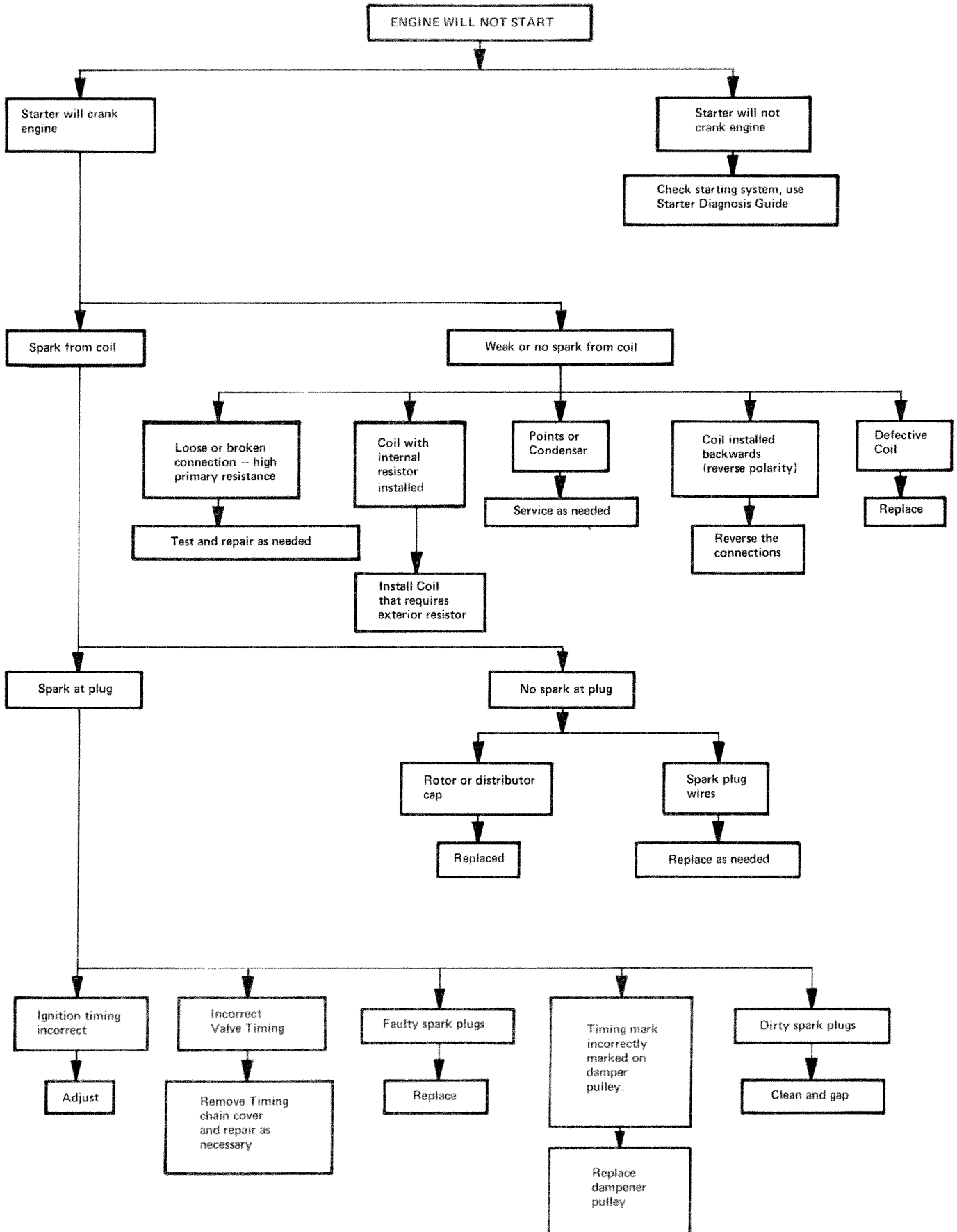


IGNITION SYSTEM DIAGNOSIS GUIDE



livolts per ampere. A voltmeter with a millivolt scale is required to accurately check for resistance in the ignition switch.

Connect a voltmeter between the battery positive post and the battery terminal of the ignition switch. The voltmeter reading should not exceed 0.2 volt. If the voltmeter reading does not exceed 0.2 volt and V-1 exceeded 0.4 volt, resistance is too high through the ignition switch or the wiring between the ignition switch and the resistor wire. If the voltmeter reading exceeds 0.2 volt, resistance is too high in the circuit between the battery terminal of the ignition switch and the battery positive post. Be sure to check the wire connections at the starter relay for looseness or corrosion while observing the voltmeter reading.

Ignition System Bypass

To obtain greatly improved starting performance at low temperature, the primary resistance wire is bypassed during cranking, thereby connecting the ignition coil directly to the battery. This provides full battery voltage to the coil, keeping ignition voltage as high as possible during cranking. The bypassing of the resistance wire during cranking is accomplished by the use of a contact within the starter solenoid. As the contact closes, the coil is connected directly to the battery from the I-terminal of the solenoid.

Secondary Ignition Wires

The operating characteristics of ignition systems are such that during normal operation certain high frequency electrical signals are produced. These signals tend to interfere with vehicle radio and television reception. One of the most common methods of suppression is the use of secondary ignition suppression wire. This type of wire serves the dual purpose of conducting current at required voltages to the spark plugs and at the same time, because of sufficient resistance incorporated over its entire length, eliminates radio interference. Calibrated resistance required in the secondary ignition circuit does not affect spark plug firing voltage.

Suppression type wire is also used in the coil high tension lead. The wires consists of a rayon braid over linen core impregnated with carbon to form a conductor. The conductor is covered with a high quality rubber insulation. Wire pins are used to connect the conductor with the terminals.

NOTE: *It is recommended that carbon core wire not be repaired. Replace the entire wire if the end is damaged.*

IGNITION COIL

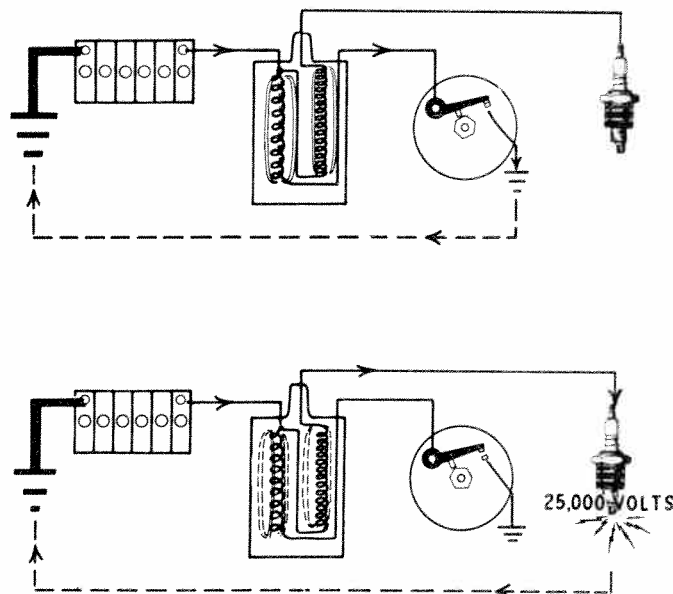
The ignition coil is an oil-filled, hermetically-sealed

unit. Ignition coils do not require special service other than keeping terminals and connections clean and tight.

All six-cylinder and V-8 engines require coils with an external resistance. The use of a coil with an internal resistor would result in hard starting and loss of engine power.

The function of the ignition coil (fig. 3-51) is to transform the low voltage, supplied by the battery or charging circuit, into the high voltage necessary to produce a spark at the spark plug gap.

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.



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Fig. 3-51 Ignition Coil Buildup and Discharge

To keep the required voltage as low as possible, the coil must be connected for correct polarity so that electron flow across the spark plug gap will be from center electrode to ground. This negative spark polarity requires a lower voltage since electrons will more readily leave the hotter center electrode.

For correct polarity, the coil primary terminal should be corrected to correspond to the battery polarity of the vehicle, with the distributor connection considered as ground.

The polarity can be checked on the car by connecting the negative lead of a voltmeter to any spark plug terminal and the positive lead to ground at the engine. Start the engine. If the voltmeter reads up-scale, the polarity is correct. If the voltmeter reads downscale, the polarity is incorrect and the coil primary connections should be reversed.

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.

Refer to the Emission Control Section for ignition coil specifications.

DISTRIBUTOR

The distributor is permanently lubricated. At the time of contact point replacement or overhaul, apply a trace of high melting point lubricant to the breaker cam.

All distributors are equipped with cam lubricators and should be replaced at recommended intervals (refer to Emission Control Section).

Diaphragm Vacuum Unit

A single vacuum unit containing one enclosed spring-loaded diaphragm is used on the distributor.

The advance section is linked mechanically to the movable breaker plate assembly. The airtight advance diaphragm is connected by a hose to the carburetor vacuum spark port above the throttle valve(s). Under part-throttle operation, the ported vacuum is sufficient to actuate the advance diaphragm and cause the breaker plate to move opposite distributor rotation, advancing the spark and increasing the fuel economy.

During acceleration or when the engine is pulling heavily, the ported vacuum is not sufficient to actuate the advance diaphragm.

NOTE: *If equipped with a coolant temperature override switch at the thermostat housing, the distributor vacuum hose is connected to a port of the switch rather than the carburetor vacuum spark port. Refer to the Emission Control Section for an operation description.*

Centrifugal Advance

The centrifugal advance mechanism consists of a cam actuated by two spring-controlled centrifugal weights. As the speed of the distributor shaft increases with engine speed, the weights are thrown outward against the pull of the springs. This advances the cam, causing the contacts points to open earlier and advancing the spark (fig. 3-52).

Removal of Vacuum Control Unit

The vacuum control unit is removed by removing the screws which hold the vacuum unit to the distributor body.

NOTE: *During assembly, the clip of the plate ground lead must be placed under the head of one of the attaching screws on V-8 distributors.*

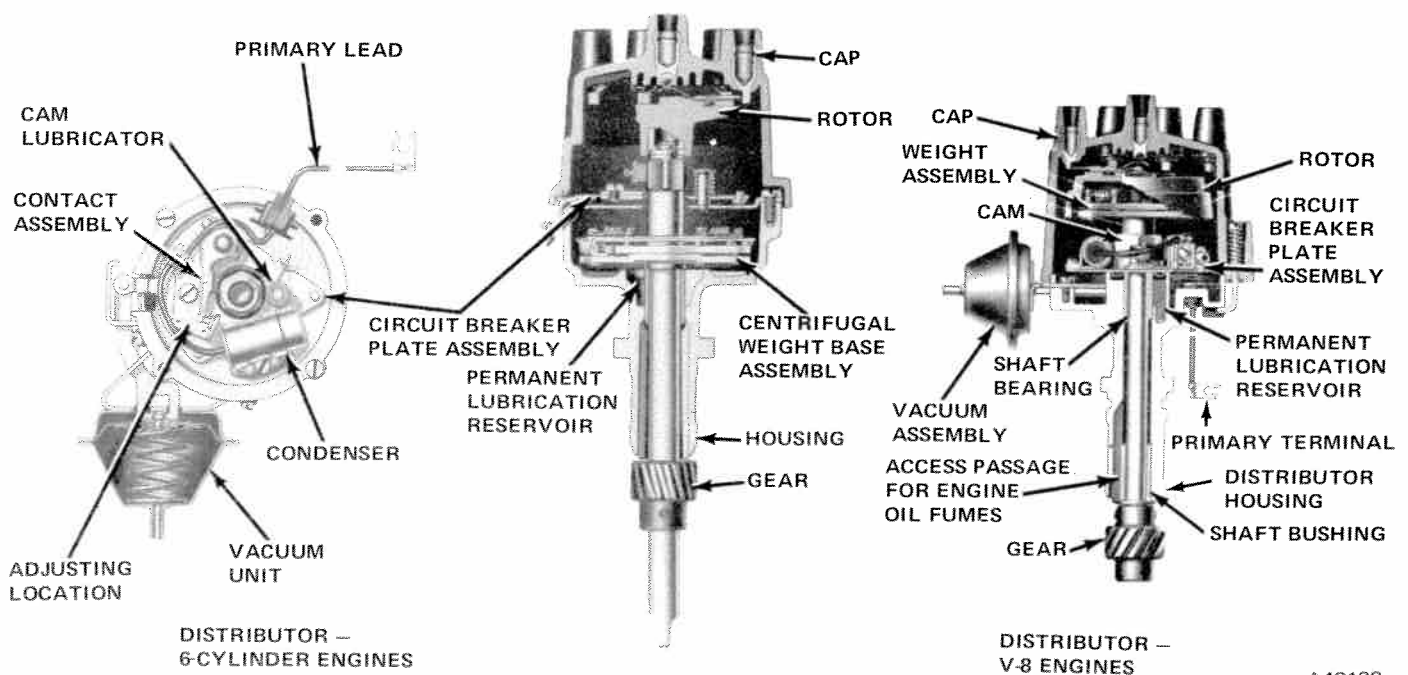


Fig. 3-52 Distributor

(1) Disconnect primary lead and vacuum hose, and remove the distributor cap. Note motor position for proper location during installation.

(2) Remove holddown bolt, clamp, and distributor assembly.

(3) Install distributor with rotor positioned in the same location as noted during removal.

NOTE: If the engine has been cranked with the distributor removed or the rotor position was not noted during removal, proceed as follows:

(4) Position No. 1 piston at TDC on the compression stroke. To determine if the piston is on compression stroke, remove No. 1 spark plug, place thumb or compression gauge over the spark plug hole, and crank the engine slowly until compression pressure begins to build up. Continue to crank the engine until the timing mark on the vibration damper is aligned with the TDC mark of the timing degree scale as shown in figures 3-53 and 3-54.

NOTE: The timing mark on the vibration damper also will be aligned with the TDC mark when No. 6 cylinder is on exhaust stroke. Therefore, it is important to be sure No. 1 cylinder is on compression stroke when installing the distributor.

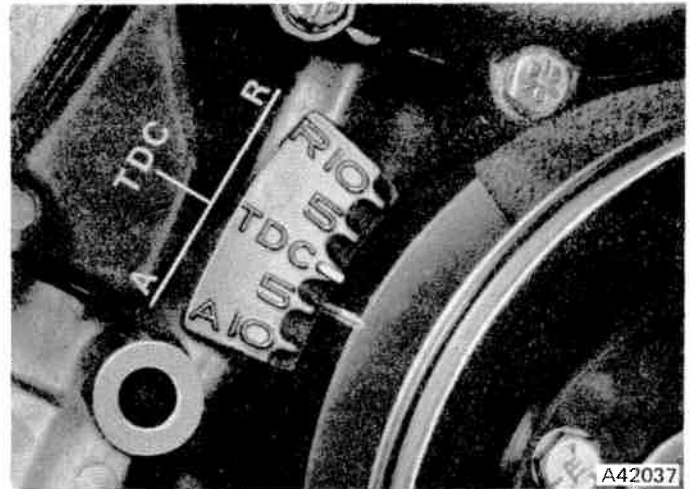


Fig. 3-54 Ignition Timing Marks - V-8

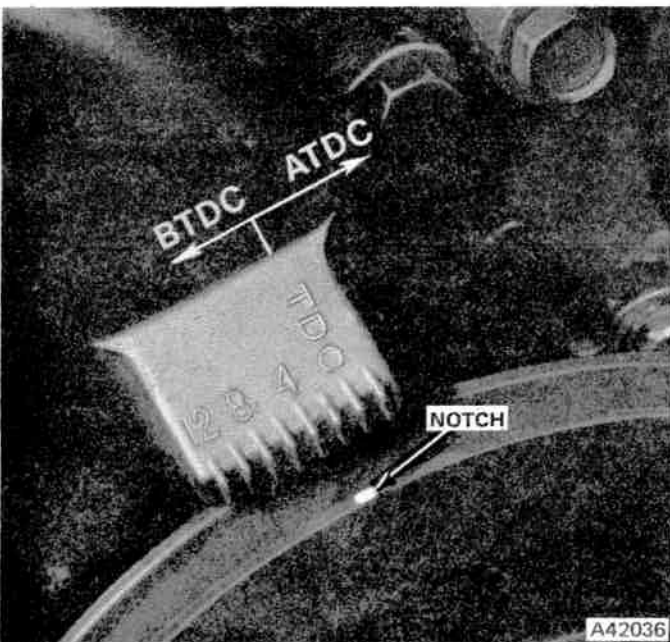


Fig. 3-53 Ignition Timing Marks - Six-Cylinder

(5) Mesh distributor drive gear with camshaft mating drive gear in such a position that rotor points to the (No. 1 cylinder) terminal of distributor cap.

NOTE: If spark plug wires have been removed from the distributor cap, refer to figure 3-55 for proper positioning.

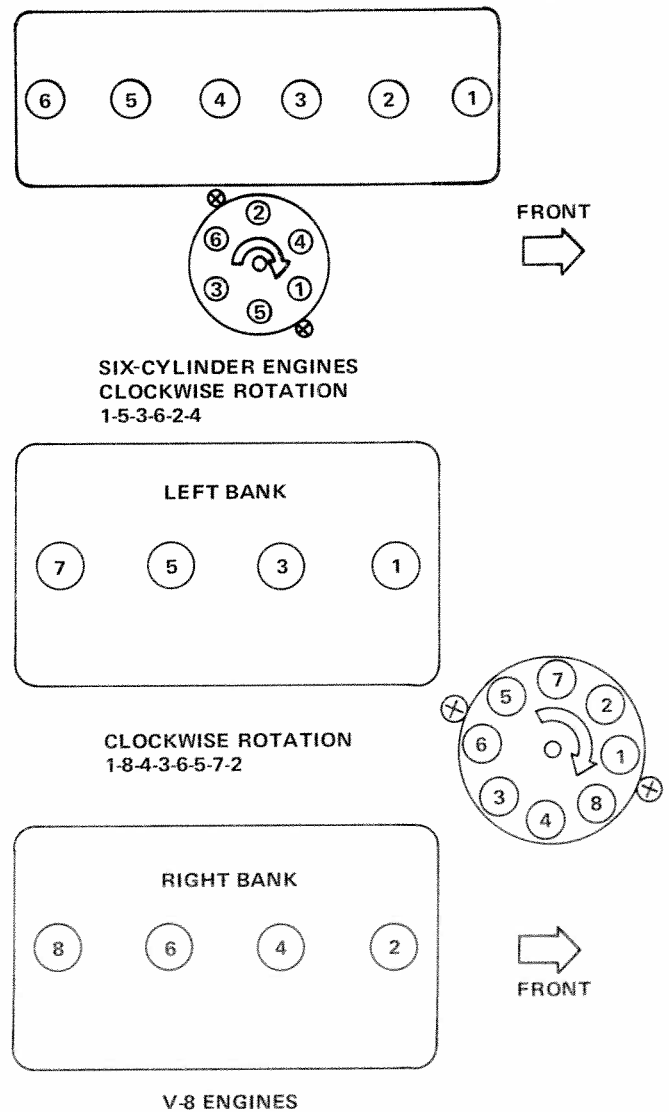


Fig. 3-55 Distributor Wiring Sequence and Firing Order

INSTRUMENT CLUSTER

CJ Models

The instrument cluster is composed of the speedometer housing, panel lighting bulbs, hi-beam indicator, turn signal indicators, amp (alternator) and oil warning lights, temperature gauge and combination fuel gauge and constant voltage regulator (CVR) (fig. 3-56 and 3-57).

Removal and Installation

- (1) Disconnect one battery cable.
- (2) Separate speedometer cable from speedometer head.
- (3) Remove two attaching screws and allow heater control bracket to drop down.
- (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, connect battery and check all lights and gauges for proper operation.

NOTE: The connector link (fig. 3-57) is not serviced. In the event a connector link has to be replaced, manufacture a connector out of 16 gauge (or larger) insulated wire.

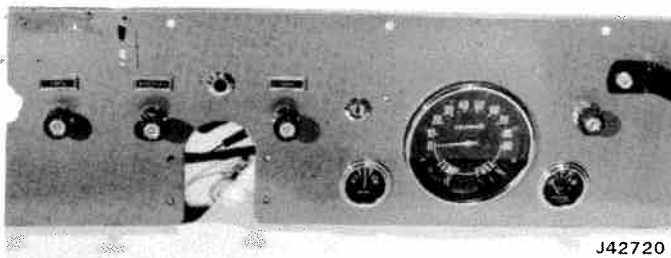


Fig. 3-56 Instrument Panel CJ Models

- (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.

NOTE: Tag each hose according to its numbered location to ensure the proper connection when installing the cluster.

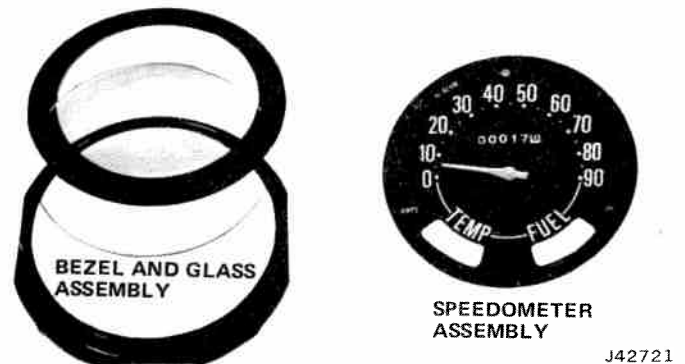
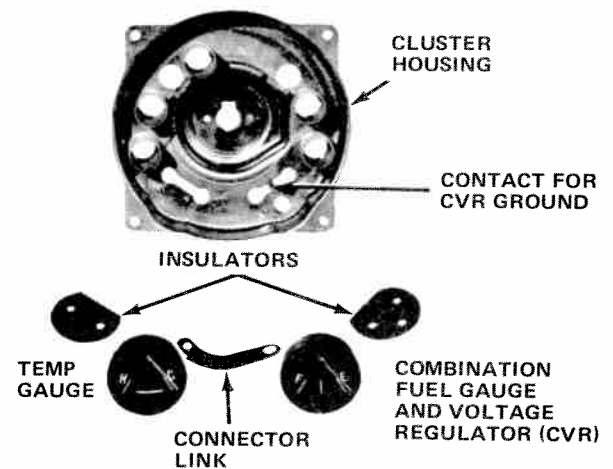


Fig. 3-57 Instrument Cluster Assembly - CJ Models

Cherokee, Wagoneer, and Truck

The instrument cluster (fig. 3-58) 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, lockout warning bulbs (Quadra-Trac), heater control lights, wiper-washer and heater control lights, and the blower motor fan switch.

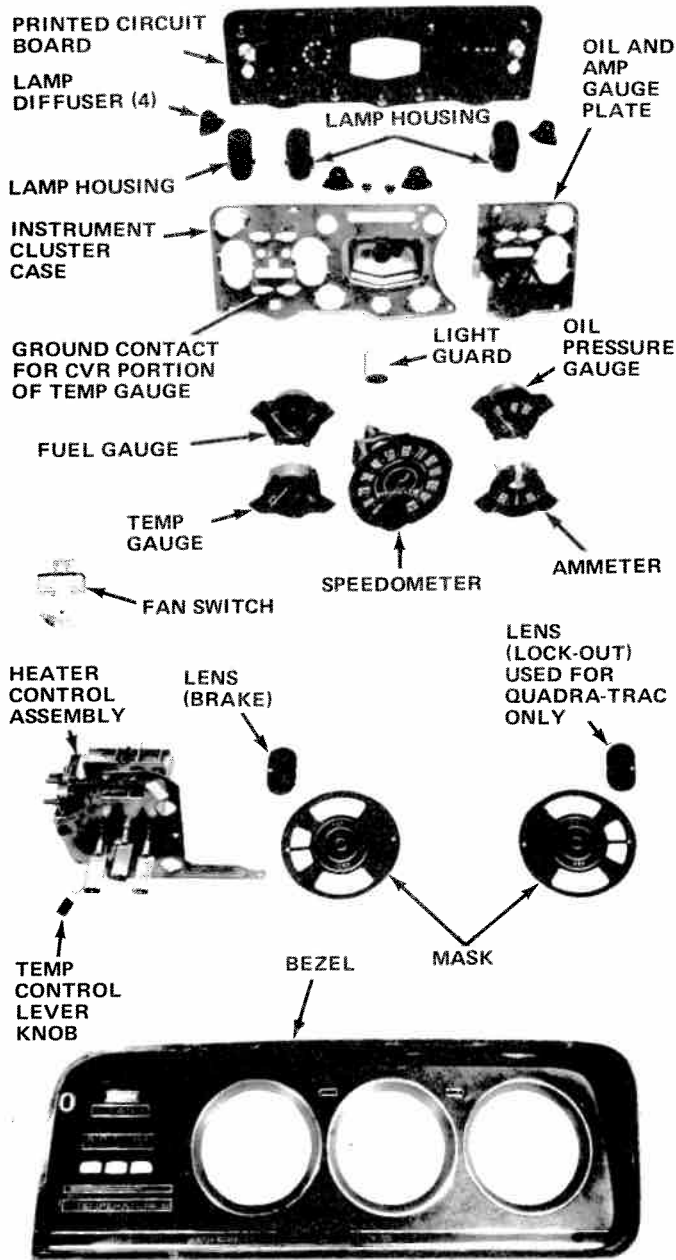
Removal

- (1) Disconnect battery.
- (2) Remove six cluster retaining screws.

- (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.



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Fig. 3-58 Instrument Cluster - Cherokee, Wagoneer and Truck

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 3-59 for pin terminal 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.

(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 should light or ohmmeter should read 0 resistance.

(5) Connect test lamp or ohmmeter lead to ground pin terminal and other lead to cluster metal case. Bulb should light or the ohmmeter should read 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

Two bulbs and three molded lamps provide instrument panel illumination and identification. Current and protection for the panel bulbs and lamps are provided by the 20-amp circuit breaker located internally in the headlamp switch. This circuit breaker is not serviceable. It is an integral part of the headlamp switch.

Do not pull on the bulb wires to remove the bulb socket; grasp the socket and pull down.

To remove the molded lamps, remove the wire connectors. Squeeze the lamp together at each end 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, and 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 headlight 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.

Charge Indicator (Amp)

The charge indicator bulb should be off when the key is off or when the engine is operating. If the indicator is on when the key is off, a positive diode in the alternator is defective.

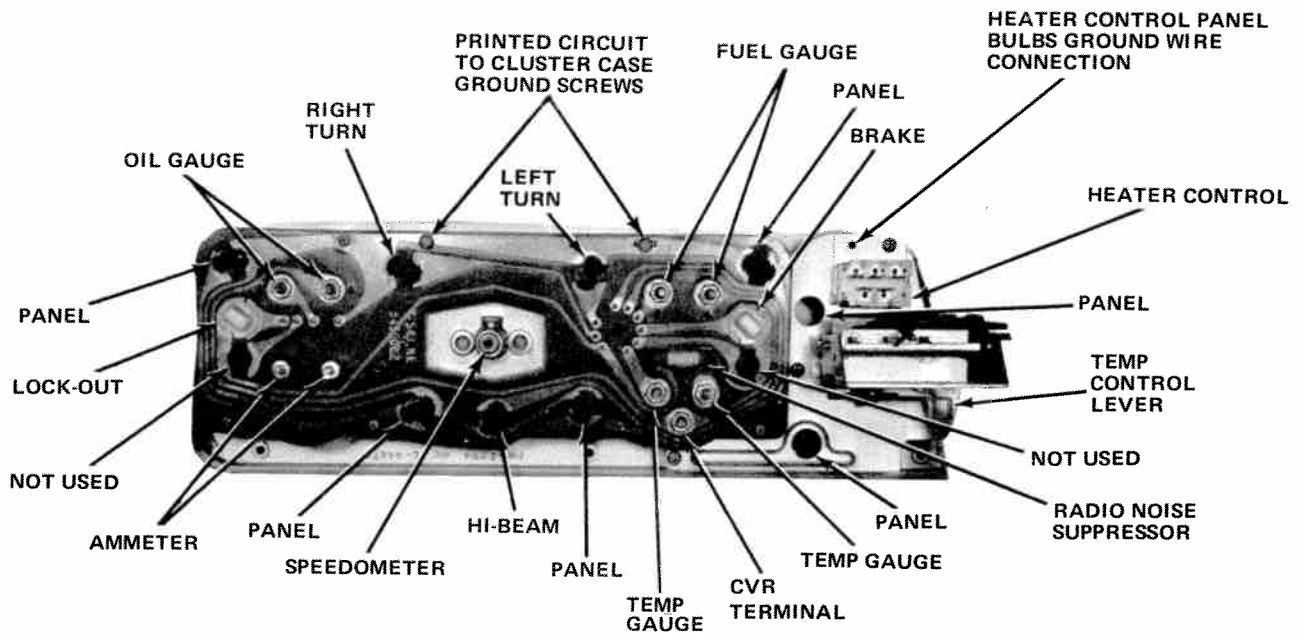


Fig. 3-59 Instrument Cluster - Rear View - Cherokee, Wagoneer, and Truck

The indicator should glow brightly when the key is on and the engine is not operating. If the indicator light is defective, it can be replaced by pulling the bulb socket down and out from the instrument cluster.

The charge indicator **does not** indicate that the battery is receiving a charge. If the alternator is producing 20 amps and there is a 30-amp load, the indicator bulb will not light unless the battery voltage drops sufficiently below the alternator voltage to cause current to flow through the indicator bulb. For a more complete diagnosis of the indicator bulb circuit, refer to the alternator section, Excitation and Bulb Circuit.

Oil Pressure Warning Light and Sending Unit Test

The low oil pressure indicator light is wired in series with the oil pressure sending unit on the engine block. This sending unit contains a diaphragm, spring, linkage, and electrical contacts. When the ignition switch is in the on position, the indicator circuit is energized and the circuit is completed to ground through the closed contacts in the sending unit. Upon starting the engine, oil pressure compresses the diaphragm and opens the contact points, thereby opening the circuit to the indicator light.

No light is used on systems utilizing an oil pressure gauge.

With the ignition switch in the IGN position and the engine not running, the oil pressure indicator

should light. If the indicator does not light, ground the oil pressure sending unit wire to the engine. If the indicator does not light, either the bulb or wiring is defective.

If the indicator does light with the wire grounded, the oil sending unit switch is defective and must be replaced.

NOTE: If the oil pressure warning light remains on constantly when the engine is operating, check the engine oil pressure by removing the sender unit and installing a direct reading oil pressure gauge.

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-22344-01, 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. gauge should read as follows:

PSI	Resistance (Ohms)
0	68 - 78
40	21 - 25
80	7 - 13

Check all circuit connections before replacing the gauge.

Sending Unit Test

After verifying a proper operating gauge, remove the oil sending unit and install a tee fitting between the block fitting 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.

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 effect 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-22344-01 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 reconnect sending unit wire.
 - (b) Proceed to Fuel or Temperature Gauge Tests 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

FUEL GAUGE CALIBRATION - ALL MODELS

73 Ohms @ Empty
23 Ohms @ 1/2
10 Ohms @ Full

NOTE: Fuel and temperature gauges are 5 per cent meters, that is, they must be accurate within 5 per cent of a specific ohm value.

Example: 5 percent of 60 ohms is 3 ohms or 60 (plus or minus 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 3-60.

(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 chart.

(4) If gauge reads correctly, wire leading to sender unit is defective.

(5) If no reading is obtained, check input voltage to gauge (I-terminal) with test light or voltmeter (fig. 3-60).

(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 voltage (as compared to battery voltage) is indicated at V-1, 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 the CVR terminal as shown. The voltmeter should pulsate about once 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 3-60.

If 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, and 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. 3-61).

CAUTION: Do not attempt to test gauges with the 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-22344-01 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 Fuel and Temperature Gauge Ohm Value Chart and observe gauge.

(10) Check full range of gauge. If gauge is not correct through entire range, it should be replaced.

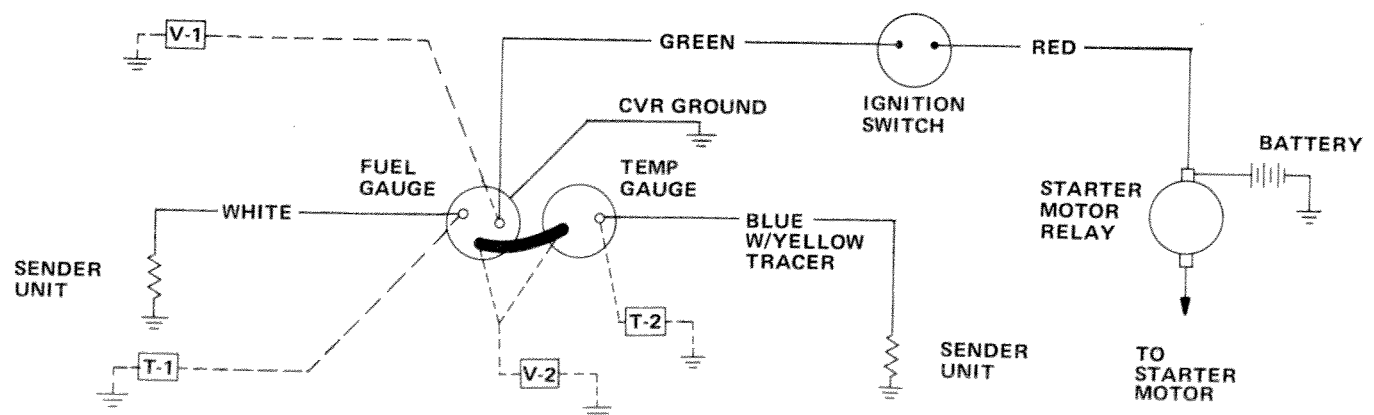
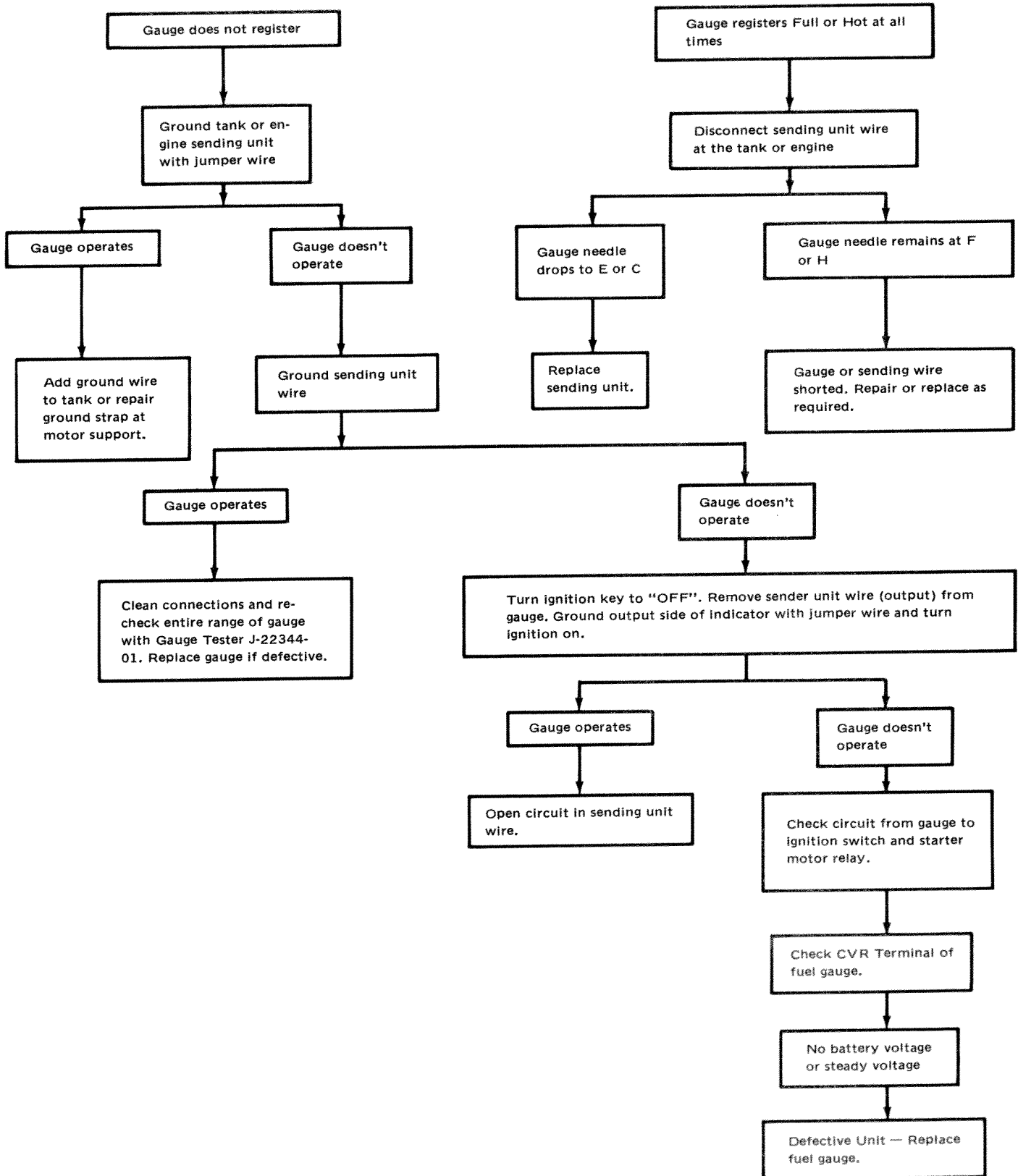


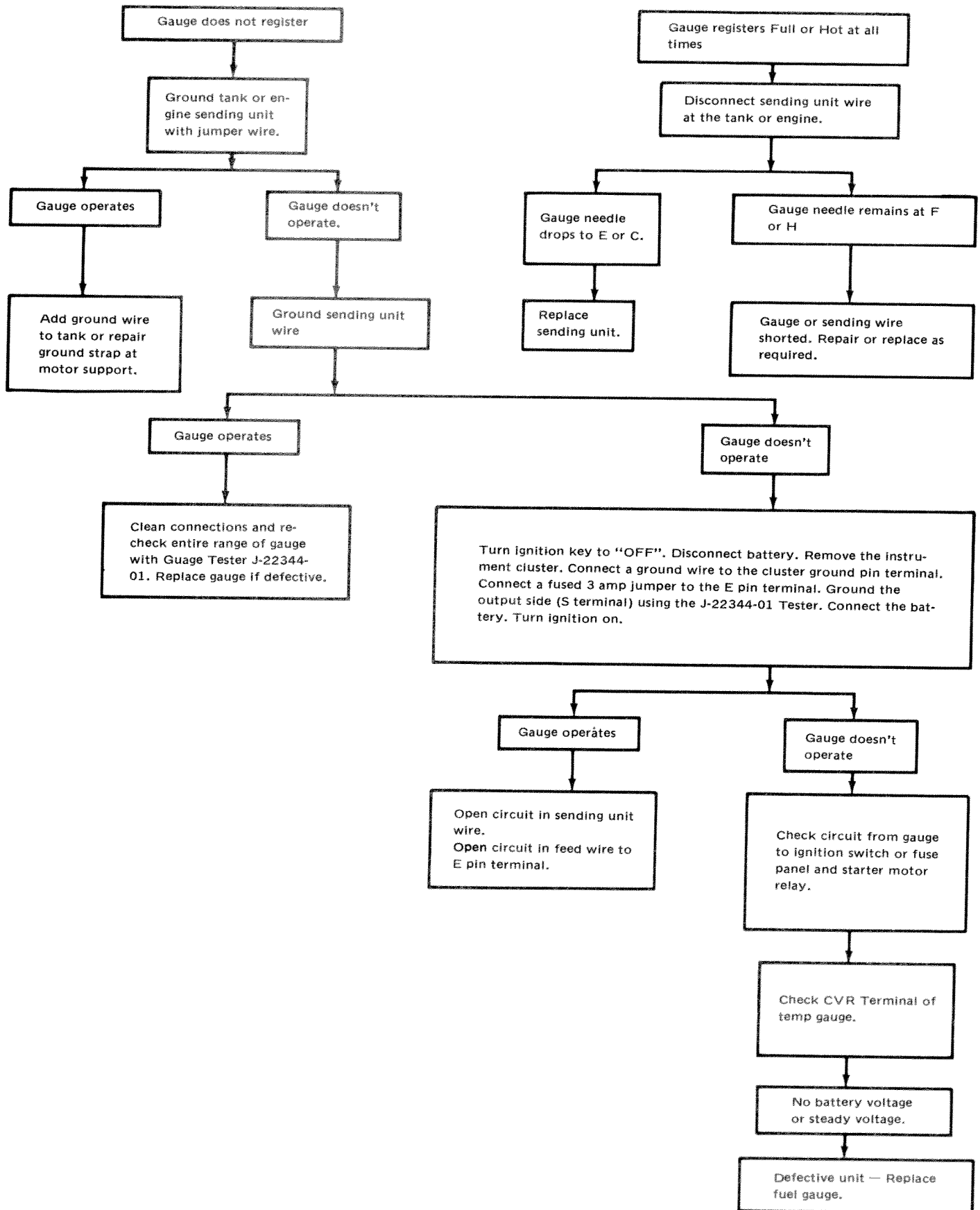
Fig. 3-60 Fuel and Temperature Gauge Circuitry - CJ Models

FUEL AND TEMPERATURE GAUGE DIAGNOSIS GUIDE - CJ MODELS

CAUTION: Gauges do not have fused or circuit breaker protected circuits.



FUEL AND TEMPERATURE GAUGE DIAGNOSIS GUIDE - CHEROKEE, WAGONEER, AND TRUCK



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.

NOTE: Be sure two printed circuit-to-cluster case ground screws are tight.

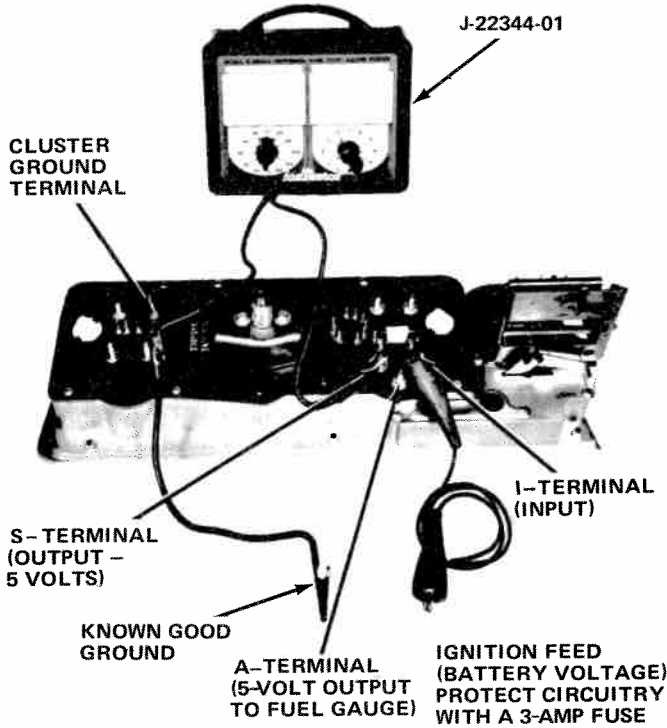


Fig. 3-61 Testing Temperature Gauge - Cherokee, Wagoneer, and Truck

TEST RESULTS With Tester Connected as Shown in Figure 3-61	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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(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 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, and Truck

(1) Remove six printed circuit retaining screws and remove instrument cluster case (fig. 3-58).

(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. 3-58). 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.

IGNITION SWITCH

CJ Models

The ignition switch has four positions: (1) Accessory, (2) off, (3) on, and (4) start. The key must be in the switch to turn it to any position. The key can be removed only in the off position.

In accessory, a connection is made from the battery terminal to the accessory terminal of the switch to allow the radio, blower and windshield wiper to be op-

erated with the ignition fuel gauge and indicator light circuits off.

If off, no accessory supplied through the ignition switch can be operated.

In on, a connection is made from the battery terminal to the accessory terminal so that all ignition switch supplied accessories can be operated. Also, the battery is connected to the resistance wire leading to the ignition coil (IGN). From this same terminal, a lead into the instrument cluster energizes the fuel gauge, oil, and alternator lights.

In start, all ignition switch supplied accessories are temporarily disconnected. A connection is made to the starter solenoid relay. The charge and oil indicator lamps will light until the engine is started.

Cherokee, Wagoneer, and Truck

The ignition switch is mounted on the lower section of the steering column and 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 Tilt columns. 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.

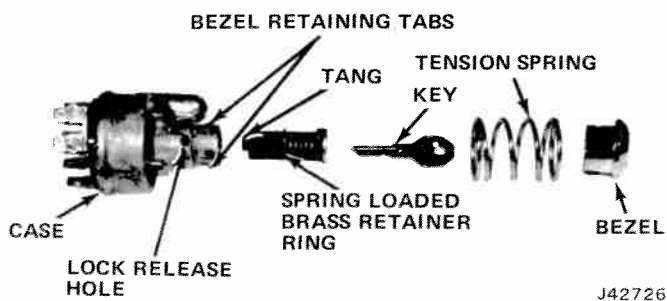


Fig. 3-62 Ignition Switch - CJ Models

Removal

CJ Models

Refer to figure 3-62.

(1) Press main switch body toward instrument panel compressing spring until notched bezel is free to be turned counterclockwise, releasing it off notch pins.

(2) Remove bezel and pull back main switch body, releasing spring tension.

(3) Lower switch body from under instrument panel so wiring harness plug can be removed from prong connection.

Installation

CJ Models

(1) Place main compression spring on main switch body.

(2) Install main switch body into instrument panel opening from rear.

(3) 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.

(4) Remove key and push on main switch body so that notched bezel can be installed freely with notches in line with notch pins.

(5) Turn bezel clockwise to lock in position. The word Starter should be on top when correctly assembled.

Cylinder Replacement

CJ Models

(1) Remove ignition switch from vehicle.

(2) A spring-loaded brass retainer holds cylinder in switch case. The cylinder can be removed with the key in or out of the cylinder and in any position except accessory position.

(3) Turn switch to the on position. This is the easiest position to depress the brass retainer. Insert a heavy-duty type paper clip through cylinder release hole and depress retainer ring until it clears retaining ridge and allows cylinder to be withdrawn.

(4) Line up male tang on cylinder with female slot in case.

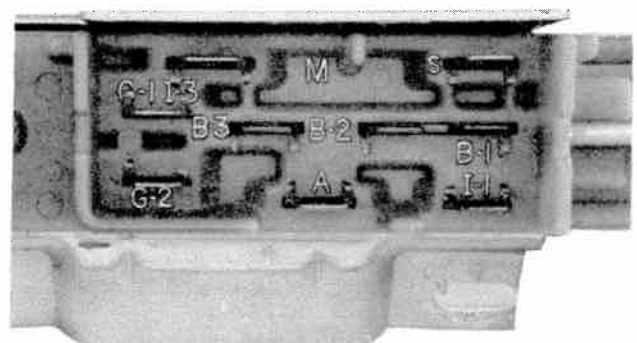


Fig. 3-63 Ignition Switch Terminals

- (5) Depress spring-loaded brass retainer and insert cylinder until retainer snaps into position.
- (6) Install ignition switch.

Removal

Cherokee, Wagoneer, and Truck

- (1) Place key lock in off LOCK position and remove two switch mounting screws.
- (2) Disconnect switch from remote rod.
- (3) Remove harness connector and remove switch.

Installation

Cherokee, Wagoneer, and Truck

- (1) With actuator rod disconnected, position switch as shown in figure 3-64.
- (2) Move slider to extreme left (accessory position).

NOTE: The left side of the ignition switch is toward the steering wheel.

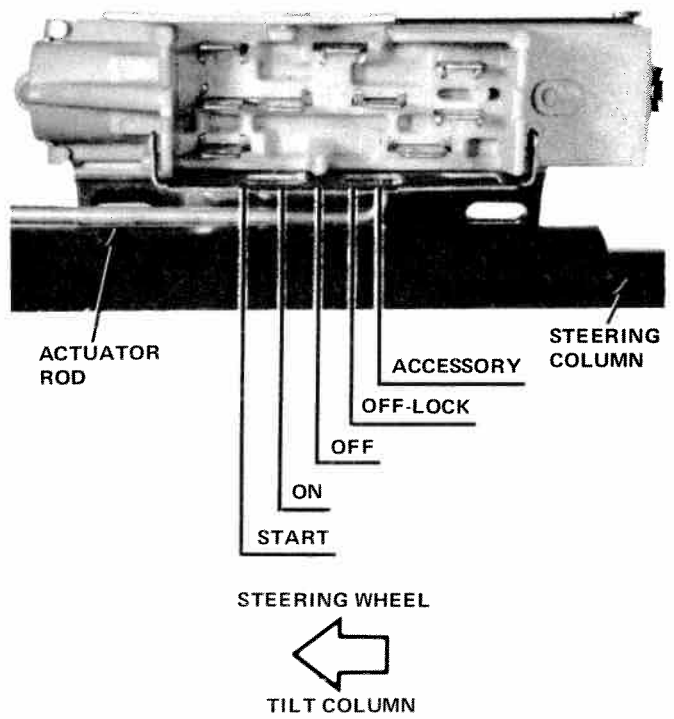
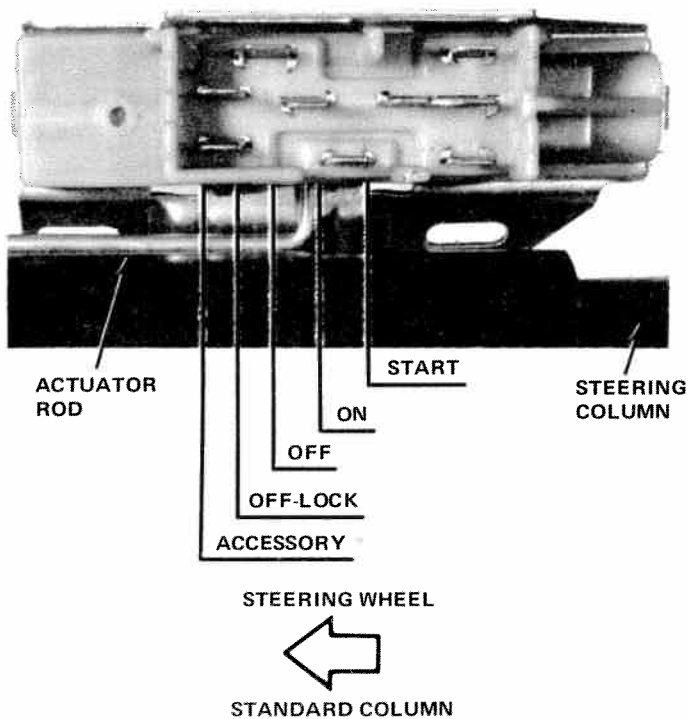
- (3) Position actuator rod in slider hole and install switch to steering column being careful not to move slider out of detent.
- (4) Tighten retaining screws securely.

Tilt Column

- (1) With actuator rod disconnected, position switch as shown in figure 3-64.
- (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.



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)

A42215

Fig. 3-64 Ignition Switch Positions - Cherokee, Wagoneer, and Truck

(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.

Cherokee, Wagoneer, and Truck

For ignition switch cylinder service, refer to Steering, Section 11, under Column Shift - Upper Section.

Ignition Switch Test

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) volts per amp. This means that a 10-amp load would allow 10×0.0125 volt to appear on the scale. A reading of 0.2 (two tenths) volt, for example, would mean that the switch is defective.

On the Cherokee, Wagoneer, and Truck, 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 SYSTEM

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 headlight 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 with 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. 3-65).

(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. 3-66).

(18) Cover lamp that has been aimed and aim other lamp using same procedure.

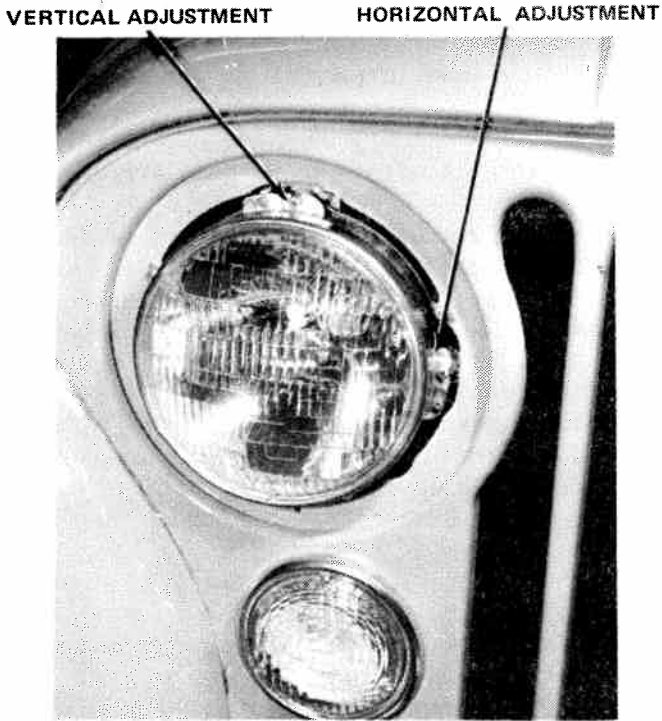
Headlamp Replacement

Each sealed beam headlamp can be replaced only as a complete unit.

NOTE: Headlamps have a figure 2 molded into the glass at the top of the lens.

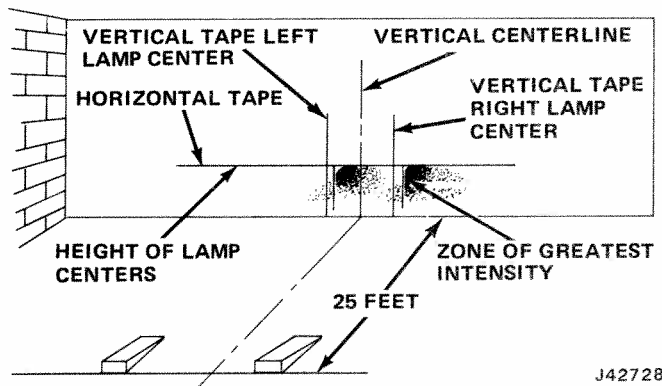
The only difference in the replacement procedure between models is the removal of the headlamp door. The remainder of the headlamp assembly is the same as for all models.

To remove the door on the CJ models, remove the



J42727

Fig. 3-65 Headlamp Adjustment



J42728

Fig. 3-66 Headlamp Aiming Chart

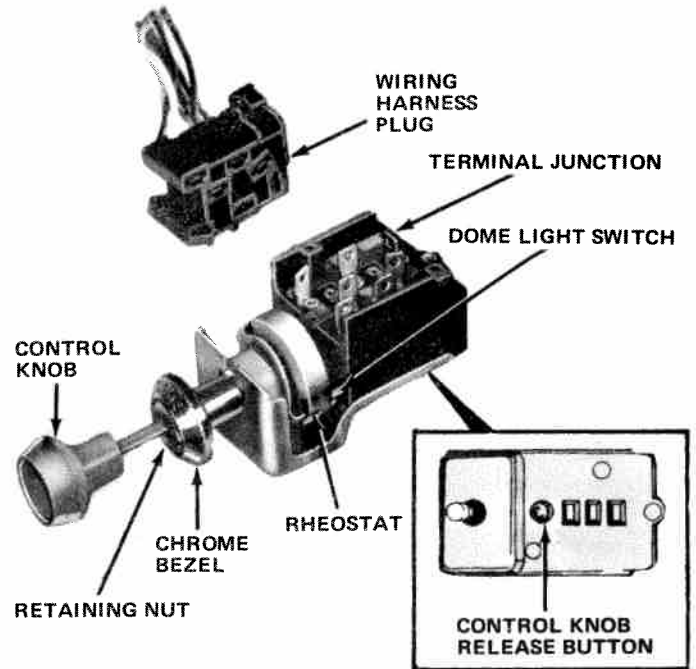
one lower attaching screw. Pull the door out slightly at the bottom and push up to disengage the upper retaining tab. The Cherokee, Wagoneer, and Truck have three screws retaining the headlamp door.

- (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 bright-

ness (fig. 3-67). Rotating the knob clockwise dims the panel lights. Rotating the knob fully counterclockwise turns on the dome and courtesy lights.



J42729

Fig. 3-67 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 3-67 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 3-68

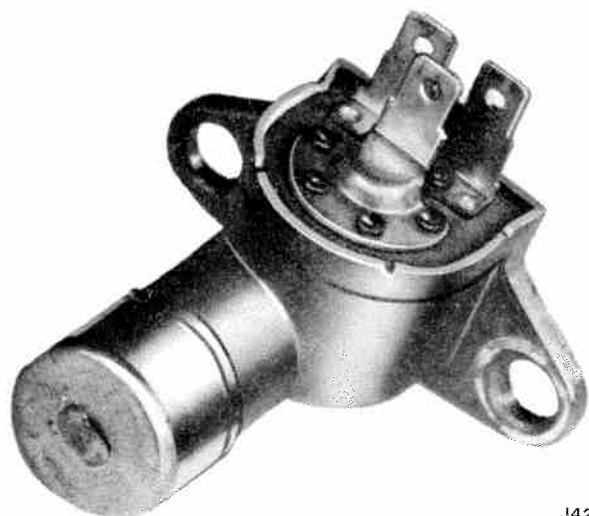
- (1) Remove wire plug from switch.
- (2) Remove two capscrews that hold dimmer switch to floorboard.
- (3) Remove plug.
- (4) Check operation of dimmer switch with a test light. A circuit across two different pairs of contacts (one to headlights, the other to the high-beam indicator light) should alternately light test lamp when switch is operated.

Parking, Side Marker, and Directional Lights

CJ Models

The parking lights are mounted in the radiator guard panel just below the headlights. These lights are

on when the headlamp switch knob is pulled out (fig. 3-69).



J42730

Fig. 3-68 Headlight Dimmer Switch

(1) Remove three screws, allowing lens to be removed.

(2) Replace lamp.

If the complete parking light assembly is to be removed for service or replacement, remove the head-

lamp assembly to gain access to the rear of the park lamp.

(1) Disconnect wire connector from harness.

(2) Remove nuts and lockwashers securing parking light 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 light. Push the assembly in and twist the socket 1/4 turn. The bulb is a wedge base type. Pull straight out to remove.

Cherokee, Wagoneer, and Truck

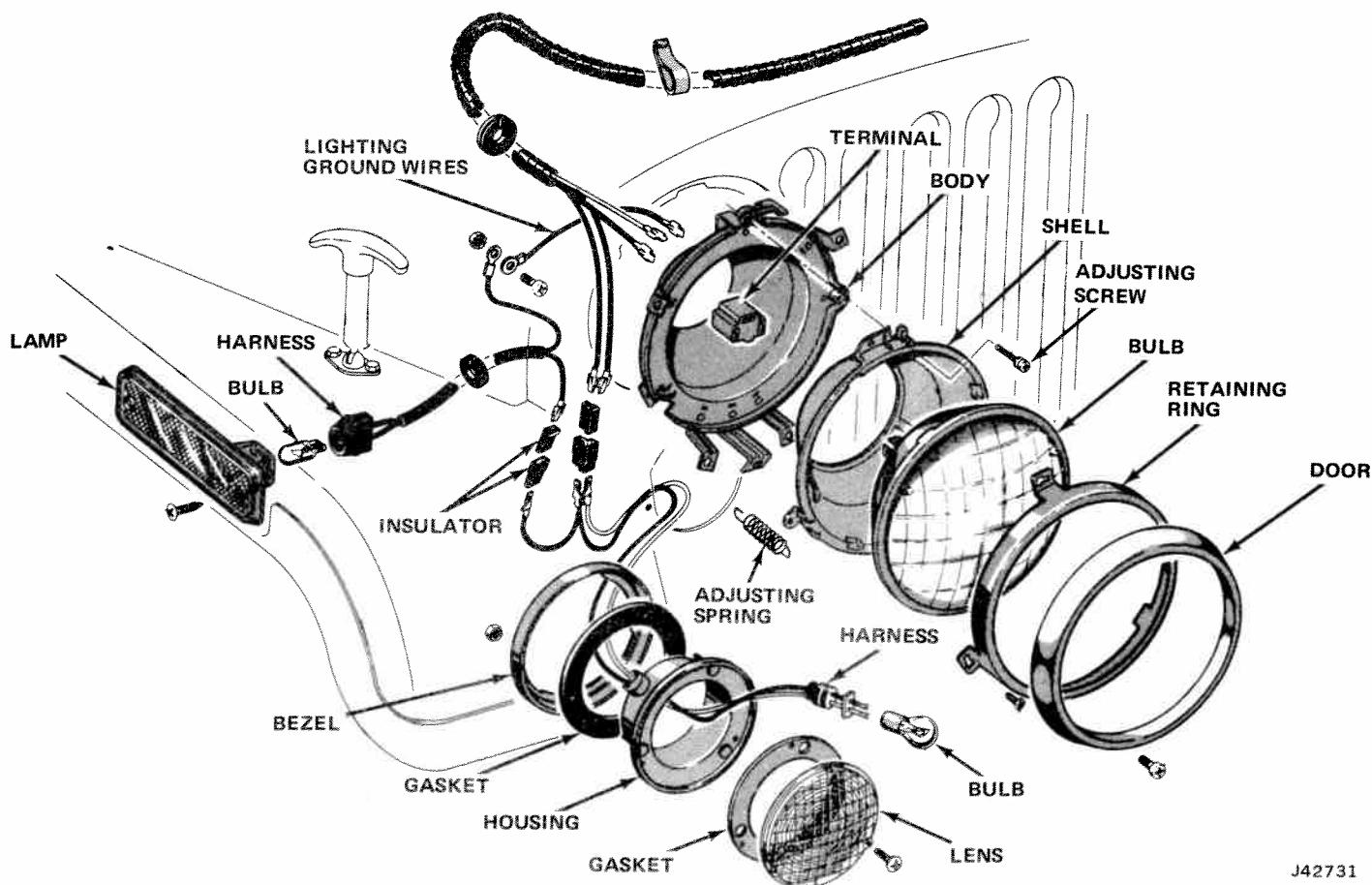
The Cherokee and Trucks have the parking lamps mounted in the headlamp panel just above the bumper (fig. 3-70).

The Wagoneer has the parking lamps mounted in the radiator grill panel (fig. 3-71).

The side marker light will flash in unison with the front turn indicator bulb. Side marker and parking lights come on when the headlamp switch is pulled out to any position.

To replace parking lamp bulbs on the Wagoneer, remove the park lamp lens.

To replace parking lamp bulbs on Cherokee and



J42731

Fig. 3-69 Headlamp, Parking, Directional and Side Marker Lamps - CJ Models

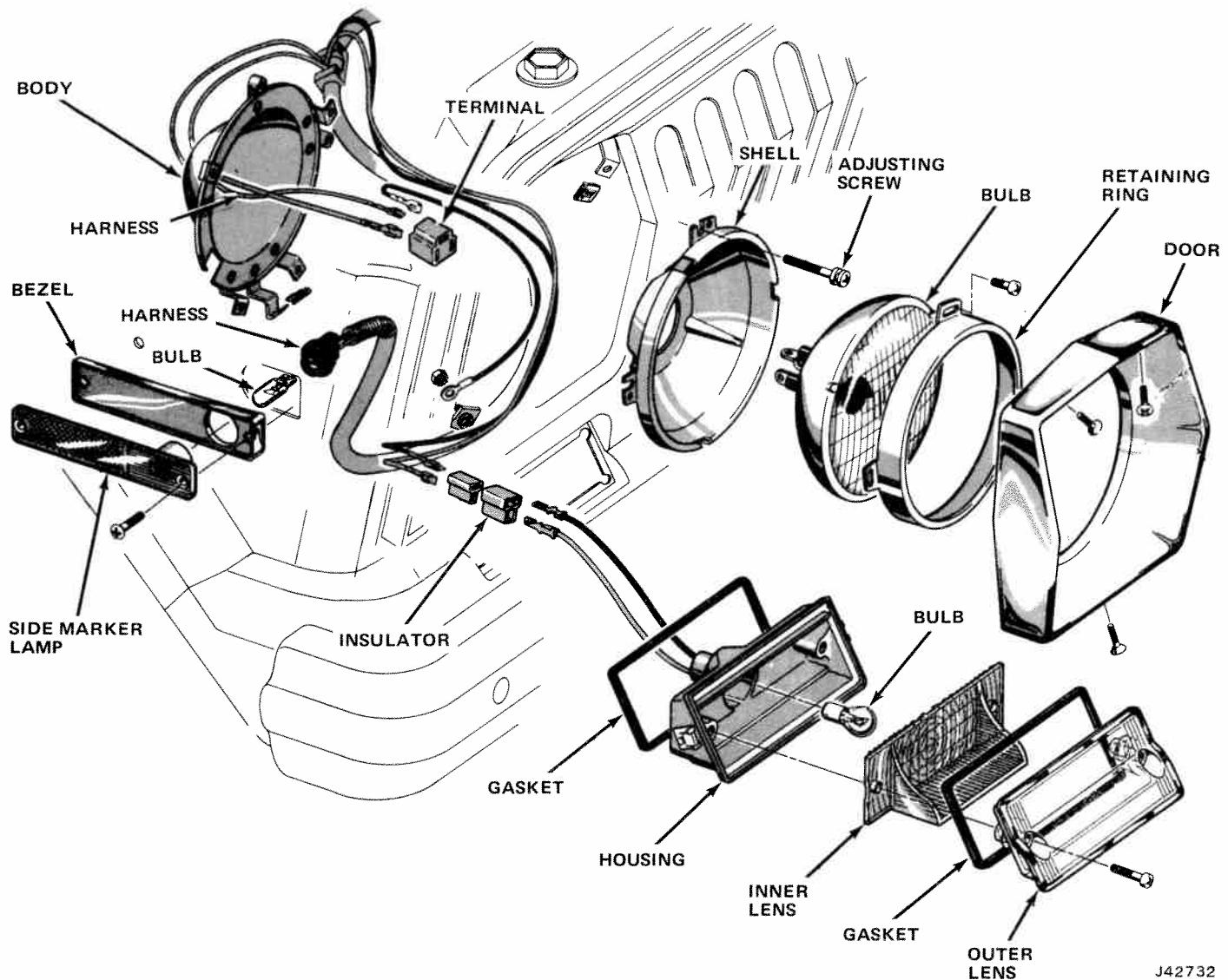


Fig. 3-70 Headlamp, Parking, Directional and Side Marker Lamps - Cherokee and Truck

Truck models, remove the lens and colored reflector.

To remove the entire park lamp assembly, remove the lens. Insert a narrow blade screwdriver 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 lights, remove the lamp assembly. Twist the socket 1/4 turn to remove. Pull straight out to remove the bulb.

Rear Directional, Side Marker, Stop and Tail-lights

CJ Models

Refer to figure 3-72.

Taillamp Bulb Replacement - Remove lens screws,

lens, and gasket. Clean lens and reflector before replacing.

Taillamp Housing Replacement - Disconnect wiring, remove the two nuts and lockwashers securing taillight assembly to 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-Wagoneer

Refer to figures 3-73 and 3-74.

Wagoneer 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 replacing.

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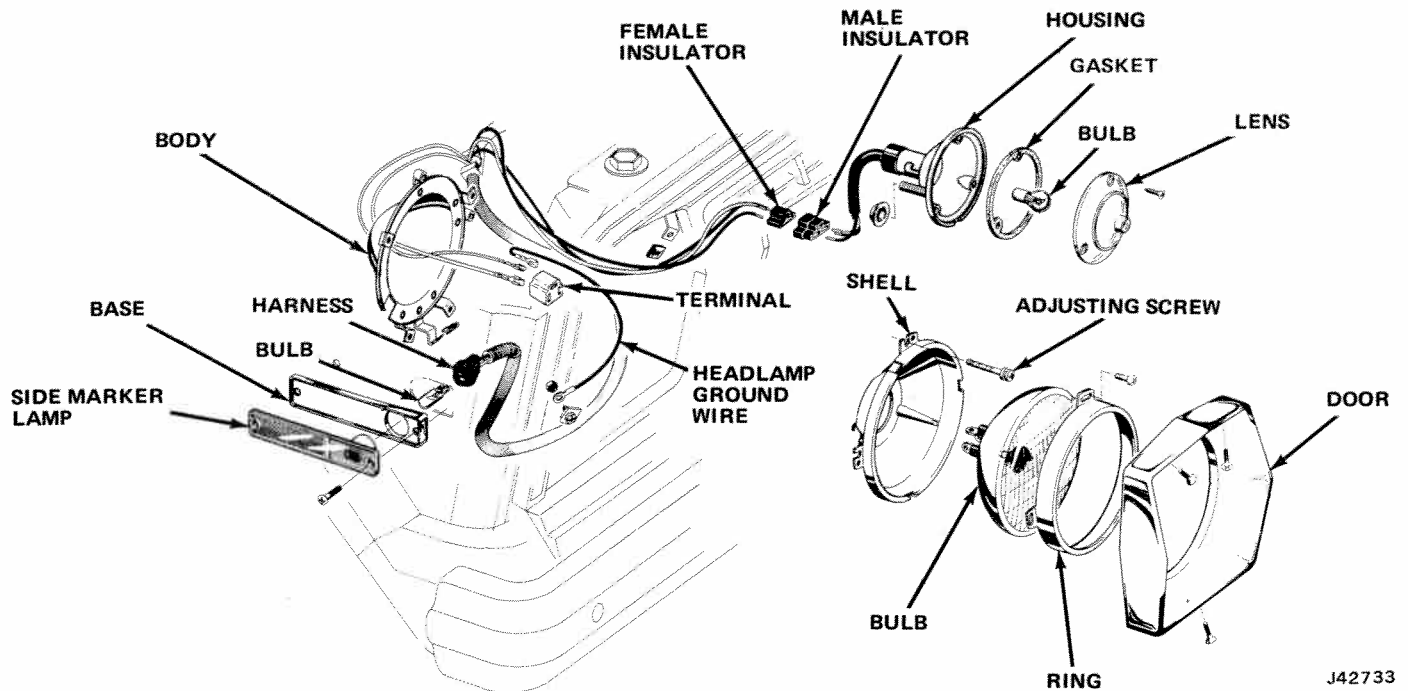


Fig. 3-71 Headlamp, Parking, Directional and Side Marker Lamps - Wagoneer

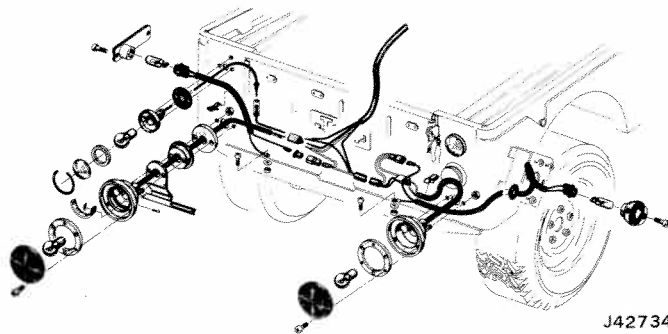


Fig. 3-72 Rear Directional, Stop, Backup, Taillights and Side Marker Lights - CJ Models

Cherokee and Truck

Refer to figures 3-73 and 3-74.

Taillamp Bulb Replacement - Remove the taillamp lens and remove the bulb. Clean the lens and housing before replacing lens.

Cherokee and Wagoneer

Taillight Housing Replacement

(1) Remove interior rear quarter trim panel. On right side, pull panel out of top and remove (this section of body contains jack and tire wrench). On left side, trim panel is held by expanding clips. Use care in prying these clips out of their recesses so panel is not bent or damaged.

(2) Disconnect taillamp harness connectors.

(3) Remove four attaching nuts and push housing out from corner posts.

Truck

On these vehicles, the light 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 replacing.

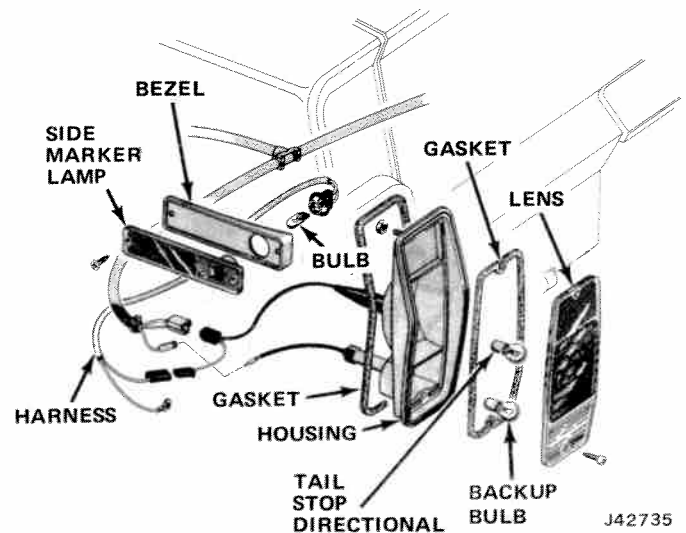


Fig. 3-73 Rear Directional, Stop, Backup and Taillight - Cherokee

Taillamp Housing Replacement

(1) Disconnect lamp harness.

(2) Remove attaching nuts.

Townside Pickup Truck - On these vehicles, the light assemblies are mounted in the pickup box end caps.

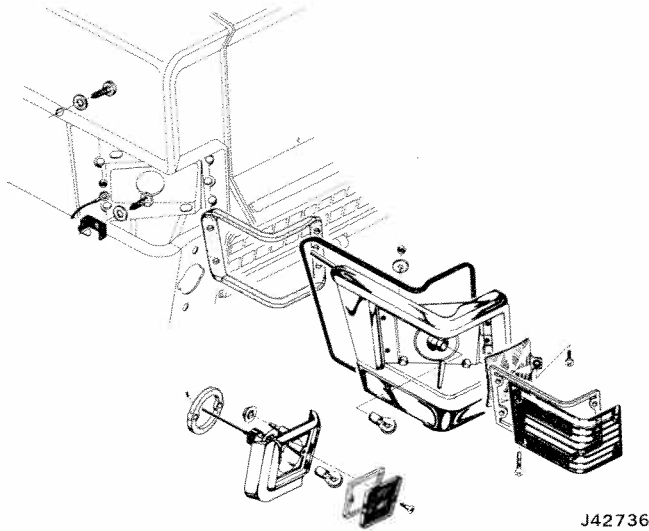


Fig. 3-74 Rear Directional, Stop, Backup and Taillight Wagoneer

Taillamp Bulb Replacement - Remove lens and remove bulb. Clean lens and reflector before replacing.

Taillamp Housing

- (1) Remove lens.

- (2) Remove two 1/4-20 screws.

- (3) Remove housing and disconnect lamp harness.

License Plate Light

CJ Models

The left taillight illuminates the license plate. Refer to figure 3-72.

NOTE: When installing a rear step bumper on the CJ and all truck models, the license plate lamp wiring must be disconnected from the original lamp. The lamp wiring from the step bumper must be spliced into the taillight harness.

Truck Models

The lamp wiring is connected to the step bumper license lamp extension wire.

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.

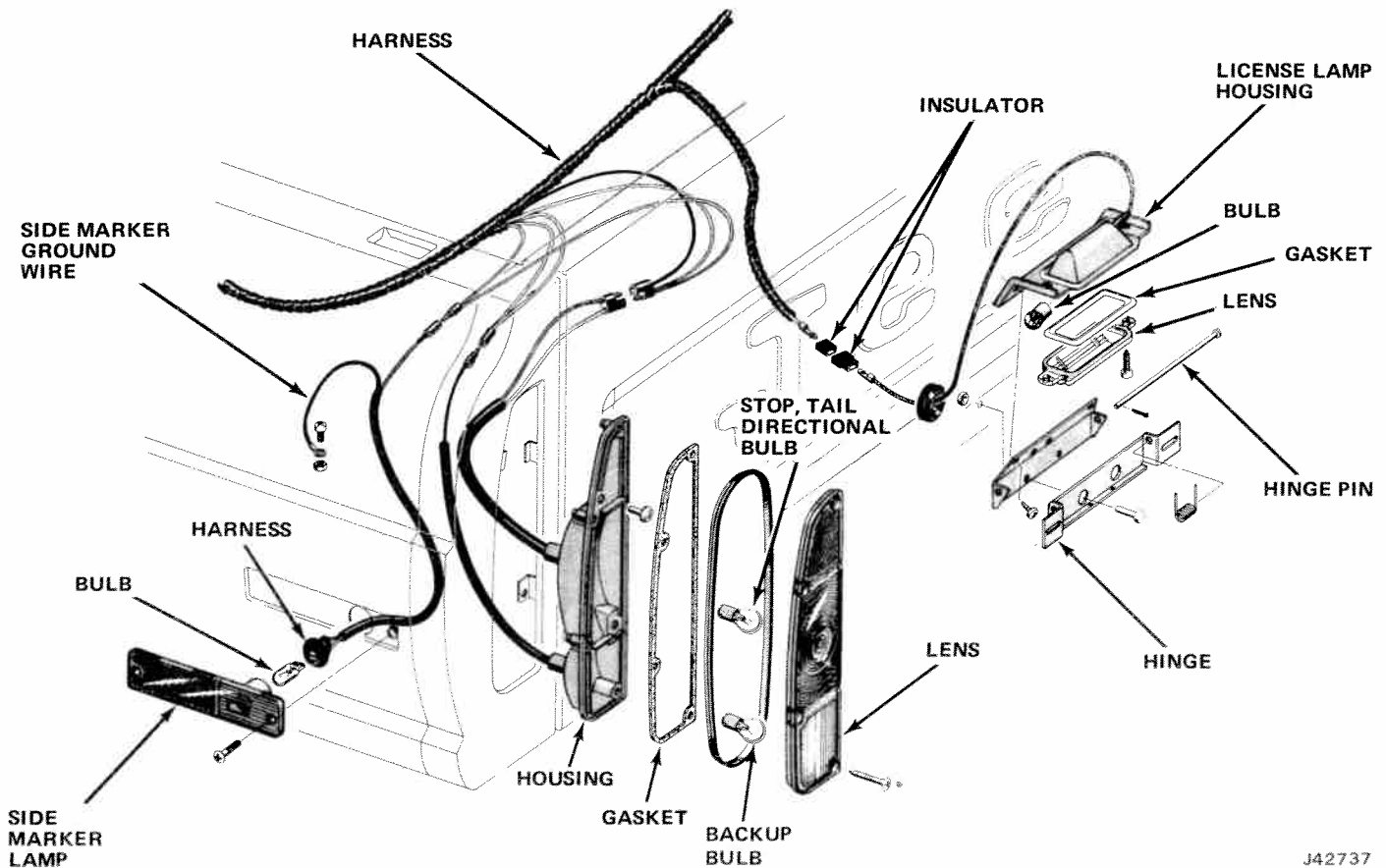


Fig. 3-75 Rear Directional, Stop, Backup, Taillight and Side Marker - Truck

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.

Backup Lights and Switch Replacement or Adjustment

CJ Models

The backup lights are located on the rear of the vehicle directly below the taillight. The backup lights are actuated by the movement of the reverse shift rail when the ignition is on. The backup light switch is threaded into the right rear corner of the transmission cover housing.

The backup light switch is not repairable and must be replaced if defective.

Bulbs can be replaced by removing the snap ring, lens, and gasket from the assembly.

Circuitry for the backup lights is as follows:

A green with white tracer is connected to the ignition terminal of the ignition switch. A 9-amp fuse is inserted in the circuit behind the ignition switch.

The instrument harness connects to the frame harness. The green with tracer wire continues back to two connectors (one on each side of the vehicle) where the backup light wires are connected. The backup lights depend on the lamp mounting studs for completion of the ground circuit to the body.

Cherokee, Wagoneer, and Truck

To replace a bulb, remove the backup light lens.

Backup light switch adjustment is as follows:

Manual (Floor Shift) Transmission - The backup light switch is threaded into the right rear corner of the transmission cover housing. The backup light switch is actuated by the reverse shift rail.

The backup light switch is not serviceable or adjustable and must be replaced as a unit.

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 light 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 lights 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 light 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 lights are operating.

Courtesy and Dome Lights

Cherokee, Wagoneer, and Truck

The courtesy and dome lights 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 headlight switch through a rheostat. When the doors are closed, the dome and courtesy lights are operated by rotating the headlamp switch knob counterclockwise to the stop. The ground for the lights is then through the headlamp switch. The dome light lens can be removed by squeezing the lens together to disengage the retaining tab (fig. 3-76).

A cargo lamp is offered on some truck models (fig. 3-77). The cargo lamp bulb is replaced by removing the outer lens.

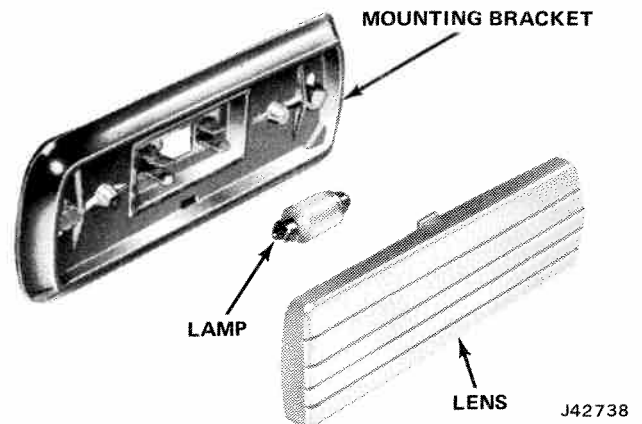


Fig. 3-76 Dome Light

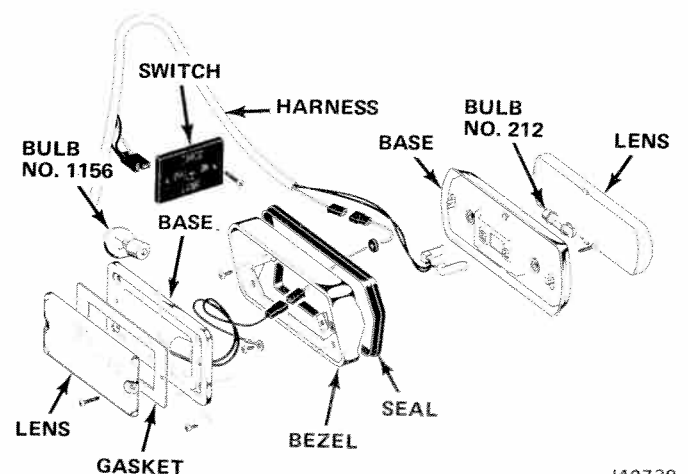


Fig. 3-77 Cargo Light - Truck

The lamp assembly can be removed after removing two attaching screws. The dome light bracket in the cab of Truck body styles is centrally located above the rear window.

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 lights 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 lights to flash too fast.

If there is no signal at any front, rear, or indicator light, first check the fuse.

If fuse checks OK, 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 stoplights function properly, rear signal light bulbs are OK.*

CJ Models

The turn signal flasher is mounted to the lower lip of the instrument panel to the left of the steering column.

The switch is a self-canceling unit clamped to the steering column with two allen head screws. The battery feed is through a 9-amp fused red wire connected to an accessory terminal of the ignition key switch. The fused lead connects directly to the flasher unit located behind the instrument panel. From the flasher unit, a white wire leads to the directional signal switch.

To determine if the directional signal switch is defective, disconnect the switch at the six-wire connector. Use a jumper wire from the white (battery feed) wire to the other wires. Circuitry is as follows:

- White to Orange - Right Rear
- White to Black - Right Front
- White to Yellow - Left Front
- White to Blue - Left Rear

Cherokee, Wagoneer, and Truck

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 negative battery 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.

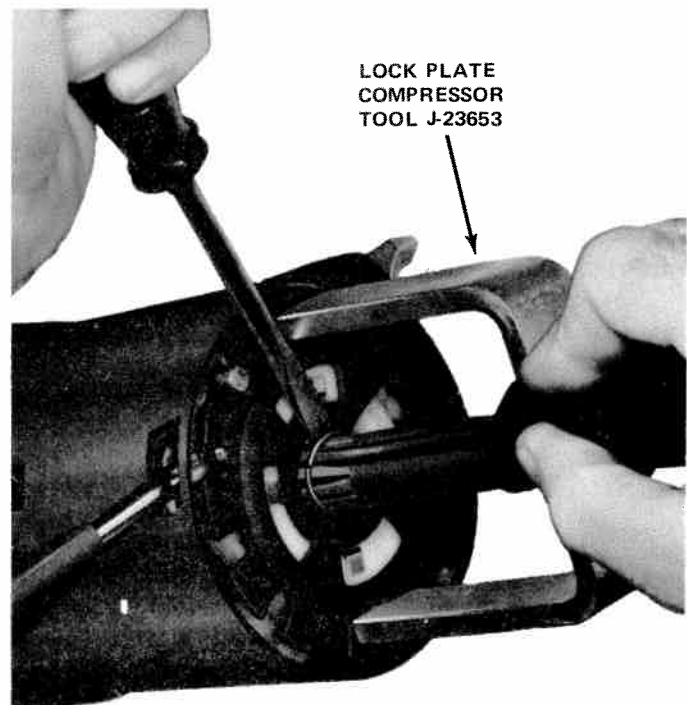
- (5) Remove steering wheel with Steering Wheel Puller C-3428-B.

- (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. 3-78).

- (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.



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Fig. 3-78 Lock Plate Snap Ring Removal

- (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.

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 light wire in the connector block.*

(13) Remove directional signal switch retaining screws and pull directional signal switch and wire harness from column (fig. 3-79).

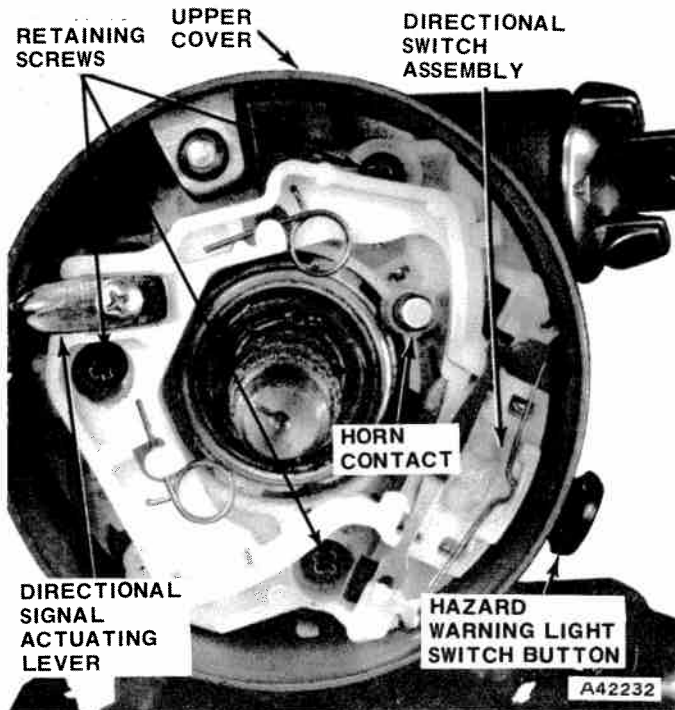


Fig. 3-79 Directional Switch

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 correct 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 dog leg 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 light bulbs, but has a separate supply wire, flasher unit and off-on switch. This makes it possible, when leaving a vehicle with the four-way flasher operating, to lock the ignition switch and car doors. When the four-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 four-way flasher circuit comes through a special heavy-duty flasher. Since the four-way warning flasher is of the heavy-duty type, it will flash any number of bulbs (from one to six bulbs) at a constant rate. Therefore, flashing indicator lights do not necessarily mean that *all* signal bulbs are flashing.

CJ Models

The switch is located on the instrument panel at the right of the steering column. To activate the system, pull the switch knob out. The switch does not cancel out when turning the steering wheel.

Battery feed is through a 14-amp fuse.

To remove the switch, remove the switch knob.

To remove the knob:

(1) Insert a small allen wrench or screwdriver in the detent on knob and exert pressure toward knob (fig. 3-80).

(2) Remove retaining nut and lower switch for access to wires.

(3) Remove wires and switch.



Fig. 3-80 4-Way Flasher Switch Knob

Cherokee, Wagoneer, and Truck

The four-way emergency flasher switch is a part of the directional signal switch.

To operate the system, push in on the switch button.

The four-way flasher can only be canceled by pulling out on the flasher switch knob.

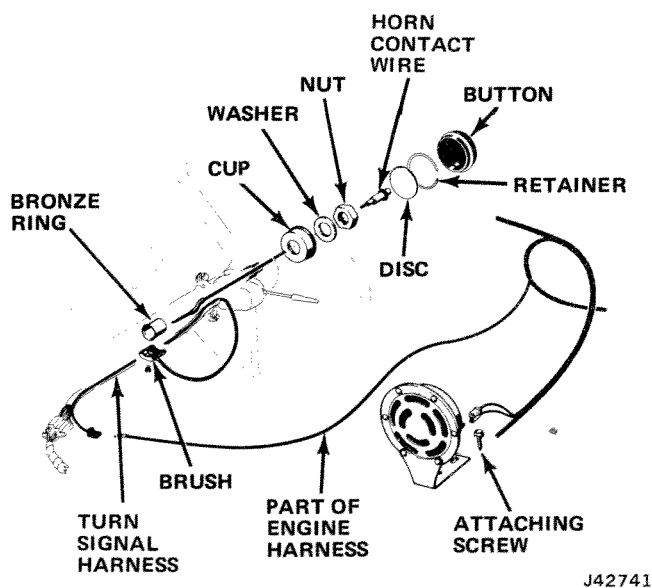
As the four-way flasher switch is part of the directional signal switch assembly, refer to Directional Signal Switch for removal or replacement procedure.

The battery feed for the four-way flasher system is from the fuse panel.

HORNS AND HORN RELAY

CJ Models

A single horn is mounted on the left fender under the hood. Battery feed is directly to the horn; no relay is used. A black with yellow tracer wire leads back to the steering column where it is connected to a plastic connector. From the plastic connector, the ground wire leads up to a terminal plate that is attached to the column with two screws. A rubbing block bears against a brass collar which is grounded when the horn button is depressed (fig. 3-81).



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Fig. 3-81 Horn and Horn Button - CJ Models

Test

If the horn does not operate, test for battery feed at the horn (red wire) with a test lamp or voltmeter. If battery voltage is available, ground the black with yellow tracer wire. If the horn does not blow, the horn is defective. If the horn operates, proceed to the connector at the steering column and then to the terminal plate close to the steering wheel if necessary.

Wagoneer and Truck

A dual set of horns is mounted to the left front

fender under the hood. Battery feed is unfused from the bulkhead connector.

Test

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, reconnect 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.

CLOCK

Cherokee, Wagoneer, and 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 up 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.

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.

Shaft Speed rpm	Indication mph
167	9 to 11
500	30 to 32.5
1000	60 to 63
1500	90 to 94

Speedometer Head Replacement

Speedometer head replacement includes resetting the replacement 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, and 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.

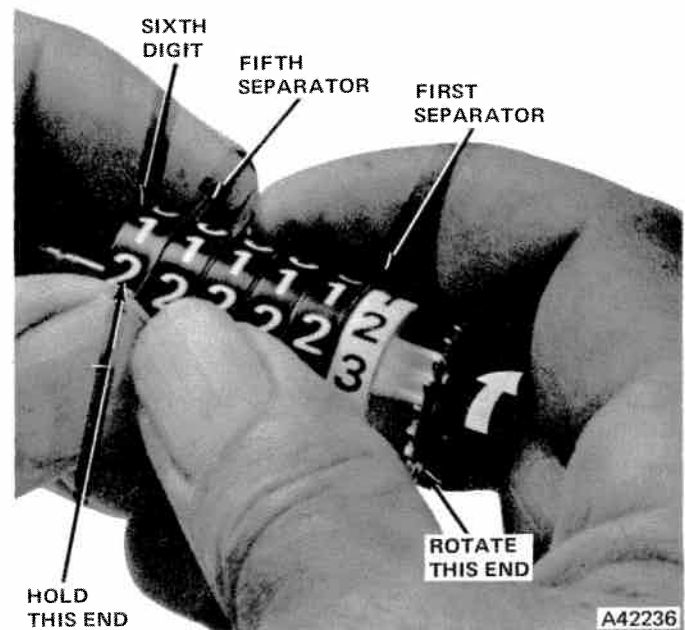
- (6) Install retaining spring clip.
- (7) Install speedometer head.
- (8) Install printed circuit board.

Odometer Setting Procedure

This procedure applies with the odometer removed from the speedometer head.

Refer to figure 3-82.

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. 3-82 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.

CIGAR LIGHTER

The cigar lighter is mounted to the instrument panel (all models).

The lighter can be removed by removing the battery feed wire and unscrewing the shell that surrounds the lighter.

CJ models have an in-line 14-amp fuse for circuit protection.

Cherokee, Wagoneer, and Truck models protect the lighter circuit with a 20-amp fuse located at the fuse block.

RADIO

Transistorized pushbutton AM and AM-FM monaural radios are optional for the Cherokee, Wagoneer, and Truck models (fig. 3-83).

All radios are protected by an in-line 5-amp fuse connected to a lead from the ignition switch or fuse panel.

There are two fuses protecting the radio. A 5-amp fuse is connected to a terminal on the fuse block which is protected by a 10-amp fuse.

Stations may be preselected by means of five push-buttons or manually tuned.

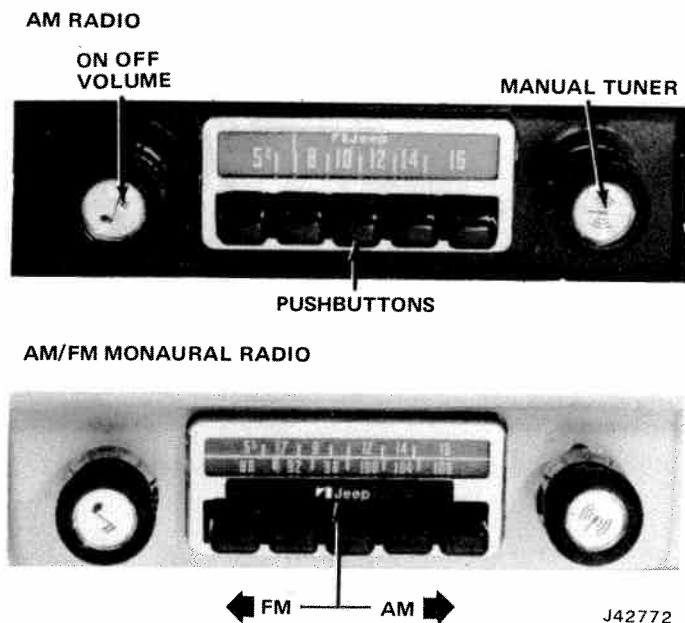


Fig. 3-83 AM and AM-FM Radio

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 trimmer adjustment is located just above the tuning control.

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) Raise antenna to maximum height.
- (2) Remove inner and outer tuning control knobs.

NOTE: AM-FM radios must be switched to the AM position.

(3) Turn radio and allow it to warm up for several seconds.

(4) Turn tuning control knob to 1400 KC range and obtain a signal (a station or just plain static). Turn volume control to medium level.

(5) Insert a common blade screwdriver through small hole above tuning control.

(6) Turn screw left or right until most volume is obtained (*without touching volume control*).

(7) Install inner and outer tuning control knobs.

Setting Pushbuttons

(1) Move vehicle outside and away from high tension power lines.

(2) Lower antenna to one half its maximum height.

(3) Pull button out (approximately one-half inch) to unlock tuner.

(4) Select station with tuning knob. Tune for clearest reception.

(5) Push button in as far as possible (to lock tuner) and release. This station is now set for automatic tuning.

(6) 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 for cycles per second.

Ignition Noise: Undesirable noise from the ignition components of the vehicle itself or an adjacent vehicle.

Interference: Undesirable radio signals or noise that interfere with the reception of the 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 distinguished 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 have different reception characteristics. The following information will help explain the normal operational characteristics of these radios.

Signal Transmission

The range of normal hearing is approximately 30 Hz to 15,000 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.

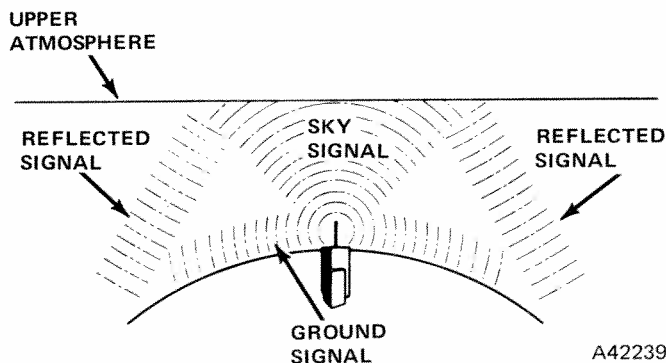


Fig. 3-84 AM Reception - Long Distance, Follows Curvature of Earth and is Reflected by Upper Atmosphere

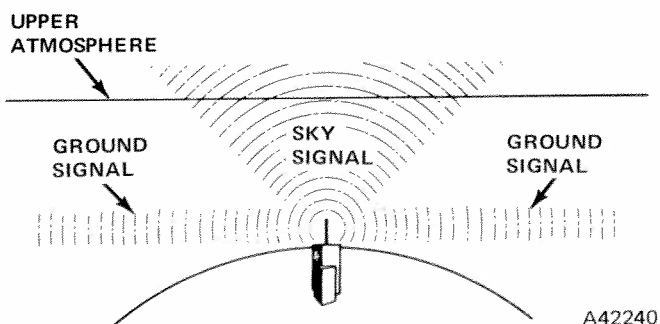


Fig. 3-85 FM Reception - Shorter Distance, Does Not Follow Curvature of Earth and Is Not Reflected By Upper Atmosphere

Fading

Fading is not usually a problem with AM because

of its long distance reception capability (fig. 3-84). FM is limited, however, to line-of-sight reception (25 to 40 miles) under average conditions of terrain and transmitted power. (fig. 3-85). Figure 3-86 illustrates fading of an FM signal due to differences in terrain. Reception behind hills may be noisy (hissing or popping). This noisy reception is sometimes called flutter or picket fencing.

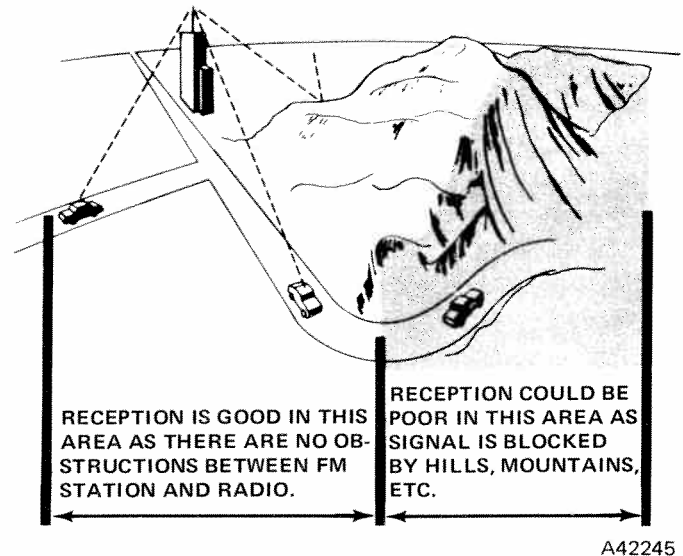


Fig. 3-86 FM Fading

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

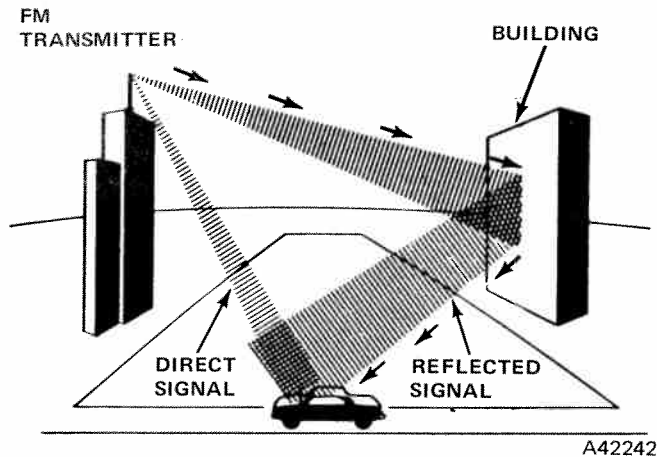
The fact that FM can be received quite well between tall buildings can unfortunately cause a detrimental side effect, namely multipath reception (fig. 3-87). It is caused by a direct signal and a reflected signal arriving at the vehicle antenna, causing distortion. This type of interference is usually 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 electrical inter-



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Fig. 3-87 Multipath Reception

ference such as power lines, thunderstorms, and other situations where electrical charges in the air cause disturbance. This electrical interference can result 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) 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. 3-87).

Using Controls Effectively

Proper use of radio controls will enhance your listening pleasure.

(1) Although pushbutton tuning may be used for stations, always fine-tune the radio manually for clearest sound and minimum noise.

(2) If noise-free reception cannot be attained, set the tone control to the bass (counterclockwise) position

to reduce noise level. When noise-free reception can be attained, reset control to its normal position.

Antennas

Although vehicle radio reception is outstanding, it is not the same as the continuous reception found in the home radio. The best AM antenna is a long antenna, the longer the better reception. However the antenna design is restricted in size, height, direction and must receive both AM and FM stations. This means there will be a compromise in reception because an FM radio has the best reception at an antenna height of approximately 32 inches.

RADIO NOISE 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:

- (1) A defective antenna (refer to Radio Antenna Ohmmeter Tests).
- (2) Noise radiated upward from the dash.
- (3) 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. 3-88).

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. 3-89).

- (1) Disconnect original antenna lead-in and plug-in test probe.

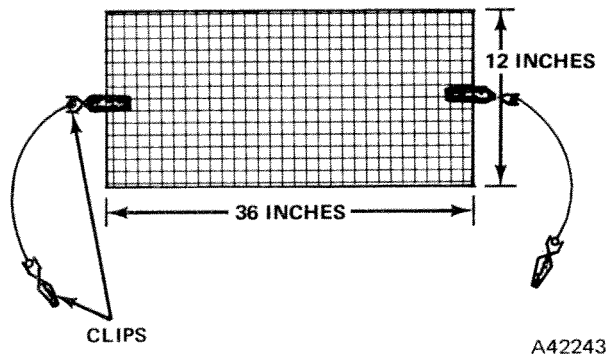


Fig. 3-88 Noise Suppression Tool

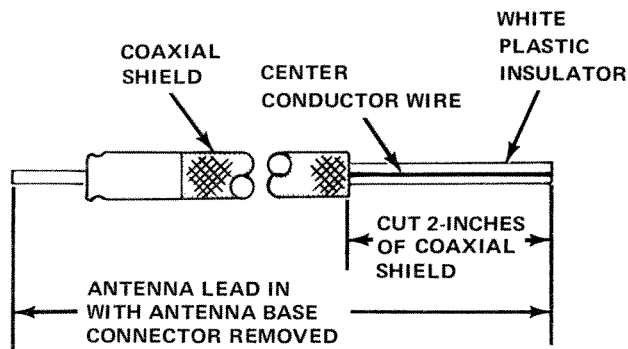


Fig. 3-89 Noise Probe

(2) Turn radio on and use probe to discover the hot spot. Do not touch end of probe with your hand, 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 lead 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 poor grounds on the points and coil capacitors, defective points, or a wire routing problem.

A new set of points or cleaning of the condenser pigtail and ground may solve the problem. Install a 0.5 mfd capacitor on the coil as shown in figure 3-90.

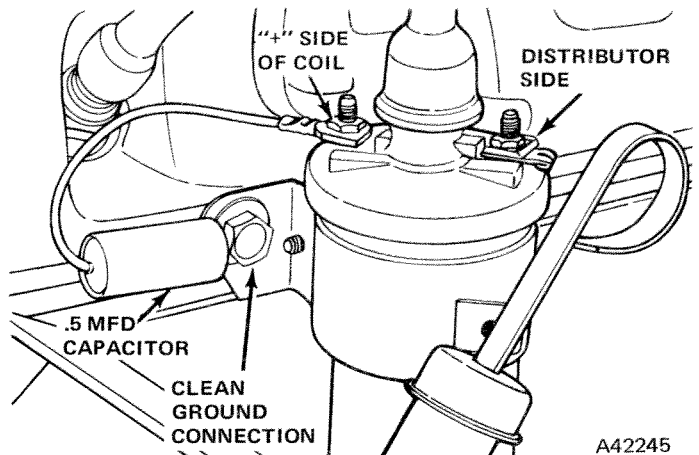


Fig. 3-90 Installing Ignition Coil Noise Suppression Capacitor

An extra long antenna lead-in may be prepared as shown in figure 3-89, 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. 3-91). In many cases, this helps reduce the amount of interference radiated from the ignition system.

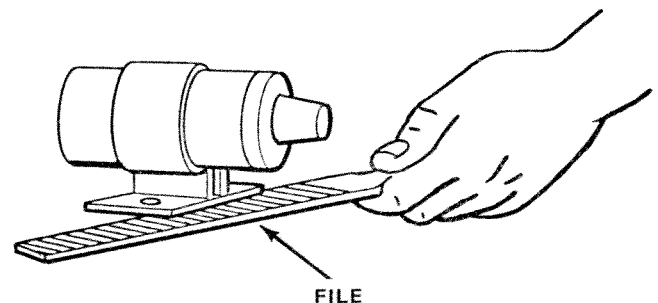


Fig. 3-91 Cleaning Coil Bracket

Be sure to check the coil polarity. The distributor must be connected to the negative side of the coil.

In some rare cases, extra suppression may be required if the vehicle is operating in fringe areas. For those special cases, perform the following steps:

(1) Install an 0.1 mfd coaxial capacitor as closely as possible to the coil battery terminal - not the distributor terminal. Do not use an ordinary bypass capacitor.

(2) Install a 0.005 mfd, 1000-volt ceramic disc capacitor at the coil distributor terminal (fig. 3-92).

(3) Install a 0.5 mfd coaxial capacitor at the alternator output terminal. Be sure it is rated to handle the maximum alternator current.

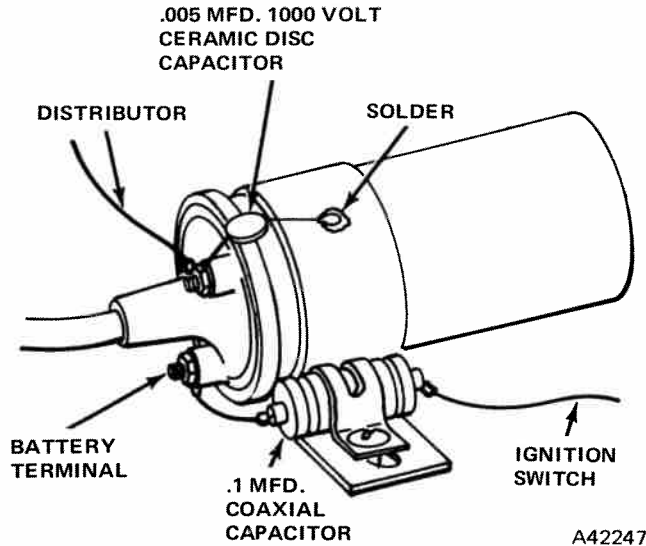


Fig. 3-92 Special Noise Suppression

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 exist 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.

A tuneup may cure most of the problems.

If the noise in questions 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.

It is a good idea to 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 a siren that increases and decreases with engine rpm.

Methods of getting rid of alternator whine are:

- (1) Provide a good fender ground (fig. 3-93).

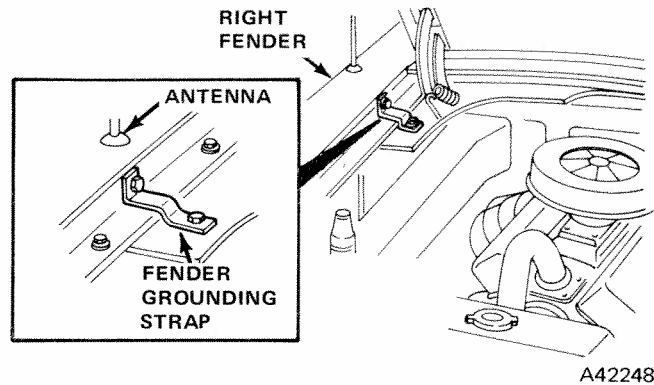


Fig. 3-93 Fender Ground Strap Installation

- (2) Install good grounding strap.
- (3) Run offending wire through a shielded (grounded) cable.
- (4) Clean slirings and make sure brushes are making good contact.
- (5) Align hood to keep fender-to-hood gap as close as possible.

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.

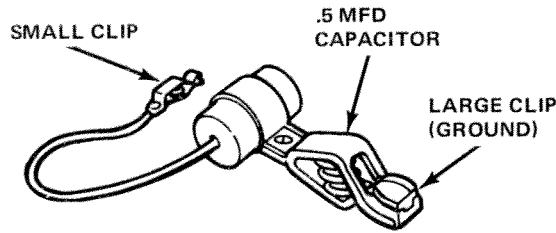
Motor noise on the A-line is usually the result of voltage spikes on this line being so large that the input filter circuit in the radio cannot handle them. There are two ways to handle this problem.

- 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. 3-94). The antenna probe (fig. 3-90) 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 as heavy as possible.



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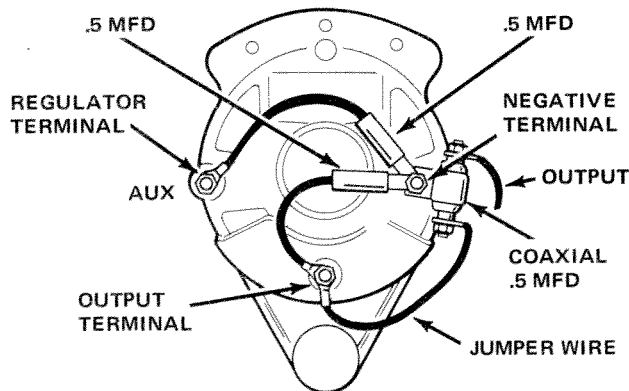
Fig. 3-94 Noise Eliminator Test Device

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. 3-95).
- (2) Install coaxial capacitor in alternator output wire (fig. 3-95).
- (3) Install noise suppressor kit.
- (4) Install 0.5 mfd capacitor to alternator regulator terminal (fig. 3-95).
- (5) Replace alternator diodes.



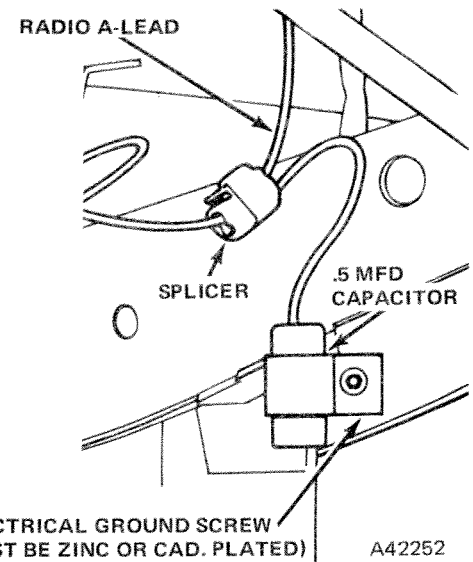
A42250

Fig. 3-95 Alternator Noise Suppression

Wiring Harness: Noise normally can be corrected as follows:

- (6) Relocate wiring away from ignition wires.
- (7) Install 0.5 mfd capacitors on each fuse panel lead. Be sure capacitor is grounded (fig. 3-96).
- (8) Relocate wiring away from tachometer and ammeter wiring.
- (9) Remove loops from harness wires.

Radio Noise Suppressor: A noise suppressor must be installed on every vehicle equipped with a radio. This suppressor (choke) is plugged into the back of the



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Fig. 3-96 Wiring Harness Noise Suppression

printed circuit board. Be sure the choke has not been installed over the copper strip that is installed on 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 electricians 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 0.001 mfd thumbnail type capacitor across the speaker.

Speaker-induced noise normally will not occur on front mounted one or two speaker systems.

Defective Radio

Swap 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. 3-97).

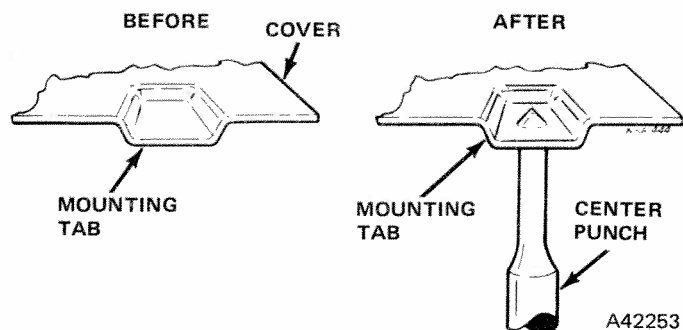


Fig. 3-97 Center Punching Covers

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. 3-98).

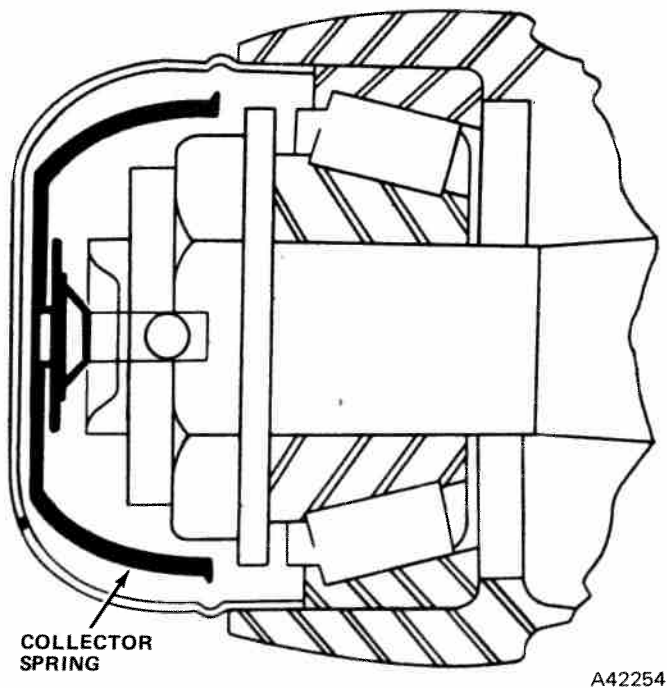


Fig. 3-98 Collector Springs

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.

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, of course, 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 the same as for turn and stop signals. The suppressor capacitors are installed at the point where the battery lead feeds the horn relay.

Be sure the horn relay cover is not loose.

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 BULB REPLACEMENT

Cherokee, Wagoneer, and Truck

Removal

- (1) Remove radio knobs, attaching nuts, and bezel.
- (2) Remove 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 remove deflector.
- (5) Remove no. 1893 bulb and bulb diffuser.

Installation

- (1) Install diffuser on bulb and install bulb.
- (2) Install dial light deflector.
- (3) Install dial cover.
- (4) Install bezel, attaching nuts, and knob.

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.

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 3-99.

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.

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).

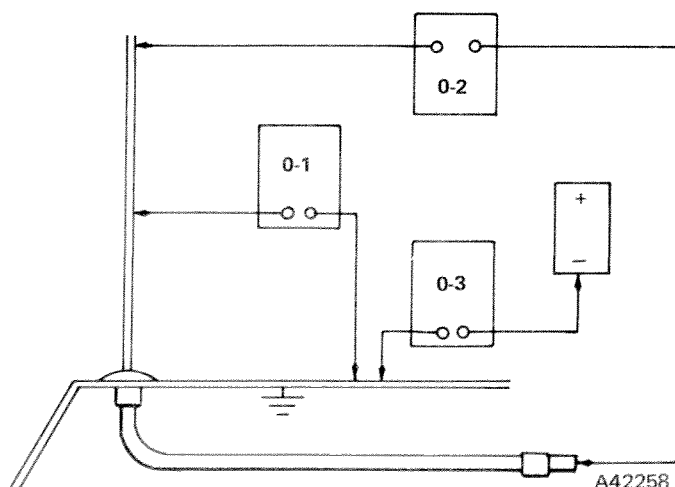


Fig. 3-99 Antenna Ohmmeter Tests

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

All speakers have an impedance of 3.2 ohm. 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.

Speaker Repairs

The most common speaker problem is a loose mounting. Another common problem is screws or other objects stuck to the back of the magnet. If a speaker is removed, it also should be checked for a loose magnet by attempting to turn the magnet by hand.

A speaker once it has been damaged is usually not repairable and should be replaced. Replacement speakers should be of the same ohm value. Defective speakers usually have one or more of the following symptoms:

- Audio distortion, particularly on the low frequency notes and at high volume.
- Rattles and fuzzes 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 openings.

If the entire speaker is not visible through the speaker grille openings, remove the grille.

NOTE: Be sure the speaker mounting screws are tightened securely.

Speaker Feed Wire Connection and Short to Ground

Check speaker feed wire for a short to ground:

- (1) Disconnect speaker harness at radio.
- (2) Connect one lead of an ohmmeter to speaker feed wire and other lead to a good ground. No resistance reading should be indicated.
- (3) Check each individual speaker wire in this manner.
- (4) If resistance is indicated on meter, wire being checked or matching speaker(s) is shorted to ground.
- (5) Speakers may be isolated and checked for a short to ground by disconnecting speaker harness at the speaker and connecting an ohmmeter as outlined above.

(7) Electrical shorts in speaker harness are generally caused by screws pierced through wire harness. Repair shorted wire or replace shorted speaker, as required.

NOTE: When reconnecting the speaker harness to the radio, be sure the antenna lead-in cable is fully engaged in the radio socket.

Radio Speaker Removal

Cherokee, Wagoneer, and Truck

The speaker is located above the radio.

- (1) Remove radio.
- (2) Remove four attaching nuts from mounting studs and remove speaker.

TRAILER TOWING PACKAGES

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 tow vehicle is dead, do not attempt to start the tow 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.

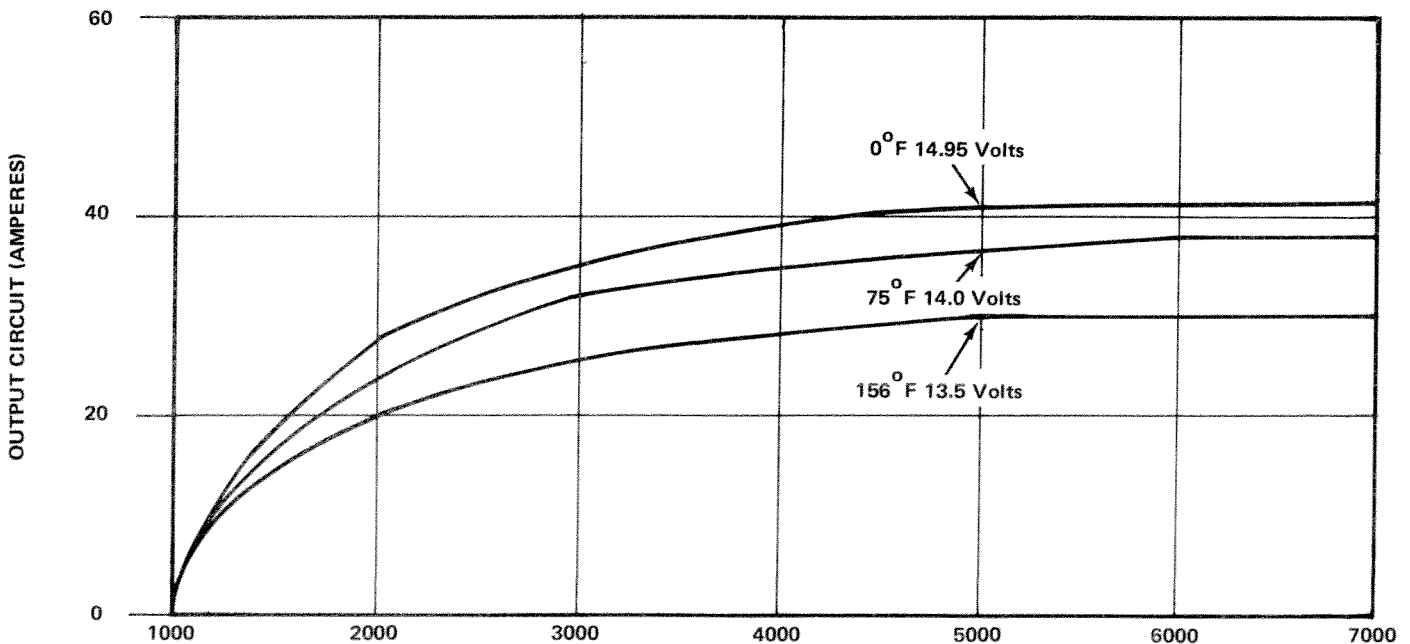
The trailer connector is connected into the existing frame harness. This type of package requires the use of heavy-duty flashers for both turn and hazard warning flashers. The maximum amount of bulbs to be used on the trailer are:

- 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 tow 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 taillight circuits are used only to trigger the relays and do not carry any of the trailer load.



J42773

Fig. 3-100 Temperature-Output Relationship (Motorola 37-Amp Alternator Shown)

SPECIFICATIONS

ALTERNATOR

Make.	Motorola
Standard — All except Camper 4800.	37 amp
— Camper Truck 4800.	51 amp
Optional — (Mandatory with Air Conditioning and 4V Carburetor).	51 amp
Rotation.	CW @ Drive End
Field Current.	1.8-2.5 amp

VOLTAGE REGULATOR (ALTERNATOR)

Make.	Motorola
Model.	8RH 2003
Type.	Solid State
Adjustment.	None

Regulator Temperature

Acceptable Voltage Range

0 - 50° F.	15.3 - 14.2
50 - 100° F.	14.8 - 13.7
100 - 150° F.	14.3 - 13.1
150 - 200° F.	13.8 - 12.7

GENERATOR

Make.	Prestolite
Model.	GJP-7402B
Ground Polarity.	Negative
Controlled Output.	35 amp
Control.	CV Regulator
Armature End Play.	0.003 to 0.010 inch
Brushes.	2
Brush Spring Tension.	18 to 36 oz

REGULATOR (GENERATOR)

Make.	Prestolite
Model.	VBO-4201E-4A
Type.	Vibrator
Cutout Relay:	
Closing Voltage @ Generator rpm.	12.6 to 13.6 @ 1325
Reverse Current to Open.	3 to 5 amp
Regulated Voltage.	14.2 to 14.4
Regulated Current.	36 amp max

BATTERY

	232-258-304 Engines	Optional	Optional
Make.	Prestolite	Prestolite	Prestolite
Rating.	50 amp hr	60 amp hr	70 amp hr
Total No. of Plates.	54	66	66
Catalog Number.	2480X	2488X	2495X

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)



STARTER MOTOR

TORQUE SPECIFICATIONS:

Starter to Engine Bolt.	30-35 foot-pounds
Starter to Bell Housing.	15-20 foot-pounds
Starter Relay Terminal Nuts.	50-60 inch-pounds
Starter Motor Through Bolts.	55-75 inch-pounds

FUSE CHART

	CJ MODELS	CHEROKEE- WAGONEER- TRUCK
Air Conditioner.	—	25 amp*
Backup Lights.	9 amp	10 amp
Brake Failure.	9 amp	—
Cigar Lighter.	14 amp	20 amp
Cluster Feed.	—	3 amp**
Control Panel (Lights, Wiper-Washer, Heater) (Circuit Breaker on CJ)	25 amp	3 amp
Directional Signal.	9 amp	9 amp
Electric Tailgate Window.	—	(2) Circuit Breaker (30 amp)
Hazard (4-Way Flasher).	14 amp	15 amp
Headlights Circuit Breaker	25 amp	25 amp
Heater.	15 amp	25 amp
Horn.	—	—
Parking Brake Warning and Brake Failure.	—	3 amp**
Radio.	—	5 amp (In Line)
Windshield Wiper-Washer.	Circuit Breaker (6)	10 amp

*One fuse for Wagoneer and Truck air conditioner and heater

**One fuse for Wagoneer and Truck parking brake and brake failure light and the cluster feed

BULB CHART

FRONT LAMPS:

Headlamp.	6014	6014
Marker and Reflector.	194	194
Parking and Directional.	1157 NA	1157

REAR LAMPS:

Backup Lamp.	1156	1156
License Lamp.	1155	1155
Marker and Reflector.	194	194
Stop, Tail and Directional.	1157	1157

INDICATOR LAMPS:

Brake Failure.	57	158
Charge or Amp Warning.	53	—
Directional Signals.	53	158
High Beam.	53	158
Oil Pressure Warning.	53	—
Parking Brake Warning.	—	158
Quadra-Trac Lockout.	—	158

VEHICLE INTERIOR:

Ammeter, Direct-Read.	57	158
Clock.	—	1816
Column Light (Auto. Trans.).	—	1816
Courtesy.	—	89

Directional Signal Flasher.....	144	144
Dome.....	—	212
Glove Box.....	—	1891
Hazard Warning.....	170	170
Heater Controls.....	57	1815
Instrument Cluster.....	57	158
Oil Pressure Gauge, Direct-Read.....	57	158
Radio.....	—	1893

TORQUE SPECIFICATIONS

All torques given in foot-pounds unless otherwise noted.

Alternator Mounting Bracket Bolt to Engine.....	25-30
Alternator Pivot Bolt or Nut.....	25-30
Battery Hold-Down Bolt.....	60-70 inch-pounds
Belt, Fan (Alternator).....	New — 125-155 Used — 90-115
Directional Signal Switch	
Handle.....	20-30 inch-pounds
Screw.....	10-15
Hazard Warning Knob	
Mounting Screws.....	2-5 inch-pounds
Horn Bracket Screw.....	10-15
Speedometer Cable to TCS Switch.....	120-130 inch-pounds
Spark Plug.....	25-30
Starter Motor to Bell Housing.....	15-20
Starter Solenoid Terminal Nuts (5/16 Stud Nut).....	50-60 inch-pounds
Steering Wheel Nut	
CJ Models.....	32-38
Cherokee, Wagoneer, and Truck.....	35-36

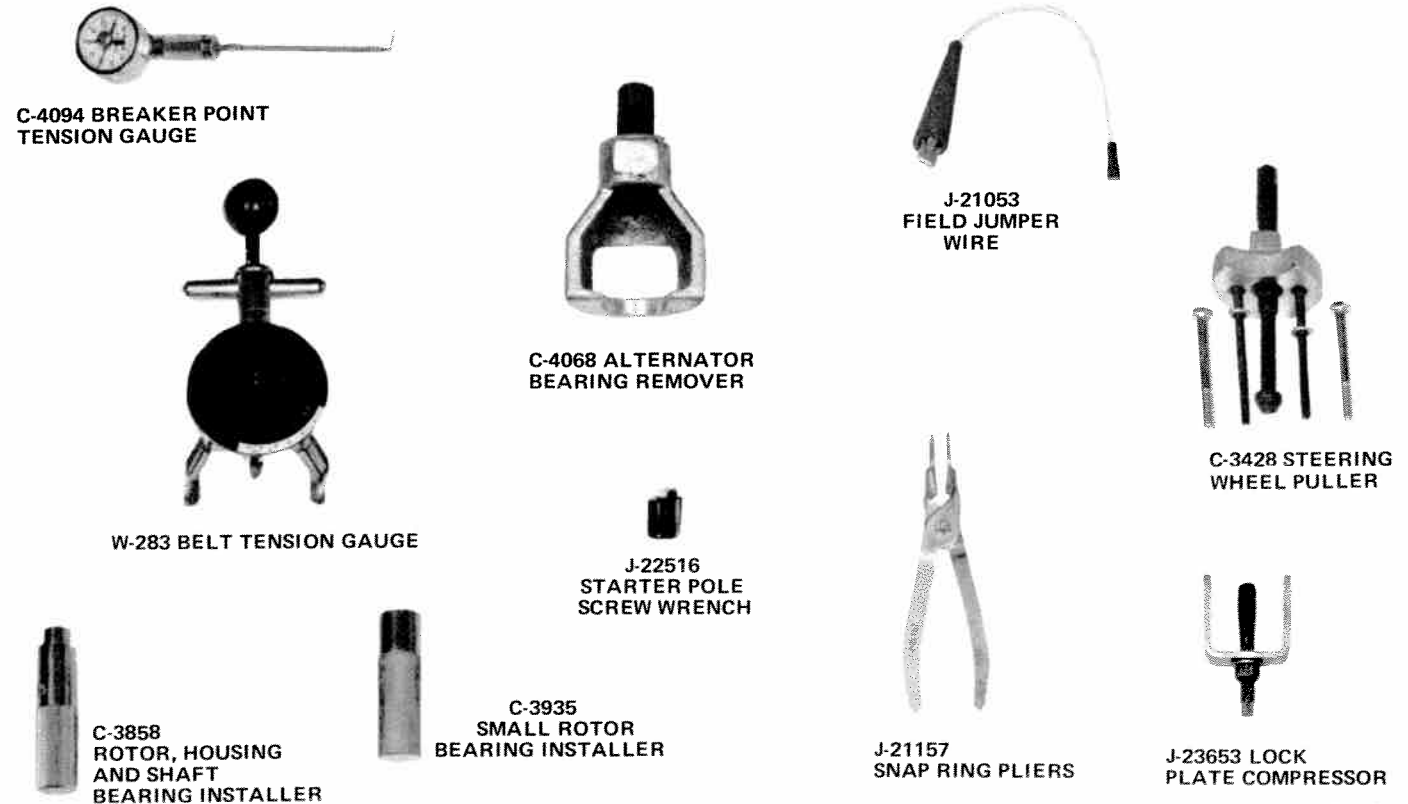


Fig. 3 - 101 Tools

