X-7525

1975 AND 1976 MAINTENANCE MANUAL MOTOR HOME

ZEO 6581

AND

TRANS MODES

ZEO 6083

ZEO 6583

GMC

TRUCK & COACH DIVISION

GENERAL MOTORS CORPORATION

PONTIAC, MICHIGAN 48053

Printed in U.S.A.
X-7525, 5M

SECTION INDEX

SECTION 0
GENERAL INFORMATION, PERIODIC MAINTENANCE, AND LUBRICATION

Contents Of This Section Are Listed Below:

VEHICLE IDENTIFICATION

The Vehicle Identification and Weight Rating Plate (figure 1) located behind the right front access door shows the "Vehicle Identification Number", and the "As Manufactured" Gross Vehicle Weight Rating for the vehicle to which it is attached.

In order that the vehicle may be specifically identified as to manufacturer, engine type, year of manufacture, etc., refer to Figure 2.

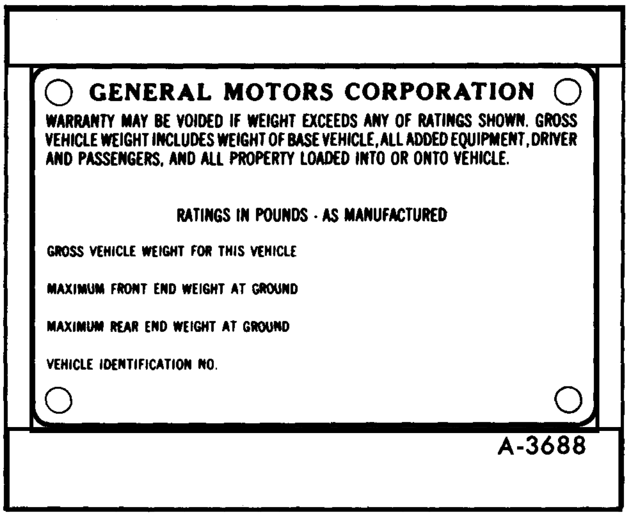


Figure 1—Vehicle Identification Plate

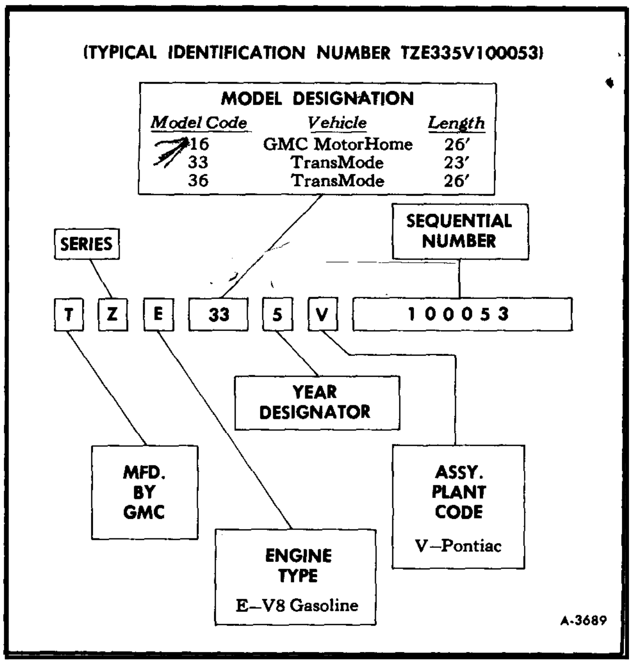


Figure 2—Vehicle Identification Number

COMPONENT IDENTIFICATION

ENGINE

The engines are identified by a code tape installed directly above the engine serial number which is stamped on the engine oil fill tube (figure 3).

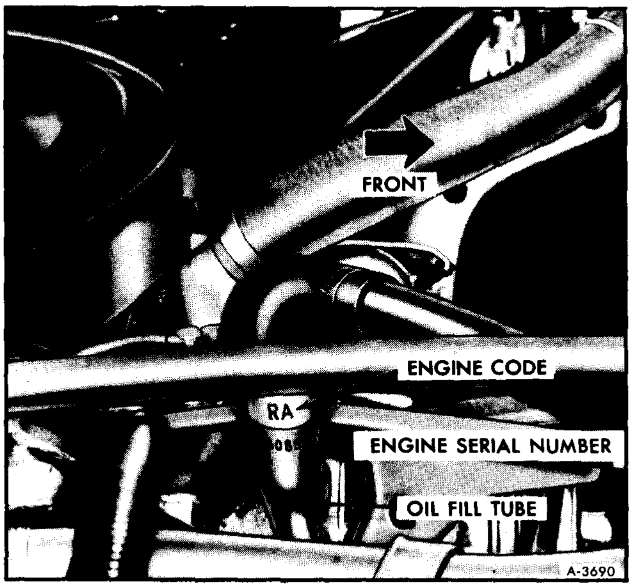


Figure 3—Engine Identification

TRANSMISSION

The transmission model and code numbers are stamped on the converter housing as shown in Figure 4.

FINAL DRIVE

The ratio and date codes are stamped on the flange near the right hand spreader hole as shown in Figure 5.

Date Code: The code letter is for the month and the number(s) are for actual date.

Ratio Code: "T" = 3.07:1 EXAMPLE: T A12 = 3.07:1, built January 12 (J = 9th month, I is not used).

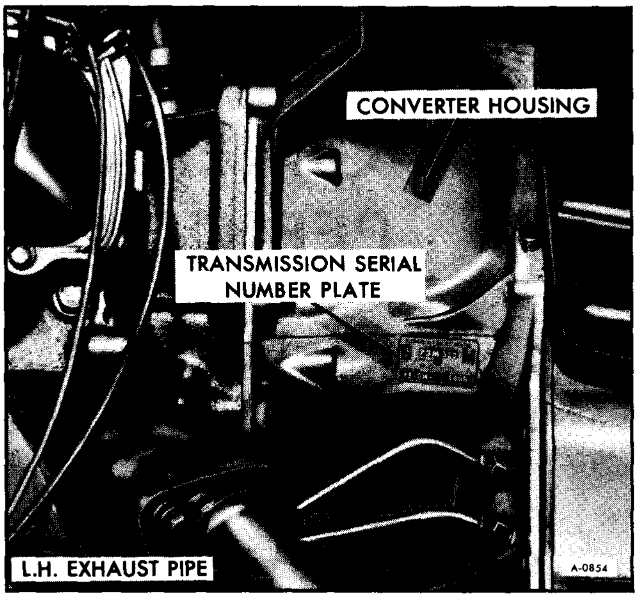


Figure 4—Transmission Serial Number Plate

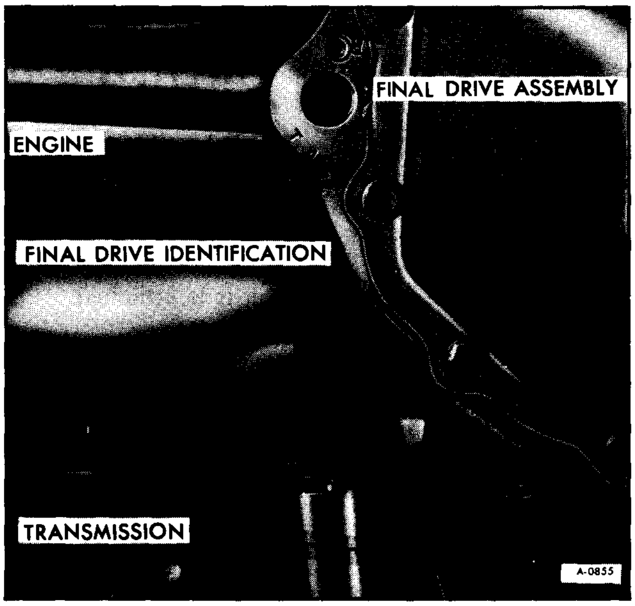


Figure 5—Final Drive Identification

HOISTING INSTRUCTIONS

A twin post hoist of sufficient capacity and with proper adapters and/or fittings must be used.

Front hoisting position is the front engine cross-member.

Rear hoisting must be done at the rear suspension brackets. If an "I" beam type adapter is used it should be approximately 82 inches in length to gain adequate support at suspension brackets. (figure 6)

If vehicle is to be placed on jack stands for maintenance or repairs, the hoisting points should be used.

CAUTION: *To help avoid serious damage to your vehicle, the vehicle should be raised only on twin post hoists of 15,000 pounds or more total rated capacity, at the suspension points noted (see diagram). Before raising, check overhead clearance to see that it is sufficient for the vehicle. Do NOT use the vehicle jack for hoisting or maintenance. It is designed for use only when changing tires.*

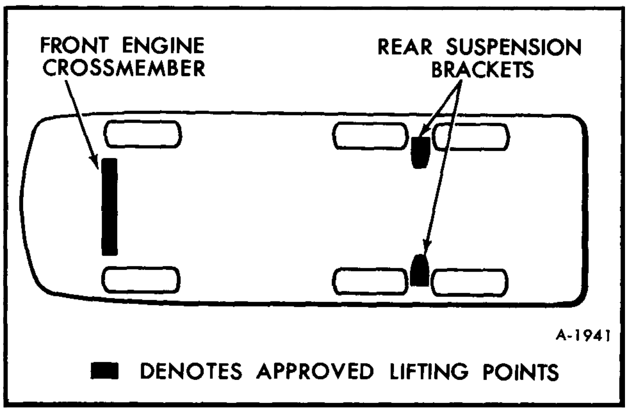


Figure 6—Vehicle Hoisting Points

JACK USAGE INSTRUCTIONS

CAUTIONS

1. Follow jacking instructions in order to reduce the possibility of serious personal injury.

2. The jack is designed for use only when changing wheels.

3. Never get beneath the vehicle when using jack.

4. Do not start or run engine while vehicle is on jack.

INSTRUCTIONS

- Park on level surface and set parking brake firmly.
- Set transmission in "PARK".
- Activate Hazard Warning Flasher.
- Jack, jack chain, handle, "jacking pad" (wooden block), and lug wrench are located under dinette seat.

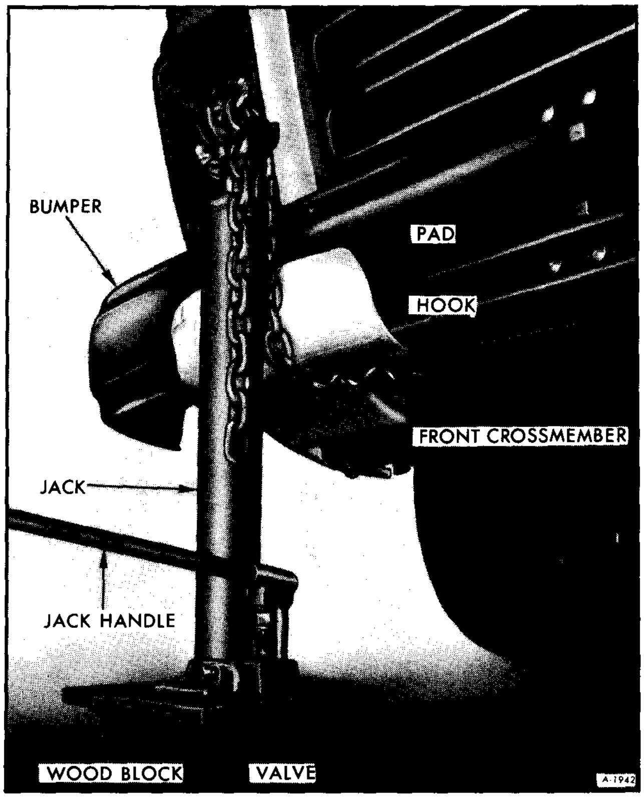


Figure 7—Jacking at Front of Vehicle

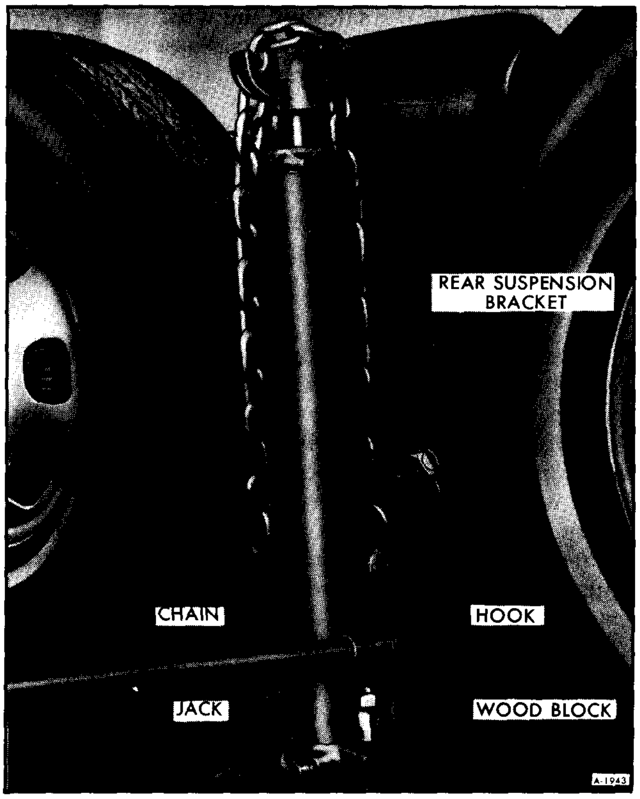


Figure 8—Jacking at Rear of Vehicle

• Block both front and rear of the wheel diagonally opposite the jack position.

• Loosen but do not remove wheel nuts.

• JACKING AT FRONT—Place hydraulic jack on wood block near energy absorbing front bumper bracket. Place hook at flange of front cross-member. Pass chain under bumper and adjust chain length to snug fit on fork on top of jack (See figure 7).

• JACKING AT REAR—Place hydraulic jack on wood block close to rear suspension bracket (See figure 8). The hook is placed in the drainage slot under bracket. Adjust chain length so link will fit in fork at top of jack.

• Close valve at base of jack and insert jack handle.

• Always operate jack with slow, smooth motion.

• Raise vehicle so tire just clears surface, replace wheel and slightly tighten wheel nuts.

• Open valve at base of jack to lower, then fully tighten wheel nuts. Proper torque is 250 foot pounds.

CAUTION: *Use lug wrench provided to tighten wheel nuts securely if torque wrench is not available. (Follow the nut tightening sequence shown in WHEELS AND TIRES, Section 10 of this manual. At the earliest opportunity have wheel nut torque checked. This is necessary to help prevent loosening or stripping of the wheel nuts.*

TOWING VEHICLE

TOWING

Proper lifting and towing equipment is necessary to prevent damage to the vehicle during any towing operation. State (Provincial in Canada) and local laws applicable to vehicles to tow must be followed. No towing operation should be attempted which would jeopardize the safety of the wrecker operator, any bystanders or other motorists. Passengers should never ride in a towed vehicle for any reason.

NOTE: Since the vehicle could exceed the lift and GVW capacity of most sling type equipment, heavier equipment such as chains and spreader bar should be used. Also, a wrecker with at least 8,000 lbs. capacity should be used.

Vehicle may be towed on all six wheels, at speeds less than 35 MPH, for distances up to 50 miles, provided the final drive, axle, transmission, and steering system are otherwise normally operable. Use only towing equipment specifically designed for this purpose following the instructions of the towing equipment manufacturer. A separate safety chain system must be used. For such towing the steering must be unlocked, transmission in neutral and the parking brake released. Attachments must be to engine front crossmember. Do not attach to bumpers or associated brackets. Remember that power brakes and power steering assists will not be available when engine is inoperative.

TOWING AT FRONT

When towing the vehicle the air bellows in the rear suspension should be inflated to maximum capacity and then place the power level controls in "HOLD" (vehicles with power level option). On vehicles without the power level option, disconnect the height control valve link (figure 9) on each side of the vehicle. Raise the arm on each height control valve to inflate the air bellows to provide maximum ground clearance for the vehicle. The leveling valve can then be released to the neutral position. Tow chains should be attached to engine front crossmember (See figure 10). Note that a six inch length of 2" x 4" wood block must be placed on top of the engine

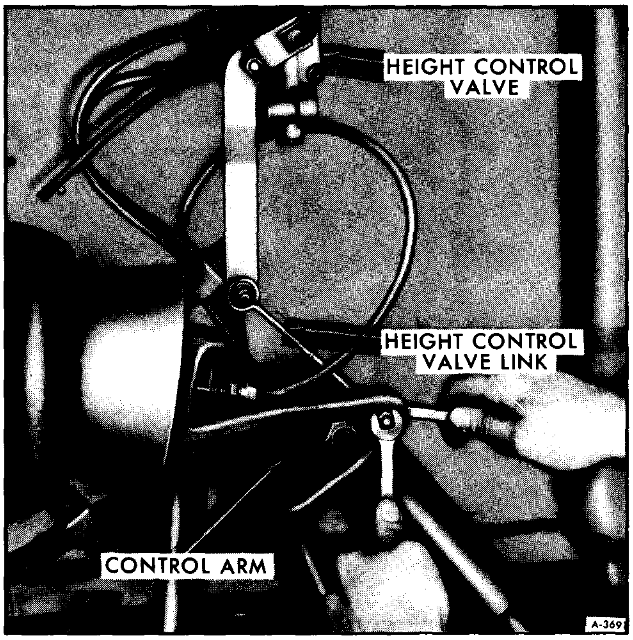


Figure 9—Disconnecting Height Control Valve Link

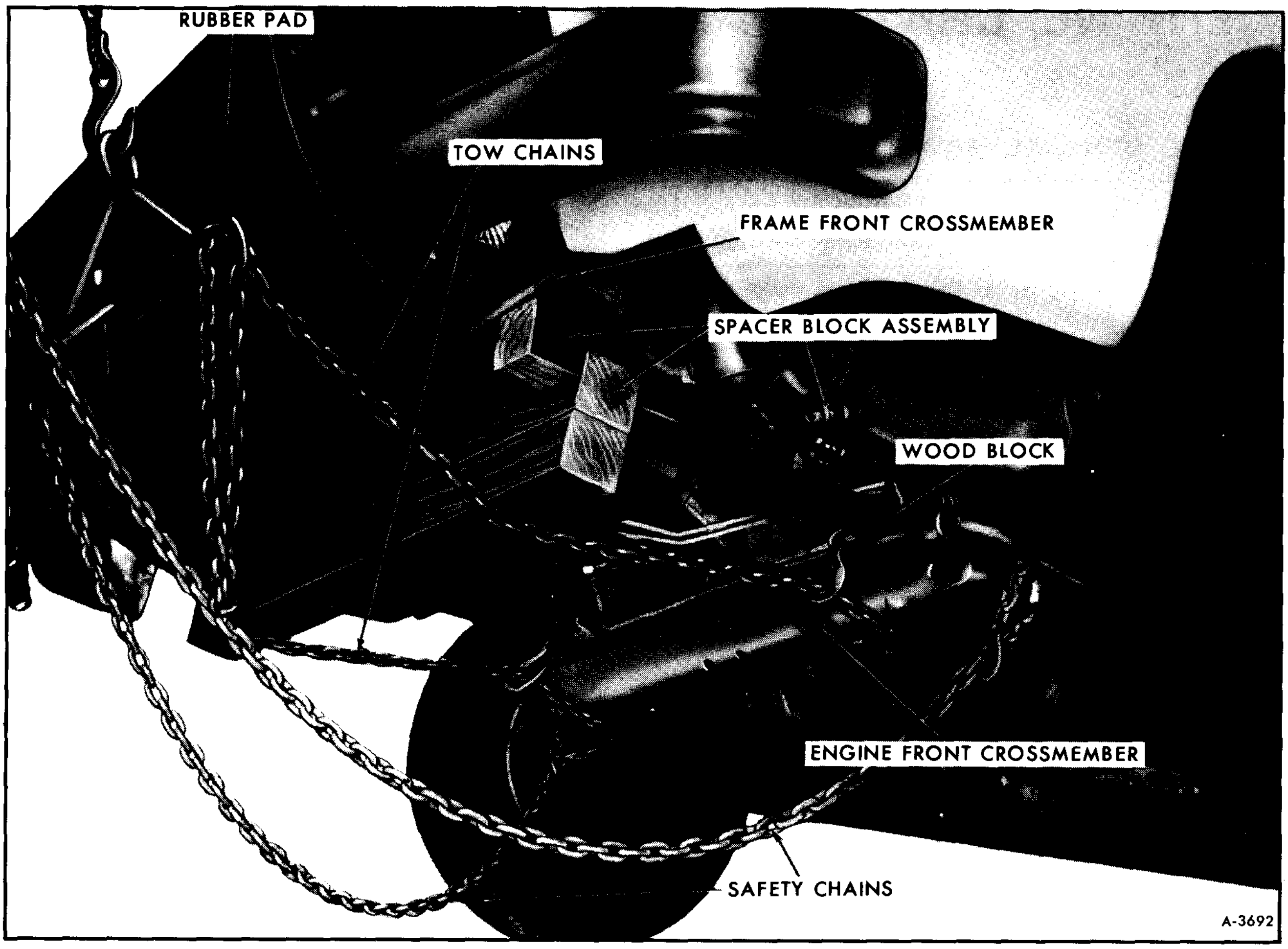


Figure 10—Towing Vehicle

front crossmember on the left side. The chain should then be attached around both the wood block and the engine front crossmember. Care should be taken so that the chain does not contact the fuel line on the engine front crossmember.

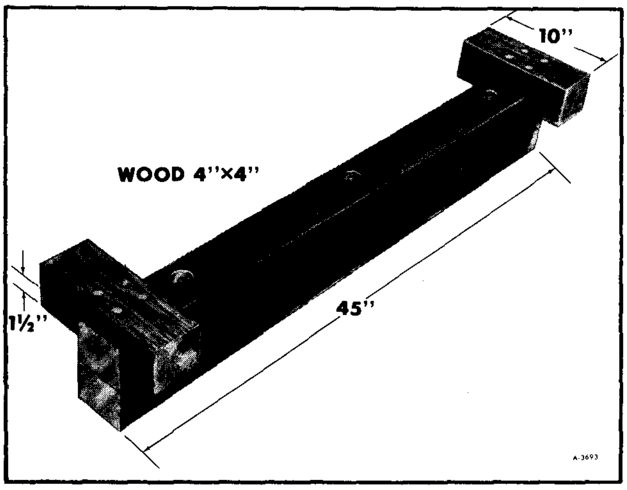


Figure 11—Spacer Block Assembly

CAUTION: *If the six inch length wood block is not installed, the towing chain could sever the fuel line on the engine front crossmember.*

A wood spacer block assembly should be placed under the front crossmember (See figure 10) to relieve some of the load from the energy absorbers and bumper. This spacer block assembly should be dimensioned, constructed of hardwood, and bolted together with three thru-bolts as shown in Figure 11.

Raising front of vehicle so front wheels are four inches off the ground will provide about five-inch ground clearance at the rear when towing. Separate safety chains should be attached to lower control arms.

TOWING AT REAR

It is not recommended that vehicle be towed with the rear raised as this could result in suspension or crossmember damage.

ENGINE, CHASSIS, AND BODY MAINTENANCE SCHEDULE

LUBE AND GENERAL MAINTENANCE

WHEN TO PERFORM SERVICES (Months or Miles, Whichever Occurs First)	Item No.	SERVICES (For Details, See Numbered Paragraphs)
Every 3 months or 3,000 miles	1	Chassis Lubrication
	2	Engine Oil — Change
Every 6 months or 6,000 miles	3	Fluid Levels — Check
	4	Air Conditioning System — Check
	5	Air Compressor Air Filter — Clean
Every 6,000 miles (Check wheel nut torque after 1st 500 miles)	6	Tire Rotation
At 1st oil change and then every 2nd	7	Engine Oil Filter — Replace
Every 12 months or 12,000 miles	8	Automatic Transmission and Final Drive Lubricant — Change
	9	Cooling System — See Explanation of Maintenance Schedule
Every 24,000 miles	10	Rear Wheel Bearings — Clean & Repack
	11	Final Drive Boots & Output Shaft Seals — Check

SAFETY MAINTENANCE

Every 6 months or 6,000 miles	12	Owner Safety Checks
	13	Tires and Wheels — Inspection
	14	Exhaust System — Check
	15	Engine Drive Belts — Check
	16	Suspension and Steering — Check
	17	Brake and Power Steering — Check
Every 12 months or 12,000 miles	18	Drum Brakes and Parking Brake — Check
	19	Throttle Linkage — Check
	20	Underbody — Flush and Check
	21	Bumper — Check

EMISSION CONTROL MAINTENANCE (1974 CERTIFIED ENGINE)*

At 1st 6 months or 6,000 miles — then at 12 months/12,000 mile intervals	22	Thermostatically Controlled Air Cleaner
	23	Carburetor Choke
	24	Timing, Dwell, Carb. Idle, Distributor & Coil
At 1st 6 months or 6,000 miles	25	Carburetor & Intake Manifold Mounting
Every 6,000 miles	26	Spark Plugs (When using leaded fuels)
Every 12 months or 12,000 miles	27	Thermal Vacuum Switch and Hoses
	28	Carburetor Fuel Filter
	29	PCV System
	30	Air Cleaner Element
	31	Spark Plugs and Ignition Coil Wires
Every 24 months or 24,000 miles	32	Engine Compression
	33	ECS System
	34	Fuel Cap. Tanks and Lines

EMISSION CONTROL MAINTENANCE (1975 AND 1976 CERTIFIED ENGINE)

At 1st 6 months or 6,000 miles – then at 12 months/12,000 mile intervals	35	Thermostatically Controlled Air Cleaner – Check
	36	Carburetor Choke – Check
	37	Engine Idle Speed and Mixture Adjustment
	38	Carburetor and Intake Manifold Mounting Torque
Every 6,000 miles	39	Spark Plug Replacement
Every 12 months or 12,000 miles	40	Carburetor Fuel Filter Replacement
	41	Thermal Vacuum Switch and Hoses – Check
	42	PCV System – Check
	43	Air Cleaner Element Replacement
	44	Spark Plug Wires – Check
	45	Engine Timing Adjustment and Distributor – Check
	46	Throttle Return Control – Check
Every 24 months or 24,000 miles	47	ECS System Check and Filter Replacement
	48	Fuel Cap, Tanks and Lines – Check

*To determine year engine was certified, refer to emission control decal on engine valve cover.

EXPLANATION OF MAINTENANCE SCHEDULE

Presented below is a brief explanation of each of the services listed in the preceding Maintenance Schedule.

Vehicle operation under conditions such as heavy dust, continuous short trips, use of other than unleaded or low lead fuels or pulling trailers, is not considered normal use and therefore more frequent maintenance will be required. Such additional maintenance requirements are included where applicable.

LUBE AND GENERAL MAINTENANCE

ITEM

NO. SERVICES

1 CHASSIS—Lubricate all grease fittings in front and rear suspension and steering linkage. Also lubricate transmission shift linkage, brake pedal spring, parking brake cable guides and linkage.

2 ENGINE OIL—Change each 3 months or 3,000 miles, whichever occurs first.

3 FLUID LEVELS—Check level of fluid in brake master cylinder, power steering pump, all batteries, engine, final drive, transmission, and windshield washer. The engine coolant should be checked for proper level and freeze protection to at least -20°F. (-29°C.) (-37°C. in Canada), or to the lowest temperature expected during the period of vehicle operation. Proper engine coolant also provides corrosion protection.

Any significant fluid loss in any of these systems or units could mean that a malfunction is developing and corrective action should be taken immediately. A low fluid level in the brake master cylinder front reservoir could also be an indicator that the disc brake pads need replacing.

4 AIR CONDITIONING—Check condition of air conditioning system hoses and refrigerant charge at sight glass. Replace hoses and/or refrigerant if need is indicated.

5 AIR COMPRESSOR—Filter should be washed with soap and water solution or replaced.

6 TIRES—To equalize wear, rotate tires as illustrated in Section 10 and adjust tire pressures as shown on tire placard on glove box door. Have wheel-nut torque checked after 1st 500 miles and 500 miles after every wheel replacement thereafter.

7 ENGINE OIL FILTER—Replace at the first oil change and every 2nd oil change thereafter.

8 AUTOMATIC TRANSMISSION FLUID AND FINAL DRIVE LUBRICANT—Change the transmission fluid and filter; change final drive lubricant.

9 COOLING SYSTEM—At 12-month or 12,000-mile intervals, wash radiator cap and filler neck with clean water, pressure test system and radiator cap for proper pressure holding capacity. (Tighten hose clamps and inspect condition of all cooling and heater hoses.) Replace hoses every 24 months or 24,000 miles or earlier if checked, swollen or otherwise deteriorated.

Also each 12 months or 12,000 miles, clean exterior of radiator core and air conditioning condenser. Every 24 months or 24,000 miles, drain, flush, and refill the cooling system with a new coolant solution.

10 REAR WHEEL BEARINGS—Clean and repack rear wheel bearings with a lubricant as specified in the "Recommended Fluids and Lubricants" chart.

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

11 FINAL DRIVE AXLE BOOTS AND OUTPUT SHAFT SEALS—Check for damaged, torn or leaking boots on drive axles and for leaking output shaft seal. Replace defective parts as necessary.

SAFETY MAINTENANCE

12 OWNER SAFETY CHECKS—The maintenance schedule folder in the glove box lists several items the owner should check and have repaired if not correct.

13 TIRES AND WHEELS—To equalize wear, rotate tires as illustrated in Section 10. Adjust tire pressures as recommended on tire placard on glove box door. Check disc brake pads and condition of rotors while wheels are removed. Check tires for excessive wear or damage. Make certain wheels are not bent or cracked and wheel nuts are tight. Check tire inflation pressure at least monthly, or more often if daily visual inspection indicates the need.

14 EXHAUST SYSTEM—Check complete exhaust system and nearby body areas of vehicle engine and motor-generator system for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the passenger compartment. Dust or water in the passenger compartment may be an indication of a problem in one of these areas. Any defects should be corrected immediately. To help ensure continued integrity, exhaust system pipes rearward of the muffler must be replaced whenever a new muffler is installed.

15 ENGINE DRIVE BELTS—Check belts driving fan, Delcotron, power steering pump and air conditioning compressor for cracks, fraying, wear and tension. Adjust or replace as necessary.

It is recommended that belts be replaced every 24 months or 24,000 miles, whichever occurs first.

16 SUSPENSION AND STEERING—Check for damaged, loose or missing parts, or parts showing visible signs of excessive wear or lack of lubrication in front and rear suspension and steering system. Questionable parts noted should be replaced by a qualified mechanic without delay.

17 BRAKES AND POWER STEERING—Check lines and hoses for proper attachment, leaks, cracks, chafing, deterioration, etc. Any questionable parts noted should be replaced or repaired immediately. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

18 DRUM BRAKES AND PARKING BRAKE—Check drum brake linings and other internal brake components at each wheel (drums, wheel cylinders, etc.). Parking brake adjustment also should be checked whenever drum brake linings are checked.

NOTE: More frequent checks should be made if driving conditions and habits result in frequent brake application.

19 THROTTLE LINKAGE—Check for damaged or missing parts, interference or binding. Any deficiencies should be corrected without delay.

20 UNDERBODY—In geographic areas using a heavy concentration of road salt or other corrosive materials for snow removal or road dust control, flush and inspect the complete under side of the vehicle at least once each year, preferably after a winter's exposure. Particular attention should be given to cleaning out underbody members where dirt and other foreign materials may have collected.

21 BUMPERS—Check the front and rear bumper systems at 12-month/12,000-mile intervals to be sure the impact protection and clearance originally designed into the system remains in a state of full readiness. They also should be checked whenever there is obvious bumper misalignment, or whenever the vehicle has been involved in a significant collision in which the bumper was struck, even when no damage to the bumper system can be seen.

EMISSION CONTROL MAINTENANCE

(1974 CERTIFIED ENGINE)

22 THERMOSTATICALLY CONTROLLED AIR CLEANER—Inspect installation to make certain that all hoses and ducts are connected and correctly installed. Also check valve for proper operation.

23 CARBURETOR CHOKE—Check choke mechanism for free operation. Any binding condition which may have developed due to petroleum gum formation on the choke shaft or from damage should be corrected.

24 TIMING, DWELL, CARBURETOR IDLE, DISTRIBUTOR AND COIL—Adjust ignition timing, dwell and carburetor idle speed accurately (following the specifications shown on the label attached to engine rocker cover) at the first 6 months or 6,000 miles of operation then at 12 month or 12,000 miles. Then at 12 month or 12,000 mile intervals. Adjustment must be made with test equipment known to be accurate.

Replace distributor points every 12 months or 12,000 miles and replace cam lubricator every 24 months or 24,000 miles. In addition, carefully inspect the interior and exterior of the distributor cap, distributor rotor and coil for cracks, carbon tracking, and terminal corrosion. Clean or replace as necessary at 24-month/24,000 mile intervals to prevent misfiring and/or deterioration.

Proper functioning of the carburetor is particularly essential to control of emissions. Correct mixtures for emission compliance and idle quality have been preset by GMC Truck. Plastic idle mixture limiters have been installed on the idle mixture screws to discourage unauthorized adjustment. These idle limiters are not to be removed unless some major carburetor repair or replacement which affects the idle screw adjustment has been necessary.

At 12 months or 12,000 mile intervals or in case of major carburetor overhaul, or when poor idle quality exists, the idle mixture should be adjusted by use of a CO meter when an accurate meter is available, or the alternate mechanical method should be used to adjust idle mixture (See SECTION 6M).

25 CARBURETOR AND INTAKE MANIFOLD MOUNTING—Torque carburetor and intake manifold attaching bolts and/or nuts at first 6 months or 6,000 miles of vehicle operation.

26 SPARK PLUGS—Replace at 6,000 mile intervals when operating with leaded fuels, or at 12,000-mile intervals when using unleaded fuels. Use of leaded fuels results in lead deposits on spark plugs and can cause misfiring at mileages less than 12,000 miles. Where misfiring occurs prior to 6,000 miles, spark plugs in good condition can often be cleaned, tested, and reinstalled in an engine with acceptable results.

27 THERMAL VACUUM SWITCH AND HOSES—Check for proper operation. A malfunctioning switch must be replaced. Check hoses for proper connection, cracking, abrasion or deterioration and replace as necessary.

28 CARBURETOR FUEL FILTER—Replace filter at 12-month/12,000-mile intervals or more frequently if clogged.

29 POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)—Check system for satisfactory operation at 12-month or 12,000-mile intervals using a tester, and clean filter. Replace the PCV valve at 24-month or 24,000-mile intervals and blow out PCV valve hose with compressed air. The PCV valve should be replaced at 12-month or 12,000-mile intervals when the vehicle is used in operations involving heavy dust, extensive idling, trailer pulling, and short trip use at freezing temperatures where engine does not become thoroughly warmed-up.

30 AIR CLEANER ELEMENT—Replace the engine air cleaner element under normal operating conditions every 12,000 miles. Operation of vehicle in dusty areas will necessitate more frequent element replacement.

> **CAUTION:** *Do not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the air cleaner is removed backfiring can cause fire in the engine compartment.*

31 SPARK PLUG AND IGNITION COIL WIRES—Inspect spark plug and ignition coil wires for evidence of checking or cracking of exterior insulation and tight fit in the distributor cap and at the spark plugs. Exterior of wires should be cleaned, any evidence of corrosion on ends removed and wire replaced if deteriorated.

32 ENGINE COMPRESSION—Test engine cranking compression. If a problem exists, have correction made. Minimum compression recorded in any one cylinder should not be less than 70% of the highest cylinder. For example, if the highest pressure in any one cylinder is 150 lbs., the lowest allowable pressure for any other cylinder would be 105 lbs. (150 X 70% = 105).

33 EVAPORATION CONTROL SYSTEM (ECS)—Check all fuel and vapor lines and hoses for proper connections and correct routing as well as condition. Remove canister(s) and check for cracks or damage. Replace damaged or deteriorated parts as necessary. Replace filter in lower section of canister.

If vehicle is equipped with two canisters, filter is located in the lower canister only.

34 FUEL CAP, FUEL LINES AND FUEL TANKS—Inspect the fuel tank cap and lines for damage which could cause leakage. Inspect fuel cap for correct sealing ability and indications of physical damage. Replace any damaged or malfunctioning parts.

EMISSION CONTROL MAINTENANCE

(1975 - 1976 CERTIFIED ENGINE)

35 THERMOSTATICALLY CONTROLLED AIR CLEANER—Inspect installation to make certain that all hoses and ducts are connected and correctly installed. Also check valve for proper operation.

36 CARBURETOR CHOKE AND HOSES—Check choke mechanism for free operation. Any binding condition which may have developed due to petroleum gum formation on the choke shaft or from damage should be corrected. Check carburetor choke hoses for proper connection, cracking, abrasion or deterioration and correct or replace as necessary.

37 ENGINE IDLE SPEED AND MIXTURE—Adjust engine idle speed accurately (following the specifications shown on the label attached to the engine rocker cover) at the first 6 months or 6,000 miles of operation, then at 12 month or 12,000 mile intervals. Adjustment must be made with test equipment known to be accurate.

At 12 month or 12,000 mile intervals or in case of major carburetor overhaul, or when poor idle quality exists, the idle mixture should be adjusted by use of a CO meter when an accurate meter is available, or the alternate mechanical method (lean drop) should be used to adjust the idle mixture. (See Section 6M).

38 CARBURETOR AND INTAKE MANIFOLD MOUNTING—Torque carburetor and intake manifold attaching bolts and/or nuts at first 6 months or 6,000 miles —then at 12 month/12,000 mile intervals.

39 SPARK PLUGS—Replace at 6,000 mile intervals when operating with leaded fuels, or at 12,000-mile intervals when using unleaded fuels. Use of leaded fuels results in lead deposits on spark plugs and can cause misfiring at mileages less than 12,000 miles. Where misfiring occurs prior to 6,000 miles, spark plugs in good condition can often be cleaned, tested, and reinstalled in an engine with acceptable results.

40 CARBURETOR FUEL FILTER—Replace filter at 12-month 12,000-mile intervals or more frequently if clogged.

41 THERMAL VACUUM SWITCH AND HOSES—Check for proper operation. A malfunctioning switch must be replaced. Check hoses for proper connection, cracking, abrasion or deterioration and replace as necessary.

42 POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)—Check the PCV system for satisfactory operation at 12,000-mile intervals, and clean filter (located in rocker cover). Replace the PCV valve at 24,000-mile intervals and blow out PCV valve hose with compressed air. Replace deteriorated hoses.

43 AIR CLEANER ELEMENT—Replace the engine air cleaner element under normal operating conditions every 12,000 miles. Operation of vehicle in dusty areas will necessitate more frequent element replacement. Your GMC MotorHome dealer can be of assistance in determining the proper replacement frequency for the conditions under which you operate your vehicle.

CAUTION: DO not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the air cleaner is removed back-firing can cause fire in the engine compartment.

44 SPARK PLUG WIRES—Clean exterior of wires; remove any evidence of corrosion on end terminals. Inspect spark plug wires for evidence of checking, burning, or cracking of exterior insulation and tight fit at distributor cap and spark plugs or other deterioration. If corrosion cannot be removed or other conditions above are noted, replace wire.

45 TIMING AND DISTRIBUTOR CAP—Adjust ignition timing following the specification on label attached to the engine rocker cover.

Also, carefully inspect the interior and exterior of the distributor cap and rotor for cracks, carbon tracking and terminal corrosion. Clean or replace as necessary.

46 THROTTLE RETURN CONTROL (TRC)—(California Vehicles) Check hoses for cracking, abrasion or deterioration and replace as necessary. Check system for proper operation.

47 EVAPORATION CONTROL SYSTEM (ECS)—Check all fuel and vapor lines and hoses for proper connections and correct routing as well as condition. Remove canister(s) and check for cracks or damage. Replace damaged or deteriorated parts as necessary. Replace filter in lower section of canister.

If vehicle is equipped with two canisters, filter is located in the lower canister only.

48 FUEL CAP, FUEL LINES AND FUEL TANKS—Inspect the fuel tank cap and lines for damage which could cause leakage. Inspect fuel cap for correct sealing ability and indications of physical damage. Replace any damaged or malfunctioning parts.

RECOMMENDED FLUIDS AND LUBRICANTS

USAGE	FLUID/LUBRICANT	CAPACITIES
Engine oil	High quality SE oil	5 qts. (6 w/filter)
Power steering system and pump reservoir. Includes windshield wiper motor	GM power steering fluid Part No. 1050017 – if not available use DEXRON® II automatic transmission fluid	1 1/2 Qts.
Final drive	SAE 80W or SAE 80W-90 GL-5 gear lubricant (SAE 80W GL-5 in Canada)	4 Pts.
Brake system and master cylinder	Delco Supreme 11 or, DOT-3 fluid or equivalent	
Transmission shift linkage	Engine oil	
Chassis lubrication	Chassis grease meeting requirements of GM 6031-M	
Transmission	DEXRON ® II automatic transmission fluid	4 Qts. *
Parking brake cables	Chassis grease	
Front wheel bearings	High-melting point lubricant Part No. 1051344	
Rear wheel bearings	Chassis grease meeting requirements of GM 6031-M	
Body door hinge pins, hinges and latches at the front access doors, external utilities, generator/storage and LP gas doors. Gas fill door hinge	Engine oil	
Windshield washer solvent	GM Optikleen washer solvent Part No. 1050001 or equivalent	
Energizers (Batteries)	Colorless, odorless, drinking water	
Engine coolant	Mixture of water and a high quality Ethylene Clycol base type anti-freeze conforming to GM Spec. 1899-M	21 Qts.

NOTE: Fluids and lubricants identified with GM part numbers or GM specification numbers may be obtained from your GMC Motor Home Service Outlet.

*12 qts. after complete overhaul.

LUBRICATION DETAILS

ENGINE

ENGINE OIL AND FILTER RECOMMENDATIONS

- Use only SE engine oil.

- Refer to "Engine, Chassis and Body Maintenance Schedule" for oil change and filter replacement intervals.

The recommendations in the "Engine, Chassis and Body Maintenance Schedule" apply to the first change as well as subsequent oil changes. The oil change interval for the vehicle's engine is based on the use of SE oils and quality oil filters. Oil change intervals longer than those listed above will seriously reduce engine life and may affect GMC Truck Coach's obligation under the provisions of the New Vehicle Warranty.

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

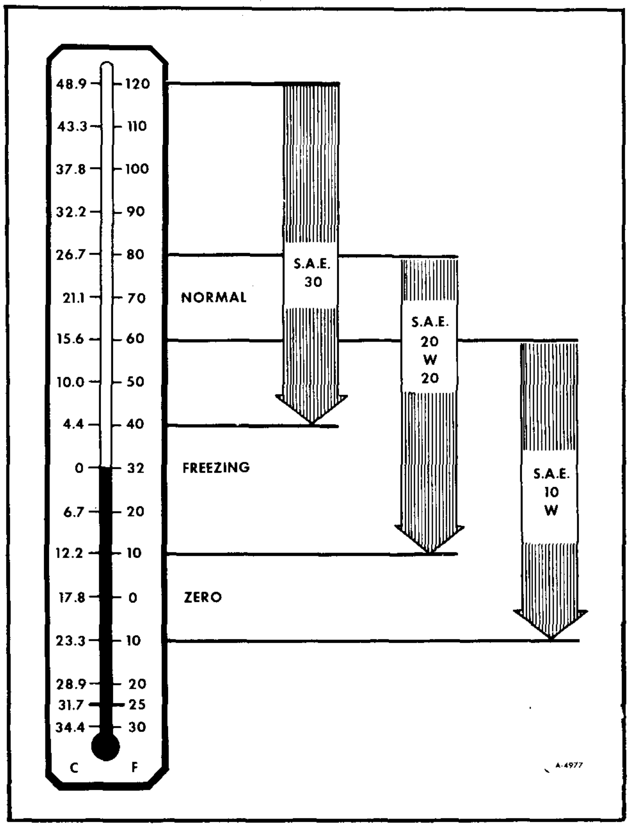


Figure 12—Engine Oil Viscosity Chart

NOTE: Non-detergent and other low quality oils are specifically not recommended. Only the use of SE engine oils and proper oil and filter change intervals assure of continued proper lubrication of the vehicle's engine.

RECOMMENDED SAE VISCOSITY (FIGURE 12)

- Single grade oils are preferred, however, multigrades such as SAE 10W-30 or 10W-40 are also acceptable.

- SAE 5W-20 oils are not recommended for sustained high speed driving.

- SAE 5W-30 oils (if available) may be used if extreme low temperatures are anticipated.

SUPPLEMENTAL ENGINE OIL ADDITIVES

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

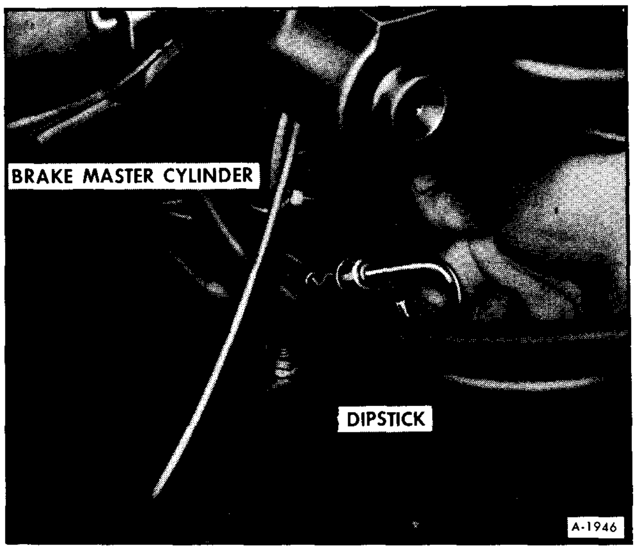


Figure 13—Removing Engine Oil Dipstick

CHECKING OIL LEVEL

The engine oil should be maintained at the proper level. The best time to check it is before operating the engine or as the last step in a fuel stop. This will allow the normal oil accumulation in the engine to drain back into the crankcase. To check the level, remove the oil level dipstick located inside the left front access door (See figure 13) wipe it clean and reinsert it fully for accurate reading. The oil level dipstick is marked "FULL" and "ADD." (figure 14) The oil level should be maintained within the margin, neither going above the "FULL" line nor below the "ADD" line. Reseat the dipstick firmly after taking the reading. One (1) quart will raise the oil level from "ADD" to "FULL."

NOTE: The oil dipstick is also marked "USE SE ENGINE OIL," as a reminder to use only SE oils.

TRANSMISSION

The transmission dipstick and fill tube is located under the engine access cover on the left side of the engine. (figure 15)

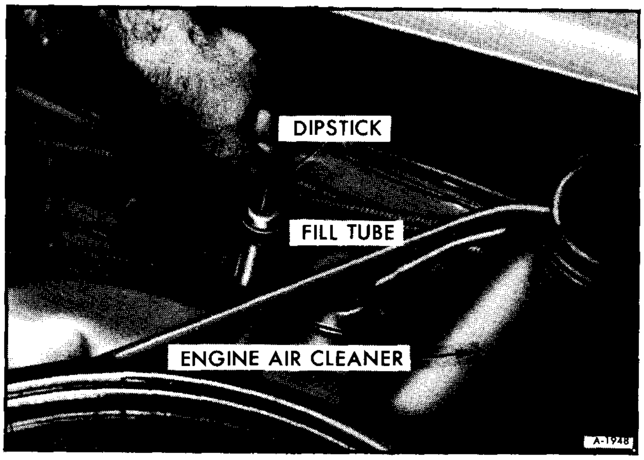


Figure 15—Removing Transmission Dipstick

Use only automatic transmission fluids identified with the mark DEXRON®II. These fluids have been specially formulated and tested for use in the automatic transmission, and are available from the GMC Motor Home service outlet or local service station.

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

1. Drive vehicle several miles, making frequent starts and stops, to bring transmission up to normal operating temperature (approx. 190-200°F.) (87.8°C.-93.3°C.).

2. Park MotorHome on a level surface.

3. Apply parking brake.

4. Place selector lever in "PARK" and leave engine running.

5. Open all but the two rear windows, then remove engine cover.

6. Remove dipstick and wipe clean.

7. Reinsert dipstick until cap seats.

8. Remove dipstick and note reading. (figure 16)

If fluid level is at or below the "ADD" mark, add sufficient fluid to raise the level to the "FULL" mark. One pint raises the level from "ADD" to "FULL." Do not overfill. Refer to the Maintenance Chart for servicing schedule.

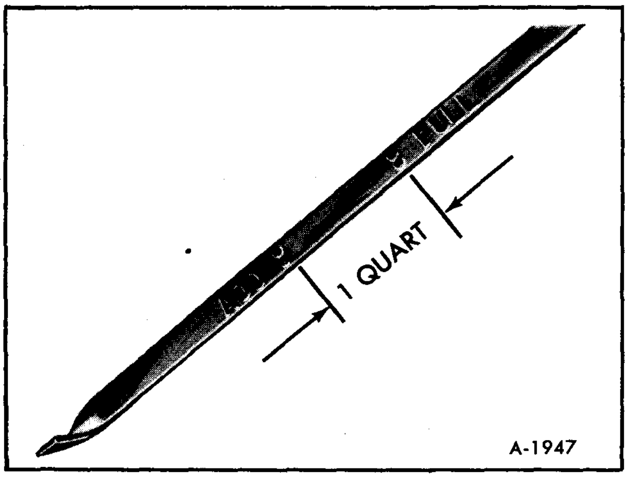


Figure 14—Engine Oil Dipstick

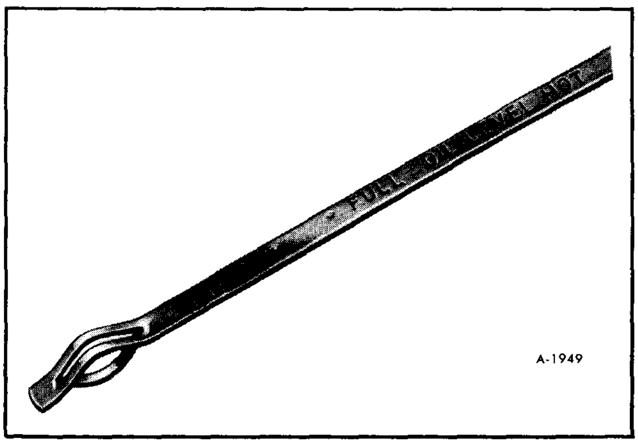


Figure 16—Transmission Dipstick

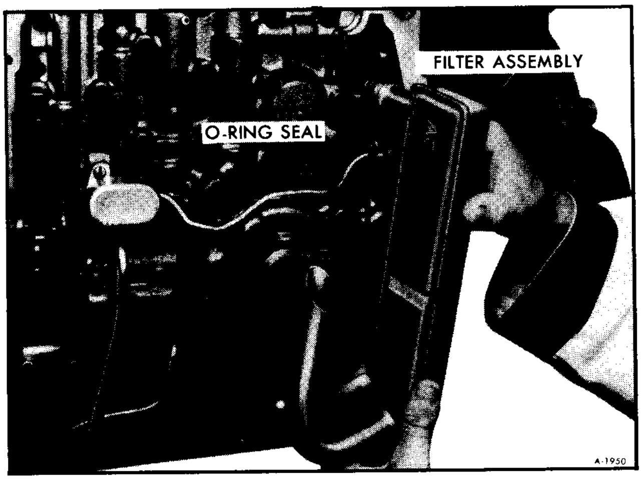


Figure 17—Replacing Transmission Oil Filter

TRANSMISSION OIL FILTER REPLACEMENT (FIGURE 17)

NOTE: Have a drain pan ready as lubricant will begin to drain as bolts are loosened.

1. Remove (13) bottom pan attaching screws.

2. Remove bottom pan and discard gasket.

3. Remove and discard oil filter assembly.

4. Install new O-ring seal on new filter and intake pipe and filter assembly and install.

5. Using a new pan gasket, install pan. Torque attaching screws to 12 foot-pounds.

6. Add four (4) quarts of DEXRON ® II automatic transmission fluid and check fluid as noted above.

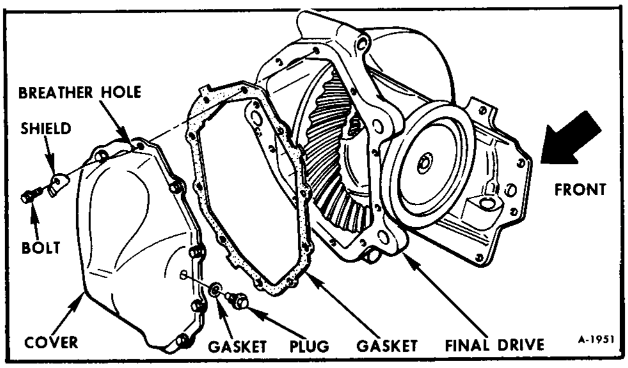


Figure 18—Final Drive Cover Removed

FINAL DRIVE (FIGURE 18)

FINAL DRIVE LUBRICANT REPLACEMENT

1. Remove (10) cover attaching bolts. Have a drain pan ready as lubricant will begin to drain as bolts are loosened.

2. Remove cover and allow lubricant to drain. Discard old gasket.

3. Using a new cover gasket, install cover. Torque attaching bolts to 24 foot-pounds. Shield to be bent over breather hole.

4. Add four pints of recommended lubricant through fill plug hole or fill until lubricant level is at the plug hole.

STEERING SYSTEM

POWER STEERING SYSTEM (FIGURE 19)

Check the fluid level in the power steering pump reservoir at each oil change period. This requires the removal of the engine access cover. The reservoir is located near the Delcotron. Add GM Power Steering Fluid (if GM Power Steering Fluid is not available, DEXRON®II Automatic Transmission Fluid may be used) as necessary to bring level into proper range on the filler cap indicator depending on fluid temperature.

If at operating temperature (approx. 150°F. *65.6°C.) hot to the touch) fluid should be between "HOT" and "COLD" marks. If at room tempera-*

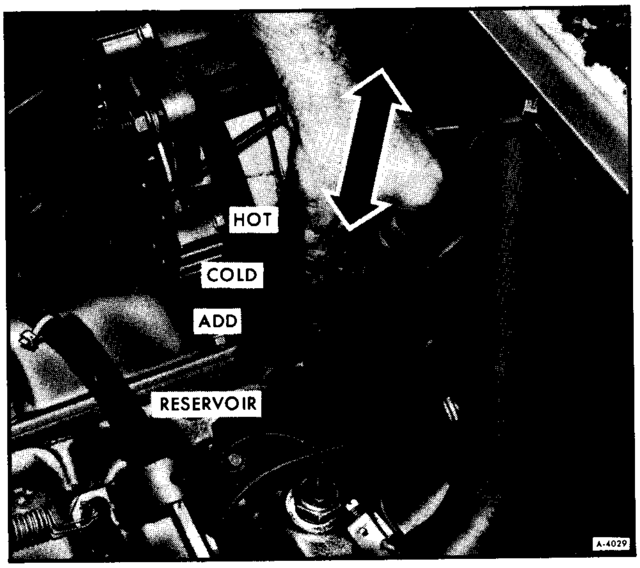


Figure 19—Checking Power Steering Fluid Level

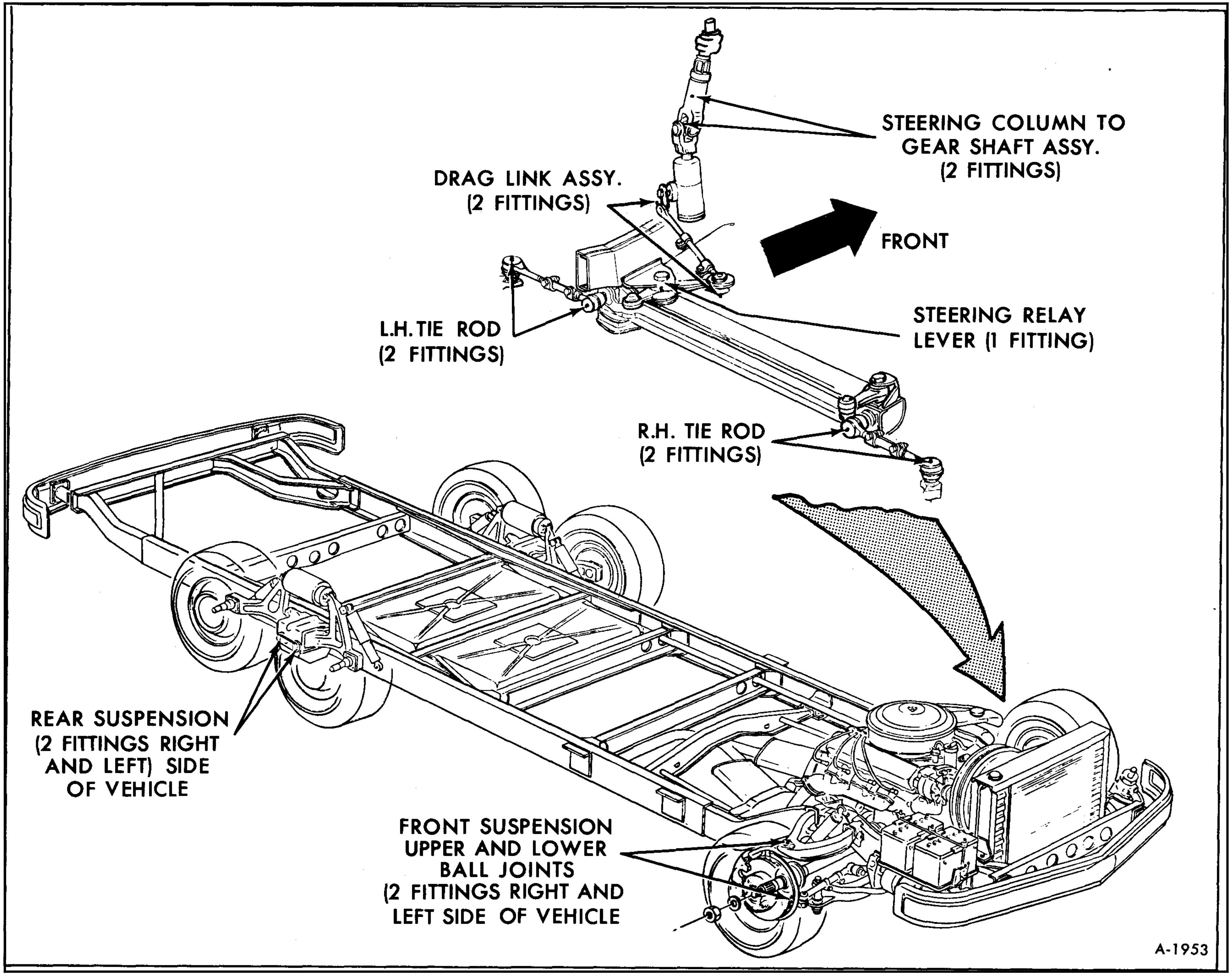


Figure 20—Location of Chassis Lubrication Fittings (Typical)

ture (approx. 70°F. (21.1°C.) fluid should be between "ADD" and "COLD" marks. The fluid does not require periodic changing.

STEERING LINKAGE (FIGURE 20)

The steering linkage (tie rods) and suspension should be lubricated, using a water resistant E.P. Chassis Lubricant that meets GM Specification 6031-M, at every oil change. Seals should be checked for damage.

BRAKE SYSTEM

BRAKE MASTER CYLINDER (FIGURE 21)

The master cylinder is located behind the left-side access door on the front of the vehicle. The fluid level in the master cylinder should be checked at each oil change. Wipe off the brake cylinder filler cap and unsnap the retainer. A low fluid level in the front brake master cylinder reservoir could be an indicator that the disc brake pads need replacing. The fluid level must be maintained at 1/4-inch below the top of each reservoir with Delco Supreme No. 11 or DOT-3 Brake Fluid or equivalent. When replacing the cap be sure to fasten the retainer securely, taking care not to let dirt enter the reservoirs.

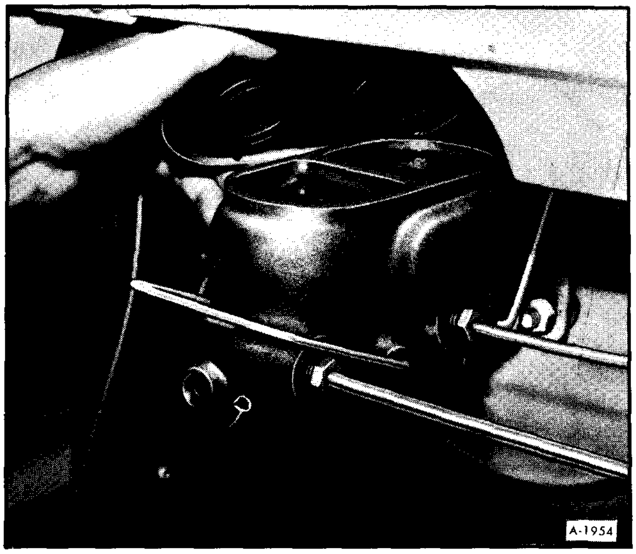


Figure 21—Checking Brake Master Cylinder

BLEEDING BRAKES

The need for bleeding brakes is generally indicated by springy, spongy pedal action. Pressure bleeding equipment must be used and a definite bleeding sequence and procedure must be followed. For proper bleeding sequence see BRAKES (SECTION 5) of this manual.

WINTERIZATION AND VEHICLE STORAGE

Winterization and vehicle storage are essential service functions which must be performed on GMC Motor Homes. Details on these items are covered in SECTION 24A "Periodic Maintenance and Lubrication"

SECTION 1
BODY, HEATING AND AIR CONDITIONING

This section includes the following:

BODY

Contents of this section are listed below:

KEY INFORMATION

Two keys are furnished with the vehicle. Each key has a different cross section so that it can be inserted only in certain locks. The key with a square head is for the ignition switch only. The key with an oval head fits the side entrance door lock, the glove box, and the external utilities compartment.

All models have ignition and glove compartment lock cylinders incorporating coded keyways and keys. The code letter is located on the key shank and the code number is stamped on the knock-out portion of the key head. These numbers identify the locks in which the keys are used and are required when ordering or making new keys.

Notch dept information will be provided, on current production keys, upon request through the manufacturer of your key cutting equipment or his locksmith association. Also he will be able to furnish a conversion package for your cutter, if required, for grinding new keys.

EXTERIOR MAINTENANCE

Entire vehicle should be regularly inspected for condition of paint and for corrosion damage, with particular attention given to chrome. Inspection should be made more frequently in freezing weather due to the corrosive effect of road deicing materials (salt, calcium chloride, etc.) on metal. If inspection discloses any evidences of corrosion, paint failure, or bare metal, corrective measures as outlined under "Painting" (later in this section) should be immediately employed.

Body painted surfaces and chrome plating should be protected by a coating of wax, applied at regular intervals. Periods between applications should be sufficiently short to assure continuous protection of the finish; 30 days after delivery, and at least once a year thereafter. Any good body wax can be used for both painted and chrome surfaces. Wax should be applied immediately after vehicle has been cleaned.

NOTE: Calcium chloride and other salts, road tar, excretion from insects, ("treesap"), chemicals from factory chimneys and other foreign matter may permanently damage paint and chrome. Frequent, regular washing and a thorough cleaning after exposure is recommended to prevent damage by these substances. Use either cold or lukewarm water. Never wash vehicle in direct rays of the sun and always wait until painted surfaces have cooled.

INTERIOR MAINTENANCE

Dust and loose dirt that accumulate on interior fabric trim should be removed frequently with a vacuum cleaner, whisk broom or soft brush. Vinyl or leather trim should be wiped clean with a damp cloth. Normal cleanable trim soilage, spots or stains can be cleaned with the proper use of trim cleaners available through General Motors Dealers or other reputable supply outlets.

IMPORTANT: Do not use commercial paint, chrome or glass cleaners on interior bright trim or painted surfaces. If cleaning is required, lukewarm water and a neutral soap may be used.

Before attempting to remove spots or stains from upholstery, determine as accurately as possible the nature and age of the spot or stain. Some spots or stains can be removed satisfactorily with water or mild soap solution (refer to "Removal of Specific Stains" later in this section). For best results, spots or stains should be removed as soon as possible.

Some types of stains or soilage such as lipsticks, some inks, certain types of grease, mustard, etc., are extremely difficult and, in some cases, impossible to completely remove. When cleaning this type of stain or soilage, care must be taken not to enlarge the soiled area. It is sometimes more desirable to have a small stain than an enlarged stain as a result of attempted cleaning.

CAUTION: *When cleaning interior do not use volatile cleaning solvents such as: acetone, lacquer thinners, enamel reducers, nail polish removers; or such cleaning materials as laundry soaps, bleaches or reducing agents (except as noted in the instructions on "Cleaning Fabrics" and "Removal of Specific Stains.") Never use carbon tetrachloride, gasoline, or naphtha for any cleaning purpose. The above materials may be toxic or flammable, or may cause damage to interior.*

INTERIOR GLASS

The interior glass surface should be cleaned on a periodic basis for continued good visibility. A commercial household glass cleaning agent containing ammonia will remove normal tobacco smoke and dust films sometimes caused by ingredients used in vinyls, plastics, or other interior trim materials.

CLEANING FABRICS

IMPORTANT: Be sure vehicle is well ventilated while using the following cleaning agents. Follow manufacturer's recommendations in using such products.

CLEANING FABRICS WITH CLEANING FLUID

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

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

CLEANING FABRICS WITH DETERGENT FOAM CLEANERS

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

REMOVAL OF SPECIFIC STAINS

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

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

FRUIT STAINS, COFFEE, LIQUOR, WINE, SOFT DRINKS, ICE CREAM AND MILK—Wipe with cloth soaked in cold water. If necessary, clean lightly with fabric cleaning fluid. Soap and water is not recommended as it might set the stain.

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

GREASE, OIL, BUTTER, MARGARINE AND CRAYON—Scrap off excess with dull knife. Use fabric cleaning fluid.

PASTE OR WAX TYPE SHOE POLISH—Light application of fabric cleaning fluid.

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

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

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

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

BALL POINT INK—Try rubbing alcohol. If stain remains after repeated applications, no other measure should be tried.

LIPSTICK—Difficult to remove. Cleaning fluid works on some brands. If stain remains after repeated applications, do not try other measures.

MUSTARD—Damp sponge with warm water, then rub detergent on dampened stain and work into fabric. Repeat several times. Some discoloration may remain.

DUST AND WATER LEAKS

Test windshield, windows and vehicle under flooring for leaks by spraying water under pressure against vehicle while assistant inside marks points of leakage, if any exist.

If location of leak has been determined to be around windshield or rear glass, dry surface and apply rubber cement. Apply cement to outside, both between glass and weatherstrip and between weatherstrip and body.

If the leak is around any side window it will be necessary to remove the window and install a new seal.

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

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

Water which shows up at a certain place inside vehicle may actually be entering at a point other than where water is found. Back-track path of water to point of entry. Apply body sealing compound over all leak points. If leakage occurs at door opening, check weatherstrip. Seal with rubber cement or replace if necessary. If door does not firmly contact weatherstrip, align door. Refer to "Door Adjustment" later in this section.

PAINTING

Aluminum corrodes just as iron and steel rusts. Under certain conditions aluminum will corrode more rapidly than steel. Inspect body surfaces regularly for corrosion and paint condition.

Only sound parts can be refinished. If corrosion is excessive, replace with new parts. Remove old parts. Refinish all exposed adjacent parts which remain on vehicle. When installing new parts use only zinc or cadmium coated bolts, washers, and nuts.

The instructions which follow cover both aluminum and fiberglass, and both new and old parts.

1. Through cleaning is essential; all corrosion, grease, and other foreign matter must be removed. Solvent cleaning, pressure steam cleaning, wire brushing, and hand sanding methods are recommended.

2. Completely remove old paint by use of organic solvents. Do not use alkaline paint remover on aluminum. If old primer is very difficult to remove and there is no evidence of metal corrosion, old primer may be left on, but all loose paint must be removed.

3. Wipe the entire area to be refinished with cloths saturated with DuPont No. T-3812 reducer (or equivalent). Wipe dry.

4. Treat any scratched or abraded areas with DuPont No. VM-5717 metal conditioner (or equivalent) reduced one (1) part by volume with four (4) parts of water.

a. Apply the above mixture with a sponge or brush and allow to stand approximately three (3) minutes.

b. Wipe area with a damp cloth. Dry thoroughly.

5. Apply a coat of pre-primer (sometimes called wash- primer), preferably by spraying to a uniform and complete coverage coat on all surfaces. This type primer uses a special accelerating agent containing phosphoric acid which produces an excellent bond to metal. AP-10 or A-158 made by M & T Chemical Co., XE-5220 made by Bakelite Corporation, and 818-012 (2 parts), plus T8539 (1 part) made by DuPont, or any equivalent material made by a reputable paint manufacturer should be acceptable. These materials must be used within a few hours after addition of accelerator, therefore, directions of manufacturer should be observed carefully. Apply by spraying. Allow parts to dry.

6. Use a zinc chromate primer such as DuPont No. 63-150 or Pontiac Varnish Company's GMT-434, or any equivalent material made by a reputable manufacturer. Apply primer, preferably by spraying, to a minimum thickness of 0.5 mils. Allow parts to dry.

7. Apply finish coats:

a. A minimum of two finish coats is required.

b. For understructure and other parts not requiring color, apply a second coat of DuPont No. 63-150, or Pontiac Coatings Division GMT-434, or equivalent.

c. To exposed understructure body parts, apply desired color coats in accordance with standard practice.

d. Effective with vehicle serial number TZE 165V100089, vehicles are painted with DuPont urethane paint trademarked "IMRON". Paint repairs on these vehicles should be made with IMRON, or an equivalent material, or a high grade automotive enamel paint. Spray touch up paint is also available for minor repairs.

NOTE: Lacquer should NOT be used to repair body finish on these vehicles.

MOTORHOME AND TRANSMODE PAINT CODES

MOTOR HOME and TRANSMODE PAINT CODES

INSTRUMENT PANEL PAINT CODES

RPO	Color	Fisher No.	DuPont Code No.	Pontiac Coatings Code No.	Refinish No.
690, 692 693, 695	Midnight Neutral	W25A-4300	864-AF738		9994LH
696	Dark Amber	W25A-4530	864-AF941		42911LH
697	Dark Saddle	W25A-4098	864-AF038		
697	Dark Saddle	GMT-544		GMT 544	
698	Dark Lime	GMT-551		GMT 551	
		EXTERIOR PAINT CODES			
525	Chamois	WEA-4326	5481		5481A
534	Beige*	WUEK-4527	826-Y-AF926		42807U
521	White*	WUEK-5111	826-Y-21667		817U
531	Buttercup Yellow*	WUEK-5241	826-Y-AH434		43916U
553	Frosted Mint*	WUEK-5254	826-Y-AH541		44017U
557	Aspen Gold*	WUEK-5267	826-Y-AH580		44313U
558	Cameo White*	WUEK-3967	826-Y-99642		5338U
580	Yellow*	WUEK-5269	826-Y-AH640		44365U
585	Cream White*	WUEK-5222	826-Y-AH718		44570U

*Effective with vehicle serial number TZE165V100089, vehicles are being painted with DuPont urethane paint trademarked IMRON. Paint repairs should be made with IMRON (DuPont refinish No. ends in U) or equivalent or a high grade enamel (DuPont acrylic enamel refinish No. ends with A) automotive paint.

NOTE: Lacquer should not be used to repair body finish on these vehicles.

GLASS

WINDSHIELD REPLACEMENT

Windshield glass is retained in the opening by a molded rubber weatherstrip with an insert-type rubber seal as shown in Figure 1. Two glass sections are used in this vehicle.

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

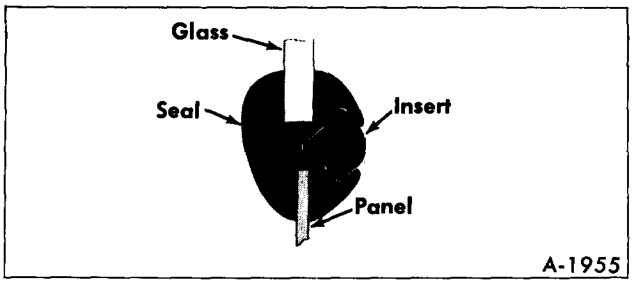


Figure 1—Windshield Weatherstrip

REMOVAL

If cracks in glass extend to outer edge of glass, mark body with chalk at these points so that weatherstrip flange opening can be examined later for possible distortion.

Protect the interior finish by placing a protective covering over steering wheel and dash panel. Mask around the windshield opening and lay a suitable cover to protect body.

WARNING: ALWAYS WEAR HEAVY GLOVES TO PREVENT POSSIBLE INJURY WHEN HANDLING GLASS.

1. Pry end of insert out of rubber seal with a pointed tool; pull insert completely out of seal.

2. With aid of an assistant to hold glass outside vehicle, push glass forward from inside vehicle.

INSPECTION

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

1. Check for the following conditions at the previous marked point of fracture:

a. Chipped edges on glass.

b. Irregularities in body opening.

c. Irregularities in rubber channel weatherstrip.

2. Remove all sealer from flange and body around windshield opening.

3. Check flange area for high spots. Remove all high spots.

INSTALLATION

NOTE: If desired, sealing cement can be applied between lip of seal and glass and seal lip at opening flange.

1. Assemble the rubber weatherstrip to the window opening flanges. Insert one end of the glass into its channel in the weatherstrip and seat into position using channel spreader hook of Glass Installing Tool J-2189-02.

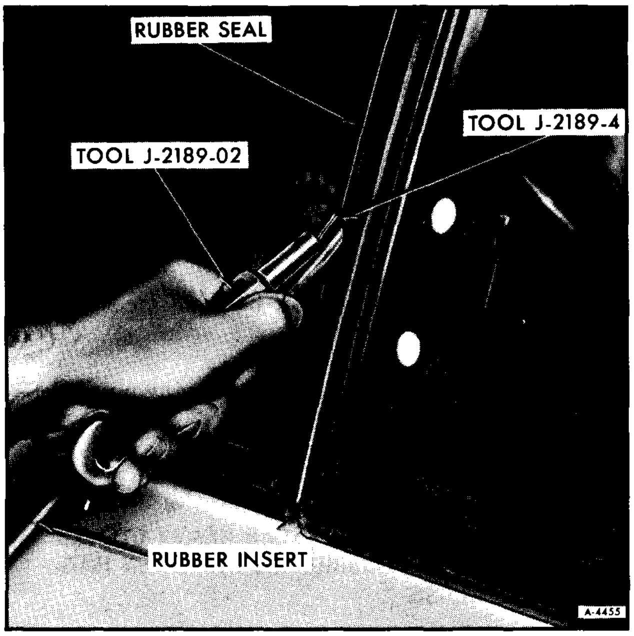


Figure 2—Installing Rubber Insert

Figure 3—Seating Rubber Insert Into Groove

2. Install Inserter J-2189-4 of Glass Installing Tool J-2189-02 into handle of tool. Feed the rubber insert (locking strip) and insert into the channel and draw the tool through the channel, feeding the rubber insert into position as shown in Figure 2. Use a hitching movement of tool to avoid elongating insert.

3. If new insert is being used, cut off insert allowing sufficient overlap for a tight joint. Use the small pin on the tool handle end to smooth the weatherstrip over the rubber insert (locking strip) as shown in Figure 3.

4. Install insert in center vertical seal (2-piece windshield) in same manner previously described in Step 2.

GMC SIDE WINDOWS

There are two types of windows or sash installed in the vehicle. Either a fixed or sliding window is mounted in an extruded aluminum channel. All side sash uses solid tempered glass. Both the glass and the channel is replaceable.

SASH ASSEMBLY

Removal

1. Remove trim mouldings as shown in Figure 4. "A" sash assemblies (sash assemblies in the drivers/-

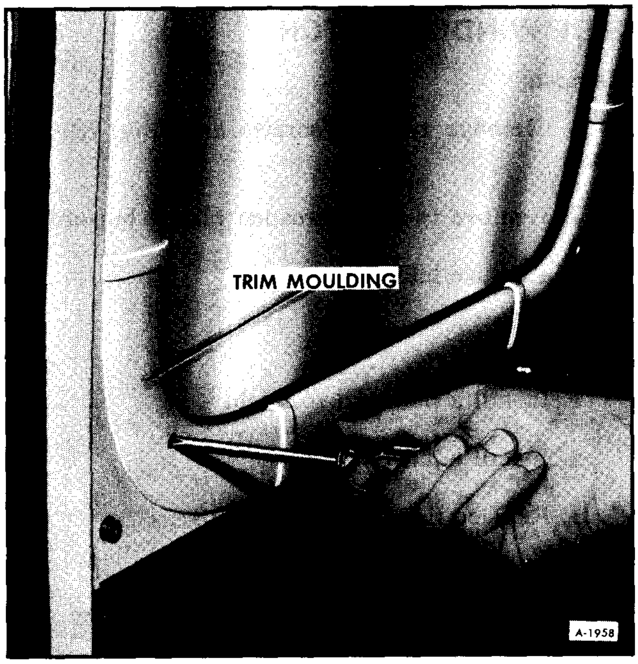


Figure 4—Removing Window Trim Moulding Screws

passenger area) will require interior trim panel removal.

2. All sash assemblies are mounted as typically shown in Figure 5. Remove retainers.

3. Tap on the inside channel using a wooden block and rubber mallet.

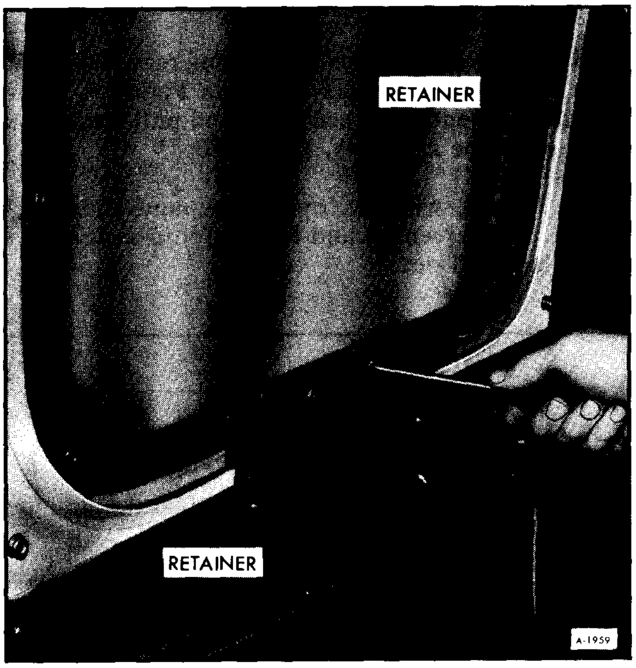


Figure 5—Removing Sash Retainers

NOTE: The sash assemblies are heavy. Have someone assist by supporting the assembly from the outside.

4. Remove sash assembly.

5. Remove filler seal from sash assembly.

Installation

1. Apply a new filler seal to the sash assembly.

2. Install sash assembly. Position spacers as shown in Figure 6.

NOTE: Late model vehicles are not equipped with spacers (figure 6). A 3/16 inch gap should be maintained between sill and sash.

3. Install retainers.

4. Install panels if removed and install trim mouldings.

GLASS

Removal

1. Remove sash assembly. Refer to "Sash Assembly - Removal" earlier in this section.

2. Remove the banding strap, if equipped, as shown in figure 7, then disassemble sash assembly as shown in Figure 8.

3. Remove glass.

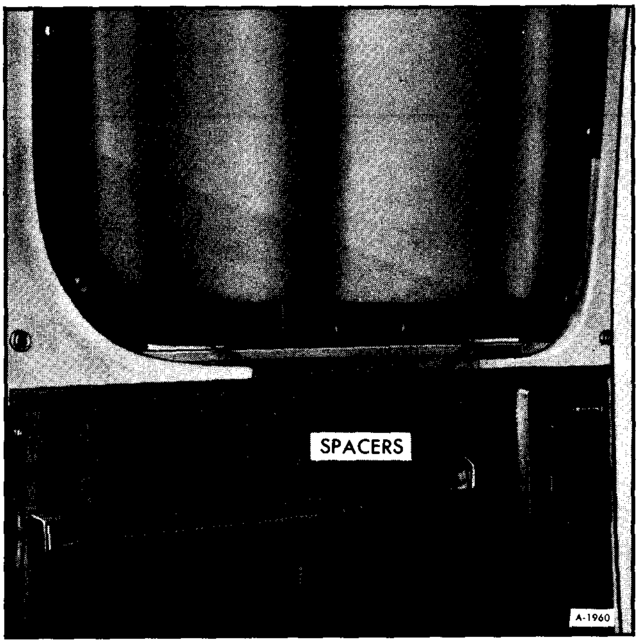


Figure 6—Sash Spacers

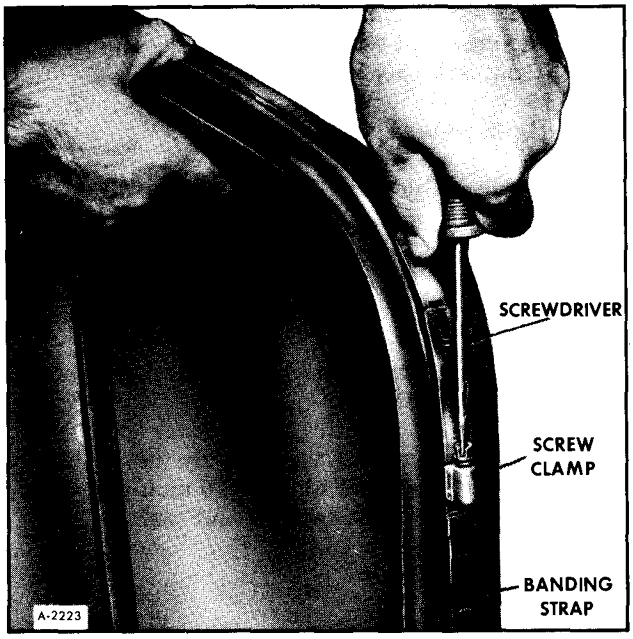


Figure 7—Removing Sash Banding Strap

4. Clean glass sash channels thoroughly.

Installation

1. Install glass into sash.

2. Referring to Figure 7 and 8, assemble sash.

3. Install sash assembly. Refer to "Sash Assembly-Installation" earlier in this section.

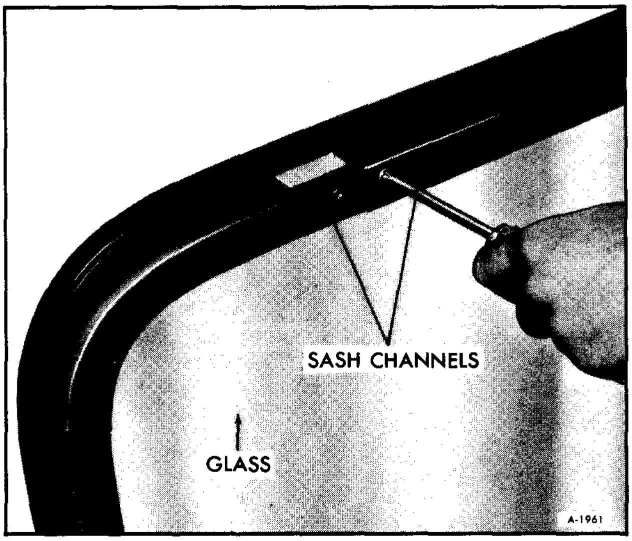


Figure 8—Disassembling Sash

SIDE WINDOW LATCH

Removal

1. Remove two (2) screws attaching latch to glass.

2. Remove two (2) threaded plastic buttons.

3. Remove latch.

Installation

1. Install a new seal to latch.

2. Install latch to glass.

3. Replace threaded plastic buttons.

"HEHR" LIVING AREA SIDE WINDOW ASSEMBLIES

A new type living area side window is now in production on 1975 GMC MotorHomes and Trans-Modes. The window assembly is identified by its one piece sash and center latch and handle. The fiber glass screen, the vent (sliding) glass, and the stationary glass are serviced with the window assembly in the vehicle as follows:

SCREEN AND VENT ASSEMBLY

Removal

1. Remove top screen track using reasonably stiff wire shaped to form tool shown in Figure 9. Insert tool at outer end of screen track and pull track from window frame assembly, Figure 10.

2. Unlock window, open vent, and slide back screen. Lift screen up and forward into sash assembly. Then pull out.

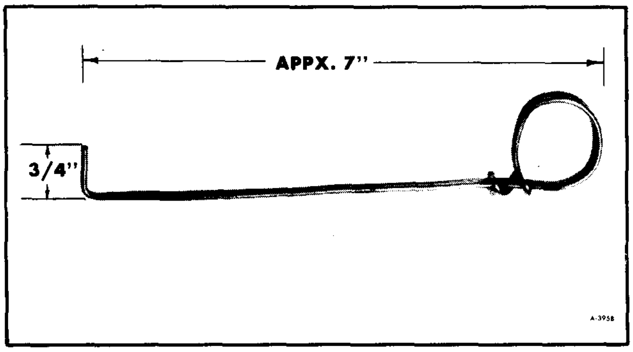


Figure 9—Fabricated Track Removal Tool

Figure 10—Removing Screen Track

3. Close vent. Remove top vent track in same manner as the screen track. Refer to Figure 10.

4. Now, open vent. Lift vent up into the window

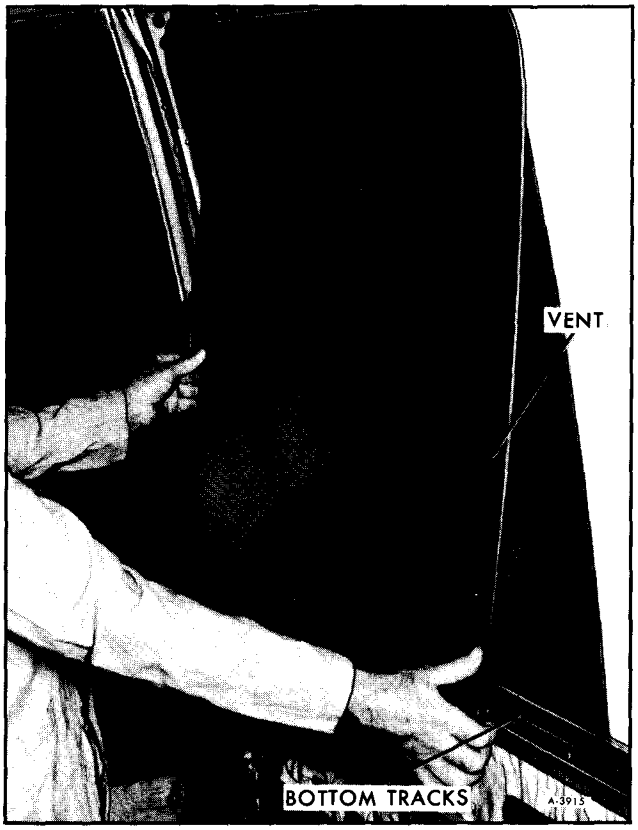


Figure 11—Removing Vent

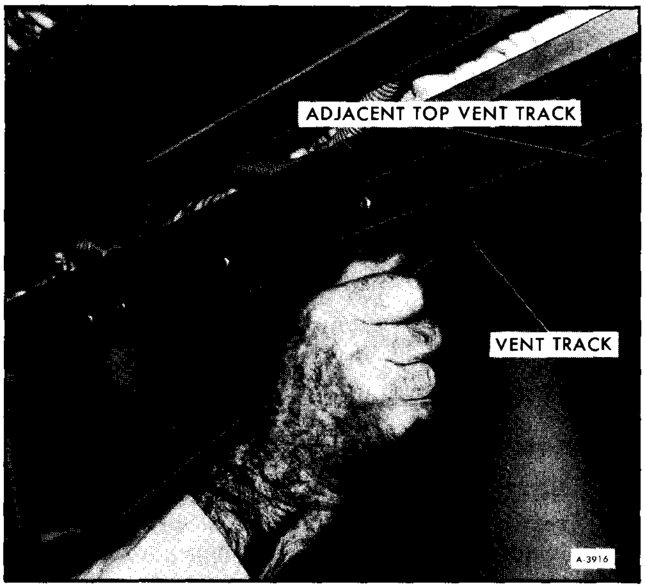


Figure 12—Installing Vent Track

frame assembly. Pull bottom of vent forward and remove vent as shown in Figure 11.

NOTE: Observe that screen track is wider than, and sits in front of vent track.

Installation

1. The screen and vent are installed by reversing removal procedure. Move vent to closed position.

2. Place vent track in groove and push against adjacent top vent track, Figure 12. Use hammer and

Figure 13—Seating Vent Track

1/8" thick plexiglass or plywood block to seat the track in place, Figure 13.

3. Install screen into widest channel of bottom screen track.

4. With vent glass and screen in closed position, seat top screen track in place in same manner as vent track. Refer to Figures 12 and 13.

> **CAUTION:** *Do not use a screwdriver to install track. Screwdriver may fracture glass.*

STATIONARY GLASS ASSEMBLY

Removal

> **NOTE:** Before stepping outside vehicle to remove stationary glass, release window latch. It is not necessary to remove vent glass when servicing stationary glass.

1. Use a screwdriver to unseat vent gasket as shown in Figure 14. Pull gasket back about six inches.

2. Dislodge mullion (center bar) with block and hammer, Figure 15. Pull mullion to side and lift it out of window frame.

3. Using a screwdriver, remove stationary gasket (or glazing bead) completely from assembly.

4. From inside vehicle, pry stationary glass from butyl sealer, using a scraper as shown in Figure 16. An assistant, standing outside vehicle, should support glass during removal.

Figure 14—Unseating Vent Gasket

Figure 15—Dislodging Mullion

5. Observe position of four plastic spacers, Figure 17. Lift spacers from butyl sealer.

6. Use a putty knife to remove all old butyl sealer from plastic spacers and window frame.

Installation

1. Install new butyl sealer in window frame. (A little water on fingertips will prevent butyl from sticking).

Figure 16—Prying Stationary Glass from Butyl Sealer

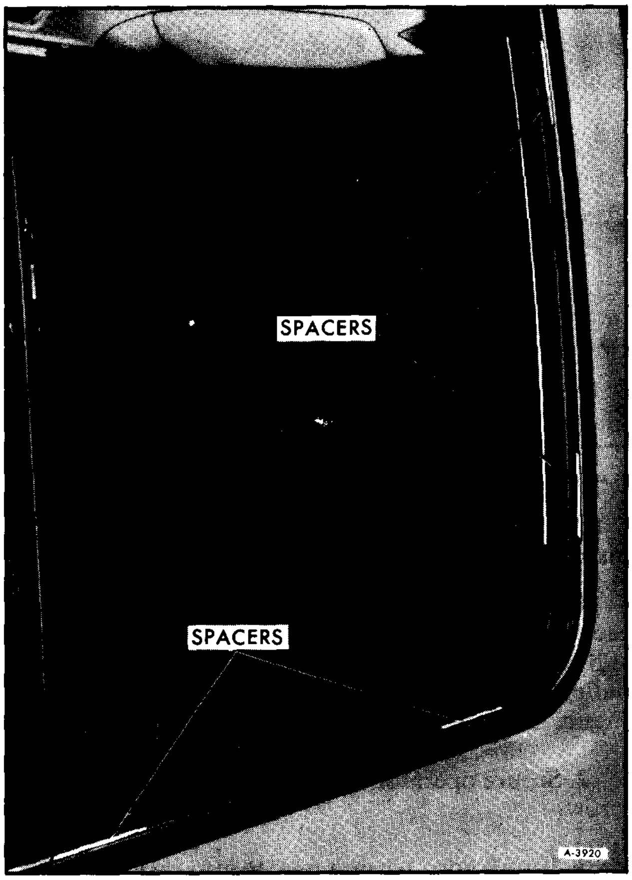


Figure 17—Location of Plastic Spacers

2. Lay plastic spacers in place as shown in Figure 17.

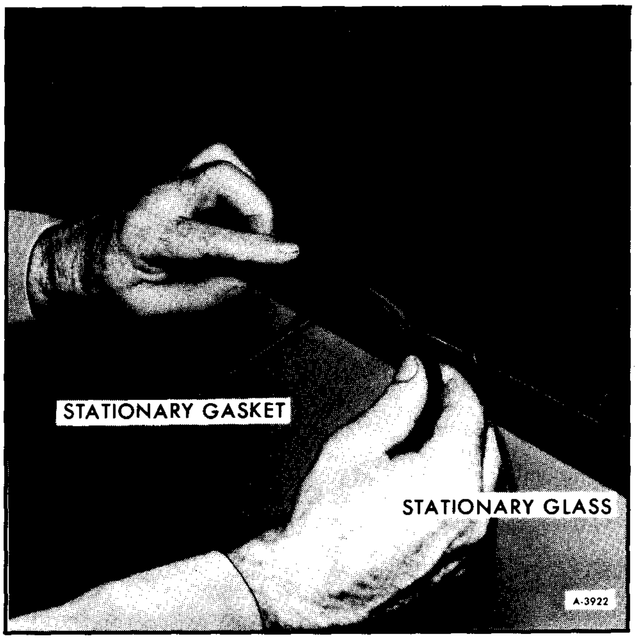


Figure 18—Installing Stationary Gasket

NOTE: Be sure when installing spacers to position them so as to contact edge of window glass.

3. Use suction cups to install glass.

Press glass firmly against butyl sealer to insure bonding.

4. Using hammer and block, install mullion.

5. Install stationary gasket by pushing it into place and locking grooves into window frame, Figure 18.

NOTE: Push stationary gasket back while installing it to avoid being left with an extra length of gasket. It may be useful to soften gasket in hot water (150°F.) (65.6°C.) before installation. Avoid leaving corner installation to last. After installation, if lumps or uneven seams appear, gasket is improperly seated. Loosen and seat gasket again.

6. Seat vent gasket back into place.

7. Using liquid butyl sealer, seal ends of stationary and vent gasket at mullion.

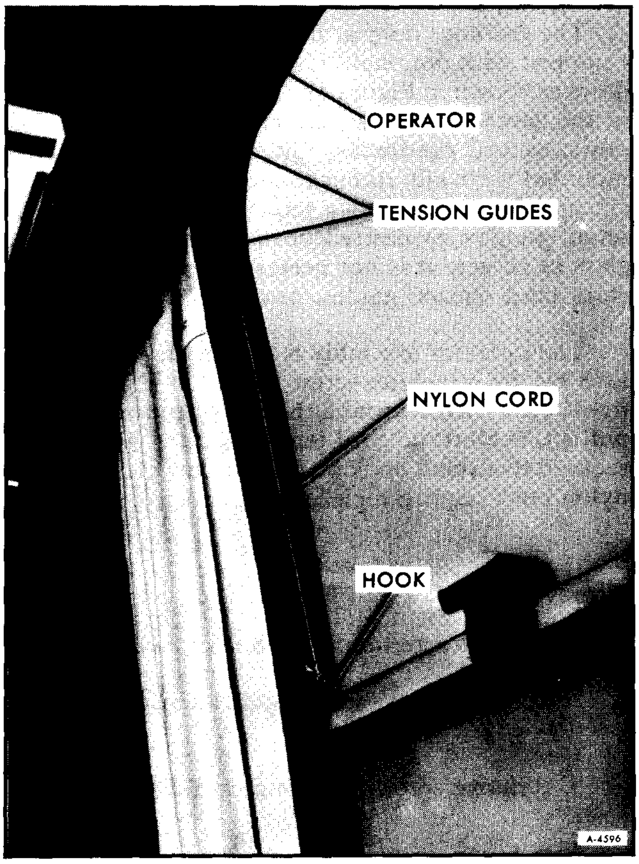


Figure 19—Vertical Sliding Window

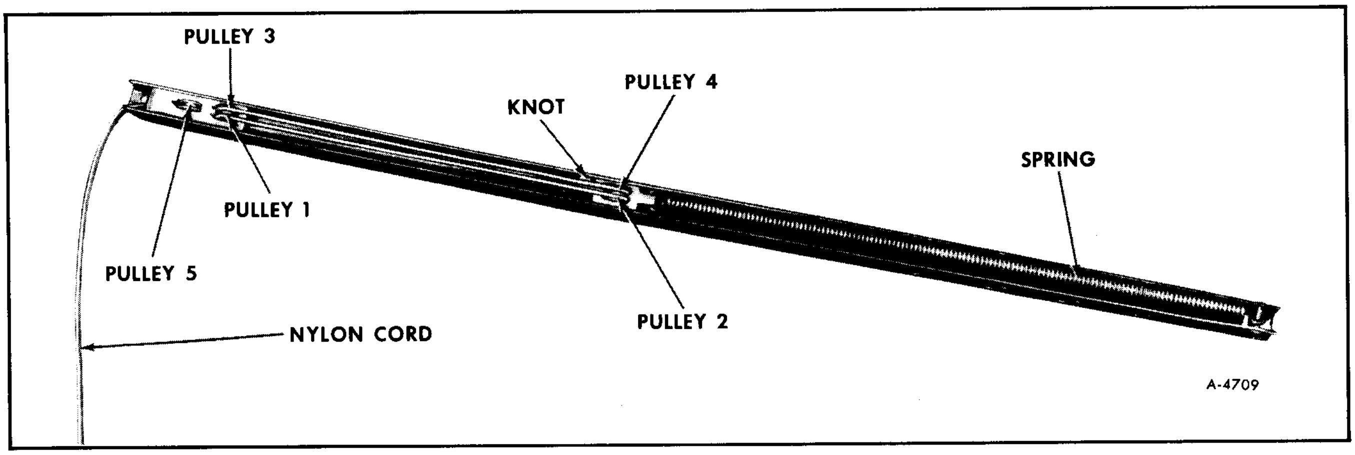


Figure 20—Operator Assembly

IMPORTANT: To avoid damaging screen track or vent track, DO NOT remove screen before removing screen track, or vent glass before removing vent track.

If screen or window does not slide easily in track, spray track grooves with Silicone Spray Lubricant, GM Part No. 150018 or equivalent.

VERICAL SLIDING WINDOW (OPTIONAL)

The entrance door at the galley windows may be equipped with optional "Hehr" vertical sliding windows as shown in Figure 19. This window is serviced in the same manner as the horizontal sliding windows, except, the tracks, vent glass, and screen are mounted vertically rather than horizontally. An operator (spring and pulley tension device) is used to retain window at desired open position. To service glass or screen, it is not necessary to remove nylon cord, cord tension guides, or operator.

The operator assembly is secured to the window sash by the attaching screw shown in Figure 20. A nylon cord travels around the five operator assembly pulleys, behind the cord tension guides, and is then secured to a small hook on the window glass. Should nylon cord require replacement, procure locally.

Removal

1. Remove screw securing hook to window glass.

2. Remove screws securing cord tension guides to window sash.

3. Remove screw attaching operator to window sash.

4. Remove nylon cord from hook and operator assembly.

Installation

1. String nylon cord from knotted hole around each consecutive pulley. Cord should travel under and over pulleys one and three, but over and under pulleys two and four, and under pulley five. Refer to Figure 20.

2. Secure operator to window sash with attaching screw.

3. Install cord tension guides into sash assembly. Be sure nylon cord is behind positioned behind the guides.

4. Secure nylon cord to hook and attach hook to glass with screw.

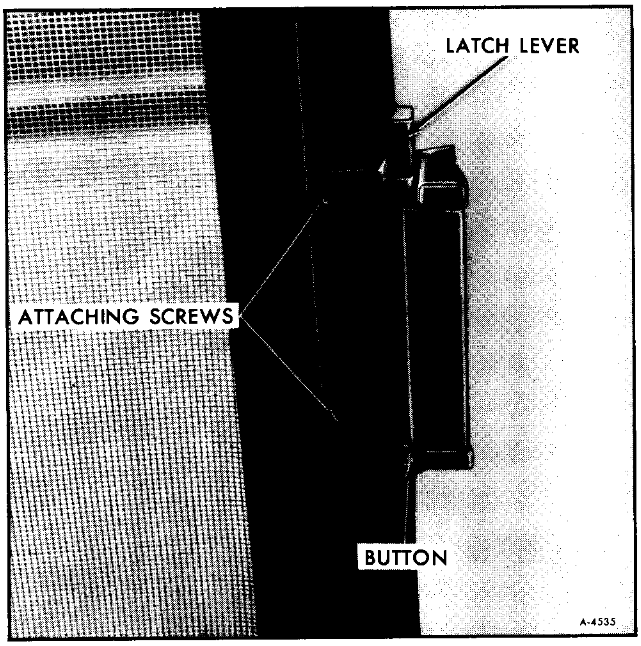


Figure 21—"Hehr" Latch in Open Position

"HEHR" WINDOW LATCH

The horizontal and optional vertical sliding "Hehr" windows are equipped with a center mounted, locking type latch. Unlock window latch by pushing upward on button until latch lever is exposed, as shown in Figure 21. To lock, push downward on latch lever until button is exposed.

Removal

1. Remove two (2) screws attaching latch to glass.

2. Remove latch and gasket.

Installation

1. Install new gasket to latch.

2. Secure latch and gasket to glass with two (2) attaching screws.

"A" WINDOWS

SASH ASSEMBLY

For removal and installation of sash, refer to discussion under Standard Side Windows. It may be necessary to remove interior furnishings (such as davo or dinette) and interior trim panels to remove sash assembly.

GLASS

Removal

1. Remove sash assembly. Refer to "Sash Assembly - Removal" earlier in this section.

2. Remove leading edge post from frame, Figure 22.

3. Slide upper glass panel and seal out of frame assembly. Stretch seal over glass to remove.

4. Remove glass run (or sash channel). Slide lower front glass panel out of frame assembly.

5. Remove screws securing rail to center bar and lower frame assembly.

6. Slide lower, rear glass panel out of frame assembly.

Installation

To install glass, reverse removal procedure.

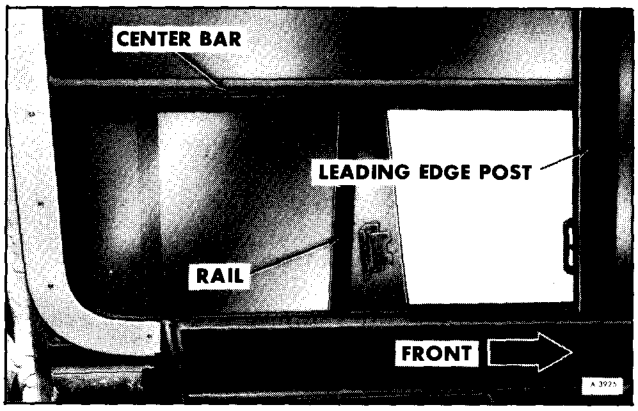


Figure 22—"A" Window

REAR WINDOW REPLACEMENT

The rear window is retained in the opening by a molded rubber weatherstrip with an insert-type rubber seal.

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

REMOVAL

If crack extends to outer edge of glass, mark body with chalk at this point so that weatherstrip flange opening can be examined later for possible distortion.

Protect interior finish by using a protective covering mask around window opening and lay a suitable cover to protect body.

WARNING: ALWAYS WEAR HEAVY GLOVES TO PREVENT POSSIBLE INJURY WHEN HANDLING GLASS.

1. From inside of vehicle pull insert out of rubber seal by pulling on ring located at top center of window; pull insert out completely.

2. With aid of an assistant to hold glass outside vehicle, push glass out from inside vehicle.

INSPECTION

Due to the expanse of rear window, it is imperative in the event of a strain break that the window opening be throughly checked before installing a replacement window.

1. Check for the following conditions at the previously marked point of fracture.

A. Chipped edges on glass.

B. Irregularities in body opening.

C. Irregularities in rubber channel weatherstrip.

2. Remove all sealer from flange and body around window opening.

3. Check flange area for high spots. All high spots should be removed.

INSTALLATION

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

If glass clearance is too small and glass is to be ground off, place a strip of tape on a line where glass is to be removed. Grind up to edge of tape.

NOTE: Add build-up to flange where necessary. Usually the building up to only one side and one-half way around one corner will provide proper glass and seal fit. Taper off ends of build-up to conform to edge of glass, otherwise glass breakage may occur, originating at a point adjacent to end of flange build-up.

NOTE: If desired, sealing cement can be applied between lip of seal and glass and seal and opening flange.

1. Assemble the rubber weatherstrip to the window opening flanges. Insert end of glass into its channel in the weatherstrip and seat into position using channel spreader hook of Glass Installing Tool J-2189-02. Move tool around glass to force outer lip of seal over edge of glass.

2. Install Inserter J-2189-4 of Glass Installing Tool J-2189-02 into handle of tool. Feed the rubber insert through the handle and inserter eye. Move inserter and tool to middle of rubber insert. Starting at top center of rubber seal push tool loop and insert into seal groove. Feed in rubber insert while proceeding around one side of window. Use a hitching movement of tool to avoid elongating insert. Position emergency exit pull ring on rubber insert at top center of window. Thread other end of rubber insert through handle and loop of inserter tool. Push tool loop and rubber insert into seal groove and position pull ring in place. Feed in rubber insert while proceeding around other side of window. If new rubber insert is being used, cut off insert allowing sufficient overlap for a tight joint; use the small pin on the tool handle end to smooth the weatherstrip over the rubber insert as shown in Figure 3.

WINDSHIELD WIPER SYSTEM

GENERAL INFORMATION

The vehicle is equipped with variable speed hydraulic wipers with washers as standard equipment. A single motor powers both blades.

The wiper motor is mounted to a bracket on the left side of the vehicle in front of the driver's toe board. A lever control on the left side of the instrument panel varies the speed of the wiper blades. The hydraulic motor is powered by power steering fluid from the discharge side of the power steering pump.

WINDSHIELD WASHER ASSEMBLY REPLACEMENT

The windshield washer reservoir and pump are one unit. The 12 volt pump in the windshield washer reservoir must be replaced with the entire washer assembly.

REMOVAL

1. Disconnect battery ground cables and then disconnect wire leads (2) to washer motor.

2. Disconnect hose at the rear of the washer reservoir.

3. Lift reservoir out of its bracket and remove it from the vehicle.

INSTALLATION

1. Position resevoir in its bracket.

2. Install two wires to terminals on motor.

3. Connect hose to back of reservoir.

4. Connect battery ground cables and check for proper operation.

WASHER NOZZLE ADJUSTMENT

The windshield washer nozzle is located on the end of the wiper arm. The nozzle is retained by the same nut and bolt which attaches the blade to the wiper arm. The nozzle should be parallel with the windshield as shown in Figure 23.

Nozzles are adjustable by loosening the attaching bolt, position nozzle as described above and tighten bolt.

TRANSMISSION PIVOT SHAFT AND LINK REPLACEMENT

REMOVAL

1. To release tension, lift wiper arm off windshield and insert pin into aligned holes at wiper arm spline shaft. Remove wiper arms from pivot shafts by removing wiper arm retaining nuts (See figure 24).

2. Remove linkage from wiper motor crank arm by sliding back clip(s) away from motor (figure 25).

3. Remove three bolts from transmission pivot shaft mounting bracket as shown in Figure 26. Remove assembly.

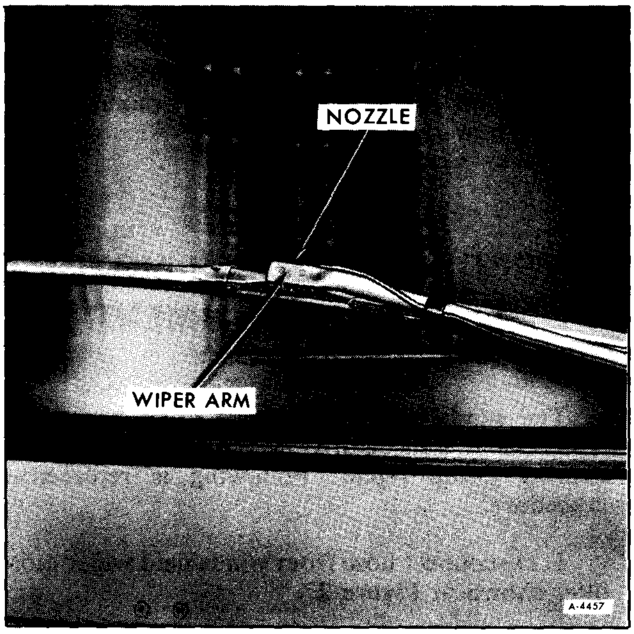


Figure 23—Windshield Wiper Nozzle Alignment

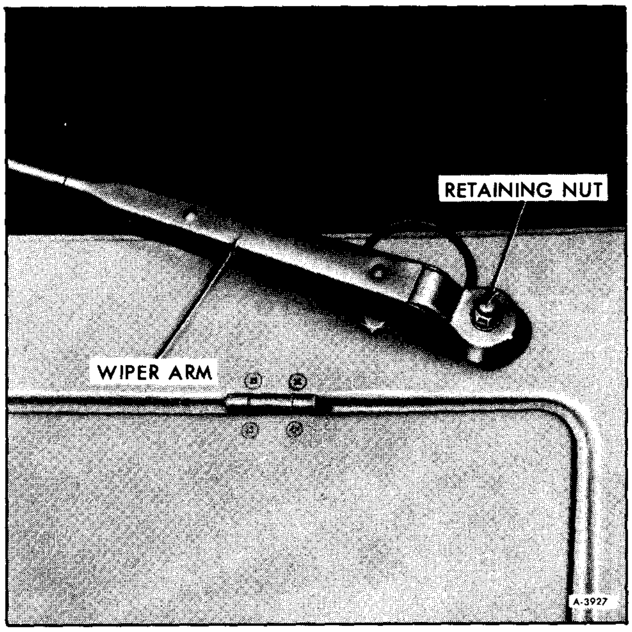


Figure 24—Wiper Arm Removal

INSTALLATION

1. Position transmission pivot shaft and secure with three bolts at its mounting bracket.

2. Install linkage to crank arm on wiper motor.

3. Install wiper arms on pivot shafts.

WIPER BLADE REPLACEMENT

The wiper blade is retained by the use of a spring type retainer clip in the end of the blade element.

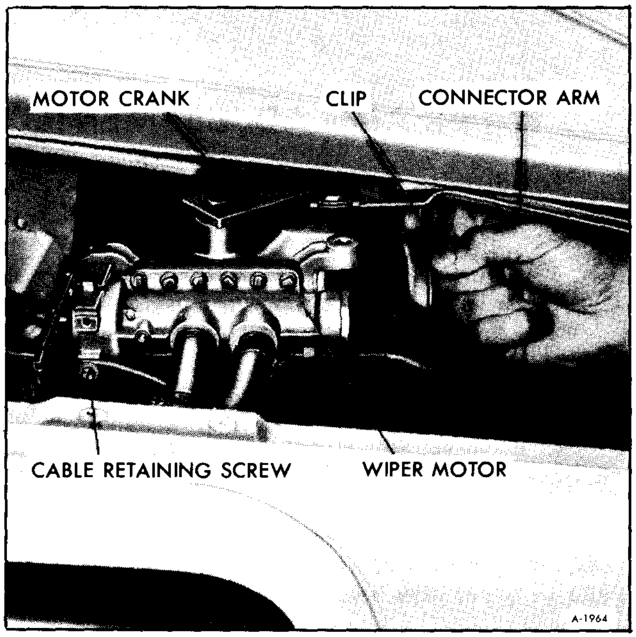


Figure 25—Removing Linkage

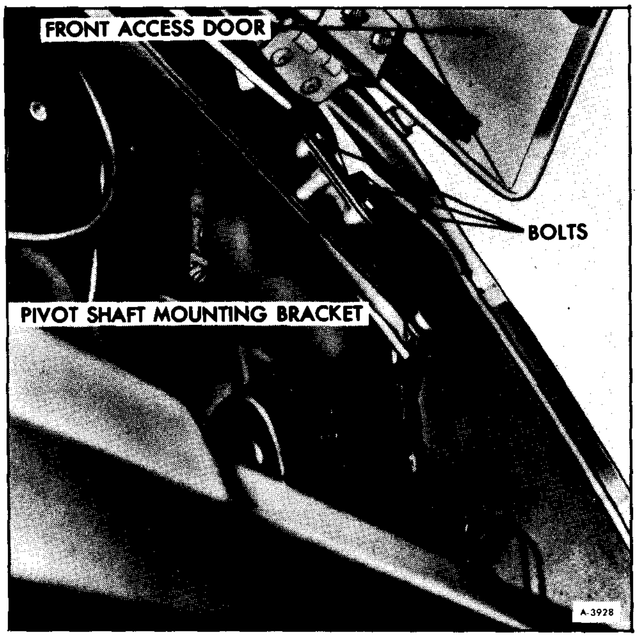


Figure 26—Pivot Shaft Mounting Bracket

When the retainer clip is squeezed together, the blade can be removed by sliding out of the blade assembly.

The blade assembly is retained to the wiper arm by a nut and bolt at the end of the arm. The removal of this nut and bolt will allow removal of the blade assembly and the windshield washer nozzle.

Wiper blades should be installed with the wiper arm in "park" position and the blade to arm bolt approximately 3.25 inches above the windshield rubber moulding.

WIPER ARM ADJUSTMENT

To adjust sweep of blades to provide maximum visibility, turn on wipers, then note sweep of arms.

CAUTION: *Do not attempt to manually force wiper arms into position as damage to linkage or motor may occur.*

If necessary, remove arms as follows;

1. Remove nut from end of wiper arm and remove arm.

2. Arm can be reinstalled in any one of several positions due to serrations on pivot shaft driver head and in wiper arm head.

NOTE: Checking blade sweep should be done with the windshield wet.

WINDSHIELD WIPER MOTOR REPLACEMENT

NOTE: The windshield wiper motor is serviced as an assembly. Do not attempt to repair the motor.

REMOVAL

1. Disconnect hoses (2) at motor and tape end to prevent loss of fluid and entrance of dirt or water into system.

2. Loosen cable retaining screw at bottom of motor and remove pin from arm on motor assembly. See Figure 24.

3. Remove connector arms by sliding back clips and disconnecting arms from the motor assembly.

4. Remove three bolts retaining motor assembly to its bracket.

INSTALLATION

1. Position wiper motor on bracket and install three retaining bolts.

2. Position connector arms on motor crank arm and secure with slide clips.

3. Insert pin at end of cable assembly and secure with retaining screw on motor assembly.

4. Connect hoses to motor assembly as shown in Figure 27.

5. Check power steering fluid level. Operate wipers on a wet windshield for several minutes. Then recheck power steering fluid level. Also check for fluid leaks. Correct as necessary.

WINDSHIELD WIPER MOTOR FILTER REPLACEMENT

The windshield wiper motor filter may require replacement particularly in the event of a power steering pump repair. Following is replacement procedure.

1. Disconnect hose from windshield wiper motor filter shown in Figure 27.

2. Remove filter from windshield wiper motor and discard.

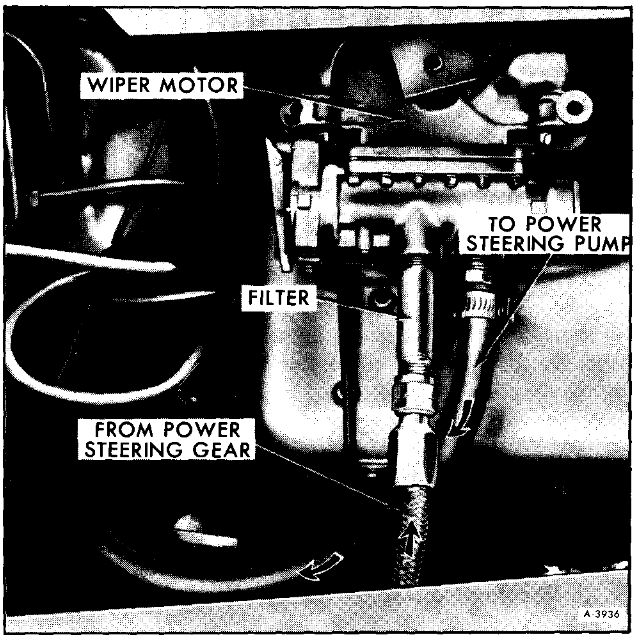


Figure 27—Windshield Wiper Motor

3. Apply pipe joint sealer to filter threads 1/8" from end of filter as shown in Figure 28.

4. Carefully screw filter into wiper motor.

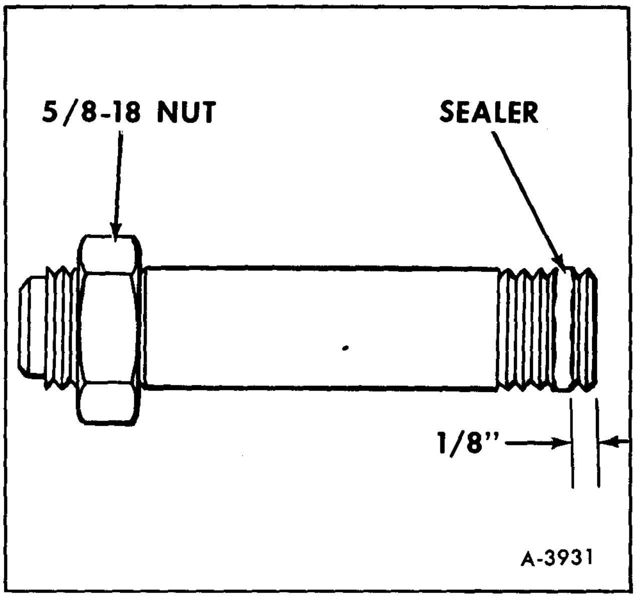


Figure 28—Windshield Wiper Motor Filter

NOTE: Do not get foreign material on motor end of filter.

5. Torque filter to 25 ft. lbs. using a 5/8-18 nut.

6. Reconnect hose to filter.

ENTRANCE DOOR

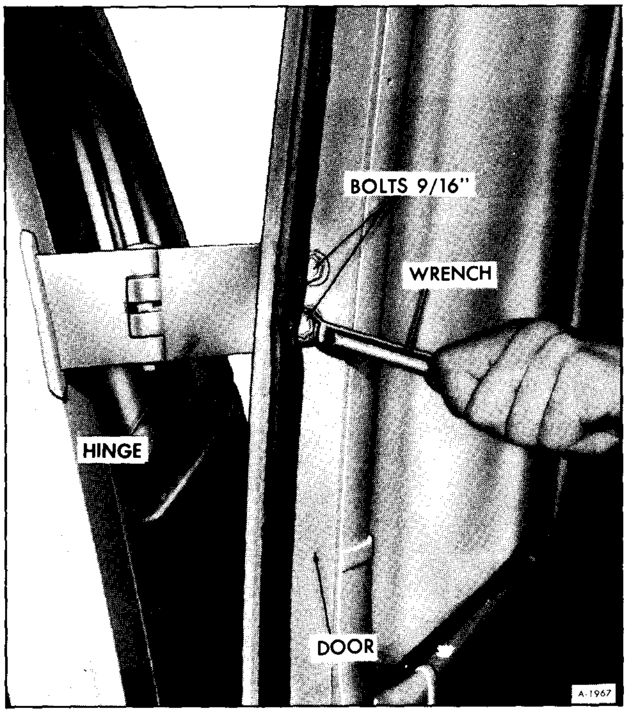


Figure 29—Entrance Door Adjustment-Vertical

ADJUSTMENT

The door may be adjusted vertically by loosening the bolts at both hinges as shown in Figure. 29.

Horizontal adjustment may be made by shimming or removing metal at the shaded area of the hinges as shown in Figure 30.

DOOR SEAL

The entrance door seal is replaceable. Clean old seal from door frame, apply adhesive to frame then install new seal.

DOOR REMOVAL

1. Remove four (4) hinge to door frame attaching bolts.

2. Remove door.

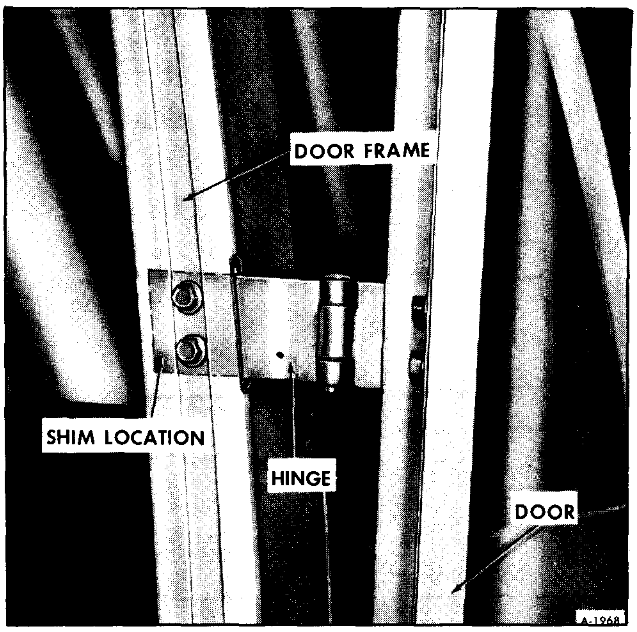


Figure 30—Entrance Door Adjustment-Horizontal

DOOR INSTALLATION

1. Install door.

2. Install four (4) bolts, torque to 25-30 ft. lbs.

3. Check for leaks and correct as necessary.

ENTRANCE DOOR LOCK

REMOVAL (FIGURE 31)

1. Remove lower door trim panel.

2. Remove lock button.

3. Remove lower window moulding.

4. Remove upper trim panel and inner handle assembly by loosening screws shown in Figure 32 and removing all other screws. Use care when removing panel to avoid damaging door handle mechanism.

5. Remove cotter pin from handle control rod. Slide rod out of lever at lock mechanism.

6. Remove actuator lever pin and lock button rod clip. See Figure 33.

7. Remove (2) screws from latch assembly at door frame. Remove this portion from the door.

8. Remove four (4) nuts and lock tumbler clip. Remove lock mechanism. See Figure 33.

INSTALLATION

1. Check sealer around lock opening in door, replace or fill in as required to insure proper seal between lock assembly and door.

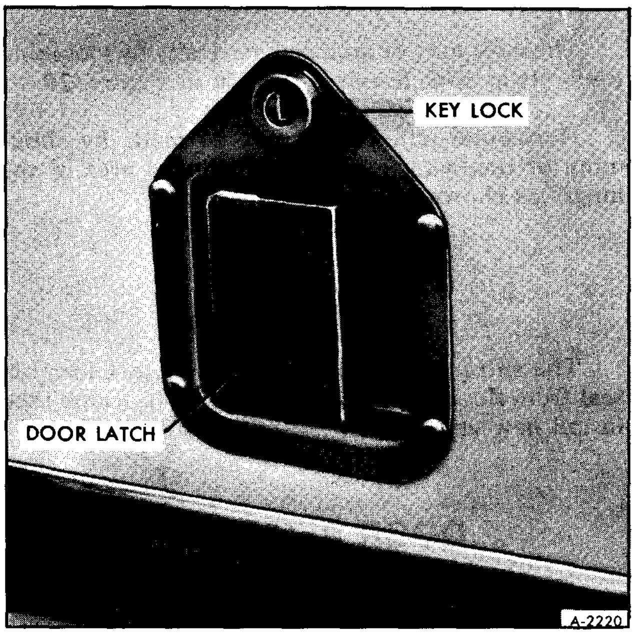


Figure 31—Door Lock

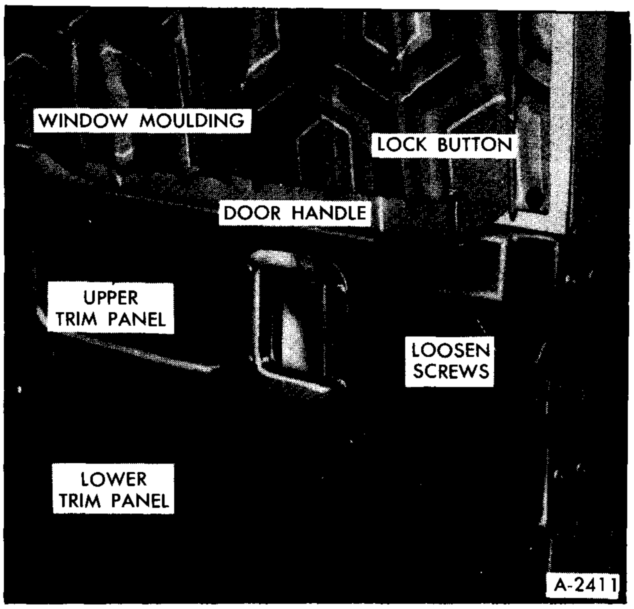


Figure 32—Removing Trim Panels

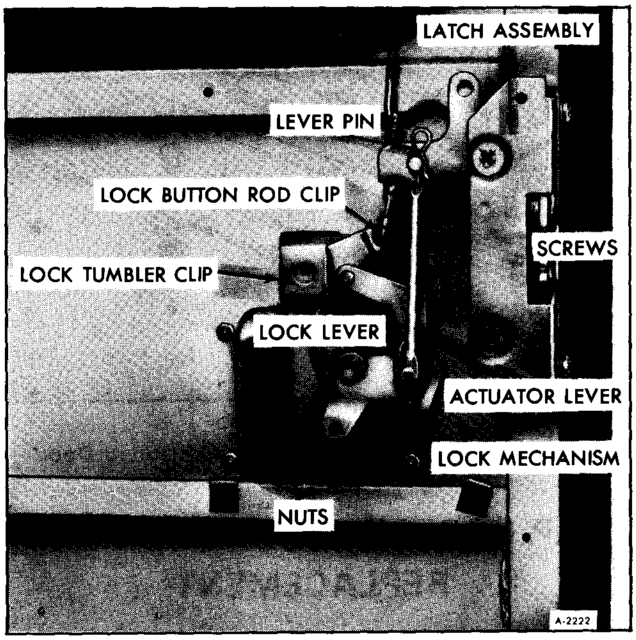


Figure 33—Lock Assembly

2. Apply a liberal amount of lubriplate to all contacting surfaces. Secure assembly with four (4) nuts.

3. Install lock tumbler and secure with clip.

4. Install latch assembly on door frame and loosely secure with two (2) screws on door frame.

5. Install lock button rod clip and actuator lever pin as shown in Figure 33.

6. Install inner panel and handle assembly. At the same time guide handle rod into lever at lock mechanism.

7. Install cotter pin to secure rod to lever.

8. Secure upper trim panel with screws.

9. Install lower door trim panel and window moulding.

DOOR HINGES

REMOVAL

1. Remove entrance door. Refer to "Door-Removal" earlier in this section.

2. Remove two (2) bolts per hinge.

3. Remove hinge.

INSTALLATION

1. Install hinge on door frame and two (2) bolts. Torque to 25-30 ft. lbs.

2. Install entrance door. Refer to "Door-Installation" earlier in this section.

ACCESS DOORS

FRONT ACCESS DOOR LATCH REPLACEMENT

REMOVAL

1. Drill out rivets (2) on each side of handle. See Figure 34.

2. Remove "T" pin. See Figure 34.

3. Slide latch mechanism out of door.

INSTALLATION

1. Position latch mechanism in access door.

2. Install pop rivets.

3. Install "T" pin.

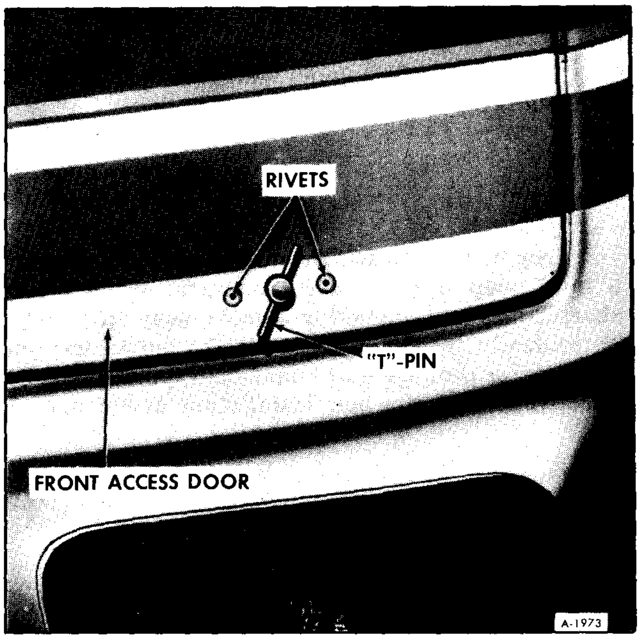


Figure 34—Front Access Door Latch

FRONT ACCESS DOOR REPLACEMENT

REMOVAL

1. On outboard side of door remove two nuts and bots retaining support to door.

2. Remove nuts and bolts retaining hinge to body.

3. Remove access door.

INSTALLATION

1. Postion access door in body opening and install hinge retaining nuts and bolts to body.

2. Position access door support to access door and secure with nut and bolt.

EXTERNAL UTILITIES COMPARTMENT DOOR REPLACEMENT

REMOVAL

1. Drill out four pop-rivets holding piano hinge to body (See figure 35).

2. Remove door. Door may be removed from hinge by drilling out four pop-rivets retaining door to hinge.

INSTALLATION

Position door and hinge assembly in its opening and pop-rivet door in place.

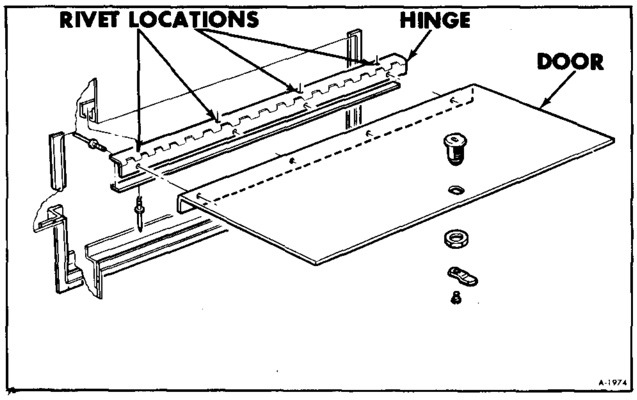


Figure 35—External Utilities Compartment Door

LP GAS, OR STORAGE DOOR REPLACEMENT

Both LP gas door and the storage (or motor generator) door are removed and installed in the same manner.

REMOVAL

1. With the access door closed drill out pop rivets that retain the hinge to the body.

2. Unfasten latches and remove door.

INSTALLATION

1. Position door in its opening.

2. Pop rivet hinge to body.

LAP BELT MAINTENANCE

Keep belts clean and dry. Clean periodically with a mild soap solution and lukewarm water. Keep sharp edges and damaging objects away from belts. Periodically inspect belts, buckles, retractors, and anchors for damage that could materially lessen the effectiveness of the belt installation and repair or replace the questionable parts. Do not bleach or dye belts as this may cause severe loss of strength.

If necessary, to replace belts or related attaching parts be sure to tighten lap belt anchor bolts to 30-45 foot-pounds torque.

FLOOR

GENERAL INFORMATION

The floor of the vehicle is made of 3/4″ plywood sections. The plywood sections are bonded and pop-riveted to the floor sub-structure and the panels of heavy duty floor insulation. The floor insulation panels fit within the lateral cross members of the sub-structure, Figure 36. Both insulation panels and

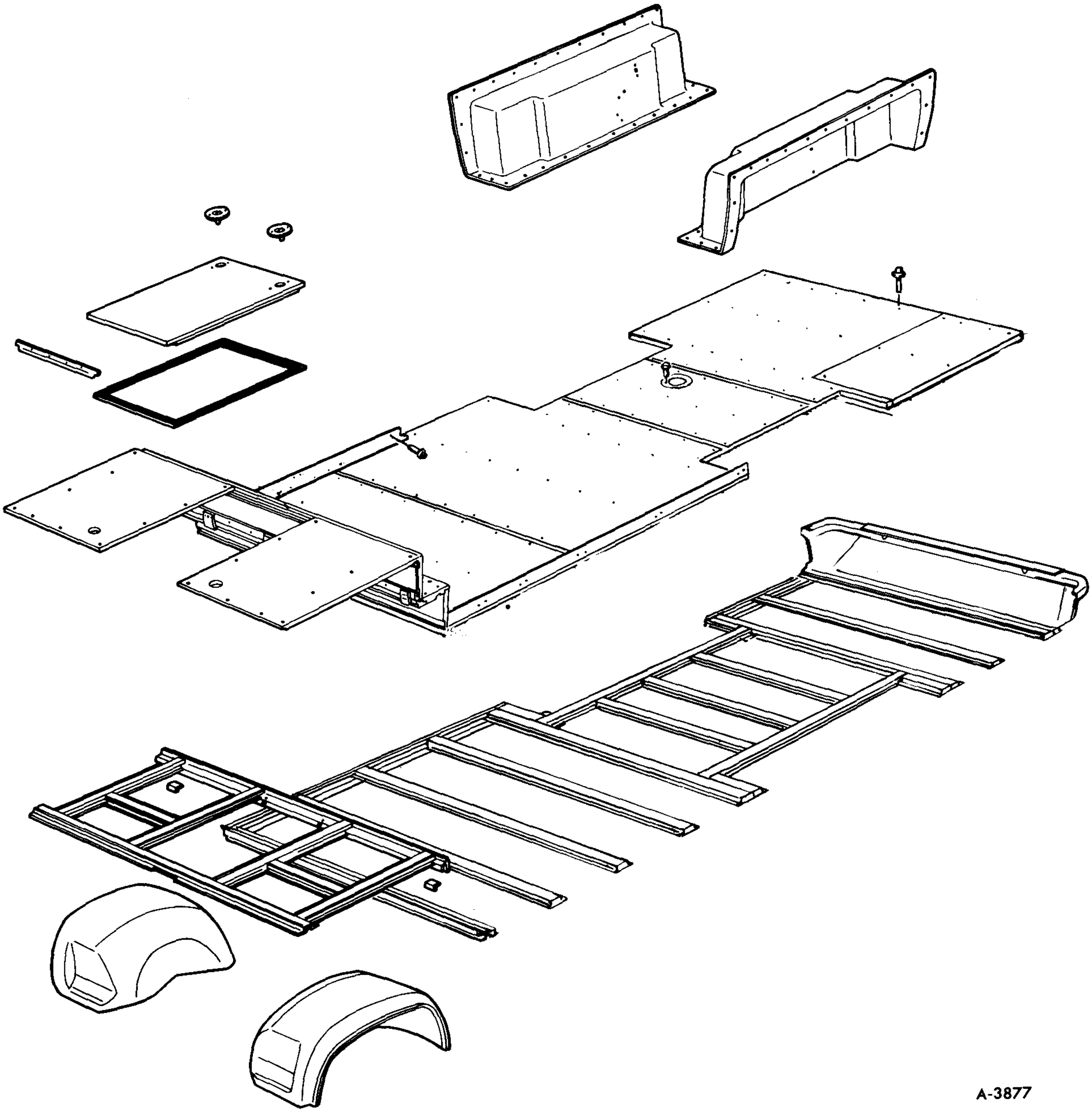


Figure 36—Wheel Housings and Floor

plywood sections can be replaced; however, repair of plywood floor is more practical and is corrected later in this section.

The engine cover, the only section designed to be removed, is located between the driver and passenger seat and is secured by a lip in the front and two screw attachments at each rear corner.

The front wheel houses are made of plastic polyethylene while the rear wheel houses are fiber glass. The front housings are repairable or replaceable if damaged. The rear housings are repairable of damaged. The entire underfloor area has been sprayed with a rust preventative and sealer undercoating.

FRONT WHEEL HOUSINGS

REMOVAL

1. Remove six (6) screws securing housing to fiberglass wheel opening.

2. Remove one (1) bolt securing housing to floor support.

3. Remove wheel housing.

INSTALLATION

1. Install and position wheel housing.

2. Install one (1) bolt securing housing to floor support.

3. Install six (6) screws to secure housing to fiberglass wheel opening.

PLYWOOD FLOOR

CAUTION: *Before drilling, sawing, chiseling etc. the plywood be sure damage will not occur to components directly under the floor.*

A thorough inspection of the damaged floor area should be made before attempting any repair. The damaged area should be replaced with 3/4 inch exterior grade plywood. It is not necessary to replace an entire section but this will depend on the location and the extent of the damage.

All sections are secured to the supports with poprivets. Any pop-rivet may be removed by drilling into the center of the rivet with a 3/16" drill bit. Drill approximately 1/8" deep and with a punch tap into this hole to drive the rivet shaft out.

CAUTION: *Care must be taken to properly seal any seams or joints resulting from floor section replacement or repair. Exhaust gases, dust, water etc. will leak past any seam or joint not caulked.*

The underside surfaces of new plywood must be coated with a wood preservative.

FLOOR INSULATION

Panels of heavy duty floor insulation fit inside the lateral cross members of the floor sub-structure (optional on TransMode vehicles). The insulation consists of rigid polyurethane foam panels bonded to an aluminum protective skin and, in turn, bonded to the sub-structure and plywood floor. Care should be used in repairing plywood floor so as not to damage the insulation package. The insulation panels are replaceable if damaged.

CAUTION: *Urethane foam is a flammable material. Welding near insulation may result in damage to insulation and/or vehicle.*

ENGINE COVER

This removable floor section is made of one inch plywood. A seal is secured to the underside of the cover with an adhesive and staples. A damaged gasket should be replaced using a suitable adhesive and staples.

The rear corners of the cover are secured by screwing the bolt into a clip nut mounted to the cover frame. Proper operation of this fastener is important to allow the cover seal to make good contact with the frame.

Fasterners are replaceable and are held in place with two wood screws. Peel back the carpeting from the corner as required to gain access to wood screws. The clip nut is a standard hardware item and is replaceable.

If the fastener is replaced apply some adhesive to the cover to hold the carpet in place at the corners.

REAR WHEEL HOUSINGS

As mentioned previously, rear wheelhouses are constructed of fiberglass and are repairable.

Any repair to the wheelhouses should be done with fiberglass patch and epoxy adhesive. Use as sufficient amount of adhesive to insure an air seal between the inside and the outside of the vehicle. Be sure to follow precautions and procedures given later in this section on repairing fiberglass components.

BODY

GENERAL INFORMATION

The body of the vehicle is constructed of aluminum and fiberglass. Extruded aluminum ribs and struts are welded together to form a cage-like framework. The exterior skin is than bonded directly to the framework (See Figure 38).

Figure 37—Cab Roof Insulation

Both front and rear end caps are fiberglass; and the lower side panels, below the belt line, are fiberglass. The side panels, above the belt line, are sheet aluminum. The main roof panel is also sheet aluminum.

The roof and side panels are bonded directly to the aluminum framing. Pop rivets are then used to secure the panels where the roof and side panels are joined. Rivets are also used at the belt line.

INSULATION

The main body area, rear end cap, side panels, and roof cap of the driver's compartment are coated with 3/4" thick rigid urethane foam, (figure 37). Areas which must remain accessible for servicing have not been coated with insulation. These areas include electrical harnesses, structure flanges, interior component mounting surfaces, and pre-insulated areas.

CAUTION: *Urethane foam is a flammable material. Welding near insulation may result in damage to insulation and/or vehicle.*

As previously discussed, polyurethane foam panels insulate the floor area. The driver toe pan mat is insulated with 1/4" of "ENSOLITE". The lower dash area is also insulated.

The insulation package applied to vehicle insures temperature control and improves performance of heating and air conditioning systems. Be careful not to damage insulation when making repairs.

REPAIR OF FIBERGLASS COMPONENTS

Before starting repair operations, look for hidden damage by applying force around the damaged area, looking for hairline cracks and other breakage. Early repair of minor damage may prevent major reapir later.

PRECAUTIONS

Creams are available to protect the skin from a condition known as occupational, or contact dermititis. Improved resin formulas have almost eliminated skin irritation. Cream is available for persons who may have a tendency toward skin irritation from the resins or dust.

The application of these creams is recommended whenever the resin materials are used. Generally the cream is not required when the plastic (epoxy) solder kit is being used.

1. Remove resin mixture from hands as soon as possible and always before mixture starts to gel. This can be observed by the action of the material being

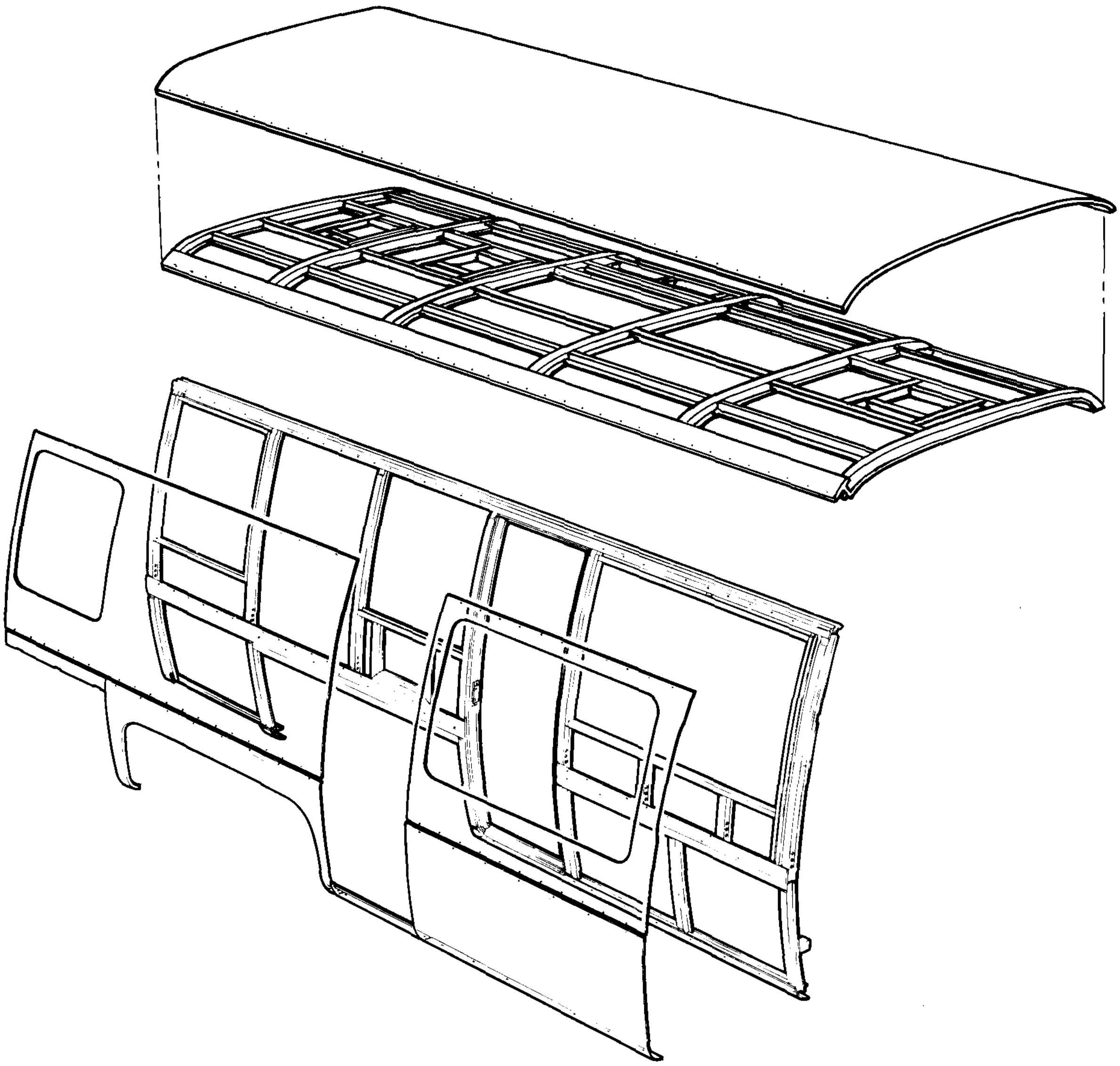


Figure 38—Side and Roof Frame

used. Resin may be removed with lacquer thinner by washing in soap and water.

2. Respirators are recommended when grinding. Also, some minor skin irritation from glass and powdered cured resin may be evident. Washing in cold water will help to minimize.

3. Use a sander with a vacuum attachment for dust control whenever possible.

4. Resin mixtures may produce toxic fumes and should be used in well vantilated areas.

5. Be careful not to get any resin material on clothing.

6. Use the proper materials for the job.

7. Keep materials, utensils and work area clean and dry. These repairs involve chemical reactions, and dirt or moisture may upset the chemical balances and produce unsatisfactory results.

8. To protect the eyes, wearing goggles is also recommended. Do not rub eyes or face when working with fiberglass.

REPAIR PROCEDURES

For repair procedures refer to General Motors Service Information Bulletin (B-4). Copies of the fiberglass repair bulletin (B-4) may be ordered from the following address:

General Motors Service Information

P. O. Box 7124

Detroit, Michigan, 48202

Materials, for repairing damaged fiberglass panels, are available in kit form through GM Dealerships, or equivalent kits can be purchased locally.

SHEET METAL REPAIR

The aluminum panels on the body may be repaired if damaged. Filler putty can be used for minor dents, scratches, scrapes etc. However, major damage to a panel will require removal of at least part of the panel. Because the panels are secured to the ribs with a polyurethane adhesive, separating and removing panels is difficult. Any rivets used on the panels are easily removed by drilling off the rivet head and, using a punch, drive out the rivet shaft.

All windows, access doors, vents, belt and roof line trim mouldings in the damaged area should be removed before removing the panel.

An air chisel will be helpful to remove the panel. Operate the air chisel along the rib to break the adhesive bond between the panel and the rib.

CAUTION: *Be careful during chiseling, sawing, drilling etc. on the aluminum panels not to damage wiring, piping, insulation, components etc. which are located immediately behind the panels.*

Any damaged rib will have to be straightened, replaced or have shim material fastened to the rib so proper support will be provided for the aluminum panel.

A replacement panel should be fitted after the ribs have been thoroughly cleaned of adhesive. A suggested method would be to grind off the adhesive with an extra coarse disc on an air driven grinding wheel.

With the ribs cleaned a new panel may be fitted into the opening. Next, with the panel in place drill holes, or use existing holes, (at each corner and along the belt line and roof line) through the panel and rib for using pop-rivets.

Remove panel and apply adhesive such as manufactured by Minnesota Mining and Manufacturing, 3539 A/B, or equivalent to the rib. This is a two part (base and accelerator) urethane adhesive designed for bonding aluminum, polyester, and steel. It is essential that the surface be thoroughly clean, dry, and grease free before application. Follow the manufacturers' mixing and curing instructions. Avoid repeated skin contact and use only in a well ventilated area.

Position panel in place and pop-rivet using predrilled holes. The adhesive will cure at room temperature in 24 hours. The rivet holes may be ground off and the holes filled with a body putty.

SEATS

DRIVER AND SINGLE PASSENGER SEAT

The seat assembly can be removed by itself or as a unit with pedestal assembly.

SEAT REMOVAL

1. Swivel chair to a 45° position.

2. This will allow access to the four retaining bolts. Remove four bolts (See figure 39).

3. Remove seat.

SEAT INSTALLATION

1. Swivel top of pedestal to allow access to seat mounting holes.

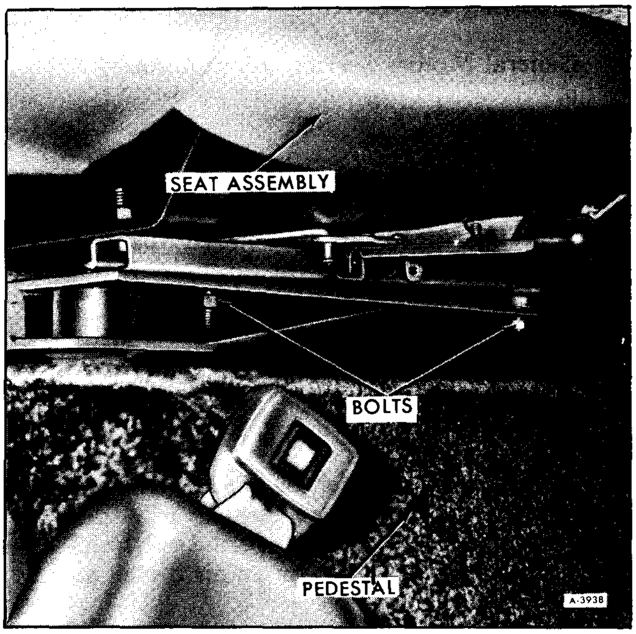


Figure 39—Seat Attaching Bolts

2. Position spacers and install retaining bolts to weld nuts in base of seat. Tighten securely.

PEDESTAL REPLACEMENT

REMOVAL

1. Remove seat as described above.

2. Remove twelve nuts and bolts from base of pedestal. (Access to nuts can be made through the engine access cover)

3. Remove pedestal.

INSTALLATION

1. Position pedestal over mounting holes.

2. Install nuts and bolts to retain pedestal.

3. Install seat as described previously in this section.

DUAL PASSENGER SEAT REPLACEMENT

The dual passenger seat is removed in the same manner as the driver and single passenger seat, refer to the preceding procedures for removal and installation.

The pedestal for the dual passenger seat is also removed by the same method as the driver and single passenger seat pedestal.

MIRRORS AND SUN VISOR

INSIDE REAR VIEW MIRROR

REMOVAL

1. Loosen set screw at base of mirror.

2. Slide mirror to the rear and remove.

INSTALLATION

1. Position mirror on sun visor and mirror mounting bracket.

2. Tighten set screw.

OUTSIDE REARVIEW MIRROR (FIGURE 40)

The entire mirror assembly can be removed by removing four retaining bolts from the mirror bracket. Install by replacing these four bolts.

Either the mirror head or support arm can be removed by removing the acorn nut as shown in Figure 40.

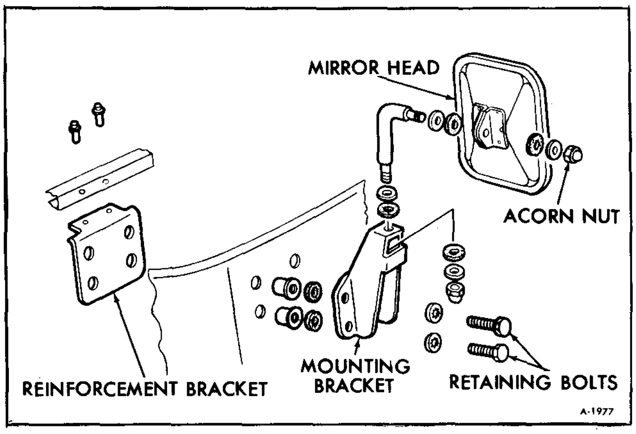


Figure 40—Exterior Mirror

A reinforcement bracket is used to back the riv-nuts which retains the mirror assembly to the body. This bracket is held in place by two rivets to the sill.

SUN VISOR

REMOVAL

Remove visor from center support bracket, and swing visor to side. Visor can now be removed by loosening hex head bolt at end of visor shaft.

INSTALLATION

Position visor and install threaded end of visor arm into its mounting bracket. Tighten hex head bolt and position visor in support clip.

RADIATOR GRILLE (FIGURE 41)

REMOVAL

1. Open front access doors.

2. Remove six nuts from inside of grille.

3. Remove grille.

INSTALLATION

1. Position grille with studs through body.

2. Install six nuts and washers to retain grille in proper position.

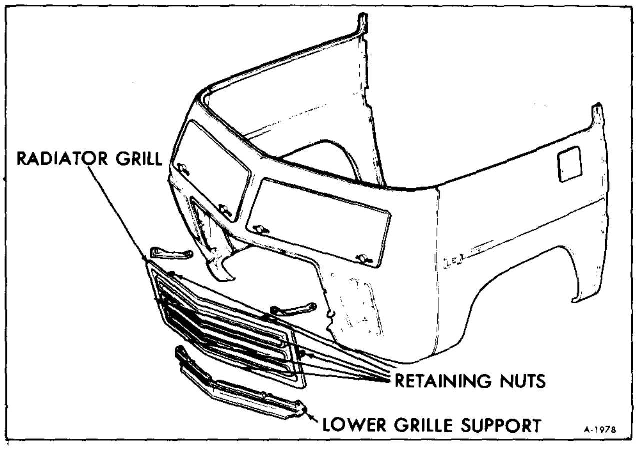


Figure 41—Radiator Grille

END CAP

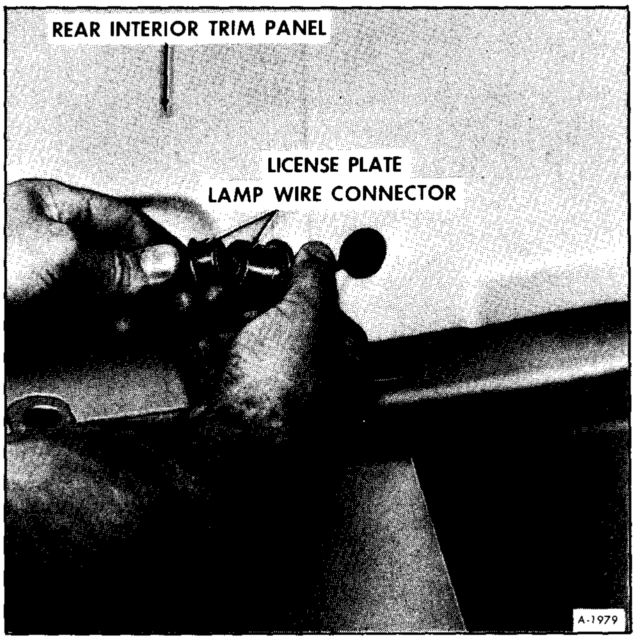


Figure 42—Disconnecting Wire to License Plate Lamp

REMOVAL

1. Disconnect wires for license plate light at lower left-hand inside corner as shown in Figure 42.

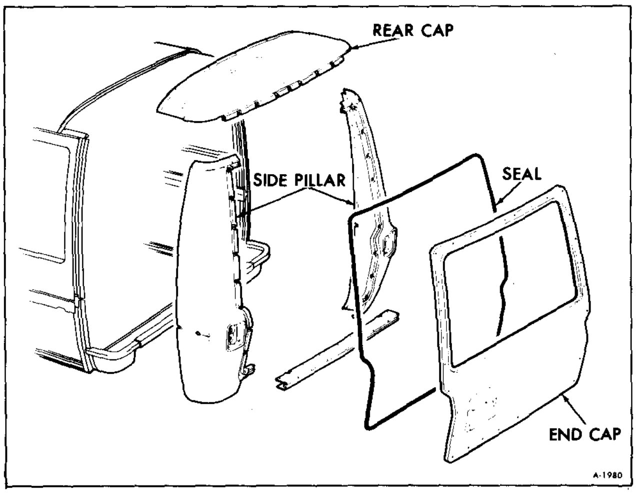


Figure 43—End Cap Components

NOTE: It may be necessary to remove interior trim at rear of Motor Home to gain access to license plate wiring connector.

2. Remove screws from interior trim to end cap.

3. Remove end cap to body retaining screws (32) from end cap (See figure 43).

4. Remove end cap from body.

INSTALLATION

1. Check seal to make sure it is still intact. Replace seal, if necessary.

2. Position end cap in place and install 32 retaining screws.

NOTE: The seven lower screws are self-tapping screws while the 25 screws on the sides and top of the end cap are hi-low screws.

3. Install screws retaining interior trim to end cap.

4. Reconnect license plate wiring.

SPECIAL TOOLS

J-2189-02	Glass Installing Tool

AIR CONDITIONING SYSTEM (INCLUDES HEATING)

Contents of this section are listed below:

GENERAL DESCRIPTION

Both the heating and cooling functions are performed by this system. Air entering the vehicle must pass through the cooling unit (evaporator) and through (or around) the heating unit, in that order, and the system is thus referred to as a "reheat" system.

The evaporator provides maximum cooling of the air passing through the core when the air conditioning system is calling for cooling. A thermostatic switch, located in the blower-evaporator case, acts to control compressor operation by sensing the fin temperature of the evaporator core.

System operation is as follows: Air, either outside air or recirculated air, enters the system and is forced through the system by the blower. As the air passes through the evaporator core, it receives maximum cooling if the air conditioning controls are calling for cooling. After leaving the evaporator, the air enters the Heater and Air Conditioner Selector Duct Assembly where, by means of diverter doors, it is caused to pass through or to bypass the heater core in the proportions necessary to provide the desired outlet temperature. Conditioned air then enters the vehicle through the dash outlets. When, during cooling operations, the air is cooled by the evaporator to below comfort level, it is then warmed by the heater to the desired temperature. During "heating only" operations, the compressor will not be in operation and ambient air will be warmed to the desired level in the same manner.

The dash outlets are rectangular in design and have two-way action. The whole outlet can be swiveled and the inside louvers can be turned to direct air as desired. Also there are two floor outlets.

THEORY OF OPERATION

HEAT

We all know what air conditioning does for use but very few understand how or why it works. An air conditioner is functionally very similar to a refrigerator. A refrigerator is a simple mechanism which, surprisingly enough, works quite a bit like a teakettle boiling on a stove. That may sound far-fetched, but there is more similarity between the two than most of us would suspect. A modern refrigerator can make ice cubes and keep food cool and fresh only because a liquid called the refrigerant boils inside the freezer.

Everyone knows a boiling teakettle is "hot" and a refrigerator is "cold". We usually think of "cold" as a definite, positive condition. The only way we can define it is in a rather negative sort of way by saying "cold" is simply the lack of heat, just as darkness is the lack of light. We can't make things cold directly. All we can do is remove some of the heat they contain and they will become cold as a result. And that is the main job of any refrigerator. Both are simply devices for removing heat.

Transfer of Heat

The only thing that will attract heat is a colder object. Like water, which always flows downhill,

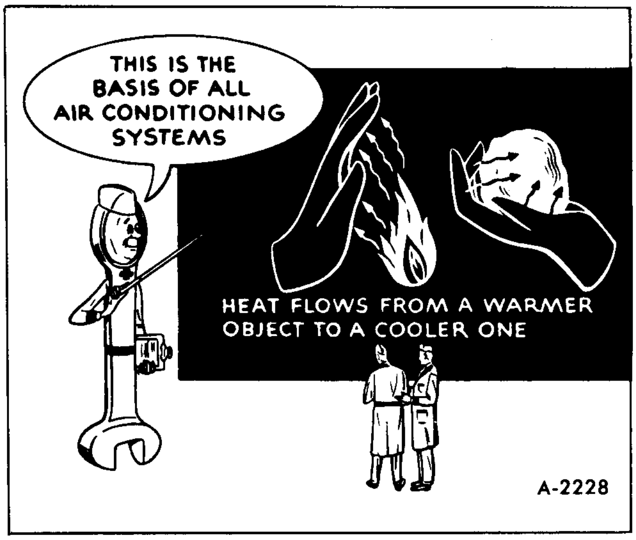


Figure 1—Heat Transfer

heat always flows down a temperature scale - from a warm level down to a colder one. When we hold our hands out toward the fireplace, heat flows from the hot fire out to our cold hands (figure 1). When we make a snowball, heat always flows from out warm hands to the colder snow.

Measurement of Heat

Everyone thinks he knows how heat is measured. Thermometers are used in every home. **(Whenever we speak of temperature from now on, we will mean Fahrenheit).** They can tell how hot a substance is, but they can't tell us everything about heat.

When we put a teakettle on a stove, we expect it to get hotter and hotter until it finally boils. All during the process, we can tell exactly how hot the water is by means of a thermometer (figure 2). Our thermometer will show us that the flame is just as hot

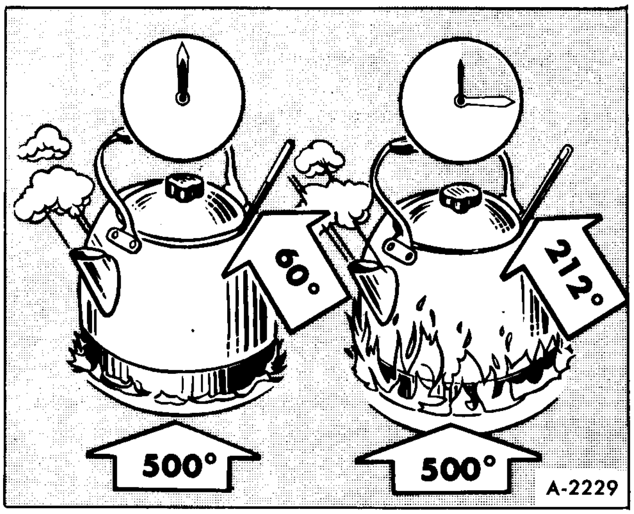


Figure 2—Measurement of Heat

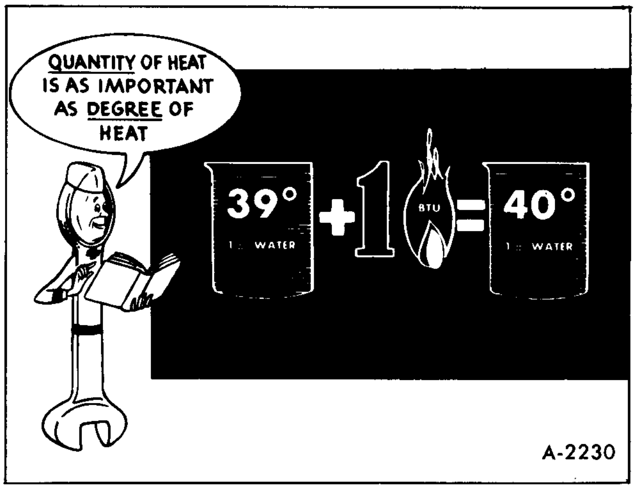


Figure 3—Quantity of Heat

when we first put the teakettle on the stove as it is when the water finally boils. Why doesn't the water boil immediately? Why does it take longer to boil a quart of water than a cupful? Obviously temperature isn't the only measurement of heat.

Even though heat is intangible, it can be measured by quantity as well as intensity. Thermometers indicate only the intensity of heat. The unit for measuring quantity of heat is specified as that amount necessary to make 1 pound of water 1 degree warmer (figure 3). We call this quantity of heat a British Thermal Unit. Oftentimes, it is abbreviated to B.T.U.

Perhaps we can get a better idea of these two characteristics of heat if we think of heat as a sort of coloring dye. If we add one drop of red dye to a glass of water, it will turn slightly pink Another drop will make the water more reddish in color. The more drops of dye we add, the redder the water will get. Each drop of dye corresponds to 1 B.T.U. and the succedingly deeper shades of red are like increases in temperature.

It may seem a little puzzling to talk about heat in a manual on air conditioning...but, when you stop to think about it, we are handling heat exclusively. Although we ordinarily think of an air conditioner as a device for making air cold, it does that indirectly. What it does is to take heat away from the air and transfer that heat outside the vehicle.

We know now that cold is nothing more than the absence of heat, and that heat always flows from a warm object to a colder one. We also have a clearer idea of how heat is measured.

From everything we've learned about heat so far, it seems to behave in a perfectly normal manner. Yet sometimes heat will disappear without leaving a single clue.

Ice vs Water For Cooling

Every once in a while in the old days, the iceman would forget to stop by to refill the icebox. Ocassionally, as the last sliver of ice melted away, somebody would come up with a bright idea. He would remember that the water in the drainpan always felt icecold when he emptied it other times. So, he would get the thermometer out and check its temperature. Sure enough, it usually was about as cold as the ice. Why not put the drainpan back in the ice compartment to keep things cold until the iceman returned the next day?

For some strange reason, the icebox never stayed cold. The drain water soon got quite warm and in a couple of hours, the butter in the icebox would begin to melt, the milk would start to sour, and the vegetables would wilt.

The drain water was only a few degrees warmer than the ice yet it didn't draw nearly as much heat out of the stored foods. The difference between the behavior of cold drain water and ice is the real secret as to how any refrigerator works, and we can easily see this by using an ordinary thermometer.

When we put a drainpan full of cold water into the ice compartment, we expect the heat to flow from the warm foods to the colder water. Remember, that heat always flows from a warm object to a colder object and when we add heat to water, it gets warmer. Each B.T.U. of heat added to a pound of water makes it one degree warmer.

If we were to put a thermometer in the cold drain water, we would see the temperature gradually creep upwards. That is to be expected because heat is flowing into the cold water making it warmer. Before long the water would be as warm as the stored foods. Then the water could no longer attract heat because heat will not flow from one warm object to another equally warm object. Since we no longer can draw heat out of the foods we no longer are cooling them.

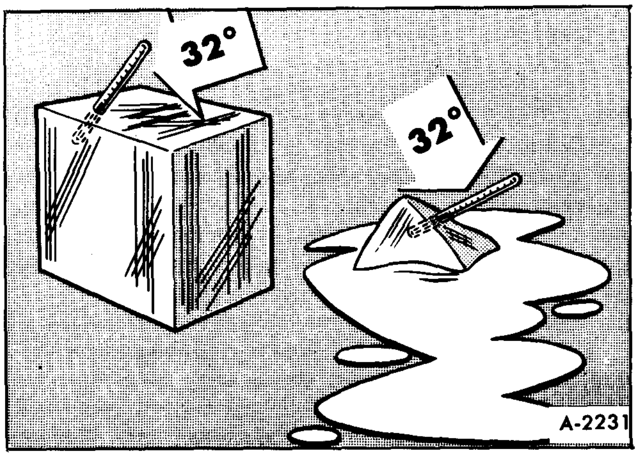


Figure 4—Melting Ice Remains at 32°F. (0°C.)

Now, let's see what happens when we put ice instead of cold water into the icebox. This time, we'll set the thermometer on top of the ice (figure 4). When we first look at the thermometer, it reads 32°F. (0°C.) A couple of hours later, the ice chunk is smaller because some of the ice has already melted away — but the thermometer still reads 32°F (0°C.).

All this time, the ice has been soaking up heat, yet it never gets any warmer no matter how much heat it draws from the stored food. On the other hand, the cold drain water got progressively warmer as it soaked up heat. The addition of heat will make water warmer yet won't raise the temperature of ice above the 32°F. (0°C.) mark.

If we fill one drinking glass with ice and another with cold water, and put both glasses in the same room where they could absorb equal amounts of heat from the room air, we will find it takes much, much longer for the ice to melt and reach room temperature than it did for the water in the other glass to reach the same temperature. Obviously, most of the heat was being used to melt the ice. But it was the heat that apparently disappeared or was transformed because it couldn't be located with a thermometer. To describe this disappearing heat scientists chose the word "latent" which means hidden.

Latent Heat

So latent heat is nothing more or less than hidden heat which can't be found with a thermometer.

At first it was thought that latent heat was in the water that melted from the ice. But that wasn't exactly the right answer because, upon checking water temperature as it melts from ice, it will be found that

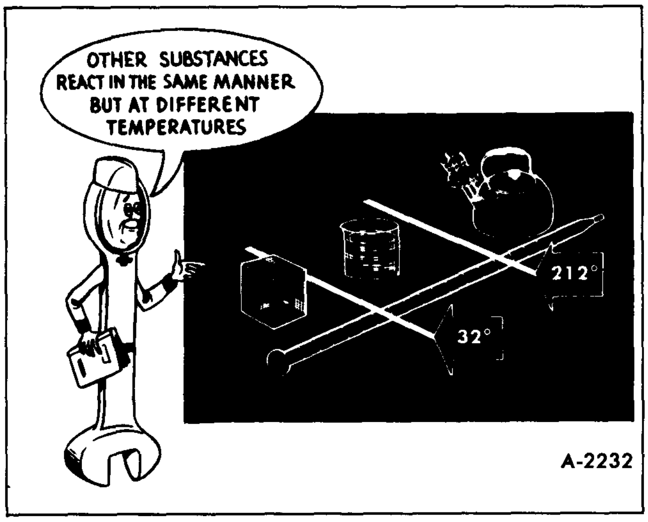


Figure 5—Temperature Determines the State of Water

it is only a shade warmer than the ice itself. It is not nearly warm enough to account for all the heat the ice had absorbed. The only possible answer is that the latent heat had been used up to change the ice from a solid into a liquid.

Many substances can be either a solid, or a liquid, or a gas. It just depends on the temperature whether water for example was a liquid, or a solid (ice), or gas (steam) (figure 5).

All solids soak up huge amounts of heat without getting any warmer when they change into liquids, and the same thing will happen when a substance changes from a liquid into a gas.

Put some water in a teakettle, set it over a fire and watch the thermometer as the water gets hotter and hotter, the mercury will keep rising until the water starts to boil. Then the mercury seems to stick at the 212°F. (100°C.) mark. Put more wood on the fire, despite all the increased heat, the mercury will not budge above the 212°F. (100°C.) mark (figure 6).

No matter how large or hot you make the flame, you can't make water any hotter than 212° at sea level. As a liquid changes into a gas, it absorbs abnormally great amounts of heat without getting any hotter.

Now we have two different kinds of latent heat, which are quite a bit alike. To keep their identities separate, the first one is called **latent heat of fusion,** which means the same as melting. The other kind is called **latent heat of vaporization** because that means the same as evaporation.

Refrigeration

It may seem as though we have discussed heat instead of refrigeration. But in doing so, we have

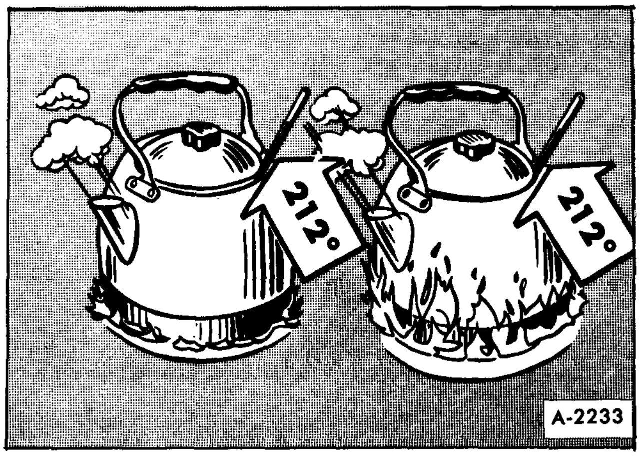


Figure 6—Boiling Water Never Exceeds 212°F. (100°C.) at Sea Level

learned how a simple icebox works. It's because the latent heat of fusion gives ice the ability to soak up quantities of heat without getting any warmer. Since it stays cold, it can continue to draw heat away from stored foods and make them cooler.

The latent heat of vaporization can be even better because it will soak up even more heat.

Whenever we think of anything boiling, we think of it being pretty hot, but that's not true in every case. Just because water boils at 212°F. (100°C.) doesn't mean that all other substances will boil at the same temperature. Some would have to be put into a blast furnace to make them bubble and give off vapor. On the other hand, others will boil violently while sitting on a cake of ice.

And so each substance has its own particular boiling point temperature. But regardless of whether it is high or low, they all absorb unusually large quantities of heat without getting any warmer when change from a liquid into a vapor.

Consequently, any liquid that will boil at a temperature below the freezing point of water, will make ice cubes and keep vegetables cool in a mechanical refrigerator.

REFRIGERANTS

The substance that carries heat out of a refrigerator cabinet is the refrigerant.

There are many refrigerants known to man. In fact, any liquid that can boil at temperatures somewhere near the freezing point of water can be used.

But a boiling point below the temperature at which ice forms is not the only thing that makes a good refrigerant. A refrigerant should also be non-poisonous and non-explosive to be safe. Besides that, we want a refrigerant that is non-corrosive and one that will mix with oil.

Chemists tried to improve existing natural refrigerants. But after exploring along that line, they still hadn't succeeded. They started from scratch and juggled molecules around to make an entirely new refrigerant. Eventually they succeeded by remodeling the molecules in carbon tetrachloride. This is the same fluid that was used in fire extinguishers and dry-cleaners' solvents.

From this fluid, the chemists removed two chlorine atoms and replaced them with two flourine atoms. This newly formed fluid carried the technical chemical name of dichlorodifluoromethane. Today, it is sold commercially by manufacturers as Refrigerant-12 or R-12. Non-tox, non-inflammable, nonexplosive, and non-poisonous, however, breathing large quantities of R-12 should be avoided.

Refrigerant-12

Refrigerant-12, which we use in Air Conditioning Systems, **boils** at 21.7°F. (-5.7°C.) below zero. Picture a flask of R-12 sitting on the North Pole boiling away just like a teakettle on a stove. No one would dare pick up the flask with his bare hands because, even though boiling, it would be so cold and it would be drawing heat away from nearby objects so fast that human flesh would freeze in a very short time.

If we were to put a flask of R-12 inside a refrigerator cabinet, it would boil and draw heat away from everything surrounding it (figure 7). So long as any refrigerant remained in the flask, it would keep on soaking up heat until the temperature got clear down to 21.7°F. (-5.7°C.) below zero.

Now we can begin to see the similarity between a boiling teakettle and a refrigerator. Ordinarily we think of the flame pushing heat into the teakettle. Yet, it is just as logical to turn our thinking around and picture the teakettle pulling heat out of the flame. Both the teakettle and the flask of refrigerant do the same thing — they both draw in heat to boil although they do so at different temperature levels.

There also is another similarity between the icebox and the mechanical refrigerator. In the icebox, water from melting ice literally carried heat out of the cabinet. In our simple refrigerator, rising vapors do the same job.

Reusing R-12

R-12, or any other refrigerant, is too expensive just to let float away into the Atmosphere. If there

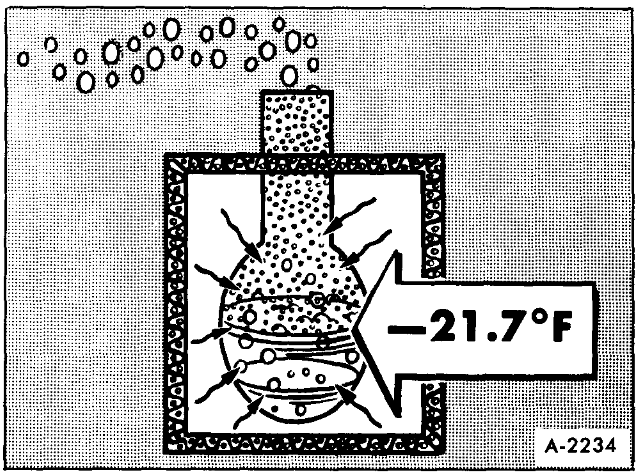


Figure 7—A Simple R-12 Refrigerator

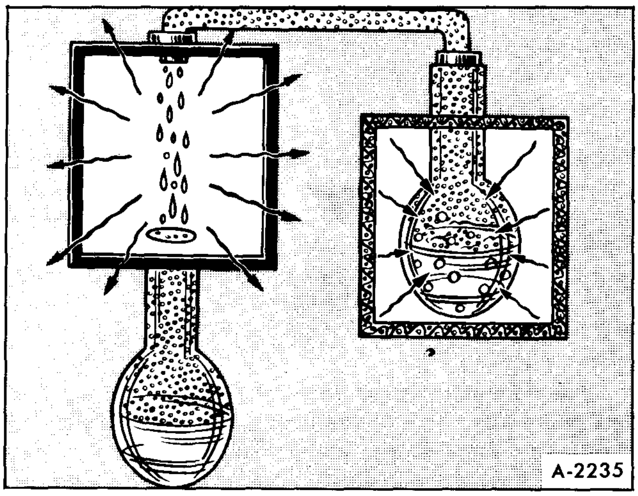


Figure 8—Reusing Refrigerant

was some way to remove the heat from the vapor and change it back into a liquid, it could be returned to the flask and used over again (figure 8).

That is where we find the biggest difference between the old icebox and the modern refrigerator. We used to put in new ice to replace that lost by melting. Now we use the same refrigerant over and over again.

We can change a vapor back into a liquid by chilling it, or do the same thing with pressure. When we condense a vapor we will find that the heat removed just exactly equals the amount of heat that was necessary to make the substance vaporize in the first place.

This is called the latent heat of vaporization - the heat that apparently disappeared when a liquid boiled into a vapor — again reappears - when that same vapor reverts back into a liquid. It is just like putting air into a balloon to expand it and then letting the same amount of air out again to return the balloon to its original condition.

We know that any substance will condense at the same temperature at which it boiled. This temperature point is a clear-cut division like a fence. On one side, a substance is a liquid. Immediately on the other side it is a vapor. Whichever way a substance would go, from hot to cold or cold to hot, it will change its character the moment it crosses over the fence.

Water will boil at 212°F. (100°C.) under normal conditions. Naturally, we expect steam to condense at the same temperature. But whenever we put pressure on steam, it doesn't. It will condense at some temperature higher than 212°F (100°C.). The greater the pressure, the higher the boiling point and the temperature at which a vapor will condense. This is the reason why pressure cookers cook food faster, since the pressure on the water permits it to boil out at a higher temperature.

We know that R-12 **boils** at 21.7°F. (-5.7°C.) below zero. A thermometer will show us that the rising vapors, even though they have soaked up lots of heat, are only slightly warmer. But the vapors must be made warmer than the room air if we expect heat to flow out of them. The condensing point temperature must be above that of room air or else the vapors won't condense.

This is where pressure helps, with pressure, we can compress the vapor, thereby concentrating the heat it contains. When we concentrate heat in a vapor that way, we increase the intensity of the heat or, we increase the temperature, because temperature is merely a measurement of heat intensity (figure 9).

Pressure in Refrigeration

Because we must use pressures and gauges in air conditioning service, the following points are mentioned so that we will all be talking about the same thing when we speak of pressures.

All pressure, regardless of how it is produced, is measured in pounds per square inch (psi).

Atmospheric Pressure is pressure exerted in every direction by the weight of the atmosphere. At sea level atmospheric pressure is 14.7 psi. At higher altitudes air has less weight (lower psi).

Any pressure less than atmospheric (14.7) is known as a partial vacuum or commonly called a vacuum. A perfect vacuum or region of no pressure has never been mechanically produced.

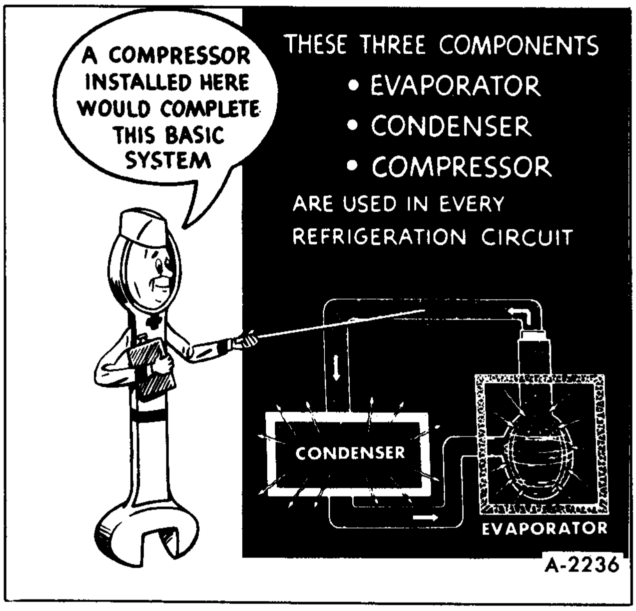


Figure 9—Basic Refrigerant Circuit

Gauge pressure is used in refrigeration work. Gauges are calibrated in pounds (psi) of pressure and inches of Mercury for vacuum. At sea level, "O" lbs. gauge pressure is equivalent to 14.7 lbs. atmospheric pressure. Pressure greater than atmospheric is measured in pounds (psi) and pressure below atmospheric is measured in inches of vacuum. The "O" on the gauge will always correspond to the surrounding atmospheric pressure, regardless of the elevation where the gauge is being used.

Pressure-Temperature Relationships of R-12

A definite pressure and temperature relationship exists in the case of liquid refrigerants and their saturated vapors. Increasing the temperature of a substance causes it to expand. When the substance is confined in a closed container, the increase in temperature will be accompanied by an increase in pressure, even though no mechanical device was used. For every temperature, there will be a corresponsing pressure within the container of refrigerant. A table of the temperature-pressure relationship of R-12 is presented below. Pressures are indicated in gauge pressure, either positive pressure (above atmospheric) in pounds or negative pressure (below atmospheric) in inches of vacuum.

Thus if a gauge is attached to a container of R-12 and the room temperature is 70°F. (21.1°C.), the gauge will register approximately 70 psi pressure; in a 100°F. (37.8°C.) room, the pressure would be 117 psi.

°F.	°C.	Pressure (psi)
-40	-40	11.0*
-35	-37.2	8.3*
-30	-33.3	5.5*
-25	-31.7	2.3*
-20	-29	0.6
-15	-26.1	2.4
-10	-23.3	4.5
-5	-20.6	6.8
0	-17.8	9.2
+5	-15	11.8
+10	-12.2	14.7
+15	-9.4	17.7
+20	-6.7	21.1
+25	-3.9	24.6
+30	-1.1	28.5
+32	0	30.1
+35	+1.7	32.6
+40	+4.4	37.0
+45	+7.2	41.7

°F.	°C.	Pressure (psi)
+50	+10	46.7
+55	+12.8	52.0
+60	+15.6	57.7
+65	+18.3	63.7
+70	+21.1	70.1
+75	+23.9	76.9
+80	+26.7	84.1
+85	+29.4	91.7
+90	+32.2	99.6
+95	+35	108.1
+100	+37.8	116.9
+105	+40.6	126.2
+110	+43.3	136.0
+115	+46.1	146.5
+120	+49	157.1
+125	+51.7	167.5
+130	+54.4	179.0
+140	60	204.5
+150	+65.6	232.0
* Inches of Vacuum		

Pressure and Flow

When we use a tire pump to inflate an automobile tire, we are creating pressure only because we are "pushing" against the air already entrapped inside the tire. If a tire has a puncture in it, you could pump all day, and still not be able to build up any pressure. As fast as you would pump the air in, it would leak out through the puncture. Unless you have something to push against — to block the flow of air — you can't create more than a mere semblance of pressure.

The same situation holds true in an air conditioning system. The compressor can pump refrigerant vapor through the system, but unless it has something to push against, it cannot build up pressure. All the compressor would be doing would be to circulate the vapor without increasing its pressure.

We can't just block the flow through the system entirely. All we want to do is put pressure on the refrigerant vapor so it will condense at normal temperatures. This must be done sometime after the vapor leaves the evaporator and before it returns again as a liquid. High pressure in the evaporator would slow down the boiling of the refrigerant and penalize the refrigerating effect.

Controlling Pressure and Flow

Pressure and flow can be controlled with a float valve, or with a pressure-regulating valve.

The float valve type will give us a better idea of pressure and flow control, let's look at it first.

It consists simply of a float that rides on the surface of the liquid refrigerant. As the refrigerant liquid boils and passes off as a vapor, naturally the liquid level drops lower and lower. Correspondingly, the float, because it rides on the surface of the refrigerant, also drops lower and lower as the liquid goes down.

By means of a simple system of mechanical linkage, the downward movement of the float opens a valve to let refrigerant in. The incoming liquid raises the fluid level and, of course, the float rides up along with it. When the surface level of the refrigerant liquid reaches a desired height, the float will have risen far enough to close the valve and stop the flow of refrigerant liquid.

We have described the float and valve action as being in a sort of definite wide open or tight shut condition. Actually, the liquid level falls rather slowly as the refrigerant boils away. The float goes down gradually and gradually opens the valve just a crack. At such a slow rate of flow, it raises the liquid level in the evaporator very slowly.

It is easy to see how it would be possible for a stablized condition to exist. By that, we mean a condition wherein the valve would be opened enough to allow just exactly the right amount of refrigerant liquid to enter the system to take the place of that leaving as a vapor.

Refrigerator Operation

We've now covered all the scientific ground-rules that apply to refrigeration. Try to remember these main points. All liquids soak up lots of heat without getting any warmer when they boil into a vapor, and, we can use pressure to make the vapor condense back into a liquid so it can be used over again. With just that amount of scientific knowledge, here is how we can build a refrigerator.

We can place a flask of refrigerant in an icebox. We know it will boil at a very cold temperature and will draw heat away from everything inside the cabinet (figure 9).

We can pipe the rising vapors outside the cabinet and thus provide a way for carrying the heat out. Once we get the heat-laden vapor outside, we can compress it with a pump. With enough pressure, we can squeeze the heat out of "cold" vapor even in a warm room. An ordinary radiator will help us get rid of heat.

By removing the heat, and making the refrigerant into a liquid, it becomes the same as it was before. So, we can run another pipe back into the cabinet and return the refrigerant to the flask to be used over again.

That is the way most mechanical refrigerators work today. Now, let's look at air conditioning to see the benefits of air conditioning and how an air conditioner works.

AIR CONDITIONING

Because air-conditioning has always been very closely allied with mechanical refrigeration, most of us are apt to think of it only as a process for cooling room air.

Air Conditioning goes beyond the mere cooling of the air. It controls the humidity, cleanliness and circulation of the air.

Whenever it gets warm and muggy in the summertime, someone is almost sure to say, "It's not the heat...it's the humidity." But that is only partly right. Actually it is a combination of the two that makes us feel so warm...temperature alone is not the only thing that makes us uncomfortable.

Humidity is the moisture content of the air. To a certain extent, it is tied in with the temperature of the air. Warm air will hold more moisture than will cold air. When air contains all the moisture it can hold, it is saturated, and the relative humidity is 100%. If the air contains only half as much water as it could hold at any given temperature, we say that the relative humidity is 50%. If it contains only a fifth of its maximum capacity, we say that the relative humidity is 20%. This amount of water vapor, or relative humidity, affects the way we perspire on hot days.

Nature has equipped our bodies with a network of sweat glands that carry perspiration to the skin surfaces. Normally, this perspiration evaporates and absorbs heat just like a refrigerant absorbs heat when it is vaporized in a freezer. Most of the heat is drawn from our bodies, giving us a sensation of coolness. A drop of alcohol on the back of your hand will demonstrate this principle convincingly. Alcohol is highly volatile, and will evaporate very rapidly and absorb quite a bit of heat in doing so, making the spot on your hand feel cool.

The ease and rapidity with which evaporation takes place, whether it be alcohol or perspiration, governs our sensation of coolness and to a certain extent, independently of the temperature. The ease and rapidity of the evaporation are directly affected by the relative humidity or comparative dampness of the air. When the air is dry, perspiration will evaporate quite readily. But when the air contains a lot of moisture, persipiration will evaporate more slowly; consequently less heat is carried away from our body.

From the standpoint of comfort, air-conditioning should control the relative humidity of the air as well as its temperature.

By reducing the humidity, we oftentimes can be just as "cool" in a higher room temperature than otherwise would be comfortable. Laboratory tests have shown that the average person will feel just as cool in a temperature of 79°F. (26.1°C.) when the relative humidity is down around 30%F. (22.2°C.) as he will in a cooler temperature of 72° with a high relative humidity of 90%.

There are practical limits though within which we must stay when it comes to juggling humidity. For comfort, we can't go much below a relative humidity of 30% because anything lower than that would cause an unpleasant and unhealthy dryness in the throat and nasal passages.

Summertime temperatures of 85°F. (29.4°C.) sometimes bring with them relative humidities around 75% to 80%. To gain maximum human comfort, an air conditioning system should cool the air down and reduce the humidity to comfortable limits.

Along with the cooling job it does, the evaporator unit also removes much of the moisture from the air. Everyone is familiar with the sight of thick frost on the freezer of a refrigerator. That frost is simply frozen moisture that has come out of the air.

The evaporator unit as an air conditioning system does the same thing with this one exception. Because its temperature is above the freezing point, the moisture remains fluid and drips off the chilling unit. A further advantage of air conditioning is that dust and pollen particles are trapped by the wet surfaces of the evaporator core and then drained off along with the condensed moisture. This provides very clean, pure air for breathing.

BASIC AIR CONDITIONER

When we look at an air conditioning unit, we will always find a set of coils or a finned radiator core through which the air to be cooled passes. This is known as the "evaporator". It does the same job as the flask of refrigerant we spoke about previously. The refrigerant boils in the evaporator. In boiling, of course, the refrigerant absorbs heat and changes into a vapor. By piping this vapor outside the vehicle we can bodily carry out the heat that caused its creation.

Once we get vapor out of the evaporator, all we have to do is remove the heat it contains. Since heat is the only thing that expanded the refrigerant from a liquid to a vapor in the first place, removal of that same heat will let the vapor condense into a liquid again. Then we can return the liquid refrigerant to the evaporator to be used over again.

Actually, the vapor coming out of the evaporator is very cold. We know the liquid refrigerant boils at temperatures considerably below freezing and that the vapors arising from it are only a shade warmer even though they do contain quantities of heat. Consequently, we can't expect to remove heat from sub-freezing vapors by "cooling" them in air temperatures that usually range between 60°F. (15.6°C.) and 100°F. (37.8°C.)...heat refuses to flow from a cold object toward a warmer object.

But with a pump, we can squeeze the heat-laden vapor into a smaller space. And, when we compress the vapor, we also concentrate the heat it contains. In this way, we can make the vapor hotter without adding any heat. Then we can cool it in comparatively warm air.

That is the only responsibility of a compressor in an air conditioning system. It is not intended to be a pump just for circulating the refrigerant. Rather, its job is to exert pressure for two reasons. Pressure makes the vapor hot enough to cool off in warm air. At the same time, the compressor raises the refrigerant's pressure above the condensing point at the temperature of the surrounding air so it will condense.

As the refrigerant leaves the compressor, it is still a vapor although it is now quite hot and ready to give up the heat that it absorbed in the evaporator. One of the easiest ways to help refrigerant vapor discharge its heat is to send it through a radiator-like component known as a condenser.

The condenser really is a very simple device having no moving parts. It does exactly the same job as the familiar radiator in a typical home steam-heating system. There,the steam is nothing more than water vapor. In passing through the radiator, the steam gives up its heat and condenses back into water.

The purpose of the condenser, as the name implies, is to condense the high pressure, high temperature refrigerant vapor discharged by the compressor into a high pressure liquid refrigerant. This occurs when the high pressure, high temperature refrigerant is subjected to the considerably cooler metal surfaces of the condenser. This is due to the fundamental laws, covered earlier, which state that "heat travels from the warmer to the cooler surface," and that "when heat is removed from vapor, liquid is produced."

When the refrigerant condenses into a liquid, it again is ready for boiling in the evaporator. So, we run a pipe from the condenser back to the evaporator.

SYSTEM COMPONENTS AND THEIR FUNCTIONS

The air conditioning system used on the GMC Motor Home utilizes components in the following catagories:

1. The Refrigeration Components
2. The Electrical Components
3. The Vacuum Components

It is important that the operation of these components be fully understood in order to properly diagnose and repair air conditioning problems.

REFRIGERATION COMPONENTS

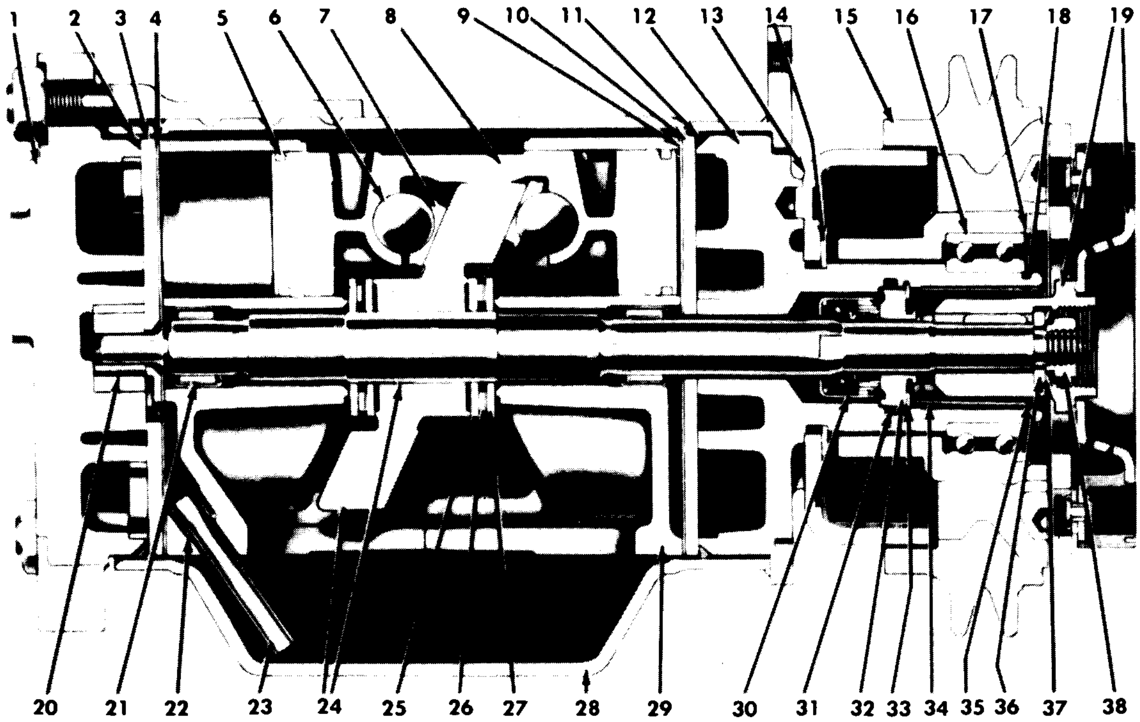
The refrigeration components are those which come in contact with and effect or are effected by the Refrigerant-12. They move it, cool it, warm it and regulate it.

COMPRESSOR

The prime purpose of the compressor (figure 10) is to take the low pressure refrigerant vapor produced by the evaporator and compress it into a high pressure, high temperature vapor which will be sent on to the condenser.

It utilizes the principle that "when a vapor is compressed, both its pressure and temperature are raised" which we have already discussed. The compressor is mounted above the engine in a special mounted bracket and is belt driven from the engine through an electromagnetic clutch pulley on the compressor.

The compressor has three double-acting pistons, making it a six cylinder compressor. The compressor has a 1.5 inch bore and 1.1875 inch stroke, giving it a total displacement of 12.6 cu. in. Identification of the compressor is by model and serial number stamped on a plate on top of the compressor.



1 Rear Head
2 Rear Head to Shell O-ring
3 Rear Discharge Valve Plate
4 Rear Suction Reed Plate
5 Piston Ring (Teflon)
6 Piston Drive Ball
7 Shoe Disc
8 Piston
9 Front Suction Reed Plate
10 Front Discharge Valve Plate
11 Front Head to Shell O-ring
12 Front Head
13 Coil and Housing Assembly
14 Coil Housing Retainer Ring
15 Pulley and Bearing Assembly
16 Pulley Bearing
17 Pulley Bearing Retainer Ring
18 Pulley and Bearing Retainer Ring
19 Clutch Hub and Drive Plate Assembly
20 Oil Pump Gears
21 Mainshaft Bearing (Rear)
22 Oil Inlet Tube O-ring
23 Oil Inlet Tube
24 Axial Plate and Mainshaft Assembly
25 Thrust Race
26 Thrust Bearing
27 Thrust Race
28 Compressor Shell
29 Cylinder Assembly
30 Shaft Seal
31 Shaft Seat Seat O-ring
32 Shaft Seal Seat
33 Shaft Seal Seat Retainer Ring
34 Felt Sleeve
35 Felt Sleeve Retainer
36 Spacer
37 Clutch Hub Retainer Ring
38 Shaft Nut

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Figure 10—Compressor Cross Sectional View

Clutch-Pulley

The movable part of the clutch drive plate is in front of the pulley and bearing assembly. The armature plate, the movable member, is attached to the drive hub through driver springs and is riveted to both members. The hub of the drive plate is pressed over a square drive key located in the compressor shaft. A spacer and retainer ring are assembled to the shaft and the assembly is held in place with a self-locking nut. The pulley rim, power element ring and pulley hub are formed into a final assembly by molding a frictional material between the rim and the hub with the power element ring imbedded in the forward face of the assembly.

A two-row ball bearing is pressed into the pulley hub and held in place by a retainer ring. The entire pulley and bearing assembly is then pressed over the front head of the compressor and secured by a retainer ring.

Clutch Coil

The coil is molded into the coil housing with a filled epoxy resin and must be replaced as a complete assembly. Three protrusions on the rear of the housing fit into alignment holes in the compressor front head. A retainer ring secures the coil and housing in place. The coil has 3.85 ohms resistance at 80°F. (26.7°C.) ambient temperature and will require no more than 3.2 amperes at 12 volts D.C. Since the clutch coil is not grounded internally, a ground lead is required as well as a "hot" lead. This will be discussed in greater detail in the Electrical Component discussion in this section.

Shaft Seal

The main shaft seal, located in the neck of the compressor front head, consists of the seal assembly with its ceramic seal face in a spring loaded cage. An "O" ring seal, located within the ceramic seal, provides a seal to the shaft surface. The contact surface of the shaft seal seat is finished to a high polish and must be protected against nicks, scratches and even fingerprints. Any surface damage will cause a poor seal. An "O" ring, located in an internal groove in the neck of the front head provides a seal with the outer diameter of the seal seat. A retainer ring, tapered side away from the seat, secures the seat in place. The hub and armature plate must be removed to gain access to the seal. A shaft seal kit contains all necessary replacement parts for field service.

After removing the clutch drive, pulley-bearing and coil housing assemblies, the rear head and internal mechanism (figure 10) may be removed from the compressor shell. Four threaded studs, welded to the compressor shell, locate the rear head and four lock nuts secure it in place.

Rear Head

The rear head (figure 11) has a machined cavity in the center for the oil pump gears. This cavity, in all compressors, is machined so that the eccentricity of the bore is approximately .042 inch to the LEFT of the centerline of the cavity. The counterclockwise rotation compressor used in some other systems has the eccentricity machined approximately .042 inch to the RIGHT of the cavity centerline. A small diameter hole is drilled in the head between the two. The unit number is stamped on a plate attached to the counterclockwise rotation head and a decal arrow indicates the direction of rotation.

Mainshaft

The central mainshaft, driven by the clutch-pulley when the coil is energized, extends through the front head to the rear head and oil pump cavity of the compressor. The shaft revolves in needle roller bearings located in the front and rear halves of the cylinder assembly. 3/16" internally drilled passage extends through the shaft from the rear oil pump cavity to the shaft seal cavity in the front compressor head. Four .078 inch holes, drilled at 90° to the main passage, direct oil under pump pressure to the shaft seal surfaces, thrust bearings and shaft-cylinder bearings.

Axial Plate

The axial plate is an angular shaped member pressed onto the mainshaft forming the mainshaft and wobble plate assembly (figure 11). A woodruff key prevents movement of the plate around the shaft. Location of the plate on the shaft is factory set and must not be changed. The very smooth angular faces of the plate are ground to be parallel within .0003 inches of each other. The plate changes the rotating action of the shaft into the reciprocating driving force for three pistons. The driving force is applied, through the drive balls and ball seats (shoe discs) to the midpoint of each of the double end pistons.

Cylinder Block

The cylinder block consists of a front and a rear half. Three piston bores are line bored in each half during production to assure proper alignment and parallelism. The two halves must be serviced as an assembly to assure correct relationship of parts.

Pistons

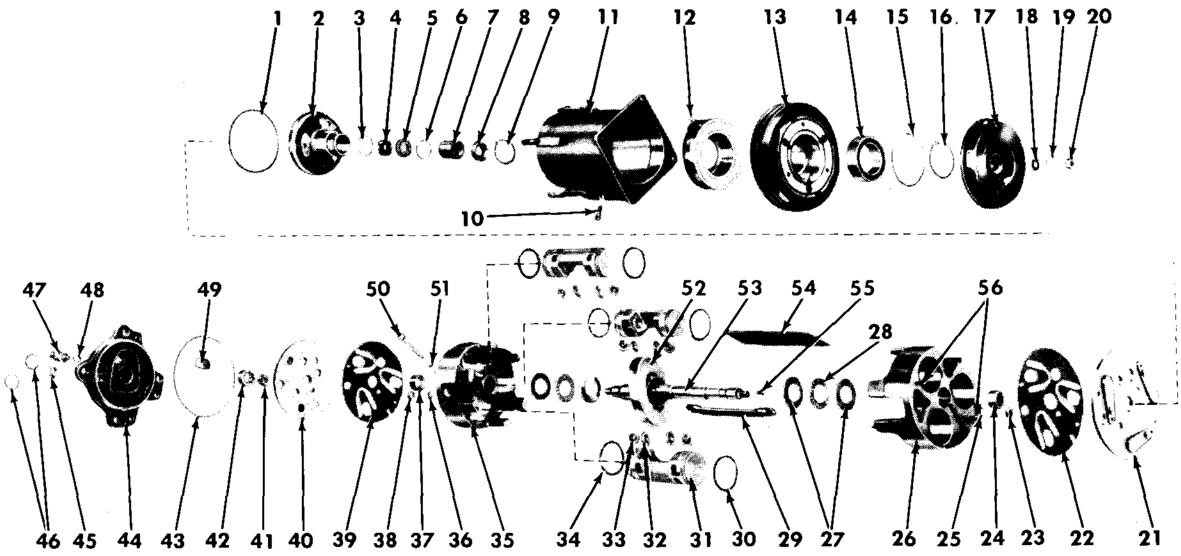
The cast aluminum double end pistons (figure 11), have special grooves to receive teflon piston rings. A notch in the casting web of each piston identifies the end of the piston which should be positioned toward the front end of the compressor. A spherical cavity is located on both inner faces of each piston to receive the piston drive balls.

Drive Balls

The hardened steel drive balls have a micro-finish. They are manufactured to a .0001 inch spherical tolerance and a .6248 - .6250 inch diameter tolerance.

Shoe Discs

The bronze shoe discs have one flat side, which contacts the axial plate, and one concave surface into which the drive ball fits. Ten discs are provided in



1 O-Ring
2 Front Head
3 O-Ring
4 Shaft Seal Assembly
5 Seal Seat
6 Seal Seat Retainer Ring
7 Absorbent Sleeve
8 Seal Retainer
9 Clutch Coil Retainer Ring
10 Oil Drain Plug
11 Compressor Shell
12 Clutch Coil and Housing Assy.
13 Pulley
14 Bearing
15 Bearing Retainer
16 Pulley Retainer Ring
17 Clutch Plate and Hub Assy.
18 Spacer
19 Retainer Ring
20 Lock Nut
21 Front Discharge Valve Plate Assembly
22 Front Suction Reed
23 Bushing
24 Needle Bearing
25 O-Ring
26 Front Cylinder Half
27 Thrust Races
28 Thrust Bearing
29 Discharge Crossover Tube
30 Teflon Piston Ring
31 Teflon Ring Type Piston
32 Shoe Disc
33 Ball
34 Teflon Piston Ring
35 Rear Cylinder Half
36 O-Ring
37 Needle Bearing
38 Bushing
39 Rear Suction Reed
40 Rear Discharge Valve Plate Assembly
41 Inner Oil Pump Gear
42 Outer Oil Pump Gear
43 O-Ring
44 Rear Head
45 Lock Nut
46 O-Rings
47 Pressure Relief Valve
48 O-Ring
49 Suction Screen
50 Oil Pick-Up Tube
51 O-Ring
52 Axial Plate
53 Shaft
54 Suction Crossover Cover
55 Key
56 Dowel Pins

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Figure 11—Compressor Exploded View

.0005 inch thickness variations including a basic ZERO disc for simple field gauging operations. Discs are marked with their size which corresponds to the last three digits of the piece part number.

Selection from this group must be made to provide .0005 inch to .0010 inch total clearance between the shoe discs and the axial plate at the tightest place throughout its 360° rotation (figure 12).

Thrust Bearings

The thrust bearings, sandwiched between two thrust races (see below) are located between the shoulders of the axial plate and the shoulders of both the front and rear cylinder hubs.

Thrust Races

The steel thrust races are ground to fixed thicknesses. A total of 14 races in increments of .0005 inch thickness are available for field service. As in the case of the ball seats the thrust races will be identified on the part by their thickness, the number on the race corresponding to the last three digits of the piece part number. The FRONT combination of a race, bearing and race is selected to provide the proper head clearance between the top of the cylinder and the underside of the suction and discharge valve plates. The REAR end combination of bearing and races is selected to obtain .0005 inch low limit to .0015 inch high limit running clearance between the hub surfaces of the axial plate and the front and rear hubs

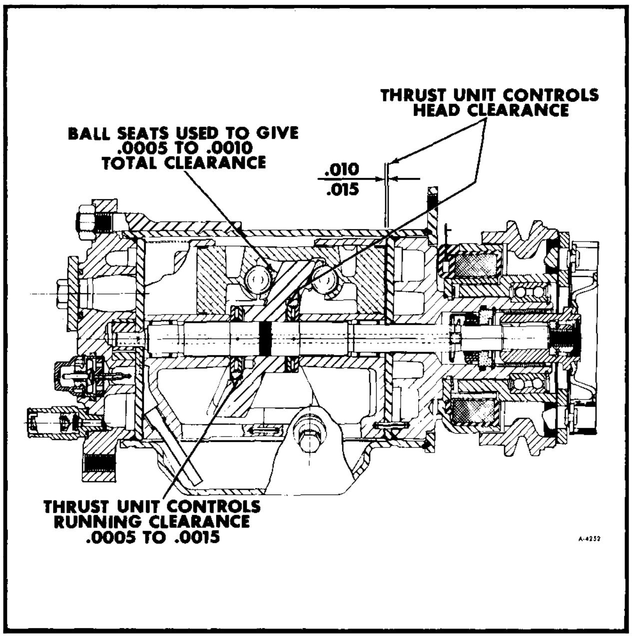


Figure 12—General Running Clearances

of the cylinder (figure 12). This allows .001 inch tolerance between the high and low limits.

Oil Pump Gears

The oil pump gears are made of sintered iron. The inner, or driver gear has a "D" shaped hole in the center which fits over a similar area on the rear of the mainshaft.

Shell

The compressor shell has a mounting flange on the front end and four threaded studs welded to the outside of the rear end. The oil sump is formed into the shell and a baffle plate is welded over the sump on the inside of the shell.

Heads

Both front and rear heads have an irregular shaped casting web. These webs provide the necessary seals to the surfaces of the discharge plates and prevent high pressure vapor from flowing into the low pressure cavity.

Suction Screen

A fine mesh inlet (or suction) screen is located in the low pressure cavity of the rear head. Its purpose is to stop any material which could damage the compressor mechanism.

Suction Cross-Over Cover

The suction cross-over cover is assembled into the dove-tail cavity in the front and rear cylinder castings to form a passage for the low pressure vapor to flow the rear head of the compressor to the front head.

Discharge Cross-Over Tube

Since the double acting pistons supply high pressure vapor at both ends of the compressor the discharge tube is needed to supply a path for the high pressure vapor to pass from the front to the rear head. Should the cylinder halves be separated during service operations a service type discharge tube, bushings and "O" rings must be substituted.

Suction Reed Valves

A separate three-reed suction valve disc is assembled to both front and rear heads. These reeds open when the piston is on the intake portion of the stroke to allow the low pressure vapor to flow into the cylinder. When the piston reverses and begins the compression portion of its stroke the reed valves close against their seats, thus preventing the high pressure vapor from being forced back into the low side of the system.

Discharge Valves

The two discharge valve plate assemblies act to direct high pressure vapor into the head castings. When the piston reverses into its suction stroke the high pressure on the opposite sideof the plate causes the reeds to close thus maintaining the differential of pressure between high and low pressure areas. The discharge plates include the valves and the retainers which prevent the high pressure from distorting the valves during the pressure stroke of the piston.

Head to Shell Seals

Two large diameter "O" rings internally seal the front and rear heads to the shell. A chamfered edge on the head castings creates a squeezing action between the discharge valve plates, the compressor, and the inside surface of the shell.

Compressor Connector

Compressor connectors, are attached to the compressor rear head by means of a single bolt and lock washer. All have inlet and outlet connections connected by a strap to form an integral unit.

Pressure Relief Valve

The pressure relief valve, located on the compressor rear head, is simply a safety valve designed to open automatically if the system pressure should reach a predetermined level high enough to cause system damage. After the pressure drops to a safe level the valve will close. After such an occurrence, the system should be thoroughly checked to discover and correct the cause of the abnormal pressure increase, and then should be purged, evacuated and charged.

REFRIGERANT LINES

Special refrigerant hose lines are required to carry the refrigerant liquid and vapor between the various system components. The hose line with the smallest diameter is called the high pressure liquid line. It is routed from the condenser or receiver-dehydrator to the evaporator or thermostatic expansion valve. The large diameter hose line connecting the compressor and evaporator is the low pressure vapor line. The large diameter hose between the compressor and condenser is the high pressure vapor discharge line.

These hoses are constructed with a synthetic material core covered with a woven metal mesh which is, in turn, covered by a woven fabric and coated for extra protection. This hose is so constructed to withstand the extreme pressures and temperatures found in the modern refrigeration system. **None but special refrigerant type hoses should be used.**

All systems make use of swaged type connections (hose to metal fittings) with metal to metal fittings being made using "O" rings. Care must be taken when making these connections that they not be turned down too tightly or damage to the "O" rings may result.

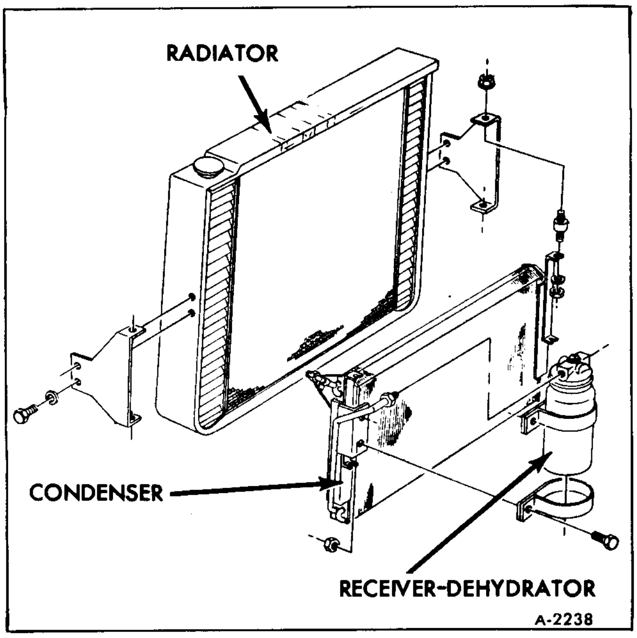


Figure 13—Condenser and Receiver-Dehydrator, Type 1

Flexible refrigerant hoses should not be permitted to contact the hot engine manifold nor should they be bent into a radius of less than 10 times their diameter.

FAN SLIP CLUTCH

A special engine fan is used. It is a seven bladed fan, limited by means of a viscous clutch to a maximum speed of 3200 rpm, regardless of the speed of the engine. The silicone fluid in the clutch transmits only enough torque to drive the fan at this limited speed, thus avoiding excessive noise and power consumption by the fan at higher engine speeds. A temperature modulating device further limits fan speed to 1000 rpm until ambient temperature at the modulating device reaches 140°F. at which time fan speed will be allowed to increase to 3200 rpm. Some adjustment of the modulating device is possible.

CONDENSER

The condenser receives the high pressure, high temperature gas which is pumped from the compressor and condenses it into a high pressure high temperature liquid. The heated gas which enters near the top of the condenser is cooled by giving off heat to the metal surfaces of the condenser. The heat is then extracted from these metal surfaces by the ram air passing over the condenser.

The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the vehicle and from the engine fan.

The condenser is similar in design to the ordinary radiator but is designed to withstand much higher pressures (figure 13).

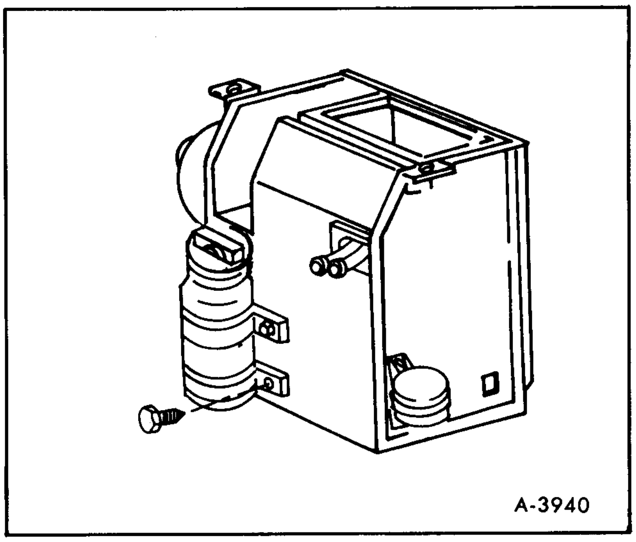


Figure 14—Location of Receiver Dehydrator, Type 2

RECEIVER-DEHYDRATOR

The receiver-dehydrater (figures 13 and 14), sometimes called the receiver-drier or just drier, is so called because of its function of receiving liquid refrigerant from the condenser and, by means of a dehydrating agent, removes any water present from it. This chemical compound is called a desiccant. The desiccant is held in place in a felt bag in the drier. Average receiver-drier desiccants collect and hold about 50 drops of water. This may not seem like much until you realize that one drop of water can block the whole air conditioning system.

The drier also filter-traps any foreign matter which may have entered the system during assembly or during any service work. This is accomplished by means of a fine wire screen.

Still another function of the receiver dehydrator is to act as a reservoir to furnish a constant column of liquid refrigerant to the expansion valve at all times. Since the entering liquid refrigerant may have some gas in it, the tank acts as a separator. The gas will tend to rise and the liquid will drop to the bottom. This is why the pick-up tube extends to the bottom of the tank insuring gas free liquid R-12 to the expansion valve. The storage of the refrigerant is temporary, and is dependent on the demand placed on it by the expansion valve.

While having no real function to perform in the system, the sight glass is a valuable aid in determining whether or not the refrigerant charge is sufficient and for eliminating some guess work in diagnosing difficulties. The sight glass, is built into the receiver-dehydrator outlet connection and is designed and located so that a shortage of refrigerant at this point will be indicated by the appearance of bubbles beneath the glass. The dust cap provided should be kept in place when the sight glass is not in use.

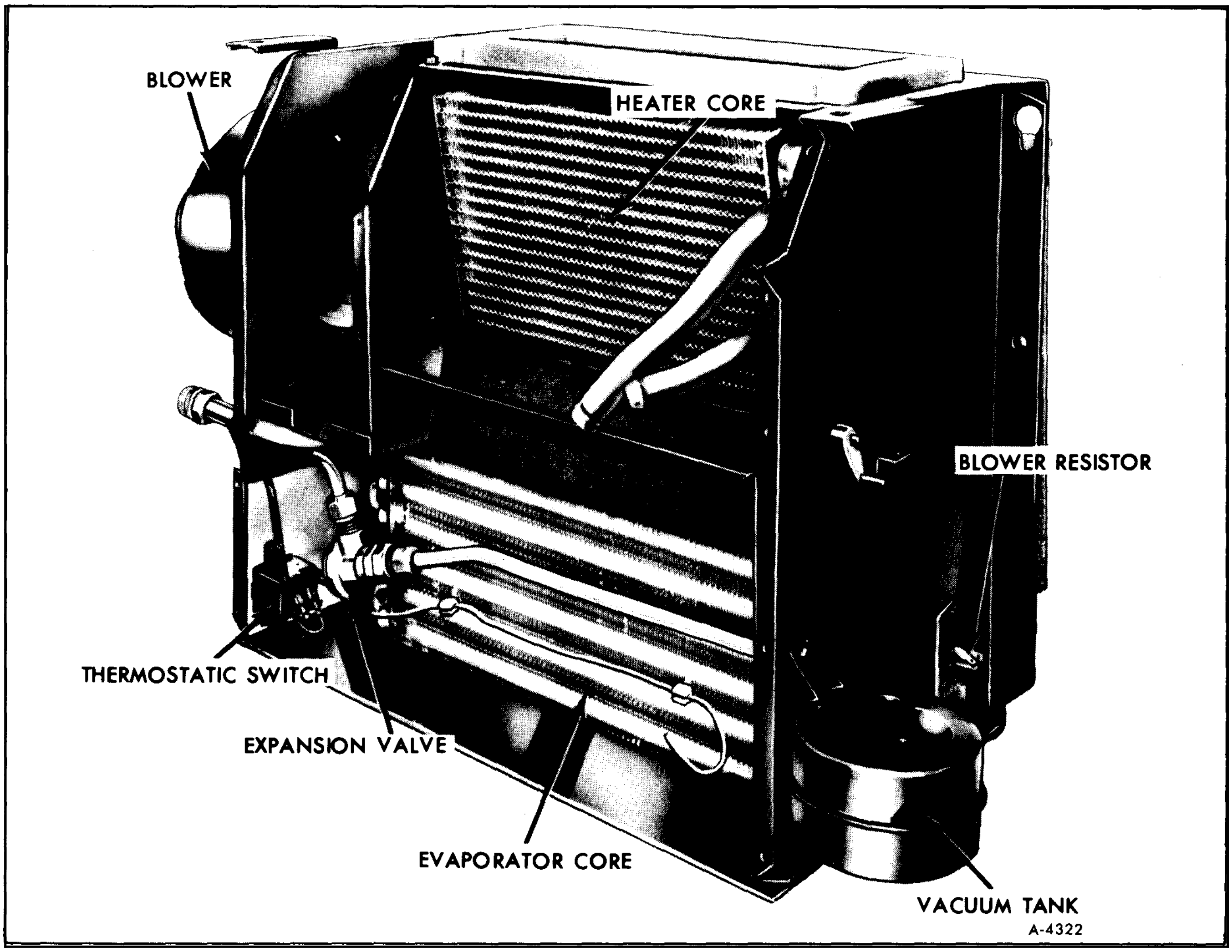


Figure 15—Evaporator Housing Components, Type 1

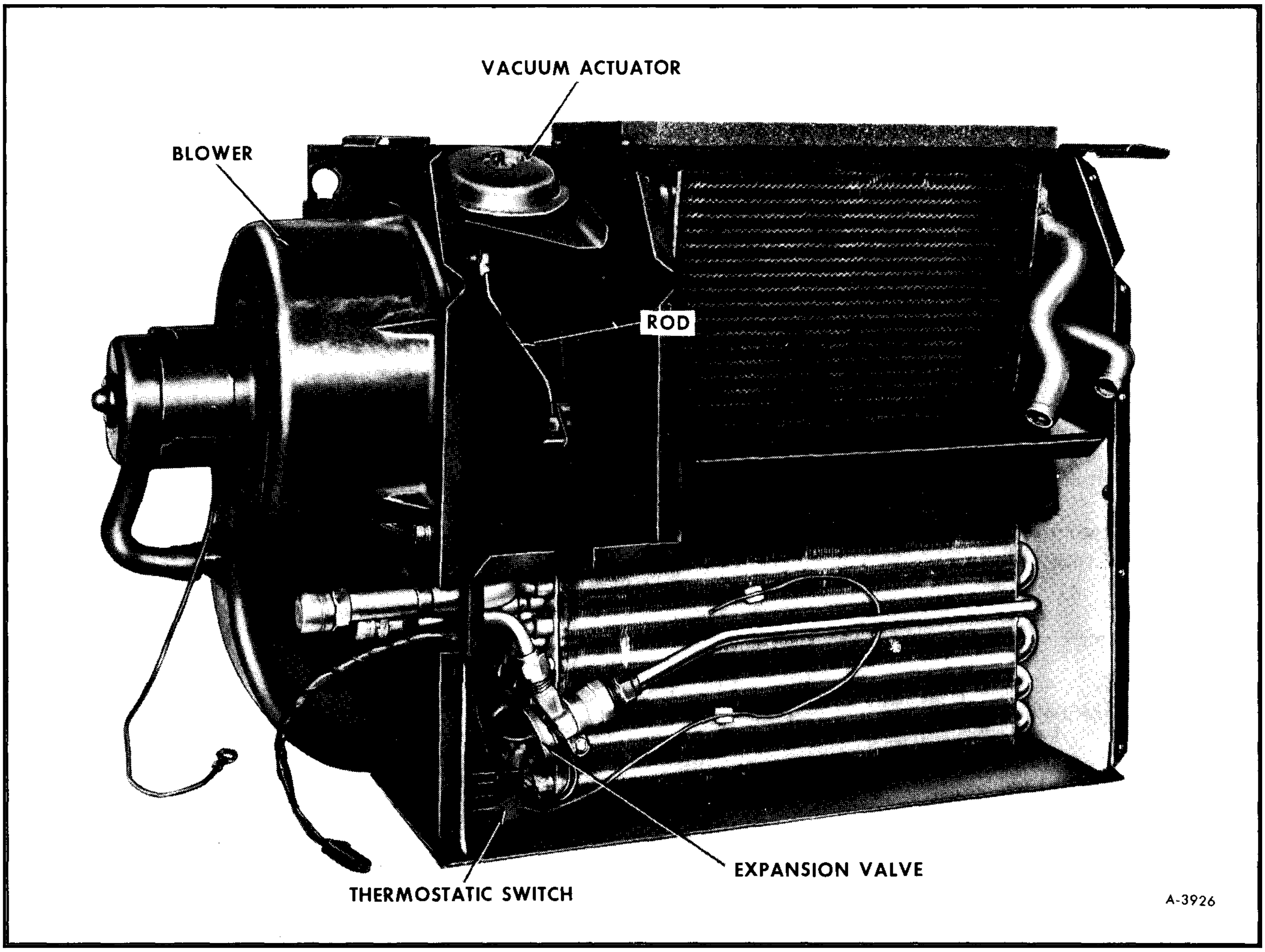


Figure 16—Evaporator Housing Components, Type 2

THERMOSTATIC EXPANSION VALVE

The valve consists primarily of the power element, body, actuating pins, seat and orifice. At the high pressure liquid inlet, is a fine mesh screen which prevents dirt, filings or other foreign matter from entering the valve orifice.

The valve is located inside the evaporator housing (See figures 15 and 16).

When the valve is connected in the system, high pressure liquid refrigerant enters the valve through the screen from the receiver-dehydrator or condenser and passes on to the seat and orifice. Upon passing through the orifice the high pressure liquid becomes low pressure liquid. The low pressure liquid leaves the valve and flows into the evaporator core where it absorbs heat from the evaporator core and changes to a low pressure vapor, and leaves the evaporator core as such. The power element bulb is clamped to the low pressure vapor line just beyond the outlet of the evaporator (figure 17).

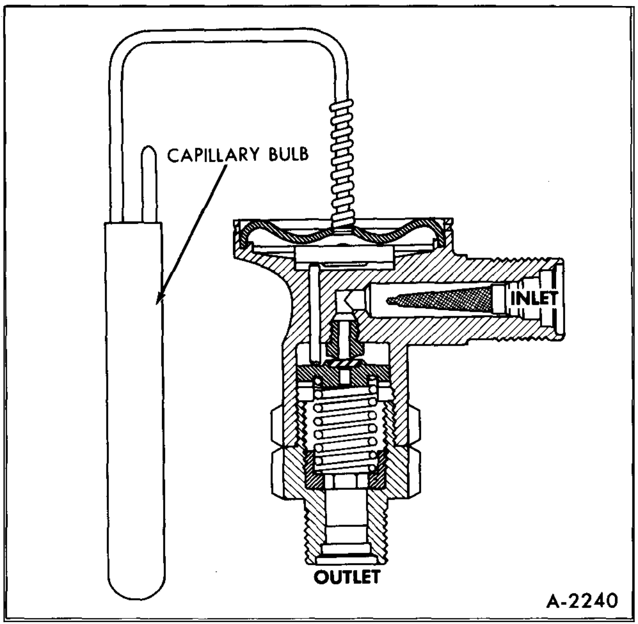


Figure 17—Expansion Valve Cross-Section

The operation of the valve is quite simple. It is a matter of controlling opposing forces produced by a spring and the refrigerant pressures. For example: The pressure in the power element is trying to push the seat away from the orifice, while the adjusting spring is trying to force the seat toward the orifice. These opposing pressures are established in the design of the valve so that during idle periods the adjusting spring tension and the refrigerant pressure in the cooling coil are always greater than the opposing pressure in the power element. Therefore, the valve remains closed. When the compressor is started, it will reduce the pressure and temperature of the refrigerant in the cooling coil to a point where the vapor pressure in the power element becomes the stronger. The seat then moves off the orifice and liquid starts to flow through the valve orifice into the cooling coil.

The purpose of the power element is to help determine the quantity of liquid that is being metered into the cooling coil. As the temperature of the low pressure line changes at the bulb, the pressure of the vapor in the power element changes, resulting in a change of the position of the seat. For example, if the cooling coil gets more liquid than is required, the temperature of the low pressure line is reduced and the resultant lowering of the bulb temperature reduces the pressure of the vapor in the power element, allowing the seat to move closer to the orifice. This immediately reduces the amount of liquid leaving the valve. Under normal operation, the power element provides accurate control of the quantity of refrigerant to the cooling coil.

To employ our tire pump analogy once more for clarity, it is the same situation that would exist if you were inflating a tire with a very slow leak. Providing you pumped the air into the tire as fast as it leaked out, you would be able to maintain pressure even though the air would merely be circulating through the tire and leaking out through the puncture.

EVAPORATOR

The function of the evaporator (figures 15 and 16) is to cool and dehumidify the air flow before it enters the passenger compartment. The evaporator assembly consists of an aluminum core enclosed in a sheet metal housing located in the front of the vehicle chassis. Two water drain holes are located in the bottom of the housing. Two refrigerant lines are connected to the sides of the evaporator core: the small inlet line on the right, and the larger outlet line on the left.

The temperature sensing bulb of the expansion valve is clamped to the outlet pipe of the evaporator core. The high pressure liquid refrigerant, after it is metered through the expansion valve, passes into the evaporator core where it is allowed to expand under reduced pressure. As a result of the reduced pressure the refrigerant begins to expand and return to the original gaseous state. To accomplish this transformation it begins to boil.

The boiling action of the refrigerant demands heat. To satify the demand for heat, the air passing over the core gives up heat to the evaporator and is subsequently cooled.

Figure 16 shows the evaporator housing on vehicles equipped with the additional air conditioning outlets shown in Figure 25. The vacuum actuator rod operates an auxiliary air flow door.

LOW REFRIGERANT CHARGE PROTECTION SYSTEM

The compressor discharge pressure switch (figure 18) performs the function of shutting off the compressor when it senses low refrigerant pressure. The switch is located in the evaporator inlet line (high pressure). The switch electrically is wired in series between the compressor clutch, the thermostatic switch, and the master switch on the control. When the switch senses low pressure it breaks contact and opens the circuit to the compressor clutch, thus shutting off the A/C system and preventing compressor failure or seizure.

The compressor discharge pressure switch also performs the function of the ambient switch as the pressure at the switch varies directly with ambient temperatures. The compressor should **not** run below 25°F. (-3.9°C.) ambient or 37 psi at the switch. The

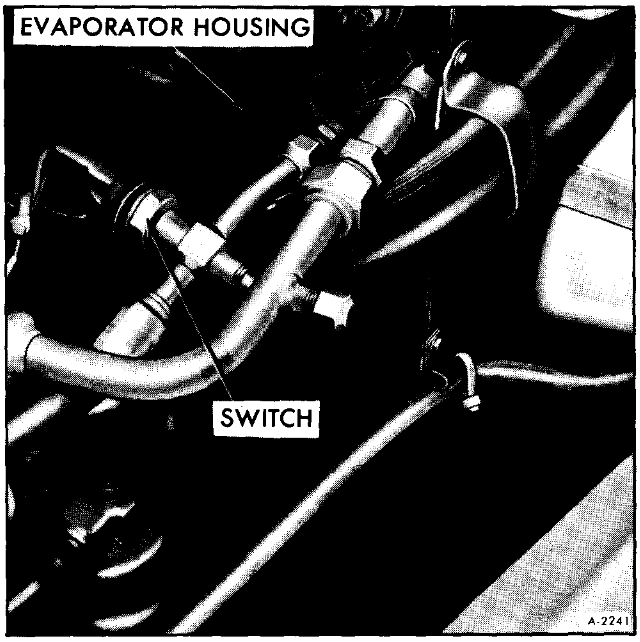


Figure 18—Compressor Discharge Pressure Switch, Typical

compressor should run in A/C modes above 45°F. (7.2°C.) ambient or 42 psi at the switch.

The switch interacts with other switches so that in an A/C system where the compressor will **not** operate above 45°F. (7.2°C.) ambient the following components should be checked for continuity:

1. Compressor discharge pressure switch.
2. Master switch (on control head).
3. Thermostatic switch.

If both switches show proper continuity, check the harness for shorts or improper ground conditions. The switch also contains the high pressure line service ports.

ELECTRICAL COMPONENTS

COMPRESSOR CLUTCH ASSEMBLY

The clutch assembly (figure 10) consists of the coil, pulley and armature. The coil is basically an electro-magnetic device charged by the battery. When energized, it sends a magnetic force through the soft iron in the pulley, which is constantly turning as a result of being belt driven by the engine, to the armature. The armature is keyed to the compressor shaft. When magnetically energized the armature is pulled into the pulley causing the compressor to be activated.

BLOWER

The blower (figure 19) is simply a device for moving air. The blower used in this vehicle is a centrifugal type fan which forces air across the evaporator and/or heat cores to the vehicle interior.

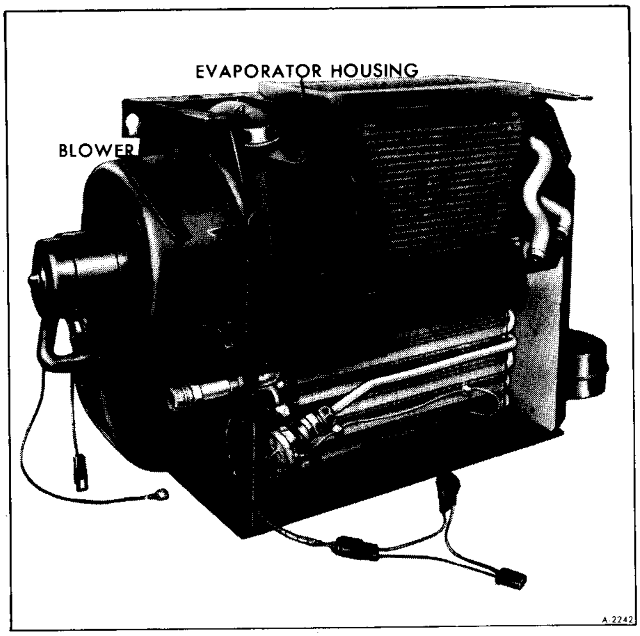


Figure 19—Blower Location, Typical

THERMOSTATIC SWITCH

The thermostatic switch (figures 15 and 16) is basically a bimetal switch which is controlled by a sensing tube across the outlet of the evaporator core. As the evaporator cools the sensing tube the bimetal switch turns off the clutch and disengages the compressor until the tube becomes warm enough to turn the compressor back on.

BLOWER SWITCH, RELAY & RESISTOR

The blower switch, blower relay and the blower resistor must be discussed together because of their interrelations with each other. The blower switch located on the instrument panel regulates low, medium and high blower speeds through a blower resistor system. This resistor (figure 15) regulates the amount of current fed to the blower thereby regulating the blower speed. The blower relay (figure 20) provides the proper connections for the low and medium speeds through the resistor assembly and direct battery current to the blower for high speed.

VACUUM COMPONENTS

The vacuum system (figure 21) consists of three basic components:

1. Vacuum tank.
2. Modes or vacuum switches.
3. Control Panel.

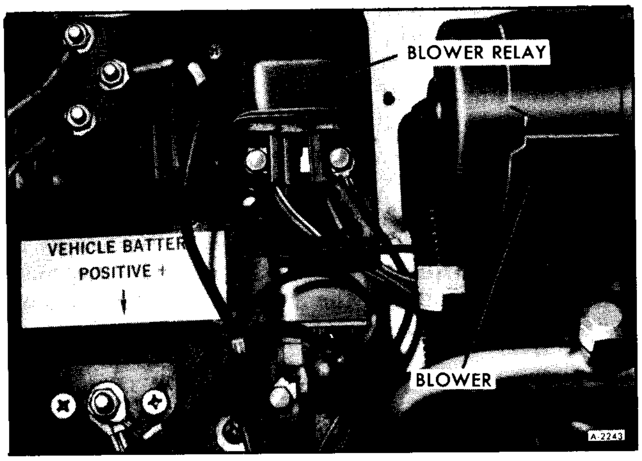


Figure 20—Blower Relay

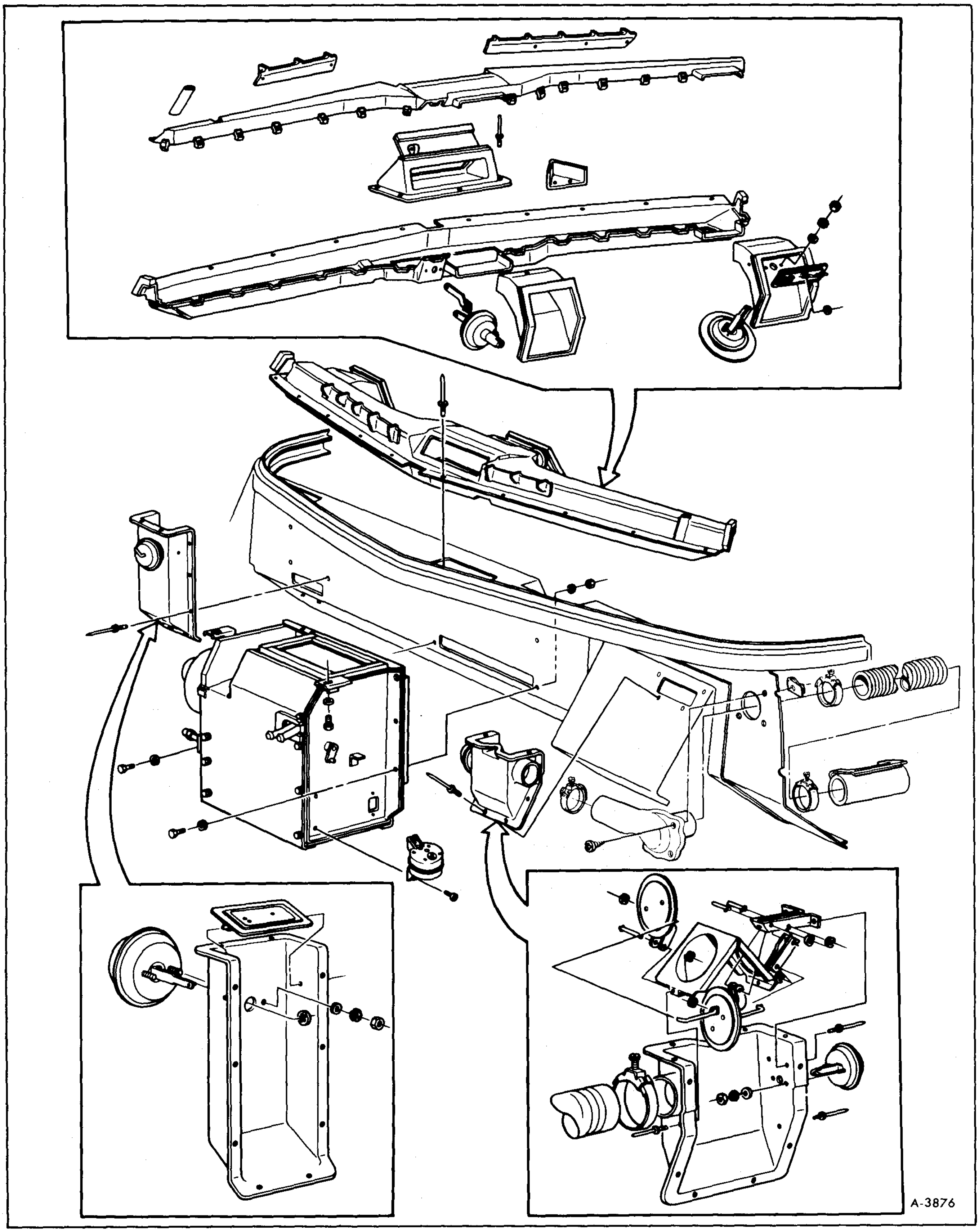


Figure 21—Vacuum Ducts and Controls

The vacuum tank is simply a reservoir of vacuum to be utilized when engine vacuum drops too low to effectively actuate the vacuum components.

The modes are diaphragm switches which open and close the various doors in the air movement system allowing "Heat" "Air Conditioning", "Defrost" and "Vent" as shown on the control panel (figures 23 and 24).

The control panel consists of a temperature valve and a select valve (See figure 22). This is the control center for directing vacuum through vacuum lines to the different modes to achieve the temperatures desired for passenger and driver comfort. More information concerning the vacuum system and the routing of the lines and operation of the modes will be covered later in this section.

PRIMARY CAUSES OF SYSTEM FAILURE

Leaks

A shortage of refrigerant causes oil to be trapped in the evaporator. Oil may be lost with the refrigerant at point of leakage. Both of these can cause compressor seizure.

Oil circulates in the globules with the vapor. It leaves the compressor by the action of the pistons and mixes with the refrigerant liquid in the condenser. The oil then enters the evaporator with the liquid and, with the evaporator properly flooded, is returned to the compressor through the low pressure line. Some of the oil returns as globules in the vapor but more importantly, it is swept as a liquid along the walls of the tubing by the velocity of the vapor. If the evaporator is starved, the oil cannot return in sufficient quantities to keep the compressor properly lubricated.

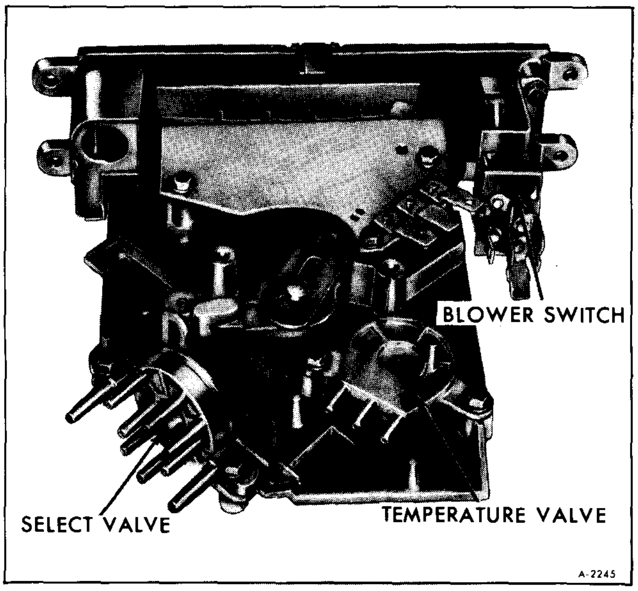


Figure 22—Control Panel Components

High Temperature and Pressure

An increase in temperature causes an increase in pressure. This accelerates chemical instability in clean systems. Other results are brittle hoses, "O" ring gaskets, and by-pass valve diaphragms with possible decomposition, broken compressor discharge reeds, and seized compressor bearings.

A fundamental law of nature accounts for the fact that when a substance, such as a refrigerant, is increased in temperature, its pressure is also increased.

Any chemical reactions caused by contaminants already in the system are greatly accelerated as the temperature increases. A 15°F. (9.4°C.) rise in temperature doubles the chemical action.

While temperature alone can cause the synthetic rubber parts to become brittle and possibly to decompose, the increased pressure can cause them to rupture or blow.

As the temperature and pressure increases, the stress and strain on the discharge reeds also increases. This can result in broken reeds. Due to the effect of the contaminants caused by high temperature and pressure, compressor bearings can be caused to seize.

High temperature and pressure is also caused by air in the system.

Air in the System

Air results from a discharged system or careless servicing procedures. This reduces system capacity and efficiency and causes oxidation of oil into gum and varnish.

When a leak causes the system to become discharged, the resulting vacuum within the system will cause air to be drawn in. Air in a system is a non-condensable gas and will build up in the condenser as it would in an air compressor tank. The resultant heat produced will contribute to the conditions discussed previously.

Many systems are contaminated and also reduced in capacity and efficiency by careless servicing procedures.

Too frequently, systems which have been open to the atmosphere during service operations have not been properly purged or evacuated. Air is also introduced into the system by unpurged gauge and charging lines. Remember that any air in the system is too much air.

Poor Connections

Hose clamp type fittings must be properly made. Hose should be installed over the sealing flanges and with the end of the hose at the stop flange. The hose should never extend beyond the stop flange. Locate the clamp properly and torque as recommended. Be especially careful that the sealing flanges are not nicked or scored or a future leak will result.

When compression fittings are used, over-tightening can cause physical damage to the "O" ring gasket and will result in leaks. The use of torque and backing wrenches is highly recommended. When making a connection with compression fittings, the gaskets should always be first placed over the tube before inserting it in the connection.

Another precaution - inspect the fitting for burrs which can cut the "O" ring.

Restrictions

Restrictions may be due to powdered desiccant or dirt and foreign matter. This may result in starved evaporator and loss of cooling, high temperature at the bypass hose, or a seized compressor.

When the amount of moisture in a system sufficiently exceeds the capacity of the desiccant, it can break down the desiccant and cause it to powder. The powder passes through the dehydrator screen with the refrigerant liquid and is carried to the expansion valve screen. While some of it may pass through the valve screen into the evaporator, it may quickly build up to cause a restriction.

Due to the fact that sufficient oil then cannot be returned to the compressor, it may seize.

Dirt

Dirt, which is any foreign material, may come from cleaner residues, cutting, machining, or preserving oils, metal dust or chips, lint or dust, loose rust, soldering or brazing fluxes, paint or loose oxide scale. These can also cause seized bearings by abrasion or wedging, discharge and expansion valve failure, decomposition of refrigerant and oil, or corrosion of metal parts.

Corrosion

Corrosion and its by-products can restrict valve and drier screens, roughen bearing surfaces or hasten fatiguing of discharge reeds. This can result in high temperature and pressure, decomposition or leaks. In any event, this means a damaged compressor.

From this, we can see the vicious circle that can be produced in a refrigerating system to cause its failure. Corrosion can be the indirect cause of leaks and leaks can be the direct cause of corrosion. We can also see the important role servicemen play in maintaining chemical stability.

The major cause of corrosion is moisture.

Moisture

Moisture is the greatest enemy of refrigerating systems. Combined with metal, it produces oxide, Iron Hydroxide, and Aluminum Hydroxide. Combined with R-12, it produces Carbonic acid, Hydrochloric acid, and Hydro-fluoric acid. Moisture can also cause freeze-up of an expansion valve and powdered desiccant.

Although high temperature and dirt are responsible for many difficulties in refrigerating systems, in most instances it is the presence of moisture in the system that accelerates these conditions. It can be said, therefore, that moisture is the greatest problem of all. The acids that it produces, in combination with both the metals and the refrigerant, causes damaging corrosion. While the corrosion may not form as rapidly with R-12 as with some other refrigerants, the eventual formation is as damaging.

If the operating pressure and temperature in the evaporator is reduced to the freezing point, moisture in the refrigerant can collect at the orifice of the expansion valve and freeze. This temporarily restricts the flow of liquid causing erratic cooling.

As previously mentioned, moisture in excess of the desiccant's capacity can cause it to powder.

Points to Remember

That the inside of the refrigerant system is completely sealed from the outside world. If that seal remains broken at any point — the system will soon be damaged.

That complete and positive sealing of the entire system is vitally important and that this sealed condition is absolutely necessary to retain the chemicals and keep them in a pure and proper condition.

That all parts of the refrigerant system are under pressure at all times, whether operating or idle, and that any leakage points are continuously losing refrigerant and oil.

That the leakage of refrigerant can be so silent that the complete charge may be lost without warning.

That refrigerant gas is heavier than air and will rapidly drop to the floor as it flows from a point of leakage.

That the pressure in the system may momentarily become as high as 480 lbs. per square inch.

That the total refrigerant charge circulates through the entire system at least once each minute.

That the compressor is continually giving up some lubricating oil to the circulating refrigerant and depends upon oil in the returning refrigerant for continuous replenishment. Any stoppage or major loss of refrigerant will therefore damage the compressor.

That the extreme internal dryness of a properly processed system is a truly desert condition, with the drying material in the receiver or accumulator holding tightly onto the tiny droplets of residual moisture.

That the attraction of the drying material for mositure is so powerful that if the receiver or accumulator is left open, moisture will be drawn in from the outside air.

That water added to the refrigerant will start chemical changes that can result in corrosion and eventual breakdown of the chemicals in the system. Hydrochloric acid is one result of an R-12 mixture with water.

That air in the refrigerant system may start reactions that can cause malfunctions.

That the drying agent in the receiver-dehydrator is Activated Silica Alumina.

That the inert gas in the expansion valve-capilary line is carbon dioxide.

CONTROLS (FIGURES 23 AND 24)

Combined air conditioning and heating system controls are located on the instrument panel in the upper right-hand corner. There are three separate controls; "FAN" lever, to control speed of blower; "OFF," "A/C," "VENT," "HEATER," "DEF" lever to control direction of air flow and which system is to be operated; "RECIRC," "COLD," "HOT" lever to control the temperature of the air. The three levers may be placed in many combined positions to deliver the climate conditions most desirable at any given time.

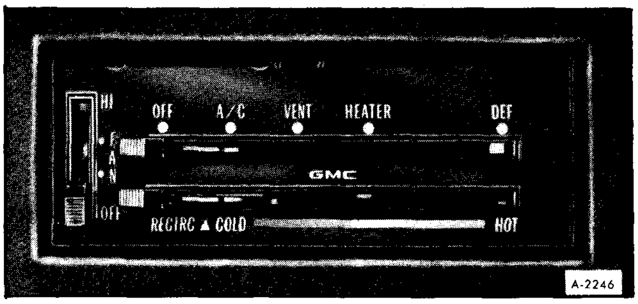


Figure 23—Air Conditioning Controls, Type 1

OPERATION

- "Type 1 Fan" (figure 23) — The fan switch has four positions; "OFF" and three blower speeds ranging from "LO" to "HI." The fan will not operate unless the top lever has been moved from the "OFF" position, and in order to operate the fan in the "HI" position the engine must be running.

- "Type 2 Fan" (figure 24) — The fan switch has four positions; "LO" and three blower speeds ranging to "HI". Fan will operate whenever the key is in the "RUN" or "ACCESSORY" position. In order to operate the fan in the "HI" position the engine must be running.

- "OFF", "A/C", "VENT", "HEATER", "DEF" (figures 23 and 24) — With the lever in the "OFF" position the system is off, except for the blower. With the lever in the "A/C" position the air conditioning system is activated.

With the lever in the "VENT" position, 100% outside air enters the driver's compartment. This setting is for use during periods of less severe heat and humidity, air flow is identical to air flow in "A/C" position, however, the air conditioning compressor is not operating. Temperature of incoming air may be controlled by moving the temperature lever to the desired position. Any one of the blower speeds may be selected.

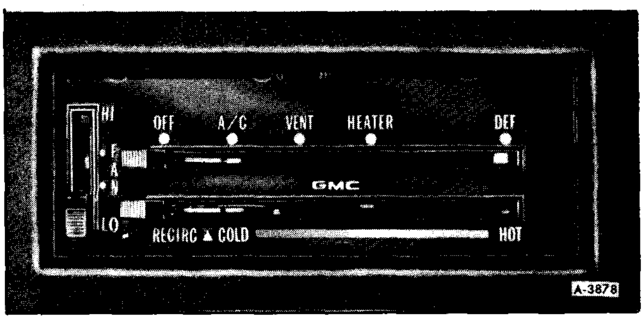


Figure 24—Air Conditioning Controls, Type 2

With the lever in the "HEATER" position, air will flow through the heater floor distributor outlets and the two center instrument panel outlets (with a slight flow of air to the defroster outlet). For maximum heat, move the temperature lever to "HOT" position and "FAN" switch lever to "HI" position.

Heating system output can be varied by moving temperature lever and "FAN" lever to different positions.

With the lever in "DEF" position, system operates the same as in the "HEATER" position except most of the air flow will be through the defroster outlets at the windshield.

• TYPE 1 "RECIRC", "COLD", "HOT" (figures 23 and 24) — This lever, used in conjunction with the system selector lever ("OFF", "A/C", "VENT", "HEATER", "DEF") and the "FAN" switch lever, will control the temperature of the output air being distributed. With the lever in the "RECIRC" position (and the upper lever in the "A/C" position) the blower automatically goes to "HI" speed providing the engine is running. This position uses 80% recirculated air. This setting will provide maximum cooling. In combination with "A/C" setting moving the temperature lever to the "COLD" position provides 100% outside air. Further movement of the temperature lever to the right (toward "HOT" position) will heat the dehumidified air to the desired temperature. The "FAN" switch can be set to meet air flow requirements.

• TYPE 2 "RECIRC", "COLD", "HOT" (figure 25) — The Type 2 lever differs in function, though not in appearance from the Type 1 lever. The Type 2 system is identified by additional air outlets, located below the instrument panel (as shown). With the lever in the "RECIRC" position, the additional air outlets are activated to provide maximum cooling. 100% outside air is used exclusively, regardless of lever position. The blower speed may be varied by moving the "FAN" switch position. The "COLD" and "HOT" positions allow for temperature modulation using the standard air outlets, as in the Type 1 system.

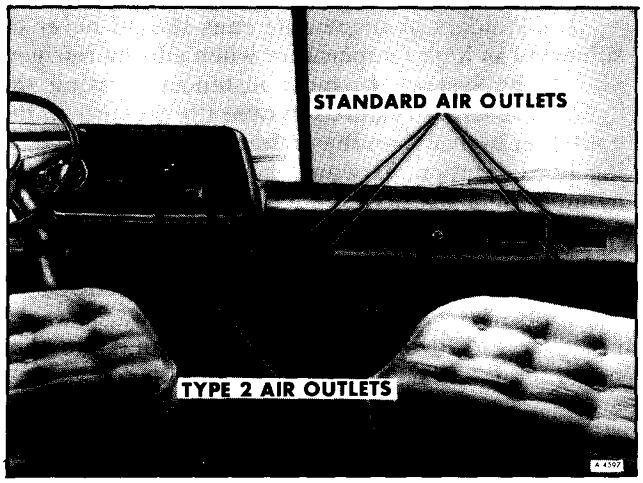


Figure 25—Location of Additional Air Conditioning Outlets

CAUTION: *Operate in "DEF" position for 30 seconds before switching to "A/C". This will remove humid air from the system and minimize rapid fogging of the glass which can occur if humid air is blown onto a cool windshield.*

• Clear windshield, rear window, outside mirrors, and all side windows of ice and snow before driving vehicle.

• Operate blower on "HI" for a few seconds before moving the vehicle, to clear the air intake of snow to further reduce the possibility of fogging on inside of windshield.

GENERAL INFORMATION

In any vocation or trade, there are established procedures and practices that have been developed after many years of experience. In addition, occupational hazards may be present that require the observation of certain precautions or use of special tools and equipment. Observing the procedures, practices and precautions of servicing refrigeration equipment will greatly reduce the possibilities of damage to the customers' equipment as well as virtually eliminate the element of hazard to the serviceman.

PRECAUTIONS IN HANDLING REFRIGERANT-12

Refrigerant-12 is transparent and colorless in both the gaseous and liquid state. It has a boiling point of 21.7°F below zero and, therefore, at all normal temperatures and pressures it will be a vapor. The vapor is heavier than air, and is nonflammable, nonexplosive, nonpoisonous (except when in contact with an open flame) and noncorrosive (except when in contact with water).

WARNING: THE FOLLOWING PRECAUTIONS IN HANDLING R-12 SHOULD BE OBSERVED AT ALL TIMES.

1. Refrigerant should not be exposed to the radiant heat from the sun since the resulting increase in pressure may cause the safety valve to release or the cylinder or can to burst.

2. Cylinders or disposable cans should never be subjected to high temperature when adding refrigerant to the system. In most instances, heating the cylinder or can is required to raise the pressure in the container higher than the pressure in the system during the operation. It would be unwise to place the cylinder on a gas stove, radiator or use a blow torch while preparing for the charging operation, for a serious accident can result. Remember, high pressure means that great forces are being exerted against the walls of the container. A bucket of warm water, not over 125°F, or warm wet rags round the container is all the heat that is required.

3. Do not weld or steam clean on or near the system. Welding or steam cleaning can result in a dangerous pressure buildup in the system.

4. Discharging large quantities of R-12 into a room can usually be done safely as the vapor would produce no ill effects; however, in the event of an accidental rapid discharge of the system, it is recommended that inhalation of large quantities of R-12 be avoided. This caution is especially important if the area contains a flame producing device such as a gas heater. While R-12 normally is nonpoisonous, heavy concentrations of it in contact with a live flame will produce a toxic gas. The same gas will also attack all bright metal surfaces.

5. Protection of the eyes is of vital importance! When working around a refrigerating system, an accident may cause liquid refrigerant to hit the face. If the eyes are protected with goggles or glasses, no serious damage can result. Just remember, any R-12 liquid that touches you is at least 21.7°F below zero. If R-12 liquid should strike the eyes, here is what to do:

A. Keep calm.

B. Do not rub the eyes. Splash the affected area with quantities of cold water to gradually get the temperature above the freezing point. The use of mineral, cod liver or an antiseptic oil is important in providing a protective film to reduce the possibility of infection.

C. As soon as possible, call or consult an eye specialist for immediate and future treatment.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

CAUTION: *The following precautions should be observed when handling refrigerant lines:*

1. All metal tubing lines should be free of kinks, because of the restriction that kinks will offer to the flow of refrigerant. The refrigeration capacity of the entire system can be greatly reduced by a single kink.

2. The flexible hose lines should never be bent to a radius of less than 10 times the diameter of the hose.

3. The flexible hose lines should never be allowed to come within a distance of 2-1/2" of the exhaust manifold.

4. Flexible hose lines should be inspected at least once a year for leaks or brittleness. If found brittle or leaking they should be replaced with new lines.

5. Use only new lines that have been sealed during storage.

6. When disconnecting any fitting in the refrigeration system, the system must first be discharged of all refrigerant. However, proceed very cautiously regardless of gauge readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid refrigerant in the line. If pressure is noticed when fitting is loosened, allow it to bleed off as described under "Purging the System" in this section.

WARNING: ALWAYS WEAR SAFETY GOGGLES WHEN OPENING REFRIGERANT LINES.

7. In the event any line is opened to atmosphere, it should be immediately capped to prevent entrance of moisture and dirt.

8. The use of the proper wrenches when making connections on "O" ring fittings is important. The use of improper wrenches may damage the connection. The opposing fitting should always be backed up with a wrench to prevent distortion of connecting lines or components. When connecting the flexible hose connections it is important that the swagged fitting and the flare nut, as well as the coupling to which it is attached, be held at the same time using three different wrenches to prevent turning the fitting and damaging the ground seat.

9. "O" rings and seats must be in perfect condition. A burr or piece of dirt may cause a leak.

10. Sealing beads on hose clamp connections must be free of nicks and scratches to assure a perfect seal.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The metal internal parts of the refrigeration system and the refrigerant and oil contained in the system are designed to remain in a state of chemical stability as long as pure R-12 and uncontaminated refrigeration oil is used in the system.

However, when abnormal amounts of foreign materials, such as dirt, air or moisture are allowed to enter the system, the chemical stability may be upset. When accelerated by heat, these contaminants may form acids and sludge and eventually cause the breakdown of components within the system. In addition, contaminants may affect the temperature-pressure relationship of R-12, resulting in improper operating temperature and pressures and decreased efficiency of the system.

The following general practices should be observed to ensure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant or gauge line, it should be immediately capped. Capping the tubing will also prevent dirt and foreign matter from entering.

2. Tools should be kept clean and dry. This also includes the gauge set and replacement parts.

3. When adding oil, the container should be exceptionally clean and dry due to the fact that the refrigeration oil in the container is as moisture-free as it is possible to make it; therefore, it will quickly absorb any moisture with which it comes in contact. For this same reason the oil container should not be opened until ready for use and then it should be capped immediately after use.

4. When it is necessary to open a system, have everything you will need ready and handy so that as little time as possible will be required to perform the operation. Don't leave the system open any longer than is necessary.

5. Finally, after the operation has been completed and the system sealed again, air and moisture should be evacuated from the system before recharging.

CHARGING STATION J-24410

This portable air conditioner service station (figure 26) features the new J-24364 High Capacity Vacuum Pump. Utilization of J-24364 enables the J-24410 service station to out-perform all competitive stations in the automotive field today.

The capacity of the J-24364 is three cubic feet per minute; four times that of the J-5428-03 which pumps at a rate of .8 cubic feet per minute. A vented exhaust aids in the removal of moisture at a much faster rate.

With the added increases in capacity the new J-24410 will enable a serviceman to perform the evacuation procedure in an automotive air conditioning system in one third less time. This of course is a money saving feature.

The J-24410 incorporates two compound gauges. The second compound gauge is used to permit checking of other Motor Home manufacturer's systems at the evaporator pressure release valve. The CMN fast flow manifold incorporates a new O ring stem which permits the manifold to be opened or closed in two and a half turns.

This station is equipped with a controlled heated cylinder which assures a complete charge into the high pressure side of the compressor. This feature reduces the charging time considerably and enables a complete and accurately measured charge without running the engine!

The line from the manifold to the pump is 3/8" I.D. copper tube which is a larger I.D. for less restriction on pull down. The cylinder is graduated for Refrigerant-12 and Refrigerant-22. Refrigerant-22 is used in some of the refrigerant systems on recreational vehicles. Also the cylinder has a heating ele-

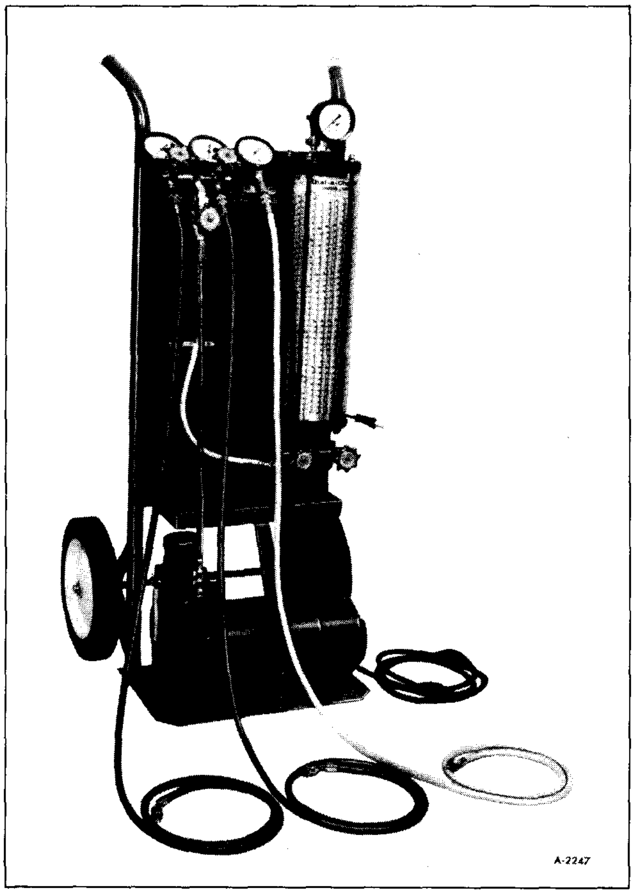


Figure 26—Charging Station J-24410

ment to provide a positive pressure advantage to overcome system pressure equalization.

GAUGE SET

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

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

The hand shutoff valves on the gauge manifold do not control the opening or closing off of pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operation, the valves must be closed. Both valves will be open at the same time during purging, evacuating and charging operations.

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

VACUUM PUMP

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

The vacuum pump (figure 26), is a component part of Charging Station described previously.

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

1. Make sure dust cap on discharge outlet of vacuum pump is removed before oerating.

2. Keep all openings capped when not in use to avoid moisture being drawn into the system.

3. Oil should be changed after every 250 hours of normal operation.

To change oil, simply unscrew hex nut located on back side of pump, tilt backward and drain out oil. Recharge with 8 ounces of vacuum pump oil Frigidaire 150 or equivalent. If you desire to flush out the pump, use this same type clean oil. Do not use solvent. Improper lubrication will shorten pump life.

4. If this pump is subjected to extreme or prolonged cold, allow it to remain indoors until oil has reached approximate room temperature. Failure to warm oil will result in a blown fuse.

5. A five ampere time delay cartridge fuse has been installed in the common line to protect the windings of the compressor. The fuse will blow if an excessive load is placed on the pump. In the event the fuse is blown, replace with a five ampere time delay fuse. **Do not use a substitute fuse** as it will result in damage to the starting windings.

6. If the pump is being utilized to evacuate a burnt-out system, a filter must be connected to the intake fitting to prevent any sludge from contaminating the working parts, which will result in malfunction of the pump.

7. Do not use the vacuum pump as an air compressor.

LEAK TESTING THE SYSTEM

Whenever a refrigerant leak is suspected in the system or a service operation performed which results in disturbing lines or connections, it is advisable to test for leaks. Common sense should be the governing factor in performing any leak test, since the necessity and extent of any such test will, in general, depend upon the nature of the complaint and the type of service performed on the system.

LEAK DETECTOR

Tool J-6084 (figure 27) is a propane gas-burning torch which is used to locate a leak in any part of the system. Refrigerant gas drawn into the sampling tube attached to the torch will cause the torch flame to change color in proportion to the size of the leak.

Propane gas fuel cylinders used with the torch are readily available commercially throughout the country.

WARNING: DO NOT USE LIGHTED DETECTOR IN ANY PLACE WHERE COMBUSTIBLE OR EXPLOSIVE GASES, DUSTS OR VAPORS MAY BE PRESENT.

OPERATING DETECTOR

1. Determine if there is sufficient refrigerant in the system for leak testing.

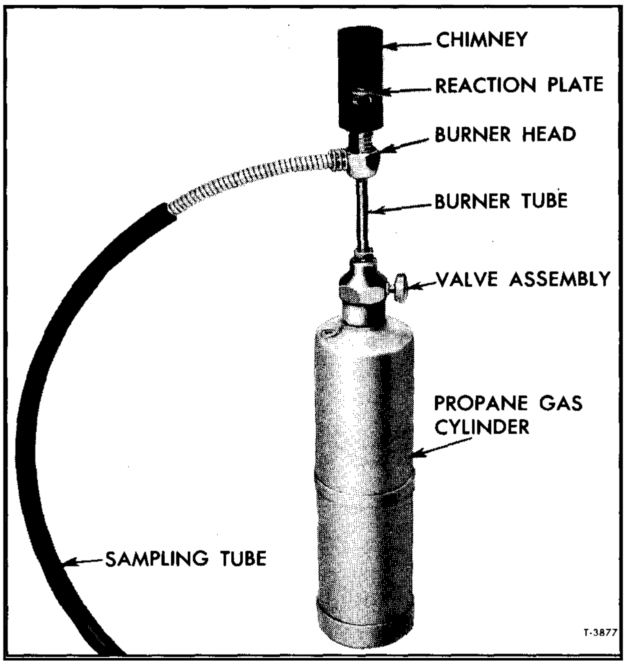


Figure 27—Leak Detector J-6084

2. Open control valve only until a low hiss of gas is heard, then light gas at opening in chimney.

3. Adjust flame until desired volume is obtained. This is most satisfactory when blue flame is approximately 3/8" above reactor plate. The reaction plate will quickly heat to a cherry red.

4. Explore for leaks by moving the end of the sampling hose around possible leak points in the system. Do not pinch or kink hose.

NOTE: Since R-12 is heavier than air, it is good practice to place open end of sampling tube immediately below point being tested, particularly in cases of small leaks.

WARNING: DO NOT BREATHE THE FUMES THAT ARE PRODUCED BY THE BURNING OF R-12 GAS IN THE DETECTOR FLAME, SINCE SUCH FUMES CAN BE TOXIC IN LARGE CONCENTRATIONS.

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

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

AVAILABILITY OF REFRIGERANT-12

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

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

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

WARNING: THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED WHEN ADDING REFRIGERANT TO A SYSTEM USING 15 OZ. DISPOSABLE CANS:

1. Do not charge while compressor system is hot.

2. Empty container completely before disposing.

3. Use opening valves designed for use with container - follow valve manufacturer's directions carefully.

4. Always use pressure gauges before and during charging.

5. NEVER connect on high pressure side of system or to any system having a pressure higher than indicated on refrigerant containers.

6. If inexperienced, seek professional assistance.

COMPRESSOR OIL

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

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

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

COMPRESSOR SERIAL NUMBER

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

INSPECTION AND PERIODIC SERVICE

PRE-DELIVERY INSPECTION

1. Check that engine exhaust in suitably ventilated.

2. Check the belt for proper tension.

3. With controls positioned for operation of the system, operate the unit for five minutes at approximately 2000 rpm. Observe the clutch pulley bolt to see that the compressor is operating at the same speed as the clutch pulley. Any speed variation indicates clutch slippage.

4. Before turning off the engine, check refrigerant charge (see "Refrigerant Quick Check Procedure").

5. Check refrigerant hose connections:

"O" Ring Connections — Check torque of fittings as charted later in this section under "Refrigerant Line Connections;" retorque if required. Leak test the complete system.

6. If there is evidence of an oil leak, check the compressor to see that the oil charge is satisfactory.

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

7. Check the system controls fpr proper operation.

6000 MILE INSPECTION

1. Check unit for any indication of a refrigerant leak.

2. If there is an indication of an oil leak, check the compressor for proper oil charge.

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

3. Check refrigerant charge (see "Refrigerant Quick Check Procedure").

4. Tighten the compressor brace and support bolts and check the belt tension.

5. Check refrigerant hose connections as in Step 5 of "Pre-Delivery Inspection."

PERIODIC SERVICE

1. Inspect condenser regularly to be sure that the fins are not plugged with leaves or other foreign material.

Also check to be sure fins are not folded over blocking air flow. Fins may be straightened.

2. Check evaporator drain tubes regularly for dirt or restrictions.

3. At least once a year, check the system for proper refrigerant charge and the flexible hoses for brittleness, wear or leaks.

4. Every 6000 miles check for low refrigerant level.

5. Check belt tension regularly.

EVACUATING AND CHARGING PROCEDURES

AIR CONDITIONING SYSTEM CAPACITY

The vehicle automotive air conditioning system has a refrigerant capacity of 3.5 lbs.

INSTALLING CHARGING STATION

1. High and low pressure gauge line fittings are provided in the air conditioning system for attaching the Charging Station. The compressor inlet line and the high pressure fitting is on the compressor outlet line.

2. With the engine stopped, remove the caps from the cored valve gauge fittings.

3. Install Gauge Adapters J-5420 and J-9459 onto the high and low pressure lines of the Charging Station.

4. Be certain all the valves on the Charging Station are closed.

5. Connect the high pressure gauge line to the high pressure fitting on the system.

6. Referring to Figure 28, turn the high pressure control one turn counterclockwise (open). Crack open the low pressure control and allow refrigerant gas to hiss from the low pressure gauge line for three seconds, and then connect the low pressure line to the low pressure fitting on the system.

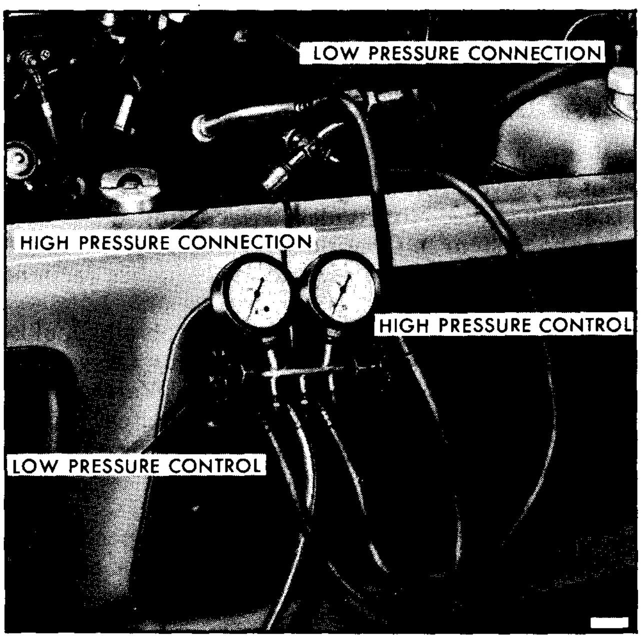


Figure 28—Charging Station Installed

WARNING: WHEN REMOVING THE GAUGE LINES FROM THE FITTINGS, BE SURE TO REMOVE THE ADAPTERS FROM THE SYSTEM FITTINGS RATHER THAN THE GAUGE LINES FROM THE ADAPTER.

7. The system is now ready for purging or performance testing.

PURGING THE SYSTEM

In replacing any of the air conditioning components, the system must be completely purged or drained of refrigerant. The purpose is to lower the pressure inside the system so that a component part can be safely removed.

1. With the engine stopped, install high and low pressure lines of Charging Station gauge set to the proper high and low pressure gauge fittings (See "Installing The Charging Station").

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

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

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

3. Fully open high (2) and low (1) pressure control valves, and allow refrigerant to purge from system at a rapid rate into the covered can.

4. Oil loss will be minimal. It may be added to the system during evacuation as described later.

5. Toward the end of the purge stage, Tool J-24095 should be flushed with refrigerant to eliminate possible contamination.

a. Disconnect refrigerant line at supply tank.

b. Flush Tool J-24095 by cracking open valve on refrigerant tank. After flushing for approximately three seconds, close valve.

c. Temporarily refasten the tool.

d. Reconnect refrigerant line to supply tank.

EVACUATING AND CHARGING THE SYSTEM

NOTE: In all evacuating procedures shown below, the specification of 28-29 inches of Mercury vacuum is used. These figures are only attainable at or near Sea Level Elevation. For each 1000 feet above sea level where this operation is being, performed, the specifications should be lowered by 1 inch. Example: at +5000 ft. elevation, only 23 to 24 inches of vacuum can normally be obtained.

Whenever the air conditioning system is open for any reason, it should not be put into operation again until it has been evacuated to remove air and moisture which may have entered the system.

The following procedures are based on the use of the J-24410 Charging Station:

ADDING OIL

If necessary, refrigeration oil may be added to the system by the following method:

1. Install charging station and purge system as previously described.

2. After system has been purged, connect the vacuum line to the vacuum pump.

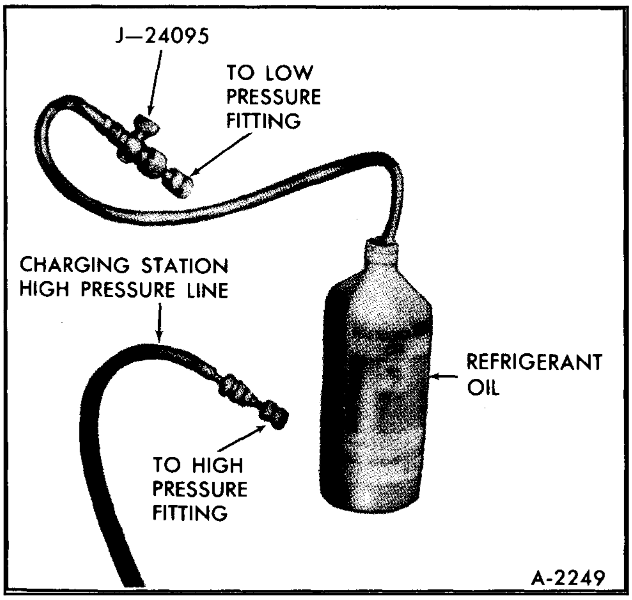


Figure 29—Adding Refrigeration Oil

3. Measure oil loss collected as a result of purging the system.

a. Disconnect the Charging Station low pressure line. Install Tool J-24095 (with valve closed) onto the system low pressure fitting. Insert pickup tube into graduated container of clean refrigerant oil (figure 29).

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

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

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

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

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

d. Disconnect and cap Tool J-24095 and reinstall charging station low pressure line to the system. Open low pressure valve.

EVACUATION

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

NOTE: If 28-29 inches cannot be obtained, close Vacuum Control Valve and shut off vacuum pump. Open Refrigerant Control Valve and allow 1/2 pound of R-12 to enter system. Locate and repair all leaks. Purge this 1/2 pound and re-evacuate for 10 minutes.

1. During the ten minute evacuation period, prepare for charging the system by filling the charging cylinder as follows:

a. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

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

b. Bleed cylinder valve on top (behind control panel) as required to allow refrigerant to enter. When refrigerant reaches desired level (see "System Capacity"), close valve at bottom of cylinder and be certain bleed valve is closed securely.

2. Continue to evacuate for remainder of 10 minute period.

3. Turn hand shut-off valves at low and high pressure gauges of gauge set to full clockwise position with vacuum pump operating, then stop pump. Carefully check low pressure gauge for approximately two minutes to see that vacuum remains constant. If vacuum reduces, it indicates a leak in the system or gauge connections; locate and repair all leaks.

CHARGING THE SYSTEM

1. Only after evacuating as above, is system ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount of refrigerant for a full charge, fill to the proper level.

2. With High and Low Pressure Valves open, close Vacuum Control Valve, turn off vacuum pump, open refrigerant control valve and allow refrigerant to enter system.

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

System is now charged and should be checked as outlined below:

CHECKING SYSTEM OPERATION

1. Operate system for a maximum of five minutes at maximum cooling, high blower speed and with engine operating at 2000 RPM (exhaust should be vented if inside).

2. When system is stabilized, the pressure gauges on the charging station should read pressures corresponding to values listed under PERFORMANCE DATA.

3. When correct system pressures are observed, check system charge as described under "Refrigerant Quick Check Procedure".

4. Feel outlet air distribution to ensure that cold air is being distributed.

5. Disconnect gauge lines and cap fittings.

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

PERFORMANCE TEST

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

NOTE: The following performance test and data do not apply to vehicles equipped with the additional air conditioning outlets shown in Figure 25.

The following fixed conditions must be adhered to in order to make it possible to compare the performance of the system being tested with the standards below:

1. Windows and curtains open. (Vehicle inside or in shade).

2. Vehicle in NEUTRAL with engine running at 2000 rpm.

3. Air Conditioning controls set for -

- Upper control on A/C.
- Lower control on cold.
- High blower speed.

4. Disconnect temperature sensor on engine cooling fan.

5. Gauge set installed.

6. System settled out (run-in approximately 10 minutes).

7. A thermometer placed in front of vehicle grille and another in the center diffuser outlet.

NOTE: Higher temperatures and pressures will occur at higher ambient temperatures. In areas of high humidity it is possible to have thermometer and gauge readings approach but not reach the figures listed in the performance table and still have a satisfactory operating unit. However, it is important to remember that low pressure has a direct relationship to nozzle outlet temperature. If pressure is too low, ice will gradually form on the evaporator fins, restricting air flow into the passenger area and resulting in insufficient or no cooling.

PERFORMANCE DATA

The following Performance Data define normal operation of the system under the above conditions.

REFRIGERANT CHARGE — 3.5 LBS.

ENGINE RPM — 2000 RPM

HEAD PRESSURE (EVAP. "IN" CHARGE PORT)*

Temp. of Air Entering Condensor Relative Humidity	70°F (21.1°C)	80°F (26.7°C)	90°F (32.2°C)	100°F (37.8°C)	110°F (43.3°C)
30%				230 - 245	270 - 285
40%			190 - 205	237 - 252	283 - 298
60%		157 - 172	202 - 217	242 - 257	
80%	127 - 142	167 - 182	210 - 225		

SUCTION PRESSURE (EVAPORATOR "OUT" CHARGE PORT)*

Temp. of Air Entering Condensor Relative Humidity	70°F (21.1°C)	80°F (26.7°C)	90°F (32.2°C)	100°F (37.8°C)	110°F (43.3°C)
30%				14.0 - 29.0	18.0 - 33.0
40%			11.0 - 26.0	15.5 - 30.5	20.5 - 35.5
60%		9.5 - 24.5	13.8 - 28.8	19.0 - 34.0	
80%	6.5 - 21.5	11.0 26.0	16.2 - 31.2		

DISCHARGE AIR TEMP. AT RIGHT UPPER OUTLET*

Temp. of Air Entering Condensor Relative Humidity	70°F (21.1°C)	80°F (26.7°C)	90°F (32.2°C)	100°F (37.8°C)	110°F (43.3°C)
30%				60 - 64	68 - 72
40%			57 - 61	65 - 69	74 - 78
60%		52 - 56	63 - 67	71 - 75	
80%	45 - 50	57 - 61	65 - 69		

*Just prior to compressor clutch disengagement.

CHECKING OIL

In the six cylinder compressor it is not recommended that the oil be checked as a matter of course. Generally, compressor oil level should be checked only where there is evidence of a major loss of system oil such as might be caused by:

- A broken refrigerant hose
- A severe hose fitting leak
- A very badly leaking compressor seal
- Collision damage to the system components

As a quick check on compressor oil charge, operate the engine at **idle** on maximum cold for approximately 10 minutes, turn off the engine and momentarily crack open the oil drain plug on bottom of the compressor letting a slight amount of oil drain out. Retighten plug. Again slightly crack open the plug. If oil comes out, the compressor has the required amount of oil.

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

To further check the compressor oil charge, should the above test show insufficient oil, it is necessary to remove the compressor from the vehicle, drain and measure the oil as outlined under "Checking Compressor Oil Charge."

CHECKING COMPRESSOR OIL CHARGE

1. Run the system for 10 minutes at 600 engine rpm with controls set for maximum cooling and high blower speed.

2. Turn off engine, discharge the system, remove compressor from vehicle, place it in a horizontal position with the drain plug downward. Remove the drain plug and, tipping the compressor back and forth and rotating the compressor shaft, drain the oil into a clean container, measure and discard the oil.

3. Add new refrigeration oil to the compressor as follows.

a. If the quantity drained was 4 fluid oz. or more, add the same amount of new refrigeration oil to the replacement compressor.

b. If the quantity drained was less than 4 fluid oz., add 6 fluid oz. of new refrigeration oil to the replacement compressor.

c. If a new service compressor is being installed, drain all oil from it and replace only the amount specified in Steps 3a and 3b above.

d. If a field repaired compressor is being installed, add an additional 1 fluid oz. to the compressor.

e. If the oil contains chips or other foreign material, flush or replace all component parts as necessary. Add the full 10 fluid oz. of new refrigeration oil to the replacement compressor.

4. Add additional oil in the following amounts for any system components being replaced.

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

CAUTION: *When adding oil to the compressor, it will be necessary to tilt the rear end of the compressor up so that the oil will not run out of the suction and discharge ports. Do not set the compressor on the shaft end.*

REFRIGERANT QUICK-CHECK PROCEDURE

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

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

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

MAINTENANCE AND ADJUSTMENTS

THERMOSTATIC SWITCH

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

CHECKING FOR PROPER OPERATION

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

2. Set the control at A/C, HI blower, max COLD and run the engine at 2000 rpm.

a. The thermostatic switch should cycle the compressor off when the low limit of the outlet air temperature is reached (see Performance Data). If it does not, the switch points are fused which will lead to evaporator freeze up. Replace the switch.

b. If the compressor does not operate, a loss of power element charge is indicated (provided that it has been established that power is supplied to the switch). This, of course, results in no cooling. Replace the switch.

c. Check the switch adjusting screw for stripped or otherwise damaged threads.

ADJUSTING SWITCH

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

1. Vehicle must be set up as described in "Performance Test."

2. The suction side of the system, read on the low pressure gauge, should pull down to the pressure shown in the chart in "Performance Data" under the ambient temperature at the time the switch is being set.

3. Remove the switch as outlined in the "General Repair Procedures" section.

4. Remove the switch non-metal end plate to gain access to the switch adjusting screw.

5. If the outlet temperature was less than the prescribed temperature at the end of each cooling cycle, turn the adjusting screw a partial turn counterclockwise (figure 30). If the outlet temperature was more than prescribed temperature, turn the adjusting screw clockwise.

NOTE: One turn of the adjusting screw will

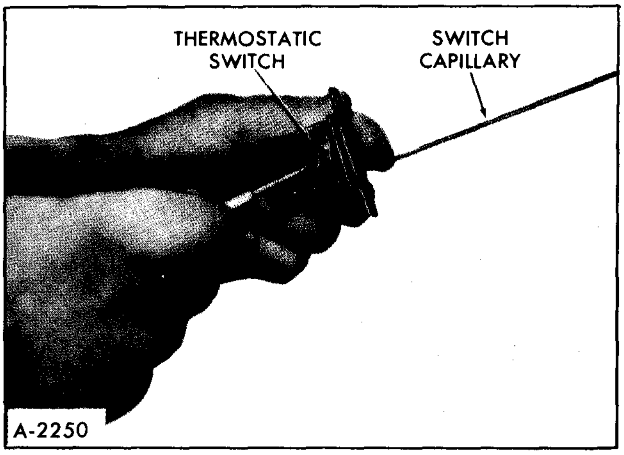


Figure 30—Adjusting Thermostatic Switch

change the outlet temperature **approximately** 4 degrees.

6. Reinstall switch end plate and reinstall switch. Be sure that the air sensing capillary has been replaced properly.

7. Check system performance. If further adjustment is needed, repeat Steps 3 through 6 until the prescribed pressure is reached.

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

EXPANSION VALVE (FIGURES 15 & 16)

A malfunction of the expansion valve will be caused by one of the following conditions; valve stuck open, valve stuck closed, broken power element, a restricted screen or an improperly located or installed power element bulb.

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

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

VALVE STUCK OPEN

Noisy Compressor.

No Cooling - Freeze Up.

VALVE STUCK CLOSED, PLUGGED SCREEN OR BROKEN POWER ELEMENT

Very Low Suction Pressure.

No Cooling.

POORLY LOCATED POWER ELEMENT BULB

Normal Pressure.

Poor Cooling.

CHECK FOR DEFECTIVE VALVE

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

1. Check to determine if the system will meet the performance test as outlined previously. If the expansion valve is defective, the low pressure readings will be above specification.

2. The loss of system performance is not as evident when the high side pressure is below 200 PSI. Therefore, it may be necessary to increase the system high side pressure by partially blocking the condenser. Disconnect the blower lead wire and repeat the "Performance Check" to determine if the low side pressure can be obtained.

GENERAL REPAIR PROCEDURES AND COMPONENT REPLACEMENT

PREPARING SYSTEM FOR REPLACEMENT OF COMPONENT PARTS

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

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

In removing and replacing any part which requires unsealing the refrigerant circuit the following operations, which are described in this section, must be performed in the sequence shown.

1. Purge the system by releasing the refrigerant to the atmosphere.

2. Remove and replace the defective part.

3. Evacuate,charge and check the system.

WARNING: ALWAYS WEAR PROTECTIVE GOGGLES WHEN WORKING ON REFRIGERATION SYSTEMS. GOGGLES J-5453 ARE INCLUDED IN THE SET OF AIR CONDITIONING SPECIAL TOOLS. ALSO, BEWARE OF THE DANGER OF CARBON MONOXIDE FUMES BY AVOIDING RUNNING THE ENGINE IN CLOSED OR IMPROPERLY VENTILATED GARAGES.

FOREIGN MATERIAL IN THE SYSTEM

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

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

1. Remove the compressor.

2. Remove the receiver-dehydrator or expansion tube and discard the unit.

3. Flush the condenser to remove foreign material which has been pumped into it.

4. Disconnect the line at the evaporator core inlet or inlet line to the expansion valve.

Inspect the expansion tube or inlet screen of the expansion valve for the presence of metal chips or other foreign material. If the tube or screen is plugged, replace it. Reconnect the line to the evaporator core or expansion valve.

5. Install the replacement compressor.

6. Add the necessary quantity of oil to the system. Remember to add the one ounce for the new receiver-dehydrator.

7. Evacuate, charge and check system.

REFRIGERANT LINE CONNECTIONS

"O" RINGS

Always replace the "O" ring when a connection has been broken. When replacing the "O" ring, first dip it in clean refrigeration oil. Always use a backing wrench on "O" ring fittings to prevent the pipe from twisting and damaging the "O" ring. Do not overtighten. Correct torque specifications are as follows:

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

Metal Tube O.D.	Thread and Fitting Size	Steel Tubing Torque*	Alum. Tubing Torque*
1/4	7/16	13	6
3/8	5/8	33	12
1/2	3/4	33	12
5/8	7/8	33	20
3/4	1-1/16	33	25

* Foot Pounds

HOSE CLAMPS

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

Removal

1. Carefully, with a sharp knife, make an angle cut in the hose as shown in Figure 31. This should loosen the hose so that it may be worked off the fitting.

2. Cut off slit end of hose.

CAUTION: *Use only approved refrigeration hose. Never use heater hose. Use extreme care not to nick or score the sealing beads when cutting off the hose. Cutting the hose lengthwise may result in this problem.*

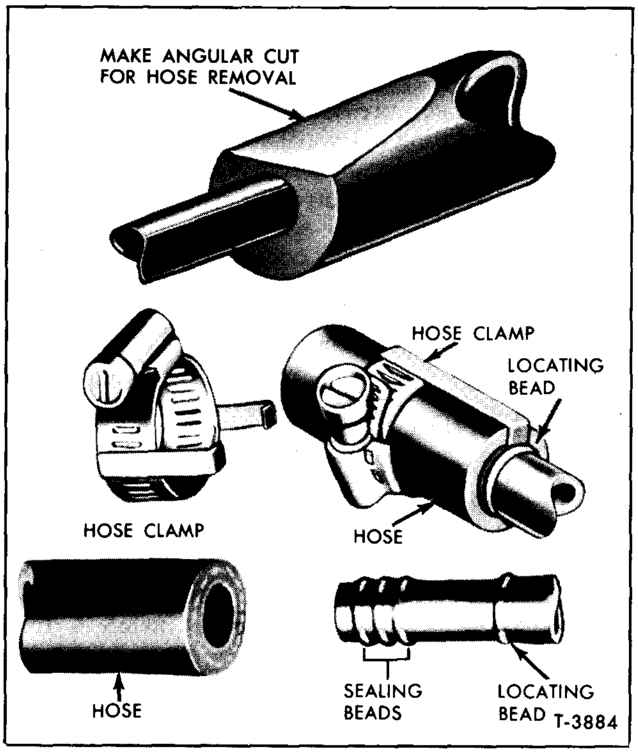


Figure 31—Hose Clamp Connections

Installation

1. Coat tube and hose with clean refrigeration oil.

2. Carefully insert hose over the three beads on the fitting and down as far as the fourth, or locating bead. Hose must butt against this fourth bead.

CAUTION: *Use no sealer of any kind.*

3. Install clamps on hose, hooking the locating arms over the cut end of the hose.

4. Tighten the hose clamp screw to 35-42 in. lbs. torque. DO NOT RETORQUE. The clamp screw torque will normally decrease as the hose conforms to the force of the clamp. The screw should be retorqued only if its torque falls below 10 in. lbs. In this case, retorque to 20-25 in. lbs. Further tightening may damage the hose.

REPAIR OF REFRIGERANT LEAKS

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

LEAKS AT "O" RING CONNECTION

1. Check the torque on the fitting and, if too loose, tighten to the proper torque. Always use a backing wrench to prevent twisting and damage to the "O" ring. Do not overtighten. Again leak test the joint.

2. If the leak is still present, discharge the refrigerant from the system as described under "Evacuating and Charging Procedures."

3. Inspect the "O" ring and the fitting and replace if damaged in any way. Coat the new "O" ring with clean refrigeration oil and install carefully.

4. Retorque the fitting, using a backing wrench.

5. Evacuate, charge and check the system.

LEAKS AT HOSE CLAMP CONNECTION

1. Check the tightness of the clamp itself and tighten if necessary. Recheck for leak.

2. If leak has not been corrected, discharge the system and loosen clamp and remove hose from connection. Inspect condition of hose and connector. Replace scored or damaged parts.

3. Dip end of new hose in clean refrigeration oil and carefully reinstall over connector. Never push end of hose beyond the locating bead. Properly torque the clamp.

4. Evacuate, charge and check the system.

COMPRESSOR LEAKS

If leaks are located around the compressor shaft seal or shell, replacement of necessary seals should be made.

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

REFRIGERANT HOSE FAILURE

After a leak or rupture has occurred in a refrigerant hose, or if a fitting has loosened and caused a considerable loss of refrigerant and oil, the entire system should be flushed and recharged after repairs have been made.

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

1. Locate the leak.

2. Discharge the system.

3. Cut out the leaking portion of the hose, making

sure that all of the failed portion is removed. If only a very small portion of the hose was removed, it may be possible to splice the two ends together, using a special hose connector and two hose clamps. If several inches of hose must be removed, a new piece of hose should be spliced in using two connectors and four hose clamps. Dip the ends of the hoses in clean refrigeration oil before installing the hoses onto the connector. Never push the end of the hose beyond the locating bead of the connector. Torque the clamp to 35-42 in. lbs.

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

4. Evacuate, charge and check the system.

COMPRESSOR

REMOVAL

1. Purge the refrigerant from the system.

2. Remove engine cover to gain access to engine components

3. Remove connector attaching bolt and hose connector (figure 32). Seal connector outlets.

4. Disconnect electrical lead to clutch actuating coil (figure 32).

5. Disconnect the hose holding clamp at the clutch pulley shield.

6. Loosen brace and pivot bolts and detach belt.

7. Remove the nuts and bolts attaching the compressor brackets to the mounting bracket.

8. Remove compressor and attaching brackets and shield by sliding rearward and dropping out bottom. Be sure compressor is removed with attaching brackets as shown in Figure 29.

9. Before beginning any compressor disassembly, drain and measure oil in the compressor. Check for evidence of contamination to determine if remainder of system requires servicing.

INSTALLATION

1. If oil previously drained from the compressor upon removal shows no evidence of contamination, replace a like amount of fresh refrigeration oil into the compressor before reinstallation. If it was necessary to service the entire system because of excessive contamination in the oil removed, install a full charge of fresh refrigeration oil into the compressor.

2. Position compressor on the mounting bracket and install all nuts, bolts and lock washers.

3. Install the connector assembly to the compressor rear head, using new "O" rings coated with clean refrigeration oil.

4. Connect the electrical lead to the coil and install and adjust compressor belt.

5. Evacuate, charge and check the system.

IMPORTANT: Adjust compressor belt, using belt tension gauge BT-33-73-F or other suitable gauge. Tension should be within 70-80 lbs. (used belt), or 110-140 lbs. (new belt). For complete

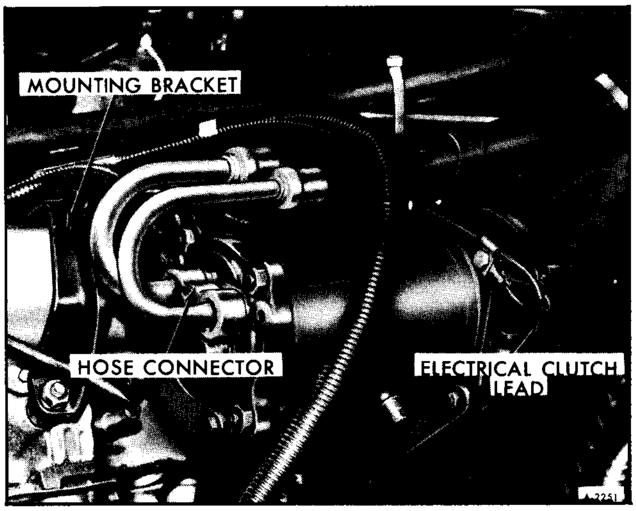


Figure 32—Compressor Installation

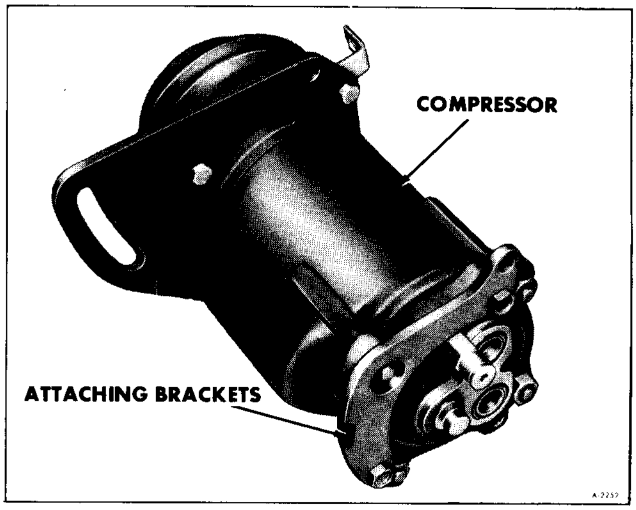


Figure 33 —Compressor Removed From Vehicle

discussion of belt tensioning or replacement, refer to "Belt Tension", SECTION 6K, ENGINE COOLING.

COMPRESSOR FAILURE

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

FALSE COMPRESSOR SEIZURE

Slipping or broken air conditioning drive belts and/or scored clutch surfaces may be experienced on initial start up of an air conditioning compressor after an extended period of storage or non-operation of the compressor. This would indicate a seized compressor; however, an overhaul or replacement of the compressor may not be necessary.

During extended periods of non-operation, changes in temperature cause the refrigerant in the air conditioning compressor to expand and contract. During this movement, lubricating oil carried by the refrigerant tends to migrate from highly polished surfaces in the compressor such as the ball seats and axial plate. Without lubricating oil at these polished surfaces, they "wring" together and appear to be seized.

Before the time and expense of an overhaul is invested, use the following check to determine if the compressor is actually seized. With a wrench on the compressor shaft lock nut or Spanner Wrench J-9403 on the clutch drive plate, "rock" the shaft in the opposite direction of normal rotation. After the compressor is broken loose, "rock" the shaft back and forth. This should be sufficient to return lubricating oil to the "wrung" surfaces and allow the compressor shaft to be turned by hand. Once the compressor turns freely, rotate the compressor at least three complete turns. Start the engine and operate the compressor for a minimum of one minute.

This procedure will not affect a compressor that is actually seized but should be attempted before overhauling a compressor known to be idle for a month or longer.

COLLISION PROCEDURE—ALL SYSTEMS

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

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

1. Remove the drive belt.

2. Visually inspect the condenser, receiver-dehydrator, compressor, mounting brackets, conditioning unit, all connecting lines and all controls to determine the extent and nature of the damage.

a. No repairs, such as soldering, welding or brazing, should be attempted on the condenser because of its construction. If the vapor passages in the horizontal tubes or return bends or manifolds have been damaged in any way, the condenser should be replaced with a new one.

b. The receiver-dehydrator should be replaced if there is any evidence of its having sustained either internal damage or a fracture at any of the lines or welded joints or if the system has been exposed to the atmosphere for an undetermined period of time.

c. Examine the compressor for any visible external damage.

d. The evaporator should be examined for damage and, if necessary, removed or replaced or the entire unit processed where damaged or exposed to the atmosphere.

e. All connecting lines and flexible hoses should be examined throughout their entire length for damage. If damaged in any manner, replace with new lines.

f. Check all controls and connecting wires for damage and replace with new parts where needed.

g. Check the clutch pulley for proper operation and freedom from damage.

3. Install Charging Station.

4. Purge the system.

5. Remove the compressor from mounting and remove the oil test fitting.

6. Pour out the oil into a clean glass container and examine it for any foreign substance such as dirt, water, metal particles, etc. If any of these are present, the compressor, expansion tube, and accumulator or receiver-dehydrator should be replaced and the other system components should be flushed with liquid refrigerant.

7. If the oil is clean and free of any harmful substance, replace oil with Frigidaire 525 Viscosity Oil, or equivalent.

NOTE: If the system components have been replaced or flushed, replace the full charge of oil. If not, add no more fresh oil than was drained in Step 6.

8. Charge up the compressor to cylinder or can pressure. Leak test the compressor seals prior to installation of compressor.

9. Reinstall the compressor and evacuate the system by following the Evacuating Procedure.

10. Introduce R-12 vapor at cylinder (room) temperature and pressure.

11. Leak test all fittings and connections and give particular attention to a leak test at the compressor shaft seal if compressor has not been leak tested on the bench.

12. Complete system processing and charge system.

CONDENSER

REPLACEMENT

1. Disconnect battery ground cables.

2. Purge the system of refrigerant.

3. Remove grill assembly.

4. Disconnect the condenser inlet and outlet lines. Cap or plug all open connections at once.

5. Remove the receiver-dehydrator (Type 1) and its holding straps (See figure 13).

6. Remove the condenser to radiator mounting screws (figure 34).

7. Remove the condenser assembly by pulling it forward and then lowering it from the vehicle through grille.

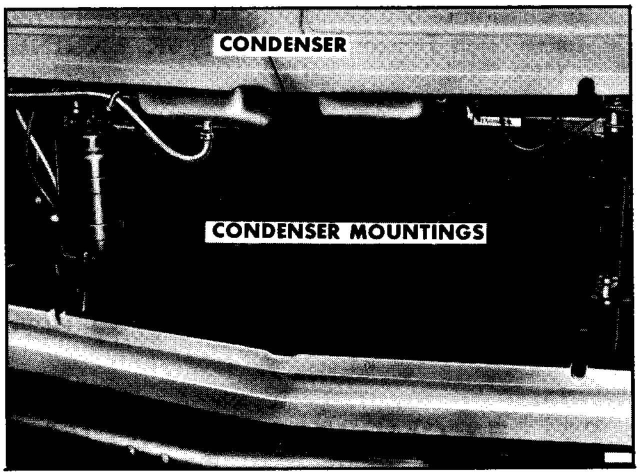


Figure 34—Condenser Mounting, Typical

8. To install a new condenser, reverse Steps 1-6 above. Add one fluid ounce of clean refrigeration oil to a new condenser.

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

9. Evacuate, charge and check the system.

RECEIVER-DEHYDRATOR

REPLACEMENT

1. Disconnect the inlet and outlet lines being sure to use a wrench on the square portion of the receiver

Figure 35—Disconnecting Lines to Receiver-Dehydrator, Type 1

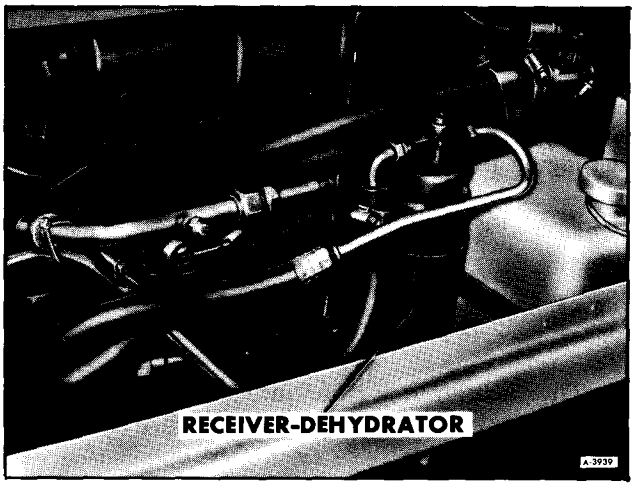


Figure 36—Disconnecting Lines to Receiver Dehydrator, Type 2

dehydrator for support. This will prevent twisting and possible breaking of the aluminum lines (See figures 35 and 36).

2. Loosen holding straps and slide out receiver-dehydrator.

3. To install, reverse steps 1 and 2 being sure to add 1 ounce of clean refrigeration oil and install new "O" rings.

BLOWER ASSEMBLY (FIGURE 37)

REPLACEMENT

1. Disconnect the battery ground cables.

2. Disconnect the blower motor lead and ground wires.

3. Disconnect the blower motor cooling tube.

4. Remove the blower to case attaching screws and remove the blower assembly. Pry the blower flange away from the case carefully if the sealer acts as an adhesive.

5. Remove the nut attaching the blower wheel to the motor shaft and separate the assemblies.

6. To install, reverse Steps 1-5 above; replace sealer as necessary.

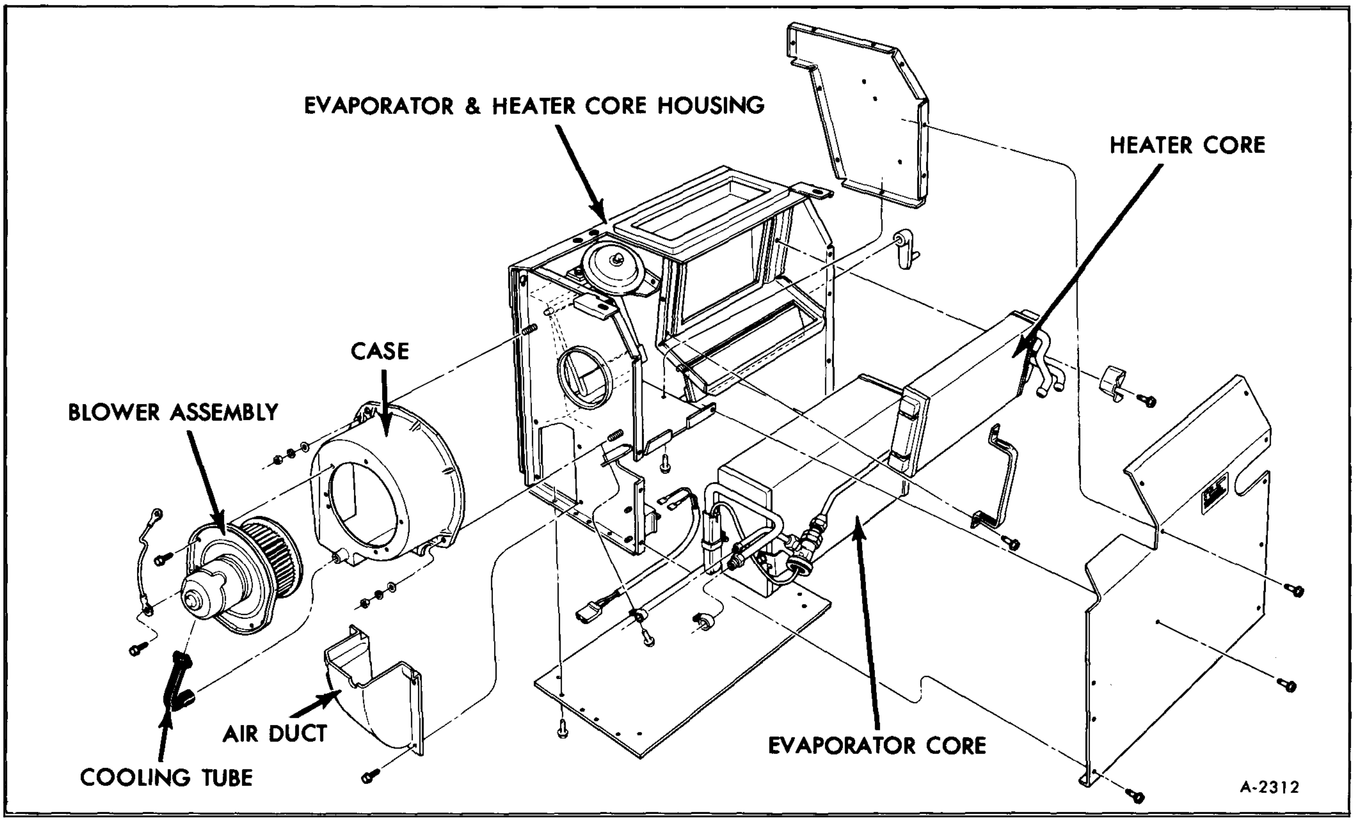


Figure 37—Evaporator and Heater Housing Components, Typical

EVAPORATOR AND HEATER CORE ASSEMBLY

REPLACEMENT (FIGURE 15)

1. Purge system.

2. Disconnect air conditioning lines from evaporator.

3. Disconnect heater hoses from heater core.

4. Disconnect all vacuum lines, wires and cables connected to the box assembly.

5. Remove windshield washer reservoir.

6. Remove coolant recovery reservoir and bracket.

7. Disconnect windshield wiper arms.

8. Remove attaching bolts and remove through front access door.

9. To install, reverse steps 1 through 8.

EVAPORATOR CORE AND EXPANSION VALVE

REPLACEMENT (FIGURE 15)

CAUTION: *When repair or replacement of the evaporator core or expansion valve is necessary, be sure to remove both as the method of attaching the sensing tube to the evaporator outlet line will cause it to be damaged if you try to remove only one item.*

1. Purge the system of refrigerant.

2. Remove all attaching items to the evaporator and heater core assembly necessary to remove the assembly front cover.

3. Remove assembly front cover exposing evaporator core, expansion valve, thermostat switch, heater core and selector door.

9$NOT After removing all the cover screws, be sure to remove the cover retaining clip.

4. Remove evaporator inlet and outlet hoses.

5. Carefully remove thermostatic switch probe from front of evaporator held by plastic clips. Do not bend this tube excessively.

6. Remove four attaching screws and gently pull out evaporator core.

7. When core and expansion valve are removed the expansion valve may easily be removed without damaging the sensing tube.

8. To install, reverse steps 1-7.

VACUUM TANK

The vacuum tank is mounted to the right side of the evaporator and heater core assembly (See figure 15).

REPLACEMENT

1. Disconnect the vacuum lines at the tank.

2. Remove the tank to dash panel screws and remove the tank.

3. To install, reverse Steps 1 and 2 above.

BLOWER MOTOR RESISTOR

The blower motor resistor is located opposite the blower side of the blower-evaporator case (figure 15).

REPLACEMENT

1. Disconnect battery ground cables and the wiring harness at the resistor.

2. Remove the resistor to case attaching screws and remove the resistor.

3. Place the new resistor in position and install the attaching screws.

4. Connect the resistor wiring harness battery cables.

THERMOSTATIC SWITCH (FIGURE 15)

The thermostatic switch is mounted to the blower side of the blower-evaporator case. The switch sensing capillary extends across the evaporator core.

REPLACEMENT

1. Disconnect the battery ground cables.

2. Disconnect the wiring harness at the switch.

3. Remove the switch to case screws and remove the switch carefully so as not to damage the capillary tube.

NOTE: Note capillary tube position across the core so that the capillary may be reinstalled in the same position.

4. Place the new switch in position, installing the capillary in the core in the same manner as at switch removal.

5. Install the switch mounting screws, connect the wiring harness and the battery ground cables.

DISCHARGE PRESSURE SWITCH

The discharge pressure switch is located in the condenser to evaporator line (figure 18).

REPLACEMENT

1. Disconnect the battery ground cables.

2. Purge the system of refrigerant.

3. Disconnect the wiring harness at the switch.

4. Remove the switch from the refrigerant line.

5. To install, reverse Steps 1-4 above.

NOTE: Be sure to use new "O" rings, coated with clean refrigeration oil, when installing the switch.

6. Evacuate charge and check system operation.

FUSE

A 25 amp fuse, located in the junction block protects the entire air conditioning system except for the blower when operating at HI.

BLOWER MOTOR RELAY

The blower motor relay is located on the firewall on the blower side of the blower-evaporator case (figure 20).

REPLACEMENT

1. Disconnect battery ground cables and the wiring harness at the relay.

2. Remove the relay to case attaching screws and remove the relay.

3. Place the new relay in position and drive the mounting screws.

4. Connect the relay wiring harness and battery ground cables.

CONTROL ASSEMBLY (FIGURES 23 and 24)

REPLACEMENT

1. Disconnect the battery ground cables.

2. Remove instrument panel bezel.

NOTE: For details on instrument panel bezel removal refer to "Instrument Panel Bezel Replacement" contained in CHASSIS ELECTRICAL (SECTION 12) of this manual.

3. Remove four screws holding control assembly to instrument panel (figure 38).

4. Pull panel forward to gain access to rear of control assembly.

CAUTION: *Be careful not to kink the bowden cable.*

5. Disconnect the bowden cable, vacuum harness and electrical harness at the control.

6. If a new unit is being installed, transfer all

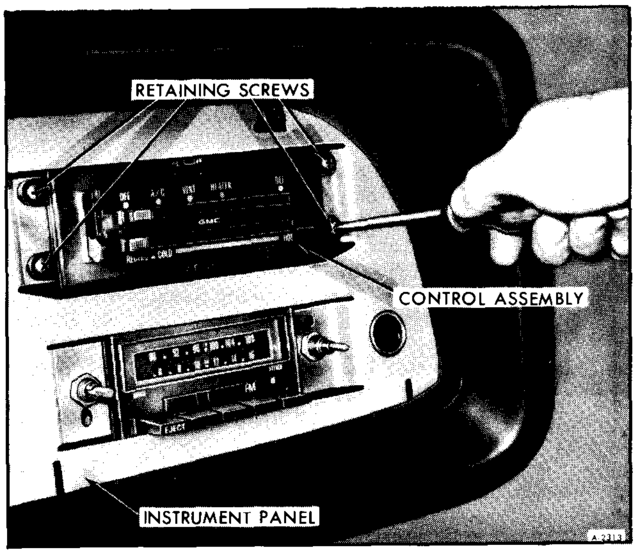


Figure 38—Removing Control Assembly

electrical switches and vacuum valves to the new control.

BLOWER SWITCH (FIGURE 22)

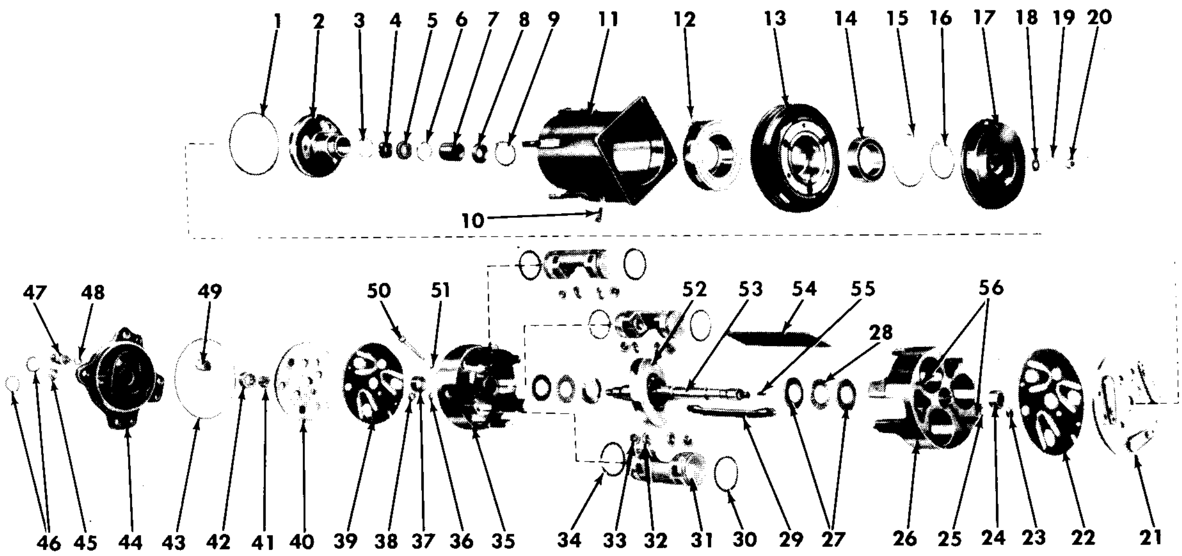
REPLACEMENT

1. Remove the control assembly as described above.

2. Disconnect wires to switch and remove two attaching screws.

3. Installation of switch is the reverse of Steps 1 and 2.

COMPRESSOR MINOR OVERHAUL PROCEDURES



1 O-Ring
2 Front Head
3 O-Ring
4 Shaft Seal Assembly
5 Seal Seat
6 Seal Seat Retainer Ring
7 Absorbent Sleeve
8 Seal Retainer
9 Clutch Coil Retainer Ring
10 Oil Drain Plug
11 Compressor Shell
12 Clutch Coil and Housing Assy.
13 Pulley
14 Bearing
15 Bearing Retainer
16 Pulley Retainer Ring
17 Clutch Plate and Hub Assy.
18 Spacer
19 Retainer Ring
20 Lock Nut
21 Front Discharge Valve Plate Assembly
22 Front Suction Reed
23 Bushing
24 Needle Bearing
25 O-Ring
26 Front Cylinder Half
27 Thrust Races
28 Thrust Bearing
29 Discharge Crossover Tube
30 Teflon Piston Ring
31 Teflon Ring Type Piston
32 Shoe Disc
33 Ball
34 Teflon Piston Ring
35 Rear Cylinder Half
36 O-Ring
37 Needle Bearing
38 Bushing
39 Rear Suction Reed
40 Rear Discharge Valve Plate Assembly
41 Inner Oil Pump Gear
42 Outer Oil Pump Gear
43 O-Ring
44 Rear Head
45 Lock Nut
46 O-Rings
47 Pressure Relief Valve
48 O-Ring
49 Suction Screen
50 Oil Pick-Up Tube
51 O-Ring
52 Axial Plate
53 Shaft
54 Suction Crossover Cover
55 Key
56 Dowel Pins

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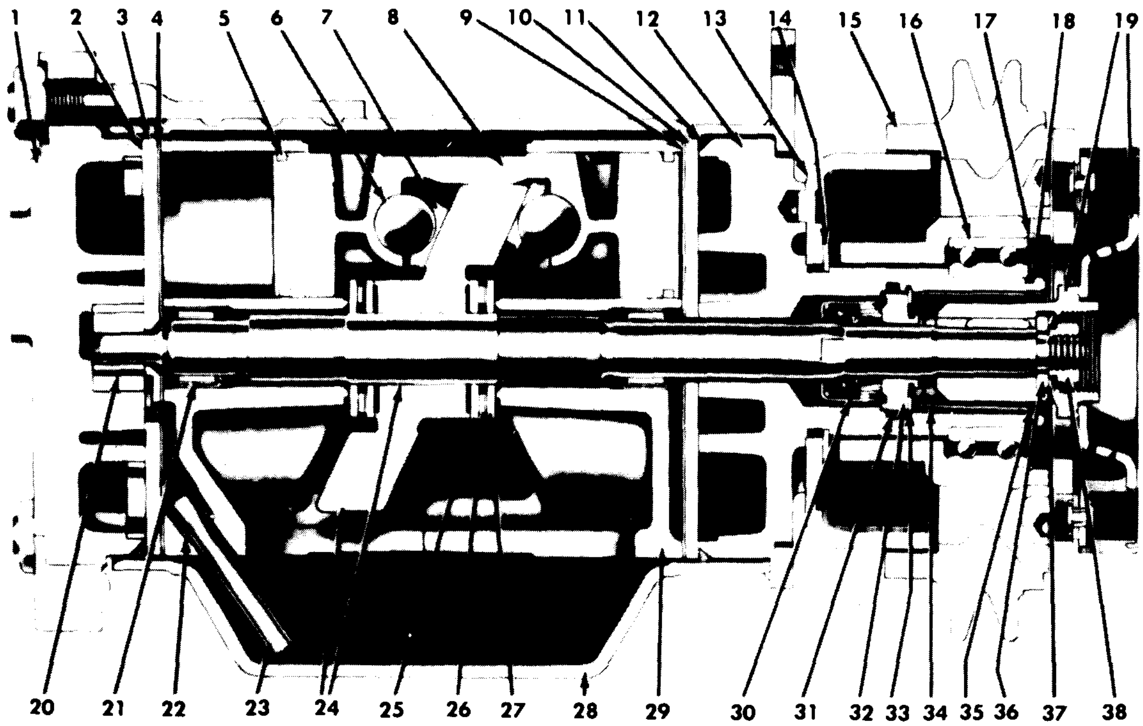
Figure 39—Exploded View of Compressor

The following operations to the Compressor Clutch Plate and Hub, Pulley and Bearing, and Coil Housing are covered as "Minor" because they may be performed WITHOUT FIRST PURGING THE SYSTEM OR REMOVING THE COMPRESSOR from the vehicle.

The Compressor Shaft Seal assembly may also be serviced WITHOUT REMOVING THE COMPRESSOR from the vehicle but this operation is covered later in this section as "Major Repair Procedures" because the system MUST FIRST BE PURGED of Refrigerant.

Illustrations used in describing these operations show the compressor removed from the vehicle only to more clearly illustrate the various operations.

When servicing the compressor, remove only the necessary components that preliminary diagnosis in-



1 Rear Head
2 Rear Head to Shell O-ring
3 Rear Discharge Valve Plate
4 Rear Suction Reed Plate
5 Piston Ring (Teflon)
6 Piston Drive Ball
7 Shoe Disc
8 Piston
9 Front Suction Reed Plate
10 Front Discharge Valve Plate
11 Front Head to Shell O-ring
12 Front Head
13 Coil and Housing Assembly
14 Coil Housing Retainer Ring
15 Pulley and Bearing Assembly
16 Pulley Bearing
17 Pulley Bearing Retainer Ring
18 Pulley and Bearing Retainer Ring
19 Clutch Hub and Drive Plate Assembly
20 Oil Pump Gears
21 Mainshaft Bearing (Rear)
22 Oil Inlet Tube O-ring
23 Oil Inlet Tube
24 Axial Plate and Mainshaft Assembly
25 Thrust Race
26 Thrust Bearing
27 Thrust Race
28 Compressor Shell
29 Cylinder Assembly
30 Shaft Seal
31 Shaft Seat Seat O-ring
32 Shaft Seal Seat
33 Shaft Seal Seat Retainer Ring
34 Felt Sleeve
35 Felt Sleeve Retainer
36 Spacer
37 Clutch Hub Retainer Ring
38 Shaft Nut

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Figure 40—Compressor Cross Sectional View

dicates are in need of service. Refer to Figure 39 and Figure 40.

Removal and installation of external compressor components and disassembly and assembly of internal components must be performed on a clean workbench. **The work area, tools, and parts must be kept clean at all times.** Parts Tray J-9402 (See figure 72) should be used for all parts being removed, as well as for replacement parts.

Although certain service operations can be performed without completely removing the compressor from the vehicle, the operations described herein are based on bench overhaul with the compressor removed from the vehicle. They have been prepared in sequence in order of accessibility of the components.

CAUTION: *Do not kink or place excessive tension on lines or hoses.*

When a compressor is removed from the vehicle for servicing, the amount of oil remaining in the compressor should be drained **and measured.** This oil should than be discarded and new 525 viscosity refrigerant oil added to the compressor (See figure 41).

COMPRESSOR CLUTCH PLATE AND HUB ASSEMBLY

REMOVE

1. Place Holding Fixture J-9396 in a vise and clamp the compressor in the Holding Fixture.

UNIT	ADD OIL
CONDENSOR	1 OUNCE
EVAPORATOR	3 OUNCES

COMPRESSOR CONDITION	AMOUNT OF OIL DRAINED FROM COMPRESSOR	AMOUNT OF OIL TO INSTALL
REPLACING COMPRESSOR WITH A NEW COMPRESSOR.	MORE THAN – 4 OZ.	*DRAIN NEW COMPRESSOR, REFILL WITH NEW OIL (SAME AMOUNT AS DRAINED FROM OLD COMPRESSOR).
	LESS THAN – 4 OZ.	**DRAIN NEW COMPRESSOR. INSTALL NEW OIL IN NEW COMPRESSOR – 6 OZ.
REPLACING COMPRESSOR WITH A SERVICE REBUILT COMPRESSOR.	MORE THAN – 4 OZ.	*SAME AS ABOVE PLUS AN ADDITIONAL OUNCE (MORE OIL IS RETAINED IN A DRAINED COMPRESSOR THAN ONE THAT HAS BEEN REBUILT).
	LESS THAN – 4 OZ.	**SAME AS ABOVE PLUS AN ADDITIONAL OUNCE.
UNABLE TO RUN COMPRESSOR BEING REPLACED, PRIOR TO REMOVAL.	MORE THAN – 1-1/2 OZ. AND SYSTEM APPEARS TO HAVE LOST LITTLE OR NO OIL	*SAME AS ABOVE.
	LESS THAN – 1-1/2 OZ OR SYSTEM APPEARS TO HAVE LOST MAJOR AMOUNT OF OIL.	**SAME AS ABOVE.
CONTAMINATED OIL DRAINED FROM SYSTEM.	ANY AMOUNT	DRAIN AS MUCH OIL AS POSSIBLE FROM SYSTEM. FLUSH SYSTEM WITH REFRIGERANT-11. REPLACE DRIER DESSICANT AND INSTALL NEW 525 VISCOSITY OIL IN NEW COMPRESSOR: 10-1/2 OZS.

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Figure 41—Compressor Oil Charge

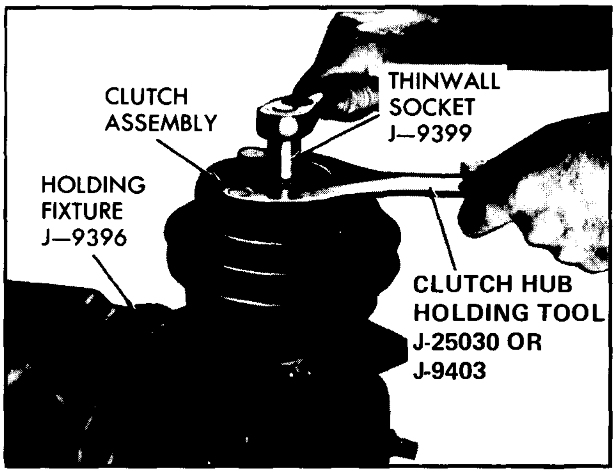


Figure 42—Removing Shaft Locknut

2. Keep clutch hub from turning with Clutch Hub Holder J-25030 or J-9403, and remove locknut from end of shaft using Thin Wall Socket J-9399 (figure 42).

CAUTION: *To avoid internal damage to the compressor, DO NOT DRIVE OR POUND on the Clutch Plate and Hub assembly OR on the end of the shaft. If proper tools to remove and replace clutch parts are not used, it is possible to disturb the position of the axial plate (keyed to the main shaft), resulting in compressor damage and seal leakage due to shifting of the crankshaft.*

4. Remove square drive key from shaft or drive plate hub.

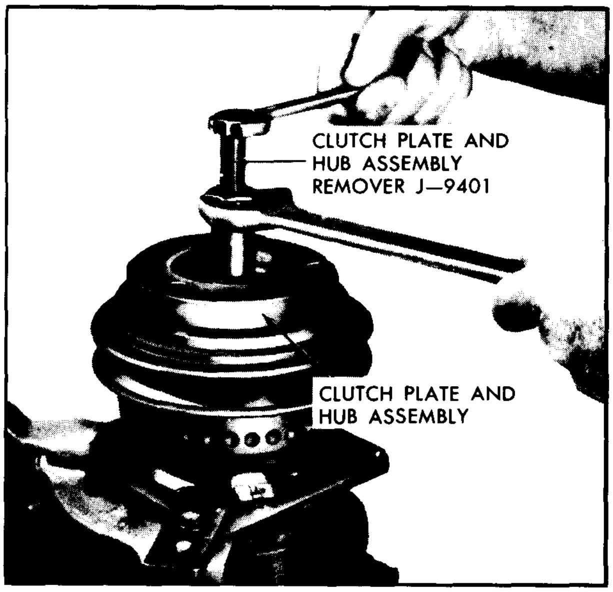


Figure 43—Removing Clutch Plate and Hub Assembly

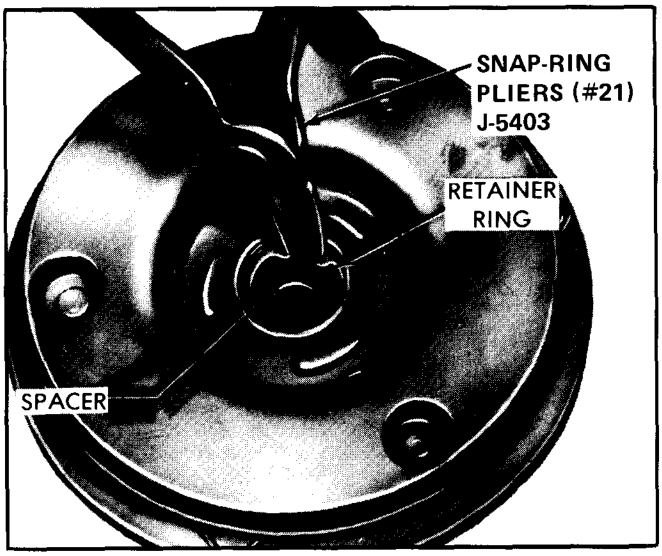


Figure 44—Removing or Installing Retainer Ring in Clutch Drive Plate

5. Remove hub spacer retainer ring using Snap-Ring Pliers J-5403(#21), and then remove hub spacer (figure 44).

6. Inspect driven plate for cracks or stresses in the drive surface. Do not replace driven plate for a scoring condition. (figure 45).

If the frictional surface shows signs of damage due to excessive heat, the clutch plate and hub and pulley and bearing should be replaced. Check further for the underlying cause of the damage (i.e. low coil voltage - coil should draw 3.2 amps at 12 volts - or binding of the compressor internal mechanism, clutch air gap too wide, broken drive plate to hub assembly springs, etc.

REPLACE

1. Insert the square drive key into the hub of driven plate; allow it to project approximately 3/16" out of the keyway.

2. Line up the key in the hub with keyway in the shaft (figure 46).

3. Position the Drive Plate Installer J-9480-1 on the threaded end of the shaft. The Spacer J-9480-2 should be in place under the hex nut on the tool. This tool has a left hand thread on the body. (figure 47).

4. Press the driven plate onto the shaft until there is approximately 3/32" space between the frictional faces of the clutch drive plate and pulley.

CAUTION: *Make certain key remains in place when pressing hub on shaft.*

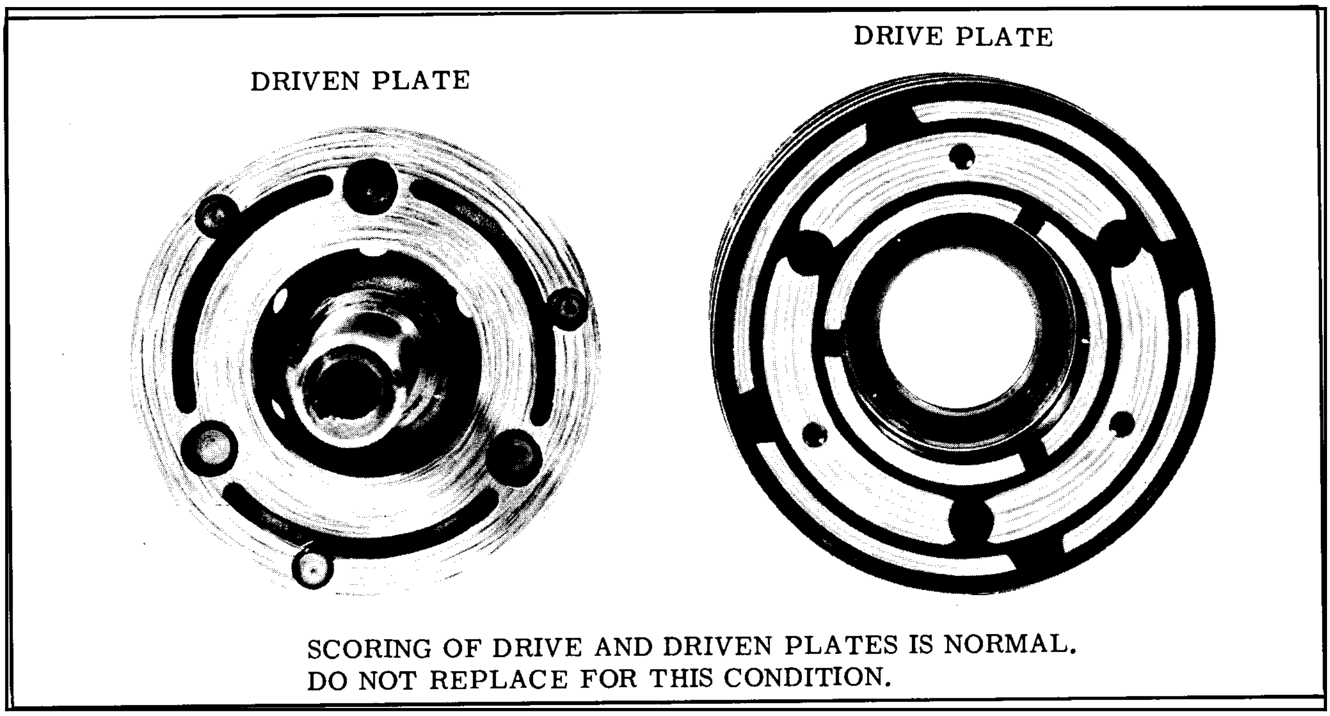


Figure 45—Clutch Driven Plate and Drive Plate

A ZERO thrust race is approximately 3/32" thick and may be used to roughly gage this operation. Use Clutch Hub Holder J-25030 or J-9403 to hold clutch plate and hub if necessary.

5. Install the hub spacer and, using Snap-Ring Pliers J-5403 (#21), install the retainer ring (see installed Retainer Ring in inset of Figure 40), with convex side of ring facing spacer.

6. Use Thin-Wall Socket J-9399 and Clutch Hub Holder J-25030 or J-9403 to install a new shaft locknut **with shoulder or circular projection on the locknut facing towards retainer ring.** Tighten the nut to 14-26 lb. ft. torque. Air gap between the frictional faces should now be .002" to .057" (figure 48). If not, check for mispositioned key or shaft.

7. The pulley should now rotate freely.

8. Operate the refrigeration system under MAXimum load conditions and engine speed at 2000 RPM. Rapidly cycle the cluty by turning the air conditioning on-and-orr at least 15 times at approximately one second intervals to burnish the mating parts of the clutch.

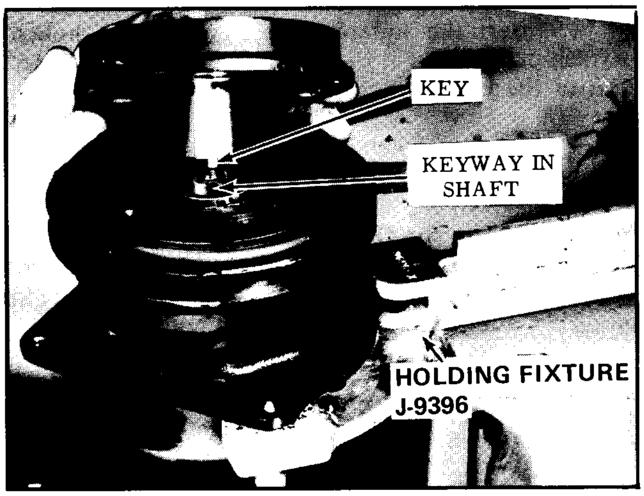


Figure 46—Aligning Drive Plate Key

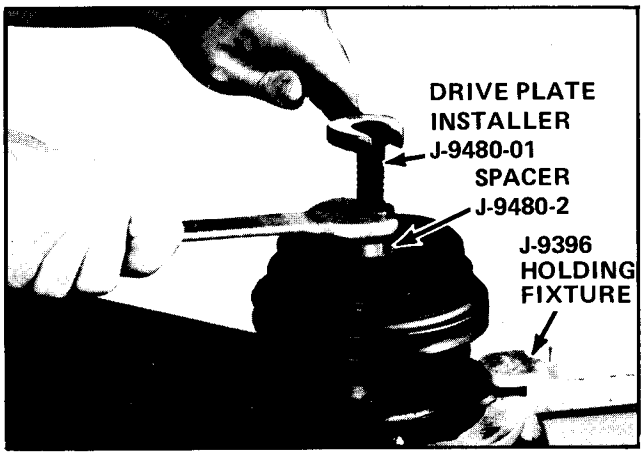


Figure 47—Installing Drive Plate

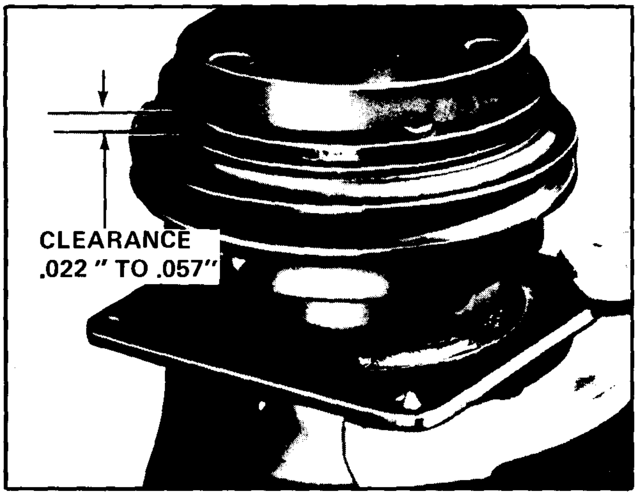


Figure 48—Checking Air Gap

PULLEY AND BEARING ASSEMBLY

REMOVE

1. Remove clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Removal procedure.

2. Remove pulley retainer ring using Snap-Ring Pliers J-6435 (#26), Figure 49.

3. Pry out absorbent sleeve retainer, and remove absorbent sleeve from compressor neck.

4. Place Puller Pilot J-9395 over end of compressor shaft.

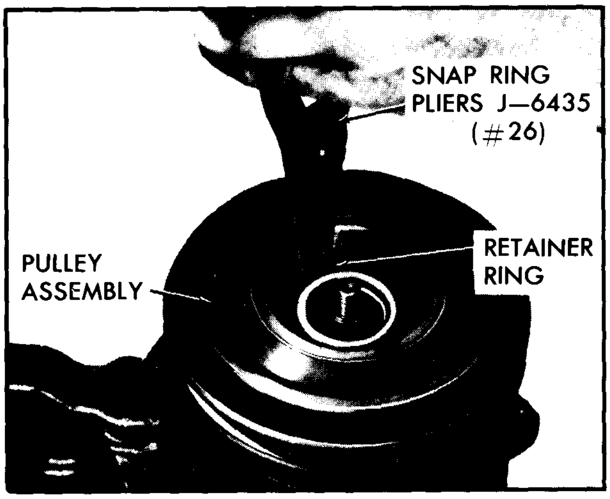


Figure 49—Removing Pulley Retainer Ring

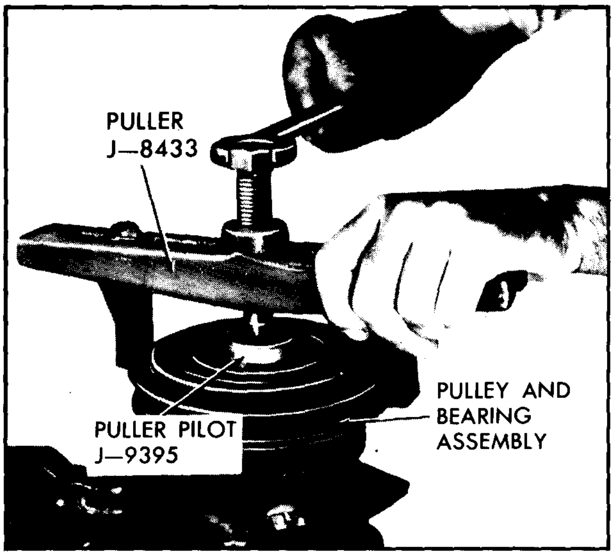


Figure 50—Removing Pulley and Bearing Assembly

CAUTION: *It is important that Puller Pilot J-9395 be used to prevent internal damage to compressor when removing pulley.* **Under no circumstances should Puller be used DIRECTLY against drilled end of shaft.**

5. Remove Pulley and Bearing Assembly using Pulley Puller J-8433 (figure 50).

INSPECTION

Check the appearance of the pulley and bearing assembly. See Figure 45. The frictional surfaces of the pulley and bearing assembly should be cleaned with suitable solvent before reinstallation.

REPLACE

1. If original pulley and bearing assembly is to be reinstalled, wipe frictional surface of pulley clean. If frictional surface of pulley shows any indication of damage due to overheating, the pulley and bearing should be replaced.

2. Check bearing for brinelling, excessive looseness, noise, and lubricant leakage. If any of these conditions exist, bearing should be replaced. See "Compressor Pulley Bearing" Replacement Procedure.

3. Press or tap pulley and bearing assembly on neck of compressor until it seats, using Pulley and Bearing Installer J-9481 with Universal Handle J-8092 (figure 51). The Installer will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

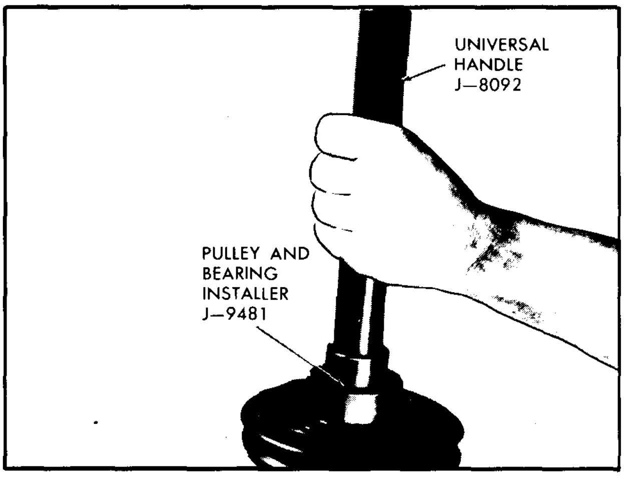


Figure 51—Installing Pulley and Bearing Assembly

5. Install retainer ring, using Snap Ring Pliers J-6435 (#26).

6. Install absorbent sleeve in compressor neck.

7. Install absorbent sleeve retainer in neck of compressor. Using sleeve from Seal Seat Remover-Installer J-23128, install retainer so that outer edge is recessed 1/32" from compressor neck face.

8. Install clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Replacement Procedure.

COMPRESSOR PULLEY BEARING

REMOVE

1. Remove clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Removal procedure.

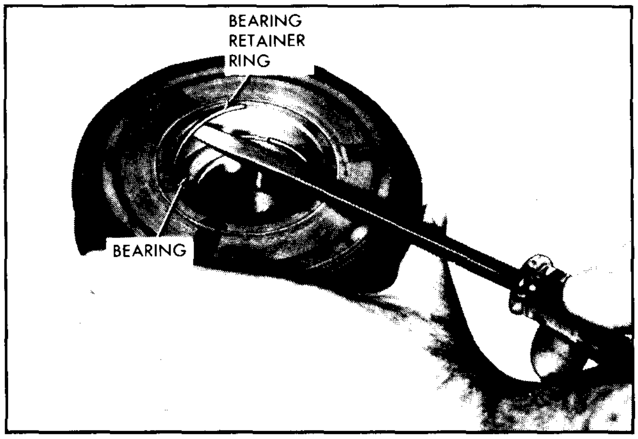


Figure 52—Removing Pulley and Bearing Retainer Ring

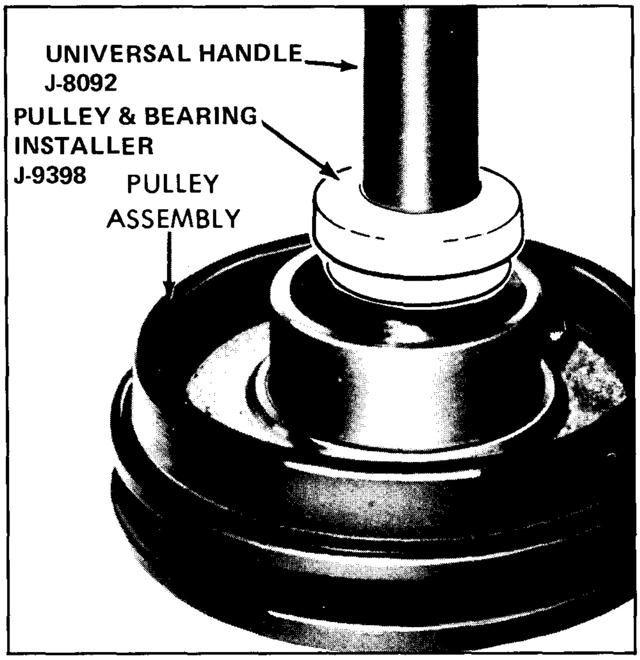


Figure 53—Removing Bearing from Pulley Assembly

2. Remove pulley and bearing assembly as described in "Compressor Pulley and Bearing Assembly" Removal procedure.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool (figure 52).

4. Place pulley and bearing assembly on inverted Support Block J-21352 and, using Pulley Bearing Remover J-9398 with Universal Handle J-8092, drive Bearing assembly out of pulley (figure 53).

REPLACE

1. Install new bearing in pulley using Pulley and Bearing Installer J-9481 with Universal Handle J-8092 (figure 54). The Installer will apply the force to the outer race of the bearing.

CAUTION: *DO NOT CLEAN NEW BEARING ASSEMBLY WITH ANY TYPE OF SOLVENT. Bearing is supplied with correct lubricant when assembled and requires no other lubricant at any time.*

2. Install bearing retainer ring, making certain that it is properly seated in ring groove.

3. Install pulley and bearing assembly as described in "Compressor Pulley and Bearing Assembly" Replacement procedure.

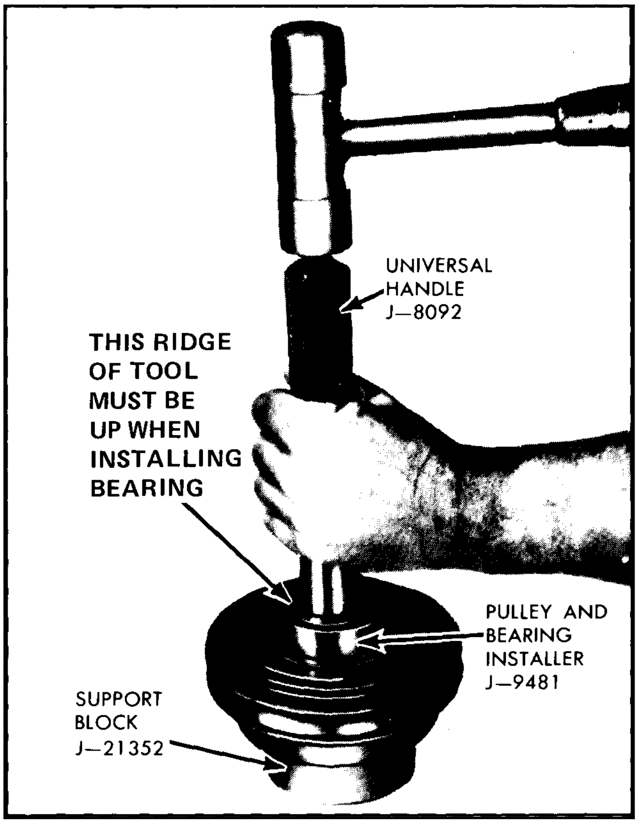


Figure 54—Installing Bearing on Pulley

4. Install clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

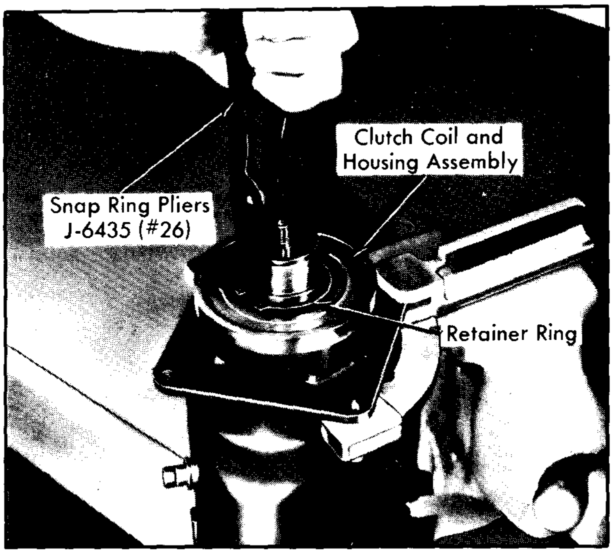


Figure 55—Removing Coil Housing Retainer Ring

COMPRESSOR CLUTCH COIL AND HOUSING ASSEMBLY

REMOVE

1. Remove clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Removal procedure.

2. Remove pulley and bearing assembly as described in "Compressor Pulley and Bearing Assembly" Removal procedure.

NOTE: Position of terminals on coil housing and scribe location on compressor front head casting.

3. Remove coil housing retaining ring using Snap-Ring Pliers J-6435 (figure 55).

4. Lift Coil and Housing assembly off compressor.

REPLACE

1. Position coil and housing assembly on compressor front head casting so that electrical terminals line up with marks previously scribed on compressor (figure 56).

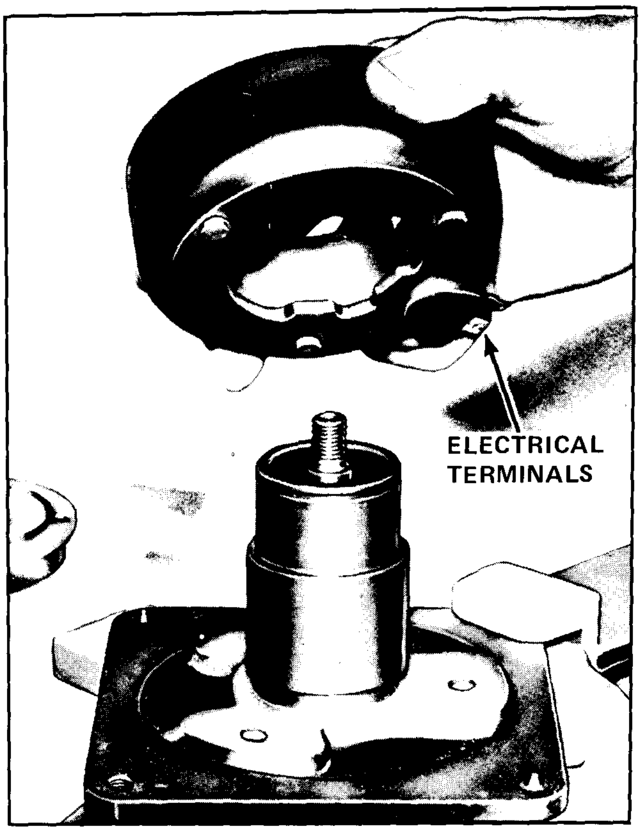


Figure 56—Installing Coil Housing

2. Align locating extrusions on coil housing with holes in front head casting.

3. Install coil housing retainer ring **with flat side of ring facing coil**, using Snap-Ring Pliers J-6435.

4. Install pulley and bearing assembly as described in "Compressor Pulley and Bearing Assembly" Replacement procedure.

5. Install clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Replacement Procedure.

COMPRESSOR MAJOR OVERHAUL PROCEDURES

Service repair procedures to the Compressor Shaft Seal, or disassembly of the Internal Compressor Mechanism are considered "MAJOR" SINCE THE REFRIGERATION SYSTEM MUST BE COMPLETELY PURGED OF REFRIGERANT before proceeding and/or because major internal operating and sealing components of the compressor are being disassembled and serviced.

A clean workbench, preferably covered with a sheet of clean paper, orderliness in the work area and a place for all parts being removed and replaced is of great importance, as is the use of the proper, clean service tools. Any attempt to use make-shift or inadequate equipment may result in damage and/or improper compressor operation.

These procedures are based on the use of the proper service tools and the condition that an adequate stock of service parts is available.

All parts required for servicing are protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the mechanism assembly just as they are removed from the service package.

Piston shoe discs and shaft thrust races will be identified by "number" on the parts themselves for reference to determine their size and dimension (See figure 80).

COMPRESSOR SHAFT SEAL

SEAL LEAK DETECTION

A SHAFT SEAL SHOULD NOT BE CHANGED BECAUSE OF AN OIL-LINE ON THE HOOD INSULATOR. The seal is designed to seep some oil for lubrication purposes. Only change a shaft seal when a leak is detected by the following procedure.

When refrigerant system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in large amounts due to leaks or a broken shaft seal.

Compressor shaft seals, unless replaced during a compressor overhaul, are to be replaced only on the basis of actual refrigerant leakage as determined by test with an electronic-type leak detector.

WHEN REPLACING THE SHAFT SEAL ASSEMBLY, even if the compressor remains on the vehicle during the operation, IT WILL BE NECESSARY TO PURGE THE SYSTEM OF REFRIGERANT as outlined earlier in this manual.

REMOVE

1. After first purging the system of refrigerant, remove the clutch plate and hub assembly and shaft key as described in "Compressor Clutch Plate and Hub Assembly" Removal procedure.

2. Pry out the sleeve retainer and remove the absorbent sleeve. Remove the shaft seal seat retaining ring, using Snap-Ring Pliers J-5403 (#21). See Figure 57.

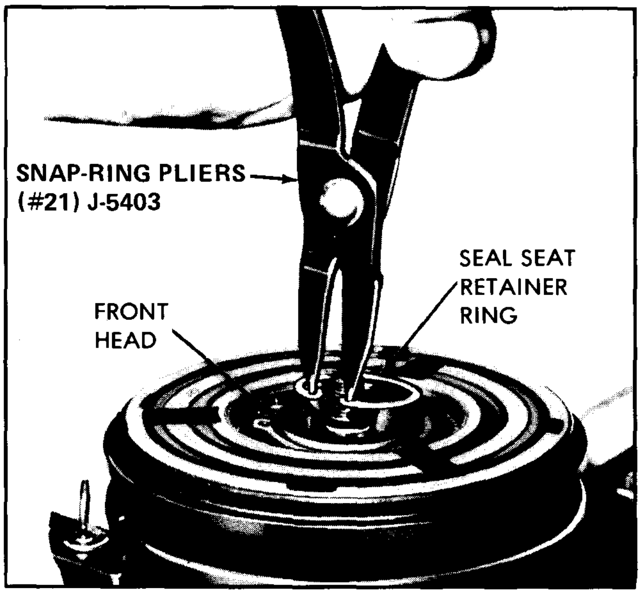


Figure 57—Removing or Installing Shaft Seal Seat Retaining Ring

3. Thoroughly clean inside of compressor neck area surrounding the shaft, the exposed portion of the seal seat and the shaft itself. **This is absolutely necessary to prevent any dirt of foreign material from getting into compressor.**

4. Place Seal Protector J-22974 over the end of the shaft to prevent chipping the ceramic seal. Fully engage the knurled tangs of Seal Seat Remover-Installer J-23128 into the recessed portion of the seal seat by turning the handle **clockwise.** Lift the seat from the compressor with a rotary motion (figure 58).

> **CAUTION:** *DO NOT tighten the handle with a wrench or pliers; however, the handle must be hand-tightened securely to remove the seat.*

5. With Seal Protector J-22974 still over the end of the shaft, engage the tabs on the seal assembly with the tangs on Seal Installer J-9392 by twisting the tool **clockwise, while pressing the tool down.** Then lift the seal assembly out (See figure 59).

Remove the seal seat O-ring from the compressor neck using O-Ring Remover J-9533 (See figure 58).

7. Recheck the shaft and inside of the compressor neck for dirt or neck foreign material and be sure these areas are perfectly clean before installing new parts.

INSPECTION

SEALS SHOULD NOT BE REUSED. ALWAYS USE A NEW SEAL KIT ON REBUILD. Be extremely careful that the face of the seal to be installed is not scratched or damaged in any way. Make sure that the seal seat and seal are free of lint and dirt that could damage the seal surface or prevent sealing.

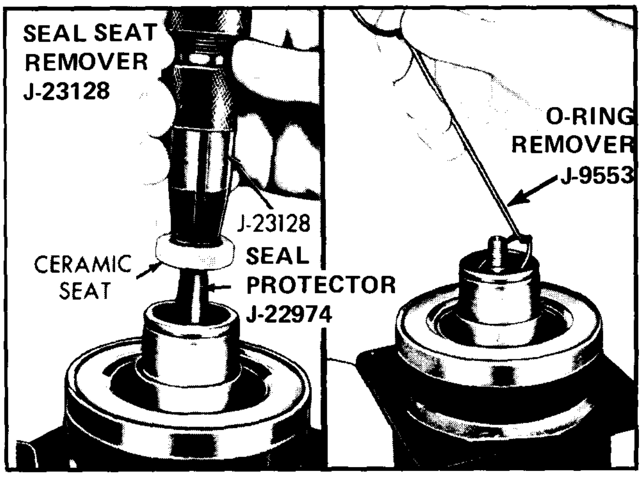


Figure 58—Removing Shaft Seal Seat and O-Ring

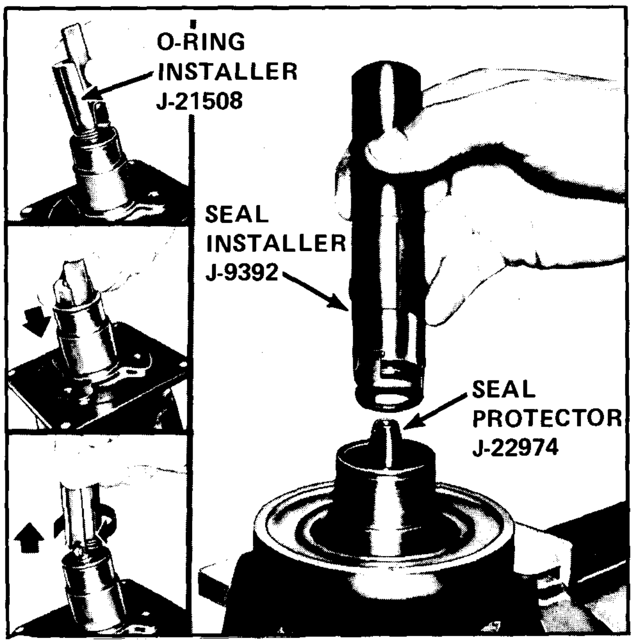


Figure 59—Replacing Seal and O-Ring

REPLACE

1. Coat new seal seat O-ring with clean 525 viscosity refrigerant oil and install in compressor neck, **making certain it is installed in bottom groove** (figures 59 and 60). Top groove is for retainer ring. Use O-Ring Installer J-21508.

2. Coat the O-ring and seal face of the new seal assembly with clean 525 viscosity refrigerant oil. Carefully mount the seal assembly to Seal Installer J-9392 by engaging the tabs of the seal with the tangs of the tool (figure 59).

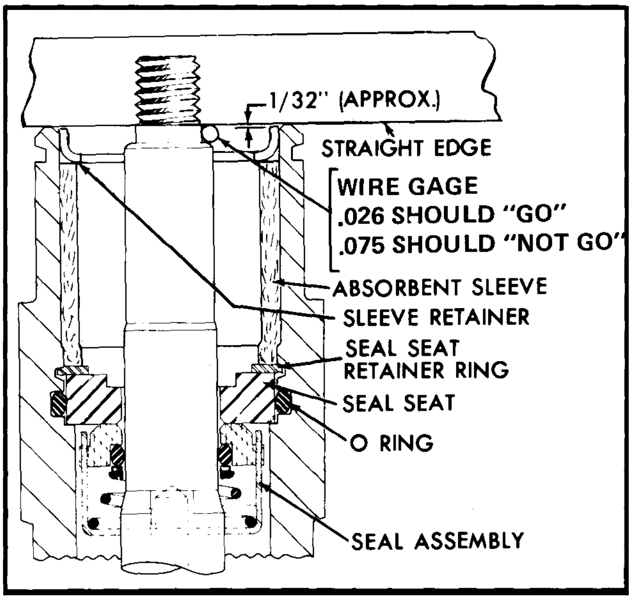


Figure 60—Compressor Shaft and Seal

3. Place Seal Protector J-22974 (figure 59) over end of shaft and **carefully slide the new seal assembly onto the shaft. Gently twist the tool CLOCKWISE, while pushing the seal assembly down the shaft** until the seal assembly engages the flats on the shaft and is seated in place. Disengage the tool by pressing downward and twisting tool counterclockwise.

4. Coat the seal face of the new seal seat with clean 525 viscosity refrigerant oil. Mount the seal seat on Seal Seat Remover-Installer J-23128 and install it in the compressor neck, taking care not to dislodge the seal seat O-ring and being sure the seal seat makes a good seal with the O-ring. Remove Seal Protector J-22974 from the end of the shaft (See figure 58).

5. Install the new seal seat retainer ring **with its flat side against the seal seat,** using Snap-Ring Pliers J-5403 (#21). See Figure 57. Use the sleeve from Seal Seat Remover-Installer J-23128 (figure 58) to press in on the seal seat retainer ring so that it snaps into its groove.

6. Install Compressor Leak Test Fixture J-9625 on rear head of compressor and connect gage charging lines as shown for bench test in Figure 61 or pressurize SUCTION SIDE of compressor on car with Refrigerant-12 vapor to equalize pressure to the drum pressure. Temporarily install the shaft nut and, with compressor in horizontal position and oil sump down, rotate the compressor shaft in normal direction of rotation several times by hand. Leak test the seal with an electronic-type Leak Detector. Correct any leak found. Remove and discard the shaft nut.

7. Remove any excess oil, resulting from installing the new seal parts, from the shaft and inside the compressor neck.

8. Install the new absorbent sleeve by rolling the material into a cylinder, overlapping the ends, and then slipping the sleeve into the compressor neck with the overlap towards the top of the compressor.

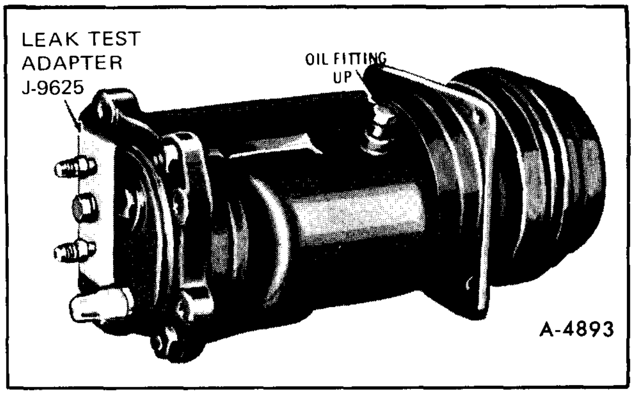


Figure 61—Leak Testing Compressor

With a small screwdriver or similar instrument, carefully spread the sleeve until the ends of the sleeve butt at the top vertical centerline.

9. Position the new metal sleeve retainer so that its flange face will be against the front end of the sleeve. Pulley Puller Pilot J-9395 (See figure 50) may be used to install the retainer. Press and tap with a mallet, setting the retainer and sleeve into place (retainer should be recessed approximately 1/32" from the face of the compressor neck). (See figure 60).

10. Reinstall the clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

Some compressor shaft seal leaks may be the result of mispositioning of the axial plate on the compressor shaft. The mispositioning of the axial plate may be caused by improper procedures used during pulley and driven plate removal, pounding, collisions or dropping the compressor. If the axial plate is mispositioned, the carbon face of the shaft seal assembly may not contact the seal seat and the rear thrust races and bearing may be damaged.

If there appears to be too much or insufficient air gap between the drive and driven plates, dislocation of the shaft should be suspected. If the carbon seal is not seating against the seal seat, it will not be possible to completely evacuate the system as outlined under "Evacuating the Refrigeration System".

To check for proper positioning of the axial plate on the shaft, remove the clutch driven plate and measure the distance between the front head extension and the flat shoulder on the shaft as shown in Figure 60. To measure this distance, use a wire gage **(the clearance should be between .026" and .075").** If the shaft has been pushed back in the axial plate (measurement greater than .075"), disassemble the compressor and replace the shaft and axial plate assembly rear thrust races and thrust bearing.

11. Evacuate and charge system as outlined under "Evacuating and Charging the Refrigeration System".

COMPRESSOR PRESSURE RELIEF VALVE

When necessary to replace the pressure relief valve, located in the compressor rear head casting, the valve assembly should be removed after PURGING THE SYSTEM OF REFRIGERANT and a new valve and gasket installed. The entire system should then be "Evacuated and Recharged". (figure 62).

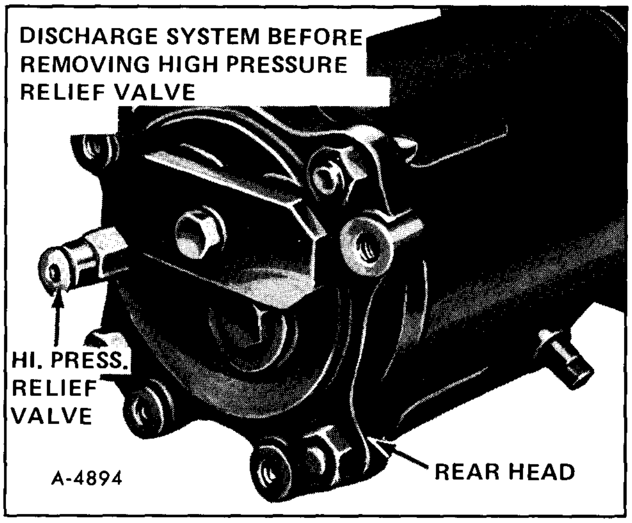


Figure 62—High Pressure Relief Valve Location

COMPRESSOR INTERNAL MECHANISM

Service operations to the rear head or internal mechanism of the compressor **should be performed with the compressor removed from the vehicle** to insure that the necessary degree of cleanliness may be maintained. Clean hands, clean tools and a clean bench, preferably covered with clean paper, are of extreme importance.

An inspection should be made of the internal mechanism assembly to determine if any service opeations should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them.

REMOVE

1. Before proceeding with disassembly, wipe exterior surface of compressor clean.

2. All oil in compressor should be drained and measured. Assist draining by positioning compressor with oil drain plug down. **Record the amount of oil drained from the compressor.**

3. Invert compressor and Holding Fixture J-9396 with front end of compressor shaft facing downward. (figure 63).

Additional oil may leak from compressor at this time. All oil must be drained into a container so that TOTAL amount can be measured. A liquid measuring cup may be used for this purpose. Drained oil should then be discarded.

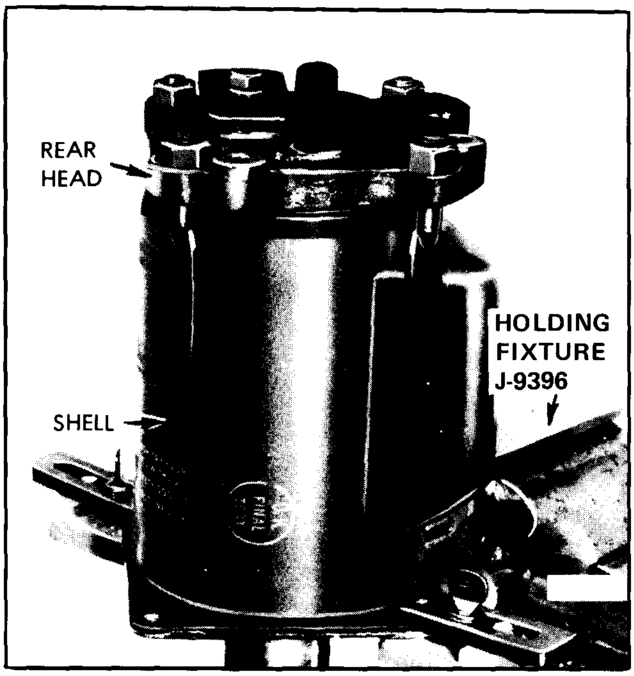


Figure 63—Compressor Installed in Holding Fixture

4. Remove four locknuts from threaded studs on compressor shell and remove rear head. Tap uniformly around rear head if head is binding. (figure 63).

Wipe excess oil from all sealing surfaces on rear head casting webs, and examine sealing surfaces (figure 64). If any damage is observed, the head should be replaced.

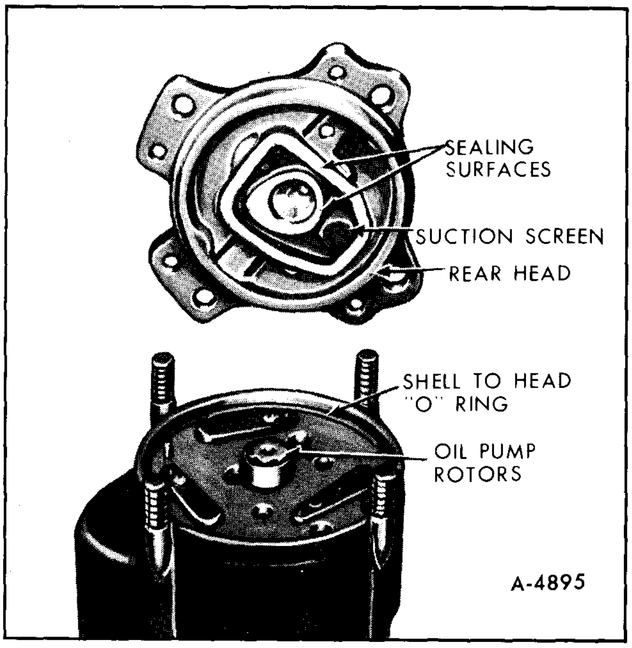


Figure 64—Rear Head Removal

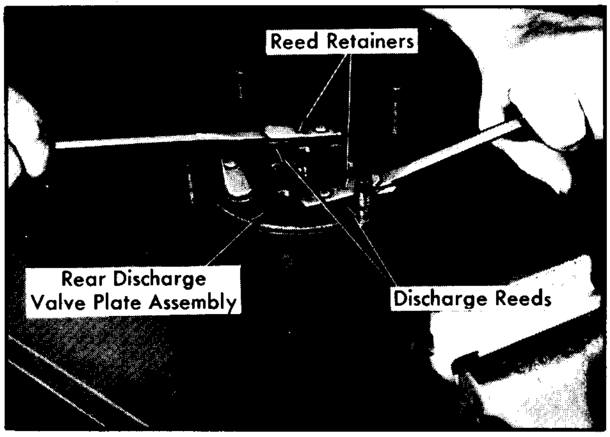


Figure 65—Removing Rear Discharge Valve Plate

6. Remove suction screen and examine for any damage or contamination. Clean or replace if necessary.

7. Paint an identifying mark on exposed face of inner and outer oil pump gears and then remove gears. Identifying marks are to assure that gears, if reused, will be installed on identical position.

8. Remove and discard rear head to shell O-ring.

9. Carefully remove rear discharge valve plate assembly. Use two small screwdrivers under reed retainers to pry up on assembly (figure 65). **Do not position screwdrivers between reeds and reed seats.**

10. Examine valve reeds and seats. Replace entire assembly if any reeds or seats are damaged.

11. Using two small screwdrivers, carefully remove rear suction reed (figure 66). **Do not pry up on horseshoe-shaped reed valves.**

12. Examine reeds for damage, and replace if necessary.

13. Using Oil Pick-Up Tube Remover J-5139

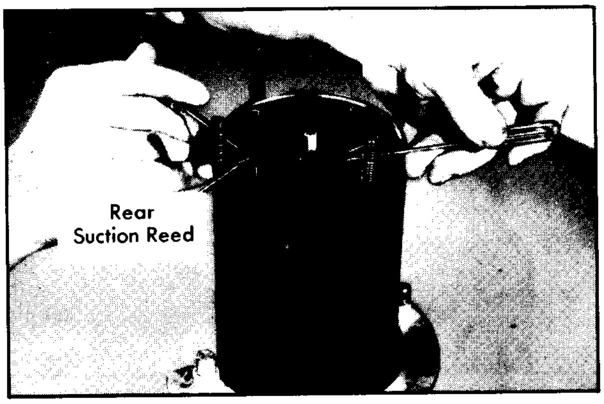


Figure 66—Removing Rear Suction Head

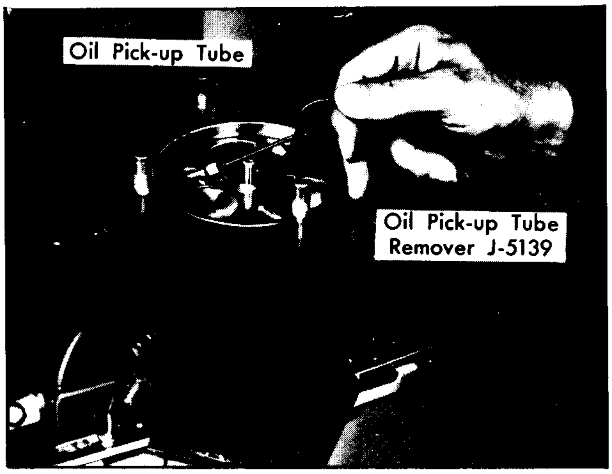


Figure 67—Removing Oil Pick-Up Tube

(figure 67), remove oil pick-up tube. Remove O-ring from oil inlet.

14. Loosen compressor from Holding Fixture J-9396, place Internal Assembly Support Block J-21352 over oil pump end of shaft and, holding Support Block in position with one hand, lift compressor from Holding Fixture with other hand. Invert compressor and position on bench with Internal Assembly Support Block resisting on bench.

15. Lift front head and compressor shell assembly up, leaving internal mechanism resting on Internal Assembly Support Block.

CAUTION: *To prevent damage to shaft, DO NOT TAP ON END OF COMPRESSOR SHAFT to remove internal mechanism. If mechanism will not slide out of compressor shell, tap on front head with a plastic hammer.*

16. Rest compressor shell on its side and push front head assembly through compressor shell, **being careful not to damage sealing areas on inner side of front head.** Discard O-ring.

It may be necessary to tap on outside of front head, using a plastic hammer, to overcome friction of O-ring seal between front head and compressor shell.

17. Wipe excess oil from sealing surfaces on front head casting webs and examine sealing surface. If any surface damage is observed, the head should be replaced.

18. Remove front discharge valve plate assembly and front suction reed plate. Examine reeds and seats. Replace necessary parts.

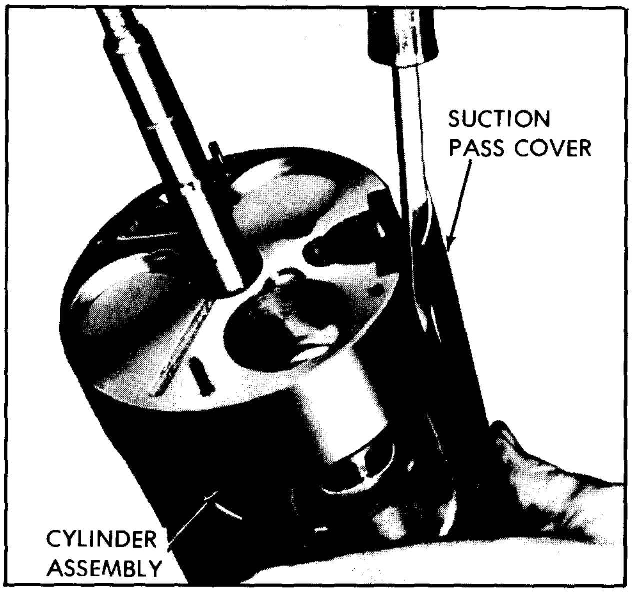


Figure 68—Removing Suction Crossover Cover

19. Remove suction cross-over cover by prying with screwdriver between cylinder casting and cover (figure 68).

20. Examine internal mechanism for any obvious damage. If internalmechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to use the Service internal mechanism Assembly rather than replace individual parts.

DISASSEMBLY

Use Parts Tray J-9402 (figure 72) to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in "Compressor Internal Mechanism" Removal procedure.

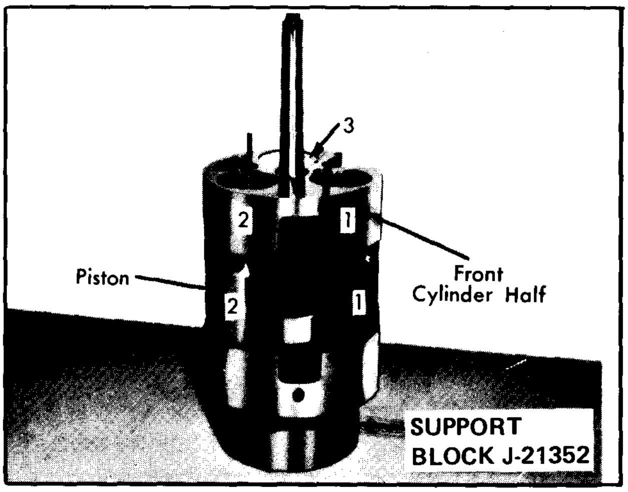


Figure 69—Numbering Piston and Cylinder Bores

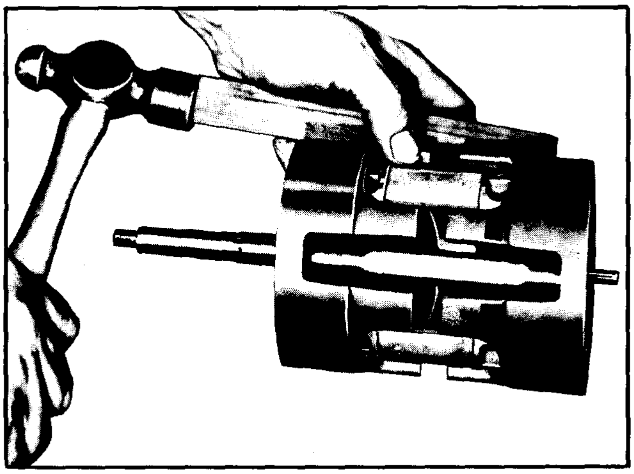


Figure 70—Separating Cylinder Halves

2. Identify by pancil mark, or some other suitable means, each piston numbering them as 1, 2, and 3 (figure 69).

Number the piston bores in the front cylinder half in like manner, so that pistons can be replaced in their original locations.

3. Separate cylinder halves, using a wood block and mallet (figure 70). Make certain that discharge cross-over tube does not contact axial plate when separating cylinder halves (a new Service discharge cross over tube will be installed later).

CAUTION: *UNDER NO CIRCUMSTANCES SHOULD SHAFT BE STRUCK AT EITHER END in an effort to separate upper and lower cylinder halves because the shaft and the axial plate could be damaged.*

4. Carefully remove the rear half of the cylinder from the pistons and set the front cylinder half, with the piston, shaft and axial plate is Compressing Fixture J-9397.

5. Pull up on compressor shaft and remove piston previously identified as No. 1, with balls and shoe discs, from axial plate.

1. **Inspect the Teflon piston rings** for nicks, cuts or metal particles imbedded in exposed ring surface and replace the piston rings as required if either condition exists. See "Teflon Piston Ring" Replacement procedure.

6. Remove and discard the piston shoe discs.

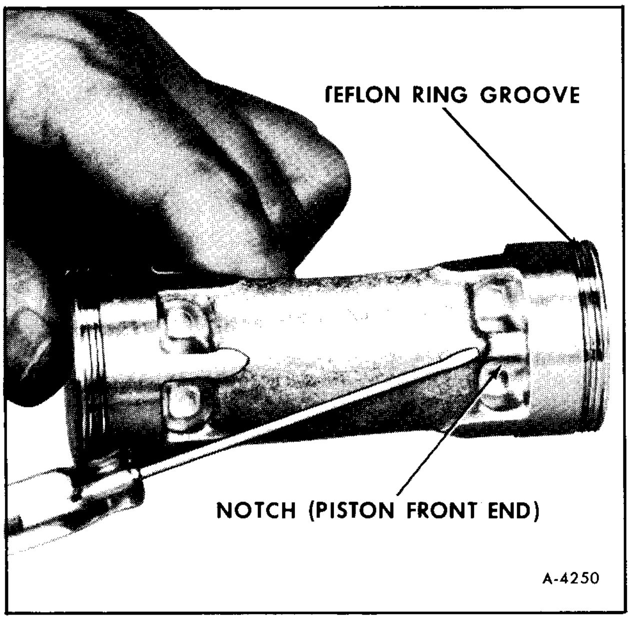


Figure 71—Notch Identifying Front End of Piston

7. Remove and examine piston balls, and if satisfactory for re-use, place balls in No. 1 compartment of Parts Tray J-9402 (figure 72).

8. Place piston in No. 1 compartment of Parts Tray J-9402, with notch in casting web at front end of piston (figure 71) into the dimpled groove of Parts Tray compartment.

9. Repeat Steps 5 through 9 for Pistons No. 2 and No. 3.

10. Remove rear combination of thrust races and thrust bearing from shaft. Discard races and bearing.

11. Remove shaft assembly from front cylinder hald. If the discharge cross-over tube remained in the front cylinder half, it may be necessary to bend discharge cross-over tube slightly in order to remove shaft.

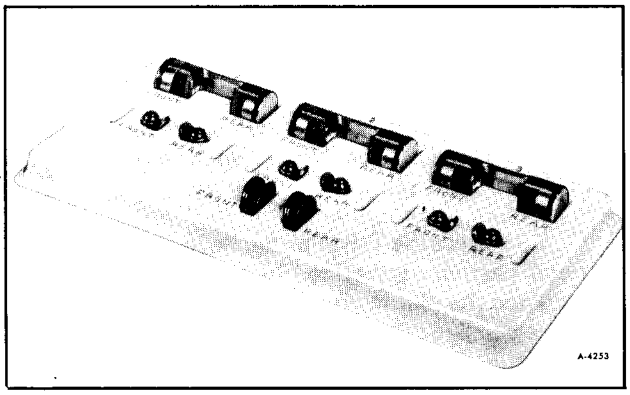


Figure 72—Parts Tray

12. Remove front combination of thrust races and bearing from shaft. Discard races and bearing.

13. Examine surface of axial plate and shaft. Replace **as an assembly,** if necessary.

A certain amount of shoe disc wear on axial plate is normal, as well as some markings indicating load of needle bearings on shaft.

14. Remove discharge cross-over tube from cylinder half, using self-clamping pliers.

This is necessary only on original factory equipment, as ends of the tube are swedged into cylinder halves. The discharge cross-over tube in internal mechanism assemblies that have been **previously** serviced have an O-ring and bushing at EACH END of the tubee, and can be easily removed by hand (See figure 92).

15. Examine piston bores and needle bearings in front and rear cylinder halves. Replace front and rear cylinders if any cylinder bore is deeply scored or damaged.

16. Needle bearings may be removed if necessary by driving them out with special Thin-Wall Socket J-9399. Insert socket in hub end (inner side) of cylinder head and drive bearing out. To install needle bearing, place cylinder half on Support Block J-21352, and insert bearing in end of cylinder head with bearing **identification marks UP.** Use Needle Bearing Installer J-9432 and drive bearing into cylinder head (figure 74), until tool bottoms on the cylinder face.

Two different width needle bearings are used in Production compressors - a 1/2" size and a 5/8" size. **The bearings ARE interchangeable.** Service replacement bearings are all 1/2".

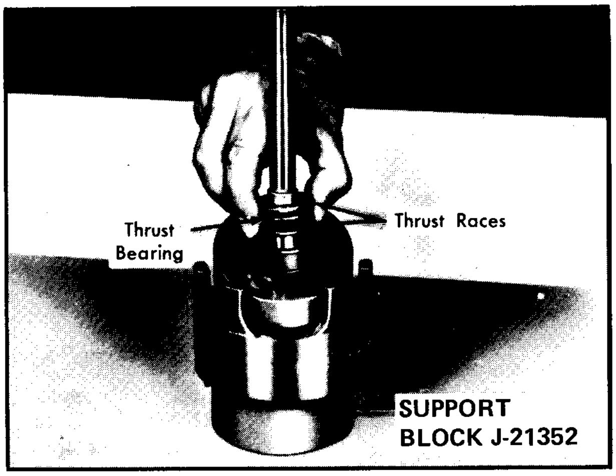


Figure 73—Removing Front Thrust Races and Bearings

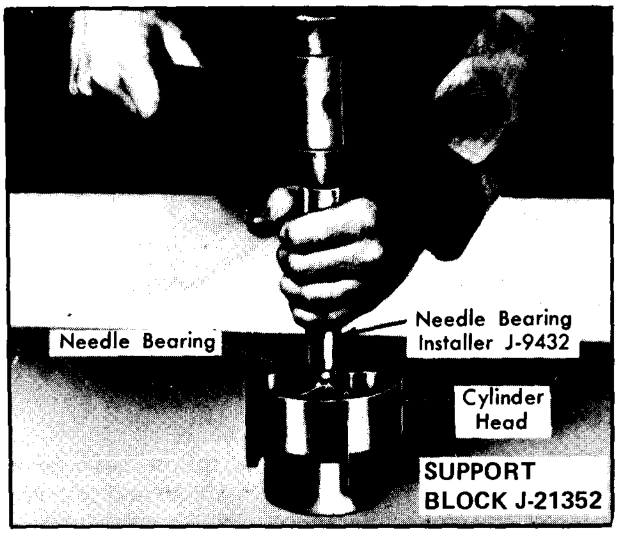


Figure 74—Installing Needle Bearing

17. Wash all parts to be re-used with trichlorethylene, naphtha, stoddard, kerosene, or a similar solvent. Air-dry parts using a source of clean, dry air.

Compressor internal components may be identified by referring to Figures 39 and 40.

GAGING OPERATION

1. Install Compressing Fixture J-9397 on Holding Fixture J-9396 in vise. Place front cylinder half in Compressing Fixture, flat side down. Front cylinder half has long slot extending out from shaft hole.

2. Secure from Service parts stock **four** ZERO thrust races and **three** ZERO shoe discs.

Install a ZERO thrust race, thrust bearing, and a second ZERO thrust race on front end of compressor shaft. Lubricate races and bearing with petrolatum.

4. Insert threaded end of shaft through needle bearing in front cylinder half, and allow thrust race and bearing assembly to rest on hub of cylinder.

5. Now install a ZERO thrust race on rear end of compressor shaft (figure 75), so that it rests on hub of axial plate. Then install thrust bearing and a second ZERO thrust race. Lubricate races and bearing with petrolatum.

6. Lubricate ball pockets of the No. 1 Piston with 525 viscosity refrigerant oil and place a ball in each socket. Use balls previously removed if they are to be re-used.

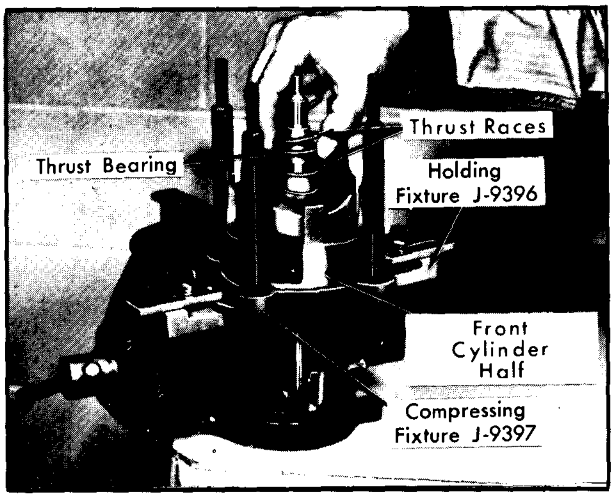


Figure 75—Installing Rear Thrust Races and Bearings

7. Lubricate cavity of a ZERO shoe disc with 525 viscosity refrigerant oil and place shoe disc over ball in **front end** of piston (figure 76). **Front end of piston has an identifying notch in casting web** (figure 71).

> **CAUTION:** *Exercise care in handling the Piston and Ring Assembly, particularly during assembly into and removal from the cylinder bores to prevent damage to the Teflon piston rings.*

Shoe discs should not be installed on rear of piston during following "Gaging" operation.

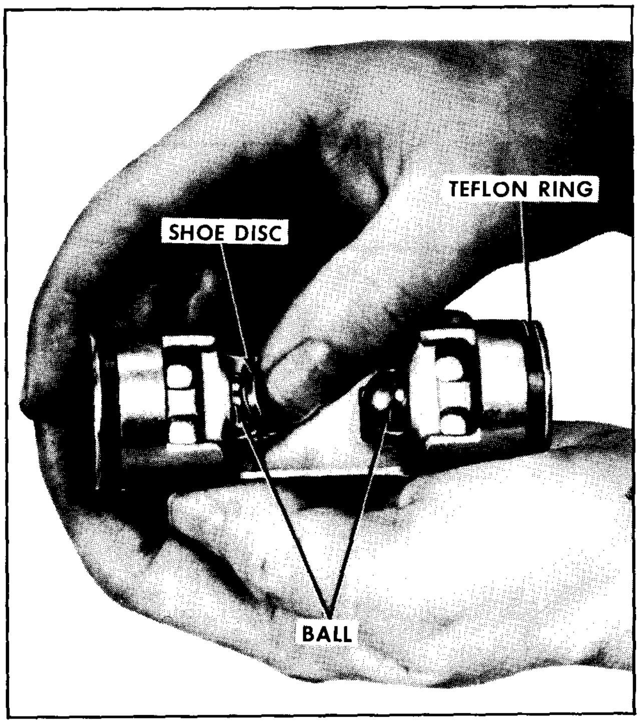


Figure 76—Installing Front Shoe Disc

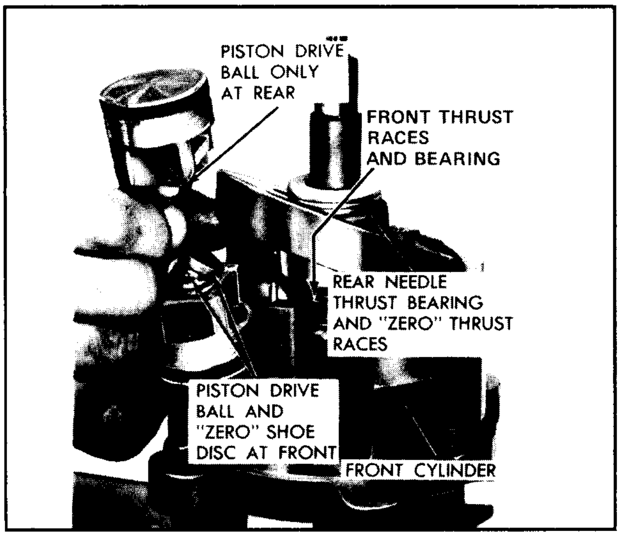


Figure 77—Installing Piston During Gaging Operation

8. Rotate shaft and axial plate until high point of axial plate is over the No. 1 Piston cylinder bore.

9. Lift shaft assembly up and hold front thrust race and bearing assembly against axial plate hub.

10. Position piston over No. 1 cylinder bore (notched end of piston being on bottom and piston straddling axial plate) and lower the shaft to allow piston to drop into its bore (figure 77).

11. Repeat Steps 6 through 10 for Pistons No. 2 and No. 3.

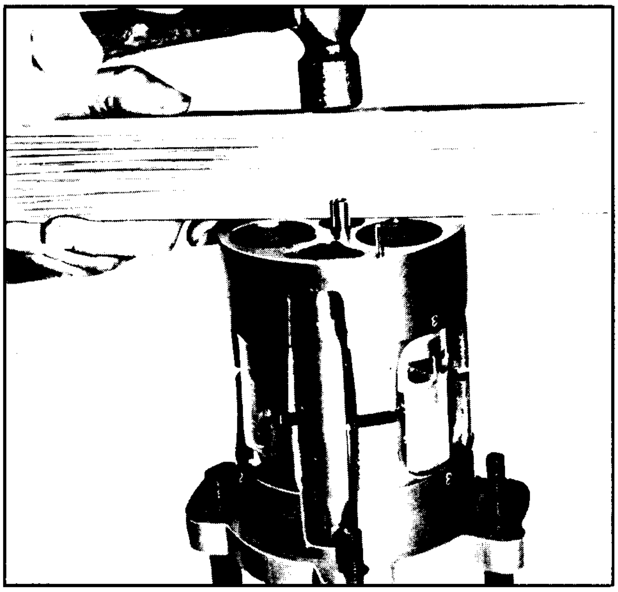


Figure 78—Assembling Cylinder Halves

12. Install rear cylinder half on pistons, aligning cylinder with discharge cross-over tube hole in front cylinder. Tap into place using a plastic mallet or piece of clean wood and hammer (figure 78).

13. Position discharge cross-over tube opening between a pair of Compressing Fixture bolts to permit access for feeler gage.

14. Install top plate on Compressing Fixture J-9397. Tighten nuts to 15 lb. ft. torque using a 0-25 lb. ft. torqud wrench.

Gaging Procedure (Steps 15 thru 18)

The gaging operations which follow have been worked out on a simple basis to establish and provide necessary running tolerances. Two gaging procedures are necessary.

The first is made to choose the proper size shoe discs to provide, at each piston, a .0016″ to .0024″ total preload between the seats and the axial plate at the tightest place through the 360-degree rotation of the axial plate at the tightest plate. The bronze shoe discs are provided in .0005″ variations, including a basic ZERO shoe.

The second, performed at the rear shaft thrust bearing and race pack, is designed to obtain .0025″ to .0030″ preload between the hub surfaces of the axial plate and the front and rear hubs of the cylinder. A total of 14 steel thrust races, including a basic ZERO race, are provided in increments of .0005″ thickness to provide the required fit.

Feeler Gage Set J-9564 or J-9661-01 may be used for gaging proper shoe disc size. Feeler Gage Set J-9564-01 or Dial Indicator Set J-8001-3 may be used to determine proper thrust race size.

PROPER SELECTION OF THRUST RACES AND BALL SEATS IS OF EXTREME IMPORTANCE.

15. Measure clearance between rear ball of No. 1 Piston and axial plate, in following manner:

a. Select a suitable combination of well-oiled Feeler Gage leaves to fit snugly between ball and axial plate.

b. Attach a spring scale, reading in 1-ounce increments, to the feeler gage. A distributor point checking scale or Spring Scale J-544 may be used.

c. Pull on Spring Scale to slide Feeler Gage stock out from between ball and axial plate, and note reading on Spring Scale as Feeler Gage is removed (figure 79). **Reading should be between 4 and 8 ounces.**

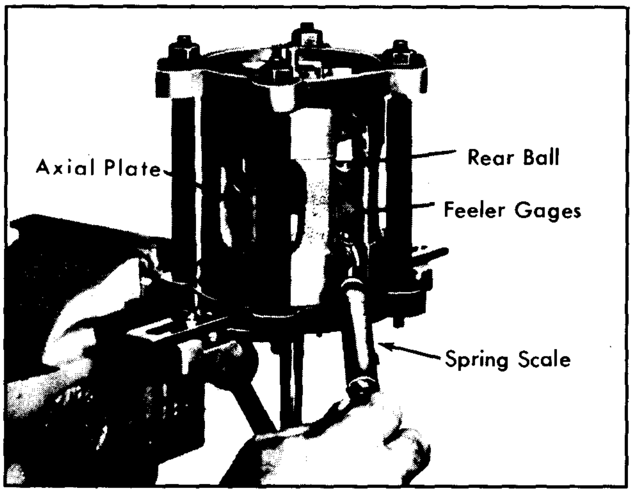


Figure 79—Gaging Rear Piston Ball

d. If reading in Step c. above is under 4 OR over 8 ounces, reduce or increase thickness of Feeler Gage leaves and repeat Steps 1. through c. above until a reading of 4 to 8 ounces is obtained. Record clearance between ball and axial plate that results in the 4 to 8-ounce pull on Spring Scale.

16. Now rotate shaft 120° and repeat Step 15 between same ball and axial plate. Record this measurement. If shaft is hard to rotate, install shaft nut onto shaft and turn shaft with wrench.

17. Rotate shaft another 120° and again repeat Step 15 between these same parts and record measurements.

SHOE DISC			THRUST BEARING RACE		
Part No. Ending In	Identi-fication Stamp	Min. Feeler Gage Reading	Part No. Ending In	Identi-fication Stamp	Dial Indi-cator Reading
000	0	.0000	000	0	.0000
175	17-1/2	.0175	050	5	.0050
180	18	.0180	055	5-1/2	.0055
185	18-1/2	.0185	060	6	.0060
190	19	.0190	065	6-1/2	.0065
195	19-1/2	.0195	070	7	.0070
200	20	.0200	075	7-1/2	.0075
205	20-1/2	.0205	080	8	.0080
210	21	.0210	085	8-1/2	.0085
215	21-1/2	.0215	090	9	.0090
220	22	.0220	095	9-1/2	.0095
			100	10	.0100
			105	10-1/2	.0105
			110	11	.0110
			115	11-1/2	.0115
			120	12	.0120

Figure 80—Available Service Shoes and Thrust Races

	POSITION 1	POSITION 2	POSITION 3	SELECT AND USE SHOE NO.
PISTON NO. 1	.019"	.0195"	.019"	19
PISTON NO. 2	.020"	.020"	.020"	20
PISTON NO. 3	.021"	.021"	.022"	21

Figure 81—Selection of Proper Shoe Disc

18. Select a "numbered" shoe disc corresponding to minimize feeler gage reading recorded in the three checks above. (See example in figure 81). Place shoe discs in Parts Tray J-9402 compartment corresponding to Piston No. 1 and rear ball pocket position.

Shoe discs are provided in .0005" (one-half thousandths) variations. There are a total of 11 sizes available for field servicing. All shoe discs are marked with the shoe size, which corresponds to the last three digits of the piece part number. (See Shoe Disc size Chart in figure 80 above).

Once a proper selection of the shoe has been made, THE MATCHED COMBINATION OF SHOE DISC TO REAR BALL AND SPHERICAL CAVITY IN PISTON MUST BE KEPT IN PROPER RELATIONSHIP during disassembly after gaging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gaging procedure outlined in Steps 15 through 18 for Piston No. 2 and No. 3.

20. Mount Dial Indicator J-8001-3 on edge of Compressing Fixture J-9397 with Clamp J-8001-1 and Sleeve J-8001-2 (figure 81). Position Dial Indicator on rear end of shaft and adjust to "zero".

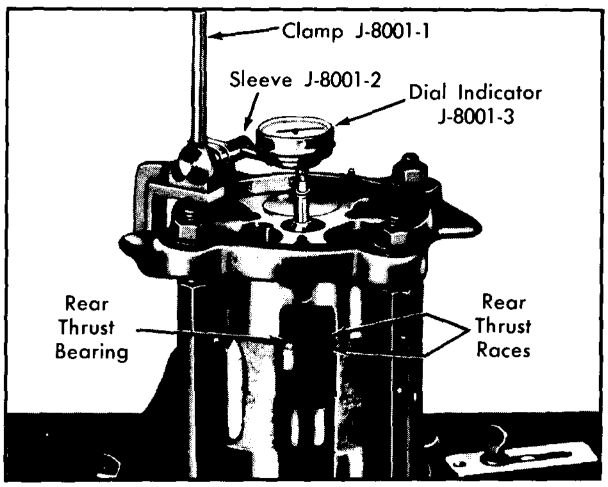


Figure 82—Gaging Rear Thrust Race

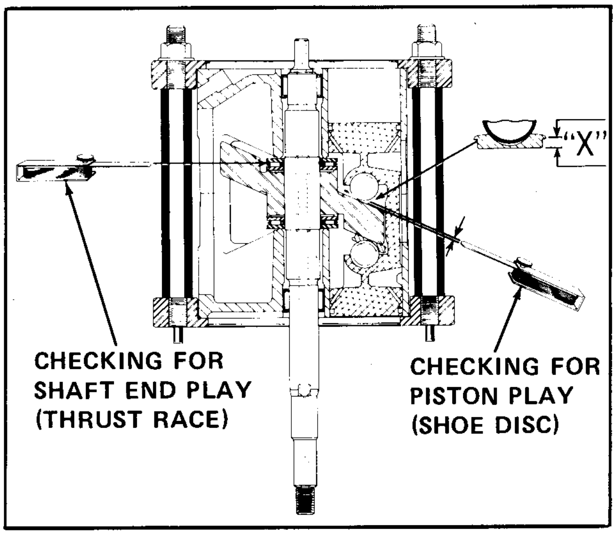


Figure 83—Checking Piston and Shaft End Play

Apply full hand-force at end of mainshaft a few times before reading clearance. This will help squeeze the oil out from/ between mating parts. Push upward and record measurement. Dial Indicator increments are 001"; therefore, reading must be estimated to nearest .0005".

An alternate method of selecting a proper race is to use Gage Set J-9661-01, selecting a suitable feeler gage leaf until the result is a 4 to 8 ounce pull on the scale between the rear thrust bearing and upper (or outer rear) thrust race (figure 83). If the pull is just less than 4 ounces, add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 8 ounces, then subtract .0005" from the thickness of the feeler stock. **Select a race TWO (2) FULL SIZES LARGER than feeler gage thickness** (If feeler gage is .007", select a No. 9 or 090 race).

21. **Select a thrust race with a "number" corresponding to TWO (2) FULL SIZES LARGER than Dial Indicator or feeler gage measurement of the amount of end play shown.** (If measurement is .007", select a No. 9 or 090 race). **Place thrust race in right-hand slot at bottom center of Parts Tray J-9402.**

Fifteen (15) thrust races are provided in increments of .0005" (one-half thounsandths) thickness and one ZERO gage thickness, providing a total of 16 sizes available for field service. Thrust races are identified on the part by their thickness in thousandths, in excess of the thickness of the ZERO thrust race.

This "number" also corresponds to the last three digits of the piece part number. See Thrust Race size Chart in Figure 80.

22. Remove nuts from top plate of Compressing Fixture J-9397, and remove top plate.

23. Separate cylinder halves while unit is in Fixture. It may be necessary to use a wood block and mallet.

24. **Remove rear cylinder half and carefully remove one piston at a time from axial plate and front cylinder half. DO NOT LOSE THE RELATIONSHIP of the front ball and shoe disc and rear ball. Transfer each piston, ball, and shoe disc to its proper place in Parts Tray J-9402.**

25. Remove rear outer ZERO thrust race from shaft and install thrust race just selected.

The ZERO thrust race may be put aside for reuse in additional gaging or rebuilding operations.

TEFLON PISTON RING REPLACEMENT

The Teflon piston ring installing, sizing and gaging tools are shown in Figure 84.

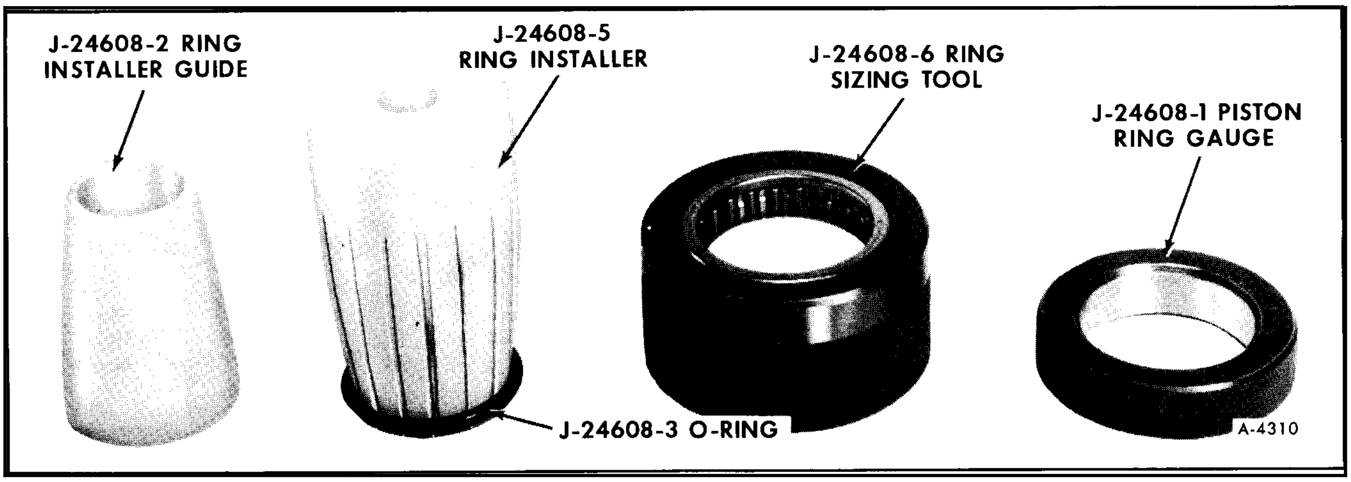


Figure 84—Teflon Piston Ring Installing, Sizing , and Gaging Tools

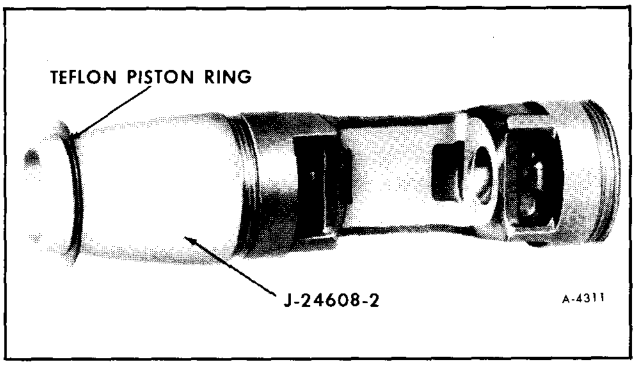


Figure 85—Teflon Piston Ring Positioned on Ring Installer Guide

1. Remove the old piston rings by CAREFULLY slicing through the ring with a knife or sharp instrument, holding the blade almost flat with the piston surface. Be fareful not to damage the aluminum piston OF piston groove in cutting to remove the ring.

WARNING: EXERCISE PERSONAL CARE IN CUTTING THE PISTON RING FOR REMOVAL.

2. Clean the piston and piston ring grooves with a recommended cleaning solvent and blow the piston dry with dry air (Trichlorethylene, naphtha, stoddard solvent, kerosene, or equivalent).

3. Set the piston on end on a clean, flat surface and install the Ring Installer Guide J-24608-2 on the end of the piston (figure 89).

4. Install a Teflon ring on the Ring Installer Guide J-24605-2 as shown in Figure 85, **with the dished or dull-side down and glossy-side up.**

5. Push the Ring Installer J-24608-5 down over the Installer Guide J-24608-2 to install the Teflon ring in the piston ring groove (figure 86). If the Teflon ring is slightly off position in the ring groove, it can be positioned into place by fingernail or blunt-edged tool that will not damage the piston.

The Ring Installer J-24608-5 will retain the Installer Guide J-24608-2 internally when the Teflon ring is installed on the piston. Remove the Installer Guide from the Ring Installer and **DO NOT STORE THE INSTALLER GUIDE IN THE RING INSTALLER, as the Ring Installer Segment Retainer O-Ring J-24608-3 will be stretched and possibly weakened during storage.** This could result in the O-Ring J-24608-3 not holding the Ring Installer segments tight enough to the Installer Guide J-24608-2 to peroperly install the Teflon ring on the piston.

6. Lubricate the piston ring area with 525 viscosity refrigerant oil and rotate the Piston and Ring

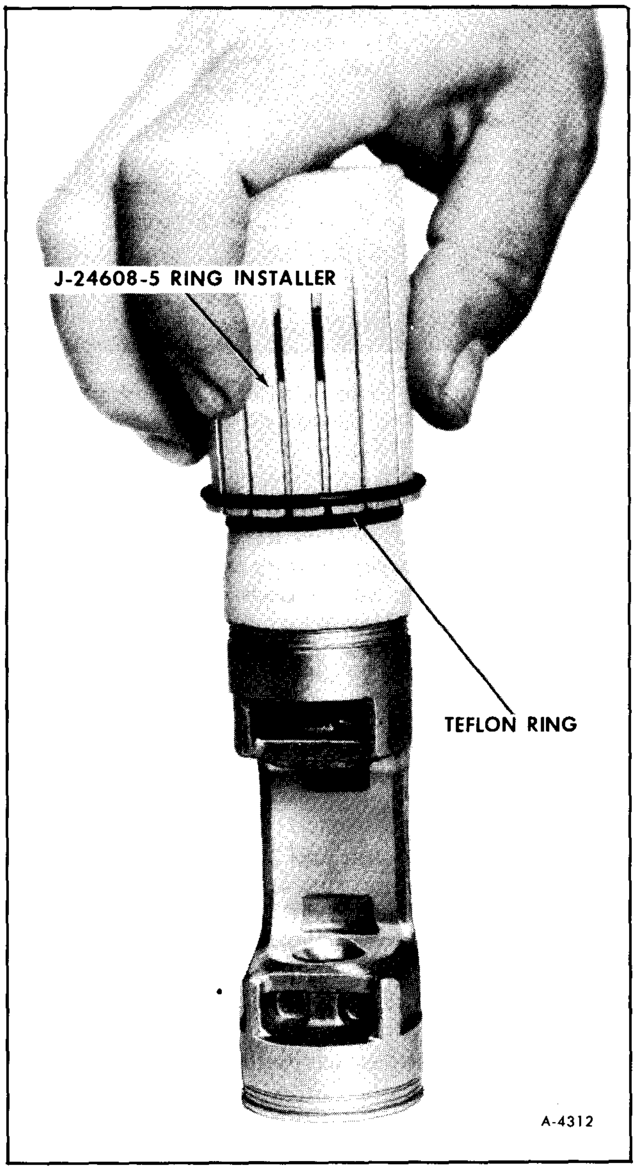


Figure 86—Installing Teflon Piston Ring

Assembly into the Ring Sizer J-24608-6 **at a slight angle** (figure 88). Rotate the piston, while pushing inward, until the piston is inserted against the center stop of the Ring Sizer J-23608-6.

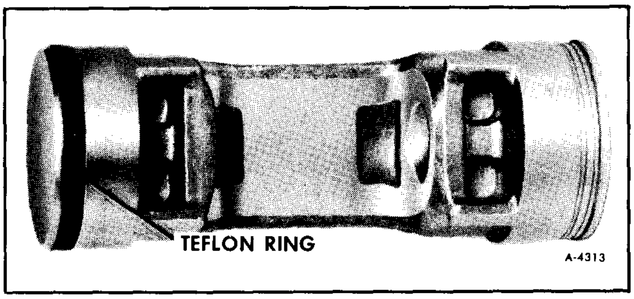


Figure 87—Teflon Piston Ring Installed on Piston Groove

Figure 88—Turning Piston and Ring Assembly into Ring Sizing Tool

CAUTION: *DO NOT push the Piston and Ring Assembly into the Ring Sizer J-24608-6 without proper positioning and rotating as described above, as the ends of the needle bearings of the Ring Sizer may damage the end of the piston.*

7. Rotate the Piston and Ring Assembly in the Ring Sizer J-24608-6 several COMPLETE turns, until the Assembly rotates relatively free in the Ring Sizer (figure 88).

8. Remove the Piston and Ring Assembly, wipe the end of the piston and ring area with a clean cloth and then push the Piston and Ring Assembly into the Ring Gage J-24608-1 (figure 87). The piston should go through the Ring Gage with a 6-lb. force or less without lubrication. If not, repeat Steps 6 and 7.

9. Repeat the procedure for the opposite end of the piston.

CAUTION: *DO NOT lay the piston down on a dirty surface where dirt or metal chips might become imbedded in the Teflon ring surface.*

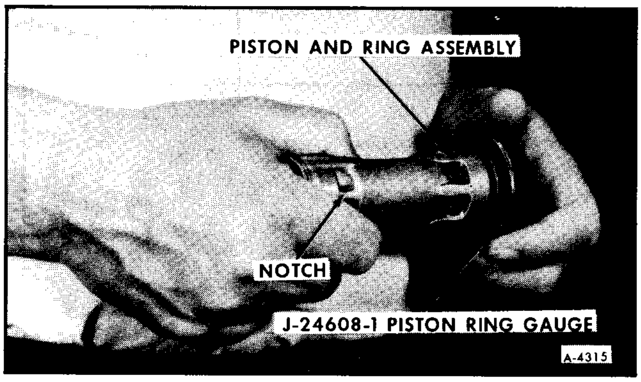


Figure 89—Gaging Piston Ring Size

10. Lubricate BOTH ENDS of the piston with 525 viscosity refrigerant oil before inserting the piston into the cylinder bore.

CAUTION: *Reasonable care should be exercised in installing the piston into the cylinder bore to prevent damage to the Teflon ring.*

ASSEMBLY

After properly performing the "Gaging Procedure", choosing the correct shoe discs and thrust races, and installing any needed Teflon Piston Rings, the cylinder assembly may now be reassembled. Be sure to install all NEW seals and O-rings. All are included in the compressor O-Ring Service Kit.

Assembly procedure is as follows:

1. Support the FRONT half of the cylinder assembly on Compressing Fixture J-9397. Install the shaft and axial plate, threaded end **down**, with its front bearing race pack (ZERO race, bearing NUMBERED race), if this was not already done at the end of the "Gaging Procedure".

2. Apply a light smear of petroleum jelly to the "numbered" shoe discs chosen in the gaging procedure and install all balls and shoe discs in their proper place in the piston assembly.

3. Rotate the axial plate so that the high point is above cylinder bore No. 1. Carefully assemble Piston No. 1, complete with ball and ZERO shoe disc on the

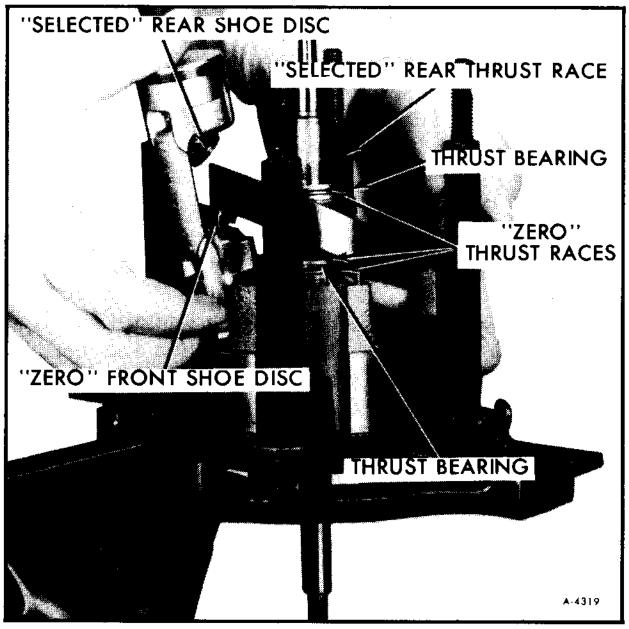


Figure 90—Installing First Piston Assembly Into Front Cylinder Half

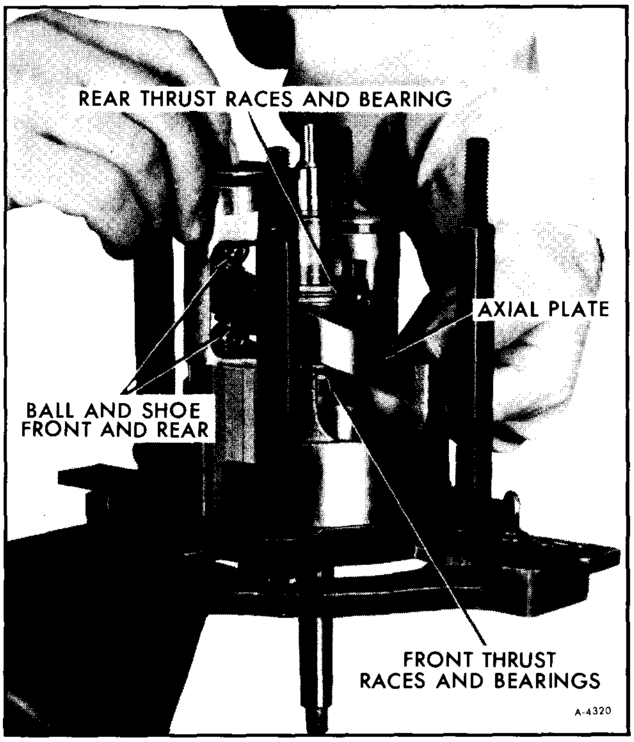


Figure 91—Installing Second Piston

front AND ball and NUMBERED shoe disc on the **rear,** over the axial plate. Hold front thrust bearing pack tightly against axial plate hub while lifting hub. Insert the Piston Assembly into the front cylinder half (figure 90).

4. Repeat this operation for Pistons No. 2 and No. 3 (figure 91).

5. Without installing any O-rings or bushings, assemble one end of the new Service discharge cross-over tube into the hole in the front cylinder half (figures 92 and 93).

Be sure the flattened portion of this tube faces the **inside** of the compressor to allow for axial plate clearance (figure 93).

6. Now rotate the shaft to position the pistons in a stair-step arrangement; then **carefully** place the rear

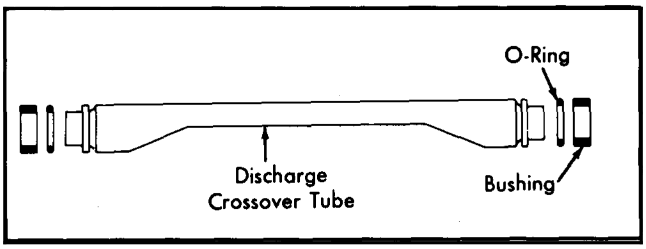


Figure 92—Service Type Discharge Cross-Over Tube

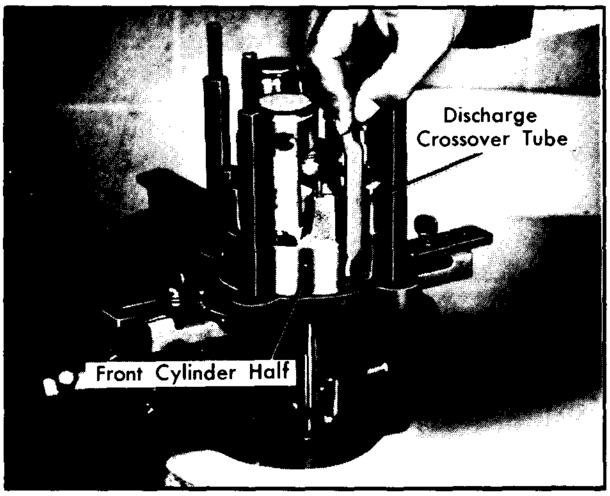


Figure 93—Installing Discharge Cross-Over Tube

cylinder half over the shaft and start the pistons into the cylinder bores (figure 94).

7. When all three Piston and Ring assemblies are in their respective cylinders, align the end of the discharge cross-over tube with the hole in the rear half of the cylinder.

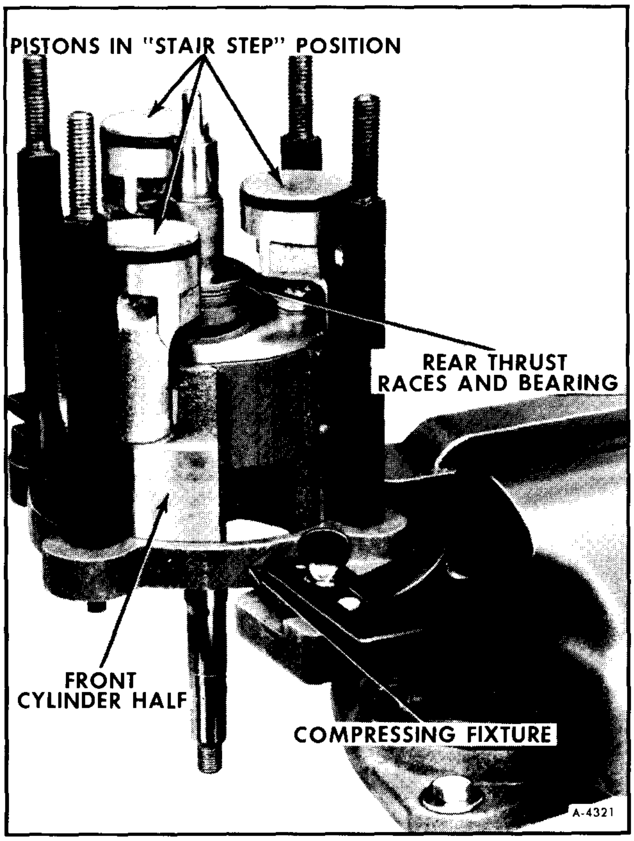


Figure 94—Pistons Postioned in Stair-Step Arrangement

8. When all parts are in proper alignment, tap with a clean wood block and mallet to seat the rear half of the cylinder over the locating dowel pins. If necessary, clamp the cylinder in Compressing Fixture J-9397, to complete drqwing the cylinder halves together.

9. Generously lubricate all moving parts with clean 525 viscosity refrigerant oil and check for free rotation of the parts.

10. Replace the suction cross-over cover (figure 95). Compress the cover as shown to start it into the slot, and then press or carefully tap it in until flush on both ends.

RE-INSTALL

1. Place internal mechanism on Internal Assembly Support Block J-21352, with **rear-end** of shaft in block hole.

2. Now install new O-ring and bushing on **front-end** of discharge cross-over tube (figure 96). The O-ring and bushing are Service parts only for internal mechanisms that have been disassembled in the field (See figure 92).

Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge cross-over tube (figure 97).

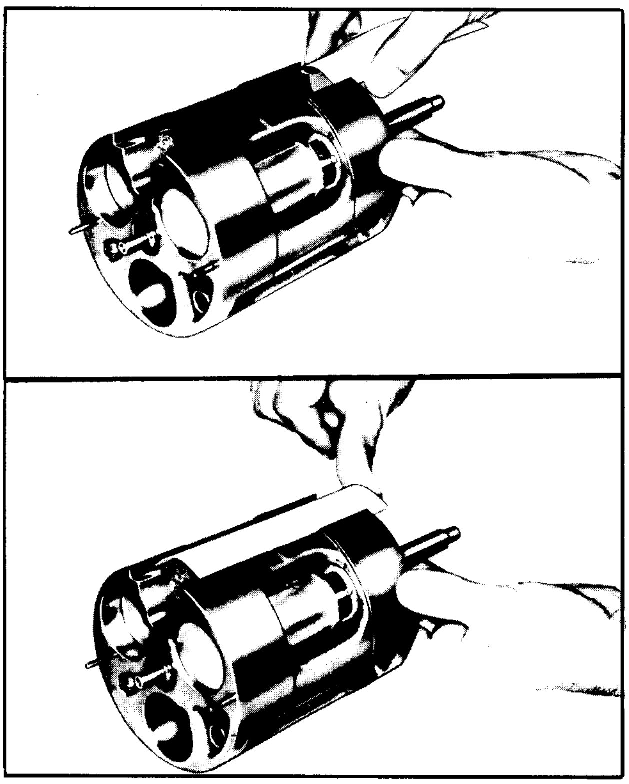


Figure 95—Installing Suction Cross-Over Cover

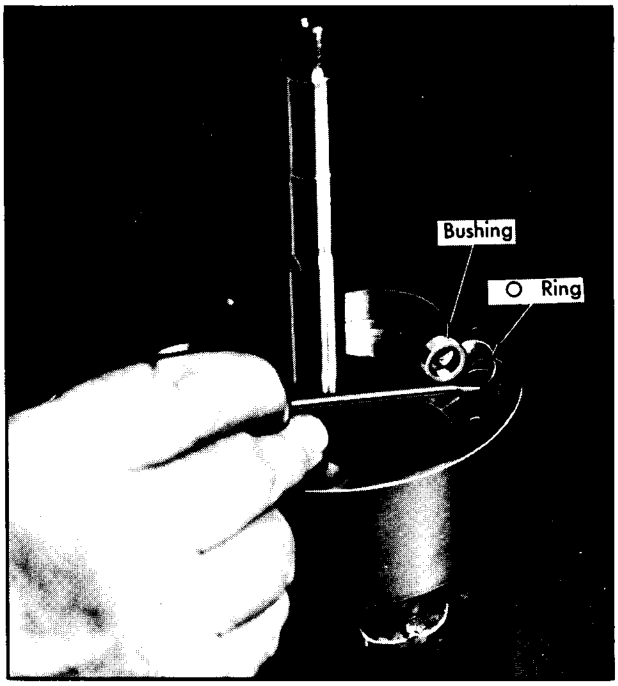


Figure 96—Installing O-Ring on Discharge Cross-Over Tube

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate (figure 98).

Front discharge plate has a large diameter hole in the center (figure 99).

6. Coat sealing surfaces on webs of compressor front ehad casting with 525 viscosity refrigerant oil.

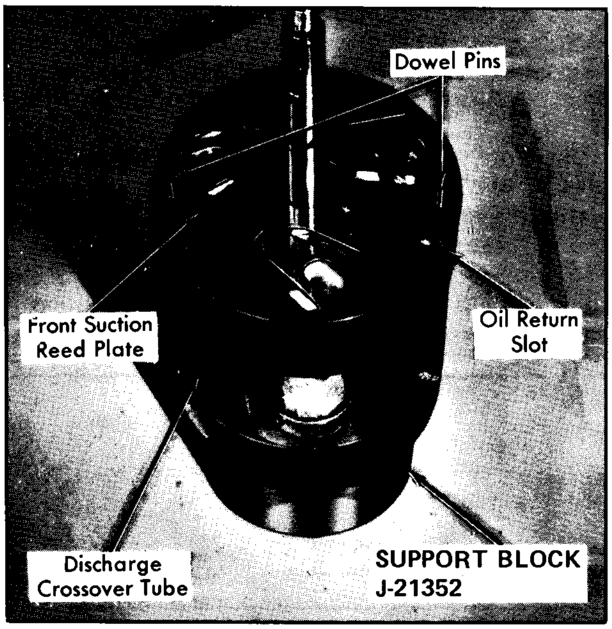


Figure 97—Installing Front Suction Reed

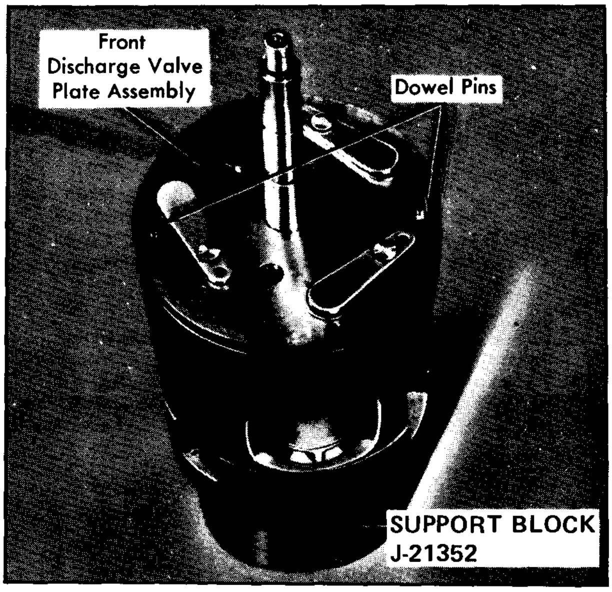


Figure 98—Installing Front Discharge Valve Plate

7. Determine **exact** position of front head casting in relation to dowel pins on internal mechanism. Mark position of dowel pins on sides of front head assembly and on sides of internal mechanism with a grease pencil. Carefully lower front head casting into position (figure 100), **making certain that sealing area around center bore of head assembly does not contact shaft** as head assembly is lowered. **Do not rotate head assembly** to line up with dowel pins, as the sealing areas would contact reed retainers.

8. Generously lubricate new O-ring and angled groove at lower edge of front head casting with 525 viscosity refrigerant oil and install new O-ring into groove (figure 101).

9. Coat inside machined surfaces of compressor shell with 525 viscosity refrigerant oil and position shell on internal mechanism, resting on O-ring seal.

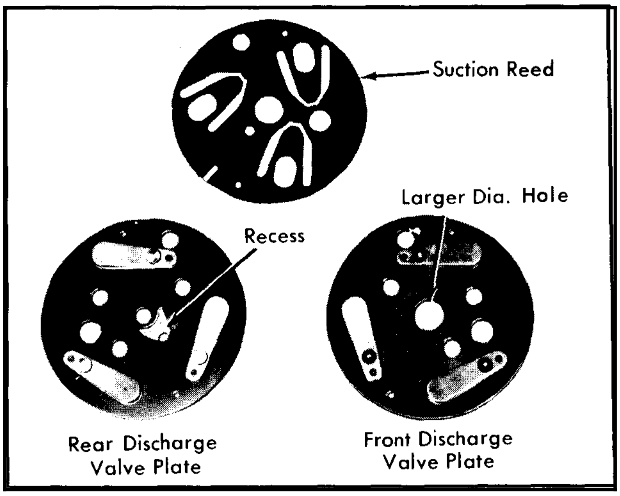


Figure 99—Front and Rear Discharge Valve Plate

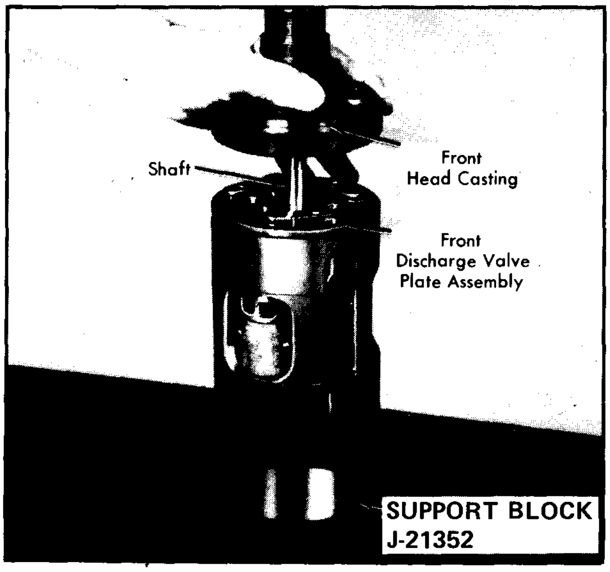


Figure 100—Installing Front Head Casting

10. Using flat-side of a small screwdriver, gently position O-ring in a round circumference of internal mechanism until compressor shell slides down over internal mechanism. As shell slides down, line up oil sump with oil intake tube hole (figure 102).

11. Holding Support Block, invert assembly and place back into Holding Fixture with front end of shaft down. Remove Support Block.

12. Install new dowel pins in rear cylinder half, if previously removed.

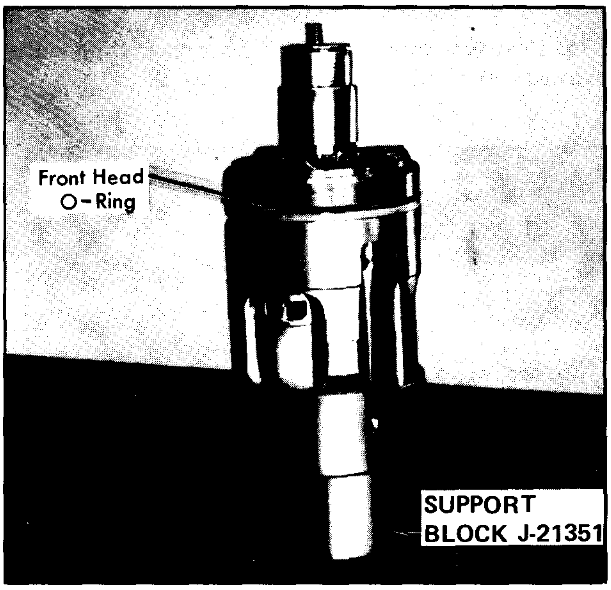


Figure 101—Front Head O-Ring Installed

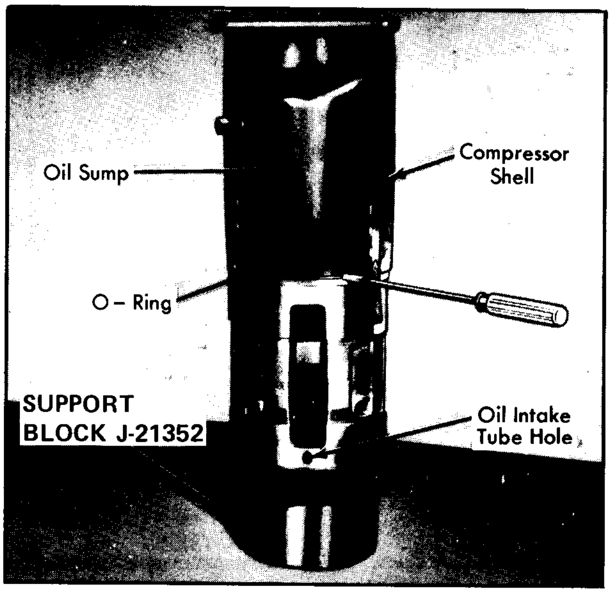


Figure 102—Installing Compressor Shell

13. Install new O-ring in oil pick-up tube cavity.

14. Lubricate oil pick-up tube with 525 viscosity refrigerant oil and install into cavity, rotating compressor mechanism to align tube with hole in shell baffle (figure 103).

15. Install new O-ring and bushing on **rear-end** of discharge cross-over tube (See figure 92).

16. Install rear suction reed over dowel pins, **with slot TOWARDS sump.**

17. Install rear discharge valve plate assembly over dowel pins, **with reed retainers UP.**

18. Position inner oil pump gear over shaft with previously applied identification **mark UP.**

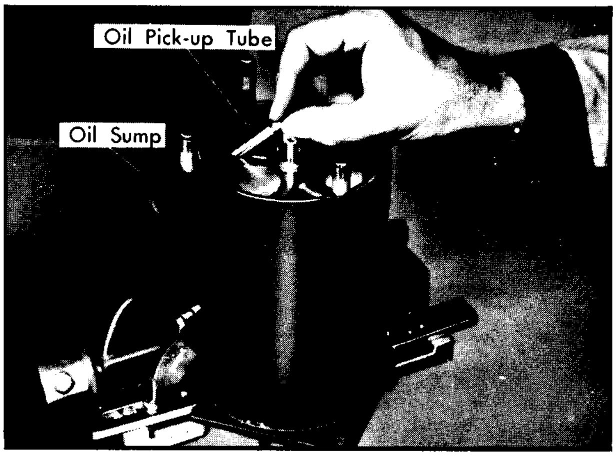


Figure 103—Installing Oil Pick-Up Tube

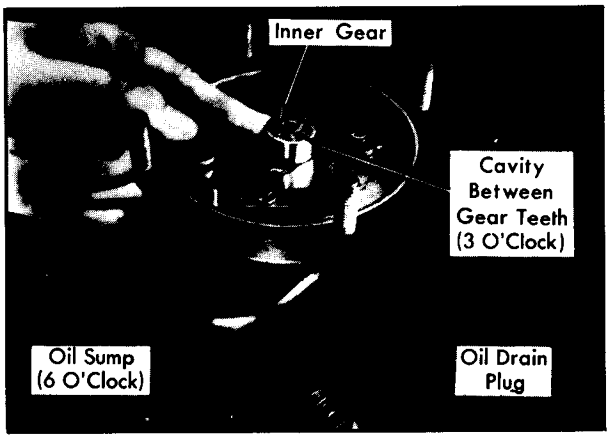


Figure 104—Positioning Oil Pump Gears

19. Position outer oil pump gear over inner gear with previously applied identification **mark UP** and, when standing facing oil sump, position outer gear so that it meshes with inner gear at the 9-o'clock position, and resulting cavity between gear teeth is then at 3-o'clock position (figure 104).

20. Generously oil rear discharge valve plate assembly with 525 viscosity refrigerant oil around outer edge where large diameter O-ring will be placed. Oil the valve reeds, pump gears, and area where sealing surface will contact rear discharge valve plate.

21. Using the 525 oil, lubricate new head to-shell O-ring and install on rear discharge valve plate, in contact with shell (figure 105).

22. Install suction screen in rear head casting, using care not to damage screen.

24. Coat sealing surface on webs of compressor rear head casting with 525 viscosity refrigerant oil.

24. Install rear head assembly over studs on compressor shell. **The two lower threaded compressor mounting holes should be in alignment with the compressor sump.**

Make certain that suction screen does not dop out of place when lowering rear head into position (figure 106).

If rear head assembly will not slide down over dowels in internal mechanism, twist front head assembly back-and-forth very slightly by-hand until rear head drops over dowel pins.

25. Install nuts on threaded whell studs and tighten evenly to 25 lb. ft. torque using a 0-50 lb. ft. torque wrench.

26. Invert compressor in Holding Fixture and

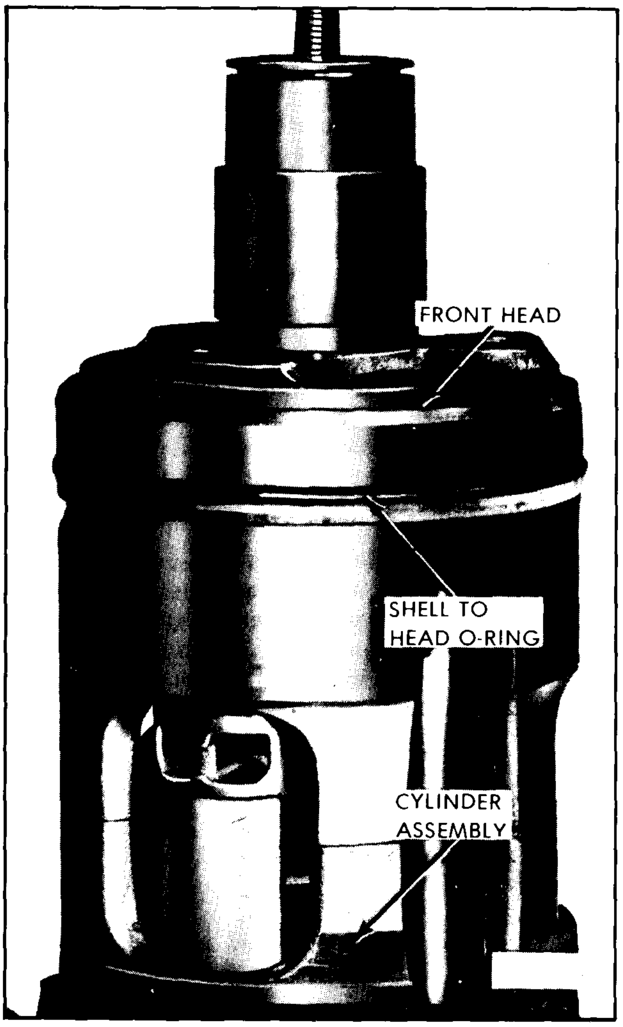


Figure 105—Shell-to-Front Head O-Ring Installation

install compressor shaft seal as described in "Compressor Shaft Seal" Replacement procedure.

27. Install compressor clutch coil and housing assembly as described in "Compressor Clutch Coil and Housing Assembly" Replacement procedure.

28. Install compressor pulley and bearing assembly as described in "Compressor Pulley and Bearing" Replacement procedure.

29. Install compressor clutch plate and hub assembly as described in "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

30. Add required amount of 525 viscosity refrigerant oil (See figure 41).

31. Check for external and internal leaks as described in the following "Compressor Leak Testing" procedure.

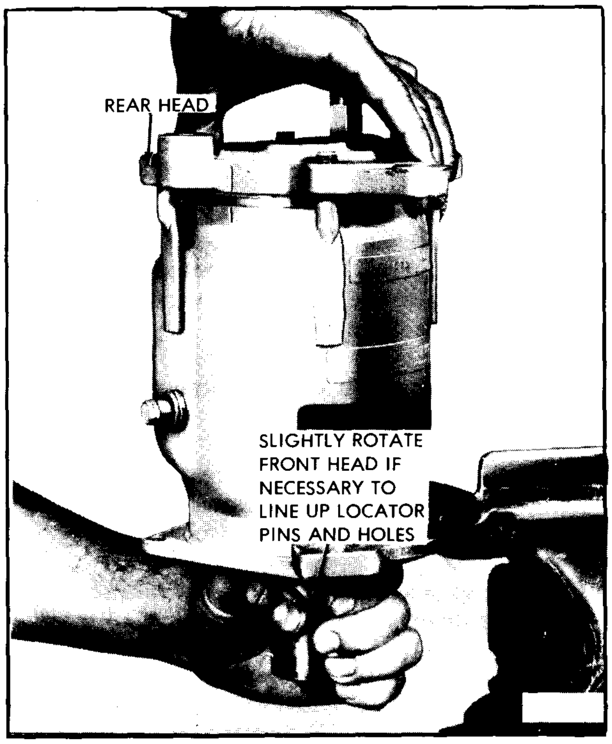


Figure 106—Installing Rear Head

COMPRESSOR LEAK TESTING — EXTERNAL AND INTERNAL

COMPRESSOR BENCH-CHECK PROCEDURE

1. Install Test Plate J-9625 on rear head of compressor.

2. Attach center hose of gage manifold set on Charging Station to a refrigerant drum standing in an upright position and open valve on drum.

3. Connect Charging Station HIGH and LOW pressure lines to corresponding fittings on Test Plate J-9625, using J-5420 Gage Adapters.

NOTE: Suction port of compressor has large internal opening. Discharge port has small internal opening into compressor.

4. Open LOW pressure control, HIGH pressure control and REFRIGERANT control on Charging Station to allow refrigerant vapor to flow into compressor.

5. Using electronic-type Leak Detector, check for leaks at pressure relief valve, compressor shell to cylinder, compressor front head seal, rear head seal

and oil charge port, and compressor shaft seal. After checking, shut off LOW pressure control and HIGH pressure control on Charging Station.

If an external leak is present, perform the necessary corrective measures and recheck for leaks to make certain the leak has been corrected.

7. Loosen the manifold gage hose connections to the Gage Adapters J-5420 connected to the LOW and HIGH sides and allow the vapor pressure to release from the compressor.

8. Disconnect both Gage Adapters J-5420 from the Test Plate J-9625.

9. Rotate the complete compressor assembly (**not the crankshaft or drive plate hub**) slowly several turns to distribute oil to all cylinder and piston areas.

10. Install a shaft nut on the compressor crankshaft if the drive plate and clutch assembly are not installed.

11. Using a box-end wrench or socket and handle, rotate the compressor crankshaft or clutch drive plate on the crankshaft several turns to ensure piston assembly to cylinder wall lubrication.

12. Connect the Charging Station HIGH pressure line or a HIGH pressure gage and Gage Adapter J-5420 to the Test Plate J-9625 HIGH side connector.

13. Attach a Adapter J-5420 to the suction or LOW pressure port of the Test Plate J-9625 to open the schrader-type valve.

> **NOTE:** Oil will drain out of the compressor suction port adapter if the compressor is positioned with the suction port down.

14. Attach the compressor to the Holding Fixture J-9396, and clamp the fixture in a vise so that the compressor can be manually turned with a wrench.

15. Using a wrench, rotate the compressor crankshaft or drive plate hub 10 complete revolutions at a speed of approximately one revolution per second.

> **NOTE:** Turning the compressor at less than one revolution per second can result in a lower pump-up pressure and disqualify a good pumping compressor.

16. Observe the reading on the HIGH pressure gage at the completion of the tenth revolution of the compressor. The pressure reading for a good pumping compressor should be 60 psi or above.

A pressure reading of less than 50 psi would indicate one or more suction and/or discharge valves leaking, an internal leak, or an inoperative valve and the compressor should be disassembled and checked for cause of leak. Repair as needed, reassemble and repeat the pump-up test. Externally leak test with the electronic-type Leak Detector.

17. When the pressure pump-up test is completed, release the air pressure from the HIGH side and remove the Gage Adapters J-5420 and Test Plate J-9625.

18. Remove oil charge screw and drain the oil sump.

19. Allow the compressor to drain for 10 minutes, then charge with the proper amount of oil. The oil may be poured into the suction port.

> **NOTE:** If further assembly or processing is required, a shipping plate or Test Plate J-9625 should be installed to keep out air, dirt and moisture until the compressor is installed.

AIR CONDITIONING DIAGNOSIS

> **NOTE:** Refer to Figures 107-109 for diagnosis details.

REFRIGERANT SYSTEM

The following is a description of the type of symptom each refrigerant component will evidence if a defect occurs:

COMPRESSOR

A compressor defect will appear in one of four ways: Noise, seizure, leakage, or low discharge pressure.

> **NOTE:** Resonant compressor noises are not cause for alarm; however, irregular noise or rattles may indicate broken parts or excessive clearances due to wear. To check seizure, deenergize

the magnetic clutch and check to see if drive plate can be rotated. If rotation is impossible, compressor is seized (See "False Compressor Seizure"). To check for a leak, refer to leak testing earlier in this section. Low discharge pressure may be due to a faulty internal seal of the compressor, or a restriction in the compressor.

Low discharge pressure may also be due to an insufficient refrigerant charge or a restriction elsewhere in the system. These possibilities should be checked prior to servicing the compressor. If the compressor is inoperative, but is not seized, check to see if current is being supplied to the magnetic clutch coil terminals.

CONDENSER

A condenser may be defective in two ways: it may leak, or it may be restricted. A condenser restriction will result in excessive compressor discharge pressure. If a partial restriction is present, sometimes ice or frost will form immediately after the restriction as the refrigerant expands after passing through the restriction. If air flow through the condenser or radiator is blocked, high discharge pressures will result. During normal condenser operation, the outlet pipe will be slightly cooler than the inlet pipe.

RECEIVER-DEHYDRATOR

A defective receiver-dehydrator may be due to a restriction inside the body of the unit. A restriction at the inlet to the receiver-dehydrator will cause high head pressures. Outlet tube restrictions will be indicated by low head pressures and little or no cooling. An excessively cold receiver-dehydrator outlet may be indicative of a restriction.

EXPANSION VALVE

A malfunction of the expansion valve will be caused by one of the following conditions: Valve stuck open, valve stuck closed, broken power element, a restricted screen or an improperly located or installed power element bulb. The first three conditions require valve replacement. The last two may be corrected by replacing the valve inlet screen and by properly installing the power element bulb.

Attachment of the expansion valve bulb to the evaporator outlet line is very critical. The bulb must be attached tightly to the line and must make good contact with the line along the entire length of the bulb. A loose bulb will result in high low side pressures and poor cooling.

Indications of expansion valve trouble are provided by Performance Test; consult Diagnostic Charts.

VALVE STUCK OPEN

Noisy Compressor.

No Cooling — Freeze Up.

VALVE STUCK CLOSED, BROKEN POWER ELEMENT OR PLUGGED SCREEN

Very Low Suction Pressure.

No Cooling.

POORLY LOCATED POWER ELEMENT BULB

Normal Pressure.

Poor Cooling.

Diagnosis for Defective Valve

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

1. Check to determine if the system will meet the performance test as outlined previously. If the expansion valve is defective, the low pressure readings (evaporator pressure) will be above specifications.

2. The loss of system performance is not as evident when the compressor head pressure is below 200 psi. Therefore, it may be necessary to increase the system head pressure by partially blocking the condenser. Disconnect the blower lead wire and repeat the "performance check" to determine if the evaporator pressure can be obtained.

3. The system will also indicate a low refrigerant charge by bubbles occurring in the sight glass.

EVAPORATOR

When the evaporator is defective, the trouble will show up as an inadequate supply of cool air. A partially plugged core due to dirt, a cracked case, or a leaking seal will generally be the cause.

REFRIGERANT LINE RESTRICTIONS

Restrictions in the refrigerant lines will be indicated as follows:

1. Suction Line — A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or no cooling.

2. Discharge Line — A restriction in the discharge line generally will cause the pressure relief valve to open.

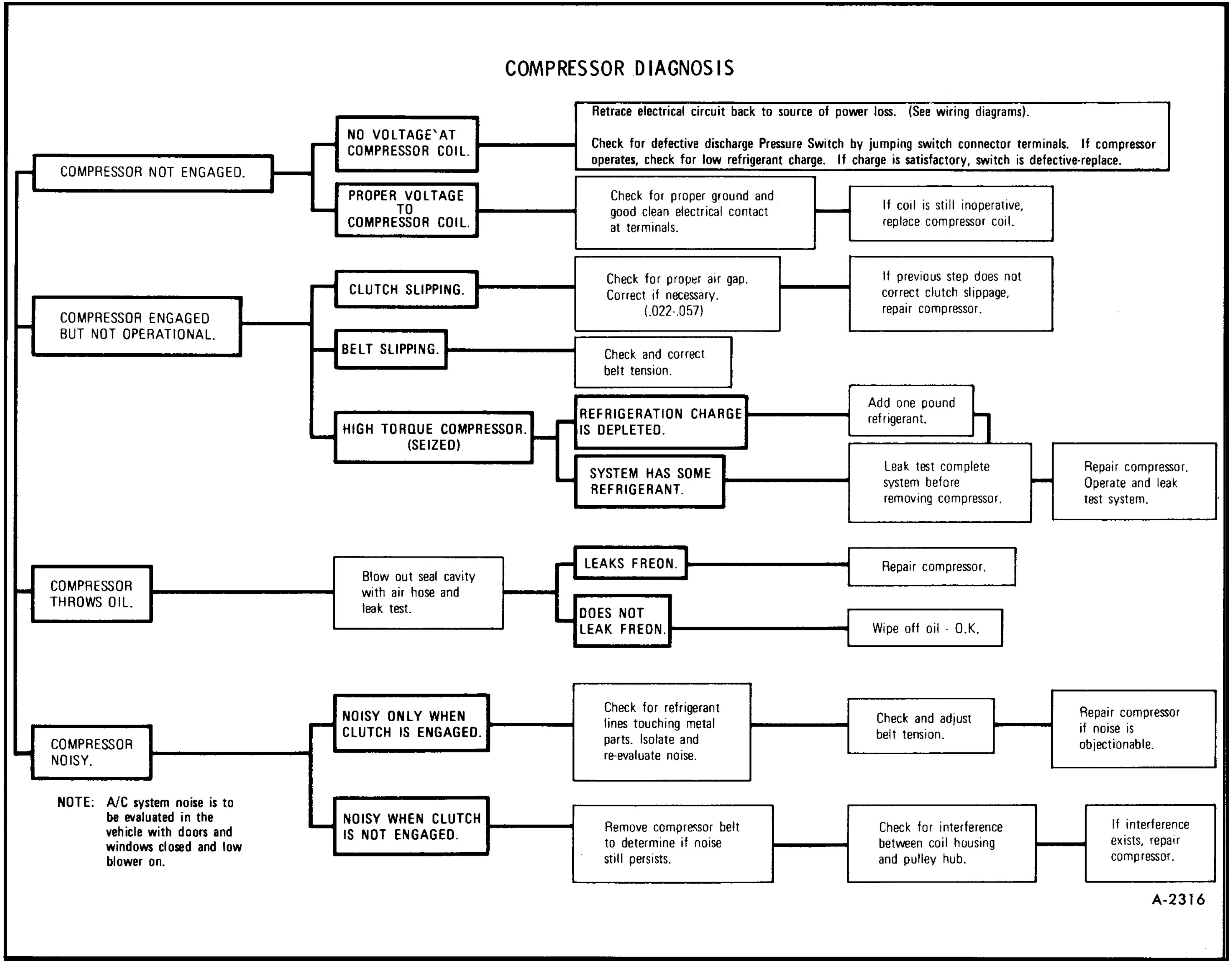


Figure 107—Compressor Diagnosis

INSUFFICIENT COOLING DIAGNOSIS CHART

The following procedures should be applied before performance testing an A/C System.
1. Check for proper belt installation and tension with J-23600.
2. Check for proper clutch coil terminal connector installation.
3. Check for clutch air Gap (.022 - .057).
4. Check for broken, burst, or cut hoses. Also check for loose fittings on all components.
5. Check for condenser air blockage due to foreign material.
6. Check for proper air ducting hose connections.
7. Check heater temperature door adjustment, adjust if incorrect.
8. Check evaporator sealing for air leak, repair if leaking.
9. Install pressure gages and thermometer and make performance test.

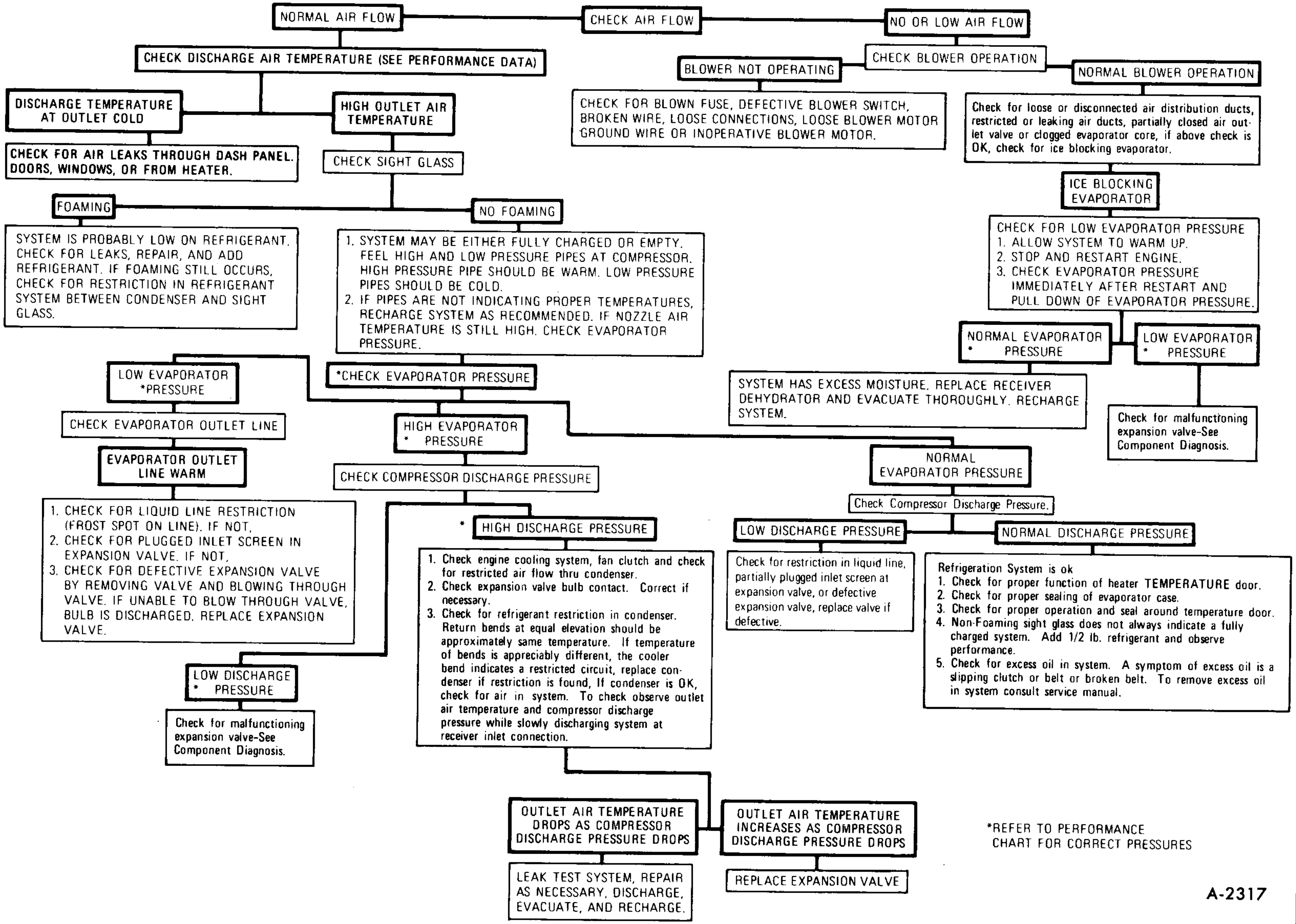


Figure 108—Insufficient Cooling Diagnosis

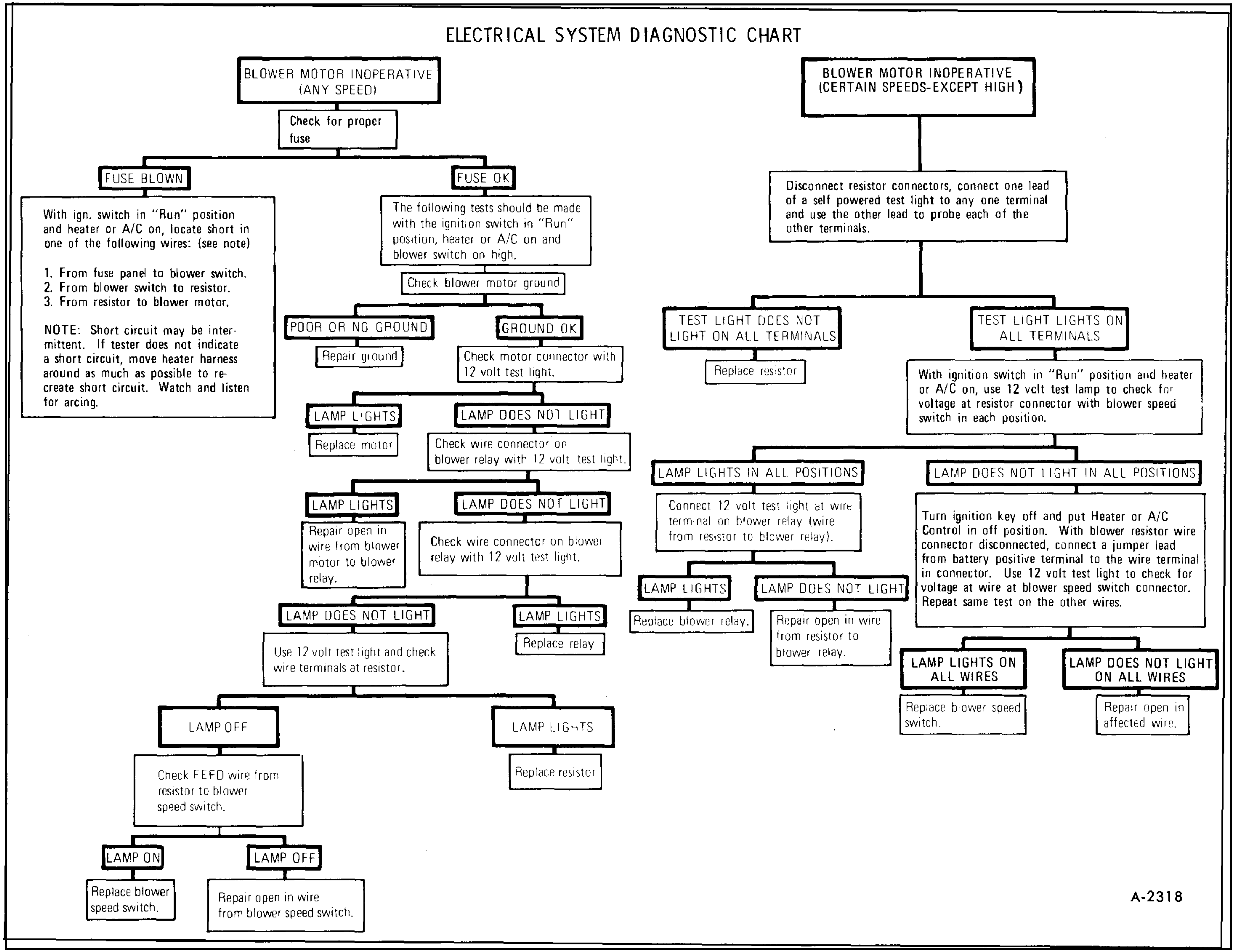


Figure 109—Electrical System Diagnosis

3. Liquid Line — A liquid line restriction will be evidenced by low discharge and suction pressure, and insufficient cooling.

SIGHT GLASS DIAGNOSIS

At temperatures higher than 70°F. (21.1°C.), the sight glass may indicate whether the refrigerant charge is sufficient. A shortage of liquid refrigerant is indicated after about five minutes of compressor operation by the appearance of slow-moving bubbles (vapor) or a broken column of refrigerant under the glass. Continuous bubbles may appear in a properly charged system on a cool day. This is a normal situation. If the sight glass is generally clear and performance is satisfactory, occasional bubbles do not indicate refrigerant shortage.

If the sight glass consistently shows foaming or a broken liquid column, it should be observed after partially blocking the air to the condenser. If under this condition the sight glass clears and the performance is otherwise satisfactory, the charge shall be considered adequate.

In all instances where the indications of refrigerant shortage continues, additional refrigerant should be added in 1/4 lb. increments until the sight glass is clear. An additional charge of 1/2 lb. should be added as a reserve after the glass clears. In no case should the system be overcharged.

ELECTRICAL SYSTEM

For electrical connections and routings, refer to the wiring diagram at the end of the manual. Also see Figure 109.

VACUUM SYSTEM DIAGNOSIS

Start the engine and allow it to idle — move the selector lever to each position and refer to the vacuum diagrams and operational charts for proper airflow, air door functioning and vacuum circuits. If airflow is not out of the proper outlets at each selector lever position, then proceed as follows:

1. **Check for good hose connection** — at the vacuum actuators, control head valve, reservoir, tees, etc.

2. **Check the vacuum source circuit as follows:**

Install vacuum tee and gauge (with restrictor) at the vacuum tank outlet (see Vacuum Diagram). Idle the engine and read the vacuum (a normal vacuum is equivalent to manifold vacuum) at all selector lever positions.

a. **Vacuum Less Than Normal At All Positions —**

Remove the tee and connect the vacuum gauge line directly to the tank — read the vacuum. If still low, then the problem lies in the feed circuit, the feed circuit to the tank or in the tank itself. If vacuum is now normal, then the problem lies downstream.

b. **Vacuum Less Than Normal at Some Positions —**

If vacuum was low at one or several of the selector lever positions, a leak is indicated in these circuits.

c. **Vacuum Normal at All Positions —**

If vacuum was normal and even at all positions, then the malfunction is probably caused by improperly connected or plugged lines or a defective vacuum valve or valves.

3. **Specific Vacuum Circuit Check**

Place the selector lever in the malfunctioning position and check for vacuum at the pertinent vacuum actuators. If vacuum exists at the actuator but the door does not move, then the actuator is defective or the door is mechanically bound. If low or no vacuum exists at the actuator, then the next step is to determine whether the cause is the vacuum harness or the vacuum valve. Check the vacuum harness first.

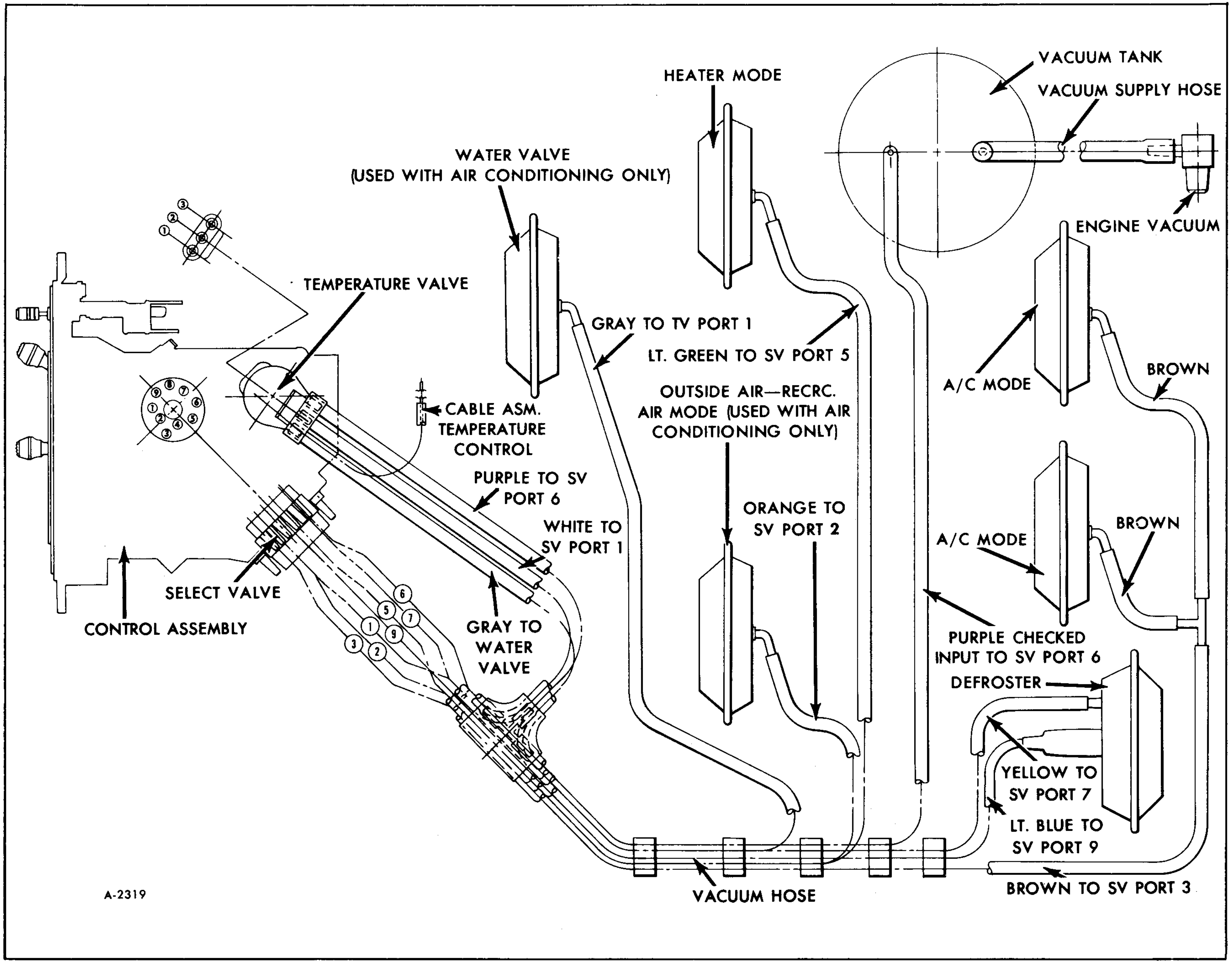


Figure 110—Vacuum Control Diagram

VACUUM CONTROL CHARTS (USE WITH FIGURE 110)

TEMPERATURE VALVE OPERATING CHART

3	VACUUM INPUT	VAC	VAC	SEAL	PURPLE
2	R. A. OVERRIDE	VAC	VENT	VENT	WHITE
1	HOT WATER VALVE	VAC	VAC	VENT	GRAY
PORT NO.	CONNECTION	RECIRC.	COLD	HOT	COLOR

SELECT VALVE OPERATING CHART

9	Defrost. Outlet	Vent	Vent	Vent	Vent	Vent	Vac	Lt. Blue
8	No. Connection							
7	Defrost. Bleed	Vent	Vent	Vent	Vac	Vent	Vac	Yellow
6	Checked Input	Seal	Vac	Vac	Vac	Vac	Vac	Purple
5	Htr. Outlet	Vent	Vent	Vac	Vac	Vac	Vac	Lt. Green
4	No Connection							
3	A/C Outlet	Vent	Vac	Vac	Vent	Vac	Vent	Brown
2	O.A. - R.A.	Vent	Conn. 1	Vent	Vent	Vent	Vent	Orange
1	R. A. Over ride	Seal	Conn. 2	Seal	Seal	Seal	Seal	White
Port No.	Connection	Off	A/C	Vent	Heater		Def.	Color

SPECIAL TOOLS

J-5139 Oil Pick-Up Tube Remover
J-5403 Snap Ring Pliers
J-5420 Gauge Adapter
J-6084 Leak Detector
J-6435 Snap Ring Pliers
J-8001-3 Dial Indicator Set
J-8092 Handle
J-8433 Pulley Puller
J-9392 Seal Remover
J-9395 Puller Pilot
J-9396 Compressor Holding Fixture
J-9397 Compressing Fixture
J-9398 Pulley Bearing Remover
J-9399 9/16" Thin Wall Socket
J-9401 Clutch Plate and Hub Remover
J-9402 Parts Tray
J-9403 Spanner Wrench
J-9432 Needle Bearing Installer
J-9459 Gauge Adapter
J-9480 Hub and Drive Plate Assembly Installer
J-9481 Pulley and Bearing Installer
J-9521 Support Block
J-9527 Pressure Test Connector
J-9553-01 O-Ring Remover
J-9564-01 Feeler Tension Gauge Set
J-9625 Compressor Leak Test Fixture
J-9661-01 Feeler Gauge Set
J-21303 Shaft Seal Protector
J-21352 Internal Assembly Support Block
J-21508 Seal Seat O-Ring Installer
J-22974 Seal Protector
J-23128 Seal Seat Remover
J-23500 Charging Station
J-23600 Belt Tension Gauge
J-24095 Oil Inducer
J-24410 Charging Station
J-24608-1 Piston Ring Gauge
J-24608-2 Ring Installer Guide
J-24608-5 Ring Installer
J-24608-6 Ring Sizing Tool
J-25030 Clutch Hub Holder

HEATING SYSTEM (WITHOUT AIR CONDITIONING)

CONTROL OPERATION

The heating system controls (figure 1) are located on the instrument panel to the right of the steering column. There are three separate controls:

"FAN" lever to control speed of blower operation; "RECIRC," "COLD," "HOT" lever to control temperature of air; "OFF," "VENT," "HEATER," "DEF" lever to control direction of air flow. The "FAN" lever works vertically and the other two levers work horizontally. The three levers may be placed in any combined position to deliver the climate conditions most desirable at any given time.

"Type 1 Fan" (figure 1) — The fan switch has four positions; "OFF" and three blower speeds ranging to "HI" and two unmarked positions between "OFF" and "HI." The fan will not operate unless the top lever has been moved from the "OFF" position, and in order to operate the fan in the "HI" position the engine must be running.

"Type 2 Fan" (figure 2) — The fan switch has four positions; "LO" and three blower speeds ranging to "HI". Fan will operate whenever the key is in the "RUN" or "ACCESSORY" position. In order to operate the fan in the "HI" position the engine must be running.

"OFF," "VENT," "HEATER," "DEF" — With the lever in the "OFF" position the system is off. With the lever in the "VENT" position 100% outside air enters the driver's compartment. The air enters through the dash mounted outlets and through the heater outlets. Temperature of incoming air may be controlled by moving the "RECIRC," "COLD," "HOT" (temperature) lever to desired position. Any one of the three blower speeds may be selected.

With the lever in the "HEATER" position, air will flow through the heater floor distributor outlet (with slight flow of air to the defroster outlet). For maximum heat, move temperature lever to "HOT" position and "FAN" switch lever to "HI" position. Heating system output can be varied by moving temperature lever and "FAN" lever to different positions.

With the lever in the "DEF" position, the system operates the same as in the "HEATER" position except most of the air flow will be through the defroster outlets at the windshield.

"RECIRC," "COLD," "HOT" — This lever, used in conjunction with the system selector lever ("OFF," "VENT," "HEATER," "DEF") and the "FAN" switch lever, will control the temperature of the output air being distributed.

Clear windshield, rear window, outside mirror, and all side windows of ice and snow before driving vehicle.

Operate blower on "HI" for a few seconds before moving the vehicle, to clear the air intakes of snow.

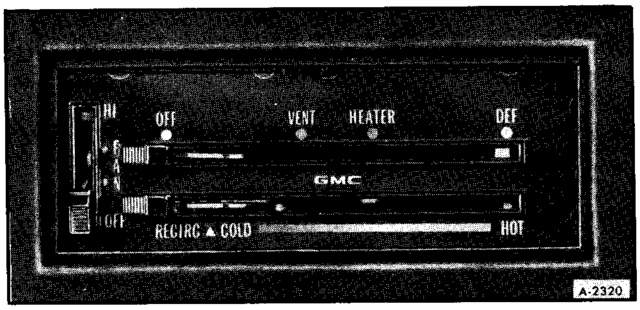


Figure 1—Heating System Controls, Type 1

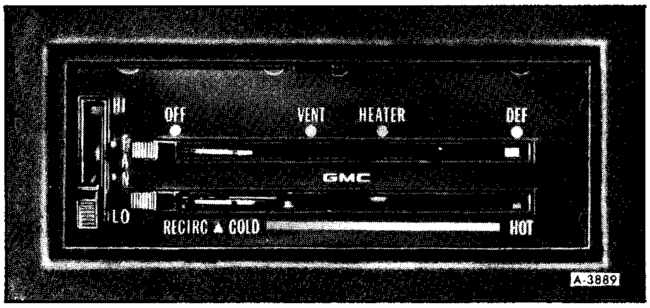


Figure 2—Heating System Controls, Type 2

COMPONENT REPLACEMENT

CONTROL ASSEMBLY

Procedures for the replacement of the heating system control assembly is the same as models equipped with air conditioning. See "Control Assembly Replacement" under air conditioning portion of this section.

BLOWER COMPONENTS

Replacement procedures for the blower motor, blower relay, and blower resister are the same as described in the air conditioning portion of this section.

HEATER CORE

Replacement procedures for the heater core is the same as for models equipped with air conditioning See "Evaporator and Heater Core Replacement" in air conditioning portion of this section.

VACUUM CONTROLS

Before replacing any vacuum control components check system for proper operation. Controls are the same as air conditioned models, except for the deletion of the water valve and "Outside Air-Recirc. Air mode". Lines to these components are simply plugged. For details see vacuum control charts and Figure 110 in air conditioning portion of this section.

SECTION 2
FRAME

Contents of this section are listed below:

GENERAL

The 23 foot and 26 foot vehicle chassis uses a channel type frame with a front frame extension, bolted cross members and a rear frame extension. An exploded view of the frame components is shown in Figure 1. A 26-foot vehicle frame is shown, the 23-foot vehicles frame differs in the length of the side rail and one less crossmember.

When supporting the vehicle for servicing on a floorjack or jackstands the vehicle should not be supported at the extreme ends of the frame or at the center of a frame rail. Refer to Section 0 for hoisting and jacking instructions.

In the event the vehicle is damaged in a collision, carefully check for proper frame alignment in addition to steering geometry and wheel alignment.

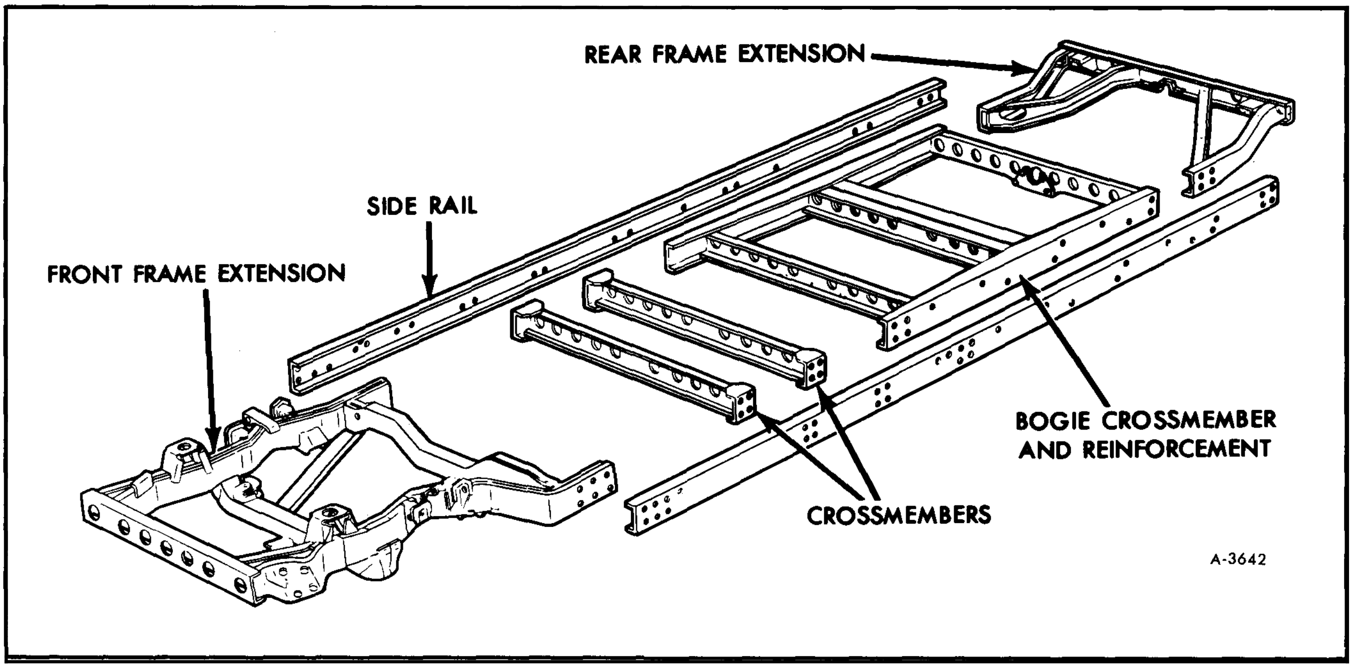


Figure 1—Frame Components

FRAME ALIGNMENT

The most convenient way to check frame alignment is to select various corresponding points of measurement on the outside of each side rail and then, by use of a plumb bob, transfer these points to a layout on a level floor. (Note: Flange width may vary and should not be used as a reference point.)

Since the frame is basically made of three different sections, the procedure for checking the frame is as follows:

CHECKING ALIGNMENT

The diagram shown in Figure 2 can be used to check the alignment of a vehicle frame that has been distorted.

Corresponding measurements must be equal within 1/4".

1. Measure A-B. If not equal, front end of frame is misaligned.

2. Measure B-C. If not equal, center portion of frame is misaligned.

3. Measure C-D. If not equal, then rear suspension crossmember is misaligned.

FRAME REPAIR

In case of collision, frame members can often be satisfactorily straightened to the required limits. However, the front suspension crossmember is made to unusually close limits necessary for proper front wheel alignment; therefore, straighetning of this unit may not be successful.

It is possible that the ordinary straightening methods will suffice for minor damage to the front suspension crossme ber; however, in case of serious damage or fracture, t e entire front suspension crossmember or front frame extension must be replaced. Before the member is replaced, it is essential that the frame alignment be checked, and corrected if necessary.

Finished bolts snugly fitted in reamed holes should be used. The nuts should be securely tightened and lockwashers used, care being taken that washers do not spread.

FRAME MATERIAL

The frame material is 950-1023-1080 steel. The frame may be welded if necessary using electrodes noted in table 1.

NOTE: It is NOT recommended that the frame be welded to repair alignmennt. If there is substantial frame damage — from collisions, etc. — replacement of major components is recommended.

ELECTRODE USAGE WITH FRAME MATERIAL

Material .... 1023-950 steel
Type or Electrode .... E6013 or E7018

REPLACING FRAME EXTENSION

The purpose of this section is to enable a technician to change a front or rear frame extension due to extensive damage from a collision, etc. It is not recommended that this procedure be used until it is

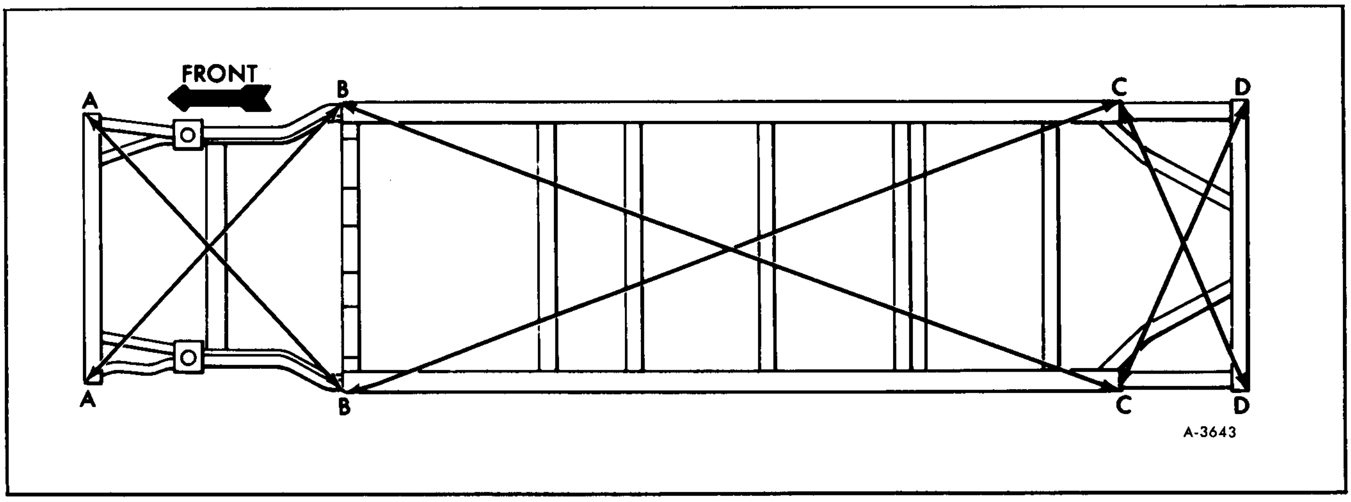


Figure 2—Frame Alignment

determined that the frame is definitely out of alignment and is unable to be fixed by the usual frame straightening operations.

FRONT FRAME EXTENSION REMOVAL

The front frame extension should only be replaced if absolutely necessary due to the complexity and amount of labor involved.

NOTE: To drain, disconnect, or remove certain components it may be necessary to refer to additional sections in this maintenance manual (such as, draining gas tanks; Refer to Section 8 "Fuel Tank and Exhaust".

Drain

1. Drain power steering fluid.

2. Drain brake fluid.

3. Release freon from A/C system.

4. Drain gas tanks.

5. Drain engine cooling system.

Disconnect

1. Fuel Filler hose at front elbow.

2. Hose from tube going to charcoal canister.

3. If two canister are used, disconnect hoses from the one mounted on the stepriser.

4. Rear brake line from combination valve.

5. Heater hoses and pre-heater at engine.

6. Vacuum lines at cruise control.

7. Power brake vacuum line.

8. Hose to thermasan switch.

9. Speedometer cable at cruise control (at transmission without cruise control).

10. Accelerator cable at carburetor.

11. Transmission shift cable at transmission.

12. Oil filler tube at front end.

13. Vacuum line at vacuum tank mounted on the side of the heater.

14. Brake lines at master cylinder.

15. Hydraulic lines to windshield wiper motor.

16. Air lines.

Remove

1. Remove Engine Transmission and Final Drive Assembly.

2. Remove mufflers and Y-pipe.

3. Remove torsion bars and rear torsion bar support.

4. Take steering gear off of frame.

5. Remove batteries and battery box with air tank.

6. Remove parking brake cable from front frame section.

7. Remove thermasan hose from unit on exhaust pipe (if used).

8. Remove front body mount bolts.

9. Remove frame section bolts.

10. Air conditioning compressor and hoses (cap all A/C hoses).

11. Front wheels.

12. Front fender wells.

13. Grille.

14. Lower fiberglass section below grille.

15. Radiator.

16. After the bolts holding the front frame extension are removed it will be possible to pull it forward and down clearing the body. A high capacity floor jack should be used to move the front frame extension forward and down.

FRONT FRAME EXTENSION INSTALLATION

Installation of the front frame extension is accomplished by reversing the removal procedures.

NOTE: The front frame extension to frame assembly retaining nuts should be tightened to 50-60 foot-pounds torque.

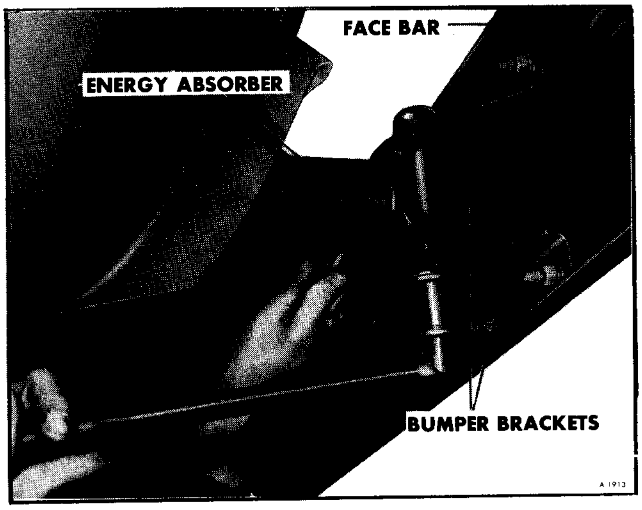


Figure 3—Removing Rear Bumper

REAR FRAME EXTENSION REMOVAL

1. Remove rear bumper by removing both bumper bracket thru bolts as shown in Figure 3. Then remove face bar assembly.

2. Remove the 4 bolts and nuts securing energy absorbers to the frame.

3. Remove spare tire carrier from rear crossmember by removing 8 bolts and nuts.

4. Using a small hydraulic or screw jack and a 3 foot wood 2x4, place jack in the middle of floor section using the 2x4 to support the floor weight, lengthwise.

5. Remove the bolt in each rear mounting pad. Location of mounts are shown in Figure 4.

NOTE: To reach bolt head inside rear of vehicle some interior components may have to be removed.

6. Remove tailpipe from rear section by loosening clamp at slip joint.

7. Drain water from water supply tank.

8. Remove holding tank dump pipe from retaining clamp on rear crossmember.

9. Remove motor generator assembly (if so equipped).

10. Remove 8 nuts and bolts securing rear frame extension to side rails.

11. Slide out rear frame extension.

REAR FRAME EXTENSION INSTALLATION

Installation of the rear frame extension is accomplished by reversing the removal procedures.

NOTE: The rear frame extension to frame assembly retaining nuts should be tightened to 50-60 foot-pounds torque.

BODY MOUNTING

Should it become necessary to replace any body mounting components, refer to figure 4. Front and rear body mount nut torque is 50 - 60 foot-pounds.

If any of the insulators between the frame and body must be replaced, be sure the old insulator is entirely removed. Then using a waterproof adhesive attach new insulator to frame in locations shown in Figure 4.

IMPORTANT: Some vehicles are equipped with insulators different than shown in Figure 4. Late model vehicles are equipped with 21 six-inch insulators located beneath the lateral crossmembers of the floor substructure.

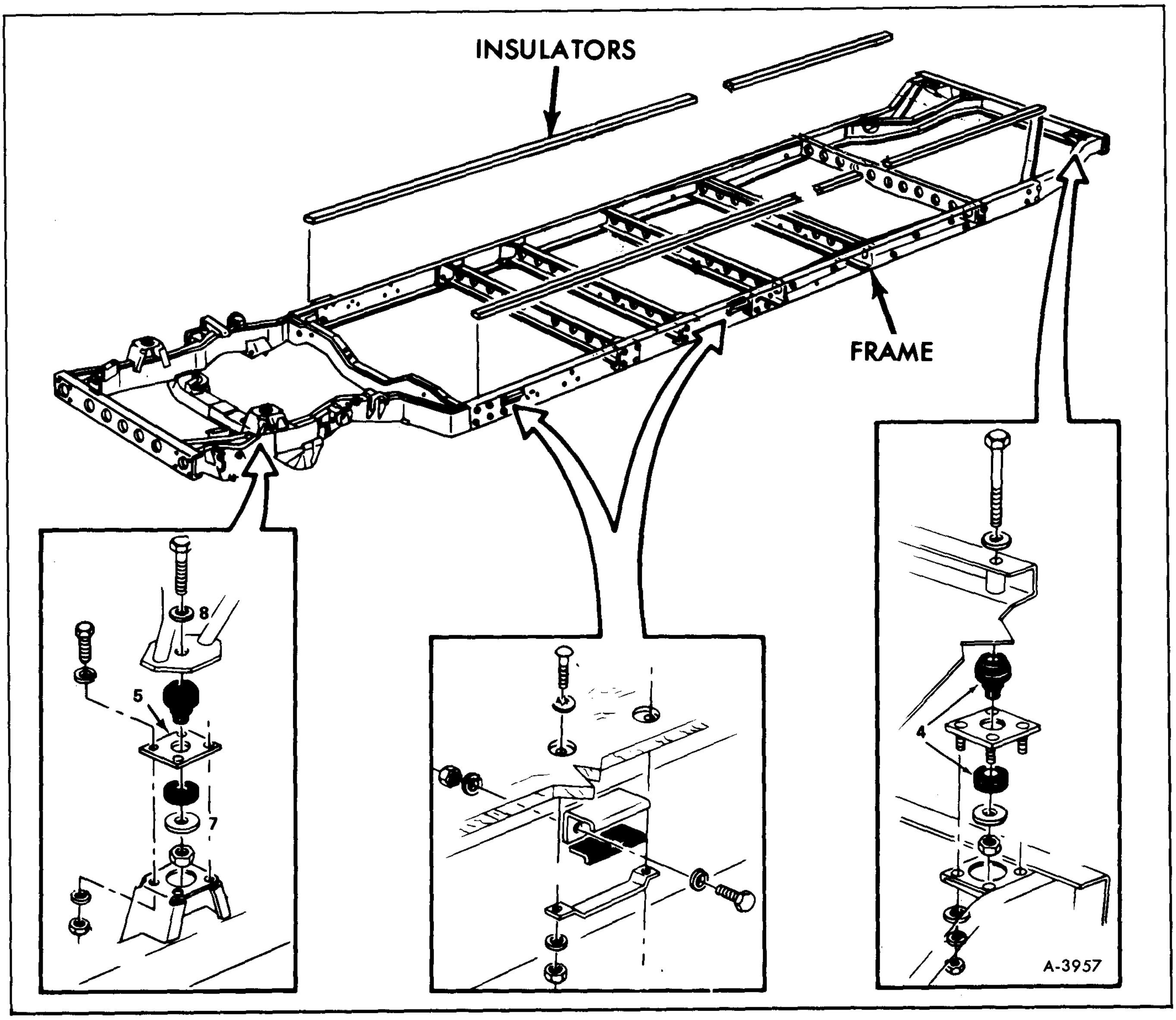


Figure 4—Body Mountings

SECTION 3
FRONT SUSPENSION AND FINAL DRIVE

SECTION 3A

FRONT SUSPENSION

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

NOTE: Never attempt to heat, quench or straighten any front suspension component. Replace it with a new part.

Contents of this section are listed below:

FRONT SUSPENSION TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Hard Steering.	1. Ball joints and steering linkage need lubrication. 2. Low or uneven front tire pressure. 3. Power steering partially or not operative. 4. Steering gear not properly adjusted.	1. Lubricate ball joints and linkage. 2. Inflate tires to the proper recommended pressure. 3. Check power steering components for proper operation. 4. Adjust steering gear. See Section 9.
Front Wheel Shimmy (Smooth Road Shake).	1. Tire and wheel out of balance, or out of round. 2. Worn tire rod ends. 3. Worn ball joints 4. Malfunctioning shock absorber.	1. Balance tires, check run-out. 2. Replace tire rod end. 3. Replace ball joints. 4. Diagnose shock absorbers.
Vehicle Pulls to One Side (No Braking Action).	1. Low or uneven tire pressure. 2. Broken or sagging torsion bar. 3. Incorrect front wheel alignment (Camber).	1. Inflate tires to the proper recommended pressure. 2. Replace torsion bar. 3. Check and align front suspension.
Poor Directional Stability	1. Ball joints and steering linkage need lubrication. 2. Low or uneven front or rear tire pressure. 3. Steering Gear not on high point. 4. Incorrect front wheel alignment (caster). 5. Broken torsion bar. 6. Malfunctioning shock absorber. 7. Broken stabilizer bar, or missing link.	1. Lubricate at proper intervals. 2. Inflate tires to the proper recommended pressure. 3. Adjust steering gear. See Section 9. 4. Check and align front suspension. 5. Replace torsion bar. 6. Diagnose shock absorbers. 7. Replace stabilizer or link.
Excessive Play in Steering.	1. Incorrect steering gear adjustment. 2. Worn steering gear parts.	1. Adjust steering gear. See Section 9. 2. Overhaul Gear. See Section 9.

Problem	Possible Cause	Correction
Noise in Front End	1. Ball joints and steering linkage lubrication. 2. Shock absorber loose or bushings worn. 3. Worn control arm bushings. 4. Worn tie rod ends. 5. Loose stabilizer bar. 6. Loose wheel nuts. 7. Loose suspension bolts.	1. Lubricate at recommended intervals. 2. Tighten bolts and/or replace bushings. 3. Replace bushings. 4. Replace tie rod ends. 5. Tighten all stabilizer bar attachments. 6. Tighten the wheel nuts to proper torque. 7. Torque to specifications or replace.
Tire Thump	1. Tire and wheel out of balance. 2. Tire and wheel out of round. 3. Blister or bump on tire. 4. Improper shock absorber action.	1. Balance wheels. 2. Replace tire. 3. Replace tire. 4. Replace shock absorber.
Excessive or Uneven	1. Underinflated or overinflated tires. 2. Improper toe-in. 3. Wheels out of balance. 4. Hard Driving. 5. Over loaded vehicle.	1. Inflate tire to proper recommended pressure. 2. Adjust toe-in. 3. Balance wheels. 4. Instruct driver. 5. Instruct driver.
Scuffed Tires	1. Toe-in incorrect. 2. Excessive speed on turns. 3. Tires improperly inflated 4. Suspension arm bent or twisted.	1. Adjust toe-in to specifications. 2. Advise driver. 3. Inflate tires to proper recommended pressure. 4. Replace arm.
Cupped Tires	1. Front shock absorbers defective. 2. Worn ball joints. 3. Wheel and tire out of balance. 4. Excessive tire or wheel runout.	1. Replace shock absorbers. 2. Replace ball joints. 3. Balance wheel and tire. 4. Compensate for runout.

Problem	Possible Cause	Correction
Shock Absorber—Weak.	1. Low or uneven tire pressure. 2. Excessive or incorrect vehicle loading. 3. Worn out shock absorber. Front. 4. Worn out shock absorber. Rear.	1. Inflate tires to the proper recommended pressure. 2. Instruct driver. 3. Perform on vehicle test. Push down and lift up at end of bumper nearest front shock in question. right and left shocks must be comparable in rebound resistance to compression ration (usually 2 to 1). If in doubt compare with vehicle having acceptable ride quality. 4. Disconnect the lower shock mountings. Stroke shocks at various rates of speed through maximum travel in both directions. Compare side to side for rebound and compression resistance. Rebound resistance is normally stronger than compression (approximately 2 to 1). It is mandatory that right and left shocks feel comparable. If in doubt about condition, compare with a known good shock.
Shock Absorber—Noisy.	1. Loose mounting. 2. Faulty shock absorber	1. Check all shock mounting torques (bolt and/or nut). 2. Observe hoisting instructions and instructions for removal of front shock absorbers. Clamp shock upside down. Clamp vise on top mount with shock vertical in vise (do not clamp on reservoir tube). Rear shocks may be tested on the vehicle by disconnecting the lower mount. Completely extend to full rebound then exert an extra pull. If a "GIVE" is felt a loose piston is indicated and the shock should be replaced. A hissing noise (orifice swish) is normal, however, replace shock absorber for any of the following: 1. A skip or lag at reversal near mid-stroke. b. A seize (except at either extreme end of travel). c. A noise such as a grunt or squeal after completing one full stroke in both directions. d. A clicking noise at fast reversal.

Problem	Possible Cause	Correction
Shock Absorber—Leaks.	1. Faulty shock absorber.	1. A slight trace of shock fluid is NOT cause for replacement as the seal permits some seepage for lubrication of the piston rod. The shock contains a fluid reverse to compensate for seepage. A shock that is truly leaking is easily detected as there will be evidence of shock fluid around the seal cover and on down the reservoir tube and should be replaced.

THEORY AND OPERATION

FRONT-END GEOMETRY

The term "FRONT-END GEOMETRY" refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground. The angle of the knuckle (now called steering axis inclination) away from the vertical, the pointing in or "toe-in" of the front wheels, the tilt of the front wheels from vertical (when viewed from the front of the vehicle) and the tilt of the suspension members from vertical (when viewed from the side of the vehicle) - all these are front end geometry. These items have an effect on steering ease, steering stability riding qualities and tire wear. Each item is covered under a separate heading.

CAMBER (FIGURE 1)

Camber is the tilting of the front wheels from the vertical. When the wheels tilt outward at the top, the camber is said to be positive (+). When the wheels tilt inward at the top, the camber is said to be negative (-). The amount of tilt is measured in degrees from the vertical and this measurement is called the camber angle.

CASTER (FIGURE 1)

Caster is the tilting of the front steering axis either forward or backward from the vertical. A backward tilt is said to be positive (+) and a forward tilt is said to be negative (-). You cannot see caster angle

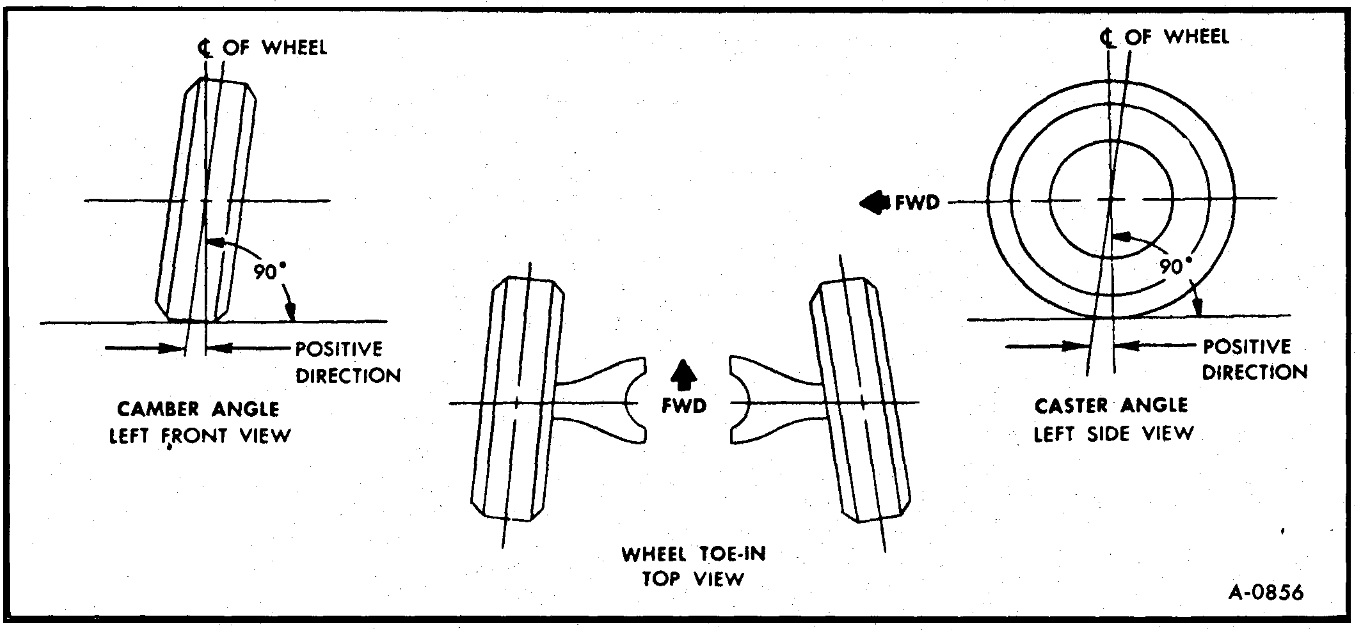


Figure 1—Caster, Camber and Toe-In

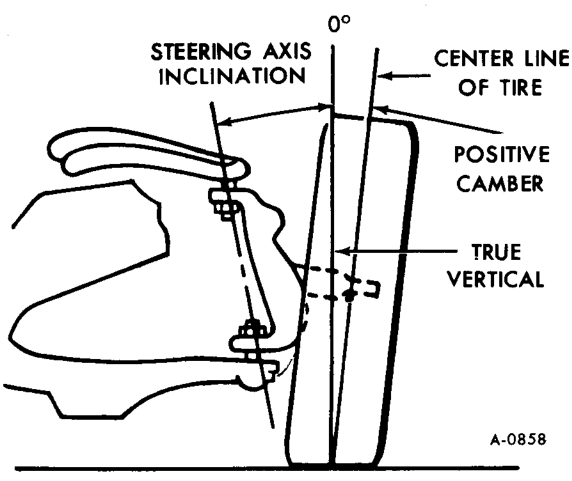


Figure 2—Steering Axis Inclination

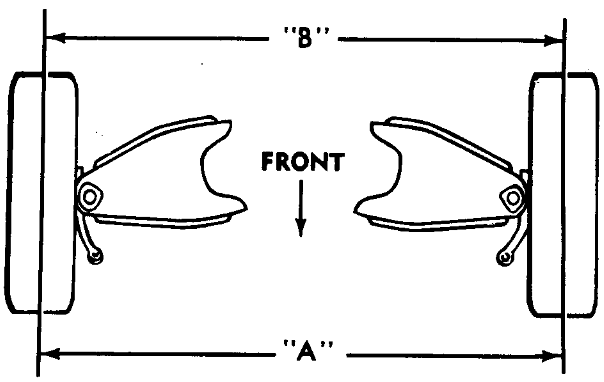
without a special instrument, but if you look straight down from the top of the upper control arm to the ground you would find that the ball joints do not line up (fore and aft) when a caster angle other than "O" is present. If you had a positive caster angle the lower ball joint would be slightly ahead of the upper ball joint center line. In short then: caster is the forward or backward tilt of the steering axis.

STEERING AXIS INCLINATION (FIGURE 2)

Steering axis inclination is the inward tilt (at the top) of the steering knuckle from the vertical. The inward tilt, or inclination, of the knuckle tends to keep the wheels straight ahead. This is desirable because, it helps return the steering wheel straight ahead after a turn. This steering wheel return comes about because the vehicle is actually "lifted" when the wheels are swung away from the straight ahead position. Then the weight of the vehicle tends to return the wheels straight ahead after a turn is completed.

TOE ADJUSTMENT (FIGURE 3)

Toe-in is the turning in of the front wheels; toe-out is the turning out of the front wheels. The actual amount of toe-in or -out is only a fraction of an inch. The purpose of the toe adjustment is to ensure parallel rolling of the front wheels. (Excessive toe adjustment will cause tire wear). Toe adjustment also serves to offset the small deflections of the wheel support system which occurs when the vehicle is rolling forward. In other words, even when the wheels are set to toe-in or toe-out slightly when the vehicle is standing still, they tend to roll parallel on the road when the vehicle is moving.



TOE IN - DIMENSION "A" EQUAL TO OR LESS THAN "B"

TOE OUT - DIMENSION "A" GREATER THAN "B"

A-5252

Figure 3—Toe Adjustment

TOE-OUT ON TURNS

Toe-out on turns refers to the difference in angles between the front wheels and the car frame during turns. Since the inner wheel turns a smaller radius than the outer wheel, when rounding a curve, it must be at a sharper angle with respect to the vehicle frame. It must toe-out more than the outside wheel toes-in. This condition allows the front wheels to turn in a concentric circle. Toe-out on turns is non-adjustable.

GENERAL DESCRIPTION

The front suspension consists of control arms, stabilizer bar, shock absorbers and a right and left torsion bar. Torsion bars are used instead of the conventional coil springs. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into an adjustable arm at the torsion bar crossmember. The carrying height of the vehicle is controlled by this adjustment. (figure 4).

DISC AND HUB (FIGURE 6)

REMOVAL

1. Siphon approximately two-thirds of the brake fluid from the front reservoir of the master cylinder. Discard fluid.

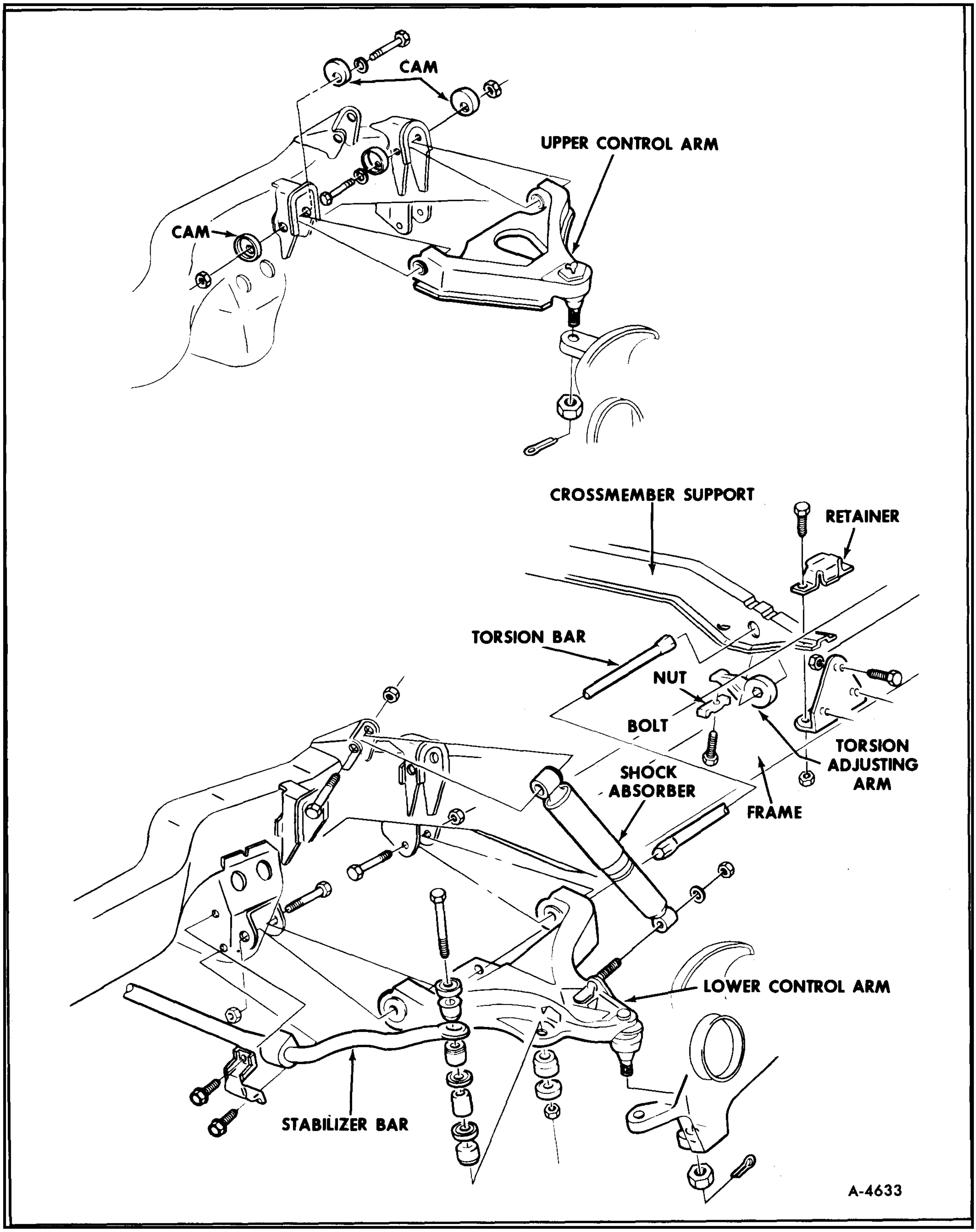


Figure 4—Front Suspension

NOTE: Do not empty front reservoir or it will be necessary to bleed the brake system.

2. Hoist vehicle. Remove light nuts from wheel studs and remove wheel.

3. Remove cotter pin, drive axle nut and washer.

4. Position Tool J-22269 on caliper as shown in Figure 5.

5. Tighten screw of tool until caliper moves outboard far enough to push piston to bottom of piston bore. This will allow the shoes to back off from disc surface. Remove Tool J-22269.

6. Remove the two caliper to knuckle attaching bolts. (figure 5).

7. Carefully lift caliper assembly from disc and reposition so that brake hose is not kinked or stretched.

8. Loosen uniformly and remove the three bolts securing the retainer to the knuckle (figure 7).

9. Position Tool No. J-24717 on hub as shown in Figure 8.

10. Operate slide hammer Tool No. J-2619, until assembly is free of knuckle. See Figure 8.

11. Remove slide hammer and Tool No. J-24717.

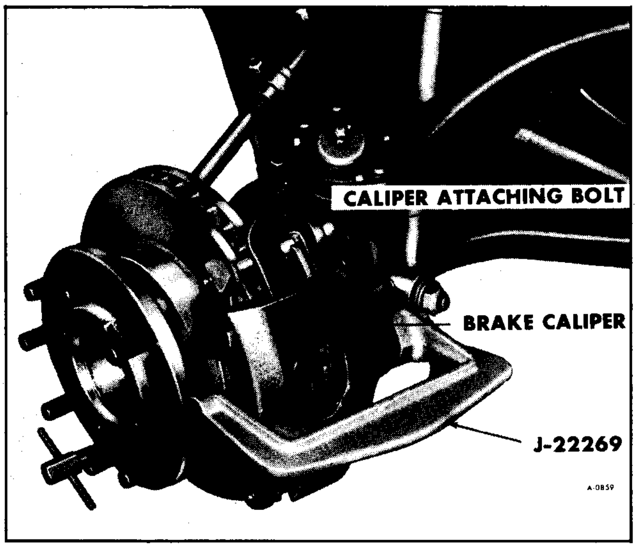


Figure 5—Caliper Removal

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Lubricate O.D. of bearing with chassis grease. Clean bearing seat of knuckle where rust or dirt may fall during removal.

2. The outer race of the bearing is a snug fit into the knuckle. Light tapping on the hubs outer surface (not the disc) will aid assembly. Care must be used when installing hub assembly over drive axle splines so that splines are in correct alignment.

3. Install three bolts attaching bearing retainer to knuckle Torque to 35 ft. lbs.

4. Install drive axle washer and nut. Torque nut to 140 ft. lbs. If necessary to align cotter pin slot, tighten nut and install NEW cotter pin and crimp. Torque not to exceed 280 ft. lbs.

NOTE: Do not back off nut to install cotter pin.

5. Replace wheel and secure with eight nuts on studs. Refer to Section 10 for tightening sequence and torque. Refill master cylinder with new brake fluid.

HUB BEARING

REMOVAL

1. Remove disc hub assembly. Refer DISC HUB ASSEMBLY-Removal.

2. Assemble Tool No. J-23345 to Tool No. J-8433-1

3. Position tool assembly as shown in Figure 9.

CAUTION: *The gripping or pulling edge of the tool must be under the inner race. If the tool slips up to the bearing cage, the bearing will be seriously damaged and need to be replaced.*

4. With Tool No. J-22214-6 in place, and a clamp in position as shown in Figure 9, tighten center screw until bearing is free of hub.

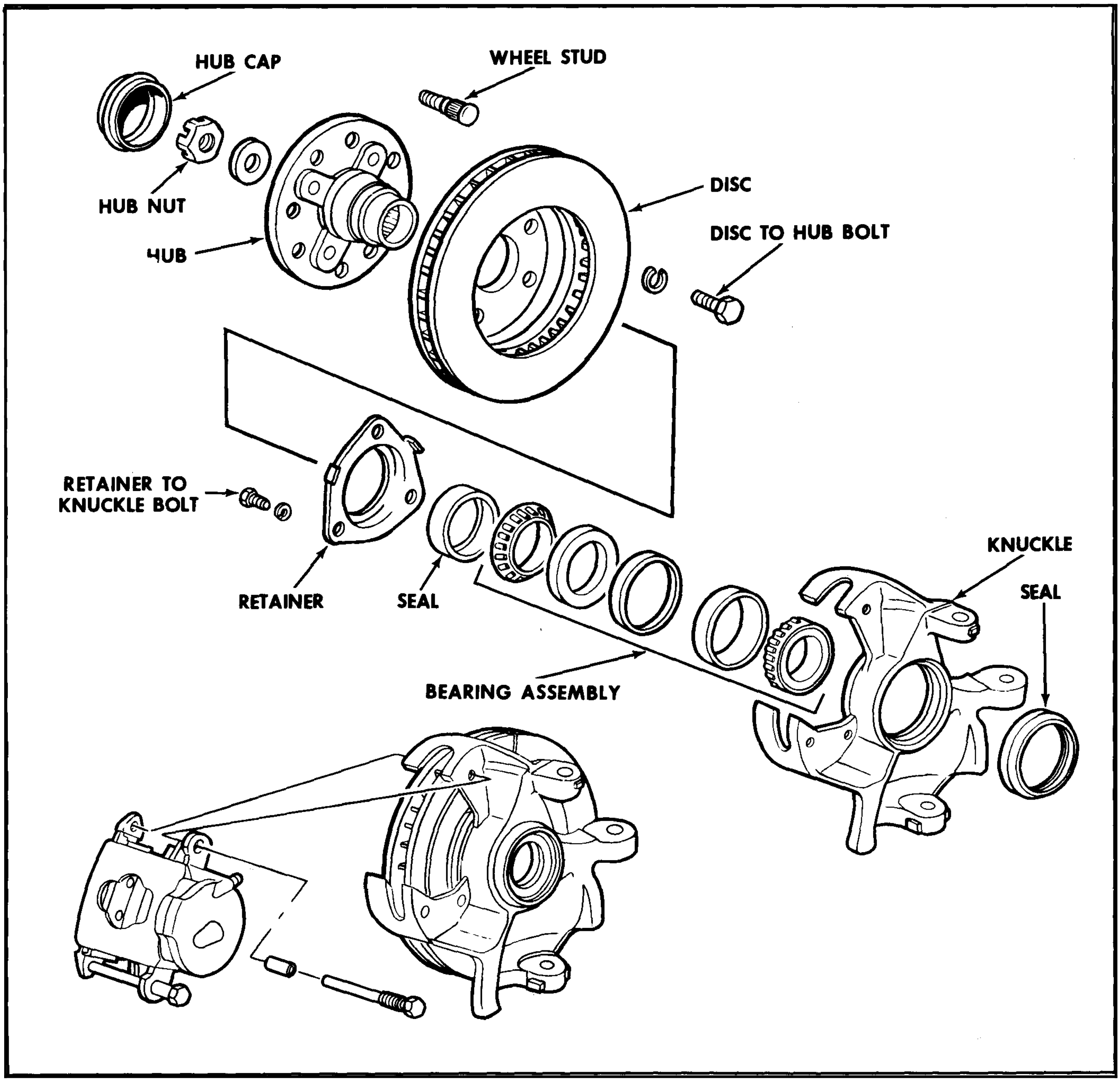


Figure 6—Disc and Hub Assembly

5. Remove seal and retainer.

6. Clean bearing and inspect for wear or damage. If bearing condition is good repack with bearing grease. Use GM part No. 1051344 or equivalent, a premium high melting point lubricant.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Position retainer over hub.

2. Lubricate seal lips with Special Seal Lubricant No. 1050169 or equivalent then position seal over hub with metal end toward retainer.

3. Install bearing as shown in Figure 11.

4. Install disc hub assembly. Refer to DISC AND HUB ASSEMBLY- Installation.

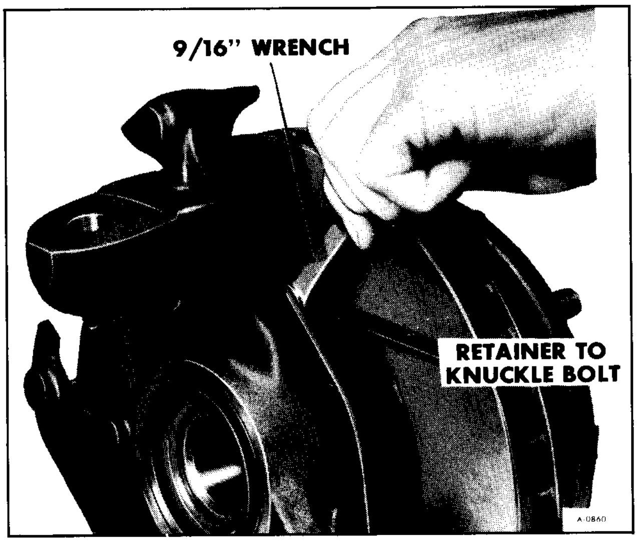


Figure 7—Retainer Bolt Removal

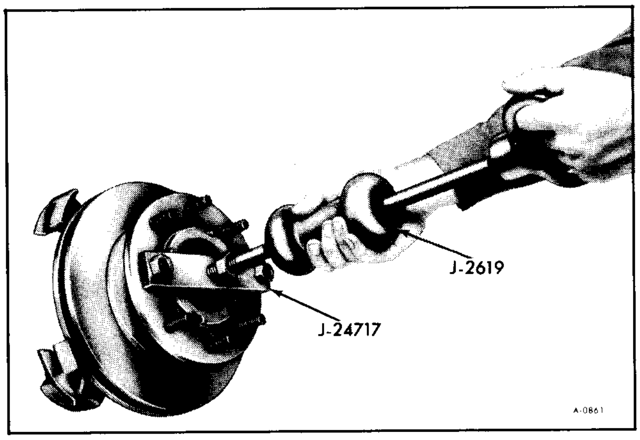


Figure 8—Hub and Disc Removal

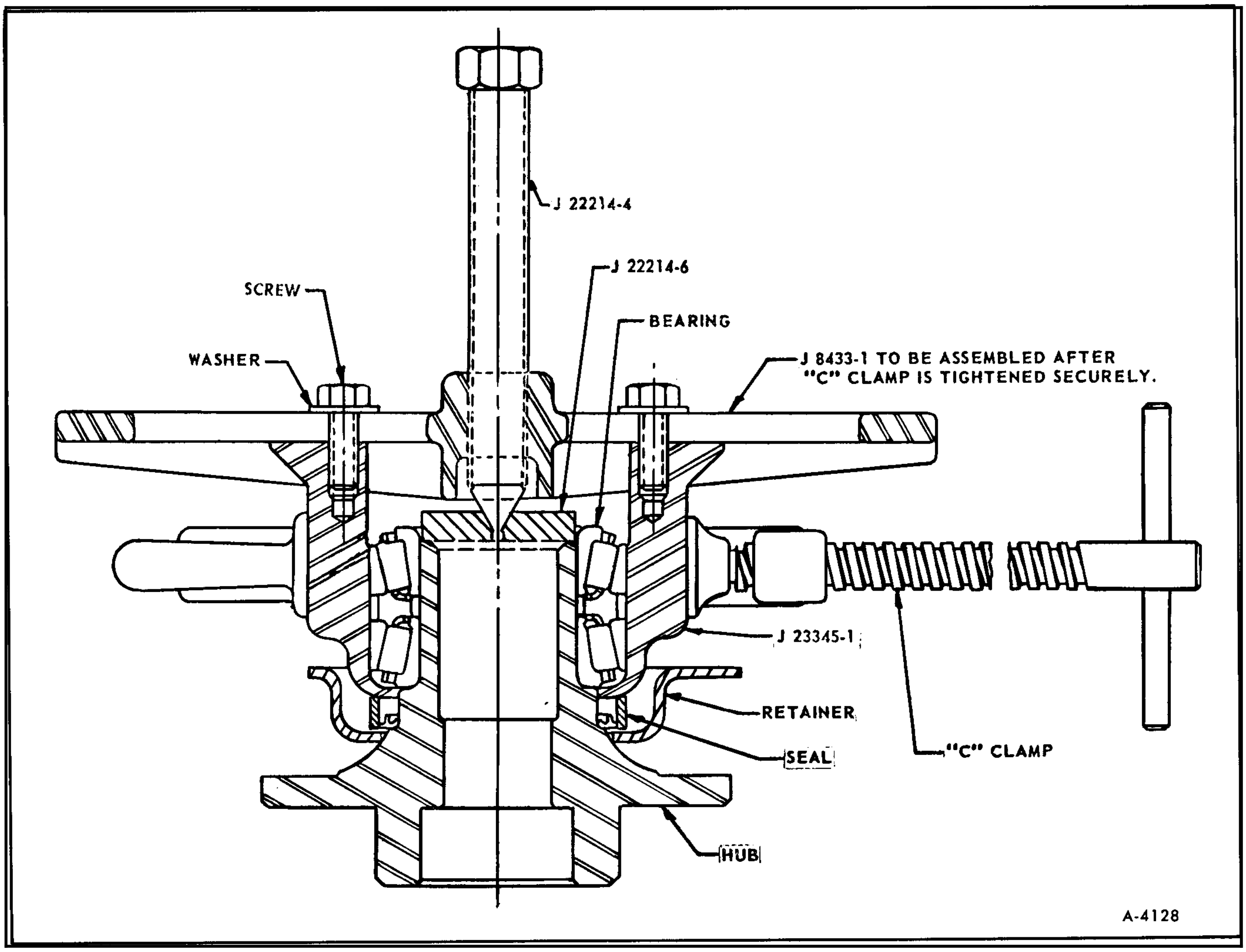


Figure 9—Bearing Removal

DISC

REMOVAL (FIGURE 10)

1. Remove disc and hub assembly. Refer to DISC AND HUB ASSEMBLY-Removal.

2. Remove hub bearing. Refer HUB BEARING-Removal.

3. Remove (4) bolts and seperate disc from hub as shown in Figure 10.

INSTALLATION

1. Install four attaching bolts and torque to 35 ft. lbs.

2. Install hub bearing. Refer HUB BEARING-Installation.

3. Install disc and hub assembly. Refer DISC and HUB ASSEMBLY-Installation.

KNUCKLE SEAL

REMOVAL

1. Remove disc and hub (See DISC AND HUB REMOVAL, Section 3A).

2. Pry seal from knuckle.

INSTALLATION

1. Place knuckle seal on Tool J-26485. Insert tool as far as possible into knuckle and then drive it in with a hammer until it bottoms (figure 12). Remove tool.

2. Install disc and hub (See DISC AND HUB INSTALLATION, Section 3A).

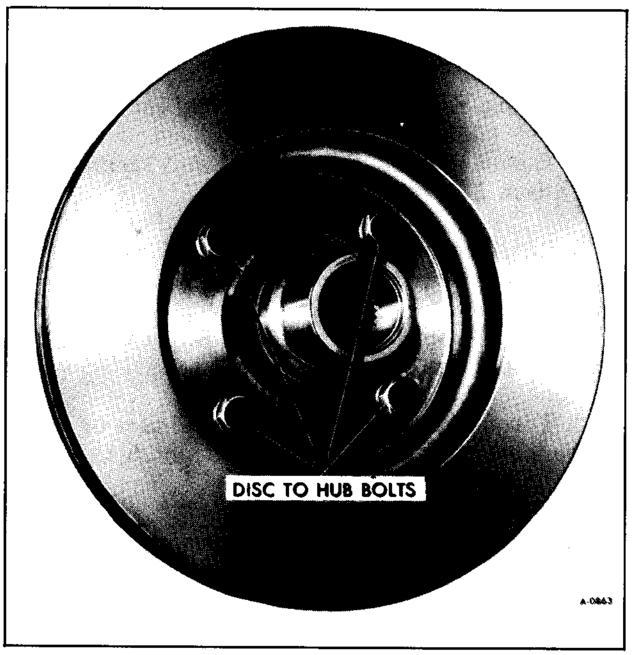


Figure 10—Disc Removal

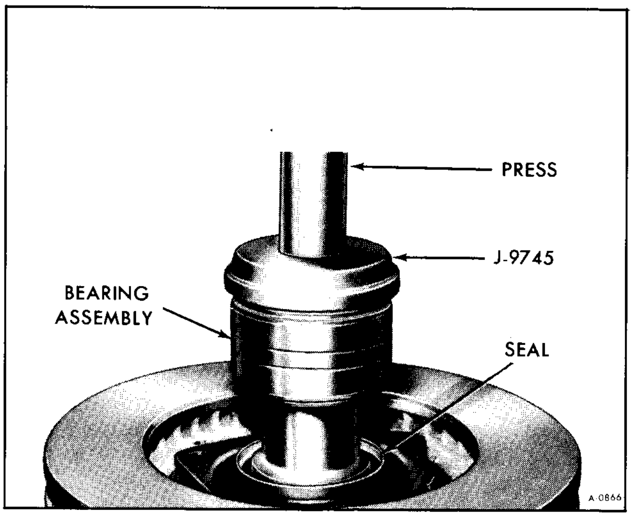


Figure 11—Installing Bearing

KNUCKLE

REMOVAL

1. Remove disc hub assembly (refer to DISC HUB ASSEMBLY, REMOVAL).

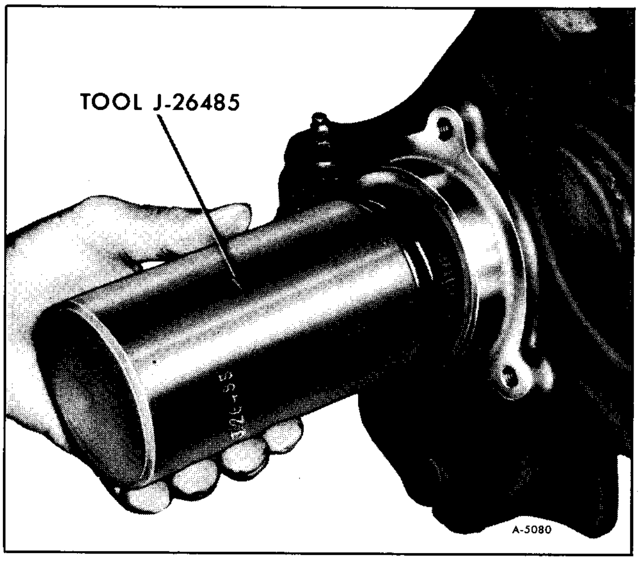


Figure 12—Installing Knuckle Seal

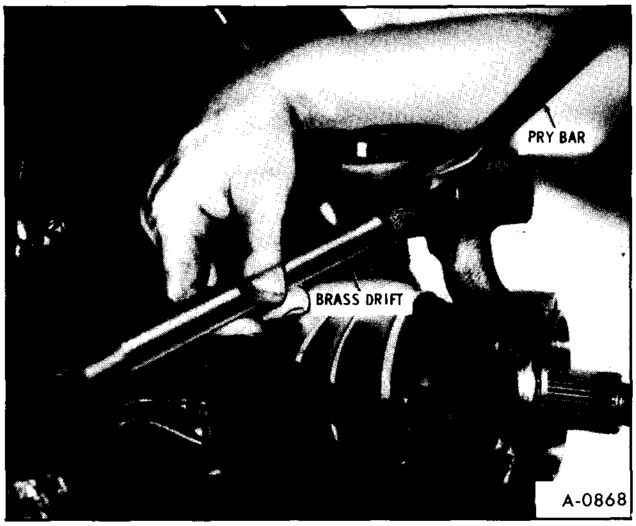


Figure 13—Removing Upper Ball Joint

2. Remove upper ball joint cotter pin and nut.

3. Remove brake line hose clip from ball joint stud.

NOTE: Do not loosen ball joint stud.

4. Using a brass drift and hammer, Figure 13, loosen upper ball joint stud.

5. Remove cotter pin and nut from tie rod end.

6. Using Tool J-21319 remove tie rod end as shown in Figure 14.

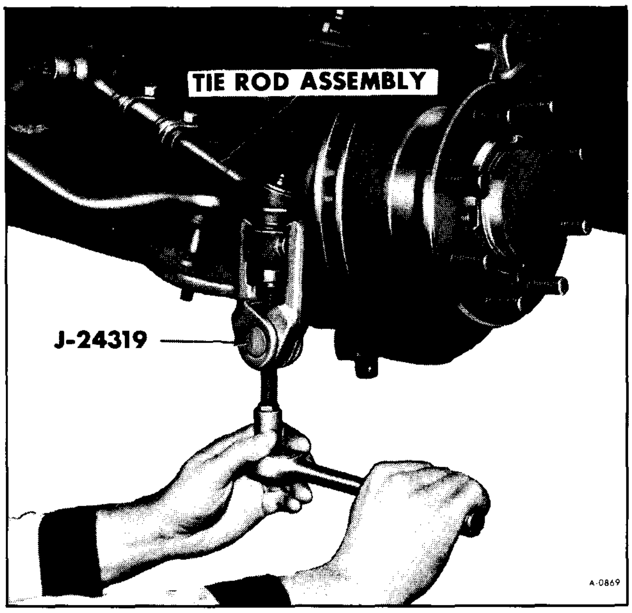


Figure 14—Removing Tie Rod End

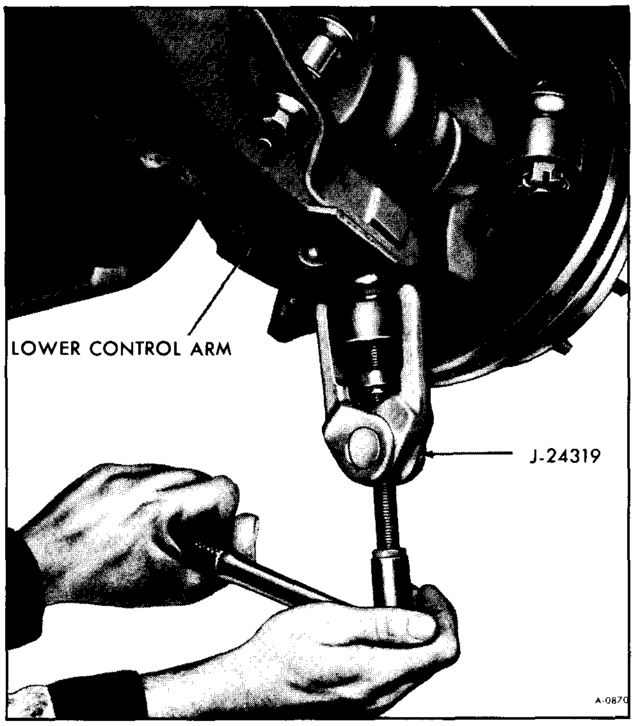


Figure 15—Removing Lower Ball Joint

7. Remove cotter pin and nut from lower ball joint.

8. Using Tool J-24319, remove lower ball joint from knuckle (figure 15).

9. Remove knuckle. Pry seal from knuckle.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Using Tool J-23115 install seal into knuckle.

2. Install lower ball joint stud into knuckle and attach nut. Do not torque.

3. Install tie rod end stud into knuckle and attach nut. Do not torque.

4. Install upper ball joint stud into knuckle and attach brake line hose clip. Install nut.

5. Torque ball joint nut to a minimum or 40 ft. lbs. (upper), 100 ft. lbs. (lower). Tighten to install NEW cotter pins.

> **CAUTION:** *Cotter pin on upper ball joint must be bent up only to prevent interference with C.V. joint seal.*

6. Torque tie rod end nut. See specifications for torque value and procedure.

NOTE: Do not back off nut to install NEW cotter pin.

7. Install disc hub assembly (refer to DISC HUB ASSEMBLY INSTALLATION).

UPPER CONTROL ARM

REMOVAL

1. Hoist vehicle and remove wheel, and place a floor stand on each side under and firmly against the lower control arm.

2. Remove upper shock attaching bolt.

3. Remove cotter pin and nut from upper ball joint.

4. Disconnect brake hose clamp from ball joint stud.

5. Using hammer and a drift, Figure 13, drive on spindle until upper ball joint stud is disengaged.

6. Remove upper control arm cam assemblies and remove control arm from vehicle by guiding shock absorber through access hole.

IMPORTANT: While cam is removed check cam adjustment surface of bracket for weld splatter. Weld splatter in this area will affect front end alignment. Remove weld splatter before reassembly.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

NOTE: Service upper control arm assemblies have plugs instead of grease fittings in ball joints. Remove plugs and install grease fittings before installing control arm.

1. Guide upper control arm over shock absorber and install bushing ends into frame bracket.

2. Install cam assemblies as shown in Figure 4.

3. Install ball joint stud into knuckle.

4. Install brake hose clip on ball joint stud.

5. Install ball joint nut. See specifications for torque value and procedure.

NOTE: Do not back off nut to install NEW cotter pin.

CAUTION: *Cotter pin must be crimped toward upper control arm to prevent interference with outer C.V. joint seal.*

6. Install upper shock attaching bolt and nut.

7. Install wheel and remove floor stands.

8. Lower hoist.

9. Check camber, caster and toe-in and adjust if necessary. Refer to FRONT END ALIGNMENT.

UPPER CONTROL ARM BUSHING

Upper control arm bushings can be removed and installed while control arm is installed on vehicle.

REMOVAL

1. Hoist vehicle, place floor stands under and firmly against the lower control arm, and remove wheel.

2. Disconnect upper shock absorber attaching bolt. (figure 18)

3. Remove cam assemblies from control arm.

4. Move control arm out of frame brackets and attaching bushing removal tools as shown in Figure 19.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install tools as shown in Figure 20 and press bushings into control arm.

2. Move control arm into frame brackets and install cam assemblies. The cams are installed with the bolts in the lower position. Torque nut to 80-95 ft. lbs.

3. Connect upper shock attaching bolt. Torque nut to 90 ft. lbs.

4. Replace wheel, remove floor stands, lower hoist.

5. Align front wheels. Refer to FRONT END ALIGNMENT.

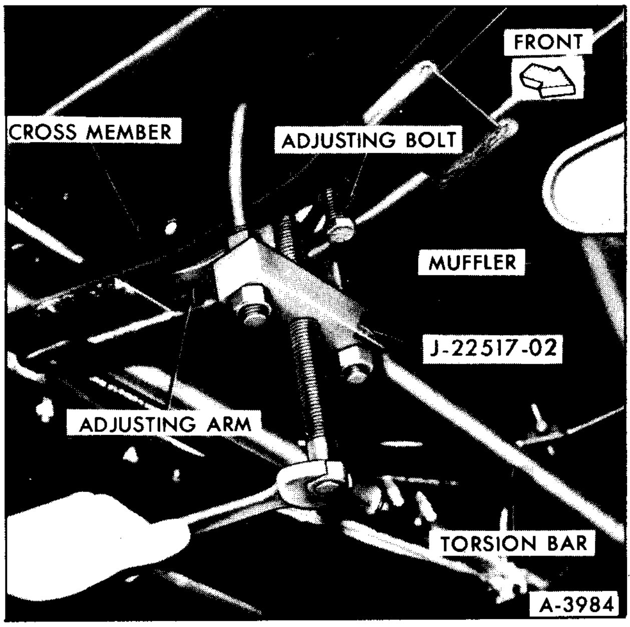


Figure 16—Removing Torsion Bar

LOWER CONTROL ARM

REMOVAL

1. Hoist vehicle and remove wheel assembly.

2. Before using Tool J-22517-02, remove two nuts and center screw, then place tool over cross-member support. Align pin of tool into hole in cross-member. Install two nuts on tool and center screw: Turn center screw until seated in dimple of torsion adjusting arm. (figure 16).

3. Using a socket on the torsion bar adjusting bolt, turn counterclockwise, counting the number of turns necessary to remove.

NOTE: The number of turns to remove the adjusting bolt will be used when installing, to obtain the original carrying height.

4. Remove adjusting bolt and nut.

5. Turn center screw of Tool J-22517-02 until torsion bar is completely relaxed and remove torsion bar noting which end is front.

6. Disconnect shock absorber and stabilizer link from lower control arm.

7. Remove drive axle nut.

8. Remove cotter pin and nut from lower ball joint stud.

9. Install Tool J-24319 and remove ball joint stud from knuckle. (figure 15)

10. Remove bolts from lower control arm to frame and remove torsion bar.

11. Push inboard on drive axle and pull outward on knuckle to gain clearance, then remove lower control arm from knuckle.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install lower control arm making certain shock absorber is guided onto lower control arm shock absorber mount. Guide ball joint stud into knuckle. Install but do not torque stud nut.

2. Install lower control arm to frame bracket bolts. Install nuts and torque to 90 ft.-lbs.

3. Torque lower ball joint stud to 100 ft. lbs.

NOTE: Do not back off nut to install NEW cotter pin.

4. Install shock absorber nut and torque to 90 ft. lbs. Install stabilizer link and torque nut to 15 ft. lbs.

5. Apply a liberal amount of chassis grease to both ends and place front end of torsion bar into control arm. Push torsion bar all the way forward into the control arm.

6. Insert adjusting arm into the crossmember and position 1-3/4" - 2" below the centerline of the cross-member (See figure 17). Slide torsion bar rearward until it is flush with the rear face of the adjusting arm.

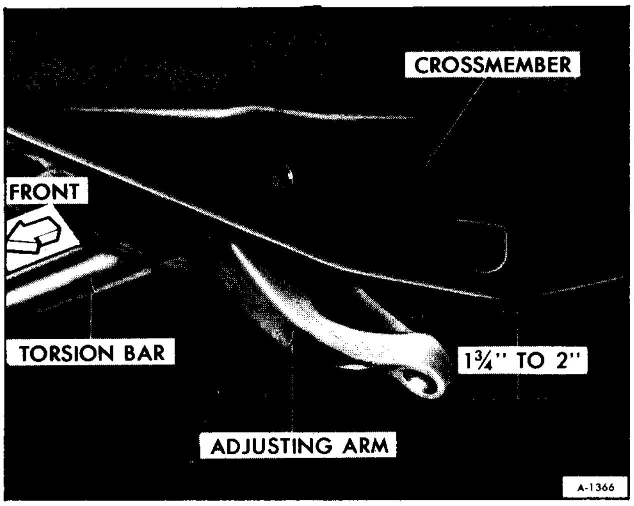


Figure 17—Positioning of Adjusting Arm

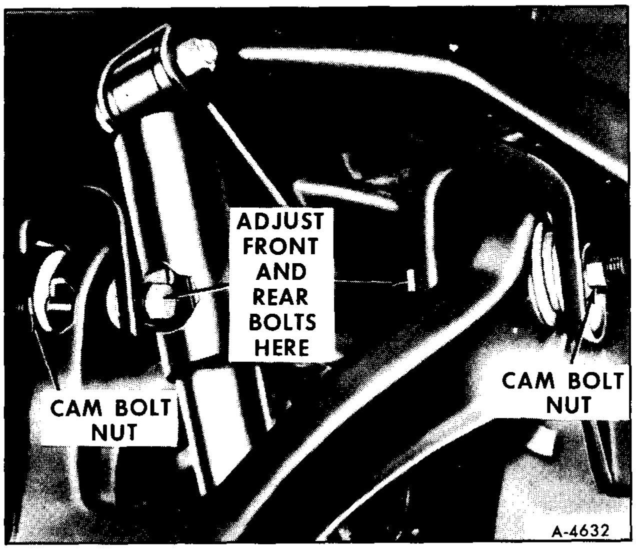


Figure 18—Upper Control Arm Attachment

7. Reposition Tool J-22517-02 making sure pin of tool is in hole in crossmember. Turn center screw of Tool J-22517-02 until adjusting arm is in position to allow installation of the adjusting nut.

8. Apply a liberal amount of chassis grease and install adjusting bolt and turn number of turns previously recorded to obtain original ride height.

9. Turn center screw until torsion is relaxed and remove tool.

10. Lower vehicle.

11. Check ride height (see figure 31) Adjust if necessary refer to "RIDE HEIGHT" in this section.

LOWER CONTROL ARM BUSHINGS

REMOVAL

1. Hoist vehicle.

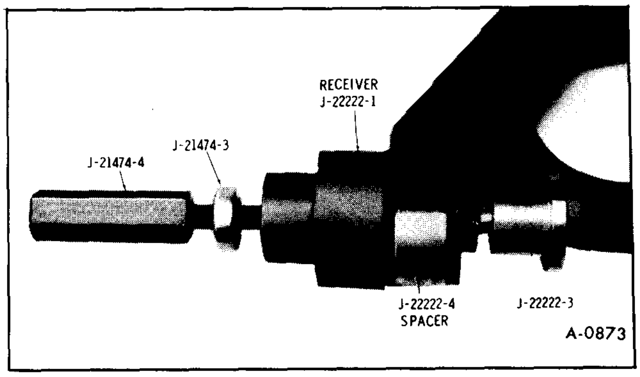


Figure 19—Removing Upper Control Arm Bushing

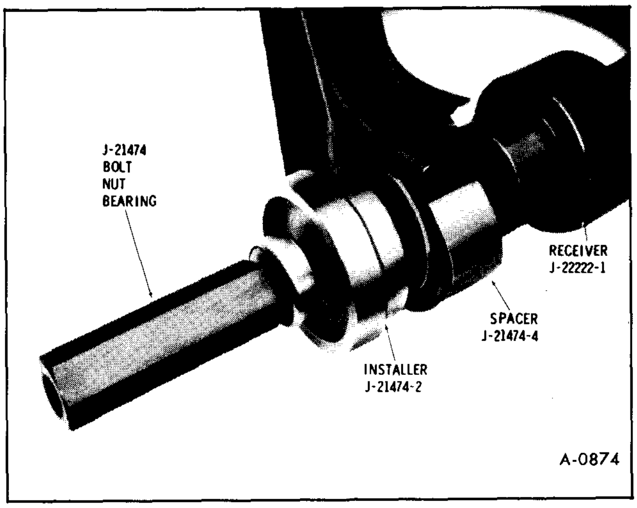


Figure 20—Installing Upper Control Arm Bushing

2. Remove stabilizer link bolt, grommets, spacer, and attaching hardware. Discard bolt.

3. Place floor stands under frame horn, and under points where frame sections are bolted. Lower front lift to floor.

4. Install Tool J-22517-02. Method for attaching, refer to TORSION BAR REMOVAL, Item 2 through 6.

5. Remove lower control arm bushing bolts and pull control arm down until free of frame brackets.

6. Install Tools through rear bushing and press out bushing as shown in Figure 21.

NOTE: Due to the torsion bar anchor attachment to the lower control arm, it will be necessary to use a hardened 1/2" x 20 nut as shown in Figure 22 to remove the front bushing.

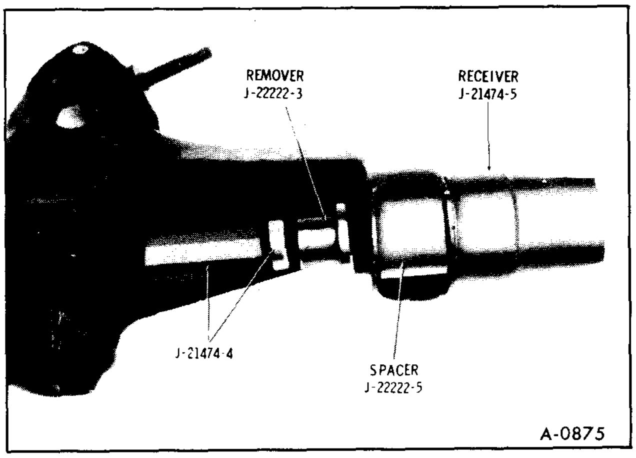


Figure 21—Removing Lower Control Arm Rear Bushing

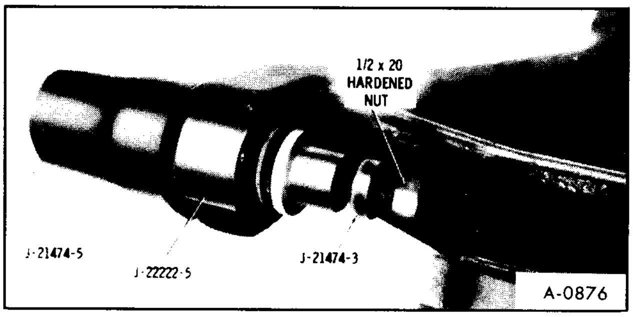


Figure 22—Removing Lower Control Arm Front Bushing

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install Tools as shown in Figure 24 and press rear bushing into lower control arm.

NOTE: Due to the torsion bar anchor attachment to the lower control arm, it will be necessary to use a hardened 1/2" x 20 nut as shown in Figure 23 to install the front bushing.

2. Raise lower control arm into frame brackets and install bushing bolts and nut. Do not torque.

3. Using Tool J-22517-02, refer to TORSION BAR INSTALLATION, item 10 through 13.

4. Raise front lift and remove floor stands.

5. Using a new bolt with grommets, spacer, and attaching hardware, attach stabilizer link bolt to lower control arm. Torque nut to 15 ft. lbs. Cut bolt off 1/4" below nut.

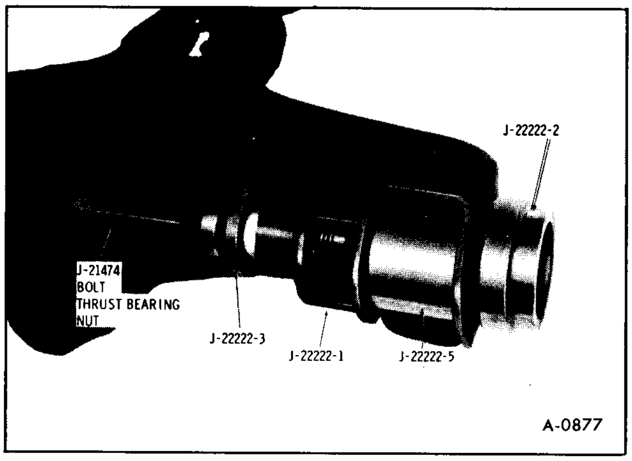
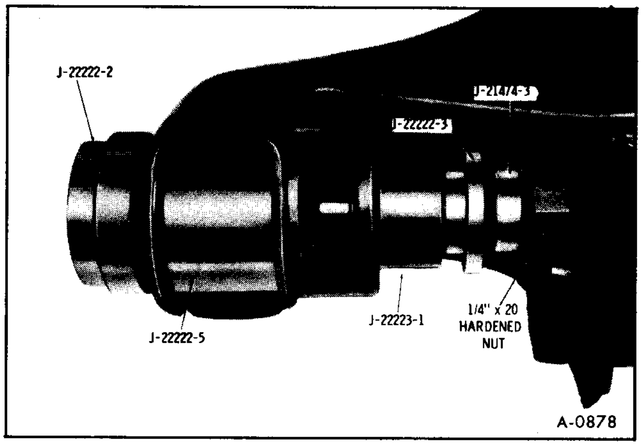


Figure 23—Installing Lower Control Arm Front Bushing



CP1 Figure 24—Installing Lower Control Arm Rear Bushing

6. Lower and torque lower control arm bushing nuts to 90 ft. lbs.

BALL JOINT

Ball joint lubrication and seal inspection is important, refer to Section 0 of specifications and maintenance intervals.

BALL JOINT CHECKS

VERTICAL CHECKS

1. Raise the vehicle and position floor stands under the left and right lower control arms as near as

Figure 25—Ball Joint Vertical Check

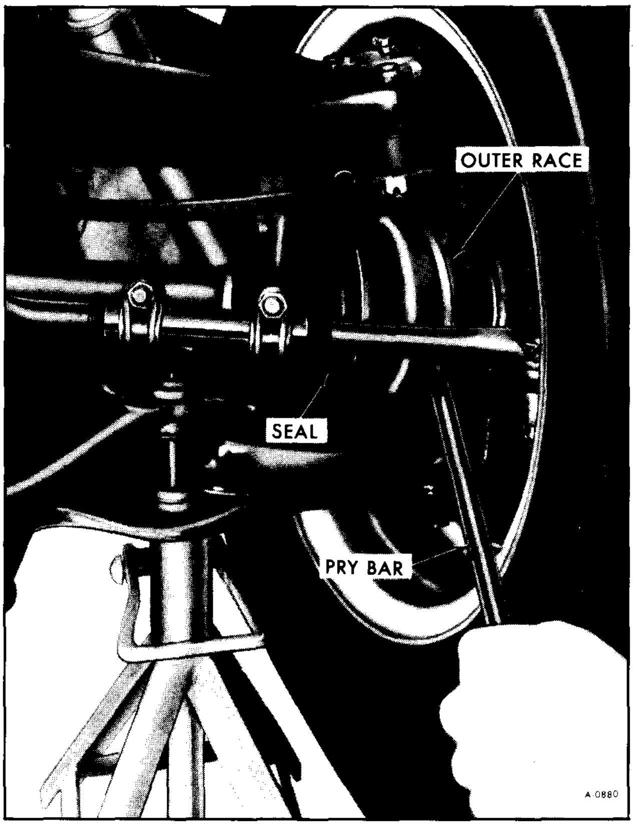


Figure 26—Pry Bar Installation

possible to each lower ball joint. Vehicle must be stable and should not rock on the floor stands. Lower front hoist.

2. Position dial indicator as shown in Figure 25.

3. Place a pry bar as shown in Figure 26 and pry down on bar. Care must be used so that drive axle seal is not damaged. Reading must not exceed .125"

LOWER CONTROL ARM BALL JOINT

REMOVAL

1. Remove knuckle. Refer to KNUCKLE REMOVAL.

2. Drill side rivets 1/2" deep using 1/4" (figure 27) drill bit. Drill same rivets again with 1/2" drill bit just deep enough to remove head of rivet.

3. Drive out rivets with hammer and punch.

4. Drill center rivet using 5/8" drill bit just deep enough to remove rivet head.

5. Using hammer and punch, drive center rivet of joint out of control arm.

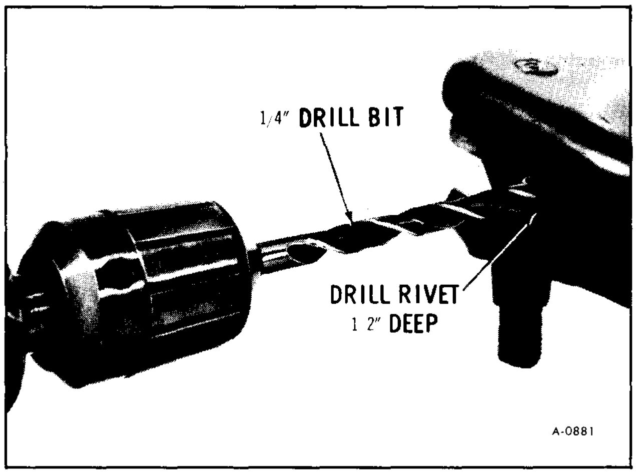


Figure 27—Drilling Ball Joint Rivets

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install service ball joint into control arm and torque bolts and nut as shown in Figure 28.

2. Install knuckle - Refer to KNUCKLE INSTALLATION.

3. Check clearance from ball joint nut to drive axle outer joint as shown in Figure 29. If no clearance is obtained, it may be necessary to grind off nut but not more then 1/16".

UPPER CONTROL ARM BALL JOINT

REMOVAL

1. Hoist vehicle under lower control arms and remove wheel.

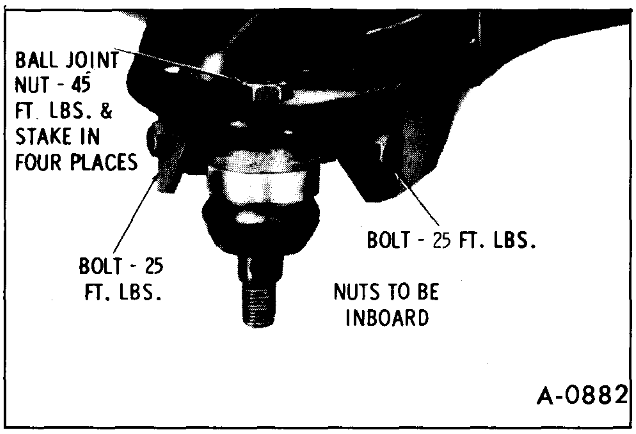


Figure 28—Installing Service Ball Joints

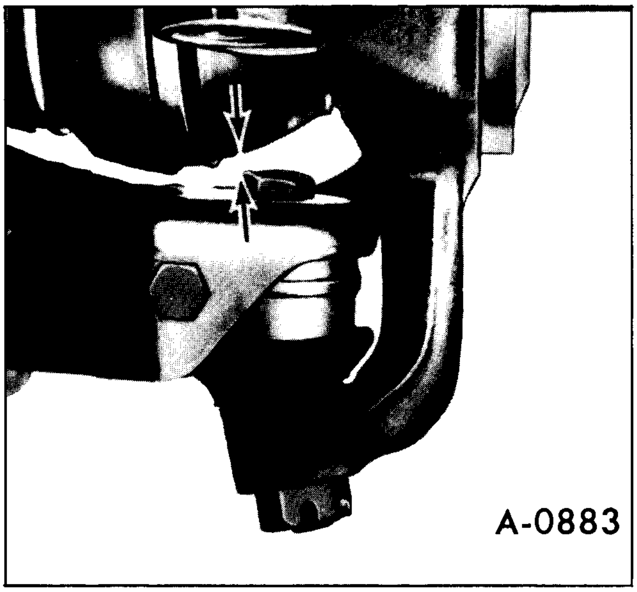


Figure 29—Checking Clearance

2. Remove cotter pin and nut from upper ball joint stud.

3. Disconnect brake hose clip from upper ball joint stud.

4. Using hammer and a brass drift similar to Figure 13 drive on spindle until upper ball joint stud is disengaged from spindle.

5. Raise control arm up and drill rivets with a 1/8" drill bit 3/8" deep.

NOTE: It may be necessary to use a block of wood between frame and control arm for support.

6. Drill off rivets using a 1/2" drill bit. Do not drill into control arm.

7. Using a punch, drive out rivets and remove ball joint.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install service ball joint into control arm (bolts must be installed from top side). Torque nuts to 20 ft. lbs.

2. Install ball joint stud into knuckle and position brake hose clip over stud.

3. Install ball joint stud nut. See specifications for torque value and procedure.

CAUTION: *Cotter pin must be bent up to prevent interference with outer C.V. Joint Seal.*

4. Install wheel and lower hoist.

STABILIZER BAR

REMOVAL

1. Remove link bolts, nuts, grommets, spacers and retainers from lower control arm. Discard bolts.

2. Remove two bolts attaching dust shield to frame (both sides).

3. Remove bracket to frame attaching bolts and remove stabilizer bar from front of vehicle.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

Reverse removal procedure.

NOTE: New link nuts are torqued to 15 ft. lbs. then bolt is cut off 1/4" below nut.

SHOCK ABSORBER (FIGURE 4)

REMOVAL

1. Raise vehicle and place a safety stand under and firmly against the lower control arm.

CAUTION: *This must be done to prevent the lower control arm from shifting and damaging the tie rod.*

2. Remove wheel.

3. Remove upper shock attaching bolt.

4. Remove lower shock attaching nut and carefully guide shock through upper control arm.

INSTALLATION

1. Guide shock absorber through upper control arm and onto lower shock mounting stud.

2. Extend shock towards upper mount as necessary and install bolt. Torque to 90 ft. lbs.

3. Install lower shock mounting nut and torque to 90 lbs.

4. Install wheel and replace wheel nuts finger tight.

5. Remove safety stands and lower vehicle. Torque wheel nuts 280 ft. lbs.

TORSION BAR AND/OR CROSSMEMBER SUPPORT

REMOVAL

1. Raise vehicle on a two post hoist.

2. Remove two nuts and center screw from Tool J-22517-02. Position tool over crossmember installing pin of tool into hole in crossmember. Install two nuts on tool, install counter screw. Grease center screw threads and the rounded end of the screw with chassis grease.

3. Turn center screw until seated in dimple of torsion bar adjusting arm. See Figure 16.

4. Remove torsion bar adjusting bolt and nut. Count the number of turns necessary to remove and record.

NOTE: The number of turns to remove the adjusting bolt will be used when installing to obtain the original carrying height.

5. Turn center screw of Tool J-22517-02 until torsion bar is completely relaxed.

6. Remove Tool J-22517-02.

7. Repeat steps 2, 3, 4, 5 and 6 on opposite torsion bar.

8. Remove bolts and retainer from torsion bar crossmember at frame (figure 4).

9. Disconnect exhaust pipe hanger from crossmember and loosen pipe saddle and "U" clamp. Slide hanger backward.

10. Move crossmember rearward until torsion bars are free and adjusting arms are removed.

11. Move torsion bar crossmember sideways to the extreme left. Move crossmembers upward and outward until opposite end clears exhaust pipe.

12. Remove torsion bars. Mark accordingly to insure proper installation.

INSTALLATION

1. Install torsion bars. New torsion bars are stamped on one end with an "R" for right or an "L" for left side. Apply a liberal amount of chassis grease to both ends.

2. Install crossmember insulators on the crossmembers.

3. Install crossmember and position approximately two inches rearward of its normal position.

4. Raise torsion bars and align with hole in crossmember. Move crossmember forward so torsion bars rest on edge of hole.

5. Insert torsion bar adjusting arm into crossmember, position so the arm will engage the torsion bar and the end of the arm will be 1-3/4"-2" below the crossmember (See figure 17). Tap crossmember forward enough to engage bar into arm.

6. Repeat step 5 for the other side of vehicle.

7. Position crossmember to its normal position. Torsion bars should be through and flush with rear face of the adjusting arm. If not repeat steps 5 and 6 after pulling torsion bar slightly out from the lower control arm.

8. Install retainer over each insulator and torque nut to 10 ft. lbs.

9. Reposition and connect exhaust pipe hanger to crossmember and tighten saddle and "U" clamp. Torque nuts 15 ft. lbs.

10. Position Tool J-22517-02 over crossmember installing pin of tool into hole in crossmember. Install two nuts on tool, install center screw.

11. Turn center screw until adjusting arm is in a position to allow installation of adjusting nut. See Figure 16.

12. Install nut and turn adjusting bolt the recorded number of turns to obtain previous ride height.

13. Turn center screw until torsion is completely relaxed. Remove tool and repeat steps 10, 11, 12, 13 on the opposite side.

14. Lower hoist.

15. If ride height requires adjustment refer to "RIDE HEIGHT" following this procedure.

RIDE HEIGHT

When checking front ride height, have the vehicle parked on a known level surface, and tire pressure at specified psi.

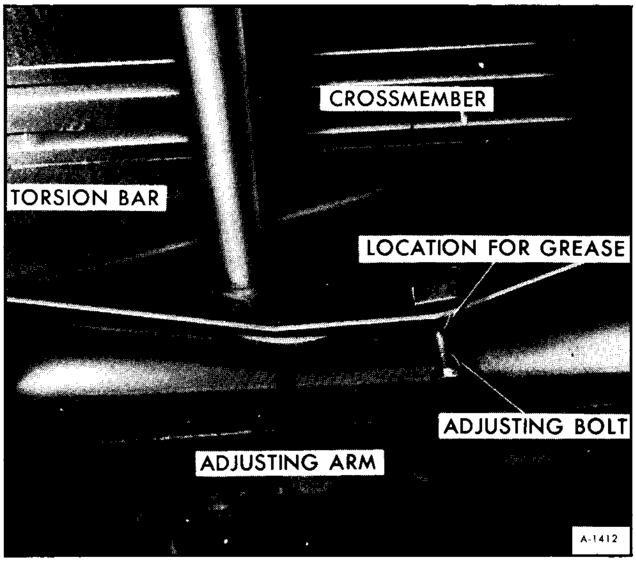


Figure 30—Location For Front Ride Height Adjustment

NOTE: For details on adjusting rear ride height refer to Section 4, REAR SUSPENSION. If vehicle is equipped with the optional Power Level System, be sure power level control knobs are set in the "TRAVEL" position prior to adjusting front ride height.

Measurements must be taken from the top of oval hole in the frame rail to the floor (figure 31). NOTE: Never attempt to increase the ride height of the vehicle using the adjusting bolt only, (figure 30). The bolt will turn but will strip threads and will necessitate replacement of the bolt. Always use special tool.

RIDE HEIGHT ADJUSTMENT

NOTE: Tool J-22517-02 (shown in figure 16) must be used the reset ride height. This tool will raise or lower the torsion bar rear anchor arm so that the adjusting bolt is not loaded.

1. Install Tool J-22517-02 with pin of tool aligned into hole in crossmember. Seat center screw in dimple of torsion bar adjusting arm.

2. If vehicle must be raised, turn tool until proper adjustment level is reached, then turn the adjusting bolt until it makes contact with the adjusting arm. Remove tool.

3. If vehicle is to be lowered, raise adjusting arm from contact with adjusting bolt. Lower bolt then lower arm with tool until proper ride height level is reached. Raise bolt to contact adjustment arm. Remove tool.

FRONT END ALIGNMENT

	Check	Set
Caster	+1-1/2° to + 2-1/2°	+2°
Camber—L.H.	+1/2° to 1°	+3/4°
Camber—R.H.	+1/4° to 3/4°	+1/2°
Toe	0 to -1/4" (toe out)	-1/8" (toe out)

Make adjustments as required. Refer to "ALIGNMENT ADJUSTMENT" below.

ALIGNMENT ADJUSTMENT

Camber

1. Loosen nuts on inboard side of upper control arm cam bolts. (figure 4).

2. Turn front cam bolt (inboard or outboard) to correct for 1/2 of incorrect setting found in checking.

3. Turn rear cam bolt (same way front bolt was turned) to correct for remaining 1/2 of incorrect setting found in checking.

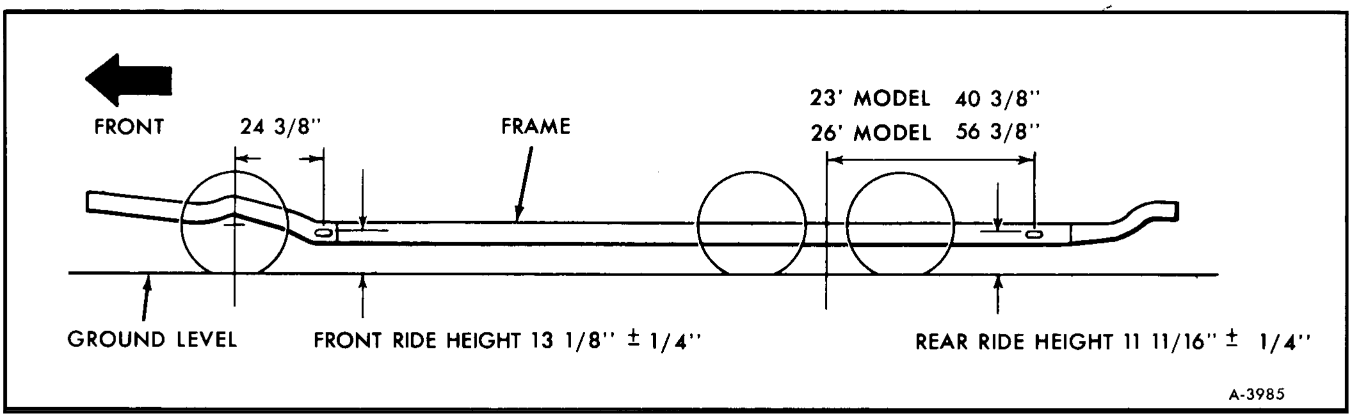


Figure 31—Vehicle Ride Height

Example:

Camber Reading (Checking).......... +1-1/4°
Amount To Be Corrected .... 1/2°
1/2 of 1/2° = 1/4° Front Cam Bolt
Remaining 1/4° Rear Cam Bolt

4. Tighten front and rear cam nuts (torque to 80-95 ft. lbs.) while holding bolts with back-up wrench so that camber is not changed. Check caster, do not reset unless caster exceeds specifications.

IMPORTANT: Check cam adjustment surface for weld splatter. Weld splatter in this area will affect front end alignment. Remove weld spatter if found.

Caster

1. Loosen front and rear cam nuts while holding bolts with back-up wrench so that camber is not changed.

2. Turn front cam bolt so that camber changes 1/4 of the desired amount of caster to be corrected.

Example:

Caster Reading (Checking) .... +5°
Amount To Be Corrected .... 3°
1/4 of 3° = 3/4° Front Cam Bolt

3. Turn rear cam bolt so that camber now returns to corrected setting.

4. Recheck caster setting.

This is a location to start from and a correct setting can be obtained with the above procedure.

NOTE: Torque upper control arm cam nuts to 90 ft. lbs. Hold head of bolt securely, any movement of the cam will effect the final setting and caster camber adjustment must be rechecked.

Toe-In Adjustment (Figure 32)

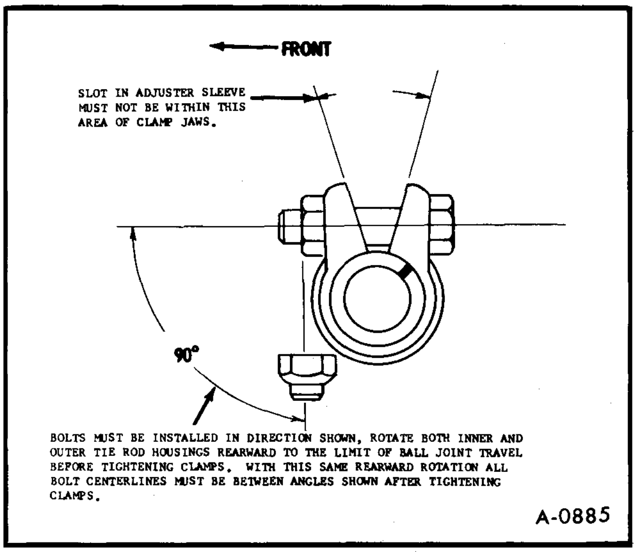


Figure 32—Positioning Tie Rod Clamp

1. Loosen the clamp bolts at each end of the steering tie rod adjustable sleeves. Tie rod assembly must be decreased in length in order to increase toe-in.

NOTE: Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt (after breakaway) exceeds 7 ft. lbs., discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts to assure proper clamping at the specified nut torque.

2. With steering wheel set in straight ahead position, turn tie rod adjusting sleeves to obtain the proper toe-in adjustment at curb load.

3. When adjustment has been completed according to the recommended specifications, check to see that the number of threads showing on each end of sleeve are equal and that the tie rod end housings are at right angles to steering arm. Position inner and outer tie rod clamps as shown in Figure 32. Torque nuts to 20 ft. lbs.

TORQUE SPECIFICIATIONS

APPLICATION	FT. LBS.
Drive axle Nut*	140-280
Hub to Disc Bolts	35
Stabilizer Link Nut	15
Stabilizer Bracket to Frame Screw	28
Torsion Bar Crossmember Retainer Bolts	25
Shock Absorber	
Upper Nut	90
Lower Nut	90
Lower Control Arm Bushing Nuts	85
Upper Control Arm Bushing Nuts	95
Ball Joint - Upper*	40-60
Ball Joint - Lower*	100-125
Tie Rod to Knuckle Nut*	40-50
Inner C.V. Joint to Output Shaft Bolts	75
Bearing Retainer to Knuckle Bolts	35

NOTE: All stud tapers on all ball joints must be kept sufficiently free of lubricant to prevent excessive pull in mating tapered holes.

*NOTE: After reaching minimum torque required, nut must always be tightened to insert cotter pin. Never back nut off.

SPECIAL TOOLS

J-2619	Slide Hammer
J-8433-1	Bearing Puller
J-9745	Front Hub Bearing Installer
J-21474-3-4-5	Control Arm Bushing Remover and Installer
J-22214-4-6	Front Hub Bearing Screw and Adapter
J-23345	Front Hub Bearing Puller
J-22269	Brake Caliper Collapser
J-22517-02	Torsion Bar Unloader
J-23115	Front Hub Seal Installer
J-24319	Pitman Arm, Idler Arm, Ball Joint Puller
J-24717	Front Hub Puller
J-26485	Knuckle Seal Installer

SECTION 3B

DRIVE AXLES

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

Contents of this section are listed below:

TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Clicking noise in turns.	Excessive wear or broken outboard joint.	Inspect and replace outboard joint if necessary.
Coast to drive "clunk".	1. Loose inboard joint flange bolts. 2. Inoperative rubber damper (RH side). 3. Loose spline. (RH damper to shaft).	1. Tighten to specified torque. 2. Replace RH shaft and damper assembly and inboard and outboard seals (use seal service kits). 3. Same as "2" above.
Shudder or vibration on acceleration.	1. Incorrect U-joint angle. 2. Excessive wear on inboard joint housing. 3. Worn spider assembly. 4. Sticking spider assembly.	1. Check front end curb height and correct if necessary. 2. Check for brinelling of housing bores and replace if necessary. 3. Check for wear or free rotation of balls on spider. Replace spider assembly if necessary. 4. Check spider ball to housing bore clearance (ball should slide freely in housing). Replace housing or spider assembly as required.
Shimmy vibration at highway speeds.	Tires out of balance or out of round.	Balance front wheels, true for out of round.

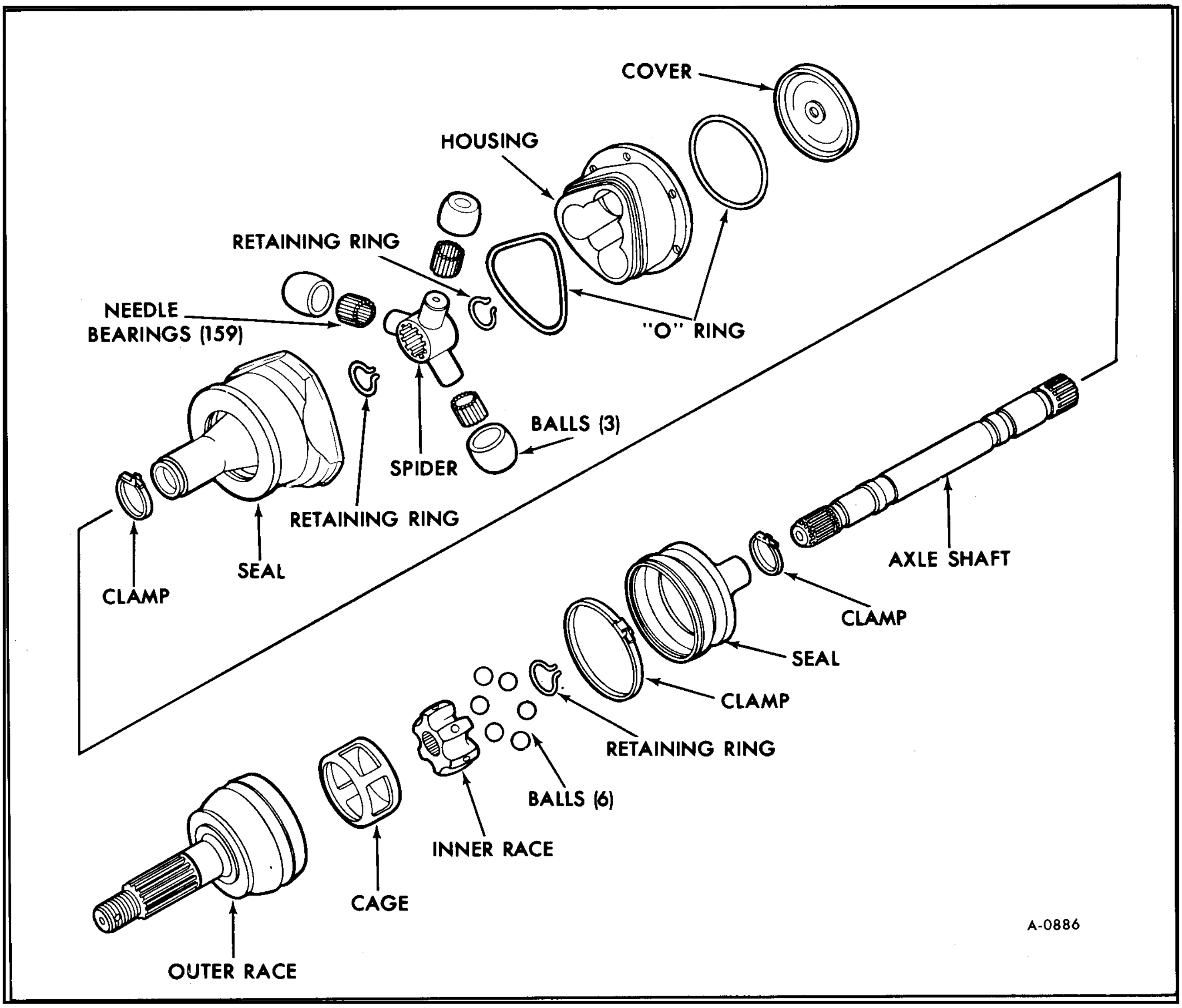


Figure 1—Drive Axle Assembly

GENERAL DESCRIPTION

Drive axles on the vehicle are completely flexible assemblies and consist of an axle shaft and an inner and outer constant velocity joint. (figure 1). The inner constant velocity joint (spider type) has complete flexibility plus inward and outward movement. The outer constant velocity joint (cage type) has complete flexibility only.

CAUTION: *Whenever any operations call for disconnecting, removal or installation of the drive axles, care must be exercised to prevent damage to constant velocity joint seals. Seals may be wrapped with floor mat rubber or old innertube, etc. Make sure any rubber protective covers that are used are removed before vehicle is started or driven.*

DRIVE AXLE ASSEMBLY (RIGHT HAND)

REMOVAL

1. Hoist vehicle under lower control arms.

2. Remove drive axle cotter pin, nut and washer. (figure 2)

3. Remove inner C.V. joint attaching bolts. (figure 3)

4. Push inner C.V. joint outward enough to disengage from R.H. final drive output shaft and move rearward.

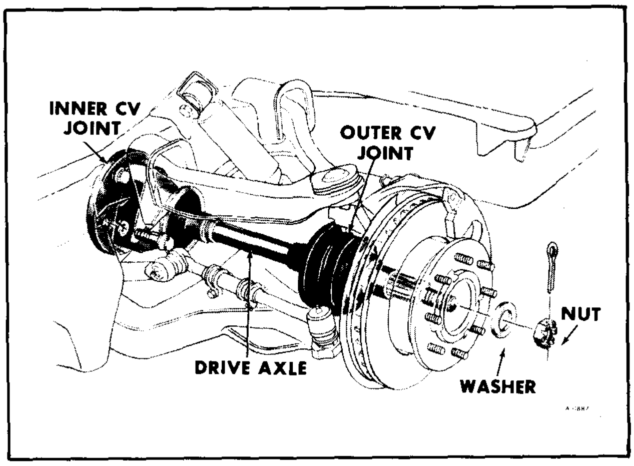


Figure 2—Drive Axle Installed

5. Remove R.H. output shaft support bolts to engine and final drive. (figure 2).

6. Remove R.H. output shaft.

7. Remove drive axle assembly.

CAUTION: *Care must be exercised so that C. V. joints do not turn to full extremes and that seals are not damaged against shock absorber or stabilizer bar.*

INSTALLATION

See CAUTION on Page 3B-1 of this section.

1. Carefully place R.H. drive axle assembly into lower control arm and enter outer race splines into knuckle.

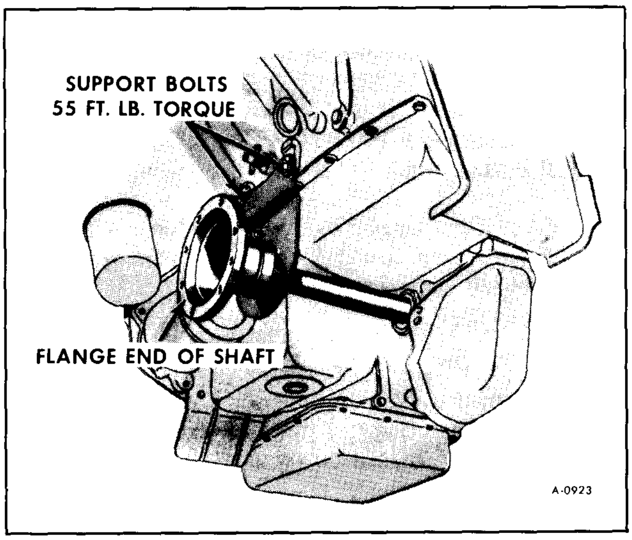


Figure 3—Aligning R.H. Output Shaft

2. Lubricate final drive output shaft seal with Special Seal Lubricant, No. 1050169 or equivalent.

3. Install R.H. output shaft into final drive and attach support bolts to engine.

IMPORTANT: When attaching the right hand output shaft to the engine bracket, do not let the shaft hang. Referring to Figure 3, assemble bracket bolts loosely, and by moving the flange end of the shaft up and down, and back and forth, find the center location. Hold the shaft in this position and then torque the bolts to 55 ft. lbs. on support.

4. Move R.H. drive axle assembly toward front of vehicle and align with R.H. output shaft. Install NEW attaching bolts and torque to 75 ft. lbs.

5. Install washer and nut on drive axle. Torque to 200 ft. lbs. Insert cotter pin and crimp. Tighten nut to insert cotter pin.

6. Lower hoist.

DRIVE AXLE ASSEMBLY (LEFT HAND)

REMOVAL

1. Hoist vehicle under lower control arms.

2. Remove wheel.

3. Remove drive axle cotter pin, nut and washer.

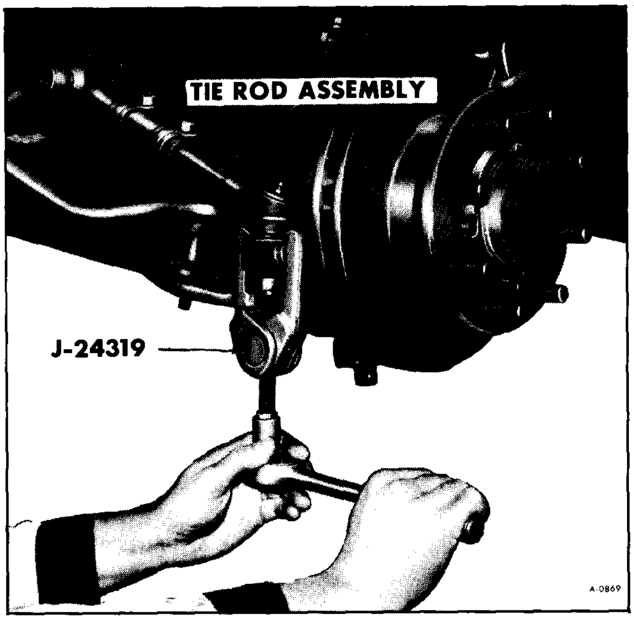


Figure 4—Removing Tie-Rod End

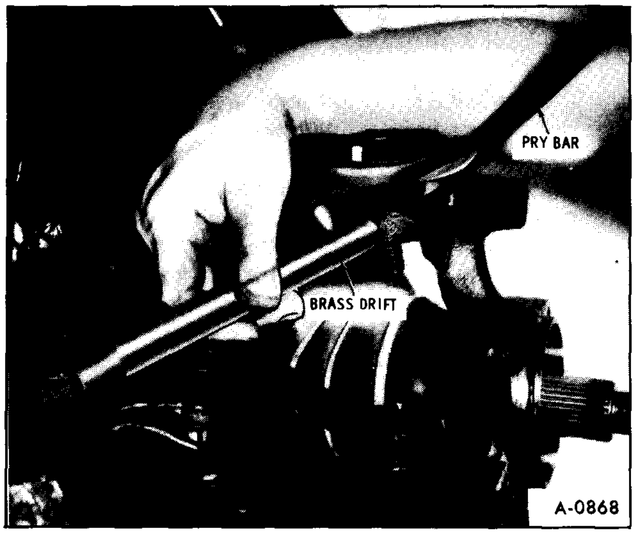


Figure 5—Removing Upper Ball Joint

4. Remove tie rod end cotter pin and nut.

5. Using Tool J-24319 as shown in Figure 4, remove tie rod end from spindle.

6. Remove bolts from drive axle assembly to left output shaft.

7. Remove upper control arm ball joint cotter pin and nut. Remove brake hose clip from ball joint stud.

8. Using hammer and brass drift, drive on knuckle until ball joint stud is free. (figure 5).

9. Using Tool J-24319 (figure 6) remove lower ball joint from knuckle. Care must be exercised so that ball joint doesn't damage drive axle seal.

10. Remove knuckle. Support knuckle so that brake hose is not damaged.

11. Carefully guide drive axle assembly outboard.

CAUTION: *Care must be exercised so that C. V. joints do not turn to full extremes and that seals are not damaged against shock absorber or stabilizer bar.*

INSTALLATION

See CAUTION on Page 1 of this section.

1. Carefully guide L.H. Drive axle assembly onto lower control arm.

2. Insert lower control ball joint stud into knuckle and attach nut. Do not torque.

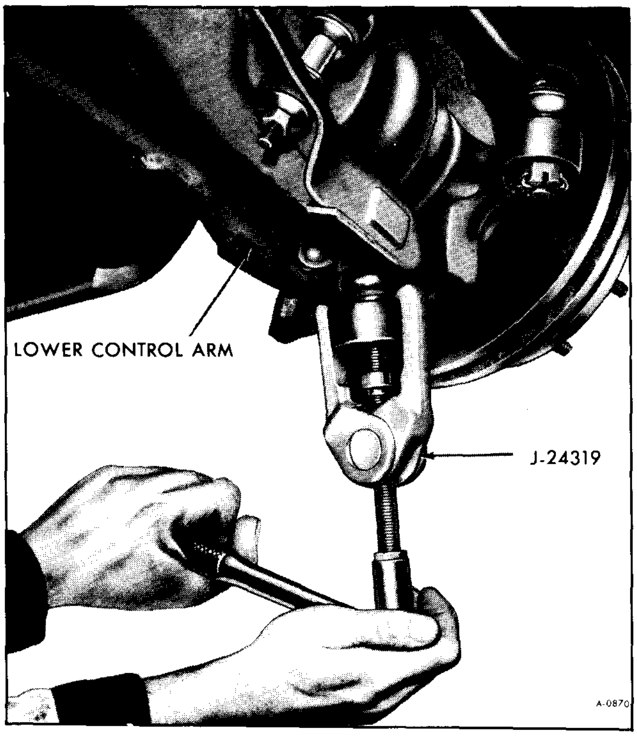


Figure 6—Removing Lower Ball Joint

3. Center L.H. drive axle assembly in opening of knuckle and insert upper ball joint stud.

4. Place brake hose clip over upper ball joint stud and install nut. Do not torque.

5. Insert tie rod end stud into knuckle and attach nut. Torque to 40 ft. lbs. Install cotter pin and crimp. Tighten nut to install cotter pin.

6. Align inner C.V. joint with output shaft and install NEW attaching bolts. Torque to 75 ft. lbs.

7. Torque upper and lower ball joint stud nuts to 40 ft. lbs. (upper); 100 ft. lbs. (lower). Tighten nut to install cotter pins.

CAUTION: *Upper ball joint cotter pin must be crimped toward upper control arm to prevent interference with outer C. V. joint seal.*

8. Install drive axle washer and nut. Torque to 200 ft. lbs. Install cotter pin and crimp. Tighten nut, if necessary to install cotter pin.

9. Install wheel.

10. Remove floor stands and lower hoist.

CONSTANT VELOCITY JOINT (C.V. JOINT OUT OF VEHICLE)

The C.V. joints are to be replaced as a unit and are only disassembled for repacking and replacement of damaged seals.

DISASSEMBLY (OUTER C.V. JOINT)

1. Refer to "DRIVE AXLE ASSEMBLY (LEFT HAND) OR (RIGHT HAND)."

2. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

NOTE: Protect against jaw marks, do not over-clamp.

3. Remove inner and outer seal clamps. (figure 7)

4. Slide seal down axle shaft to gain access to C.V. joint.

NOTE: Seal may need to be rolled back or cut away on R.H. drive axle.

5. Using Tool J-5586, spread retaining ring until C.V. joint can be removed from axle spline. (figure 8)

6. Remove retaining ring (figure 20).

7. Slide seal from axle shaft and discard.

8. Remove excess grease from C.V. joint.

9. Insert C.V. joint in vise, clamping on shank.

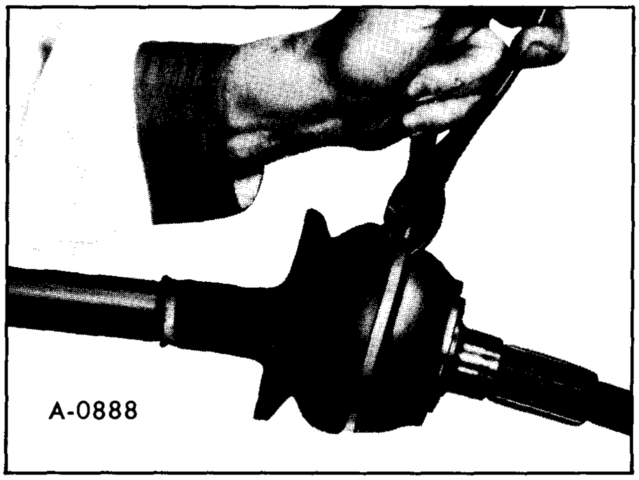


Figure 7—Cutting Seal Clamp

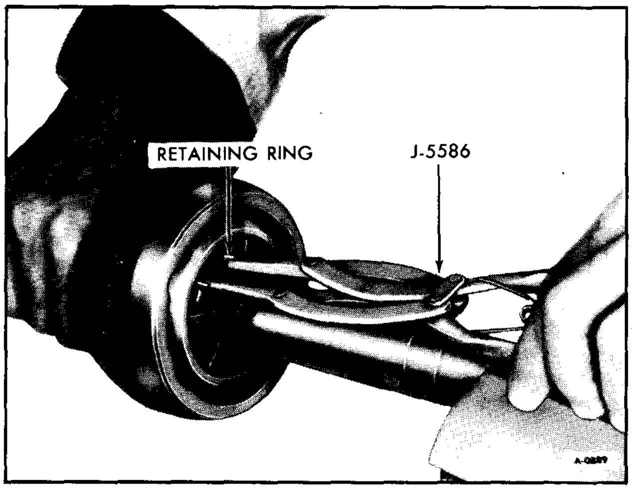


Figure 8—Spreading Retaining Ring

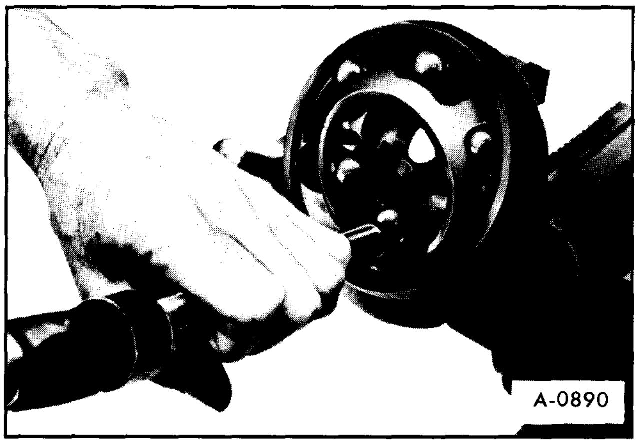


Figure 9—Tapping on Inner Race

NOTE: Use jaw blocks to prevent damage to the joint shank.

10. Carefully place a brass drift against one of the lobes of the inner race and tap gently as shown in Figure 9. Tip the race far enough to remove the first ball. The rest of the balls should be removed one at a time, with the cage tipped as shown in Figure 10. It may be necessary to carefully pry the last ball out of the cage with a screwdriver.

11. Turn cage 90° and with slot in cage aligned with land in outer race lift out inner race and cage. (figure 11).

12. While holding cage and inner race, turn inner race 90°. Line up short land of inner race with slot in cage. Move short land through cage and turn inner race up and out of cage. (figure 12)

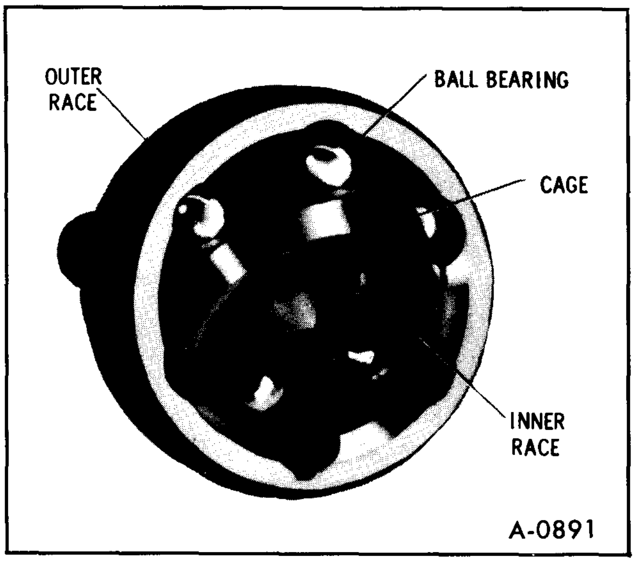


Figure 10—Removing Ball Bearings

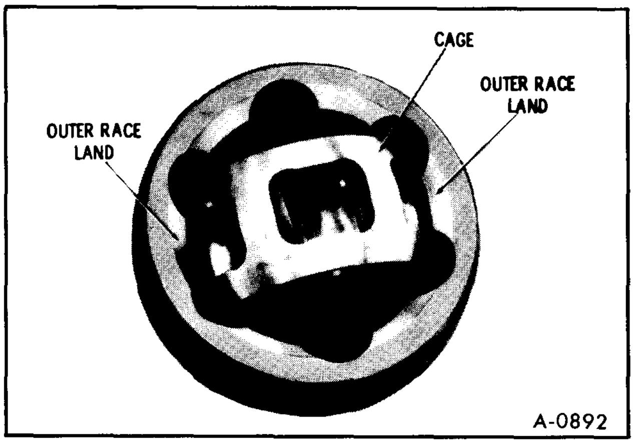


Figure 11—Positioning Cage

CLEANING AND INSPECTION (OUTER)

Wash all metallic parts thoroughly in a cleaning solvent. Dry with compressed air. Rubber seal must be replaced whenever C.V. joint is disassembled for service.

NOTE: Outer and inner race may show a definite polished area where the balls travel. The C.V. joint should not be replaced for this reason. However, if this wear pattern is suspected to be the cause of a noisy or vibrating C.V. joint, the joint should be replaced.

1. Inspect outer race for excessive wear or scoring in the ball grooves. Inspect shaft splines and threads for damage.

2. Inspect balls (six) for nicks, cracks, breaks or scores.

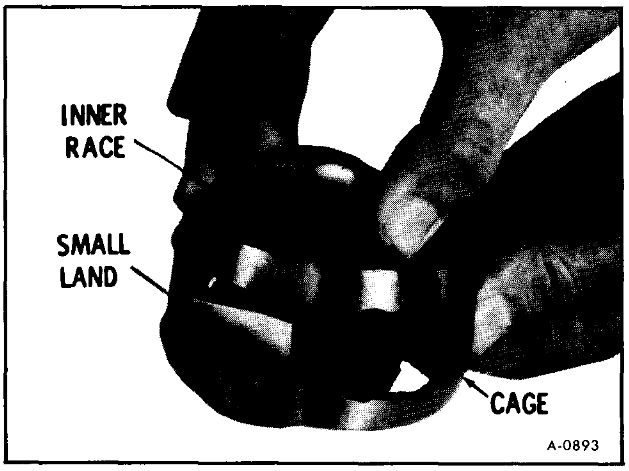


Figure 12—Removing or Installing Inner Race from Cage

NOTE: Slight scuffing or nicking is considered normal.

3. Inspect cage for cracks, breaks or excessive brinelling of the window flats. Some wear and slight brinelling from ball contact is normal.

4. Inspect inner race for excessive wear, scores or breaks.

5. Inspect retaining ring for breaks.

NOTE: If any of the above defects, except Item 5 are found, the C.V. joint assembly will have to be replaced as a unit. Retaining ring may be replaced separately.

ASSEMBLY

1. Insert short land of inner race through bore of cage and pivot to install in cage. (figure 12).

2. Insert outer race in vise, clamping on shank. Protect shank from damage. Do not tighten too tight. Put a light coat of lubricant GM 1050802 or equivalent on ball grooves of inner and outer races.

3. Insert cage and inner race into outer race by aligning windows on cage with lands on outer race. (figure 11). Pivot cage and inner race 90°, being certain that step on cage bore is positioned to inside of joint and snap ring groove in inner race is facing outside. (figure 13).

4. Insert balls into outer race one at a time by rocking assembly to each subsequent ball groove until all six balls are installed. (figure 13)

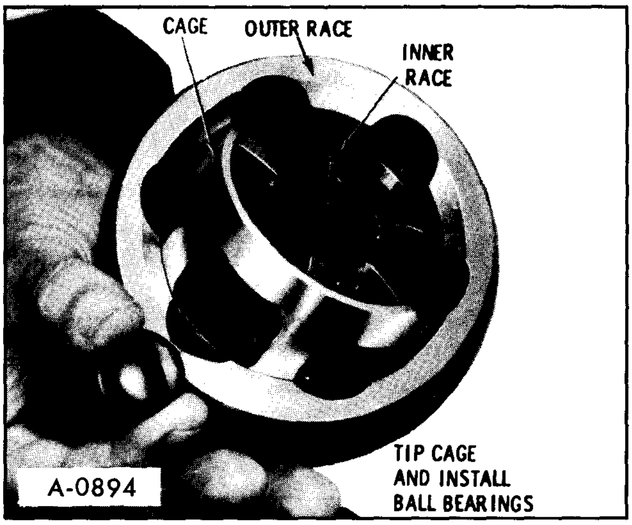


Figure 13—Installing Balls in Outer Race

NOTE: If a brass drift is used to install the sixth ball, make certain metallic chips from drift do not enter assembly.

5. Pack C.V. joint full of Lubricant No. 1050802 or equivalent.

6. Pack inside of seal with Lubricant No. 1050802 or equivalent until folds of seal are full.

7. Place service clamp on axle shaft. Two wraps of band are required.

8. Install seal onto axle shaft.

9. Install retaining ring into inner race with tangs protruding into relieved area. (figure 16)

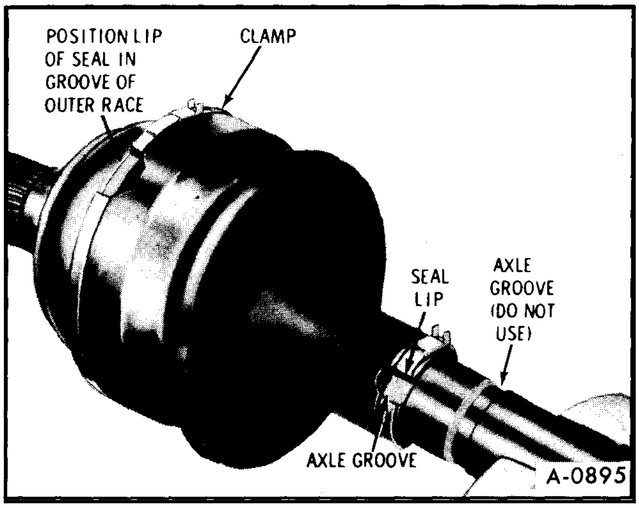


Figure 14—Positioning Seal

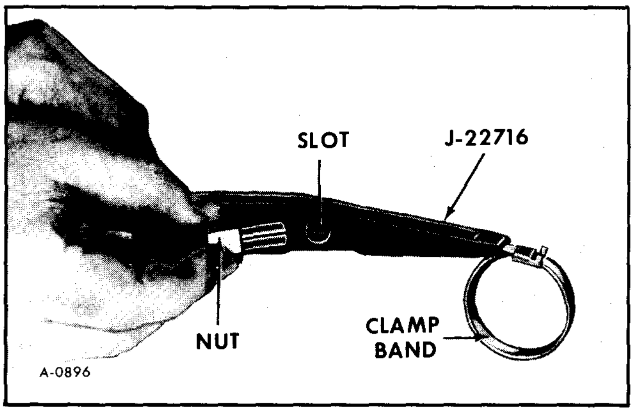


Figure 15—Assembly of J-22716 to Band

10. Insert axle shaft into splines of outer C.V. joint until retaining ring secures shaft in second snap ring groove.

11. Position seal in groove of outer race. (figure 14)

12. Position small end of seal in nearest joint groove on axle shaft. (figure 14)

NOTE: After seal is in position on axle shaft make sure no lubricant is in grooves of seal before installing seal clamp band.

13. With service clamps over seals in correct position, follow procedures listed below.

a. Pull clamp to desired size and insert band into Tool J-22716. Then insert nut into tool with band in slot of nut as shown in Figure 15.

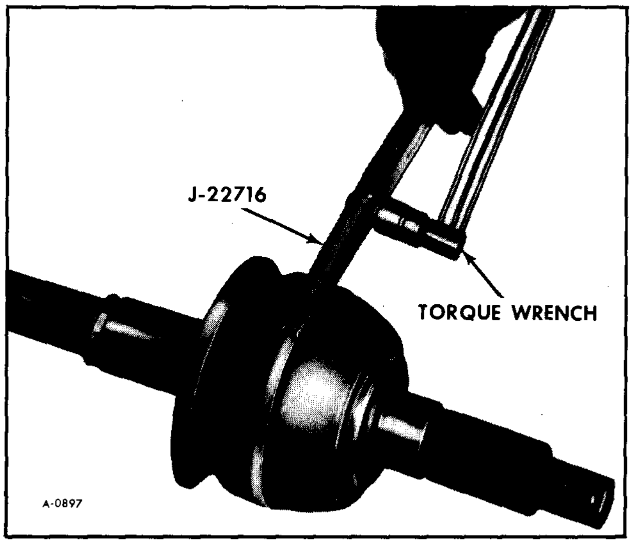


Figure 16—Tightening Band

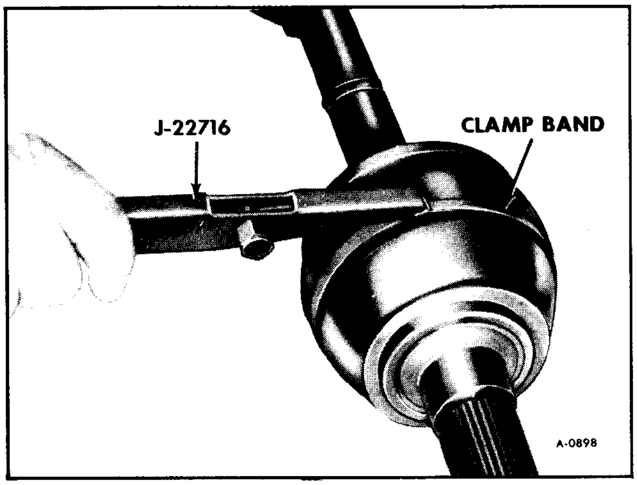


Figure 17—Bending Band Over Lock Tangs

b. Loop seal clamp band around seal end twice with strap passing through its own retainer each time a loop is completed.

c. After completion of second loop, feed extra length of strap into small end of Seal Clamp Band Installer, J-22716.

NOTE: Be sure to have the open side of the tool facing up.

d. Slide bolt through holes in side of tool and at the same time, secure strap in slot in the nut.

e. Lift end of strap up and out of the open side of tool.

f. Place a wrench on nut and draw band up tight, then torque nut to 65 in. lbs. (See figure 16). After desired torque is obtained, turn tool over to

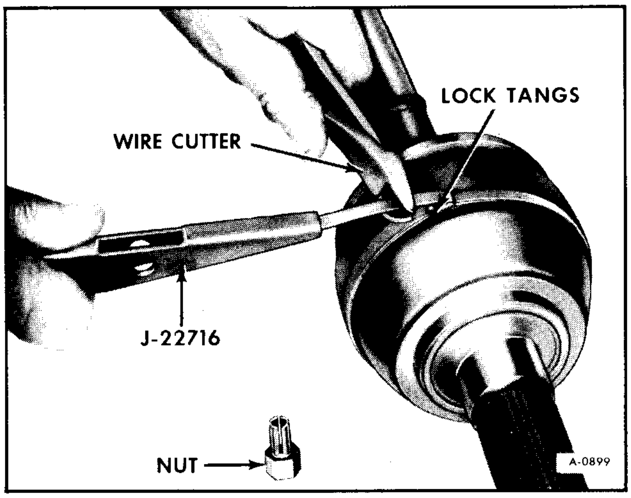


Figure 18—Cutting Off Band

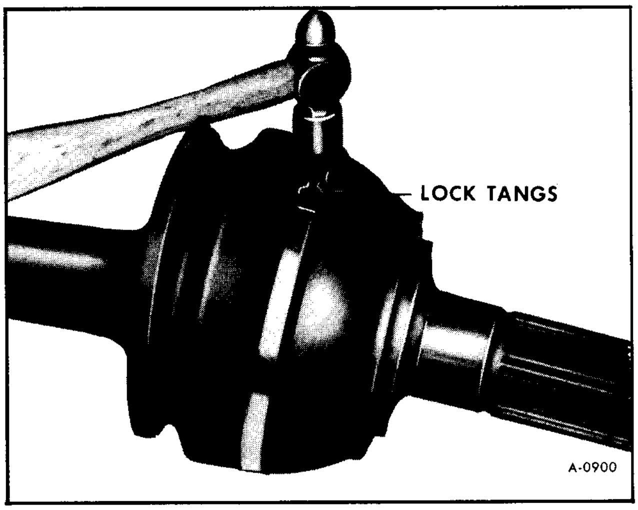


Figure 19—Bending Lock Tangs

bend band over lock tangs of clamp, do not let band slip back through tool as this will decrease clamping force (Refer to figure 17).

g. Back tool off just enough to permit tapping band with a hammer until it lies flat across top of retainer. Unwind the excess strap and cut it off close to retainer as shown in Figure 18. Tap the tabs down until they retain strap. Tap lightly as excessive force will damage seal (See figure 19).

DISASSEMBLY (INNER C.V. JOINT)

1. With axle assembly on a bench, pry up staked areas on seal retainer and drive seal off housing with hammer and chisel. (figure 21)

2. Grasp axle assembly with one hand and joint housing with the other and stand both vertically on the bench. Carefully withdraw axle from housing, being certain not to lose the balls and needles from the axle. (figure 22)

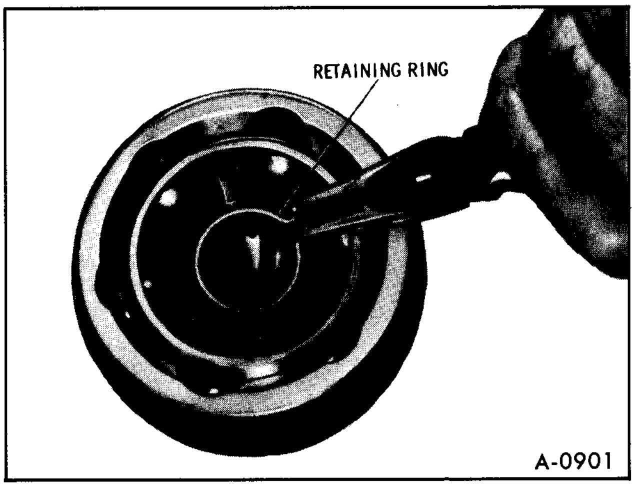


Figure 20—Removing Retaining Ring

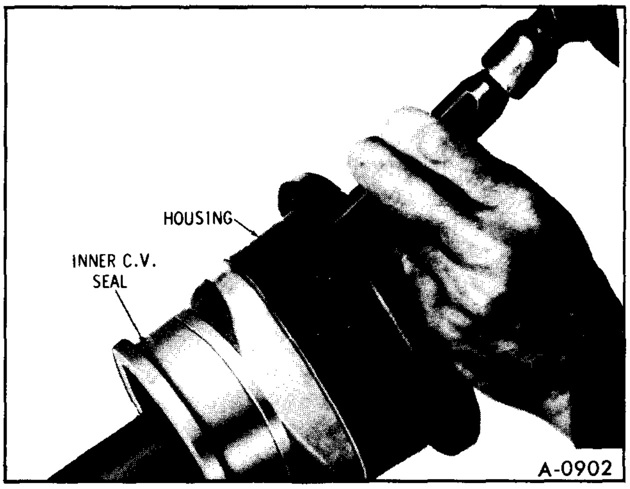


Figure 21—Removing Inner C.V. Joint Seal

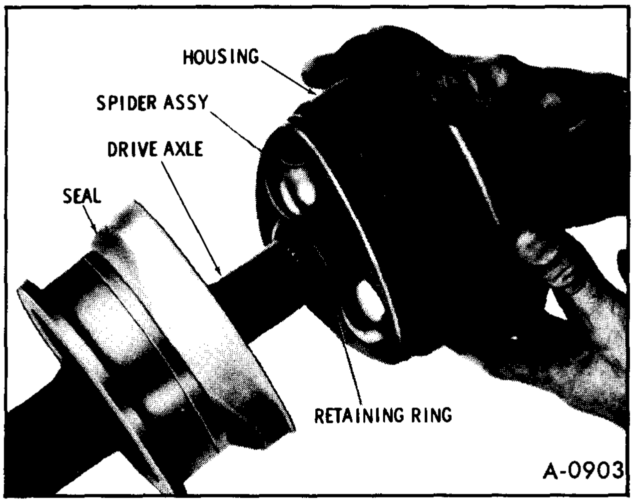


Figure 22—Removing Housing Assembly

NOTE: Place a rubber band over ends of spider to retain the three balls and needle bearings. Wipe all excess grease from C.V. parts joint. Remove housing "O" ring seal and discard. Set housing aside.

3. Insert axle assembly in vise. Clamp on mid-portion of axle shaft. Protect against jaw marks.

4. Using Tool J-5586, remove retaining ring from end of axle shaft.

5. Slide spider assembly from axle shaft. (figure 23)

6. Remove retaining ring (inner) from axle shaft using Tool J-5586. (figure 24)

7. Remove small seal clamp.

8. Slide boot seal off axle shaft and discard seal.

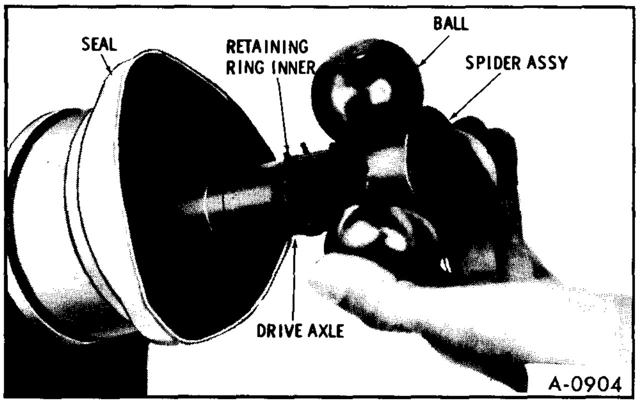


Figure 23—Removing Spider Assembly

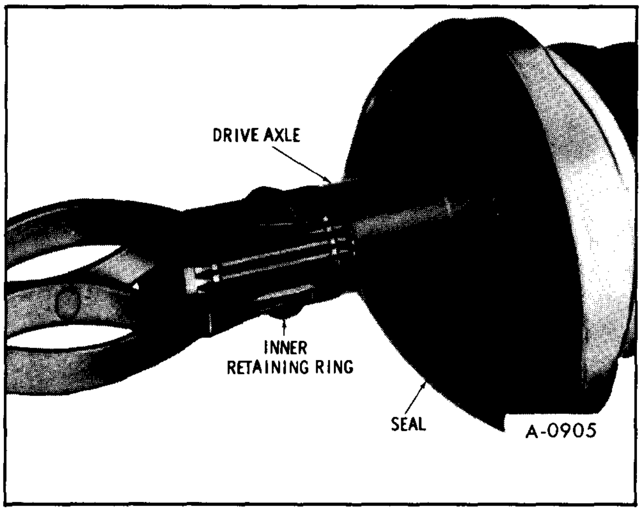


Figure 24—Removing Inner Retaining Ring

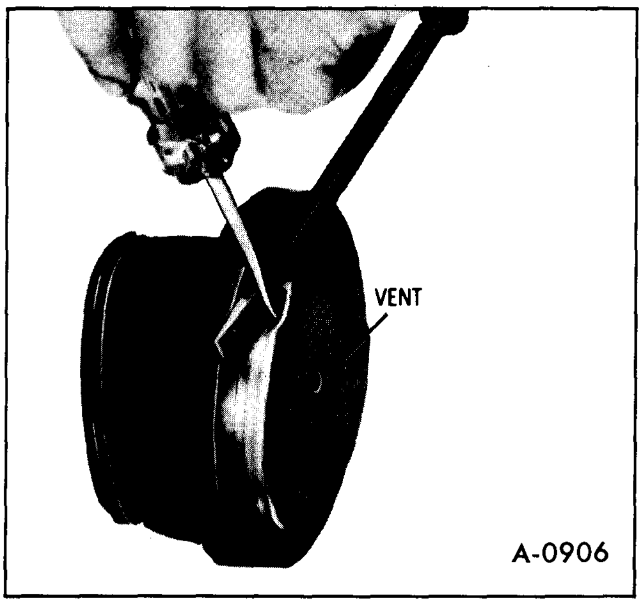


Figure 25—Removing Cover from Housing

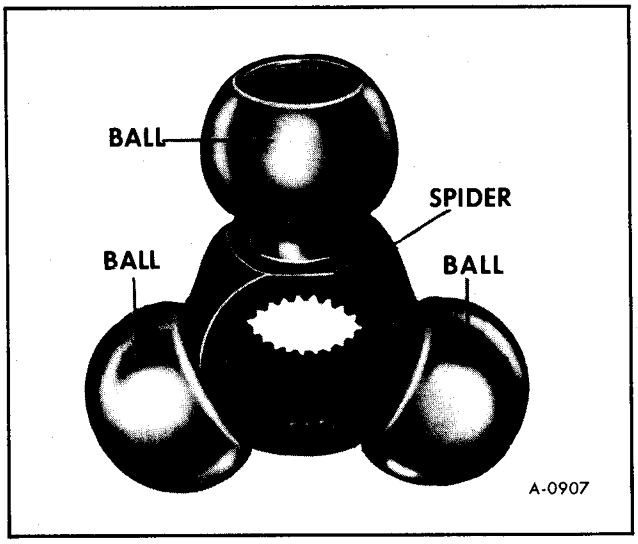


Figure 26—Spider Assembly

NOTE: If there is no leakage or apparent damage to rear cup, it is not necessary to remove it from housing.

9. If necessary to remove cover, proceed as shown in Figure 25 and discard cover.

10. Remove "O" ring from housing and discard.

11. Remove balls (three) from spider, (figure 26) being careful not to lose any of the 53 needle bearings in each of the balls. (figure 27)

CLEANING AND INSPECTION

Wash all metallic parts thoroughly in a cleaning solvent. Dry with compressed air.

Rubber boot seal, "O" rings and clamp should be replaced whenever C.V. joint is disassembled for service.

NOTE: Housing may show a definite polished area where the balls travel but C.V. joint need not be replaced. However, if this wear pattern is suspected to be the cause of a noisy or vibrating C.V. joint, then the housing should be replaced.

1. Inspect housing for excessive wear, brinneling, cracks or chips in housing bore.

2. Inspect retaining rings for cracks or bends.

3. Inspect balls (three) for excessive wear, cracks, nicks, scores or breaks.

4. Inspect needle bearings for wear breaks or bends.

5. Inspect spider for excessive wear, chips or cracks.

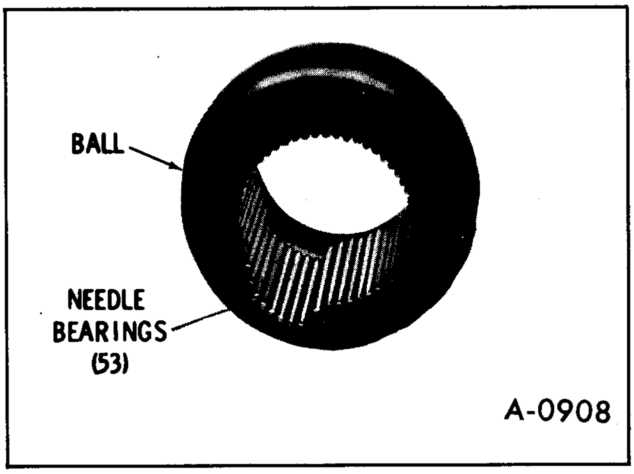


Figure 27—Spider Ball Needle Bearings

ASSEMBLY

1. Slide new clamp on axle shaft, to be used after seal positioning.

2. Slide seal onto axle shaft.

3. Position retaining ring on axle shaft in the inner groove. (figure 28)

4. Using Lubricant, No. 1050802, or equivalent load balls (three) with the needle bearings (53 to each ball). (figure 23)

5. Carefully install balls on each of the spider journals. (figure 26)

NOTE: A rubber band may be used to retain balls in position until spider assembly is installed in housing.

6. Position spider assembly on axle shaft and retain with retaining ring.

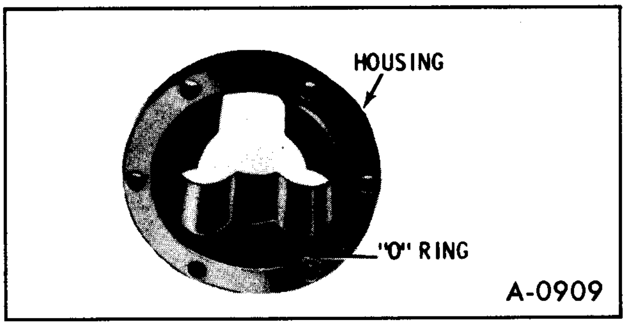


Figure 28—Installing "O" Ring in Housing

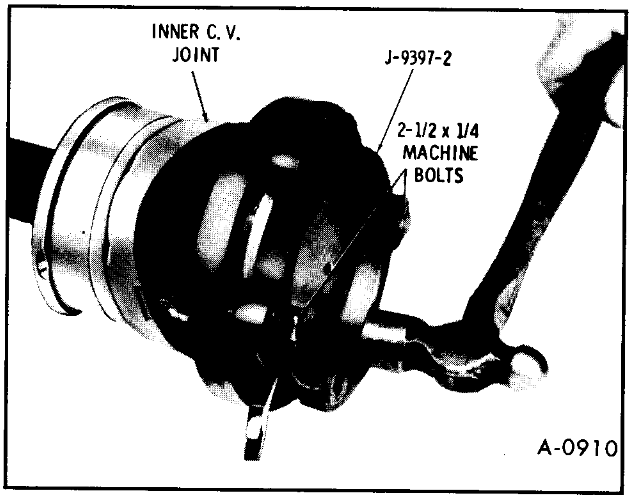


Figure 29—Installing Cover Into Housing

7. If rear cover was removed, install new "O" ring in housing and lubricate "O" ring with 1050802 lubricant or equivalent. (figure 28)

8. Install cover into housing using existing A/C Tool No. J-9397-2. Attach two machine bolts (1/4" x 2-1/4" Lg.) as shown in Figure 29 and tighten bolts alternately while tapping lightly with hammer until cover bottoms.

CAUTION: *Be careful that seal is positioned correctly so that "O" ring is not cut.*

9. Install new "O" ring in outer groove in housing. (figure 30)

10. Pack housing approximately one-half full with lubricant 1050802 or equivalent.

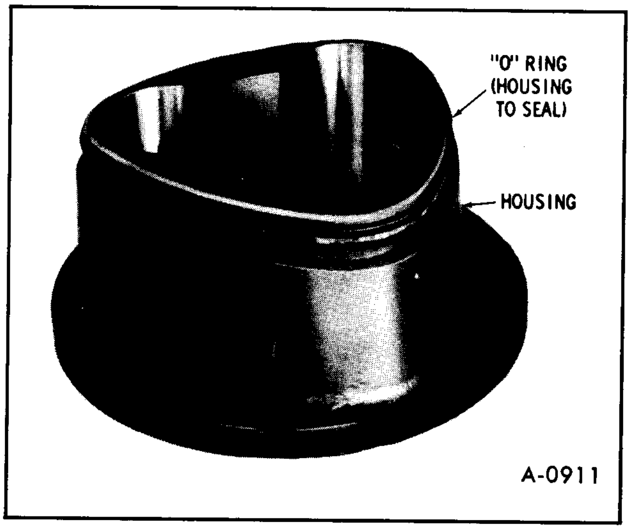


Figure 30—Installing "O" Ring on Housing

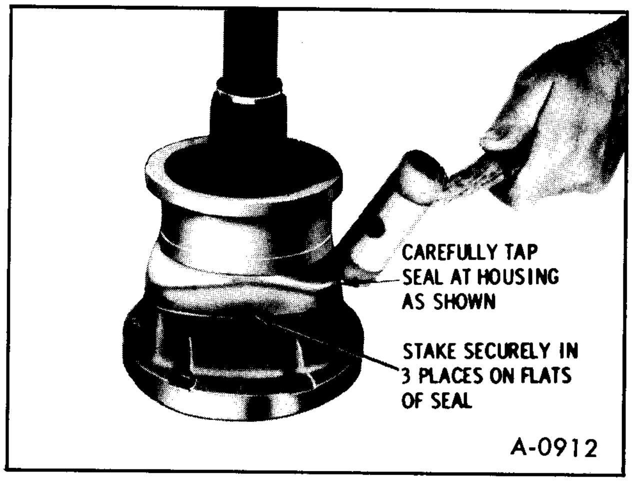


Figure 31—Installing Seal to Housing

11. Remove rubber band, if used, from spider assembly.

12. Position spider assembly in line with housing assembly and push into housing until bottomed. (figure 22)

13. Fill housing with lubricant 1050802 or equivalent.

14. Lubricate inside of boot seal retainer and housing outer groove "O" ring with 1050802 lubricant or equivalent.

CAUTION: *Be careful that seal retainer is positioned so that "O" ring is not cut.*

15. With housing positioned as shown in Figure 31 tap seal retainer on three lobes alternately with plastic hammer as shown until firmly bottomed, then stake three places into staking groove.

16. Extend inboard joint to maximum length and position seal into furthest groove from joint in axle.

17. Install clamp following procedure outlined in Figures 15, 16, 17, 18, 19, and Outer C.V. Joint-Assembly-Step 13.

DRIVE AXLE

DISASSEMBLY

1. Remove drive axle assembly (Refer to DRIVE AXLE ASSEMBLY—R. or L. Removal).

2. Remove outer C.V. joint. Refer to Outer C.V. Joint-Disassembly.

3. Remove inner C.V. joint. Refer to Inner C.V. Joint-Disassembly.

ASSEMBLY

1. Assemble inner C.V. joint. Refer to Inner C.V. Joint Assembly.

2. Assemble outer C.V. joint. Refer to Outer C.V. Joint - Assembly.

3. Install drive assembly. (Refer to DRIVE AXLE ASSEMBLY - RIGHT OR LEFT INSTALLATION).

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
R.H. Output Shaft Support to Engine Bolts	55
Drive Axle to Output Shaft Bolts	75
Drive Axle Nut at Wheel Hub	200
Tie Rod End to Knuckle Nut	40
Ball Joint Stud Nuts	60

Nut must be tightened to insert cotter pin.

SPECIAL TOOLS

J-5586	Snap Ring Pliers
J-9397-2	C.V. Joint Cover Installer
J-22716	C.V. Joint Boot Clamp Tool
J-24319	Pitman Arm, Idler Arm, Ball Joint Puller

SECTION 3C
FINAL DRIVE

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

Contents of this section are listed below:

TROUBLE DIAGNOSIS

Many noises reported as coming from the final drive actually originate from other sources such as tires, road surfaces, engine, transmission, muffler or body drumming. A thorough and careful check should be made to determine the source of the noise before disassembling the final drive. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in the final drive. Final drive gears are not absolutely quiet and are acceptable unless some abnormal noise is present.

To make a systematic check for final drive noise under standard conditions, observe the following:

1. Select a level tarvia or asphalt road to reduce tire noise and body drumming.

2. Check final drive lubricant to assure correct level, then drive car far enough to thoroughly warm up the lubricant.

3. Note speed at which noise occurs. Then stop vehicle and with automatic transmission in neutral, run engine slowly up and down through engine speeds, corresponding to vehicle speed at which noise was most pronounced, to determine if it is caused by exhaust muffler roar or other engine conditions.

AXLE NOISES

Gear Noise

After the noise has been determined as being in the final drive by following the above appraisal procedure, the type of final drive noise should be determined to aid in making repairs if necessary.

Gear noise (whine) is audible from 20 to 65 mph under four driving conditions.

1. Drive - Acceleration or heavy pull.

2. Road load - Vehicle driving load or constant speed.

3. Float - Using enough throttle to keep the vehicle from driving the engine - vehicle slows down gradually but engine still pulls slightly.

4. Coast - Throttle closed and vehicle in gear. Gear has periods when noise is more prominent, usually 30 to 40 mph and 50 to 60 mph.

Bearing Noise

Bad bearings produce a rough growl or grating sound, rather than the whine typical of gear noise. Defective pinion or differential side bearing frequently causes a bearing "WOW-WOW" noise.

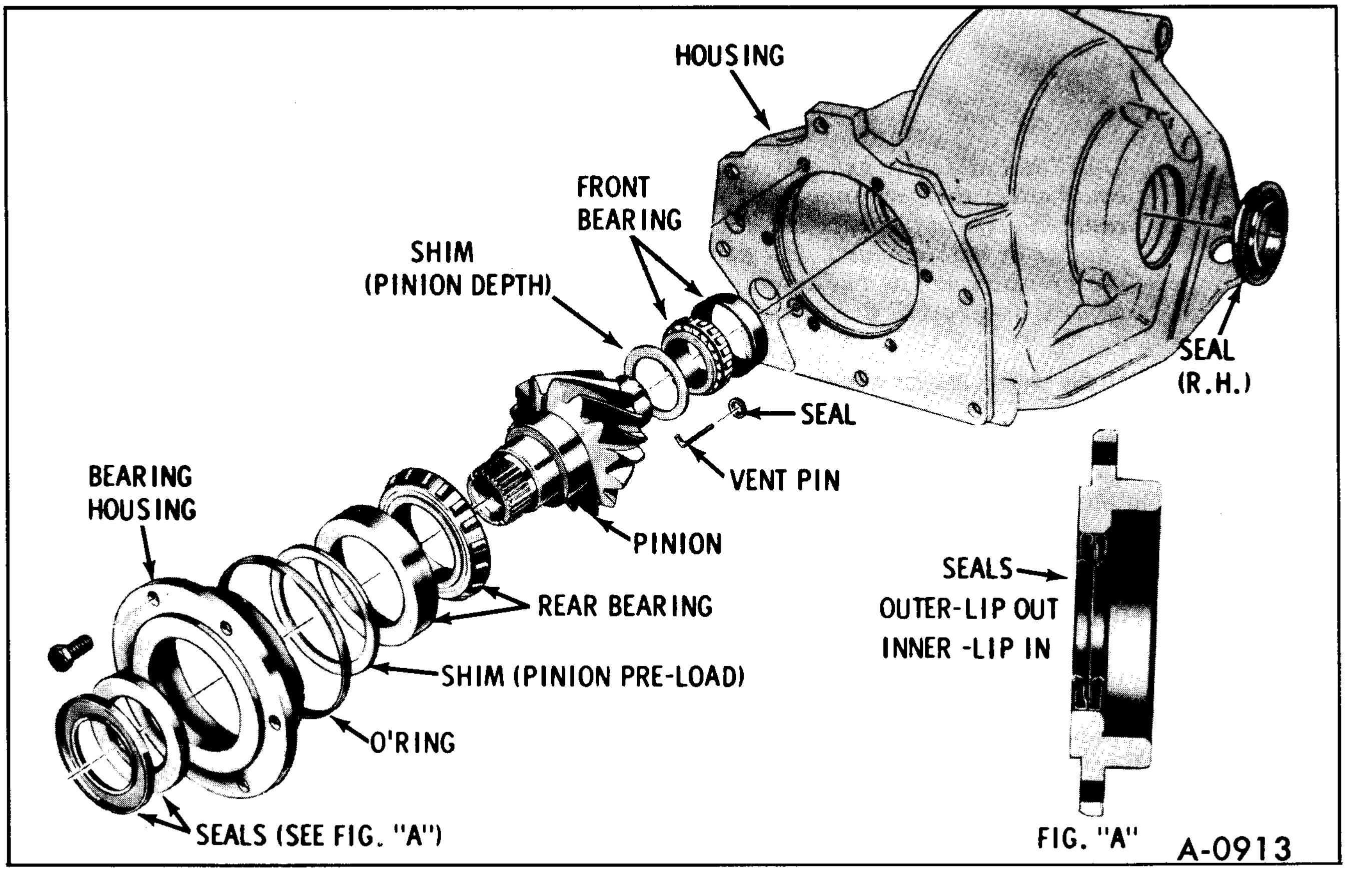


Figure 1—Final Drive Pinion Assembly

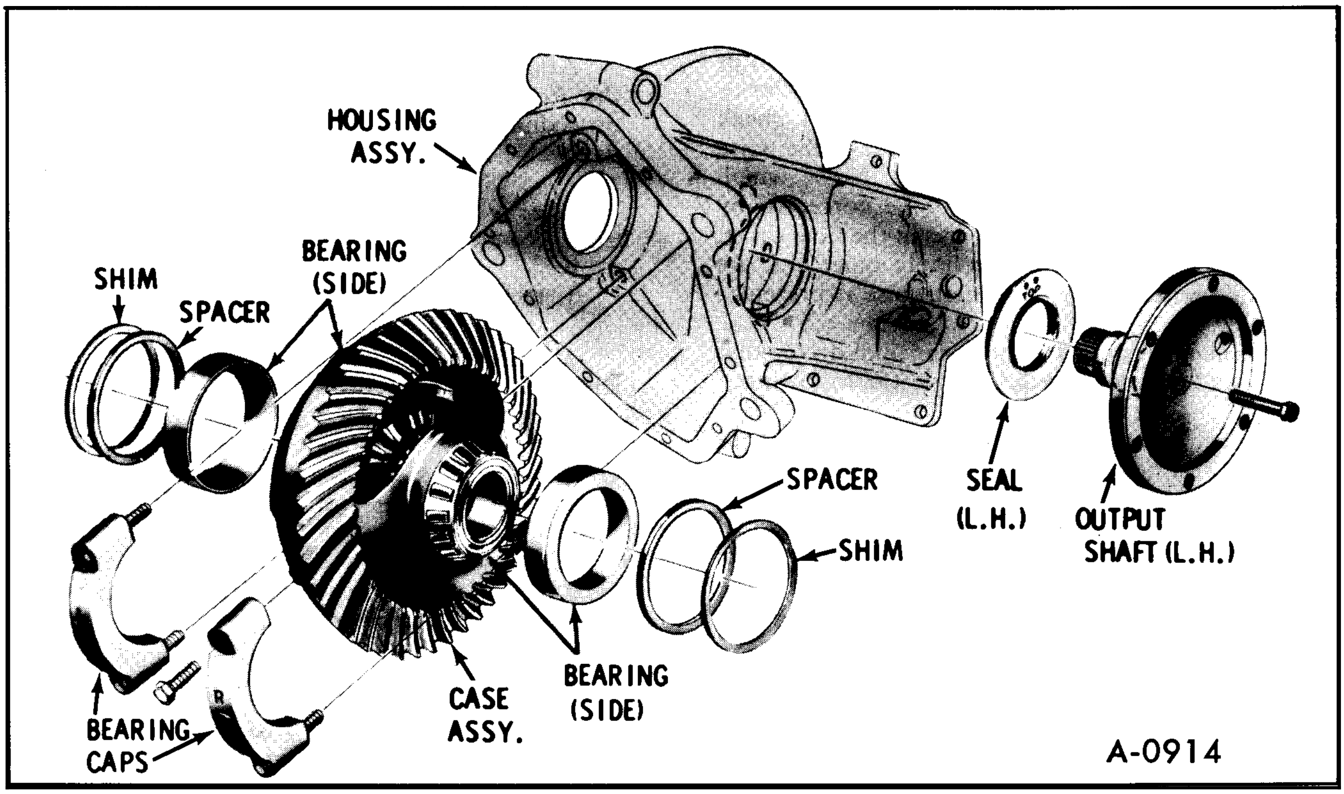


Figure 2—Final Drive Case Assembly

GENERAL DESCRIPTION (Figures 1, 2 and 3)

The final drive assembly, mounted and splined directly to the automatic transmission, consists of a pinion drive and ring gear set (with a ratio of 3.07:1), case assembly with two side gears and two pinion gears which are retained to the case with a pinion shaft. A lock pin is used instead of a bolt to lock the pinion shaft to the case. There are thrust washers used behind the side gears and shims behind the pinion gears the same as the conventional differential. The left side gear is different than the right side. It has a threaded retainer plate that the left output shaft bolts to. The two side bearings are the same and the pre-load shims are identical for the right and left side.

The left output shaft retainer bolt goes through the shaft to the side gear. The right output shaft has a vent hole in the flange.

CAUTION: *When removing or installing the right drive axle, be sure to disconnect the negative battery cable. It is possible to short out the starter motor by making contact between the wrench and the starter motor terminals.*

RH OUTPUT SHAFT, BEARING AND SEAL

REMOVAL

1. Disconnect negative battery cables.

2. Hoist vehicle.

3. Remove attaching bolts, R.H. drive axle to R.H. output shaft. Then move drive axle rearward until free from output shaft.

4. Disconnect support from engine. (figure 4)

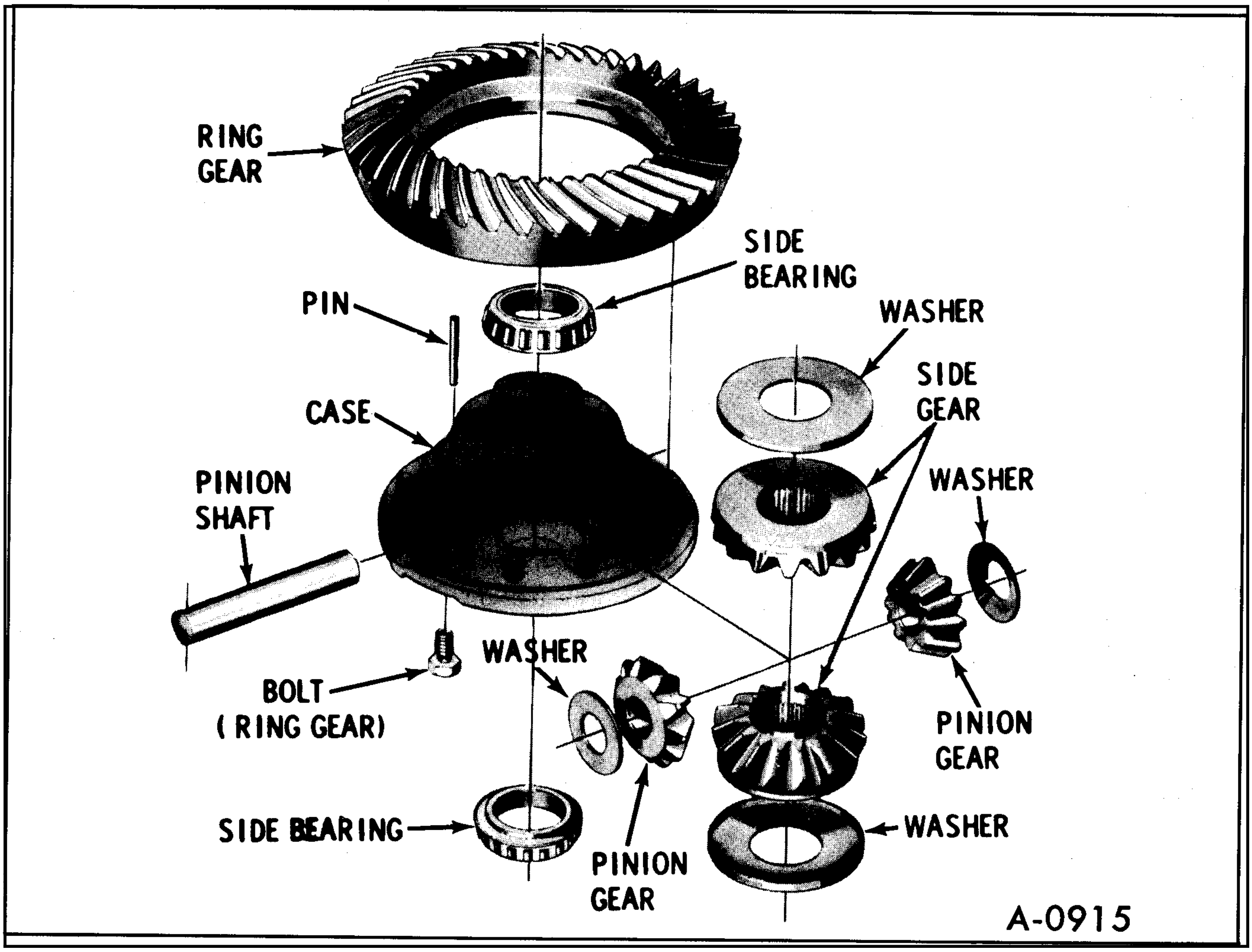


Figure 3—Final Drive Case Assembly (Exploded View)

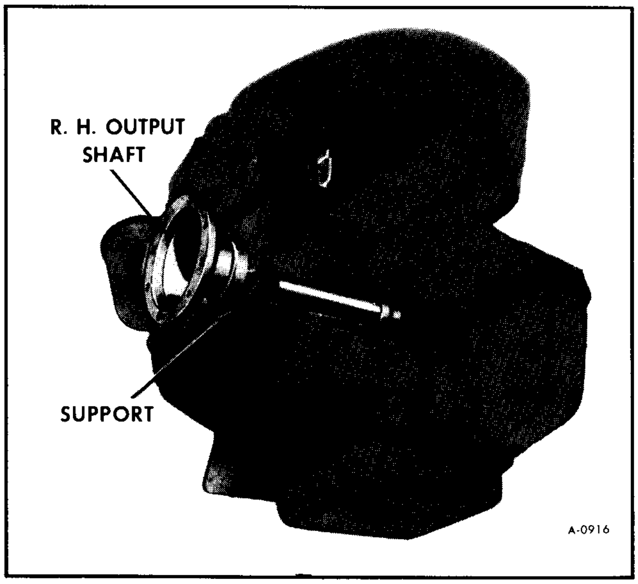


Figure 4—R.H. Output Shaft Attachment

5. Remove output shaft assembly.

6. If output shaft seal is to be replaced, install Seal Remover J-23129 into seal and drive seal out with a hammer. (figure 5)

7. If output shaft bearing is to be replaced, it can be removed with a press as shown in Figure 6.

INSTALLATION

See CAUTION on Page 3C-1 of this section.

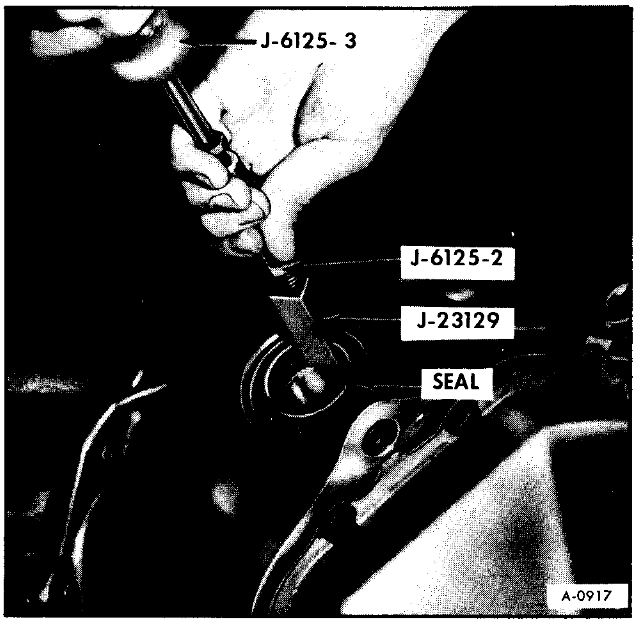


Figure 5—Removing R.H. Output Shaft Seal

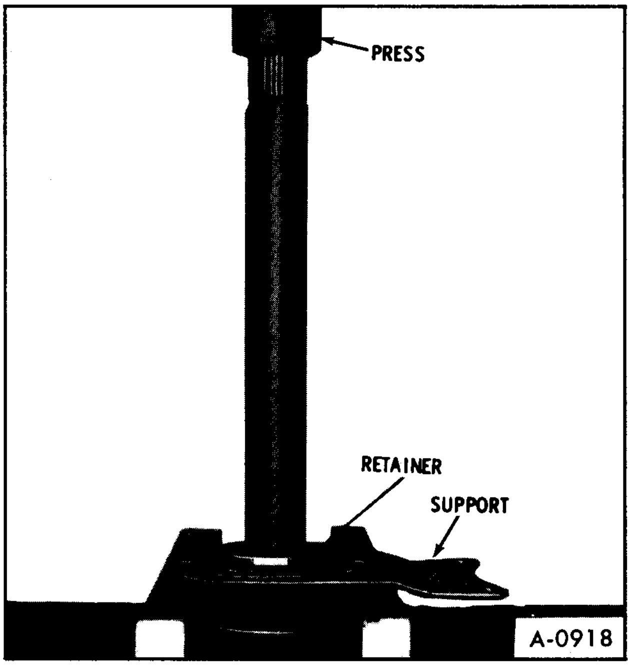


Figure 6—Removing R.H. Output Shaft Bearing

1. If output shaft bearing was removed, assemble parts as shown in Figure 7.

2. Position assembly in a press and install bearing until seated as shown in Figure 8.

3. Pack area between bearing and retainer with wheel bearing grease, then install slinger as shown in Figure 9.

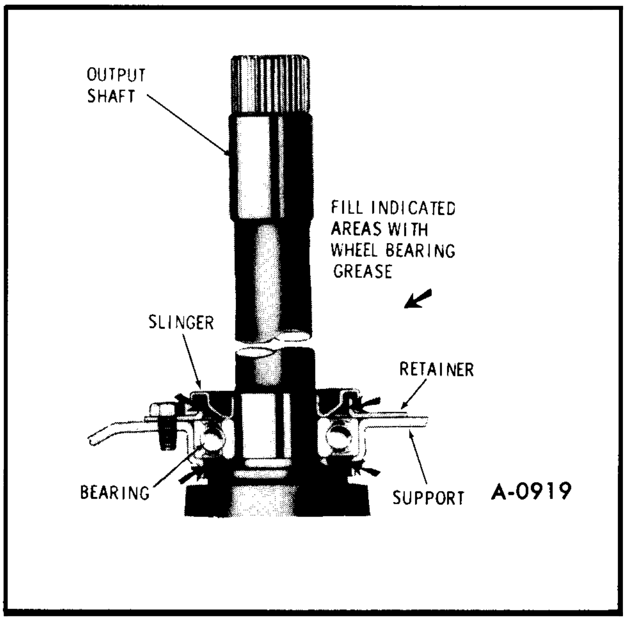


Figure 7—R.H. Output Shaft Assembly

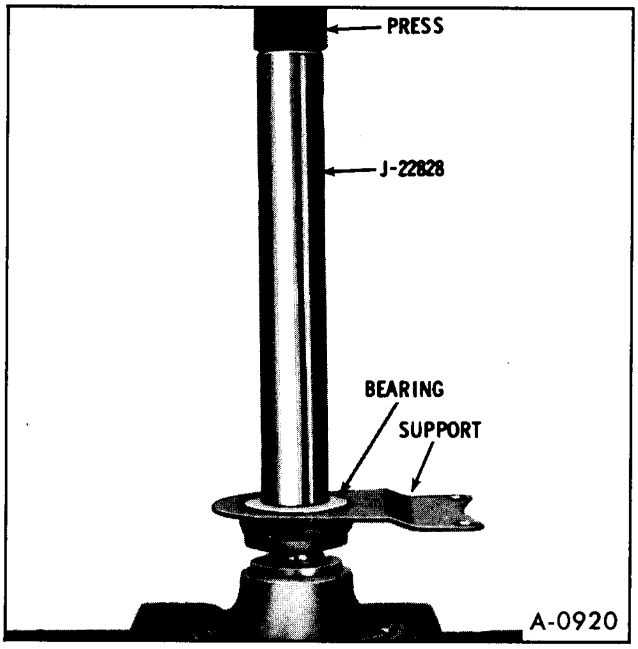


Figure 8—Installing R.H. Output Shaft Bearing

4. If output shaft seal was removed, new seal can be installed as shown in Figure 10.

5. Apply Special Seal Lubricant No. 1050169 or equivalent to output shaft seal, then install output

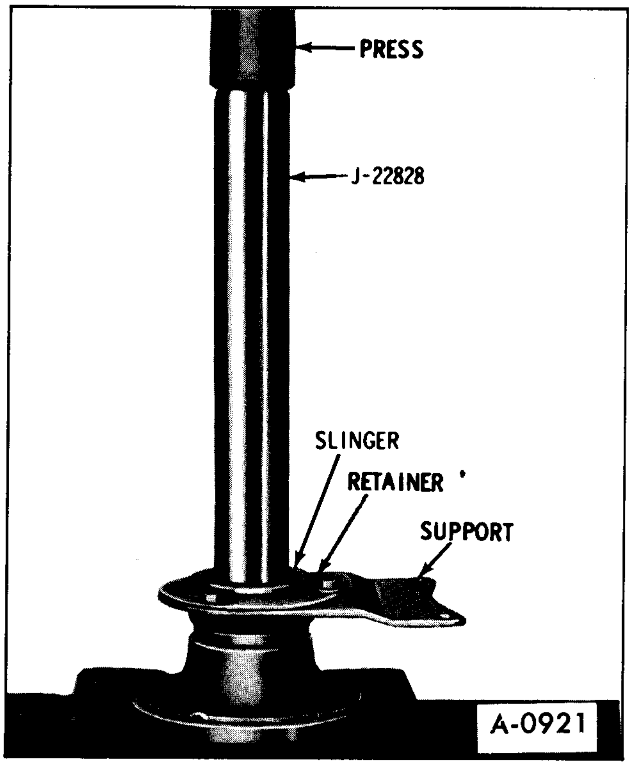


Figure 9—Installing Slinger

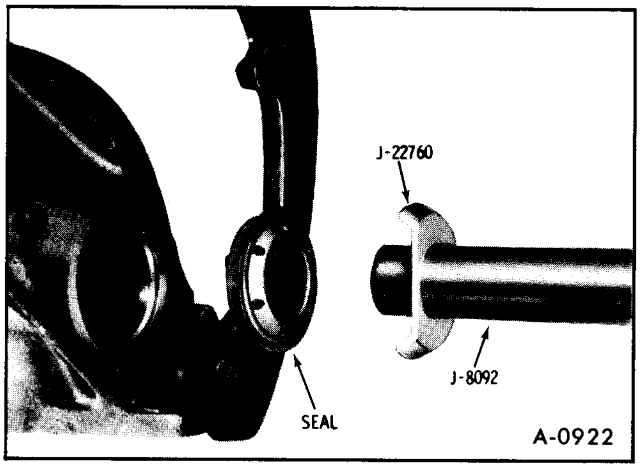


Figure 10—Installing R.H. Output Shaft Seal

shaft into final drive indexing splines of output shaft with splines in side gear.

6. Install support to engine and brace. (figure 4)

NOTE: When attaching the right hand output shaft to the engine, do not let the shaft hang. Assemble support bolts loosely, and by moving the flange end of the shaft up and down, and back and forth, find the center location. Hold the shaft in this position and then torque the bolts to 55 ft. lbs. on support. Figure 11.

7. Move drive axle forward until it aligns with output shaft. Install NEW attaching bolts. Torque to 75 ft. lbs.

8. Connect negative battery cables.

9. Check final drive oil level and check for oil leaks.

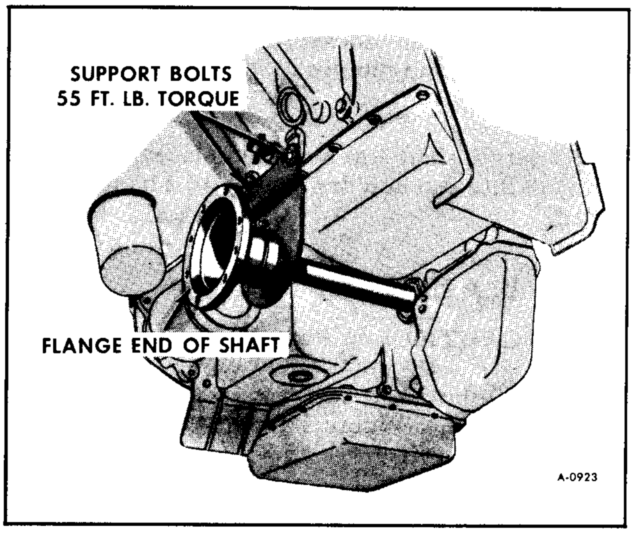


Figure 11—Aligning R.H. Output Shaft

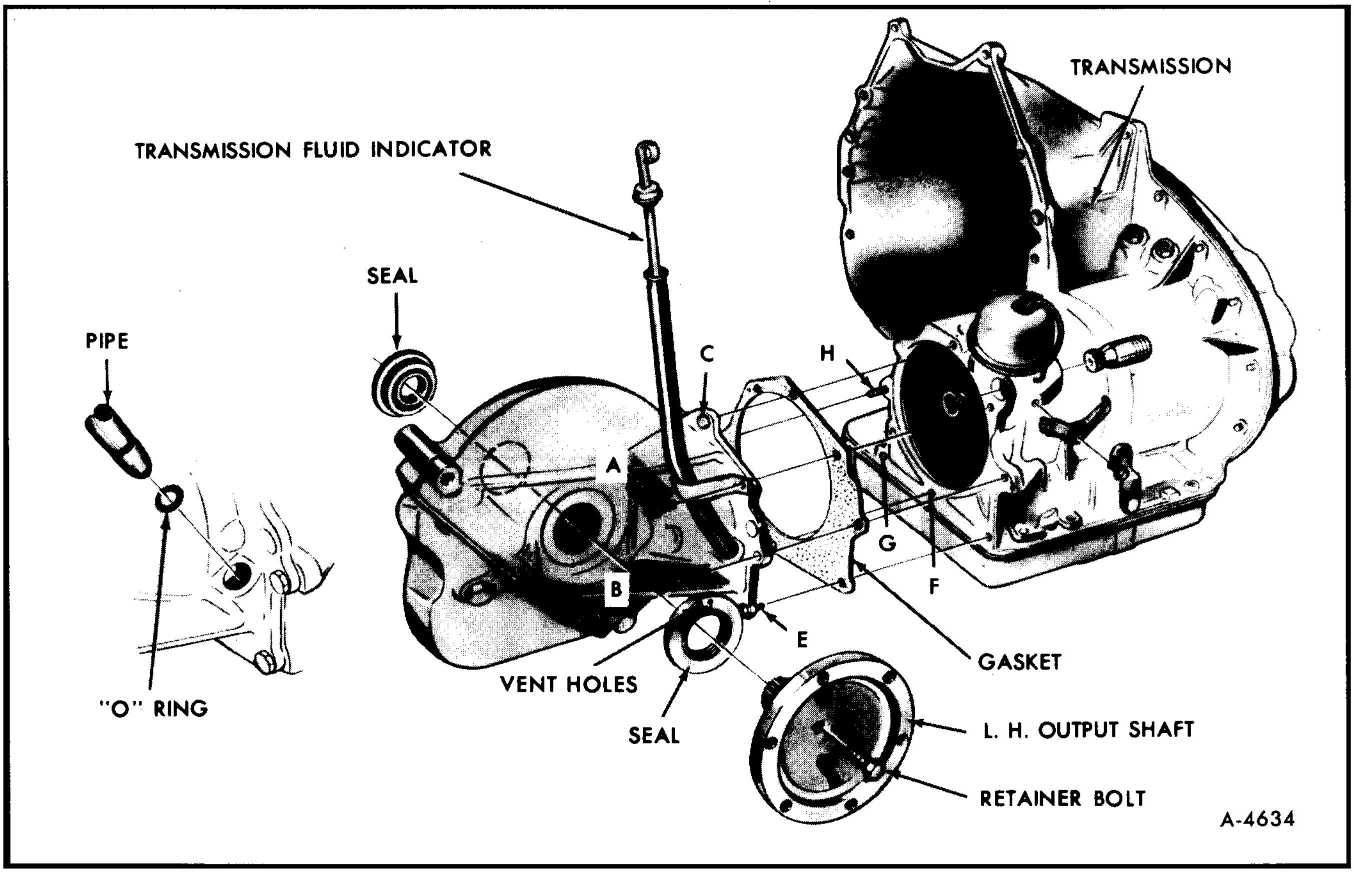


Figure 12—Final Drive Attachment

LH OUTPUT SHAFT AND SEAL

REMOVAL

1. Remove L.H. Drive axle. Refer to Section 3B "DRIVE AXLE ASSEMBLY (LEFT HAND)", Steps 1 through 12 under "REMOVAL".

2. Using a 9/16" socket remove L.H. output shaft retaining bolt and remove L.H. output shaft. (figure 12)

If output shaft seal is to be replaced, insert Tool J-23129 into seal and drive out with a hammer. (figure 13)

INSTALLATION

See CAUTION on Page 3C-1 of this section.

1. If output shaft seal was removed, install new seal as shown in Figure 14.

NOTE: Left output shaft seal is installed with vent hole toward top of final drive housing in the in-vehicle Position.

2. Apply Special Seal Lubricant No. 1050169 or equivalent to the seal; then, insert output shaft into

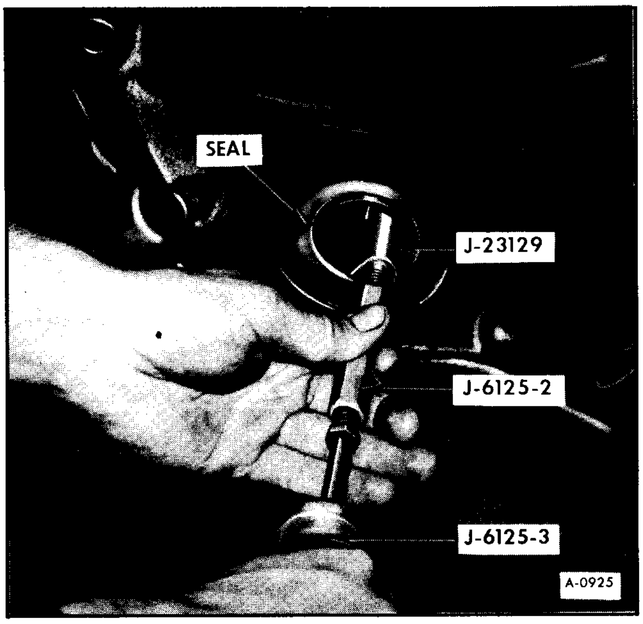


Figure 13—Removing L.H. Output Shaft Seal

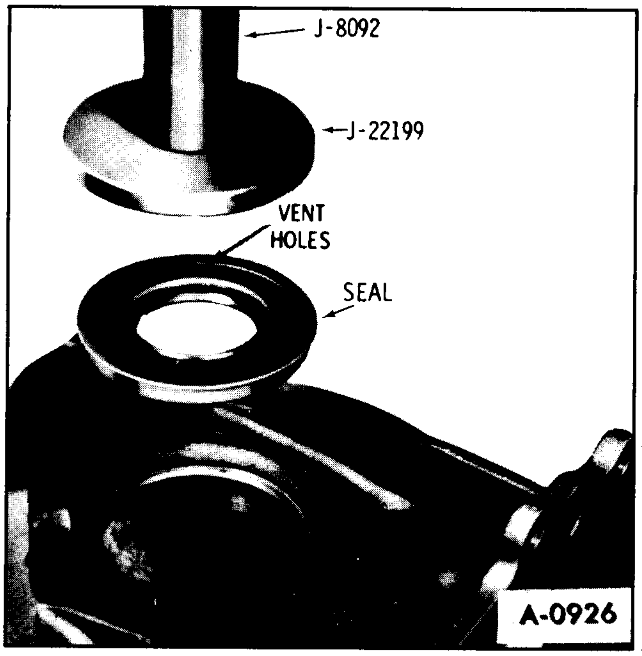


Figure 14—Installing L.H. Output Shaft Seal

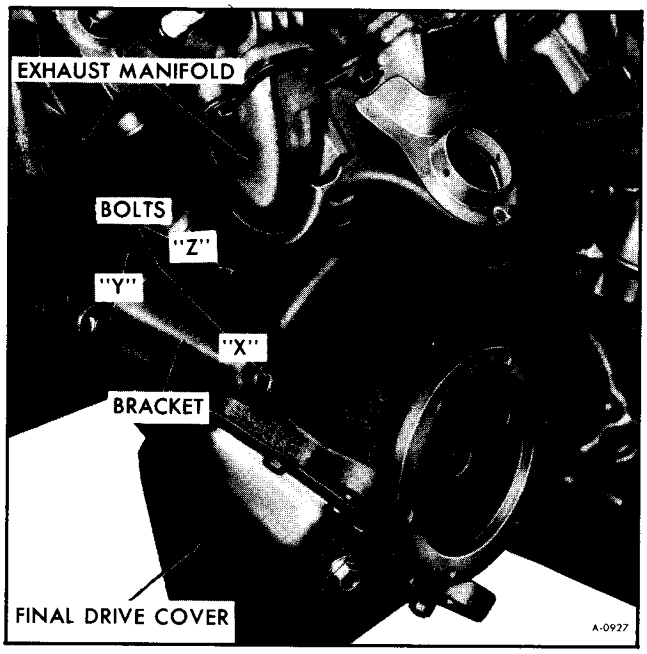


Figure 15—Disconnecting Final Drive From Engine

final drive assembly, indexing splines of output shaft with splines in side gear.

3. Install L.H. output shaft retaining bolt and torque to 45 ft. lbs. (figure 12)

4. Install L.H. drive axle. Refer to Section 3B, DRIVE AXLE ASSEMBLY (LEFT HAND), Steps 1 through 10 under INSTALLATION.

TRANSMISSION FILLER TUBE

REMOVAL AND INSTALLATION

The automatic transmission filler tube is located on the final drive. The filler tube can be removed by removing bolt "A", Figure 12 and then pulling the filler tube out of the housing. To install, position a new "O" ring seal on the filler tube. Coat seal with Special Seal Lubricant No. 1050169 or equivalent and install filler tube into housing. Install bolt "A" and torque to 25 ft. lbs.

FINAL DRIVE

REMOVAL

1. Disconnect battery.

2. Hoist vehicle.

3. Remove bolts "A", "B", and "C". (Figure 12)

4. Disconnect right and left drive axles from the output shafts.

5. Move R.H. Drive axle rearward until R.H. output shaft is clear to be removed from final drive.

6. Disconnect R.H. output shaft support from engine (figure 4) and remove from final drive.

7. Remove bolt "X" and "Y" and loosen "Z". (figure 15)

8. Remove final drive cover and allow lubricant to drain.

9. Position transmission jack with adapter for final drive as shown in Figure 16. Install an anchor bolt through final drive housing and lift pad.

NOTE: Adapters for removing final drive assemblies are available from most transmission jack manufacturers.

10. Remove bolts "E", "F" and "G" and nut "H" (figure 12).

11. Move transmission lift toward front of vehicle to disengage final drive splines from transmission.

NOTE: As the final drive is disengaged from transmission, some transmission fluid will be lost. Provide a container to prevent oil from running on floor.

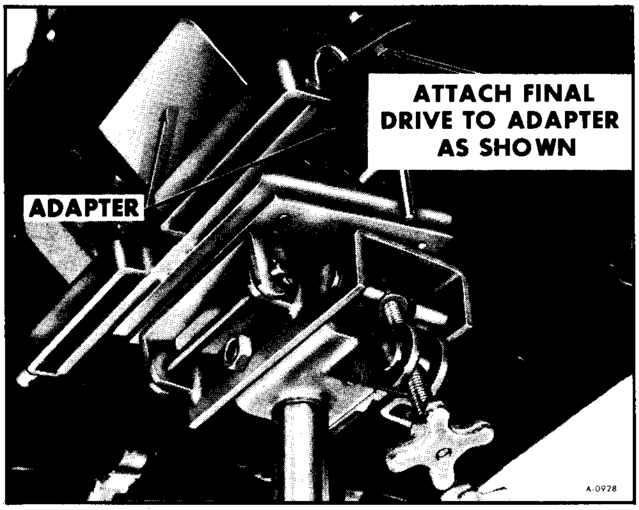


Figure 16—Connecting Lift to Final Drive

12. Pivot final drive support bracket upward for clearance.

13. Lower transmission lift and remove final drive from lift.

14. Using a 9/16" socket remove the left output shaft retainer bolt, then pull output shaft from final drive. (figure 12)

15. Remove transmission to final drive gasket.

INSTALLATION

See CAUTION on Page 3C-1 of this section.

1. Apply Special Seal Lubricant No. 1050169 or equivalent to both output shaft seals.

2. Install the left output shaft into the final drive. Retain with bolt. Torque bolt to 45 ft. lbs. (figure 12)

3. Position final drive on transmission lift and install an anchor bolt through housing and lift pad. (figure 16)

4. Apply a thin film of Special Seal Lubricant No. 1050169 or equivalent on the transmission side of a new final drive to transmission gasket, then position gasket on transmission.

5. Raise transmission lift. Align the bolt stud "H" on the transmission with the mating hole in the final drive. Move final drive until it mates with the transmission. (Figure 12)

NOTE: It may be necessary to rotate the left output shaft so that the splines of the final drive pinion engage the splines of the transmission output shaft. Do not allow gasket to become mispositioned while engaging splines.

6. Install bolts "E", "F" and "G" and nut "H" (figure 12). Install bolts "A", "B" and "C". (figure 12) Torque all final drive to transmission bolts to 30 ft. lbs. Torque nut to an approximate 30 ft. lbs.

7. Install bolt "X" and torque to 110 ft. lbs. Tighten and torque bolts "Y" and "Z" to 55 ft. lbs. (figure 15)

8. Loosen and remove lift from final drive.

9. Position a new cover gasket on the final drive, then install cover. Torque cover bolts to 30 ft. lbs.

10. Install right output shaft into final drive indexing splines of output shaft with splines of side gear. Install support bolts.

NOTE: When attaching the right hand output shaft to the engine, do not let the shaft hang. Assemble support bolts loosely, and by moving the flange end of the shaft up and down, and back and forth, find the center location. Hold the shaft in this position and then torque the bolts to 55 ft. lbs. on support. (Figure 11).

11. Connect drive axles to output shafts using NEW bolts. Torque bolts to 75 ft. lbs.

12. Raise hoist, remove floor stands and lower vehicle.

13. Install a new "O" ring and install filler tube.

14. Connect battery.

15. Fill final drive with four pints of Lubricant No. 1051022 or equivalent. Fluid level should be maintained at "Fill Level" stamped on final drive cover.

16. Start engine and check transmission fluid level. Add fluid as necessary.

17. Check for any oil leaks.

PINION HOUSING SEALS

REMOVAL

1. Remove final drive. Refer to final drive removal steps 1-13.

2. Remove the bearing housing bolts. Remove the drive pinion and housing as shown in Figure 24.

Remove housing from drive pinion. Remove "O" ring seal from O.D. of bearing housing.

3. Using a punch, drive seals out of housing on the opposite side of the rear pinion bearing outer race.

INSTALLATION

See CAUTION on Page 3C-1 of this section.

1. Position seals as shown in Figure 45 and using Tool J-22212, drive seals into housing until tool bottoms.

2. Position drive pinion into final drive and install Seal Protector J-22236 over end of pinion.

> **CAUTION:** *Seal protector must be used or inner seal lip will fold between seal case and pinion shaft resulting in a leak.*

3. Install new "O" ring over O.D. of bearing housing and install bearing housing over seal protector into position on the housing. Torque bearing housing attaching bolts alternately to 45 ft. lbs. Remove seal protector.

4. Apply Special Seal Lubricant No. 1050169 or equivalent to right output shaft seal.

5. Install final drive. Refer to FINAL DRIVE—INSTALLATION steps 3-17.

FINAL DRIVE (REMOVED FROM VEHICLE)

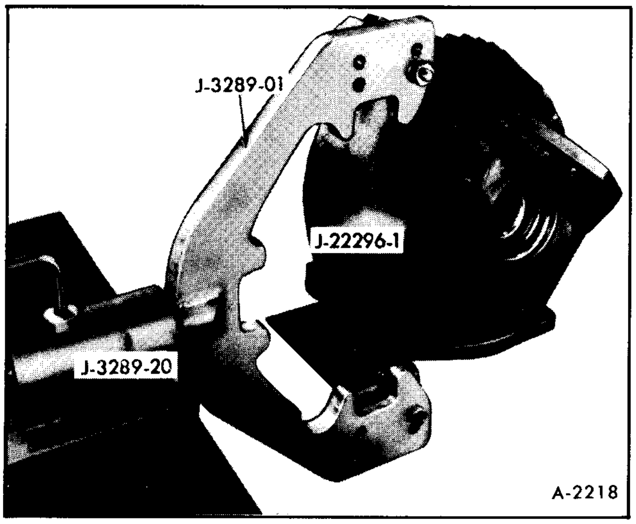


Figure 17—Final Drive Holding Fixture

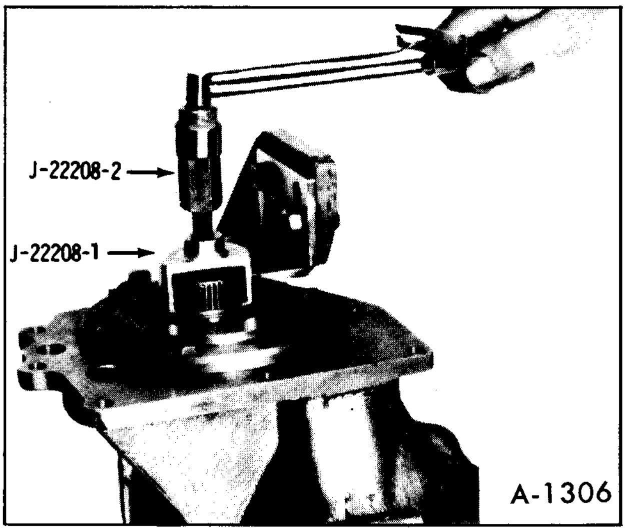


Figure 18—Checking Pinion and Side Bearing Pre-Load

DISASSEMBLY

1. Install adapter J-22296-1 on Differential Holding Fixture J-3289. Mount final drive in holding fixture as shown in Figure 17.

2. Rotate housing so that pinion is up. Install tools as shown in Figure 18, and turn torque wrench several turns and record torque reading. This combined pinion and side bearing pre-load reading will be helpful in determining cause of final drive failure. Remove tools and rotate carrier so that pinion is down.

3. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Figure 19. Use a small button on the indicator stem so

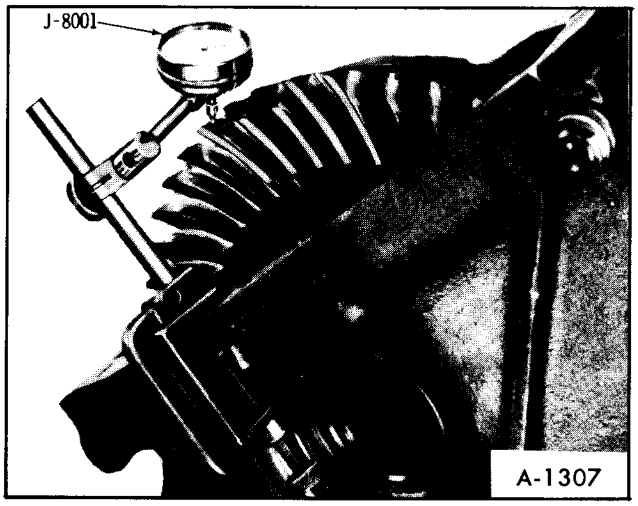


Figure 19—Checking Ring Gear to Pinion Gear Backlash

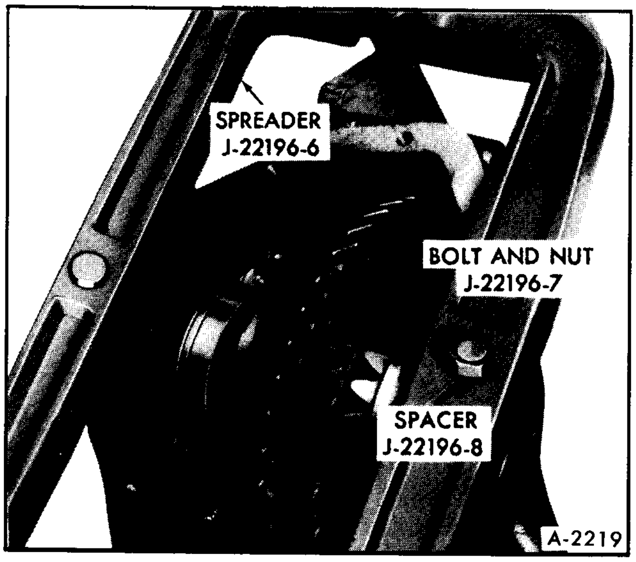


Figure 20—Spreader Installation

that contact can be made near heel end of tooth. Set dial indicator so that stem is in line as nearly as possible with gear rotation and perpendicular to tooth angle for accurate backlash reading.

4. Check backlash at three of four points around ring gear. Lash must not vary over .002" around ring gear.

NOTE: Pinion must be held stationary when checking backlash. If variation is over .002" check for burrs, uneven bolting conditions or distorted case and make corrections as necessary.

5. Remove side bearing cap bolts.

NOTE: Bearing caps are of same size and must be installed in their original position. Mark right and left bearing caps to identify for reassembling. Keep the original bearing outer races with their corresponding caps.

6. Install spreader on housing as shown in Figure 20.

NOTE: Spreader must be modified with Tools J-22196-7-8.

7. Turn the spreader screw to expand spreader until the spacer and shim(s) can be removed from between the right side bearing and the housing. Retain spacers and shims for reassembly.

NOTE: Spread housing only enough to relieve tension on the spacer and shims. The shims may be removed with Tool J-22608 as shown in Figures 21 and 22.

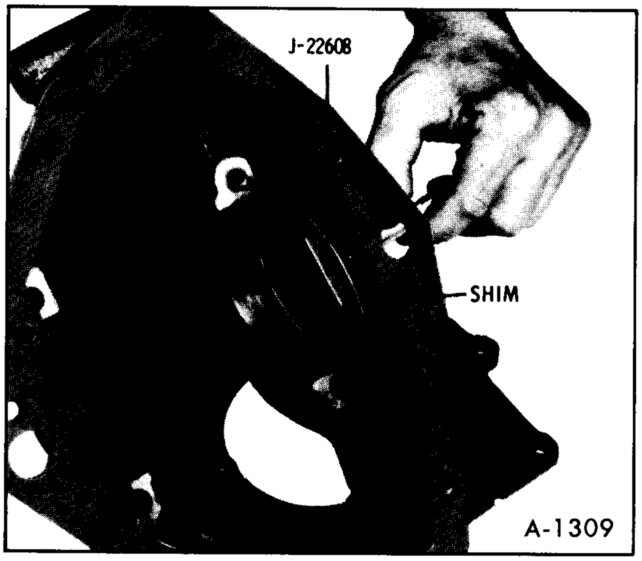


Figure 21—Removing Shims

8. Remove spreader from housing.

9. Remove the spacer and shims, then slide the case assembly to the left, away from the pinion gear. Remove case assembly from housing.

10. Rotate housing so that the pinion is up. Check pinion bearing pre-load as shown in Figure 23. Record the pinion bearing pre-load.

11. Remove the bearing housing bolts. Remove the drive pinion and housing as shown in Figure 24. Remove housing from drive pinion. Remove "O" ring seal from bearing housing.

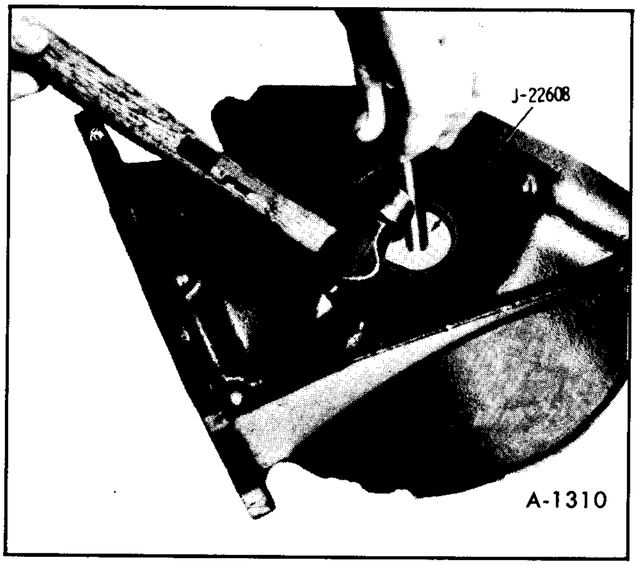


Figure 22—Positioning Tool J-22608

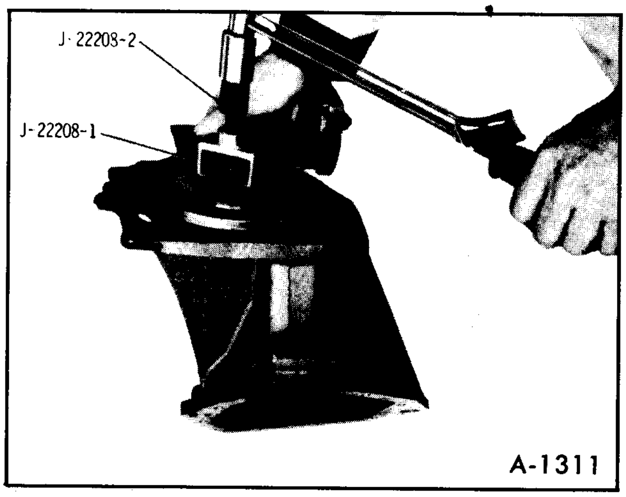


Figure 23—Checking Pinion Pre-Load

12. Remove seal and vent pin from housing. (figure 25)

13. Install Tool J-22201 on Slide Hammer J-2619. Position Tool J-22201 as shown in Figure 26, and tighten screw. Remove pinion front bearing outer race.

14. Remove the output shaft oil seals as shown in Figures 5 and 13.

15. Remove the two oil seals from the pinion bearing housing as shown in Figure 27.

16. If necessary to remove the pinion rear outer race, it can be removed as shown in Figure 28.

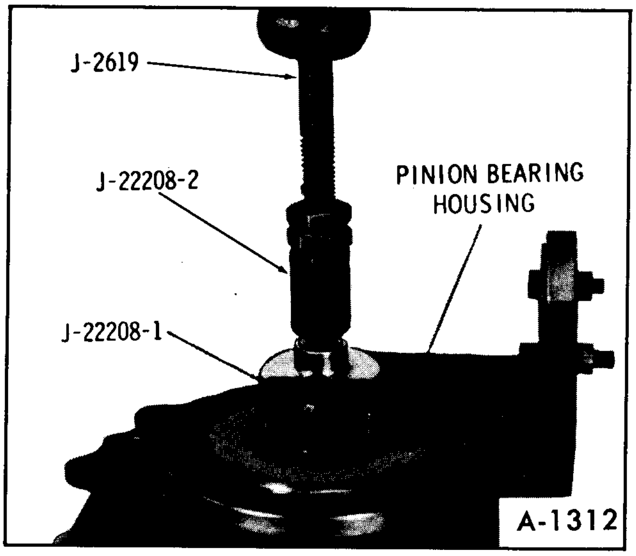


Figure 24—Removing Pinion And Bearing Housing

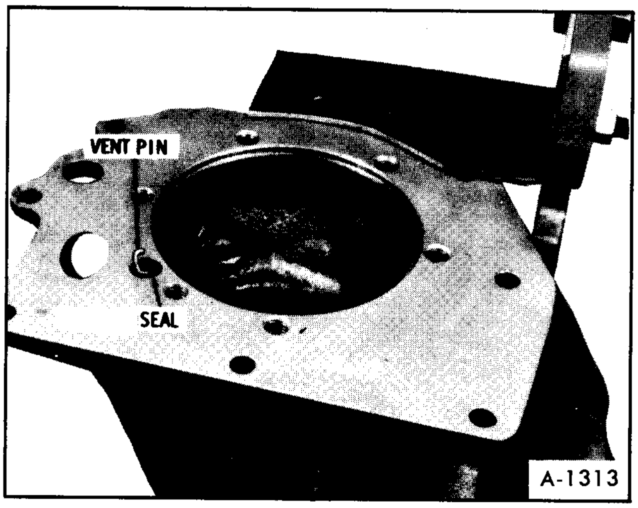


Figure 25—Removing Vent Pin And Seal

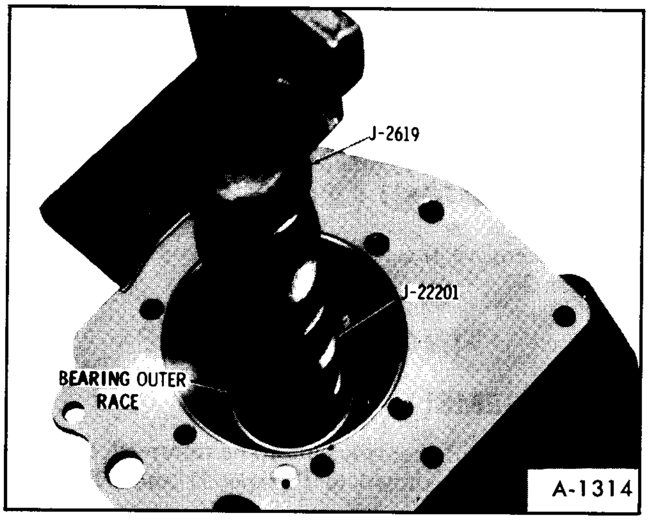


Figure 26—Removing Pinion Front Bearing Outer Race

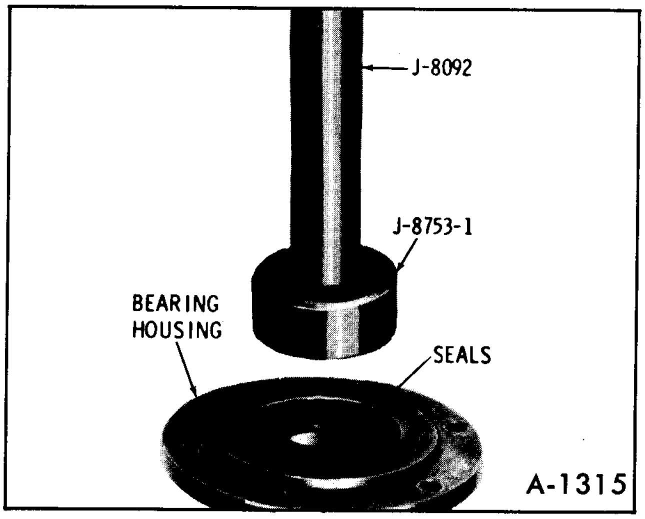


Figure 27—Removing Oil Seals From Pinion Bearing Housing

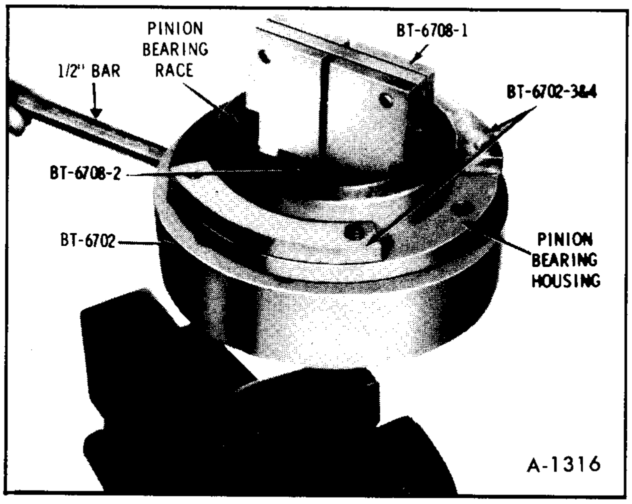


Figure 28—Removing Pinion Rear Bearing Outer Race

PINION BEARINGS

REMOVAL

1. Remove the pinion front bearing and selective shim as shown in Figure 29. Bearing can be removed without Tool J-8433-1 if a press is available.

2. Remove the pinion rear bearing as shown in Figure 30.

FINAL DRIVE CASE

DISASSEMBLY

1. If the side bearings are to be removed, they can be removed as shown in Figures 31 and 32.

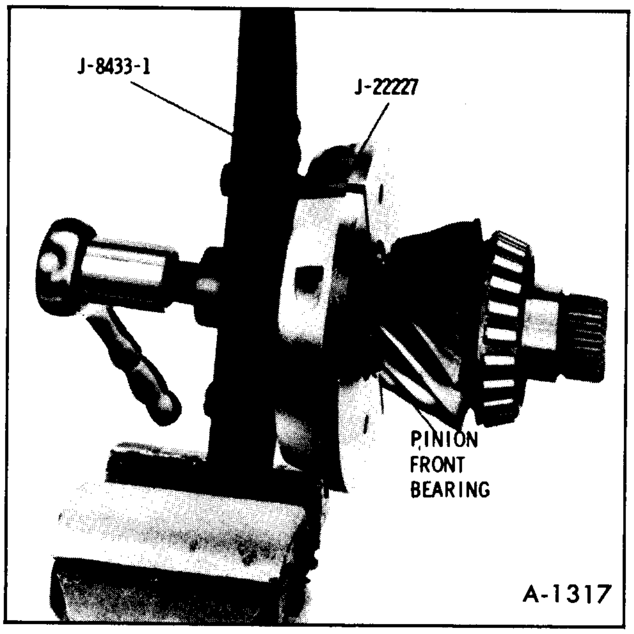


Figure 29—Removing Pinion Front Bearing

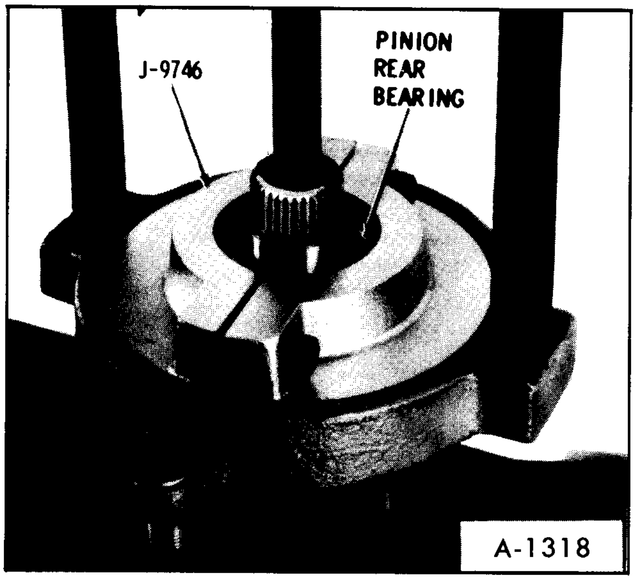


Figure 30—Removing Pinion Rear Bearing

2. Mark ring gear and case, then remove all but two of the case to ring gear bolts. Leave two of the bolts, 180° apart, loose.

NOTE: Ring gear must be removed to remove pinion and side gears.

3. Position case as shown in Figure 33 and tap lightly on a bench to separate the case from ring gear.

4. Remove the two remaining ring gear bolts and separate ring gear from case.

5. Drive lock pin from pinion shaft with a 3/16" punch (figure 34).

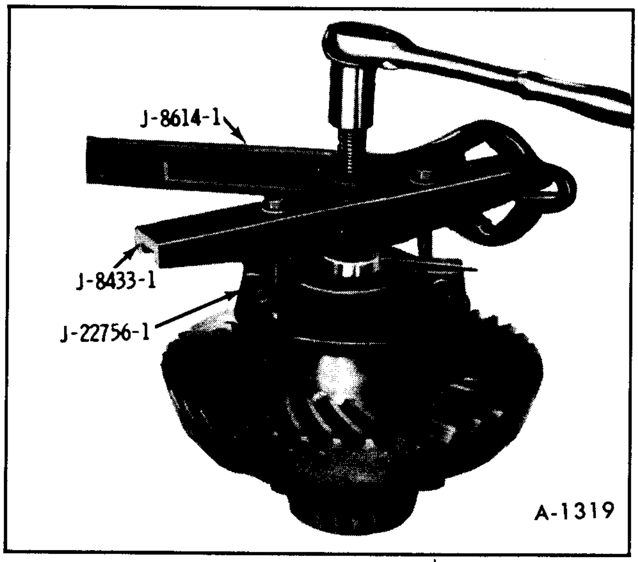


Figure 31—Removing Left Side Bearing

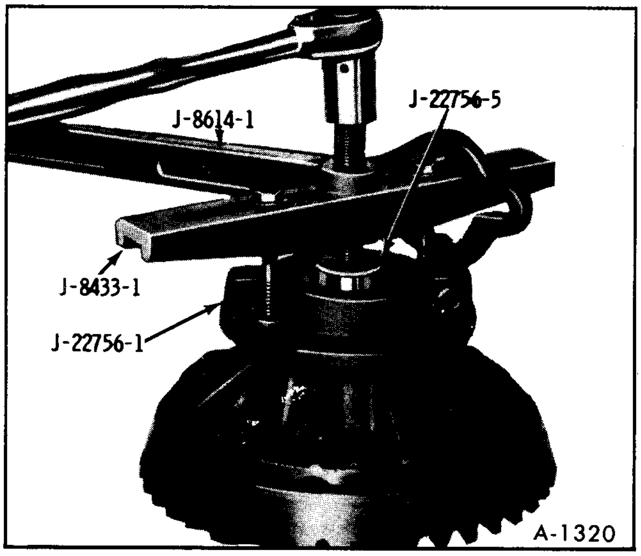


Figure 32—Removing Right Side Bearing

6. Push pinion shaft out of case.

7. Rotate one pinion gear and shim towards access hole in case and remove.

NOTE: Keep the corresponding shims and pinion gear together for correct assembly.

8. Remove the other pinion gear and shim.

9. Remove side gears keeping the same thrust washer with the side gear it is mated with. Inspect thrust washers and shims for wear and replace as necessary.

NOTE: The left side gear has the threaded retainer that retains the (short) left output shaft.

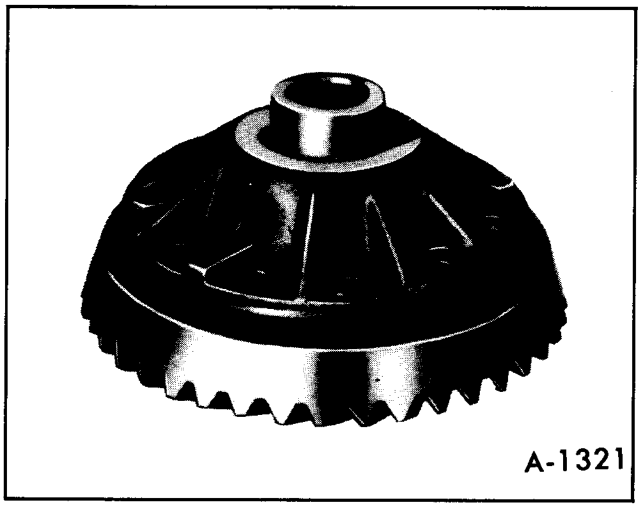


Figure 33—Separating Ring Gear From Case

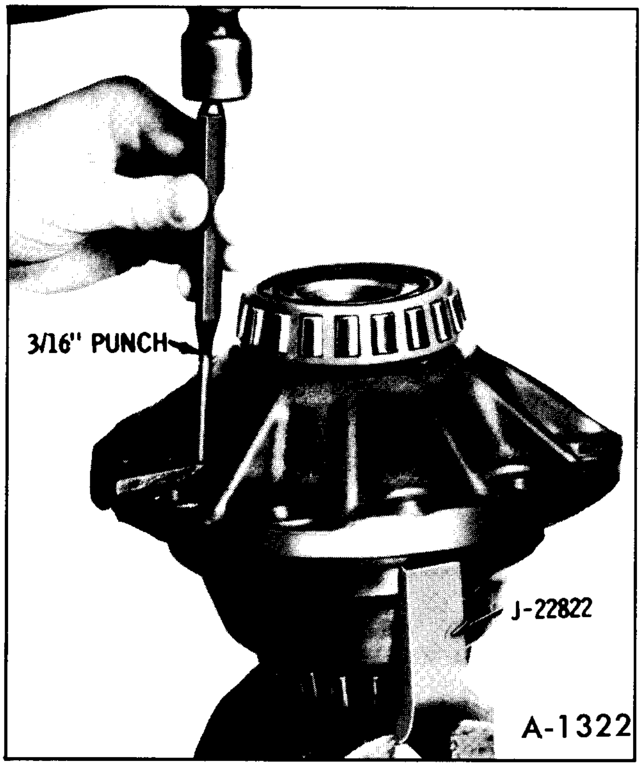


Figure 34—Removing Lock Pin From Pinion Shaft

If threaded retainer is to be removed, use a brass drift and hammer to remove from left side gear.

CLEANING AND INSPECTION

1. Clean all bearings throughly in clean solvent. (Do not use a brush). Examine bearings visually and by feel. All bearings should feel smooth when oiled

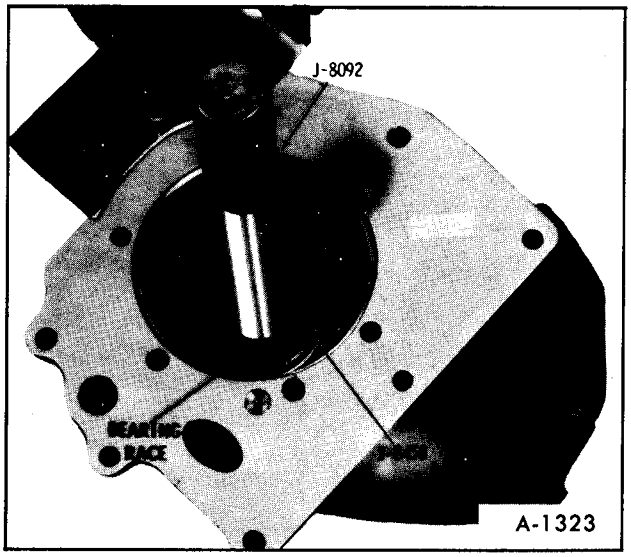


Figure 35—Installing Pinion Front Bearing Outer Race

and rotated while applying as much hand pressure as possible.

NOTE: Minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load and bearings having these marks should not be rejected.

2. Examine the ring gear and drive pinion teeth for excessive wear and scoring. Any of these conditions will require replacement of the gear set.

3. Examine housing bores and remove any burrs that might cause leaks around the OD of the seal.

4. Inspect the differential pinion shaft for unusual wear; also check the pinion and side gears and thrust washers.

5. Side beatings must be a tight press fit on the hub.

6. Diagnosis of a differential failure such as chipped bearings, loose (lapped-in) bearings, chipped gears etc. is a warning that some foreign material is present; therefore, the housing must be thoroughly cleaned and inspected.

CHECKING PINION DEPTH

1. Install pinion front outer race as shown in Figure 35. Drive race until it bottoms.

2. Lubricate front bearing with final drive lubricant and install into front outer race.

3. Position Tool J-21777-10 on front bearing. Install Tool J-21579 on final drive housing and retain with two bolts. Thread screw J-21777-13 into J-21579 until tip of screw engages Tool J-21777-10. Torque screw J-21777-13 to 20 in. lbs. to pre-load bearing. (figure 36)

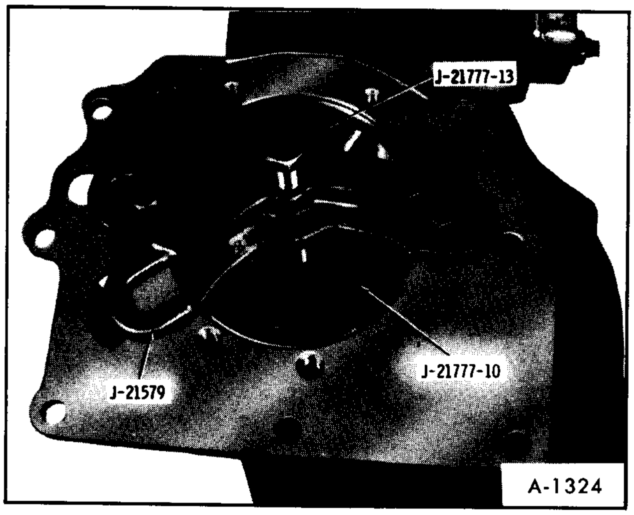


Figure 36—Pre-Loading Pinion Front Bearing

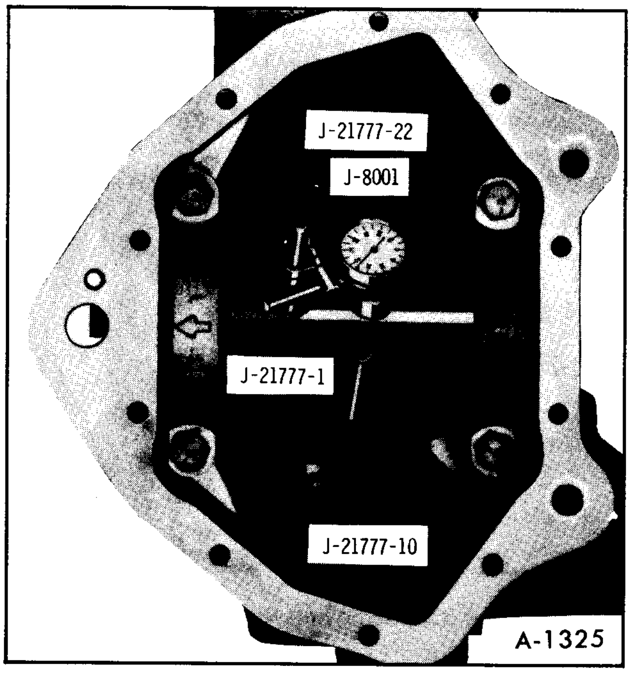


Figure 37—Pinion Depth Gauge Tool Installation

4. Remove dial indicator post from Tool J-21777-1 and install Discs J-21777-22 as shown in Figure 37. Reinstall dial indicator post.

5. Place the gauging discs in the side bearing bores and install the side bearing caps. Torque cap bolts to 75 ft. lbs.

6. Position the dial indicator, J-8001 on the mounting post of the gauge shaft and with the contact rod OFF the gauging area of J-21777-10. Set dial indicator on ZERO, then depress the dial indicator until the needle rotates 3/4 turn clockwise. Tighten the dial indicator in this position. RESET DIAL INDICATOR ON ZERO.

7. Position the gauge shaft assembly in the housing so that the dial indicator contact rod is directly in line with the gauging area BUT NOT ON and the discs seated fully in the side bearing bores.

8. Rotate the gauge shaft assembly until the dial indicator rod contacts the gauging area of J-21777-10. Rotate gauge shaft slowly back and forth until the dial indicator reads the greatest deflection.

9. At the point of greatest deflection, read the dial indicator directly for pinion depth.

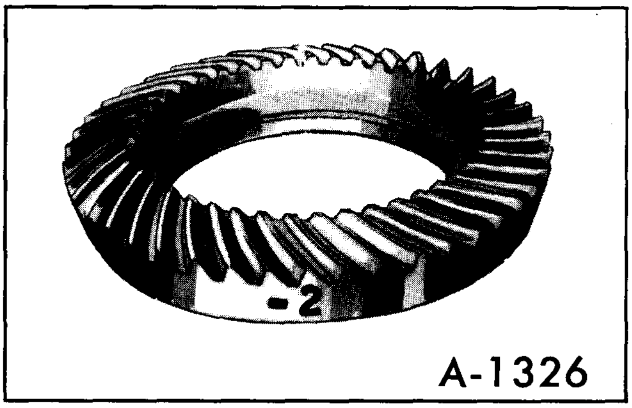


Figure 38—Location of Pinion Marking

10. Select the correct pinion shim to be used during pinion reassembly on the following basis:

a. If a service gear set or a production gear set with no paint marking, on outer circumference of ring gear is being used, the correct shim will have a thickness equal to the indicator gauge reading found in Step 9. (figure 38)

b. If the gear set being used is painted "+" or "-", the correct shim will be determined as follows.

Ring gear painted "+" (plus), the shim thickness indicated by the dial indicator on the pinion setting gauge must be INCREASED by the amount painted on the ring gear. (figure 38)

Ring gear painted "-" (minus), the shim thickness indicated by the dial indicator on the pinion setting gauge must be DECREASED by the amount painted on the ring gear. (figure 38)

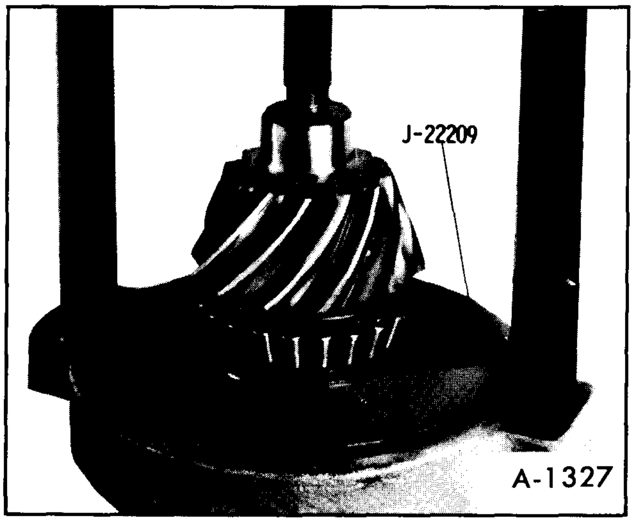


Figure 39—Installing Pinion Rear Bearing

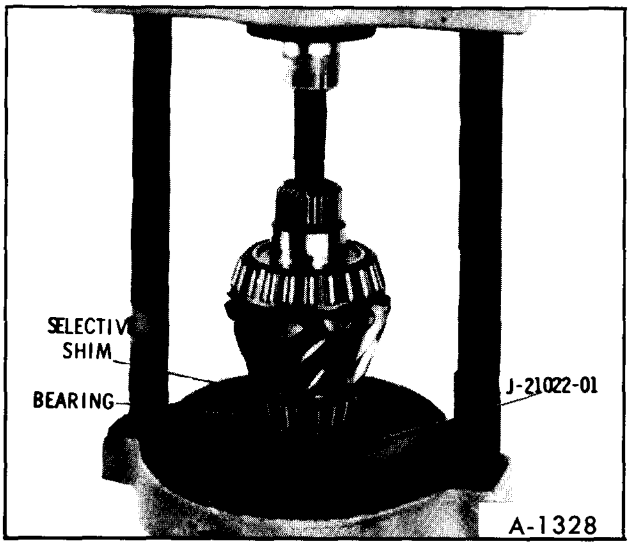


Figure 40—Installing Pinion Front Bearing And Shim

11. Remove pinion depth checking tools and front bearing from housing.

12. Install rear pinion bearing as shown in Figure 39.

NOTE: Shims are available from .040" to .070" in increments of .002".

13. Position correct shim on drive pinion and install the drive pinion front bearing as shown in Figure 40.

PINION BEARING PRE-LOAD ADJUSTMENT

1. The pre-load shim will have to be changed or

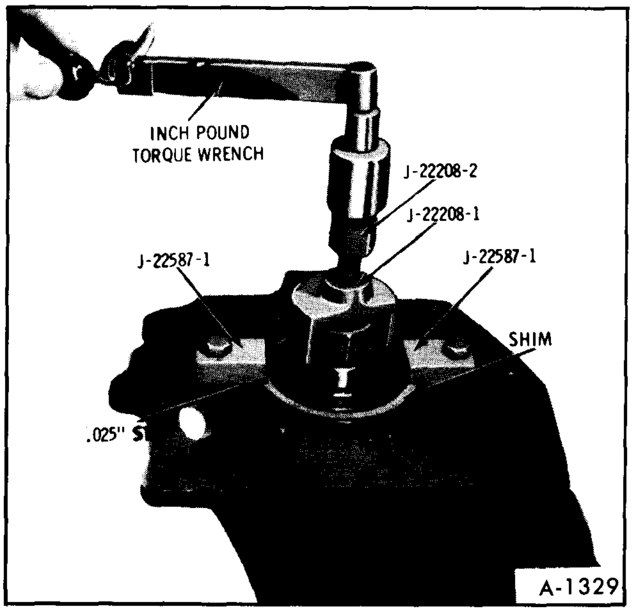


Figure 41—Checking Shim Thickness for Pinion Bearing

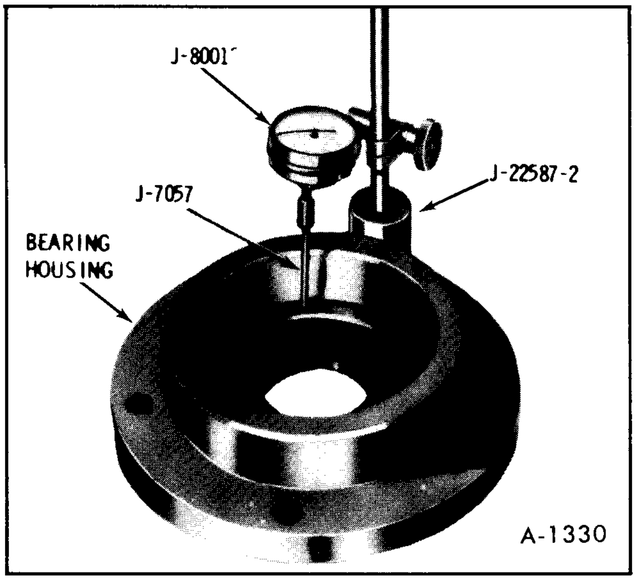


Figure 42—Checking Inner Flange Of Housing

checked any time the following parts have been replaced:

a. Ring gear and pinion.

b. Pinion bearings (front or rear).

c. Rear bearing retainer.

d. Final drive housing.

2. Position pinion bearing race on pinion bearing and install Tool J-22587-1 as shown in Figure 41. Using a feeler gauge check thickness between bearing race and Tool J-22587-1. Loosen bolts holding Tool J-22587-1 so that pinion bearing shim can be installed. Shims are available in sizes from .036" to .070" in increments of .002". Add shims until a preload of 2 to 5 in. lbs. for used bearings, 2 to 5 in. lbs. for new bearings is obtained. RECORD FINAL SHIM THICKNESS.

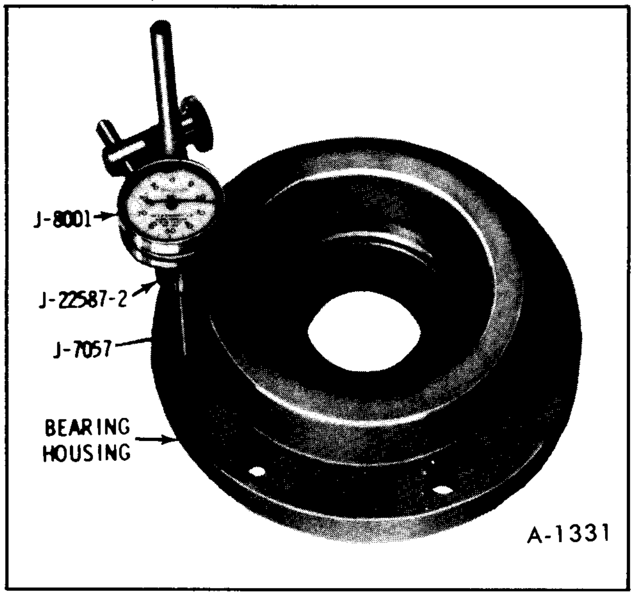


Figure 43—Checking Outer Flange Of Housing

3. Remove Tool J-22587-1.

4. With dial indicator J-8001 and extension J-7057, attach existing dial indicator post to Tool J-22587-2. (figure 42) While holding contact studs (three) of Tool J-22587-2 firmly against shoulder of bearing housing, position dial indicator as shown in Figure 42 and rotate dial to ZERO.

5. Carefully lift dial indicator assembly over flange of bearing housing and position assembly as shown in Figure 43. With the three contact studs held firmly against shoulder of bearing housing, read the dial indicator deflection. RECORD THIS DEFLECTION.

The following is an example of finding the correct pinion bearing pre-load with information obtained above.

(Shims recorded in Step 2) .... .053"
(Diff. in housing - Step 5).......................... +..024"

... .077"
(Built in step in Tool J-22587-1) .... -.025"

... .052"
(To compensate for increase in pre-load when installing housing).. -.002"
(Actual pinion bearing pre-load shim required).. .050"

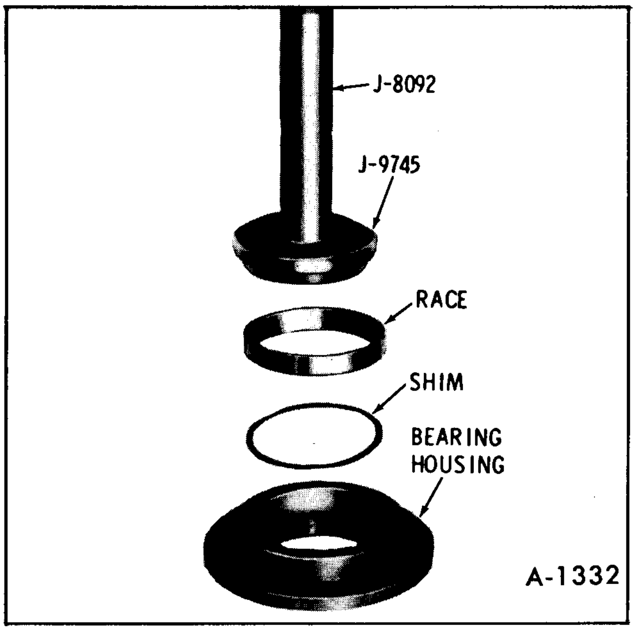


Figure 44—Installing Pinion Rear Bearing Outer Race

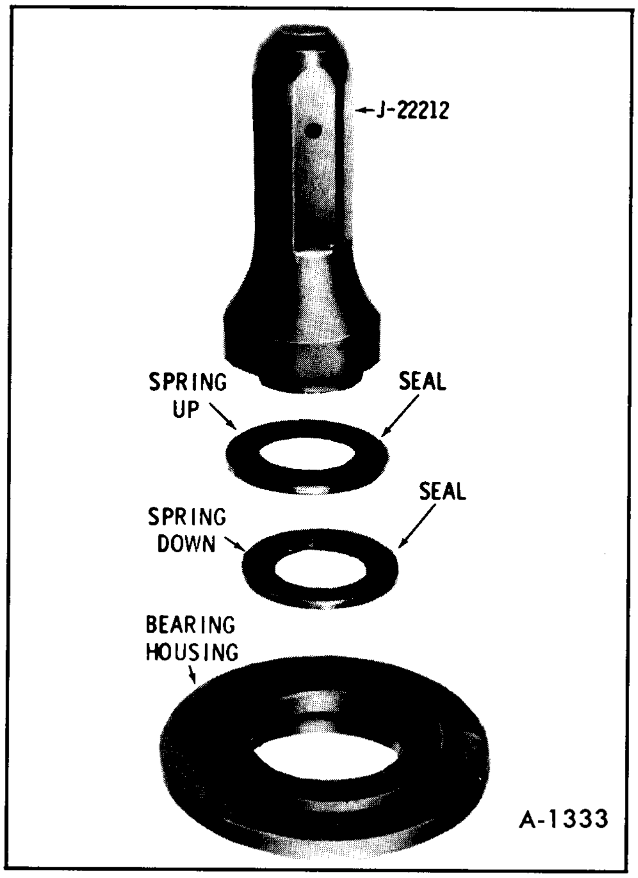


Figure 45—Installing Seals Into Bearing Housing

6. Position shim into bearing housing and install pinion rear bearing outer race as shown in Figure 44.

7. Install seals into bearing housing as shown in Figure 45.

8. Install a new "O" ring seal on the bearing housing.

9. Install seal and vent pin on face of housing. (figure 25)

10. Install seal protector J-22236 over drive pinion and install bearing housing over seal protector and position on the final drive housing. Torque the attaching bolts to 45 ft. lbs. (figure 46). Remove Tool J-22236.

CAUTION: *Seal protector must be used or inner seal lip will fold between seal case and pinion shaft resulting in a leak.*

11. Reinstall Tool J-22208-1-2 and recheck pinion pre-load. Must be two to five in. lbs. for used bearings, two to 15 in. lbs. for new bearings (figure 23).

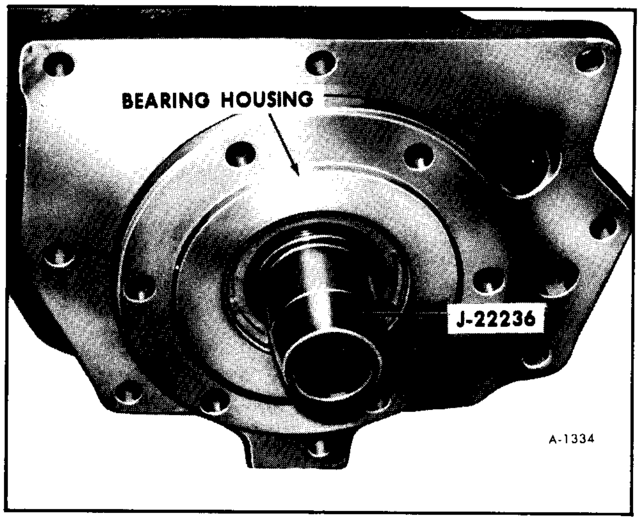


Figure 46—Installing Bearing Housing Into Final Drive Housing

CASE ASSEMBLY

Side Bearing

Installation

1. Install the side bearings as shown in Figures 47 and 48. Drive evenly until seated.

NOTE: Do not let the bearing cock as it is being driven on. Excess metal could be wiped off the mounting surfaces and the bearing could become loose on the case.

SIDE AND PINION GEARS

Installation

Before assembling the differential case, lubricate all parts with Lubricant No. 1051022 or equivalent.

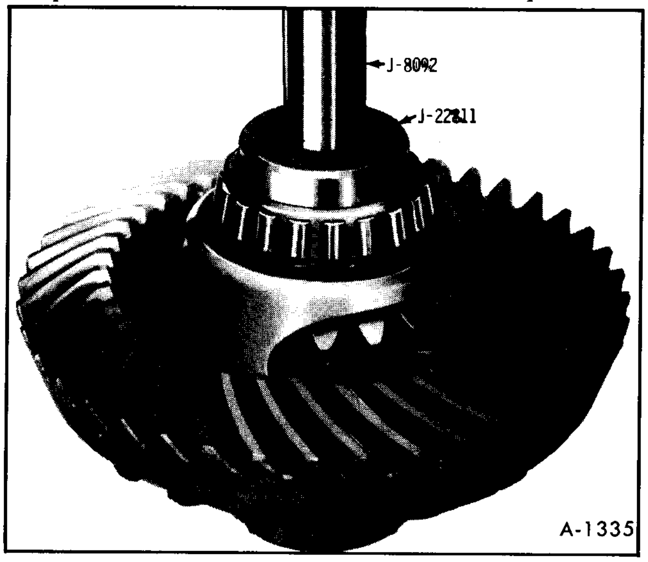


Figure 47—Installing Left Side Bearing

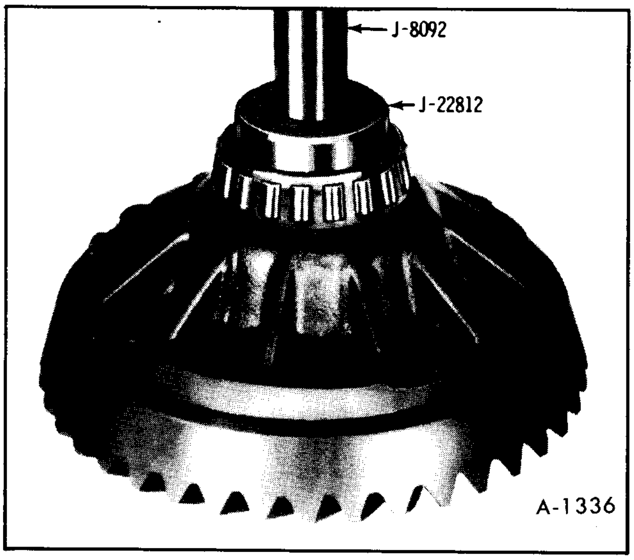


Figure 48—Installing Right Side Bearing

1. Place side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, install in original sides.

NOTE: Position side gear with threaded retainer on left side of case.

2. Position one pinion (without shims) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion shaft holes are in line; then rotate gears to make sure holes in pinions will line up with holes in case.

3. If holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion gear shims.

4. Install pinion shaft. Drive pinion shaft retaining lock pin into position. (figure 49)

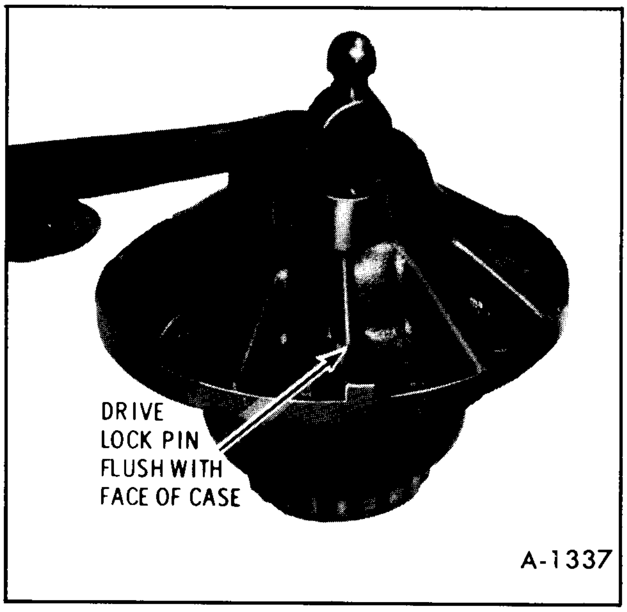


Figure 49—Installing Lock Pin

RING GEAR

Installation

1. After making certain that mating surfaces of case and ring gear are clean and free of burrs, install three 7/16-20 x 1-3/4 in. bolts as shown in Figure 50 to correctly position ring gear.

2. Install Tool J-22822 into a vise and place case assembly over tool as shown in Figure 51. Install NEW ring gear attaching bolts in remaining holes and then remove three 7/16-20 x 1-3/4 in. bolts. Install remaining three NEW bolts into ring gear and torque bolts alternately in progressive stages to 85 ft. lbs.

NOTE: Tool J-22822 must be used to correctly torque ring gear bolts.

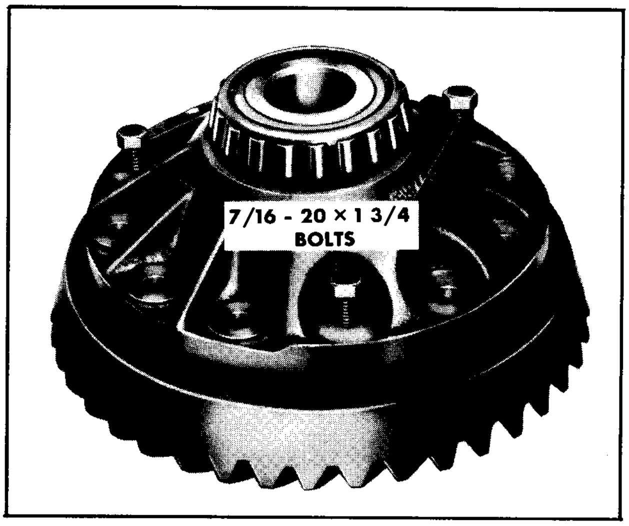


Figure 50—Installing Ring Gear to Case

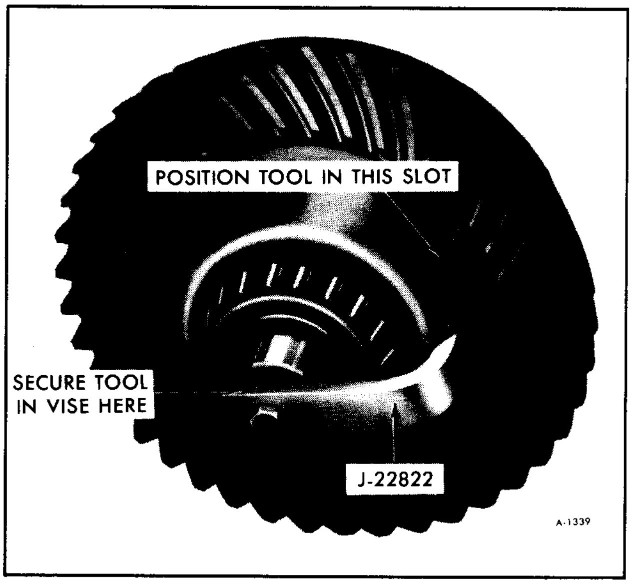


Figure 51—Installing Tool J-22822

SIDE BEARING PRE-LOAD ADJUSTMENT

Differential side bearing pre-load is adjusted by means of shims placed between the side bearing and housing. Shims are used on both sides and 19 shims are available in increments of .002" from .038" to .074". Two spacers .140" ±.005", are used one on the right side and one on the left side. By adding or subtracting the same amount of shims from both sides, the ring gear to pinion backlash will not change.

1. Before installing the case assembly, make sure that side bearing surfaces in the housing are clean and free of burrs. Side bearings must be oiled with Lubricant No. 1051022 or equivalent. Turn fixture and housing so cover side is up.

2. Place differential case and bearing assemblies in position in housing.

3. Install the original spacers on left and right side. If the recorded side bearing pre-load was correct on disassembly, the original shims may be used.

4. Install Spreader J-22196 on housing and spread housing just enough so that shim can be inserted between the spacer and the housing. (figure 52)

5. Release tension on spreader tool install side bearing caps, and torque cap bolts to 75 ft. lbs., then check pre-load as shown in Figure 53. Pre-load should be 10 to 15 in. lbs. for new bearings, 5 to 7 in. lbs. for old bearings over the pinion bearing pre-load.

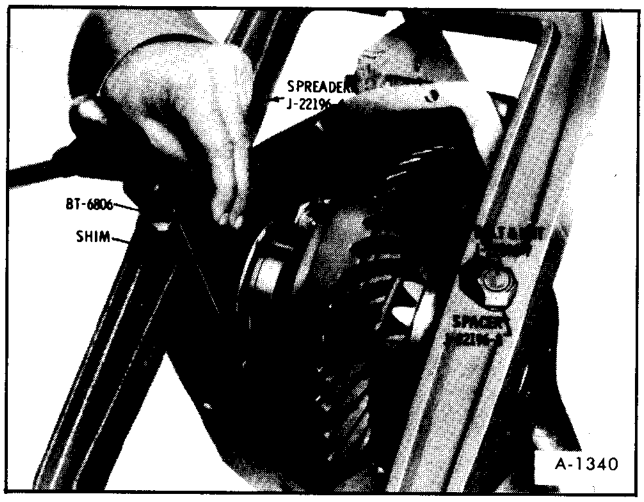


Figure 52—Spreading Housing For Shim Installation

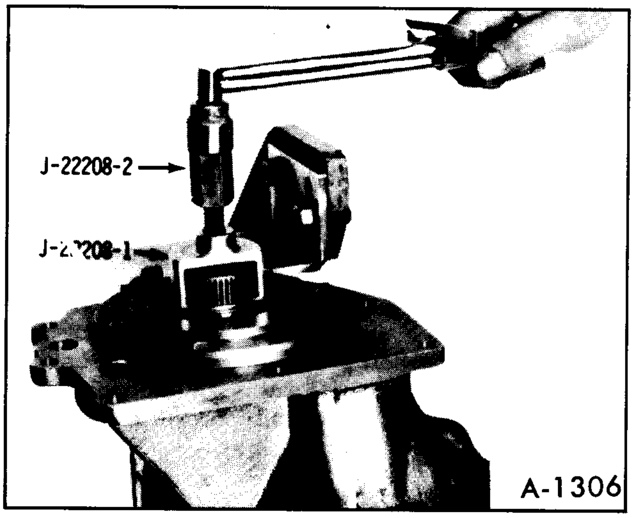


Figure 53—Checking Pinion And Side Bearing Pre-Load

6. If pre-load is not within specifications, obtain proper combination of shims, either thicker or thinner, until side bearing pre-load is 10 to 15 in. lbs. for new bearings, 5 to 7 in. lbs. for old bearings over the pinion bearing pre-load.

BACKLASH ADJUSTMENT

1. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Figure 54. Use a small button on the indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is in line as nearly as possible with gear rotation and perpendicular to tooth angle for accurate backlash reading.

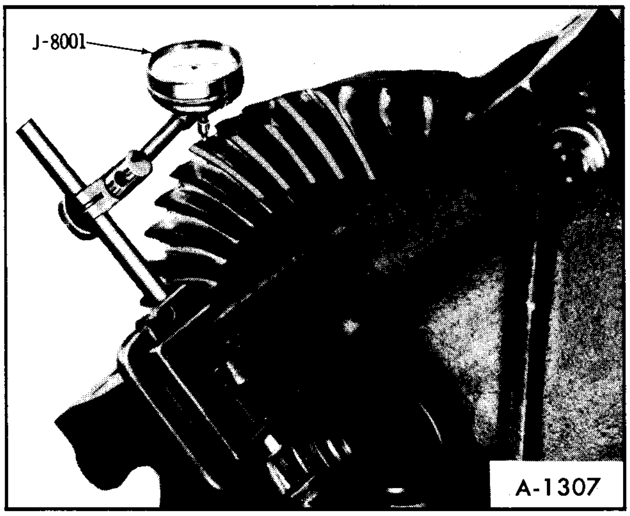


Figure 54—Checking Ring Gear To Pinion Gear Backlash

2. Check backlash at three or four points around ring gear. Lash must not vary over .002" around ring gear.

NOTE: Pinion must be held stationary when checking backlash. If variation is over .002" check for burrs, uneven bolting or distorted case and make corrections as necessary.

3. Backlash at the point of minimum lash should be between .005" and .009" for all new gears. If original ring gear and pinion was installed, backlash should be set at the same reading obtained in Step 4 of the Final Drive Disassembly procedure, provided reading was within specifications.

4. If backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. This will maintain correct differential side bearing pre-load.

For each .001" change in backlash desired, transfer .002" in shim thickness. To decrease backlash .001" INCREASE thickness of right shim .002" and DECREASE thickness of left .002". To increase backlash .002" DECREASE thickness of right shim .004" and INCREASE thickness of left shim .004".

5. When backlash is correctly adjusted, remove spreader. Install the bearing caps and bolts. Torquer to 75 ft. lbs.

6. Install new output shaft seals as shown in Figure 10 and 14.

NOTE: Left output shaft seal in installed with vent hole toward top of final drive housing in the in-car position.

7. Install new gasket on housing. Install cover, torque cover bolts to 30 ft. lbs.

Fill final drive with fluid to "FILL LEVEL" line stamped on cover near fill hole.

Use only Gear Lubricant No. 1051022 or equivalent.

NOTE: If final drive was removed without removing the transmission, do not install gasket, cover or lubricant until final drive has been installed in vehicle.

FINAL DRIVE SPECIFICATIONS

LUBRICATION

Capacity .... 4 Pints
Replenish .... Special Lubricant No. 1051022 or equivalent

ADJUSTMENTS

Backlash .... .005" to .009"
Pinion Bearing Pre-load
New Bearings .... 2 to 15 in. lbs.
Old Bearings .... 2 to 5 in. lbs.
Side Bearing Pre-load
New Bearings .... 10 to 15 in. lbs. over Pinion Bearing Pre-load
Old Bearings .... 5 to 7 in. lbs. over Pinion Bearing Pre-load

GEAR RATIO 3.07:1

TORQUE SPECIFICATIONS

APPLICATION	FT. LBS.
Final Drive Cover Bolts	30
Side Bearing Cap Bolts	75
Bearing Housing Bolts	45
Ring Gear Bolts	85
Drive Axle to Output Shaft Bolts	75
Final Drive Support Bracket to Engine Bolt	55
Final Drive to Support Bolt	110
RH Output Shaft Support to Engine Bolts	55
LH Output Shaft Retainer Bolt	45
Final Drive to Transmission Bolts and Nut	30

SPECIAL TOOLS

J-2619	Slide Hammer
J-3289-01	Holding Fixture
J-6125-2-3	Slide Hammer
BT-6708-1	Pinion Bearing Cup Remover
BT-6708-2	Pinion Bearing Cup Remover
BT-6806	Side Bearing Shim Inst.
J-7057	Extension
J-8001	Dial Indicator
J-8092	Driver Handle
J-8433-1	Puller
J-8458	Race Installer
J-8614-1	Companion Flange Holder
J-8753-1	Timing Case Cover Seal Installer
J-9745	Race Installer
J-9746	Pinion Rear Bearing Remover
J-21022-01	Front Pinion Bearing Installer
J-21777-1-50	Pinion Setting Tools
J-22196-6-7-8	Housing Spreader
J-22199	Left Output Shaft Seal Installer
J-22201	Front Pinion Bearing Race Remover
J-22208-1-2	Adapter
J-22209	Pinion Bearing Inst.
J-22212	Pinion Seal Inst.
J-22227	Front Pinion Bearing Remover
J-22236	Pinion Oil Seal Protector
J-22296-1	Holding Fixture Adapter
J-22587-1-2	Pinion Bearing Preload Gauge Set
J-22608	Side Bearing Shim Remover
J-22756-1-5	Side Bearing Remover
J-22760	R.H. Output Shaft Seal Inst.
J-22811	R.H. Side Bearing Inst.
J-22812	L.H. Side Bearing Inst.
J-22822	Carrier Holder
J-22828	Axle Brg. and Slinger Inst.
J-23129	Seal Remover
J-26485	Knuckle Seal Installer