1977 AND 1978 MAINTENANCE MANUAL SUPPLEMENT

MOTORHOME

ZE06581, ZE06584

TRANSMODE

ZE06083, ZE06583

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

GMC TRUCK & COACH
DIVISION OF GENERAL MOTORS CORPORATION
PONTIAC, MICHIGAN 48053

Printed in U.S.A.

TABLE OF CONTENTS

SECTION 0

GENERAL INFORMATION, PERIODIC MAINTENANCE, AND LUBRICATION

The information described in Maintenance Manual X-7525 (SECTION 0) is applicable to Models covered by this manual with the exception of the following:

CONTENTS

VEHICLE IDENTIFICATION NUMBER

Figure 1 is an explanation of the Vehicle Identification Number (VIN) for the models covered by this supplement. The VIN plate is located behind the right front access door. The VIN also appears on the Vehicle Certificate of Title and Registration.

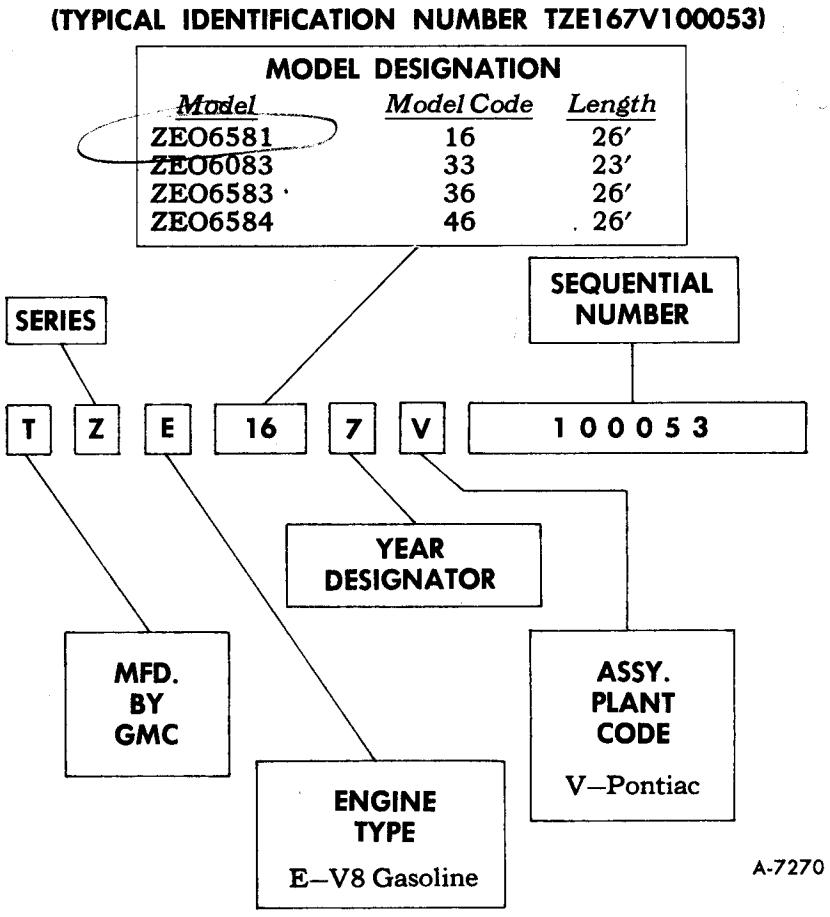


Figure 1—Vehicle Identification Number

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 (4 800 km)	1	Chassis Lubrication
	2	Engine Oil–Change
	3	Air Compressor Wet Tank–Drain (If so equipped)
Every 6 months or 6,000 miles (9 600 km)	4	Fluid Levels–Check
	5	Air Conditioning–Check
	6	Air Compressor Air Filter-Clean (If so equipped)
Every 6,000 miles (9 600 km) (Check wheel nut torque after 1st 500 miles) (800 km)	7	Tire Rotation
At 1st oil change-then every 2nd	8	Engine Oil Filter-Replace
Every 12 months or 12,000 miles (19 200 km)	9	Automatic Transmission Fluid and Final Drive Lubricant-Change
	10	Cooling System-See Explanation of Maintenance Schedule
Every 24,000 miles (38 400 km)	11	Rear Wheel Bearings-Clean and Repack. 1978 Vehicles, Front Wheel Bearings-Clean and Repack
	12	Final Drive Boots & Output Shaft Seals-Check
SAFETY MAINTENANCE		
Every 6 months or 6,000 miles (9 600 km)	13	Owner Safety Checks
	14	Tires, Wheels, & Disc Brakes-Inspection
	15	Exhaust System–Check
	16	Suspension and Steering–Check
	17	Brakes and Power Steering–Check
Every 12 months or 12,000 miles (19 200 km)	18	Engine Drive Belts–Check
	19	Drum Brakes and Parking Brake–Check
	20	Throttle Linkage–Check
	21	Underbody Flush & Check
EMISSION CONTROL MAINTENANCE (1977 CERTIFIED 455 CUBIC INCH ENGINE)*		
At 1st 6 months or 6,000 miles, (9 600 km) then at 12 month/12,000 mile (19 200 km) intervals thereafter	22	Thermostatically Controlled Air Cleaner–Check
	23	Carburetor Choke–Check
	24	Engine Idle Speed and Mixture Adjustment
	25	Carburetor and Intake Manifold Mounting Torque
Every 6,000 miles (9 600 km)	26	Spark Plug Replacement
Every 12 months or 12,000 miles (19 200 km)	27	Carburetor Fuel Filter Replacement
	28	Thermal Fuel Filter Replacement
	29	PCV System Check
	30	Air Cleaner Element Replacement
	31	Spark Plug Wires–Check
	32	Engine Timing Adjustment & Distributor–Check
Every 24 months or 24,000 miles (38 400 km)	33	ECS System Check & Filter Replacement
	34	Fuel Cap, Tanks and Lines–Check

ENGINE, CHASSIS, AND BODY MAINTENANCE SCHEDULE

EMISSION CONTROL MAINTENANCE
(1977 AND 1978 CERTIFIED 403 CUBIC INCH ENGINE)*

At 1st 3,000 miles (4800 km)	35	Carburetor Mounting Torque
At 3,000 miles (4800 km), 12,000 miles (19 200 km) then at 12,000 mile (19 200 km) mile intervals	36	Idle Speed Adjustment
Every 12 months or 12,000 miles (19 200 km)	37	Thermostatically Controlled Air Cleaner–Check
	38	Carburetor Choke–Check
	39	Carburetor Fuel Filter–Replace
	40	PCV System–Check
	41	Spark Plug Wires–Check
	42	Air Cleaner Element–Replace
	43	Thermal Vacuum Switch & Hoses–Check
	44	Throttle Return Control–Check
	45	Engine Timing Adjustment & Distributor Check
	46	Carburetor Vacuum Break Adjustment **
Every 12,000 miles (19 200 km)	47	Spark Plugs–Replace
Every 24 months or 24,000 miles 38 400 km)	48	ECS System Check & Filter Replace
	49	Fuel Cap, Tank & Lines–Check

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

** 1978 Certified 403 engine ONLY

EXPLANATION OF MAINTENANCE SCHEDULE

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

NORMAL VEHICLE USE—The maintenance instructions contained in this maintenance schedule are based on the assumption that the vehicle will be used as designed:

- To carry passengers and cargo within the limitations indicated on the Vehicle Identification Number plate, located behind the right front access door.
- On reasonable road surfaces within legal operating speeds.
- On unleaded or regular grade leaded gasoline.

Unusual operating conditions will require more frequent vehicle maintenance as specified in the respective sections included below.

LUBE AND GENERAL MAINTENANCE

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 (4800 km), whichever occurs first.

3. AIR COMPRESSOR WET TANK—Drain the wet tank (if so equipped) at 3 month or 3,000 mile intervals (4 800 km).

NOTE: More frequent drain intervals should be made if driving conditions and habits result in excessive air compressor operation.

4. 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 $-20^{\circ}F$ ($-29^{\circ}C$) 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.

5. AIR CONDITIONING—Check condition of automotive air conditioning system hoses and refrigerant charge at sight glass. Replace hoses and/or refrigerant if need is indicated. If equipped with roof mount air conditioner(s), clean filter(s).

6. AIR COMPRESSOR—Filter (if so equipped) should be washed with soap and water solution or replaced.

7. TIRES—To equalize wear, rotate tires and adjust tire pressures. Have wheel-nut torque checked after 1st 500 miles and 500 miles (800 km) after every wheel replacement thereafter.

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

9. AUTOMATIC TRANSMISSION FLUID AND FINAL DRIVE LUBRICANT—Change the transmission fluid and filter; change final drive lubricant. Under unusual conditions such as heavy traffic (stop and go driving) during hot weather or where the engine idles for long periods, the transmission fluid should be changed at 6,000 mile intervals (9 600 km).

10. COOLING SYSTEM—At 12-month or 12,000-mile intervals (19 200 km), 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 if checked, swollen or deteriorated.

Also each 12 months or 12,000 miles (19 200 km), clean exterior of radiator core and air conditioning condenser. Every 24 months or 24,000 miles (38 400 km), drain, flush, and refill the cooling system with a new coolant solution.

11. WHEEL BEARINGS—Clean and repack wheel bearings with lubricant specified in the "Recommended Fluids and Lubricants" chart.

12. 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

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

14. TIRES, WHEELS AND DISC BRAKES—Check disc brake pads for wear and surface condition of rotors while wheels are removed during tire rotation. Check tires for excessive wear or damage. Make certain wheels are not bent or cracked and that wheel nuts have been tightened to the specified torque value. Check tire inflation pressure (including the spare tire) when the tires are "cold" at least monthly, or more often if daily visual inspection indicates the need.

15. 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 may be an indication of a problem in one of these areas. Any necessary corrections should be made immediately. To help ensure continued integrity, exhaust system pipes rearward of the muffler must be replaced whenever a new muffler is installed.

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 without delay.

17. BRAKES AND POWER STEERING—Check lines and hoses for proper attachment, binding, 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. ENGINE DRIVE BELTS—Check belts driving fan, generator, power steering pump and air conditioning compressor for cracks, fraying, wear and tension. Adjust or replace as necessary.

19. DRUM BRAKES AND PARKING BRAKE—Check drum brake linings for wear or cracks 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.

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

21. UNDERBODY—Corrosion materials used for ice and snow removal and dust control accumulate on the underbody. If allowed to remain, these materials can result in accelerated rusting and deterioration of underbody components such as fuel lines, frame, floor, exhaust system, etc. At least once each year, preferably after a winter's exposure, these corrosive materials should be removed by flushing the underbody with plain water. Particular attention should be given to cleaning out those areas where mud and other foreign materials collect.

EMISSION CONTROL MAINTENANCE

(1977 CERTIFIED 455 CUBIC INCH ENGINE)

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

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 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.

24. 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 (9 600 km) of operation, then at 12 month or 12,000 mile intervals (19 200 km). Adjustment must be made with test equipment known to be accurate.

At 12 month or 12,000 mile intervals (19 200 km) 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.

25. CARBURETOR AND INTAKE MANIFOLD MOUNTING—Torque carburetor and intake manifold attaching bolts and/or nuts at first 6 months or 6,000 miles (9 600 km) —then at 12 month/12,000 mile intervals (9 600 km).

26. SPARK PLUGS—Replace at 6,000 mile intervals (9 600 km) when operating with leaded fuels, or at 12,000-mile intervals (19 200 km) 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 (19 200 km). Where misfiring occurs prior to 6,000 miles (9 600 km) spark plugs in good condition can often be cleaned, tested, and reinstalled in an engine with acceptable results.

27. CARBURETOR FUEL FILTER — Replace filter at 12-month/12,000-mile intervals (19 200 km) or more frequently if clogged.

28. 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.

29. POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)—Check the PCV system for satisfactory operation at 12,000-mile intervals (19200 km), and clean filter (located in rocker cover). Replace the PCV valve at 24,000-mile intervals (38 400 km) and blow out PCV valve hose with compressed air. Replace deteriorated hoses.

30. AIR CLEANER ELEMENT—Replace the engine air cleaner element under normal operating conditions every 12,000 miles (19 200 km). 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 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.

32. 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.

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.

NOTE: 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

(1977 AND 1978 CERTIFIED 403 CUBIC INCH ENGINE)

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

35. CARBURETOR MOUNTING—Check carburetor attaching bolt torque at the first 3,000 miles (4 800 km), only. If torque on any bolt is less than 48 in. lbs., tighten all bolts to 120 in. lbs. using the following tightening sequence:

a—Left Rear Bolt
b—Right Front Bolt
c—Right Rear Bolt
d—Left Front Bolt

36. ENGINE IDLE SPEED—Adjust engine idle speed accurately (following the specifications shown on the label attached to engine air cleaner) at 3,000 miles (4 800 km) of operation, 12,000 miles, then at 12,000-mile intervals (19 200 km) thereafter. Adjustments must be made with test equipment known to be accurate.

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

38. 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.

39. CARBURETOR FUEL FILTER — Replace filter at 12-month/12,000-mile intervals (19 200 km) or more frequently if clogged.

40. POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)—Check the PCV system for satisfactory operation at 12 month or 12,000-mile intervals (19 200 km), and clean filter (located in rocker cover). Replace the PCV valve and filter at 24 month or 24,000-mile intervals (38 400 km) and blow out PCV valve hose with compressed air. Replace deteriorated hoses. The PCV valve should be replaced at 12 month or 12,000 mile intervals (19 200 km) when the vehicle is used in operations involving heavy dust, extensive idling, and short trip use at freezing temperatures where engine does not become thoroughly warmed up.

41. SPARK PLUG WIRES—Clean exterior of wires with a clean cloth or soft bristle brush and a solution of mild detergent and warm water. 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.

42. AIR CLEANER ELEMENT—Replace the engine air cleaner element under normal operating conditions every 12,000 miles (19 200 km). 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.*

43. 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.

California engines are equipped with an additional low temperature thermal vacuum switch.

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

45. TIMING AND DISTRIBUTOR CAP—Adjust ignition timing following the specification on label attached to the engine rocker cover (1977 engines).

NOTE: On 1978 engine the label is located on the air cleaner.

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

46. CARBURETOR VACUUM BREAK (1978 Certified Engine ONLY)—Inspect vacuum break linkage for proper operation. A binding condition must be corrected. Check hose for proper connection, cracking, abrasion or deterioration. Replace parts as necessary. Adjust vacuum break at 12 month or 12,000 mile intervals (19 200 km).

47. SPARK PLUGS—Replace at 12,000 mile intervals. Where misfiring occurs prior to 12,000 miles (19 200 km), spark plugs in good condition can often be cleaned, tested and reinstalled in the engine with acceptable results.

48. 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.

NOTE: If 1977 vehicle is equipped with two canisters, filter is located in the lower canister only. If 1978 vehicle is equipped with two canisters, a filter is located in the lower portion of each canister.

49. 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 U.S.	CAPACITIES IMPERIAL
Engine oil	High quality SE oil	5 Qts. 6 w/filter	4¼ Qts. 5 w/filter
Motor generator	High quality oil meeting both SE and CC requirements	4 Qts. 4½ w/ filter	3¼ Qts. 3-3/4 w/ filter
Power steering system and pump reservoir. Includes windshield wiper motor	GM power steering fluid Part No. 1050017 or equivalent		
Final drive	SAE 80W or SAE 80W-90 GL-5 gear lubricant (SAE 80W GL-5 in Canada)	4 Pts.	3¼ Pts.
Brake system and master cylinder	Delco Supreme 11 or, DOT-3 fluid or equivalent		
Transmission shift linkage	Engine oil		
Chassis lubrication	Lithium soap multi-purpose chassis grease meeting requirements of GM 6031-M		
Transmission	DEXRON II automatic transmission fluid	4 Qts. *	3¼ Qts.*
Parking brake cables	Chassis grease		
Front Wheel Bearings	High-melting point lubricant Part No. 1051344		

RECOMMENDED FLUIDS AND LUBRICANTS

USAGE	FLUID/LUBRICANT	CAPACITIES U.S.	CAPACITIES IMPERIAL
Rear wheel bearings	Lithium soap multi-purpose 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		
Batteries	Colorless, odorless, drinking water		
Engine coolant	Mixture of water and a high quality Ethylene Glycol base type anti-freeze conforming to GM Spec. 1899-M.	21 Qts. (TransMode) 23 1/2 Qts. (Motorhome)	17½ Qts. 19 1/2 Qts.

*12 U.S. Qts. (10 Imperial Qts.) after complete overhaul.

SECTION 1

BODY, HEATING AND AIR CONDITIONING

This section is sub-divided into two parts:

SECTION 1A

BODY

The information described in Maintenance Manual X-7525 under the heading BODY, HEATING AND AIR CONDITIONING (SEC. 1) is applicable to models covered by this supplement with the exception of the following:

CONTENTS

MOTORHOME AND TRANSMODE PAINT CODES

1977 EXTERIOR PAINT CODES

COLOR	RPO	MODEL USAGE	FISHER NO.	DITZLER NO.	DUPONT REFINISH NO.
Beige	534	Eleganza II	WUEK-4527	2646	42807U
Frosted Mint	553	Palm Beach	WUEK-5254	45197	44017U
Cameo White	558	All	WUEK-3967	2058	5338U
Yellow	580	TransMode	WUEK-5269	82277	44365U
Cream White	585	Birchaven TransMode Crestmont	WUEK-5222	90070	44570U
Santa Fe Tan	581	Kingsley	WUEK-5236	2777	43486A*

MOTORHOME AND TRANSMODE PAINT CODES

1978 EXTERIOR PAINT CODES

PAINT RPO CODE & COLOR*	RPO	MODEL USAGE	FISHER NO.	DITZLER NO.	DUPONT REFINISH NO.
39P White 36S Saffron	641	Kingsley	WUEK-5252 WUEK-6205	90035** 24575**	43976U 45558U
38P Frost Beige 35S Medium Beige	697	Eleganza II	WUEK-6201 WUEK-6202	24573** 24574**	45554U 45555U
41P Frost Green 37S Medium Green	698	Palm Beach	WUEK-6203 WUEK-6204	45399** 45400**	45556U 45557U
42P Cameo White 42S Cameo White		TransMode	WUEK-3967	2058**	5338U
38P Frost Beige 38S Frost Beige		TransMode	WUEK-6201	24573**	45554U

*Must specify both Primary & Secondary Color.
**Paint available in urethane, acrylic lacquer and acrylic enamel, by using following prefix with Ditzler No.

DU - Urethane DDL - Acrylic Lacquer DAR - Acrylic Enamel

1977 & 1978 INSTRUMENT PANEL PAINT CODES

COLOR	RPO	MODEL USAGE	FISHER NO.	DITZLER NO.	PONTIAC COATINGS CODE NO.	DUPONT REFINISH NO.	DETROIT AUTOBODY NO.
Midnight Neutral	690	Sequoia	W25A-4300	UCV2-183	----------	9994LH	4300**
	692	Painted Desert	"	"	"	"	"
	693	Glacier	"	"	"	"	"
	695	Canyon Lands	"	"	"	"	"
	---	TransMode-(Pre 1977)	"	"	"	"	"
Dark Amber	696	Eleganza SE	W25A-4530	UCV2-214	---	42911LH	4530**
Dark Saddle	697	Eleganza II	WOA-4098	UCV 152	GMT-544*	----	4098**
	681	Glenbrook	"	"	"	"	"
	641	Kingsley	"	"	"	"	"
	---	TransMode 1977	"	"	"	"	"
Avocado	698	Palm Beach	WOA-4926	UCV2-405	GMT-551*	10049LH	---

*Vinyl Coating manufactured by: Pontiac Coatings, Inc.
30 Brush Street, Box 45
Pontiac, MI 48056

**Vinyl coating manufactured by: Detroit Autobody Equipment Company
(Requires No. 4000 non-glare clear top coat) Box 717
Royal Oak, MI 48068

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

GLASS

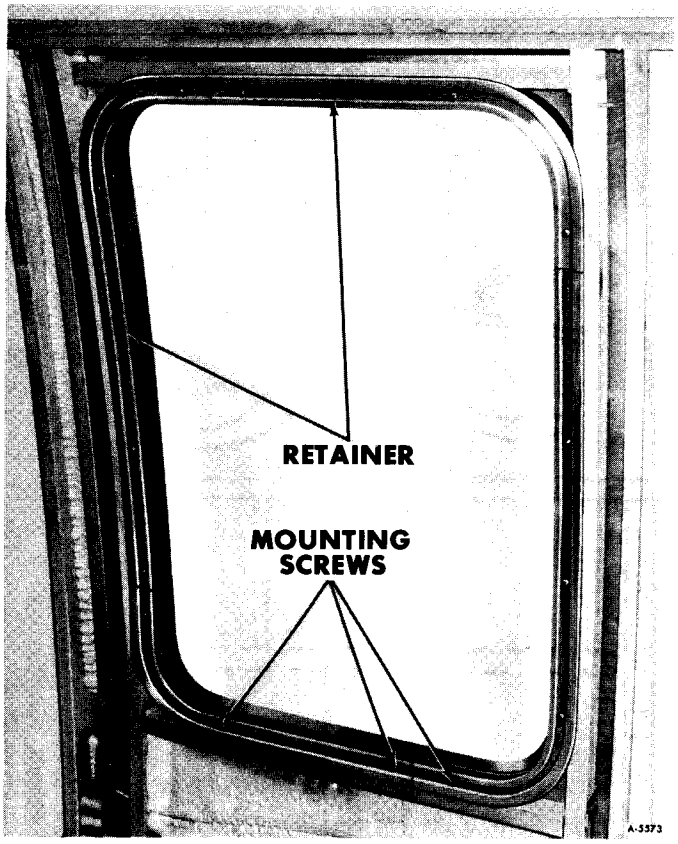


Figure 1—Sash Retainer

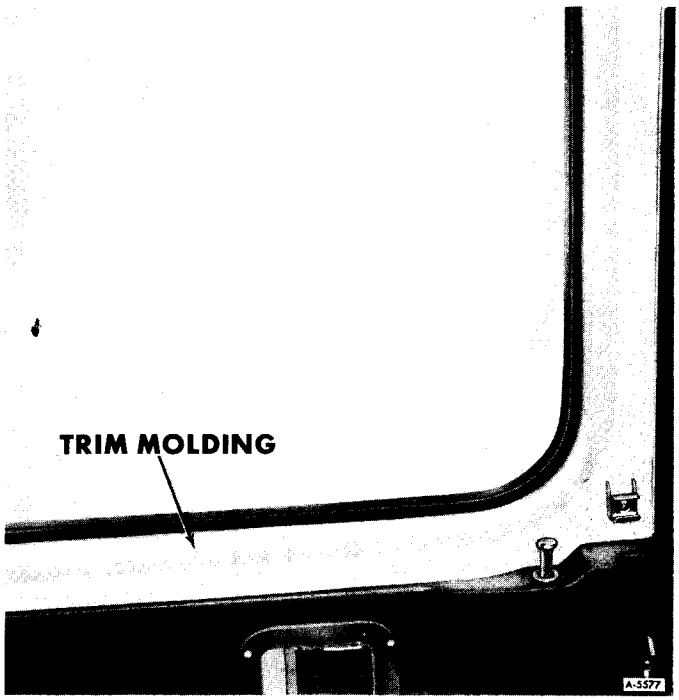


Figure 2—Window Trim

"HEHR" LIVING AREA WINDOW ASSEMBLIES

"Hehr" living area window assemblies have formed retainers that screw directly to the sash assembly (figure 1). The trim molding has been redesigned (figure 2), and installs directly into the sash retainer. No mounting screws are needed. These new features do not affect removal and installation procedures as outlined in "Screen and Vent Assembly", Section 1, Maintenance Manual X-7525.

REAR WINDOW REPLACEMENT

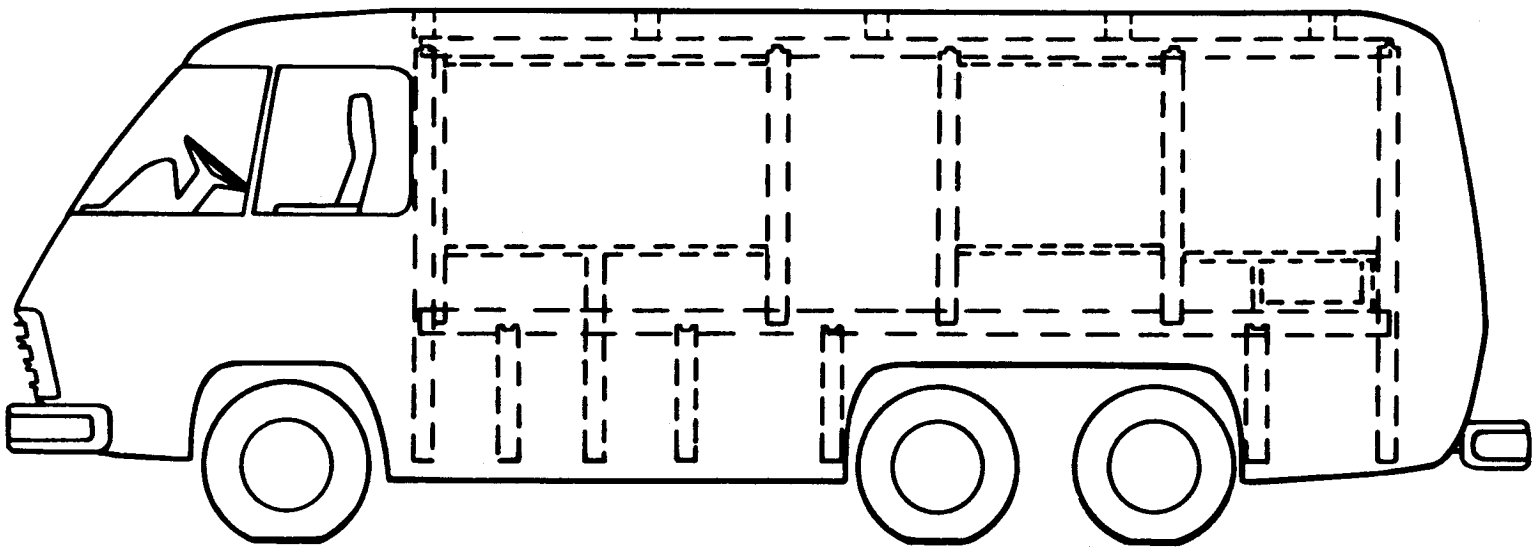
Rear windows are made of solid tempered glass. Care is necessary in handling and installation. If glass clearance of replacement window is too small, adjustment may be made by "trimming" fiberglass flange around window. Do not attempt to grind tempered glass. Grinding may cause glass to shatter.

WINDSHIELD WIPER SYSTEM

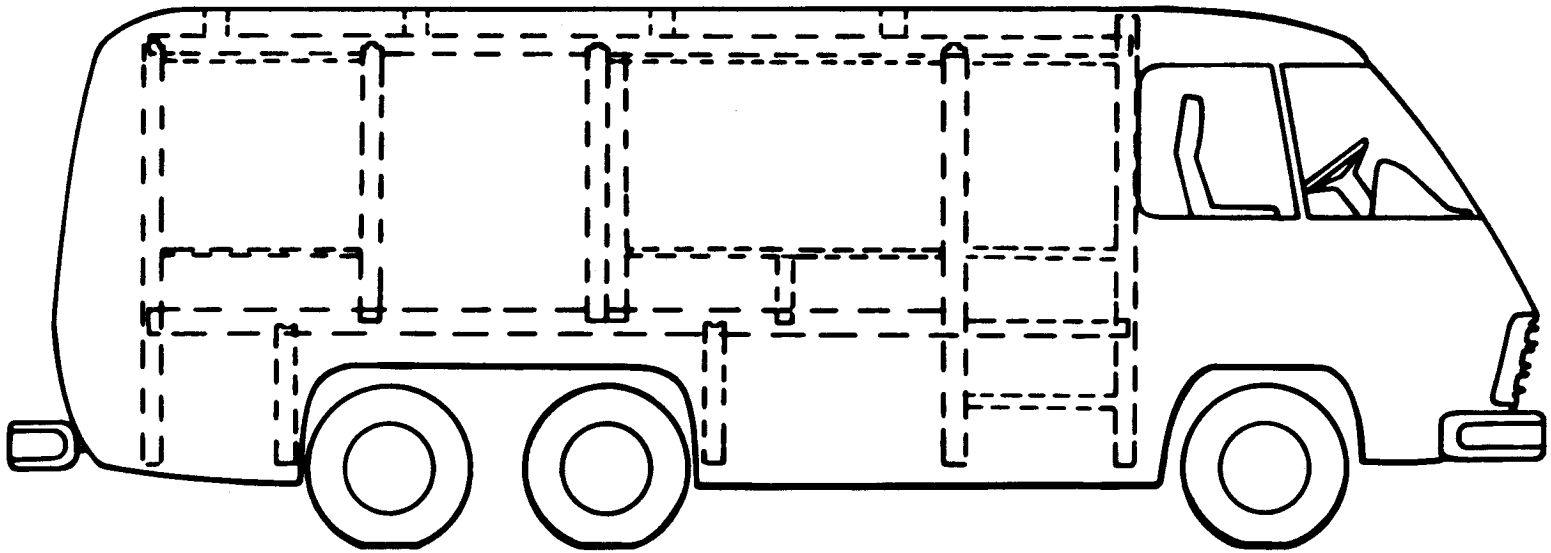
CAUTION: *When replacing the windshield wiper motor, correct routing of the power steering hoses is very important. Although sequence of assembly is not vital, the power steering hoses, when installed, must not be twisted, kinked, or tightly bent. The hoses should have sufficient natural curvature in the routing to absorb movement and hose shortening in operation. They should also be free of twist under strain. All fittings must be held while tightening or loosening nuts.*

ALUMINUM AND FIBERGLASS REPAIR

The aluminum and fiberglass panels on the body may be repaired if damaged. Refer to Sec. 1, Maintenance Manual X-7525 for fiberglass repair procedure. Filler putty can be used for minor dents, scratches and scrapes on the aluminum panels. However, major damage to a panel (fiberglass or aluminum) will require removal and replacement of the panel. Before



ZEO6083 DRIVER'S SIDE



ZEO6083 PASSENGER SIDE

A-6086

Figure 3—TransMode Body Side Structure (ZEO6083)

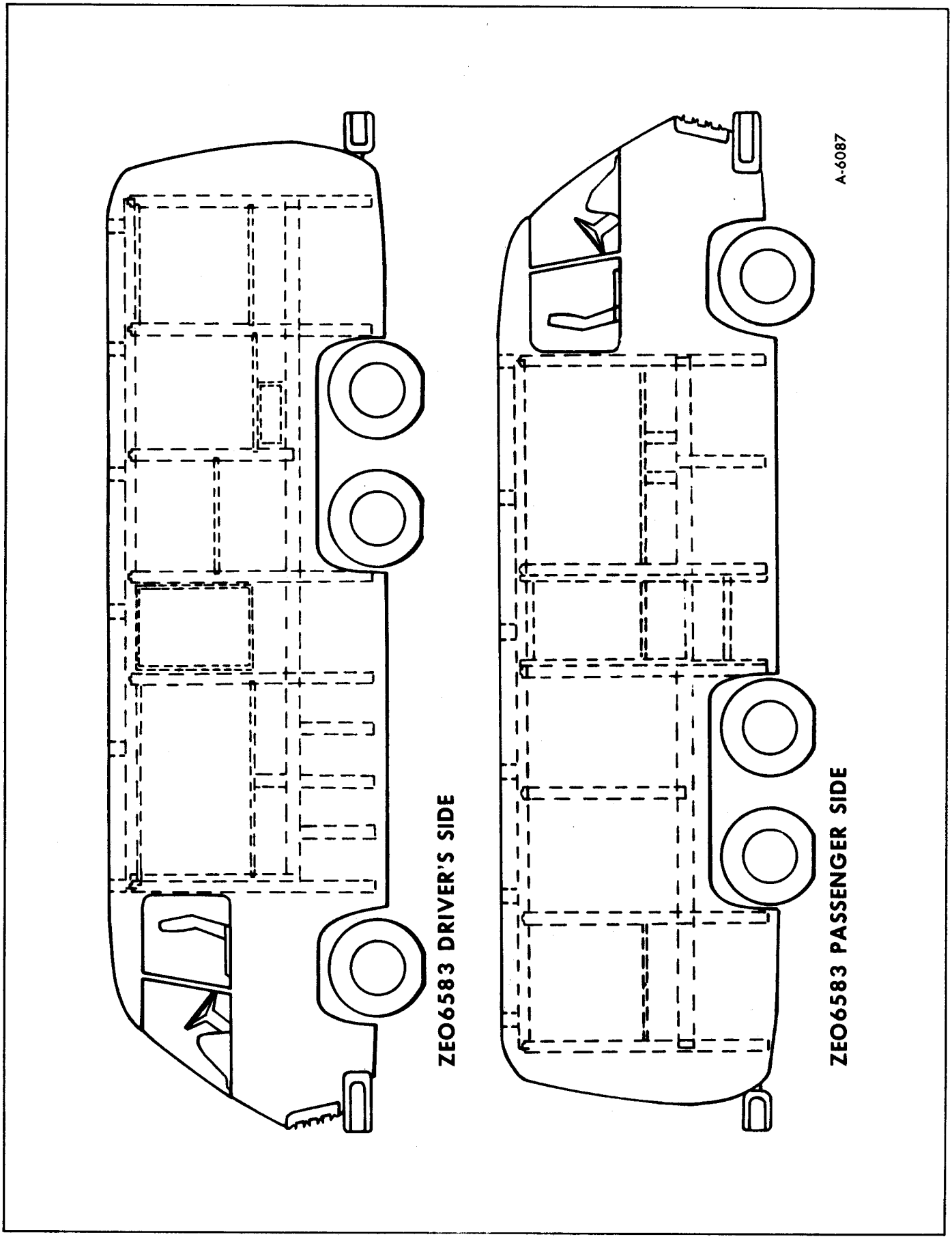
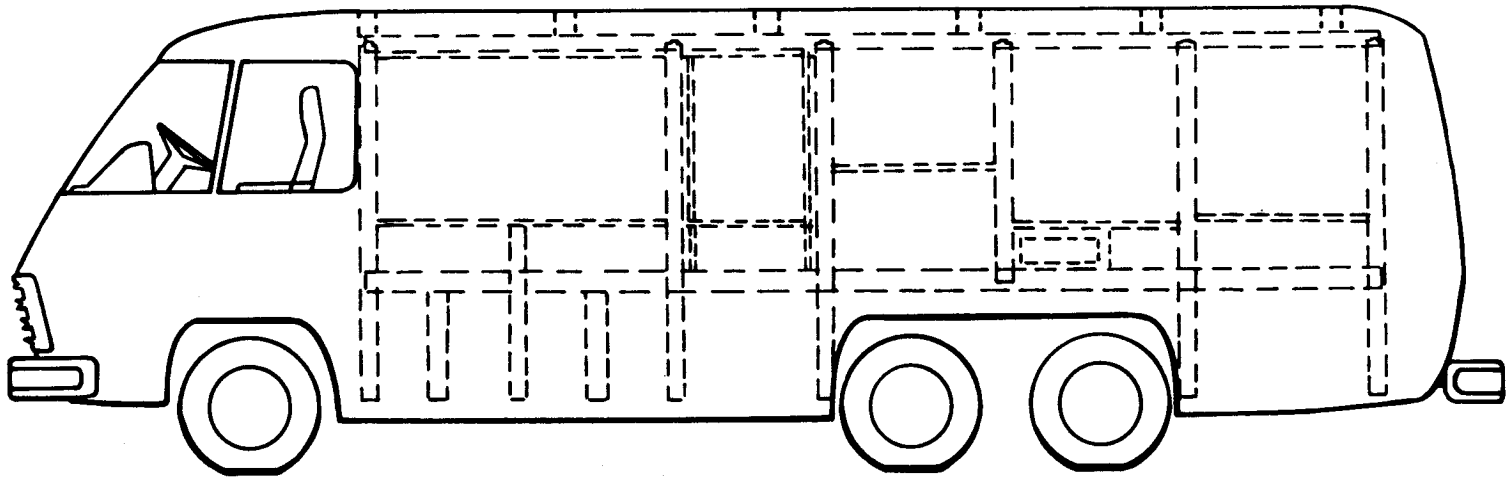
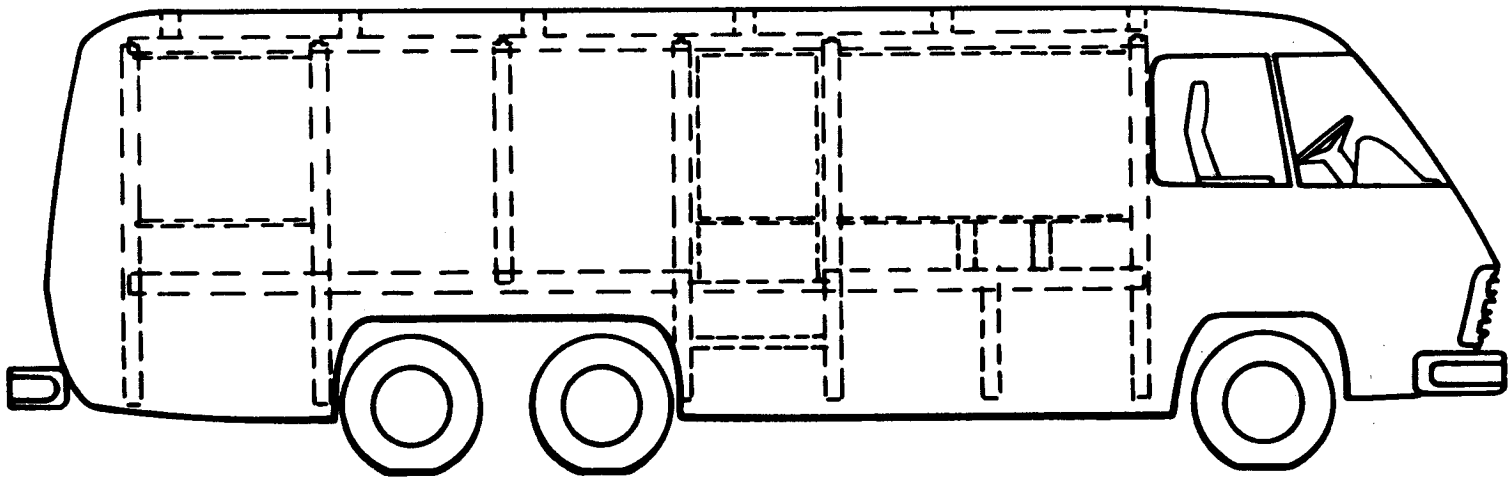


Figure 4—TransMode Body Side Structure (ZEO6583)



ZEO6581 DRIVER'S SIDE



ZEO6581 PASSENGER SIDE

A-6088

Figure 5—Motorhome Body Side Structure (ZEO6581)

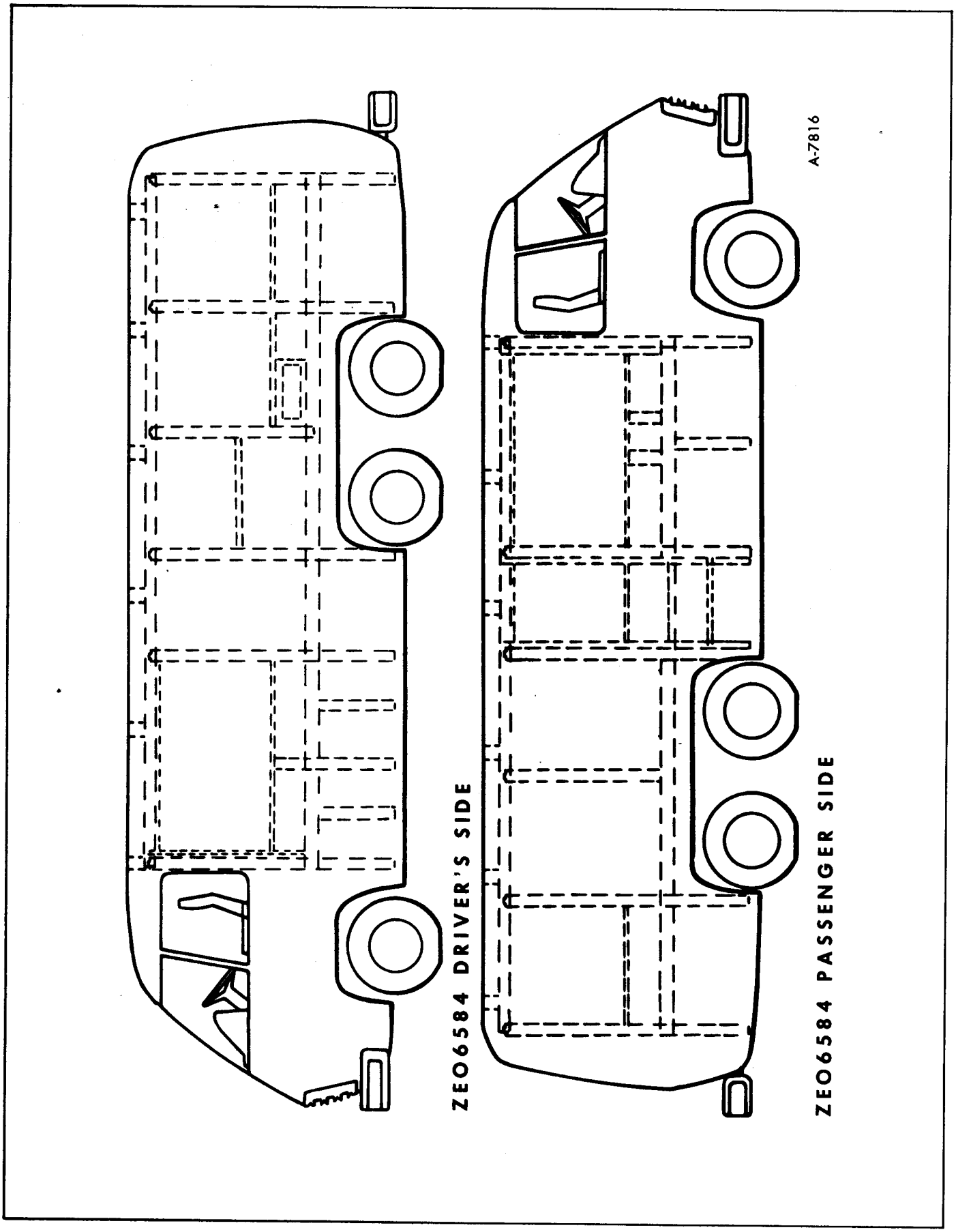


Figure 6—"Twin Bed" Motorhome Body Side Structure (ZE06584)

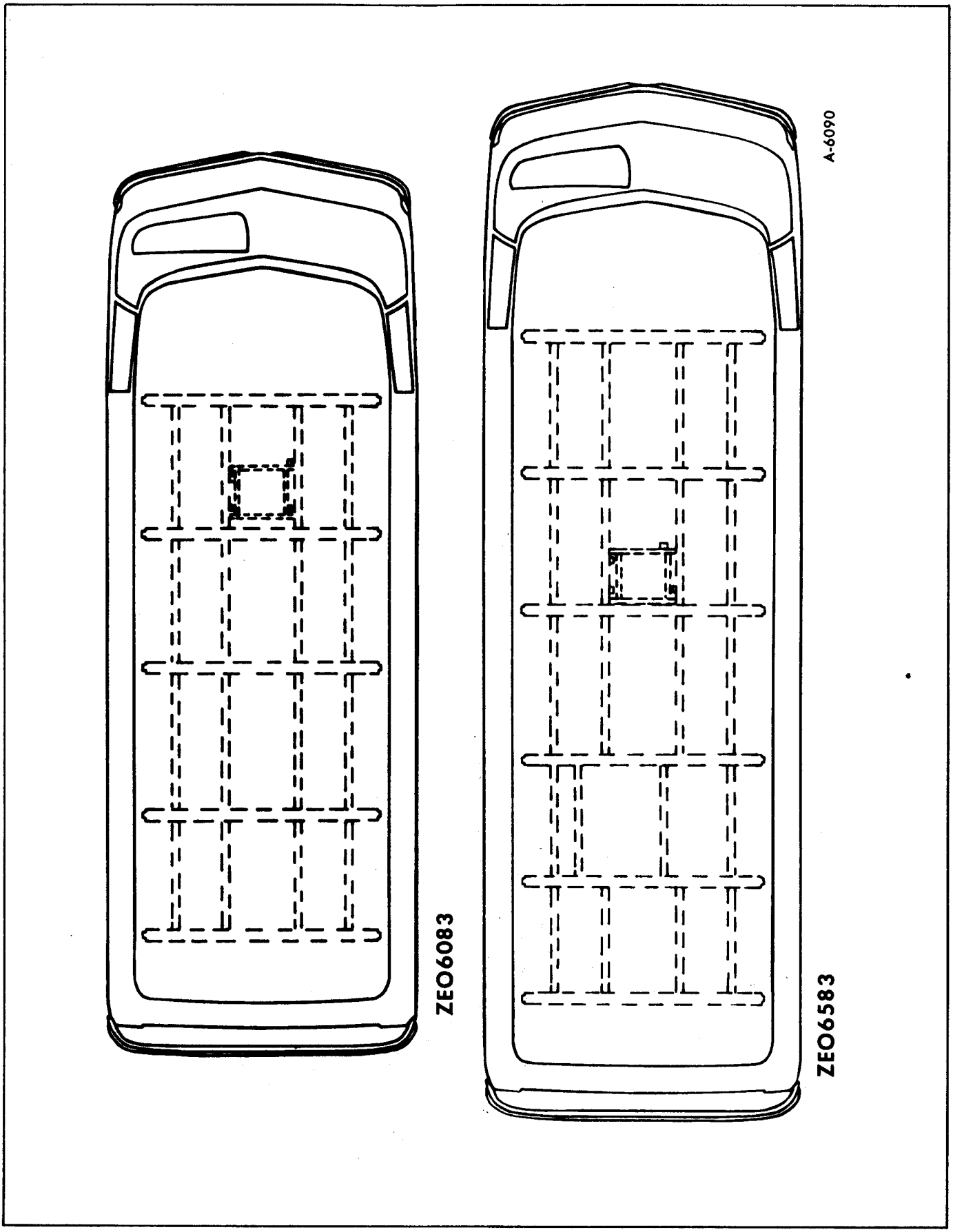


Figure 7—TransMode Roof Structure (ZE06083, ZE06583)

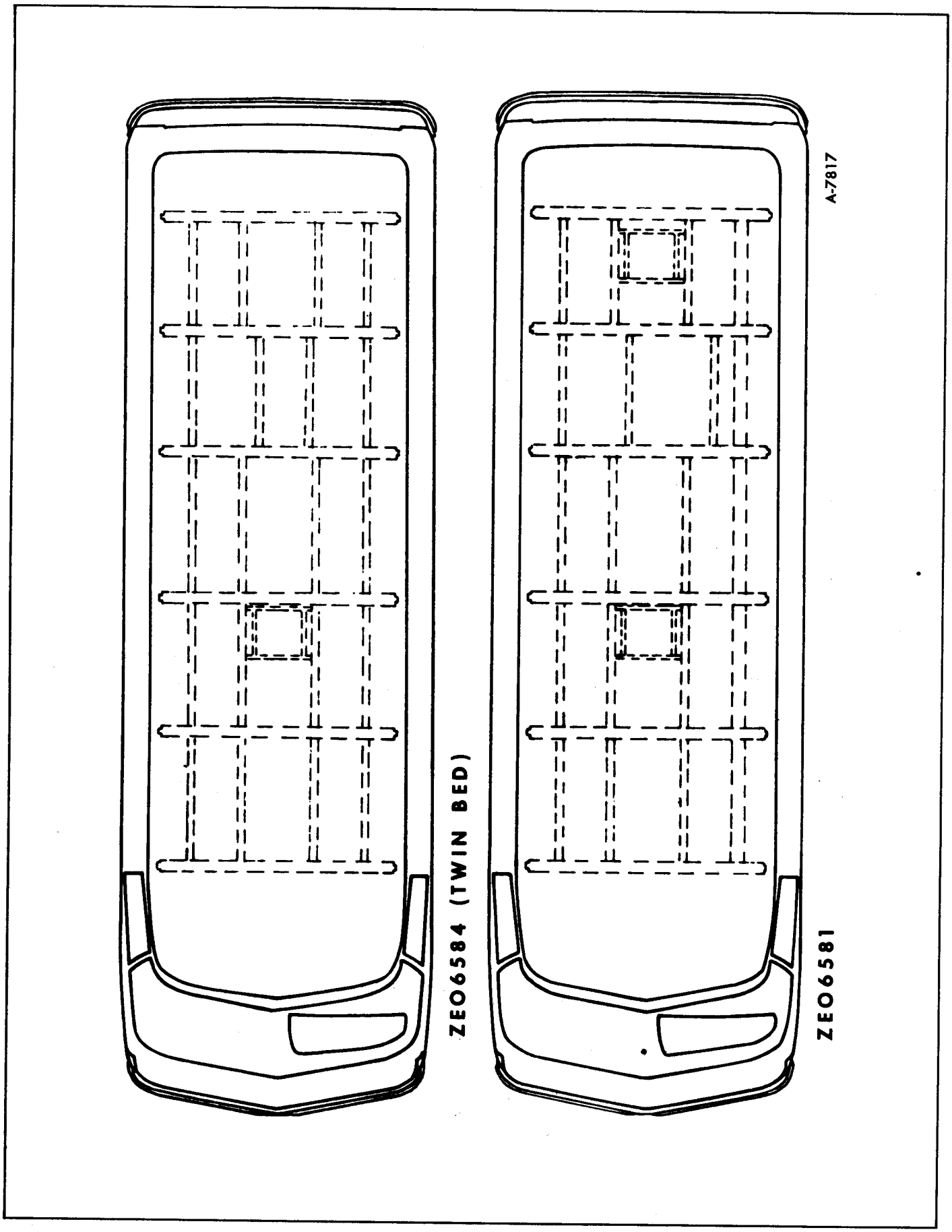


Figure 8—Motorhome Roof Structure (ZE06581, ZE06584)

this can be done all windows, access doors, vents, belt and roof line trim moldings in the damaged area should be removed. The panels, which are secured to the rib with a polyurethane adhesive, are difficult to separate and remove from the body. The suggested method which follows should make the repair job easier.

NOTE: There are numerous overlapping joints on the vehicle where the front and rear fiberglass panels are joined to the body structure and to each other. These joints are glued together. Some panels are also bolted together or held by fasteners behind the exterior skin. These panels include: (a) the lower front panel which is bolted to the lower front side panels at the front corners of the vehicle (five bolts each side of vehicle), (b) the lower side panels, which are held to the main body side panels with two screws and a pop rivet, and (c) the rear corner pillar assemblies, which are bolted to the main rear side panels (eight bolts each side of vehicle).

Should the corners of the vehicle become damaged, or should any part of the front or rear "cap" need replacement, the lap joint bolts must be loosened or removed. To do so may require that specific interior components, trim panels, cabinets, dash panel, etc., be removed to allow access to certain of the bolts. When all the attaching bolts are loosened or removed, the adhesive bond between the joints must be broken. Then the exterior skin must be "peeled back" before the affected panel(s) can be pulled off the vehicle for repair or replacement.

NOTE: Carefully read and follow all manufacturer's safety precautions for primer, solvent and body adhesive.

PANEL REMOVAL

Typical positioning of body structural members (right and left hand views) in the standard TransMode and Motorhome vehicles is depicted in figures 3 through 6. Figures 7 and 8 illustrate TransMode and Motorhome roof structures.

NOTE: Individual Motorhome and TransMode vehicles may have structural additions and changes not represented by these views. If possible, determine vehicle alterations from standard before beginning body repair.

Using these figures for reference, it is essential to determine position of the rib structure of the vehicle prior to repair. This is important to avoid damaging structural components, piping, wiring, insulation, etc. located immediately behind the panels. It is suggested that each damaged panel be removed in two parts, using Special Tool J-26805 (figure 9). This tool is a Pneumatic Chisel Bit Set, to be used with a standard air chisel (parker shank) for body repair.

1. Remove all mechanical attachments. When removing rivets, drill only deep enough to remove the rivet, or piping, wiring, insulation, etc. directly behind the panels will be damaged. After rivet head is drilled off, use a punch to carefully drive out the rivet shaft.

2. Determine position of vehicle structural supports in area to be repaired. Trace frame or rib area with washable marker on outside of vehicle.

3. Working from the vehicle exterior and using a standard air chisel with a Rip Bit (J-26805-1), begin to cut the damaged panel out, cutting parallel to the "ribs" and approximately two inches "inside" of the rib structure. (See figure 10.) Then remove the cut-out section of the panel.

With the largest part of the panel out of the way it will now be easier to remove the remainder of the panel (which is secured to the crossmember with adhesive) without damaging the crossmember.

4. Using a Flat End Scraper Bit (J-26804-2), operate the air chisel along the rib line and underneath the panel piece to break the adhesive bond between the panel and the rib. Note that figure 11 shows panel "remains" from two body side panels (panel A & panel B) being removed from the structural support. This would be necessary only if both panels were damaged. If only one panel needs replacement, only one panel is removed from the rib, using the visible seam between panels as a guide. (Refer to figure 11).

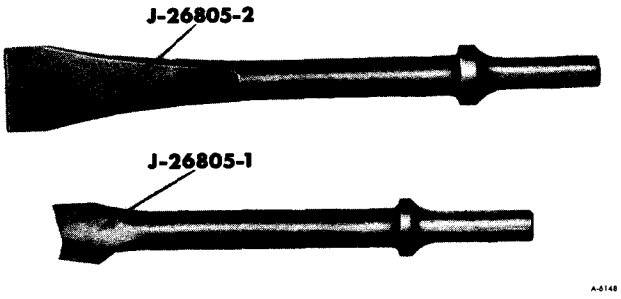


Figure 9—Pneumatic Chisel Set

Follow the same 2-part cutting method along the roof seams and any other structural supports that border damaged panels. Use care not to damage structural components behind adjacent panels. All small pieces which have broken free must be removed.

ADHESIVE REMOVAL

Before prefitting or any further structural work on the vehicle, the old cured adhesive must be removed from ribs and body structural supports. A suggested method would be to grind off the adhesive with an extra coarse disc on an air driven grinding wheel. An air chisel with Flat End Scraper Bit (J-26805-2) may also be used.

INSPECTION

Inspect crossmembers for damage. 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 panel.

PANEL INSULATION

New body panels must be insulated to insure temperature control and good performance of heating and air conditioning systems. Insulate with rigid urethane foam (available in aerosol cans) or 1-inch, 1 1/2 lb. density fiberglass insulation sheets, cut to fit. Both types of insulation are available locally. Do not cover areas which must remain accessible for servicing, such as structural flanges and interior component mounting surfaces. If urethane

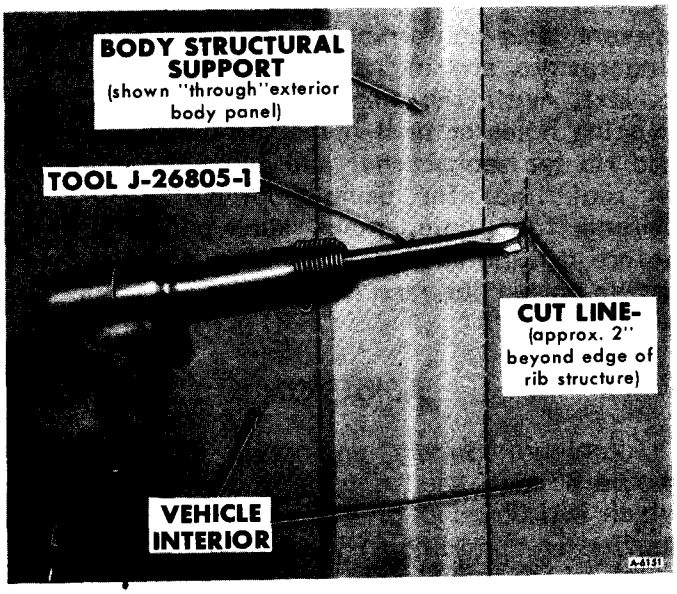


Figure 10—Panel Removal with Air Chisel —Step 3

foam is used, take care not to spray adhesive bonding surfaces.

PREFITTING

A replacement panel should be prefitted for proper fixturing after panel has been insulated and ribs have been thoroughly cleaned of adhesive. This should be done before the ribs have been solvent wiped or primed, in order to

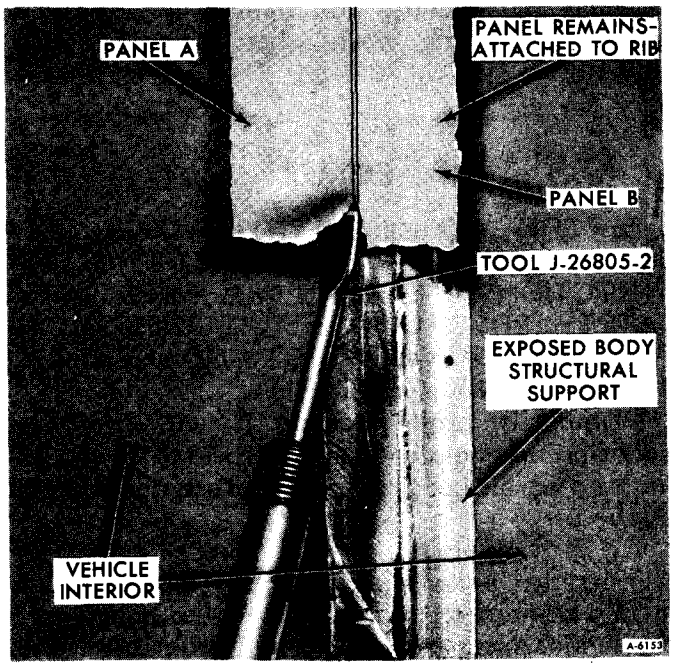


Figure 11—Panel Removal with Air Chisel - Step 4

prevent later contamination from dirt, grease, fingerprints, etc. in the glue line areas.

Next, with the panel held in place, use existing holes or drill holes through the panel and rib (at each corner and along the beltline or roof line) for using pop-rivets. After drilling first hole, make sure panel is flat before drilling second hole. The panel should not be bowed between holes.

ABRASION

Aluminum panels and body frame parts should be disc sanded to bare metal in areas which will be bonded. Fiberglass* may also be scuffed on bond line. Finished surface will be rough to the touch.

*Glass fiber reinforced panels, commonly called fiberglass. Not the same as fiberglass insulation referred to earlier.

SOLVENT

BEFORE WORKING WITH SOLVENT, BE SURE TO READ MANUFACTURER'S INSTRUCTIONS AND TAKE ALL NECESSARY SAFETY PRECAUTIONS.

Wipe bond surfaces on fiberglass and aluminum panels and on body structural supports with Methylene Chloride solvent. It is important that all surfaces be clean and free of surface contaminants such as shop dirt, grease, drawing compounds, and overspray. Safety gloves should be worn when cleaning with solvent.

PRIMER

BEFORE WORKING WITH PRIMER, BE SURE TO READ MANUFACTURER'S INSTRUCTIONS AND TAKE ALL NECESSARY SAFETY PRECAUTIONS. SPECIFICALLY, AVOID ALL SKIN CONTACT AND USE ONLY IN WELL VENTILATED AREA.

Primer is used because it will promote adhesion and help prevent corrosion. It should be used on all bond surfaces before adhesive is applied.

It is important that primer base be thoroughly agitated. No settled pigment should remain on the bottom of the container. Mix equal parts by volume of primer base and accelerator, such as 3M EC-1945 B/A or equivalent. Follow manufacturer's mixing and use instructions.

Primer may be sprayed, or brushed on with a clean brush. Apply a "mist" coat or a thin brush coat of primer to all sanded structural surfaces. Do not spray heavy coat or let primer run on surface.

Drying time is dependent upon ambient temperature, air movement and relative humidity. Cure primer by air drying or heating to a minimum temperature of 150°F (65°C) for 15 to 30 minutes. Temperature must not exceed 250°F (121°C) at any time. Heat lamps normally used for paint curing may be used when heat drying. If air drying, cure for a minimum of one hour at room temperature.

NOTE: Adhesive must be applied within 16 hours of primer application to achieve maximum adhesion. If primer is exposed beyond 16 hours, surface must be reprepped and reprimed.

ADHESIVE

BEFORE WORKING WITH BODY ADHESIVES, BE SURE TO READ MANUFACTURER'S INSTRUCTIONS AND TAKE ALL NECESSARY SAFETY PRECAUTIONS. SPECIFICALLY, AVOID ALL SKIN CONTACT AND USE ONLY IN WELL VENTILATED AREA.

Use adhesive such as manufactured by Minnesota Mining and Manufacturing, EC-3549 B/A, or equivalent. This is a two-part (base and accelerator) urethane adhesive designed for bonding aluminum, polyester and steel. Adhesive should be used only at room temperature of about 75°F (24°C) as viscosity increases at lower temperatures. Also, if heat dry has been used for primed areas, be sure that panels and frame sections to be bonded are cooled to room temperature before proceeding. Hot surfaces will greatly shorten adhesive work life and lower ultimate bond strength.

It is essential that bonding surfaces be thoroughly clean, dry and grease-free to maintain good adhesion. Also, be sure that all fixtures, clamps, metering devices and safety equipment are at hand before mixing adhesive.

Mix adhesive just prior to application, keeping in mind that adhesive work life is from 15 to 30 minutes (normally closer to 15 minutes). Follow manufacturer's mixing and curing instructions. It is very important that mix be "on ratio" to obtain maximum bond strength.

Using disposable adhesive cartridge and applicator, apply about a 3/8-inch diameter bead to bonding surface (either stationary part or new panel, but not both). Use two beads for wide area. Application with putty knife not recommended. Adhesive must wet total surface area being bonded to assure maximum adhesion.

NOTE: After the new panel has been positioned on the body, it will be necessary to see a "witness bead" of excess adhesive along the edge of the panel. This will assure that adhesive has been properly applied. One 6-oz. cartridge will normally bond about 6-8 lineal feet unless large mismatch of parts requires greater quantity.

FIXTURING

Put replacement panel into position before adhesive cures and press firmly into place by hand. Clean cotton or plastic gloves are recommended to prevent contamination of primed panels and to keep adhesive off the hands.

NOTE: If adhesive gets on gloves, they should be discarded before further handling of panels. Adhesive will definitely leave blemish marks which are difficult to remove from exterior panel surface.

Next, insert pop-rivets where indicated to prevent movement of panel while adhesive is curing. Use closed-end (ie., waterproof) rivets for roof seams. Clamp as practical and necessary.

Look for "witness bead" of excess adhesive around panel edges as assurance that adhesive has completely "wetted" the glue line area. Then, remove excessive squeeze-out on exterior within one hour after application. Use a plastic tool or a wooden tongue depressor for removal. Any excess remaining after this can be wiped off with a clean cloth dampened with white gasoline. (Be sure to use cautions as appropriate for flammable liquids.) It is important that excess adhesive be removed before curing takes place and before pop-rivets or clamps are removed. Discard all partially used containers of mixed primer and adhesive.

CURING

This adhesive must cure for 24 hours at room temperature (65-85°F) (-18-29°C) before any structural work or movement of the vehicle is permitted. This will assure maximum bonding of the adhesive. After 24 hours the rivet heads may be ground off and the holes filled with a body putty. Proceed with final finishing work.

RUB RAIL

1977 and 1978 model vehicles are equipped with a new body rub rail which is installed the length of the vehicle at the belt line.

The rub rail is bonded to the belt rail with double-backed pressure-sensitive adhesive tape. In addition, retaining screws are used at the end of each individual strip of rub rail and at the front and rear side marker lamps to hold the lamps and the rub rail strips securely in place.

Rub rails may be replaced or repaired if necessary. On-vehicle repair may include: (1) application of adhesive to a small area directly behind rub rail where pressure-sensitive tape is not secure, or (2) addition of fasteners to secure a larger piece or pieces of the rub rail which are not adhering to the body. A combination of adhesive and fasteners may be necessary in certain repair situations. If adhesive is required, use GM#1051910 or equivalent. Be sure to follow all manufacturer's safety precautions (included with adhesive package). If additional fasteners are required, use a sheet metal screw to fasten rub rail to belt rail. Use GM#2006755 screw and washer assembly (or equivalent), or a phosphate coated (black) flat or oval-headed self tapping screw. Fasteners should be approximately .75" long.

RUB RAIL REPLACEMENT

If rub rail has been badly damaged and needs replacement, perform the following:

REMOVAL

1. Remove screws from ends of damaged rub rail pieces. If side marker lamp is damaged, remove two screws holding marker lamp to rub rail. Pull lamp forward and disconnect bulb socket from lamp. Take lamp out.
2. With all retaining screws removed, pull rub rail off of vehicle.

INSTALLATION

NOTE: Do not clean surface to be bonded or peel off adhesive tape backing from rub rail until just prior to installation of rub rail. If marker lamp was damaged, install new marker lamp assembly. Connect bulb socket and fasten two retaining screws.

When the bonding operation is to be performed, the rub rail and the bonding surface should be at a temperature of 70 to 90°F (21.1°to 32.2°C). If practical, it is desirable to lay the new rub rail out flat in the same environment as the vehicle for 24 hours prior to installation. This will assure temperature equilibrium between the replacement part and the application area. It will also help to eliminate problems of shrinkage and curling.

Clean the bonding surface on the vehicle thoroughly with isopropyl alcohol or equivalent. Dry the surface with a clean (lint-free) cloth. It is important that bonding surface remain clean and oil-free. Bond will not hold if surface contamination exists.

After cleaning, when ready to install rub rail, peel off backing paper. Line the strip up evenly with one edge of the aluminum belt rail. Do not touch the surface with hands and do not allow the tape backing to come into contact with dirt or foreign matter. Apply rub rail with a uniform pressure of 20 lbs. minimum to seal the adhesive tape to the bonding surface. Secure rub rail pieces with screws where called for.

ENTRANCE DOOR

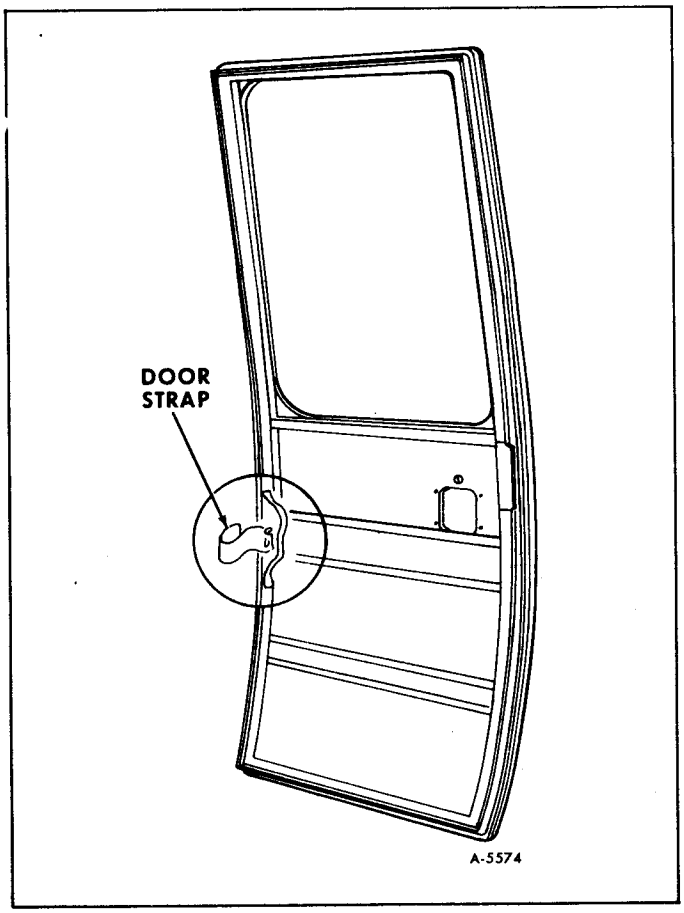


Figure 12—Door Strap

DOOR STRAP

The vehicle entrance door has a check strap (figure 12) to prevent the door from opening out too far and making contact with the body panel. The strap assembly and bracket hardware may be replaced if necessary.

END CAP

NOTE: When installing new or repaired rear access panel, 32 retaining screws are needed. The seven lower screws are self tapping. The remaining 25 screws on the sides and top of the rear access panel are double helix thread ("hi-low") screws. To prevent damage to the threads in the vehicle fiberglass body when hi-low screws are installed, position screw and then turn counterclockwise to engage screw in hole; then rotate screw clockwise to attach rear panel. IMPORTANT: Before screws are installed, sealing is required to prevent water leaks in the vehicle. Using caulking gun or any suitable applicator, apply a small amount of

clear, air-dry rubber-based sealer into the screw holes in the fiberglass body. Sealer can be a butyl-type sealer, an RTV silicone, a windshield repair sealer, or equivalent.

FLOOR

GENERAL INFORMATION

The floor and floor sub-structure in 1977-78 model vehicles have changed. Refer to figure 13 for typical layout. Note that substructure may vary with specific optional equipment.

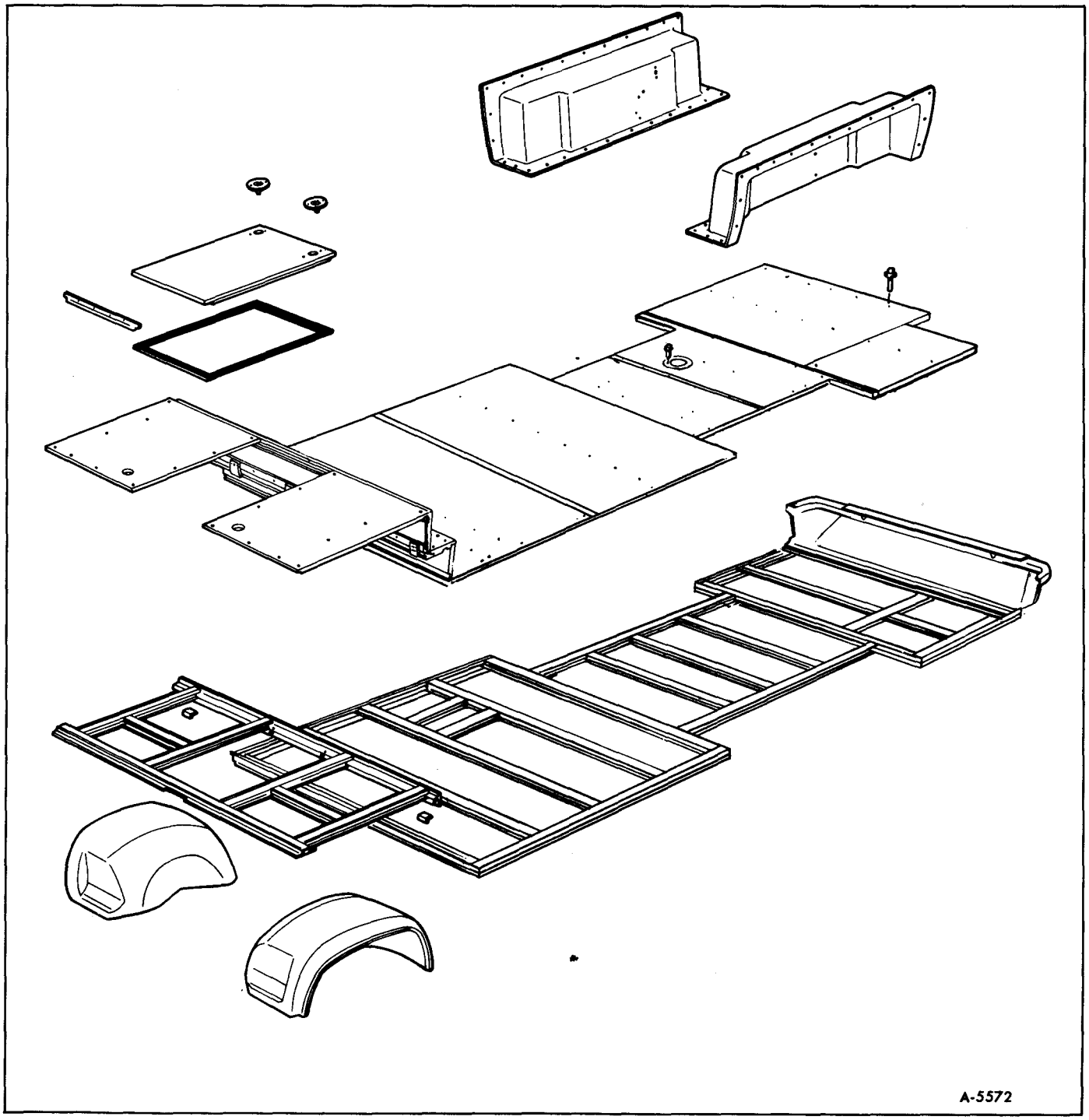


Figure 13—Wheel Housing, Floor and Floor Sub-Structure (Typical)

SECTION 1B
HEATING AND AIR CONDITIONING SYSTEM

CONTENTS

The following "Caution" applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology "See Caution on page two of this section".

CAUTION: THIS FASTENER IS AN IMPORTANT ATTACHING PART IN THAT IT COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. IT MUST BE REPLACED WITH ONE OF THE SAME PART NUMBER OR WITH AN EQUIVALENT PART IF REPLACEMENT BECOMES NECESSARY. DO NOT USE A REPLACEMENT PART OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THIS PART.

SUMMARY OF AIR CONDITIONING/HEATING CHANGES

Changes in the air conditioning/heating system include the following:

1. Increased refrigerant charge capacity—now 3-3/4 lb.
2. New A/C heater control head and new control panel components.
3. New A/C plenum and revised duct system.
4. New vacuum system.
5. Revised heater and evaporator assembly.
6. Baffles added at condenser and heater/evaporator housing.
7. Addition of time delay relay in blower circuit wiring.
8. Externally equalized thermal expansion valve.
9. Smaller diameter high pressure service fitting on late 1977 model vehicles and on all 1978 model vehicles — fitting size is 3/8" - 24.
10. Revised compressor mounting.
11. Inverted vacuum tank mounting.
12. Revised Discharging, Evacuating and Charging Procedures.

These changes have different effective

points during the 1977 model year. All changes are current for 1978 model vehicles. Explanation of these changes will be discussed under the appropriate major category.

DESCRIPTION AND OPERATION

Both the heating and cooling functions are performed by an integrated air conditioning/heating system. Air entering the vehicle interior through the duct system must first pass through the cooling unit (evaporator) and then through or by-passing the heating unit (heater core), depending upon Temperature Lever selection. This system provides complete comfort control during any season of the year.

HEATING AND AIR CONDITIONING CONTROLS

Full control of the heating/air conditioning system is obtained through the use of a single control panel (figure 1). The panel is located in the instrument panel bezel in the upper right hand corner (above the optional radio controls). There are three separate levers on the control panal face: the System Selector Lever, the Temperature Lever, and the Fan Switch (figure 2).

These control levers make use of electrical and vacuum connections and a bowden cable to activate the various doors and switches necessary for system operation.

A brief explanation of the system operation at various lever settings follows.

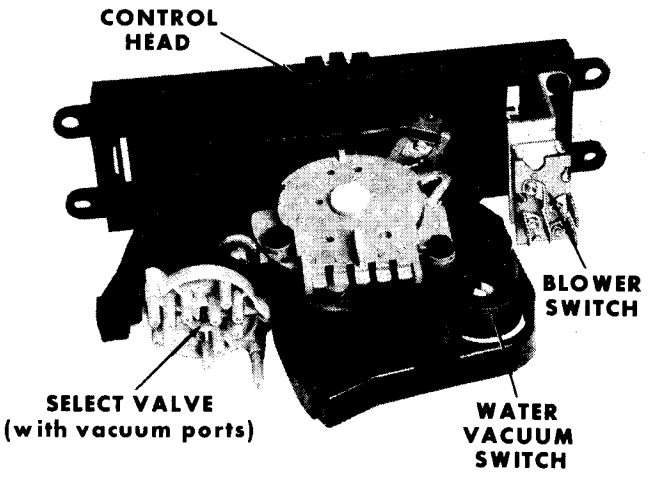


Figure 1—Control Panel Components

SELECTOR LEVER

The system Selector Lever determines the mode of system operation and the direction of outlet air flow inside the vehicle. When the system Selector Lever is placed in MAX, NORM, or DEFROST, electrical circuit connection is made to the compressor clutch through the control panel switch. If the low pressure switch is closed (ambient temperature above 40^{o} to 45^{o}F (4^{o} to 7^{o}C), the compressor will run. When system Selector Lever is in OFF, VENT or HEATER positions, the compressor clutch is not energized.

Moving the lever from mode to mode varies the position of the rotary vacuum valve ("Select" valve) at the back of the control head. This nine-port vacuum valve will supply vacuum to, or vent, vacuum diaphragms which in turn position air doors in the heater/evaporator housing assembly and in the distribution box.

The position of these air doors determines if output air flow is directed from the heater outlet only (OFF), the heater outlet with slight air flow from the defroster nozzles (HEATER), the air conditioning registers only (MAX or NORM), the air conditioning registers with slight air flow from the heat outlet (VENT), or defrost nozzles with slight air flow from the heat outlet (DEFROST). Typical air flow patterns for specific control panel settings will be discussed later in this section.

The Selector Lever also provides a fixed HI fan speed and air recirculation operation for maximum cooling whenever MAX position is selected. There are no bowden cables connected to this lever.

TEMPERATURE LEVER

The Temperature Lever ("COLD" to "HOT")

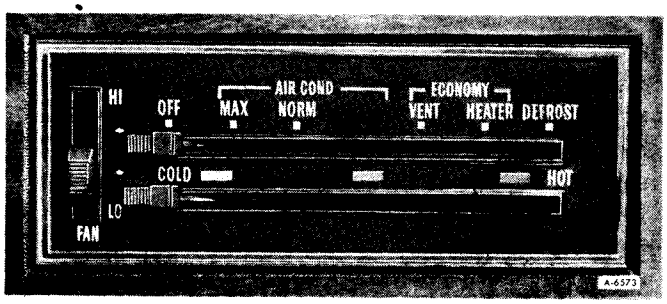
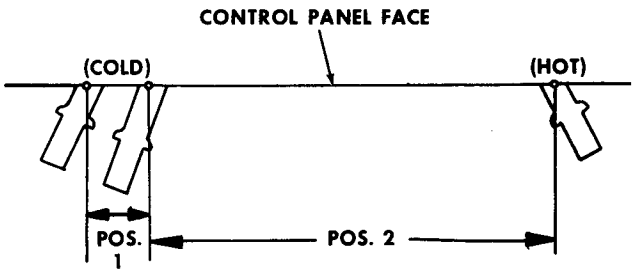


Figure 2—Control Panel Face



POSITION 1 OF TEMPERATURE LEVER: SUPPLIES VACUUM TO WATER VACUUM VALVE, BLOCKING PASSAGE OF WATER TO HEATER CORE.

POSITION 2 OF TEMPERATURE LEVER: VENTS WATER VACUUM VALVE, ALLOWING WATER TO FLOW FREELY THROUGH THE HEATER CORE.

A-6574

Figure 3—Temperature Lever Positions

(see figure 2) determines the temperature of outlet air flow from the system by positioning the temperature door in the heater/evaporator assembly. This movement is accomplished mechanically by means of a bowden cable. When the Temperature Lever is positioned fully to the left ("COLD"), the temperature door is fully closed and prevents air flow through the heater core. When the Temperature Lever is positioned midway in its range of travel, the temperature door is moved in proportion to allow more outside air to flow through the heater core and be warmed. When the Temperature Lever is positioned fully to the right ("HOT"), the temperature door is fully open and directs all outside air through the heater core.

The Temperature Lever also operates the water vacuum valve located in the heater water inlet line, at the heater/evaporator face panel. When the Temperature Lever is in Position 1, or"COLD" (figure 3), vacuum is supplied to the water vacuum valve, cutting off the flow of hot water through the heater core. Position 2 of the Temperature lever vents the water valve, allowing water to circulate freely through the core.

FAN SWITCH

The four-speed Fan Switch provides a means of selecting the amount of air flow from the system by regulating the speed of the blower motor. The blower operates at LO, two intermediate speeds, or HI, depending upon the setting of the Fan Switch lever. To provide constant ventilation in the vehicle, the blower motor electrical circuit is designed for continuous blower operation whenever the ignition switch is in the "RUN" position. It is not recommended that this system be rewired to provide an OFF position for the Fan Switch.

An electrical "override" to the Fan Switch is provided through the A/C control panel whenever the Selector Lever is in MAX position. This position automatically provides a "HI" blower speed, regardless of Fan Switch setting.

AIR CONDITIONING CYCLE OF OPERATION

Motorhome and TransMode vehicles operate with a cycling clutch thermostatic expansion valve (CCTXV) air conditioning refrigerant control system. The CCTXV system cycles "on and off" to maintain the evaporator core at approximately 32°F (0°C). Cooling is accomplished by circulating a refrigerant through closed lines and components of the system. Five major components, interconnected by rubber hose and metal tubing, are involved — (1) the compressor; (2) condenser; (3) receiver-dehydrator; (4) thermostatic expansion valve; and (5) evaporator core. Refer to figure 4 for a general schematic of the refrigeration system showing relationship of components on Motorhome and TransMode air conditioning/heating systems. Figure 5 shows location of air conditioning refrigerant system components on the vehicle itself.

Explanation of the basic refrigeration cycle is as follows: Refrigerant enters a finned coil core, over which the air to be cooled passes. This is known as the "evaporator". When warm air is blown over the evaporator surface, heat from the air is absorbed by the refrigerant inside, cooling the air and causing the refrigerant to boil and vaporize.

By the time the refrigerant leaves the evaporator, much of it has vaporized (through the process of boiling) and its temperature has warmed slightly.

Once the vapor is out of the evaporator, all that is needed is to 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 the liquid refrigerant can be returned to the evaporator to be used over again.

Actually, the vapor coming out of the evaporator is very cold. Liquid refrigerant boils at temperatures considerably below freezing, and the vapors arising from it are only a shade warmer even though they do contain quantities of heat. Consequently, heat cannot be re-

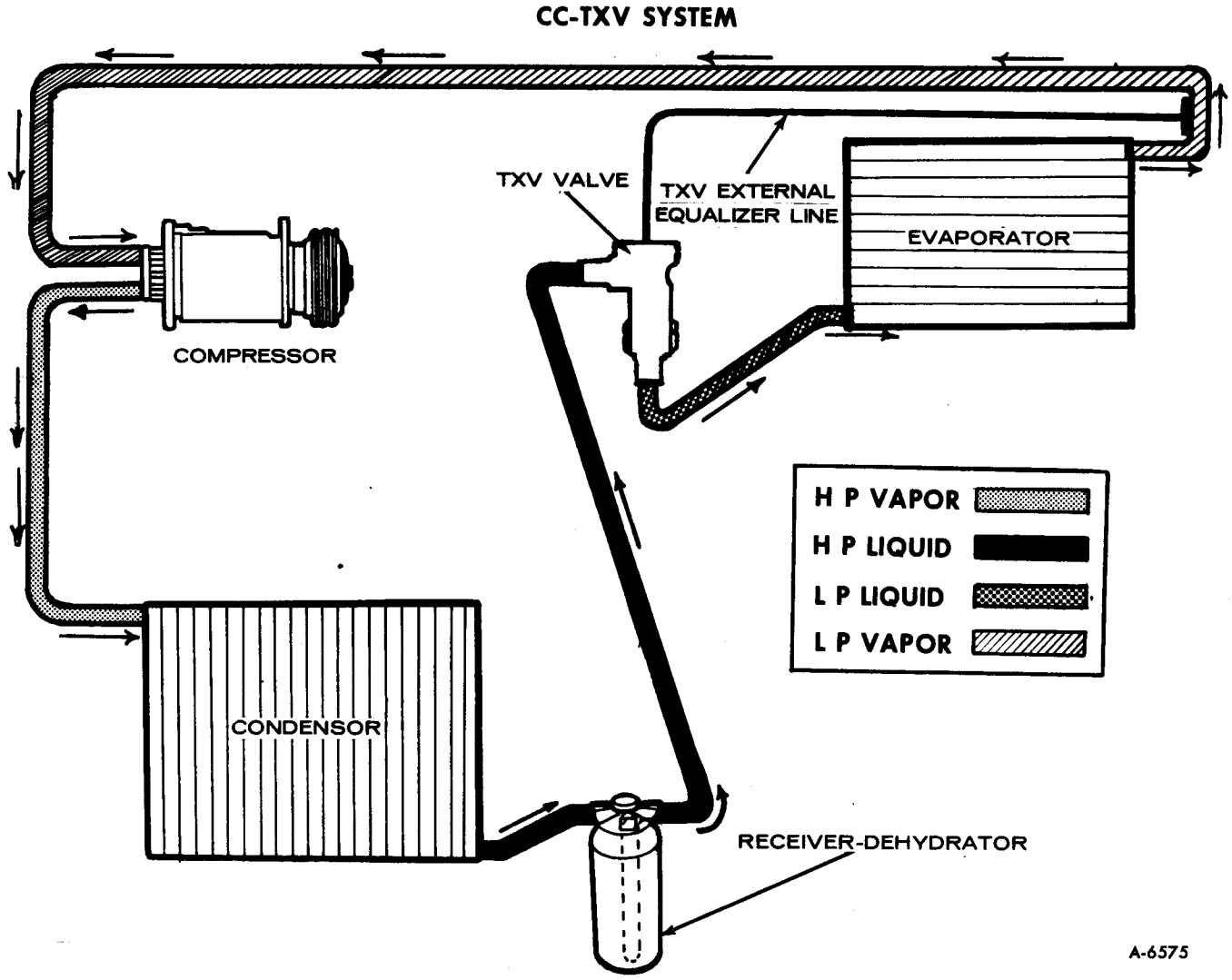


Figure 4—Refrigeration System Schematic

moved from sub-freezing vapors by "cooling" them in air temperatures that usually range from 60-100°F (15-38°C). . . . heat only flows from a warm object to a cold object.

But with a pump, the heat-laden, low-pressure vapor can be squeezed into a smaller space. And when the vapor is compressed, it becomes hotter. This is the job of the compressor. The heat-laden refrigerant is drawn from the evaporator outlet through the "suction" line into the compressor, where it is subjected to compression. Now this vapor is hot enough to be cooled off in warm air. At the same time, the refrigerant's pressure is raised above the condensing point at the temperature of the surrounding air so that it will condense.

Then, refrigerant vapor that has been compressed is pumped at high pressure through the compressor discharge line to the condenser. The condenser is a radiator-like component with no moving parts. The purpose of the condenser, as the name implies, is to condense

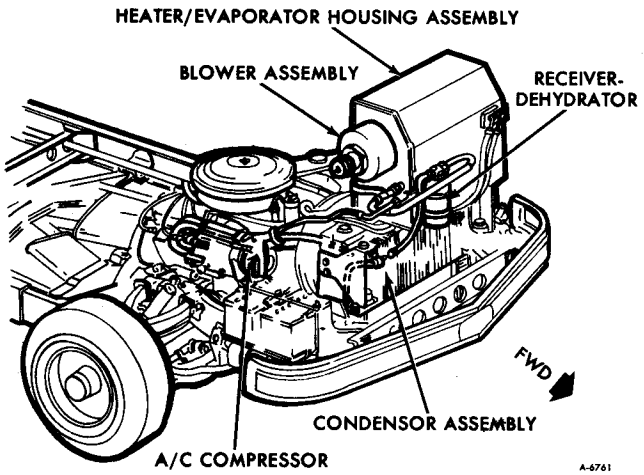


Figure 5—Location of Air Conditioning Refrigeration System Components, Typical

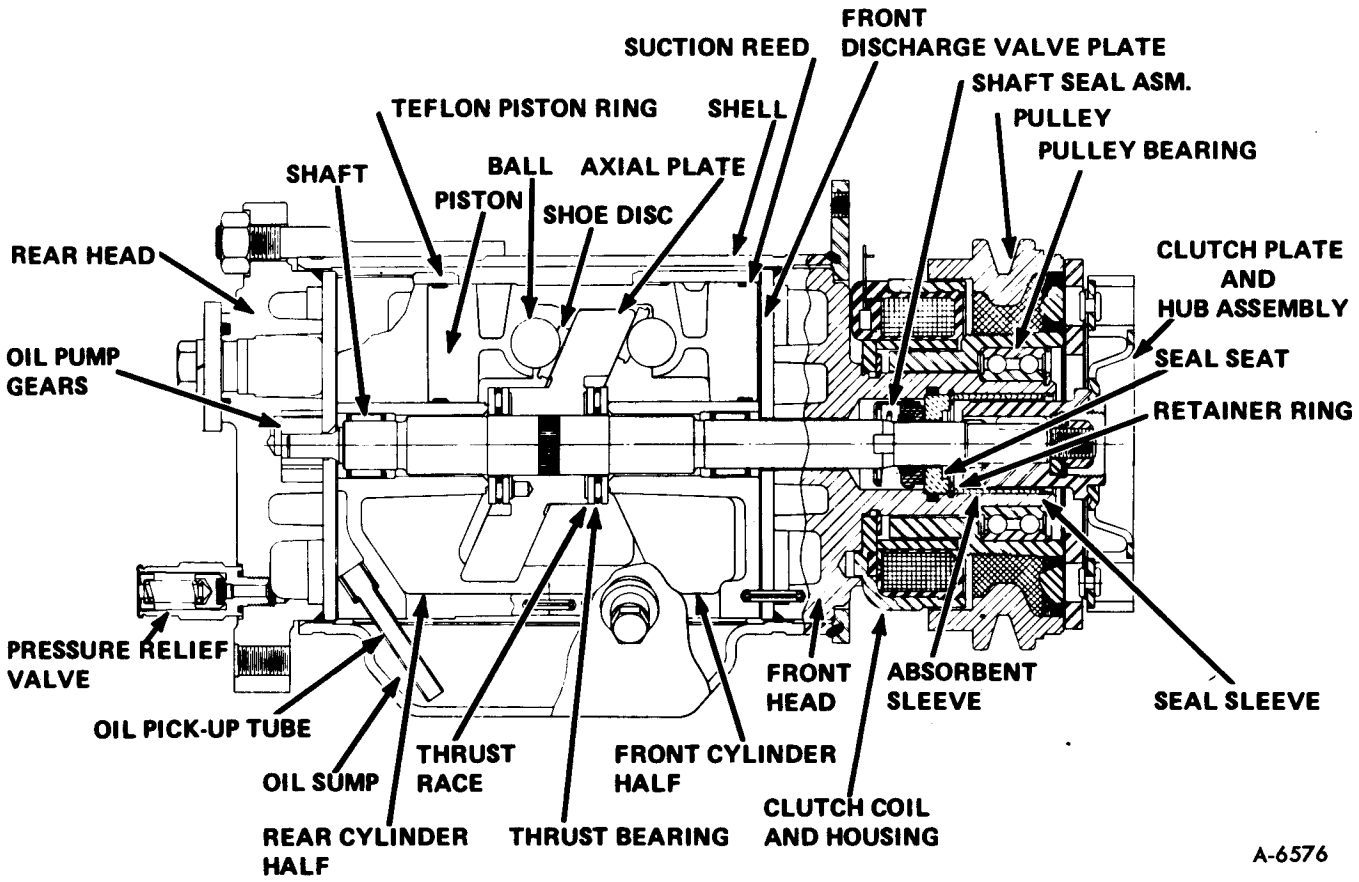


Figure 6—Compressor Cross-Sectional View

the high-presure, high-temperature refrigerant vapor into a high-pressure liquid refrigerant. This happens as the refrigerant passes through the condenser, giving up much of its heat to the air going across the metal surfaces of the condenser.

The liquid refrigerant, which is still under high pressure, travels from the condenser outlet to the receiver-dehydrator. The receiver-dehydrator acts as a reservoir, assuring a constant column of liquid refrigerant to the thermostatic expansion valve, which is installed in the refrigerant line at the evaporator inlet.

The expansion valve meters the liquid refrigerant into the evaporator as required by the evaporator outlet temperature and pressure. During normal operation the refrigerant enters the expansion valve as a medium-temperature, high-pressure liquid. As it passes through the valve orifice it becomes a low-pressure, low-temperature liquid. The liquid refrigerant in the evaporator boils (vaporizes) and the cycle is repeated.

CYCLING CLUTCH

The refrigerant cycle, however, is not constant. When the evaporator temperature drops below a specified value, a temperature sensing switch cycles the compressor on and off to prevent condensate from freezing on the evaporator core. This cycling helps to control the temperature of air flowing from the evaporator as well as insuring maximum air flow through the core. This basic principle is known as the cycling clutch. In the cycling clutch thermostatic expansion valve system (CCTXV), the compressor pumps refrigerant through the system only as long as necessary to maintain the comfort level as selected by the setting of the temperature lever on the A/C control panel.

During some air conditioning operating conditions, slight increases and decreases of engine speed/power may be noticed. This should be considered normal, as the system is designed to cycle on and off.

When the ignition switch is turned "OFF" with the air conditioning controls still "ON", refrigerant pressures in the air conditioning system will stabilize as the refrigerant flows from the high pressure side of the system to the low pressure side of the system. This may be detected audibly as a faint sound of liquid flowing for 30 to 60 seconds, and is a normal condition.

REFRIGERATION AND HEATING COMPONENT OPERATION

COMPRESSOR

The prime purpose of the compressor (figure 6) 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". 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 code number stamped on a plate on top of the compressor.

Clutch and Pulley Assembly

The armature plate is the movable member of the clutch. The plate is attached to a driven ring by driver springs, which are riveted to the armature plate and the driven ring. The driven ring is attached to the clutch hub by a rubber disc, which is bonded to both the driven ring and the clutch hub. The clutch hub is pressed onto the compressor shaft and is aligned with a square drive key located in the keyway of the compressor shaft. This hub and drive plate assembly is retained by a spacer and retainer ring (assembled to the shaft) and is held in place with a hexagonal lock nut.

The rubber disc isolates the compressor shaft from the drive pulley to prevent vibrations from being transmitted either into or out of the compressor shaft.

The pulley hub and ring assembly consists of three parts:

1. Pulley rim, which contains the belt groove.
2. Power element ring.
3. Pulley hub.

These parts are formed into an assembly by molding a frictional material between the hub and the rim. The power element ring is embedded in the forward face of the assembly, between the outer rim and the inner hub.

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

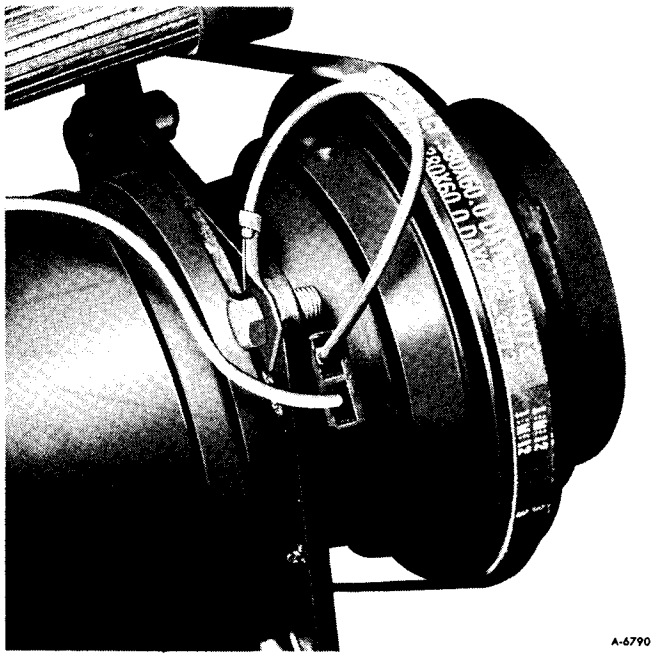


Figure 7—Compressor Clutch Electrical Connections

Clutch Coil

The coil is molded into the coil housing 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 (27°C) ambient temperature and will require no more than 3.2 amperes at 12 volts DC. Since the clutch coil is not grounded internally, a ground lead is required as well as a "hot" lead (figure 7). This will be discussed in greater detail under "Electrical Component Operation" later 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 carbon seal face in a spring loaded cage. An O-ring seal, located within the carbon seal, provides a seal to the shaft surface. The contact surface of the shaft seal and ceramic seal seat are 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 felt sleeve and sleeve retainer must be removed to gain access to the seal. A shaft seal kit contains all necessary replacement parts for

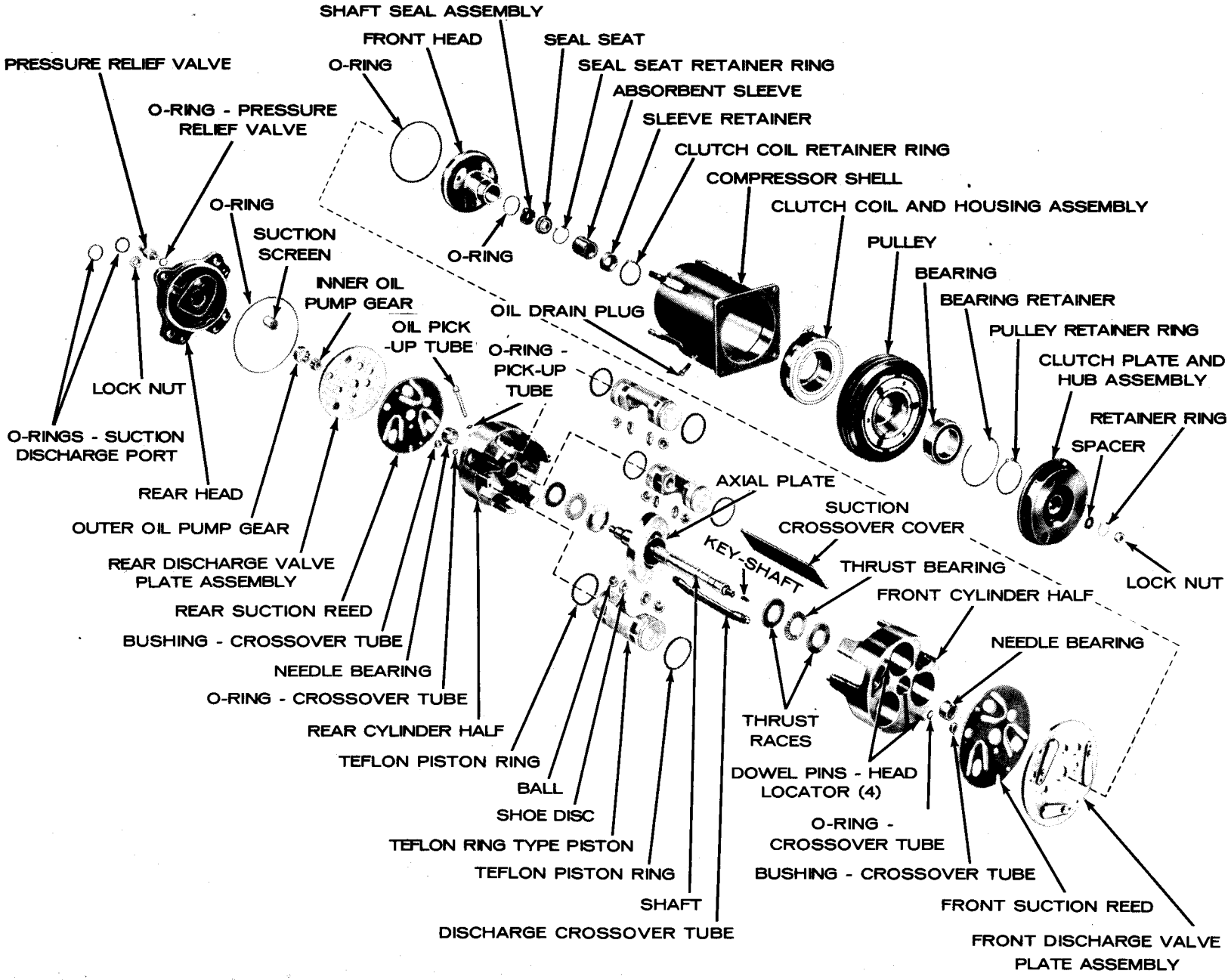


Figure 8—Compressor Components

field service.

After removing the clutch drive, pulley and bearing and coil housing assemblies, the rear head and internal mechanism (figure 6) 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 8) has a machined cavity in the center for the oil pump gears. This cavity, in all clockwise rotation 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 .187" diameter hole is drilled in the rear head near the lower left mounting hole.

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. A 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^{0} 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 axial plate assembly (figure 8). Knurling on the shaft and press fit of the axial plate to the shaft prevent 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. The shaft bearings are included and in place in the service assembly.

Pistons

The cast aluminum double end pistons (figure 8) 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 .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.

Thrust Bearings

The thrust bearings, sandwiched between two thrust races, 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 16 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 "ZERO" race, bearing and "ZERO" race is selected to provide the proper head clearance between the top of the piston and the underside of the suction and discharge valve plates. The REAR end combination of "ZERO" thrust race, bearing and selected race is selected to obtain proper operating preload of the bearings and races for quiet operation of the compressor assembly (figure 9).

Oil Pump Gears

The oil pump gears are made of sintered

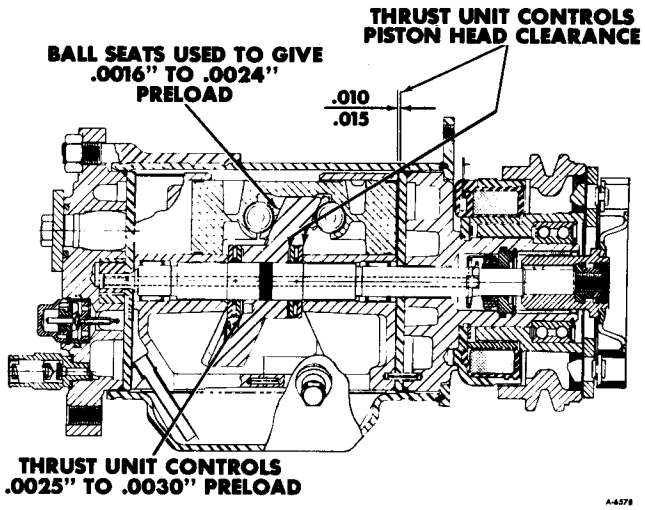


Figure 9—General Running Tolerances

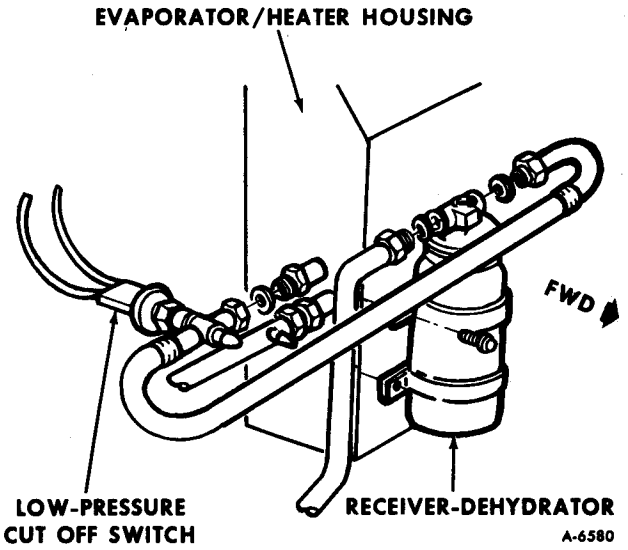


Figure 11—Receiver-Dehydrator Location

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. Both gears have a mark on one side for proper gear match identity.

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 Crossover Cover

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

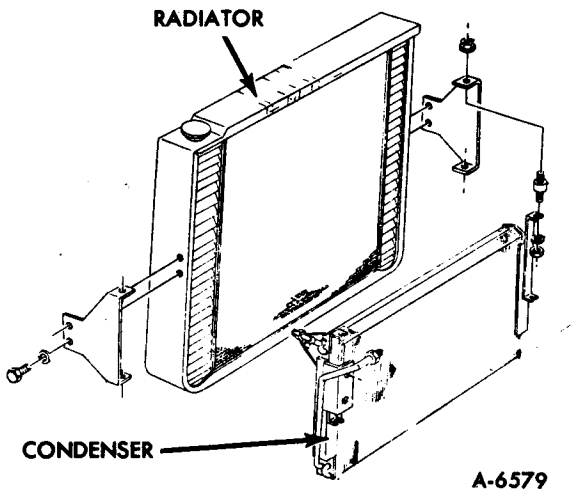


Figure 10—Condenser Location

Discharge Crossover Tube

Since the double acting pistons pump 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 side of 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, and the inside surface of the compressor 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 diagnose and correct the cause of the abnormal pressure increase.

CONDENSER

The condenser (figure 10) is an assembly similar in appearance to the ordinary radiator but able to withstand much higher pressures.

Made completely of aluminum, this unit consists of serpentine tubes assembled into cooling fins which provide rapid transfer of heat from the refrigerant to the air flowing through the condenser.

In this refrigerant system the condenser connects between the discharge side of the compressor and the inlet side of the receiver-dehydrator.

The condenser functions as follows: High-pressure high-temperature vapor is pumped from the compressor to the condenser. The heated vapor which enters near the top of the condenser is cooled by giving off heat to the metal finned surfaces of the condenser. The heat is then extracted from these metal surfaces by the ram air or fan air passing over the condenser. Meanwhile, as the refrigerant vapor gives up its heat to the condenser surfaces, it condenses into a liquid.

Refrigerant temperatures found in the condenser normally range from 120-200°F (49 to 93°C), while pressures are normally between 150 and 300 psi.

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.

RECEIVER-DEHYDRATOR

The receiver-dehydrator (figure 11) receives liquid refrigerant (and some refrigerant vapor) from the condenser, and removes any moisture present in the refrigerant. This moisture removal is accomplished by means of a chemical compound called a desiccant. The desiccant is held in place in a felt bag in the receiver-dehydrator. Average receiver-dehydrator desiccants collect and hold about 50 drops of water.

The receiver-dehydrator 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 mounted on the end of the liquid pick-up tube.

In addition to moisture removal, the receiver-dehydrator acts as a reservoir to furnish a constant column of liquid refrigerant to the expansion valve. Since the liquid refrigerant entering the receiver may have some vapor in it, the tank itself acts as a separator. Vapor 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 vapor free liquid R-12 to the expansion valve. Storage of the refrigerant is temporary, and is dependent upon the demand placed upon it by the expansion valve.

Located between the condenser outlet and the evaporator inlet, the receiver-dehydrator is not servicable. It should be replaced when there has been a leak in the suction side of the system (permitting air and moisture to be drawn into the system) or when at any time, evidence of "free moisture" is noted in the system. This would be evident from corrosion or corroded particles noted during service.

Sight Glass

There is a sight glass built into the receiver-dehydrator (figure 12). This glass can be a valuable aid in diagnosis by permitting the refrigerant to be observed. The appearance of

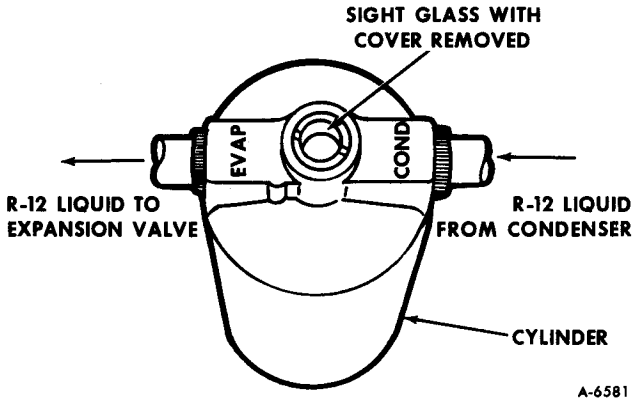


Figure 12—Sight Glass

a steady flow of bubbles, or a broken column of refrigerant under the glass indicates (under certain conditions) a shortage of refrigerant in the system.

The receiver-dehydrator sight glass has a dust cap that should be kept in place when the sight glass is not in use.

For further information regarding diagnosis with use of sight glass, refer to "Air Conditioning Diagnosis" later in this section.

EVAPORATOR (FIGURE 13)

The function of the evaporator is to cool and dehumidify the air before it enters the passenger compartment. The evaporator assembly consists of an aluminum core enclosed in sheet metal housing and is located at the front of the vehicle chassis. There are two water drain holes located in the bottom of the housing, and two refrigerant lines are connected to the evaporator core: the small inlet line and the larger outlet, or suction line. A thermostatic expansion valve is attached in

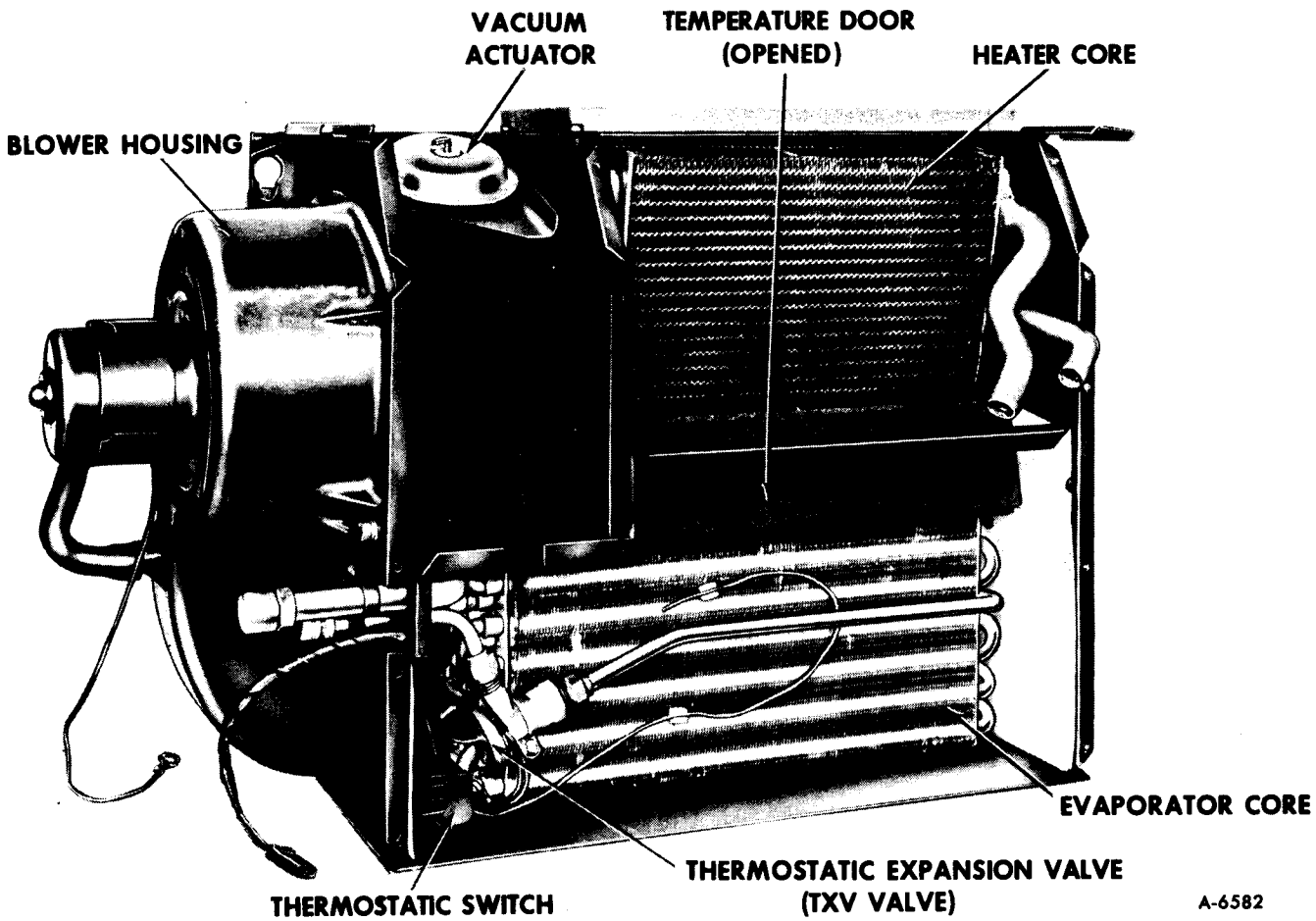


Figure 13—Evaporator Housing Components

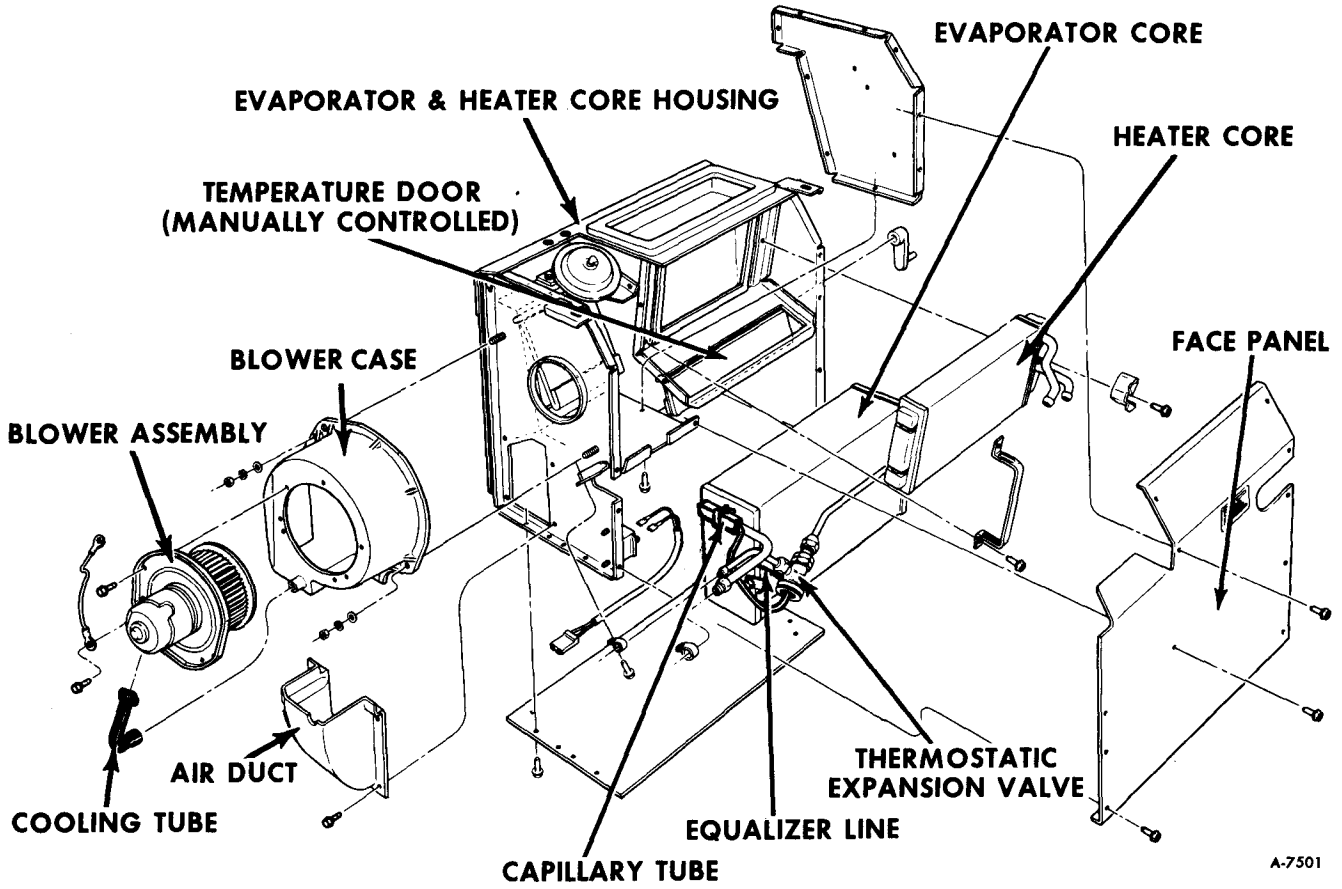


Figure 14—Evaporator and Heater Housing Components, Typical

the smaller diameter inlet line, and the temperature-sensing bulb of this valve is clamped to the outlet pipe of the evaporator core (refer to figure 14).

The refrigerant cycle in the evaporator is as follows: High pressure liquid refrigerant is metered through the expansion valve, where it expands to a low-pressure liquid and flows into the evaporator core. As the refrigerant absorbs heat from the air that passes over the evaporator fins, the liquid boils (vaporizes) at this low pressure into low-pressure low-temperature refrigerant. Air passing over the evaporator fins is then cooled, providing cool air for the passenger compartment. If heat is called for by the A/C control head, this air will be "reheated" by passing through the heater core.

As the air passes over the evaporator fins moisture in the air condenses on the evaporator surface and is drained off, carrying dust and pollen with it.

Evaporator temperature must be controlled so that the water collecting on the core surface will not freeze and form ice, blocking off air passage through the core. Freeze protection control on Motorhome and TransMode evaporators is provided by a cycling thermostatic switch. (See "Thermostatic Switch" for description of function.)

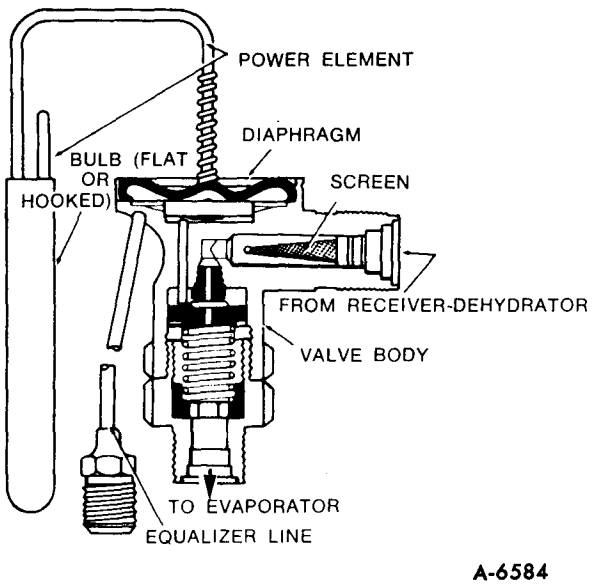


Figure 15—Expansion Valve Cross Section

Evaporator air temperature will vary from approximately 40°F (4°C) to approximately 55°F (13°C).

THERMOSTATIC EXPANSION VALVE (REFER TO FIGURE 15)

The thermostatic expansion valve is located just inside the heater/evaporator housing (passenger side) and is connected to the refrigerant inlet line (see figure 13). The purpose of this valve is to meter the liquid refrigerant into the evaporator core. The expansion valve is the dividing point in the system between high and low pressure liquid refrigerant. The valve consists primarily of a valve body (including orifice, valve, operating pins, spring and screen) and a power element (diaphragm, capillary tube and bulb).

All vehicles now have an externally equalized expansion valve — that is, the valve has an additional equalizer line connected to the evaporator discharge line. The equalizer line is used primarily to prevent prolonged or constant operation of the compressor under conditions where it is not receiving enough refrigerant. Such operation would be undesirable due to the resultant noise factor and also due to the possiblity of subjecting the compressor to reduced oil return. The equalizer line functions to permit the outlet pressure of the evaporator to be imposed on the diaphragm of the expansion valve. When the outlet pressure of the evaporator drops below a predetermined pressure, this decrease in pressure is also transmitted to the diaphragm of the expansion valve via the equalizer line. The expansion valve is caused to open and flood refrigerant through the evaporator, thereby resulting in an increase in the evaporator pressure. This action only occurs during times when the compressor capacity becomes greater than the evaporator output with the resultant drop in evaporator outlet pressure.

During normal operation, refrigerant enters the expansion valve as a medium-temperature, high-pressure liquid from the receiver-dehydrator. As it passes through the valve orifice, it becomes a low-temperature, low-pressure liquid. As the liquid absorbs heat, vapor is formed. By the time the vapor leaves the evaporator, its temperature has increased several degrees higher than that of the liquid from which it was produced.

The quantity of liquid leaving the expansion valve (i.e., into the evaporator core) is controlled by both the temperature of the power element bulb and the pressure of the liquid in the evaporator.

NOTE: It is very important that the power element capillary bulb be tightly clamped (full length of bulb) to the suction line at the evaporator. Both the suction line and the capillary bulb should be clean at the points of contact. Do not kink capillary tube when removing or installing.

The expansion valve is factory adjusted to control the refrigerant liquid level going into the evaporator. The only component of the valve that may be replaced is the screen, which can become plugged if any dirt or corrosion particles are circulating in the system.

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 (60°C) at which time fan speed will be allowed to increase to 3200 rpm.

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

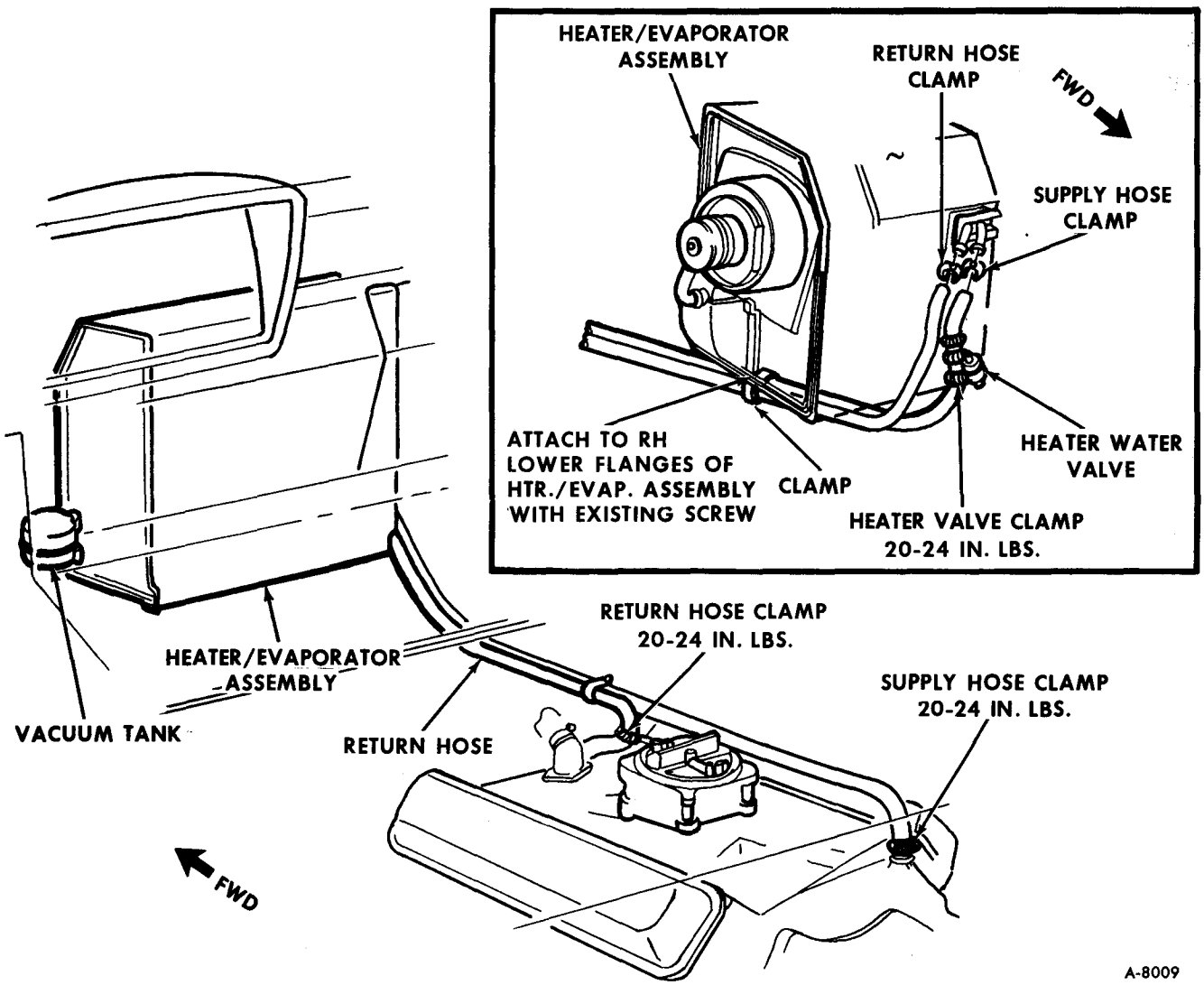


Figure 16—Heater Hoses

hose is 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 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. Consult the torque chart for refrigerant line connection torques.

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.

HEATER HOSES

Heater hoses are routed from the water pump and thermostat housing to the heater core inlet and outlet pipes (figure 16) and return to the engine block. Hoses are attached at each end with screw-type clamps.

ELECTRICAL COMPONENT OPERATION

COMPRESSOR CLUTCH ASSEMBLY

The clutch assembly (refer to figure 6) consists of the coil, pulley and armature. The

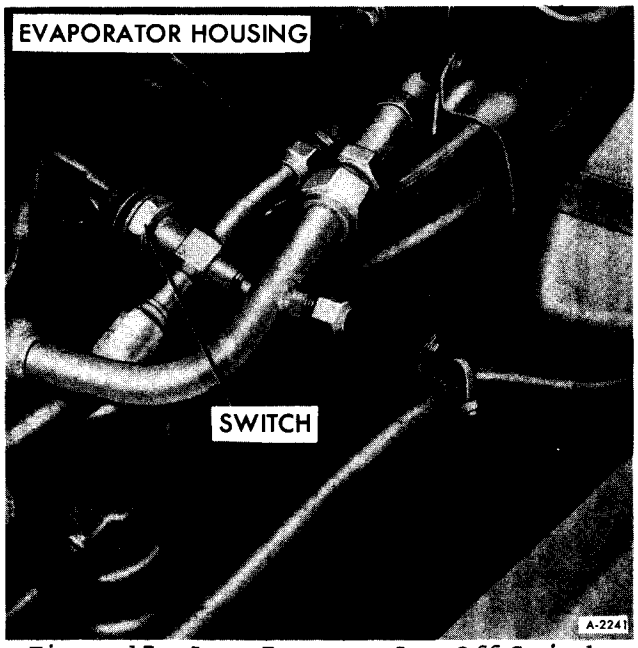


Figure 17—Low-Pressure Cut-Off Switch

coil is basically an electro-magnetic device energized 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.

LOW-PRESSURE CUT-OFF SWITCH

The compressor discharge pressure switch, or low-pressure cut-off switch (figure 17) performs the function of shutting off the compressor when it senses low refrigerant pressure. Located in the evaporator inlet line (high pressure line), the switch electrically is wired in series between the compressor clutch, the thermostatic switch, and the master switch on the air conditioning control panel. When the pressure drops below 37 psi, the switch breaks contact and opens the electrical circuit to the compressor clutch, thus shutting off the A/C system and preventing compressor failure or seizure. The switch should normally be closed at all pressures above 37 psi (+5, -0).

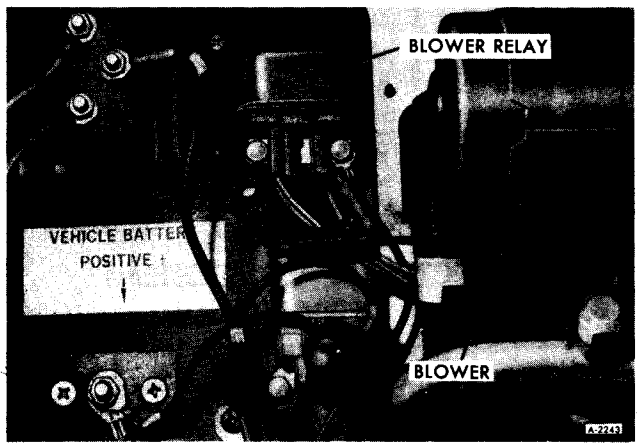


Figure 18—Blower Relay

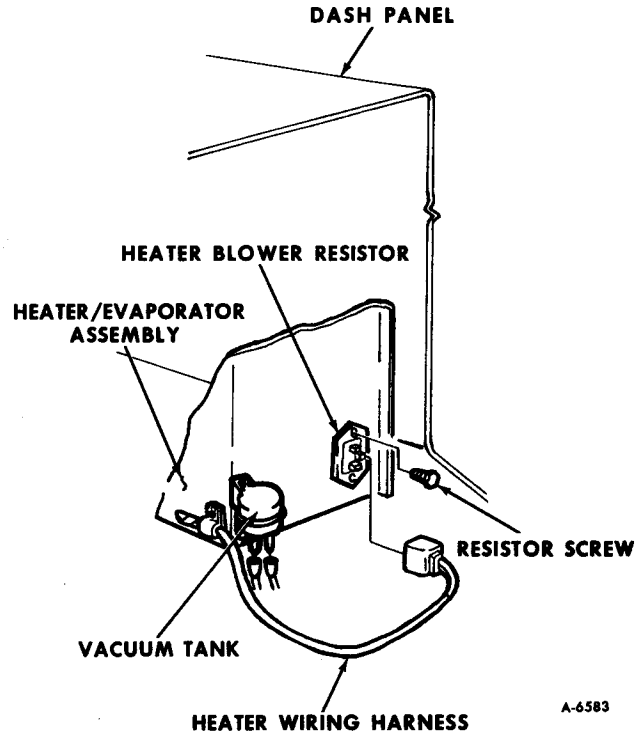


Figure 19—Blower Resistor

The switch also performs the function of the ambient switch or outside air temperature sensor, as the pressure of the refrigerant at the switch varies directly with ambient temperatures. When the outside air temperature drops below 25°F (-4°C), the reduced system pressure keeps the compressor turned off.

In A/C modes, the air conditioning compressor should run above 45°F (7°C) ambient or approximately 42 psi at the switch.

The switch interacts with other electrical switches in the refrigeration system electrical system; in an A/C system where the compressor will not operate above 45°F (7°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 switches show proper continuity, check the wiring harness for loose, open or improper ground conditions.

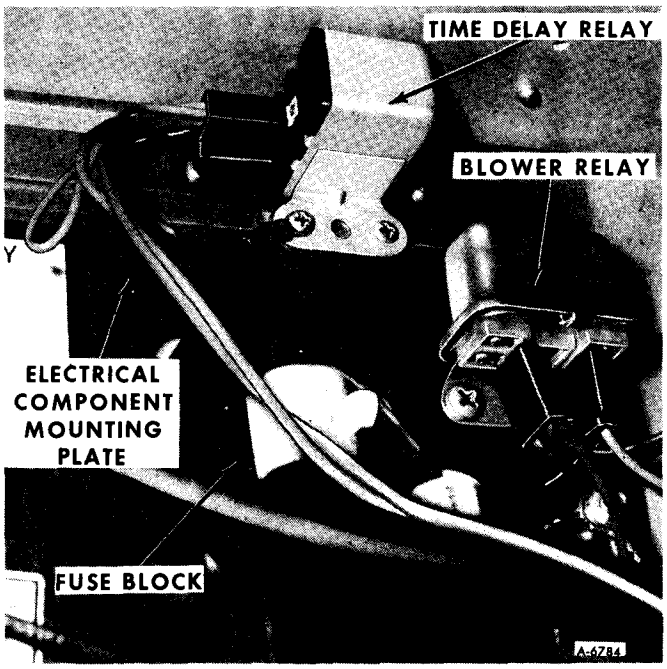


Figure 20—Time Delay Relay

THERMOSTATIC SWITCH

The thermostatic switch (refer to figure 13), mounted inside the evaporator/heater housing (blower side), is basically a bimetal switch whose function in the system is to cycle the compressor on and off. Need for cycling is determined by evaporator core temperature.

The thermostatic switch is controlled by a temperature sensing capillary tube (see figure 14) mounted across the face of the evaporator core. As the discharge air cools the sensing tube, the bimetal switch breaks the compressor clutch electrical circuit and cycles the compressor off until the sensing tube becomes warm enough to cycle the compressor back on.

If the thermostatic switch does not cycle

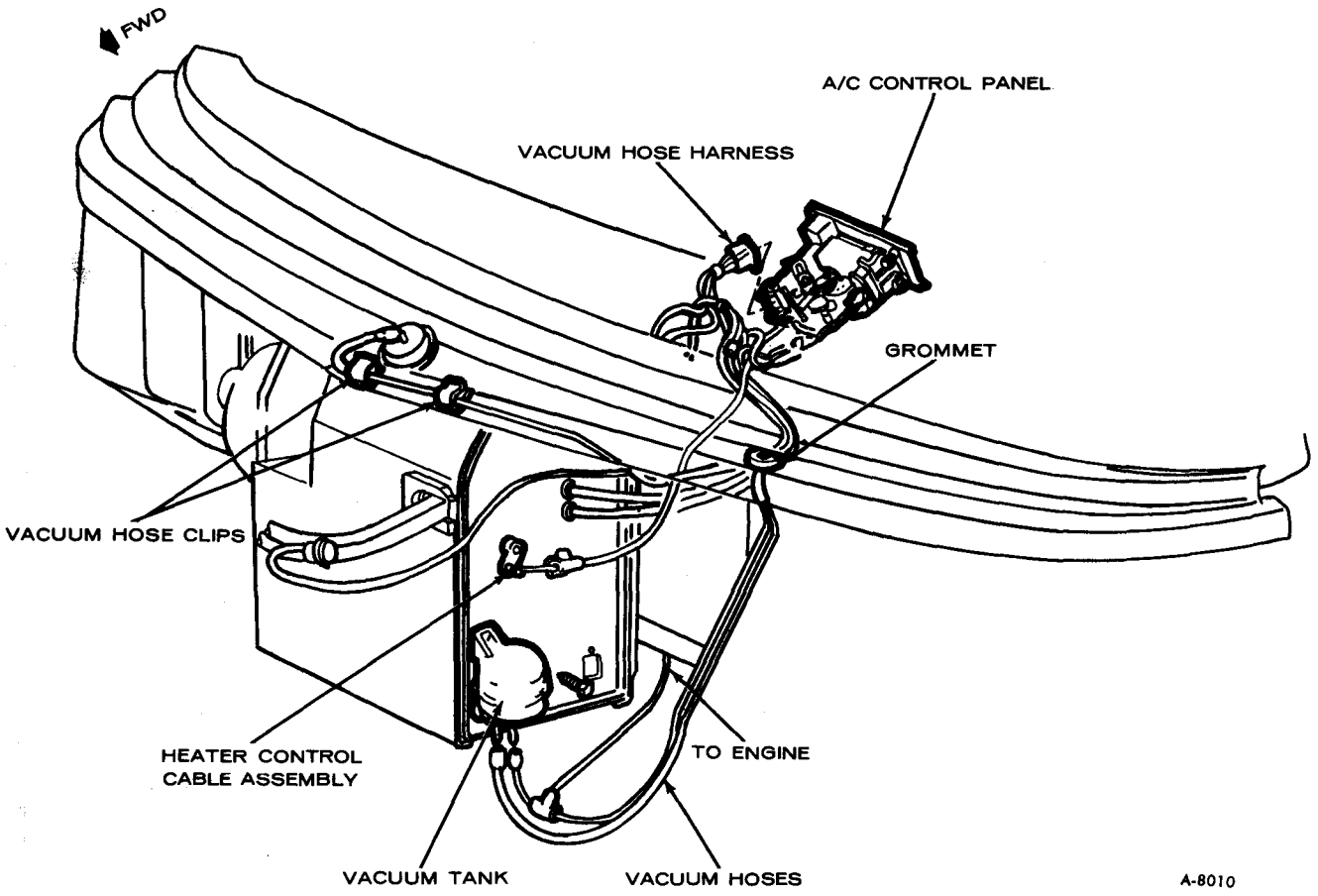


Figure 21—Vacuum Tank and Vacuum Harness

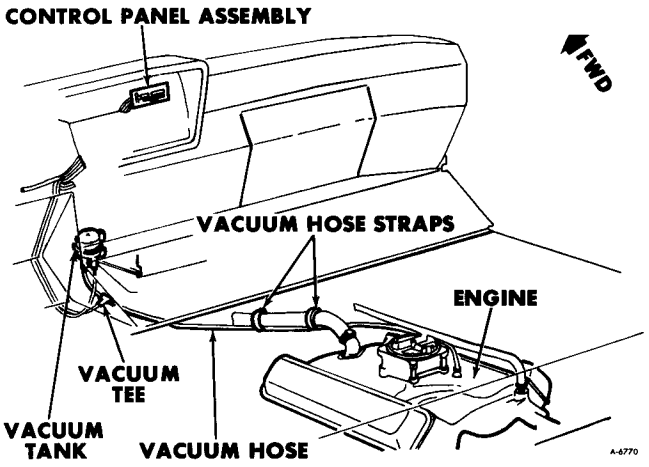


Figure 22—A/C Vacuum Hose to Engine

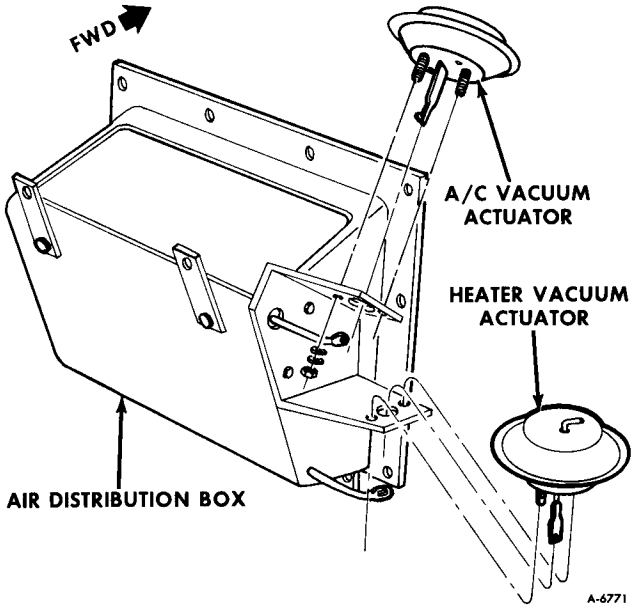


Figure 23—Vacuum Actuator Assembly, Typical

the compressor off when the low limit of evaporator outlet temperature is reached, the switch points are fused. This will lead to evaporator freeze-up unless the switch is replaced.

BLOWER RELAY

A single-pole, double-throw relay is used to supply power to the blower. The relay provides the proper connections for the low and two medium speeds through the resistor assembly, and direct battery current to the blower for "HI" speed.

The blower relay (figure 18) is located in the engine compartment on the vehicle firewall (under the passenger side access door).

BLOWER SWITCH

The four-speed blower switch, located on the air conditioning control head in the instrument panel (refer to figure 1) regulates LO, two medium, and a HI blower speed through a resistor system.

BLOWER RESISTOR

The blower resistor (refer to figure 19) on the driver side of the evaporator housing regulates the amount of electrical current fed to the blower, thereby regulating blower speed. This resistor assembly is by-passed during "HI" speed blower operation, thus allowing full battery current to reach the blower for maximum air speed delivery.

TIME DELAY RELAY

The time delay relay is wired in series between the blower relay and the blower switch. This relay provides a 3-5 second delay of blower motor operation whenever the blower is switched into "HI", assuring maximal operation of the heater door in the air conditioning distribution box.

The time delay relay (figure 20) is located in the engine compartment on the vehicle firewall (under the passenger side access door).

VACUUM COMPONENT OPERATION

The heating/air conditioning vacuum system consists of three basic components:

1. Vacuum control valves located on the A/C control head.

2. Vacuum tank and vacuum feed circuit.

3. Vacuum actuators (also called modes, or diaphragms).

VACUUM CONTROL VALVES

The vacuum control valves on the air conditioning control panel include the select valve and the water vacuum switch (refer to figure 1).

The select valve, located at the forward edge of the control head, is a nine-port rotary valve which either interconnects or vents the vacuum hoses attached to it, positioning air doors in the heater/evaporator assembly and the air distribution box. Refer to figures 24 through 41 later in this section for select valve connections and specific vacuum circuit operation.

The water vacuum switch, also located at the forward edge of the control panel, is controlled by the Temperature Lever on the A/C control panel. This switch supplies vacuum to, or vents, the water vacuum valve located in the heater core inlet line. Vacuum at the heater water vacuum valve causes this valve to block the flow of water to the core. When the switch at the control panel vents the vacuum valve, water flows freely through the core, allowing air that passes through the core to be heated.

VACUUM TANK AND VACUUM FEED CIRCUIT

The vacuum tank (figure 21) is simply a reservoir of vacuum to be used when engine vacuum drops too low to effectively actuate the vacuum components. Vacuum is supplied to the vacuum system through a 1/8-inch hose connected to the air intake manifold at the engine. The hose is routed from the engine to a tee located at the vacuum tank (figure 22). One leg of the tee supplies vacuum to the vacuum tank mounted on the driver side of the evaporator/heater housing, which in turn connects to the vacuum control switch at the A/C control panel. The control panel is the control center for directing vacuum through vacuum lines to the different actuators, to achieve correct air door positions in the distribution box.

VACUUM ACTUATORS (FIGURE 23)

Vacuum actuators are diaphragm switches which open and close the various doors in the air distribution box and the heater/evaporator assembly, allowing for "Heat", "Air Conditioning", "Defrost" and "Vent" conditions as shown on the control panel face.

There are four vacuum actuators, plus a water vacuum valve in the heater core inlet line. The "Recirc" actuator (to allow for recirculated air) and the "A/C" actuator are single-ported vacuum diaphragms which position the Recirc door in the evaporator/heater housing and the A/C door in the air distribution box, respectively. Both the Recir door and the A/C door have two positions — open, and closed. The "Defrost" actuator is a two-ported vacuum switch with an external locator spring. This actuator positions the Defrost door in the distribution box, locating it in one of three positions — closed, 1/4-inch open, or fully open. The "Heater" actuator is a two-ported, "push-pull" vacuum diaphragm with a restrictor in the upper port vacuum line. This actuator positions the heat door in the distribution box, locating it in a closed, 1/4-inch open or fully open position. The porous delay plug in the upper port line (green stripped vacuum line) slows the opening of the heat door by approximately 10-15 seconds when the control panel is set for "HEAT". This assures proper A/C door closing before heat door begins to open.

For further discussion of normal door positions and vacuum system operation, refer to "Operation of Air Flow and Vacuum Systems" following.

OPERATION OF AIR FLOW AND VACUUM SYSTEMS

When the ignition key is "OFF", no vacuum is supplied to any vacuum actuators. Figure 24 shows normal position of the air doors in the distribution box and the heater/evaporator assembly when the ignition key is "OFF"

When the ignition key is "ON" (engine running) vacuum is supplied to the A/C actuator, closing the A/C door in the air distribution box. All other door positions in the distribution box and the heater/evaporator assembly remain the same (figure 25).

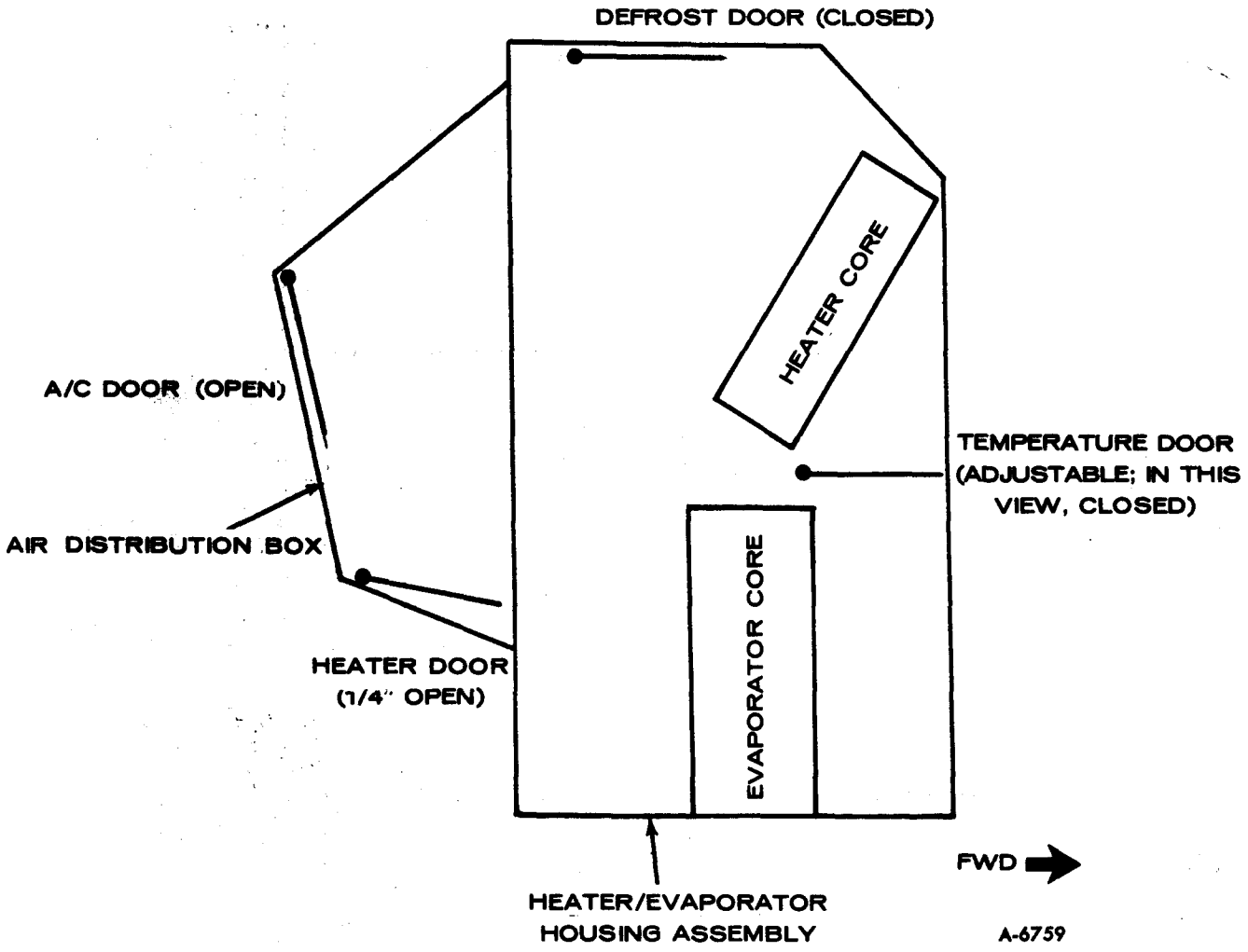


Figure 24—Air Door Positions — Ignition Key "OFF"

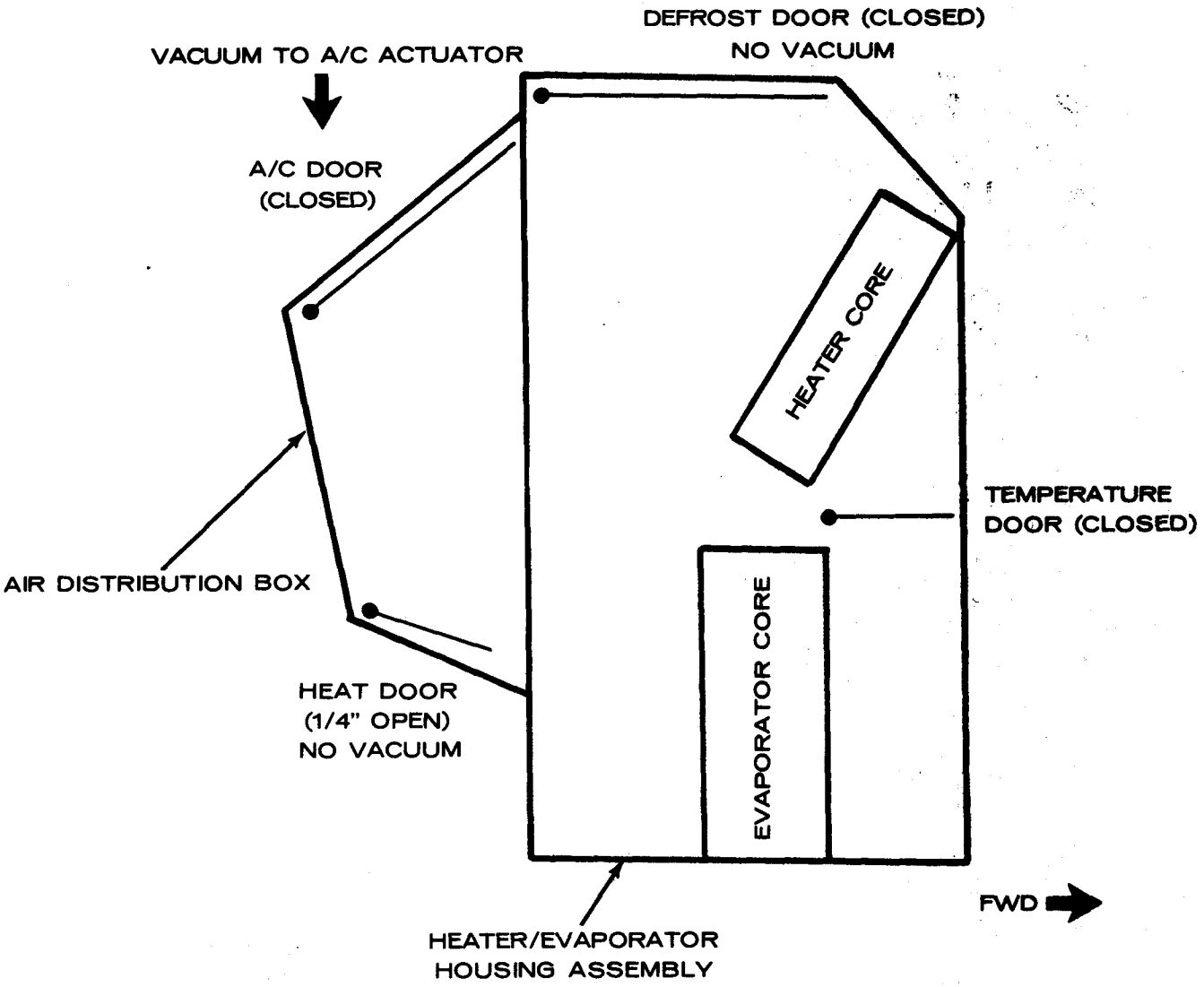


Figure 25—Air Door Positions — Engine Running, Air Conditioning System "OFF"

AIR DELIVERY SYSTEM

AIR SOURCE

Air drawn into the blower and utilized by the system is either outside air or recirculated air (figure 26). Outside air is the air inlet source for four selected positions on the air conditioning control panel: "NORM", "VENT", "HEATER" and "DEFROST". Recirculated air from the passenger compartment is the air inlet source for "MAX" A/C position only.

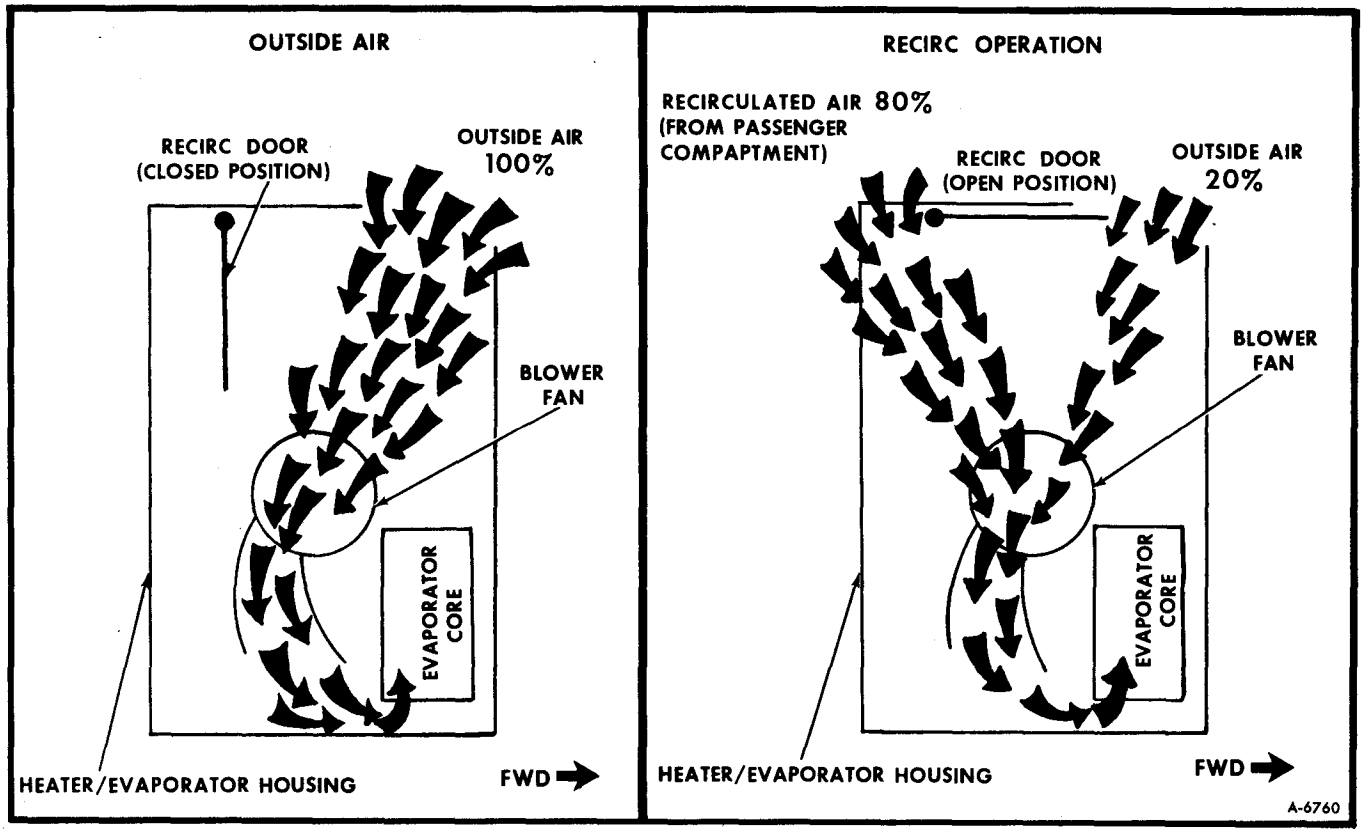


Figure 26—Air Inlet Source

AIR DELIVERY

In normal operation air utilized by the system enters the blower and is directed across the evaporator fins, where it is filtered, dehumidified and cooled to approximately 35°F (2°C). The air is then "reheated" (if called for at control panel) by being passed through and around the heater core. The temperature door in the heater/evaporator housing controls the amount of reheat that takes place. Then, directed by air doors in the distribution box, the air travels out through the plenum assembly to the various outlets in the vehicle instrument panel (figure 27).

AIR OUTLET

Air outlets located in the instrument panel can be seen in figure 28. Depending upon setting of Selector Lever at the A/C control panel, air may flow out the four A/C outlets (two above the glove box, one on either side of the driver seat), out the heater distributor at the lower center of the instrument panel or out the Defroster outlets at the base of the windshield.

Blower operaton is continuous, providing positive air flow even when windows are closed and A/C system is in "OFF" (provided ignition key is "ON"). See information immediately following for discussion of air flow and vacuum system operation in selected air conditioning and heating modes.

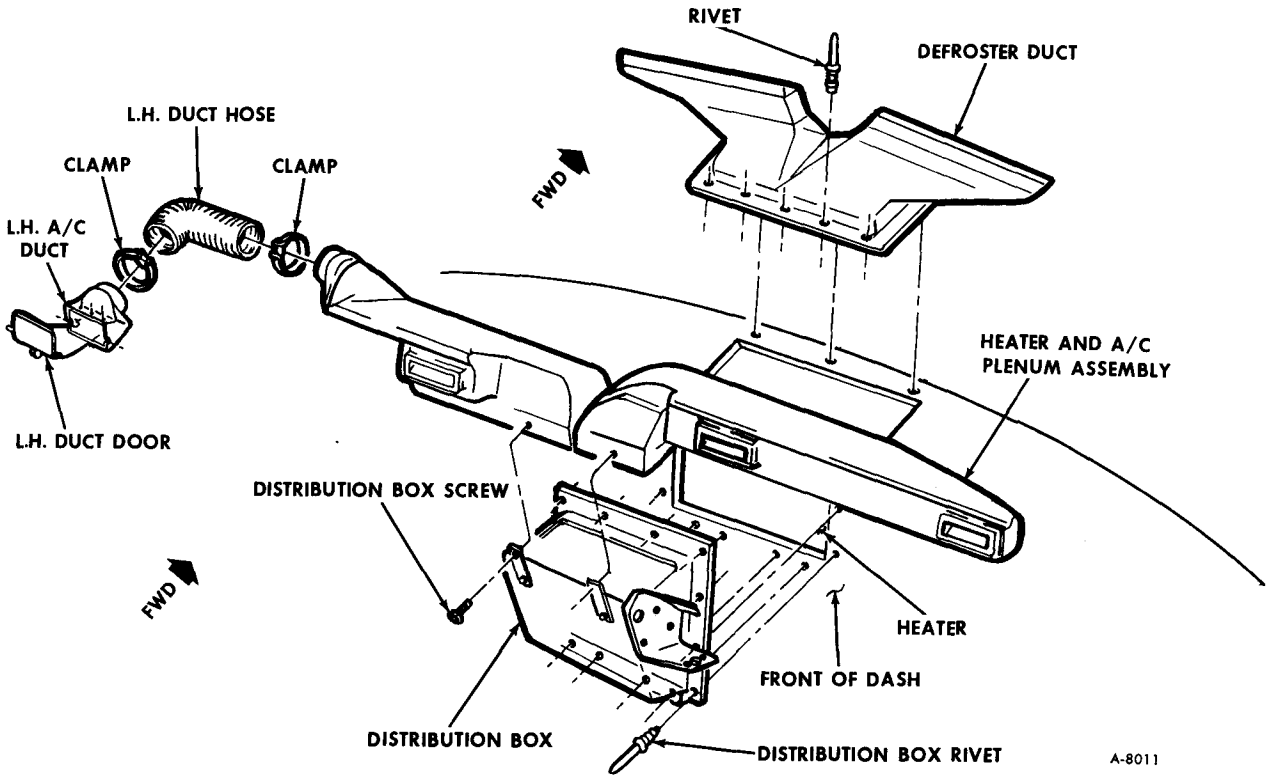


Figure 27—A/C and Heater Plenum and Defroster Duct Assembly

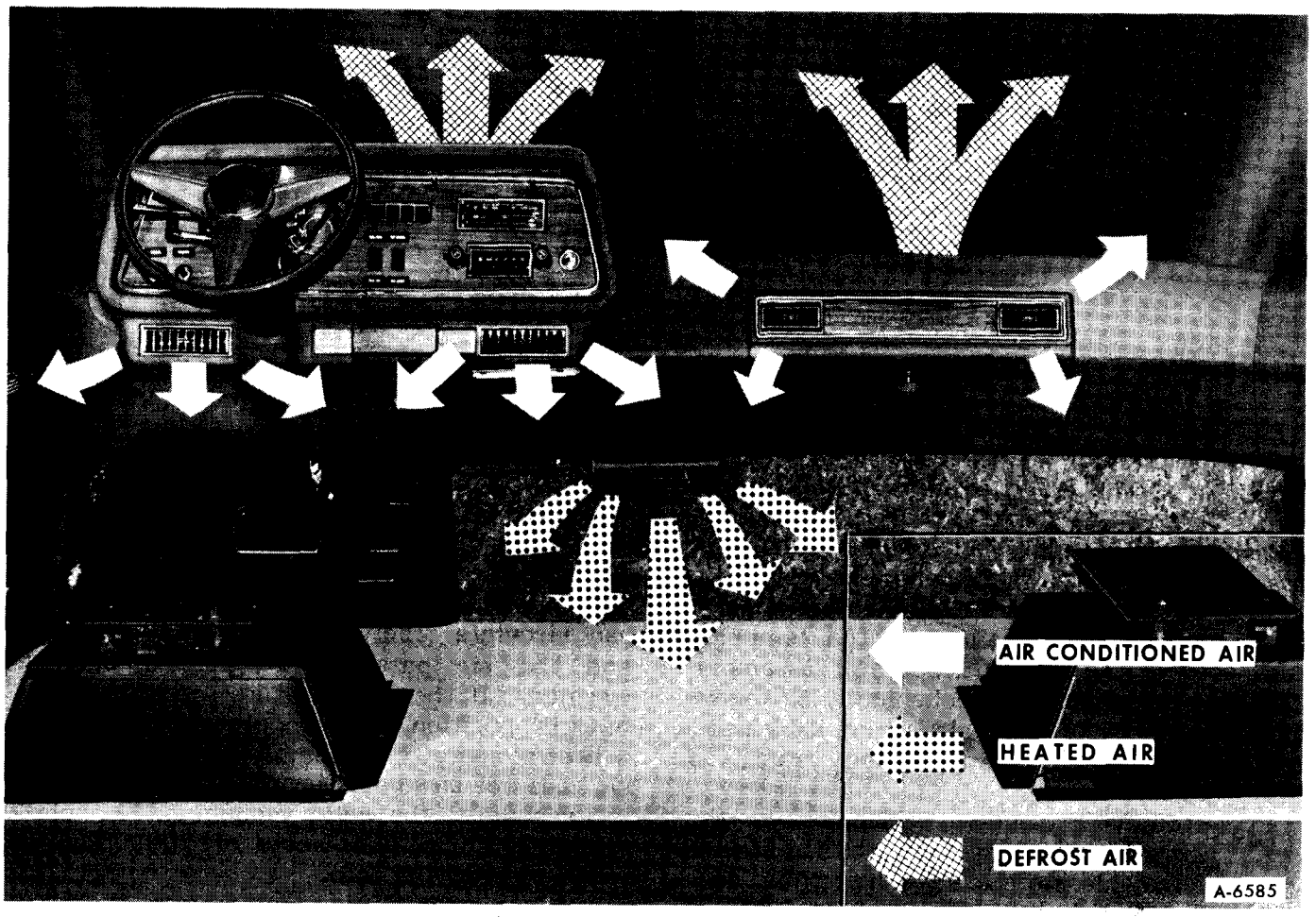


Figure 28—Air Flow — Vehicle Interior

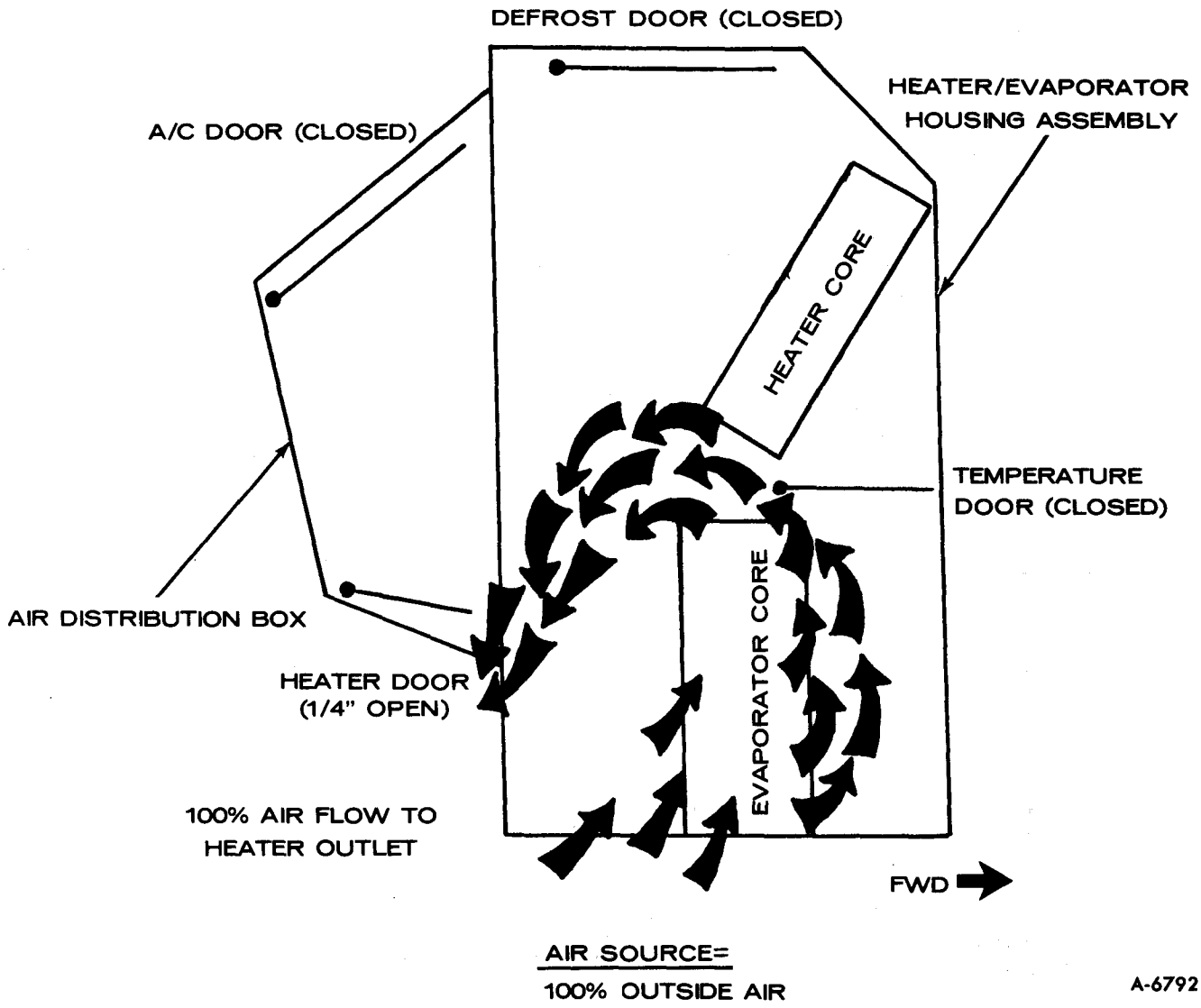


Figure 29—A/C "OFF" Position Air Flow (Engine Running)

AIR FLOW AND VACUUM OPERATION

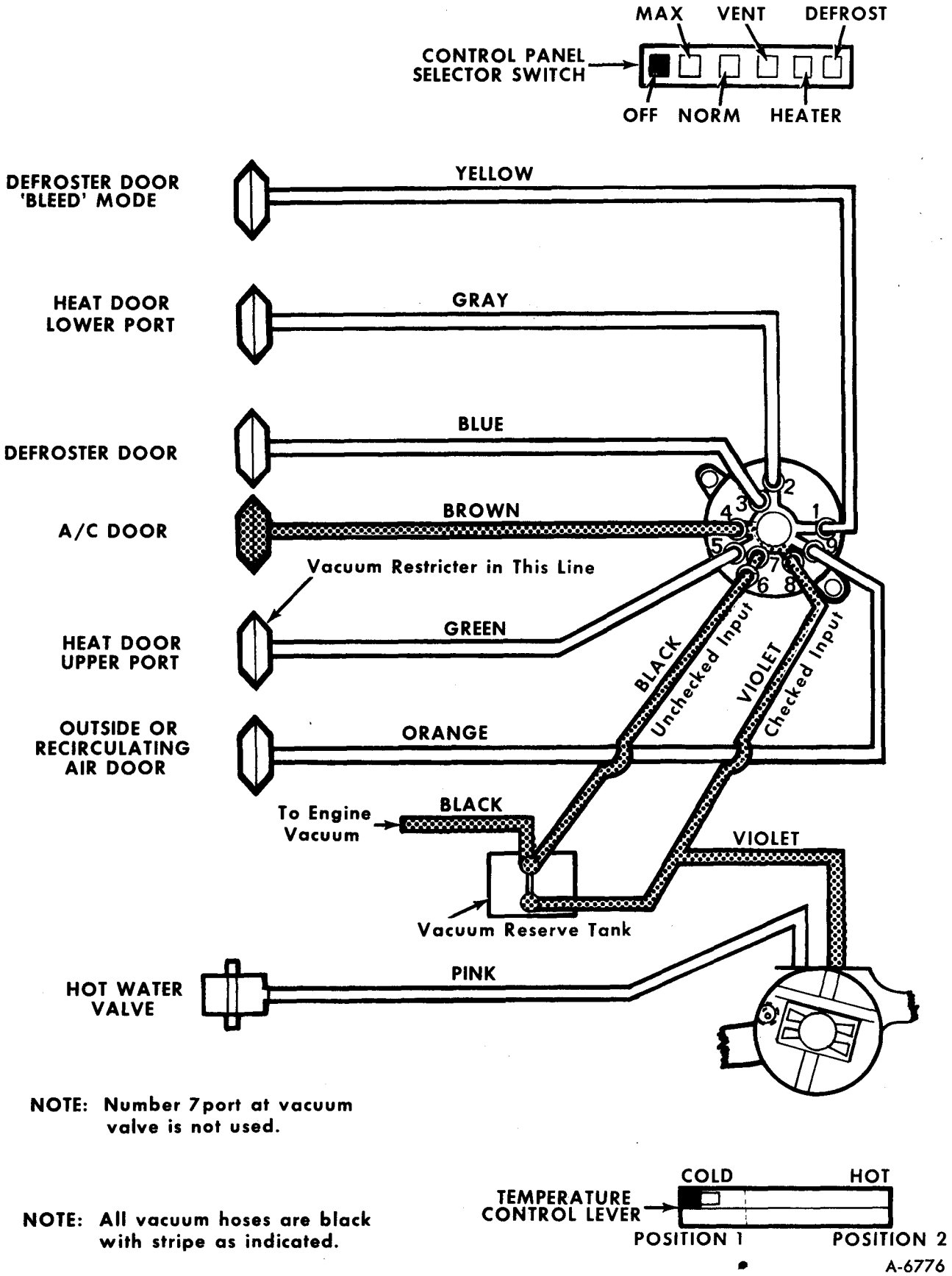
"OFF" POSITION (FIGURES 29 AND 30)

With the air conditioning system in OFF position (ignition switch "ON", engine running), outside air is circulated at a fixed low blower speed through the heater/evaporator assembly. It may be circulated through the heater core, depending upon the position of the temperature door in the heater/evaporator assembly. This door is controlled mechanically by means of a bowden cable. The air is then discharged into the passenger compartment from the heater outlet.

In system OFF vacuum is supplied to the A/C actuator through the brown-striped vacuum line, closing the air conditioning door in the distribution box. This routes 100% of system air through the heater door (1/4 inch open — normal position) in the distribution box and out the heater outlet in the instrument panel.

When the Temperature Lever on the control panel is adjusted to add heat to the incoming air (position 2 — see figure 3), the temperature door is opened and the water vacuum valve in the heater core inlet line is vented. With no vacuum supplied to this valve, water can circulate freely through the heater core and the air passing through the core is warmed. If the Temperature Lever is in the "COLD" position, the temperature door in the heater/evaporator assembly remains closed, air does not circulate through the heater core, and vacuum to the water vacuum valve (violet-striped vacuum line) seals off the flow of water through the core.

The air conditioning compressor is disengaged at this setting.



NOTE: Number 7 port at vacuum valve is not used.

NOTE: All vacuum hoses are black with stripe as indicated.

A-6776

Figure 30—Vacuum Circuit Selector Switch in "OFF" Position (Engine Running)

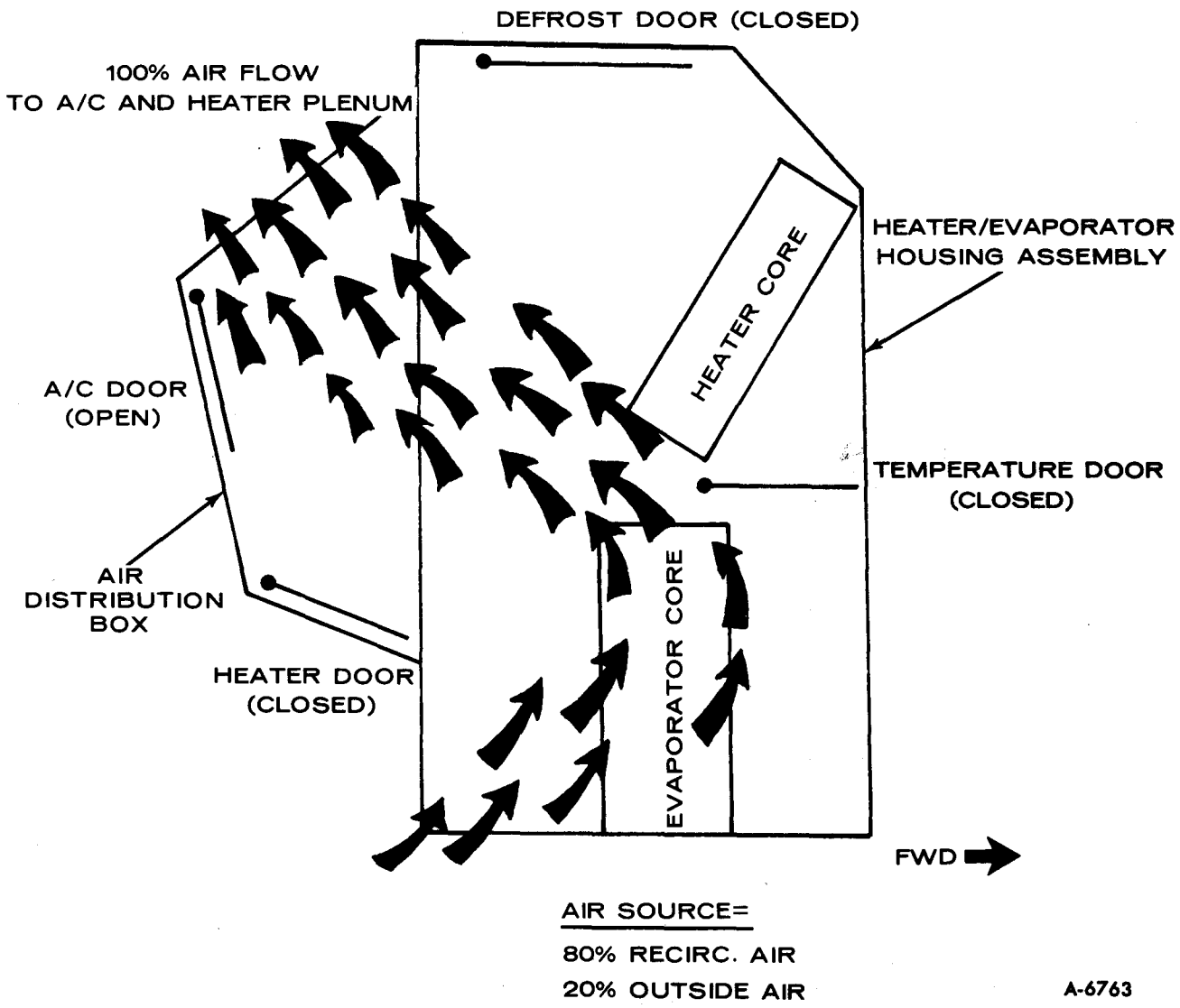


Figure 31—"Max" A/C Position Air Flow

"MAX" A/C POSITION

(FIGURES 31 AND 32)

Operation at this setting provides maximum cooling at a fixed "HI" blower speed, independent of fan switch setting. With the system selector lever in MAX, air inlet source is almost completely from the vehicle interior, as shown in figure 31. Vacuum supplied to the Recirc actuator (orange-striped vacuum line) opens the Recirc door, allowing about 80% of system air to be drawn into the blower channel from the passenger compartment. The remaining 20% system air enters through a small open area at the outside air inlet. Air is then routed through the evaporator core and out the normally open air conditioning door in the distribution box (figure 31). Directed through the A/C plenum behind the instrument panel, air then flows out the air conditioning registers in the instrument panel.

In addition to vacuum at the Recirc actuator, MAX A/C position supplies vacuum to the heater actuator lower port (gray-striped vacuum line), closing the heater door and blocking passage of air to the heater outlet. The A/C and Defrost actuators are vented, leaving these doors in their normal positions.

Maximum cooling is maintained by positioning the Temperature Lever all the way in the "COLD" position. This position of the Temperature Lever (refer to figure 3) causes vacuum to be supplied to the water vacuum valve (violet-striped vacuum line), sealing off water flow through the heater core. This lever position also closes the temperature door in the heater/evaporator housing assembly by means of a bowden cable. This assures that no air is diverted through the heater core.

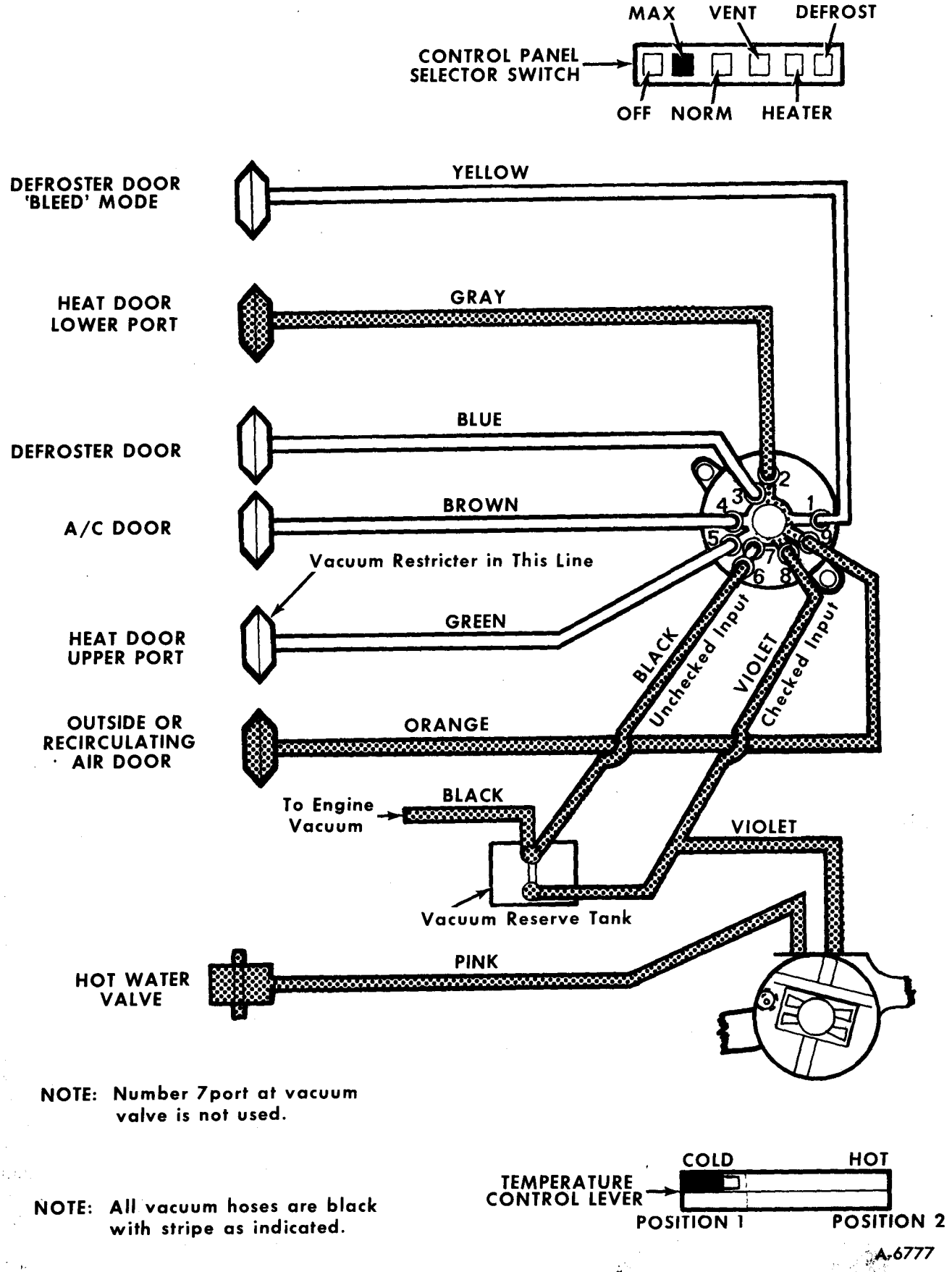


Figure 32—Vacuum Circuit Selector Switch in "MAX" A/C Position and Temperature Lever in Position 1

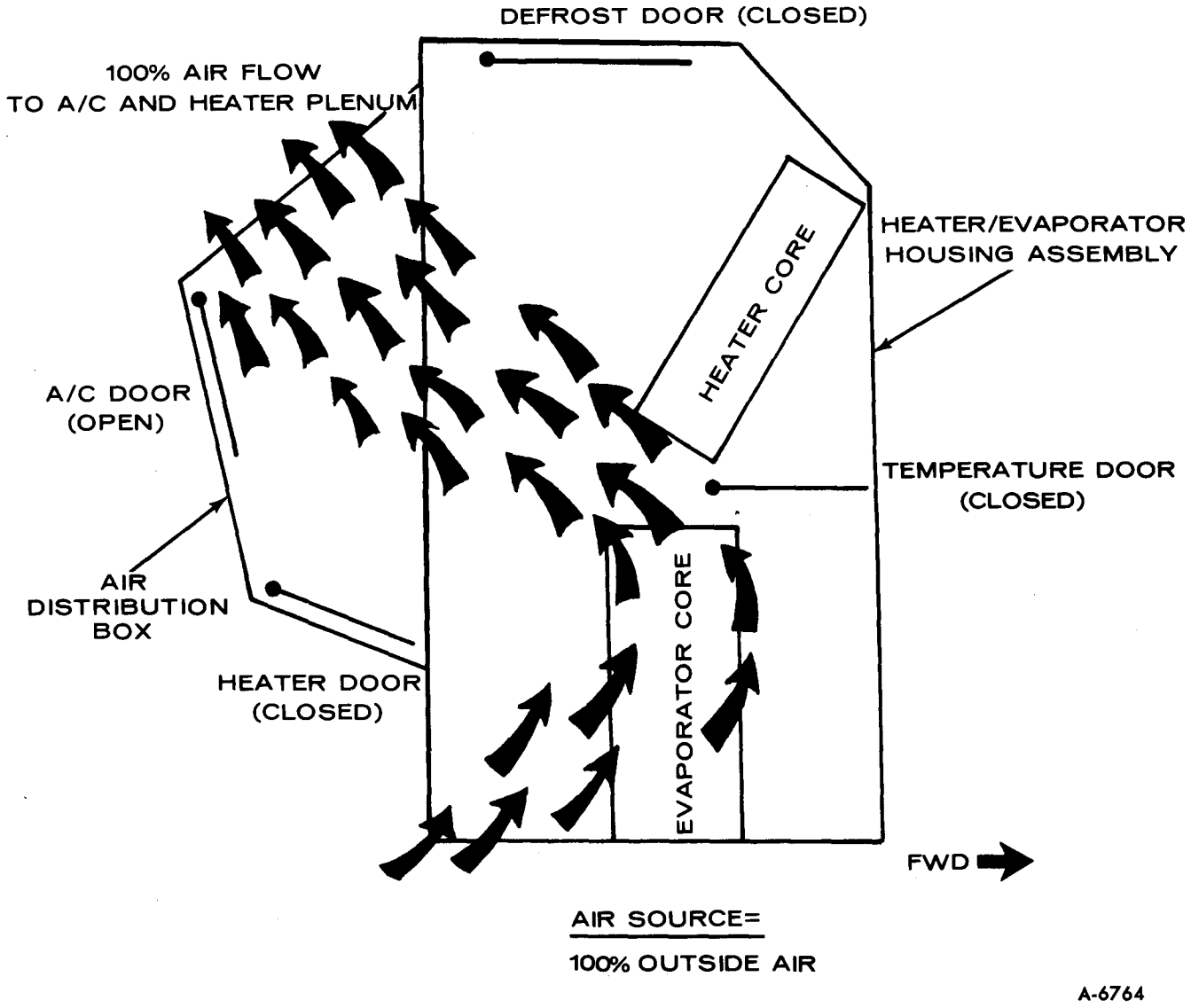


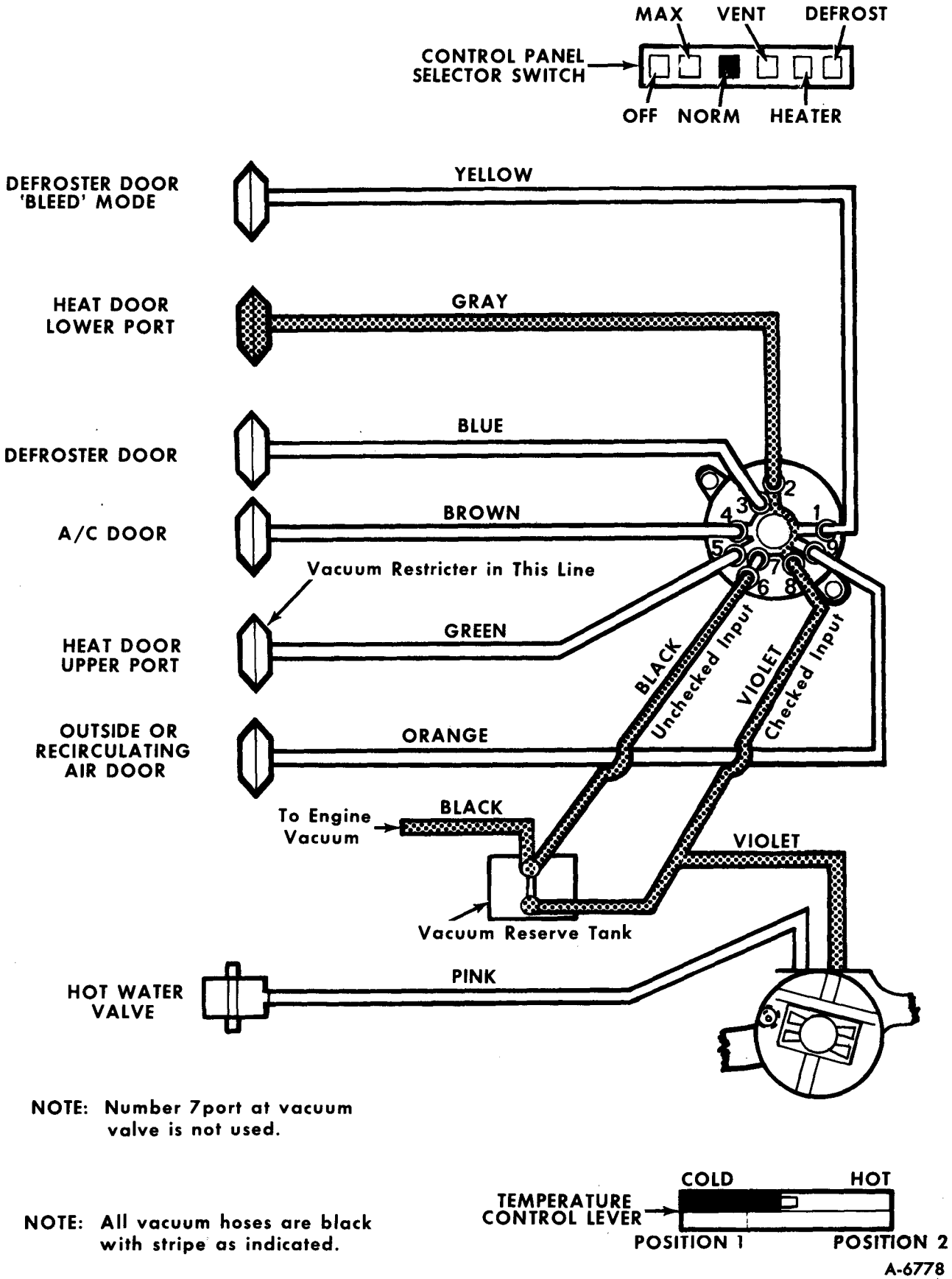
Figure 33—"NORM" A/C Position Air Flow

"NORM" POSITION (FIGURES 33 AND 34)

In NORM air conditioning position, 100% outside air enters the system for cooling. Once inside the blower channel, air flow and vacuum logic are the same as those in MAX A/C. However, blower speed in NORM is adjustable and is determined by fan switch setting.

As in all other modes, temperature of air being circulated is adjusted at the control panel temperature lever. "COLD" position of the lever closes the temperature door in the heater/evaporator housing assembly by means of a bowden cable. Thus all air is routed through the evaporator. "COLD" position also supplies vacuum to the water vacuum valve, sealing off the flow of water to the heater core.

The compressor will operate in NORM when outside temperature is above approximately 40°F (4°C).



NOTE: Number 7port at vacuum valve is not used.

NOTE: All vacuum hoses are black with stripe as indicated.

A-6778

Figure 34—Vacuum Circuit Selector Switch in "NORM" A/C Position and Temperature Lever in Position 2

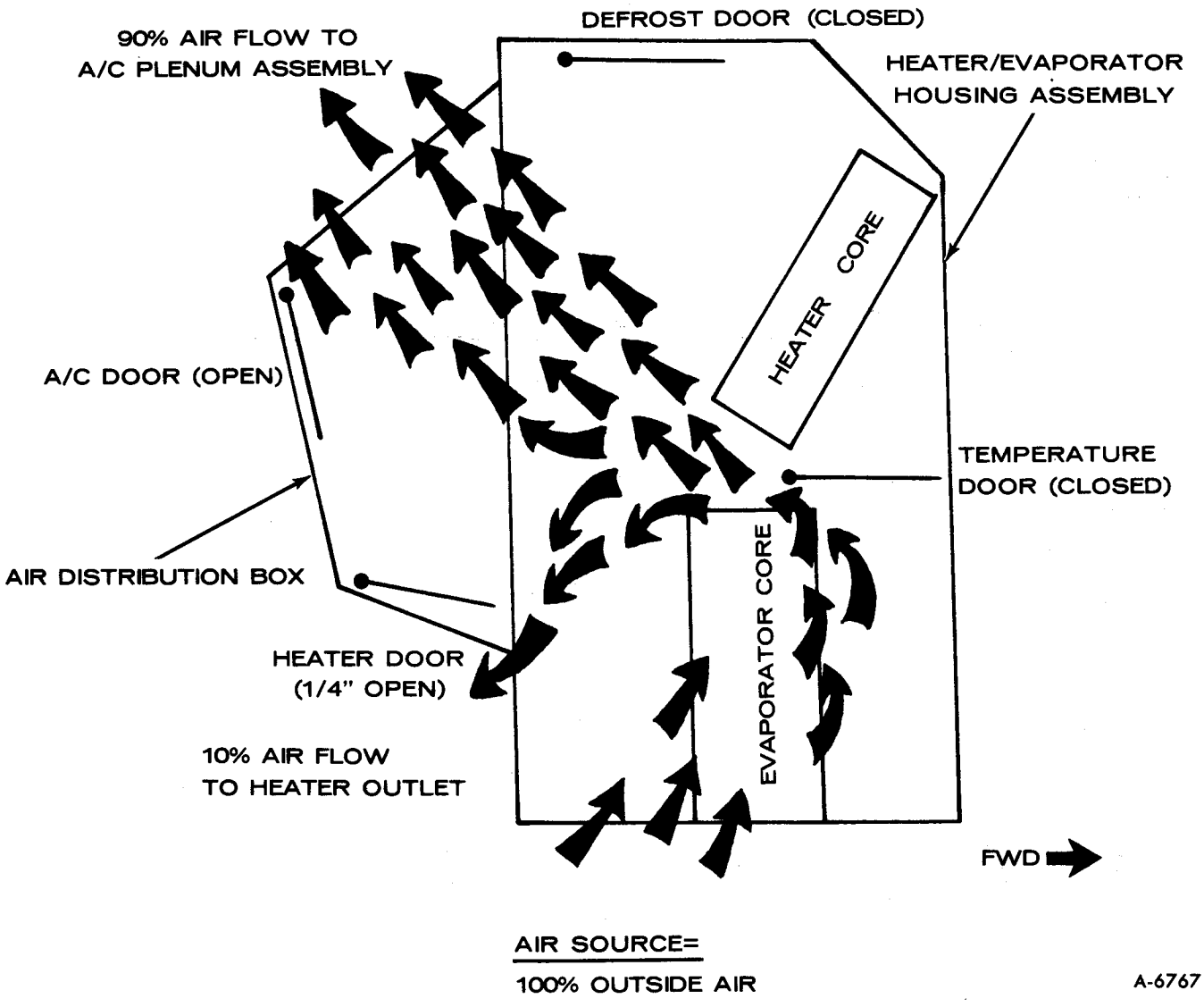


Figure 35—"VENT" Position Air Flow

"VENT" POSITION (FIGURES 35 AND 36)

Operation in VENT provides for circulation of 100% outside air at any selected blower speed. Air that has passed through the evaporator core may circulate through the heater core, depending upon the position of the temperature door in the heater/ evaporator housing assembly. With all vacuum actuators vented, 90% of air flows out the open air conditioning door in the distribution box through the A/C plenum to the air conditioning registers in the instrument panel. The remaining 10% of air flows out the heater door in the distribution box, which is 1/4 inch open. This air is then discharged from the heater outlet at the lower center of the instrument panel.

Heat is added to vent air as desired by adjustment of the temperature lever on the control panel.

VENT is one of two economy positions in which the air conditioning compressor does not operate.

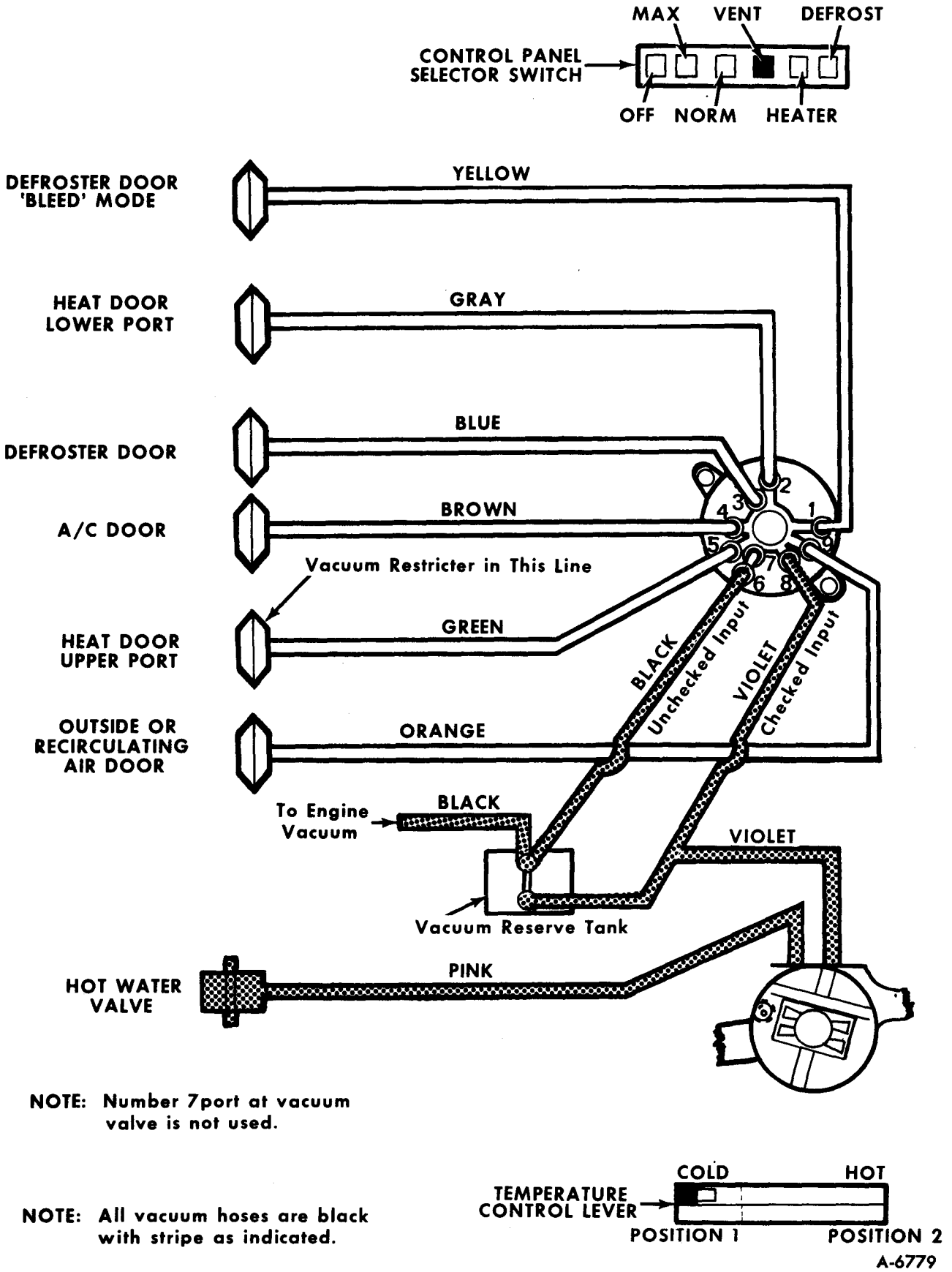


Figure 36—Vacuum Circuit Selector Switch in "VENT" Position and Temperature Lever in Position 2

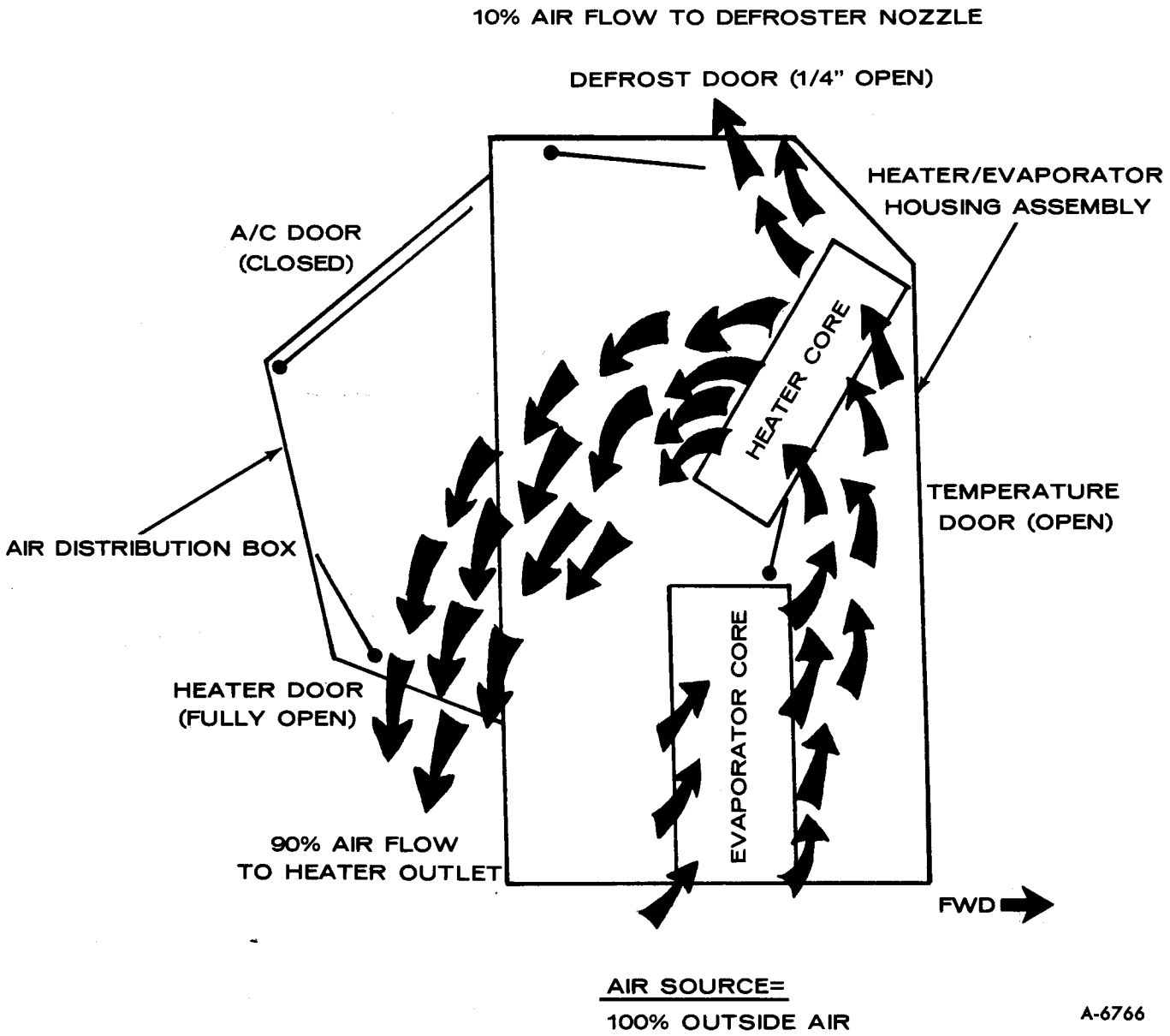


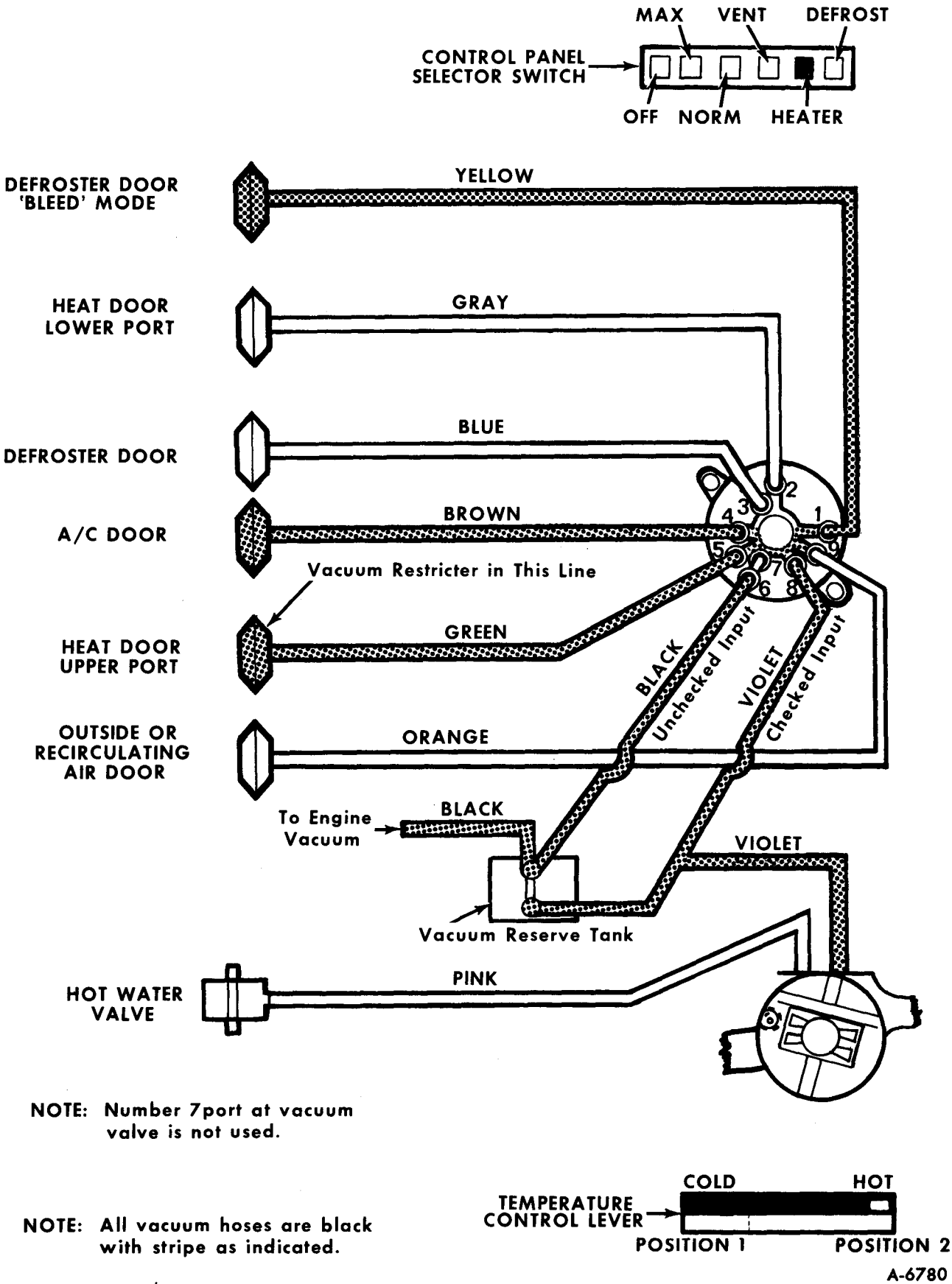
Figure 37—"HEATER" Position Air Flow

"HEATER" POSITION
(FIGURES 37 AND 38)

Operation in this setting circulates most or all air through the heater core. With the Temperature Lever all the way to "HOT", the temperature door in the heater/evaporator assembly is open and the water vacuum valve is vented, allowing water to circulate through the heater core. Air is then heated as it passes through the core.

HEATER mode supplies vacuum to the bleed port at the Defrost actuator (yellow-striped vacuum line), opening the Defrost door (1/4 inch). Vacuum is also supplied to the A/C actuator (brown-striped vacuum line) and the Heat actuator upper port (green-striped vacuum line), closing the A/C door and fully opening the heat door. This allows 90% of system air to flow through the open heater door in the distribution box and out the heater outlet in the lower center of the instrument panel. The remaining 10% of air is directed through the partially open defrost door in the top of the heater/evaporator housing to the defroster nozzles at the base of the windshield.

HEATER is one of two economy positions in which the air conditioning compressor does not operate.



NOTE: Number 7port at vacuum valve is not used.

NOTE: All vacuum hoses are black with stripe as indicated.

A-6780

Figure 38—Vacuum Circuit Selector Switch in "HEATER" Position and Temperature Lever in Position 2

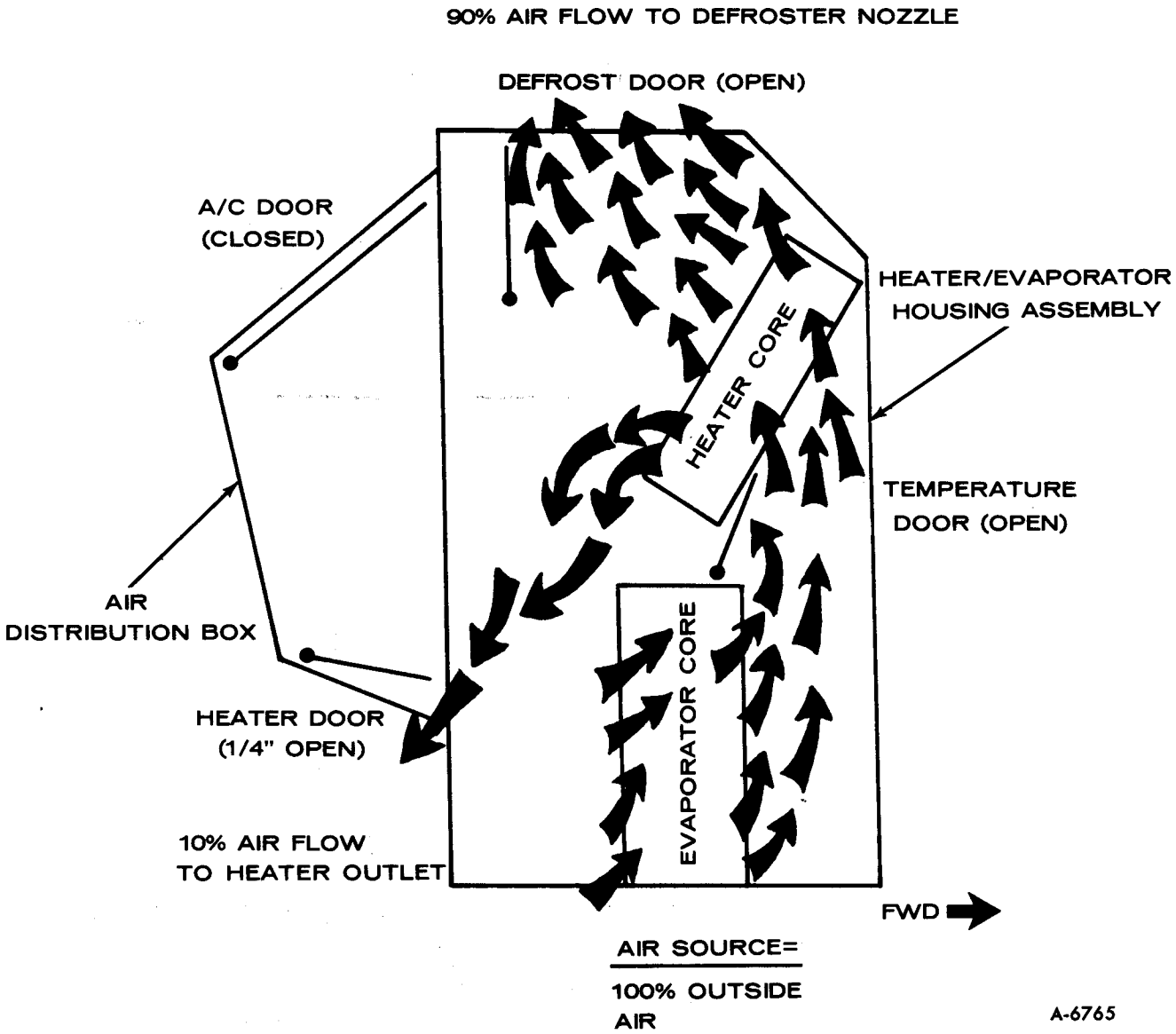


Figure 39—"DEFROST" Position Air Flow

"DEFROST" POSITION (FIGURES 39 AND 40)

In DEFROST position, air is routed through the heater/evaporator assembly at any selected blower speed. The air may be circulated through the heater core, depending upon the position of the temperature door.

Vacuum is supplied to both ports of the Defrost actuator (blue-striped vacuum line and yellow-striped vacuum line). This fully opens the Defrost air door at the top of the heater/evaporator housing assembly. Vacuum is also supplied to the A/C actuator (brown-striped vacuum line), closing the air conditioning door in the distribution box. In DEFROST mode, then, 90% of system air flows out the fully open Defrost door to the defroster nozzles at the top forward edge of the instrument panel. The remaining 10% of air is directed through the heater door (1/4 inch open — normal position) and is discharged through the heater outlet in the instrument panel.

Heat is added to Defrost air as desired by adjustment of the temperature lever on the control panel. If the Temperature Lever is moved to position 2 (figure 3), vacuum is supplied to the water vacuum valve at the control panel (violet-striped vacuum line).

The air conditioning compressor engages automatically in DEFROST if outside temperatures are above 40-45°F (4-7°C).

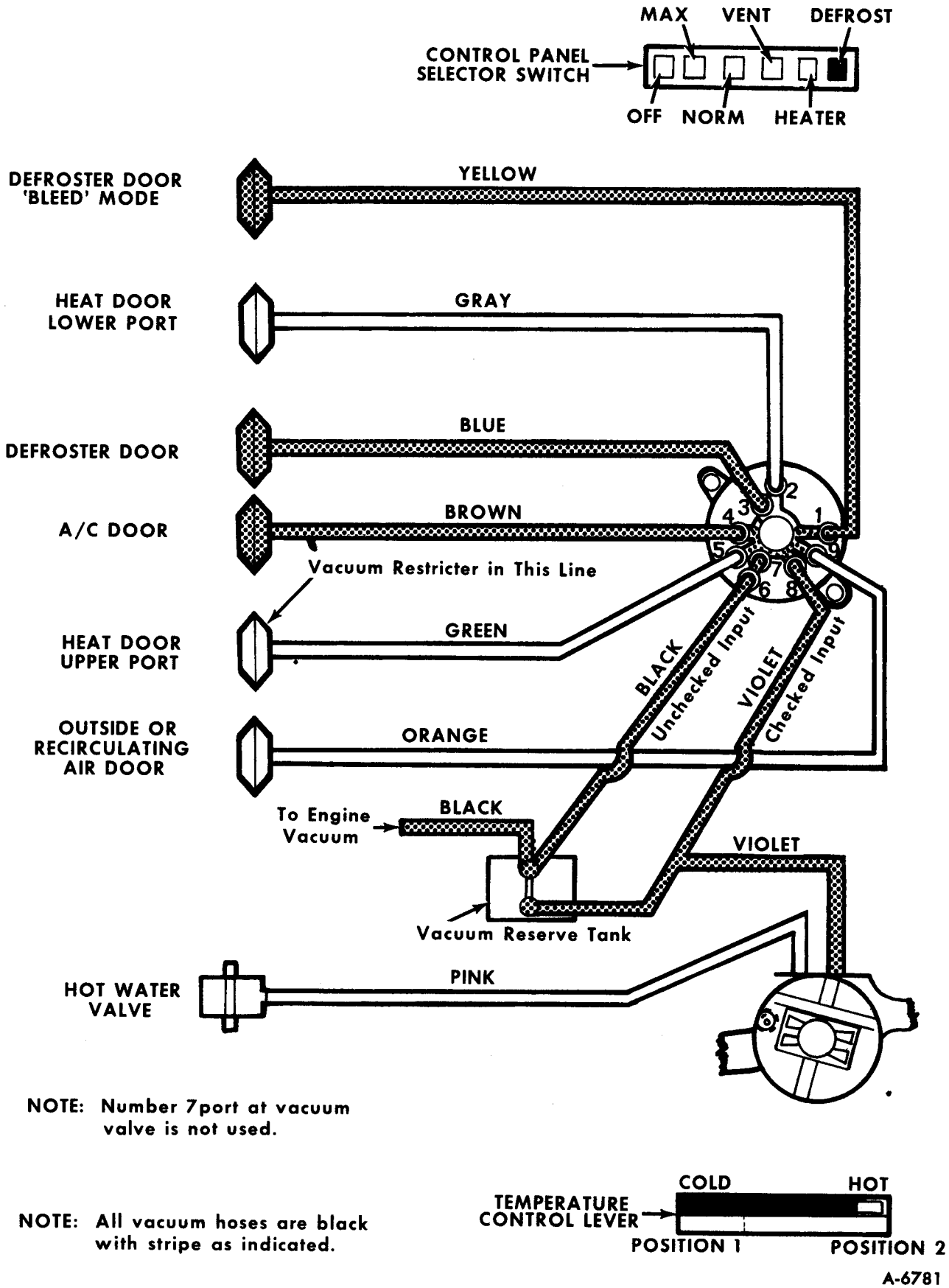


Figure 40—Vacuum Circuit Selector Switch in "DEFROST" Position and Temperature Lever in Position 2

WATER VALVE OPERATING CHART

Port No.	Function	Position 1	Position 2	Stripe
1	Input	Conn 2	Seal	Violet
2	Water/ Valve Signal	Conn 1	Vent	Pink

SELECT VALVE OPERATING CHART

PORT NO.	CONN	OFF	MAX	NORM		VENT	HEAT	DEFROST	STRIPE
1	DEFROSTER BLEED	VENT	VENT	VENT	VENT	VENT	CONN. 6	CONN.6	YELLOW
2	HEAT DOOR (LOWER)	VENT	CONN. 8,9	CONN. 8	VENT	VENT	VENT	VENT	GRAY
3	DEFROST	VENT	VENT	VENT	VENT	VENT	VENT	CONN. 4,8	BLUE
4	A/C DOOR	CONN. 8	VENT	VENT	VENT	VENT	CONN. 5,8	CONN. 3,8	BROWN
5	HEAT DOOR (UPPER)	VENT	VENT	VENT	VENT	VENT	CONN. 4,8	VENT	GREEN
6	INPUT UNCHECKED	SEAL	SEAL	SEAL	SEAL	SEAL	CONN. 1	CONN. 1	
7	NOT USED—SEAL IN CONNECTOR								
8	INPUT CHECKED	CONN. 4	CONN. 2,9	CONN. 2	SEAL	SEAL	CONN. 4,5	CONN. 3,4	VIOLET
9	O/AIR R/AIR	VENT	CONN. 2,8	VENT	VENT	VENT	VENT	VENT	ORANGE

A-6768

Figure 41—Select Valve Operating Chart

INSPECTION AND PERIODIC SERVICE

PRE-DELIVERY INSPECTION

1. Check that engine exhaust is suitably ventilated.
2. Check the belt for proper tension.
3. With controls positioned for operation of the system, operate the unit for five minutes at approximately 2000 rpm. Observe the clutch pulley belt 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" under "DIAGNOSIS OF PROBLEMS" later in this section).
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 for proper operation.

6000 MILE INSPECTION

1. Check unit for any indication of a refrigerant leak.
2. If there is an indication of an excessive 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" under "DIAGNOSIS OF PROBLEMS" later in this section).
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 if bent.

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

AIR CONDITIONING AND HEATING DIAGNOSIS

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 as 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 of refrigerant, the oil cannot return in sufficient quantities to keep the compressor properly lubricated.

HIGH TEMPERATURE AND PRESSURE

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

REFRIGERANT-12 PRESSURE-TEMPERATURE RELATIONSHIP

TEMP. (°F.)	(°C.)	PRESSURE (PSI)	TEMP. (°F.)	(°C.)	PRESSURE (PSI)
−40	−40	*11″	45	7.2	41.7
−35	−37.2	* 8.3″	50	10	46.7
−30	−33.3	* 5.5″	55	12.8	52.0
−25	−37.7	* 2.3″	60	15.6	57.7
−21.7	−29.8	** 0	55	18.3	63.7
−20	−29	0.6	70	21.1	70.1
−15	−26.1	2.4	75	23.9	76.9
−10	−23.3	4.5	80	26.7	84.1
− 5	−20.6	6.8	85	29.4	91.7
0	−17.8	9.2	90	32.2	99.6
5	−15	11.8	95	35	108.1
10	−12.2	14.7	100	37.8	116.9
15	− 9.4	17.7	105	40.6	126.2
20	− 6.7	21.1	110	43.3	136.0
25	− 3.9	24.6	115	46.1	146.5
30	− 1.1	28.5	120	49	157.1
32	0	30.1	125	51.7	167.5
35	1.7	32.6	130	54.4	179.0
40	4.4	37.0	140	60	204.5
			150	65.6	232.0

*Inches Vacuum.
**Atmospheric Pressure.

A-6155

Figure 42—Refrigerant-12 Pressure-Temperature Relationship

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 corresponding pressure within the container of refrigerant.

The table above (figure 42) indicates the pressure of Refrigerant-12 at various temperatures. Pressures are indicated in gauge pressure, either positive pressure (above atmospheric) in pounds, or negative pressure (below atmospheric) in inches of vacuum.

If a gauge is attached to a container of R-12 and the room temperature is 70°F (21°C), the gauge will register approximately 70 psi; in a 100°F (38°C) room, the pressure would be 117 psi. This relationship can also be used conversely to determine the temperature at which Refrigerant-12 boils under various pressures. For example, at a pressure of 30.1 psi, Refrigerant-12 boils at 32°F (0°C).

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

Any chemical reactions caused by contaminants already in the system are greatly accelerated as the temperature increases. A 15°F (9°C) rise in temperature doubles the rate of 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, open 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 caused by temperature change will cause air and moisture to be drawn in. Air in a system is a noncondensable gas and will usually tend to move toward and collect at the condenser as it would in an air compressor tank.

The discharge pressure will rise to a point above the pressure corresponding to the temperature at which the vapor is condensing. In extreme cases, the pressure may rise to a point to cause the pressure relief valve at line end of compressor to "POP" open.

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 sytem by unpurged gauge and charging lines. Any air in the system is too much air.

To determine whether or not there is air in the system, the compressor must be allowed to stand idle long enough for the entire system to cool down to the temperature of the surrounding air. After the system has attained the same temperature as the surrounding air, the reading of the discharge pressure test gauge should not be more than 5 lbs. above

the saturation pressure corresponding to the surrounding air temperature.

POOR CONNECTIONS

Hose clamp-type fittings must be properly made. Hoses 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, overtightening 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 be first placed over the tube before inserting it in the connections.

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

RESTRICTIONS

Restrictions may be due to corrosion by-products or dirt and foreign matter. This may result in a 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 cause corrosion which can be carried with the refrigerant liquid to the expansion valve screen. While some of it may pass through the valve screen into the evaporator, it may quickly build up at the screen to cause a restriction.

Due to the fact that sufficient oil then cannot be returned to the compressor, the compressor 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 refrigeration 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 servicepersons 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 Hydrofluoric acid. Moisture can also cause freeze-up of an expansion valve.

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. The acids that moisture produces, in combination with both the metals and the refrigerant, cause 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.

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 is 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.

HOW TO ISOLATE THE PROBLEM

To diagnose an air conditioning problem in the shortest time and with the least effort, it

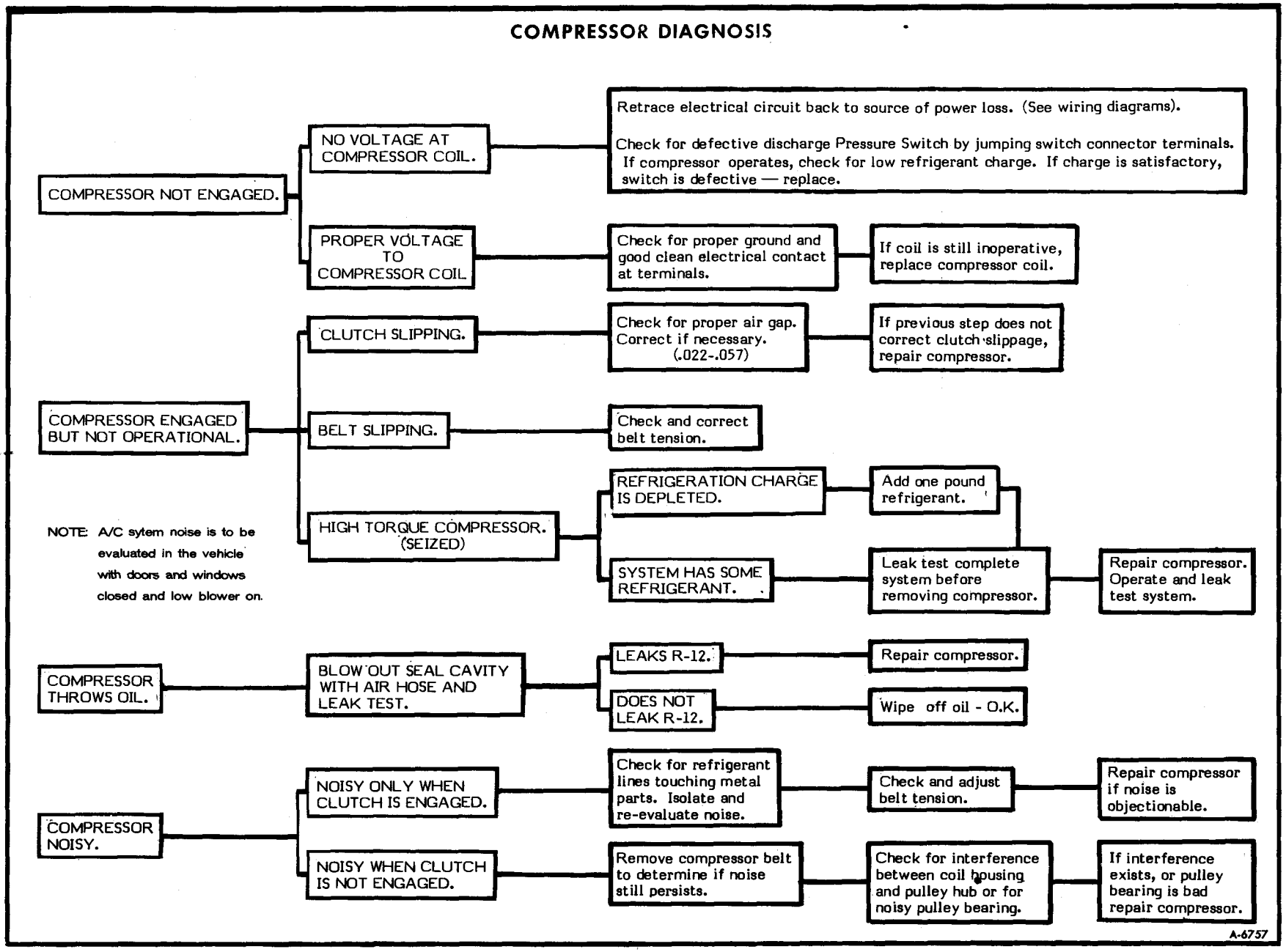


Figure 43—Compressor Diagnosis Chart

is essential to follow a logical service procedure.

STEP 1 - Visual Checks.
STEP 2 - Operational Checks.
STEP 3 - Performance Tests.

NOTE: Do the easiest checks first.

STEP 1 - VISUAL CHECKS

1. Check compressor drive belt tension.
2. Check wiring connection at compressor.
3. Check compressor clutch air gap (.022"-.057").
4. Check for broken, burst, or cut refrigerant lines and hoses. Also, check for refrigerant leaks.
5. Check for air flow restriction through condenser.
6. Check operation of temperature control door.
7. Check for air leakage anywhere around the evaporator.

STEP 2 - OPERATION CHECKS

NOTE: Warm up the engine and operate at approximately 2000 rpm.

Electrical System—If the compressor is engaged and blower is operating, this generally indicates that electrical circuits are OK.

NOTE: Refer to Compressor Diagnosis Chart (figure 43) for diagnostic procedures for many compressor electrical problems.

Air conditioning system electrical wiring diagrams are included at back portion of this supplement.

Air Flow System—Insufficient cooling may be caused by:

1. Air flow restriction through evaporator core.
2. Warm air leaks in vehicle interior.
3. Improper heat door control adjustment, loose connections or improper installation, or cold air ducts (under instrument panel - loose connections).

Refrigeration System

1. Check sight glass for "clear" condition. Bubbles or foaming indicates low refrigerant or low ambient temperature.
2. Compressor high pressure line should be warm. The low pressure line should be cool.

NOTE: If lines are not of indicated temperatures, low refrigerant may be the cause.

Step 3 - Performance Tests

NOTE: Using the gauge readings on "Performance Data Chart," and following the procedures indicated on the "Insufficient Cooling Diagnosis Chart" (figure 44), determine the cause of malfunction.

This test consists of checking the following:

Air Temperature

1. Entering the condenser.
2. Leaving the air discharge nozzles within the vehicle.

Evaporator Pressures.

1. At suction side of evaporator (low pressure service fitting in evaporator outlet line).
2. At discharge side of system (high pressure service fitting in evaporator inlet line).

NOTE: Compare these figures with figures on the "Performance Data Chart" shown in this section. If related figures correspond under a particular ambient condition, this indicates that the system is normal.

Test Procedures - The following conditions must be adhered to in order to compare the performance of system being tested with the figures listed on the "Performance Data Chart."

1. The vehicle should be inside or in the shade.
2. The access doors should be raised.
3. Place "Air Conditioning" controls for "MAX" cooling and "HI" blower speed. Set temperature lever at "COLD".
4. Install the refrigerant pressure checking gauge set, attaching correct lines to high and low pressure service fittings on vehicle.
5. Support a thermometer just ahead of the radiator and condenser, in front of vehicle grille.
6. Support another thermometer inside the vehicle next to center air register in instrument panel.
7. Make sure transmission shift lever is in "NEUTRAL".
8. Operate engine at approximately 2000 rpm for 10 minutes to allow system to level out.
9. Read the gauge pressures and thermometers, then compare these figures with those on the "Performance Data Chart".

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.

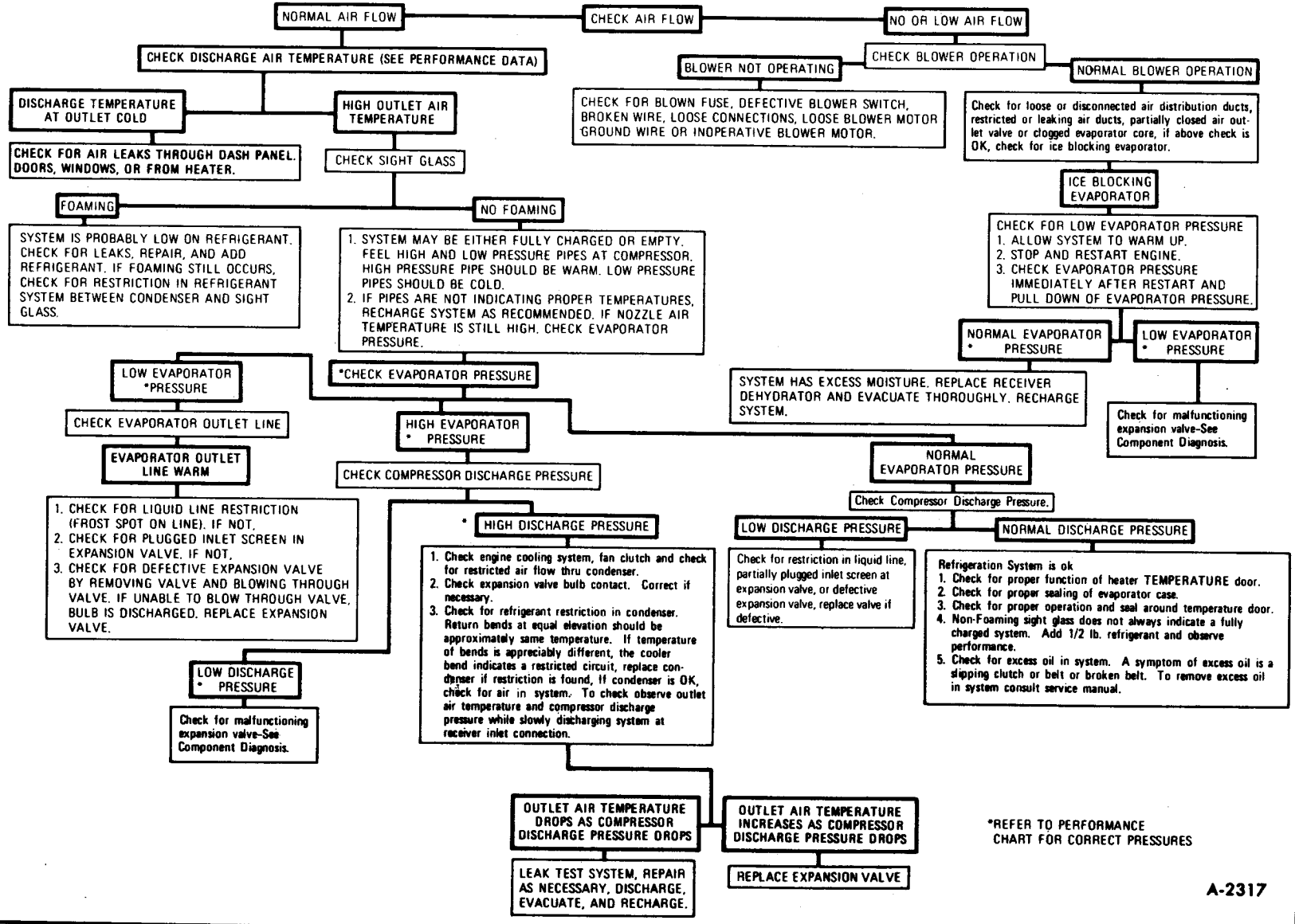


Figure 44—Insufficient Cooling Diagnosis Chart

NOTE: Should excessive discharge pressures be encountered at higher ambient temperatures, an 18-inch fan placed in front of the vehicle and blowing into the condenser will provide the extra circulation of air needed to bring the pressures to within the limits specified.

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 Data Chart" and still have a satisfactory operating unit. However, it is important to remember that low pressure has a direct relationship to nozzle outlet temperature. If pressure is too low, ice will gradually form on the evaporator fins, restricting airflow into the vehicle and resulting in insufficient or no cooling. Engine fan not operating properly will cause high head pressures and may cause pressure relief valve on compressor to blow and lose refrigerant oil.

REFRIGERANT SYSTEM DIAGNOSIS

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 clearance 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 later 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.

Broken valves (reeds) in compressor are generally indicated by a rapid rise in suction pressure as soon as the compressor stops. Before the compressor is replaced, it should be determined that the pressure rise is not due to an open or leaky expansion valve which could cause a similar reaction.

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.

NOTE: When the expansion valve is stuck open, there will be an excessive amount of sweating on the suction line and compressor due to the large amount of liquid being passed into the suction line.

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 malfuction 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 usually show up as uncooled air or 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.

If a malfunction in the refrigerant system is suspected due to abnormal evaporator core pressures, check for the following:

1. Restrictions in evaporator core, hoses, tubes, etc.
2. Refrigerant leaks.
3. Compressor clutch slippage.
4. Improper drive belt tension.
5. Excessive moisture in refrigerant system.
6. Inoperative expansion valve.

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.
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°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 sight 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 should 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 or 1/2 lb. should be added as a reserve after the glass clears. In no case should the system be overcharged.

ELECTRICAL SYSTEM DIAGNOSIS

For electrical connections and routings, refer to the wiring diagram at the end of the manual. Also see figure 45.

VACUUM SYSTEM DIAGNOSIS

Start the engine and allow it to idle—move the selector lever to each position and refer to

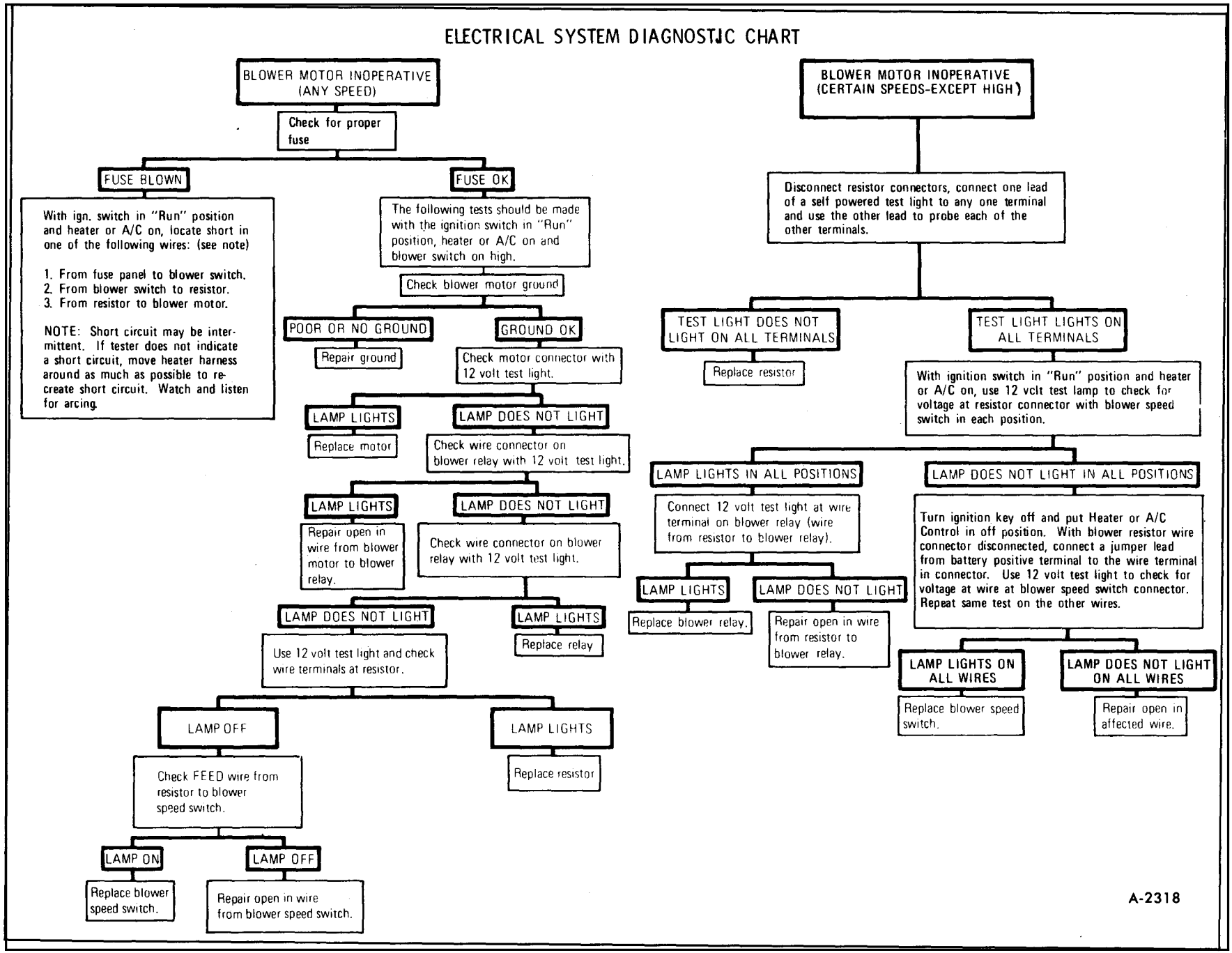


Figure 45—Electrical System Diagnosis Chart

Vacuum Control Diagram vacuum operational schematics and air flow drawings for proper air flow, air door functioning and vacuum circuit operation. If air flow 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 valves, vacuum 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 is 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.

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.

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

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

LIQUID LEAK DETECTORS

There are a number of fittings and surface areas throughout the air conditioning system where a liquid leak detector solution may be used to pinpoint leaks.

When solution is applied to the area with a swab that is attached to the bottle cap, bubbles will form within seconds if there is a leak.

For confined areas, such as sections of the evaporator and condenser, electronic leak detectors are more practical for determining leaks.

ELECTRONIC LEAK DETECTORS

Electronic leak detector J-26934 is available for detecting refrigerant leaks. Instructions for use are included with leak detector.

NOTE: A refrigerant leak in the high pressure side of the system may be more easily detected when, if possible, the system is in operation. A leak on the low pressure side may be most easily detected after the engine has been shut off for several minutes to allow system pressures to equalize. This particularly applies to a front seal leak.

REFRIGERANT PROBLEMS

SHORTAGE OF REFRIGERANT

There should always be sufficient liquid in the receiver shell to completely submerge the inlet to the liquid pickup tube. If there is a shortage of refrigerant, the liquid level will fall below the inlet to the tube and a mixutre of gas and liquid will pass into the expansion valve cavity and sight glass area.

HEATING DIAGNOSIS (INSUFFICIENT HEAT)

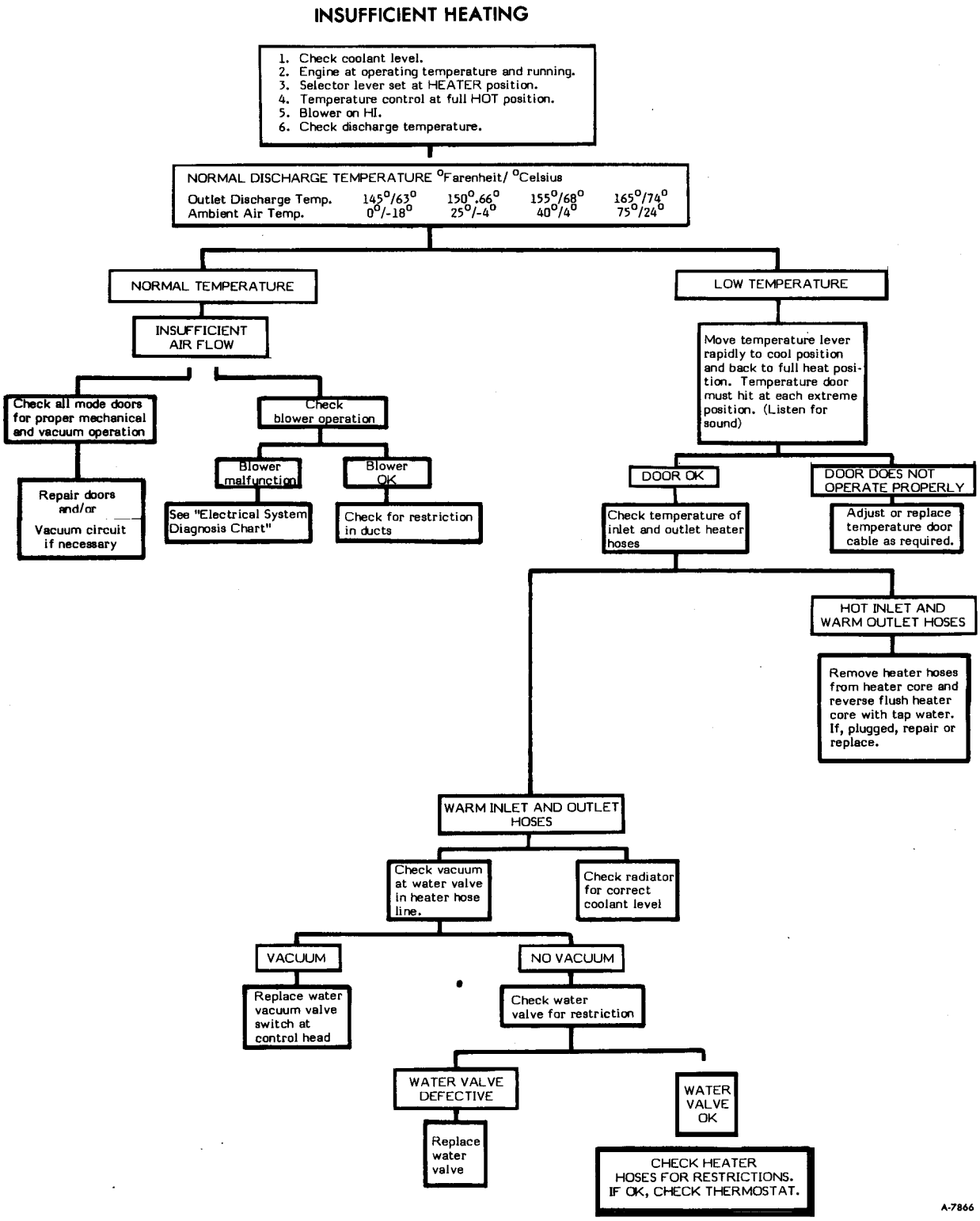


Figure 46—Insufficient Heating Diagnosis Chart

Bubbles will appear in the sight glass — the larger the bubbles, the more severe the refrigerant shortage; there may also be a hissing or whistle at the expansion valve. If the shortage is severe, the suction line will be relatively warm while the suction pressure will be low due to little or no liquid being supplied to the evaporator.

OVERCHARGE OF REFRIGERANT

Overcharge of refrigerant will cause high discharge pressures. The liquid will back up in the condenser and decrease the amount of surface available for condensing. In extreme cases, pressure may rise to a point to cause the pressure relief valve at line end of compressor to "pop" open.

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 matter of minutes, thus facilitating system diagnosis by pinpointing the problem to an improper charge in the system or by eliminating this possibility from the overall checkout.

Start engine and place on fast idle. Set controls for "MAX" cold with blower on "HI".

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 settling away from sight glass) an overcharge is indicated. Verify with a performance check.

If refrigerant foams and then settles away from sight glass in less than 45 seconds, it can be assumed that there is a proper charge of refrigerant in system. Continue checking out system using performance checks outlined previously.

SPECIAL TOOLS FOR DISCHARGING, EVACUATING AND CHARGING

CHARGING STATION J-24410

Charging Station J-24410 (figure 47) is a portable assembly consisting of a vacuum pump, two compound gauges, shut-off valves, refrigerant supply connection, and a 5-lb.

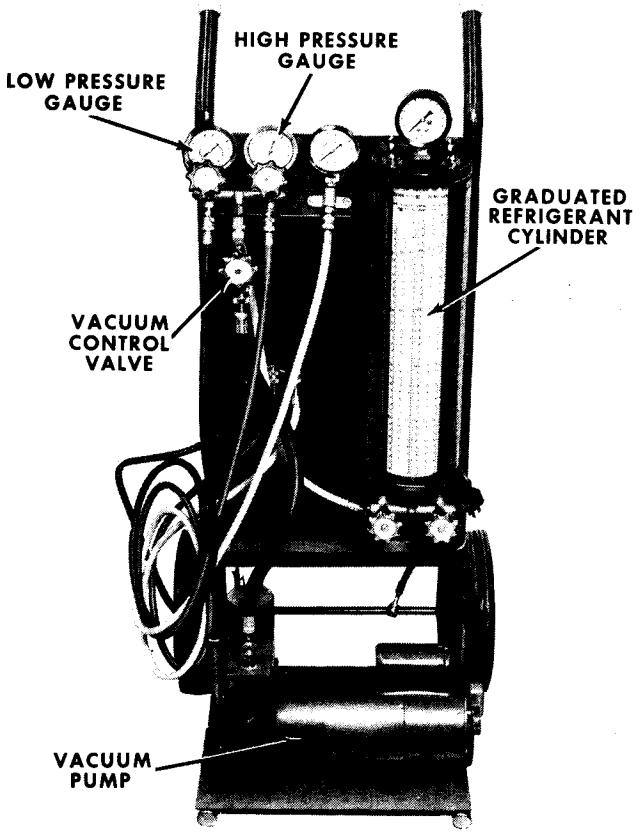


Figure 47—Charging Station J-24410

metering refrigerant charging cylinder. The use of the charging cylinder eliminates the need for scales, hot water pails, etc.

The vacuum pump on this service station evacuates at the rate of three cubic feet per minute, and has a vented exhaust to aid in the removal of moisture.

The cylinder (which can be heated to provide a positive pressure advantage during charging) is graduated for both Refrigerant-12 and Refrigerant 22. Refrigerant-22 is used in some of the refrigerant systems on recreational vehicles.

All the necessary evacuating and charging equipment is hooked together in a compact portable unit. Use of a charging station brings air conditioning service down to the basic problem of hooking on two hoses, and manipulating clearly labeled valves.

MANIFOLD GAUGE SET

The Manifold Gauge Set (or Manifold Assembly) J-23575-01 (figure 48) is used when discharging, evacuating, charging or diagnosing trouble in the system.

The gauge at the left is known as the low

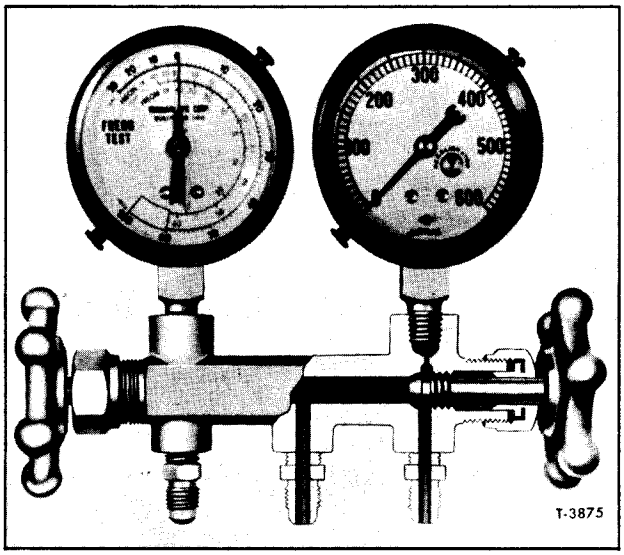


Figure 48—Manifold Gauge Set J-23575-01

pressure gauge. The face is graduated into pounds of pressure and, in the opposite direction from "O" pounds, 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 connection at the far left is for attaching the low pressure gauge line and the one at the right is for attaching the high pressure gauge line. The center connector is common to both and is for the purpose of attaching a line for adding refrigerant to a system, discharging refrigerant, evacuating the system and other uses. When not required, this line or connection should be capped.

NOTE: Gauge fitting connections should be installed hand-tight only and the connection leak-tested before proceeding with leak testing or charging with R-12 through the low side only.

The hand shutoff valves on the gauge manifold do not control the opening or closing off of pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operations, the valves must be closed. The only occasion for opening both at the same

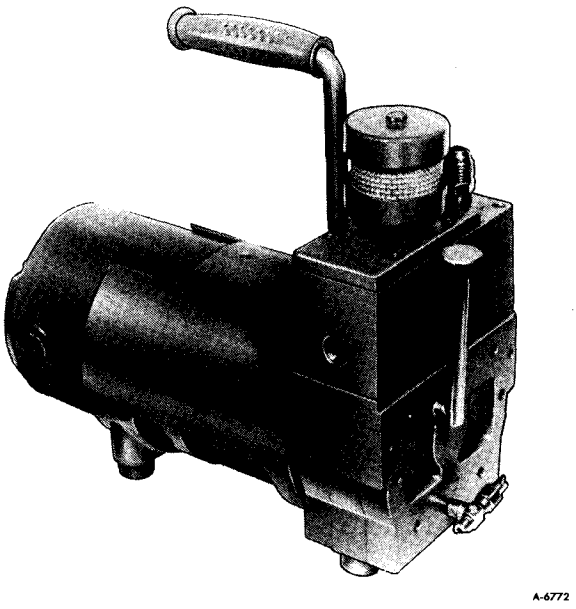


Figure 49—Vacuum Pump J-24364

time would be to bypass refrigerant vapor from the high pressure to the low pressure side of the system, or in evacuating both sides of the system.

The Gauge Set Asembly includes three color coded flexible hoses for connecting the gauge set to the system.

VACUUM PUMP

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

Figure 50—Leak Detector J-26934

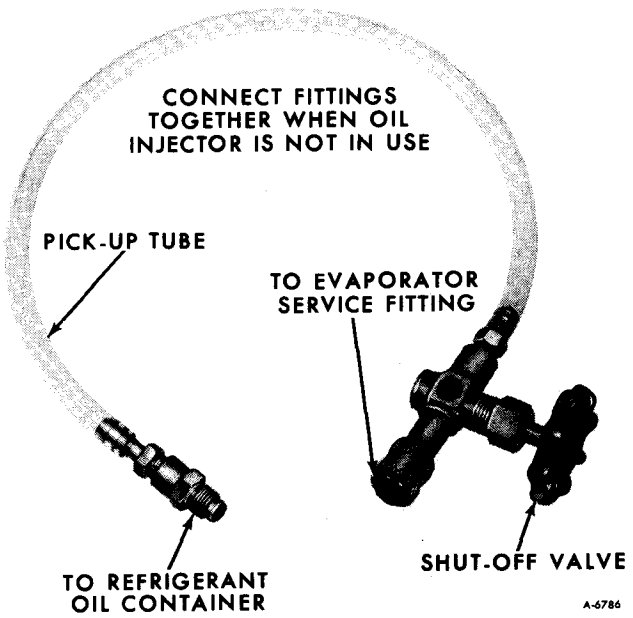


Figure 51—Compressor Oil Injector Tool J-24095

Vacuum Pump J-24364 (figure 49) is available for this purpose. It can be used together with a Manifold Gauge Set. A vacuum pump is a component part of the Charging Station described previously. The following precautions should be observed relative to the operation and maintenance of the vacuum pump:

1. Make sure dust cap on discharge outlet of vacuum pump is removed before operating.
2. Keep all openings capped when not in use to avoid moisture being drawn into the system.
3. Oil should be changed as recommended by manufacturer.

NOTE: Improper lubrication will shorten the life of the pump.

4. If this pump is subjected to extreme or prolonged cold, allow it to remain indoors until oil has reached approximately room temperature.
5. 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. Contamination will result in malfunction of the pump.
6. Do not use the vacuum pump as an air compressor.

LEAK TESTERS

Electronic Leak Detector J-26934 (figure 50) is available for detecting refrigerant leaks.

For information on leak testing, refer to "Leak Testing the System" (AIR CONDITIONING DIAGNOSIS") earlier in this section.

COMPRESSOR OIL INJECTOR TOOL J-24095

Oil can be added to the refrigeration system after discharge and before evacuation using Compressor Oil Injector Tool J-24095 (figure 51). Before the tool is used on the system, however, it must be flushed with clean Refrigerant-12 to eliminate possible contamination. Tool ends should be joined together when tool is not in use. Refer to "Adding Oil" procedure later in this section for usage instructions.

REFRIGERANT HANDLING PROCEDURES AND PRECAUTIONS

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.

Before any service is attempted which requires opening of refrigerant lines or components, the person doing the work should be thoroughly familiar with the following information on "Precautions in Handling Refrigerant-12", and should follow very carefully the instructions given for the unit being serviced. The major reasons behind these measures are safety and the prevention of dirt and moisture in the system. Dirt contaminant is apt to cause leaky valves or wear in the compressor, and moisture can freeze into ice at the expansion valve, causing the valve stem to freeze. The presence of moisture can also cause the formation of hydrochloric or hydrofluoric acids in the system. Air in the system can cause high head pressure and also carries into the system varying amounts of moisture.

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 (-30°C) 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 OF 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 OR RADIATOR OR TO 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 (52°C) OR WARM WET RAGS AROUND 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 SMALL 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, THE REFRIGERANT MAY DISPLACE ALL THE OXYGEN IN THE ROOM. IT IS RECOMMENDED THAT INHALATION OF LARGE QUANTITIES OF R-12 BE AVOIDED AND ADEQUATE VENTILATION BE PROVIDED. 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 (FIGURE 52), NO SERIOUS DAMAGE CAN RESULT. JUST REMEMBER ANY R-12 LIQUID THAT TOUCHES YOU IS AT LEAST 22°F (6°C) 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.

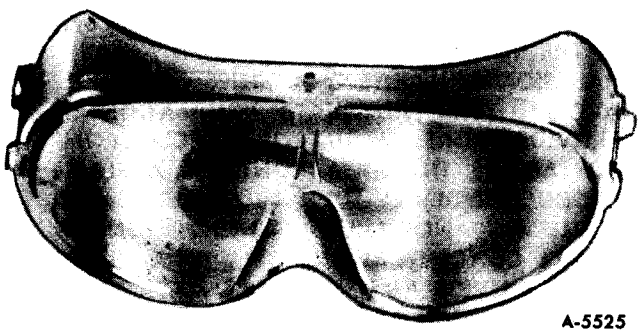
PRECAUTIONS IN HANDLING REFRIGERANT LINES

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. Kinks can lead to early tube fatigue-type failures.
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 wth 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 "Discharging 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-rings fittings is important. The use of improper wrenches may damage the connections. 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 seals 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.



A-5525

Figure 52—Goggles

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation of the air conditioning refrigeration system is dependent upon the pressure-temperature relationship of pure Refrigerant-12. As long as the system contains pure R-12 (plus a certain amount of 525 viscosity compressor oil which mixes with the R-12), it is considered to be chemically stable.

However, when 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 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 insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant or gauge line, the opening 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.

AVAILABILITY OF REFRIGERANT—12

Refrigerant-12 is available in 10-and 25-lb. drums and in 14-oz. disposable containers.

Normally, air conditioning systems are charged making use of an air conditioning charging station which uses the 25-lb. container. All Refrigerant-12 drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for the same reason.

If the occasion arises to fill a small Refrigerant-12 drum from a large one, never fill the drum completely. Space should always be allowed above the liquid for expansion. If the R-12 drum were completely full and the temperature was increased, tremendous hydraulic force could be developed.

The 14-oz. disposable cans are generally used for miscellaneous operations such as flushing, adding refrigerant to the system charge, and purging.

WARNING: THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED WHEN ADDING REFRIGERANT TO A SYSTEM USING 14-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 manufacturers directions carefully.
4. Always use pressure gauges before and during charging.
5. NEVER connect disposable-type cans on high pressure side of system or to any system having a pressure higher than pressure limit indicated on refrigerant containers.
6. If inexperienced, seek professional assistance.

DISCHARGING, EVACUATING AND CHARGING THE SYSTEM, AND RELATED SERVICE PROCEDURES

The refrigeration system may be discharged, evacuated and charged using air conditioning Charging Station J-24410 or complete Manifold and Gauge Assembly J-23575-01 with 14-oz. disposable cans (or a drum) of Refrigerant-12.

Procedures following are written for Charging Station J-24410 or Manifold Assembly J-23575-01. Different charging stations or manifold gauge sets may be used. For other than the units specified above, consult the operating instructions included with the equipment being used.

PRECAUTIONARY SERVICE MEASURES

Persons doing air conditioning service work should be thoroughly familiar with safety

PIPE AND HOSE CONNECTION TORQUE CHART

METAL TUBE OUTSIDE DIAMETER	THREAD AND FITTING SIZE	STEEL TUBING TORQUE FT. LBS.	STEEL TUBING TORQUE N.m	ALUMINUM OR COPPER TUBING TORQUE FT. LBS.	ALUMINUM OR COPPER TUBING TORQUE N.m	NOMINAL TORQUE WRENCH SPAN
1/4	7/16	10-15	14-20	5-7	7-9	5/8
3/8	5/8	30-35	41-48	11-13	15-18	3/4
1/2	3/4	30-35	41-48	15-20	20-27	7/8
5/8	7/8	30-35	41-48	21-27	29-37	1-1/16
3/4	1-1/16	30-35	41-48	28-33	38-45	1-1/4

A-6795

CAUTION: *Tighten all tubing connections as shown in torque chart. Insufficient or excessive torque when tightening can cause loose joints or deformed joint parts. Either condition can result in refrigerant leakage. Where steel-to-aluminum connections are being made, use torque for aluminum tubing to prevent damage to the tubing.*

Figure 53—Pipe and Hose Connection Torque Chart

measures covered earlier in this section under "REFRIGERANT HANDLING PROCEDURES AND PRECAUTIONS": this includes "Precautions in Handling R-12", "Precautions in Handling Refrigerant Lines and Fittings", "Maintaining Chemical Stability in the Refrigerant System", and "Refrigerant Charging Precautions". Any person servicing Motorhome or TransMode air conditioning systems should follow very carefully the DISCHARGING, EVACUATING AND CHARGING PROCEDURES outlined in this section, and the ADDING OIL and ADDING REFRIGERANT procedures included here also.

The purpose for these precautionary measures is two-fold: (1) to insure the safety of the mechanic working on the system, and (2) to prevent the entrance of dirt and moisture into the system (which can restrict refrigerant flow). The presence of moisture can also cause the formation of hydrochloric or hydrofluoric acids in the system.

FURTHER PRECAUTIONS

All sub-assemblies are dehydrated and sealed prior to shipping. They are to remain sealed until just prior to making connections. All sub-assemblies should be at room temperature before uncapping (this prevents condensation of moisture from the air that enters the system). If, for any reason, caps are removed

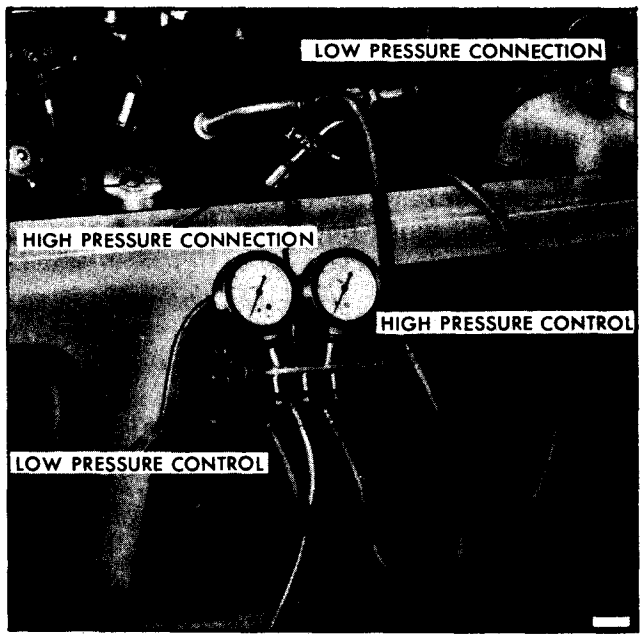


Figure 54—Manifold Gauge Set Installed To High and Low Side Service Fittings

but the connections are not made, parts should be resealed as soon as possible.

All precautions should be taken to prevent damage to fittings or connections. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with trichlorethylene (naphtha, stoddard solvent or kerosene may be used). Make sure fittings are dry prior to reassembly. If dirt, grease or moisture get inside pipes and cannot be removed, the pipe should be replaced.

Sealing caps should be removed from subassemblies just prior to making connections for final assembly. Use a small amount of clean 525 viscosity refrigerant oil on all tube and hose joints. Always use new O-rings dipped in the clean refrigerant oil when assembling joints. The oil will aid in assembly and help provide a leak-proof joint. When tightening joints, use a second wrench to hold stationary part of connection so that a solid feel can be attained. This will indicate proper assembly.

High and low pressure gauge line fittings are provided in the air conditioning system for attaching the charging station or the manifold gauge set to the vehicle. Both high and low pressure fittings are accessible on Motorhome and TransMode vehicles in the engine compartment, under the right front (passenger side) access door. The HIGH PRESSURE or HIGH-SIDE fitting is located on the evaporator inlet line and the LOW PRESSURE or LOW-SIDE service fitting is located on the evaporator outlet. Service fittings can be seen in figure 54, showing a manifold gauge set installed on the vehicle.

However, charging lines from the Charging Station or Manifold and Gauge Set require the use of gauge adapters to connect to system service fittings. A straight gauge adapter (J-5420) and a 90-degree angle gauge adapter (J-9459) are available. High and low pressure fittings on all 1978 vehicles and on late model 1977 vehicles are different sizes, to prevent error in attachment of lines. The low pressure fitting is a 7/16"-20 thread while the high pressure fitting is smaller—3/8"-24 thread. Straight gauge adapter J-25498 (or 90-degree angle J-25499) is required when servicing a vehicle equipped with the smaller size high pressure fitting (figure 55).

WARNING: ALWAY WEAR SAFETY GOGGLES AND WRAP A CLEAN CLOTH AROUND FITTINGS AND CONNECTIONS WHEN DOING WORK THAT INVOLVES OPENING THE REFRIGERATION SYSTEM. IF LIQUID REFRIGERANT COMES INTO CONTACT WITH THE SKIN OR EYES, INJURY CAN RESULT.

CHARGING STATION METHOD OF DISCHARGING, EVACUATING AND CHARGING THE SYSTEM

NOTE: For charging stations other than that shown in figure 47, consult the operating instructions included with the charging station being used.

DISCHARGING

In replacing any of the air conditioning components, the system must be completely discharged or drained of Refrigeration-12. The purpose is to remove the pressure inside the system so that a component part can be safely removed.

While discharging, keep these precautions in mind:

*KEEP HIGH PRESSURE VALVE ON MANIFOLD GAUGE SET CLOSED AT ALL TIMES.

*DO NOT CONNECT THE HIGH PRESSURE LINE TO THE VEHICLE AIR CONDITIONING SYSTEM.

1. Be certain that ignition key is in "OFF" position.
2. Remove protective cap from the LOW-SIDE service fitting at evaporator outlet. Remove center manifold hose from the vacuum pump connection.

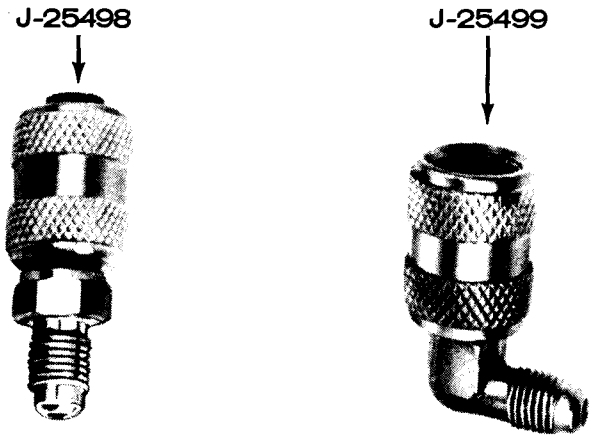


Figure 55—Charging Line Adapters

3. Close all the control valves on the manifold gauge set, including the gauge set vacuum valve. If low pressure gauge line does not have a built-in Schrader type core depressor, install Gauge Adapter J-5420 onto the low pressure line of the Manifold Assembly. Place end of center manifold hose into an empty refrigerant bottle or covered can as shown in figure 56.

NOTE: An empty 3-lb. coffee can with a plastic cover as shown in figure 56 which has been cross-slit (X'ed) works well for this purpose. This will allow refrigerant to be discharged safely. Container will also collect any oil lost due to rapid discharge of system, and will allow for later measurement of oil loss.

4. Connect Low Side gauge hose (with J-5420 adapter if necessary) to the Low Side service fitting at evaporator outlet as rapidly as possible to prevent the possibility of liquid R-12 coming in contact with the skin. See Warning Note under "Precautions in Handling Refrigerant-12". After the hose or adapter is tightened down onto the access fitting, open the low side gauge valve and partially open the vacuum valve to allow the system refrigerant to discharge from the system into the oil collection container. It will be necessary to regulate the refrigerant flow out of the system with the vacuum valve, to keep the hose in the collection container and prevent spewage of oil out of the container. If no discharge occurs, check for a missing or deformed Schrader valve depressor in the hose end or in the J-5420 adapter fitting

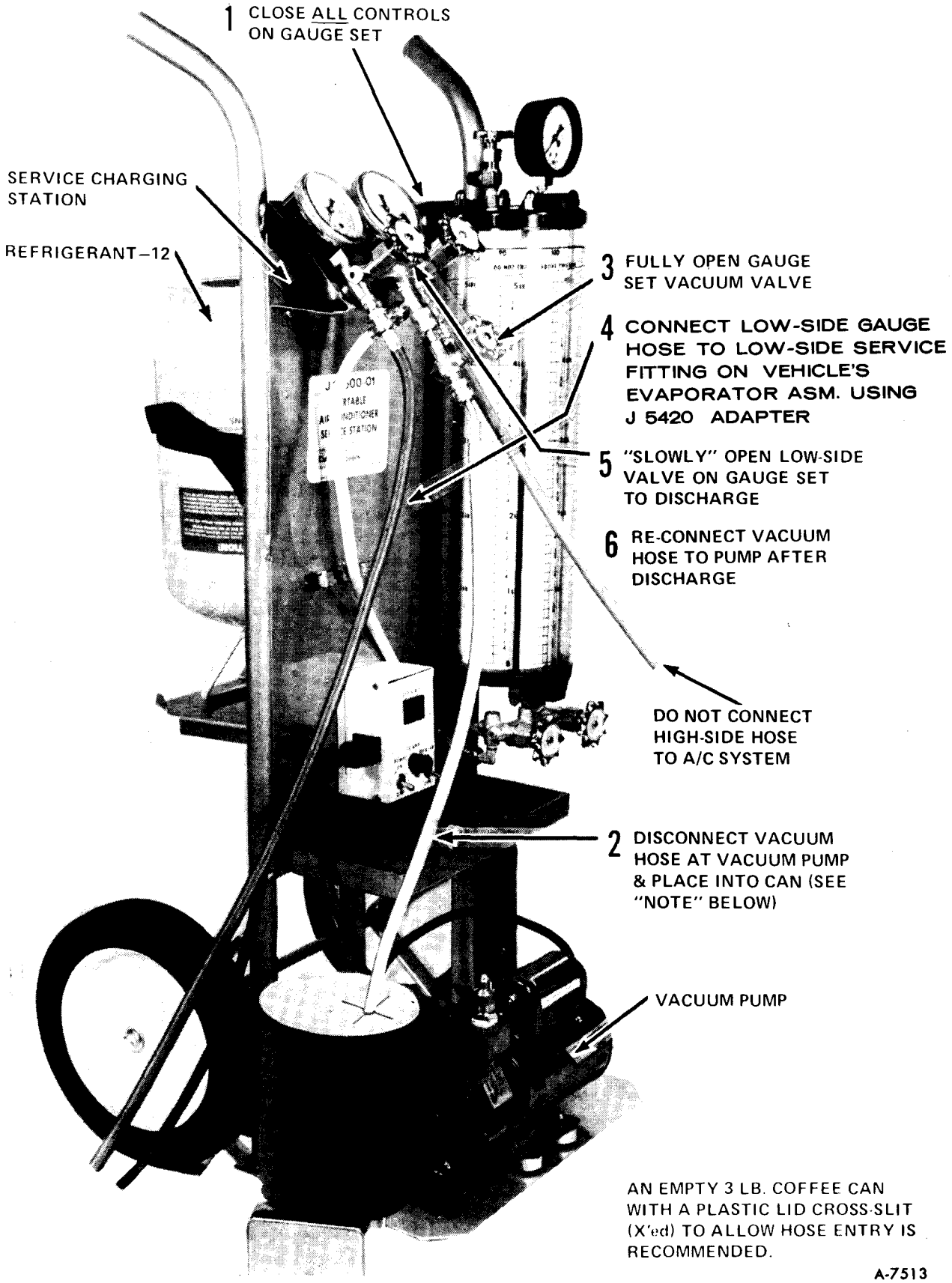


Figure 56—Discharging the A/C System with Charging Station

5. When system appears fully discharged from the LOW SIDE, check the HIGH SIDE system fitting at evaporator inlet line for any sign of remaining pressure. Do this by connecting a downward directed 36" section J-5418-36B charging line with an attached J-24598 straight or J-24599 90-degree angle fitting adapter to the HIGH SIDE service fitting at the evaporator inlet. Slowly tighten down the adapter to depress the valve fitting to determine if pressure is present.

6. IF PRESSURE IS FOUND ON THE HIGH SIDE of the system, the system is not completely discharged of refrigerant. Attempt to discharge high side, using same procedure as used for low-side.

NOTE: This condition indicates a restriction (i.e., possible plugged expansion valve screen, kinked line or kinked condenser pass). HIGH-SIDE components should be removed and/or diagnosed to determine the area restricted.

WARNING: AS ALWAYS, PERSONAL CARE MUST BE TAKEN WHENEVER A COMPONENT IS REMOVED WHERE ENTRAPMENT OR REFRIGERANT IS SUSPECTED.

7. When the system is completely discharged (no vapor escaping with hose fully tightened down), measure, record and discard any collected oil. (Loss should be minimal.) If this quantity is 1/2 ounce or more, an equivalent amount of new oil must be added to the system, plus any oil trapped in removed parts, BEFORE evacuation and charging with Refrigerant-12. (See "Adding Oil" later in this section for complete instructions.)

EVACUATION

When the refrigerant system has been discharged and opened for any repair, or the Refrigerant-12 charge lost, the complete system must be evacuated prior to charging, to remove any trace of air or moisture. Evacuating is the process of removing all air from the system, thereby creating a vacuum in the system.

Evacuation and Charging is a combined procedure, with all lines and gauges, as well as the vehicle air conditioning system, to be purged with Refrigerant-12 and evacuated immediately prior to charging.

CAUTION: *Under no circumstances should alcohol be used in the system in an attempt to remove moisture, regardless of the successful use of alcohol in other refrigerant systems.*

NOTE: ADDING OIL TO THE CCTXV SYSTEM should take place AFTER discharge and BEFORE evacuation. Refer to "Adding Oil" in this section for procedure.

Prior to Evacuation, check the low pressure gauge on the Manifold Gauge Assembly for proper calibration. With the gauge hose disconnected from the vehicle refrigeration system, be sure that the pointer indicates to the center of "O". Lightly tap gauge a few times to be sure pointer is not sticking. If necessary, calibrate gauge according to the instructions included with the Charging Station.

Adjust as necessary to position pointer through center of "O" position. Tap gauge a few times to be sure pointer is not sticking.

When evacuating and charging with Charging Station manifold gauge assembly and vacuum pump, follow instructions included with the Charging Station and particularly the following precautions;

1. DO NOT CONNECT THE HIGH PRESSURE LINE OF MANIFOLD GAUGE ASSEMBLY TO THE VEHICLE AIR CONDITIONING SYSTEM. During evacuation, High Pressure Gauge Line connects to Vacuum Pump.
2. KEEP THE HIGH PRESSURE VALVE ON THE MANIFOLD GAUGE ASSEMBLY CLOSED DURING CHARGING.
3. PERFORM THE ENTIRE EVACUATE AND CHARGE PROCEDURE THROUGH THE VEHICLE LOW-SIDE SERVICE FITTING.

NOTE: Before evacuating, be certain system is completely discharged, thus preventing refrigerant from entering the vacuum pump through the Manifold Assembly.

VACUUM: In all evacuation procedures, the specification of at least 28-29 inches of Mercury vacuum is used. This specification can only be reached at or near sea level. For each 1,000 feet above sea level where this operation is being performed, specification should be lowered by one inch of Mercury vacuum. Example: At 5,000 feet elevation, only 23-24 inches of vacuum can normally be attained. (See chart below.)

	ELEVATION							
Ambient	Sea Level	500 Feet	1000 Feet	1500 Feet	2000 Feet	2500 Feet	3000 Feet	4000 Feet
45°	29.6	29.1	28.6	28.1	27.6	27.1	26.6	25.6
59°	29.4	28.9	28.4	27.9	27.4	26.9	26.4	25.4
69°	29.2	28.7	28.2	27.7	27.2	26.7	26.2	25.2
76°	29.0	28.5	28.0	27.5	27.0	26.5	26.0	25.0
80°	28.9	28.4	27.9	27.4	26.9	26.4	25.9	24.9
86°	28.7	28.2	27.7	27.2	26.7	26.2	25.7	24.7
+ Vacuum Requirements in Inches Hg. to Boil Water								A-6796

Figure 57—Vacuum Chart

Before attempting to evacuate the system, check the vacuum pump to determine how much vacuum the pump is capable of reaching. To do this, attach the Low Side gauge line to the vacuum pump and make sure that the pump electrical cord is plugged into 110-volt outlet. With the Low Side Gauge Valve on the manifold "closed", turn on vacuum pump and look for vacuum reading of at least 28-29 inches of Mercury vacuum at sea level (see chart for altitude adjustment). If vacuum reading does not come up to minimum specification for the respective altitude, it indicates a leak in the connections or a defective pump. In any case, there will not be enough vacuum to boil out moisture that may be trapped in the air conditioning system. Repair pump or substitute another that is capable of reaching minimum vacuum. Then proceed with evacuation instructions.

Check oil level in vacuum pump according to Charging Station or vacuum pump service instructions and, if necessary, add vacuum pump oil. Make sure dust cap on discharge side of vacuum pump has been removed, and that vacuum pump electrical cord is connected to 110-volt outlet.

TO EVACUATE:

1. Connect the Charging Station gauge lines similar to that as shown in figure 56, attaching low pressure gauge line to LOW SIDE service fitting. If hose is not equipped with Schrader-type valve depressor add J-5420 adapter to the gauge line before connecting line to LOW SIDE service fitting. Attach high pressure gauge line to the vacuum pump.

2. Close the gauge set vacuum valve located in the center line from the gauge manifold assembly.

3. Start vacuum pump and slowly open low and high pressure control valves on Manifold Assembly, to avoid forcing oil out of refrigerant system and pump. Pressure is now being reduced in the vehicle system through the LOW-SIDE.

4. Observe low pressure gauge. Run pump until at least 28-29 inches of vacuum is obtained. Close HIGH SIDE gauge valve and turn off vacuum pump. Watch LOW SIDE gauge to be sure vacuum holds for five (5) minutes. Proceed to charging if vacuum is held.

If prescribed vacuum cannot be reached, it indicates a leak in the system or gauge connections. In this case it will be necessary to check the system for leaks. With vacuum pump turned "off" and High Side pressure gauge valve "closed", pressurize the A/C system with R-12 vapor from the charging cylinder or drum of refrigerant to drum pressure, (preferably 70 psi or above). Using appropriate method, locate and repair all leaks and release pressure from system. Repeat evacuation procedure.

CHARGING

WARNING: ALWAYS WEAR GOGGLES AND WRAP A CLEAN CLOTH AROUND FITTINGS AND CONNECTIONS WHEN DOING WORK THAT INVOLVES ACCESS OR OPENING THE REFRIGERATION SYSTEM. IF LIQUID REFRIGERANT COMES INTO CONTACT WITH THE SKIN OR EYES, INJURY CAN RESULT.

CHARGING IS TO BE DONE THROUGH THE LOW-SIDE SERVICE FITTING ONLY. DO NOT CONNECT HIGH PRESSURE LINE TO HIGH SIDE OF THE VEHICLE AIR CONDITIONING SYSTEM.

KEEP HIGH SIDE GAUGE VALVE ON THE MANIFOLD OF CHARGING STATION CLOSED AT ALL TIMES DURING THE CHARGING SEQUENCE.

***USE THE COMPRESSOR TO HELP DRAW IN THE R-12 CHARGE* AS INDICATED IN THE CHARGING PROCEDURE BELOW.**

NOTE: It is important that the compressor be operated as recommended during the charging procedure. If the compressor is not operated as recommended the liquid R-12 entering the system during charging may pick-up, and float, refrigerant oil from internal surfaces of the compressor. This oil could then be "carried" out of the compressor at system start-up, causing immediate-to-short life seizure due to shortage of internal lubrication.

With the vehicle A/C system evacuated and proper charge of R-12 in charging cylinder, charge the system according to the following procedure:

1. Pull plastic connector off of low-pressure cut-off switch (refer to figure 17 for

location). Attach jumper wire to terminals inside the connector body. This will insure that the compressor clutch does not cycle on and off during operation.

2. After checking to make sure the engine compartment is clear of obstructions, start the engine. Run with choke open and fast idle speed reduced to normal idle. A/C control panel switch must be "OFF".

3. With low pressure hose still connected to vehicle LOW-SIDE service fitting and low pressure gauge control valve on Manifold Assembly open, proceed to open the charge cylinder valve and allow 1 lb. of liquid refrigerant to enter the system through the LOW-SIDE.

4. When 1 lb. of refrigerant has been added to the system, immediately engage the compressor by setting the A/C control lever to "NORM" and blower speed to "HI" to draw in the remainder of the R-12 charge. (Total R-12 charge for 1978 and late model 1977 Motorhome and TransMode air conditioning systems is 3-3/4 lb.)

NOTE: This charging operation can be speeded by placing a large volume fan in front of the condenser. If condenser temperature is maintained below that of charging cylinder, refrigerant will enter the system more rapidly.

5. When full charge has entered the system, shut off the R-12 source valve at the cylinder.

6. Run engine for 30 seconds to clear lines and gauges. Then close low pressure gauge control valve on Manifold Assembly.

7. With the engine running, remove the charging LOW-SIDE hose adapter from the LOW-SIDE service fitting. Unscrew rapidly to avoid excess R-12 escape from the system.

WARNING: NEVER REMOVE A GAUGE LINE FROM ITS ADAPTER WHEN LINE IS CONNECTED TO A/C SYSTEM. ALWAYS REMOVE THE LINE ADAPTER FROM THE SERVICE FITTING TO DISCONNECT A LINE. DO NOT REMOVE CHARGING HOSE AT GAUGE SET WHILE ATTACHED TO VEHICLE LOW-SIDE SERVICE FITTING. THIS WILL RESULT IN COMPLETE DISCHARGE OF SYSTEM DUE TO THE DEPRESSED SCHRADER VALVE IN SERVICE LOW-SIDE FITTING.

8. Replace protective cap on low-side service fitting.

9. Leak check the system with Electronic Leak Detector J-26934 or other suitable leak detector. Do not use propane gas burning torch as a leak detector.

10. Remove jumper from low pressure switch connector and reattach connector to switch.

11. With system fully charged and leak checked, continue to operate system and test for proper system pressures as outlined under "Performance Data" and "Performance Test".

DISPOSABLE CAN OR REFRIGERANT DRUM METHOD OF DISCHARGING, EVACUATING AND CHARGING THE SYSTEM

NOTE: For manifold gauge sets other than that shown in figure 48, consult the operating instructions included with the manifold gauge set being used.

DISCHARGING

In replacing any of the air conditioning components, the system must be completely discharged or drained of Refrigerant-12. The purpose is to remove the pressure inside the system so that a component part can be safely removed.

While discharging, keep these precautions in mind:

*KEEP HIGH PRESSURE VALVE ON MANIFOLD GAUGE SET CLOSED AT ALL TIMES.

*DO NOT CONNECT THE HIGH PRESSURE LINE TO THE VEHICLE AIR CONDITIONING SYSTEM.

1. Be certain that ignition key is in "OFF" position.

2. Remove protective cap from the LOW-SIDE service fitting at evaporator outlet.

3. Close all the control valves on the manifold gauge set. If low pressure gauge line does not have a built-in Schrader type core depressor, install Gauge Adapter J-5420 onto the low pressure line of the Manifold Assembly. Place end of center manifold hose into an empty refrigerant bottle or covered can as shown in figure 58.

NOTE: An empty 3-lb. coffee can with a plastic cover as shown in figure 58 which has been cross-slit (X'ed) works well for this purpose. This will allow refrigerant to be discharged safely. Container will also collect any oil lost due to rapid discharge of system, and will allow for later measurement of oil loss.

4. Connect Low Side gauge hose (with J-5420 adapter if necessary) to the Low Side

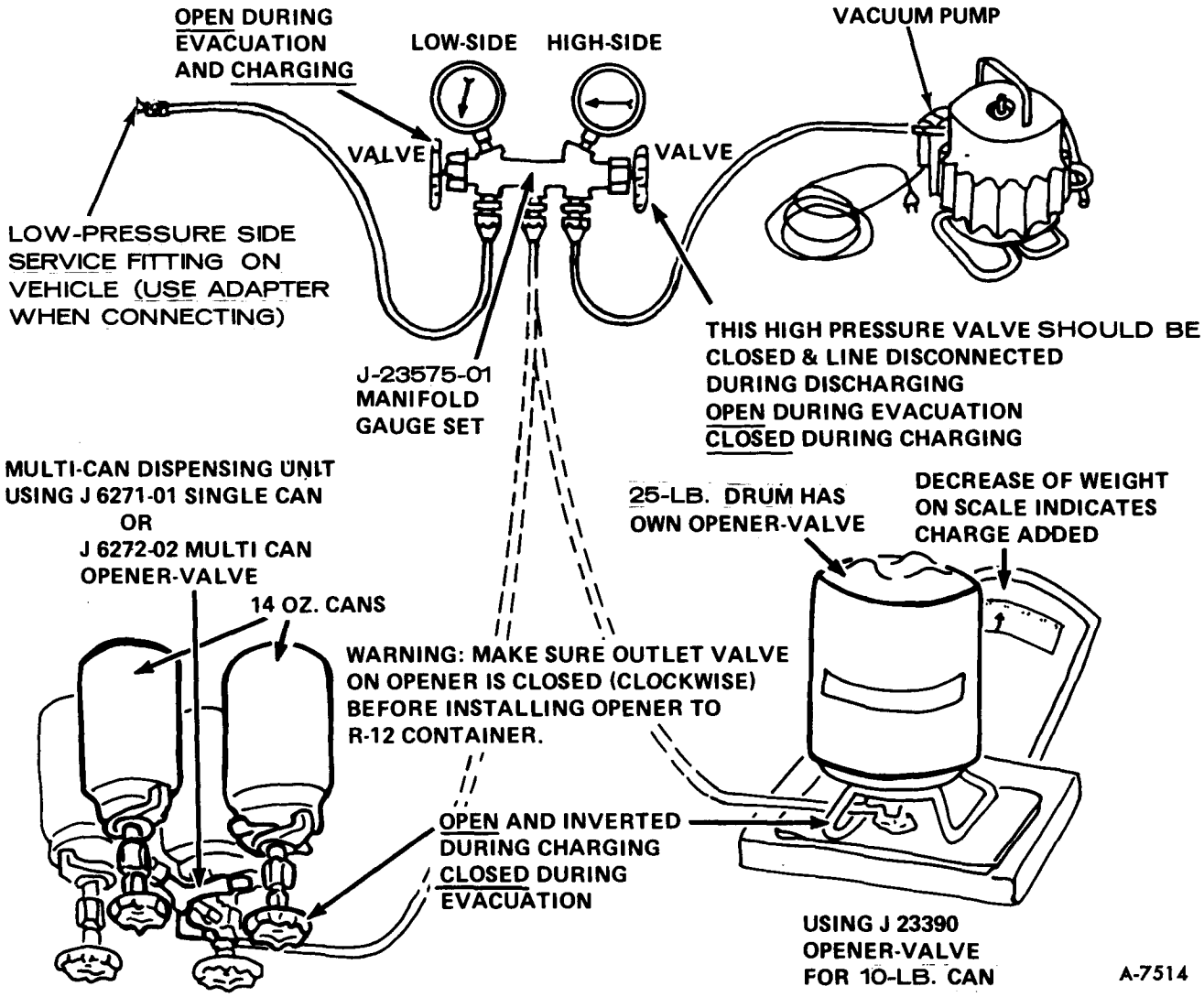


Figure 58—Charging the 1977 A/C System with Disposable Can or Refrigerant Drum

service fitting at evaporator outlet as rapidly as possible to prevent the possibility of liquid R-12 coming in contact with the skin. See Warning Note under "Precautions In Handling Refrigerant- 12". After the hose or adapter is tightened down onto the access fitting, open the low side gauge valve partially and allow the system refrigerant to discharge from the system into the oil collection container. It will be necessary to regulate the refrigerant flow out of the system with the low side gauge valve, to keep the hose in the collection container and prevent spewage of oil out of the container. If no discharge occurs, check for a missing or deformed Schrader-type valve depressor in the hose end of J-5420 adapter fitting.

5. When system appears fully discharged from the LOW SIDE, check the HIGH SIDE system fitting at evaporator inlet line for any sign of remaining pressure. Do this by connecting a downward directed 36" section J-5418-36B charging line with an attached J-24598 straight or J-24599 90-degree angle fitting adapter to the HIGH SIDE service fitting at the evaporator inlet. Slowly tighten down the adapter to depress the valve fitting to determine if pressure is present.

6. IF PRESSURE IS FOUND ON THE HIGH SIDE of the system, the system is not completely discharged of refrigerant. Attempt to discharge high side, using same procedure as used for low-side.

NOTE: This condition indicates a restriction (i.e., possible plugged expansion valve screen, kinked line or kinked condenser pass). HIGH-SIDE components should be removed and/or diagnosed to determine the area restriced.

WARNING: AS ALWAYS, PERSONAL CARE MUST BE TAKEN WHENEVER A COMPONENT IS REMOVED WHERE ENTRAPMENT OF REFRIGERANT IS SUSPECTED.

7. When the system is completely discharged (no vapor escaping with hose fully tightened down), measure, record and discard any collected oil. (Loss should be minimal.) If this quantity is 1/2 ounce or more, an equivalent amount of new oil must be added to the system, plus any oil trapped in removed parts, BEFORE evacuation and charging with Refrigerant-12. (See "Adding Oil" later in this section for complete instructions.)

EVACUATION

When the refrigerant system has been discharged and opened for any repair, or the Refrigerant-12 charge lost, the complete system must be evacuated prior to charging, to remove any trace of air or moisture. Evacuating is the process of removing all air from the system, thereby creating a vacuum in the system.

Evacuation and Charging is a combined procedure, with all lines and gauges, as well as the vehicle air conditioning system, to be purged with Refrigerant-12 and evacuated immediately prior to charging.

CAUTION: *Under no circumstances should alcohol be used in the system in an attempt to remove moisture, regardless of the sucessful use of alcohol in other refrigerant systems.*

NOTE: ADDING OIL TO THE CCTXV SYSTEM should take place AFTER discharge and BEFORE evacuation. Refer to "Adding Oil" later in this section for procedure.

Prior to Evacuation, check the low pressure gauge on the Manifold Gauge Assembly for proper calibration. With the gauge hose disconnected from the vehicle refrigeration system, be sure that the pointer indicates to the center of "O". Lightly tap gauge a few times to be sure pointer is not sticking. If necessary, calibrate gauge according to the instructions included with the Manifold Gauge Set.

Adjust as necessary to position pointer through center of "O" position. Tap gauge a few times to be sure pointer is not sticking.

When evacuating and charging with Manifold Gauge Assembly and Vacuum Pump, follow instructions below, particularly the following precautions:

1. DO NOT CONNECT THE HIGH PRESSURE LINE OF MANIFOLD GAUGE ASSEMBLY TO THE VEHICLE AIR CONDITIONING SYSTEM. (High Pressure Gauge Line connects to Vacuum Pump as shown in figure 58)
2. KEEP THE HIGH PRESSURE VALVE ON THE MANIFOLD GAUGE ASSEMBLY CLOSED DURING CHARGING.
3. PERFORM THE ENTIRE EVACUATE AND CHARGE PROCEDURE THROUGH THE VEHICLE LOW-SIDE SERVICE FITTING.

Following these precautions (particularly during charging) will prevent disposable refrigerant cans from being accidentally subjected to high vehicle system pressure in the event an error is made in valve sequence. This is particularly applicable when the compressor is being used during charging to draw in the remainder of the R-12 charge.

NOTE: Before evacuating, be certain system is completely discharged, thus preventing refrigerant from entering the vacuum pump through the Manifold Assembly.

VACUUM: In all evacuation procedures, the specification of at least 28-29 inches of Mercury vacuum is used. This specification can only be reached at or near sea level. For each 1,000 feet above sea level where this operation is being performed, specification should be lowered by one inch of Mercury vacuum. Example: At 5,000 feet elevation, only 23-24 inches of vacuum can normally be attained. (Refer to figure 56.)

Before attempting to evacuate the system, check the vacuum pump to determine how much vacuum the pump is capable of reaching. To do this, attach the Low Side gauge line to the vacuum pump and make sure that the pump electrical cord is plugged into 110-volt outlet. With the Low Side gauge valve on the manifold "Closed", turn on vacuum pump and look for vacuum reading of at least 28-29 inches of Mercury vacuum at sea level (see above for altitude adjustment). If vacuum reading does not come up to minimum specification for the respective altitude, it indicates a leak in the connections or a defective pump. In any case, there will not be enough vacuum to boil out moisture that may be trapped in the system. Repair pump or substitute another that is capable of reaching minimum vacuum. Then proceed with evacuation instructions. Check oil level in vacuum pump according to the

vacuum pump service instructions and, if necessary, add vacuum pump oil. Make sure dust cap on discharge side of vacuum pump has been removed, and that vacuum pump electrical cord is connected to 110-volt outlet.

TO EVACUATE:

1. Connect manifold gauge assembly J-23575-01 as shown in figure 58, attaching low pressure gauge line to LOW SIDE service fitting. If hose is not equipped with Schrader-type valve depressor add J-5420 adapter to the gauge line before connecting line to LOW SIDE service fitting. Attach high pressure gauge line to the vacuum pump. Connect center hose of manifold to the R-12 source. If a Refrigerant-12 drum is used, place it on a scale and note the total weight before charging. Watch the scale during charging to determine the amount of R-12 used.

If disposable R-12 14-oz. cans are used, rotate tapping valve handle counterclockwise until point of valve needle is recessed far enough into the valve body to prevent puncturing the refrigerant can top when the can adapter is installed and valve body tightened in place.

NOTE: Refrigerant cans must not be punctured until evacuation is complete and system is ready to charge. With valve needle(s) retracted, the line to the single or multi-can adapter(s) will be evacuated through to the top of the can(s) to be punctured. Follow the instructions included with the tap valve being used.

If using Multi-Opener J-6272-02 or Single Can Opener J-6271-01, proceed as follows:

1. Rotate valve handle(s) counterclockwise to back stem(s) out of the valve body(s) until the piercing needle end is approximately 1/8" to the rear of the contact surface of the adapter valve to can top rubber seal(s). Remove the valve body from the can adapter(s).

NOTE: For "flat top" cans, the brass bushing over the valve body threads is removed; for "spud" or threaded type cans the brass bushing over the valve threads is left in place over the threads when installing the valve body into the can adapter(s).

2. Move the locking cam of the can adapter to the left to permit placing can adapter on refrigerant can(s). Move the locking cam all the way to the right to lock the adapter(s) in place.

3. Screw the valve assembly into the adapter(s) hand tight, with or without brass bushing per Step 1.

4. Check valve stem packing nut(s) (tighten if necessary to seal valve stem). Attach charging line to valve or multi-can connection DO NOT pierce refrigerant can(s) before system is evacuated and ready to charge the system. Steps covering the piercing of the cans will be covered under "CHARGING THE SYSTEM".

5. Start vacuum pump and slowly opne lwo and high pressure control valves on Manifold Assembly, to avoid forcing oil out of refrigerant system and pump. Pressure is now being reduced in the vehicle system through the LOW-SIDE.

6. Observe low pressure gauge. Run pump until at least 28-29 inches of vacuum is obtained. Close High Side gauge valve and turn off vacuum pump. Watch Low Side gauge to be sure vacuum holds for five (5) minutes. Proceed to charging if vacuum is held.

If prescribed vacuum cannot be reached, it indicates a leak in the system or gauge connections. In this case it will be necessary to check the system for leaks. With vacuum pump turned "off" and High Side pressure gauge valve "closed", pressurize the A/C system with R-12 vapor, from a can or drum of refrigerant, to drum pressure (preferably 70 psi or above). Using appropriate method locate and repair all leaks and release pressure from system. Repeat evacuation procedure.

CHARGING

WARNING: ALWAYS WEAR GOGGLES AND WRAP A CLEAN CLOTH AROUND FITTINGS AND CONNECTIONS WHEN DOING WORK THAT INVOLVES ACCESS OR OPENING THE REFRIGERATION SYSTEM. IF LIQUID REFRIGERANT COMES INTO CONTACT WITH THE SKIN OR EYES, INJURY CAN RESULT.

CHARGING IS TO BE DONE THROUGH THE LOW-SIDE SERVICE FITTING ONLY. *DO NOT* CONNECT HIGH PRESSURE LINE TO HIGH SIDE OF THE VEHICLE AIR CONDITIONING SYSTEM.

KEEP HIGH SIDE GAUGE VALVE ON THE MANIFOLD OF CHARGING STATION CLOSED AT ALL TIMES DURING THE CHARGING SEQUENCE.

***USE THE COMPRESSOR TO HELP DRAW IN THE R-12 CHARGE* AS INDICATED IN THE CHARGING PROCEDURE BELOW.**

NOTE: It is important that the compressor be operated as recommended during the charging procedure. If the compressor is not

operated as recommended, the liquid R-12 entering the system during charging may pick-up, and float, refrigerant oil from internal surfaces of the compressor. This oil could then be "carried" out of the compressor at system start-up, causing immediate-to-short life seizure due to shortage of internal lubrication.

With the vehicle A/C system evacuated and R-12 source containers attached to openers, as indicated in figure 58, charge the system using the following procedure:

1. Pull plastic connector off of low-pressure cut-off switch (refer to figure 17 for location). Attach jumper wire to terminals inside the connector body. This will insure that the compressor clutch does not cycle on and off during charging operation.
2. After checking to make sure the engine compartment is clear of obstructions, start the engine. Run with choke open and fast idle speed reduced to normal idle. A/C control panel switch must be "OFF".
3. With low pressure hose still connected to vehicle LOW-SIDE service fitting and low pressure control valve on Manifold Assembly fully open, invert refrigerant drum or cans and open refrigerant source valve. Allow 1 lb. (or 1 to 2 14-oz. cans) of liquid refrigerant to enter the system through the LOW-SIDE. (Multi-Opener J-6272-02 or Single-Can Opener J-6272-01).

Turn valve handles clockwise to pierce refrigerant can(s). To release refrigerant from can into the system during charging sequence, turn the valve handles counterclockwise serveral turns until the refrigerant flows into the system. To shut off the refrigerant flow, turn valve handle(s) clockwise until the stem seats in the valve body.

NOTE: Until refrigerant can is empty and pressure in line between can and Low Side control valve is released, DO NOT release can adapter. Always close the Low Side control valve before removing Single or Multi-Can adapters.

For other type adapters, consult Use Instructions included with the adapter.

4. When 1 lb. or 1 to 2 14-oz. cans of refrigerant have been added to the system, immediately engage the compressor by setting the A/C control lever to "NORM" and blower speed to "HI" to draw in the remainder of the R-12 charge. (Total R-12 charge for 1978 and late model 1977 Motorhome and TransMode air conditioning systems is 3-3/4 lb.)

NOTE: This charging operation can be speeded by placing a large volume fan in front of the condenser. If condenser temperature is maintained below that of charging cylinder, refrigerant will enter the system more rapidly.

5. When full charge has entered the system, shut off the R-12 source valve.
6. Run engine for 30 seconds to clear lines and gauges. Then close low pressure gauge control valve on Manifold Assembly. Release the pressure from the charging cylinder or charging adapter line and remove line from fitting.
7. With the engine running, remove the charging LOW-SIDE hose adapter from the LOW-SIDE service fitting. Unscrew rapidly to avoid excess R-12 escape from the system.

WARNING: NEVER REMOVE A GAUGE LINE FROM ITS ADAPTER WHEN LINE IS CONNECTED TO A/C SYSTEM. ALWAYS REMOVE THE LINE ADAPTER FROM THE SERVICE FITTING TO DISCONNECT A LINE. DO NOT REMOVE CHARGING HOSE AT GAUGE SET WHILE ATTACHED TO VEHICLE LOW-SIDE SERVICE FITTING. THIS WILL RESULT IN COMPLETE DISCHARGE OF SYSTEM DUE TO THE DEPRESSED SCHRADER VALVE IN SERVICE LOW-SIDE FITTING.

8. Replace protective cap on low-side service fitting.
9. Leak check the system with Electronic Leak Detector J-26934 or other suitable leak detector. Do not use propane gas burning torch as a leak detector.
10. Remove jumper from low pressure switch connector and re-attach connector to switch.
11. With system fully charged and leak checked, continue to operate system and test for proper system pressures as outlined under "Performance Data" and "Performance Test".

ADDING OIL

If necessary, refrigeration oil may be added to the refrigeration system after discharge and before evacuation, using Compressor Oil Injector Tool J-24095 (refer to figure 51). Before the tool is used on the system, however, it must be flushed with clean Refrigerant-12 to eliminate possible contamination.

TO CLEAN TOOL J-24095:

1. Disconnect refrigerant line at refrigerant supply tank (back of Charging Station, beneath refrigerant container) or refrigerant can opener dispensing valve.
2. Disconnect ends of tool J-24095 and connect injector end of tool to refrigerant supply.
3. With shut-off valve on tool J-24095 open, flush tool for approximately 3 seconds by cracking open valve at refrigerant tank (or opener dispensing valve). Then close supply valve on refrigerant tank (or dispensing valve) and close shut-off on tool.
4. Disconnect tool from refrigerant supply. Temporarily refasten tool ends to each other, and reconnect refrigerant supply line to tank (or dispensing valve).

TO ADD OIL TO THE SYSTEM:

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

NOTE: This adding oil procedure is based on the use of Charging Station J-24410. If using Manifold Gauge Assembly and separate vacuum pump, there is no vacuum control valve on the gauge assembly. After necessary amount of oil is added to the system, close the HIGH-PRESSURE valve on the Manifold Assembly first. Then close shut-off valve on Oil Injector Tool and turn off vacuum pump.

1. If not already done, measure oil loss collected as a result of discharging the system.
2. Using Charging station J-24410, connect vacuum line to vacuum pump. (This is done only after system has been discharged of refrigerant.)
3. Connect high pressure hose of Charging Station to vehicle HIGH-SIDE service fitting at evaporator inlet. Make sure high pressure control valve on Charging Station is closed.
4. Disconnect Charging Station low pressure line (blue hose) from vehicle LOW-SIDE service fitting. Disconnect ends of tool J-24095 and install injector end of tool (with shut-off valve closed) onto the vehicle LOW-SIDE service fitting. Insert pick-up end of tool into graduated container of clean refrigerant oil. Make certain that pick-up end of tool is completely submerged in oil so that system does not draw in any air.

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

5. Turn on the vacuum pump and open the vacuum control valve on Charging Station. Then open the high pressure control valve on the charging station SLOWLY, to avoid forcing oil out of the refrigerant system and pump.

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

6. Note oil level in container. Next, open shut-off valve on oil injector 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 shut-off valve on tool J-24095.
7. Close high pressure valve on Charging Station. Disconnect high pressure hose from vehicle HIGH-SIDE service fitting. Replace protective cap on service fitting.
8. Turn off vacuum pump and close vacuum control valve on Charging Station.
9. Disconnect Tool J-24095 from vehicle and connect ends of tool. Refastening tool in this fashion will protect tool from moisture and foreign material.

COMPRESSOR OIL

The refrigerant system with six-cylinder axial (A-6) compressor requires approximately 10-1/2 fluid ounces of 525 viscosity oil. When the system is operated, oil circulates throughout the system with the refrigerant, leaving the compressor with the high pressure gas and returning to the compressor with the suction gas.

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 oil bottle when not in use.

Refer to "Performance Data Chart" 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 at the compressor. Therefore, the refrigerant charge in the system has a definite tie-in with the amount of oil found in the compressor. An insufficient charge may also eventually lead to an oil build-up in the evaporator.

CHECKING COMPRESSOR OIL CHARGE

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

- Broken refrigerant hose or line.
- Severe connection leak.
- Very badly leaking compressor shaft or O-ring seal.
- Collision damage to the system components.

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

To check the compressor oil charge, it is necessary to determine that the system is properly charged with refrigerant. Operate the system as specified and then remove the compressor from the vehicle, drain and measure the oil as outlined below:

1. Run the A/C system for 10 minutes at 2000 engine rpm with controls set for "MAX" cooling and "HI" blower speed. During operation, check for proper refrigerant charge so that the oil will have normal distribution through the system.
2. Turn off engine, discharge the system and remove compressor from vehicle.
3. Place compressor in horizontal position with the drain plug downward. Remove the drain plug and drain the oil into a clean container. Remove the compressor from the horizontal position to the vertical position, shaft end up, and allow any remaining oil to drain through the suction and discharge ports of the rear head. Then measure and discard the oil.
4. Add new refrigeration oil to the compressor as follows:

a. If the quantity drained was 4 fluid ounces or more, add the same amount of new refrigeration oil to the replacement compressor.

b. If the quantity drained was less than 4 fluid ounces, add 6 fluid ounces of new refrigeration oil to the replacement compressor.

c. New service compressors are shipped with 10-1/2 fluid ounces of oil already inside. Therefore, if a new service compressor is being installed, sufficient oil must be drained to leave only a like amount to that drained and measured from the old compressor.

NOTE: The oil drain screw must be torqued to 10-15 ft. lbs. if the screw has either been loosened or removed.

d. If a field repaired compressor is being installed, add one more additional fluid ounce of new oil to the compressor than that determined to be added in Step 4a or 4b above.

5. In the event that it is not possible to idle the compressor as outlined in Step 1 to effect oil return to compressor, proceed as follows:

a. Remove the compressor, drain, measure and discard the oil.

b. If the amount drained is more than 1-1/2 fluid ounces, and the system shows no signs of a major leak, add the same amount to the replacement compressor.

c. If the amount drained is less than 1-1/2 fluid ounces and the system appears to have lost an excessive amount of oil, add 6 fluid ounces of clean refrigeration oil to replacement compressor, 7 fluid ounces to a repaired compressor.

If the oil contains chips or other foreign material, replace the receiver-dehydrator, repair the compressor as required and flush or replace all component parts as necessary. Add the full specified volume of new refrigeration oil to the system.

6. Add additional oil in the following amounts for any system components being replaced:

Evaporator	1 fluid ounce
Condenser	1 fluid ounce
Receiver-Dehydrator	1 fluid ounce
Compressor	See above

NOTE: When adding oil to the compressor, it will be necessary to tilt the rear end of the compressor up so that the oil will not run out of the suction and discharge ports. Do not set the compressor on the shaft end. A compressor suction discharge port shipping plate in good condition or test plate may be used as a closure during installation until the refrigerant line connector block is to be attached.

ADDING REFRIGERANT CHARGING STATION METHOD)

See "WARNING" under "Precautions in Handling Refrigerant-12" on page 1B-51 of this section.

The following procedures should be used in adding small amounts of refrigerant such as that lost due to a leak in the system. Before adding refrigerant to replace that lost by leaks, check for evidence of oil loss and add oil if necessary. See "Adding Oil" and "Compressor Oil" earlier in this section.

1. Pull plastic connector off of low-pressure cut-off switch (located in the evaporator inlet line). Attach jumper wire to terminals inside the connector body. This will insure that the compressor clutch does not cycle on and off during operation.
2. Remove protective caps from gauge fittings and connect charging station. Refer to "Charging Station Method of Discharging, Evacuating and Charging the System" covered earlier in this section.
3. Start engine and set A/C control panel for A/C mode, "HI" fan speed and full "COLD" position. Operate engine at low idle for a few minutes to stabilize system.
4. Observe sight glass in receiver-dehydrator assembly for evidence of bubbles. If no bubbles are evident, and temperature is above 70°F (21°C) system is operating normally. If bubbles appear, continue as described following.
5. Fill charging cylinder according to charging station instructions.
6. Turn charging cylinder sight glass to match pressure reading on cylinder pressure gauge. Crack open refrigerant and low pressure control valves on charging station and allow refrigerant to slowly enter low pressure side of system until system sight glass shows clear (no bubbles). Close both valves.
7. Note refrigerant level in charging cylinder. Re-open control valves and allow an additional 1/2 lb. of refrigerant to enter the system. Close both valves.
8. Make sure all control valves on charging station are closed. Test for leaks and check system pressures as outlined under "Performance Data" later in this section.
9. Disconnect and cap charging lines and return protective caps to system gauge fittings. Disconnect jumper wire from low-pressure cut-off switch and reattach plastic connector to switch.

ADDING REFRIGERANT (DISPOSABLE CAN METHOD)

See "WARNING" under "Precautions in Handling Refrigerant-12" on page 1B-51 of this section.

The following procedures should be used in adding small amounts of refrigerant such as that lost due to a leak in the system. Before adding refrigerant to replace that lost by leaks, check for evidence of oil loss and add oil if necessary. See "Adding Oil" and "Compressor Oil" earlier in this section.

NOTE: This procedure will only apply if the air inlet temperature is above 70°F (21°C) at the condenser.

1. Pull plastic connector off of low-pressure cut-off switch (located in the evaporator inlet line). Attach jumper wire to terminals inside the connector body. This will insure that the compressor clutch does not cycle on and off during operation.
2. Remove protective caps from gauge fittings on vehicle. Attach Manifold Gauge Set (J-23575 or equivalent), making sure low pressure gauge hose is connected to low pressure fitting and high pressure gauge hose connects to high pressure gauge fitting. Use gauge adapters to make connections, when necessary.
3. Start engine, turn air conditioning temperature control lever to full "COLD" position, fan switch to "HI" and system selector lever to "A/C" mode. Operate for a few minutes at low idle to stabilize system.
4. Observe sight glass in receiver-dehydrator assembly for evidence of bubbles. If no bubbles are evident, and temperature is above 70°F (21°C) system is operating normally. If bubbles appear, continue as described following.
5. Attach flexible hose from center fitting of gauge set loosely to disposable can valve with 14-oz. or 10-lb. can attached. Open high and low pressure valves on gauge set slightly to purge lines of air. Tighten fitting at refrigerant can valve when satisfied that all air has been removed from gauge lines. Close (in clockwise direction) both hand shut-off valves of gauge set.
6. Open low pressure valve on gauge set. Slowly open valve on refrigerant can and allow refrigerant to flow into system (through manifold gauge set and low pressure hose) until system sight glass shows clear (no bubbles). Immediately shut-off valves at gauge set and

refrigerant can. Check weight of can and valve assembly and record.

7. Add an additional 1/2-lb. of refrigerant by adding refrigerant from can just weighed until can weighs appropriate amount less.

8. Close valves at gauge set and refrigerant can.

9. Test for leaks and make pressure check of system as outlined under "Performance Data" later in this section.

10. Disconnect and cap charging lines and return protective caps to system gauge fittings. Disconnect jumper wire from low-pressure cut-off switch and reattach plastic connector to switch.

PERFORMANCE TEST AND PERFORMANCE DATA

PERFORMANCE TEST

This test may be conducted to determine if the system is performing in a satisfactory manner and should be used as a guide by the serviceman in diagnosing trouble within the system. Testing is a measurement of the air conditioning system performance, to determine if discharge air temperature, pressure in suction line, and pressure in discharge line are within specific limitations.

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 "MAX" A/C.
- Lower control on "Cold".
- "HI" blower speed.

4. Temperature sensor on engine cooling fan disconnected.

5. Gauge set installed on vehicle service fittings.

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 inside the vehicle (lower center instrument panel).

PERFORMANCE DATA

The following "Performance Data" defines normal operation of the system under above conditions. A properly operating, tuned engine, with choke open and fast idle speed having been reduced to a normal idle, should be idled at 2000 rpm for a minimum of 7-10 minutes with air conditioning system operating prior to evaluation of test readings. Compare the actual pressures and temperatures with the pressures and temperatures indicated below.

Should excessive head pressures be encountered at higher ambient temperatures, an 18-inch fan placed in front of the vehicle and blowing into the condenser will provide the extra circulation of air needed to bring the pressures to within the limits specified.

NOTE: Higher temperatures and pressures will occur at higher ambient temperatures. In areas of high humidity it is possible to have thermometer and gauge readings approach but not reach the figures listed in the "Performance Data Chart" and still have a satisfactorily 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
REFRIGERANT CHARGE 3.75 LBS.
ENGINE RPM-2000 RPM
HEAD PRESSURE (EVAP. "IN" CHARGE PORT)*

Temp. Of Air Entering Condensor Relative Humidity	70°F (21°C)	80°F (27°C)	90°F (32°C)	100°F (38°C)	110°F (43°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°C)	80°F (27°C)	90°F (32°C)	100°F (38°C)	110°F (43°C)
30%				14.0-29.0	18.0-33.0
40%			1.0-26.0	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°C)	80°F (27°C)	90°F (32°C)	100°F (38°C)	110°F (43°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.

COMPONENT REPLACEMENT AND REPAIR PROCEDURES

CAUTION: *See "Caution" on page two of this section.*

PREPARING SYSTEM FOR REPLACEMENT OF COMPONENT PARTS

WARNING: REFER TO "SAFETY PRECAUTIONS (REFRIGERANT-12)" PREVIOUSLY IN THIS SECTION UNDER "PRECAUTIONS IN HANDLING REFRIGERANT-12" TO PREVENT PERSONAL HARM.

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 to prevent costly repairs, personal injury or damage to equipment. For this reason it is strongly recommended that the preceding information in this section be studied thoroughly before attempting to service the 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 and charge the system with R-12 refrigerant.

WARNING: ALWAYS WEAR PROTECTIVE GOGGLES WHEN WORKING ON REFRIGERATION SYSTEMS. ALSO, BEWARE OF THE DANGER OF CARBON MONOXIDE FUMES BY AVOIDING RUNNING THE ENGINE IN CLOSED OR IMPROPERLY VENTILATED GARAGES TO PREVENT PERSONAL HARM.

FOREIGN MATERIAL IN THE SYSTEM

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

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

1. Remove the compressor.
2. Remove the receiver-dehydrator and discard the unit.
3. Flush the condenser to remove foreign material which has been pumped into it.
4. Disconnect the line at the evaporator core inlet or inlet line to the expansion valve.

Inspect the 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 one (1) 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 kinking or damaging the O-ring. Do not overtighten. Correct torque specifications for O-ring fittings can be found in figure 53.

HOSE CLAMPS

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

Removal

1. Carefully, with a sharp knife, make an angle cut in the hose as shown in figure 59. 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.*

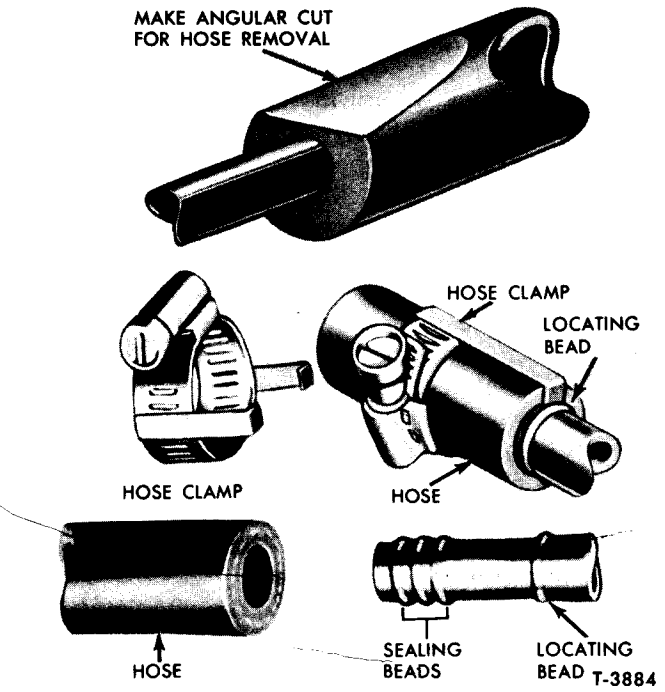


Figure 59—Hose Clamp Connections

Installation

1. Coat tube and inside of 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 tube or 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. Coat inside of new hose with 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 had to be removed, a new piece of hose should be spliced in using two connectors and four hose clamps. Coat the insides of the hose ends in clear 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. The hose must be routed and supported properly.

4. Evacuate, charge and check the system.

COMPRESSOR FAILURE

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

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 Spanner Wrench J-7624 on the clutch drive plate, "rock" the shaft in the opposite direction of normal rotation. After the compressor is broken loose, rotate 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 counterclockwise. Start the engine and operate the compressor for a minimum of one minute or until normal operating pressures are reached for a stabilized operating condition.

This procedure will not affect a compressor that is actually seized by 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 and repaired as soon as possible. The extent of damage to any or all of the component parts and the length of time the system has been exposed to the atmosphere will determine the replacement of parts and processing that will be required. The greater the length of time of exposure to the atmosphere, the greater will have been the chances for air, moisture and dirt to have entered and damaged the system. Every case may be entirely different so it is not possible to establish a hard and fast procedure to follow each time. Good judgement 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 undertermined 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 drive plate assembly and the clutch pulley for proper operation and freedom from damage.

3. Install Charging Station or Gauge Set.

4. Discharge the system of R-12.

COMPRESSOR REPLACEMENT

REMOVAL

1. If possible, operate compressor which is to be replaced for 10 minutes at 1500-2000 engine rpm with A/C controls set for "MAX" cooling and "HI" fan speed. This operation is performed to effect return of oil to the compressor from other system parts and a normal distribution of oil in the system.

2. Disconnect battery ground cable.

3. Lift up engine access cover (inside vehicle) to gain access to engine components.

4. If necessary, remove the engine air cleaner to gain access to the A/C compressor.

5. Discharge the system of refrigerant as described under "Discharging, Evacuating and Charging the System" earlier in this section.

6. After the A/C system is completely depressurized, very slowly loosen bolt which retains high and low pressure line fitting assembly to compressor rear head (refer to figure 60). As bolt is being loosened, carefully work fitting assembly back and forth to break seal, and bleed off any remaining pressure before removing the mounting bolt completely.

WARNING: HIGH PRESSURE MAY STILL EXIST AT THE DISCHARGE FITTING. IF THIS PRESSURE IS RELEASED TOO RAPIDLY, THERE WILL BE A CONSIDERABLE DISCHARGE OF REFRIGERANT AND OIL.

7. When all pressure has been relieved, remove bolt, fitting assembly and O-ring seals.

8. Immediately cap or plug all openings in hoses and compressor. Test plate J-9625 may be used to seal compressor.

9. Disconnect electrical lead from clutch coil. (Refer to figure 7.)

10. Disconnect hose holding clamp at clamp mounting bracket (compressor front bracket). Refer to figure 60.

11. Remove bolt securing support strut at compressor rear head (figure 60). Loosen bolt securing other end of strut to engine, and move strut out of way, leaving attached to engine.

12. Remove remaining fastener securing rear support bracket to compressor mounting bracket (figure 60).

13. Loosen brace and pivot bolts at the compressor brace adjustment. Detach drive belt from compressor.

14. At compressor front head remove bolt and nut (lower fastener) and stud nut (upper fastener) securing compressor bracket to the mounting bracket (figure 60). Stud will remain in engine mounting bracket. Compressor may now be removed from vehicle.

15. Remove compressor and attaching brackets by sliding compressor rearward, tipping up and lowering compressor and bracket assembly out from underneath vehicle. Be sure compressor is removed with attaching brackets as shown in figure 61.

16. If there is any possibility that broken parts from the compressor have entered the discharge line or the condenser, all refrigerant system parts should be checked and cleaned and a new receiver-dehydrator assembly installed. This should be done in case any broken parts have been trapped in the desiccant inside of the receiver-dehydrator.

17. Remove bolts securing rear support bracket to compressor and front support bracket to compressor. Remove brackets.

18. Before beginning any compressor disassembly, drain and measure oil from compressor. Check for evidence of contamination to determine if remainder of A/C system requires servicing.

INSTALLATION

1. Attach support brackets to front and rear of compressor.

2. If oil previously drained from compressor upon removal showed no evidence of contamination, replace compressor oil with new 525 viscosity refrigeration oil. Refer to "Compressor Oil Charge Chart" later in this section for specified amount of oil charge. If it was necessary to service the entire A/C system because of excessive contamination in the oil removed, install a full charge of fresh refrigeration oil into the compressor.

3. Position compressor on mounting bracket and install all fasteners. Be sure to secure support strut at compressor rear head. Tighten all fasteners to specifications listed at the end of this section.

NOTE: If front support bracket stud hole does not line up with engine mounting bracket stud, it may be necessary to loosen mounting bracket bolts where they attach to the engine. With mounting bracket fasteners loose, align compressor to mount-

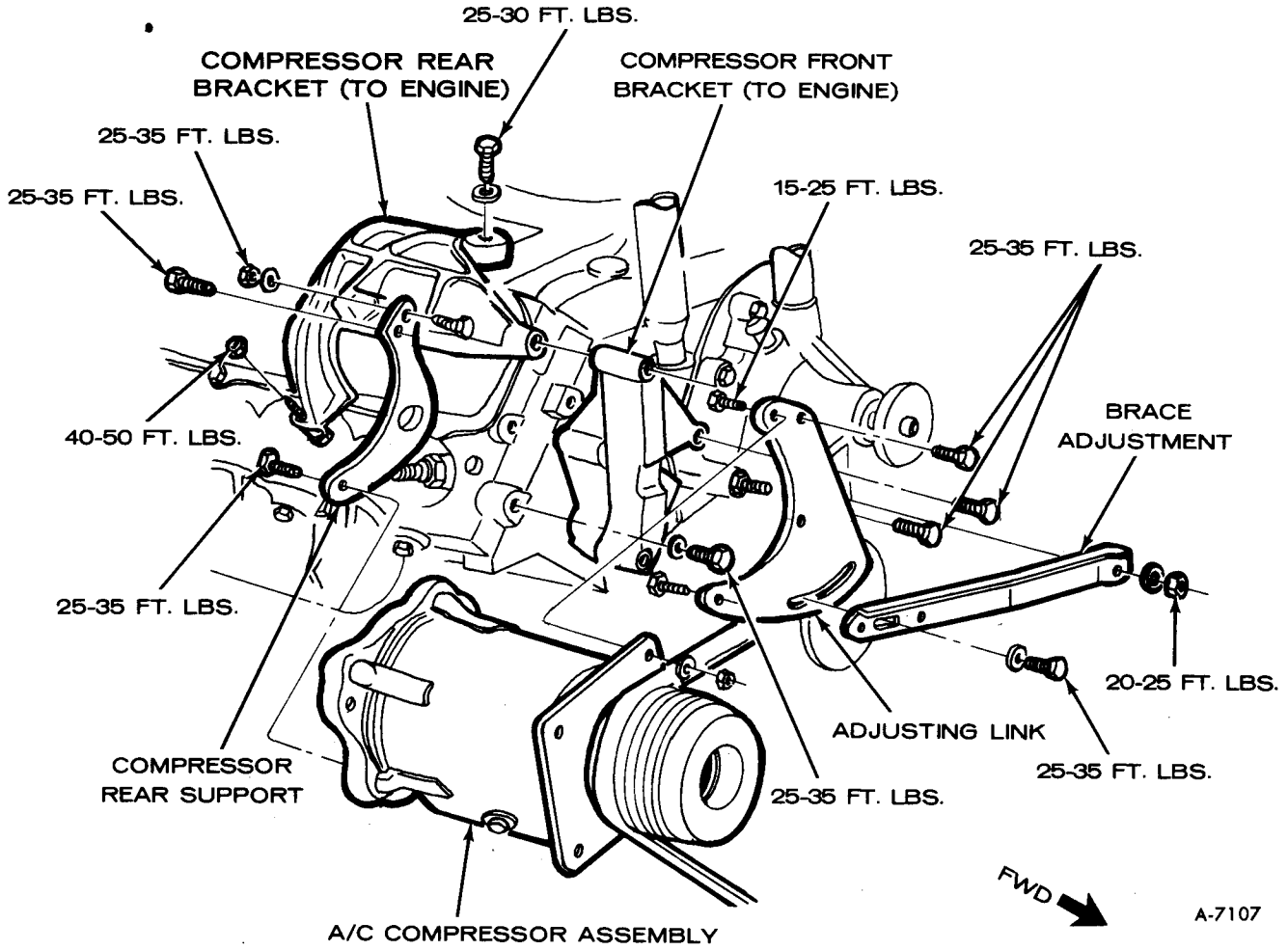


Figure 60—Air Conditioning Compressor Mounting

ing brackets. Thread stud through stud hole, install stud nut and tighten. Tighten to specification any other compressor fasteners that were loosened, and secure mounting bracket to engine block. Tighten to specification.

4. Remove Test Plate J-9625 (or plugs if used) from compressor.

NOTE: New compressors are charged with 11 fluid ounces of 525 viscosity refrigerant oil and have a minimal holding charge. If installing a new compressor, remove the compressor cover slowly to release any pressure from the unit.

5. Position hose fitting assembly at compressor rear head. Using new O-rings coated with clean refrigeration oil, secure fitting with single bolt. Tighten to specification listed at the end of this section.

6. Connect electrical lead to clutch coil.

7. Install and adjust compressor drive belt.

NOTE: Adjust compressor belt using belt tension gauge BT-33-73-F or other suitable

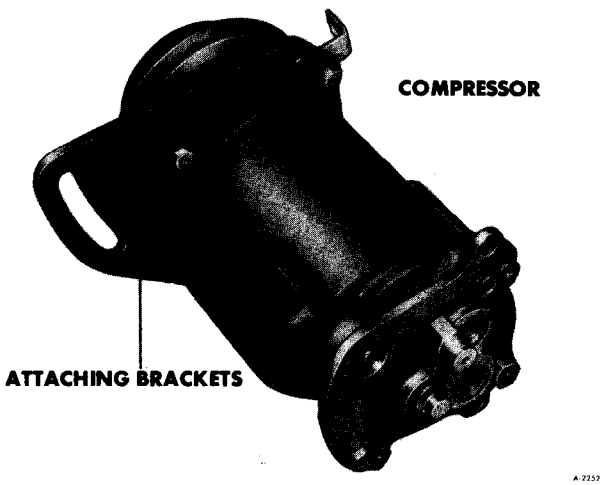


Figure 61—Compressor Removed from Vehicle

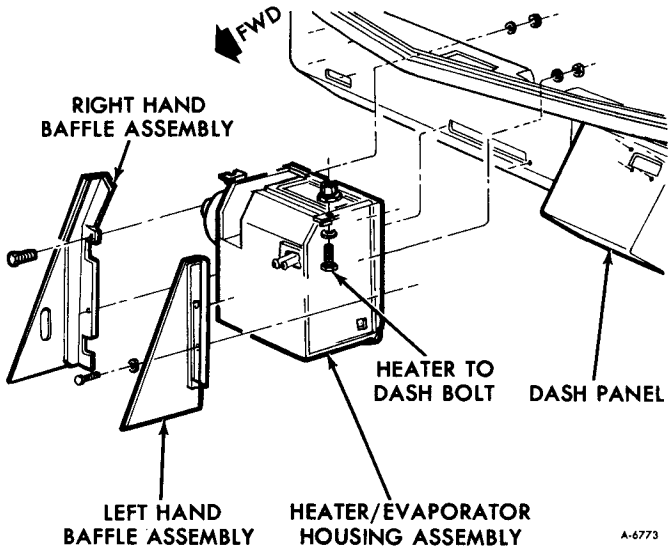


Figure 62—Heater/Evaporator Housing Assembly with Baffles (403 cu. in. Engine)

gauge. Tension should be within 70-80 lbs. (used belt) or 110-140 lbs. (new belt). For complete discussion of belt tensioning or replacement, refer to "Engine Cooling" (SEC. 6K) of this supplement.

8. Install hose holding clamp at clamp mounting bracket (compressor front head).
9. Connect battery ground cable.
10. Evacuate, charge and leak check the refrigeration system. Specifically, leak test all compressor connections. (Refer to "Compressor Leak Testing-- External and Internal," discussed later in this section.)

CAUTION: *All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists. Loss of refrigerant prevents proper oil return to the compressor and operating compressor under such conditions may damage it.*

HEATER CORE REPLACEMENT

REMOVAL

NOTE: In most 1977 vehicles it is not necessary to purge the system of refrigerant when only the heater core is being removed. All 1978 model vehicles and some late model 1977 vehicles have an aluminum tube assembly connected from the receiver-dehydrator outlet fitting to the evaporator inlet. This aluminum tube assembly is inflexible and does not permit the receiver-dehydrator to be "swung" over to the passenger side and out of the way of the heater/evaporator housing face panel. Consequently, all vehicles equipped with this aluminum tube assembly must have the A/C system discharged of refrigerant so that fittings at the receiver-dehydrator can be disconnected. This is necessary before the heater core can be serviced. Make certain that all open refrigerant line connections are capped or plugged immediately.

1. Disconnect battery ground cable.
2. If necessary, discharge the system of refrigerant as described under "Discharging, Evacuating and Charging the System" earlier in this section. (See "NOTE" above.)
3. Remove baffle from passenger side of heater/evaporator housing. (1977 model vehicles equipped with 403 cubic inch engines, and all 1978 model vehicles will have an additional baffle mounted on the driver's side of the heater/evaporator housing. Remove this baffle also.) (Refer to figure 62).
4. Unclip right hand windshield wiper connector arm at wiper motor. If necessary, move right hand windshield wiper out of way to allow working room at heater/evaporator housing face panel.
5. Remove bracket mounting screws (2) from receiver-dehydrator. If hose and tube assembly is used at receiver-dehydrator, swing dehydrator over toward passenger side of vehicle and position out of way of evaporator face panel. Hoses can be left connnected to the dehydrator. If the newer aluminum tube assembly is used at receiver-dehydrator, lines to dehydrator must be disconnected. (In this case the refrigerant system must be dis-

charged first.) Be sure to use a wrench on the square portion of the receiver-dehydrator for support. This will prevent twisting and possible breaking of the aluminum lines. Cap or plug all open refrigerant lines immediately.

6. Disconnect electrical connection at windshield washer reservoir. Disconnect hose from reservoir and remove reservoir.

7. Disconnect hoses from coolant recovery tank. Remove tank and mounting bracket (4 screws). Drain any coolant from hoses into a pan.

8. Disconnect vacuum line from water valve at heater hose.

9. Remove heater hose clamps. Carefully pull heater hoses off of core inlet and outlet pipes. Let heater core fluid drain into pan when hoses are removed.

NOTE: The heater core can be easily damaged in the area of the core tube attachment seams whenever undue force is exerted on them. Whenever the heater hoses do not readily come off the tubes, the hoses should be cut just forward of the core tubes. The portion of the hose remaining on the core tubes should then be split longitudinally. Once the hoses have been split, they can be removed from the tubes without damage to the core.

10. Remove cap screws retaining face panel to heater/evaporator housing assembly.

11. Remove sponge pad from behind heater hose connecting tubes (at face panel). Evaporator housing face panel can now be lifted off.

12. Remove heater core mounting screws and brackets (two screws on passenger side of core, one screw on driver's side of core) and carefully remove heater core.

INSTALLATION

1. Position heater core carefully in heater/evaporator housing.

2. Install core mounting brackets. Bracket on passenger side of core mounts with two screws; bracket on driver's side of core mounts with one screw. Tighten screws until snug.

3. Position evaporator housing face panel in place. Tighten all but two lower screws on passenger side of panel. Receiver-dehydrator bracket will mount with these screws.

4. Replace sponge pad behind heater hose outlet and inlet lines (at face panel).

5. Install heater hoses, and clamp to specification listed at the end of this section.

6. Connect vacuum line to water valve in heater hose.

7. Install coolant recovery tank mounting bracket. Replace tank and connect hoses to tank.

8. Replace windshield washer reservoir. Connect hose.

9. Secure electrical lead to windshield wiper reservoir.

10. Clip right hand windshield wiper connector arm at wiper motor.

11. Install receiver-dehydrator in brackets (two screws). Tighten to specification listed at the end of this section. Evaporator housing face panel is now secured.

12. If disconnected, reconnect inlet and outlet lines to receiver-dehydrator.

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

13. Replace baffle(s) removed from sides of evaporator/heater housing.

14. If refrigeration system was opened, evacuate and charge the system as described under "Discharging, Evacuating and Charging the System" covered earlier in this section.

15. Leak check the system.

16. Connect battery ground cable.

EVAPORATOR CORE REPLACEMENT

REMOVAL

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. Remove six screws and washers retaining grille to front of vehicle. Lift grille out.

2. Disconnect battery ground cable.

3. Discharge the system of refrigerant as described under "Discharging, Evacuating and Charging the System" earlier in this section.

4. Remove baffle from passenger side of heater/evaporator housing. (1977 model vehicles equipped with 403 cubic inch engines, and all 1978 model vehicles will have an additional baffle mounted on the driver side of the heater/evaporator housing. Remove this baffle also,) (Refer to figure 62.)

5. Unclip right hand windshield wiper connector arm at wiper motor. If necessary, move right hand windshield wiper out of way

to allow working room at housing face panel.

6. Disconnect high and low pressure lines from evaporator (just under blower fan housing) and seal all line connections.

NOTE: Openings must be plugged or sealed immediately to prevent entry of dirt and moisture into the system.

7. Remove bracket mounting screws (2) from receiver-dehydrator. If flexible hose and tube assembly is used at receiver-dehydrator, swing dehydrator away from evaporator housing units. Hoses may be left connected to receiver. However, if aluminum tube assembly is used at receiver-dehydrator, this assembly is inflexible and fittings must be disconnected before receiver-dehydrator can be moved away from face panel. System must be discharged first. Make certain that all open connections are capped or plugged immediately after the refrigeration system is opened.

8. Disconnect electrical connection at windshield washer reservoir. Disconnect hose from reservoir and remove reservoir.

9. Disconnect hose fom coolant recovery tank and remove tank and mounting bracket. Drain any coolant from hoses into a pan.

10. Disconnect vacuum line from water valve at heater hose.

11. Remove heater hose clamps. Carefully pull heater hoses off of core inlet and outlet pipes. Plug heater core pipes immediately.

NOTE: The heater core can be easily damaged in the area of the core tube attachment seams whenever undue force is exerted on them. Whenever the heater core hoses do not readily come off the tubes, the hoses should be cut just forward of the core tubes. The portion of the hose remaining on the core tube should then be split longitudinally. Once the hoses have been split, they can be removed from the tubes without damage to the core.

12. Remove cap screws retaining face panel to heater/evaporator housing.

13. Remove padding from behind heater hose connecting tubes. Heater/evaporator housing face panel can now be lifted off.

14. With face panel removed, carefully remove thermostatic switch probe which is held to front face of evaporator core by nylon clips. Do not bend this tube excessively.

15. Remove two screws securing thermostatic switch to heater/evaporator housing assembly. Disconnect electrical connection at the switch and remove switch.

16. Remove two screws from bracket securing high and low pressure line hold down clamp (passenger side of heater/evaporator housing, just under blower fan housing).

17. Remove evaporator core mounting screws.

18. Carefully pull out evaporator core. The expansion valve will be removed with the core.

NOTE: It may be necessary to remove bottom panel of air conditioning unit to obtain sufficient leverage to remove evaporator core from isolator material which seals top of core to housing. If installing new evaporator core, add one fluid ounce of clean refrigerant oil to new core.

INSTALLATION

1. Position evaporator core carefully in evaporator housing, aligning high and low pressure refrigerant lines with openings in housing (passenger side of housing). Be certain core-to-housing sealer is intact before installing core. Use new sealer if necessary.

2. Install evaporator core mounting screws at top of core, i.e., two on each side of core.

3. Install thermostatic switch and sensing tube. Make sure that electrical leads are securely connected at the switch.

NOTE: Be sure to install thermostatic switch capillary in the same position as on previous coil.

4. Using two screws, install bracket which secures high and low pressure line hold down clamp (located on passenger side of heater/evaporator housing, just under blower fan housing).

5. Connect high and low pressure lines, using new O-rings coated with clean refrigeration oil.

6. Replace evaporator housing face panel. Tighten mounting screws on side, except the two lower screws on passenger side of panel. Receiver-dehydrator bracket will mount with these screws.

7. Replace sponge padding at heater core inlet and outlet lines. Install heater hoses and clamp to specification.

8. Connect vacuum line to water valve in heater hose line.

9. Install coolant recovery tank mounting bracket. Replace tank and connect hoses to tank.

10. Replace windshield wiper reservoir. Connect hose.

11. Secure electrical lead to windshield wiper reservoir.

12. Clip right hand windshield wiper connector arm at wiper motor.
13. Install receiver-dehydrator in brackets (two screws). Tighten to specification listed at the end of this section. Evaporator housing face panel is now secured.
14. Connect inlet and outlet lines to receiver-dehydrator (if disconnected).

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

15. Replace baffle (one or two) removed from side of heater/evaporator housing.
16. Evacuate and charge refrigeration system as described udner "Discharging, Evacuating and Charging the System" earlier in this section.
17. Leak check the system. Connect battery ground cable and install grille.

CONDENSER REPLACEMENT

REMOVAL

1. Disconnect battery ground cable.
2. Remove grille assembly.
3. Discharge the system of refrigerant.
4. If vehicle is equipped with 403 cubic inch engine, remove lower baffle and two side baffles from condenser (figure 63).
5. Disconnect condenser inlet and outlet lines. Cap or plug all open connections at once.
6. Remove the condenser-to-radiator mounting screws.
7. Remove condenser assembly from vehicle by pulling it forward and then lowering it from the vehicle through the grille opening.
8. If installing a new condenser, transfer mounting brackets.

INSTALLATION

1. Add one fluid ounce of clean refrigerant oil to new condenser. (See "Adding Oil" procedure discussed earlier in this section.)
2. With top of condenser tipped rearward, lower condenser into position until mounting brackets line up with attaching points at radiator assembly.
3. Secure condenser to radiator mounting brackets with screws (both sides). Refer to figure 64.
4. Connect high pressure vapor line to condenser. Be sure to use a new O-ring coated with clean refrigerant oil.
5. Connect liquid line from receiver-dehydrator to condenser at outlet pipe. Be sure to use a new O-ring coated with clean refrigerant oil.

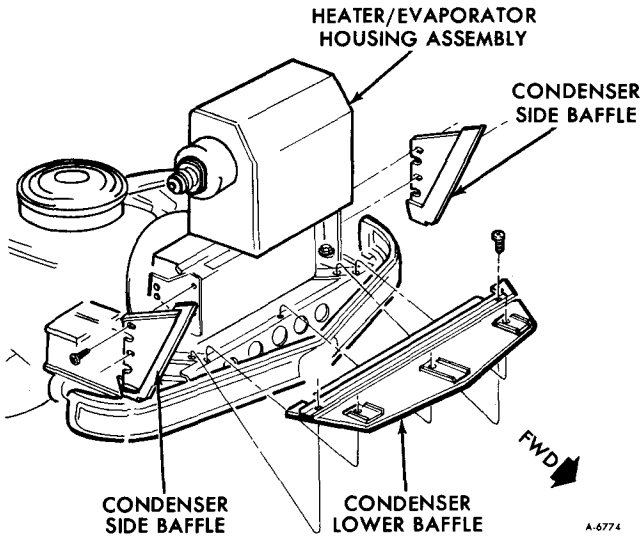


Figure 63—Condenser Baffles (403 cu. in. Engine)

6. Install condenser baffles (where applicable). (Refer to figure 63.)
7. Evacuate system.
8. Charge system with refrigerant as described in "Discharging, Evacuating and Charging the System" earlier in this section. Leak test condenser connections.
9. Install grille assembly.
10. Connect battery ground cable.

AIR CONDITIONING REGISTER REPLACEMENT

REMOVAL

1. Using Remover and Installer Tool J-24612 (figure 65), compress grille release tabs.

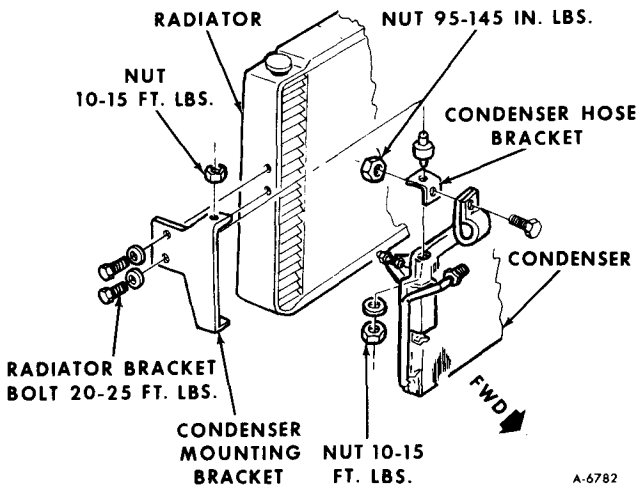
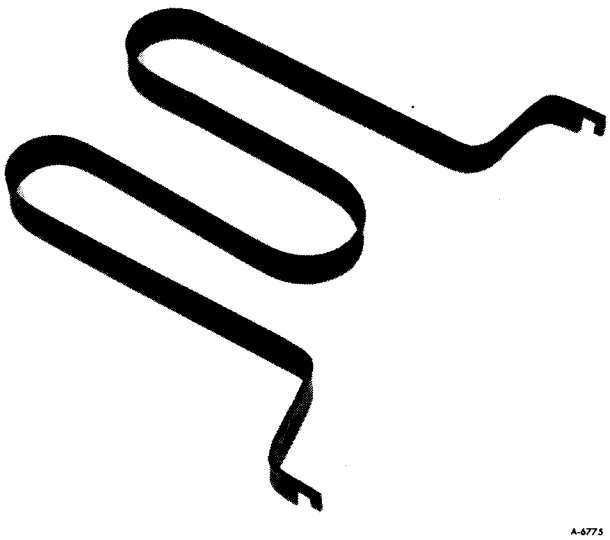


Figure 64—Condenser Mounting



A-6775

Figure 65—Air Conditioning Outlet Remover and Installer Tool J-24612

2. Rotate grille upward and remove grille.

INSTALLATION

1. Using Remover and Installer Tool J-24612, compress release tabs and position grille in instrument panel.
2. Remove tool and position grille so that tabs snap into retaining holes.

TIME DELAY RELAY REPLACEMENT

The time delay relay is mounted above the blower motor relay at the electrical component mounting plate (refer to figure 20). This is located in the engine compartment on the firewall, behind the passenger side access door.

REPLACEMENT

1. Disconnect battery ground cable.
2. Disconnect wiring harness at the time delay relay.
3. Remove the relay-to-case attaching screws and remove the relay.
4. Place the new relay in position and mount with screws.
5. Connect the relay wiring connector.
6. Connect the battery ground cable.

RECEIVER-DEHYDRATOR REPLACEMENT

The receiver-dehydrator assembly for the air conditioning system has a service replacement which includes two O-rings for the inlet and outlet connections. The desiccant within the shell is not serviced separately — it is part of the sealed receiver-dehydrator assembly.

REPLACEMENT

1. Disconnect battery ground cable.
2. Discharge system of refrigerant.
3. Disconnect receiver-dehydrator inlet and outlet connections, being sure to use a wrench on the square portion of the receiver-dehydrator for support. This will prevent twisting and possible breaking of the aluminum lines (refer to figure 66).
4. Loosen holding straps and slide out receiver-dehydrator.
5. Check amount of refrigeration oil in old receiver-dehydrator, and install the same amount of fresh 525 viscosity refrigerant oil into the new receiver-dehydrator. Then install an additional one ounce to replace the amount of oil captured in the old desiccant of the replaced receiver-dehydrator. (See Oil Chart later in this section.)
6. Install replacement unit, using clean 525 viscosity refrigerant oil on O-rings.
7. Evacuate and recharge the system. Leak check.
8. Connect battery ground cable.

A/C CONTROL HEAD REPLACEMENT

REMOVAL

1. Disconnect battery ground cable.
2. Remove retaining screw from passenger side of instrument cluster cowl panel (refer to Section 12 (CHASSIS ELECTRICAL) in this supplement). Lift cowl panel up and back to allow hand clearance behind instrument panel bezel.
3. Remove instrument panel bezel. Refer to "Instrument Panel Bezel Replacement" in Section 12 (CHASSIS ELECTRICAL) of this supplement.
4. Remove four screws securing control assembly to instrument panel foam ring cluster assembly.
5. Pull A/C control forward to gain access to rear of control assembly.

CAUTION: *Be careful not to kink the bowden cable.*

6. Disconnect light bulb at the A/C control. Disconnect select valve electrical connector, all vacuum connections and blower fan switch.
7. Disconnect bowden cable at control panel by removing cable mounting screw underneath control panel.

INSTALLATION

1. Connect vacuum connector, electrical connector, blower fan switch and bulb to control panel.
2. Secure bowden cable with mounting screw underneath control panel. Adjust cable for full temperature lever travel.
3. Install control panel to foam ring with four mounting screws.
4. Install instrument panel bezel. Refer to "Instrument Panel Bezel Replacement" in Section 12 (CHASSIS ELECTRICAL) of this supplement.
5. Attach cowl panel to bezel.
6. Connect battery ground cable.

THERMOSTATIC SWITCH REPLACEMENT

The thermostatic switch is mounted to the blower side of the evaporator/heater housing (behind face panel), with a sensing tube that extends out across the face of the evaporator core.

REPLACEMENT

1. Disconnect battery ground cable.
2. If vehicle has an aluminum tube assembly connected from the receiver-dehydrator outlet fitting to the evaporator inlet, system must be discharged of refrigerant before receiver-dehydrator can be moved out of way of evaporator housing face panel. If necessary, discharge the system of refrigerant as described under "Discharging, Evacuating and Charging the System" earlier in this section.
3. Remove baffle from passenger side of heater/evaporator housing. (1977 model vehicles equipped with 403 cubic inch engine, and all 1978 model vehicles will have an additional baffle mounted on the driver's side of the heater/evaporator housing. Remove this baffle also.) (Refer to figure 62).
4. Unclip right hand windshield wiper connector arm at wiper motor. If necessary, move right hand windshield wiper out of way to allow working room at evaporator housing face panel.
5. Remove bracket mounting screws (2) from receiver-dehydrator. If hose and tube assembly is used at receiver-dehydrator, swing dehydrator over toward passenger side of vehicle and position out of way of evaporator face panel. Hoses can be left connected to the dehydrator and system does not require discharging. If newer aluminum tube assembly is used at receiver-dehydrator, system must be discharged of refrigerant before lines to dehydrator can be disconnected. Be sure to use a wrench on the square portion of the receiver-dehydrator for support. This will prevent twisting and possible breaking of the aluminum lines.

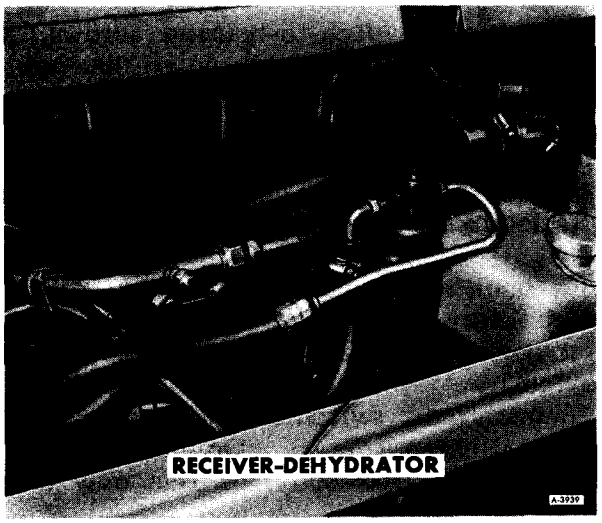


Figure 66—Lines to Receiver-Dehydrator

6. Disconnect electrical connection at windshield washer reservoir. Disconnect hose from reservoir. Remove reservoir.
7. Disconnnect hoses from coolant recovery tank.
8. Remove tank and mounting bracket (4 screws). Drain any coolant from hoses into a pan.
9. Disconnect vacuum line from water valve at heater hose.
10. Remove heater hose clamps. Carefully pull heater hoses off of core inlet and outlet pipes. Let heater core fluid drain into pan when hoses are removed.

NOTE: The heater core can be easily damaged in the area of the core tube attachment seams whenever undue force is exerted on them. Whenever the heater hoses do not readily come off the tubes, the hoses should be cut just forward of the core tubes. The portion of the hose remaining on the core tubes should then be split longitudinally. Once the hoses have been split, they can be removed from the tubes without damage to the core.

11. Remove cap screws retaining face panel to heater/evaporator housing assembly.
12. Remove sponge pad from behind heater hose connecting tubes (at face panel). Evaporator housing face panel can now be lifted off.
13. Remove electrical connector to the thermostatic switch.

14. Remove switch-to-housing screws, and remove the switch capillary 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.

15. Place new switch in position, installing the capillary in the core with nylon clips. Be sure capillary tube is in same position as previously.
16. Install the switch mounting screws. Do not overtighten screws. Do not damage or distort the switch body, as this may affect switch calibration.
17. Reconnect electrical terminals to switch.
18. Reinstall face panel on evaporator housing, reinstall heater hoses and clamps, water vacuum valve and vacuum line at valve, coolant recovery tank and hoses, and windshield washer reservoir and hose.
19. Make electrical connection at windshield washer reservoir. Clip righthand windshield wiper connector arm at wiper motor.
20. Install receiver-dehydrator in brackets (two screws). Tighten to specifications listed at the end of this section. Evaporator housing face panel is now secured.
21. If disconnected, reconnect inlet and outlet lines to receiver-dehydrator.

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

22. Replace baffle(s) removed from side(s) of heater/evaporator housing.
23. If refrigeration system was opened, evacuate and charge system as described under "Discharging, Evacuating and Charging the System" covered earlier in this section.
24. Leak check the system. Connect battery ground cable.

WATER CONTROL VALVE REPLACEMENT

REMOVAL

1. Clamp off inlet and outlet hoses.
2. Disconnect vacuum line from water valve. (Refer to figure 16).
3. Loosen clamps securing water valve to heater hose and remove water valve.

INSTALLATION

1. Install new water valve in heater hose line. Clamp to specifications listed at the end of this section.
2. Remove clamps closing off heater hoses.
3. Connect vacuum line (pink striped) to water valve.
4. Replace any coolant lost.

BLOWER ASSEMBLY REPLACEMENT

1. Disconnect battery ground cable.
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.

VACUUM TANK REPLACEMENT

The vacuum tank is mounted to the driver side of the evaporator/heater housing (see figure 21).

1. Disconnect the vacuum lines at the tank.
2. Remove the tank-to-housing screws and remove the tank.
3. To install, reverse steps 1 and 2 above.

BLOWER MOTOR RESISTOR REPLACEMENT

The blower motor resistor is located opposite the blower side of the evaporator/heater housing.

1. Disconnect battery ground cable 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 and the battery ground cable.

LOW PRESSURE SWITCH REPLACEMENT

The low pressure cut-off switch, or discharge pressure switch, is located in the

receiver-dehydrator to evaporator line (refer to figure 17).

1. Disconnect battery ground cable.
2. Discharge the system of refrigerant as described in "Discharging, Evacuating and Charging the System" earlier in this section.
3. Disconnect electrical wiring harness at the low pressure 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.

BLOWER MOTOR RELAY REPLACEMENT

The blower motor relay is located on the firewall on the blower side of the evaporator/heater housing (figure 18).

1. Disconnect battery ground cable 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 install the mounting screws.

4. Connect the relay wiring harness and battery ground cable.

BLOWER SWITCH REPLACEMENT

1. Remove air conditioning control assembly as described earlier.

2. Disconnect wires to blower switch and pull knob off switch. Remove two switch attaching screws from back.

3. Install switch by reversing steps 1 and 2 above.

COMPRESSOR MINOR REPAIR PROCEDURES

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 DISCHARGING 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 DISCHARGED 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 indicates are in need of service. Refer to figures 67 and 68.

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 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 then be discarded and new 525 viscosity refrigerant oil added to the compressor (figure 69).

COMPRESSOR CLUTCH PLATE AND HUB ASSEMBLY

REMOVAL

1. Place Holding Fixture J-9396 in a vise and clamp the compressor in the holding fixture.

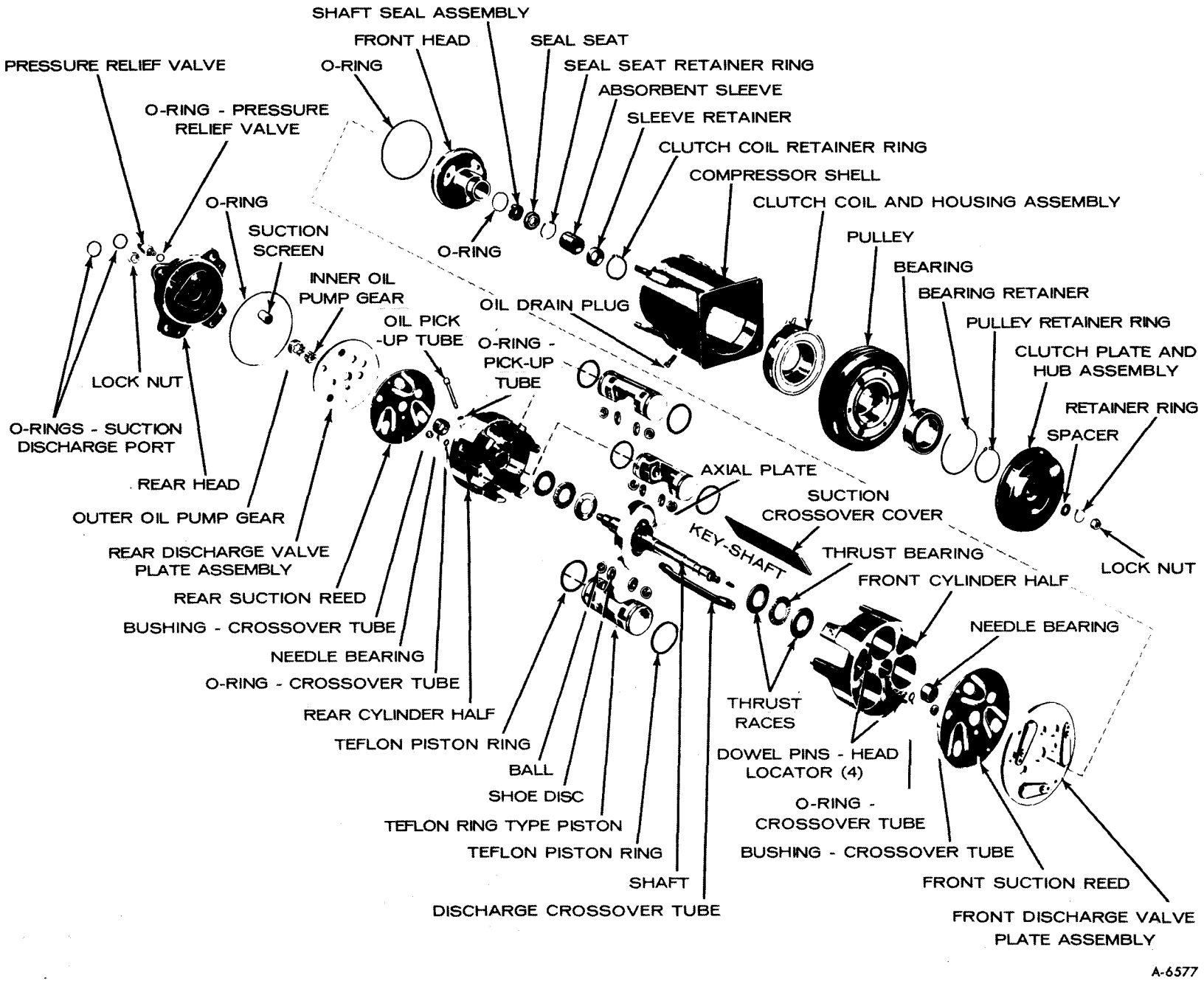


Figure 67—Compressor Components

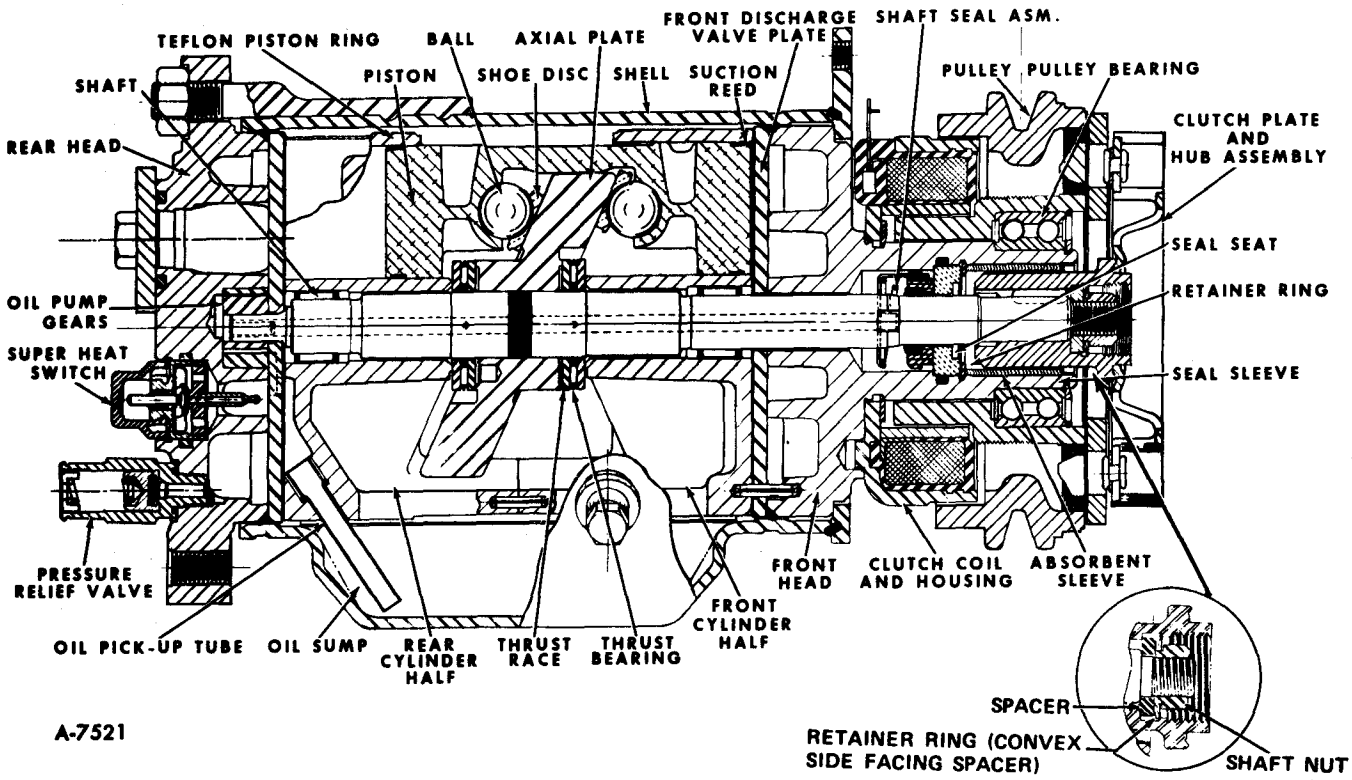


Figure 68—Sectional View of Compressor

2. Keep clutch hub from turning with Clutch Hub Holder J-25030 or J-9403, and remove lock nut from end of shaft using Thin Wall Socket J-9399 (figure 70).

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.*

3. Thread clutch plate and hub assembly remover J-9401 into hub. Hold body of remover with a wrench and tighten center screw to remove clutch plate and hub assembly (figure 71).

4. Remove square drive key from shaft or drive plate hub.

5. Remove hub spacer retainer ring using Snap-Ring Pliers J-5403 (#21), and then remove hub spacer (figure 72).

6. Inspect driven plate for cracks or stresses in the drive surface. Do not replace driven plate for a scoring condition (figure 73).

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.

INSTALLATION

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 74).

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

UNIT	ADD OIL
CONDENSOR	1 OUNCE
EVAPORATOR	1 OUNCE
RECEIVER-DEHYDRATOR	1 OUNCE

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 Less Than - 1-1/2 oz. Or System Appears To Have Lost Major Amount Of Oil.	* Same As Above. ** Same As Above.
CONTAMINATED OIL DRAINED FROM SYSTEM.	Any Amount	Drain As Much Oil As Possible From System. Flush System With Refrigerant-11. Replace Receiver-Dehydrator And Install New 525 Viscosity Oil In New Compressor: 10-1/2 ozs.

A-7495

Figure 69—Compressor Oil Charge Chart

on the tool. This tool has a left hand thread on the body (figure 75).

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.*

A ZERO thrust race is approximately 3/32" thick and may be used to roughly gauge 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 68), 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 lock nut with shoulder or circular projection on the lock nut facing towards retainer ring. Tighten the nut to 14-26 ft. lbs. torque. Air gap between the frictional faces should now be .022" to .057" (figure 76). If not, check for mispositioned key or shaft.

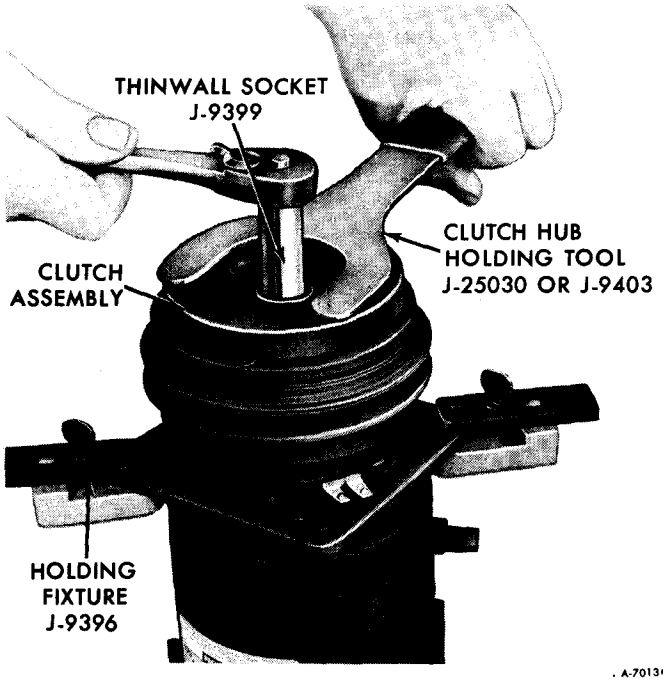


Figure 70—Removing Shaft Locknut

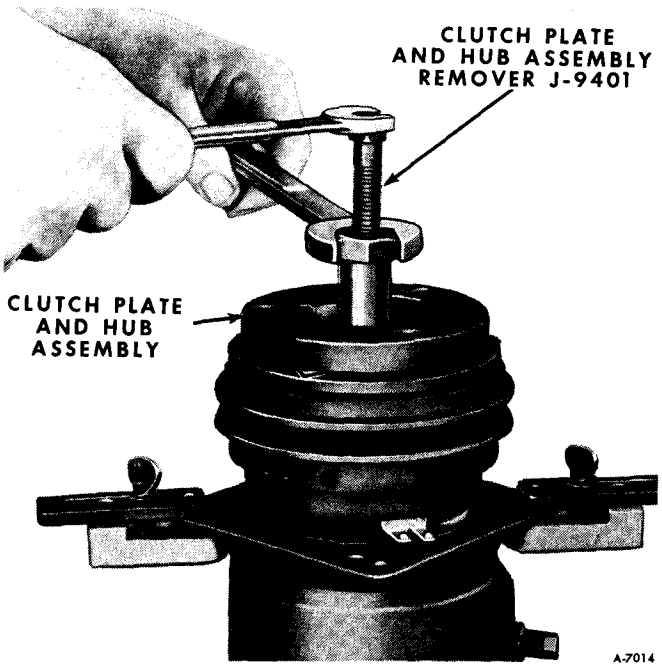


Figure 71—Removing Clutch Plate And Hub Assembly

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 clutch by turning the air conditioning on and off at least 15 times at approximately one second intervals to burnish the mating parts of the clutch.

PULLEY AND BEARING ASSEMBLY

REMOVAL

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 77.
3. Pry out absorbent sleeve retainer, and remove absorbent sleeve from compressor neck.
4. Place Puller -Pilot J-9395 over end of compressor shaft.

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 78).

INSPECTION

Check the appearance of the pulley and bearing assembly (see figure 73). The frictional surfaces of the pulley and bearing assembly should be cleaned with suitable solvent before reinstallation.

INSTALLATION

1. If original pulley and bearing assembly is to be reinstalled, wipe frictional surface of

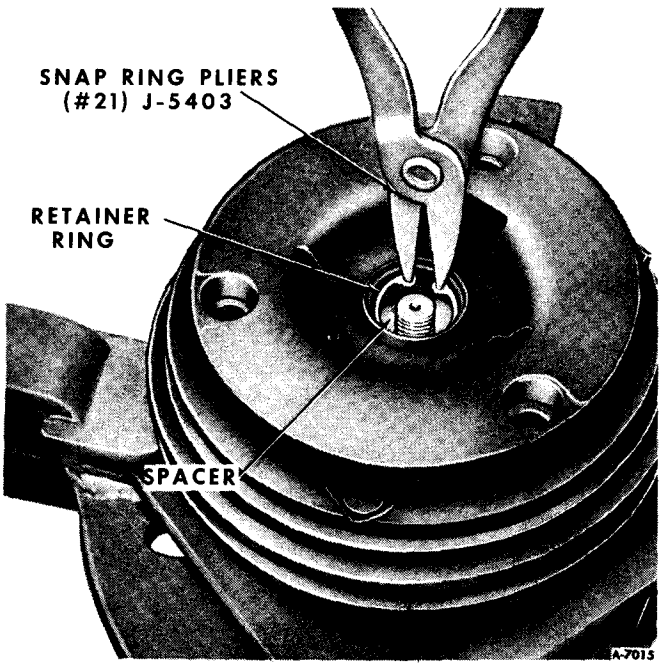


Figure 72—Replacing Retaining Ring

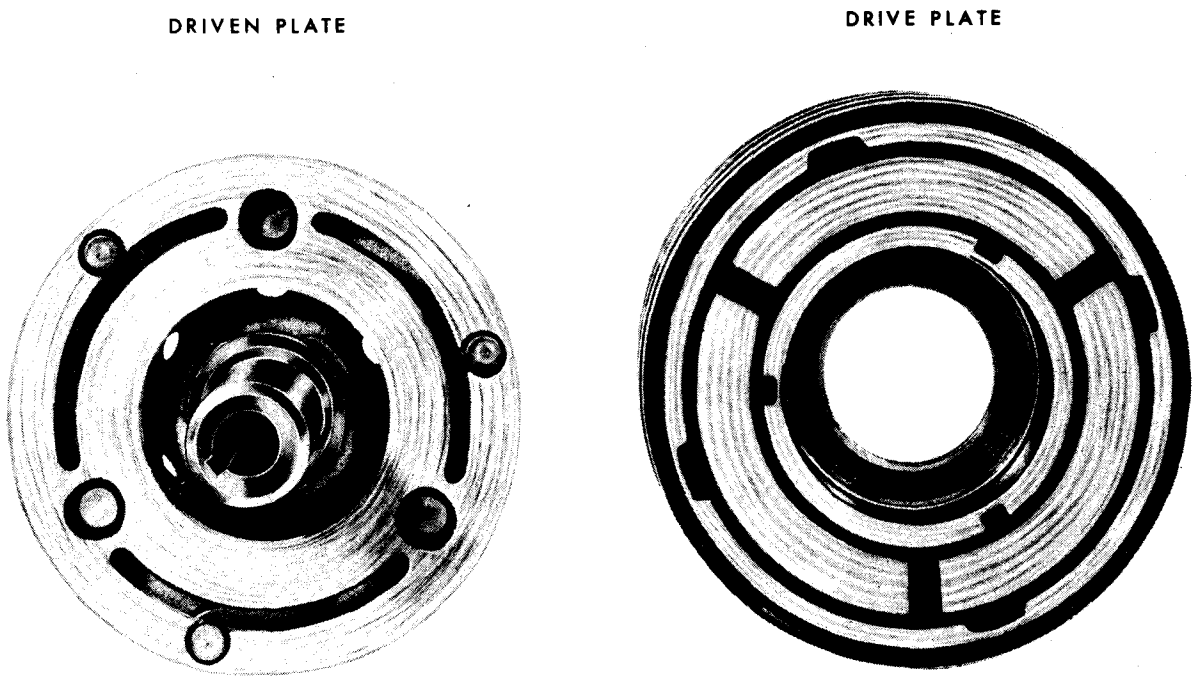


Figure 73—Clutch Driven Plate and Drive Plate

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 exists, 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 79). The Installer

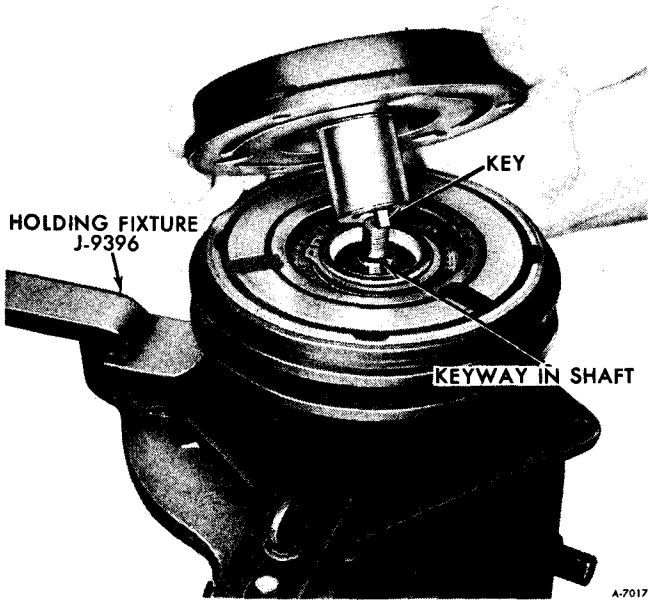


Figure 74—Aligning Drive Plate Key

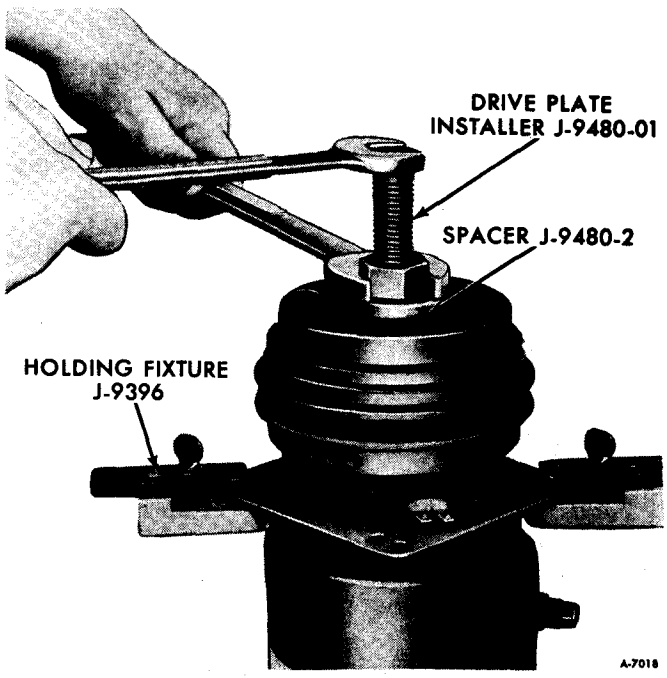


Figure 75—Installing Drive Plate

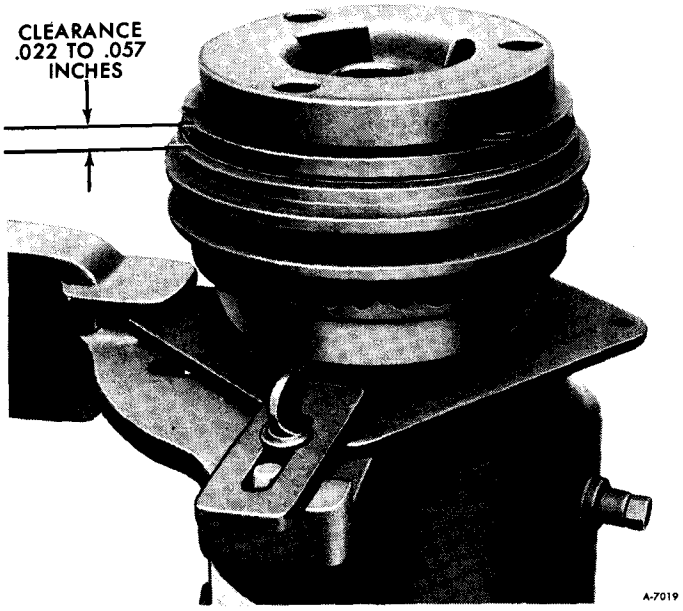


Figure 76—Checking Air Gap

will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

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.

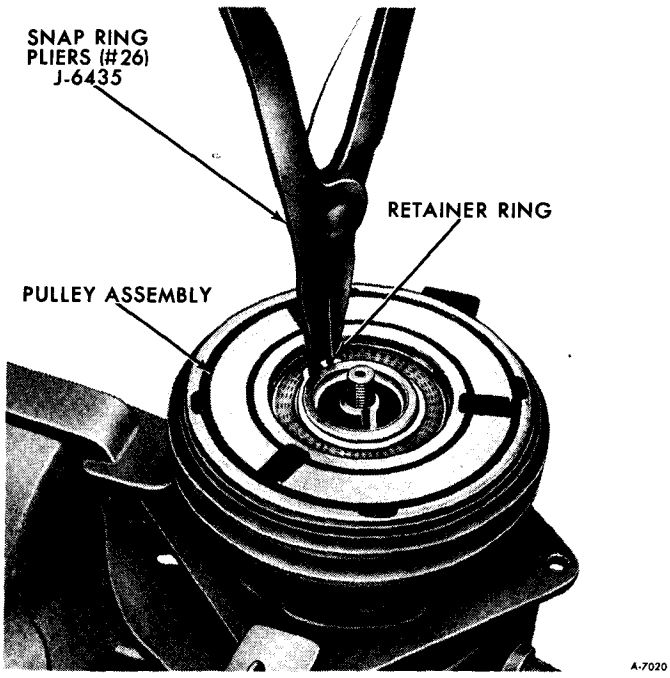


Figure 77—Removing Pulley Retainer Ring

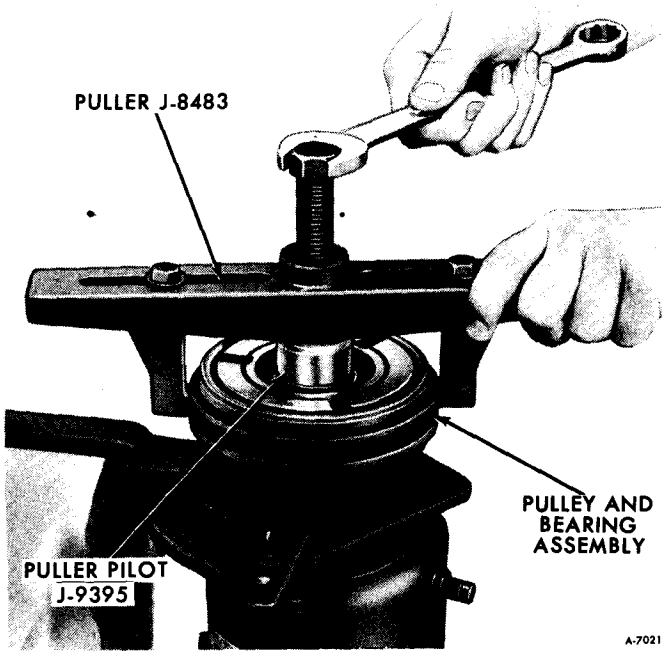


Figure 78—Removing Pulley and Bearing Assembly

COMPRESSOR PULLEY BEARING

REMOVAL

1. Remove clutch plate and hub assembly as

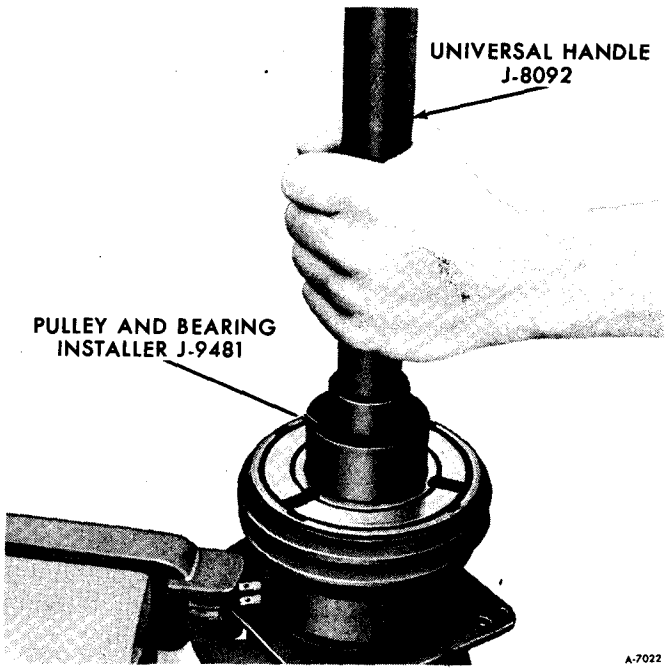


Figure 79—Installing Pulley and Bearing Assembly

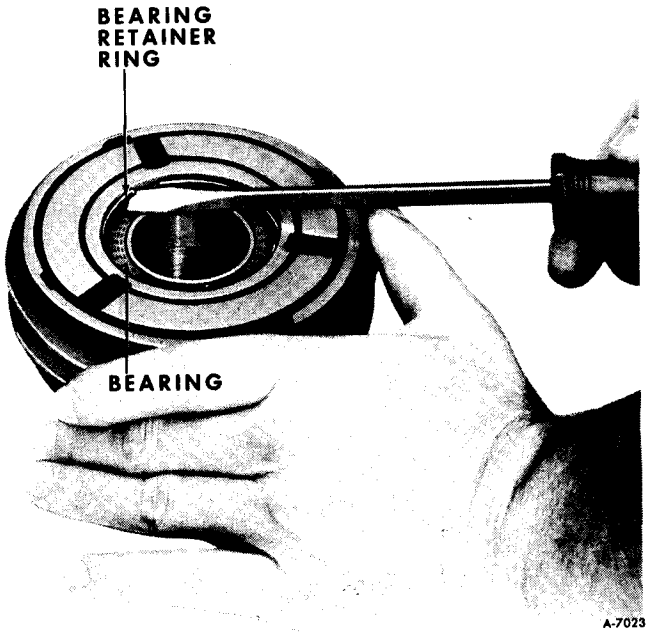


Figure 80—Removing Pulley and Bearing Retainer Ring

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.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool (figure 80).

4. Place pulley and bearing assembly on inverted Support Block J-21352 and, using Pulley Bearing Remover J-9398 with Universal

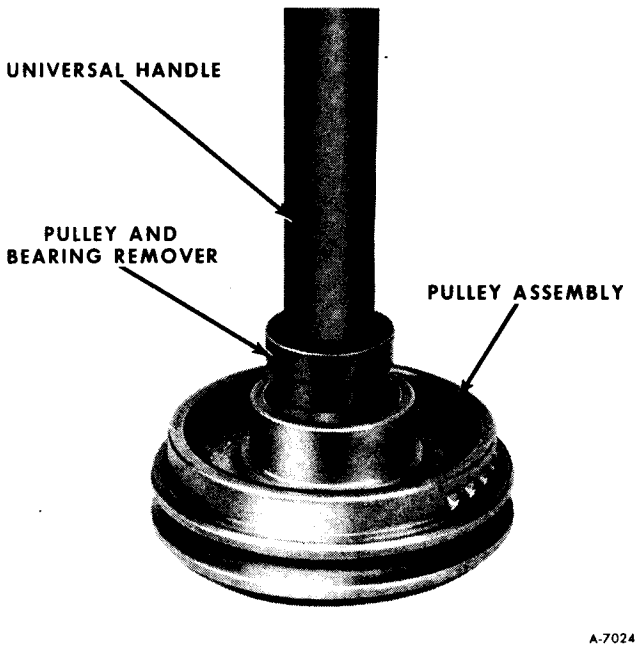


Figure 81—Removing Bearing From Pulley Assembly

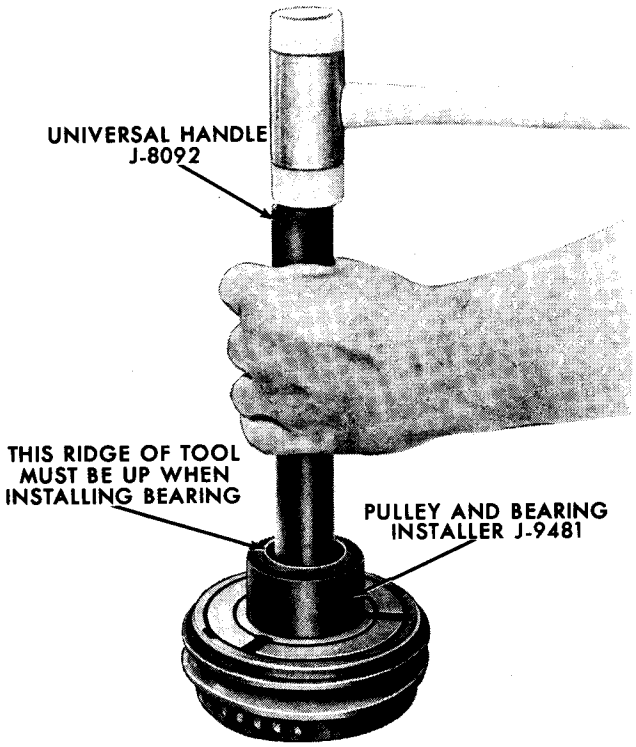


Figure 82—Installing Bearing on Pulley

Handle J-8092, drive bearing assembly out of pulley (figure 81).

INSTALLATION

1. Install new bearing in pulley using Pulley and Bearing Installer J-9481 with Universal

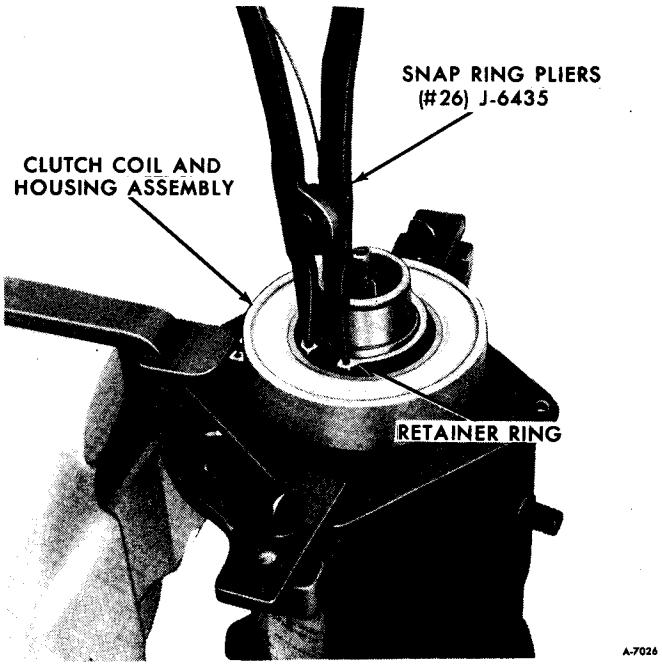


Figure 83—Removing Coil Housing Retaining Ring

Handle J-8092 (figure 82). The Installer will apply 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.
4. Install clutch plate and hub assembly as described in "Compressor Clutch Plate Assembly" Replacement procedure.

COMPRESSOR CLUTCH COIL AND HOUSING ASSEMBLY

REMOVAL

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: 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 (#26) (figure 83).
4. Lift coil and housing assembly off compressor.

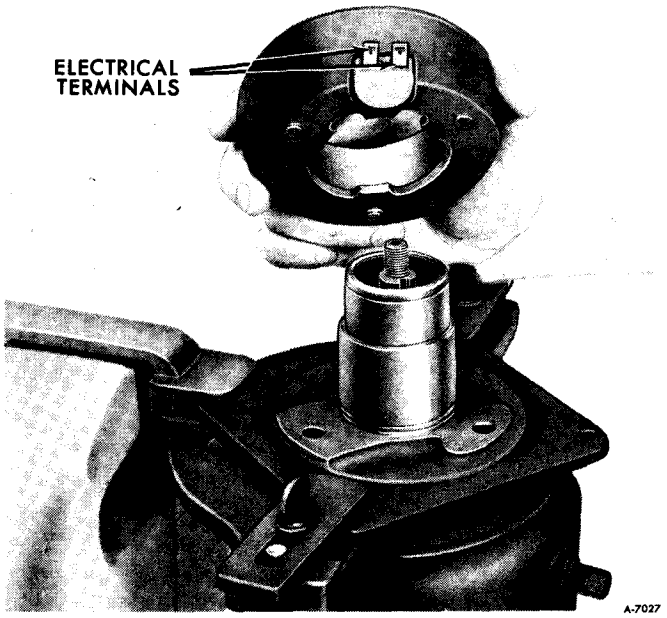


Figure 84—Installing Coil Housing

INSTALLATION

1. Position coil and housing assembly on compressor front head casting so that electrical terminals line up with marks previously scribed on compressor (figure 84).
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 (#26).
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 REPAIR PROCEDURES

Service repair procedures to the compressor shaft seal and pressure relief valve or disassembly of the internal compressor mechanism are considered "Major" since the refrigeration system must be completely discharged 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 proper and clean service tools. Any attempt to use makeshift 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

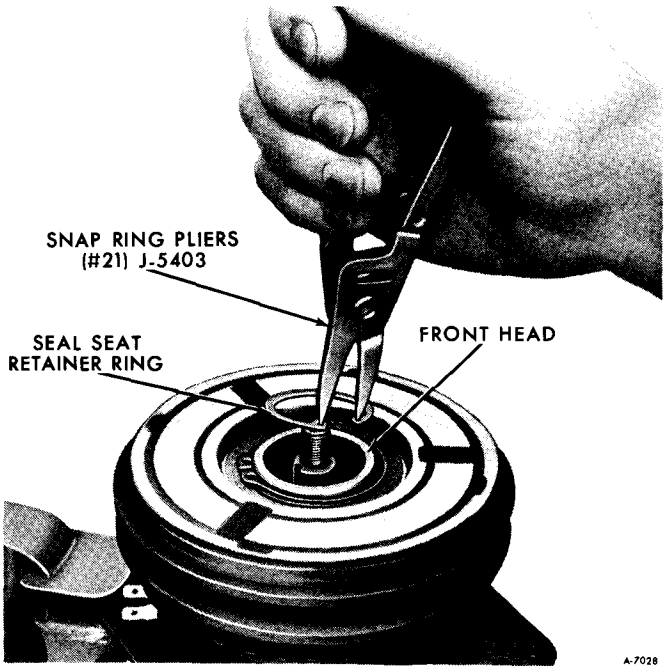


Figure 85—Replacing Shaft Seal Seat Retaining Ring

be identified by "number" on the parts themselves. For reference to determine their size and dimension see chart later in this section.

COMPRESSOR SHAFT SEAL

SEAL LEAK DETECTION

A shaft seal should not be changed because of an oil line around the seal. The seal is designed to seep some oil for lubrication purposes. Only change a shaft seal when a leak is detected by a leak-testing procedure.

When refrigerant system components other than the compressor are replaced, the compressor must be removed and oil drained from

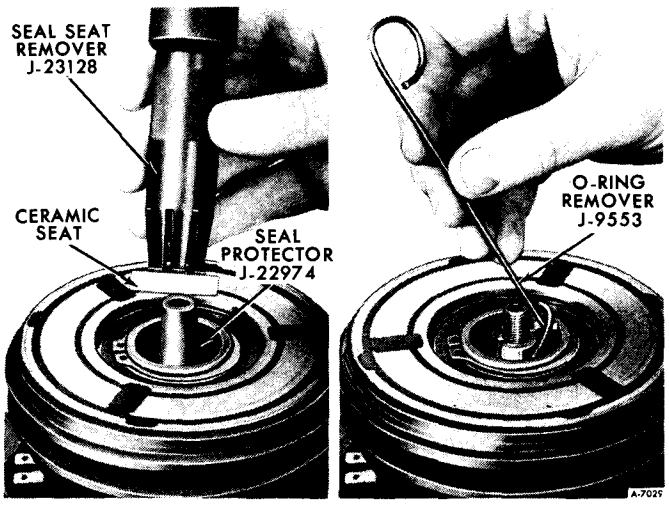
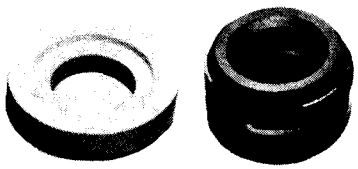


Figure 86—Removing Shaft Seal Seat And O-Ring



SPECIFICATION PARTS	
SEAL	CARBON MATERIAL. LARGE CHAMFER ON INSIDE DIAMTER.
SEAT	CERAMIC MATERIAL WITH POLISHED FACE.
O-RINGS	NEOPRENE, THUS CAPABLE OF GIVING HEAT RESISTANCE AND LIFE EXPECTANCY.

A-6797

Figure 87—Shaft Seal Kit Specifications

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 leak detector.

When replacing the shaft seal assembly, even if the compressor remains on the vehicle during the operation, it will be necessary to discharge the system of refrigerant.

REMOVAL

1. After first discharging 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) (figure 85).
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 or foreign material from getting into compressor.
4. Place seal protector J-22974 over the end of the shaft to prevent chipping the ceramic seat. 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 86).

CAUTION: *Do not tighten the handle with a wrench or pliers; however, the handle must be hand-tightened securely to remove the seat.*

Figure 88—Replacing O-Ring

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 (figure 86).

6. Remove the seal seat O-ring from the compressor neck using O-ring remover J-9533.

7. Recheck the shaft and inside of the compressor neck for dirt or 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 (figure 87). 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.

INSTALLATION

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 88 and 89). Top groove is for retainer ring. Use O-ring installer J-21508.

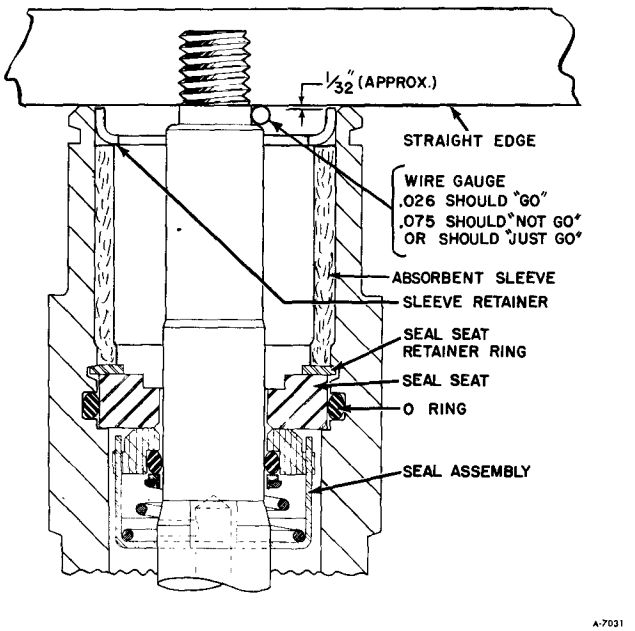


Figure 89—Compressor Shaft and Seal

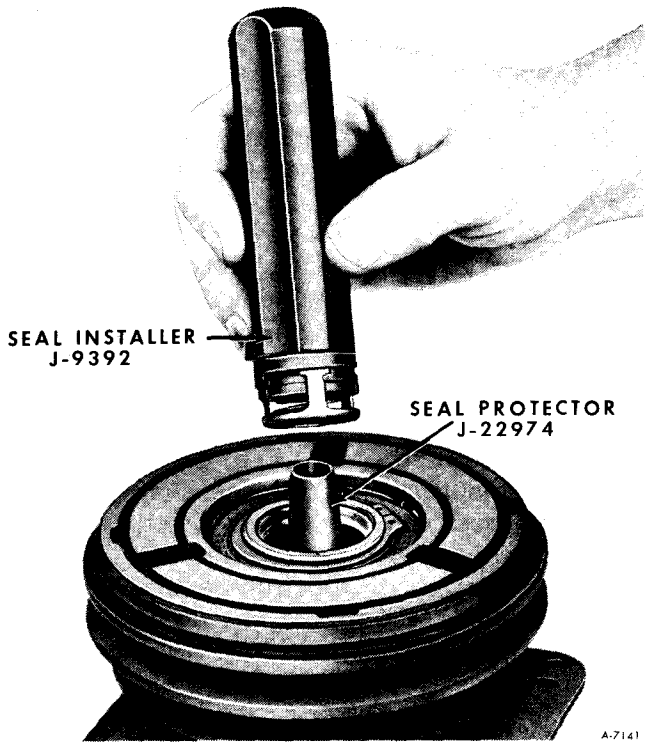


Figure 90—Replacing Seal

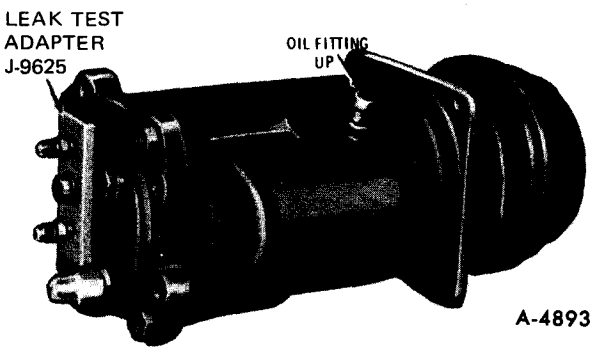


Figure 91—Leak Testing Compressor

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 90).

3. Place seal protector J-22974 (figure 90) 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 (figure 86).

5. Install the new seal seat retainer ring with its flat side against the seal seat, using snap-ring pliers J-5403 (#21) (figure 85). Use the sleeve from seal seat remover-installer J-23128 (figure 86) 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 gauge charging lines as shown for bench test in figure 91 or pressurize SUCTION SIDE of compressor on vehicle 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 leak detector. Correct any leak found. Remove 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.

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 (figure 78) 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) (figure 89).

10. Install 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 and Charging the 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 89. To measure this distance, use a wire gauge (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. Add oil, evacuate and charge system.

COMPRESSOR PRESSURE RELIEF VALVE

When necessary to replace the pressure relief valve, located in the compressor rear head casting (figure 92), the valve assembly should be removed after discharging the system of refrigerant and a new valve and

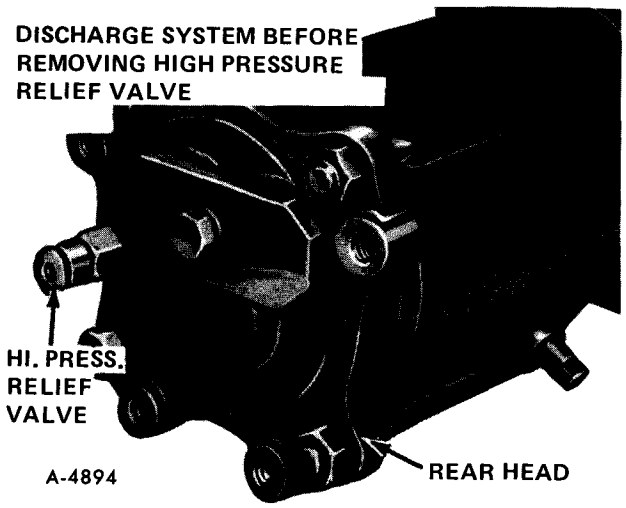


Figure 92—High Pressure Relief Valve

gasket installed. The entire system should then be evacuated and charged.

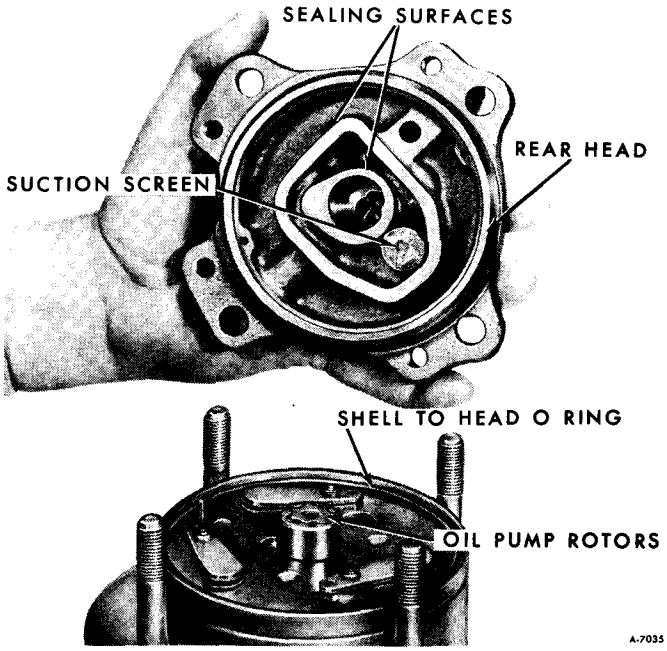


Figure 94—Rear Head Removed

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 operation should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them.

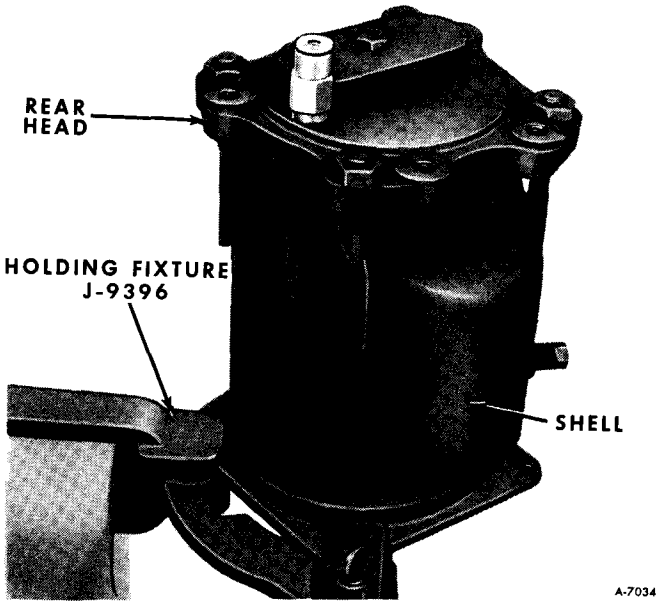


Figure 93—Compressor Installed in Holding Fixture

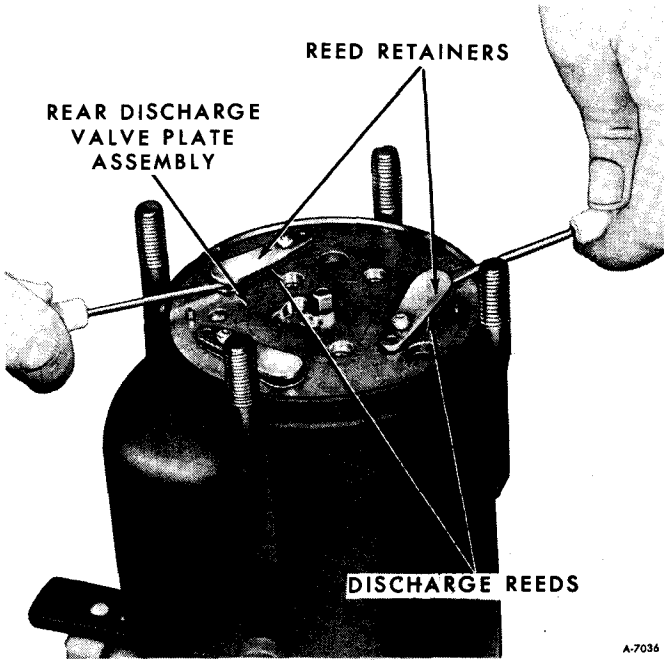


Figure 95—Removing Rear Discharge Valve Plate

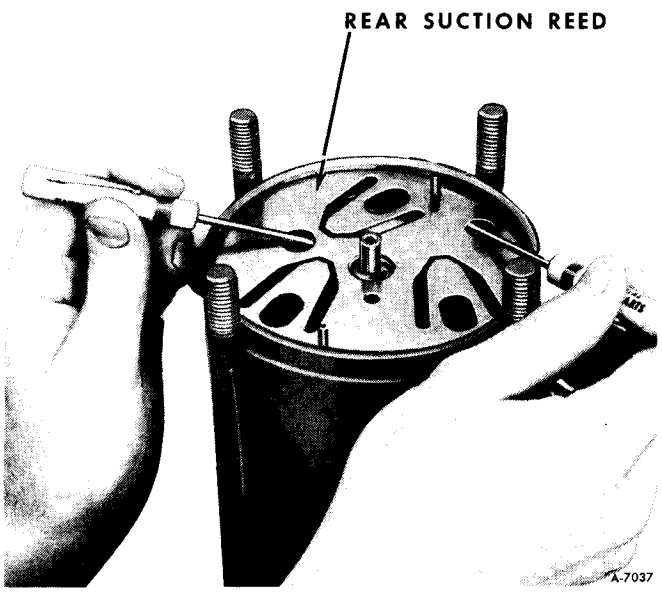


Figure 96—Removing Rear Suction Reed

REMOVAL

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 93).

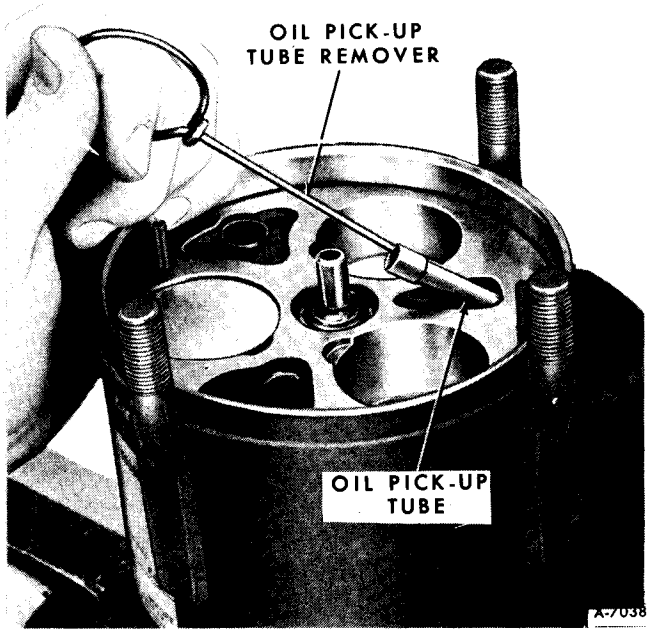


Figure 97—Removing Oil Pick-Up Tube

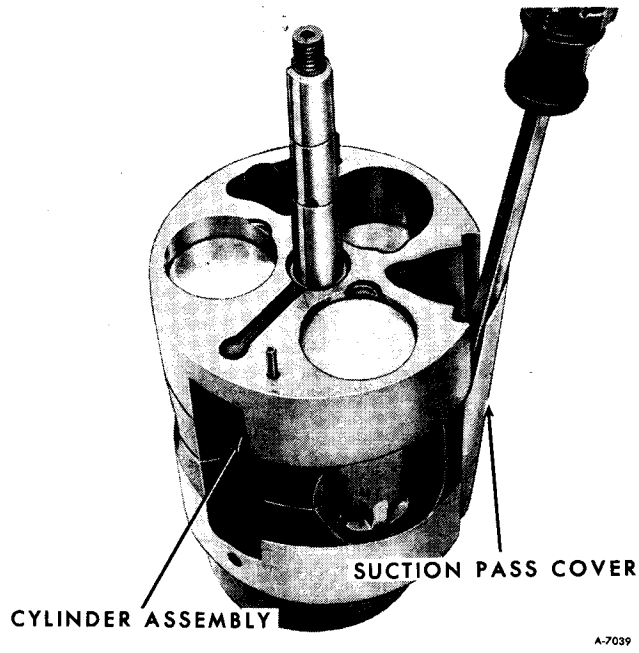


Figure 98—Removing Suction Crossover Cover

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.

4. Remove four lock nuts from threaded studs on compressor shell and remove rear head. Tap uniformly around rear head if head is binding (figure 93).

5. Wipe excess oil from all sealing surfaces on rear head casting webs, and examine sealing surfaces (figure 94). If any damage is observed, the head should be replaced.

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

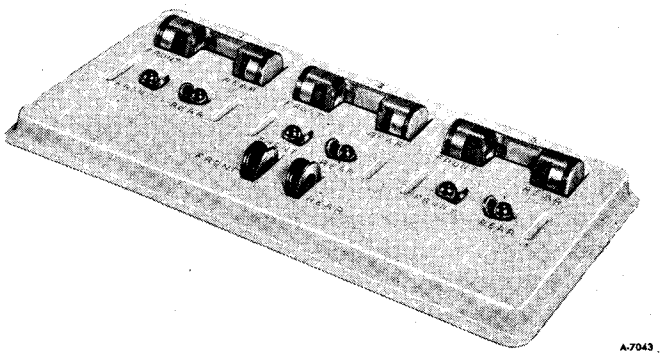


Figure 99—Parts Tray

then remove gears. Identifying marks are to assure that gears, if reused, will be installed in 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 95). 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 96). 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 97), 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 resting 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 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.

19. Remove suction crossover cover by prying with screwdriver between cylinder casting and cover (figure 98).

20. Examine internal mechanism for any obvious damage. If internal mechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to use a new cylinder and shaft assembly rather than replace individual parts.

DISASSEMBLY

Use parts tray J-9402 (figure 99) to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in "Compressor Internal Mechanism" removal procedure.

2. Identify by pencil mark, or some other suitable means, each piston, numbering them as 1, 2, and 3 (figure 100).

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 101). Make certain that discharge crossover tube does not contact axial plate when separating cylinder halves (a new service discharge crossover 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, in 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.

a. 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 later in this section.

6. Remove and discard the piston shoe discs.

7. Remove and examine piston balls, and if satisfactory for reuse, place balls in No. 1 compartment of parts tray J-9402 (figure 99).

8. Place piston in No. 1 compartment of parts tray J-9402, with notch in casting web at front end of piston (figure 102) 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

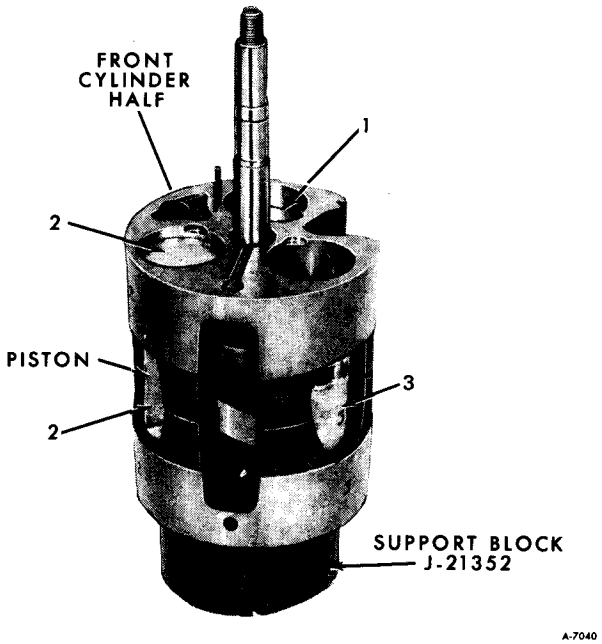


Figure 100—Numbering Piston and Cylinder Bores

and thrust bearing from shaft. Discard races and bearing.

11. Remove shaft assembly from front cylinder half. If the discharge crossover tube remained in the front cylinder half, it may be necessary to bend discharge cross-over tube slightly in order to remove shaft.

12. Remove front combination of thrust races and bearing from shaft. Discard races and bearing (figure 103).

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.

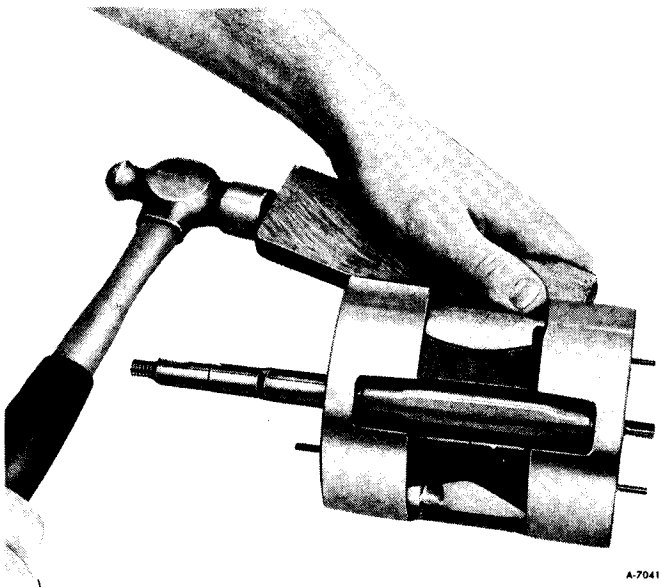


Figure 101—Separating Cylinder Halves

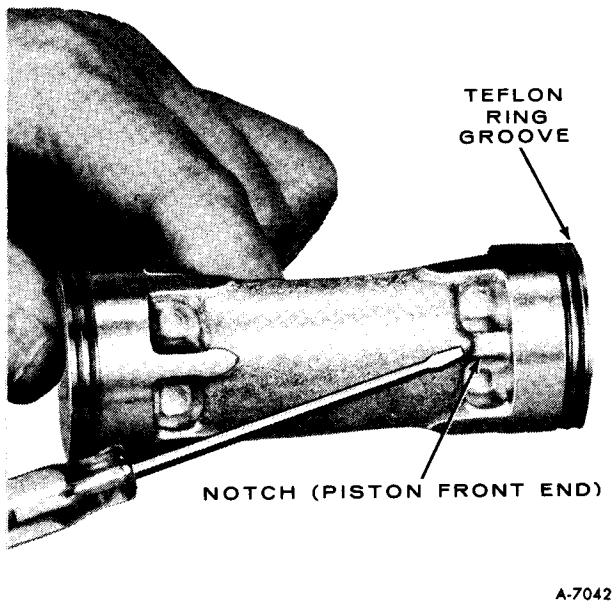


Figure 102—Notch Identifying Front End Of Piston

14. Remove discharge crossover 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 crossover tube in internal mechanism assemblies that have been previously serviced have an O-ring

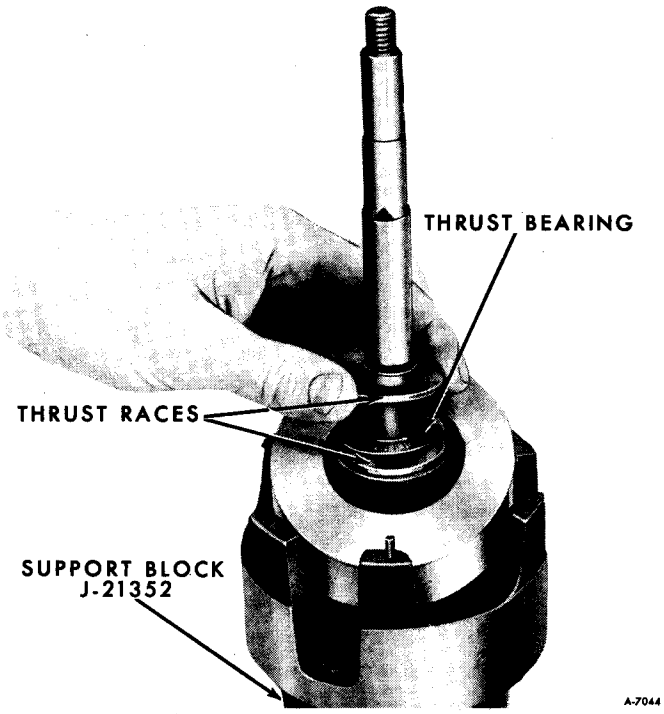


Figure 103—Removng Front Thrust Races And Bearings

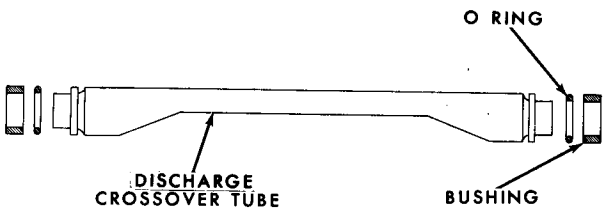


Figure 104—Service-Type Discharge Crossover Tube

and bushing at EACH END of the tube, and can be easily removed by hand (see figure 104).

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 105) 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.

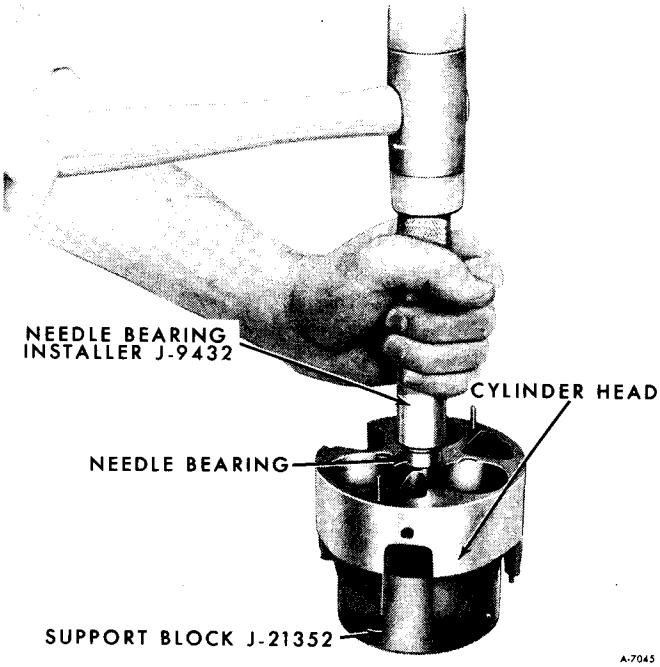


Figure 105—Installing Needle Bearing

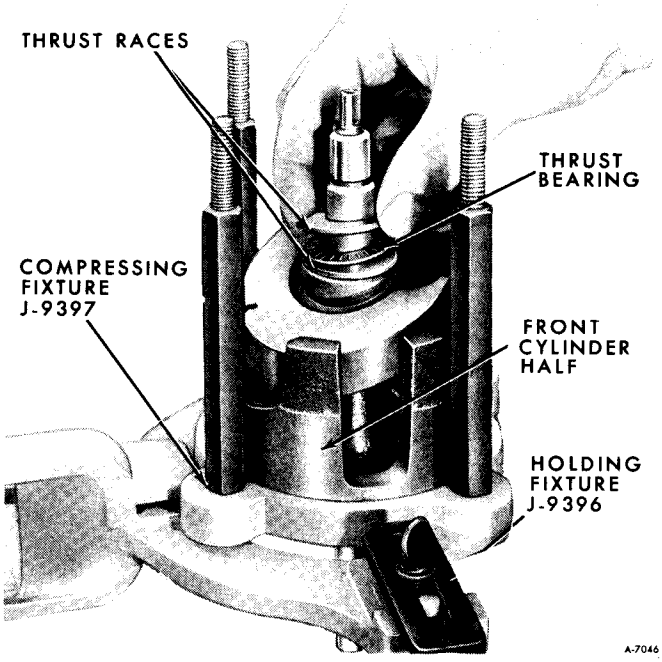


Figure 106—Installing Rear Thrust Races And Bearings

17. Wash all parts to be re-used with trichlorethylene, naptha, stoddard solvent, 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 67 and 68.

GAUGING OPERATION

1. Install Compressing Fixture J-9397 on Holding Fixture J-9396 in vise. Place front cylinder half in Compressing Fixture, flat side

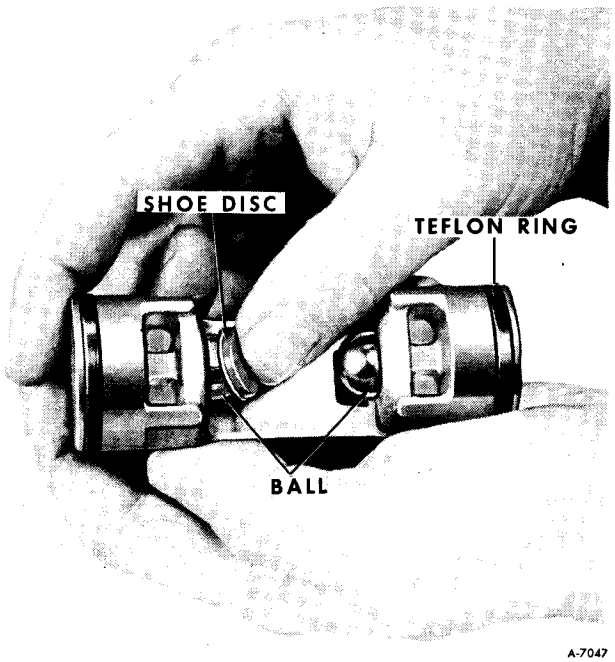


Figure 107—Installing Front Shoe Disc

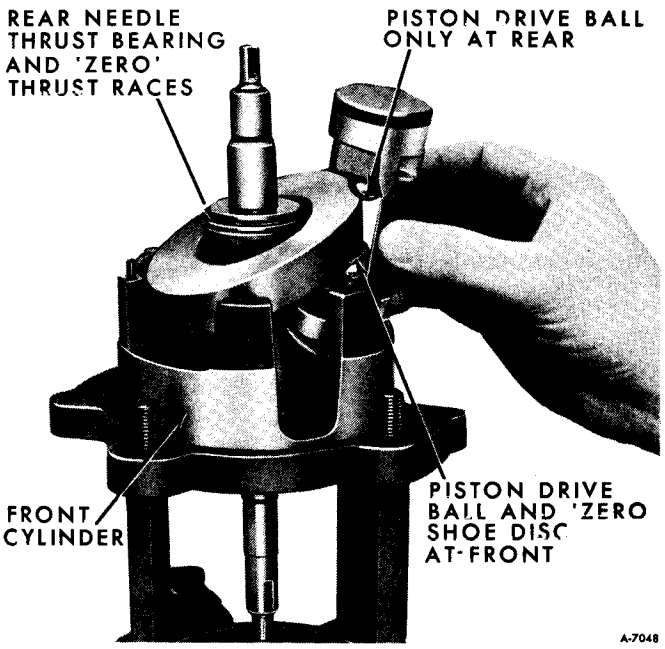


Figure 108—Installing Piston During Gauging Operation

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 106), 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.

7. Lubricate cavity of zero shoe disc with 525 viscosity refrigerant oil and place shoe disc over ball in front end of piston (figure 107).

Front end of piston has an identifying notch in casting web (figure 102).

> 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 "Gauging" 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 on bottom and piston straddling axial plate) and lower the shaft to allow piston to drop into its bore (figure 108).

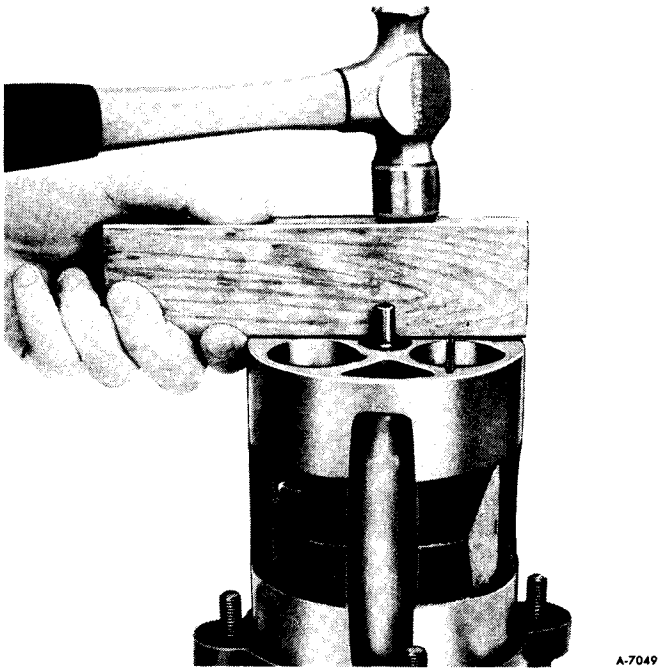


Figure 109—Assembling Cylinder Halves

11. Repeat Steps 6 through 10 for pistons No. 2 and No. 3

12. Install rear cylinder half on pistons, aligning cylinder with discharge crossover tube hole in front cylinder.

Tap into place using a plastic mallet or piece of clean wood and hammer (figure 109).

13. Position discharge crossover tube opening between a pair of compressing fixture bolts to permit access for feeler gauge.

14. Install top plate on compressing fixture J-9397. Tighten nuts to 15 ft. lbs. torque using a 1-25 ft. lb. torque wrench.

GAUGING PROCEDURE (STEPS 15 THRU 18)

The gauging 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"

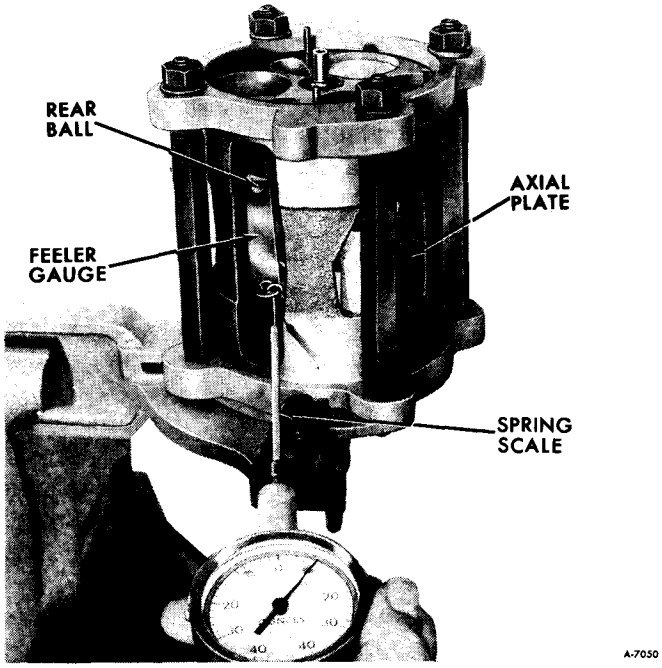


Figure 110—Gauging Rear Piston Ball

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 place. 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 15 steel thrust races, including a basic ZERO race, are provided in increments of .0005" thickness to provide the required fit.

Feeler Gauge Set J-9564 or J-9661-01 may be used for gaging proper shoe disc size. Feeler Gauge Set J-9564-01 or Dial Indicator Set J-8001 may be used to determine proper thrust race size.

PROPER SELECTION OF THRUST RACES AND BALL SEATS IS OF EXTREME IMPORTANCE.

	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

A-7033

Figure 111—Selection of Proper Shoe Disc

SHOE DISC			THRUST BEARING RACE		
Part No. Ending In	Identification Stamp	Min. Feeler Gage Reading	Part No. Ending In	Identification Stamp	Dial Indicator 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
		A-7032	120	12	.0120

Figure 112—Available Service Shoes And Thrust Washers

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 gauge leaves to fit snugly between ball and axial plate.

b. Attach a spring scale, reading in 1-ounce increments, to the feeler gauge. A distributor point checking scale or Spring Scale J-544 may be used.

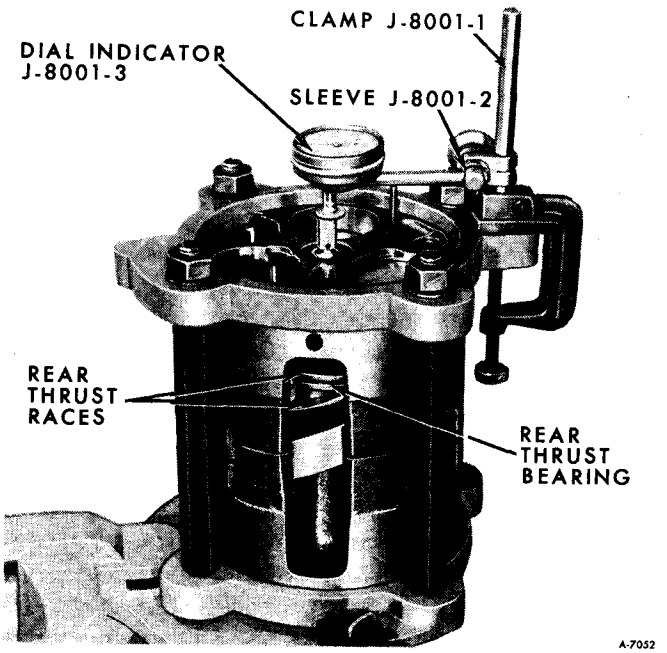


Figure 113—Gauging Rear Thrust Race

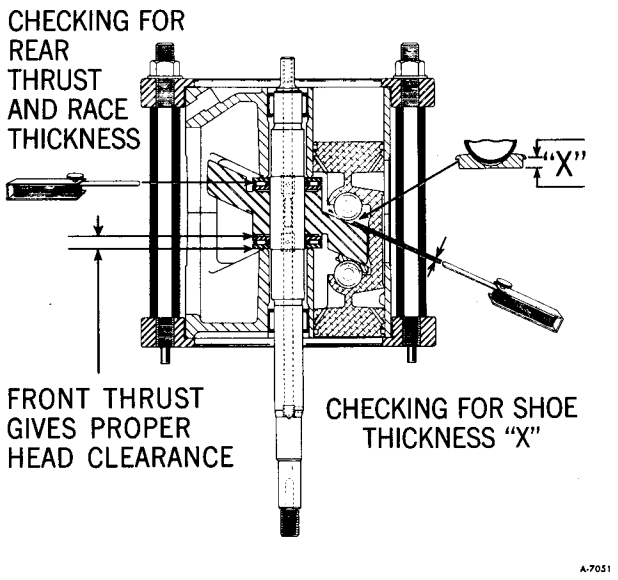


Figure 114—Checking Piston and Shaft End Play

c. Pull on spring scale to slide feeler gauge stock out from between ball and axial plate, and note reading on spring scale as feeler gauge is removed (figure 110). Reading should be between 4 and 8 ounces.

d. If reading in Step c. above is under 4 or over 8 ounces, reduce or increase thickness of feeler gauge 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.

18. Select a "numbered" shoe disc corresponding to minimum feeler gauge reading recorded in the three checks above. (See example in figure 111). 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 112 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 gauging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gauging 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 113). Position dial indicator on rear end of shaft and adjust to "zero".

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 gauge set J-9661-01 selecting a suitable feeler gauge 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 114). 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 gauge thickness.

(If feeler gauge 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 gauge 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 thousandths) thickness and one zero gauge thickness, providing a total of 16 sizes available for field service.

The thrust race "number" also corresonds to the last three digits of the piece part number. See "Thrust Race Size Chart" in figure 112.

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 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.

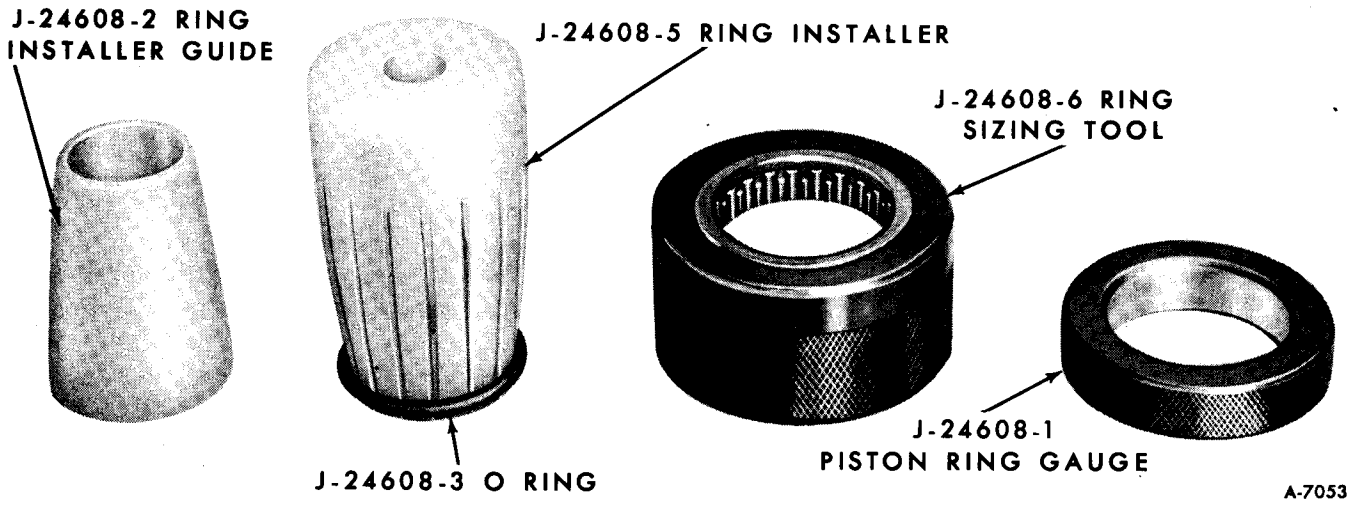


Figure 115—Teflon Piston Ring Installing, Sizing and Gauging Tools

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 gauging or rebuilding operations.

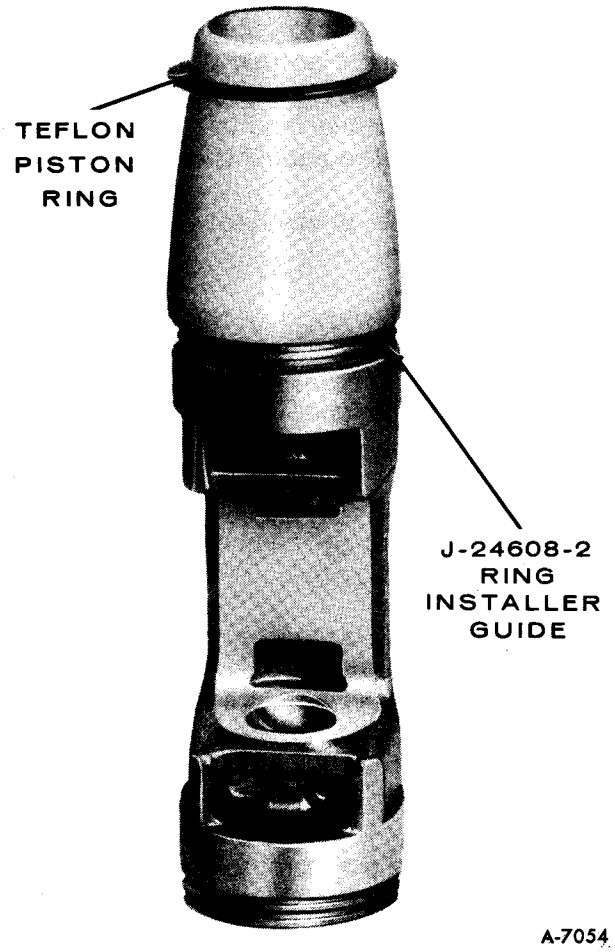


Figure 116—Teflon Piston Ring Positioned On Ring Installer Guide

TEFLON PISTON RING REPLACEMENT

The Teflon piston ring installing, sizing and gauging tools are shown in figure 115.

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 careful not to damage the aluminum piston or piston groove in cutting to remove the ring.

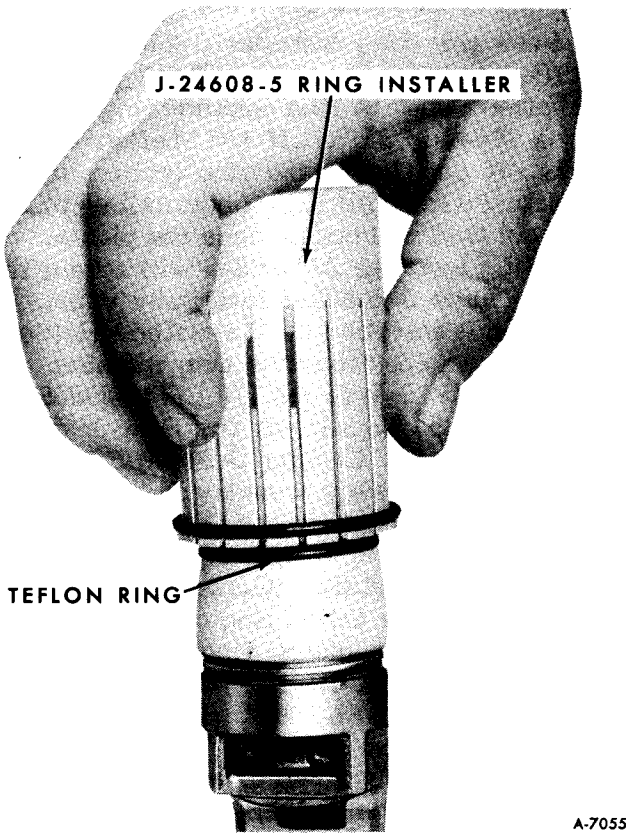


Figure 117—Installing Teflon Piston Ring

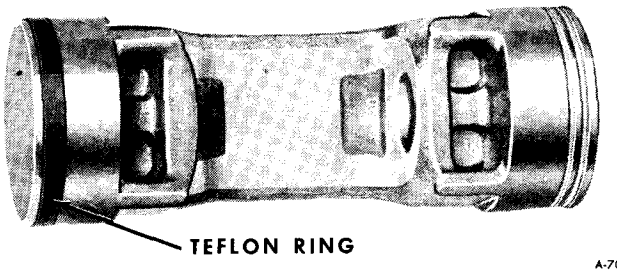


Figure 118—Teflon Piston Ring Installed On Piston Groove

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 116).

4. Install a teflon ring on the Ring Installer Guide J-24605-2 as shown in figure 116, 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 (figures 117 and 118). 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 properly install the teflon ring on the piston.

6. Lubricate the piston ring area with 525 viscosity refrigerant oil and rotate the piston and ring assembly into the Ring Sizer J-24608-6 at a slight angle (figure 119). Rotate the piston, while pushing inward, until the piston is inserted against the center stop of the Ring Sizer J-23608-6.

7. Rotate the piston and ring assembly in the ring sizer J-24608-6 several complete

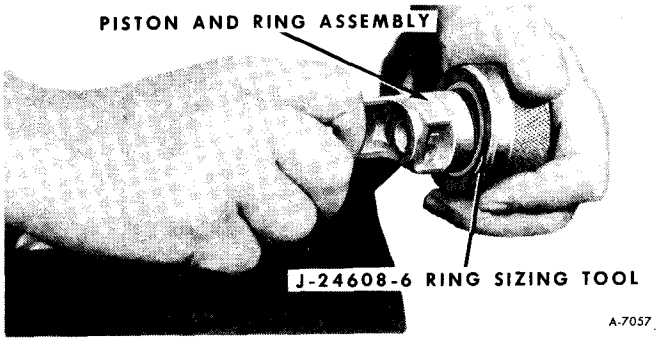


Figure 119—Turning Piston and Ring Assembly into Sizing Tool

turns, until the assembly rotates relatively free in the ring sizer (figure 119).

8. Remove the piston and ring asembly, wipe the end of the piston and ring area with a clean cloth and then push the piston and ring assembly into the ring gauge J-24608-1 (figure 120). The piston should go through the ring gauge with a 6 lb. force or less without lubrication. If not, repeat Steps 6 and 7.

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.*

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.*

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 "Gauging 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.

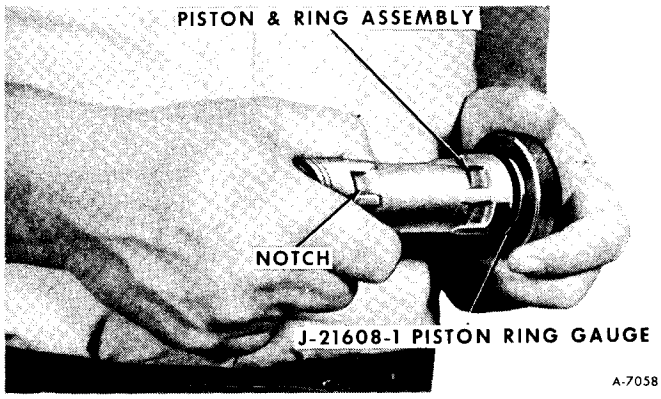


Figure 120—Gauging Piston Ring Size

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 "Gauging Procedure".

2. Apply a light smear of petroleum jelly to the "numbered" shoe discs chosen in the gauging 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 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 121).

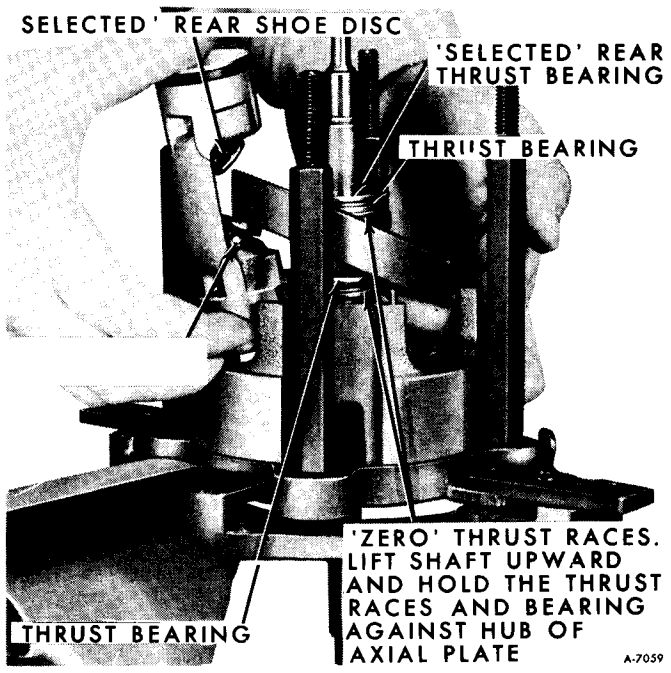


Figure 121—Installing 1st Piston Assembly Into Front Cylinder Half

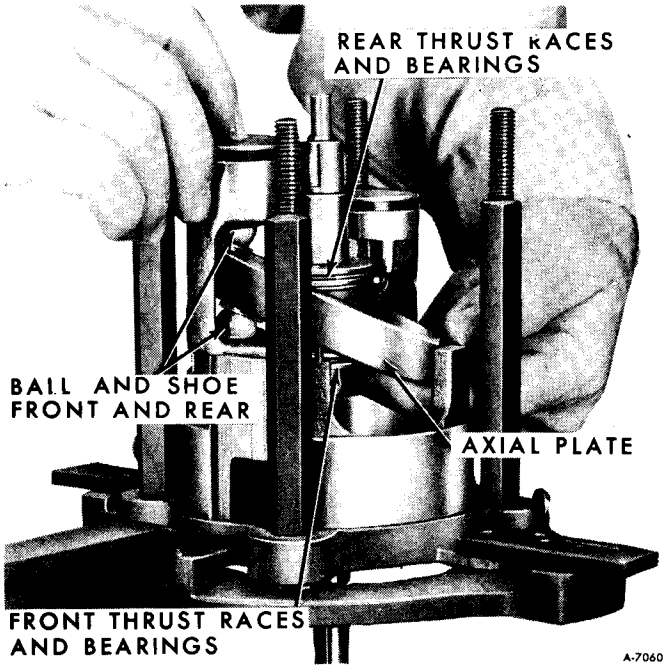


Figure 122—Installing 2nd Piston

4. Repeat this operation for pistons No. 2 and No. 3 (figure 122).

5. Without installing any O-rings or bushings, assemble one end of the new service discharge crossover tube into the hole in the front cylinder half (figures 104 and 123).

Be sure the flattened portion of this tube

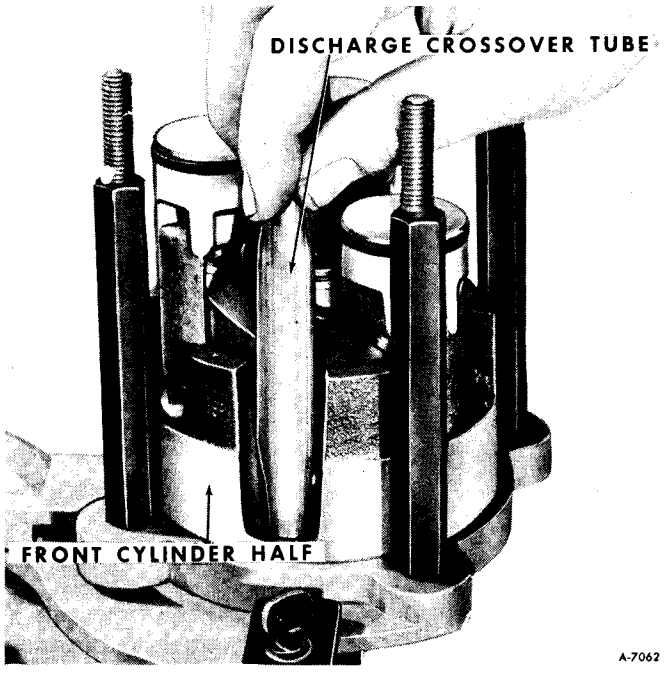


Figure 123—Installing Discharge Crossover Tube

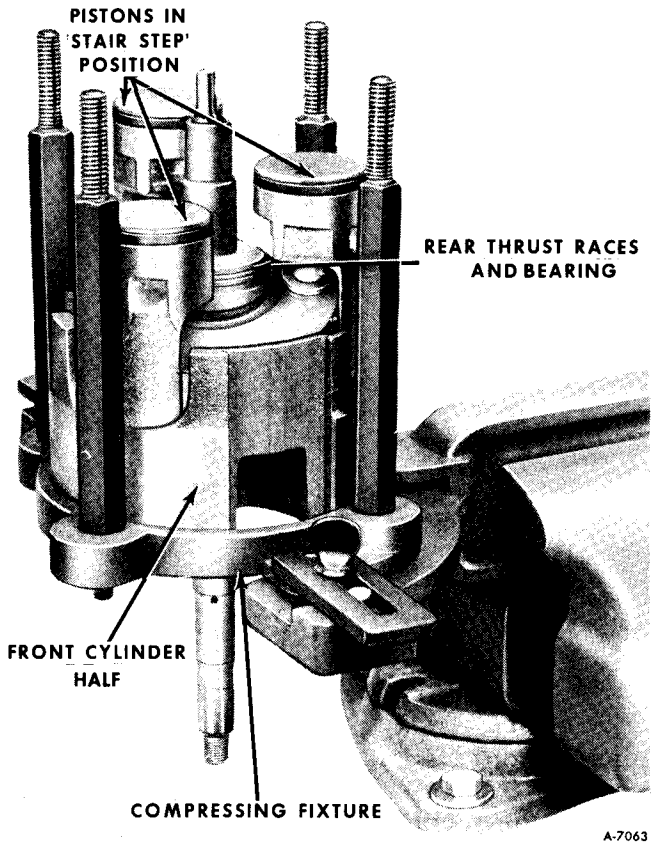


Figure 124—Pistons Positioned in Stair-Step Arrangement

faces the inside of the compressor to allow for axial plate clearance (figure 123).

6. Now rotate the shaft to position the pistons in a stair step arrangement; then carefully place the rear cylinder half over the shaft and start the pistons into the cylinder (figure 124).

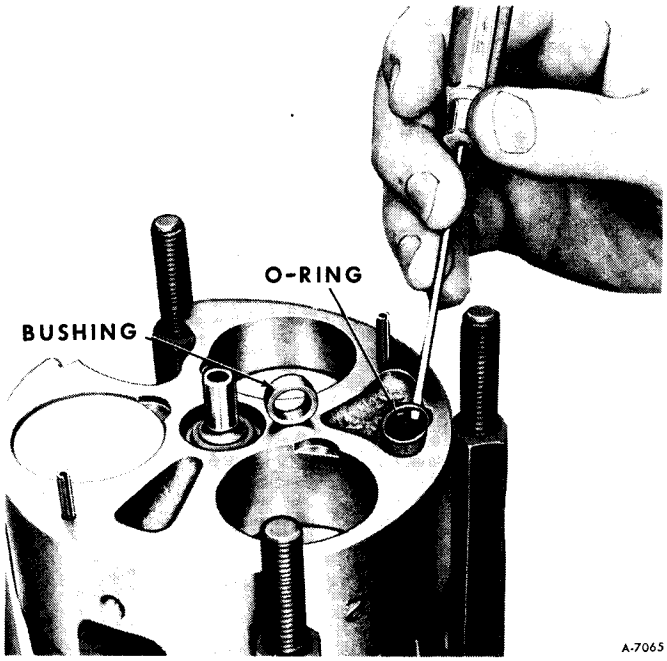


Figure 126—Installing O-Ring on Discharge Crossover Tube

7. When all three piston and ring assemblies are in their respective cylinders, align the end of the discharge crossover tube with the hole in the rear half of the cylinder.

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 drawing the cylinder halves together.

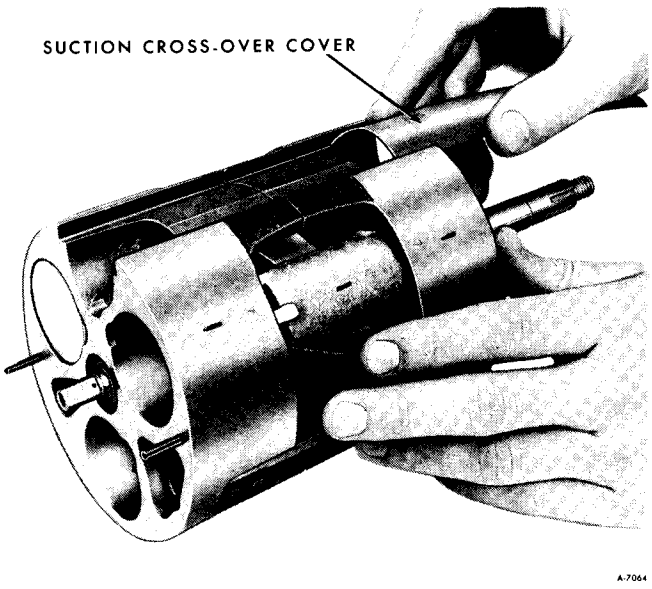


Figure 125—Installing Suction Crossover Cover

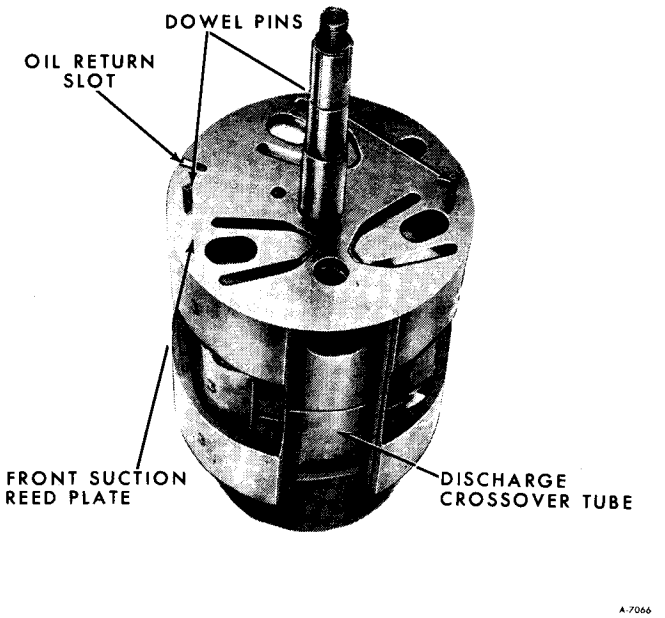


Figure 127—Installing Front Suction Reeds

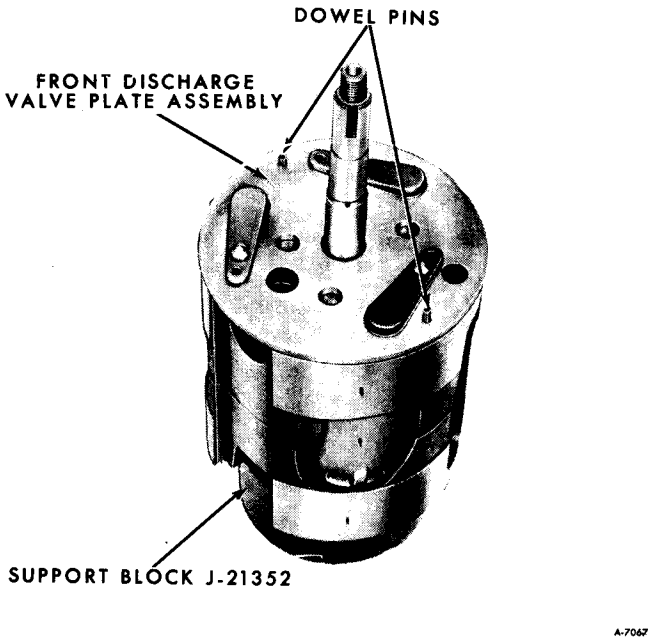


Figure 128—Installing Front Discharge Valve Plate

9. Generously lubricate all moving parts with clean 525 viscosity refrigerant oil and check for free rotation of the parts.

10. Replace the suction crossover cover (figure 125). Compress the cover as shown to start it into the slot, and then press or carefully tap it in until flush on both ends.

INSTALLATION

1. Place internal mechanism on internal assembly support block J-21352, with rear end of shaft in block hole.

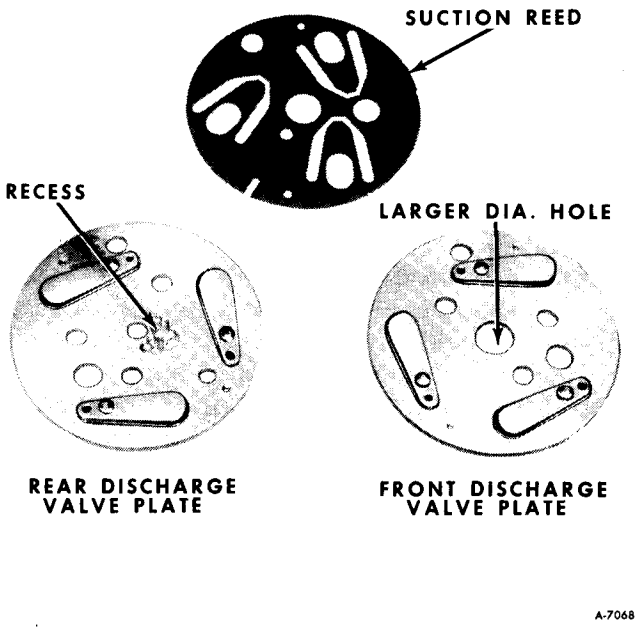


Figure129—Front and Rear Discharge Valve Plate

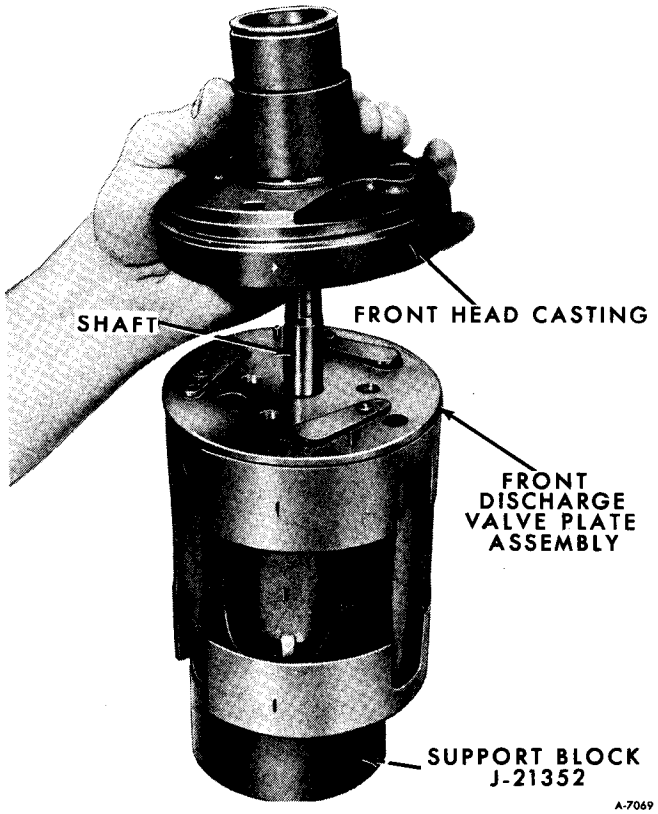


Figure 130—Installing Front Head Casting

2. Now install new O-ring bushing in front end of the discharge crossover tube (figure 126). The O-ring and bushing for internal mechanism are service parts only that have been disassembled in the field (refer to figure 104).

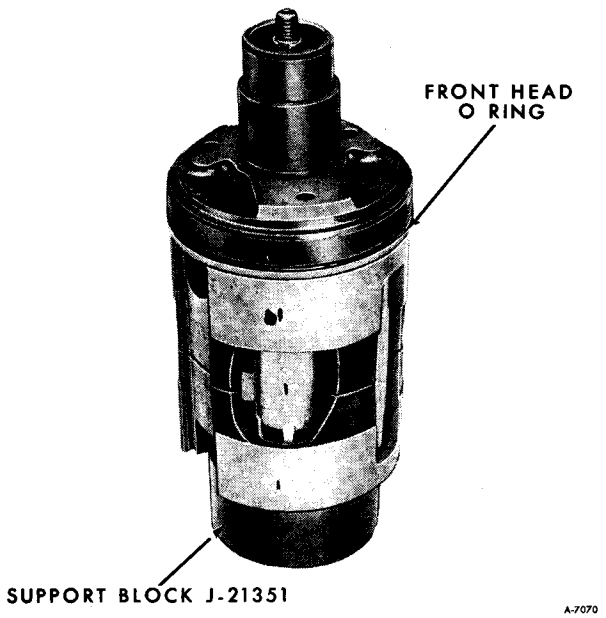


Figure 131—Front Head O-Ring Installed

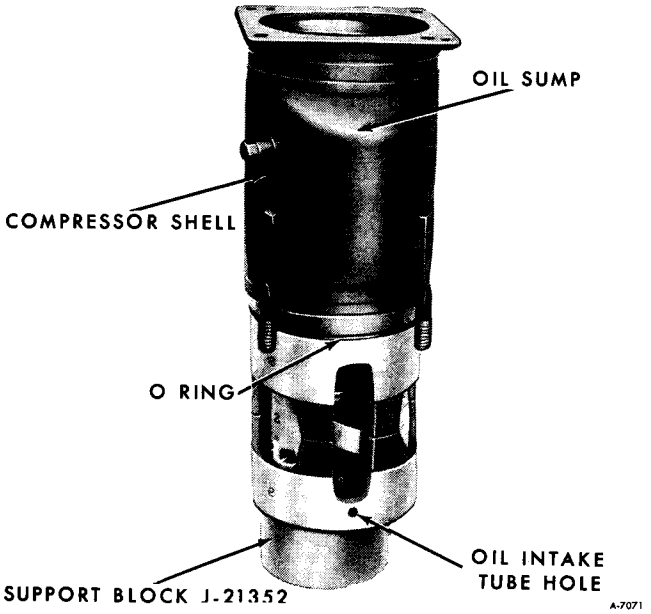


Figure 132—Installing Compressor Shell

3. Install new dowel pins in front cylinder half, if previously removed.

4. Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge crossover tube (figure 127).

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate (figure 128).

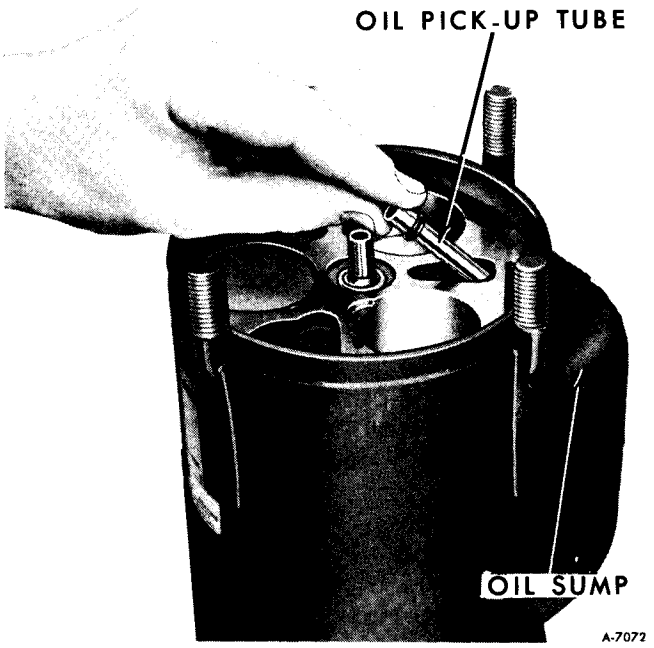


Figure 133—Installing Oil Pick-Up Tube

Front discharge plate has a large diameter hole in the center (figure 129).

6. Coat sealing surfaces on webs of compressor front head casting with 525 viscosity refrigerant oil.

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 130), 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 131).

9. Coat inside machined surfaces of compressor shell with 525 viscosity refrigerant oil and position shell on internal mechanism, resting on O-ring seal.

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 132).

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.

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 133).

15. Install new O-ring and bushing on rear end of discharge crossover tube (figure 104).

16. Install rear suction reed over dowel pins, with slot towards sump.

17. Install rear discharge valve plate assembly over dowel pins, with reed retainer up.

18. Position inner oil pump gear over shaft with previously applied identification mark up.

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 a 3 o'clock position (figure 134).

20. Generously oil rear discharge valve plate assembly with 525 viscosity refrigerant oil

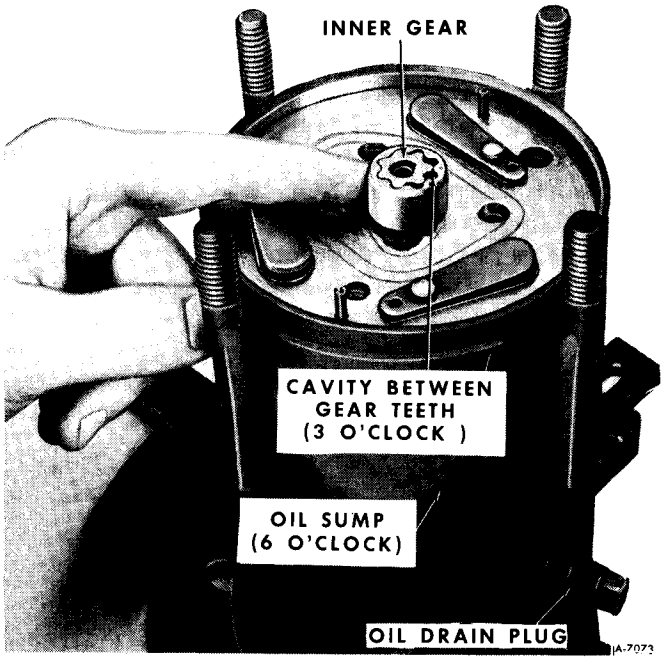


Figure 134—Positioning Oil Pump Gears

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 135).

22. Install suction screen in rear head casting, using care not to damage screen.

23. 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 drop out of place when lowering rear head into position (figure 136).

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 shell studs and tighten evenly to 25 ft. lbs. torque using a 0-50 ft. lbs. torque wrench.

26. Invert compressor in holding fixture and 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.

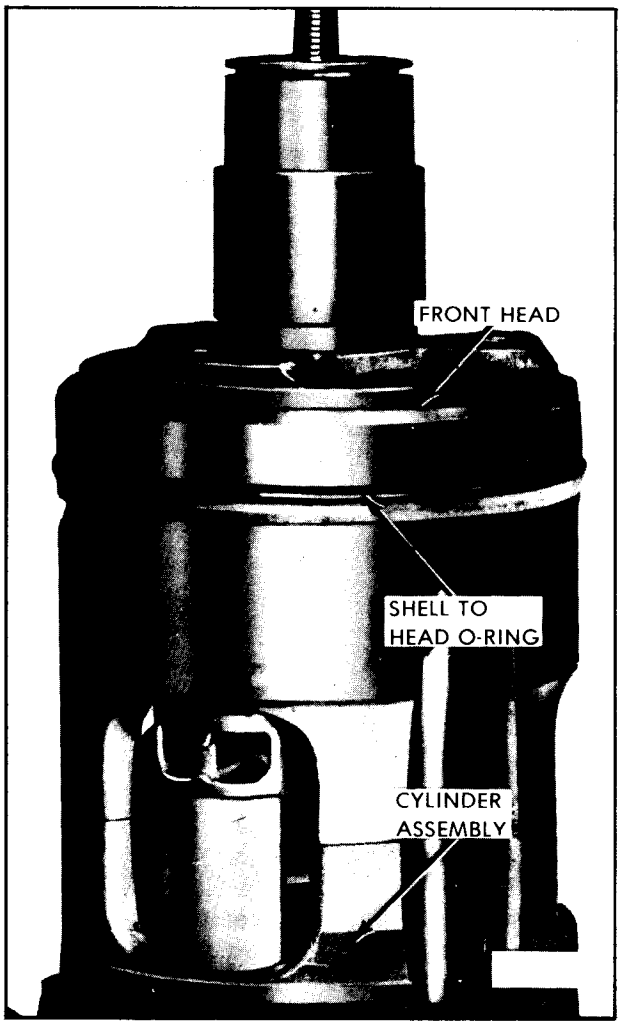


Figure 135—Shell-to-Front Head Installations

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.

31. Check for external and internal leaks as described in the following "Compressor Leak Testing" procedure.

COMPRESSOR LEAK TESTING— EXTERNAL AND INTERNAL

BENCH-CHECK PROCEDURE

1. Install test plate J-9625 on rear head of compressor.

2. Attach center hose of gauge manifold set on charging station to a refrigerant drum standing in an upright position and open valve on drum.

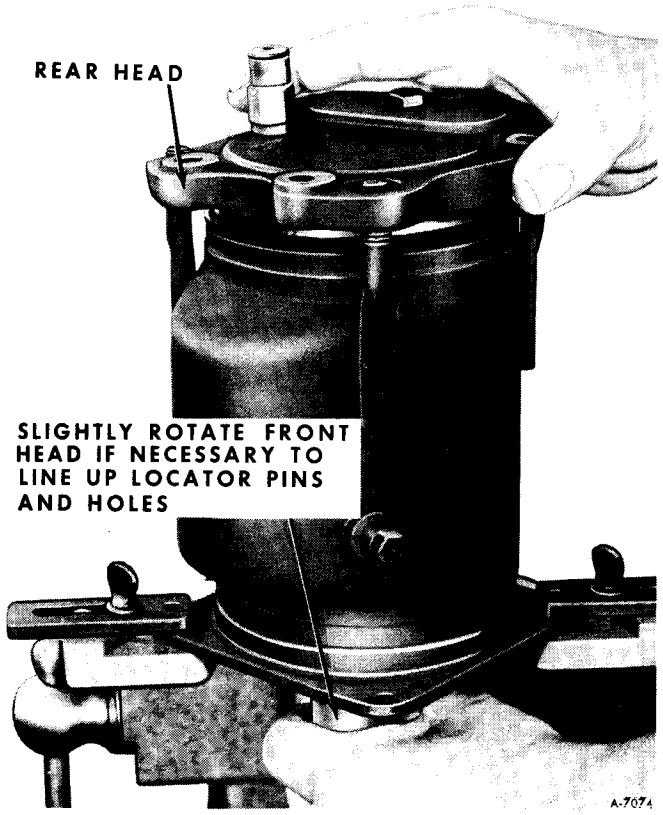


Figure 136—Installing Rear Head

3. Connect charging station "high" and "low" pressure lines to corresponding fittings on test plate J-9625, using J-5420 (7/16") gauge adapters, or J-25498 (3/8") gauge adapters.

4. Open "low" pressure control, "high" pressure control and refrigerant control on charging station to allow refrigerant vapor to flow into compressor.

5. Using leak detector, check for leaks at pressure relief valve, compressor shell to cylinder, compressor front head seal, rear head seal, oil charge port, and compressor shaft seal. After checking, shut off "low" pressure control and "high" pressure control on charging station.

6. 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 gauge hose connections to the gauge adapters connected to the "low" and "high" sides and allow the vapor pressure to release from the compressor.

8. Disconnect both gauge adapters 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 gauge and gauge adapter J-5420 or J-25498 to the test plate J-9625 high side connector.

13. Attach adapter J-5420 or J-25498 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 to 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.

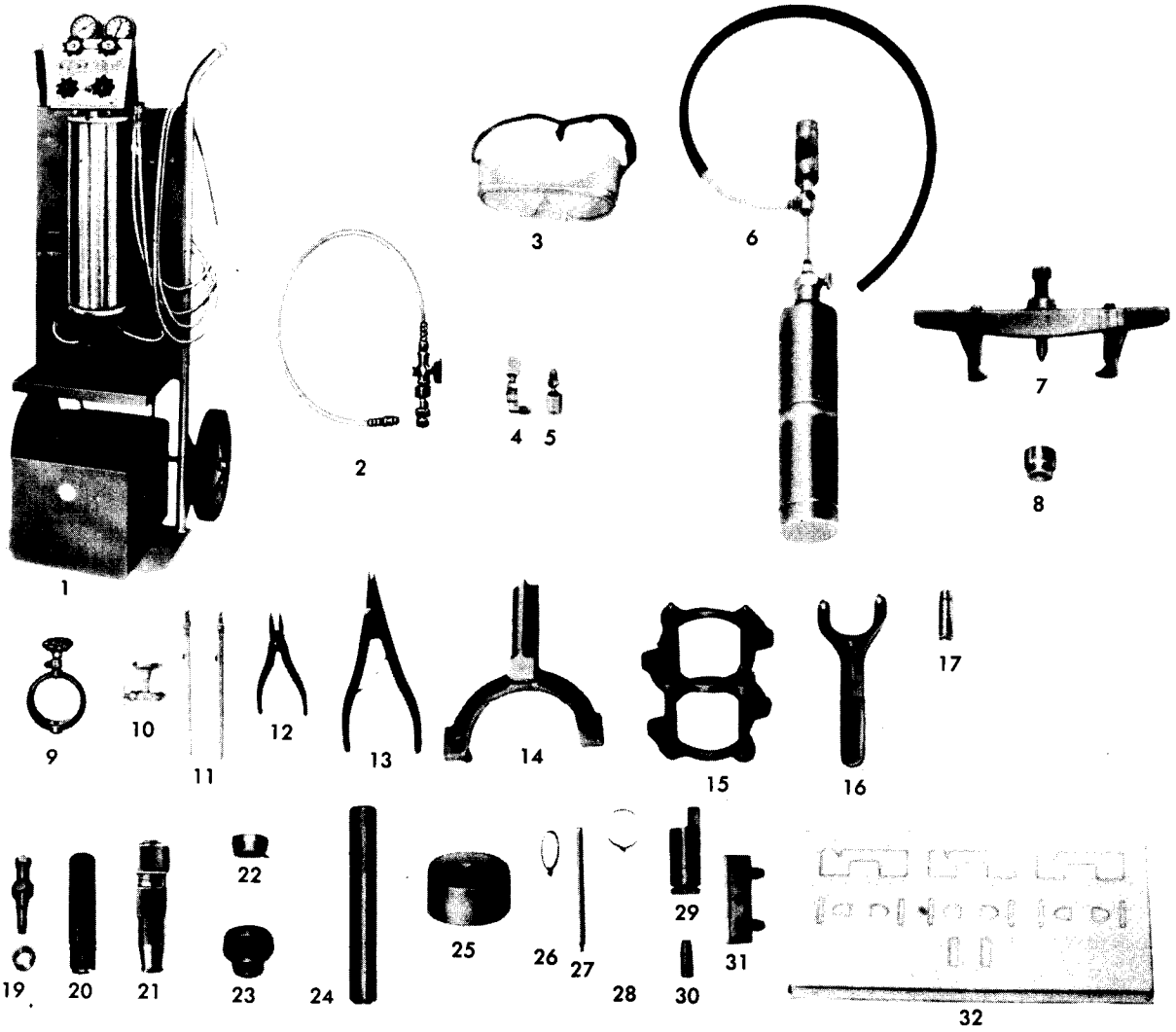
16. Observe the reading on the "high" pressure gauge at the completion of the tenth revolution of the compressor. The pressure reading for a good pumping compressor should be 60 psi or above. A pressure reading of less than 50 psi would indicate one or more suction and/or discharge valves leaking, an 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.

17. When the pressure pump up test is completed, release the air pressure from the "high" side and remove the gauge adapters J-5420 or J-25498 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 525 viscosity 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.



1. J-23500	Charging Station	12. J-5403	No. 21 Snap Ring Pliers	22. J-9398	Pulley Bearing Remover
2. J-24095	Oil Inducer	13. J-6435	No. 26 Snap Ring Pliers	23. J-9481	Pulley and Bearing Installer
3. J-5453	Goggles	14. J-9396	Compressor Holding Fixture	24. J-8092	Handle
4. J-9459	7/16"-20 90° Gauge Line			25. J-21352	Internal Assembly Support Block
J-25499	3/8"-24 Adapter	15. J-9397	Compressing Fixture		
5. J-5420	7/16"-20 Straight Gauge Line	16. J-9403 &	Clutch Hub Holding Tool	26. J-5139	Oil Pickup Tube Remover
J-25498	3/8" Adapter	J-25030	Clutch Hub Holding Tool	27. J-9432	Needle Bearing Installer
6. J-6084	Leak Detector	17. J-9399	9/16" Thin Wall Socket	28. J-9553-01	Seal Seat "O" Ring Remover
7. J-8433	Puller	18. J-9401	Hub and Drive Plate Assembly Remover	29. J-21508	Seal Seat "O" Ring Installer
8. J-9395	Puller Pilot			30. J-22974	Shaft Seal Protector
9. J-23595	Refrigerant Can Valve (Side-Tap)	19. J-9480-01	Hub and Drive Plate Assembly Installer	31. J-9625	Pressure Test Connector
10. J-6271-01	Refrigerant Can Valve (Top-Tap)	20. J-9392	Seal Remover	32. J-9402	Parts Tray
11. J-5421-02	Pocket Thermometers (2)	21. J-23128	Seal Seat Remover		

Not Illustrated J-24092 Pulley Puller (Polly V Pulley)

A-7500

Figure 137—Special Tools

SPECIFICATIONS

COMPRESSOR

Type	6 Cylinder Axial
Displacement	12.6 Cu. In.
Rotation	Clockwise

COMPRESSOR CLUTCH COIL

Ohms (at 80°F, 27°C)	3.85
Amps (at 80°F, 27°C)	3.2 (max.) @ 12 volts
Clutch	.022" to .057"

SYSTEM CAPACITIES (REFER TO COMPRESSOR OIL CHART)

TORQUE SPECIFICATIONS

Compressor Suction & Discharge Connector Bolt	10-25 (max.) ft. lbs.
Rear Head to Shell Stud Nuts	25 ft. lbs.
Shaft Mounting Nut	25 ft. lbs.
Pressure Relief Valve	10-14 (max.) ft. lbs.
Oil Drain Screw	10-15 (max.) ft. lbs.
Rear Bracket to Compressor	25-35 ft. lbs.
Front Bracket to Compressor	25-35 ft. lbs.
Rear Compressor Bracket to Engine Mounting Bracket	25-35 ft. lbs.
Front Compressor Bracket to Engine Mounting Bracket	25-35 ft. lbs.
Compressor Brace Adjustment	
Link Upper Bolt	20-25 ft. lbs.
Link Lower Bolt	25-35 ft. lbs.
Hose Assembly Mounting Bolt	10-25 ft. lbs.
Heater Hose Clamps	20-24 in. lbs.
Water Valve Clamps	20-24 in. lbs.
Compressor Hose O-ring Nuts	
High Pressure Line Nut	11-13 ft. lbs.
Low Pressure Line Nut	21-27 ft. lbs.
Receiver-Dehydrator Bracket Mounting Screws	25-35 in. lbs.

SPECIAL TOOLS

(Not Illustrated on Page 1B-109)

J-24364	Vacuum Pump (3 c.f.m displacement)
J-23575-01	Manifold Gauge Set
J-24410	Charging Station
J-26933	Electronic Leak Detector
J-24095	Compressor Oil Injector
J-24612-01	A/C Register Remover and Installer
J-8001-3	Dial Indicator Set
J-9564-01	Feeler Gauge Set (5/1000 through 22/1000)
J-9661-01	Feeler Gauge Set (17/1000 through 22/1000)
J-24608	Teflon Piston Ring Service Set

SECTION 2
FRAME

The information described in Maintenance Manual X-7525 under the heading FRAME (SEC. 2) is applicable to models covered by this supplement with exception of the following illustration of revised front body mountings and body insulators (figure 1).

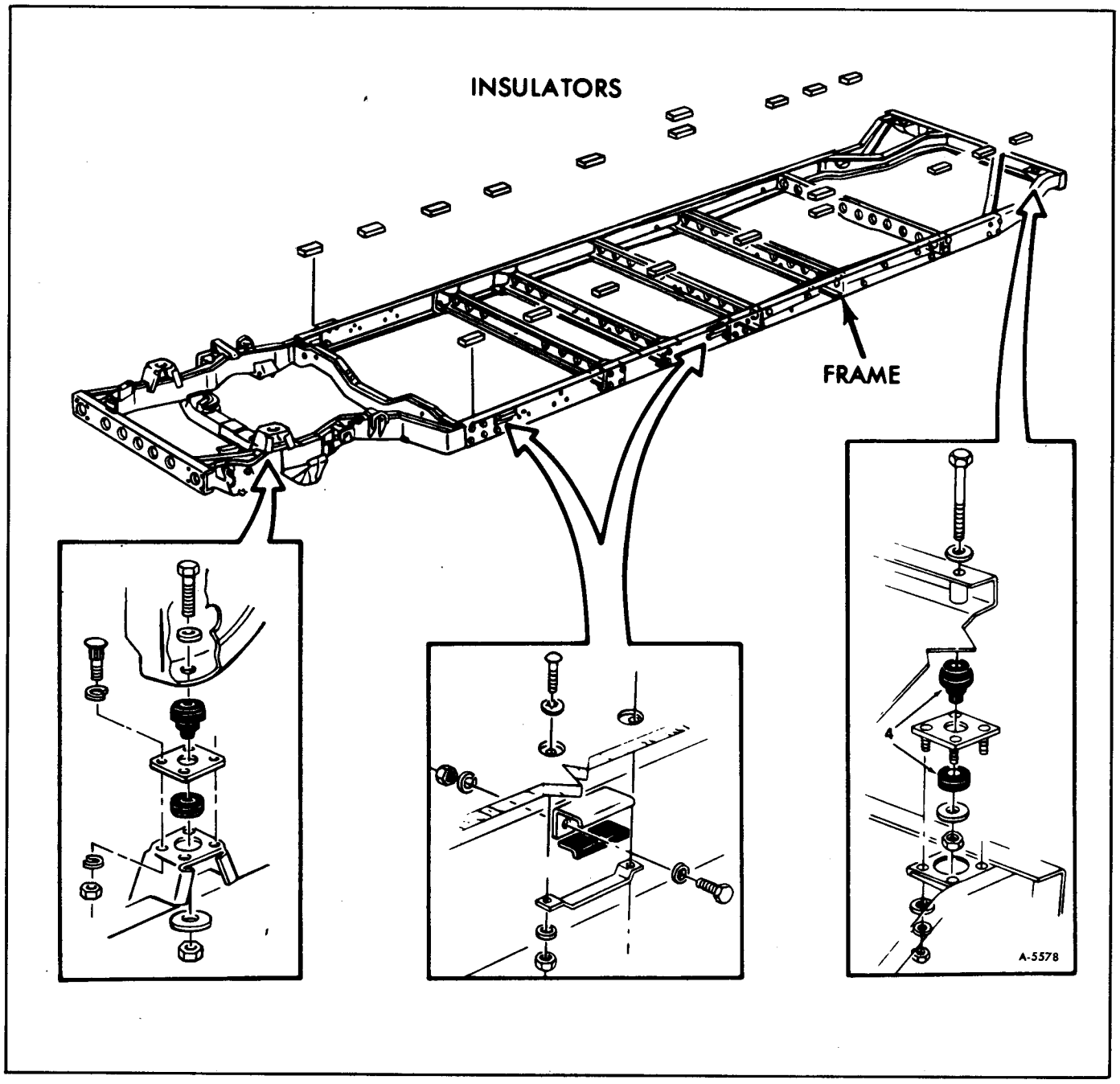


Figure 1—Body Mountings

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.

The information described in Maintenance Manual X-7525 under the heading FRONT SUSPENSION (SEC. 3A) is applicable to models covered by this supplement with the exception of the following:

CONTENTS

DIAGNOSIS OF FRONT SUSPENSION AND STEERING

Before making any adjustment to a vehicle because of suspension, steering and tire wear problems, it is necessary to make a preliminary inspection of all moving parts from the steering wheel to the road wheels.

Wear, looseness or binding of any of the moving parts of the steering system and suspension system will affect vehicle alignment. Vehicle misalignment cannot be corrected as long as conditions of bind or looseness exist. A complete inspection should be made, even if the cause of the problem is suspected.

INSPECTION PROCEDURE

1. Inflate tires to proper pressure (when cold):

- Bias belted nylon or steel belted bias ply tires — 60 psi.
- Steel belted radial tires — 65 psi.

2. Check ride height for sag and uneveness. Before adjusting front ride height, park the vehicle on a known level surface and adjust the rear ride height. (Refer to "RIDE HEIGHT" in Section 4 of this supplement.)

3. Adjust front ride height. (Refer to "RIDE HEIGHT" discussed later in this section.)

If you are unable to adjust the front ride height to 13-1/8" plus or minus 1/4", it will be necessary to change the torsion bar anchor arm. Use the following guide to select the proper anchor arm:

Condition	Use Part Number	Anchor Arm Angularity
Vehicle too high	413683	23^{o}
Vehicle too low	418352	$25\ 1/2^{o}$
Vehicle extremely low	416373	28^{o}

If changing the anchor arm does not correct the ride height, inspect the lower control arm for galling, bulging or splitting, and inspect the control arm end of the torsion bar for wear. Replace as necessary.

4. Check shock absorber control. (Refer to "Front Suspension and Steering Trouble Diagnosis Chart" later in this section.)

5. Check wheels and tires for runout and wobble. (Refer to Sec. 10, Maintenance Manual X-7525.)

6. Check tires for side wear, misalignment wear, cornering wear or uneven wear. (Refer to Sec. 10, Maintenance Manual X-7525.)

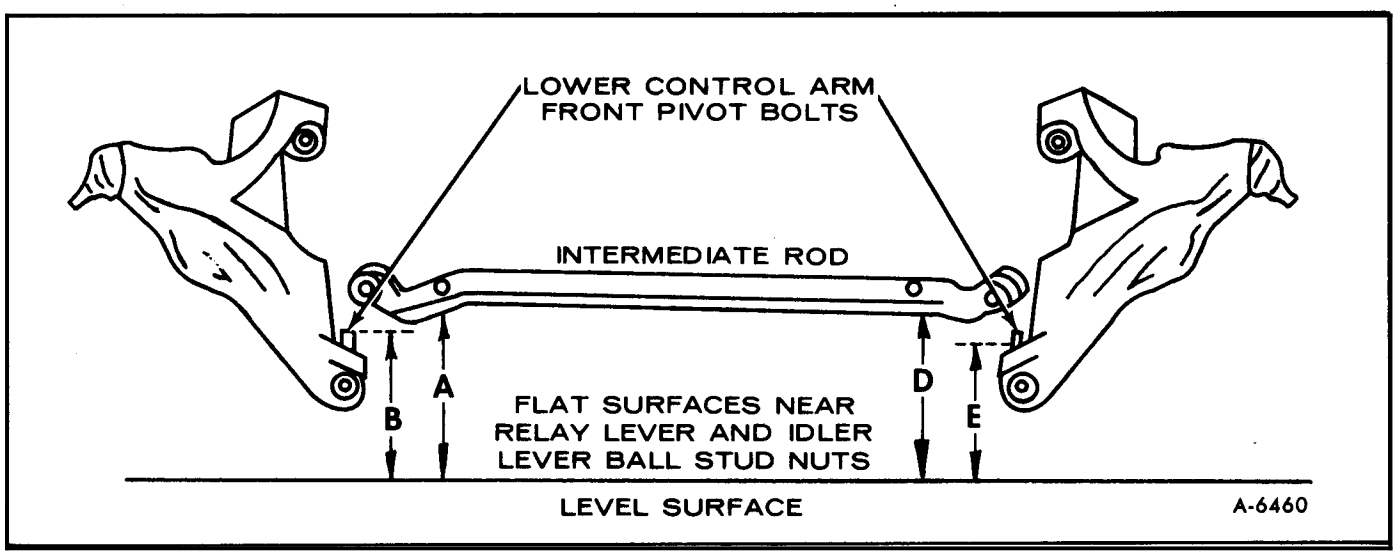


Figure 1—Measuring Intermediate Rod Parallelism

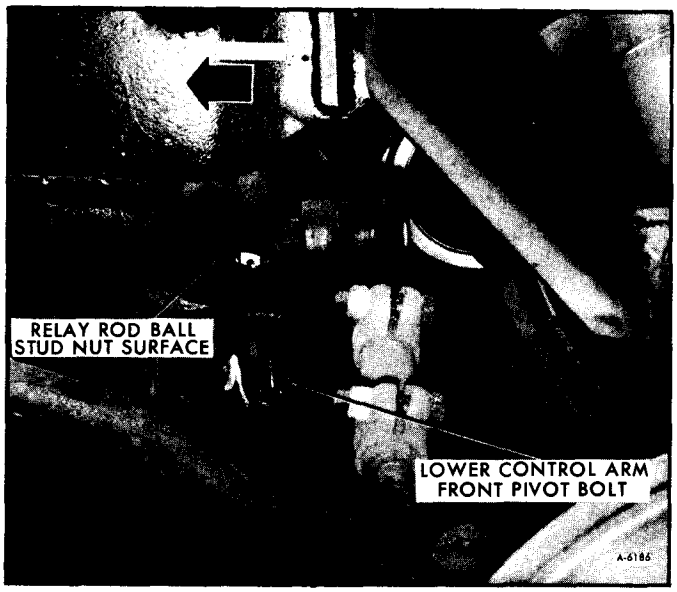


Figure 2—Measuring Relay Rod Levelness

7. Check brakes for dragging. (Refer to "Brake System Trouble Diagnosis," Sec. 5, Maintenance Manual X-7525.)

8. Check front hub bearings for wear or adjustment. (Refer to "Hub Bearing" later in this section.)

9. Check ball joints for looseness. (Refer to "Ball Joint Checks" later in this section.)

10. Check all steering connections for looseness or binding. (Refer to "Front Suspension and Steering Trouble Diagnosis Chart" later in this section.)

11. Inspect the intermediate rod for parallelism with the front axle to eliminate the possiblity of front tires wearing unevenly. The parallelism can be measured and corrected as follows (see figure 1):

a. Position vehicle on a level surface.
b. Record the following measurements: (Refer to figure 2)

		Col 1	Col 2
Entry D	Distance from the flat surface surrounding the relay lever ball stud nut to level surface.		—
Entry E	Distance from lower left hand control arm front pivot bolt to level surface.		—
Entry F	Subtract entry "E" from entry "D" and record in column 2.	—	
Entry A	Distance from the flat surface surrounding the idler lever ball stud nuts to level surface.		—
Entry B	Distance from lower right hand control arm front pivot bolt to level surface.		—
Entry C	Subtract entry "B" from entry "A" and record in column 2.	—	
Entry G *	Subtract entry "C" from entry "F" and record in Column. 2.	—	

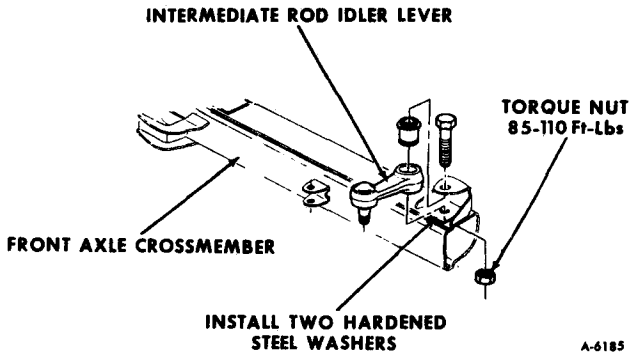


Figure 3—Installing Washer Under Idler Pivot

*If entry "G" is .125" or greater, add two hardened steel washers under the idler lever pivot as shown in figure 3. Otherwise, the intermediate rod parallelism is acceptable.

12. Check rear suspension for alignment and correct toe-in (see figure 4). (Refer also to Section 4A of this supplement.

13. Check steering gear for adjustment, binding and centering. (Refer to "Trouble Diagnosis," Section 9, Maintenance Manual X-7525.)

14. Check rear suspension bushings for wear. (Refer to bulletins 75-TM-23, 75-TM-4.)

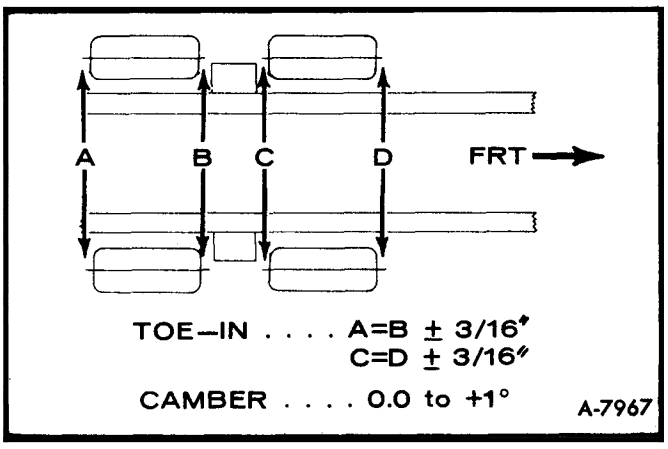


Figure 4—Measuring Toe on Rear Suspension

DIAGNOSIS OF FRONT SUSPENSION AND STEERING

PROBLEM	POSSIBLE CAUSE	CORRECTION
HARD STEERING, EXCESSIVE EFFORT REQUIRED AT STEERING WHEEL	1. Low or uneven tire pressure.	1. Inflate tires to recommended pressure.
	2. Suspension ball joints or steering linkage need lubrication.	2. Lubricate ball joints and linkage with specified lubricant.
	3. Tight or frozen relay lever pivot or idler lever pivot.	3. Lubricate or replace as necessary.
	4. Steering gear to column misalignment.	4. Align column.
	5. Steering gear adjusted too tightly.	5. Adjust preload to specification.
	6. Front wheel alignment incorrect.	6. Check alignment and ride height and correct as necessary.
	7. Relay arm or idler arm pivot over-torqued.	7. Torque to specification.
	8. Power steering partially or not operative.	8. Check power steering components for proper operation.
FRONT WHEEL SHIMMY (SMOOTH ROAD SHAKE)	1. Tire and wheel out of balance, or out of round.	1. Balance tires, check runout.
	2. Worn tie rod ends.	2. Replace tie rod ends.
	3. Worn lower suspension ball joints.	3. Replace entire lower control arm assembly.
	4. Worn upper suspension ball joints.	4. Replace upper ball joints.
	5. Malfunctioning shock absorber.	5. Replace shock absorbers.
	6. Worn or loose wheel bearings.	6. Replace or adjust wheel bearings.
VEHICLE PULLS TO ONE SIDE (NO BRAKING ACTION)	1. Low or uneven tire pressure.	1. Inflate tires to recommended pressure.
	2. Broken or sagging torsion bar.	2. Replace torsion bar.
	3. Incorrect front wheel alignment (camber).	3. Check ride height and align front suspension.
	4. Wheel bearings worn out.	4. Replace wheel bearings.
	5. Brakes dragging.	5. Inspect and adjust brakes.
POOR DIRECTIONAL STABILITY	1. Suspension ball joints and steering linkage need lubrication.	1. Lubricate at proper intervals.
	2. Low or uneven front or rear tire pressure.	2. Inflate tires to recommended pressure.
	3. Steering gear not on high point.	3. Adjust steering gear. See Maintenance Manual X-7525, Sec. 9.
	4. Incorrect front wheel alignment (caster).	4. Check ride height and align front suspension.
	5. Broken torsion bar.	5. Replace torsion bar.
	6. Malfunctioning shock absorber.	6. Replace shock absorbers.
	7. Broken stabilizer bar or missing link.	7. Replace stabilizer or link.

DIAGNOSIS OF FRONT SUSPENSION AND STEERING (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
	8. Intermediate rod not parallel.	8. Correct to specification.
EXCESSIVE PLAY IN STEERING	1. Front wheel bearings loosely adjusted.	1. Adjust bearings or replace with new parts as necessary.
	2. Worn couplings or steering shaft U-joints.	2. Replace.
	3. Worn upper ball joints.	3. Replace.
	4. Steering wheel loose on shaft.	4. Tighten to specified torque.
	5. Incorrect steering gear adjustment.	5. Adjust steering gear. See Maintenance Manual X-7525, Sec. 9.
	6. Loose pitman arm, tie rods, steering arms or steering linkage ball studs. Worn intermediate rod or tie rod sockets.	6. Replace loose or worn parts.
	7. Loose relay arm pivot.	7. Replace.
	8. Loose idler arm pivot.	8. Replace.
POOR RETURNABILITY	1. Steering linkage or suspension ball joints need lubrication.	1. Lubricate with specified lubricant.
	2. Steering gear adjusted too tightly.	2. Adjust to specification.
	3. Steering gear to column misalignment.	3. Align column.
	4. Front wheel alignment incorrect.	4. Check ride height alignment and correct as necessary.
NOISE IN FRONT END	1. Suspension ball joints and steering linkage need lubrication.	1. Lubricate at recommended intervals.
	2. Shock absorbers loose or bushings worn.	2. Tighten bolts and/or replace shock absorber.
	3. Worn upper control arm bushings.	3. Replace bushings.
	4. Worn lower control arm bushings.	4. Replace entire lower control arm assembly.
	5. Worn tie rod ends.	5. Replace tie rod ends.
	6. Loose stabilizer bar.	6. Tighten all stabilizer bar attachments.
	7. Loose wheel nuts.	7. Tighten wheel nuts to proper torque.
	8. Loose suspension bolts.	8. Torque to specifications or replace.
TIRE THUMP	1. Tire and wheel out of balance.	1. Balance wheels.
	2. Tire and wheel out of round.	2. Replace tire.
	3. Blister or bump on tire.	3. Replace tire.
	4. Improper shock absorber action.	4. Replace shock absorber.

DIAGNOSIS OF FRONT SUSPENSION AND STEERING (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
EXCESSIVE OR UNEVEN TIRE WEAR	1. Underinflated or over-inflated tires.	1. Inflate tire to recommended pressure.
	2. Improper toe-in.	2. Realign front end.
	3. Wheels out of balance.	3. Balance wheels.
	4. Hard driving.	4. Instruct driver
	5. Overloaded vehicle.	5. Instruct driver.
	6. Improper camber.	6. Realign front end.
	7. Unparallel intermediate rod.	7. Correct as necessary.
SCUFFED TIRES	1. Toe-in incorrect.	1. Adjust toe-in to specifications.
	2. Excessive speed on turns.	2. Advise driver.
	3. Tires improperly inflated.	3. Inflate tires to recommended pressure.
	4. Rear suspension arm bent or twisted.	4. Replace arm.
	5. Intermediate rod not parallel.	5. Correct to specifications.
	6. Incorrect ride height.	6. Adjust ride height.
CUPPED TIRES	1. Shock absorbers defective.	1. Replace shock absorbers.
	2. Worn upper suspension ball joint.	2. Replace upper ball joint.
	3. Worn lower suspension ball joint.	3. Replace entire lower control arm assembly.
	4. Wheel and tire out of balance.	4. Balance wheel and tire.
	5. Excessive tire or wheel runout.	5. Compensate for runout.
WEAR IN THE SECOND TREAD ROW ON EACH SIDE OF TIRE	1. Underinflation or inherent problem of bias belted tires.	1. Inflate tire to recommended pressure and rotate tires.
EXCESSIVE LOOSENESS IN TIE ROD OR INTERMEDIATE ROD PIVOTS, OR EXCESSIVE VERTICAL LASH IN IDLER PIVOT OR RELAY ARM PIVOT.	1. Seal damage and leakage resulting in loss of lubricant, corrosion and excessive wear or improper torque.	1. Replace damaged parts as necessary and check torque.
SHOCK ABSORBER— WEAK.	1. Low or uneven tire pressure.	1. Inflate tires to recommended pressure.
	2. Excessive or incorrect vehicle loading.	2. Instruct driver.
	3. Worn out shock absorber. Front.	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 ratio (usually 2 to 1). If in doubt compare with vehicle having acceptable ride quality.

DIAGNOSIS OF FRONT SUSPENSION AND STEERING (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
SHOCK ABSORBER— WEAK (CONT'D)	4. Worn out shock absorber. Rear.	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 manadatory 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. 2. A seize (except at either extreme end of travel). 3. A noise such as a grunt or squeal after completing one full stroke in both directions. 4. A clicking noise at fast reversal.
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; any leaking shock should be replaced.

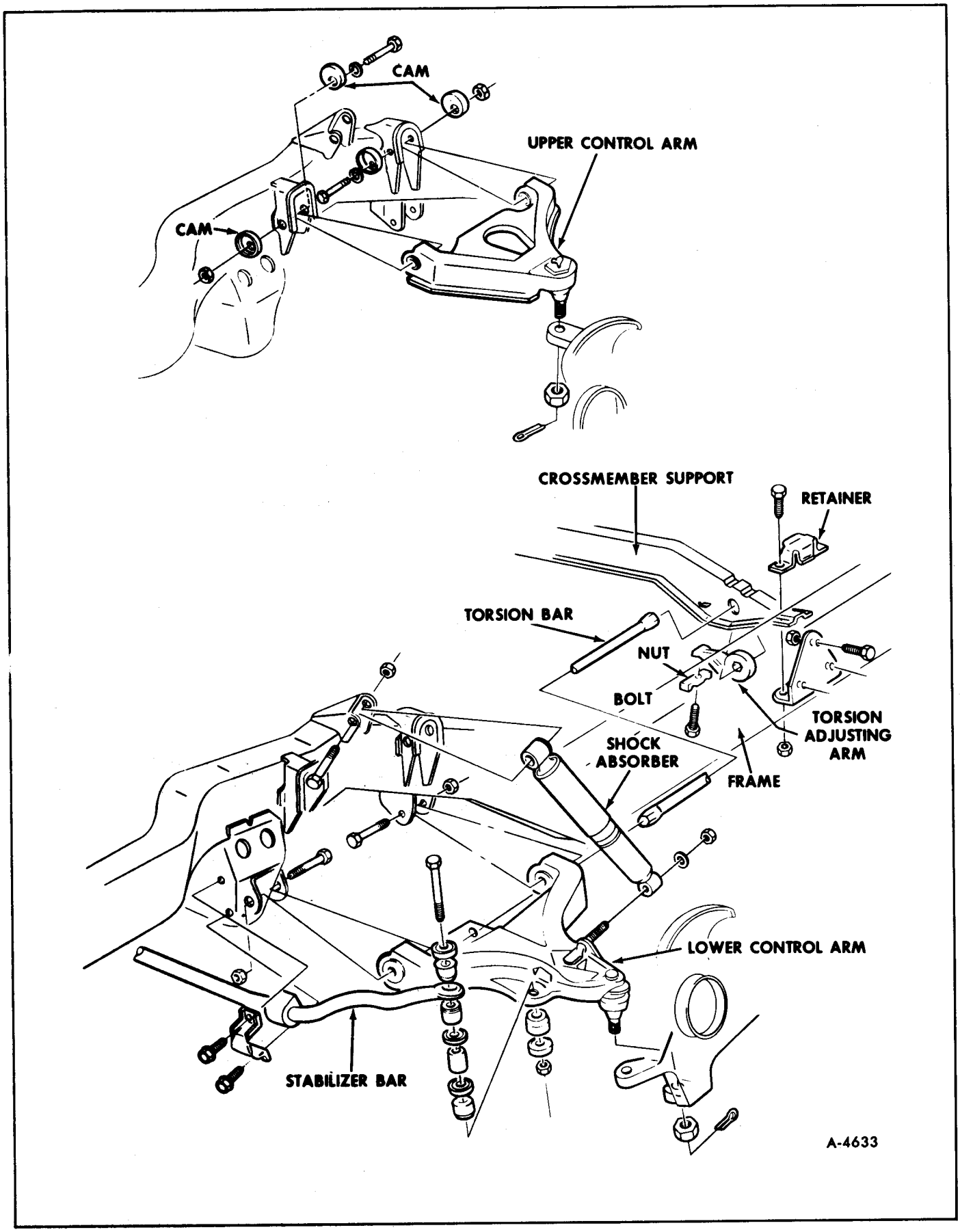


Figure 5—Front Suspension

GENERAL DESCRIPTION

The front suspension consists of control arms, stabilizer bar, shock absorbers and a right and left side 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 support. The front ride height of the vehicle is controlled by this adjustment (figure 5).

COMPONENT REPLACEMENT

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.

NOTE: Do not empty front reservoir or it will be necessary to bleed the brake system.

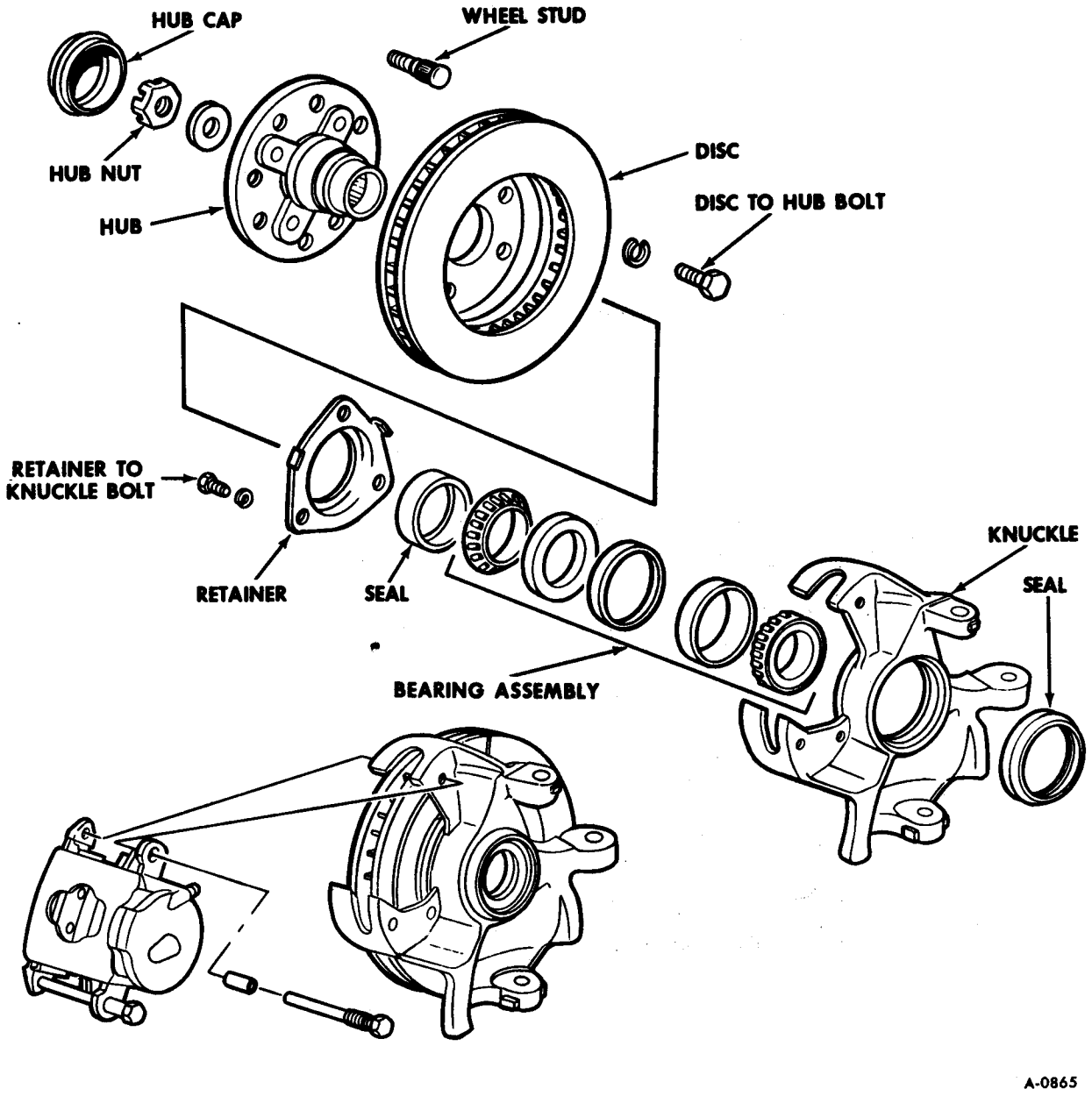


Figure 6—Disc and Hub Assembly

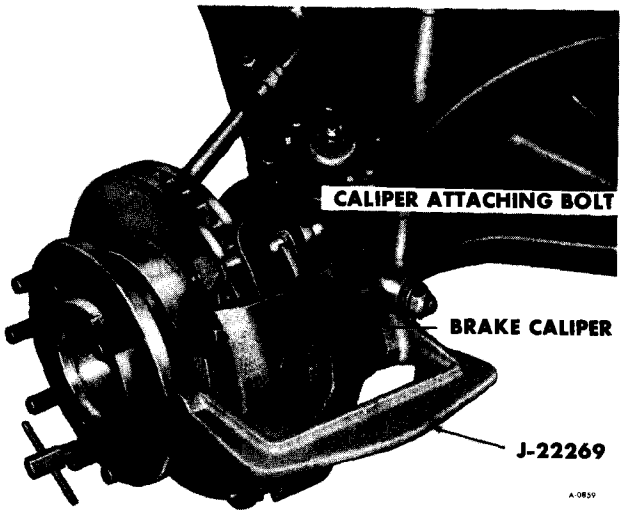


Figure 7—Caliper Removal

2. Hoist vehicle. Remove eight hub nuts from wheel studs and remove wheel. Support vehicle with floor stands.

NOTE: Wheel studs and nuts should be checked after every wheel removal and replaced if necessary. If wheel studs require replacement, removal of studs from hub may be accomplished by the use of Wheel Stud Remover Tool J-5504-01.

3. Remove cotter pin, drive axle nut and washer.

4. Position Tool J-22269 on caliper as shown in figure 7.

5. Tighten screw of tool until caliper moves outboard far enough to push piston to bottom of piston bore. This will allow shoes to back off from the disc surface. Remove Tool J-22269.

Figure 8—Retainer Bolt Removal

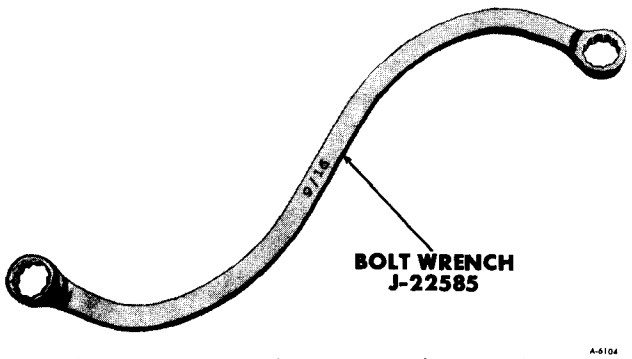


Figure 9—Front Hub Retainer Bolt Wrench J-22585

6. Remove the two caliper-to-knuckle attaching bolts (figure 7).

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 8). Removal of these bolts may be expedited by the use of special Bolt Wrench J-22585 (figure 9).

9. Position Tool No. J-24717 on hub as shown in figure 10.

10. Operate slide hammer Tool No. J-2619, until assembly is free of knuckle. See figure 10.

11. Remove slide hammer and Tool No. J-24717.

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 hub's outer surface (not the disc) will aid assembly.

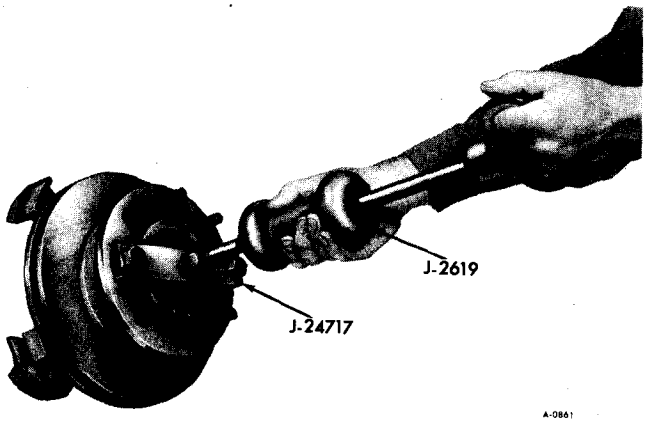


Figure 10—Hub and Disc Removal

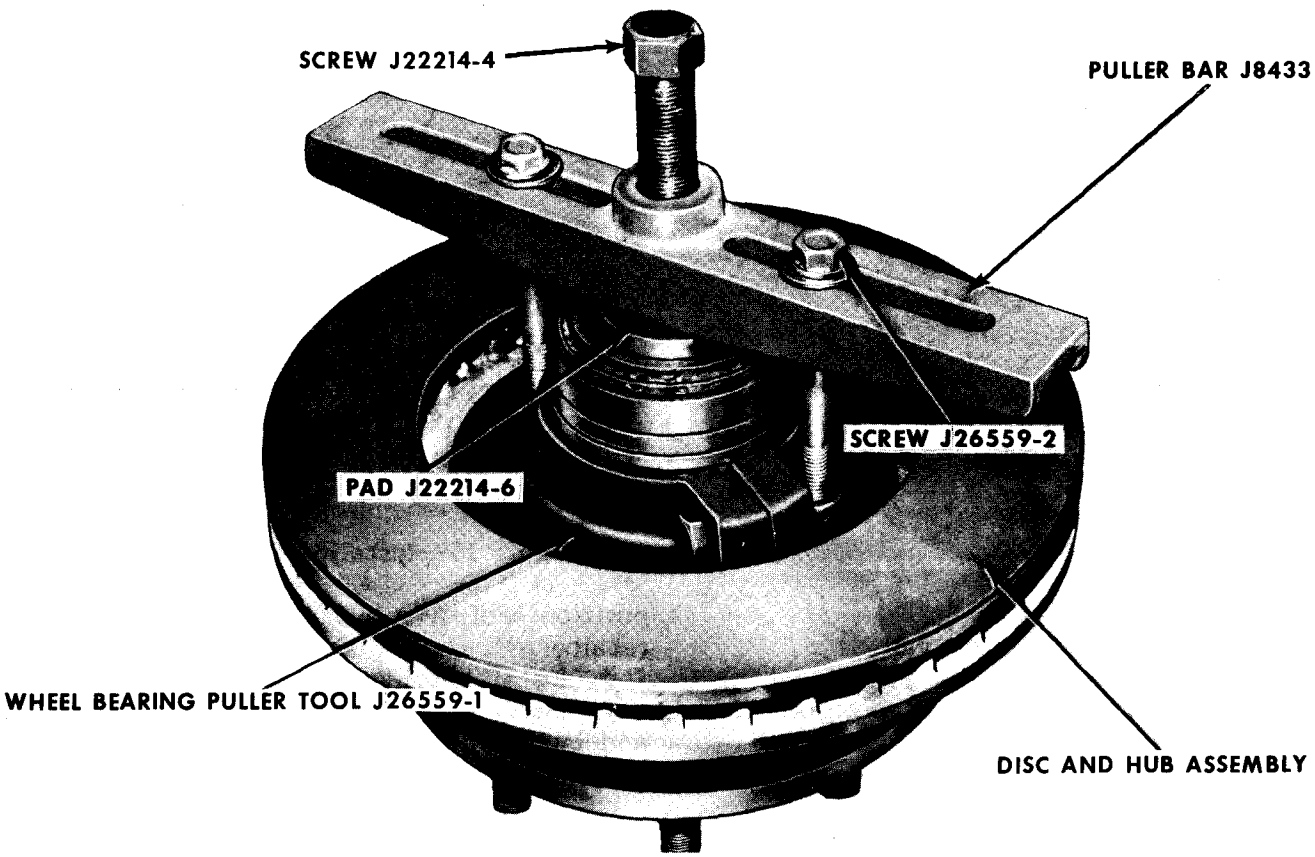


Figure 11—Wheel Bearing Puller Tool J-26559

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 bolts. See Specifications at the end of this section for torque value and procedure.

4. Install drive axle washer and nut. Torque nut. See Specifications at the end of this section for torque value and procedure. If necessary to align cotter pin slot, tighten nut and install NEW cotter pin and crimp.

5. Replace wheel and secure with eight nuts on studs. Refer to Maintenance Manual X-7525, Sec. 10 for torque values and tightening sequence. Refill master cylinder with new brake fluid.

6. Remove floor stands. Lower vehicle.

HUB BEARING

NOTE: Front wheel bearings on 1978 model vehicles must be cleaned and repacked at specific intervals. Refer to 1978 Motorhome and TransMode Maintenance Schedule (X-7822A) for interval listing and lubricant recommendation.

There is a new Bearing Puller Ring, Tool J-26559, used to facilitate the removal of front wheel bearings from the front hub/ rotor

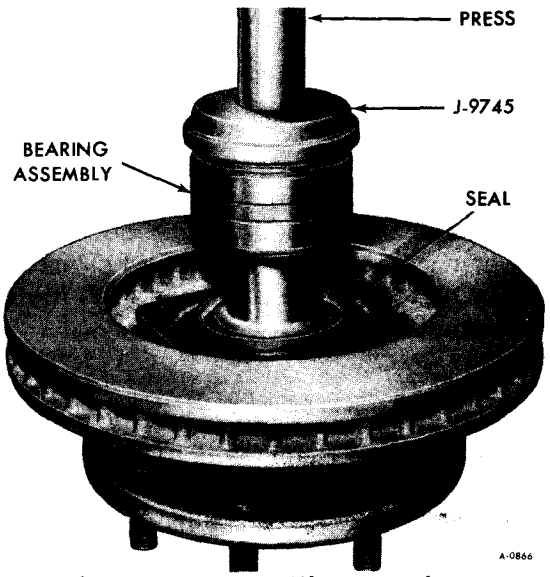


Figure 12—Installing Bearing

Figure 13—Disc Removal

assembly (figure 11). This tool is to be used in conjunction with Puller Bar J-8433.

REMOVAL

1. Remove disc and hub assembly. Refer to "Disc and Hub Removal" covered earlier in this section.
2. Assemble Tool No. J-26559-1 to Tool No. J-8433.
3. Position tool assembly as shown in figure 11.

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, tighten center screw (J-22214-4) until bearing is free of hub.
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. Postion 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 12.
4. Install disc hub assembly. Refer to "Disc and Hub Installation" covered earlier in this section.

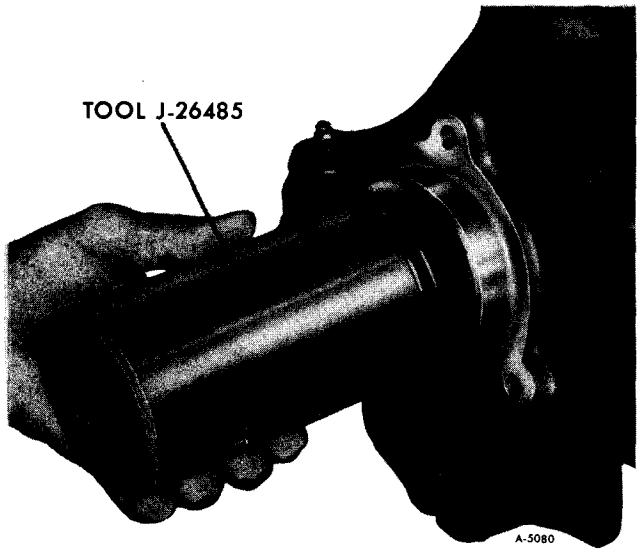


Figure 14—Installing Knuckle Seal

DISC

REMOVAL (FIGURE 13)

1. Remove disc and hub assembly. Refer to "Disc and Hub -Removal"
2. Remove hub bearing. Refer to "Hub Bearing Removal".
3. Remove four bolts and separate disc from hub as shown in figure 13.

INSTALLATION

1. Install four attaching bolts. See Specifications at the end of this section for torque value.
2. Install hub bearing. Refer to "Hub Bearing - Installation".
3. Install disc and hub assembly. Refer to "Disc and Hub Installation".

KNUCKLE SEAL

REMOVAL

1. Remove disc and hub. Refer to "Disc and Hub - Removal".
2. Pry seal from knuckle.

INSTALLATION

1. Lubricate seal inner lips with Special Seal Lubricant No. 1050169 or equivalent.

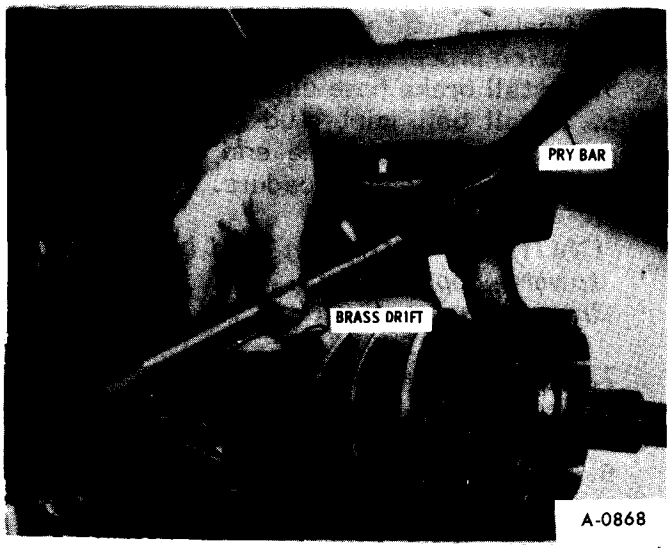


Figure 15—Removing Upper Ball Joint

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 14). Remove tool.

2. Install disc and hub. (See "Disc and Hub - Installation").

KNUCKLE

REMOVAL

1. Remove disc and hub assembly (refer to "Disc Hub -Removal").
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 in upper control arm.

4. Using a brass drift and hammer, and a pry bar, placed as in figure 15, loosen upper ball joint stud from knuckle. Remove upper ball joint from knuckle.
5. Remove cotter pin and nut from tie rod end.
6. Using Tool J-21319, remove tie rod end as shown in figure 16.
7. Remove cotter pin and nut from lower (suspension) ball joint.
8. Using Tool J-24319 remove lower (suspension) ball joint from knuckle (figure 17).
9. Remove knuckle. Pry seal from knuckle.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Lubricate seal inner lips with Special

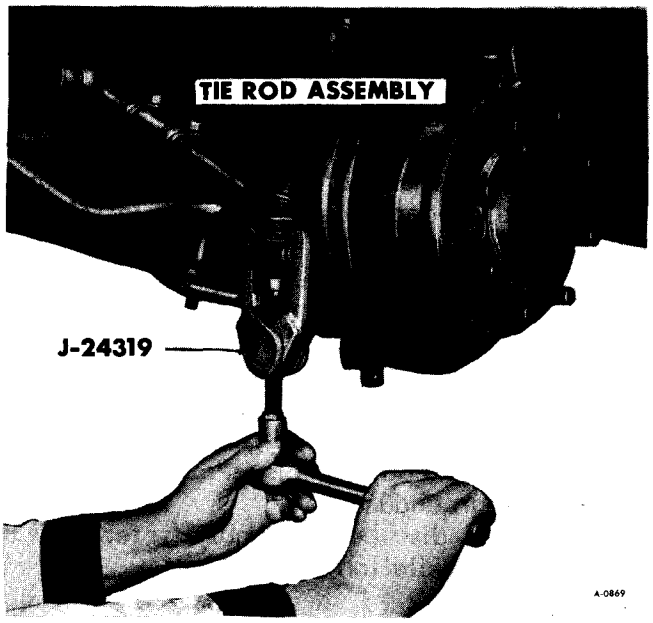


Figure 16—Removing Tie Rod End

Seal Lubricant No. 1050169 or equivalent. Then, using Tool J-26485 install seal into knuckle until it bottoms.

2. Install lower ball joint stud into knuckle and attach nut. Do not torque. See Specifications at the end of this section for installation procedure.
3. Install tie rod end stud into knuckle and attach nut. Do not torque. See Specifications at the end of this section for installation procedure.

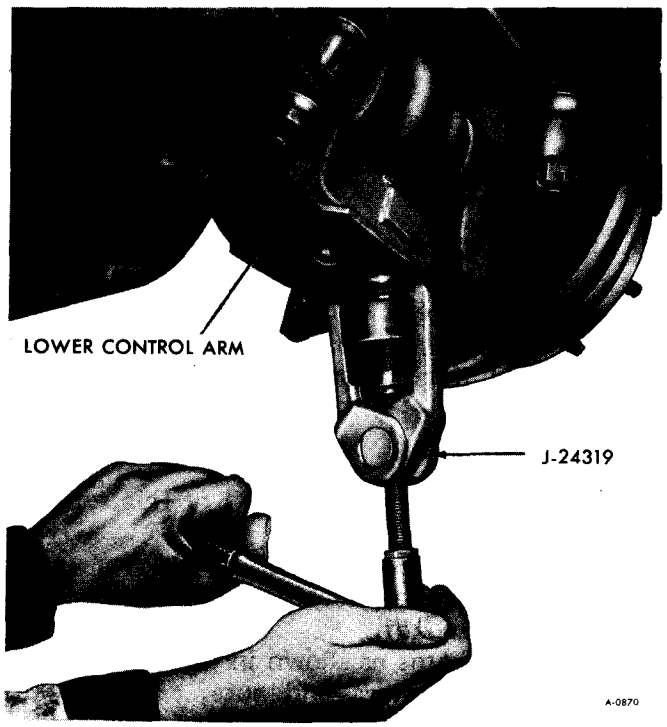


Figure 17—Removing Lower Ball Joint

4. Install upper ball joint stud into knuckle. Attach nut. See Specifications at the end of the section for installation procedure. Attach brake line hose clip.
5. Torque ball joint stud nut. See Specifications at the end of this section for torque value and procedure. 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 at the end of this section for torque value and procedure.
7. Install disc hub assembly (refer to "Disc and Hub -Installation").

UPPER CONTROL ARM

REMOVAL

1. Hoist vehicle and remove wheel. Place floor stand on each side, under and firmly against the lower control arm.
2. Remove upper shock absorber attaching bolt.
3. Remove cotter pin and nut from upper ball joint.
4. Disconnect brake hose clip from ball joint stud.
5. Using hammer and a drift (figure 15), drive on spindle until upper ball joint stud is disengaged from knuckle.
6. Remove upper control arm cams, washers and nuts. Remove control arm from vehicle by guiding shock absorber through access hole.

NOTE: 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.

1. Guide upper control arm over shock absorber and install bushing end of control arm into frame bracket.
2. Install cams as shown in figure 5.
3. Install washers and nuts. Torque nuts. See Specifications at the end of this section for torque values.
4. Install ball joint stud into knuckle. See Specifications at the end of this section for installation procedure.
5. Install brake hose clip on ball joint stud.
6. Install ball joint stud nut. Torque nut. See Specifications at the end of this section for torque value and procedure.

CAUTION: *Cotter pin must be crimped toward upper control arm to prevent interference with outer C. V. joint seal.*

7. Install upper shock attaching bolt and nut. Torque nut. See Specifications at the end of this section for torque value.
8. Replace wheel and secure with eight nuts on studs. Refer to Maintenance Manual X-7525, Sec. 10, for torque values and tightening sequence.
9. Remove floor stands and lower hoist.
10. Check camber, caster and toe-in and adjust if necessary. Refer to FRONT END ALIGNMENT later in this section.

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 cams, bolts, washers and nuts from control arm.
4. Move control arm out of frame brackets and attach bushing removal tools as shown in figure 19. Remove bushings.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

1. Install tools and press bushings into control arm (figure 20).
2. Move control arm into frame brackets and install cams, bolts, washers and nuts. The cams are installed with the bolts in the lower position. Torque cam nuts. See Specifications at the end of this section for torque value and procedure.
3. Connect upper shock attaching bolt. Torque nut. See Specifications at the end of this section for torque value and procedure.
4. Install wheel and secure with eight nuts on studs. Refer to Maintenance Manual X-

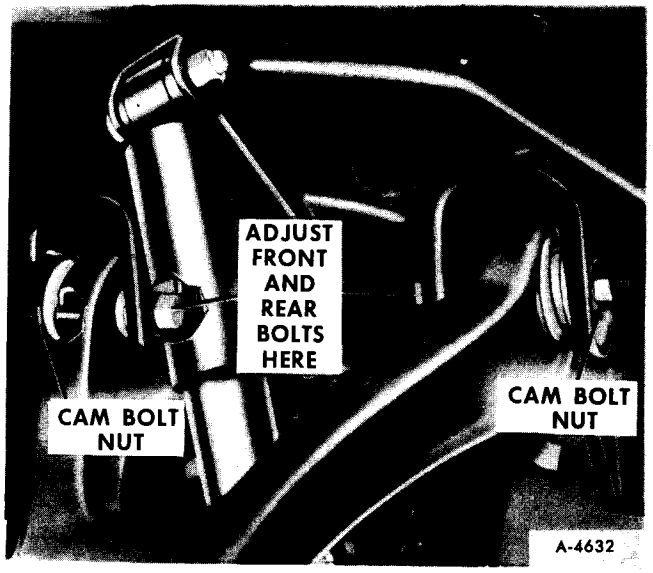


Figure 18—Upper Control Arm Attachment

7525, Sec. 10 for torque values and tightening sequence.

5. Remove floor stands and lower hoist.

6. Align front wheels. Refer to FRONT END ALIGNMENT later in this section.

LOWER CONTROL ARM

NOTE: Service parts for lower control arm ball joints and bushings are no longer available. If lower control arm ball joints or bushings require replacement, entire new lower control arm assembly must be installed.

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 crossmember support. Align pin of tool into hole in crossmember. Install two nuts on tool and center screw. Turn center screw until seated in dimple of torsion adjusting arm.

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 ride 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.

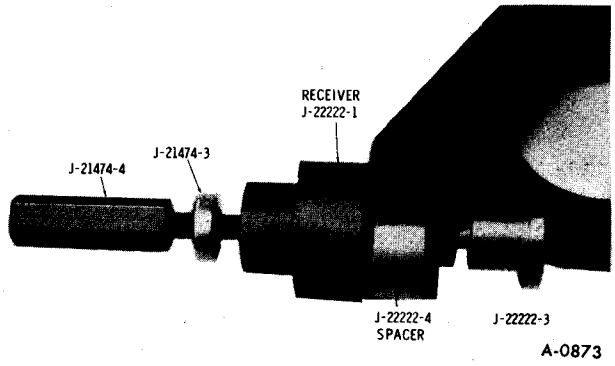


Figure 19—Removing Upper Control Arm Bushing

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 17).

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. Make sure that shock absorber is guided onto lower control arm shock absorber mount and drive axle is positioned in knuckle. Guide ball joint stud into knuckle. Install but do not torque stud nut. See Specifications at the end of this section for installation procedure.

2. Install lower control arm to frame bracket bolts. Install nuts and torque. See Specifications at the end of this section for torque values.

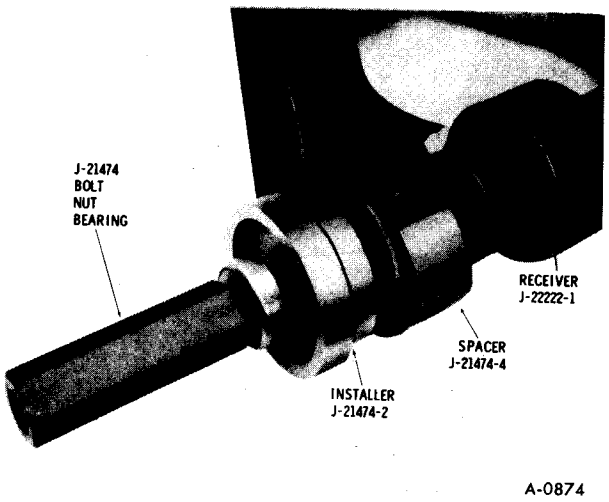


Figure 20—Installing Upper Control Arm Bushing

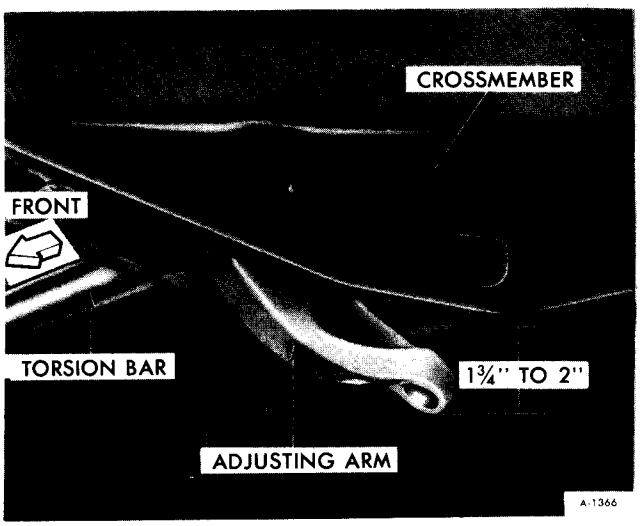


Figure 21—Positioning of Adjusting Arm

3. Torque lower ball joint stud nut. See Specifications at the end of the section for torque value and procedure.

4. Install shock absorber nut, and torque. Install stabilizer link and torque nut. Install drive axle nut and torque. See Specifications at the end of this section for torque values.

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 approximately 1 3/4" below the centerline of the crossmember (see figure 21). Slide torsion bar rearward until it is flush with the rear face of the adjusting arm.

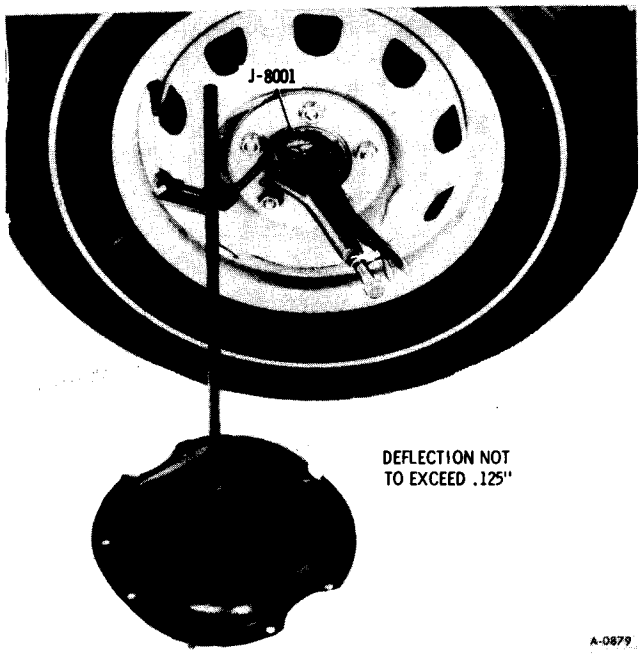


Figure 22—Ball Joint Vertical Check

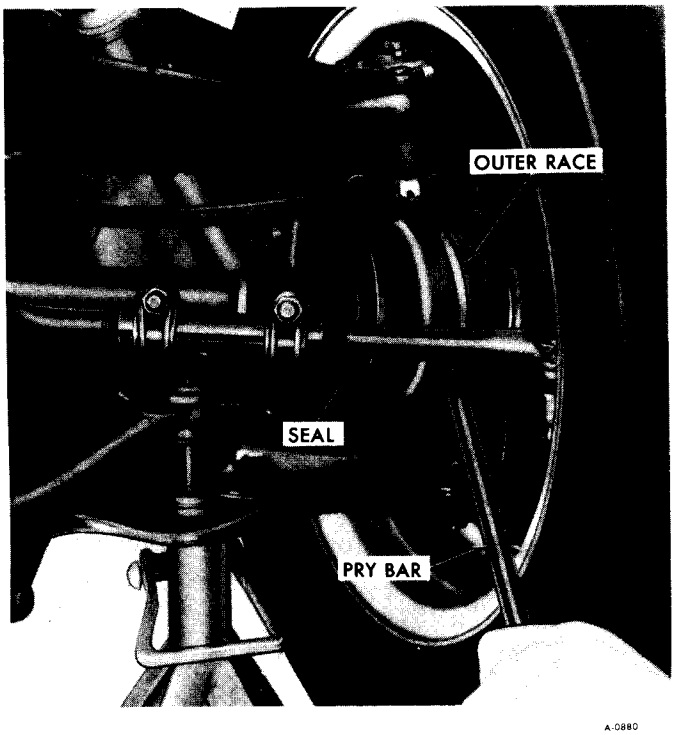


Figure 23—Pry Bar Installation

NOTE: There must be 3/16" to 1/4" clearance between the rear end of the torsion bar and the rear inside face of support crossmember.

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. Tighten as necessary to obtain original ride height. (Check number of turns previously recorded).

9. Turn center screw until torsion is relaxed and remove tool.

10. Install wheel and secure with eight stud nuts. Refer to Maintenance Manual X-7525, Sec. 10 for torque values and tightening sequence. Lower vehicle.

11. Check ride height and adjust if necessary. Refer to "RIDE HEIGHT" later in this section.

LOWER CONTROL ARM BUSHING

NOTE: Lower control arm bushings are no longer serviced separately. If bushings are worn and need replacement, it is now neces-

sary to install entire right or left hand lower control arm assembly as needed.

BALL JOINT

Ball joint lubrication and seal inspection is important. Refer to Section 0, Maintenance Manual X-7525 for 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 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 22.
3. Place pry bar as shown in figure 23 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

NOTE: Lower control arm ball joints are no longer serviced separately. If ball joints are worn, it is now necessary to install entire right or left hand lower control arm.

UPPER CONTROL ARM BALL JOINT

REMOVAL

1. Hoist vehicle under lower control arms and remove wheel.
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 15, 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 four nuts. See Specifications at the end of this section for torque value.
2. Install service ball joint into knuckle. See Specifications at the end of this section for procedure. Do not torque at this time. Position brake hose clip over stud.
3. Install ball joint stud nut. Torque nut. See Specifications at the end of this section 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 bracket-to-frame attaching bolts and remove stabilizer bar from front of vehicle.

INSTALLATION

See CAUTION on Page 3A-1 of this section.

To install, reverse removal procedure.

NOTE: New link nuts must be torqued, then bolt cut off 1/4" below nut. See Specifications at the end of this section for torque value.

SHOCK ABSORBER

(Refer to Figure 5)

REMOVAL

1. Raise vehicle. 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.

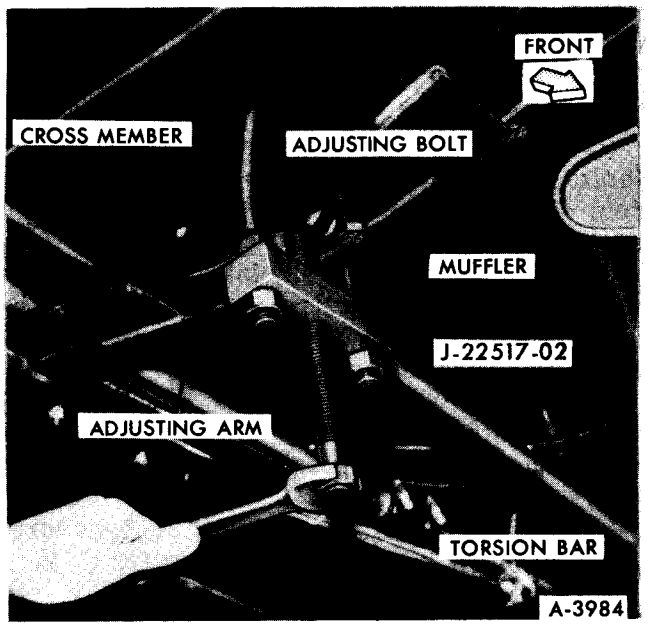


Figure 24—Removing Torsion Bar

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 and nut. Torque upper mounting nut. See Specifications at the end of this section for torque value.
3. Install lower shock mounting nut and torque. See Specifications at the end of this section for torque value.
4. Install wheel and wheel stud nuts finger tight.
5. Remove safety stands and lower vehicle. Torque wheel nuts. See Sec. 10, Maintenance Manual X-7525 for torque value and tightening sequence.

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 center 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 24.
4. Remove torsion bar adjusting bolt and nut. Count the number of turns necessary to remove and record.

NOTE: The number of turns necessary to remove the adjusting bolt will be used when installing to obtain the original ride 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 5).
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 crossmember 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 approximately 1 3/4" below the centerline of the crossmember. (Refer to figure 21.) Tap crossmember forward enough to engage bar into arm.
6. Repeat step 5 for the other side of the vehicle.
7. Position crossmember to its normal position. Torsion bar should be through and flush with rear face of the adjusting arm. If torsion bar is not flush with rear face of adjusting arm, repeat steps 5 and 6 after pulling torsion bar slightly out from the lower control arm.

NOTE: There must always be 3/16" to 1/4" clearance between the rear end of the

torsion bar and the rear inside face of support crossmember.

8. Install torsion bar retainer over each insulator on crossmember support. Torque nuts (torsion bar retainer bolt nuts). (See figure 5.) See Specifications at the end of this section for torque value.

9. Reposition and connect exhaust pipe hanger to crossmember and tighten saddle and "U" clamp. Torque U-clamp bolt nuts. See Specifications at the end of this section for torque value.

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 24.

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" immediately following.

ALIGNMENT AND RIDE HEIGHT

RIDE HEIGHT

When checking front ride height, have the vehicle parked on a known level surface, and tire pressure at specified psi.

NOTE: For details on adjusting rear ride height refer to Section 4, REAR SUSPENSION. Vehicles equipped with the Electro-Level Rear Air Suspension System must have power level control switches for right and left hand side of vehicle in "OFF" position. Set center control switch to "TRAVEL AUTO" position prior to adjusting front ride height.

Measurements must be taken from the top of oval hole in the frame rail to ground level (figure 25).

NOTE: Never attempt to increase the ride height of the vehicle using the adjusting bolt only (figure 26). The bolt will turn but will strip threads and will necessitate replacement of the bolt. Always use special tool.

RIDE HEIGHT ADJUSTMENT (FIGURE 25)

NOTE: Tool J-22517-02 (shown in figure 24) 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.

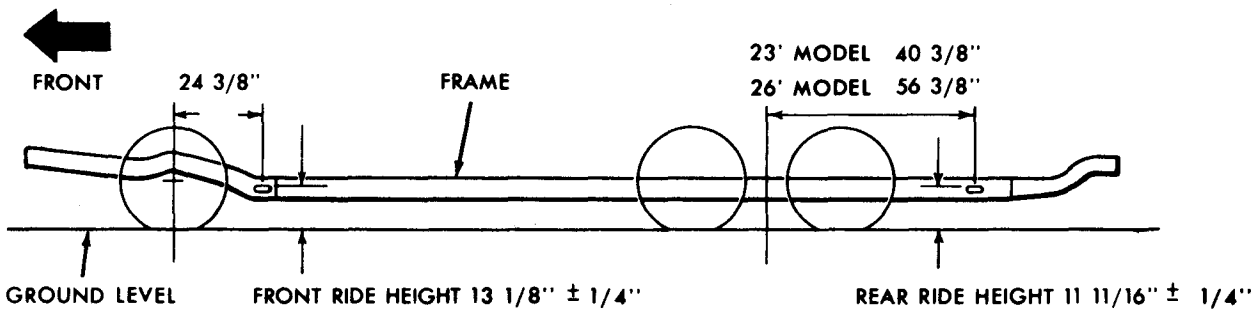


Figure 25—Vehicle Ride Height

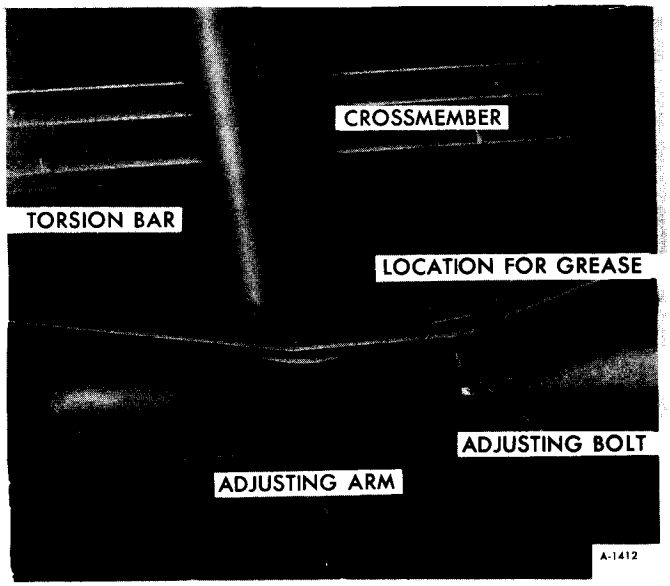


Figure 26—Location for Front Ride Height Adjustment

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	-1/16" to -3/16" (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 5).
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.

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 upper control arm cam nuts (front and rear). Torque to Specifications while holding bolts with back-up wrench so that camber is not changed. Check caster; do not reset unless caster exceeds specifications.

NOTE: Check cam adjustment surface for weld splatter. Weld splatter in this area will affect front end alignment. Remove weld splatter 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 Specifications. Hold head of bolt securely; any movement of the cam will affect the final setting and caster-camber adjustment must be rechecked.

Toe-In Adjustment

NOTE: Effective with Vehicle Identification Numbers TZE167V101401 (Motorhome), TZE337V101429 (23' TransMode) and TZE367V101393 (26' TransMode), Motorhome and TransMode vehicles are equipped with METRIC TIE ROD CLAMPS. The new torque for these clamps is 16-22 N•m (12-16 ft. lb.). Replacement clamps and fasteners must be correct part number and must be tightened to proper torque specifications.

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 on the adjuster tube. Install new metric bolts and nuts to assure proper clamping at the specified nut torque. (Refer to figure 27.)

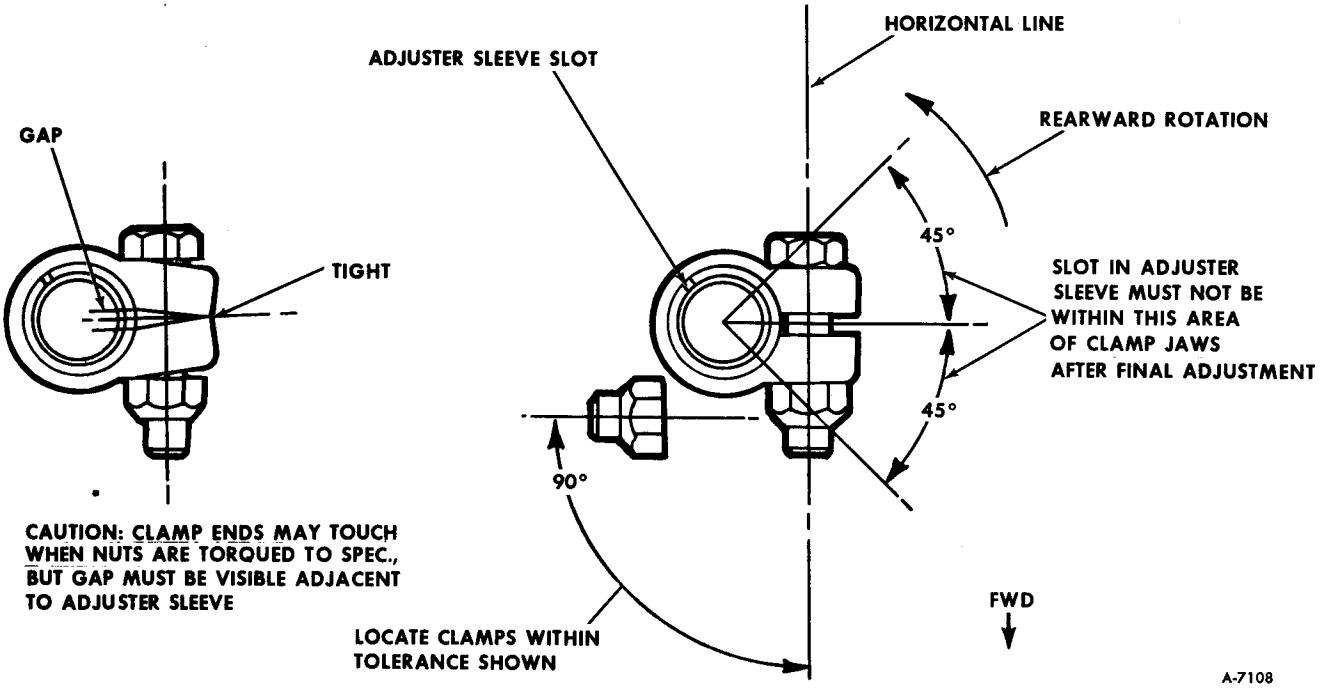


Figure 27—Positioning Tie Rod Clamp

2. With steering wheel set in straight ahead position, turn tie rod adjusting sleeves to obtain proper toe 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.

With this same rearward rotation, all bolt centerlines must be between angles shown.

Rotate toward forward, and leave tightened tie rod assembly in its centered position (outer socket square with its stud).

TORQUE SPECIFICATIONS

APPLICATION	IN. LBS.
Exhaust "U" Clamp Bolts (2) (nut torque)	95-150 In. Lbs.
Exhaust Mounting Bracket to Crossmember Bolts (4) (nut torque)	95 - 120 In. Lbs.

APPLICATION	FT. LBS.
Bearing Retainer to Knuckle Bolts (3)	35 Ft. Lbs.
Drive Axle Nut*	110-140 Ft. Lbs. (Do not exceed 280 ft. lbs.)
Disc to Hub Bolts (4)	35 Ft. Lbs.
Stabilizer Link Nut	10 - 15 Ft. Lbs.
Stabilizer Bracket to Frame Screw	20 - 28 Ft. Lbs.
Torsion Bar Retainer Bolts (2) (nut torque)	8 - 12 Ft. Lbs.
Crossmember Support Bracket to Frame Bolts (3) (nut torque)	25 - 30 Ft. Lbs.
Tie Rod to Knucke Nut *	40 - 50 Ft. Lbs.
Tie Rod Clamp Nuts (2) (16-22 N.m)	12 - 16 Ft. Lbs.

TORQUE SPECIFICATIONS (CONT'D)

APPLICATION	FT. LBS.
Shock Absorber	
Upper Attaching Bolt (nut torque)	80 - 95 Ft. Lbs.
Lower Attaching Bolt (nut torque)	80 - 95 Ft. Lbs.
Upper Control Arm Ball Joint to Control Arm Bolts (4) (nut torque)	20 Ft. Lbs.
Upper Control Arm to Frame Bracket Bolts (2) (cam nut torque)	80 - 95 Ft. Lbs.
Lower Control Arm to Frame Bracket Bolts (2) (nut torque)	75 - 85 Ft. Lbs.
Ball Joint Stud Nut - Lower *	40 - 60 Ft. Lbs.
Ball Joint Stud Nut - Upper *	100 - 125 Ft. Lbs.

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-2619-01	Slide Hammer
J-8433-1	Puller Bar
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-26559	Front Wheel Bearing Puller Ring
J-22269	Brake Caliper Collapser
J-22517-02	Torsion Bar Unloader
J-24319-01	Ball Joint, Pitman Arm and Idler Arm Puller
J-24717	Front Hub Puller
J-26485	Knuckle Seal Installer
J-22585	Front Hub Retainer Bolt Wrench
J-5504-01	Wheel Stud Remover

SECTION 3C
FINAL DRIVE

The information described in Maintenance Manual X-7525 under the heading FINAL DRIVE (SEC. 3C) is applicable to models covered by this supplement with the addition of the following illustration, showing new final drive attachment to engine (figure 1). Note that final drive bracket shown in Maintenance Manual X-7525 is no longer used.

Figure 1—Disconnecting Final Drive From Engine

SECTION 4
REAR SUSPENSION

CONTENTS

SECTION 4A
1977 REAR SUSPENSION

The information described in Maintenance Manual X-7525 under the heading REAR SUSPENSION (SEC. 4) is applicable to models covered by this supplement with the exception of the following:

CONTENTS

GENERAL DESCRIPTION

There are two types of rear air suspension systems available in the 1977 Motorhome and TransMode vehicles — the standard air system and the Electro-Level I System (optional). The standard suspension system operates automatically as vehicle load varies to retain frame at proper ride height. The optional Electro-Level system provides the ability to raise or lower the rear of the vehicle approximately four inches from normal ride height.

The rear suspension system (either type) on the vehicle exterior consists of air bellows, shock absorbers, control arms and height control valves. Suspension control components — air compressor, wet tank, solenoid valves and

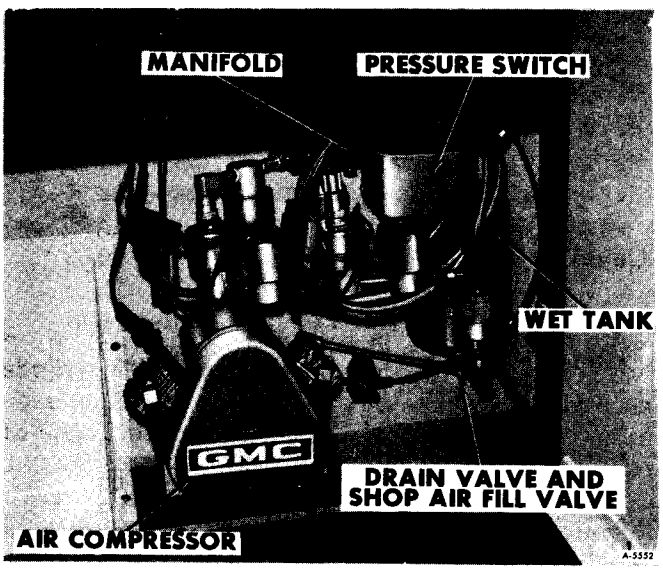


Figure 1—Air Suspension Control Components (Typical) (Model ZE06581)

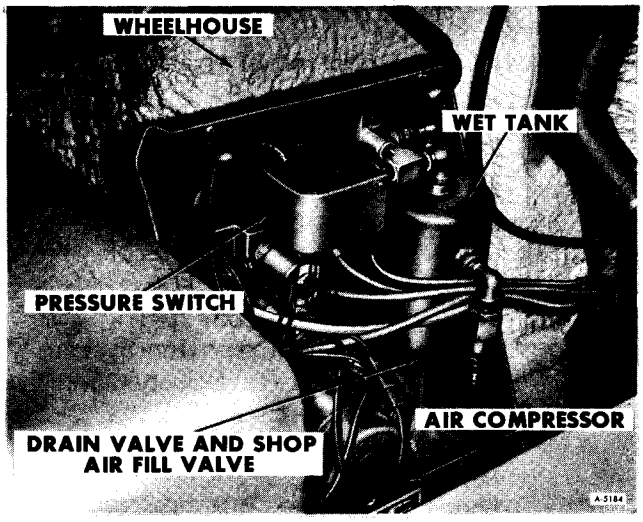


Figure 2—"TWIN BED" Air Suspension Control Components (Typical) (Model ZE06584)

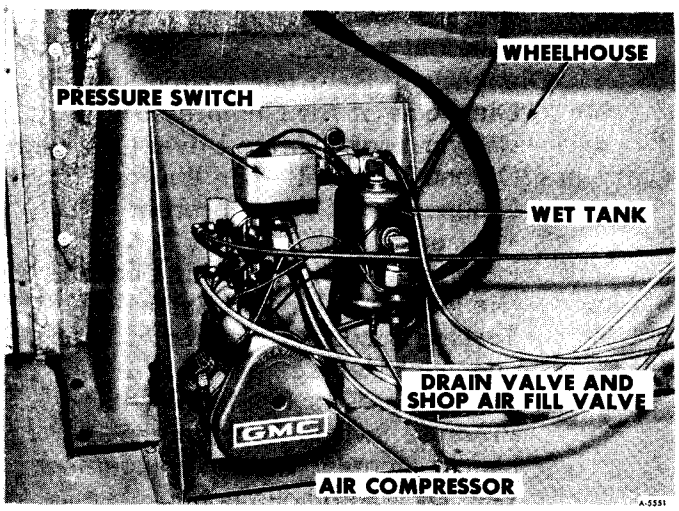


Figure 3—TRANSMODE Air Suspension Control Components (Typical) (Models ZE06083, ZE06583)

pressure switch — are positioned in a control module inside the vehicle. This module is located in the closet of Motorhome model ZEO6581 (figure 1), beneath the left rear twin bed in Motorhome model ZEO6584 (figure 2), and in front of the left rear wheelhousing in TransMode models ZEO6083 and ZEO6583 (figure 3). Control components vary slightly from standard to Electro-Level I suspension (as discussed following).

SYSTEM OPERATION

STANDARD REAR SUSPENSION SYSTEM

As stated, the standard suspension system operates automatically as vehicle load varies to retain frame at proper ride height. Compressed air flows to and from the air bellows as determined by the height control valves.

AIR FLOW (REFER TO FIGURE 4)

The air flow in the standard suspension system is controlled by two components: the height control valves (bolted to the wheel well and linked to the control arm) and two 2-way normally closed solenoid valves (located in the air suspension control module inside the vehicle). These electrically actuated air valves, when closed or de-energized, block air flow either to or from the bellows. This helps to maintain proper ride height with a minimum possibility of leak down.

When the ignition key is turned to the "ON" or "ACCESSORY" position, these valves are electrically energized, allowing positive air flow in either direction (ie., into or out of the bellows). The demand for air is "read" by the height control valves, which move up and down with the frame as ride height varies.

However, these valves will allow air into or out of the bellows only when a change in vehicle load causes actuation of the valve inlet or exhaust cores. Road bumps and irregularities move the HC valves within a free travel range, without adding or releasing compressed air to the system.

ELECTRO-LEVEL I REAR SUSPENSION SYSTEM

The optional Electro-Level I system operates automatically or manually. In automatic mode, the suspension is adjusted as vehicle load varies, to retain frame at proper ride height. Compressed air flows to and from the air bellows as determined by the height control valves. In addition, however, the Electro-Level I system provides the ability to raise or lower the rear of the vehicle approximately four inches from normal ride height. The control components and the physical system on the vehicle are the same as those on the standard system, with the addition of four 3-way solenoid valves.

The Electro-Level driver control switches are mounted on the lower dash panel to the right of the steering wheel (figure 5). The controls consist of three rocker switches that automatically or manually level the vehicle. Figure 6 is a schematic of the Electro-Level controls.

SWITCHES

The two RAISE-LOWER switches are used as necessary to raise or lower the rear of the vehicle (as when parked on surface that is not level). Engine need not be running to operate the system in either of these modes. However, the ignition switch must be in the "ON" or "ACCESSORY" Position.

The center TRAVEL switch has two positions — TRAVEL HOLD and TRAVEL AUTO.

TRAVEL HOLD is the switch position to be used for normal highway driving. This mode allows the vehicle to maintain a designed ride height and eliminates unnecessary operation of the air compressor. TRAVEL AUTO is the position to be used to "ready" the vehicle for highway driving after it has been parked in a raised or lowered position. This leveling of the vehicle will take place in the first five minutes with the rocker switch in TRAVEL AUTO position.

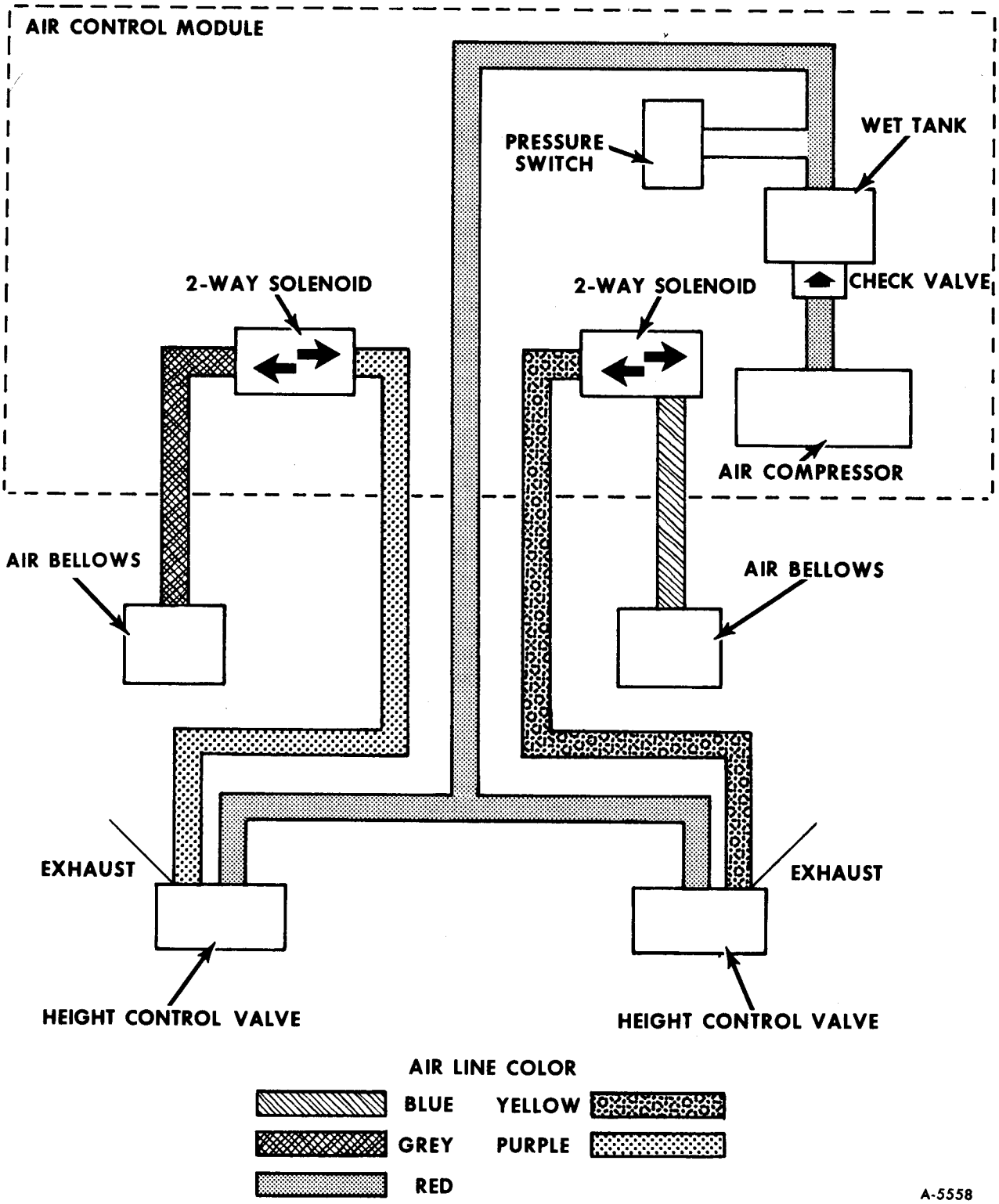


Figure 4—Standard Air Suspension System Schematic

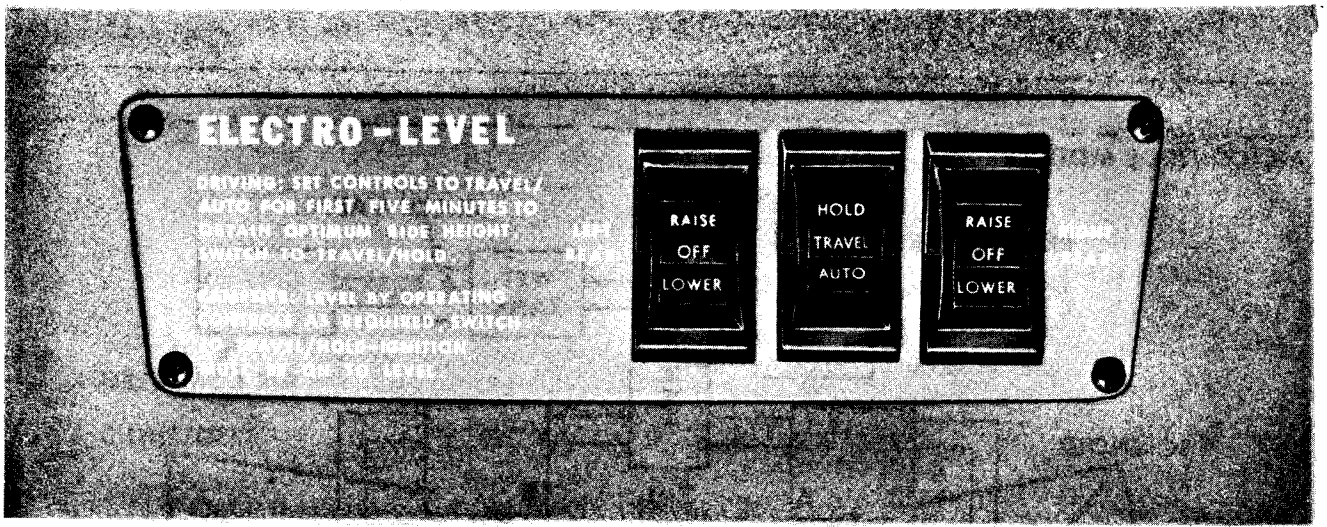


Figure 5—Electro-Level Controls

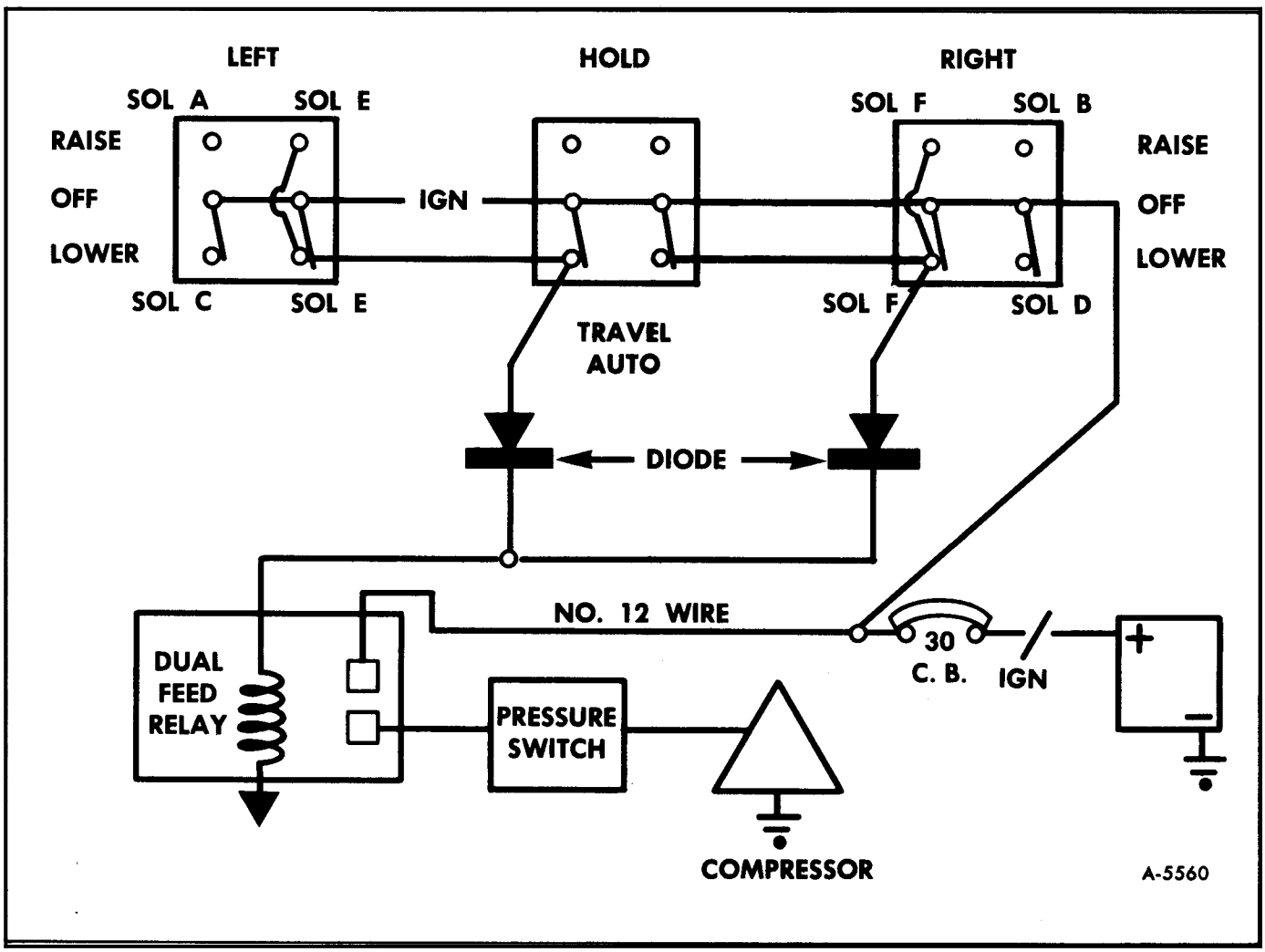


Figure 6—Electro-Level Controls Schematic

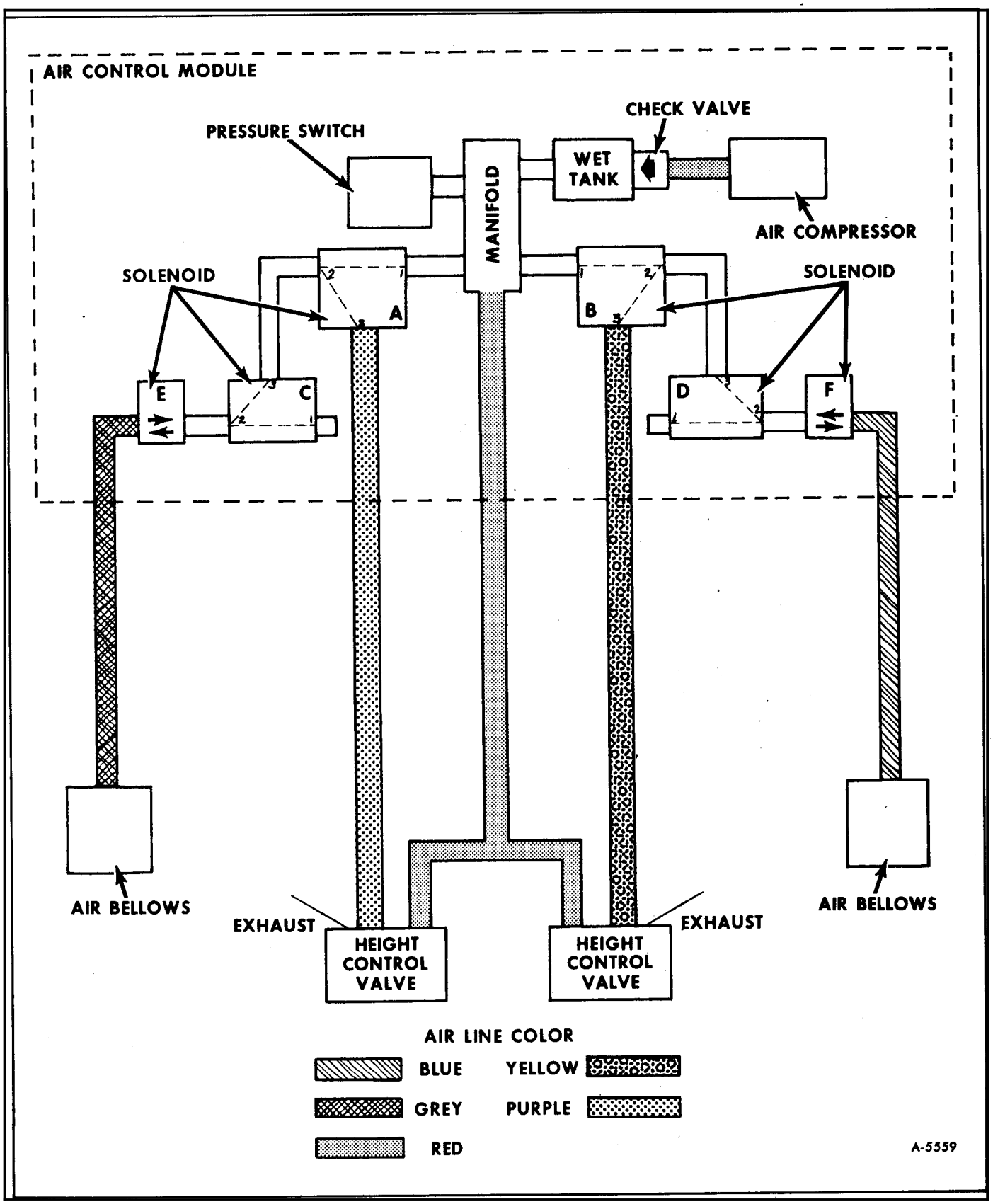


Figure 7—Electro-Level Air Suspension System Schematic

AIR FLOW (REFER TO FIGURE 7)

The air flow in the system (to or from the air bellows) is controlled by switch position on the Electro-Level control panel.

When the center switch is placed in TRAVEL AUTO, only the two-way solenoids "E" and "F" are open, i.e., energized. If air is needed in the system, this mode will allow air to flow from the compressor through the height control valve and further through solenoids "A", "C" and "E" on the left side to the bellows. On the right side, air will flow through solenoids "B", "D" and "F" to the bellows. The air flow can occur because the 3-way solenoids ("A", "B", "C", "D") will allow air to pass from the No. 3 port to the No. 2 port even though they are not electrically actuated. This is the normal air flow of these valves when they are de-energized.

When leveling requires pressure to be released from the system, TRAVEL AUTO position allows the necessary air flow from the bellows through the appropriate solenoids to the exhaust fiting at the height control valve. Two-way solenoids "E" and "F" are energized for this demand. Three-way solenoids "A", "B", "C" and "D" are de-energized yet will allow air to pass from the No. 2 to the No. 3 port.

When the vehicle is moving, the center switch should be in TRAVEL HOLD position, (with the RAISE-LOWER switches in "OFF"). In this mode the 2-way solenoids "E" and "F" are closed (i.e., de-energized), trapping air in the bellows and isolating the bellows from the rest of the system. This means the only possible areas of leakage will be the bellows themselves, the fittings at the solenoids, or the air line running between. The same air flow situation exists when the vehicle is parked and the key is in "OFF".

When the vehicle is in RAISE position, air flow is different. Solenoids "A" and/or "B" are electrically actuated. System pressure no longer goes through these valves from the No. 3 port to the No. 2 port. Instead, this passage within each valve is blocked and air must flow from the No. 1 to the No. 2 port. This means that the height control valve is now taken "OUT" of the system. Air moving through solenoids"A" or "B" is regulated only by the rocker switch on the dash panel. Air flow will continue through solenoids"C" and "E" to the left side bellows or "D" and "F" to the right side bellows. In this mode, the two-way solenoids "E" and "F" are energized also.

To lower the system, the RAISE-LOWER switch on the dash will be set in the LOWER position (right- or left-hand side, or both). With both RAISE-LOWER switches in LOWER, solenoids "C" and "D" are energized. This causes the normal passage of air between the No. 3 port and the No. 2 port to be blocked. Air flows instead from the bellows through open solenoids "E" and "F", and then from the No. 2 to the No. 1 (exhaust) ports in solenoids "C" and "D". Thus the vehicle ride height lowers by the release of air to the atmosphere through the exhaust ports of the "LOWER" solenoids.

SYSTEM COMPONENTS

CONTROL ARMS

The rear suspension control arms (one on either side of air bellows) attach to a control arm mounting bracket which in turn mounts to the vehicle frame rail. The control arms support the air bellows and the tandem rear wheels.

AIR BELLOWS

The air bellows for the tandem rear wheels are mounted between the control arms. On each side of the air bellows is a piston which is connected directly to the control arm.

The air bellows serve as a flexible connection between the two control arms on each side of suspension bracket. The flexing of the air bellows allows the control arms to move up and down in relation to the frame. This action absorbs road shocks in the same manner as an inflated rubber tire cushions shock caused by road roughness.

SHOCK ABSORBERS

A double acting shock absorber is used at each wheel on the rear suspension. The shocks are mounted to the top of the control arms and to the frame at the bottom.

The shock absorbers are gas filled cell-type shocks. They are filled with a calibrated amount of fluid and sealed during production. They are nonadjustable, nonrefillable and cannot be disassembled. The only service they require is replacement if they have lost their resistance, are damaged or leaking fluid.

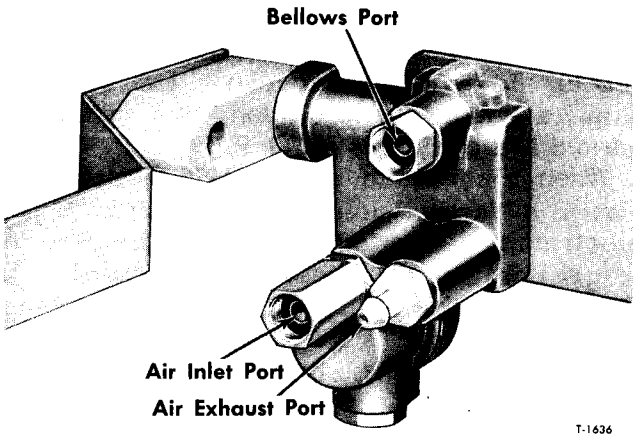


Figure 8—Height Control Valve (Port Identification)

HEIGHT CONTROL VALVE
(REFER TO FIGURE 8)

Height control valve automatically maintains a constant vehicle height by controlling the flow of compressed air into or out of suspension system air bellows. A delay piston in each valve provides a momentary delay in intake and exhaust valve action. Therefore, air in bellows is exhausted only during load changes and not during intermittent road bumps.

The height control valve contains an intake valve, air bellows outlet, exhaust valve, delay piston, and overtravel control body. The overtravel control body contains a spring-loaded nylon piston which protects valve part if overtravel lever is moved beyond normal operating range.

HEIGHT CONTROL VALVE OPERATION – (FIGURE 9)

Loading

When vehicle is being loaded, frame tends to settle. Since valve is linked to control arm, and valve is bolted to wheel well, valve moves downward with frame as vehicle is loaded. As valve arm and control shaft turns, a force is applied to the delay piston which moves slowly and allows the intake valve lever to move against the intake valve core. As pin is pushed in, air pressure flows through height control valve into bellows. Increased air pressure expands the bellows and raises frame.

Inlet valve is "PROTECTED" by check valve in inlet adapter. Light spring in core freely admits reservoir air, but return flow of air is blocked.

Neutral Position

As increased air pressure expands bellows and lifts frame, the height control valve moves upward with frame. As frame is returning to normal ride height, valve arm and shaft return to a neutral position. Inlet valve lever also moves away from inlet valve core and inlet valve closes. This stops the flow of air into bellows. The exhaust valve remains closed. Since the exhaust valve is closed, and the check valve in the inlet adapter prevents compressed air from returning to air reservoir, air is trapped in bellows and in valve. No

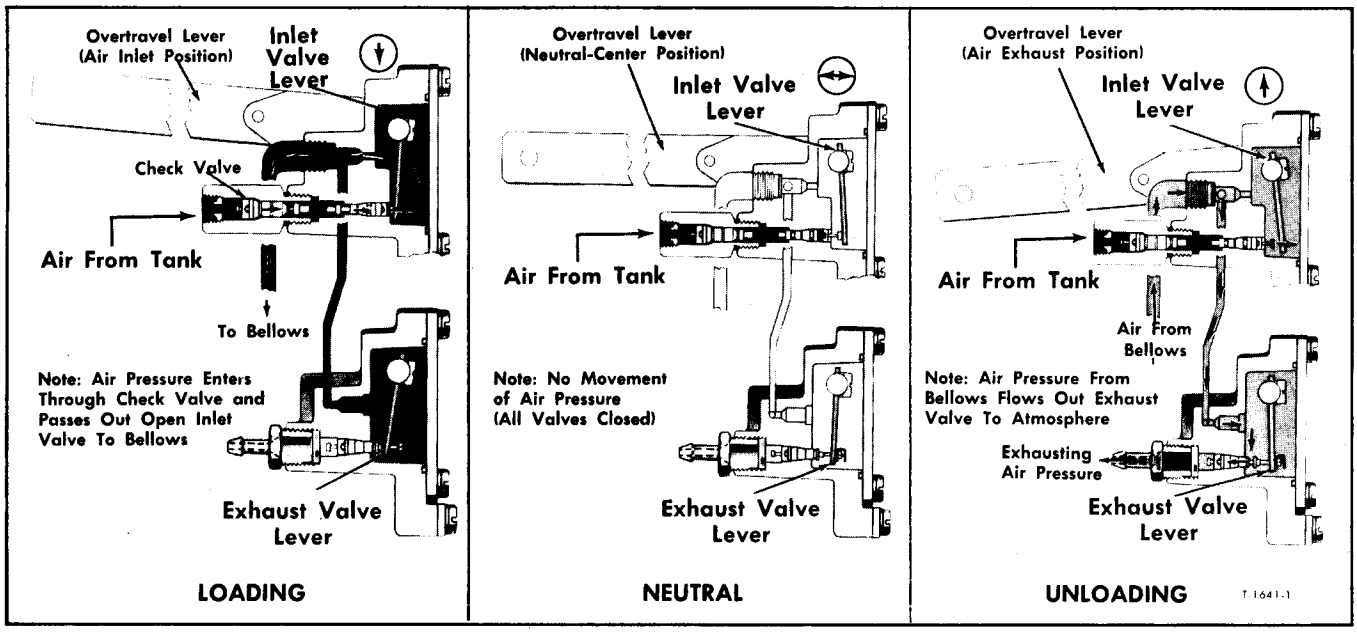


Figure 9—Operation of Height Control Valve

further valve action or air pressure change takes place until load is increased or decreased, moving valve arm out of neutral positon for four seconds or more to actuate intake valve or exhaust valve.

Unloading

When part of load is removed, air pressure in bellows lifts frame. Valve arm, linked to axle, is pulled downward from neutral position. This applies a force on the delay piston, which moves it slowly. The exhaust valve lever moves with the delay piston. The outer end of exhaust valve lever fits around stem of exhaust valve core.

As soon as lever moves beyond free-travel range, lever pulls on stem and opens exhaust valve. Inlet valve remains closed.

Compressed air from bellows then flows through the open exhaust valve and out exhaust fitting to atmosphere. As the compressed air is exhausted from bellows, the frame lowers until overtravel lever and shaft are again in normal (neutral) position.

Valve Arm Free Travel

With vehicle in motion and frame at normal ride height, control valve arm and shaft are in neutral position. Small irregularities in the road cause slight up and down movement of valve arm.

Clearances are provided between operating levers and cores of inlet and exhaust valves, to permit 1/4-inch up or down movement of valve arm from neutral position without causing valve action.

This compensates for small road bumps. The bumps are absorbed by tires and bellows without causing movement of compressed air either into or out of suspension system.

Hydraulic Delaying Action

Operation of delay piston in height control valve prevents change of bellows air pressure as a result of momentary road shocks, conserves air supply, and adds life to valve.

The nylon piston moves inside cylinder containing a silicone type fluid. A flapper valve on either end of piston allows displacement of fluid or acts as a check valve, depending on direction piston moves.

Delay piston is moved by piston pin that is threaded into overtravel shaft. A 4 to 18 second delay exists from the closing of one valve to the opening of other valve.

Overtravel piston is held against flat side of overtravel shaft by two springs inside piston. Piston keeps overtravel shaft in proper position relative to valve arm.

Piston also allows valve arm to rotate through a complete circle, if necessary, without damaging parts inside valve.

AIR COMPRESSOR

Compressed air for the system is supplied by an electric compressor which operates when the ignition key is in the "ON" or "ACCESSORY" position.

It is a demand-type compressor which will start compressing air when the pressure in the

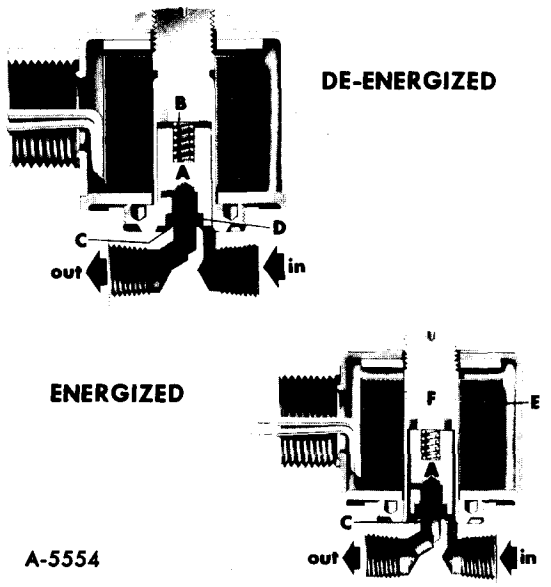


Figure 10—Two-Way Normally Closed Solenoid Valve

system drops below 100 psi, and will shut off when the pressure reaches 120 psi.

WET TANK

The purpose of the wet tank (or air tank) is to provide a place where the air, heated during compression, can cool and water vapor can condense. A drain and shop air fill valve is located at the bottom of the tank.

The wet tank should be drained at 3-month or 3,000-mile intervals, or more often if above normal air compressor operation is encountered.

PRESSURE SWITCH

The air pressure switch is designed to maintain air pressure in the wet tank between 100 and 120 psi. Switch activates at 100 psi and opens at 120 psi.

SOLENOID VALVES

Air flow in the rear suspension system is electrically controlled by two solenoid air valves on the standard system and four additional solenoid air valves on the optional Electro-Level I System.

The two valves on the standard system are two-way, normally closed valves.

The four additional solenoid valves on the optional Electro-Level I system are three-way multipurpose valves plumbed to function either as three-way normally closed valves or three-way directional control valves.

TWO-WAY NORMALLY CLOSED SOLENOID VALVE —

This is a valve in which the single orifice is closed in the de-energized position and no flow can exist between the inlet and the outlet ports (figure 10).

THREE-WAY VALVE —

This is a valve that has 2 orifices and three ports. One orifice is always open when the other is closed and one port is always open to one of the other two ports.

Flow is controlled by electrically opening or closing either of the two orifices (figure 11).

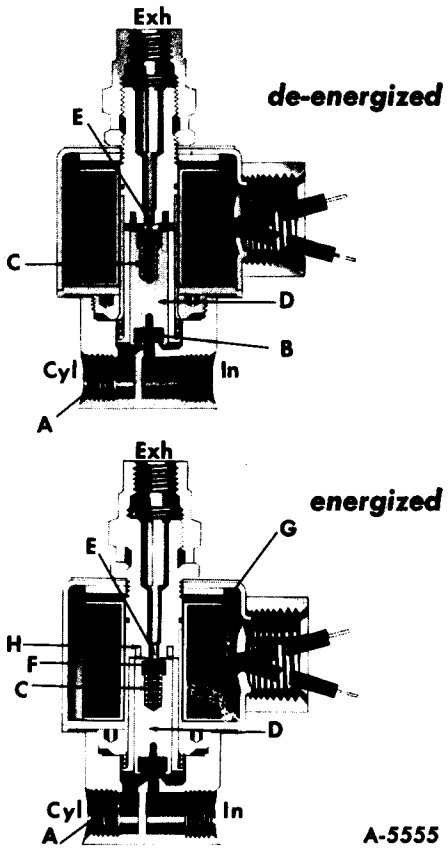


Figure 11—"Three-Way Solenoid Valve

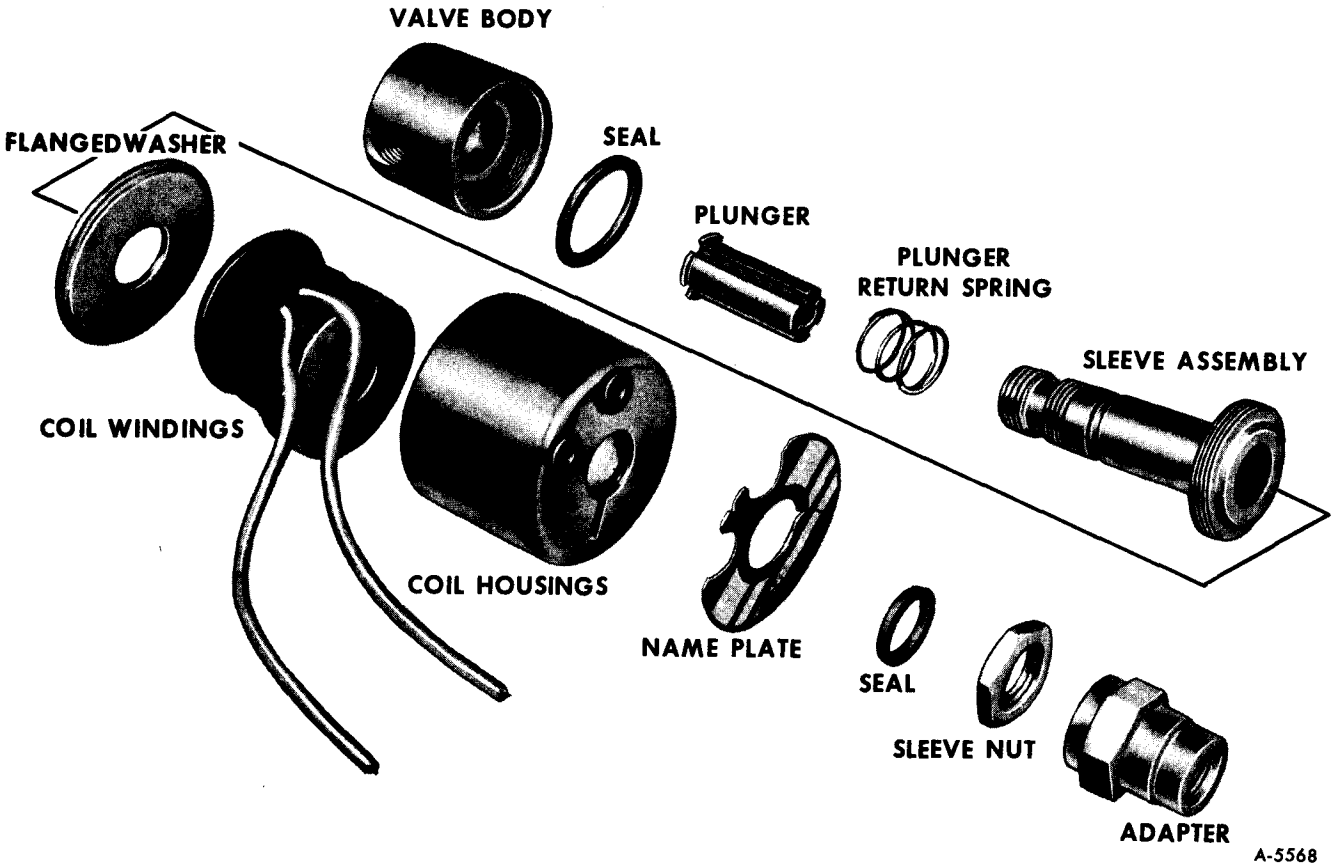


Figure 12—Solenoid Valve Components

PRINCIPLES OF OPERATION

The solenoid valve is an electromagnet so arranged that when current is applied to the coil (when the valve is "energized") the plunger either opens or seals an orifice, thereby controlling the flow of air. Typical solenoid valve components are shown in figure 12.

The solenoid valve has two basic functional parts: a solenoid coil and a plunger or armature. The coil surrounds the plunger which has a soft synthetic seal at one end. The valve body has an orifice which is sealed by the insert in the plunger. The orifice is opened or closed by the movement of the plunger. The coil causes the plunger to move when the coil is energized. When the coil is de-energized the plunger is returned to its original position by means of a spring.

The only moving parts of the valve are the plunger and the spring which are enclosed in the sleeve assembly. This arrangement within the sleeve is referred to as an internal solenoid. The plunger closes the negative circuit of the coil by coming into "face to face" contact with the stop. The stop, magnetic steel, is welded to a nonmagnetic steel tube which is welded to a magnetic stainless steel flange to make up the sleeve assembly. The "face to face" design permits the plunger to be spring loaded for positive operation regardless of valve mounting position.

DIAGNOSIS OF REAR SUSPENSION SYSTEM (1977)

DIAGNOSIS OF AIR COMPRESSOR

(REFER TO FIGURES 4 AND 7)

PROBLEM	POSSIBLE CAUSE	CORRECTION
COMPRESSOR NOT OPERATING. NO AIR PRESSURE.	1. Open circuit breaker. (Circuit breaker is located behind glove box door.)	1. Find cause of circuit breaker being open and correct it.

DIAGNOSIS OF AIR COMPRESSOR (CONT'D) (REFER TO FIGURES 4 AND 7)

PROBLEM	POSSIBLE CAUSE	CORRECTION
	2. Faulty wiring. (Compressor feed at ground wire not connected.)	2. Check to see that wiring is intact.
	3. Low battery.	3. The compressor runs off the automotive battery. Check battery condition and correct as necessary.
	4. Faulty pressure switch.	4. Replace pressure switch.
	5. Compressor motor has developed an open circuit.	5. Motor brushes or commutator worn out. Replace motor.
	6. Defective diode. (Electro-Level option only.)	6. Replace diode assembly in wiring harness. (See figure 17).
	7. Defective relay.	7. Replace relay.
COMPRESSOR OPERATES. NO AIR PRESSURE	1. Leak in air system.	1. Eliminate air leaks in system as described later in this sectior
	2. Compressor valve seat or valve spring worn or broken.	2. Replace valve seat and/or valve spring.
	3. Piston rings are worn—air leaks heavily at rings.	3. Replace piston rings.
	4. Pressure switch not properly adjusted.	4. Adjust pressure switch settings to operate at the 100-120 psi range.
AIR PRESSURE IN SYSTEM. COMPRESSOR OPERATES ERRATICALLY—TAKES TOO LONG TO PRESSURIZE SYSTEM.	1. Air leak in system.	1. Eliminate air leaks in system as described later in this section.
	2. Compressor valve seat or valve spring broken or worn.	2. Replace valve seat and/or valve spring.
	3. Piston rings are worn—air leaks heavily by rings.	3. Replace piston rings.
	4. Pressure switch contacts are pitted causing improper compressor action.	4. Replace pressure switch.
	5. Battery voltage too low to operate motor.	5. Charge battery.
	6. Bearing failure which causes unit to seize occasionally and break loose if galling occurs.	6. Replace bearings or parts with bearings.
AIR LINES FROZEN UP.	1. Water in lines	1. Drain wet tank.

DIAGNOSIS OF ELECTRO-LEVEL CONTROLS

(REFER TO FIGURE 6)

PROBLEM	POSSIBLE CAUSE	CORRECTION
COMPLETE OR PARTIAL LOSS OF AIR WITH TRAVEL SWITCH IN "HOLD".	1. Leak in air bellows.	1. Eliminate air leak.
	2. Leak at air lines between bellows and solenoid.	2. Eliminate air leak.
	3. Leak in 2-way solenoid.	3. Service or replace solenoid.
COMPLETE OR GRADUAL LOSS OF AIR OVER-NIGHT AT CAMP-SIGHT WITH IGNITION OFF.	1. Leak at air bellow.	1. Eliminate air leak.
	2. Leak in air line between solenoid and bellows.	2. Eliminate air leak.
	3. Leak at fitting between solenoid and air line or bellows and air line.	3. Eliminate air leak.
	4. Defective 2-way solenoid valve.	4. Service or replace solenoid
COMPLETE OR PARTIAL LOSS OF AIR WITH TRAVEL SWITCH IN "AUTO", IGNITION ON. (COMPRESSOR RUNS TOO FREQUENTLY).	1. Air leak in system.	1. Eliminate air leak. Note: Vehicle should be operated with travel switch in "HOLD" position. Do not operate vehicle with travel switch in "AUTO".
	2. Defective height control valve.	2. Service or replace valve.
TRAVEL SWITCH IN "AUTO". NOTHING HAPPENS.	1. Compressor not operating.	1. Check feed at ground wire.
	2. Defective control switch.	2. Replace switch.
	3. Defective pressure switch.	3. Replace switch.
	4. Defective diode.	4. Check diode. Replace as required.
	5. Defective wiring.	5. Check wiring and electrical connections.
	6. Check relay.	6. Replace relay.
	7. Defective solenoid valves.	7. Service or replace solenoid valves.
	8. Leak at air bellows.	8. Eliminate air leak.
	9. Leak in air lines.	9. Eliminate leak.
LEFT OR RIGHT SWITCH IN "RAISE" POSITION. VEHICLE DOESN'T RAISE. COMPRESSOR RUNS.	1. Leak in air lines.	1. Eliminate air leak.
	2. Solenoid valves plumbed incorrectly. (RAISE solenoids.)	2. Properly install solenoid valve.
	3. Faulty HOLD solenoid valves.	3. Service or replace valves.
	4. Faulty RAISE solenoid.	4. Follow bench check of solenoid. Service or replace as necessary.
	5. Faulty control switch.	5. Replace switch.
	6. Defective wiring between control switch and solenoid.	6. Check wiring and electrical connections.
LEFT OR RIGHT SWITCH IN "RAISE" POSITION. VEHICLE DOESN'T RAISE. COMPRESSOR NOT OPERATING.	1. Open circuit in compressor motor.	1. Motor brushes or commutator worn out. Replace motor.
	2. Defective relay.	2. Clean contacts or replace relay.
	3. Open in pressure switch.	3. Pitted contacts. Replace pressure switch.
	4. Battery undercharged.	4. Charge or replace automotive battery.

DIAGNOSIS OF ELECTRO-LEVEL CONTROLS (CONT'D)

(REFER TO FIGURE 6)

PROBLEM	POSSIBLE CAUSE	CORRECTION
	5. Defective diode.	5. Replace diode.
	6. Defective wiring. (Compressor feed at ground wire not connected.)	6. Check wiring and electrical connections.
	7. Open circuit breaker.	7. Check for cause of open circuit breaker. Reset.
	8. Faulty control switch.	8. Replace switch.
LEFT OR RIGHT SWITCH IN "LOWER" POSITION. VEHICLE DOESN'T LOWER.	1. LOWER solenoid valves incorrectly plumbed.	1. Correctly install solenoid valves.
	2. Undercharged battery.	2. Charge or replace battery.
	3. Defective wiring.	3. Check wiring and electrical connections.
	4. Open circuit breaker.	4. Find cause for open circuit breaker. Reset.
	5. Defective solenoid valves.	5. Service or replace solenoid valves.
	6. Defective control switch.	6. Replace switch.

DIAGNOSIS OF TELL-TALE WARNING LIGHT "SET LEVEL TO TRAVEL AUTO"

(REFER TO FIGURE 13)

PROBLEM	POSSIBLE CAUSE	CORRECTION
START VEHICLE. MOVE TRANSMISSION SELECTOR LEVER TO "DRIVE" POSITION.	1. Defective bulbs (two bulbs.)	1. Replace light bulbs.
	2. Defective time delay relay.	2. Replace thermal time-delay relay (located behind instrument panel). (Refer to Section 12 of this supplement).
TELL-TALE LIGHT DOES NOT ILLUMINATE.	3. Defective tell-tale warning light fuse.	3. Replace fuse. (Fuse is located in fuse panel behind glove compartment).
	4. Defective wiring.	4. Check wiring and electrical connections.
	5. Defective neutral start, B/U, and safety switch.	5. Adjust switch or replace as necessary.
START VEHICLE. MOVE TRANSMISSION LEVER TO "DRIVE" POSITION. TELL-TALE LIGHT ONLY PARTIALLY ILLUMINATES	1. Defective light bulb.	1. Replace burnt out bulb.

DIAGNOSIS OF TELL-TALE WARNING LIGHT "SET LEVEL TO TRAVEL AUTO" (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
START VEHICLE. MOVE TRANSMISSION LEVER TO "DRIVE" POSITION. TELL-TALE LIGHT REMAINS ON AFTER 10-15 SECOND DELAY.	1. Defective time-delay relay.	1. Replace relay.
START VEHICLE. TALL-TALE LIGHT INTERMITTENTLY LIGHTS WHEN MOVING TRANSMISSION SELECTOR LEVER TO "DRIVE"	1. Defective time-delay relay. 2. Defective neutral start, B/U and safety switch.	1. Replace relay. 2. Adjust switch or replace as necessary.

DIAGNOSIS OF SHOCK ABSORBER

PROBLEM	POSSIBLE CAUSE	CORRECTION
SHOCK ABSORBER— WEAK.	1. Low or uneven tire pressure.	1. Inflate tires to recommended pressure.
	2. Excessive or incorrect vehicle loading.	2. Instruct driver.
	3. Worn out shock absorber. Front.	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 ratio (usually 2 to 1). If in doubt compare with vehicle having acceptable ride quality.
	4. Worn out shock absorber. Rear.	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.

DIAGNOSIS OF SHOCK ABSORBER (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
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. 2. A seize (except at either extreme end of travel). 3. A noise such as a grunt or squeal after completing one full stroke in both directions. 4. A clicking noise at fast reversal.
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; any leaking shock should be replaced.

AIR LEAKS

With the air system at normal operating pressure, coat all suspension air line connections with soap and water solution. Air leakage will produce soap bubbles. No leakage is permissible. Leakage at air line connections can sometimes be stopped by tightening connection. If this does not stop the leak replace the affected fittings.

1. Cut end of hose (tube) off square.
2. Place brass insert into end of tube and put appropriate fitting over it (figure 14).
3. Crimp fitting in place with Special Tool J-25520. This tool is designed so that crimp must be completed before tool will release (figure 15).
4. Air line leaks can be repaired with the coupling illustrated in figure 16.

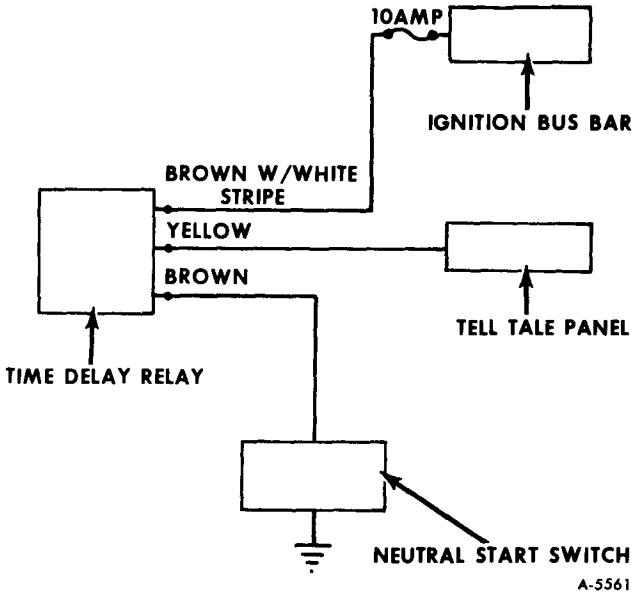


Figure 13—Tell-Tale Warning Light Schematic

HEIGHT CONTROL VALVE AIR LEAKAGE CHECKS

NOTE: Air leakage check can be performed for air line connections only when valve is installed on vehicle. The following instructions give procedure for performing air leakage check on valve when valve is removed from vehicle.

1. Clean exterior of valve assembly.
2. Connect air pressure line to air inlet port, then open the air pressure (90-120 psi).
3. Submerge valve assembly in a container of water, then watch for air bubbles when the valve arm is in center (neutral) position. No air should escape from any point of valve assembly.
4. If bubbles appear from the bellows port, this is an indication the air inlet valve assembly is defective and must be replaced.
5. Remove air pressure line from air inlet fitting and connect it to the bellows port. If bubbles appear at the air inlet check valve port, this is an indication that check valve unit is defective and must be replaced.
6. If bubbles appear at the exhaust port it is an indication the exhaust valve assembly is defective and must be replaced.
7. If bubbles appear around edge of valve cover plate, the cover plate gasket must be replaced.
8. If no leaks are detected, remove valve assembly from water. Then, with air pressure still connected to bellows port, actuate valve arm to expel any water which may have entered exhaust valve chamber. Remove air line and connect it to air inlet port. Actuate valve with air pressure to remove water from air inlet valve chamber.

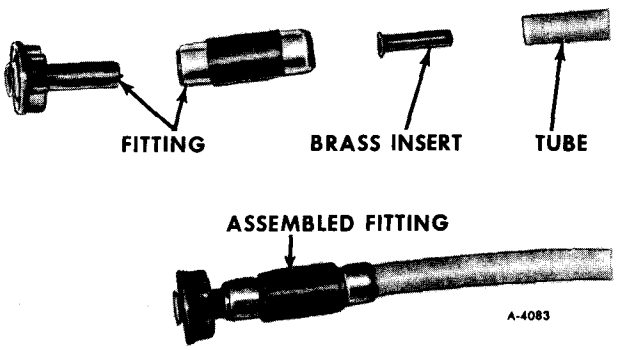


Figure 14—Coupling Assembly

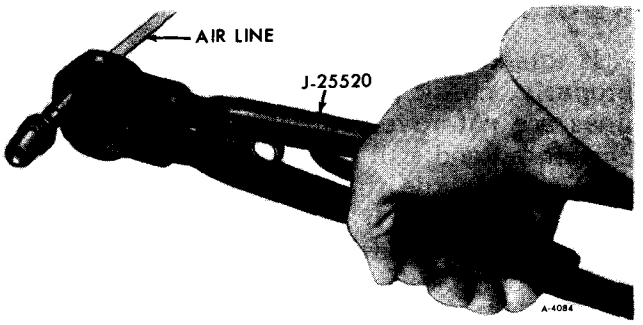


Figure 15—Special Tool J-25520 Crimping Air Line

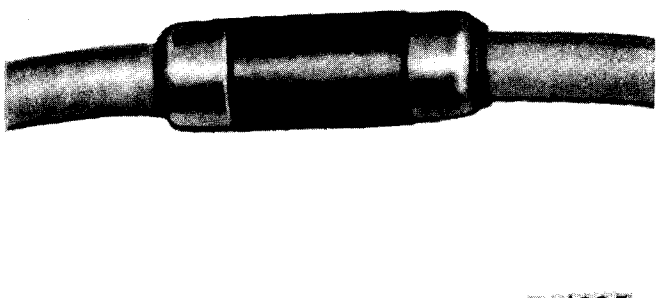


Figure 16—Air Line Repair Coupling

DIAGNOSIS OF SOLENOID VALVES

If solenoid does not appear to be functioning properly, check to see that connections to air lines are not reversed. If solenoid is properly connected and still malfunctions, remove solenoid and use the following procedure to bench check solenoid. If solenoid fails bench test, unit can be disassembled for cleaning and inspection. Plunger, spring, and seals are available for service replacement. If replacing entire solenoid unit, be sure to use equivalent solenoid valve.

BENCH CHECK OF SOLENOID

An air source of approximately 50-100 psi and an electrical 12-volt source are required for a bench test of the solenoid. Apply air to the supply (IN) port of the solenoid. Actuate the valve from the electrical source and note air outlet change to the other port.

Two-Way Normally Closed Solenoid

Air pressure applied at inlet port. Air is stopped internally. No air at out port. With 12 volts applied (solenoid energized) air will flow from inlet port through out port.

Three-Way Multipurpose Valves

The three-way valves used are multipurpose valves and their operation as a normally open or normally closed valve depends upon hookup. Port stampings on multipurpose valves are as follows: "1" for normally closed, "2" for common, and "3" for normally open. Inlet pressure can be applied at any port.

- Inlet pressure applied at normally closed port (1): Air is stopped internally. With 12 volts applied (solenoid energized) air will flow from normally closed port (1) to common port (2). No air at normally open port (3).

- Inlet pressure applied at common port (2): Air flows out normally open port (3). With 12 volts applied (solenoid energized) air will flow from common port (2) through normally closed port (1). No air at normally open port (3).

- Inlet pressure applied at normally open port (3): Air flows out common port (2). With 12 volts applied (solenoid energized) air will flow from normally open port (3) to normally closed port (1). No air at common port (2).

TESTING DIODE ASSEMBLIES

With the Electro-Level option there are two diode assemblies in the wiring harness (figure 17). These can be tested using an ohmmeter. Holding two meter leads to either side of diode, measure the resistance in one direction. Reverse the test lead connections to measure the resistance in the other direction. If the diode is good, the resistance in one direction will be much higher than the resistance in the other direction. If diode does not test good, replace.

COMPONENT REPLACEMENT

CAUTION: *Whenever it is necessary to support the rear suspension with jack stands or other supporting equipment, be sure the jack stands are used only at junction points of the frame rail and crossmember. Failure to locate jack stand as instructed could result in damage to frame of vehicle.*

Removal procedure for height control valve, air bellows, control arm and shock absorber are given in REAR SUSPENSION (SEC. 4) of Maintenance Manual X-7525.

AIR COMPRESSOR REPLACEMENT

REMOVAL

1. Release pressure in system through Schrader valve at wet tank.
2. Disconnect electrical leads at rear of compressor motor.
3. Disconnect air lines at back of compressor and at head of one piston.
4. Remove bolts securing compressor to mounting bracket and remove compressor.

INSTALLATION

1. Install bolts securing compressor to mounting bracket.
2. Connect air lines at back of compressor and at head of one piston.
3. Connect electrical leads at rear of compressor.

PRESSURE SWITCH REPLACEMENT

REMOVAL

1. Release pressure in system through wet tank Schrader valve.
2. Remove screw at top of pressure switch cover and remove switch cover.
3. Disconnect two electrical leads secured by screws inside switch body.
4. Remove bolts securing pressure switch in place. Remove copper fitting securing pressure switch to wet tank.
5. Remove pressure switch.

INSTALLATION

1. Install pressure switch at wet tank fitting. Install bolts securing pressure switch in place.
2. Connect electrical leads secured inside switch body with screws.
3. Install switch cover and secure with screw.

HEIGHT CONTROL VALVE REPLACEMENT

Refer to SEC. 4, REAR SUSPENSION, Maintenance Manual X-7525 for height control valve removal and installation procedure.

WET TANK REPLACEMENT

REMOVAL

1. Release air from system at Schrader valve on wet tank.
2. Disconnect air lines.
3. Remove wet tank mounting elbow from manifold.
4. Remove copper fitting, check valve and Schrader valve from tank.

INSTALLATION

1. Install check valve, Schrader valve and copper fittings at wet tank.
2. Connect air lines.
3. Install wet tank mounting elbow.

SOLENOID VALVE REPLACEMENT

REMOVAL

1. Release air from system at Schrader valve on wet tank.
2. Disconnect electrical leads from solenoid at connector.

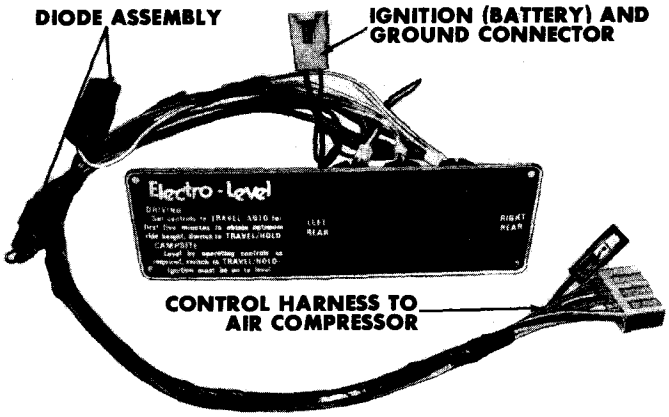


Figure 17—Location of Diodes

3. Identify air lines and ports. Disconnect air lines to solenoid valve.
4. Remove solenoid.

INSTALLATION

1. Secure solenoid to bracket or copper fittings. Be sure to hook up solenoid ports identical to original installation.
2. Connect air lines to solenoid valve. Refer to air line schematics given in figures 4 and 7.
3. Connect electrical leads.

ELECTRO-LEVEL CONTROL PANEL REPLACEMENT

REMOVAL

1. Remove four screws securing control panel to lower dash panel.
2. Disconnect electrical leads at switches.
3. Remove switches from control panel.

INSTALLATION

1. Install switches into control panel.
2. Connect harness leads to switches.
3. Install control panel to lower dash panel and secure in place with four mounting screws.

CONTROL ARM REPLACEMENT

Refer to SEC. 4, REAR SUSPENSION, Maintenance Manual X-7525 for control arm removal and installation procedure.

SHOCK ABSORBER REPLACEMENT

Refer to SEC. 4, REAR SUSPENSION, Maintenance Manual X-7525 for shock absorber removal and installation procedure.

AIR BELLOWS REPLACEMENT

Refer to SEC. 4, REAR SUSPENSION, Maintenance Manual X-7525 for air bellows removal and installation procedure.

AIR LINE REPLACEMENT

Nylon tubing is used throughout the vehicle for rear suspension air lines (as shown in schematics). It is flexible, durable and weather-resistant.

If tubing has been disconnected and must be replaced, new tubing must be cut to required length and related fittings assembled.

NOTE: Whenever threaded fittings on the rear suspension (excluding the height control valve itself) are disassembled for any reason, be sure threads on male portion of fitting are wrapped with teflon tape or equivalent to avoid leakage.

1. After nylon tubing is cut to required length, be sure components assembled are free of nicks or scratches.

2. Position nut and sleeve over tube.

3. Push tube insert into tube, then push tube and insert into fitting until firmly seated.

4. Seat sleeve into fitting, then tighten nut securely.

5. Install fitting at other end of nylon tube using the above procedure, then check for leaks.

6. If any trouble symptoms, such as slow suspension operation, indicate a restricted air line, disconnect suspected tube or hose at both ends and blow through it to make sure the passage is clear. Inspect tubing and hose for partial restrictions such as dents or kinks. If such condition is found, replace the tubing.

COMPONENT REPAIR

Overhaul procedures for air compressor and height control valve are given in REAR SUSPENSION (SEC. 4) of Maintenance Manual X-7525.

SOLENOID VALVE REPAIR

Disconnect air lines from solenoid and remove solenoids from manifold (or bracket).

Solenoid valve shown in figure 12 can be disassembled for cleaning and inspection. Plunger, spring and seals are available for service replacement.

DISASSEMBLY

1. Remove adapter and seal from sleeve assembly, then remove sleeve nut which holds housing and coil assembly to sleeve assembly.
2. Remove name plate, housing, and coil assembly by sliding off lower end of sleeve assembly. Remove washer.
3. Using spanner wrench (SKINNER # VD-233, or equivalent) remove sleeve, plunger and spring from valve body. (See figure 18).
4. Separate plunger and spring from sleeve and remove nylon seal from valve body.

INSPECTION

1. Seals should be discarded and new seals installed when assembling valve.
2. Inspect plunger inserts (both ends) for cuts, nicks, and depressions caused from hitting valve seats. Replace if necessary. Wear must be significant before necessary to replace.
3. Replace spring if broken. If plunger is replaced, spring should be replaced at the same time. Plunger and spring are included in a repair kit.
4. Visually inspect valve threads for damage and clean if necessary.

ASSEMBLY

NOTE: DO NOT use any lubricant during asesmbly of valve components.

Reverse the disassembly procedure for reassembly of valve. DO NOT tighten sleeve nut excessively.

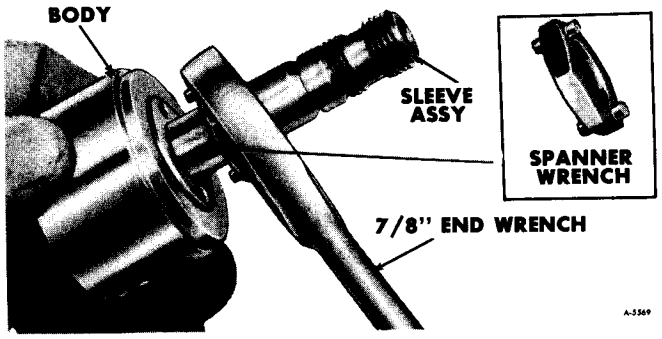


Figure 18—Removing or Replacing Sleeve With Special Tool (Spanner Wrench — Skinner # V0233)

ON-VEHICLE ADJUSTMENTS

REAR WHEEL ALIGNMENT

Proper rear wheel alignment must be maintained to ensure correct handling and satisfactory tire life.

Before checking alignment the following inspections should be made:

1. Check that tires are inflated to recommended pressure.
2. Check wheel bearing adjustment and correct if necessary.

NOTE: Rear wheel alignment requires the vehicle to be level while being checked. Vehicle must be empty and full weight must be on wheels.

TOE-IN MEASUREMENT

Toe-in is measured from center of tire tread. Measurements at both wheels must be made in same relationship.

NOTE: Both sets of tandems should be checked for toe-in to assure alignment of front and rear tandems (see figure 19).

Hoist vehicle and spin wheels to obtain a center line on tire tread. Roll vehicle ahead several feet to where the inspection is to be made. This will remove any slack caused by looseness in wheel bearings.

Measure toe on the front tandem wheels and the rear tandem wheels.

If the toe reading on the front tandem wheels or rear tandem wheels exceeds plus or minus 3/16", shims must be added to bring the rear suspension into proper alignment.

NOTE: Prior to adding a shim, determine the effect it will have on each set of tandems. If adding a shim brings one set of the tandems into specification and moves the other out of specification, refer to the 'Misalignment between front and rear tandems' later in this section.

TOE-IN ADJUSTMENT

If toe-in is not correct, it must be shimmed as shown in figure 20. Follow this procedure for adjustment.

1. Raise vehicle off floor.
2. Loosen six bolts on mounting bracket.
3. Insert proper shim as shown in figure 20.

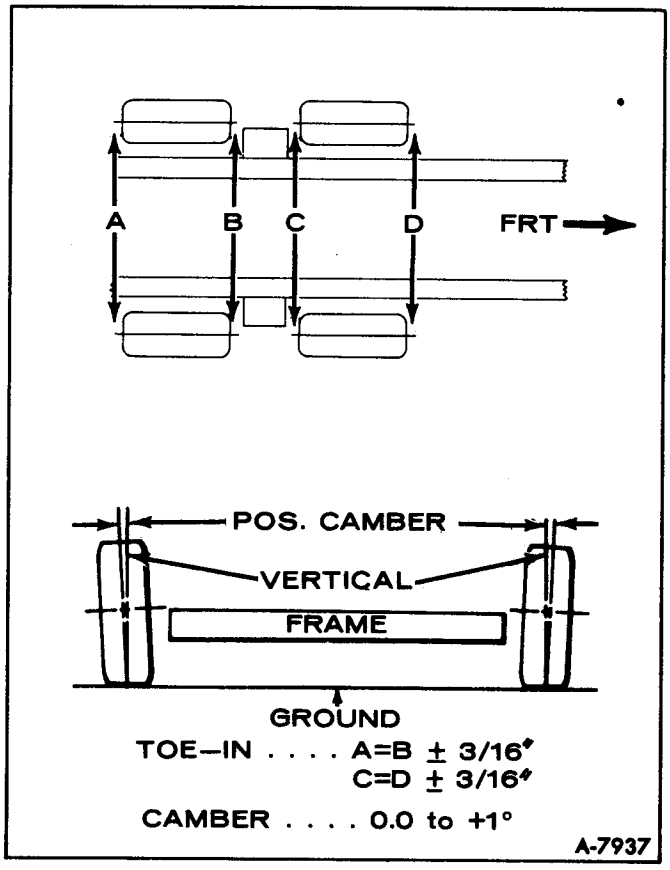


Figure 19—Rear Wheel Alignment Chart

4. Tighten retaining nuts on frame rail. Tighten two retaining nuts on crossmember. See Specifications at the end of this section for torque values.
5. Lower vehicle to floor and roll backward and forward several feet.
6. Recheck alignment.

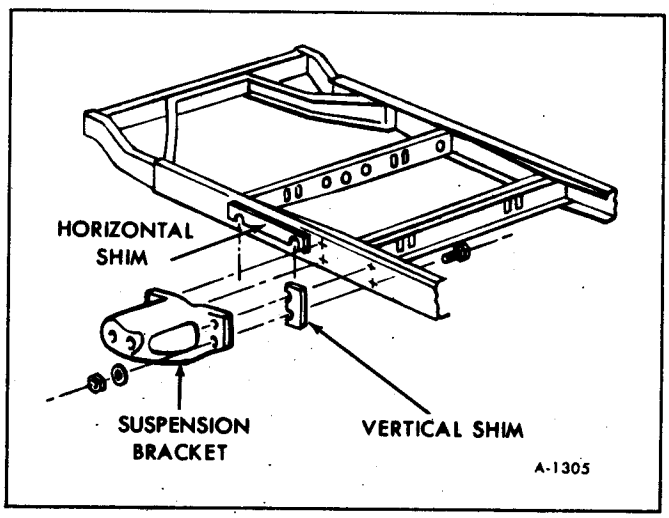


Figure 20—Rear Wheel Skim Location

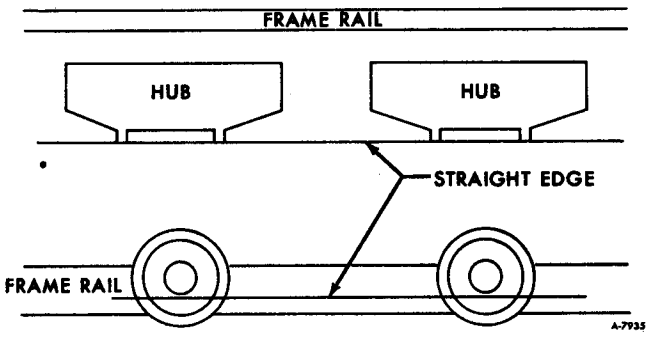


Figure 21—Measuring for Toe at Rear Suspension

MISALIGNMENT BETWEEN FRONT AND REAR TANDEMS

If one side of the rear suspension appears to be the primary cause of excessive toe, review the following factors to assist you in determining which rear suspension component is defective or damaged.

1. Loose wheel bearings.
2. Worn control arm bushings.
3. Loose suspension bracket bolts.
4. Bent control arm.
5. Bent wheel assemlby.
6. Bent frame.

Loose Wheel Bearings

If a loose wheel bearing is found, it should be inspected and then adjusted according to the following procedure.

While rotating hub assembly—

1. Tighten nut to 25-30 lbs. ft. torque.
2. Back off nut 1/2 turn.
3. Retighten nut finger tight; secure if possible.
4. If unable to secure at finger tight, back off to first securing position.
5. Rear hub must be rotated at least three revolutions of spindle nut during tightening and retightening operations.
6. Check dimensions—.001—.005 end play between hub and spindle.

Worn Control Arm Bushing

1. Raise vehicle.
2. Remove wheel bearing dust caps, and wipe grease from end of spindle.
3. Place dial indicator at end of spindle. Mount dial indicator on a suitable stand.
4. Check wheel and control arm assembly. Total indicated reading on dial indicator should not exceed .050". If later movement is greater than this, bushings and/or mounting pins should be replaced.

Loose Suspension Bracket Bolts

Be sure bracket bolts to frame rail have a bolt torque of 65-85 lbs. ft, and the retaining nuts to the crossmember have a torque of 50-60 lbs. ft.

If any of these nuts are found to be loose, inspect all components for wear. Replace worn parts as required.

Bent Control Arm

1. Raise vehicle.
2. Remove the wheels, wheel covers, outer dust cap, and inner dust cap on the side of the vehicle that appears to be the primary cause of rear suspension misalignment.
3. Place straight edge across the face of the hubs as shown in figure 21.
4. The straight edge should lie flat on each hub as shown in figure 21. If the straight edge does not visibly rest on both points of each hub, a bent control arm will be evident and it should be replaced.

Bent Wheel Assembly

Check lateral run-out of wheel assembly. Refer to Section 10 of the Maintenance Manual X-7525.

Bent Frame

Check frame for straightness following the procedure set forth in Section 2 of the Maintenance Manual X-7525.

REAR WHEEL CAMBER

The rear wheels are set with positive camber. Positive camber is outward inclination of wheels at top.

To check camber, use an accurate gauge. The camber should be set at 0^{o} to $+1^{o}$. (See figure 19.)

Excessive positive camber results in irregular wear of tires at outer shoulder. Negative or reverse camber causes wear at inner shoulders.

Camber is adjusted by shimming as shown in figure 20. Follow the same shimming procedure used to set toe-in.

AIR COMPRESSOR PRESSURE SWITCH ADJUSTMENT

The pressure switch is designed to maintain air pressure in the air reservoir between 100 and 120 psi. If the pressure in the reservoir drops to 100 psi the contact points will close and this will complete the circuit, supplying electricity to the compressor. If the pressure raises above 120 psi the contact points will

open the circuit to the compressor. This setting may be adjusted at the nut which is located on the end of the spring inside the cover. (Refer to figure 22.) The pressure will rise by tightening the spring. Both the cut-in pressure and the cut-out pressure will be affected by this adjustment. The pressure can be measured at the Schrader valve on the wet tank.

Figure 22—Air Compressor Pressure Switch Adjustment

RIDE HEIGHT ADJUSTMENT

Measure the rear suspension ride height at the elongated slot on the frame rail. Refer to figure 23.

To adjust ride height loosen adjustment nut on height control valve (See figure 24.) The valve arm has an elongated hole at the adjustment nut. This allows the valve arm to move in relation to the valve itself, and thus allows the ride height to change. Intake and exhaust valves of height control valve can then

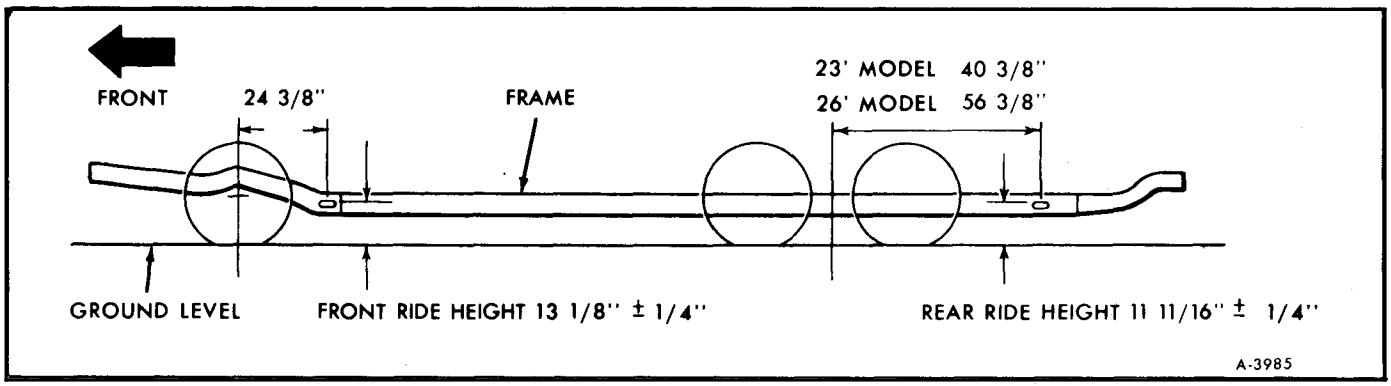


Figure 23—Checking Vehicle Ride Height

be operated independently of linkage. When proper ride height is reached tighten nut to 70-80 in. lbs.

Height control valve lever will move 1/4 inch up or down from neutral position (free travel) without causing any valve action. If amount of adjustment required falls within these limits, adjust lever the required amount. However, frame will not raise or lower until load is increased or decreased to actuate height control valve.

If either of the height control valves does not function properly with the lever correctly adjusted, check for restricted air lines. If valve still does not hold frame at normal ride height with lever properly adjusted, and with no restriction in air line, valve should be overhauled or replaced with a new or rebuilt unit.

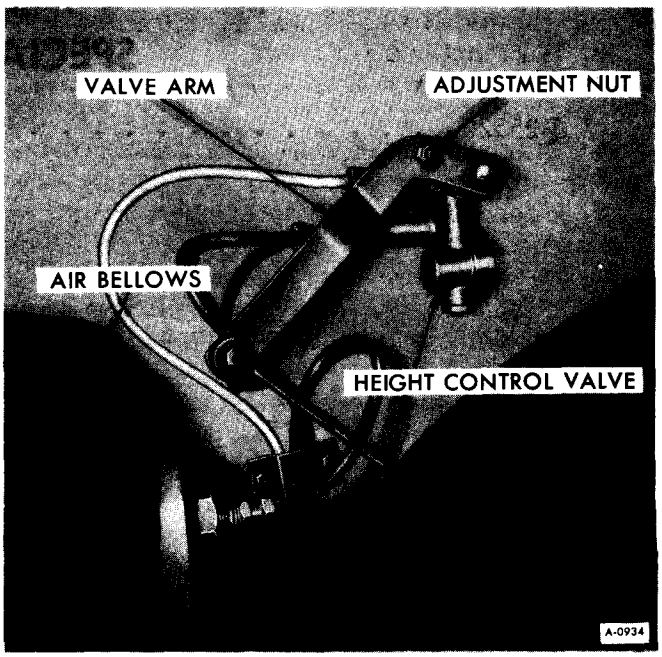


Figure 24—Location for Rear Ride Height Adjustment

PERIODIC MAINTENANCE

AIR COMPRESSOR FILTER REPLACEMENT

The air filter on the compressor should be cleaned or replaced every six months or 6,000 miles.

Remove tubing at back of each housing assembly. Remove filter retainer and pull intake assembly off and carefully take filter out from behind inside retainer. Wash filter with soap and water, and dry completely before replacing.

WET TANK MAINTENANCE

Condensation should be drained at least once a month. To drain tank properly, leave Schrader valve drain cock open until air escapes and draining stops.

Wet tank mounting bolts and brackets should be checked at regular intervals for looseness. Tighten if necessary. Wet tank may be cleaned inside using steam or hot water. If corrosion or other damage has weakened tank it must be replaced.

LUBRICATION

Details on lubrication of rear suspension components are covered in Section 0 of Maintenance Manual X-7525.

SPECIFICATIONS

LOCATION	TORQUE
Control Arm Mounting Bracket to Frame Rail Nuts (4)	65-85 Ft. Lbs.
Control Arm Mounting Bracket to Crossmember Nuts (2)	50-60 Ft. Lbs.
Height Control Valve Mounting Bolt	80-120 Ft. Lbs.
Height Control Valve Link	
Link to Arm Nut	69-90 Ft. Lbs.
Link to Control Arm Nut	60-90 Ft. Lbs.
Control Arm Lock Nut	15-20 Ft. Lbs.

SPECIAL TOOLS

J-25520. . . . . Air Line Crimp Tool

SECTION 4B

1978 REAR SUSPENSION

The information described in Maintenance Manual X-7525 under the heading REAR SUSPENSION (SEC. 4) is applicable to models covered by this supplement with the exception of the following:

CONTENTS

GENERAL DESCRIPTION

1978 model vehicles are equipped with either a Type I or Type II rear suspension system. (Refer to figures 1 and 2 for identification of suspension type.) Early 1978 model vehicles with Type I (Electro-Level I) rear suspension are discussed in subsection 4A of this section. Late model 1978 vehicles with Type II rear suspension (Electro-Level II) are discussed in the following:

ELECTRO-LEVEL II

The Type II rear suspension system—Electro-Level II—operates automatically or manually. In automatic mode, the suspension is adjusted as vehicle load varies, to retain frame at proper ride height. In addition, the Electro-Level II system provides the ability to raise or lower the rear of the vehicle approximately four inches from normal ride height. This function is controlled manually at the Electro-Level Control panel (see later in this section for information on controls operation). Electro-Level II system wiring can be seen in figure 3. Components on the new Electro-Level II suspension are discussed immediately following.

SYSTEM COMPONENT DESCRIPTION

The Electro-Level II rear air suspension system consists of the following control components:

Control Panel (1)
Air Compressor (2)
Air Dryer (2)
Compressor Relay (2)
Exhaust Solenoid (2)
Shut-Off Solenoid (2)
Electronic Height Sensor (2)
Air Lines and Fittings

Additional suspension system components include air bellows, shock absorbers and control arms.

COMPRESSOR
(FIGURE 4)

There are two compressor assemblies, one for each side of the vehicle. The compressor assembly used with this system is a permanently lubricated, positive displacement single-piston air pump powered by a 12-volt DC permanent magnet motor. The compressor head casting contains both piston intake and exhaust valves plus a solenoid operated exhaust valve which releases air from the system when energized. The compressors are located in the closet of Motorhome model ZEO6581 and in front of the driver side wheelhousing (rear) in TransMode models ZEO6083 and ZEO6583.

AIR DRYER
(FIGURE 5)

Two air dryers are used with this system, one with each compressor. The air dryer is attached externally to the compressor output. It contains a dry chemical that absorbs moisture from the air before it is delivered to the air bellows and returns the moisture to the air when it is being exhausted. This action provides a long chemical life.

The air dryer also contains a valving arrangement that helps maintain air pressure in the bellows for good ride characteristics.

COMPRESSOR RELAY

There is one control relay for each compressor. The relay is a single-pole, single-throw type that completes the 12-volt circuit to the compressor motor when energized by the electronic height sensor or the driver's control switches. Relays are located above the compressor mounting bracket in Motorhome models, and are fastened to the wall in the closet module with screws (figure 6.) TransMode relays are located at either end of the compressor mounting bracket (see figure 7).

EXHAUST SOLENOID
(FIGURE 8)

There are two exhaust solenoids, one located in the head of each compressor assembly. The exhaust solenoid has two functions:

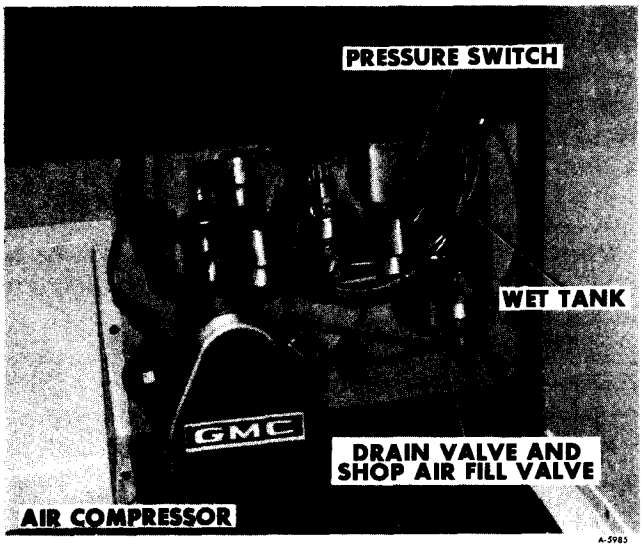


Figure 1—Type I Rear Suspension—Electro-Level I

1. It exhausts air from the system when energized. The electronic height sensor and driver control switch control this function.
2. It acts as a pressure protection valve to limit maximum pressure output of the compressor to 150-180 psi.

"SHUT-OFF" SOLENOID

Two "shut off" solenoids are wired in series between the compressor and the air bellows, one solenoid for each side of the suspension system (refer to figures 6 and 7). These solenoids are 2-way, normally closed valves that must be energized to permit air to enter or exit the bellows. In the de-energized position, the single orifice is closed and no flow can occur between the inlet and the outlet ports. Figure 9 shows the components of this solenoid valve.

When the ignition key is turned to the "ON" or "ACCESSORY" position, these valves are electrically energized, allowing positive air flow in either direction (i.e., either into or out of the bellows). The demand for air is either "read" by the electronic height sensors (automatic mode) or created by use of Electro-Level control switches (manual mode). When the ignition switch is turned to the "OFF" or "LOCK" position, these valves are de-energized or "shut off". Ignition switch control of the "shut off" solenoids will aid in preventing bellows leak down when vehicle is parked.

PRINCIPLES OF OPERATION

The solenoid valve is an electromagnet so arranged that when current is applied to the

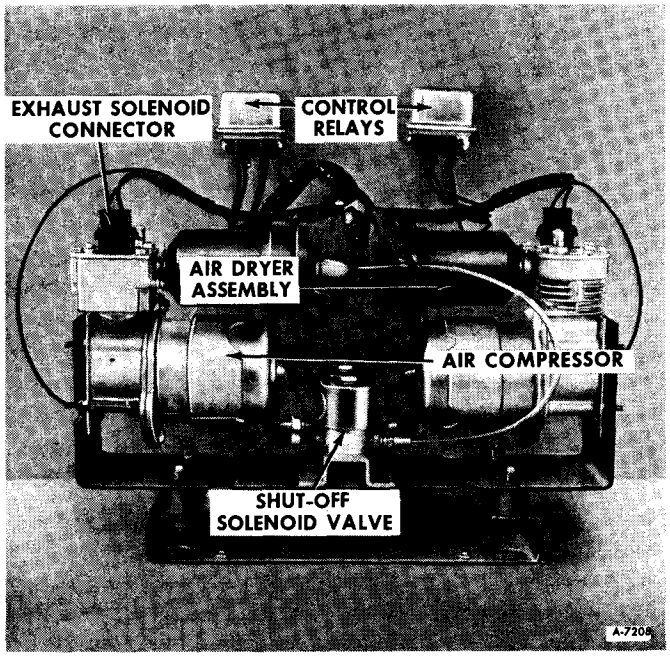


Figure 2—Type II Rear Suspension—Electro-Level II

coil (when the valve is "energized") the plunger either opens or seals an orifice, thereby controlling the flow of air.

The solenoid valve has two basic functional parts: a solenoid coil and a plunger or armature. The coil surrounds the plunger which has a soft synthetic seal at one end . The valve body has an orifice which is sealed by the insert in the plunger. The orifice is opened or closed by the movement of the plunger. The coil causes the plunger to move when the coil is energized. When the coil is de-energized the plunger is returned to its original position by means of a spring.

The only moving parts of the valve are the plunger and the spring which are enclosed in the sleeve assembly. This arrangement within the sleeve is referred to as an internal solenoid. The plunger closes the negative circuit of the coil by coming into "face to face" contact with the stop. The stop, magnetic steel, is welded to a nonmagnetic stainless steel flange to make up the sleeve assembly. The "face to face" design permits the plunger to be spring loaded for positive operation regardless of valve mounting position.

ELECTRONIC HEIGHT SENSOR
(FIGURE 10)

There are two height sensors, one for each side of the vehicle. The height sensor is an

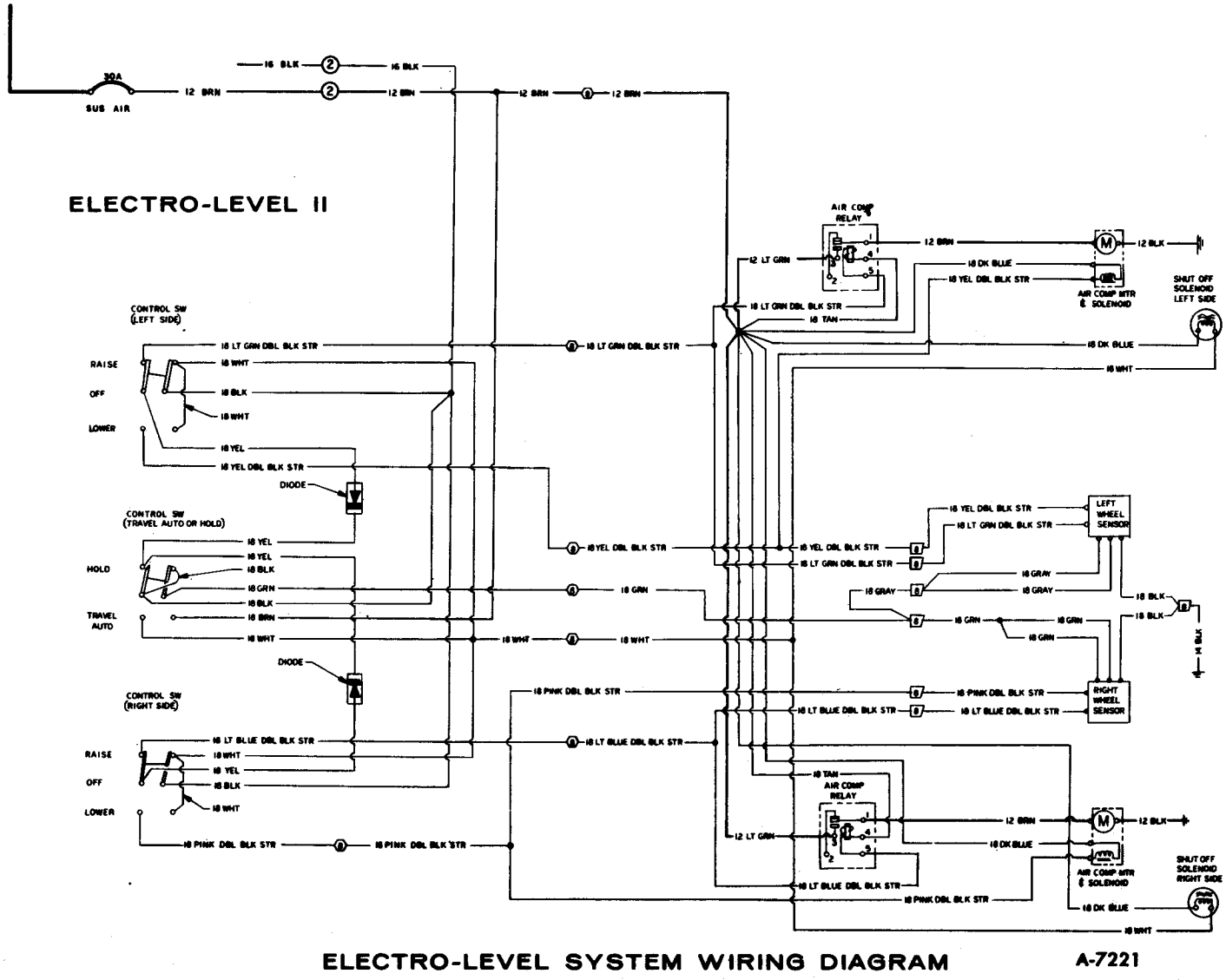


Figure 3—Electro-Level II System Wiring Diagram

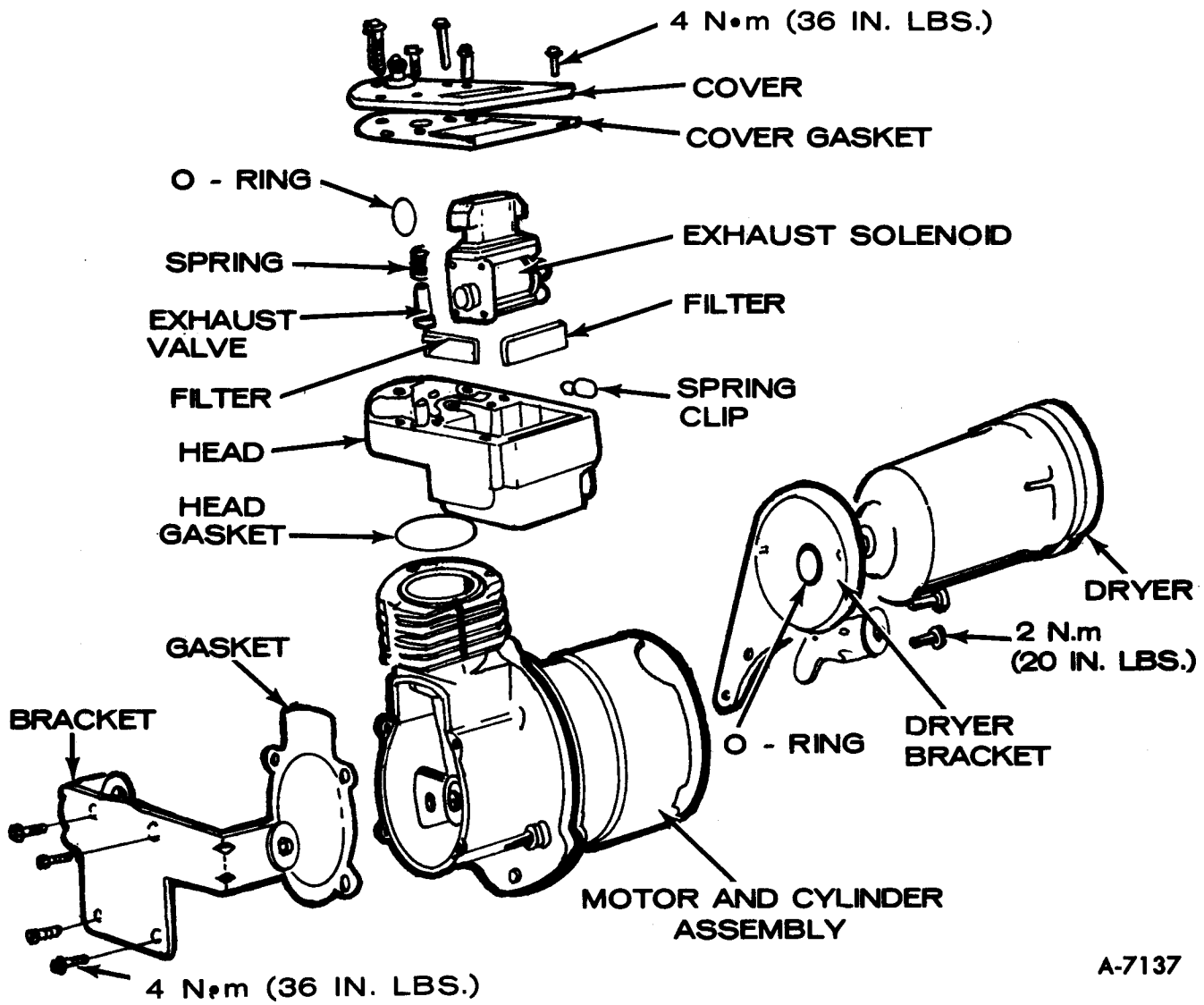


Figure 4—Compressor Components

electronic device that controls two basic circuits:

1. The compressor relay coil ground circuit.
2. Exhaust solenoid coil ground circuit.

The height sensor, through the use of photo couplers , can determine rear trim height and provide the necessary system response to do one of three things:

1. determine that the rear trim height (either side) is low and provide a ground circuit for the compressor relay, operate the compressor to inflate the air bellows and raise the rear of the vehicle (either side);

2. determine that the rear trim height (either side) is high and provide a ground circuit for the exhaust solenoid, deflate the bellows and lower the rear of the vehicle, or

3. determine that the rear trim height is correct and maintain that position by not grounding the relay or the solenoid.

The actual method by which the height sensor senses the need for air is through the use of two optic devices known as photo couplers, which consist of a light-emitting diode and a light-sensitive transistor.

These devices are powered any time the ignition is "ON". Depending upon rear standing height, a shutter is used to block or allow light from the light emitting diode to reach the light sensitive transistor (figure 11). With light in contact with the transistor, it is "ON"; with no light it is "OFF." As shown, both transistors "ON" results in compressor relay activation and in turn, compressor operation; both transistors "OFF" results in exhaust solenoid operation, and one transistor "ON"—one "OFF" is interpreted as trim, or correct ride height.

The height sensor, besides providing these two basic functions, also has time circuits

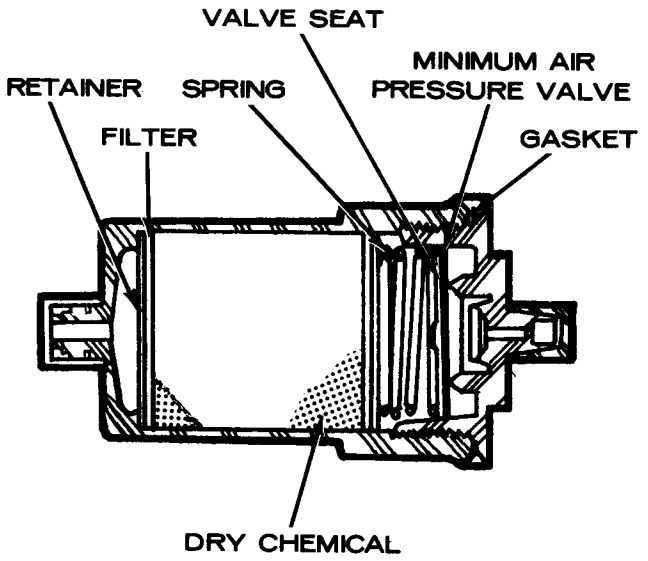


Figure 5—Air Dryer Detail

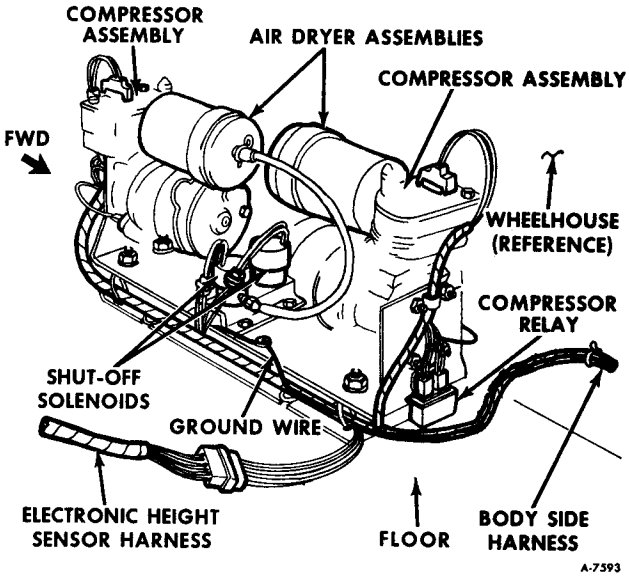


Figure 7—Compressor Wiring—Electro-Level II (TRANSMODE)

built into its operation. One is a 14-28 second delay any time height sensor arm movement calls for compressor or exhaust solenoid activation. This is done to rule out any false cycling caused by temporary changes in trim height. Another feature of the height sensor is the "dead band"—the capability of the sensor to tolerate as much as a 5^{0} amount of movement with no action forthcoming.

HEIGHT SENSOR CONNECTOR

An oval connector lock is included at the wiring connector to the height control sensor.

If harness disconnection is required, squeeze the oval sides of the connector lock to release the two locking tabs and pull the harness connector from the height sensor plug.

To assure proper circuit connections, the height sensor plug has an indexing slot and a matching boss is molded into the outer dia-

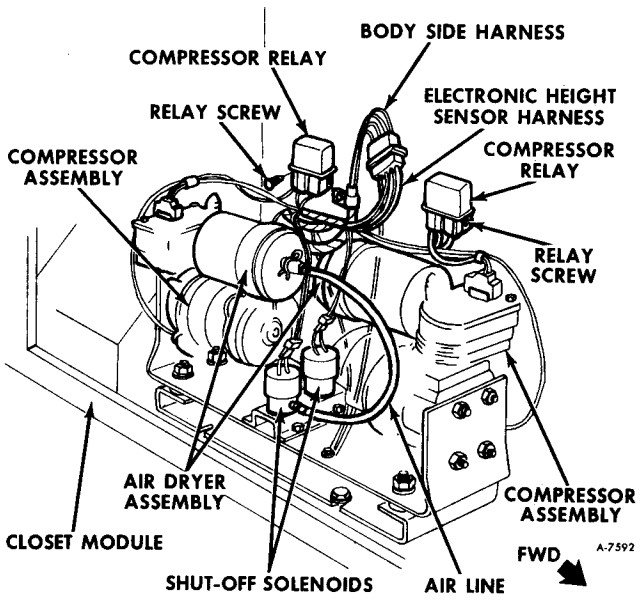


Figure 6—Compressor Wiring—Electro-Level II (MOTORHOME)

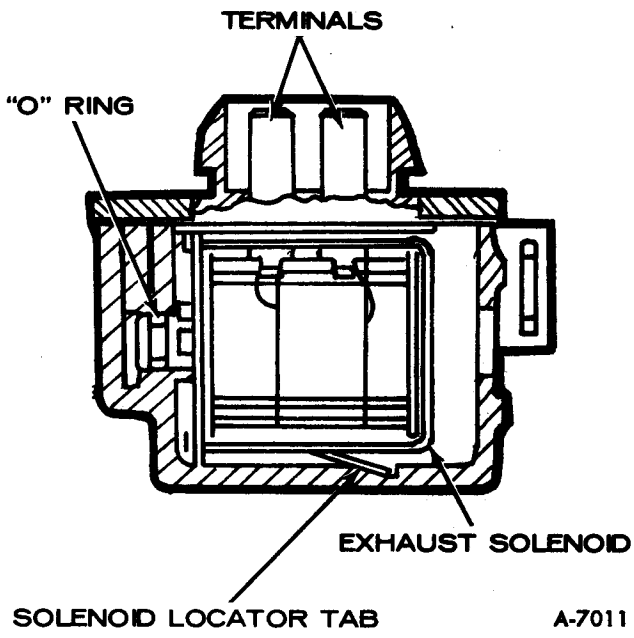


Figure 8—Exhaust Solenoid In Compressor Casting

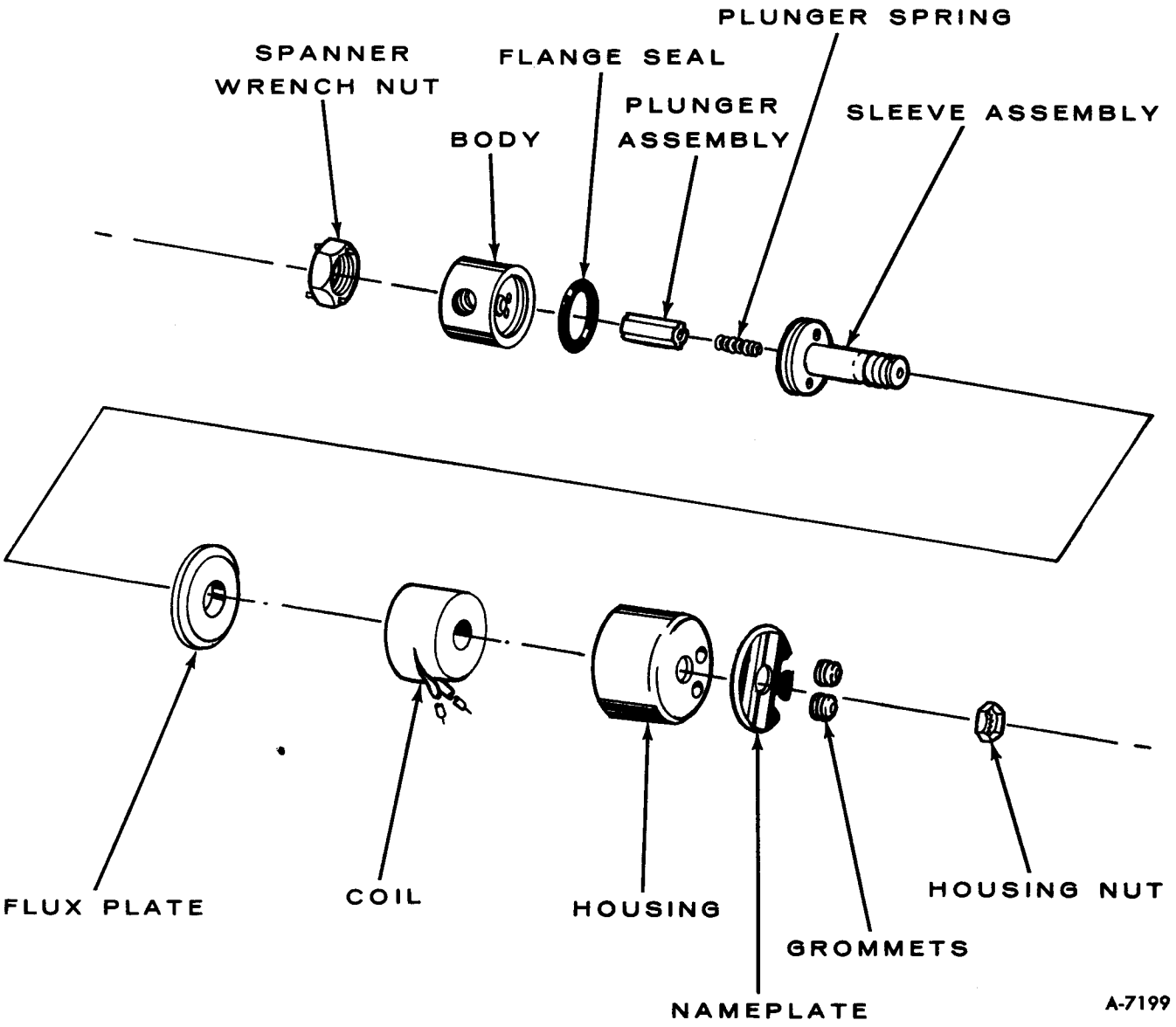


Figure 9—Solenoid Valve Components

meter of the weatherproof connector.

When reconnecting the harness to the sensor, push the connector into the sensor plug until the sloped shoulder on the rear edge of the boss it is visible in the plug slot, then push the oval connector lock onto the plug until its two locking tabs snap over the shoulder of the sensor plug. Refer to figure 12 for view of height sensor harness routing.

AIR LINES AND FITTINGS

Clear flexible air lines of 1/8 inch diameter tubing are used to attach the air dryer to the shut-off solenoid (see figures 6 and 7). A new type of "snap-on" connector attaches the tubing to the dryer. When the air line is

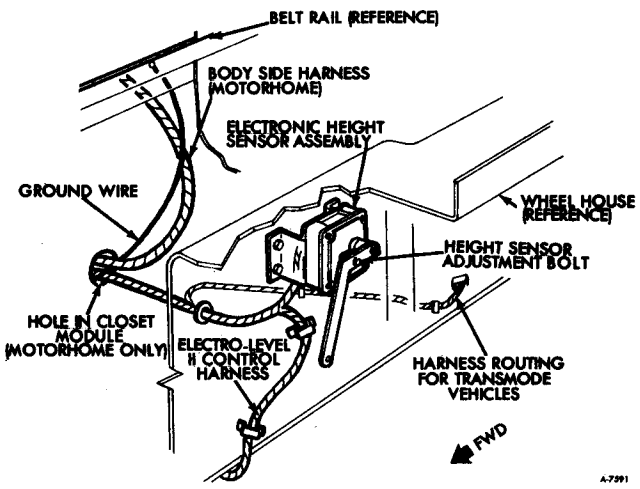


Figure 10—Electronic Height Sensor Wiring

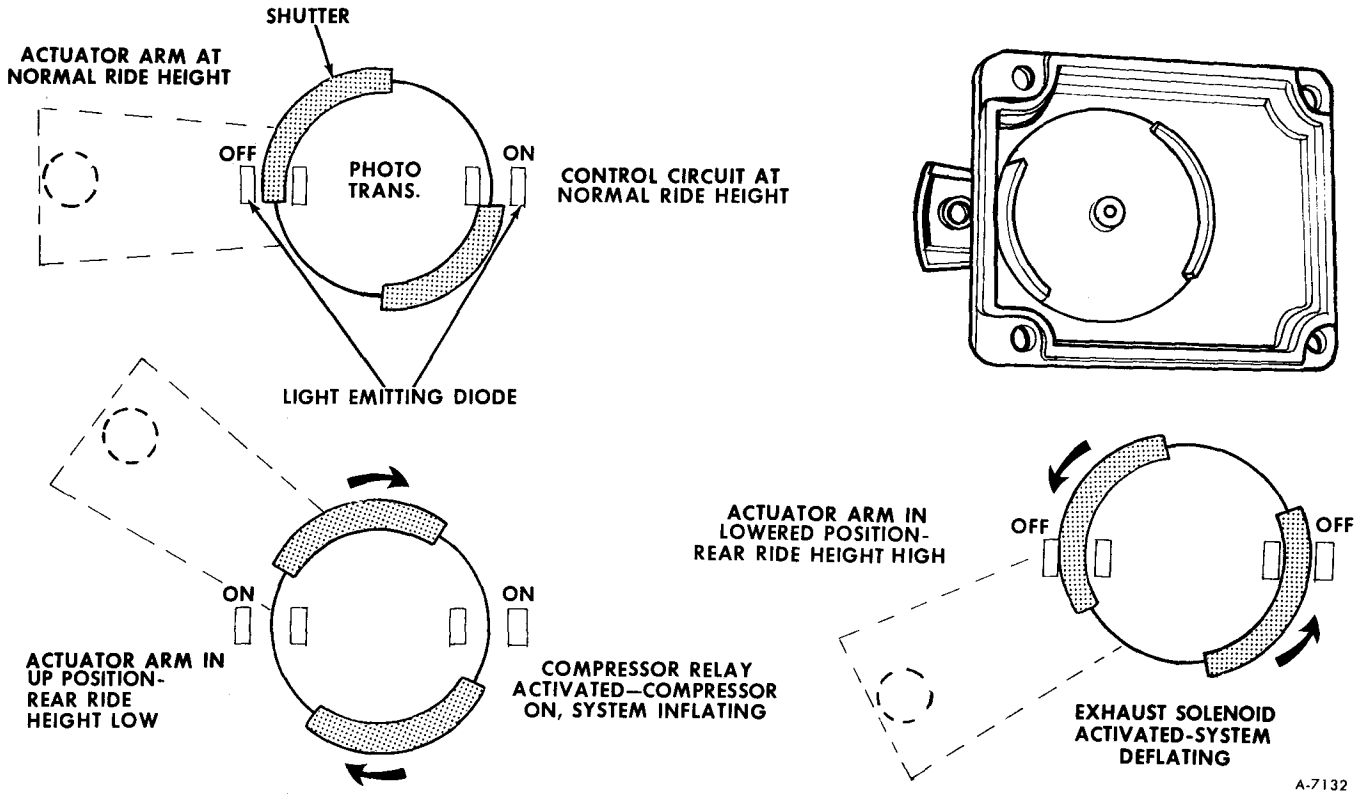


Figure 11—Electronic Height Sensor Light Shutter Operation

attached to the fitting at the air dryer, a retainer clip snaps into a groove in the fitting, locking the air line into position (figure 13).

To remove the air line, rotate the retainer clip 90° to release it from the groove and pull on the air line.

NOTE: While the lines are flexible for easy routing and handling, care should be taken not to kink them.

Additional nylon tubing is used for remaining rear suspension air lines, connecting output side of shut off solenoid to air bellows (one air line for each side of vehicle). (Refer to figure 14). This tubing is flexible, durable and weather resistant.

Whenever threaded fitting on rear suspension is disassembled for any reason, be sure threads on male portion of fitting are wrapped with teflon tape or equivalent to avoid air leakage.

CONTROL PANEL

The Electro-Level control panel is mounted to the left of the driver's seat, in the side interior trim panel (figure 15). The controls consist of three rocker switches that automatically or manually level the vehicle.

The two RAISE-LOWER switches are used as necessary to raise or lower the rear of the vehicle (as when parked on surface that is not level). Engine need not be running to operate the system in either of these modes. However, the ignition switch must be in the "ON" or "ACCESSORY" position.

The center TRAVEL SWITCH has two positions—TRAVEL HOLD and TRAVEL AUTO.

TRAVEL HOLD is the switch position to be used for normal highway driving. This mode allows the vehicle to maintain a designed ride height and eliminates unnecessary operation of the air compressor. TRAVEL AUTO is the position to be used to "ready" the vehicle for highway driving after it has been parked in a raised or lowered position. This leveling of the vehicle will take place in the first five minutes with the rocker switch in TRAVEL AUTO position.

AIR BELLOWS

The air bellows for the tandem rear wheels are mounted between the control arms. On

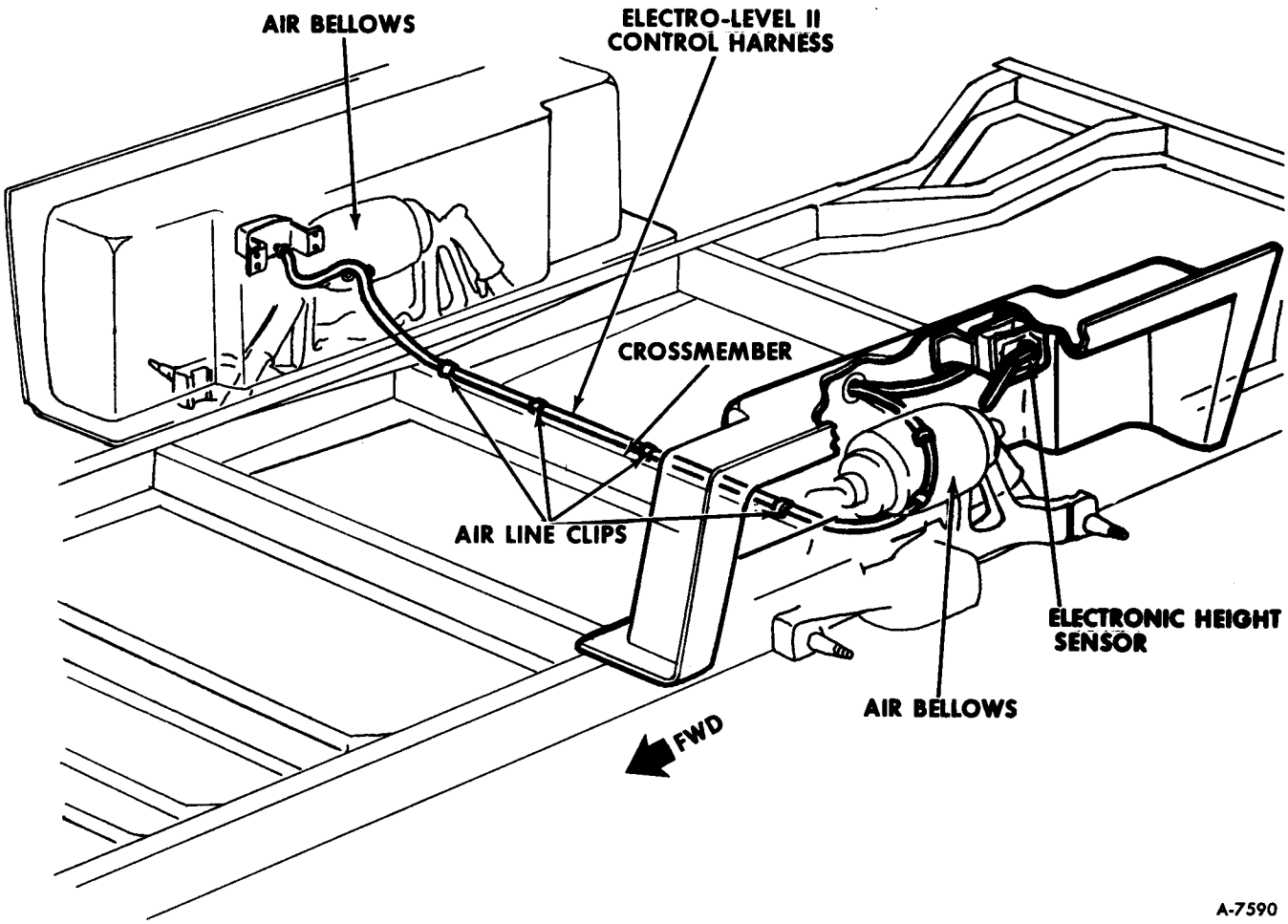


Figure 12—Height Sensor Harness Routing

each side of the air bellows is a piston which is connected directly to the control arm.

The air bellows serve as a flexible connection between the two control arms on each side of suspension bracket. The flexing of the air bellows allows the control arms to move up and down in relation to the frame. This action absorbs road shocks in the same manner as an inflated rubber tire cushions shock caused by road roughness.

CONTROL ARMS
(FIGURE 16)

The rear suspension control arms (one on either side of air bellows) attach to a control arm mounting bracket which in turn mounts to the vehicle frame rail. The control arms support the air bellows and the tandem rear wheels.

SHOCK ABSORBERS

A double acting shock absorber is used at

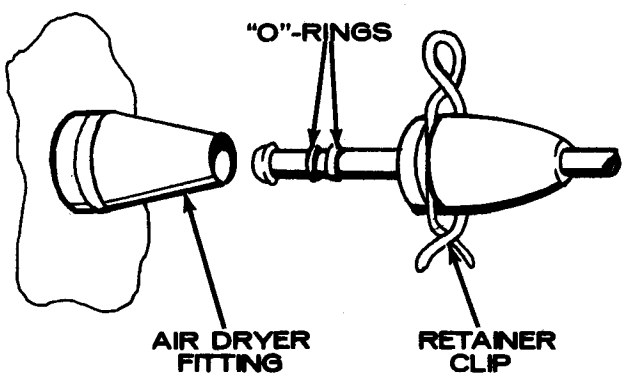


Figure 13—Connecting Air Line to Air Dryer

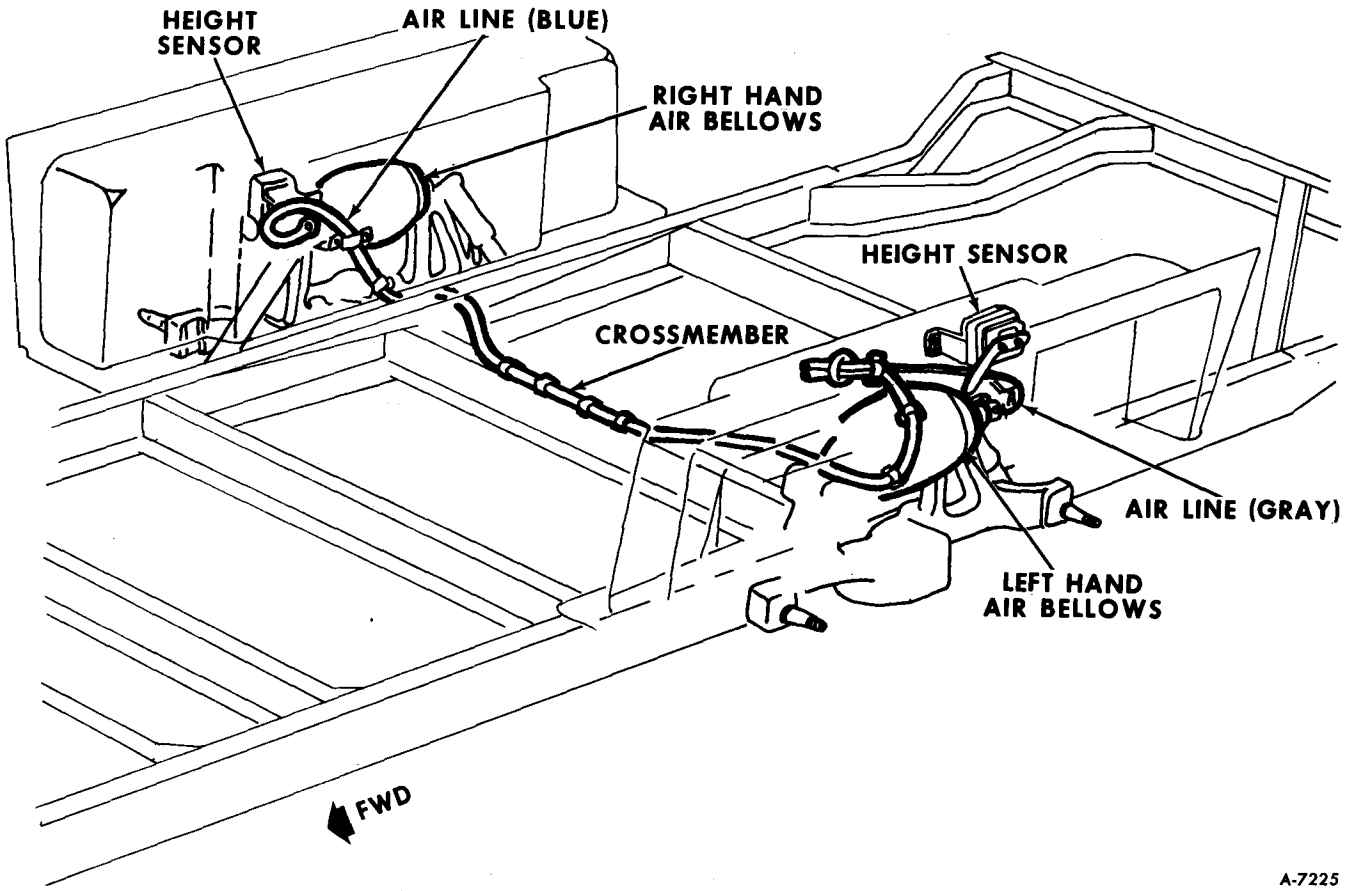


Figure 14—Rear Suspension Air Hose Routing
(Electro-Level II)

each wheel on the rear suspension. The shocks are mounted to the control arms and to the frame.

The shock absorbers are gas filled celltype shocks. They are filled with a calibrated amount of fluid and sealed during production. They are nonadjustable, nonrefillable and cannot be disassembled. The only service they require is replacement if they have lost their resistance, are damaged or leaking fluid.

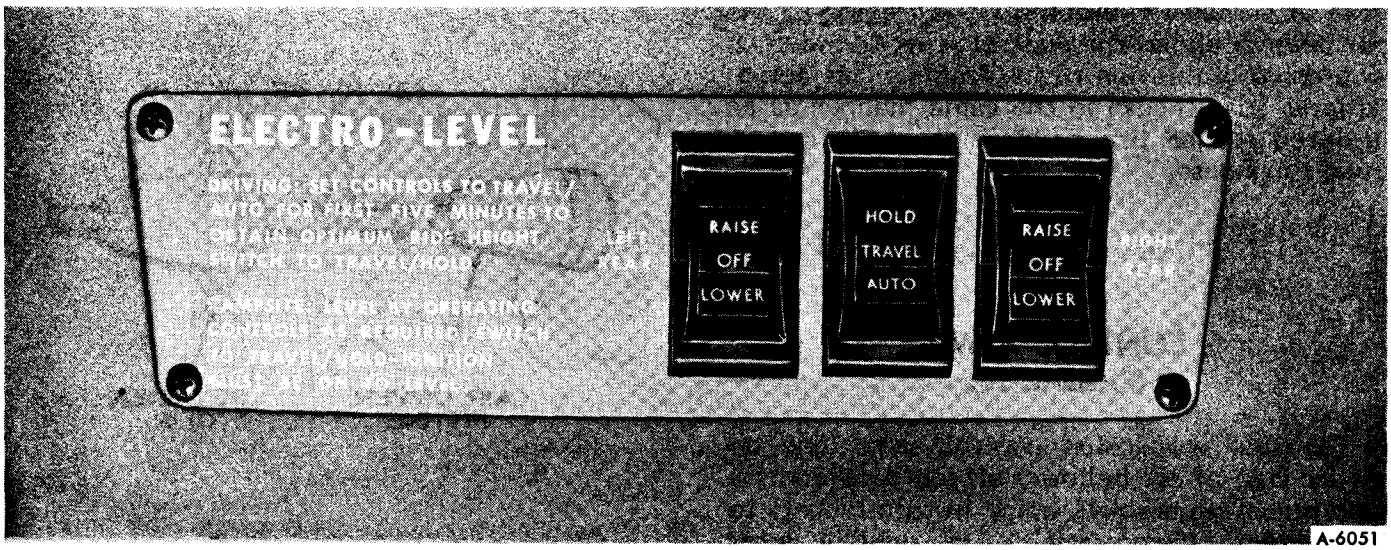


Figure 15—Electro-Level Control Panel

DIAGNOSIS OF REAR SUSPENSION SYSTEM (1978)

SYSTEM OPERATION CHECK

1. Check to see that vehicle is at recommended ride height. If correction is necessary, adjust as described later in this section.
2. Start and run engine.
3. Set Electro-Level controls for LOWER (both sides) and lower vehicle approximately 2-3 inches. Then put right and left side switches in OFF and move TRAVEL switch to AUTO.

a. There should be a 14-28 second delay before compressor turns on and vehicle starts to raise.

b. Vehicle should raise to within ¼" of measurement made in Step 1 by the time the compressor shuts off. If vehicle does not raise, refer to diagnosis charts.

4. Set Electro-Level controls for RAISE (both sides) and raise vehicle approximately 2-3 inches. Then put right and left-side switches in OFF and move TRAVEL switch to AUTO.

a. There should be a 14-28 second delay before vehicle starts to lower.

b. Vehicle should lower to within ¼" of measurement made in Step 1 in approximately 5 minutes. If vehicle does not lower, refer to diagnosis charts in this section.

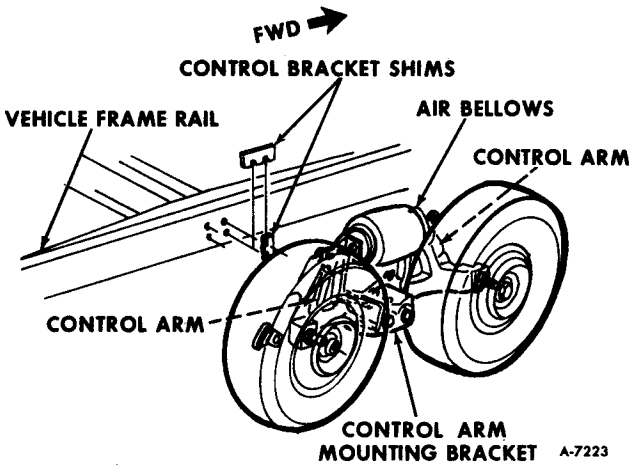


Figure 16—Rear Suspension Control Arms And Mounting Bracket

COMPRESSOR/DRYER PERFORMANCE TEST

COMPRESSOR CURRENT DRAW, PRESSURE OUTPUT AND LEAKDOWN TEST

1. Disconnect wiring from compressor motor and exhaust solenoid terminals.

2. Disconnect existing air line from dryer and attach pressure gage J-22124-A to dryer fitting (refer to figure 17).

3. Connect ammeter to 12-volt source and to compressor as shown in figure 17.

a. Current draw should NOT exceed 14 amps.

b. When gauge reads 110-120 psi, SHUT COMPRESSOR OFF and observe if pressure leaks down.

NOTE: If compressor is permitted to run until it reaches its maximum output pressure, the solenoid exhaust valve will act as a relief valve. The resulting leak down when compressor is shut off will indicate a false leak.

c. Leak down—pressure should not drop below 90 psi when compressor is shut off.

4. Refer to compressor/dryer diagnosis chart if compressor fails to meet specification.

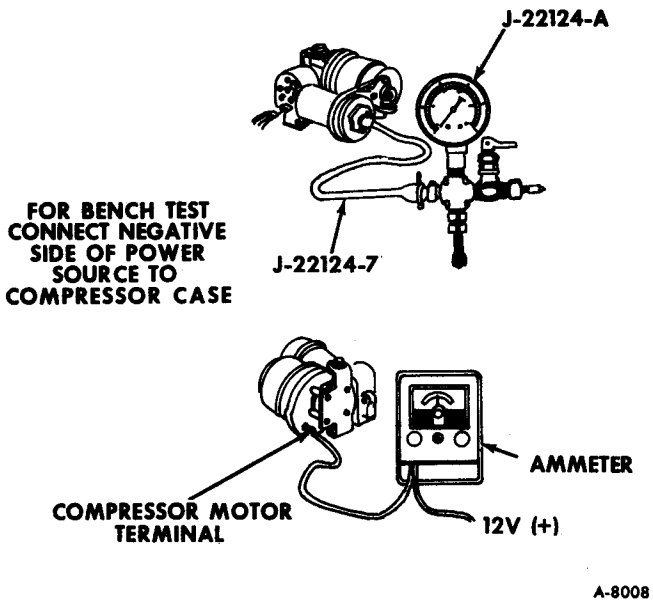


Figure 17—Testing Compressor Performance

DIAGNOSIS OF COMPRESSOR/DRYER

PROBLEM	CORRECTION
1. Current draw exceeds 14 amps.	1. Replace motor cylinder assembly.
2. Compressor inoperative.	2. Replace motor cylinder assembly.
3. Pressure build up OK but leaks down below 90 psi before holding steady.	3. Replace solenoid exhaust valve assembly.
4. Compressor pressure leaks down to 0 psi.	4. Leak test compressor/dryer assembly. Refer to "Compressor Leak Test Procedure."
5. Compressor output less than 11 psi and current draw normal.	5. Perform compressor/dryer leak test. If no leak is found, replace motor cylinder assembly.

COMPRESSOR LEAK TEST

1. Attach pressure gauge J-22124A to dryer (refer to figure 17) and pressurize compressor/dryer assembly to 100 psi through the gauge fill valve.

2. Using soap bubble solution, check following items (see figure 18):

a. dryer O-ring casting bore.

b. service valve (tighten or replace as required).

c. around edge of cover gasket (if leak is found, check torque of cover bolts before replacing gasket).

d. around edge of solenoid valve terminal housing (replace solenoid valve if leak is found).

e. head casting air intake and exhaust opening (replace solenoid valve if leak is found).

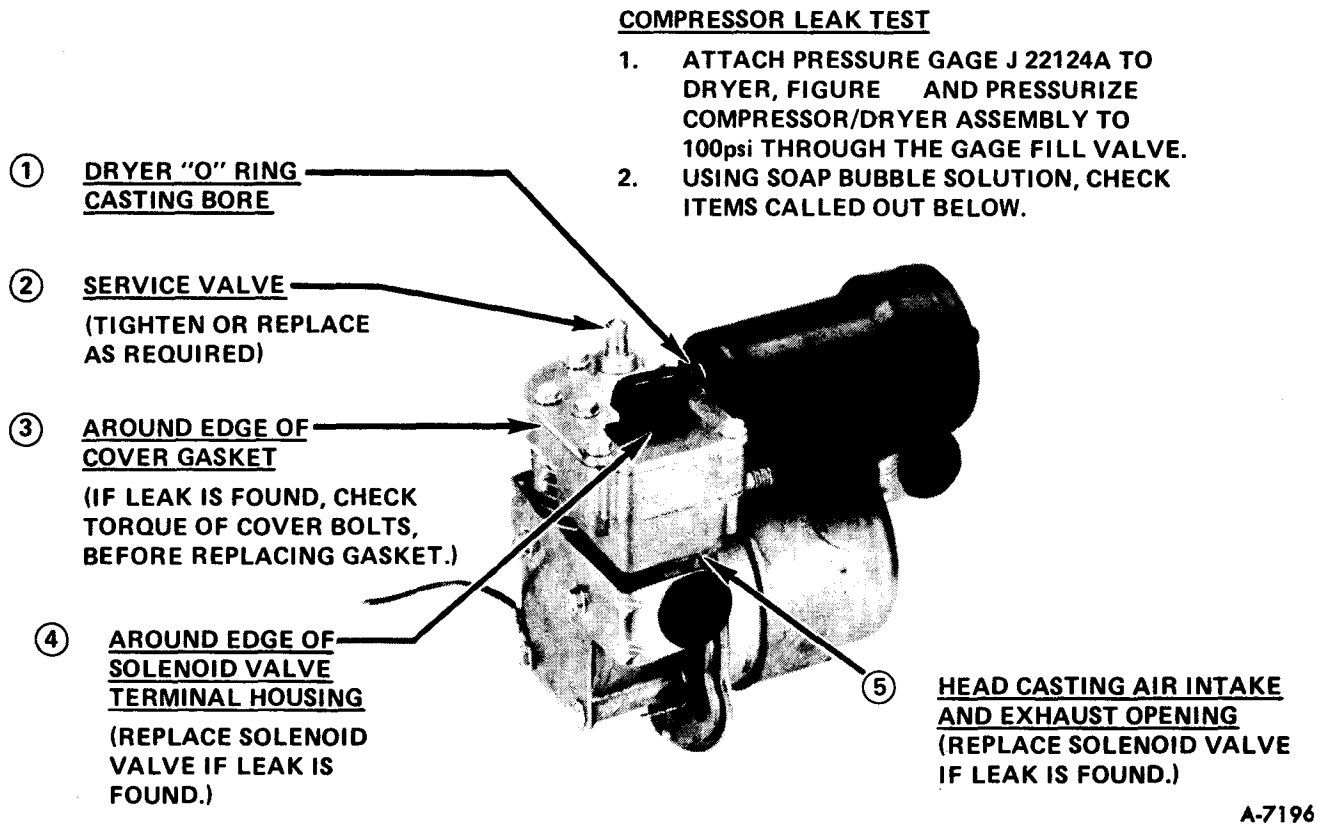


Figure 18—Compressor Leak Test

DIAGNOSIS OF AIR COMPRESSOR

PROBLEM	POSSIBLE CAUSE	CORRECTION
COMPRESSOR NOT OPERATING	1. Open circuit breaker. (Circuit breaker is located behind glove box door.)	1. Find cause of circuit breaker being open and correct it.
	2. Faulty wiring. (Compressor ground wire or height sensor ground wire not connected.)	2. Check to see that wiring is intact.
	3. Low battery.	3. The compressor runs off the automotive battery. Check battery condition and correct as necessary.
	4. Defective relay.	4. Replace relay.
	5. Compressor motor has developed an open circuit.	5. Motor brushes or commutator worn out. Replace motor.
	6. Defective diode.	6. Replace diode assembly in wiring harness. Refer to "Testing Diode Assemblies" in this section.
COMPRESSOR OPERATES. NO AIR PRESSURE.	1. Leak in air system.	1. Eliminate air leaks in system as described later in this section.
	2. Piston rings are worn—air leaks heavily at rings.	2. Replace compressor.
AIR PRESSURE IN SYSTEM. COMPRESSOR OPERATES ERRATICALLY—TAKES TOO LONG TO PRESSURIZE SYSTEM.	1. Air leak in system.	1. Eliminate air leaks in system as described later in this section.
	2. Compressor worn—air leaks heavily by rings.	2. Replace compressor.
	3. Battery voltage too low to operate motor.	3. Charge battery.

DIAGNOSIS OF ELECTRO-LEVEL CONTROLS

PROBLEM	POSSIBLE CAUSE	CORRECTION
COMPLETE OR PARTIAL LOSS OF AIR WITH TRAVEL SWITCH IN "HOLD".	1. Leak in air bellows.	1. Eliminate air leak.
	2. Leak at air lines between bellows and solenoid.	2. Eliminate air leak.
	3. Leak in 2-way solenoid.	3. Service or replace solenoid.
COMPLETE OR GRADUAL LOSS OF AIR OVERNIGHT AT CAMPSIGHT WITH IGNITION OFF.	1. Leak at air bellows.	1. Eliminate air leak.
	2. Leak in air line between solenoid and bellows.	2. Eliminate air leak.
	3. Leak at fitting between solenoid and air line or bellows and air line.	3. Eliminate air leak.
	4. Defective 2-way solenoid.	4. Service or replace solenoid.
COMPLETE OR PARTIAL LOSS OF AIR WITH TRAVEL	1. Air leak in system.	1. Eliminate air leak. Note: Vehicle should be operated with travel switch in "HOLD"

DIAGNOSIS OF ELECTRO-LEVEL CONTROLS (CONT'D)

PROBLEM	POSSIBLE CAUSE	CORRECTION
SWITCH IN "AUTO" IGNITION ON (COMPRESSOR RUNS TOO FREQUENTLY).		position. Do not operate vehicle with travel switch in "AUTO".
	2. Defective height sensor.	2. Replace sensor.
TRAVEL SWITCH IN "AUTO". VEHICLE WILL NOT RAISE OR LOWER.	1. Compressor not operating.	1. Check compressor ground wire.
	2. Defective control switch.	2. Replace switch.
	3. Defective wiring.	3. Check wiring and electrical connections.
	4. Defective relay.	4. Replace relay.
	5. Defective solenoid valves.	5. Service or replace solenoid valves.
	6. Leak at air bellows.	6. Eliminate air leak.
	7. Leak in air lines.	7. Eliminate leak.
	8. Defective height sensor.	9. Replace height sensor.
VEHICLE DOES NOT RAISE WITH LEFT OR RIGHT SWITCH IN "RAISE" POSITION, BUT COMPRESSOR RUNS.	1. Leak in air bellows.	1. Eliminate air leak.
	2. Leak in air lines.	2. Eliminate air leak.
	3. Faulty 2-way solenoid valve.	3. Service or replace valve.
	4. Faulty control switch.	4. Replace switch.
	5. Defective wiring between control switch and solenoid.	5. Check wiring and electrical connections.
VEHICLE DOES NOT RAISE WITH LEFT OR RIGHT SWITCH IN "RAISE" POSITION. COMPRESSOR DOES NOT OPERATE.	1. Open circuit in compressor motor.	1. Motor brushes or commutator worn out. Replace motor.
	2. Defective relay.	2. Replace relay.
	3. Battery undercharged.	3. Charge or replace automotive battery.
	4. Defective diode.	4. Replace diode.
	5. Defective wiring. (Compressor feed at ground wire not connected.)	5. Check wiring and electrical connections.
	6. Open circuit breaker.	6. Check for cause of open circuit breaker. Correct cause.
	7. Faulty control switch.	7. Replace switch.
VEHICLE DOES NOT LOWER WITH LEFT OR RIGHT SWITCH IN "LOWER" POSITION.	1. Undercharged battery.	1. Charge or replace battery.
	2. Defective wiring.	2. Check wiring and electrical connections.
	3. Open circuit breaker.	3. Find cause for open circuit breaker. Reset.
	4. Defective 2-way solenoid valves.	4. Service or replace solenoid valves.
	5. Defective control switch.	5. Replace switch.

DIAGNOSIS OF TELL-TALE WARNING LIGHT "SET LEVEL TO TRAVEL AUTO"

(REFER TO FIGURE 19)

PROBLEM	POSSIBLE CAUSE	CORRECTION
START VEHICLE. MOVE TRANSMISSION SELECTOR LEVER TO "DRIVE" POSITION. TELL-TALE LIGHT DOES NOT ILLUMINATE.	1. Defective bulbs (two bulbs.) 2. Defective time-delay relay. 3. Defective tell-tale warning light fuse. 4. Defective wiring. 5. Defective neutral start, B/U, and safety switch.	1. Replace light bulbs. 2. Replace thermal time-delay relay (located behind instrument panel). (Refer to Section 12 of this supplement.) 3. Replace fuse. (Fuse is located in fuse panel behind glove compartment). 4. Check wiring and electrical connections. 5. Adjust switch or replace as necessary.
START VEHICLE. MOVE TRANSMISSION LEVER TO "DRIVE" POSITION. TELL-TALE LIGHT ONLY PARTIALLY ILLUMINATES.	1. Defective light bulb. (Two bulbs.)	1. Replace burnt out bulb.
START VEHICLE. MOVE TRANSMISSION LEVER TO "DRIVE" POSITION. TELL-TALE LIGHT REMAINS ON AFTER 10-15 SECOND DELAY.	1. Defective time-delay relay.	1. Replace relay.
START VEHICLE. TELL-TALE LIGHT INTERMITTENTLY LIGHTS WHEN MOVING TRANSMISSION SELECTOR LEVER TO "DRIVE"	1. Defective time-delay relay. 2. Defective neutral start, B/U and safety switch.	1. Replace relay. 2. Adjust switch or replace as necessary.

HEIGHT SENSOR OPERATION CHECK

1. Cycle ignition switch "OFF" then "ON". This will assure resetting the height sensor timer circuits.

2. Check that wiring is properly and securely connected to height sensor and harness ground wire is securely connected.

3. Disconnect link from height sensor arm.

4. Move metal sensor arm up. There should be a 14-28 second delay before compressor

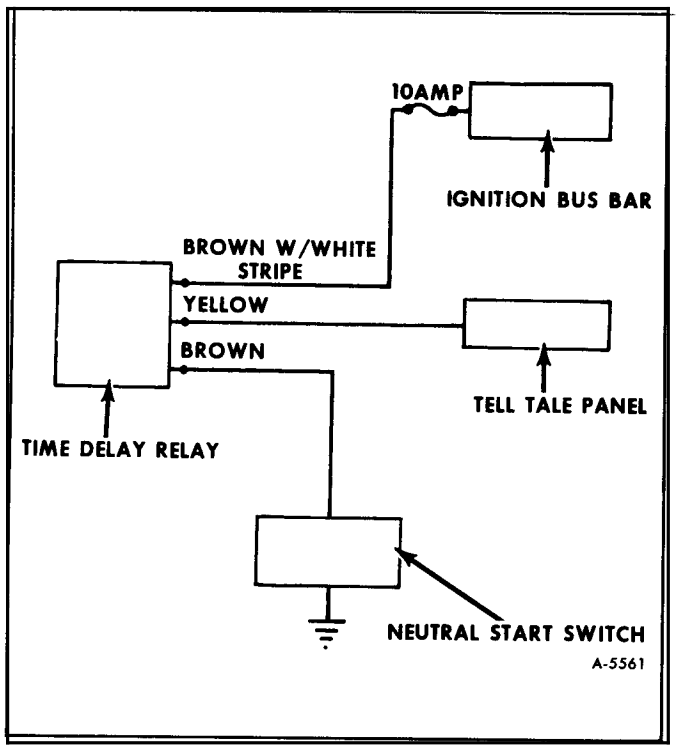


Figure 19—Tell-Tale Warning Light Schematic

turns "ON" and bellows start to inflate. As soon as air bellows noticeably fill, stop compressor by moving sensor arm down.

5. Move sensor arm down below position where compressor stopped. There should be a 14-28 second delay before bellows start to deflate and vehicle lowers.

DIAGNOSIS OF SHOCK ABSORBER

Refer to sub-section 4A of this section for Shock Absorber diagnosis.

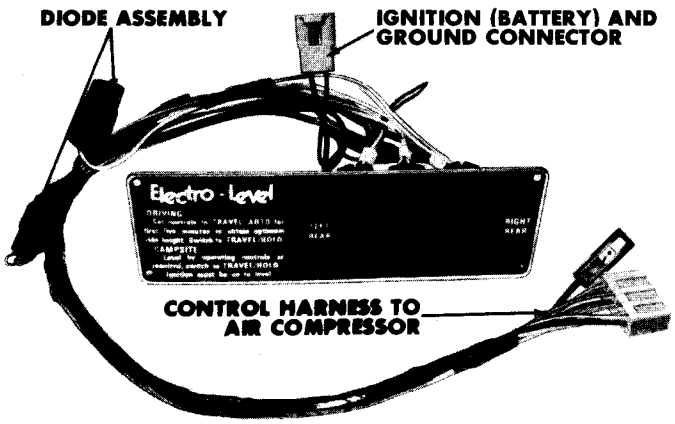


Figure 20—Location of Diodes

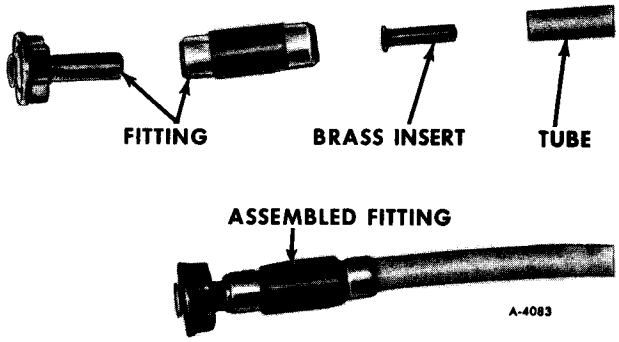


Figure 21—Coupling Assembly

TESTING DIODE ASSEMBLIES

With the Electro-Level suspension system there are two diode assemblies in the wiring harness near the control panel (figure 20). These prevent cross-feed between right and left side systems when used in manual mode.

These diodes can be tested using an ohmmeter. Holding two meter leads to either side of diode, measure the resistance in one direction. Reverse the test lead connections to measure the resistance in the other direction. If the diode is good, the resistance in one direction will be much higher than the resistance in the other direction. If diode does not test good, replace.

AIR LEAKS

With the suspension system at normal operating pressure coat air line connections with soap and water solution. Air leakage will produce soap bubbles. No leakage is permissible. Leakage at air line connections (between dryer and bellows) can sometimes be stopped by tightening connection. If this does not stop the leak replace the affected fitting(s) as follows:

1. Cut end of hose (tube) off square.
2. Place brass insert into end of tube and put appropriate fitting over it (figure 21).
3. Crimp fitting in place with Special Tool J-25520. This tool is designed so that crimp must be completed before tool will release (figure 22).
4. Air line (gray or blue line) leaks can be

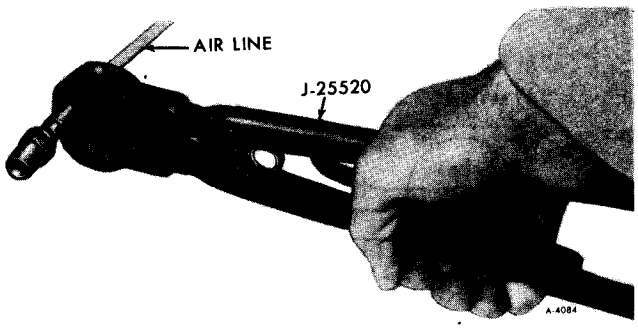


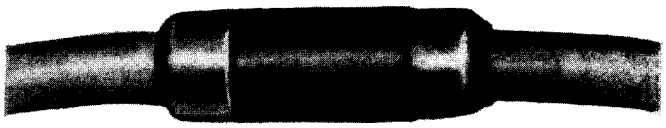
Figure 22—Special Tool J-25520 Crimping Air Line

repaired with the coupling illustrated in figure 23.

NOTE: This crimping procedure applies only to $\frac{1}{4}$" I.D. air lines, connecting compressors and bellows.

DIAGNOSIS OF "SHUT-OFF" SOLENOID VALVES

If "shut-off" solenoid does not appear to be functioning properly, check to see that connections to air lines are not reversed. If solenoid is properly installed and still appears to malfunction, remove solenoid and use the following procedure to bench check solenoid. If solenoid fails bench test, unit can be



A-4085

Figure 23—Air Line Repair Coupling

disassembled for cleaning and inspection. Plunger, spring and seal are available for service replacement. If replacing entire solenoid unit, be sure to use equivalent solenoid valve.

BENCH CHECK OF SOLENOID

An air source of approximately 50-100 psi and an electrical 12-volt source are required for bench test of the solenoid. Apply air pressure to the supply, or "INLET" port of the solenoid. Because this is a two-way normally closed valve, air should be stopped internally (no air at "OUTLET" port). With 12 volts applied (solenoid energized) air should flow from inlet to outlet port.

MAINTENANCE AND ON-VEHICLE ADJUSTMENTS

MAINTENANCE

No routine maintenance is required on Type II rear suspension systems other than an occasional check of the air bellows to see if they are caked with mud deposits. If deposits are present, remove them from bellows.

LUBRICATION

Details on lubrication of rear suspension components are covered in Section O of Maintenance Manual X-7525.

REAR WHEEL ALIGNMENT

Refer to subsection 4A of this section for "Rear Wheel Alignment" procedure.

RIDE HEIGHT ADJUSTMENT
(FIGURE 24)

Rear suspension ride height is measured at the elongated slot on the frame rail. (Refer to figure 21.)

To adjust vehicle ride height:

NOTE: Link should be attached to actuator arm when making the adjustment.

1. Loosen adjustment bolt on height control sensor. The actuator arm has an elongated hole at the adjustment bolt. This allows the actuator arm to move in relation to the height sensor itself.
2. To increase vehicle ride height, move actuator arm upward and tighten adjustment bolt.

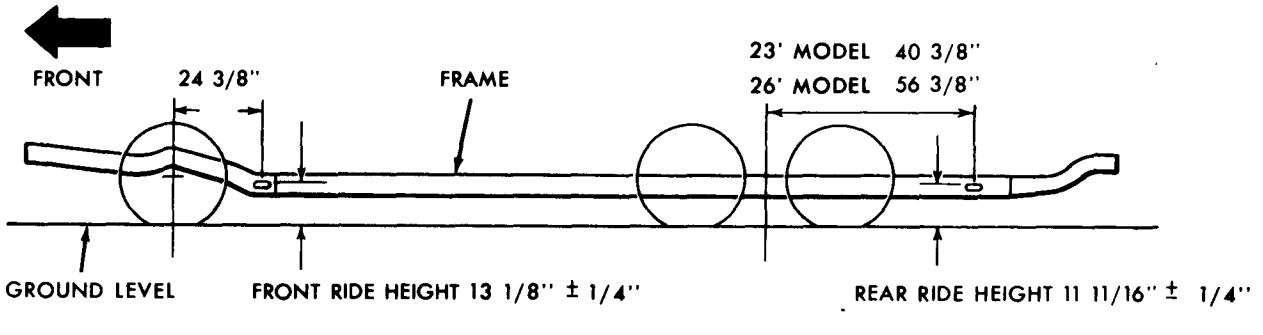


Figure 24—Checking Vehicle Ride Height

NOTE: If all adjustment is used up, check vehicle ride height at frame rail. Refer to figure 24.

3. To lower vehicle ride height, move actuator arm downward and tighten adjustment bolt.

4. If adjustment cannot be made, check for correct height sensor. (Sensor identification code for Motorhome and TransMode vehicles is "AL".)

Actuator arm is adjustable with respect to sensor ± 5°. Refer to figure 25.

COMPONENT REPLACEMENT

CAUTION: *Whenever it is necessary to support the rear suspension with jack stands or other supporting equipment, be sure the jack stands are used only at junction points of the frame rail and crossmember. Failure to locate jack stand as instructed could result in damage to frame of vehicle.*

COMPRESSOR AND BRACKET REPLACEMENT

REMOVAL

1. Disconnect battery ground cable.
2. Disconnect air line at solenoid output (both solenoids).
3. Disconnect solenoid and motor connectors.
4. Disconnect height sensor ground and Electro-Level wiring harness connector.

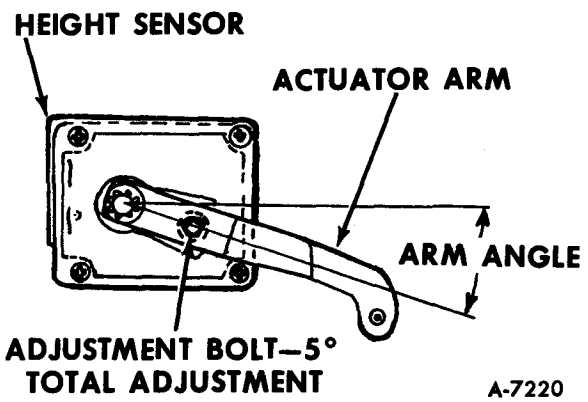


Figure 25—Height Sensor Adjustment

5. Remove relay to wall screws (Motorhome) or relay to compressor bracket screws (TransMode) and allow relays to hang free.
6. Remove riser bracket bolts and lift compressor mounting bracket (with riser bracket) out of compartment.
7. Disconnect air line at air dryer by revolving spring clip 90° while holding connector end and removing tube assembly.
8. Remove stud nuts securing compressor to mounting bracket, then remove compressor and dryer from bracket. Refer to figure 26.
9. If replacing compressor assembly, remove dryer bracket bolts and disconnect air dryer from compressor by revolving spring clip and pulling air dryer assembly away from compressor.

INSTALLATION

1. If compressor was replaced install dryer and bracket and torque dryer bracket bolts to 2 N.m (20 in. lbs.).
2. Install compressor assembly to mounting bracket and torque stud nuts (4 each compressor) to 2.8 to 4.0 N.m (24-36 in. lbs.).
3. Connect solenoid and motor connectors, and Electro-Level wiring harness connector.

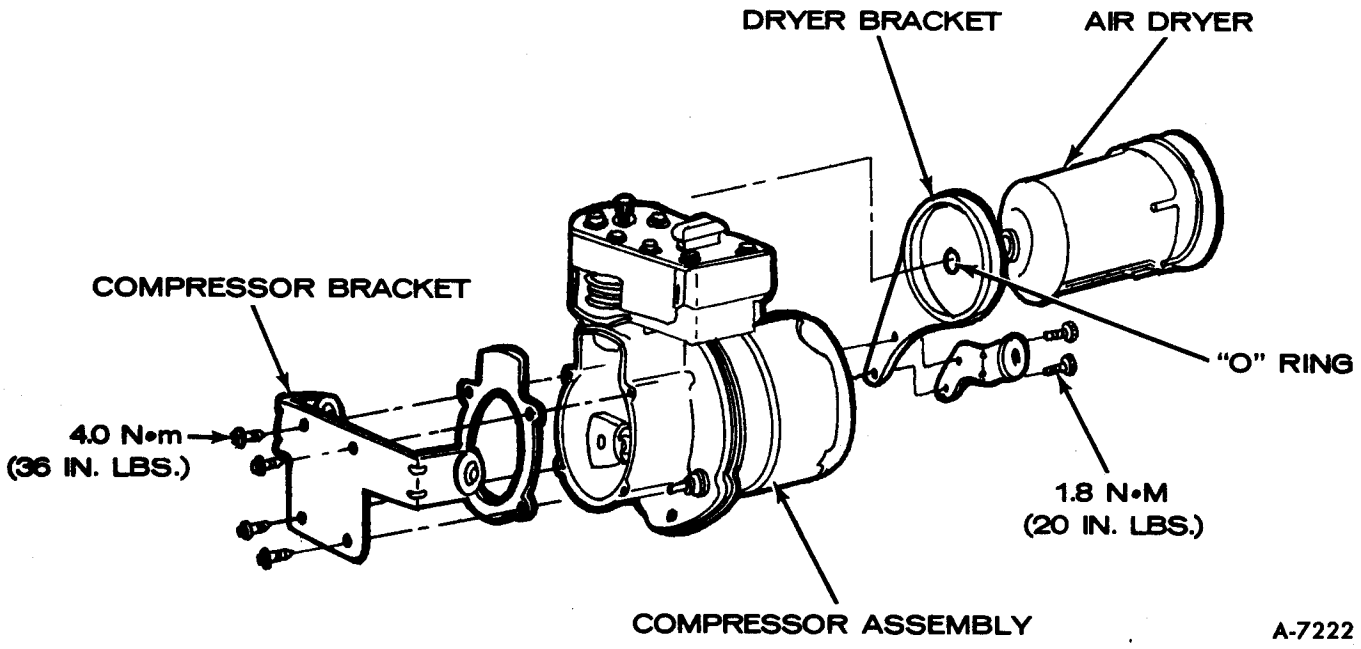


Figure 26—Compressor, Dryer and Mounting Brackets

Secure sensor ground wire at compressor mounting bracket.

4. Install four bolts mounting compressor riser bracket to floor.

5. Install relay attaching screws.

6. Rotate clip on air pressure line until clip snaps in groove, then connect air pressure line at air dryer.

7. Connect battery ground cable.

8. Turn ignition key "ON" and cycle air suspension system "ON" at control panel by pressing RAISE switch first for one side of vehicle, then for the other side. Check for system operation and leaks at air dryer. When satsified that system operation is OK, lower vehicle to normal ride height.

AIR DRYER REPLACEMENT

REMOVAL

1. Remove compressor and mounting bracket as described under "Compressor and Bracket Replacement".

2. Remove dryer bracket bolts and disconnect air dryer from compressor by revolving spring clip 90° and pulling air dryer assembly away from compressor. Remove O-ring from compressor lead.

INSTALLATION

Lubricate dryer O-ring with Vaseline or equivalent before installing dryer in head casting.

1. Reverse removal procedure.

2. Torque dryer bracket bolts to 1.8 N.m (20 in. lbs.). Refer to figure 26.

3. Check for leaks.

HEIGHT SENSOR REPLACEMENT

NOTE: Replacement height sensors are supplied without the mounting bracket.

REMOVAL

1. Disconnect battery ground cable.

2. Disconnect electrical connector from back of height sensor by squeezing sides of connector retainer.

3. Disconnect link from height sensor arm.

4. Remove height sensor bracket nuts from mounting plate and remove sensor and bracket.

INSTALLATION

1. Position sensor bracket to mounting plate and secure. Torque nuts to 95-120 in. lbs. Refer to figure 27.

2. Connect link to actuator arm and tighten nut to 60-90 ft. lbs.

3. Connect electrical connector to height sensor and snap retainer securely on sensor boss.

4. Make sure that ride height adjustment bolt is in center of slot.

5. Connect battery ground cable.

6. Check vehicle ride height. Refer to Specifications at the end of this section, and

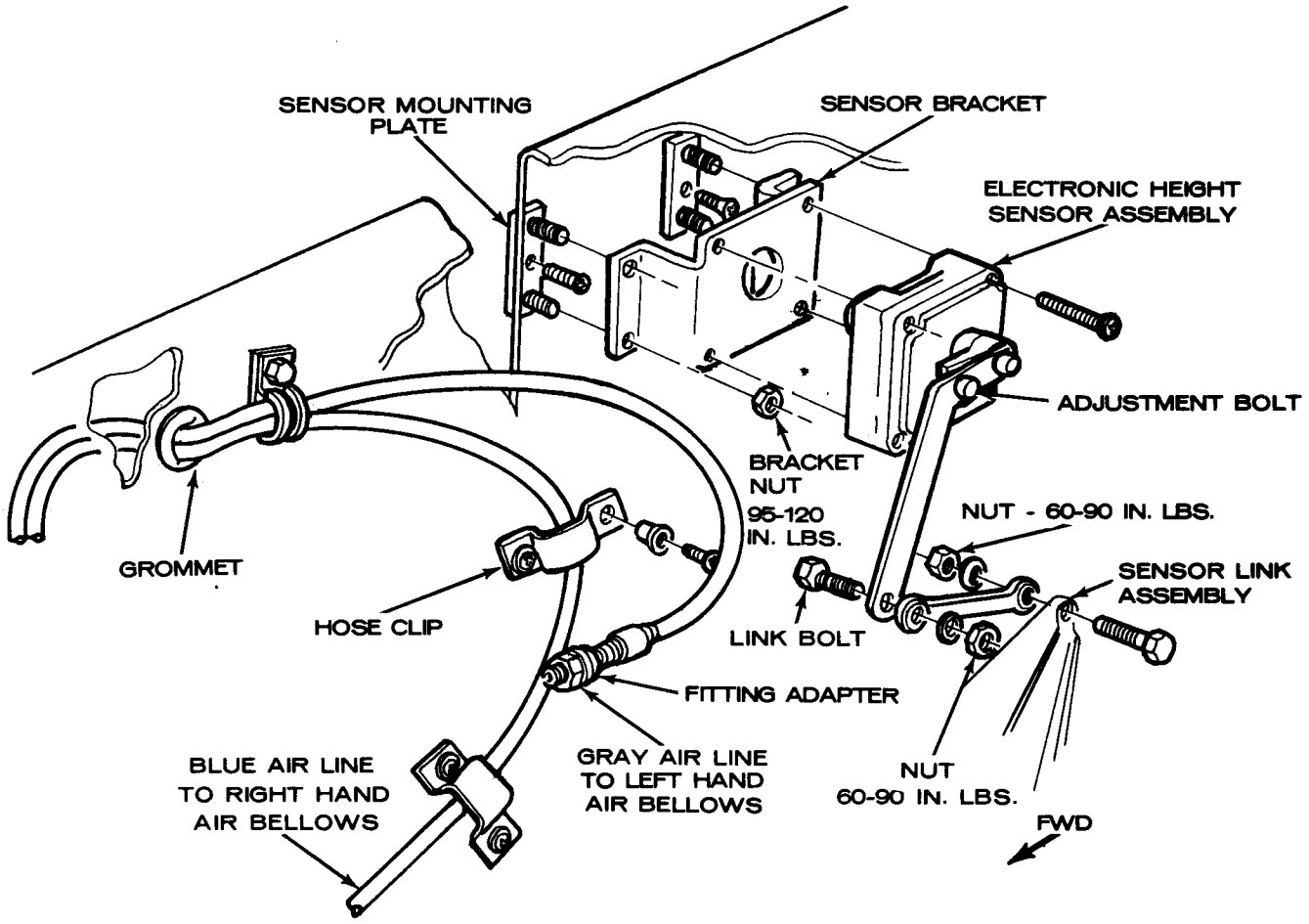


Figure 27—Electronic Height Sensor Assembly

"Ride Height Adjustment" earlier in this section if adjustment is necessary.

ELECTRO-LEVEL CONTROL PANEL REPLACEMENT

REMOVAL

1. Remove four screws securing control panel to side trim panel at left of driver's seat.
2. Disconnect electrical leads at switches.
3. Remove switches from control panel.

INSTALLATION

1. Install switch into control panel.
2. Connect wiring harness leads to switches.
3. Install control panel to side trim panel at left of driver's seat.

"SHUT-OFF" SOLENOID REPLACEMENT

REMOVAL

1. Disconnect air line fitting from each side of solenoid.
2. Disconnect solenoid wiring connectors from sensor wiring harness.
3. Remove three bolts and nuts securing solenoid mounting bracket to compressor mounting bracket.
4. Remove solenoid from bracket.

INSTALLATION

1. To install, reverse removal procedure.

NOTE: Solenoids must be assembled to mounting bracket with arrows in position shown prior to assembly of solenoid mounting bracket to compressor mounting bracket (see figure 28).

CONTROL ARM REPLACEMENT

Refer to "Control Arm Removal" and "Control Arm Installation", SEC. 4, Maintenance Manual X-7525.

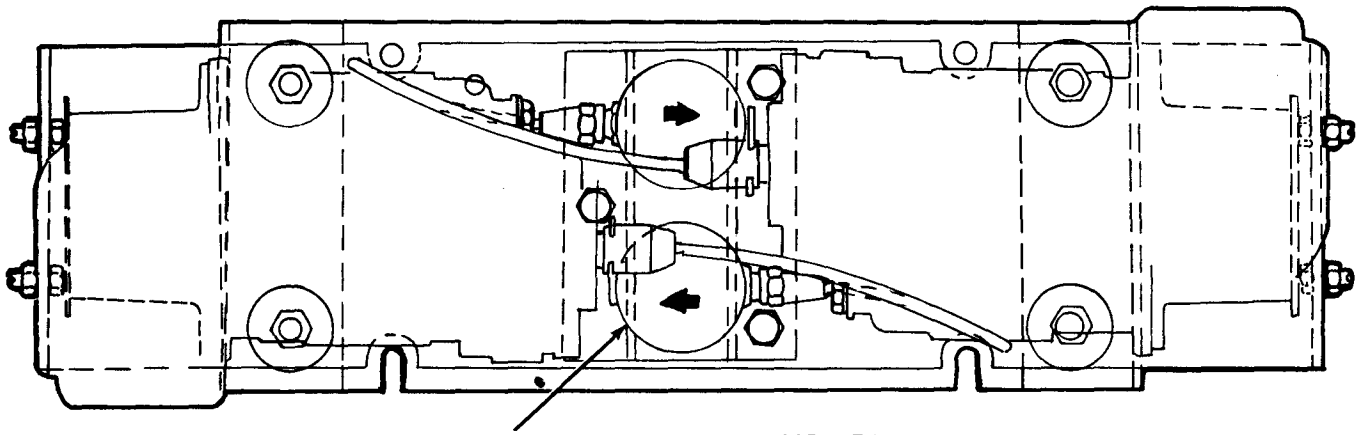


Figure 28—Solenoid Mounting—Top View

SHOCK ABSORBER REPLACEMENT

Refer to "Shock Absorber Removal" and "Shock Absorber Replacement", SEC 4, Maintenance Manual X-7525.

AIR BELLOWS REPLACEMENT

Refer to "Air Bellows Removal" and "Air Bellows Installation", SEC. 4, Maintenance Manual X-7525.

COMPONENT REPAIR

"SHUT-OFF" SOLENOID VALVE REPAIR

DISASSEMBLY

Solenoid valve shown in figure 9 can be disassembled for cleaning and inspection. Plunger, spring and seal are available for service replacement.

1. Remove housing nut and name plate.
2. Remove valve body from coil housing.
3. After separating flanged washer from valve body, use Spanner wrench (SKINNER # VD-233 or equivalent) to remove sleeve, plunger assembly and spring from valve body.

NOTE: Remove carefully as spring is under considerable tension.

INSPECTION

1. Seal should be discarded and new seal installed when assembling valve.
2. Inspect plunger inserts (both ends) for cuts, nicks, and depressions caused from hitting valve seat. Replace if necessary.

Wear must be significant before necessary to replace.

3. Replace spring if broken. If plunger is replaced, spring should be replaced at the same time. Plunger, spring and seal are included in a repair kit.
4. Visually inspect valve threads for damage and clean if necessary.

ASSEMBLY

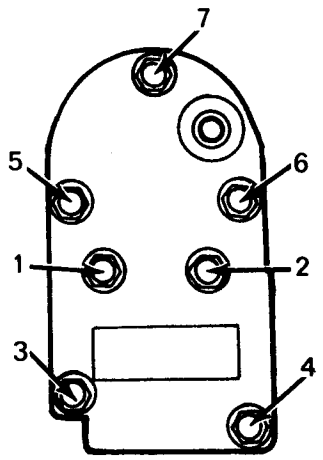
NOTE: DO NOT use any lubricant during assemby of valve components.

Reverse the disassembly procedure for assembly of valve. DO NOT tighten sleeve nut excessively.

COMPRESSOR REPAIR

DISASSEMBLY

1. Remove seven compressor cover screws, then remove compressor cover and gasket.
2. Remove head and solenoid assembly.
3. Remove two filters, exhaust valve and spring and air dryer O-ring from head assembly.
4. Remove solenoid from head by lifting up slightly and sliding to the outlet side.
5. Remove O-ring from solenoid assembly.



TORQUE SCREWS TO 4 N•m (36 IN. LBS.) IN SEQUENCE SHOWN A-7218

Figure 29—Compressor Head Tightening Sequence

6. Remove head gasket from cylinder assembly.

7. Remove four mounting bracket screws and remove bracket and gasket.

Note ground wire position for installation.

ASSEMBLY

1. Install gasket and mounting bracket to cylinder assembly, then install screws and ground wire. Torque bolts to 4 N.m (36 in. lbs.).
2. Install head gasket on cylinder assembly.
3. Install O-ring on solenoid assembly, then install solenoid in head with valve opposite the dryer outlet.
4. Install two filters, exhaust valve and spring on head assembly.
5. Install cover gasket and cover on head assembly and install four short cover screws.
6. Install head cover assembly to cylinder assembly using three long screws. Torque all seven screws in sequence as shown in figure 29.
7. Position dryer O-ring on compressor end of dryer.

SPECIFICATIONS

FASTENER	TORQUE
Air Dryer Bracket to Compressor Bolts	2 N.m (20 In. Lbs.)
Motor and Cylinder Assembly to Bracket Stud Nuts	4.0-2.8 N.m (36 to 24 In. Lbs.)
Compressor Head Screws*	4 N.m (36 In. Lbs.)
Compressor Mounting Bracket to Riser Bracket Bolts	(20-25 Ft. Lb.)
Solenoid Mounting Bracket to Compressor Mounting Bracket	35-60 In. Lbs.
Connector-Tube Assembly to Shut-Off Solenoid	100-125 In. Lbs.
Adapter-Tube Assembly to Shut-Off Solenoid	10-15 In. Lbs.
Height Sensor Mounting Bracket to Sensor Mounting Plate Nuts	95-120 In. Lbs.
Height Sensor Link Assembly Nuts (Upper and Lower)	60-90 In. Lbs.
Link Arm To Height Sensor Actuator Arm-Nut	60-90 Ft. Lbs.
Link to Control Arm Nut	60-90 Ft. Lbs.
Control Arm Mounting Bracket to Frame Rail Nuts (4)	65-85 Ft. Lbs.
Control Arm Mounting Bracket to Crossmember Nuts (2)	50-60 Ft. Lbs.
Control Arm Lock Nut	15-20 Ft. Lbs.

*Compressor Head Screws must be torqued in sequence. See figure 29.

SPECIAL TOOLS

J-22124-A	Pressure Gauge
J-25520	Air Line Crimp Tool

SECTION 5
BRAKES

The information described in Maintenance Manual X-7525 under the heading BRAKES is applicable to models covered by this supplement with the exception of the following:

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology "See Caution on page 5-1 of this supplement".

CAUTION: THIS FASTENER IS AN IMPORTANT ATTACHING PART IN THAT IT COULD AFFECT THE PERFORMANCE OF VITAL COMPONENTS AND SYSTEMS, AND/OR COULD RESULT IN MAJOR REPAIR EXPENSE. IT MUST BE REPLACED WITH ONE OF THE SAME PART NUMBER OR WITH AN EQUIVALENT PART IF REPLACEMENT BECOMES NECESSARY. DO NOT USE A REPLACEMENT PART OF LESSER QUALITY OR SUBSTITUTE DESIGN. TORQUE VALUES MUST BE USED AS SPECIFIED DURING REASSEMBLY TO ASSURE PROPER RETENTION OF THIS PART.

WARNING: WHEN SERVICING WHEEL BRAKE PARTS DO NOT CREATE DUST BY GRINDING OR SANDING BRAKE LININGS OR BY CLEANING WHEEL BRAKE PARTS WITH A DRY BRUSH OR WITH COMPRESSED AIR. (A WATER DAMPENED CLOTH SHOULD BE USED.) MANY WHEEL BRAKE PARTS CONTAIN ASBESTOS FIBERS WHICH CAN BECOME AIRBORNE IF DUST IS CREATED DURING SERVICING. BREATHING DUST CONTAINING ASBESTOS FIBERS MAY CAUSE SERIOUS BODILY HARM.

ON-VEHICLE SERVICING

BLEEDING BRAKE SYSTEM

A new brake bleeding sequence is shown in figure 1. This new sequence reduces the possibility of having to rebleed wheel cylinders a second time to eliminate air from the system.

REAR BRAKE SHOE ADJUSTMENT

Under normal operating conditions it is not necessary to make any manual adjustment to this type brake due to the automatic adjustment feature. However, when it is necessary to remove a brake drum it may also be necessary to "back-off" the adjusting screw in order to pull edge of drum past linings. (see figure 2)

1. If shoes are being adjusted for the first time, use a suitable punch to knock out the metal blank in backing plate (located at lanced area, see figure 3). Be sure all metal is removed from the brake assembly.
2. Install hub and drum assembly. Refer to BRAKE DRUM INSTALLATION.
3. Use brake adjusting tool (J-4735) to turn brake adjusting screw. Expand brake shoes at each wheel until the wheel can just be turned by hand. The drag should be equal at all wheels.
4. Back off brake adjusting screw (figure 2) at each wheel 30 notches. If shoes drag lightly on drum back off adjusting screw one or two additional notches.

NOTE: Brake should be free of drag when screw has been backed off approximately 12 notches. Heavy drag at this point indicates tight parking brake cables.

5. Install brake adjustment cover in backing plate when adjustment is completed.
6. Check parking brake adjustment.

COMPONENT REPLACEMENT

BRAKE DRUM REMOVAL

1. Hoist wheels off ground.

NOTE: It may be necessary to back off the brake shoe adjustment before the brake drum can be removed. To back off brake shoe adjustment, refer to Figure 2.

2. Remove wheel and tire.
3. Remove outer dust cap as shown in Figure 4, and then inner cap.

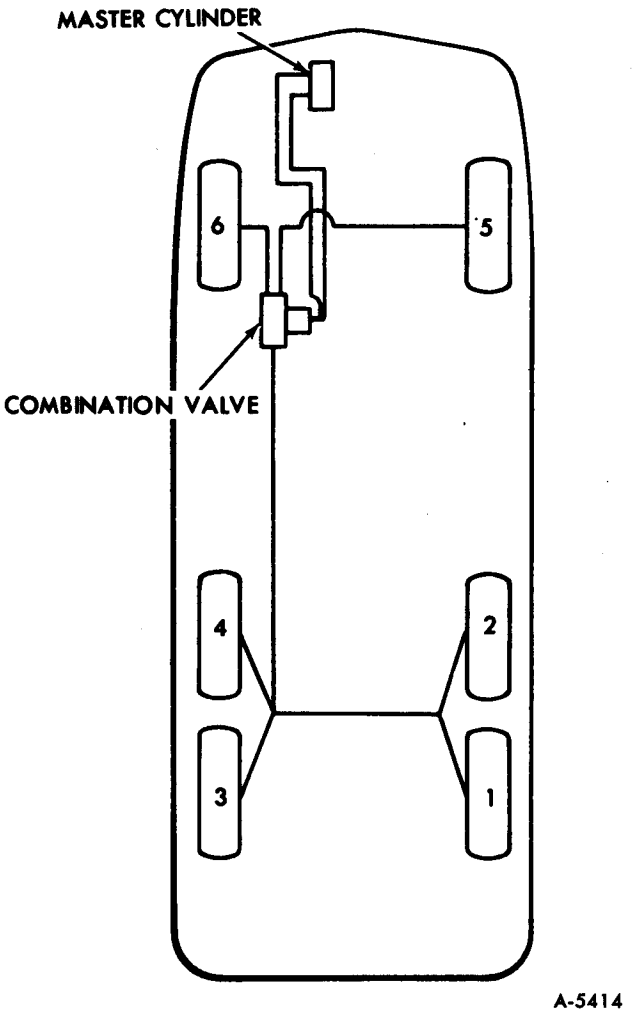


Figure 1—Brake Bleeding Sequence

4. Remove cotter pin and castillated nut from hub as shown in Figure 5.

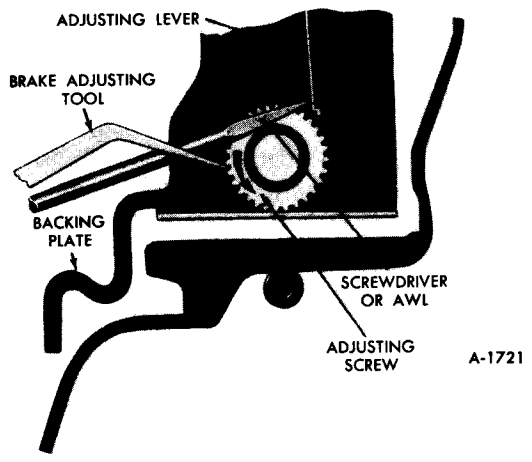


Figure 2—Backing Off Brake Adjustment

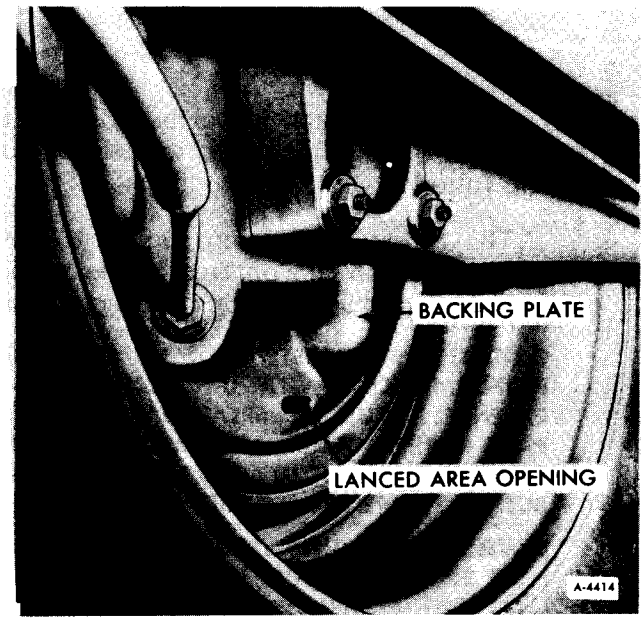


Figure 3—Lanced Area in Backing Plate

5. Hub and drum assembly can now be removed. See Figure 6.

6. Using a suitable punch, knock out the metal blank in backing plate (located at lanced area, see figure 3). Be sure all metal is removed from the brake assembly.

BRAKE DRUM INSTALLATION

CAUTION: *See "Caution" on page 5-1 of this supplement.*

1. Install hub and drum assembly (figure 6).
2. Install flat washer and castillated nut on hub while rotating hub and drum assembly.

Figure 4—Removing Dust Cap

3. Tighten castillated nut to 25-30 lbs. ft. torque to position bearings. (Be sure drum is rotating while tightening nut).
4. Back off nut 1/2 turn.
5. Retighten nut finger tight, secure if possible with cotter pin.
6. If unable to secure at finger tight, back off nut to first securing position.
7. Check end play between hub and spindle it should be .001 to .005 inch.
8. Replace inner and outer dust caps.
9. Adjust brake shoes as outlined under BRAKE SHOE ADJUSTMENT.
10. Be sure brake adjustment cover is installed in lanced area opening of backing plate, see figure 3.
11. Install wheel and tire assembly. Refer to Section 10 of Maintenance Manual X-7525 for details.

REAR BRAKE SHOE REMOVAL
(Refer to Figure 7)

1. Hoist vehicle. Remove wheel and brake drum.
2. Remove the brake shoe return springs actuating link and guide.
3. Remove the brake shoe hold-down springs, adjuster lever, return spring and parking brake lever strut and spring.
4. Spread shoes to clear wheel cylinder links then remove the brake shoes as an assembly.
5. Disconnect the parking brake cable from the operating lever.
6. Using a suitable punch, knock out the metal blank in backing plate (located at lanced area, see figure 3). Be sure all metal is removed from the brake assembly.

REAR BRAKE SHOE INSTALLATION

CAUTION: *See "Caution" on page 5-1 of this supplement.*

WARNING: WHEN SERVICING WHEEL BRAKE PARTS DO NOT CREATE DUST BY GRINDING OR SANDING BRAKE LININGS OR BY CLEANING WHEEL BRAKE PARTS WITH A DRY BRUSH OR WITH COMPRESSED AIR. (A WATER DAMPENED CLOTH SHOULD BE USED.) MANY WHEEL BRAKE PARTS CONTAIN ASBESTOS FIBERS WHICH CAN BECOME AIRBORNE IF DUST IS CREATED DURING SERVICING. BREATHING DUST CONTAINING ASBESTOS FIBERS MAY CAUSE SERIOUS BODILY HARM.

1. Lubricate the adjusting screw threads, thrust washer mating surfaces and backing plate ledges with brake lubricant, such as Part No. 1050110 or equivalent.
2. Assemble the adjusting screw.
3. Attach the primary to secondary shoe spring to the shoes and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw sprocket.
4. Position shoe assembly on the backing plate. Be sure wheel cylinder links are properly positioned in the shoe notches.
5. Position the upper end of the actuating link on the brake shoe guide.

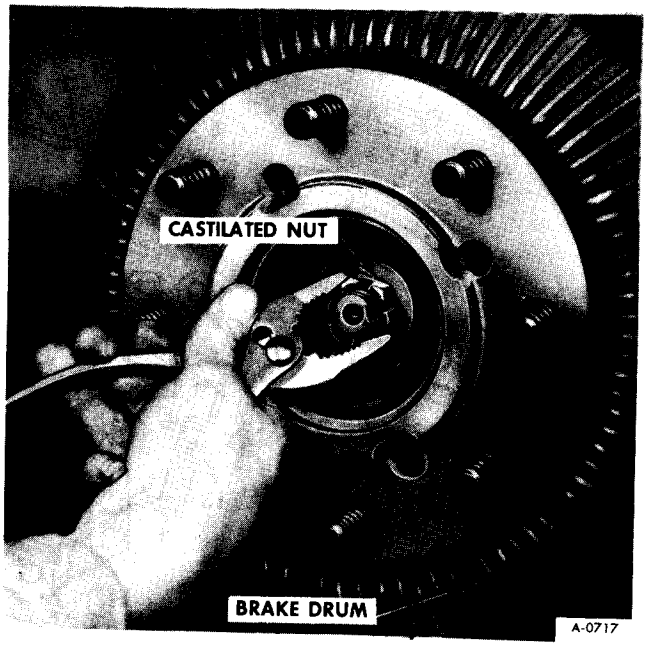
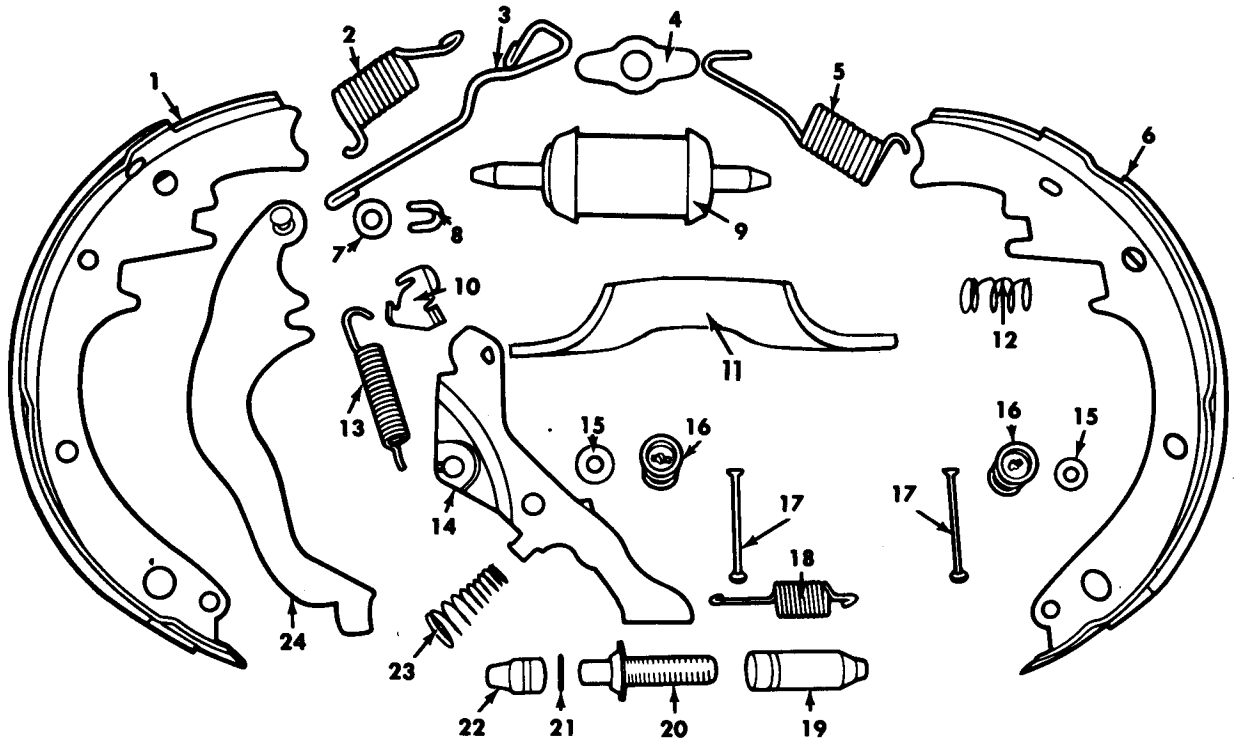


Figure 5—Removing Castillated Nut

Figure 6—Removing Hub and Drum



1. Secondary Shoe And Lining
2. Return Spring
3. Actuating Link
4. Guide Plate
5. Return Spring
6. Primary Shoe And Lining
7. Washer
8. Clip
9. Wheel Cylinder
10. Pivot
11. Strut
12. Spring
13. Override Spring
14. Adjuster Lever
15. Washer
16. Hold Down Spring
17. Pin
18. Spring
19. Nut
20. Adjusting Screw
21. Washer
22. Socket
23. Return Spring
24. Lever

A-4129

Figure 7—Brake Assembly (Rear)

6. Engage the actuating link with the override pivot. Then position the adjuster lever and return spring on the secondary shoe. Position sleeve in the hole in secondary shoe and fasten to backing plate with hold-down spring assembly and pin.

7. Install the remaining primary hold-down spring, washer and pin.

8. Install the primary and secondary brake shoe return springs.

9. Install hub and drum assembly. Refer to BRAKE DRUM INSTALLATION.

10. Adjust brake shoes as outlined under BRAKE SHOE ADJUSTMENT.

11. If wheel cylinder was removed, bleed brakes.

12. Check fluid level in master cylinder. Fluid level should be no more than 1/4" below the reservoir opening at rear.

13. Install wheel and tire assembly. Refer to Section 10 of Maintenance Manual X-7525 for details.

COMPONENT REPAIR

DELCO-MORAINE DUAL DIAPHRAGM POWER BRAKE BOOSTER REPAIR

A new power booster repair procedure is required due to following internal component changes within the booster:

1. Secondary diaphragm and support ring has been replaced by a diaphragm with an integral ring.
2. The retainer plate has been deleted.
3. A new divider housing.

DISASSEMBLY

1. Scribe a mark on the top center of the front and rear housings in line with master cylinder reservoir cover to facilitate re-assembly.

2. Remove the two nuts which hold the master cylinder to the front housing, and remove the master cylinder from the mounting studs.

3. Remove front housing seal (figure 8).

4. Install booster assembly in brake booster separating fixture (J-23456) as shown in figure 9.

CAUTION: *When separating housings maintain light pressure on rear housing as it is under spring tension.*

5. With booster clamped slightly, rotate bar counterclockwise to unlock housings. If the front housing cannot be readily loosened, tap the rear housing lightly with a plastic hammer.

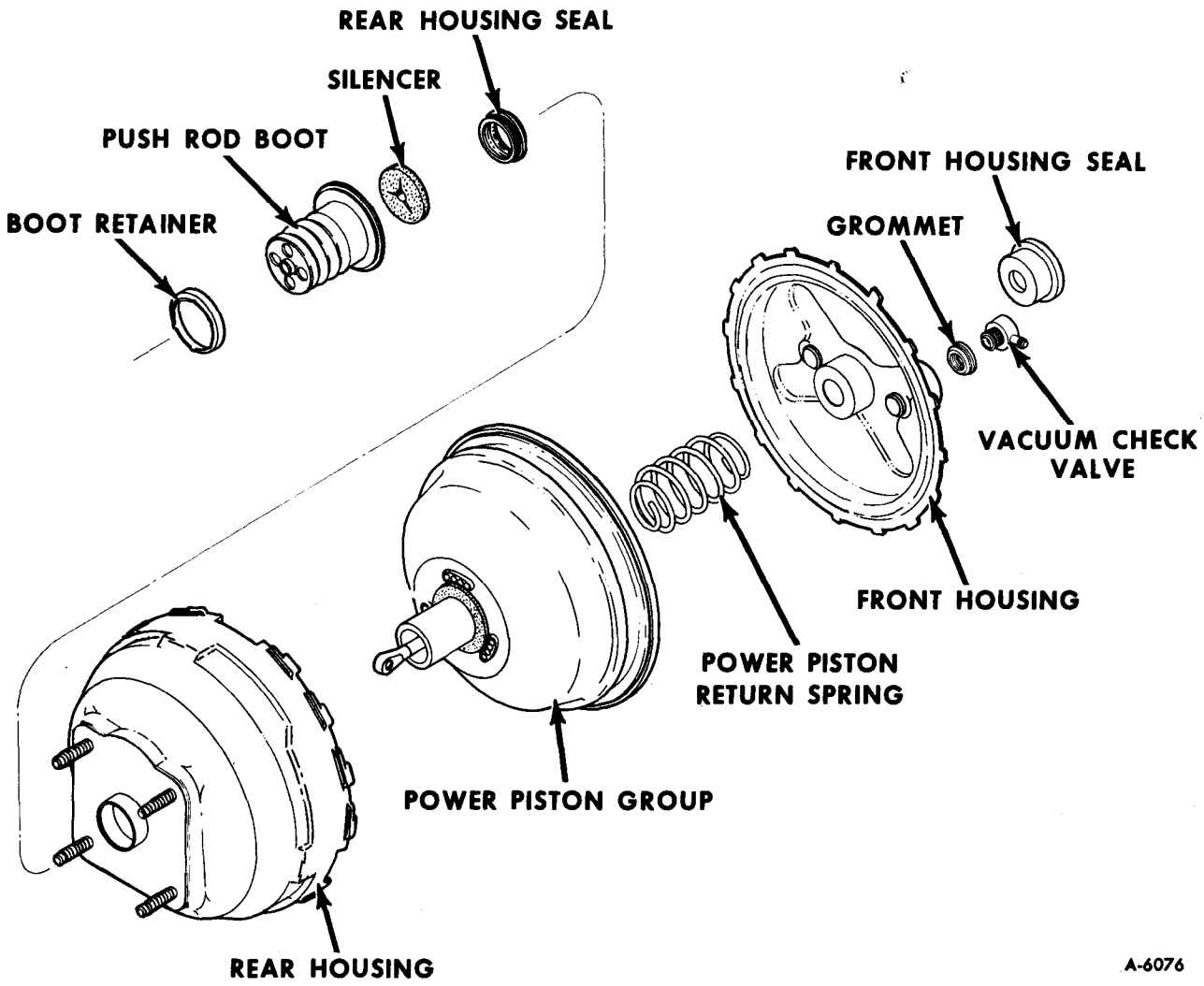


Figure 8—Delco Moraine Power Booster Components

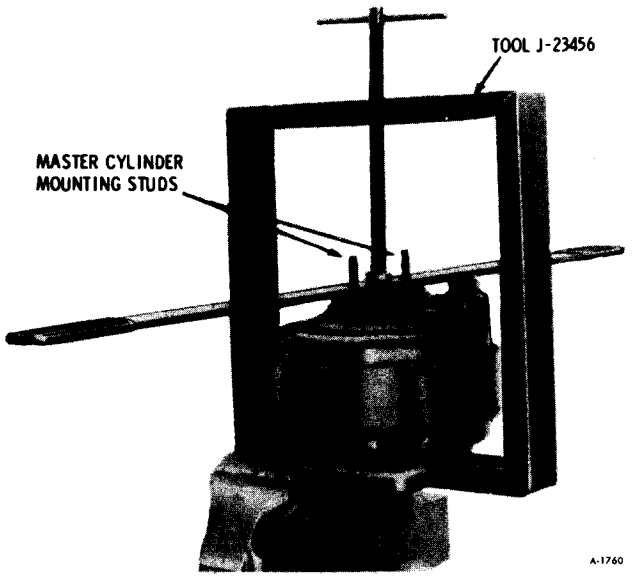


Figure 9—Using Brake Booster Separating Fixture

NOTE: Care must be exercised not to damage or loosen studs in housings. Also take care that no pressure is exerted on plastic power piston.

6. Back off the hold down bar sufficiently to remove front housing.

FRONT HOUSING GROUP DISASSEMBLY

1. Remove the power piston return spring and piston rod retainer.
2. Remove the vacuum check valve and grommet from the front housing. If the check valve is defective or the grommet cracked, cut or damaged it must be replaced.
3. Remove the front housing seal.

REAR HOUSING GROUP DISASSEMBLY

1. Remove the boot retainer and piston rod boot from the rear housing.
2. Remove the felt silencer from inside the piston rod boot.
3. Remove the power piston group from the rear housing.
4. Remove the rear housing seal from the center opening in the rear housing.

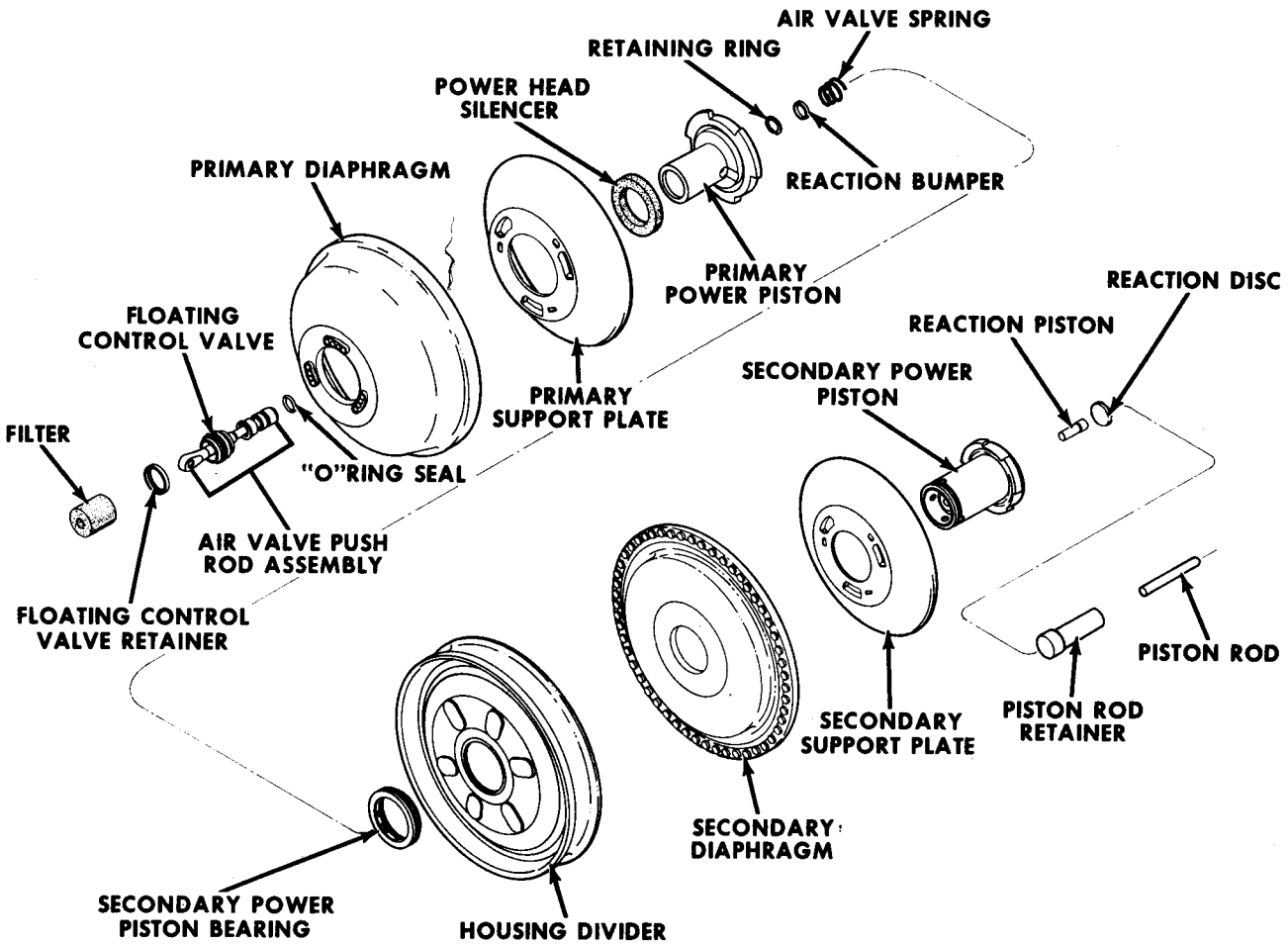


Figure 10—Power Piston Group

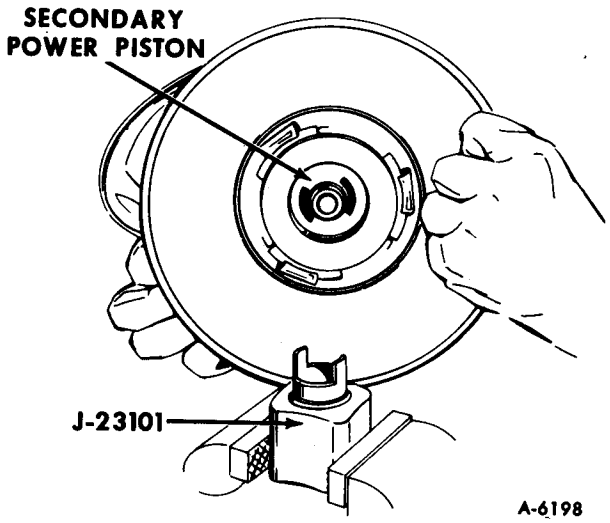


Figure 11—Positioning Secondary Power Piston on Tool J-23101

POWER PISTON GROUP DISASSEMBLY (Figure 10)

1. Lift the bead on the outside diameter of the secondary diaphragm.

2. Remove the piston rod retainer and piston rod from the secondary piston.

3. Mount double-ended Tool J-23101 (with large diameter end up) in a vise. Position the secondary power piston so that the two radial slots in the piston fit over the ears (tangs) of the tool (figure 11).

4. Fold back the primary diaphragm from the outside diameter of the primary support plate. Grip the edge of the support plate and rotate counterclockwise to unscrew the primary power piston from the secondary power piston.

NOTE: It is possible that the primary support plate will unlock from the primary piston before the primary piston unscrews from the secondary piston. If this happens, continue to turn the primary support plate counterclockwise. Tabs (stops) on the primary support will temporarily lock the primary support plate to the primary power piston and permit continued counterclockwise rotation to unscrew the primary power piston from the secondary power piston. (figure 12).

5. Remove the housing divider from the secondary power piston. Remove the secondary power piston bearing from the housing divider.

6. The secondary power piston should still be positioned on Tool J-23101. Fold back secondary diaphragm from outside diameter of

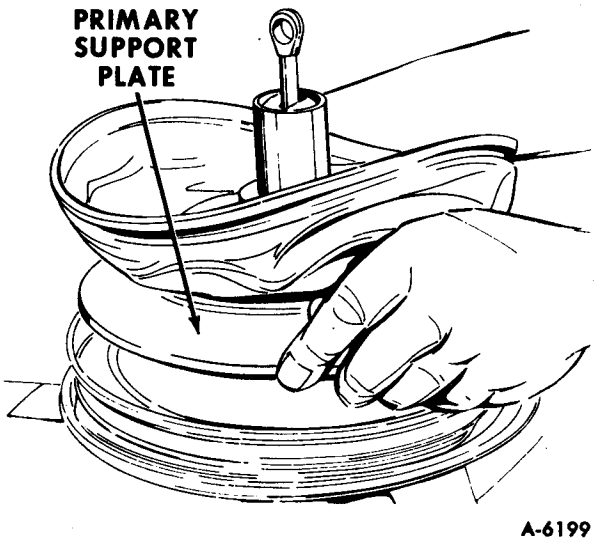


Figure 12—Locking or Unlocking Primary And Secondary Power Pistons

secondary support plate. Grip the edges of the support plate and rotate clockwise to unlock the secondary support plate from the secondary power piston (figure 13).

7. Remove the secondary diaphragm from the secondary support plate.

8. Remove the reaction piston and reaction disc from the center of the secondary power piston by pushing down on the end of the reaction piston with a small object, such as a pencil, wooden dowel or metal rod (figure 14).

9. Remove the air valve spring from the end of the air valve (if it didn't come off during disassembly of the power piston).

10. Mount Tool J-23101 in a vise (with small diameter end up). Position the primary power

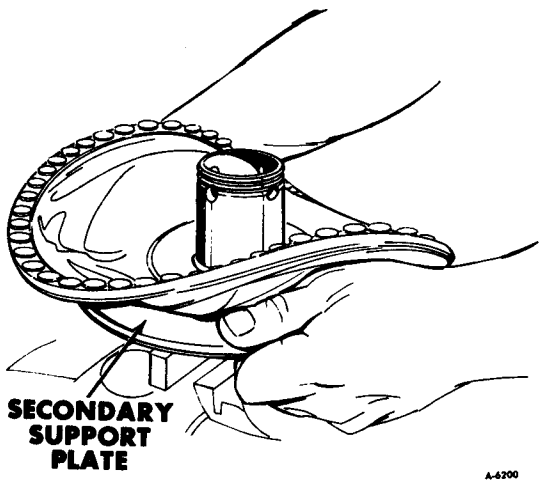


Figure 13—Locking or Unlocking Secondary Support Plate and Secondary Power Piston

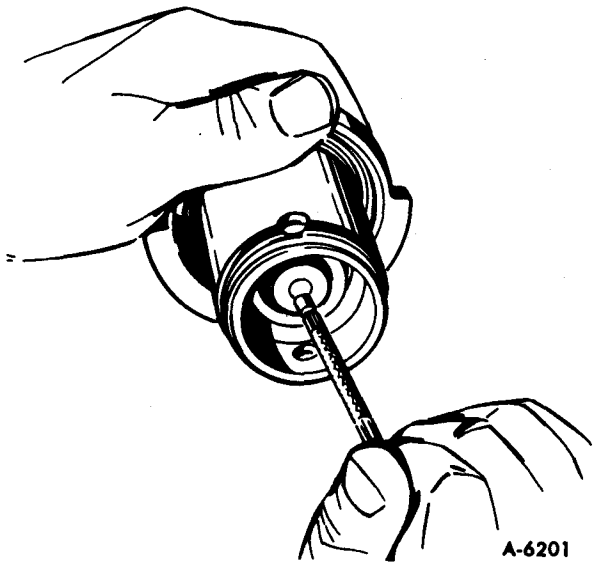


Figure 14—Removing Reaction Piston And Reaction Disc from Secondary Power Piston

piston so that the two radial slots in the piston fit over the ears (tangs) of the tool (figure15).

11. Fold back primary diaphragm from the support plate. Grip the edge of the support plate and rotate in a counterclockwise direction to unlock the primary support plate from the primary power piston (figure 16).

12. Remove the primary diaphragm from the primary support plate.

13. Remove the air filter from the tubular section of the primary power piston.

14. Remove the power head silencer from the neck of the power piston tube.

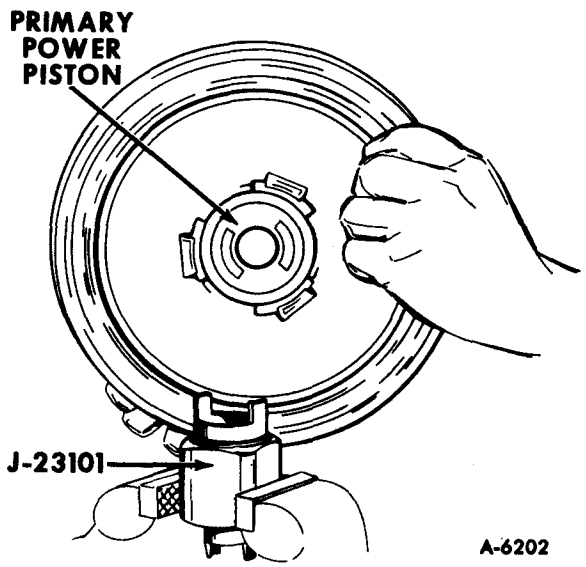


Figure 15—Positioning Primary Power Piston in Tool J-23101 (Small Dia. End Up)

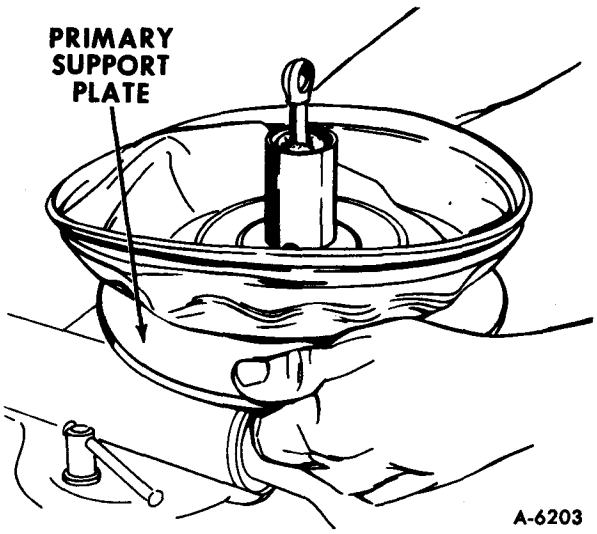


Figure 16—Locking or Unlocking Primary Support Plate from Primary Power Piston

15. Remove the rubber reaction bumper from the end of the air valve.

16. Using snap ring pliers J-4880, remove the retaining ring from the air valve (figure 17).

17. Remove the air valve-push rod assembly from the tube end of the primary power piston. The following removal method is recommended:

Place the primary power piston in an arbor press and press the air valve push rod assembly out the bottom of the power piston tube with a rod not exceeding 1/2" in diameter.

18. Removal of air valve push rod assembly will disassemble control valve retainer.

19. Remove "O" ring seal from air valve.

Figure 17—Removing Retaining Ring Front Air Valve

INSPECTION CHART		
Part	**Inspect For**	**Corrective Action**
Power Pistons and Support Plates	1. Damaged threads.	1. Replace
	2. Cracks, distortion, chipping, pitted or rough holes, worn seal surfaces (tubes).	2. Clean up or replace.
Piston Rod Retainer	1. Cracks, distortion, chipping.	1. Replace
Air Valve–Push Rod Assembly	1. Air Valve scratches, dents, distortion, or corrosion of I.D. or O.D. All seats to be smooth and free of nicks and dents.	1. Do not repair–Replace.
	2. Push rod must move freely in air valve, but must not pull out.	2. If worn, replace air valve push rod assembly.
	3. Deterioration of rubber or warped valve face in floating control valve.	3. Replace
Spring Retainers	1. Check for cracks, deformation.	1. Replace
Front and Rear Housings	1. Scratches, scores, pits, dents, or other damage affecting rolling or sealing diaphragm or other seals.	1. Replace, unless easily repaired.
	2. Cracks, damaged threads on studs, broken studs.	2. Replace, unless easily repaired.
	3. Bent or nicked locking lugs.	3. Replace, unless easily repaired.
	4. Loose studs.	4. Replace or repair.
Filter and Silencers	1. Dirty	1. Replace

A-6205

Figure 18—Delco-Moraine Power Booster Inspection Chart

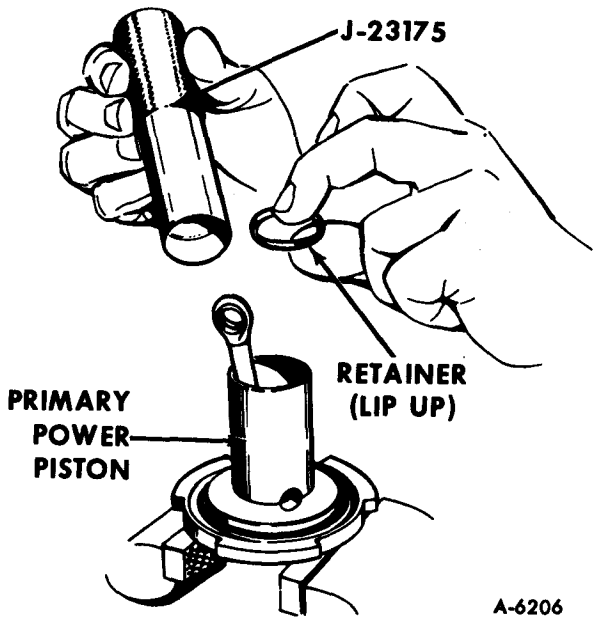


Figure 19—Installing Floating Control Valve Retainer with Installer J-23175

CLEANING

Use denatured alcohol to clean all metal, plastic and rubber parts of the power cylinder. Immerse parts in cleaning fluid and use a hair brush to remove foreign matter. Blow out all passages, orifices and valve holes. AIR DRY and place cleaned parts on clean paper or lint-free cloth. If slight rust is found on inside surface of power cylinder housing, polish clean with crocus cloth or fine emery cloth, then follow with a thorough cleaning as outlined above.

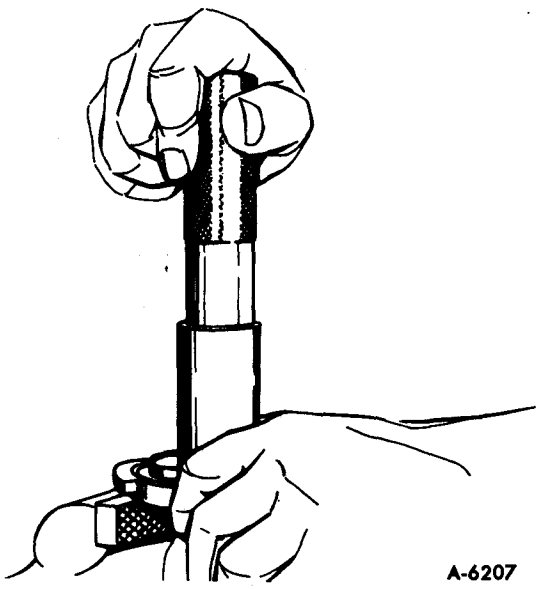


Figure 20—Seating Floating Control Valve with Installer J-23175

CAUTION: *Use of gasoline, kerosene, antifreeze alcohol or any other cleaner with even a trace of mineral oil, will damage rubber parts.*

INSPECTION

Wipe cleaning fluid from all parts and carefully inspect each part for damage and wear. Inspect rubber parts for cuts, nicks and distortion. These rubber parts are the key to control of air flow and should account for the majority of troubles traceable to leakage. If there is any question whatever as to serviceability of any part, replace it.

Refer to "Inspection Chart" (figure 18) for more detailed instructions.

ASSEMBLY

CAUTION: *See "Caution" on page 5-1 of this supplement.*

CAUTION: *Be sure to keep parts clean until reassembly. Re-wash at reassembly if there is any occasion to doubt cleanliness - such as parts dropped or left exposed for eight hours or longer.*

If you suspect there is any contamination or any evidence of corrosion, completely flush the vehicle hydraulic brake system in accordance with the Maintenance Manual.

Lubricate rubber, plastic and metal friction points with Delco Silicone Lube #5459912 (or equivalent).

Front Housing Group

1. Replace vacuum check valve using a new grommet if old one is cracked or damaged.
2. Place new front housing seal in housing so flat surface of cup lies against bottom of depression in housing.

Power Piston Group

1. Lubricate the inside diameter and outside diameters of the "O" ring seal with Delco Silicone Lube #5459912 (or equivalent) and place on the air valve.
2. Wipe a thin film of Delco Silicone Lube #5459912 (or equivalent) on the large and small outside diameter of the floating control valve.

NOTE: If the floating control valve needs replacement, it will be necessary to replace the complete air valve-push rod assembly.

Since the floating control valve is a component part of this assembly and cannot be disassembled from the push rod.

3. Place the air valve end of the air valve push rod assembly into the tube of the primary power piston. Manually press the air valve push rod assembly so that the floating control valve bottoms on the tube section of the primary power piston. Installer Tool J-23175 can be used to manually press the floating control valve to its seat.

4. Place the inside diameter of the floating control valve retainer on the outside diameter of floating control valve Retainer Installer J-23175. Place over the push rod so that the closed side of the retainer seats on the floating control valve (figure 19). With Installer J-23175, manually press the retainer and floating control valve assembly to seat in the primary power piston tube (figure 20).

5. The filter element can now be stretched over the push rod and pressed into the primary power piston tube.

6. Using Snap Ring Pliers J-4880, place the retaining ring into the groove in the air valve (figure 17).

7. Position the rubber reaction bumper on the end of the air valve.

NOTE: Tolerances of component parts affecting output of the power booster are very critical. To maintain correct power brake output, the power piston assembly is serviced as an assembly which includes a pre-selected REACTION PISTON, PRIMARY POWER PISTON, and SECONDARY POWER PISTON. No gauging is required when power piston service package is used.

8. Assemble the primary diaphragm to the primary support plate from the side of the support plate opposite the locking tangs. Press the raised flange on the inside diameter of the diaphragm through the center hole of the support plate. Be sure that the edge of the support plate center hole fits into the groove in the raised flange of the diaphragm. Lubricate the diaphragm inside diameter and the raised surface of the flange (that fits into a groove in the primary power piston) with a light coat of Delco Silicone Lube #5459912 (or equivalent).

9. Mount Tool J-23101 (small diameter end up) in a vise. Position the primary power piston so that the two radial slots in the piston fit over the ears (tangs) of the tool (figure 15).

10. Fold the primary diaphragm away from the outside diameter of the primary support plate.

11. Holding the edges of the support plate, with the locking tangs down, place the primary support plate and diaphragm assembly over the tube of the primary power piston. The flange on the inside diameter of the primary diaphragm will fit into a groove in the primary power piston.

12. Grip the edges of the primary support plate, press down, and rotate clockwise until the tabs on the primary power piston contact the stops on the support plate (figure 16).

13. Place the power head silencer on the tube of the primary power piston so that the holes at the base of the tube are covered.

14. Apply Delco Silicone Lube #5459912 (or equivalent) to the outside diameter of the primary power piston tube.

15. Remove the primary piston assembly from Tool J-23101 and lay it aside.

16. Assemble the secondary diaphragm to the secondary support plate from the side of the support plate opposite the locking tangs. Press the raised flange on the inside diameter of the diaphragm through the center hole of the support plate. Be sure that the edge of the support plate center hole fits into the groove in the raised flange of the diaphragm. Apply a thin coat of Delco Silicone Lube #5459912 (or equivalent) to the inside diameter of the secondary diaphragm and the raised surface of the flange (that fits into a groove in the secondary power piston).

17. Mount Tool J-23101 (with large diameter end up) in a vise. Position the secondary power piston so that the radial slots in the piston fit over the ears (tangs) of the tool. Apply a light coat of Delco Silicone Lube #5459912 (or equivalent) to the tube of the secondary power piston (figure 11).

18. Fold the secondary diaphragm away from the outside diameter of the secondary plate.

19. Holding the edges of the support plate with the locking tangs down, place the secondary diaphragm and support plate assembly over the tube of the secondary power piston. The flange of the inside diameter of the secondary diaphragm will fit into the groove in the secondary piston.

20. Grip the edges of the secondary support plate, press down, and rotate counterclockwise until the tabs on the secondary power piston contact the stops on the support plate. Fold the secondary diaphragm back into position on the secondary support plate. Leave the secondary power piston assembly on Tool J-23101 in the vise (figure 13).

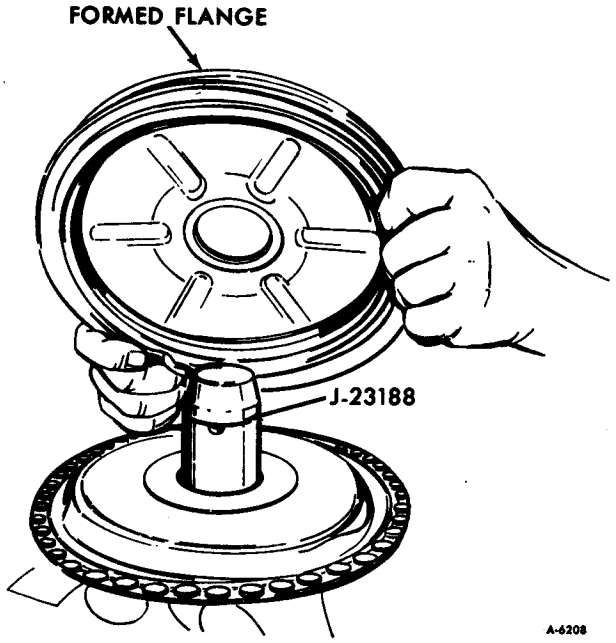


Figure 21—Positioning Housing Divider Over Secondary Bearing Protector Tool J-23188

21. Apply a light coat of talcum powder or Delco Silicone Lube #5459912 (or equivalent) to the bead on the outside diameter of the secondary diaphragm. This will faciltate reassembly of front and rear housings.

22. Hold the housing divider so that the formed over flange (that holds the primary diaphragm) of the divider faces down. Place the secondary bearing in the inside diameter of the divider so that the extended lip of the bearing faces up.

23. Lubricate the inside diameter of the secondary bearing with Delco Silicone Lube #5459912 (or equivalent).

24. Position secondary Bearing Protector Tool J-23188 on the threaded end of the secondary power piston (figure 21).

25. Hold the housing divider so that the six oblong protrusions on the middle of the divider are facing up. Press the divider down over the tool and onto the secondary power piston tube where it will rest against the diaphragm support ring. Remove Tool J-23188 from secondary power piston; however, do not remove the secondary power piston sub-assembly from Tool J-23101.

26. Pick up the primary power piston assembly and fold the primary diaphragm away from the outside diameter of the primary support plate.

27. Position the small end of the air valve return spring on the air valve so that it contacts the air valve retaining ring.

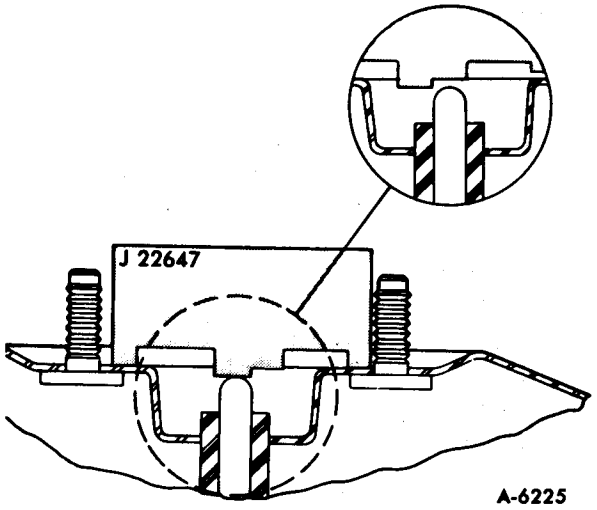


Figure 22—Gauging Piston Rod

28. Position the primary power piston on the tubular portion of the secondary power piston, making sure that the air valve return spring seats down over the raised center section of the secondary power piston.

29. Grip the edge of the primary support plate, press down, and start the threads on the secondary power piston into the threaded portion of the primary power piston by rotating in clockwise direction (figure 12).

30. Continue to tighten the primary power piston until it is securely attached (approximately 5-15ft. lbs.) to the secondary power piston.

31. Fold the primary diaphragm back into position on the primary support plate and pull the diaphragm outside diameter over the formed flange of the housing divider. Check that the bead on the diaphragm is seated evenly around the complete circumference.

32. Wipe a thin film of Delco Silicone Lube #5459912 (or equivlanet) on the outside diameter of the piston rod retainer. Insert the master cylinder piston rod so that the flat end bottoms against the rubber reaction disc in the bottom of the cavity.

Rear Housing Group

1. Coat the inside diameter of the rear housing seal with Delco Silicone Lube #5459912 (or equivalent).

2. Place the NEW seal in the rear housing center hole so that the formed flange of the housing center hole fits into the groove of the seal. The thin lip of the seal will protrude to the outside of the housing.

FINAL ASSEMBLY

1. Mount the front housing assembly in a vise.
2. Position the power piston return spring over the inset in the front housing.
3. Assemble the power piston group to the rear housing by pressing the tube of the primary piston through the rear housing bearing. Press down until the housing divider seats in the rear housing and the primary power piston bottoms against the housing.
4. Hold the rear housing assembly (with mounting studs up) over the front housing. (Make sure that the piston rod retainer does not dislodge from the secondary housing power piston during this operation.) Position the rear housing so that when the tangs on the edge of the front housing are locked in the slots on the edge of the front housing, the scribe marks on the top of the housings will be in line.
5. Lower the rear housing assembly onto the front housing. The power piston spring must seat in the depression in the face of the secondary power piston. Check that the bead on the outside diameter of the secondary diaphragm is positioned between the edges of the housing.
6. Continue to press down on the rear housing and fit the slots in the appropriate tangs on the front housing.
7. To facilitate locking, position front housing seal in the depression in the front housing and apply a vacuum source to the vacuum check valve in the front housing. Using Tool J-23456, press down and rotate the rear housing clockwise into the locked position. Remove Tool J-23456; remove the vacuum source. See Figure 9.
8. Place the silencer in the closed end of the power head boot. Push the boot retainer over the boot. Stretch the boot over the push rod and over the flange in the center of the rear housing.
9. Place the booster assembly in a padded vise with the front housing facing up. Insert the master cylinder push rod, flat end first, into the piston rod retainer.
10. Press down on the master cylinder piston rod (with approximately 40-50 pound load) to be sure it is properly seated.
11. Remove the front housing seal to be sure that no vacuum is in the power head while gauging.
12. Place gauge J-22647 over the piston rod in a position which will allow the gauge to be moved to the left or right without contacting the studs (see figure 22).

NOTE: The adjustment is correct if the lower step contacts the piston rod and the upper step clears the piston rod.

13. If the push rod is not within specifications and the push rod does not have an adjusting screw, a new service adjustable push rod must be installed and adjusted to specification. If the push rod being checked has an adjusting screw, adjust the push rod to specification.
14. Wipe a thin film of lubricant on the inside diameter of the front housing seal and position seal in the depression in the opening.
15. Position the master cylinder assembly on the front housing. Install the master cylinder retaining nuts and tighten to 28 foot - pounds torque.

SPECIAL TOOLS

J-4480	Snap Ring Pliers
J-22647	Push Rod Adjusting Gauge
J-23101	Diaphragm Plate Separator
J-23175	Control Valve Installer
J-23188	Secondary Power Piston Bearing Seal Protector
J-23456	Brake Booster Separating Fixture