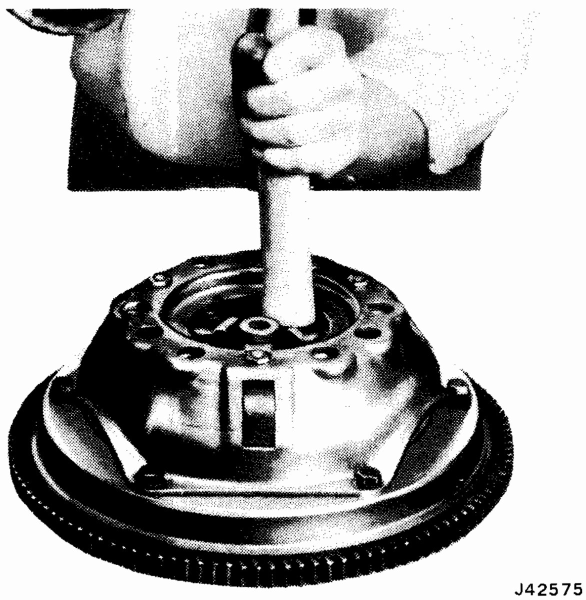


Fig. 5-7 Compressing Release Levers

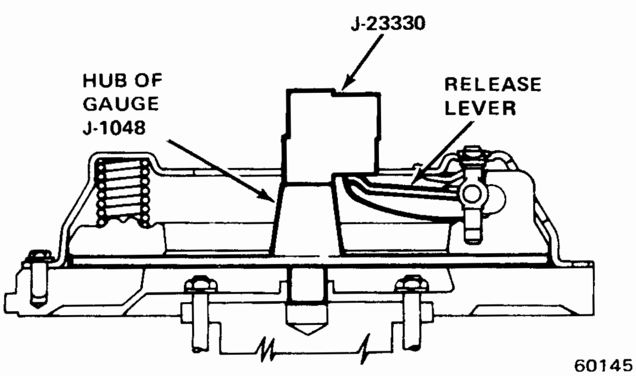


Fig. 5-8 Release Lever Height Measurement

(6) Adjust release levers by turning lever height adjusting nuts until lever is at specified height.

(7) After reach lever has been adjusted, work lever down and up several times and recheck adjustment. If correct, stake nut with dull punch to secure.

CLUTCH INSTALLATION

(1) Check clutch release lever height and correct if necessary.

(2) Install driven plate and loosely attach cover assembly to flywheel. Use Aligning Tool to install driven plate during installation. Use transmission clutch shaft if alignment tool is not available.

(3) Tighten cover attaching screws in rotation to prevent cover distortion.

(4) Install clutch housing, starter, and throwout bearing and sleeve assembly (fig. 5-9).

CAUTION: *Do not operate clutch pedal until transmission has been installed.*

(5) Install transmission and transfer case (refer to Section 6—Manual Transmission).

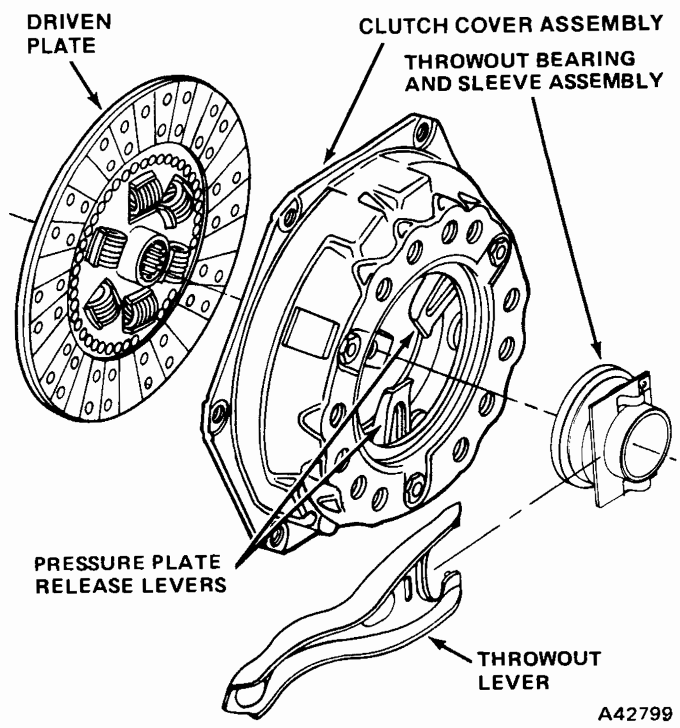


Fig. 5-9 Clutch Components—CJ Models

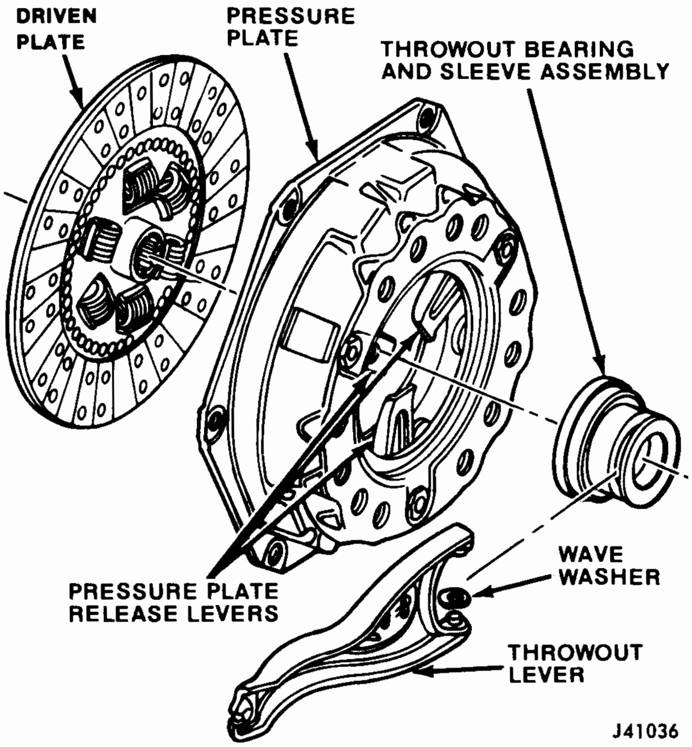


Fig. 5-10 Clutch Components—Cherokee and Truck

Specifications

Model	Engine (CID)	Clutch Diameter (Inches)	Release Lever Height (Inches Above Gauge Hub)	Pedal Free Play (Inches)
CJ-5/CJ-7	232,258, 304	10.5	3/32 to 7/64	0.88 to 1.00
Cherokee, Wagoneer, Truck,	258	10.5	3/32 to 7/64	0.38 to 0.62
	360	11.0	3/16	0.38 to 0.62

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Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Clutch Bellcrank Bracket to Frame Rail Bolt (Cke., Wag., Trk.)	14	12-16
Clutch Bellcrank Pivot	35	30-40
Clutch Cover Bolt	40	35-45
Clutch Housing to Engine Block Bolt		
232-258 CID Engines		
Top	35	30-40
Bottom	45	40-50
304-360 Engines		
Top	30	25-35
Bottom	30	25-35
Clutch Housing to Engine Dowel Bolt Nut	45	40-50
Clutch Housing Spacer to Block Bolt (304-360 CID Engines)	15	12-17
Clutch Housing to Starter Motor Bolt	45	40-50
Clutch Pedal Rebound Bumper, Bolt, Nut, and Lockwasher Assembly to Pedal	40	35-45
Clutch Pedal Shaft Locknut	33	30-36
Transmission Case to Clutch Housing Bolt	55	50-60

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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Clutch Housing Alignment Specifications (Inches)

Clutch Housing Bore to Crankshaft Centerline	0.010 max.
Clutch Housing Transmission Mounting Face to Crankshaft Centerline	0.010 max.
Clutch Housing to Transmission Adapter Bore to Crankshaft Centerline	0.010 max.
Clutch Housing to Transmission Adapter Face to Crankshaft Centerline	0.010 max.
Flywheel Runout at Face	0.005 max.

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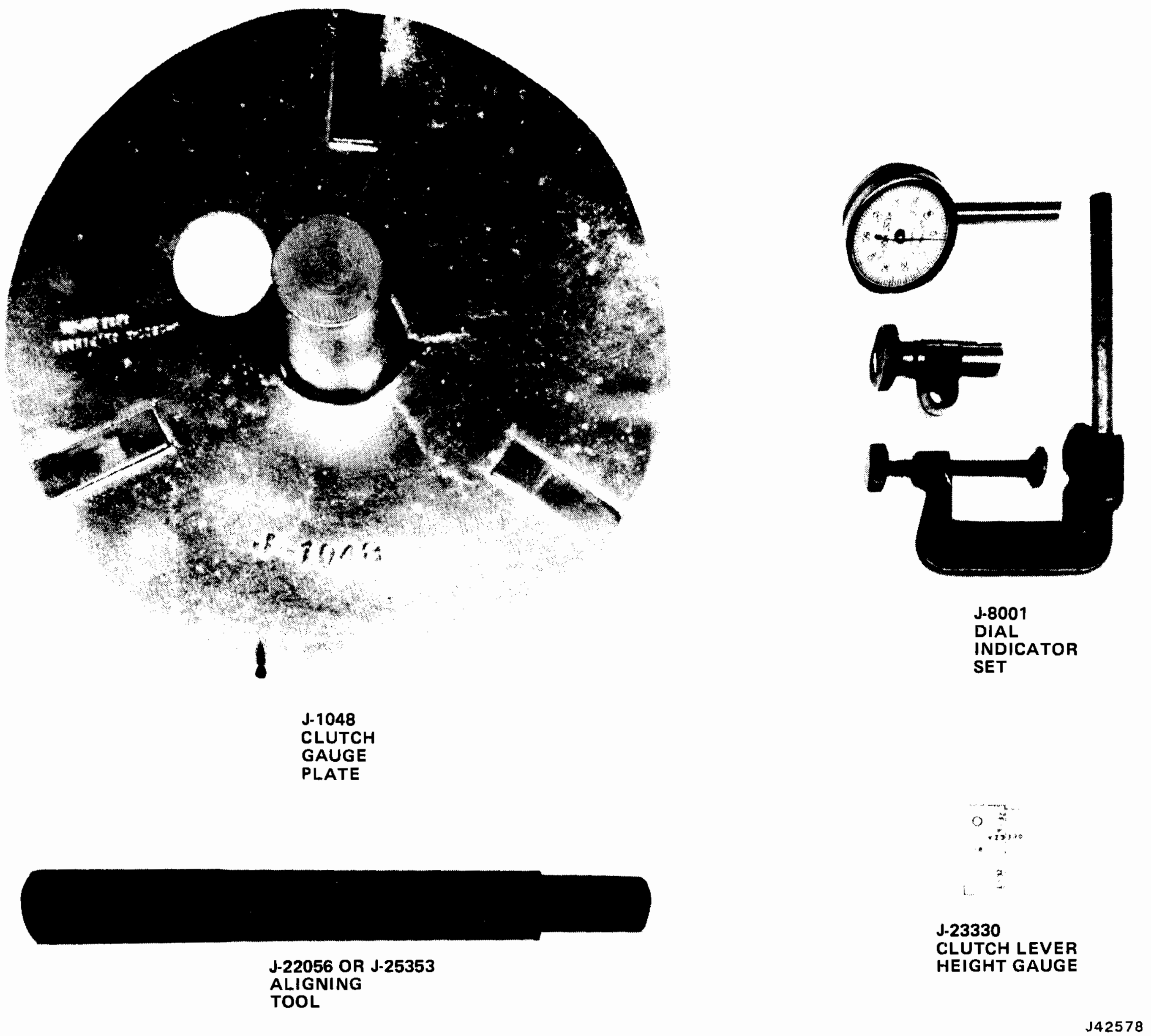

Fig. 5-11 Clutch Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

MANUAL TRANSMISSION

GENERAL

Three transmission models are used, they are: T-150, T-15A, and T-18A. Models T-150 and T-15A are 3-speed, constant mesh units which provide synchromesh engagement in all three forward gears. Model T-18A is a 4-speed, constant mesh unit which provides synchromesh engagement in Second, Third, and Fourth speeds only—First gear is not synchronized.

Service Diagnosis

Condition	Possible Cause	Correction
LOCKS IN TWO GEARS	(1) Worn poppet components.	(1) Replace.
HARD SHIFTING	(1) Improper Clutch linkage adjustment. (2) Synchro-Clutch wear or failure. (3) Incorrect lubricant.	(1) Adjust. (2) Replace. (3) Replace.
JUMPS OUT OF GEAR	(1) Synchro-Clutch wear or failure. (2) Incorrect lubricant. (3) Gear teeth worn or tapered. (4) Insufficient inter-lock spring tension. (5) Misaligned or loose clutch housing or clutch housing to transmission adapter. (6) Excessive transmission end play. (7) Worn or loose engine mounts. (8) Damaged clutch shaft roller bearings. (9) Damaged or worn crankshaft pilot bushing.	(1) Replace. (2) Replace. (3) Replace. (4) Replace parts. (5) Align and tighten. (6) Adjust. (7) Tighten or replace. (8) Replace. (9) Replace.
NOISE IN LOW GEAR	(1) Gear teeth worn or broken. (2) Shifting fork bent. (3) Lack of lubrication.	(1) Replace gears. (2) Replace fork. (3) Add lubricant as required.
LUBRICANT LEAKS INTO CLUTCH HOUSING	(1) Gasket leaking at front bearing cap or cap oil seal leaking. Oil slinger broken or missing.	(1) Inspect oil seal, gasket, and oil slinger. Replace as required.

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Model T-150 is used in CJ models with six-cylinder or V-8 engines. Model T-15A is used in Cherokee, and Truck models with six-cylinder or V-8 engines. Model T-18A is used in all models and with six-cylinder or V-8 engines.

IDENTIFICATION

An identification tag which displays the vendor and Jeep part number is attached to the transmission shift control housing. The information on this tag is necessary to obtain the correct components should replacement be necessary.

NOTE: *During transmission assembly, be sure to attach the identification tag to the transmission in the original location.*

TRANSMISSION REMOVAL—ALL MODELS

(1) Remove shift lever knob, trim ring, and boot.

(2) Remove floor covering and transmission access cover from floorpan.

(3) On Cherokee and Truck models with T-15A 3-speed transmission, remove shift control lever housing assembly (fig. 6-1).

(4) On all models with T-18A 4-speed or CJ models with T-150 3-speed, remove shift control housing cap, spring retainer, spring, shift lever, and pin (fig. 6-2).

(5) On models with T-18A 4-speed, remove transfer case shift lever.

(6) Raise vehicle.

(7) Index mark propeller shafts before removal for proper alignment at installation.

(8) Remove front propeller shaft and disconnect rear propeller shaft from transfer case.

(9) Disconnect speedometer cable, backup lamp switch wires, transmission controlled spark (TCS) advance (if equipped) and parking brake cable (if connected to crossmember).

(10) On models equipped with V-8 engines, remove nuts securing exhaust pipes to manifolds and lower catalytic converter (if equipped) and exhaust pipes.

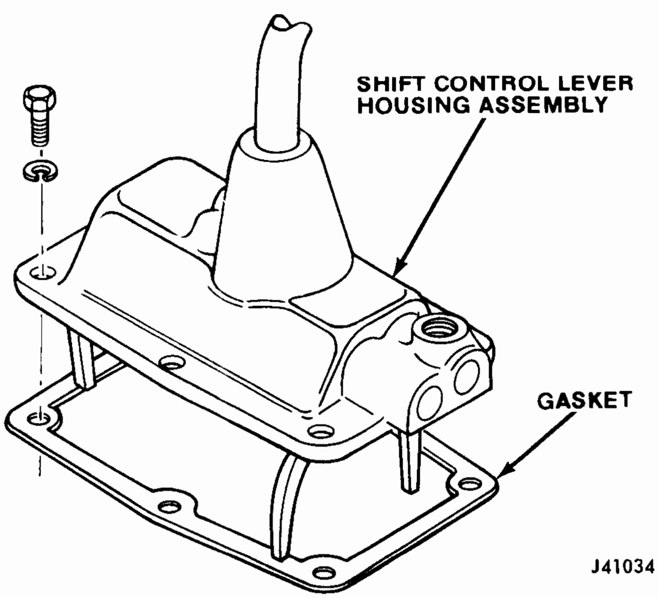


Fig. 6-1 Shift Control Lever Housing Assembly Removal—3-Speed Transmission (T-15 Shown)

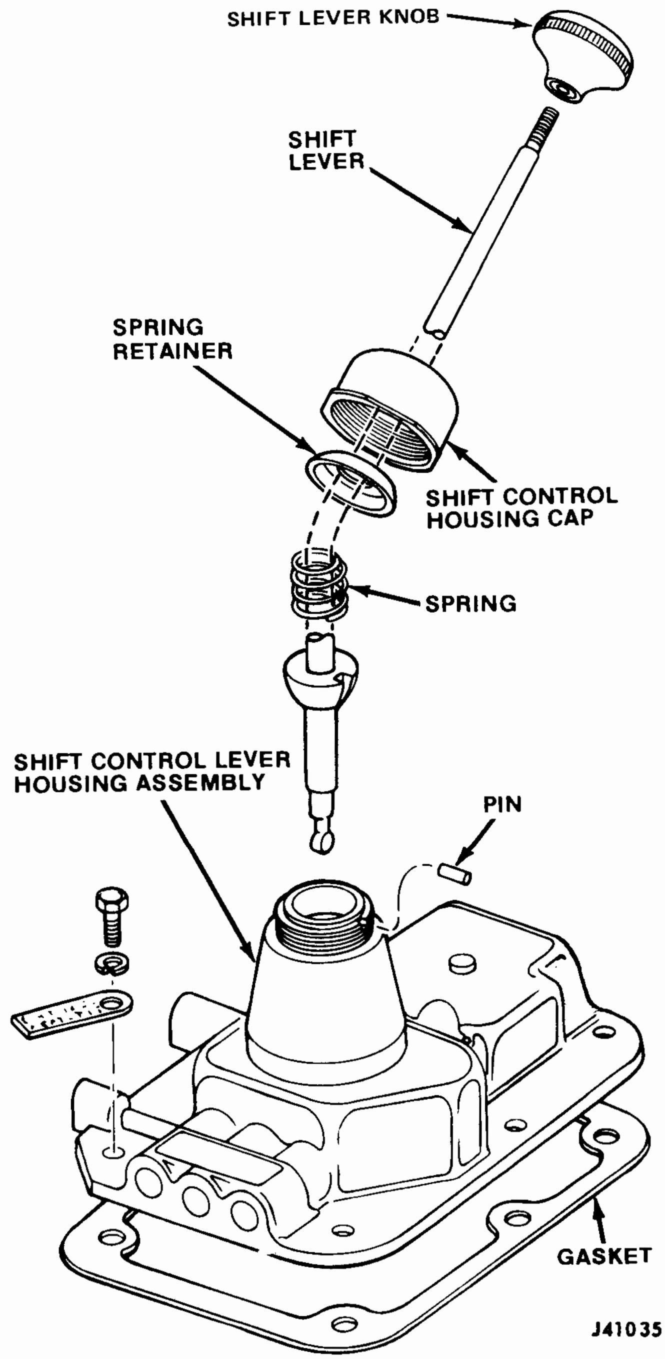


Fig. 6-2 Shift Control Lever Housing Assembly Removal—4-Speed Transmission

(11) Support transmission and engine with suitable support under clutch housing.

(12) Disconnect rear support crossmember from side sills.

(13) Remove bolts attaching transmission to clutch housing or transmission adapter.

(14) Lower transmission slightly, and move transmission, transfer case, and crossmember rearward until transmission clutch shaft clears clutch housing or transmission adapter.

(15) Remove assembly from vehicle. Remove oil wick from pilot bushing and soak wick in engine oil.

TRANSMISSION INSTALLATION

(1) Install oil wick in pilot bushing. If removed, position wave washer, throwout bearing, and sleeve assembly in throwout lever fork. Center throwout bearing over pressure plate release lever.

CAUTION: *Protect splines and preserve throwout bearing alignment while installing transmission.*

(2) Slide transmission slowly into position. Some maneuvering may be required to align transmission input shaft splines and clutch-driven plate splines.

(3) Install bolts which attach transmission to clutch housing or transmission adapter.

(4) Attach rear support crossmember to side sills.

(5) On models equipped with V-8 engines, connect exhaust pipes to manifolds.

(6) Connect speedometer cable, backup lamp switch wires, and transmission controlled spark (TCS) advance (if equipped).

(7) Install front propeller shaft, align index marks made during removal, and connect rear propeller shaft to transfer case. Check for proper alignment.

(8) Lower vehicle.

(9) On models with T-18A 4-speed, install transfer case shift lever.

(10) On all models with T-18A 4-speed or CJ models with T-150 3-speed, install pin, shift lever, spring, spring retainer, and shift control housing cap.

(11) On Cherokee and Truck models with T-15A 3-speed, install shift control lever housing assembly. Place transmission gears and shift lever and forks in Neutral before installing assembly. Be sure shifter forks are seated in synchronizer sleeves.

(12) Align cover, case, and gasket holes and install bolts and lockwashers. Tighten bolts to 12 foot-pounds torque.

(13) Install transmission access cover and floor covering on floorpan.

(14) Install boot trim ring, and shift knob on shift lever.

(15) Check transmission for proper shifting.

(16) Check and correct lubricant level if necessary.

MODEL T-150 3-SPEED TRANSMISSION

DISASSEMBLY

(1) Remove bolts attaching transfer case to transmission.

(2) Separate transfer case and transmission.

(3) Remove transfer case drive gear locknut, flat washer, and drive gear. Remove large fiber washer from rear bearing adapter (fig. 6-3). Move Second-Third clutch sleeve forward and First-Reverse sleeve rearward before removing locknut.

(4) Remove fill plug and drive out countershaft using Arbor Tool J-25232 (fig. 6-5). Do not lose countershaft access plug when removing countershaft. With countershaft removed, allow countershaft gear to lie at bottom of case.

(5) Punch alignment marks in front bearing cap and transmission case for assembly reference.

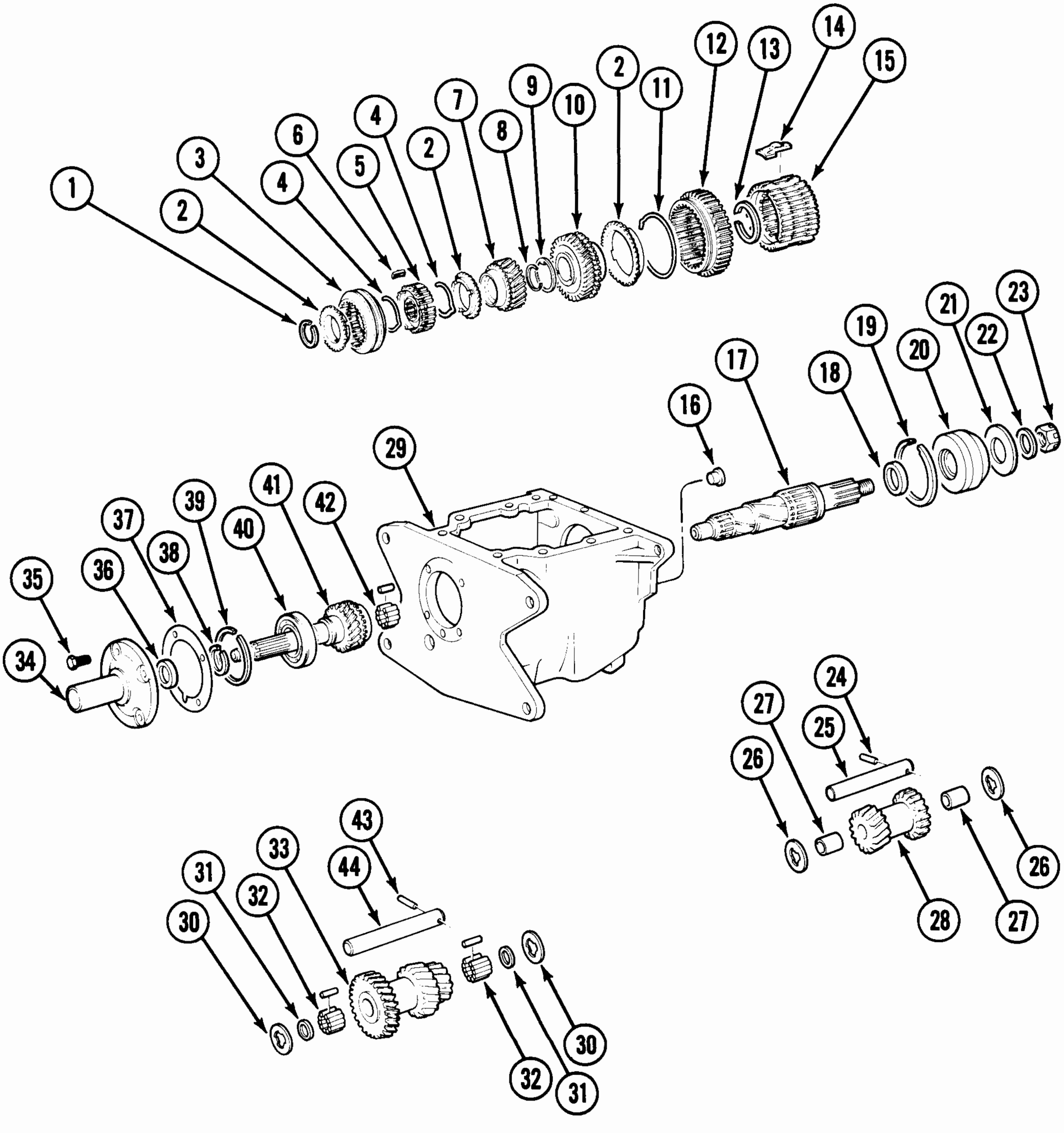
(6) Remove front bearing cap and gasket.

(7) Remove large lockring from front bearing.

(8) Remove clutch shaft, front bearing and Second-Third synchronizer blocking ring as an assembly using Tool J-6654-01 (fig. 6-6).

CAUTION: *Do not damage threaded holes in case when using Tool J-6654-01.*

(9) Remove rear bearing and adapter assembly using brass drift and hammer. Drive adapter out rear of case with light hammer blows (fig. 6-7).



1. MAINSHAFT RETAINING SNAP RING
2. SYNCHRONIZER BLOCKING RINGS (3)
3. SECOND-THIRD SYNCHRONIZER SLEEVE
4. SECOND-THIRD SYNCHRONIZER INSERT SPRING (2)
5. SECOND-THIRD HUB
6. SECOND-THIRD SYNCHRONIZER INSERT (3)
7. SECOND GEAR
8. FIRST GEAR RETAINING SNAP RING
9. FIRST GEAR TABBED THRUST WASHER
10. FIRST GEAR
11. FIRST-REVERSE SYNCHRONIZER INSERT SPRING
12. FIRST-REVERSE SLEEVE AND GEAR
13. FIRST-REVERSE HUB RETAINING SNAP RING
14. FIRST-REVERSE SYNCHRONIZER INSERT (3)
15. FIRST-REVERSE HUB
16. COUNTERSHAFT ACCESS PLUG
17. MAINSHAFT
18. MAINSHAFT SPACER
19. REAR BEARING ADAPTER LOCK RING
20. REAR BEARING AND ADAPTER ASSEMBLY
21. FIBER WASHER
22. FLAT WASHER
23. LOCKNUT
24. ROLL PIN
25. REVERSE IDLER GEAR SHAFT
26. THRUST WASHER
27. BUSHING (PART OF IDLER GEAR)
28. REVERSE IDLER GEAR
29. TRANSMISSIONCASE
30. THRUST WASHER (2)
31. BEARING RETAINER (2)
32. COUNTERSHAFT NEEDLE BEARINGS (50)
33. COUNTERSHAFT GEAR
34. FRONT BEARING CAP
35. BOLT (4)
36. FRONT BEARING CAP OIL SEAL
37. GASKET
38. FRONT BEARING RETAINER SNAP RING
39. FRONT BEARING LOCKRING
40. FRONT BEARING
41. CLUTCH SHAFT
42. MAINSHAFT PILOT ROLLER BEARINGS
43. ROLL PIN
44. COUNTERSHAFT

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Fig. 6-3 Model T-150—Exploded View

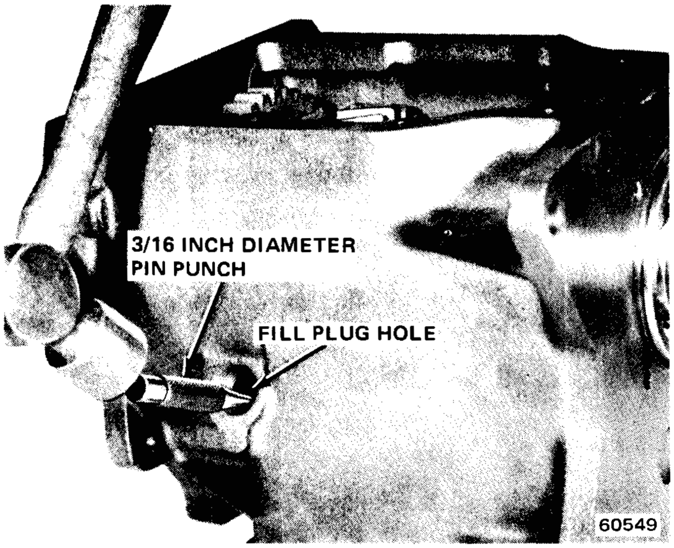

Fig. 6-4 Removing-Installing Countershaft Roll Pin

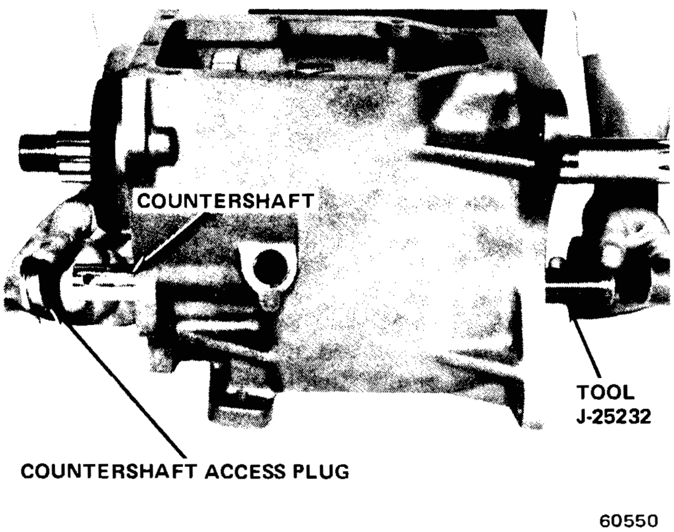

Fig. 6-5 Removing-Installing Countershaft

(10) Remove main shaft assembly. Tilt spline end of main shaft downward and lift forward end of shaft upward and out of case.

(11) Remove countershaft gear and arbor tool as assembly. Remove countershaft gear thrust washers, countershaft roll pin, and any main shaft pilot roller bearings which may have fallen into case during clutch shaft removal.

(12) Remove reverse idle gear shaft. Insert brass drift through clutch shaft bore in front of case and tap shaft until end of shaft with roll pin clears counterbore in rear of case (fig. 6-8), then remove shaft.

(13) Remove reverse idler gear and thrust washers from case.

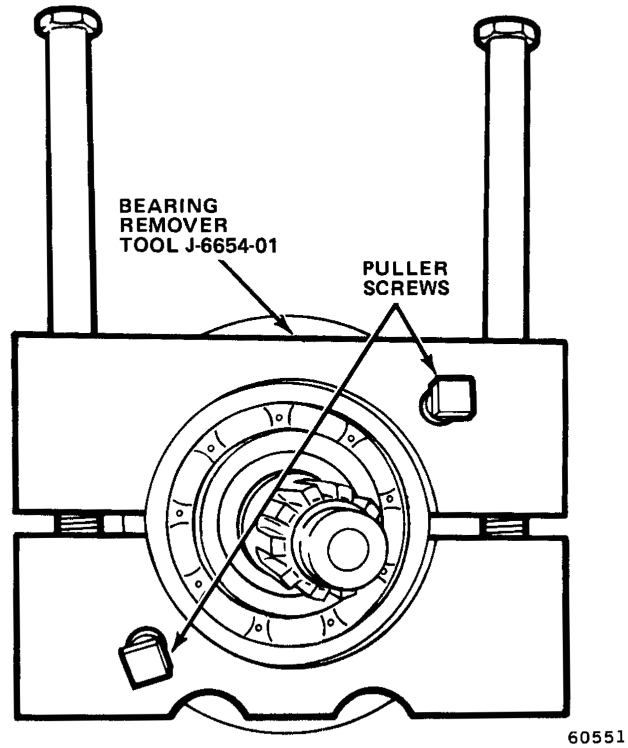

Fig. 6-6 Removing Clutch Shaft

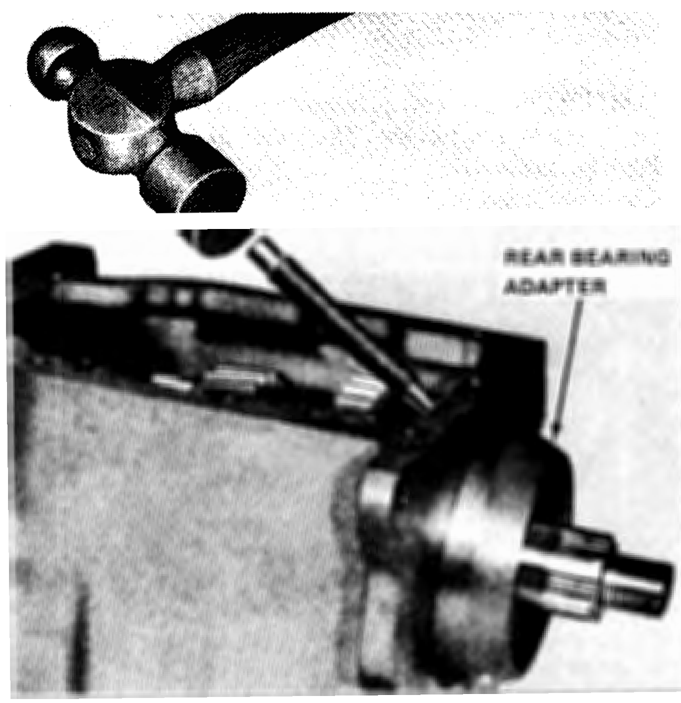

Fig. 6-7 Removing Rear Bearing And Adapter Assembly

Main Shaft Gear Train—Disassembly

(1) Remove retaining snap ring from front of main shaft and remove Second-Third synchronizer assembly and Second gear. Mark hub and sleeve for assembly reference.

NOTE: *Observe position of insert springs and inserts during removal for correct assembly.*

(2) Remove insert springs from Second-Third synchronizer, remove three inserts, and separate sleeve from synchronizer hub (fig. 6-3).

(3) Remove snap ring and tabbed thrust washer from shaft and remove first gear and blocking ring.

(4) Remove First-Reverse hub retaining snap ring.

NOTE: *Observe position of inserts and spring before removal for correct assembly.*

(5) Remove sleeve and gear, insert spring, and three inserts from hub (fig. 6-3). Remove spacer from rear of main shaft.

(6) Remove hub from output shaft using an arbor press.

CAUTION: *Do not attempt to hammer press-fit hub from shaft. Hammer blows will damage hub and shaft.*

Clutch Shaft—Disassembly

(1) Remove front bearing retaining snap ring and any remaining roller bearings.

(2) Press front bearing from shaft with Arbor Press and Tool J-6654-01.

CAUTION: *Do not attempt to drive bearing from shaft with a hammer. Hammer blows will damage bearing and shaft.*

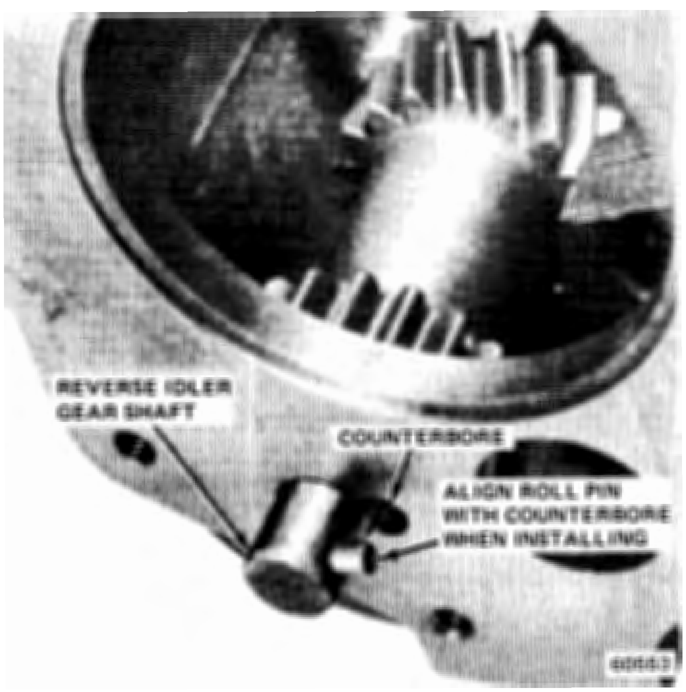

Fig. 6-8 Removing-Installing Reverse Idler Gear Shaft

Rear Bearing and Adapter—Disassembly

(1) Clamp rear bearing adapter in vise. Do not overtighten.

(2) Using pointed-type tool, remove rear bearing retaining snap ring. Remove bearing adapter from vise.

(3) Press rear bearing out of adapter using arbor press.

(4) Remove bearing adapter lockring.

CLEANING AND INSPECTION

Cleaning

Thoroughly wash all parts in solvent and dry with compressed air. Do not dry bearings with compressed air; air dry bearings or use a clean cloth only.

Clean needle and clutch shaft roller bearing by wrapping bearings in a clean cloth and submerging them in solvent. Or, place bearings in a shallow parts cleaning tray and cover them with solvent. Allow bearings to air dry on clean cloth.

Inspection

Check transmission components for the following:

Case

- Cracks in bores, sides, bosses, or at bolt holes.
- Stripped threads in bolt holes.
- Nicks, burrs, rough surfaces in shaft bores or on gasket surfaces.

Gear and Synchronizer Assemblies

- Broken, chipped, or worn gear teeth.
- Damaged splines on synchro hubs or sleeves.
- Broken or worn teeth or excessive wear of blocking rings.
- Bent or broken inserts.
- Damaged needle bearings or bearing bores in countershaft gear.
- Wear or galling of countershaft, clutch shaft, or idler gear shafts.
- Worn thrust washers.
- Nicked, broken, or worn main shaft or clutch shaft splines.
- Bent, distorted, weak snap rings.
- Worn bushings in reverse idler gear. Replace gear if bushings are worn.
- Rough, galled, or broken front or rear bearing.

ASSEMBLY

(1) Lubricate reverse idler gear shaft bore and bushings with transmission lubricant.

(2) Coat transmission case reverse idler gear thrust washer surfaces with petroleum jelly and install thrust washers in case.

NOTE: *Be sure to engage locating tabs on thrust washers in locating slots in case.*

(3) Install reverse idler gear. Align gear bore, thrust washers, case bores, and install reverse idler gear shaft from rear of case. Be sure to align and seat roll pin in shaft into counterbore in rear of case (fig. 6-8).

(4) Measure reverse idler gear end play by inserting feeler gauge between thrust washer and gear. End play should be 0.004 to 0.018 inch. If end play exceeds 0.018 inch, remove idler gear and replace thrust washers.

(5) Coat needle bearing bores in countershaft gear with petroleum jelly. Insert Arbor Tool J-25232 in bore of gear and install 25 needle bearing retainers with petroleum jelly and install one retainer in each end of gear (fig. 6-3).

(6) Coat countershaft gear thrust washer surfaces with petroleum jelly and position thrust washers in case.

NOTE: *Be sure to engage locating tangs on thrust washers in locating slots in case.*

(7) Insert countershaft into bore at rear of case just far enough to hold rear thrust washer in position. This will prevent thrust washer from being displaced when countershaft gear is installed.

(8) Install countershaft gear. (Do not install roll pin at this time.) Align gear bore, thrust washers, bores in case, and install countershaft.

NOTE: *Do not remove Arbor Tool J-25232 completely.*

(9) Measure countershaft gear end play by inserting feeler gauge between washer and countershaft gear. End play should be 0.004 to 0.018 inch. If end play exceeds 0.018 inch, remove gear and replace thrust washers. After correct end play has been obtained, install arbor tool fully in countershaft gear and allow gear to remain at bottom of case. Leave countershaft in rear case bore to hold rear thrust washer in place.

NOTE: *Countershaft gear must remain at bottom of case to provide sufficient clearance for installation of main shaft and clutch shaft assemblies.*

(10) Coat all splines and machined surfaces on main shaft with transmission lubricant and start First-Reverse synchronizer hub on output shaft splines by hand. End of hub with slots should face front of shaft. Use arbor press to complete hub installation on shaft and install retaining snap ring in most rearward groove (fig. 6-9).

CAUTION: *Do not attempt to drive hub onto shaft with hammer. Hammer blows will damage hub and splines.*

(11) Coat splines on First-Reverse hub with transmission fluid and install First-Reverse sleeve and gear halfway onto hub with gear end of sleeve facing rear of shaft. Index sleeve to hub with alignment marks made during disassembly.

(12) Install insert spring in First-Reverse hub. Make sure spring is bottomed in hub and covers all three insert slots. Position three T-shaped inserts in hub with small ends in hub slots and large ends inside hub (fig. 6-9). Push inserts fully into hub so they seat on insert spring, then slide First-Reverse sleeve and gear over inserts until inserts engage in sleeve (fig. 6-10).

(13) Coat bore and blocking ring surface of First gear with transmission fluid and place First gear blocking ring on tapered surface of gear.

(14) Install gear on output shaft. Rotate gear until notches in blocking ring engage inserts in First-Reverse hub, then install tabbed thrust washer (sharp edge facing out) and retaining snap ring on main shaft (fig. 6-11).

(15) Coat bore and blocking ring surface of Second gear with transmission lubricant and place Second gear blocking ring on tapered surface of gear.

(16) Install Second gear on output shaft with tapered surface of gear facing front of main shaft (fig. 6-12).

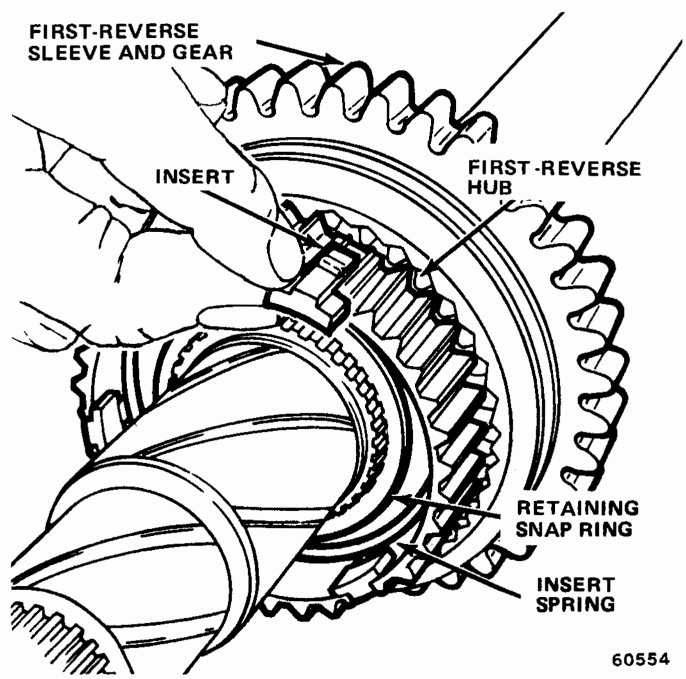

Fig. 6-9 Installing Inserts in First-Reverse Hub

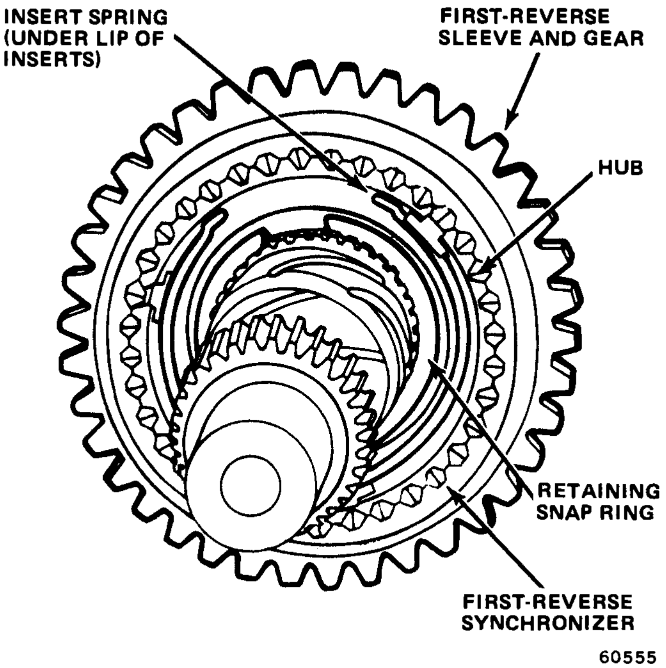

Fig. 6-10 Snap Ring and Insert Spring Position in First-Reverse Hub

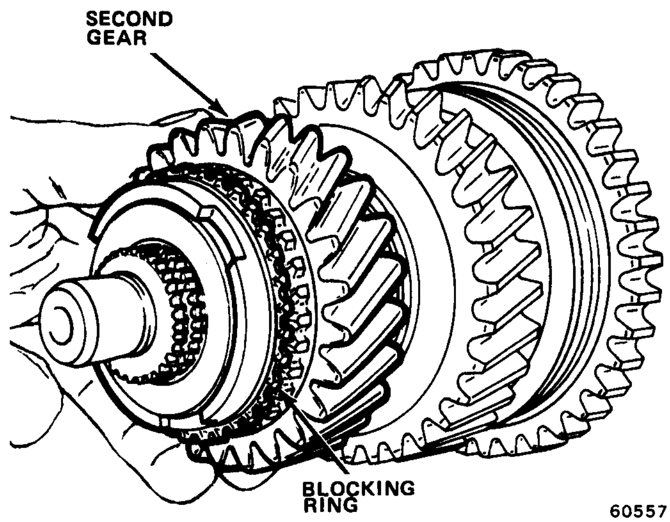

Fig. 6-12 Installing Second Gear on Main Shaft

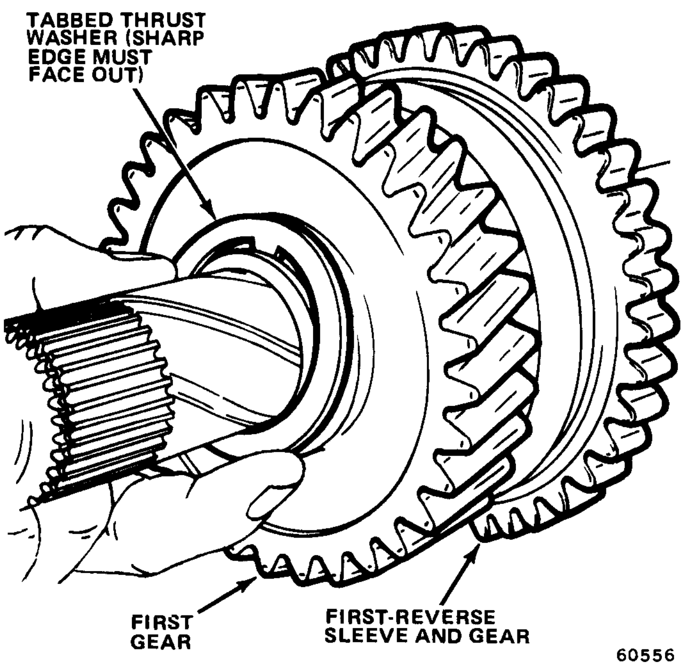

Fig. 6-11 Installing First Gear Thrust Washer on Main Shaft

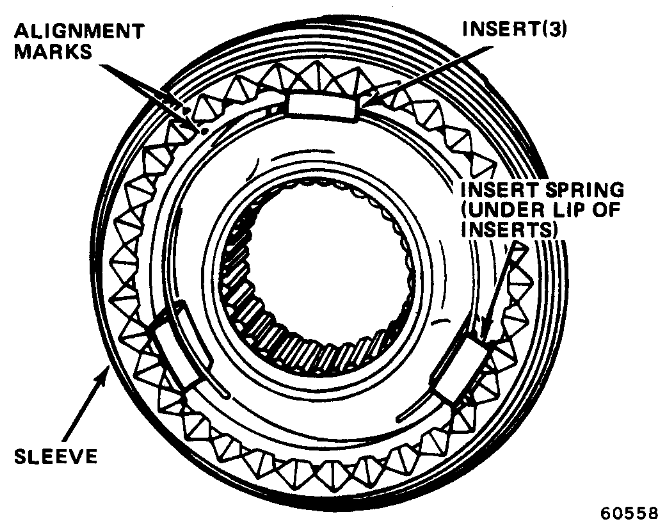

Fig. 6-13 Second-Third Synchronizer Assembly

(17) Install one insert spring into Second-Third hub. Be sure spring covers all three insert slots in hub. Align Second-Third sleeve to hub using marks made during disassembly, and start sleeve onto hub.

(18) Place three inserts into hub slots and on top of insert spring, then push sleeve fully onto hub to engage inserts in sleeve (fig. 6-13). Install remaining insert spring in exact same position as first spring. Ends of both springs must cover same slots in hub and not be staggered.

NOTE: *Inserts have a small lip on each end. When correctly installed, this lip will fit over insert spring (fig. 6-13).*

(19) Install Second-Third synchronizer assembly on main shaft. Rotate Second gear until notches in blocking ring engage inserts in Second-Third synchronizer assembly.

(20) Install retaining snap ring on main shaft and measure end play between snap ring and Second-Third synchronizer hub with feeler gauge (fig. 6-14). End play should be 0.004 to 0.014 inch. If end play exceeds

0.014 inch, replace thrust washer and all snap rings on output shaft assembly. Install spacer on rear of main shaft.

(21) Install main shaft assembly in case. Be sure First-Reverse sleeve and gear is in Neutral (centered) position on hub so gear end of sleeve will clear top of case when output shaft assembly is installed.

(22) Press rear bearing into rear bearing adapter using arbor press. Install rear bearing retaining ring and bearing adapter lockring.

(23) Support main shaft assembly and install rear bearing and adapter assembly in case. Use plastic hammer to seat adapter in case.

(24) Install large fiber washer in rear bearing adapter. Install transfer case drive gear, flat washer, and locknut. Tighten locknut to 150 foot-pounds torque.

(25) Press front bearing onto clutch shaft. Install bearing retaining snap ring on clutch shaft and lockring in front bearing groove.

NOTE: *When correctly installed, snap ring groove in front bearing will be nearest to front of clutch shaft.*

(26) Coat bore of clutch shaft assembly with petroleum jelly and install 15 roller bearings in clutch shaft bore.

CAUTION: *Do not use chassis grease or a similar "heavy" grease in clutch shaft bore. Heavy grease will plug the lubricant holes in the shaft and prevent proper lubrication of the roller bearings.*

(27) Coat blocking ring surface of clutch shaft with transmission fluid and position blocking ring on shaft.

(28) Support main shaft assmebly and insert clutch shaft through front bearing bore in case. Seat main shaft pilot in roller bearings of clutch shaft and tap bearing into position in case with plastic or rawhide mallet.

(29) Apply thin film of sealer to front bearing cap gasket and position gasket on case. Be sure cutout in gasket is aligned with oil return hole in case.

(30) Remove front bearing cap oil seal with screwdriver. Install new oil seal with Tool J-25233 (fig. 6-15).

(31) Install front bearing cap and tighten attaching bolts to 33 foot-pounds torque. Be sure to index cap to case with alignment marks, and that oil return slot in cap is aligned with oil return hole in case.

(32) Make wire loop about 18 to 20 inches long and pass wire under countershaft gear assembly. Wire loop should raise and support gear assembly when loop is pulled upward.

(33) Raise countershaft gear with wire loop (fig. 6-16), align bore in countershaft gear with front thrust washer and countershaft, and start countershaft into gear using plastic hammer (fig. 6-16).

(34) Align roll pin hole in countershaft and roll pin holes in case (fig. 6-16) and complete installation of countershaft. Install countershaft access plug in rear of case and seat plug with plastic hammer.

(35) Install countershaft roll pin in case. Use magnet or needlenose pliers to insert and start pin in case. Use 1/2-inch diameter punch to seat pin and install fill plug.

(36) Shift synchronizer sleeves into all gear positions and check operation. If clutch shaft and main shaft appear to bind in Neutral position, check for blocking rings sticking on First or Second speed gear tapers.

(37) Attach transmission to transfer case. Tighten attaching bolts to 30 foot-pounds torque.

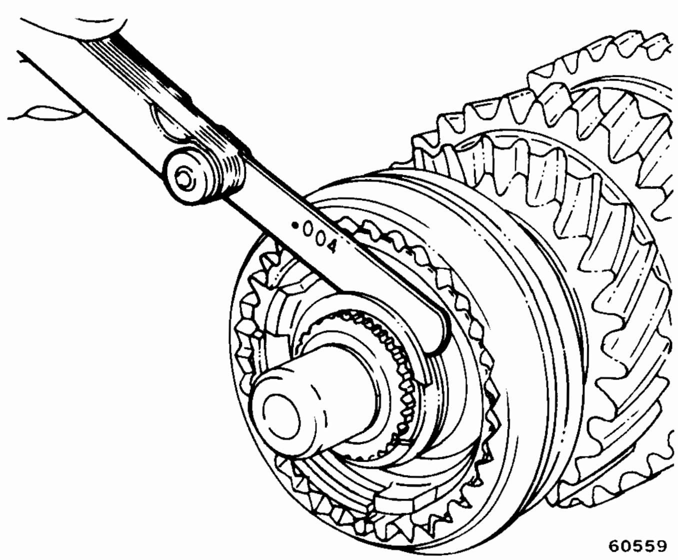

Fig. 6-14 Measuring Main Shaft End Play

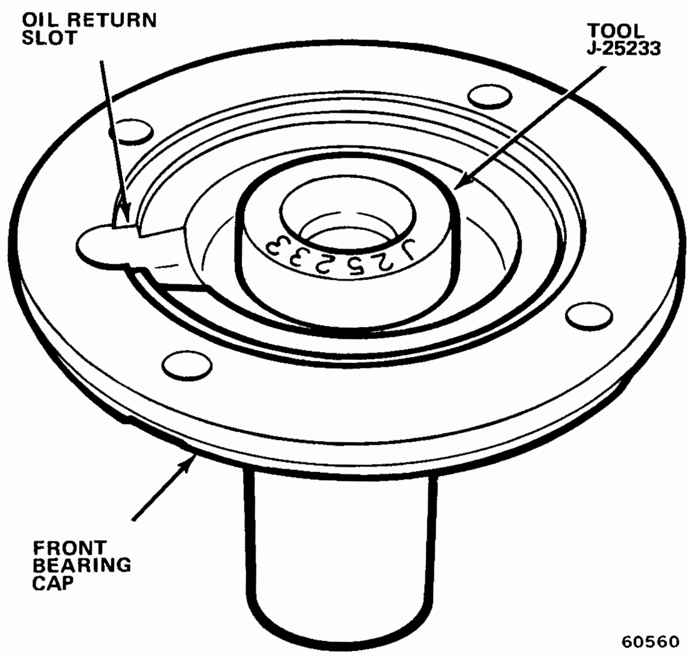

Fig. 6-15 Front Bearing Cap Oil Seal Installation

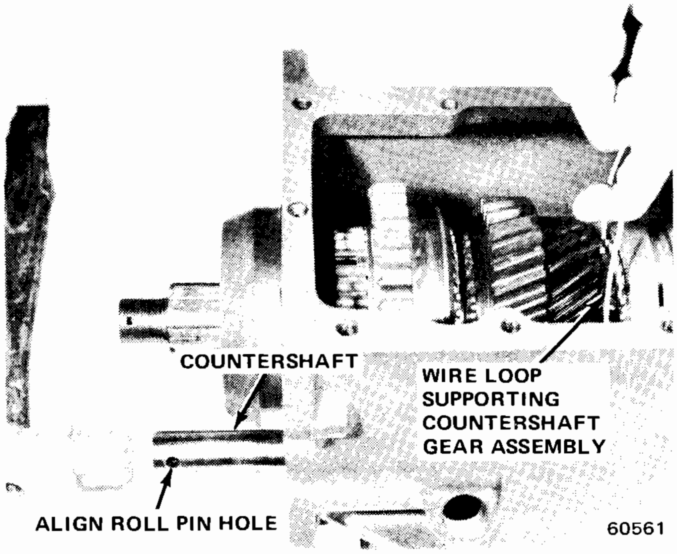

Fig. 6-16 Installing Countershaft

SHIFT CONTROL HOUSING

Disassembly

(1) Remove backup lamp switch and transmission controlled spark switch (TCS) if equipped.

(2) Unthread shift control housing cap and remove cap, gasket, spring retainer, and shift lever spring as assembly (fig. 6-17).

(3) Invert housing and mount in vise. Clamp housing at shift lever tower. Do not overtighten.

(4) Move Second-Third shift rail to rear of housing, rotate shift fork toward First-Reverse rail until roll pin is accessible. Drive roll pin out of fork and rail with pin punch, and remove shift fork and roll pin.

NOTE: *Roll pin hole in shift fork is offset. Mark position of shift fork for assembly reference.*

(5) Remove Second-Third shift rail using brass drift or hammer. Catch shift rail plug as rail drives it out of housing. Do not lose poppet ball during removal of shift rail. Cover shift and poppet ball holes in housing with cloth or tape before removing shift rail. Mark location of shift rail for assembly reference.

(6) Rotate First-Reverse shift fork away from notch in housing until roll pin is accessible. Drive roll pin out of fork and rail using pin punch, and remove shift fork and roll pin.

NOTE: *Roll pin hole in shift fork is offset. Mark position of shift fork for assembly reference.*

(7) Remove First-Reverse shift rail using brass drift or hammer. Catch shift rail plug as rail drives it out of housing. Do not lose poppet ball during removal of shift rail. Cover shift tower and poppet ball holes in housing with cloth or tape before removing shift rail. Mark location of shift rail for assembly reference.

(8) Remove poppet balls, springs, and interlock plunger from housing.

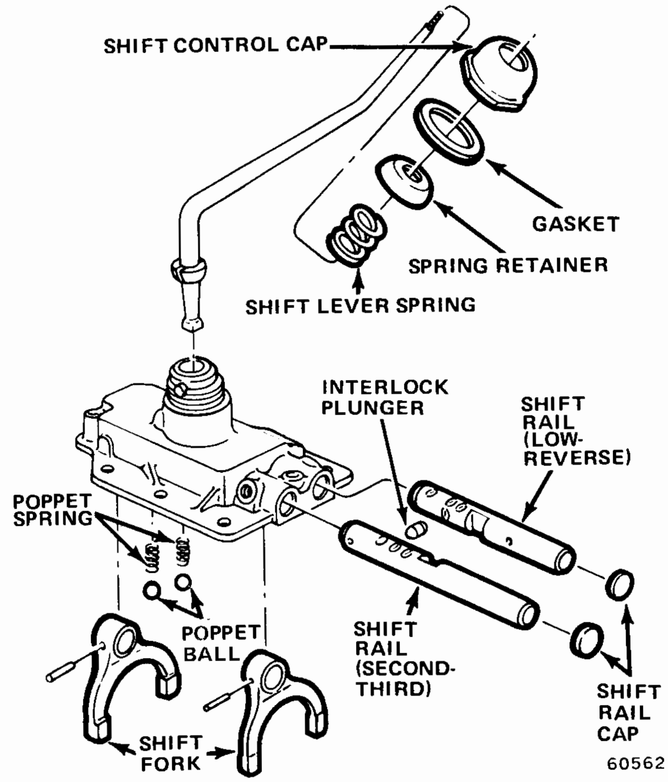

Fig. 6-17 Shift Control Housing—CJ Models

Assembly

(1) Install poppet springs and detent plug in housing.

(2) Insert First-Reverse shift rail into housing, and install shift fork on shift rail.

(3) Install poppet ball on top of spring in First-Reverse shift rail bore.

(4) Using punch or wooden dowel, push poppet ball and spring downward into housing bore and install First-Reverse shift rail.

(5) Align roll pin holes in First-Reverse shift rail and shift fork and install roll pin. Move shift rail to Neutral (center) detent.

(6) Insert Second-Third shift rail into housing and install poppet ball on top of spring in Second-Third shift rail bore.

(7) Using punch or wooden dowel, push poppet ball and spring downward into housing bore and install Second-Third shift rail.

(8) Align roll pin holes in Second-Third shift rail and shift fork and install roll pin. Move shift rail to Neutral (center) detent.

(9) Install shift rail plugs in housing, and remove shift control housing from vise.

(10) Install shift lever, shift lever spring, spring retainer, gasket and shift control housing cap as assembly. Tighten cap securely.

(11) Install backup lamp switch and transmission controlled spark switch (TCS) if equipped.

MODEL T-15A 3-SPEED TRANSMISSION

DISASSEMBLY

(1) Remove bolts attaching transfer case to transmission.

(2) Separate transfer case and transmission.

(3) Remove nut and flat washer which attach transfer case drive gear to main shaft (fig. 6-18). Move Second-Third sleeve forward and First-Reverse sleeve rearward before removing nut.

(4) Remove drive gear, adapter, and spacer.

(5) Punch alignment marks on front bearing cap and transmission case for assembly reference.

(6) Remove front bearing cap and gasket.

(7) Remove front and rear bearing retaining snap rings.

(8) Remove front and rear bearings using Puller Set J-25152 (fig. 6-19 and 6-20).

(9) Remove clutch shaft from case.

(10) Shift transmission into Second gear and remove main shaft and gear assembly.

(11) Remove reverse idler and countershaft lock plate. Tap lightly on shafts to ease removal.

(12) Remove countershaft from rear of case using Arbor Tool J-25199 (fig. 6-21).

(13) Remove countershaft gear assembly, arbor tool, and thrust washer.

(14) Remove arbor tool, spacer washers, bearing rollers and center spacer from countershaft gear.

(15) Remove reverse idler gear shaft using Tool J-25203 (fig. 6-22).

(16) Remove reverse idler gear, thrust washers, and roller bearings as assembly.

Main Shaft Gear Train—Disassembly

(1) Remove Second-Third synchronizer retaining snap ring and remove synchronizer assembly (fig. 6-23).

(2) Remove Second gear and blocking ring.

(3) Remove Reverse gear.

(4) Remove First gear clutch hub retaining snap ring and remove First gear synchronizer assembly (fig. 6-24).

(5) Remove First gear and blocking ring.

(6) Remove synchronizer springs from Second-Third synchronizer assembly (fig. 6-25). Mark synchronizer sleeve and hub for assembly reference and remove sleeve and shifting plates from hub.

(7) Remove synchronizer spring from First gear synchronizer assembly (fig. 6-26). Mark synchronizer sleeve and hub for assembly reference and remove sleeve and shifting plates from hub.

NOTE: *First gear synchronizer assembly uses only one synchronizer spring (fig. 6-26).*

Clutch Shaft—Disassembly

(1) Remove main shaft pilot bearing rollers from clutch shaft.

(2) Remove front bearing snap ring.

(3) Remove front bearing from clutch shaft using Puller Set J-25152.

CLEANING AND INSPECTION

Cleaning

Thoroughly wash all parts in solvent and dry with compressed air. Do not dry bearings with compressed air; air dry bearings or use a clean cloth only.

Clean needle and clutch shaft roller bearings by wrapping bearings in a clean cloth and submerging them in solvent. Or place bearings in a shallow parts cleaning tray and cover them with solvent. Allow bearings to air dry on clean cloth.

Inspection

Check transmission components for the following.

Case

- Cracks in bores, sides, bosses, or at bolt holes.
- Stripped threads in bolt holes.
- Nicks, burrs, rough surfaces in shaft bores or on gasket surfaces.

Gear and Synchronizer Assemblies

- Broken, chipped, or worn gear teeth.
- Damaged splines on synchro hubs or sleeves.
- Broken or worn teeth or excessive wear of blocking rings.

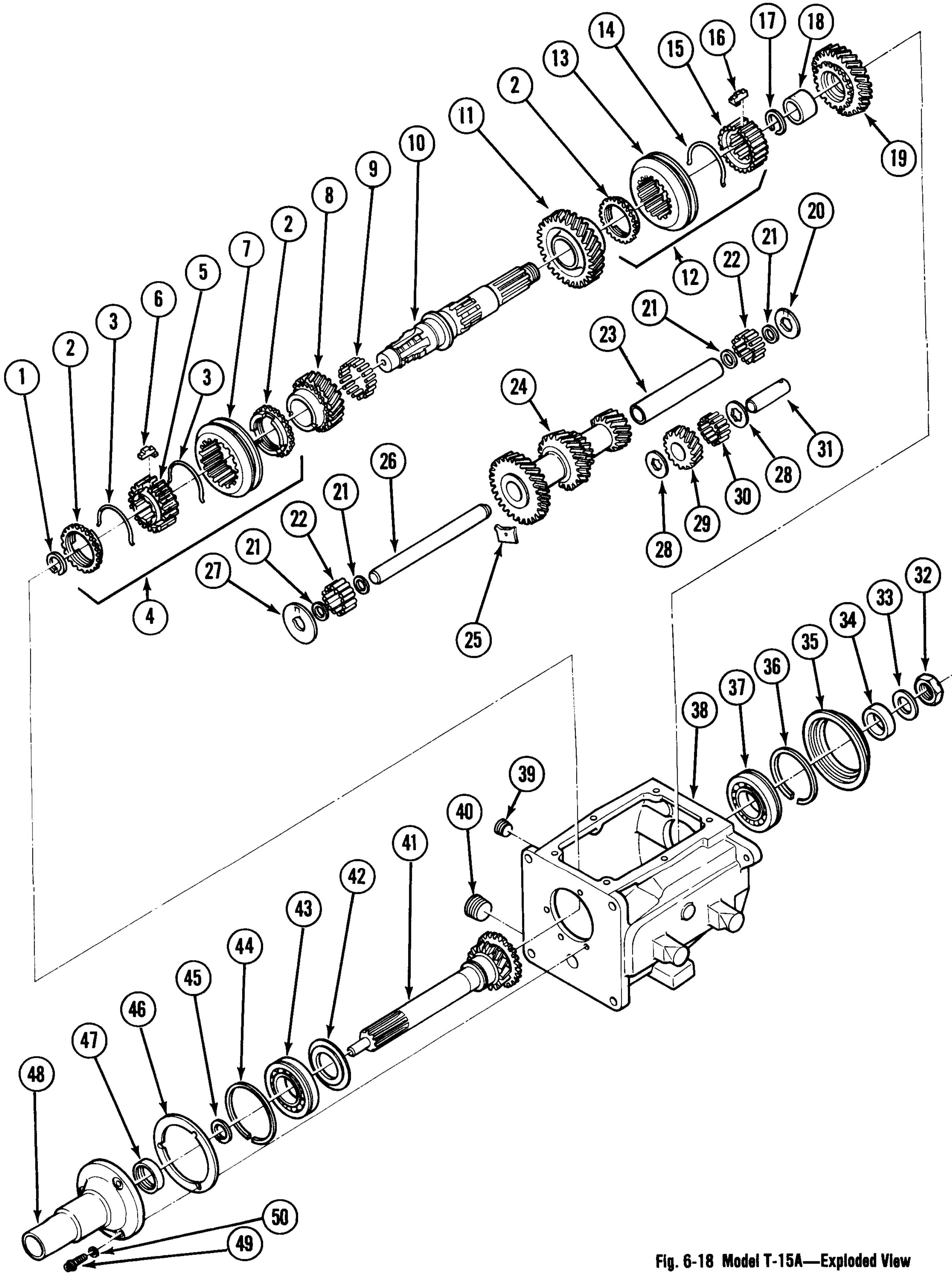

Fig. 6-18 Model T-15A—Exploded View

1. SECOND-THIRD SYNCHRONIZER SNAP RING
2. BLOCKING RINGS (3)
3. SYNCHRONIZER SPRINGS (2)
4. SECOND-THIRD SYNCHRONIZER ASSEMBLY
5. SECOND-THIRD CLUTCH HUB
6. SECOND-THIRD SHIFTING PLATE (3)
7. SECOND-THIRD CLUTCH SLEEVE
8. SECOND GEAR
9. MAINSHAFT PILOT BEARING ROLLERS (21)
10. MAINSHAFT
11. FIRST GEAR
12. FIRST GEAR SYNCHRONIZER ASSEMBLY
13. FIRST-REVERSE CLUTCH SLEEVE
14. SYNCHRONIZER SPRING (1)
15. FIRST GEAR CLUTCH HUB
16. FIRST GEAR SHIFTING PLATE (3)
17. FIRST GEAR SNAP RING
18. REVERSE GEAR BUSHING (INCLUDED WITH REVERSE GEAR)
19. REVERSE GEAR
20. COUNTERSHAFT GEAR THRUST WASHER (REAR)
21. COUNTERSHAFT GEAR BEARING WASHER (4)
22. COUNTERSHAFT GEAR BEARING ROLLERS (44)
23. COUNTERSHAFT GEAR BEARING SPACER
24. COUNTERSHAFT GEAR
25. COUNTERSHAFT-REVERSE IDLER SHAFT LOCKPLATE
26. COUNTERSHAFT
27. COUNTERSHAFT GEAR THRUST WASHER (FRONT)
28. REVERSE IDLER GEAR THRUST WASHER (2)
29. REVERSE IDLER GEAR
30. REVERSE IDLER GEAR BEARING ROLLERS
31. REVERSE IDLER GEAR SHAFT
32. MAINSHAFT LOCKNUT
33. MAINSHAFT WASHER
34. MAINSHAFT BEARING SPACER
35. REAR BEARING ADAPTER
36. REAR BEARING LOCK RING
37. REAR BEARING
38. TRANSMISSION CASE
39. FILL PLUG
40. DRAIN PLUG
41. CLUTCH SHAFT
42. FRONT BEARING RETAINER
43. FRONT BEARING
44. FRONT BEARING LOCK RING
45. FRONT BEARING SNAP RING
46. FRONT BEARING CAP GASKET
47. FRONT BEARING CAP OIL SEAL
48. FRONT BEARING CAP
49. FRONT BEARING CAP BOLT
50. LOCKWASHER

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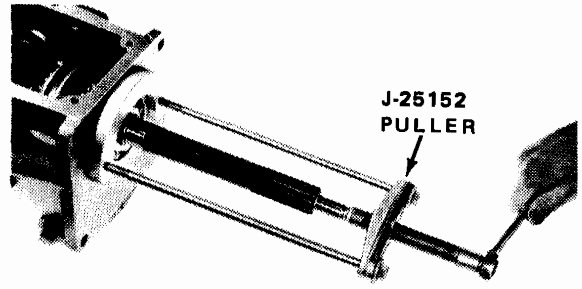

Fig. 6-19 Front Bearing Removal

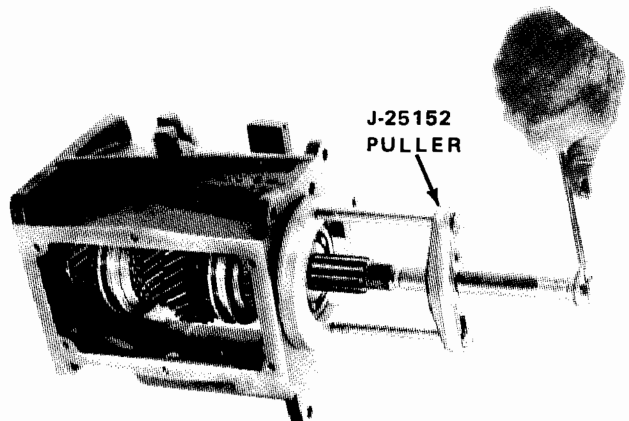

Fig. 6-20 Rear Bearing Removal

- Bent or broken inserts.
- Weak insert springs.
- Damaged needle bearings or bearing bores in countershaft gear.
- Wear or galling of countershaft, clutch shaft, or idler gear shafts.
- Worn thrust washers.
- Nicked, broken, or worn main shaft or clutch shaft splines.
- Bent, distorted, weak snap rings.
- Worn bushings in reverse idler gear.
- Rough, galled, or broken front or rear bearing.

If any transmission gears require replacement, also replace gear with which it meshes.

NOTE: *Should either synchronizer assembly be replaced for any reason, the shift fork that operates the synchronizer being replaced must have an identifying letter A appearing just under the shaft hole on the side opposite the pin. If the letter A does not appear on the existing fork, it must be replaced with a letter A fork.*

ASSEMBLY

Lubricate all parts with transmission lubricant during assembly unless noted otherwise.

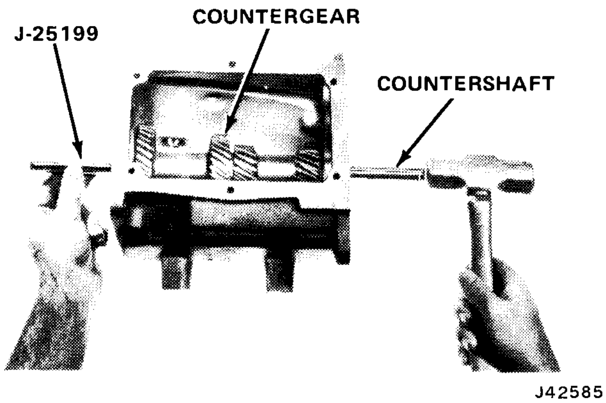

Fig. 6-21 Countershaft Removal-Installation

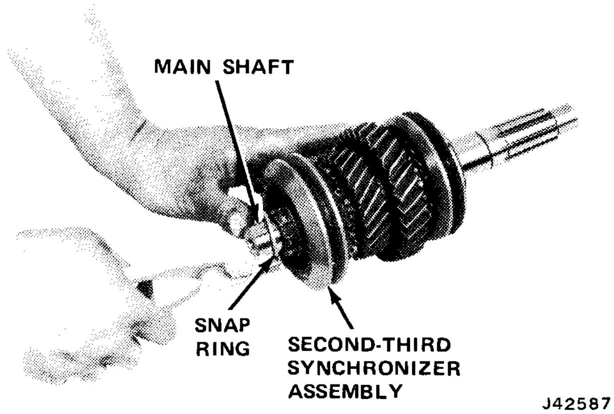

Fig. 6-23 Second-Third Clutch Hub Snap Ring Removal—Installation

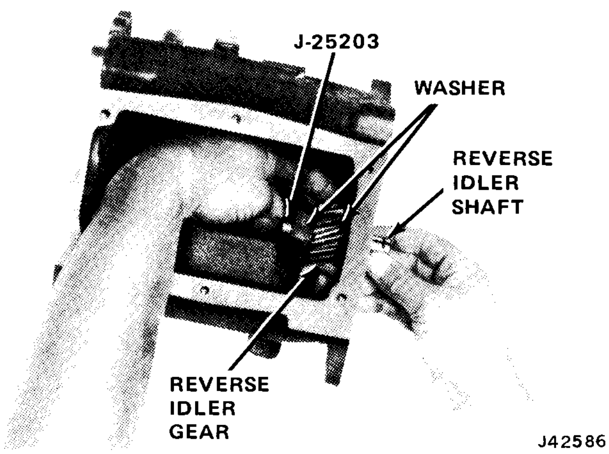

Fig. 6-22 Reverse Idler Gear Removal—Installation

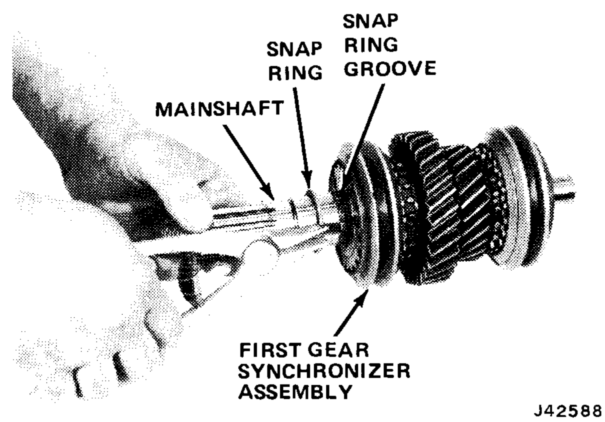

Fig. 6-24 First Gear Synchronizer Hub Snap Ring Removal—Installation

(1) Install reverse idler gear, roller bearings, and thrust washer using Tool J-25203.

(2) Install reverse idler gear shaft (forcing out Tool J-25203). Be sure slotted end of shaft is correctly aligned with lock plate.

(3) Install center spacer and Arbor Tool J-25199 in countershaft gear bore.

(4) Install bearing washer at each end of center spacer. Slide washers over arbor tool until seated against spacer.

(5) Install 22 roller bearings at each end of countershaft gear and install bearing washer over roller bearings at each end of gear (fig. 6-27 and 6-28).

(6) Coat large countershaft gear thrust washer with petroleum jelly and install at front of case.

(7) Coat small countershaft gear thrust washer with petroleum jelly and install on countershaft gear hub with lip facing groove in case.

(8) Position countershaft gear assembly in case. Align gear bores with case bores and install countershaft from rear of case. Be sure lock plate slot in shaft is correctly aligned with slot in reverse idler gear shaft. Arbor tool will be forced out as countershaft is installed.

(9) Install lock plate in slots of reverse idler shaft and countershaft. Tap end of shafts until lock plate is seated against case (fig. 6-30).

(10) Install First gear and blocking ring on main shaft.

(11) Assemble First gear synchronizer assembly (fig. 6-26). Index sleeve to hub using alignment marks made at disassembly. Install sleeve shifting plates and insert spring and install assembly on main shaft.

(12) Install First gear clutch hub snap ring (fig. 6-24).

NOTE: *Main shaft snap rings are select-fit to eliminate clutch hub and main shaft bearing end play. Be sure correct snap ring is installed.*

(13) Install Second gear and blocking ring on main shaft.

(14) Assemble Second-Third synchronizer assembly (fig. 6-25). Index sleeve to hub using alignment marks

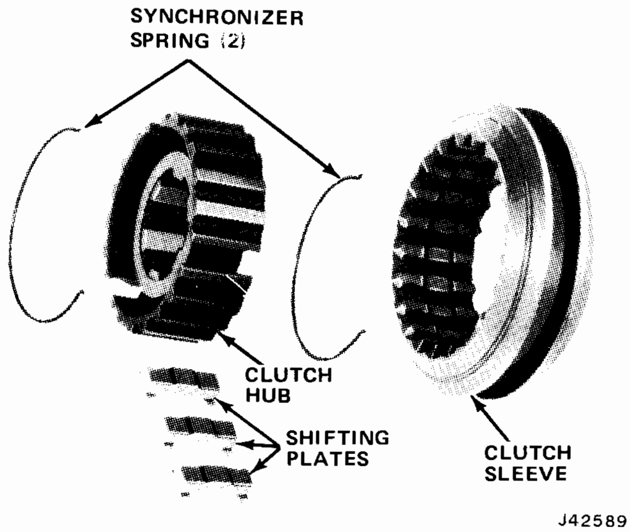

Fig. 6-25 Second-Third Synchronizer Assembly

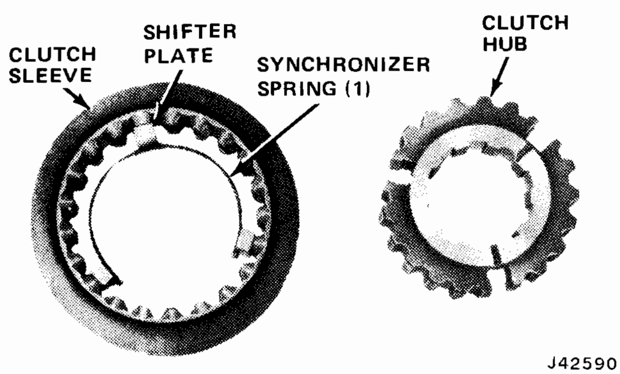

Fig. 6-26 First Gear Synchronizer Assembly

made at disassembly. Install shifting plates and insert springs. Be sure insert springs are installed with open ends opposite one another or approximately 120° apart.

(15) Install Second-Third synchronizer assembly on main shaft and install synchronizer snap ring and blocking ring.

NOTE: *Main shaft snap rings are select-fit to eliminate clutch hub and main shaft bearing end play. Be sure correct snap ring is installed.*

(16) Install Reverse gear on main shaft.

(17) Install main shaft and gear assembly in case.

(18) Install main shaft pilot bearing rollers in clutch shaft bore. Use petroleum jelly to hold rollers in place.

CAUTION: *Do not use chassis grease or similar heavy grease in clutch shaft bore. This type of grease may plug clutch shaft lubricant holes, preventing proper lubrication of roller bearings.*

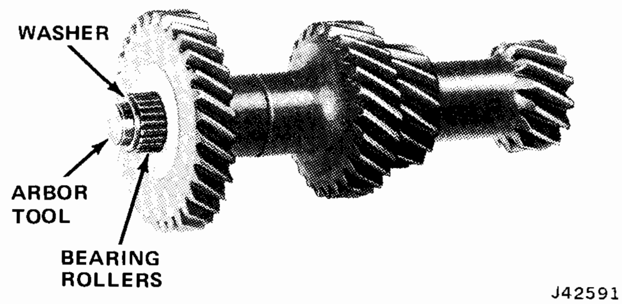

Fig. 6-27 Countershaft Gear Arbor Tool Installed

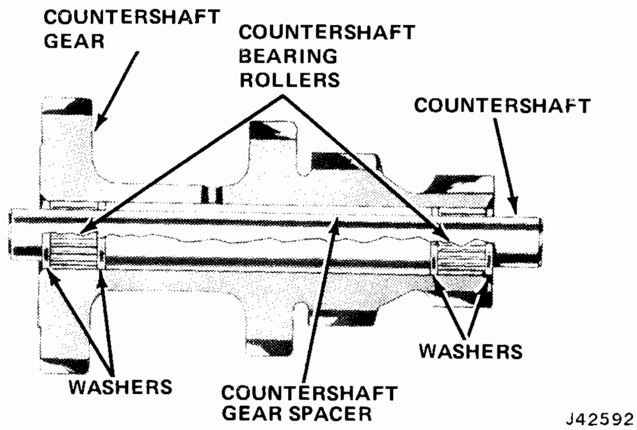

Fig. 6-28 Bearing, Spacer, and Washer Location

(19) Install clutch shaft in case with cutaway portion of shaft facing downward (fig. 6-30). Guide shaft onto main shaft. Do not displace main shaft pilot bearing rollers during installation.

(20) Install front bearing retainer on clutch shaft.

(21) Install lockrings on front and rear bearings and install bearings using Installer Set J-25153 and Thrust Yoke Tool J-25200 (to prevent damaging synchronizer parts during bearing installation).

(22) Install thrust yoke tool into Second gear groove and between clutch shaft teeth and blocking ring. Use both bearing driver tools from set J-25153 and wooden backup block when installing bearings (fig. 6-31 and 6-32).

(23) Install front and rear bearing retaining snap rings.

NOTE: *The rear bearing snap ring is 0.010-inch thicker than front bearing snap ring. Be sure correct snap ring is installed.*

(24) Install rear bearing adapter, spacer, transfer case drive gear, flat washer, and locknut. Tighten locknut to 150 foot-pounds torque.

(25) Inspect front bearing cap oil seal. Replace seal if cut, worn, loose, or distorted (fig. 6-33).

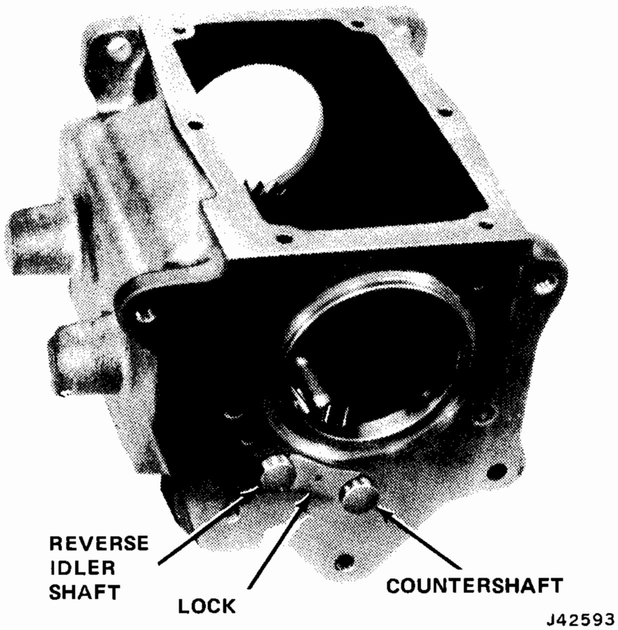

Fig. 6-29 Lock Plate Installation

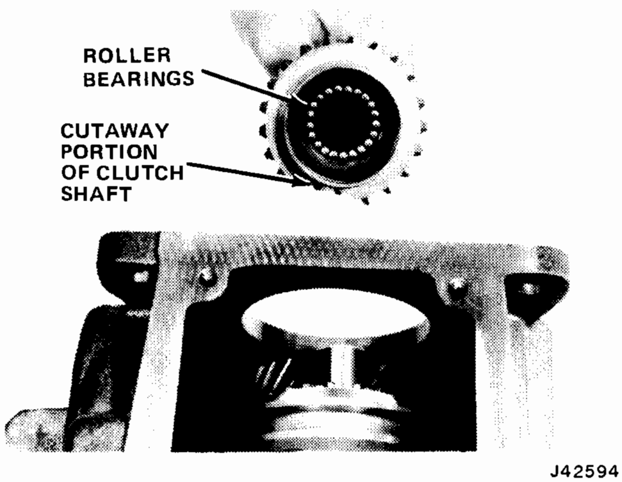

Fig. 6-30 Clutch Shaft Installation

(26) Install front bearing cap and gasket. Be sure oil drain slot in cap and gasket are aligned with hole in case. Tighten bearing cap bolts to 15 foot-pounds torque.

(27) Check operation of gears in all positions. Be sure gears are in Neutral position before installing case cover and gasket.

(28) Assemble transmission and transfer case. Tighten attaching bolts to 30 foot-pounds torque. Use new transfer case-to-transmission gasket during assembly.

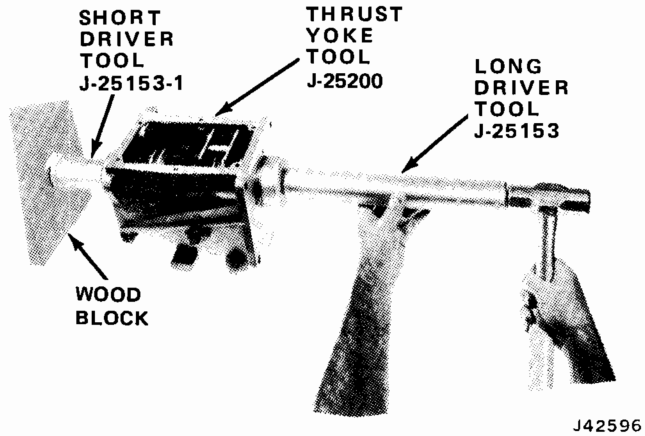

Fig. 6-31 Front Bearing Installation

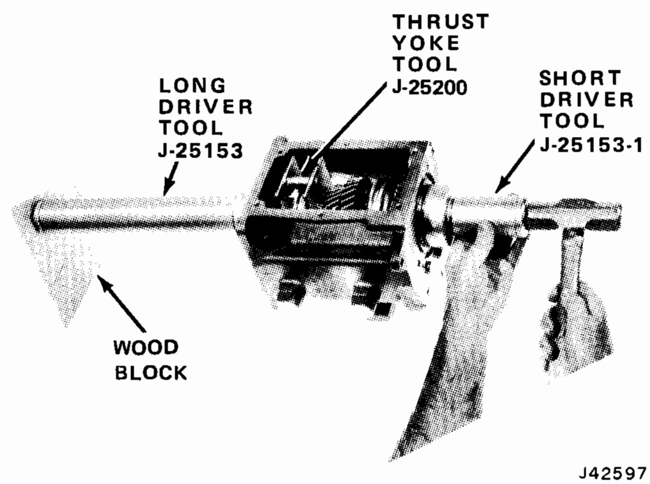

Fig. 6-32 Rear Bearing Installation

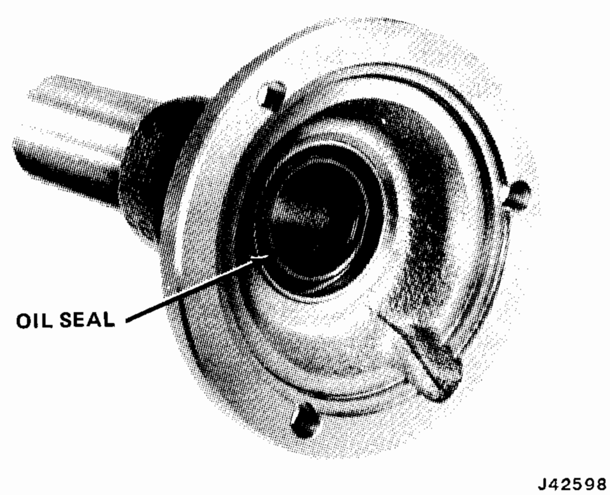

Fig. 6-33 Front Bearing Cap Oil Seal

SHIFT CONTROL HOUSING

Disassembly

(1) Remove TCS switch and backup lamp switch.

(2) Remove shift rail sealing plugs from rear of control housing (fig. 6-34). Remove plugs by driving them sideways in bore then prying them out.

(3) Place First and Reverse shift rail in First gear position.

(4) Remove roll pin from First and Reverse shift fork and rail.

(5) Slide First and Reverse fork rearward to expose roll pin hole in rail.

(6) Insert tapered punch in roll pin hole in shaft.

(7) Rotate First and Reverse rail toward Second and Third rail to align groove at rear of First and Reverse rail with interlock plunger. Slide First and Reverse rail forward as far as possible.

(8) Remove interlock plunger.

NOTE: *Before removing rail, cover poppet ball holes with cloth to prevent loss of ball and spring.*

(9) Rotate First and Reverse rail away from Second and Third rail and, at same time, push rail rearward out of control housing.

(10) Remove roll pin from Second and High shift fork and rail.

NOTE: *Before removing rail, cover poppet ball holes with cloth to prevent loss of ball and spring.*

(11) Remove Second and Third shift rail.

(12) Remove shift lever retainer spring and shift lever.

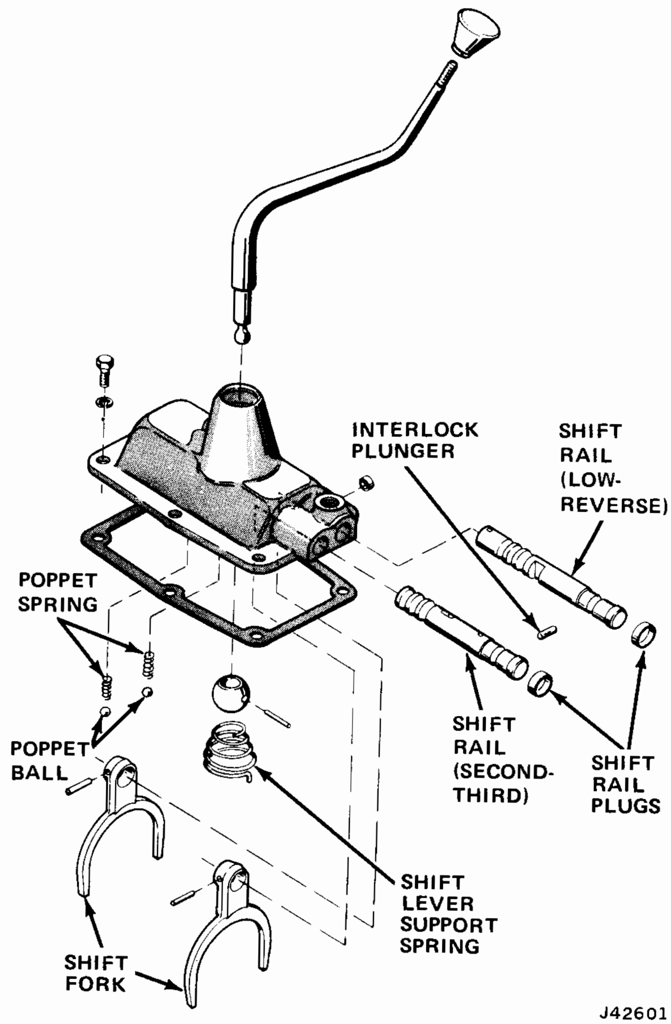

Fig. 6-34 Shift Control Housing—3-Speed Transmission

Assembly

(1) Install shift lever and retainer spring.

NOTE: *Small end of spring cone should be against lever ball. Be sure spring is snapped in behind shoulders in cover.*

(2) Slide Second and Third shift rail into housing to poppet boss.

(3) Insert poppet spring and ball.

(4) Compress ball and spring and slide rail just through boss.

(5) Rotate rail to position shift lever slot toward center of housing.

(6) Install Second-Third fork with flanged side of fork toward front of housing.

(7) Install roll pin.

(8) Hold First-Second shift fork in position, with flange side of fork toward rear of housing.

(9) Slide First-Second shift rail into housing, through fork, to poppet boss.

(10) Insert and compress poppet spring and ball.

(11) Push shift rail as far forward as possible.

(12) Install interlock plunger. Be sure Second-Third shift rail is in Neutral position and that interlock end of rod faces away from housing.

(13) Move rail backward until end of rail contacts interlock plunger.

(14) Rotate rail to align notch with interlock plunger, then move rail as far backward as possible.

(15) Rotate rail to align roll pin holes in rail and fork.

(16) Install roll pin.

(17) Install shift rail sealing plugs, backup lamp switch, and TCS switch.

MODEL T-18 4-SPEED TRANSMISSION

DISASSEMBLY

(1) Separate transmission and transfer case.

(2) Remove shift control housing.

(3) Move Third-Fourth gear hub forward and First-Second gear hub rearward and remove locknut, flat washer, transfer case drive gear and spacer.

(4) Move Third-Fourth gear hub to Neutral position.

(5) Remove transmission-to-transfer case adapter (if equipped). Remove oil seal from adapter. Replace seal if damaged.

(6) Remove Reverse shifting arm, shifting arm shoe, pivot pin, and pivot. Remove O-ring from pivot and discard.

CAUTION: *Pivot pin is tapered and must be driven out toward rear of case only.*

(7) Move First-Second gear hub to Neutral position.

(8) Punch alignment marks in front bearing cap and case for assembly reference and remove cap and gasket.

(9) Remove lockring from clutch shaft and snap ring from front bearing (fig. 6-35).

(10) Remove front bearing from clutch shaft using Puller Set J-25152 (fig. 6-37).

(11) Remove front bearing retaining washer from clutch shaft.

(12) Remove speedometer drive gear spacer.

(13) Remove snap ring from rear bearing and remove rear bearing using Puller Set J-25152.

NOTE: *If bearing puller plates will not seat in groove of rear bearing, strike end of clutch shaft with lead hammer to drive main shaft rearward and expose bearing groove.*

(14) Move Third-Fourth clutch sleeve rearward and disengage main shaft from clutch shaft.

(15) Remove main shaft and gear assembly.

(16) Remove clutch shaft.

(17) Remove main shaft pilot bearing rollers from clutch shaft.

(18) Remove lock plate from countershaft and reverse idler gear shaft.

(19) Remove reverse idler gear shaft. Use pry bar in lock plate slot of shaft to pry shaft out of gear and case.

(20) Remove reverse idler gear assembly.

(21) Drive countershaft toward rear of case using brass drift and hammer. Stop when shaft is approximately even with front inside edge of case bore.

(22) To complete removal of countershaft, make dummy shaft tool from steel rod that is 1.115-inches in diameter by 9.85-inches long. Use file to break all sharp edges on tool. When removing countershaft, keep tool in constant contact with countershaft to avoid displacing roller bearings or washers.

(23) Remove countershaft gear and thrust washers. Tip case on side and roll gear out. Remove any main shaft pilot bearing rollers that may have fallen into case during main shaft removal.

(24) Remove dummy shaft tool from countershaft gear and remove bearing rollers, washers, and spacer.

(25) Remove snap rings, bearing rollers, washers, and sleeve from reverse idler gear.

(26) Remove power takeoff cover and fill and drain plugs from case.

Main Shaft Gear Train—Disassembly

(1) Scribe alignment marks on main shaft splines and clutch hubs for assembly reference.

(2) Remove pilot bearing spacer from front of main shaft (fig. 6-35).

(3) Remove Third-Fourth synchronizer snap ring and remove Third-Fourth synchronizer assembly and Third gear (fig. 6-35).

(4) Remove First-Second synchronizer snap ring and remove First-Second synchronizer assembly (fig. 6-36).

(5) Move Second gear rearward. Remove Second gear snap ring and remove Second gear.

(6) Punch alignment marks on clutch hubs and sleeves for assembly reference.

(7) Remove insert springs and shifting plates from Third-Fourth synchronizer assembly and separate sleeve and hub.

NOTE: *Observe position of insert springs and shift plates before disassembly for assembly reference.*

(8) Position First-Second synchronizer assembly on bench with shift fork groove facing upward. Wrap cloth around sleeve (to avoid losing shift plate lock balls) and separate sleeve and hub.

(9) Remove cloth from First-Second synchronizer assembly and remove lock balls, springs, and shift plates.

Cleaning and Inspection

Clean and inspect transmission case and all components thoroughly. If any transmission gear requires replacement, also replace the gear with which it meshes. Use new gaskets, oil seals, and snap rings during assembly.

Inspect transmission case for cracks, bearing bosses for wear or scoring which would indicate that the bearing has been revolving in its housing. Examine ball bearings for cracked races and worn balls, for proper fit on shaft, and for tight fit in case bores. Inspect teeth of all gears for cracks, chips, or spots where case hardening is worn through. Main shaft gears should slide on and off shaft smoothly without bind or excessive play. Inspect synchro-blocking rings for excessive wear or pitting of tapered area of ring. If condition of thrust washers is doubtful, replace them.

Check all bearing rollers for flat spots, pitting, cracks, or other damage. Replace rollers as required. Inspect countershaft and reverse idler shafts for pitting, wear, scores, nicks, cracks, and flat spots. Small nicks or scores can be reduced using crocus cloth or fine file. Replace shafts if severely worn or damaged. Inspect main shaft and synchronizer hubs and sleeves for damaged or worn splines, cracks, worn pilot hub on main shaft and damaged threads on main shaft. Replace parts as required. Check Reverse shifting arm and pivot pin for wear or other damage, and replace if necessary.

ASSEMBLY

Reverse Idler Gear

NOTE: *Use petroleum jelly for assembly and initial lubrication of all components.*

(1) Install snap ring in one end of reverse idler gear.

(2) Install thrust washer in gear bore against snap ring.

(3) Install sleeve in gear bore and insert one set of 37 roller bearings, then install spacer, 37 more roller bearings, and second thrust washer and snap ring in gear.

Countershaft Gear

(1) Use dummy shaft tool to assemble countershaft gear.

(2) Lubricate bearing spacer sleeve, and install sleeve and dummy shaft into countershaft gear.

(3) Insert one bearing spacer over dummy shaft against spacer sleeve.

(4) Insert 22 roller bearings.

(5) Insert second bearing spacer and 22 more roller bearings, followed by third spacer.

(6) Repeat assembly operation at opposite end of countershaft gear.

Second Gear Synchronizer

NOTE: *Use Third-Fourth gear synchronizer hub to aid in assembly of Second-gear synchronizer assembly.*

(1) Place Third-Fourth clutch hub on work bench.

(2) Place First-Second clutch sleeve over Third-Fourth hub with shift fork groove facing downward (fig. 6-38).

(3) Align punch marks and insert First-Second clutch hub in sleeve with lock ball holes facing up (fig. 6-39).

(4) Insert shifting plates in slots of hub.

(5) Install poppet spring through shifting plate.

(6) Compress spring with lock ball while pressing on shifting plate until poppet ball is held in position by synchronizer sleeve. Repeat operation until three shifting plates, poppet springs, and lock balls are installed in sleeve.

(7) Complete assembly by pressing down on hub and pulling up on sleeve (fig. 6-39).

Third-Fourth synchronizer clutch hub and sleeve.

(1) Align punch marks made at disassembly.

(2) Insert three shifting plates in slots of hub. Install retaining rings so one end of each ring is hooked into same shifting plate (fig. 6-40).

Clutch Shaft

(1) Using petroleum jelly, install 22 roller bearings into bore of clutch shaft.

(2) Coat blocking ring with petroleum jelly and install on clutch shaft.

Main Shaft and Gear Assembly

(1) Install Second gear from front of main shaft (fig. 6-41).

(2) Install thrust washer with step bore toward front of main shaft.

(3) Install snap ring. Be certain step bore of thrust washer fits over snap ring (fig. 6-41).

(4) From rear of main shaft, install Second gear rear snap ring, blocking ring, First-Second synchronizer assembly and snap ring.

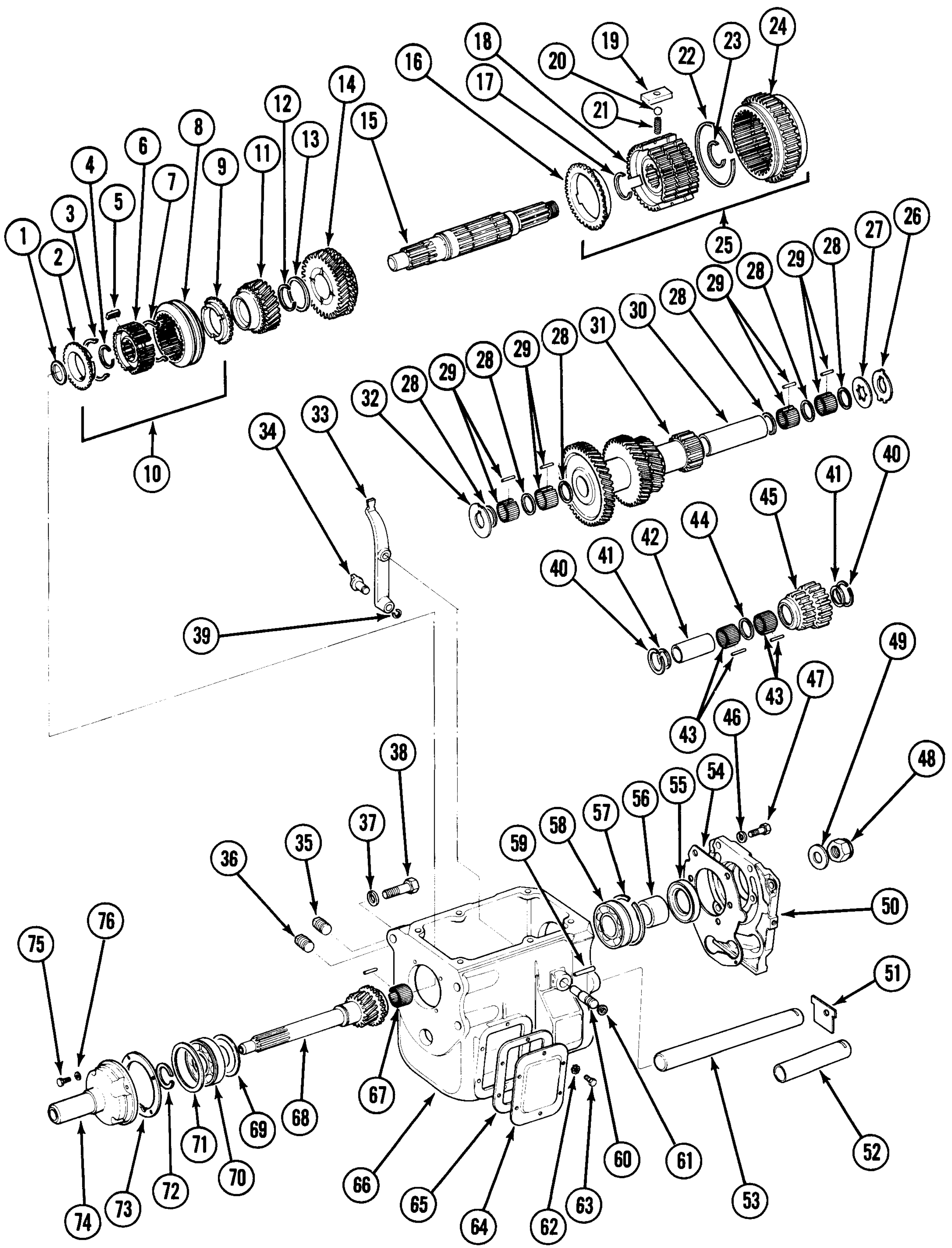

Fig. 6-35 Model T-18A Transmission

Legend

1. MAINSHAFT PILOT BEARING SPACER
2. THIRD-FOURTH BLOCKING RING
3. THIRD-FOURTH RETAINING RING
4. THIRD-FOURTH SYNCHRONIZER SNAP RING
5. THIRD-FOURTH SHIFTING PLATE (3)
6. THIRD-FOURTH CLUTCH HUB
7. THIRD-FOURTH RETAINING RING
8. THIRD-FOURTH CLUTCH SLEEVE
9. THIRD-FOURTH BLOCKING RING
10. THIRD-FOURTH GEAR SYNCHRONIZER ASSEMBLY
11. THIRD GEAR
12. MAINSHAFT SNAP RING
13. SECOND GEAR THRUST WASHER
14. SECOND GEAR
15. MAINSHAFT
16. SECOND GEAR BLOCKING RING
17. MAINSHAFT SNAP RING
18. FIRST-SECOND CLUTCH HUB
19. FIRST-SECOND SHIFTING PLATE (3)
20. POPPET BALL (3)
21. POPPET SPRING (3)
22. FIRST-SECOND RETAINING RING
23. MAINSHAFT SNAP RING
24. FIRST-SECOND CLUTCH SLEEVE
25. SECOND GEAR SYNCHRONIZER ASSEMBLY
26. COUNTERSHAFT GEAR THRUST WASHER (STEEL) (REAR)
27. COUNTERSHAFT GEAR THRUST WASHER (STEEL BACKED BRONZE) (REAR)
28. COUNTERSHAFT GEAR BEARING WASHER
29. COUNTERSHAFT GEAR BEARING ROLLERS (88)
30. COUNTERSHAFT GEAR BEARING SPACER
31. COUNTERSHAFT GEAR
32. COUNTERSHAFT GEAR THRUST WASHER (FRONT)
33. REVERSE SHIFTING ARM
34. REVERSE SHIFTING ARM SHOE
35. FILLER PLUG
36. DRAIN PLUG
37. LOCKWASHER
38. BOLT (TRANSMISSION-TO-CLUTCH HOUSING)
39. C-WASHER
40. REVERSE IDLER GEAR SNAP RING
41. REVERSE IDLER GEAR THRUST WASHER
42. REVERSE IDLER SHAFT SLEEVE
43. REVERSE IDLER GEAR BEARING ROLLERS (74)
44. REVERSE IDLER GEAR BEARING WASHER
45. REVERSE IDLER GEAR
46. LOCKWASHER (6)
47. ADAPTER PLATE BOLTS (6)
48. MAINSHAFT NUT
49. WASHER
50. ADAPTER PLATE
51. COUNTERSHAFT-REVERSE IDLER SHAFT LOCKPLATE
52. REVERSE IDLER GEAR SHAFT
53. COUNTERSHAFT
54. ADAPTER PLATE GASKET
55. ADAPTER PLATE SEAL
56. SPEEDOMETER GEAR SPACER
57. REAR BEARING RETAINER
58. REAR BEARING
59. REVERSE SHIFTING ARM PIVOT PIN
60. REVERSE SHIFTING ARM PIVOT
61. REVERSE SHIFTING ARM PIVOT O-RING
62. WASHER (6)
63. SIDE COVER BOLT (6)
64. SIDE COVER
65. SIDE COVER GASKET
66. TRANSMISSION CASE
67. MAINSHAFT PILOT BEARING ROLLERS (22)
68. CLUTCH SHAFT
69. FRONT BEARING RETAINER WASHER
70. FRONT BEARING
71. FRONT BEARING SNAP RING
72. FRONT BEARING LOCK RING
73. FRONT BEARING CAP GASKET
74. FRONT BEARING CAP
75. FRONT BEARING CAP BOLTS (4)
76. LOCKWASHER (4)

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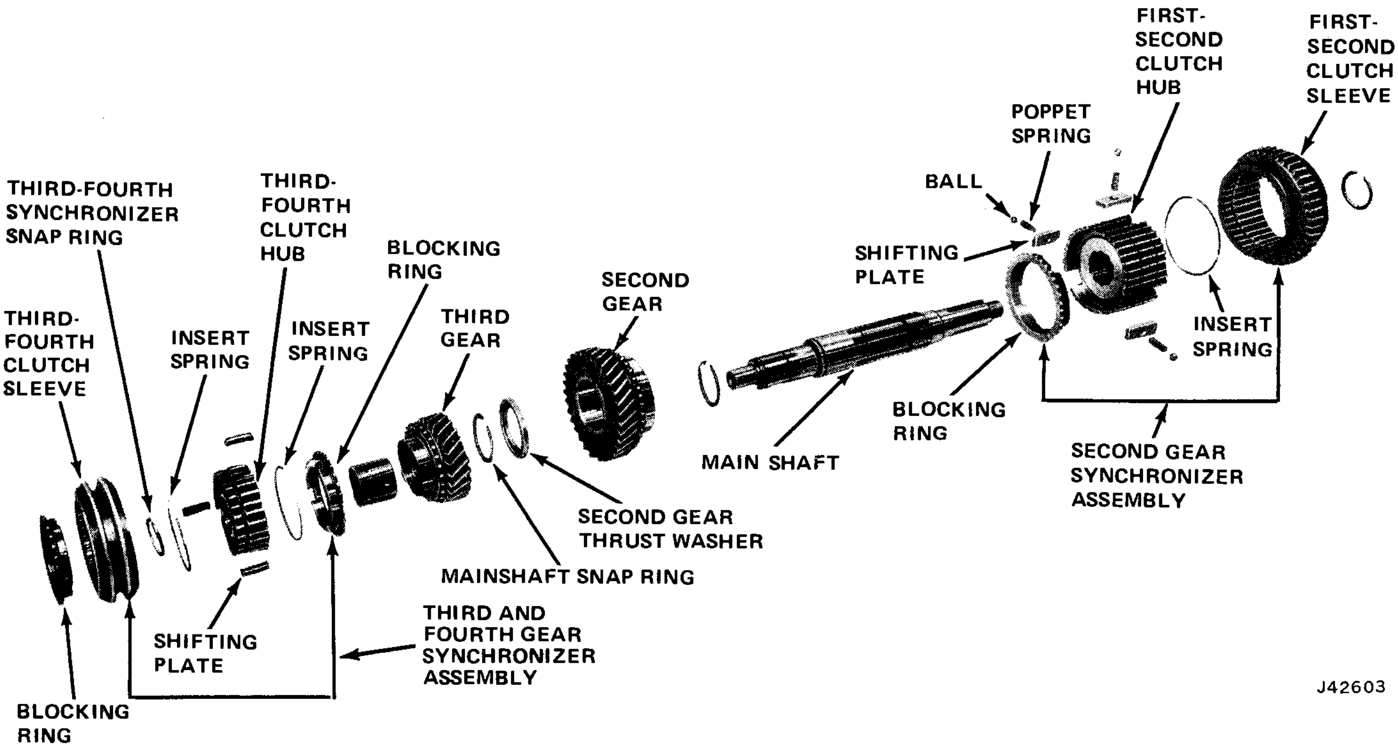

Fig. 6-36 Main Shaft Assembly

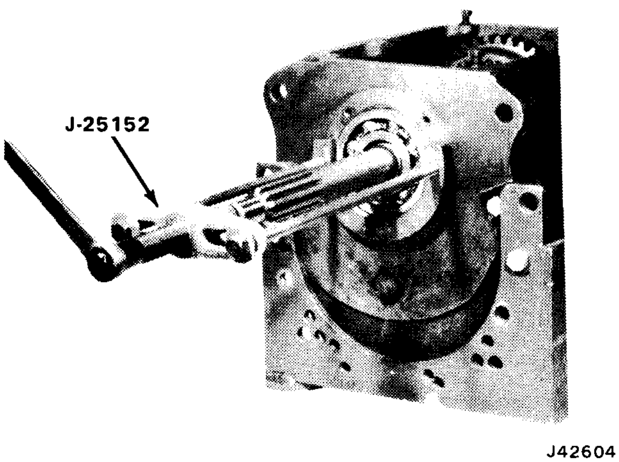

Fig. 6-37 Front Bearing Removal

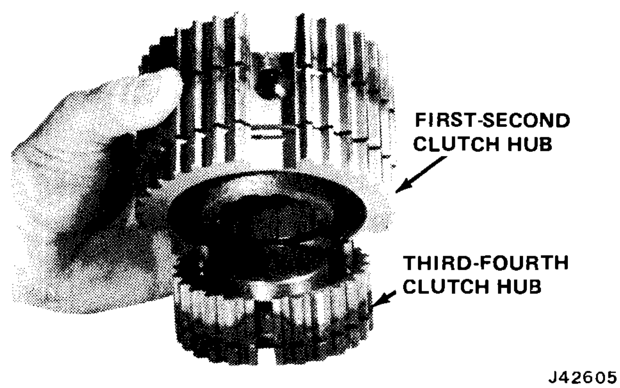

Fig. 6-38 Supporting First-Second Clutch Hub

NOTE: *Second gear synchronizer sleeve shift fork groove must face rear of main shaft (fig. 6-42).*

(5) Install Third gear, blocking ring, Third-Fourth synchronizer assembly, snap ring, and main drive gear roller bearing thrust washer.

NOTE: *Third-Fourth synchronizer unit must be installed with chamfered side of hub facing front of main shaft (fig. 6-43).*

Transmission Case

(1) Install countershaft thrust washers. Coat washers with petroleum jelly. Index tab of large bronze faced washer in recessed area at front of case. Index notch of smaller steel washer with lug at rear of case.

(2) Install countershaft gear assembly.

(3) Insert remaining countershaft thrust washer between end of countershaft gear and rear thrust washer.

(4) Insert countershaft from rear of case, keeping countershaft and dummy shaft in contact to prevent displacing bearing rollers or washers.

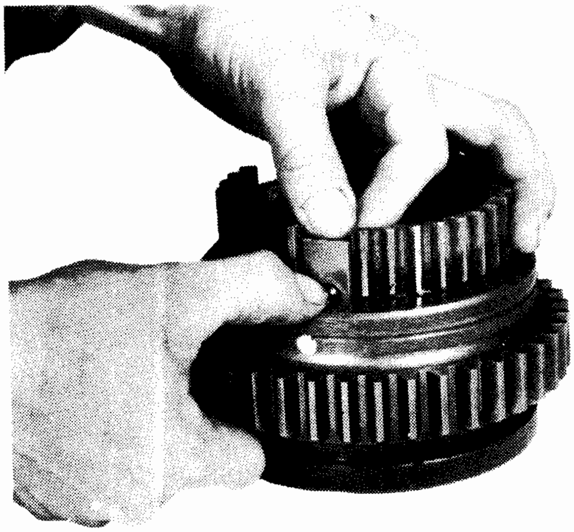

Fig. 6-39 Assembling Second Gear Synchronizer

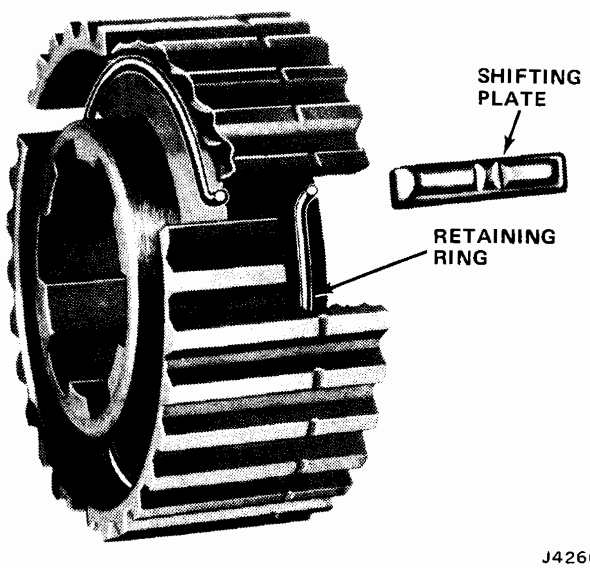

Fig. 6-40 Synchro-Plate and Retainer Installation

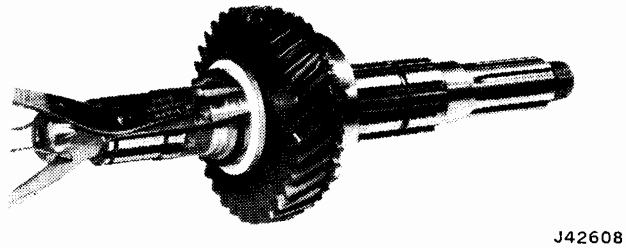

Fig. 6-41 Second Gear and Thrust Washer Installation

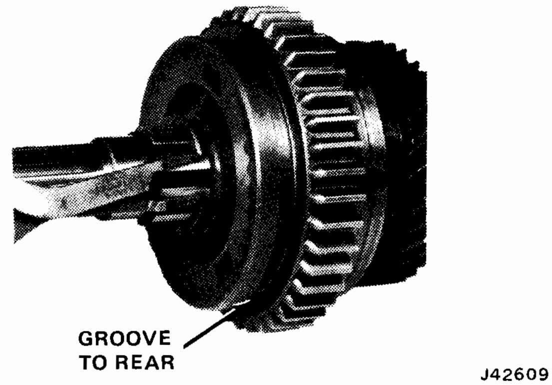

Fig. 6-42 Installing Second Gear Synchronizer Assembly

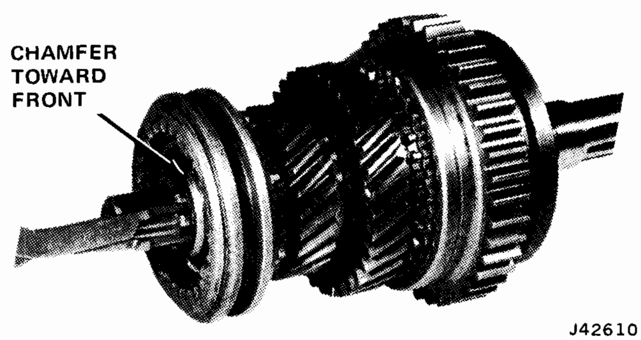

Fig. 6-43 Installing Third - Fourth Synchronizer Assembly

(5) Insert countershaft in front of case, but do not seat it until reverse idler gear and shaft have been installed.

(6) Install reverse idler gear with large gear facing rear of case.

(7) Insert reverse idler gear shaft from rear of case, and tap forward until lock plate slot is aligned with slot in countershaft.

(8) Insert lock plate in shafts making sure plate ends are square with slots in shafts.

(9) Install lock plate to act as a guide and tap shafts alternately into position.

(10) Insert clutch shaft assembly and Fourth gear blocking ring through transmission case into front bearing bore.

(11) Install main shaft and gear assembly.

(12) Be sure clutch shaft roller bearing spacer is on main shaft pilot and install main shaft pilot into bore of clutch shaft. Be sure roller bearings are not displaced and Fourth gear blocking ring notches are aligned with shifting plates.

(13) Temporarily install clutch shaft front bearing cap to support clutch shaft.

(14) Install snap ring on rear bearing. Drive bearing onto main shaft and into rear case bore. Seat snap ring against case.

(15) Install rear oil seal in transfer case adapter plate.

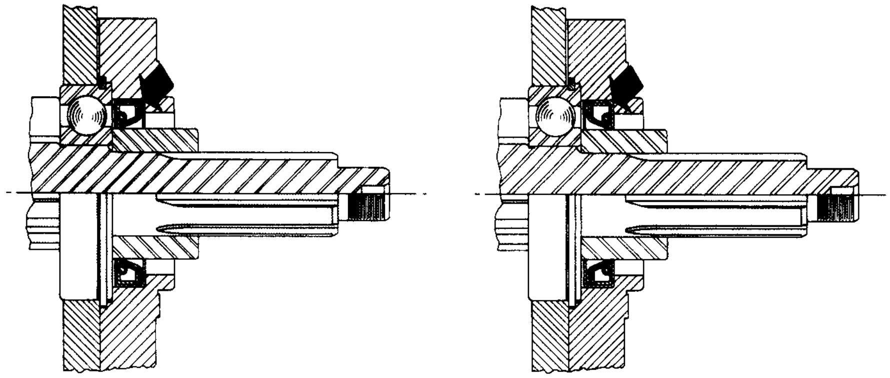

Fig. 6-44 Oil Seal Position

NOTE: *It is important that 4-speed transmission adapter plate oil seal be installed correctly to prevent flow of lubricant from transfer case to transmission. Correctly positioned, lip of oil seal is toward transfer case (fig. 6-44).*

(16) Coat lip of rear oil seal with petroleum jelly. Position transmission-to-adapter gasket on transmission and install adapter plate. Apply nonhardening sealer to attaching bolts.

(17) Remove front bearing cap and install front bearing retaining washer on clutch shaft with dished side of washer facing main shaft.

(18) Install front bearing on clutch shaft and into case bore using section of pipe or driver sleeve (fig. 6-45). Seat bearing against clutch shaft gear and bearing retaining washer.

(19) Install thickest of four available front bearing lockrings in groove of clutch shaft.

(20) Pull clutch shaft and front bearing out of case just far enough to permit installation of front bearing snap ring. Install snap ring and push clutch shaft into case until snap ring seats against case.

(21) Position front bearing cap gasket on front bearing cap. Coat threads of bearing cap attaching bolts with nonhardening sealer. Align oil return holes in cap, gasket, and case, and install attaching bolts. Tighten bolts to 15 foot-pounds torque.

(22) Check all synchronizer blocking rings for free movement. If blocking rings were wedged onto the tapered hubs of the clutch shaft, Third, and Second speed gears during front bearing installation, pry them free using screwdriver.

(23) Install Reverse shifting arm. Move First-Second synchronizer to rear to provide clearance.

(24) Install O-ring on Reverse shifting arm pivot.

(25) Engage Reverse shifting arm shoe in groove of reverse idler gear, align pivot holes in arm and case, and install pivot. Install tapered pivot pin from rear of pivot boss in case. Tap pivot pin with hammer until seated.

(26) Position power takeoff cover gasket on cover and install gasket ond cover. Use nonhardening sealer on cover attaching bolts. Tighten bolts to 12 foot-pounds torque.

(27) Install transfer case drive gear spacer, drive gear, flat washer and locknut. Move Third-Fourth synchronizer sleeve forward and First-Second synchronizer sleeve rearward to prevent main shaft from turning. Tighten locknut to 150 foot-pounds torque.

(28) Move synchronizer sleeves to Neutral position.

(29) Install fill and drain plugs and pour pint of gear lubricant over all gears while rotating main shaft.

(30) Install top cover gasket on transmission case and install shift control housing. Be sure shift forks engage synchronizer sleeves and that Reverse shift arm engages flat on Reverse shift rail. Install shift control housing attaching bolts and tighten to 12 foot-pounds torque.

(31) Shift gears through all positions to check operation.

(32) Assemble transfer case and transmission. Tighten attaching bolts to 30 foot-pounds torque.

SHIFT CONTROL HOUSING

Disassembly

(1) Remove shift lever (fig. 6-46).

(2) Mount housing in vise with shift forks facing upward.

(3) Remove backup lamp switch, spring, and plunger.

(4) Remove transmission controlled spark switch (TCS) if equipped.

(5) Remove shift rail plugs using small punch.

(6) Move shift rails to Neutral position.

(7) Remove Third-Fourth shift fork roll pin.

(8) Cover poppet ball holes in housing with tape to prevent losing springs and balls during removal.

(9) Remove Third-Fourth shift rail. Drive rail out rear of housing using brass drift and hammer. Remove shift fork, poppet ball and spring. Do not lose shift rail plug when rail is removed.

(10) Remove roll pins from Reverse rail end, First-Second shift fork, and First-Second rail end.

(11) Move First-Second rail forward and remove shift fork.

(12) Remove First-Second and Reverse shift rails. Drive rails out rear of case using brass drift and hammer. Reverse rail will drive backup lamp switch and adapter out of case as it is removed. Do not lose shift rail plugs when rails are removed.

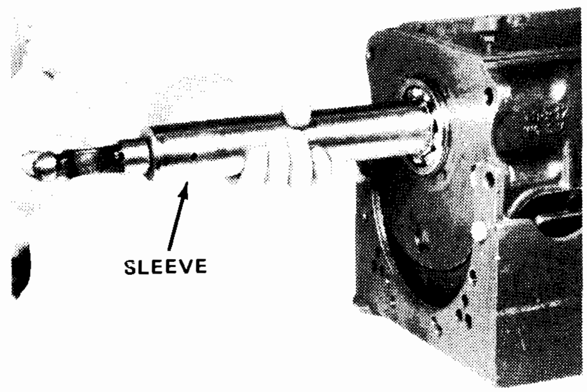

Fig. 6-45 Front Bearing Installation

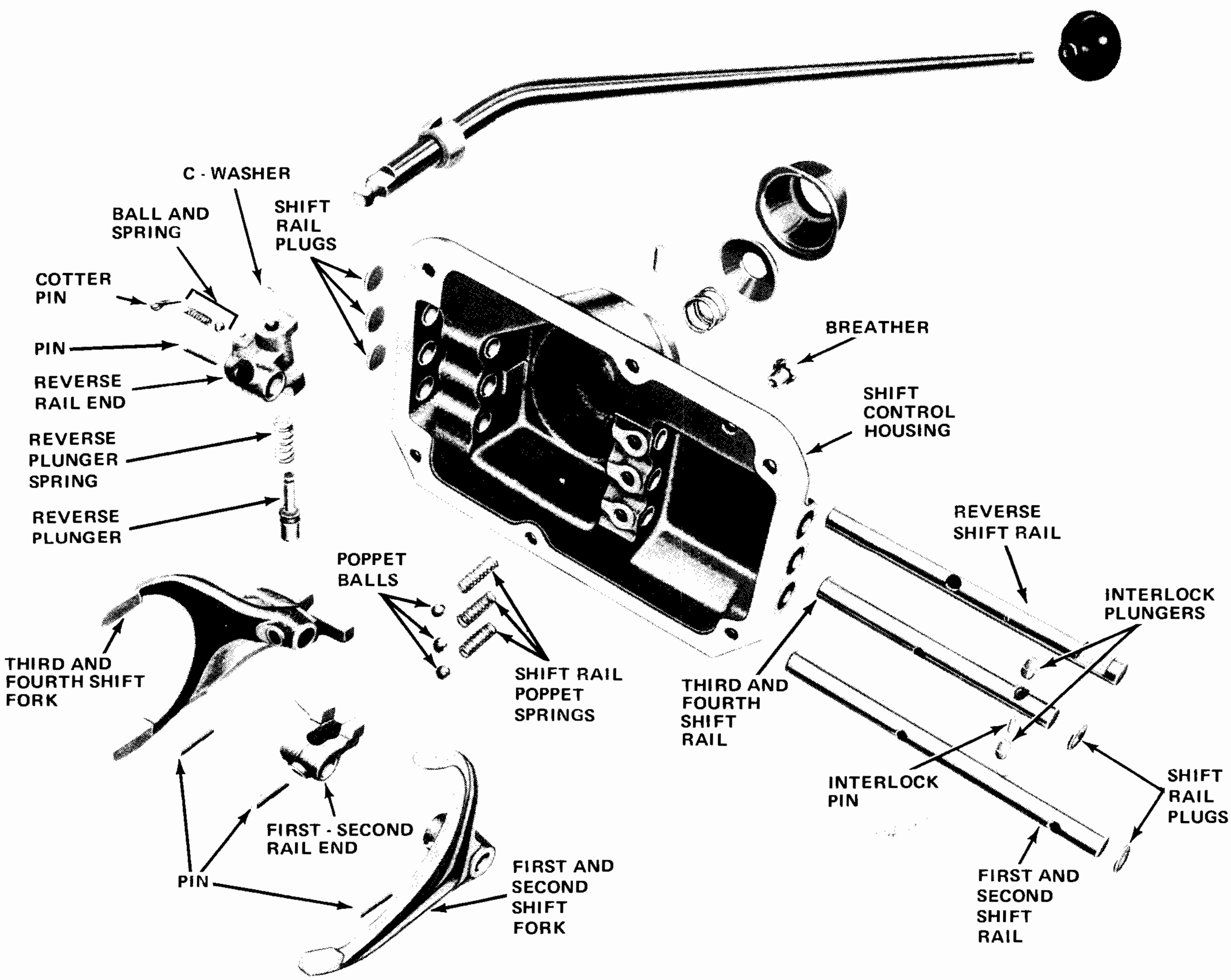

Fig. 6-46 Four-Speed Transmission Shift Control Housing

(13) Remove interlock plungers from housing bores using bent wire.

(14) Remove cotter pin from Reverse rail end and remove poppet ball and spring. Compress Reverse plunger and spring, remove C-clip from plunger, and remove plunger and spring.

(15) Inspect breather vent in housing. If damaged, remove vent.

Assembly

(1) Install breather vent if removed.

(2) Install Reverse plunger and spring in Reverse rail end. Compress plunger and spring and install C-clip. Install poppet ball, spring, and cotter pin in Reverse rail end.

(3) Install Reverse rail poppet ball and spring in housing bore. Compress ball and spring using punch and install Reverse shift rail.

(4) Install Reverse rail end on reverse rail. Be sure rail end is seated on machined edge of housing and C-clip faces outer edge of housing. Install lockpin in Reverse rail end.

(5) Install First-SEcond shift rail poppet ball and spring in housing bore. Compress ball and spring using punch and install First-Second shift rail.

(6) Move First-Second shift rail forward and install shift fork with roll pin hole in fork toward front of housing. Install roll in fork and move shift rail to Neutral position.

(7) Install interlock plungers in housing bores.

NOTE: *Shift rails must be in Neutral position in order to seat plungers completely in housing bores.*

(8) Install Third-Fourth shift rail poppet ball and spring in housing bore. Compress ball and spring using punch and install Third-Fourth shift rail.

(9) Install Third-Fourth shift fork on rail with roll pin hole in fork toward rear of housing. Install roll pin in fork and rail.

(10) Install shift lever and check operatin of shift rails and forks.

(11) Install shift rail plugs, TCS switch (if equipped), backup lamp swtich adapter, and backup lamp switch.

Specifications

	Three-Speed		Four-Speed	
Model	T-150	T-15A	T-18	
Type	Synchromesh	Synchromesh	Synchromesh	
Speeds	3 Forward-1 Reverse	3 Forward-1 Reverse	4 Forward-1 Reverse	
Ratios:			CJ	Cke - Trk
First	2.99:1	2.997 to 1	4.02 to 1	6.32 to 1
Second	1.75:1	1.832 to 1	2.41 to 1	3.09 to 1
Third	1.00:1	1.000 to 1	1.41 to 1	1.68 to 1
Fourth	–	–	1.00 to 1	1.00 to 1
Reverse	3.17:1	2.997 to 1	4.73 to 1	7.44 to 1

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Lubrication

End Play Tolerances

T150
- Countershaft Gear to Case . . . . . . 0.004 to 0.018 Inch
- Reverse Idler Gear to Case . . . . . . 0.004 to 0.018 Inch
- Mainshaft Gear Train . . . . 0.004 to 0.014 Inch

T15A – T18A
All end play controlled by selective thickness snap rings. Use thickest snap ring available.

Frequency
Inspect/Correct Fill Level . . . . Every 5000 Miles

Lubricants
SAE 80 or SAE 90 Gear Lubricant

Capacity
- T150 . . . . 3.0 Pints
- T15A . . . . 2.7 Pints
- T18A . . . . 6.5 Pints

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Torque Specifications

Service Set-To Torques should be used when assembling components.
Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Backup Lamp Switch – T150	18	15-20
Fill and Drain Plugs (All)	15	10-20
Front Bearing Cap Bolt		
T150	33	30-36
T15A	15	12-18
T18A	15	12-18
Shift Control Housing Bolts		
T15A–T18A	12	10-15
T150	22	20-25
Transfer Case Drive Gear Locknut (All)	150	145-155
Transfer Case-To-Transmission Case Bolts (All)	30	25-35
TCS Switch – T150	18	15-20

All torque values given in foot-pounds with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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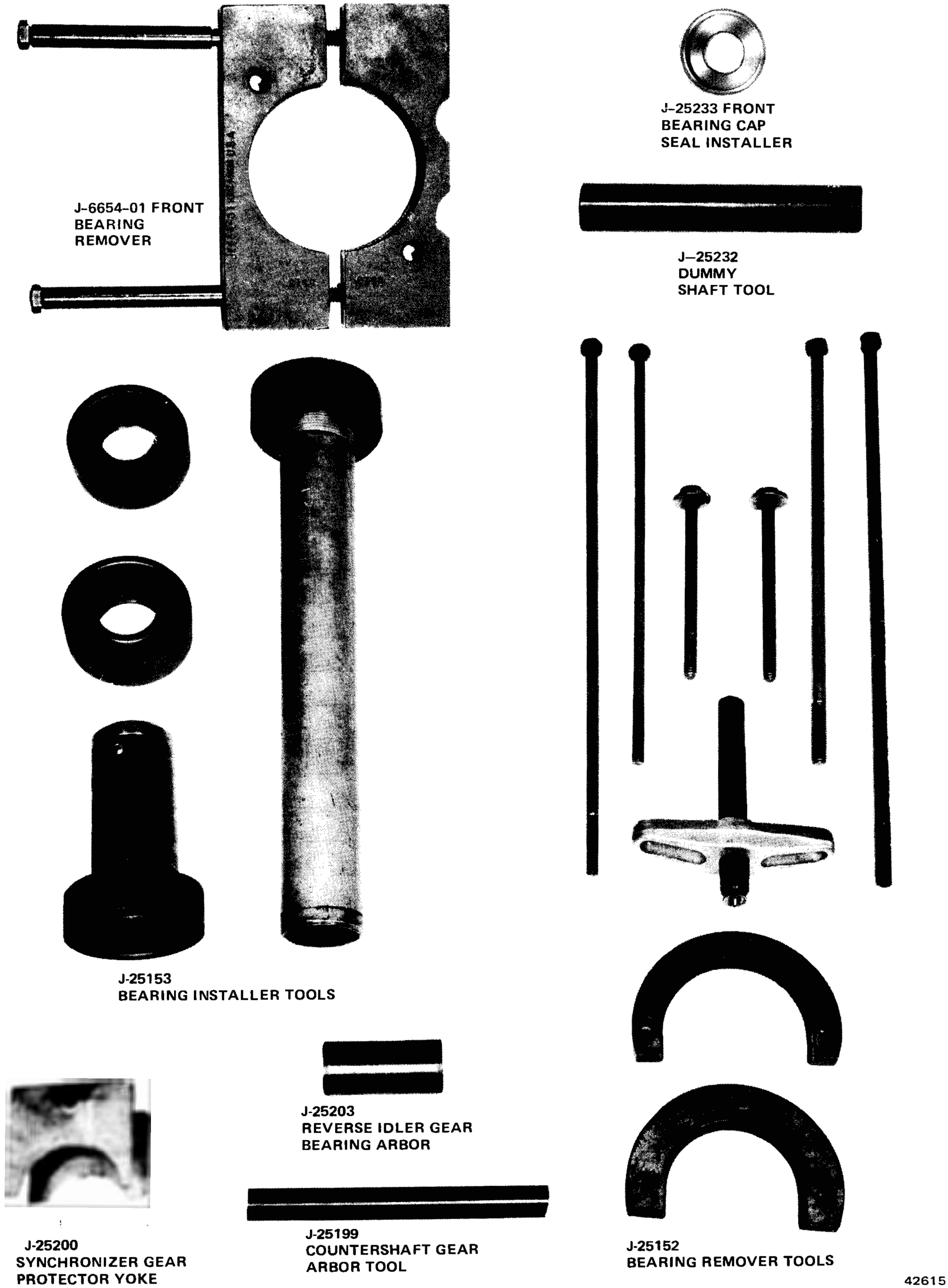


Fig. 6-47 Manual Transmission Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

TRANSFER CASE

MODEL 20 TRANSFER CASE

GENERAL

The Model 20 Transfer Case is a four-position type that provides two gear ratios in 4-wheel drive, one ratio in 2-wheel drive, and a neutral position. The 4-wheel drive low provides a reduction ratio of 2.03:1 for off-road use and applications that require increased pulling power. Four-wheel drive high and 2-wheel drive high both provide 1:1 ratio in the transfer case. Neutral position is used for stationary power takeoff applications such as winching. In neutral, power is not transmitted to the wheels.

IDENTIFICATION

An identification tag which displays the vendor and Jeep part number is attached to the intermediate shaft lockplate bolt. This information is necessary to obtain the correct service replacement parts.

POWER FLOW

Power flow through the transfer case in the four positions is shown in figures 8-1 through 8-4. The darkened areas of the illustrations show which gears are engaged and the positions of the gears in the various drive ranges.

Lubricant circulates between the transfer case and the transmission on the manual 3-speed transmission only.

TRANSFER CASE SHIFT SEQUENCE

Transfer case shifting is controlled by a lever located forward and just to the right of the transmission shift lever. The lever is connected through linkage to the shift rods on the transfer case and must be moved only through the sequence indicated on the top of the knob (fig. 8-5).

TOWING

Manual Transmission

Ignition Key Available: Shift transmission and transfer case into Neutral. Vehicle can now be towed with all four wheels on the ground or with front or rear wheels raised. If vehicle is equipped with selective drive hubs, set them in the FREE position.

Ignition Key Not Available and Vehicle is Unlocked: Shift transmission and transfer case into Neutral and tow vehicle with front wheels raised.

Ignition Key Not Available and Vehicle is Locked: Place dolly under rear wheels and tow vehicle with front end raised; or, disconnect rear propeller shaft at rear axle yoke (be sure to index mark propeller shaft and yoke for proper alignment at assembly), secure shaft to underside of vehicle, and tow with front end raised.

SERVICE PROCEDURES—IN VEHICLE

Shift Rod Oil Seal Replacement

(1) Disconnect transfer case shift rod control links.

(2) Install Puller Tool J-25175 and remove seal (fig. 8-6).

(3) Using thimble and Driver J-25167, install seal (fig. 8-7).

(4) Connect transfer case shift rod control links.

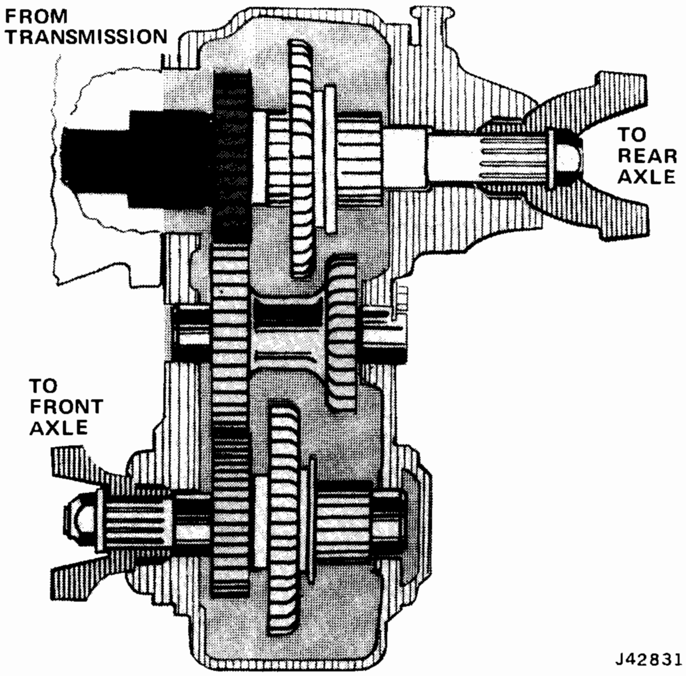


Fig. 8-1 Neutral

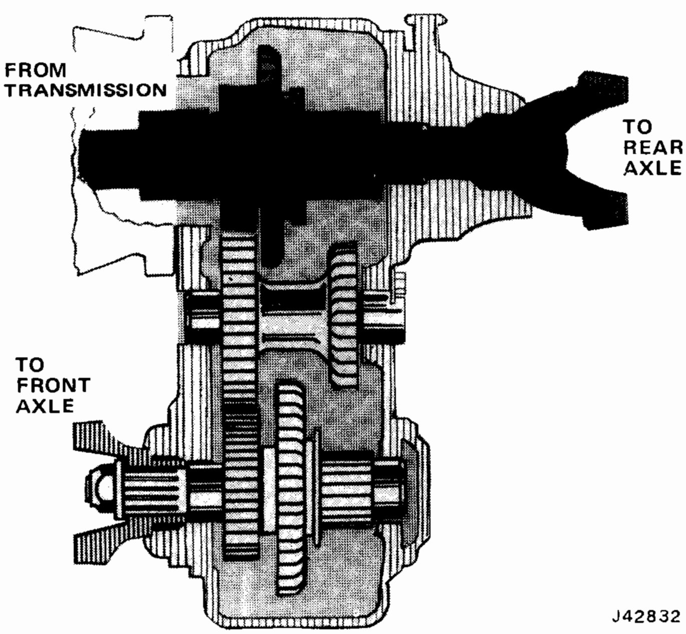


Fig. 8-2 2-Wheel Drive High

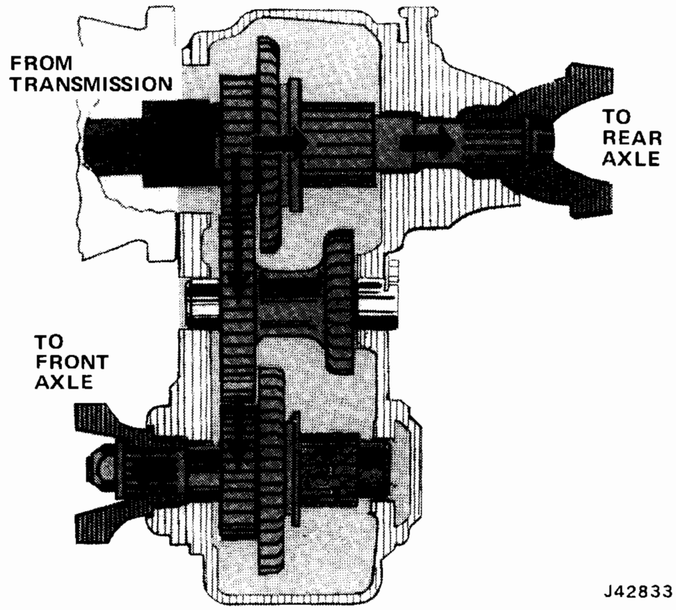


Fig. 8-3 4-Wheel Drive High

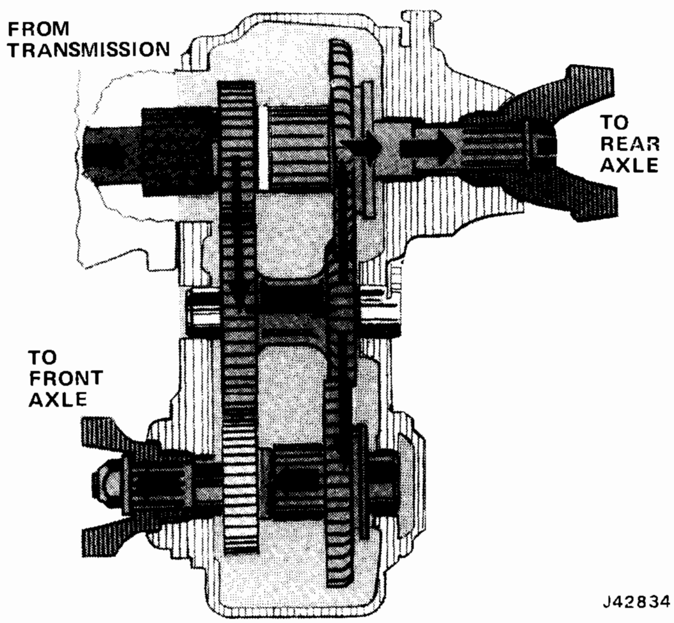


Fig. 8-4 4-Wheel Drive Low

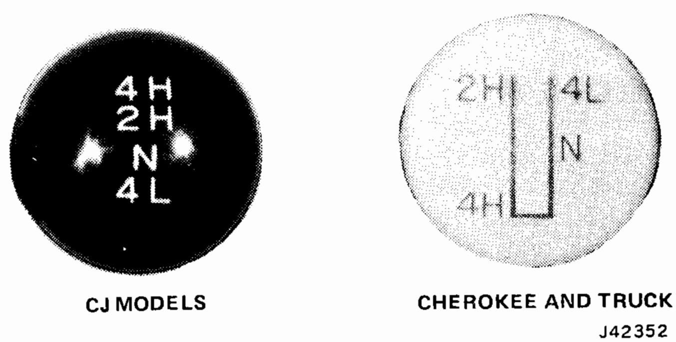


Fig. 8-5 Transfer Case Shift Knob

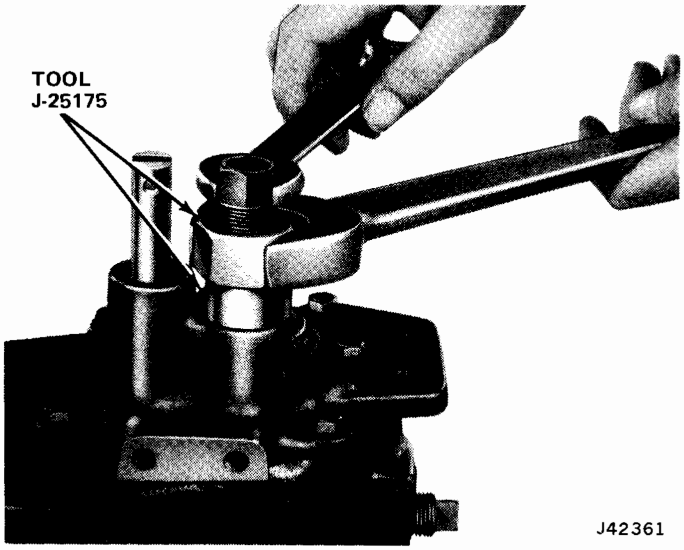


Fig. 8-6 Shift Rod Oil Seal Removal

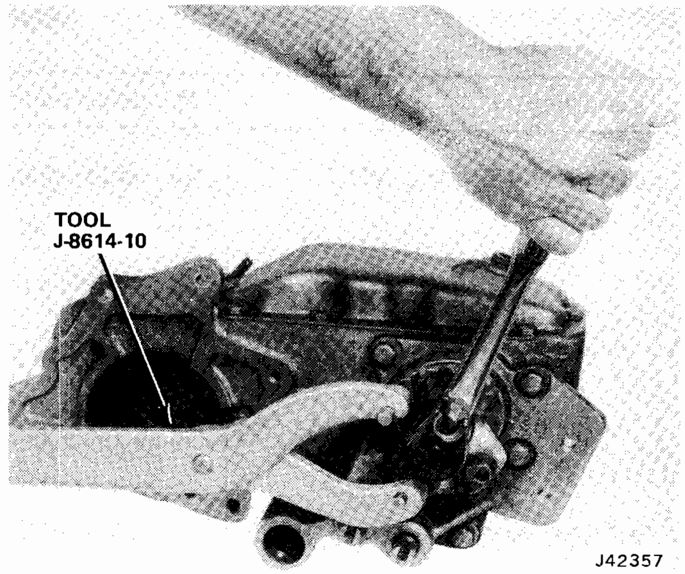


Fig. 8-8 Removing Front Output Shaft Nut

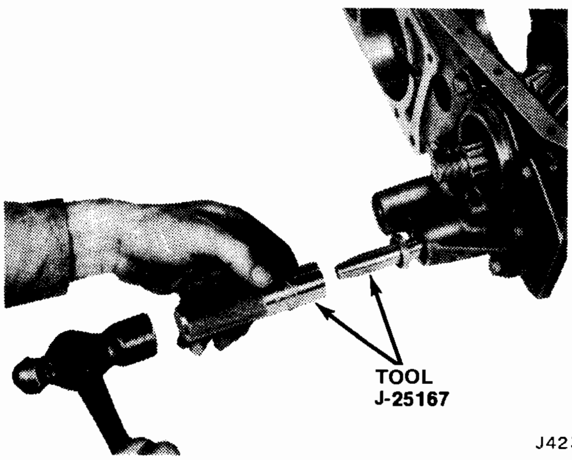


Fig. 8-7 Shift Rod Oil Seal Installation

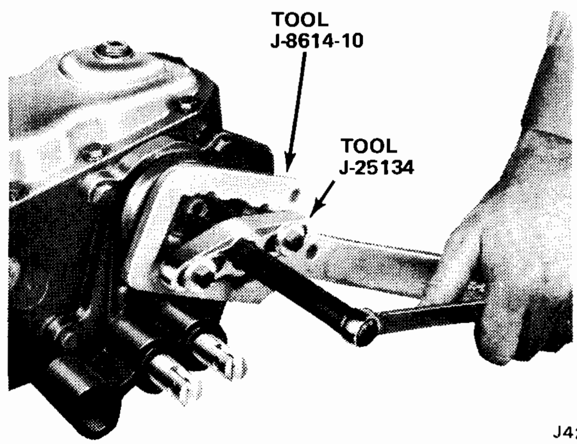


Fig. 8-9 Universal Joint Yoke Puller

Front Yoke Oil Seal Replacement

(1) Disconnect front propeller shaft from yoke.

(2) Remove front propeller shaft nut and washer using Tool J-8614-10 (fig. 8-8).

(3) Remove front propeller shaft yoke with Puller J-25134 (fig. 8-9).

(4) Remove oil seal with Puller J-25180 (fig. 8-10).

(5) Install new seal with Driver J-25132.

(6) Install yoke, washer, and nut. Tighten nut to 240 foot-pounds torque.

REAR BEARING CAP

Removal

(1) Disconnect rear propeller shaft at transfer case yoke. Use wire to tie disconnected end of propeller shaft to frame.

(2) Disconnect speedometer cable.

(3) Remove bearing-cap-to-transfer case bolts and remove bearing cap.

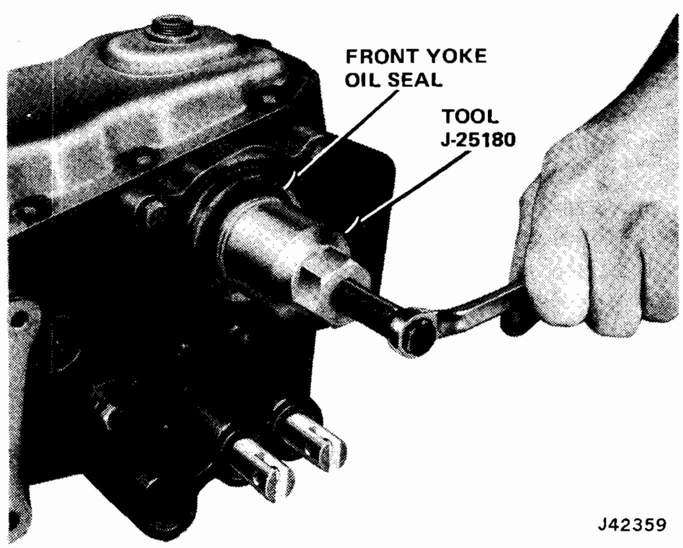


Fig. 8-10 Front Yoke Oil Seal Removal

Service Diagnosis

Condition	Possible Cause	Correction
JUMPS OUT OF 2 WD	(1) Main shaft gear disengaged from rear output shaft sliding gear.	(1) Check torque on main shaft gear nut.
	(2) Shift lever torsion spring not holding.	(2) Replace spring.
JUMPS OUT OF 4 WD HIGH	(1) Front output shaft sliding gear disengaged from front output shaft gear.	(1) Excessive end play, worn or bent shift fork.
	(2) Main shaft gear disengaged from rear output shaft sliding gear.	(2) Check torque on main shaft gear nut.
	(3) Shift lever torsion spring not holding.	(3) Replace torsion spring.
	(4) Rear shift rod poppet spring not holding.	(4) Replace poppet spring.

Disassembly

(1) Remove speedometer driven gear sleeve and driven gear from bearing cap.

(2) Mount bearing cap assembly in vise.

(3) Using Yoke Holding Wrench J-8614-10, remove yoke nut (fig. 8-8).

(4) With Universal Joint Yoke Puller J-25134, remove yoke from shaft (fig. 8-9).

(5) Remove seal from bearing cap bore with Puller J-25180 (fig. 8-10).

(6) Remove bearing cap assembly from vise, and using rear face of cap as support, drive output shaft from bearing cap using brass drift and hammer.

(7) Lift out tapered bearing and drive bearing cup from bearing cap rear bore.

(8) Drive front bearing cup from bearing cap front bore.

(9) Remove speedometer drive gear and shims from shaft.

NOTE: *Keep shims together for use in assembly.*

(10) Remove front bearing from shaft.

(11) If necessary, remove speedometer driven gear bushing from bearing cap.

Assembly

(1) If removed, install speedometer driven gear bushing using Bushing Installer Tool J-25169.

(2) Drive front bearing cup into bore.

(3) Install front bearing on shaft.

(4) Drive rear bearing cup into bore.

(5) Install speedometer drive gear and shims on shaft.

(6) Place output shaft in bearing cap and rest end of output shaft on firm surface.

(7) Place rear cone and roller on output shaft and drive bearing onto shaft and seat it against shims.

(8) Install yoke seal with Driver J-25132.

(9) Install yoke, flat washer, and nut. Tighten nut to 240 foot-pounds torque.

(10) Clamp dial indicator onto bearing cap and position indicator against output shaft as shown in figure 8-11.

(11) Pry output shaft back and forth to check end play. End play should be 0.001 to 0.003 inch.

(12) If end play is excessive, it can be corrected by installing shims between speedometer drive gear and output shaft front bearing.

(13) Place speedometer driven gear in bearing cap and install driven gear sleeve.

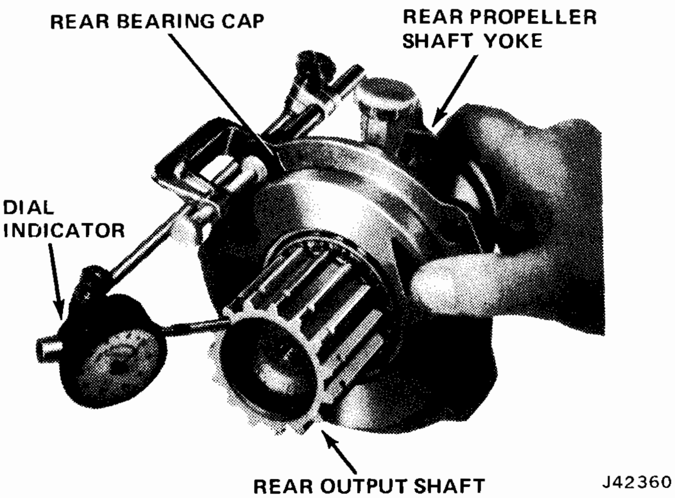


Fig. 8-11 Checking Rear Bearing Cap End Play

Installation

(1) Install bearing cap and install bearing-cap-to-transfer-case bolts. Tighten bolts to 30 foot-pounds torque.

(2) Connect speedometer cable.

(3) Install propeller shaft to yoke and tighten U-bolts to 15 foot-pounds torque. If equipped with ball and trunnion-type propeller shaft, tighten flange bolts to 30 foot-pounds torque.

SERVICE PROCEDURES—OUT OF VEHICLE

Transfer Case Removal—All Models

(1) Remove shift lever knob, trim ring, and boot from transmission and transfer case shift levers.

(2) Remove floor covering (if equipped) and remove transmission access cover from floorpan.

(3) Raise vehicle and drain lubricant from transmission (CJ models only) and transfer case.

(4) Disconnect torque reaction bracket from crossmember (if equipped).

(5) On CJ models, position support stand under clutch housing to support engine and transmission and remove rear crossmember.

(6) Disconnect front and rear propeller shafts at transfer case. Mark propeller shaft yokes for assembly reference.

(7) Disconnect speedometer cable at transfer case.

(8) On Cherokee and Truck models, disconnect parking brake cable at equalizer and disconnect exhaust pipe support bracket at transfer case.

(9) Remove bolts attaching transfer case to transmission and remove transfer case. Remove transfer case gasket.

NOTE: *One transfer case attaching bolt must be removed from front end of case. Bolt is located at bottom right corner of transmission.*

Transfer Case Installation

(1) Install transmission-to-transfer case gasket on transmission.

(2) Shift transfer case to 4 WD low position.

(3) Install one 3/8-16 x 4-inch dowel pin on each side of transmission to assist in guiding transfer case into place during installation.

(4) Install and position transfer case on dowel pins.

(5) Rotate transfer case output shaft (by turning yoke) until main shaft gear on transmission engages rear output shaft gear in transfer case. Slide transfer case forward until case seats against transmission.

CAUTION: *Be sure transfer case is flush against transmission. Severe damage to transfer case will result if attaching bolts are tightened while transfer case is in bind or cocked.*

(6) Install two transfer case attaching bolts but do not tighten completely.

(7) Remove dowel pins and install remaining transfer case attaching bolts. Tighten bolts to 30 foot-pounds torque.

(8) Fill transmission (on CJ models) and transfer case with SAE 80W-90 gear lubricant, API GL-4 quality. On Cherokee and Truck models, check transmission fluid level and add if necessary.

(9) Connect speedometer gear to transfer case.

(10) Connect front and rear propeller shafts to transfer case. Align reference marks made during removal. Tighten U-bolt clamp nuts to 15 foot-pounds torque. If equipped with ball and trunnion-type propeller shaft, tighten flange bolts to 30 foot-pounds torque.

(11) On CJ models, install rear support crossmember and remove support stand from under clutch housing.

(12) On Cherokee and Truck models, connect parking brake cable to equalizer and connect exhaust pipe support bracket to transfer case.

(13) Connect torque reaction bracket (if equipped).
(14) Lower vehicle.
(15) Install transmission access cover plate on floorpan. Install floor covering if equipped.
(16) Install boots, trim rings, and shift knobs.

Disassembly

NOTE: *Refer to figure 8-12 for parts nomenclature.*

(1) Remove shift lever assembly.
(2) Remove bottom cover and gaskets.
(3) Remove bolts attaching rear bearing cap assembly to transfer case and remove assembly.

NOTE: *Refer to Rear Bearing Cap in Service Procedures—In Vehicle for service procedures.*

(4) Remove intermediate shaft lock plate.
(5) Using Arbor Tool J-25142 and plastic mallet, drive intermediate shaft out rear of case (fig. 8-12).

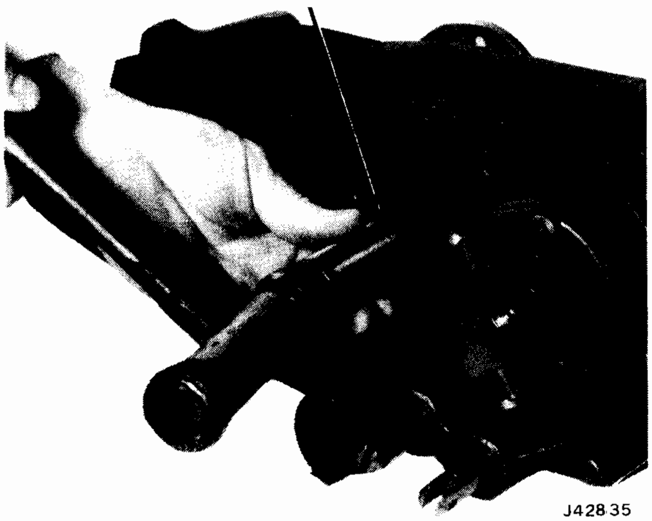


Fig. 8-12 Intermediate Shaft Removal

(6) Align Arbor Tool J-25142 in intermediate gear assembly and remove gear assembly and thrust washers.
(7) Remove front output shaft nut and washer.
(8) Remove front output shaft yoke using Yoke Holding Wrench J-8614-10 and Yoke Puller J-25134 (fig. 8-9).
(9) Remove front oil seal using Puller J-25180 (fig. 8-10).
(10) Remove cover plate attaching screws and remove cover. Remove front output shaft rear bearing.

CAUTION: *When removing cover plate, do not damage the gaskets and shims.*

(11) Move rear output shaft shift rail to rear.
(12) Remove rear output shaft shift fork setscrew.
(13) Remove poppet ball and spring plugs.
(14) Insert punch through pin hole in rod and rotate rear output shaft rod 1/4-turn counterclockwise and pull rod out of case.

NOTE: *When shift fork is free of rod, use hand to catch poppet ball and spring under shift rod.*

(15) Remove front shift rod housing attaching screws and slide housing off remaining shift rail.
(16) Remove rear output shaft sliding gear and shift fork.
(17) Using hammer and brass drift, drive front output shaft out rear of case. Support transfer case on wood blocks when removing shaft.
(18) Remove gears, spacer, and bearing from case and rotate shift rod to expose setscrew.
(19) Remove setscrew and pull out shift rod.
(20) Remove shift rail thimbles using 3/8-drive, 7/16-inch socket and extension to drive thimbles from case.
(21) Remove arbor tool, thrust washers, spacers, and roller bearings from intermediate gear.
(22) Remove front output shaft front bearing cup using brass drift and hammer.
(23) Remove shift rod seals from housing using Tool J-25175.
(24) Remove front output shaft rear bearing. Use sliding gear as support. Mount gear in vise with shaft lever groove facing downward. Insert front output shaft through gear splines and drive shaft out of bearing using brass drift and hammer.

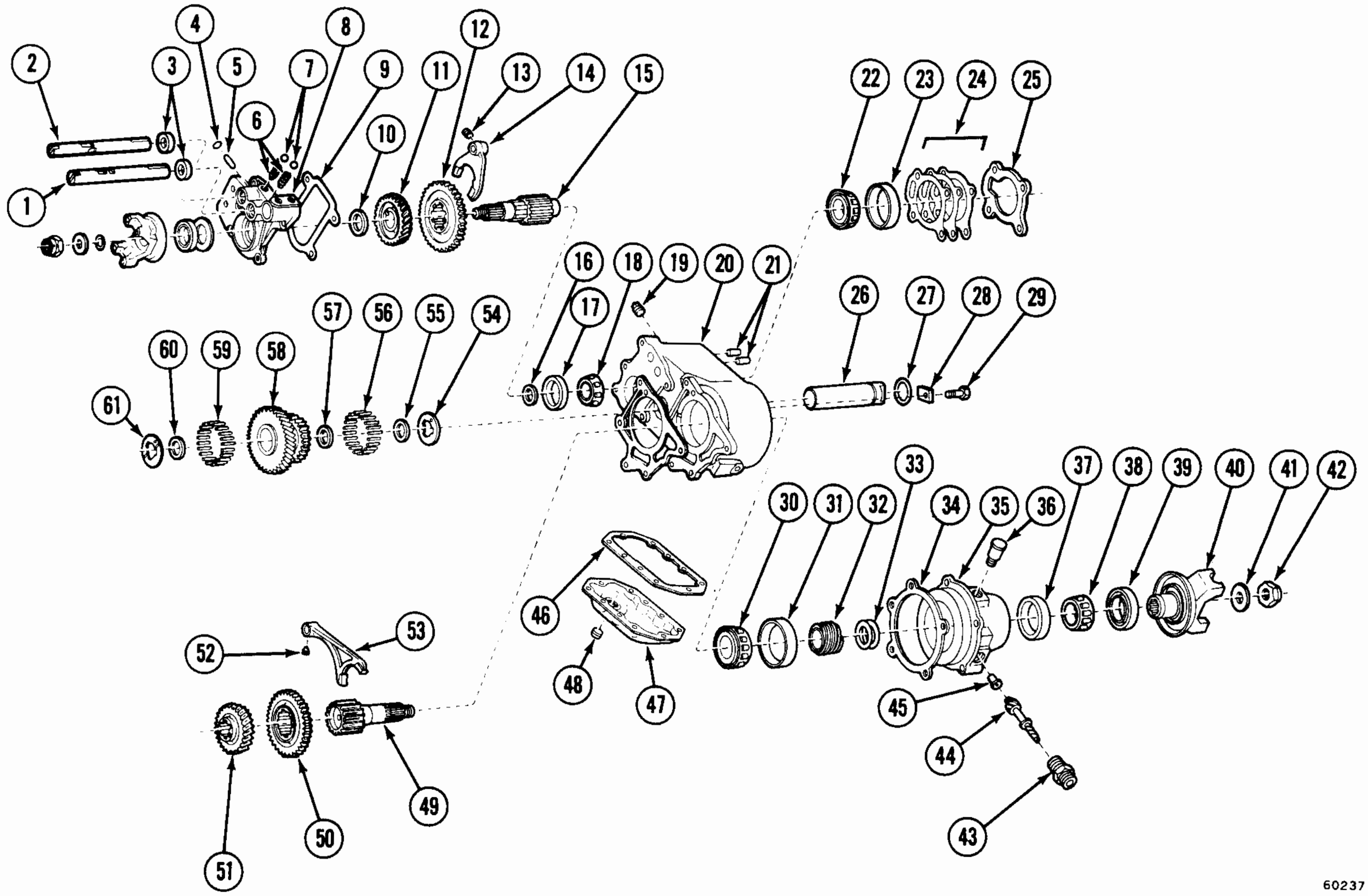
Cleaning and Inspection

Wash all transfer case components and transfer case housing in solvent. Clean gasket material from all gasket surfaces and dry all components with compressed air.

Inspect all bearings, thrust washers, shafts and gears for excessive wear, pitting, and scoring. Replace any part that is damaged or worn.

Assembly

(1) Install front output shaft front bearing cup in case. Seat cup flush with exterior surface of case.
(2) Install shift rail thimbles.
(3) Install shift rod housing. Tighten attaching bolts to 30 foot-pounds torque.
(4) Support front output shaft rear bearing on 1-1/4-inch socket and install shaft into bearing using brass drift and hammer.
(5) Install front output shaft shift rail poppet ball and spring.



1. SHIFT ROD - REAR OUTPUT SHAFT SHIFT FORK
2. SHIFT ROD - FRONT OUTPUT SHAFT SHIFT FORK
3. SHIFT ROD OIL SEAL
4. INTERLOCK PLUG
5. INTERLOCK
6. POPPET BALL SPRING
7. POPPET BALL
8. FRONT BEARING CAP
9. FRONT BEARING CAP GASKET
10. FRONT OUTPUT SHAFT THRUST WASHER
11. FRONT OUTPUT SHAFT GEAR
12. FRONT OUTPUT SHAFT SLIDING GEAR
13. SETSCREW
14. FRONT OUTPUT SHAFT SHIFT FORK
15. FRONT OUTPUT SHAFT
16. FRONT OUTPUT SHAFT SPACER
17. FRONT OUTPUT SHAFT FRONT BEARING CUP
18. FRONT OUTPUT SHAFT FRONT BEARING
19. FILLER PLUG
20. TRANSFER CASE
21. THIMBLE COVER
22. FRONT OUTPUT SHAFT REAR BEARING
23. FRONT OUTPUT SHAFT REAR BEARING CUP
24. FRONT OUTPUT SHAFT REAR BEARING CUP SHIMS
25. COVER PLATE
26. INTERMEDIATE SHAFT
27. INTERMEDIATE SHAFT O-RING
28. LOCK PLATE
29. LOCK PLATE BOLT
30. REAR OUTPUT SHAFT FRONT BEARING
31. REAR OUTPUT SHAFT FRONT BEARING CUP
32. SPEEDOMETER DRIVE GEAR
33. REAR OUTPUT SHAFT BEARING SHIM
34. REAR BEARING CAP GASKET
35. REAR BEARING CAP
36. BREATHER
37. REAR BEARING CAP CUP
38. REAR BEARING CAP BEARING
39. REAR BEARING CAP OIL SEAL
40. REAR YOKE
41. REAR YOKE WASHER
42. REAR YOKE NUT
43. SPEEDOMETER SLEEVE
44. SPEEDOMETER DRIVEN GEAR
45. SPEEDOMETER BUSHING
46. BOTTOM COVER GASKET
47. BOTTOM COVER
48. DRAIN PLUG
49. REAR OUTPUT SHAFT
50. REAR OUTPUT SHAFT SLIDING GEAR
51. MAINSHAFT GEAR
52. SETSCREW
53. REAR OUTPUT SHAFT SHIFT FORK
54. INTERMEDIATE GEAR THRUST WASHER
55. INTERMEDIATE GEAR BEARING SPACER
56. INTERMEDIATE GEAR SHAFT NEEDLE BEARINGS
57. INTERMEDIATE GEAR BEARING SPACER
58. INTERMEDIATE GEAR
59. INTERMEDIATE GEAR SHAFT NEEDLE BEARINGS
60. INTERMEDIATE GEAR BEARING SPACER
61. INTERMEDIATE GEAR THRUST WASHER

Fig. 8-13 Model 20 Transfer Case Components

(6) Compress ball and spring and install front output shaft rail part way in case.

(7) Install front output shaft shift fork with setscrew off at facing front of case and slide shift rail through shift fork.

(8) Align setscrew holes in fork and rail and install setscrew. Tighten setscrew to 14 foot-pounds torque.

(9) Install front output shaft front bearing, bearing spacer, front output shaft sliding gear, and front output shaft gear. Be sure shift fork groove in sliding gear faces rear of case.

(10) Install front output shaft through gears, spacer, and bearing.

(11) Support case on wood blocks and drive front output shaft into front housing using brass drift and hammer. Be sure bearing is seated against shoulder on front output shaft.

(12) Install front output shaft rear bearing cup using wood block and hammer.

(13) Install rear bearing, cover plate, and shims. Tighten cover plate bolts to 30 foot-pounds torque.

(14) Check front output shaft end play as follows (fig. 8-14):

(a) Seat rear bearing cup against cover plate by striking end of front output shaft with lead hammer.

(b) Mount dial indicator on front bearing cap and position indicator stylus against end of output shaft.

(c) Pry shaft rearward and zero dial indicator. Pry shaft forward and observe dial indicator reading. End play should be 0.001 to 0.003 inch. If necessary, adjust end play by adding or subtracting shims between cover plate and case. If shims are added, seat rear bearing cup as outlined in step (a) before checking end play.

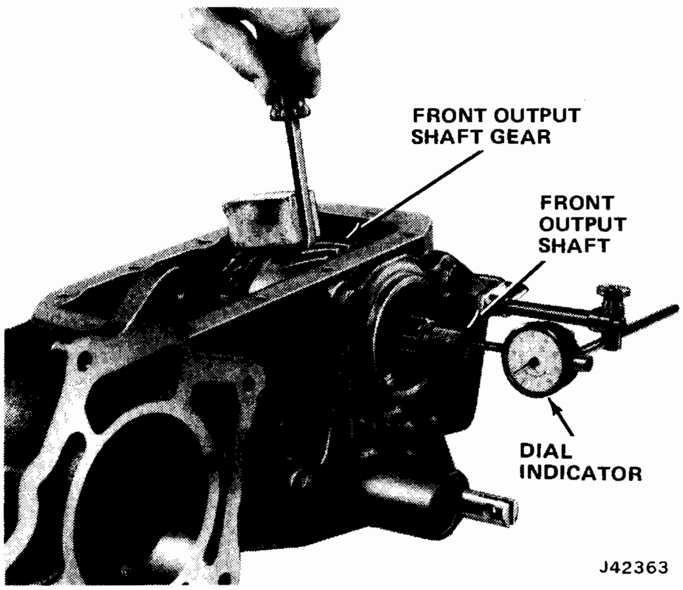


Fig. 8-14. Checking Front Output Shaft End Play

(15) Install rear output shaft shift rail poppet ball and spring in shift rod housing.

(16) Compress ball and spring and install rear output shaft shift rail part way in case.

NOTE: *Before installing shift rail, be sure front output shaft shift rail is in Neutral and that interlock is seated in housing bore.*

(17) Install rear output shaft shift fork and sliding gear. Be sure shift fork groove in gear faces rear of case.

(18) Align setscrew holes in fork and rail and install setscrew. Tighten setscrew to 14 foot-pounds torque.

(19) Assemble intermediate gear rollers and spacers using Arbor Tool J-25142.

(20) Install intermediate gear thrust washers in case tangs aligned with grooves in case.

NOTE: *Rear washer can be held in place by starting intermediate shaft into case. Hold front washer in position with petroleum jelly.*

(21) Install O-ring on intermediate shaft and install install intermediate gear in case. Using rawhide mallet or lead hammer, drive intermediate shaft into intermediate gear, forcing Arbor Tool J-25142 out front of case.

(22) Install intermediate shaft lock plate, identification tag, lockwasher, and bolt. Tighten bolt to 14 foot-pounds torque.

(23) Install rear bearing cap assembly using a new gasket, and slide rear output shaft through gear. Tighten bearing cap bolts to 30 foot-pounds torque.

(24) Install front yoke seal with Driver J-25132.

(25) Install front propeller shaft yoke and tighten locknut to 240 foot-pounds torque.

(26) Install bottom cover and gasket. Tighten bolts to 14 foot-pounds torque.

(27) Install shift rod oil seals using Tool Set J-25167.

SHIFT CONTROL CASE—CHEROKEE AND TRUCK

Shifter rods from the shift control case connect to the shift rods of the transfer case either directly or through nonadjustable links (fig. 8-15). The lever assembly mounts to a support tube which is attached to the transfer case. The tube is secured to the transfer case and to the lever assembly by capscrews. The support tube has locating holes drilled to ensure alignment of the transfer case, support tube, and lever assembly.

Figure 8-16 shows the position of the shift lever and rails in relation to the gears in the transfer case in 2 High, 4 High, and 4 Low positions.

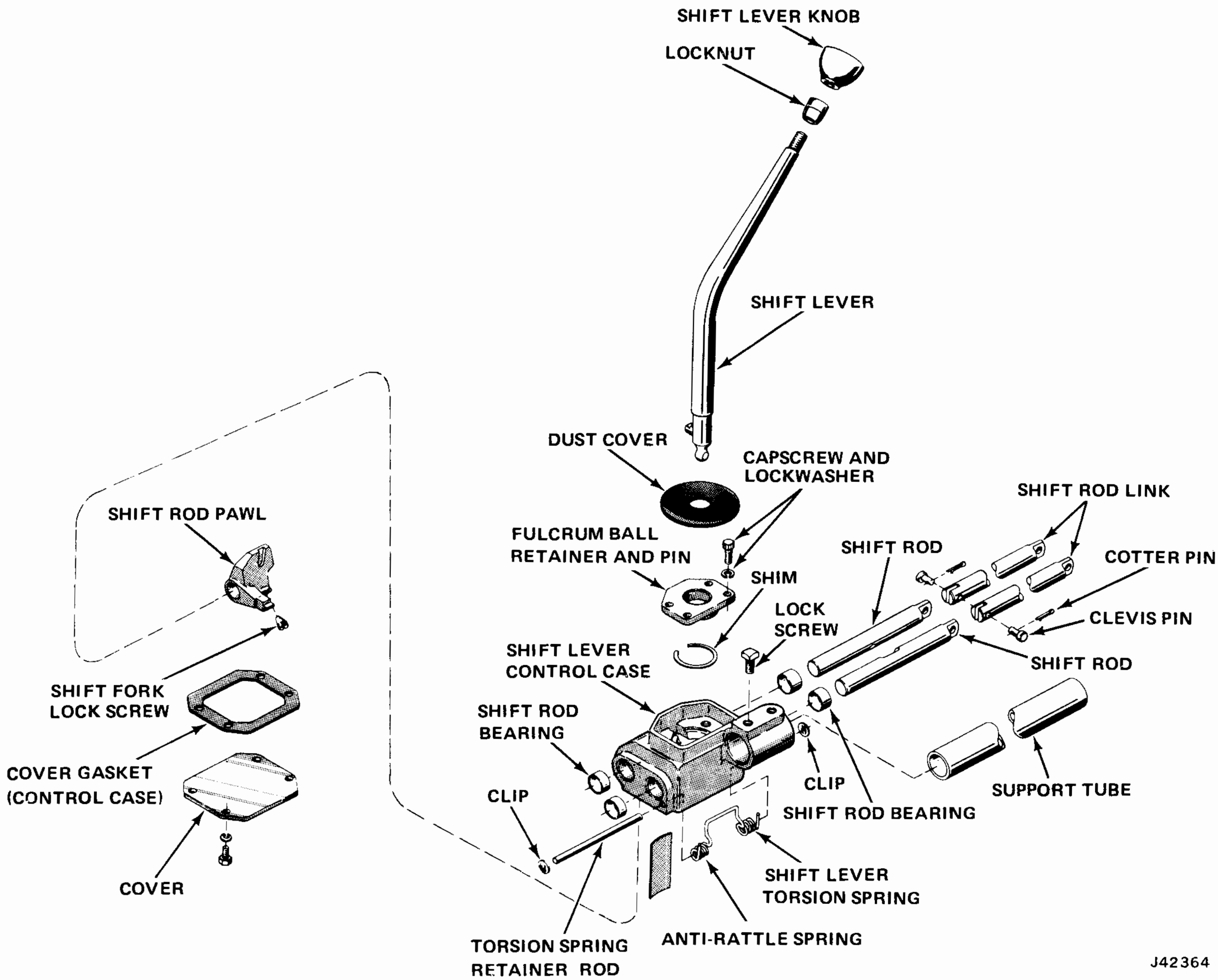


Fig. 8-15 Shift Control Case—Cherokee and Truck

- 2 **High**—Inner rail is fully forward, pawl on outer rail is to rear of slot in inner rail, and legs of torsion spring are in notches in inner rail.
- 4 **High**—Inner rail is fully forward, pawl on outer rail is to rear of slot in inner rail, and legs of torsion spring are in notches in inner rail. Shift lever ball is forward and pin on shift lever is engaged in slot in pawl. The outside rail is in the forward position.
- 4 **Low**—Both rails are fully to the rear, the pawl is to the front of the slot, the shift lever ball is in (and to the rear of) the slot, and the spring legs are out of the notches. The pin on the shift lever is disengaged from the slot in the pawl.

Removal

(1) Remove shift lever, knob, trim ring, and boot.

(2) Remove clevis pins attaching control case shift rods to shift rod links.

(3) Remove control-case-to-support-tube attaching screws and remove control case.

NOTE: *On vehicles with V-8 engine and 4-speed transmission, the transfer case must be removed in order to remove the control case.*

Disassembly

(1) Remove retainer capscrews, retainer, shift lever and shims.

(2) Remove cover. Remove lock screw from pawl and remove 4 WD and neutral shift rod and pawl.

(3) Pry tension spring from notches in direct and low range shift rod and remove rod.

(4) Remove clips from torsion spring retainer and remove rod and spring.

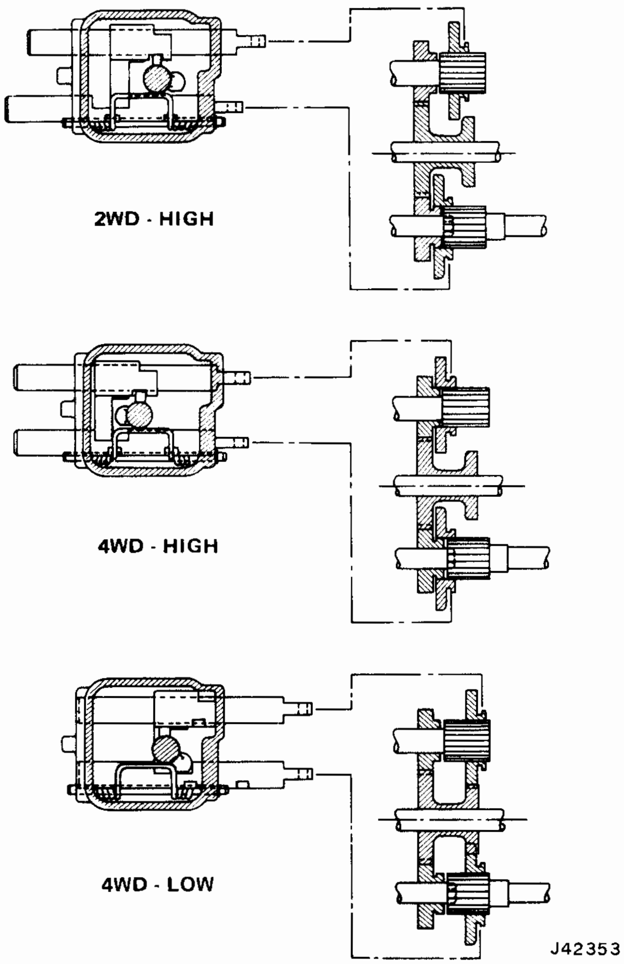


Fig. 8-16 Shift Positions

Assembly

(1) Install torsion spring, retaining rod, and clips.

(2) Install direct and low range shift rod and set torsion spring in notches in rod.

(3) Position shift rod pawl in case. Insert 4 WD and neutral shift rod through case and pawl and install setscrew and tighten.

NOTE: *Be sure holes are aligned to permit setscrew to bottom in rod.*

(4) Install gasket, cover, and attaching screws.

(5) Install shift lever, retainer, and retainer-to-control case attaching screws.

Installation

(1) Place shift lever in 4H (4 WD High).

(2) Position control case on support tube (do not install bolts).

(3) Attach control case shift rods to shift rod links with clevis pins.

(4) Install shift-control-case-to-support-tube lockscrews and tighten.

(5) Install boot, trim ring, and shift lever knob.

SHIFT LINKAGE—CJ Models

The shift lever is connected to the transfer case shift rails through rods and nonadjustable links (fig. 8-17). The support tube connects to the transfer case and is retained by capscrews. Locating holes are drilled in the support tube at the transfer case end to ensure proper alignment.

(1) Remove shift lever knobs, trim ring, and boot.

(2) Remove clevis pins that attach shifting lever links to transfer case shift rods.

(3) Remove capscrews that secure support tube to transfer case.

(4) Slide lever assembly from transfer case.

Installation

(1) Shift lever to 4H (4 WD High) position.

(2) Position support tube on transfer case (do not install capscrews).

(3) Using clevis pins, attach shifting lever links to transfer case shift rods.

(4) Install transfer-case-to-support-tube capscrews and tighten.

(5) Install boot, trim ring, and shift lever knob.

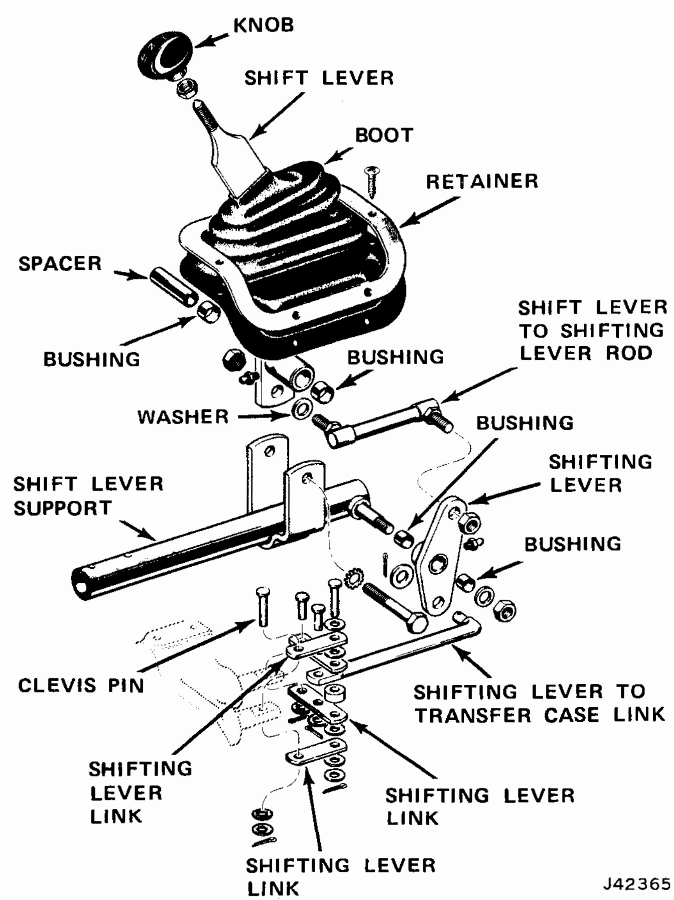


Fig. 8-17 Shift Linkage—CJ Models

QUADRA-TRAC TRANSFER CASE

GENERAL

The Quadra-Trac transfer case system provides full-time, four-wheel drive in all driving conditions. The transfer case contains a limited slip differential which is operated by a chain drive unit. In operation, engine torque is transmitted to both the front and rear axles through the chain-driven limited slip differential.

A low range reduction unit, which provides maximum engine braking and torque at low speeds, is available as an option with Quadra-Trac.

EMERGENCY DRIVE

Emergency Drive is a control device, which locks the front and rear wheel drives together, resulting in undifferentiated 4-wheel drive, and is provided for use under extreme situations such as encountered in rough terrain.

CAUTION: *When attempting to move the vehicle out of a particular position, do not spin the wheels excessively unless emergency drive is engaged.*

Excessive wheel spin could damage the Quadra-Trac limited-slip differential. Do not drive the vehicle on dry pavement with emergency drive engaged. This will result in harsh operation and possibly damage driveline components.

Should loss of a front or rear propeller shaft assembly or front axle shaft failure occur, activating the emergency drive will permit 2-wheel drive operation until repair or replacement can be made. To engage emergency drive, slow the vehicle to under 5 mph and turn the control knob inside the glove box counterclockwise.

A reminder signal light in the instrument panel cluster will come on immediately after emergency drive engagement occurs, and will glow continuously until disengaged.

NOTE: *A slight delay may occur until front and rear axles become synchronized.*

To disengage emergency drive, turn the control knob clockwise. If the lockout light does not go off, back the vehicle in an "S" pattern for approximately 15 feet.

Because emergency drive is infrequently used, it is recommended that the system be activated and deactivated at least once each month.

REDUCTION UNIT SHIFT LEVER

The reduction unit is engaged and disengaged by the reduction unit shift lever. On CJ-7 models, the lever is located on the driver's side of the floorpan transmission tunnel. On Cherokee, Wagoneer, and Truck models, the lever is located on the floorpan just below the driver's seat (fig. 8-18).

There are three shift lever positions: High range, Low Range, and Neutral. The High range position is used for normal driving. The Low range position engages the reduction unit when maximum engine braking and torque is required. The Neutral position is for towing use only. This position allows the vehicle to be towed without removing or disconnecting the propeller shafts.

LOW RANGE—REDUCTION UNIT OPERATION

For operation under unusually severe on- or off-road conditions, the low-range reduction unit provides maximum engine braking and maximum torque at low speed.

To engage Low Range drive:

- Take foot off accelerator.
- Shift automatic transmission into Neutral (with vehicle moving).

- When vehicle speed drops below 5 mph, engage reduction unit by moving lever fully forward (CJ-7 models) or up (Cherokee, Wagoneer, and Truck models). Do not stop at Neutral position, which is for towing use only.

To disengage Low Range drive:

- Take foot off accelerator.
- When vehicle speed drops to 5 to 10 mph, shift automatic transmission into Neutral.
- On CJ-7 models, pull lever fully rearward. On Cherokee, Wagoneer, or Truck models, push lever fully downward. Do not stop at Neutral position (on any model) when disengaging low range reduction unit.

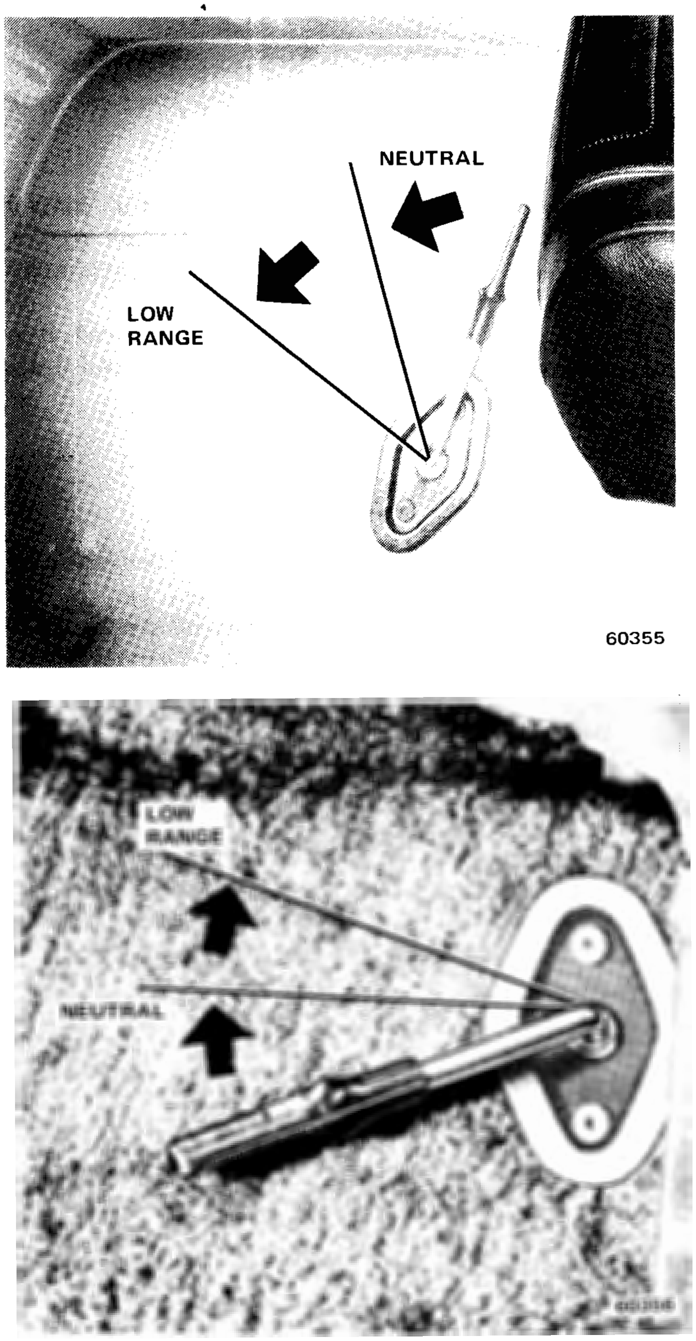


Fig. 8-18 Reduction Unit Shift Lever

TOWING

Automatic Transmission with Quadra-Trac Less Low Range Reduction Unit

Ignition Key Available: Turn ignition key to OFF position to unlock steering column and gearshift selector linkage. Place transmission gearshift lever in N (Neutral). If vehicle is to be towed with all four wheels on the ground, disconnect **both** propeller shafts from axle yokes (be sure to index mark propeller shafts and yokes for proper alignment at assembly), secure shafts to underside of vehicle, and proceed with towing. If vehicle is to be towed with front end raised, disconnect rear propeller shaft only (index mark for proper assembly later) and secure shaft to underside of vehicle.

Ignition Key Not Available: Place dolly under rear wheels and tow vehicle with front end raised; or, disconnect rear propeller shaft at rear axle yoke (index mark for correct assembly later), secure shaft to underside of vehicle, and tow with front wheels raised.

Automatic Transmission with Quadra-Trac and Low Range Reduction Unit

Ignition Key Available: Vehicle can be towed with all four wheels on the ground without disconnecting propeller shafts. Place transmission gearshift lever in P (Park) and shift low-range reduction unit gearshift lever to N (Neutral) position. If Emergency Drive control (in glove box) was in EMERGENCY DRIVE when the engine was shut down, restart engine and turn the control knob to the NORMAL position. Never tow the vehicle with the Emergency Drive control activated or with reduction unit in Low Range position.

Ignition Key Not Available and Vehicle is Locked or Unlocked: Place dolly under rear wheels and tow vehicle with front wheels raised; or, disconnect rear propeller shaft at rear axle (index mark for proper assembly), secure shaft to underside of vehicle, and tow with front wheels raised.

STICK-SLIP CONDITION

When the clutch elements of the Quadra-Trac drive system stick, it is under a torque windup condition as in a conventional transfer case. Sudden release of the clutch under this condition results in a constant, pulsating, grunt-like or rasping noise. This is a low-frequency stick-slip noise that, if it occurs, is evident to the driver at slow speeds, such as when slowly turning a corner, or when maneuvering to park.

The stick-slip noise will not occur when the vehicle is driven in a straight-ahead position. If a noise similar to stick-slip, but much louder, occurs in the straight-ahead position, the chain should be inspected for excessive looseness.

Proper lubricant is important in preventing stick-slip noise. Use a 30W nondetergent oil only, such as Valvoline, Union Custom, or equivalent. Multi-grade, detergent-type oils must not be used. Vehicles experiencing stick-slip caused by improper lubricants may be corrected by completely draining the units and refilling with the specified lubricants.

NOTE: *If a vehicle is not driven for a week or more, the stick-slip condition may occur when the vehicle is first driven. This is considered normal and should be of no concern, as the noise will disappear with continued driving.*

Uneven tire inflation pressures and mismatched tire types and sizes will also cause stick-slip noise. Be sure all tires are inflated equally and are of the same size and type.

LUBRICATION

The Quadra-Trac transfer case does not require periodic or scheduled lubrication. However, should a stick-slip condition occur, a full eight fluid ounces of Jeep Lubricant Concentrate, Part Number 8123004, or Lubrizol 5901 or equivalent, should be added. This applies to the Quadra-Trac transfer case with or without reduction unit. It may be necessary to drain a small amount of lubricant from the transfer case to permit addition of the full eight ounces of lubricant.

If the addition of the lubricant does not correct the stick-slip condition, the unit should be drained and refilled.

After adding lubricant, drive the vehicle slowly in left- and right-hand circles for approximately 15 minutes in each direction with the steering wheel one-half turn off full lock. This must be done to circulate the lubricant through the differential assembly in the Quadra-Trac unit.

Lube Change—Without Reduction Unit

Lubricant Blend:

- Jeep Lubricant Concentrate, Part No. 8123004 (or equivalent brand). Use eight ounces.
- SAE 30W good quality nondetergent motor oil (Ashland Valvoline, or equivalent brand). Requirement is 3.5 pints (2.9 Imperial pints or 1.7 liters).

Remove fill plug and drain plug and allow the transfer case to drain completely. Replace drain plug. Install concentrate, then fill to fill-hole level with lubricant blend, as specified above. Replace fill plug (fig. 8-19).

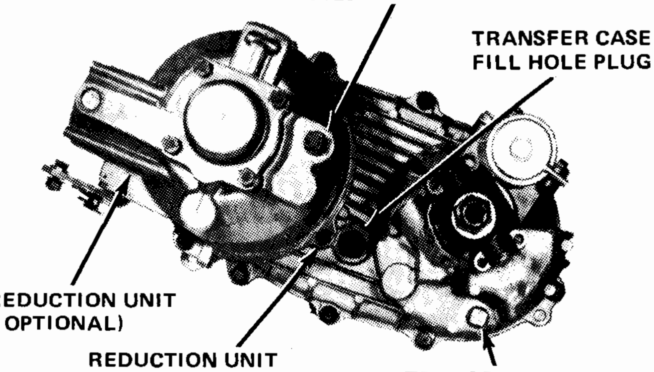


Fig. 8-19 Quadra-Trac Drain and Fill Plug Locations

Lube Change—With Reduction Unit

Use Lubricant Blend:

- Jeep Lubricant Concentrate, Jeep Part No. 8123004 (or equivalent). Use eight ounces.
- SAE 30 (good quality) nondetergent motor oil (Ashland Valvoline, or equivalent). Requirement is 4.5 pints (3.7 Imperial pints or 2.1 liters).

(1) Remove fill plugs from transfer case and reduction unit.

(2) Remove transfer case drain plug. After it has drained completely, replace drain plug.

(3) Loosen five bolts on reduction unit housing (no drain plug), so that the unit can be pulled back far enough to permit the unit to drain. After it has drained completely, move the housing back into position and tighten bolts to 15 foot-pounds torque.

First fill the reduction unit to fill-hole level with lubricant blend, as specified previously. Replace the fill plug. Next, fill the transfer case to fill-hole level with the specified lubricant blend. Replace fill plug (fig. 8-19).

CAUTION: *Fill plugs, drain plugs, and reduction housing bolts should not be overtightened. Torque values are 20 foot-pounds for the plugs and the 3/8-16 bolts. Torque for the 5/16-18 bolts is 15 foot-pounds.*

CAUTION: *Overtightening may result in thread stripping or breakage of the aluminum unit(s).*

TORQUE BIAS CHECK

(1) Be sure Quadra-Trac lockout is not engaged. The differential must be free to operate and not locked.

(2) Place transmission in N (Neutral).

(3) Disconnect rear propeller shaft front universal joint from transfer case rear yoke.

(4) Have helper apply brakes firmly to lock front wheels and use a socket and torque wrench to apply torque in tightening direction (clockwise) to transfer case rear yoke retaining nut. Differential cone clutches should slip when 80 to 170 foot-pounds of torque is applied.

NOTE: *Slippage with torques below 80 foot-pounds indicates the need for differential unit replacement. If the unit will not slip by applying 170 foot-pounds torque or less, improper lubricant may be the cause. Refer to Stick-Slip Condition and Lubrication paragraphs in this section.*

DRIVE CHAIN TENSION INSPECTION

(1) Remove transfer case drain plug and drain lubricant. Install drain plug.

(2) Remove chain inspection plug.

(3) Thread Chain Tension Gauge, Tool Number J-25162, into inspection hole just finger-tight until tool shoulders against case.

(4) The tool plunger should protrude past the outer end of the checking tool (fig. 8-20). If tool plunger is flush or below the end of the tool, the chain should be replaced.

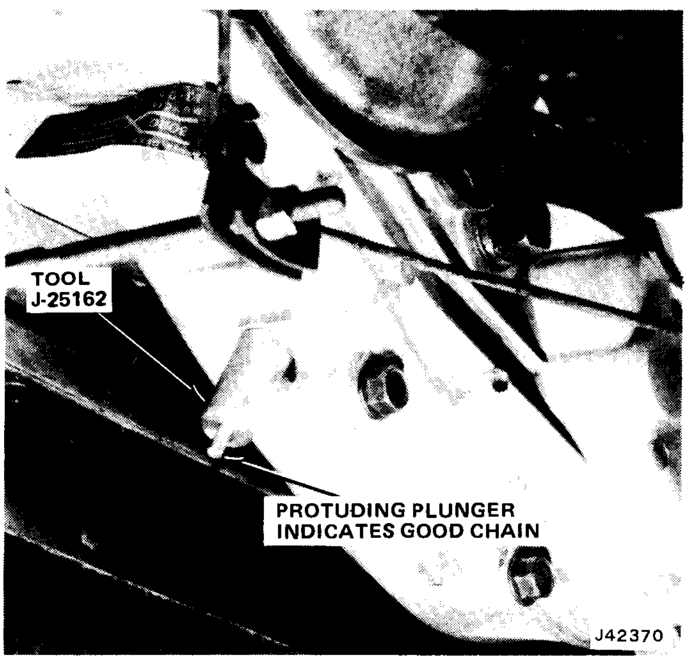


Fig. 8-20 Chain Tension Gauge Installed

REDUCTION UNIT REMOVAL

(1) Raise vehicle.

(2) Loosen bolts attaching reduction unit to transfer case cover (fig. 8-21).

(3) Move reduction unit rearward just far enough to allow oil to drain from unit.

(4) Disconnect shift linkage at reduction unit control lever.

(5) When oil has drained, remove bolts attaching reduction unit to transfer case cover.

(6) Move reduction unit rearward to clear transmission output shaft and pinion cage which is attached to transfer case drive sprocket.

NOTE: *The pinion cage should not be removed if the transfer case cover assembly is to be removed, but may be removed for inspection or replacement if the transfer case cover assembly is to remain in the vehicle. Pinion cage removal involves removing the snap ring which secures the cage to the sprocket and sliding the cage rearward.*

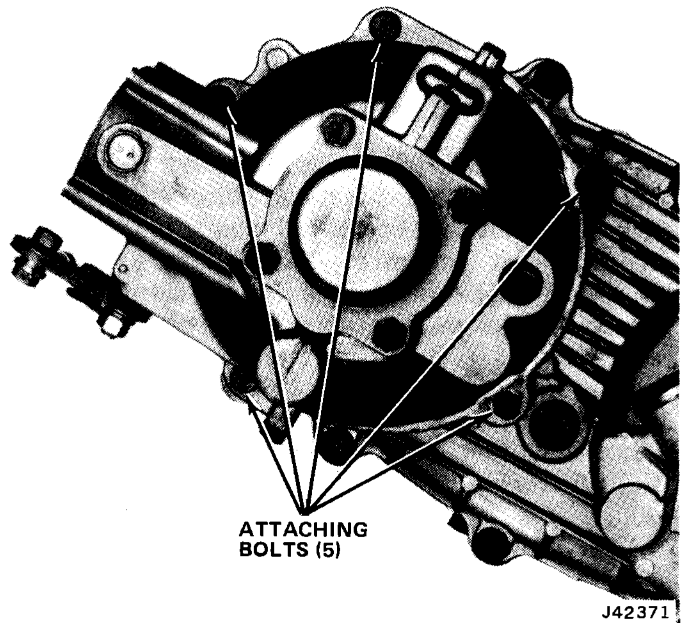


Fig. 8-21 Reduction Unit Attaching Bolts

REDUCTION UNIT INSTALLATION

(1) If removed, install pinion cage onto transfer case drive sprocket splines.

(2) Install retaining snap ring. Be sure snap ring is seated completely in groove (fig. 8-22).

(3) Clean sealing ring groove in transfer case cover and install sealing ring.

(4) Lift reduction unit and mesh caged pinions with sun gear and ring gear, and align sun gear inner splines with transmission output shaft splines.

(5) Move reduction unit forward until it contacts sealing ring.

(6) Install attaching screws. Alternately tighten screws to 15 foot-pounds torque.

(7) Connect shift lever linkage at reduction unit control lever.

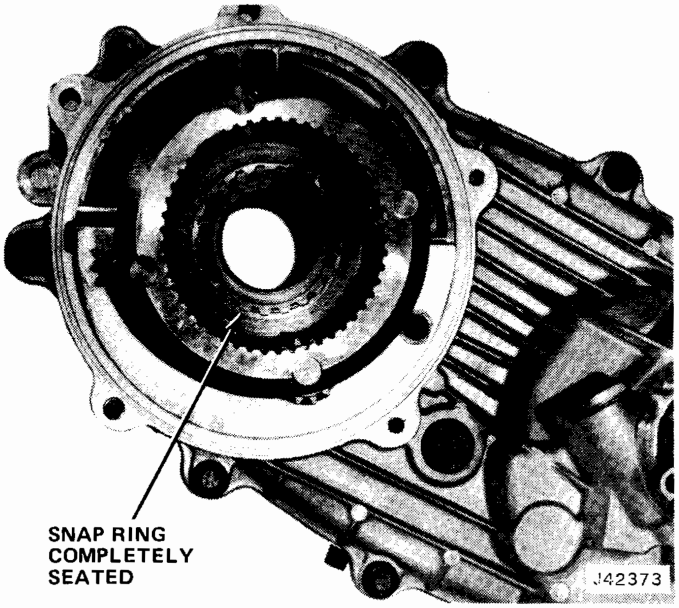


Fig. 8-22 Reduction Pinion Cage Installed

(8) Fill reduction unit and transfer case assembly with proper quantities and types of lubricants. Refer to Lubrication paragraph for quantity, type, and procedure.

REDUCTION UNIT DISASSEMBLY

(1) Remove power takeoff cover (fig. 8-23).

(2) Position 11/16-inch, 1/2-inch drive, deep well socket in vise and clamp securely. Allow two inches of socket to extend beyond top of vise.

(3) Place reduction onto socket. Be sure socket enters bore of sun gear (fig. 8-24). Reduction unit should be supported by socket.

(4) Move reduction unit control lever rearward to high range position.

(5) Remove snap ring and spacer from main shaft (fig. 8-25).

(6) Lift reduction unit housing off gear train (fig. 8-26).

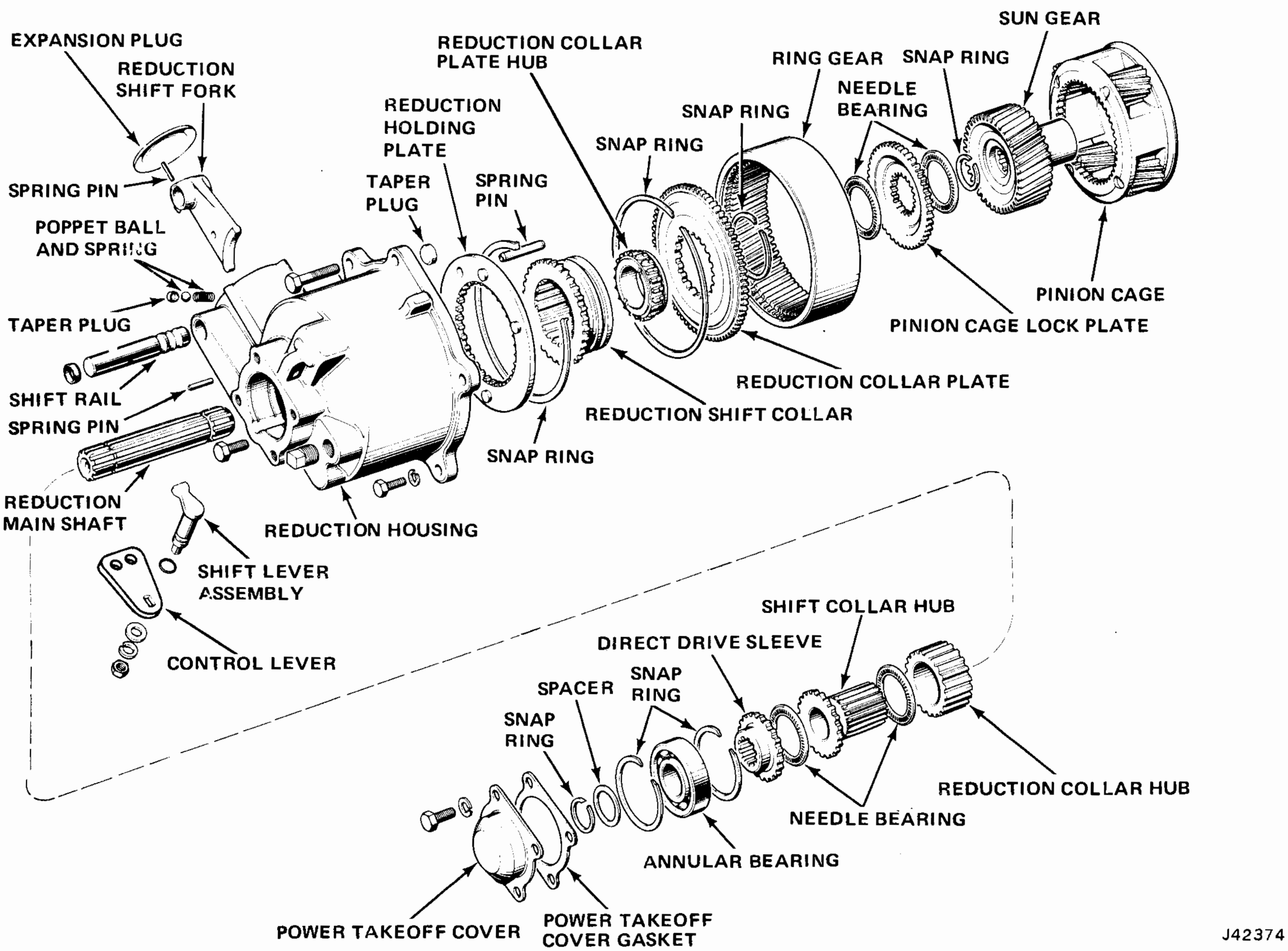


Fig. 8-23 Reduction Unit Components

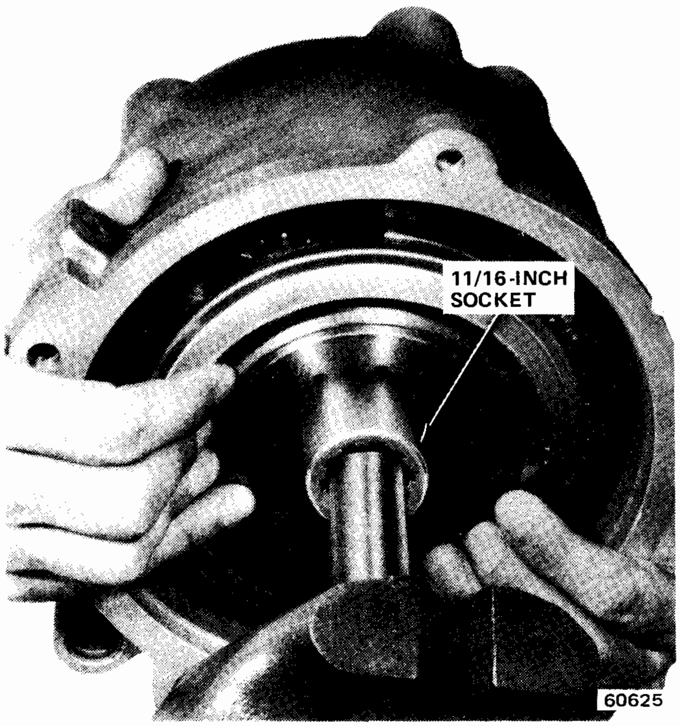


Fig. 8-24 Mounting Reduction Unit on Socket

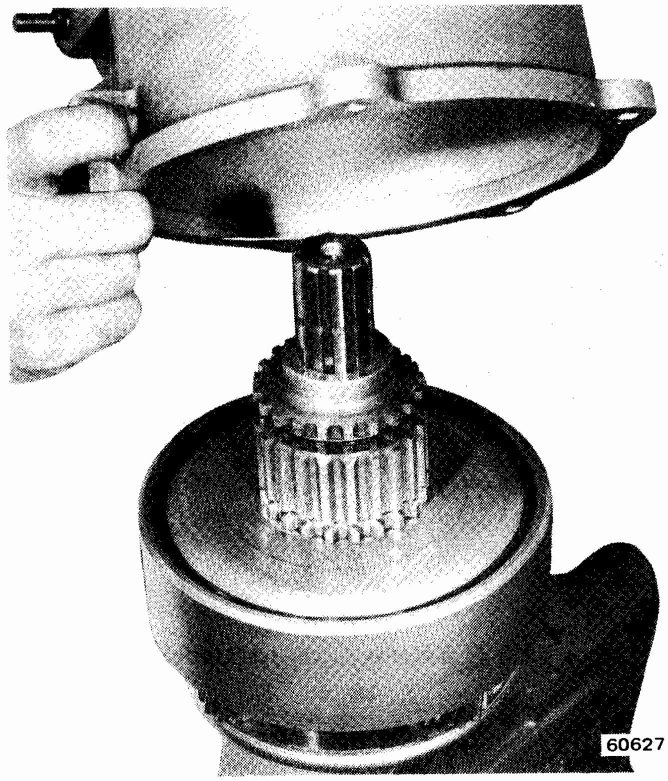


Fig. 8-26 Removing-Installing Housing

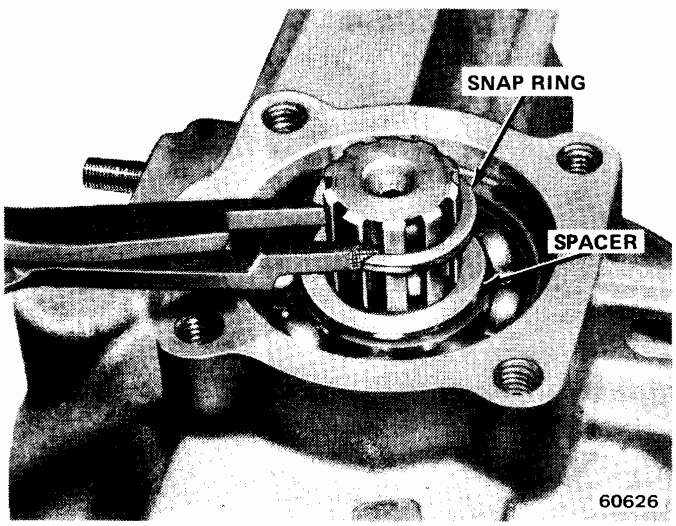


Fig. 8-25 Removing-Installing Main Shaft Snap Ring

NOTE: *If only the shift collar, annular bearing, or reduction housing are to be serviced, do not remove and disassemble gear train. Leave gear train in place on socket to simplify assembly.*

(7) Remove direct drive sleeve and needle bearing, shift collar hub and needle bearing, reduction collar hub, and ring gear and needle bearings as an assembly (fig. 8-27).

NOTE: *If necessary, reduction collar plate hub and reduction collar plate can be separated from ring gear by removing retaining snap rings.*

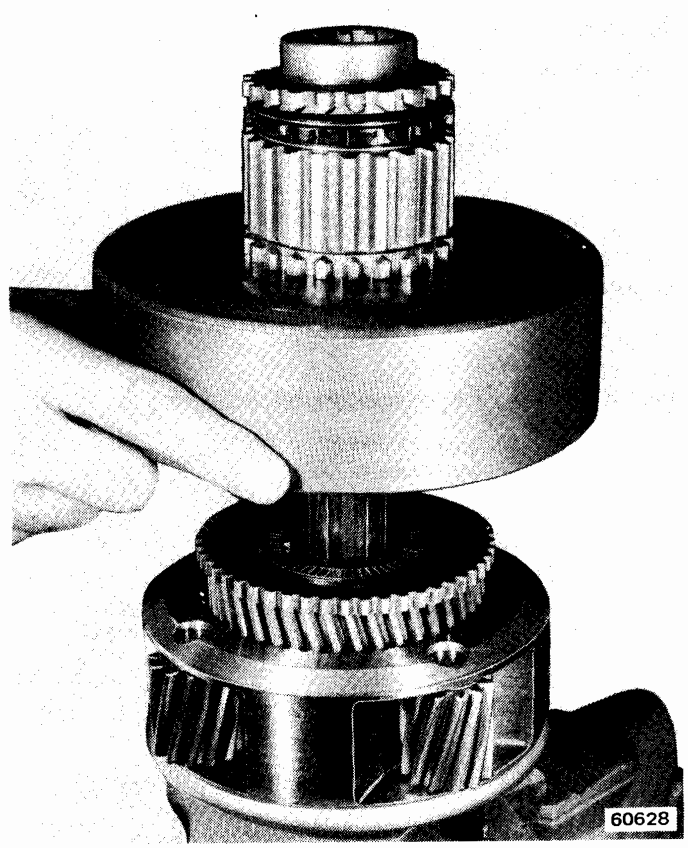


Fig. 8-27 Removing Sleeve, Hubs, and Ring Gear Assembly

(8) Remove pinion cage lock plate and needle bearings.

(9) Remove sun gear and main shaft from pinion cage (fig. 8-28). Do not attempt to disassemble sun gear and main shaft.

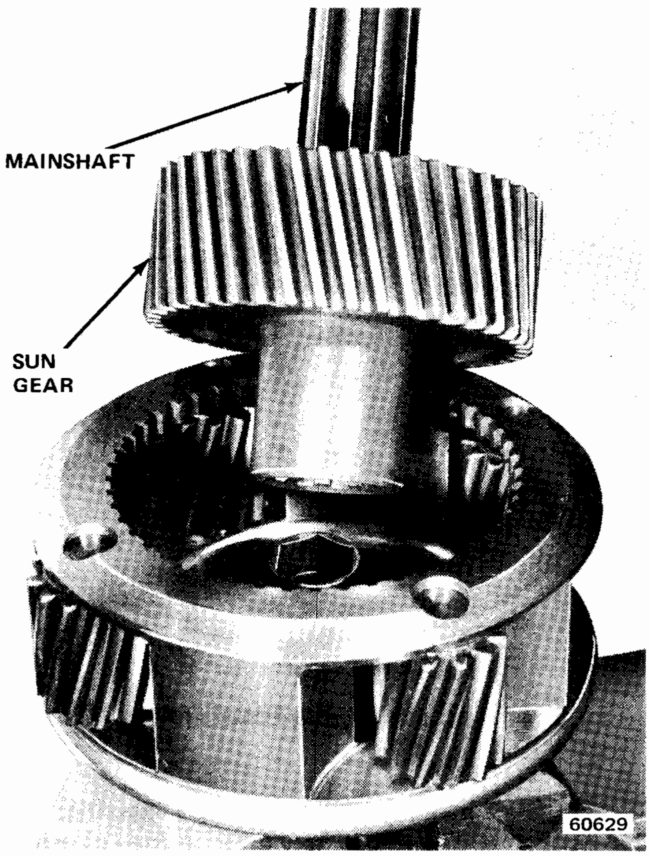


Fig. 8-28 Removing Sun Gear and Main Shaft

Shift Collar Removal

(1) Move control lever to Neutral position and disengage shift collar from shift fork.

(2) Move control lever rearward to high range position and align outer teeth on shift collar with inner teeth on holding plate.

(3) Using control lever, move shift fork and shift collar forward to low range position and remove shift collar (fig. 8-29).

Annular Bearing Replacement

(1) Remove rear snap ring and annular bearing (fig. 8-30). The rear snap ring is select-fit and available in thickness ranges of 0.086 to 0.088 inch, 0.089 to 0.091 inch, 0.092 to 0.094 inch, 0.095 to 0.097 inch, and 0.098 to 0.100 inch. The front snap ring should be 0.086 to 0.088 inch.

(2) Install front snap ring and bearing, then install thickest rear snap ring that will seat completely.

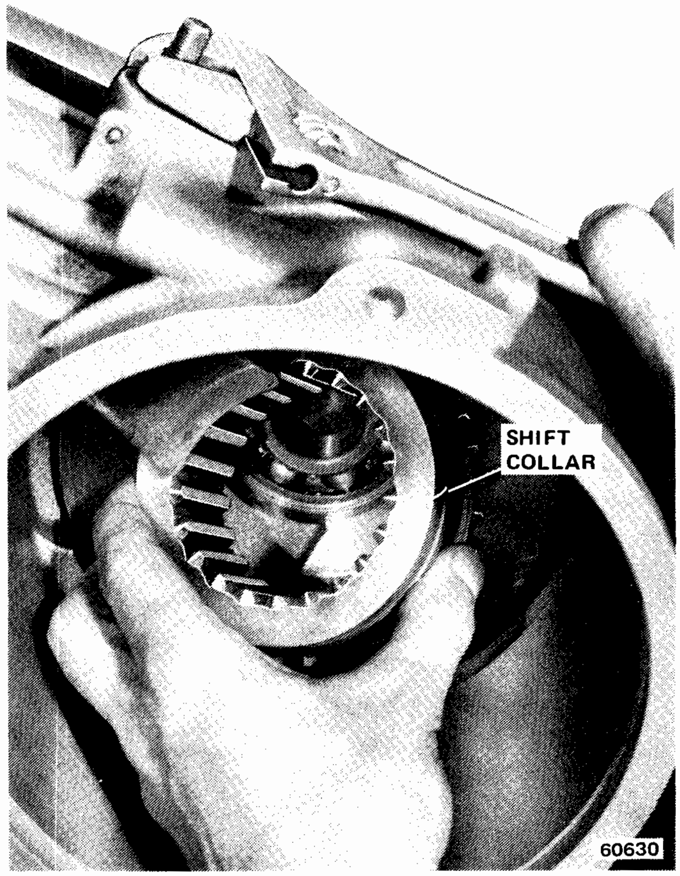


Fig. 8-29 Removing-Installing Shift Collar

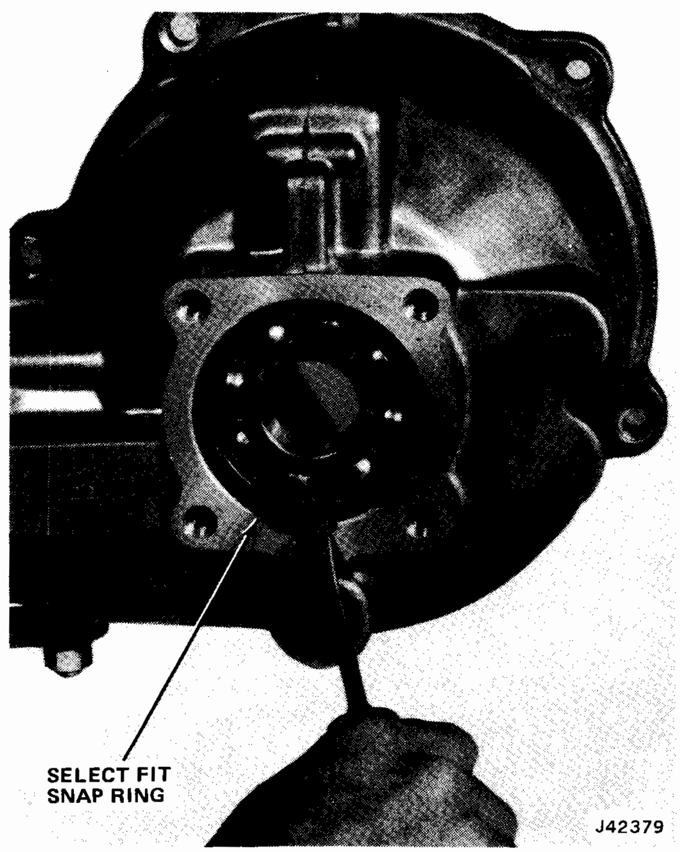


Fig. 8-30 Removing Rear Annular Bearing Snap Ring

Reduction Housing Disassembly

(1) Remove shift fork locating spring pin by pulling and rotating with pliers (fig. 8-31).

(2) Remove large expansion plug.

(3) Remove shift rail taper plugs.

(4) Remove control lever from shift lever assembly.

(5) Use 3/16-pin punch and drive spring pin from shift fork and shift rail (fig. 8-32).

(6) Slide shift rail forward out of shift fork. Remove shift fork.

(7) Remove shift rail poppet ball.

(8) Drive poppet taper plug into shift rail bore and remove plug and poppet spring.

(9) Remove shift lever retaining pin and shift lever assembly.

(10) Remove reduction holding plate retaining snap ring and reduction holding plate.

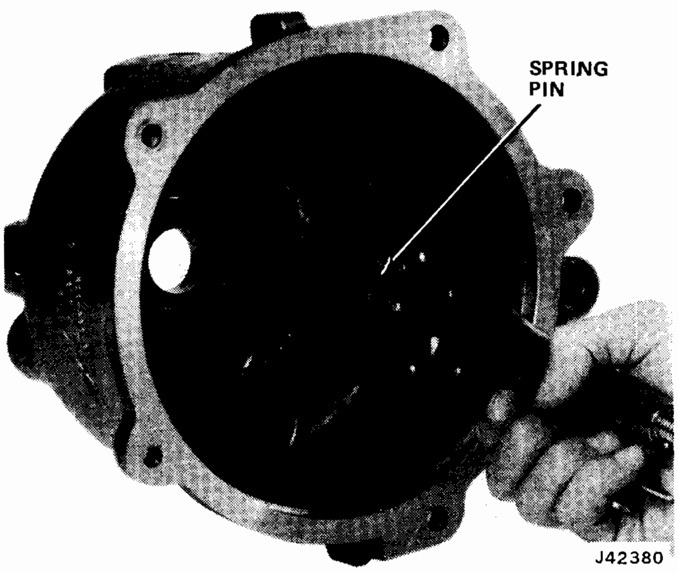


Fig. 8-31 Removing Shift Fork Locating Spring Pin

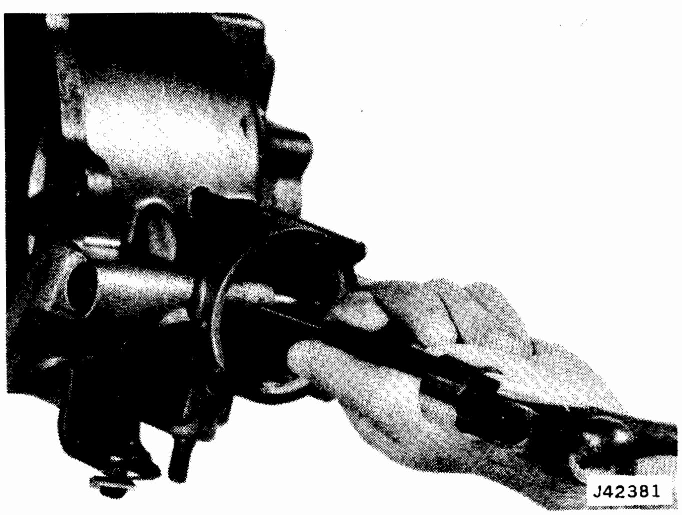


Fig. 8-32 Removing Spring Pin

Reduction Unit Assembly

(1) Install reduction holding plate.

NOTE: *The locating pins should index in case, and shift fork locating spring pin holes in holding plate and housing must align (fig. 8-31).*

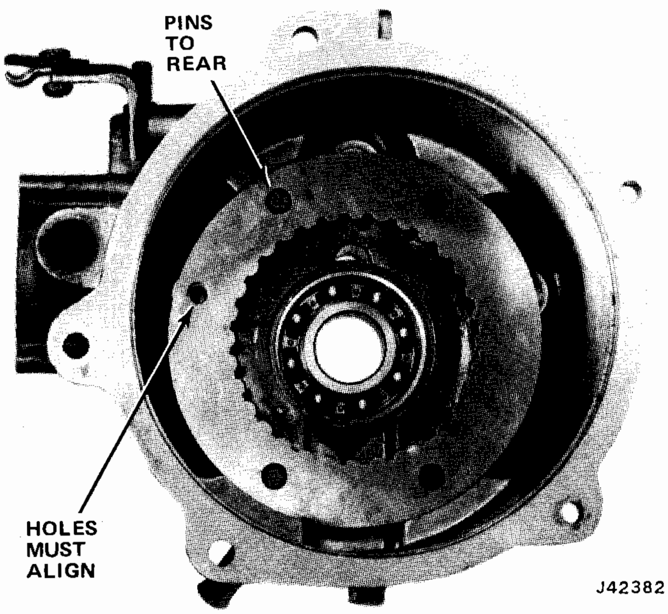


Fig. 8-33 Reduction Holding Plate Indexed Properly in Case

(2) Install holding plate retaining snap ring. Snap ring tabs should face forward. Be sure snap ring seats completely in groove and clears shift fork.

(3) Install shift fork locating spring pin.

(4) Insert shift lever assembly, without O-ring, fully into housing with lever end facing rearward.

(5) Install O-ring seal in groove in shift lever shaft (fig. 8-34).

(6) Move shift lever assembly inward just far enough to allow installation of shaft locating taper pin.

(7) Install taper pin.

(8) Insert shift rail, grooved end first, into shift rail rear bore in case.

(9) Rotate rail so flat side will be adjacent to poppet spring.

(10) Slide rail far enough to allow shift fork to be meshed with shift lever assembly and on rail.

(11) Move rail through shift fork until end of rail is even with edge of poppet bore.

(12) Place poppet ball on end of spring.

(13) Use spring pin as tool to depress poppet ball (fig. 8-35).

(14) Slide shift rail over poppet ball as far as spring pin will allow.

(15) Remove spring pin and slide shift rail to first detent position.

Fig. 8-34 Shift Lever O-Ring Installation

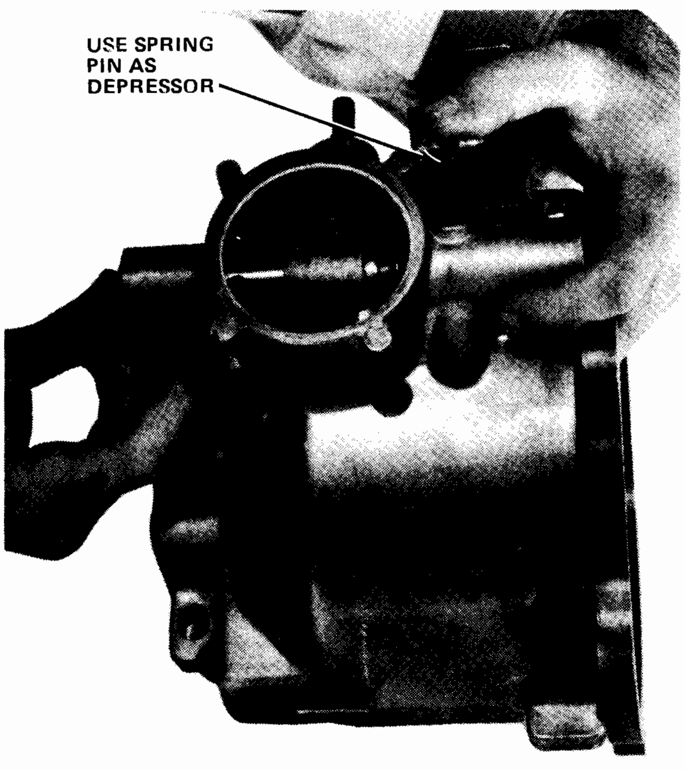


Fig. 8-35 Installing Shift Rail and Poppet

(16) Rotate shift rail until flat side is facing shift lever assembly and spring pin bore is aligned with spring pin bore in shift fork.

(17) Slide shift fork on shift rail to align spring pin holes.

(18) Install spring pin flush with outside surface of shift fork (fig. 8-36).

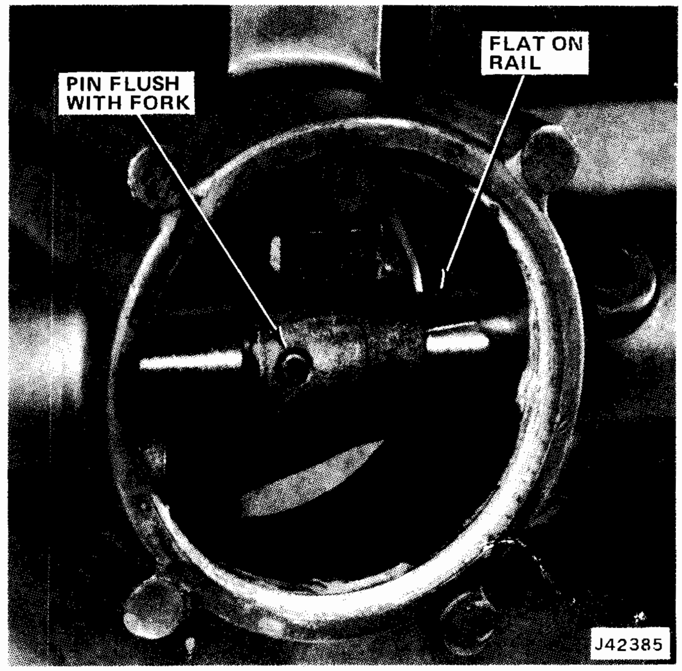


Fig. 8-36 Shift Rail

(19) Install shift rail taper plugs, poppet bore taper plug and shift rail cover expansion plug.

(20) Install control lever.

(21) Install reduction shift collar as follows:

(a) Position shift fork in center (neutral) detent.

(b) Place reduction shift collar outer teeth in mesh with reduction holding plate inner teeth. Shift collar fork groove should be just forward of shift fork.

(c) Move shift fork to rear detent.

(d) Move shift collar rearward away from fork until groove in collar aligns with fork.

(e) Move collar toward fork to engage collar groove with shift fork.

(22) Install needle bearing and reduction collar hub on shift collar hub (fig. 8-37).

(23) If ring gear was disassembled, install reduction collar and reduction collar plate hub and install retaining snap rings (fig. 8-38).

(24) Install ring gear assembly on top of reduction collar hub with open end of ring gear facing up (fig. 8-39).

(25) Install needle bearing, pinion cage lock plate, and another needle bearing on that part of shift collar hub that extends through ring gear.

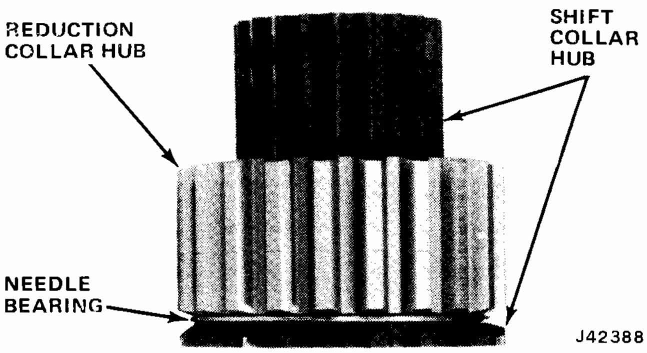


Fig. 8-37 Needle Bearing and Reduction Collar Hub Assembled with Shift Collar Hub

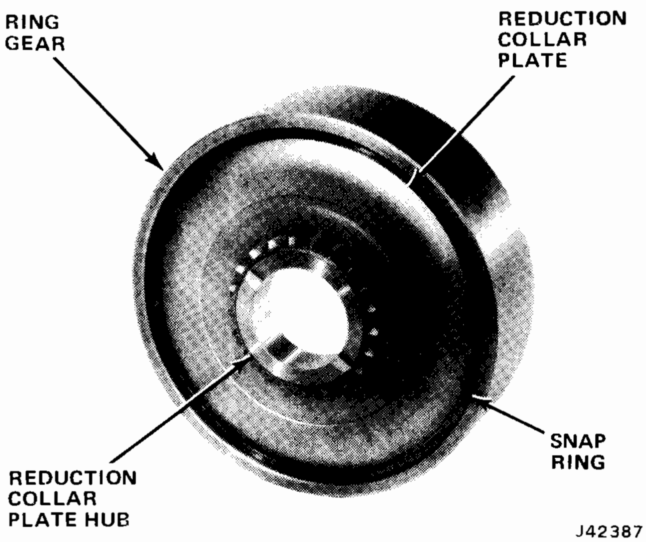


Fig. 3-38 Ring Gear Assembly

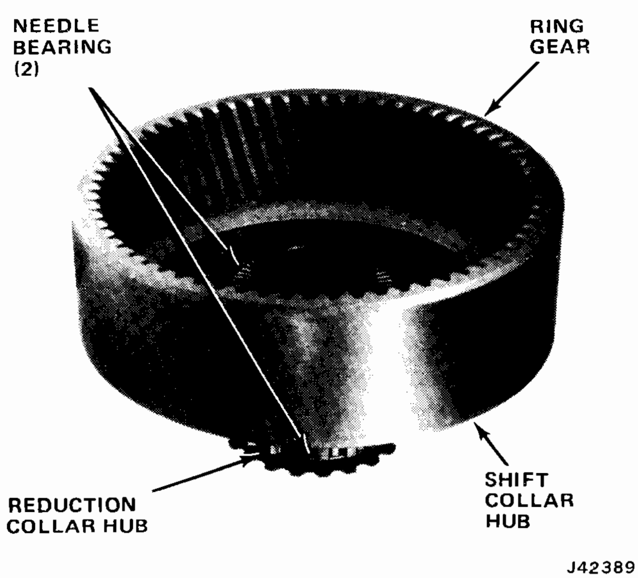


Fig. 3-39 Ring Gear Assembled on Reduction Collar Hub

(26) Slide assembled parts toward edge of workbench just far enough to expose bore in shift collar hub. Support assembly with one hand and insert main shaft in bore of shift collar hub with other hand. Be sure main shaft and sun gear are fully seated. Install main shaft and sun gear from open end of ring gear.

(27) Hold assembled parts firmly together, lift assembly and place assembly on socket (in vise) used to suppport reduction unit during disassembly.

(28) Install needle bearing and direct drive sleeve on main shaft.

(29) Align splines on assembled parts and install reduction housing (fig. 8-26). Be sure housing is seated firmly against direct drive sleeve.

(30) Install rear spacer and snap ring. The snap ring is select-fit and is available in thickness ranges of 0.089 to 0.091 inch, 0.092 to 0.094 inch, 0.095 to 0.097 inch, 0.099 to 0.101 inch, and 0.103 to 0.105 inch. Install thickest ring possible to provide 0.004-to-0.009 inch spacer clearance. Be sure snap ring fits securely in groove.

(31) Install power takeoff cover and gasket. Tighten cover attaching screws to 20 foot-pounds torque.

(32) Remove unit from support socket and install pinion cage.

(33) Remove socket from vise.

TRANSFER CASE COVER REMOVAL—IN VEHICLE

Removal

(1) Raise and support vehicle.

(2) Remove reduction unit, if equipped. Refer to Reduction Unit Removal for procedure.

NOTE: *The pinion cage will remain with the transfer case assembly.*

(3) Remove transfer case drain plug and drain unit.

(4) Mark rear output shaft yoke and universal joint for alignment reference at assembly. Disconnect rear propeller shaft front universal joint from transfer case rear yoke.

(5) Mark diaphragm control vacuum hoses for assembly reference and disconnect hoses, switch wire, and speedometer cable. Remove emergency drive indicator switch.

(6) Disconnect park brake cable guide from pivot at right side frame rail.

(7) On CJ-7 models, place support stand under clutch housing and remove rear crossmember.

(8) Remove bolts which attach case cover assembly to case.

(9) Slide cover assembly backward off front output shaft and transmission output shaft.

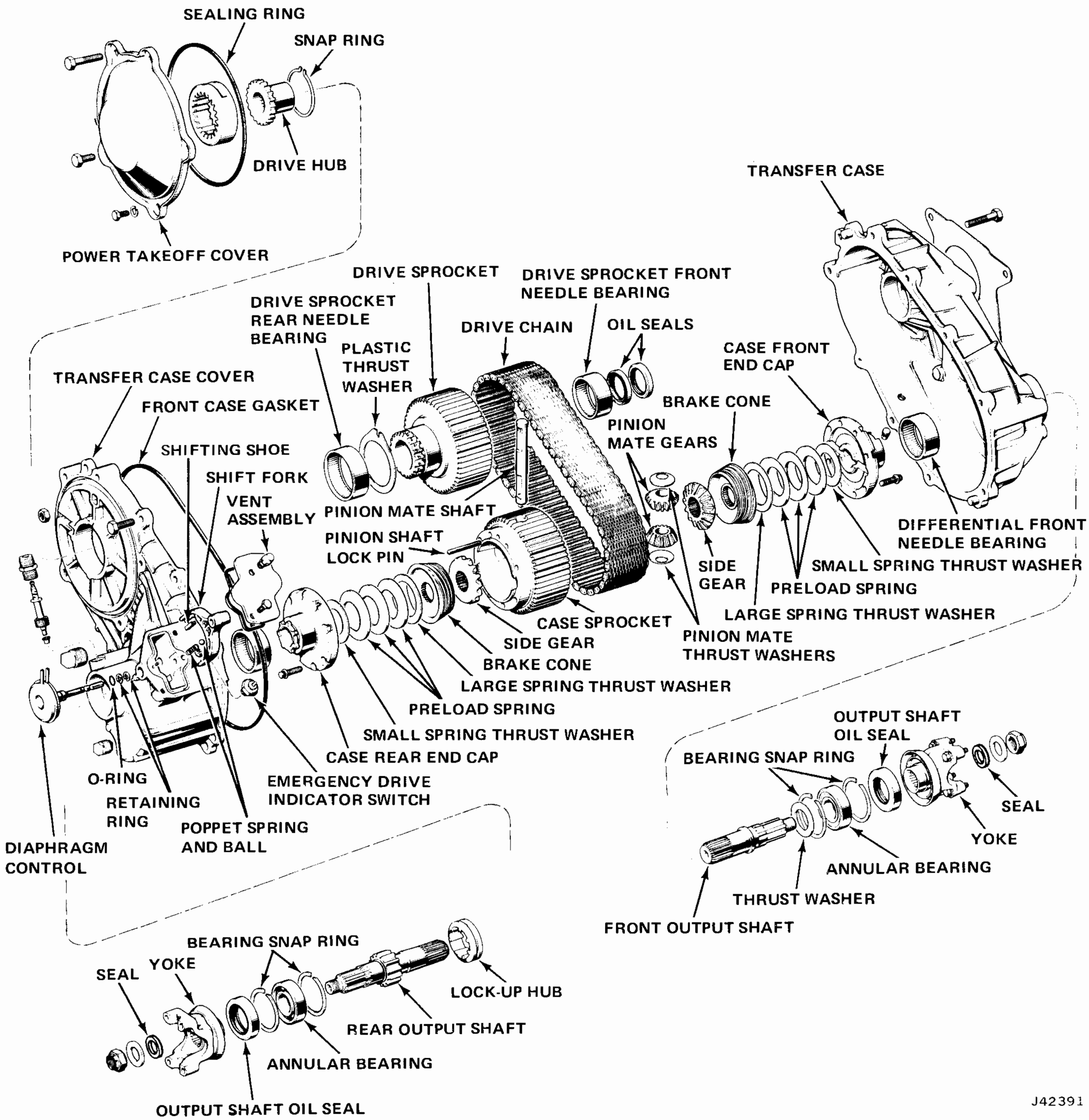


Fig. 8-40 Quadra-Trac Transfer Case Components

TRANSFER CASE COVER—DISASSEMBLY

(1) Remove rear output shaft yoke.

(2) If not equipped with reduction unit, remove power takeoff cover from rear of transfer case cover. Remove sealing ring from transfer case cover (fig. 8-40).

(3) Using wooden block 2 by 4 by 6 inches long, position cover and drive sprocket on wooden block (fig. 8-41).

(4) If not equipped with reduction unit, remove drive hub and sleeve from drive sprocket rear splines by expanding internal snap ring (the ring expanding tabs are accessible through a slot in the outside edge of the drive sleeve).

(5) If equipped with reduction unit, remove pinion cage snap ring and carrier.

(6) Remove case cover from drive sprocket and differential. Cover, rear output shaft, bearings, and seal,

drive sprocket rear needle bearing, and lockup hub may be serviced without disassembling other units.

(7) Slide drive sprocket toward differential unit and remove chain.

NOTE: *The differential unit may be serviced without disassembling other units.*

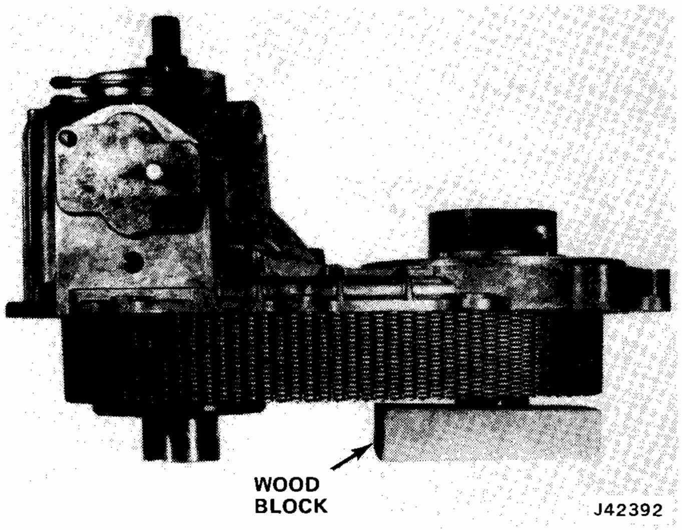


Fig. 8-41 Transfer Case Cover Positioned for Disassembly

TRANSFER CASE COVER—ASSEMBLY

(1) Position drive sprocket on wooden block.

(2) Position differential assembly about 2 inches from drive sprocket and with front end of differential on bench (fig. 8-42).

(3) Install drive chain on drive sprocket and differential assembly as shown (fig. 8-43).

NOTE: *Be sure chain is engaged with teeth in sprocket and differential and that slack is removed from chain.*

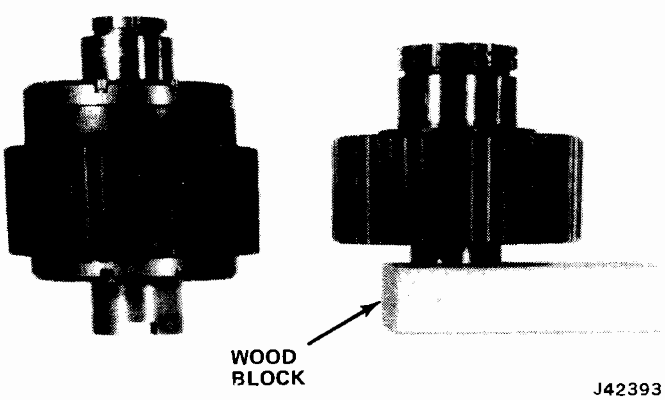


Fig. 8-42 Differential and Drive Sprocket Positioned for Chain Installation

(4) Insert rear output shaft into differential.

(5) Move lockup hub rearward in case cover. Lubricate drive sprocket thrust washer with petroleum jelly and position on case cover (fig. 8-44).

(6) Align and position case cover on drive sprocket and differential. Output shaft may require slight rotation to align with lockup hub. Be sure drive sprocket thrust washer is not displaced.

(7) If equipped with reduction unit, install pinion cage on drive sprocket rear splines. Be sure snap ring seats completely in groove.

(8) If not equipped with reduction unit, assemble drive hub, drive sleeve, and snap ring, and install on drive sprocket rear splines. Be sure snap ring seats completely in groove.

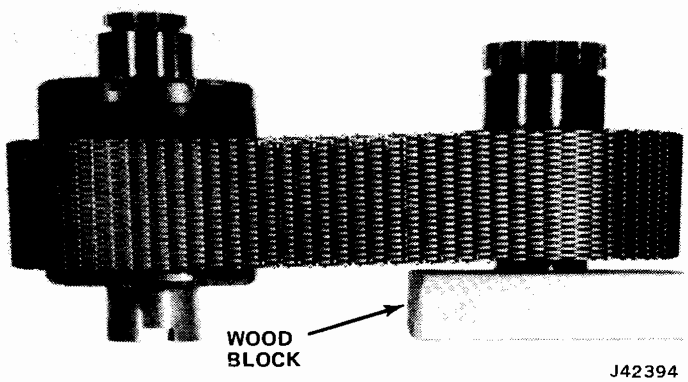


Fig. 8-43 Drive Chain Positioned Around Differential and Drive Sprocket

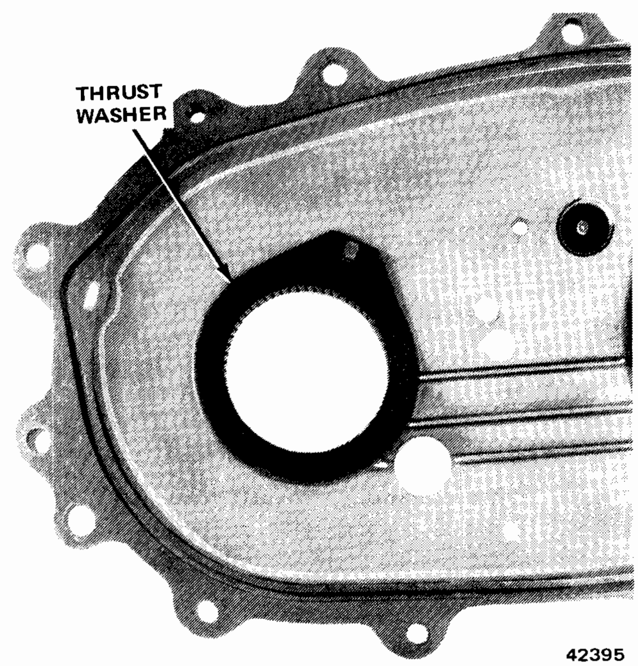


Fig. 8-44 Drive Sprocket Thrust Washer in Position on Case Cover

(9) Rotate drive sleeve or pinion cage to be sure drive sprocket thrust washer did not become displaced. Unit should turn easily with no binding.

(10) If not equipped with reduction unit, install power takeoff sealing ring and cover. Tighten attaching screws to 20 foot-pounds torque.

(11) Install speedometer gear on rear output shaft (fig. 8-45).

(12) Using Seal Driver J-25160, install rear output shaft oil seal (fig. 8-46).

(13) Install rear yoke and nut. Tighten nut to 120 foot-pounds torque.

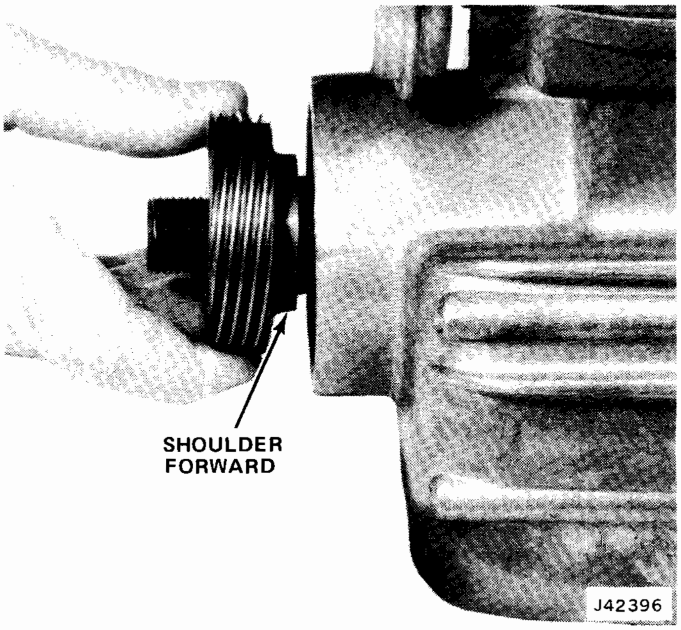


Fig. 8-45 Installing Speedometer Drive Gear

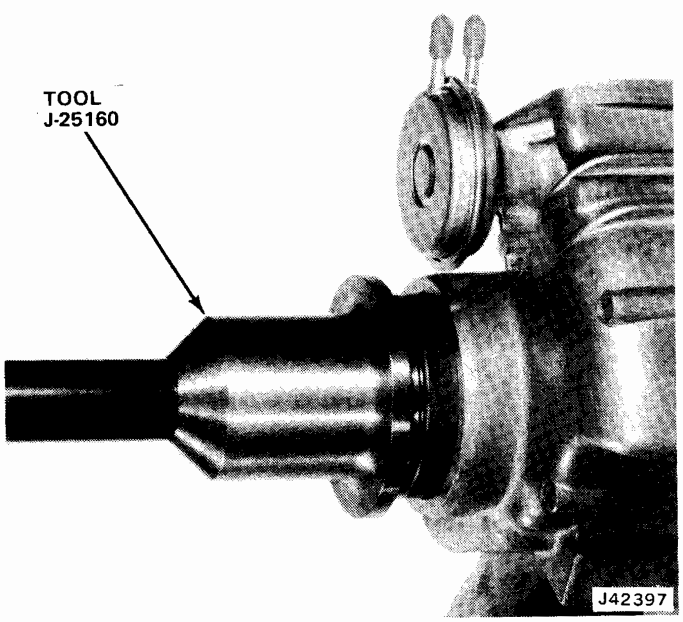


Fig. 8-46 Installing Rear Output Shaft Oil Seal

TRANSFER CASE COVER—INSTALLATION

(1) Clean oil seal groove and install seal ring.

(2) Install two 3/8-16 x 2-inch-long pilot studs in transfer case (front housing).

(3) Move cover assembly forward to mesh with front output shaft and transmission output shaft.

NOTE: *It may be necessary to rotate the rear output shaft to allow two sets of splines to engage.*

(4) Move cover assembly forward until it seats on case. Remove pilot studs and install cover-to-case attaching bolts. Tighten bolts to 15 to 25 foot-pounds torque.

(5) Install emergency drive signal switch. Connect signal switch wire, diaphragm control vacuum hoses and speedometer cable.

(6) Connect rear propeller shaft to transfer case yoke. If necessary, raise rear wheels to align shaft and yoke.

(7) Connect parking brake cable guide to pivot.

(8) If equipped with reduction unit, install reduction unit and connect shift lever linkage.

(9) On CJ-7 models, install rear crossmember and remove support stand.

(10) Install proper amount of specified lubricant. Refer to Lubrication paragraph for quantity, type, and procedure.

(11) Lower vehicle.

TRANSFER CASE —REMOVAL

Assembly removal is not required except when the front output shaft, front annular bearing, transmission output shaft seals or the transfer case (front housing) require service. The drive chain, drive sprocket, differential unit, diaphragm control system, needle bearing, thrust washer, or rear output shaft are serviced in the vehicle by removing the case cover. Refer to Transfer Case Cover Removal—In Vehicle.

(1) Raise vehicle.

(2) Mark front and rear output shaft yokes and universal joints for assembly reference. Disconnect front propeller shaft at transfer case front yoke.

(3) Disconnect rear propeller shaft at transfer case rear yoke.

(4) Remove bolts attaching exhaust pipe support bracket to transfer case.

(5) Mark diaphragm control vacuum hoses for assembly reference, and disconnect diaphragm control vacuum hoses, emergency drive signal switch wire, and speedometer cable.

(6) Disconnect park brake cable guide from pivot on right frame side.

(7) On CJ-7 models, place support stand under clutch housing and remove rear crossmember.

(8) Remove two transfer-case-to-transmission bolts which enter from front side. Install 7/16-14 x 5 inch guide pin in upper hole.

(9) Remove two transfer-case-to-transmission bolts which enter from rear. Install a 7/16-14 x 5-inch guide pin in upper hole.

(10) Move transfer case assembly rearward until free of transmission output shaft and guide pins and remove assembly.

(11) Remove all gasket material from rear of transmission.

TRANSFER CASE —INSTALLATION

(1) Position gasket on rear of transmission.

(2) Install 7/16-14 x 5-inch guide pins in upper threaded holes in transmission adapter and transfer case.

(3) Raise transfer case assembly and install it on transmission. Drive hub splines must align with transmission output shaft. Slight rotation of transfer case rear output shaft yoke may be necessary.

NOTE: *Do not install any transfer case attaching bolts until transfer case is seated against transmission.*

(4) Install front and rear transfer case-to-transmission attaching bolts. Tighten bolts to 40 foot-pounds torque.

(5) Attach exhaust pipe support bracket to transfer case.

(6) Align and connect front propeller shaft.

(7) Connect emergency drive signal switch wire and diaphragm control vacuum hoses. Connect parking brake cable guide to pivot bracket on right frame side.

(8) On CJ-7 models, install rear crossmember and remove support stand.

(9) Install proper amount of specified lubricant. Refer to Lubrication paragraph for quantity, type, and procedure.

(10) Lower vehicle.

Drive Sprocket Oil Seal Replacement

Drive sprocket oil seals may be replaced without disassembling the transfer case.

(1) Remove seals using J-type puller or a smooth-ended pry bar. Do not damage case bore.

(2) Install rear seal (lip to rear) using Seal Installer J-25213 and Sleeve J-25213-1 as driver. Install seal until driver shoulder touches case front surface.

(3) Remove Sleeve J-25213-1. Install front seal with lip to front until driver shoulder touches case front surface (fig. 8-47).

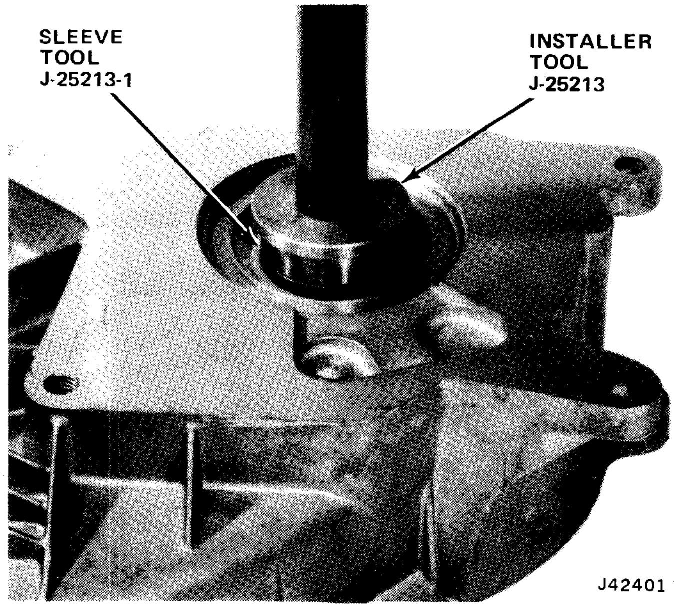


Fig. 8-47 Installing Drive Sprocket Front and Rear Oil Seals

TRANSFER CASE DISASSEMBLY

(1) Remove front and rear output shaft yokes.

(2) If not equipped with reduction unit, remove power takeoff cover from rear of transfer case cover.

(3) Remove sealing ring from transfer case cover.

(4) Remove transfer case cover to transfer case attaching bolts, and remove cover. Drive chain, drive sprocket, differential unit, and output shaft will remain in cover.

NOTE: *The case, front output shaft, bearings, and seals may be serviced at this time without removing the chain, sprocket, differential, etc.*

(5) Using wooden block 2 by 4 by 6 inches long, position cover and drive sprocket on wooden block (fig. 8-41).

(6) If not equipped with reduction unit, remove drive hub and sleeve from drive sprocket rear splines by expanding internal snap ring.

NOTE: *Ring expanding tabs are accessible through a slot in outside edge of drive sleeve.*

(7) If equipped with reduction unit, remove pinion cage from drive sprocket rear splines.

(8) Lift case cover from drive sprocket and differential. Cover rear output shaft, bearings and seal, drive sprocket rear needle bearings, and lockup hub may be serviced without disassembly of other units.

(9) Slide drive sprocket toward differential unit and remove chain.

NOTE: *Differential unit may be serviced without disassembly of other units.*

Subassembly Service

Differential Inspection

The differential unit is an unloading cone, limited-slip type unit. Belleville springs are used to preload the brake cones. The unit is serviced only as an assembly; however, it may be disassembled for component inspection and cleaning purposes.

During disassembly be sure that the side gears, brake cones, preload springs, and thrust washers are identified and kept together as matched sets. The side gears, brake cones, preload springs, and thrust washers must be installed in their original order in the case sprocket during assembly.

Disassembly

(1) Place paint marks on case sprocket and both end caps for assembly reference and orientation of both caps on case sprocket (fig. 8-48).

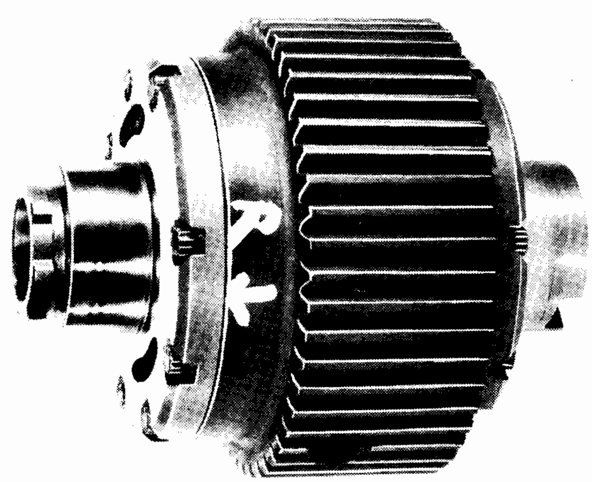


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Fig. 8-48 Case Sprocket and End Caps Marked for Assembly Reference

(2) Remove screws attaching front end cap to case sprocket. Remove end cap.

NOTE: *It may be necessary to tap the end cap with a plastic hammer.*

(3) Remove thrust washers, preload springs, brake cone, and side gear from case sprocket.

NOTE: *Keep these parts together and identify them as a matched set.*

(4) Invert case sprocket and remove screws which attach rear end cap. Remove rear end cap from case sprocket.

NOTE: *It may be necessary to tap the end cap with a plastic hammer.*

(5) Remove thrust washers, preload springs, brake cone and side gear from case sprocket.

NOTE: *Keep these pieces together and identify them as a matched set.*

(6) Lift case sprocket from bench.

(7) Pinion shaft lockpin should fall free; however, it may be necessary to remove pin using 1/4-inch pin punch.

(8) Drive pinion mate shaft from case sprocket using brass shift and hammer.

CAUTION: *Do not damage pinion mate thrust washers.*

Cleaning

Clean all parts thoroughly in solvent. Be sure that lubricant and metal particles are removed from all surfaces of every component. The side gears, brake cones, preload springs, and thrust washers must be maintained as matched sets.

Inspection

Case Sprocket

The tapered clutch surfaces and pinion gear thrust surfaces will be highly polished. Very small but smooth score marks and original machining marks are permissible; rough score marks or severe wear are not, and replacement is required.

The pinion mate shaft bores may be polished. The shaft should fit tightly in the bores.

The sprocket teeth will show a polished wear pattern. However, deep ridges and valleys on the teeth indicate excessive wear and that replacement is required.

Pinion Mate Gears, Washers, and Shaft

The teeth should be free of chip marks; however, a rough machined look is normal. The thrust surfaces and shaft bores may be highly polished with some slightly tarnished spots—this is normal. Galling or excessive wear is not acceptable.

The thrust washers should be smooth and should conform to their mating surfaces. Washer distortion or galling is not acceptable.

The shaft should be straight and fit tightly in the case sprocket. A polished wear pattern is normal. Galling or shouldered-wear on the shaft is not acceptable.

Side Gears

The teeth should be free of chip marks but a rough machined look is normal. The thrust surfaces and shaft splines may be highly polished with some slightly tarnished spots—this is normal. Galling or measurable wear is not acceptable.

Brake Cones

The spiral tapered braking surfaces will be highly polished. Very small but smooth score marks and original machining marks are permissible; rough score marks or severe wear are not, and replacement is required.

Preload Springs and Thrust Washers

The thrust washers should be flat and smooth. Light scratches and circular wear pattern are acceptable; severe wear, warping and galling are not, and replacement is required.

The preload springs should be dished approximately 1/4 inch and should be smooth. Light scratches and circular wear pattern are normal. Severe wear, warping, galling, and flatness indicate that replacement is required.

End Caps

The bearing and end thrust surfaces must be polished and smooth. Deep pitting, galling, and scoring indicate that replacement is required.

Differential Unit Assembly

NOTE: *During assembly, all bearing and thrust surfaces must be prelubricated with Jeep Lubricant Concentrate, Part No. 8123004, or Lubrizol 5901, or equivalent.*

(1) Slide pinion mate shaft into case sprocket about three inches.

(2) Install pinion mate thrust washers and gears on shaft in proper order (fig. 8-40).

(3) Align pinion mate shaft lockpin hole with lockpin hole in case sprocket. Drive pinion mate shaft into case sprocket until lockpin holes are aligned.

NOTE: *Alignment can be checked by looking through the lockpin hole in the case sprocket.*

(4) Slide pinion mate gears apart until side gears are pressing washers against case sprocket (fig. 8-49).

(5) Mesh appropriate (front or rear) side gear into pinion mate gears.

(6) Position appropriate brake cone over side gear and into case sprocket.

(7) Place large thrust washer on brake cone.

(8) Place preload springs against thrust washer with concave side of all springs facing brake cone.

(9) Lubricate small thrust washer and position it on appropriate end cap.

(10) Place end cap and thrust washer onto end of case sprocket.

NOTE: *Be sure cap is centered in preload springs and that cap is rotated to its original alignment on case sprocket.*

(11) Install attaching screws hand-tight, then tighten screws alternately and evenly to 27 foot-pounds torque.

(12) Invert case sprocket and end cap.

(13) Install pinion shaft lockpin in case sprocket and through pinion mate shaft.

(14) Engage remaining side gear in pinion mate gears.

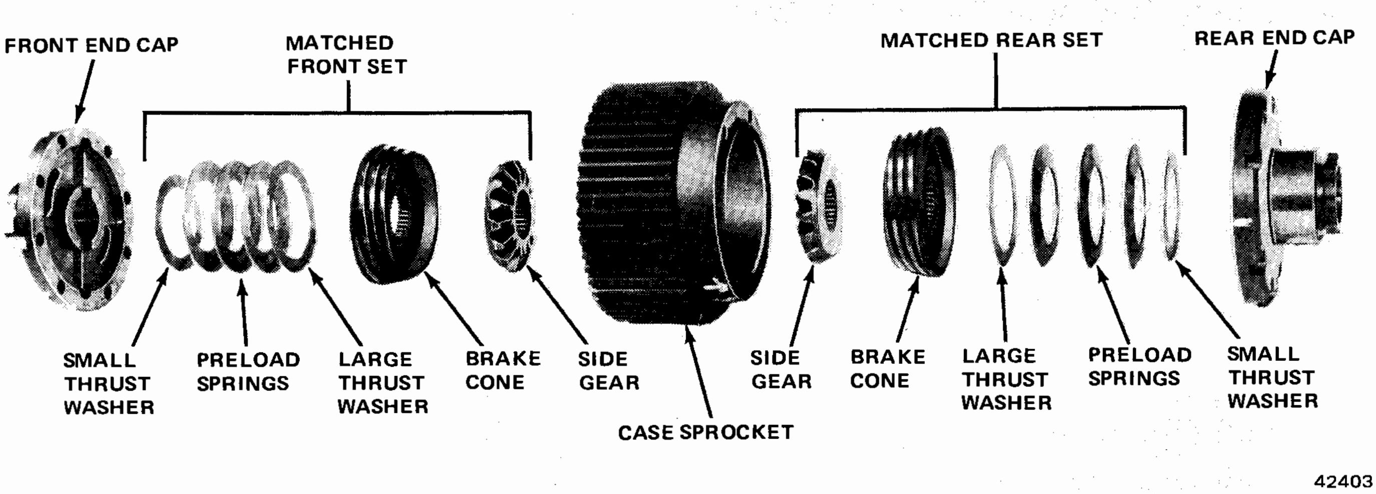

Fig. 8-49 Differential Unit Assembly Sequence

(15) Position remaining brake cone over side gear and in case sprocket.

(16) Place large thrust washer on brake cone.

(17) Place preload springs against thrust washer with concave side of all washers facing brake cone.

(18) Lubricate remaining small thrust washer and install on appropriate end cap.

(19) Place end cap and thrust washer on end of case sprocket. Be sure cap is centered in preload springs and that cap is rotated to its original alignment on case sprocket.

(20) Install attaching screws hand-tight.

(21) Using front and rear output shafts as assembly tools, insert shafts into differential and rotate shafts until both are aligned and have entered brake cone splines and side gear splines.

(22) Tighten end cap attaching screws alternately and evenly to 27 inch-pounds torque.

Bearing Replacement

Needle Bearings

To remove the differential front and rear needle bearings and drive sprocket front needle bearing, use Bearing Remover Tool J-25159 (fig. 8-50).

Use Bearing Installer Tool J-25212 less Pilot Adapter J-25212-1 to install the differential front and rear needle bearings (fig. 8-51).

Use Bearing Installer Tool J-25212 with Pilot Adapter J-25212-1 inserted into the case bore to install the drive sprocket front needle bearing. The drive sprocket oil seals must be removed to allow the pilot adapter to enter the case bore (fig. 8-52).

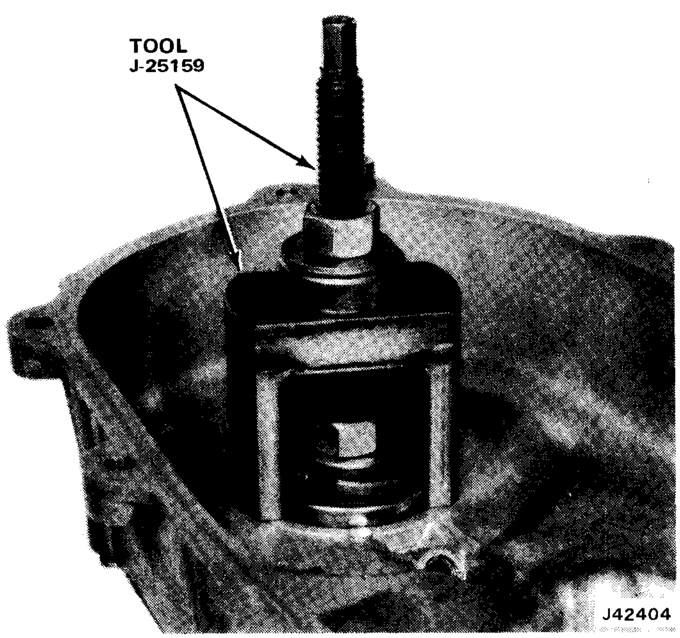

Fig. 8-50 Removing Differential Front or Rear Needle Bearing

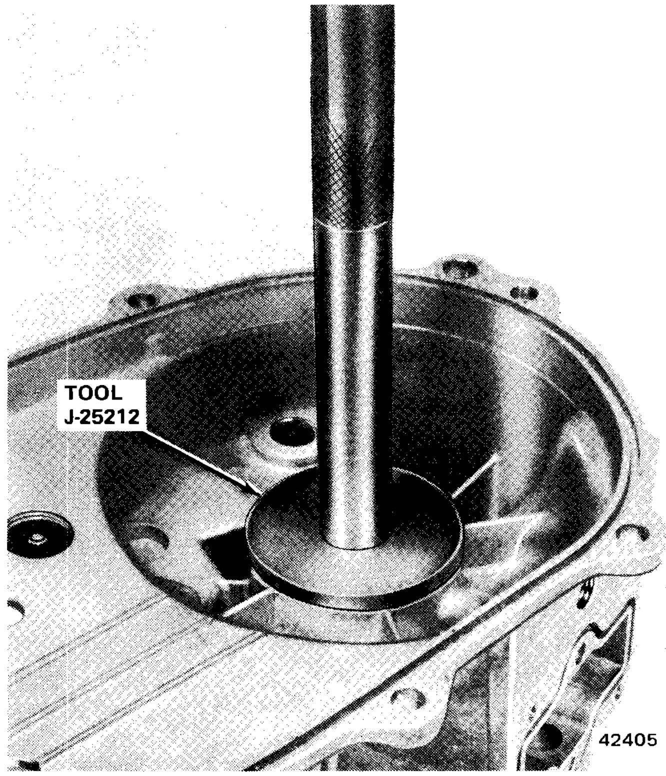

Fig. 8-51 Installing Differential Rear Needle Bearing

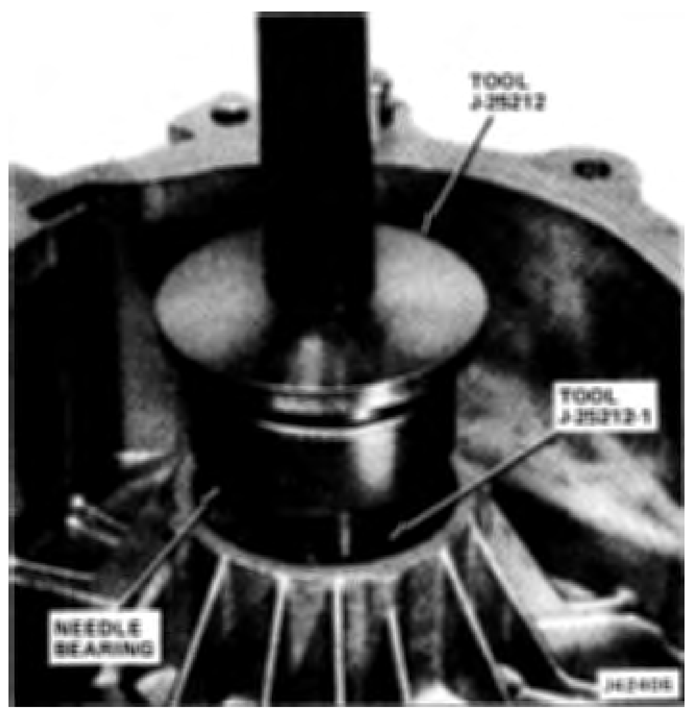

Fig. 8-52 Installing Drive Sprocket Front Needle Bearing

The drive sprocket rear needle bearing may be removed using Bearing Remover and Installer Tool J-25161 and Pilot J-25161-1. The cover must be supported on the side opposite the driver when the bearing is being removed (fig. 8-53).

Use Bearing Driver Tool J-25161 with Pilot J-25161-1 inserted into the case bore to install the drive sprocket rear needle bearing. The cover must be supported on the side opposite the driver when the bearing is being installed (fig. 8-54).

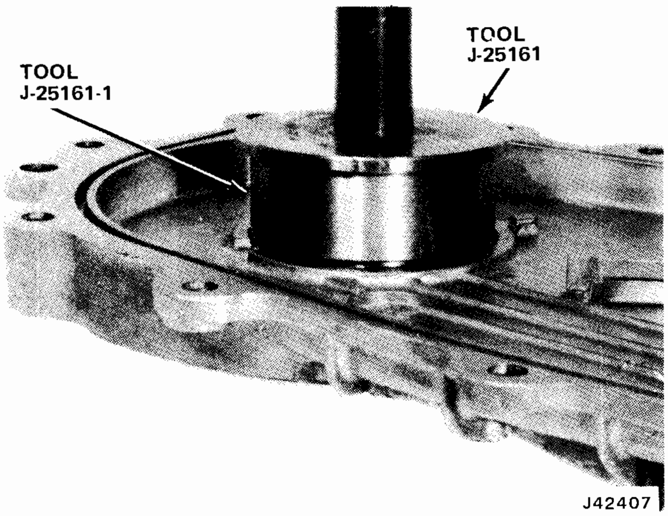

Fig. 8-53 Removing Drive Sprocket Rear Needle Bearing

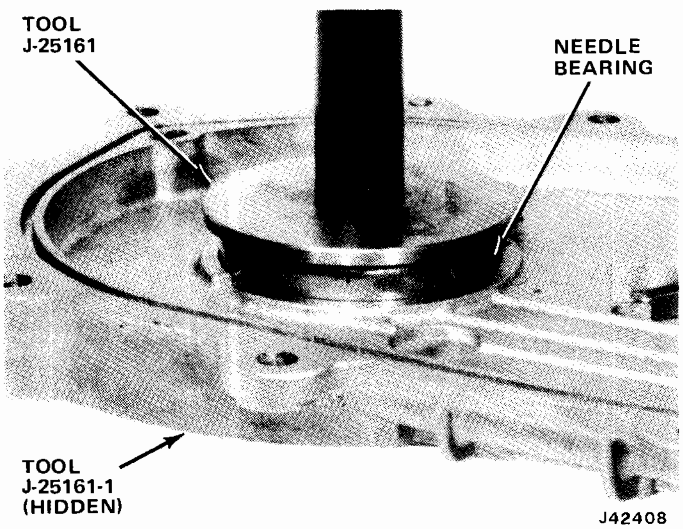

Fig. 8-54 Installing Drive Sprocket Rear Needle Bearing

Annular Bearings

The front and rear output shaft annular bearings are retained in the transfer case and case cover by snap rings. Th outer snap ring for each bearing is select-fit and available in four thickness ranges: 0.060 to 0.063 inch, 0.064 to 0.066 inch, 0.067 to 0.069 inch, and 0.070 to 0.072 inch. The inner snap ring for the bearings should always be 0.060 to 0.063 inch thick.

(1) Remove output shaft yoke seal.

NOTE: *If rear bearing is being replaced, remove speedometer gear.*

(2) Remove outer snap ring.

(3) Remove annular bearing. Bearing is snug-fit in bore and can be removed by hand. However, if bearing is tight or if bore is scratched, use brass drift to remove bearing.

(4) Install inner (0.060 to 0.063 inch) snap ring if removed Insert bearing—shielded side to inside—in bore and tap into stop against inner snap ring. Use Snap Ring Groove Gauge Tool J-25163 to determine snap ring thickness needed. Install thickest snap ring possible to provide 0.001 to 0.003 inch bearing end play.

Diaphragm Control, Shift Fork, and Lockup Hub

(1) Remove vent cover and sealing ring.

(2) Remove retaining rings which position shift fork on diaphragm control rod.

NOTE: *Shift fork may be pried forward or rearward to gain access to retaining rings.*

(3) Remove spring using magnet.

CAUTION: *The diaphragm control rod is held in position by a spring-loaded detent ball.*

(4) Insert magnet into opening before removing diaphragm control (fig. 8-55).

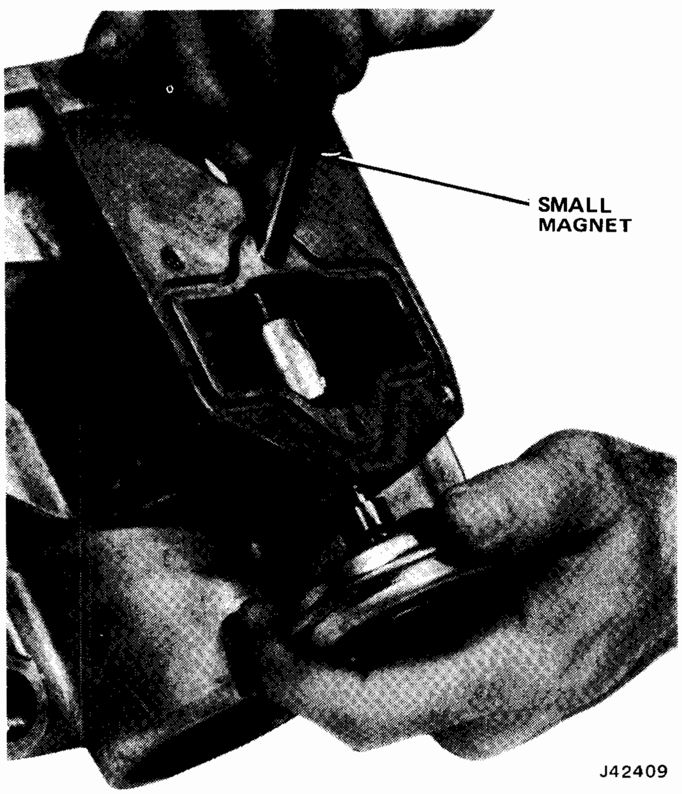

Fig. 8-55 Removing Diaphragm Control

(5) Remove diaphragm from case cover.

(6) Remove detent ball and spring.

(7) Remove shift fork and plastic shifting shoes.

(8) Remove lockup hub.

(9) Lubricate and install shifting shoes in shift fork. Install lockup hub in shift fork (fig. 8-56).

(10) Insert fork, with long side of fork to rear, and hub assembly in case cover.

NOTE: *Reach through differential needle bearing to keep lockup hub and shift fork from separating.*

(11) Slide diaphragm control rod in case cover, through shift fork but not past detent ball hole.

(12) Install detent spring and ball in hole. Use 1/4-inch pin punch to depress detent ball and slide diaphragm control rod past ball.

(13) Install shift fork retaining clips.

(14) Install diaphragm control retaining spring. Spring should seat below edge of hole. Install vent cover sealing ring and vent cover.

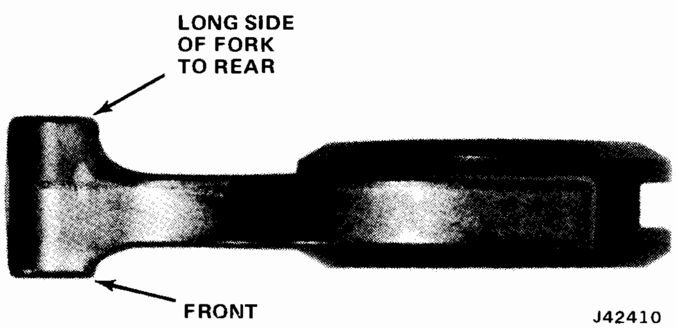

Fig. 8-56 Shift Fork and Lockup Hub Assembly

TRANSFER CASE ASSEMBLY

NOTE: *During assembly, lubricate all bearing and thrust surfaces with Jeep Lubricant Concentrate, Part No. 8123004, or Lubrizol 5901, or equivalent.*

(1) Position drive sprocket on wooden block (fig. 8-42).

(2) Place differential assembly about 2 inches from drive sprocket and with front end of differential on bench.

(3) Install drive chain around drive sprocket and differential assembly. Be sure chain is properly engaged with sprocket and differential teeth and that slack is removed from chain (fig. 8-43).

(4) Insert rear output shaft in differential.

(5) Move lockup hub rearward in case cover. Lubricate drive sprocket thrust washer and install on case cover (fig. 8-44).

(6) Align and install case cover on drive sprocket and differential. Rotate output shaft and align with lockup hub if necessary. Be sure drive sprocket thrust washer is not displaced

(7) Assemble drive hub, drive sleeve, and snap ring if disassembled (fig. 8-57).

(8) If not equipped with reduction unit, install drive sleeve and hub on drive sprocket. Be sure snap ring seats completely.

(9) If equipped with reduction unit, be sure oil baffle is in position, and install pinion cage and snap ring.

(10) Install case assembly on cover assembly and install front output shaft, output shaft thrust washer and front case gasket.

(11) Align and install case on differential drive sprocket. Install case-to-cover attaching screws. Tighten screws alternately and evenly to 20 foot-pounds torque.

NOTE: *Do not exceed the maximum specified torque.*

(12) Rotate drive sleeve to be sure drive sprocket thrust washer did not become displaced. The sleeve should turn easily without binding.

(13) Install power takeoff sealing ring and cover.

(14) Install speedometer gear on rear output shaft (fig. 8-45).

(15) Install rear output shaft oil seal using Seal Driver J-25160 (fig. 8-46).

(16) Install rear yoke and nut. Tighten nut to 120 foot-pounds torque.

(17) Install front output shaft oil seal using Seal Driver J-25160.

(18) Install front yoke and nut. Tighten nut to 120 foot-pounds torque.

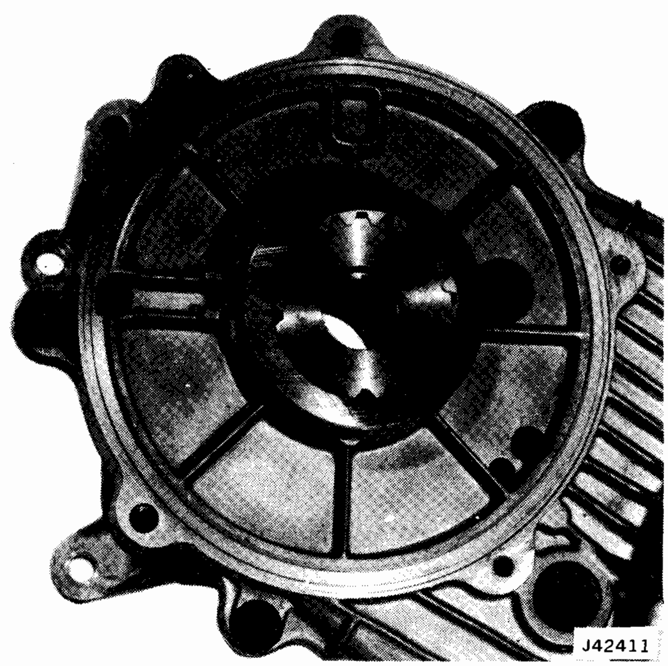

Fig. 8-57 Drive Hub and Sleeve Installed

Specifications

Quadra-Trac Transfer Case

Type . . . Automatically Differentiated Constant 4-Wheel Drive	
Make	Warner Gear
Model	Quadra-Trac
Gear Ratio:	
High	1:1
Low (With Reduction Unit)	2.57:1

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Quadra-Trac Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Transfer Case		
Breather	8	6-10
Chain Measuring Access Hole Plug	12	6-14
Differential End Bolts	27	24-30
Drain Plug	20	15-25
Fill Plug	20	15-25
Lock-Up Cover to Transfer Case	10	8-10
Emergenct Drive Indicator Switch	12	10-15
Output Shaft Nut	120	90-150
Power Takeoff Cover to Transfer Case Bolt:		
3/8-16 Bolts	20	15-25
5/16-18 Bolts	15	10-20
Speedometer Adapter	25	20-30
Transfer Case Cover to Transfer Case	20	15-25
Transfer Case to Transmission Extension Bolt	40	30-50
Reduction Unit		
Fill Plug	20	15-25
Reduction Power Takeoff Cover to Case	20	15-25
Reduction Unit to Transfer Case Bolt:		
3/8-16 Bolt/Nut	20	15-25
5/16-18 Bolt/Nut	10	8-10
Shift Lever to Shaft Nut	20	15-25

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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Lubricants

Model 20 Transfer Case . . . . SAE 80 or 90 Gear Lubricant

Quadra-Trac Transfer Case . . . . SAE 30W Non-Detergent Engine Oil (Valveline or Equivalent) and 8 ounces Jeep Lubricant Concentrate or Lubrizol 5901.

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Model 20 Transfer Case

Type	Four-Position
Make	Spicer
Model	20
Gear Ratio:	
High	1:1
Low	2.03:1
Two-Wheel Drive	1:1

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Model 20 Torque Specifications

Service Set-To Torques should be used when assembling components.

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torques	Service In-Use Recheck Torques
Front and Rear Output Shaft Yoke Nuts	240	225-250
Front Output Shaft Rear Bearing Cover to Case Bolts	30	28-32
Intermediate Shaft Lock Plate to Case Bolts	14	12-15
Lower Cover to Case Bolts	14	12-15
Rear Bearing Cap Assembly to Case Bolts	30	28-32
Right and Left Shift Fork Setscrews	14	12-15
Shift Rod Housing to Case Bolts	30	28-30
Transfer Case to Transmission Bolts	30	28-32

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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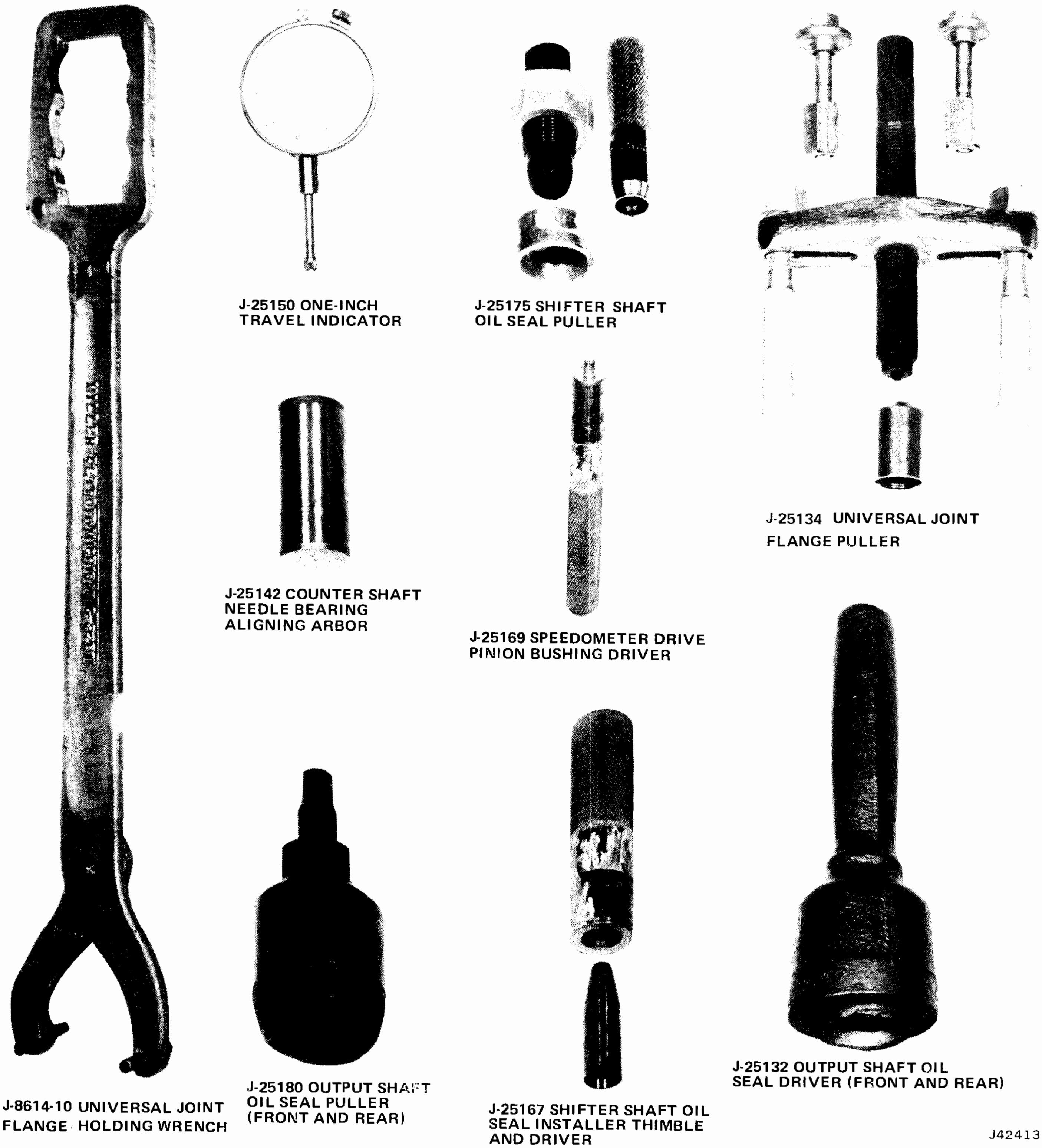

Fig. 8-58 Tools (Sheet 1 of 2)

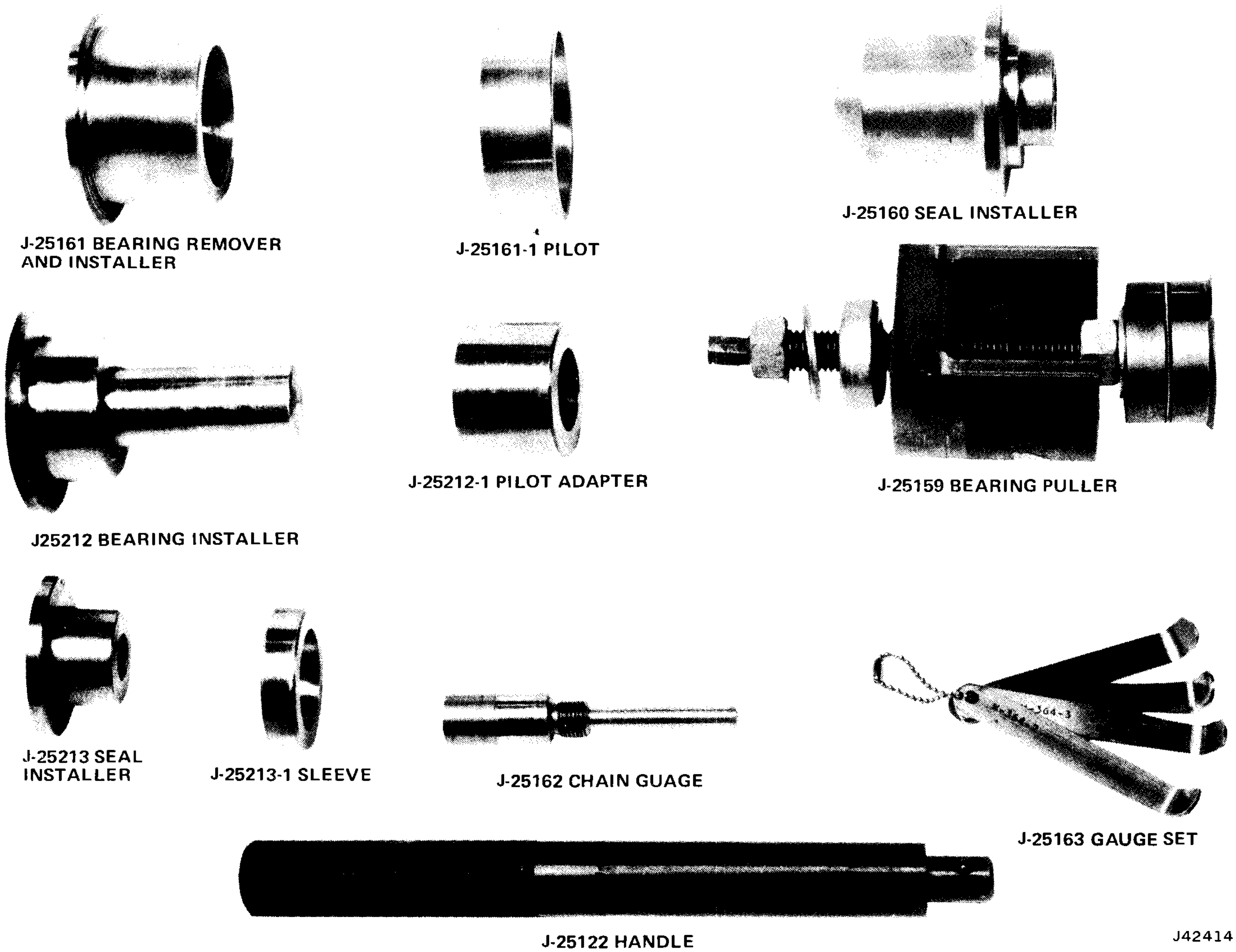

Fig. 8-59 Tools (Sheet 2 of 2)

BRAKES AND WHEELS

BRAKE DIAGNOSIS

GENERAL

In most instances, the customer will describe the difficulty as one or more of the conditions listed in the diagnosis charts. Road test the vehicle with the customer to confirm the difficulty and obtain additional information. Follow procedures listed in the diagnosis charts to pinpoint the cause of the problem.

ADJUSTMENTS

Brake Pedal and Linkage

The one-piece suspended brake pedal is connected to the support bracket by the brake pedal shaft. The shaft serves both as an attaching part and as a pivot for the brake pedal.

The power pedal linkage to the master cylinder piston (or power unit push rod, if equipped with power brakes) should be lubricated and inspected regularly for binding, looseness, or excessive play. Binding can cause improper pedal release which may result in brake drag and rapid lining wear. Worn pedal linkage may cause low pedal or frequent need for brake adjustment.

Pedal free play should be 1/16 to 1/4 inch. Inadequate free play can result in brake drag or grab Excessive free play can result in a low brake pedal. Pedal free play on models with nonpower brakes is governed by the brake pedal push rod length which is preset at manufacture. Push rod length is not adjustable on these models and, under normal circumstances, should not require further attention. Power brake equipped vehicles utilize a single push rod in the power unit which is not adjustable. When replacing power brake units, use the push rod supplied with the replacement power unit as it has been properly gauged and preset for use with the replacement unit. Pedal free play for power brake equipped vehicles is the same as for vehicles with manual brakes (1/16 inch to 1/4 inch).

Parking Brake Adjustment—All Models

NOTE: *Wheel brakes must be adjusted prior to adjusting parking brakes.*

(1) Release parking brake.

(2) Loosen locknuts at equalizer and relieve tension on cables.

(3) Inspect all cables for binds, kinks, or frayed condition. Replace defective cables.

(4) Tighten cables until slight drag is produced at wheels.

(5) Loosen cables until wheels rotate freely and no drag is felt.

(6) Tighten locknuts at equalizer.

(7) Check operation of parking brake.

Stoplamp Switch—All Models

The stoplamp switch is mounted on a flange attached to the brake pedal support bracket (fig. 9-1). A spring-loaded plunger in the switch makes and breaks the stoplamp circuit.

When the brake pedal is in the released position, the pedal arm contacts the switch plunger, holding it in the off position. When the brake pedal is depressed, the spring-loaded plunger extends with brake pedal movement until the switch is in the on position (fig. 9-1).

Switch Adjustment

(1) Release brake pedal to its normal position. On Cherokee, Wagoneer, and Truck models, unhook retaining fingers that secure wire harness plug to switch. On all models, disconnect wire at rear of switch.

(2) Adjust switch by turning in or out of mounting bracket. Switch plunger should be in ON position and activate stop lamps after 3/8 to 5/8 inch of brake pedal travel. Measure pedal travel from center of pedal pad.

(3) Connect wire or harness plug to switch.

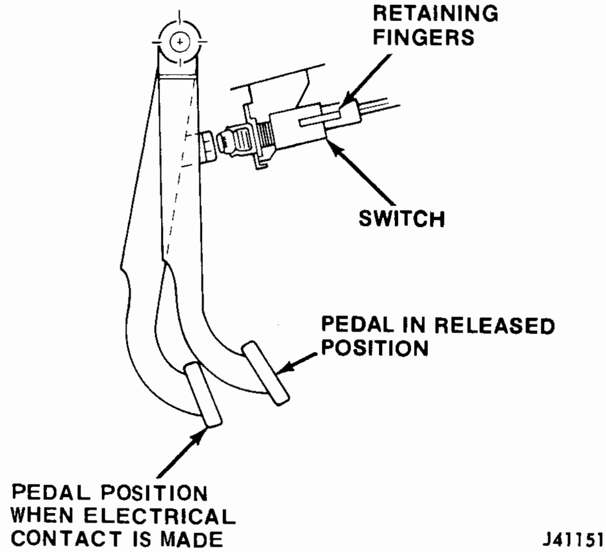

Fig. 9-1 Stoplamp Switch Operation

Power Brake Diagnosis Procedure

With engine stopped and transmission in neutral, apply brakes several times to deplete all vacuum reserve in the system. Depress brake pedal, hold light foot pressure on pedal, and start engine.

If the vacuum system is operating, pedal will tend to fall away under foot pressure, and less pressure will be required to hold pedal in applied position.

With engine running and brakes off, run to medium speed and turn off ignition, immediately closing throttle. This builds up vacuum. Wait no less than ninety seconds, then try brake action.

If vacuum assisted for two or more applications.

Road Test Vehicle. If problem still exists, see Brake Service Diagnosis Charts.

If not vacuum assisted for two or more applications, vacuum check valve is faulty or there is a leak in the vacuum system.

See Power Unit Service Diagnosis.

If no action is felt, vacuum system is not functioning.

See Power Unit Service Diagnosis.

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Power Unit Service Diagnosis

Condition	Possible Cause	Correction
HARD PEDAL (NO POWER ASSIST)	(1) Refer to EXCESSIVE PEDAL EFFORT.	(1) Refer to EXCESSIVE PEDAL EFFORT.
	(2) Loss of vacuum to power unit.	(2) Check for loose hose or check valve seal. Check for collapsed or damaged hose. Inspect vacuum check valve for damage or leak. Replace parts as required.
	(3) Internal malfunction in power unit.	(3) Replace power unit.
SLOW RETURN OF BRAKE PEDAL	(1) Bellcrank pivot pins binding (CJ only) or, pedal linkage binding. See PULLS and GRABBING BRAKES in Brake Service Diagnosis Charts.	(1) Lube all pedal pivot points. Remove, clean, lube and install pivot pins.
	(2) Internal malfunction in power unit.	(2) Replace power unit.
GRABBING OR DRAGGING BRAKES	(1) Bellcrank pivot pins binding (CJ only).	(1) Remove, clean, lubricate, and install pivot pins.
	(2) Refer to PULLS and GRABBING BRAKES in Brake Service Diagnosis Charts.	(2) See PULLS and GRABBING BRAKES in Brake Service Diagnosis Charts.
	(3) Push rod (in power unit) binding due to corrosion or burrs on push rod.	(3) Check and correct as required. Do not lube push rod. Clean push rod with brake fluid and clean cloth only.
	(4) Internal malfunction in power unit.	(4) Replace power unit.

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Drum Brakes Service Diagnosis—All Models

LOW PEDAL OR PEDAL GOES TO TOE BOARD	(1) Low fluid level.	(1) Fill reservoir with approved brake fluid.
	(2) Excessive clearance between lining and drums.	(2) Adjust brakes.
	(3) Automatic adjusters not working.	(3) Make forward and reverse stops; if pedal stays low, repair faulty adjusters.
	(4) Leaking brake lines.	(4) Repair or replace faulty parts.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
LOW PEDAL OR PEDAL GOES TO TOE BOARD (Continued)	(5) Leaking wheel cylinders.	(5) Overhaul wheel cylinder.
	(6) Internal leak in master cylinder.	(6) Overhaul master cylinder.
	(7) Air in system.	(7) Bleed system.
	(8) Improper brake fluid.	(8) Flush system and refill with approved fluid.
SPRINGY, SPONGY PEDAL	(1) Air trapped in hydraulic system.	(1) Remove air by bleeding.
	(2) Improper brake fluid.	(2) Flush and bleed system; use approved brake fluid.
	(3) Improper lining thickness or location.	(3) Install new lining or replace shoe and lining.
	(4) Drums worn too thin, (beyond 0.060 inch oversize specification)	(4) Replace drum(s) as required.
	(5) Master cylinder filler vent clogged	(5) Clean vent or replace cap; bleed brakes.
	(6) Hoses-lines collapsed, kinked, leaking.	(6) Replace as required.
	(7) Master cylinder compensator port blocked.	(7) Disassemble master cylinder. Repair as required.
EXCESSIVE PEDAL PRESSURE REQUIRED TO STOP VEHICLE	(1) Brake adjustment not correct.	(1) Adjust brakes.
	(2) Incorrect lining.	(2) Install new linings.
	(3) Grease or fluid-soaked lining.	(3) Repair grease seal or wheel cylinder. Install new linings.
	(4) Improper fluid.	(4) Flush system; use approved brake fluid.
	(5) Frozen master or wheel cylinder pistons.	(5) Overhaul master or wheel cylinders.
	(6) Brake pedal binding on shaft.	(6) Lubricate pivot points.
	(7) Linings watersoaked.	(7) Drive with brakes lightly applied to dry linings.
	(8) Glazed linings.	(8) Replace linings.
	(9) Bell-mouthed, barrel-shaped, or scored drums.	(9) Replace or resurface drums in left and right hand pairs.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
LIGHT PEDAL PRESSURE-BRAKES TOO SEVERE	(1) Brake adjustment not correct.	(1) Adjust brakes.
	(2) Loose support plates.	(2) Tighten support plates.
	(3) A small amount of grease or fluid on linings.	(3) Replace the linings.
	(4) Pedal linkage binding, or power unit bellcrank pivot pins binding (CJ only).	(4) Lube linkage and bellcrank pivot pins.
	(5) Internal bind in power unit.	(5) Replace power unit.
	(6) Incorrect lining.	(6) Install new linings.
	(7) Lining loose on shoe.	(7) Replace lining or shoe and lining.
	(8) Bell-mouthed, barrel-shaped, or scored drums.	(8) Turn drums in pairs or replace.
	(9) Combination valve faulty.	(9) Replace combination valve.
PULSATING BRAKE PEDAL	(1) Drums out-of-round.	(1) Refinish drums.
	(2) Loose brake drum on hub.	(2) Tighten.
	(3) Worn or loose wheel bearings.	(3) Replace or adjust.
	(4) Bent shoes or linings.	(4) Replace shoe-lining assembly as required.
	(5) Bent rear axle shaft.	(5) Replace axle shaft.
	(6) Loose or bent support plate.	(6) Tighten or replace support plate.
BRAKE FADE	(1) Incorrect lining.	(1) Replace lining.
	(2) Air in lines or improper brake fluid.	(2) Bleed system. Drain and flush if fluid is improper type.
	(3) Master cylinder primary piston worn, or bore scored, corroded.	(3) Disassemble master cylinder. Repair as required.
ALL BRAKES DRAG (ADJUSTMENT IS KNOWN TO BE CORRECT)	(1) Pedal bellcrank pivot pins binding (CJ only).	(1) Lubricate pedal pivot or bellcrank pivot pins.
	(2) Improper fluid.	(2) Replace rubber parts and fill.
	(3) On power brakes (CJ only) push rod height is incorrect.	(3) Adjust push rod height.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
ALL BRAKES DRAG (ADJUSTMENT IS KNOWN TO BE CORRECT (Continued)	(4) Compensating or bypass port of master cylinder closed.	(4) Open with compressed air.
	(5) Use of inferior hydraulic fluid or rubber parts. (Swollen cups, corroded wheel or master cylinder bores.	(5) Overhaul wheel and/or master cylinder.
BRAKE PEDAL TRAVEL DE-CREASING	(1) Master cylinder compensating port plugged.	(1) Use compressed air to unplug.
	(2) Power bellcrank pivot pins binding (CJ only) or pedal pivot binding on manual brakes.	(2) Lube pedal pivot or pivot pins.
	(3) Swollen cup in master cylinder.	(3) Replace rubber parts. Flush system.
	(4) Master cylinder piston not returning.	(4) Overhaul master cylinder.
	(5) Wheel cylinder pistons sticking.	(5) Overhaul wheel cylinder.
ONE WHEEL DRAGS	(1) Weak or broken brake shoe retracting springs.	(1) Replace the defective brake shoe springs and lubricate the brake shoe ledges.
	(2) Power unit bellcrank pivot pins binding (CJ only) or pedal pivot binding.	(2) Lube pedal pivot or pivot pins.
	(3) Insufficient brake shoe-to-drum clearance.	(3) Adjust brakes. Repair automatic adjusters if necessary.
	(4) Loose wheel bearings.	(4) Adjust wheel bearings.
	(5) Wheel cylinder piston cups swollen and distorted.	(5) Overhaul wheel cylinders.
	(6) Pistons sticking in wheel cylinder.	(6) Clean or replace pistons; clean cylinder bore.
	(7) Restriction in brake line.	(7) Clean out or replace.
	(8) Loose anchor pin.	(8) Adjust and tighten lock nut.
	(9) Parking brake components seized or incorrectly adjusted.	(9) Repair or replace parts as necessary.
ONE WHEEL LOCKS	(1) Contaminated linings.	(1) Replace the linings.
	(2) Tire tread slick.	(2) Replace tire or, match up tire treads from side to side.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
BRAKES GRAB OR WON'T HOLD IN WET WEATHER	(1) Linings water-soaked.	(1) Dry out linings by driving with brakes lightly applied.
	(2) Dirt, water in drums.	(2) Clean drums.
	(3) Bent support plate allowing excessive water to enter drum.	(3) Replace support plate.
	(4) Scored drums.	(4) Grind or turn in pairs.
BRAKES SQUEAK	(1) Support plate bent or shoes twisted.	(1) Replace damaged parts.
	(2) Metallic particles or dust imbedded in lining.	(2) Sand the surfaces of the linings and drums. Remove all particles of metal that may be found in the surface of the linings.
	(3) Lining rivets loose or lining not held tightly against the shoe at the ends.	(3) Replace rivets. Replace shoe lining assemblies if damaged.
	(4) Drums distorted.	(4) Turn, grind, or replace drums.
	(5) Shoes scraping on support plate ledges.	(5) Lubricate.
	(6) Weak or broken hold-down springs.	(6) Replace defective parts.
	(7) Loose wheel bearings.	(7) Tighten to proper setting.
	(8) Charred lining.	(8) Replace lining.
	(9) Loose support plate, anchor, drum, or wheel cylinder.	(9) Tighten.
	(10) Linings located wrong on shoes.	(10) Install linings correctly.
REAR BRAKES DRAG	(1) Adjustment not correct.	(1) Adjust brake shoes and parking brake mechanism.
	(2) Parking brake cables frozen.	(2) Lubricate or replace as required.
	(3) Dirty lining.	(3) Clean lining.
	(4) Wheel cylinder cups swollen or piston sticking.	(4) Overhaul cylinders.
	(5) Weak retracting springs.	(5) Replace springs.
	(6) Shoes binding on support plate.	(6) Lubricate support plate ledges.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
VEHICLE PULLS TO ONE SIDE	(1) Grease or fluid-soaked lining.	(1) Locate and correct leakage; replace with new linings.
	(2) Adjustment not correct.	(2) Adjust the brakes.
	(3) Loose wheel bearings, loose support plate(s) or loose spring bolts.	(3) Adjust wheel bearing; tighten support plate(s) and tighten spring bolts.
	(4) Linings not of specified kind or primary and secondary shoes reversed.	(4) Install new linings.
	(5) Power unit bellcrank pivot pins binding (CJ only).	(5) Lube pivot pins.
	(6) Tires not properly inflated or unequal wear of tread. Different tread design side to side.	(6) Inflate the tires to recommended pressures. Rotate tires so that tread surfaces of similar design and equal wear will be installed on the front wheels.
	(7) Water, mud, or foreign matter in brakes.	(7) Remove foreign material from brake parts and inside of the drums. Lubricate the shoe ledges and the rear brake cable ramps.
	(8) Wheel cylinder sticking.	(8) Overhaul or replace wheel cylinder.
	(9) Weak or broken retracting springs.	(9) Check springs. Replace bent, opencoiled or cracked springs.
	(10) Out-of-round drums.	(10) Resurface or replace drums in left and right hand pairs (both front and both rear).
	(11) Brake dragging.	(11) Check for loose lining. Repair or replace as required.
	(12) Broken spring or loose U-bolts.	(12) Replace spring or tighten U-bolts.
	(13) Loose steering components.	(13) Tighten or repair and adjust as required.
	(14) Unequal camber.	(14) Replace axle housing.
	(15) Clogged or crimped brake line.	(15) Repair or replace line.
	(16) Wheel cylinder incorrect size.	(16) Replace with correct cylinders.
	(17) Worn steering knuckle bearings.	(17) Replace.

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Drum Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
BRAKES CHATTER	(1) Incorrect lining-to-drum clearance.	(1) Adjust to recommended clearances.
	(2) Loose brake support plate.	(2) Tighten support plate.
	(3) Grease, fluid, road dust on lining.	(3) Clean out dust; replace grease and fluid-soaked lining.
	(4) Weak or broken retractor spring.	(4) Replace.
	(5) Loose wheel bearings.	(5) Adjust.
	(6) Drums out-of-round.	(6) Grind or replace drums in pairs.
	(7) Cocked or distorted shoes.	(7) Straighten or replace.
	(8) Tapered or barrel-shaped drums.	(8) Turn or replace drums in pairs.
SHOE CLICK	(1) Shoes lift off support plate and snap back.	(1) Change drums side to side or turn drums (in pairs).
	(2) Holddown springs weak.	(2) Replace springs.
	(3) Shoe bent.	(3) Replace shoes on both sides.
	(4) Grooves in support plate ledges.	(4) Replace support plate.
SNAPPING NOISE IN FRONT END	(1) Grooved support plate ledges.	(1) Replace support plate.
	(2) Lack of lubrication on support plate ledges.	(2) Lubricate ledges.
	(3) Loose drums or support plates.	(3) Tighten.
	(4) Loose or worn front end parts.	(4) Tighten or replace defective parts.

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Disc Brakes Service Diagnosis—Cherokee-Wagoneer-Truck

Condition	Possible Cause	Correction
BRAKE CHATTER OR ROUGHNESS. BRAKE PEDAL PULSATES	(1) Excessive rotor lateral runout.	(1) Check rotor runout. Refinish if not to specs (refer to Rotor Measurements).Replace if unable to refinish.
	(2) Excessive thickness variation.	(2) Check thickness variation. Refinish if out of spec. Replace if unable to refinish.
	(3) Loose or worn wheel bearings.	(3) Adjust to specs. Replace if worn or damaged.

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Disc Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
BRAKE CHATTER OR ROUGHNESS: BRAKE PEDAL PULSATES (Continued)	(4) Rear drums out-of-round.	(4) Check runout. If not to specs turn drum. Do not remove more than .060 inch.
	(5) Disc brake shoes reversed (steel side of shoe riding on rotor).	(5) Replace rotor and shoes.
	(6) Shoes bent or linings worn.	(6) Replace shoes.
EXCESSIVE PEDAL EFFORT REQUIRED	(1) Malfunction in power brake unit.	(1) Check operation. Refer to Power Brake Units.
	(2) Malfunction in front or rear brake system (dual master cylinder) such as: wheel cylinder leaks, defective brake lines, caliper piston seal leak, master cylinder piston cups not holding pressure.	(2) Check both brake systems and correct as required. Check for failed brake warning light if brake failure occurred and light did not operate.
	(3) Lining worn.	(3) Check and replace linings as required.
	(4) Caliper piston(s) sticking.	(4) Rebuild caliper(s).
	(5) Brake fade caused by incorrect or non-recommended linings.	(5) Replace with correct or recommended lining.
	(6) Incorrect master cylinder.	(6) Check and replace if required.
EXCESSIVE PEDAL TRAVEL	(1) Low fluid level.	(1) Add fluid as required.
	(2) Leak in system.	(2) Inspect and correct as required.
	(3) Air in system.	(3) Bleed brakes.
	(4) Rear brakes not adjusting properly.	(4) Adjust rear brakes and repair automatic adjusters.
	(5) Worn lining.	(5) Replace linings. If wear is excessive or premature, check for incorrect lining, sticking caliper pistons, binding park brake cables, shoe drag on support plate, weak return springs on drum brakes, improper rear brake adjustment.
	(6) Bent or broken shoe.	(6) Replace as required.
	(7) Master cylinder mounting bolts loose.	(7) Check and retighten.
	(8) Rotor thickness or drum diameter below specification.	(8) Inspect, measure and replace as required.

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Disc Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
DRAGGING BRAKES NOTE: A very light drag occuring after releasing the brake pedal is a characteristic of disc brakes.	(1) Master cylinder pistons not returning properly.	(1) Remove cover, check for spurt of fluid at compensator holes as brake pedal is depressed. Rebuild master cylinder if fluid spurt is not observed. Inspect compensator ports for blockage, use compressed air to clear passages.
	(2) Restrictions in brake lines or hoses.	(2) Check for kinks or dents in steel lines. Check rubber hoses for swelling or restrictions inside hose.
	(3) Incorrect parking brake adjustment.	(3) Check and readjust to spec. Inspect cables for bind or frayed conditions.
	(4) Rear shoes not returning to normal position.	(4) Return springs weak. Shoes dragging on support plate due to lack of lube or ridges on support plate ledges. Wheel cylinder cups swollen or pistons sticking. Repair or replace faulty parts as required.
	(5) Caliper pistons not releasing. Pistons stuck due to piston scoring or corrosion or piston cocking in bore.	(5) Repair or replace pistons or caliper as required.
	(6) Lines to combination valve installed incorrectly.	(6) Check and correct as required. Port marked inlet goes to master cylinder; port marked outlet goes to calipers.
	(7) Bind in brake pedal or power unit bellcrank pivot pins (CJ only)	(7) Lube pedal pivot or pivot pins.
	(8) Check valve installed in master cylinder outlet port.	(8) Check outlet. Remove valve if present. Bleed brakes.
GRABBING BRAKES	(1) Refer to all conditions listed under PULLS WHEN BRAKES ARE APPLIED.	(1) See PULLS WHEN BRAKES ARE APPLIED.
	(2) Power brake unit malfunction or bellcrank pivot pins binding (CJ only).	(2) Check operation and replace or repair as required. Refer to POWER UNIT SERVICE DIAGNOSIS Chart.
	(3) Combination valve malfunction.	(3) Replace valve and bleed system.
	(4) Incorrect power unit.	(4) Check and replace as required.

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Disc Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
PULLS WHEN BRAKES ARE APPLIED	(1) Incorrect tire pressures.	(1) Inflate to spec.
	(2) Mismatched tires on same axle.	(2) Install equal size, type tires.
	(3) Wheel bearings misadjusted or worn.	(3) Adjust or replace as required.
	(4) Malfunction in caliper.	(4) Check for stuck piston.
	(5) Damaged or contaminated shoe and lining (grease on lining or bent shoe).	(5) Replace shoe and lining on both sides. Replace axle seals, wheel cylinder cups, or caliper piston seals, if leaking.
	(6) Rear brake problem: automatic adjusters inoperable, contaminated lining, defective wheel cylinders, seized or improperly adjusted park brake cables, shoes binding on support plate, linings worn, linings charred or cracked, bent support plate, weak retracting springs, drums out-of-round.	(6) Inspect and repair or replace malfunctioning parts. Check for equal size wheel cylinders on rear brakes.
	(7) Loose calipers.	(7) Check mounting bolt torque, inspect threads on bolts for galling or stripped threads, check support plate for broken welds.
	(8) Loose suspension parts.	(8) Inspect and correct as required.
	(9) Front end out of alignment.	(9) Check and correct as required.
	(10) Lining soaked with water after operation in heavy rains, or flooding conditions.	(10) Allow lining to air dry, or while driving, keep brakes lightly applied to warm up lining and evaporate water.
	(11) Disc brake rotor out of tolerance.	(11) Check and refinish or replace as required.
REAR DRUM BRAKES SKID PREMATURELY ON HARD BRAKE APPLICATION	(1) Combination valve proportioner section malfunctioning.	(1) Replace valve and bleed brakes.
	(2) Check items listed under PULLS and GRABBING.	(2) See PULLS and GRABBING.
SPONGY PEDAL	(1) Air in system.	(1) Bleed brakes. Inspect for broken lines, loose fittings, leaking caliper pistons, or wheel cylinders; check rubber seal on master cylinder cover. Check cover itself for distortion or cracks, check all bleed valves for proper torque.
	(2) Rear drums thin or cracked.	(2) Inspect and correct as required.

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Disc Brakes Service Diagnosis (Continued)

Condition	Possible Cause	Correction
SPONGY PEDAL (Continued)	(3) Calipers loose.	(3) Check mounting bolt torque.
	(4) Loose master cylinder or brake booster attaching parts.	(4) Check and correct as required.
	(5) Compensator port blocked in master cylinder.	(5) Check and correct as required.
	(6) Improper (low quality) brake fluid in system. Fluid boils and becomes aerated.	(6) Drain and flush system.

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HYDRAULIC SYSTEM

GENERAL

When servicing the hydraulic system, prevent the entry of contaminants by capping all lines and ports, and by avoiding the use of mineral-oil based fluids for cleaning system components.

CAUTION: *Never use gasoline, kerosene, carbon tetrachloride, paint thinner, alcohol, nor any other fluid containing mineral oil, to clean or lubricate hydraulic system components. These materials will cause swelling, deterioration, and premature aging of rubber parts. Use brake fluid or brake cleaning solvent only.*

To determine if dirt, moisture, or mineral-oil based cleaners have contaminated the hydraulic fluid, drain off a sample and check for suspended particles, discoloration, or separation of the fluid into distinct layers. Layering indicates the presence of water or mineral oil content. If system contamination should occur, drain and flush the system with an approved brake fluid only.

Approved Brake Fluids

Whenever the hydraulic system is filled, use Jeep Brake Fluid or equivalent marked SAE J1703.

CAUTION: *Never fill the hydraulic system with used or reclaimed fluid.*

Master Cylinder Fill Level

Master cylinder fluid level should be checked at least four times a year or every 5,000 miles. **The master cylinder fluid reservoirs should be filled to within 1/4 inch of the rim of each reservoir.** When checking fluid level, the rubber diaphragm seal on the master cylinder cover should be inspected for cracks, cuts, distortion, or any other condition that might allow air or foreign material to enter the master cylinder. When the cover is removed for any reason, do not allow the rubber diaphragm seal to come in contact with dirt, grease, or other foreign material.

Hydraulic System Inspection Procedure

(1) Check master cylinder cover retaining spring for proper tension and fit. The spring should provide enough tension on the cover to maintain an airtight seal.

(2) Inspect rubber diaphragm seal for cracks and distortions.

(3) Check master cylinder fill level.

(4) Check for dirt and foreign material in reservoirs. Drain off a sample of brake fluid into a clean glass container and test for contamination as outlined above.

(5) Inspect all fittings and brake lines for leakage, kinks, or other damage.

(6) Inspect condition of front brake hoses. Replace if cut, cracked, swollen, or leaking.

(7) Check for evidence of fluid leakage at all wheel cylinders and front calipers (if equipped with disc brakes).

POWER BRAKE UNITS

A tandem-diaphragm unit (fig. 9-2) is used on CJ models equipped with power brakes while Cherokee, Wagoneer, and J-10 Truck models use a 9-1/2-inch single diaphragm power unit (fig. 9-3); J-20 truck models (6500 GVW and up) use a 9-1/2-inch tandem-diaphragm power unit.

Fig. 9-2 Power Brake Unit, CJ Models

Power Unit Service

All power brake units are serviced as an assembly. When diagnosis indicates a unit is defective, it should be replaced, not overhauled. The single and tandem diaphragm units have a single push rod (fig. 9-4) of a preset, nonadjustable length. When replacing a power unit, use the push rod supplied with the replacement power unit. This push rod has been correctly gauged and preset to the replacement unit.

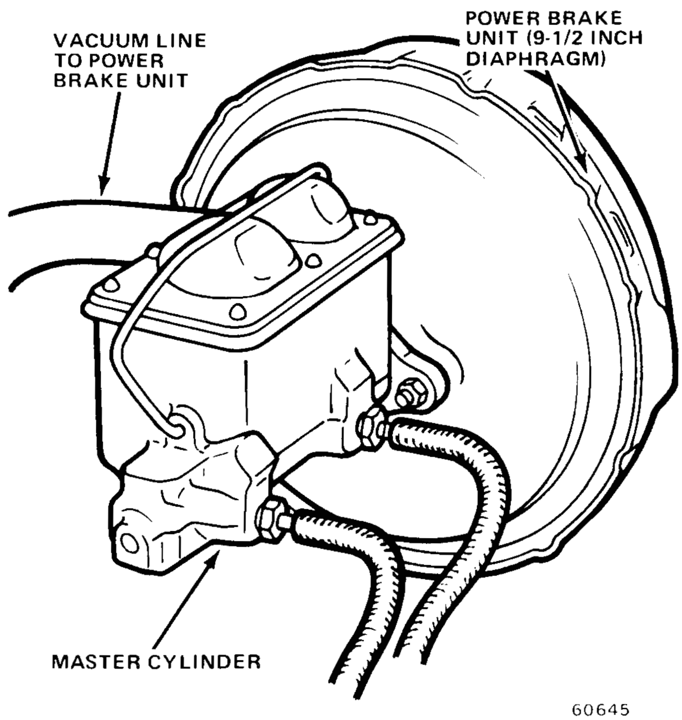

Fig. 9-3 Power Brake Unit, 9-1/2-Inch Diaphragm Cherokee-Wagoneer-Truck

DUAL MASTER CYLINDER—DOUBLE-SAFETY BRAKES

In the Double-Safety brake system, the hydraulic system for the front brakes is completely separate from the rear brakes. In the event of hydraulic brake failure in the front system, the rear hydraulic brakes will still operate. If a failure occurs in the rear brakes, the front brakes will still operate.

A double hydraulic cylinder with two outlets, two fluid reservoirs, and two hydraulic pistons (a primary and secondary) is operated in tandem by a single push rod.

With the master cylinder fluid reservoirs filled and the front and rear brake systems bled, there is a solid column of fluid on the forward side of both the primary and the secondary pistons.

Upon application of the brakes, fluid is displaced by the pistons into the wheel cylinders to activate both front and rear brakes. Upon release of the brakes, fluid returns from the wheel cylinders to the master cylinder.

MASTER CYLINDER—ALL MODELS

Removal

(1) Disconnect brake lines at master cylinder. Cap or tape outlet ports in master cylinder and open ends of brake lines to prevent entry of dirt.

(2) On vehicles with manual brakes, disconnect master cylinder push rod at brake pedal.

(3) Remove bolts or nuts attaching master cylinder to cowl or power unit and remove master cylinder.

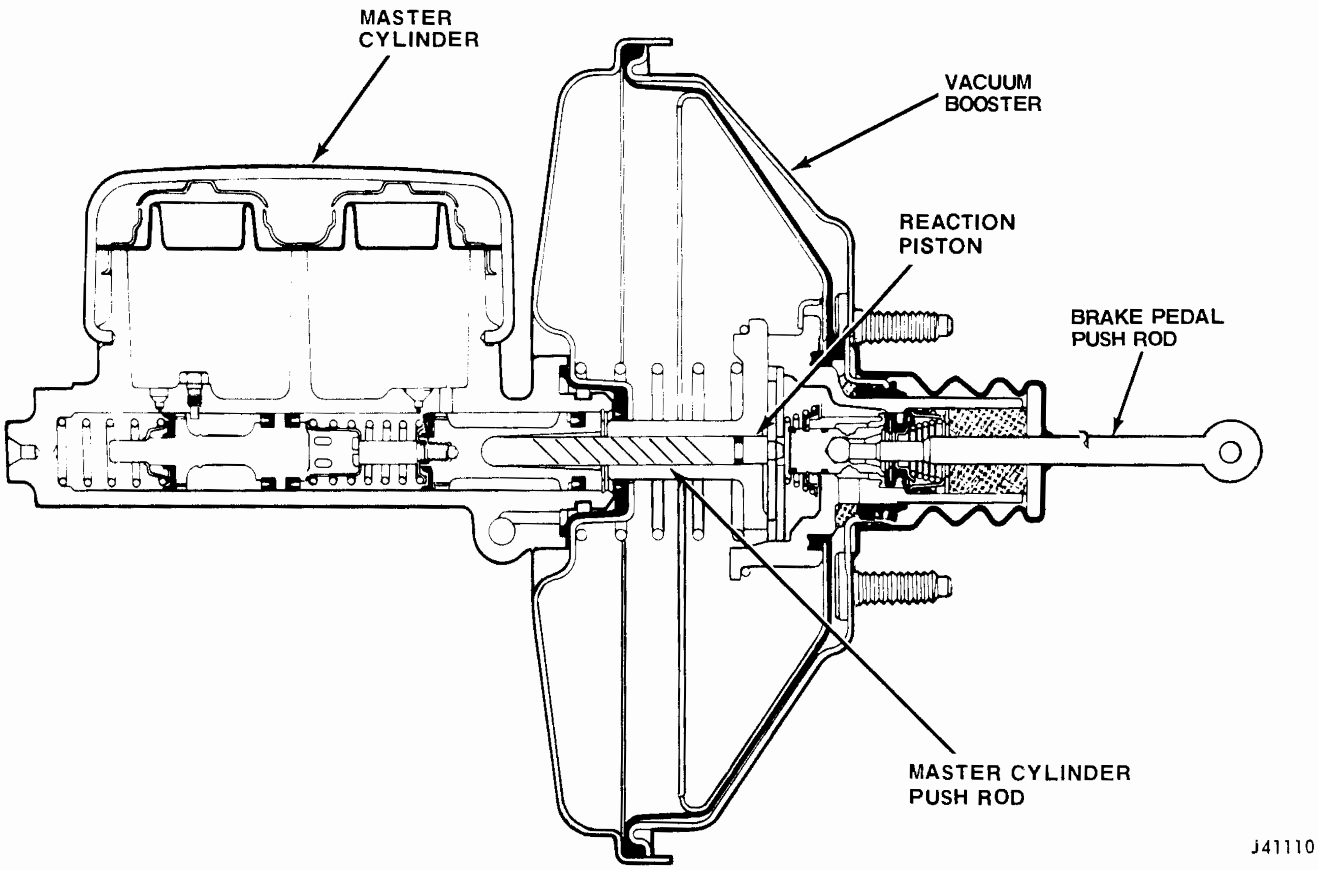

Fig. 9-4 Single Diaphragm Power Brake Unit

Disassembly

(1) Remove cover and diaphragm seal and drain fluid from master cylinder. Mount master cylinder in vise.

(2) On vehicles with manual brakes, remove boot, push rod, and push rod retainer (fig. 9-5 and 9-6). On CJ models, remove retainer by straightening lock tab in side of retainer.

(3) On Cherokee, Wagoneer, and Truck models, remove secondary piston stop from bottom of front reservoir using 5/16-inch socket.

(4) Push primary piston inward with phillips screwdriver, remove snap ring from groove in master cylinder bore, and remove primary and secondary piston assemblies. Air pressure applied through piston stop hole will aid in removal of secondary piston assembly.

(5) Remove piston seal and piston cups from secondary piston. It is not necessary to disassemble primary piston assembly. Primary piston is supplied as complete assembly in repair kit.

(6) Clean and inspect master cylinder. Replace if bore is severely scored, corroded, or pitted. Replace if body is cracked, porous, or has sustained other damage. Check compensator and bypass ports in reservoirs. If plugged or dirty, open them using brake cleaning solvent and air pressure only. Do not use wire as wire may raise a burr in port or push burr into cylinder bore.

CAUTION: *Clean master cylinder with brake fluid or approved cleaning solvent only. Do not use any solvent containing mineral oil such as gasoline, kerosene, alcohol, or carbon tetrachloride. Mineral oil is very harmful to the rubber piston cups and seals.*

(7) Inspect tube seats in outlet ports. Replace seats only if cracked, scored, cocked in bore, or loose. If replacement is necessary, remove seats as follows:

(a) On Cherokee, Wagoneer, and Truck models, thread 6-32 x 5/8-inch long self-tapping screw into tube seat. Using two screwdrivers, pry up on screw to remove seat. Remove chips using brake cleaning solvent.

(b) On CJ models, enlarge hole in tube seats using 13/64-inch drill. Place flat washer on each outlet port and thread 1/4-20 x 3/4-inch long screw into seat. Tighten screw until seat is loosened. Remove seat, screw, and washer. Remove chips using brake cleaning solvent and compressed air.

Assembly

(1) Install replacement tube seats (if removed) using spare tube fitting nuts to press seats into place. Do not allow seats to become cocked during installation. Be sure seats are bottomed. Remove tube fitting nuts and check for burrs or chips. Remove burrs or chips. Rinse master cylinder in brake cleaning solvent and blow out all passages with compressed air.

(2) Install piston cups on secondary piston. Piston cup installed in groove at end of piston should have lip facing away from piston. Install next cup so lip faces piston (fig. 9-5 and 9-6).

(3) Install seal protector, piston seal, spring retainer, and return spring on secondary piston (fig. 9-5 and 9-6). Install piston seal so lip faces interior of master cylinder bore when assembly is installed. Be sure return spring seats against retainer and that retainer is located inside lip of piston seal.

(4) Lubricate master cylinder bore and secondary piston seal and cups with brake fluid and install secondary piston assembly in cylinder bore.

(5) Lubricate seals on primary piston assembly with brake fluid and install assembly in master cylinder bore.

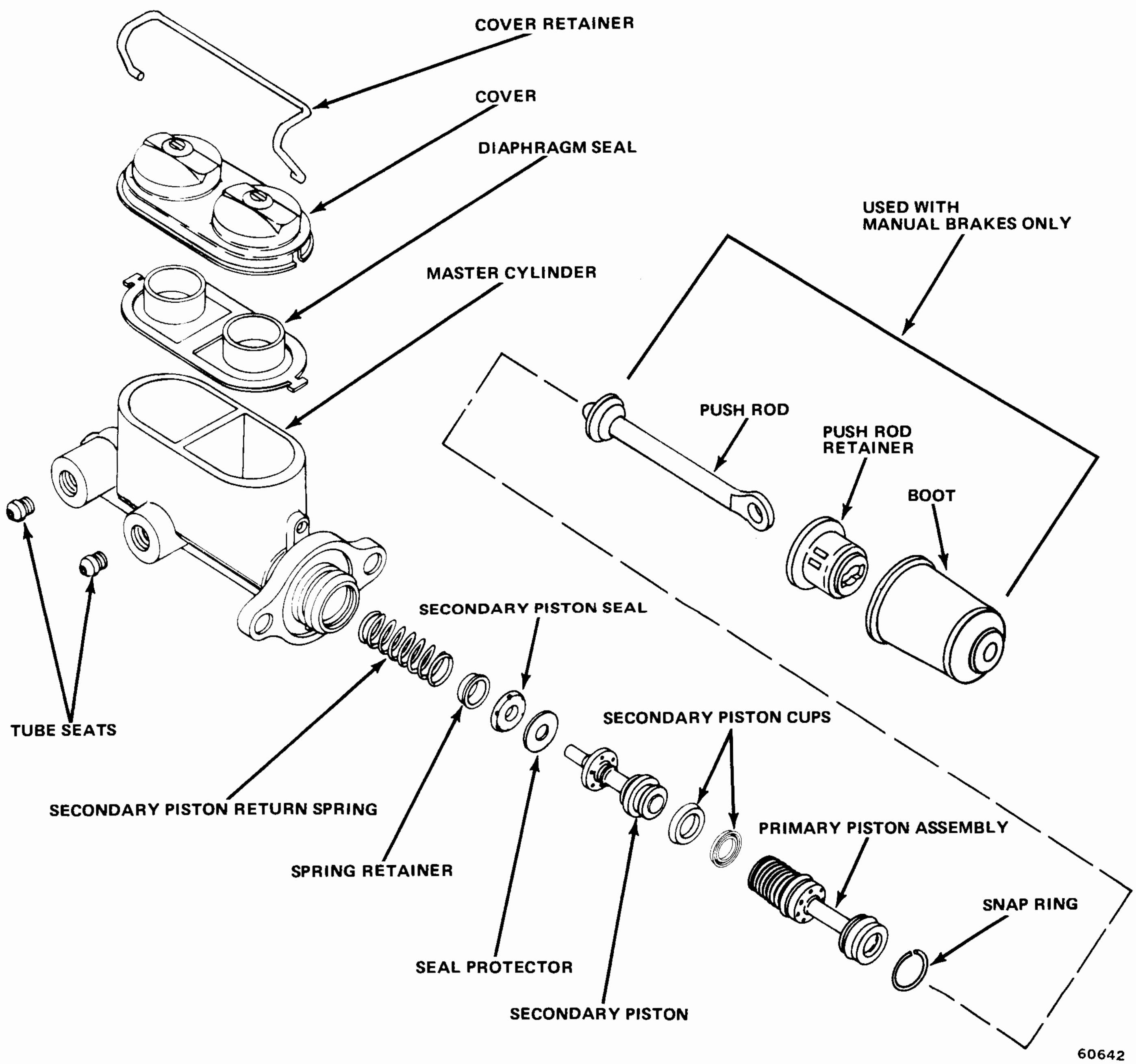

Fig. 9-5 Master Cylinder—CJ Models

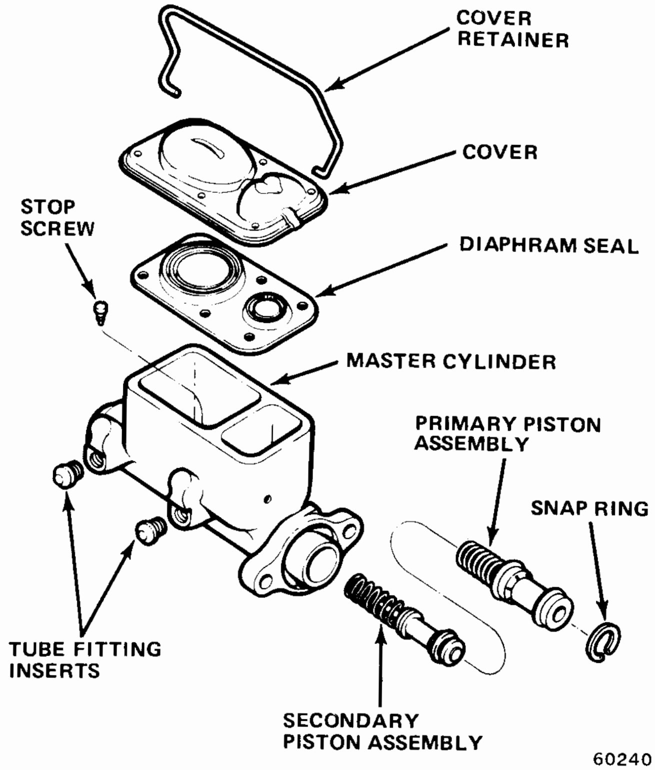

Fig. 9-6 Master Cylinder—Cherokee-Wagoneer-Truck Models

(6) Push primary piston inward with phillips screwdriver and install snap ring in groove of master cylinder bore.

(7) On Cherokee, Wagoneer, and Truck models, push both piston assemblies into cylinder bore and install piston stop in front reservoir. Be sure secondary piston is pushed back far enough to clear piston stop. Tighten stop to 33 inch-pounds torque.

(8) On all vehicles with manual brakes, install push rod, push rod retainer, and boot. On CJ models only, bend small lock tab in side of retainer into groove at end of master cylinder and install boot.

CAUTION: *Do not install push rod, boot, and retainer on vehicles equipped with power brakes.*

(9) Install diaphragm seal on master cylinder cover.

Installation

(1) Position master cylinder on cowl or power unit and install attaching parts. Tighten nuts or bolts to 30 foot-pounds torque.

(2) Connect brake lines to master cylinder.

(3) Fill master cylinder reservoirs to within 1/4-inch of rim with Jeep Brake Fluid or equivalent and install cover and diaphragm seal.

(4) On vehicles with manual brakes, connect push rod to brake pedal.

(5) Bleed brake systems as outlined under Brake System Bleeding.

COMBINATION VALVE—CJ MODELS

All CJ Models are equipped with a combination valve (fig. 9-7) which is attached to the inner side of the left frame rail.

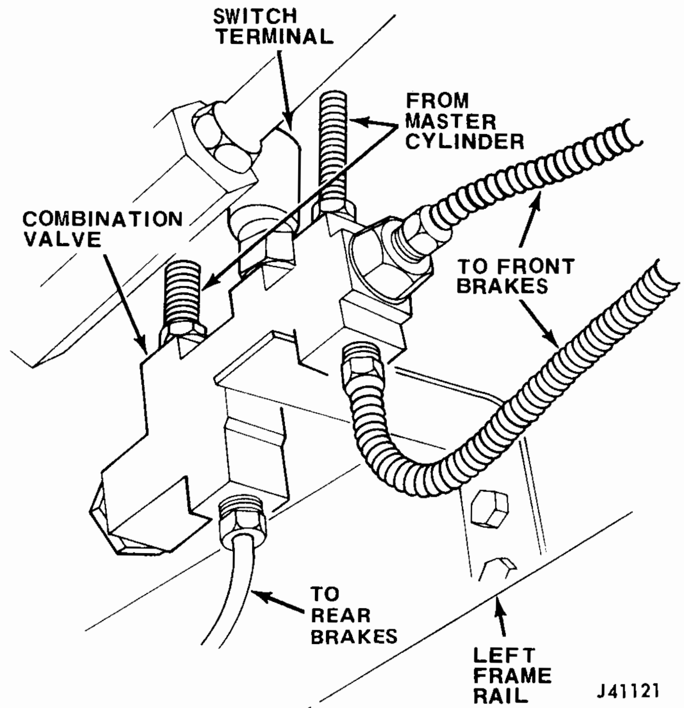

Fig. 9-7 Combination Valve—CJ Models

Description and Operation

The combination valve used on CJ models contains a brake pressure differential warning section and a proportioning section which are combined into a single assembly. The valve also serves as the front junction block for the brake system.

Pressure Differential Warning Switch Section

The switch in the valve is activated when a hydraulic pressure loss occurs in either the front or rear brake systems. When the switch is activated it completes the electrical circuit to the brake warning light on the dash.

Should a failure occur in the rear brake system, the switch piston is forced to the rear of the valve by pressure from the good front brake system. As the piston moves, the piston ramp contacts the switch pin forcing it up into the switch, making contact, and completing the electrical circuit to the warning light on the dash. In the event of front brake failure, the switch is activated in the same manner except that the piston moves in the opposite direction.

NOTE: *The presence of air in either the front or rear brake system can produce a pressure differential causing the switch to activate the warning light on the dash. Bleeding the system will correct this condition.*

Proportioner Section

The proportioner section provides balanced front-to-rear braking during high speed stops. At high deceleration, rear weight is transferred to the front wheels and must be compensated for to avoid early rear wheel skid. The proportioner section of the valve reduces initial line pressure to the rear wheels, delaying rear brake lockup and avoiding early rear wheel skid.

The proportioner does not operate during normal or light brake application.

Service

The valve is not repairable. If any section of the valve is found defective, the entire assembly must be replaced.

When bleeding the brake system, the pressure differential switch wire, switch terminal, and contact plunger-spring assembly must be removed. Refer to Brake System Bleeding.

NOTE: *If any leakage is evident at the switch terminal after reinstallation following brake bleeding, replace the entire valve assembly.*

COMBINATION VALVE—CHEROKEE-WAGONEER-TRUCK

All models are equipped with a combination valve (fig. 9-8) which is attached to the inner side of the left frame rail.

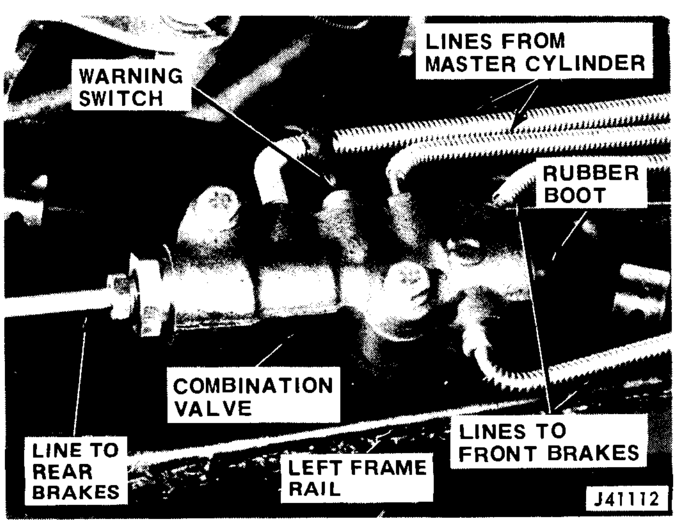

Fig. 9-8 Combination Valve—Cherokee-Wagoneer-Truck

Description and Operation

The combination valve used on Cherokee, Wagoneer, and Truck models (fig. 9-9) contains a metering valve section, a pressure differential warning switch section, and a proportioner valve section. The combination valve also serves as the front junction block for the brake system.

Metering Valve Section

The metering valve holds off (delays) full hydraulic fluid pressure to the front brakes until the rear brakes overcome retracting-spring tension and the rear linings make contact with the rear drums.

When the brakes are not applied (fig. 9-10) the metering valve permits free flow of brake fluid. This feature allows the fluid to expand and contract with changes in temperature.

Pressure Differential Warning Switch Section

The warning switch in the valve is activated when a hydraulic pressure loss occurs in either the front or rear brake systems, and when activated, completes the electrical circuit to the brake warning light on the dash.

Should a failure occur in the rear brake system (fig. 9-10), the switch piston is forced to the right (toward the rear brake outlet port in the valve) by pressure from the good front system. As the piston moves, the piston ramp forces the switch pin up into the switch, making contact and completing the electrical circuit which activates the dash light. In the event of a front brake system failure, the switch is activated in the same manner except that the switch piston will move forward.

Proportioner Section

The proportioner section provides balanced front-to-rear braking action during high pedal pressure stops. During light pedal pressure application, the proportioner does not operate. Brake fluid normally flows into the proportioner through the space between the piston center hole and valve stem, then through the stop plate and the rear brakes. Spring pressure loads the piston, holding it against the stop plate for normal brake pressures.

Service

The combination valve is not repairable. If any section of the valve is found defective, the entire valve assembly must be replaced.

When bleeding the brake system, the metering section of the valve must be held open. Refer to Brake System Bleeding for procedure.

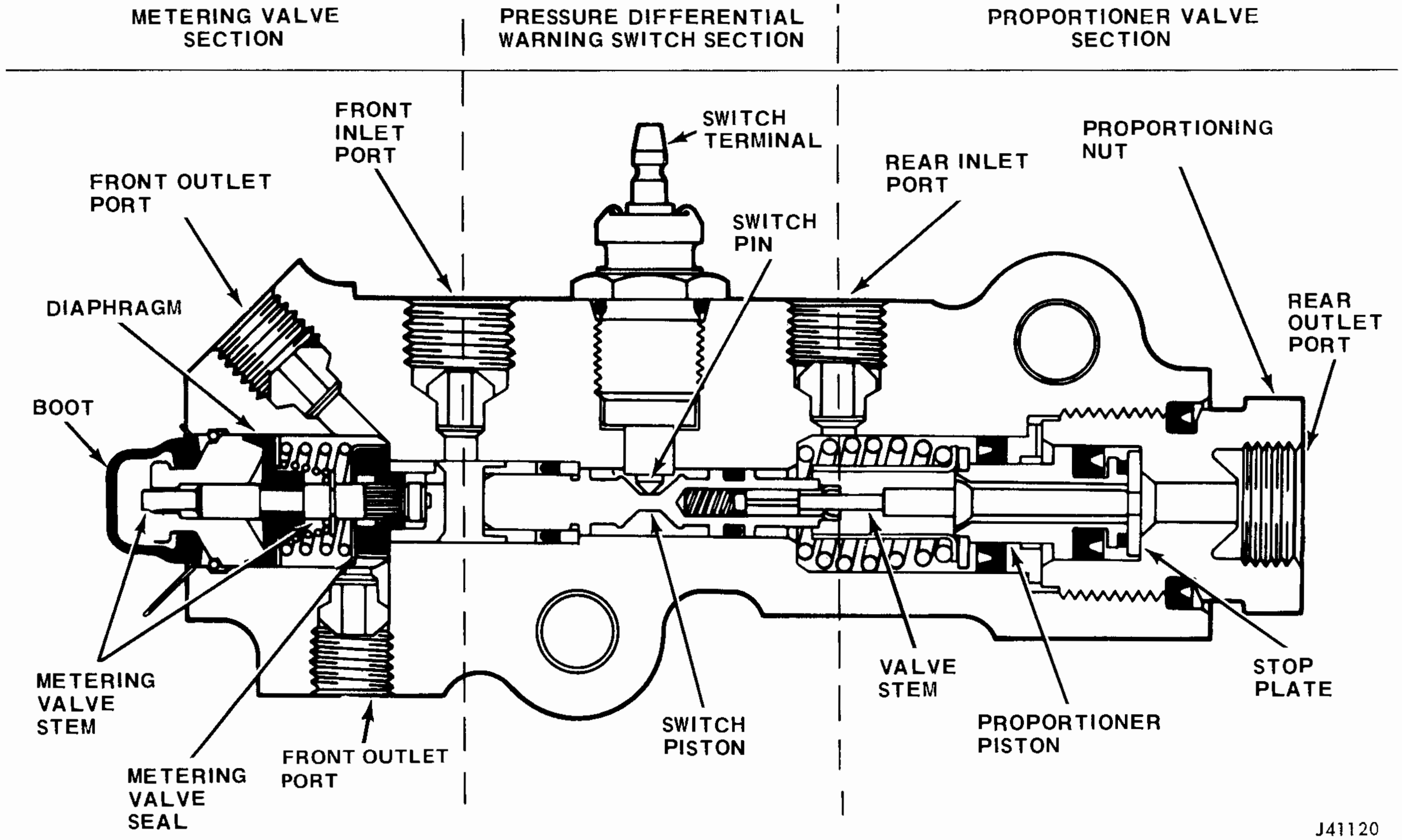

Fig. 9-9 Combination Valve Cross Section—Cherokee-Wagoneer-Truck

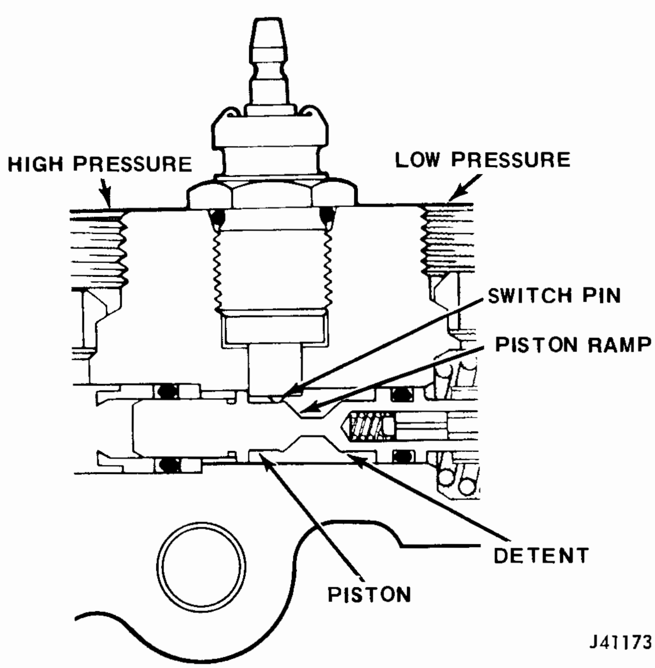

Fig. 9-10 Rear System Failure

BRAKE SYSTEM BLEEDING

General

The hydraulic system must be bled whenever a line has been disconnected or if air has entered the system.

Brake system bleeding can be performed manually or with pressure equipment. Bleeder screws are provided at the calipers and wheel cylinders.

Manual Bleeding Procedure

(1) Clean any accumulated dirt from master cylinder cover.

(2) Remove master cylinder cover.

(3) Fill master cylinder if required and reinstall cover.

(4) Hold combination metering valve open as follows: On Cherokee, Wagoneer, and Truck models, loosen front mounting bolt on combination valve and insert slotted end of Tool J-23709 under mounting bolt. Push in on metering valve pin to open it and retighten the mounting bolt to hold Tool J-23709 in place (fig. 9-11). On CJ models remove the brake warning switch wire, switch terminal, plunger and spring from the combination valve.

(5) Bleed brake system in following sequence:

(a) Left front wheel
(b) Right front wheel
(c) Left rear wheel
(d) Right rear wheel

NOTE: *Correct bleeding procedure is as follows. Place wrench on bleeder screw. Install rubber hose on screw with free end of hose* **submerged** *in a* *transparent container partially filled with clean brake fluid. Open screw 3/4 turn. Have helper depress brake pedal. Close bleeder screw before pedal reaches end of travel. Have helper pump up pedal each time bleeder screw is closed to ensure a good surge of fluid at the bleeder screw when valve is reopened. Repeat bleed process until fluid comes out in a solid stream without the presence of air bubbles.*

CAUTION: *Do not allow master cylinder to exhaust its supply of brake fluid. Check fluid level frequently while bleeding, and refill as required. Do not bleed two wheels at a time, and do not bleed system with calipers or drums not in place.*

(6) Remove master cylinder cover and refill as required. Fill reservoir to within 1/4 inch of reservoir rim. Install cover. Make sure cover retainer is in place.

(7) For Cherokee, Wagoneer, and Truck, remove combination valve tool. On CJ models, reinstall plunger, spring, and terminal in valve.

(8) Test brake operation before moving vehicle.

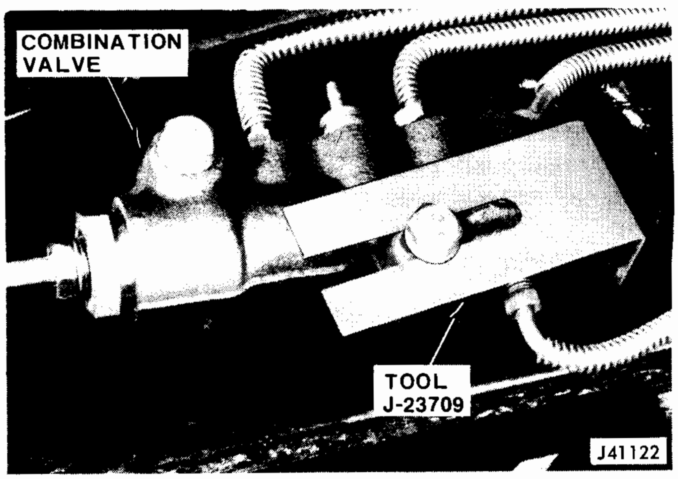

Fig. 9-11 Metering Section Hold-Open Tool Installed

Pressure Bleeding Procedure

(1) Clean any accumulated dirt from master cylinder cover.

(2) Remove cover and rubber diaphragm seal. Place cover on work bench or on lint-free cloth. Do not allow diaphragm to contact dirt or foreign material.

(3) Fill master cylinder if required.

(4) Install brake bleeder adapter cover on master cylinder (fig. 9-12). Connect hose from pressure bleeder to fitting on adapter and open release valve on pressure bleeder.

(5) Hold combination metering valve open. On Cherokee, Wagoneer, and Truck models, install Tool J-23709 as described in step (4) of Manual Bleeding Procedure (fig. 9-11). On CJ models, remove the brake warning switch wire, switch terminal-plunger-and spring from the combination valve before bleeding the system.

(6) Bleed brake system in following sequence:
- (a) Left front wheel
- (b) Right front wheel
- (c) Left rear wheel
- (d) Right rear wheel

NOTE: *When using pressure equipment, bleeding procedure is the same as outlined in step (5) of Manual Bleeding Procedure except that a helper is not required to depress the brake pedal. The pressure bleeder develops enough system pressure to permit bleeding without the use of the brake pedal.*

(7) When system has been purged of all air, turn off pressure bleeder and close release valve.

(8) Disconnect pressure bleeder hose at adapter fitting and remove master cylinder cover adapter.

(9) Refill master cylinder reservoirs to within 1/4 inch of reservoir rim.

(10) Install cover and rubber diaphragm. Make sure cover retainer is in place.

(11) On Cherokee, Wagoneer, and Truck, remove combination valve tool and tighten mounting bolt. On CJ models, reinstall plunger, spring, and terminal in valve.

(12) Test brake operation before moving vehicle.

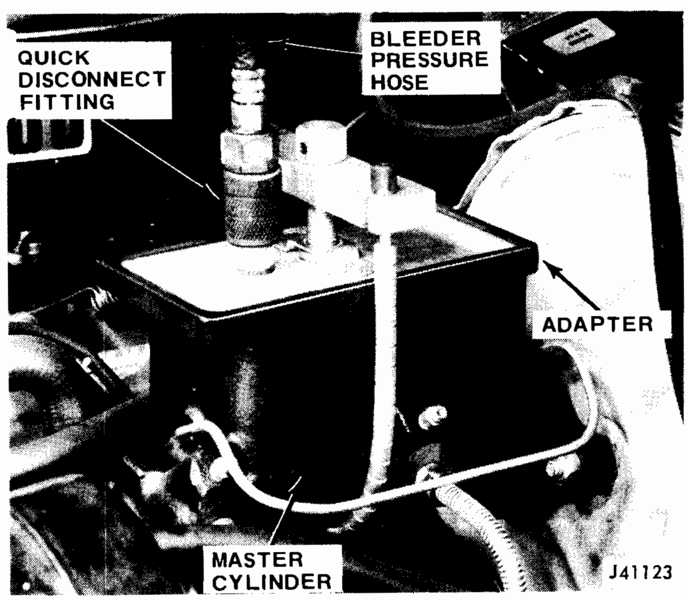

Fig. 9-12 Pressure Bleeder Adapter Installed

DRUM BRAKES

GENERAL

The drum brake units consist of a support plate, two brakeshoes, brakeshoe return springs, adjuster screw, holddown springs, automatic adjuster components, and a wheel cylinder (fig. 9-13 and 9-16).

The automatic adjuster continuously maintains correct operating clearance between the brake linings and the drums by adjusting the brakes in small increments in direct proportion to lining wear. This continuous adjustment prevents gradual increase in the brake pedal travel as the linings wear. The adjuster adds the safety feature of maintaining adequate pedal reserve during the service life of the lining.

After the lining wears enough to require adjustment, the adjusting cable (CJ models) or actuating lever (Cherokee, Wagoneer, and Truck models) will lift the lever into engagement with the next tooth of the adjusting screw when the brakes are applied. When the brake is released, the shoes return to the anchor.

The automatic-adjuster utilizes movement of the secondary shoes in a reverse brake application to actuate the adjuster mechanism.

This action will repeat on subsequent brake applications until the shoe-to-lining clearance is reduced to a point at which the shoe movement is not enough to cause the automatic adjuster to lift the lever to the next tooth.

The adjusting lever and adjusting screw assembly are left- or right-hand parts, **not** interchangeable, and **must** be kept separated.

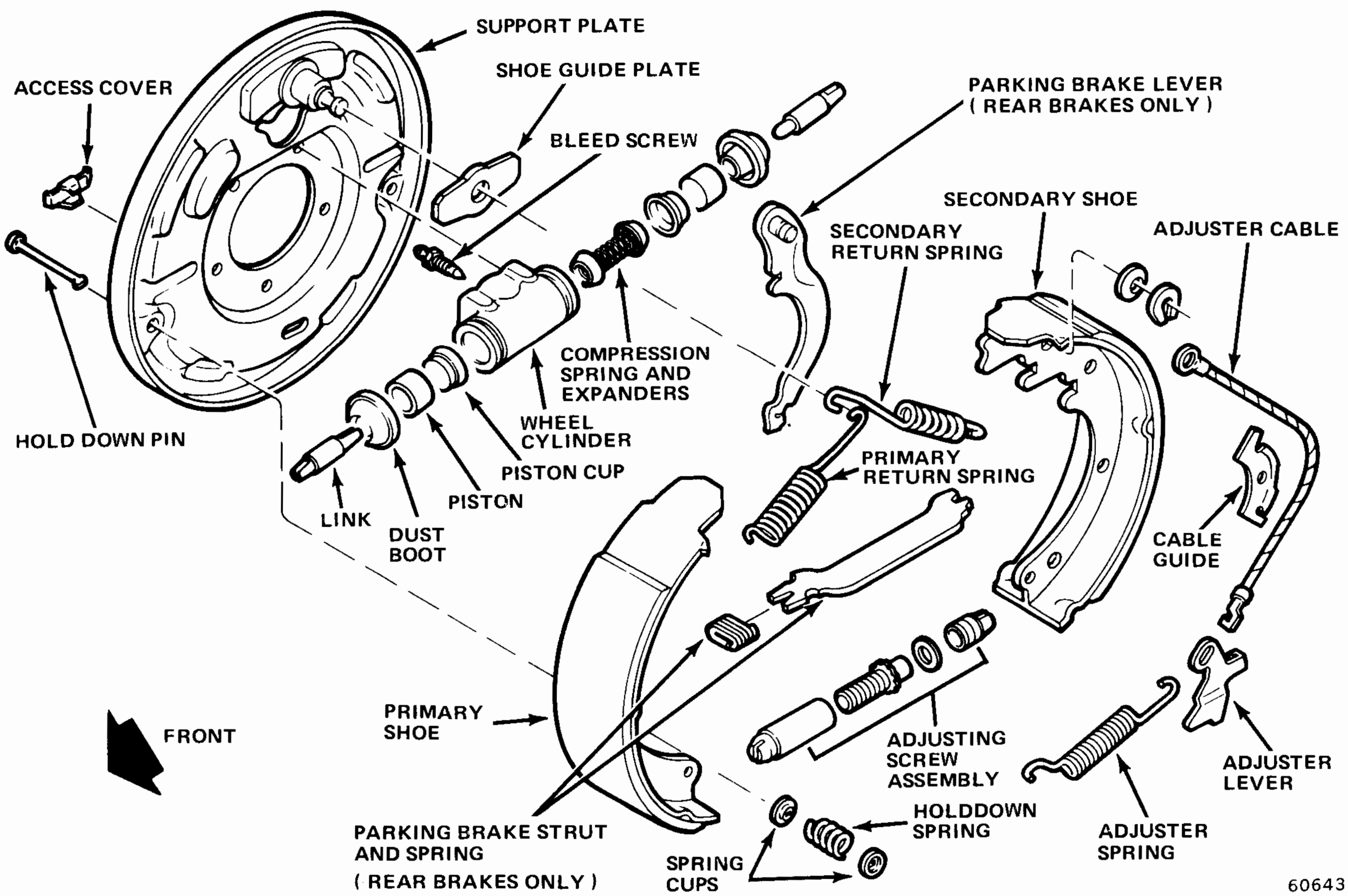

Fig. 9-13 Drum Brake Assembly—CJ Models

SERVICE—CJ MODELS

Disassembly

(1) Raise vehicle.

(2) Remove wheels and drums.

(3) Grasp adjusting lever with pliers and remove tang from hole in secondary shoe.

(4) Place Brake Cylinder Clamps J-8002 over wheel cylinders to hold pistons in place while shoes are removed.

(5) Remove return springs using Brake Spring Remover Tool J-8057.

(6) Remove secondary return spring, adjuster cable, primary return spring, cable guide, adjuster lever, and adjuster springs.

(7) Remove holddown springs and brakeshoes. On rear brakes, disengage parking brake cable from parking brake lever (parking brake strut is removed with brakeshoe assemblies).

Cleaning and Inspection

Cleaning

For grease contamination, clean all parts, except brake drums, with a suitable solvent. Clean brake drums with a soap and water solution.

For brake fluid contamination, clean all parts with alcohol. Do not attempt to clean contaminated brake lining.

Inspection

Pull back wheel cylinder dust boot to inspect for leakage. If evidence of leakage is observed, the cylinder should be disassembled and inspected as described in Wheel Cylinder.

Polish ledges of the brake support plate with fine sandpaper or emery cloth. If grooves which may restrict shoe movement still exist after polishing, the brake support plate must be replaced. Attempting to remove grooves by grinding may result in improper shoe to drum contact.

Inspect the lining wear pattern. If the wear across the width of the lining is uneven, check drums for bell-mouthed condition, inspect drums for correct position, and inspect support plate for distortion. Inspect all springs for evidence of overheating (discoloration) and fractures. The self-adjusting cable should be inspected for kinks, fraying and an elongated eyelet.

Inspect the adjusting screw for freedom of rotation and the self-adjuster lever for wear and distortion.

Wheel Cylinders

(1) Inspect for evidence of leakage. Pull back dust boot and inspect condition of rubber piston cups and cylinder bore.

(2) Inspect bleeder screw and hydraulic line connection for evidence of leakage. Check brake lines for swelling, distortion, kinks, and cracks.

(3) If wheel cylinders require overhaul proceed to step (4):

(4) Disconnect brake line. Do not bend line away from wheel cylinder. When cylinder is removed from support plate, line will separate from cylinder easily.

(5) Remove cylinder mounting bolts and remove cylinder.

(6) Remove links and dust boots. Push piston cups, pistons, and expansion spring from cylinder bore. Clean all metal parts with brake fluid.

(7) If bore is corroded or pitted, replace wheel cylinder. If bore is only stained or discolored, it may be polished with crocus cloth. Do not polish in a lengthwise direction; polish by rotating cylinder around crocus cloth supported on fingers.

CAUTION: *Do not hone wheel cylinders. If polishing was performed, clean cylinder thoroughly with brake fluid only.*

(8) Inspect pistons. If scored or worn replace. If discolored or stained, pistons may be lightly polished with crocus cloth. Clean pistons thoroughly if they were polished.

(9) Coat cylinder bore with clean brake fluid. Do not lubricate pistons or cups. Assemble wheel cylinder components.

CAUTION: *Piston cups should have flat ends facing open ends of cylinder and flared ends of cups facing interior of cylinder.*

(10) Clean wheel cylinder mounting surface on support plate. Clean brake line fitting and threads.

(11) Start brake line fitting in wheel cylinder. Attach wheel cylinder to support plate and tighten brake line fitting. Tighten cylinder mounting bolts to 18 foot-pounds torque.

Support Plate

(1) Remove dirt using compressed air or cloth. Polish anchor pin with crocus cloth.

(2) Polish ledges of brake support plate with fine sandpaper or emery cloth. If grooves, which may restrict shoe movement, still exist after polishing, replace support plate.

CAUTION: *Attempting to remove grooves by grinding may result in improper shoe-to-drum contact. Do not attempt to reduce ridges or grooves by grinding.*

(3) Inspect support plate for warpage or cracks.

(4) Check torque of support plate-to-axle flange bolts.

(5) Check anchor pin for wear or loose attaching part.

(6) Replace support plate if inspection reveals nonrepairable defect.

Brake Drums

(1) Clean dirt from drums. Use compressed air and clean cloth. If drums require further cleaning, use soap and water solution only.

CAUTION: *Do not use brake fluid, gasoline, kerosene, or similar solvents to clean drums.*

(2) Inspect for scoring, cracks, heat checking, hard spots, and distortion.

(3) Check drum for excess runout or bell-mouthed condition. Perform this check with drums mounted on brake lathe. Use dial indicator to obtain readings.

NOTE: *Brake drum radial runout must not exceed 0.005 inch.*

(4) Based on findings of steps (1) through (3), replace or recondition drum as required.

CAUTION: *When machining drums, do not remove more than 0.030 inch. Maximum allowable oversize for any drum is 0.060 inch over original diameter.*

NOTE: *Remove hard spots in drum by grinding. The normal cutting tool will ride over hard spots dulling the tool and leaving high spots on the drum surface.*

Assembly and Adjustment

IMPORTANT: When necessary to replace brakelining on one wheel, the brakelining should also be replaced on the opposite wheel to maintain braking balance.

(1) Before assembly, lubricate support plate ledges, anchor pin, self-adjusting cable guide adjuster screw threads, and pivot with molydisulphide grease or chassis lubricant. If servicing rear brakes, lubricate parking brake cable lever located on secondary shoes.

(2) Position brakeshoes on the brake support plate and install holddown springs. On rear brakes, install parking brake lever. Install parking brake cable on lever and install strut and spring.

(3) Place adjuster cable eyelet on anchor pin.

(4) Install primary return spring.

(5) Install cable guide and install secondary return spring (fig. 9-13).

(6) Install adjuster screw assembly. Place small hooked end of adjuster spring in large hole in primary shoe and place large hooked end of adjuster spring in adjuster lever.

(7) Place hooked end of adjuster cable over cable guide (fig. 9-13 and 9-14).

(8) Grasp adjuster lever with pliers and hook adjuster lever tang in large hole in bottom of secondary shoe.

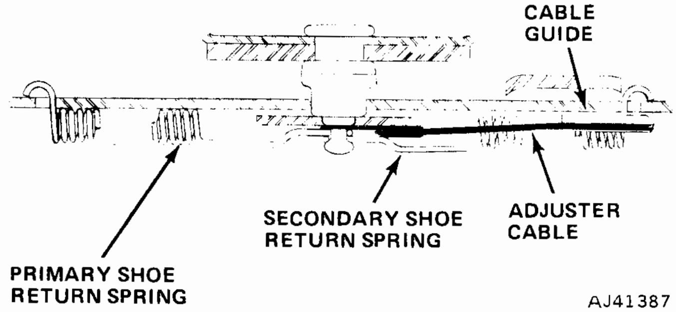

Fig. 9-14 Brakeshoe Spring Installation

(9) Perform initial brake adjustment using clearance gauge or initially adjust adjusting screw assemblies so that approximately 3/8 inch of thread is exposed between adjuster screw and adjuster screw nut.

(10) Install drums.

CAUTION: *DO NOT attempt to back off on adjuster screw without holding adjuster lever away from screw as adjuster will be damaged.*

(11) If any brake lines were disconnected, bleed brakes as described in Brake System Bleeding.

(12) Install wheels and tires and lower vehicle.

(13) After initial adjustment and final assembly, check brake pedal height to ensure brake operation before moving vehicle.

(14) Drive car in reverse and forward, making 10 to 15 brake applications before road testing. This procedure balances adjustment of all brake units and raises brake pedal to satisfactory height.

NOTE: *If drums were installed before making initial adjustment, adjustment may be made manually by removing access slot cover and using a brake adjusting tool or screwdriver to rotate adjuster screw until wheel is locked (fig. 9-15). To tighten, rotate adjuster screw in clockwise direction. Then back off adjuster screw at least 15 to 20 notches (clicks).*

To back off adjuster screw on brake, insert ice pick or thin blade screwdriver in adjuster screw slot to hold lever away from adjuster screw. Back off on adjuster screw until wheel and drum turn freely. Replace adjusting hole cover.

SERVICE—CHEROKEE-WAGONEER-TRUCK

Disassembly

(1) Raise vehicle.

(2) Remove necessary wheels and drums. Release parking brake and loosen locknuts at parking brake equalizer to relieve cable tension before removing rear drums.

NOTE: *On trucks with Model 60 full-floating rear axle, remove two screws that locate rear drums on hubs (fig. 9-17).*

(3) Remove primary shoe return spring (fig. 9-16). Remove automatic adjuster actuating spring and secondary shoe return spring using Spring Remover Tool J-8057.

(4) Remove holddown springs and remove brakeshoe assemblies. On rear brakes, disengage parking brake cable from parking brake lever. Parking brake strut is removed with brakeshoe assemblies (fig. 9-16).

(5) Place Wheel Cylinder Clamps J-8002 over wheel cylinders to retain pistons (fig. 9-18).

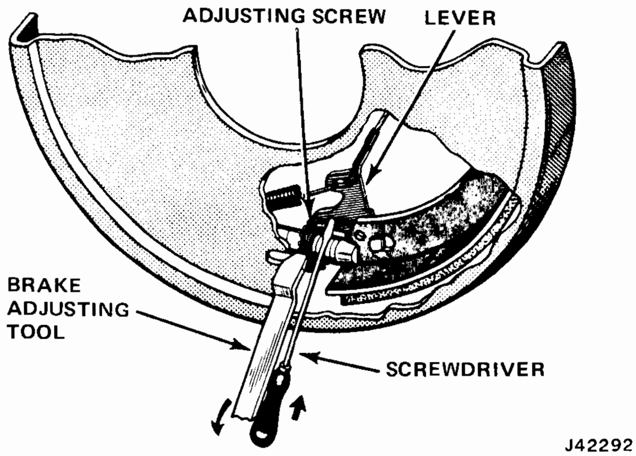

Fig. 9-15 Brakeshoe Adjustment

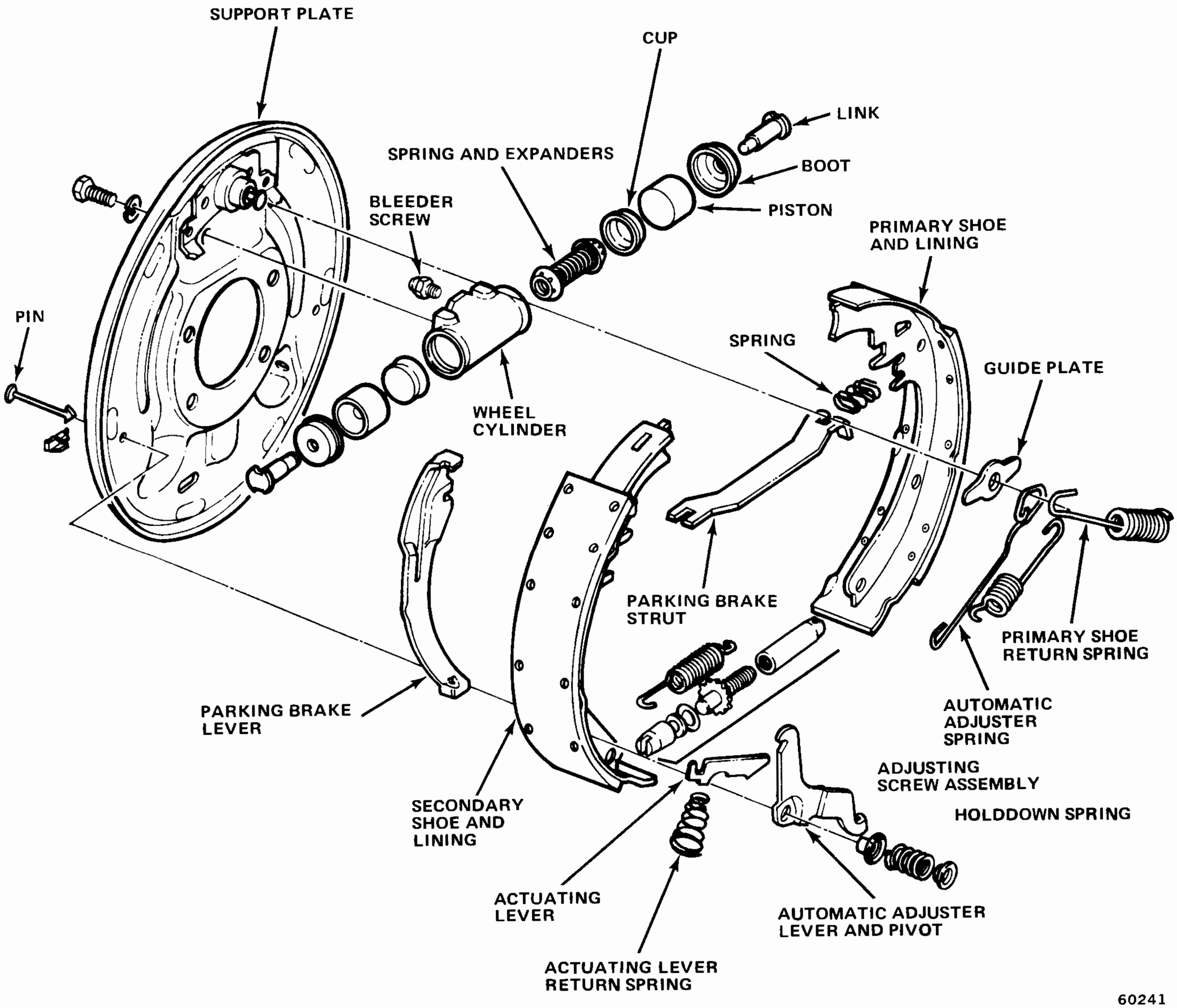

Fig. 9-16 Drum Brake Assembly—Cherokee-Wagoneer-Truck

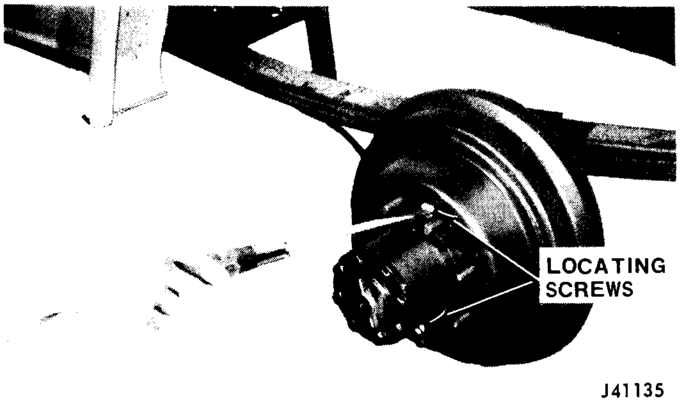

Fig. 9-17 Locating Screw Removal—Model 60 Axle

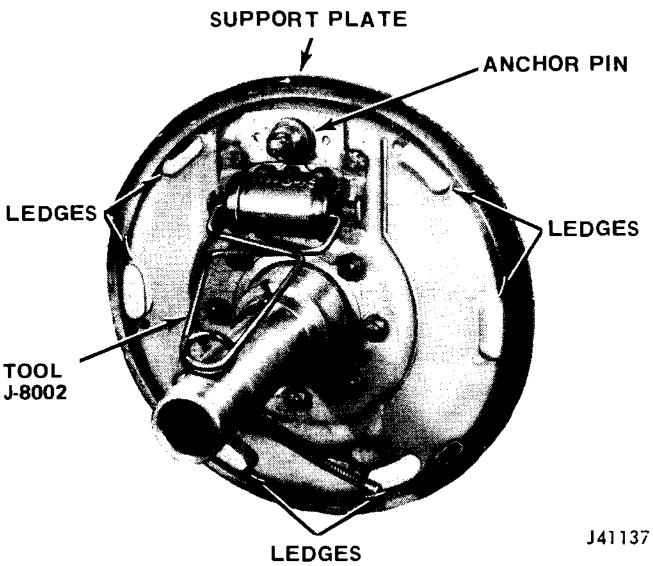

Fig. 9-18 Wheel Cylinder Clamp Installed

Cleaning and Inspection

Brakeshoe Assembly

(1) Inspect lining wear. If worn to within 1/32 inch of rivet head, replace lining.

(2) Inspect lining wear pattern. If wear is uneven across width of lining, replace lining and check drum for bell-mouthed condition.

(3) Inspect lining for cracks, charred surface, or broken rivets.

(4) Replace linings if contaminated with brake fluid, axle lubricant, or similar contaminants.

(5) Inspect adjusting screw spring, return springs, holddown springs, actuating lever return spring, and automatic adjuster spring. Replace springs if weakened, broken, or discolored (evidence of overheating causing tension loss).

(6) Inspect parking brake lever, automatic adjuster lever and pivot, and actuating lever for wear and defects. Replace levers if bent, broken, or excessively worn.

(7) Inspect adjuster screw for free operation. Screw should rotate freely. Inspect serrations on adjuster screw for excessive wear (which could effect automatic adjustment).

(8) Inspect parking brake cables for frayed condition. Check for missing or loose cable end retainer button. Inspect parking brake lever for distortion, worn pivot pin, proper cable retention, and proper cable operation.

Wheel Cylinders

(1) Inspect for evidence of leakage. Pull back dust boot and inspection condition of rubber piston cups and cylinder bore.

(2) Inspect bleeder screw and hydraulic line connection for evidence of leakage. Check brake lines for swelling, distortion, kinks, or cracks.

(3) If wheel cylinders required overhaul proceed to step (4).

(4) Disconnect brake line. Do not bend line away from wheel cylinder. When cylinder is removed, line will separate from cylinder.

(5) Remove cylinder mounting bolts and remove cylinder.

(6) Remove links and dust boots. Remove piston cups, pistons, and compression spring and expanders from cylinder bore. Clean all metal parts with brake fluid.

(7) If bore is corroded or pitted, replace wheel cylinder. If bore is only stained or discolored, it may be polished with crocus cloth. Do not polish in a lengthwise direction; polish by rotating cylinder around crocus cloth wrapped around fingers.

CAUTION: *Do not hone wheel cylinders. If polishing was performed, clean the cylinder thoroughly with brake fluid only.*

(8) Inspect pistons. If scored or worn replace. Pistons may be polished lightly with crocus cloth if discolored or stained. Clean pistons thoroughly if they were polished.

(9) Coat cylinder bore with clean brake fluid. Do not lubricate pistons or cups. Assemble wheel cylinder.

CAUTION: *Piston cups should have flat ends facing open ends of cylinder and flared ends of cups facing interior of cylinder.*

(10) Clean wheel cylinder mounting surface on support plate. Clean brake line fitting and threads.

(11) Start brake line fitting in wheel cylinder. Attach wheel cylinder to support plate and tightening brake line fitting. Tighten cylinder mounting bolts to 18 foot-pounds.

Support Plate

(1) Remove dirt using compressed air or cloth. Polish anchor pin with crocus cloth (fig. 9-18).

(2) Polish support plate ledges (fig. 9-18) with emery cloth. If ledges have deep grooves or ridges which might restrict shoe movement, the support plate should be replaced. Do not attempt to reduce ridges or grooves by grinding.

(3) Inspect support plate for warpage or cracks.

(4) Check torque of support plate-to-axle flange bolts.

(5) Check anchor pin for wear or loose attaching part.

(6) Replace support plate if inspection reveals non-repairable defect.

Brake Drums

(1) Clean dirt from drums. Use compressed air and clean cloth. If drums require further cleaning, use soap and water solution only.

CAUTION: *Do not use brake fluid, gasoline, kerosene, or similar solvents to clean drums.*

(2) Inspect for scoring, cracks, heat checking, hard spots, and distortion.

(3) Check drum for excess runout or bell-mouthed condition. Perform this check with drum mounted on brake lathe. Use a dial indicator to obtain readings.

NOTE: *Brake drum radial runout must not exceed 0.005 inch.*

(4) Based on findings of steps (1) through (3), replace or recondition drum as required.

CAUTION: *When machining drums, do not remove more than 0.030 inch. Maximum allowable oversize for any drum is 0.060 inch over original diameter.*

NOTE: *Hard spots in a drum should be removed by grinding. The normal cutting tool will ride over hard spots dulling the tool and leaving high spots on the drum surface.*

Assembly and Adjustment

(1) Apply thin film of molydisulphide grease, or chassis lubricant to following parts (fig. 9-16).

(a) Support plate ledges.

(b) Anchor pin.

(c) Adjuster screw threads and pivot.

(d) Adjuster lever-to-secondary brakeshoe contact surface.

(2) When assembling rear brakes, lubricate parking brake lever pivot and portion of lever that contacts secondary brakeshoe.

(3) On rear brakes attach parking brake cable to parking brake lever on secondary shoe.

NOTE: *When installing parking brake lever on new shoe, pinch C-clip to retain lever on shoe.*

(4) Install secondary shoe and automatic adjuster lever and pivot as an assembly. Secure assembly to support plate with holddown spring.

(5) Install actuating lever and adjusting lever. Install return spring on actuating lever tang. Large end of tapered spring rests on brakeshoe.

(6) Install primary shoe and holddown spring. Install guide plate on anchor pin.

(7) On rear brakes, install parking brake strut.

(8) Install adjusting screw and spring. Short hooked end of springs goes on primary shoe; long hooked end goes on secondary shoe (fig. 9-16).

(9) Install return springs and adjuster spring in following sequence (fig. 9-16).

(a) Adjuster spring.

(b) Secondary shoe return spring (to shoe and adjuster spring).

(c) Primary shoe return spring.

NOTE: *After springs are installed, be sure shoes are properly located on anchor pin.*

(10) Perform initial brake adjustment as follows:

(a) Determine drum diameter with drum-to-brakeshoe clearance gauge (fig. 9-19).

(b) Reverse gauge and place on brake linings (fig. 9-20). Turnurn adjuster screw until gauge just slides over brake lining surface.

(c) Rotate gauge around lining surface to ensure adequate clearance.

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Fig. 9-19 Using Drum-to-Lining Clearance Gauge

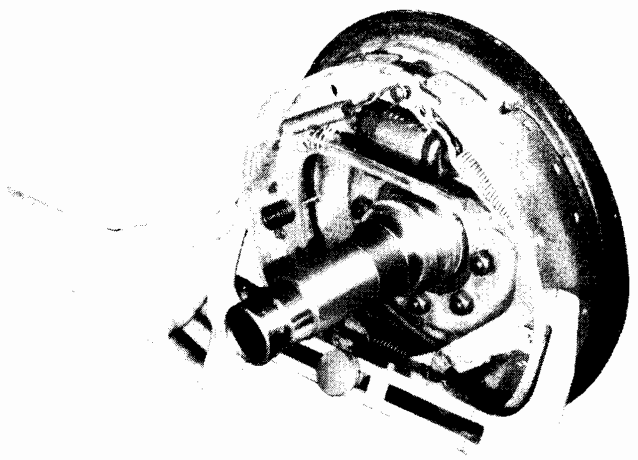

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Fig. 9-20 Checking Lining-to-Drum Clearance

(11) If drum-to-shoe gauge is not available, initial brake adjustment may be performed as follows:

(a) Turn adjuster screw until drum slides over shoes with slight drag.

(b) With drum in place, back off adjuster screw 30 notches. Use brake adjusting tool to turn adjuster screw. Use screwdriver to push automatic adjuster lever away from adjuster screw serrations while adjusting. If access hole in support plate has a metal plug in it, knock out the plug to perform adjustment. Be sure to remove loose plug from drum and install rubber or metal plug in access hole to prevent brake contamination after adjustment is completed.

(12) Install brake drums.

(13) If brake lines were disconnected, bleed brakes as described in Brake System Bleeding.

(14) Install wheels and tires and lower vehicle.

(15) Test brake operation before moving vehicle.

(16) Perform final brake adjustment by making 10 to 15 forward and reverse stops until satisfactory brake pedal height is obtained.

CAUTION: *If vehicle has automatic transmission, do not use forward range to halt reverse motion of vehicle. This procedure will prevent the automatic adjusters from operating properly, resulting in unsatisfactory pedal heights. All stops must be completed.*

DISC BRAKES

GENERAL

Application

Floating caliper-type front disc brakes (fig. 9-21) are standard on Wagoneer and heavy-duty Trucks Model J-20. A common disc brake caliper and 12.0-inch rotor are used on all models. However, heavy-duty Trucks are equipped with a 12.5 inch disc brake rotor.

Description

The disc brake system consists of: a caliper assembly, hub and rotor assembly, and support and shield assembly. The caliper (fig. 9-22) is a one-piece casting with the inboard side containing the single piston, the piston bore, the bleeder screw and fluid inlet holes.

The piston bore contains the piston, piston seal, and dust boot. A groove is machined in the sidewall of the piston bore to accept the piston seal. This groove is slightly tapered, and is narrower at the bottom tan at the top. Tapering the groove puts more compression on the edge of the square-cut seal that is exposed to brake fluid pressure (fig. 9-23).

The upper edge of the piston bore is counterbored to accept the dust boot seal retainer. The metal retainer part of the dust boot seal is pressed into the counterbore. The lip portion of the seal fits in a groove machined in the piston outer surface.

The exterior surface of the steel piston is precision ground and nickle-chrome plated to provide a hard, durable surface.

CAUTION: *Do not sandpaper or machine the outer surface of the piston. Removal of the protective plating or altering the diameter could cause pitting, rusting, and eventual cocking of the piston in the bore.*

The piston bore does not contain a return spring; lining wear is compensated for by the lateral sliding movement of the caliper and by increased piston extension (fig. 9-24).

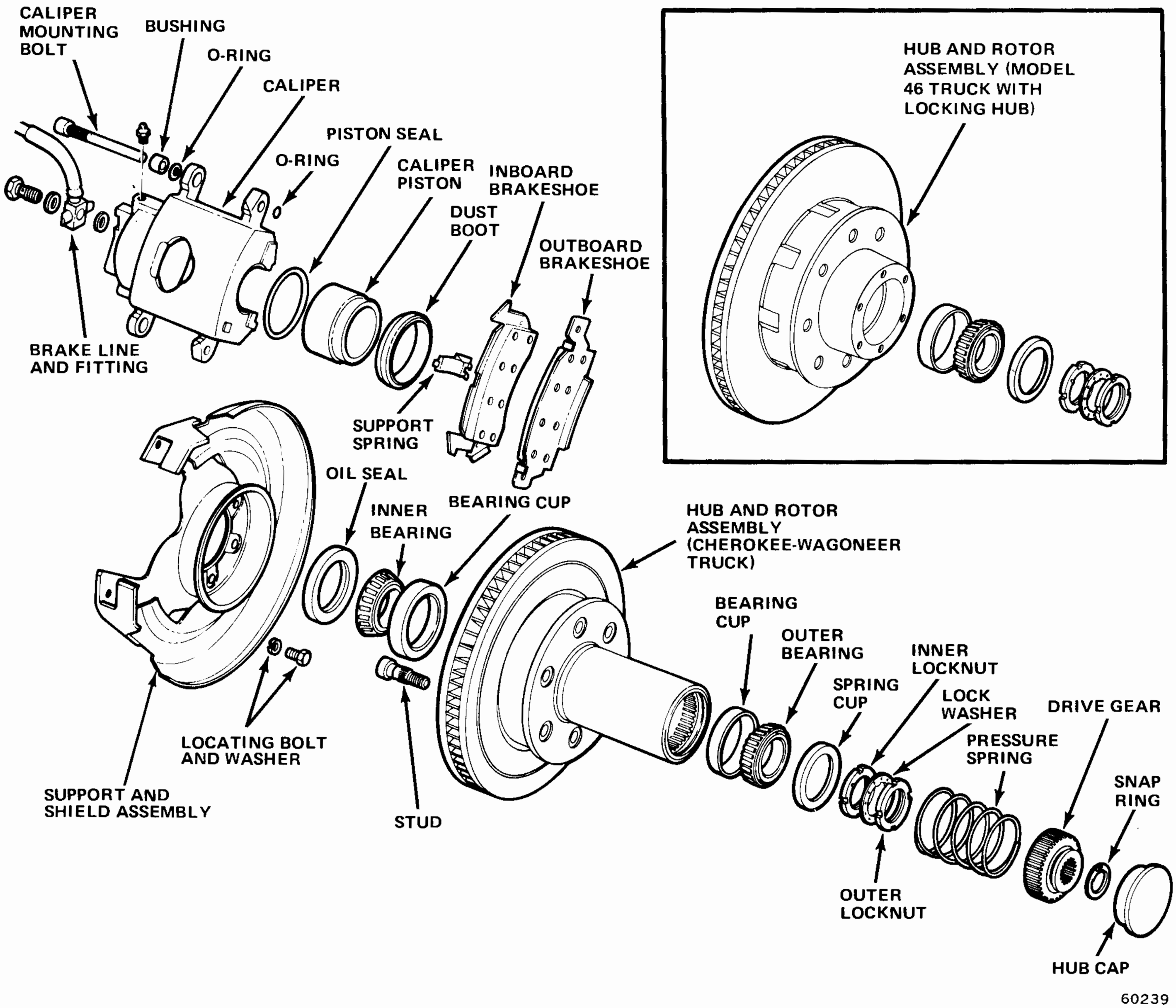

Fig. 9-21 Disc Brake Assembly—Cherokee-Wagoneer-Truck

The caliper assembly has two mounting ears at each end. Holes are machined in these ears. The holes in the inboard ears are larger than those in the outboard ears. A groove is machined in the inside diameter of each hole to accommodate rubber bushings. A sleeve is installed through each of the larger holes in the inboard ears (fig. 9-22). The caliper assembly is attached to the support bracket which is welded to, and is part of, the disc brake shield. The integral shield and support bracket are bolted to the steering knuckle assembly.

Two allen head support bolts attach the caliper to the support bracket. The bolts are inserted through sleeves in inboard mounting ear holes of the caliper, under the ears of the inboard shoe, and through the outboard ears of the caliper. The threaded portion of the bolt heads are tightened against the sleeve ends. The caliper slides on the sleeves in the inboard ears and on the unthreaded portion of the bolt that fits in the outboard ears (fig. 9-35).

Each caliper contains two shoe and lining assemblies, each assembly consisting of a stamped metal shoe and riveted lining.

When installed in the caliper, the shoe and lining assemblies straddle the disc brake rotor. The inboard and outboard lining differ as follows:

(a) Inboard shoe and lining are slightly thicker.

(b) Outboard shoe has flanged mounting ears at top.

(c) Outboard shoes have a large tap at the bottom of the shoe, which is bent at right angles to the shoe.

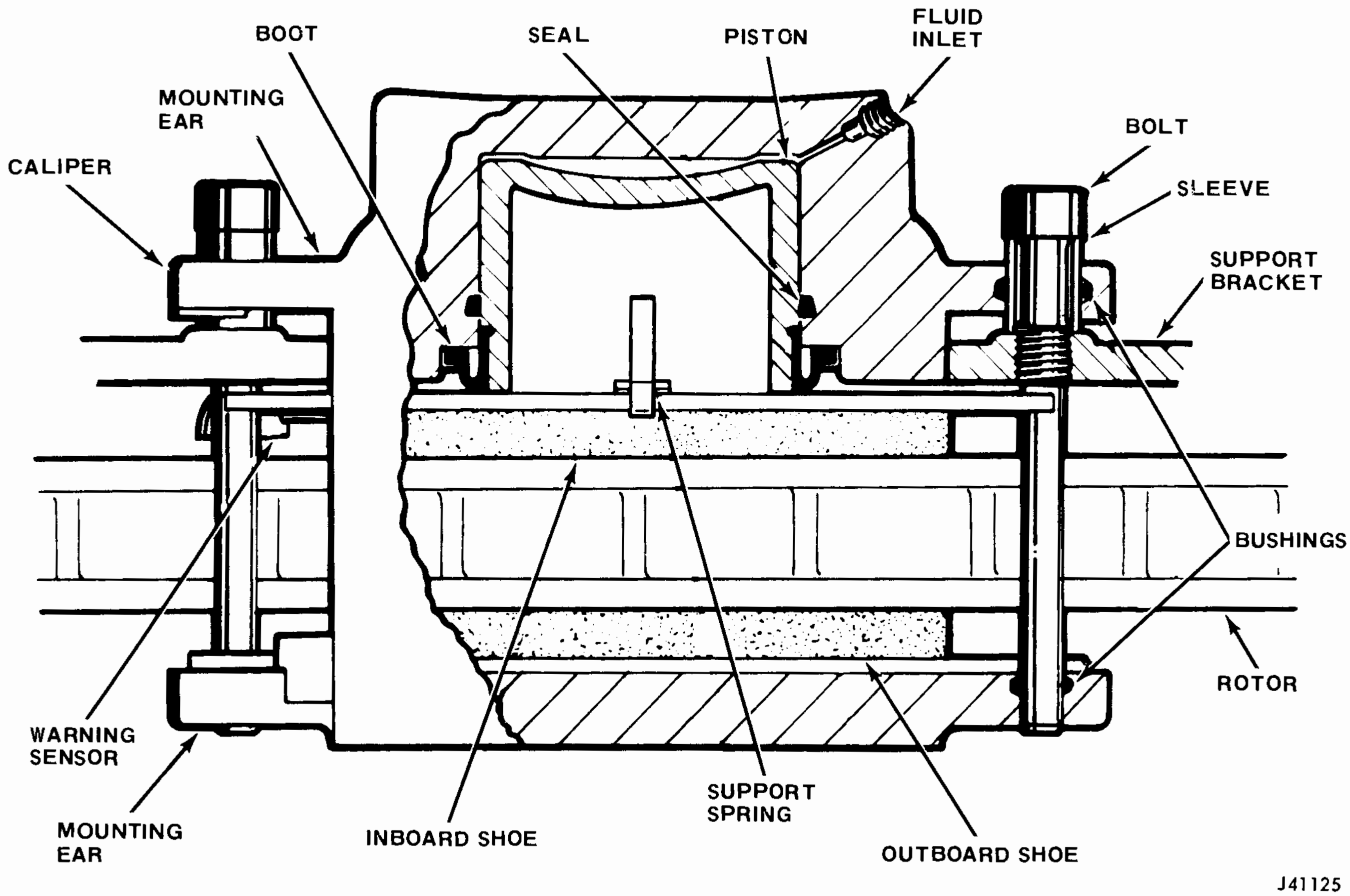

Fig. 9-22 Caliper and Rotor—Single Piston

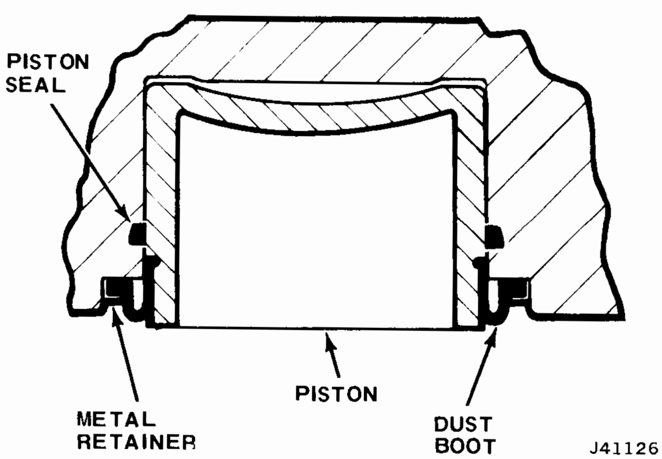

Fig. 9-23 Cross Section of Caliper Cylinder and Piston

(d) Inboard shoe has mounting ears on top which fit over retaining bolts.

(e) Inboard shoe has a notch at the top for the supporting spring.

A wear warning sensor, a strip of flanged metal, is attached to the back of all disc brakeshoes. When brake lining wears to the point of replacement, the sensor contacts the rotor surface making a screeching or scraping noise to warn the driver that the shoe and lining assemblies are in need of replacement (fig. 9-25).

An inspection port is provided at the top center of the caliper casting for visual inspection of lining condition (fig. 9-26).

Operation

The significant feature of the single-piston caliper operation is that it is free to slide laterally on the two mounting bolts threaded into the support bracket.

Figure 9-27 shows a simplified cross section of the floating caliper and the forces at work when the brakes are applied. During brake application, fluid pressure behind the piston increases. This pressure is exerted equally against the bottom surface of the piston and against the bottom surface of the piston bore.

Pressure applied to the piston is transmitted to the inboard shoe and lining, forcing the lining against the inboard rotor surface. Pressure applied to the bottom of the piston bore forces the caliper to slide on the mounting bolts, toward the inboard side. This inward movement of the caliper causes the outboard section of the caliper to force the outboard shoe and lining assembly against the rotor surfaces.

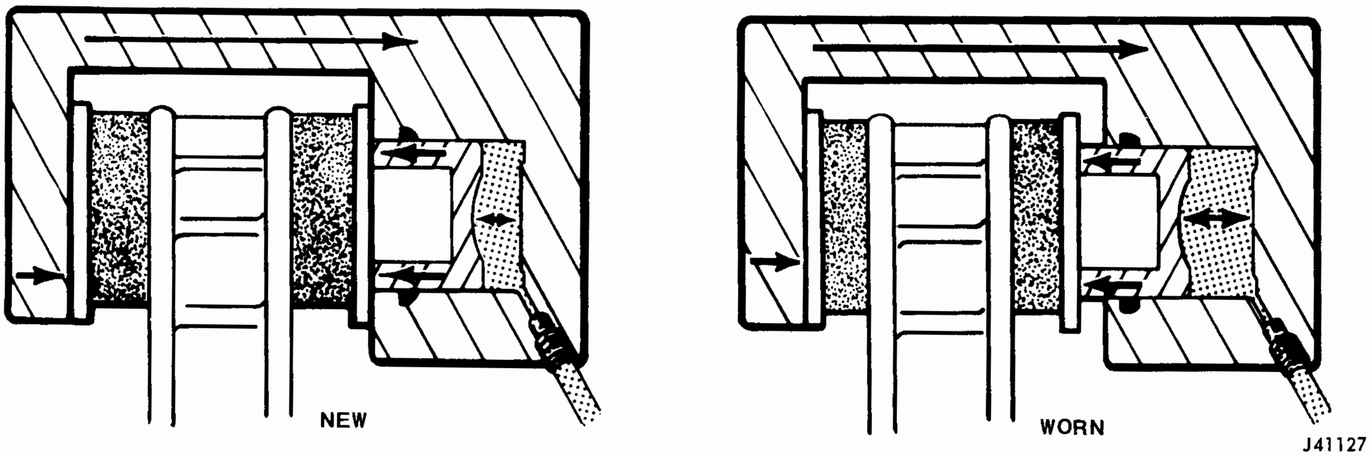

Fig. 9-24 Piston Travel—New and Worn Linings

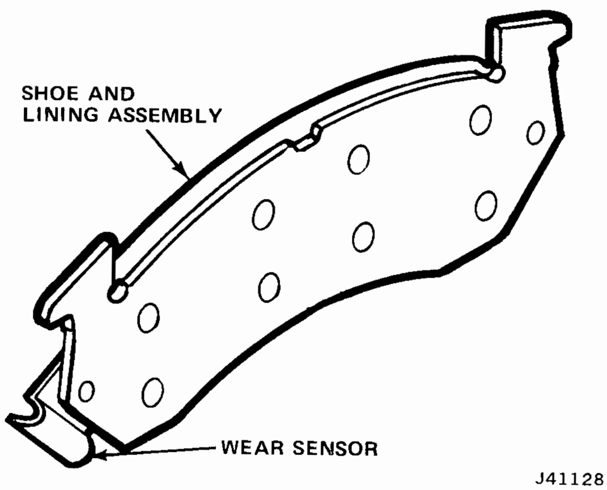

Fig. 9-25 Wear Sensor Location

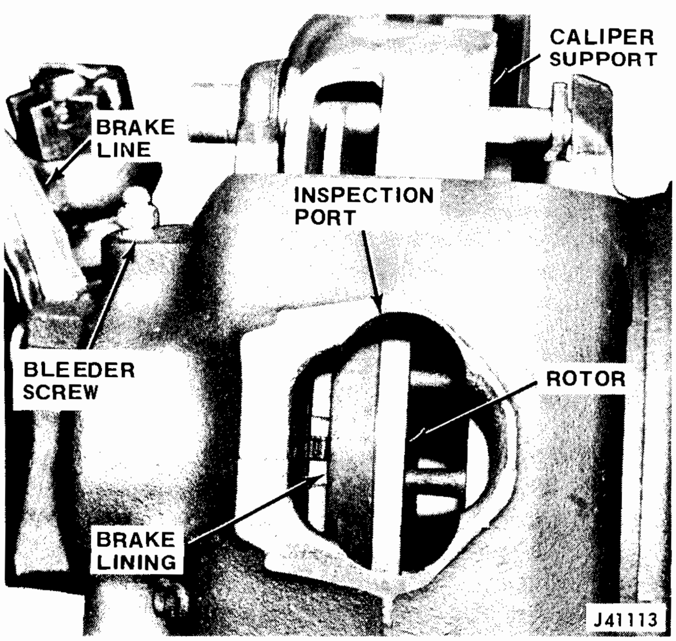

Fig. 9-26 Caliper Inspection Port

Any application or release of pressure on the brake pedal causes only a very slight movement of the piston and caliper. Upon release of the pedal, the piston and caliper return to an at-rest position; the brake lining does not retract any appreciable distance from the rotor. This provides the advantages of improved brake response, and reduced pedal travel. The disc brakeshoes operate at a zero clearance and continually wipe the rotor free of foreign matter.

As the linings wear, the piston extends farther out of the caliper bore, and the caliper repositions itself on the mounting bolts to maintain proper lining-to-rotor relationship. The caliper bore receives additional brake fluid to compensate for lining wear and increased piston extension (fig. 9-24).

SERVICE

Disc Brake Shoe Replacement

(1) Remove two-thirds of brake fluid from front reservoir.

(2) Raise vehicle.

(3) Remove front wheel and tire assemblies.

(4) Place C-clamp on caliper (fig. 9-28). Solid end of clamp should contact back of caliper. Screw end should contact metal part of outboard shoes. Tighten clamp until caliper moves far enough to force piston to bottom of bore (this will back shoes off rotor surface, easing lining removal and installation). Remove C-clamp.

(5) Remove allen head mounting bolts (fig. 9-29), and remove caliper (fig. 9-30). Place caliper on front spring or other suitable support. Do not allow brake hose to support weight of caliper.

(6) Remove both shoe and lining assemblies. Remove support spring from inboard shoes. Note spring position for correct installation later (fig. 9-30).

(7) Remove sleeves from inboard ears of caliper. Remove rubber bushings from all holes in caliper ears.

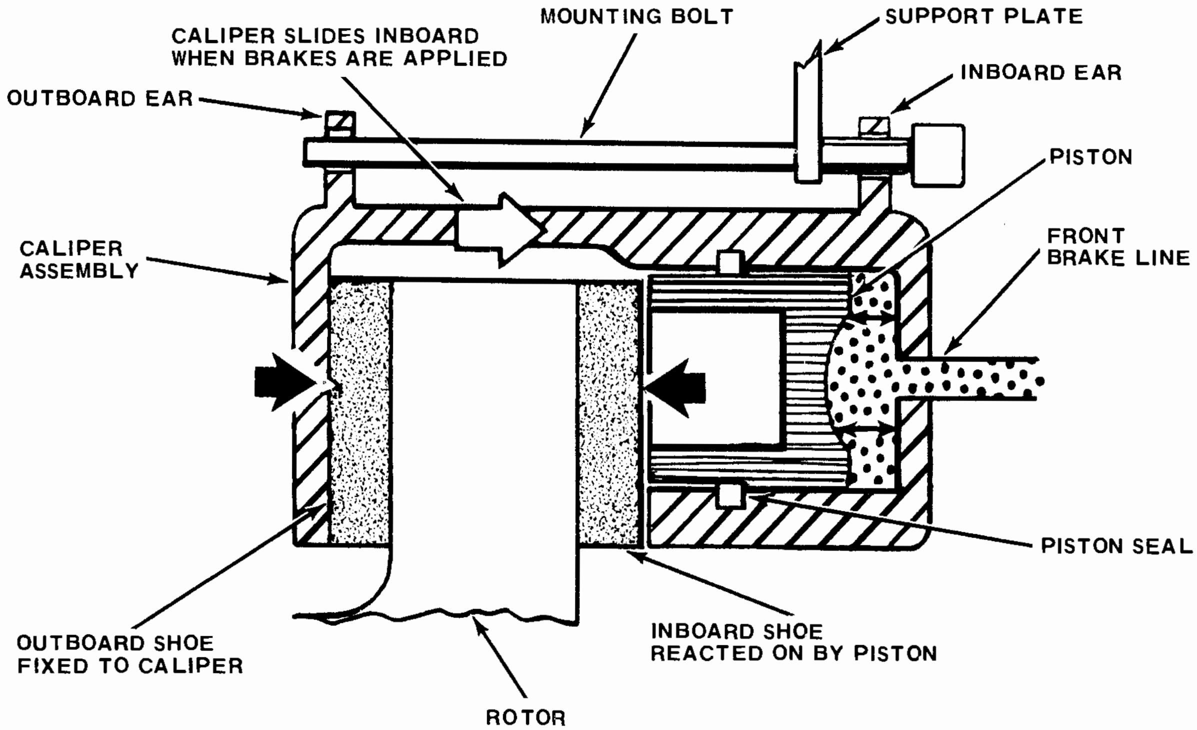

Fig. 9-27 Disc Brake Operation

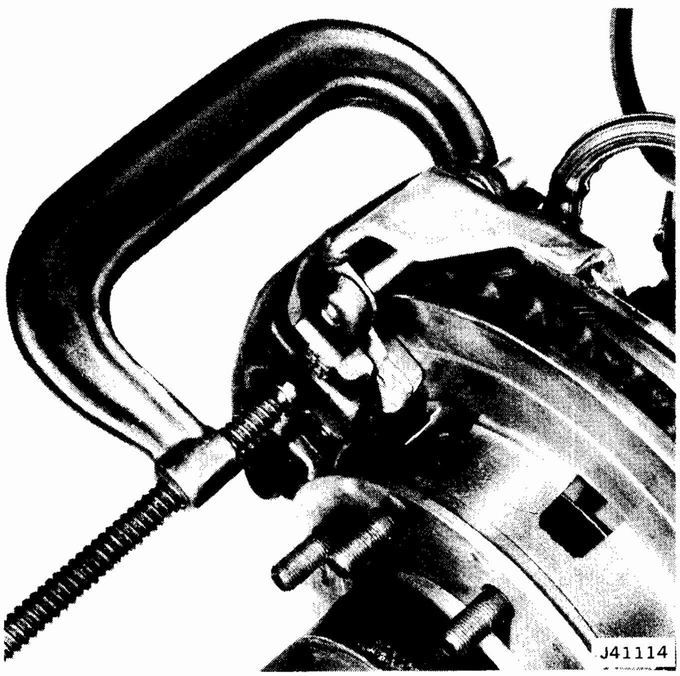

Fig. 9-28 Bottoming Piston with C-Clamp

(8) Clean all mounting holes and bushing grooves in caliper ears. Clean mounting bolts. Replace bolts if corroded or threads are damaged.

NOTE: *Do not use abrasives on bolts as they will destroy the protective plating on the bolts.*

(9) Wipe inside of caliper clean, including exterior of dust boot. Inspect dust boot for cuts, cracks, and for proper seating in piston bore. If evidence of fluid leakage is noted during inspection, caliper should be overhauled.

NOTE: *Do not use compressed air to clean inside of caliper as it may unseat the dust boot seal.*

(10) Lubricate new bushings, sleeves, bushing grooves, and small ends of mounting bolts with silicone lubricant. Install rubber bushings in all caliper mounting ears.

CAUTION: *Do not use old bushings and sleeves. Use new parts only.*

(11) Install sleeves in inboard mounting ears. Position sleeves so that sleeve end facing shoe and lining is flush with machined surface of mounting ear.

(12) Install support spring on inboard shoe. Place single tang end of spring over notch in shoe (fig. 9-31).

(13) Install inboard shoe in caliper (fig. 9-32). Shoe must lay flat against piston. Be sure support spring is fully seated in piston (fig. 9-32).

(14) Install outboard shoe. Ears on shoe should rest on top of ears in caliper. Bottom tab on shoe fits in cutout in caliper. Be sure shoe is fully seated (fig. 9-45).

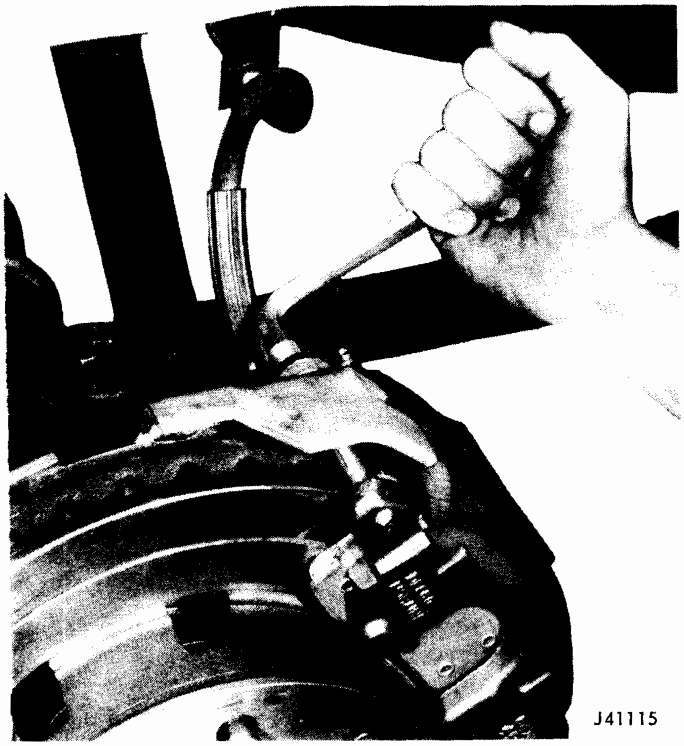

Fig. 9-29 Removal of Caliper Mounting Bolts

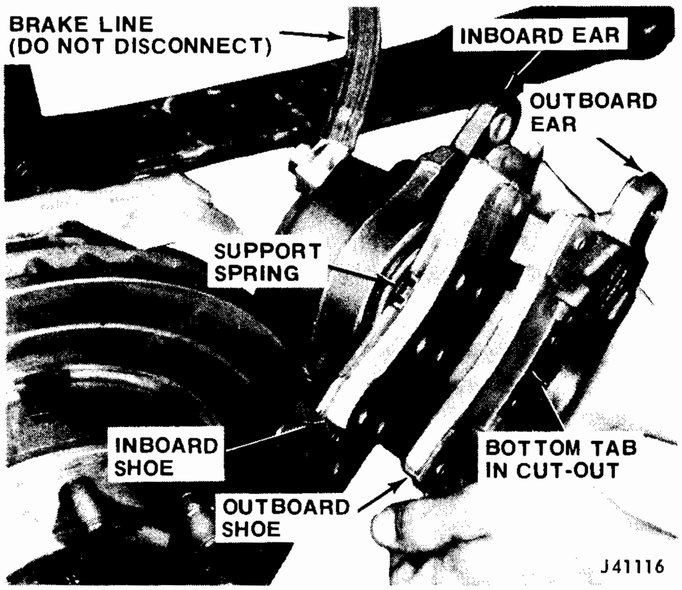

Fig. 9-30 Caliper Removal

(15) Install shoes and position caliper over rotor. Align mounting holes in caliper and support bracket and install mounting bolts. Be sure bolts pass under retaining ears on inboard shoes. Push bolts through untily engage holes of outboard shoe and caliper ears. Thread bolts into support bracket and tighten to 35 foot-pounds torque.

(16) Fill master cylinder with brake fluid and pump brake pedal to seat shoes.

(17) Use channel-lock pliers to bend (clinch) both upper ears of outboard shoe until radial clearance between shoe and caliper is eliminated.

NOTE: *Outboard shoes with formed ears are designed for original installation only and are fitted to caliper. The shoes should never be relined or reconditioned for installation.*

(18) Install wheel and tire assemblies and lower vehicle.

(19) Check cylinder fill level. Add fluid as required to fill master cylinder to within 1/4 inch of reservoir rim. Test brake operation before moving vehicle.

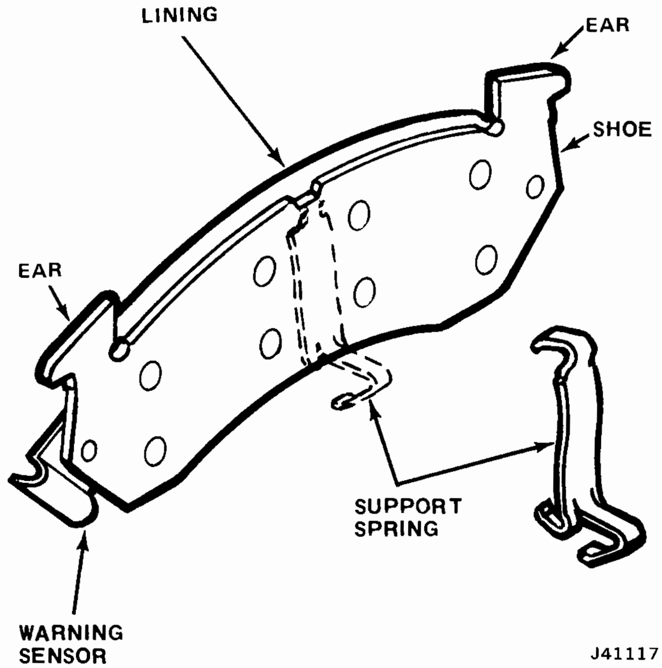

Fig. 9-31 Support Spring Installation

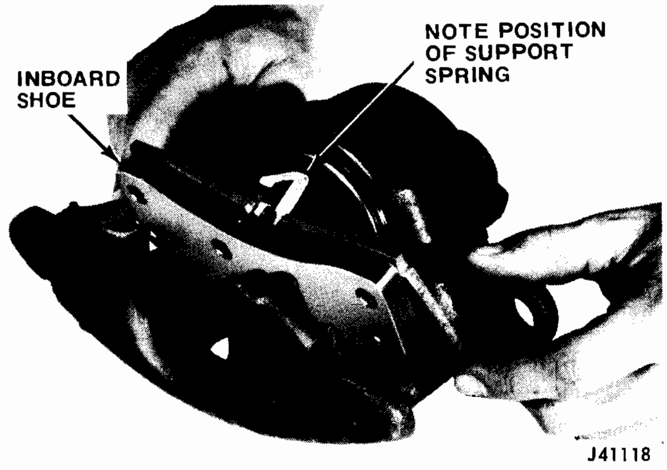

Fig. 9-32 Installing Inboard Brakeshoes

Caliper Overhaul

(1) Remove two-thirds of the brake fluid from front reservoir.

(2) Raise vehicle.

(3) Remove wheel and tire assemblies.

(4) Bottom caliper piston with C-clamp (fig. 9-28).

(5) Clean brake hose-to-caliper connection thoroughly. Remove hose-to-caliper bolt. Cap or tape open connections to keep out dirt. Discard copper gaskets.

(6) Remove caliper assembly and remove shoes from caliper.

CAUTION: *If shoes are to be reused, mark their location in caliper.*

(7) Wash caliper exterior with clean brake fluid. Drain residual fluid from caliper. Place caliper on clean work surface.

WARNING: *Caliper piston removal requires use of compressed air. Do not, under any circumstances, place fingers in front of piston in an attempt to catch or protect it when applying compressed air to remove piston.*

(8) Pad interior of caliper with clean shop towels. Insert air nozzle into inlet hole in caliper and gently apply air pressure on piston to push it out of the bore (fig. 9-33).

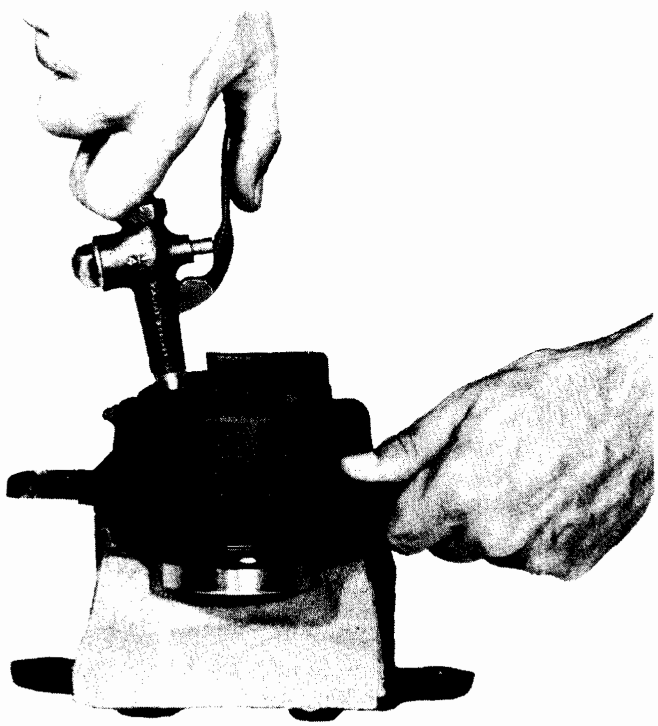

Fig. 9-33 Piston Removal

CAUTION: *To avoid possible piston damage, use only enough air pressure to ease piston out of bore. Do not blow piston out of bore.*

(9) Pry dust boot out of bore with screwdriver (fig. 9-34). Do not scratch bore. Discard dust boot.

(10) Remove piston seal from piston bore and discard seal. Use only nonscratching implements such as a pencil, wooden stick, or piece of plastic to remove seal (fig. 9-35). Do not use metal tool or similar object to remove seal as bore may be scratched.

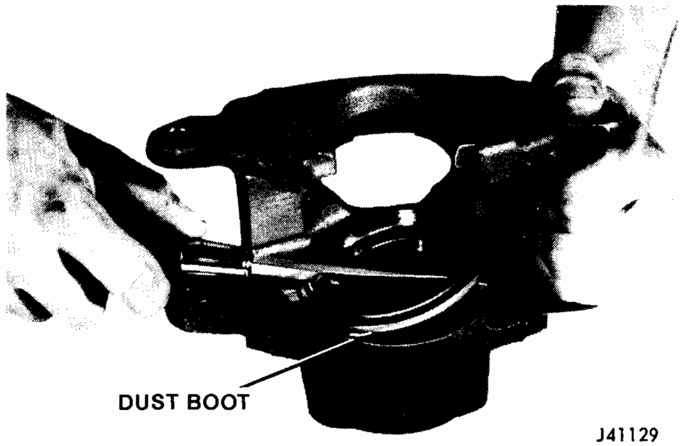

Fig. 9-34 Dust Boot Removal

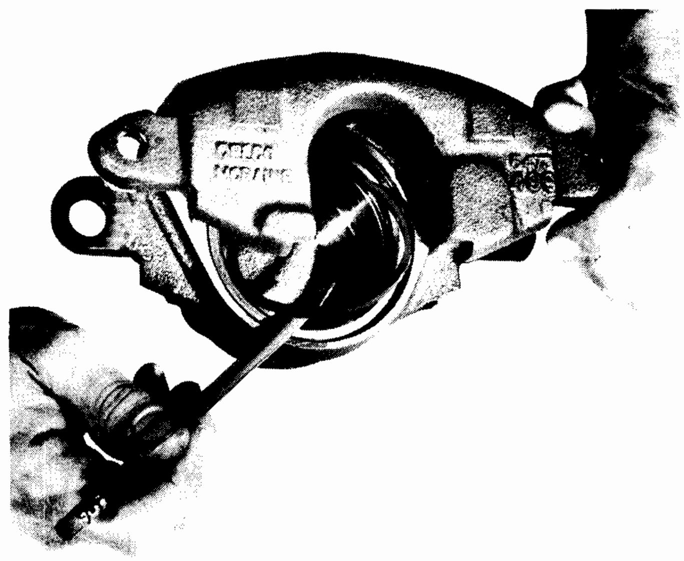

Fig. 9-35 Piston Seal Removal

(11) Remove bleeder screw. Remove and discard sleeves and rubber bushings from mounting ears.

(12) Wash all parts in clean brake fluid. Blow out all passages in caliper and bleeder valve using dry, filtered compressed air. Replace mounting bolts if corroded or if threads are damaged.

CAUTION: *Do not attempt to clean bolts with abrasives, as the protective plating will be removed.*

(13) Inspect caliper piston. Replace piston if nicked, scratched, corroded, or protective plating has worn off.

CAUTION: *Do not attempt to refinish piston in any way. The outside diameter is the sealing surface and is manufactured to very close tolerances; removal of the nickel-chrome plating will lead to pitting, rusting, and eventual cocking of the piston in the piston bore.*

(14) Inspect caliper piston bore. Replace caliper if bore is nicked, scratched, corroded, worn, or cracked. The bore is not plated and minor stains or corrosion can be polished with crocus cloth.

CAUTION: *Do not use emery cloth or similar abrasives on piston bore. If bore does not clean up with crocus cloth, replace caliper. Clean caliper thoroughly with brake fluid if bore was polished with crocus cloth.*

(15) Lubricate bore and new seal with brake fluid and install seal in groove.

(16) Lubricate piston with brake fluid and install new dust boot on piston. Install dust boot in piston groove so that fold in boot faces open end of piston. Slide metal retainer portion of dust boot over open end of piston and push retainer toward back of piston until lip on fold seats in piston groove (fig. 9-36). Push retainer portion of boot forward until boot is flush with rim at open end of piston and snaps into place (fig. 9-37).

(17) Insert piston in bore. Do not unseat piston seal. It requires 50 to 100 pounds of force to bottom piston.

(18) Install dust boot retainer in counterbore at top of piston bore. Seat dust boot retainer using Tool J-22904 (fig. 9-38).

CAUTION: *Metal retainer portion of boot must be evenly seated in counterbore and fit below the face of the caliper.*

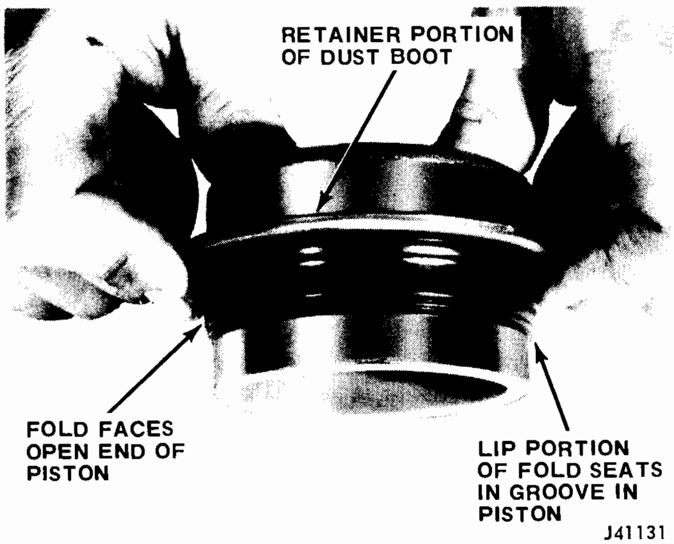

Fig. 9-36 Installing Dust Boot on Piston

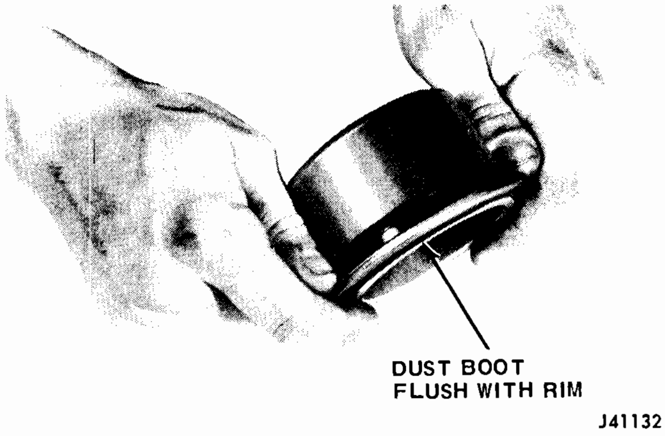

Fig. 9-37 Snapping Dust Boot Into Place

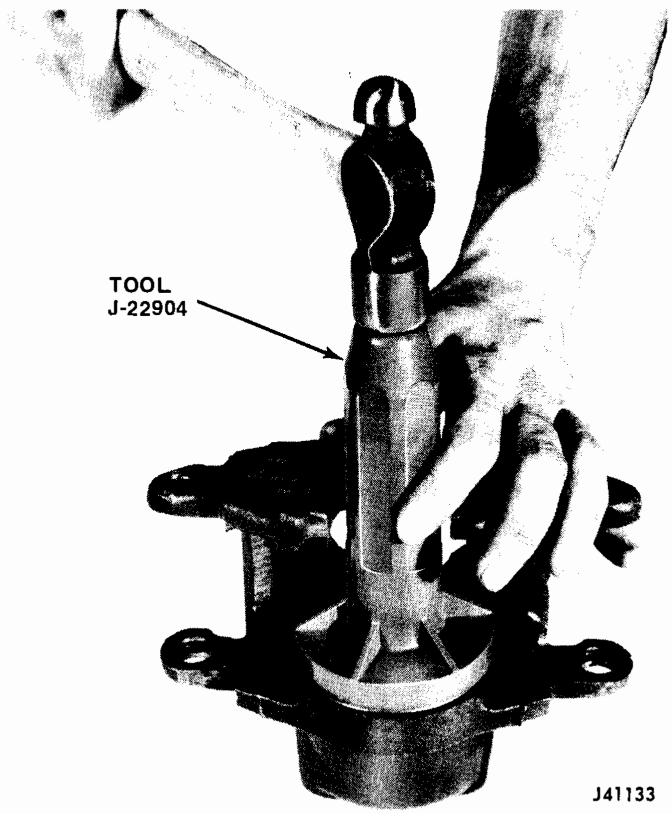

Fig. 9-38 Seating Dust Boot Retainer

(19) Install bleeder screw. Tighten to 90 inch-pounds torque.

(20) Connect brake line to caliper using new copper gaskets. Tighten bolt 160 inch-pounds torque.

(21) Install shoes, sleeves, and rubber bushings as outlined in Disc Brakeshoe Replacement.

(22) Install caliper over rotor. Attach caliper to support bracket. Tighten mounting bolts to 35 foot-pounds torque.

(23) Bleed brakes as outlined in Brake System Bleeding.

(24) Install wheel and tire assemblies and lower vehicle.

(25) Test brake operation before driving vehicle.

Rotor Service

Rotor service is extremely important because rotor tolerances must be accurate to ensure proper brake operation. Rotor service involves the following steps: inspection, measurement, refinishing, and replacement where indicated.

Inspection

(1) Raise vehicle and remove wheels.

(2) If rotor braking surfaces are heavily rusted or scaled, clean surfaces with flat sanding disc (while turning rotor) before attempting inspection or measurement.

(3) Check braking surfaces for cracks, nicks, broken cooling fins, and scoring. Some scoring of surfaces may occur during normal use, however, scoring that is 0.015-inch deep or less is not detrimental to brake operation. Replace rotor if cracked or broken.

Measurement

(1) Tighten wheel bearing adjusting nut enough to remove all end play from wheel bearings.

(2) Check Lateral Runout: Lateral (face) runout of rotor, as measured at outboard braking surface, must not exceed 0.005 inch (fig. 9-39). Lateral runout will cause rotor wobble resulting in chatter vibration, pedal pulsation, and excessive pedal travel (brakeshoes knock pistons back into caliper core).

(a) Check runout by mounting dial indicator on pedestal-type stand or on spindle with indicator stylus contacting outboard braking surface one inch from edge of rotor (fig. 9-39).

(b) Turn rotor full 360 degrees and observe reading. If runout exceeds tolerance, refinish rotor.

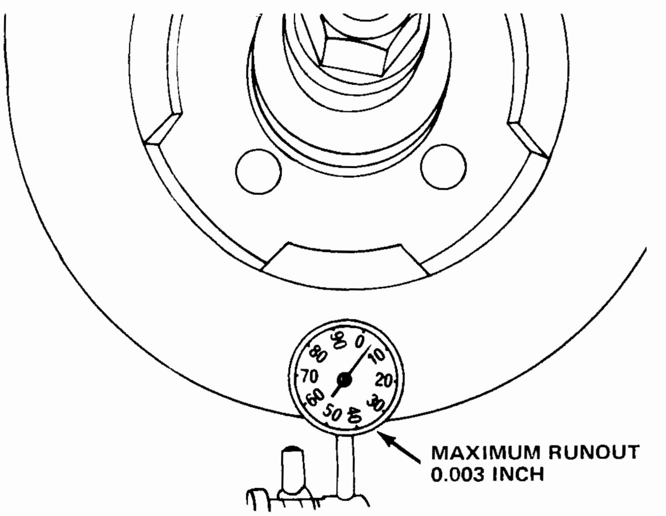

Fig. 9-39 Checking Lateral Runout

(3) Check Thickness Variation: Thickness of rotor, as measured at four or more equally spaced points, must not exceed 0.0005 inch. Thickness variations can cause pedal pulsation and vibration when applying brakes.

(a) Check variation by measuring thickness of rotor at four or more equally spaced points around circumference of rotor (fig. 9-40). Use micrometer or two dial indicators to perform measurement and measure thickness at same distance in from edge of rotor at all points.

(b) If variation exceeds tolerance, refinish rotor.

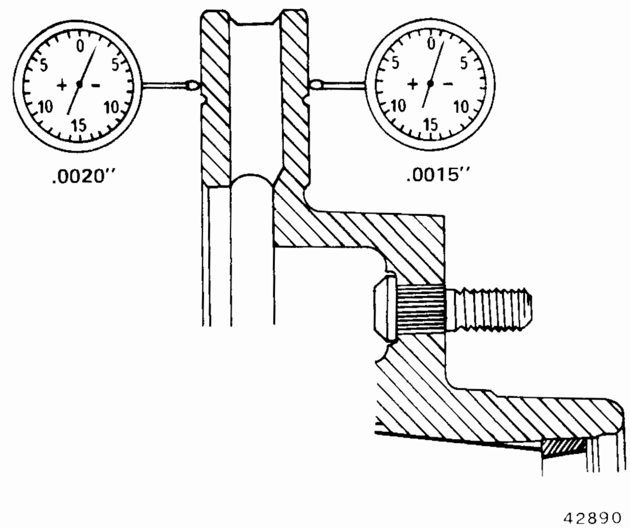

Fig. 9-40 Checking Thickness Variation

(4) Check Hub-to-Bore Runout: Wheel mounting surface of hub must be square with centerline of bearing cup bore to within 0.010 inch (fig. 9-41).

NOTE: *Although hub-to-bore runout does not affect brake operation or action, it can cause a mechanical-type vibration at high speed. Measure hub-to-bore runout only if car has unexplained high speed vibration or excessive lateral runout of rear wheel(s). Refer to Tire and Wheel Runout in this section.*

(a) Mount dial indicator on spindle with indicator stylus contacting wheel mounting surface of hub.

(b) Rotate hub and observe reading.

(c) Replace hub and rotor if runout exceeds tolerance.

NOTE: *If rotor braking surfaces are not scored or otherwise damaged and all measurements were within tolerance, rotor can be reused with no further servicing required.*

(5) Remove driving flange using Front Axle Shaft Drive Flange Puller J-25133.

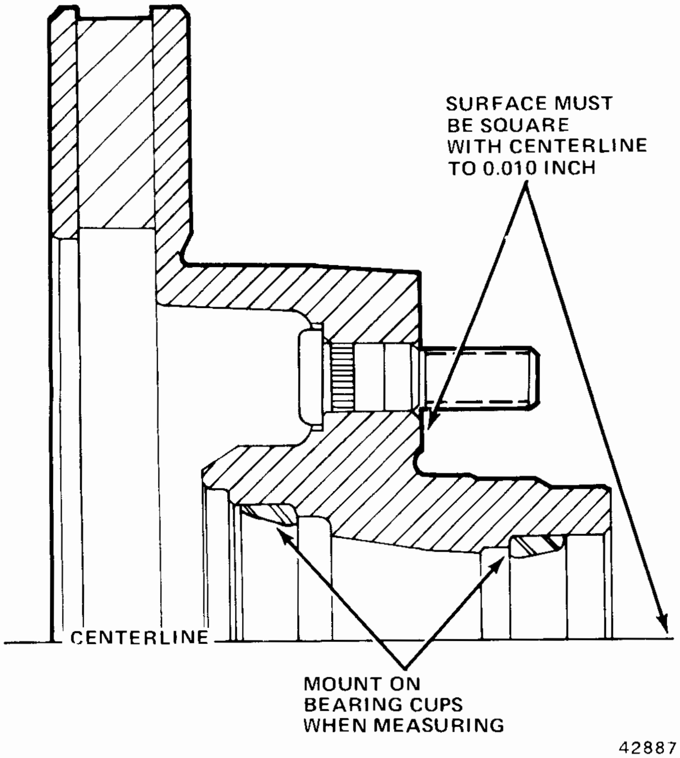

Fig. 9-41 Checking Hub-to-Bore Runout

Rotor Refinishing

Resurface rotor on brake lathe using flat sanding discs only if scoring is light (0.015 inch deep or less), if rotor surfaces have heavy rust and scale, and only if rotor meets all measurement specifications listed under Rotor Measurement.

Refinish rotor on disc brake lathe if scoring is deeper than 0.015 inch, or if runout, thickness variation, and hub-to-bore runout exceed specifications in Rotor Measurement.

NOTE: *Rotor finish should be 20 to 60 micro-inches and not be directional. After turning the rotor in a disc brake lathe, flat sanding discs should be used as a final step in the refinishing procedure to provide the desired microfinish and cross-hatch pattern on the rotor surface (fig. 9-42).*

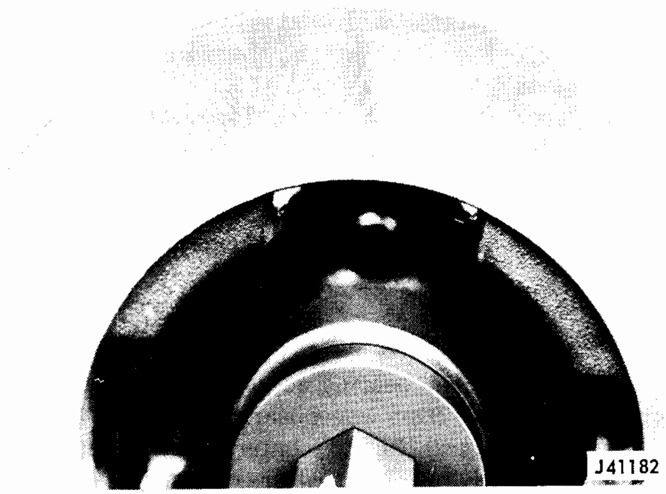

Fig. 9-42 Correct Surface Finish—Nondirectional Cross-Hatch Pattern

Replace the rotor if refinishing will cause the rotor to fall below the minimum thickness specification (after refinishing) of 1.215 inches.

WHEELS AND TIRES

WHEELS

Wheel Balancing

Wheel balancing with the wheel on the vehicle is recommended in all cases except as follows:

- If the vehicle is equipped with a Trac-Lok axle, remove wheels and balance off of the vehicle.
- When balancing with the wheel on a vehicle equipped with the Model 20 transfer case, shift the transmission and transfer case into the neutral position.
- When balancing with the wheels on a vehicle equipped with Quadra-Trac, disconnect the front or rear propeller shafts (as required).

Wheel Bearing Service

Adjustment of the wheel bearings is critical because it establishes the running clearance of the wheel bearings. Wheel bearing adjustment that is too tight preloads the bearings and causes them to run hot. Loose wheel bearings permit the drum hub to shift its position on the bearings as thrust load vary with acceleration, braking, and cornering.

Loose bearings also cause erratic braking. when checking wheel bearing adjustment, brakes must be fully released.

Front Wheel Bearing Adjustment—CJ Models

With vehicle on hoist or jack, use the following procedure to adjust front wheel bearings on four-wheel drive vehicles.

(1) Remove hubcap, snap ring, capscrews, and washers that attach driving flange to hub (fig. 9-43).

(2) Using Front Axle Shaft Drive Flange Puller J-25133, pull driving flange.

(3) Bend lip of lockwasher and remove locknut and lockwasher.

(4) Rotate wheel and tighten adjustment nut until wheel binds using Tool J-25103.

NOTE: *Front tire and wheel must be rotated by hand as the adjusting nut is tightened to ensure positive seating of the bearing.*

(5) Back off adjusting nut about 1/6- to 1/4-turn. Be sure wheel rotates freely without lateral shake.

(6) Install lockwasher and locknut and bend lockwasher lip.

(7) Check adjustment.

(8) Install driving flange and hub cap. Be sure gasket is installed between hub and flange.

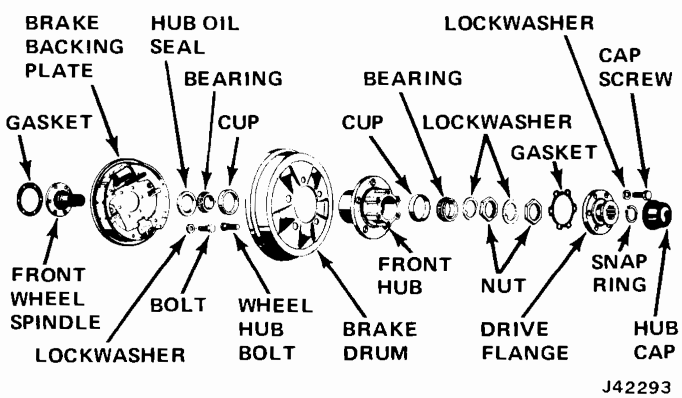

Fig. 9-43 Front Wheel and Hub Assembly—CJ Models

Front Wheel Bearing Adjustment—Cherokee, Wagoneer, Truck

(1) Raise vehicle and remove hubcap, snap ring, drive gear, pressure spring, outer locknut, and lockwasher.

(2) Loosen inner wheel bearing adjusting nut (nut has peg on side).

(3) Tighten inner wheel bearing adjusting nut to 50 foot-pounds torque using Wheel Bearing Wrench J-6893.

(4) Rotate hub, then back off inner wheel bearing adjusting nut 1/4 turn (maximum).

(5) Install lockwasher with inner tab aligned with keyway in spindle and turn inner wheel bearing adjusting nut until peg engages nearest hole in lockwasher.

(6) Install outer locknut and tighten to 50 foot-pounds torque (minimum) using Wheel Bearing Wrench J-6893-02.

(7) Install pressure spring, drive gear, snap ring and hub cap and lower vehicle.

Rear Wheel Bearing

Adjustment—Tapered and Flanged Axle—All Models (Except 8000 GVWR Truck)

Vehicles equipped with the tapered or flanged type rear axle (fig. 9-44) shafts require no wheel bearing adjustment. These axle shafts are equipped with a tapered-type roller bearing capable of accepting thrust in either direction. However, on tapered axle shafts used in CJ models, axle shaft end play must be correct to obtain proper bearing operating clearance. Refer to Section 9—Axle and Propeller Shaft for end play inspection and adjustment.

Adjustment—Full-Floating Axle (8000 GVWR Truck)

(1) Remove axle shaft (fig. 9-45).

(2) Bend lip of lockwasher and remove locknut and lockwasher.

(3) Raise vehicle.

(4) Rotate wheel and tighten adjusting nut with Tool J-25106 until wheel binds. Back off nut about 1/6-turn on until wheel rotates freely without lateral shake.

(5) Install locknut, tighten locknut to 50 foot-pounds torque, and bend lockwasher lip.

(6) Check adjustment and correct if necessary.

(7) Install axle shaft and lower vehicle.

TIRES

Tire Service

Tire maintenance is one of the most important factors of safe vehicle operation. Tires must sustain the weight of a loaded vehicle, withstand more than ordinary rough service, and provide maximum safety over all types of terrain. Although there are other elements of tire service, inflation maintenance is the most important and in many instances the most neglected. Correct tire pressure should be maintained for safe operation. An underinflated tire is subject to severe flexing which could damage the casing. Overinflation will cause a harsh ride and may in time cause a blowout.

Incorrect front wheel alignment, wheel balance, dragging brakes, poor driving habits, and fast cornering, all contribute to the wear. Such conditions should be corrected.

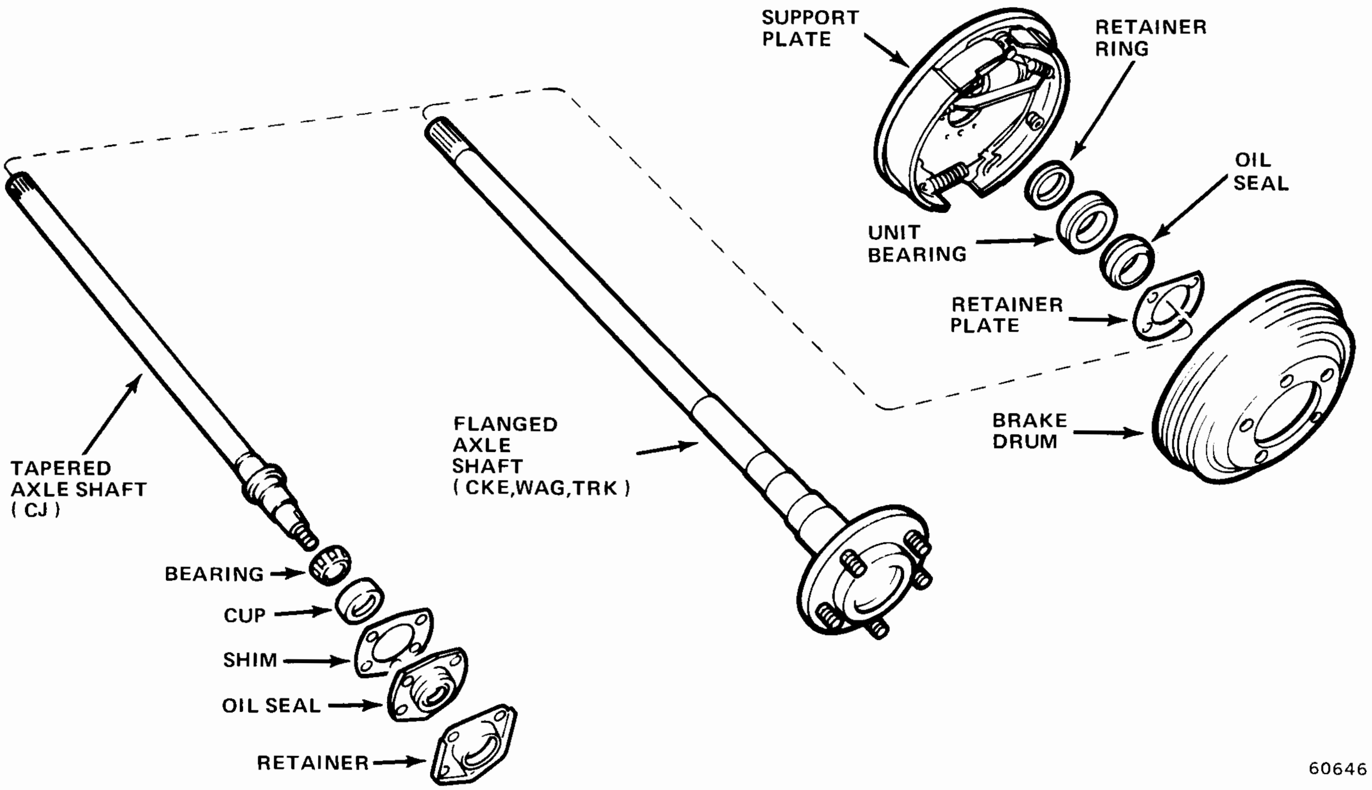

Fig. 9-44 Rear Wheel Attaching Parts—Flanged and Tapered Axles

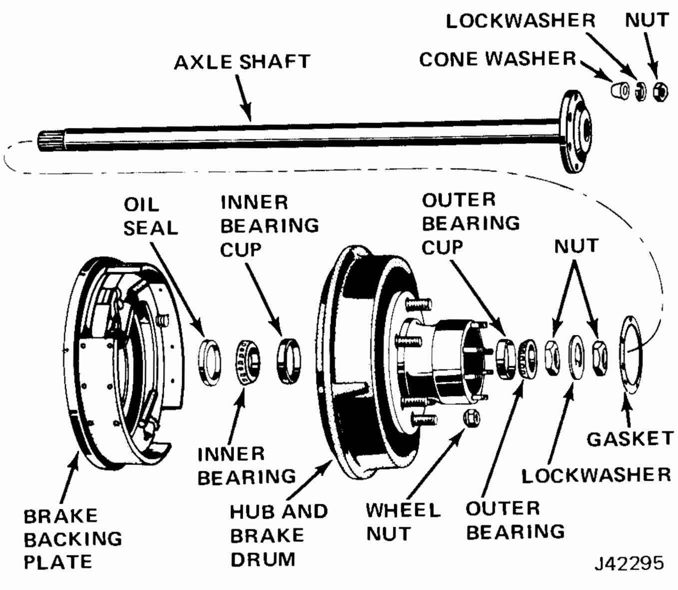

Fig. 9-45 Rear Wheel Attaching Parts—Full-Floating Axle

Underinflation

Underinflation distorts the normal contour of the tire body and the tire bulges or bellies out with an extreme flexing action. This wears the tread at the edges more than the center and generates excessive internal heat, weakening the cords and resulting in bruises, broken cords, or ply separation. Underinflation also leads to rim bruises as insufficient resistance is provided to protect the tire from being jammed against the rim and crushed or cut when the tire strikes a curb, rock, or rut.

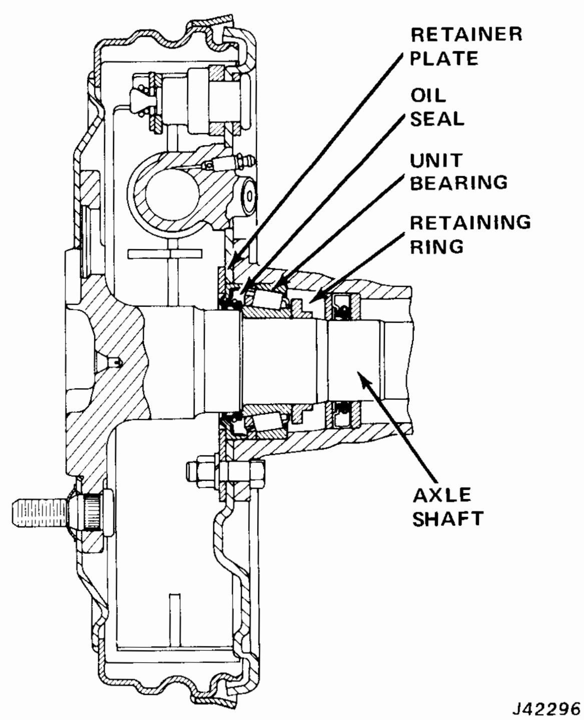

Fig. 9-46 Rear Wheel—Flanged Axle (8000 GVWR Truck)

Overinflation

When a tire is overinflated, increased tension caused by excessive pressure prevents proper deflection of the sidewalls. This results in wear in the center of the tread and the tire also loses its ability to absorb road shocks. Under this increased strain, cords in the tread area eventually snap under impact, causing a casing break.

Misalignment

Excessive wheel camber can result in excessive wear on one side of the tire tread.

Front wheels require a specified amount of toe-in. However, excessive toe-in or toe-out will cause the tires to "scrub"when the vehicle is moving straightahead, resulting in excessive tread wear. The tires will show a feathered edge with excessive toe-in or toe-out.

Balance

Cupping or bald spotting of tires is associated with wear on a vehicle driven mostly at highway speeds without the recommended tire rotation, inflation or balance.

Tire Care

CAUTION: *For satisfactory operation, all four-wheel drive vehicles MUST be equipped with the same size tires of equal circumference on all four wheels. The tires must be inflated to proper factory recommended pressures at all times. The intermixing of tires of different construction or size can cause unusual handling, road noise, and damage to drive train components.*

Correct tire pressures depend on tire size, tire ply, gross vehicle weight rating (GVWR), vehicle load, and the type of driving.

Tire inflation should be checked and adjusted to recommended pressures periodically (at least monthly), especially when extreme temperature (20°F) in average seasonal temperature occur. Tire inflation pressures should be checked and adjusted when the tires are cold or driven less than two miles at moderate speeds of less than 40 mph after the vehicle has been at rest for at least six hours.

Do not reduce inflation pressure if the tires are hot or driven over 10 miles in excess of 60 mph. Hot tire pressure may increase as much as 6 psi over cold pressures. If tire pressure must be adjusted while hot, temporarily set pressure at 6 psi (10 psi for sustained high speeds) greater than those specified until such time as cold inflation pressure can be checked and adjusted.

The correct tire inflation pressures for any given set of driving conditions may be determined by referring to the Tire Inflation Pressure (PSI) Chart.

Tire Rotation

Rotate tires every 5,000 miles. See figure 9-47 for rotation sequence.

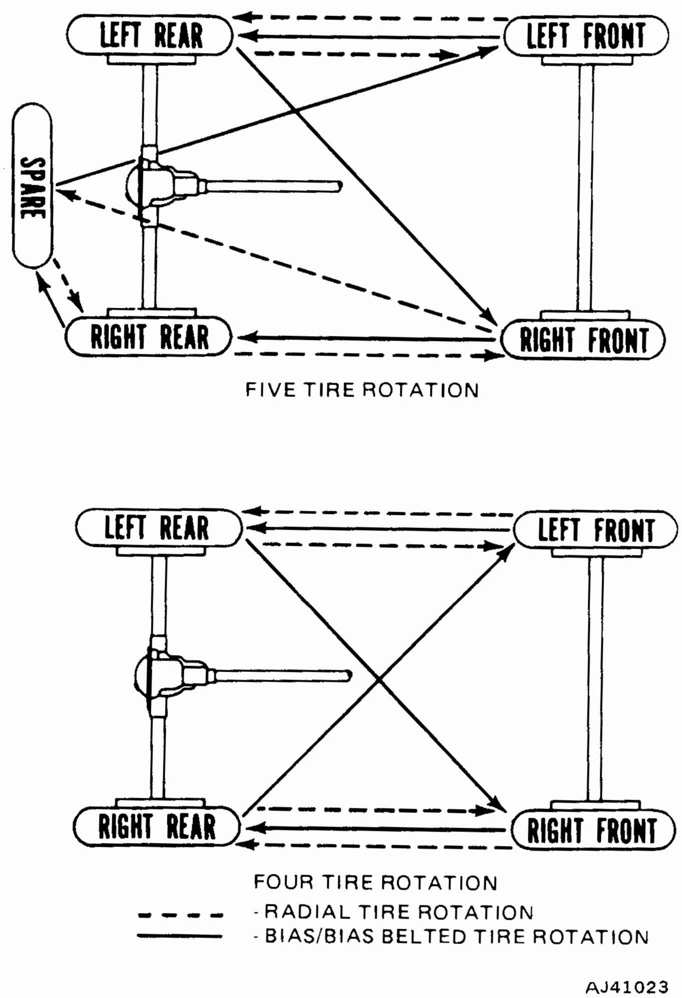

Fig. 9-47 Tire Rotation

SAE Brass Tube Fittings

Fitting Size	Tube Size (Inch)	Half-Hard Copper Tubing (Inch-Pounds)	Double Flared Bundy Tubing (Inch-Pounds)
2	1/8	45	50
3	3/16	55	75
4	1/4	65	100
5	5/16	80	120
6	3/8	125	175
8	1/2	250	350

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Torque Specifications

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service In-Use Recheck Torques
Bleeder Screw, Wheel Cylinder 1/4-28	30-90 in-lbs
Bleeder Screw, Wheel Cylinder 5/16-24	40-140 in-lbs
Brake Shoe or Tube-to-Wheel Cylinder 3/8-24	120-200 in-lbs
Brake Support Plate Mounting Bolt Front (Cherokee, Wagoneer, Truck)	20-30
Brake Support Plate Mounting Bolt and Nut, Rear (8000 GVWR Truck)	45-55
Brake Support Plate Mounting Bolt and Nut, Rear (Cherokee, Wagoneer, Truck)	35-55
Front Brake Support Plate Mounting Bolt and Nut (CJ Models)	35-55
Power Brake Unit to Spacer and Firewall (Cherokee, Wagoneer, Truck)	18-25
Wheel-to-Hub Nuts	
CJ Models	65-90
Cherokee, Wagoneer, Truck	65-80
8000 GVWR Truck	110-125

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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Tire Inflation Pressure (PSI) Chart

Model	GVW Rating	Tire Size	Load Range	Normal Load (1): Sustained Driving Over 65 mph (3) Front	Rear	Normal Load (1): Under 65 mph Front	Rear	Maximum Load (2): Sustained Driving Over 65 mph (3) Front	Rear	Maximum Load (2): Under 65 mph Front	Rear	Wheel Size
CJ-5 & CJ-7	3750 & 4150	F78x15	B	24	24	20	20	32*	32*	32	32	15 x 6 (Aluminum Wheel is 15 x 7)
		H78x15	B & D	24	24	20	20	28	28	24	24	15 x 6
		HR78x15	B	24	24	20	20	28	28	24	24	15 x 6
		6.00x16	C	40	40	30	30	50	50	40	40	16 x 6
Wagoneer & Cherokee	6025	H78x15	B & D	26	26	22	22	32*	32*	32	32	15 x 6 (Aluminum Wheel is 15 x 7)
		HR78x15	B	26	26	22	22	32*	32*	32	32	15 x 6
		10.00x15	B	30	30	20	20	40	40	30	30	15 x 8
Truck J-10	6025	H78x15	B & D	28	28	24	24	32*	32*	32	32	15 x 6
		HR78x15	B	26	26	22	22	32*	32*	32	32	15 x 6
		10.00x15	B	30	30	20	20	40	40	30	30	15 x 8
Truck J-20	6500	8.00x16.5	D	45	45	35	35	55	70	45	60	16.5 x 6
		7.50x16	C	40	40	30	30	45	55	35	45	16.0 x 6
	7200	9.50x16.5	D	45	45	35	35	55	70	45	60	16.5 x 6.75
		7.50x16	D	40	40	30	30	55	70	45	60	16.0 x 6
	8000	9.50x16.5	D	45	45	35	35	55	70	45	60	16.5 x 6.75
		7.50x16	E	40	40	30	30	55	85	45	75	16.0 x 6

NOTE: Inflate tires while cold, before running. Do not reduce pressures if tires are warm.

*Speed limited to 75 mph.

(1) Normal Load—Frequently selected accessories, plus driver and two passengers. For CJ models, driver and one passenger.

(2) Maximum Load—Gross Vehicle Weight Rating (GVWR).

(3) Sustained driving over 75 mph for Cherokee and Wagoneer.

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Brake Size and Application Chart

Model	Master Cylinder Bore Diameter	Front Brakes		Rear Brakes		Power Brake (4) (Booster Type)
		Brake Size and Type	Caliper Piston or Wheel Cyl. Dia.	Brake Size and Type	Wheel Cyl. Dia.	
CJ-5/CJ-6	1	11 x 2 Drum	1-1/8 Wheel Cyl.	11 x 2 Drum	15/16	Tandem Diaphragm (5) 7-3/4
Cherokee (2)	1	11 x 2 Drum	1-1/8 Wheel Cyl.	11 x 2 Drum	15/16	Single Diaphragm 9-1/2
Wagoneer	1-1/8	12.0 Disc	2-15/16 Single Piston	11 x 2 Drum	15/16	Single Diaphragm 9-1/2
Truck: 6025 GVW (2) 120" W.B.	1	11 x 2 Drum	1-1/8 Wheel Cyl.	11 x 2 Drum	15/16	Single Diaphragm (2) 9-1/2
6025 GVW (3) 132" W.B.	1	11 x 2 Drum	1-1/8 Wheel Cyl.	11 x 2 Drum	15/16	Single Diaphragm (3) 9-1/2
6500 GVW	1-1/8	12.5 Disc	2-15/16 Single Piston	12 x 2.5 Drum	1-1/8	Tandem Diaphragm 9-1/2
7200 GVW	1-1/8	12.5 Disc	2-15/16 Single Piston	12 x 2.5 Drum	1-1/8	Tandem Diaphragm 9-1/2
8000 GVW	1-1/8	12.5 Disc	2-15/16 Single Piston	12 x 2.5 Drum	1-1/8	Tandem Diaphragm 9-1/2

(1) All dimensions are in inches.
(2) 12.0 disc brake optional on these models.
(3) Single diaphragm type booster used with optional power disc brake application.
(4) Models equipped with power booster.
(5) Power available only on CJ-5 with V-8

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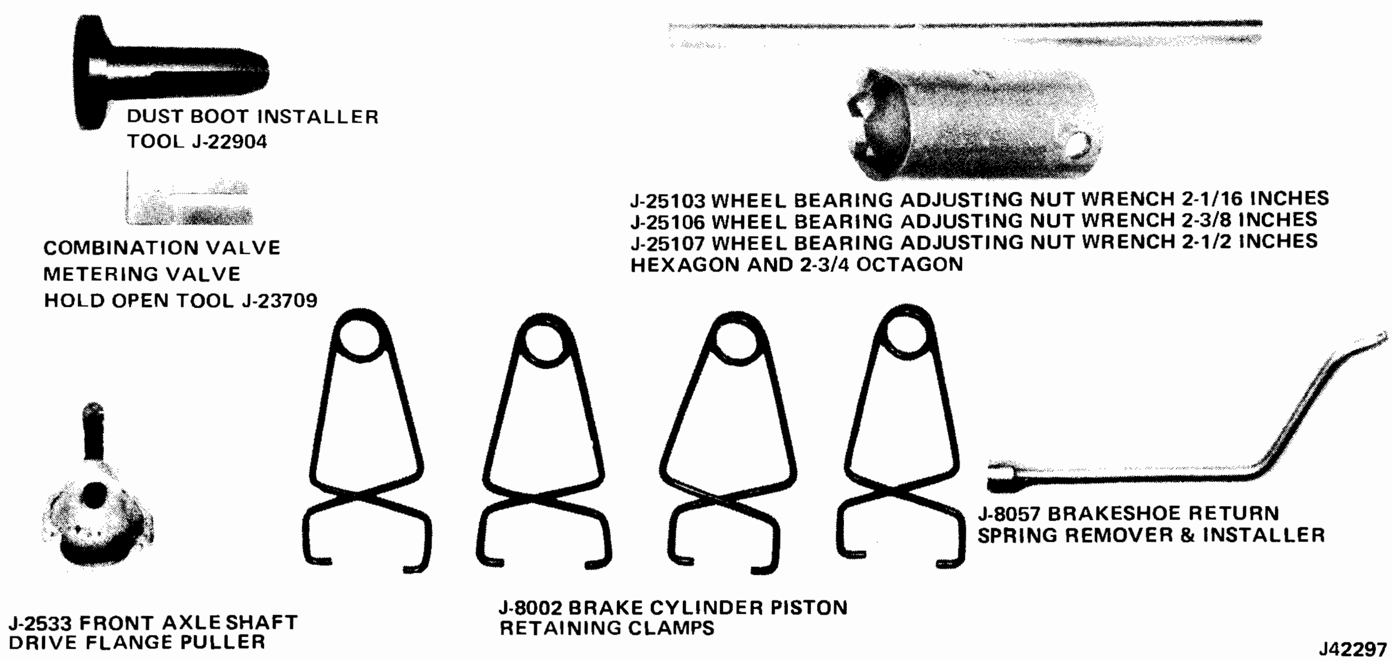

Fig. 9-48 Brake and Wheel Service Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

www.cargeek.ir

AXLES—PROPELLER SHAFTS

TESTING AND DIAGNOSIS

GENERAL

In diagnosing a reported axle noise condition, obtain a complete description of the noise and driving conditions when the noise occurred. A preliminary road test, with the customer demonstrating the complaint condition, is recommended.

The action of transmitting engine torque to the wheels will produce some noise in the axles. Slight axle noises confined to a short speed range or to a specific period are considered normal.

Noises produced by the engine, transfer case, transmission, tires, wheel bearings, exhaust system, propeller shaft, or the action of wind on the body or grille may be incorrectly diagnosed as produced by an axle. Thoroughly test the vehicle to isolate the problem component.

With the vehicle stopped and the transmission in neutral, run the engine at various speeds. If the noise is heard during this test, the noise is confined to the engine, exhaust system, clutch, transmission, transfer case, or engine-driven accessory equipment.

Prior to the diagnostic road test, check the tire pressure and axle lubricant levels.

TIRE NOISE TESTS

Since some types of tire tread wear or tread patterns may produce objectionable noises, drive on various types of road surfaces and listen for a change in the noise. If the noise varies with the type of surface, tires may be the cause.

WHEEL BEARING TESTS

Worn, loose, or damaged wheel bearings may be confused with axle noise. Wheel bearing noise is usually more noticeable when coasting at lower vehicle speeds. Applying the brakes gently will usually change wheel bearing noise. Another test is to turn the vehicle alternately left and right, which side-loads the bearings, causing the defective bearing to become noisy.

AXLE TESTS

Drive the vehicle a distance sufficient to bring the axle to normal operating temperature. Tests should be performed using different transmission and transfer case gear combinations.

Axle noise conditions are usually related to vehicle speed rather than engine rpm or transmission gears.

Axle noises may be classified into two types: gear noise and bearing noise.

Gear noise is recognized as a whine or high-pitched resonating sound more pronounced at certain speeds and usually within a narrow speed range under a drive (accelerating load), coast (decelerating load), or float (maintained speed) condition.

Axle bearing noise is usually constant and the pitch is related to the vehicle speed.

Since the pinion gear turns faster than the ring gear, the pinion bearings produce a higher pitch than the differential bearings. The pinion bearings are usually heard at low vehicle speeds (20 to 30 mph).

Differential bearings are lower in pitch because they are turning at the same speed as the wheels when the vehicle is driven straight ahead. Differential bearing noise will not vary when the vehicle is turned alternately left and right or when the brakes are gently applied.

AXLE NOISY ON PULL AND COAST

- Excess backlash ring gear and pinion—adjust.
- Pinion shaft end play—adjust.
- Worn pinion bearing—replace.
- Pinion set too deep in ring gear—adjust.
- Wrong Trac-Lok differential lubricant—replace.

AXLE NOISY ON PULL

- Pinion and ring gear out of adjustment—adjust.
- Pinion bearings rough—replace.
- Pinion bearings—adjust.

AXLE NOISY ON COAST

- Excessive backlash in ring gear and pinion—adjust.
- End play in pinion gear—adjust.
- Rough bearings—replace.

BACKLASH

Excessive backlash in the vehicle drive line may be the result of excessive backlash in the transmission, propeller shaft spline, universal joint, ring gear and pinion, axle shaft spline, or differential.

CHATTER—TRAC-LOK DIFFERENTIAL

Chatter in the Trac-Lok rear differential is usually caused by the use of improper lubricant. If this is determined to be the cause of chatter, change lubricant. Use only Jeep Trac-Lok Lubricant, part number 8991018 (or equivalent).

OTHER AXLE CONDITIONS

A knocking or clucking noise heard at low speed or when coasting may be caused by a loose fitting differential side gear in the differential case bore. When this condition is encountered, applying the brakes lightly will usually reduce the sound.

Differential gear noise is considered normal when spinning a rear wheel for on-the-vehicle wheel balancing, or when a rear wheel is spinning due to icy conditions.

When a noise has been determined to be caused by the bearings, the gears do not require replacement unless an inspection reveals signs of obvious damage.

When the noise is determined to be caused by the pinion and ring gears at low mileages, the need for bearing replacement is dependent upon inspection of the bearings during overhaul.

DRIVE LINE VIBRATIONS

Vibration in the drive line can be caused by a variety of conditions. The following procedure can be used to isolate the most common causes.

(1) Check condition of tires. Compare differences in tread wear, side to side, and front to rear. Be sure tire type and sizes are same, especially with Quadra-Trac equipped vehicles.

(2) Check tire pressures and set-to specifications.

(3) Check wheel and tire balance and correct if necessary.

(4) Check all drive line components (universal joints, engine mounts, transmission mounts, and spring bushings) for tightness.

(5) Check front and rear pinion angle as follows:

(a) Place vehicle on rail hoist (one that supports vehicle on all four tires).

(b) Check level of vehicle by placing a bubble protractor on straight portion of frame side rail and reading out-of-level condition. Shim low end by placing a spacer between tire and lift rail to bring vehicle to level position.

(c) Using bubble protractor, check pinion angle by taking a reading from cover face of differential housing. Reading can be taken from cover flange; however, differential can be drained, cover removed, and reading taken from machined surface of housing.

NOTE: *All angles are given in degrees above horizontal. Refer to Pinion Angle Chart in Specifications portion of this section.*

FRONT AXLE

GENERAL

The front axle used on all Jeep vehicles is a drive-type axle equipped with hypoid gears and steering knuckles. Engine torque is transmitted to the wheels through full-floating axle shafts which have integral universal joints that revolve within the steering knuckles. All front axles are an open-end design. The knuckles are not enclosed.

CJ models use the Model 30 front axle. Cherokee, Wagoneer, and Truck models use the Model 44F front axle. Refer to Axle Application Chart in Specifications for further information.

On all front axles, toe-in and caster are the only adjustable front alignment angles. Camber is built into the axle and cannot be adjusted. Toe-in is adjusted at the steering tie rod. Caster is adjusted by installing tapered shims between the spring and spring seat. However, a change in caster will also change the front pinion angle. If caster is adjusted, correct the front pinion angle as well. Refer to Pinion Angle Chart in Specifications portion of this section.

IDENTIFICATION

The axle model is cast into the upper surface of the left side reinforcing rib of the housing (fig. 10-1).

The build date and manufacturer's part numbers are stamped on the right-hand tube adjacent to the cover. The build date is as follows. First number is the month, second number is the day of the month, third number is the year, the alpha-letter is the shift and the last number is the assembly line. If there are two build dates, the latter will be the date when the brake components were installed.

The gear ratio tag, attached to the left side of the housing cover, indicates the Jeep manufacturing reference part number and the tooth combination of the ring gear and pinion.

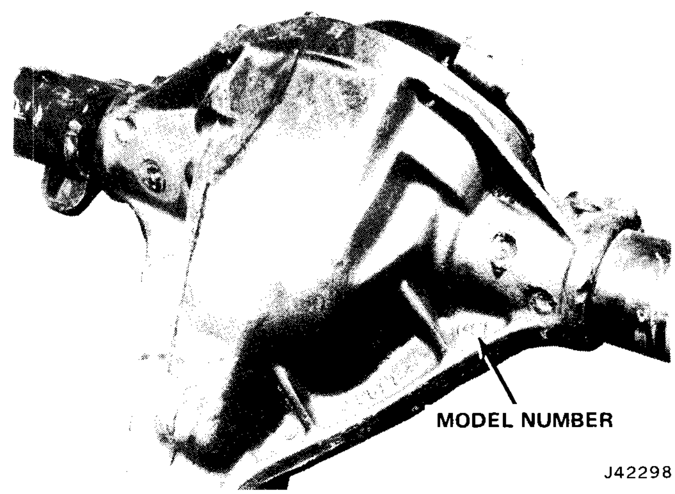

Fig. 10-1 Axle Identification

AXLE HOUSING

The front axle housing should be checked periodically for weld cracks and other damage that may Cause loss of lubricant, or affect driving characteristics, especially misalignment of the front wheels.

If the vehicle is driven through water deep enough to cover the front hubs, it is recommended that the wheel ends be disassembled and inspected for water damage or contamination.

Examine, clean, and replace damaged parts, if necessary, prior to lubricating and assembling the wheel end components. Pay particular attention to the axle bearings and brake components.

PINION SHAFT OIL SEAL OR FRONT YOKE REPLACEMENT

(1) Raise and support vehicle.

(2) Index propeller shaft to front yoke for assembly reference and disconnect shaft at yoke.

(3) Remove pinion shaft nut and washer. Remove yoke using Holding Wrench J-8614-10 and Yoke Puller J-25134 (fig. 10-2).

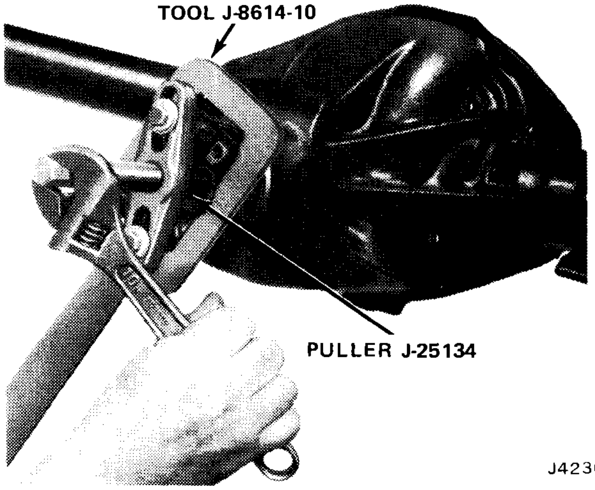

Fig. 10-2 Removing Yoke

(4) Remove pinion shaft oil seal using Remover Tool J-25180.

(5) Install replacement oil seal using Installer Tool J-25104.

(6) Install yoke using Installer Tool J-25173 (fig. 10-3).

(7) Install pinion shaft washer and nut. Tighten nut to 210 foot-pounds torque.

(8) Align index marks on propeller shaft and yoke and install shaft. Tighten attaching bolts or nuts to 16 foot-pounds torque.

(9) Remove supports and lower vehicle.

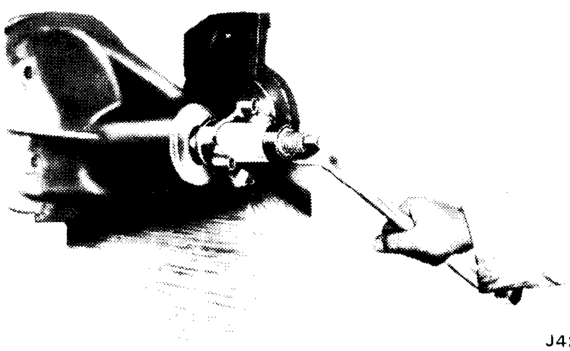

Fig. 10-3 Installing Yoke

AXLE SHAFT

Removal—CJ Models

(1) Raise vehicle. Remove hub cap.

(2) Remove drive flange snap ring.

(3) Remove axle flange bolts.

(4) Remove axle flange using Puller J-25133.

(5) Release locking lip of lockwasher and remove outer nut, lockwasher, adjusting nut, and bearing lockwasher. Use Wrench J-25103 for locknut removal.

(6) Back off brake adjuster screw and remove brake drum assembly and bearings. Do not damage oil seal.

(7) Remove brake support plate.

(8) Remove spindle and spindle bearing.

(9) Remove axle shaft and universal joint assembly.

Installation

(1) Clean all parts thoroughly.

(2) Install universal joint and axle shaft assembly in axle housing. Do not remove inner oil seal.

(3) Insert splined end of axle shaft into differential and push into place.

(4) Install wheel bearing, spindle, and bearing.

(5) Install brake support plate.

(6) Lubricate and install wheel bearings and oil seal.

(7) Install wheel hub and drum on wheel bearing spindle. Install wheel bearing washer and adjusting nut. Tighten nut using Wrench J-25103 until there is slight drag on bearings when hub is turned, then back off approximately 1/4- to 1/6-turn.

(8) Install lockwasher and nut. Tighten nut and bend lip of lockwasher over locknut.

(9) Install drive flange and gasket on hub and install attaching bolts. Install snap ring on outer end of axle shaft.

(10) Install hub cap.

(11) Install wheel and lower vehicle.

Removal—Cherokee-Wagoneer-Truck

(1) Raise and support vehicle.

(2) Remove wheel and dust cover.

(3) Remove axle shaft snap ring, drive flange, pressure spring, and spring retainer. If drive flange is stuck to shaft, use screwdriver to pry out.

(4) Use Nut Wrench J-6893-02 to remove wheel bearing locknut, lockring, and wheel bearing adjusting nut.

(5) If equipped with disc brakes, remove two bolts securing brake caliper assembly to disc brake shield and move caliper assembly aside.

(6) Remove hub and drum assembly or rotor and hub assembly if equipped with disc brakes (spring retainer and outer wheel bearing will slide out as assembly is removed).

(7) Remove nuts and bolts attaching spindle and disc brake shield (if equipped with disc brakes).

(8) Remove spindle and disc brake shield. If necessary tap lightly with a rawhide hammer to free components from knuckle (fig. 10-4).

(9) Remove axle shaft.

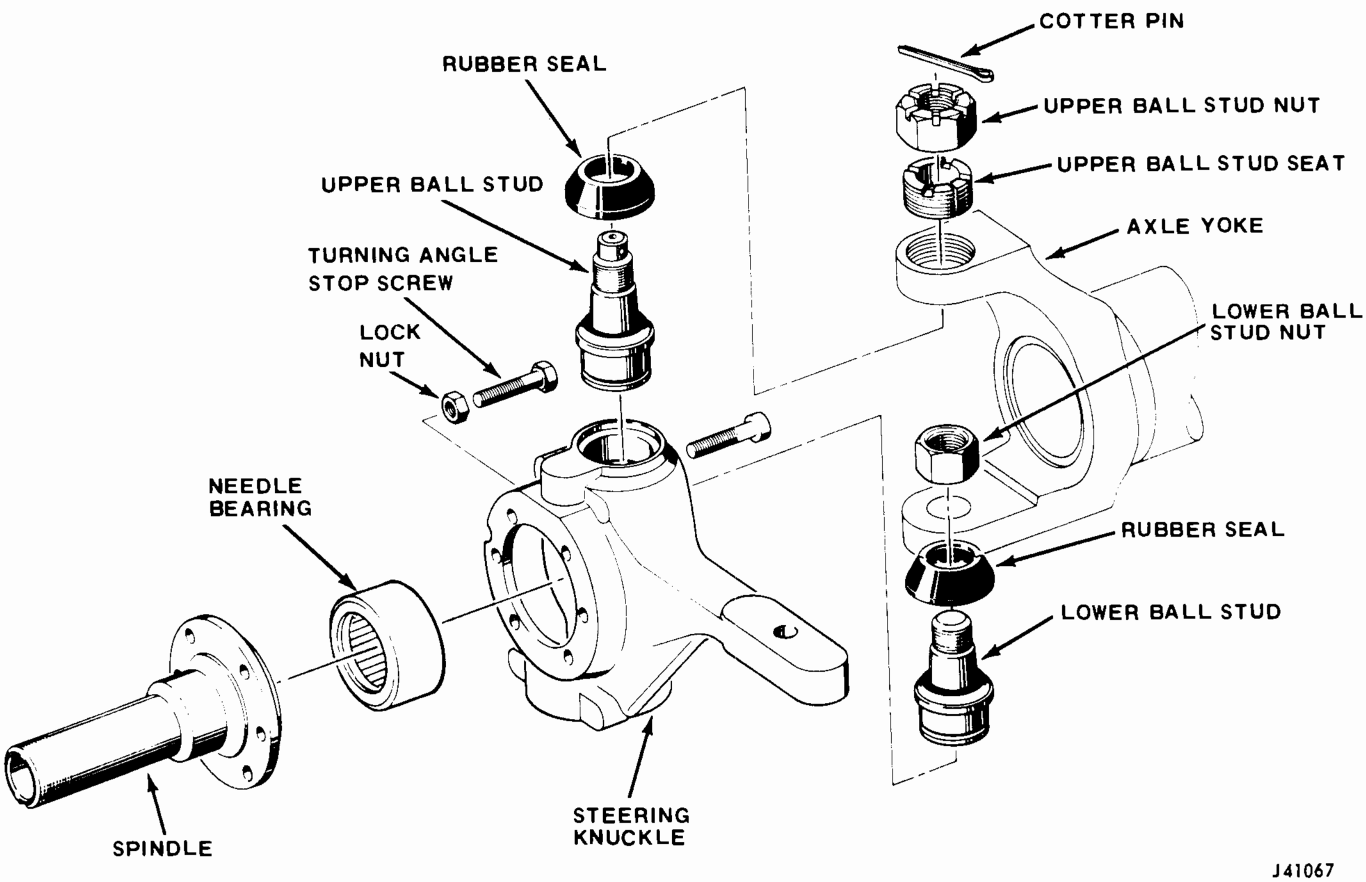

Fig. 10-4 Model 44F Steering Knuckle Assembly

Installation—Cherokee-Wagoneer-Truck

(1) Install axle shaft, spindle, and bearing assembly.

(2) Install hub and drum or brake shield, rotor, and hub assembly, if equipped with disc brakes. Install brake caliper assembly.

(3) Install inner wheel bearing adjusting nut (one with peg on side). Tighten nut to 50 foot-pounds torque using wheel bearing wrench. Rotate hub and back off adjusting nut 1/4-turn maximum.

(4) Install lockwasher with inner tab lined up with keyway in spindle. Turn inner adjusting nut until peg engages nearest hole in lockwasher. Install outer locknut and tighten to 50 foot-pounds torque (minimum) using wheel bearing wrench. Install spring retainer, pressure spring, and drive flange.

CAUTION: *Install spring retainer with cupped side facing toward center of vehicle.*

(5) Push drive flange inward to provide clearance, and install axle shaft snap ring.

(6) Install wheel and dust cover.

(7) Remove supports and lower vehicle.

AXLE SHAFT UNIVERSAL JOINT

Replacement

(1) Remove axle shaft.

(2) Remove snap rings from bearing cup assemblies (fig. 10-5).

(3) Press on end of one bearing cup assembly until opposite bearing is pushed from yoke half.

(4) Turn yoke over and press first bearing out by pressing on exposed end of journal shaft.

NOTE: *To avoid damaging the bearing, use a brass drift with a flat face about 1/32-inch smaller in diameter than hole in yoke arm to drive out bearing.*

(5) Repeat step (4), above, for remaining two bearings; then lift out bearing cross-journal by sliding it to one side.

(6) Wash all parts in cleaning solvent and inspect parts after cleaning. Replace any part that shows extensive wear.

(7) Pack bearing cups one-third full of lubricant and install rollers.

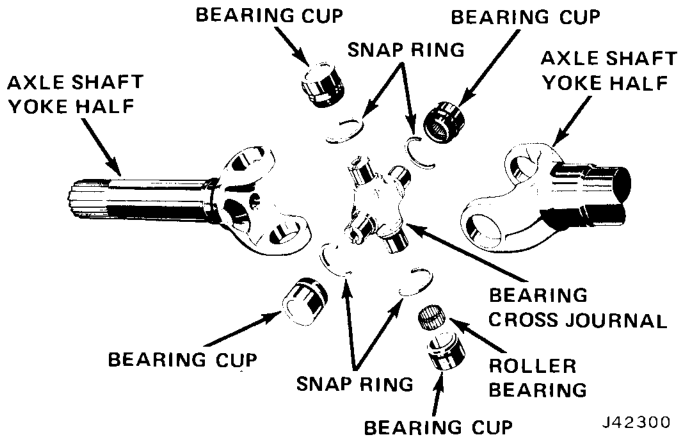

Fig. 10-5 Axle Shaft Universal Joint

(8) Insert bearings into axle shaft yoke half and seat them firmly against bearing shoulders.

(9) Insert bearing cross-journal while holding bearings in a vertical position to prevent needles from dropping out.

(10) Press bearing cup on from opposite side until firmly seated.

(11) Repeat steps (9) and (10) on opposite journal.

(12) Install snap rings on bearing cup assemblies.

NOTE: *If the joint binds when assembled, tap the yoke lightly to relieve any pressure on the bearings at the end of the journal.*

(13) Install axle shaft.

STEERING KNUCKLE REMOVAL

NOTE: *The open-end type knuckle pivots on ball studs. Ball stud replacement requires removal of the axle shaft and steering knuckle.*

(1) Remove axle shaft.

(2) Disconnect steering tie-rod end from knuckle arm.

(3) Remove and discard lower ball stud nut (fig. 10-6).

(4) Remove cotter pin from upper stud and loosen stud nut until top edge is flush with top of stud.

(5) Unseat upper and lower studs using a lead hammer.

(6) Remove upper nut and knuckle assembly.

(7) Remove upper ball stud seat using Nut Wrench J-25158.

STEERING KNUCKLE BALL STUD

Replacement

(1) Remove lower ball stud snap ring.

(2) Clamp knuckle assembly securely in vise with upper ball stud pointing downward.

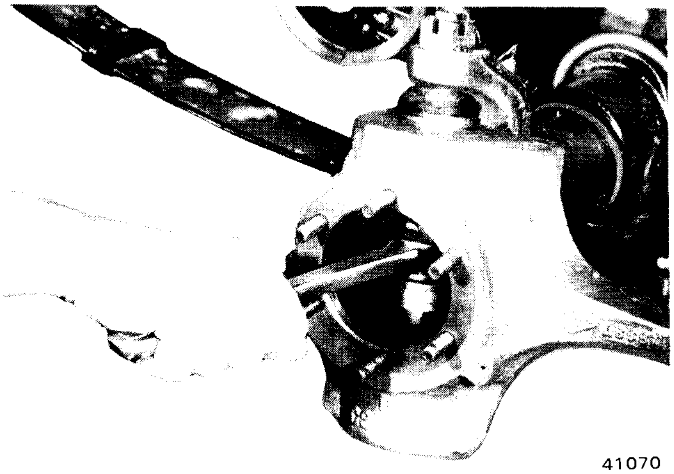

Fig. 10-6 Lower Ball Stud Nut Removal

(3) Attach Plate J-25211-1 to spindle mating surface of knuckle assembly (fig. 10-7). Position Button J-25211-3 on lower joint. Assemble and align Puller J-25215. Tighten puller screw to press lower stud out of knuckle.

(4) Disassemble Puller J-25215. On CJ models, install Adapter J-25211-4 on puller screw with adapter shoulder toward head of screw. Thread puller nut about halfway onto screw. Place Button J-25211-3 on upper joint and install puller in knuckle (fig. 10-8). Tighten screw to remove upper ball stud.

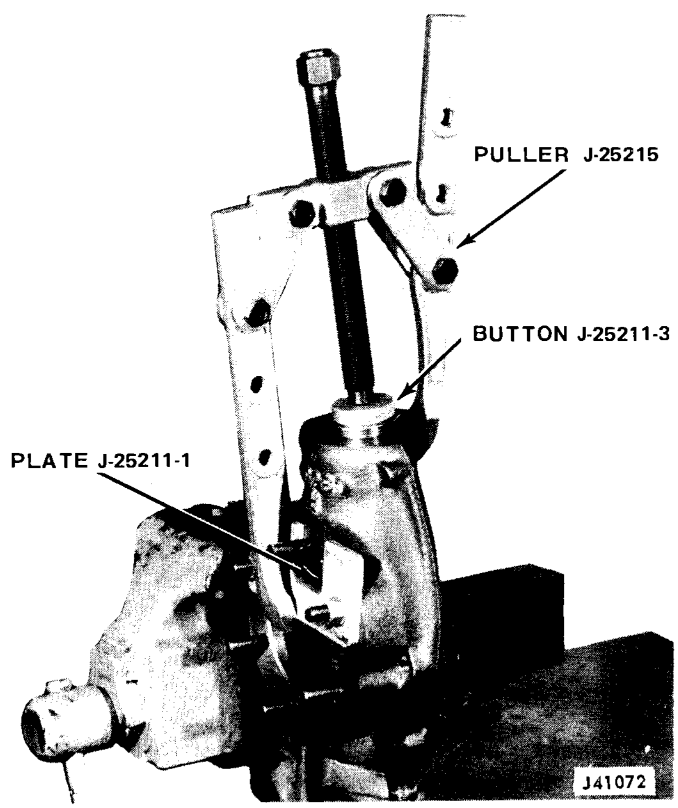

Fig. 10-7 Lower Ball Stud Removal

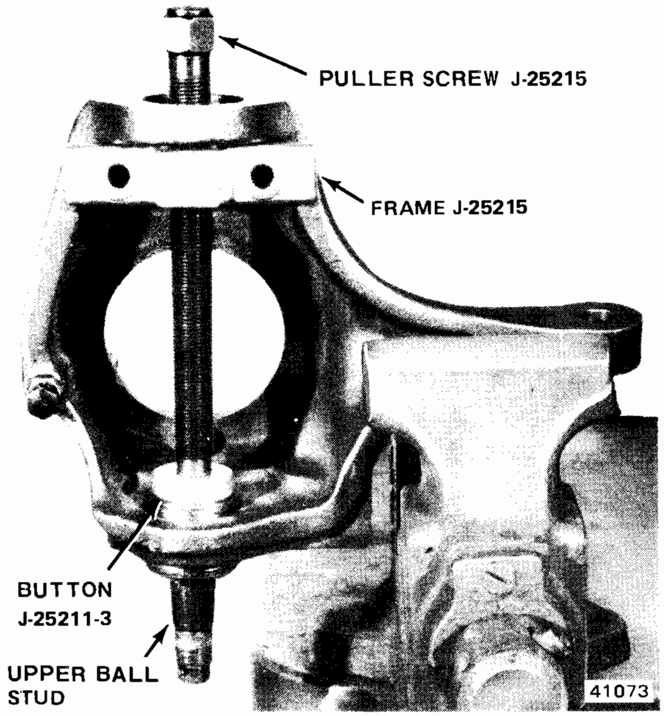

Fig. 10-8 Upper Ball Stud Removal

(5) Invert knuckle in vise. Position lower ball stud in knuckle. Use Installer Cup J-25211-2, Adapter J-25211-4, and Puller J-25215 screw and nut (fig. 10-9) to press in the lower stud. Install ball stud snap ring.

(6) Position upper ball stud on knuckle. Use Installer Cup J-25211-2 and Puller J-25215 to press in upper ball stud (fig. 10-10).

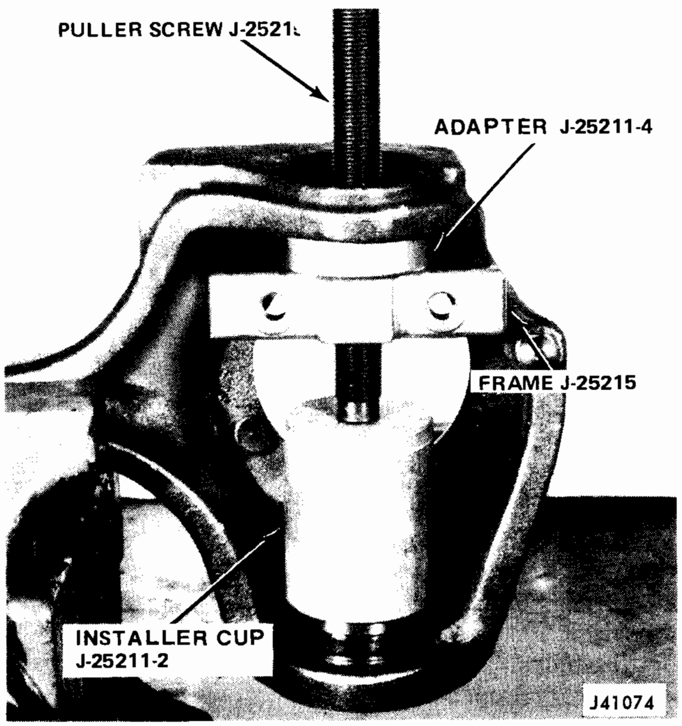

Fig. 10-9 Lower Ball Stud Installation

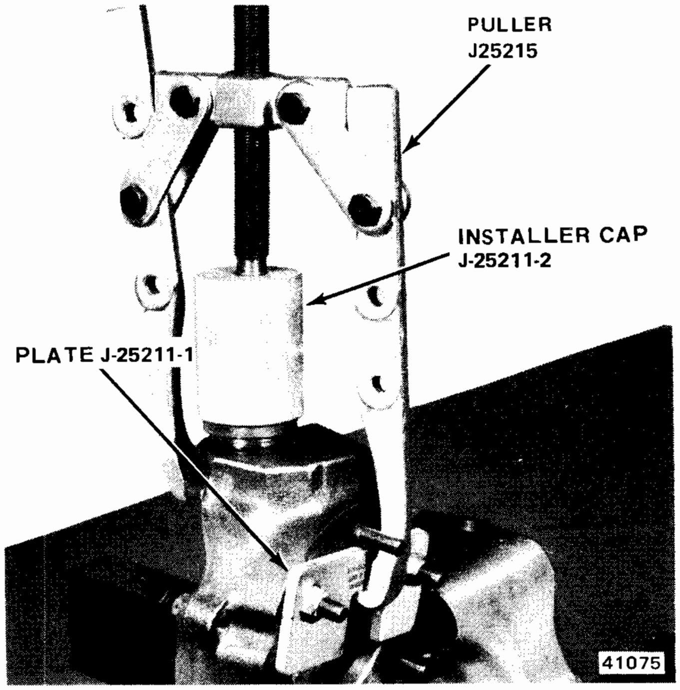

Fig. 10-10 Upper Ball Stud Installation

STEERING KNUCKLE INSTALLATION

(1) Install upper ball stud seat into axle yoke. Top of stud seat should be flush with top of yoke.

(2) Install knuckle assembly onto axle yoke. Install lower stud nut. Hand-tighten nut only. Position and align Nut Wrench J-25158, Buttom J-25211-3, Plate J-25211-1, and Puller J-25212 (fig. 10-11). Tighten puller screw until lower ball stud is held firmly in its seat. Tighten lower stud nut to 75 foot-pounds torque (85 foot-pounds torque on CJ models). Remove puller and plate.

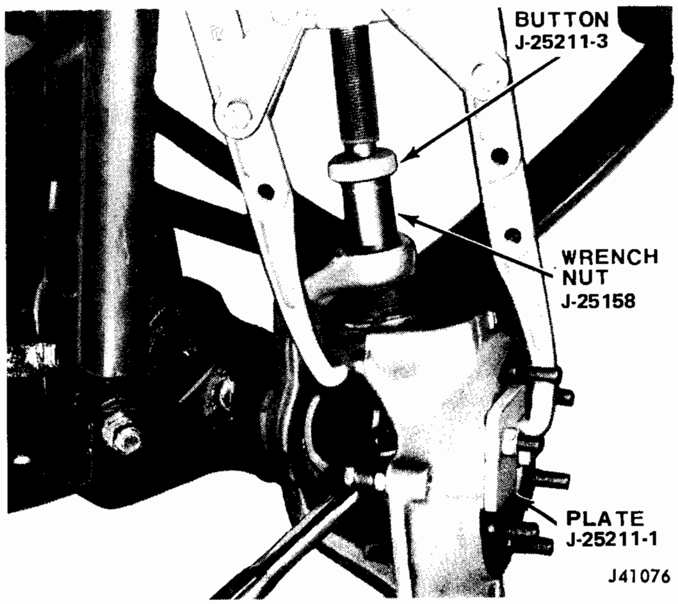

Fig. 10-11 Steering Knuckle Installation

(3) Use Nut Wrench J-25158 to tighten upper ball stud seat to 50 foot-pounds torque (fig. 10-12).

(4) Install upper stud nut and tighten to 100 foot-pounds torque. Install cotter pin. If cotter pin holes do not align, tighten nut until cotter pin can be installed. Do not loosen nut to align holes.

(5) Connect steering tie rod. Tighten nuts to 50 foot-pounds torque.

NOTE: *When the steering knuckle is removed or replaced, check the turning angle.*

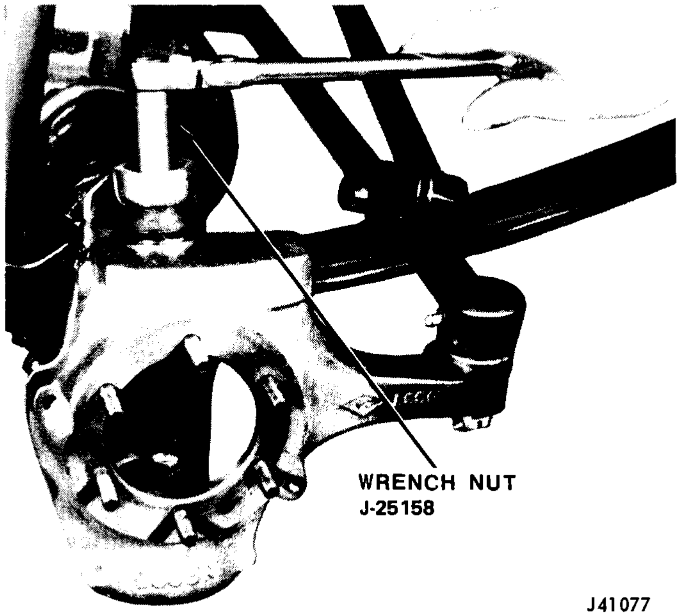

Fig. 10-12 Tightening Upper Ball Stud Seat

AXLE SHAFT SEAL

Replacement

(1) Remove seal (fig. 10-13).

(2) Remove bronze thrust washer. If washer is worn, replace it.

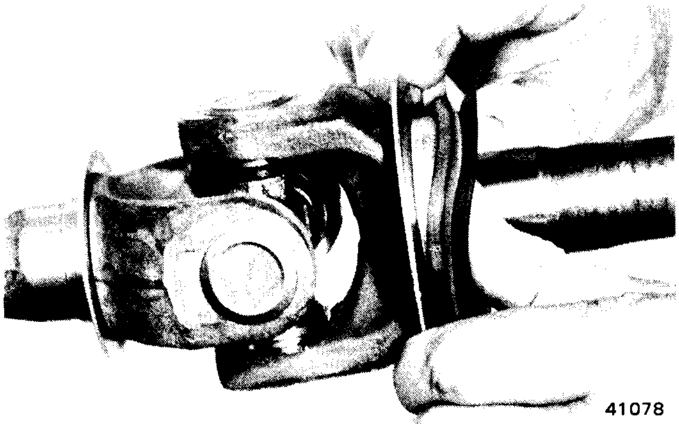

Fig. 10-13 Axle Shaft Seal Replacement

(3) Clean area of dirt and foreign matter.

(4) Install bronze washer with chamfered side toward axle shaft seal.

(5) Install seal. Direct lip of seal toward spindle (fig. 10-13).

(6) Pack wheel bearing grease around thrust face of shaft and seal. Fill seal area of spindle with wheel bearing grease.

SPINDLE BEARING

Replacement

NOTE: *Front axle spindles are equipped with a needle roller bearing located at the rear spindle flange (fig. 10-14).*

(1) Mount spindle in vise. Use caution and protect all machined surfaces on spindle.

(2) Remove needle bearing using internal-type puller.

(3) Clean area of dirt and foreign matter.

(4) Install needle bearing and pack needle bearing with grease.

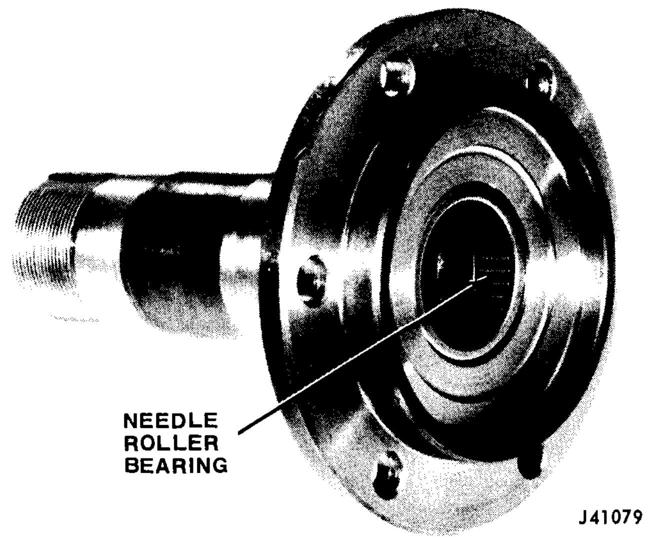

Fig. 10-14 Spindle Bearing

FRONT AXLE REMOVAL

(1) Raise and support front end. Position frame stands at rear of front springs.

(2) Remove wheel covers, wheel locknuts, and wheels.

(3) Index propeller shaft for assembly reference, and remove propeller shaft.

(4) Disconnect steering connecting rod at ball and socket connection on steering knuckles.

(5) Disconnect shock absorbers at axle housing.

(6) Disconnect breather tube from axle housing.

(7) Disconnect sway bar link bolts at tie plates.

(8) Remove brake drums and support plates or brake calipers, hub and rotor, and brake shields.

(9) Remove U-bolts and tie plates.

(10) Support axle assembly on jack; raise jack slightly to relieve spring tension.

(11) Loosen nuts securing rear spring shackles but do not remove bolts.

(12) Remove bolts securing front spring shackles and rest springs on floor.

(13) Pull jack and axle assembly from underneath vehicle.

FRONT AXLE INSTALLATION

(1) Support axle assembly on jack and slide assembly into position underneath vehicle.

(2) Raise springs and install bolts in front spring shackles, but do not tighten.

(3) Lower axle assembly on springs and rotate axle assembly into position.

(4) Install U-bolts and tie plates.

(5) Tighten front and rear spring shackle bolts.

(6) On models with disc brakes, install brake shield, hub and rotor, and brake clipers. On models with drum brakes, install support plates and hubs and drums.

(7) Connect breather tube.

(8) Connect shock absorbers.

(9) Connect steering connecting rod at steering knuckles.

(10) Install propeller shaft. Align index marks made during removal.

(11) Install wheels and wheel locknuts.

(12) Remove support stands and lower vehicle.

(13) Tighten wheel locknuts and install wheel covers.

(14) Check front wheel alignment.

(15) Check turning angle.

TURNING ANGLE ADJUSTMENT

The turning angle stopscrews are located at the rear of the steering knuckle just above the axle centerline. If adjustment is necessary, proceed as follows.

(1) Loosen locknut on turning angle stopscrew.

(2) Using a turntable to measure angle, adjust stopscrew to obtain proper turning angle (see Specifications).

(3) Tighten stopscrew locknut.

NOTE: *Turning adjusting screw inward increases turning angle. Turning screw outward decreases turning angle.*

Turning Angle Specifications: On CJ models, set turning angle at 31 degrees. On Cherokee, Wagoneer, and Truck, set the turning angle at 36 to 37 degrees.

REAR AXLE

GENERAL

CJ models use the AMC/Jeep semi-floating rear axle with an 8-7/8-inch diameter ring gear and tapered axle shafts. Cherokee, Wagoneer, and Truck models use the Model 44F semi-floating rear axle which has flanged axle shafts. Truck models rated from 6500 to 8000 GVWR use the Model 60 full-floating rear axle. Refer to the Axle Application Chart in Specifications for further information.

IDENTIFICATION

CJ Axle

The axle ratio identification code letter is located on the axle housing tube boss, adjacent to the dowl hole (fig. 10-15).

Cherokee-Wagoneer-Truck Axles

On Model 44 rear axles, the model number is cast into the upper surface of the left side reinforcing rib of the housing (fig. 10-1). On the Model 60 rear axle, the model number is cast into a boss on the lower right side of the housing, adjacent to the housing cover.

The axle build date and manufacturer's part numbers are stamped on the right-hand tube, adjacent to the cover (fig. 10-16). The build date of the axle is as follows. First number is the month, second number is the day of the month, third number is the year, the alpha-letter is the shift and the last number is the assembly line. If there are two build dates, the latter will be the date in which the brake components were installed.

The gear ratio tag, attached to the left side of the housing cover, indicates the Jeep manufacturing reference part number, the tooth combination of the drive gear and pinion, and the gear ratio.

Axles equipped with the Trac-Lok differential have a tag attached which states that a special lubricant must be used: Use only Jeep Trac-Lok Lubricant, Part No. 8991018 (or equivalent) (fig. 10-16).

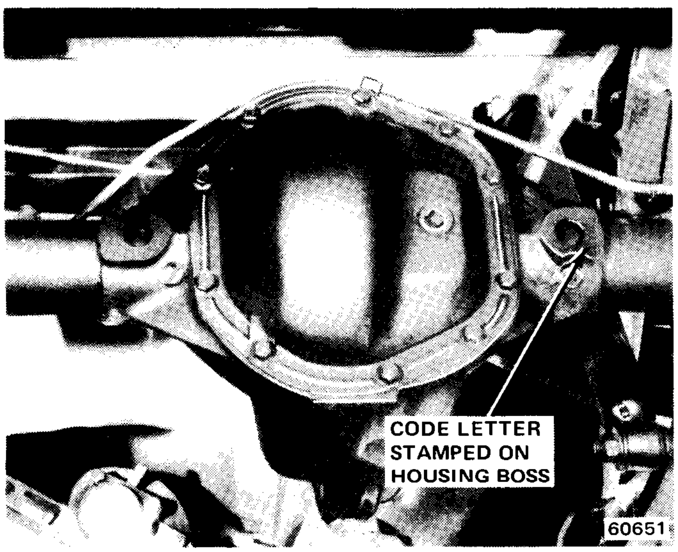

Fig. 10-15 Axle Ratio Code Location AMC-Jeep Axle

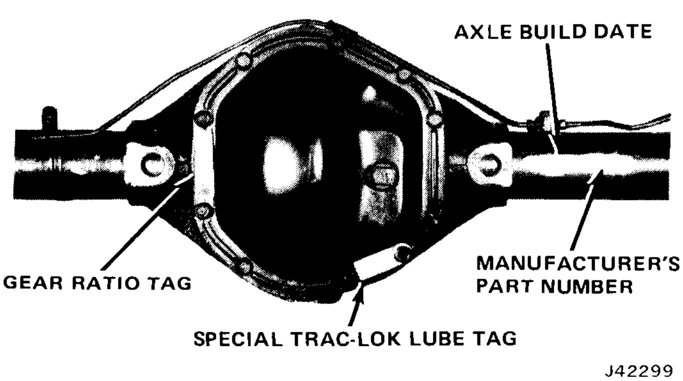

Fig. 10-16 Axle Identification

Letter code chart-AMC/Jeep Axle

	Letter	Ratio	Pinion/Drive Gear Teeth
Trac-Lok	N	3.54:1	11/39
Trac-Lok	M	4.09:1	10/41
Standard	A	3.54:1	11/39
Standard	L	4.09:1	10/41

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AXLE HOUSING

The rear axle housing should be checked periodically for weld cracks and other damage that may cause loss of lubricant, or affect driving characteristics.

If the vehicle is driven through water deep enough to cover the hubs, it is recommended that the wheel ends be disassembled and inspected for water damage or contamination.

Examine, clean, and replace damaged parts, if necessary, prior to lubricating and assembling the wheel end components. Pay particular attention to the axle bearings and brake components.

REAR AXLE HUB REPLACEMENT—TAPERED AXLE SHAFT (CJ MODELS)

Removal

(1) Remove axle shaft dust cap.
(2) Remove axle shaft nut and washer.
(3) Raise and support vehicle.
(4) Remove wheel and tire.
(5) Remove three screws attaching brake drum to rear hub and remove drum.
(6) Install Hub Puller Tool J-25109 and remove rear hub (fig. 10-17).

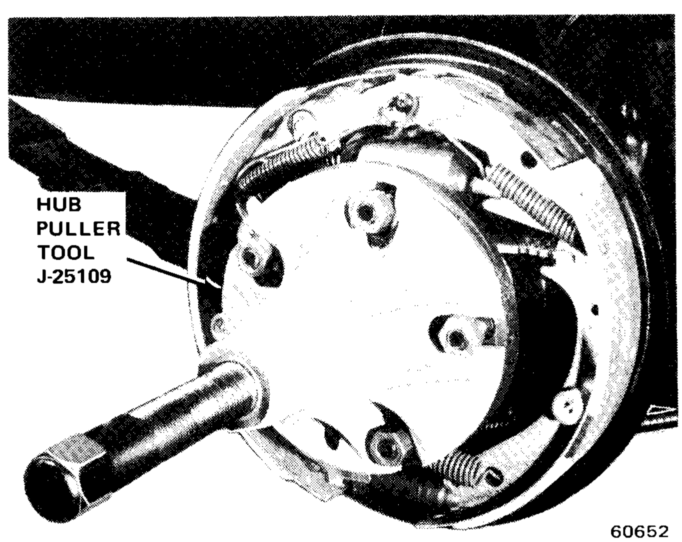

Fig. 10-17 Removing Rear Axle Hub—CJ Models

CAUTION: *Do not use a knockout or slide hammer-type puller to remove hub. This type of puller may damage axle bearings, axle shaft, or differential thrust block.*

Inspection

Inspect hub for loose or distorted wheel lug studs. Inspect keyway and tapered center bore for wear, damaged serrations, or cracks. Replace hub if worn or damaged.

Installation

NOTE: *Procedures for installing an original hub and installing a replacement hub differ.*

Install an original hub as follows:

(1) Align keyway in hub with axle shaft key.

(2) Slide hub onto axle shaft as far as possible.

(3) Install axle shaft nut and washer.

(4) Install drum, drum retaining screws, and road wheel.

(5) Lower vehicle onto wheels. Tighten axle shaft nut to 250 foot-pounds torque. If cotter key hole is not aligned, tighten nut to the next castellation and install cotter key. Do not loosen nut to align cotter key hole.

NOTE: *When a replacement axle shaft is installed, a replacement hub must also be installed. However, a replacement hub may be installed on an original axle shaft if the serrations on the shaft are not worn or damaged.*

Install a replacement hub as follows:

(1) Align keyway in hub with axle shaft key.

(2) Slide hub onto axle shaft as far as possible.

(3) Install two well-lubricated thrust washers and axle shaft nut.

(4) Install drum, drum retaining screws, and road wheel.

(5) Lower vehicle onto wheels. Tighten axle shaft nut until distance from hub outer face to axle shaft outer end is 1.30 inches (fig. 10-18).

NOTE: *Pressing hub onto axle shaft to specified dimension is necessary to form hub serrations properly.*

(6) Remove axle shaft nut and one thrust washer.

(7) Install axle shaft nut and tighten to 250 foot-pounds torque. If cotter key hole is not aligned, tighten nut to next castellation and install cotter key. Do not loosen nut to align cotter key hole.

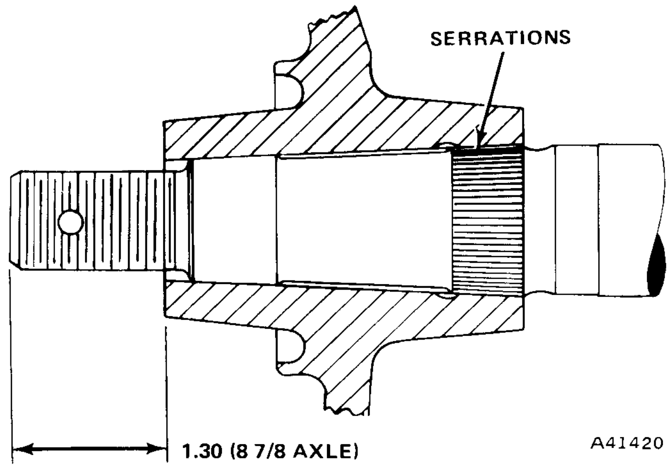

Fig. 10-18 Replacement Hub Installation Measurement (In Inches)

AXLE SHAFT AND BEARING REPLACEMENT

Removal—Tapered Shaft

(1) Remove rear wheel, drum, and hub as outlined in Rear Axle Hub Replacement.

(2) Disconnect parking brake cable at equalizer.

(3) Disconnect brake line at wheel cylinder and remove brake support plate assembly, oil seal, and shims from axle shaft.

NOTE: *If both axle shafts are removed, keep shims separated. Axle shaft end play is adjusted on left side only.*

(4) Use Axle Shaft Bearing Puller Tool J-2498 to remove axle shaft and bearing (fig. 10-19).

(5) Remove and discard axle shaft inner oil seal.

NOTE: *Bearing cone is press-fit on axle shaft and must be removed using an arbor press (fig. 10-20).*

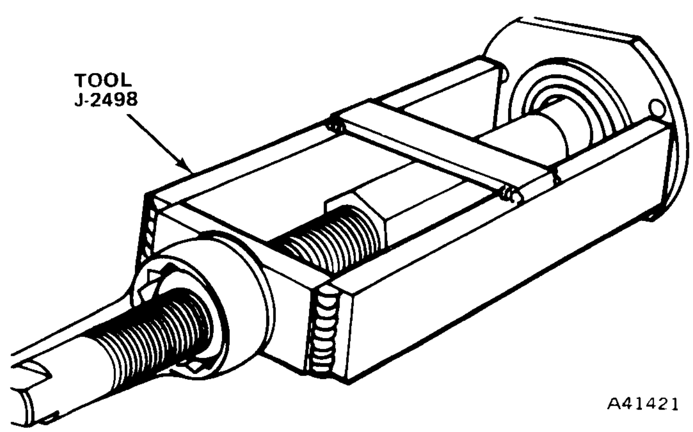

Fig. 10-19 Removing Axle Shaft

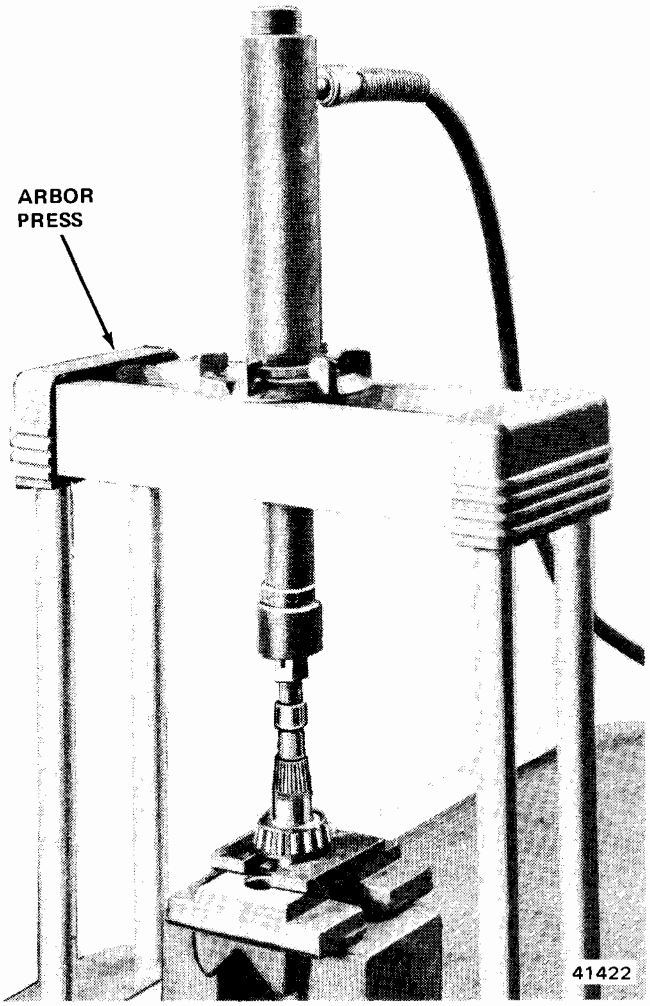

Fig. 10-20 Removing Axle Shaft Bearing

Installation—Tapered Shaft

Tapered shaft axle bearings have no provision for lubrication after assembly and should be packed with a good quality wheel bearing lubricant before installation.

(1) Press axle shaft bearing(s) onto axle shaft(s) with small diameter of cone toward outer tapered end of shaft using Bearing Replacing Tool J-2995.

NOTE: *Coat inner axle shaft seal with a light lubricating oil.*

(2) Coat outer surface of seal metal retainer with nonhardening sealer.

(3) Install inner oil seal with Axle Shaft Seal Installer J-21788 (fig. 10-21).

(4) Install axle shaft(s). Align splined end with differential gears.

(5) Install outer bearing cup.

(6) Inspect brake support plate for elongated bolt holes. Replace support plate if necessary.

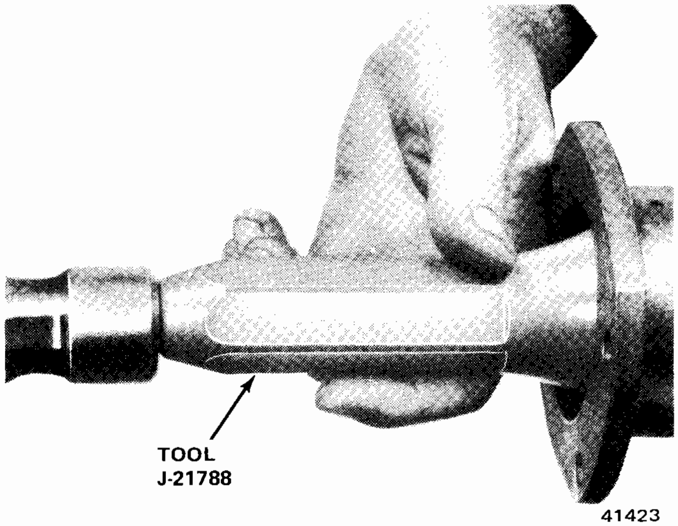

Fig. 10-21 Installing Inner Seal

NOTE: *At assembly, apply sealing material to axle tube flange and brake support plate mounting area to prevent entry of dust and water.*

(7) Install original shims, oil seal assembly, and brake support plate. Tighten attaching bolts to 35 foot-pounds torque.

NOTE: *Oil seal and retainer are located on outside of brake support plate.*

End Play Adjustment

Axle shaft end play is adjusted at the left side axle shaft only.

(1) Strike end of each axle shaft with lead hammer to seat bearing cups against support plate.

(2) Attach Axle Shaft End Play Tool J-2092 to end of left side axle shaft. Mount dial indicator on support plate or tool, and check end play while pushing and pulling on axle shaft (fig. 10-22).

(3) End play should be 0.004 to 0.008 inch, 0.006 inch is desired.

(4) Add shims to increase end play, remove shims to decrease end play.

(5) Install hub and drum as outlined in Rear Axle Hub—Installation.

(6) After axle shaft end play is checked and corrected, adjust brakes as outlined in Brake Section.

Removal—Flanged Shaft

(1) Raise and support vehicle and remove wheels.

(2) Remove brake drum locknuts (spring-type) and remove drum.

(3) Remove axle shaft flange cup plug by piercing center with sharp tool and prying out.

(4) Remove nuts attaching support plate and retainer to axle tube flange using access hole in axle shaft flange.

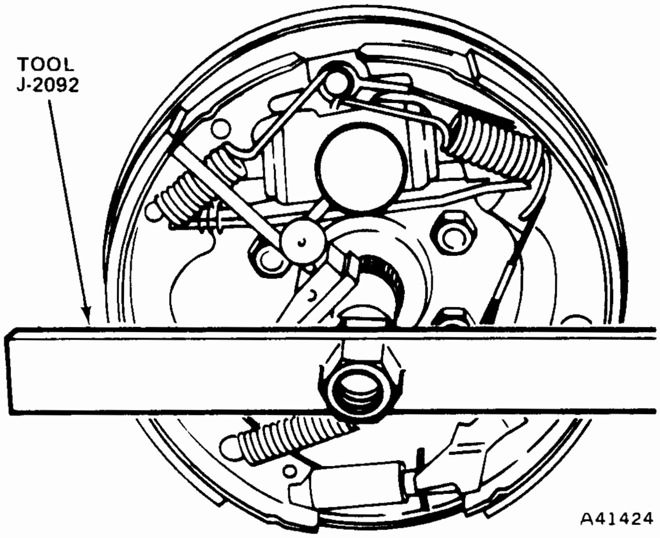

Fig. 10-22 Checking Axle Shaft End Play

(5) Attach Axle Shaft Adapter Tool J-25156, and Slide Hammer Handle J-2619 to axle shaft flange and remove axle shaft (fig. 10-23).

CAUTION: *Be sure old bearing cup has been removed from axle housing.*

(6) Remove axle shaft oil seal from axle housing tube.

(7) Wipe seal bore in axle housing tube clean and install oil seal using Driver J-25135.

CAUTION: *Under no circumstances should axle shaft retaining rings or bearings be removed using a torch. Heat will transfer into the axle shaft bearing journal and weaken it.*

(8) Mount axle shaft assembly in vise.

(9) Using chisel, cut deep groove into retaining ring. This will enlarge ring, or split it, allowing ring to be driven off axle shaft (fig. 10-24).

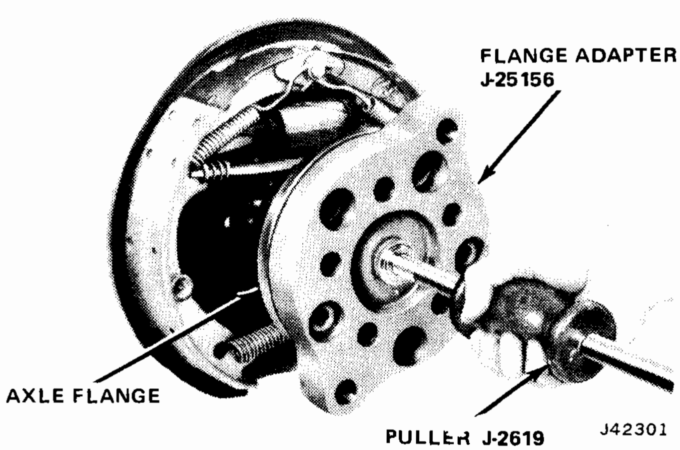

Fig. 10-23 Removing Flanged Axle Shaft

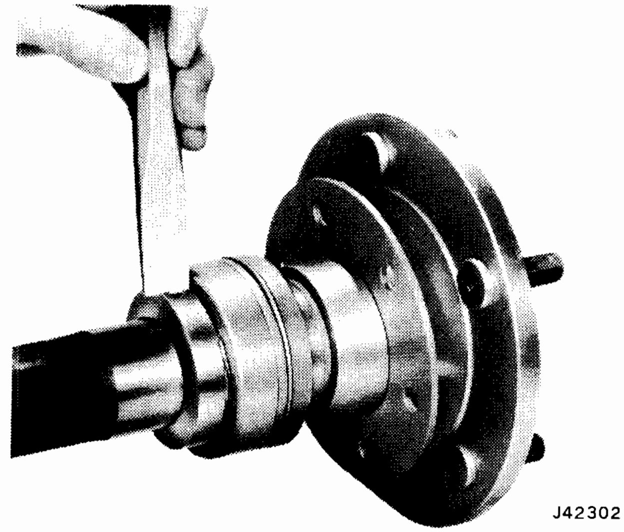

Fig. 10-24 Notching Bearing Retainer Ring

(10) Using hacksaw, cut through oil seal. Do not damage seal contact surface. Remove oil seal from axle shaft.

CAUTION: *Thoroughly lubricate Axle Shaft Adapter Tool J-25156, flange adapter bolts, and bolt contact points on holding ring before removing bearing from axle shaft.* **Do not use power operated impact tools on flange adapter bolts.**

(11) Attach Axle Shaft Adapter Tool J-25156 to axle shaft using flange stud nuts. Position flange adapter bolts against dimples of holding ring and alternately tighten them until bearing is pressed from shaft (fig. 10-25).

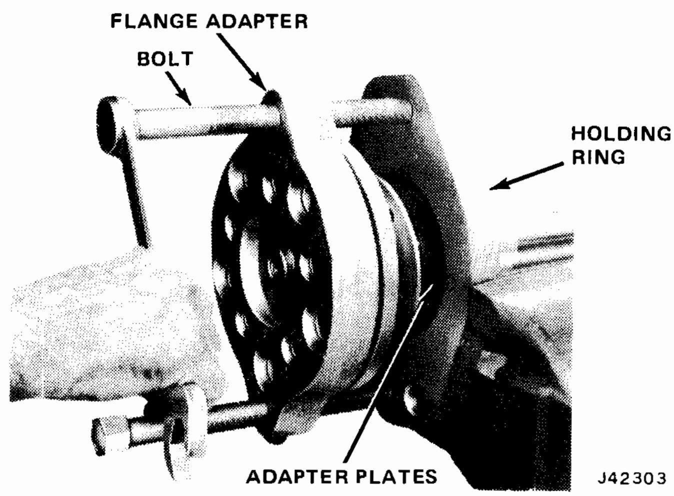

Fig. 10-25 Removing Axle Shaft Bearing

Installation—Flanged Shaft

(1) Inspect axle shaft oil seal journal for scratches. Remove scratches with crocus cloth if necessary.

(2) Install retainer plate on axle shaft.

(3) Apply wheel bearing grease to oil seal cavity and between seal lips and install seal on axle shaft seal seat. Outer face of seal must face axle flange.

(4) Before instllation, pack bearing with wheel bearing grease.

(5) Install bearing on axle shaft. Be sure cup rib ring is facing axle flange.

(6) Install bearing retainer ring on axle shaft.

(7) Using Flange Adapter J-25156, press new axle shaft bearing and retainer ring on axle shaft simultaneously. Tighten puller bolts alternately until bearing and retainer ring are properly seated against shaft shoulder.

(8) Install axle shaft through support plate using care not to damage axle housing tube inner oil seal.

(9) Apply thin coating of wheel bearing grease to outside diameter of bearing cup before installing in bearing bore.

(10) Tap end of flanged shaft lightly with rawhide mallet to position axle shaft bearing in bearing bore of housing.

(11) Attach axle shaft retainer and brake support plate to axle tube flange. Install attaching nuts and lockwashers.

(12) Install cup plug in axle shaft flange hole.

(13) Install brake drum, spring-type locknuts, and rear wheels.

(14) Remove supports and lower vehicle.

Removal—Full-Floating Shaft (Model 60)

NOTE: *It is not necessary to raise rear wheels in order to remove rear axle shafts on Model 60 full-floating rear axles.*

(1) Remove axle flange nuts, lockwashers, and split washers retaining axle shaft flange (fig. 10-26).

(2) Remove axle shaft from housing.

Installation—Full-Floating Shaft (Model 60)

(1) Be sure axle flange mating area on hub and axle are clean and free of old gasket material.

(2) Install new flange onto hub studs.

(3) Insert axle shaft into housing.

NOTE: *It will be necessary to rotate the axle shaft to simultaneously align the shaft splines with the differential gear splines and the flange attaching holes with the hub studs.*

(4) Install split washers, lockwashers, and flange nuts. Tighten nuts securely.

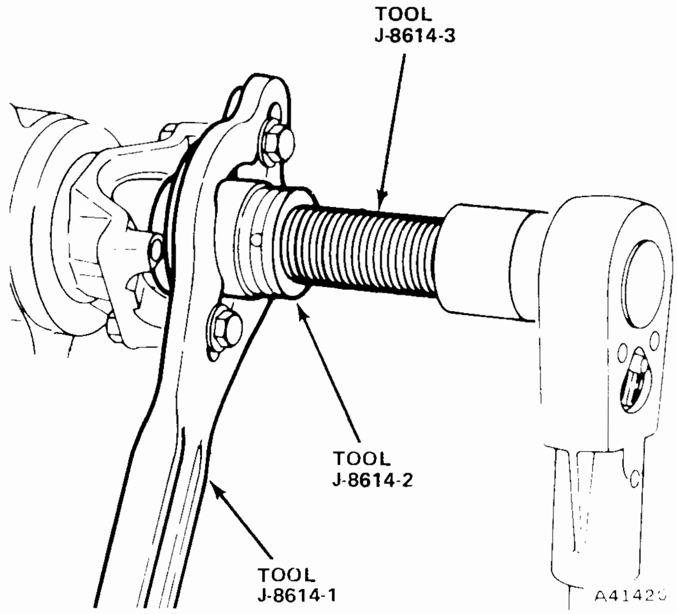

Fig. 10-26 Removing Rear Yoke

PINION SHAFT OIL SEAL OR REAR YOKE REPLACEMENT

Semi-Floating Axle with Tapered Shaft

(1) Raise and support vehicle. Remove rear wheels and brake drums.

(2) Disconnect propeller shaft from rear yoke. Index shaft to yoke for assembly reference.

(3) Rotate drive pinion several revolutions. Use Companion Flange Nut Socket Tool J-22575 and an inch-pound torque wrench to check torque required to turn drive pinion.

NOTE: *The torque required to turn the drive pinion must be recorded for reference at time of assembly.*

(4) Remove pinion nut. Use Companion Flange Holder and Remover Tool J-8614-1 or J8614-10 and Companion Flange Nut Socket Tool J-22575 (fig. 10-26).

NOTE: *Discard pinion nut.*

(5) Mark yoke and drive pinion shaft to assure correct alignment at time of assembly.

(6) Remove rear yoke using tools J8614-10 or J-8614-1, -2, and -3 (fig. 10-26).

(7) Inspect seal surface of yoke. If surface is damaged or grooved, replace yoke.

(8) Remove pinion oil seal using Seal Remover J-9233 (fig. 10-27).

(9) Before installing replacement seal, coat seal lip with rear axle lubricant.

(10) Install seal using Pinion Oil Seal Installer J-22661 (fig. 10-28).

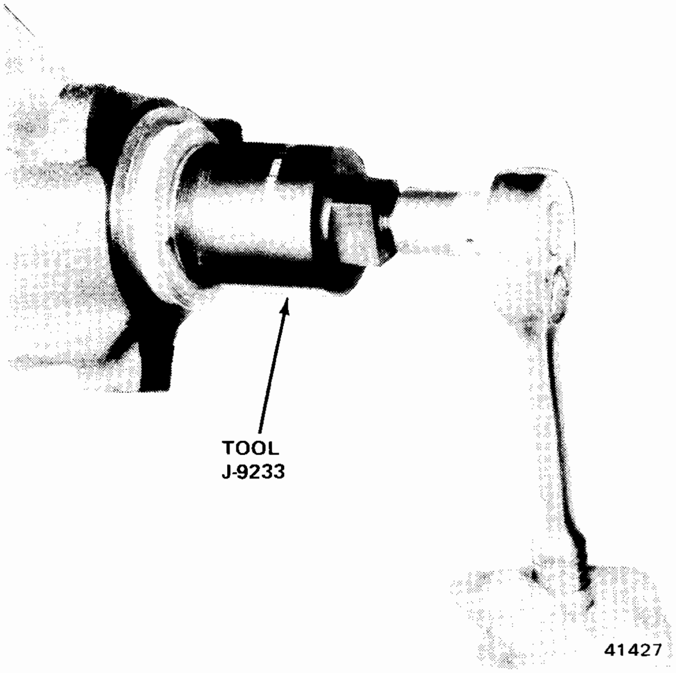

Fig. 10-27 Removing Pinion Oil Seal

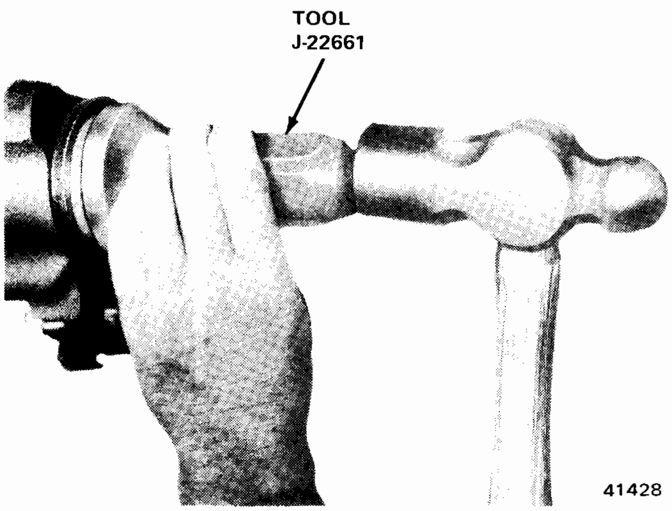

Fig. 10-28 Installing Pinion Seal

(11) Install yoke on pinion shaft; note alignment marks. Install a **new pinion nut**. Tighten nut using tools J-8614-1 and J-22575 to remove pinion bearing end play only. **Do not overtighten.**

(12) Check torque required to turn drive pinion. Pinion must be turned several revolutions to obtain accurate torque reading. Refer to torque reading recorded during disassembly, and add 5 inch-pounds for proper amount of torque.

(13) If preload torque is less than desired amount (disassembly torque reading plus 5 inch-pounds), tighten pinion nut slightly and check torque.

(14) Repeat these steps until desired torque is attained. **Do not loosen and retighten nut.**

CAUTION: *Do not overtighten pinion nut; if desired torque is exceeded, a new collapsible pinion spacer sleeve must be installed and the pinion gear preload reset (refer to Differential Overhaul).*

(15) Install propeller shaft. Align index marks made at disassembly.

(16) Install rear brake drums and wheels.

Semi-Floating and Full-Floating Axles with Flange Shaft

(1) Raise and support vehicle.

(2) Index propeller shaft to front yoke for assembly reference and disconnect shaft at yoke.

(3) Remove pinion shaft nut and washer. Remove yoke using Holding Wrench J-8614-10 and Yoke Puller J-25134 (fig. 10-29).

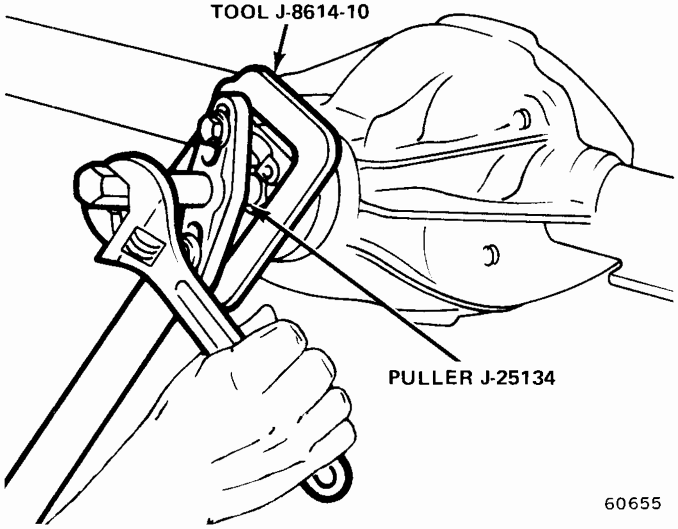

Fig. 10-29 Removing Yoke

(4) On semi-floating axle, remove pinion shaft oil seal using Remover Tool J-25180. On full-floating axle, use Tool J-25144.

(5) Install replacement oil seal using Installer Tool J-25104.

(6) Install yoke using Installer Tool J-25173 (fig. 10-30).

(7) Install pinion shaft washer and nut. Tighten nut to 210 foot-pounds torque on Model 44 and 260 foot-pounds torque on Model 60.

(8) Align index marks on propeller shaft and yoke and install shaft. Tighten attaching bolts or nuts to 16 foot-pounds torque.

(9) Remove supports and lower vehicle.

REAR AXLE REMOVAL

(1) Raise vehicle. Position frame support stands forward of rear springs.

(2) Remove wheels.

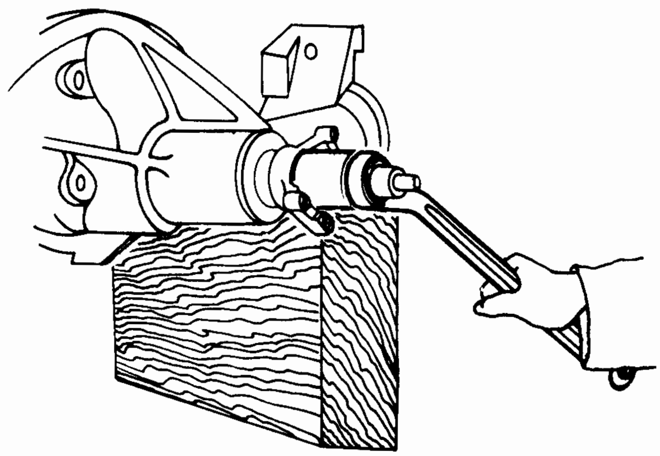

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Fig. 10-30 Installing Yoke

(3) Index propeller shaft at rear yoke for assembly reference and disconnect propeller shaft.

(4) Disconnect shock absorbers from axle tubes.

(5) Disconnect brake hydraulic hose at rear axle tee fitting. Tape ends of hose and fitting to keep out dirt.

(6) Disconnect parking brake cable to equalizer.

(7) Support axle on floor jack.

(8) Remove U-bolts. On vehicle with spring-mounted above axle, disconnect shackle bolts and move spring away from axle.

(9) Slide axle from under vehicle.

REAR AXLE INSTALLATION

NOTE: *All service replacement axle assemblies are shipped from the factory without lubricant in the differential. Lubricant must be added to the differential before the axles are installed in vehicles. Use Gear Lubricant Grade SAE 80 for standard axles. Use Jeep Trac-Lok Lubricant, Part No. 8991018 (or equivalent) in Trac-Lok axles.*

When adding differential lubricant, suspend axle with axle shafts horizontal and yoke end of pinion housing hanging down; then, turn pinion shaft several times to be sure that lubricant reaches pinion shaft bearings.

(1) Support axle assembly on floor jack and position under vehicle.

(2) Align springs with axle spring pads, and install U-bolts and nuts. On vehicle with spring-mounted above axle, position spring on shackle and install bolt. Do not tighten bolt completely.

(3) Attach brake line hose at tee fitting on top of housing.

(4) Connect parking brake cables.

(5) Connect shock absorbers to axle tubes.

(6) Install propeller shaft. Align marks made during removal.

(7) Bleed brakes and adjust.

(8) Install wheels, remove supports, and lower vehicle.

(9) Check axle housing with lubricant. Check level and add lubricant if required.

STANDARD DIFFERENTIAL

GENERAL

CJ models use the Model 30 front axle and the AMC/Jeep rear axle, which has an 8-7/8-inch ring gear and tapered axle shafts.

Cherokee, Wagoneer, and Truck models use the Model 44F front axle and the Model 44 rear axle with flanged axle shafts. Truck models rated at 6500 GVWR and up use the Model 60 full-floating rear axle.

Axle Models 30, 44, and AMC/Jeep are all semi-floating type axles. Only the Model 60 is a full-floating type unit.

DIFFERENTIAL OPERATION

The differential gear system divides the torque between the axle shafts and allows them to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

In operation, power flow is as follows: the pinion gear rotates the ring gear. The ring gear, being bolted to the differential case, rotates the case. The differential pinion gears, which are mounted on the pinion mate shaft (which is fitted in the case), rotate the side gears. The side gears, which are splined to the axle shafts, rotate the shafts.

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft because input torque on thegears is equally divided between the two side gears. As a result, the pinion gears revolve with the pinion shaft, but do not rotate around it (fig. 10-31).

When turning corners, the outside wheel has to travel farther than the inside wheel. This difference in travel must be compensated for in order to prevent the wheels from scuffing and sliding through the turn. To accomplish this, the differential becomes effective and allows the axle shafts to rotate at unequal speeds (fig. 10-32).

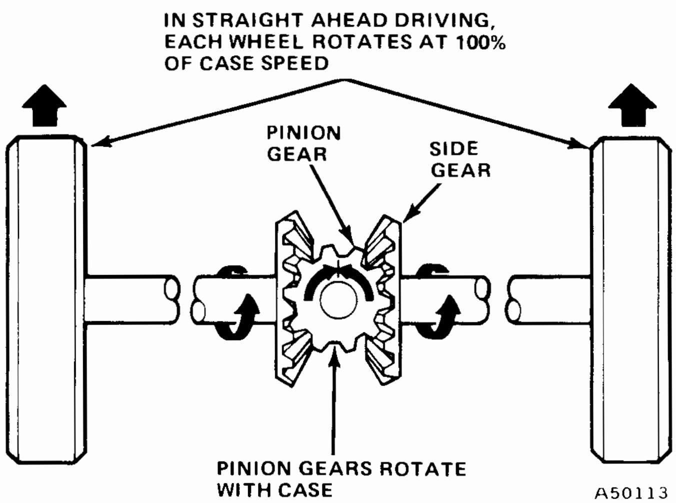

Fig. 10-31 Differential Operation—Straight-Ahead Driving

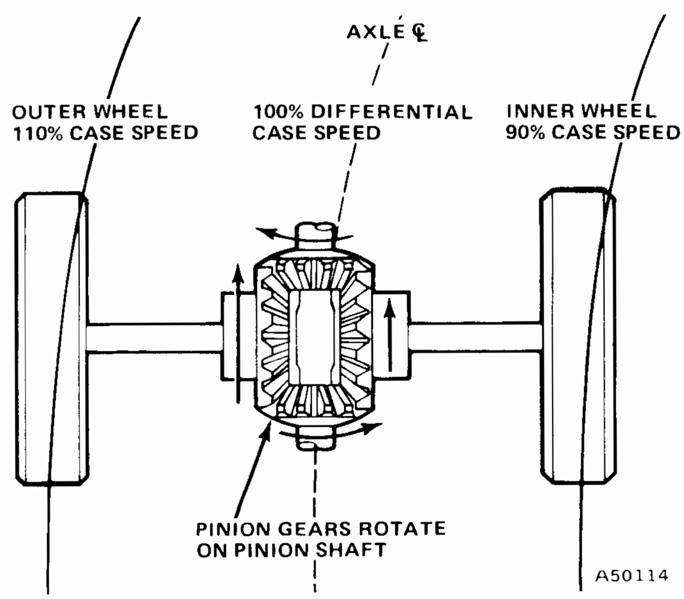

Fig. 10-32 Differential Operation—On Turns

DIFFERENTIAL OVERHAUL—AMC/JEEP AXLE

Disassembly (Fig. 10-33)

NOTE: *It is not necessary to remove the rear axle assembly to overhaul the differential.*

(1) Remove axle shaft dust caps and retaining nuts.

(2) Raise and support vehicle.

(3) Remove axle housing cover and drain lubricant.

(4) Remove wheels, brake drums, hubs, axle shafts, and seals. Keep left and right side axle parts separated.

(5) Mark bearing caps with center punch for assembly reference.

(6) Loosen bearing cap bolts until only several threads are engaged, then pull bearing caps away from bearings. This will prevent differential from falling out and sustaining damage when pried from axle housing.

(7) Pry differential loose in axle housing.

(8) Remove bearing caps and remove differential.

(9) Tie differential bearing shims to their respective bearing caps and cups to prevent misplacement.

Differential Bearing Removal

Use Puller J-2497-01 to remove differential bearing cones from differential case (fig. 10-34). When using this tool, be sure it pulls on bearing cone in such a manner that rollers are free. If puller bears on bearing roller cage, it will damage cage.

Ring Gear Removal

(1) Remove ring gear-to-differential case bolts.

(2) Using brass drift, tap ring gear from case. Do not nick ring gear face of differential case or drop gear.

CAUTION: *Do not chisel or wedge gear from case.*

Pinion Mate Shaft Removal

(1) Using 3/16-inch diameter drift at least 3 inches long drive out lockpin that holds pinion mate shaft in place (fig. 10-35).

(2) Remove pinion mate shaft and remove thrust block (fig. 10-36).

(3) Roll pinion gears around on side gears until they can be removed from case, then remove side gears and thrust washers.

Pinon Gear Removal

(1) Remove pinion nut using Tool J-8614-1 or J-8614-10 and Nut Socket Tool J-22575 (fig. 10-37).

(2) Remove yoke using Tool J-8614-1 or J-8614-10, and Tool J-8614-2, and -3 (fig. 10-38).

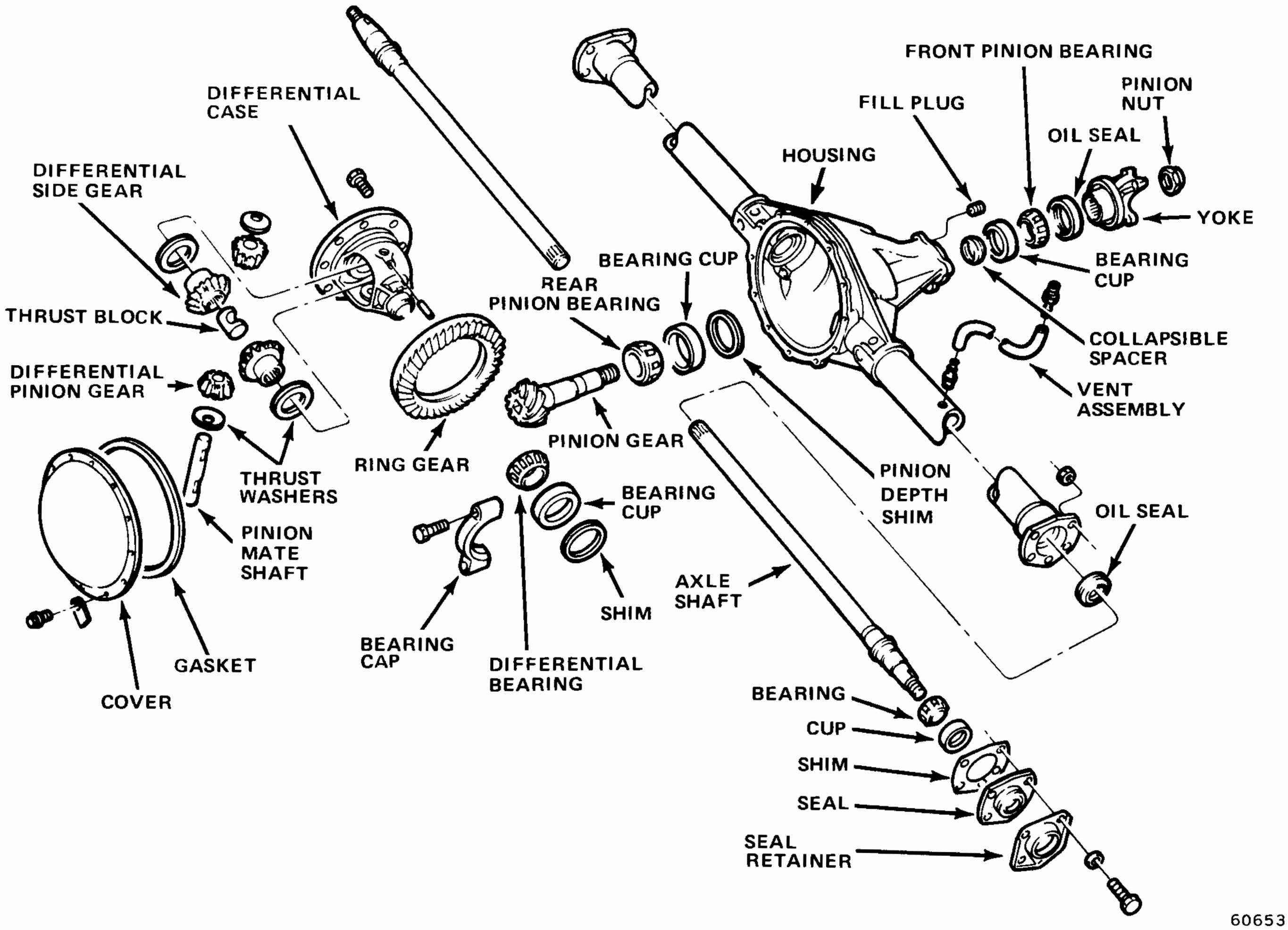

Fig. 10-33 AMC-Jeep Rear Axle (CJ Models)

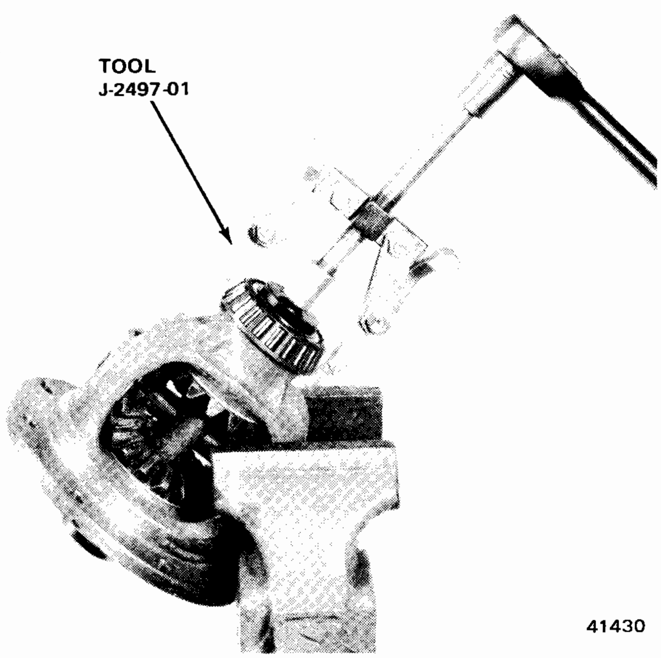

Fig. 10-34 Removing Differential Bearing

(3) Install housing cover after removing nut. Secure cover with two bolts to prevent pinion gear from dropping when it is driven out.

(4) Remove pinion oil seal, tap end of pinion gear with fiber hammer to free front bearing cone from pinion gear, and remove bearing.

NOTE: *A collapsible spacer is used to control pinion bearing preload.* **Discard this spacer; it is not reusable.**

(5) Remove housing cover, pinion gear, and rear bearing from housing.

Pinion Rear Bearing Cup Removal

(1) Remove rear bearing cup using Driver Handle J-8592 and Cup Remover J-21786.

NOTE: *Pinion depth adjustment shims are located behind rear bearing cup. Tag shims for assembly reference.*

(2) Remove front bearing cup using Driver Handle J-8592 and Cup Remover J-21787.

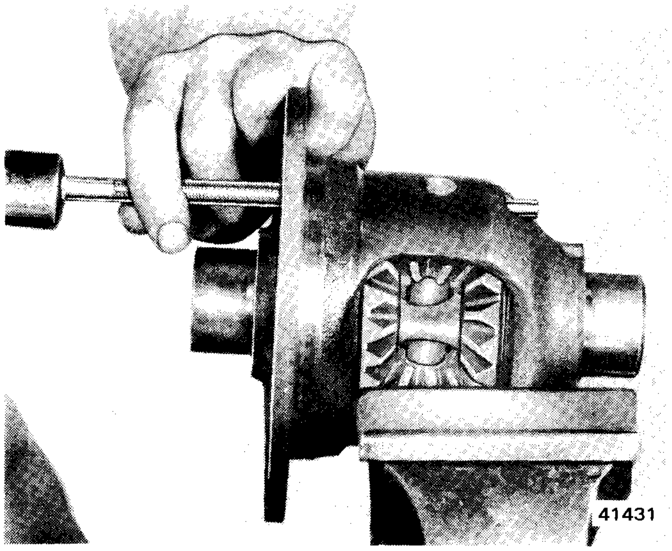

Fig. 10-35 Removing Pinion Mate Shaft Lockpin

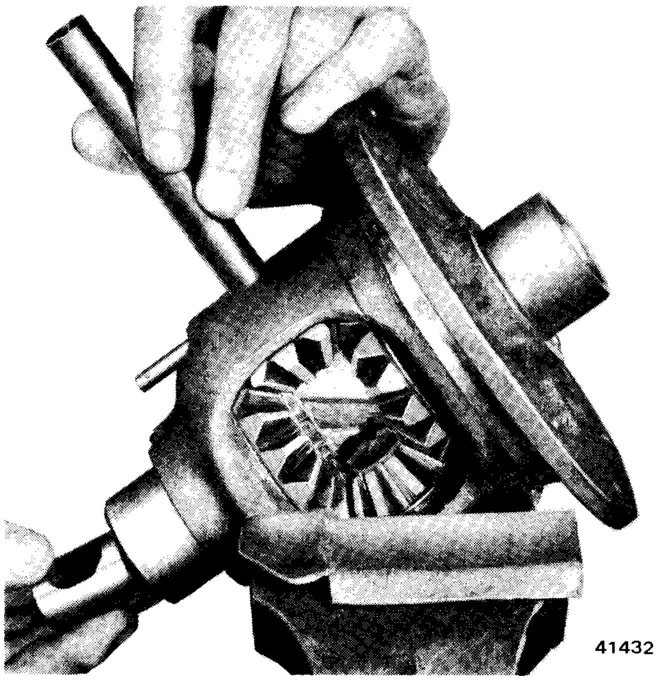

Fig. 10-36 Removing Pinion Mate Shaft and Thrust Block

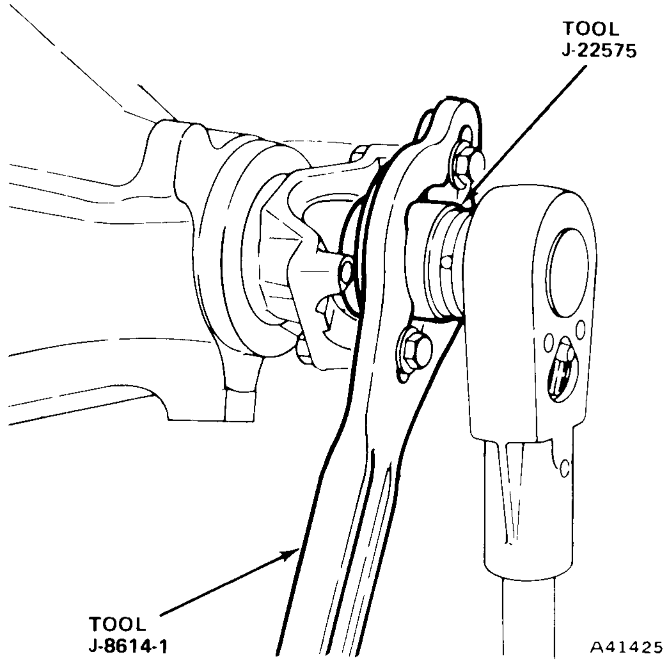

Fig. 10-37 Removing Pinion Nut

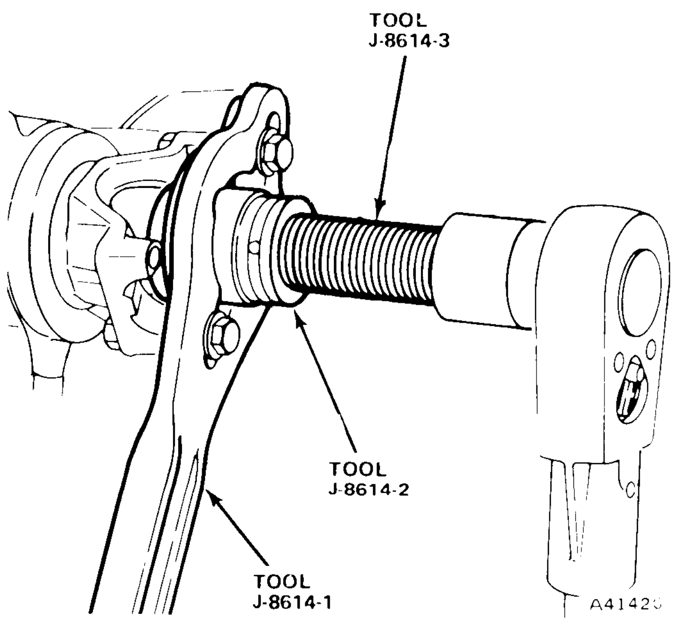

Fig. 10-38 Removing Pinion Yoke

CAUTION: *Keep cups square in bore to prevent damaging cup bores.*

Cleaning and Inspection

Clean all parts in solvent. Allow bearings to air dry. Dry other parts with compressed air.

Inspect differential bearing cones, cups, and rollers for pitting, galling, flat spots, or cracks.

Inspect differential case for elongated or enlarged pinion mate shaft hole. The machined thrust washer surface areas and counterbores must be smooth and free of nicks, gouges, cracks, or burrs. Inspect differential case for cracks or other visible damage which would necessitate replacement.

Inspect pinion mate shaft for excessive wear in contact area of differential pinions. Shaft should be smooth and round with no scoring or metal pickup.

Inspect side gears and pinions; they should have smooth teeth with a uniform contact pattern without excessive wear or broken surfaces. The side gear and pinion thrust washers should be smooth and free from any scoring or metal pickup.

Inspect pinion mate shaft lockpin for damage or looseness in case. Replace pin or case as necessary.

Inspect ring gear and pinion for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace both the ring gear and pinion as matched set only.

Inspect pinion bearing cones, cups, and rollers for pitting, galling, excessive wear, or other visible damage. If inspection reveals that either are unfit for further service, replace both cup and cone.

Inspect axle housing for cracks or other visible damage which might necessitate replacement. Raised metal on shoulder of bearing cup bores incurred in removing pinion cups should be flattened by use of a blunt punch.

Inspect pinion gear for damaged bearing journals and mounting shim surfaces or excessively worn splines. If replacement is necessary, replace both the pinion gear and ring gear (available in matched sets only).

Inspect pinion yoke for cracks, worn splines, pitted, rough or corroded oil seal contacting surface. Repair or replace pinion yoke as necessary.

Inspect pinion bearing shim pack for broken, damaged, or distorted shims. Replace shims if necessary during setting of pinion bearing preload.

Assembly

(1) Install rear bearing on pinion gear with large diameter of roller case toward gear. Press bearing against rear face of gear using Bearing Installer J-22697.

(2) Clean axle housing bearing bores to correctly check pinion gear depth.

NOTE: *When installing a new gear set, use original depth shim as starting point.*

(3) Install shim in rear bearing bore of housing and install rear bearing cup with Driver Handle J-8592 and Bearing Cup Installer J-8608 (fig. 10-39).

NOTE: *Install shim with chamfered side facing bottom of bearing cup bore in housing. If shim is not chamfered, be sure shim is centered when installed to prevent misaligning bearing cup when it is installed.*

(4) Install front bearing cup using Driver Handle J-8592 and Bearing Cup Installer J-8611-01.

(5) Install pinion gear, front bearing, rear yoke, and original pinion nut. Tighten nut only enough to remove bearing end play. Do not install new nut and collapsible spacer at this time.

(6) Measure pinion gear depth to determine correct shim thickness.

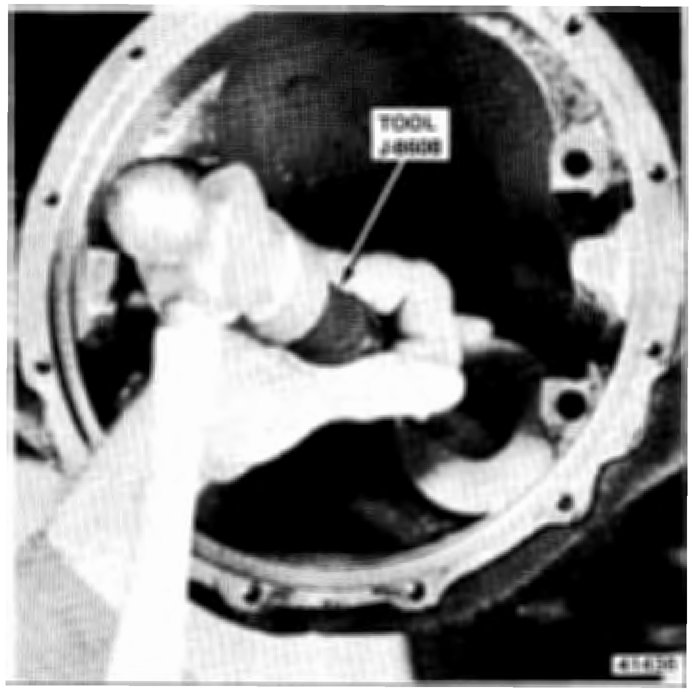

Fig. 10-39 Inatalling Pinion Rear Bearing Cup

Pinion Gear Depth

Pinion gear depth refers to the distance (measured in inches) from the end face of the pinion gear to the centerline of the axle shafts (fig. 10-40). This dimension is controlled by shims which are installed between the pinion gear inner bearing cup and the axle housing (fig. 10-33).

Ring and pinion gear sets are factory tested to detect machining variances. The test is started at a standard setting which is then varied to obtain the most desirable tooth contact pattern and quiet operation. When this setting is determined, the ring gear and pinion gear are etched with identifying numbers (fig. 10-41).

The ring gear receives one number. The pinion gear receives two numbers which are separated by a plus (+) or minus (-) sign.

The second number on the pinion gear indicates pinion position in relation to the centerline of the axle shafts where tooth contact was best and gear operation was quietest. This number is the pinion depth variance. The number on the ring gear and first number on the pinion gear identify the gears as a matched set. Do not attempt to use a ring and pinion gear set that have different numbers. This is not a matched set.

The second number on the pinion gear indicates the amount, in thousandths of an inch, that the gear set varied from the standard setting. When the pinion gear is marked plus, the distance from the pinion end face to the axle shaft enterline must be more than the standard setting. When the pinion gear is marked minus, the distance from the pinion end face to the

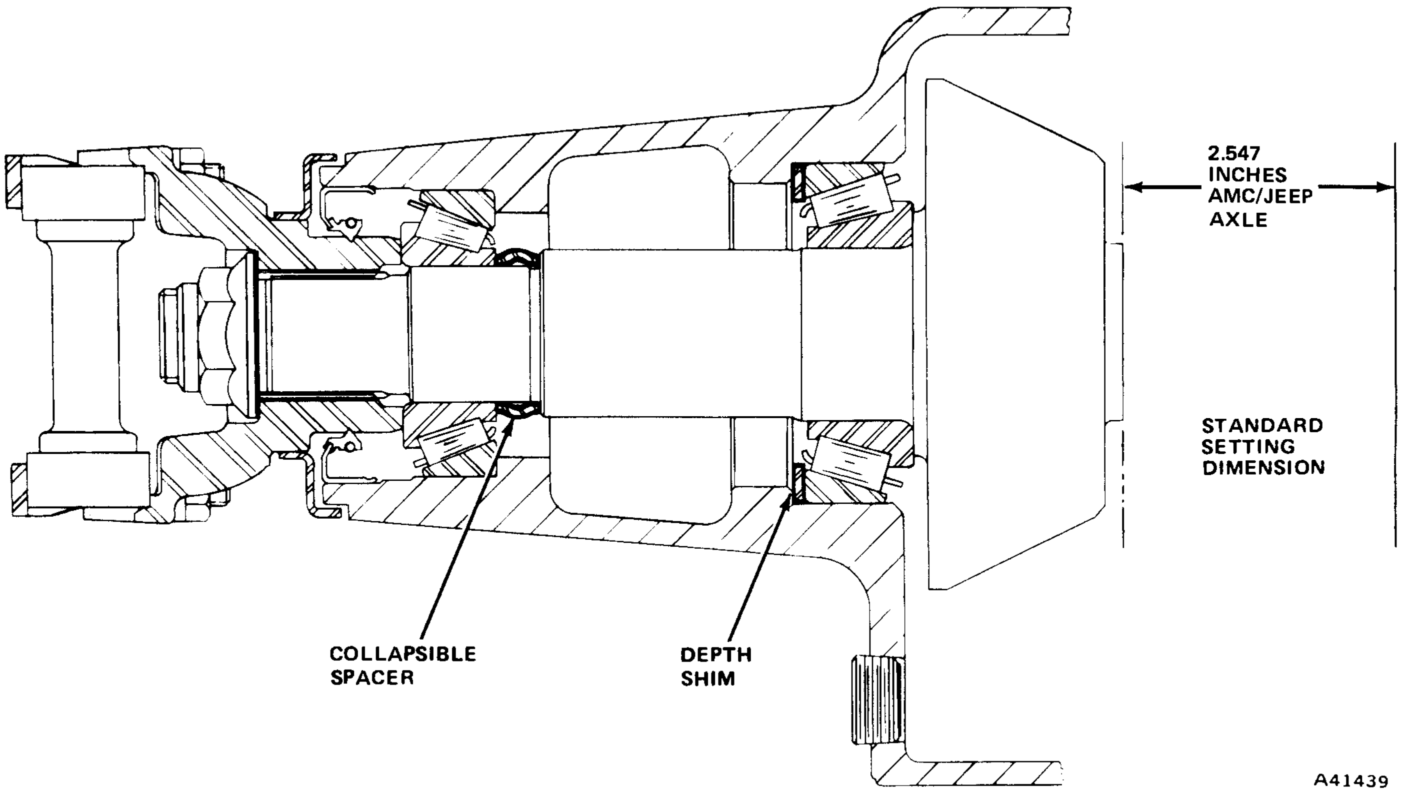

Fig. 10-40 Standard Setting Dimension and Pinion Depth Shim Location

axle shaft centerline must be less than the standard setting. The standard setting for the AMC/Jeep axle is 2.547 inches (fig. 10-40).

NOTE: *Service replacement gear sets marked + or -0.009 (or more) should be returned to Zone Parts Distribution Center. Do not attempt to install these gear sets. The number on the pinion gear must match the first of the two numbers of the ring pinion. If the number on the pinion gear differs from the first number on the ring pinion, the gear set is not matched.*

Pinion Gear Depth Measurement

Observe the pinion depth variance marked on the pinion gear. If the number is preceded by a plus (+) sign, add that amount (in thousands) to the standard setting for the axle model being overhauled. If the number is preceded by a minus (-) sign, subtract that amount (in thousandths) from the standard setting. The result of this addition or subtraction is the desired pinion depth. Record this figure for future reference.

(1) Assemble Arbor Tool J-5223-4 and Discs J-55223-23 and install in differential bearing cup bores in axle housing. Be sure discs are seated in bearing bores.

(2) Install bearing caps in axle housing and over discs (fig. 10-42). Tighten bearing cap bolts securely, but not to specified torque.

Fig. 10-41 Ring and Pinion Gear Markings

(3) Position Gauge Block J-5223-20 on end face of pinion gear with anvil end of gauge block seated on gear and plunger underneath Arbor Tool J-5223-4 (fig. 10-42).

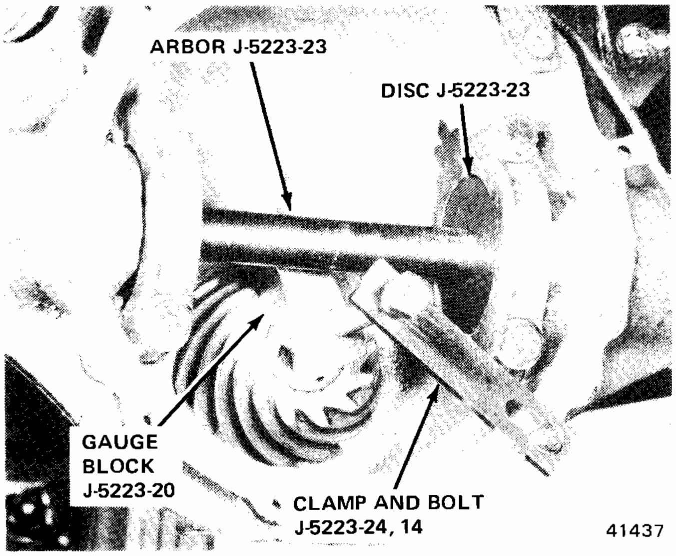

Fig. 10-42 Installing Pinion Depth Gauge Tools

(4) Mount Clamp and Bolt Assembly **J-5223-24** on axle housing (fig. 10-420. Use housing cover bolt to attach clamp to housing.

(5) Extend clamp bolt until it presses against gauge block with enough force to prevent gauge block from moving.

(6) Loosen thumbscrew in gauge block to release plunger in gauge block. When plunger contacts arbor tool, tighten thumbscrew to lock plunger in position. Do not distrub plunger position.

(7) Remove clamp and bolt assembly from axle housing.

(8) Remove gauge block and measure distance from end of anvil to end of plunger using a 2- to 3-inch micrometer (fig. 10-43). This dimension represents the **measured pinion depth**. Record this dimension for assembly reference.

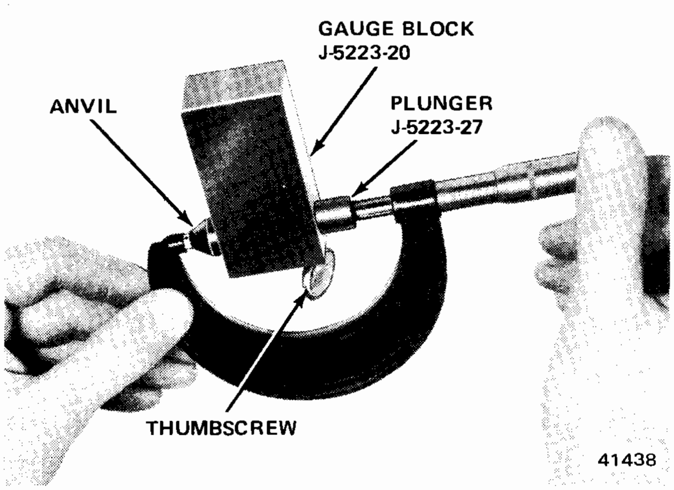

Fig. 10-43 Measuring Gauge Block

(9) Remove bearing caps and remove arbor tool and discs from axle housing.

(10) Remove pinion gear, rear bearing cup, and depth shim from axle housing.

(11) Measure thickness of depth of shim removed in step (10). Add this dimension to measured pinion depth obtained in step (8). From this total, subtract the desired pinion depth. The result represents the correct shim thickness required.

NOTE: *Desired pinion depth is the standard setting plus or minus the pinion depth variance.*

The following examples illustrate the procedure for determining correct shim thickness.

Example I—Pinion Depth Variance is Plus (+.007)

Step 1—Determine desired pinion depth

Add pinion depth variance (marked on pinion gear) to standard setting. Result is desired pinion depth.

$$\begin{array}{r} 2.547 \\ +\ 0.007 \\ \hline 2.554 \end{array}$$

Step 2—Determine total measured pinion depth

Add measured pinion depth to measured shim thickness. Result is total measured pinion depth.

$$\begin{array}{r} 2.550 \\ +0.101 \\ \hline 2.651 \end{array}$$

Step 3—Determine correct shim thickness

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

$$\begin{array}{r} 2.651 \\ -2.554 \\ \hline 0.097 \end{array}$$

Example II—Pinion Depth Variance is Minus (-.003)

Step 1—Obtain desired pinion depth

Subtract pinion depth variance (marked on pinion gear) from standard setting. Result is desired pinion depth.

$$\begin{array}{r} 2.547 \\ -0.003 \\ \hline 2.544 \end{array}$$

Step 2—Determine total measured pinion depth

Add measured pinion depth to measured shim thickness. Result equals total measured pinion depth.

$$\begin{array}{r} 2.553 \\ +0.096 \\ \hline 2.649 \end{array}$$

Step 3—Determine correct shim thickness

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

$$\begin{array}{r} 2.649 \\ -2.544 \\ \hline 0.105 \end{array}$$

(12) Install correct thickness shim(s) in axle housing bearing cup bore and install rear bearing cup and pinion gear.

Pinion Gear Bearing Preload Adjustment

(1) Install collapsible spacer and front bearing on pinion gear. Install pinion oil seal using Installer Tool J-22661 (fig. 10-28).

CAUTION: *Collapsible spacer controls preload on pinion gear bearings. Do not reuse old spacer. Use new part only.*

(2) Install pinion yoke and new pinion nut. Tighten pinion nut finger-tight only.

(3) install Yoke Holding Wrench J-8614-1 or J-8614-1 on yoke and tighten pinion nut only enough to remove end play and seat bearings. Rotate pinion gear while tightening nut to seat bearings evenly. Use Tool J-22575 to tighten nut.

(4) Remove Yoke Holding Wrench and check torque required to turn pinion gear. Use Tool J-22575 and inch-pound torque wrench to check. Correct pinion bearing preload torque is 17 to 25 inch-pounds torque. Continue tightening pinion nut until required preload torque is obtained.

CAUTION: *Do not exceed specified preload torque. Do not loosen nut to reduce preload torque if specified torque is exceeded.*

(5) If pinion bearing preload torque is exceeded, replace pinion nut and collapsible spacer and adjust preload to correct torque.

Differential Case Assembly

(1) Install differential bearings on case using Installer Tool J-21784 and Driver Handle J-8592 (fig. 10-44).

(2) Install thrust washers on differential side gears and install gears in differntial case.

(3) Install differential pinion gears in case and install thrust washers behind pinion gears. Align bores in pinion gears.

(4) Rotate differential side and pinion gears in case until pinion mate shaft bores in pinion gears are aligned with shaft bores in case.

(5) Install thrust block in case. Insert block through bore in side gear. Align bore in block with pinion mate shaft bores in gears and case.

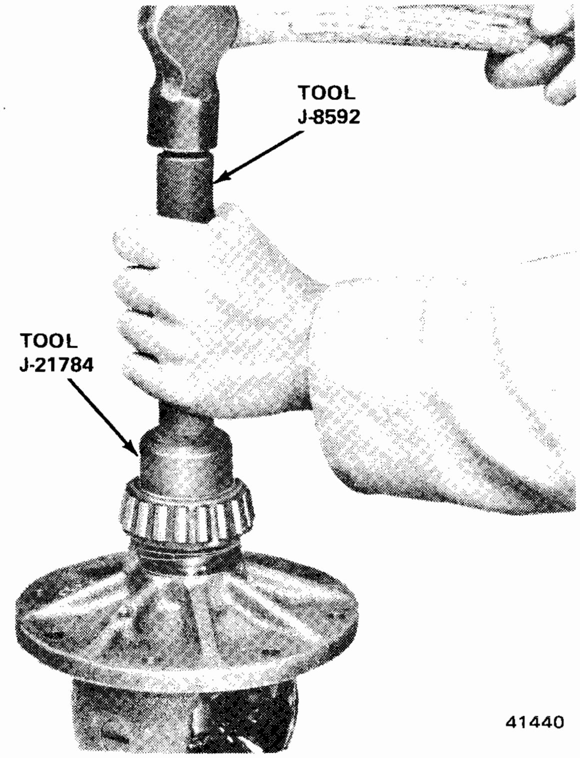

Fig. 10-44 Installing Differential Bearings

(6) Install pinion mate shaft. Align lockpin bore in shaft with bore in case and install lockpin.

Differential Bearing Adjustment

(1) Place bearing cup over each differential bearing and install differential case assembly in axle housing.

(2) Install shim on each side between bearing cup and housing. Use 0.080-inch shims as starting point (fig. 10-45).

(3) Install bearing caps and tighten bolts finger-tight. Mount dial indicator as shown in figure 10-46.

(4) Using two screwdrivers, pry between shims and housing. Pry assembly to one side and zero indicator. Pry assembly to opposite side and read indicator.

NOTE: *Do not zero or read indicator while prying.*

(5) Amount read on indicator is amount of shim that should be added to arrive at zero preload and zero end play. Repeat procedure to ensure accuracy. Adjust if necessary.

(6) Shims are available in thicknesses from 0.080 to 0.110 inch in 0,002-inch variations.

(7) When sideplay is eliminated, a slight bearing drag will be noticed. Install bearing caps and tighten bolts to specified torque.

(8) Attach dial indicator to axle housing and check ring gear mounting face of differential case for runout (fig. 10-46). Runout should not exceed 0.002 inch.

(9) Remove case from housing. Retain shims used to adjust sideplay.

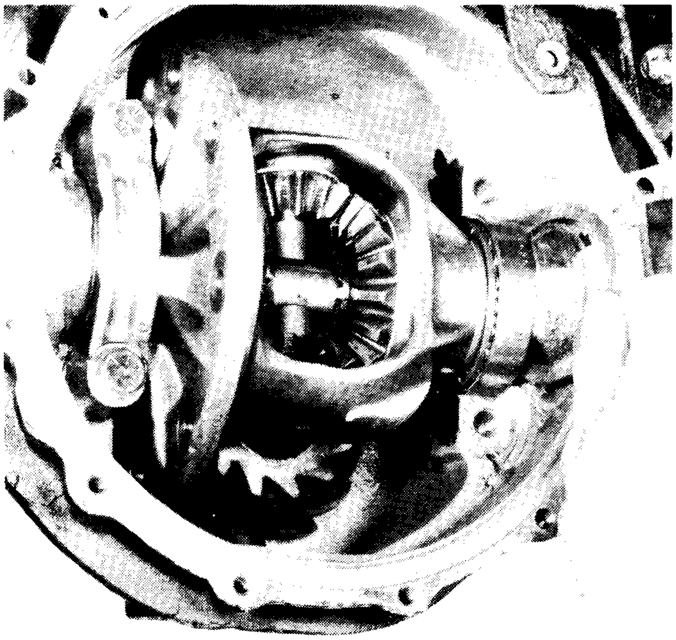

Fig. 10-45 Adjusting Sideplay

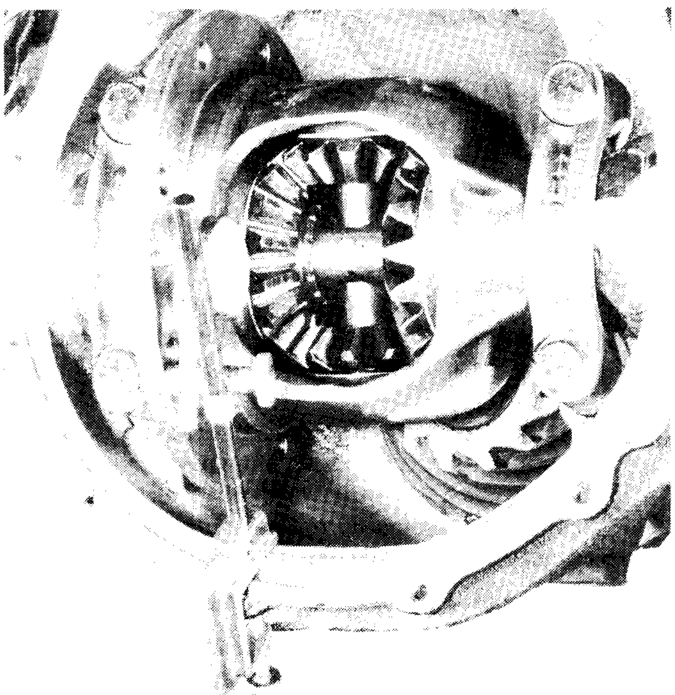

Fig. 10-46 Checking Ring Gear Face of Case for Runout

Ring Gear Installation

(1) Place ring gear on differential case.

(2) Bolt ring gear to differential case.

NOTE: *Two bolts installed in opposite holes may be used as guides to pull gear into position.*

(3) Tighten attaching bolts to 105 foot-pounds torque.

Ring and Pinion Gear Backlash Adjustment

(1) Install differential assembly in housing using shims previously selected to remove sideplay. Tighten bearing cap bolts to 87 foot-pounds torque. Attach dial indicator to housing with button contacting drive side of a tooth on ring gear and at right angle to it (fig. 10-47).

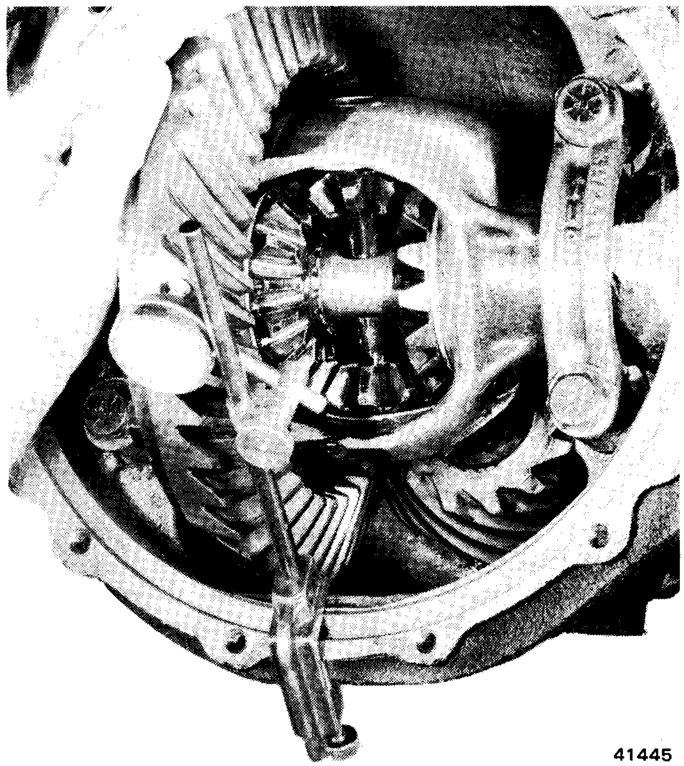

Fig. 10-47 Checking Backlash

(2) Rock ring gear and note movement registered on dial indicator. Backlash of ring gear should be 0.005 to 0.009 inch, 0.008 inch desired.

(3) Adjust backlash as follows: to increase backlash, install thinner shim on ring gear side and thicker shim on opposite side. To decrease backlash, reverse procedure; however, do not change total thickness of shims.

Example: Sideplay was removed using 0.090-inch shims on each side totaling 0.180 inch. Backlash is checked and found to be 0.011 inch. To correct backlash, add 0.004 inch to shim on ring gear side and subtract 0.004 inch from shim on opposite side.

This will result in 0.094-inch shim on ring gear side and 0.086-inch shim on other side. Backlash will be approximately 0.007 inch to 0.008 inch. Total shim thickness remains 0.180 inch.

Differential Bearing Preload Adjustment

Differential bearings should be preloaded to compensate for heat and loads during operation. Correct preload is 0.008 inch.

Differential bearings are preloaded by increasing each shim 0.004 inch in thickness.

(1) Install differential bearing shims in axle housing bearing bores.

(2) Assemble differential bearing cups on differential bearings. Bearings should completely cover differential bearing rollers.

(3) Position differential so that bearings just start in axle housing bearing bores (fig. 10-48).

NOTE: *Slightly tipping bearing cups will ease starting cups into bores. Keep differential assembly square in housing and push it in as far as possible.*

(4) Using plastic mallet, tap outer edge of bearing cups until seated in housing.

CAUTION: *Do not distort shims by hammering them into housing.*

(5) Install bearing caps, aligning punch marks correctly. Tighten bolts to 87 foot-pounds torque.

(6) Preloading differential bearings may change backlash setting. Check backlash and correct if necessary.

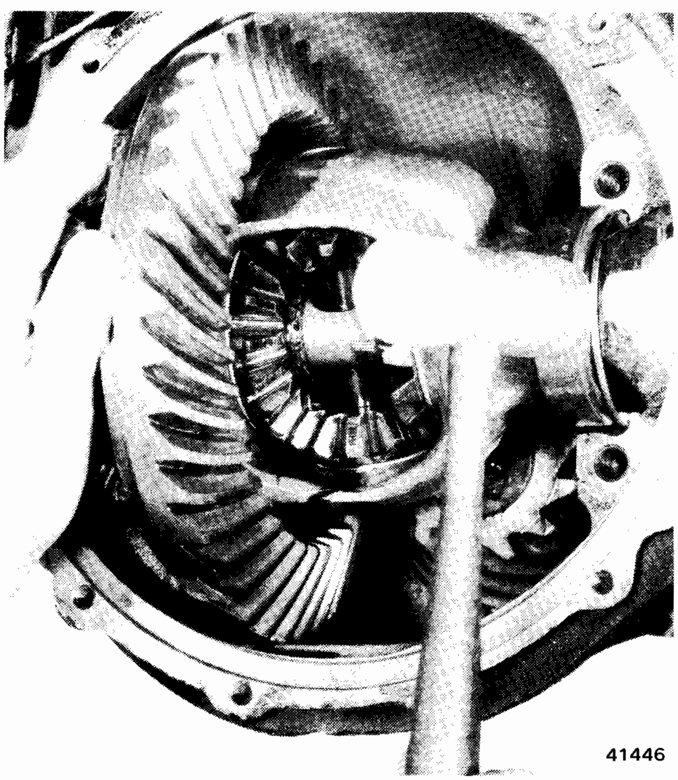

Fig. 10-48 Differential Installation

(7) Install propeller shaft, aligning index marks made at disassembly.

(8) Install axle shafts, bearings, seals, and brake support plates.

(9) Fill rear axle with Trac-Lok Lubricant, part number 8991018, or equivalent.

(10) Check and adjust axle shaft end play if necessary. Adjust end play at left side of axle shaft only.

(11) Install hubs, drums, and wheels, and lower vehicle.

DIFFERENTIAL OVERHAUL—AXLE MODELS 30-44-60

Disassembly (Fig. 10-49 and 10-50)

NOTE: *It is not necessary to remove the axle assembly to overhaul the differential.*

(1) Raise vehicle and remove axle shafts.

(2) Remove axle housing cover and loosen bolts that retain differential bearing caps. Do not remove caps.

NOTE: *Centerpuch identification marks on bearing caps and housing so caps are installed in same position at assembly.*

(3) Spread axle housing using Tool J-25102. Install holddown clamps to keep spreader tool in position (fig. 10-51). Position dial indicator as shown in figure 10-51 and measure amount housing is spread by Tool J-25102. Do not spread housing more than 0.020 inch.

(4) When housing has been spread sufficiently, remove dial indicator and bearing caps.

(5) Pry differential from housing using pry bars under heads of ring gear bolts and carrier casting.

(6) Remove spreader immediately to prevent possibility of housing taking set.

(7) Remove bolts that attach ring gear to differential case.

(8) Remove pinion mate shaft lockpin using small punch (fig. 10-52).

(9) Remove pinion mate shaft and thrust block.

(10) Remove differential pinion gears.

NOTE: *Do not lose pinion gear thrust washers.*

(11) Use Wrench J-8614-10 to hold yoke and remove pinion nut. Remove yoke using Puller J-25134.

(12) Using rawhide hammer, strike end of pinion gear to force pinion out of housing.

NOTE: *Pinion bearing preload adjusting shims may remain on pinion shaft, or stick to bearing that remains in housing, or may fall out. These shims should be collected and retained for assembly.*

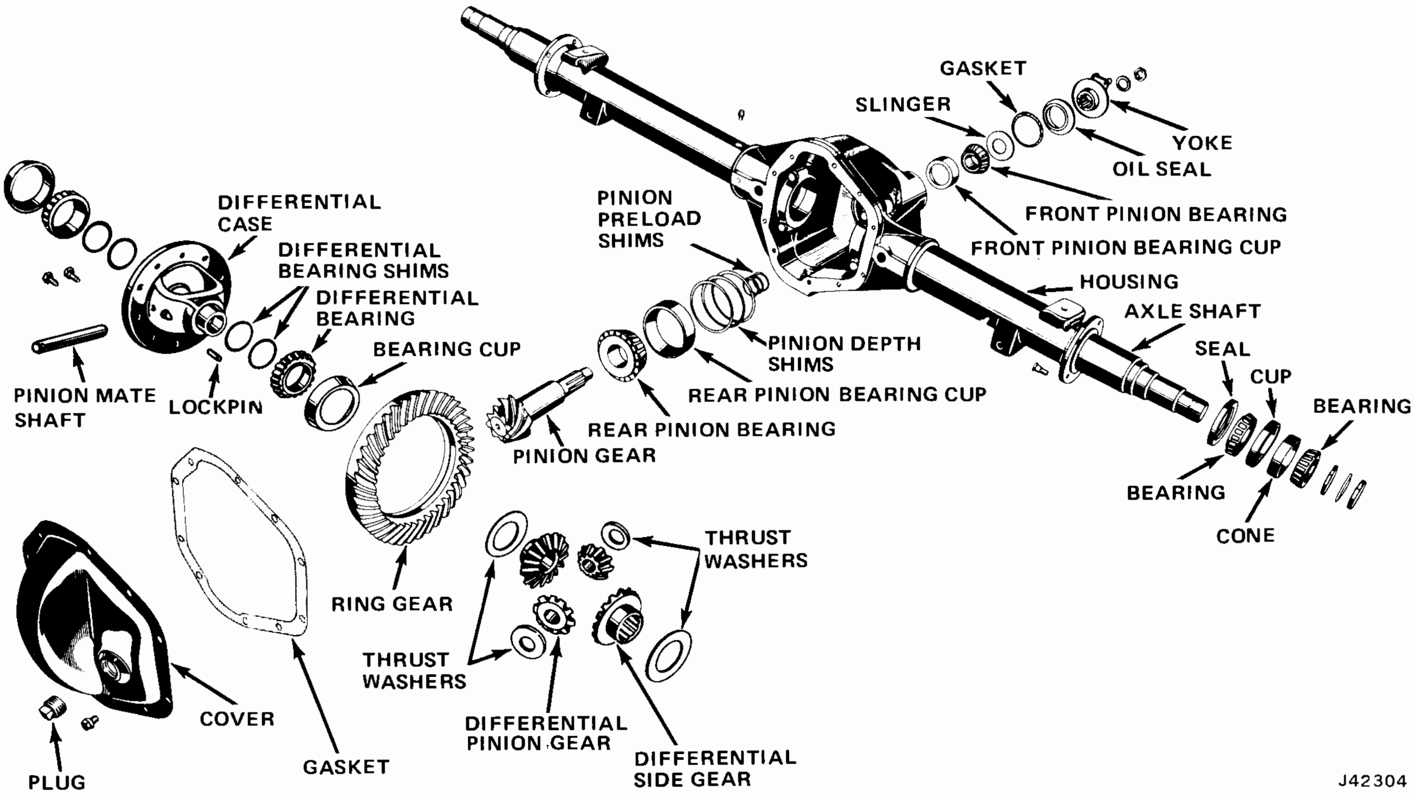

Fig. 10-49 Model 60 Rear Axle

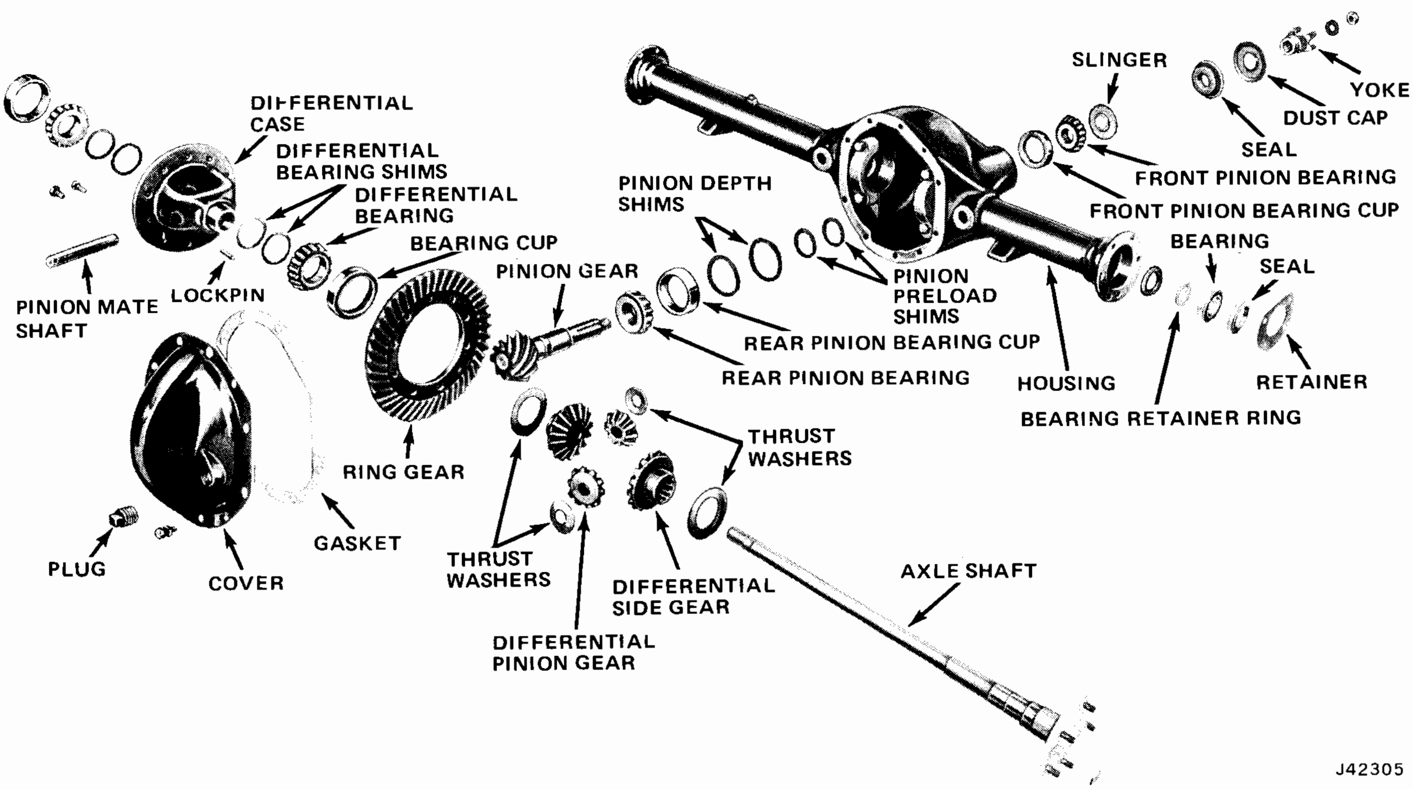

Fig. 10-50 Model 44 Rear Axle (Model 30 Front Axle—Typical)

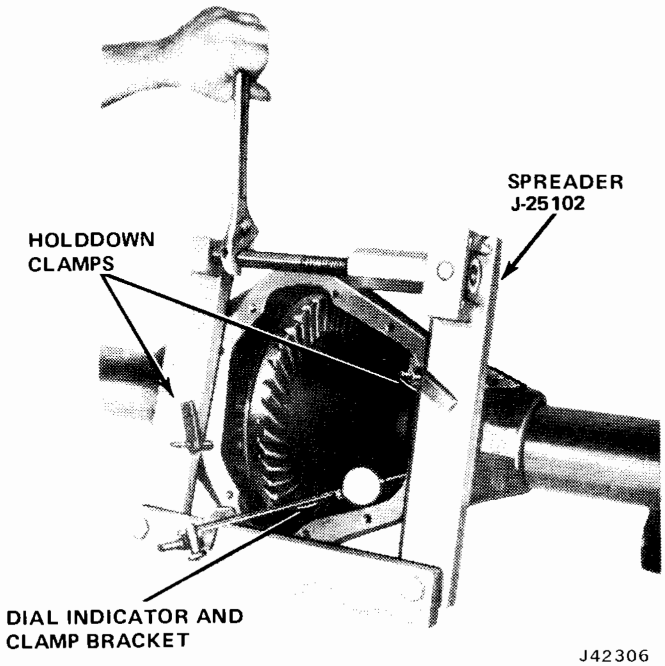

Fig. 10-51 Spreading Axle Housing

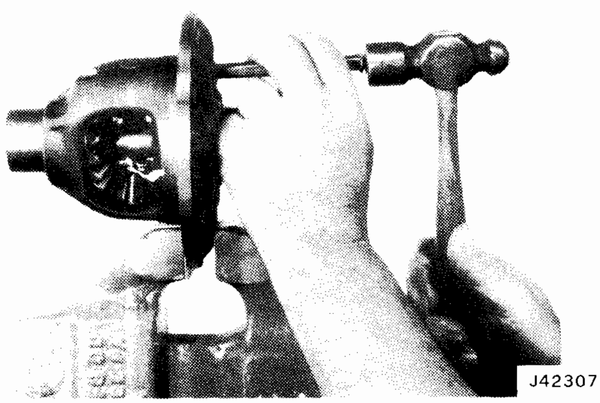

Fig. 10-52 Removing Lockpin

(13) Remove outer pinion bearing, oil slinger, and oil seal, using two-inch by two-inch piece of hardwood or length of pipe. Drive bearing, slinger, and seal out of housing. Discard seal.

Differential Bearing Removal—Axle Models 30-44

Remove differential bearings and pinion inner bearing using Bearing Puller J-25100. This puller eases removal of bearings without damaging cone rollers, as pulling pressure is applied directly to bearing (fig. 10-53).

NOTE: *When removing front axle differential inner pinion bearing with oil slinger attached, two puller adapter plates must be inserted from top into one side of J-25100 puller base, then repositioned 180 degrees apart (fig. 10-53).*

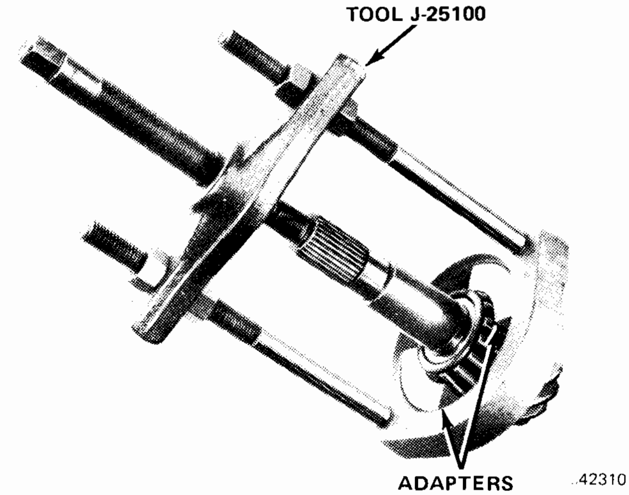

Fig. 10-53 Removing Differential Bearing

Differential Bearing Removal—Axle Model 60

Remove differential bearings using Press J-25123, Extension J-25124, Button J-25127, Holding Ring J-25125 and Adapter J-25128 (fig. 10-54).

Remove pinion inner bearing using Puller Set J-25123 with Holding Ring J-25126 and Adapter J-25128.

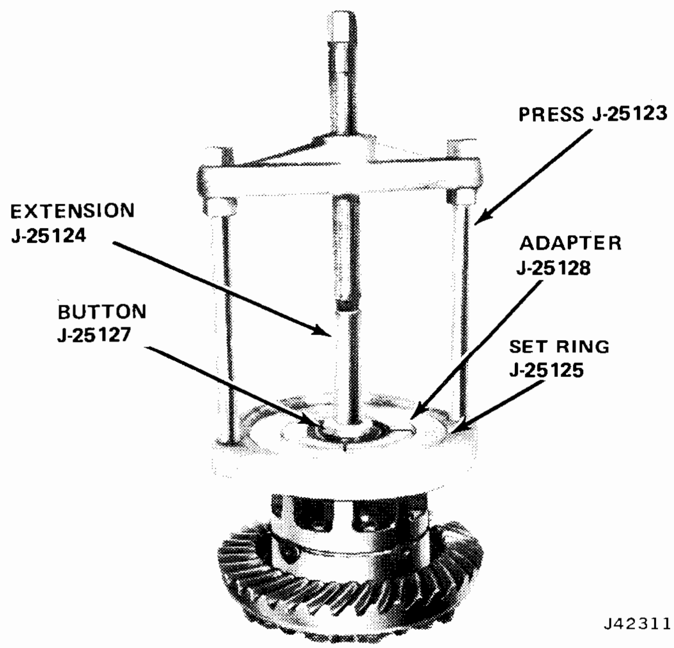

Fig. 10-54 Removal Differential Bearing

Pinion Bearing Cup Removal

(1) Using brass drift, drive inner pinion bearing cup and shims from housing. Shims should be kept for assembly reference even if mutilated.

(2) Using brass drift, drive outer pinion bearing cup from housing.

Cleaning and Inspection

Clean all parts in solvent. Allow bearings to air dry. Dry other parts with compressed air.

Inspect differential, cups, and bearing rollers for pitting, galling, flat spots, or cracks.

Inspect differential case for elongated or enlarged pinion mate shaft hole. The machined thrust washer surface areas and counterbores must be smooth and free of nicks, gouges, cracks, or burrs. Inspect case for cracks or other visible damage which would necessitate replacement.

Inspect pinion mate shaft for excessive wear in contact area of differential pinions. Shaft should be smooth and round with no scoring or metal pickup.

Inspect side gears and pinions$ they should have smooth teeth with a uniform contact pattern without excessive wear or broken surfaces. The side gear and and pinion thrust wahers should be smooth and free from any scoring or metal pickup.

Inspect pinion mate shaft lockpin for damage or looseness in case. Replace pin or case as necessary.

Inspect ring gear and pinion gear for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace both the ring gear and pinion as matched set only.

Inspect pinion bearing cones, cups, and rollers for pitting, galling, excessive wear, or other visible damage. If inspection reveals that either are unit for further service, replace both cup and cone.

Inspect differential case for cracks or other visible damage which might necessitate replacement. Raised metal on shoulder of bearing cup bores incurred in removing pinion cups should be flattened using a blunt punch.

Inspect pinion gear for damage bearing journals and mounting shim surfaces or excessively worn splines. If replacement is necessary, replace both the pinion gear and ring gear (available in matched sets only).

Inspect pinion yoke for cracks, worn splines, pitted, rought or corroded oil seal contacting surface. Repair or replace pinion yoke as necessary.

Inspect pinion bearing shim pack for broken, damaged, or distorted shims. Replace shims if necessary during setting of pinion bearing preload.

Assembly

Pinion Gear Installation

NOTE: *Front axles use an oil slinger between the bearing cone and the pinion head. If the oil slinger is not installed correctly, the pinion shim pack dimension will be incorrect.*

(1) Install outer bearing cup using Driver J-25101.

(2) Install inner bearing cup using Installer J-25101 on Model 30 axles, and Installer J-25157 on Model 44 and Model 60 axles to drive cup into housing.

(3) Use Sleeve J-25218 to press inner bearing onto pinion shaft on axle Models 44 and 60. Use Sleeve 25181 on Model 30 (fig. 10-55).

(4) Install pinion gear in housing and install 0.065-inch shim, inner bearing, and universal joint yoke to hold pinion in position for pinion depth adjustment. Install pinion nut. Tighten nut only enough to remove end play and allow 10 to 15 inch-pounds of rotating (drag) torque and measure pinion depth.

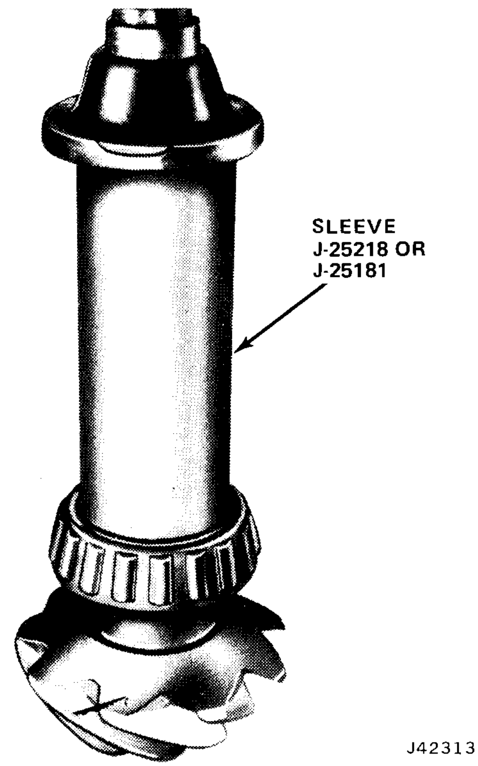

Fig. 10-55 Pinion Bearing Installing Sleeve

Pinion Gear Depth

Pinion gear depth refers to the distance (measured in inches) from the end face of the pinion gear to the centerline of the axle shafts (fig. 10-40). This dimension is controlled by shims which are installed between the pinion gear inner bearing cup and the axle housing (fig. 10-56).

Ring and pinion gear sets are factory tested to detect machining variances. The test is started at a standard setting which is then varied to obtain the most desrable tooth contact pattern and quiet operation. When this setting is determined, the end of each pinion gear is etched with a plus (+), minus (-), or zero (number). This number indicates the amount, in thousandths of an inch, that the gear set varied from the standard setting and is the pinion depth variance.

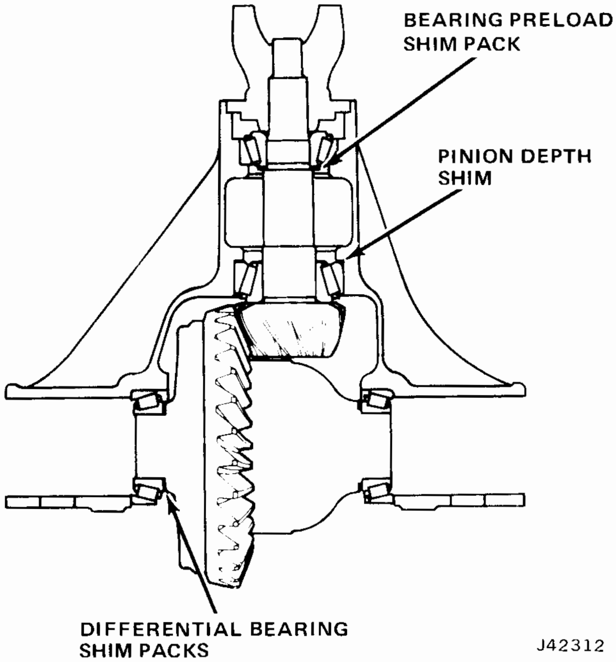

Fig. 10-56 Differential Shim Locations

The standard setting for axle Models 30, 44, and 60 are as follows: Refer to figure 10-40.

- Model 30: 2.250
- Model 44: 2.625
- Model 60: 3.125

If the pinion is marked +2, the gear set varied from the standard setting by 0.002 inch and will require 0.002 inch less shims than a gear set marked 0 (zero). When the pinion gear is marked plus (+), the distance from the pinion end face to the axle shaft centerline must be more than the standard setting. If the pinion is marked -3, the gear set will require 0.003 inch more shims than a gear set marked 0 (zero).

When the pinion gear is marked minus (-), the distance from the pinion end face to the axle shaft centerline must be less than the standard setting. Refer to figure 10-41 for an illustration of standard setting dimension.

Pinion Gear Depth Adjustment

Observe the pinion depth variance marked on the pinon gear. If the number is preceded by a plus (+) sign, add that amount (in thousands) to the standard setting for the axle model being overhauled. If the number is preceded by a minus (-) sign, subtract that amount (in thousands) from the standard setting. The result of this addition or subtraction is the desired pinion depth. Record this figure for further reference.

NOTE: *If the gear is marked 0 (zero), use the standard setting.*

(1) Assemble Arbor Tool J-5223-4 and Discs J-5223-26 (Model 30 axle) or Discs J-5223-25 (Model 44 and 60 axles) and install in differential bearing cup bores in axle housing (fig. 10-57). Be sure discs are seated in bearing cup bores.

(2) Install differential bearing caps in axle housing and over discs. Tighten bearing cap bolts securely, but do not tighten to specified torque.

(3) Install Plunger J-5223-27 in Gauge Block J-5223-20. Compress plunger and tighten thumbscrew in gauge block.

(4) Position Gauge Block J-5223-20 on end face of pinion gear with anvil end of gauge block seated on gear and plunger underneath Arbor Tool J-5223-4 (fig. 10-57).

(5) Install bolt J-5223-29 in Clamp J-5223-24 and mount assembly on axle housing (fig. 10-57). Use housing cover bolt to attach clamp to housing.

(6) Extend clamp bolt until it presses against gauge block with enough force to prevent gauge block from moving.

(7) Loosen thumbscrew in gauge block to release plunger. When plunger contacts arbor tool, tighten thumbscrew in gauge block to lock plunger in position. Do not disturb plunger position.

(8) Remove clamp and bolt assembly from axle housing.

(9) Remove gauge block and measure distance from end of anvil to end of plunger using a 2- to 3-inch micometer (fig. 10-58). This dimension represents the *measured pinion depth*. Record this dimension for assembly reference.

(10) Remove bearing caps and remove arbor tool and discs from axle housing.

(11) Remove pinion gear, rear bearing cup, and depth shim from axle housing.

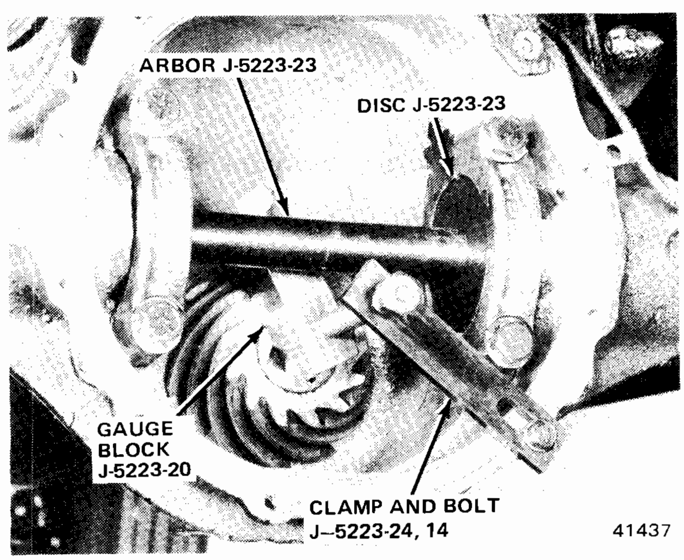

Fig. 10-57 Installing Pinion Depth Gauge Tools

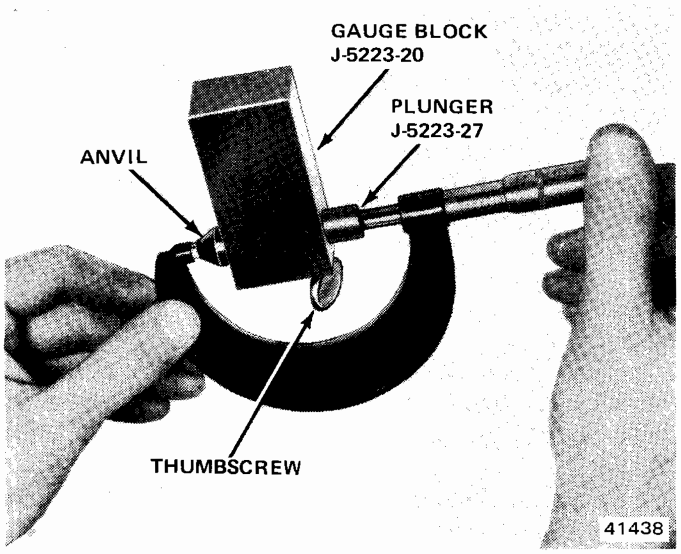

Fig. 10-58 Measuring Gauge Block

(12) Measure thickness of depth shim removed in step (11). Add this dimension to measured pinion depth obtained in step (9). From this total, subtract the desired pinion depth. The result represents the correct shim thickness required.

NOTE: *Desired pinion depth is the standard setting plus or minus the pinion depth variance.*

The following examples illustrate the procedure for determining correct shim thickness.

Example I—Pinion Depth Variance is Plus (+) Model 44 Axle

Step 1—Determine desired pinion depth

Add pinion depth variance (marked on pinion gear) to standard setting. Result is desired pinion depth.

$$\begin{array}{r} 2.625 \\ +0.004 \\ \hline 2.629 \end{array}$$

Step 2—Determine total measured pinion depth

Add mesured pinion depth to measure shim thickness. Result is total measured pinion depth.

$$\begin{array}{r} 2.601 \\ +0.107 \\ \hline 2.708 \end{array}$$

Step 3—Determine correct shim thickness

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

$$\begin{array}{r} 2.708 \\ -2.629 \\ \hline 0.079 \end{array}$$

Example II—Pinion Depth Variance is Minus (-) Model 60 Axle

Step 1—Obtain desired pinion depth

Subtract pinion depth variance (marked on pinion gear) from standard setting. Result is desired pinion depth.

$$\begin{array}{r} 3.125 \\ -0.002 \\ \hline 3.123 \end{array}$$

Step 2—Determine total measured pinion depth

Add measured pinion depth to measured shim thickness. Result equals total measured pinion depth.

$$\begin{array}{r} 3.120 \\ +0.100 \\ \hline 3.220 \end{array}$$

Step 3—Determine correct shim thickness

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

$$\begin{array}{r} 3.220 \\ -3.123 \\ \hline 0.097 \end{array}$$

(13) Install correct thickness shim in bearing cup bore of axle housing and install rear bearing cup and pinion gear.

Differential Side Gear Adjustment

Clearance between differential side gears and case should be 0.000 inch to 0.006 inch.

(1) With differential positioned on end (fig. 10-59), tap differential lightly on flat surface so differential gears settle in position.

(2) Measure clearance between side gear and case with feeler gauge.

(3) If clearance exceeds 0.006 inch, add shims between gears and case.

NOTE: *If shims are required, at least one shim should be placed on each side and the shim packs kept as even as possible. After adding shims, repeat the clearance check.*

Differential Bearing Preload and Ring Gear Backlash Adjustment

Differential bearing preload is controlled by shims between the differential case and differential bearing.

(1) Install differential case and bearings in axle housing without shims and with bearing cups snug.

(2) Hold ring gear in contact with pinion, use screwdriver to move differential bearing cups toward center, and insert feeler gauge (on each side) between differential bearing cup and axle housing. There should be only 0.001 inch to 0.002 inch backlash remaining with feeler gauge inserted.

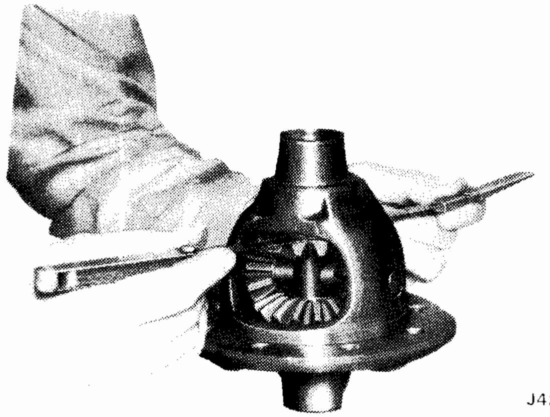
J42317

Fig. 10-59 Checking Side Gear Clearance

(3) After shim pack requirement for each bearing has been established, remove differential assembly. Make up shim packs and keep separated.

(4) Add additional 0.015-inch thickness of shims to pack on tooth side of ring gear.

(5) Place differential bearing shim packs on differential case under each bearing. Install bearings with Driver J-25136 for Model 44 rear axle and Driver J-25519 for Model 60 rear axle (fig. 10-60).

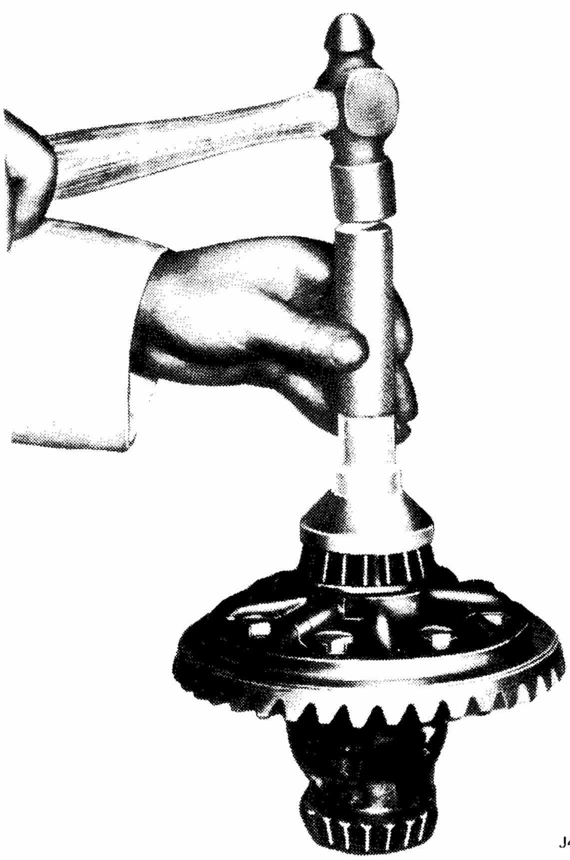
J42318

Fig. 10-60 Installing Differential Bearings

NOTE: *When overhauling front axle differential, check axle inner oil seals. Should new seals be required, install using Tool J-25111 for Model 44 axle (fig. 10-61).*

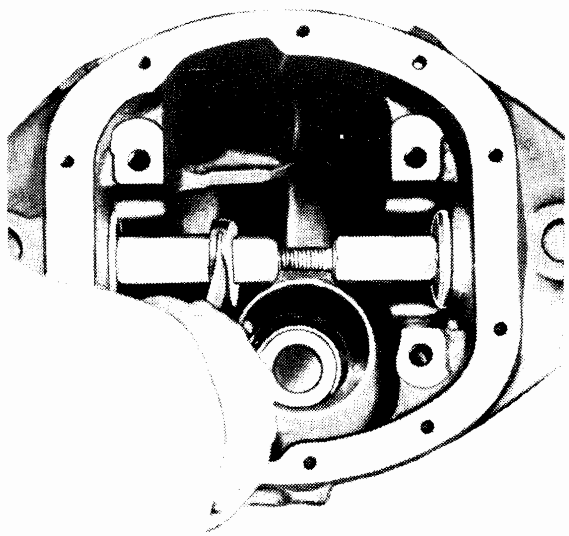
J42319

Fig. 10-61 Installing Inner Oil Seals

(6) Attach Carrier Spreader J-25102, install dial indicator, and spread carrier maximum of 0.020 inch.

(7) Remove dial indicator.

(8) Lubricate bearings and install differential in housing.

(9) Tap unit into place using plastic mallet. Be sure ring gear teeth mesh with pinion teeth.

(10) Apply sealing compound to bearing cap bolt threads. Tighten bolts to 40 foot-pounds torque (Model 30) or 80 foot-pounds torque (Model 44 and 60).

(11) Install dial indicator and check ring gear backlash (fig. 10-62). Check backlash at two points.

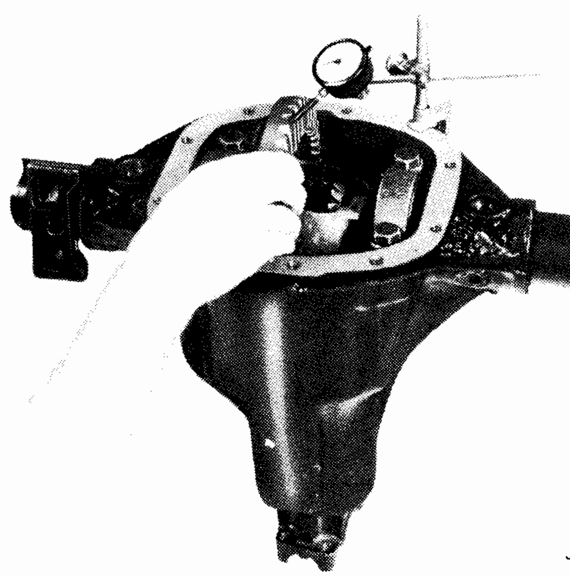
J42320

Fig. 10-62 Checking Ring Gear Backlash

Backlash must be between 0.005 inch to 0.010 inch. If backlash is incorrect, install shims between differential bearing shim packs until correct backlash is obtained.

NOTE: *Changing position of a 0.005-inch shim from one side to the other will change the amount of backlash approximately 0.003 inch.*

(12) Check ring gear runout. A reading in excess of 0.006 inch indicates sprung differential case, dirt between case and gear, or loose ring gear bolts.

(13) Remove universal joint yoke and install oil seal using Driver J-25104 on all axles except Model 60 rear axle. Use Driver J-25110 on Model 60 rear axle.

(14) Install universal joint yoke using Tool J-25173 (fig. 10-30). Install pinion washer and nut. Tighten nut to 210 foot-pound torque (Models 30 and 44) or 260 foot-pounds torque (Model 60).

(15) Install axle shafts and axle housing cover.

TRAC-LOK DIFFERENTIAL

OPERATION

A conventional differential transmits all of the ring gear torque through the differential gears to the axle shafts. Torque is at all times equal on the axle shafts, and if one wheel slips, the other wheel can only put out as much torque as the slipping wheel.

The Trac-Lok differential differs in that part of the torque from the ring gear is transmitted through clutch packs between the side gears and differential case. The multiple disc clutches with radial grooves on the plates and concentric grooves on the discs are engaged by a preload from Belleville springs, plus separating forces from the side gears as torque is applied through the ring gear.

The Trac-Lok construction permits differential action when required for turning corners and transmits equal torque to both wheels when driving straight ahead. However, when one wheel encounters ice or leaves the ground and spins, the clutch packs automatically provide more torque to the wheel which is not spinning. The Trac-Lok differential resists wheel spin on bumpy roads and provides more pulling power when one wheel tries to slip. Pulling power will be automatically provided until both wheels start to slip. If, with unequal traction, both wheels slip, Trac-Lok operation is normal. In extreme cases of differences in traction, the wheel with the least traction may spin after the Trac-Lok has transferred as much torque as possible to the nonslipping wheel.

LUBRICATION

The Trac-Lok differential requires a special lubricant. Ordinary multipurpose gear lubricants MUST NOT be used. Use Jeep Lubricant, part number 8991018, or equivalent.

Trac-Lok differentials may be cleaned only by disassembling the unit and wiping with clean rags.

NOTE: *The Trac-Lok differential is serviced at the same time intervals as the standard differential.*

TROUBLE SYMPTOMS

If noises or roughness such as chatter occur when turning corners, the probable cause is incorrect or contaminated lubricant.

Before any differential is removed and disassembled for chatter complaints, check to see if proper lubricant is used.

A complete lubricant drain and refill with specified differential lubricant will usually correct chatter.

DRAINING LUBRICANT

(1) Warm lubricant by driving vehicle for 5 minutes of operation in gear at 30 mph with wheels off ground (on hoist).

WARNING: *Never place the transmission in gear with the engine running when only one wheel of a Trac-Lok equipped vehicle is raised. The vehicle might drive itself off the jack and cause damage or injury.*

(2) Drain lubricant while warm. Remove drain plug or cover to drain completely. If cover is removed, it may be necessary to replace gasket at this time.

(3) Refill axle with specified lubricant, Jeep part number 8991018 or equivalent.

(4) Operate vehicle for approximately ten miles, making at least ten figure-eight turns to flush old lubricant out of clutch packs.

(5) Repeat steps (2) through (4), above, making sure to replace cover gasket if required.

NOTE: *If slight chatter occurs after draining and flushing Tac-Loc, drive vehicle an additional 10 to 20 miles or until chatter stops. If chatter still persists after the lubricant change, disassembly and repair will be necessary.*

OPERATIONAL TEST

A properly functioning Trac-Lok unit can be determined by the following operational test.

Place one wheel on good dry pavement, and the other on ice, mud, grease, etc.

Gradually increase engine rpm to obtain maximum traction prior to breakaway. The ability to move the vehicle effectively will demonstrate proper performance.

If extremely slick surfaces such as ice or grease are used, some question may exist as to proper performance. In these extreme cases, a properly performing Trac-Lok will provide greater pulling power by lightly applying the parking brake.

DISASSEMBLY (fig. 10-63)

(1) Remove Trac-Lok differential from axle housing. Removal procedures are same as outlined for standard differential.

(2) Install one axle shaft in vise with spline end up and tighten vise. Do not allow more than 2-3/4 inch of shaft to extend above top of vise (fig. 10-64). This will prevent shaft from fully entering side gear, causing interference with step plate tool used to remove differential gears.

(3) Mount differential case on axle shaft with ring gear bolt heads facing up (fig. 10-65).

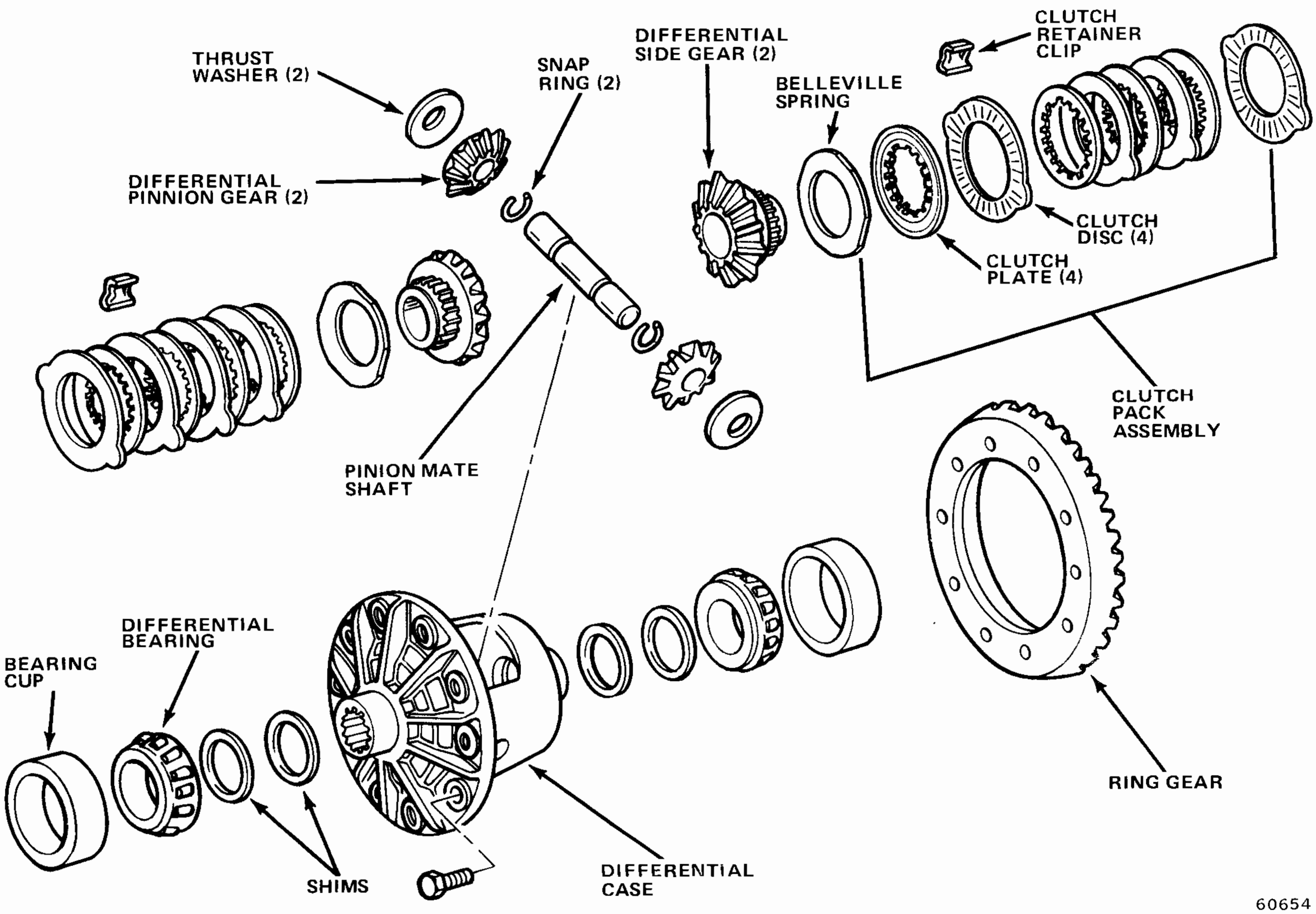

Fig. 10-63 Trac-Lok Differential

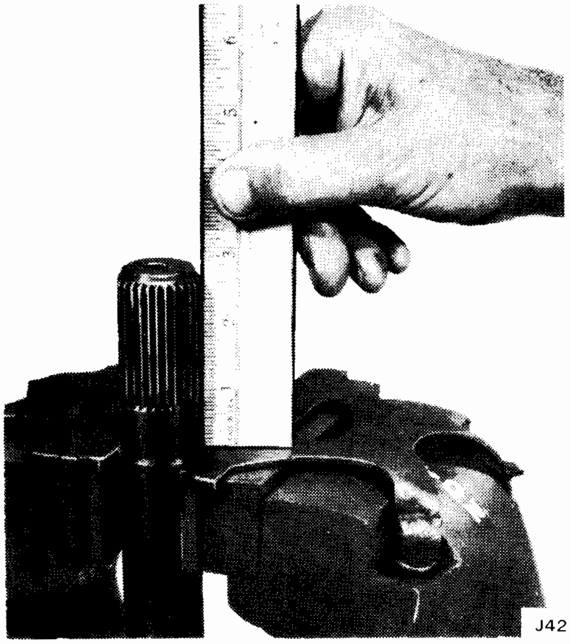

Fig. 10-64 Axle Shaft Positioned in Vise

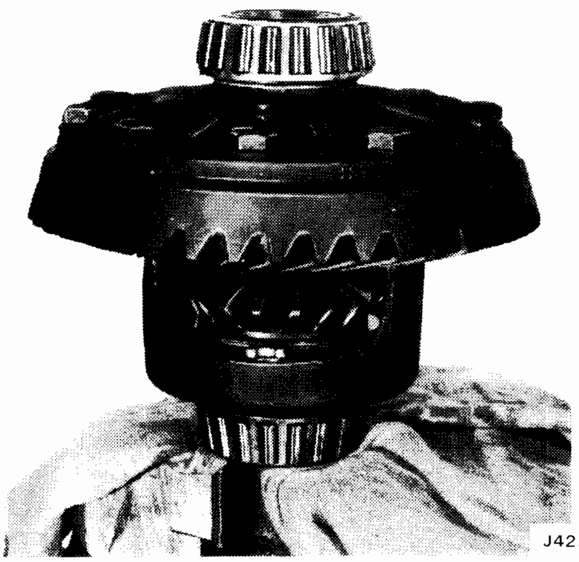

Fig. 10-65 Differential Mounted on Axle Shaft

(4) Remove and discard ring gear bolts.

(5) Place shop towels on vise under ring gear to protect gear when it is removed from case (fig. 10-65).

(6) Remove ring gear from case using rawhide hammer.

(7) Remove differential case from axle shaft and remove ring gear.

(8) Mount differential case on axle shaft.

(9) Remove snap rings from pinion mate shaft (fig. 10-66). Use two screwdrivers to disengage snap rings. Place shop towel on opposite opening of case to prevent snap rings from flying out of case.

Fig. 10-66 Removing Snap Rings from Pinion Mate Shaft

NOTE: *On Model 60 Trac-Lok, pinion mate shaft is retained in case by roll pin. Use 3/16-inch diameter punch to remove pin.*

(10) Remove pinion mate shaft using hammer and brass drift.

NOTE: *Gear Rotating Tool J-23781 is required to perform the following steps. The tool consists of three parts: gear rotating tool, forcing screw, and step plate.*

(11) Install step plate in lower differential side gear (fig. 10-67).

(12) Position pawl end of gear rotating tool on step plate (fig. 10-68).

(13) Insert forcing screw through top of case and thread into gear rotating tool.

NOTE: *Before using forcing screw, apply daub of grease to centering hole in step plate and oil threads of forcing screw.*

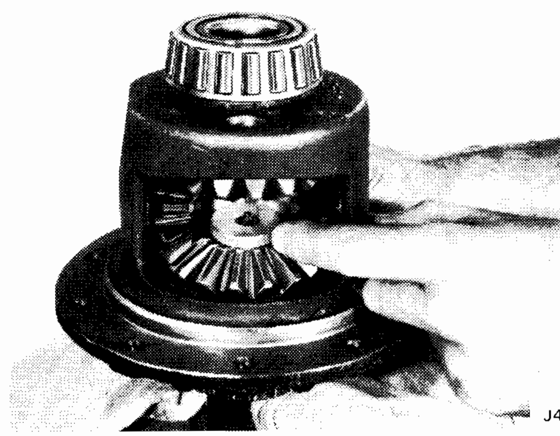

Fig. 10-67 Installing Step Plate

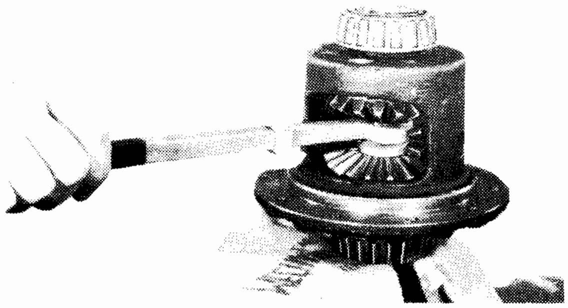

Fig. 10-68 Installing Gear Rotating Tool

(14) Center forcing screw in step plate and tighten screw to move differential side gears away from differential pinion gears.

(15) Remove differential pinion gear thrust washers using feeler gauge or shim stock of 0.030-inch thickness. Insert shim stock or gauge between weasher and case and withdraw shim stock and thrust washer (fig. 10-69).

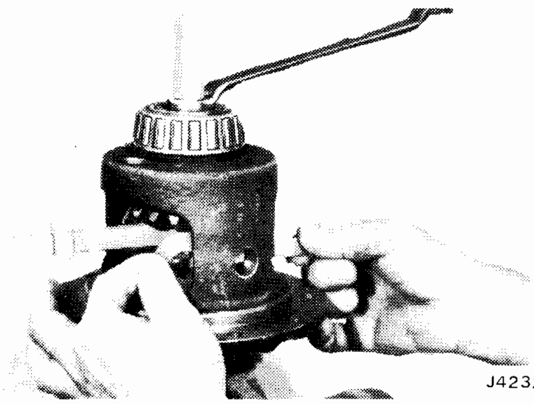

Fig. 10-69 Removing Pinion Thrust Washer

(16) Tighten forcing screw until a slight movement of differential pinion gears is observed.

(17) Insert pawl end of gear rotating tool between teeth of one differential side gear. Pull handle of tool to rotate side gears and pinion gears. Remove pinion gears as they appear in case opening (fig. 10-70).

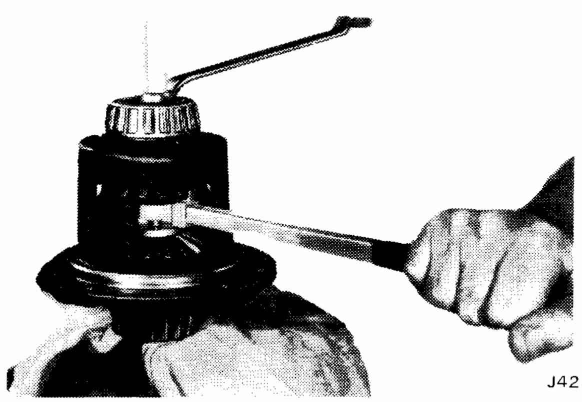

Fig. 10-70 Removing Pinion Gears

NOTE: *It may be necessary to adjust tension applied on Belleville springs by forcing screw before gears can be rotated in case.*

(18) Retain upper side gear and clutch pack in case by holding hand on bottom of rotating tool while removing forcing screw. Remove rotating tool, upper side gear, and clutch pack.

(19) Remove differential case from axle shaft. Invert case with flange or ring gear side up and remove step plate tool, lower side gear, and clutch pack from case. Remove retainer clips from both clutch packs to allow separation of plates and discs (fig. 10-71).

Fig. 10-71 Removing Side Gear and Clutch Pack

Inspection

Clutch Plates and Disc

If any one member of either clutch pack shows evidence of excessive wear or scoring, then complete clutch pack must be replaced on both sides.

Differential Side and Pinion Gears

The gear teeth should be checked for extreme wear or possible cracks. The external teeth of the side gear which holds the clutch pack also should be checked for wear or cracks. If replacement of one gear is required due to wear, etc., then both side gears, pinion gears, and thrust washers are to be replaced.

Pinion Mate Shaft

If excessive wear is evident on any one of the retainer clips, it is suggested that all clips be replaced.

Differential Case

If scoring, wear, or metal pickup is evident on the machined surfaces, then replacement of the case is necessary.

Examples of radial groove clutch plate (A) and the concentric groove disc (B) are shown in figure 10-72.

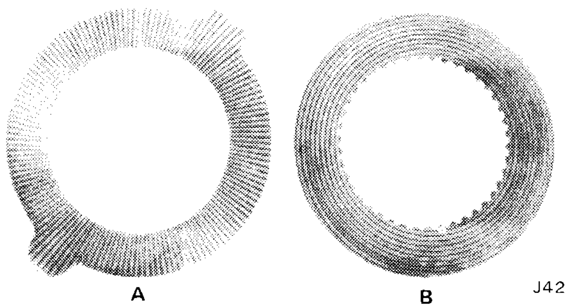

Fig. 10-72 Plate and Disc Identification

ASSEMBLY

(1) Lubricate differential gear teeth, thrust faces and splines. Lubricate clutch discs and plates. Use Trac-Lok lubricant or equivalent only.

(2) Assemble clutch packs. Install plates and discs in same position as when removed regardless of whether they are replacement or original parts.

(3) Install clutch retainer clips on ears of clutch plates. Be sure clutch packs are completely assembled and seated on ears of plates.

(4) Install clutch packs on differential side gears and install assembly in case.

NOTE: *Be sure clutch pack stays assembled on side gear splines and that retainer clips are completely seated in case pockets. To prevent pack from falling out of case, it will be necessary to hold them in place by hand while mounting case on axle shaft (fig. 10-73).*

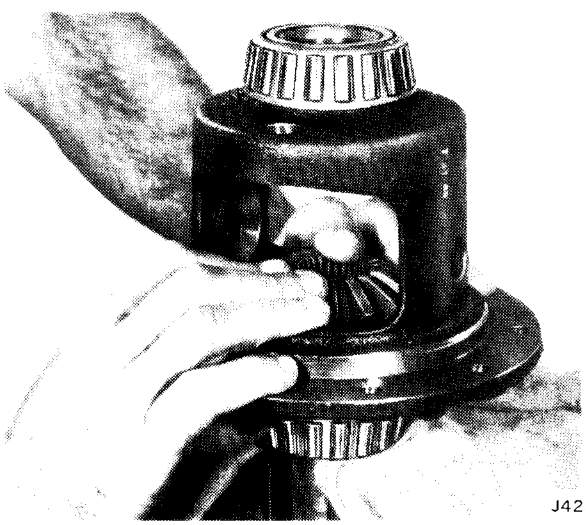

Fig. 10-73 Mounting Differential Case on Axle Shaft

(5) Mount case assembly on axle shaft (fig. 10-73).

CAUTION: *When installing differential case on axle shaft, be sure that splines of side gears are aligned with those of axle shaft. Be sure clutch pack is still properly assembled in case after installing case on axle shaft.*

(6) Install step plate tool in side gear. Apply small daub of grease in centering hole of step plate.

(7) Install remaining clutch pack and side gear. Be sure clutch pack stays assembled on side gear splines and that retainer clips are completely seated in pockets of case (fig. 10-74).

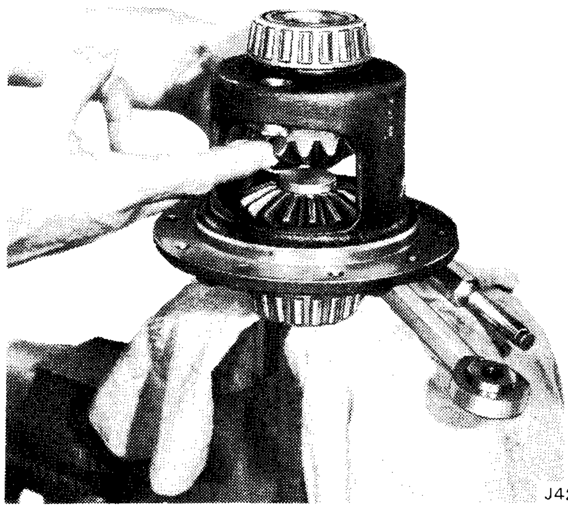

Fig. 10-74 Installing Clutch Pack and Side Gear

(8) Position gear rotating tool in upper side gear.

(9) Keep side gear and rotating tool in position by holding with hand. Insert forcing screw through top of case and thread into rotating tool (fig. 10-75).

(10) Install both differential pinion gears in case. Be sure bores of gears are aligned. Hold gears in place by hand (fig. 10-76).

Fig. 10-75 Threading Forcing Screw into Rotating Tool

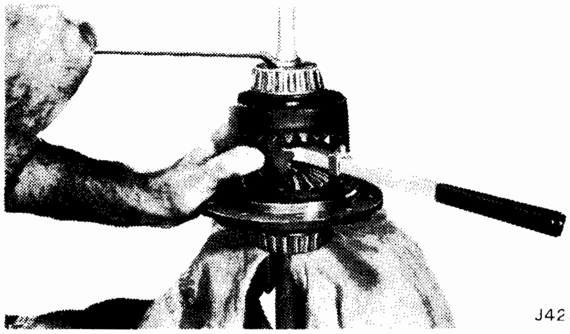

Fig. 10-76 Starting Pinion Gears into Case

(11) Tighten forcing screw to compress Belleville springs and provide clearance between teeth of pinion gears and side gears.

(12) While holding pinion gears in place, insert pawl of rotating tool between teeth of side gear. Pull on handle to rotate gear and allow pinion gears to be installed.

NOTE: *It may be necessary to adjust forcing screw by very slightly loosening or tightening until required load is applied to Belleville springs to allow side and pinion gears to rotate.*

(13) Pull on tool until handle hits gear. Remove pawl from between gear teeth and reposition handle and pawl. Repeat same operation until holes of both pinion gears are aligned with those of case.

(14) Lubricate both sides of pinion gear thrust washers with Trac-Lok lubricant.

(15) Apply torque to forcing screw to allow installation of thrust washers.

(16) Install washers in case. Use small screwdriver to push washers into place (fig. 10-77).

CAUTION: *Be sure holes of washers and gears are aligned with those of case.*

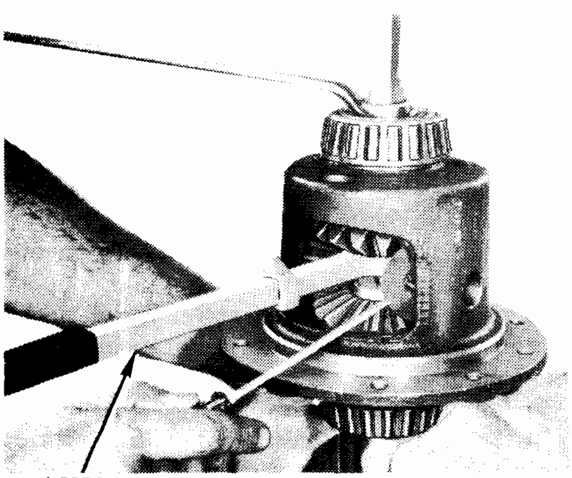

Fig. 10-77 Installing Pinion Gear Thrust Washers

(17) Remove forcing screw, rotating tool, and step plate.

(18) Lubricate pinion mate shaft and install in case using hammer. Be sure snap ring grooves of shaft are exposed to allow assembly of snap rings (fig. 10-78).

(19) Install snap rings.

NOTE: *On Model 60 Trac-Lok, align hole in shaft with hole in case. Drive shaft into position and install retaining roll pin. If case is positioned in vise with machined side of ring gear flange facing upward, use 5/16-inch diameter punch to install roll pin until punch bottoms in case bore. If case is positioned in vise with machined side of ring gear flange facing downward, wrap piece of tape around 3/16-inch diameter punch approximately 1-3/4 inch away from end of punch and install roll pin in case until edge of tape is flush with roll pin bore.*

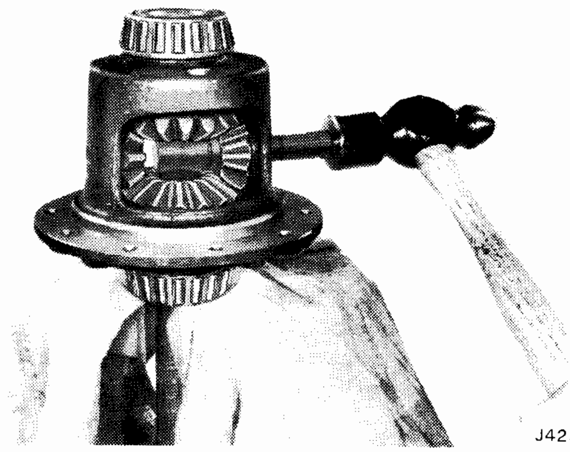

Fig. 10-78 Installing Pinion Mate Shaft

(20) Remove case from axle shaft. Install ring gear on case.

NOTE: *Use new ring gear bolts only. Do not use original bolts.*

(21) Align ring gear bolt holes with those of case. Install ring gear bolts finger-tight.

(22) Mount differential case on axle shaft, and tighten bolts evenly to specified torque (refer to Torque Specifications).

(23) Install Trac-Lok differential assembly in axle housing. Follow service procedures previously outlined for conventional axles to complete differential and axle assembly servicing.

TRAC-LOK ASSEMBLY REPLACEMENT

If inspection reveals that replacement of the Trac-Lok as a unit is required, the following steps should be followed.

(1) Remove differential bearings and shims. Mark or tag each bearing and shim pack to indicate from which side of the case they were removed.

(2) Remove ring gear from case.

(3) Install ring gear on case. Be sure gear flange on differential case is free of nicks or burrs.

(4) Inspect shims and bearings which were removed. If shims and bearings show excessive wear or damage, they should be replaced. Be sure shims and bearings are used on same sides of replacement case as on old case.

(5) Install shims and differential bearings. Use step plate on bottom bearing to protect bearing from damage during installation of upper bearing. Seat bearings, using bearing driver tool.

(6) Lubricate differential bearings with specified lubricant and install case in axle housing.

(7) Follow service procedures previously outlined for conventional axles to complete differential and axle assembly servicing.

PROPELLER SHAFTS AND UNIVERSAL JOINTS

GENERAL

Torque transfer from the transfer case to the front and rear axles is accomplished by means of tubular propeller shafts; each shaft is equipped with a universal joint at each end.

Because of the various combinations of drive line components, several types of propeller shafts are required.

Always check the replacement propeller shaft for correct part number before installation.

Both the propeller shafts and the universal joints should be checked regularly for foreign matter on the shafts, dented or bent shafts, and loose attaching bolts. Refer to Section B—Maintenance for proper lubrication requirements and specifications.

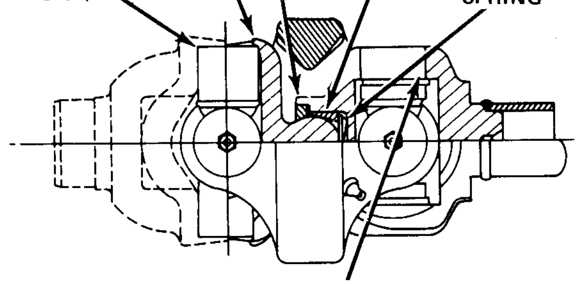

Fig. 10-79 Double Cardan Joint

Universal Joint Service

Each shaft is equipped with a splined slip joint at one end to allow for variations in length caused by vehicle spring action. The yokes at the front and rear of the shaft must be aligned in the same horizontal plane. This is necessary to avoid vibration.

CARDAN CROSS-TYPE UNIVERSAL JOINT

Disassembly

NOTE: *Repair of single and double Cardan joints are similar except for the center ball and socket in the double Cardan joint (fig. 10-79). The rollers and bushings are replaceable once the joint is disassembled.*

(1) Position tube or propeller shaf, near cross-type universal joint, in vise and clamp tightly.

(2) Remove two cup retainer rings, which fasten bearing cups to tube yoke. If necessary, tap ends of bearing cups with brass hammer to release pressure on retainer rings before removal.

(3) Mount joint in vise so that ears on one yoke are supported on vise jaws.

(4) Using brass hammer, strike ear of yoke behind bearing to drive bearing out. Remove opposite bearing in same manner.

(5) Remove cross from yoke.

(6) Disengage and remove tie link from bearing block retainers. Remove retainers and roller bearing cups from cross. Remove bearing seals and seal retainers from cross.

(7) Clean tube yoke of propeller shaft with suitable cleaning solvent and dry thoroughly.

(8) Inspect yoke for wear and damage. If bent out of alignment with propeller shaft tube, or if bearing bores are worn or damaged, replace propeller shaft.

Assembly

(1) If cross of universal joint has not been replaced, install four new seal retainers and bearing seals, one on each arm of cross.

(2) Install two roller bearing cup assemblies, on opposite arms of cross.

(3) Install bearing block retainer on each bearing cup, and connect retainers with tie link to fasten bearings to cross.

(4) Thread remaining arms of cross, which do not carry bearings, into tube yoke.

(5) Position yoke in vise, so that inner surface is supported by vise jaws.

(6) Using brass hammer, tap roller bearing cup assembly into bearing of yoke, so that bearing fits over ends of cross. Drive bearing cup downward until retaining ring groove is fully exposed below yoke inner surface.

(7) Attach bearing to yoke using a retainer ring; be sure retainer ring is properly seated.

(8) Reverse yoke on vise and repeat steps (5) through (7), above, to install opposite bearing assembly.

Torque Specifications

Service Set-To Torques should be used when assembling components.
Service In-Use Recheck Torques should be used for checking a pre-torqued item.

Model 30 Front Axle

	Service Set-To Torques	Service In-Use Recheck Torques
Axle Housing Cover	20	15-25
Differential Bearing Bolts	45	35-50
Drive Gear-to-Case Bolts	55	45-65
Lower Ball Joint Nut	80	—
Pinion Yoke Nut	210	200-220
Universal Joint U-Bolts	15	13-18
Upper Ball Joint Nut	100	—
Upper Ball Stud Seat	50	—
Wheel-to-Hub Nuts	80	65-90

Model 44 Axle
(Full-Floating and Semi-Floating Types)

Axle Housing Cover	20	15-25
Backing Plate Mounting Bolts/Nuts		
Front Brakes	28	25-30
Rear Brakes	30	25-35
Differential Bearing Bolts	80	70-90
Disc Brake Shield Bolt	8	5-10
Disc Brake Shield Nuts	35	30-40
Drive Gear-to-Case Bolts	55	45-65
Lower Ball Joint Nut	80	—
Pinion Yoke Nut	210	200-220
Upper Ball Joint Nut	100	—
Upper Ball Stud Seat	50	—
Universal Joint Flange Bolts	35	25-45
Universal Joint U-Bolts	15	13-18
Wheel-to-Hub Nuts	80	65-90

Model 60 Axle

	Service Set-To Torques	Service In-Use Recheck Torques
Axle Housing Cover Bolts	20	15-25
Backing Plate Mounting Bolts/Nuts	50	45-55
Differential Bearing Bolts	80	70-90
Drive Gear-to-Case Bolts	105	100-110
Pinion Yoke Nut	260	250-270
Universal Joint Flange Bolts	35	25-45
Universal Joint U-Bolts	15	13-18
Wheel-to-Hub Nuts	120	110-125

AMC — Jeep Axle
(Semi-Floating Tapered Shaft)

Axle Cover Screw	170 in-lbs	150-190 in-lbs
Brake Tubing-to-Rear Wheel Brake Cylinder	97 in-lbs	90-105 in-lbs
Differential Bearing Capscrew	87	80-95
Ring Gear-to-Case Screw	105	95-115
Rear Brake Support Plate Screw Nut	32	25-40
Rear Wheel Hub-to-Shaft Nut	250 Min	250 Min
Universal Joint U-Bolt Clamp	13	10-18

All torque values given in foot-pounds with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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Adjustments

Model 30 Front Axle

Differential Bearing Preload . . . . .015 in
Differential Side Gear-to-Case
Clearance . . . . .000-.006 in
Drive Gear-to-Pinion Backlash. . . . . . .005-.009 in
Drive Pinion Bearing Break-
Away Preload
Original Bearings . . . . 15-25 in-lbs
New Bearings . . . . 20-40 in-lbs

Model 44 Axle (Full-Floating and Semi-Floating Types)

Differential Bearing Preload . . . . . . .015 in
Differential Side Gear-to-Case
Clearance . . . . .000-.006 in
Drive Gear-to-Pinion Backlash. . . . . . .005-.010 in
Drive Pinion Bearing Break-
Away Preload
Original Bearings . . . . 10-20 in-lbs
New Bearings . . . . 20-40 in-lbs

Model 60 Axle

Differential Bearing Preload . . . . .015 in
Differential Side Gear-to-Case
Clearance . . . . .000-.006 in

Model 60 Axle (Continued)

Drive Gear-to-Pinion Backlash. . . . . . .005-.009 in
Drive Pinion Bearing Break-Away
Original Bearings . . . . 10-20 in-lbs
New Bearings . . . . 20-40 in-lbs

AMC – Jeep Axle (Semi-Floating Tapered Shaft)

Axle Shaft End Play (Shims—
Left Side Only) . . . . .004-.008 in
(.006 in desired)
Bearing Preload (Collapsible
Sleeve) . . . . 17-18 in-lbs
Differential Bearing Preload
(Shims) . . . . .008 in
Differantial Case Flange
Runout . . . . .002 in max
(Inspection only—no adjustment)
Differential Gear-to-Case
Preload (Adjusted Using
Oversize Thrust Washers) . . . 0-180 in-lbs
Ring Gear-to-Drive Pinion
Gear Backlash (Shims) . . . . .005-.009 in
(.008 in desired)
Pinion Gear Standard
Setting (Shims) . . . . 2.547 in

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Pinion Angle Chart

	Front		Rear	
	OK Range	Set-To	OK Range	Set-To
Wagoneer — Cherokee (Quadra-Trac)	7° to 9°	8°	$1/2^\circ$ to $2\text{-}1/2^\circ$	$1^\circ\text{-}1/2^\circ$
Cherokee (Dana 20)	7° to 9°	8°	6° to 8°	7°
Truck Models 25, 45	7° to 9°	8°	4° to 6°	5°
Truck Models 26, 46	7° to 9°	8°	2° to 4°	3°

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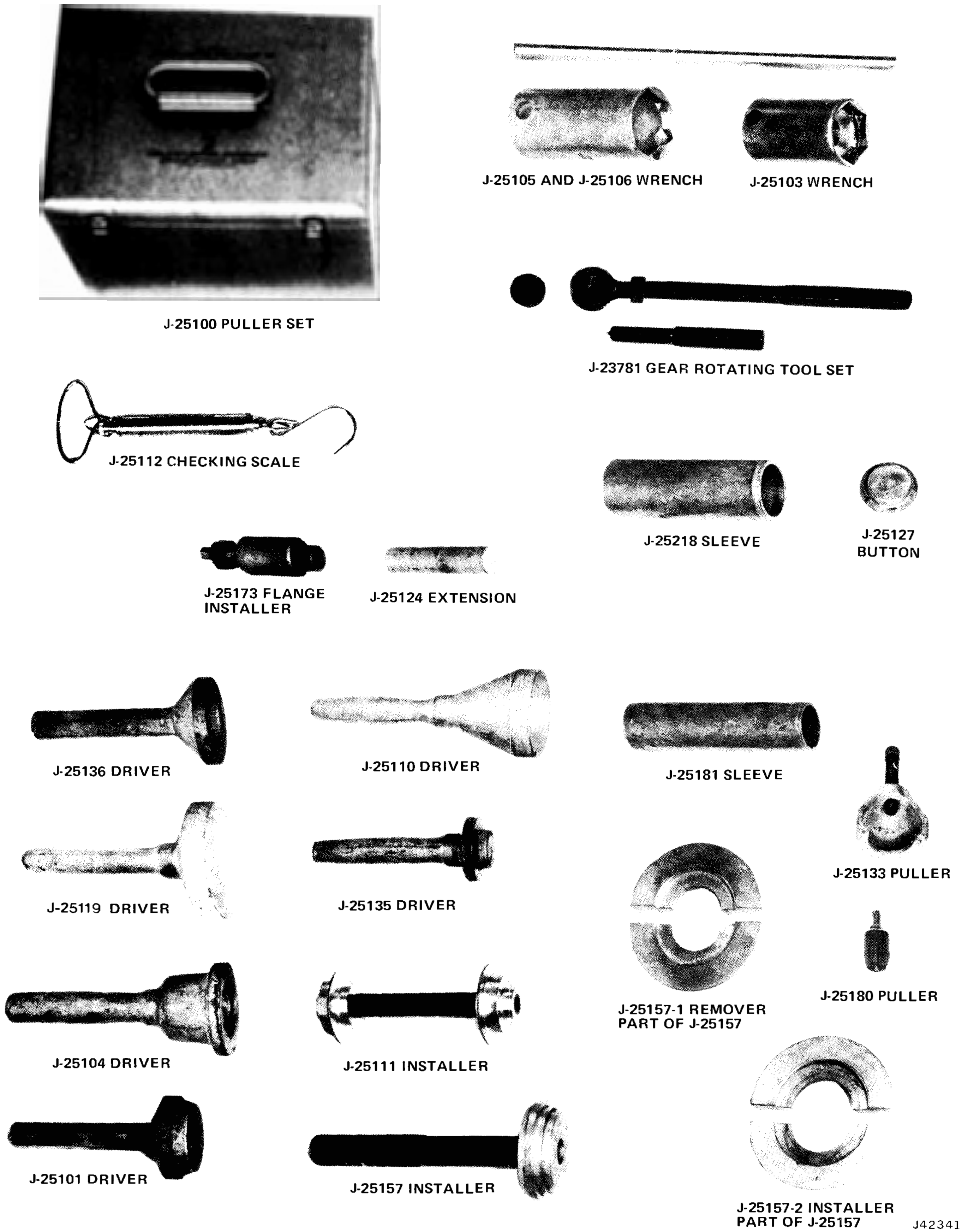

Fig. 10-80 Axle and Propeller Shaft Service Tools (Sheet 1 of 2)

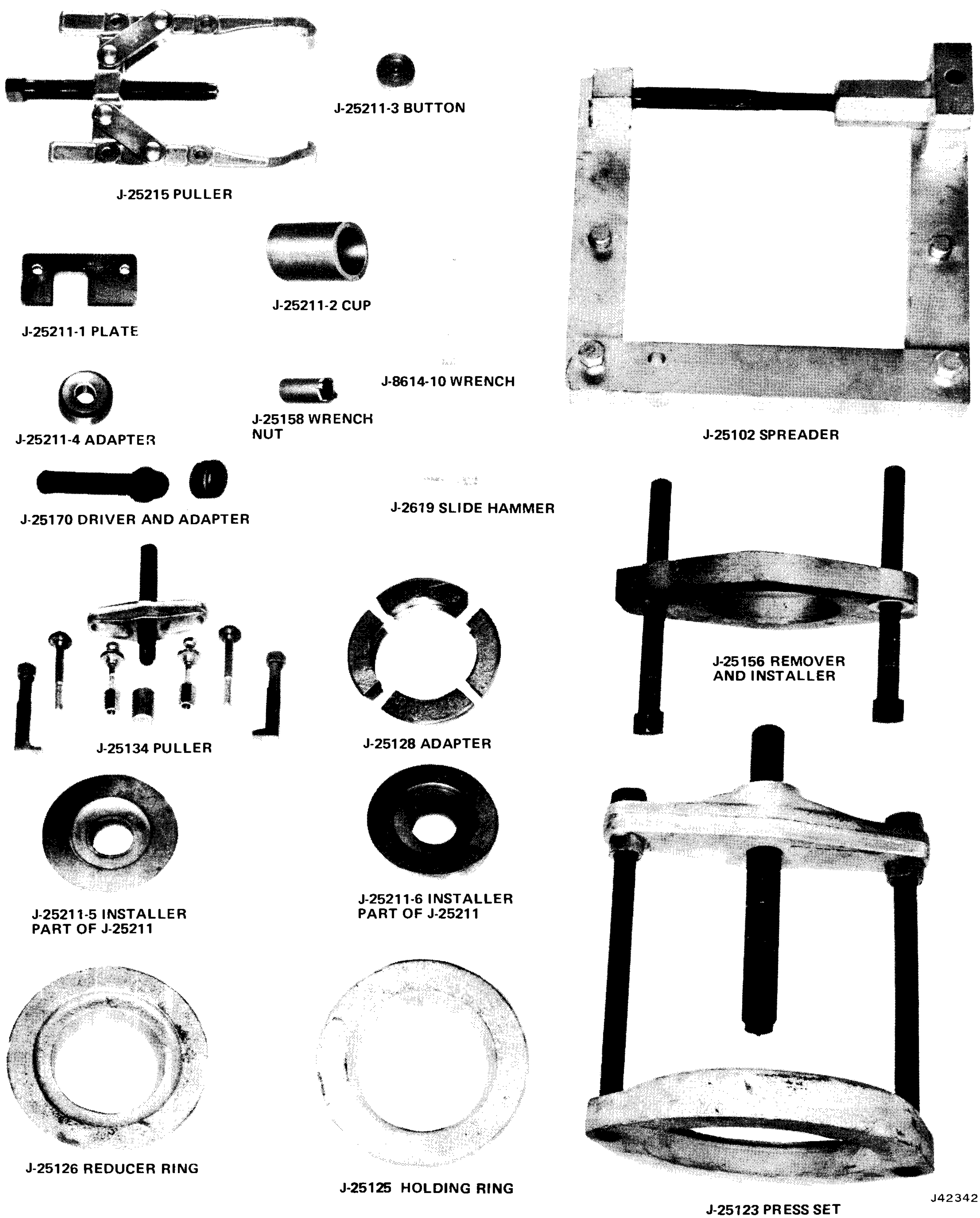

Fig. 10-81 Axle and Propeller Shaft Service Tools (Sheet 2 of 2)

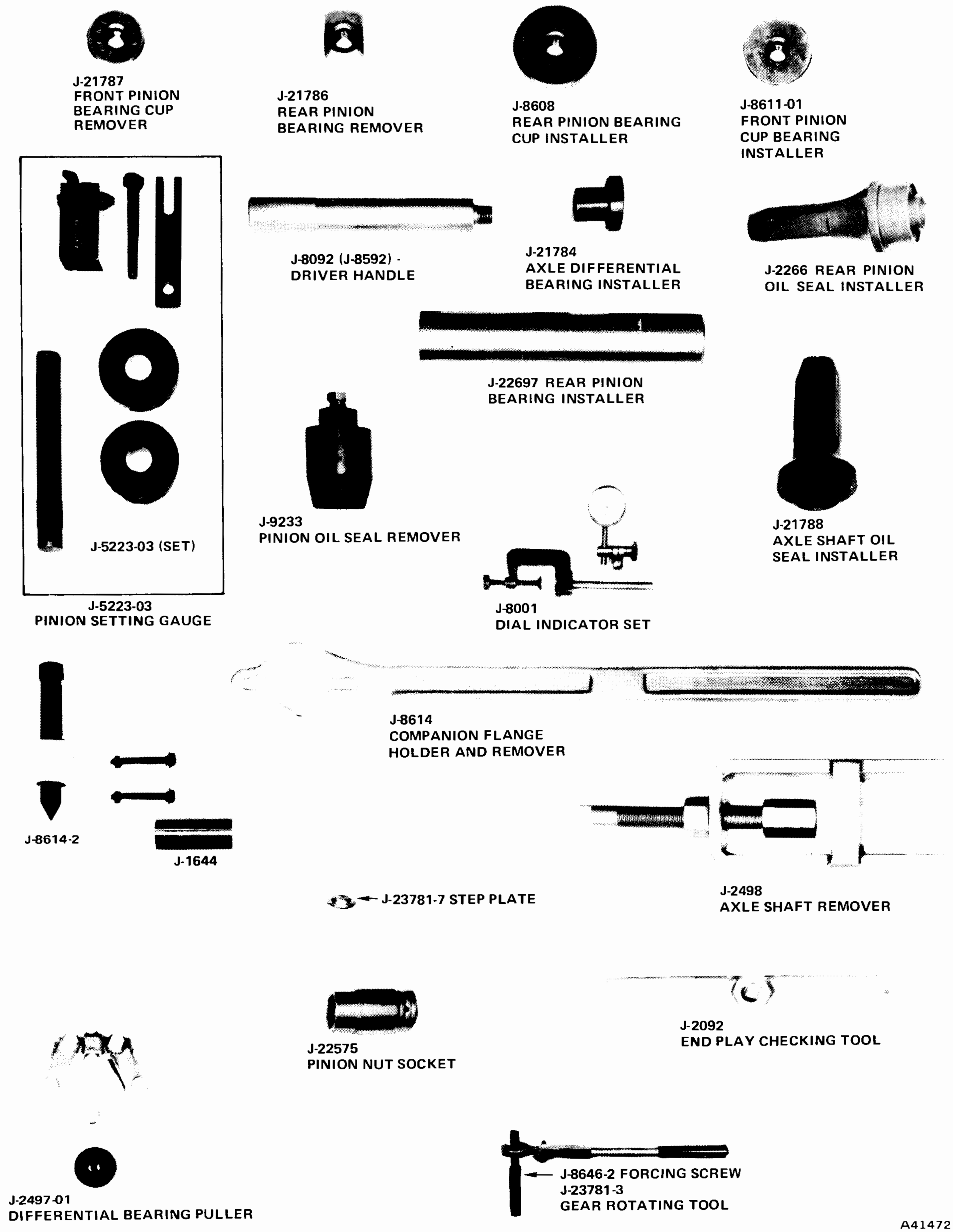

Fig. 10-82 Rear Axle Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

STEERING

STEERING COLUMNS

GENERAL

All models are equipped with an anti-theft, energy-absorbing steering column. The column is designed to compress during a front end collision. The ignition switch and lock cylinder are mounted in the column. When the lock is engaged, the ignition, the steering, and the gearshift mechanisms cannot be operated.

An Adjust-O-Tilt steering column is optionally available on all except CJ models. This column also has the energy-absorbing and anti-theft features.

A center slip-type (telescoping) intermediate shaft is used on all models. It is attached to the steering gear with a flexible-type coupling and to the steering column with a cardan joint.

STEERING COLUMN ALIGNMENT

(1) Loosen two-piece toeboard seal cover and remove lower clamp bracket.

(2) Remove instrument panel lower trim.

(3) Loosen column mounting-bracket-to-instrument-panel attaching bolts.

(4) Pull steering column upward. Maintain upward pressure and tighten instrument-panel-to-column mounting bracket bolts to 20 foot-pounds torque.

(5) Install lower clamp bracket and tighten bolts to 15 foot-pounds torque.

(6) TIghten seal cover bolts to 10 foot-pounds torque.

(7) Install instrument panel lower trim.

(8) On vehicles with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.

STEERING WHEEL REMOVAL

CJ Models

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove rubber boot and horn button from steering wheel. Rotate button until lock tabs on button align with notches in contact cup and pull upward to remove.

(4) Remove steering wheel nut and washer.

NOTE: *If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.*

(5) Remove plastic horn contact cup retainer and remove horn contact cup and contact plate from steering wheel.

(6) Remove horn contact pin and bushing from steering wheel.

(7) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

(8) Remove steering wheel using Puller J-21232.

Cherokee-Wagoneer-Truck Models

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove horn cover attaching screws from underside of steering wheel and remove horn cover.

NOTE: *If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.*

Service Diagnosis—All Columns

Lock System

Condition	Possible Cause	Correction
WILL NOT UNLOCK	(1) Sector stripped.	(1) Replace sector.
	(2) Lock bolt damaged.	(2) Replace lock bolt.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Damaged housing.	(4) Replace housing.
	(5) Damaged sector.	(5) Replace sector.
	(6) Damaged rack.	(6) Replace rack.
	(7) Shear flange on sector shaft collapsed (tilt column).	(7) Replace sector.
WILL NOT LOCK	(1) Lockbolt spring broken or defective.	(1) Replace lock bolt spring.
	(2) Damaged sector tooth.	(2) Replace sector.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Burr on lock bolt or housing.	(4) Remove burr.
	(5) Damaged housing.	(5) Replace housing.
	(6) Damaged rack.	(6) Replace rack.
	(7) Ignition switch stuck.	(7) Replace ignition switch.
	(8) Actuator rod restricted.	(8) Remove restriction.
	(9) Transmission gearshift linkage adjustment incorrect.	(9) Adjust linkage.
	(10) Sector installed incorrectly.	(10) Install correctly.
	(11) Interference between bowl (shroud) and remote rod (tilt column).	(11) Replace bowl (shroud) or remote rod as required.
HIGH EFFORT	(1) Lock cylinder defective.	(1) Replace lock cylinder.
	(2) Ignition switch defective.	(2) Replace ignition switch.
	(3) Rack preload spring broken or deformed.	(3) Replace preload spring.
	(4) Burrs on sector, rack, housing, support or actuator rod coupling.	(4) Remove burr.

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Lock System (Continued)

Condition	Possible Cause	Correction
HIGH EFFORT (Continued)	(5) Bent sector shaft.	(5) Replace shaft.
	(6) Defective rack.	(6) Replace rack.
	(7) Remote rod restricted.	(7) Remove restriction.
	(8) Bent remote rod.	(8) Straighten or replace.
	(9) Ignition switch mounting bracket bent.	(9) Straighten or replace.
	(10) Extreme misalignment of housing to cover (tilt column).	(10) Replace either or both.
	(11) Distorted coupling slot in rack (tilt column).	(11) Replace rack.
WILL STICK IN "START"	(1) Remote rod deformed.	(1) Straighten or replace.
	(2) Any high effort condition.	(2) Check items under high effort.
KEY CANNOT BE REMOVED IN "OFF-LOCK"	(1) Ignition switch is not set correctly.	(1) Readjust.
	(2) Defective lock cylinder.	(2) Replace lock cylinder.
LOCK CYLINDER CAN BE REMOVED WITHOUT DEPRES-SING RETAINER	(1) Lock cylinder with defective retainer.	(1) Replace lock cylinder.
	(2) Lock cylinder retainer missing.	(2) Replace lock cylinder.
	(3) Burr over retainer slot in housing cover.	(3) Remove burr.
HIGH EFFORT ON LOCK CYLINDER BETWEEN "OFF" AND "OFF-LOCK"	(1) Distorted rack.	(1) Replace rack.
	(2) Burr on tang of shift gate (automatic column).	(2) Remove burr.
	(3) Linkage not adjusted.	(3) Adjust linkage.
LOCK BOLT HITS SHAFT LOCK IN "OFF" POSITION	(1) Ignition switch is not adjusted correctly (all except tilt column).	(1) Adjust ignition switch.

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Ignition System

Condition	Possible Cause	Correction
ELECTRICAL SYSTEM WILL NOT FUNCTION	(1) Poor battery connection.	(1) Connect securely.
	(2) Connector body loose or defective.	(2) Tighten or replace.
	(3) Defective wiring.	(3) Repair or replace.
	(4) Defective ignition switch.	(4) Replace ignition switch.
	(5) Ignition switch not adjusted properly.	(5) Adjust switch.
SWITCH WILL NOT ACTUATE MECHANICALLY	(1) Defective ignition switch.	(1) Replace switch.
SWITCH CANNOT BE ADJUSTED CORRECTLY	(1) Switch remote rod deformed.	(1) Repair, straighten or replace.
	(2) Sector to rack engaged in wrong tooth.	(2) Engage correctly.

Column

Condition	Possible Cause	Correction
NOISE IN COLUMN	(1) Coupling bolts not tightened.	(1) Tighten pinch bolts to 30 ft.-lbs. torque.
	(2) Column not correctly aligned.	(2) Align column.
	(3) Coupling pulled apart.	(3) Align column and replace coupling.
	(4) Broken lower joint.	(4) Repair or replace joint and align column.
	(5) Horn contact ring not lubricated.	(5) Lubricate with multi-purpose grease.
	(6) Lack of grease on bearings or bearing surfaces.	(6) Lubricate with multi-purpose grease.
	(7) Lower shaft bearing worn or broken.	(7) Replace bearing. Check shaft and replace if scored.
	(8) Upper shaft bearing worn or broken.	(8) Replace bearing assembly.
	(9) Shaft lock plate cover loose.	(9) Tighten three screws to 15 in.-lbs. torque, or if missing, replace. CAUTION: Use specified screws only.

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Column (Continued)

Condition	Possible Cause	Correction
NOISE IN COLUMN (Continued)	(10) Shaft lock retaining ring not seated.	(10) Replace snap ring. Check for proper seating in groove.
	(11) One click when in "off-lock" position and the steering wheel is moved (all except automatic column).	(11) Normal—lock bolt is seating.
	(12) Loose sight shields (all except automatic column).	(12) Bend to eliminate rattle.
HIGH STEERING SHAFT EFFORT	(1) Column misaligned.	(1) Align column.
	(2) Defective upper or lower bearing.	(2) Replace as required.
	(3) Tight steering universal joint (tilt column only).	(3) Repair or replace.
	(4) Flash on I.D. of shift tube at plastic joint (tilt column only).	(4) Replace shift tube.
	(5) Frozen upper or lower bearings (all except manual column).	(5) Replace bearings.
MISCELLANEOUS	(1) Shroud loose on shift bowl. Housing loose on jacket—will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	(1) Bends on shroud over lugs on bowl. Tighten four mounting screws to 60 in.-lbs. torque.
LASH IN MOUNTED COLUMN ASSEMBLY	(1) Instrument panel bracket mounting bolts loose.	(1) Tighten to 20 ft.-lbs. torque.
	(2) Broken weld nuts on jacket.	(2) Replace jacket assembly.
	(3) Column bracket capsule sheared.	(3) Replace bracket assembly.
	(4) Column bracket to jacket mounting bolts loose.	(4) Tighten to 20 ft.-lbs. torque.
	(5) Loose lock shoes in housing (tilt column only).	(5) Replace shoes.
	(6) Loose tilt head pivot pins (tilt column only).	(6) Replace pivot pins.
	(7) Loose lock shoe pin in support (tilt column only).	(7) Replace pin.
	(8) Loose support screws (tilt column only).	(8) Tighten to 60 in.-lbs. torque.

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Column (Continued)

Condition	Possible Cause	Correction
STEERING WHEEL UPPER HOUSING LOOSE (TILT COLUMN ONLY)	(1) Excessive clearance between holes in support or housing and and pivot pin diameters.	(1) Replace eighter or both.
	(2) Defective or missing anti-lash spring in centering spheres.	(2) Add spring or replace both spheres.
	(3) Upper bearing not seating in housing.	(3) Replace bearing and housing.
	(4) Upper bearing inner race seat missing.	(4) Install seat.
	(5) Loose support screws.	(5) Tighten to 60 in.-lbs. torque.
	(6) Bearing preload spring missing or broken.	(6) Replace preload spring.
STEERING WHEEL LOOSE—EVERY OTHER TILT POSITION (TILT COLUMN ONLY)	(1) Loose fit between lock shoe and shoe pivot pin.	(1) Replace lock shoes and pivot pin.
STEERING COLUMN NOT LOCKING IN ANY TILT POSITION (TILT COLUMN ONLY)	(1) Shoe seized on its pivot pin.	(1) Replace both.
	(2) Shoe grooves may have burrs or dirt.	(2) Replace shoe.
	(3) Shoe lock spring weak or broken.	(3) Replace lock spring.
STEERING WHEEL FAILS TO RETURN TO TOP TILT POSITION (TILT COLUMN ONLY)	(1) Pivot pins are bound up.	(1) Replace pivot pins.
	(2) Wheel tilt spring is defective.	(2) Replace tilt spring.
	(3) Turn signal switch wires too tight (improperly routed).	(3) Adjust position of wires.
NOISE WHEN TILTING COLUMN (TILT COLUMN ONLY)	(1) Upper tilt bumpers worn.	(1) Replace tilt bumper.
	(2) Tilt spring rubbing in housing.	(2) Lubricate with multi-purpose grease.
ONE CLICK WHEN IN "OFF-LOCK" POSITION AND THE STEERING WHEEL IS MOVED	(1) Seating of lock bolt.	(1) None. Click is normal characteristic sound produced by lock bolt as it seats.

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Column (Continued)

Condition	Possible Cause	Correction
HIGH SHIFT EFFORT (AUTOMATIC AND TILT COLUMN ONLY)	(1) Column not aligned correctly in car.	(1) Align.
	(2) Lower bowl bearing not aligned correctly.	(2) Assemble correctly.
	(3) Lack of grease on seal or bearing areas.	(3) Lubricate.
IMPROPER TRANSMISSION SHIFTING (AFTER ANY NECESSARY CORRECTIONS, THE NEUTRAL START SWITCH IS TO BE CHECKED AND ADJUSTED AS REQUIRED) (AUTOMATIC AND TILT COLUMN ONLY)	(1) Sheared shift tube joint.	(1) Replace shift tube assembly.
	(2) Improper transmission gearshift	(2) Adjust linkage.
	(3) Loose lower shift lever.	(3) Replace shift tube assembly.
	(4) Improper shift gate.	(4) Replace with correct part.
TURN SIGNAL WILL NOT CANCEL	(1) Loose switch mounting screws.	(1) Tighten to specified torque (25 in.-lbs.).
	(2) Switch or anchor bosses broken.	(2) Replace switch.
	(3) Broken, missing or out of position detent, return or cancelling spring.	(3) Reposition springs or replace switch as required.
	(4) Uneven or incorrect cancelling cam to cancelling spring interference. .120 in/side.	(4) Adjust switch position. (a) If interference is correct and switch will still not cancel, replace switch. (b) If interference cannot be corrected by switch adjustment, replace cancelling cam or switch.

Turn Signal

Condition	Possible Cause	Correction
TURN SIGNAL DIFFICULT TO OPERATE	(1) Turn signal lever loose.	(1) Tighten mounting screw (12 in.-lbs.).
	(2) Yoke broken or distorted.	(2) Replace switch.
	(3) Loose or misplaced springs.	(3) Reposition springs or replace switch.
	(4) Foreign parts and/or materials.	(4) Remove foreign parts and/or material.
	(5) Switch mounted loosely.	(5) Tighten mounting screws (25 in.-lbs.).

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Turn Signal (Continued)

Condition	Possible Cause	Correction
TURN SIGNAL WILL NOT INDICATE LANE CHANGE	(1) Broken lane change pressure pad or spring hanger.	(1) Replace switch.
	(2) Broken, missing or misplaced lane change spring.	(2) Replace or reposition as required.
	(3) Jammed base or wires.	(3) Loosen mounting screws, reposition base or wires and retighten screws (25 in.-lbs).
TURN SIGNAL WILL NOT STAY IN TURN POSITION	(1) Foreign material or loose parts impeding movement of yoke.	(1) Remove material and/or parts.
	(2) Broken or missing detent or cancelling springs.	(2) Replace switch.
	(3) None of the above.	(3) Replace switch.
HAZARD SWITCH CANNOT BE TURNED OFF	(1) Foreign material between hazard support cancelling leg and yoke.	(1) Remove foreign material. (a) No foreign material impeding function of hazard switch—replace turn signal switch.
HAZARD SWITCH WILL NOT STAY ON OR DIFFICULT TO TURN OFF	(1) Loose switch mounting screws.	(1) Tighten mounting screws (25 in.-lbs.).
	(2) Interference with other components.	(2) Remove interference.
	(3) Foreign material.	(3) Remove foreign material.
	(4) None of the above.	(4) Replace switch.
NO TURN SIGNAL LIGHTS	(1) Defective or blown fuse.	(1) Replace fuse.
	(2) Inoperative turn signal flasher.	(2) Replace turn signal flasher.
	(3) Loose chassis to column connector.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand. If vehicle lights now operate normally, signal switch is inoperative.	(4) Replace signal switch.
	(5) If vehicle lights do not operate check chassis wiring for opens, grounds, etc.	(5) Repair chassis wiring as required.

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Turn Signal (Continued)

TURN INDICATOR LIGHTS (ON INSTRUMENT PANEL) ON, BUT NOT FLASHING	(1) Inoperative turn flasher.	(1) Replace turn flasher. Note: There are two flashers in the system. Consult manual for location.
	(2) Loose chassis to column connection.	(2) Connect securely.
	(3) Burned out or damaged front or rear turn signal bulb.	(3) Replace bulb.
	(4) Inoperative turn signal switch.	(4) Replace turn signal switch.
	(5) To determine if turn signal switch is defective, substitute new switch into circuit and operate switch by hand. If the vehicle's lights operate normally, signal switch in inoperative.	(5) Replace signal switch.
	(6) If the vehicle's lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc.	(6) Repair chassis wiring as required using manual as guide.
FRONT OR REAR TURN SIGNAL LIGHTS NOT FLASHING	(1) Burned out or damaged turn signal bulb.	(1) Replace bulb.
	(2) High resistance connection to ground at bulb socket.	(2) Remove or repair defective connection.
	(3) Loose chassis to column connector.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system and operate switch by hand. If turn signal lights are now on and flash, turn signal switch is inoperative.	(4) Replace turn signal switch.
	(5) If vehicle lights do not operate, check chassis wiring harness to light sockets for opens, grounds, etc.	(5) Repair chassis wiring as required using manual as guide.

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Turn Signal (Continued)

Condition	Possible Cause	Correction
STOP LIGHT NOT ON WHEN TURN INDICATED	(1) Loose column to chassis connection.	(1) Connect securely.
	(2) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If brake lights work with switch in the turn position, signal switch is defective.	(2) Replace signal switch.
	(3) If brake lights do not work check connector to stop light sockets for grounds, opens, etc.	(3) Repair connector to stop light circuits using service manual as guide.
TURN INDICATOR PANEL LIGHTS NOT FLASHING	(1) Burned out bulbs.	(1) Replace bulbs.
	(2) High resistance to ground at bulb socket.	(2) Replace socket.
	(3) Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights.	(3) Locate and repair as required. Use service manual as guide.
TURN SIGNAL LIGHTS FLASH VERY SLOWLY	(1) Inoperative turn signal flasher.	(1) Replace turn signal flasher.
	(2) System charging voltage low.	(2) Increase voltage to specified. Use service manual.
	(3) High resistance ground at light sockets.	(3) Repair high resistance grounds at light sockets.
	(4) Loose chassis to column connection.	(4) Connect securely.
	(5) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If flashing occurs at normal rate, the signal switch is defective.	(5) Replace signal switch.
	(6) If the flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for grounds, high resistance points, etc.	(6) Locate and repair as required. Use service manual as guide.

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Turn Signal (Continued)

Condition	Possible Cause	Correction
HAZARD SIGNAL LIGHTS WILL NOT FLASH—TURN SIGNAL FUNCTIONS NORMALLY	(1) Blown fuse.	(1) Replace fuse.
	(2) Inoperative hazard warning flasher.	(2) Replace hazard warning flasher in fuse panel.
	(3) Loose chassis to column connection.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system without removing old. Depress the hazard warning lights. If they now work normally, the turn signal switch is defective.	(4) Replace the turn signal switch.
	(5) If the lights do not flash, check wiring harness "K" lead for open between hazard flasher and connector. If open, fuse block is defective.	(5) Repair or replace brown wire or connector as required.

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(4) Disconnect horn wire from switch in steering wheel cavity. Gently pull and wiggle connector to remove.

(5) Remove steering wheel nut and connector.

(6) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

(7) Remove steering wheel using Puller J-25115 (fig. 11-1).

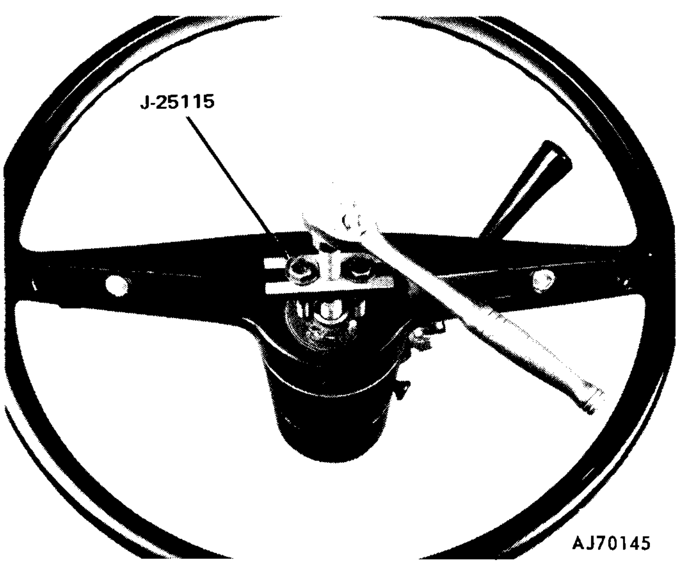


Fig. 11-1 Steering Wheel Removal—Typical

STEERING WHEEL INSTALLATION

CJ Models

(1) Align paint or scribe marks on steering wheel and steering shaft and install steering wheel.

(2) Install horn contact pin and bushing in steering wheel. Be sure bushing is seated fully.

(3) Assemble contact plate, horn contact cup, and plastic horn contact cup retainer. Install assembled parts in steering wheel and install attaching screws.

(4) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(5) Install rubber boot and horn button on steering wheel.

(6) Connect battery negative cable.

Cherokee-Wagoneer-Truck Models

(1) Align paint or scribe marks on steering shaft and steering wheel and install steering wheel.

(2) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(3) Connect horn wire to switch in steering wheel.

(4) Install steering wheel horn cover.

NOTE: *If equipped with sport style wheel, install horn contact ring, button retaining ring, washer and nut, and button.*

(5) Connect battery negative cable.

STEERING COLUMN REMOVAL

CAUTION: *When removed from the vehicle, handle the column with special care. Sharp blows on the end of the steering shaft or shift levers, leaning on the column assembly, or dropping the assembly could shear or loosen the plastic fasteners that maintain column rigidity.*

(1) Disconnect battery negative cable.
(2) Disconnect steering column wiring connectors from wiring harness and ignition switch.

NOTE: *Steering wheel does not have to be removed to remove steering column.*

(3) Scribe alignment marks on steering shaft and universal joints for assembly reference.
(4) Disconnect steering column gearshift linkage from shift lever on automatic column shift models.
(5) Remove column to toeboard parts.
(6) Remove lower instrument panel trim, steering column bezel, left side air conditioning duct (if equipped), and column-to-instrument panel bracket stud nuts (or bolts).
(7) Remove bracket-to-column bolts and remove column mounting bracket.

CAUTION: *Set bracket aside to protect breakaway capsules.*

NOTE: *Bracket capsules are slotted to permit column movement for adjustment.*

(8) Remove column from vehicle.

STEERING COLUMN INSTALLATION

WARNING: *Use only specified screws, bolts, and nuts when servicing the column, and tighten only to the specified torque to maintain the energy-absorbing (compression) action of the steering column. Bolts longer than specifications must not be used as they may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must be tightened to the proper torque so that the bracket will break away under impact.*

(1) Attach column mounting bracket to column. Tighten bolts to 15 foot-pounds torque.

CAUTION: *Do not use substitute bolts. Position column and loosely attach column to instrument panel with rear attaching studs at mounting bracket. Be sure that column instrument panel mounting is never unsupported when either dash mounting or gear mounting is connected.*

(2) Align scribe marks on steering shaft and universal joints. Install universal joint pinch bolt. Tighten pinch bolt to 30 foot-pounds torque.
(3) Pull steering column upward. Maintain upward pressure and tighten column mounting bracket-to-instrument panel attaching nuts to 20 foot-pounds torque.

CAUTION: *Do not overtighten bolts and nuts. Correct torque on bolts and nuts is necessary to ensure breakaway action of column bracket and capsules.*

(4) Install toeboard parts.
(5) Connect all electrical components and check for proper operation.
(6) Install instrument panel trim, steering column bezel, and left side air conditioning duct (if equipped).
(7) On vehicle with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.
(8) Connect battery negative cable.

STEERING COLUMN—MANUAL TRANSMISSION

Disassembly

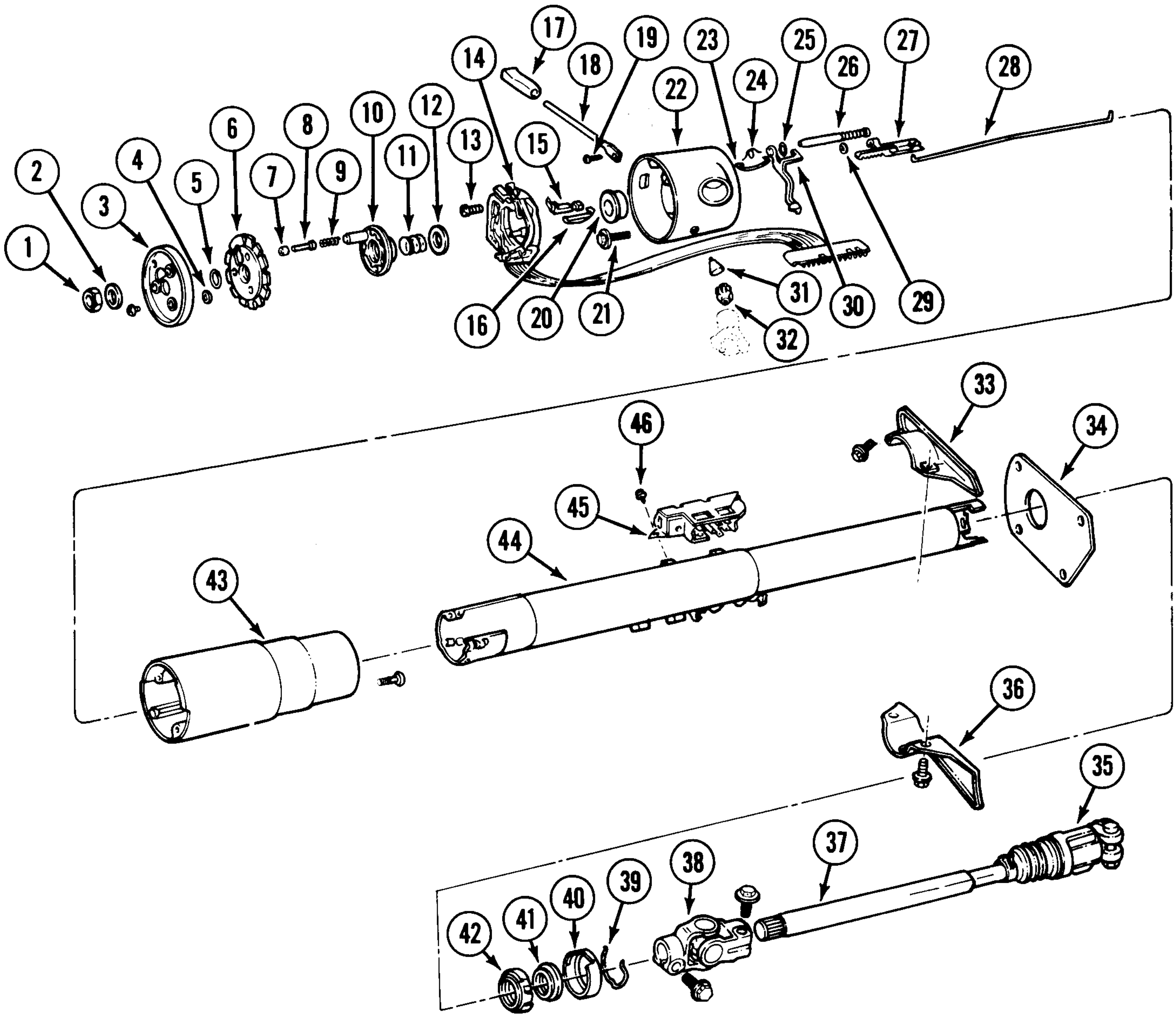
Column removal is not necessary if only the anti-theft cover lock plate and snap ring, cancelling cam turn signal switch, buzzer switch, upper bearing spring, or lock cylinder are to be serviced (fig. 11-2). The column must be removed in order to service any of the remaining components.

If the column is removed, remove the column-to-instrument panel mounting bracket (fig. 11-3), install Support Fixture J-23074 (fig. 11-4), and mount column in vise by clamping flange of support fixture in vise.

(1) Place front wheels in straight-ahead position. Disconnect battery negative cable.
(2) Cover painted areas of column.
(3) Remove steering wheel.
(4) Loosen anti-theft cover retaining screws and lift cover from column (fig. 11-5). It is not necessary to completely remove these screws as they are held on cover by plastic retainers.
(5) Use Lock Plate Compressor Tool J-23653 to compress lock plate and unseat round wire snap ring from steering wheel shaft groove (fig. 11-6).

WARNING: *Lock plate is under strong spring tension.*

(6) Remove lock plate compressor tool.
(7) Remove snap ring, lock plate, turn signal canceling cam, upper bearing preload spring, and thrust washer from steering shaft.



1. STEERING WHEEL NUT
2. WASHER
3. ANTI-THEFT COVER
4. ANTI-THEFT COVER SCREW RETAINER (3)
5. STEERING SHAFT SNAP RING
6. LOCKPLATE
7. BUSHING
8. HORN CONTACT PIN
9. SPRING
10. CANCELLING CAM
11. UPPER BEARING PRELOAD SPRING
12. THRUST WASHER
13. TURN SIGNAL SWITCH SCREW (3)
14. TURN SIGNAL SWITCH
15. BUZZER SWITCH
16. BUZZER SWITCH SPRING
17. TURN SIGNAL LEVER KNOB
18. TURN SIGNAL LEVER
19. TURN SIGNAL LEVER SCREW
20. UPPER BEARING
21. HOUSING RETAINING SCREW (4)
22. HOUSING
23. RACK PRELOAD SPRING
24. KEY RELEASE LEVER SPRING
25. WAVE WASHER
26. LOCK BOLT
27. LOCK RACK
28. REMOTE ROD
29. SPRING WASHER
30. KEY RELEASE LEVER
31. HAZARD WARNING SWITCH KNOB
32. SECTOR
33. TOE PLATE (UPPER HALF)
34. SEAL
35. INTERMEDIATE SHAFT COUPLING
36. TOE PLATE (LOWER HALF)
37. INTERMEDIATE SHAFT
38. INTERMEDIATE SHAFT-TO-STEERING SHAFT U-JOINT
39. SNAP RING
40. RETAINER
41. LOWER BEARING
42. LOWER BEARING ADAPTER
43. SHROUD
44. JACKET
45. IGNITION SWITCH
46. IGNITION SWITCH SCREW (2)

Fig. 11-2 Steering Column—Manual Transmission

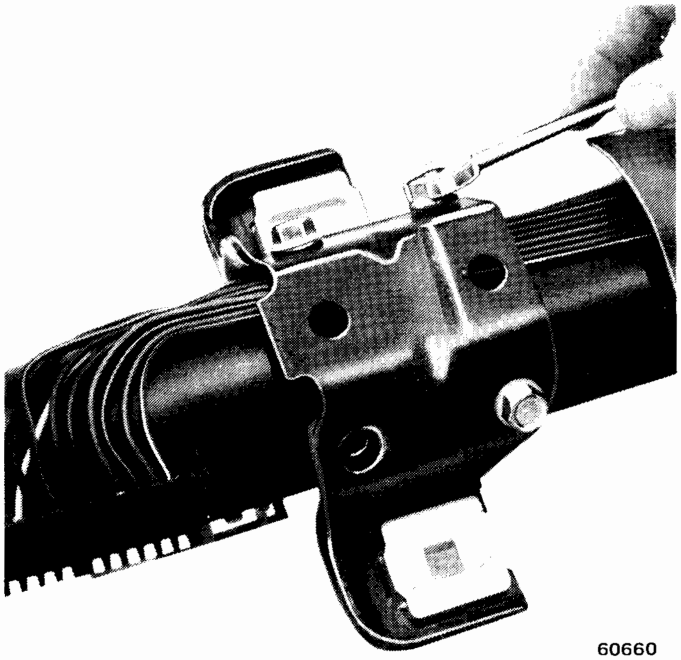


Fig. 11-3 Removing-Installing Mounting Bracket

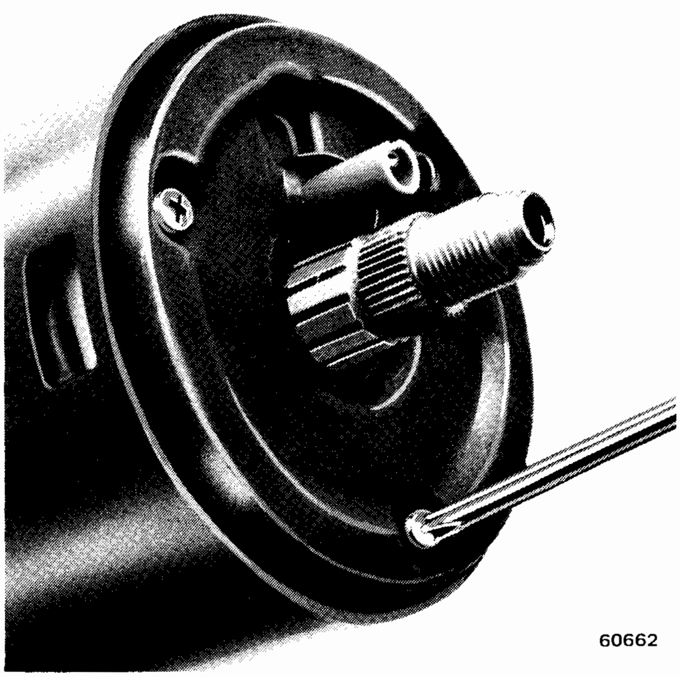


Fig. 11-5 Removing Anti-Theft Cover

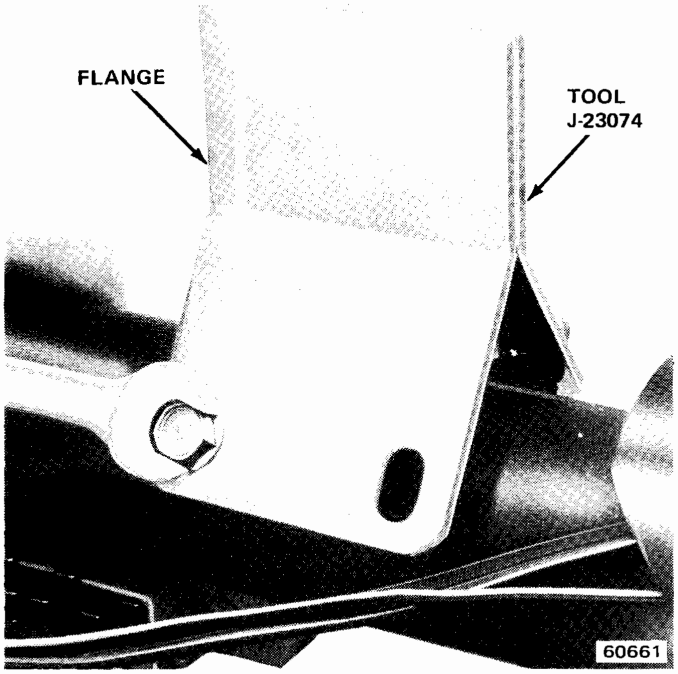


Fig. 11-4 Attaching Support Fixture

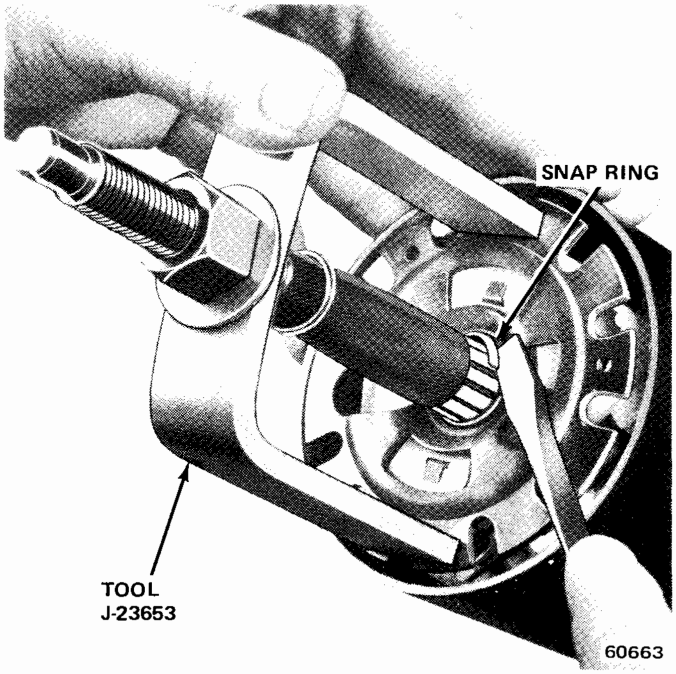


Fig. 11-6 Removing Lock Plate Snap Ring

NOTE: *Steering shaft is now free in column. During bench overhaul, remove steering shaft by pulling out from lower end of column. If column is out of vehicle, do not allow shaft to fall out of column when snap ring is removed.*

(8) Push hazard warning switch knob in, unthread knob, and remove from column.

(9) Remove turn signal lever attaching screw and remove lever. Remove column-to-instrument panel bracket.

(10) Unhook turn signal switch wire harness connector from bracket at lower end of column (under instrument panel). Unhook plastic lock tab and disconnect signal switch harness from instrument panel harness (fig. 11-7). Wrap tape around harness connector to prevent snagging during removal.

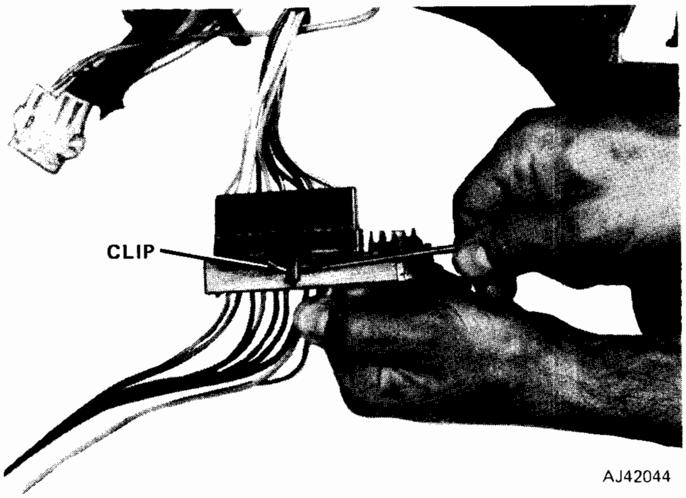


Fig. 11-7 Disconnecting Signal Switch Harness

(11) Remove three screws that attach turn signal switch to housing and remove switch. Pull switch and harness straight up and out of housing (fig. 11-8).

(12) Remove buzzer switch and spring from housing as assembly. Use needlenose pliers or straightened paper clip with 90° bend in it to remove spring and switch (fig. 11-9). Insert bent end of clip in spring and pull upward to remove spring and switch.

(13) Place ignition key in run position. Depress lock cylinder retaining tab using thin-bladed screwdriver and remove lock cylinder from column. Lock cylinder retaining tab is accessible through slot adjacent to turn signal switch mounting boss (fig. 11-10).

NOTE: *If retaining tab is not visible through slot, scrape or knock flashing out of slot to provide access.*

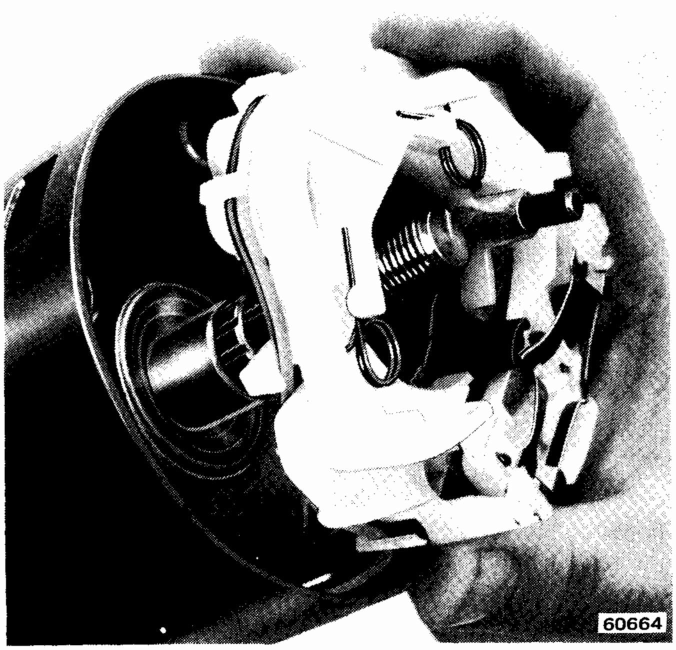


Fig. 11-8 Removing-Installing Turn Signal Switch

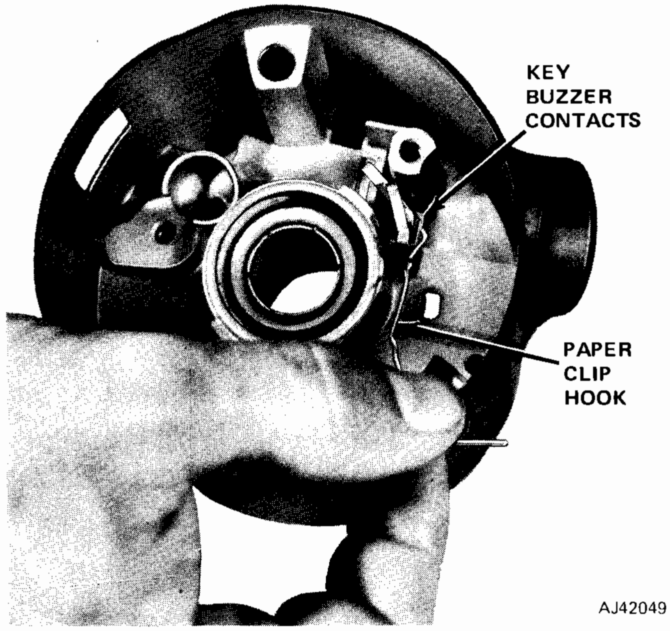


Fig. 11-9 Removing Buzzer Switch and Spring

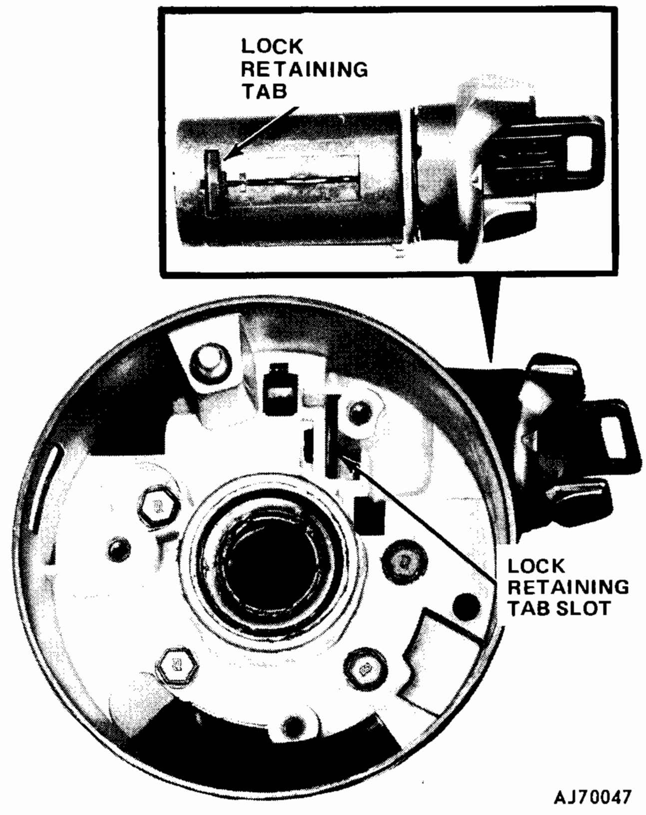


Fig. 11-10 Lock Cylinder Retainer Tab Location

(14) Remove ignition switch from jacket (fig. 11-11).

(15) Remove four screws attaching housing and shroud to jacket (fig. 11-12) and remove housing and shroud.

(16) Disengage remote rod from rack.

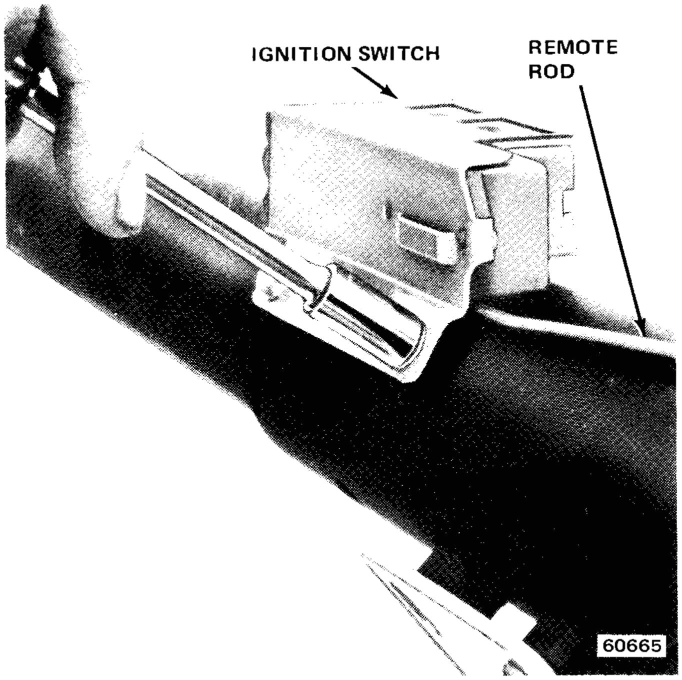


Fig. 11-11 Removing-Installing Ignition Switch

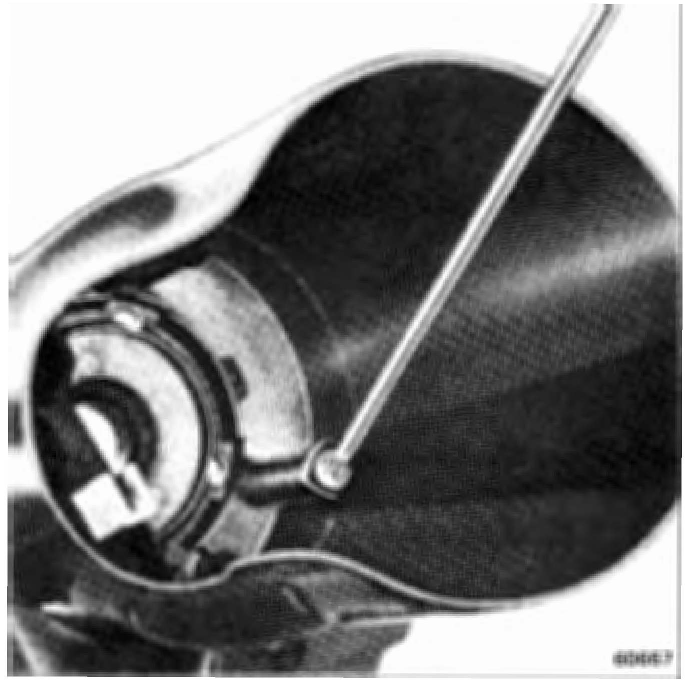


Fig. 11-13 Removing-Installing Shroud

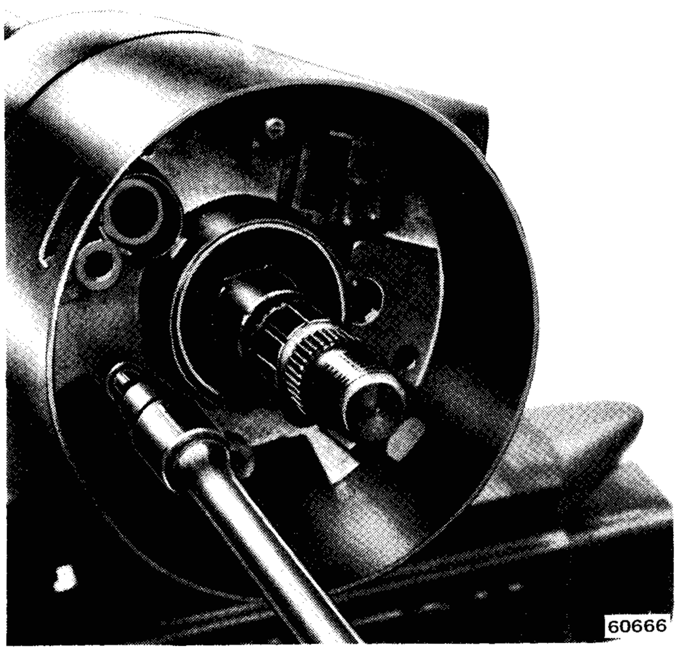


Fig. 11-12 Removing-Installing Housing

Fig. 11-14 Wave Washer Position

(17) Remove three screws attaching shroud to housing (fig. 11-3) and separate parts.

(18) Remove wave washer from release lever pivot and remove release lever and spring (fig. 11-14).

(19) Remove rack and lock bolt assembly (fig. 11-15).

(20) Remove rack preload spring (fig. 11-16).

(21) Remove sector through lock cylinder hole in housing. Push on block tooth of sector with blunt punch to remove (fig. 11-17).

NOTE: *Although steps (1) through (23) can be performed with the column in the vehicle, steps (24) and (25) can be performed only if the column is removed.*

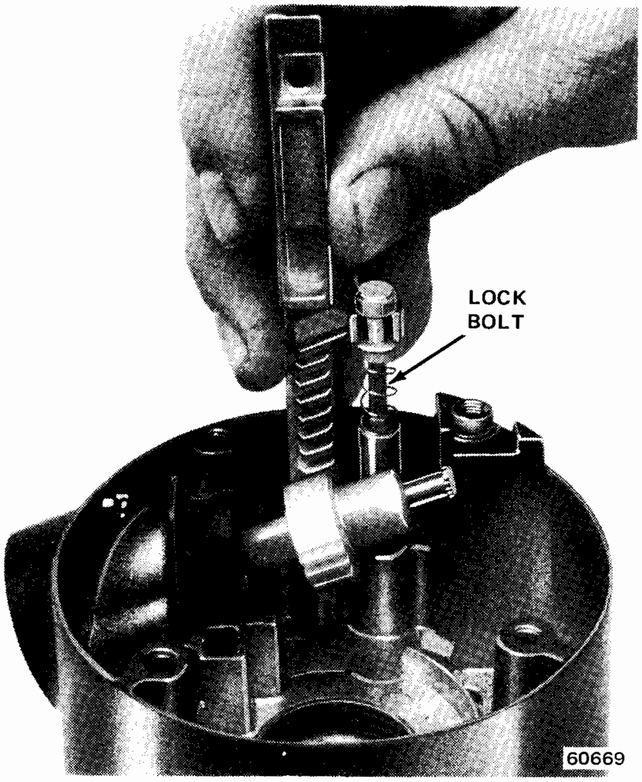


Fig. 11-15 Removing Rack and Lock Bolt

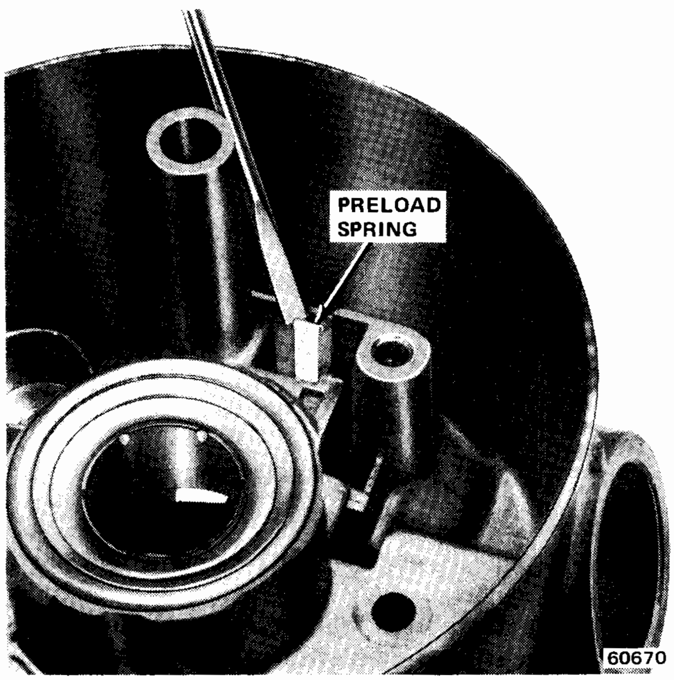


Fig. 11-16 Removing-Installing Preload Spring

(22) Remove steering shaft.

(23) Remove snap ring from lower jacket bearing retainer and remove retainer and bearing and adapter assembly.

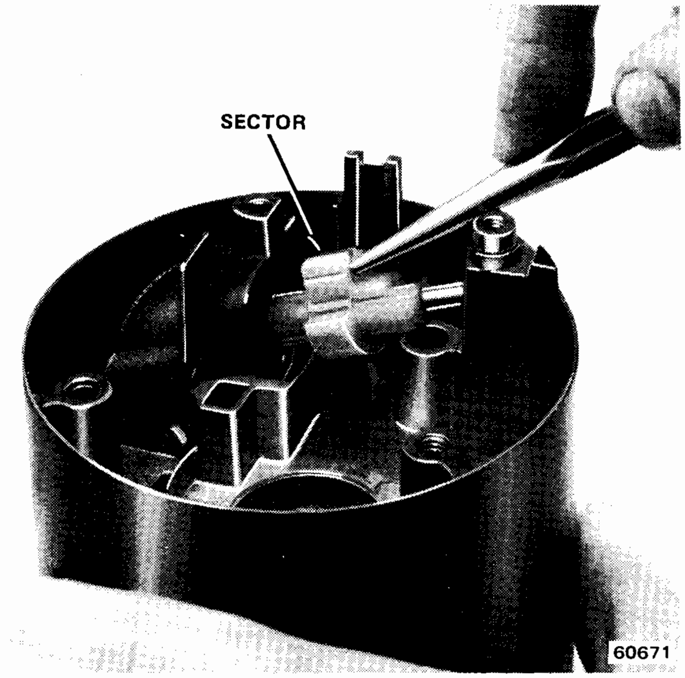


Fig. 11-17 Removing Sector

Assembly

WARNING: *Use only specified screws, bolts, and nuts when servicing the column, and tighten only to the specified torque to maintain the energy-absorbing (compression) action of the steering column. Bolts may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must be tightened to the proper torque so that the bracket will break away under impact.*

(1) Install sector on sector shaft. Install sector through lock cylinder hole in housing (fig. 11-18). Use blunt tool to press sector onto shaft. Sector should turn freely after installation.

(2) Install rack preload spring (fig. 11-16). Bowed side of spring must bear against lock rack when rack is installed.

(3) Assemble lock bolt and lock rack (fig. 11-19).

(4) Install assembled lock bolt and lock rack in housing (fig. 11-20). Mate block tooth on rack with block tooth on sector (fig. 11-19 and 11-20).

(5) Install release lever return spring over post in housing (fig. 11-21). Insert release lever finger in slot in lock rack and position hole in lever over threaded hole in housing post (fig. 11-22). Be sure inner end of spring contacts release lever as shown in figure 11-22.

(6) Raise release lever slightly and install end of release lever spring between lever and housing boss (fig. 11-23).

(7) Coat wave washer with multi-purpose grease and install on post over release lever (fig. 11-14).

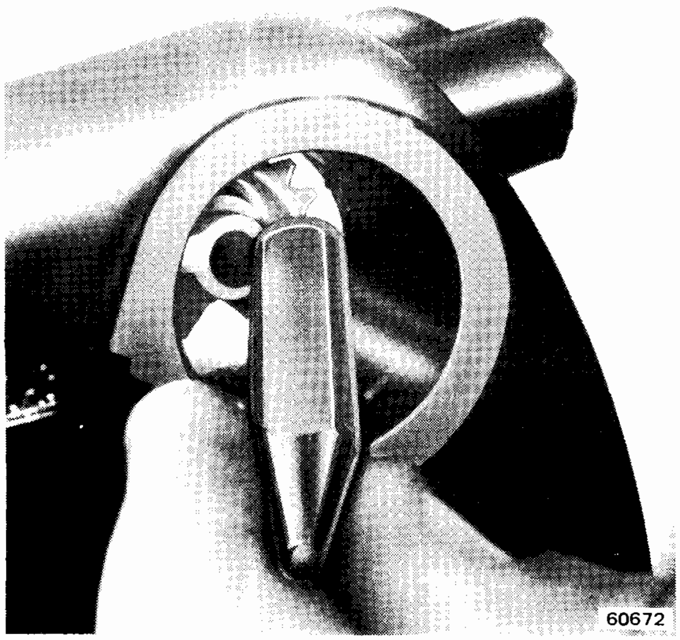


Fig. 11-18 Installing Sector

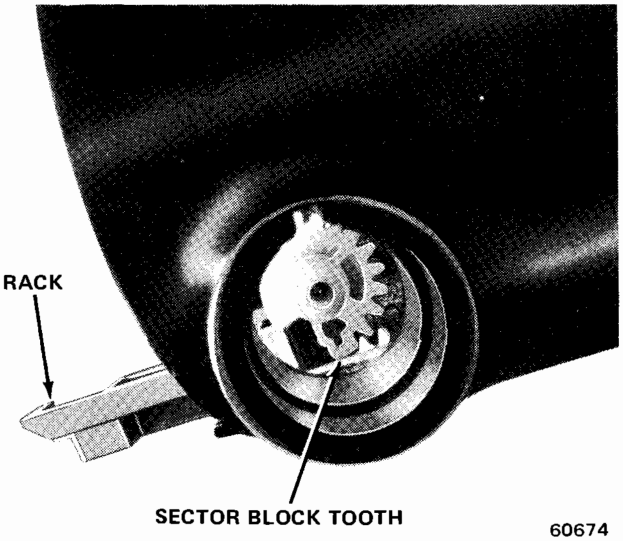


Fig. 11-20 Installing Lock Bolt and Rack

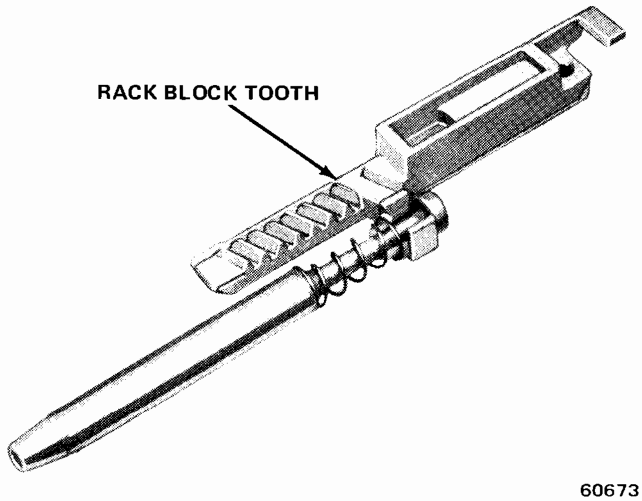


Fig. 11-19 Assembling Lock Bolt and Rack

Fig. 11-21 Installing Release Lever and Spring

(8) Install shroud on housing and install three attaching screws. Tighten screws to 18 inch-pounds torque. Do not displace wave washer when assembling shroud and housing.

(9) Install remote rod on lock rack. Short hooked end of rod goes in rack.

(10) Install assembled shroud and housing on jacket and install four attaching screws (fig. 11-12). Tighten screws to 60 inch-pounds torque.

(11) Assemble buzzer switch and spring. Formed end of spring fits on lower end of switch (fig. 11-24). Insert assembled spring and switch in housing with switch contacts toward lock cylinder bore (fig. 11-9).

(12) Install lock cylinder in housing. Insert key in lock, hold cylinder sleeve in one hand, and rotate key clockwise until it steps. This retracts actuator. Insert cylinder in housing bore with tab on cylinder sleeve aligned with keyway in housing. Push cylinder in until it bottoms. Rotate key counterclockwise until drive section of cylinder mates with sector. Push cylinder in fully until tab engages in housing groove.

(13) Turn lock cylinder clockwise to stop, then counterclockwise to stop at Off-Unlock position. Place ignition switch in Off-Unlock position as follows:

(a) Position switch on jacket (fig. 11-25).

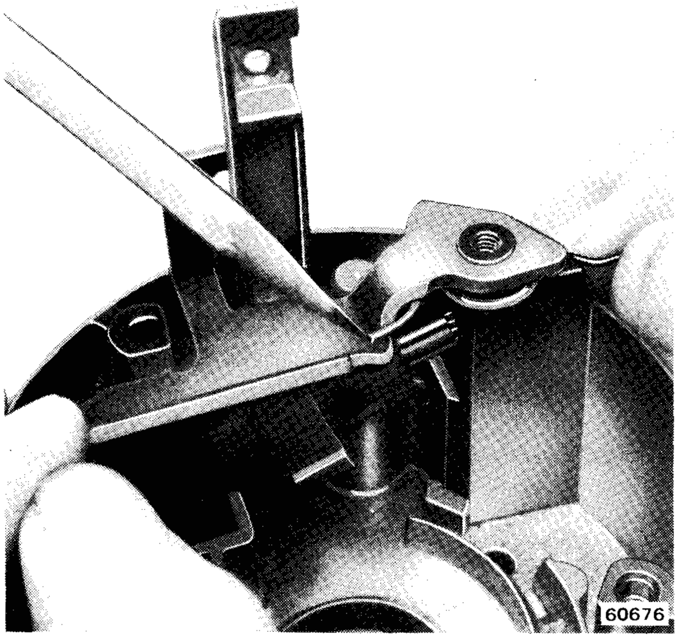


Fig. 11-22 Positioning Release Lever Spring

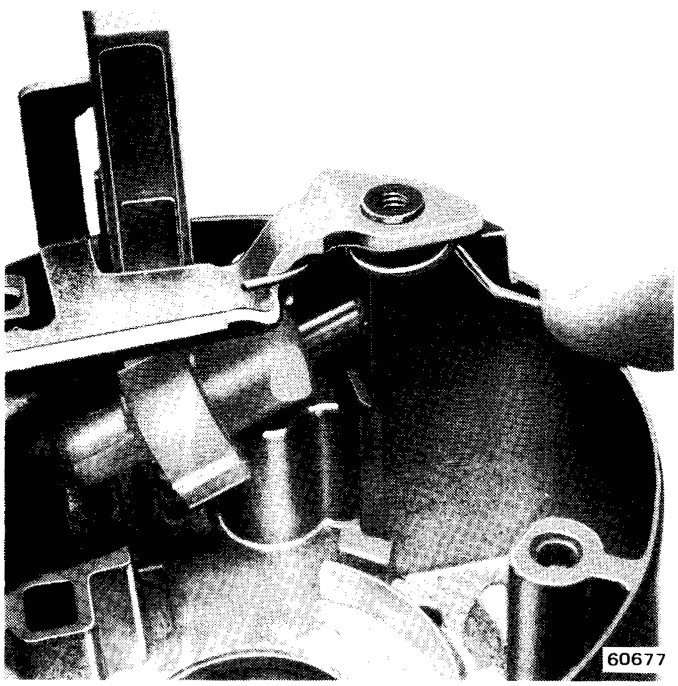


Fig. 11-23 Securing Release Lever Spring

(b) Move switch slider to extreme left to Accessory position.

(c) Move slider two positions to right from Accessory position to Off-Unlock position.

(d) Insert remote rod into hole in switch slider, position switch on jacket, and install attaching screws. Tighten screws to 35 inch-pounds torque.

(14) Install lower bearing and adapter assembly, retainer, and snap ring in jacket.

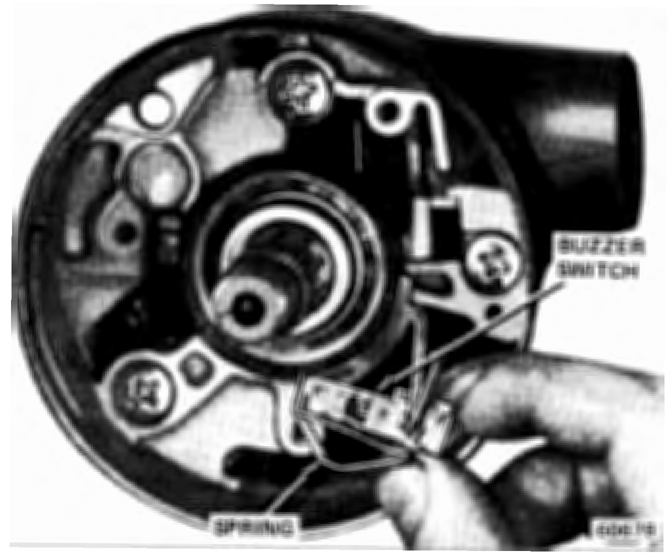


Fig. 11-24 Installing Buzzer Switch and Spring

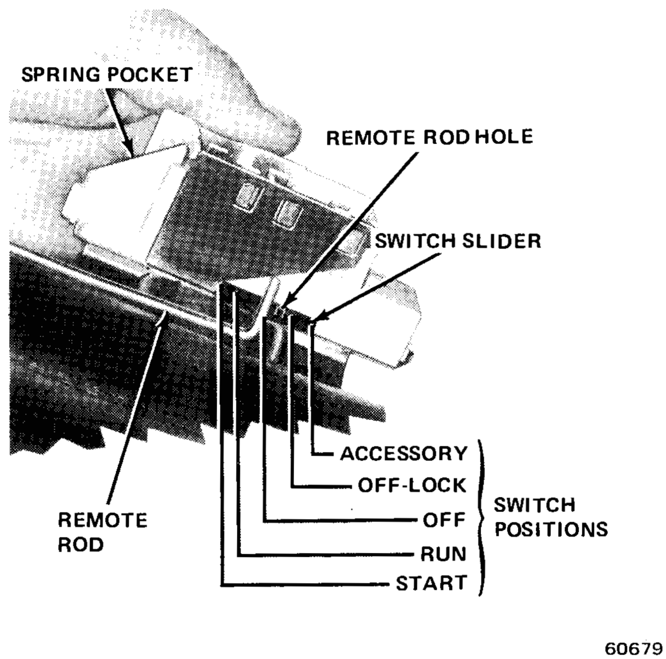


Fig. 11-25 Positioning Ignition Switch

(15) Install steering shaft through lower end of jacket and into upper bearing in housing.

(16) Install turn signal switch and wire harness. Bend wires against connector and feed connector through housing and shroud. Install signal switch and lever attaching screws. Install turn signal lever. Tighten screws to 35 inch-pounds torque.

(17) Install washer, upper bearing spring, and cancelling cam on steering shaft. Position cancelling cam as shown in figure 11-26.

(18) Place turn signal switch in neutral position and install hazard warning switch knob.

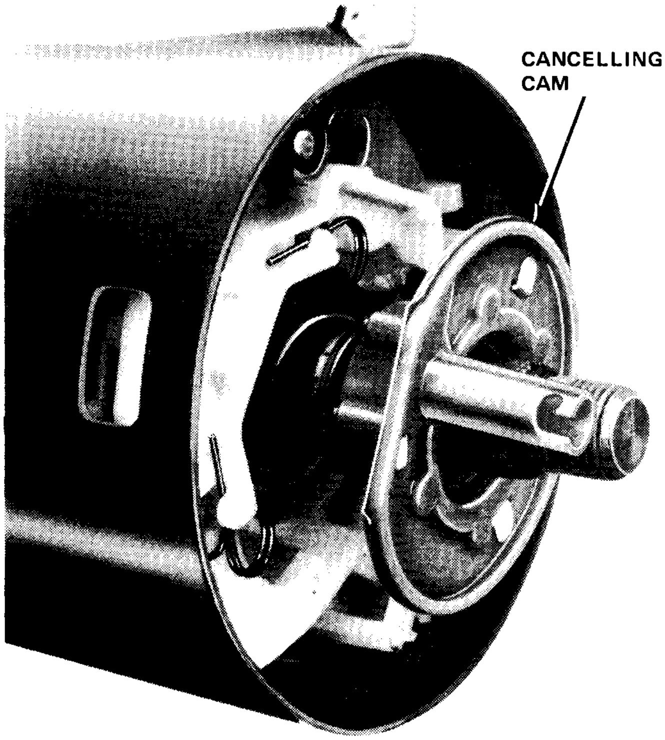


Fig. 11-26 Positioning Cancelling Cam

(19) Install lock plate on steering shaft. Install snap ring on sleeve of Compressor Tool J-23653, thread sleeve onto end of steering shaft, compress lock plate, and install snap ring in groove of steering shaft (fig. 11-27).

(20) Install anti-theft cover. Tighten screws to 22 inch-pounds torque.

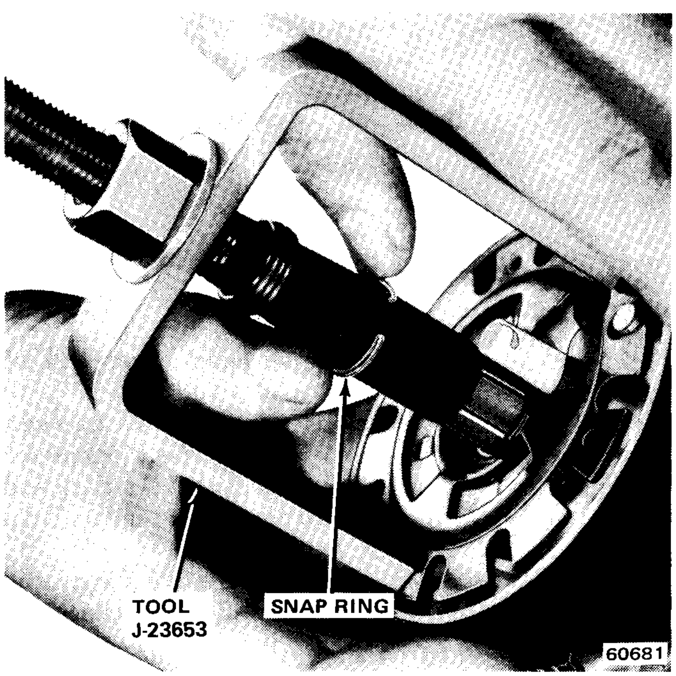


Fig. 11-27 Installing Lock Plate and Snap Ring

(21) Remove Support Fixture Tool J-23074 and install column mounting bracket. Tighten screws to 22 foot-pounds torque.

(22) Install signal switch harness connector on mounting lugs of jacket.

(23) Install steering wheel. Tighten nut to 30 foot-pounds torque.

(24) Install steering column in vehicle (if removed).

(25) Connect battery negative cable.

STEERING COLUMN—AUTOMATIC TRANSMISSION

Disassembly—Upper Section

Column removal is not necessary if only the upper section is to be serviced. If the complete column or lower section is to be serviced, remove column, column mounting bracket, and install Support Fixture J-23074 to mount column in vise (fig. 11-4).

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove column-to-instrument panel bezel and left air conditioning duct (if equipped).

(4) Cover painted areas of column.

(5) Remove steering wheel (fig. 11-1).

(6) Remove anti-theft cover (fig. 11-5). Do not unthread screws completely. They are secured to cover with plastic retainers.

(7) Compress lock plate using Compressor Tool J-23653 and unseat snap ring from groove in steering shaft (fig. 11-6).

WARNING: *Lock plate is under strong spring tension.*

(8) Remove compressor tool, snap ring, lock plate, cancelling cam, upper bearing preload spring, and thrust washer (fig. 11-28).

NOTE: *Steering shaft is now free in column. If column is removed for bench overhaul, remove shaft from lower end of column. Do not let shaft fall out of column.*

(9) Place turn signal switch lever in right turn position and remove lever.

(10) Push inward on hazard warning switch knob and remove by unthreading knob in counterclockwise direction.

(11) Place gearshift lever in Park position. Remove lever by driving pivot pin out with punch.

(12) Unhook turn signal switch wire harness connector from jacket.

(13) Disconnect turn signal harness from instrument panel harness (fig. 11-7).

(14) Use stiff wire or paper clip to depress lock tab retaining shift quadrant light wire in connnector block.

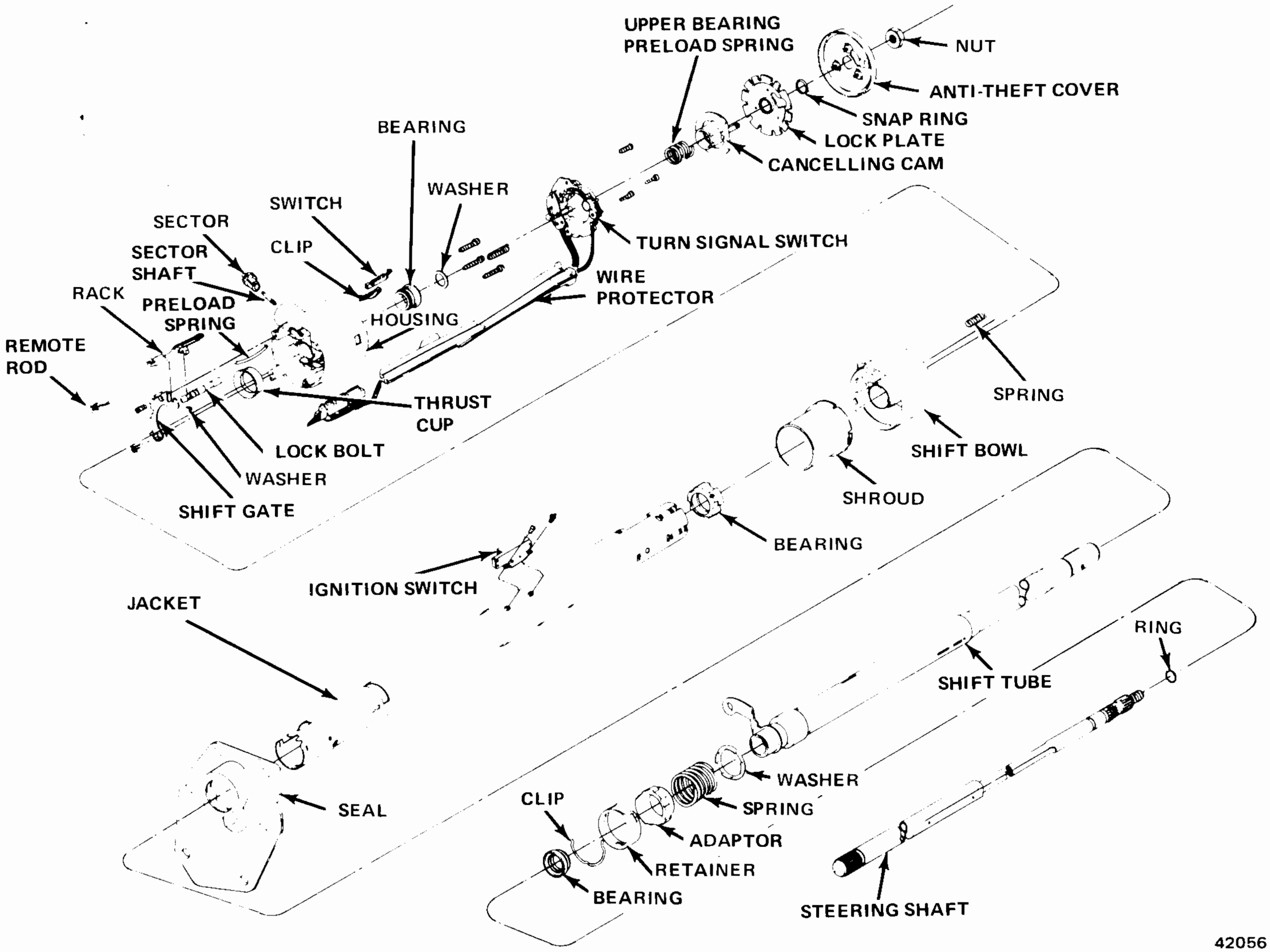


Fig. 11-28 Steering Column—Automatic Transmission

(15) Remove lower column bracket and plastic harness protector from column jacket.

(16) Wrap piece of tape around upper harness connector to prevent snagging and remove harness (fig. 11-29).

(17) Place key in ON position and remove key warning buzzer contacts using wire hook (paper clip with right angle bend) or needlenose pliers (fig. 11-9).

CAUTION: *Do not attempt to remove switch separately, as spring can fall into column.*

(18) Place key in LOCK position, depress key cylinder retaining tab, and remove lock cylinder (fig. 11-10).

NOTE: *If tab is not visible through slot, scrape or knock flashing from slot (fig. 11-10).*

(19) Remove ignition switch from lower end of jacket.

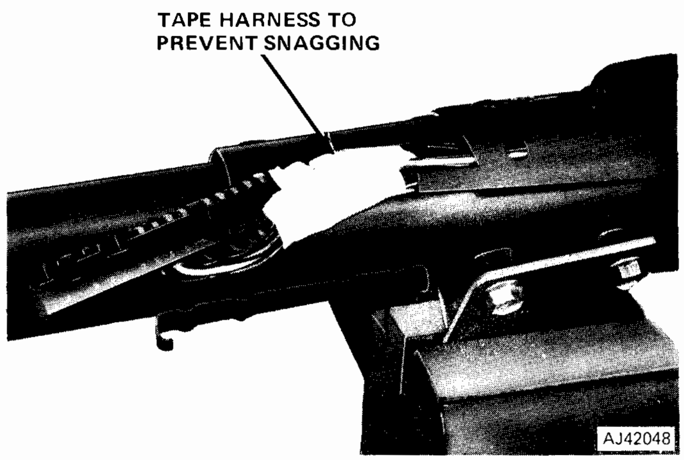


Fig. 11-29 Signal Switch Harness Removal

(20) Remove four upper housing attaching screws and remove upper housing. Remote lock rod and automatic column shift quadrant light wire (if equipped) will be removed with upper housing.

(21) Remove thrust cup from upper housing (fig. 11-30).

(22) Remove lock bolt and rack and remove rack preload spring (fig. 11-31).

(23) If sector gear requires service, note position of sector on shaft for assembly reference and remove by driving shaft out of lock cylinder hole with punch (fig. 11-17).

(24) Remove shift gate lock from upper housing. Examine shift gate lock detents for wear; replace if excessively worn.

(25) Remove shift quadrant. Quadrant is retained by two clips which must be pried out with small punch (fig. 11-32).

(26) Remove shift quadrant light cover, remove screw which retains socket assembly, and remove assembly.

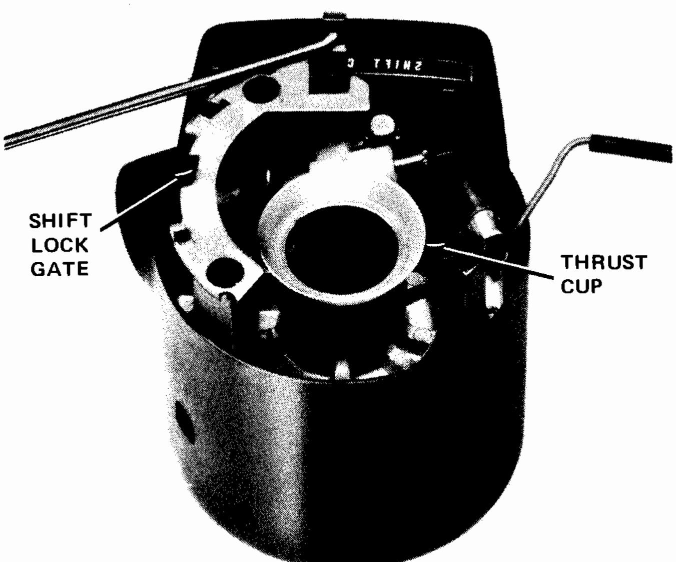


Fig. 11-30 Thrust Cup Position

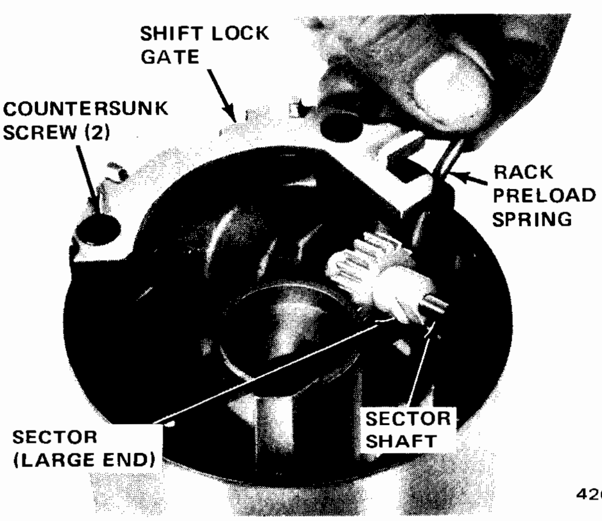


Fig. 11-31 Housing Components

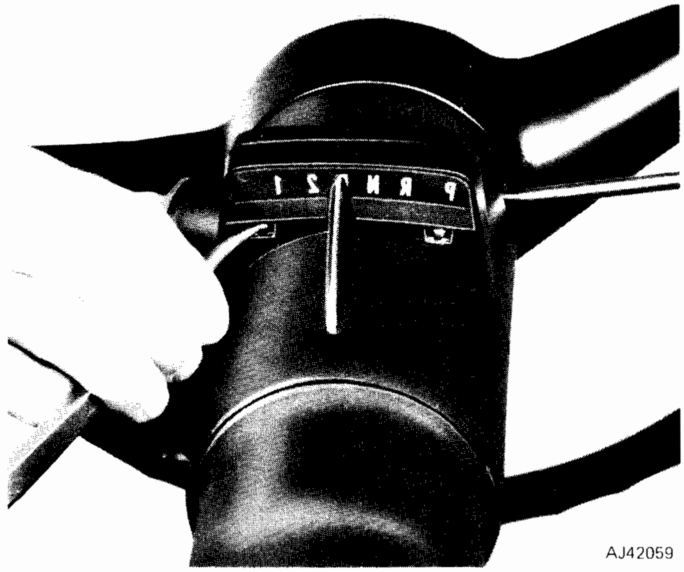


Fig. 11-32 Retainer Clip Removal

(27) Remove shift bowl from column.

(28) Remove nylon lower bowl bearing from upper end of jacket tube (fig. 11-33).

NOTE: *If lower section is also being disassembled, it is easier to remove nylon bearing after shift tube is removed.*

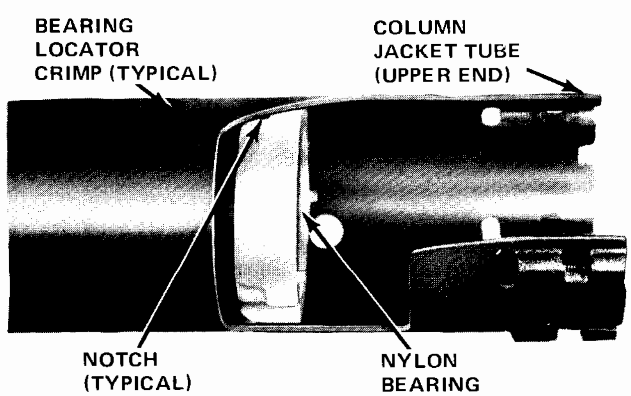


Fig. 11-33 Lower Bowl Bearing

Disassembly—Lower Section

NOTE: *The following steps require steering column removal.*

(1) If lower section only is to be serviced, remove upper steering shaft snap ring, lock plate, turn signal switch, cancelling cam, upper bearing preload spring, and thrust washer as outlined in Disassembly—Upper Section. Further disassembly of upper section is not required.

(2) Remove steering shaft from lower end of jacket.

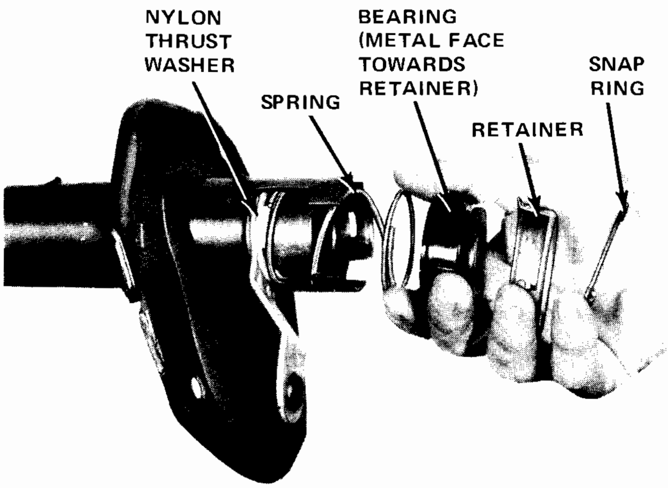
(3) Remove lower bearing retainer ring, lower bearing preload spring, and nylon washer (fig. 11-34).

(4) Remove neutral safety and backup lamp switch.

(5) Remove shift tube bearing retaining screws.

(6) Remove shift tube.

NOTE: *If nylon shift tube bearing was not removed during upper section disassembly, remove it at this time.*



Assembly—Lower Section

Apply multipurpose grease to all friction and bearing surfaces during assembly.

(1) Install shift tube.

(2) Install nylon thrust washer in lower end of shift tube with flat side of bearing toward top end of tube (fig. 11-34).

(3) Install preload spring, lower bearing (with metal face toward retainer), bearing retainer, and lockring.

(4) Install netural safety and backup lamp switch.

NOTE: *If complete column overhaul is being performed, continue with Upper Section Assembly. Otherwise, install steering shaft, upper bearing thrust washer and preload spring, upper bearing, turn signal switch, canceling cam, lock plate, and snap ring as outlined in Assembly—Upper Section.*

Assembly—Upper Section

(1) Install nylon lower bowl bearing in upper end of jacket.

NOTE: *Bearing must be installed with smaller inside diameter toward lower end of jacket, and bearing notches must engage three locator crimps in column (fig. 11-33).*

(2) Align shift bowl with shift tube spline and install bowl.

(3) Install rack preload spring in upper housing (fig. 11-31).

(4) Position large end of sector on sector shaft and press into place (fig. 11-18).

(5) Install shift lock gate using two countersunk screws (fig. 11-31). Tighten screws to 45 inch-pounds torque.

(6) Install shift quadrant lamp and install lamp cover.

(7) Install shift quadrant indicator and press retainer clips into place with flat side toward bowl.

(8) Assemble lock bolt and rack (fig. 11-19) and install in shift bowl (fig. 11-35).

NOTE: *Block tooth of rack must engage block tooth of sector (fig. 11-19 and 11-20).*

(9) Install nylon thrust cup in upper housing with flared end facing out (fig. 11-30).

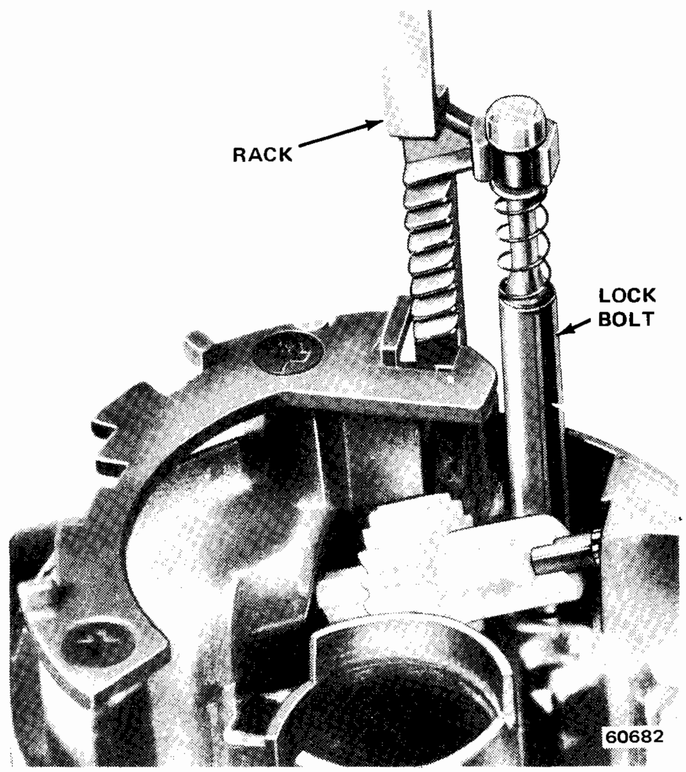


Fig. 11-35 Installing Rack and Lock Bolt

(10) Rotate shift bowl counterclockwise to stop and install upper housing. Tighten housing attaching screws to 60 inch-pounds torque.

NOTE: *Shift bowl should be in Park position and the rack pulled downward.*

(11) Guide shift quadrant lamp wire and remote lock rod into position between shift bowl and jacket.

(12) Assemble buzzer switch and spring. Install buzzer switch with brass tabs pointing upward toward shift indicator (fig. 11-24).

(13) Install turn signal switch assembly. Guide wire harness into position and carefully align switch assembly.

(14) Untape turn signal switch wire harness connector, assemble wires in protector and protector-to-column jacket, and install switch retaining screws. Be sure actuating lever pivot is correctly aligned and seated in upper housing pivot boss before installing retaining screws.

(15) Install turn signal lever and actuate turn signal switch to check operation.

(16) Install steering shaft.

(17) Install thrust washer, spring, and canceling cam on upper end of steering shaft.

(18) Align lock plate splines with steering shaft splines and place lock plate in position, with canceling cam shaft protruding through dogleg opening in lock plate (fig. 11-36).

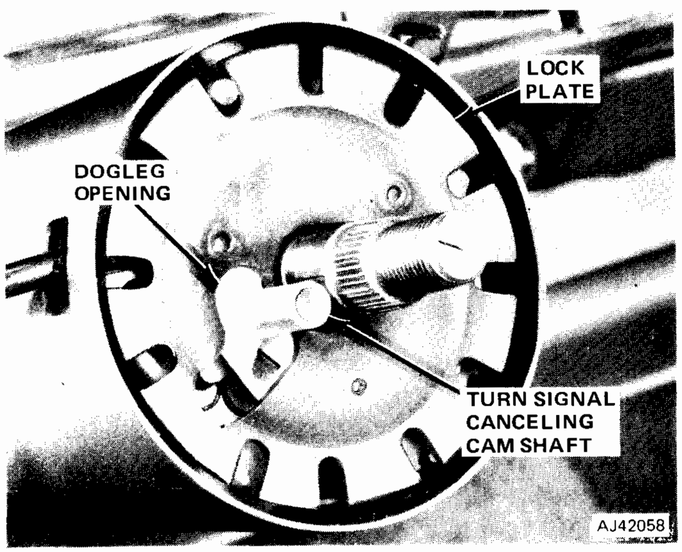


Fig. 11-36 Cancelling Cam and Lock Plate Position

(19) Place steering shaft snap ring on sleeve of Lock Plate Compressor Tool J-23653 (fig. 11-27).

(20) Install tool on steering shaft, compress lock plate, and push snap ring into place.

(21) Remove tool.

(22) Install anti-theft cover.

(23) Align canceling cam, index marks on steering shaft and steering wheel, and install steering wheel. Tighten steering wheel nut to 20 foot-pounds torque.

(24) Install hazard warning light switch knob and steering wheel trim cover.

(25) Install shift lever.

(26) Install key lock cylinder.

(27) Install ignition switch. Place shift bowl in any position except Park and rotate bowl counterclockwise until rack bottoms against lower surface of bowl. Place ignition switch in Off-Unlocked position as follows (fig. 11-27):

(a) Move switch slider to left (Accessory position).

(b) Move slider two positions to right to Off-Unlock position.

(c) Insert remote rod into slider hole and attach ignition switch to jacket. Tighten screws to 35 inch-pounds torque.

(d) Move switch out of Off-Unlock position when attaching switch to jacket.

(28) Adjust neutral safety and backup lamp switch.

(29) Install lower finish panel, air conditioning duct (if equipped), and column-to-instrument panel bezel.

(30) Remove protective wrapping from painted areas of column.

(31) Connect battery negative cable.

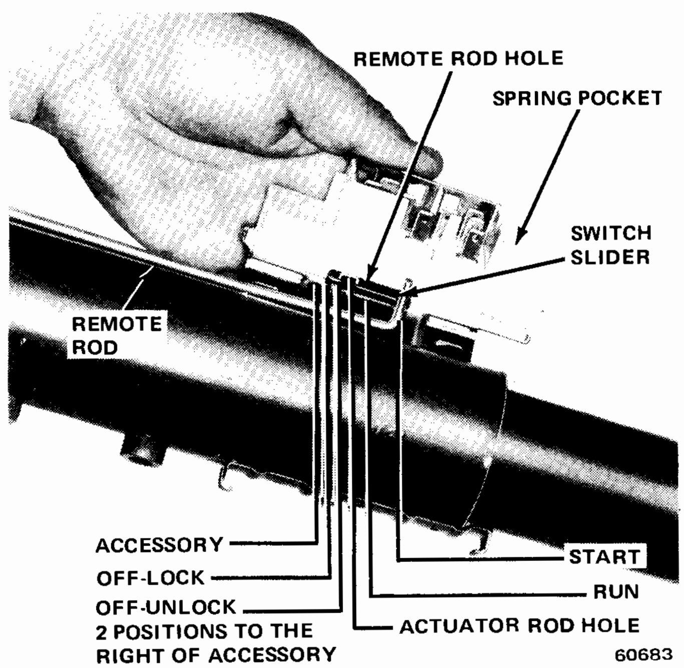


Fig. 11-37 Positioning Ignition Switch

ADJUST-O-TILT STEERING COLUMN

Disassembly—Upper Section

NOTE: *Although it is possible to disassemble column down to the upper housing without column removal, the column must be removed if disassembly is to be more extensive. Use Steering Column Support Fixture J-23074 to mount column assembly in a vise (fig. 11-4).*

(1) Disconnect battery negative cable.
(2) Cover painted areas of column.
(3) Remove steering wheel.
(4) Remove gearshift lever retaining pin and shift lever (if equipped).
(5) Loosen anti-theft cover screws and lift cover from column. Do not remove screws completely. They are held on cover by plastic retainers.
(6) Compress lock plate using Lock Plate Compressor Tool J-23653, and remove round wire snap ring from steering shaft groove (fig. 11-6).

WARNING: *Lock plate is under strong spring pressure.*

(7) Remove lock plate compressor tool, snap ring, lock plate, cancelling cam, upper bearing preload spring, bearing race seat, and bearing race.
(8) Place turn signal switch in right turn position and remove lever.
(9) Press hazard warning light switch knob inward and remove by turning counterclockwise.
(10) Remove turn signal wire harness connector from mounting bracket on lower right side of jacket.
(11) Loosen toeboard bolts.
(12) Remove support-bracket-to-jacket screws.
(13) Remove support-bracket-to-instrument panel attaching nuts and remove bracket.
(14) Remove turn signal harness plastic protector from jacket.
(15) Wrap tape around harness connector to prevent snagging, and remove harness (fig. 11-29).
(16) Remove turn signal switch retaining screws and remove switch and wire harness.
(17) With key in ON position, remove key warning buzzer contacts using wire hook (paper clip with right angle bend), or needlenose pliers (fig. 11-9).

NOTE: *Do not attempt to remove switch separately, as spring can fall into column.*

(18) Place key lock in LOCK position.
(19) Press lock cylinder retaining tab and remove lock cylinder (fig. 11-10).

NOTE: *If tab is not visible through slot, remove flashing from slot.*

(20) Remove shift quadrant.

NOTE: *Quadrant is retained by a spring clip which may be removed with long-nose pliers (fig. 11-32).*

(21) Remove shift quadrant mounting bracket and light socket (if equipped).
(22) Remove tilt release handle.
(23) Remove three upper cover retaining screws.
(24) Tap upper cover from column.
(25) Remove lock sector tension spring retaining screw and remove spring.

NOTE: *Spring must be unhooked from lock bolt.*

(26) Remove snap ring from lock sector shaft and remove sector, shaft, and lockpin.
(27) Install tilt release handle and place upper housing in full upward tilt position.
(28) Insert screwdriver in tilt spring retainer slot.
(29) Depress retainer approximately 3/16 inch, rotate 1/8-turn counterclockwise and remove retainer and spring.

WARNING: *Tilt spring is under strong spring tension.*

(30) Place upper housing in straight position.
(31) Remove two pivot pins using Pivot Pin Remover Tool J-38854-1 (fig. 11-38).
(32) Lift tilt release handle to disengage lock shoes and remove bearing housing assembly.
(33) Remove tilt release lever.

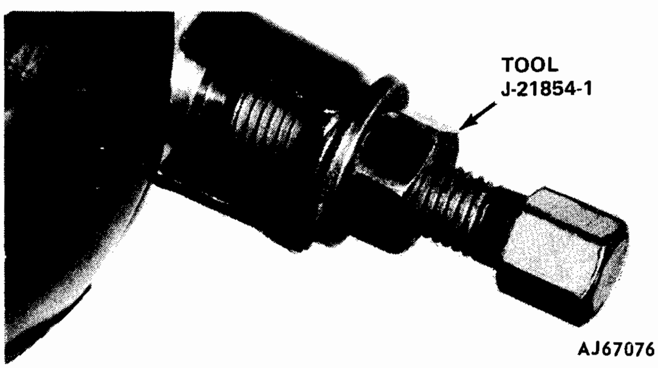


Fig. 11-38 Pivot Pin Removal

(34) If lock shoes, release lever, or springs are to be serviced, remove release lever pin and lock shoe pin with a punch or Pin Remover and Installer Tool J-22635. Hold lock shoe springs in compression to relieve load on pins (fig. 11-39 and -40).
(35) Disconnect steering shaft at intermediate shaft. Remove steering shaft from top of column. Shaft is disassembled by folding it 90° (fig. 11-41).
(36) Remove ignition switch.
(37) Remove neutral safety and backup switch.

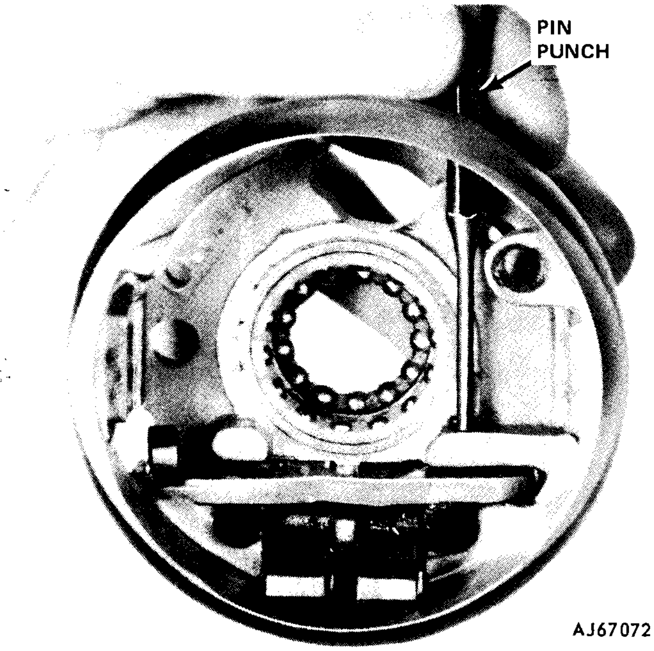


Fig. 11-39 Release Lever Pin Removal

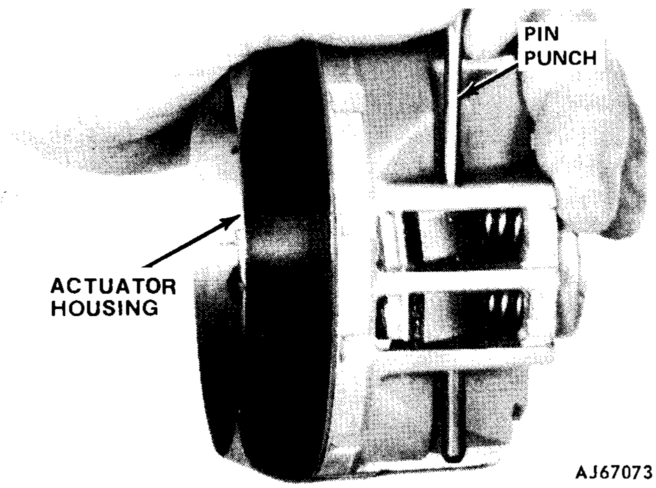


Fig. 11-40 Lock Shoe Pin Removal

(38) Remove lock rack and rod.

(39) Remove lower bearing retainer snap ring, retainer, bearing, and adapter.

(40) Remove upper support attaching screws and upper support. Remove shift gate pin and shift gate.

(41) Remove shift tube retainer ring and thrust washer.

(42) Remove shift tube using Shift Tube Remover Tool J-23072 (fig. 11-42).

(43) Remove retainer plate by rotating shift bowl clockwise, sliding plate out of jacket notches, tipping it down toward shift bowl hub at 12 o'clock position and removing bottom side of plate first (fig. 11-43).

(44) Remove wave washer, tube spring, and shift bowl from column.

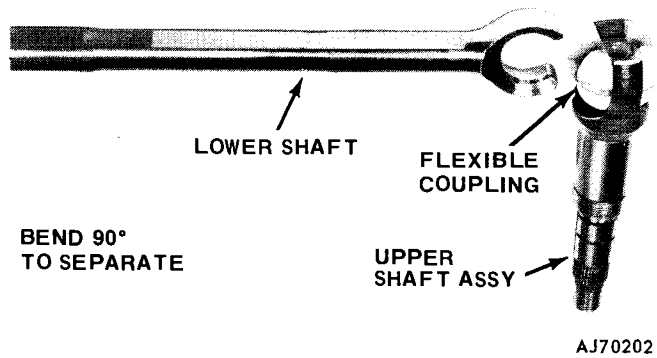


Fig. 11-41 Flexible Joint

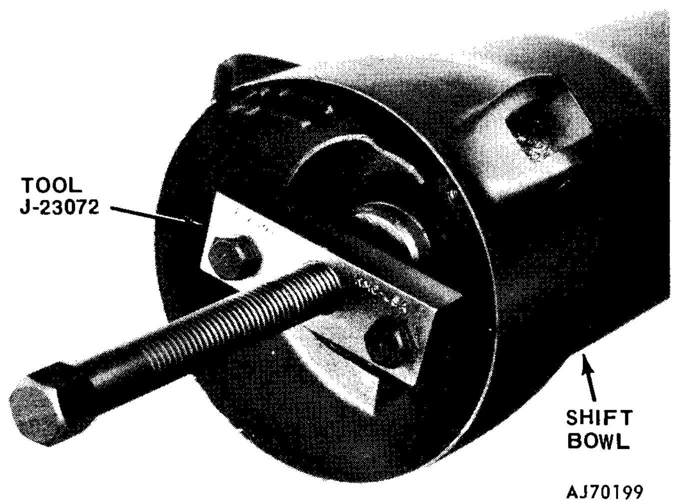


Fig. 11-42 Shift Tube Removal

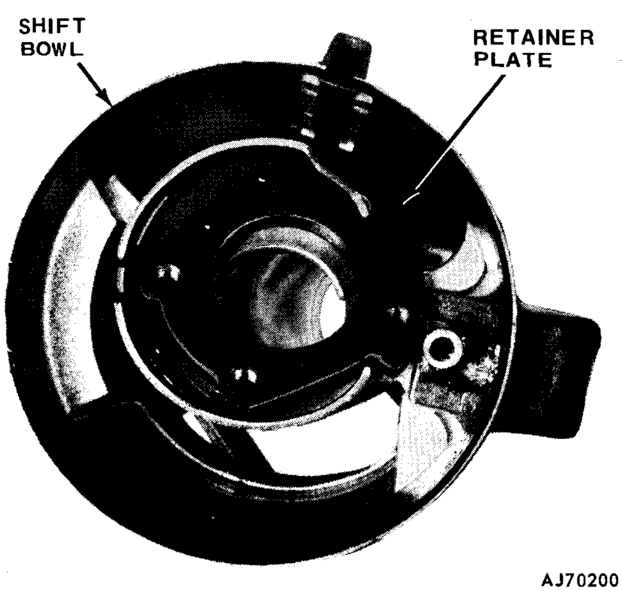


Fig. 11-43 Retainer Plate Removal

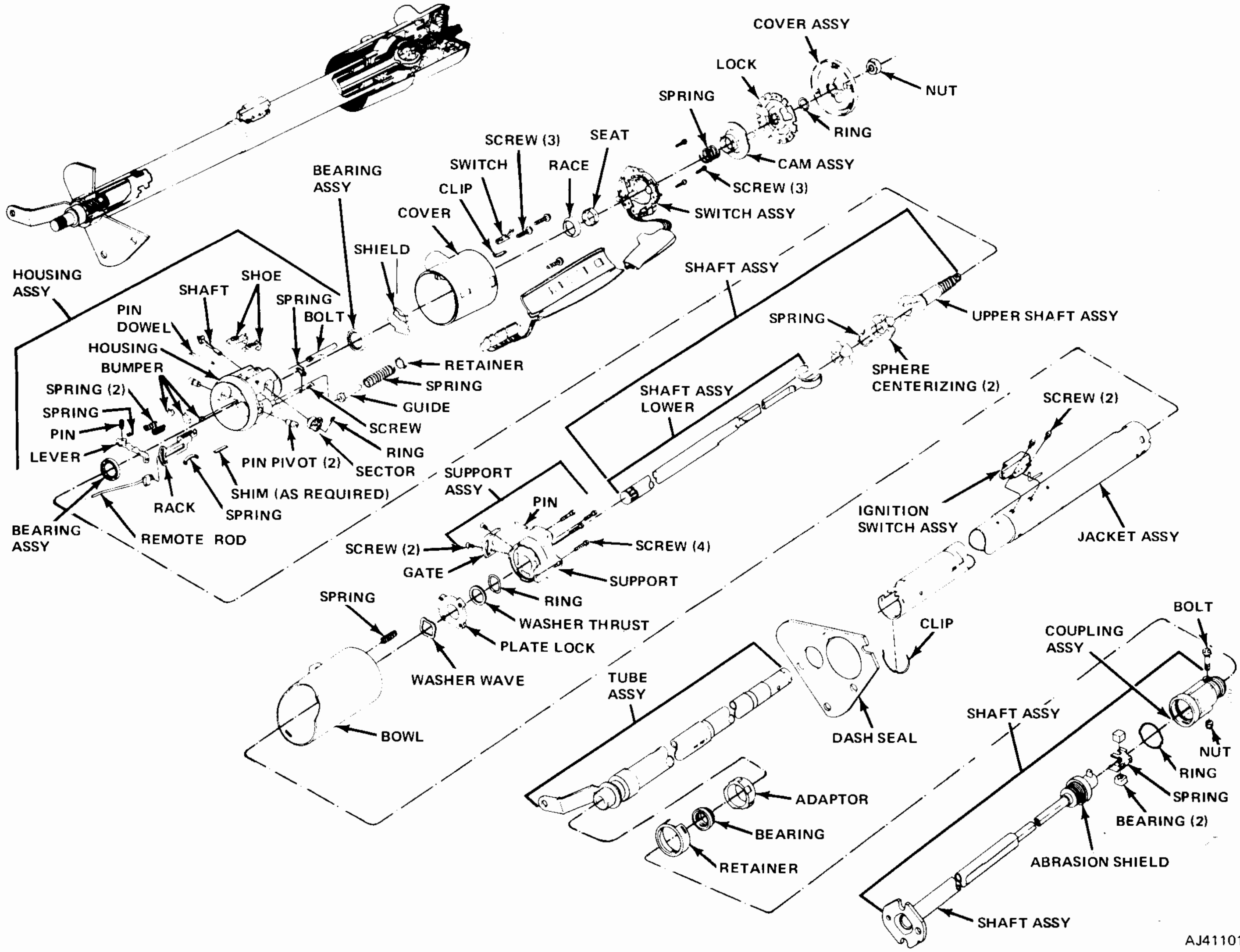


Fig. 11-44 Adjust-O-Tilt Steering Column

Disassembly and Assembly—Lower Section

For assembly and disassembly of lower section of Adjust-O-Tilt Column, refer to procedures outlined in Lower Section Disassembly and Assembly, Manual and Automatic Transmission Steering Columns.

Upper Section Assembly

(1) Apply thin coat of multipurpose grease to all friction surfaces.

(2) Mount shift bowl on column.

(3) Install wave washer and retainer plate in column.

(4) Install shift tube in lower end of jacket. Align spline on tube with keyway in shift bowl.

(5) Insert Shift Tube Installer Tool J-23073-2 and -4 into shift tube (fig. 11-45). Spring-loaded lower foot must engage tube inner shoulder and guide should seat in tube. Tighten spring tension nut to snug fit.

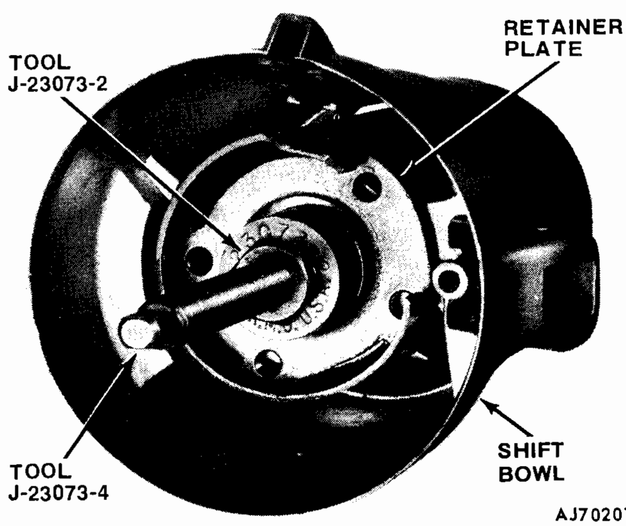


Fig. 11-45 Shift Tube Installer Seated in Tube

(6) Place Receiver Tool J-23073-3 and -4 over puller stud and tighten puller nut to pull tube into bowl (fig. 11-46).

(7) Install shift tube thrust washer and shift tube retainer snap ring.

(8) Install lower bearing (with metal face toward retainer), retainer, and snap ring.

(9) Install pin and shift gate on upper support and install upper support. Align V-notch in support with notch in column (located at 9 o'clock position).

(10) Install four retaining screws.

(11) Assemble steering shaft and install in column.

(12) Place bearings (14 balls each) in upper housing (if removed).

(13) Install tilt handle.

(14) Insert ignition switch remote rod between shift bowl and mast jacket and into guide channel in left side of upper support.

(15) Place lock rack on remote rod (fig. 11-47).

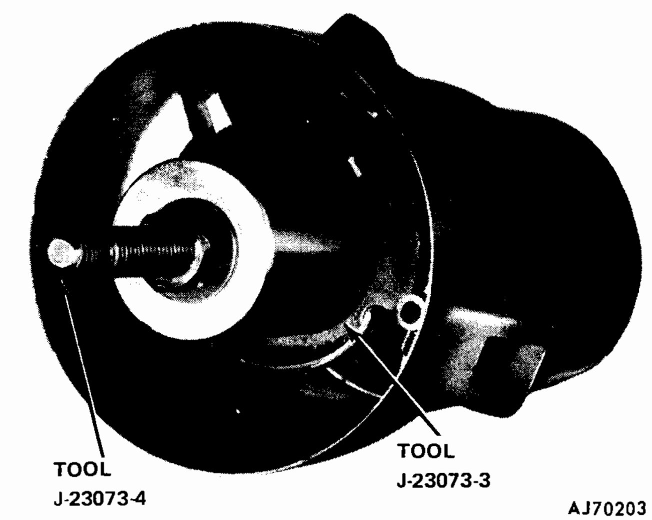


Fig. 11-46 Pulling Shift Tube Into Bowl

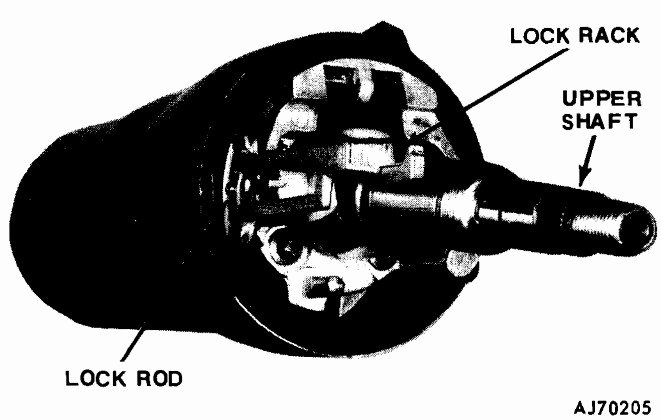


Fig. 11-47 Lock Rack and Remote Rod Position

(16) Guide upper housing over steering shaft and lock rack. Align lock shoes with teeth in upper support.

(17) Align upper housing and upper support pivot pin holes and install pivot pins using fiber mallet or brass drift.

(18) Install lock shoes, lock shoe springs, tilt bumpers, and lockpin in upper housing.

(19) Install lock sector and sector shaft. Large tooth on sector must engage large slot in lock rack. Install sector shaft retaining snap ring.

(20) Hook lock sector tension spring on lockpin, engage sector, and install spring retaining screw (fig. 11-48).

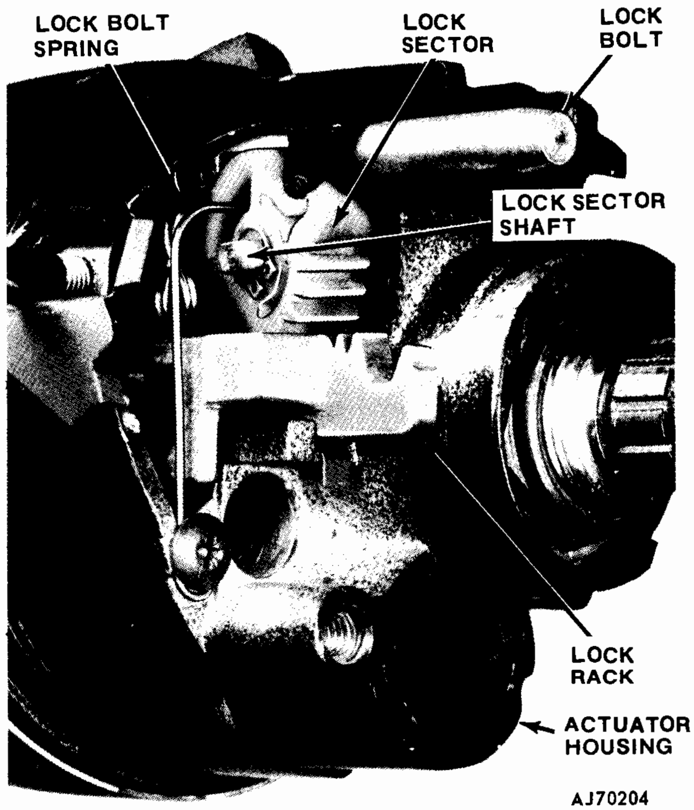


Fig. 11-48 Position of Lock Sector Tension Spring

(21) Place upper housing in full upward tilt position and install tilt spring and seat. Press spring retainer approximately 3/16 inch into housing. Rotate retainer approximately 1/8-turn clockwise to secure spring. Place housing in center tilt position and remove tilt handle.

(22) Install upper housing cover and install three retaining screws.

(23) Install key warning buzzer switch and tension spring. Buzzer switch brass contact should point upward, toward shift indicator.

(24) Guide shift quadrant light wire up through upper housing and down between shift bowl and mast jacket.

(25) Install shift quadrant mounting bracket and attach light socket.

(26) Hook base of shift quadrant over tabs on left side of retainer and place in position.

(27) Install shift pointer into bowl and engage with quadrant.

(28) Install quadrant retainer clip with flat side of clip facing down.

(29) Install tilt release handle.

(30) Install turn signal switch assembly. Guide wire harness between cover and mast jacket and carefully align switch assembly.

(31) Untape connector, assemble wires into protector and protector-to-column jacket, and install switch retaining screws. Assure that actuating lever pivot is correctly aligned and seated in upper housing pivot boss prior to installing retaining screws.

(32) Install column-to-instrument panel bracket and tighten toeboard bolts.

(33) Install turn signal switch lever and actuate switch to check operation.

(34) Install upper bearing race, bearing race seat, preload spring, and canceling cam on steering shaft.

(35) Align lock plate splines with steering shaft splines and install lock plate. Turn signal switch canceling cam shaft should protrude through dogleg opening in lock plate (fig. 11-36).

(36) Place steering shaft snap ring on Lock Plate Compressor Tool J-23653. Install tool on steering shaft. Compress lock plate and push snap ring into place (fig. 11-27).

(37) Connect steering shaft to intermediate shaft.

(38) guide gear shift lever over tension spring and into shift bowl. Align pivot pin holes with pin punch. Drive pivot pin through lever with a fiber mallet or brass drift.

(39) Install key lock cylinder.

(40) Hold lock cylinder sleeve and rotate cylinder clockwise against stop. Insert cylinder into housing with key on cylinder sleeve aligned with housing keyway. Lightly push cylinder against sector and rotate cylinder counterclockwise until cylinder engages sector. Push in until cylinder retainer tab snaps into place and cylinder is secured.

(41) Install steering wheel.

(42) Adjust shift linkage and neutral safety and backup lamp switch.

(43) Install lower finish panel and air conditioning duct (if equipped). Install steering column-to-instrument panel bezel.

(44) Remove protection from painted column areas.

(45) Connect battery negative cable.

MANUAL STEERING GEAR

LEFT-HAND DRIVE VEHICLES

Removal

(1) Disconnect steering gear from lower steering shaft by removing bolt and nut attaching coupling to wormshaft.

(2) Disconnect steering arm from connecting rod using Tool J-6632.

(3) Remove upper steering gear-to-frame bracket bolt.

(4) Remove two lower steering gear-to-frame bracket bolts and remove steering gear.

Disassembly

(1) Rotate wormshaft until at center of travel. Mark on shaft, beneath double spline, should be centered between top and bottom of shaft when looking at shaft from side cover side (fig. 11-49).

(2) Remove adjuster locknut.

(3) Remove side cover bolts and lockwashers and turn lash adjuster screw clockwise to force side cover from housing. Remove side cover and gasket (fig. 11-50).

(4) Remove adjuster screw and shim from T-slot in pitman shaft. Keep shim with screw.

(5) Remove pitman shaft from housing. Do not damage seal in housing with pitman shaft splines or threads. If necessary, tap lightly to remove shaft.

(6) Remove worm adjuster nut, remove worm adjuster, and lower worm bearing.

Service Diagnosis

Condition	Possible Cause	Correction
HARD STEERING	(1) Incorrect tire pressure.	(1) Adjust.
	(2) Lack of lubrication.	(2) Lubricate steering linkage.
	(3) Tie rod ends worn.	(3) Replace.
	(4) Drag link ball joints tight.	(4) Adjust.
	(5) Steering gear parts worn.	(5) Replace.
	(6) Frozen steering shaft bearings.	(6) Replace bearings.
	(7) Lower coupling flange rubbing against steering shaft.	(7) Loosen bolt and assemble properly.
	(8) Steering gear adjusted incorrectly.	(8) Check adjustment. Disconnect pitman arm from gear or disconnect linkage from pitman arm and adjust gear if necessary.
	(9) Front spring sagged.	(9) Check front end jounce height. It should be approximately the same at both wheels. Replace front springs if sagged.
	(10) Frame bent or broken.	(10) Repair frame as necessary.
	(11) Steering knuckle bent.	(11) Install new knuckle.
	(12) Ball joint galled or too tight.	(12) Replace ball joint.
	(13) Steering knuckle ball studs binding.	(13) Reset studs.
	(14) Steering gear or connections binding.	(14) Test steering system with wheels off floor. Adjust and lubricate.
LOOSE STEERING	(1) Tie rod ends worn.	(1) Replace.
	(2) Drag link ball sockets worn.	(2) Replace.
	(3) Steering gear parts worn.	(3) Replace.
	(4) Steering gear improperly adjusted.	(4) Adjust.
EXCESSIVE ROAD SHOCK	(1) Axle clip loose.	(1) Repair as necessary.
	(2) Wheel bearings loose.	(2) Repair as necessary.
	(3) Shock absorbers worn.	(3) Replace.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
TURNING RADIUS SHORT ONE SIDE	(1) Center bolt in spring sheared off.	(1) Repair as necessary.
	(2) Axle shifted.	(2) Repair as necessary.
	(3) Steering arm bent.	(3) Replace.

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(7) If bearing is damaged, pry retainer out with screwdriver. Remove bearing from worm adjuster.

(8) Remove assembled wormshaft, ball nut, and upper worm bearing from housing (fig. 11-51). Do not allow ball nut to rotate freely to end of worm travel; this could damage ball return guides. Do not damage oil seal with wormshaft splines.

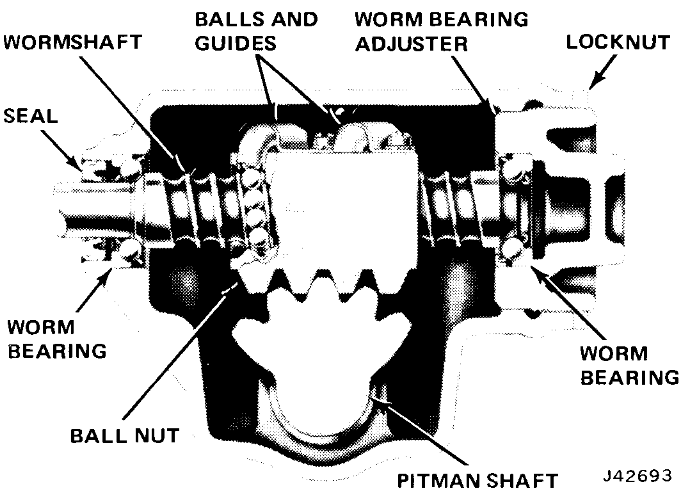

Fig. 11-49 Cross-Section of Steering Gear

(9) Remove upper bearing from shaft.

(10) If oil seals are damaged, pry them out of housing.

(11) Remove three screws attaching clamp to ball nut and remove ball guides from nut.

(12) Turn ball nut over and rotate wormshaft back and forth until all balls drop out on clean cloth (50 balls).

(13) Remove ball nut from shaft.

Inspection

Wash all parts in clean solvent and wipe dry with a clean cloth.

Inspect bearing cups in worm adjuster and in housing. If damaged, remove them using Wormshaft Bearing Cup Remover Tool J-5754 and Slide Hammer J-2619 (fig. 11-52).

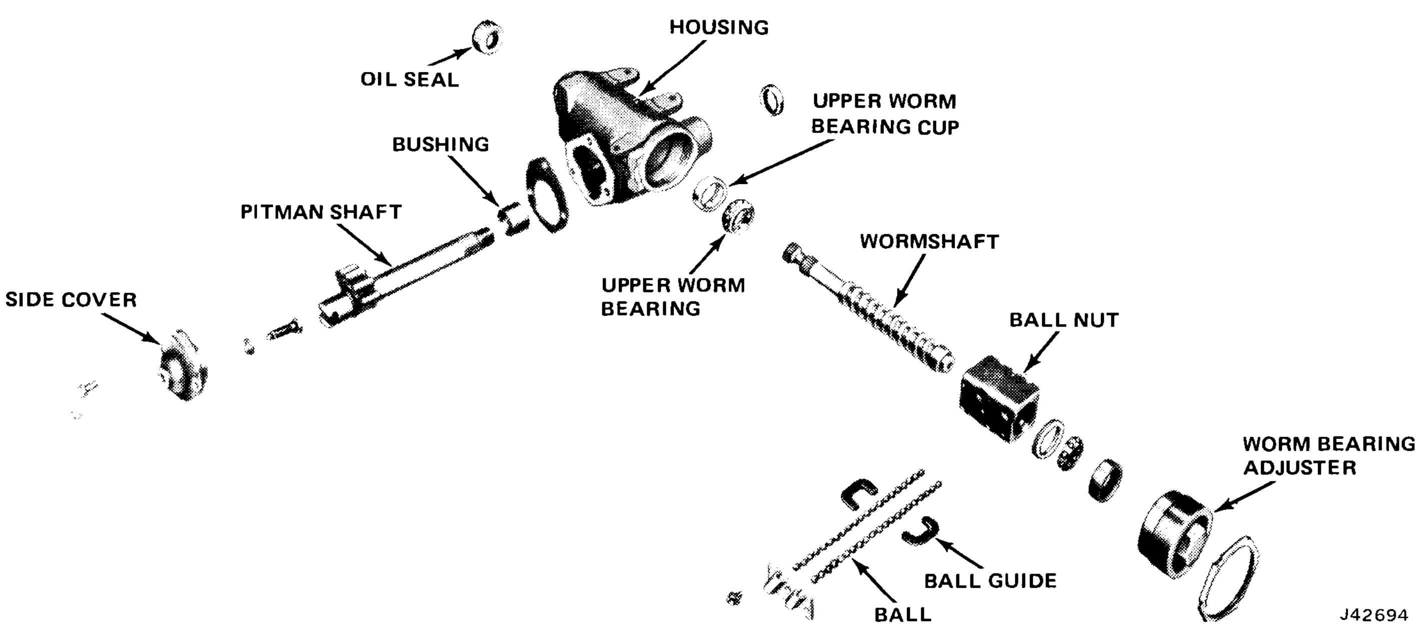

Fig. 11-50 Left-Hand Drive Manual Steering Gear

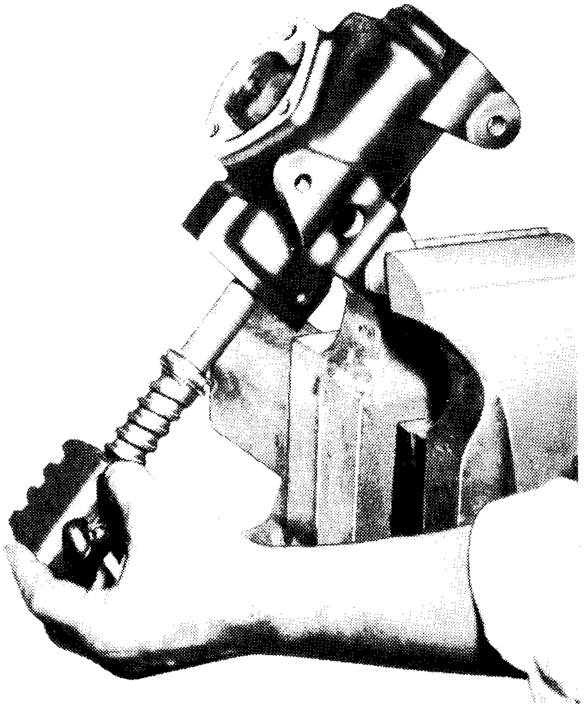

Fig. 11-51 Wormshaft and Ball Nut Removal

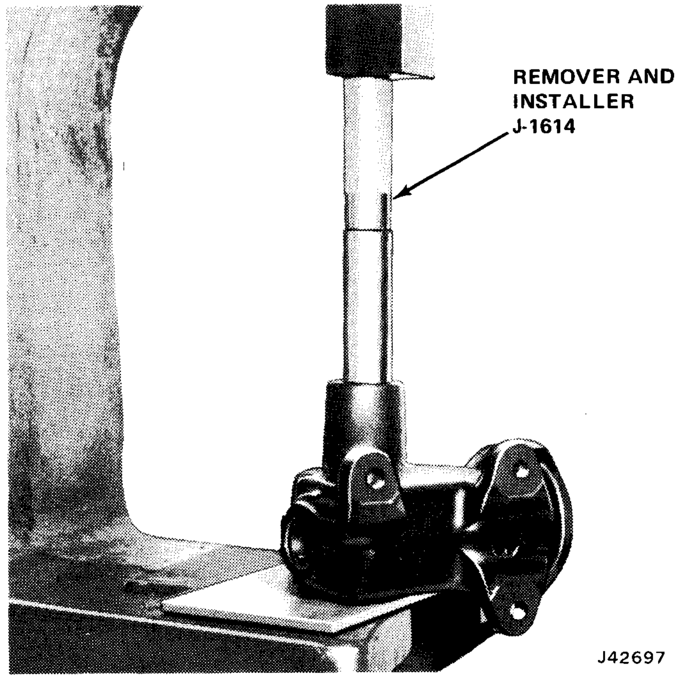

Fig. 11-53 Pitman Shaft Bushing Removal

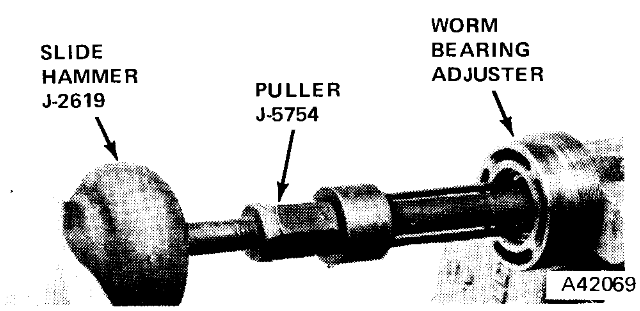

Fig. 11-52 Wormshaft Bearing Cup Removal

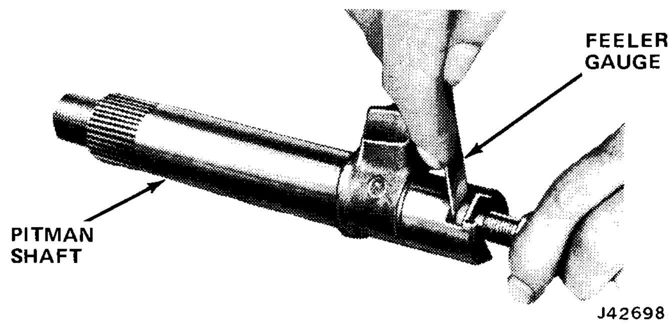

Fig. 11-54 Checking Lash Adjuster End Play

Inspect wormshaft, particularly in area near worm for pitting, grooving, or other damage; replace if damaged.

Inspect bushings for pitman shaft in housing and in side cover. If bushing in housing is damaged, drive bushing into housing with Remover and Installer Tool J-1614 (fig. 11-53). If bushing in side cover is damaged, replace side cover and bushing assembly.

Inspect teeth of ball nut and pitman shaft for pitting and heavy scoring. Replace ball nut or pitman shaft if pitted or scored.

Inspect ball guides, balls, and clamp for damage; if damaged, install new ball kit.

Check fit of lash adjuster screw and shim in T-slot of pitman arm (fig. 11-54).

Lash adjuster screw must be free to turn, and end play should not exceed 0.002 inch. If end play exceeds this limit, change shim thickness to obtain correct end play. A lash adjuster shim kit is available for this purpose.

Assembly

NOTE: *Lubricate all parts before assembly. Use special lubricant, Jeep part number 940657, or equivalent.*

(1) Position ball nut on wormshaft so deep side teeth will be toward side cover when shaft is installed in housing.

(2) Install 20 balls in each circuit. Rock wormshaft back and forth to aid in installation. Use punch to install balls (fig. 11-55).

(3) Install ball guides in ball nut (fig. 11-56). Hold them in place with fingers and install 5 more balls in each circuit through hole in top of ball guide.

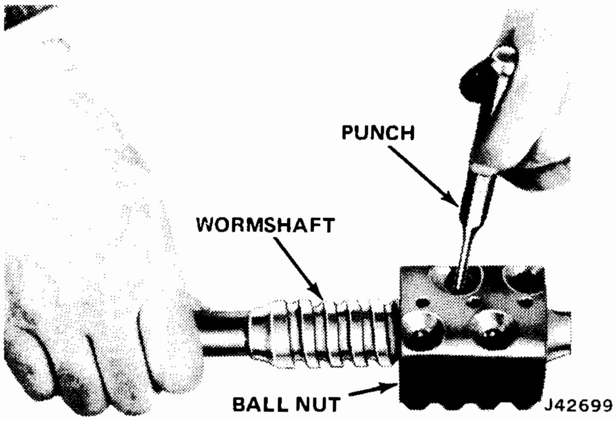

Fig. 11-55 Filling Ball Circuits

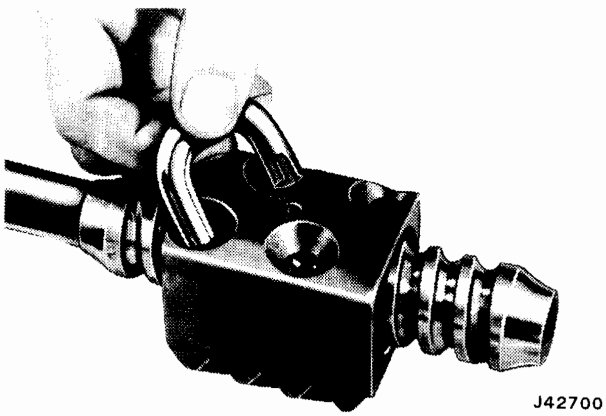

Fig. 11-56 Installing Ball Guides

(4) Install clamp over two ball guides and install attaching bolts and washers.

(5) Rotate worm through complete travel several times to be sure balls are installed correctly and rotate freely. Do not allow ball nut to bottom at end of worm travel; this could damage ball return guides.

(6) If bearing cups were removed from worm adjuster or housing, press in new bearing cup, using Wormshaft Bearing Cup Installer J-5755 (fig. 11-57).

(7) Install upper worm bearing on upper part of wormshaft and center ball nut on worm.

(8) Install assembly in housing with bearing seated in bearing cup.

(9) If bearing was removed from worm adjuster, install a new bearing and retainer in worm adjuster.

(10) Install adjuster in bottom of housing. Seat wormshaft in lower bearing in adjuster.

(11) Install bearing adjuster locknut, but do not tighten. Turn wormshaft until center tooth space of ball nut is centered in opening for side cover. Install correct shim, and lash adjuster screw in T-slot of pitman shaft.

(12) Install pitman shaft in housing, meshing center tooth of sector gear on shaft with center tooth space of ball nut.

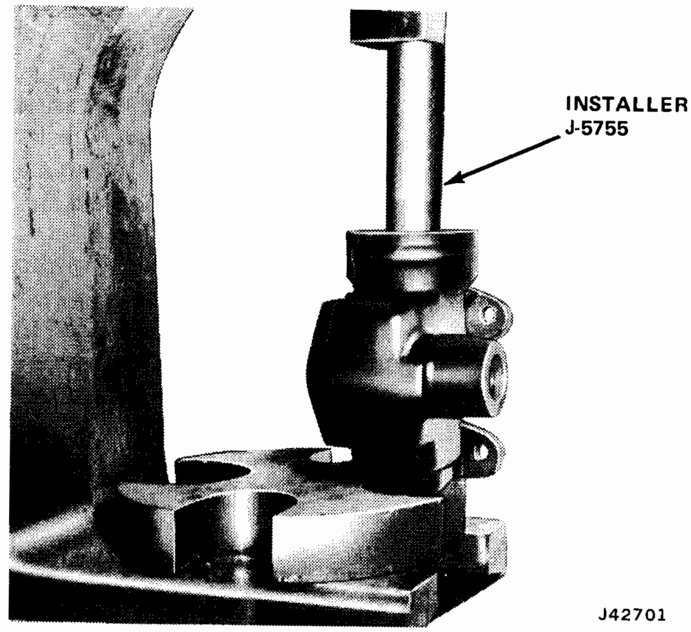

Fig. 11-57 Pressing In Bearing Cup

(13) Install gasket and side cover on housing; turn lash adjuster screw in threaded opening of side cover but do not tighten.

(14) Install side cover attaching bolts and lockwashers. Tighten bolts to 30 foot-pounds torque. Install nut on lash adjuster screw hand-tight.

(15) If pitman shaft oil seal was removed, use Pitman Shaft Oil Seal Protector J-5787 and Pitman Shaft Oil Seal Installer J-7171 to install oil seal in housing over pitman shaft threads and splines.

(16) If wormshaft oil seal was removed, use Wormshaft Upper Oil Seal Installer J-7017 to install oil seal in housing.

(17) Fill steering gear with 11 ounces of lubricant, Jeep part no. 940657, and adjust steering gear overcenter and worm bearing preload torque.

Adjustments

NOTE: *Worm bearing adjustment should always precede each adjustment of steering gear.*

Worm Bearing Preload Adjustment

(1) Attach Torque Wrench J-7754 to splined end of wormshaft and turn shaft to either extreme left or right position. Do not hit travel stops.

(2) Tighten worm bearing adjuster until torque wrench registers 8 inch-pounds. Be sure adjustment is made within 1/2-turn of either extreme position of shaft.

(3) Tighten adjuster locknut to 90 foot-pounds torque. Recheck torque of wormshaft and adjust if necessary. Record torque reading.

Overcenter Adjustment

(1) Turn steering gear from full left turn position to full right turn position, and count number of turns.

(2) Turn gear back one-half total number of turns. This places steering gear on high point or straight-ahead position (total number of turns should be 6.14).

(3) With Torque Wrench J-7754 on the pitman shaft, tighten lash adjuster screw until torque registered is 4 to 10 inch-pounds in excess of worm bearing preload. Total torque must not exceed 16 inch-pounds through center of travel. Make sure torque does not exceed this value in over center range.

(4) Tighten nut on adjuster screw to 23 foot-pounds torque. Recheck torque and adjust if necessary.

Installation

(1) Install coupling on splines of wormshaft, and secure coupling to shaft with attaching bolt and nut.

(2) Position steering gear against side frame rail; secure with three bolts.

(3) Check steering column alignment and adjust if necessary.

(4) Install pitman steering arm on pitman shaft; secure with lockwasher and nut. Tighten nut to 185 foot-pounds.

(5) Attach steering arm to connecting rod.

NOTE: *After gear is installed in vehicle, it may produce a slightly rough feel. To eliminate this roughness, turn gear full left and full right for 10 to 15 complete turn cycles.*

RIGHT-HAND DRIVE VEHICLES

Removal

(1) Disconnect steering gear from steering column by removing flexible coupling-to-gear allen-head clamping screw.

(2) Disconnect connecting rod from steering arm.

(3) Remove three bolts attaching steering gear to frame.

(4) Remove steering gear by sliding it slightly forward and to right and lifting it out of engine compartment.

Disassembly

Refer to figures 11-58 and 11-59.

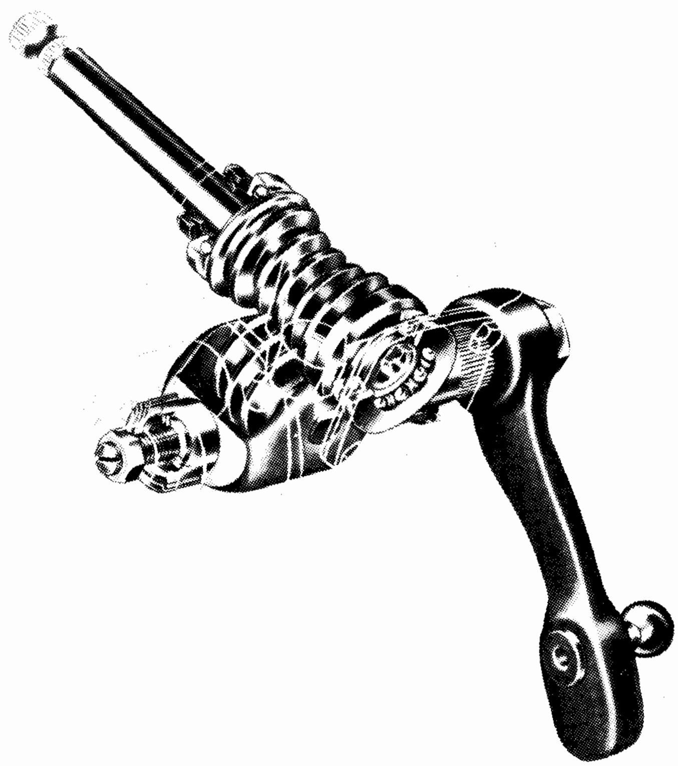

Fig. 11-58 Right-Hand Drive Steering Gear

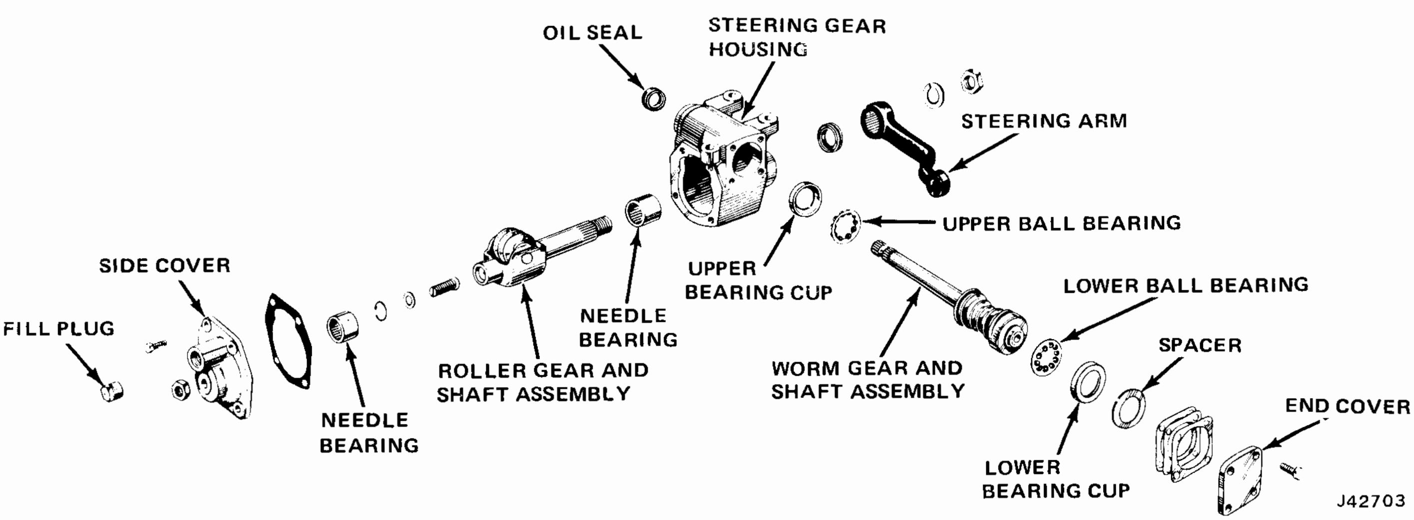

Fig. 11-59 Steering Gear Exploded View

(1) Clean exterior of steering gear.

(2) Remove filler plug from steering gear housing and drain lubricant from gear.

(3) Paint index marks on roller gear and shaft assembly on steering arm for correct alignment during assembly.

(4) Remove nut and lockwasher from shaft.

(5) Remove arm from shaft using pitman arm puller.

CAUTION: *Do not use a hammer or wedge to remove steering arm from roller gear and shaft assembly. This will damage gear and shaft assembly.*

(6) Using fine file or emery cloth, remove any nicks or burrs from exposed portions of roller gear and shaft assembly and from worm gear and shaft assembly.

(7) Remove four attaching capscrews, side cover, and gasket from steering gear housing. When cover is removed, attached roller gear and shaft assembly can also be withdrawn from housing.

(8) Remove locknut from adjustment screw.

(9) Turn screw clockwise until completely unthreaded from side cover; then remove roller gear and shaft assembly from cover.

(10) Remove four attaching capscrews and end cover from steering gear housing.

(11) Remove worm gear and shaft assembly.

(12) Remove lower and upper bearing cups and ball bearings from shaft.

(13) Remove worm gear shaft oil seal and roller gear shaft oil seal from housing. Discard both seals.

Inspection

Clean all parts with cleaning solvent and wipe dry.

Inspect the steering gear housing for cracks, breaks, or other damage. Replace if damaged.

Inspect the roller gear and shaft assembly for wear, scoring, or pitting. If necessary, polish lightly with a fine abrasive cloth. Be sure roller gear has proper freedom of movement and does not have excessive lash or roughness. Replace gear and shaft assembly if visibly worn or damaged.

Check adjustment screw of roller gear and shaft assembly for excessive end play. If end play exceeds 0.015 inch, remove the retaining ring, thrust washer, and screw from the gear and shaft assembly. Replace the retaining ring if unserviceable. Secure a new adjustment screw and thrust washer in the gear and shaft assembly with a retaining ring.

Inspect needle bearings, which carry roller gear and shaft assembly, in the side cover and the steering gear housing. Replace if visibly worn or damaged. Insert a shaft through each bearing and check for clearance. If clearance exceeds 0.010 inch, replace bearings.

To remove needle bearings, press them out using a piloted mandrel. To install new needle bearings, press the bearing into the side cover or steering gear housing so that the face of the bearing is flush with the bearing boss of the cover or housing.

Inspect the worm gear and shaft assembly visually for wear, scoring, or pitting. If necessary, polish lightly with a fine abrasive cloth. Replace assembly if it is visibly worn or damaged.

Inspect upper and lower ball bearings and cups of the worm gear and shaft assembly for wear and damage. Replace if visibly worn or damaged.

NOTE: *Bearing balls must be replaced as a full set in each bearing.*

Assembly

(1) Position new oil seals at wormshaft and roller gear shaft oil seal bores of steering gear housing with longer lip of each seal facing into housing.

(2) Press each seal into housing using suitable diameter tool that will contact seal bore of housing around its entire perimeter.

(3) Lubricate worm gear and shaft assembly and upper ball bearing and cup with Gear Lubricant Grade SAE 80W.

(4) Install bearing and cup on shaft.

(5) Install shaft assembly in steering gear housing. Be sure splined end of shaft does not damage oil seal.

(6) Lubricate lower end of worm gear and shaft assembly and lower ball bearing and cup with Gear Lubricant Grade SAE 80W.

(7) Install bearing, cup, and spacer on shaft.

(8) Install shims and end cover on steering gear housing and install attaching bolts. Tighten bolts hand-tight only.

(9) Adjust bearing preload.

(10) Mount tapped hole of side cover on adjustment screw of roller gear and shaft assembly.

(11) Thread screw counterclockwise into cover until end of shaft just touches inner face of cover.

(12) Install locknut on adjustment screw hand-tight.

(13) Install gasket on side cover.

(14) Lubricate gear of roller gear and shaft assembly with Gear Lubricant Grade SAE 80W.

(15) Insert gear and shaft assembly in housing. Be sure end of shaft does not damage oil seal in housing.

(16) Roller gear and worm gear must mesh to seat side cover to housing.

(17) Install cover to housing attaching bolts. Tighten bolts to 20 foot-pounds torque.

(18) Adjust gear clearance.

(19) Clamp exposed section of roller gear and shaft assembly in vise.

(20) Align index marks made during disassembly and install steering arm on splined end of shaft.

(21) Install lockwasher and nut on shaft threads, and tighten nut to draw arm into position on spline.

(22) Fill steering gear housing with Gear Lubricant Grade SAE 80W.

(23) Adjustments

Bearing Preload Adjustment

This steering gear adjustment determines preload applied to upper and lower ball bearings which support the worm gear and shaft assembly. It is made by adding or subtracting shims from between the steering gear housing and end cover.

If necessary, loosen capscrews which attach the end cover to the steering gear housing (fig. 11-59).

Tighten capscrews alternately, and only a few turns at a time, while rotating the worm gear shaft. Tighten screws to 20 foot-pounds torque.

Check rolling torque required to rotate the worm gear shaft. When bearing preload is correct, this torque will be 2 to 5 inch-pounds. If necessary, remove end cover. Either add to or subtract from the number of shims, and repeat the above procedure to obtain correct bearing preload.

Steering Gear Clearance Adjustment

This steering gear adjustment sets proper backlash between the worm gear and the roller gear of the steering gear assembly. It prevents gear wear resulting from insufficient backlash, and steering play which would result from excessive backlash. Gear backlash is adjusted by an adjustment screw which determines the longitudinal position of the roller gear and shaft assembly.

(1) If necessary, loosen locknut and turn adjustment screw at the side cover counterclockwise until worm gear shaft turns freely through its entire range of travel (fig. 11-59).

(2) Count number of turns necessary to rotate worm gear shaft through its entire range of travel.

(3) Turn shaft to center of its travel.

(4) Rotate shaft back and forth through center of travel and tighten adjustment screw until shaft shows slight bind at center of travel.

(5) Adjust screw until rolling torque of 7 to 12 inch-pounds to rotate shaft through center of travel.

(6) Hold adjustment screw in position and tighten locknut to 18 foot-pounds torque.

(7) Recheck rolling torque necessary to rotate worm gear shaft through center of its travel. If necessary, repeat above procedure until rolling torque is correct.

STEERING LINKAGE

GENERAL

The steering linkage consists of a pitman arm attached to the steering gear assembly, a connecting rod, a tie rod, a steering damper, and a steering knuckle arm (integral with the steering knuckle). Ball-studs and adjusting tubes are used on the tie rod and connecting rod for the adjustments and steering wheel centering (fig. 11-60).

The connecting rod attaches to the pitman arm at one end and to the tie rod at the opposite end. The tie-rod ends are connected to the steering knuckle arms at the wheels. The steering damper is attached to the tie rod on one end and to a bracket on the left spring tie-plate at the other end.

Tie Rod

On Cherokee, Wagoneer, and Truck models, the tie rod (fig. 11-61) consists of a solid rod that is threaded on one end, and has an integral ball-stud end assembly at the opposite end. An adjusting tube and removable ball-stud end complete the tie rod assembly. The threaded end of the tie rod has right-hand threads which accept the turnbuckle. On CJ models, the tie rod has ball-studs and adjusting tubes at both ends. The ball-stud tie rod end is threaded into the adjusting tube. A large boss is located on the tie rod about eight inches from the unthreaded right-hand end. A tapered hole machined into the boss accepts the steering connecting rod end. The steering damper is connected to a stud which is attached to a bracket that is clamped to the center of the tie rod.

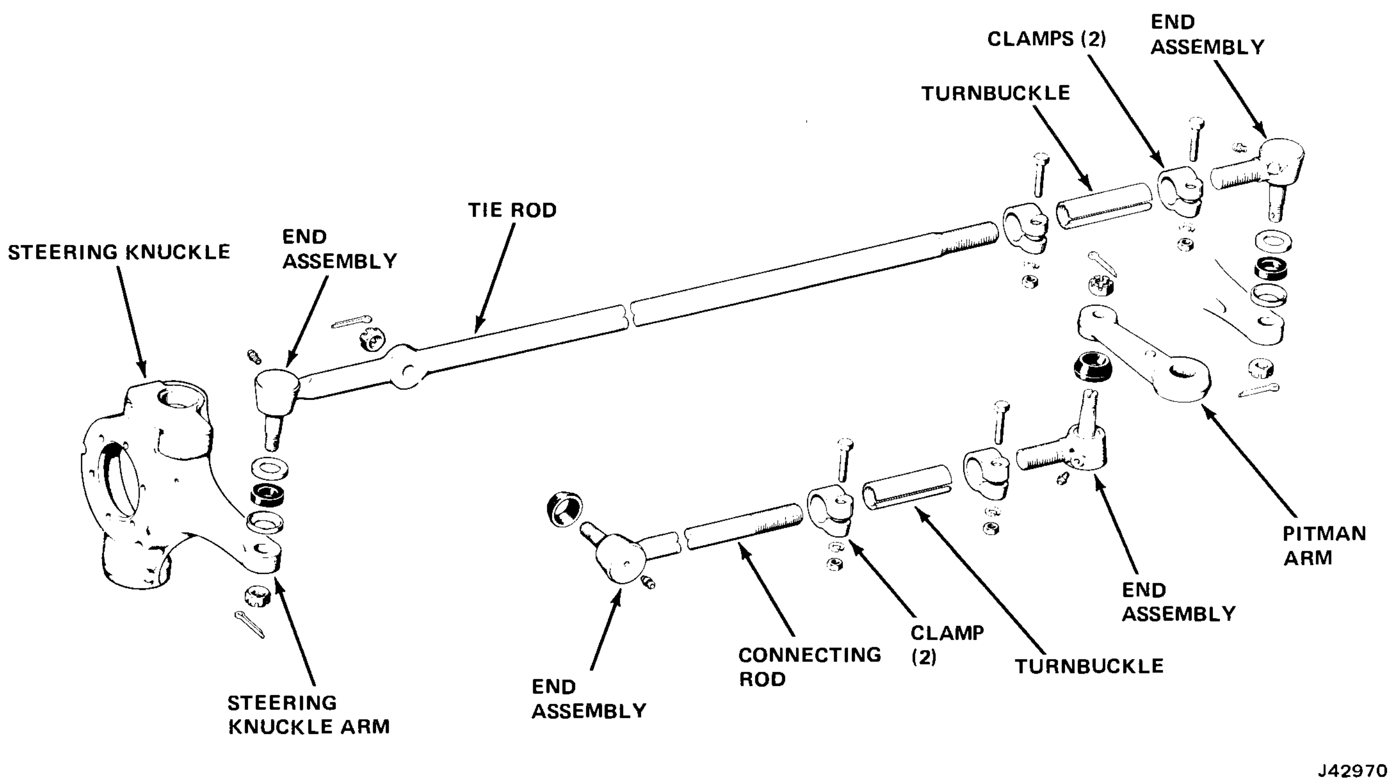

Fig. 11-60 Steering Linkage—Cherokee, Wagoneer, Truck

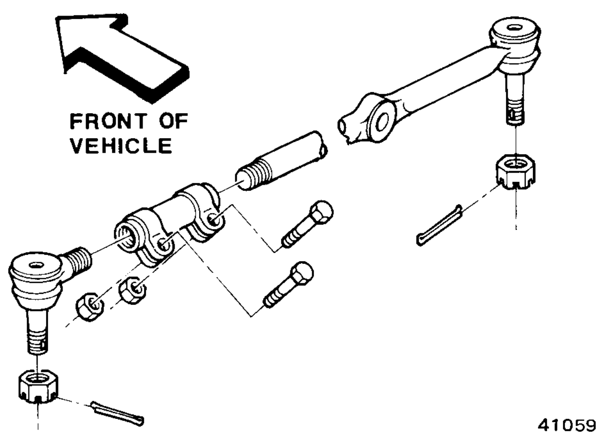

Fig. 11-61 Tie Rod Exploded View

Tie Rod

Removal

(1) Remove cotter pins and retaining nuts at both ends of tie rod, and from end of connecting rod where it attaches to tie rod.

(2) Remove nut attaching steering damper push rod to tie rod bracket and move damper aside.

(3) Remove tie rod ends from steering arms and connecting rod using puller.

NOTE: *After removal, the tie rod ends can be removed from the tie rod by loosening the adjusting tube clamp bolts and unthreading the ends.*

Installation

(1) Attach tie rod ends to steering arms. Tighten nuts to 50 foot-pounds torque and use new cotter pins to secure nuts.

(2) Attach connecting rod to tie rod. Tighten nut to 50 foot-pounds torque and use new cotter pin to secure nut.

(3) Attach steering damper to tie rod bracket.

(4) Adjust toe-in as necessary.

Connecting Rod

The connecting rod (fig. 11-62) consists of a rod threaded at the left end, with an integral ball-stud end assembly at the right end. An adjusting tube and removable ball-stud end complete the connecting rod assembly. On Cherokee, Wagoneer, and Truck models, the end having the integral ball-stud end assembly attaches to the tie rod. On CJ models, it is attached to the right side steering arm. The threaded end, with the adjusting tube and removable ball-stud end assembly, is attached to the pitman arm. However, the ball-stud end assembly can be replaced separately.

The steering connecting rod can be removed by removing the cotter pins and nuts from both ball stud ends, and then removing the rod. The steering connecting rod ball stud ends cannot be disassembled for service.

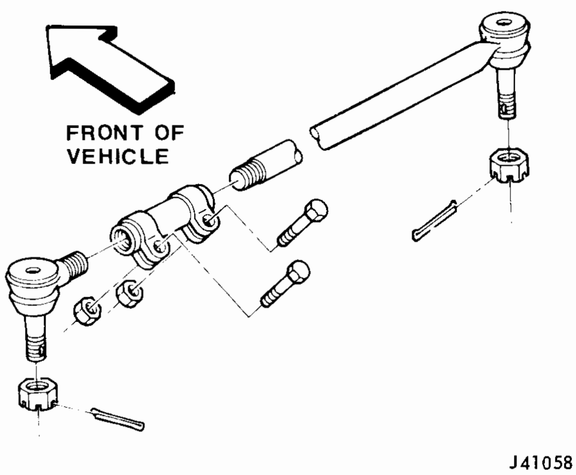

Fig. 11-62 Connecting Rod Exploded View

When installing the steering connecting rod, place the wheels in the straight-ahead position and place the steering arm parallel to the centerline of the vehicle. Have the steering gear steering arm properly indexed, with line marks on the steering arm and gear shaft and the steering gear on center of high point. With the steering arm so positioned, install the connecting rod.

STEERING DAMPER

The steering damper (fig. 11-63) has eyelets at each end for mounting on studs. The body end of the damper attaches to a stud on a bracket mounted between the left axle spring and the axle spring pad. The push rod end is attached to a bracket that is clamped to the tie rod.

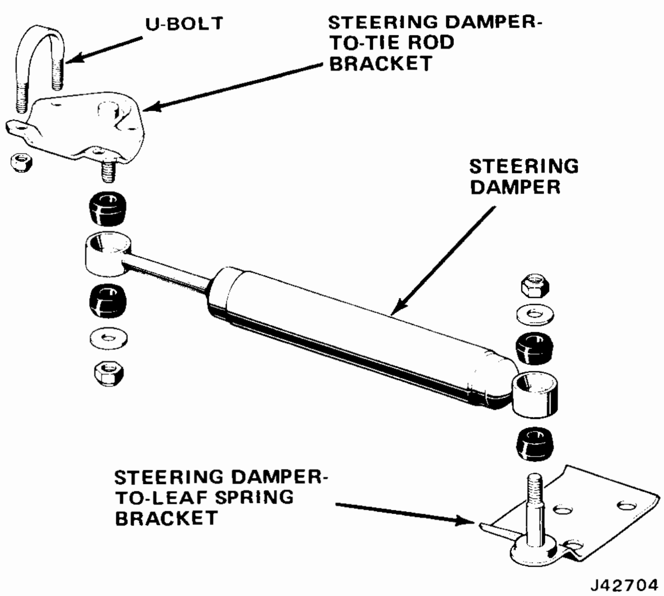

Fig. 11-63 Steering Damper

The steering damper is serviced as an assembly. If damaged or leaking, replace with a new assembly. The rubber bushings used in the damper eyelets can be replaced individually, if required.

Removal

(1) Place front wheels in straight-ahead position.

(2) Remove locknut securing damper to bracket on tie plate and lift damper off stud (fig. 11-63).

(3) Remove locknut securing push rod end to tie rod bracket and remove damper assembly.

Installation

(1) Insert rubber bushings in damper eyelets.

(2) Secure eyelet at push rod end to stud on tie rod bracket with attaching parts.

(3) Extend push rod by pulling back on damper body until eyelet can be located on, and secured to, stud on damper bracket at spring pad.

(4) Tighten all locknuts securely.

FRONT WHEEL ALIGNMENT

Alignment should be checked and adjusted using an alignment rack. To ensure correct alignment, the following inspection is recommended.

(1) Equalize tire pressures and place vehicle on level surface.

(2) Check steering gear-to-steering column alignment.

(3) Inspect steering knuckle pivots, spindle, and wheel bearings for looseness.

(4) Check for spring sag.

(5) Check brakes and shock absorbers for proper operation.

(6) Check steering gear play.

(7) Check caster.

(8) Check toe-in.

(9) Check camber.

(10) Check tracking of front and rear wheels. Check for broken spring center bolts.

NOTE: *Be sure all front suspension and steering system nuts and bolts are tight before checking wheel alignment.*

Toe-In

Refer to figure 11-64. The use of an alignment rack to measure toe-in is recommended. To measure toe-in, without an alignment rack, raise the front of the vehicle and turn the front wheels to the straight-ahead position. Using chalk, draw a 1/2-inch wide strip around the circumference of each tire at the center of each tire tread while turning the wheels by hand. Using a steady rest, scribe a pencil line in the chalk strip at the exact center of each tire tread.

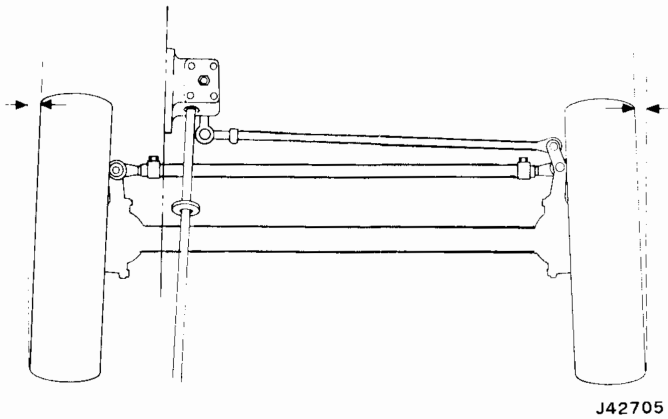

Fig. 11-64 Front Wheel Toe-In (Top View)—Typical

Measure the distance between the scribed pencil lines at the front and rear of the wheels. Be sure that both measurements are made at an equal distance from the floor. The distance between the lines should be greater at the rear than at the front by 3/64 inch to 3/32 inch. To adjust toe-in, loosen the clamp bolts and turn the tie rod with a small pipe wrench. The tie rod is threaded with right- and left-hand threads to provide equal adjustment at both wheels. After adjustment, tighten the clamp bolts to specified torque.

NOTE: *It is common practice to measure between the wheel rims, which is a satisfactory method providing the wheels run true. However, by scribing a line on the tire tread, measurement is taken between the actual road contact points.*

Camber

Refer to figure 11-65. Correct wheel camber of 1-1/2° is preset in the solid front axle at the time of manufacture and cannot be altered by adjustment. It is important that the camber is the same on both front wheels. Camber angle should be checked using wheel alignment equipment.

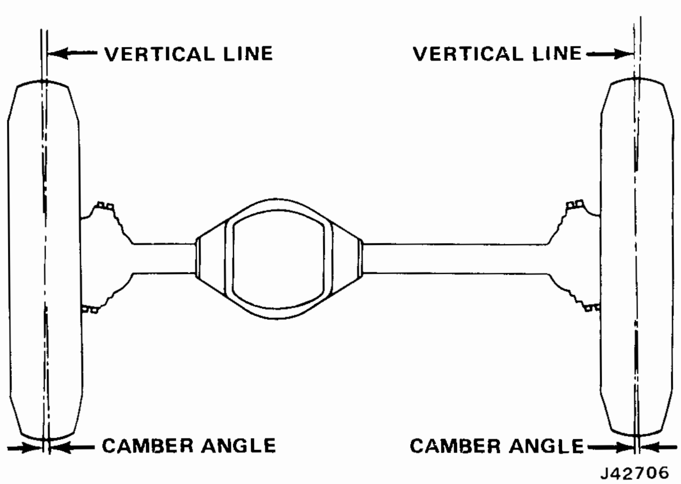

Fig. 11-65 Front Wheel Camber (Front View)

CAUTION: *Do not attempt to adjust camber angle by heating or bending an axle or any suspension components. If camber is incorrect, the component(s) causing the camber angle to be incorrect should be replaced.*

Caster

Refer to figure 11-66. Axle caster is preset at 3° for CJ models and 4° for Cherokee, Wagoneer, and Truck. Caster should be checked using wheel alignment equipment. If caster is incorrect, adjustment may be made by installing new parts or installing caster shims between the axle pad and the springs.

If the camber and toe-in are correct and it is known that the axle is not twisted, a satisfactory check may be made by road-testing the vehicle. Before road-testing, make sure all tires are properly inflated,being particularly careful that both front tires are inflated to exactly the same pressure.

If vehicle turns easily to either side but returns hard to straight-ahead position, incorrect caster is indicated.

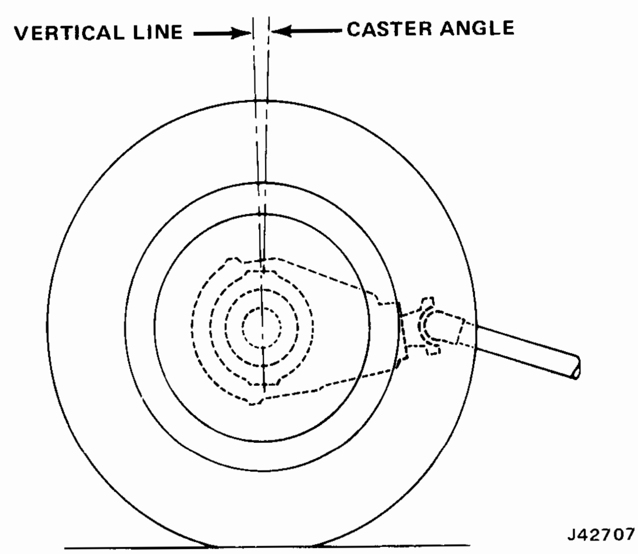

Fig. 11-66 Axle Caster (Side View)

STEERING WHEEL SPOKE ALIGNMENT

After checking and adjusting front wheel alignment, align the steering wheel spokes as follows.

(1) Center steering wheel by aligning spokes with steering gear in straight-ahead position and clamp wheel in position.

(2) Loosen connecting rod adjusting tube clamp and turn tube until front wheels are in straight-ahead position.

(3) Tighten adjusting tube clamps.

(4) Road-test to check spoke alignment adjustment.

FRONT WHEEL SHIMMY

Front wheel shimmy may be caused by one or more of the following conditions:

- Incorrectly adjusted front wheel bearings
- Worn or out-of-balance or out-of-round front tires
- Loose steering damper to tie rod bracket (CJ, Cherokee, Wagoneer, Truck)
- Steering damper malfunction
- Worn (loose) tie rod ends
- Worn (loose) steering knuckle ball studs
- Incorrect tire pressures

The following procedure outlines a method of correcting the causes of wheel shimmy.

(1) Raise and support front of vehicle.

(2) Inspect condition of front tires. Check and correct tire inflation pressure. Check for evidence of tire imbalance such as flat spots, scalloping, cupping or bald spots. If necessary, balance or replace tires.

(3) Check front wheel bearing adjustment. Correct wheel bearing adjustment if necessary. Refer to procedure outlined in Section 9 of this manual.

(4) Check for loose steering damper tie rod bracket on vehicles so equipped. If bracket is loose, center bracket on tie rod and tighten attaching bolts.

(5) Disconnect steering damper at tie rod bracket and check operation as follows:

(a) Alternately compress and extend damper. Damper should provide equal resistance throughout length of each stroke.

(b) Replace damper if lack of resistance is evident.

(6) Inspect all tie rod ends. If excessive play is observed in any tie rod end when checked, replace it.

(7) Inspect steering knuckle ball studs. Insert pry bar between knuckle and yoke, adjacent to ball stud, and pry against each ball stud. If none of the studs move or appear to be loose in their sockets, proceed to step (8). If any stud moves or appears to be loose in is socket, reseat both studs on that side of the axle as follows:

(a) Remove wheels and tires. Remove axle shafts.

(b) Remove cotter pin and slotted nut from upper ball stud and loosen lower ball stud jamnut.

(c) Unseat upper and lower ball studs by striking upper ball stud with rawhide or lead hammer. Remove upper ball stud split ring seat using Tool J-25158. Discard split ring seat.

(d) Remove lower ball stud jamnut and remove steering knuckle. Discard lower ball stud jamnut.

(e) Clean upper ball stud split ring seat threads and lower ball stud taper in steering knuckle. Clean threads and tapered surfaces of both ball studs. Clean threads in upper ball stud retaining nut.

(f) Install steering knuckle. Support knuckle by hand and install new lower ball stud jamnut. Tighten jamnut finger-tight only. Install upper ball stud nut. Tighten nut until lower ball stud is drawn into tapered hole in axle yoke. Do not install split ring seat at this time.

(g) Tighten upper ball stud jamnut to 80 foot-pounds torque. Remove upper ball stud nut and install new upper ball stud split ring seat. Tighten split ring seat to 50 foot-pounds torque using Tool J-25158. Tighten lower ball stud jamnut to 100 foot-pounds torque and install cotter pin.

(h) Install axle shafts and steering spindles, and repeat step (7).

(i) Install wheels and tires.

(8) On CJ models not equipped with steering damper, if components inspected are O.K., install steering damper.

(9) Remove supports and lower vehicle.

(10) Road-test vehicle to verify repair.

POWER STEERING SYSTEM

GENERAL

The power steering system consists of a power steering gear, connecting hoses, and a hydraulic pump. The engine-driven pump supplies oil from its integral reservoir through the pressure and return hoses which connect the gear and pump.

If for any reason the power system should malfunction, the steering gear will operate manually, giving the driver continued control of the vehicle. The steering gear, in this condition, operates as a typical recirculating ball-type manual steering gear. Hydraulic fluid is bypassed through the valve so that it does not restrict manual operation.

DESCRIPTION AND OPERATION

Steering Gear

All models use a recirculating ball-type power steering gear. Steel balls act as a rolling thread between the steering gear wormshaft and the rack-piston nut.

Wormshaft fore and aft thrust is controlled by a thrust bearing and two races at the lower end, and a bearing assembly in the adjuster plug at the upper end. The lower thrust bearing races are conical and provide continual spring-loaded pressure on the wormshaft to prevent loss of thrust bearing preload. The adjuster plug provides initial preload adjustment when servicing the gear.

As the wormshaft is turned right, the rack-piston moves upward, turning the wormshaft left moves the rack-piston downward.

The rack-piston teeth mesh with the sector which is forged as part of the pitman shaft. Turning the wormshaft turns the pitman shaft which, through mechanical linkage, turns the wheels.

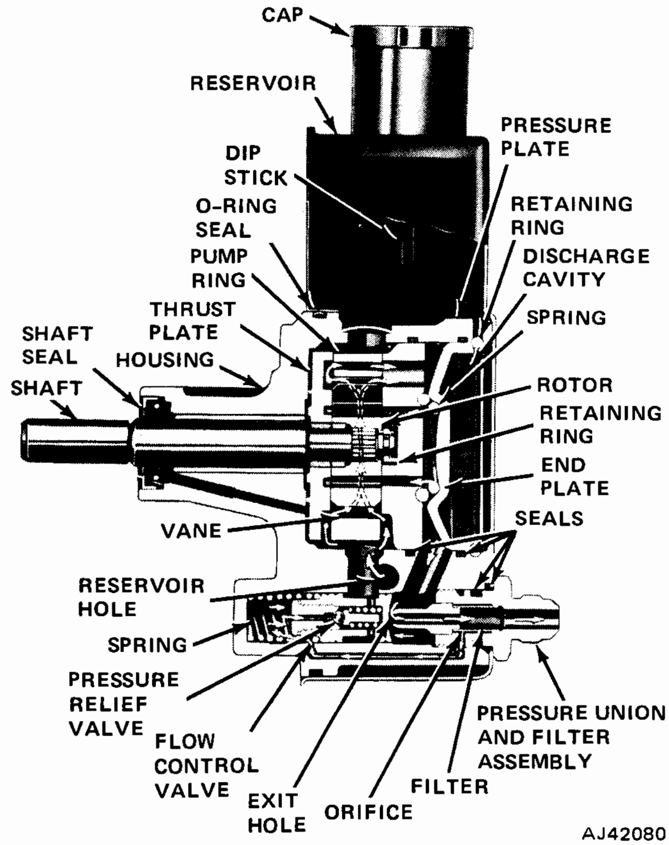

Fig. 11-67 Power Steering Pump

Pump

The vane-type, constant-displacement pump develops the system oil pressure that is applied against the rack-piston nut to rotate the pitman shaft (fig. 11-67).

The integral pump reservoir provides a reserve supply of oil for the hydraulic system.

The reservoir cap is vented to maintain atmospheric pressure in the reservoir and to allow air trapped in the system to escape.

A flow control valve contained within the pump is used to control and maintain system operating pressure. A pressure relief valve is incorporated into the flow control valve. The flow control valve can be serviced without removing the pump from the engine.

Hydraulic Assist

The power steering gear has an open center, three-way, rotary valve to control hydraulic assist. Pump-supplied oil is applied to the pressure hole in the gear housing and then routed by the valve through the gear oil passages (fig. 11-68 and 11-69).

Through mechanical connections, the valve body, spool valve, torsion bar, and stub shaft which is pinned to the torsion bar, are, in effect, attached to the front wheels. Due to the pressure exerted on the front wheels by the weight of the vehicle, the wheels and, consequently, the valve body, tend to resist any turning effort that is applied. As resistance to turning by the wheels and valve body increases, the torsion bar deflects, permitting the stub shaft to rotate within the valve body. Since the spool valve is connected to the stub shaft by a locating pin, the spool valve also rotates within the valve body. As the spool valve rotates, the fluid directional passages machined into the spool valve are brought into alignment with machining passages in the valve body. When these passages are aligned, high pressure fluid from the pump is directed through the aligned passages and against either side of the rack-piston nut.

VARIABLE RATIO POWER STEERING

A variable ratio power steering gear is included in the optional power steering package offered on Cherokee, Wagoneer, and Truck models. CJ-5 and CJ-7 models are equipped with a constant ratio steering gear.

The ratio of a steering system is the relationship of steering wheel movement to that of the front wheels, in terms of the number of degrees that the steering wheel must be moved to turn the front wheels one degree.

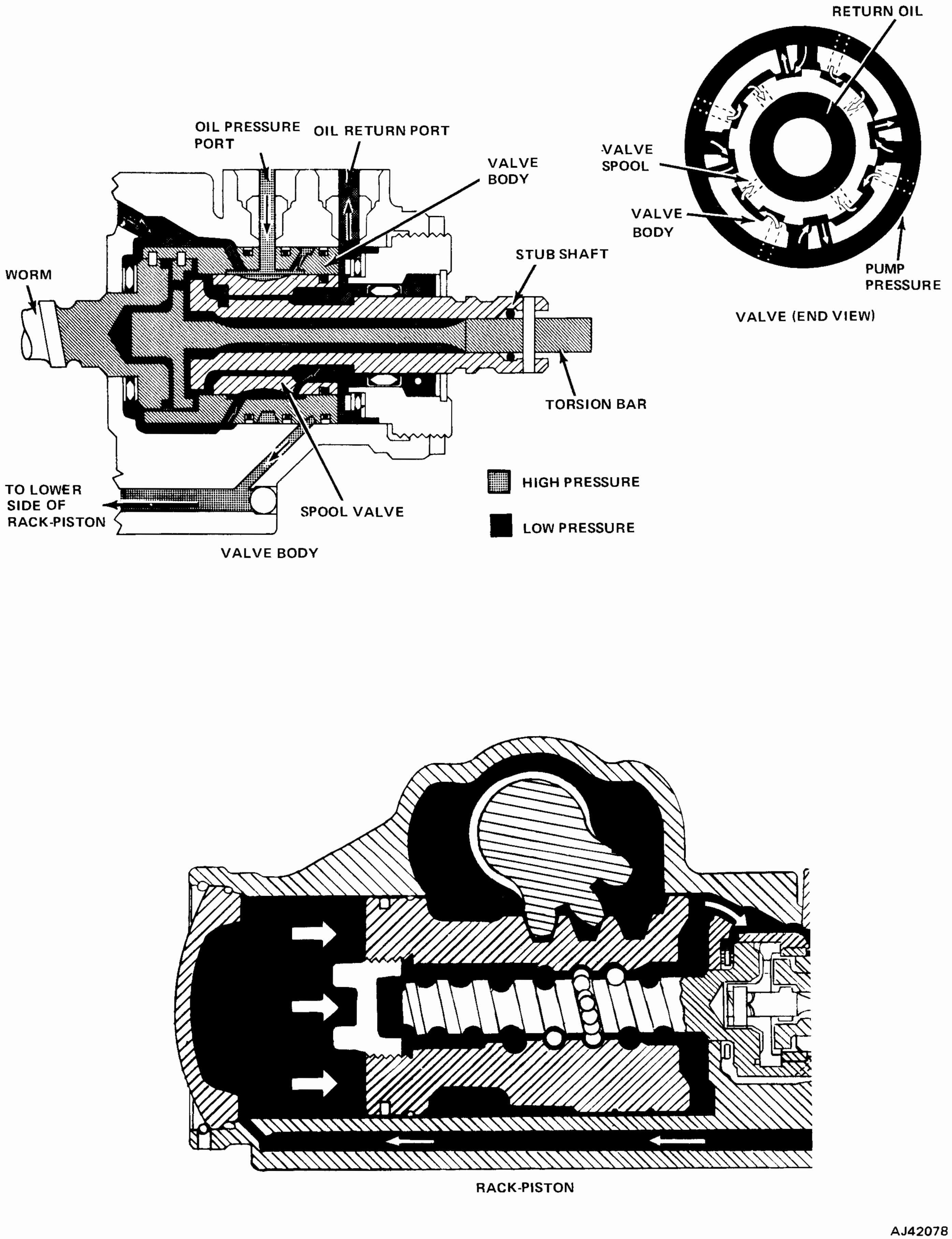

Fig. 11-68 Valve Oil Flow—Right Turn Position

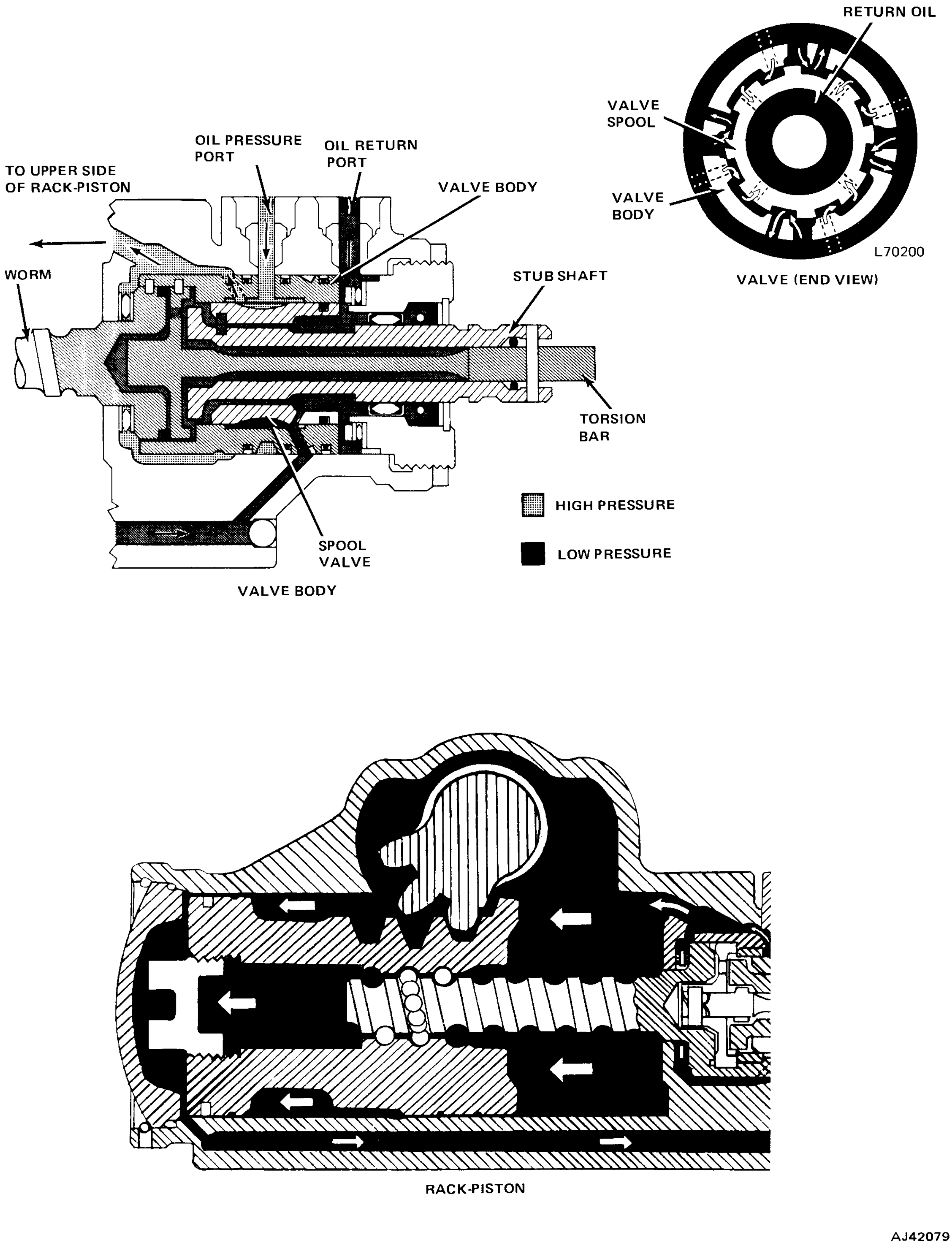

Fig. 11-69 Valve Oil Flow—Left Turn Position

Variable ratio steering is accomplished by a pitman shaft sector incoporating 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. Companion changes are also made in the rack-piston teeth (fig. 11-70).

Since the sector is basically a series of levers, any movement of the rack will cause the sector to swing the pitman arm in the same ratio; that is, it will turn the pitman arm the same number of degrees with each tooth in the sector.

To increase or decrease the ratio, it is only necessary to change the length of the sector teeth. A low ratio, or smaller radius sector with shorter teeth, produces greater pitman arm movement than the high ratio sector with its longer teeth and greater leverage.

On this basis, the variable ratio sector is in reality one long, high-ratio lever at the center, flanked by two lower-ratio levers for left and right turns.

Since only the tip of the long center tooth is in contact with the rack when the front wheels are straight, initial movement of the rack in either direction causes a relatively small response of the sector and pitman arm because of the high ratio that results from this long lever relationship.

As a result, the steering ratio remains a nearly constant 16.0:1 for the first 40 degrees of steering wheel movement in either direction from center.

Turning the steering wheel further reduces the length of the lever. The point of contact now rolls down the side of the center tooth, to act as a shorter radius, providing a steering ratio of 13.0:1 at full lock.

NOTE: *Service procedures for constant and variable ratio steering are the same.*

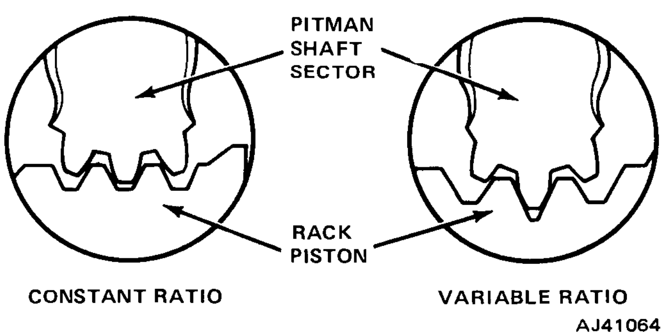

Fig. 11-60 Rack and Sector Comparison

PERIODIC MAINTENANCE—POWER STEERING

Oil must be maintained at the level indicated on the dipstick. If necessary, add fluid to correct the level.

Start the engine and operate it for ten minutes. Do not turn the steering wheel during this time. Raise the front wheels from the floor and perform several complete power-operated turns. Do not hold the steering wheel at maximum turn position or overheating of the pump will occur.

Check the fluid level and, if necessary, fill reservoir to required level. Inspect the system for external leaks. Check the fluid in the system for foam, which indicates air in the system.

NOTE: *Air bubbles circulating through the pump and gear will result in noise. Refer to Fluid Level and Initial Operation at the end of this section for hydraulic system bleeding procedure.*

Pump Drive Belt Tension

Adjust belt so that tension is as specified when measured with Belt Tension Gauge J-23600. When using a belt tension gauge, make sure gauge is placed in the center of the longest belt span. When checking notched belts, make sure the center finger of the gauge is in the notched groove of the belt.

POWER STEERING GEAR SERVICE

Removal

(1) Disconnect hoses from return port and pressure port. Raise hoses above pump to prevent oil from draining.

(2) On CJ models, disconnect intermediate shaft coupling at steering gear stub shaft. On Cherokee, Wagoneer, and Truck models, disconnect flexible coupling at intermediate shaft.

(3) Remove pitman arm nut, lockwasher, and remove pitman arm using Tool J-6632.

(4) Remove mounting bolts attaching steering gear assembly to frame, and remove steering gear assembly.

Installation

(1) Mount steering gear on frame and install attaching bolts. Tighten bolts to 65 foot-pounds torque.

(2) Install pitman arm on pitman shaft. Install lockwasher and pitman arm nut. Tighten nut to 190 foot-pounds torque.

(3) On CJ models, connect stub shaft to intermediate shaft. Tighten clamp bolt to 40 foot-pounds torque.

(4) On Cherokee, Wagoneer, and Truck models, install flexible coupling on stub shaft, if removed, and tighten clamp to 30 foot-pounds torque. Connect intermediate shaft to flexible coupling and tighten attaching bolts and nuts to 20 foot-pounds torque.

(5) Connect hoses to power steering gear. Tighten hose fittings to 30 foot-pounds torque.

(6) Check and correct fluid level in power steering pump as outlined in Fluid Level and Initial Operation.

Service Diagnosis—Steering Gear and Pump

Condition	Possible Cause	Correction
HISSING NOISE IN STEERING GEAR	(1) There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.	(1) Slight hiss is normal and in no way affects steering.
RATTLE OR CHUCKLE NOISE IN STEERING GEAR	(1) Gear loose on frame.	(1) Check gear-to-frame mounting screws. Tighten screws to 65 foot-pounds torque.
	(2) Steering linkage looseness.	(2) Check linkage pivot points for wear. Replace if necessary.
	(3) Pressure hose touching other parts of car.	(3) Adjust hose position. Do not bend tubing by hand.
	(4) Loose pitman shaft over center adjustment. **NOTE**: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.	(4) Adjust to specifications.
	(5) Loose pitman arm.	(5) Tighten pitman arm nut to specifications.
SQUAWK NOISE IN STEERING GEAR WHEN TURNING OR RECOVERING FROM A TURN	(1) Damper O-ring on valve spool cut.	(1) Replace damper O-ring.
CHIRP NOISE IN STEERING PUMP	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.
BELT SQUEAL (PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND STAND STILL PARKING)	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.

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Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
GROWL NOISE IN STEERING PUMP	(1) Excessive back pressure in hoses or steering gear caused by restriction.	(1) Locate restriction and correct. Replace part if necessary.
GROWL NOISE IN STEERING PUMP (PARTICULARLY NOTICEABLE AT STAND STILL PARKING)	(1) Scored pressure plates, thrust plate or rotor.	(1) Replace parts and flush system.
	(2) Extreme wear of cam ring.	(2) Replace parts.
GROAN NOISE IN STEERING PUMP	(1) Low oil level.	(1) Fill reservoir to proper level.
	(2) Air in the oil. Poor pressure hose connection.	(2) Tighten connector to specified torque. Bleed system by operating steering from right to left-full turn.
RATTLE NOISE IN STEERING PUMP	(1) Vanes not installed properly.	(1) Install properly.
	(2) Vanes sticking in rotor slots.	(2) Free up by removing burrs, varnish, or dirt.
WHINE NOISE IN STEERING PUMP	(1) Pump shaft bearing scored.	(1) Replace housing and shaft. Flush system.
POOR RETURN OF STEERING WHEEL TO CENTER	(1) Tires not properly inflated.	(1) Inflate to specified pressure.
	(2) Lack of lubrication in linkage and ball studs.	(2) Lube linkage and ball studs.
	(3) Lower coupling flange rubbing against steering gear adjuster plug.	(3) Loosen pinch bolt and assemble properly.
	(4) Improper front wheel alingment.	(4) Check and adjust as necessary. With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or ball joints are binding.
	(5) Steering linkage binding.	(5) Replace pivots.
	(6) Ball studs binding.	(6) Replace ball studs.
	(7) Tight or frozen steering shaft bearings.	(7) Replace bearings.

60702B

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
POOR RETURN OF STEERING WHEEL TO CENTER (Continued)	(8) Sticky or plugged spool valve.	(8) Remove and clean or replace valve.
	(9) Steering gear adjustments over specifications.	(9) Check adjustment with gear out of vehicle. Adjust as required.
	(10) Steering gear poppet valve installed incorrectly.	(10) Inspect and install valve correctly.
CAR LEADS TO ONE SIDE OR THE OTHER (KEEP IN MIND ROAD CONDITION AND WIND. TEST CAR IN BOTH DIRECTIONS ON FLAT ROAD)	(1) Incorrect tire pressure.	(1) Check and adjust.
	(2) Front end misaligned.	(2) Adjust to specifications.
	(3) Unbalanced steering gear valve.	(3) Replace valve.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump.	(1) Add power steering fluid as required.
	(2) Pump belt slipping.	(2) Tighten or replace belt.
	(3) High internal leakage.	(3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level.	(1) Fill as required.
	(2) Loose pump belt.	(2) Adjust tension to specification.
	(3) Insufficient pump pressure.	(3) Check pump pressure. (See pressure test). Replace relief valve if defective.
	(4) Sticky flow control valve.	(4) Inspect for varnish or damage, replace if necessary.
LOOSE STEERING	(1) Steering gear loose on frame.	(1) Tighten attaching screws to specified torque.
	(2) Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose.	(2) Tighten flange pinch bolts to 30 foot-pounds, if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque.
	(3) Steering linkage joints worn enough to be loose.	(3) Replace loose pivots.
	(4) Worn poppet valve (Gear).	(4) Replace poppet valve.
	(5) Loose thrust bearing preload adjustment (Gear).	(5) Adjust to specification with gear out of vehicle.
	(6) Excessive overcenter lash in gear.	(6) Adjust to specification with gear out of vehicle.

60702C

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
HARD STEERING OR LACK OF ASSIST	(1) Loose pump belt.	(1) Adjust belt tension to specification.
	(2) Low oil level in reservoir. NOTE: Low oil level will also result in excessive pump noise.	(2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors.
	(3) Tires not properly inflated.	(3) Inflate to recommended pressure.
NOTE: If checks (1) through (3) do not reveal cause of hard steering, refer to pressure test.	Further possible causes could be: (4) Sticky flow control valve. (5) Insufficient pump pressure output. (6) Excessive internal pump leakage. (7) Excessive internal gear leakage.	In order to diagnose conditions such as listed in (4), (5), (6), (7) a test of the entire power steering system using gauge tool J 21567 is required.
FOAMING AERATED POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	(1) Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
LOW PRESSURE DUE TO STEERING PUMP	(1) Flow control valve stuck or inoperative.	(1) Remove burrs or dirt or replace. Flush system.
	(2) Pressure plate not flat against cam ring.	(2) Correct.
	(3) Extreme wear of cam ring.	(3) Replace parts. Flush system.
	(4) Scored pressure plate, thrust plate, or rotor.	(4) Replace parts. Flush system.
	(5) Vanes not installed properly.	(5) Install properly.
	(6) Vanes sticking in rotor slots.	(6) Freeup by removing burrs, varnish, or dirt.
	(7) Cracked or broken thrust or pressure plate.	(7) Replace part.
LOW PRESSURE DUE TO STEERING GEAR	(1) Pressure loss in cylinder due to worn piston ring or badly worn housing bore.	(1) Remove gear from car for disassembly and inspection of ring and housing bore.
	(2) Leakage at valve rings, valve body-to-worm seal.	(2) Remove gear from car for disassembly and replace seals.

60702D

Disassembly

NOTE: *In most cases, complete disassembly of the power steering gear will not be necessary. It is suggested that only those subassemblies that are malfunctioning should be disassembled. Disassembly and assembly operations must be performed on a clean work bench. As in repairing any hydraulically operated unit, cleanliness is of the utmost importance. The work bench, tools, and parts must be kept clean at all times. Thoroughly clean the exterior of the unit with a suitable solvent before disassembly.*

Pitman Shaft and Side Cover

Refer to figure 11-71.

(1) Drain oil from gear assembly and mount gear in holding fixture or clamp rear portion. of housing in vise. Do not overtighten vise. This will distort housing.

(2) Place pitman shaft on center or high spot.

(3) Rotate stub shaft until pitman shaft gear is in center position and remove side cover bolts and lockwashers.

(4) Tap end of pitman shaft with plastic mallet, and slide pitman shaft and side cover out of housing.

(5) Remove and discard side cover O-ring seals.

(6) Hold lash adjuster with allen wrench and remove lash adjuster nut (fig. 11-72). Discard nut.

(7) Remove lash adjuster from side cover by threading adjuster clockwise into pitman shaft. **Do not remove** adjuster from pitman shaft.

(8) Remove pitman shaft seal retaining ring, using internal Snap Ring Pliers J-4245.

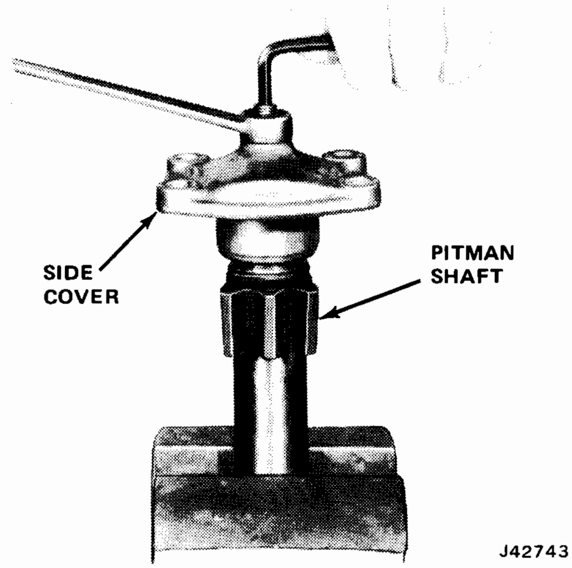

Fig. 11-72 Removing Lash Adjuster Locknut

(9) Remove outer backup washer. Tap screwdriver between outer seal and inner backup washer and pry out seal (fig. 11-73).

(10) Insert screwdriver between inner seal and shoulder in gear housing and pry out second seal. Do not damage seal bore. Discard seals.

(11) Remove needle bearing from housing using Tool J-6657. To remove bearing, drive it out of housing, **not** into housing. Discard bearing.

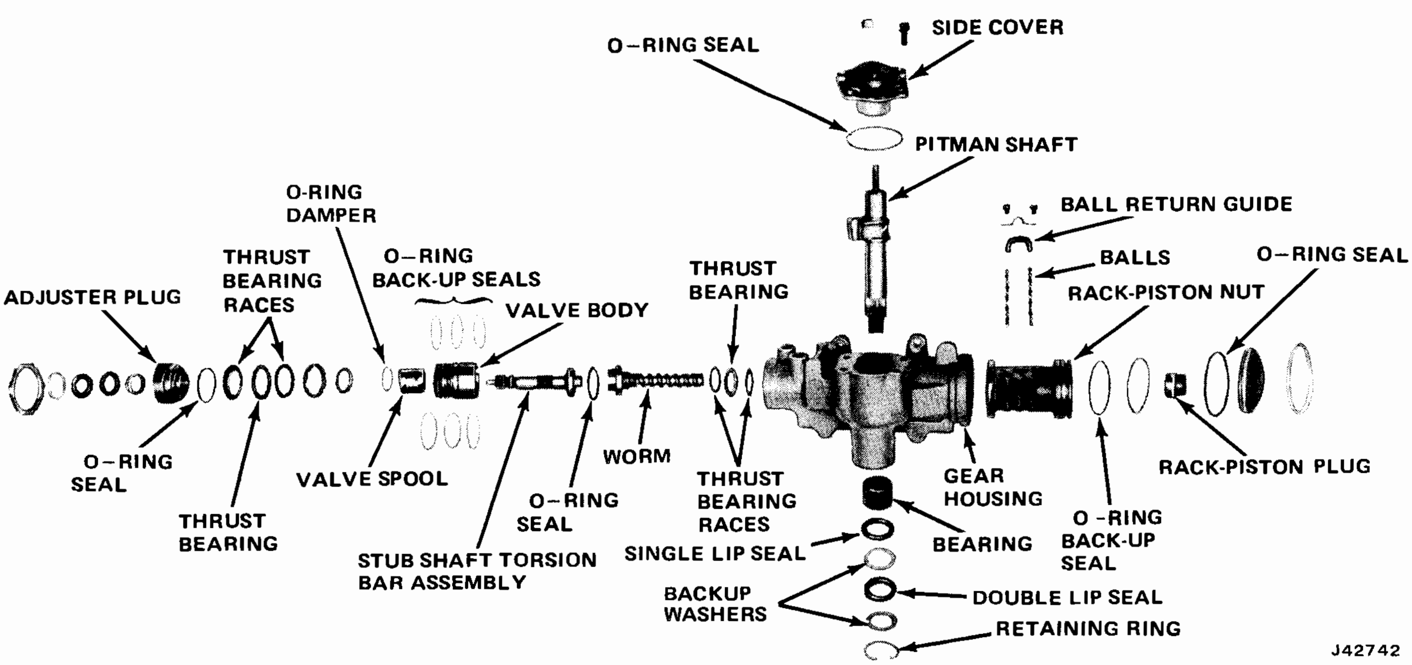

Fig. 11-71 Power Steering Gear

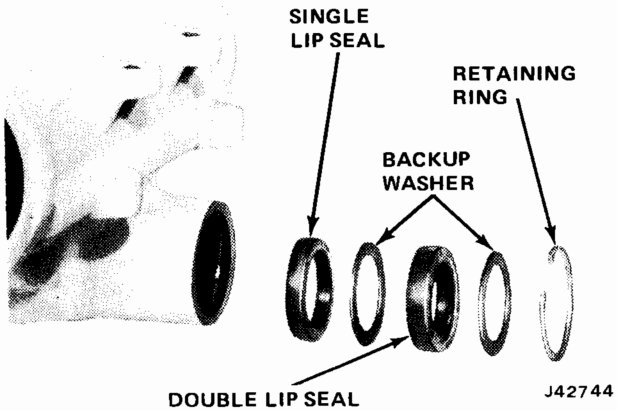

Fig. 11-73 Pitman Shaft Seal

Adjuster Plug Assembly

(1) Loosen adjuster plug locknut using Wrench J-25194.

(2) Loosen adjuster plug assembly using Tool J-7624 (fig. 11-74). Prevent stub shaft from turning and unthread adjuster plug assembly.

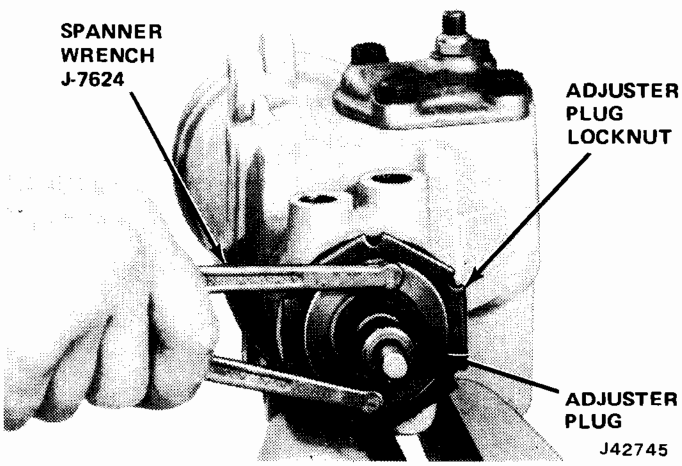

Fig. 11-74 Adjuster Plug Removal or Installation

(3) Remove thrust bearing retainer using screwdriver (fig. 11-75) Do not score needle bearing bore. Discard retainer.

(4) Remove thrust bearing spacer, thrust bearing, and thrust bearing races (fig. 11-71).

(5) Remove and discard adjuster plug O-ring seal.

(6) Remove stub shaft seal retainer ring and stub shaft dust seal from adjuster plug.

(7) Remove stub shaft seal by prying out with screwdriver. Discard seal.

(8) If adjuster plug needle bearing rollers are broken or pitted, drive bearing from plug using Adjuster Plug Bearing Removal and Installer Tool J-6221. Discard bearing.

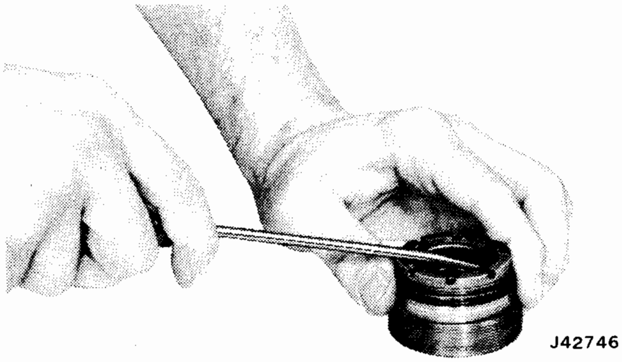

Fig. 11-75 Removal of Thrust Bearing Retainer

Valve Assembly

Refer to figure 11-71. The complete valve spool assembly is a precision unit with select-fit parts that are hydraulically balanced during manufacture.

NOTE: *It is uncommon to make service repairs of the valve assembly with the possible exception of the valve spool damper O-ring. Do not disassemble the valve unless absolutely necessary . This may result in damaging the assembly. If the valve spool damper O-ring requires replacement, remove the valve spool, replace the O-ring, and reinstall the spool immediately. If the valve spool or valve body requires replacement, it must be replaced as an assembly only. Do not attempt to interchange parts. If disassembly of the valve spool assembly is necessary, proceed as follows.*

(1) Remove valve body and stub shaft torsion bar assembly by grasping stub shaft torsion bar and pulling straight out.

(2) Remove cap-to-O-ring seal. Discard seal.

(3) Hold valve assembly in both hands with stub shaft pointing down. Tap stub shaft lightly against bench until shaft cap is free from valve body (fig. 11-76).

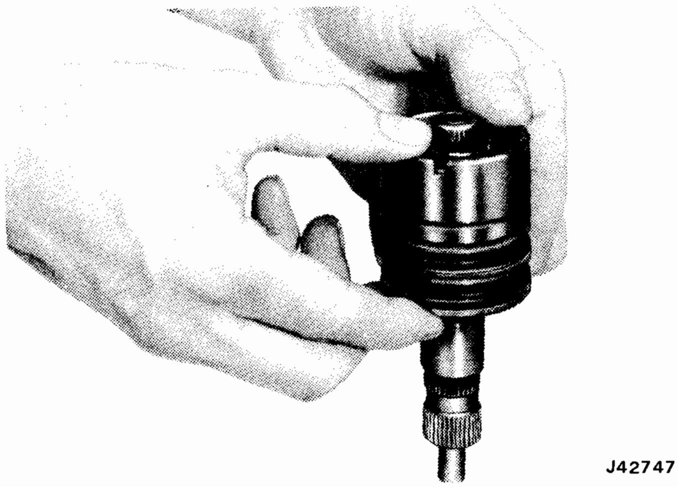

Fig. 11-76 Tapping Torsion Bar to Remove Valve Cap

(4) Pull shaft assembly until valve cap clears valve body approximately 1/4 inch.

CAUTION: *Do not pull shaft assembly out too far or valve spool may become cocked in valve body.*

(5) Disengage shaft pin from valve spool and carefully remove shaft assembly.

(6) Push valve spool out of valve body while rotating valve. If valve becomes cocked, carefully realign valve, and remove.

(7) Remove and discard damper O-ring from valve spool.

(8) Cut and remove valve O-rings and backup seals (fig. 11-71).

NOTE: *Remove and discard seal rings and O-rings only if worn excessively. Valve seal rings are made of filled teflon, and it is unusual for replacement to be required.*

Rack-Piston and Wormshaft

(1) Rotate end plug retainer ring so that one end of ring is over hole in housing. Unseat end of ring using punch inserted through hole. Use screwdriver to unseat and remove ring (fig. 11-77).

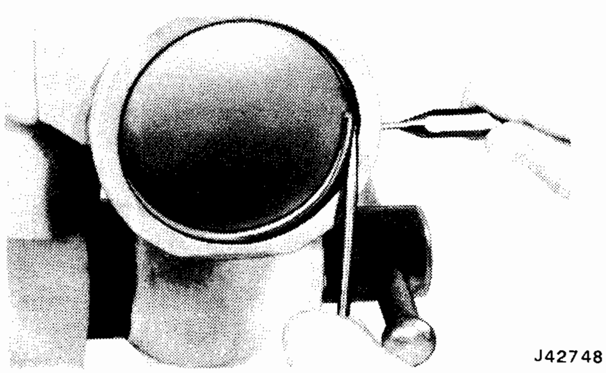

Fig. 11-77 End Plug Retaining Ring Removal

(2) Rotate stub shaft torsion bar using 12-point, 3/4-inch box end or socket wrench to extreme left-turn position to force plug out of housing.

CAUTION: *Do not rotate farther than necessary or balls in rack and worm assembly will fall off end of worm.*

(3) Remove and discard housing end plug O-ring seal.

(4) Strike rack piston plug with brass drift and hammer to loosen and remove plug by inserting 1/2-inch drive socket extension into square hole in plug and turning counterclockwise.

NOTE: *This can be done only with the pitman shaft in place.*

(5) Remove rack-piston nut using Arbor Tool J-7539-01 (fig. 11-78). rack-piston nut (fig. 11-78). Rotate stub shaft torsion bar to left to force rack-piston nut onto arbor and remove rack-piston nut.

NOTE: *The arbor prevents the balls from falling out of the rack-piston nut. After removing the rack-piston nut, place it on the workbench with the ring end toward the bench. Keep the arbor tool inserted in the rack-piston nut.*

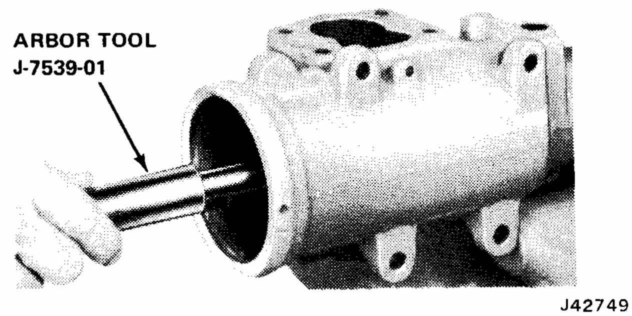

Fig. 11-78 Removing Rack-Piston Nut

(6) Remove valve body and adjuster plug assembly.

(7) Remove worm, lower thrust bearing, and races.

(8) Cut and remove piston ring and O-ring backup seal from rack-piston nut. Discard ring and seal.

(9) Remove screw and lockwasher assemblies from rack-piston nut using screwdriver.

(10) Remove return guide clamp.

(11) Place assembly on clean cloth, and remove ball return guides and arbor tool to release balls. Be sure all balls are caught in cloth.

Inspection and Repair

Gear Housing

(1) Inspect gear housing bore. If badly scored or worn, replace the gear housing.

(2) Check hose connectors. If damaged, scored, or brinelled, remove connectors as follows.

(3) Tap connector using 5/16-18 tap (fig. 11-79).

(4) Thread bolt with nut and flat washer attached into connectors.

(5) Hold bolt and rotate nut from bolt to remove connectors (fig. 11-80).

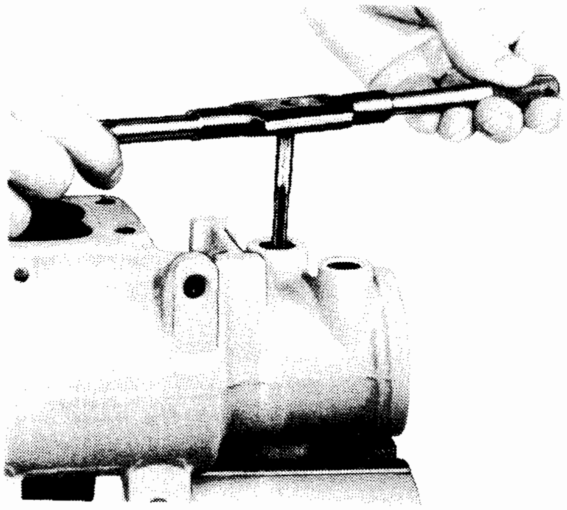

Fig. 11-79 Threading Connector with Tap

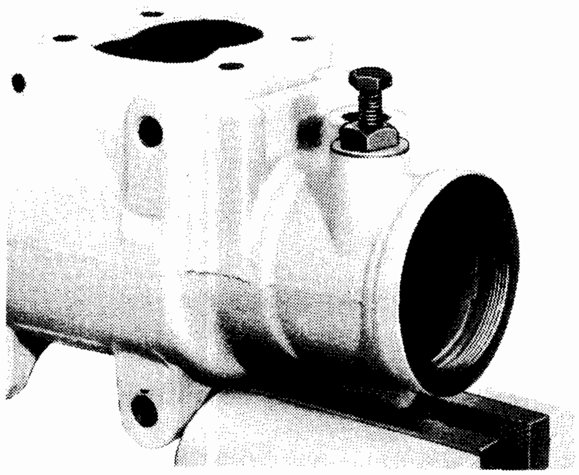

Fig. 11-80 Removing Connector

(6) If necessary to remove poppet valve from pressure port, use No. 5 screw extractor. Drive new connector into connector port using Installation Tool J-6217 (fig. 11-81).

NOTE: *After installing the connector, compress the poppet valve with a pencil point. When correctly installed, the poppet valve will spring back when the pencil is removed.*

(7) Inspect all seal surfaces and retaining ring grooves for damage. Replace housing if damaged.

(8) Inspect ball plug in housing. If prior leakage was noted around plug or if ball is raised above housing surface, drive it in until flush with or 1/16 inch below surface. Secure ball by staking housing around it.

NOTE: *If gear is installed and fluid leaks past ball after it has been seated and staked in place, replace the steering gear housing.*

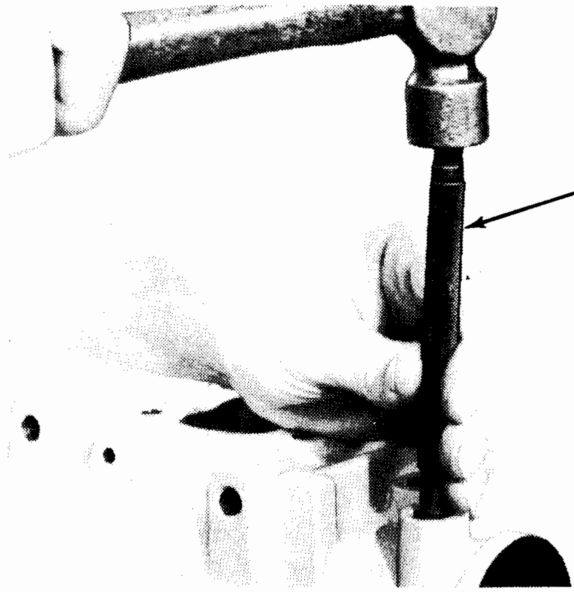

Fig. 11-81 Installing Connector

Rack-Piston Nut, Worm, and Balls

(1) Inspect wormshaft for wear, scoring, pitting, distortion, nicked threads, or cracks.

(2) Inspect rack-piston nut for scored, pitted, or nicked ball races.

(3) Inspect exterior diameter of nut for wear or scoring. Make sure seal seats are clean and free from burrs.

(4) Inspect rack teeth for chips, cracks, dents, or scoring. If either wormshaft or the rack-piston are damaged, both must be replaced as a matched set.

(5) Carefully inspect each of the balls for dents, nicks, excessive wear, flaking, or flat spots. Replace as necessary.

(6) Inspect ball return guides. Be sure ends, where balls enter and leave guides, are free of burrs or distortion.

(7) Inspect lower thrust bearing and races for wear or scoring. Replace if damaged or worn.

Valve Assembly Components

(1) If fluid leaked externally between torsion bar and stub shaft, replace entire assembly.

(2) Check pin in valve body which engages cap. If badly damaged, replace entire valve assembly.

(3) Check worm pin groove in valve body. If smaller groove is damaged, replace entire valve assembly.

(4) Check spool drive pin in stub shaft. If cracked, broken, or worn badly, replace entire valve assembly.

(5) Examine outside diameter of spool for nicks and burrs. If any are found, remove with a very fine hone. A slight polishing is normal on the valve surfaces.

(6) Examine valve body for nicks or burrs. If any are found, polish with crocus cloth until spool turns freely in body. Do not remove any stock from surface

of valve body. A slight polishing is normal on the valve surfaces.

Pitman Shaft, End Cover, and Bearings

(1) Inspect pitman shaft bushing in the side cover for excessive wear or scoring. If badly worn or scored, replace side cover and bushing assembly.

(2) Check pitman shaft sector teeth and bearing and seal surfaces. If badly worn, pitted, or scored, replace pitman shaft.

(3) Inspect needle bearings for rough or binding operation, scored or worn rollers, distorted cases, or other damage. Replace needle bearings if necessary.

Assembly

Rack-Piston and Wormshaft

NOTE: *Thoroughly lubricate all internal parts with power steering fluid during assembly. Prevent entry of dirt into the assembly.*

(1) Lubricate backup O-ring seal and install in ring groove on rack-piston nut (fig. 11-82).

(2) Install seal ring in ring groove on top of backup O-ring seal.

NOTE: *The seal ring may be slightly loose after assembly. This is normal. The seal ring will tighten when subjected to hot oil in the system.*

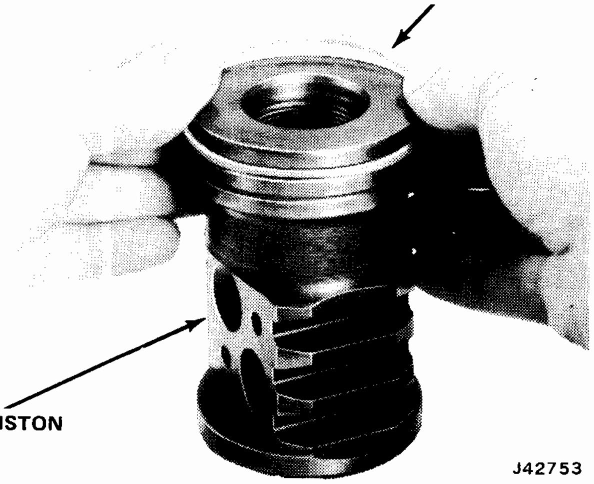

Fig. 11-82 Assembling Seal Ring on Rack-Piston Nut

(3) Install wormshaft in rack-piston as shown in figure 11-83.

(4) Align ball return guide holes with worm groove. Load 16 balls into guide hole nearest piston ring, while slowly rotating worm counterclockwise to feed balls through circuit (fig. 11-84). Alternate black balls with standard balls.

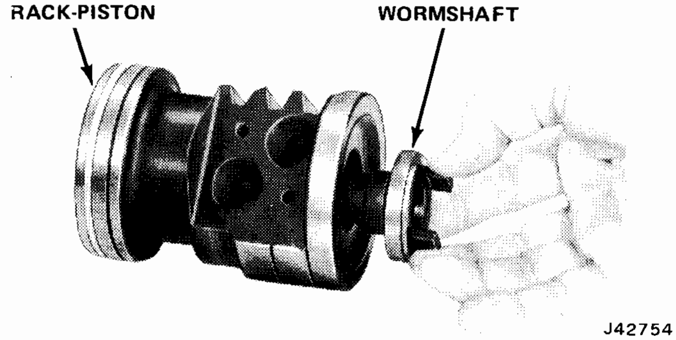

Fig. 11-83 Installing Wormshaft

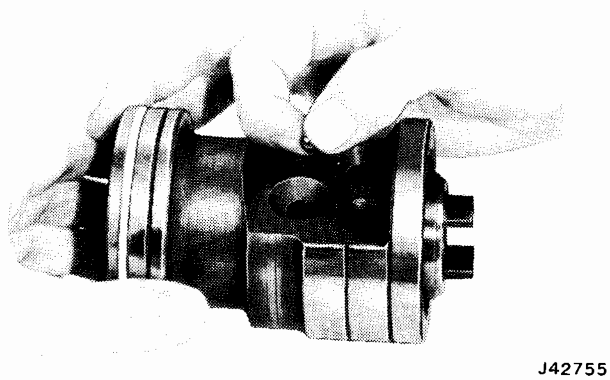

Fig. 11-84 Installing Balls in Rack-Piston Nut

(5) Fill one ball return guide with remaining balls. Place other guide over balls and plug ends with petroleum jelly to prevent balls from falling out when installing guide into rack-piston nut (fig. 11-85).

(6) Insert guides in guide holes of rack-piston nut (fig. 11-86). Guides should fit loosely.

(7) Place return guide clamp over guides and install attaching bolts and washers. Tighten bolts to 10 foot-pounds torque.

Do not allow the arbor to separate from the worm until the rack-piston nut is fully installed on the arbor.

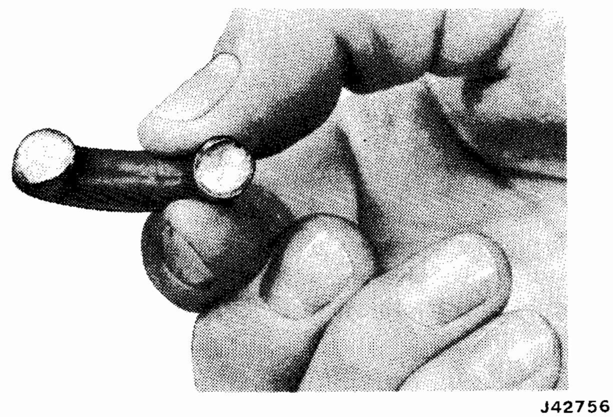

Fig. 11-85 Ball Return Guides Plugged with Petroleum Jelly

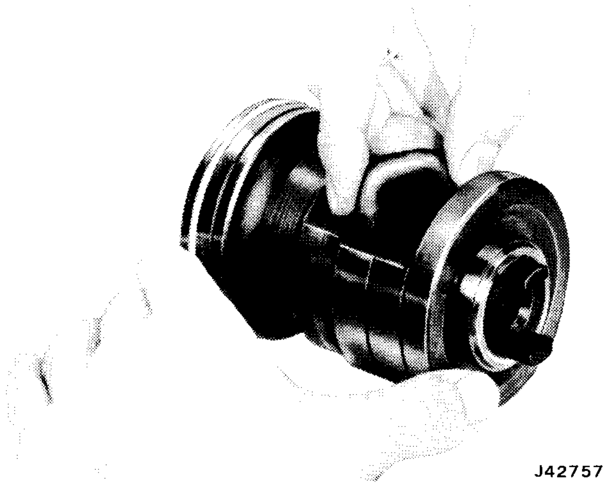

Fig. 11-86 Installing Ball Return Guides in Rack-Piston Nut

Valve Assembly

(1) Lubricate three backup O-ring seals and install in ring grooves on valve body.

(2) Install valve seal rings in ring grooves over O-ring seals (fig. 11-87). Rings may appear loose or twisted in grooves, but heat of oil in system will tighten them.

(3) Install spool valve damper O-ring seal in valve groove.

(4) Lubricate spool valve and valve body and install valve spool in valve body. Push valve spool through valve body until shaft pin hole is visible from opposite end (valve spool flush with shaft cap end of valve body).

(5) Install shaft assembly into valve spool until shaft pin can be placed into valve spool.

Fig. 11-87 Installing Valve Seal Rings

(6) Align notch in shaft cap with pin in valve body and press valve spool and shaft assembly into valve body.

CAUTION: *Make sure that shaft cap notch is mated with valve body pin before installing valve body into gear assembly.*

(7) Lubricate new cap-to-worm O-ring seal and install in valve assembly.

If the stub shaft and cap assembly are allowed to slip out of engagement with the valve body pin, the valve spool will extend too far into the valve body. This causes the damper O-ring seal to expand into the valve body oil grooves, preventing withdrawal of the valve spool. If this occurs, attempt to withdraw the spool with a slight pull and rotary motion. If this does not free the valve spool after several tries, make sure valve spool is free to rotate; place valve body on a flat surface with notched end up, and tap valve spool with wooden or plastic rod until the O-ring seal is cut and the valve spool can be removed. Replace damper O-ring seal and proceed with assembly. Make sure any cut pieces of O-ring are removed.

Power Steering Gear Subassemblies

(1) Use Pitman Shaft Needle Bearing Tool J-6657 to install needle bearing in housing. Install bearing from inside of housing toward outside. Make sure identification end is toward inside of gear and that tool is placed against identification end during installation. Press bearing into housing until it clears shoulder in gear housing by 0.030 inch.

(2) Lubricate and install pitman shaft seals. Install single lip seal first, then backup washer (fig. 11-73).

(3) Use Seal Seating Tool J-6219 (fig. 11-88) to seat seal and washer far enough to provide clearance for second seal and backup washer. Make sure seal does not bottom in counterbore.

(4) Install double lip seal and second backup washer using Seal Seating Tool J-6219. Make sure both seals are installed with lips toward gear housing.

(5) Install retaining ring.

(6) Assemble thrust bearings and races on worm of assembled worm and valve.

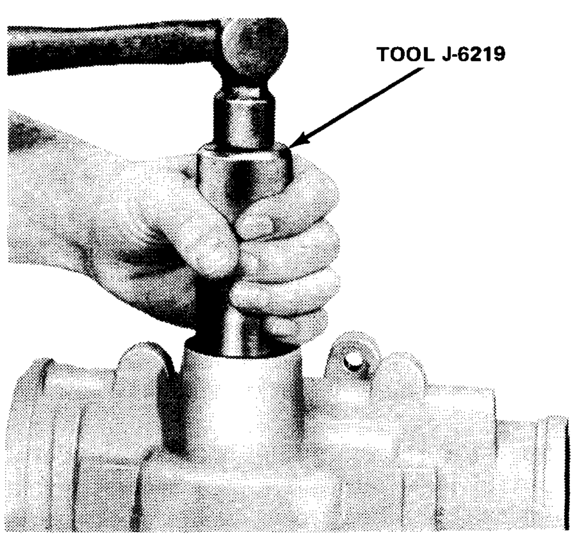

Fig. 11-88 Seating Pitman Shaft Seal in Housing

NOTE: *Two types of thrust bearing races may be used. Conical races must be installed so top of cone is facing bottom of gear. Flat races can be installed in any manner as long as one is above bearing and one below.*

(7) Install assembled valve and worm in housing as assembly. Align valve body drive pin in worm with narrow pin slot on valve body. Insert valve assembly into gear housing (fig. 11-89).

NOTE: *Push only on valve body—NOT on stub shaft.*

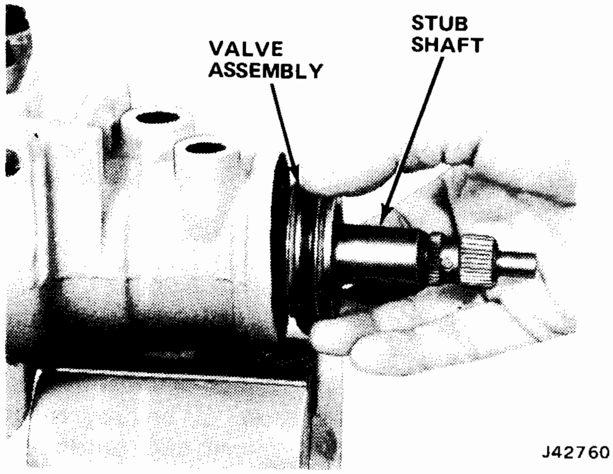

Fig. 11-89 Installing Valve Assembly

CAUTION: *Do not push against stub shaft as this may cause stub shaft and cap to pull out of valve body, allowing valve spool O-ring to slip into valve body oil grooves. The valve assembly should be inserted by pressing against the valve body with the fingertips (fig. 11-90). Before assembling the adjuster plug assembly, be sure the valve is properly seated. Most of the oil return hole in the gear housing should be fully visible at this time. If not, valve and worm are misaligned or thrust bearings are improperly installed.*

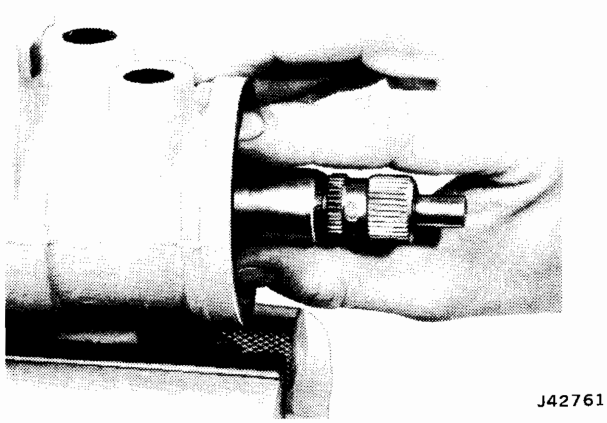

Fig. 11-90 Installing Valve Assembly Fully into Housing

(8) Install needle bearing in adjuster plug by pressing from thrust bearing end of adjuster plug against identification end of bearing, using Tool J-6621 (fig. 11-91). The end of the bearing must be flush with bottom surface of stub shaft seal bore.

(9) Lubricate new stub shaft seal and, using Tool J-5188 (fig. 11-92), install far enough to provide clearance for dust seal and retaining ring.

(10) Lubricate new dust seal and install with rubber surface facing out.

(11) Install retaining ring. Be sure ring is properly seated.

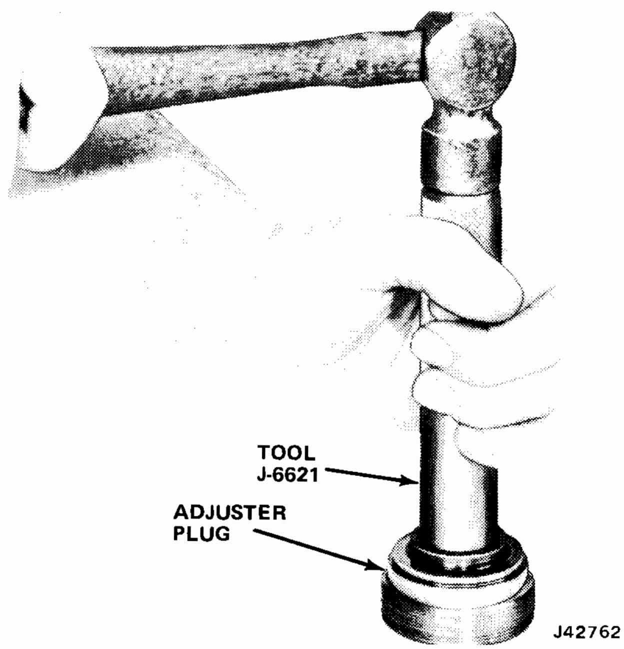

Fig. 11-91 Installing Needle Bearing in Adjuster Plug

(12) Lubricate O-ring seal with petroleum jelly and install on adjuster plug.

(13) Assemble large OD thrust bearing race, thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Do not flatten dimples. Spacer should rotate freely after assembly. Radial location of dimples is not important.

(14) Place Seal Protector Tool J-6222 over end of stub shaft.

(15) Install adjuster plug assembly in gear housing. Before adjusting preload, tighten adjuster plug to 20 foot-pounds torque.

(16) Adjust thrust bearing preload as follows:

With Conical Races

(a) Mark housing opposite one of the holes in adjuster plug (fig. 11-93).

(b) Measure counterclockwise 3/16 to 1/4 inch and remark housing (fig. 11-94).

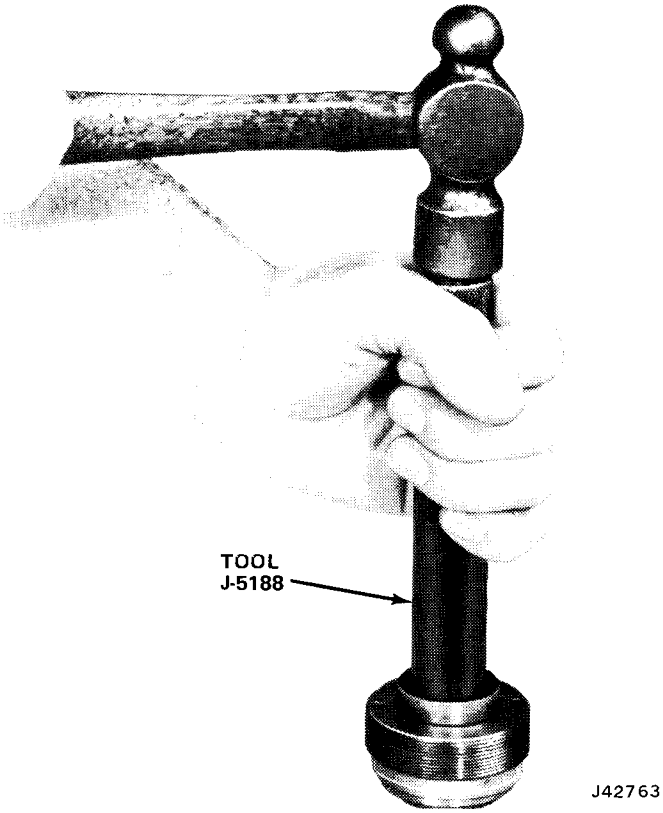

Fig. 11-92 Installing Stub Shaft Seal in Adjuster Plug

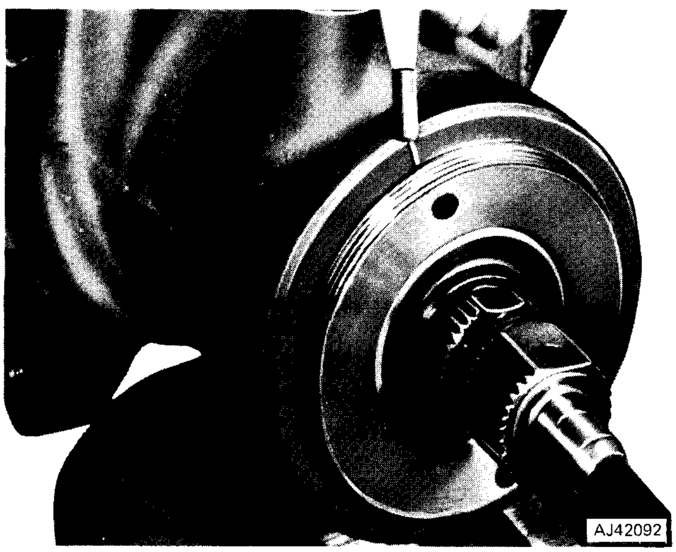

Fig. 11-93 Marking Housing

(c) Rotate adjuster plug counterclockwise until hole in plug is in line with second mark.

(d) Install and tighten adjuster plug locknut to 80 foot-pounds torque using Tool J-25194 while holding adjuster plug in position.

(e) Using an inch-pound torque wrench and 3/4-inch deep socket, measure drag torque required to turn stub shaft. Reading should be taken with beam of

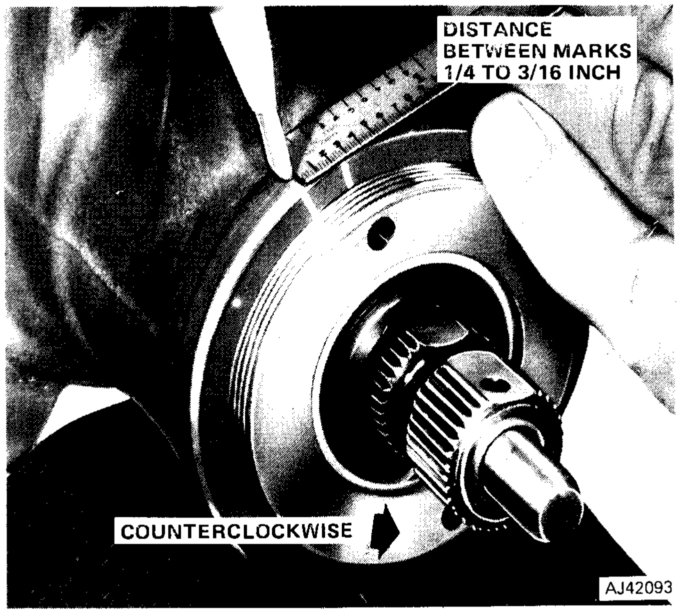

Fig. 11-94 Position of Second Mark

torque wrench near vertical while turning counterclockwise at an even rate. If reading is less than 4 inch-pounds or more than 10 inch-pounds, use adjustment procedure for flat races. If reading is within 4-to-10 inch-pound range, record and continue with overcenter adjustment (fig. 11-95).

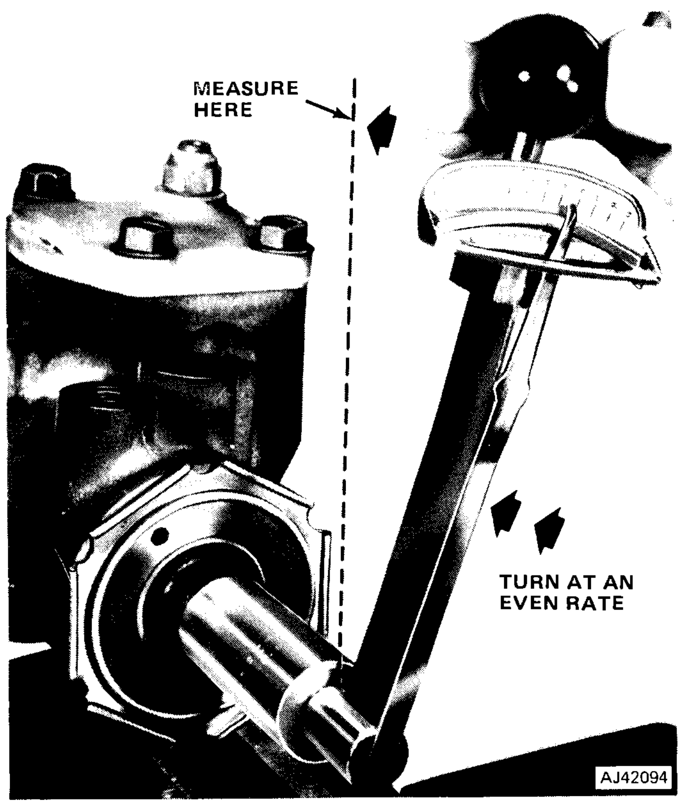

Fig. 11-95 Drag Torque Measurement

With Flat Races

(a) Tighten adjuster plug to 20 foot-pounds torque and back off 1/2-turn.

(b) Using inch-pound torque wrench and 3/4-inch deep socket, turn stub shaft and measure valve body drag torque. Record reading (fig. 11-95).

(c) Tighten or loosen adjuster plug to obtain an additional drag torque of 4 inch-pounds above torque obtained previously.

(d) Tighten adjuster plug locknut securely to 80 foot-pounds torque, while holding adjuster plug in position.

(e) Recheck torque and record reading.

NOTE: *Preload tends to drop when locknut is tightened.*

(17) Install Ring Compressor Tool J-8947 in gear housing. Hold it tightly against shoulder in housing. Insert rack-piston nut in housing until arbor engages worm. Turn stub shaft clockwise, to draw rack-piston nut into housing. When piston ring is in housing bore, remove arbor from rack-piston nut. Remove ring compressor tool. Move rack-piston to center position.

(18) Install rack-piston end plug using 1/2-inch drive socket extension in square hole of plug. Temporarily install pitman shaft to prevent rack-piston nut from turning. Tighten plug to 75 foot-pounds torque.

(19) Lubricate housing end plug O-ring and install in gear housing.

(20) Insert end plug in gear housing and seat against O-ring seal. Install end plug retainer ring. It is necessary to install one end of ring first, then work rest of ring into groove until seated. When installed, one end of retainer ring must be 1/2 inch from hole in body.

NOTE: *If necessary, tap lightly on retainer ring to bottom ring in gear housing.*

(21) Assemble side cover and bushing on pitman shaft. Thread lash adjuster through side cover until side cover bottoms on pitman shaft, then back off 1/2 turn. Lubricate new side cover O-ring seal and install in groove in side cover face. Hold O-ring in place with petroleum jelly.

(22) Rotate stub shaft until middle rack groove is aligned with center of pitman shaft needle bearing. Install pitman shaft gear so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before seating side cover on gear housing.

(23) Install side cover attaching bolts and lockwashers. Tighten bolts to 38 foot-pounds torque. Install lash adjuster nut on lash adjuster but do not tighten nut.

(24) Measure total drag with gear on center and pitman shaft backed off. With gear on center, adjust pitman shaft thrust screw until preload is 4 to 8 inch-pounds in excess of total preload and drag but do not exceed 18 inch-pounds torque. Readings are to be made through an arc not exceeding 20 degrees with gear on center. Tighten locknut to 25 foot-pounds torque.

POWER STEERING PUMP SERVICE

Removal

NOTE: *It is not necessary to remove the pump to service the flow control valve. The flow control valve is retained in the pump housing by a pressure union and filter assembly.*

(1) Remove pump drive belt and air pump belt (if equipped).

(2) Disconnect return and pressure hoses from pump. Cover the hose connector and union on pump and open ends of the hoses to avoid entry of dirt.

(3) On V-8, remove front bracket from engine

(4) Remove two nuts attaching rear of pump to bracket, and two bolts attaching pump to front bracket, and remove pump.

Pump Shaft Seal Replacement—Pump Assembled

(1) Remove pump drive belt from pulley.

(2) Remove pulley using Tool J-25034 (fig. 11-96). **Do not hammer pulley from shaft.**

(3) Wrap length of 0.005-inch shim stock, approximately 2-1/2 inches long, around shaft and push it past seal until it bottoms in pump housing (fig. 11-97).

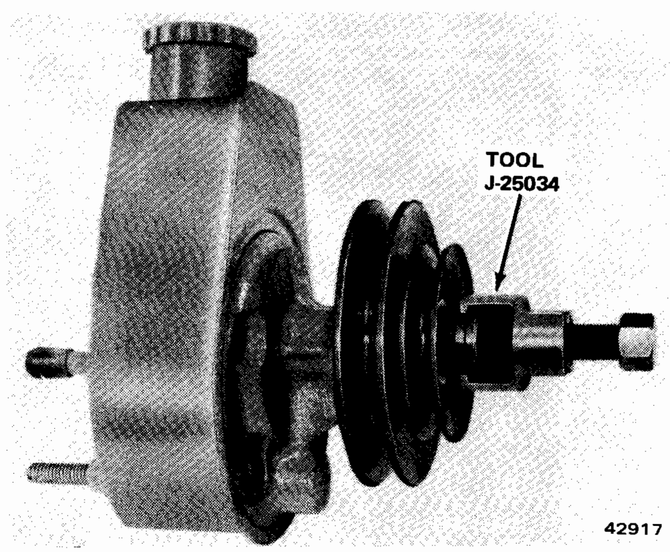

Fig. 11-96 Removing Pump Pulley

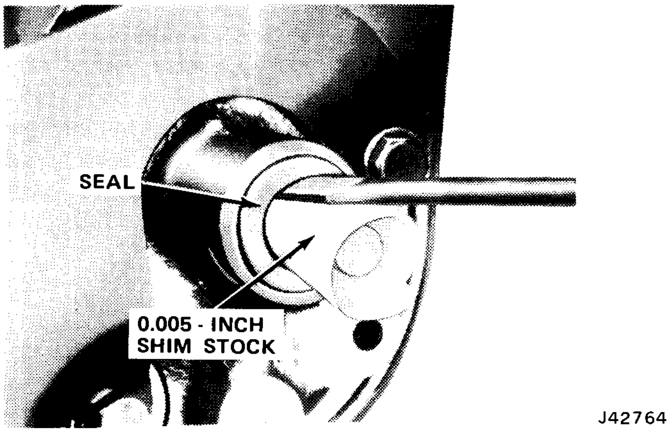

Fig. 11-97 Removing Oil Seal

(4) Remove seal by cutting metal body of seal using sharp tool and then prying out using screwdriver (fig. 11-97). **Do not damage shaft or pump housing.**

(5) Place Seal Protector J-7586-01 over shaft.

(6) Lubricate new seal with power steering fluid and install in pump housing, spring side first, using Installer J-7728 (fig. 11-98). Bottom seal in housing. Do not use excessive force when installing seal.

(7) Install pulley using Tool J-25033 (fig. 11-99).

(8) Install drive belt and air pump belt (if equipped).

(9) Adjust belt tension to specification.

Fig. 11-98 Installing Pump Shaft Seal

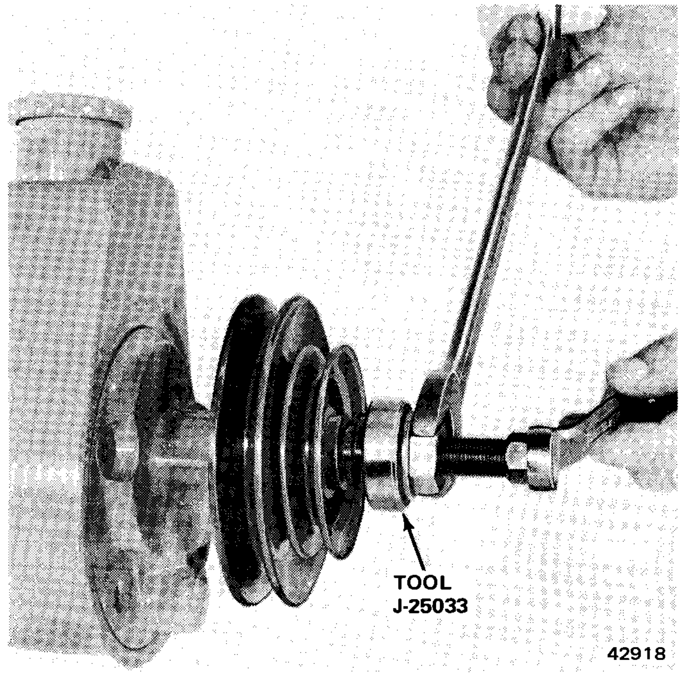

Fig. 11-99 Installing Pump Pulley

(10) Fill pump reservoir to proper level with power steering fluid and bleed pump as outlined in Fluid Level and Initial Operation.

Pump Disassembly

(1) Using masking tape, cover hose union and pipe on pump and clean exterior of pump.

(2) Remove pump pulley using Tool J-25034 (fig. 11-96).

(3) Remove reservoir cap and drain oil from pump reservoir.

(4) Mount pump in vise with pump shaft pointing down.

CAUTION: *Do not clamp pump tightly in vise. This will distort bushing.*

(5) Remove two reservoir-to-pump housing studs and O-rings. Discard O-rings.

(6) Remove pressure union. Remove O-ring from union and discard O-ring.

(7) Remove flow control valve and spring.

(8) Remove reservoir from pump by rocking reservoir back and forth and pulling upward.

(9) Remove reservoir O-ring seal on housing and discard.

(10) Remove small reservoir-to-housing O-ring seal from counterbore in housing and discard.

(11) Rotate end plate retaining ring until one end of ring is over hole in housing. Unseat ring using 1/8-inch punch and remove ring using screwdriver (fig. 11-100).

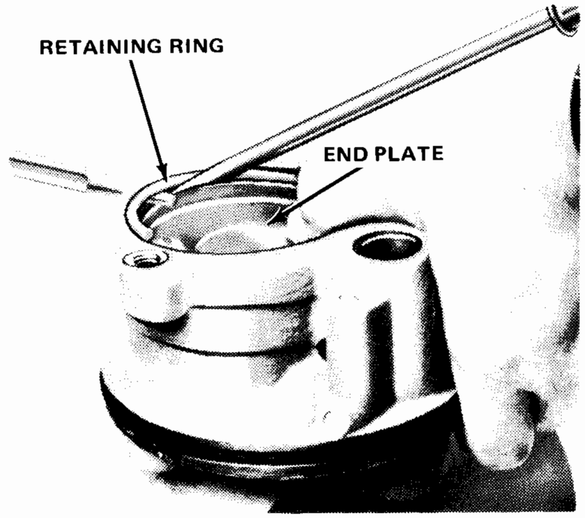

Fig. 11-100 End Plate Retaining Ring Removal

(12) Remove pump from vise. Invert pump and remove end plate, pressure plate spring, flow control valve and spring. If end plate should stick in housing, tap it lightly to remove it.

NOTE: *Do not disassemble control valve.*

(13) Remove and discard end plate O-ring seal.

(14) Place end of shaft on bench and press down on housing to force shaft out.

(15) Turn housing over and remove shaft and rotor assembly. Do not drop parts. If two dowel pins did not come out with assembly, remove dowel pins from housing.

(16) If shaft and rotor assembly must be disassembled, use screwdriver to remove retainer ring and separate parts (fig. 11-101).

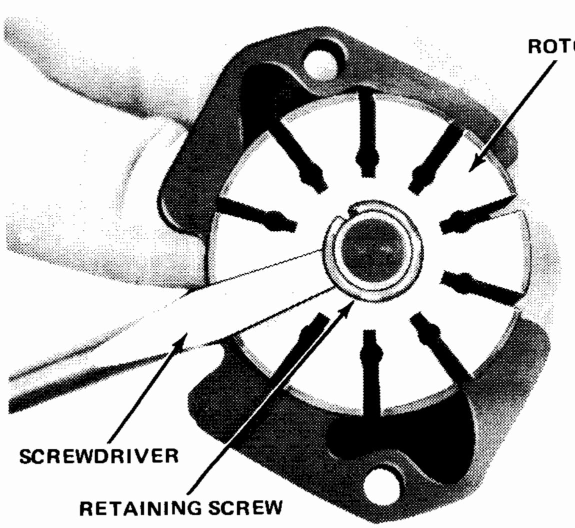

Fig. 11-101 Rotor Retaining Ring Removal

(17) Remove and discard pressure plate O-ring seal.

(18) Remove shaft seal by prying out with small screwdriver.

Power Steering Pump Inspection

Clean all parts thoroughly in solvent and dry using clean, lint-free cloth.

Inspect shaft for wear.

Check fit of the ten Vanes in rotor slots. Vanes must slide freely but fit snugly in slots. Burrs or irregularities on vanes may be removed using an oil stone. Replace rotor if vanes are excessively loose in rotor slots, or if worn or scored Light scoring on the rotor can be repaired by carefully lapping surface of rotor with crocus cloth. Clean thoroughly after lapping.

Inspect all ground surfaces of the rotor ring for roughness or irregular wear. Slight irregularities may be removed with an oil stone. Replace ring if inside cam surface is badly scored or worn and inspect outside radius of vanes very closely for damage.

Inspect the surfaces of the pressure plate and thrust plate for wear and scoring. Light scoring can be repaired by carefully lapping with crocus cloth until surface is smooth and flat, Clean thoroughly after lapping.

Inspect the flow control valve bore in the housing for scoring, burrs or other damage. Hairline scratches are normal. Replace valve if badly scored or if it is the cause of low pump pressure. Check the screw in the end of the valve. If loose, tighten it but do not damage the machined surfaces. Clean filter in end of screw with in solvent and dry with compressed air.

Check orifice in pressure union to be sure it is not plugged.

Power Steering Pump Assembly

Refer to figure 11-102.

(1) Lubricate seals and moving parts with power steering fluid during assembly. Be sure parts are clean.

(2) Install shaft seal using Installer J-7017. Install seal with spring side of seal facing housing (fig. 11-103). Bottom seal in housing.

(3) Mount housing in vise with shaft end facing down. Install pressure plate O-ring seal in groove in housing bore.

(4) Insert shaft in housing and press down on splined end with thumb to seat shaft. Do not damage shaft seal in housing.

(5) Install two dowel pins in housing and install thrust plate on pins with ported face of plate to rear of housing.

(6) Install pump ring with small holes in ring on dowel pins and with arrow on outer edge of ring pointing to rear of housing.

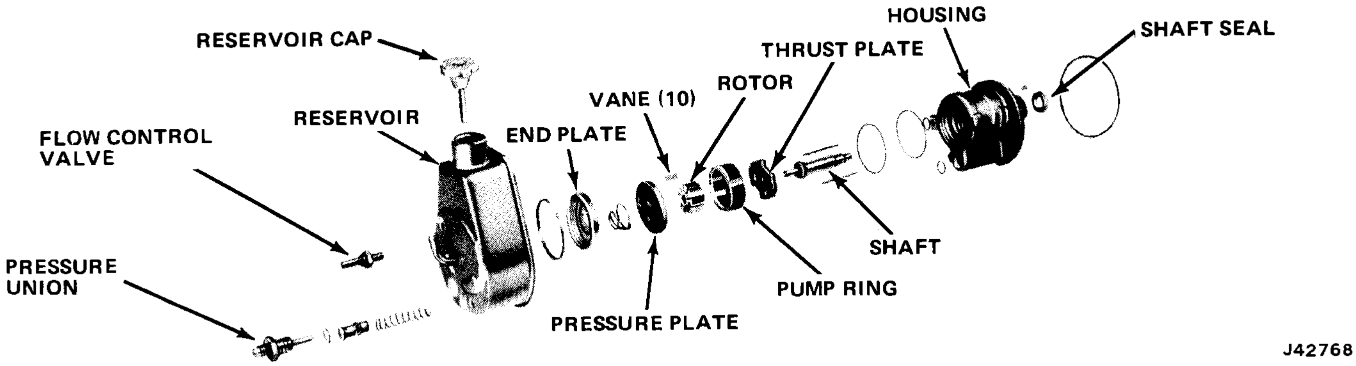

Fig. 11-102 Power Steering Pump

(7) Install rotor on pump shaft with spline side of rotor to rear of housing. Rotor must be free on shaft splines.

(8) Install shaft retaining ring on pump shaft.

(9) Install ten vanes in rotor slots with rounded edge of vane facing pump ring and flat edge toward center of rotor.

(10) Lubricate outside diameter and chamfer of pressure plate with petroleum jelly and install on dowel pins with ported face toward rotor. Dowel pins fit into slots in plate that are nearest outside diameter of plate. Use plastic or wooden rod and tap lightly around outside diameter of pressure plate to seat it. Pressure plate will travel approximately 1/16 inch to seat.

CAUTION: *Never press or hammer on the center of the pressure plate. This will cause permanent distortion and result in pump failure.*

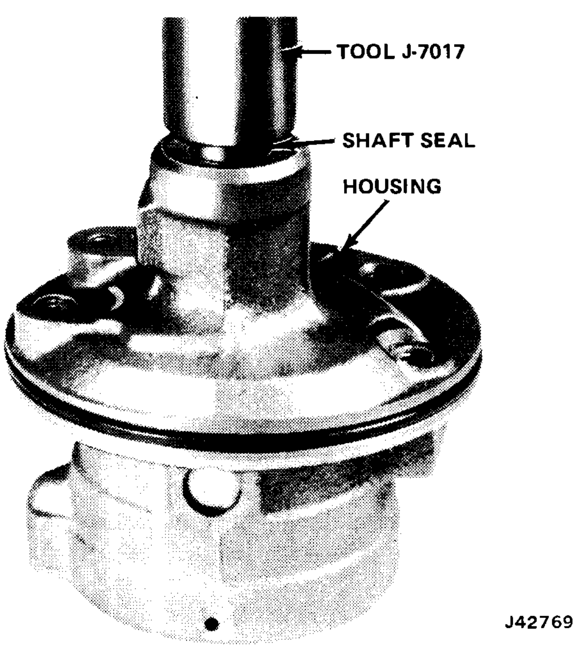

Fig. 11-103 Installing Pump Shaft Seal

(11) Install end plate O-ring seal in groove in bore of housing. Do not install it in end plate retaining ring groove which is first groove from rear of housing (fig. 11-104).

(12) Install pressure plate spring.

(13) Lubricate outside diameter and chamfer of end plate with petroleum jelly and insert in housing.

(14) Place end plate retaining ring on top of end plate. Using arbor press, install end plate in housing until ring groove in housing is evenly exposed. Be sure ring is completely seated in housing groove and end plate is aligned properly.

CAUTION: *Press end plate into housing only far enough to install retaining ring in groove.*

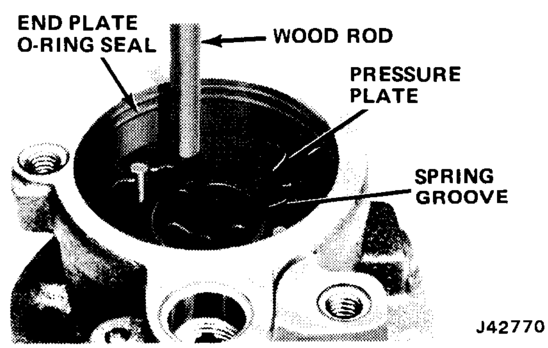

Fig. 11-104 Seating Pressure Plate in Housing

(15) Install reservoir O-ring seal on housing.

(16) Install pressure union seal and two stud seals in proper counterbores at rear of housing.

(17) Install reservoir on housing and align stud holes. Tap reservoir with plastic mallet to seat it on housing. Install reservoir-to-housing studs with short end of stud installed in housing. Tighten studs to 35 foot-pounds torque.

(18) Install flow control valve spring in housing, and install flow control valve with hex head of valve facing into housing. Check for free movement of valve in housing.

(19) Install O-ring in groove nearest outlet end of pressure union. Install union in pump and tighten to 35 foot-pounds torque.

CAUTION: *If O-ring is installed in groove on pressure union that contains the flow orifice, pump will not build up pressure.*

(20) Remove pump from vise and install pulley using Tool J-25033 (fig. 11-87).

(21) Check for bind in pump by rotating drive shaft. Shaft must rotate freely by hand.

Power Steering Pump Installation

(1) Position pump in bracket and install rear attaching screws.

(2) On V-8, install front bracket.

(3) Connect hydraulic hoses.

(4) Fill reservoir with power steering fluid.

(5) Bleed air from pump by turning pulley counterclockwise (viewed from front) until bubbles cease to appear.

(6) Install drive belt.

(7) Using 1-5/8-inch open-end wrench on pump housing boss, pull outward on pump to adjust belt tension, and tighten pump attaching nuts.

(8) Check and adjust belt tension using Gauge J-23600. Refer to Specifications for desired belt tension.

(9) Tighten pump nuts to 30 foot-pounds torque.

(10) Tighten pump bracket nuts.

(11) Install and adjust air pump belt.

NOTE: *If pump or gear has been disassembled, refer to Fluid Level and Initial Operation.*

Fluid Level and Initial Operation

(1) Fill reservoir with power steering fluid.

(2) Operate engine until power steering fluid reaches normal operating temperature of approximately 170°F then stop engine. Remove reservoir filler cap and check fluid level.

(3) If fluid level is low, add power steering fluid as required and replace filler cap. When checking fluid level after steering system has been serviced, air must be bled from system. Proceed as follows:

(a) With wheels turned full left, add power steering fluid to Cold mark on dipstick.

(4) Start engine. With engine operating at fast idle, recheck fluid level. Add fluid if necessary to Cold mark on dipstick.

(a) Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above pump housing. Fluid with air in it will have a light tan or red appearance. Air must be eliminated from fluid before normal steering action can be obtained.

(b) Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

(c) Recheck fluid level as described in steps (2) and (3), making sure fluid level is at Hot mark on dipstick after system has stabilized at normal operating temperature.

(d) Road-test car to make sure steering functions normally and is free from noise.

Oil Pump Pressure Check

NOTE: *The combination of any type tester and fittings is acceptable for this test and connection may be made to pump body or gear housing, whichever is most convenient. However, the gauge must, at all times, be connected* **between** *pump and tester valve in pressure line circuit.*

(1) Check belt tension and adjust if necessary.

(2) Position drip pan beneath engine.

(3) Disconnect power steering pump pressure hose, keeping hose end raised to prevent excess fluid loss.

(4) Connect pressure hose to Power Steering Pressure Tester Gauge J-21567.

(5) Connect tester hose to power steering pump.

(6) Open tester valve fully counterclockwise.

(7) Replenish fluid level.

(8) Operate engine until it reaches normal operating temperature.

(9) Note initial pressure on gauge (valve open). Initial pressure should be 80 to 125 psi. If pressure is in excess of 200 psi, check hoses for restrictions and poppet valve (in gear housing) for proper assembly.

(10) Close tester valve fully and reopen three times. Record highest pressure noted each time.

CAUTION: *Do not hold valve closed for more than five seconds as pump damage may result.*

(a) If pressures are within specification (1200 psi for CJ; 1400 psi for Cherokee, Wagoneer, and Truck), and range of readings is within 50 psi, pump is functioning within specifications.

EXAMPLE: On CJ models, if pressures noted are 1200-1210-1220 psi, pump operation is acceptable.

(b) If pressure recorded are high, but do not repeat within 50 psi, flow control valve is sticking. Remove and clean valve and remove any burrs with crocus cloth or fine hone. If system contains some dirt, flush the system.

CAUTION: *The power steering hydraulic system is a closed circuit. Contamination of fluid in either the pump or gear can be transferred to the other the pump or gear. If system is exceptionally dirty, both pump and gear must be disassembled, cleaned, and reassembled.*

(11) If pump performance is within specifications, with valve open, turn (or have assistant turn) steering wheel to both left and right stops and note highest pressures. Compare with maximum pump output.

CAUTION: *Do not hold wheel against stops over five seconds as pump may be damaged.*

If pump output cannot be met in either (or one) side of gear, gear is leaking internally and must be disassembled and repaired.

(12) Shut off engine and remove tester.
(13) Connect pressure hose to pump.
(14) Make necessary repairs or replenish fluid level.
(15) Remove drip pan.

SPECIFICATIONS

Power Steering Gear

Type	Recirculating Ball, Worm and Nut
Ratio	CJ - 17.5:1 Constant Ratio
	All Others 13/16:1 Variable Ratio
Bearings:	
Worm - Upper	Ball
Lower	Ball
Pitman Shaft	Bushing
Torque:	
Pitman Arm to Pitman Shaft	160-210 ft-lbs
Adjuster Plug Locknut	50-110 ft-lbs
Pitman Shaft Lash-Adjuster Locknut	27-37 ft-lbs
Pressure and Return Hose Fittings	25-35 ft-lbs
Rack-Piston Plug	50-100 ft-lbs
Return Guide Clamp Screws	3-6 ft-lbs
Side Cover Bolts	30-45 ft-lbs
Steering System Oil Capacity (Dry)	1 1/4 qts

Power Steering Pump

Capacity at 465 rpm	1.25 gpm
Flow Control Range	1.25-2.15 gpm
Relief Valve Setting:	
CJ Models	1100-1200 psi
Cherokee, Wagoneer, Truck	1400-1500 psi

Engine Drive Belt Tension

	New Belt*	Used Belt
Air Conditioner, Six-Cylinder	125-155	90-115
Air Conditioner, V-8	125-155	105-130
Air Pump (All except Six-Cylinder w/AC)	125-155	90-115
Air Pump Six-Cylinder w/AC (3/8 Inch Belt)	65-75	60-70
Fan	125-155	90-115
Idler Pulley	125-155	90-115
Power Steering Pump	125-155	90-115

***New belt specifications apply only to replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.**

Manual Steering Gear

Left-Hand Drive Vehicles:	
Type	Recirculating Ball
Ratio	24:1
Bearings - Upper	Ball
Lower	Ball
Pitman Shaft	Bushing
Torque:	
Worm Bearing Adjuster Nut	8 in-lbs
Pitman Shaft Adjuster Screw	18 in-lbs
Cover Bolts	25-35 ft-lbs
Pitman Shaft Lash-Adjustment Locknut	18-27 ft-lbs
Worm Thrust-Adjustment Locknut	70-110 ft-lbs
Right-Hand Drive Vehicles:	
Type	Cam and Lever
Ratio	24:1
Bearings - Upper	Ball
Lower	Ball
Lever Shaft	Roller and Bushing

Wheel Alignment

Torque:	
Cam Bearing Preload	2-5 in-lbs
Input Torque Over Center (Maximum)	7-12 in-lbs
Cover to Housing Cap Screws	18-20 ft-lbs
Flexible Coupling to Flange	15-20 ft-lbs
Worm Gear Shaft Locknut	16-20 ft-lbs

Steering Axis Inclination	$8\text{-}1/2^{\circ}$
Caster	
CJ	$3^{\circ} + 1^{\circ}$
Cherokee, Wagoneer, and Truck	$4^{\circ} + 1^{\circ}$
Camber	$1\ 1/2^{\circ} + 1/2^{\circ}$
Toe-In	3/64 to 3/32 inch
Turning Angle	
CJ	28°
Cherokee, Wagoneer, and Truck	37 to 38°

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Torque Specifications

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service In-Use Recheck Torque
Clamp Bolt, Flexible Coupling, Intermediate Shaft to Power Steering Gear 3/8-24	25-35
Clamp, Intermediate Shaft to Steering Gear	40-50
Clamp, Shaft U-Joint, Upper Shaft Assembly to Lower Shaft Assembly	45-55
Column Capsule Bracket to Column Bolt	12-17
Column Capsule Bracket to Instrument Panel Nut to Support Rod	15-25
Connecting Rod 5/8-18 (To Castellated Nut Slot)	70 min
Connecting Rod Clamp Bolts (Cherokee-Wagoneer-Truck)	25-35
Connecting Rod Stud Nuts 9/16-18 (Cherokee-Wagoneer-Truck)(To Castellated Nut Slot)	60 min
Intermediate Shaft to Steering Gear Coupling (Power Steering) 3/8-24, 5/16-24	15-25
Pitman Arm to Pitman Shaft	160-210
Steering Bracket to Frame 3/8-16 Bolt (CJ)	35-45
Steering Bracket to Frame Bolt and Nut 7/16-20 (CJ)	60-70
Steering Bracket to Frame 7/16-20 (Cherokee-Wagoneer-Truck)	60-80

	Service In-Use Recheck Torques
Steering Gear to Bracket - All Models	60-80
Steering Wheel Nut (CJ)	32-38
Steering Wheel Nut (Cherokee-Wagoneer-Truck)	15-25
Tie-Rod Clamp Bolt 5/16-24 (CJ)	10-15
Tie-Rod Clamp Bolt 3/8-24 (CJ)	20-30
Tie-Rod Clamp Bolt 7/16-14 (Cherokee-Wagoneer-Truck)	25-35
Tie-Rod Stud Nuts 1/2-20 (CJ) (To Castellated Nut Slot)	40 min
Tie-Rod Stud Nuts (To Castellated Nut Slot)	60 min
Wheel to Hub Nuts (CJ)	90-115
Wheel to Hub Nuts (Cherokee-Wagoneer-Truck Models 25 and 45)	65-80
Wheel to Hub Nuts (Model 46 Truck)	100-150

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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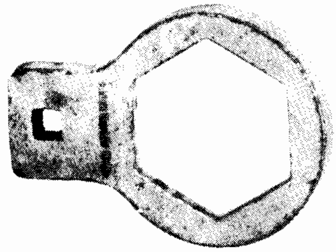
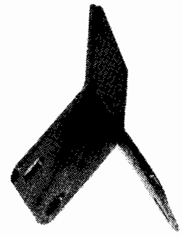
TECHNICAL BULLETIN REFERENCE

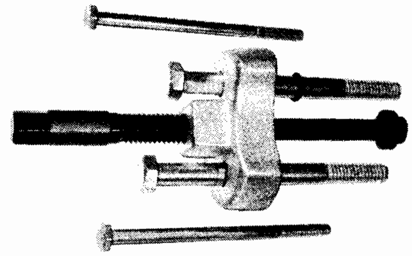
Date	TB No.	Subject	Changes Information on Page No.



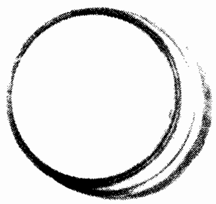
J-25194 THRUST BEARING ADJUSTER WRENCH (2-3/4" x 3-1/4")



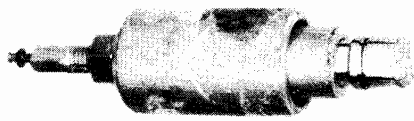
J-23074 STEERING COLUMN HOLDING FIXTURE



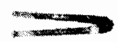
J-25115 STEERING WHEEL PULLER



J-8947 PISTON INSTALLER (POWER STEERING)

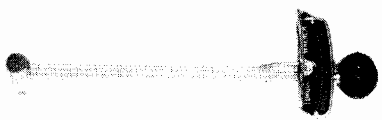


C-3780 WORM SHAFT BEARING CUP REMOVER (MANUAL STEERING)



J-7624 ADJUSTER PLUG ADJUSTABLE SPANNER WRENCH

J-6217 OIL LINE CONNECTOR (POWER STEERING)

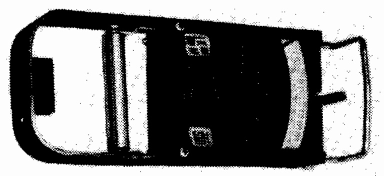


J-7754 TORQUE WRENCH (0 - 25 INCH POUNDS)

C-3777 WORM SHAFT BEARING CUP INSTALLER (MANUAL STEERING)

J-7539-01 RACK PISTON BALLS RETAINING ARBOR (POWER STEERING)

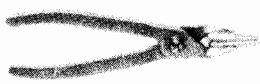
J-1614 PITMAN SHAFT BUSHING REMOVER AND INSTALLER



J-23600 BELT TENSION GAUGE

J-7171 PITMAN SHAFT OIL SEAL INSTALLER

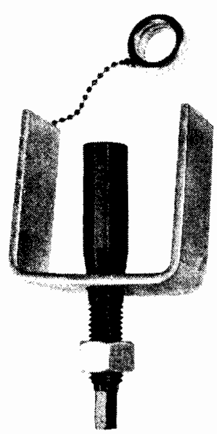
J-5787 PITMAN SHAFT OIL SEAL PROTECTOR



J-4245 SNAP RING PLIERS (INTERNAL)

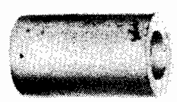
J-7017 WORM SHAFT UPPER OIL SEAL INSTALLER

J-5188 ADJUSTER PLUG OIL SEAL INSTALLER



J-23653 LOCK PLATE COMPRESSOR AND SNAP RING INSTALLER

J-6657 PITMAN SHAFT NEEDLE BEARING REMOVER AND INSTALLER

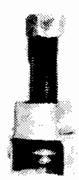


J-6219 PITMAN SHAFT OIL SEAL INSTALLER

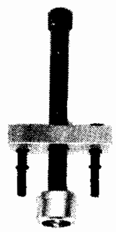
J-6222 ADJUSTER PLUG OIL SEAL PROTECTOR

J-1586-01 PUMP SHAFT OIL SEAL PROTECTOR

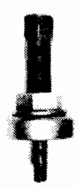
J-23073 SHIFT TUBE INSTALLER



J-25034 REMOVER



J-23072 SHIFT TUBE REMOVER



J-25033 INSTALLER

J-21854-1 PIVOT PIN PULLER

42771

Service Tools

SUSPENSION

GENERAL

All vehicles have semi-eliptical leaf springs and double-action hydraulic shock absorbers. A front axle stabilizer bar is standard on the 8000 GVWR Model 46 Truck and CJ models with the molded hard top. A front stabilizer bar is optional on all other Jeep models.

SPRINGS

Springs are mounted parallel to the frame side rails. The forward end of the front springs and the rear end of the rear springs are attached by pivoting shackles to the frame. The opposite ends are attached to fixed pivot points on the frame. All spring ends have silent block-type rubber bushings. **These rubber bushings should never be lubricated.**

All front springs are mounted below the axle. Cherokee, Wagoneer, and Truck models use multi-leaf or taper-leaf springs (fig. 12-1 through 12-3).

All rear springs, except those on CJ models are mounted above the axle. CJ model springs are multi-leaf springs and are mounted below the axle (fig. 12-4). Rear springs on Cherokee, Wagoneer, and Truck models are multi-leaf springs or tapered-leaf springs (fig. 12-5 and 12-6).

All springs are attached to the axle by U-bolts, spring saddles (welded to the axles), and tie plates. They should be checked at each vehicle inspection.

Spring center bolts are used to align and hold the spring leaves in position. The springs should be examined periodically for broken or shifted leaves, loose or missing rebound clips, and broken center bolts.

FRONT AXLE WINDUP CONTROL DEVICE

A front axle windup control device is used on all models. The control device consists of a stamped bracket with a rubber bumper affixed to it (fig. 12-7). The bracket is attached to the inner side of the right frame rail adjacent to and approximately seven inches above the front axle carrier housing. During severe operation, when extreme spring deflection and front axle travel occurs, the rubber bumper on the control contacts a pad on the front axle housing to prevent excessive movement of the housing.

SHOCK ABSORBERS

The hydraulic, double-action shock absorbers used on Jeep vehicles are designed to control suspension spring movement. The upper ends of the shock absorber are attached to the vehicle frame rails with mounting brackets and pins. The lower ends are attached to the springs or axle. Rubber bushings are installed between the mounting pins and shock eyes. Movement at the bushings is absorbed by flexing of the rubber.

Squeaking may occur when movement between the rubber bushings and the metal parts occur. It can be eliminated by placing the bushings under increased compression by tightening the mounting bolts and nuts. Do not use mineral lubricants on rubber bushings.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a unit, hold it in an upright position and work the plunger up and down four or five times. The action through the full stroke should be smooth and with an equal amount of resistance in each direction.

NOTE: *The shock piston is smoothly machined to work through a tight seal in the upper end of the shock absorber body. Do not roughen the piston with pliers or similar tools during replacement. This will destroy the effectiveness of the seal.*

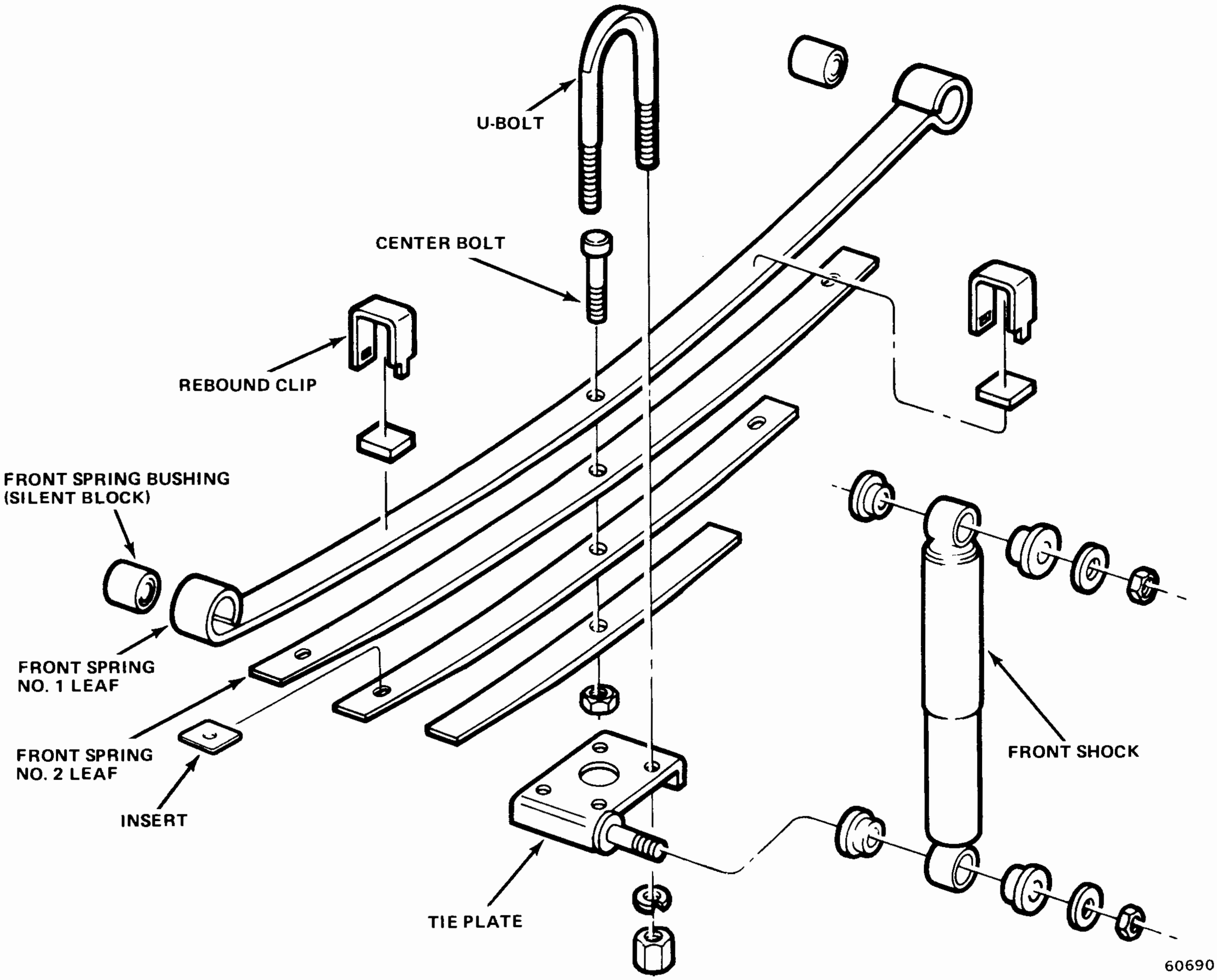


Fig. 12-1 Front Spring—CJ Models

Replacement

The rubber bushings in the shock eyes are held in place on the mounting pins by a flat washer and locknut. To remove a shock, remove the locknuts and washers and pull the shock eyes and rubber bushings from the mounting pins.

To install a shock absorber, install the rubber bushings in the shock eyes and position the shock on the mounting pins. Install the washers and locknuts. Tighten the locknuts securely.

STABILIZER BAR

The stabilizer bar extends across the front undersides of the frame, and is attached to the frame rails by bolted clamps and rubber bushings (fig. 12-8). The ends of the bar extend rearward to a position above the front springs and are connected to the axle and springs by two rubber shock-mounted connecting links (fig. 12-9).

SPRING MOUNTED BELOW AXLE

Removal

(1) Raise vehicle and support axle.

(2) Disconnect shock absorber and stabilizer bar (if equipped).

(3) Remove U-bolts and tie plates.

(4) Disconnect front and rear ends of spring.

(5) Remove spring.

NOTE: *Spring can be disassembled by removing spring rebound clips and center bolt. If spring bushings are to be removed, refer to Spring Bushing Replacement.*

Installation

(1) Mount spring in vehicle but do not tighten pivot bolts.

(2) Align spring center bolt and install tie plate and U-bolts (refer to Torque Specifications).

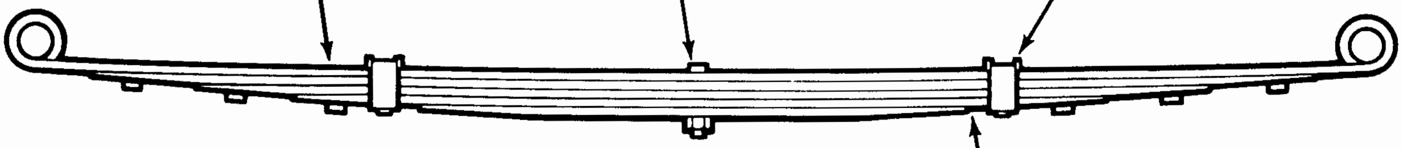


Fig. 12-2 Standard Front Springs—Cherokee-Wagoneer-Truck

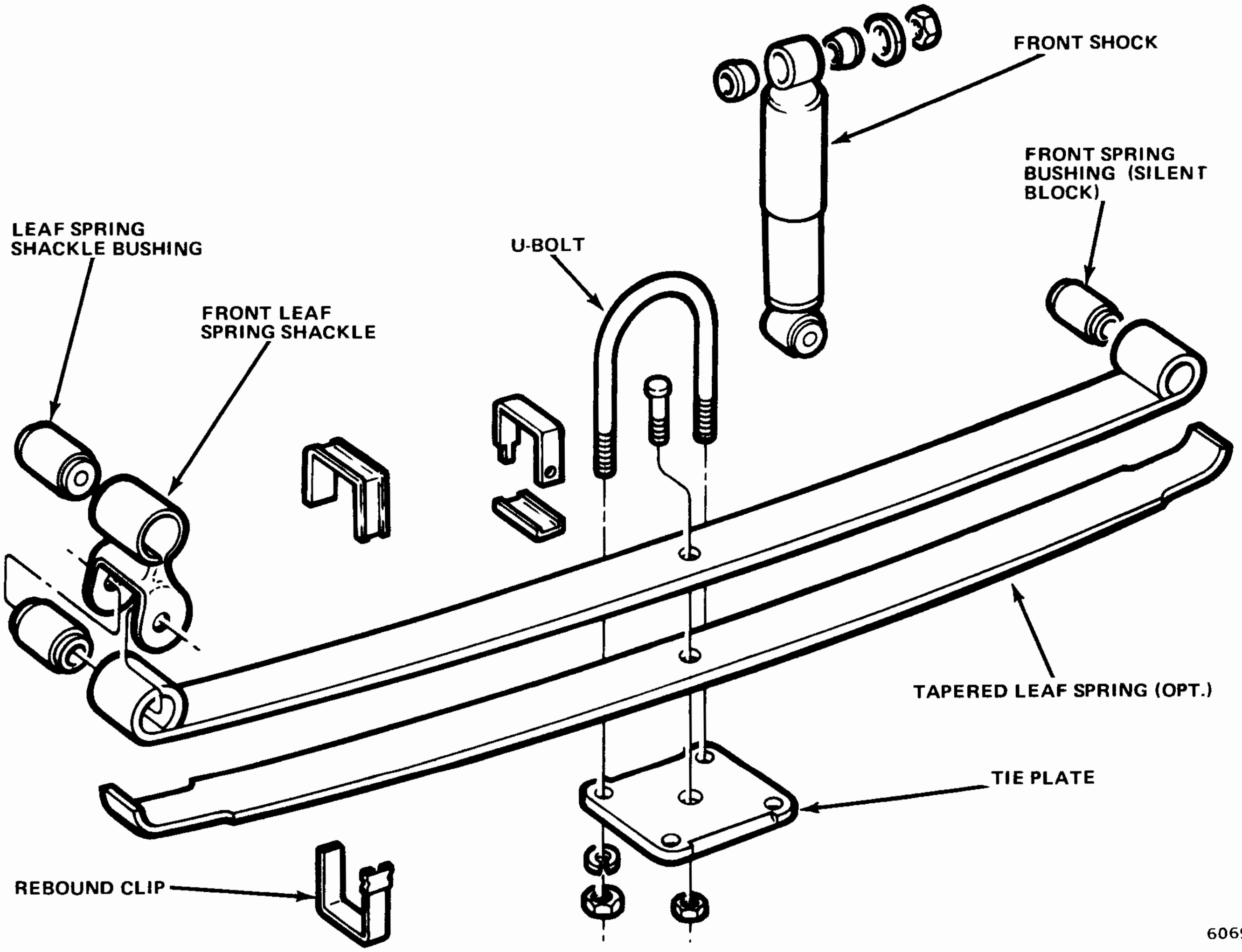


Fig. 12-3 Optional Heavy-Duty Front Spring—Cherokee-Wagoneer-Truck

(3) Connect shock absorber and stabilizer bar (if equipped).

(4) Remove axle support and lower vehicle.

(5) Tighten pivot bolts with vehicle weight on springs.

SPRING MOUNTED ABOVE AXLE

Removal

(1) Raise vehicle and support frame ahead of axle.

(2) Remove U-bolts.

(3) Unclip axle vent hose from frame.

(4) Disconnect shock absorber.

(5) Remove spring pivot bolts.

(6) Lower axle enough for spring to be turned over and remove spring.

NOTE: *Spring can be disassembled by removing spring rebound clips and center bolt. If spring bushings are to be removed, refer tp Spring Bushing Replacement.*

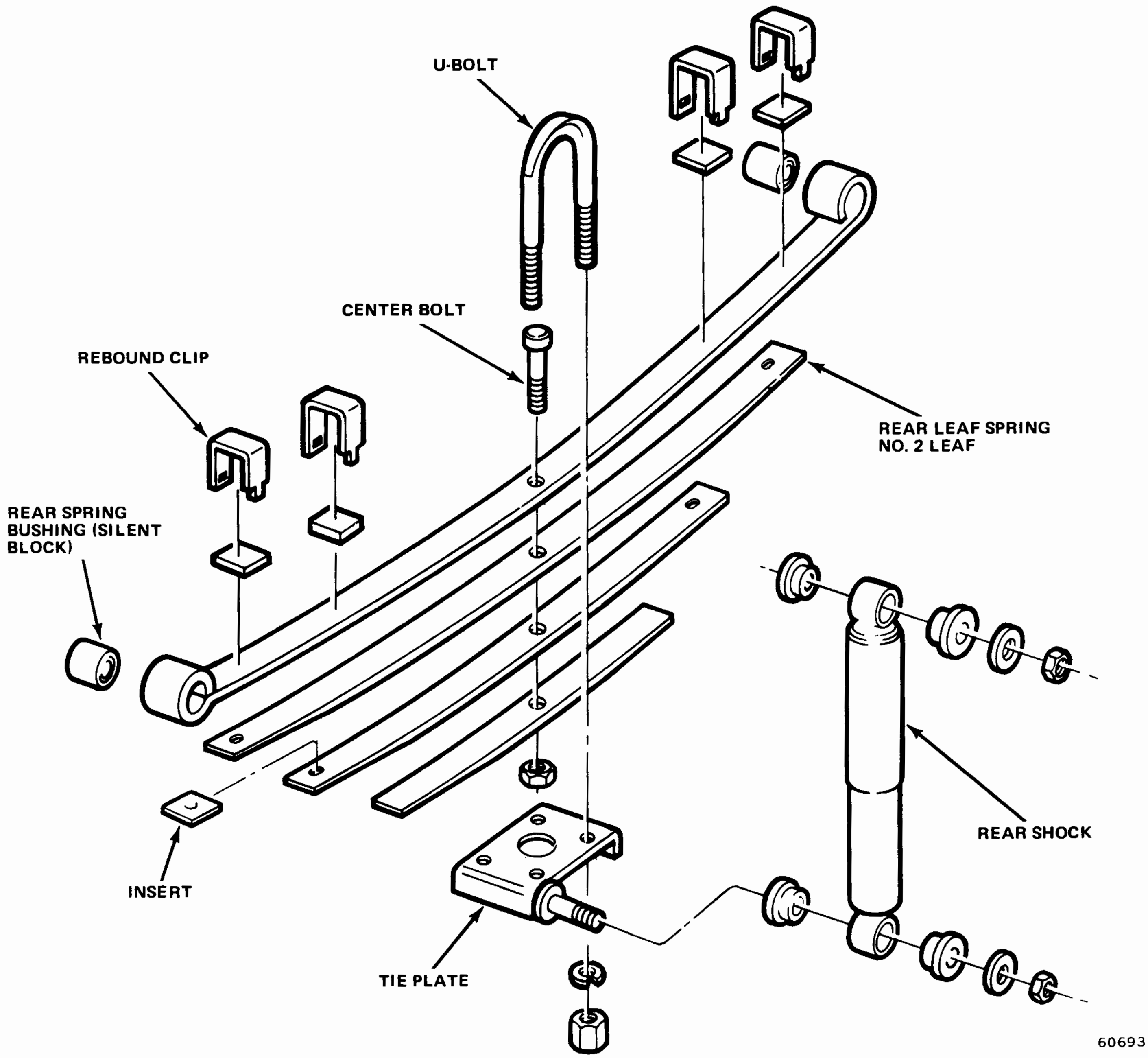


Fig. 12-4 Rear Spring—CJ Models

Installation

(1) Mount spring in vehicle and install pivot bolts and nuts.

(2) Raise axle, align spring center bolt, and install U-bolts.

(3) Connect shock absorber.

(4) Connect axle vent hose.

(5) Remove supports and lower vehicle.

(6) Tighten pivot bolts.

SPRING BUSHING REPLACEMENT

Small Bushing

(1) Place 8-inch length of threaded rod halfway through bushing and place a 1-1/8-inch socket (open end toward bushing), one 1/2-inch flat washer and one 3/8-inch hex nut on one end of rod (fig. 12-10).

(2) On opposite end of threaded rod, place 2-inch section of 1-5/8-inch or 1-3/8-inch ID pipe, one 3/4-inch flat washer, one 1/2-inch flat washer, and one 3/8-inch hex nut.

(3) Tighten both 3/8-inch hex nuts finger-tight and align all components.

NOTE: *Be sure socket is positioned in the spring eye and aligns with the bushing. The pipe section must butt against the spring eye so the bushing can pass through it. The socket will act as a press ram and press the bushing out of the spring eye.*

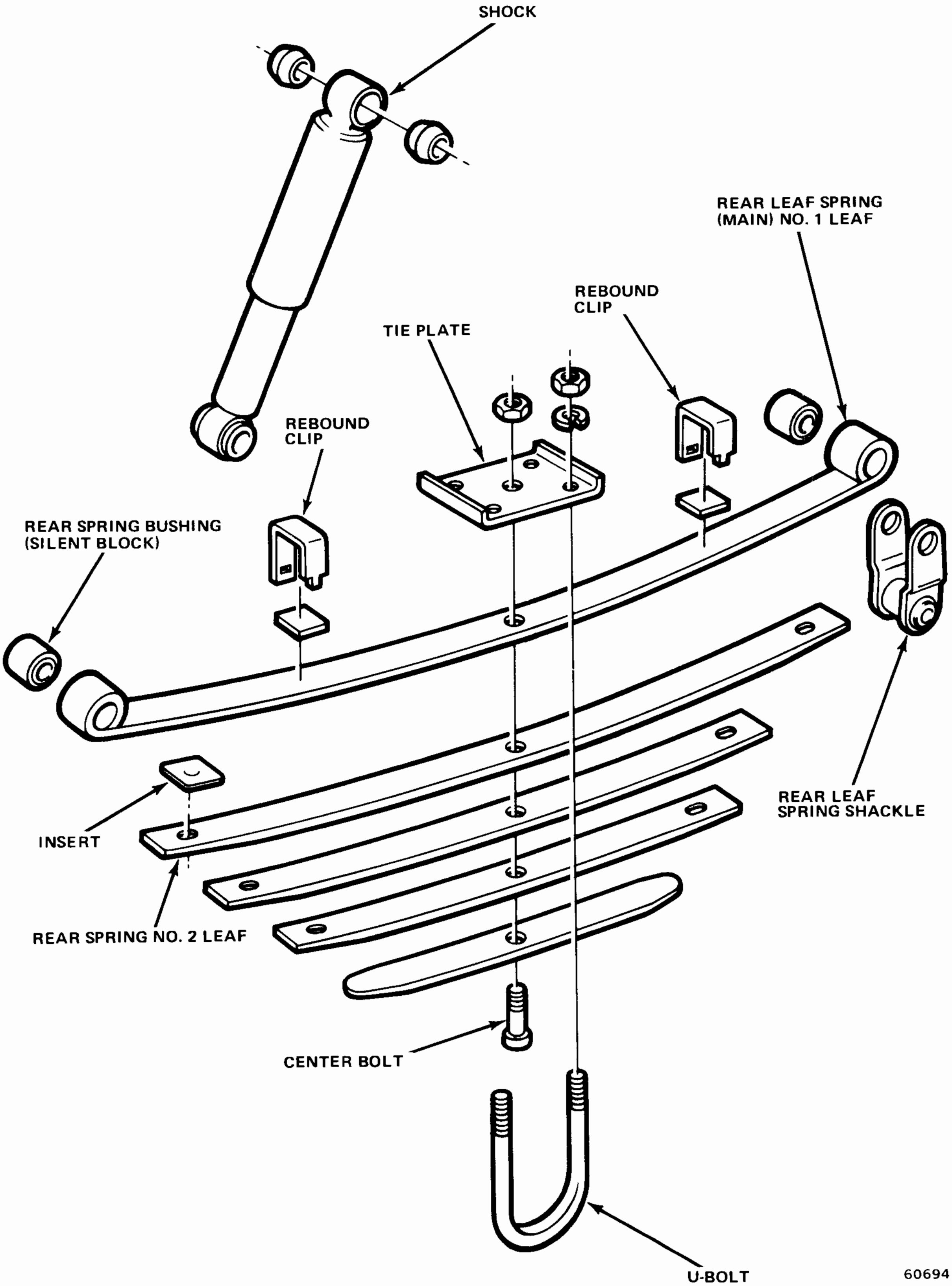


Fig. 12-5 Multi-Leaf Rear Spring—Cherokee-Wagoneer-Truck

(4) Tighten nut at socket end of rod until bushing is pressed out of spring eye.

(5) Tighten nut at socket to press bushing out of spring eye. Remove tools and bushing.

(6) Install replacement bushing on threaded rod and assemble bushing tools as outlined in steps (1) and (2) and press bushing into spring eye. Be sure bushing is centered in spring eye.

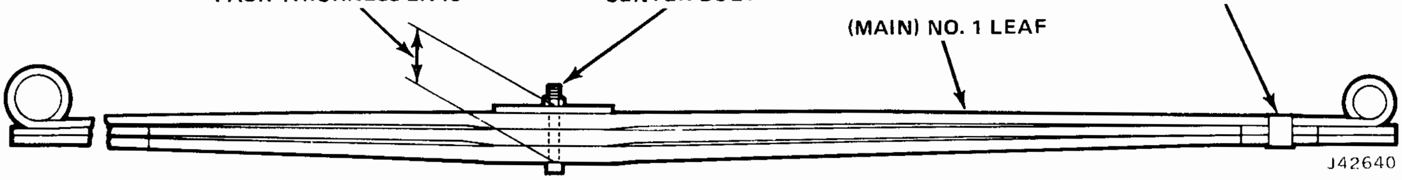


Fig. 12-6 Rear Tapered Leaf Spring—Typical

Large Bushing

(1) Place 1/2 x 11-inch length of threaded rod halfway through bushing and install 1-1/16-inch deep socket (open end toward bushing), one 1/2-inch flat washer, and one 1/2-inch nut on end of rod (fig. 12-11).

(2) On opposite end of threaded rod, install 3-inch length of 1-1/2-inch ID pipe, one 1/2-inch flat washer and one 1/2-inch nut.

(3) Tighten both nuts finger-tight and align all parts.

NOTE: *Be sure socket is positioned in the spring eye and aligns with the bushing. The pipe section must butt against the spring eye so that bushing can pass through it. The socket will act as a press ram and press the bushing out of the spring eye.*

(4) Tighten nut at socket to press bushing out of spring eye.

(5) Install replacement bushing on threaded rod and assemble bushing tools as outlined in steps (1) and (2) and press bushing into spring eye. Be sure bushing is centered in spring eye.

Fig. 12-7 Axle Windup Bumper

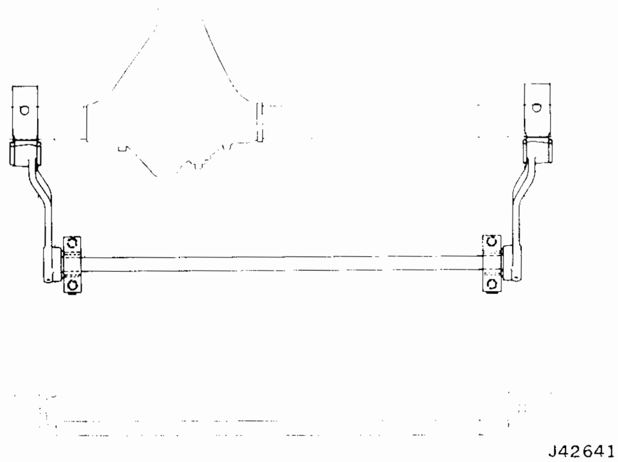


Fig. 12-8 Front Stabilizer Bar Mounting

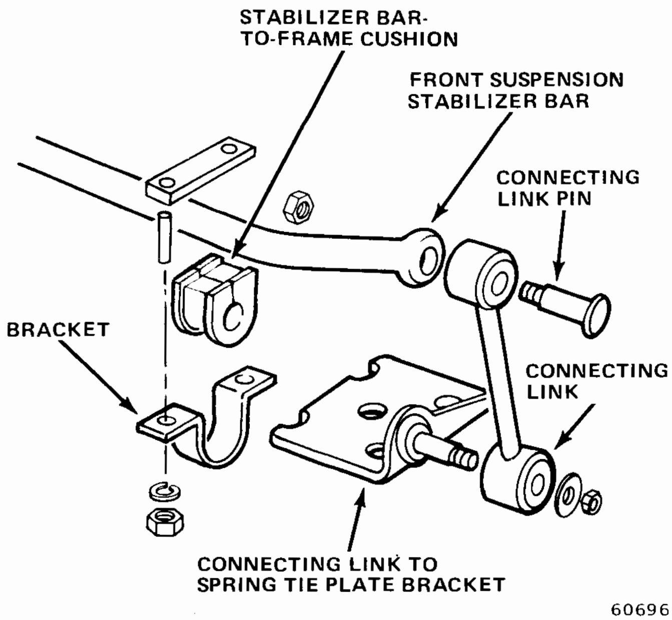


Fig. 12-9 Front Stabilizer Bar Mounting

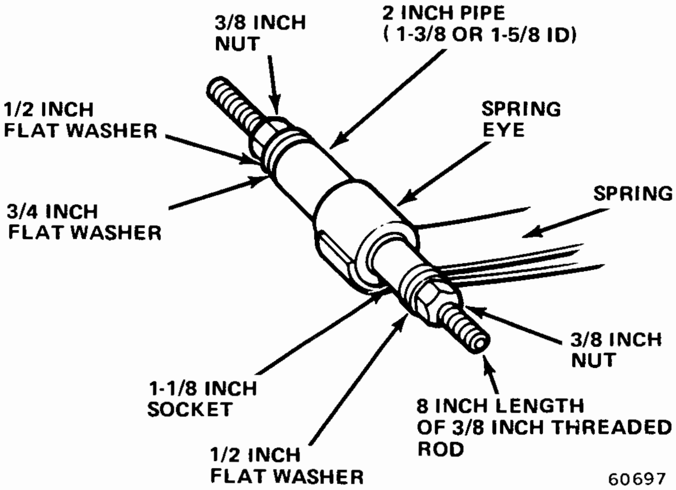


Fig. 12-10 Bushing Replacement Tools

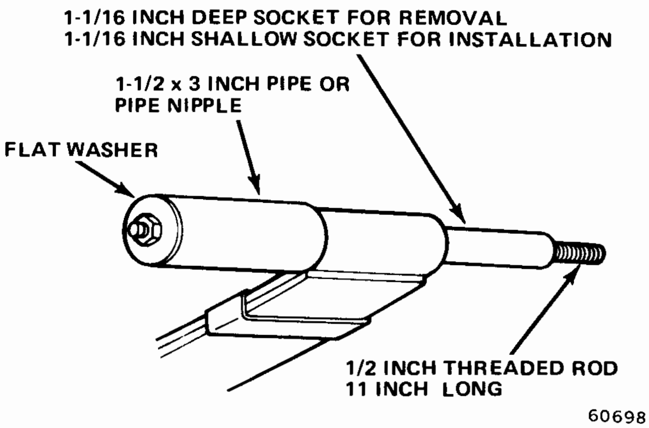


Fig. 12-11 Bushing Replacement Tools

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service Set-To Torque	Service In-Use Recheck Torque
Shock Upper Attachment (7/16-20)	35	25-40
Shock—Lower Attachment (1/2-20)	50	40-55
Spring—Pivot Bolts (CJ Models - 7/16-14)	45	35-50
Spring—Shackle Bolts (CJ Models - 7/16-14)	45	35-50
Spring Clip U-Bolt (9/16-18)	100	85-105
Spring Clip U-Bolt (1/2-20)	55	45-65
Spring Clip U-Bolt (7/16-20)	40	36-42
Spring Shackle and Pivot Bolts (Cke., Wag., and Model 25-45 Trk. - 9/16-12)	75	50-100
Stabilizer Bar Mounting Bracket to Frame Rail (Model 46 Trk. - 7/16-20)	35	25-40
Rear Spring Front Hanger Shaft Nut and Front Shackle Shaft (5/8-18)	55	45-65
Rear Spring Rear Hanger Shaft Nut (5/8-18)	55	45-65
Rear Spring Shackle Bolt (Model 46 Trk. - 5/8-18)	55	45-65
Wheel to Hub Nuts (CJ Models - 1/2-20)	85	65-90
Wheel to Hub Nuts (Cke., Wag., and Model 25-45 Trk. - 7/16-20)	75	65-85
Wheel to Hub Nuts (Model 46 Trk. - 9/16-18)	130	110-150

All torque values given in foot-pounds with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

HEATER AND DEFROSTER

GENERAL

The blend-air type heater and defroster system is used on all model vehicles. The blend-air method of heating uses a constant flow system with engine coolant continuously flowing through the heater core. The temperature of the heated air entering the passenger compartment is controlled by regulating the quantity of air which flows through the heater core air passages, then blending it with a controlled amount of cool, fresh air which bypasses the heater core. System controls and operation are described in this section.

When servicing a malfunctioning heater system, refer to the Service Diagnosis Guide for a list of the possible causes and recommended service procedures.

SYSTEM CONTROLS

CJ Models

The heater and defroster controls consist of a fan control switch and three push-pull knobs and cable assemblies which are located on the instrument panel (fig. 13-1).

The air control knob operates a door in the fresh air intake duct, which controls the amount of air entering the heater housing through the heater-to-air-deflector duct.

The defrost control knob operates a door in the heater housing which regulates heater and defroster operation by directing the flow of air through the defroster hose or floor outlet.

The temperature control knob adjusts the amount of airflow around the heater core and through the heater core air passages. This regulates the degree of heat entering the passenger compartment.

The fan control is a three-position control switch (OFF, LOW, and HIGH), which regulates the blower motor and airflow for heat, defrost, and fresh air ventilation.

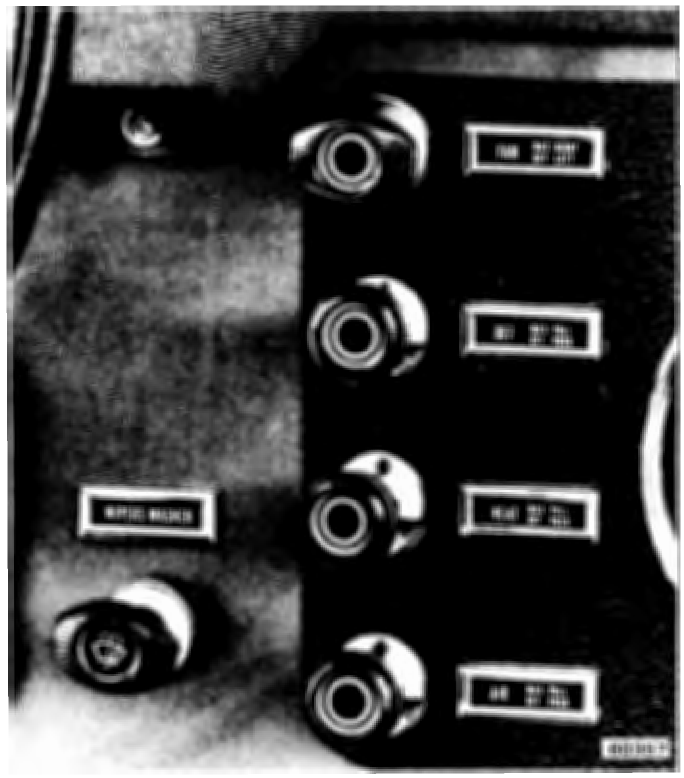


Fig. 13-1 Heater and Defroster Controls—CJ Models

Cherokee-Wagoneer-Truck

The heater and defroster controls consists of a fan control switch, a vacuum control switch operated by three pushbuttons, and a slide temperature control lever (fig. 13-2).

The three pushbuttons manually operate the vacuum control switch which directs vacuum to two vacuum motors, controling airflow and point of air distribution.

The temperature control lever adjusts the amount of airflow around the heater core and through the heater core air passages. This regulates the degree of heat entering the passenger compartment.

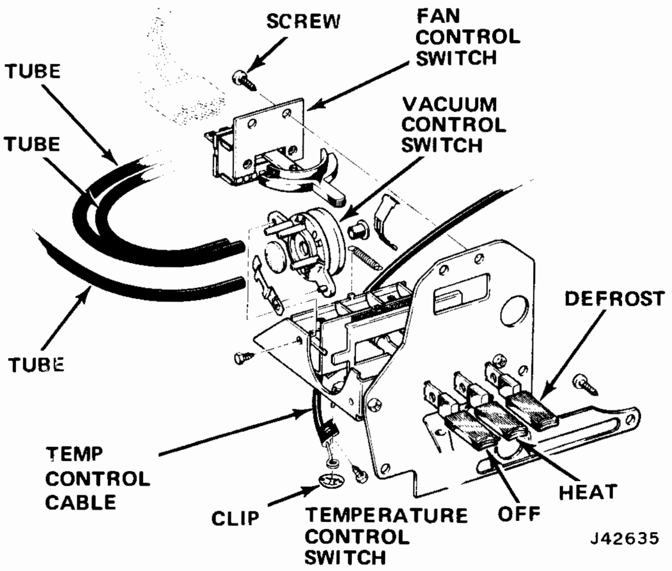


Fig. 13-2 Heater and Defroster Controls—Cherokee-Wagoneer-Truck

The fan control is a four-position control switch (OFF, LOW, MEDIUM, and HIGH), which regulates the blower motor and airflow for heat, defrost, and fresh air ventilation.

HEATER AND DEFROSTER OPERATION

The heater is part of the engine cooling system and depends on normal engine operating temperature and airflow through the cowl fresh air intake to heat the interior of the vehicle. During heater operation, close the fresh air vents.

CJ Models

The air control knob operates a door in the fresh air intake duct which controls the amount of air entering the heater housing. When the knob is pushed in, no air will enter the passenger compartment. As the knob is pulled out, the door opens, allowing more airflow until the maximum flow is reached when the knob is pulled completely out. The air control knob must be at least partially out to operate the heater.

The temperature control knob operates the Blend Air door in the heater housing (fig. 13-3). At the full out position, all air is directed through the heater core, providing maximum heat flow. At the full in position, all air is directed around the heater core, providing unheated fresh air. Any in between position of the control allows a blend of cool, fresh outside air

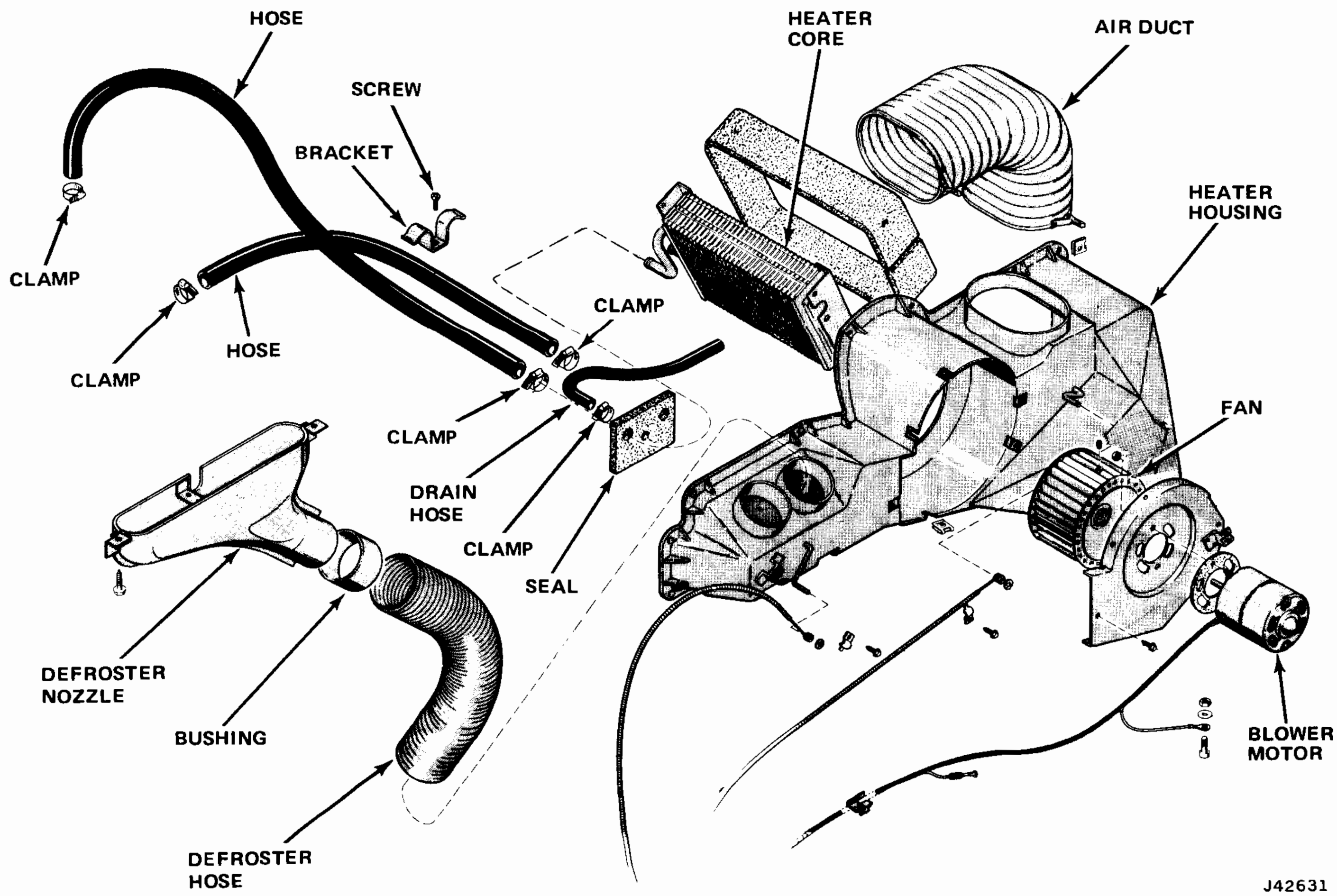


Fig. 13-3 Heater and Defroster—CJ Models

and heated air. The defrost control knob must be pushed in for the blended air to enter through the floor heat duct. When the defrost control knob is pulled out completely, all airflow will be directed through the defroster hose and onto the windshield. Any in between position of the defrost control divides the airflow between the defroster hose and the floor heat duct.

If additional airflow is required, the blower motor should be operated at one of the two available speeds.

Cherokee-Wagoneer-Truck

The OFF, HEAT, and DEF buttons (fig. 13-2) on the heater control panel operate a vacuum control switch which controls two vacuum motors. When the OFF button is pressed, the vacuum switch shuts off vacuum to the air inlet door vacuum motor. A spring closes this door, preventing any outside air from entering the heater (fig. 13-4).

When the HEAT button is pressed, the air inlet door is opened by the air inlet vacuum motor and air will flow through the heat transition housing and out of the floor heat distributor.

When the DEF button is pressed, the vacuum switch directs vacuum to the defrost vacuum motor, which closes the door to the floor heat distributor. Airflow is then directed through the defroster hoses onto the windshield. The air inlet door remains open to allow airflow through the heat transition housing.

The TEMPERATURE control lever operates the blend air door in the heater core housing. At the full left position all air is directed through the heater core providing maximum heat flow. At the full right position all air is directed around the heater core providing unheated fresh air. The temperature control lever may be placed in any in between position to provide a blend of cool, fresh, outside air and heater air. However, either the HEAT or DEF button must be pressed before any air can enter the vehicle.

If additional airflow is required, the blower motor should be operated at one of the three available speeds.

FRESH AIR VENTILATION

CJ Models

The fresh air ventilating system has one air intake duct which directs fresh outside air into the heater housing. The vent door is cable controlled by the AIR control knob on the heater and defroster control panel. When the knob is pulled out, fresh air enters the heater housing and is distributed through the floor outlet. When the knob is pushed in, no air will enter the vehicle. The air intake duct is equipped with a drainage hose (fig. 13-5) to prevent water from entering the vehicle through the heater housing.

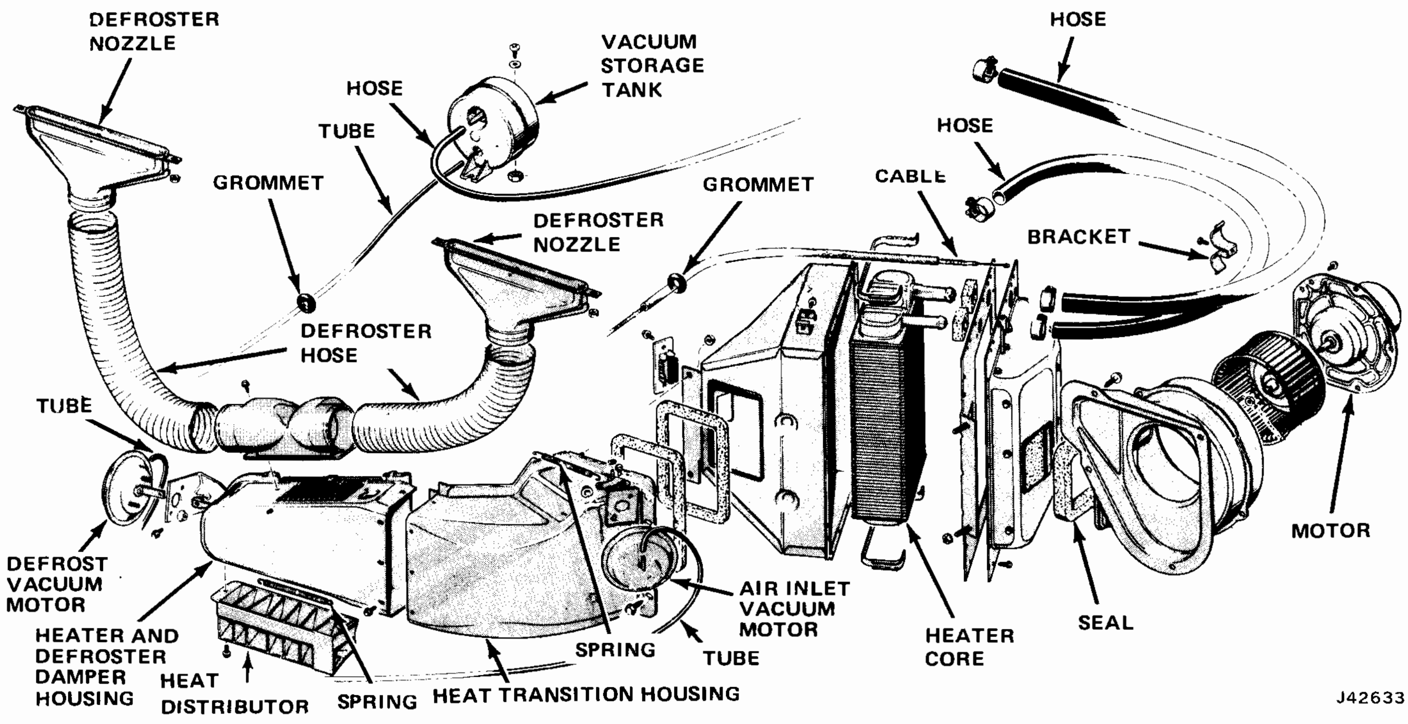


Fig. 13-4 Heater and Defroster—Cherokee-Wagoneer-Truck

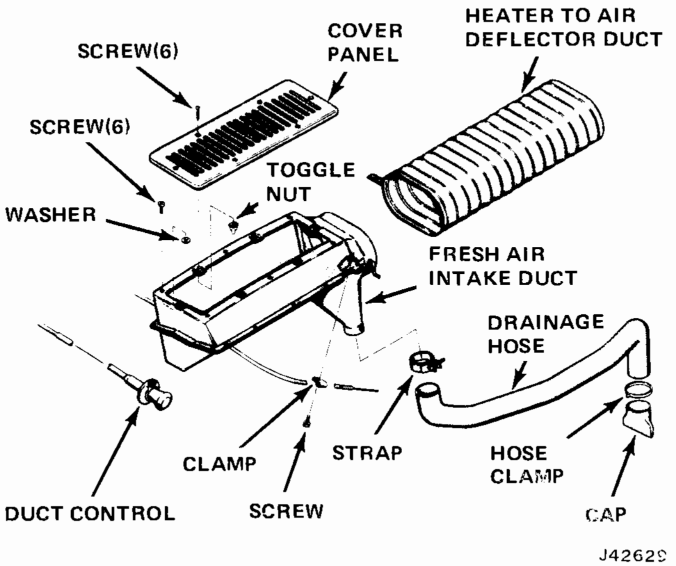


Fig. 13-5 Fresh Air Intake CJ Models

Cherokee—Wagonner—Truck

The ventilating system has two fresh air vents, one in the right cowl trim panel and one in the left cowl trim panel (fig. 13-6). Both vents are cable controlled with the control knobs mounted on the instrument panel to the right and left of the steering column.

FAN CONTROL SWITCH

CJ Models

Removal

(1) Rotate knob until slot in neck of knob is visible. Insert a small bladed screwdriver in the slot and depress spring metal clip toward knob. This will relieve tension on the spring metal clip and allow knob to slide off shaft (fig. 13-7).

Service Diagnosis

Condition	Possible Cause	Correction
FAN MOTOR WILL NOT RUN AT ANY SPEED	(1) Blown fuse (2) Loose connection (3) Poor ground (4) Faulty switch (5) Faulty motor (6) Faulty resistor	(1) Replace fuse (2) Inspect and tighten (3) Clean and tighten (4) Replace switch (5) Replace motor (6) Replace resistor
FAN MOTOR RUNS AT ONE SPEED ONLY	(1) Faulty switch (2) Faulty resistor	(1) Replace switch (2) Replace resistor
FAN RUNS BUT DOES NOT CIRCULATE AIR	(1) Intake blocked (2) Fan not secured to motor shaft (3) Inlet door not opening (Cherokee, Wagoneer, Truck)	(1) Clean intake (2) Tighten securely (3) Replace defective vacuum motor, switch or hose.
HEATER WILL NOT HEAT	(1) Coolant does not reach proper temperature (2) Heater core blocked internally (3) Heater core air-bound (4) Blend-air door not in proper position	(1) Check and replace thermostat if necessary (2) Flush or replace core if necessary (3) Purge air from core (4) Adjust cable
WILL NOT DEFROST	(1) Vacuum motor not operating (Cke-Wag-Trk) (2) Vacuum control switch inoperative (Cke-Wag-Trk) (3) Control cable adjustment incorrect (CJ Models) (4) Defroster hose damaged	(1) Check for engine vacuum at vacuum motor (2) Check for engine vacuum at switch (3) Adjust control cable (4) Replace defroster hose

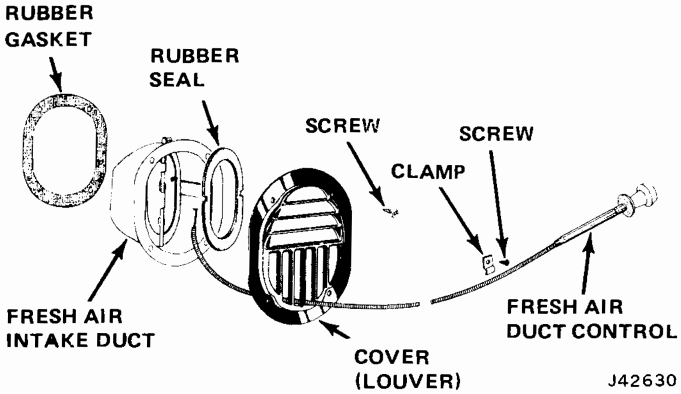


Fig. 13-6 Fresh Air Intake Duct and Control—Cherokee-Wagoneer-Truck

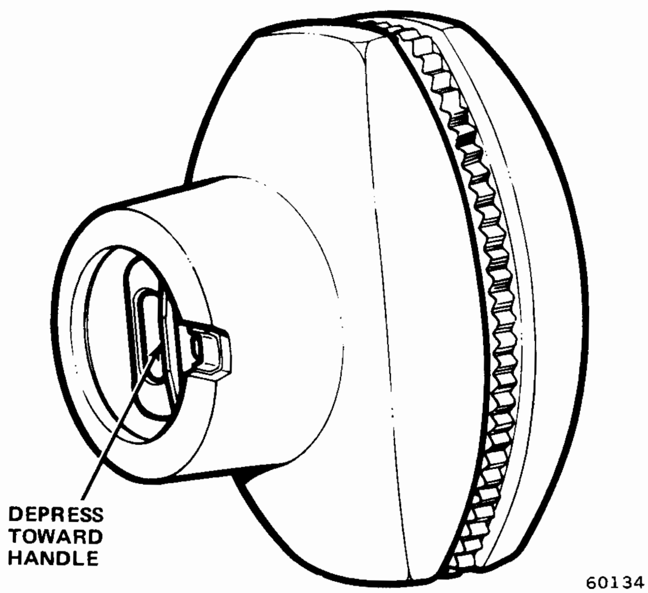


Fig. 13-7 Fan Control Knob Locking Feature

(2) Remove retaining nut and trim ring.
(3) Remove switch from instrument panel and disconnect wires.

Installation

(1) Connect wires and position switch in instrument panel.
(2) Install trim ring and retaining nut.
(3) Install control knob.

HEATER CONTROL PANEL

Cherokee-Wagoneer-Truck

Removal

(1) Disconnect battery negative cable.
(2) Remove instrument cluster retaining screws.
(3) Disconnect speedometer cable.
(4) Disconnect electrical connectors from cluster.
(5) Disconnect vacuum hoses from vacuum control switch.

NOTE: *Tag hoses according to their numbered location for ease of assembly.*

(6) Remove cluster lights.
(7) Disconnect cable from temperature control lever.
(8) Remove instrument cluster.
(9) Remove heater and defroster control attaching screws and remove control from cluster.
(10) Remove fan control switch attaching screws and remove switch.

Installation

(1) Install fan control switch.
(2) Install heater and defroster control to cluster.
(3) Position instrument cluster in dash opening.
(4) Install cluster lights.
(5) Connect cable to temperature control lever.
(6) Connect vacuum hoses.
(a) Number 1 on the vacuum control switch goes to the defroster vacuum motor.
(b) Number 3 on the vacuum control switch goes to the vacuum storage tank.
(c) Number 4 on the vacuum control switch goes to the air inlet door vacuum motor.
(7) Connect cluster electrcial connectors.
(8) Connect speedometer cable.
(9) Install cluster retaining screws.
(10) Connect battery negative cable.
(11) Check heater, defroster, and fan operation.

CONTROL CABLE ADJUSTMENT

CJ Models

(1) Remove cable housing retaining clip screw.
(2) Place control knob in OFF (full in) position.
(3) Hold door tightly closed.
(4) Install retaining clip screw.
(5) Check control operation.

Cherokee-Wagoneer-Truck

The blend air door control cable is equipped with a turnbuckle to simplify adjustment. The turnbuckle is located under the instrument panel to the right of the steering column.

(1) Rotate turnbuckle counterclockwise to obtain complete closing of the blend air door when the temperature control lever is in the far left COOL position.
(2) Check blend air door operation by moving temperature control lever to the WARM position and back to the COOL position. Adjust cable if necessary.

CONTROL CABLE REPLACEMENT

CJ Models

(1) Disconnect cable from door and housing.

NOTE: *The control cables are retained on the backside of the instrument panel by plastic tabs. To disengage the cables from the instrument panel, press the plastic tabs together and pull out the cable.*

(2) Remove cable from instrument panel.
(3) Remove cable-to-damper door.
(4) Route replacement cable through hole in instrument panel.
(5) Connect cable to door and housing.
(6) Install cable to damper door.
(7) Adjust cable and check operation.

Cherokee-Wagoneer-Truck

(1) Disconnect battery negative cable.
(2) Remove instrument cluster retaining screws.
(3) Disconnect speedometer cable.
(4) Disconnect electrical connectors from cluster.
(5) Disconnect vacuum hoses from vacuum control switch.

NOTE: *Tag hoses according to their numbered location for ease of assembly.*

(6) Remove cluster lights.
(7) Disconnect cable from temperature control lever.
(8) Remove instrument cluster.
(9) Disconnect cable from temperature control lever.
(10) Disconnect cable from blend air door.
(11) Connect cable to blend air door.
(12) Route cable through dash panel and connect to temperature control lever.
(13) Position instrument cluster in dash opening.
(14) Install cluster lights.
(15) Connect cable to temperature control lever.
(16) Connect vacuum hoses.
(a) Number 1 on the vacuum control switch goes to the defroster vacuum motor.
(b) Number 3 on the vacuum control switch goes to the vacuum storage tank.
(c) Number 4 on the vacuum control switch goes to the air inlet door vacuum motor.
(17) Connect cluster electrical connectors.
(18) Connect speedometer cable.
(19) Install cluster retaining screws.
(20) Connect battery negative cable.
(21) Check heater, defroster, and fan operation.
(22) Adjust cable.
(23) Check cable operation.

HEATER CORE

CJ Models

The heater housing assembly must be removed to gain access to the heater core.

Removal

(1) Drain approximately two quarts of coolant from the radiator.
(2) Disconnect battery cables and remove battery.
(3) Remove battery box.
(4) Disconnect heater hoses.
(5) Disconnect damper door control cables.
(6) Disconnect blower motor wire harness at switch and ground wire at instrument panel.
(7) Remove glove box attaching screws and remove glove box.
(8) Disconnect water drain hose and defroster hose.
(9) Disconnect heater-to-air-deflector duct at heater housing.
(10) Remove nuts from heater housing studs in engine compartment.
(11) Remove heater housing assembly.
(12) Remove heater core from heater housing.

Installation

(1) Install heater core in housing.
(2) Position heater core housing and install attaching nuts.
(3) Connect water drain hose and defroster hose.
(4) Connect heater-to-air-deflector duct at heater housing.
(5) Position glove box and install attaching screws.
(6) Connect blower motor wire harness at switch and ground wire at instrument panel.
(7) Connect and adjust damper door control cables.
(8) Connect heater hoses.
(9) Install battery box.
(10) Install battery and connect battery cables.
(11) Replace coolant.
(12) Check heater operation.

Cherokee-Wagoneer-Truck

Removal

(1) Drain approximately two quarts of coolant from radiator.
(2) Disconnect temperature control cable from blend air door.
(3) Disconnect heater hoses at heater core.
(4) Disconnect blower motor resistor wires.
(5) Remove heater core housing to dash panel attaching nuts.
(6) Remove heater core housing assembly.

(7) Remove attaching screws holding housing halves together and separate housing.

(8) Remove heater core to housing attaching screws and remove core.

Installation

(1) Position heater core in housing and install attaching screws.

(2) Seal and assemble two halves of heater core housing and install attaching screws.

(3) Position heater core housing on dash panel and install attaching nuts.

(4) Connect heater resistor wires.

(5) Connect heater hoses.

(6) Connect temperature control cable to blend air door.

(7) Replace coolant.

(8) Check heater operation.

BLOWER MOTOR

CJ Models

Removal

(1) Disconnect blend air cable.

(2) Disconnect blower motor electrical connections.

(3) Remove blower motor housing-to-heater housing attaching screws and remove blower motor housing.

(4) Remove fan and blower motor from blower motor housing.

Installation

(1) Install fan and blower motor on blower motor housing.

(2) Position blower motor housing to heater housing and install attaching screws.

(3) Connect blower motor electrical connections.

(4) Connect and adjust blend air door cable.

(5) Check blower motor operation.

Cherokee-Wagoneer-Truck

Removal

(1) Disconnect blower motor electrical connector.

(2) Remove blower motor-to-blower motor housing attaching screws and remove blower motor and fan assembly.

Installation

(1) Position blower motor and fan assembly on blower motor housing and install attaching screws.

(2) Connect blower motor electrical connector.

(3) Check blower motor operation.

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

AIR CONDITIONING

AIR CONDITIONING SYSTEM

General

When driving at normal highway speeds the Jeep air conditioning unit will provide maximum efficiency. However, when operating under stop-and-go city driving conditions a slight reduction in cooling efficiency generally will be experienced.

It is recommended that maximum temperature setting be used for average city driving and intermediate temperature setting for highway driving.

The same air conditioning unit, as shown for the Wagoneer in figure 13A-1, is applicable to Cherokee and Truck Models.

When driving at relatively high speed for an extended period of time, the cooling coil may possibly frost over, resulting in a temporary loss of cooling. Should this occur, simply turn the TEMP knob to OFF and allow the blower to operate for a few minutes to allow the cooling coil to defrost. Then turn the TEMP knob to a setting which is not as cold as the setting at which frosting occurred.

To maintain maximum cooling efficiency, periodically remove bugs and foreign matter from the condenser and radiator fins. DO NOT install a bug screen or other screen material in front of the condenser and radiator.

Water forming under a vehicle, at a point below the cooling case, is condensation water draining from the unit and is considered normal.

The engine TEMP gauge pointer will indicate a slightly higher than normal temperature when the air conditioning unit is operating. However, should excessive overheating occur, check the condition of all water hoses, check the radiator for rust or scaling conditions, and make sure that the condenser is free of bugs or other foreign matter.

The air conditioner also can be used for fast, efficient defogging of windows during cool, damp weather.

The condenser is mounted ahead of the radiator and the remaining components are in the engine compartment.

The compressor is a two-cylinder, belt-driven pump. An electromagnetic clutch couples the compressor to the drive pulley. The drive pulley freewheels when the air conditioner is not in use.

The start position on the ignition switch automatically disconnects all accessories, including the air conditioner, to reduce the battery load and provide easier starting.

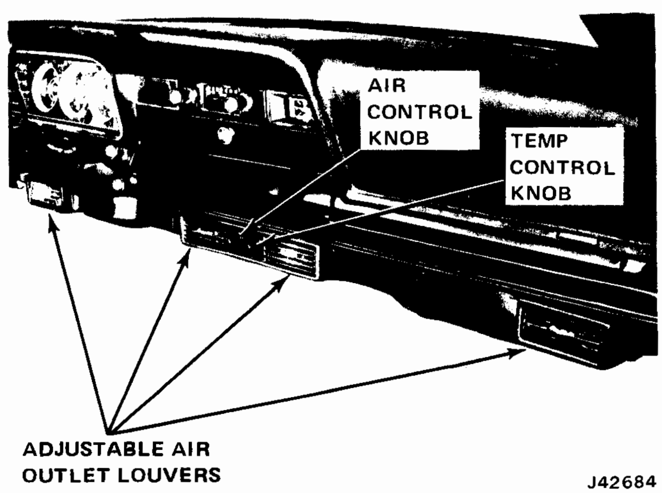


Fig. 13A-1 Air Conditioner—Cherokee-Wagoneer-Truck

Operation

For fast, maximum efficiency, purge the vehicle of hot air by driving the equivalent of two or three city blocks with at least one window open. During this time, place the TEMP control in the MAX position and the FAN control in the PC position. This permits the evaporator to precool in hot weather.

CAUTION: *Do not leave fan control on PC for longer than 30 seconds. Move the fan control to HI position and raise all windows.*

Adjust the air outlets to obtain desired airflow distribution by moving the louver levers left, right, up, or down. Airflow can be adjusted for quick delivery to a specific spot or for gentle diffusion of air throughout the vehicle.

When the interior of the vehicle has cooled to the desired temperature, the AIR knob may be set to obtain the desired volume of air from the air outlets. The TEMP knob may be rotated to vary the temperature. It may be necessary to experiment with the TEMP knob to determine the settings best suited to various driving conditions. Generally, the MAX setting is comfortable for city driving, and a lesser setting comfortable for open road driving.

Run the engine well above idle speed for more efficient cooling under conditions in which the system is operated with the vehicle standing.

Performance Diagnosis

Condition	Possible Cause	Correction
COMPRESSOR NOISE	(1) Broken valves	(1) Replace valve plate
	(2) Overcharged	(2) Discharge, evacuate, and install correct charge
	(3) Incorrect oil level	(3) Isolate compressor and check oil level. Correct as necessary
	(4) Piston slap	(4) Replace compressor
	(5) Broken rings	(5) Replace compressor
EXCESSIVE VIBRATION	(1) Incorrect belt tension	(1) Set belt tension. Refer to Compressor Belt Tension
	(2) Clutch loose	(2) Tighten clutch
	(3) Overcharged	(3) Discharge, evacuate, and install correct charge
	(4) Pulley misaligned	(4) Align pulley
CONDENSATION DRIPPING IN PASSENGER COMPARTMENT	(1) Drain hose plugged or improperly positioned	(1) Clean drain hose and check for proper installation
	(2) Insulation removed or improperly installed	(2) Replace insulation on expansion valve and hoses
FROZEN EVAPORATOR COIL	(1) Faulty thermostat	(1) Replace thermostat
	(2) Thermostat capillary tube improperly installed	(2) Install capillary tube correctly

Pressure Diagnosis

Condition	Possible Cause	Correction
LOW SIDE LOW—HIGH SIDE LOW	(1) System refrigerant low	(1) Evacuate, leak test, and charge system
LOW SIDE HIGH—HIGH SIDE LOW	(1) Internal leak in compressor—worn	(1) Remove compressor cylinder head and inspect compressor. Replace valve plate assembly if necessary. If compressor pistons, rings, or cylinders are excessively worn or scored replace compressor
	(2) Head gasket leaking	(2) Install new cylinder head gasket
	(3) Expansion valve	(3) Replace expansion valve
	(4) Drive belt slipping	(4) Set belt tension
LOW SIDE HIGH—HIGH SIDE HIGH	(1) Clogged condenser fins	(1) Clean out condenser fins
	(2) Air in system	(2) Evacuate, leak test, and charge system
	(3) Expansion valve	(3) Replace expanison valve
	(4) Loose or worn fan belts	(4) Adjust or replace belts as necessary
LOW SIDE LOW—HIGH SIDE HIGH	(1) Expansion valve	(1) Replace expansion valve
	(2) Restriction in liquid line	(2) Check line for kinks-replace if necessary
	(3) Restriction in receiver	(3) Replace receiver
	(4) Restriction in condenser	(4) Replace condenser
LOW SIDE AND HIGH SIDE NORMAL (INADEQUATE COOLING)	(1) Air in system	(1) Evacuate, leak test, and charge system
	(2) Moisture in system	(2) Evacuate, leak test, and charge system. Add 2cc of anhydrousmethanol for each pound of refrigerant used

SYSTEM COMPONENTS—FUNCTION

Compressor—The compressor is a two-cylinder belt-driven pump used to increase the pressure of the refrigerant in the system.

Condenser—The condenser is mounted in front of the radiator to allow air to flow over the cooling fins and receive heat from the refrigerant. As the refrigerant passes through the condenser, it liquifies (condenses).

Receiver/Dryer—The receiver/dryer is a reservoir used to store the precise amount of refrigerant required by the system. The receiver capacity must be adequate to provide a steady flow of refrigerant to the expansion valve.

Expansion Valve—The thermostatic expansion valve is located at the inlet side of the evaporator. It meters the refrigerant to the evaporator. If too much refrigerant is metered, a flooding condition results and the unit will not cool. If too little refrigerant is metered, the system is starved and will not cool. The metering action of the expansion valve is controlled by the temperature sensing bulb mounted on the outlet (suction) line of the evaporator.

Evaporator—The evaporator is an air cooler and dehumidifier. As the refrigerant enters the evaporator core it begins to boil. The heat in the air passing over the evaporator transfers or gives up its heat to the boiling refrigerant. As the air cools, the moisture in the air condenses on the evaporator core and is drained off as water.

REFRIGERATION CYCLE

As the compressor increases the pressure of the system refrigerant, it also heats it (fig. 13A-2). The hot refrigerant is then pumped into the condenser where it cools by giving off heat to air passing over

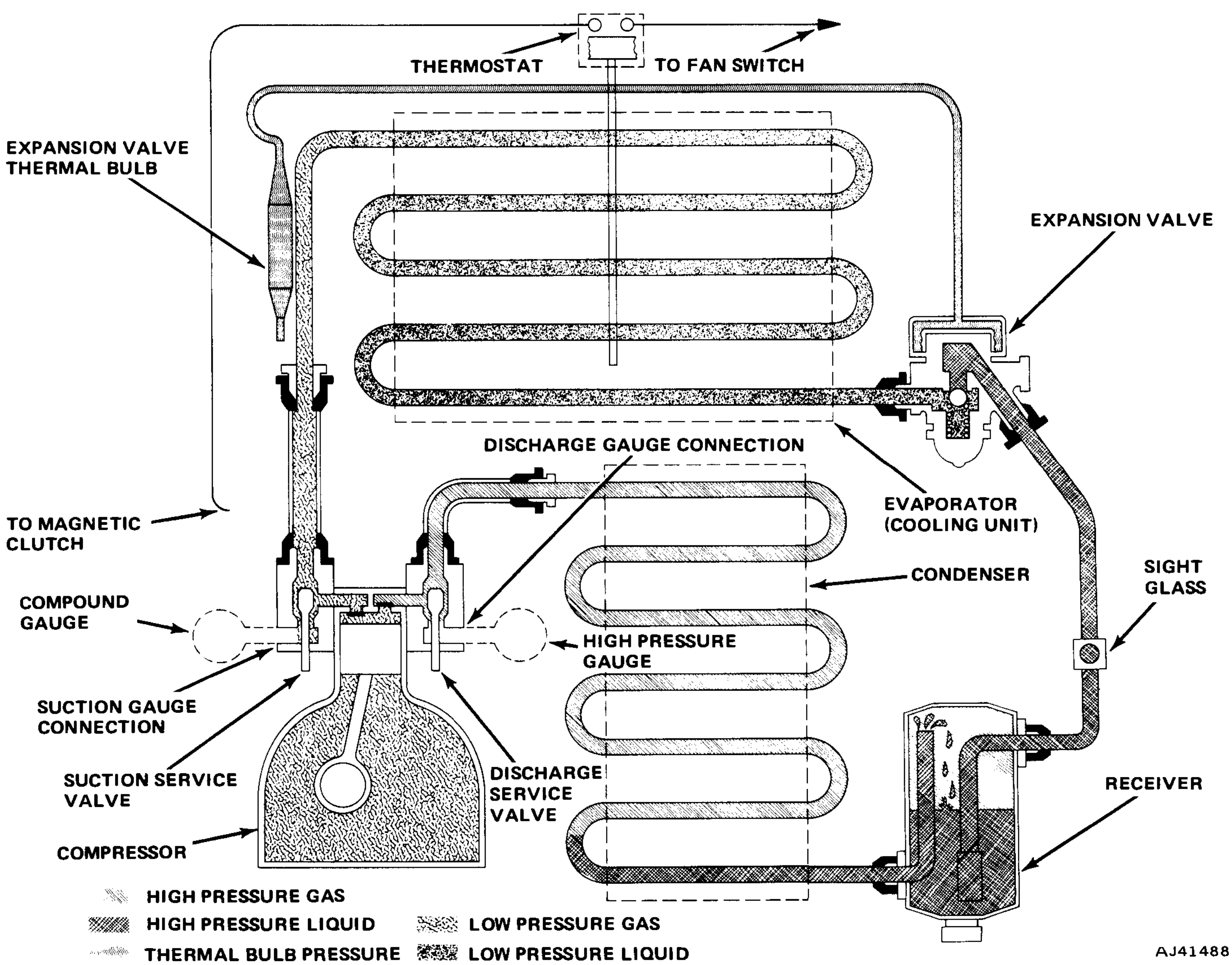


Fig. 13A-2 Refrigerant Cycle

the condenser fins. As the refrigerant cools in the condenser, it condenses into a liquid. Still under high pressure, the refrigerant passes into the receiver. The receiver acts as a reservoir to furnish refrigerant to the expansion valve at all times. From the receiver, the high pressure liquid refrigerant passes to the expansion valve. The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the suction side of the compressor. As it enters the evaporator, the refrigerant immediately begins to boil by absorbing the heat from the air passing over the evaporator core. Having given up its heat to boil the refrigerant, the air is cooled and passes into the passenger compartment of the vehicle. The refrigerant continues to boil in the evaporator until all the liquid has vaporized. From the evaporator, the refrigerant is drawn back to the compressor to repeat the cycle.

REFERIGERANT SAFETY PRECAUTIONS

The refrigerant used in air conditioning systems is dichlorodifluoromethane, commonly known as Refrigerant 12 (or R-12). It is transparent and colorless in both the liquid and vapor state. Since it has a boiling point of **21.7°F below zero**, at atmospheric pressure, it vaporizes at all normal temperatures and pressures. The vapor is heavier than air, nonflammable and nonexplosive. It is nonpoisonous except when in direct contact with open flame, and is noncorrosive except when combined with water. Observe the following precautions when handling R-12.

R-12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes.

WARNING: *Always wear safety goggles when servicing the refrigeration part of the air conditioning system. Keep a bottle of sterile mineral oil and a weak solution of boric acid handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out (R-12 is rapidly absorbed by the oil). Next, wash the eyes with the weak solution of boric acid. Call a doctor immediately, even though irritation has ceased after first-aid treatment.*

WARNING: *Do not heat R-12 above 125°F.*

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant. A bucket or large pan of hot water not over 125°F is all the heat required for this purpose. Do not heat the refrigerant container with a blowtorch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

When metering R-12 into the refrigeration system, **keep the supply tank or cans in an upright position.** If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

WARNING: *Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation.*

Although R-12 vapor is normally nonpoisonous, it can be changed into a very poisonous gas if allowed to come in contact with an open flame. Do not discharge large quantities of refrigerant in an area having an open flame. A poisonous gas is produced when using the halide torch leak detector. Avoid inhaling the fumes from the leak detector.

CAUTION: *Refrigerant will tarnish bright metal and chrome surfaces. Avoid splashing refrigerant on any surface. Refrigerant in combination with moisture is very corrosive and can cause great damage to all metal surfaces.*

SERVICE VALVES

The discharge and suction service valves are connected to the compressor cylinder head and are used for diagnosis, charging, discharging, evacuating, and component removal.

- The service valves have three positions (fig. 13A-3). The normal operating position, shown in figure 13A-3, View B, has the valve stem turned **counterclockwise** to the **back-seated** (full-out) position.

When the valve stem is turned **clockwise to the front-seated** (full-in) position (fig. 13A-3, View A), the compressor is isolated from the system. This position is used when removing the compressor or when checking compressor oil level.

When the valve is **midpositioned** (cracked) (fig. 13A-3, View C), the gauge port is **open**. This position is used when charging, discharging, evacuating, and checking system pressures.

PRESSURE GAUGE AND MANIFOLD ASSEMBLY

The Pressure Gauge and Manifold Assembly, Tool J-23575 (fig. 13A-4), is the most important tool used to service the air conditioning system. The gauge assembly is used to determine system high and low side gauge pressures, the correct refrigerant charge, and in system diagnosis. It is designed to provide simultaneous high and low side pressure indications, because these pressures must be compared to determine correct system operation.

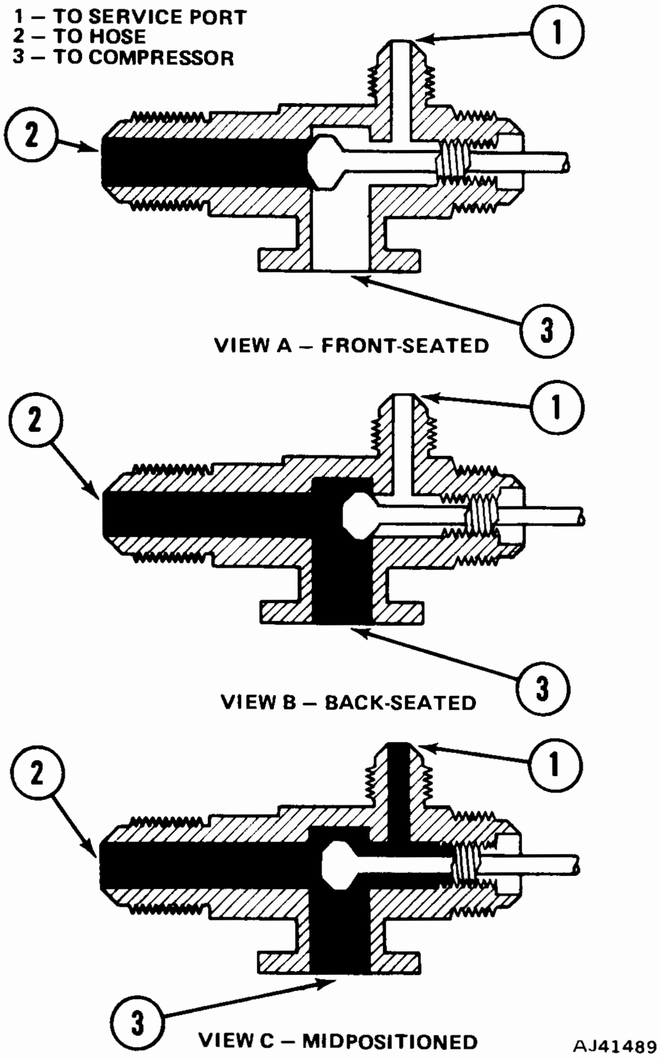


Fig. 13A-3 Service Valve Operating Positions

Low Side Gauge

The low side gauge is a compound gauge, which means that it will register both pressure and vacuum. The compound gauge is calibrated 0 to 150 pounds pressure and 0 to 30 inches vacuum. It is connected to the suction service valve to check low side pressure or vacuum.

High Side Gauge

The high side gauge is used to check pressure in the discharge side of the air conditioning system.

Manifold

The gauges are connected into the air conditioning system through a manifold (fig. 13A-4). The manifold has three connections. The low side hose and fitting is connected directly below the low side gauge. The high side hose and fitting is connected below the high side gauge.

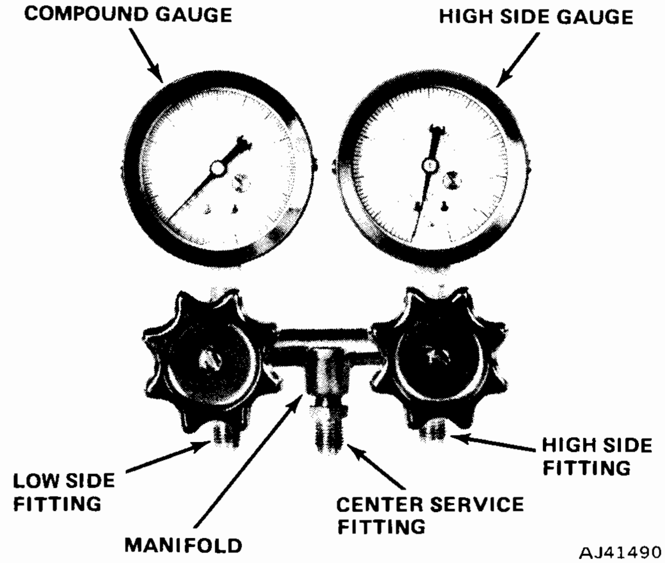


Fig. 13A-4 Pressure Gauge and Manifold Assembly Tool J-23575

The center connection of the manifold is used for charging, discharging, evacuating and any other necessary service. Both the high and low side of the manifold have hand shutoff valves. The hand shutoff valves open or close the respective gauge connections to the center service connection or to each other. The manifold is constructed so that pressure will be indicated on the gauges regardless of hand valve position.

Connecting the Pressure Gauge and Manifold Assembly

(1) Remove protective caps from service valve gauge ports and valve stems.

(2) Close both hand valves on the gauge manifold set.

(3) Connect compound gauge hose to compressor suction service valve gauge port (low side).

(4) Connect high pressure gauge hose to discharge service valve gauge port (high side).

NOTE: *If necessary, to faciliate installation of gauge assembly, loosen the service-valve-to-compressor fitting and rotate the service valve slightly. Tighten the service valve-to-compressor fitting to 25 foot-pounds torque.*

(5) Set both service valve stems to cracked or mid-position. The gauges will indicate the high and low side pressures respectively.

(6) Purge any air from the high side test hose by opening the high side hand valve on the manifold for 3 to 5 seconds (center connection on manifold must be open).

(7) Purge air from the low side test hose by opening the low side hand valve on the manifold for 3 to 5 seconds (center connection on manifold must be open).

The air conditioning system may be operated with the gauge manifold assembly connected in this manner. The gauges will indicate the respective operative pressures.

CHECKING SYSTEM PRESSURES

The pressure developed on the high and low sides of the compressor indicate whether the system is operating properly.

(1) Attach Pressure Gauge and Manifold Assembly.

(2) Close both hand valves on Gauge and Manifold Assembly.

(3) Set both service hand valve stems to midposition.

(4) Operate AC system with engine running at 1500 rpm and controls set for maximum cooling.

(5) Insert a thermometer into the discharge air outlet and observe air temperature.

(6) Observe high and low side pressures and compare with those shown in the Normal Operating Temperatures and Pressures chart. If pressures are abnormal, refer to Pressure Diagnosis chart.

SIGHT GLASS

A sight glass is incorporated in the receiver/dryer-to-evaporator hose at the quick-disconnect coupling. The sight glass provides a visual check of the system refrigerant level. A continuous stream of bubbles will appear in the sight glass of a system which is not properly charged. Properly charged and completely discharged systems will appear similar through the sight glass because of the lack of bubbles. To distinguish between the two situations, cycle the magnetic clutch OFF and ON with the engine running at 1500 rpm. During the time the clutch is off, bubbles will appear if refrigerant is in the system and will disappear when the clutch is on. If no bubbles appear when cycling the magnetic clutch, there is no refrigerant in the system, since some bubbles would appear in a fully charged system. If the system is discharged, it will be necessary to leak test, repair as required, evacuate, and charge the system.

DISCHARGING THE SYSTEM

Refrigerant should be discharged from the system before replacing any part in the system except the compressor.

(1) Connect Pressure Gauge and Manifold Assembly to the proper service valves.

(2) Turn both manifold hand valves to the maximum counterclockwise (open) position.

(3) Open both service valves a slight amount and allow the refrigerant to discharge slowly from the system (fig. 13A-5).

CAUTION: *Do not allow the refrigerant to rush out, as the oil in the compressor will be forced out along with it.*

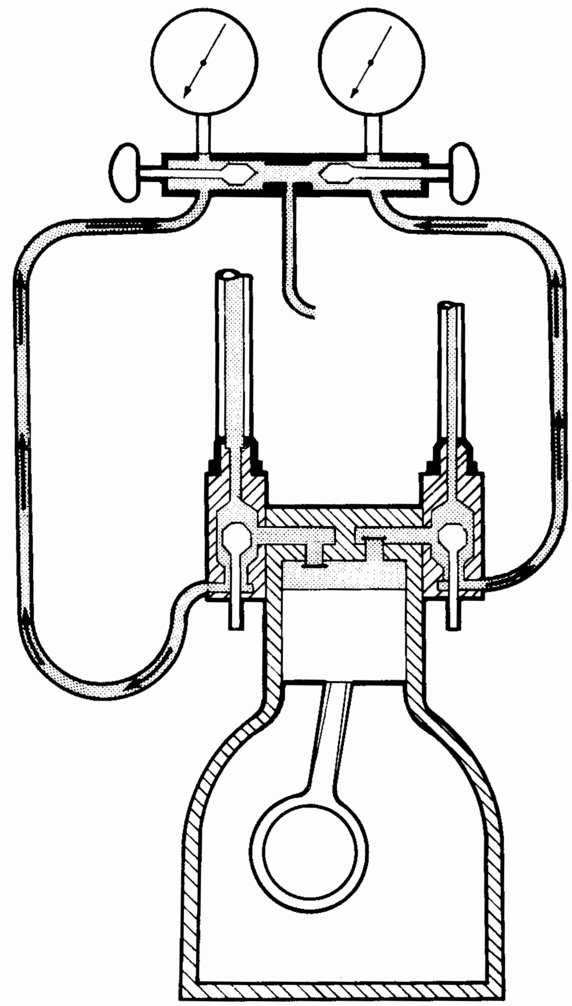


Fig. 13A-5 Valve Positions for Discharging

EVACUATING THE SYSTEM

A system that has had the refrigerant removed during repair, or that is excessively low on refrigerant, must be evacuated with a vacuum pump before new refrigerant is installed. The primary reason for evacuating a system is to remove moisture that may have entered the system.

Moisture in any quantity is extremely harmful to the air conditioning system. Moisture may collect and freeze in the thermostatic expansion valve orifice, blocking refrigerant flow and preventing system cooling. Moisture will also react with R-12 to form hydrochloric acid which will corrode metal parts of the system. Corrosion particles may become detached and block the small passages and orifices in the system.

Unwanted air and moisture are removed from the system by controlling the pressure, that is creating a vacuum throughout the system. A vacuum pump is used to lower the pressure sufficiently so that the moisture boiling temperature is reduced to a point at which the water will vaporize and can then be evacuated from the system.

Water boils at 212°F at 14.7 psi (sea level). As the vacuum pump lowers the pressure of the closed air conditioning system, the boiling point of the moisture in the system will also be lowered. In evacuating the system, it is necessary to lower the boiling point of any moisture in the system to a point lower than the ambient (surrounding) temperature to ensure that all moisture is boiled off. At an ambient temperature of 75°F, when the desired vacuum of 29.5 inches of Hg is reached, water will boil at approximately 72°F and a complete boiling off of all moisture in the system is assured when this vacuum reading has been reached.

At altitudes higher than sea level, it will not be possible to obtain a vacuum reading of 29.5 inches of Hg on the low side compound gauge. For each 1,000 feet of altitude, the vacuum gauge must be corrected by one inch of mercury (Hg) to compensate for a change in the atmospheric pressure. For example, at altitudes of 1,000 feet, a gauge reading of 28.5 Hg will be the same as a gauge reading of 29.5 inches of Hg at sea level. When this vacuum is reached, a minimum of 30 minutes should be allowed in evacuating the system to ensure complete moisture removal.

Evacuating Procedure with J-23178 Vacuum Pump

The J-23178 vacuum pump and motor is a self-contained unit equipped with a carrying handle and stand. The unit must be kept upright at all times to prevent oil from spilling.

(1) Connect Pressure Gauge and Manifold Assembly, Tool J-23575.

(2) Discharge system.

(3) Connect center service hose to inlet fitting of vacuum pump (fig. 13A-6).

(4) Open both manifold hand valves wide open.

(5) Start vacuum pump; note compound gauge reading.

(6) Test system for leaks. Close both manifold hand valves, turn off vacuum pump, and note compound gauge reading. Gauge needle should remain stationary at point where pump turned off.

(7) If gauge needle returns to zero rapidly, install a partial charge in the system and locate the leak with leak detector. Repair leak and repeat evacuation procedure.

(8) If gauge needle remains stationary and vacuum is maintained for 3 to 5 minutes, resume evacuation for minimum of 30 minutes.

(9) Close both manifold hand valves and stop vacuum pump.

(10) Disconnect center service hose from vacuum pump. The system is ready for charging.

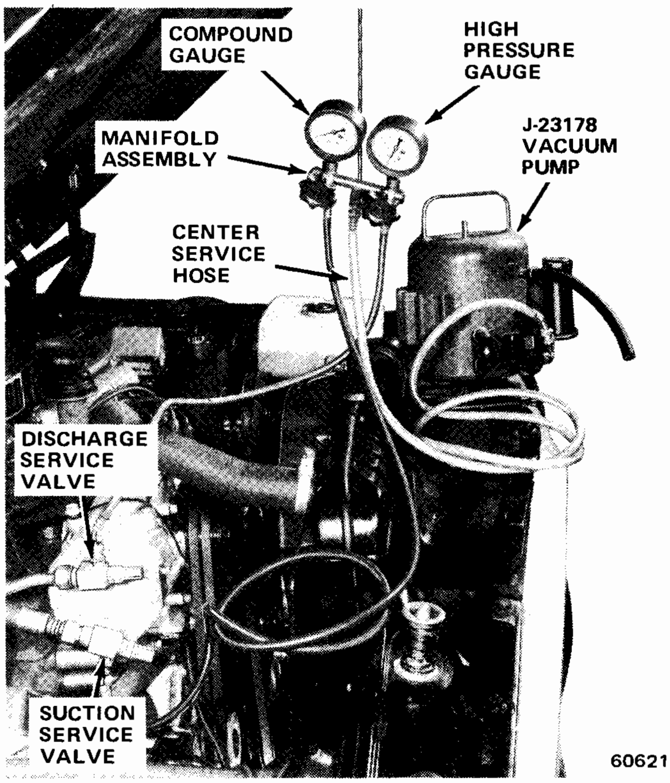


Fig. 13A-6 Evacuating System with Vacuum Pump

Evacuation Procedure with J-23500 Portable Air Conditioning Service Station

The J-23500 Portable Air Conditioning Service Station (fig. 13A-7) is a completely portable station equipped with vacuum pump, metering-charging cylinder, refrigerant supply, gauges, hoses and hand control valves.

The control switch for the vacuum pump is mounted on the rear of the charging station. It should be in the OFF position before inserting plug into the power source.

There are four hand control valves on the face of the control panel, identified and numbered as follows: low-pressure control (1), high-pressure control (2), vacuum control (3), and R-12 control (4). When not in use, keep all hand control valves in the OFF position to prevent dirt and moisture from entering.

(1) Close all hand valves.

(2) Connect high-pressure line (red hose) to discharge service port on the compressor.

(3) Connect low-pressure line (blue hose) to suction service port on the compressor.

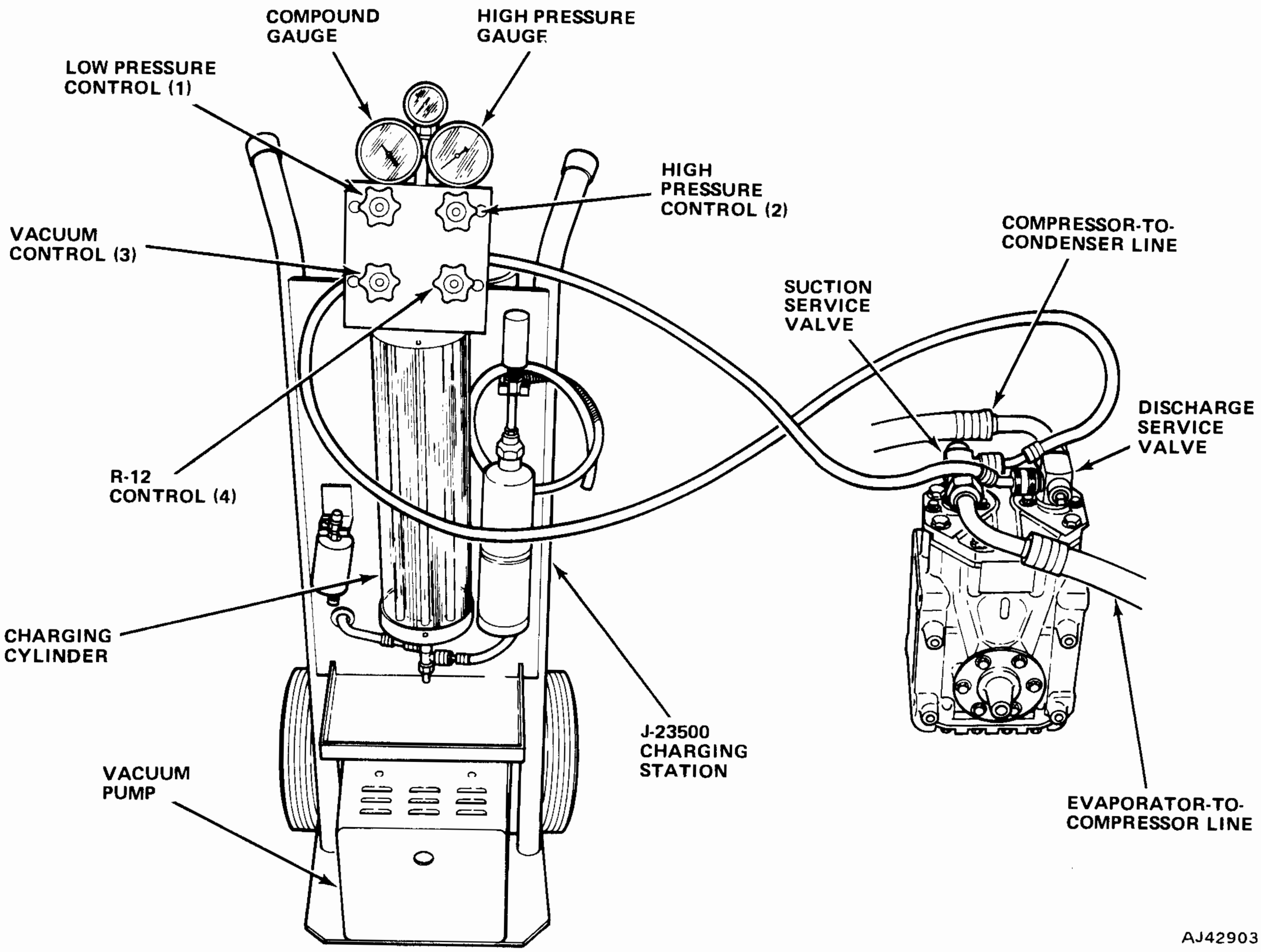


Fig. 13A-7 Portable Air Conditioning Service Station

(4) Discharge system, leaving suction and discharge service valves in the cracked or midposition.

(5) Connect vacuum pump hose to vacuum pump inlet.

(6) Open low-pressure hand control valve (1) and the high-pressure hand control (2).

(7) Start vacuum pump; note compound gauge reading.

(8) Operate pump a minimum of 30 minutes after reaching lowest vacuum.

(9) Close vacuum control valve (3) and stop vacuum pump. The system is ready for charging.

CHECKING FOR LEAKS

Whenever a system requires more than 1/2 pound of refrigerant after a season's operation, a serious leak is indicated which must be located and repaired.

Most leaks will be located at points of connection and are caused by vehicle vibration. Correction of this type of leak may only require retightening of the connection. However, some leaks may occur only at periods of high traffic on a very warm day. This type of leak most often occurs through the compressor shaft seal or service valve gasket.

A system must contain an adequate quantity of refrigerant to be properly leak tested. If a system is completely discharged, evacuate and install 1/2 pound of refrigerant.

External leaks are detected and located with a halide torch, Tool J-6084 (fig. 13A-8). The torch burns propane fuel and is equipped with a search hose. When air is drawn into the hose by the torch, it contacts a heated copper reactor ring in the torch. If refrigerant gas is present in the air, the normally light blue flame will change color. A small refrigerant leak will change the flame color to yellow. A large refrigerant leak will change it to green or purplish-blue.

Leak Test Procedure Using Halide Torch

NOTE: *Use compressed air to purge test area of refrigerant. This prevents the torch from indicating a leak in an area where none exists.*

(1) Open torch valve and light torch, adjusting flame just high enough to heat copper reactor ring to a cherry red.

(2) Lower flame until it is about 1/4 inch above or even with the copper reactor ring. The smaller flame is more sensitive to refrigerant.

(3) Move search hose slowly **under** all connections, joints, and seals. Because refrigerant is heavier than air, leaks may be detected more readily on the lower side of the areas being checked.

(4) Watch for color change or flame indicating area of leak.

WARNING: *When refrigerant comes into contact with an open flame, phosgene gas is formed. Never inhale the vapors or fumes from the halide torch; they may be poisonous.*

(5) Repair leaks as required.

(6) Evacuate and leak-test system after all leaks are corrected.

(7) Charge system.

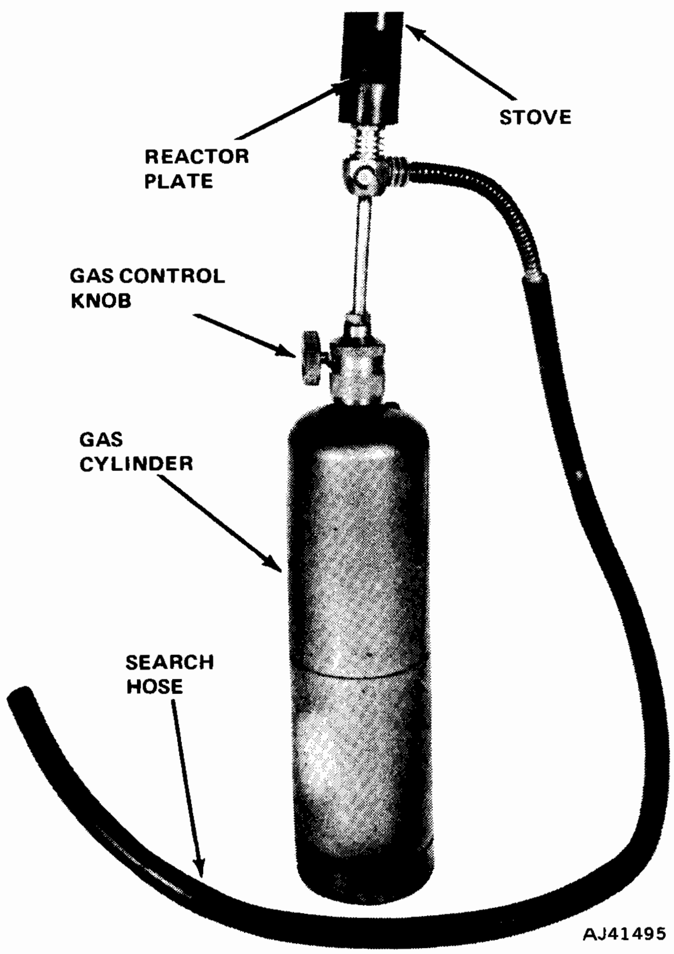


Fig. 13A-8 Halide Torch J-6084

CHARGING THE SYSTEM

Before making a complete charge, check the compressor oil level, leak test if necessary, and evacuate the system.

Charge Capacity

The capacity for all models is 2-1/4 pounds of Refrigerant R-12 (dichlorodifluoromethane).

Charging Procedure with J-6272-02 No. 4 Multi-Refrigerant Can Opener

The following charging procedure is based on the use of Pressure Gauge and Manifold Assembly (Tool J-23575) and No. 4 Multi-Refrigerant Can Opener (Tool J-6272-02). Refer to figure 13A-9.

WARNING: *Wear goggles to protect eyes.*

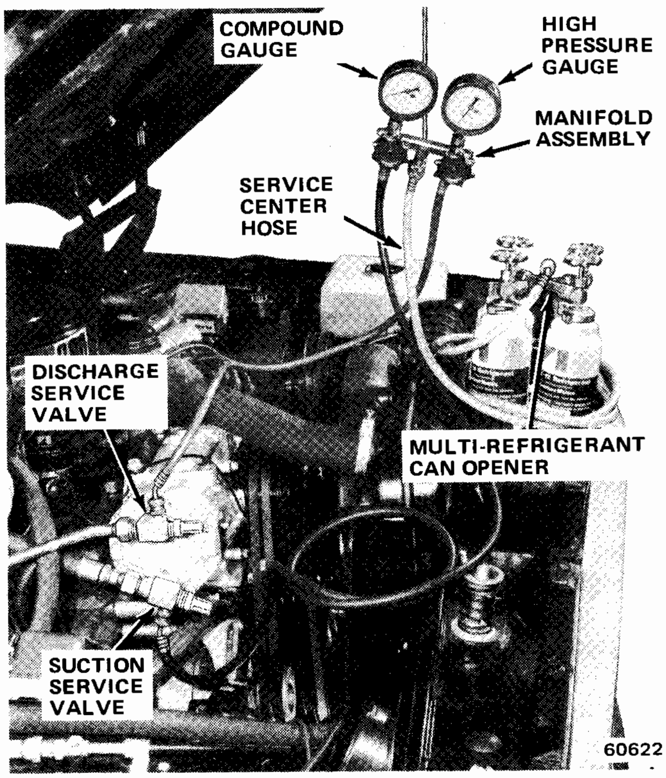


Fig. 13A-9 Charging System with Multi-Refrigerant Can Opener

(1) Connect Pressure Gauge and Manifold Assembly J-23575 and evacuate system. Keep both service valves in the cracked or midposition.

(2) Close both gauge hand valves.

(3) Disconnect service hose from vacuum pump and connect it to the center of the No. 4 Multi-Refrigerant Can Opener J-6272-02. Close the petcock valves on the dispenser.

(4) Attach the necessary number of refrigerant cans to the dispenser. Refer to Charge Capacity for the proper weight of refrigerant necessary to charge the vehicle being serviced.

(5) Open one dispenser petcock valve. Loosen the center service hose at the Pressure Gauge and Manifold Set allowing refrigerant to purge air from the line. Tighten the service hose connection and close dispenser petcock valve.

(6) Open the suction (compound) gauge hand valve and one dispenser petcock valve. Do not open the discharge (high pressure) gauge hand valve.

(7) Start engine and place AC controls in the maximum cooling position. The compressor will operate and help pull refrigerant gas into the suction side of the system.

NOTE: *The refrigerant cans may be placed upright in warm water no hotter than 125°F to speed up the charging process.*

(8) When the first refrigerant can is empty, open another dispenser petcock valve to continue charging the system.

(9) Continue charging until the specified amount of refrigerant is in the system. The frost line on the refrigerant can will indicate what portion of the refrigerant in the can has entered the system. This check may be used as a visual guide when a system requires a fraction of a full can.

NOTE: *If an accurate scale is available, weigh the refrigerant cans before and during the charging procedure to assure that the correct amount of refrigerant is being used.*

(10) When system is fully charged, close the suction (compound) gauge hand valve and all dispenser petcock valves.

(11) Back-seat the suction and discharge service valves for their normal operating position by turning them fully counterclockwise.

(12) Loosen the Pressure Gauge and Manifold Set service hoses to allow refrigerant trapped in hoses to discharge.

(13) Remove Pressure Gauge and Manifold Set and install all dust caps on fittings.

(14) Operate the system 10 to 15 minutes to allow it to normalize and to determine if the system will cycle properly.

Charging Procedure with J-23500 Portable Air Conditioner Service Station

The following charging procedure is based on the use of the Portable Air Conditioning Service Station, Tool J-23500.

WARNING: *Wear goggles to protect eyes.*

(1) Discharge and evacuate system.

(2) With all control valves on the charging station closed, open the refrigerant drum valve.

(3) Bleed the charging cylinder through valve located on the back of the control panel directly above cylinder. Close bleed valve occasionally to check level in charging cylinder. Raising the refrigerant drum above the level of the charging cylinder will speed up the filling process. When correct amount of refrigerant is in the charging cylinder, close the bleed valve.

(4) Close refrigerant drum valve.

(5) Close low-pressure control valve (1) and mid-position (cracked) suction and discharge service valves.

(6) Fully open refrigerant control valve (4) and high-pressure control valve (2). Liquid refrigerant contained in charging cylinder will enter high side of system.

(7) When full charge has entered system, close refrigerant control valve (4) and high-pressure control valve (2). Back-seat the suction and discharge service valves.

NOTE: *During charging, place a fan in front of the vehicle to pass air over the condenser, which will shorten the time required for charging.*

(8) Disconnect service hoses from suction and discharge service valves.

(9) Operate system 10 to 15 minutes to allow it to normalize and to determine if the system will cycle properly.

COMPRESSOR

The compressor is the belt-driven, two-cylinder reciprocating type. It is attached to the engine with a mounting bracket as shown in figures 13A-10 and -11.

Compressor Valve Leak Diagnosis

The compressor should be at operating temperature to perform an accurate test.

(1) Install Pressure Gauge and Manifold Assembly, Tool J-23575.

(2) Front-seat the suction and discharge service valves by turning them clockwise.

(3) Discharge refrigerant remaining in compressor by opening suction gauge hand valve slowly.

(4) Open the suction gauge hand valve and close the high pressure gauge hand valve.

(5) Start engine and operate compressor. Pressure will build up rapidly. Stop compressor at 150 to 200 pounds pressure.

(6) Pressure should hold if the discharge valve is operating properly. Loss of pressure indicates leaking compressor discharge valve or head gasket.

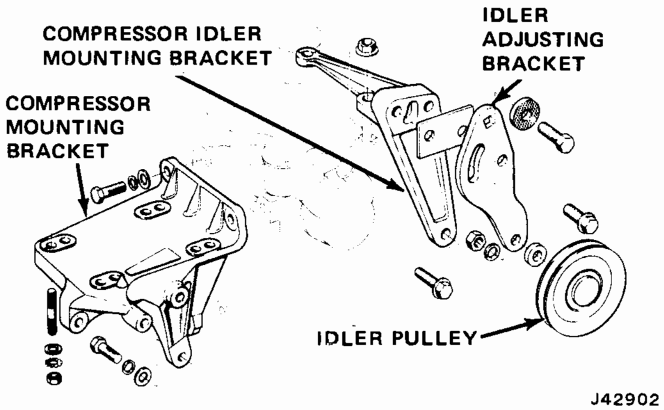


Fig. 13A-10 Compressor Mounting—Six-Cylinder

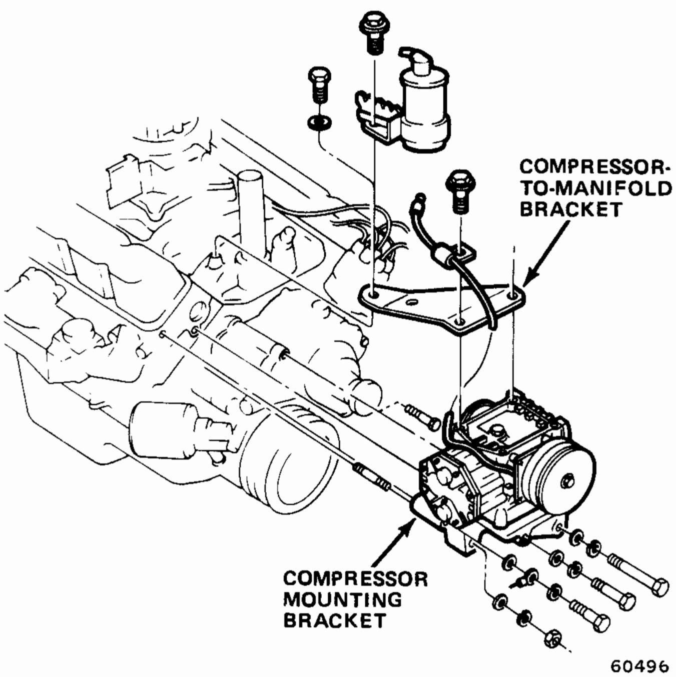


Fig. 13A-11 Compressor Mounting—V-8

Compressor Belt Tension

Belt tensions are important and should be inspected at time of new vehicle pre-delivery and at subsequent scheduled maintenance intervals.

Belt Tension Gauge, Tool J-23600, will provide accurate belt tension adjustments. Install the gauge on the longest accessible belt(s) span. Belts tension for new vehicle pre-delivery and all belts with previous service should be 90 to 115 pounds. for six-cylinder engines.

Six-cylinder belt tension is adjusted by the idler mounting bracket.

V-8 belt tension is adjusted by the alternator.

When a new belts is installed, it should be adjusted to 125 to 155 pounds (155 preferred) tension to compensate for the initial run-in loss that occurs within the first several minutes of operation.

NOTE: *New belt tension specifications apply only to service replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used-belt specifications.*

A characteristic of the **Dacron-type belt(s)** used to drive the AC compressor is that it tends to increase in tension—rather than stretch—when subjected to heat. The loss in belt tension which can be observed after the initial run-in is the result of wear-in which allows the belt to ride deeper in the V-groove of the pulleys.

If a belt is run with less than the specified tension, slippage can occur which can cause belt contact surfaces to become glazed. A glazed belt has lost some of its load carrying capability and may slip even when adjusted to specified belt tension.

Belt **vibration**, particularly on six-cylinder models, is usually the result of improper belt tension. When excessive belt vibration or flutter is encountered, adjust the belt tension to specifications. Adjusting belt tension to higher tensions will not stop vibration but will increase stress on the idler assembly.

Isolating the Compressor

It is not necessary to discharge the system for compressor removal. The compressor can be isolated from the remainder of the system, eliminating the need for recharging when performing compressor service.

(1) Connect Pressure Gauge and Manifold Assembly, Tool J-23575.

(2) Close both gauge hand valves and mid-position (cracked) both service valves.

(3) Start engine and operate air conditioning.

(4) Turn the suction service valve slowly clockwise toward the front-seated position. When suction pressure is reduced to zero or less, stop engine and compressor and quickly finish front-seating the suction service valve. Suction pressure should be slightly above zero.

(5) Front-seat the discharge service valve.

(6) Loosen oil check plug slowly to release any internal pressure in compressor. The compressor is now isolated from the remainder of the system. Refrigerant lines and service valves can be removed from compressor as complete assemblies.

Compressor Removal—V-8

(1) Disconnect battery negative cable.

(2) Isolate compressor (see above procedure).

(3) Remove both service valves and place protective caps over compressor head fittings.

(4) Loosen and remove compressor belt set.

(5) Disconnect clutch wire.

(6) Remove alternator.

(7) Remove coil from upper compressor-to-manifold bracket.

(8) Remove battery ground cable from lower bracket-to-compressor attaching stud.

(9) Remove upper bracket-to-intake manifold attaching bolt.

(10) Remove lower bracket-to-engine attaching bolts, nuts, and washers.

(11) Remove compressor and mounting bracket as an assembly and place on work bench.

(12) Remove bracket and bracket attaching studs.

Compressor Installation—V-8

(1) Bench assemble the lower mounting bracket to the compressor.

(2) Position compressor and bracket assembly on engine and install bolts, washers, and nuts.

(3) Install upper bracket-to-intake manifold attaching bolt.

(4) Install battery ground cable to lower bracket-to-compressor stud.

(5) Install coil to upper compressor-to-manifold bracket.

(6) Install alternator.

(7) Install compressor drive belt set and adjust to proper tension.

(8) Attach compressor service valves and lines.

(9) Purge compressor of air and open service valves.

(10) Connect clutch wire.

(11) Connect battery negative cable.

Compressor Front Seal Replacement

The compressor front seal is serviced in kit form. Kit components are shown in figure 13A-12. All seal parts must be replaced if a leak has been detected at the seal.

NOTE: *A small amount of oil around the shaft seal is normal and does not indicate a seal leak. All seal parts were dipped in oil at the time of assembly and operation may force out surplus oil.*

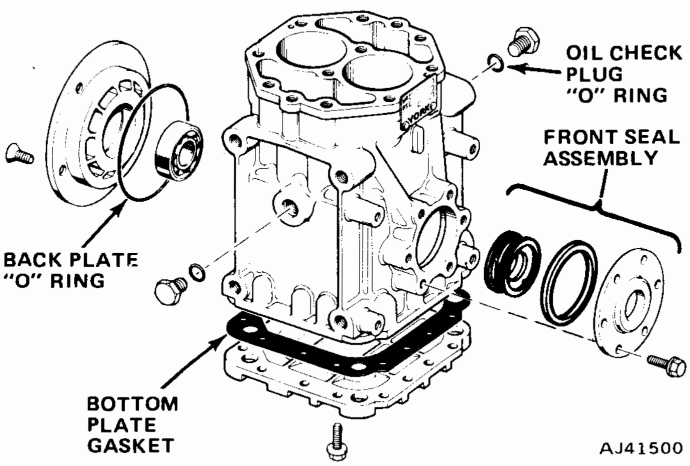


Fig. 13A-12 Compressor Seal Components and Gaskets

(1) Discharge remaining refrigerant in system, then back-seat both service valves to prevent air, moisture, and dirt from entering system.

(2) Remove belts.

(3) Remove clutch pulley and woodruff key from compressor shaft.

(4) Remove seal plate capscrews and washers, pry seal plate loose, and remove.

(5) Carefully pry behind seal drive ring, that part of the seal assembly farthest back on the shaft, and remove seal assembly.

(6) Clean new seal assembly components in clean refrigeration oil.

NOTE: *Cleanliness, careful handling, and clean refrigeration oil are important elements of successful seal replacement.*

(7) Push seal assembly, less carbon ring, if loose, over compressor shaft with carbon ring retainer facing out. Move assembly in and out on shaft to seat neoprene ring on shaft. Push assembly in until seal retainer assembly contacts bearing race. If carbon ring was loose, position it in ring retainer with polished side out.

NOTE: *The carbon ring must seat in the retainer.*

(8) Coat mating surfaces of compressor and seal plate with a film of refrigeration oil. Position seal ring in groove on the seal plate and install seal plate.

(9) Install seal plate capscrews and tighten evenly while rotating compressor shaft. Center seal plate on shaft by lightly tapping plate. Tighten capscrews in a diagonal pattern to 90 inch-pounds torque.

Back Plate O-Ring Seal Replacement

NOTE: *On six-cylinder engines, it is not necessary to remove the compressor.*

(1) Isolate and remove compressor.

(2) Remove four back plate attaching screws using Torx Bit Tool J-25359.

(3) Remove back plate by gently prying it loose from crankcase. Pry in such a manner to pull parallel to bearing surface.

(4) Remove O-ring seal from back plate.

(5) Clean back plate and apply a light film of refrigeration oil to O-ring sealing area.

(6) Position O-ring seal on back plate and install back plate over rear bearing and into the crankcase.

(7) Install four back plate attaching screws using Torx Bit Tool J-25359 and tighten in a diagonal pattern to 9 to 17 foot-pounds torque.

(8) Install and purge compressor of air.

(9) Leak test system. Evacuate and charge if necessary.

Head, Valve Plate, and Gasket Replacement

(1) Isolate compressor.

(2) Remove service valves from compressor. The compressor head service valve ports are identified D for discharge and S for suction.

(3) Remove compressor head attaching screws.

(4) Tap under valve plate ears (short, half-round projections on the valve plate) to remove head and valve plate (fig. 13A-13).

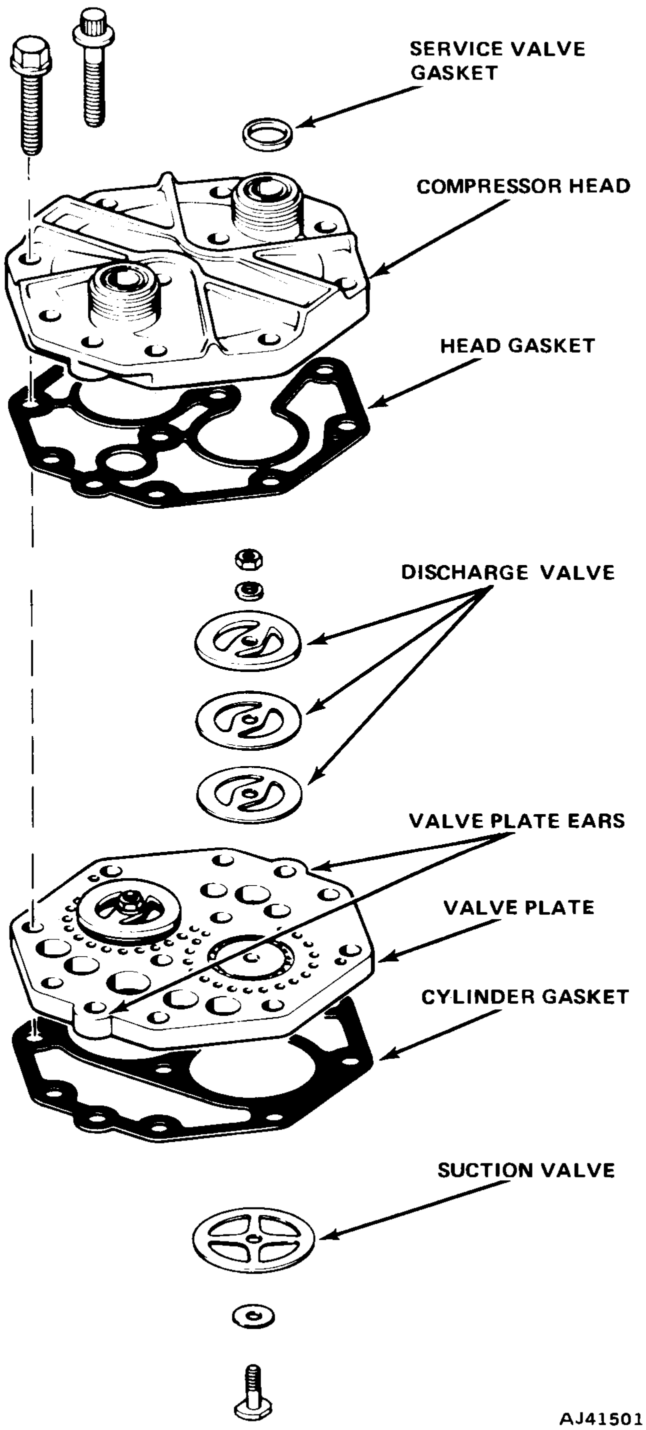


Fig. 13A-13 Head and Valve Plate Assembly Sequence

(5) Tap valve plate ears while holding the compressor head to separate the head from the valve plate.

(6) Clean all gasket material from head, valve plate, and compressor using care not to scratch or nick the sealing surfaces.

(7) Coat all machined sealing surfaces with a light film of refrigeration oil.

(8) Install a new valve plate cylinder gasket on the compressor body, locating the gasket on the dowel pins.

(9) Install the valve plate on the compressor, locating it on the dowel pins so that the discharge valve is at top. Figure 13A-13 shows the correct assembly sequence.

(10) Install a new head gasket, locating it on the dowel pins.

(11) Install head. Tighten compressor head capscrews to 15 foot-pounds torque, following sequence outlined in figure 13A-14.

(12) Coat service valve ports with a light film of refrigeration oil and install new service valve gaskets.

(13) Install service valves.

(14) Purge compressor of air.

(15) Leak test system. Evacuate and charge if necessary.

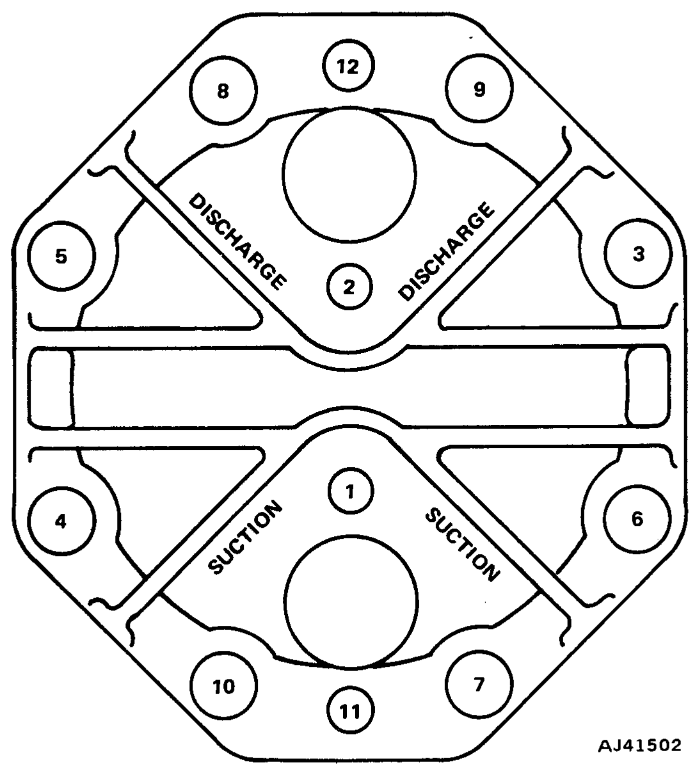


Fig. 13A-14 Compressor Head Capscrew Tightening Sequence

Bottom Plate Gasket Replacement

(1) Isolate and remove compressor.

(2) Remove bottom plate attaching screws and carefully remove bottom plate.

(3) Clean all gasket material from bottom plate and compressor using care not to scratch or nick the sealing surfaces.

(4) Coat all sealing surfaces with a light film of refrigeration oil.

(5) Install a new bottom plate gasket and install bottom plate. Tighten the bottom plate attaching screws to 150 inch-pounds torque.

(6) Install and purge compressor of air.

(7) Leak test system. Evacuate and charge as necessary.

Checking Compressor Oil Level

Initially, the compressor has 7 ounces of 280 to 300 Seybolt refrigeration oil in the crankcase. In normal operation, a small amount of oil is always circulating with the refrigerant in the system. Unless the system has developed a leak, the oil level will remain constant.

CAUTION: *The oil level should be checked whenever the system is discharged for a service part replacement, and especially after a rapid loss of refrigerant has occurred because of a ruptured line, etc.*

NOTE: *Check compressor oil level with compressor in operating position, and only after the vehicle interior air has been cooled to the desired temperature. Operating the system stabilizes the oil entrained in the system, and provides an accurate oil level reading. The oil check plugs are located on their side of the compressor crankcase.*

Before installing a new compressor, check the oil level in the compressor to be replaced prior to removing it. The oil level in the replacement compressor must be adjusted to correspond to that of the replaced compressor.

(1) Isolate the compressor.

(2) Loosen crankcase oil check plug slowly to release any internal pressure in the compressor. Remove check plug when all pressure is relieved.

(3) Fabricate a dipstick rod as shown in figure 13A-15.

(4) Hold dipstick as vertical as possible and insert in check plug opening. The oil level should be within the specified levels indicated in figure 13A-15.

NOTE: *Refrigeration oil readily absorbs moisture. Keep the container capped until ready to use, and recap immediately after use.*

(5) Install oil check plug O-ring seal. Be sure O-ring is not twisted.

NOTE: *Oil filler plug leaks are usually due to a damaged O-ring or dirt on the seat.*

(6) Install plug, being careful not to overtighten it.

(7) Purge compressor of air.

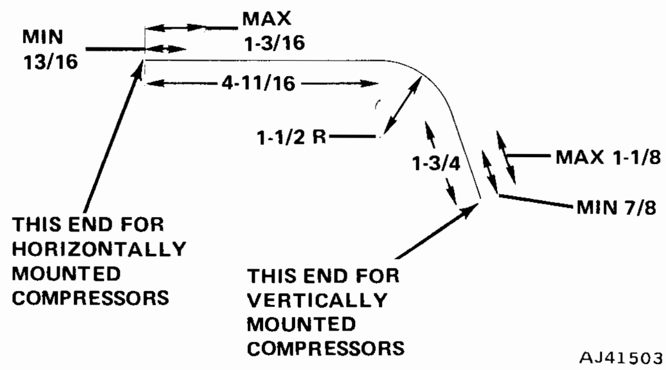


Fig. 13A-15 Oil Dipstick Fabrication Dimensions (Inches)

Purging Compressor of Air

The compressor must be purged of air whenever it has been isolated for oil level check or other service procedures without discharging the entire system.

(1) Cap service gauge ports on both service valves.

(2) Back-seat the suction service valve to allow system refrigerant to enter compressor.

(3) Place the discharge service valve in the cracked or midposition.

(4) Loosen the discharge service valve gauge port cap to permit the refrigerant to force air out of the compressor.

(5) Back-seat the discharge service valve and tighten the gauge port cap.

Compressor is now ready for service.

MAGNETIC CLUTCH

The magnetic clutch consists of a stationary electromagnetic coil and a rotating pulley and plate assembly.

The electromagnetic coil is mounted on four bosses on the compressor. The pulley and plate assembly is mounted on the compressor shaft. When the air conditioner is off, the pulley is free to run on the clutch hub bearing. When the clutch is energized, the plate is magnetically attracted to the pulley and turns the compressor crankshaft.

Do not attempt to replace the bearing, pulley or clutch plate separately. These components are serviced only as a complete assembly. The coil is serviced as a separate unit.

Electrical Diagnosis

Refer to the Magnetic Clutch Troubleshooting guide when diagnosing magnetic clutch malfunctions.

Diagnosis for Noisy Clutch

Spin the pulley by hand. There must be no interference between the field and the rotor assembly. The clutch coil must be mounted properly using the special capscrews which position the field coil to the compressor.

A worn pulley bearing can be detected by the roughness felt when spinning the pulley. Do not attempt to replace the bearing.

A new clutch may emit a short squeal when initially engaged. After a few cycles of operation the noise will disappear.

Clutch Removal

(1) Remove compressor belts.

(2) Energize the clutch or use a spanner wrench to hold the clutch plate while removing the clutch-to-shaft attaching bolt and washer.

(3) Install a 5/8-11 standard thread bolt in the threaded center of the clutch plate.

(4) Tighten bolt and pull clutch from the shaft.

CAUTION: *Do not pry on clutch to remove.*

(5) Remove capscrews which retain the magnetic coil and disconnect coil wire. Remove coil.

Clutch Installation

(1) Install magnetic coil with the four special capscrews provided with the replacement unit. These capscrews are used to ensure the coil is positioned properly on the compressor.

(2) Tighten capscrews to 7 to 10 foot-pounds torque.

(3) Align clutch assembly with key and install clutch on shaft.

(4) Install clutch-to-shaft attaching bolt and tighten to 20 foot-pounds torque. Connect clutch coil wire and energize clutch to hold unit when tightening.

(5) Install compressor belt(s) and adjust belt tension to specifications.

CONDENSER AND RECEIVER/DRYER ASSEMBLY

Removal

(1) Discharge refrigerant from system.

NOTE: *Discharge system slowly to prevent loss of compressor oil.*

(2) Drain radiator.

(3) Remove fan shroud and radiator.

(4) Disconnect pressure line at condenser.

(5) Remove four condenser attaching screws and tilt bottom of condenser toward engine.

NOTE: *Plug all open connections to prevent entry of dirt and moisture.*

(6) From underside of vehicle, disconnect receiver/dryer-to-evaporator hose at receiver/dryer.

(7) Remove condenser and receiver/dryer assembly.

(8) Remove receiver/dryer from condenser, if necessary.

Installation

(1) If removed, install receiver/dryer to condenser.

(2) Place condenser in position and connect receiver/dryer-to-evaporator hose at receiver/dryer.

(3) Install condenser attaching screws.

(4) Connect pressure line at condenser.

(5) Install radiator and fan shroud.

(6) Fill radiator.

(7) Evacuate, leak test, and charge the system.

EVAPORATOR HOUSING ASSEMBLY

Removal

(1) Discharge system.

(2) Disconnect inlet (suction) line at compressor.

(3) Disconnect receiver/dryer-to-evaporator hose at the quick-disconnect coupling (fig. 13A-16).

(4) Remove hose clamps and dash grommet retaining screws.

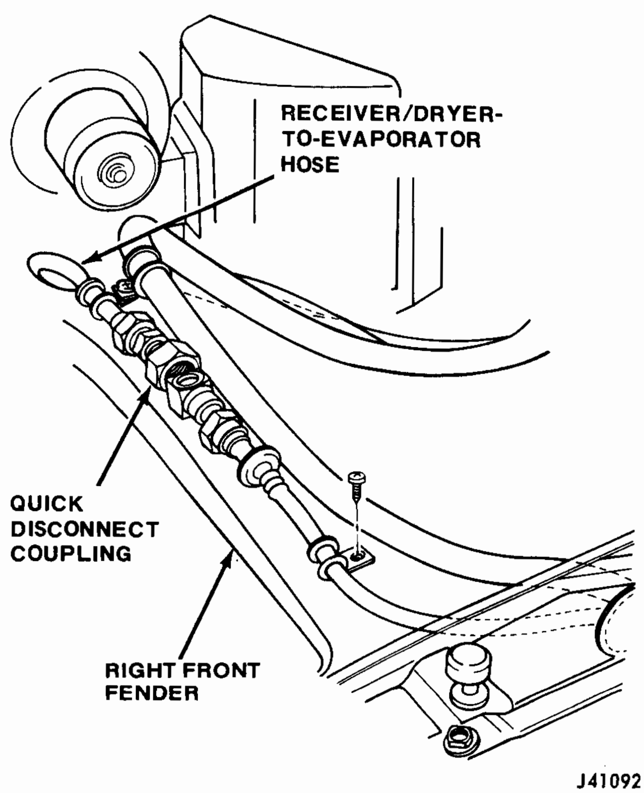


Fig. 13A-16 Quick-Disconnect Coupling

(5) Remove eight evaporator housing-to-instrument panel retaining screws and the one evaporator housing-to-mounting bracket screw (fig. 13A-17).

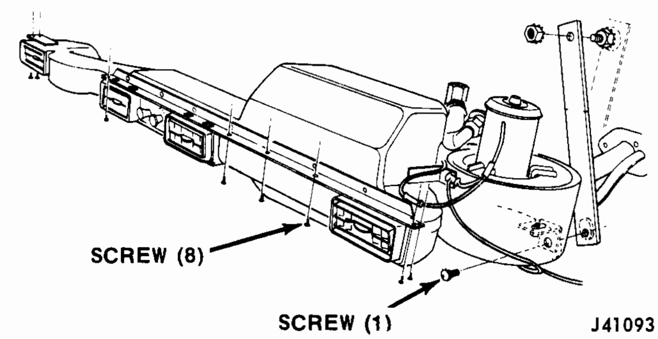


Fig. 13A-17 Evaporator Housing Mounting

(6) Lower evaporator housing and pull hoses and grommet through opening.

The blower motor, blower motor housing, and evaporator core may be serviced after the evaporator housing is removed (fig. 13A-18).

NOTE: *It is not necesary to discharge the system to service the blower motor. The evaporator housing may be lowered from the instrument panel to gain access to the blower motor attaching screws.*

Installation

(1) Push hoses through grommet opening, and install grommet by pushing toward engine compartment of vehicle.

(2) Raise evaporator and install evaporator-housing-to-instrument-panel retaining screws and the evaporator-to-mounting-bracket screw.

(3) Install hose clamps and grommet retaining screws.

(4) Connect receiver-to-evaporator hose at quick-disconnect coupling.

(5) Connect inlet (suction) line to compressor.

(6) Evacuate, leak test, and charge the system.

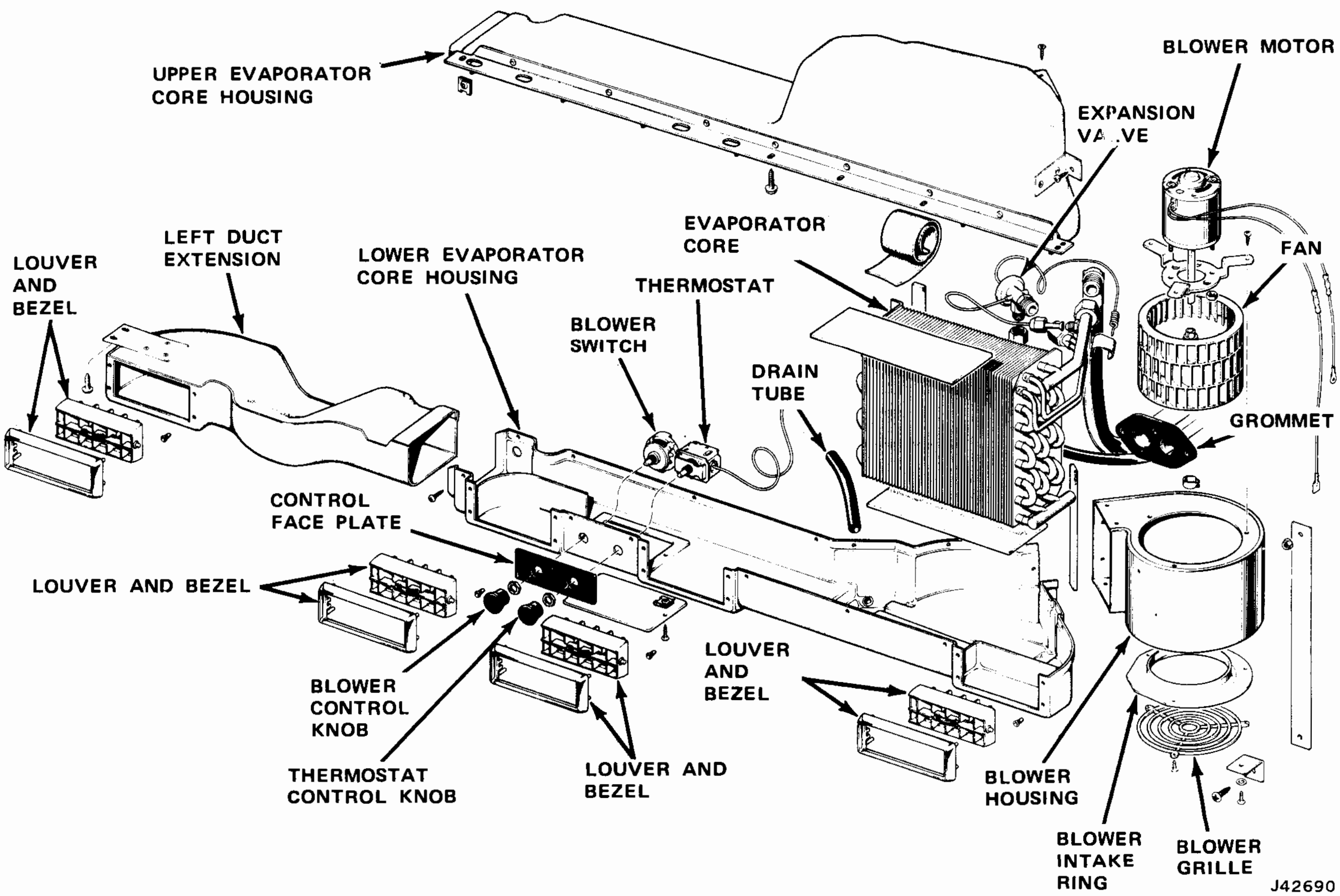
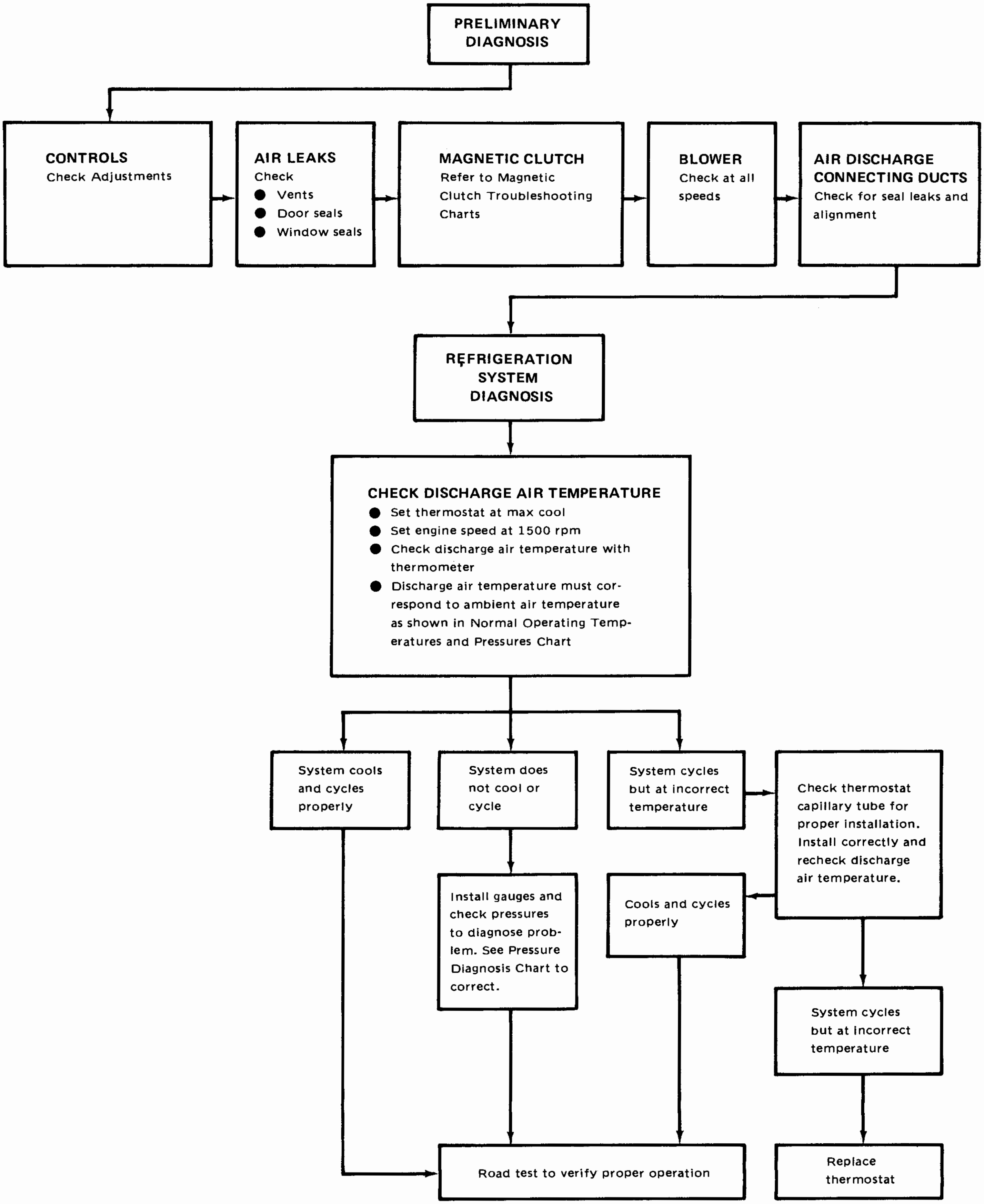
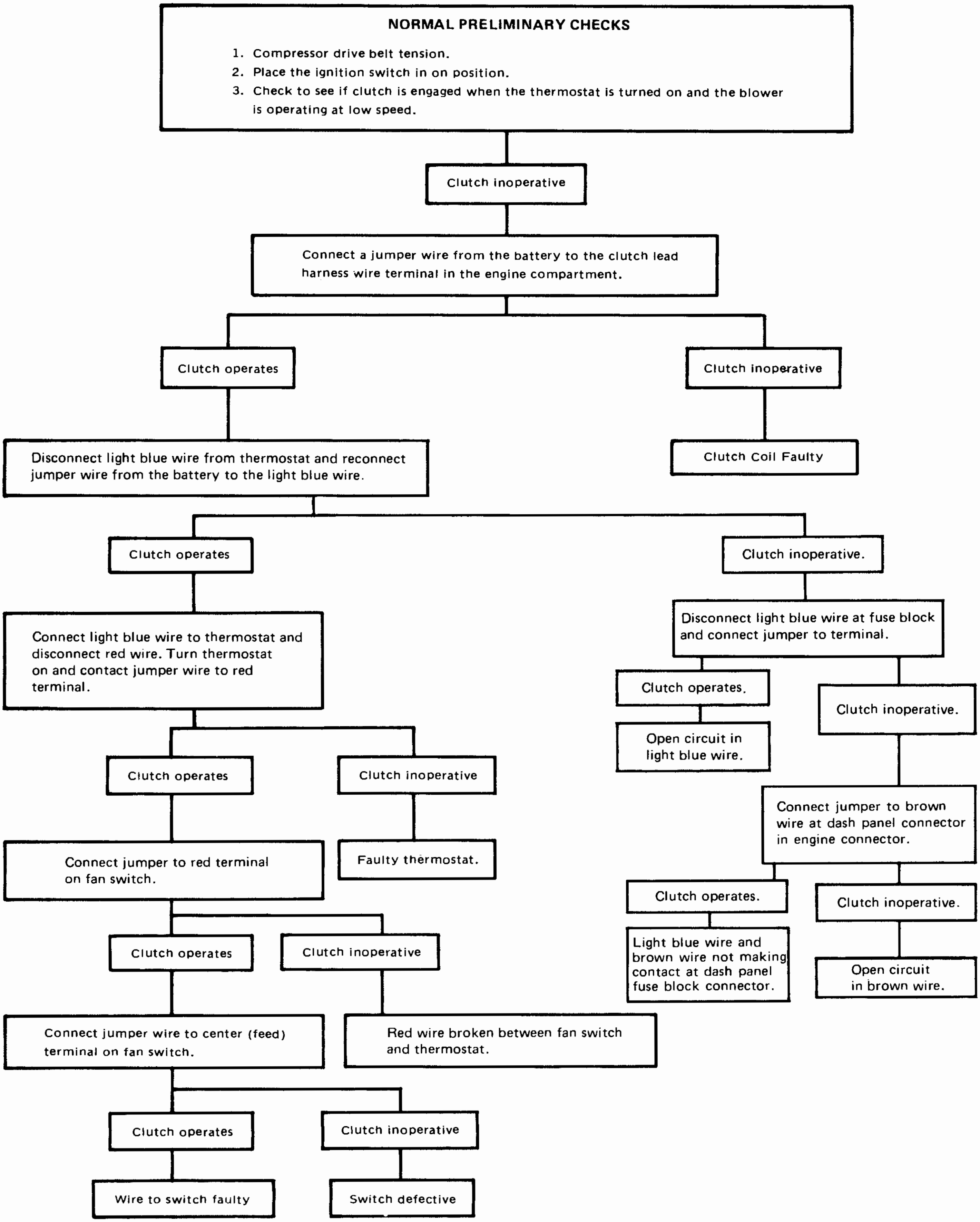


Fig. 13A-18 Evaporator Housing Assembly

System Troubleshooting



Magnetic Clutch Troubleshooting



Normal Operating Temperatures and Pressures

Relative Humidity (percent)	Surrounding Air Temperature (°F)	Engine Speed (RPM)	Maximum Desirable Center Register Discharge Air Temperature (°F)	Suction Pressure PSI (REF)	Head Pressure PSI (+25 PSI)
	70		40	11	177
20	80	1500	41	15	208
	90		42	20	226
	100		43	23	255
	70		40	12	181
30	80	1500	41	16	214
	90		42	22	234
	100		44	26	267
	70		40	13	185
40	80	1500	42	18	220
	90		43	23	243
	100		44	26	278
	70		40	14	189
50	80	1500	42	19	226
	90		44	25	251
	100		46	27	289
	70		41	15	193
60	80	1500	43	21	233
	90		45	25	259
	100		46	28	300
	70		41	16	198
70	80	1500	43	22	238
	90		45	26	267
	100		46	29	312
	70		42	18	202
80	80	1500	44	23	244
	90		47	27	277
	100		—	—	—
	70		42	19	206
90	80	1500	47	24	250
	90		48	28	284
	100		—	—	—

*Operate engine with transmission in neutral. Keep car out of direct sunlight.

EXPANSION VALVE SERVICE

The valve is preset and should not be adjusted. A defective valve requires replacement.

(1) Discharge system.

(2) Remove evaporator housing assembly.

(3) Remove insulation wrapped around suction line and expansion valve. Mark capillary tube location on suction line.

(4) Disconnect inlet and outlet connections, capillary tube clamp, and equalizer tube.

(5) Remove expansion valve.

(6) Clean suction line to provide a positive contact with replacement expansion valve capillary tube.

(7) Connect inlet and outlet hoses. Clamp capillary tube at marked position and connect equalizer tube.

NOTE: *Clamp capillary tube securely so that a firm contact with the suction line is formed.*

(8) Wrap expansion valve and line with insulation.

(9) Install evaporator housing assembly.

(10) Evacuate, leak test, and charge system.

SYSTEM CONTROLS SERVICE

Fan Switch

The fan switch may be serviced by removing the access plate located on the lower evaporator core housing below the control panel.

Temperature Control Thermostat

To service the temperature control thermostat, the evaporator core housing must be disassembled.

When installing a new temperature control thermostat, insert the capillary tube into the evaporator coil a minimum of three inches (fig. 13A-19).

CAUTION: *Handle the tube with care to avoid bends or kinks which could cause the thermostat to malfunction.*

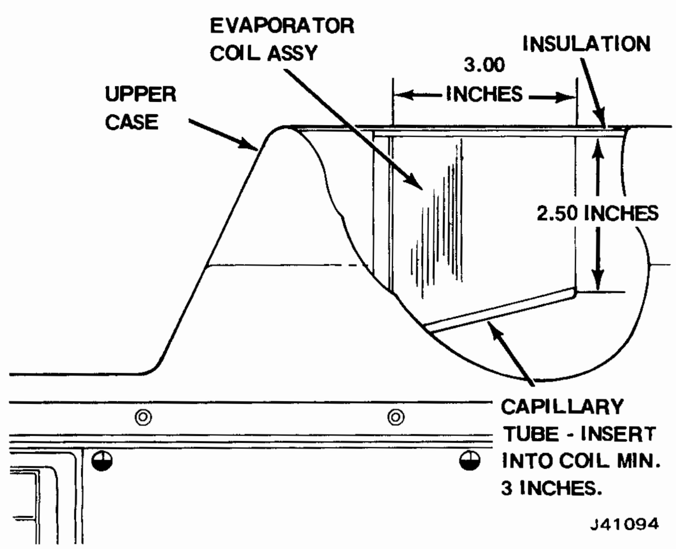
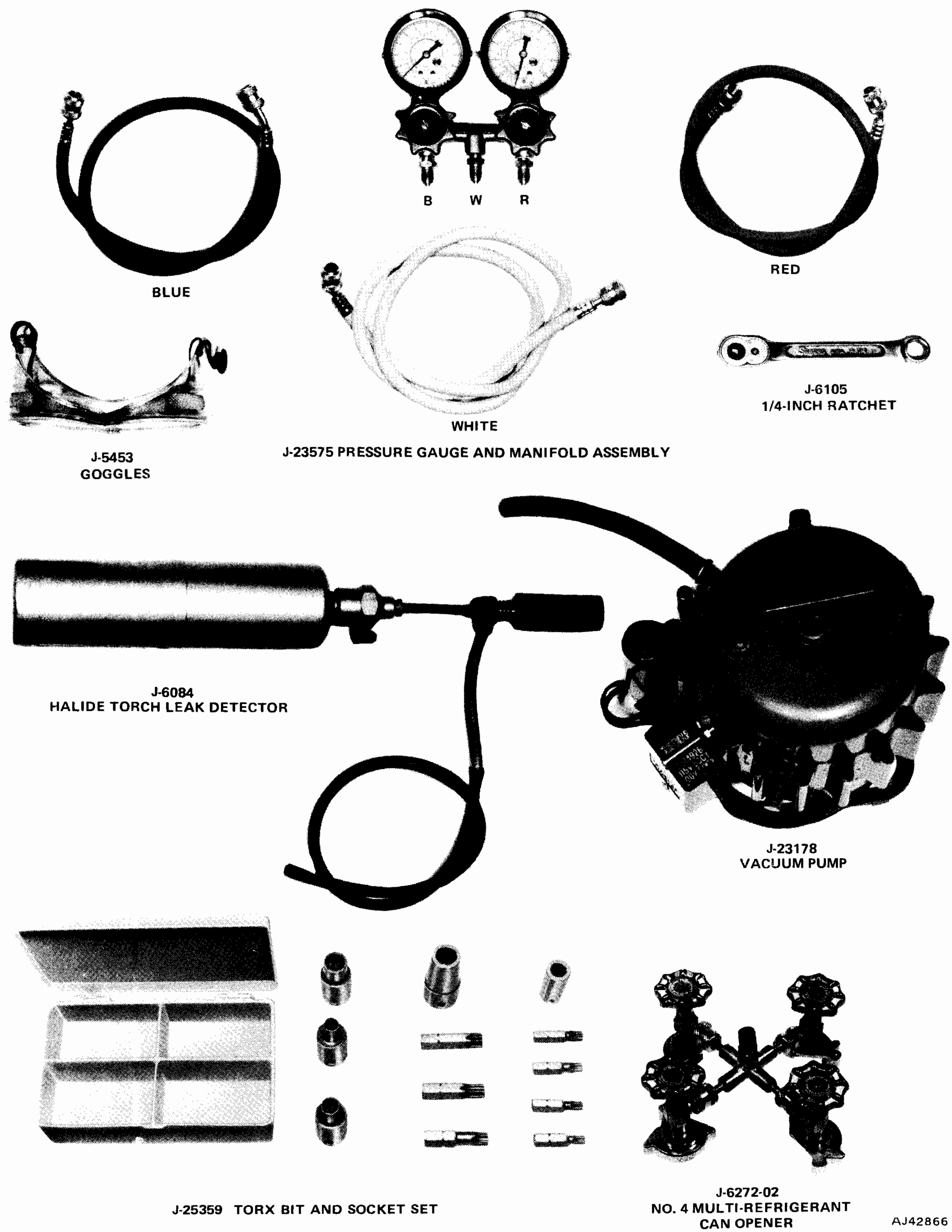


Fig. 13A-19 Capillary Tube Position



Air Conditioning Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

BODIES—PANELS—FENDERS—HOODS—BUMPERS

BODIES

BODY CONSTRUCTION

General

Jeep vehicles are of all-steel construction, with insulated body mounting points that provide a secure attachment to the chassis frame.

All major body panels are of heavy gauge steel, reinforced, flanged, and welded. The bodies are completely detachable from the chassis unit and are insulated from the frame by body spacers placed between the body and frame and held in position with body bolts.

Spacers are located between the body and chassis mounting points to insulate against vibrations and road noises.

Periodic inspection is necessary to determine the condition of body spacers and holddown bolts. Worn, loose, or fatigued spacers permit the body to settle causing body lean or possible interference between the floorpan and various chassis components.

Water Test Procedure

Water testing can be performed without the need of a helper, by utilizing a suitable stand to which a water hose can be attached. The hose attachment should be adjustable to permit changing the spray direction as needed. This method will make it possible for one man to observe and detect the point of water entry while the water is being applied.

Always begin the water spray at the lowest point and allow sufficient saturation before moving the water spray upward.

To best simulate conditions that cause water leaks, i. e., rain or car wash, it is advisable to water-test with a spray pattern rather than a heavy, solid stream of water which can create misleading symptoms.

This procedure can be used on any area suspected of having a water leak.

Correction of Leaks

The following is a list of sealing compounds best suited to correct water or dust leaks in the respective areas as described. Comply with specific instructions recommended by the manufacturer and noted on the container.

Body Joint Sealer—A heavy-bodied asphalt base compound with properties very similar to undercoating material. Used to seal body joints. Do not use where scuffing of sealer may occur. Ideal for use in wheel splash area after adequate cleaning of surface.

Undercoat Spray—Undercoating material in a pressurized spray container is ideal for quick sealing of body seams and joints. A four-inch plastic tube used as a nozzle extension allows access to hard-to-seal areas.

Body Caulk-String Caulk—A heavy-bodied material which can be molded easily and pressed into place and remain pliable. Adjoining surfaces must be clean for good adhesion. Caulk is best suited as a gasketing material and must not be substituted for a sealant which requires an adhering bond.

Plastisol or Hard-Setting Sealers—Fast curing sealers which can be used on an exposed painted surface. Surface of sealer will harden smoothly and quickly for repaint or touch-up. Use for sealing coach joints of exposed surface requiring a hard, smooth finish.

Flowable Black Sealers—Black, thin-bodied sealers with a butyl or rubber base, remain soft and tacky to fill voids which may occur due to flexing.

FRAME CONSTRUCTION

The frame is the foundation and structural center of the vehicle. In addition to carrying the load, it mounts and supports the power unit while maintaining correct relationship and alignment of the power train. This relationship assures normal functioning of the units and freedom from excessive wear, stress, and strain. The frame is constructed of heavy channel steel side rails and crossmembers. The crossmembers maintain the proper positions of the side rails in direct relationship to each other, providing maximum resistance to torsional twist and strains.

In the event of collision damage, it is important that the frame alignment be checked and realigned to frame dimensions shown on the individual dimension charts (fig. 14-1 through 14-5).

Wheel geometry and axle alignment should be checked.

FRAME ALIGNMENT

The most efficient method of checking frame alignment is with a frame alignment machine.

NOTE: *The following procedure is adequate for checking most frame dimensions. However, if torsional twist or frame rail height is in question, the vehicle must be checked on an alignment machine using datum gauges. Follow alignment machine manufacturer's instructions.*

If a frame straightening machine is not available, frame alignment may be determined by using the "X" or diagonal method. Figures 14-1 through 14-5 provide all frame dimensions.

The most convenient method of checking frame dimensions is to locate with a plumb-bob and chalk mark on a level floor all dimensional points from which measurements are taken. This is known as "plumb-bobbing" the frame. If working on a cement floor, clean it so that the chalk marks will be visible underneath the frame. If working on a wooden floor, lay sheets of paper underneath the vehicle. Drop a plumb-bob from each point indicated in figures 14-1 through 14-5, marking the floor directly underneath the point. Satisfactory checking depends on the accuracy of the marks in relation to the frame.

To check points that have been marked, carefully move the vehicle away from the layout on the floor, and proceed as follows:

Check the frame at front and rear end using corresponding marks on the floor. If widths correspond to frame specifications, draw a centerline the full length of the vehicle, halfway between the marks indicating front and rear widths. If frame width is not correct and the centerline cannot be laid out from checking points at the end of the frame, it can be drawn through intersections of any two pairs of equal dimensions.

With the centerline correctly laid out, measure the distance to several opposite points over the entire length of the frame. If the frame is in proper alignment, opposite measurement should be the same.

To locate the points at which the frame is sprung, measure the diagonals between selected points on the frame (fig. 14-1 through 14-5).

If the diagonals in each pair are within 1/8-inch, that part of the frame included between points of measurement may be considered as satisfactorily aligned. These diagonals should also intersect at the centerline. If the measurements do not agree within the above limits, it means that a frame alignment correction is necessary and will have to be made between those points that are not equal.

NOTE: *During the process of straightening the frame, be extremely careful not to overstretch the frame. This could cause the already aligned sections of the frame to become misaligned or weakened.*

FRAME STRAIGHTENING

A bent or twisted frame may be straightened, provided the extent of misalignment is not excessive. To avoid weakening the frame, straightening should be performed without the application of heat. Severely damaged frame parts should be replaced.

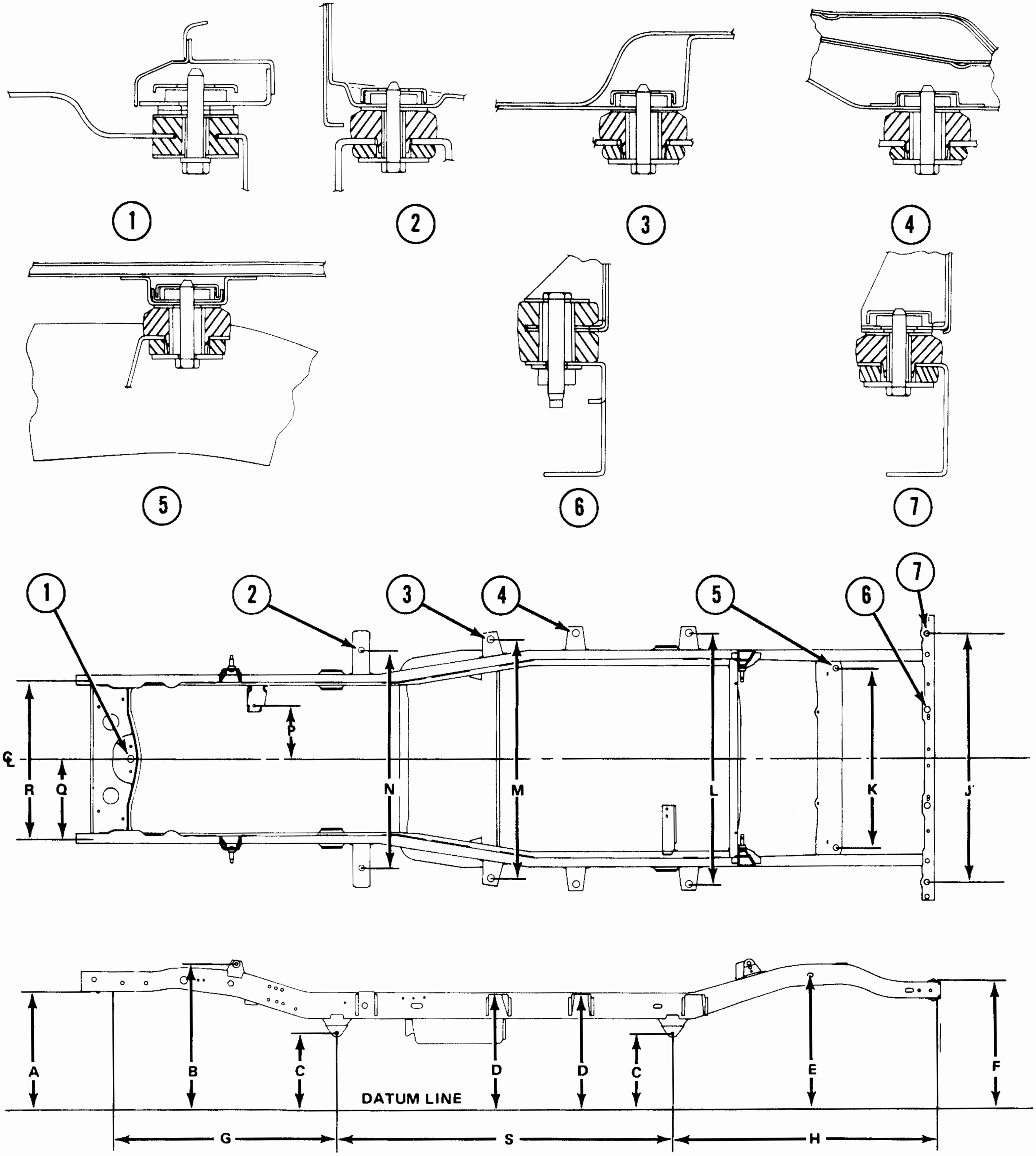
NOTE: *The controlled-heat technique can be utilized where a frame section is squashed and must be brought out without tearing or excessive stretch to the metal.*

AXLE ALIGNMENT

When the frame is properly aligned, the front axle alignment to the frame should be checked also. The front axle is square with the frame if the distance between the front and rear axles is the same on both sides and the "X" dimensions are the same.

The distance from the spring upper bushings to the axle on both sides should be equal. Check both axles.

NOTE: *Always inspect the springs for broken spring center-bolts when checking the frame and axle alignment.*

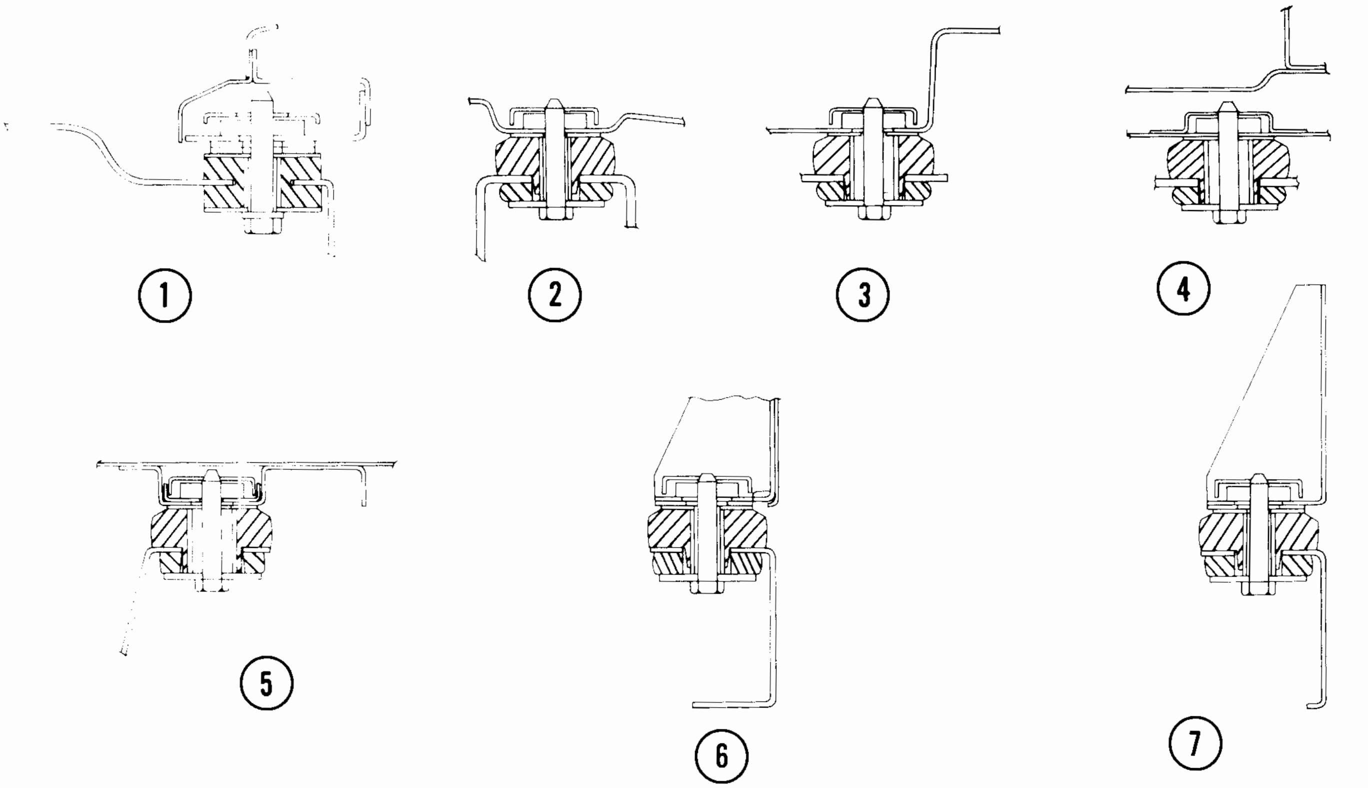


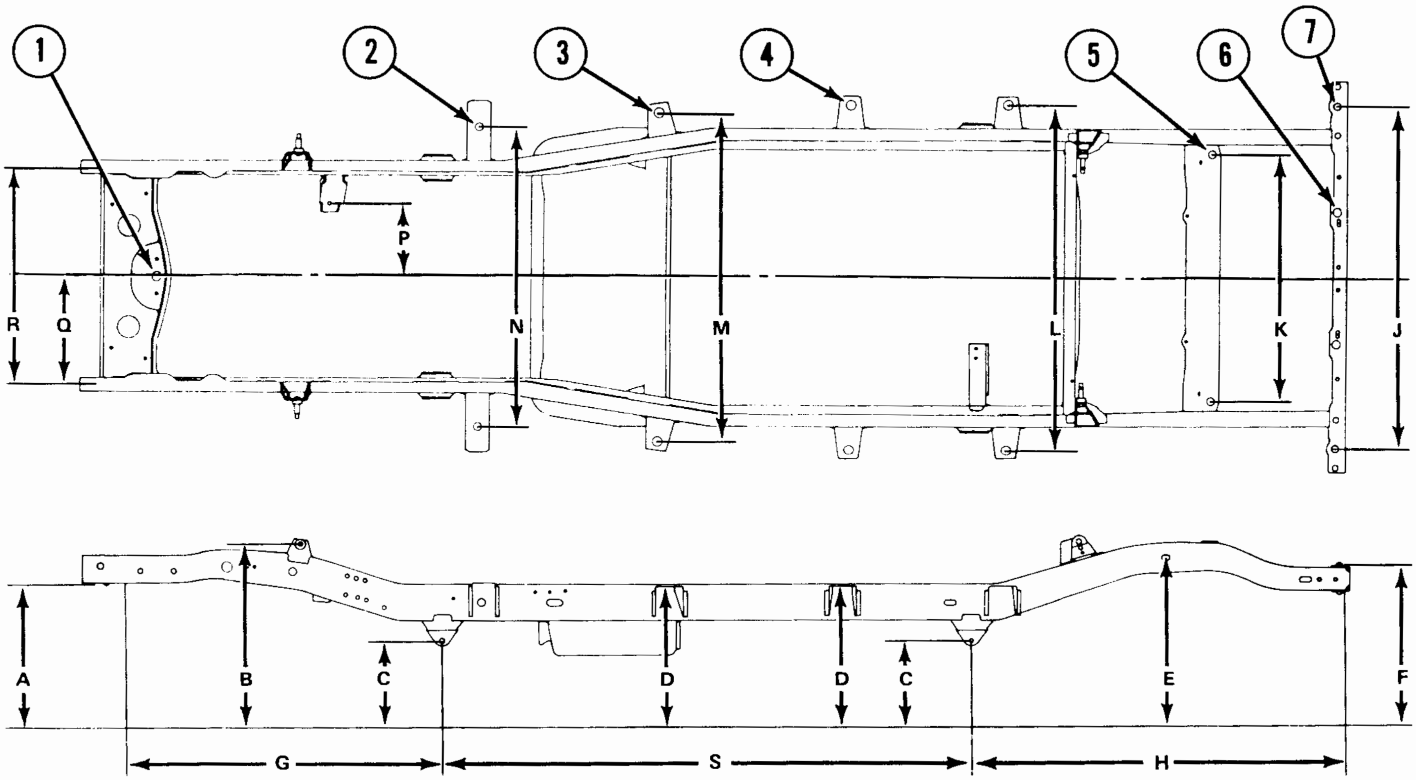
A–	12.51
B–	17.50
C–	5.20
D–	12,19
E–	15.73
F–	14.57
G–	40.61
H–	46.16
J–	43.50

K–	31.26
L–	43.64
M–	41.52
N–	37.84
P–	9.39
Q–	13.75
R–	27.50
S–	39.06

60581

Fig. 14-1 CJ-5 Model Frame Dimensions (Inches)



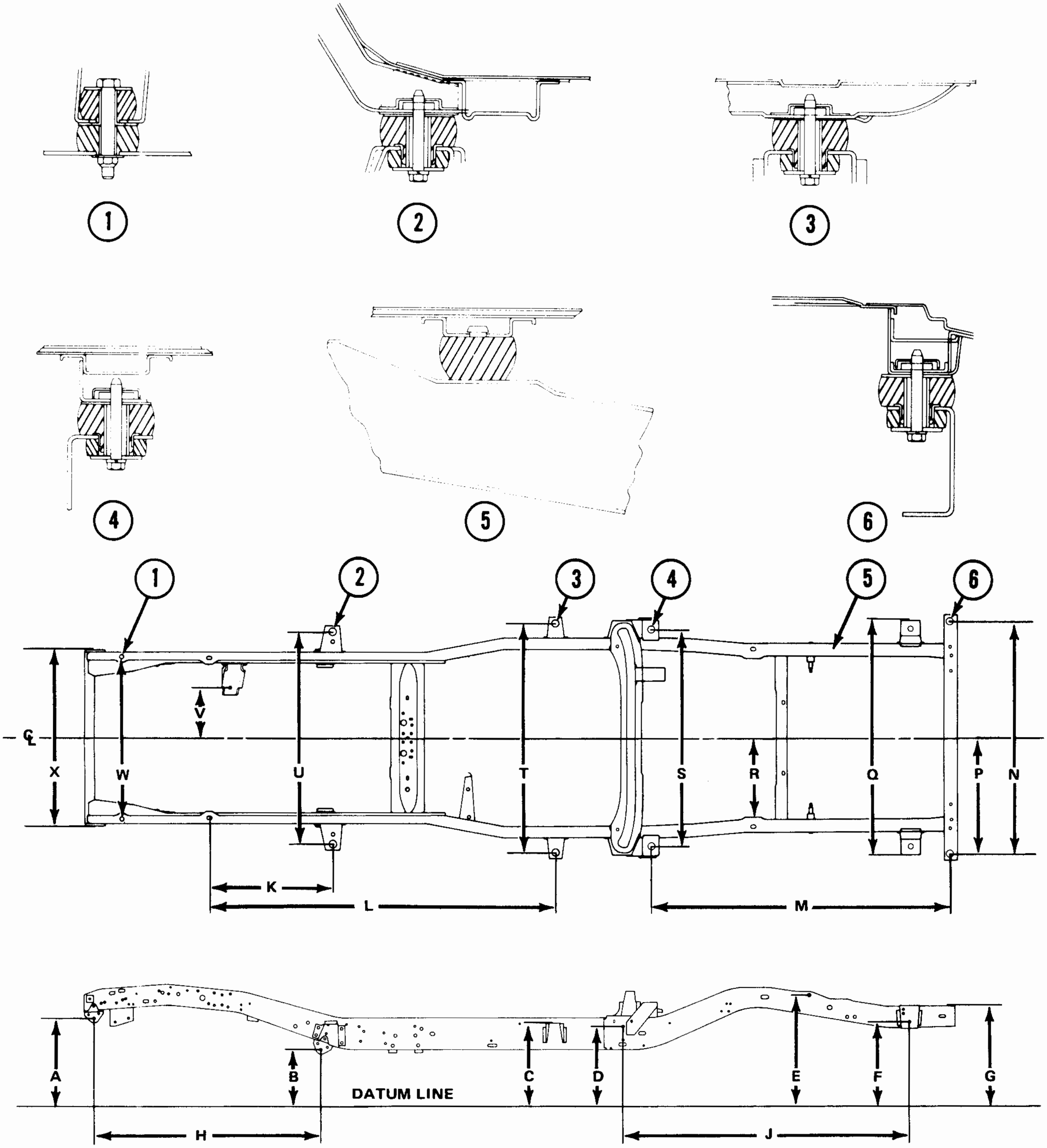


A—	12.51
B—	17.50
C—	5.20
D—	12.19
E—	15.73
F—	14.57
G—	40.61
H—	46.16
J—	43.50

K—	31.26
L—	43.64
M—	41.52
N—	37,84
P—	9.39
Q—	13.75
R—	27.50
S—	49.06

60582

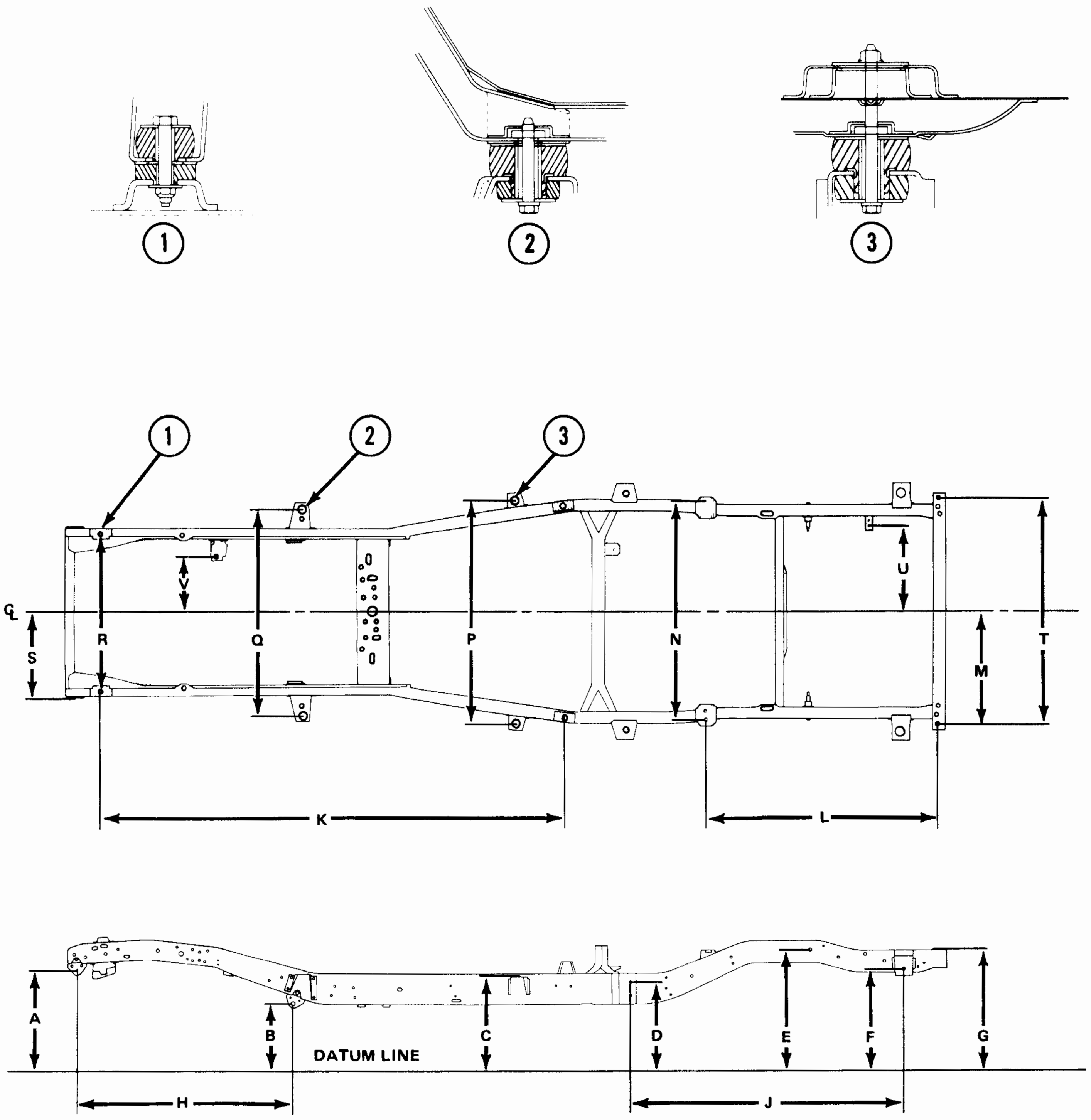
Fig. 14-2 CJ-7 Model Frame Dimensions (Inches)



A –	12.05	M –	59.63
B –	5.46	N –	46.76
C –	10.60	P –	23.38
D –	9.94	Q –	47.02
E –	16.17	R –	17.88
F –	10.82	S –	43.54
G –	14.03	T –	45.88
H –	45.26	U –	42.50
J –	57.25	V –	11.52
K –	24.68	W –	32.40
L –	69.00	X –	35.22

60583

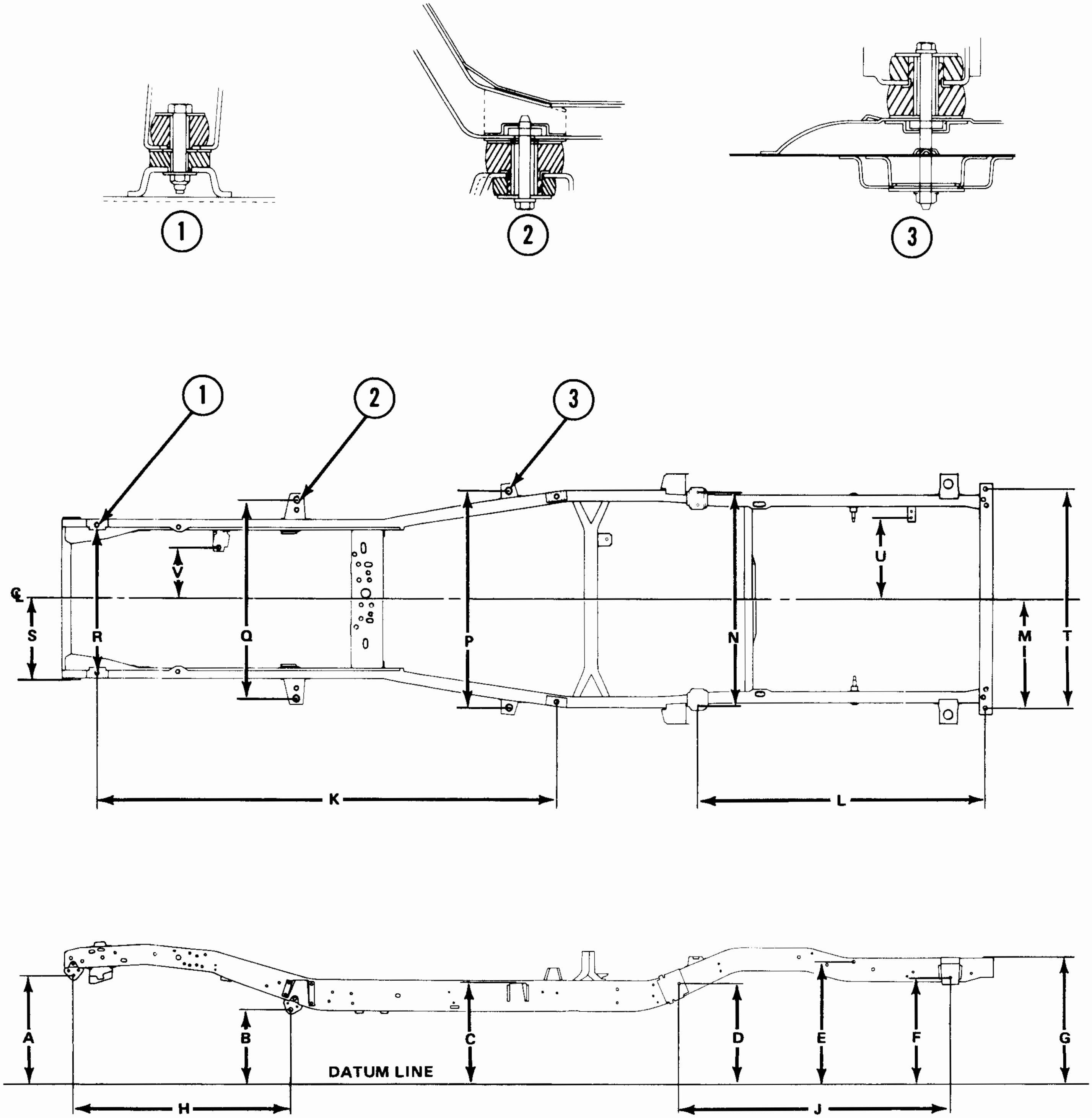
Fig. 14-3 Cherokee and Wagoneer Frame Dimensions (Inches)



A —	11.97	L —	48.79
B —	5.39	M —	23.38
C —	11.35	N —	45.72
D —	9.94	P —	45.92
E —	16.80	Q —	42.52
F —	12.55	R —	32.40
G —	16.78	S —	17.69
H —	45.23	T —	46.75
J —	57.22	U —	17.06
K —	96.80	V —	11.52

60584

Fig. 14-4 Truck Frame Dimensions 119 Inch Wheelbase (Inches)



A –	11.97	L –	60.79
B –	5.39	M –	23.38
C –	11.35	N –	45.72
D –	9.94	P –	45.92
E –	15.92	Q –	42.52
F –	12.57	R –	32.40
G –	16.78	S –	17.69
H –	45.23	T –	46.75
J –	56.47	U –	17.06
K –	96.80	V –	11.52

60585

Fig. 14-5 Truck Frame Dimensions 131 Inch Wheelbase (Inches)

PANELS

GENERAL

Assembled sections or any of the individual panels available for replacement are complete and may be installed as a unit. When only a portion of the unit is damaged, the damaged unit may be cut from the body at the location best suited for welding, and the new unit cut to the desired size and welded in place.

Galvanized Panels

For protection against rust, panels vulnerable to corrosion on Cherokee, Wagoneer, and Truck vehicles are galvanized. A neutralizer must be applied to these panels prior to painting to ensure good adhesion of the paint.

Replacement

Where replacement is required, careful examination should be made as to the extent of damage to determine which panels require replacement.

In most cases, the weld joints of one panel to another are visible and can be separated for installation of a new panel.

DOORS

The complete door, with outer and inner door panels flanged and welded together and primed, is available as well as the outer panel only.

These outer panels may be used in cases in which the inner panel and pillar assemblies are not damaged to avoid the extra expense of using a complete door.

REAR QUARTER PANELS

The rear quarter panels are welded to the body as indicated by dotted lines in figures 14-6 through 14-8.

Whenever a rear quarter panel is replaced, it is very important to apply a suitable rust preventive such as a weld primer to all mating surfaces prior to welding. It is also very necessary to seal all welded joints with Jeep Metal Joint Sealer or equivalent.

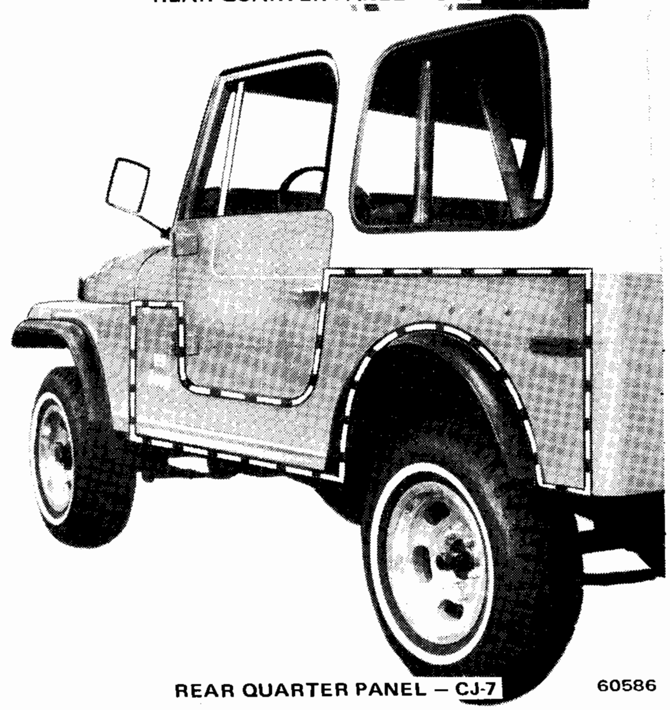


Fig. 14-6 Rear Quarter Panel—CJ

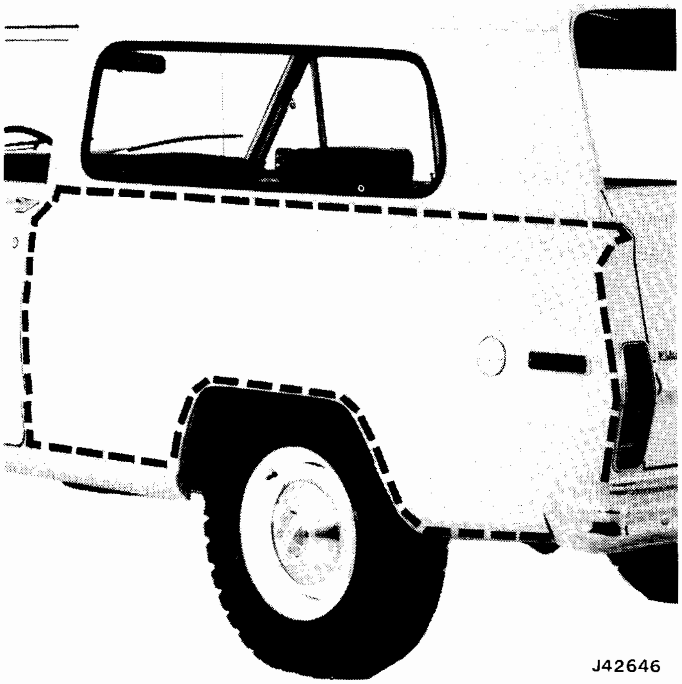


Fig. 14-7 Rear Quarter Panel—Cherokee

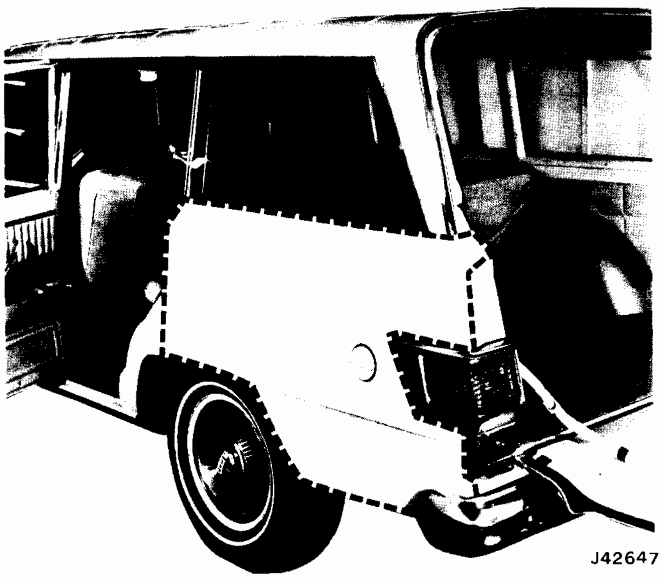


Fig. 14-8 Rear Quarter Panel—Wagoneer

RADIATOR GRILLES

CJ Models

The CJ grille and the support and baffle are welded together to form a maximum-strength radiator guard (fig. 14-9).

Removal

(1) Remove screws and washers securing radiator and shroud to radiator guard panel.

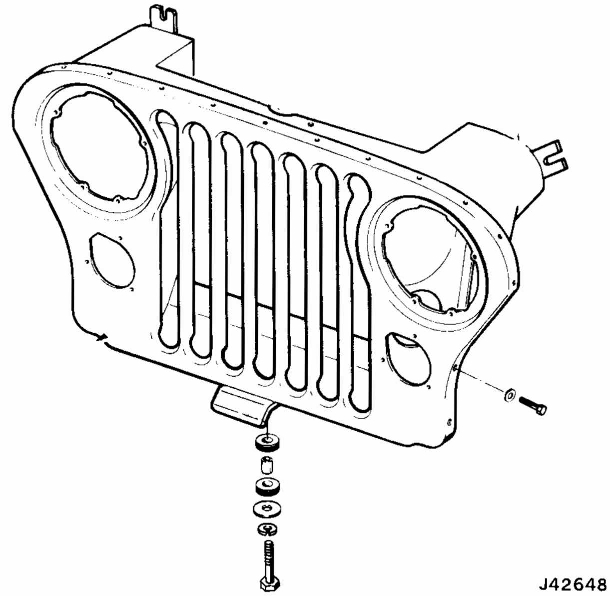


Fig. 14-9 Grille Panel—CJ Models

(2) Remove bolts and washers securing guard panel to fenders.

(3) Remove radiator grille to frame crossmember holddown assembly. Note sequence of parts.

(4) Loosen nuts securing the two radiator support rods to the radiator grille guard support brackets.

(5) Remove rods from brackets.

(6) Tilt guard panel forward and disconnect electrical wiring at head lamp sealed beam unit and parking lamp assembly wiring harness at connectors.

(7) Lift radiator guard panel from vehicle.

Installation

(1) Position guard panel and connect electrical wiring at headlamp sealed beam unit and parking lamps.

(2) Position radiator support rods in radiator grille guard support brackets and install attaching rods.

(3) Install radiator grille to frame crossmember holddown assembly.

(4) Position guard panel to fenders and install attaching bolts and washers.

(5) Install radiator and radiator shroud to radiator guard panel attaching screws and washers.

Cherokee-Wagoneer-Truck

Removal

(1) Remove headlamp doors and disconnect headlamp wiring at sealed beam unit.

(2) Remove parking lamp assemblies on Wagoneer Models.

(3) Remove screws, bolts, and washers securing grille.

(4) Remove grille.

Installation

(1) Position grille and install attaching screws, bolts, and washers.

(2) Install parking lamp assemblies on Wagoneer Models.

(3) Connect headlamp wiring at sealed beam unit and install headlamp doors.

WAGONEER GRILLE INSERT

Replacement

(1) Push the pin through and out the back of the button-shaped plastic fasteners using a 1/8-inch diameter tool (fig. 14-10).

(2) Remove and discard plastic fastener buttons.

(3) Remove grille insert from grille panel and disconnect parking lamp wiring at harness connectors.

(4) Connect parking lamp wiring to harness connectors and position grille insert in grille panel.

(5) Align holes in grille insert with grille panel holes and install plastic fasteners. Push pin in flush with fastener button, expanding fastener prongs.

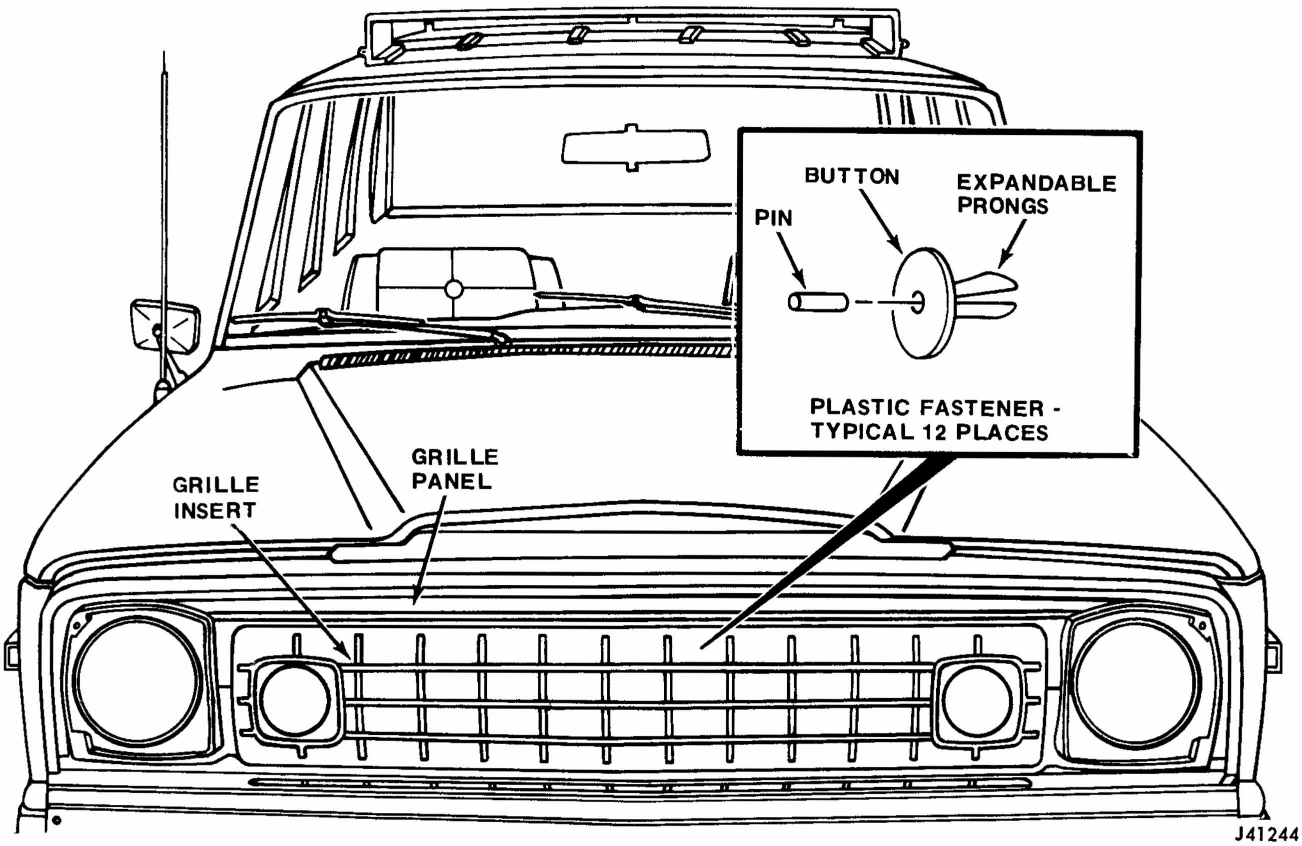


Fig. 14-10 Grille Insert and Fasteners—Wagoneer

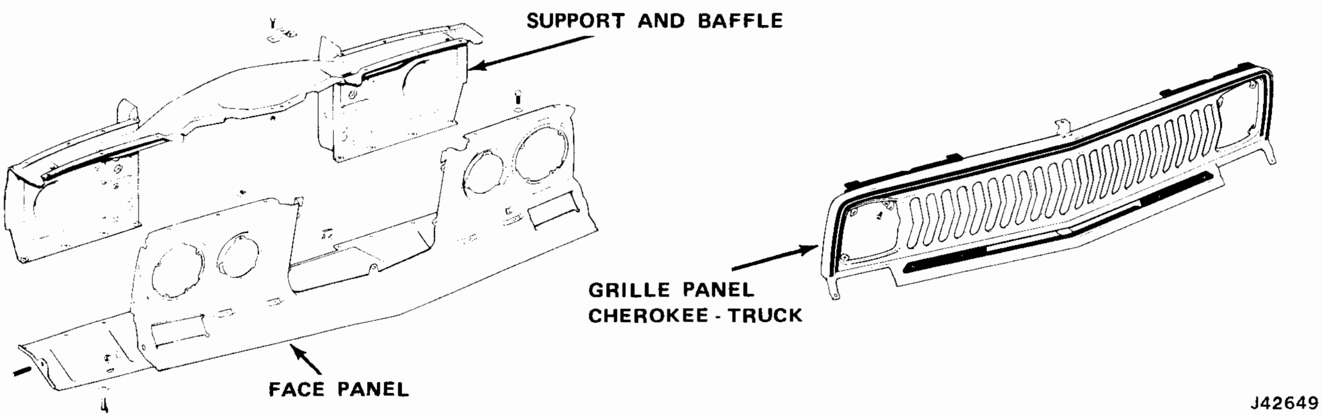


Fig. 14-11 Grille Panel—Cherokee-Truck

FENDERS

FRONT FENDER AND APRON

CJ Models

Replacement

(1) Remove or disconnect all items attached to apron of fender.

(2) Disconnect electrical connector at side marker lamp.

(3) Remove bolts and washers securing fender and brace to dash panel (fig. 14-12).

(4) Remove bolts, washers, and nuts attaching fender to radiator grille guard panel.

(5) Pull fender outboard and lift from vehicle.

(6) Position fender or vehicle and install fender-to-radiator grille guard panel attaching bolts, washers, and nuts.

(7) Intall fender and brace-to-dash panel attaching bolts and washers.

(8) Connect side marker lamp electrical connector.

(9) Install and connect items previously removed from apron of fender.

(6) Disconnect brace at fender.

(7) Remove bolts and washers attaching fender to rocker panel just below the hinge pillars.

(8) Remove bolts and washers that attach the top of the fender to the fender apron, the hood hinge support bracket, and the fender-to-firewall bracket.

NOTE: *Note the number and position of shims between fender and rocker panels so they can be assembled in the same position.*

(9) Open doors and remove the fender from the vehicle.

(10) Remove or disconnect all items attached to the apron.

(11) Remove bolts and washers that attach the fender apron to the radiator support and to two brackets on the firewall.

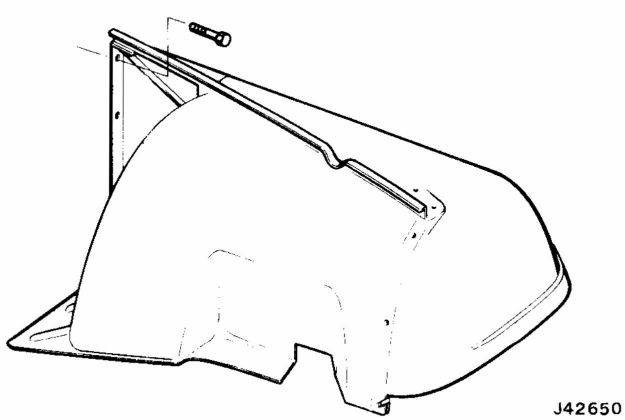


Fig. 14-12 Front Fender—CJ Models

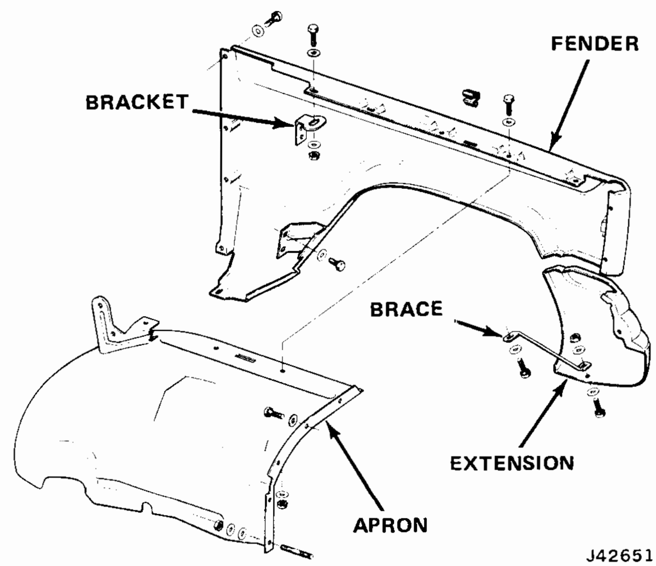


Fig. 14-13 Front Fender—Cherokee-Wagoneer-Truck

Cherokee-Wagoneer-Truck

Removal

(1) Remove front bumper.

(2) Remove headlamp to gain access through opening.

(3) Reach through headlamp opening and remove bolts and washers attaching fender to grille face panel.

(4) Remove side marker lamp reflector lens and disconnect lamp socket assembly from lens.

(5) Remove bolts and washers holding fender to grille face panel.

Installation

(1) Spread sealer evenly over and along surfaces where fender and apron make metal-to-metal contact with other sheet metal parts.

(2) Install apron and fender in place with finger-tightened bolts until all bolts and washers have been installed. Secure all nuts and bolts.

(3) Install and reconnect all items removed from the fender and apron, such as wiring harness, electrical components.

(4) Secure items, such as headlight, grille and front bumper, which were released or removed to faciliate removal of fender and apron.

HOODS

GENERAL

The CJ hood consists of an outer flanged panel with inner U-channels welded at the front and rear of the hood panel.

The Cherokee, Wagoneer, and Truck hood consists of an inner and outer panel flanged and welded together at the outer edges.

Removal and Disassembly

(1) Mark position of hinges on their respective mounting panels before removing hood.

(2) Detach hood panel from hinges by removing attaching bolts, lockwashers, and flat washers.

(3) Disassembly of CJ hood is accomplished by removing hood prop rod, hood prop rod retainer clip, hood side catch brackets, footman loop, and windshield bumpers (fig. 14-14).

(4) Disassembly of Cherokee, Wagoneer, and Truck hood is accomplished by removing hood lever lock assembly, front filler bezel, left and right hood panel brace rods, and insulation pad (Cherokee and Wagoneer) cemented to the hood panel (fig. 14-15).

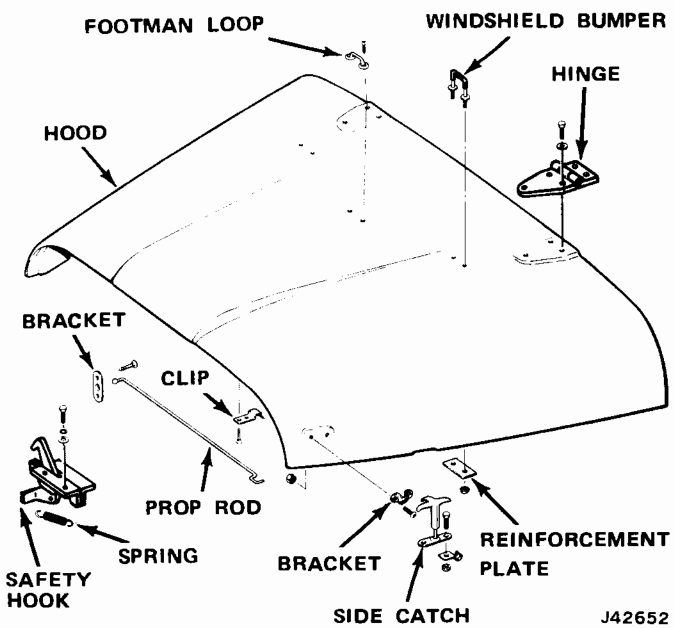


Fig. 14-14 Hood and Related Parts—CJ Models

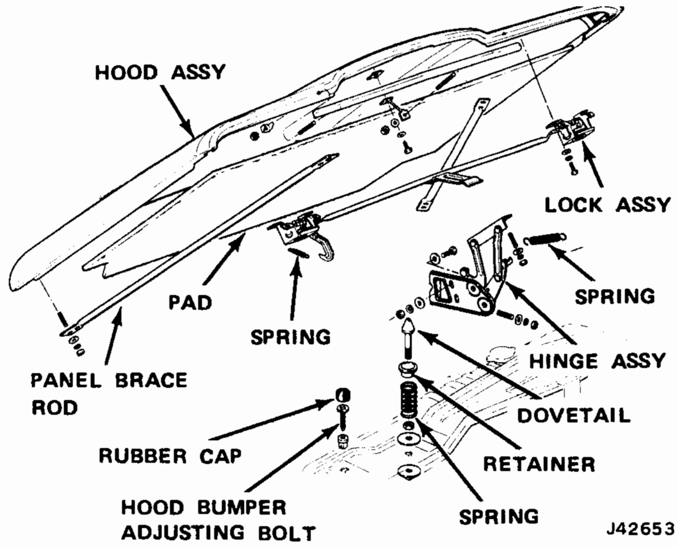


Fig. 14-15 Hood and Related Parts— Cherokee-Wagoneer-Truck

Assembly and Installation

(1) Finger-tighten related component parts and assemblies to hood panel.

(2) If Cherokee or Wagoneer hood panel insulation pad has been removed, clean off all loose cement and pad particles from panel to ensure good adhesion when recemented.

(3) Position hood panel assembly and align hinges with scribe marks on the respective mounting panels. Torque all attaching bolts.

(4) Check hood alignment. If not correct, apply following procedure.

Alignment

The hood hinge mounting holes are oversized to permit adjustment when aligning the hood.

NOTE: *If the hood must be moved to either side, the hood lock striker, hood lever lock, and safety hook assembly, according to vehicle model, must first be loosened.*

(1) Loosen hinge mounting bolts slightly on one side and tap hinge in opposite direction hood is to be moved.

(2) Tighten bolts.

(3) Repeat procedure on opposite hinge.

(4) Hood lock striker, hood lever lock, and safety hook assembly must be adjusted to ensure positive locking.

(5) Shim between hinge and hood with caster and camber shims or flat washers at the rear bolt if hood is low in relation to the cowl top.

(6) Shim at the front bolt if the hood is too high at the cowl.

HOOD LOCK

Cherokee-Wagoneer-Truck

The hood lock and safety catch incorporates a release system, whereby the release lever operates the hood lock and the safety catch.

The hood lock release latch is located under the front center of the hood, above the grille. To release the latch, reach under the hood, lift up and raise the hood.

CJ Models

The CJ hood is secured to the front fenders by two hood retaining latches. To release, pull the latches straight up and turn slightly at the end of travel. The hood now may be raised with the release of the safety catch by inserting fingers between the grille bars to the right of center and by pulling to the left on the catch. To secure the hood in the raised position, remove the support bar from its retaining clip and insert the free end into the support bar bracket.

HOOD BUMPER

The hood bumpers on CJ Models are located across the top of the radiator grille guard and are not adjustable.

The hood bumpers on the Cherokee, Wagoneer, and Truck are adjustable. Rubber caps must be removed to adjust the bumper bolts.

BUMPERS

GENERAL

Front bumpers on CJ models are of one-piece construction. When vehicle is equipped with rear mounted spare, two separate bumperettes are used.

Front bumpers on the Cherokee, Wagoneer, and Truck models are of three-piece construction. Rear bumpers of three-piece construction are used on the Cherokee and Wagoneer. Trucks, when equipped with a rear bumper, have a one-piece bumper.

Bumper bar ends on the Cherokee, Wagoneer, and Truck may be removed individually.

Front bumper guards and nerf strips are available as an option on standard bumpers on all except CJ models.

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

DOORS AND REAR QUARTER

CJ WITH MOLDED TOP

DOOR ADJUSTMENTS

The doors are adjusted at the hinge mounting points on the body or door.

Enlarged holes are provided in the body, lower hinge only, for fore, aft, and tilt adjustments. Enlarged holes are also provided in the door, upper and lower hinges, for up, down, fore, aft, and tilt adjustments.

Prior to any door adjustment or alignment, the door latch must be removed to allow the door to close freely in proper alignment.

The door latch striker should be adjusted in or out to allow the door latch to be fully engaged. The door should be flush with the adjacent body panels.

WINDOW REGULATOR HANDLE

The window regulator handle is attached to the splined shaft of the window regulator with a 5/32-inch allen head screw. To remove the handle, remove the screw and pull the handle straight off the shaft.

Install the handle with the knob forward, the handle horizontal and the glass all the way up.

DOOR TRIM PANELS

Trim panels consist of fiber board composition covered with a vinyl material. They are fastened to the door with spring clips inserted into holes in the door inner panel.

Removal

(1) Remove screws attaching door assist strap using Torx Bit Tool J-25359. Remove strap.

(2) Remove window regulator handle.

(3) Pry trim-panel-to-door clips along sides loose with Trim Pad Depressor Tool J-2631-01 and remove panel.

Installation

(1) Position trim panel on door and install clips in hole in inner door panel.

NOTE: *To prevent creasing the trim panel cover, do not hammer or exert excessive force on the clips.*

(2) Install window regulator handle.

(3) Position door assist strap on trim panel and install attacing screws using Torx Bit Tool J-25359.

WATER SHIELD

The water shield is attached to the door inner panel with adhesive. To remove water shield, use a putty knife between shield and door inner panel to loosen adhesive.

When installing water shield, be sure the slit lower portion is tucked inside the door panel at the access opening and that the shield is bonded securely to the door inner panel.

HINGE REPLACEMENT

(1) Mark outline of existing hinge on body and door with wax pencil.

(2) Remove hinge-to-body screws and hinge-to-door screws using Torx Bit Tool J-25359 and remove hinge.

NOTE: *Upper hinge is part of windshield hinge assembly. When replacing, adequately support windshield frame prior to removal and check alignment after installation.*

(3) Clean replacement hinge in a suitable solvent and blow dry with compressed air.

(4) Color-coat hinge to match body using Jeep exterior spray paint.

(5) Lubricate hinge with Lubriplate or equivalent.

(6) Position hinge on door, align carefully with wax pencil marks, and install screws using Torx Bit Tool J-25359.

(7) Position hinge on body, align carefully with wax pencil marks, and install screws using Torx Bit Tool J-25359.

(8) Check door alignment. Adjust if necessary (refer to Door Adjustment).

DOOR LATCH REPLACEMENT

(1) Remove screws attaching door latch-to-door using Torx Bit Tool J-25359 and remove latch.

(2) Lubricate door latch with Lubriplate or equivalent.

(3) Position door latch on door and install attaching screws using Torx Bit Tool J-25359.

OUTSIDE DOOR HANDLE REPLACEMENT

NOTE: *The replacement outside door handle is furnished without the lock cylinder. The lock cylinder is furnished uncoded without the keys.*

(1) Remove screws attaching outside door handle-to-door using Torx Bit Tool J-25359 and remove handle.

(2) Code existing door lock key to replacement cylinder.

(a) Insert key in replacement cylinder.

(b) File tumblers until flush with cylinder body.

(c) Remove and install key, check that tumblers are flush with body.

(d) Install cylinder in replacement outside door handle.

(3) Install outside door handle on door and install attaching screws using Torx Bit Tool J-25359.

DOOR GLASS

Adjustment

One adjustment point is available, regulating the amount of effort required to raise and lower the door glass. The door glass division channel is adjustable fore and aft at the lower attachment point.

(1) Remove door trim panel and water shield.

(2) Loosen division channel lower adjusting screw and move division channel fore or aft to obtain the desired door glass operation (fig. 15-1).

NOTE: *Movement of division channel fore and aft reduces or increases free play between channels.*

(3) Tighten division channel lower adjusting screw.

(4) Install water shield and door trim panel.

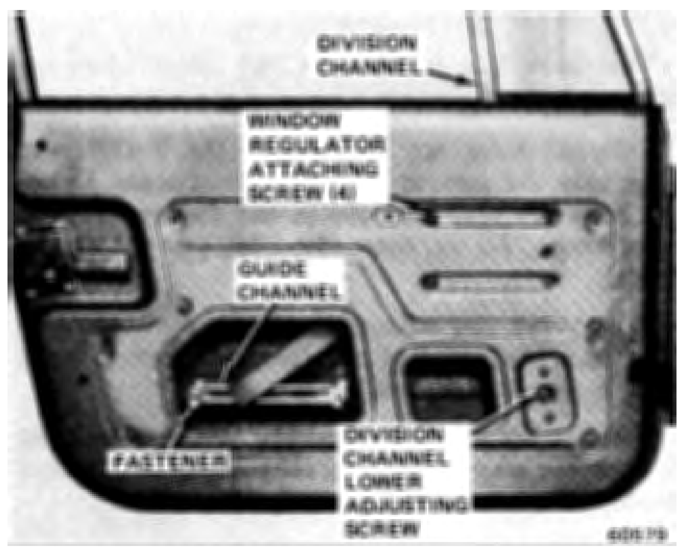


Fig. 15-1 Door Glass Replacement—CJ

Removal

(1) Remove door trim panel and water shield.

(2) Remove glass down-stop.

(3) Remove screws attaching guide channel to plastic fasteners. Remove guide channel and plastic fasteners.

(4) Lower glass to bottom of door.

(5) Remove division channel upper attaching screw and lower adjusting screw. Disengage front three inches of glass weatherstrip from upper door frame. Remove division channel.

(6) Tilt glass toward hinge side of door and disengage from rear channel.

(7) Pull glass up and out of door panel.

Installation

(1) Lower glass into door with front of glass tilted down, while positioning glass into rear channel.

(2) Install plastic fasteners into glass.

(3) Slide glass down into bottom of door panel.

(4) Lower division channel into door and position glass in channel.

(5) Install upper attaching screw and lower adjusting screw. Engage weatherstrip in upper door frame.

(6) Slide guide channel onto regulator arm and position channel on glass. Install attaching screws.

(7) Install glass down-stop.

(8) Check operation and adjustment.

(9) Install water shield and door trim panel.

STATIONARY VENT WINDOW

Removal

(1) Remove door trim panel and water shield.

(2) Lower glass to down-stop.

(3) Remove division channel upper attaching screw and lower adjusting screw.

(4) Disengage front three inches of weatherstrip from upper door frame. Lower division channel and tilt toward rear of door.

(5) Remove stationary vent glass from weatherseal.

Installation

(1) Install stationary vent glass into weatherseal.

(2) Install division channel into door and position channel on glass.

(3) Install upper attaching screw and lower adjusting screw.

(4) Engage weatherstrip in upper door frame.

(5) Water test and check for leaks.

(6) If water leakage is evident, apply sealant or realign weatherseal.

(7) Check operation and adjustment of door glass.

(8) Install water shield and door trim panel.

STATIONARY REAR QUARTER WINDOW REPLACEMENT

(1) Free weatherstrip-to-top flange (on inside of vehicle) by starting at top corner using fingers or wooden wand and pulling weatherstrip down to clear flange while exerting outward pressure on glass.

(2) Push window and weatherstrip toward outside of vehicle and remove glass.

(3) Remove weatherstrip from glass and clean off all sealer from glass cavity.

(4) Before installing glass in weatherstrip, apply a 3/16-inch bead of 3M Windshield Sealer or equivalent in weatherstrip glass cavity using pressure-type applicator.

(5) Install glass into weatherstrip.

(6) Lubricate weatherstrip with soapy water.

(7) Place glass and weatherstrip into position in window opening.

(8) With weatherstrip-to-top flange in proper position at bottom of window opening, use a wooden wand and walk weatherstrip-to-top flange into position.

(9) Clean excess sealer from glass with 3M Adhesive Cleaner or equivalent.

(10) Water test and check for leaks.

(11) If water leakage is evident, apply sealant in the affected areas and realign weatherstrip.

DOOR RUBBER SEALER

The door rubber sealer is made of molded latex foam with a smooth rubber skin on the outside.

Plastic retainers are used to retain the rubber sealer to the door below the belt line. Barbs on the retainer depress when inserted in the holes and spread when fully inserted. Above the belt line the sealer is retained in a channel formed in the upper door frame.

Maintenance of Rubber Sealers

Cold weather may cause the rubber sealer to harden and lose resiliency. This may cause the tailgate to loosen in its opening, resulting in noise. When servicing, use a dampened cloth to clean rubber sealer. Clean dirt from all points where the rubber sealer contacts the body. Apply AMC Silicone Lubricant or equivalent to sealer.

CAUTION: *Do not use graphite, brake fluid, or wax on rubber sealer.*

Replacement

Replacement rubber sealers are coated with powder to prevent stickiness in storage. Remove all powder with a dampened cloth before installation.

(1) Carefully remove rubber sealer from door using needle-nose pliers to remove plastic retainers from panel holes. Remove upper portion from upper door frame with fingers or wooden wand.

(2) Remove dust and dirt from rubber sealer, door, and body.

(3) Install upper front corner of sealer to door first using fingers or wooden wand to engage sealer into

channel. Place inner shoulder of sealer in channel-to-window frame above belt line.

(4) Press retainers, starting at rear edge of door, into door panel holes.

WINDOW

Removal

(1) Remove trim panel and water shield.

(2) Lower glass to expose guide channel fasteners. Remove fasteners and guide channel. Raise window to full up position and apply masking tape to glass and over top of window frame.

(3) Remove regulator attaching screws. Remove regulator through access hole in inner door panel.

Installation

(1) Position regulator in door and install attaching screws.

(2) Remove masking tape from glass and lower glass.

(3) Slide guide channel onto regulator arm and position channel on glass. Install attaching screws.

(4) Check operation.

(5) Install water shield and door trim panel.

CHEROKEE-WAGONEER-TRUCK

DOOR ADJUSTMENTS

The doors are adjusted at the hinge mounting points on the body or door.

On rear doors, floating plates are located in the body pillars to permit adjustment up, down, in or out. To adjust forward or back, add or remove shims between the hinge and hinge pillar.

On front doors, slotted holes are provided in the hinge for in or out adjustment on the pillars, and up and down and fore and aft or tilt on the doors.

Prior to any door adjustment or alignment, the adjustable striker must be removed to allow the door to close freely in proper alignment without striker interference.

The door lock striker is adjustable up, down, in or out and can be shimmed forward or back to hold the door in the properly aligned position.

The door latch striker should be set so that the latch enters the striker without binding, yet provides secure retention for the lock and prevents up and down or in and out movement of the door.

The striker also should be adjusted in or out to allow the door latch to be fully engaged. The door should be flush with the adjacent body panels.

NOTE: *It is possible to set the striker in so far that the door is closed tight but only the safety catch is engaged. This will prevent locking the door with the key or the pushbutton lock rod.*

DOOR TRIM PANELS

Trim panels consist of fiber board composition covered with a vinyl material. They are fastened to the door with spring clips inserted into holes in the door inner panel and screws along the bottom edge.

Removal

(1) Remove metal strip on armrest (if equipped) and remove attaching screws and armrest.

(2) Remove window regulator handle and door latch remote control handle.

(3) Remove trim panel attaching screws on bottom of trim panel.

(4) Pry trim-panel-to-door clips along sides loose with Tool J-2631-01 and remove panel.

(5) Loosen setscrew securing remote control mirror control cable to escutcheon (if equipped).

Installation

(1) Insert remote control mirror control cable in escutcheon and tighten setscrew (if equipped).

(2) Position trim panel on door and install clips in holes in inner door panel.

NOTE: *To prevent creasing the trim panel cover, do not hammer or exert excessive force on the clips.*

(3) Install screws along bottom of trim panel.

(4) Install window regulator handle and door latch remote control handle.

(5) Install armrest and metal strip.

WATER SHIELD

The water shield is attached to the door inner panel with adhesive. To remove water shield, use a putty knife between shield and door inner panel to loosen adhesive.

When installing water shield be sure the slit lower portion is tucked inside the door panel at the access opening and that the shield is bonded securely to the door innner panel.

HINGE REPLACEMENT

Front Doors

(1) Remove trim panel and water shield.
(2) Disconnect door speaker wiring, if equipped.
(3) Scribe outline of existing hinges on body pillar and door for reference.
(4) Position door in holding fixture.
(5) Remove all hinge-to-body screws.
(6) Remove door from vehicle.
(7) Remove all hinge-to-door screws and remove hinges.
(8) Clean replacement hinges in a suitable solvent and blow dry with compressed air.

CAUTION: *Do not immerse hinge in solvent.*

(9) Color-coat hinges to match body.
(10) Lubricate hinges with a Lubriplate or equivalent.
(11) Position hinges on door, being careful to align with scribe marks, install screws. Tighten screws to 25 to 35 foot-pounds torque.
(12) Position door in body opening and align hinges with scribe marks on body pillar. Install and tighten two outside screws, then install and tighten inner screw on each hinge. Tighten screws to 25 to 35 foot-pounds torque.
(13) Remove door holding fixture.
(14) Check door alignment. Adjust if necessary (refer to Door Adjustment).
(15) Connect door speaker wiring, if equipped.
(16) Install water shield and trim panel.

Rear Doors

(1) Scribe outline of hinges on body pillar and door for reference.
(2) Position door in holding fixture.
(3) Remove all hinge screws and remove hinges. Retain shims.
(4) Clean replacement hinges in a suitable solvent and blow dry with compressed air.

CAUTION: *Do not immerse hinge in solvent.*

(5) Color-coat hinges to match body.
(6) Lubricate hinges with a Lubriplate or equivalent.
(7) Position hinges on door with original shims, being careful to align with scribe marks, and install screws. Tighten screws to 12 to 18 foot-pounds torque.
(8) Remove door holding fixture.
(9) Check door alignment. Adjust if necessary (refer to Door Adjustment).

OUTSIDE DOOR HANDLE

Removal

(1) Remove door trim panel and water shield.
(2) Raise window to fully closed position.
(3) Through opening in inner door panel, remove handle attaching screws and remove handle and gaskets.

Installation

(1) Position gaskets and handle on door and secure with attaching screws.
(2) Install water shield and door trim panel.

KEY LOCK

Removal

(1) Remove rubber sealer along rear edge of door by prying out retaining pins to expose lock cylinder retainer (fig. 15-2).
(2) Using flat-bladed screwdriver, remove retainer.
(3) Remove lock cylinder and extension rod from outside of door.

Installation

(1) Position lock cylinder in door, making sure extension rod is inserted in square hole in latch.
(2) Install lock cylinder retainer.
(3) Install rubber sealer with retaining pins.

LOCK CYLINDER CODING

The lock cylinder is serviced in a kit which includes an uncoded cylinder, housing, and a dust cover.

Whenever a lock cylinder replacement is required, the uncoded service cylinder can be coded to match the existing key.

(1) Remove lock cylinder from door.
(2) Remove dust cover from original lock housing and remove lock cylinder and discard.
(3) Insert original key into new uncoded service lock cylinder.
(4) Press cylinder into special Door Cylinder Lock Tumbler Filing Fixture Tool J-22977, with notched side of key up and long tumbler in slot (fig. 15-3).
(5) Hold filing fixture in vise and file tumblers flush with flat side of fixture. Use a standard 5/8-inch, double-cut bastard file. Finish filing with smooth mill file.
(6) Remove lock cylinder from fixture and insert cylinder into opposite end of fixture with notched side of key down (fig. 15-3).

NOTE: *This side of the fixture can be identified as the end without the double slot cut out (180° apart).*

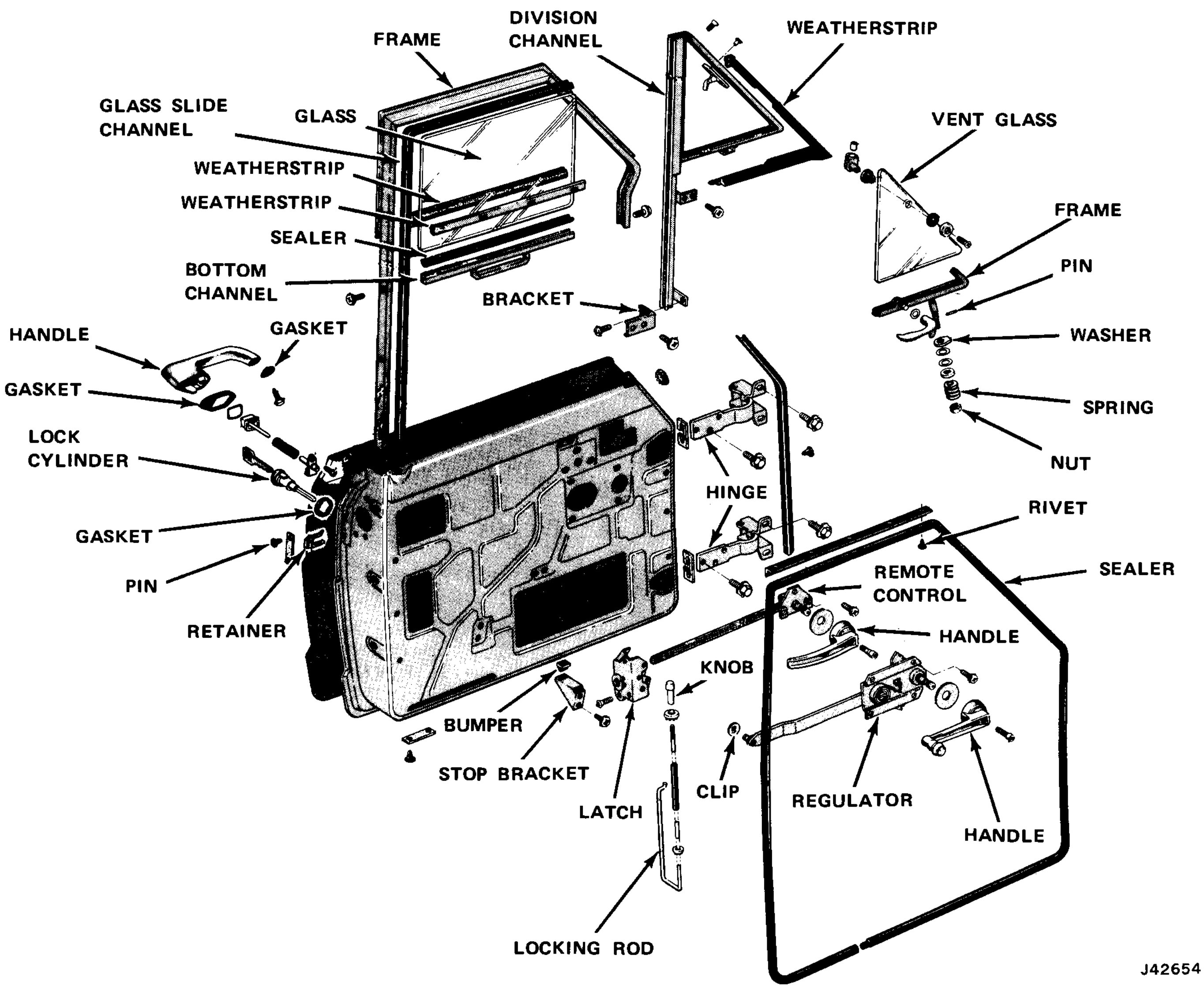


Fig. 15-2 Front Door—Cherokee-Wagoneer-Truck

(7) File tumblers flush with flat side of fixture.

NOTE: *Utilize the filing fixtures as a test gauge. Remove the fixture from the vise and if the tumblers are filed correctly, the lock cylinder will turn in the fixture.*

(8) Insert new lock cylinder into lock housing.
(9) Install new dust cap and crimp ends of cap over lock housing.
(10) Install lock cylinder in door.

LATCH AND REMOTE CONTROL

Removal

(1) Remove door trim panel and water shield.
(2) Remove lock cylinder.
(3) Remove screws from door lock remote control (fig. 15-2). Push control in and lower to bottom of door.
(4) Disconnect remote control arm from door latch and remove remote control assembly through access hole at bottom of door.
(5) Remove screws attaching door latch to door panel.
(6) Push door latch in and turn it 90° to free it from lock lever rod and remove through lower access hole.

Installation

(1) Connect lock lever rod to door latch.
(2) Position door latch on door panel and install attaching screws.
(3) Connect remote control arm to door latch. Position remote control on door inner panel and install attaching screws.

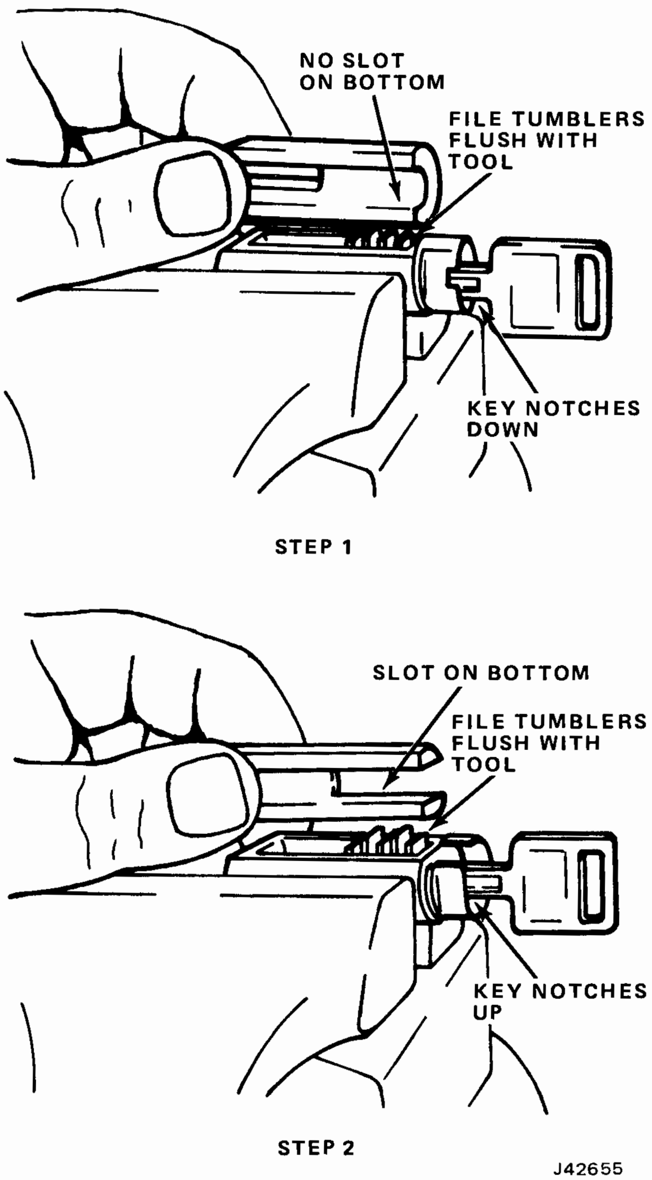


Fig. 15-3 Filing Lock Tumblers

(4) Install outside lock assembly.
(5) Install water shield and door trim panel.

DOOR LOCKING ROD

Removal

(1) Remove door trim panel and water shield.
(2) Remove door lock push knob.
(3) Push nylon bushing (on rod) off bracket.
(4) Loosen latch mounting screws and disengage locking rod.

Installation

(1) Engage locking rod and latch and tighten latch mounting screws.
(2) Install nylon bushing on bracket.
(3) Install door lock push knob.
(4) Install water shield and door trim panel.

FRONT DOOR GLASS

Removal

(1) Remove door trim panel and water shield.
(2) Remove glass stop bracket (fig. 15-2).
(3) Remove lower division channel attaching bracket.
(4) Remove division channel upper bracket-to-door panel attaching screws.
(5) Remove lock rod guide bushing.

NOTE: *Move lock rod aside so glass may be lowered to bottom of door.*

(6) Remove screws attaching remote control assembly to door panel and lower to bottom of door.
(7) Lower door glass and remove retaining clip.
(8) Lower glass to bottom of door.
(9) Push lower end of division channel toward front of door to release glass from channel.
(10) Move glass toward front of door to release it from rear channel.
(11) Rotate glass vertically 90° and guide it between inner and outer door panels.

Installation

(1) Position door glass in lower section of door so lifter channel has recessed portion of guide groove toward inner door panel.
(2) Position glass in rear channel and position front channel so glass can be inserted.
(3) Slide glass up channels and crank regulator arm down to align pin at end of regulator arm with slot in lifter channel.
(4) Install retainer on regulator arm.
(5) Position remote control assembly and install attaching screws.
(6) Position lock rod and install lock rod guide bushing to door panel.
(7) Install door lock push knob.
(8) Install upper and lower division bar attaching brackets.
(9) Install glass stop.
(10) Check glass operation.
(11) Install water shield and trim panel.

FRONT DOOR VENT ASSEMBLY

Removal

(1) Remove door trim panel and water shield.
(2) Remove door window glass.
(3) Remove upper glass channel.

(4) Remove vent assembly attaching screws on leading edge of door frame and under base of vent weatherseal (fig. 15-2).

(5) Move vent assembly toward rear of door, tipping it to clear upper door frame.

(6) Pull ventilator assembly straight out until upper attaching bracket is above opening between outer and inner door panels.

(7) Rotate vent assembly 90° to position lower attaching bracket on run channel to clear opening between door panels.

(8) Remove vent assembly.

Installation

(1) Position vent assembly in door.

(2) Install vent assembly attaching screws through door frame.

(3) Install upper glass run channel.

(4) Install door window glass.

(5) Install water shield and door trim panel.

VENT GLASS REPLACEMENT

(1) Remove screw and washers securing vent glass to upper pivot.

(2) Remove vent glass from frame.

(3) Install vent glass in frame.

(4) Install washers and screw securing vent glass to upper pivot.

FRONT DOOR WINDOW REGULATOR

Removal

(1) Remove door trim panel and water shield.

(2) Lower glass and remove clips holding regulator arm to glass bottom channel (fig. 15-2).

(3) Raise and support glass.

(4) Lower regulator arm and remove attaching screws.

(5) Remove regulator through access hole in door.

Installation

(1) Install regulator in door and secure with attaching screws.

(2) Position regulator arm in glass bottom channel.

(3) Install retainer clip on regulator arm.

(4) Remove glass support.

(5) Install water shield and door trim panel.

REAR DOOR REMOTE CONTROL AND LOCK LEVER ROD

Removal

(1) Remove trim panel and water shield.

(2) Remove door lock push knob.

(3) Remove screws attaching lock control arm to inner door panel.

(4) Remove lock lever rod.

(5) Remove door latch attaching screws.

(6) Disconnect remote control arm and turn latch 90°.

(7) Remove lock lever rod and bellcrank (fig. 15-4).

Installation

(1) Position latch in door and install lock lever rod and bellcrank.

(2) Connect remote control arm to latch and turn latch 90°. Secure latch to door panel with attaching screws.

(3) Install lock lever rod.

(4) Position lock control arm on inner door panel and install attaching screws.

(5) Install door lock push knob.

(6) Install water shield and trim panel.

REAR DOOR GLASS

Removal

(1) Remove door trim panel and water shield.

(2) Remove glass stop bracket.

(3) Remove rear glass channel lower attaching bracket.

(4) Lower door glass to obtain access to retainer clip.

(5) Remove retainer clip, disengage pin from slot in channel and lower glass to bottom of door (fig. 15-4).

(6) Remove inner and outer belt weatherstrips.

(7) Remove upper glass channel.

(8) Remove stationary vent assembly attaching screws (fig. 15-4).

(9) Tilt top of vent assembly forward approximately one inch.

(10) Push lower end of rear glass channel toward rear of door to release glass.

(11) Move glass toward rear of door to release glass from front channel.

(12) Rotate glass 90° and guide glass between inner and outer door panels.

Installation

(1) Position door glass in lower section of door so channel has recessed portion toward inner door panel.

(2) Position door glass in front run channel and push rear channel over glass.

(3) Slide glass up and crank regulator arm down until pin on regulator arm can be inserted in slot of lifter channel.

(4) Install retainer.

(5) Position stationary vent assembly and install attaching screws.

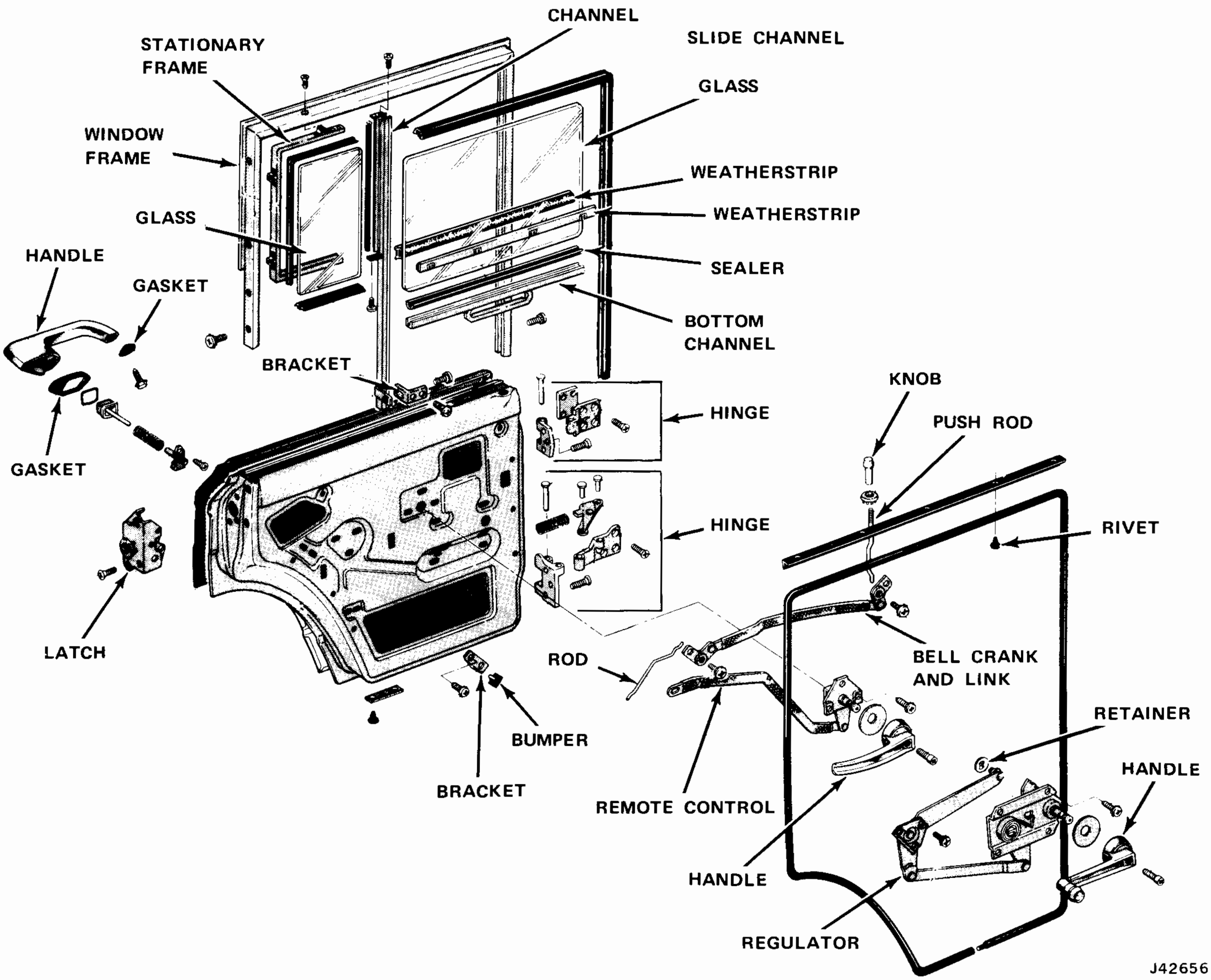


Fig. 15-4 Rear Door—Wagoneer

(6) Install upper glass run channel.
(7) Install inner and outer belt weatherstrip.
(8) Install rear channel attaching bracket.
(9) Install glass stop bracket.
(10) Check operation of glass.
(11) Install water shield and door trim panel.

REAR DOOR VENT ASSEMBLY

Removal

(1) Remove door glass.

(2) Apply soap solution under vent weatherstrip and along inner and outer door panels.

(3) Slide vent assembly forward to center of door glass opening.

(4) Push vent assembly down through opening between inner and outer door panels to disengage assembly from upper door frame.

(5) Lower top of vent assembly down to clear upper door frame.

(6) Pull vent assembly straight up until all weatherseal is clear of door panel and vent assembly can be rotated.

(7) Rotate assembly to position lower attaching bracket on channel and pull assembly up and out between panels.

Installation

(1) Install assembly between panels.

(2) Engage vent assembly in upper door frame and slide vent into position.

(3) Install door glass.

REAR DOOR WINDOW REGULATOR

Removal

(1) Remove trim panel and water shield.
(2) Remove regulator arm-to-glass bottom channel retaining clip.
(3) Push regulator pin out of glass channel.
(4) Remove regulator attaching screws and remove regulator.

Installation

(1) Position regulator on inner door panel and secure with attaching screws.
(2) Install regulator pin in glass channel and install retaining clip.
(3) Install water shield and door trim panel.

REAR QUARTER TRIM PANEL

NOTE: *The metal trim panels are held in place with sheet metal screws. Remove all attaching screws to remove panel.*

Removal

(1) Remove ash receiver, holder screws, and holder (if equipped).
(2) Remove armrest metal overlay strip, screws, and armrest (if equipped).
(3) Remove trim panel screws at base of panel.
(4) Pry loose trim panel attaching clips along both vertical sides of panel and remove panel.

Installation

(1) Inspect all panel attaching clips; replace any that are bent. To prevent damage to trim panel, do not hammer or exert excessive force on clips.
(2) Install trim panel attaching screws.
(3) Install armrest and armrest metal overlay strip (if equipped).
(4) Install ash receiver holder and ash receiver (if equipped).

PIVOT VENT WINDOW (CHEROKEE)

NOTE: *The glass only can be removed without removing weatherstrip (refer to Vent Window Glass).*

Removal

(1) Remove mylar insert from weatherstrip.
(2) Pull weatherstrip back and remove window frame-to-body screws from inside vehicle (fig. 15-5).

NOTE: *If weatherstrip sticks to body, use a wooden wand and pry loose at one corner.*

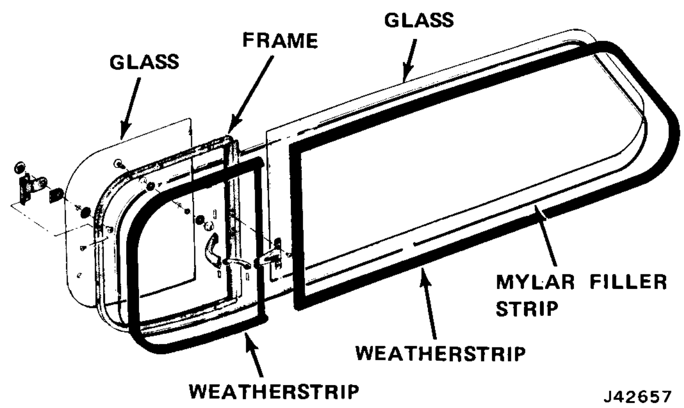


Fig. 15-5 Rear Quarter Window—Cherokee

(3) Remove window frame and weatherstrip assembly.
(4) Inspect weatherstrip and replace if necessary.

Installation

(1) Lubricate weatherstrip with soap and water solution.
(2) Place window frame and weatherstrip assembly into position in window opening.

NOTE: *Apply 3M Windshield Sealer or equivalent at window frame rear corners.*

(3) Using wooden wand, work weatherstrip inner flange into position.
(4) Obtain proper mylar alignment with weatherstrip and work into recess in weatherstrip.

Vent Window Glass

Removal

(1) Remove handle-to-frame attaching screws (fig. 15-5).
(2) Remove glass hinge screws and washers.
(3) Remove glass.

NOTE: *If glass sticks to hinges, remove glass by carefully pushing out hinge screw inserts.*

(4) To remove handle assembly from glass, carefully drive out handle- assembly-to-stud roll pin.
(5) Unscrew stud nut and remove stud from glass.

Installation

(1) Attach glass to frame using hinge screw inserts, washers, and screws.
(2) Attach handle assembly to frame.
(3) Attach stud and nut to glass, and connect stud to handle assembly with roll pin.

(4) Latch window and check for water leaks.

(5) If water leakage is evident, apply sealant in affected areas.

STATIONARY WINDOW—WAGONEER

(1) Remove interior garnish mouldings from around window and break seal loose between weatherstrip and body panels.

(2) Push glass toward inside of vehicle.

(3) Remove weatherstrip from around glass and clean old sealer from glass cavity and flange cavity.

(4) Before installing glass in weatherstrip, apply a 3/16-inch bead of 3M Windshield Sealer or equivalent in glass cavity completely around weatherstrip using a pressure type applicator (fig. 15-6).

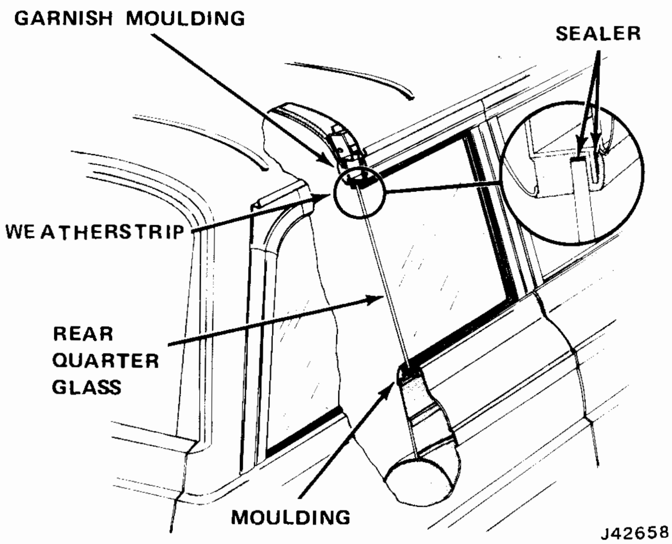


Fig. 15-6 Rear Quarter Window—Wagoneer

(5) With glass installed in weatherstrip and before installing glass and weatherstrip into opening, insert a 1/4-inch cord completely around weatherstrip in flange cavity.

NOTE: *The ends of the cord should hang out over the outside surface of the glass approximately in the center of the upper weatherstrip.*

(6) Place glass and weatherstrip into position in window opening with ends of cord hanging outside vehicle (fig. 15-7).

(7) Pull on ends of cord to pull lip of weatherstrip over body panel. With cord removed, weatherstrip should be positioned correctly.

(8) Replace interior garnish moulding.

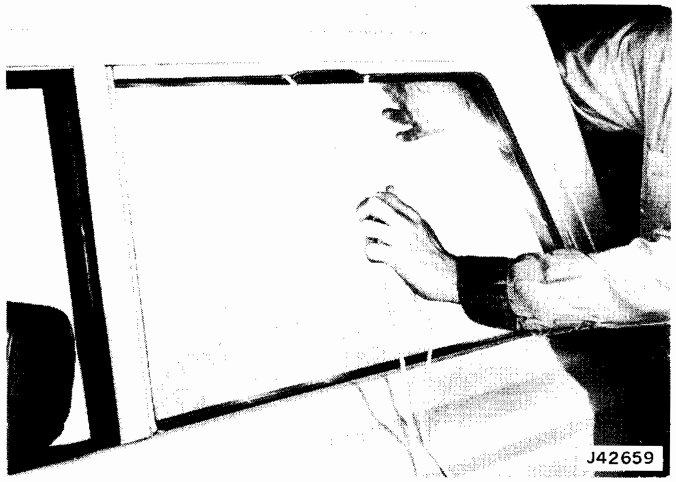


Fig. 15-7 Rear Quarter Window Installation

(9) Apply bead of medium-bodied sealer from outside of vehicle between weatherstrip and body panels.

(10) Clean excess sealer from glass and exterior body surface.

(11) Test window for water leaks.

STATIONARY WINDOW—CHEROKEE

NOTE: *On Cherokee custom models, the pivoting rear quarter vent window and frame may remain in the vehicle but removal of the mylar filler strip is required to accomplish removal of the stationary window.*

(1) Free weatherstrip-to-body flange (on inside of vehicles) as follows: starting at top corner, using fingers or a wooden wand, pull weatherstrip down to clear flange while exerting an outward pressure on glass.

(2) Push window and weatherstrip toward outside of vehicle.

(3) Remove weatherstrip from glass and clean off sealer from glass cavity.

(4) Before installing glass in weatherstrip, apply a 3/16-inch bead of 3M Windshield Sealer or equivalent in weatherstrip glass cavity using a pressure type applicator.

(5) Lubricate weatherstrip with soapy water.

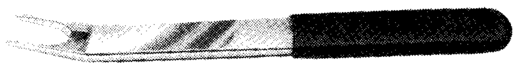
(6) Place glass and weatherstrip into position in window opening.

(7) With weatherstrip body flange in proper position at bottom of window opening, use a wooden wand and walk weatherstrip-to-body flange into position.

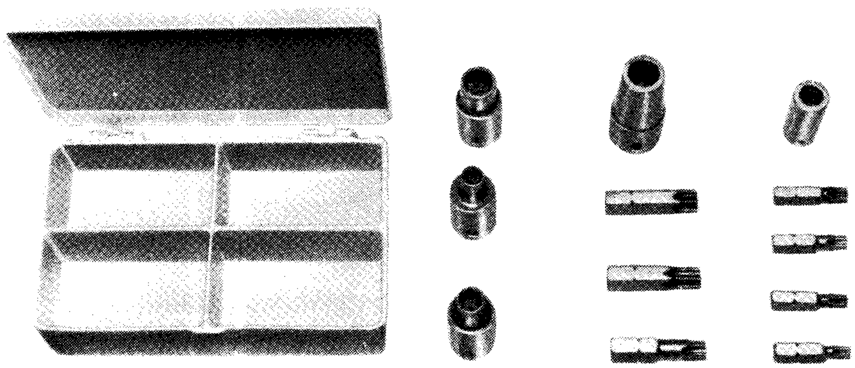
(8) Clean excess sealer from glass.

(9) Check for water leaks.

(10) If water leakage is evident, apply sealant in the affected areas and realign weatherstrip.



TRIM PAD DEPRESSOR J-2631-01



J-25359 TORX BIT AND SOCKET SET

60580

Special Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

TAILGATE—LUGGAGE RACK

TAILGATE

CJ-5

General

The hinged tailgate is held in the closed, up position with hooks which pass through slotted brackets on the tailgate and on the body. The hinges are designed in such a way that the tailgate can be removed easily. The body half of the hinge is slotted and the tailgate half has a matching flat surface. However, to prevent accidental dropping of the tailgate, the flat surface on the left hinge pin is not in line with the flat surface on the right hinge pin.

Removal

(1) Rotate tailgate approximately 45 degrees from full up position and disengage right hinge.
(2) Rotate tailgate an additional few degrees and then disengage left hinge.

Installation

(1) Hold tailgate at approximately 45 degrees from full up position and engage right hinge.
(2) Rotate tailgate an additional few degrees and then engage left hinge.

Adjustment

(1) Loosen hinge attaching bolts and slide body half of hinge up, down, or to the sides as needed.
(2) Tighten bolts.

CJ-7

General

The new tailgate is hinged at the bottom and held in the closed up position with dual latches. The tailgate is supported in the open position by two steel cables.

Removal

(1) Remove screws and wave washers attaching support cables to tailgate.
(2) With tailgate closed, remove screws attaching hinges to tailgate using Torx Bit Tool J-25359. Disengage latches and remove tailgate.

Installation

(1) Position and align tailgate in body opening and engage latches.
(2) Install hinge attaching screws using Torx Bit Tool J-25359.
(3) Position support cables on tailgate and install attaching screws and wave washers.

Adjustment

(1) Loosen hinge-to-body attaching screws and align tailgate to body opening.
(2) Tighten hinge attaching screws.

Hinge Replacement

(1) Remove all hinge attaching screws using Torx Bit Tool J-25359 and remove hinge.

(2) Clean replacement hinge in a suitable solvent and blow dry with compressed air.

(3) Paint hinge to match body with Jeep exterior spray paint.

(4) Lubricate hinge with Lubriplate or equivalent.

(5) Position hinge on body and tailgate and install attaching screws using Torx Bit Tool J-25359.

Rubber Sealer

The tailgate rubber sealer is made of molded latex foam with a smooth rubber skin on the outside.

Plastic retainers are used to retain the rubber sealer to the tailgate. Barbs on the retainers depress when inserted in the holes and spread when fully inserted.

Maintenance of Rubber Sealers

Cold weather may cause the rubber sealer to harden and lose resiliency. This may cause the tailgate to loosen in its opening, resulting in noise. When servicing, use a dampened cloth to clean rubber sealer. Clean dirt from all points where the rubber sealer contacts the body. Apply AMC Silicone Lubricant or equivalent to rubber sealer.

CAUTION: *Do not use graphite, brake fluid, or wax on rubber sealer.*

Replacement

Replacement rubber sealers are coated with powder to prevent stickiness in storage. Remove all powder with a dampened cloth before installation.

(1) Carefully remove rubber sealer from tailgate using needle-nose pliers to remove plastic retainers from tailgate panel holes.

(2) Remove dust and dirt from rubber sealer, tailgate, and body.

(3) Install lower corner of rubber sealer to tailgate first.

(4) Press plastic retainers into tailgate panel holes.

CHEROKEE-WAGONEER

General

The tailgate is a horizontally hinged unit equipped with a manual or electrically operated window regulator. An access hole in the inner panel is for installing and servicing the window regulator and latch assemblies (fig. 16-1).

The torque rods serve to counterbalance and assist in opening as well as closing the tailgate.

Tailgate hinges are accessible at the body side of the hinge for easier adjustment or replacement.

Tailgate weatherseal is body-mounted for better wind and water-leak resistance.

Adjustment

Tailgate adjustment is similar to side door adjustments; proper alignment is obtained by changing the position of the hinges relative to the body and tailgate. On models equipped with carpeting, remove carpeting to gain access to hinge cover plates. Cherokee and Wagoneer vehicles have hinge cover plates in the body floor and tailgate for easy access to hinge screws (fig. 16-1). The dovetail assemblies, which stabilize the tailgate and function as an overslam bumper, are adjusted by bringing the dovetail studs into alignment with the dovetail cap. The dovetail studs are located on the body pillars near the striker plates, and are adjustable. The dovetail caps are located on the tailgate and are nonadjustable.

Hinges

(1) Remove dovetail studs from body pillars.

(2) If equipped with carpeting, remove carpeting to gain access to hinge cover plates.

(3) Remove two body hinge cover plates.

(4) Loosen screws attaching hinges to body and adjust floating plates until lower portion of tailgate closes flush or underflush with body sheet metal to ensure proper compression of weatherseal. Tighten hinge screws to 15 to 20 foot-pounds torque.

(5) Replace body hinge cover plates and carpeting, if equipped.

(6) Replace and adjust dovetail studs.

Dovetail Assemblies

(1) Loosen dovetail stud locking nuts.

(2) Close tailgate into locks.

(3) Adjust dovetail studs into dovetail caps and tighten stud locking nuts.

(4) Check tailgate for proper alignment and adjustment. Be sure tailgate latches properly with strikers and dovetails align into caps.

Striker Assemblies

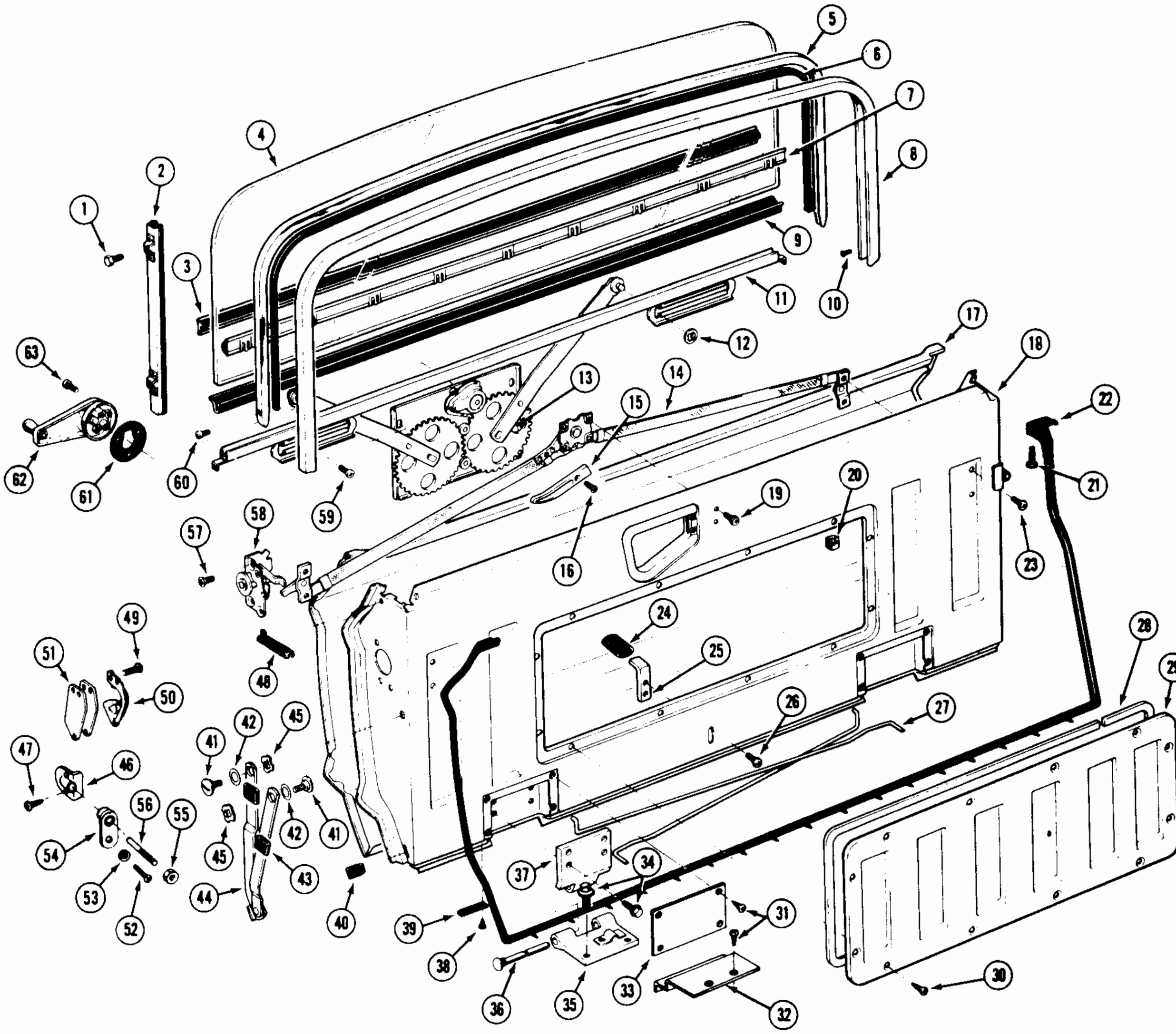
(1) Loosen dovetail stud locking nuts.

(2) Latch teeth should be aligned and nest in the center of the strikers.

(3) Add or remove striker shim to obtain this adjustment.

(4) Adjust strikers so latches enter the strikers freely and tailgate provides a flush fit with adjacent panels.

(5) Perform dovetail assemblies adjustment.



1. Hexagon Screw
2. Lower Channel
3. Weatherstrip
4. Tailgate Glass
5. Run Channel
6. Upper Cushion
7. Weatherstrip
8. Glass Frame
9. Channel Sealer
10. Tapping Screw
11. Bottom Channel
12. Stud Retainer
13. Window Regulator
14. Remote Control
15. Release Handle
16. Oval Head Screw
17. Outer Panel
18. Tailgate
19. Machine Screw
20. Speed Nut
21. Plastic Rivet
22. Tailgate Sealer
23. Machine Screw
24. Bracket Bumper
25. Stop Bracket
26. Machine Screw
27. Torque Rod
28. Cover Gasket
29. Access Cover
30. Tapping Screw
31. Tapping Screw
32. Cover Plate
33. Cover Plate
34. Hinge Screw
35. Body Half Hinge
36. Hinge Pin
37. Tailgate Half Hinge
38. Plastic Rivet
39. Dust Seal
40. Arm Bumper
41. Shoulder Bolt
42. Spring Washer
43. Arm Sleeve
44. Support Arm
45. Lock Washer
46. Dovetail Cap
47. Tapping Screw
48. End Cap
49. Machine Screw
50. Tailgate Striker
51. Striker Shim
52. Machine Screw
53. Lock Washer
54. Tailgate Dovetail
55. Hexagon Nut
56. Dovetail Stud
57. Machine Screw
58. Tailgate Latch
59. Machine Screw
60. Machine Screw
61. Handle Gasket
62. Regulator Handle
63. Machine Screw

J41006

Fig. 16-1 Tailgate—Manual Regulator—Cherokee-Wagoneer

Hinge Replacement

(1) Open tailgate and, if vehicle is equipped with cargo area floor covering, remove moulding and place floor covering aside.

(2) Remove access hole cover plates from body and tailgate.

(3) Raise tailgate to vertical position to unload counterbalance torque rods, and pry rods from clip welded to body half of hinge.

(4) Scribe outline of existing hinge(s) on body and tailgate for reference.

(5) Support tailgate in horizontal position, remove screws attaching hinge(s), and remove hinge(s).

(6) Clean replacement hinges in a suitable solvent and blow dry with compressed air.

CAUTION: *Do not immerse hinge in solvent.*

(7) Color coat hinges to match body.

(8) Lubricate hinges with a suitable lubricant.

(9) Install replacement hinge(s), being careful to align with scribe marks. Tighten screws to 15 to 20 foot-pounds torque.

(10) Raise tailgate to vertical position and install counterbalance torque rods in welded clips on body half of hinges.

(11) Check tailgate alignment and adjust if necessary.

(12) Install access hole cover plates on body and tailgate and, if equipped, replace cargo area floor covering and moulding.

Tailgate and Torque Rod

Removal

(1) Remove carpeting from tailgate (if equipped).

(2) Remove tailgate access cover plate and disconnect wiring.

(3) Remove carpeting (if equipped) to gain access to hinge access hole cover plates.

(4) Remove hinge access hole cover plates on body.

(5) Close tailgate and drive out hinge pins.

(6) With tailgate in a vertical position, counterbalance torque rods are unloaded and can be removed from the clip which is attached to the body half of the hinge.

(7) Remove screws holding lower end of support arms to tailgate.

Installation

(1) Attach support arms to tailgate and raise tailgate to a vertical position in tailgate opening.

(2) Insert curved end of one torque rod in hole at bottom edge of tailgate and right-angle tapered end of rod in clip which is attached to body half of the hinge. Attach other torque rod in same manner.

(3) Install hinge pins with head of pin on inboard side of hinge.

(4) Install hinge access hole cover plates on body.

(5) Install carpeting, if equipped.

(6) Connect wiring and replace tailgate access cover plate and carpeting (if equipped).

(7) Adjust tailgate.

Tailgate Lock Remote Control

Replacement

(1) Lower tailgate and move tailgate glass to the extreme out position so remote control assembly will be accessible. Tailgate glass should be supported to relieve stress on its lower edge.

(2) Remove carpeting from tailgate, if equipped.

(3) Remove access cover and tailgate latch handle from tailgate.

(4) Remove screws holding center of remote control assembly.

(5) Remove screws on each end of remote control rods.

(6) Release lower edge of vinyl water shield on vehicle (if equipped).

(7) Pull rods down toward bottom of tailgate to obtain side clearance.

(8) Move remote control assembly toward side of tailgate and free remote control from latch opening in tailgate. Remove remote control assembly through access cover opening.

Tailgate Latch Replacement

(1) Lower tailgate and move tailgate glass to the extreme out position so remote control assembly will be accessible. Tailgate glass should be supported to relieve stress on its lower edge.

(2) Remove carpeting from tailgate, if equipped.

(3) Remove access cover and remove screws attaching ends of remote control rods to tailgate.

(4) Remove screws attaching latch assemblies to ends of gate and remove latch assemblies.

Tailgate Glass Replacement

Tailgate glass is operated by a double-arm window regulator which is connected directly to an outside window regulator handle. The complete window assembly will slide up and out of the run channels when the pins at the ends of the regulator arms are withdrawn from the slot in the lifter channel.

(1) Remove access cover on inside tailgate panel and pry off retainers with a screwdriver.

NOTE: *Retainers can be damaged when removed and their condition should be checked. When installing retainers, the tabs must be firmly locked in groove of* *pin. If difficulty is experienced when installing retainers, they were probably damaged during removal and should be replaced.*

(2) When installing tailgate glass, check glass assembly and regulator separately to make sure that both operate freely before connecting the two together.

(3) Should difficulty be experienced in raising the window from its lowered position, replace existing glass stop bumper.

(4) Push new bumper on bracket as far as possible.

(5) Position free end to lay up against outside panel.

Tailgate Window Regulator Replacement

(1) Remove access cover.

(2) Remove tailgate window.

(3) Remove regulator by sliding nameplate cover aside and rotating handle until hole in handle is aligned with screws that attach handle assembly to the tailgate. Remove attaching screws and handle.

(4) Remove screws that attach regulator assembly to tailgate.

(5) Remove regulator assembly through access cover opening.

(6) After installation and before access cover is replaced, raise and lower window to check that window fits properly. The window regulator can be adjusted by loosening attaching screws and moving regulator assembly in slotted screw holes until proper window adjustment is obtained.

(7) Adjust handle to be in vertical position when window is full up.

Tailgate Glass Adjustment

The tailgate glass, when closed, must seat fully into the upper glass channel to obtain a positive seal at the horizontal weatherstrip located at the top of the tailgate. If tailgate does not seat properly when closed, check the upper glass channel to be certain it is bottomed in the body opening, also check alignment of the tailgate glass run channel.

(1) If adjustment is necessary, loosen two capscrews on either side panel of the tailgate (fig. 16-2).

(2) Raise and lower glass several times with tailgate in the closed position. This will align the glass with the channel.

(3) Open tailgate slightly and tighten adjusting screws with tailgate in vertical position.

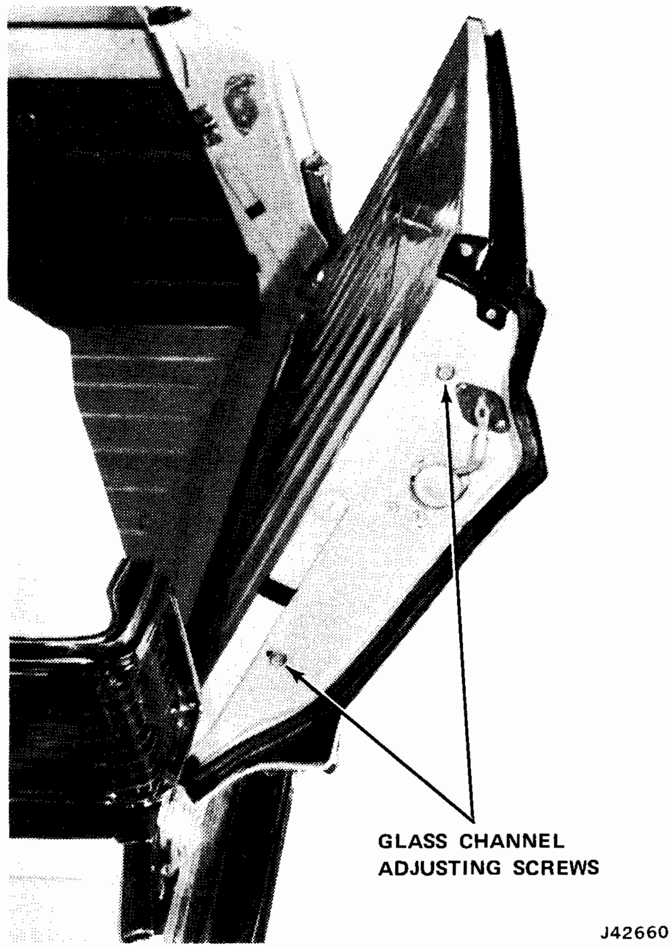


Fig. 16-2 Glass Channel Adjustment

TRUCK TAILGATE

The tailgate on the pickup box is hinged at both sides. It is necessary to lower the tailgate for access to the cross-recessed countersunk attaching screws.

The tailgate on the pickup box is held in the up or closed position with spring-loaded latches at the top of the gate. A paddle handle, located in the center of the tailgate operates the latches at each side through connecting rods.

Pin type hinges are located on the sides of the pickup box. The hinge pin brackets are attached with cross-recessed countersunk attaching screws and cage nuts for easier adjusting.

The left side hinge pin is a solid round bar. The right side pin is similar but with two flat surfaces which correspond with a notch and the two flat surfaces allow the tailgate to be removed quickly from the tailgate opening.

To remove, open and lower the tailgate. Remove the side supports and then raise the tailgate to about 45 degrees from horizontal. Disengage the right side hinge and move the tailgate to the right to disengage the left side hinge.

ELECTRICAL TAILGATE WINDOW

The ignition switch must be in either the accessory or ignition position to energize the window lift circuit.

The rear window control switch is located left of the steering column on the instrument panel. The switch is spring-loaded and will return to the neutral position.

The tailgate glass also can be lowered or raised, by inserting the ignition key in the tailgate lock. Turn the key to the left to lower and to the right to raise the tailgate glass.

After the glass has been lowered, the tailgate can be opened by lifting up on the tailgate latch release handle on the inside of the tailgate at the center.

NOTE: *The tailgate safety switch is in series with the brown wire which feeds the up circuit of the tailgate motor. It prevents up operation when the tailgate is open.*

The proper assembly of all moveable parts is important for satisfactory operation of the tailgate window.

The glass assembly must be in alignment in the tailgate and glass slide channels to operate with free movement. The window regulator teeth in all gears, the coil springs, and the bottom channel slide sections must be lubricated with Lubriplate or equivalent to ensure proper operation of the glass when it is raised or lowered.

Safety Switch

A safety switch, mounted in the upper left side of the tailgate, prevents raising the glass when the tailgate is in the open position to avoid possible damage to glass channels and regulator.

Circuit Breakers

The electric tailgate regulator motor and wiring harness are protected by two 30-ampere circuit breakers located in the fuse block.

Instrument Panel Switch

The rear window switch is mounted at the lower left side of the instrument panel. For removal, remove knob by depressing spring clip. Remove attaching screws. Disconnect wiring and remove switch.

Wiring Harness

The tailgate circuit is a two-section wire harness: the body section, which is routed along the left side of the vehicle, and the section in the tailgate. The two harnesses are connected at the rear body crossmember.

Remove the tailgate access cover to gain access to the wiring harness.

Tailgate Key Lock

The tailgate key lock assembly is held in place by two special screws located under the key hole cover. Remove the screws using Torx Bit Tool J-25359.

Tailgate Window Switch

The tailgate window switch is mounted to the bottom side of the left regulator mounting support. It is fastened with two screws which are visible and accessible after the window regulator is removed.

Diagnosis Guide

Three colors are used for coding the wires in the tailgate electric window regulator circuit.

Refer to Cherokee and Wagoneer Wiring Diagram.

To test the tailgate wiring, switches, and motor, a 12-volt test lamp can be used at the three-way connector located under the body at rear of the crossmember. Separate the connector 1/16-inch or just far enough to insert a thin test probe without disrupting the circuit.

Connect one probe of the test lamp to ground and the other to the individual tan, brown, or red wires.

The red is hot at all times to supply the tailgate key-operated switch.

When the ignition switch is in either the off or on position and both tailgate switches are in the neutral position, there is no current flow in the tan or brown wires.

When either switch is operated, current flow will be indicated in both the tan and brown wires.

The tailgate safety switch must be closed to perform the above test. If the switch is open, no current flow will be indicated in the brown wire when the tailgate switch is operated.

LUGGAGE RACK

GENERAL

The luggage rack (fig. 16-3) consists of side rails, adjustable end rails, end and center supports, and roof mounted slats. A spanner wrench, located in the vehicle glove box, facilitates securing the adjustable end rails.

The ends and center supports are attached to the roof top with well nuts and machine screws. The roof slats are attached with sheet metal screws and pressure sensitive tape.

Luggage rack components can be replaced without removing the entire assembly from vehicle.

NOTE: *Do not apply extreme pressure to support mounting screws during removal or installation as this may cause the well nuts to drop between the roof panel and headliner.*

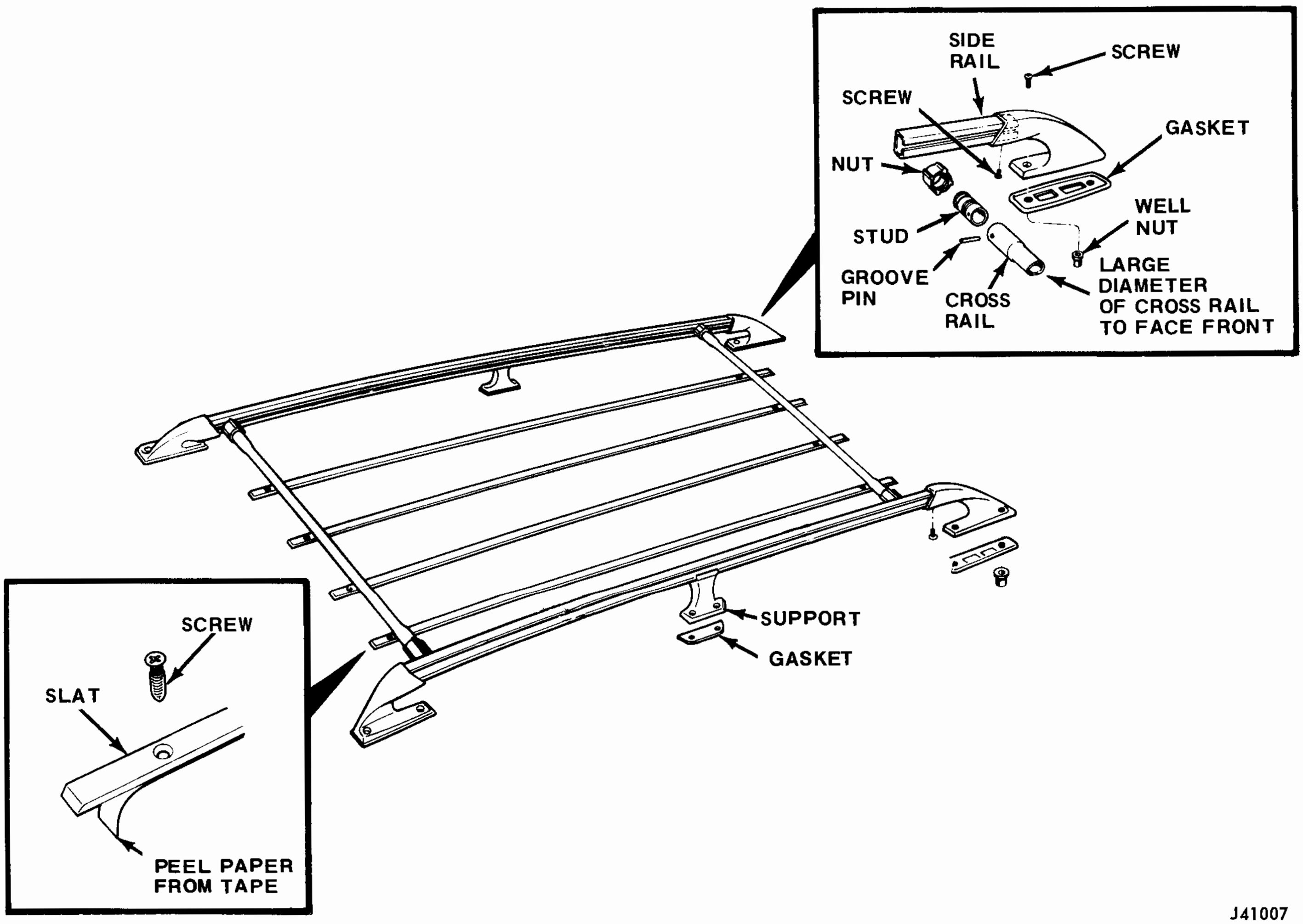
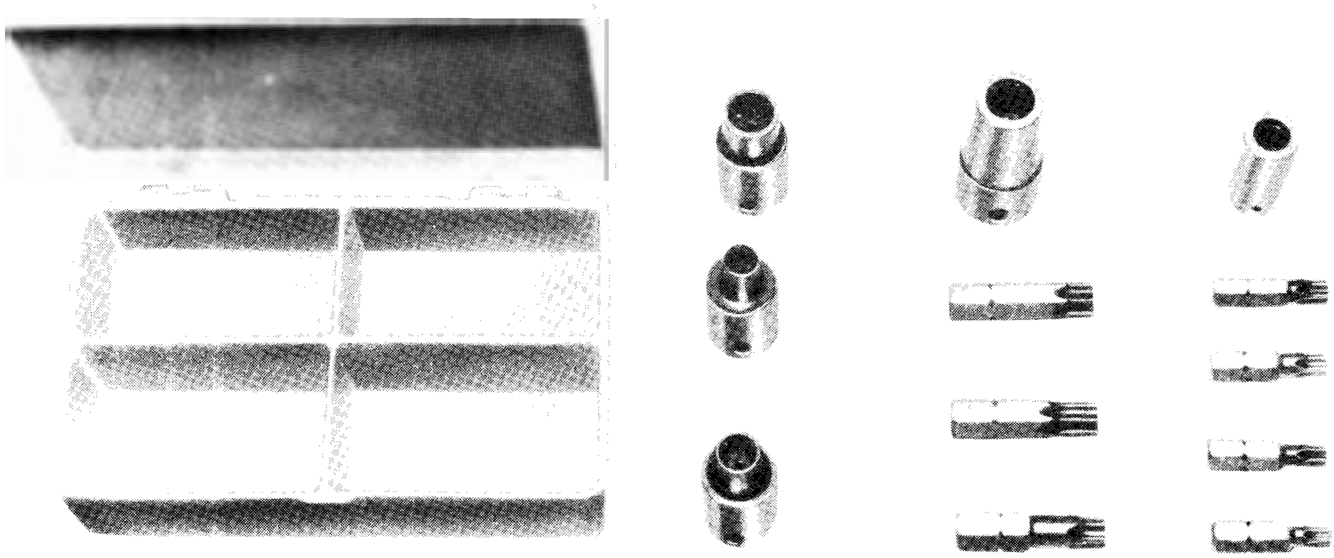


Fig. 16-3 Luggage Rack



J-25359 TORX BIT AND SOCKET SET

50420

Special Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

WINDSHIELD—REAR WINDOW—WINDSHIELD WIPER

WINDSHIELD

GENERAL

The windshields on all models consist of two sheets of glass, some flat and some curved, laminated together to form a one-piece safety glass.

All windshields are retained in their respective openings by rubber weatherstrips (channels).

The safety type glass is designed with adequate clearance to prevent stress and strains. When replacing cracked glass resulting from causes other than a direct blow or a known instance of temporary misalignment, it is very important that the cause of the breakage be determined and the condition corrected.

The inside rear view mirror bracket for all models is bonded directly to the windshield glass with a polyvinyl-butyral compound, through a heat-induction process.

Service replacement windshield glass may have the rear view mirror bracket bonded to the windshield glass. In this case the mirror is simply transferred from the unserviceable windshield to the bracket on the replacement windshield.

If the replacement windshield does not have the mirror bracket bonded to it, or if on serviceable windshields the bracket bond has been lost, a service kit is available for bracket installation. The kit is available from your local parts distribution center and consists of a replacement bracket and firm-setting, two-component adhesive. Installation instructions are included in this section, as well as in the kit.

NOTE: *Do not attempt to remount the original bracket. For best results use a new bracket with the proper adhesive, available as a service kit.*

GLASS REMOVAL

CJ Models

(1) Cover adjoining painted surfaces to protect finish.

(2) Remove windshield wiper arms using wide blade screwdriver.

(3) Remove inside rear view mirror from bracket.

(4) Remove sun visors and defroster ducts.

(5) Starting at top of windshield frame, pull glass weatherstrip away from flange while gently pushing out on glass.

(6) Work entire weatherstrip from pinch weld and remove glass.

GLASS INSTALLATION

CJ Models

(1) Use 3M Auto Bedding and Glazing Compound or equivalent and apply a 1/16-inch bead of sealer completely around weatherstrip in flange cavity.

(2) Install weatherstrip on glass. Split in weatherstrip should be bottom of glass.

(3) Beginnning at bottom of glass, work weatherstrip over flange using a fibre or wooden wand.

(4) Use 3M Windshield Seater or equivalent and apply sealer between weatherstrip and outside of glass around entire perimeter.

(5) Clean off excess sealer.

(6) Install inside rear view mirror on bracket.

(7) Install defroster ducts and sun visors.

(8) Install windshield wiper arms.

(9) Test windshield for water leaks.

GLASS REMOVAL

Cherokee-Wagoneer-Truck

An interlocking type lip is part of the weatherstrip. The weatherstrip should be 75°F (24°C) or above before windshield removal is attempted.

(1) Cover adjoining painted surfaces to protect finish.

(2) Remove windshield wiper arms using a wide blade screwdriver.

(3) On vehicles with stainless steel mouldings.

(a) Remove moulding screws on the top and bottom of side mouldings.

(b) Remove top corner moulding by lifting bottom and pulling outboard.

(c) Tip side mouldings toward center of vehicle and lift off.

(d) Remove top moulding.

(4) Slide center moulding clip to left or right and remove bottom mouldings. This will expose the locking type weatherstrip.

(5) Use a wedge-shaped fiber or hardwood stick or wand as shown in figure 17-1 to unlock the weatherstrip as shown in figures 17-2 and 17-3. The locking type weatherstrip without mouldings is shown in figure 17-3.

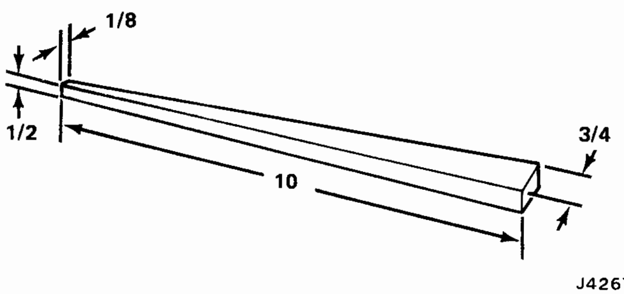


Fig. 17-1 Wooden Wand Dimensions (Inches)

(6) On units with or without mouldings, unlock the rubber weatherstrip starting at the bottom with a fiber stick or wand (fig. 17-4).

(7) Remove inside rear view mirror from bracket.

(8) Use fiber stick to break seal between windshield glass and weatherstrip.

(9) Use two men to remove windshield from weatherstrip, one man lifting as windshield comes free.

(10) Remove weatherstrip from opening.

(11) Inspect weatherstrip and clean off sealer from glass cavity and flange cavity.

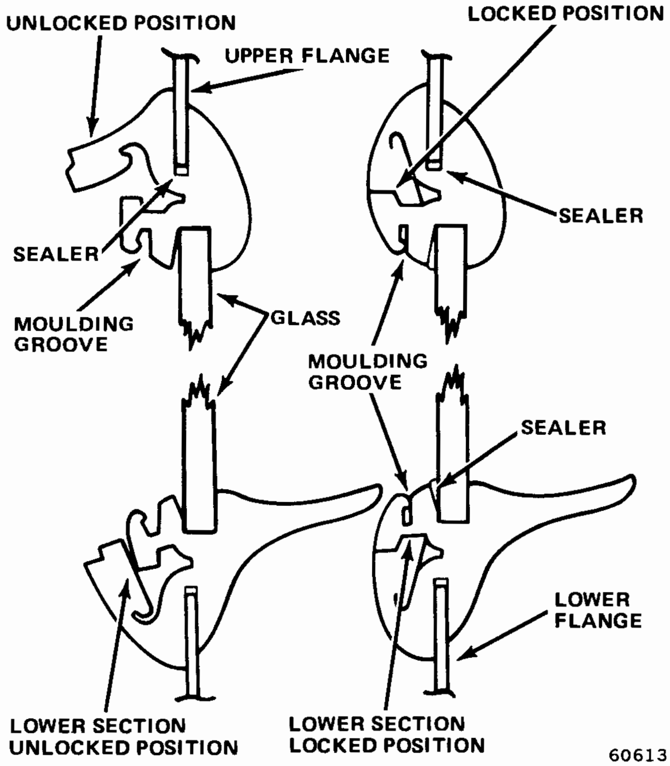


Fig. 17-2 Windshield Weatherstrip Cross Section—Moulding Removed

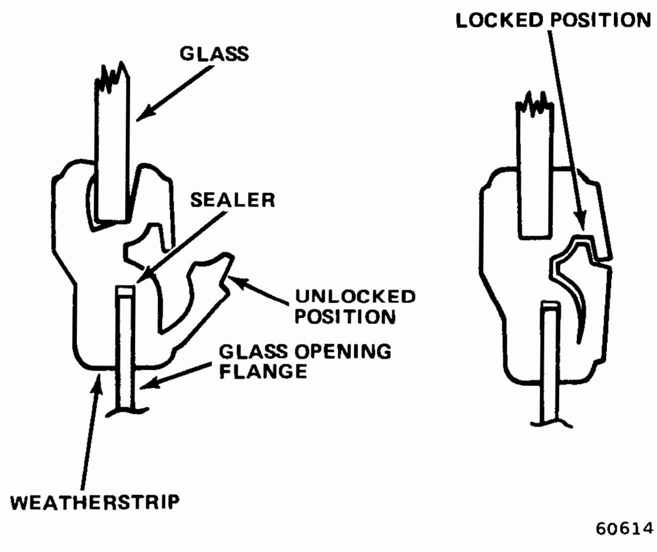


Fig. 17-3 Windshield Weatherstrip Cross Section

NOTE: *Inspect for uneven surfaces or irregularities in the windshield opening flange that could cause stress damage to the windshield glass.*

(12) If windshield has been removed for reasons other than damaged glass and is to be replaced, clean hardened sealer from edges.

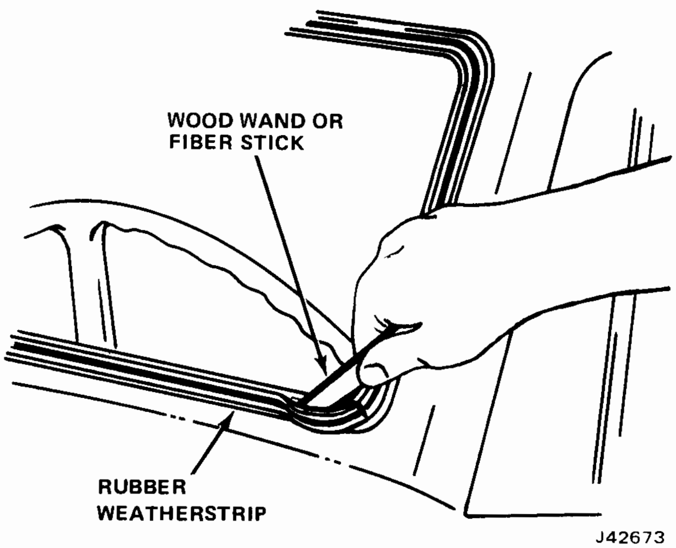


Fig. 17-4 Unlock Rubber Weatherstrip

GLASS INSTALLATION

Cherokee-Wagoneer-Truck

NOTE: *Windshield installation should be accomplished in relatively warm surroundings in order that the windshield weatherstrip will remain pliable to make the installation operation easier and reduce the possibility of breaking the windshield.*

(1) Clean old sealer from windshield opening flange.

(2) If removed weatherstrip is to be reused, be sure glass cavity and flange cavity are clean.

(3) Use 3M Auto Bedding and Glazing Compound or equivalent and apply a 1/16-inch bead of sealer completely around weatherstrip in flange cavity as shown in figure 17-2.

(4) Install weatherstrip on windshield opening flange.

(5) Apply a liberal amount of liquid soap solution in glass cavity of the weatherstrip.

(6) With two men working on the outside of the vehicle, work windshield into upper glass cavity and into each side. Position wooden wand under bottom of glass and lift windshield up and into lower glass cavity. Check for equal side clearances.

(7) Use wooden wand to lock weatherstrip as shown in locked position (fig. 17-2 and 17-3).

NOTE: *Soap solution should be removed from the weatherstrip and glass before installing sealer.*

(8) Use 3M Windshield Sealer or equivalent and apply sealer between the weatherstrip and glass on outside of glass around entire perimeter (fig. 17-2).

NOTE: *Excessive soap solution should be removed from the weatherstrip before installing trim moulding.*

(9) Bottom mouldings are installed one at a time. To facilitate installation, place a 1/8-inch diameter cord in weatherstrip moulding retaining groove along entire length of weatherstrip, leaving enough cord hanging out at each end to permit a good grip on cord.

(10) Working first with either left or right bottom moulding, place moulding in groove.

(11) Starting at the outside corner of the weatherstrip, pull up on cord while lightly tapping top of moulding with rubber mallet. This will lock the moulding in the weatherstrip retaining groove. Continue to process until moulding is installed in weatherstrip, and then repeat process with the other bottom moulding, again starting at the outside corner.

(12) Install center moulding clip to cover gap between left and right bottom moulding.

(13) The one-piece top moulding is installed in the same manner, except that the moulding is tapped upward into retaining groove.

(14) Side and upper corner mouldings can then be inserted in retaining groove and secured by installing upper and lower screws.

(15) Fill gap at upper outboard corner between trim moulding and body with black sealer.

(16) Clean excess sealer from windshield and moulding.

(17) Install side moulding screws.

(18) Install windshield wiper arms.

(19) Install inside rear view mirror on bracket.

(20) Test windshield for water leaks.

REAR VIEW MIRROR BRACKET INSTALLATION

(1) Locating windshield mounted rear view mirror bracket can be accomplished as shown in figures 17-5 and 17-6. Use wax pencil on outside of glass to locate mounting bracket.

(2) If vinyl pad has remained on the windshield glass, apply low heat with an electric heat gun until vinyl softens, then peel pad from glass using care not to scratch or mar the glass surface.

(3) Clean bracket mounting area of windshield glass thoroughly. Use a midly abrasive cleaning powder (Ajax, Comet, or equivalent) applied to clean cloth saturated with alcohol.

(4) Remove all traces of cleanser by wiping area with a paper towel moistened with alcohol.

(5) Scuff bonding surface (the side without the 3/8-inch circular depression) of the mirror bracket with a clean piece of fine grit sandpaper. Apply alcohol to a clean towel and wipe surface clean.

(6) Apply a generous amount of the accelerator, supplied with the kit, to mirror bracket mounting surface. Allow five minutes to dry.

(7) Apply a thin film of accelerator to windshield. Allow one minute to dry.

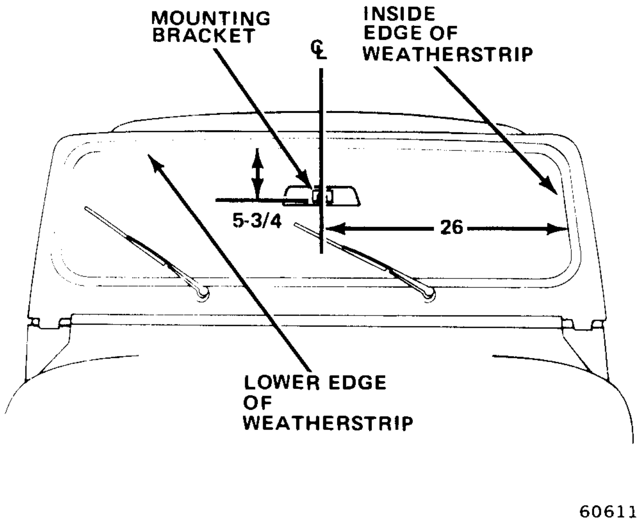


Fig. 17-5 Windshield Mounted Rear View Mirror Bracket Location (Inches)—CJ Models

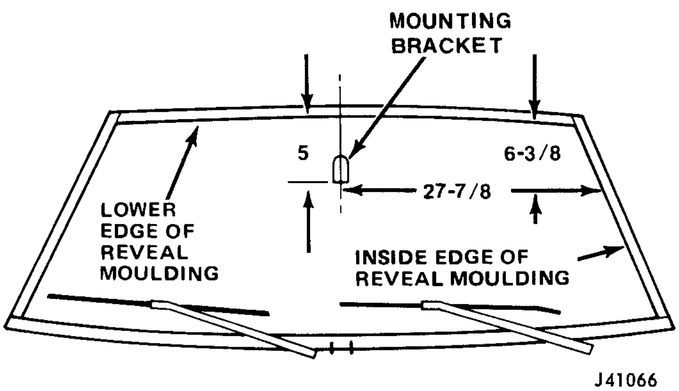


Fig. 17-6 Windshield Mounted Rear View Mirror Bracket Location (Inches)—Cherokee-Wagoneer-Truck

CAUTION: *Do not touch surfaces to which accelerator has been applied - an imperfect bond could result.*

(8) Apply one drop of adhesive at the center of the mirror bracket bonding surface. Use bottom of adhesive tube to distribute the adhesive evenly over the entire surface.

(9) Position bottom straightedge of the bracket on the horizontal line (fig. 17-5 and 17-6). Press bracket to glass and hold firmly for one minute. Be sure bracket is properly located as adhesive sets quickly.

FOLDING WINDSHIELD

On CJ models the windshield and frame assembly may be lowered to the hood by removing the knobs at each side of the windshield. When in the lowered position, always secure the windshield by passing the strap at the top of the windshield through the loop on the hood and drawing the strap up firmly.

Removal

(1) Remove necessary components from windshield frame.

(2) Disconnect wiper motor wiring harness from switch.

(3) Remove windshield hinge-to-frame attaching screws using Torx Bit Tool J-25359.

(4) Remove windshield holddown knobs and remove windshield frame.

Installation

(1) Position windshield frame on vehicle and install windshield hinge-to-frame attaching screws using Torx Bit Tool J-25359.

(2) Install windshield holddown knobs.

(3) Connect wiper motor wiring harness to switch.

(4) Install necessary top components to windshield frame.

REAR WINDOW

GENERAL

The rear window is a one-piece, tempered glass. The overall size of the glass varies with the different vehicles.

Cherokee-Wagoneer

For service replacement and adjustment of tailgate window glass, refer to Section 16—Tailgate-Luggage Rack.

Truck Models

For service replacement of solid rear glass, refer to Windshield Glass Removal or Installation.

The sliding rear window on J-10 and J-20 cabs, which provides cab ventilation and ease of communication between passengers in the truck cab and camper body, is replaced as an assembly.

WINDSHIELD WIPER

GENERAL

All models are equipped with a two-speed, electric wiper motor.

On CJ models, the motor is mounted on the lower left corner of the windshield (fig. 17-7).

Cherokees, Wagoneers, and Trucks are equipped, on the driver's side, with an articulated windshield wiper arm (fig. 17-8).

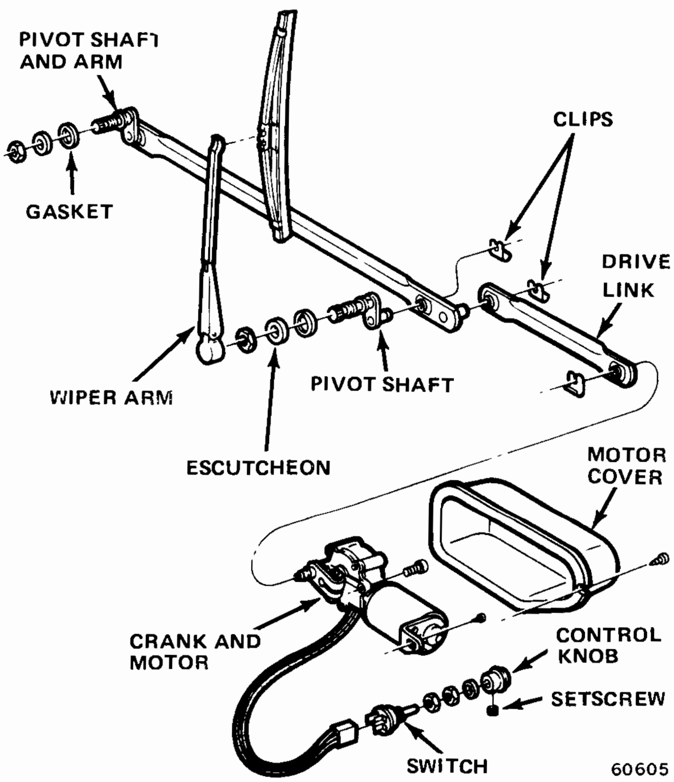


Fig. 17-7 Windshield Wiper Components—CJ Models

WIPER AND WASHER CONTROLS

The control switches are mounted on the instrument panel. The switch for CJ Models is a through-type multiposition switch which does not require grounding for proper operation. The switch for Cherokee-Wagoneer, and Truck vehicles is a grounding-type switch and must be grounded for proper operation or diagnosis.

The two-speed wiper motor is energized for continuous wiping action by turning the control knob in a clockwise direction.

The electric washer pump is operated by depressing the wiper control knob or, on some models, the push-button in the center of the control knob.

Wiper Control Removal

(1) Remove control knob.

(2) Remove nut and switch.

(3) Mark the wire color locations on switch and disconnect wires.

WIPER BLADES

Replacement—CJ Models

The wiper blade assembly is removed from the wiper arm by holding the blade away from the windshield, and pushing it firmly against the tip of the arm to compress the locking spring and disengage the retaining pin. At the same time, pivot the blade clockwise to unhook it from the end of the arm.

To install, place blade assembly on wiper arm and snap blade assembly into position.

Replacement—Cherokee-Wagoneer-Truck

(1) To remove wiper blade from mounting pin on wiper arm, insert a screwdriver into spring release opening of blade saddle and depress spring clip. Pull blade from arm (fig. 17-9).

(2) To install, push blade saddle onto mounting pin so that spring clip engages pin. Be sure blade is securely attached to arm.

WIPER ARM REPLACEMENT

CJ Models

(1) To remove the windshield wiper arms from the pivot body shaft, first mark the pivot shaft and arm

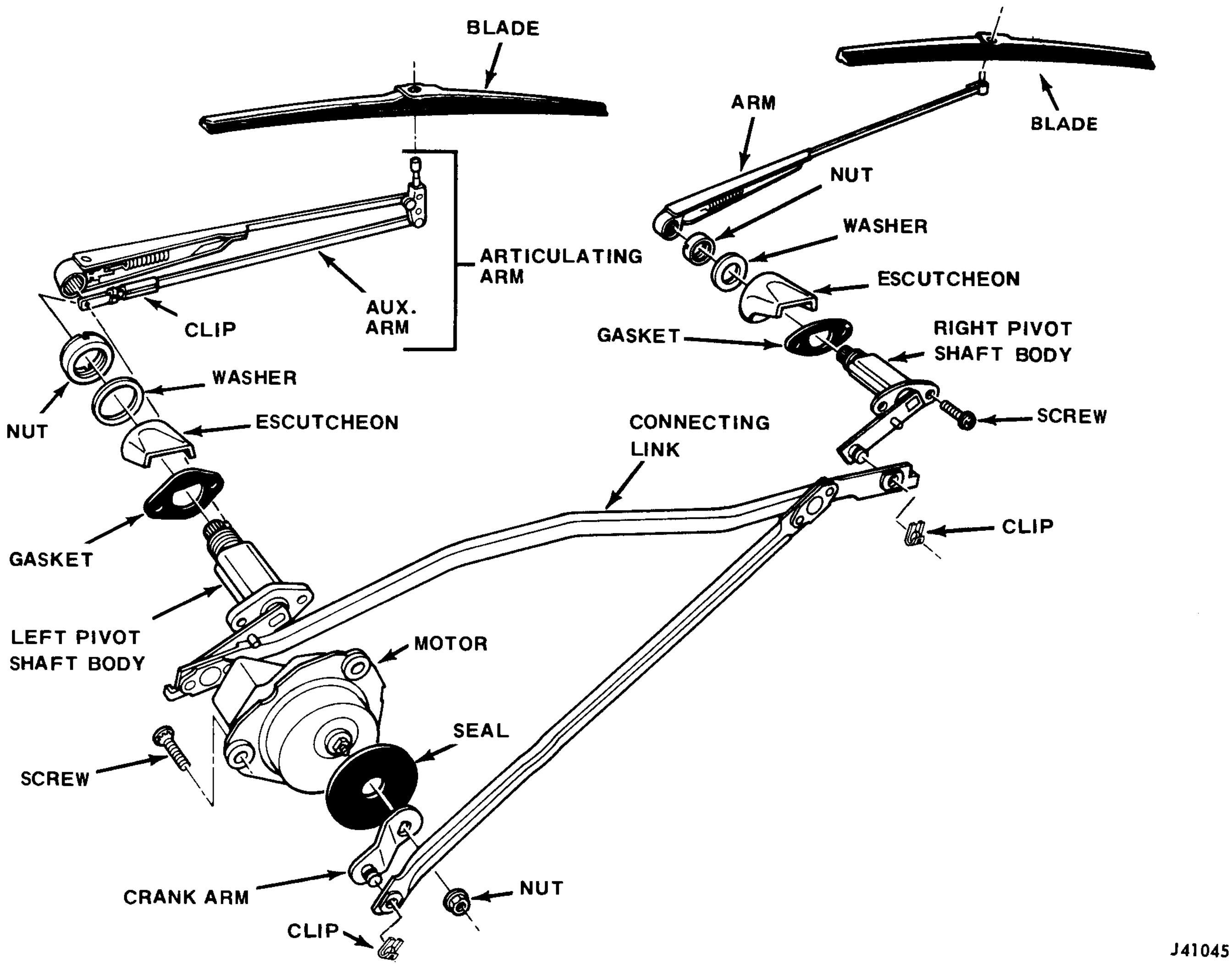


Fig. 17-8 Windshield Wiper Components—Cherokee-Wagoneer-Truck

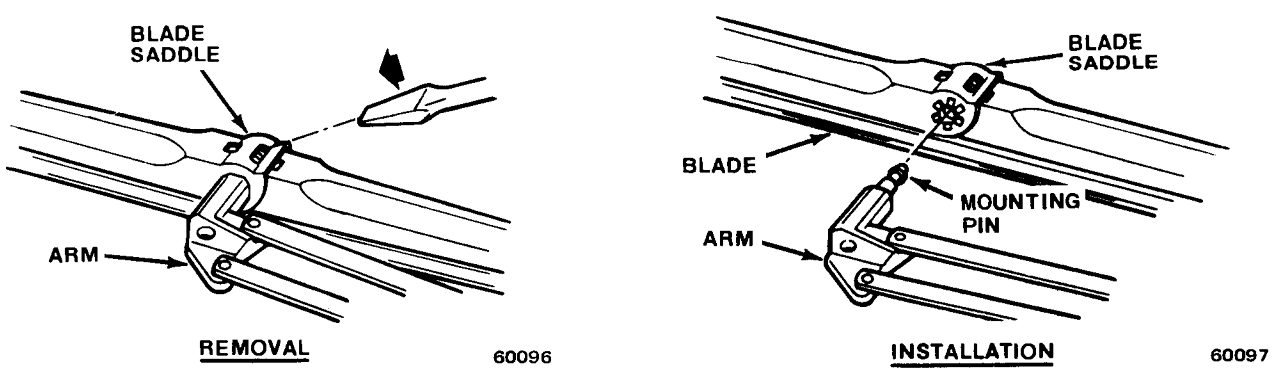


Fig. 17-9 Wiper Blade Replacement

so that the wiper arm can be installed in the same position, and then pry up carefully on the wiper arm as shown in figure 17-10.

(2) Push wiper arm over pivot shaft. Be sure pivot shaft is in park position and wiper arm is positioned as shown in figure 17-11.

Cherokee-Wagoneer-Truck

(1) Raise blade end of arm from windshield and move spring tab away from pivot shaft. Disengage auxiliary arm retainer clip (driver's side only) from

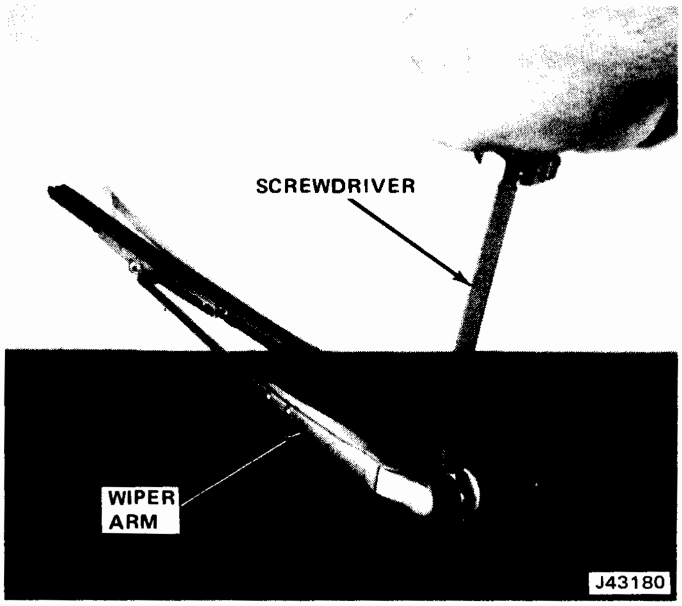


Fig. 17-10 Wiper Arm Removal

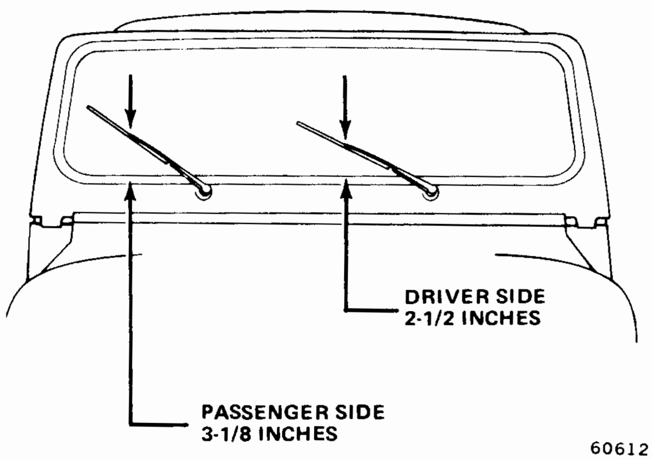


Fig. 17-11 Wiper Arm Park Position—CJ Models

pivot pin and pull wiper arm from pivot shaft (fig. 17-9).

(2) To install, position auxiliary (if equipped) over pivot pin and engage retainer clip. Push wiper arm over pivot shaft. Be sure that pivot shaft is in park position and wiper arm is positioned as shown in figure 17-12.

TWO-SPEED WIPER MOTOR—CJ MODELS

General

The wiper motor is protected by a 10-amp fuse in the fuse panel.

When the wiper switch is moved to the low speed position, current flows from the fuse panel to terminal

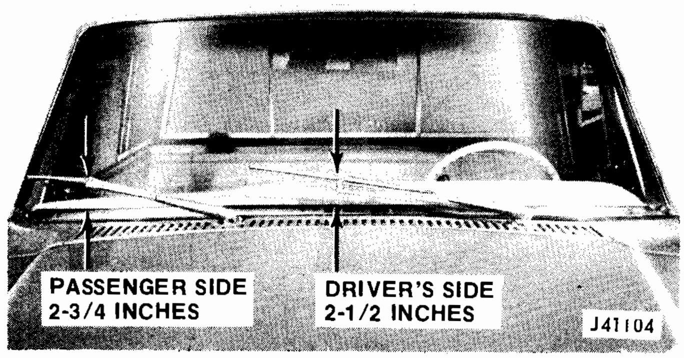


Fig. 17-12 Wiper Arm Park Position—Cherokee-Wagoneer-Truck

B (fig. 17-13) of the wiper switch, through the wiper switch to terminal 2, then through the green wire to the motor low-speed brush and through the armature to ground.

With the wiper switch in the high speed position, current flows from the fuse panel to terminal B of the wiper switch, through the wiper switch to terminal 3, then through the red wire to the motor high speed brush and through the armature to ground.

When the wiper switch is turned off, current flows from the fuse panel to terminal B of the wiper switch, through the wiper switch to terminal 1, then through the black wire to the park contact points to the motor low speed brush and through the armature to ground. When the cam on the wiper drive gear opens the park contact points, the feed circuit to the motor low speed brush is interrupted and the motor is in park.

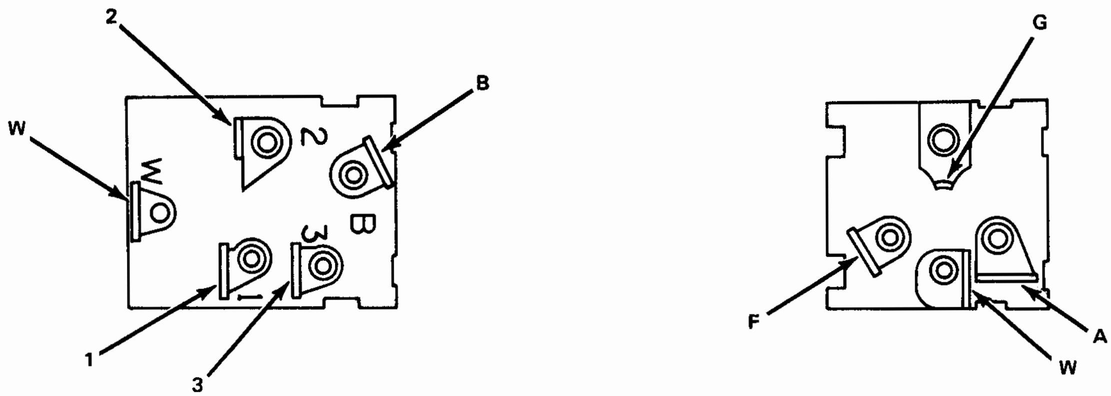
TWO-SPEED WIPER MOTOR—CHEROKEE-WAGONEER-TRUCK

General

The wiper motor is protected by a 10-amp fuse in the fuse panel. When the dash switch is moved to the low-speed position, the circuit between terminals A and F on the motor are connected and (G) ground through the switch. Current from the battery flows through a series field coil and is divided. One part passes through the shunt field coil to ground at the dash switch; the other part passes through the armature to ground at the dash switch.

Moving the dash switch to the high-speed position opens the shunt field circuit to ground at the dash switch and keeps the armature circuit closed to ground. The shunt field current must then pass through a 20-ohm resistor located on the back of the wiper terminal board and then through terminal A that connects the armature circuit to (G) ground through the dash switch.

Moving the dash switch to the OFF position opens both the armature and shunt field circuits to ground



SELECTOR POSITION	CJ MODELS	CHEROKEE-WAGONEER-TRUCK MODELS
OFF OR PARK	B-1	A-F
LOW SPEED	B-2	A-F-G
HIGH SPEED	B-3	A-G
WASH	B-W	W-G

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Fig. 17-13 Continuity Test for Wiper Switches

at the dash switch. However, both of these circuits are still closed to ground through the parking switch. When the cam on the wiper output gear opens the park switch contacts, the ground circuit is broken and the wiper blades are in the parked position.

NOTE: *The shunt field is connected directly to ground by passing the resistor with the switch in the off position. This results in low speed operation during the park operation.*

Troubleshooting Procedures—CJ Models

The wiper motor may be operated independently of the switch to aid in determining defective components.

NOTE: *The wiper motor must be grounded for proper operation and during all wiper tests.*

With ignition switch on, check for 12 volts at switch terminal B (fig. 17-3) (switch need not be grounded). If 12-volt test lamp lights but wiper motor does not operate, connect a jumper wire from ground strap on motor to a good body ground. If motor still does not operate, disconnect wiring from switch. Using a jumper wire, connect switch terminals 2 and B. This connection should give low speed operation. If wiper motor does not operate in low speed, there is an open in the green wire, a defective internal motor connection or a stuck low speed brush.

To obtain high speed, connect a jumper wire between terminals 3 and B. If wiper motor fails to operate, there is an open in the red wire, a defective internal motor connection, or a stuck high speed brush.

With the wiper blades in a position other than park, connect a jumper wire between terminals 1 and B. The wiper blades should run on low speed and stop in the park position. If, after making the jumper connection, the motor does not run, there is an open in the black wire, a defective internal motor connection, a misaligned or damaged set of contact points or a bad connection through the park point set to the low speed brush. If the wiper motor runs but does not park, the cam on the drive gear is not sufficiently breaking the contact points.

If wiper motor operation is intermittent, a defective solder joint, wiring connection, body ground or worn brush may cause the condition.

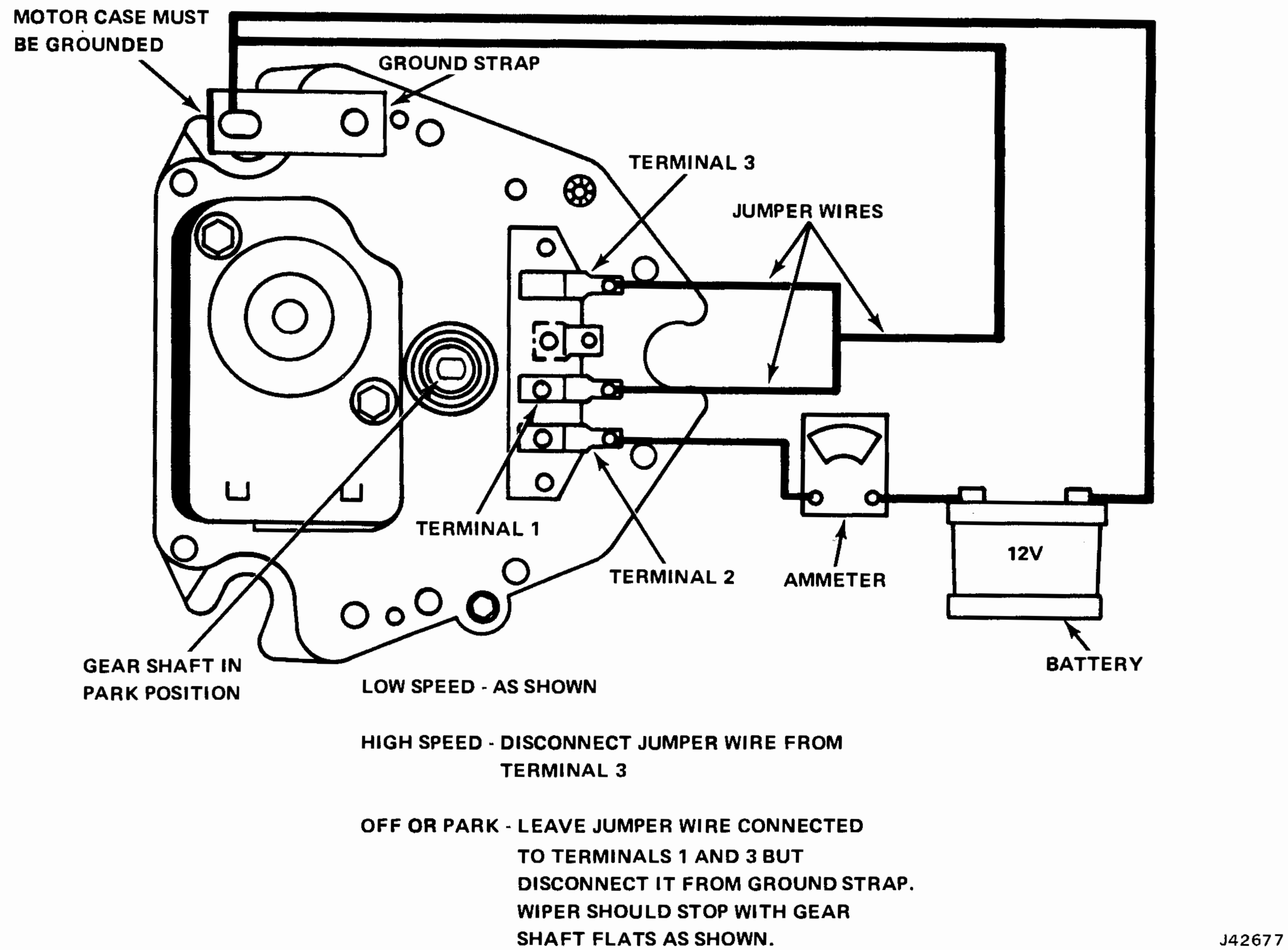


Fig. 17-14 Two-Speed Wiper Test Connections—Cherokee-Wagoneer-Truck

Troubleshooting Procedure—Cherokee-Wagoneer-Truck

Figure 17-14 illustrates the method of connecting leads to the two-speed wiper either for bench operation or to run wiper independently of dash switch and vehicle wiring when installed in vehicle.

Typical wiper troubles are as follows: wiper inoperative; wiper will not shut off; wiper operates only on fast speed; wiper shuts off with dash switch in high-speed position; blades do not return to park position when wiper is turned OFF; wiper speed normal at low but too fast in high; intermittent operation during normal wiping cycle.

Troubleshooting procedures are divided into two categories: wiper troubleshooting in vehicle; wiper troubleshooting on bench.

Troubleshooting in Vehicle

If wiper is inoperative check the following items:

- Fuse
- Wiring harness to motor connections
- Dash switch connection and ground
- Wiper ground strap

With ignition switch on, check for 12 volts at harness terminal that connects to wiper terminal. To determine if dash switch or wiring is at fault, disconnect harness from wiper motor and try operating wiper as shown in figure 17-14. If wiper fails to operate, remove body parts as required, disconnect transmissions from wiper crank arm, and recheck wiper motor operation. If wiper motor still fails to perform correctly, remove wiper motor from vehicle and check wiper motor according to procedure under Troubleshooting on Bench.

If wiper motor will not shut off, determine if wiper motor has both low and high speeds, slow speed only or high speed only. It is important that the wiper operates at low speed during parking cycle. High speed motor momentum may carry cam past normal park position, allowing park contact points to close.

Disconnect wiring harness from wiper motor and try operating wiper independently of dash switch as shown in figure 17-14.

If wiper shuts off correctly with crank arm in park position and wiper has both speeds after performing tests, check the lead between terminal 1 and dash switch ground, and check for defective dash switch. If wiper shuts off correctly but wiper has low speed only, check lead between wiper terminal 3 and dash switch ground and check for defective dash switch. If wiper shuts off correctly but has high speed only, check lead between wiper terminal 1 and dash switch for open circuit and check for defective dash switch. If wiper still fails to operate correctly, remove it from vehicle and check it according to instructions under Wiper Troubleshooting on bench.

If wiper has slow speed only and shuts off with dash switch in high-speed position, reverse harness leads that connect to wiper terminals 1 and 3 (fig. 17-15).

If blades do not return to park position when wiper is turned off, check wiper ground strap connection to vehicle body. Remove wiper from vehicle and check for dirty, bent, or broken park switch contacts.

If wiper speed is normal in slow, but too excessive in fast speed, remove wiper motor from vehicle and check for an defective resistor.

If wiper motor operates erratically, check for loose wiper motor ground strap connection or loose dash switch mounting.

Troubleshooting on Bench

Using ammeter capable of reading at least 30 amperes, check feed wire circuit shown in figure 17-14 for open circuit.

The low speed amp draw with no load should be 4 amps; high speed amp draw 3.5 amps; motor stalled (cold) 12 amps.

If wiper motor is inoperative, connect wiper motor to operate in low speed and observe current draw. If the reading is zero amps, check for loose solder connection at feed terminal or loose splice joints. If reading is 1 to 1.5 amps, check for open armature, sticking brushes, or loose splice joint. If reading is 11 amps, check for broken gear, seized shaft, or some other condition that will stall the wiper.

If wiper motor will not shut off, this condition may exist if wiper motor has one or both speeds. If wiper motor has both speeds, check for park switch contacts not opening or internal wiper motor lead that connects to wiper terminal 1 being grounded. If wiper motor has low speed only, check for grounding of internal wiper motor lead that connects to wiper terminal 3 and check shunt field coil for grounding. If wiper motor has high speed only, check for open in internal wiper motor lead that connects to wiper terminal 3 and check for shunt field open circuit.

If wiper crank arm does not return to park position when wiper motor is turned off, check for dirty, bent, or broken park switch contacts.

If wiper speed is normal in low, but too excessive in high speed, check for open circuit in the 20-ohm resistor on back of wiper terminal board.

If wiper motor operates erratically, check for sticky brushes or loose splice joints.

If the wiper motor will not shut off or wiper crank arm fails to stop in park position when jumper wire is removed from ground 1, check that park switch contacts are opening. Also check for ground in internal motor lead that connects to terminal 3.

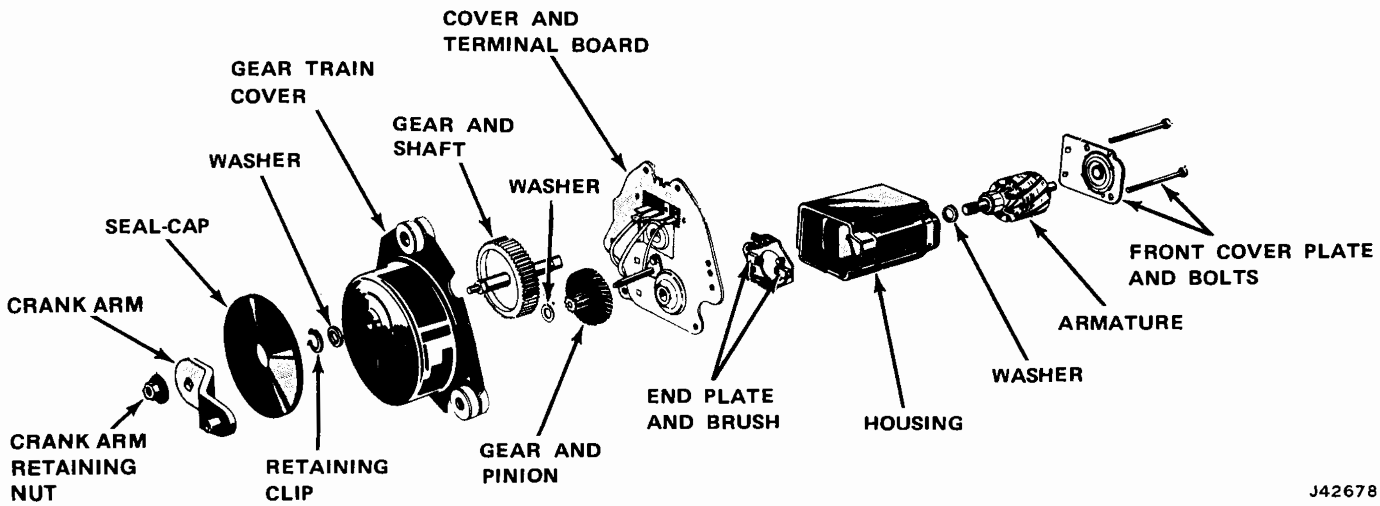


Fig. 17-15 Two-Speed Wiper Motor—Cherokee-Wagoneer-Truck

WIPER MOTOR

CJ Models

Removal With Crash Pad

NOTE: *Without crash pad, remove wiper motor cover.*

(1) Remove necessary top components from windshield frame.
(2) Remove right and left windshield holddown knobs and fold windshield down.
(3) Remove left access hole cover.
(4) Disconnect drive link from left wiper pivot.
(5) Disconnect wiper motor wire harness from switch.
(6) Remove attaching screws and remove wiper motor.

Installation With Crash Pad

(1) Position wiper motor on windshield frame and install attaching screws.
(2) Connect wiper motor wire harness to switch.
(3) Connect drive link to left wiper pivot.
(4) Install left access hole cover.
(5) Raise windshield to upright position and install right and left windshield holddown knobs.
(6) Install necessary top components on windshield frame.

Cherokee-Wagoneer-Truck

Removal

(1) Disconnect wiper drive link from crank under instrument panel.
(2) Disconnect motor wires at motor under hood.
(3) Remove motor-to-dash mounting screws and remove motor.

Disassembly

Refer to figure 17-15.
(1) Clamp crank arm in vise and loosen crank arm retaining nut.
(2) Remove seal cap, retaining ring, and end plate washer. Seal cap should be cleaned and repacked with a waterproof grease before assembly.
(3) Punch out the gear box cover retaining rivets and remove cover from gear train. Mark ground strap location for assembly purposes.
(4) Remove output gear and shaft, then slide intermediate gear and pinion off shaft.

Assembly

(1) When assembling the gear box cover, be sure cover is located properly over locating dowel pins.
(2) Also be sure to install ground strap.
(3) When assembling the crank arm, operate wiper to park position and install crank arm on output shaft so that identification marks line up with those in cover.
(4) Clamp crank in vise before securing retaining nut.

Installation

(1) Position motor on dash and install mounting screws.
(2) Connect motor wires to motor.
(3) Connect wiper drive link to motor crank.

WIPER PIVOT SHAFT AND LINKAGE

CJ Models

Removal

(1) Remove right and left wiper arms.
(2) Remove nuts attaching pivots to windshield frame.
(3) Remove necessary top components from windshield frame.
(4) Remove right and left windshield holddown knobs and fold windshield down.
(5) Remove right and left access hole covers.
(6) Disconnect wiper motor drive link from left wiper pivot.
(7) Remove wiper pivot shafts and linkage from access hole.

Installation

(1) Install wiper pivot shafts and linkage in windshield frame.
(2) Connect wiper motor drive link to left wiper pivot.
(3) Install right and left access hole covers.
(4) Raise windshield to upright position and install right and left windshield holddown knobs.
(5) Install nuts attaching pivots to windshield frame.
(6) Install right and left wiper arms.
(7) Install necessary top components on windshield frame.

Cherokee-Wagoneer-Truck

Removal

(1) Remove wiper arms, pivot shaft nuts, washers, escutcheons, and gaskets.
(2) Disconnect drive arm from motor crank.

(3) Remove individual links where necessary to remove pivot shaft bodies without excessive interference.

Installation

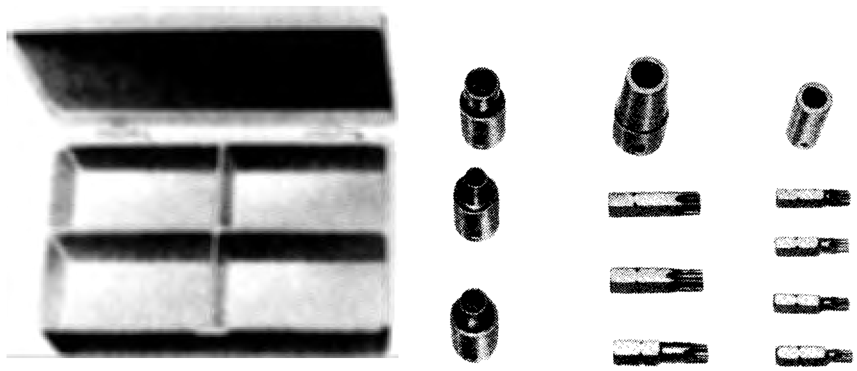
(1) Install wiper pivot shafts and linakge.

(2) Connect drive arm to motor crank.

(3) Install gaskets, escutcheons, washers, pivot shaft nuts, and wiper arms.

WASHER PUMP

The electric washer pump assembly is mounted in the water reservoir. The impeller motor case is grounded to the body sheet metal by a black ground wire. It is energized by a yellow feed wire from the single blade terminal on the control switch.



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J-25359 TORX BIT AND SOCKET SET

Special Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

INSTRUMENT PANEL AND MOUNTED ASSEMBLIES

GENERAL

All instrument panels are of formed sheet metal construction and are reinforced with braces and fastened to adjacent body panels with bolts.

A vinyl-covered polyurethane crash pad is attached to the instrument panel on all Cherokee, Wagoneer, and Truck models (fig. 18-1). A crash pad is also available for CJ models and is attached to the instrument panel (fig. 18-2).

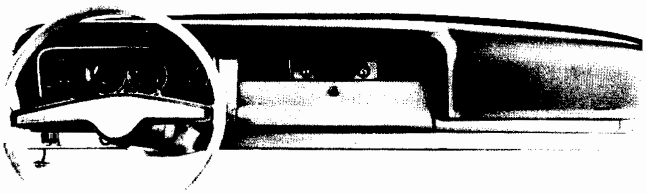


Fig. 18-1 Instrument Panel—Wagoneer and Truck Shown (Cherokee Similar)

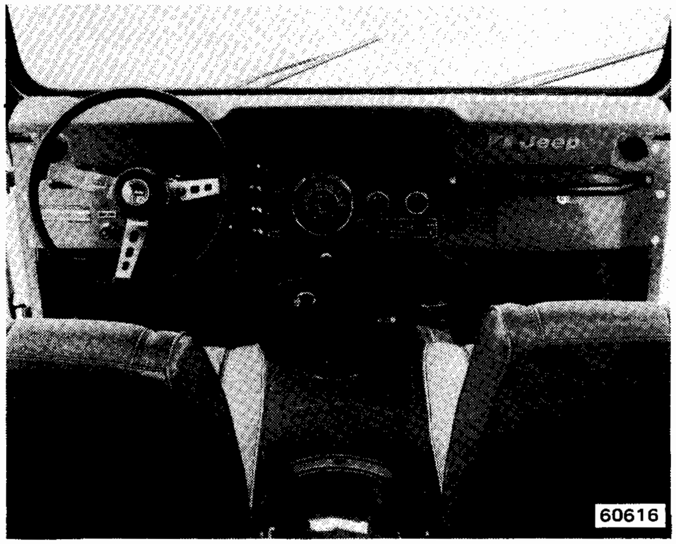


Fig. 18-2 Instrument Panel—CJ Models

INSTRUMENT CLUSTER

CJ Models

Removal

(1) Disconnect battery negative cable.
(2) Disconnect speedometer cable.
(3) Remove radio (if equipped) and voltmeter.
(4) Remove cluster attaching nuts and remove cluster.
(5) Mark bulb and wire connectors, and disconnect cluster electrical connectors and lights.

Installation

(1) Connect cluster lights and electrical connectors.
(2) Position cluster on instrument panel and install attaching screws.
(3) Install voltmeter and radio (if equipped).
(4) Connect speedometer cable.
(5) Connect battery negative cable.

Cherokee-Wagoneer-Truck

Removal

(1) Disconnect battery negative cable.
(2) Disconnect speedometer cable.
(3) Cover steering column to prevent damaging paint.
(4) Remove cluster attaching screws and tilt top of cluster toward interior of vehicle.
(5) Mark electrical connectors and hoses, and disconnect electrical connectors and heater vacuum hoses.
(6) Disconnect blend air door control cable.
(7) Remove cluster.

Installation

(1) Position cluster on instrument panel.
(2) Connect blend air door control cable.
(3) Connect electrical connectors and heater vacuum hoses.
(4) Install cluster attaching screws.
(5) Connect speedometer cable.
(6) Connect battery negative cable.
(7) Remove covering on steering column.
(8) Check heater and gauge operation.

INSTRUMENT PANEL

CJ Models

Removal

(1) Disconnect battery negative cable.

(2) Remove screws attaching steering column bezel to instrument panel. Remove bezel.

(3) Disconnect emergency brake bracket from instrument panel.

(4) Disconnect speedometer cable.

(5) Disconnect heater control cables from heater.

(6) Remove windshield clamp knobs and brackets.

(7) Remove crash pad, if equipped.

(a) If equipped with a soft top, unsnap top snaps at windshield corners, unfasten straps at center and sides of front top support, lay top support back to rear and release top from header retainer.

(b) If equipped with a molded top, remove hardware attaching molded top to windshield and rear quarter panels and support top with wood (fig. 18-3).

(c) Fold windshield down onto hood.

(d) Remove screws attaching crash pad and crash pad.

(8) Disconnect all electrical connections.

(9) Remove steering wheel (refer to Section 11).

(10) Remove turn signal lever (refer to Section 11).

(11) Remove automatic transmission shift lever, if equipped.

(a) Place automatic transmission shift lever in Park.

(b) Drive out roll pin attaching shift lever to shift bowl and remove shift lever.

(12) Remove instrument panel-to-dash panel attaching screws and remove instrument panel.

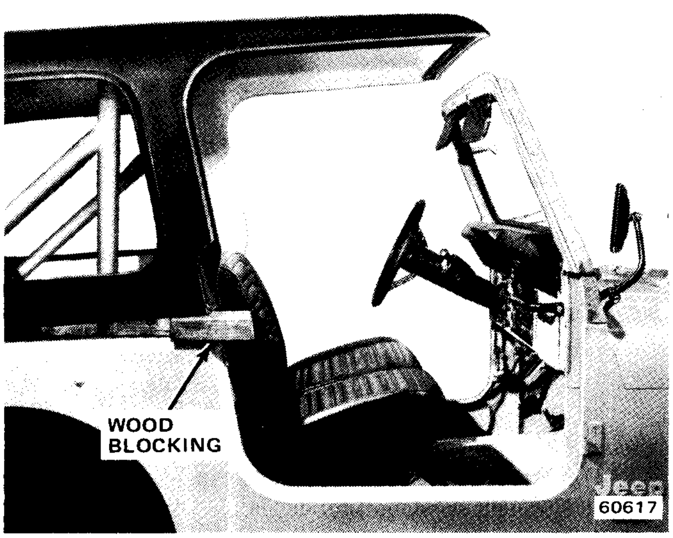


Fig. 18-3 Molded Top Suppported with Wood

Installation

(1) Position instrument panel in vehicle and install attaching screws.

(2) Install automatic transmission shift lever, if equipped. Insert shift lever in shift bowl and install roll pin.

(3) Install turn signal lever (refer to Section 11).

(4) Install steering wheel (refer to Section 11).

(5) Connect all electrical connections.

(6) Install crash pad, if equipped.

(a) Position crash pad on instrument panel and install attaching screws.

(b) Raise windshield to upright position.

(c) If equipped with a molded top, remove wood blocking supporting top and lower top onto body and windshield. Install hardware attaching top to windshield and rear quarter panels.

(d) If equipped with a soft top, engage top with header retainer, position top support in upright position and fasten center and side straps, and snap top snaps at windshield corners.

(7) Install windshield brackets and clamp knobs.

(8) Connect heater control cables to heater.

(9) Connect speedometer cable.

(10) Install emergency brake bracket to instrument panel.

(11) Position steering column bezel on instrument panel and install attaching screws.

(12) Connect battery negative cable.

Cherokee-Wagoneer-Truck

Removal

(1) Disconnect battery negative cable.

(2) Remove instrument panel crash pad.

(3) Remove evaporator assembly and ducts, if equipped with air conditioning.

(4) Remove instrument cluster.

(5) Remove radio (if equipped).

(6) Remove parking brake lever assembly.

(7) Remove air vent cables.

(8) Disconnect electrical connectors and remove courtesy lights.

(9) Disconnect defroster hoses.

(10) Remove steering column trim panel.

(11) Lower steering column and remove bolt from center of brace.

(12) Remove instrument panel attaching bolts and remove panel.

Installation

(1) Position instrument panel and dash panel and install attaching bolts.

(2) Raise steering column and install bolt in center of brace.

(3) Install steering column trim panel.

(4) Connect defroster hoses.

(5) Connect electrical connectors and courtesy lights.
(6) Install air vent cables.
(7) Install parking brake lever assembly.
(8) Install instrument cluster.
(9) Install radio (if removed).
(10) Install evaporator assembly and ducts (if removed).
(11) Install instrument panel crash pad.
(12) Connect battery negative cable.

CRASH PAD

CJ Models

Removal

(1) If equipped with a soft top, unsnap top snaps at windshield corners, unfasten straps at center and sides of front top support, lay top support back to rear and release top from header retainer.
(2) If equipped with a molded top, remove hardware attaching molded top to windshield and rear quarter panels and support molded top with wood (fig. 18-3).
(3) Remove windshield clamp knobs and fold windshield down onto hood.
(4) Remove screws attaching crash pad and remove crash pad.

Installation

(1) Position crash pad on instrument panel and install attaching screws.
(2) Raise windshield to upright position and install clamp knobs.
(3) If equipped with a molded top, remove wood blocking supporting top and lower top onto body and windshield. Install hardware attaching top to windshield and rear quarter panels.
(4) If equipped with a soft top, engage top with header retainer, position top support in upright position and fasten center and side straps, and snap top snaps at windshield corner.

Cherokee-Wagoneer-Truck

Removal

(1) Remove windshield and windshield weatherstrip to expose crash pad retaining screws at base of windshield (refer to Windshield Removal—Section 17).
(2) Remove instrument cluster.
(3) Remove glove box.
(4) Remove ashtray and retainer.
(5) Remove radio.
(6) Remove crash pad-to-instrument panel attaching screws and nuts.

NOTE: *The nuts are accessible through the cluster, ash receiver, and glove box openings.*

Installation

(1) Position crash pad on instrument panel.
(2) Install attaching screws and nuts.
(3) Install radio.
(4) Install ashtray and retainer.
(5) Install glove box.
(6) Install instrument cluster.
(7) Install windshield weatherstrip and windshield (refer to Windshield Installation—Section 17).

GLOVE BOX ASSEMBLY

CJ Models

Glove Box Removal

(1) Remove glove-box-to-instrument-panel attaching screws.
(2) Remove striker.
(3) Compress glove box at the crease lines and remove box through opening.

Glove Box Installation

(1) Compress glove box at the crease lines and insert box in opening.
(2) Install glove-box-to-instrument-panel attaching screws.
(3) Install and adjust striker.

Glove Box Door and Hinge Removal

The glove box door hinge mounting holes are elongated to provide adjustment. The hinge screws may be loosened and the door moved in the desired direction to fit the door opening.
(1) Remove hinge-to-instrument-panel attaching screws.
(2) Remove door and hinge assembly.

Glove Box Door and Hinge Installation

(1) Position door and hinge assembly on instrument panel.
(2) Install hinge-to-instrument-panel attaching screws.
(3) Adjust door.

Glove Box Door Lock Striker Adjustment

The glove box door lock striker is attached to the instrument panel opening with sheet metal screws. The striker can be moved in or out for door closing adjustment.

Cherokee-Wagoneer-Truck

Glove Box Removal

(1) Remove glove-box-to-instrument-panel attaching screws.
(2) Remove striker.
(3) Remove lockout control switch (if equipped).
(4) Move glove box down and out from rear of instrument panel.

NOTE: *On vehicles equipped with air conditioning, compress the glove box at the crease lines and remove box through opening.*

Glove Box Installation

(1) Position glove box in glove box opening.
(2) Install glove-box-to-instrument-panel attaching screws.
(3) Install lockout control switch (if removed).
(4) Install and adjust striker.

Glove Box Door and Hinge Removal

The glove box door hinge mounting holes are elongated to provide adjustment. The hinge screws may be loosened and the door moved in the desired direction to fit the door opening.

(1) Remove hinge-to-instrument panel attaching screws.

NOTE: *On vehicles equipped with air conditioning, the evaporator housing must be lowered to obtain access to the hinge-to-instrument panel attaching screws.*

(2) Remove door-to-hinge attaching screws.
(3) Remove hinges and glove box door.

Glove Box Door and Hinge Installation

(1) Position hinges on instrument panel and install attaching screws.
(2) Install door-to-hinge attaching screws.
(3) Adjust door.

Glove Box Door Lock Striker Adjustment

The glove box door lock striker is attached to the instrument panel opening with sheet metal screws. The striker can be moved in or out for door closing adjustment.

Glove Box Lock Cylinder Replacement

The glove box lock assembly is inserted through the glove box door from the outside. The assembly is held in place by a screw through the lock clamp cup and into the lock case.

(1) Insert key in lock and rotate cylinder counterclockwise to expose the tumblers.
(2) Remove key and press retainer tumbler down.
(3) Insert key and remove lock cylinder.
(4) If replacement lock cylinder is being installed, insert original key into replacement cylinder and file tumblers flush with cylinder. Stake tumblers into cylinder.
(5) Press retainer tumbler down on lock cylinder and insert key in cylinder.
(6) Insert cylinder into lock case.
(7) Hold cylinder in place and remove key.

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

SEAT ASSEMBLIES AND ADJUSTERS

GENERAL

Front Bucket Seats

Bucket seats are standard on the Cherokee and CJ and optional on the Wagoneer and Truck models. The passenger side bucket seat, except CJ, is adjustable fore and aft and has a forward tilting seat back, except Wagoneer, which permits access to the rear seat on Cherokee models and, on Truck models, provides better access to the tool storage area behind the seats. A new 4-bar design for passenger side bucket seat on CJ models allows the whole seat to move forward for easier entry to the rear area.

The fore-and-aft seat adjuster mechanism for Cherokees, Wagoneers and Trucks has a turnbuckle to allow for slight dimensional variances during production assembly of seats and seat support components. The turnbuckle permits the seat sliding and latching components to be adjusted for trouble-free operation. Adjustment of the turnbuckle is covered in this section.

Rear Seat Assemblies

Cherokee cargo area and rear seat mounting are identical to Wagoneer. The rear seats are mounted to the floorpan with hinges to allow folding the seat forward. They are fastened with latches at the wheel house during normal operation.

Seat Belts

Seat belts on CJ, Cherokee, Wagoneer, and Truck models are equipped with clip on retractors. All seat belts utilize quick-release buckle latches. Cherokee and Wagoneer models are equipped with three sets of rear seat belts; the two outboard seat belt retractors are anchored on the wheel housings.

FRONT SEAT ASSEMBLY SERVICE

Adjustment

All driver seats and all passenger seats, except CJ models, are horizontally adjustable by means of a control lever located under the right-hand front corner of the seat.

The front seat frame attaches to the seat tracks and the seat tracks, in turn, attach to brackets which are bolted to the floor. Spring-release locks are mounted on the seat tracks and positioned so the lock stop will fall into one of the notches on the flange of the track. The locks are released by moving the front seat adjustment lever arm.

Adjustment—Cherokee-Wagoneer-Truck

(1) Locate turnbuckle under the bench seat (fig. 19-1). Loosen turnbuckle wingnut.

(2) Tighten turnbuckle until slack is removed from wire.

(3) Back off turnbuckle three turns.

(4) Secure wingnut up against turnbuckle.

(5) Check for proper seat adjustment operation. If right side of seat will not release, increase tension by tightening turnbuckle. If right side of seat will not lock in place, decrease tension by loosening turnbuckle.

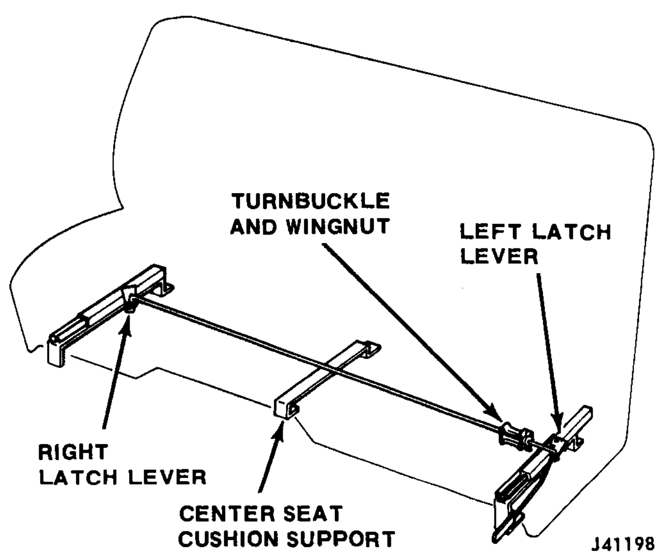


Fig. 19-1 Front Seat Adjustment—Typical

Forward Tilting Seat Back Replacement—Cherokee and Truck

(1) If equipped with center arm rest, remove bucket seat from vehicle.

(2) Remove screw attaching side wing panel-to-hockey stick using Torx Bit Tool J-25359.

(3) Remove screws attaching hockey sticks to bottom frame using Torx Bit Tool J-25359.

(4) Remove seat back.

(5) Position seat back on bottom frame and install screws attaching hockey sticks to bottom frame using Torx Bit Tool J-25359.

(6) Position side wing panel on outboard hockey stick and install attaching screw using Torx Bit Tool J-25359.

(7) Install bucket seat in vehicle, if removed.

Tilt Lock Pawl Assembly

Removal

(1) Remove forward tilting seat back.

(2) Remove screw attaching release handle-to-latching rod using Torx Bit Tool J-25359. Remove handle.

(3) Remove screws attaching plastic bumpers using Torx Bit Tool J-25359. Remove bumpers.

(4) Unzip upholstery and pull back.

(5) Remove spring retainers attaching latching rod (fig. 19-2).

(6) Remove rod, pawl, and spring from seat.

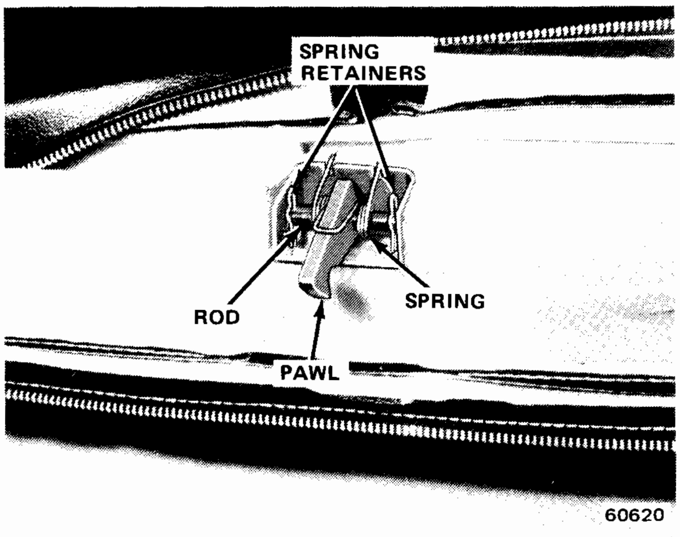


Fig. 19-2 Tilt Lock Pawl Assembly

Installation

(1) Position pawl and spring in seat and install latching rod.

(2) Install spring retainers attaching latching rod to seat.

(3) Pull upholstery over pad, zip up and tuck end of zipper under upholstery.

(4) Position plastic bumpers on seat and install attaching screws using Torx Bit Tool J-25359.

(5) Position release handle on latching rod and install attaching screw using Torx Bit Tool J-25359.

(6) Install forward tilting seat back.

Front Seat Removal

To remove the front seat, bucket or bench, remove the bolts, lockwashers, or nuts that attach the front seat support brackets to the floorpan.

REAR SEAT ASSEMBLIES

CJ Models

The rear seat is of one-piece construction and is mounted by bolts to two brackets which, in turn, are secured to the floor of the vehicle by bolts.

All seats are of spring design and utilize padding and foam rubber in their construction.

Cherokee and Wagoneer

The full width rear seat is assembled to the body floor by two hinges to allow the seat to be folded to provide maximum rear cargo loading space (fig. 19-3).

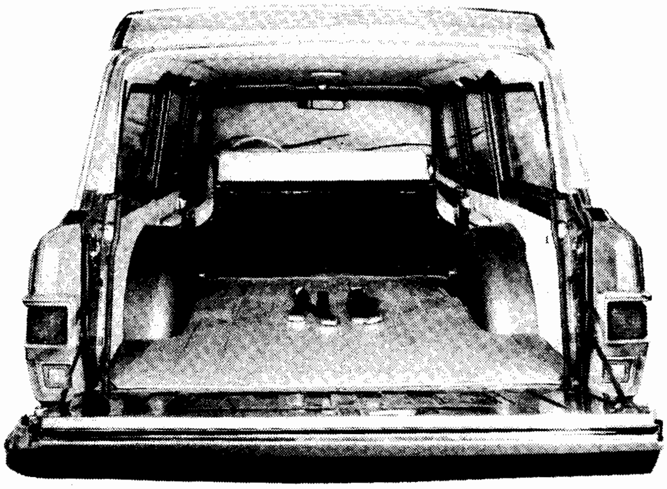


Fig. 19-3 Maximum Rear Cargo Area

A latch on each side of the rear seat back engages a striker bolted into cage nuts on the rear wheelhouse panels. The cage nuts allow movement for striker adjustment.

To tilt the seat back forward, release the latch on the right side by raising the latch lever (fig. 19-4) and simultaneously pulling the seat back forward.

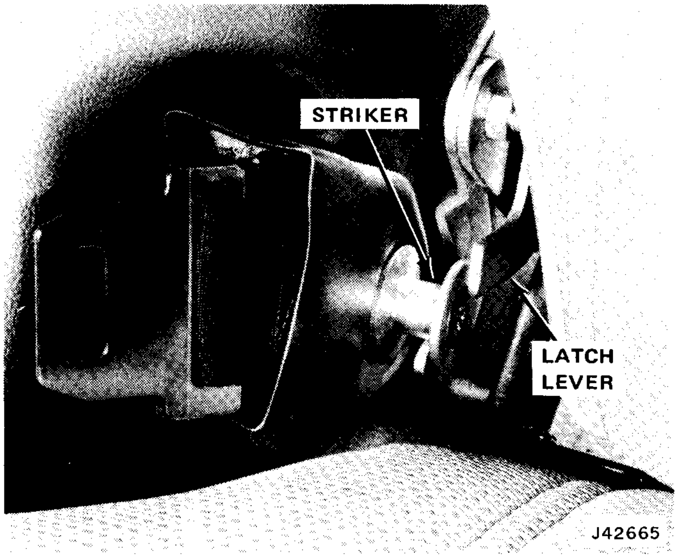


Fig. 19-4 Rear Folding Seat—Latched Position

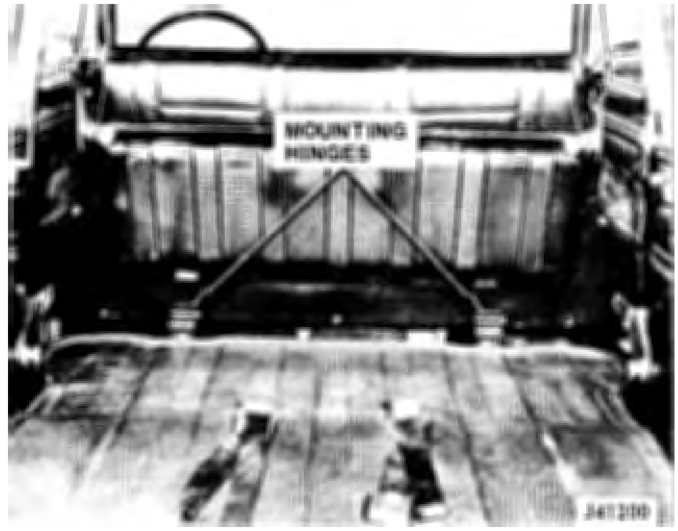


Fig. 19-5 Rear Seat Assembly

A rear seat holding strap, attached to the door pillar, prevents the seat from falling backward when the seat is in the folded position. An eye on the strap is engaged with the latch to prevent the seat from falling backward. The strap always should be connected to the seat whenever the seat is in the folded position.

Adjustment

(1) Tilt seat back forward and loosen striker bolt to allow forced movement of striker.
(2) Raise seat back to upright position and tap striker into position for maximum latch/striker engagement.
(3) Unlatch seat back carefully so as not to change striker position and tighten striker securely.
(4) Check striker/latch operation.

REAR SEAT ASSEMBLY SERVICE

CJ Models

Removal

(1) Remove bolts attaching rear seat assembly to floorpan.
(2) Remove rear seat assembly from vehicle.

Installation

(1) Position rear seat assembly in vehicle.
(2) Install bolts attaching rear seat assembly to floorpan.

Cherokee and Wagoneer

Removal

(1) Release latch at lower right side of seat back. Raise complete seat assembly forward (fig. 19-5).
(2) Lift complete seat assembly from two floor mounting hinges.
(3) Remove seat assembly from vehicle.

Installation

(1) Install seat assembly onto hinges.
(2) Position seat back in proper location.
(3) Secure seat back latch.

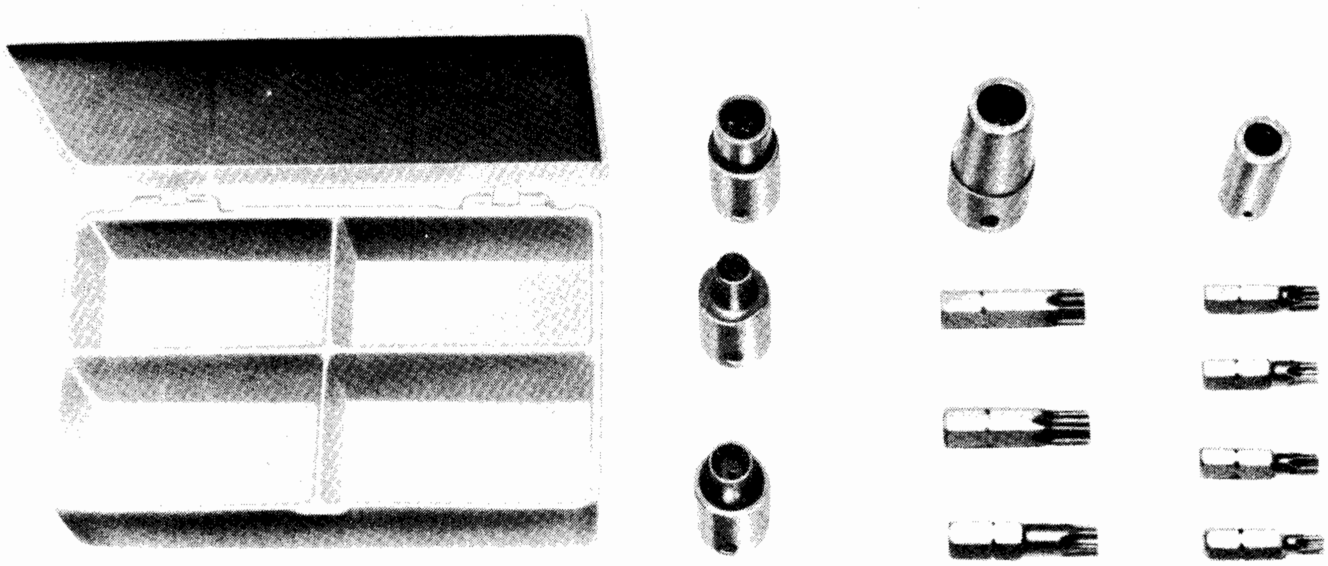
SEAT BELTS

Removal

(1) Remove seat belt anchor bolt with Torx Bit Tool J-25359.
(2) Remove seat belt.
(3) Obtain access to seat belt retractor removing trim covers.
(4) Remove seat belt retractor anchor bolts with Torx Bit Tool J-25359.
(5) Remove seat belt retractor.
(6) Inspect seat belt material for evidence of wear, cuts, or fraying. Replace as required.

Installation

(1) Install seat belt and seat belt retractor anchor bolts. Tighten to 25 to 35 foot-pounds torque.
(2) Replace seat belt retractor trim cover.



J-25359 TORX BIT AND SOCKET SET

50420

Special Tools

TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

HEADLINING—MOLDED TOP—EXTERIOR DECALS AND OVERLAYS

HEADLINING

GENERAL

The headlining used in Cherokee, Wagoneer, and Truck models is made of laminated polystyrene backing board which is finished, depending on the model, with either a plastic coating or a soft vinyl covering. Lines scored into the backing board allow the headlining to be shaped to fit the contour of the roof while providing added strength for self-support.

CHEROKEE-WAGONEER

Removal

(1) Remove sun visors, escutcheons, and center support.

(2) Remove windshield moulding and end caps.

(3) Remove rear opening moulding and end caps.

(4) Remove plastic trim strip and end cap retainers.

(5) Remove lens from dome lamp and cargo lamp (if equipped). Remove screws securing lamp to roof bows.

(6) Remove coat hooks.

(7) Free rear headlining from J-moulding by pulling down carefully at the center, while pushing up on either outside edge.

(8) Push cargo lamp (if equipped) through die-cut opening in headlining.

(9) Remove rear headlining through tailgate opening.

(10) Free front headlining from J-moulding by pulling down carefully at the center, while pushing up on outside edges.

(11) Remove front headlining through tailgate opening.

Installation

(1) Position front headlining in vehicle and insert left side into J-moulding.

(2) Pull dome lamp through die-cut opening in headlining and align front headlining to vehicle roof.

(3) Pull down carefully at center of front headlining and insert right side of headlining into J-moulding.

(4) Position rear headlining in vehicle and insert left side into J-moulding.

(5) Pull cargo lamp (if equipped) through die-cut opening in rear headlining and align rear headlining to vehicle roof.

(6) Pull down carefully at center of rear headlining while pushing up on right edge, and insert right side of headlining into J-moulding.

(7) Check alignment of front headlining using sun visor and dome lamp holes and leading edge of headlining as guide. Adjust fore or aft as required.

(8) Check alignment of rear headlining using the trailing edge as a guide. Adjust fore or aft as required.

(9) Secure dome lamp (if equipped) and cargo lamp (if equipped) to roof bows and install lamp lenses.

(10) Install plastic trim strip and end cap retainers.

(11) Install coat hooks.

(12) Install rear opening moulding and end caps.

(13) Install windshield moulding and end caps.

(14) Install escutcheons, sun visors, and center support.

TRUCK

Removal

(1) Remove sun visors and center support.

(2) Remove lens from dome lamp. Remove screws securing dome lamp to rear window panel.

(3) Remove windshield moulding and end caps.

(4) Pull down carefully at center of headlining while pushing up on outside edges to disengage headlining from J-moulding.

(5) Push dome lamp through die-cut opening in headlining.

(6) Remove headlining from vehicle.

Installation

(1) Position headlining in vehicle and insert left side into J-mouldings.

(2) Pull dome lamp through die-cut opening and align headling to vehicle roof.

(3) Pull down carefully at center of headlining while pushing up on right edge, and insert right side of headlining into J-moulding.

(4) Check alignment of the headlining using the sun visor and dome lamp holes and headlining leading edge as guides. Adjust fore and aft as necessary.

(5) Secure dome lamp to rear window panel and install dome lamp lens.

(6) Install windshield moulding and end cap.

(7) Install sun visors and center support.

MOLDED TOP AND LIFTGATE

GENERAL

A new lightweight, removable molded top is available for the CJ-7. The top is constructed of injection molded polycarbonate (a high quality foamed plastic material). The molded top and steel liftgate are painted with a special spatter finish enamel.

MOLDED TOP

Removal

(1) Remove screws and washers attaching molded top to windshield frame.

(2) Remove nuts, washers, and screws attaching molded top to rear quarter panels.

(3) Remove molded top from vehicle.

CAUTION: *When removing molded top, avoid damaging foam sealer installed between the molded top and rear quarter panels.*

Installation

(1) Inspect tubular windshield seal, bonded to molded top, for damage. Replace if necessary.

(2) Carefully position molded top on vehicle.

CAUTION: *When installing the molded top, avoid damaging foam sealer installed between the molded top and rear quarter panels.*

(3) Install screws, washers, and nuts attaching molded top to rear quarter panels.

(4) Install screws and washers attaching molded top to windshield frame.

PAINT REPAIR KITS

Paint repair kits are available from National Parts Distribution Centers in black or white. The paint repair kits consist of:

- One quart spatter enamel
- One quart sealer coat
- One pint catalyst
- One quart reducer (methyl-ethyl-ketone)

NOTE: *Methyl-ethyl-ketone (MEK) is usually available from chemical houses listed under SOLVENTS in the Yellow Pages. If not available locally in small quantities, the solvent may be obtained from mail order chemical houses such as E. H. Sargent & Co. and Fisher Scientific,* which have sales-service centers through the country.*

**This is not a complete list, nor is it a recommendation for the exclusive use of the chemical houses listed.*

LIFTGATE

Adjustment

(1) Open liftgate, support to prevent closing, and remove lockpins (fig. 20-1) from liftgate support attaching screws.

(2) Remove screws attaching supports to liftgate and fold supports downward.

WARNING: *To prevent injury or damage, never remove supports when liftgate is closed. The supports are under spring tension.*

(3) Remove screws, using Torx Bit Tool J-25359, attaching latches to liftgate.

NOTE: *Do not disconnect remote control cables from latches.*

(4) Loosen screws, using Torx Bit Tool J-25359, attaching hinges (fig. 20-2).

(5) Close liftgate and shift liftgate to obtain desired gap (side-to-side).

(6) Open liftgate and tighten hinge-to-liftgate screws using Torx Bit Tool J-25359.

(7) Position latches on liftgate and install attaching screws using Torx Bit Tool J-25359.

(8) Position supports on liftgate and install attaching screws.

(9) Install lockpins on support attaching screws.

Strikers

The strikers provide durable retention points for the latches and prevent movement of the liftgate. Latches may be moved in or out to compensate for body and molded top variations. Use Torx Bit Tool J-25359 for removal.

Removal

(1) Open liftgate, support to prevent closing, and remove lockpins from liftgate support attaching screws.

(2) Remove screws attaching supports to liftgate and fold supports downward.

WARNING: *To prevent injury or damage, never remove supports when liftgate is closed. The supports are under spring tension.*

(3) Remove screws, using Torx Bit Tool J-25359, attaching hinges to liftgate and remove liftgate.

Installation

(1) Position liftgate on hinges and install hinge-to-liftgate attacing screws using Torx Bit Tool J-25359.

(2) Position supports on liftgate and install attaching screws.

(3) Install lockpins on support attaching screws.

Rubber Sealer

The liftgate rubber sealer is made of molded latex foam with a smooth rubber skin on the outside.

Plastic retainers are used to retain the rubber sealer to the liftgate. Barbs on the retainers depress when inserted in the holes and spread when fully inserted.

Maintenance of Rubber Sealers

Cold weather may cause the rubber sealer to harden and lose resiliency. This may cause the liftgate to loosen in its opening, resulting in noise. When servicing, use a dampened cloth to clean rubber sealer. Clean dirt from all points where rubber sealer contacts the molded top and tailgate. Apply AMC Silicone Lubricant or equivalent to rubber sealer.

CAUTION: *Do not use graphite, brake fluid, or wax on rubber sealer.*

Replacement

Replacement rubber sealers are coated with powder to prevent stickiness in storage. Remove all powder with a dampened cloth before installation.

(1) Carefully remove rubber sealer from liftgate, using needlenose pliers to remove plastic retainers from liftgate panel holes.

(2) Remove dust and dirt from rubber sealer, liftgate, and molded top.

(3) Install lower corner of sealer to liftgate first.

(4) Press retainers, starting at lower edge of liftgate, into liftgate panel holes.

Hinge Replacement

(1) Open liftgate, support to prevent closing, and remove lockpins from liftgate support attaching screws.

(2) Remove screws attaching supports to liftgate and fold supports downward.

WARNING: *To prevent injury or damage, never remove supports when liftgate is closed. The supports are under spring tension.*

(3) Remove screws, using Torx Bit Tool J-25359, attaching hinge to liftgate.

(4) Remove screws, using Torx Bit Tool J-25359, attaching reinforcement to molded top. Remove reinforcement and sealer from molded top.

(5) Remove nuts and washers attaching hinge to molded top. Remove hinge and sealer.

(6) Clean replacement hinge in a suitable solvent and blow dry with compressed air.

(7) Color-coat hinge to match molded top.

(8) Lubricate hinge with Lubriplate or equivalent.

(9) Position hinge on molded top and install attaching washers and nuts.

(10) Position reinforcement on molded top and install attaching screws using Torx Bit Tool J-25359.

(11) Seal hinge and reinforcement using white or black 3M Strip-Calk or equivalent to match molded top.

(12) Position liftgate on hinge and install hinge-to-liftgate attaching screws using Torx Bit Tool J-25359.

(13) Position supports on liftgate and install attaching screws.

(14) Install lockpins on support attaching screws.

Support Replacement

(1) Open liftgate, support to prevent closing, and remove lockpins from support attaching screws.

(2) Remove screws attaching supports and remove supports.

(3) Install supports and attaching screws.

(4) Install lockpins on support attaching screws.

Latch Replacement

(1) Loosen screw attaching remove control cable to latch. Disconnect cable from screw.

(2) Remove screws attaching latch (fig. 20-1) to liftgate using Torx Bit Tool J-25359. Remove latch.

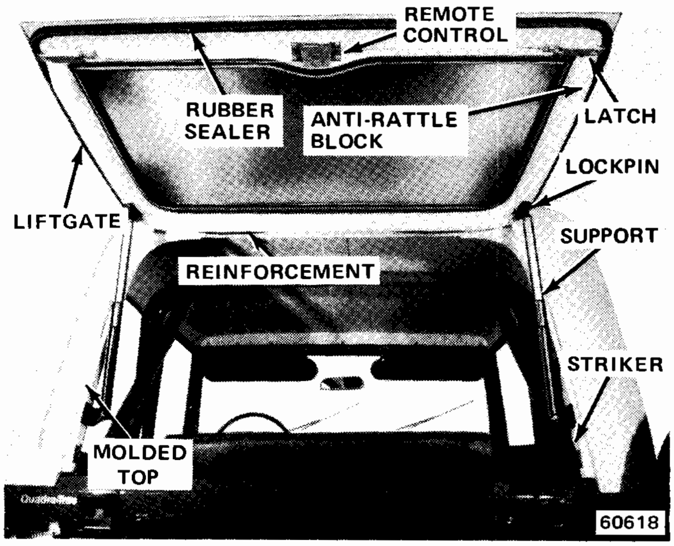


Fig. 20-1 Liftgate Interior Components

(3) Position latch on liftgate and install attaching screws using Torx Bit Tool J-25359.

(4) Connect remote control cable to latch screw and tighten screw.

Remote Control Replacement

(1) Loosen screws attaching remote control cables to latch. Disconnect cables from screws.

(2) Remove screws attaching remote control (fig. 20-1) to liftgate using Torx Bit Tool J-25359.

(3) Position remote control on liftgate and install attaching screws using Torx Bit Tool J-25359.

(4) Connect remote control cables to latch screws and tighten screws.

Outside Handle Replacement

(1) Remove screws attaching remote control to liftgate using Torx Bit Tool J-25359.

(2) Remove nuts attaching outside handle to liftgate and remove handle.

NOTE: *The replacement outside handle is furnished without the lock cylinder. The lock cylinder is furnished uncoded without keys.*

(3) Code existing door lock key to replacement cylinder.

(a) Insert key in replacement cylinder.

(b) File tumblers until flush with cylinder body.

(c) Remove and install key, and check that tumblers are flush with body.

(d) Install cylinder in replacement outside handle.

(4) Position outside handle in liftgate and install attaching nuts.

(5) Position remote control on liftgate and install attaching screws using Torx Bit Tool J-25359.

Rear Window Replacement

(1) Unlock rubber weatherstrip (fig. 20-2) using wood wand or fiber stick.

(2) Use fiber stick to break seal between glass and rubber weatherstrip.

(3) Push glass and weatherstrip toward outside of vehicle. Remove glass.

(4) Remove weatherstrip from liftgate opening.

(5) Inspect weatherstrip and clean off sealer from glass cavity and flange cavity.

NOTE: *Inspect for uneven surfaces or irregularities in the opening flange that could cause stress damage to the glass.*

(6) Before installing weatherstrip on flange, apply a 3/16-inch bead of 3M Auto Bedding and Glazing Compound or equivalent in weatherstrip flange cavity using a pressure-type applicator.

(7) Install weatherstrip on liftgate opening flange.

(8) Apply a liberal amount of liquid soap solution to glass cavity of weatherstrip.

(9) Position glass into upper glass cavity and into each side. Position wooden wand under glass and lift up and into lower cavity. Check for equal side clearance.

(10) Use wooden wand to lock weatherstrip.

NOTE: *Soap solution should be removed from the weatherstrip and glass before installing sealer.*

(11) Using a pressure-type applicator, apply 3M Windshield Sealer or equivalent between weatherstrip and glass on outside of glass around entire perimeter.

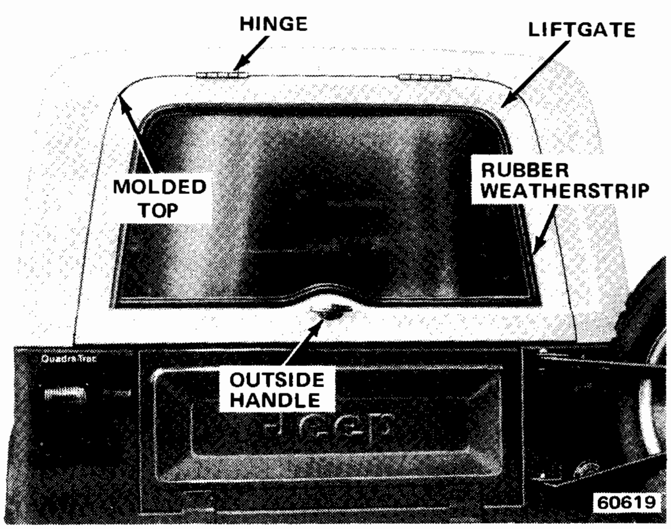


Fig. 20-2 Liftgate Exterior Components

EXTERIOR DECALS

GENERAL

Exterior decals are made from a tough, durable, weather-resistant, solid vinyl with a pressure-sensitive back. The pressure-sensitive back is protected by a paper backing which is easily peeled away upon installation. During shipment and storage the face is protected with an easy-release paper.

REPAIRS

Repair small nicks or scratches with touch-up paints mixed to blend with the affected area.

Repair blisters or air bubbles by piercing them with a sharp needle or pin. Work the trapped air out through the pin hole and press the decal firmly against the panel. It may be necessary to preheat the panel slightly to soften the adhesive. Heat also may be used to remove small wrinkles or irregularities.

PREPARATION

Workroom temperature should be between 65°F and 90°F. Decals should not be replaced in temperatures below 65°F.

The following equipment and materials are necessary to make a quality decal installation.

- Liquid detergent (Joy, Vel, or equivalent)
- Wax and silicone remover (3M Adhesive Cleaner, Acrylic-Clean, Prep-Sol, xylol, or equivalent)
- Isopropyl alcohol (rubbing alcohol)
- Squeegee—four to five inches wide (plastic or hard rubber)
- Water bucket and sponge
- 750 Degrees F heat gun with grounding adapter, or infrared heat bulb and extension cord
- Clean wiping rags or paper towels
- Sharp knife, single-edge razor blade, or Exacto knife
- Scissors
- Sharp needle or pin
- Grease pencil

REMOVAL

(1) Clean repair surfaces, adjacent panels, and openings as required.

(2) Remove decal overlapping parts from affected panel.

(3) Remove decal by starting at one edge and peeling it from painted surface. Apply heat to decal to facilitate removal.

NOTE: *Avoid using pointed or sharp tools as they may damage the painted surface.*

(4) Remove adhesive from painted surfaces by wiping area with a rag saturated with 3M Adhesive Cleaner, xylol or equivalent and then scraping with a squeegee.

NOTE: *Exercise care when using solvents because of possible damage to painted surfaces. To determine if solvent is harmful to body paint, test it on a hidden area of the vehicle.*

(5) Rinse thoroughly with clean water.

(6) Clean painted surface with wax and silicone remover (3M Adhesive Cleaner, Acrylic-Clean, Prep-Sol, or equivalent). Wipe surface with clean cloth and allow to dry.

NOTE: *Freshly painted surfaces must be thoroughly dry. Residual solvents in fresh paint may cause decal to blister.*

(7) Position decal on panel surface and mark position with grease pencil (fig. 20-3). Allow 1/2-inch overlap around door and fender areas. Cut decal to approximate length using scissors.

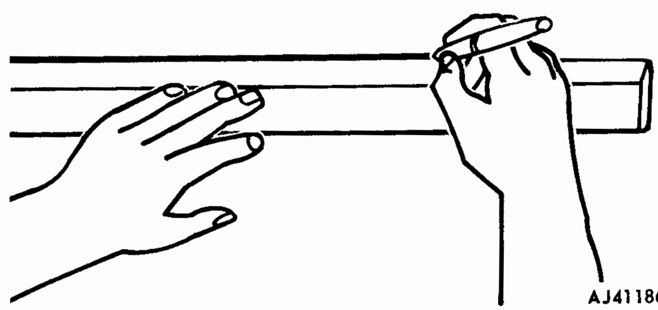


Fig. 20-3 Marking Decal Position

(8) Position decal on panel and hold in place with small strips of masking tape (fig. 20-4). Be sure decal is aligned with decal on adjacent panels.

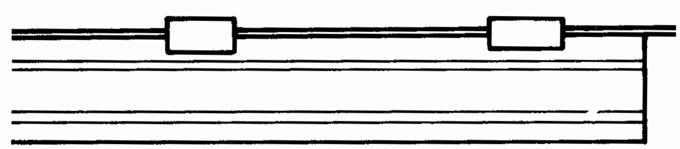


Fig. 20-4 Positioning Decal on Panel

(9) Swing decal up using strips of masking tape as hinges (fig. 20-5).

(10) Remove approximately six inches of paper backing from one end (fig. 20-6).

(11) Swing decal back down to aligned position. Squeegee decal to panel using firm strokes while removing remainder of paper backing (fig. 20-7).

NOTE: *To avoid pre-adhesion or stretching of the decal, do not remove more than six inches of paper backing at one time.*

(12) Where possible, extend decal 1/2 inch beyond corners or edges (fig. 20-8) and wrap firmly using finger pressure and squeegee. Avoid trapping air in these areas.

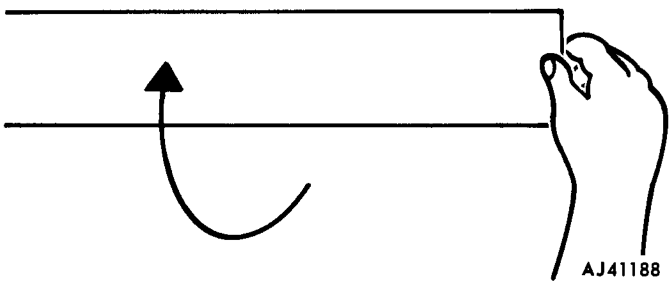


Fig. 20-5 Lifting Decal

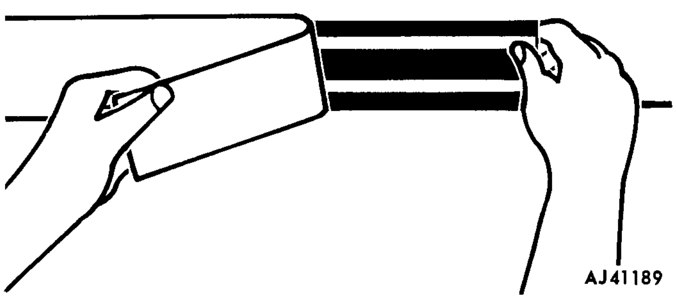


Fig. 20-6 Removing Backing Paper

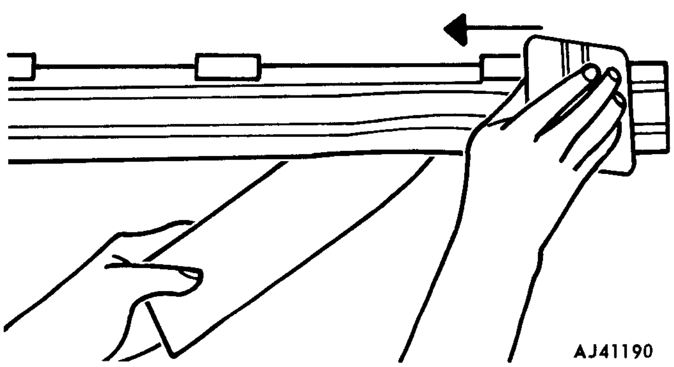


Fig. 20-7 Installing Decal with Squeegee

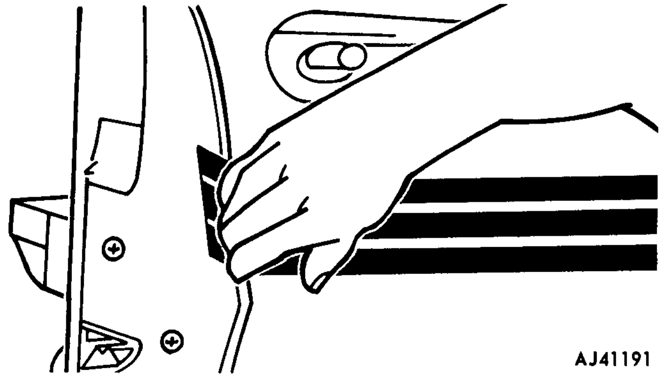


Fig. 20-8 Overlapping Decal at Corners or Edges

(13) Remove easy-release paper from face of decal (if applicable).

(14) Inspect decal installation using reflected light to detect any irregularities that may have developed during installation. Remove all air or moisture bubbles. Refer to Repair for the procedure.

(15) Install previously removed parts and clean vehicle as required.

Installation of Intricate Decals

For large intricately-shaped decals, the following procedure will simplify installation.

(1) The use of wetting solution assures a better bond between decal and painted surfaces. Prepare a supply of wetting solution by thoroughly mixing two or three teaspoons of detergent (Joy, Vel, or equivalent) in one gallon of water.

NOTE: *Too much detergent will reduce the effectiveness of the bond.* **Do not use soap.**

(2) Place decal on clean, flat surface with paper backing side up. Bend up a corner and separate edge of paper backing from decal. Hold decal firmly to the surface of a table and, in a smooth motion, remove entire paper backing. Under hot, humid conditions, a slight jerking motion will aid in removing the paper backing.

CAUTION: *Always remove the paper backing from the decal; never the decal from the backing, as possible film stretching may result. Hold decal in corners when removing paper backing as fingerprints will adversely affect adhesion.*

(3) Using clean sponge, apply ample wetting solution to decal adhesive and panel surface. The wetting solution permits ease of movement of decal while positioning it on panel surface.

(4) Immediately apply wetted decal to panel surface. Apply wetting solution to decorative face of decal to allow squeegee to slip during application.

(5) Squeegee a short section of decal at the center. Lift right or left side of decal, position it straight and close to panel, and squeegee toward lifted edge. Avoid stetching decal at lifted edge. Squeegee progressively from center with firm, overlapping strokes.

(a) Lift upper area of decal (up to bonded area) and, working upward from the bonded section at center, squeegee decal into place.

(b) Lift lower area of decal (up to bonded area) and, working downward from bonded section at center, squeegee decal into place.

NOTE: *If a wrinkle is trapped during sequeegee operations, stop immediately. Carefully lift affected section, align section to panel, and prgressively sequeegee decal into place.*

OVERLAYS

GENERAL

The opaque exterior woodgrain overlay panels are made of a tough, durable, weather-resistant, cast vinyl and have a pressure-sensitive back. The pressure-sensitive back is protected by a paper backing which is removed at installation. The simulated woodgrain is embedded in the cast vinyl for a longer lasting attractive appearance.

REPAIRS

Small nicks, bruises, or scratches can be touched up with paint in much the same manner as painted surfaces. Proper color match can be obtained by blending small amounts of appropriate paint colors, and then applying to the affected area of the overlay.

Repair blisters or air bubbles by piercing them with a sharp needle or pin. Work the trapped air out through the pin hole and press the overlay firmly against the panel. It may be necessary to preheat the panel slightly to soften the adhesive. Heat also may be applied to remove small wrinkles or irregularities.

PREPARATION

Workroom temperature should be between 65°F and 90°F. Overlays should not be replaced in temperatures below 65°F.

The following equipment and materials are necessary to make overlay installation.

- Liquid detergent (Joy, Vel, or equivalent)
- Wax and silicone remover (3M Adhesive Cleaner, Acrylic-Clean, Prep-Sol, xylol, or equivalent)
- Isopropyl alcohol (rubbing alcohol)
- Squeegee—four to five inches wide (plastic or hard rubber)
- Water bucket and sponge
- Sandpaper (No. 360 or 400, wet-or-dry type)
- 750°F heat gun with grounding adapter, or infrared heat bulb and extension cord
- Clean wiping rags or paper towels
- Sharp knife, single-edge razor blade, or Exacto knife
- Scissors
- Sharp needle or pin
- Grease pencil

Prepare supply of wetting solution by thoroughly mixing two to three teaspoons of detergent (Joy, Vel, or equivalent) in one gallon of water. The use of a wetting solution will provide a better bond between overlay and painted surface. Too much detergent will reduce the effectiveness of the bond. **Do not use soap.**

REMOVAL

(1) Clean repair surfaces, adjacent panels, and openings as required.

(2) Remove lock assembly, rear taillamps, and/or other overlay overlapping parts from affected panel.

(3) Remove overlay by starting at one edge and peeling it from painted surface. Apply heat to overlay to facilitate removal.

NOTE: *Avoid using pointed or sharp tools as they may damage the painted surface.*

(4) Remove adhesive residue from painted surface with 3M Adhesive Cleaner, xylol, isopropyl alcohol, or equivalent.

INSTALLATION

(1) Scuff-sand painted surface with No. 360 or No. 400 sandpaper.

NOTE: *Freshly painted surfaces must be thoroughly dry. Residual solvents in fresh paint may cause overlay to blister.*

(2) Clean painted surface with wax and silicone remover (3M Adhesive Cleaner, (Acrylic-Clean, xylol, or equivalent). Wipe surface with clean cloth and allow to dry.

(3) Position overlay on repair panel surface and mark approximate outline of overlay with a grease pencil.

(4) Place overlay on a table or clean, flat surface with protective paper backing side up. Bend up a corner of overlay. Hold overlay firmly to the surface of the table and remove entire paper backing in a smooth motion. Under hot, humid conditions, a slight jerking motion will aid in removing paper backing.

CAUTION: *Always remove the paper backing from the overlay; never the overlay from the backing, as film stretching may result. Hold overlay in corners when removing paper backing as fingerprints will adversely affect adhesion.*

(5) Using clean sponge, apply ample wetting solution to overlay adhesive and to repair panel surface. The wetting solution permits ease of movement of overlay while positioning it on a panel surface.

(6) Immediately apply wetted overlay to repair panel surface. Position overlay in center of area to be covered with at least 1/2 inch extending beyond edges. Apply wetting solution to woodgrain surface of overlay to allow squeegee to slip during application.

(7) Squeegee from center to edges of overlay with firm strokes to remove all air bubbles and wetting solution and to assure bonding of overlay to painted surface. On large overlays, the following steps will simplify installation.

(a) Squeegee a short (4- to 6-inch) horizontal section of the overlay at center of panel. Lift right or left side of overlay, position it straight and close to panel, and squeegee toward lifted edge. Avoid stretching overlay at lifted end, squeegee progressively from middle with firm, overlapping strokes.

(b) Lift upper area of overlay (up to bonded area) and, working upward from bonded section at center, squeegee overlay into place.

(c) Lift lower area of overlay (up to bonded area) and, working downward from bonded section at center, squeegee overlay into place.

NOTE: *If a wrinkle is trapped during squeegee operations, stop immediately. Carefully lift affected section, realign section to panel, and progressively squeegee it into place. Do not lift overlay if only a few bubbles are trapped.*

(8) Notch corner or curved edges of overlay where necessary and trim off excess material.

(9) Allow 1/2-inch extra material beyond edges that are to be wrapped around flange areas. To activate adhesive, wipe adhesive side of overlay with isopropyl alcohol. Warm overlay at edges by passing a heat source, such as a heat gun or lamp, over surface to soften it. Firmly press overlay into position with fingertips, a cloth, and finally a squeegee, alternately warming and pressing it until complete adhesion is obtained.

CAUTION: *Use extreme care to avoid spilling isopropyl alcohol (rubbing alcohol) on trim or painted surfaces. Wipe spills immediately as alcohol will discolor trim or painted surfaces on prolonger contact.*

NOTE: *Avoid undue pulling or stretching at ends of overlay as tearing could result.*

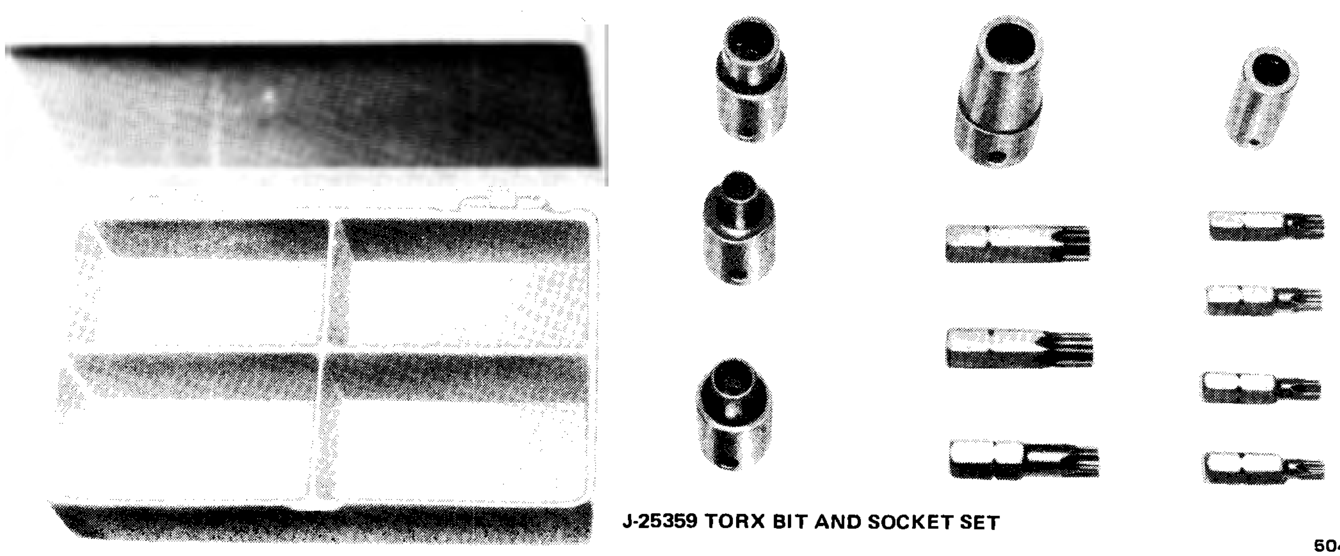
(10) Apply heat to overlay at lock assembly depressions. Press overlay uniformly into depression to obtain formed bond.

(11) With sharp knife, carefully cut out excess overlay from lock assembly openings in panel.

(12) Inspect overlay installation using reflected light to detect irregularities that may have developed during installation.

(13) Remove all air or moisture bubbles by piercing them with a sharp needle or pin and then press firmly until overlay adheres to body panel.

(14) Install previously removed parts and clean up vehicle as required.


J-25359 TORX BIT AND SOCKET SET

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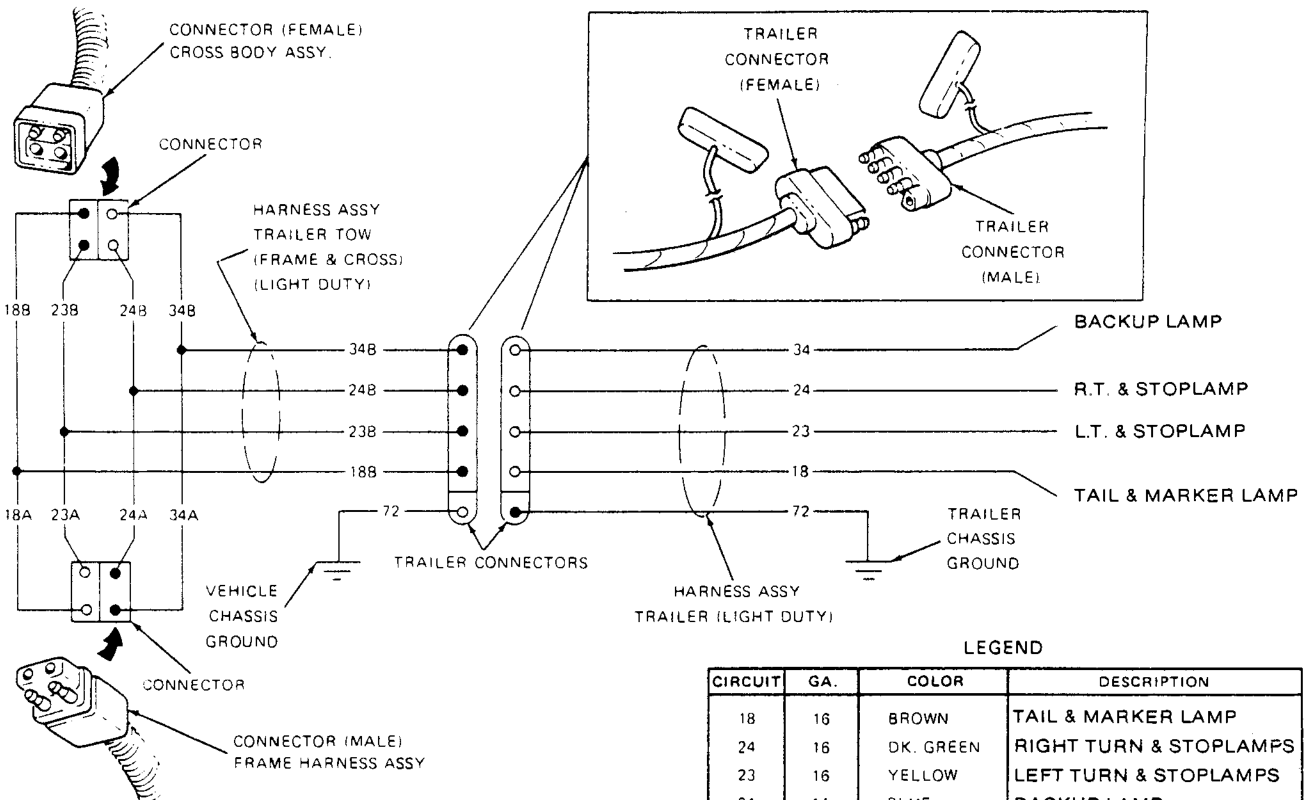
Special Tools

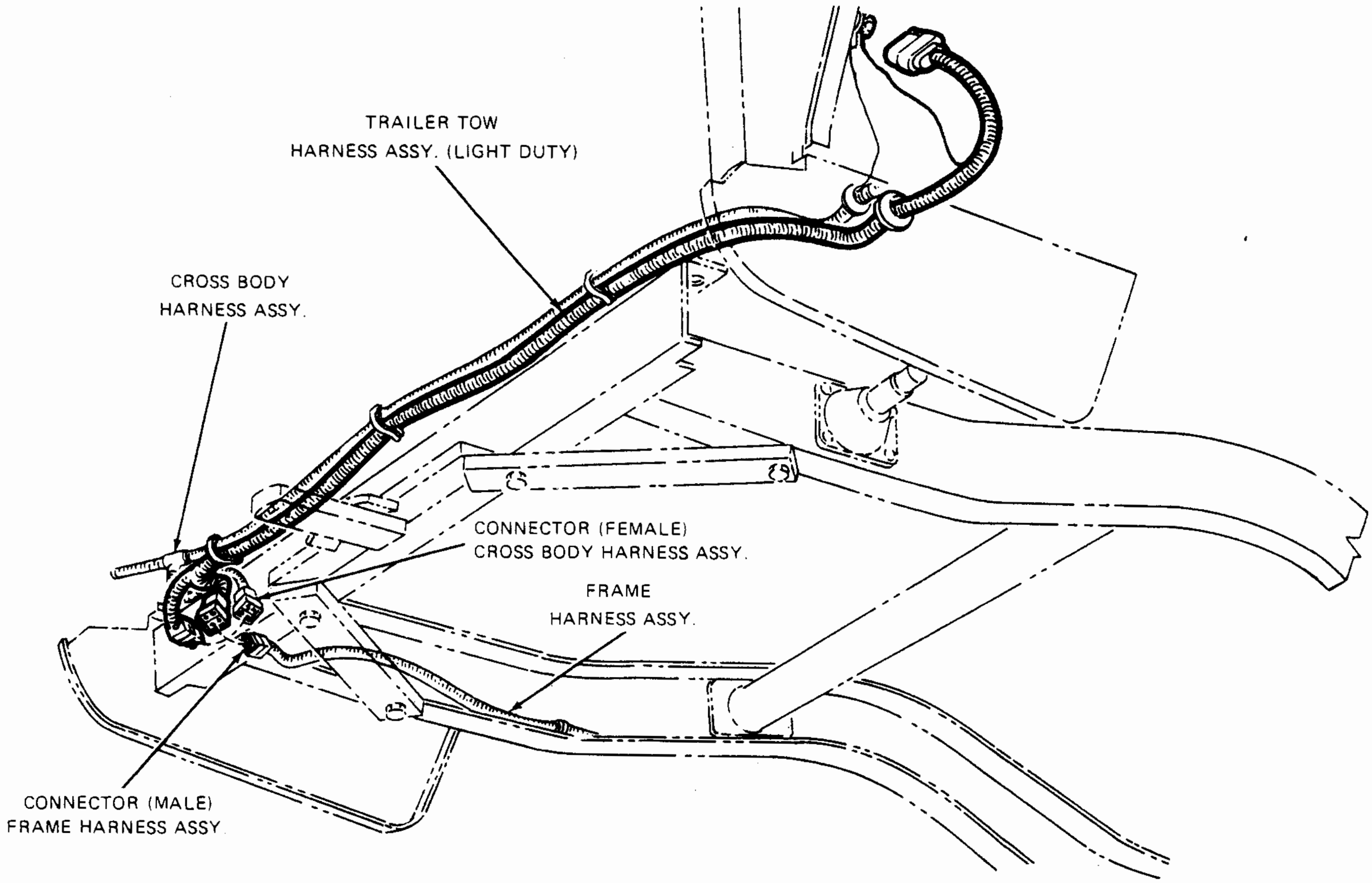
WIRING DIAGRAMS



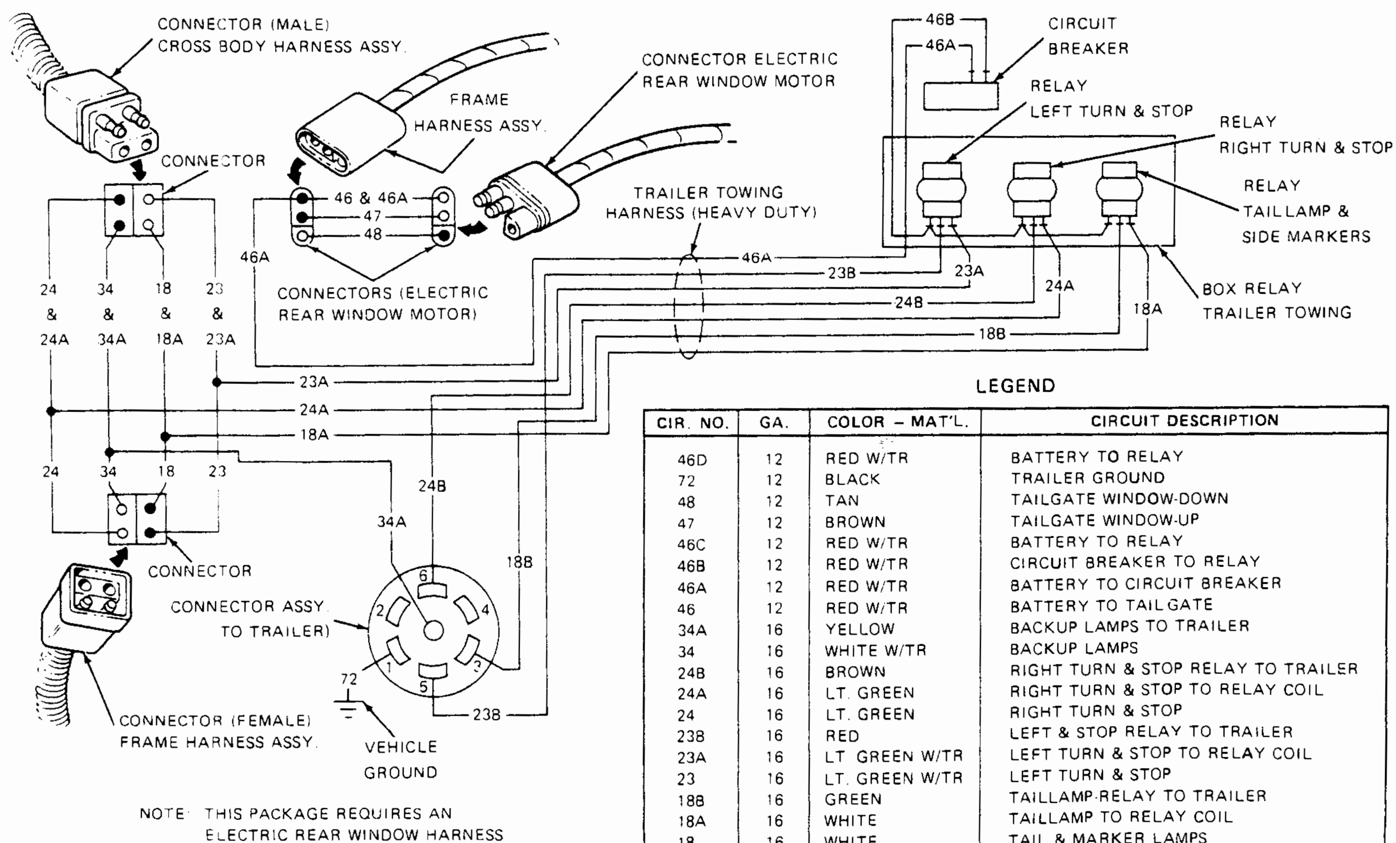
LEGEND

CIRCUIT	GA.	COLOR	DESCRIPTION
18	16	BROWN	TAIL & MARKER LAMP
24	16	DK. GREEN	RIGHT TURN & STOPLAMPS
23	16	YELLOW	LEFT TURN & STOPLAMPS
34	14	BLUE	BACKUP LAMP
72	14	WHITE	GROUND

LIGHT-DUTY TRAILER TOWING PACKAGE, CLASS 1 AND 2 WIRING DIAGRAM



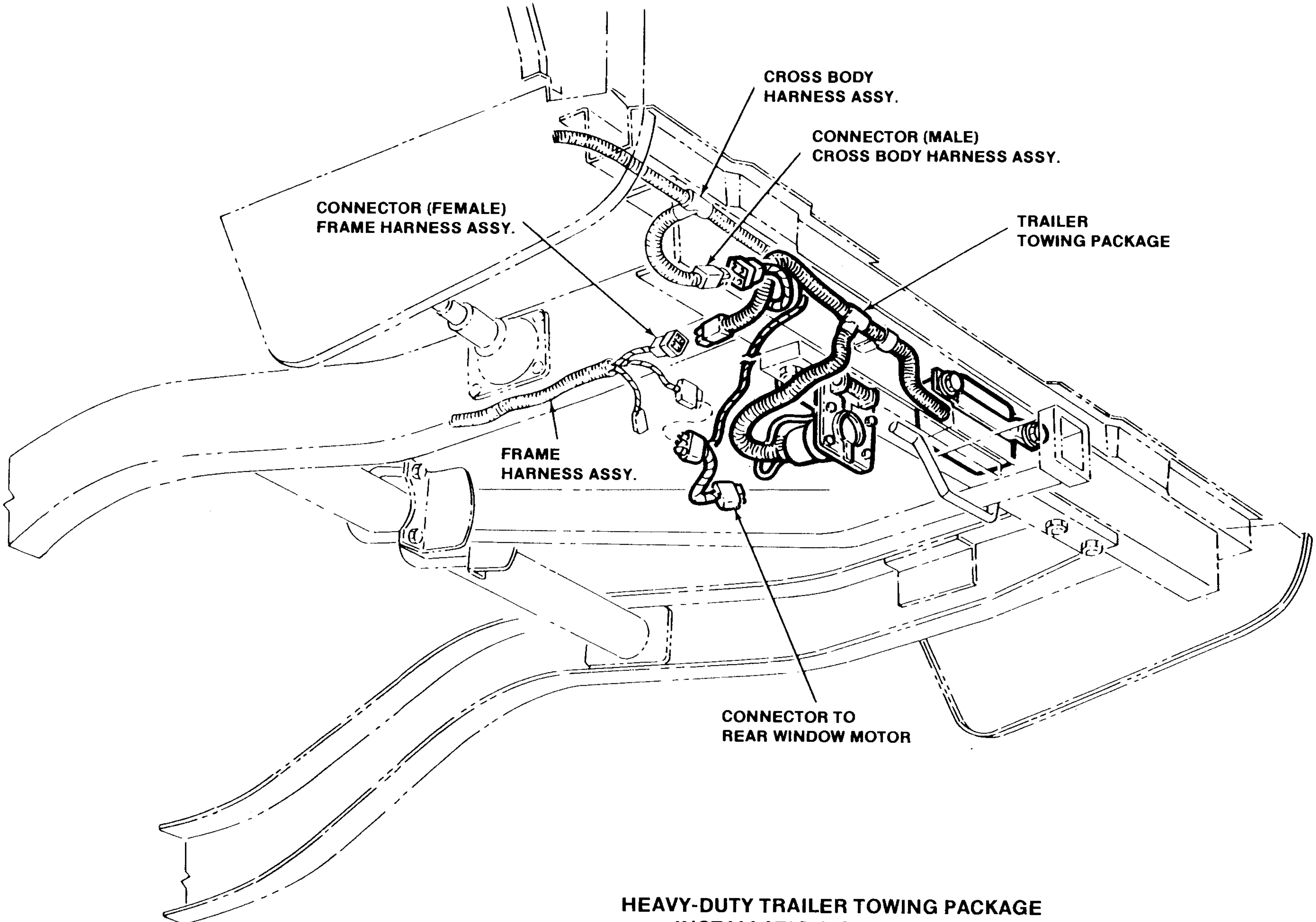
LIGHT-DUTY TRAILER TOWING PACKAGE INSTALLATION, CLASS 1 AND 2



LEGEND

CIR. NO.	GA.	COLOR – MAT'L.	CIRCUIT DESCRIPTION
46D	12	RED W/TR	BATTERY TO RELAY
72	12	BLACK	TRAILER GROUND
48	12	TAN	TAILGATE WINDOW-DOWN
47	12	BROWN	TAILGATE WINDOW-UP
46C	12	RED W/TR	BATTERY TO RELAY
46B	12	RED W/TR	CIRCUIT BREAKER TO RELAY
46A	12	RED W/TR	BATTERY TO CIRCUIT BREAKER
46	12	RED W/TR	BATTERY TO TAILGATE
34A	16	YELLOW	BACKUP LAMPS TO TRAILER
34	16	WHITE W/TR	BACKUP LAMPS
24B	16	BROWN	RIGHT TURN & STOP RELAY TO TRAILER
24A	16	LT. GREEN	RIGHT TURN & STOP TO RELAY COIL
24	16	LT. GREEN	RIGHT TURN & STOP
23B	16	RED	LEFT & STOP RELAY TO TRAILER
23A	16	LT GREEN W/TR	LEFT TURN & STOP TO RELAY COIL
23	16	LT. GREEN W/TR	LEFT TURN & STOP
18B	16	GREEN	TAILLAMP-RELAY TO TRAILER
18A	16	WHITE	TAILLAMP TO RELAY COIL
18	16	WHITE	TAIL & MARKER LAMPS

HEAVY-DUTY TRAILER TOWING PACKAGE, CLASS 3 AND 4 WIRING DIAGRAM



HEAVY-DUTY TRAILER TOWING PACKAGE
INSTALLATION, CLASS 3 AND 4

COMPONENT GRID LOCATOR — CJ MODELS

NOMENCLATURE	LOCATION
Alternator, V-8 (Motorcraft)	A-2
Alternator/Regulator (Delco), 6 Cylinder	D-2
Anti-Diesel Solenoid	C-4
Backup Lamp, Left Rear	D-11
Backup Lamp, Right Rear	C-11
Backup Lamp Switch, Man. Trans.	E-2
Backup Lamp Switch, Auto. Trans.	D-9
Battery, 6 Cylinder	C-3
Battery, V-8	A-4
Brake Failure Switch	E-3
Brake Warning Light	C-9
Cigar Lighter	D-9
Coil, 6 Cylinder	D-3
Coil, V-8	B-2
Dimmer Switch	D-6
Directional Signal Switch	D-8
Distributor, 6 Cylinder	D-3
Distributor, V-8	B-2
Electronic Ignition Pack, 6 Cylinder	C-2
Electronic Ignition Pack, V-8	A-2
Fuel Gauge	B-10
Fuel Sender	D-10
Fuel Sender Connector	E-10
Frame Harness Connector	E-9
Fuse Panel	C-5 & C-6
Fusible Link, Ignition Circuit, 6 Cylinder	C-3
Fusible Link, Ignition Circuit, V-8	A-3
Headlamp, Left	D-1
Headlamp, Right	B-1
Headlamp Ground, Left	D-1
Headlamp Ground, Right	B-1
Heater Blower Motor	A-5
Heater Blower Switch	A-6
Heater Control Lights	A-7 & A-8
High Beam Indicator	B-9
Horn	E-3
Horn Relay	C-7
Ignition Switch	C-8
Instrument Cluster	B-10
Instrument Cluster Lights	B-9
Instrument Panel Lights Ground	C-9
Kickdown and Quadra-Trac Switch Connector	E-2 & E-3
Light Switch	E-8
Light Switch Light	E-9
Marker & Reflector, Left Front	E-1

NOMENCLATURE	LOCATION
Marker & Reflector, Left Rear	E-10
Marker & Reflector, Right Front	A-1
Marker & Reflector, Right Rear	A-11
Oil Pressure Gauge	A-10
Oil Pressure Gauge Light	A-10
Oil Pressure Sender, 6 Cylinder	D-4
Oil Pressure Sender, V-8	B-3
Park & Signal Lamp, Left Front	D-1
Park & Signal Lamp, Right Front	A-1
Resistance Wire, 6 Cylinder	D-3
Splice "A"	C-6
Splice "B"	C-6
Splice "C"	B-7
Splice "D"	B-7
Splice "E"	C-7
Splice "F"	C-9
Splice "G"	A-3
Splice "H"	A-3
Splice "I"	C-2
Splice "J"	C-3
Splice "K"	C-1
Splice "L"	E-1
Splice "M"	E-1
Splice "N"	A-1
Splice "O"	A-1
Splice "P"	C-7
Starter Solenoid	A-3 & C-3
Starting Motor	B-4 & D-4
Steering Column Connector	D-8
Stoplamp Switch	D-6
Tail, Stop & License Lamp, Left Rear	D-11
Tail & Stop Lamp, Right Rear	C-11
TCS System Connector	D-4
Temperature Gauge	B-10
Temperature Sender, 6 Cylinder	D-2
Temperature Sender, V-8	B-2
Turn Indicator & Hazard, Left	C-9
Turn Indicator & Hazard, Right	C-9
Voltage Regulator Connector, V-8	B-2
Voltmeter	A-9
Voltmeter Light	A-9
Windshield Wiper Motor	D-8
Windshield Wiper & Washer Switch	D-8
Windshield Wiper & Washer Switch Light	D-8

LEGEND – CJ MODELS

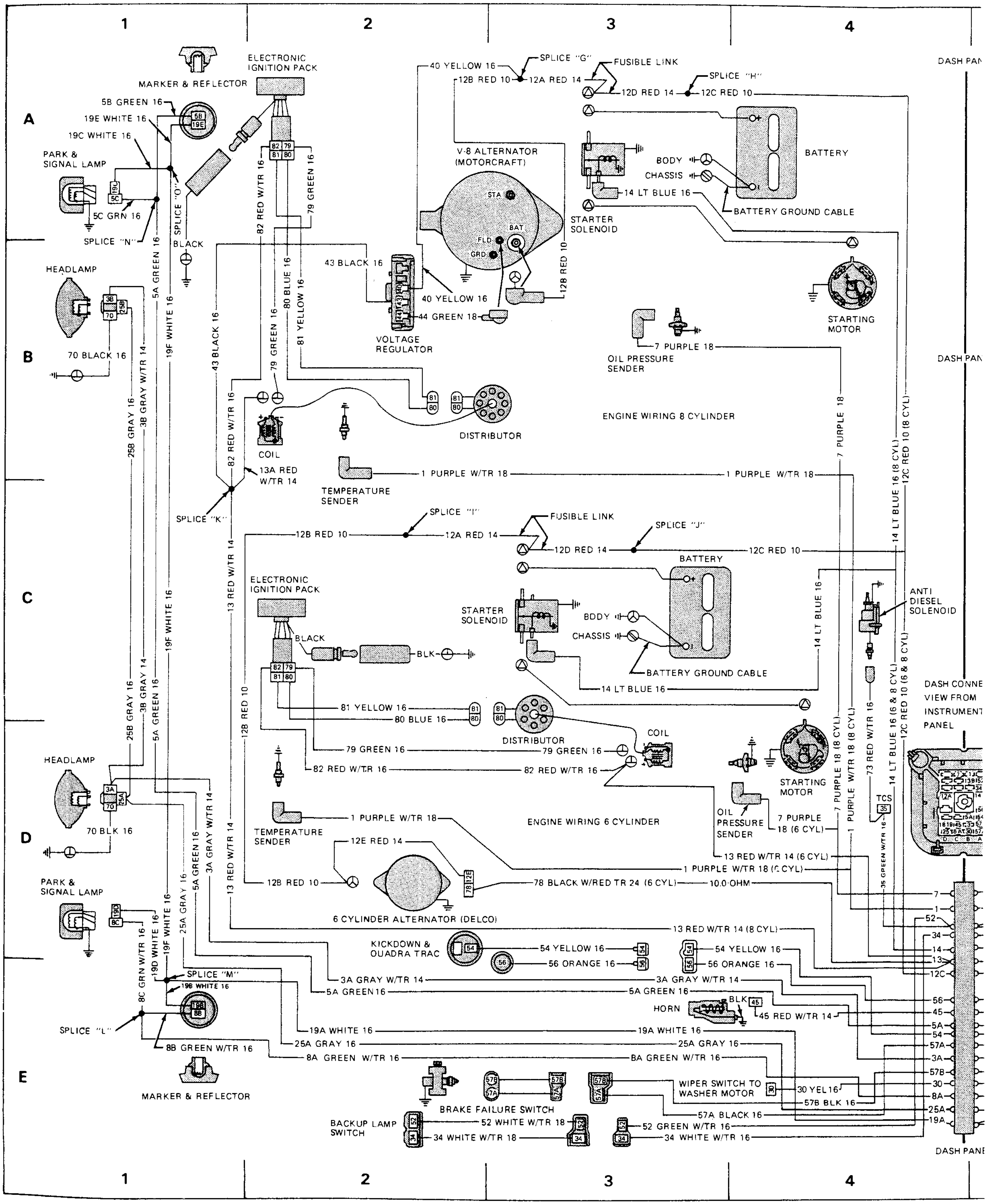
NO.	GA.	COLOR	INSTRUMENT AND CONTROL HARNESS
1	18	PURPLE W/TR	BULKHEAD CONNECTOR (TEMPERATURE SENDER) TO TEMPERATURE GAUGE
2	18	GRAY W/TR	FOOT DIMMER SWITCH (HI-BEAM) TO INSTRUMENT CLUSTER (HI-BEAM INDICATOR)
3	14	GRAY W/TR	FOOT DIMMER SWITCH (HI-BEAM) TO BULKHEAD CONNECTOR (HI-BEAM)
4	18	RED	FUSE PANEL (CLUSTER FEED) TO INSTRUMENT CONSTANT VOLTAGE REGULATOR
4A	18	RED	INSTRUMENT CONSTANT VOLTAGE REGULATOR (IGNITION TERMINAL) TO OIL PRESSURE GAUGE (IGNITION TERMINAL)
5A	18	GREEN	BULKHEAD CONNECTOR (RIGHT TURN & HAZARD FRONT) TO HAZARD SWITCH
5B	18	GREEN	HAZARD SWITCH TO STEERING COLUMN CONNECTOR (RIGHT TURN & HAZARD FRONT)
5C	18	GREEN	STEERING COLUMN CONNECTOR TO INSTRUMENT CLUSTER LAMP (RIGHT TURN)
7	18	PURPLE	BULKHEAD CONNECTOR (OIL PRESSURE SENDER) TO OIL PRESSURE GAUGE
8A	18	GREEN W/TR	BULKHEAD CONNECTOR (LEFT TURN & HAZARD FRONT) TO HAZARD SWITCH
8B	18	GREEN W/TR	HAZARD SWITCH TO STEERING COLUMN CONNECTOR (LEFT TURN & HAZARD FRONT)
8C	18	GREEN W/TR	STEERING COLUMN CONNECTOR TO INSTRUMENT CLUSTER LAMP (LEFT TURN)
9A	18	BLACK	SPLICE "F" TO INSTRUMENT PANEL LIGHT GROUND
9B	18	BLACK	SPLICE "F" TO LIGHT SWITCH LIGHT
9C	18	BLACK	SPLICE "F" TO WIPER & WASHER SWITCH LIGHT
9D	18	BLACK	SPLICE "F" TO CIGAR LIGHTER
9E	18	BLACK	SPLICE "F" TO VOLTMETER
9F	18	BLACK	SPLICE "F" TO AIR LIGHT
9G	18	BLACK	AIR LIGHT TO HEAT LIGHT
9H	18	BLACK	HEAT LIGHT TO DEF. LIGHT
9J	18	BLACK	DEF. LIGHT TO FAN LIGHT
10	18	PINK	FRAME HARNESS (FUEL SENDER UNIT) TO INSTRUMENT CLUSTER FUEL GAUGE (S-TERMINAL)
11A	18	ORANGE	FUSE PANEL (LIGHTS-ACCESSORIES) TO SPLICE "A"
11B	18	ORANGE	SPLICE "A" TO STEERING COLUMN CONNECTOR
11C	18	ORANGE	SPLICE "A" TO LIGHT SWITCH LIGHT
11D	18	ORANGE	SPLICE "A" TO WIPER AND WASHER SWITCH LIGHT
11E	18	ORANGE	SPLICE "A" TO SPLICE "C"
11F	18	ORANGE	SPLICE "C" TO CLUSTER LIGHT
11G	18	ORANGE	SPLICE "C" TO CLUSTER LIGHT
11H	18	ORANGE	SPLICE "C" TO OIL PRESSURE GAUGE LIGHT
11J	18	ORANGE	SPLICE "C" TO VOLTMETER LIGHT
11K	18	ORANGE	SPLICE "C" TO AIR LIGHT CONNECTOR
11L	18	ORANGE	AIR LIGHT CONNECTOR TO HEAT LIGHT CONNECTOR
11M	18	ORANGE	HEAT LIGHT CONNECTOR TO DEF. LIGHT CONNECTOR
11N	18	ORANGE	DEF. LIGHT CONNECTOR TO FAN LIGHT CONNECTOR
12A	10	RED	BULKHEAD CONNECTOR (ALTERNATOR & VOLTAGE REGULATOR) TO SPLICE "P"
12B	12	RED	SPLICE "P" TO HORN RELAY
12C	12	RED	FUSE PANEL (TRAFFIC HAZARD) TO SPLICE "P"
12D	12	RED	SPLICE "P" TO LIGHT SWITCH (BATTERY FEED)
12E	12	RED	SPLICE "P" TO IGNITION SWITCH
12F	12	RED	FUSE PANEL (CIGAR LIGHTER) TO SPLICE "P"
13A	14	RED W/TR	BULKHEAD CONNECTOR (COIL) TO TACHOMETER CONNECTOR
13B	14	RED W/TR	TACHOMETER CONNECTOR TO IGNITION SWITCH
14	16	LT BLUE	BULKHEAD CONNECTOR (STARTING MOTOR SOLENOID) TO NEUTRAL SAFETY SWITCH CONNECTOR
14A	16	LT BLUE	IGNITION SWITCH TO NEUTRAL SAFETY SWITCH CONNECTOR
15	14	RED W/TR	LIGHT SWITCH (FOOT DIMMER SWITCH FEED) TO FOOT DIMMER SWITCH
16	18	BLACK	LIGHT SWITCH TO COURTESY LAMP GROUND CONNECTOR
17	14	RED W/TR	FUSE PANEL (TAIL-STOP) TO STOP LIGHT SWITCH
18	16	WHITE	BULKHEAD CONNECTOR TO CHASSIS HARNESS (TAIL LAMPS)
19	16	WHITE	BULKHEAD CONNECTOR (MARKER LAMPS) TO LIGHT SWITCH (PARKING LAMPS)
23	16	LT GREEN W/TR	STEERING COLUMN CONNECTOR (LEFT TURN & HAZARD-REAR) TO FRAME HARNESS CONNECTOR
24	16	LT GREEN W/TR	STEERING COLUMN CONNECTOR TO FRAME HARNESS CONNECTOR
25	16	GRAY	BULKHEAD CONNECTOR (HEADLAMPS) TO FOOT DIMMER SWITCH (LO-BEAM)
26	14	RED W/TR	FUSE PANEL (HEATER-BATTERY) TO HEATER BLOWER SWITCH
27	18	BLACK W/TR	STEERING COLUMN CONNECTOR TO HORN RELAY
30	16	YELLOW	BULKHEAD CONNECTOR (WINDSHIELD WIPER & WASHER) TO WINDSHIELD WIPER & WASHER SWITCH
33	14	RED W/TR	FUSE PANEL (RADIO) TO WINDSHIELD WIPER & WASHER SWITCH
34B	18	WHITE W/TR	BULKHEAD CONNECTOR (BACK-UP LIGHT SWITCH) TO BULKHEAD CONNECTOR (CHASSIS HARNESS - BACK-UP LIGHTS)
39	16	PINK	FUSE PANEL (TRAFFIC HAZARD FLASH) TO STEERING COLUMN CONNECTOR
45	16	RED W/TR	BULKHEAD CONNECTOR TO HORN RELAY
51	16	ORANGE	LIGHT SWITCH TO COURTESY LAMP FEED CONNECTOR
52	18	RED	FUSE PANEL (BACK-UP LAMPS) TO BULKHEAD CONNECTOR (BACK-UP LIGHT SWITCH - MAN. TRANS.)
52B	18	RED	FUSE PANEL (BACK-UP LAMPS) TO BULKHEAD CONNECTOR (BACK-UP LIGHT SWITCH - AUTO. TRANS.)
54	16	YELLOW	BULKHEAD CONNECTOR TO AUTOMATIC TRANSMISSION KICKDOWN SWITCH
56	16	ORANGE	BULKHEAD CONNECTOR TO EMERGENCY DRIVE LIGHT
57A	18	BLACK	BULKHEAD CONNECTOR (BRAKE FAILURE SWITCH) TO IGNITION SWITCH
57B	18	BLACK	BULKHEAD CONNECTOR TO SPLICE "E"
57C	18	BLACK	SPLICE "E" TO PARKING BRAKE SWITCH CONNECTOR
57D	18	BLACK	SPLICE "E" TO BRAKE WARNING LIGHT CONNECTOR
60	14	RED	BACK-UP SWITCH TO CIGAR LIGHTER CONNECTOR
65	16	RED W/TR	STOP LIGHT SWITCH TO STEERING COLUMN CONNECTOR (BRAKE SWITCH & HAZARD FEED)
66	18	RED W/TR	FUSE PANEL (PANEL LAMPS) TO LIGHT SWITCH (PANEL LIGHTS FEED)
67A	12	YELLOW	FUSE PANEL LAMPS TO IGNITION SWITCH
67B	18	YELLOW	IGNITION SWITCH TO INSTRUMENT CLUSTER VOLTMETER (+) TERMINAL
68	16	YELLOW	AUTOMATIC TRANSMISSION KICKDOWN SWITCH TO FUSE PANEL (CLUSTER FEED)
74	18	RED W/TR	FUSE PANEL (FLASH - DIRECTIONAL SIGNAL) TO STEERING COLUMN CONNECTOR (FLASHER & DIRECTIONAL SIGNAL FEED)
75A	12	RED W/TR	IGNITION SWITCH TO SPLICE "B"
75B	12	RED W/TR	FUSE PANEL LAMPS TO SPLICE "B"
75C	12	RED W/TR	FUSE PANEL (HEATER - BATTERY) TO SPLICE "B"
77	16	BLACK W/TR	IGNITION SWITCH TO BRAKE WARNING LIGHT CONNECTION

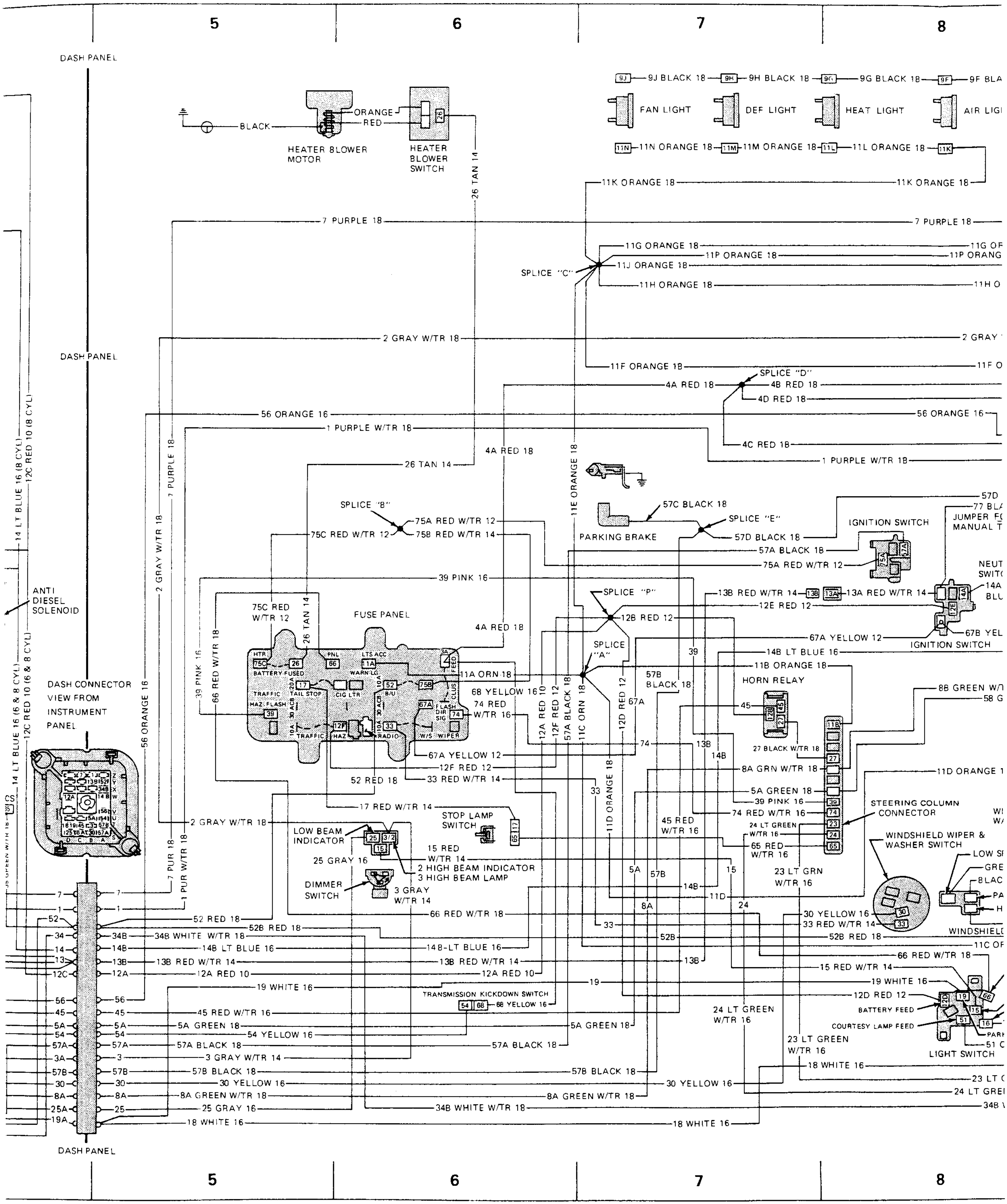
W/TR = WITH TRACER

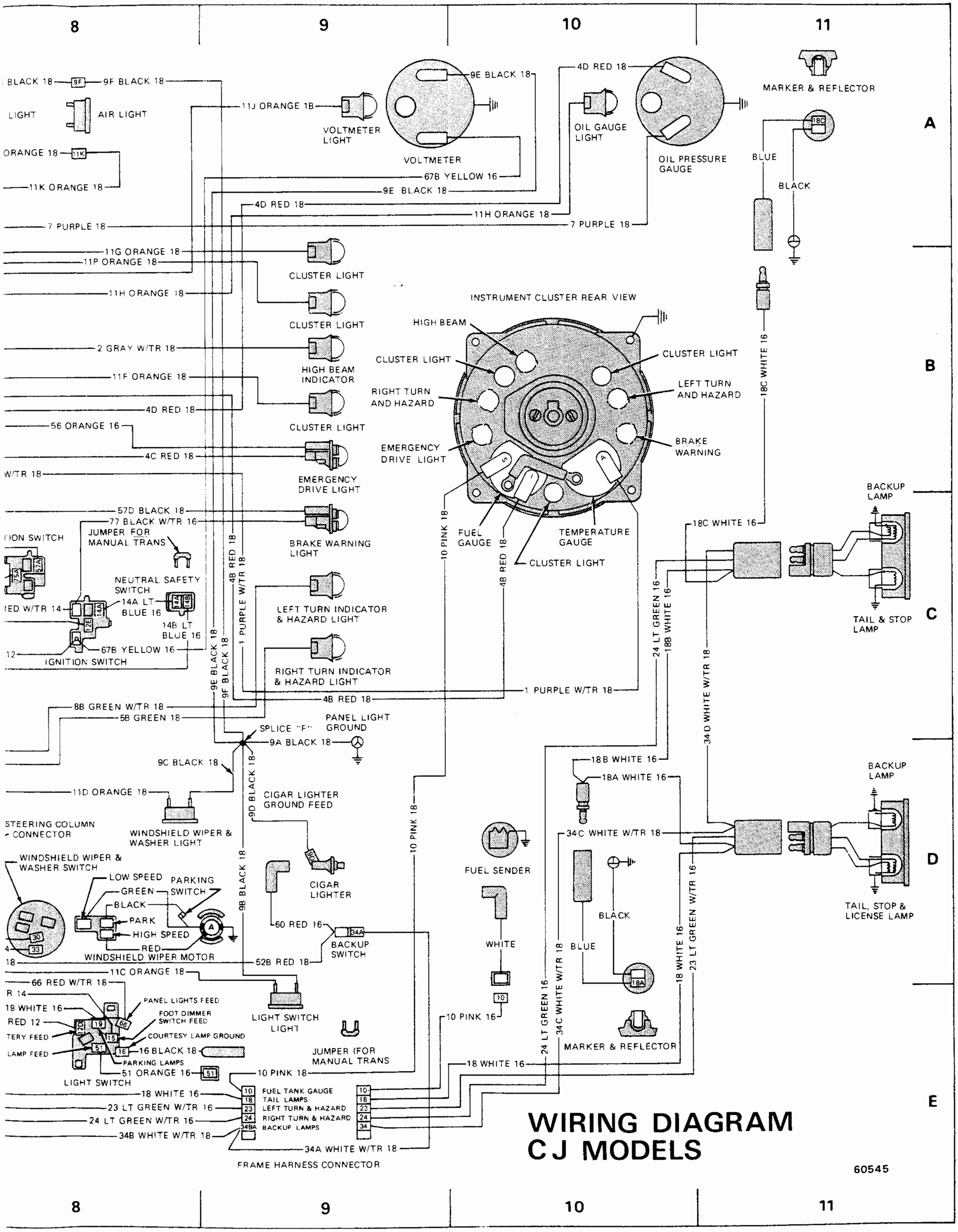
LEGEND – CJ MODELS – CONTINUED

NO.	GA.	COLOR	HARNESS ASSEMBLY – HEADLAMP, PARKING AND SIGNAL LAMP
3A	14	GRAY W/TR	BULKHEAD CONNECTOR (HI-BEAM) TO LEFT HEADLAMP CONNECTOR (HI-BEAM)
3B	14	GRAY W/TR	LEFT HEADLAMP CONNECTOR (HI-BEAM) TO RIGHT HEADLAMP CONNECTOR (HI-BEAM)
5A	16	GREEN	BULKHEAD CONNECTOR (RIGHT TURN SIGNAL) TO RIGHT TURN SIGNAL SPLICE "N"
5B	16	GREEN	RIGHT TURN SPLICE "N" TO RIGHT SIDE MARKER LAMP ASSEMBLY
5C	16	GREEN	RIGHT TURN SPLICE "N" TO RIGHT FRONT PARK & TURN SIGNAL LAMP ASSEMBLY
8A	16	GREEN W/TR	BULKHEAD CONNECTOR (LEFT TURN SIGNAL) TO LEFT TURN SIGNAL SPLICE "L"
8B	16	GREEN W/TR	LEFT TURN SPLICE "L" TO LEFT SIDE MARKER LAMP ASSEMBLY
8C	16	GREEN W/TR	LEFT TURN SPLICE "L" TO LEFT FRONT PARK & TURN SIGNAL LAMP ASSEMBLY
19A	16	WHITE	BULKHEAD CONNECTOR (PARKING LIGHTS) TO SPLICE "M"
19B	16	WHITE	PARKING LIGHTS SPLICE "M" TO LEFT SIDE MARKER LAMP ASSEMBLY
19C	16	WHITE	PARKING LIGHTS SPLICE "O" TO RIGHT FRONT PARK & TURN SIGNAL LAMP ASSEMBLY
19D	16	WHITE	PARKING LIGHTS SPLICE "M" TO LEFT FRONT PARK & TURN SIGNAL LAMP ASSEMBLY
19E	16	WHITE	PARKING LIGHTS SPLICE "O" TO RIGHT SIDE MARKER LAMP ASSEMBLY
19F	16	WHITE	LEFT PARKING LAMPS SPLICE "M" TO RIGHT PARKING LAMPS SPLICE "O"
25A	16	GRAY	BULKHEAD CONNECTOR (LO-BEAM) TO LEFT HEADLAMP CONNECTOR (LO-BEAM)
25B	16	GRAY	LEFT HEADLAMP CONNECTOR (LO-BEAM) TO RIGHT HEADLAMP CONNECTOR (LO-BEAM)
45	14	RED W/TR	BULKHEAD CONNECTOR (HORN) TO HORN ASSEMBLY
57A	16	BLACK	BULKHEAD CONNECTOR (BRAKE FAILURE SWITCH) TO BRAKE FAILURE SWITCH CONNECTOR TO BRAKE FAILURE SWITCH
70	16	BLACK	LEFT AND RIGHT HEADLAMP GROUND TERMINALS TO GROUND MOUNTING
77	16	BLACK W/TR	BULKHEAD CONNECTOR (BRAKE FAILURE SWITCH) TO BRAKE FAILURE SWITCH CONNECTOR TO BRAKE FAILURE SWITCH
			HARNESS ASSEMBLY – ENGINE (SIX CYLINDER)
1	18	PURPLE W/TR	BULKHEAD CONNECTOR (TEMPERATURE GAUGE) TO TEMPERATURE SENDER
7	18	PURPLE	BULKHEAD CONNECTOR (OIL PRESSURE GAUGE) TO OIL PRESSURE SENDER
12A	14	RED	5/16 STUD TO SPLICE "E" (FUSIBLE LINK IN ALTERNATOR/REGULATOR CIRCUIT)
12B	10	RED	SPLICE "E" TO 1/4 STUD (ALTERNATOR/REGULATOR CIRCUIT)
12C	10	RED	BULKHEAD CONNECTOR (ALTERNATOR/REGULATOR) TO SPLICE "F" AT FUSIBLE LINK
12D	14	RED	SPLICE "F" TO 5/16 STUD (FUSIBLE LINK IN ALTERNATOR/REGULATOR CIRCUIT)
12E	14	RED	1/4 STUD TO ALTERNATOR/REGULATOR ASSEMBLY
13	14	RED W/TR	BULKHEAD CONNECTOR (IGNITION SWITCH) TO COIL (+) TERMINAL
14	16	LT BLUE	BULKHEAD CONNECTOR (IGNITION SWITCH) TO STARTING MOTOR SOLENOID (STARTING TERMINAL)
30	16	YELLOW	BULKHEAD CONNECTOR TO WINDSHIELD WASHER MOTOR
34	18	WHITE W/TR	BULKHEAD CONNECTOR (BACK-UP LAMPS) TO BACK-UP LIGHT SWITCH CONNECTOR
34A	18	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO BACK-UP LIGHT SWITCH
35	16	GREEN W/TR	BULKHEAD CONNECTOR TO TCS SYSTEM CONNECTOR
52	16	WHITE W/TR	BULKHEAD CONNECTOR (BACK-UP LAMPS) TO BACK-UP LIGHT SWITCH CONNECTOR
52A	18	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO BACK-UP LIGHT SWITCH
54	16	YELLOW	BULKHEAD CONNECTOR TO KICKDOWN CONNECTOR
56	16	ORANGE	BULKHEAD CONNECTOR TO QUADRA-TRAC EMERGENCY DRIVE CONNECTOR
73	16	RED W/TR	TCS SYSTEM CONNECTOR TO ANTI-DIESEL SOLENOID CONNECTOR
78	24	BLACK W/TR	BULKHEAD CONNECTOR (ALTERNATOR/REGULATOR) TO ALTERNATOR & VOLTAGE REGULATOR
79	16	GREEN	COIL (–) TERMINAL TO ELECTRONIC IGNITION PACK
80	16	BLUE	DISTRIBUTOR TO ELECTRONIC IGNITION PACK
81	16	YELLOW	DISTRIBUTOR TO ELECTRONIC IGNITION PACK
82	16	RED W/TR	COIL (+) TERMINAL TO ELECTRONIC IGNITION PACK
			HARNESS ASSEMBLY – ENGINE (V-8)
1*	18	PURPLE W/TR	BULKHEAD CONNECTOR (TEMPERATURE GAUGE) TO TEMPERATURE SENDER
7*	18	PURPLE	BULKHEAD CONNECTOR (OIL PRESSURE GAUGE) TO OIL PRESSURE SENDER
12A*	14	RED	5/16 STUD TO SPLICE "G" (FUSIBLE LINK IN ALTERNATOR CIRCUIT)
12B	10	RED	SPLICE "G" TO 1/4 STUD (ALTERNATOR CIRCUIT)
12C*	10	RED	BULKHEAD CONNECTOR (ALTERNATOR) TO SPLICE "K" AT FUSIBLE LINK
12D*	14	RED	SPLICE "H" TO 5/16 STUD (FUSIBLE LINK IN ALTERNATOR CIRCUIT)
13	14	RED W/TR	BULKHEAD CONNECTOR (IGNITION SWITCH) TO SPLICE "K"
13A	14	RED W/TR	SPLICE "K" TO COIL (+) TERMINAL
14*	16	LT BLUE	BULKHEAD CONNECTOR (IGNITION SWITCH) TO STARTING MOTOR SOLENOID (STARTING TERMINAL)
30	16	YELLOW	BULKHEAD CONNECTOR TO WINDSHIELD WASHER MOTOR
34*	16	WHITE W/TR	BULKHEAD CONNECTOR (BACK-UP LIGHTS) TO BACK-UP LIGHT SWITCH CONNECTOR
34A*	18	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO BACK-UP LIGHT SWITCH
40	16	YELLOW	SPLICE "G" (CIRCUIT NO. 12) TO VOLTAGE REGULATOR
43	16	BLACK	VOLTAGE REGULATOR TO ALTERNATOR
44	18	GREEN	VOLTAGE REGULATOR TO ALTERNATOR
52	16	GREEN W/TR	BULKHEAD CONNECTOR (BACK-UP LIGHTS) TO BACK-UP LIGHT SWITCH CONNECTOR
52A	18	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO BACK-UP LIGHT SWITCH
54	16	YELLOW	BULKHEAD CONNECTOR TO KICKDOWN CONNECTOR
56	16	ORANGE	BULKHEAD CONNECTOR TO QUADRA-TRAC EMERGENCY DRIVE CONNECTOR
79	16	GREEN	COIL (–) TERMINAL TO ELECTRONIC IGNITION PACK
80	16	BLUE	DISTRIBUTOR TO ELECTRONIC IGNITION PACK
81	16	YELLOW	DISTRIBUTOR TO ELECTRONIC IGNITION PACK
82	16	RED W/TR	SPLICE "K" (CIRCUIT NO. 13) TO ELECTRONIC IGNITION PACK
			HARNESS ASSEMBLY – CHASSIS
10	16	PINK	BULKHEAD CONNECTOR (FUEL GAUGE – INSTRUMENT UNIT) TO CONNECTOR (FUEL TANK SENDING UNIT)
18	16	WHITE	BULKHEAD CONNECTOR (TAIL LAMPS) TO CONNECTOR (LEFT TAIL, STOP & LICENSE LAMP)
18A	16	WHITE	CONNECTOR (LEFT TAIL, STOP & LICENSE LAMP) TO CONNECTOR (LEFT REAR MARKER LAMP)
18B	16	WHITE	CONNECTOR (LEFT REAR MARKER LAMP) TO CONNECTOR (RIGHT TAIL & STOP LAMP)
18C	16	WHITE	CONNECTOR (RIGHT TAIL & STOP LAMP) TO CONNECTOR (RIGHT REAR MARKER LAMP)
23	16	LT GREEN W/TR	CONNECTOR (LEFT TURN & HAZARD) TO CONNECTOR (LEFT TAIL, STOP & LICENSE LAMP)
24	16	LT GREEN	CONNECTOR (RIGHT TURN & HAZARD) TO CONNECTOR (RIGHT TAIL & STOP LAMP)
34C	18	WHITE W/TR	CONNECTOR (BACK-UP LAMPS) TO LEFT TAIL, STOP & BACK-UP LAMP CONNECTOR
34D	18	WHITE W/TR	LEFT TAIL, STOP & BACK-UP LAMP CONNECTOR TO RIGHT TAIL, STOP & BACK-UP LAMP CONNECTOR

(*) COMBINED WITH 6 CYLINDER WIRING
W/TR = WITH TRACER


1
2
3
4
A
B
C
D
E
MARKER & REFLECTOR
ELECTRONIC IGNITION PACK
5B GREEN 16
19E WHITE 16
19C WHITE 16
PARK & SIGNAL LAMP
5C GRN 16
SPLICE "N"
SPLICE "O"
BLACK
82 RED W/TR 16
79 GREEN 16
40 YELLOW 16
12B RED 10
12A RED 14
SPLICE "G"
FUSIBLE LINK
SPLICE "H"
12D RED 14
12C RED 10
V-8 ALTERNATOR (MOTORCRAFT)
STA
BAT
FLD
GRD
BATTERY
BODY
CHASSIS
14 LT BLUE 16
BATTERY GROUND CABLE
STARTER SOLENOID
DASH PAN
HEADLAMP
43 BLACK 16
44 GREEN 18
VOLTAGE REGULATOR
STARTING MOTOR
5A GREEN 16
19F WHITE 16
3B GRAY W/TR 14
25B GRAY 16
43 BLACK 16
80 BLUE 16
81 YELLOW 16
70 BLACK 16
7 PURPLE 18
OIL PRESSURE SENDER
ENGINE WIRING 8 CYLINDER
DISTRIBUTOR
COIL
13A RED W/TR 14
TEMPERATURE SENDER
1 PURPLE W/TR 18
SPLICE "K"
14 LT BLUE 16 (8 CYL)
12C RED 10 (8 CYL)
SPLICE "I"
12B RED 10
12A RED 14
FUSIBLE LINK
SPLICE "J"
12D RED 14
12C RED 10
13 RED W/TR 14
ELECTRONIC IGNITION PACK
BLACK
BLK
STARTER SOLENOID
BODY
CHASSIS
BATTERY GROUND CABLE
14 LT BLUE 16
ANTI DIESEL SOLENOID
14 LT BLUE 16 (6 & 8 CYL)
12C RED 10 (6 & 8 CYL)
DASH CONNECTOR VIEW FROM INSTRUMENT PANEL
81 YELLOW 16
80 BLUE 16
79 GREEN 16
82 RED W/TR 16
DISTRIBUTOR
COIL
7 PURPLE 18 (8 CYL)
1 PURPLE W/TR 18 (8 CYL)
73 RED W/TR 16
STARTING MOTOR
OIL PRESSURE SENDER
7 PURPLE 18 (6 CYL)
TCS
ENGINE WIRING 6 CYLINDER
70 BLK 16
25A GRAY 16
5A GREEN 16
3A GRAY W/TR 14
12E RED 14
13 RED W/TR 14 (6 CYL)
1 PURPLE W/TR 18 (6 CYL)
78 BLACK W/RED TR 24 (6 CYL)
10.0 OHM
6 CYLINDER ALTERNATOR (DELCO)
13 RED W/TR 14 (8 CYL)
KICKDOWN & QUADRA TRAC
54 YELLOW 16
56 ORANGE 16
SPLICE "M"
19B WHITE 16
19D WHITE 16
8C GRN W/TR 16
3A GRAY W/TR 14
5A GREEN 16
HORN
45 RED W/TR 14
SPLICE "L"
8B GREEN W/TR 16
19A WHITE 16
25A GRAY 16
8A GREEN W/TR 16
MARKER & REFLECTOR
BRAKE FAILURE SWITCH
WIPER SWITCH TO WASHER MOTOR
30 YEL 16
57B BLK 16
57A BLACK 16
BACKUP LAMP SWITCH
52 WHITE W/TR 18
34 WHITE W/TR 18
52 GREEN W/TR 16
34 WHITE W/TR 16
DASH PANEL


5
6
7
8
DASH PANEL
HEATER BLOWER MOTOR
HEATER BLOWER SWITCH
ORANGE
RED
BLACK
26 TAN 14
9J BLACK 18
9H BLACK 18
9G BLACK 18
FAN LIGHT
DEF LIGHT
HEAT LIGHT
11N ORANGE 18
11M ORANGE 18
11L ORANGE 18
11K ORANGE 18
7 PURPLE 18
11G ORANGE 18
11P ORANGE 18
11J ORANGE 18
11H ORANGE 18
SPLICE "C"
2 GRAY W/TR 18
11F ORANGE 18
SPLICE "D"
4A RED 18
4B RED 18
4D RED 18
4C RED 18
56 ORANGE 16
1 PURPLE W/TR 18
26 TAN 14
11E ORANGE 18
57C BLACK 18
PARKING BRAKE
SPLICE "E"
57D BLACK 18
57A BLACK 18
IGNITION SWITCH
SPLICE "B"
75A RED W/TR 12
75B RED W/TR 14
75C RED W/TR 12
75A RED W/TR 12
39 PINK 16
ANTI DIESEL SOLENOID
SPLICE "P"
13B RED W/TR 14
13A RED W/TR 14
12E RED 12
12B RED 12
67A YELLOW 12
67B YEL
IGNITION SWITCH
FUSE PANEL
SPLICE "A"
11A ORN 18
68 YELLOW 16
74 RED W/TR 16
14B LT BLUE 16
11B ORANGE 18
HORN RELAY
57B BLACK 18
88 GREEN W/TR
27 BLACK W/TR 18
DASH CONNECTOR VIEW FROM INSTRUMENT PANEL
67A YELLOW 12
12F RED 12
33 RED W/TR 14
52 RED 18
8A GRN W/TR 18
11D ORANGE
5A GREEN 18
39 PINK 16
74 RED W/TR 16
STEERING COLUMN CONNECTOR
17 RED W/TR 14
STOP LAMP SWITCH
LOW BEAM INDICATOR
45 RED W/TR 16
24 LT GREEN W/TR 16
65 RED W/TR 16
WINDSHIELD WIPER & WASHER SWITCH
15 RED W/TR 14
2 HIGH BEAM INDICATOR
3 HIGH BEAM LAMP
25 GRAY 16
DIMMER SWITCH
3 GRAY W/TR 14
23 LT GRN W/TR 16
30 YELLOW 16
33 RED W/TR 14
66 RED W/TR 18
52B RED 18
34B WHITE W/TR 18
14B LT BLUE 16
13B RED W/TR 14
12A RED 10
19 WHITE 16
TRANSMISSION KICKDOWN SWITCH
68 YELLOW 16
45 RED W/TR 16
5A GREEN 18
54 YELLOW 16
57A BLACK 18
3 GRAY W/TR 14
57B BLACK 18
30 YELLOW 16
8A GREEN W/TR 18
25 GRAY 16
18 WHITE 16
12D RED 12
BATTERY FEED
COURTESY LAMP FEED
LIGHT SWITCH
23 LT GREEN W/TR 16
24 LT GREEN W/TR 16



WIRING DIAGRAM CJ MODELS

60545

COMPONENT GRID LOCATOR — CHEROKEE — WAGONEER — TRUCK

NOMENCLATURE	LOCATION
Air Conditioner Compressor, 6 Cylinder	C-3
Air Conditioner Compressor, V-8	B-3
Alternator, V-8 (Motorcraft)	B-3
Alternator/Regulator, 6 Cylinder (Delco)	C-2
Ammeter	B-7
Auxillary Harness Connector	E-7
Back-up Lamp, Left Rear (25, 45 & 46)	C-10
Back-up Lamp, Left Rear (14 & 15)	D-11
Back-up Lamp, Right Rear (25, 45 & 46)	B-10
Back-up Lamp, Right Rear (14 & 15)	A-11
Back-up Switch, 6 Cylinder	B-6
Back-up Light Switch, V-8	D-10
Battery, 6 Cylinder	C-2
Battery, V-8	A-2
Body Ground	C-1
Brake Warning Light	E-8
Carburetor Solenoid	B-2
Cigar Lighter	A-6
Cluster Connection	B-6
Coil, 6 Cylinder	C-2
Coil, V-8	B-2
Courtesy Lamp, Left Side (14, 15, 16 & 17)	C-8
Courtesy Lamp, Right Side (14, 15, 16 & 17)	A-8
Dash Connector	D-4
Defogger & Heater Ground	D-7
Dimmer Switch	D-6
Distributor, 6 Cylinder	C-3
Distributor, V-8	B-3
Dome & Courtesy Lamp Feed	C-9
Dome & Courtesy Lamp Ground	C-9
Dome Lamp (14, 15, 16 & 17)	C-9
Door Switch, Left Side (2 Door 16 & 17) (Optional for 25, 45 & 46)	D-9
Door Switches, Left Side (4 Door, 14 & 15)	D-9
Door Switch, Right Side (2 Door, 16 & 17) (Optional for 25, 45 & 46)	A-9
Door Switches, Right Side (4 Door, 14 & 15)	A-9
Electronic Control Unit, 6 Cylinder	C-2
Electronic Control Unit, V-8	A-2
Frame Harness Connector	E-4
Fuel Gauge	C-7
Fuel Sender Extension Wire (25, 45 & 46)	E-9
Fuel Sender (14, 15, 16 & 17)	D-9
Fuse Panel	C-5
Gas Tank (Gauge Unit)	D-9
Headlamp, Left	D-1
Headlamp, Right	B-1
Heater Blower Motor	D-3
Heater Control Switch	C-8
Heater Ground	C-8
Heater Lamps	C-6
Horns	E-3
Horn Relay	D-6
Ignition Switch	A-6 & B-6
Junction 18	E-10
Junction 23	E-10
Junction 24	E-10
Kickdown & Quadratrac Switch	E-3
License Lamp (14, 15, 16 & 17)	C-11
License Lamp (25, 45 & 46)	C-10
Light Switch	D-7
Marker & Reflector Lamp, Left Front	E-2
Marker & Reflector Lamp, Left Rear (25, 45 & 46)	D-10
Marker & Reflector Lamp, Left Rear (16 & 17)	D-11
Marker & Reflector Lamp, Right Front	A-2
Marker & Reflector Lamp, Right Rear (16 & 17)	B-11
Marker & Reflector Lamp, Right Rear (25, 45 & 46)	B-10
Neutral Safety Switch	B-6
Oil Gauge	B-7
Oil Pressure Sender, 6 Cylinder	C-3
Oil Pressure Sender Unit, V-8	B-3
Parking Brake Warning Switch	D-8
Park & Signal Lamp, Left Front (14 & 15)	D-1
Park & Signal Lamp, Left Front (16, 17, 25, 45 & 46)	E-1
Park & Signal Lamp, Right Front (14 & 15)	B-1
Park & Signal Lamp, Right Front (16, 17, 25, 45 & 46)	A-1
Radio Noise Suppressor	B-7
Resistor Assembly	D-3
Splice "A"	C-6
Splice "B"	C-7
Splice "C"	B-5
Splice "D"	B-7
Splice "F"	A-2
Splice "G"	E-2
Splice "H"	D-2
Splice "I"	B-2
Splice "J"	C-3
Splice "K"	A-3
Splice "L"	C-2
Starter Solenoid, 6 Cylinder	C-3
Starter Solenoid, V-8	A-3
Starting Motor, 6 Cylinder	C-4
Starting Motor, V-8	A-4
Stop Lamp Switch	A-7
Stop Lamp Switch & Cruise Control	A-7
Tail, Stop & Back-up Lamp, Left Rear (16 & 17)	C-11
Tail, Stop & Back-up Lamp, Right Rear (16 & 17)	B-11
Tail & Stop Lamp, Left Rear (25, 45 & 46)	C-10
Tail & Stop Lamp, Right Rear (25, 45 & 46)	B-10
Tail, Stop & Marker Lamp, Left Rear (14 & 15)	E-11
Tail, Stop & Marker Lamp, Right Rear (14 & 15)	A-11
Temperature Gauge	C-7
Temperature Sender, 6 Cylinder	C-3
Temperature Sender, V-8	B-3
Throttle Closing Solenoid	B-3
Transmission Kickdown Switch	B-6
Turn Signal Switch	A-7
Voltage Regulator, V-8	A-3
Washer Bottle Connection	D-3
Windshield Wiper Motor	D-2 & D-3
Windshield Wiper & Washer Switch	D-6

LEGEND – CHEROKEE – WAGONEER – TRUCK

NO.	GA.	COLOR	INSTRUMENT AND CONTROL HARNESS
1	18	PURPLE W/TR	DASH CONNECTOR TO CLUSTER CONNECTION ("C" TERMINAL)
2	18	GRAY W/TR	FOOT DIMMER SWITCH TO CLUSTER CONNECTION ("K" TERMINAL)
3	14	GRAY W/TR	DASH CONNECTOR TO FOOT DIMMER SWITCH
4	18	RED	CLUSTER CONNECTION ("E" TERMINAL) TO FUSE PANEL (CLUSTER FEED)
5A	18	GREEN	DASH CONNECTOR TO CLUSTER CONNECTION ("F" TERMINAL)
5B	18	GREEN	DASH CONNECTOR TO TURN SIGNAL SWITCH
7	18	PURPLE	DASH CONNECTOR TO CLUSTER CONNECTION
8A	18	GREEN W/TR	DASH CONNECTOR TO CLUSTER CONNECTION ("G" TERMINAL)
8B	18	GREEN W/TR	DASH CONNECTOR TO TURN SIGNAL SWITCH
9A	18	BLACK	CLUSTER CONNECTION TO HEATER GROUND TERMINAL
9B	18	BLACK	HEATER GROUND TO DEFOGGER & HEATER GROUND
10	18	PINK	DASH CONNECTOR TO CLUSTER CONNECTION ("L" TERMINAL)
11A	18	ORANGE	FUSE PANEL (PANEL LIGHTS) TO SPLICE "A"
11B	18	ORANGE	SPLICE "A" TO RIGHT HEATER LAMP
11C	18	ORANGE	SPLICE "A" TO LEFT HEATER LAMP
11D	18	ORANGE	SPLICE "A" TO CLUSTER CONNECTION ("J" TERMINAL)
11E	18	ORANGE	SPLICE "A" TO TURN SIGNAL SWITCH
12A	10	RED	DASH CONNECTOR TO SPLICE "B"
12B	12	RED	SPLICE "B" TO HORN RELAY
12C	10	RED	SPLICE "B" TO FUSE PANEL
12D	12	RED	SPLICE "B" TO LIGHT SWITCH
12E	10	RED	SPLICE "B" TO IGNITION SWITCH
12F	12	RED	SPLICE "B" TO AMMETER
13A	14	RED W/TR	DASH CONNECTOR TO SPLICE "C"
13B	14	RED W/TR	SPLICE "C" TO FUSE PANEL (BACK-UP LAMPS)
13C	14	RED W/TR	SPLICE "C" TO IGNITION SWITCH
14A	16	LT BLUE	IGNITION SWITCH TO NEUTRAL SAFETY SWITCH
14B	16	LT BLUE	NEUTRAL SAFETY SWITCH TO DASH CONNECTOR
15	14	RED W/TR	LIGHT SWITCH TO FOOT DIMMER SWITCH
16	18	BLACK	LIGHT SWITCH TO DOME & COURTESY LAMP GROUND
17A	14	RED W/TR	FUSE PANEL TO STOP LAMP SWITCH & CRUISE CONTROL CONNECTOR
17B	14	RED W/TR	STOP LAMP SWITCH & CRUISE CONTROL CONNECTOR TO STOP LAMP SWITCH
18	16	WHITE	DASH CONNECTOR TO LIGHT SWITCH
19	16	WHITE	DASH CONNECTOR TO DASH CONNECTOR
20	14	TAN	DASH CONNECTOR TO HEATER CONTROL SWITCH
21	16	BROWN	DASH CONNECTOR TO HEATER CONTROL SWITCH
22	16	BROWN W/TR	DASH CONNECTOR TO HEATER CONTROL SWITCH
23	16	LT GREEN W/TR	DASH CONNECTOR TO TURN SIGNAL SWITCH
24	16	LT GREEN	DASH CONNECTOR TO TURN SIGNAL SWITCH
25	16	GRAY	DASH CONNECTOR TO FOOT DIMMER SWITCH
26	14	RED W/TR	FUSE PANEL (HEATER – AIR CONDITIONER) TO HEATER CONTROL SWITCH
27	18	BLACK W/TR	HORN RELAY TO TURN SIGNAL SWITCH
31	14	BLUE	DASH CONNECTOR TO WINDSHIELD WIPER & WASHER SWITCH
32	14	BLUE W/TR	DASH CONNECTOR TO WINDSHIELD WIPER & WASHER SWITCH
33	14	RED W/TR	DASH CONNECTOR TO FUSE PANEL (WINDSHIELD WIPER & WASHER)
34	18	WHITE W/TR	DASH CONNECTOR TO BACK-UP LIGHT SWITCH CONNECTOR
34	18	GRN & WHT W/TR	MANUAL TRANSMISSION BACK-UP SWITCH BYPASS
39	16	PINK	FUSE PANEL (TRAFFIC HAZARD – FLASH) TO TURN SIGNAL SWITCH
45	16	RED W/TR	DASH CONNECTOR TO HORN RELAY
50	16	BROWN	DASH CONNECTOR TO FUSE PANEL (AIR CONDITIONER COMPRESSOR)
51	16	ORANGE	LIGHT SWITCH TO DOME & COURTESY LAMP FEED
52	18	RED	FUSE PANEL (BACK-UP LAMPS) TO BACK-UP LIGHT SWITCH CONNECTOR
54	16	YELLOW	DASH CONNECTOR TO TRANSMISSION KICK-DOWN SWITCH
55	10	YELLOW	DASH CONNECTOR TO AMMETER
56	16	ORANGE	DASH CONNECTOR TO CLUSTER CONNECTION
57A	18	BLACK	DASH CONNECTOR TO SPLICE "D"
57B	18	BLACK	SPLICE "D" TO PARKING BRAKE WARNING SWITCH
57C	18	BLACK	SPLICE "D" TO CLUSTER CONNECTION ("A" TERMINAL)
57D	18	BLACK	SPLICE "D" TO IGNITION SWITCH
60	16	RED	BACKUP SWITCH TO CIGAR LIGHTER
65A	16	PINK	TURN SIGNAL SWITCH TO STOP LAMP SWITCH & CRUISE CONTROL CONNECTOR
65B	16	PINK	STOP LAMP SWITCH & CRUISE CONTROL CONNECTOR TO STOP LAMP SWITCH
66	18	RED W/TR	FUSE PANEL (PANEL LIGHTS) TO LIGHT SWITCH
67	12	YELLOW	FUSE PANEL (DIRECTIONAL SIGNAL FLASHER) TO IGNITION SWITCH
68	16	YELLOW	FUSE PANEL TO TRANSMISSION KICK-DOWN SWITCH
74	18	RED W/TR	FUSE PANEL (DIRECTIONAL SIGNAL FLASHER) TO TURN SIGNAL SWITCH
75	14	RED W/TR	IGNITION SWITCH TO FUSE PANEL
91	18	RED	DASH CONNECTOR TO DASH CONNECTOR
92	18	BLACK	DASH CONNECTOR TO WINDSHIELD WIPER & WASHER CONNECTOR
			HARNESS ASSEMBLY – HEADLAMP, PARKING AND SIGNAL LAMPS
3A	14	GRAY W/TR	DASH CONNECTOR TO LEFT HEADLAMP CONNECTOR
3B	14	GRAY W/TR	LEFT HEADLAMP CONNECTOR TO RIGHT HEADLAMP CONNECTOR
5A	16	GREEN	DASH CONNECTOR TO SPLICE "F"
5B	16	GREEN	SPLICE "F" TO RIGHT MARKER & REFLECTOR LAMP
5C	16	GREEN	SPLICE "F" TO RIGHT PARK & SIGNAL LAMP CONNECTOR (14 & 15 ONLY)
5C	16	GREEN	SPLICE "F" TO RIGHT PARK & SIGNAL LAMP CONNECTOR (16, 17, 25, 45 & 46 ONLY)

W/TR = WITH TRACER

LEGEND – CHEROKEE – WAGONEER – TRUCK – CONTINUED

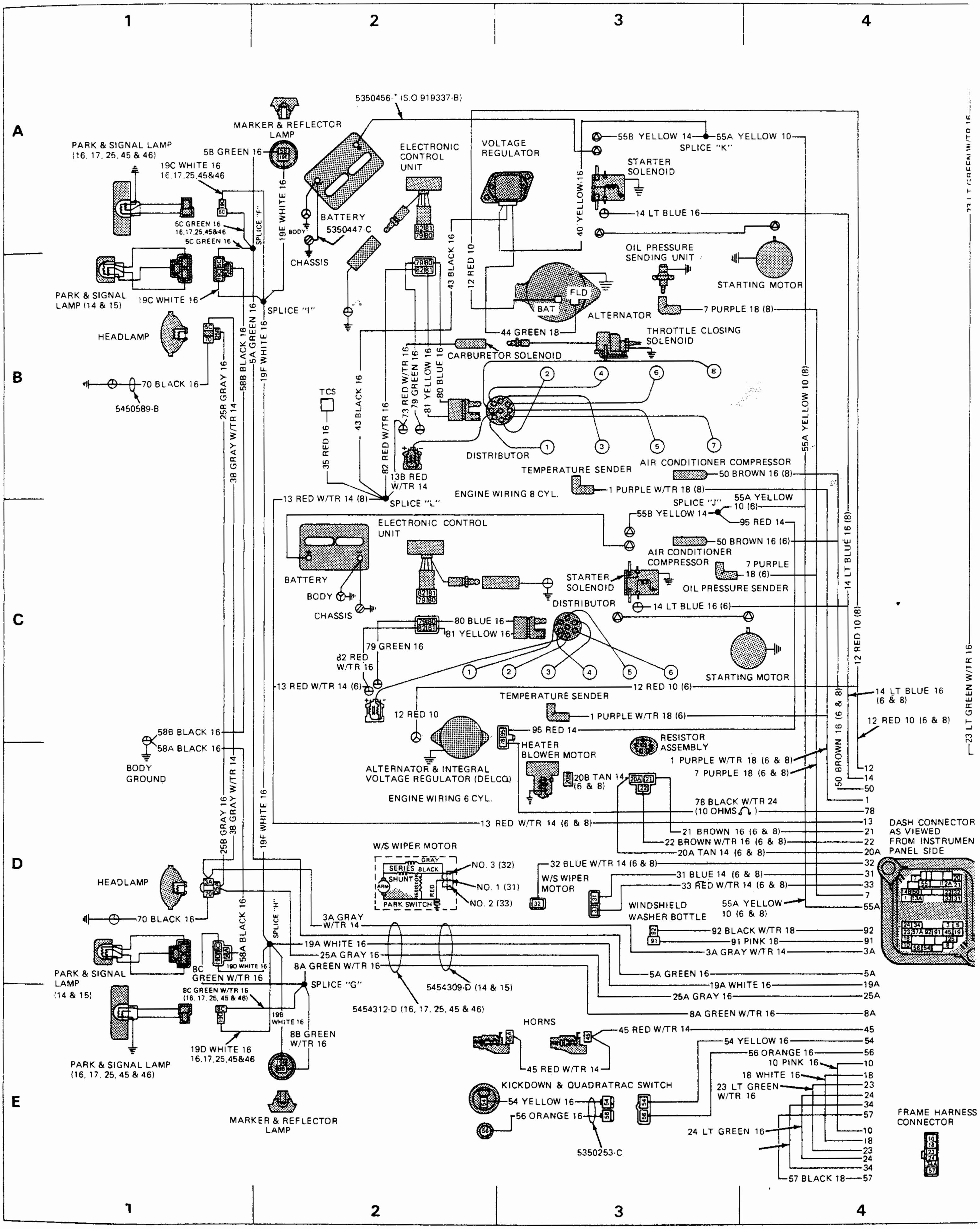
NO.	GA.	COLOR	HARNESS ASSEMBLY – HEADLAMP, PARKING AND SIGNAL LAMPS – CONTINUED
8A	16	GREEN W/TR	DASH CONNECTOR TO SPLICE "G"
8B	16	GREEN W/TR	SPLICE "G" TO LEFT MARKER & REFLECTOR LAMP
8C	16	GREEN W/TR	SPLICE "G" TO LEFT PARK & SIGNAL LAMP CONNECTOR (14 & 15 ONLY)
8C	16	GREEN W/TR	SPLICE "G" TO LEFT PARK & SIGNAL LAMP CONNECTOR (16, 17, 25, 45 & 46 ONLY)
19A	16	WHITE	DASH CONNECTOR TO SPLICE "H"
19B	16	WHITE	SPLICE "H" TO LEFT MARKER & REFLECTOR LAMP
19C	16	WHITE	SPLICE "I" TO RIGHT PARK & SIGNAL LAMP (14 & 15 ONLY)
19C	16	WHITE	SPLICE "I" TO RIGHT PARK & SIGNAL LAMP (16, 17, 25, 45 & 46 ONLY)
19D	16	WHITE	SPLICE "H" TO LEFT PARK & SIGNAL LAMP (14 & 15 ONLY)
19D	16	WHITE	SPLICE "H" TO LEFT PARK & SIGNAL LAMP (16, 17, 25, 45 & 46 ONLY)
19E	16	WHITE	SPLICE "I" TO RIGHT MARKER & REFLECTOR LAMP
19F	16	WHITE	SPLICE "H" TO SPLICE "I"
25A	16	GRAY	DASH CONNECTOR TO LEFT HEADLAMP
25B	16	GRAY	LEFT HEADLAMP TO RIGHT HEADLAMP
58A	16	BLACK	BODY GROUND TO LEFT PARK & SIGNAL LAMP CONNECTOR (14 & 15 ONLY)
58B	16	BLACK	BODY GROUND TO RIGHT PARK & SIGNAL LAMP CONNECTOR (14 & 15 ONLY)
70	16	BLACK	RIGHT HEADLAMP TO GROUND
70	16	BLACK	LEFT HEADLAMP TO GROUND
			HARNESS ASSEMBLY – ENGINE (SIX CYLINDER)
1	18	PURPLE W/TR	DASH CONNECTOR TO TEMPERATURE SENDING UNIT
7	18	PURPLE	DASH CONNECTOR TO OIL PRESSURE SENDER
12	10	RED	DASH CONNECTOR TO ALTERNATOR
13	14	RED W/TR	DASH CONNECTOR TO COIL (+ TERMINAL)
14	16	LT BLUE	DASH CONNECTOR TO STARTER SOLENOID
20A	14	TAN	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
20B	14	TAN	HEATER BLOWER MOTOR CONNECTOR TO HEATER BLOWER MOTOR
21	16	BROWN	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
22	16	BROWN W/TR	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
31	14	BLUE	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 1 TERMINAL)
32	14	BLUE W/TR	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 3 TERMINAL)
33	14	RED W/TR	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 2 TERMINAL)
45	14	RED W/TR	DASH CONNECTOR TO HORN
45	14	RED W/TR	HORN TO HORN
50	16	BROWN	DASH CONNECTOR TO AIR CONDITIONING COMPRESSOR
54	16	YELLOW	DASH CONNECTOR TO KICK-DOWN & QUADRATRAC CONNECTOR
54	16	YELLOW	KICK-DOWN & QUADRATRAC SWITCH TO CONNECTOR
55A	10	YELLOW	DASH CONNECTOR TO SPLICE "J"
55B	14	YELLOW	SPLICE "J" TO STARTER SOLENOID (+ TERMINAL)
56	16	ORANGE	DASH CONNECTOR TO KICK-DOWN & QUADRATRAC CONNECTOR
56	16	ORANGE	KICK-DOWN & QUADRATRAC SWITCH TO CONNECTOR
78	24	BLACK W/TR	DASH CONNECTOR TO ALTERNATOR (DELCO)
79	16	GREEN	COIL (– TERMINAL) TO ELECTRONIC CONTROL UNIT
80	16	BLUE	DISTRIBUTOR TO ELECTRONIC CONTROL UNIT
81	16	YELLOW	DISTRIBUTOR TO ELECTRONIC CONTROL UNIT
82	16	RED W/TR	COIL (+ TERMINAL) TO ELECTRONIC CONTROL UNIT
91	18	PINK	DASH CONNECTOR TO WINDSHIELD WASHER BOTTLE
92	18	BLACK W/TR	DASH CONNECTOR TO WINDSHIELD WASHER BOTTLE
95	14	RED	SPLICE "J" TO ALTERNATOR (DELCO)
			HARNESS ASSEMBLY – ENGINE (V-8)
1	18	PURPLE W/TR	DASH CONNECTOR TO TEMPERATURE SENDING UNIT
7	18	PURPLE	DASH CONNECTOR TO OIL PRESSURE SENDING UNIT
12	10	RED	DASH CONNECTOR TO ALTERNATOR
13	14	RED W/TR	DASH CONNECTOR TO SPLICE "L"
13B	14	RED W/TR	SPLICE "L" TO COIL (+ TERMINAL)
14	16	LT BLUE	DASH CONNECTOR TO STARTER SOLENOID
20A	14	TAN	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
20B	14	TAN	HEATER BLOWER MOTOR CONNECTOR TO HEATER BLOWER MOTOR
21	16	BROWN	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
22	16	BROWN W/TR	DASH CONNECTOR TO HEATER BLOWER MOTOR CONNECTOR
31	14	BLUE	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 1 TERMINAL)
32	14	BLUE W/TR	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 3 TERMINAL)
33	14	RED W/TR	DASH CONNECTOR TO WINDSHIELD WIPER MOTOR (NO. 2 TERMINAL)
40	16	YELLOW	SPLICE "K" TO VOLTAGE REGULATOR
43	16	BLACK	VOLTAGE REGULATOR TO ALTERNATOR
44	18	GREEN	VOLTAGE REGULATOR TO ALTERNATOR
45	14	RED W/TR	DASH CONNECTOR TO HORN
45	14	RED W/TR	HORN TO HORN
50	16	BROWN	DASH CONNECTOR TO AIR CONDITIONING COMPRESSOR
54	16	YELLOW	DASH CONNECTOR TO KICK-DOWN & QUADRATRAC CONNECTOR
54	16	YELLOW	KICK-DOWN & QUADRATRAC SWITCH TO CONNECTOR
55A	10	YELLOW	DASH CONNECTOR TO SPLICE "K"
55B	14	YELLOW	SPLICE "K" TO STARTER SOLENOID (+ TERMINAL)
56	16	ORANGE	DASH CONNECTOR TO KICK-DOWN & QUADRATRAC CONNECTOR
56	16	ORANGE	KICK-DOWN & QUADRATRAC SWITCH TO CONNECTOR
73	16	RED W/TR	COIL (+ TERMINAL) TO CARBURETOR SOLENOID

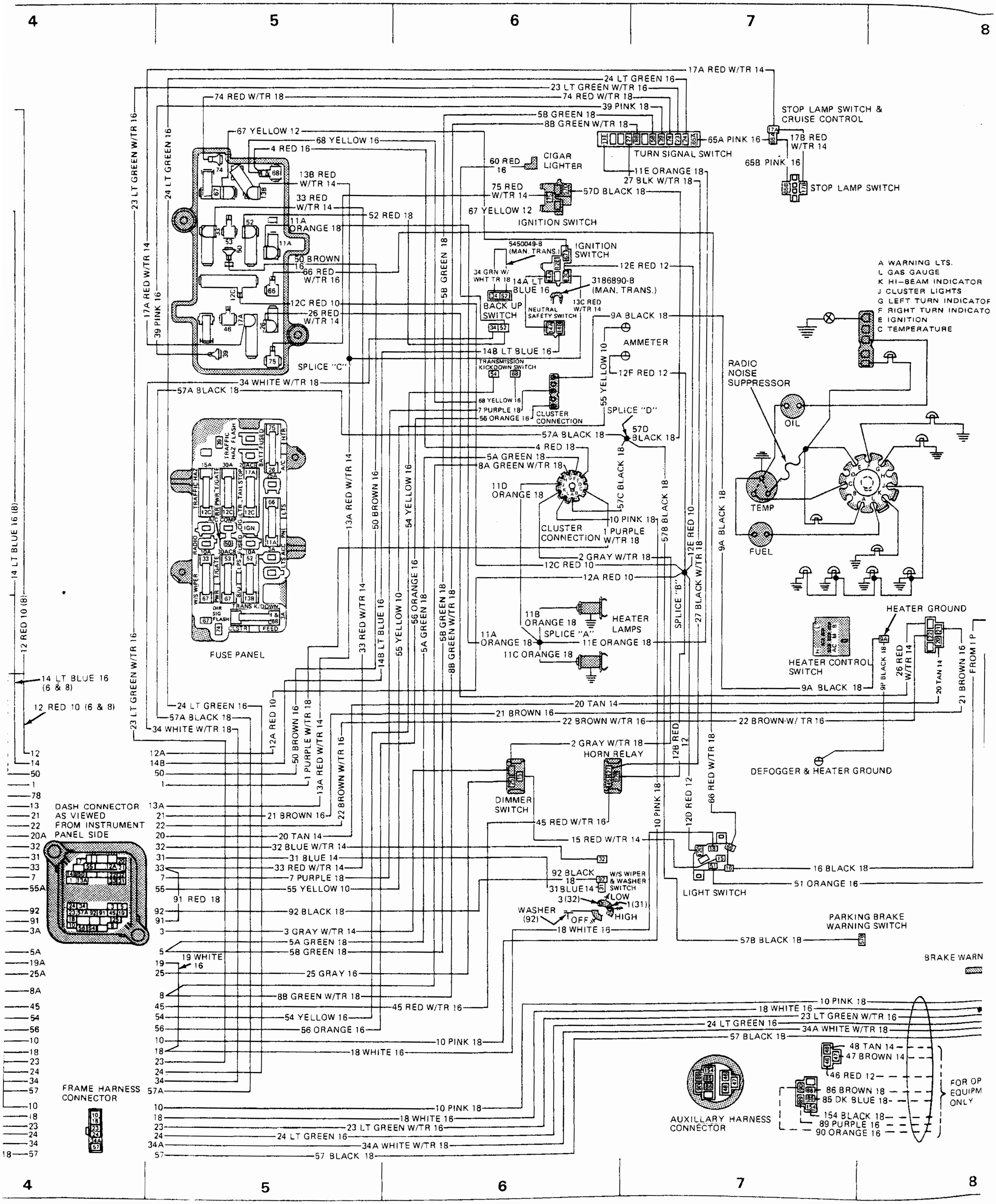
W/TR = WITH TRACER

LEGEND – CHEROKEE – WAGONEER – TRUCK – CONTINUED

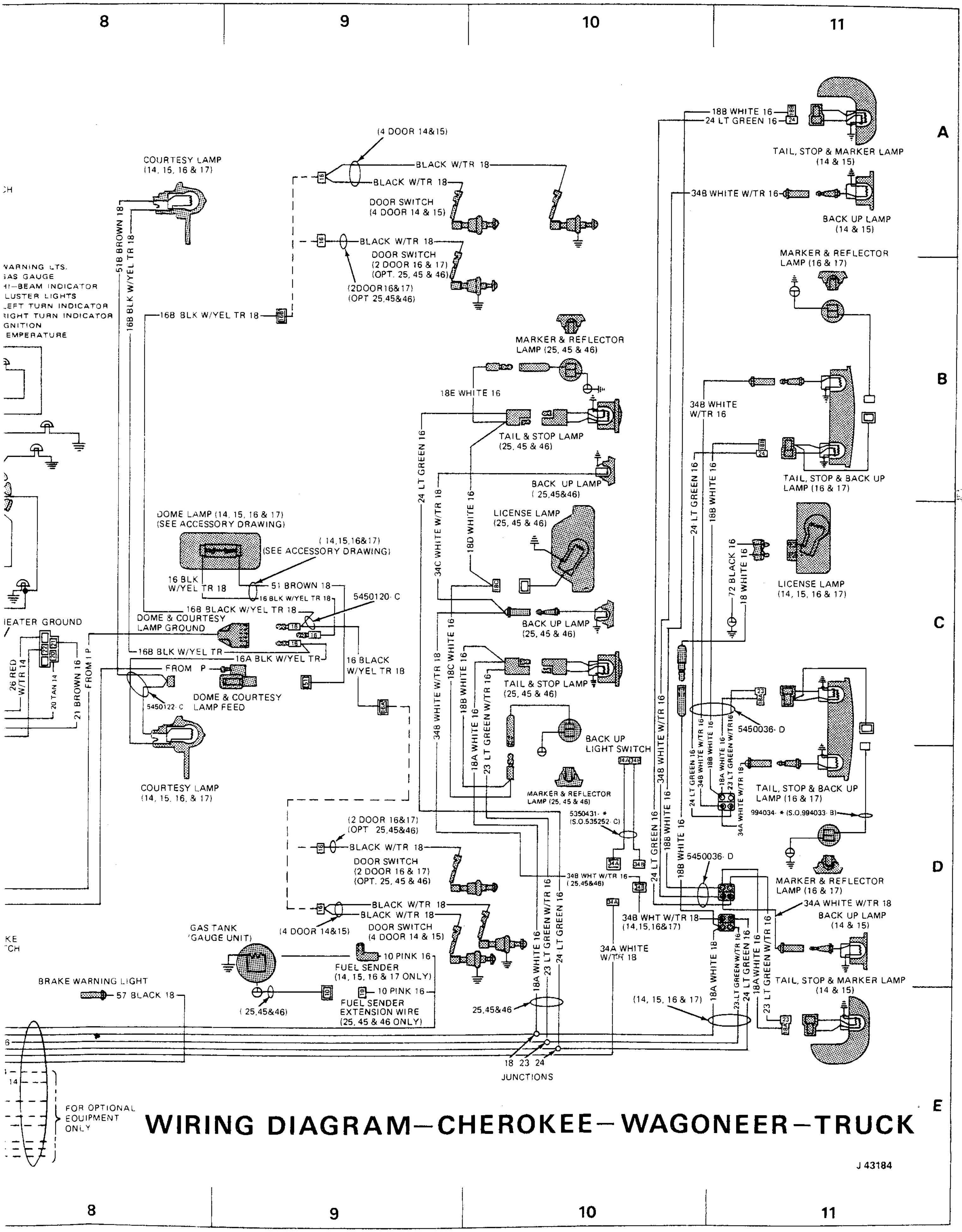
NO.	GA.	COLOR	HARNESS ASSEMBLY – ENGINE (V-8) – CONTINUED
79	16	GREEN	COIL (– TERMINAL) TO ELECTRONIC CONTROL UNIT
80	16	BLUE	DISTRIBUTOR TO ELECTRONIC CONTROL UNIT
81	16	YELLOW	DISTRIBUTOR TO ELECTRONIC CONTROL UNIT
82	16	RED W/TR	SPLICE "L" TO ELECTRONIC CONTROL UNIT
91	18	PINK	DASH CONNECTOR TO WINDSHIELD WASHER BOTTLE
92	18	BLACK W/TR	DASH CONNECTOR TO WINDSHIELD WASHER BOTTLE
			HARNESS ASSEMBLY – CHASSIS
10	18	PINK	DASH CONNECTOR THRU HARNESS CONNECTOR TO FUEL SENDING UNIT
18	16	WHITE	DASH CONNECTOR THRU HARNESS CONNECTOR TO JUNCTION 18
18	16	WHITE	REAR HARNESS CONNECTOR THRU CIRCUIT PLUG TO LICENSE LAMP (14, 15, 16 & 17 ONLY)
18A	16	WHITE	JUNCTION 18 TO TAIL & STOP LAMP CONNECTOR (25, 45 & 46 ONLY)
18A	18	WHITE	JUNCTION 18 TO REAR HARNESS CONNECTOR
18A	16	WHITE	REAR HARNESS CONNECTOR TO LEFT TAIL, STOP & MARKER LAMP (14 & 15 ONLY)
18A	16	WHITE	REAR HARNESS CONNECTOR TO LEFT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
18B	16	WHITE	TAIL & STOP LAMP CONNECTOR TO LEFT MARKER & REFLECTOR LAMP PLUG (25, 45 & 46 ONLY)
18B	16	WHITE	REAR HARNESS CONNECTOR TO LICENSE LAMP PLUG
18B	16	WHITE	REAR HARNESS CONNECTOR TO RIGHT TAIL, STOP & MARKER LAMP (14 & 15 ONLY)
18B	16	WHITE	REAR HARNESS CONNECTOR TO RIGHT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
18C	16	WHITE	LEFT MARKER & REFLECTOR LAMP PLUG TO LICENSE LAMP CONNECTOR (25, 45 & 46 ONLY)
18D	16	WHITE	LICENSE LAMP CONNECTOR TO RIGHT TAIL & STOP LAMP CONNECTOR (25, 45 & 46 ONLY)
18E	16	WHITE	RIGHT TAIL & STOP LAMP CONNECTOR TO RIGHT MARKER & REFLECTOR LAMP PLUG (25, 45 & 46 ONLY)
23	16	LT GREEN W/TR	DASH CONNECTOR THRU HARNESS CONNECTOR TO JUNCTION 23
23	16	LT GREEN W/TR	JUNCTION 23 TO LEFT TAIL & STOP LAMP CONNECTOR (25, 45 & 46 ONLY)
23	16	LT GREEN W/TR	JUNCTION 23 TO REAR HARNESS CONNECTOR
23	16	LT GREEN W/TR	REAR HARNESS CONNECTOR TO LEFT TAIL, STOP & MARKER LAMP (14 & 15 ONLY)
23	16	LT GREEN W/TR	REAR HARNESS CONNECTOR TO LEFT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
24	16	LT GREEN	DASH CONNECTOR THRU HARNESS CONNECTOR TO JUNCTION 24
24	16	LT GREEN	JUNCTION 24 TO RIGHT TAIL & STOP LAMP CONNECTOR (25, 45 & 46 ONLY)
24	16	LT GREEN	JUNCTION 24 TO REAR HARNESS CONNECTOR
24	16	LT GREEN	REAR HARNESS CONNECTOR TO RIGHT TAIL, STOP & MARKER LAMP (14 & 15 ONLY)
24	16	LT GREEN	REAR HARNESS CONNECTOR TO RIGHT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
34A	18	WHITE W/TR	DASH CONNECTOR THRU HARNESS CONNECTOR TO BACK-UP LIGHT SWITCH CONNECTOR
34A	18	WHITE W/TR	REAR HARNESS CONNECTOR TO LEFT BACK-UP LAMP (14 & 15 ONLY)
34A	18	WHITE W/TR	REAR HARNESS CONNECTOR TO LEFT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
34B	18	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO REAR HARNESS CONNECTOR
34B	16	WHITE W/TR	BACK-UP LIGHT SWITCH CONNECTOR TO LEFT BACK-UP LAMP (25, 45 & 46 ONLY)
34B	16	WHITE W/TR	REAR HARNESS CONNECTOR TO RIGHT BACK-UP LAMP (14 & 15 ONLY)
34B	16	WHITE W/TR	REAR HARNESS CONNECTOR TO RIGHT TAIL, STOP & BACK-UP LAMP (16 & 17 ONLY)
34C	18	WHITE W/TR	LEFT BACK-UP LAMP TO RIGHT BACK-UP LAMP (25, 45 & 46 ONLY)
57	18	BLACK	DASH CONNECTOR THRU HARNESS CONNECTOR TO BRAKE WARNING LIGHT
72	16	BLACK	LICENSE LAMP TO BODY GROUND (14, 15, 16 & 17 ONLY)
			DOME AND COURTESY LIGHT CIRCUITS
16	18	BLK W/YEL TR	DOME & COURTESY LAMP GROUND CONNECTOR TO DOME LAMP (14, 15, 16 & 17 ONLY)
16	18	BLK W/YEL TR	DOME & COURTESY LAMP GROUND CONNECTOR TO LEFT DOOR SWITCH(ES) CONNECTOR (14, 15, 16 & 17 ONLY)
16A	18	BLK W/YEL TR	DOME & COURTESY LAMP CONNECTOR TO LEFT COURTESY LAMP (14, 15, 16 & 17 ONLY)
16B	18	BLK W/YEL TR	DOME & COURTESY LAMP GROUND CONNECTOR TO RIGHT COURTESY LAMP (14, 15, 16 & 17 ONLY)
16B	18	BLK W/YEL TR	DOME & COURTESY LAMP GROUND CONNECTOR TO RIGHT DOOR SWITCH(ES) CONNECTOR (14, 15, 16 & 17 ONLY)
51	18	BROWN	DOME LAMP FEED CONNECTOR TO DOME LAMP (14, 15, 16 & 17 ONLY)
51B	18	BROWN	COURTESY LAMP FEED CONNECTOR TO RIGHT COURTESY LAMP (14, 15, 16 & 17 ONLY)

W/TR = WITH TRACER


1
2
3
4
A
B
C
D
E
5350456-* (S.O.919337-B)
MARKER & REFLECTOR LAMP
PARK & SIGNAL LAMP (16, 17, 25, 45 & 46)
5B GREEN 16
19C WHITE 16 16,17,25,45&46
5C GREEN 16 16,17,25,45&46
5C GREEN 16
SPLICE "F"
19E WHITE 16
BODY
CHASSIS
BATTERY 5350447-C
ELECTRONIC CONTROL UNIT
VOLTAGE REGULATOR
40 YELLOW 16
55B YELLOW 14
55A YELLOW 10
SPLICE "K"
STARTER SOLENOID
14 LT BLUE 16
OIL PRESSURE SENDING UNIT
STARTING MOTOR
PARK & SIGNAL LAMP (14 & 15)
19C WHITE 16
SPLICE "I"
43 BLACK 16
12 RED 10
FLD
BAT
ALTERNATOR
7 PURPLE 18 (8)
HEADLAMP
44 GREEN 18
THROTTLE CLOSING SOLENOID
CARBURETOR SOLENOID
70 BLACK 16
5450589-B
25B GRAY 16
3B GRAY W/TR 14
58B BLACK 16
5A GREEN 16
19F WHITE 16
TCS
35 RED 16
43 BLACK 16
82 RED W/TR 16
73 RED W/TR 16
79 GREEN 16
81 YELLOW 16
80 BLUE 16
DISTRIBUTOR
55A YELLOW 10 (8)
AIR CONDITIONER COMPRESSOR
50 BROWN 16 (8)
TEMPERATURE SENDER
1 PURPLE W/TR 18 (8)
13B RED W/TR 14
13 RED W/TR 14 (8)
SPLICE "L"
ENGINE WIRING 8 CYL.
55A YELLOW 10 (6)
SPLICE "J"
55B YELLOW 14
95 RED 14
14 LT BLUE 16 (8)
ELECTRONIC CONTROL UNIT
BATTERY
BODY
CHASSIS
50 BROWN 16 (6)
AIR CONDITIONER COMPRESSOR
7 PURPLE 18 (6)
STARTER SOLENOID
OIL PRESSURE SENDER
DISTRIBUTOR
14 LT BLUE 16 (6)
12 RED 10 (8)
80 BLUE 16
81 YELLOW 16
79 GREEN 16
82 RED W/TR 16
STARTING MOTOR
13 RED W/TR 14 (6)
12 RED 10 (6)
14 LT BLUE 16 (6 & 8)
TEMPERATURE SENDER
12 RED 10
1 PURPLE W/TR 18 (6)
12 RED 10 (6 & 8)
58B BLACK 16
58A BLACK 16
BODY GROUND
95 RED 14
HEATER BLOWER MOTOR
RESISTOR ASSEMBLY
1 PURPLE W/TR 18 (6 & 8)
7 PURPLE 18 (6 & 8)
ALTERNATOR & INTEGRAL VOLTAGE REGULATOR (DELCO)
20B TAN 14 (6 & 8)
50 BROWN 16 (6 & 8)
23 LT GREEN W/TR 16
ENGINE WIRING 6 CYL.
78 BLACK W/TR 24 (10 OHMS)
13 RED W/TR 14 (6 & 8)
21 BROWN 16 (6 & 8)
22 BROWN W/TR 16 (6 & 8)
20A TAN 14 (6 & 8)
DASH CONNECTOR AS VIEWED FROM INSTRUMENT PANEL SIDE
25B GRAY 16
3B GRAY W/TR 14
19F WHITE 16
W/S WIPER MOTOR
SERIES
SHUNT
BLACK
GRAY
RED
ARM
PARK SWITCH
NO. 3 (32)
NO. 1 (31)
NO. 2 (33)
32 BLUE W/TR 14 (6 & 8)
W/S WIPER MOTOR
31 BLUE 14 (6 & 8)
33 RED W/TR 14 (6 & 8)
HEADLAMP
70 BLACK 16
58A BLACK 16
SPLICE "H"
3A GRAY W/TR 14
WINDSHIELD WASHER BOTTLE
55A YELLOW 10 (6 & 8)
92 BLACK W/TR 18
91 PINK 18
3A GRAY W/TR 14
19A WHITE 16
25A GRAY 16
8A GREEN W/TR 16
PARK & SIGNAL LAMP (14 & 15)
8C GREEN W/TR 16
19D WHITE 16
SPLICE "G"
8C GREEN W/TR 16 (16, 17, 25, 45 & 46)
5454309-D (14 & 15)
5454312-D (16, 17, 25, 45 & 46)
5A GREEN 16
19A WHITE 16
25A GRAY 16
8A GREEN W/TR 16
19B WHITE 16
8B GREEN W/TR 16
19D WHITE 16 16,17,25,45&46
PARK & SIGNAL LAMP (16, 17, 25, 45 & 46)
HORNS
45 RED W/TR 14
45 RED W/TR 14
54 YELLOW 16
56 ORANGE 16
10 PINK 16
18 WHITE 16
23 LT GREEN W/TR 16
KICKDOWN & QUADRATRAC SWITCH
54 YELLOW 16
56 ORANGE 16
5350253-C
24 LT GREEN 16
57 BLACK 18
FRAME HARNESS CONNECTOR
MARKER & REFLECTOR LAMP
12
14
50
1
78
13
21
22
20A
32
31
33
7
55A
92
91
3A
5A
19A
25A
8A
45
54
56
10
18
23
24
34
57
23 LT GREEN W/TR 16

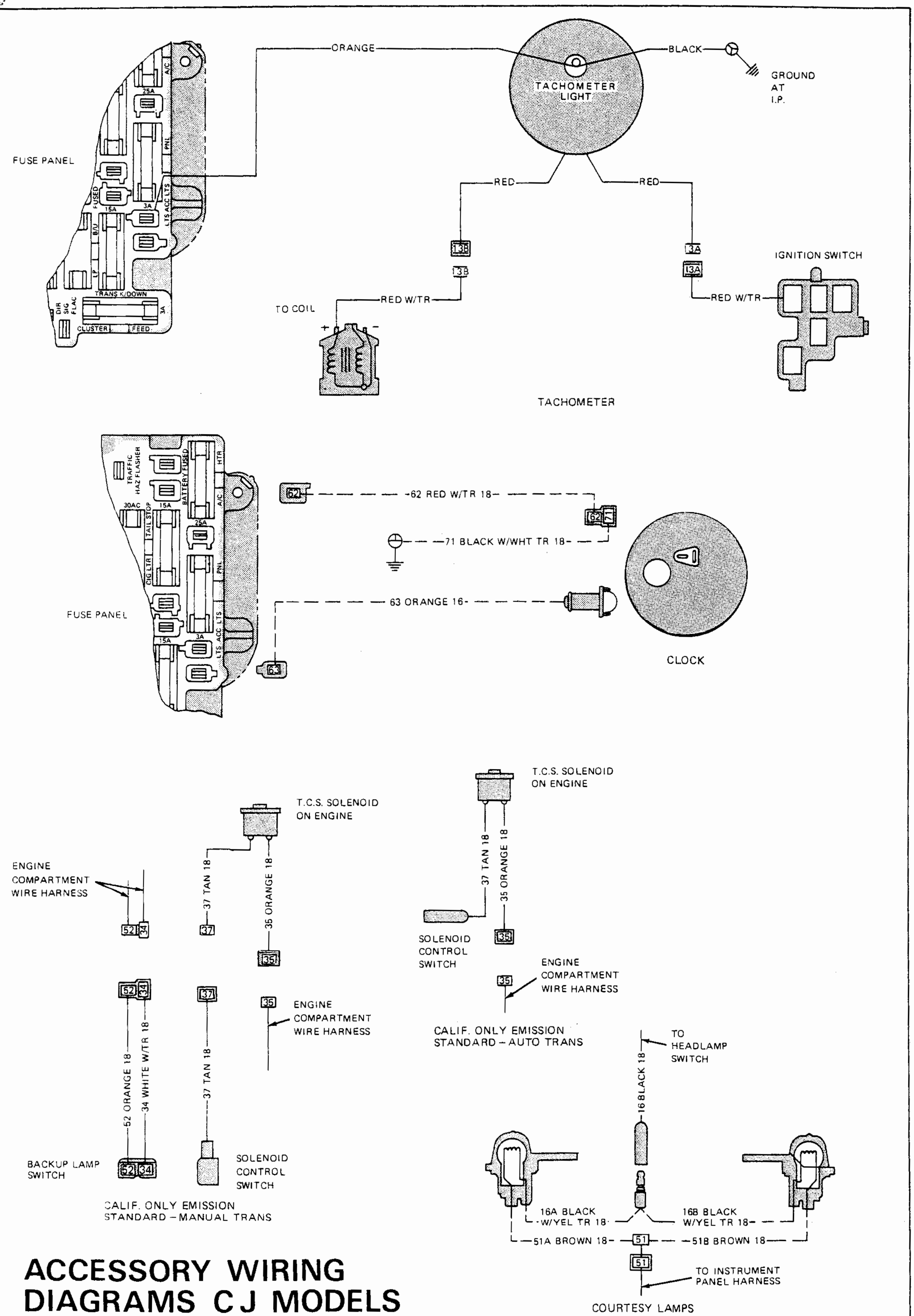


4
5
6
7
8
17A RED W/TR 14
24 LT GREEN 16
23 LT GREEN W/TR 16
74 RED W/TR 18
39 PINK 18
58 GREEN 18
88 GREEN W/TR 18
67 YELLOW 12
68 YELLOW 16
4 RED 16
STOP LAMP SWITCH & CRUISE CONTROL
65A PINK 16
17B RED W/TR 14
TURN SIGNAL SWITCH
65B PINK 16
STOP LAMP SWITCH
11E ORANGE 18
27 BLK W/TR 18
60 RED 16
CIGAR LIGHTER
13B RED W/TR 14
33 RED W/TR 14
52 RED 18
75 RED W/TR 14
57D BLACK 18
67 YELLOW 12
IGNITION SWITCH
11A ORANGE 18
50 BROWN 16
66 RED W/TR 16
12C RED 10
26 RED W/TR 14
5450049-B (MAN. TRANS.)
IGNITION SWITCH
12E RED 12
34 GRN W/ WHT TR 18
14A LT BLUE 16
3186890-B (MAN. TRANS.)
BACK UP SWITCH
NEUTRAL SAFETY SWITCH
13C RED W/TR 14
9A BLACK 18
AMMETER
14B LT BLUE 16
SPLICE "C"
TRANSMISSION KICKDOWN SWITCH
12F RED 12
34 WHITE W/TR 18
57A BLACK 18
68 YELLOW 16
7 PURPLE 18
56 ORANGE 16
CLUSTER CONNECTION
SPLICE "D"
55 YELLOW 10
57A BLACK 18
57D BLACK 18
4 RED 18
5A GREEN 18
8A GREEN W/TR 18
11D ORANGE 18
10 PINK 18
1 PURPLE W/TR 18
CLUSTER CONNECTION
2 GRAY W/TR 18
12C RED 10
12A RED 10
57C BLACK 18
57B BLACK 18
SPLICE "B"
12E RED 10
27 BLACK W/TR 18
9A BLACK 18
11B ORANGE 18
HEATER LAMPS
11A ORANGE 18
SPLICE "A"
11E ORANGE 18
11C ORANGE 18
FUSE PANEL
23 LT GREEN W/TR 16
24 LT GREEN 16
17A RED W/TR 14
39 PINK 16
58 GREEN 18
13A RED W/TR 14
50 BROWN 16
54 YELLOW 16
33 RED W/TR 14
14B LT BLUE 16
55 YELLOW 10
56 ORANGE 16
5A GREEN 18
58 GREEN 18
88 GREEN W/TR 18
A WARNING LTS.
L GAS GAUGE
K HI-BEAM INDICATOR
J CLUSTER LIGHTS
G LEFT TURN INDICATOR
F RIGHT TURN INDICATOR
E IGNITION
C TEMPERATURE
RADIO NOISE SUPPRESSOR
OIL
TEMP
FUEL
HEATER GROUND
HEATER CONTROL SWITCH
9A BLACK 18
26 RED W/TR 14
20 TAN 14
21 BROWN 16
FROM I P
14 LT BLUE 16 (8)
12 RED 10 (8)
14 LT BLUE 16 (6 & 8)
12 RED 10 (6 & 8)
24 LT GREEN 16
57A BLACK 18
34 WHITE W/TR 18
20 TAN 14
21 BROWN 16
22 BROWN W/TR 16
22 BROWN W/ TR 16
12A RED 10
1 PURPLE W/TR 18
13A RED W/TR 14
22 BROWN W/TR 16
2 GRAY W/TR 18
HORN RELAY
12B RED 12
DEFOGGER & HEATER GROUND
DIMMER SWITCH
12D RED 12
66 RED W/TR 18
10 PINK 18
DASH CONNECTOR AS VIEWED FROM INSTRUMENT PANEL SIDE
21 BROWN 16
45 RED W/TR 16
20 TAN 14
15 RED W/TR 14
32 BLUE W/TR 14
31 BLUE 14
33 RED W/TR 14
7 PURPLE 18
55 YELLOW 10
16 BLACK 18
51 ORANGE 16
92 BLACK 18
31 BLUE 14
W/S WIPER & WASHER SWITCH
LIGHT SWITCH
91 RED 18
LOW
HIGH
OFF
WASHER (92)
92 BLACK 18
3 GRAY W/TR 14
18 WHITE 16
5A GREEN 18
58 GREEN 18
PARKING BRAKE WARNING SWITCH
57B BLACK 18
19 WHITE 16
25 GRAY 16
BRAKE WARN
8B GREEN W/TR 18
45 RED W/TR 16
54 YELLOW 16
56 ORANGE 16
10 PINK 18
18 WHITE 16
10 PINK 18
18 WHITE 16
23 LT GREEN W/TR 16
24 LT GREEN 16
34A WHITE W/TR 18
57 BLACK 18
48 TAN 14
47 BROWN 14
46 RED 12
86 BROWN 18
85 DK BLUE 18
154 BLACK 18
89 PURPLE 16
90 ORANGE 16
FOR OP EQUIPM ONLY
AUXILLARY HARNESS CONNECTOR
FRAME HARNESS CONNECTOR
10 PINK 18
18 WHITE 16
23 LT GREEN W/TR 16
24 LT GREEN 16
34A WHITE W/TR 18
57 BLACK 18



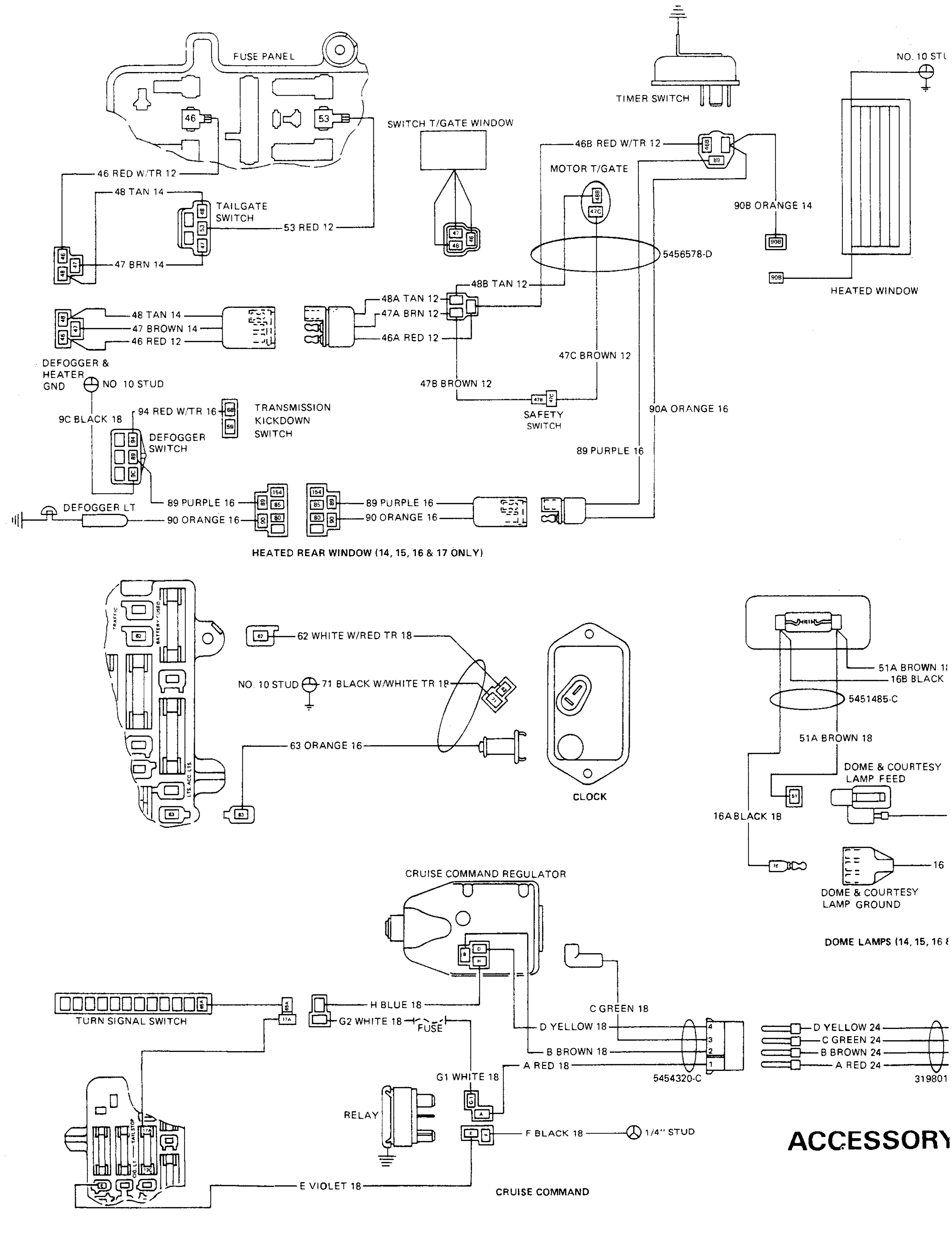
WIRING DIAGRAM—CHEROKEE—WAGONEER—TRUCK

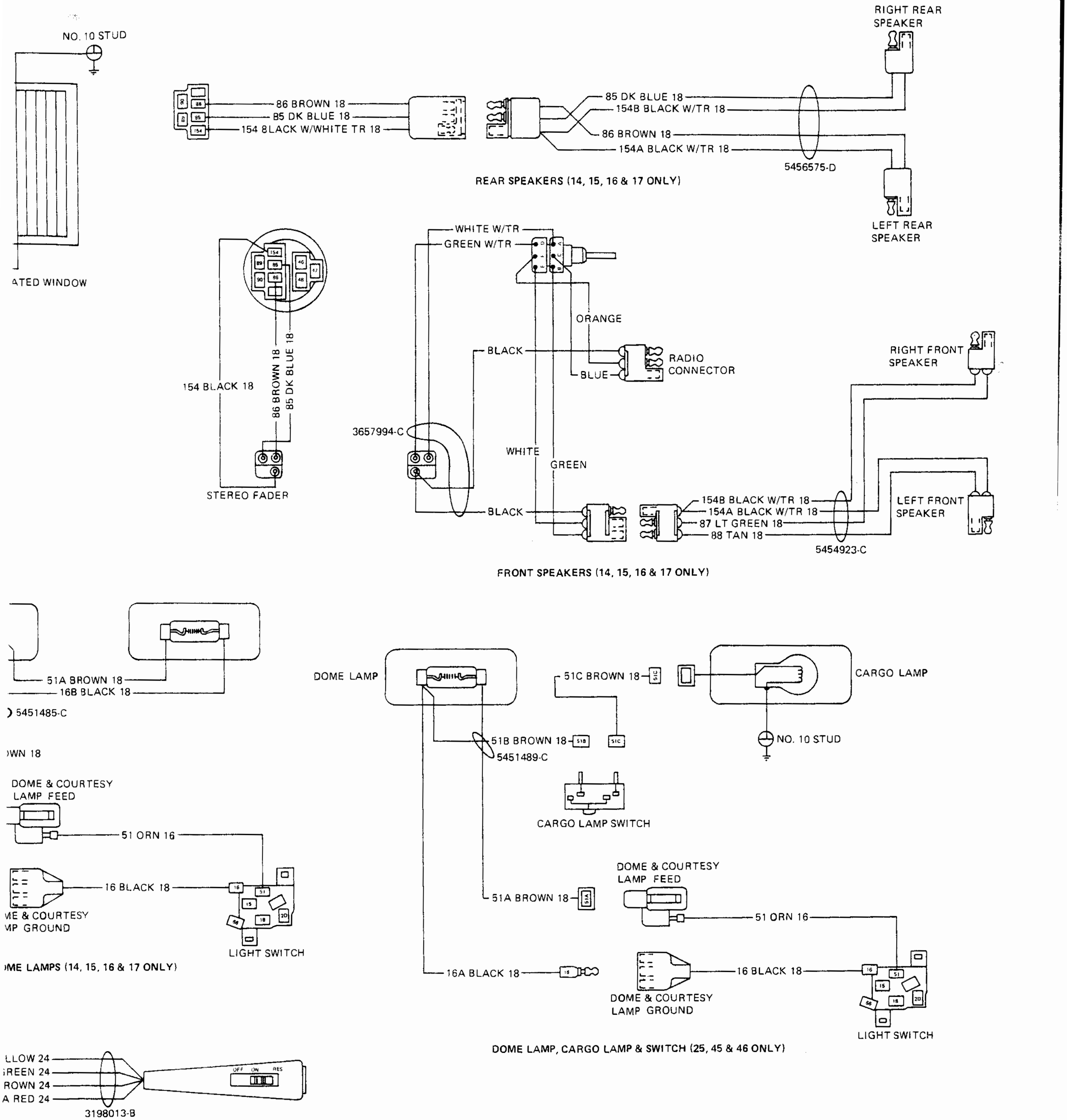
ACCESSORIES



ACCESSORY WIRING DIAGRAMS CJ MODELS

60546


FUSE PANEL
46
53
SWITCH T/GATE WINDOW
TIMER SWITCH
NO. 10 STU
46B RED W/TR 12
MOTOR T/GATE
46 RED W/TR 12
48 TAN 14
TAILGATE SWITCH
53 RED 12
90B ORANGE 14
5456578-D
47 BRN 14
HEATED WINDOW
48B TAN 12
48A TAN 12
47A BRN 12
48 TAN 14
47 BROWN 14
46 RED 12
46A RED 12
DEFOGGER & HEATER GND
NO 10 STUD
47C BROWN 12
47B BROWN 12
94 RED W/TR 16
TRANSMISSION KICKDOWN SWITCH
SAFETY SWITCH
90A ORANGE 16
9C BLACK 18
DEFOGGER SWITCH
89 PURPLE 16
DEFOGGER LT
89 PURPLE 16
90 ORANGE 16
89 PURPLE 16
90 ORANGE 16
HEATED REAR WINDOW (14, 15, 16 & 17 ONLY)
62 WHITE W/RED TR 18
NO. 10 STUD
71 BLACK W/WHITE TR 18
63 ORANGE 16
CLOCK
51A BROWN 1
16B BLACK
5451485-C
51A BROWN 18
DOME & COURTESY LAMP FEED
16A BLACK 18
16
DOME & COURTESY LAMP GROUND
DOME LAMPS (14, 15, 16 &
CRUISE COMMAND REGULATOR
TURN SIGNAL SWITCH
H BLUE 18
G2 WHITE 18
FUSE
C GREEN 18
D YELLOW 18
B BROWN 18
A RED 18
G1 WHITE 18
5454320-C
D YELLOW 24
C GREEN 24
B BROWN 24
A RED 24
319801
RELAY
F BLACK 18
1/4" STUD
E VIOLET 18
CRUISE COMMAND
ACCESSORY



CESSORY WIRING DIAGRAM—CHEROKEE—WAGONEER—TRUCK

J 43183

A

A
(Continued)

B

C

C
(Continued)

D

D
(Continued)

E

E

(Continued)

F

F

(Continued)

G

H

I

J

K

L

M

M
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O

P

Q

R

S

S
(Continued)

T

T

(Continued)

U

U

(Continued)

V

W

THE TOUGHEST 4-LETTER WORD ON WHEELS.

Jeep