

TABLE OF CONTENTS

ENGINE	01
CLUTCH	02
FUEL SYSTEM	03
EXHAUST SYSTEM	04
COOLING SYSTEM	05
ELECTRICAL SYSTEM	06
TRANSMISSION	07
PROPELLER SHAFT	09
FRONT AXLE	10
REAR AXLE	11
BRAKE AND AIR SYSTEM	12
WHEELS, HUBS AND TIRES	13
STEERING	14
SUSPENSION	16
BODY	18
HEATING AND A/C SYSTEMS	22
ACCESSORIES	23
LUBRICATION	24

XL MAINTENANCE MANUAL

SAFETY NOTICE

This maintenance manual has been prepared in order to assist skilled mechanics in the efficient repair and maintenance of PRÉVOST CAR - XL VEHICLES.

This manual covers only the procedures as of the manufacturing date.

Safety features may be impaired if other than genuine PRÉVOST parts are installed.

Torque wrench tightening specifications must be strictly observed. Locking devices must be installed or replaced by new ones, where specified. If the efficiency of a locking device is impaired, It must be replaced.

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The following words are used to emphasize particularly important information:

Warning: *Identifies instructions which if not followed, could result in serious personal injury or loss of life.*

Caution: *Denotes instructions which if not followed, could cause serious damage to vehicle components.*

Note: *Indicates supplementary information needed to fully understand and complete an instruction.*

Although, the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use.

For your own safety and to ensure prolonged service life of the vehicle, heed our *Cautions*, *Warnings* and *Notes*; Ignoring them could result in extensive damage and/or serious personal injury.

SECTION 01: ENGINE

CONTENTS

1. ENGINE	1 - 3
1.1 Description.....	1 - 3
2. ENGINE-MOUNTED COMPONENTS.....	1 - 3
2.1 Electronic Control Module.....	1 - 4
2.2 Electronic Unit Injector	1 - 4
2.3 Synchronous Reference Sensor.....	1 - 5
2.4 Timing Reference Sensor	1 - 6
2.5 Turbo Boost Pressure Sensor	1 - 6
2.6 Coolant Temperature Sensor	1 - 6
2.7 Fuel Temperature Sensor.....	1 - 6
2.8 Air Temperature Sensor.....	1 - 7
2.9 Oil Pressure Sensor	1 - 7
2.10 Oil Temperature Sensor.....	1 - 7
3. ENGINE-RELATED COMPONENTS.....	1 - 7
3.1 Coolant Level System (CLS).....	1 - 8
3.2 Electronic Foot Pedal Assembly (EFPA) & Throttle Position Sensor	1 - 8
3.3 Cruise Control Switch.....	1 - 8
3.4 Diagnostic System Accessories.....	1 - 9
4. DDEC III Diagnostic Codes	1 - 10
4.1 Reading Diagnostic Codes - Flash Method.....	1 - 10
4.2 DDEC III Diagnostic Codes List.....	1 - 11
5. ENGINE OIL LEVEL.....	1 - 14
6. ENGINE OIL AND FILTER CHANGE	1 - 14
7. RECOMMENDED ENGINE OIL TYPE.....	1 - 15
8. WELDING PRECAUTION	1 - 15
9. POWER PLANT ASSEMBLY REMOVAL (Automatic and Manual).....	1 - 16
10. POWER PLANT ASSEMBLY INSTALLATION (Automatic and Manual).....	1 - 19
11. ENGINE MOUNTS	1 - 19
12. JAKE BRAKE.....	1 - 19
13. SPECIFICATIONS.....	1 - 20

LIST OF ILLUSTRATIONS

FIG. 1: DETROIT DIESEL SERIES 60/50 ENGINES.....	1 - 3
FIG. 2: ELECTRONIC CONTROL MODULE	1 - 4
FIG. 3: ELECTRONIC UNIT INJECTOR CROSS-SECTION	1 - 5
FIG. 4: SRS LOCATION.....	1 - 5
FIG. 5: BULL GEAR.....	1 - 5
FIG. 6: TIMING REFERENCE SENSOR AND RELATED PARTS.....	1 - 6
FIG. 7: TURBO BOOST PRESSURE SENSOR	1 - 6
FIG. 8: ENGINE FUEL TEMPERATURE SENSOR	1 - 7
FIG. 9: ENGINE OIL PRESSURE AND OIL TEMPERATURE SENSOR.....	1 - 7
FIG. 10: ELECTRONIC FOOT PEDAL ASSEMBLY	1 - 8
FIG. 11: DDL REMOTE CONNECTOR	1 - 10
FIG. 12: ENGINE OIL LEVEL DIPSTICK.....	1 - 14
FIG. 13: OIL RESERVE TANK.....	1 - 14
FIG. 14: ENGINE OIL DRAIN PLUG.....	1 - 15
FIG. 15: BELT TENSIONER CONTROL VALVE	1 - 16
FIG. 16: POWER PLANT ASSEMBLY REMOVAL	1 - 16
FIG. 17: ELECTRIC FAN CLUTCH CONNECTOR.....	1 - 17
FIG. 18: RUBBER DAMPER TOLERANCE	1 - 19
FIG. 19: POWER PLANT CRADLE INSTALLATION	1 - 20

1. ENGINE

1.1 Description

This vehicle may be powered by a 6-cylinder, four-cycle, Detroit Diesel Series 60 engine or a 4 cylinder, four cycle, Detroit Diesel, Series 50 engine, both equipped with an electronic control system (DDEC III). Two volumes of charge are used in the Series 60 engine: 11 liters or 12.7 liters, and one (8.5 liters) in the Series 50 engine. Summary information on the Electronic Control System is given in this section. Complete maintenance and repair information on the engine will be found in the current DDEC III Service Manual #6SE483. Engine controls, accessories and related components are covered in the applicable sections of this maintenance manual. Engine removal and installation procedures are given at the end of this section. The DDEC system is self-diagnostic, It can identify faulty components and other engine-related problems by providing the technician with a diagnostic code. Refer to DDEC Troubleshooting Guide # 6SE492 for more complete information on diagnosis of components and system problems published by Detroit Diesel.

DDEC III (Detroit Diesel Electronic Control) controls the timing and amount of fuel injection by the electronic unit injectors (EUI). The system also monitors several engine functions using electrical sensors which send electrical signals to the Electronic Control Module (ECM). The ECM computes the electrical signals and determines the correct fuel output and timing for optimum power, fuel economy and emissions. The ECM also has the ability to display warnings or shut down the engine completely (depending on option selection) in the event of damaging engine conditions, such as low oil pressure, low coolant, or high oil temperature.

The system components are divided in two categories: engine-mounted components and engine-related components.

2. ENGINE-MOUNTED COMPONENTS

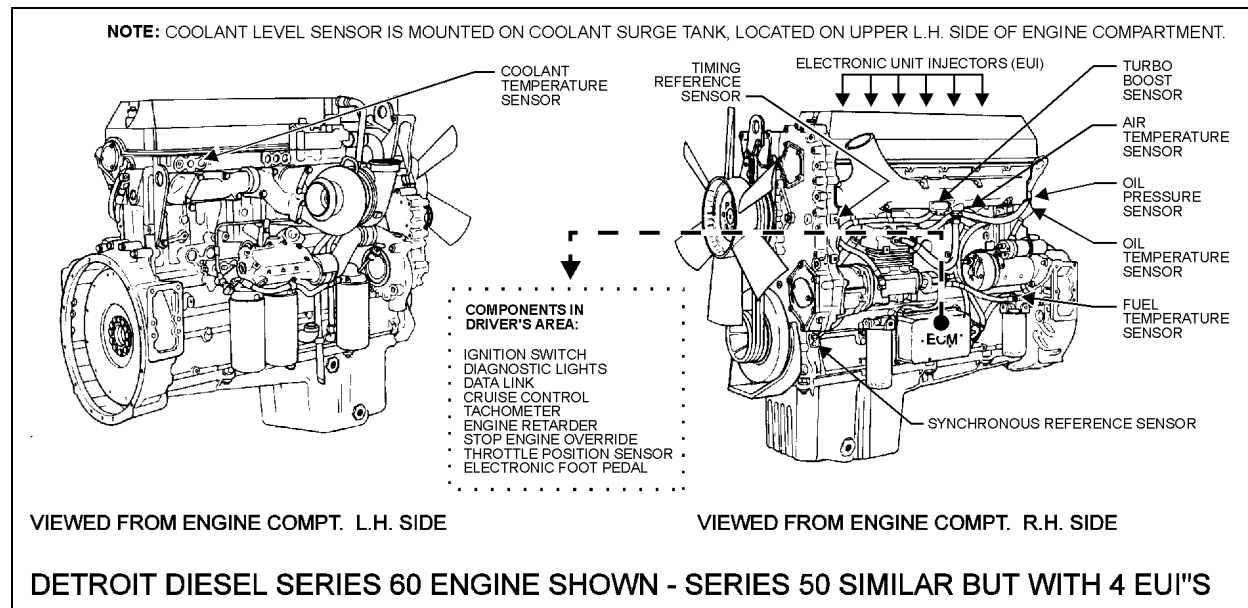


FIGURE 1: DETROIT DIESEL SERIES 60 ENGINE

01015

Section 01: Engine

Engine-mounted components are as follows:

- Electronic Control Module
- Electronic Unit Injector
- Synchronous Reference Sensor
- Timing Reference Sensor
- Turbo Boost Pressure Sensor
- Coolant Temperature Sensor
- Fuel Temperature Sensor
- Air Temperature Sensor
- Oil Pressure Sensor
- Oil Temperature Sensor

2.1 Electronic Control Module

The Electronic Control Module is mounted on the starter side of the engine (Fig. 2). It is considered the "*Brain*" of the DDEC III system because it provides overall monitoring and control of the engine by comparing input data from the various sensors to a set of calibration data stored in the EEPROM (**E**lectrically **E**rasable, **P**rogrammable, **R**ead-**O**nly **M**emory) within the Electronic Control Module. After comparing the input data with the calibrations data, the ECM sends high current command pulses to the Electronic Unit Injectors (EUI) to initiate fuel injection. The ECM also receives feedback regarding the start and end of injection for a given cylinder.

The EEPROM within the Electronic Control Module is factory programmed by Detroit Diesel. Reprogramming must be done at a Detroit Diesel authorized service center. However, some changes may be performed to the cruise control and road speed limit using a diagnostic data reader (see item #4 "*DDEC III DIAGNOSTIC CODES*" in this section).

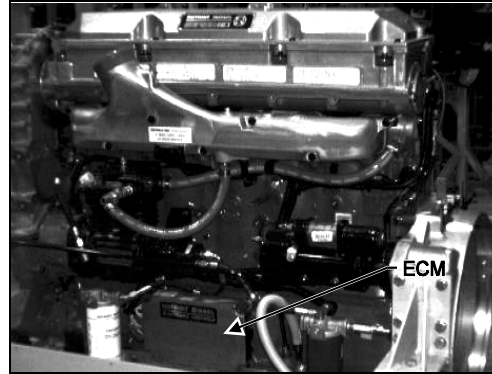
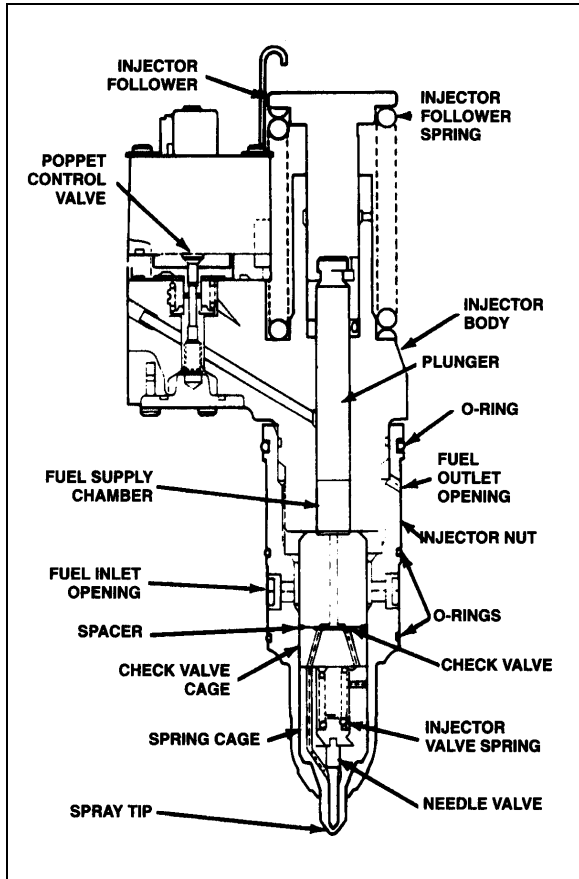


FIGURE 2: ELECTRONIC CONTROL MODULE (ECM)
01018

2.2 Electronic Unit Injector

The Electronic Unit Injector is a compact unit that injects diesel fuel directly into the combustion chamber (Fig. 3). The amount of fuel injected and beginning of injection timing is determined by the Electronic Control Module (ECM). The ECM sends a command pulse which activates the injector solenoid. The EUI performs four functions:

- Creates the high-fuel pressure required for efficient injection
- Meters and injects the exact amount of fuel required to handle the load
- Atomizes the fuel for mixing with the air in the combustion chamber
- Permits continuous fuel flow for component cooling



01019

FIGURE 3: ELECTRONIC UNIT INJECTOR CROSS-SECTION

2.3 Synchronous Reference Sensor

The Synchronous Reference Sensor (SRS) is an electronic component that is mounted to the rear of the gear case (Fig. 4). It extends through a hole in the gear case and is positioned near the rear of the bull gear. A bolt, inserted through a hole in the SRS bracket, secures the SRS assembly to the gear case. The SRS connector is black. The SRS sends a signal to the ECM. This signal is generated by a raised metal pin on the rear of the bull gear (Fig. 5).

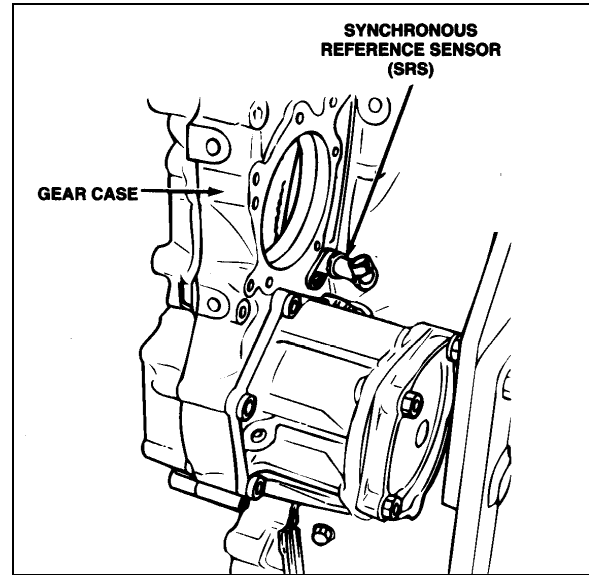


FIGURE 4: SRS LOCATION

01020

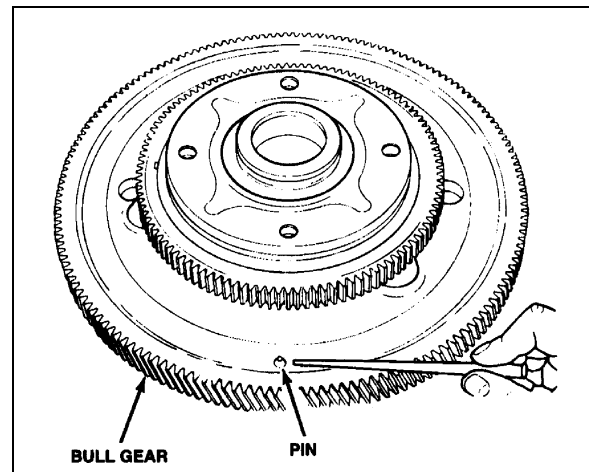


FIGURE 5: BULL GEAR

01021

The bull gear pin passes by the SRS as the number one piston reaches 45° before Top-Dead-Center. This information is used by the ECM to determine engine speed.

The SRS is non-serviceable and must be replaced as a unit. No adjustment is required.

2.4 Timing Reference Sensor

The Timing Reference Sensor (TRS) is an electronic component that is mounted on the left side of the gear case, near the crankshaft center line (Fig. 6).

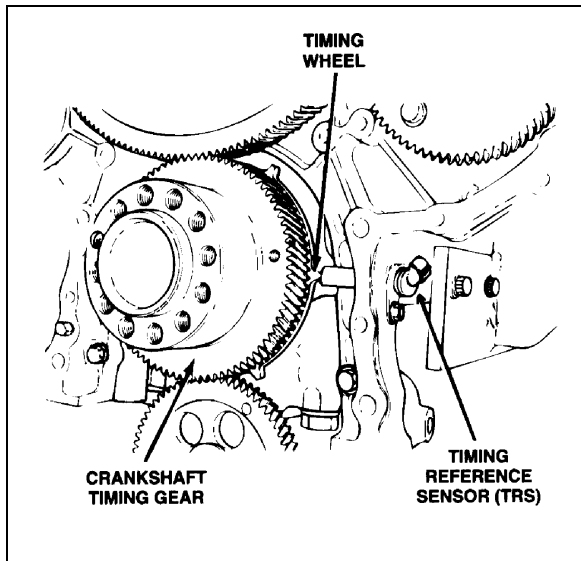


FIGURE 6: TIMING REFERENCE SENSOR AND RELATED PARTS

The TRS sensor extends through an opening in the gear case and is positioned near the timing wheel gear teeth. A bolt, inserted through a hole in the TRS bracket, secures the TRS assembly to the gear case. The TRS connector is Gray.

The TRS sensor sends a signal to the ECM. This is generated by a series of evenly spaced teeth on the timing wheel, rotating by the crankshaft. A tooth passes by the TRS as each cylinder reaches 10° before Top-Dead-Center. These signals are used by the ECM to determine injector solenoid operation time. The TRS is non-serviceable and must be replaced as a unit. No adjustment is required.

2.5 Turbo Boost Pressure Sensor

The Turbo Boost Pressure Sensor is mounted to the intake manifold with two bolts. A rubber O-ring is used to seal the sensor to the manifold (Fig. 7). This device is a pressure sensor that sends an electrical signal to the ECM. The ECM uses this information to compute the amount of air entering the engine. Fuel supply is regulated by the turbo boost sensor information to control engine exhaust. The turbo boost sensor is non-serviceable and must be replaced as an assembly. No adjustment is required.

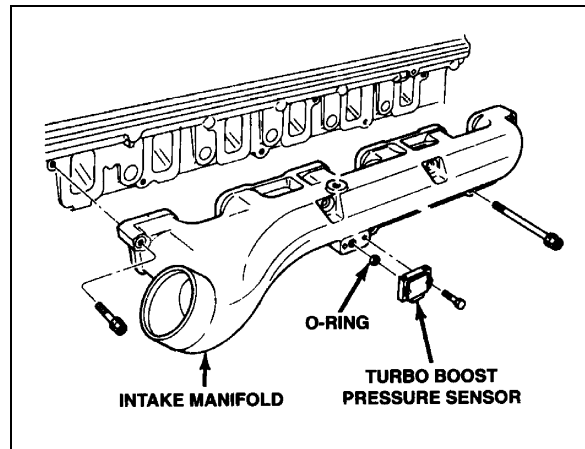


FIGURE 7: TURBO BOOST PRESSURE SENSOR

2.6 Coolant Temperature Sensor

The coolant temperature sensor is mounted on the radiator side of the engine (Fig. 1). The sensor protects the engine in case of overheating by sensing coolant temperature.

2.7 Fuel Temperature Sensor

The Fuel Temperature Sensor (FTS) is installed on the secondary fuel filter (Fig. 8). The FTS sends an electrical signal to the ECM indicating

fuel inlet temperature. The ECM uses this information to calculate fuel consumption.

The FTS is non-serviceable and must be replaced as a unit. No adjustment is required.

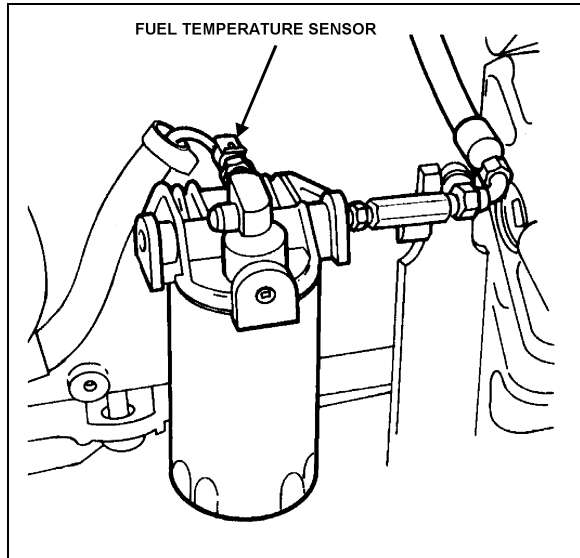


FIGURE 8: ENGINE FUEL TEMPERATURE SENSOR
01024

2.8 Air Temperature Sensor

The Air Temperature Sensor (Fig. 1) located on the engine (starter side) near the intake manifold, provides input data to vary hot idle speed and injection timing. This helps to improve cold starts and reduces white exhaust.

2.9 Oil Pressure Sensor

The Oil Pressure Sensor (OPS) is installed in the main engine oil gallery. A typical location is the left rear corner of the cylinder block (Fig. 9).

The OPS sends an electrical signal to the ECM indicating the engine oil pressure at any given speed. A low oil pressure signal exceeding seven seconds is used by the ECM to begin the stop engine or warning function. The OPS is non-serviceable and must be replaced as a unit. No adjustment is required.

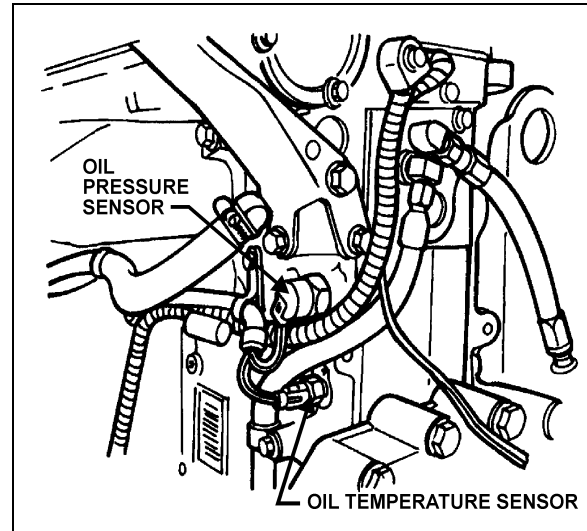


FIGURE 9: ENGINE OIL PRESSURE AND OIL TEMPERATURE SENSOR
01025

2.10 Oil Temperature Sensor

The Oil Temperature Sensor (OTS) is installed on the main engine oil gallery. A typical location is the left rear corner of the cylinder block as shown in Figure 9. The OTS sends an electrical signal to the ECM indicating engine oil temperature. The ECM uses this information to modify engine speed for better cold weather starts and faster warm-ups. Oil temperatures exceeding engine specifications for two seconds or more will illuminate the "Check Engine" light. The OTS is non-serviceable and must be replaced as a unit. No adjustment is required.

3. ENGINE-RELATED COMPONENTS

Engine-related components:

- Coolant Level System (CLS)
- Electronic Foot Pedal Assembly (EFPA) and Throttle Position Sensor
- Cruise Control Switch (CCS)
- Diagnostic System Accessories (DSA)

3.1 Coolant Level System (CLS)

The coolant level system consists of a conductivity probe mounted in the surge tank and an electronic interface module located, inside the rear junction box. Coolant level is determined by the change in impedance of the probe and its brass mount when it is immersed in coolant. The electronic device in the module conditions the signal to levels compatible with DDEC. Low coolant level will trigger the warning engine functions. The probe and the electronic interface module are non-serviceable items and if found defective, they should be replaced as units. No adjustment is required.

3.2 Electronic Foot Pedal Assembly (EFPA) & Throttle Position Sensor

The Electronic Foot Pedal Assembly (EFPA) connects the accelerator pedal to a Throttle Position Sensor (TPS). The (TPS) is a device that sends an electrical signal to the Electronic Control Module (ECM) varying in voltage, depending on how far down the pedal is depressed. The system is installed in the space normally occupied by the mechanical foot pedal. The (EFPA) has maximum and minimum stops that are built into the unit during manufacturing (Fig. 10).

The (TPS) converts the operator's foot pedal input into a signal for the ECM. The (EFPA) is shown in Figure 10.

When installed by the equipment manufacturer, the TPS should not require adjustment. If the TPS is suspected of being misadjusted, first check that the sensor is installed in accordance with the manufacturer's specifications. It is recommended that the idle count be at 50 or higher with a full throttle count of up to 200.

The TPS is self-calibrating and therefore has no optimum closed throttle or wide open throttle count value. If the counts are within the 50 to 200 range, the sensor is properly set.

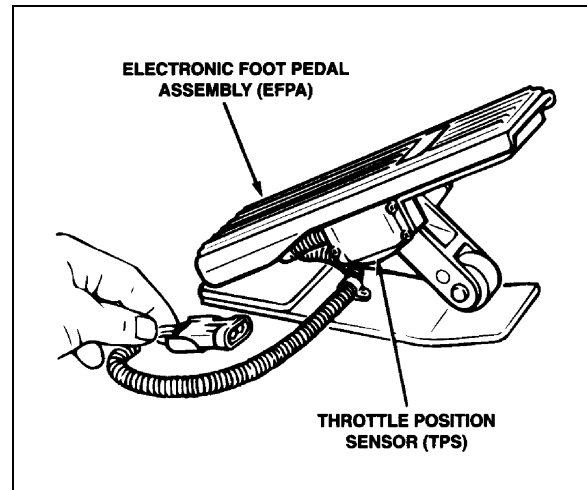


FIGURE 10: ELECTRONIC FOOT PEDAL ASSEMBLY 01026

Monitor the (TPS) as the controls move it through its full stroke. Be sure there is no misalignment or obstruction preventing the smooth movement of the TPS through the full stroke. Using a diagnostic data reader, check that the idle and full throttle position counts do not fall within the error zones. The error zones occur when the idle position is less than 14 counts, or when the full throttle position is more than 233 counts. Should these conditions occur, the ECM will signal diagnostic codes of 21-12 for idle error and 21-23 for wide open throttle error.

3.3 Cruise Control Switches (CCS)

The four cruise control switches are located in the driver's area on the L.H. side control panel.

1. **Cruise On/Off:** This is the main switch that actuates the ECM memory in order to use the speed regulating mode.
2. **Cruise Set:** This switch is used to set the cruise control speed or to decrease the set speed by 2 MPH at each application.

Note: *Cruise control system will not accept speed settings, nor will the "Resume" switch operate below 20 mph (32 km/h) and the engine speed must be above 1100 RPM.*

3. **Cruise Resume:** Each time this switch is actuated, the speed will be increased by 2 mph (3,5 km/h). This switch allows the driver to return to the last regulated speed following a brake or "DECEL" switch application.

Note: *On-off switch must be in the "ON" position in order to return to the last regulated speed.*

4. **Cruise Decel:** Will cancel the cruise temporarily like a brake application but without actuating brake light. Set speed is still in memory for resume.

For additional information, see your "Operator's Manual".

3.4 Diagnostic System Accessories (DSA)

The DDEC III engine Diagnostic System Accessories include the following:

- "Check Engine" warning light;
- "Stop Engine" warning light;
- "Stop Engine Override" switch; and
- Diagnostic Data Link (DDL) connectors.

1. **"Check Engine" Warning Light:** This light, mounted on the central dashboard panel, illuminates to indicate that a problem is currently being detected and that a code has been stored in the ECM memory. This light also has a 5-second bulb check when the ignition is first turned on. The Check Engine Light illuminates when the temperature at coolant sensors reaches 217°F (103°C) and the temperature at oil sensors reaches 239°F (115°C). In extremely hot weather and high altitude, the coolant temperature can reach 215°F (102°C) and more when climbing a long grade at full throttle. If this situation occurs, the "Check engine" light

will come on (at 217°F - 103°C) and the engine overtemperature protection system (EOP) will be activated. If the cooling system is properly maintained, the temperature should stabilize below the shut back temperature of 222°F (106°C) so the vehicle can operate normally.

Note: *Engine is not considered "overheating" when below 215°F (102°C).*

2. **"Stop Engine" Warning Light:** This light, also mounted on the central dashboard panel, illuminates to indicate that a major engine problem is occurring (with the exception of a 5-second bulb check when the ignition is first turned on). The Stop Engine Light illuminates when temperature at coolant sensors reaches 222°F (106°C) and the temperature at oil sensors reaches 260°F (127°C). When sensors reach those temperatures, the engine will shut down after 30 seconds. This 30-second delay period may be repeated using the "Stop Engine Override" switch.

Note: *Once engine is stopped, it can not be restarted until the malfunction is corrected.*

3. **"Stop Engine Override" Switch:** This switch, mounted on the L.H. lower switch panel, is used when the "Stop Engine" warning light is illuminated. Push down rocker switch to reset the 30 second delay period and the shutdown procedure. This switch can be repeatedly depressed, **i.e. one (1) pulse is sufficient for each 30 second period**, for engine power in an emergency situation.

Note: *The "Stop Engine Override" switch will be operative only if it has been depressed before the end of the 30 second delay period.*

Caution: *The "Stop Engine Override" must be used only in emergency situations to bring vehicle to a safe stop. Excessive use of this switch could cause serious damage to the engine.*

4. **Diagnostic Data Link (DDL) Connectors:** The driver's side connector is located at rear of L.H. side control panel on XL Coaches and on L.H. lateral console on XL Shells; the remote connector is located in steering compartment (Fig. 11). They are used to connect the Diagnostic Data Reader (DDR) for reading codes or to access pertinent data on the engine condition. This enables a more complete analysis of any defect found in the DDEC system operation. For more information, see "Detroit Diesel Troubleshooting Guide #6SE492".

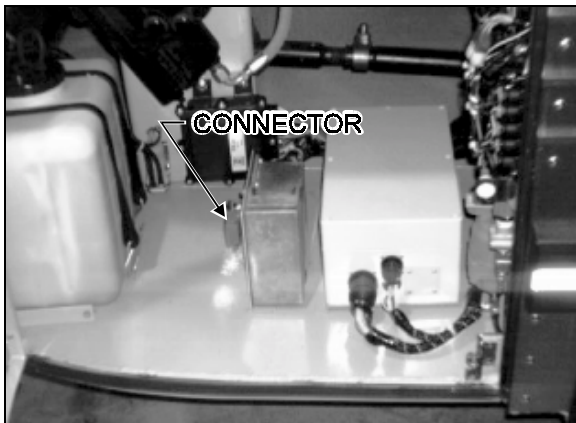


FIGURE 11: DDL REMOTE CONNECTOR
07005B

4. DDEC III DIAGNOSTIC CODES

4.1 Reading Diagnostic Codes - Flash Method:

DDEC III makes use of two types of codes; active and inactive. The difference between the two are as follows:

1. **Active Codes:** These are the codes which are currently keeping the "Check Engine" or "Stop Engine" light illuminated. Active codes are flashed via the "Stop Engine" warning light when checked with the "Stop Engine Override" switch.
2. **Inactive Codes:** These are all the codes logged in the ECM (whether or not they are currently turning "ON" the "Stop Engine" or "Check Engine" lights). Inactive codes are flashed via the "Check Engine" warning light when checked with the "Stop Engine Override" switch.

In most instances, only the DDR can provide the information necessary for a quick diagnosis of a problem. However, if you do not have a DDR available, the following procedure will let you "read out" codes. Make sure the starter selector switch (located on rear junction box in engine compartment) is in the normal position. Momentarily depress the "Stop Engine Override" switch with the ignition "ON" and the engine idling or not running. Active codes will be flashed on the "Stop Engine" warning light, followed by the inactive codes being flashed on the "Check Engine" warning light. The cycle repeats itself until the operator depresses the "Stop Engine Override" switch i.e.: A code "43" consists of four flashes, followed by a short pause, then three flashes in quick succession.

4.2 DDEC III Diagnostic Codes List

DDC Code Number (Flashed)	Description	DDC Code Number (Flashed)	Description
11	Variable speed governor sensor voltage low	12	Variable speed governor sensor voltage high
13	Coolant level circuit failed low	14	Intercooler temperature circuit failed high
14	Coolant temperature circuit failed high	14	Oil temperature circuit failed high
15	Intercooler temperature failed low	15	Coolant temperature circuit failed low
15	Oil temperature circuit failed low	16	Coolant level circuit failed high
17	Bypass position circuit failed high	18	Bypass position circuit failed low
21	EFPA circuit failed low	22	EFPA circuit failed low
23	Fuel temperature circuit failed high	24	Fuel temperature circuit failed low
25	Reserved for "no codes"	26	Aux. shutdown #1 active
26	Aux. shutdown #2 active	27	Air temperature circuit failed high
28	Air temperature circuit failed low	31	Aux. output #3 open circuit (high side)
31	Aux. output #3 short to ground (high side)	31	Aux. output #4 open circuit (high side)
31	Aux. output #4 short to ground (high side)	32	SEL open circuit
32	SEL short to battery	33	Turbo boost pressure circuit failed high
34	Turbo boost pressure circuit failed low	35	Oil pressure circuit failed high
36	Oil pressure circuit failed high	37	Fuel pressure circuit failed high

Section 01: Engine

DDC Code Number (Flashed)	Description	DDC Code Number (Flashed)	Description
38	Fuel pressure circuit failed low	41	Too many SRS (missing TRS)
42	Too few SRS (missing SRS)	43	Coolant level low
44	Intercooler temperature high	44	Coolant temperature high
44	Oil temperature high	45	Oil pressure low
46	Battery voltage low	47	Fuel pressure high
48	Fuel pressure low	52	A/D conversion fail
53	Nonvolatile checksum incorrect	53	EEPROM write error
54	Vehicle speed sensor fault	55	J1939 data link fault
55	Proprietary link fault (master)	55	Proprietary link fault (receiver)
56	J1587 data link fault	57	J1922 data link fault
58	Torque overload	61	Response time long
62	Aux. output #1 short to battery	62	Aux. output #1 open circuit
62	Aux. output #2 short to battery	62	Aux. output #2 open circuit
62	Aux. output #5 short to battery	62	Aux. output #5 open circuit
62	Aux. output #6 short to battery	62	Aux. output #6 open circuit
62	Aux. output #7 short to battery	62	Aux. output #7 open circuit
62	Aux. output #8 short to battery	62	Aux. output #8 open circuit
63	PWM #1 short to battery	63	PWM #1 open circuit
63	PWM #2 short to battery	63	PWM #2 open circuit
63	PWM #3 short to battery	63	PWM #3 open circuit
63	PWM #4 short to battery	63	PWM #4 open circuit
64	Turbo speed circuit failed	65	Reserved for air filter differential pressure circuit failed high
65	Reserved for air filter differential pressure circuit failed low	66	Reserved for oil filter differential pressure circuit failed high

DDC Code Number (Flashed)	Description	DDC Code Number (Flashed)	Description
66	Reserved for oil filter differential pressure circuit failed low	67	Coolant pressure circuit failed high
67	Coolant pressure circuit failed low	68	Idle validation circuit fault (grounded circuit)
68	Idle validation circuit fault (open circuit)	71	Injector response time short
72	Vehicle overspeed	72	Reserved for vehicle overspeed (absolute)
73	Reserved for air differential pressure high	74	Oil differential pressure high
75	Battery voltage high	76	Engine overspeed with engine brake
77	All other faults not listed	81	Timing actuator (dual fuel) failed high
81	Oil level circuit failed high	81	Crankcase pressure circuit failed high
82	Timing actuator (dual fuel) failed low	82	Oil level circuit failed low
82	Crankcase pressure circuit failed low	83	Oil level high
83	Crankcase pressure high	84	Oil level low
84	Crankcase pressure low	85	Engine overspeed
86	Pump pressure circuit failed high	86	Barometric pressure circuit failed high
87	Pump pressure circuit failed low	87	Barometric pressure circuit failed high
88	Coolant pressure low	--	CEL short to battery
--	CEL open circuit	--	Clock Module failure
--	Clock module abnormal rate		

5. ENGINE OIL LEVEL

Check the oil level daily with the engine stopped. If the engine has just been stopped and is warm, wait at least 10 minutes to allow the oil to drain back to the oil pan before checking. Wipe the dipstick clean, then check oil level. The level should always be within the safe range on the dipstick (Fig. 12) . Add the proper grade of oil to maintain the correct level on the dipstick. All diesel engines are designed to consume some oil, so a periodic addition of oil is normal.

Warning: *Touching a hot engine can cause serious burns.*

Caution: *Do not overfill. Oil may be blown out through the crankcase breather if the crankcase is overfilled.*

Caution: *Clean end of tube before removing the dipstick to prevent oil contamination.*

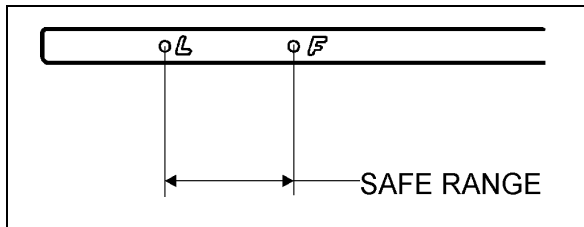


FIGURE 12: ENGINE OIL LEVEL DIPSTICK 01027

Caution: *If the oil level is constantly above normal and excess lube oil has not been added to the crankcase, consult with an authorized Detroit Diesel service outlet for the cause. Fuel or coolant dilution of lube oil can result in serious engine damage.*

The vehicle is provided with an oil reserve tank in the engine compartment. To adjust oil level, open the tank drain valve and allow oil to discharge into the engine until it reaches the "Full" mark on the dipstick, then close the valve. Check reserve tank oil level through the level sight tube on the side of the tank and top-up if necessary (Fig. 13).

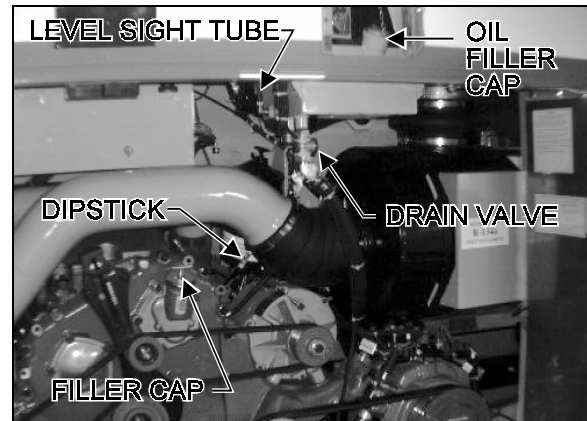


FIGURE 13: OIL RESERVE TANK 01033

6. ENGINE OIL AND FILTER CHANGE

Both the oil and filter should be changed every 12,500 miles (20 000 km) or once a year, whichever comes first. However, more frequent changes may be required when the engine is subject to high level of contamination and/or overheating. Change intervals may be decreased or gradually increased with experience on specific lubricants until the most practical service condition has been established. Always refer to the lubricant manufacturer's recommendations (analysis of drained oil can be helpful).

Caution: *Do not use solvent to dilute the engine oil when draining oil. Dilution of the fresh oil can occur which may be detrimental to the engine.*

Change engine oil with the vehicle on a flat and level surface and with the parking brake applied. It is best to drain the oil when the engine is still warm.

1. From under the vehicle, remove the engine drain plug on the oil pan. Allow oil to drain (Fig. 14).

Warning: *Hot engine oil can cause serious burns. Wear coveralls with sleeves pulled down and gloves to protect hands.*

2. Reinstall the drain plug.

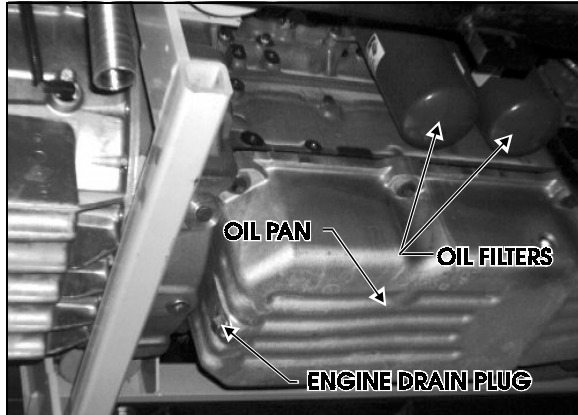


FIGURE 14: ENGINE OIL DRAIN PLUG

01029

3. Remove the spin-on filter cartridge using a 1/2" drive socket wrench and extension.
4. Dispose of the used oil and filter in an environmentally responsible manner in accordance with state and/or federal (EPA) recommendations.
5. Clean the filter adapter with a clean rag.
6. Lightly coat the filter gasket (seal) with clean engine oil.
7. Install the new filter on the adapter and tighten manually until the gasket touches the mounting adapter head. Tighten full-flow filters an additional two-thirds of a turn manually. Then, tighten bypass filter one full turn manually.

Caution: Overtightening may distort or crack the filter adapter.

8. Remove the engine oil filler cap and pour oil in the engine until it reaches the "FULL" mark on the dipstick (Fig. 13).
9. Start and run the engine for a short period and check for leaks. After any leaks have been corrected, stop the engine long enough for oil from various parts of the engine to drain back to the crankcase (approximately 20 minutes).

Add oil as required to bring the level within the safe range on the dipstick (Fig. 12).

7. RECOMMENDED ENGINE OIL TYPE

To provide maximum engine life, lubricants should meet the following specifications:

SAE Viscosity Grade: 15W-40
API Classification: CG-4
HT/HS Viscosity: 3.7 cP minimum

Note: Monograde oils should not be used in these engines regardless of API Service Classification.

Note: The use of supplemental oil additives are discouraged from use in Detroit Diesel Engines.

Synthetic oils

Synthetic oils may be used in Detroit Diesel engines provided they are API licensed and meet the performance and chemical requirements of non-synthetic oils outlined previously. Synthetic oils do not permit extension of recommended oil drain intervals.

Lubricant Selection World Wide

Oils meeting API CD or CC specifications may be used if they also meet military specification MIL-L-2104 E or F. Oil which meets European CCMC D4 specifications may also be used. Modification of drain intervals may be necessary, depending on fuel quality. Contact Detroit Diesel Corporation for further guidance.

8. WELDING PRECAUTION

Caution: Precautions must be taken to prevent damage to the DDEC electronic control system when welding. Disconnect battery power, ground cables and the 6-pin power connector at the ECM (Electronic Control Module) before welding. Failure to isolate the DDEC system from high current flow can result in severe ECM damage.

9. POWER PLANT ASSEMBLY REMOVAL (AUTO. / MAN. TRANS.)

To access the engine or engine-related components, the vehicle power plant assembly must be removed as a whole unit by means of a slide-out cradle. The power plant assembly includes the engine, transmission (including retarder if so equipped), air compressor, alternator and transmission oil cooler.

Remove the power plant assembly as follows:

Caution: Tag hoses and cables before disconnecting in order to facilitate reinstallation. Plug all openings to prevent dirt from entering the system.

Note: No parts within the ECM are serviceable. If found defective, replace the complete ECM unit.

1. Disconnect the battery or batteries from the starting system by removing one or both of the battery cables from each battery system. With the electrical circuit disrupted, accidental contact with the starter button will not produce an engine start. In addition, the Electronic Unit Injectors (EUI) will be disabled, preventing any fuel delivery to the injector tips.

Warning: Due to the heavy load of the rear bumper assembly, it must be adequately supported before attempting to remove it.

2. Remove the rear bumper assembly from the vehicle. Refer to Section 18, "BODY", under heading "Rear Bumper Removal and Installation".
3. Drain the engine cooling system. Refer to Section 05, "COOLING" under heading "Draining Cooling System".

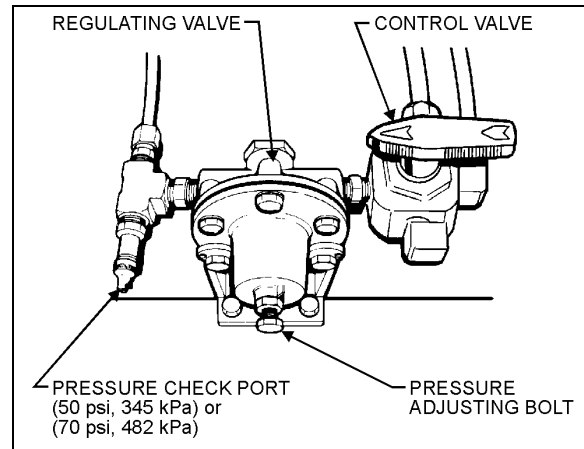


FIGURE 15: BELT TENSIONER CONTROL VALVE
12018

4. Locate the belt tensioner control valve (4, Figs. 15 & 16). Turn handle counter-clockwise in order to reverse pressure in belt tensioner air bellows and release tension on belts. Remove belts.
5. Exhaust all air from the air system. (if necessary, refer to Section 12, "BRAKES & AIR SYSTEM").

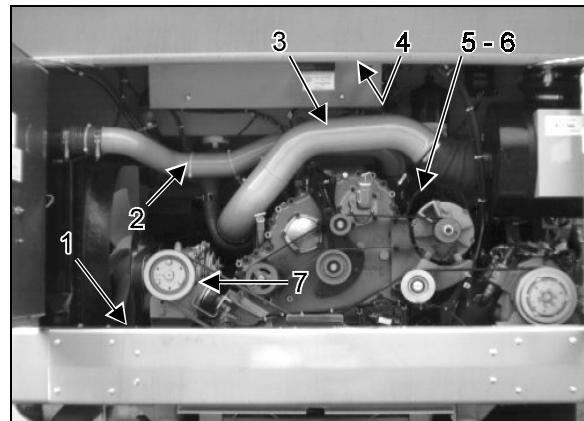


FIGURE 16: POWER PLANT ASSEMBLY REMOVAL
01014B

6. Disconnect and remove the engine air intake duct mounted between air cleaner housing and turbocharger inlet (3, Fig. 16).

Caution: To avoid damage to turbocharger, cover the turbocharger inlet opening to prevent foreign material from entering.

7. Disconnect and remove the air intake duct mounted between the air cooler outlet and the intake engine (2, Fig. 16).

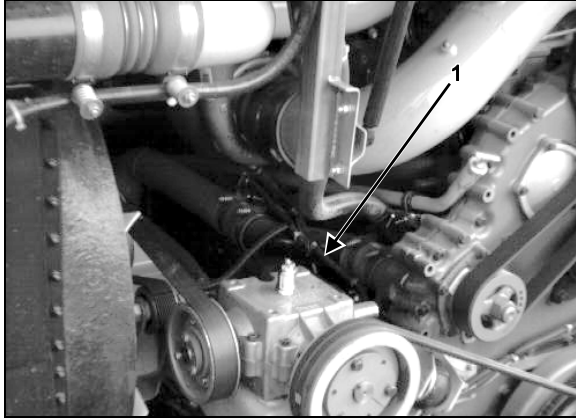


FIGURE 17: ELECTRIC FAN CLUTCH CONNECTOR
01031

8. Disconnect and remove the section of coolant pipe assembly mounted between the radiator outlet and the water pump inlet (1, Fig. 16).
 9. Disconnect the coolant delivery hose located inside of engine close to the water pump.
 10. Disconnect the electric fan clutch connector located next to water pump (1, Fig. 17).
 11. Dismantle the air bellow from the upper bracket tensioner for the fan drive assembly. Remove the upper bracket (7, Fig. 16).
 12. If necessary, remove the fan drive system from the engine compartment by removing the four retaining bolts, washers and nuts securing the fan drive to the radiator floor.
 13. Disconnect and remove the air intake duct mounted between the turbocharger outlet and the air cooler inlet.
 14. Disconnect two vent hoses from the thermostat housing and from the coolant pipe assembly.
 15. Disconnect and remove the section of coolant pipe assembly mounted between the thermostat housings and the radiator inlet.
 16. Disconnect and remove the small hose connected from the heater line valve to the water pump.
 17. Disconnect the small heater hose located on the cylinder head at the back of the engine.
 18. Disconnect temperature sensor for the pyrometer located above the exhaust pipe, close to the turbocharger (optional).
 19. Disconnect and remove the exhaust pipe mounted between the turbocharger outlet and the exhaust bellows. If necessary, refer to Section 4, under heading "Exhaust System".
- Caution: To avoid damage to turbocharger, cover the turbocharger outlet opening to prevent foreign material from entering.**
20. Disconnect the block heater connector above the power steering pump (R.H. side).
 21. Disconnect the steel-braided air line from the A/C compressor air bellows.
 22. Disconnect the engine oil pressure steel-braided hose from the mechanical oil pressure gauge and the cable of the gauge water temperature (5 & 6, Fig. 16).
 23. Disconnect the oil delivery hose from the valve located at the reserve tank exit.
 24. Disconnect the power steering pump supply and discharge hoses. Cap hose openings immediately to limit fluid loss. Remove retaining clips from cradle.

Section 01: Engine

25. Close engine fuel supply shutoff valve on primary fuel filter. Disconnect the fuel line connected to the inlet port. On vehicles equipped with the optional water separator fuel filter, disconnect the connector and remove cable ties from cradle.
26. Disconnect the air compressor discharge, governor steel-braided air lines and the manual filling air lines from compressor. Remove retaining clips.
27. Disconnect the hose connecting the compressor head to the septic reservoir.
28. Disconnect ground cables from rear subframe ground stud, located close to the starting motor.
29. Disconnect positive cable (red terminal) from starting motor solenoid.
30. Disconnect the power plant wiring harness main connectors from EMC and remove retaining clips from engine compartment back wall.
31. On vehicles equipped with an automatic transmission with output retarder, disconnect steel-braided air line from pressure regulator output. On XL-40 & 45E vehicles, the pressure regulator is mounted on the curb side rear wheel housing, inside the engine compartment. On XL-45 vehicles, the regulator is mounted inside R.H. side rear service compartment (rear L.H. corner).
32. Disconnect fuel return line from bulkhead fixed on engine cylinder head end.
33. On vehicles equipped with an electrically operated cold starting aid, disconnect the delivery hose from the starting aid cylinder solenoid valve. Remove cable ties securing hoses.
34. Disconnect turbo boost pressure gauge air line (if vehicle is so equipped) from engine air intake.
35. (Only if vehicle is equipped with an output retarder). Remove the transmission rubber damper assembly above transmission by removing: nut, bushing, rubber damper, rubber damper guide, bolt and washer. Remove the rubber damper bracket from transmission
36. Disconnect connectors from transmission - On left side: four at rear and one close to yoke - On right side: close to output retarder's solenoid valve.
37. From under the vehicle, disconnect the propeller shaft as detailed in Section 09 "PROPELLER SHAFT".

Manual Transmission:

- **Disconnect gear shift linkage.**
 - **Remove clutch slave cylinder from transmission without disconnecting the hydraulic hose.**
38. Inspect the power plant assembly to ensure that nothing will interfere when sliding out the cradle.
 39. Remove the six retaining bolts, washers and nuts securing the power plant cradle to the vehicle rear subframe (Fig. 19).

Note: *Check if any spacer(s) have been installed between power plant cradle and vehicle rear subframe, and if so, note position of each washer for reinstallation purposes.*

40. Using a forklift, with a minimum capacity of 4,000 lbs (1 800 kg), slightly raise the power plant cradle. Pull engine out slowly from the engine compartment. Make sure all lines, wiring and controls are disconnected and are not tangled.

Caution: *Due to the minimum clearance between the power plant equipment and the top of the engine compartment, extreme care should be used to raise the power plant cradle, just enough to free the cradle. Clearance between power plant cradle and mounting rail should range between 1/4" and 1/2" (6-12 mm).*

10. POWER PLANT ASSEMBLY INSTALLATION (AUTO. / MAN. TRANS.)

To install a power plant assembly, follow the same procedure as in step 9., except in reverse order. Then proceed with the following:

1. Torque the power plant cradle mounting bolts to 113-144 lbf•ft (153-195 N•m).
2. (only if the vehicle is equipped with an automatic transmission with retarder).
 - Install the bracket from transmission (torque screw to 71-81 lbf•ft [96-110 N•m]).
 - Install the transmission rubber damper assembly above transmission by assembling: bolt, washer, rubber damper guide, rubber damper, bushing and nut. Respect rubber damper tolerance (Fig. 18).

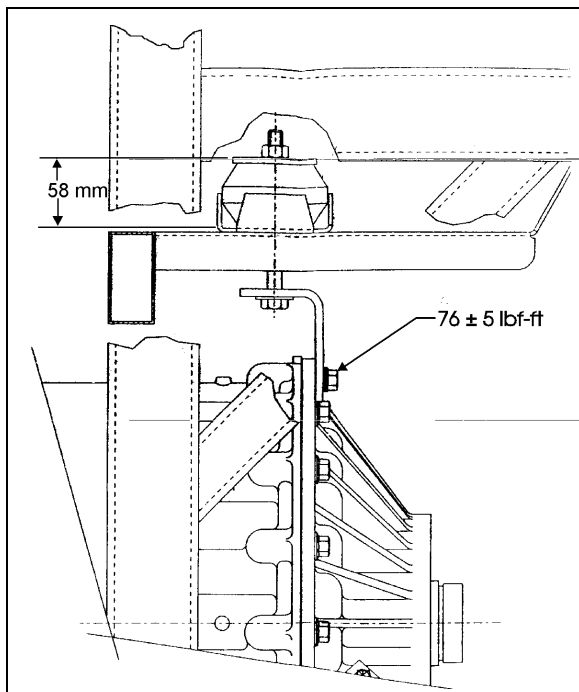


FIGURE 18: RUBBER DAMPER TOLERANCE

07014

3. If fan drive has been removed, reinstall and align as per Section 05, "COOLING", under heading "Fan Drive Alignment".
4. Refill cooling system with recuperated fluid (refer to Section 05, "COOLING").
5. After engine fuel system has been drained, it will aid restarting if fuel filters are filled with fuel oil (refer to Section 03, "FUEL SYSTEM").
6. After work has been completed start engine for a visual check. Check fuel, oil, cooling, pneumatic and hydraulic system connections for leakage. Test operation of engine controls and accessories.

11. ENGINE MOUNTS

The power plant assembly is mounted to the cradle by means of four rubber mounts. Two rubber mounts are located at the front of the engine while the other two are mounted on each side of the flywheel housing (Fig. 19).

It is recommended that new rubber mounts be installed at each major overhaul.

12. JAKE BRAKE

Refer to Technical Publications web site for The Jake Brake "Maintenance Manual" and "Tune-up instruction for Models 760/760A/765 Engine Brakes".

Section 01: Engine

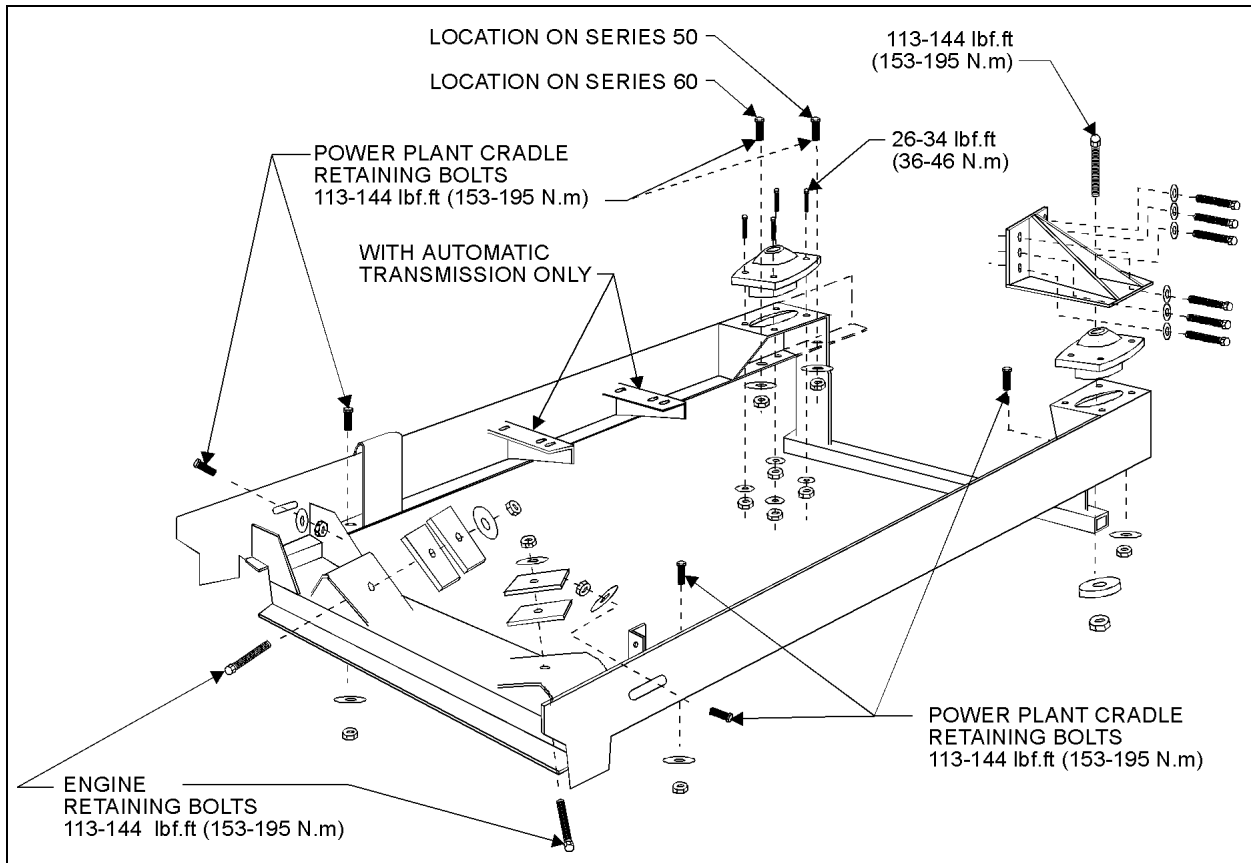


FIGURE 19: POWER PLANT CRADLE INSTALLATION

01032A

13. SPECIFICATIONS

Series 60 Engines

Make.....Detroit Diesel
 Type..... Diesel four cycle/in-line engine
 Description..... Turbo/Air to air intercooled
 No. of cylinders.....6
 Operating range..... 1200-2100 RPM
 Maximum RPM.....2100

Model 11.1 Liter

Bore & stroke.....5.12 X 5.47 in (130 X 139 mm)
 Horsepower.....325 BHP

Model 12.7 Liter

Bore & stroke.....5.12 X 6.30 in (130 X 160 mm)
 Horsepower.....400 BHP (Coach), 470 BHP (Shells)

Series 50 Engines

Make.....	Detroit Diesel
Type	Diesel four cycle/in-line engine
Description	Turbo/Air to air intercooled
No. of cylinders	4
Operating range	1200-2100 RPM
Maximum RPM	2100
Displacement	8,5 liters
Bore & stroke	5.12 X 6.30 in (130 X 160 mm)
Horsepower.....	315 BHP

Lubricants

Heavy-duty engine oil SAE Viscosity Grade 15W-40, API Classification CG-4, HT/HS Viscosity 3.7 cP and meeting MIL-L-2104 E or F specifications. Synthetic oil may be used if it meets the performance and chemical requirements of non-synthetic oils outlined previously. Some engine operating conditions may require exceptions to this recommendation.

Caution: *To avoid possible engine damage, do not use single grade (monograde) lubricants in Detroit Diesel four-cycle Series 50 and 60 engines, regardless of API classification.*

Capacity

Oil reserve tank.....	10 quarts/9.5 liters
-----------------------	----------------------

Engine oil level quantity (Series 60)

Oil Pan Capacity, Low Limit.....	26 quarts/25 liters
Oil Pan Capacity, High Limit.....	32 quarts/30 liters
Total Engine Oil Capacity With Filters	41 quarts/39 liters

Engine oil level quantity (Series 50)

Oil Pan Capacity, Low Limit.....	19 quarts/18 liters
Oil Pan Capacity, High Limit.....	22 quarts/21 liters
Total Engine Oil Capacity With Filters	28 quarts/26 liters

Engine Oil Filters

Make.....	AC Rochester Div. GM # PF-2100
Make.....	Detroit Diesel # 25014505
Type	Full Flow
Prévost P/N.....	510458

Torque specification

Engine oil filter.....	Tighten 2/3 of a turn after gasket contact
------------------------	--

Section 01: Engine

Filters

Engine Air Cleaner Filter

Make..... Nelson # 70337-N
Prévost P/N 530197

Engine Primary Fuel Filter

Make.....AC Rochester Div. GM # TP-915D
Make..... Detroit Diesel # 25014274
Prévost P/N 510137

Engine Primary Fuel Filter With Water Separator (Optional)

Make..... Racor S 3202
Prévost P/N 531390

Engine Secondary Fuel Filter

Make.....AC Rochester Div. GM # TP-916D
Make..... Detroit Diesel # 25014342
Prévost P/N 510128

Engine Coolant Filter/Conditioner

Make..... Nalco Chemical Company # DDF3000
Make..... Detroit Diesel # 23507545
Prévost P/N 550630

SECTION 02: CLUTCH

CONTENTS

1. CLUTCH.....	2 - 2
1.1 Description	2 - 2
2. CLUTCH ADJUSTMENT.....	2 - 2
2.1 Clutch Pedal Adjustment	2 - 2
2.2 Internal Clutch Adjustment.....	2 - 3
2.3 Free Travel Setting	2 - 4
2.4 Air Pressure Regulator	2 - 4
3. RENEW CLUTCH HYDRAULIC LINE	2 - 4
3.1 Bleeding	2 - 4
3.2 Filling	2 - 5
4. LUBRICATION.....	2 - 5
5. TROUBLESHOOTING	2 - 6
6. SPECIFICATIONS.....	2 - 8

LIST OF ILLUSTRATIONS

FIG. 1: FREE PLAY ADJUSTMENT	2 - 3
FIG. 2: RELEASE TRAVEL AND FREE PLAY TRAVEL ADJUSTMENT.....	2 - 3
FIG. 3: SQUARE HEAD BOLT	2 - 3
FIG. 4: CLUTCH INSTALLATION	2 - 4
FIG. 5: AIR PRESSURE REGULATOR.....	2 - 4
FIG. 6: SERVO UNIT	2 - 5

1. CLUTCH

1.1 Description

Vehicles equipped with a manual transmission are provided with the "Spicer" Angle-Spring Clutch. The clutch assembly consists of a 15 1/2" dry disc two-plate model. It is a pull-type design with riveted organic wear surface facing on driven discs. It is manually adjustable to compensate wear, hydraulically operated and pneumatically assisted. A torque limiting clutch brake as well as a positive separator pin system are also provided. One type of clutch is installed regardless of transmission (6 or 7 speeds).

Refer to the "SPICER - SERVICE MANUAL" annexed to the end of this section for the following:

- Transmission Removal

Note: For more details, refer to section 07 "Transmission".

Note: Disconnect the clutch operating cylinder external linkage and remove cylinder assembly (without disconnecting hydraulic hose), to permit the release yoke to turn up and pull free of the release bearing thrust pads, then disconnect the transmission shift linkage.

- Clutch Removal
- Engine and Transmission Alignment (Inspection)
- Clutch Installation
- Transmission Installation

Note: For more details, refer to Section 07 "Transmission"

Note: Position the torque limiting clutch brake on the main drive gear of the transmission, then shift transmission into gear so that the input shaft can be rotated during assembly to align with clutch-driven disc hub splines.

Note: Rotate clutch release bearing housing so that flat section is on top.

Note: Rotate clutch release yoke so that release yoke fingers clear the pads on the release bearing housing. Use a suitable transmission jack to support and maintain the engine-to-transmission alignment while installing the transmission. Use care to avoid having the weight of the transmission bearing on the clutch or forcing the transmission into the clutch or flywheel housing. Such abuse can cause bent or "sprung" driven discs and prevent the clutch from releasing. Rotate clutch release yoke into proper position as transmission is moved into place.

Note: Start all transmission bell housing cap screws and tighten progressively around the housing to 45 lbf•ft (61 Nm).

Note: Connect the transmission shift linkage. Install the clutch operating cylinder and its linkage, then proceed with the clutch adjustment in accordance with paragraph 2.

2. CLUTCH ADJUSTMENT

Note: If for any reason, air is present inside clutch hydraulic line, bleed clutch in accordance with paragraph 3.1.

2.1 Clutch Pedal Adjustment

Adjust clutch pedal as follows:

1. Free play adjustment is made by loosening nut (1, Fig. 1) and moving bolt in slot. The pedal moves down allowing a 1/4" (6 mm) of free play before the master cylinder (5, Fig. 1) starts to move.
2. Keep this adjustment by tightening nut (1, Fig. 1).
3. Push the clutch pedal until the master cylinder piston touches the cylinder bottom.

4. Loosen the adjustment bolt (2, Fig. 1) until it touches the pedal wall support (3, Fig. 1).
5. Loosen the adjustment bolt (2, Fig. 1) for another 1-1/2 turn. Lock in position by tightening nut (4, Fig. 1).

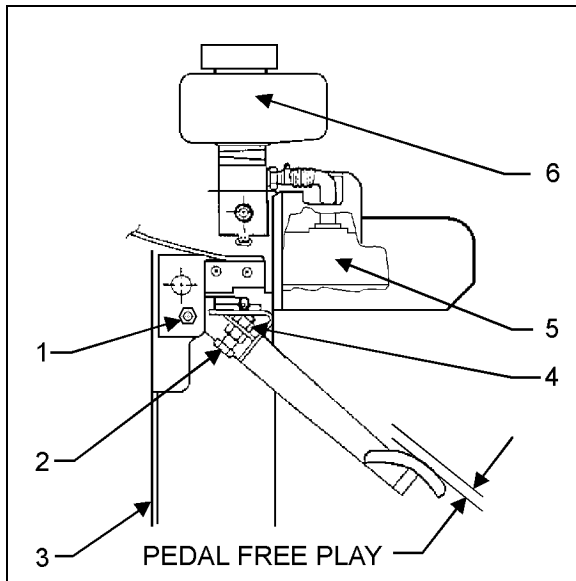


FIGURE 1: FREE PLAY ADJUSTMENT 02004

Note: Clean reservoir internal pieces with jet air to eliminate dirt.

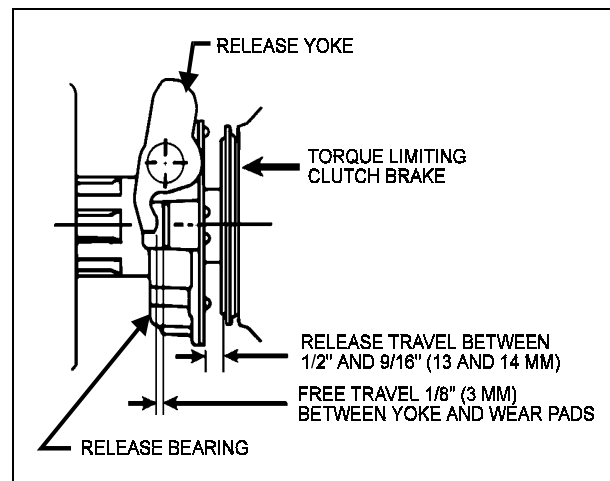
2.2 Internal Clutch Adjustment

1. Remove inspection cover at bottom of clutch housing (Fig. 4).
2. Measure the **release travel** (clearance between release bearing housing and clutch brake) (Fig. 2). The clearance should be between 1/2" and 9/16" (13 and 14 mm).
3. If clearance is incorrect, release the clutch by depressing the clutch pedal to end of pedal travel. Insert a 3/4" socket (12 points) or a 3/4" box-end wrench through inspection hole. Depress square-head bolt to adjust clutch (Figs. 3 & 4).

The "Kwik-Adjust" will re-engage at a quarter of a turn. The flat surface on the bolt head will align with the flat edge of the bracket.

Note: If clearance between release bearing housing and clutch brake is less than 1/2" (13 mm), rotate the adjusting ring counterclockwise to move the release bearing towards the engine. If clearance is greater than 9/16" (14 mm), rotate the adjusting ring clockwise to move the release bearing towards the transmission.

4. Ensure "Kwik-Adjust" is engaged in the locked position. Release the clutch pedal to engage clutch.



02005
FIGURE 2: RELEASE TRAVEL AND FREE PLAY TRAVEL ADJUSTMENT

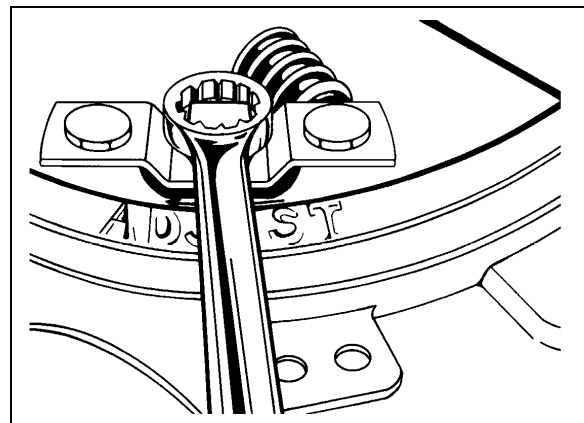


FIGURE 3: SQUARE HEAD BOLT 02006

2.3 Free Travel Setting

1. Check **free travel** as shown in figure 2. The clearance should be 1/8" (3 mm).
2. If clearance is incorrect, adjust bolt until it touches the shaft lever and locks in position with nut (Fig. 4).

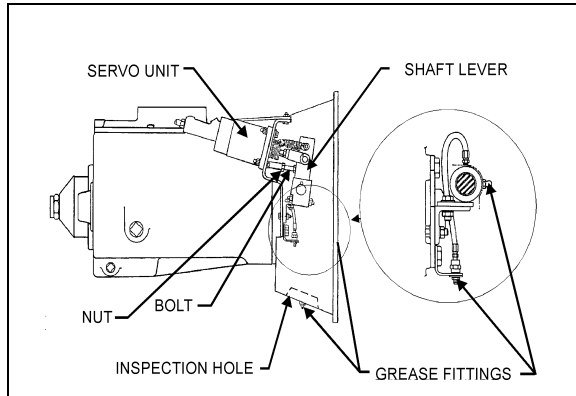


FIGURE 4: CLUTCH INSTALLATION

02001

Note: The return springs do not require any tension adjustment.

2.4 Air Pressure Regulator

The air pressure regulator is located in engine compartment and accessible through R.H. side door (Fig. 5). To adjust, remove dust cap from regulator. Attach a pressure gauge to port. Loosen adjusting screw lock nut. Turn screw to **adjust pressure to 40 psi (275 kPa)**. Tighten lock nut, then reinstall dust cap. Refer to Section 12, "BRAKE AND AIR SYSTEM".



FIGURE 5: AIR PRESSURE REGULATOR

02007

3. RENEW CLUTCH HYDRAULIC LINE

3.1 Bleeding

The clutch hydraulic system must be bled whenever air enters it. Unlike hydraulic fluid, air is compressible. This means that instead of transmitting pedal pressure through the hydraulic line, the master cylinder will compress air in the line. This results in a spongy feel in the pedal, incomplete clutch disengagement and hard shifting.

Note: Two people are required to bleed air from the hydraulic lines. One to operate the clutch pedal and the other to open and close the bleed valve.

Warning: Wear safety glasses during the following operation.

1. Locate the bleed valve mounted at the end of servo unit. Remove dust cap (Figs. 4 and 6).
2. Attach a plastic tube to the bleeding valve (Fig. 6). Dip the other end of the tube in a jar containing several inches of clean brake fluid.
3. Press the clutch pedal as far as it will go 2 or 3 times, then hold it down.
4. With the clutch pedal down, open the bleeding valve until the pedal goes to the floor, then close the bleeding valve. Do not release the pedal until the bleeding valve is closed.
5. Close valve and slowly release the pedal.

6. Repeat steps 4-6 until the fluid entering the jar is free of air bubbles.

3.2 Filling

1. Remove the master cylinder reservoir cap.
2. Slightly loosen teflon flexible hydraulic hose connector from adapter mounted on extremity of servo unit (Fig. 6).

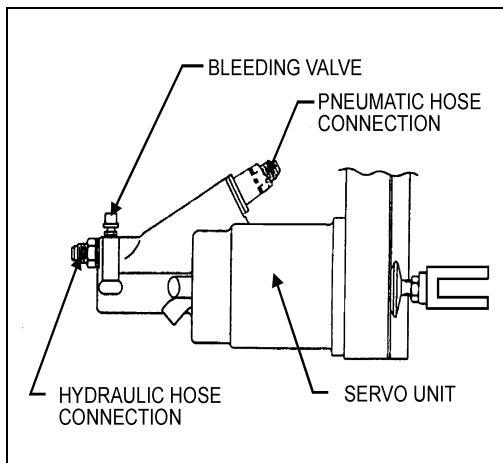


FIGURE 6: SERVO UNIT

02002

3. Remove the plastic tube on the bleeding valve. Make sure the bleeding valve is open. Force fluid (meeting DOT 3 specifications) through the bleeding valve opening. Tighten teflon flexible hose connector when fluid is free of air bubbles. Continue to force brake fluid until it enters master cylinder reservoir and flows free of air bubbles.

Note: A 40 psi (275 kPa) pressure allows filling hydraulic line in reasonable time.

4. Tighten bleeding valve and reinstall dust cap.
5. Fill master cylinder reservoir.
6. Install the master cylinder reservoir cap.

Note: To make the filling procedure easier to perform, the reservoir support may be unbolted and reservoir moved closer to you.

Caution: Never re-use brake fluid which has been bled from the system. Discard old brake fluid and use a fresh supply.

4. LUBRICATION

The clutch components should be lubricated every 6,250 miles (10 000 km) or twice a year, whichever comes first (refer to previous Fig. 4 to identify the clutch component grease fittings). The clutch release bearing (one grease fitting) and the clutch control cross shaft (three grease fittings, two on the operating cylinder side and one on the other side) should be lubricated with a good quality lithium-based soap or equivalent E.P. grease meeting N.L.G.I. grades 1 or 2.

5. TROUBLESHOOTING

Poor Clutch Release or Poor Engagement	
Probable cause	Corrective action
Clutch adjustment incorrect.	Recheck adjustment as per instructions.
Air in clutch hydraulic line.	Bleed clutch hydraulic line as per instructions.
Flywheel pilot bearing too tight in flywheel or on end of drive gear.	Free pilot bearing with a light push. If bearing is rough, replace it.
Damage clutch release bearing.	Replace bearing. Lubricate with recommended lube.
Clutch release shaft projecting through release yoke.	Relocate release shaft so that it does not project. Check bell housing bushing and release yoke for wear.
Release yoke contacting cover assembly at full release position.	Replace release yoke with proper yoke.
Release yoke not aligned properly with release bearing.	Check flywheel. Probably has been resurfaced more than the 0.060" (1,52 mm) recommended.
Intermediate plate sticking on drive lugs	Check that drive pins are 90° square to flywheel surface and that there is a minimum .006" (0,152 mm) clearance between drivepins and intermediate plate slots.
Pressure plate not retracting.	<ul style="list-style-type: none"> a. Check pressure plate drive lugs for 0.006" (0,152 mm) clearance. b. Check pressure plate return springs for proper tension. c. Check amount of release travel. d. Lever nose out of groove.
Driven disc distorted.	Should be straight within 0.015" (0,381 mm). Replace if distortion cannot be corrected.

Poor Clutch Release or Poor Engagement (cont'd)	
Probable cause	Corrective action
Worn splines on drive gear of transmission.	Check drive gear and driven disc hubs for excessive wear.
Disc facings gummed with oil or grease.	Replace facings or entire disc. Cleaning not recommended. Check for leak causing gumming.
Broken intermediate plate.	Replace entire intermediate plate/driven disc assembly. Damage such as this is almost always caused by abusive use of clutch.

Clutch Slipping	
Probable Cause	Corrective action
Pedal has no free play	Re-adjust as per instructions.
Release mechanism binding.	Check release mechanism and linkage. Lube if necessary.
Worn clutch facings.	Replace facings or complete disc, if necessary.
Grease or oil on facings.	Replace facings.
Weak pressure springs.	Replace springs
Overloaded clutch	Check to assure that proper clutch has been specified.

Noisy Clutch	
Probable Cause	Corrective action
Clutch release bearing dry or damaged.	Lubricate bearings or replace.
Flywheel pilot bearing dry or damaged.	Lubricate bearings or replace.
Clutch release bearing housing striking flywheel ring.	Adjust clutch. Also check wear on cross shafts, bell housing bushings and release yoke fingers. Replace if necessary.
Improper clearance between drive slots and drive lugs on pressure plates.	Clearance should be at least 0.006" (0,152 mm).

6. SPECIFICATIONS

Clutch Adjustment

Pedal free play	1/4 ±1/8" (6±3 mm)
Internal clutch adjustment.....	between 1/2-9/16" (13-14 mm)
Free travel setting	1/8" (3 mm)
Clutch brake setting (between stopper and adjusting bolt).....	between 1/4-3/8" (6-9 mm)

Clutch Assembly - Series 60

Make.....	DANA Corp. (Spicer)
Supplier number.....	108391-78
Prevost number.....	520147
Model.....	Easy Pedal
Type	Dry, two-plate, pull-type, manually adjustable (Kwik- Adjust)
Size	15 1/2" (394 mm)
Plate Load Capacity	4000 lbs (17 792 N)
Maximum Torque Capacity	1450 lbf•ft (1966 N•m)
Disc Facing Thickness.....	0.487/0.452
Hub Spline Size (No. splines).....	2" (10)
Disc Assembly Max. Runout (T.I.R.).....	0.015" (0,381 mm)
Disc Assembly Max. Out-of-Flat.....	0.020" (0,508 mm)
Release Sleeve Bushing Dia. (new).....	2.010/2.008" (51,054/51,003 mm)
Intermediate Plates, driving lugs to slot clearance (new min.).....	0.006" (0,152 mm)
Intermediate Plates, driving lugs to slot clearance (max. worn)	0.015 to .021" (0,381 to 0,508 mm)
Pressure Plates, driving lugs to slot clearance (new)	0.003 to .010" (0,076 to 0,254 mm)
Pressure Plates, driving lugs to slot clearance (max. worn).....	0.016/.021" (0,406/0,533 mm)
Intermediate Plates & Pressure Plates: Out-of-Flat.....	0.000 to .004 Concave (0,000 to 0,102 mm)
Scoring - Max. depth that can be re-used	0.015" (0,381 mm)
Release Sleeve Retainer, driving lugs to slot clearance (max. worn)	0.020" (0,508 mm)
Maximum Engine RPM.....	2600

Clutch Assembly - Series 50

Make.....DANA Corp. (Spicer)
 Supplier number..... 108925-84
 Prevost number..... 520148
 Model..... Easy Pedal
 Type Ceramic, two-plate, pull-type, manually adjustable (Kwik- Adjust)
 Size 15 1/2" (394 mm)
 Plate Load Capacity..... 3200 lbs (14 080 N)
 Maximum Torque Capacity 1150 lbf•ft (1564 N•m)
 Disc Facing Thickness..... 0.487/0.452
 Hub Spline Size (No. splines).....2" (10)
 Disc Assembly Max. Runout (T.I.R.) 0.015" (0,381 mm)
 Disc Assembly Max. Out-of-Flat 0.020" (0,508 mm)
 Release Sleeve Bushing Dia. (new).....2.010/2.008" (51,054/51,003 mm)
 Intermediate Plates, driving lugs to slot clearance (new min.)..... 0.006" (0,152 mm)
 Intermediate Plates, driving lugs to slot clearance (max. worn) 0.015 to .021" (0,381 to 0,508 mm)
 Pressure Plates, driving lugs to slot clearance (new) 0.003 to .010" (0,076 to 0,254 mm)
 Pressure Plates, driving lugs to slot clearance (max. worn) 0.016/.021" (0,406/0,533 mm)
 Intermediate Plates & Pressure Plates: Out-of-Flat0.000 to .004 Concave (0,000 to 0,102 mm)
 Scoring - Max. depth that can be re-used 0.015" (0,381 mm)
 Release Sleeve Retainer, driving lugs to slot clearance (max. worn) 0.020" (0,508 mm)
 Maximum Engine RPM.....2600

Master Cylinder

Make.....Kongsberg Automotive
 Supplier Number624409-P01
 Prevost Number 520139

Operating Cylinder (slave cylinder)

Make.....Kongsberg Automotive
 Supplier Number624410-P01
 Prevost Number 520138

SECTION 03: FUEL SYSTEM

CONTENTS

1. FUEL SYSTEM	3 - 3
1.1 Description.....	3 - 3
2. FUEL LINES AND FLEXIBLE HOSES.....	3 - 4
3. FUEL VALVES.....	3 - 4
4. FILTERS AND WATER SEPARATOR	3 - 4
4.1 Fuel Filter/Water Separator Servicing.....	3 - 4
4.2 Fuel Filter Servicing (Primary and Secondary).....	3 - 5
4.3 Preheater Fuel Filter	3 - 6
5. FUEL TANK	3 - 6
5.1 Tank Removal	3 - 6
5.1.1 Main Fuel Tank.....	3 - 6
5.1.2 Auxiliary Fuel Tank	3 - 7
5.2 Tank Installation	3 - 7
6. PRIMING FUEL SYSTEM	3 - 8
7. FUEL PUMP INSTALLATION	3 - 8
8. FUEL OIL SPECIFICATIONS	3 - 9
9. AIR CLEANER (dry type)	3 - 9
9.1 Pre-Cleaner Servicing.....	3 - 9
9.2 Air Cleaner Servicing	3 - 9
9.3 General Recommendations	3 - 9
9.4 Air Cleaner Restriction Indicator	3 - 10
10. FUEL COOLER	3 - 10
11. FUEL PEDAL.....	3 - 10
11.1 Fuel Pedal Adjustment.....	3 - 10
11.2 Potentiometer Replacement	3 - 11
12. SPECIFICATIONS.....	3 - 12

LIST OF ILLUSTRATIONS

FIG. 1: FUEL SYSTEM SCHEMATIC	3 - 3
FIG. 2: LOCATION OF MANUAL SHUT-OFF VALVES.....	3 - 4
FIG. 3: ACCESS TO MAIN FUEL TANK	3 - 6
FIG. 4: FUEL TANKS.....	3 - 7
FIG. 5: PRIMER SWITCH LOCATION	3 - 8
FIG. 6: AIR CLEANER LOCATION.....	3 - 9
FIG. 7: AIR CLEANER RESTRICTION INDICATOR	3 - 10
FIG. 8: ELECTRONIC FOOT PEDAL ASSEMBLY	3 - 11

1. FUEL SYSTEM

1.1 Description

A schematic of the fuel system is shown in figure 1. Fuel is drawn from the fuel tank through a manual shut-off valve, the primary fuel filter or a fuel filter/water separator (optional) and enters the fuel pump. Leaving the pump under pressure, the fuel flows through the secondary fuel filter and a shut-off valve, then to cylinder head. The fuel flows to injectors in the cylinder head through passages integral with the head. Surplus fuel exits at the rear of the head just above the inlet, through a restrictive return fitting which maintains fuel pressure in the system. Finally, the fuel flows through the fuel cooler and the check valve then returns to the fuel tank. Two preheaters are available: 40 000 BTU or 80 000 BTU. If the vehicle is equipped with the 40 000 BTU preheater, the fuel is drawn from the tank through the fuel pump to the preheater. If the vehicle is equipped with the 80 000 BTU preheater the fuel is drawn from the fuel tank through a fuel filter to the preheater. Excess fuel returns to the fuel tank.

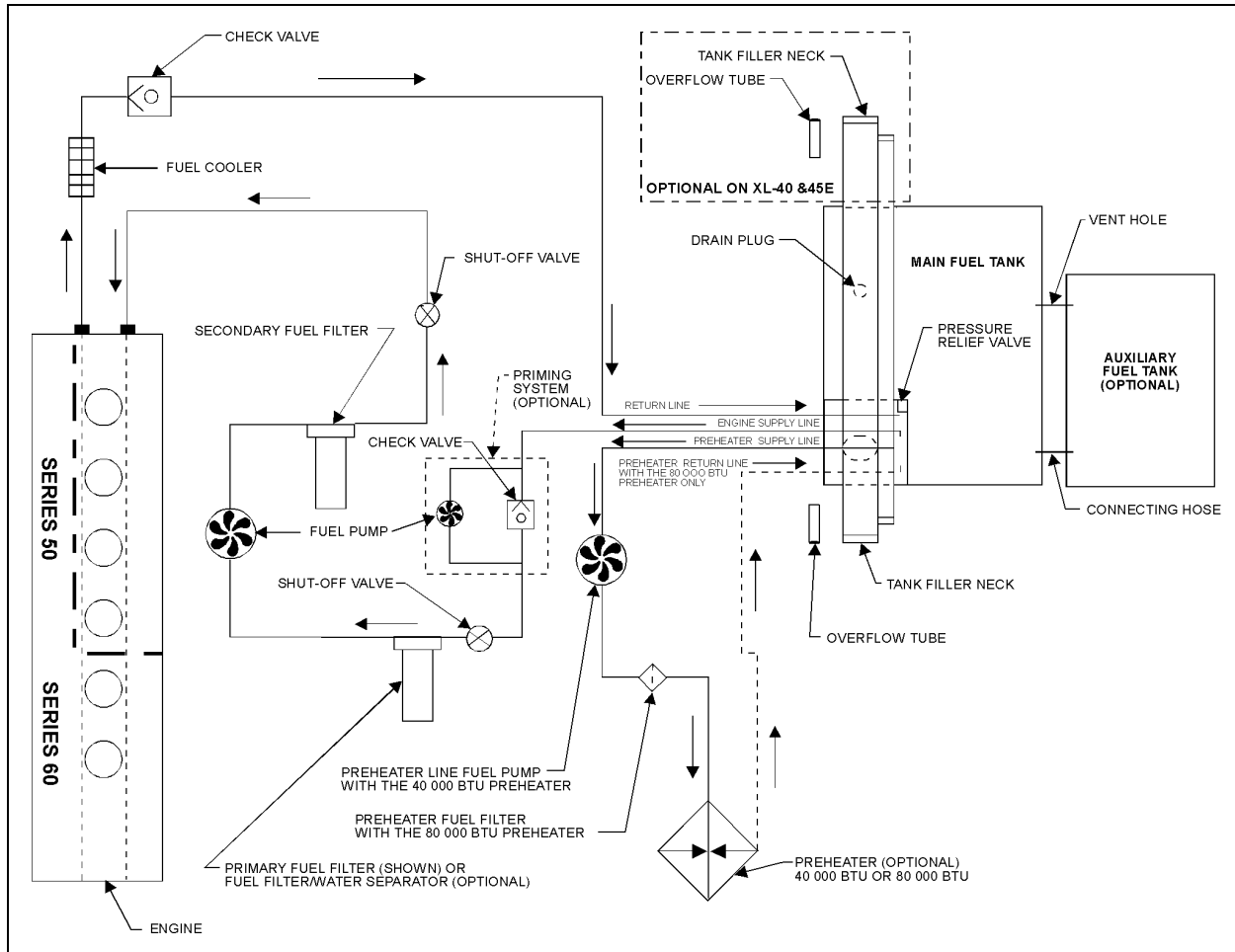


FIGURE1: FUEL SYSTEM SCHEMATIC

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2. FUEL LINES AND FLEXIBLE HOSES

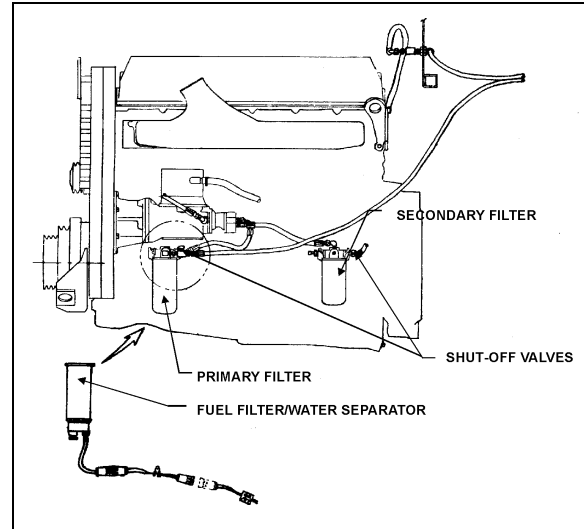
Make a visual check for fuel leaks at all engine-mounted fuel lines and connections and at the fuel tank suction and return lines. Since fuel tanks are susceptible to road hazards, leaks in this area may best be detected by checking for accumulation of fuel under the tanks. Engine performance and auxiliary equipment is greatly dependent on the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel oil. Diligent maintenance of hoses is an important step in ensuring efficient, economical and safe operation of engine and related equipment.

Check hoses daily as part of the pre-start-up inspection. Examine hoses for leaks and check all fittings, clamps and ties carefully. Make sure that the hoses are not resting on or touching shafts, couplings, heated surfaces, including exhaust manifolds, any sharp edges or other obviously hazardous areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary. Refer to the schematic diagram of the fuel system (Fig. 1).

Caution: *Oil level above the dipstick full mark or a decrease in lube oil consumption may indicate internal fuel leaks. Check oil level frequently.*

3. FUEL VALVES

Manual shut-off valves on engine fuel supply line are located on the R.H. side of engine compartment (Fig. 2). A manual shut-off valve is located at the inlet side of the primary fuel filter (fuel filter/water separator, if vehicle is so equipped) under the air compressor. Another manual shut-off valve is located at the outlet side of the secondary fuel filter, under the starter. No manual valve is required on preheater fuel supply line, since the positive-displacement fuel pump (located close to the fuel tank) will shut off line when it is not activated.



03006

FIGURE 2: LOCATION OF MANUAL SHUT-OFF VALVES

4. FILTERS AND WATER SEPARATOR

The fuel system is equipped with primary and secondary fuel filters for additional protection of the injectors. A fuel filter/water separator may be installed in primary fuel filter location, to prevent water infiltration in engine fuel system (Fig. 2). It should be drained periodically, or when the water separator indicator lamp lights on dashboard. To drain, loosen self venting drain below separator, and tighten after water has been flushed out.

Note: *The service intervals of the filter/water separator element and the secondary fuel filter cartridge are determined by the operating conditions and cleanliness of type of fuel used.*

4.1 Fuel Filter/Water Separator Servicing

The fuel filter/water separator is located on the starter side of the engine, below the air compressor. The water separator must be drained periodically or when the indicator light on the dashboard illuminates.

Replace the water separator element as follows:

1. Drain the fuel filter/water separator as stated previously.
2. With engine "OFF" and engine fuel supply line valves closed, remove the filter element from mounting head with bowl connected (For valve location, see "3. FUEL VALVES" in this section).
3. Remove bowl from filter element. Clean bowl and O-ring gland.

Note: *Bowl is reusable, do not discard.*

4. Lubricate O-ring with clean diesel fuel or motor oil and place it in bowl gland.

Caution: *Do not use tool to tighten bowl. Tighten by hand only.*

5. Screw bowl onto new filter element snugly by hand.
6. Lubricate filter to seal with clean diesel fuel or motor oil.
7. Fill filter element/bowl assembly with clean diesel fuel and attach onto mounting head. Hand tighten an additional 1/3 to 1/2 turn after full seal contact is made.
8. Open valves of the engine fuel supply line.
9. Run the engine and check for leaks.

Caution: *If the water separator continuously requires draining, it is possible that water or sediment is accumulated in the fuel tank. To correct this situation, open the drain plug under the tank when the fuel gauge indicates tank is 1/4 full in order to drain any contaminant.*

4.2 Fuel Filter Servicing (Primary and Secondary)

The primary and secondary fuel filters are located on the R.H. side of the engine. The primary filter is installed below the air compressor, and the secondary fuel filter is below the starter. They are of a spin-on type and must be replaced every 12,500 miles (20 000 km) or once a year, whichever comes first.

A method of determining when filters are plugged to the extent that they should be changed is based on the fuel pressure at the cylinder head fuel inlet fitting and the inlet restriction at the fuel pump. In a clean system, the maximum pump inlet restriction should not exceed 6 inches of mercury (20.3 kPa) and must not exceed 12 inches of mercury (41 kPa) with a dirty system.

At normal operating speeds and with the standard 0.080" restriction fittings, the fuel pressure at the cylinder head inlet is 50-75 psi (345-577 kPa). Change the fuel filters whenever the inlet restriction at the fuel pump reaches 12 inches of mercury (42 kPa) at normal operating speeds and whenever the fuel pressure at the cylinder head inlet fitting falls to the minimum fuel pressure given above.

Change the filter cartridge(s) as follows.

Note: *Use a suitable band wrench or filter wrench, such as J22775, to remove the filters.*

1. Stop engine, shut off the engine fuel supply line valves (For valve location, See "3. FUEL VALVES"). Unscrew and discard filters.
2. Fill new filter replacement cartridge(s) with clean fuel oil, about two thirds (2/3). Apply a thin coat of clean fuel oil on gasket.
3. Install new filters. Tighten until filter is snug against the gasket, with no side movement. Rotate an additional 1/2 turn by hand.
4. Open engine fuel supply line valves.

Caution: Mechanical tightening of the fuel filters is not recommended and may result in seal and/or cartridge damage. Tighten the fuel filters by hand only.

5. Start the engine and check for leaks.

Note: There is a fuel system shut-off valve on the discharge side of the secondary fuel filter. This check valve is designed to prevent loss of fuel at time of filter replacement.

4.3 Preheater Fuel Filter

The preheater fuel filter is installed only on vehicles with the optional 80 000 BTU preheater. The filter is located next to preheater: on XL-40 & 45E vehicles, the filter is installed on rear wheel housing and is accessible through engine curb side door - on XL-45 vehicles, the filter is located on rear wheel housing and is accessible through L.H. side rear service compartment. Replace the filter every 50,000 miles (80 000 km) or once a year, whichever comes first.

5. FUEL TANK

XL-40 & 45E vehicles are equipped with a welded stainless steel fuel tank with a capacity of 160 US gal (606 liters) and an optional 90 US gal (341 liters) auxiliary tank. XL-45 vehicles are equipped with a high density cross link polyethylene fuel tank with a capacity of 208 US gal (787 liters) and an optional welded stainless steel 90 US gal (341 liters) auxiliary tank. The main tank is located just forward of the rear baggage compartment, between Condenser and A/C and heating compartments. The auxiliary tank is located in baggage compartment just forward of main tank.

On XL-40 & 45E vehicles, fuel filler neck is accessible by opening a small door located amidships, on R.H. side of vehicle. On XL-45 vehicles, fuel filler necks (Qty=2) are accessible by opening a small door located amidships, on either R.H. or L.H. side of vehicle.

A pressure relief valve in the tank relieves high pressure buildup, and an air vent allows offset air in the tank to escape during filling. A drain plug, accessible from under the vehicle, is fitted at the bottom of the tank(s).

5.1 Tank Removal

Note: Prior to removal, the fuel tank should be completely drained by unscrewing the drain plug. Ensure that the container used has a capacity equal to the amount of fuel remaining in the tank(s).

For vehicles equipped with an auxiliary tank, drain it as well since it is directly connected to the main tank.

It is possible to drain both tanks through only one plug, but the other tank will not drain completely since the connecting hose is not on the bottom.

5.1.1 Main Fuel Tank

1. Open the rear baggage compartment and remove the fuel tank access panel (Fig. 3).

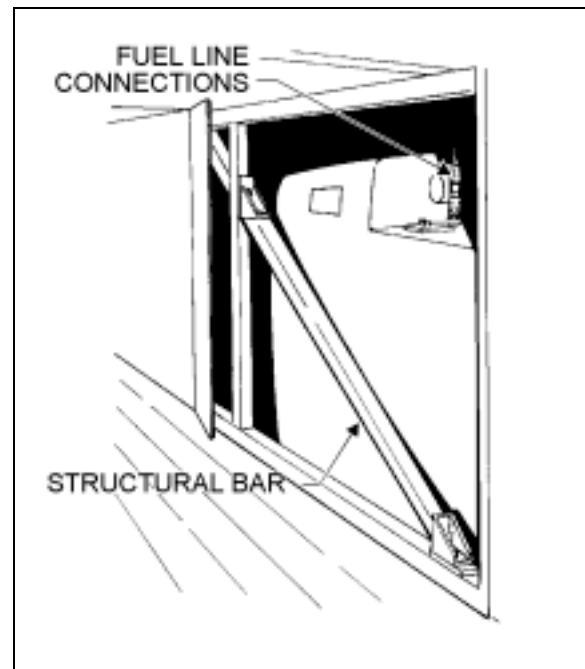


FIGURE 3: ACCESS TO MAIN FUEL TANK

03011

2. Remove the structural bar fastened to the frame with four (4) bolts, then locate the fuel tank line connections.
3. disconnect all fuel and air vent lines, alarms and fuel gauge connectors.

Note: On XL-45 vehicles, disconnect components through fuel tank access panel inside condenser compartment.

Note: For vehicles equipped with an auxiliary tank, the two hoses joining tanks should be disconnected.

4. From underneath vehicle, unscrew the four (4) bolts (two (2) on each side) retaining the tank straps.
5. From inside the rear baggage compartment, slightly raise both straps and pull out main fuel tank.

Caution: Protective cushions or rags should be placed on the baggage compartment floor to prevent it from being scratched by the fuel tank during removal.

5.1.2 Auxiliary Fuel Tank (if so equipped)

1. Open the baggage compartment just forward of condenser compartment, disconnect the two (2) hoses previously joining the tanks.
2. From underneath vehicle, unscrew the two (2) bolts retaining the tank strap (one on each side).
3. From inside the baggage compartment just forward of condenser compartment, slightly raise the strap and pull out auxiliary fuel tank using the same care as for the main fuel tank.

5.2 Tank Installation

To install Main and Auxiliary Fuel Tanks, simply reverse the "Tank Removal" procedure.

Warning: For proper assembly, check connections and fasteners for tightness.

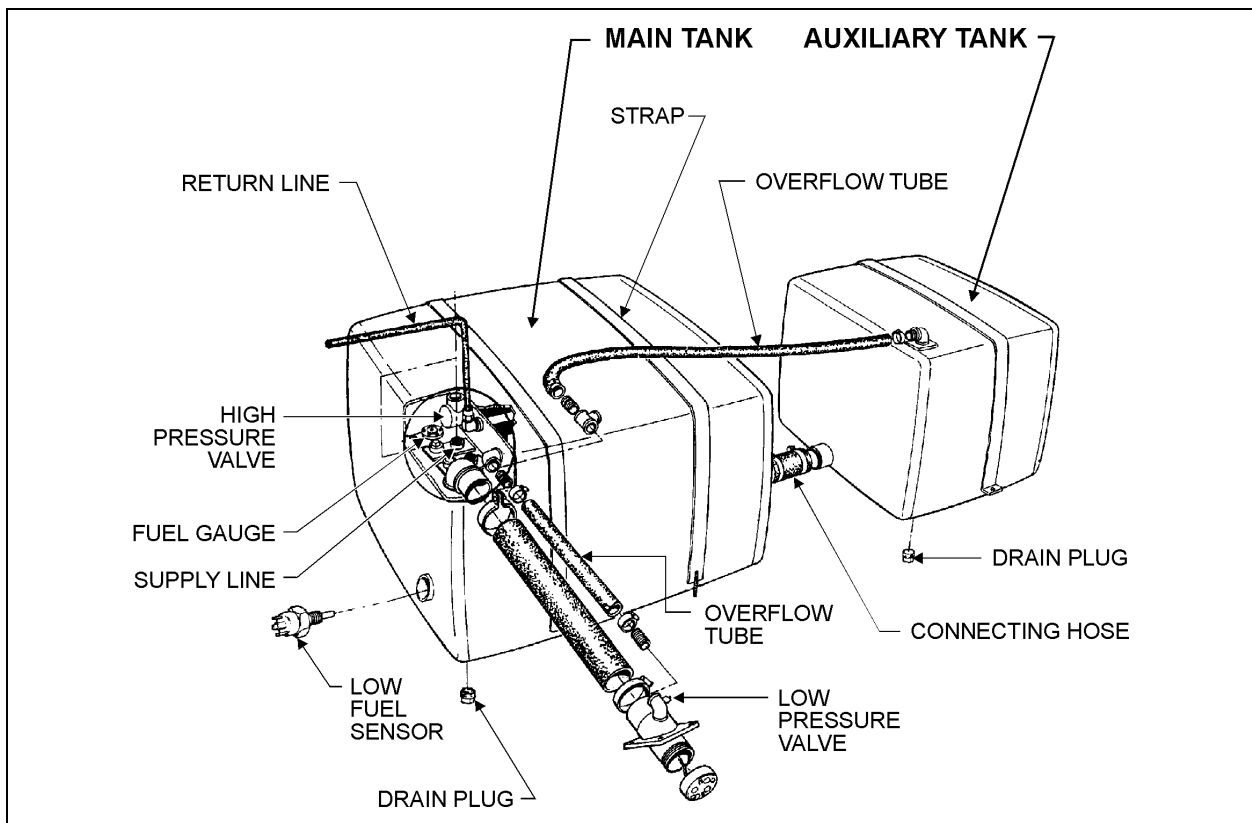


FIGURE 4: FUEL TANKS

03008

6. PRIMING FUEL SYSTEM

The problem with restarting a diesel engine that has run out of fuel, is that after the fuel is exhausted from the tank, it is pumped from the primary fuel filter or the fuel filter/water separator, if vehicle is so equipped, and sometimes partially removed from the secondary filter resulting in an insufficient fuel supply to sustain engine firing. The primary fuel filter or fuel filter/water separator and secondary filter must be free of air in order for the systems to provide adequate fuel for the injectors. When the engine runs out of fuel, the following operations must be performed before restarting.

Fill fuel tank with the recommended fuel oil. If only partial filling is possible, add a minimum of 10 gallons (38 liters) of fuel.

If the vehicle is equipped with an optional priming pump see Figure 1.

Start the priming pump. The switch is located in the engine compartment on rear junction box just below "Rear Start" push-button switch. Start the engine and check for leaks.

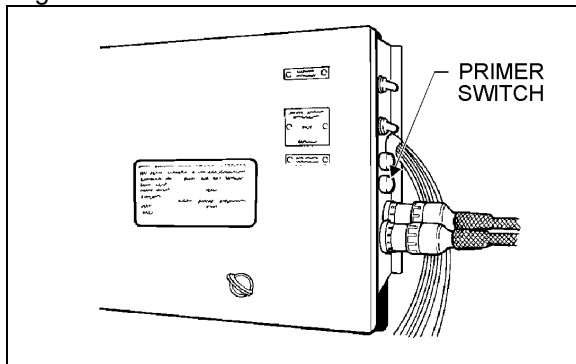


FIGURE 5: PRIMER SWITCH LOCATION

01037

If the vehicle is not equipped with a priming pump.

1. Unscrew the cap on the priming valve located on the secondary filter.
2. Direct fuel under pressure 25 psi (172 kPa) to the priming valve using a quick coupling.
3. Start the engine and check for leaks.

7. FUEL PUMP INSTALLATION

The fuel pump is attached to a drive assembly mounted on the rear side of the gear case.

1. If removed, install inlet and outlet fittings in the cover of the fuel pump.

Note: *New fittings have sealant already applied. If reusing fittings, coat the threads lightly with Loctite Pipe Sealant, Detroit Diesel number J 26558-92, or equivalent, before installing. To prevent sealant from entering fuel system, do not apply it to the first two (2) threads of the fitting. Do not use teflon tape or paste on the fittings.*

2. Install drive coupling in drive hub of the fuel pump. Install a new gasket to the mounting flange of the pump.
3. Align the drive coupling with the coupling on the fuel pump drive assembly pump mounting bolt holes with those in the fuel pump drive assembly.

Note: *When correctly positioned, the outlet fitting on the pump should be in approximately an 8 o'clock position when viewed from the rear, and the drain opening in the pump body facing down.*

4. Seat the pump squarely against the drive assembly. Install three (3) fuel pump mounting bolts and tighten them to 22-28 lbf•ft (30-38 N•m).
5. Connect the fuel inlet and outlet lines to the fuel pump and tighten.
6. Prime engine fuel system before starting engine to ensure pump seal lubrication and prompt engine starting.

8. FUEL OIL SPECIFICATIONS

The quality of fuel oil used for high speed diesel engine operation is a very important factor in obtaining satisfactory engine performance, long engine life and acceptable exhaust emission levels. The fuel oil should meet ASTM designation D 975. Grade 1-D is recommended, but grade 2-D is also acceptable.

Note: *These fuel grades are very similar to grade DF-1 or DF-2 of Federal Specifications VV-F-800. For detailed fuel recommendations, refer to publication "Engine Requirements-Lubricating Oil, Fuel, and Filters" #7SE270 available from Detroit Diesel Distributors.*

9. AIR CLEANER (dry type)

The vehicle is equipped with a dry-type replaceable element air cleaner, located in the engine compartment. Access to the air cleaner is through the engine R.H. side door. Engine air enters the air cleaner through two (2) intake ducts located just above engine side doors, then flows through a pre-cleaner and finally through the air cleaner. The pre-cleaner consists of a gallery air cleaner in series with a replaceable impregnated paper filter element (air cleaner). Dust and moisture is drained through discharge holes located at bottom of inlet air ducts.

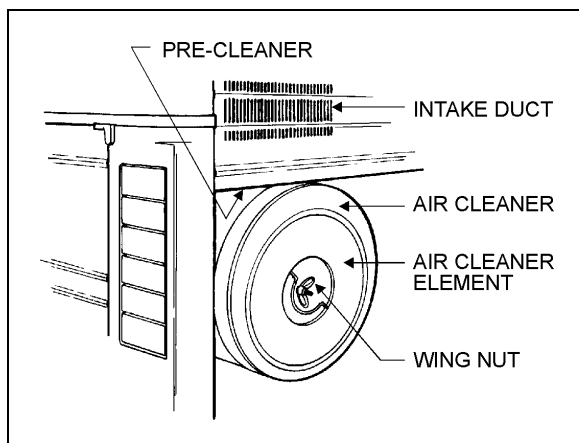


FIGURE 6: AIR CLEANER LOCATION
03009

9.1 Pre-Cleaner Servicing

The pre-cleaner is designed to be self-cleaning; however, it should be inspected and any accumulated foreign material removed during the periodic replacement of the impregnated paper filter element.

9.2 Air Cleaner Servicing

Stop the engine, open the R.H. side engine compartment door, and loosen the wing nut retaining the air cleaner element to the air cleaner. Remove the element by pulling on the handle in the center of the air cleaner element.

Install cleaner element as follows:

1. Inspect the gasket sealing surface inside the air cleaner. It must be smooth, flat and clean.
2. Install the air cleaner element.
3. Make sure that the element seals securely.
4. Inspect element cover gasket and replace if necessary.

Whenever it becomes necessary to remove the air cleaner assembly (dry type) for maintenance or other repair in this area, great care should be taken when installing air cleaner assembly.

The pre-filter should be installed snugly in the air duct and clamped tightly to the air cleaner inlet to prevent any dust infiltration into the air cleaner.

9.3 General Recommendations

The following maintenance procedures will ensure efficient air cleaner operation:

1. Keep the air cleaner housing tight on the air intake pipe.

Section 03: FUEL SYSTEM

2. Make sure the correct filters are used for replacement.
3. Keep the air cleaner properly assembled so the joints are air-tight.
4. Immediately repair any damage to the air cleaner or related parts.
5. Inspect, clean or replace the air cleaner or elements as operating conditions warrant. Whenever an element has been removed from the air cleaner housing the inside surface of the housing must be cleaned with a soft clean cloth.
6. Periodically inspect the entire system. Dust-laden air can pass through an almost invisible crack or opening which may eventually cause damage to an engine.
7. Never operate the engine without an element in the air cleaner assembly.
8. Do not ignore the warning given by the air restriction indicator. This could result in serious engine damage.
9. Store new elements in a closed area free from dust and possible damage.

9.4 Air Cleaner Restriction Indicator

A resettable restriction indicator is installed on the engine air intake duct near the turbocharger, to constantly monitor the level of vacuum between the air cleaner and engine in order to detect and indicate an abnormal increase in vacuum due to a dirt-laden and therefore restricted air cleaner element.

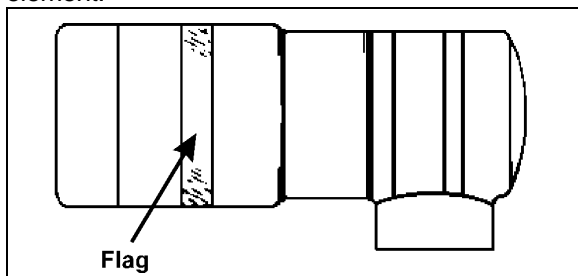


FIGURE 7: AIR CLEANER RESTRICTION INDICATOR
04002

When the red signal flag locks in full view, the air cleaner element must be inspected and replaced if necessary. Press down on indicator to reset flag (Fig. 7).

10. FUEL COOLER

The fuel cooler serves to cool the surplus diesel fuel after it has exited the cylinder head, on its way back to the fuel tank. It is accessible through engine L.H. side door and is located just in front of radiator.

11. FUEL PEDAL

The EFPA (Electronic Foot Pedal Assembly) connects the accelerator pedal to a potentiometer (a device that sends an electrical signal to the ECM which varies in voltage, depending on how far down the pedal is depressed). The EFPA is installed in the space normally occupied by a mechanical foot pedal. It has maximum and minimum stops that are built into the unit during manufacture.

11.1 Fuel Pedal Adjustment

The EFPA contains a throttle position sensor that varies the electrical signal sent to the ECM. The sensor must be adjusted whenever an EFPA is serviced. In addition, the sensor should be adjusted any time codes 21 and 22 are flashed.

With the ignition "ON" and the proper diagnostic tool (DDR) (for information regarding the DDR, see "01 ENGINE" in this manual), check the throttle counts at idle and full throttle positions. Proper pedal output should be 20/30 counts at idle and 200/235 at full throttle. If adjustment is necessary, remove the potentiometer cover, loosen the retaining screw and rotate the potentiometer clockwise to increase counts or counterclockwise to decrease. When correct output is confirmed, tighten retaining screws and reinstall the potentiometer cover.

11.2 Potentiometer Replacement

1. Remove the electronic foot pedal assembly from the vehicle.

Caution: Note the routing and clamping locations of the cable before disassembly. Proper cable routing and fastening is critical to the operation of this system. Marking the foot pedal assembly to record cable routing is recommended.

2. Discard screws (item 1) and cable clamps (item 2) securing wire.
3. Loosen the three (3) screws and remove potentiometer cover. Retain for reassembly.
4. Discard potentiometer (item 3), screws (item 4), washers (item 5) and grommet (item 6).
5. Position new potentiometer (item 3) with flat side towards you. Press potentiometer onto the potentiometer shaft (item 7), matching cutouts in shaft

to drive tangs of potentiometer. Apply hand pressure until potentiometer has bottomed out in housing. Install new screws and washers (items 4 & 5) and tighten just enough to lightly secure potentiometer. Rotate potentiometer counterclockwise as far as possible. Tighten screws to 10/20 lbf•in (1.1/2.2 N•m).

7. Install new cable clamps and screws (items 1 & 2), making sure new potentiometer's wire harness is routed in the same manner as the original harness. Tighten screws to 34/45 lbf•in (3.7/5 N•m).
8. Connect electronic foot pedal assembly's cable harness to the ECM connector. Then, Potentiometer calibration is now necessary (see "11.1 FUEL PEDAL ADJUSTMENT" in this section). When correct output is confirmed, install the pedal assembly in its proper location.

Caution: Make sure the cable harness is routed correctly, and securely installed so that it does not become pinched, stretched, or otherwise damaged during vehicle operation.

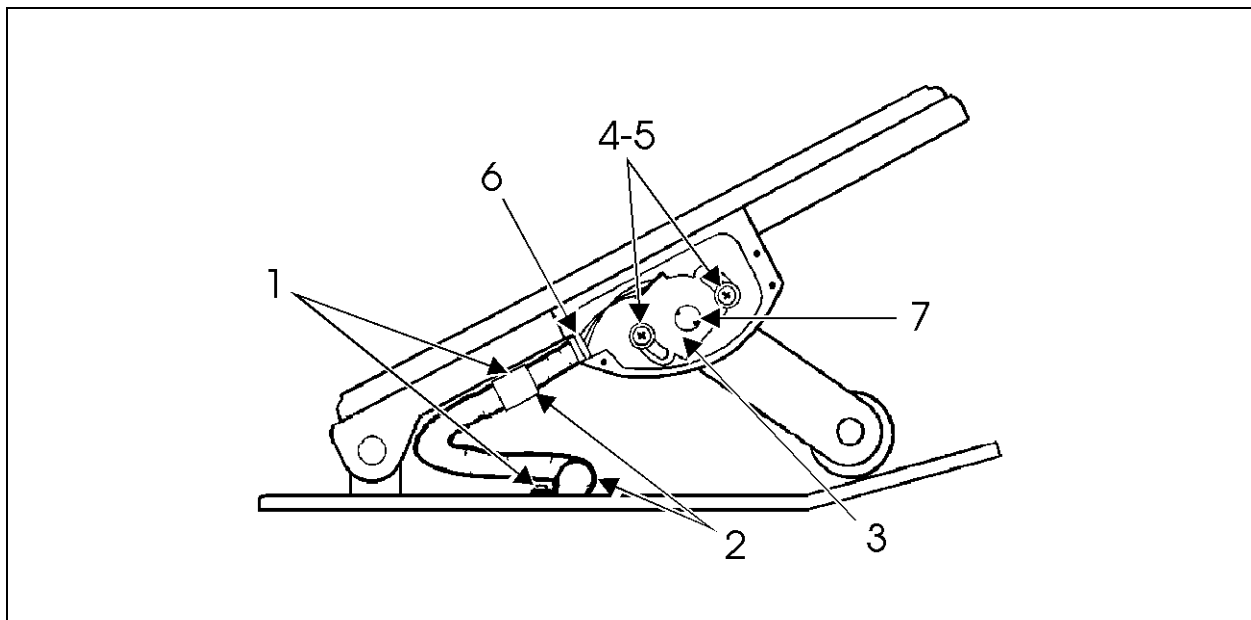


FIGURE 8: ELECTRONIC FOOT PEDAL ASSEMBLY

03010

12. SPECIFICATIONS

Primary Fuel Filter/Water Separator (optional)

(May be used instead of primary filter (never use with a primary filter).

Make..... Racor
Type Spin-on

ELEMENT

Supplier number..... S 3202
Prévost number..... 531390

BOWL

Supplier number..... RK30051
Prévost number..... 531389

DRAIN VALVE AND SEAL

Supplier number..... RK30058
Prévost number..... 531397

O-RING

Supplier number..... RK30076
Prévost number..... 531398

PROBE/WATER SENSOR

Supplier number..... RK21069
Prévost number..... 531391

Primary Fuel Filter

Make..... AC
Type Spin-on
Filter No..... T-915D
Service Part No..... 25014274
Prévost number..... 510137

OR

Service Part No (Type with Water Separator)..... 23512317
Prévost number..... 531407
Element torque..... 1/2 turn after gasket contact

Secondary Fuel Filter

Make.....AC
Type Spin-on
Filter No..... T-916D
Service Part No..... 25014342
Prévost number..... 510128
Element torque..... 1/2 turn after gasket contact

Fuel tank(s) Capacity(ies)

Standard (XL-40 & 45E) 160 US gal (606 liters)
Standard (XL-45) 208 US gal (787 liters)
Optional (All XL vehicles)..... 90 US gal (341 liters)

Air Cleaner

Make..... Nelson
Prevost Number 53-0206
Service Part No..... 7182 8N
Supplier number (element cartridge)..... 70337N
Prévost number (element cartridge)..... 530197

Air Cleaner Restriction Indicator

Make..... Donaldson
Model..... RBX00-2220
Indicates at 20" (508 mm) of water
Prévost number..... 530161

Preheater Fuel Filter (80 000 BTU)

Make..... Webasto
Supplier number..... 603.359
Prévost number..... 871037

Preheater Line Fuel Pump

Make..... Espar
Supplier number..... 25-1571-45-0000
Prévost number..... 870973

Fuel Cooler

Make..... Berendsen
Supplier number..... DB-1240
Prévost number..... 950109

SECTION 04: EXHAUST SYSTEM

CONTENTS

1. DESCRIPTION	4 - 2
2. MAINTENANCE.....	4 - 2
3. MUFFLER REMOVAL/INSTALLATION.....	4 - 4
4. FLEXIBLE TUBE INSTALLATION	4 - 4
5. HEAT BLANKETS (Converted vehicles only)	4 - 4
5.1 Exhaust.....	4 - 4
5.1.1 Installation on XL-45 Shells.....	4 - 4
5.1.2 Installation on XL-40 & 45E Shells.....	4 - 5
5.2 Turbo (All Shells).....	4 - 5

LIST OF ILLUSTRATIONS

FIG. 1: EXHAUST SYSTEM - XL-40 & 45E (COACH & SHELL) INSTALLATION	4 - 2
FIG. 2: EXHAUST SYSTEM - XL-45 (COACH & SHELL) INSTALLATION	4 - 3
FIG. 3: FLEXIBLE TUBE INSTALLATION	4 - 4
FIG. 4: EXHAUST BLANKET INSTALLATION.....	4 - 4
FIG. 5: LACING WIRE INSTALLATION.....	4 - 5
FIG. 6: INSTALLATION OF TURBO BLANKET	4 - 5

1. DESCRIPTION

The muffler is rubber mounted on the vehicle frame. This feature reduces the transmission of vibrations to the muffler thus resulting in extended life of muffler, brackets and other components.

2. MAINTENANCE

The exhaust system should be inspected periodically for restrictions and leaks. The exhaust systems are shown on Figures 1 & 2 (Fig. 1 = XL-40 & 45E and Fig. 2 = XL-45). Restrictions such as kinked or crimped pipes result in excessive back pressure that can lead to increased fuel consumption, power loss, and possible damage to engine combustion chamber components. Exhaust leaks are commonly the result of loose clamp bolts, corroded pipes, or a punctured muffler. In addition to objectionable noise, a leaking exhaust system could allow toxic gases to enter the vehicle. Inspect the exhaust system as follows:

- At vehicle inspection intervals,
- Whenever a change is noticed in the sound of the exhaust system, and
- Whenever the exhaust system is damaged.

Replace damaged or corroded exhaust system components without delay.

When operating the engine in a service garage or in a closed area, the exhaust must be vented to the outside. Place the shop vent hose over the exhaust outlet pipe.

Warning: Avoid breathing exhaust gases since they contain carbon monoxide which is odorless and colorless but harmful. Carbon monoxide is a dangerous gas that can cause unconsciousness and can be lethal. If, at any time you suspect that exhaust fumes are entering the vehicle, locate and correct the cause(s) as soon as possible.

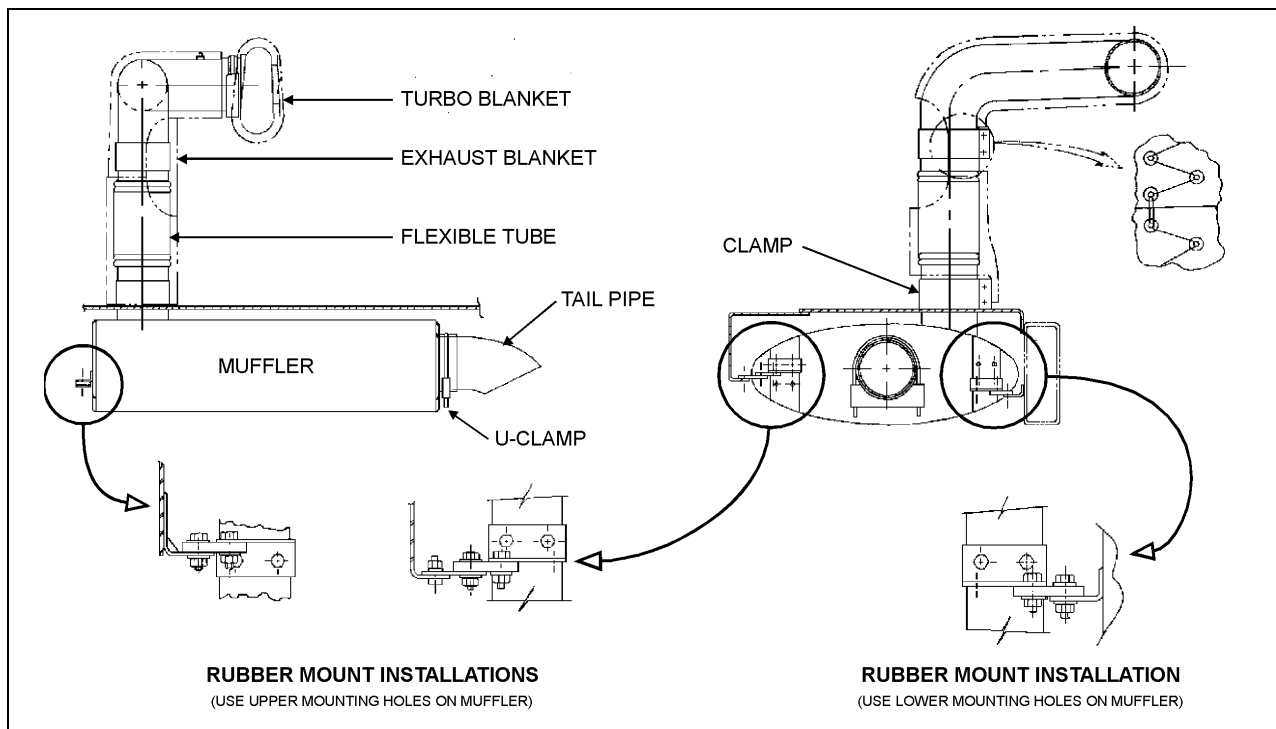


FIGURE 1: EXHAUST SYSTEM - XL-40 & 45E (COACH & SHELL) INSTALLATION

04004

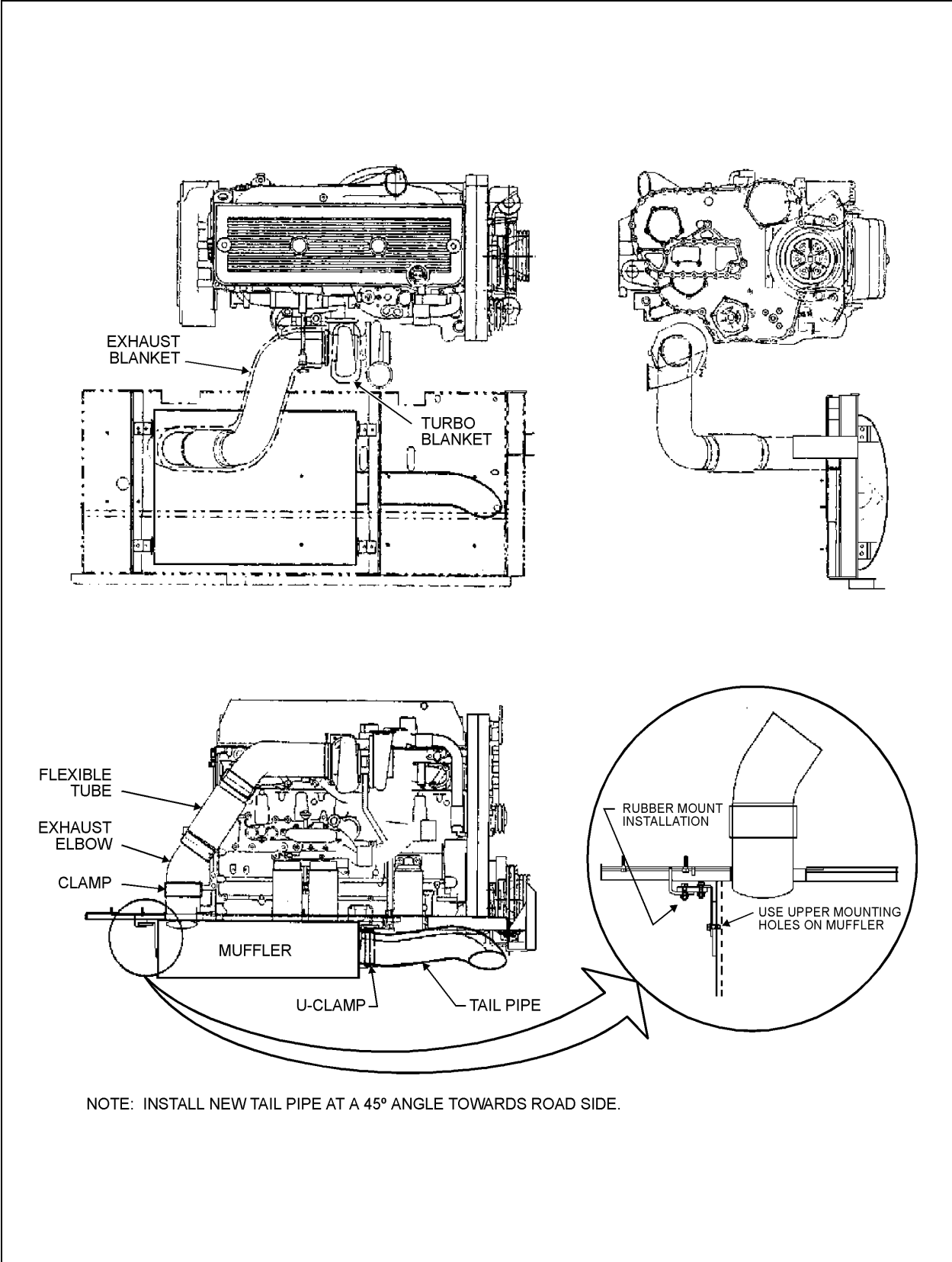


FIGURE 2: EXHAUST SYSTEM - XL-45 (COACH & SHELL) INSTALLATION

04005

3. MUFFLER REMOVAL & INSTALLATION

Warning: *Make sure that muffler and components are cold before handling.*

1. Remove bolts and clamps securing exhaust pipe bellows to the muffler.
2. Support the muffler from underneath vehicle.
3. Remove U-clamp retaining the tail pipe to the muffler.
4. Remove bolt holding the tail pipe to the frame bracket.
5. Remove the tail pipe.
6. Remove the fasteners holding the four rubber mounts to the frame brackets.
7. Remove the fasteners securing the rubber mounts to the muffler brackets.
8. Remove rubber mounts then muffler from underneath vehicle.
9. Remove parts which are attached to the muffler such as brackets and collar.
10. Inspect and replace parts if necessary. Reinstall parts on the new muffler.

For installation, reverse the removal procedure.

Warning: *Check connections for tightness and fasteners for proper assembly.*

4. FLEXIBLE TUBE INSTALLATION

The flexible exhaust tube contains an inside rigid pipe. To allow appropriate flexibility for assembly, make sure that the rigid pipe is concentric to the flexible part. To maintain the pipe centered at the

time of installation, cardboard spacers must be inserted at four places at equal distance around tubing (Fig. 3). These spacers may be left in place and will deteriorate over time.

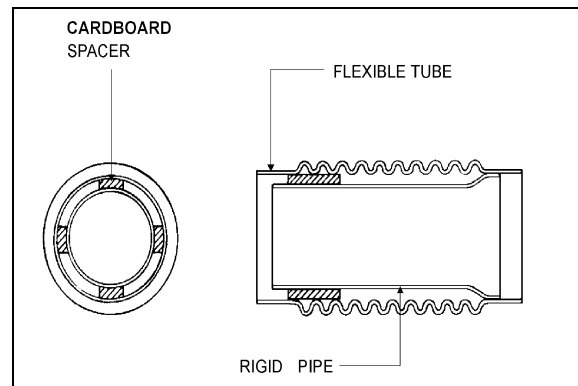


FIGURE 3: FLEXIBLE TUBE INSTALLATION 04003

5. HEAT BLANKETS (Converted vehicles only)

5.1 Exhaust

5.1.1 Installation on XL-45 Shells

1. Open L.H. side rear service compartment door, then working from inside compartment, cover bellows and exhaust pipe with blanket #040507 (Fig. 4). Position blanket so its recess is facing square tubing.

Note: *If access from L.H. side rear service compartment is limited, remove engine access panel from inside vehicle then work from this area.*

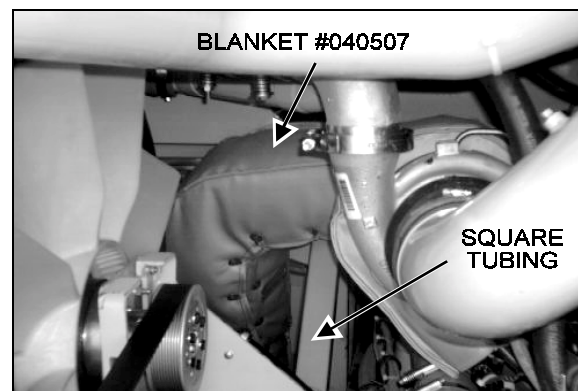


FIGURE 4: EXHAUST BLANKET INSTALLATION 01034

2. Form and compress blanket always working towards seams. Use temporary ties to position and hold blanket for forming, then shoelace for length of blanket using wire #509754 (Fig. 5 shows typical installation). Perform a single loose wrap on each capstan. Align the small hole provided in the blanket with the exhaust port fitted on the exhaust pipe.

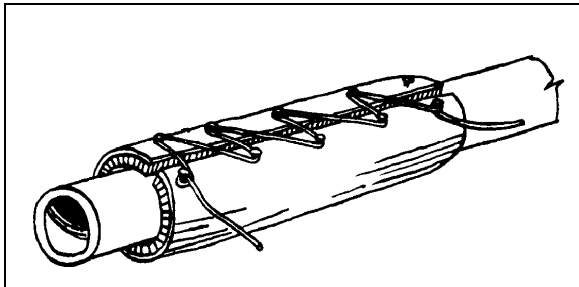


FIGURE 5: LACING WIRE INSTALLATION 01035

3. Form and compress blanket always working towards seams. Use temporary ties to position and hold blanket for forming, then shoelace for length of blanket using lacing wire #509754 (see figure 5 showing typical installation). Perform a single loose wrap on each capstan. Align the small hole provided in the blanket with the exhaust port fitted on the exhaust pipe.

Caution: Ensure radiator fan does not touch the exhaust blanket.

5.2 Turbo (All Shells)

3. Install the turbo blanket as described further in this bulletin.

1. Attach a section of lacing wire #509754 to both upper capstans of turbo blanket #040505, then cover turbine housing (Fig. 6). Attach upper capstans with lower capstans to secure blanket in place.

5.1.2 Installation on XL-40 & XL-45E Shells

1. Working from inside vehicle, locate engine access panel located at rear of vehicle (just over engine), unscrew bolts (4 or 6) retaining panel then remove.
2. Cover bellows and exhaust pipe with blanket #040511. Position blanket so its recess is facing radiator shroud & fan. Refer to figure 4 showing installation on XL-45 vehicles; on this model, the blanket is not provided with a recess since the clearance between radiator fan and exhaust pipe is sufficient.

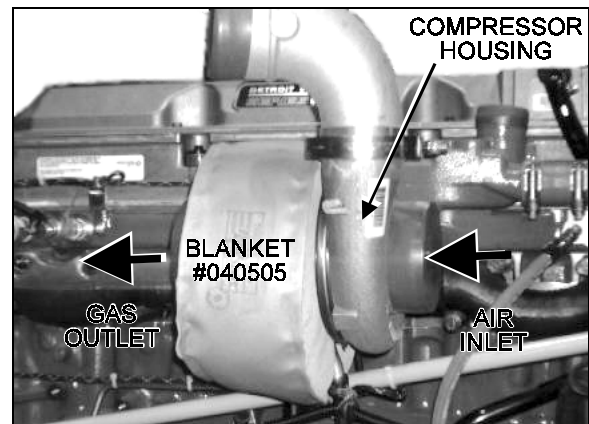


FIGURE 6: INSTALLATION OF TURBO BLANKET 01036

Note: The compressor housing does not require a blanket.

Note: It may be necessary to work from under vehicle to install the lower section of blanket.

SECTION 05: COOLING SYSTEM

CONTENTS

1. COOLING SYSTEM	5 - 3
1.1 Description.....	5 - 3
1.2 Maintenance.....	5 - 4
2. HOSES.....	5 - 5
2.1 Inspection	5 - 5
3. CONSTANT-TORQUE HOSE CLAMPS	5 - 6
3.1 Description.....	5 - 6
3.2 Installation	5 - 6
3.3 Maintenance.....	5 - 6
4. COOLANT.....	5 - 6
4.1 Thawing Cooling System	5 - 6
4.2 Coolant Level Verification	5 - 6
4.3 Coolant Level Sensor.....	5 - 7
4.4 Coolant Requirements	5 - 7
4.5 General Cooling System Recommendations	5 - 7
4.6 Coolant Recommendations.....	5 - 7
4.7 Draining Cooling System.....	5 - 8
4.8 Refilling Cooling System	5 - 10
4.9 Flushing	5 - 11
4.10 Cooling System Cleaners	5 - 11
4.11 Reverse Flushing	5 - 11
5. COOLANT FILTER.....	5 - 12
5.1 Description.....	5 - 12
6. RADIATOR	5 - 12
6.1 Maintenance.....	5 - 12
7. RADIATOR VARIABLE SPEED FAN.....	5 - 13
7.1 Description.....	5 - 13
7.2 Maintenance.....	5 - 13
7.3 Inspection	5 - 13
7.4 Thermostat Operation	5 - 14
8. FAN GEARBOX.....	5 - 14
8.1 Description	5 - 14
8.2 Maintenance.....	5 - 14
8.3 Oil Change.....	5 - 14
9. RADIATOR FAN BELT REPLACEMENT AND BELT TENSIONERS	5 - 15
10. FAN DRIVE ALIGNMENT	5 - 15
11. SPECIFICATIONS.....	5 - 17

LIST OF ILLUSTRATIONS

FIG. 1: COOLING SYSTEM DESCRIPTION.....	5 - 3
FIG. 2: SURGE TANK - ENGINE COMPARTMENT	5 - 4
FIG. 3: CONSTANT-TORQUE CLAMP	5 - 6
FIG. 4: SURGE TANK SIGHT GLASS.....	5 - 6
FIG. 5: HEATER LINE SHUTOFF VALVE.....	5 - 8
FIG. 6: HEATER LINE SHUTOFF VALVE.....	5 - 9
FIG. 7: HEATER LINE SHUTOFF VALVES	5 - 9
FIG. 8: ENGINE COOLANT DRAIN COCKS.....	5 - 9
FIG. 9: WATER PUMP DRAIN COCK	5 - 9
FIG. 10: RADIATOR DRAIN COCK.....	5 - 10
FIG. 11: COOLANT FILTER.....	5 - 12
FIG. 12: FAN - MECHANICAL LOCKING DEVICE	5 - 13
FIG. 13: THERMOSTAT AND RELATED PARTS.....	5 - 14
FIG. 14: FAN GEARBOX.....	5 - 14
FIG. 15: ENGINE COMPARTMENT - BELT TENSIONER CONTROL VALVE	5 - 15
FIG. 16: ANGLE SUPPORT	5 - 15
FIG. 17: PULLEY ALIGNMENTS	5 - 16
FIG. 18: PULLEY'S VERTICAL ANGLE	5 - 16
FIG. 19: BELLOW - DISTANCE CHECK.....	5 - 16
FIG. 20: VALVES.....	5 - 16

1. COOLING SYSTEM

1.1 Description

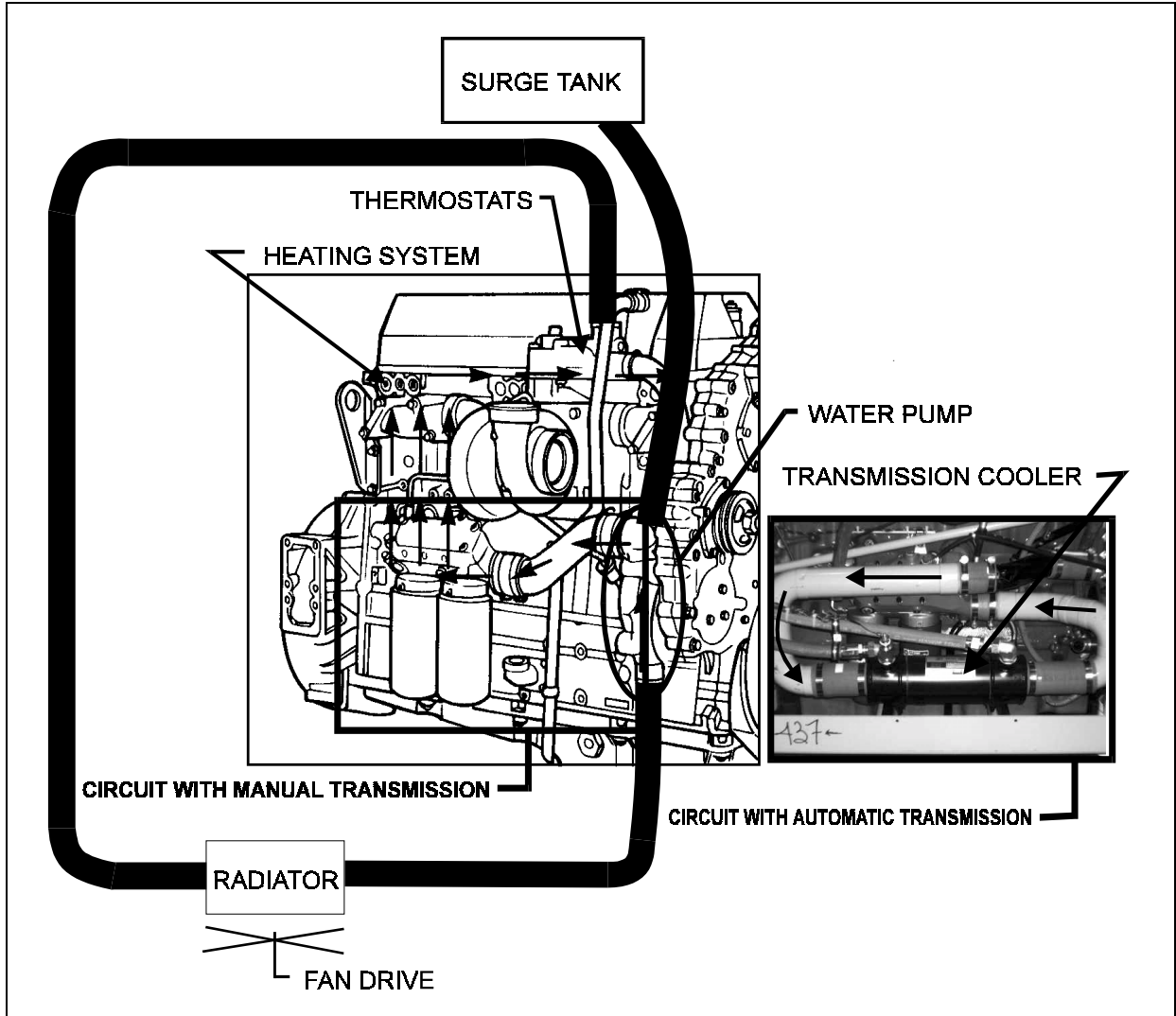


FIGURE 1: COOLING SYSTEM DESCRIPTION

05023

A radiator and thermo-modulated fan are used to effectively dissipate the heat generated by the engine. A centrifugal-type water pump is used to circulate the engine coolant (Fig. 1).

Two full blocking-type thermostats are used in the water outlet passage to control the flow of coolant, providing fast engine warm-up and regulating coolant temperature.

Section 05 : COOLING SYSTEM

The engine coolant is drawn from the lower portion of the radiator by the water pump and is forced through the oil cooler and into the cylinder block. For vehicles with automatic transmissions the coolant circulates in the transmission cooler before going through the oil cooler and the cylinder block.

From the cylinder block, the coolant passes up through the cylinder head and, when the engine is at normal operating temperature, through the thermostat housing and into the upper portion of the radiator. Then the coolant passes through a series of tubes where the coolant temperature is lowered by air streams created by the revolving fan and the motion of the vehicle.

Upon starting a cold engine or when the coolant is below operating temperature, the closed thermostats direct coolant flow from the thermostat housing through the by-pass tube to the water pump. Coolant is recirculated through the engine to aid engine warm up. When the thermostat opening temperature is reached, coolant flow is divided between the radiator inlet and the by-pass tube. When the thermostats are completely open, all of the coolant flow is to the radiator inlet.

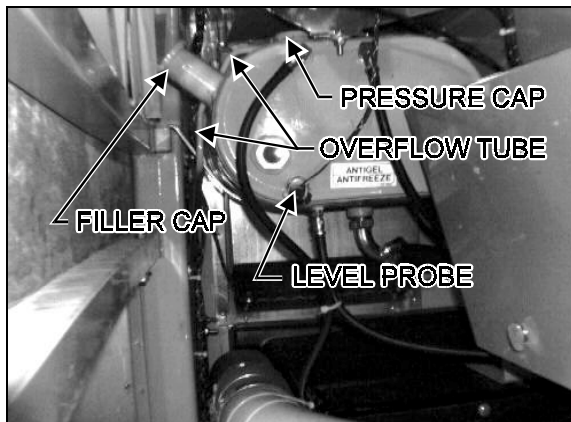


FIGURE 2 : SURGE TANK - ENGINE COMP'T 05036

The cooling system is filled through a filler cap on the surge tank (Fig. 2). A pressure cap on top of surge tank is used to maintain pressure within the system. When system exceeds normal pressure rating (14 psi - 96.53 kPa), the cap releases air and if necessary, coolant through the overflow

tube (Fig. 2). Two thermostats are located in the housings attached to the right side of the cylinder head (Fig. 1). Furthermore, a water temperature sensor mounted on the cylinder head (radiator side) is also supplied for engine protection purposes.

The engine cooling system is also used to provide hot coolant for the vehicle heating system. Refer to "22. HEATING AND AIR CONDITIONING" in this manual for information relating to heating system water circulation.

1.2 Maintenance

A systematic routine inspection of cooling system components is essential to ensure maximum engine and heating system efficiency.

- Check coolant level in the surge tank daily, and correct if required. Test antifreeze strength.
- Maintain the prescribed inhibitor strength levels as required. Coolant and inhibitor concentration must be checked at each oil change, every 12,500 miles (20 000 km) or once a year, whichever comes first to ensure inhibitor strength. For vehicles equipped with coolant filters replace precharge element filter with a maintenance element filter as per "5. COOLANT FILTER" in this section. If the vehicle is not equipped with a filter, add the recommended inhibitor concentration to the antifreeze/water solution.
- Drain, flush, thoroughly clean and refill the system every two years or every 200,000 miles (320 000 km), whichever comes first. For vehicle equipped with coolant filters, change the precharge element filter or the existing maintenance element filter for a new maintenance element filter. If the vehicle is not equipped with the filter add the recommended inhibitor concentration to the antifreeze/water solution.

Note: Do not add inhibitors to the antifreeze/water solution if vehicle is equipped with a coolant filter.

Note: The coolant must be discarded in an environmentally safe manner.

Vehicles without coolant filters

Refer to Nalcool 3000 with Stabil-Aid bulletin annexed to the end of this section for preventive maintenance (at each oil change) and initial treatment instructions (each time the cooling system is drained, flushed and cleaned).

Vehicles with coolant filters

Change the coolant precharge element filter for a maintenance element filter at initial oil change (see "11. Specifications" at the end of this section) and replace existing maintenance element filter with a new one as per "5. COOLANT FILTER" in this section. Use a new precharge element filter each time the cooling system is drained, flushed and cleaned.

- Check belts for proper tension; adjust as necessary and replace any frayed or badly worn belts.
- Check radiator cores for leaks and make sure the cores are not clogged with dirt or insects. To avoid damaging the fins, clean cores with a low pressure air hose. Steam clean if required.
- Inspect the water pump operation. A leaky pump sucks in air, increasing corrosion.
- Repair all leaks promptly. Unchecked leaks can lead to trouble. Inspect and tighten radiator mounts periodically. Test and replace thermostats regularly.

Note: In order to ensure the integrity of the system, it is recommended that a periodic cooling system pressure check be made. Pressurize the cooling system to 103-138 kPa (15-20 psi) using Radiator and Cooling System Tester, J24460-1. Do not exceed 138 kPa (20 psi). Any measurable drop in pressure may indicate a leak. Whenever the oil pan is removed, the cooling system should be pressure checked as a means of identifying any incipient coolant leaks. Make sure the cause of the internal leak has been corrected before flushing the contaminated system.

Leaks at the thermostat housing hose connections may be caused by deformation and rough surfaces on the castings of the hose mounting surfaces. It is recommended that "Dow Corning RTV-102 Compound" or any equivalent product be applied on cast surfaces prior to hose installation.

Caution: Castings should be clean and free of oil and grease before applying compound. No other sealer should be used with RTV-102 compound.

2. HOSES

2.1 Inspection

Rotten, swollen, and worn out hoses or loose connections are frequent causes of cooling system problems.

Serious overheating is often caused by an old hose collapsing or from rotten rubber shedding from hoses and clogging the coolant passages.

Connections should be inspected periodically and hose clamps tightened. Replace any hose found to be cracked or swollen.

When installing a new hose, clean pipe connections and apply a thin layer of a non-hardening sealing compound. Replace worn out clamps or clamps that pinch hoses.

3. CONSTANT-TORQUE HOSE CLAMPS

3.1 Description

All hose clamps of 1 3/8" ID and over, used on the heating and cooling systems, are of the "Constant-torque" type. These clamps are worm-driven, made of stainless steel, and supplied with a series of Belleville spring washers. They also feature an extended integral liner that covers the band slots to protect soft/silicone hoses from damage, and help maintain consistent sealing pressure.

This type of clamp is designed to automatically adjust its diameter to compensate for the normal expansion/contraction of a hose and metal connection that occurs during vehicle operation and shutdown. The constant-torque clamp virtually eliminates coolant losses due to "Cold flow" leakage and greatly minimizes clamp maintenance.

3.2 Installation

A torque wrench should be used for proper installation. The recommended torque is 90 to 100 lbf•in. (10 to 11 N•m). The Belleville spring washer stacks should be nearly collapsed flat and the screw tip should extend 1/4" (6 mm) beyond the housing (Fig. 3).

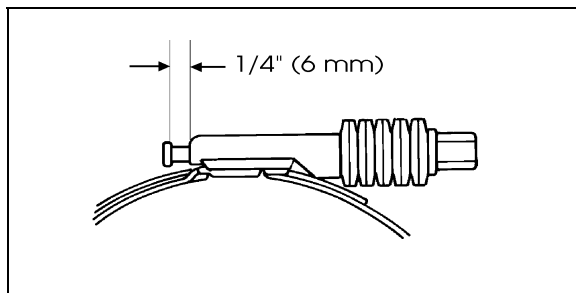


FIGURE 3: CONSTANT-TORQUE CLAMP 05037

Caution: The hose clamps will break if over-torqued. Do not overtighten, especially during cold weather when hose has contracted.

3.3 Maintenance

The constant-torque clamps contain a "Visual torque check" feature. When the tip of the screw is extending 1/4" (6 mm) out of the housing, the clamp is properly installed and maintains a leak-proof connection. Since the constant-torque clamp automatically adjusts to keep a consistent sealing pressure, there is no need to retorque hose clamps on a regular basis. During vehicle operation and shutdown, the screw tip will adjust according to the temperature and pressure changes. Proper installation torque should be checked at room temperature.

4. COOLANT

4.1 Thawing cooling System

If the cooling system becomes frozen solid, place the coach in a warm area until the ice is completely thawed. Under no circumstances should the engine be operated when the cooling system is frozen, as it will result in engine overheating due to insufficient coolant.

4.2 Coolant Level Verification

Coolant level is correct when the cold coolant is visible through the surge tank sight glass (Fig. 4). If coolant level is low, fill cooling system.



FIGURE 4: SURGE TANK SIGHT GLASS 05038

4.3 Coolant Level Sensor

The loss of coolant warning device, consists of a level probe mounted on the surge tank and a sensor module mounted on the vehicle. The module sends a signal to the ECM to indicate coolant level. If the coolant level drops below the probe, the "Check Engine" light flashes and a diagnostic code is registered (see "01. ENGINE").

Caution: Do not run engine with the "Check Engine" light flashing.

The level probe is mounted on the R.H. side of the surge tank while the electronic module is mounted inside the rear electric junction box.

4.4 Coolant Requirements

The coolant provides a medium for heat transfer and controls the internal temperature of the engine during operation. In an engine having proper coolant flow, some of the combustion heat is conveyed through the cylinder walls and the cylinder head into the coolant. Without adequate coolant, normal heat transfer cannot take place within the engine, and engine temperature rapidly rises. Therefore, coolant must be carefully selected and properly maintained.

Coolant solutions must be carefully selected and properly maintained in order to meet the following basic requirements:

1. Provide for adequate heat transfer.
2. Provide protection from cavitation damage.
3. Provide a corrosion/erosion-resistant environment within the cooling system.
4. Prevent formation of scale or sludge deposits in the cooling system.
5. Be compatible with the cooling system hose and seal materials.
6. Provide adequate freeze protection during cold weather operation.

The first five requirements are satisfied by combining suitable water with reliable inhibitors. When freeze protection is required, a solution of suitable water and antifreeze containing adequate inhibitors will provide a satisfactory coolant. Ethylene glycol-based antifreeze is recommended for use in Series 60 engines. The cooling system capacity is 24 US gal (91 liters).

Note: In general, antifreeze does not contain adequate inhibitors. For this reason, supplemental coolant additives are required.

For a complete overview of engine coolants used with Detroit Diesel Engines, refer to Section 13.3 "Coolant Specification" in the "Detroit Diesel Engine Manual".

4.5 General Cooling System Recommendations

Always maintain cooling system at the proper coolant level. Check daily.

The cooling system must be pressurized to prevent localized boiling of coolant. The system must be kept clean and leak-free. The filler and pressure caps must be checked periodically for proper operation.

4.6 Coolant Recommendations

1. Always use recommended antifreeze and inhibitor & water at proper concentration levels. A 50% coolant/water solution is normally used as factory fill. Antifreeze concentration over 70% is not recommended because of poor heat transfer capability, adverse freeze protection and silicate dropout. Antifreeze concentration below 30% offers little freeze, boilover or corrosion protection.
2. Use only ethylene glycol antifreeze meeting the GM 6038-M or ASTM D 4985 formulation or an equivalent antifreeze with a 0.15% maximum silicate content meeting GM 1899-M performance specifications.

Section 05 : COOLING SYSTEM

3. Use an antifreeze solution year-round for freeze and boil-over protection. Seasonal changing of coolant from an antifreeze solution to an inhibitor/water solution is recommended.
4. Pre-mix coolant makeup solutions at proper concentrations before adding to the cooling system.
5. Maintain the prescribed inhibitor strength levels as required.

Vehicles Without Coolant Filters

Refer to Nalcool 3000 with Stabil-Aid bulletin annexed to the end of this section for preventive maintenance (at each oil change) and initial treatment instructions (at each time the cooling system is drained, flushed and cleaned).

Vehicles With Coolant Filters

Change the coolant precharge element filter for a maintenance element filter at initial oil change (see Specifications at the end of this section) and replace existing maintenance element filter with a new one as per "5. COOLANT FILTER" in this section. Use a new precharge element filter each time the cooling system is drained, flushed and cleaned.

Note: *The coolant filter contains inhibitors.*

6. Do not mix different base inhibitor packages.
7. Use only non-chromate inhibitors.
8. DO NOT USE THE FOLLOWING:
 - Soluble oil
 - Chromate inhibitor
 - Methoxy propanol-base antifreeze
 - Methyl alcohol-base antifreeze
 - Sealer additives or antifreezes containing sealer additives
9. Distilled water is recommended.
10. Always maintain proper coolant level.

Note: *Always test the solution before adding water or antifreeze.*

11. If not at the proper protection level. Mix coolant/water solution to the proper concentration before adding to the cooling system.

Warning: *Never remove filler cap while coolant is hot. When coolant is at ambient temperature, release pressure from system by turning the pressure cap counterclockwise, 1/4 turn; then remove filler cap slowly. A sudden release of pressure from the heated cooling system can result in personal injury from the expulsion of hot coolant if these precautions are not followed.*

4.7 Draining Cooling System

The cooling system may be completely or partially drained by using the following procedures.

The engine and related components may be drained as follows:

1. Stop engine and allow engine time to cool. Close both heater line shutoff valves.

On XL-40 & 45E vehicles, the valves are located in engine compartment. One is on the R.H. side of compartment and is accessible through engine compartment R.H. side door (Fig. 5).

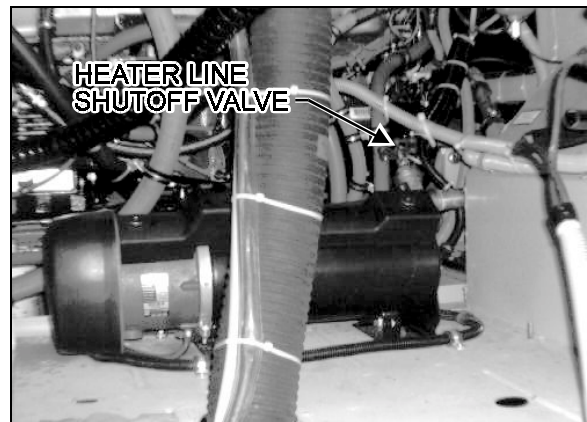


FIGURE 5: HEATER LINE SHUTOFF VALVE

05039

The other is located on the L.H. side of engine underneath fan gearbox and is accessible through engine compartment rear doors (Fig. 6).

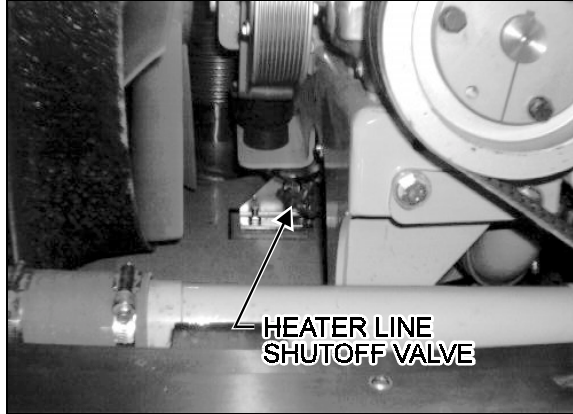


FIGURE 6: HEATER LINE SHUTOFF VALVE 05040

On XL-45 vehicles, the valves are located in engine compartment, on the L.H. side of engine and are accessible through L.H. side rear service compartment (Fig. 7).



FIGURE 7: HEATER LINE SHUTOFF VALVES 05041

Warning: Before proceeding with the following steps, make sure the coolant has cooled down. The sudden release of pressure from a heated cooling system can result in loss of coolant and possible personal injury (scalding) from the hot liquid.

2. Unscrew the pressure cap counterclockwise, 1/4 turn to release pressure from system and permit the coolant to drain completely from system.

3. Open the drain cock (1) located at rear corner of the engine (radiator side) (Fig. 8).

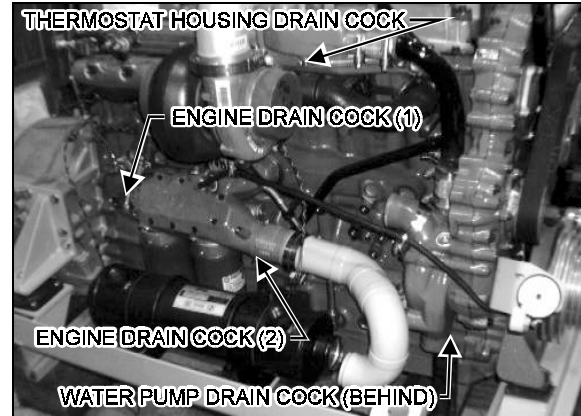


FIGURE 8: ENGINE COOLANT DRAIN COCKS 05042

4. Open the water pump housing inlet line drain cock (Fig. 9).

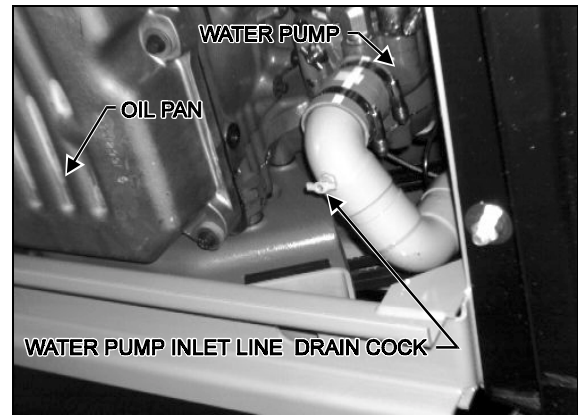


FIGURE 9: WATER PUMP DRAIN COCK (VIEWED FROM UNDERNEATH VEHICLE) 05028

5. Open drain cock at bottom of thermostat housing to drain the coolant trapped above the thermostats (Fig. 8).
6. Open the water pump drain cock (Fig. 8) (if applicable).
7. Open the radiator drain cock (Fig. 10).
8. Open engine drain cock (2) (Fig. 8).

Caution: if freezing weather is anticipated and the engine is not protected with antifreeze, drain the cooling system completely. Trapped water in the cylinder

block, radiator or other engine parts may freeze and expand resulting in damage to the engine. Leave the drain plugs open until the cooling system can be refilled with antifreeze.

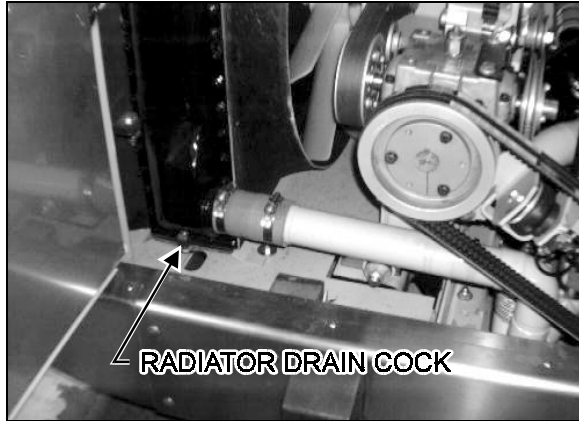


FIGURE 10: RADIATOR DRAIN COCK 05043

To drain the entire system (including heating units), redo the previous steps while maintaining the shutoff valves in their open position; then follow the procedure under “9.2 Draining Heating System” in Section 22.

4.8 Refilling Cooling system

If only the engine and related components have been drained, maintain the two heater line shutoff valves in their closed position, then proceed as follows.

1. Close all drain cocks (refer to “4.7 Draining Cooling System” for the location of draining points).
2. From the surge tank filler cap inlet, refill cooling system with a recommended ethylene glycol-base antifreeze and water solution with the required concentration. Add required Detroit Diesel selected product cooling system inhibitors (if required).

Note: *The coolant level should remain within two inches of the surge tank filler neck.*

Note: *Make sure the vent line at top of thermostat housing is properly connected and not obstructed. The vent line (thermostat*

housing dome to radiator top tank) is required to ensure complete engine fill and proper venting of air in the system.

3. Install the filler and pressure caps, then start the engine and run it at fast idle until normal operating temperature is reached. Check for leaks.

Note: *If for any reason, the coolant level drops below the surge tank level probe, the Check Engine light will flash.*

4. Stop engine and allow it to cool.
5. Open the two heater line shutoff valves, check the coolant level in the surge tank, then add as required.

Caution: *Never pour cold coolant into a hot engine. The sudden change in temperature may crack the cylinder heads or block.*

If the entire system has been drained, redo the previous steps while maintaining the two heater line shutoff valves in the "Open" position. With engine running, activate the driver's and central heating systems to permit coolant circulation, then complete the procedure by bleeding the heater cores as explained in Section 22, under “9.4 Bleeding Heating System”.

4.9 Flushing

If the cooling system is contaminated, flush the cooling system as follows:

1. Drain the coolant from the engine.
2. Refill with soft clean water.

Caution: *If the engine is hot, fill slowly to prevent rapid cooling and distortion of the engine castings.*

3. To thoroughly circulate the water, start the engine and run for 15 minutes after the thermostats have opened.

4. Fully drain system.
5. Refill with clean water and operate for 15 minutes after the thermostats have opened.
6. Fully drain system.
7. Fill with a 50/50 antifreeze/water solution and add required inhibitors (if applicable). Replace the coolant filter (if applicable) with a precharge element filter; in this case do not mix inhibitors with antifreeze/water solution.

4.10 Cooling System Cleaners

If the engine overheats, and the fan belt tension, coolant level, and thermostat operation have been found to be satisfactory, it may be necessary to clean and flush the entire cooling system.

Remove scale formation by using a reputable and safe descaling solvent. Immediately after using the descaling solvent, neutralize the system with a neutralizer. It is important that the directions printed on the container of the descaler be thoroughly read and followed.

After the solvent and neutralizer have been used, fully drain system, then reverse flush the engine and radiator (see "4.11 Reverse Flushing") before refilling the system with coolant solution.

4.11 Reverse Flushing

After the engine and radiator have been thoroughly cleaned, they should be reverse flushed. The water pump should be removed and the radiator and engine reverse flushed separately to prevent dirt and scale deposits from clogging the radiator tubes or being forced through the pump. Reverse flushing is accomplished by hot water, under pressure, being forced through the cooling system in a direction opposite to the normal flow of coolant, loosening and forcing deposits out.

The radiator is reverse flushed as follows:

1. Remove the radiator inlet and outlet hoses and replace existing radiator cap with a new one.
2. Attach a hose to the top of the radiator to lead water away from the engine.
3. Attach a hose at the bottom of the radiator and insert a flushing gun in the hose.
4. Connect the water hose of the gun to the water outlet and the air hose to the compressed air outlet.
5. Turn on the water and when the radiator is full, turn on the air in short blasts, allowing the radiator to fill between blasts.

Note: Apply air gradually. Do not exert more than 138 kPa (20 psi) air pressure. Too great a pressure may rupture a radiator tube.

6. Continue flushing until only clean water is expelled from the radiator.

The cylinder block and cylinder head water passages are reverse flushed as follows:

1. Remove the thermostats and the water pump.
2. Attach a hose to the water inlet of oil cooler housing to drain water away from engine.
3. Attach a hose to the water outlet at the top of the cylinder head (thermostat housing) and insert the flushing gun in the hose.
4. Turn on the water and when the jackets are filled, turn on the air in short blasts, allowing the engine to fill with water between air blasts.
5. Continue flushing until the water from the engine runs clean.

If scale deposits in the radiator cannot be removed by chemical cleaners or reverse flushing as outlined above, it may be necessary to remove the upper tank and rod out the individual radiator

tubes with flat steel rods. Circulate the water through the radiator core from the bottom to the top during this operation.

5. COOLANT FILTER (if applicable)

5.1 Description

The engine cooling system filter is used to filter out impurities such as scale or sand from the coolant and it also eliminates the process of adding inhibitors to the antifreeze/water solution. The filter is available as optional equipment and is mounted to the engine cradle (Fig. 11).

The precharge element filter lasts for 12,500 miles (20 000 km) or a year, whichever comes first. Replace the precharge element filter with a maintenance element filter, which lasts for 200,000 miles (320 000 km) or two years, whichever comes first. Every time the cooling system is flushed, drained and cleaned, you must first install a precharge element filter for its required lifespan; then install a maintenance element filter.

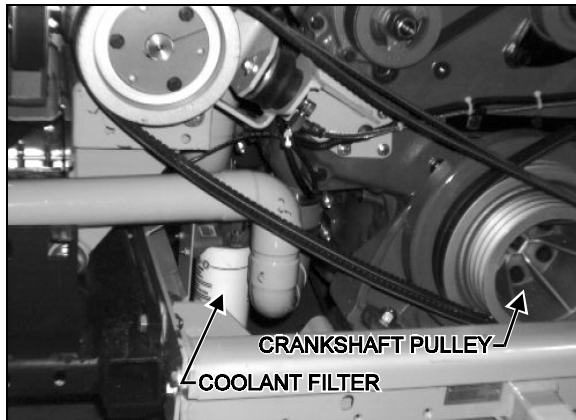


FIGURE 11: COOLANT FILTER

05032

Note: *If a coolant filter is to be installed on an engine already in service, drain and flush the cooling system prior to the installation of the filter.*

To replace a filter:

1. Close the two shutoff cocks at the filter mounting heads and unscrew the old filter from mounting.

Warning: *Failure to relieve cooling system pressure may result in personal injury.*

2. Remove and discard the filter.
3. Clean the filter adapter with a clean, lint-free cloth.
4. Coat surface of gasket with oil, tighten 2/3 to 1 turn after gasket contacts base.
5. Open the two shutoff cocks at filter.
6. Start engine and check for leaks.

Caution: *Do not exceed recommended service intervals.*

6. RADIATOR

The radiator is mounted at the L.H. side of engine compartment. It is designed to reduce the temperature of the coolant under all operating conditions. It is essential that the radiator core be kept free from corrosion and scale at all times.

6.1 Maintenance

Inspect the exterior of the radiator core every 25,000 miles (40 000 km) or once a year, whichever comes first. Clean with a quality grease solvent, such as a mineral spirits and dry with compressed air. Do not use fuel oil, kerosene or gasoline. It may be necessary to clean the radiator more frequently if the engine is being operated in extremely dusty or dirty areas.

7. RADIATOR VARIABLE SPEED FAN

7.1 Description

The radiator speed fan is thermostatic. The two speeds are controlled by the engine temperature (coolant temperature and air inlet temperature). The fan drive clutch is electromagnetic. An electric current regulates speeds by activating one magnetic coil for the first speed and two magnetic coils for the second speed.

The settings are:

For Series 60 engines with motor serial numbers up to 06R0194000 inclusively

- 204°F (96°C) First speed
- 208°F (98°C) Second speed

For Series 50 & 60 engines with motor serial numbers from 06R0194000

- 196°F (91°C) First speed
- 203°F (95°C) Second speed

Caution: Mechanical locking device

In case of an electrical power failure: unscrew the bolt from the end of the shaft and screw it into the locking plate. This procedure will prevent engine from overheating (Fig. 12).

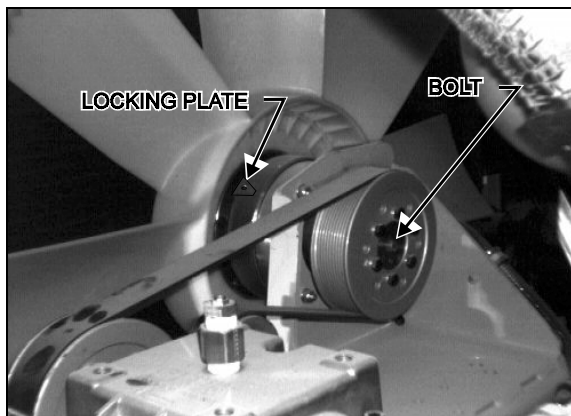


FIGURE 12: FAN-MECHANICAL LOCKING DEVICE 05033

7.2 Maintenance

1. Clean the fan and related parts with clean fuel oil and dry them with compressed air. Do not clean with steam or high pressure jet.
2. Check the fan blades for cracks or other damage. Replace the fan if the blades are cracked or deformed.
3. Remove any rust or rough spots in the grooves of the fan pulley. If the grooves are damaged or severely worn, replace the pulleys.
4. Do not add any fluids or lubricants to the fan drive.
5. Do not restrict fan rotation during engine operation for any reason.
6. Do not operate fan drive with a damaged fan assembly. Replace a damaged fan as soon as the fault is noted.
7. Immediately investigate and correct any operator complaint involving drive or cooling system performance.
8. When questions arise, obtain answers before proceeding. Assistance is available through the authorized Field Sales distributor serving your area.

7.3 Inspection

Warning: Set the starter selector switch in engine compartment to the "Off" position to prevent accidental starting of the engine.

- Check security of fasteners holding fan blade assembly to fan drive.
- Check coupling installation to gearbox.
- Visually inspect fan drive, fan blade assembly, shroud, radiator, and surrounding area for evidence of contact between rotating and non-rotating parts.

Section 05 : COOLING SYSTEM

- Check fan transfer belt for fraying, cracking, and proper tension.
- Turn fan through at least 360° of rotation. It should turn smoothly with no resistance.

7.4 Thermostat Operation

The temperature of the engine coolant is controlled by two blocking-type thermostats located in a housing attached to the right side of the cylinder head (Fig. 13).

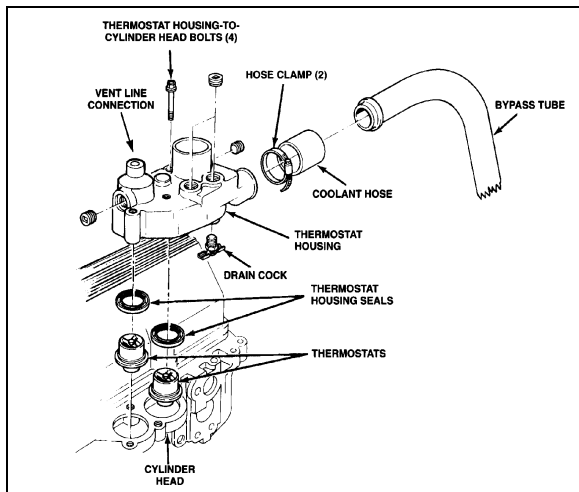


FIGURE 13: THERMOSTAT AND RELATED PARTS 05034

At coolant temperature below approximately 190°F (88°C), the thermostat valves remain closed and block the flow of coolant from the engine to the radiator. During this period, all of the coolant in the system is recirculated through the engine and directed back to the suction side of the water pump via a bypass tube. As the coolant temperature rises above 190°F (88°C) the thermostat valves start to open, restricting the bypass system, and allowing a portion of the coolant to recirculate through the radiator. When the coolant temperature reaches approximately 205-207°F (96-97°C) thermostat valves are fully open, the bypass system is blocked off, and the coolant is directed through the radiator.

8. FAN GEARBOX

8.1 Description

The radiator fan is belt driven from the engine crankshaft pulley through a gearbox standard assembly which is supplied with two output shafts.

8.2 Maintenance

Change the gearbox oil at 3 000 miles (4 800 km) and subsequently every 50,000 miles (80 000 km) or once a year, whichever comes first.

8.3 Oil change

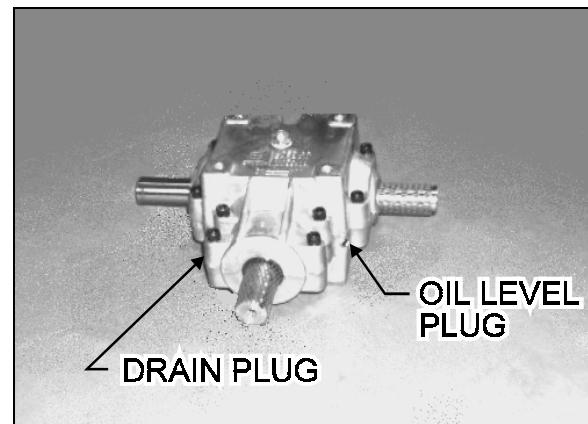


FIGURE 14: FAN GEARBOX

05008

1. Stop engine and make sure that all engine safety precautions have been observed.
2. Unscrew the air vent tube to permit the air to enter and the draining of gearbox (Fig. 14).
3. Remove the drain plug located at the gearbox base.
4. Drain gearbox.
5. Replace drain plug.
6. Remove the oil level plug located on the R.H. side of gearbox (Fig. 14).

7. Fill gearbox with synthetic oil (Esso imperial mobil SHC 630 (180217)) until oil runs out of the level plug.
8. Reinstall the level plug and the air vent tube.

9. RADIATOR FAN BELT REPLACEMENT AND BELT TENSIONERS

1. Locate the belt tensioner two-way control valve (Fig. 15), then turn handle counterclockwise in order to reverse pressure in belt tensioner air bellows, thus releasing tension on belts.



FIGURE 15: ENGINE COMPARTMENT 05044

2. Remove old belts (3 V belts & 1 Poly) from fan assembly and place the new ones on.
3. Turn clockwise the two-way control valve to its initial position to apply tension on the new belt.
4. For proper operation of the belts, adjust the air bellow tensioner pressure regulating valve (located next to control valve) to 50 psi for vehicles with Series 60 engines and to 70 psi for vehicles with Series 50 engines.

10. FAN DRIVE INSTALLATION & ALIGNMENT

1. Install both attachment assembly plates (#48 - P/N 051779) through lower plating and secure them with four spring nuts (#70 - P/N 500666). Then install one spacer (#49 - 050705) on spring nuts at both anchoring locations (Fig. 16).

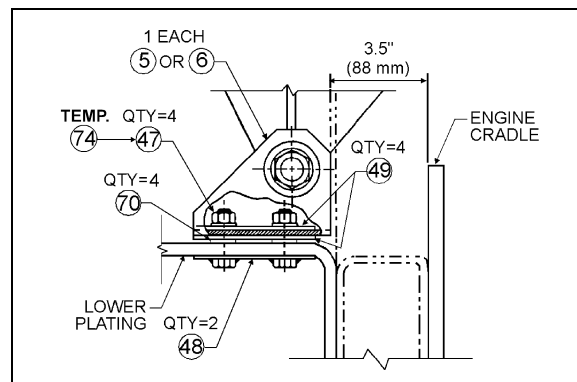


FIGURE 16: ANGLE SUPPORT 05014

2. Center seat assembly in the fan shroud using the horizontal displacement of the fan drive installation : center with the slots in the floor at anchoring angle support (on some vehicles only). The vertical displacement of fan clutch is made possible by slots at the base of the fan clutch (on some vehicles only) or by shimming with additional spacers at anchoring locations. Temporarily secure assembly with two nuts (#74 - P/N 500709) at both anchoring locations.

Caution: Tilt fan and check for clearance.

3. Using a straight edge, align the 3"V pulley on gearbox central shaft pulley with engine pulley, while taking pulleys outer edge thicknesses under consideration *i.e.* 3"V pulley's outer edge is thicker than that of engine pulley's (Fig. 17).

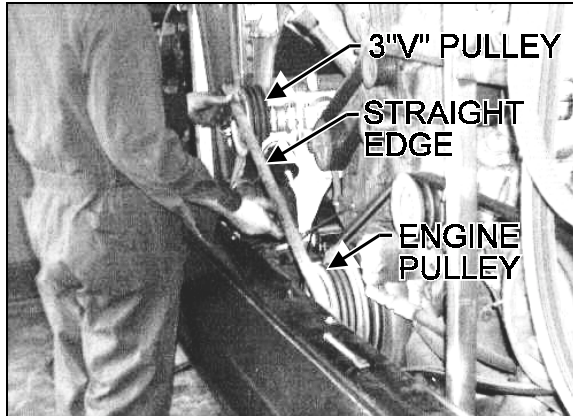


FIGURE 17: PULLEY ALIGNMENT 05015

4. Using a universal protractor, check 3"V" pulley's vertical angle with that of engine pulley's. If angles do not correspond, raise seat assembly by shimming with additional spacers (#49 - P/N 050705).

Note: Use a straight edge to measure engine pulley's vertical angle. (Fig. 18)

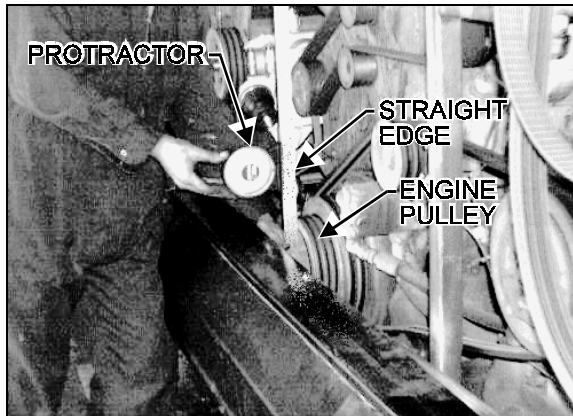


FIGURE 18: PULLEY'S VERTICAL ANGLE 05016

5. Recheck alignments (steps 3, 4 & 5), then replace temporary anchoring nuts (#74 - 500709) with four nuts (#47 - 500714) and tighten with wrench.
6. Align multi"V" pulley with fan pulley. Adjust the depth of the pulley on the gearbox shaft.

Caution: In order for tensioning system to work properly, the distance between the inside faces of "Tensioning Arm to Engine" bellow brackets should be between 2 3/8" (60 mm) and 2 1/2" (64 mm); if not, release tension on system and readjust distance using bolts securing upper tensioning bracket (Fig. 19).

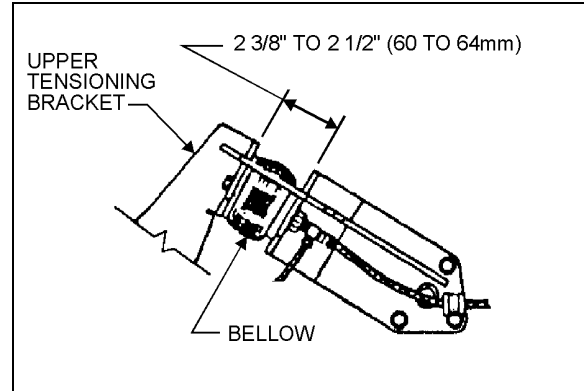


FIGURE 19: BELLOW - DISTANCE CHECK 12017

7. Reset belt tensioning pressure control valve to 50 PSI - 345 kPa (70 psi - 482 kPa for Series 50 engines) as per Section 12, "BRAKE" (Fig. 20).

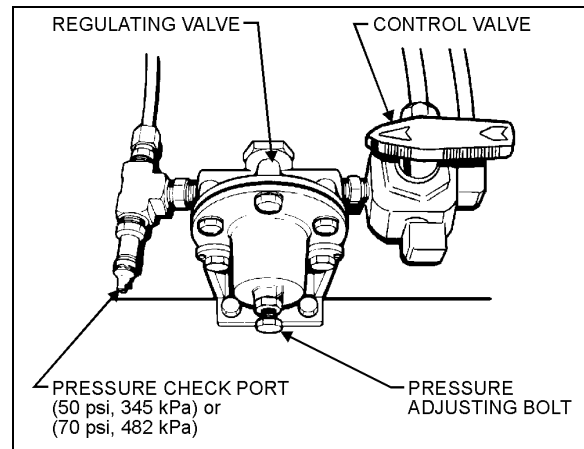


FIGURE 20: VALVES 12018

11. SPECIFICATIONS

Cooling System Capacity (Approx.)

Includes heating system 24 US gal (91 liters)

Thermostat

Number used2
 Start to open..... (186-193 °F) 86-89 °C
 Fully open..... 207 °F (97 °C)

Radiator

Make.....Long
 Location..... Rear L.H. side

XL Buses

Supplier number..... 7601-8317-1
 Prevost number..... 550687

XL Shells

Supplier number..... 7601-8336
 Prevost number..... 550689

Surge Tank Filler Cap

Make..... Stant
 Model..... R3
 Prevost number..... 530191

Pressure Cap

Make..... Stant
 Pressure setting 14 psi (96.53 kPa)
 Supplier number..... R12
 Prevost number..... 550606

Fan Clutch

Make..... Linnig
 Type3 speeds
 Supplier number.....LA1.2.024Y
 Prevost number..... 550634

Note: The fan clutch is controlled by DDEC (not by thermostitch).

Fan Gearbox

Make..... Superior Gearbox
 Ratio..... 1:1
 Supplier number.....411ACF-097-6
 Prevost number..... 550688

Section 05 : COOLING SYSTEM

Fan Belt (gearbox-fan)

Make..... Dayco
Type Multi-V, Poly rib, 51”
Qty..... 1
Supplier number..... 5100495
Prevost number..... 506663

Fan Belt (gearbox-motor)

Make..... Gates
Type V belt
Qty..... 3

Series 60 Engines:

Supplier number..... AX74
Prevost number..... 506690

Series 50 Engines:

Supplier number..... AX73
Prevost number..... 506691

Corrosion Inhibitor and Coolant Stabilizer

Supplier number..... Detroit Diesel..... 23507857
Supplier number..... Nalco DD3000-15

Coolant Filter

Number used 1
Make..... Nalco
Type Spin-on

MAINTENANCE ELEMENT FILTER

Supplier number. Detroit Diesel..... 23507545
Supplier number..... Nalco DDF3000
Prevost number..... 550630

PRECHARGE ELEMENT FILTER

Supplier number. Detroit Diesel..... 23507189
Supplier number..... Nalco DDF60
Prevost number..... 550629

Temperature Gauge (in engine compartment)

Make..... VDO Yazaki
Operating range 100-265 °F (40-130 °C)
Supplier number..... 1 131 015 015B
Prevost number..... 562331

Temperature Gauge (on instrument panel)

Make..... Datcon
Type Electrical
Operating range 100-280 °F (38-138 °C)
Supplier number..... 07718-40
Prevost number..... 562214

SECTION 6: ELECTRICAL SYSTEM

CONTENTS OF THIS SECTION

1.	ELECTRICAL SYSTEM PRECAUTIONS	6-8
2.	GENERAL DESCRIPTION OF THE ELECTRICAL SYSTEM.....	6-8
3.	WIRING AND MISCELLANEOUS ELECTRICAL.....	6-8
3.1	Wiring Diagrams	6-8
3.1.1	Wiring Diagram Symbols.....	6-8
3.1.2	Using the Wiring Diagrams.....	6-8
3.1.3	Testing Circuits	6-9
3.2	Wires and Connectors.....	6-9
3.2.1	Wire Sizes and Colors	6-9
3.2.2	Spare Wires	6-9
3.2.3	Cleaning Connectors with a Freon-Based Solvent	6-9
3.3	Relays	6-10
4.	ELECTRICAL COMPARTMENTS	6-12
4.1	XL-40 Coach	6-12
4.1.1	Maintenance.....	6-13
4.1.2	Engine R.H. Side Compartment	6-13
4.1.3	Main Battery Disconnect Switch	6-13
4.1.4	Battery Compartment.....	6-13
4.1.5	R.H. Side Rear Baggage Compartment.....	6-14
4.1.6	Main Breakers.....	6-14
4.1.7	Front Electrical Compartment.....	6-14
4.1.8	Steering Compartment.....	6-14
4.1.9	L.H. Side Rear Baggage Compartment (Vehicle Equipped With Video System)	6-16
4.1.10	Engine Rear Compartment (Rear Junction Box)	6-16
4.2	XL-45 Coach	6-17
4.2.1	Maintenance.....	6-17
4.2.2	Main Power Compartment.....	6-18
4.2.3	Main Breakers	6-19
4.2.4	Condenser Compartment	6-19
4.2.5	Front Electrical Compartment.....	6-19
4.2.6	Steering Compartment.....	6-19
4.2.7	L.H. Side Rear Baggage Compartment (Vehicles Equipped With Video System)	6-21
4.2.8	Engine Rear Compartment (Rear Junction Box).....	6-21
4.3	XL-40 and XL-45E Converted Vehicles.....	6-22
4.3.1	Maintenance.....	6-23
4.3.2	Engine R.H. Side Compartment	6-23
4.3.3	Main Breakers.....	6-24
4.3.4	Front Electrical Compartment.....	6-24
4.3.5	Steering Compartment.....	6-24
4.3.6	Engine Rear Compartment (Rear Junction Box).....	6-26
4.4	XL-45 Converted Vehicle.....	6-27
4.4.1	Maintenance	6-28
4.4.2	Engine R.H. Side Compartment	6-28
4.4.3	Main Breakers.....	6-29
4.4.4	R.H. Side Rear Service Compartment	6-29
4.4.5	Front Electrical Compartment.....	6-29
4.4.6	Steering Compartment.....	6-30

Section 6: ELECTRICAL SYSTEM

- 4.4.7 Engine Rear Compartment (Rear Junction Box) 6-31
- 5. BATTERIES 6-32
 - 5.1 General Description 6-32
 - 5.2 Battery Safety Precautions 6-32
 - 5.3 Battery (XL-40 Coach) 6-32
 - 5.3.1 Removal 6-32
 - 5.3.2 Installation 6-33
 - 5.4 Battery (XL-45 Coach) 6-33
 - 5.4.1 Removal 6-33
 - 5.4.2 Installation 6-33
 - 5.5 Battery (XL-40 and XL-45E Converted Vehicles) 6-34
 - 5.5.1 Removal 6-34
 - 5.5.2 Installation 6-34
 - 5.6 Battery (XL-45 Converted Vehicle) 6-34
 - 5.6.1 Removal 6-34
 - 5.6.2 Installation 6-35
 - 5.7 Battery Rating 6-35
 - 5.8 Battery Testing 6-35
 - 5.8.1 Visual Inspection 6-36
 - 5.8.2 Removing Surface Charge 6-36
 - 5.8.3 Load Test 6-36
 - 5.8.4 Testing Battery Cables 6-37
 - 5.9 Battery Charging 6-37
 - 5.9.1 Charging Procedure 6-38
 - 5.9.2 Battery Charging Guide 6-38
 - 5.9.3 Emergency Jump Starting With Auxiliary (Booster) Battery 6-39
 - 5.10 Cleaning and Inspection 6-41
 - 5.11 Common Causes of Battery Failure 6-41
 - 5.12 Troubleshooting 6-41
- 6. ELECTRICAL SYSTEM MONITOR 6-42
 - 6.1 Warning Lamp Definition 6-42
 - 6.1.1 Battery Hi/Lo 6-42
 - 6.1.2 Battery Balance 6-42
 - 6.1.3 "Battery" Warning Light 6-42
- 7. ALTERNATOR 6-43
 - 7.1 Gear Driven Alternator Oil Cooled (24V-270 Amps) 6-43
 - 7.2 Diagnosis of Charging System Problems 6-45
 - 7.2.1 Alternator or Voltage Regulator 6-45
 - 7.3 Alternator Diagnosis 6-46
 - 7.3.1 Diode Checks 6-46
 - 7.3.2 Field Winding Checks 6-48
 - 7.3.3 Stator Winding Checks 6-48
 - 7.4 Diode Replacement 6-49
 - 7.4.1 Diode (in Support) Replacement 6-49
 - 7.4.2 Diode (in End Frame) Replacement 6-49
 - 7.5 Field Winding Replacement 6-49
 - 7.5.1 Removal 6-49
 - 7.5.2 Installation 6-49
 - 7.6 Stator Winding Replacement 6-50
 - 7.6.1 Removal 6-50
 - 7.6.2 Soldering Stator Terminal Leads 6-50

7.6.3	Installation	6-50
7.7	Diode End Cover Installation	6-50
7.8	Alternator Replacement	6-50
7.8.1	Removal	6-50
7.8.2	Disassembly	6-51
7.8.3	Alternator Cleaning and Inspection	6-51
7.8.4	Bearing or Rotor Replacement	6-51
7.8.5	Reassembly	6-52
7.8.6	Output Check	6-52
7.9	Alternator Drive Belt	6-53
7.9.1	Removal and Installation	6-53
7.9.2	Adjustment	6-53
7.10	Alternator (24 Volts-75 Amps).....	6-54
7.10.1	Alternator Wiring Test.....	6-54
7.10.2	Charging Circuit Voltage Drop Test.....	6-54
7.10.3	Alternator Output Test	6-55
7.11	Alternator (12 & 24 Volts) Removal and Installation.....	6-56
7.11.1	Removal.....	6-56
7.11.2	Alternator Service	6-57
7.11.3	Alternator Installation	6-57
8.	VOLTAGE REGULATOR	6-58
8.1	Description	6-58
8.2	Troubleshooting Procedures.....	6-58
8.3	Checking Regulator Voltage Setting.....	6-59
8.3.1	Undercharged Battery.....	6-59
8.3.2	Overcharged Battery.....	6-60
8.4	Regulator Checks.....	6-60
8.5	Adjusting Voltage	6-61
9.	BATTERY EQUALIZER	6-61
10.	STARTING MOTOR.....	6-61
10.1	Description	6-61
10.2	Maintenance.....	6-62
10.3	Cranking Motor Replacement Determination	6-62
10.4	Removal	6-63
10.5	Cleaning	6-63
10.6	Armature Servicing.....	6-63
10.7	Field Coil Checks	6-64
10.8	Field Coil Removal	6-64
10.9	Nose Housing Relocation	6-64
10.10	Installation	6-64
10.11	Pinion Clearance.....	6-65
10.12	Starter Solenoid.....	6-65
10.12.1	Description	6-65
10.12.2	Disassembly.....	6-65
10.12.3	Solenoid Maintenance	6-65
10.12.4	Solenoid Tests	6-65
10.12.5	Recommendations.....	6-66
11.	ENGINE BLOCK HEATER	6-67
11.1	Maintenance.....	6-67
12.	EXTERIOR LIGHTNING EQUIPMENT	6-67
12.1	Headlight	6-67

Section 6: ELECTRICAL SYSTEM

12.1.1	Headlight Dimmer Switch	6-67
12.1.2	Maintenance	6-67
12.1.3	Headlight Adjustment.....	6-68
12.1.4	Bulb Replacement	6-69
12.2	Front Turn Signal.....	6-70
12.2.1	Bulb Removal and Replacement.....	6-70
12.3	Stop, Tail, Directional, Back-up, and Hazard Warning Lights.....	6-70
12.3.1	Bulb Removal and Replacement.....	6-70
12.4	License Plate Light.....	6-70
12.5	Clearance, Identification and Marker Lights - Bulb Removal and Replacement	6-71
12.6	Marker / Side Directional Lights - Bulb Removal and Replacement	6-71
12.7	Clearance / Identification Lights - Bulb Removal and Replacement.....	6-71
12.8	Docking / Cornering Lights - Bulb Removal and Replacement.....	6-72
12.9	Fog Light - Bulb Removal and Replacement.....	6-72
13.	INTERIOR LIGHTNING EQUIPMENT	6-73
13.1	Control Panel Lightning.....	6-73
13.1.1	Switch Bulb Replacement	6-73
13.1.2	Indicator Light Bulb Replacement	6-73
13.1.3	Gauge Light Bulb Replacement	6-74
13.1.4	Panel Light Bulb Replacement	6-74
13.2	Stepwell Light.....	6-74
13.2.1	Bulb Removal and Replacement.....	6-74
13.3	Dome, Rear Roof and Lavatory Lights	6-74
13.3.1	Bulb Removal and Replacement.....	6-75
13.4	Passenger Section Lightning.....	6-75
13.4.1	Removal and Replacement of Aisle Fluorescent.....	6-76
13.4.2	Removal and Replacement of Fluorescent Light.....	6-76
13.4.3	Reading Lamp - Bulb Removal and Replacement.....	6-76
13.4.4	Parcel Rack / Lavatory Night Light - Bulb Removal and Replacement	6-76
13.4.5	Lavatory "Occupied" Light - Bulb Removal and Replacement	6-76
13.4.6	Emergency Exit Light - Bulb Removal and Replacement.....	6-77
13.4.7	Destination Sign Light - Bulb Removal and Replacement	6-77
13.4.8	Destination Sign - Fluorescent Removal and Replacement	6-77
13.4.9	Aisle Light - Bulb Removal and Replacement.....	6-77
13.5	Engine and Front Electrical Compartment Lightning.....	6-78
13.6	Exterior Compartment Lights (Except engine and Front Electrical Compartment).....	6-78
14.	LIGHT BULB DATA	6-79
15.	SPECIFICATIONS	6-82

LIST OF ILLUSTRATIONS

FIGURE 1: WIRE IDENTIFICATION.....	6-9
FIGURE 2: TYPES OF RELAYS	6-11
FIGURE 3: ELECTRICAL COMPARTMENT (XL-40 COACH).....	6-12
FIGURE 4: ENGINE R.H. SIDE COMPARTMENT	6-13
FIGURE 5: MAIN BATTERY DISCONNECT SWITCH.....	6-13
FIGURE 6: BATTERY COMPARTMENT	6-13
FIGURE 7: R.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING.....	6-14
FIGURE 8: FRONT ELECTRICAL COMPARTMENT.....	6-14
FIGURE 9: STEERING COMPARTMENT (LEFT WALL).....	6-15
FIGURE 10: STEERING COMPARTMENT	6-15
FIGURE 11: STEERING COMPARTMENT (RIGHT WALL)	6-15
FIGURE 12: DDEC III JUNCTION BOX	6-15
FIGURE 13: L.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING	6-16
FIGURE 14: REAR JUNCTION BOX SWITCHES.....	6-16
FIGURE 15: REAR JUNCTION BOX	6-16
FIGURE 16: ELECTRICAL COMPARTMENT (XL-45 COACH).....	6-17
FIGURE 17: MAIN POWER COMPARTMENT.....	6-18
FIGURE 18: MAIN POWER COMPARTMENT.....	6-18
FIGURE 19: L.H. LOWER SWITCH PANEL (BATTERY MASTER SWITCH)	6-18
FIGURE 20: MAIN POWER COMPARTMENT	6-19
FIGURE 21: A/C JUNCTION BOX	6-19
FIGURE 22: FRONT ELECTRICAL COMPARTMENT.....	6-19
FIGURE 23: STEERING COMPARTMENT (LEFT WALL).....	6-20
FIGURE 24: STEERING COMPARTMENT	6-20
FIGURE 25: STEERING COMPARTMENT (RIGHT WALL)	6-20
FIGURE 26: DDEC III JUNCTION BOX	6-21
FIGURE 27: L.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING	6-21
FIGURE 28: REAR JUNCTION BOX SWITCHES.....	6-21
FIGURE 29: ENGINE REAR COMPARTMENT.....	6-21
FIGURE 30: ELECTRICAL COMPARTMENT (XL-40 AND XL-45E CONVERTED VEHICLES).....	6-22
FIGURE 31: ENGINE R.H. SIDE COMPARTMENT	6-23
FIGURE 32: CONDENSER COMPARTMENT	6-24
FIGURE 33: FRONT ELECTRICAL COMPARTMENT.....	6-24
FIGURE 34: STEERING COMPARTMENT (LEFT WALL).....	6-25
FIGURE 35: STEERING COMPARTMENT	6-25
FIGURE 36: STEERING COMPARTMENT (RIGHT WALL)	6-25
FIGURE 37: DDEC III JUNCTION BOX	6-26
FIGURE 38: ENGINE REAR COMPARTMENT.....	6-26
FIGURE 39: REAR JUNCTION BOX SWITCHES.....	6-26
FIGURE 40: REAR JUNCTION BOX	6-26
FIGURE 41: ELECTRICAL COMPARTMENT (XL-45 CONVERTED VEHICLE)	6-27
FIGURE 42: BOOSTER BLOCK	6-28
FIGURE 43: ENGINE R.H. SIDE COMPARTMENT	6-28
FIGURE 44: CONDENSER COMPARTMENT	6-29
FIGURE 45: R.H. SIDE REAR SERVICE COMPARTMENT.....	6-29
FIGURE 46: FRONT ELECTRICAL COMPARTMENT.....	6-30
FIGURE 47: STEERING COMPARTMENT (LEFT WALL).....	6-30
FIGURE 48: STEERING COMPARTMENT	6-30

Section 6: ELECTRICAL SYSTEM

FIGURE 49: STEERING COMPARTMENT (RIGHT WALL)	6-31
FIGURE 50: DDEC III JUNCTION BOX	6-31
FIGURE 51: REAR JUNCTION BOX SWITCHES.....	6-31
FIGURE 52: ENGINE REAR COMPARTMENT	6-31
FIGURE 53: BATTERY COMPARTMENT	6-33
FIGURE 54: BATTERY (XL-40 AND XL-45E CONVERTED VEHICLES)	6-34
FIGURE 55: BATTERY (XL-45 CONVERTED VEHICLE).....	6-35
FIGURE 56: TEST INDICATOR	6-36
FIGURE 57: LOAD TEST	6-36
FIGURE 58: ALLIGATOR CLAMP AND BATTERY	6-38
FIGURE 59: BOOSTER BLOCK (XL-40 AND XL-45E CONVERTED VEHICLES).....	6-40
FIGURE 60: BOOSTER BLOCK (XL-40 COACH).....	6-40
FIGURE 61: BOOSTER BLOCK (XL-45 COACH).....	6-40
FIGURE 62: BOOSTER BLOCK (XL-45 CONVERTED VEHICLE)	6-40
FIGURE 63: ENGINE REAR COMPARTMENT (ALTERNATOR)	6-43
FIGURE 64: ALTERNATOR	6-44
FIGURE 65: ALTERNATOR WIRING DIAGRAM.....	6-44
FIGURE 66: ALTERNATOR	6-45
FIGURE 67: ALTERNATOR FLEXIBLE LEADS.....	6-46
FIGURE 68: DIODES TEST	6-47
FIGURE 69: DIODES TEST	6-47
FIGURE 70: STATOR WINDING TEST.....	6-48
FIGURE 71: ALTERNATOR (HOSES AND WIRES).....	6-51
FIGURE 72: ALTERNATOR	6-51
FIGURE 73: ALTERNATOR DRIVE BELT.....	6-53
FIGURE 74: ENGINE REAR COMPARTMENT (ALTERNATOR)	6-54
FIGURE 75: CHARGING CIRCUIT VOLTAGE DROP TEST.....	6-54
FIGURE 76: CHARGING CIRCUIT VOLTAGE DROP TEST.....	6-55
FIGURE 77: ALTERNATOR OUTPUT TEST.....	6-56
FIGURE 78: 12V-145 AMPS AND 24V-75 AMPS ALTERNATORS	6-56
FIGURE 79: FAN CLUTCH SUPPORT.....	6-56
FIGURE 80: VOLTAGE REGULATOR.....	6-58
FIGURE 81: TYPICAL WIRING DIAGRAM OF A NEGATIVE GROUND SYSTEM.....	6-58
FIGURE 82: REGULATOR VOLTAGE TEST	6-59
FIGURE 83: REGULATOR ADJUSTMENT	6-59
FIGURE 84: REGULATOR VOLTAGE TEST (UNDERCHARGED BATTERY)	6-59
FIGURE 85: TRANSISTOR TEST.....	6-61
FIGURE 86: TRANSISTOR TEST.....	6-61
FIGURE 87: CRANKING MOTOR MOUNTING	6-61
FIGURE 88: TYPICAL CRANKING MOTOR CROSS-SECTION.....	6-62
FIGURE 89: CRANKING MOTOR AVAILABLE VOLTAGE TEST	6-63
FIGURE 90: PINION CLEARANCE.....	6-65
FIGURE 91: HEATER MALE ELECTRIC PLUG LOCATION.....	6-67
FIGURE 92: RIGHT HEADLIGHT	6-67
FIGURE 93: HEADLIGHT ALIGNER.....	6-68
FIGURE 94: HEADLIGHT ALIGNER.....	6-68
FIGURE 95: HEADLIGHT ALIGNER.....	6-69
FIGURE 96: HEADLIGHT ALIGNER.....	6-69
FIGURE 97: HEADLIGHT ALIGNER.....	6-69
FIGURE 98: HEADLIGHT ASSEMBLY	6-70
FIGURE 99: LICENSE PLATE HOLDER.....	6-71

FIGURE 100: MARKER LIGHT / SIDE DIRECTIONAL LIGHT	6-71
FIGURE 101: TYPE "A" LIGHT	6-71
FIGURE 102: TYPE "B" LIGHT	6-72
FIGURE 103: DOCKING AND CORNERING	6-72
FIGURE 104: FOG LIGHT	6-73
FIGURE 105: SWITCH	6-73
FIGURE 106: INDICATOR	6-74
FIGURE 107: GAUGE	6-74
FIGURE 108: A/C STANDARD CONSOLE	6-74
FIGURE 109: PARCEL RACK	6-75
FIGURE 110: PARCEL RACK / LAVATORY NIGHT LIGHT	6-76
FIGURE 111: LAVATORY "OCCUPIED" LIGHT	6-77
FIGURE 112: EMERGENCY EXIT LIGHT	6-77
FIGURE 113: DESTINATION SIGN	6-77
FIGURE 114: AISLE LIGHT	6-78
FIGURE 115: ENGINE AND FRONT ELECTRICAL LIGHT.....	6-78

1. ELECTRICAL SYSTEM PRECAUTIONS

Observe the following items when working on the system:

1. Always remove rings, watches, etc. before working on the electrical system. Even with the batteries disconnected, capacitive discharge could occur if a component live terminal is earthed through a metal object. This could cause a shock or nasty burn.
2. Do not reverse battery connections. Components such as the alternator or any other having semi-conductor circuitry could be irreparably damaged.
3. Never disconnect the battery terminals, or alternator wiring, when the engine is running.
4. The battery leads and alternator(s) wiring must be disconnected before carrying out any electric arc-welding on the car.
5. Wear safety glasses when working near batteries.
6. Do not smoke near batteries.
7. Work on batteries in a well ventilated area.
8. Work on batteries with rubber gloves.
9. When working on battery terminals, isolate your tool with electric tape.

2. GENERAL DESCRIPTION OF THE ELECTRICAL SYSTEM

The electrical system consists of four (4) 12 volt batteries, electrical system monitor, alternator(s), voltage regulator, battery equalizer(s), starter motor and related electrical accessories, components and wiring.

Caution: Before carrying out any work on the vehicle electrical system, read through the electrical system precautions.

3. WIRING AND MISCELLANEOUS ELECTRICAL

3.1 Wiring Diagrams

A master wiring diagram of the electric circuits, covering standard and optional accessories and systems, is annexed in the technical publication box provided with the vehicle. Usually, a separate wiring diagram page is provided for each major function or system. In some cases, more than one circuit may appear on one wiring diagram page; when it occurs, each circuit covered in this page is listed in the wiring diagram index. Moreover, a circuit may appear on several pages; in such case, the number(s) at the extremity of diagram title will indicate the sheet reference number. Refer to the "Wiring diagram index" to ensure the correct diagram is being used to trace the circuit in question.

3.1.1 Wiring Diagram Symbols

Various symbols are used on the wiring diagrams to depict different types of electrical components. It is essential to become familiar with these symbols in order to understand the diagrams. The major symbols shown on the diagrams are identified under "Wiring Diagram symbols" (page K of wiring diagrams).

3.1.2 Using the Wiring Diagrams

Two methods are used to "work" with electric wiring diagrams.

1. You have identified the defective part (breaker, diode, relay, etc.), and you wish to locate its corresponding circuit.

Problem: Circuit breaker #83 is released (open circuit) and you don't know which circuit is affected.

- a) Refer to wiring diagram index, and look for "Circuit breaker code", pages F.
- b) In the first column, you will find item C.B #83. In the second column, you will find the page number on which to find the corresponding diagram. In the third column the breaker ampere rating, and in the fourth column, the Prévost number. The other columns give you the location and the function of the breaker.
- c) Refer to page 4 keeping in mind the function of the breaker, i.e. "World Transmission VIM Power".

- d) When you have located "World Transmission VIM Power", follow wiring until you come across C.B #83 and its circuit.

2. You have a problem with a specific system and you want to find the corresponding diagram.

- a) Refer to wiring diagram index and look for specific system.
- b) You will find the page number of the components as well as the electric wiring, thus providing you with a complete understanding of this circuit.

3.1.3 Testing Circuits

A careful study of the wiring diagrams should be made to determine the source and flow of current through each circuit. When a circuit is thoroughly understood, a point-to-point check can be made with the aid of the applicable wiring diagrams. Any circuit can be tested for continuity or short circuits with a multimeter or a suitable voltmeter.

All electrical connections must always be kept clean and adequately tight. Loose or corroded connections can result in discharged batteries, difficult starting, dim lights and improper functioning of other electric circuits. Inspect all wiring connections at regular intervals. Make sure knurled nuts on all amphenol-type plugs are securely tightened. Knurled nuts on the plastic amphenol-type connectors will click into a detent when properly tightened. Line connectors, which have the side locking tabs, must have the locks latched in place to ensure a proper electrical connection.

3.2 Wires and Connectors

3.2.1 Wire sizes and colors

Each wire in the electrical system has a specific size as designated on the wiring diagram. When replacing a wire, the correct size must be used. Never replace a wire with one of a smaller size.

On vehicle, taking into account that the electric system is provided with different voltages, the insulation on each wire is distinctly colored in order to determine visually the wiring voltage and to assist in making connections. The wires are color coded as follows:

Red	24 volt system
Yellow	12 volt system
Black	grounded wire
Blue	110 V ac system (live)
White	110 V ac system (neutral)
Green	110 V ac system (ground)

Orange	speakers (+)
Brown	speakers (-)
Grey	spare wire

Note: In addition, the wires are identified at each 4-6 inch intervals by a printed number.

Each wire on a diagram is patterned to assist in tracing and testing circuits; the wire number is designed in order to identify at first, the voltage rating, then the wire identification number, and finally the basic wire gauge as illustrated in figure 1.

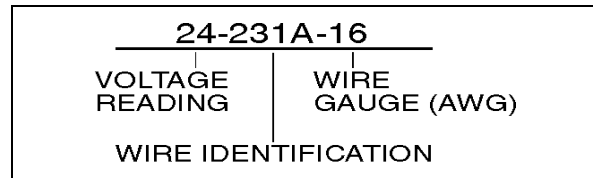


FIGURE 1: WIRE IDENTIFICATION

06048

3.2.2 Spare Wires

When vehicle leaves factory, and even in the case of a full-equipped vehicle, an important number of unconnected spare wires are routed between the junction boxes. Consequently, for any connection of an additional accessory, refer to page D "Spare wires" in master wiring diagram to determine the number, the gauge and location of these wires.

Note: In addition to the number, the letters "SP" are printed on each spare wire.

3.2.3 Cleaning Connectors with a Freon-Based Solvent

When the pins and sockets of connectors become dirty, clean them with a good quality solvent containing HFC 134A refrigerant as its active ingredient. HFC 134A has two qualities that recommend it. First, it does not conduct electricity and therefore, will not cause shorting between connector pins and sockets. Second, it evaporates quickly, eliminating the possibility of condensation within the connectors.

Always shake out or gently blow out any excess HFC 134A before assembling a connector to its mating connector or hardware. HFC 134A trapped in the connector can affect the connector seal.

Warning: HFC 134A based compounds should always be used in a naturally well-ventilated area, never in a confined space.

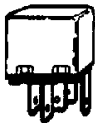

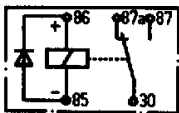
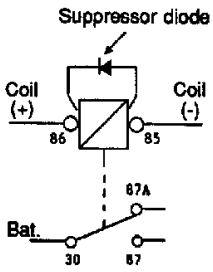
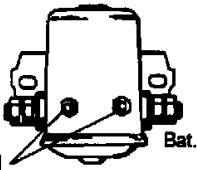
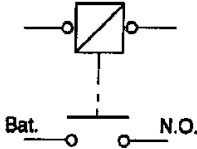
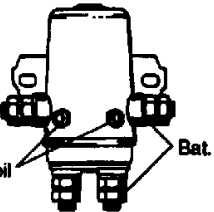
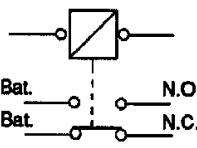
3.3 Relays

Relays are used to automatically energize or deenergize a circuit from a remote location. The relay draws a very low current to energize its coil. Once the coil is energized, it develops a magnetic field which pulls a switch arm closed or open, to either energize or deenergize a given component. As the control current required for the coil is very low, the relay allows a remote station to control a high energy circuit without running great lengths of costly high capacity cable, and also eliminates the need for high amperage switches and heavy connectors.

Many systems on this vehicle are provided with control relays, which are all located in or on the junction boxes (Fig. 2).

Note: *Each relay is identified with a 12 V or 24 V printed on its casing in order to identify the coil operating voltage.*

Caution: *The magnetic relays for the starting motor, evaporator and both condenser motors and condenser speed controls should have the 5/16" stud nuts torqued to 4.1 ± 0.4 lbf•ft ($5,5 \pm 0,5$ N•m).*

	Configuration on base	Key printed on casing	Key used on wiring diagram	Example
<p>Cubic relay (Steel or plastic casing) Type: S.P.D.T.</p> 				R #5
<p>NOTE: This relay is provided with an internal suppressor diode; never reverse wiring terminals #85 and 86 at base as a direct short circuit will result. The relay coils connected to the alternator "relay terminal" should never be provided with a suppressor diode as the output current at this terminal is not rectified, thus rendering relay inoperative.</p>				
<p>Magnetic relay (Round steel casing) Type: S.P.S.T.</p> 	None	None		R #4
<p>Magnetic relay (Round steel casing) Type: D.P.D.T.</p> 	None	None		R #40

LEGEND

- Bat. Battery
- N.O. Normally Open
- N.C. Normally Closed
- S.P.D.T. Single Pole Double Throw
- S.P.S.T. Single Pole Single Throw
- D.P.D.T. Double Pole Double Throw

FIGURE 2: TYPES OF RELAYS

06050

4. ELECTRICAL COMPARTMENTS

4.1 XL-40 Coach

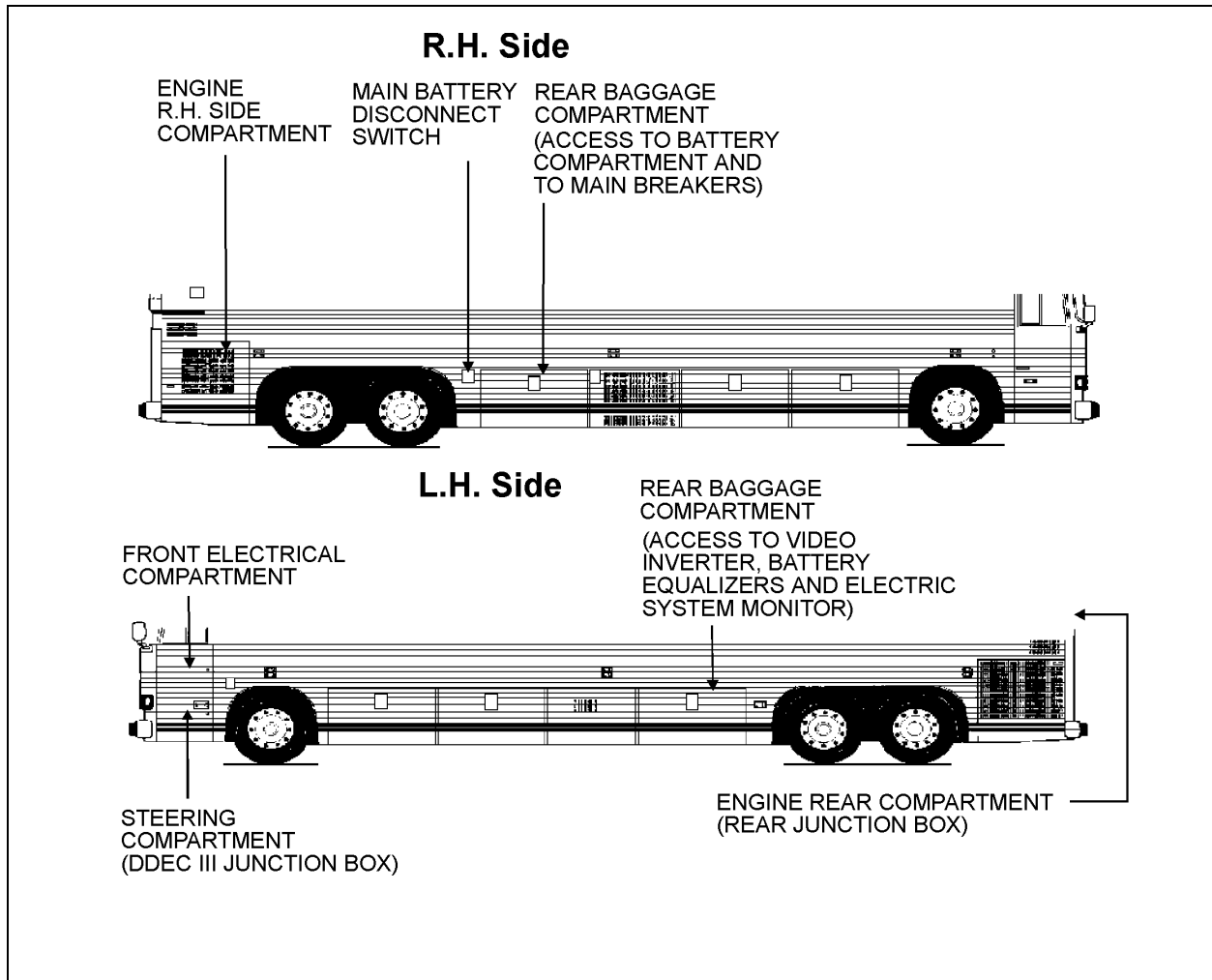


FIGURE 3: ELECTRICAL COMPARTMENT (XL-40 COACH)

06116

4.1.1 Maintenance

To protect components from corrosion, a Cortec VCI-238 corrosion inhibitor has been sprayed in the following electrical compartments and components:

- front electrical compartment;
- DDEC III junction box (steering compartment);
- battery compartment;
- rear junction box (engine rear compartment).

The life expectancy of this product is five years, so it is recommended to spray it back every five years. It is also recommended to spray it on new components when added or replaced.

Warning: Use in a well ventilated area. Do not smoke. Avoid prolonged contact with skin and breathing of spray mist. Harmful or fatal if swallowed. Do not induce vomiting. Call physician immediately.

4.1.2 Engine R.H. Side Compartment

On XL-40 coach, booster block is located in the engine R.H. side compartment and is accessible through engine R.H. side door (Fig. 4).

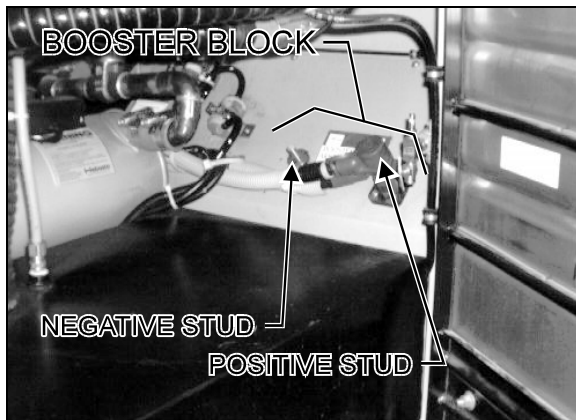


FIGURE 4: ENGINE R.H. SIDE COMPARTMENT 06098

4.1.3 Main Battery Disconnect Switch

This switch disconnect both the 12 and 24 volts. This manual switch is located next to the R.H. Side rear baggage compartment door (Fig. 5).

Caution: When vehicle is parked overnight or for an extended period of time, main battery disconnect switch (Fig. 5) should be set to the "OFF" position in order to avoid battery voltage imbalance.

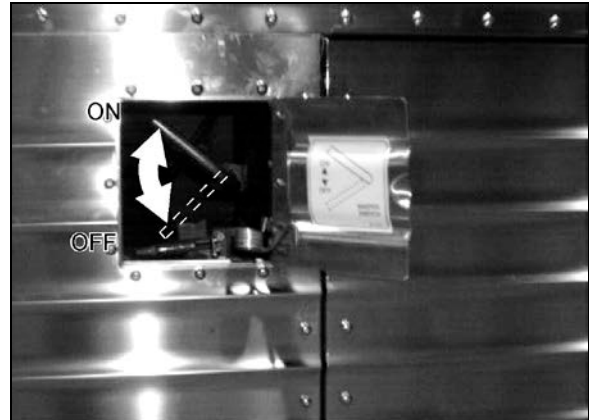


FIGURE 5: MAIN BATTERY DISCONNECT SWITCH 06047

Note: When battery disconnect switch is set to the "OFF" position, the electrical supply from the batteries is cut off, with the exception of the Fire Detection System, the Engine & Transmission Electronic Controls, the Auxiliary Heating System, the Battery Equalizers and the Digital Clock.

4.1.4 Battery Compartment

To gain access to the battery compartment, open the R.H. side rear baggage compartment. Batteries are accessible by means of an access door which is located on the back wall of the rear baggage compartment. To open battery access door, simply take out handle from it's cavity, turn $\frac{1}{4}$ counterclockwise and pull on the handle.

This compartment contains the following components (Fig. 6):

- the four batteries;
- breakers;
- voltage regulator;
- relays;
- ground stud; and
- 24 volts cut-out switch.

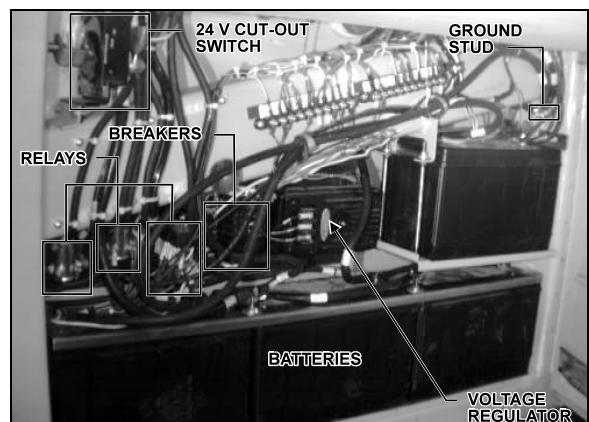


FIGURE 6: BATTERY COMPARTMENT 06117

4.1.5 R.H. Side Rear Baggage Compartment

Electric Circuit Protection

Two type of cutoff mechanisms are installed to protect the vehicle's electrical system; fuses and manually-resettable circuit breakers. If an electrical device is inoperative, check the corresponding cutoff mechanism.

Caution: *Never replace a fuse with a higher rated one because it will cause severe damage to the electric system.*

4.1.6 Main Breakers

Most of the manually-resettable circuit breakers are located in the: DDEC III junction box, rear junction box, front electrical compartment and in the battery compartment. An identification decal is affixed on the inside face of each door.

XL-40 coach is equipped with six (6) main breakers; they are installed just below R.H. side rear baggage compartment's ceiling and can be identified as follows (Fig. 7):

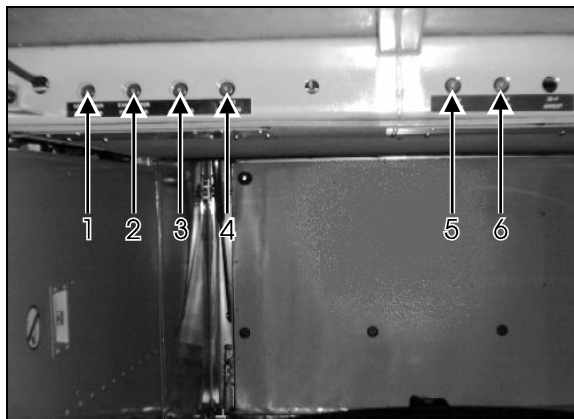


FIGURE 7: R.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING 06099

1. Condenser fan motor (CB8) 105 amps-24 volts;
2. Evaporator fan motor (CB9) 105 amps-24 volts;
3. Rear junction box (CB7) 90 amps-24 volts;
4. Front junction box (CB6) 90 amps-24 volts;
5. Front junction box (CB4) 90 amps-12 volts;
6. Rear junction box (CB3) 70 amps-12 volts.

4.1.7 Front Electrical Compartment

The front electrical compartment is located on L.H. side of vehicle, under the driver's window. It contains the following components (Fig. 8):

- relays;
- breakers;
- diodes.

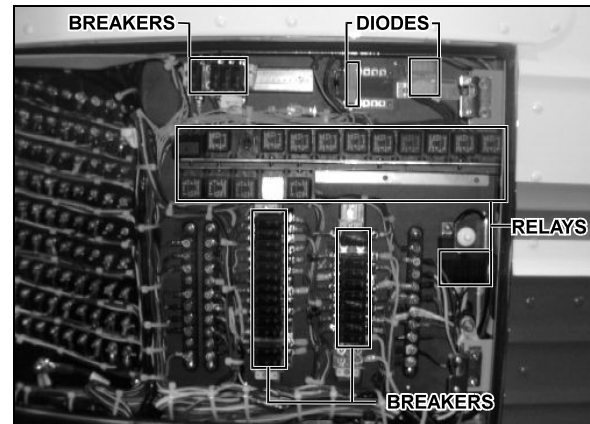


FIGURE 8: FRONT ELECTRICAL COMPARTMENT 06118

4.1.8 Steering Compartment

The front electrical compartment is located on L.H. side of vehicle, under the front electrical compartment. It contains the following components (Fig. 9, 10 and 11):

- ABS blinker switch;
- electronic control unit for ABS;
- electronic control unit vehicle interface module;
- electronic control unit for world transmission;
- DDR connector;
- DDEC III junction box;
- speed limit switch module;
- kneeling module.

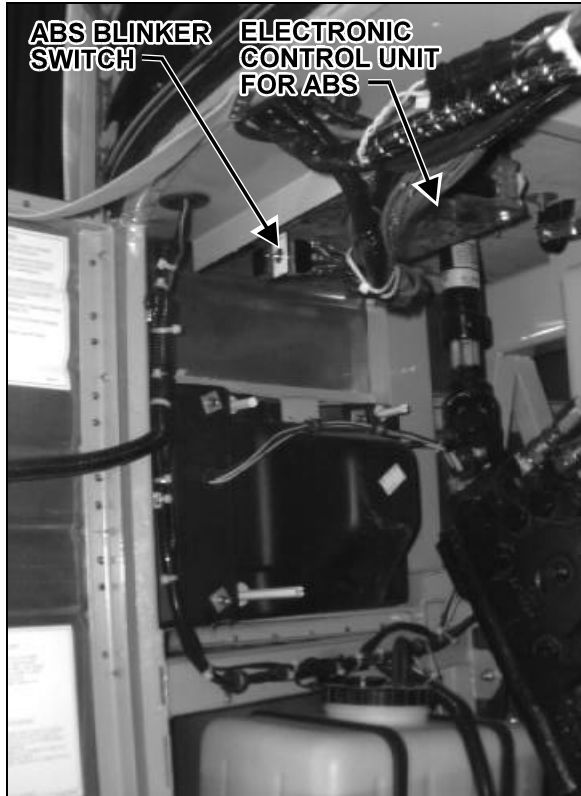


FIGURE 9: STEERING COMPARTMENT (LEFT WALL) 06119

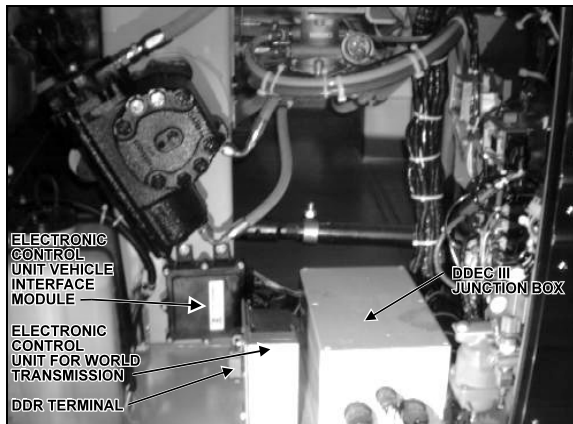


FIGURE 10: STEERING COMPARTMENT 06120

DDR connector

To enhance troubleshooting and to allow interrogation of the ECU for valuable service information, a DDR (diagnostic data reader) can be used. To use it, plug the appropriate connector (not furnished by the manufacturer) in the terminal located in the steering compartment or the connector located on L.H. control panel. You can also use your push-button shifter to perform certain maintenance operations (see Section 01, Engine, under paragraph "4. DDEC III Diagnostic codes").

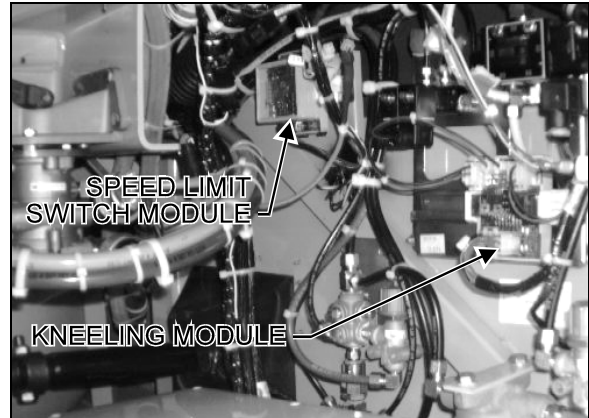


Figure 11: STEERING COMPARTMENT (RIGHT WALL) 06105

Burned fuses (Fig. 11)

- Speed limit switch module 3 amps (qty=1)
- Kneeling module 3 amps (qty=2)

DDEC III Junction Box

The DDEC III Junction Box is located in the steering compartment, on the floor. It contains the following components (Fig. 12):

- connector;
- relays;
- junction block;
- breakers;
- ABS connectors;
- retarder connectors;
- jacob connectors.

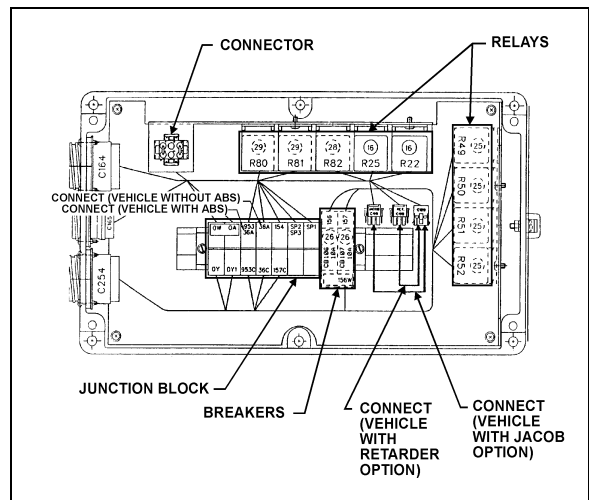


FIGURE 12: DDEC III JUNCTION BOX 06121

4.1.9 L.H. Side Rear Baggage Compartment (Vehicle Equipped With Video System)

This compartment contains the following components (Fig.13):

- protective screen (with video system);
- video inverter (with video system);
- battery equalizers;
- electronic system monitor.

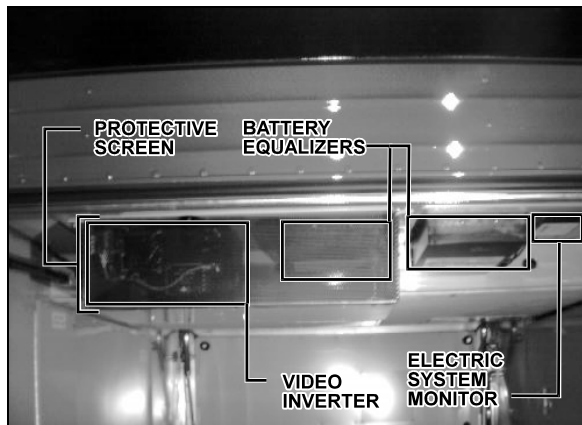


FIGURE 13: L.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING

Locate burned fuses as follows (Fig. 13):

video inverter 40 amps (qty=2)

To gain access to the fuses, simply remove the inverter's front protective screen.

Battery Equalizers

On XL-40 coach the two (2) battery equalizers ("VANNER"-50 amps-12 & 24 volts) are installed just below L.H. side rear baggage compartment's ceiling. The reset buttons are located on the end of equalizers facing the center of the coach (Fig. 13).

4.1.10 Engine Rear Compartment (Rear Junction Box)

The rear junction box is located in the engine rear compartment.

Switches are located on R.H. side of rear junction box (Fig.14):

- engine compartment light switch;
- starter selector switch;
- rear start (push button switch).

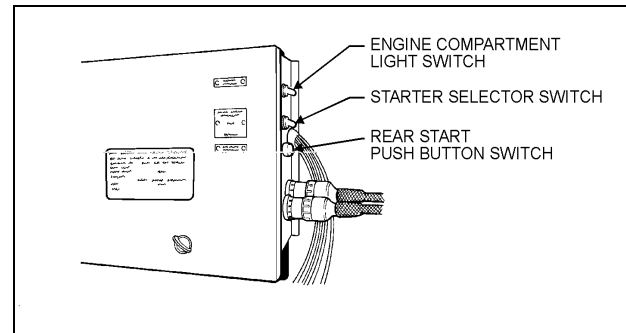


FIGURE 14: REAR JUNCTION BOX SWITCHES

The rear junction box contains the following components (Fig. 15):

- relays;
- breakers;
- diodes;
- time delay relay.

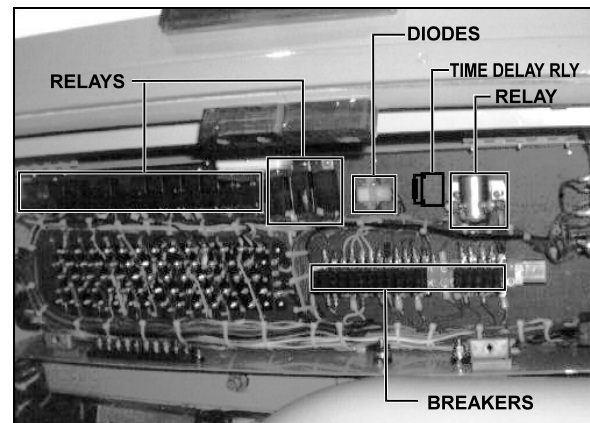


FIGURE 15: REAR JUNCTION BOX

4.2 XL-45 Coach

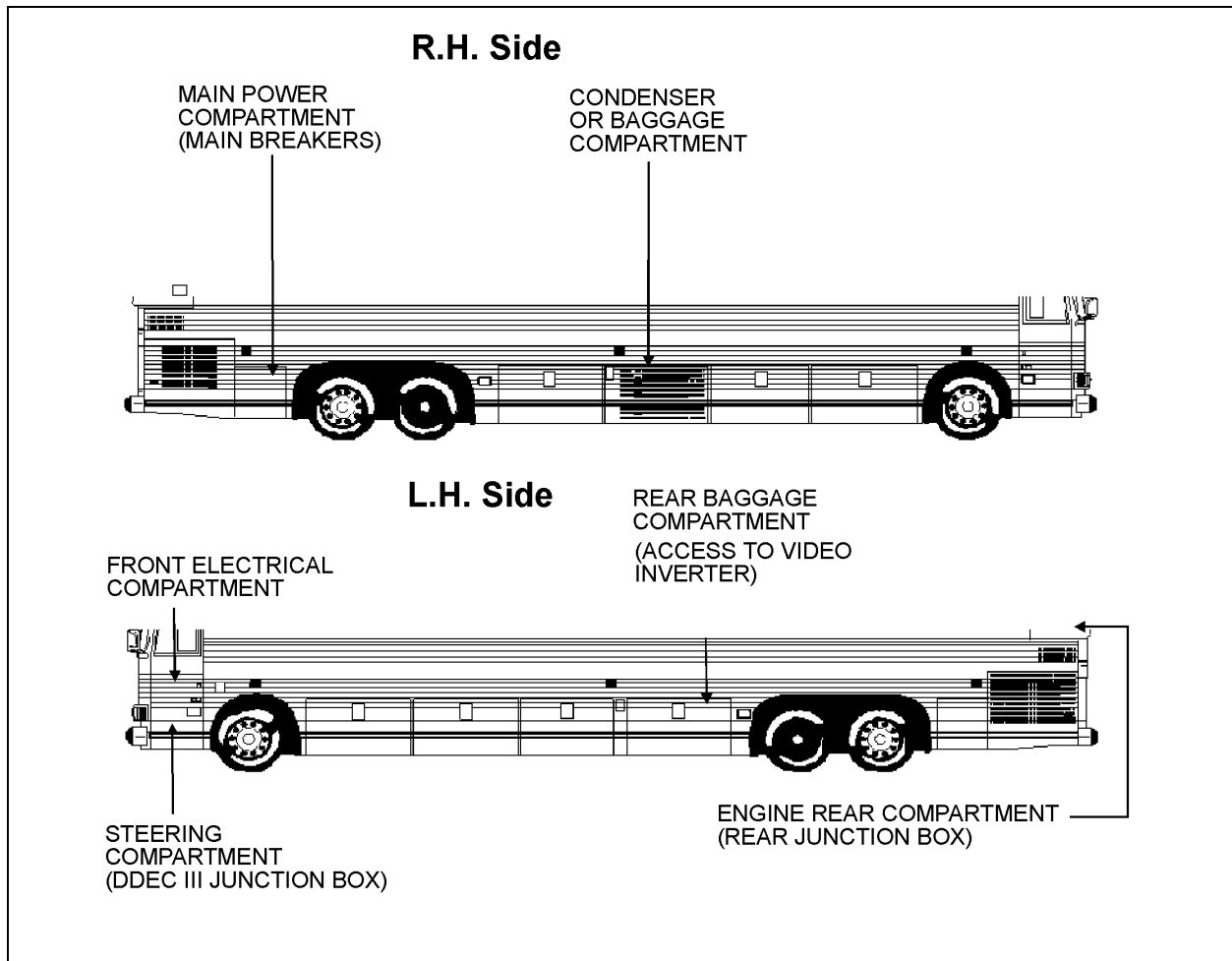


FIGURE 16: ELECTRICAL COMPARTMENT (XL-45 COACH)

06124

4.2.1 Maintenance

To protect components from corrosion, a Cortec VCI-238 corrosion inhibitor has been sprayed in the following electrical compartments and components:

- front electrical compartment;
- DDEC III junction box (steering compartment);
- main power compartment;
- rear junction box (engine rear compartment);
- A/C junction box (condenser compartment).

The life expectancy of this product is five years, so it is recommended to spray it back every five years. It is also recommended to spray it on new components when added or replaced.

Warning: Use in a well ventilated area. Do not smoke. Avoid prolonged contact with skin and breathing of spray mist. Harmful or fatal if swallowed. Do not induce vomiting. Call physician immediately.

4.2.2 Main Power Compartment

The main power compartment is located on rear R.H. side of vehicle aft the rear wheelhousing. This compartment contains the following components (Fig. 17 and 18):

- the four batteries;
- main circuit breakers;
- voltage regulator;
- battery equalizer (100 amps);
- electric system monitor;
- master relay;
- relays;
- breakers;
- toggle switch;
- booster block (stud).

The toggle switch which disconnects both the 12 and 24 volt systems is located on back wall of main power compartment (Fig.18). Use this switch for maintenance purposes only. The remote battery master switch which also disconnects both 12 and 24 volt systems is located on L.H. lower switch panel (1 , Fig. 19).

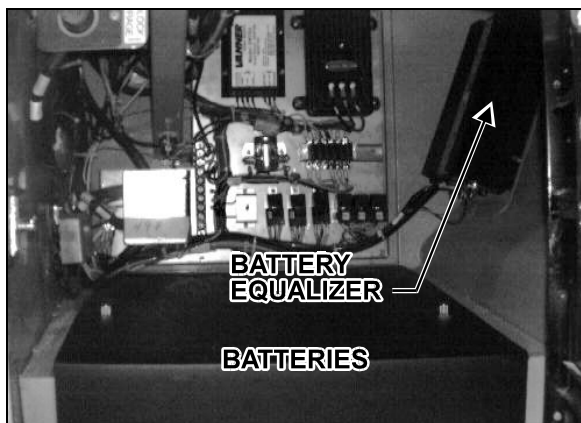


FIGURE 17: MAIN POWER COMPARTMENT 06102

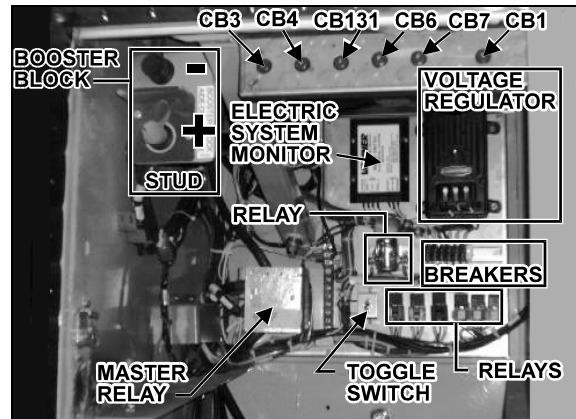


FIGURE 18: MAIN POWER COMPARTMENT 06125

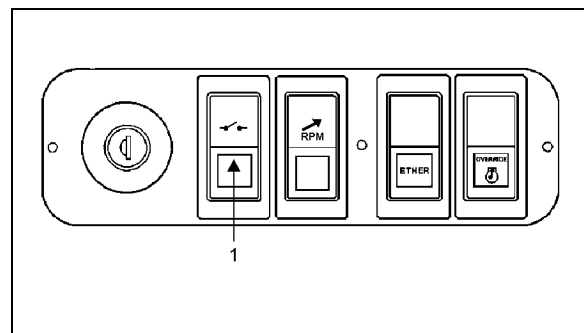


FIGURE 19: L.H. LOWER SWITCH PANEL (BATTERY MASTER SWITCH) 18116

Caution: When vehicle is parked overnight or for an extended period of time, battery master switch (1, Fig. 19) should be set to the "OFF" position in order to avoid draining batteries.

Note: When the battery master switch is set to the "OFF" position, the electrical supply from the batteries is cut off, with the exception of the Fire Detection System, the Engine & Transmission Electronic Controls, the Auxiliary Heating System, the Battery Equalizers and the Digital Clock.

Electric Circuit Protection

Two type of cutoff mechanisms are installed to protect the vehicle's electrical system; fuses and manually-resettable circuit breakers. If an electrical device is inoperative, check the corresponding cutoff mechanism.

Caution: Never replace a fuse with a higher rated one because it will cause severe damage to the electric system.

4.2.3 Main Breakers

Most of the manually-resettable circuit breakers are located in the: DDEC III junction box, rear junction box, front electrical compartment, condenser compartment and in the main power compartment. An identification decal is affixed on the inside face of each door.

XL-45 vehicle is equipped with eleven (11) main breakers; five (5) are installed on A/C junction box located in condenser compartment and the other six (6) are installed in main power compartment and can be identified as follows:

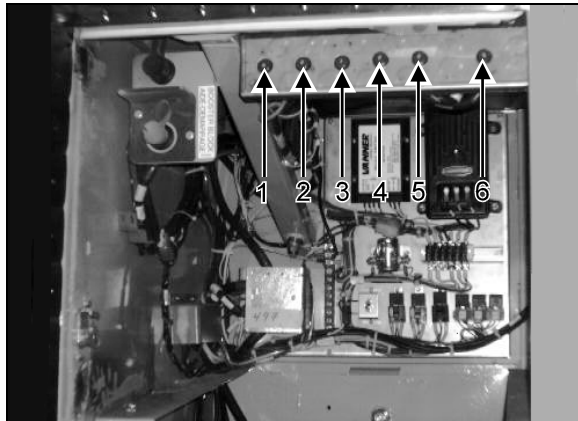


FIGURE 20: MAIN POWER COMPARTMENT 06101

- | | |
|-------------------------------|--------------------|
| 1. CB3: Rear junction box | 70 amps-12 volts; |
| 2. CB4: Front junction box | 90 amps-12 volts; |
| 3. CB131: Video system (Opt.) | 40 amps-12 volts; |
| 4. CB6: Rear junction box | 90 amps-24 volts; |
| 5. CB7: Front junction box | 90 amps-24 volts; |
| 6. CB1: A/C main | 200 amps-24 volts. |

4.2.4 Condenser Compartment

The five (5) main breakers installed on A/C junction box (Fig. 21) can be identified as follows:

1. (from left to right)

CB134: Condenser fan motor	15 amps-24 volts;
CB135: Condenser fan motor	15 amps-24 volts;
CB136: Condenser fan motor	15 amps-24 volts;
CB137: Condenser fan motor	15 amps-24 volts;
2. CB9: Evaporator fan motor 105 amps-24 volts.

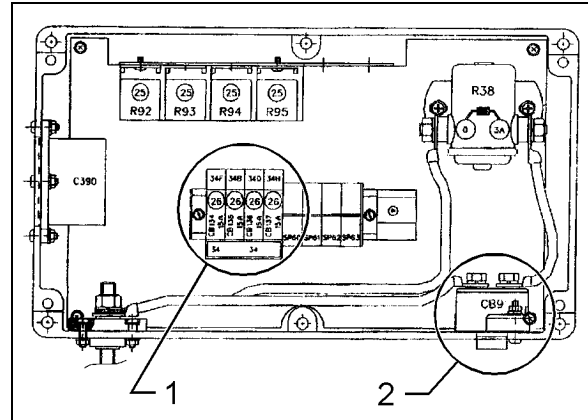


FIGURE 21: A/C JUNCTION BOX 06100

4.2.5 Front Electrical Compartment

The front electrical compartment is located on L.H. side of vehicle, under the driver's window. It contains the following components (Fig. 22):

- relays;
- breakers;
- diodes.

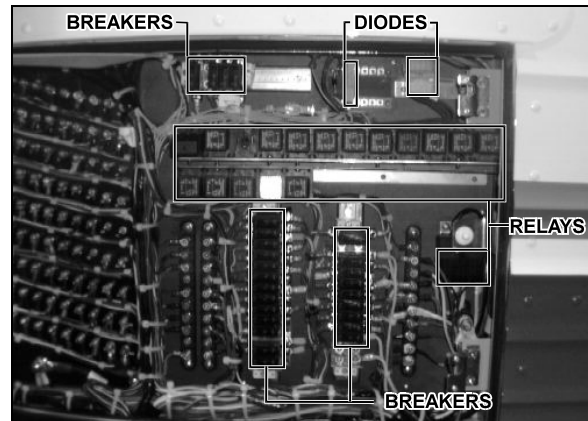


FIGURE 22: FRONT ELECTRICAL COMPARTMENT 06126

4.2.6 Steering Compartment

The front electrical compartment is located on L.H. side of vehicle, under the front electrical compartment. It contains the following components (Fig. 23, 24 and 25):

- ABS blinker switch;
- electronic control unit for ABS;
- electronic control unit vehicle interface module;
- electronic control unit for world transmission;

Section 6: ELECTRICAL SYSTEM

- DDR connector;
- DDEC III junction box;
- speed limit switch module;
- kneeling module.



FIGURE 23: STEERING COMPARTMENT (LEFT WALL) 06119

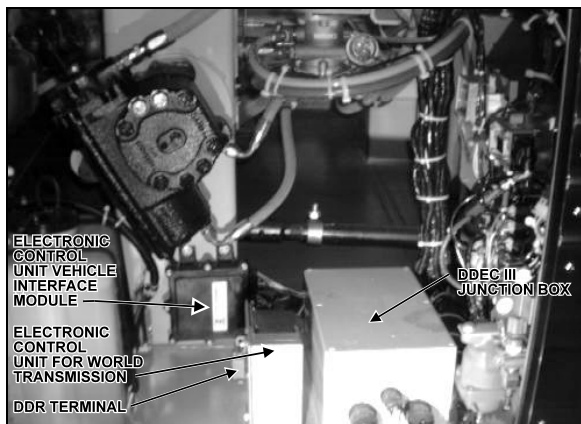


FIGURE 24: STEERING COMPARTMENT 06120

DDR connector

To enhance troubleshooting and to allow interrogation of the ECU for valuable service information, a DDR (diagnostic data reader) can be used. To use it, plug the appropriate connector (not furnished by the manufacturer) in the terminal located in the steering compartment or the connector located on L.H. control panel. You can also use your push-button shifter to perform certain maintenance operations (see Section 01, Engine, under paragraph "4. DDEC III Diagnostic codes").

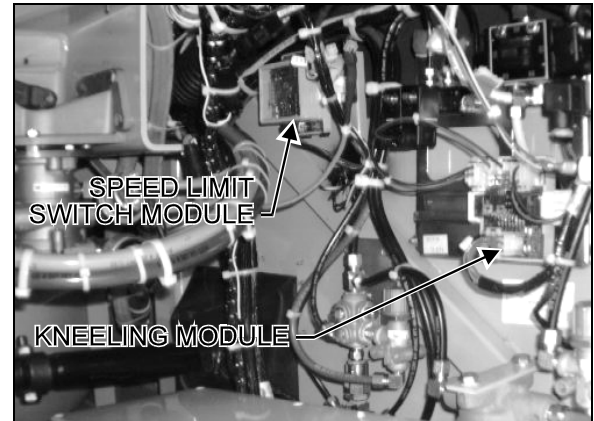


FIGURE 25: STEERING COMPARTMENT (RIGHT WALL) 06105

Burned fuses (Fig. 25)

- Speed limit switch module 3 amps (qty=1)
- Kneeling module 3 amps (qty=2)

DDEC III Junction Box

The DDEC III Junction Box is located in the steering compartment, on the floor. It contains the following components (Fig. 26):

- connector;
- relays;
- junction block;
- breakers;
- ABS connectors;
- retarder connectors;
- jacob connectors.

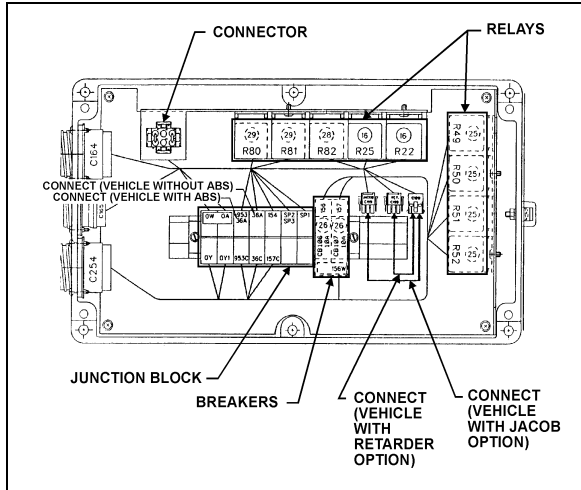


FIGURE 26: DDEC III JUNCTION BOX 06121

4.2.7 L.H. Side Rear Baggage Compartment (Vehicles Equipped With Video System)

This compartment contains the following components (Fig. 27):

- protective screen;
- video inverter.

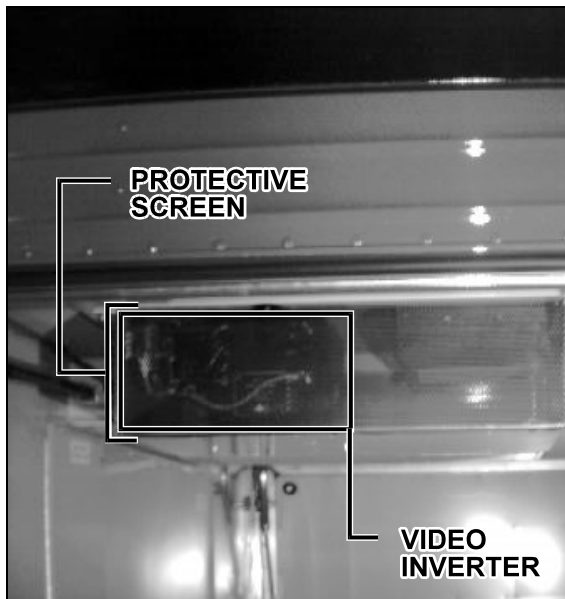


FIGURE 27: L.H. SIDE REAR BAGGAGE COMPARTMENT'S CEILING 06126

Locate burned fuses as follows:

video inverter 2 amps (qty=2)

To gain access to the fuses, simply remove the inverter's front protective screen.

4.2.8 Engine Rear Compartment (Rear Junction Box)

The rear junction box is located in the engine rear compartment.

Switches are located on R.H. side of rear junction box (Fig. 28):

- engine compartment lights switch;
- starter selector switch;
- rear start (push button switch).

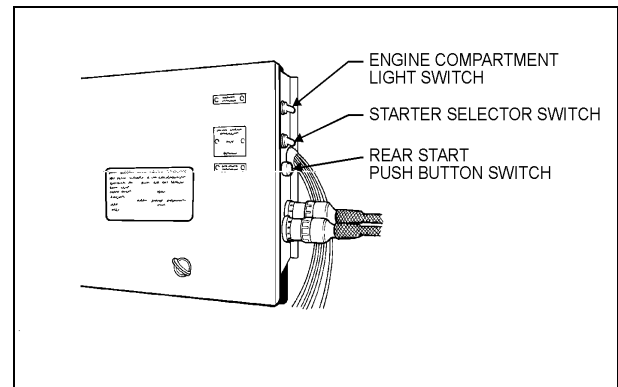


FIGURE 28: REAR JUNCTION BOX SWITCHES 01017

The rear junction box contains the following components (Fig. 29):

- relays;
- breakers;
- diodes;
- time delay relay.

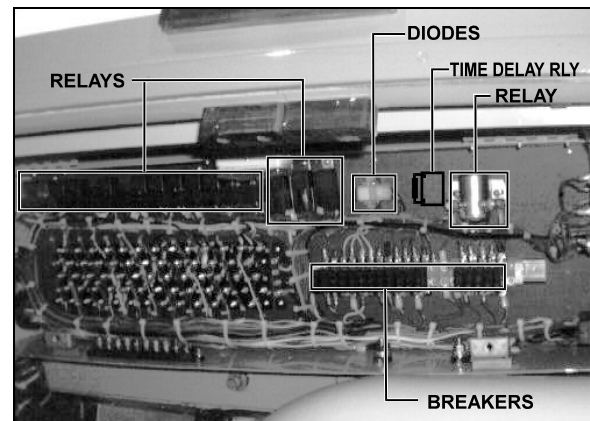


FIGURE 29: ENGINE REAR COMPARTMENT 06123

4.3 XL-40 and XL-45E Converted Vehicles

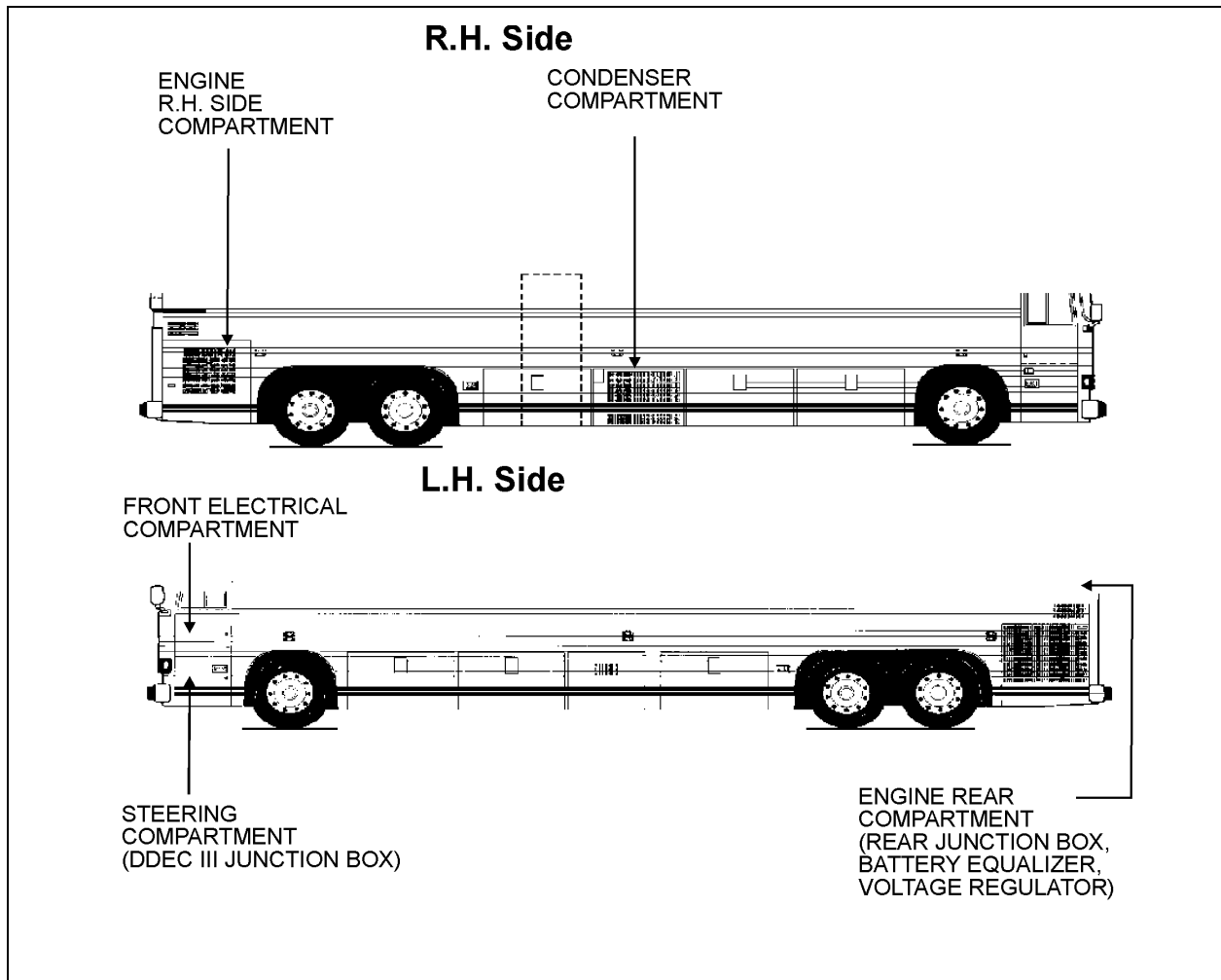


FIGURE 30: ELECTRICAL COMPARTMENT (XL-40 AND XL-45E CONVERTED VEHICLES)

06127

NOTE: *XL-40 and XL-45E converted vehicles have the same electric system (XL-45E vehicle is extended by its center, it has one extra baggage compartment).*

4.3.1 Maintenance

To protect components from corrosion, a Cortec VCI-238 corrosion inhibitor has been sprayed in the following electrical compartments and components:

- front electrical compartment;
- DDEC III junction box (steering compartment);
- rear junction box (engine junction box);
- evaporator fan junction box (condenser compartment).

The life expectancy of this product is five years, so it is recommended to spray it back every five years. It is also recommended to spray it on new components when added or replaced.

Warning: Use in a well ventilated area. Do not smoke. Avoid prolonged contact with skin and breathing of spray mist. Harmful or fatal if swallowed. Do not induce vomiting. Call physician immediately.

4.3.2 Engine R.H. Side Compartment

The engine R.H. side compartment is located on rear R.H. side of vehicle aft the rear wheelhousing. This compartment contains the following components (Fig. 31):

- breaker panel;
- 12 volts main battery disconnect switch;
- 24 volts main battery disconnect switch;
- battery equalizer (100 amps);
- electric system monitor;
- batteries;
- volt battery disconnect switch post (+);
- engine ground stud (-);
- battery isolator.

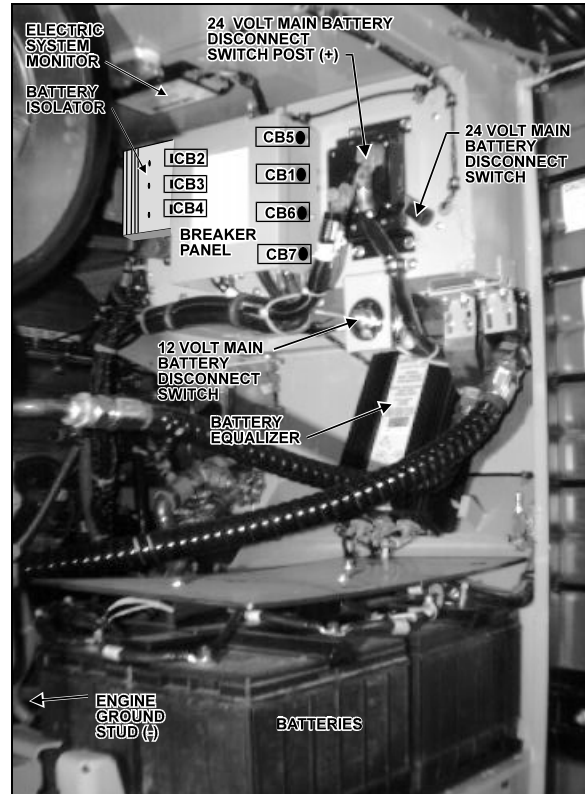


FIGURE 31: ENGINE R.H. SIDE COMPARTMENT 06128

The 24 volts main battery disconnect switch is located above batteries and is accessible by the engine R.H. side access door.

The 12 volts main battery disconnect switch is located directly below the 24 volts main battery disconnect switch.

Caution: When vehicle is parked overnight or for an extended period of time, both main battery disconnect switches (24 V & 12 V) should be set to the "OFF" position in order to avoid battery voltage imbalance.

Note: When both main battery disconnect switches are set to the "OFF" position, the electrical supply from the batteries is cut off, with the exception of the Fire Detection System, the Engine & Transmission Electronic Controls, the Auxiliary Heating System, the Battery Equalizers.

4.3.3 Main Breakers

Nine (9) main breakers may be installed on your vehicle; six (6) of which are standard and three (3) supplied only on vehicles with central A/C system. Breakers CB2 to CB7 are standard and breakers CB1, CB8 & CB9 are optional. breakers are located as follows:

On XL-40 & XL-45E, breakers CB1 to CB7 are installed on breaker panel located in engine R.H. side compartment (Fig. 31). They are accessible through engine R.H. side door and can be identified as follows:

- CB1: A/C Full air 200 amps;
- CB2: Hot wire rear junction box 30 amps-12 volts;
- CB3: Feed rear junction box 70 amps-12 volts;
- CB4: Feed front junction box 90 amps-12 volts;
- CB5: Hot wire rear junction box 30 amps-24 volts;
- CB6: Feed rear junction box 90 amps-24 volts;
- CB7: Feed front junction box 90 amps-24 volts.

On all vehicles, optional breakers CB8 & CB9 are installed on evaporator fan junction box located in condenser compartment and can be identified as follows (Fig. 32):

- CB8: Condenser fan motor 120 amps;
- CB9: Evaporator fan motor 105 amps.

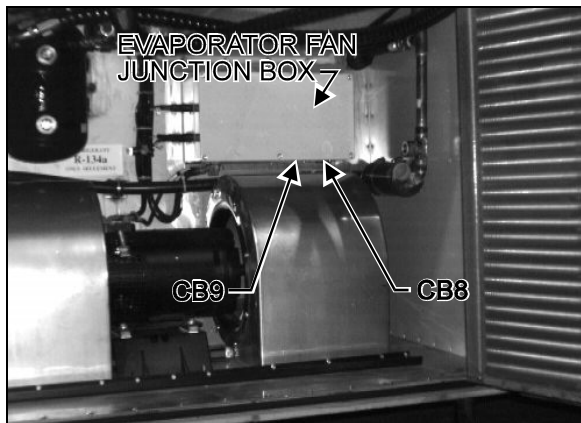


FIGURE 32: CONDENSER COMPARTMENT 06044

4.3.4 Front Electrical Compartment

The front electrical compartment is located on L.H. side of vehicle, under the driver's window. It contains the following components (Fig. 33):

- level-low;
- parking brake alarm;
- relays;
- breakers;
- diodes.

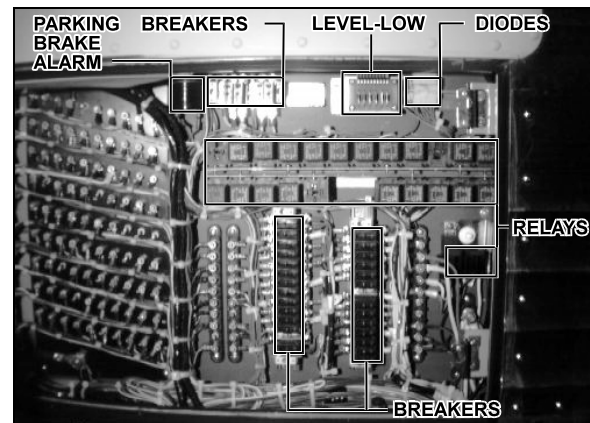


FIGURE 33: FRONT ELECTRICAL COMPARTMENT 06129

4.3.5 Steering Compartment

The steering compartment is located on L.H. side of vehicle, under the front electrical compartment. It contains the following components (Fig. 34, 35 and 36):

- ABS blinker switch;
- electronic control unit for ABS;
- electronic control unit vehicle interface module;
- electronic control unit for world transmission;
- DDR connector;
- DDEC III junction box;
- Speed limit switch module.



FIGURE 34: STEERING COMPARTMENT (LEFT WALL) 06119



FIGURE 36: STEERING COMPARTMENT (RIGHT WALL) 06169

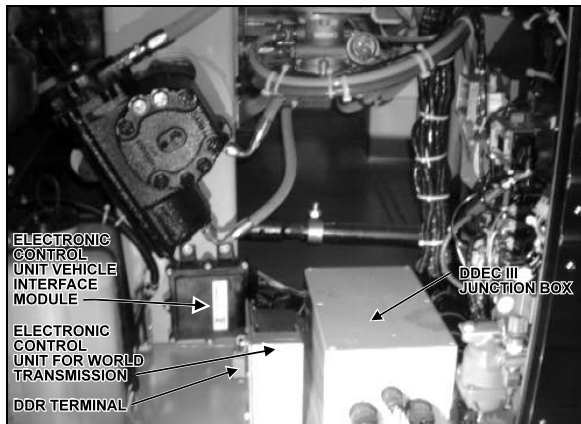


FIGURE 35: STEERING COMPARTMENT 06120

DDR connector

To enhance troubleshooting and to allow interrogation of the ECU for valuable service information, a DDR (diagnostic data reader) can be used. To use it, plug the appropriate connector (not furnished by the manufacturer) in the terminal located in the steering compartment or the connector located on L.H. control panel. You can also use your push-button shifter to perform certain maintenance operations (see Section 01, Engine, under paragraph "4. DDEC III Diagnostic codes").

Burned fuses (Fig. 36)

Speed limit switch module 3 amps (qty=1)

DDEC III Junction Box

The DDEC III Junction Box is located in the steering compartment, on the floor. It contains the following components (Fig. 37):

- connector;
- relays;
- junction block;
- breakers;
- ABS connectors;
- retarder connectors;
- jacob connectors.

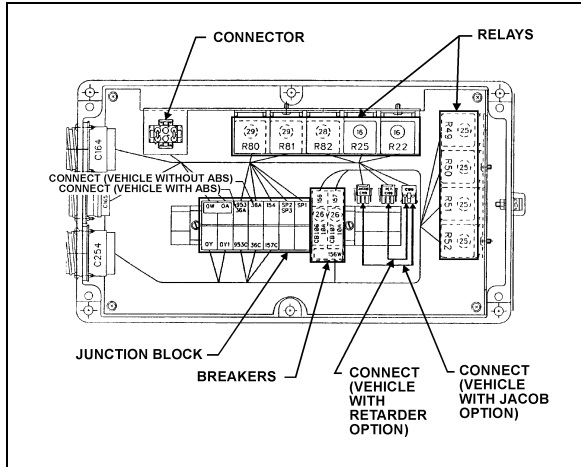


FIGURE 37: DDEC III JUNCTION BOX 06121

4.3.6 Engine Rear Compartment (Rear Junction Box)

The engine rear compartment contains (Fig. 38): rear junction box, voltage regulator and maybe an optional battery equalizer (50 or 100 amps).

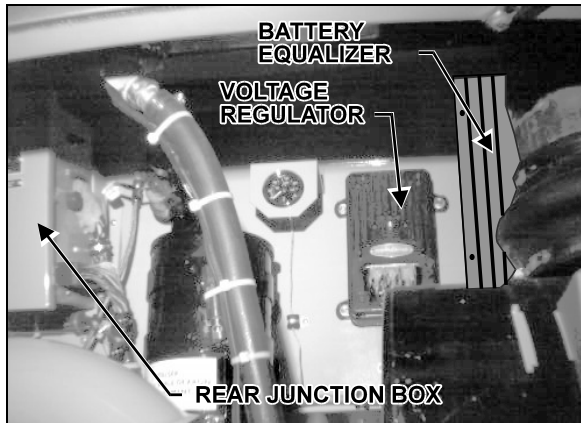


FIGURE 38: ENGINE REAR COMPARTMENT 06130

REAR JUNCTION BOX

Switches are located on R.H. side of rear junction box (Fig. 39):

- engine compartment lights switch;
- starter selector switch;
- rear start (push button switch).

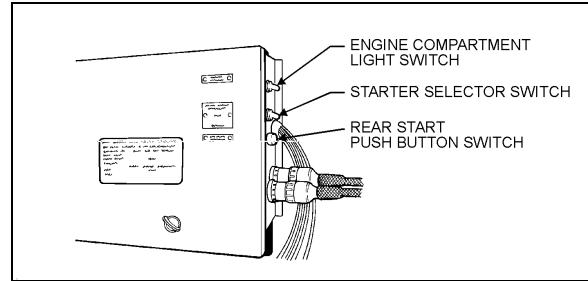


FIGURE 39: REAR JUNCTION BOX SWITCHES 01017

The rear junction box contains the following components (Fig. 40):

- relays;
- breakers;
- diodes;
- time delay relay.

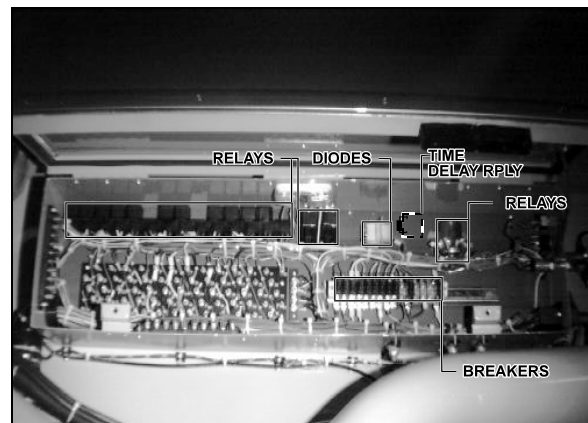


FIGURE 40: REAR JUNCTION BOX 06131

4.4 XL-45 Converted Vehicle

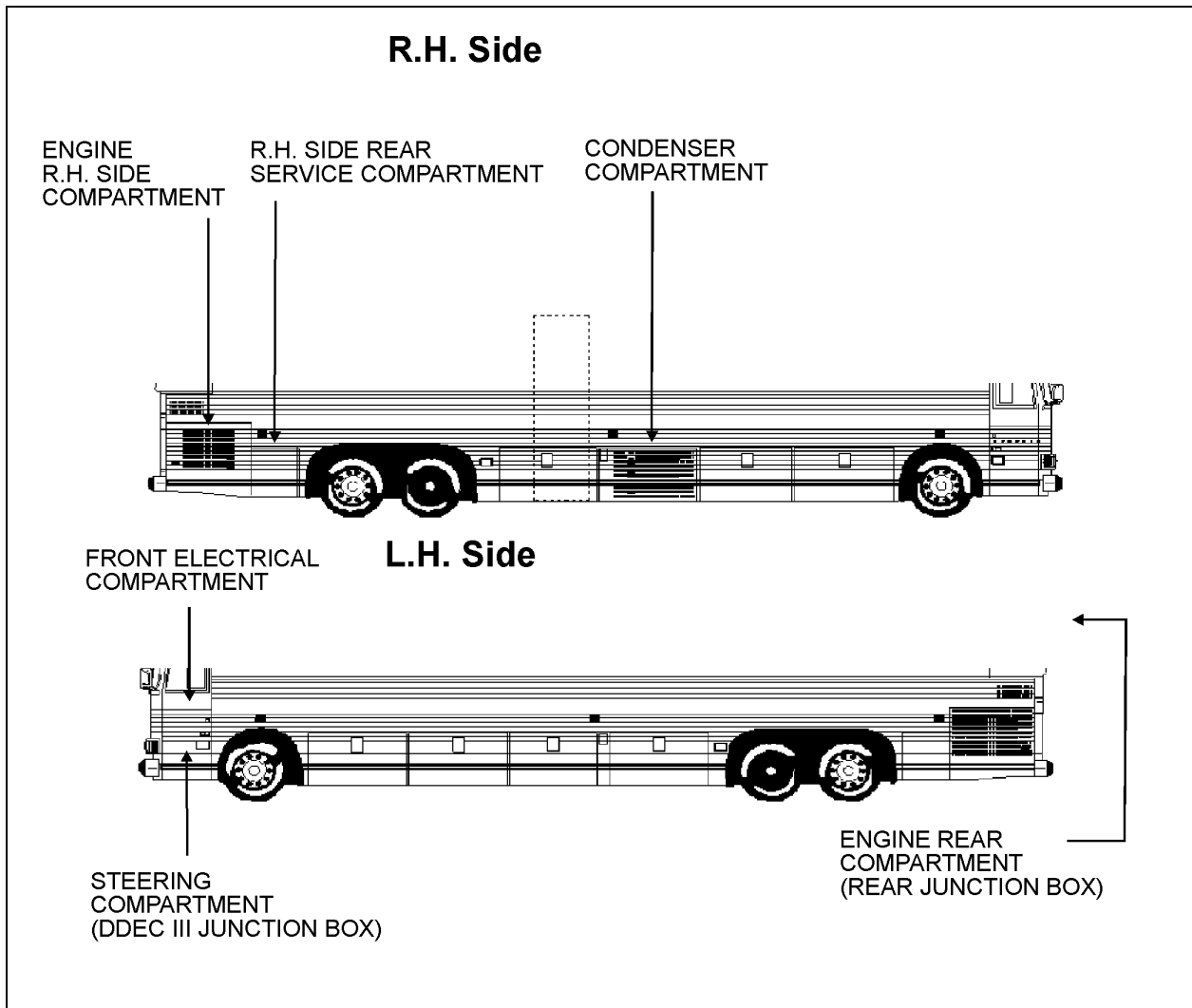


FIGURE 41: ELECTRICAL COMPARTMENT (XL-45 CONVERTED VEHICLE)

06132

4.4.1 Maintenance

To protect components from corrosion, a Cortec VCI-238 corrosion inhibitor has been sprayed in the following electrical compartments and components:

- front electrical compartment;
- DDEC III junction box (steering compartment);
- rear junction box (engine junction box);
- evaporator fan junction box (condenser compartment).

The life expectancy of this product is five years, so it is recommended to spray it back every five years. It is also recommended to spray it on new components when added or replaced.

Warning: Use in a well ventilated area. Do not smoke. Avoid prolonged contact with skin and breathing of spray mist. Harmful or fatal if swallowed. Do not induce vomiting. Call physician immediately.

4.4.2 Engine R.H. Side Compartment

The engine R.H. side compartment contains the following components (Fig.42 and 43):

- booster block;
- the four batteries;
- main breakers panel;
- voltage regulator;
- battery equalizer;
- battery isolator & relay (optional);
- electric system monitor;
- 12 volts main battery disconnect switch;
- 24 volts main battery disconnect switch.

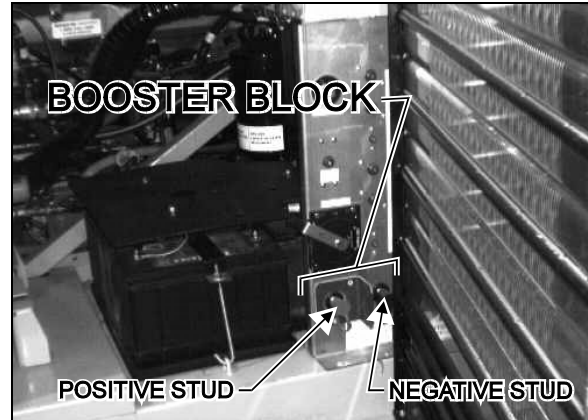


FIGURE 42: BOOSTER BLOCK

06045

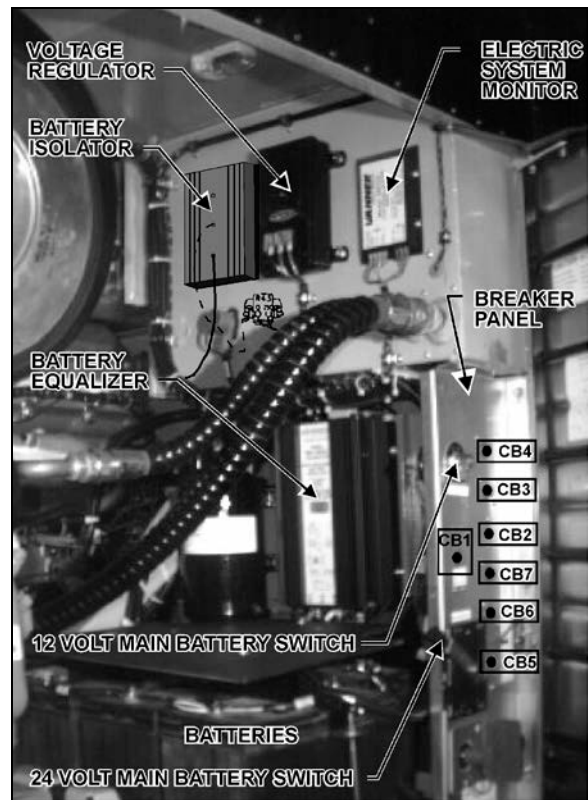


FIGURE 43: ENGINE R.H. SIDE COMPARTMENT

06133

The 24 volts main battery disconnect switch is located on R.H. side of batteries and is accessible by the engine R.H. side access door. The 12 volts main battery switch is located directly above the 24 volt disconnect switch.

Caution: When vehicle is parked overnight or for an extended period of time, both battery main disconnect switches (24 V & 12 V) should be set to the "OFF" position in order to avoid battery voltage imbalance.

Note: When both main battery disconnect switches are set to the "OFF" position, the electrical supply from the batteries is cut off, with the exception of the Fire Detection System, the Engine & Transmission Electronic Controls, the Auxiliary Heating System, the Battery Equalizers.

4.4.3 Main Breakers

Nine (9) main breakers may be installed on your vehicle; six (6) of which are standard and three (3) supplied only on vehicles with central A/C system. Breakers CB2 to CB7 are standard and breakers CB1, CB8 & CB9 are optional. Breakers are located as follows:

On XL-45, breakers CB1 to CB7 are installed on breaker panel and can be identified as follows:

CB1: A/C Full air	200 amps;
CB2: Hot wire rear junction box	30 amps-12 volts;
CB3: Feed rear junction box	70 amps-12 volts;
CB4: Feed front junction box	90 amps-12 volts;
CB5: Hot wire rear junction box	30 amps-24 volts;
CB6: Feed rear junction box	90 amps-24 volts;
CB7: Feed front junction box	90 amps-24 volts.

On all vehicles, optional breakers CB8 & CB9 are installed on evaporator fan junction box located in condenser compartment and can be identified as follows (Fig. 44):

CB8: Condenser fan motor	120 amps;
CB9: Evaporator fan motor	105 amps.

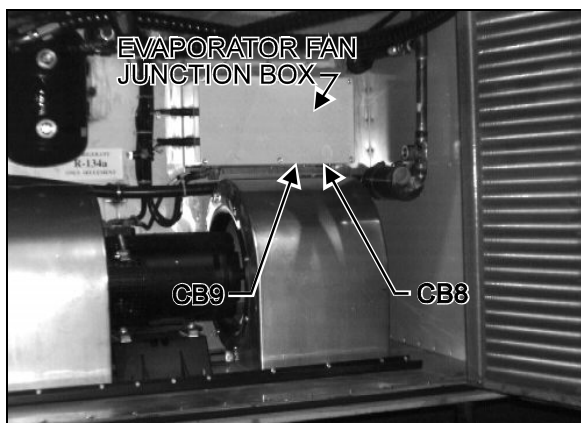


FIGURE 44: CONDENSER COMPARTMENT

06044

4.4.4 R.H. Side Rear Service Compartment

This service compartment is located on rear R.H. side of vehicle aft the rear wheelhousing (Fig. 45). This compartment contains a optional battery equalizer (50-100 amps).



FIGURE 45: R.H. SIDE REAR SERVICE COMPARTMENT

06134

4.4.5 Front Electrical Compartment

The front electrical compartment is located on L.H. side of vehicle, under the driver's window. It contains the following components (Fig. 46):

- relays;
- breakers;
- parking brake alarm;
- level-low;
- diodes.

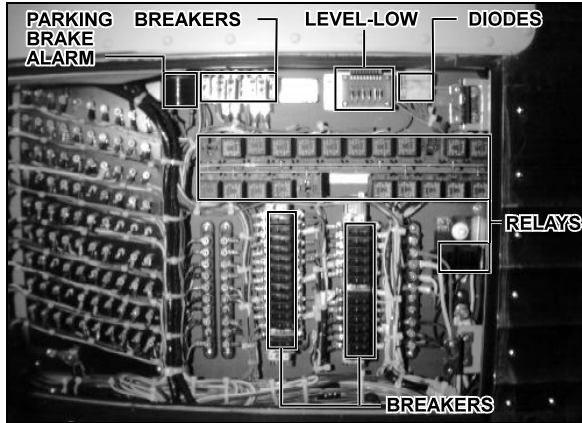


FIGURE 46: FRONT ELECTRICAL COMPARTMENT 06129

4.4.6 Steering Compartment

The front steering compartment is located on L.H. side of vehicle, under the front electrical compartment. It contains the following components (Fig. 47, 48 and 49):

- ABS blinker switch;
- electronic control unit for ABS;
- electronic control unit vehicle interface module;
- electronic control unit for world transmission;
- DDR connector;
- DDEC III junction box;
- speed limit switch module.

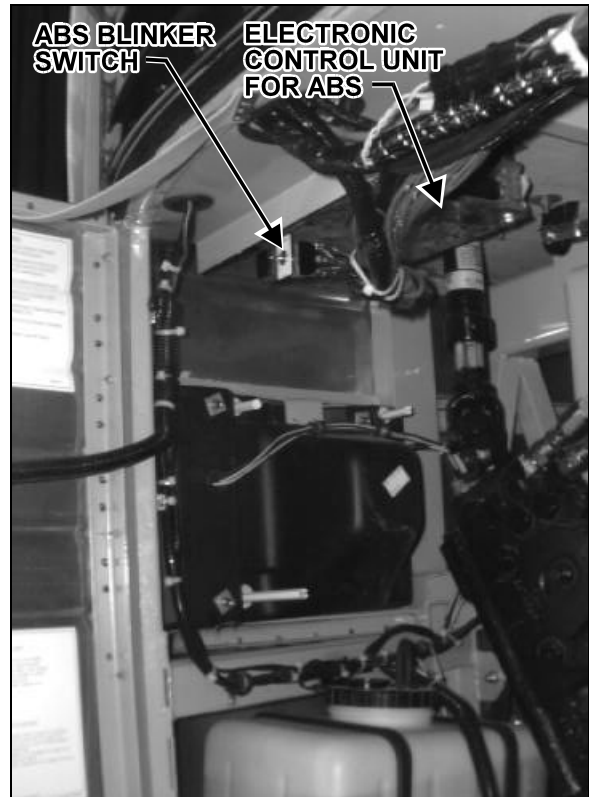


FIGURE 47: STEERING COMPARTMENT (LEFT WALL) 06119

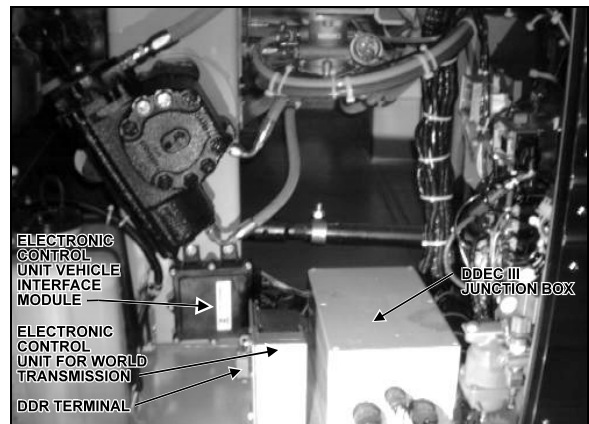


FIGURE 48: STEERING COMPARTMENT 06120

DDR connector

To enhance troubleshooting and to allow interrogation of the ECU for valuable service information, a DDR (diagnostic data reader) can be used. To use it, plug the appropriate connector (not furnished by the manufacturer) in the terminal located in the steering compartment or the connector located on L.H. control panel. You can also use your push-button shifter to perform certain maintenance operations (see Section 01, under paragraph "4. DDEC III Diagnostic codes").

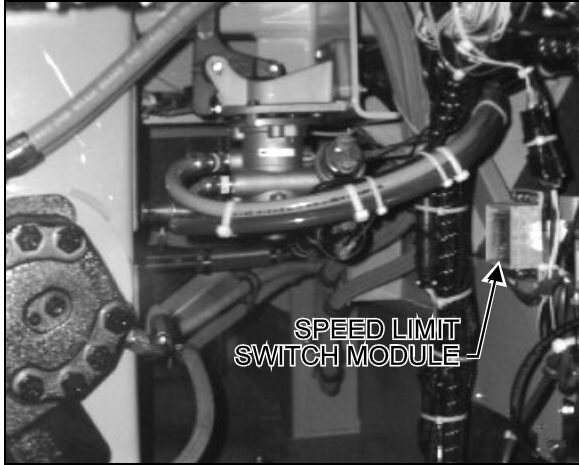


FIGURE 49: STEERING COMPARTMENT 06169

Burned fuses (Fig. 49)

Speed limit switch module.....3 amps (qty=1)

DDEC III Junction Box

The DDEC III Junction Box is located in the steering compartment, on the floor. It contains the following components (Fig. 50):

- connector;
- relays;
- junction block;
- breakers;
- ABS connectors;
- retarder connectors;
- jacob connectors.

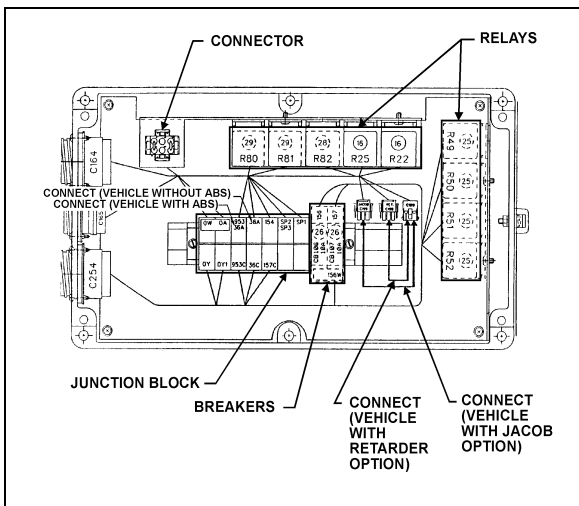


FIGURE 50: DDEC III JUNCTION BOX 06121

4.4.7 Engine Rear Compartment (Rear Junction Box)

The rear junction box is located in the engine rear compartment.

Switches are located on R.H. side of rear junction box (Fig. 51):

- engine compartment lights switch;
- starter selector switch;
- rear start (push button switch).

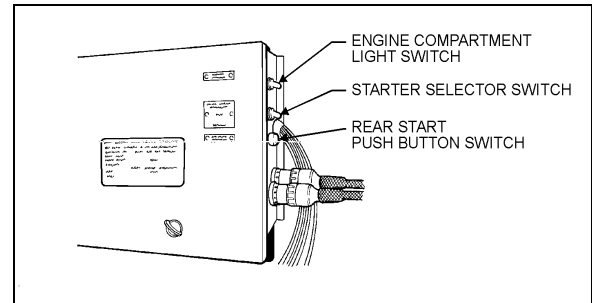


FIGURE 51: REAR JUNCTION BOX SWITCHES 01017

The rear junction box contains the following components (Fig. 52):

- relays;
- breakers;
- diodes;
- relays and resistors;
- time delay relay.

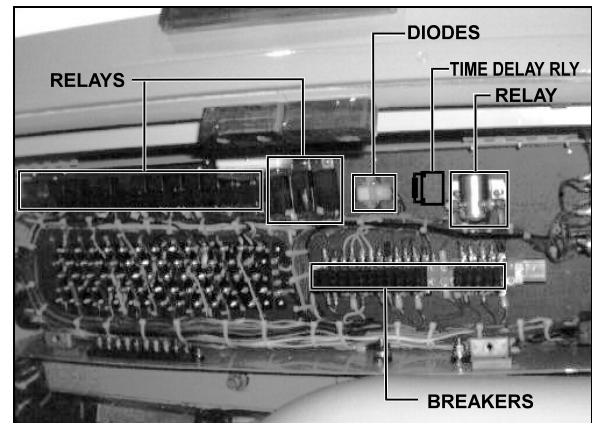


FIGURE 52: ENGINE REAR COMPARTMENT 06135

5. BATTERIES

5.1 General Description

The vehicle is provided with four (4) maintenance-free 12 volts heavy-duty batteries connected in series-parallel. The top-mounted negative and positive terminals are tightly sealed to prevent leaks. Water never needs to be added to this type of battery. There are no filler caps in the cover. The battery is sealed, except for small vent holes in the cover. The vents must not be restricted as they allow small amount of gases that are produced in the battery to escape. The special chemical composition inside the battery reduces gassing to a very small amount at normal charging voltages. Besides reducing gassing, the special chemistry greatly reduces the possibility of overcharge damage.

The vents require keeping the battery in an upright position to prevent electrolyte leakage. Tipping the battery beyond a 45° angle in any direction can allow a small amount of electrolyte to leak out of the vent holes.

Warning: DO NOT exceed this 45° angle when carrying or installing the battery.

Evidence of electrolyte leakage does not necessarily mean the battery is defective.

With special cables properly attached to batteries, the metal surfaces that carry the current are completely sealed from the atmosphere. This prevents terminal oxidation and corrosion that may cause starting and charging problems. If new cables are required, sealed terminal cable replacements should be used to retain the reliability of the original maintenance-free connections.

The battery has four (4) major functions which consist in:

1. Providing a source of current for starting the engine.
2. Stabilizing the voltage in the electrical system.
3. Supplying current for a limited time, when electrical demands of the equipment exceed the power output of the alternator.
4. Providing a limited source of power for connected accessories, when the engine is not running.

5.2 Battery Safety Precautions

When batteries are being charged, an explosive gas mixture forms beneath the cover of each cell. Part of this gas escapes through the holes in the vent plugs and may form an explosive atmosphere around the battery itself if ventilation is poor.

Caution: Explosive gas may remain in or around the battery for several hours after it has been charged. Sparks or flames can ignite this gas causing an internal explosion which could shatter the battery. Flying pieces of the battery structure and splash of the electrolyte can cause personal injury. Battery electrolyte is acid. Extreme care should be exercised to avoid skin or eye contact with the electrolyte, wear safety glasses when working near batteries. If you come in contact with battery electrolyte:

- Flush your skin with water.
- Apply baking soda or lime to help neutralize the acid.
- Flush your eyes with water for 10-15 minutes.
- Get medical attention immediately.

5.3 Battery (XL-40 Coach)

5.3.1 Removal

The batteries are located in the rear baggage compartment (battery compartment).

Warning: To prevent possible electric shocks or sparking, the main battery disconnect switch should be in the "Off" position before disconnecting cables from the batteries (see paragraph "4.1.3 Battery disconnect switch").

To remove lower defective batteries:

1. Remove the two (2) batteries retaining bracket nuts. Remove the batteries retaining bracket (Fig. 53).
2. Unscrew terminal nuts of each defective battery. Remove battery cables from the batteries.
3. Remove defective batteries.

To remove the upper battery:

1. Loosen the two (2) rod nuts and remove the battery securing bracket (Fig. 53).

2. Unscrew terminal. Remove battery cables from the battery.
3. Remove defective battery.

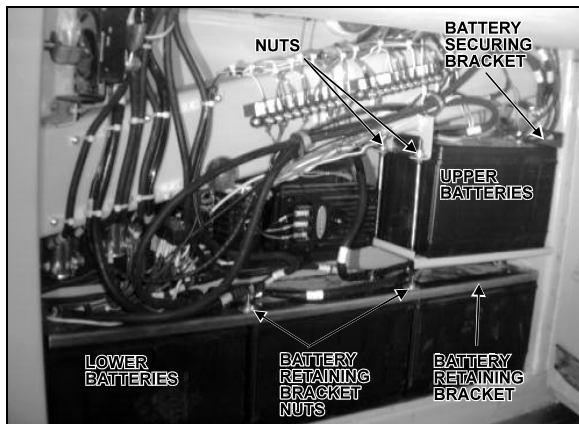


FIGURE 53: BATTERY COMPARTMENT

06136

Note: When the battery cables have been removed from the batteries, wrap the battery terminals and cable ends with electric tape to prevent accidental grounding. The ground cables should always be disconnected first and replaced last.

5.3.2 Installation

Reverse removal procedure to reinstall the batteries.

Note: In replacing batteries, only batteries of the same specification should be used. Refer to "Specifications" at the end of this section for further details.

Caution: Ensure that connections are not reversed when reinstalling batteries, since damage to electrical system components will result.

When reinstalling batteries, battery connections must be torqued to 10-15 lbf•ft (13-20 N•m). A torque wrench is required to ensure an accurate tightening torque.

Note: A protective coating should be applied on all terminals that have been disconnected, and this coating should be clear of silicone. We recommend the use of Cortec VCI-238 (Prévost part #682460) on all electrical connections of the vehicle.

5.4 Battery (XL- 45 Coach)

5.4.1 Removal

The batteries are located in the main power compartment.

1. Remove the two screws at the bottom of the plastic protective cover, then unscrew the two quarter turn nuts to remove the protective cover.

Warning: To prevent possible electric shocks or sparking, the toggle switch or the remote battery master switch should be in the "Off" position before disconnecting cables from the batteries (see paragraph "4.2.2 Main Power Compartment").

2. Remove the supports, and unscrew terminal nuts of each defective battery.
3. Remove battery cables from the batteries.

Note: When the battery cables have been removed from the batteries, wrap the battery terminals and cable ends with electric tape to prevent accidental grounding. The ground cables should always be disconnected first and replaced last.

4. Remove batteries.

5.4.2 Installation

Reverse removal procedure to reinstall the batteries.

Note: In replacing batteries, only batteries of the same specification should be used. Refer to "Specifications" at the end of this section for further details.

Caution: Ensure that connections are not reversed when reinstalling batteries, since damage to electrical system components will result.

When reinstalling batteries, battery connections must be torqued to 10-15 lbf•ft (13-20 N•m) and the nut on top of sliding tray to 45-55 lbf•in (5-6 N•m). A torque wrench is required to ensure an accurate tightening torque.

Note: A protective coating should be applied on all terminals that have been disconnected, and this coating should be clear of silicone. We recommend the use of Cortec VCI-238 (Prévost part #682460) on all electrical connections of the vehicle.

5.5 Battery (XL-40 and XL-45E Converted Vehicles)

5.5.1 Removal

The batteries are located in the engine R.H. side compartment (Fig. 54).

1. Remove the three (3) plastic protective cover retaining bolts. Remove the plastic protective cover.
2. Remove the support retaining bolt.

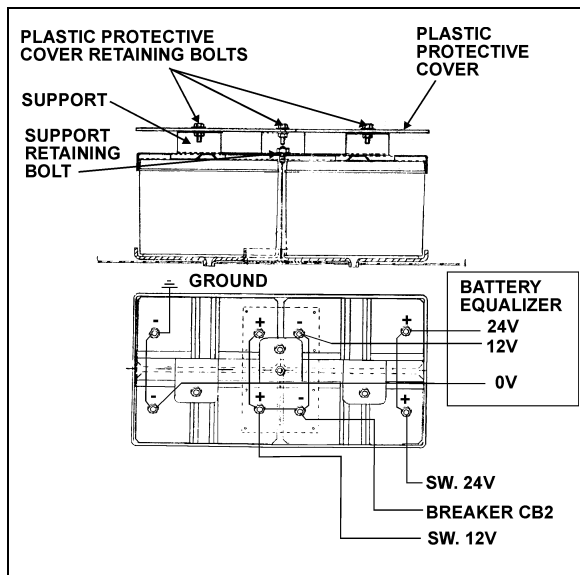


FIGURE 54: BATTERY (XL-40 & XL-45E CONVERTED VEHICLES)

06137

Warning: To prevent possible electric shocks or sparking, the 12 and 24 volts main battery disconnect switch should be in the "Off" position before disconnecting cables from the batteries (see paragraph "4.3.2 Engine R.H. Side Compartment").

3. Remove the support (if necessary, remove battery cables). To remove battery cables, unscrew terminal nuts and remove cables.
4. Remove battery cables from defective batteries.

Note: When the battery cables have been removed from the batteries, wrap the battery terminals and cable ends with electric tape to prevent accidental grounding. The ground cables should always be disconnected first and replaced last.

5. Remove defective batteries.

5.5.2 Installation

Reverse removal procedure to reinstall the batteries.

Note: In replacing batteries, only batteries of the same specification should be used. Refer to "Specifications" at the end of this section for further details.

Caution: Ensure that connections are not reversed when reinstalling batteries, since damage to electrical system components will result.

When reinstalling batteries, battery connections must be torqued to 10-15 lbf•ft (13-20 N•m). A torque wrench is required to ensure an accurate tightening torque.

Note: In engine R.H. side compartment two protective coatings should be applied. On battery terminals we recommend the Nyogel grease (Prévost part #681095). On all other electrical connections that have been disconnected in this compartment, we recommend the protective coating (Prévost part #680745).

5.6 Battery (XL-45 Converted Vehicle)

5.6.1 Removal

The batteries are located in the engine R.H. side compartment (Fig. 55).

1. Remove the three (3) plastic protective cover retaining bolts. Remove the plastic protective cover.
2. Remove the J-bolt.
3. Remove the two (2) support retaining bolts.

Warning: To prevent possible electric shocks or sparking, the 12 and 24 volts main battery disconnect switch should be in the "Off" position before disconnecting cables from the batteries (see paragraph "4.4.2 Engine R.H. Side Compartment").

4. Remove the support (if necessary, remove battery cables). To remove battery cables, unscrew terminal nuts and remove cables.
5. Remove battery cables from defective batteries.

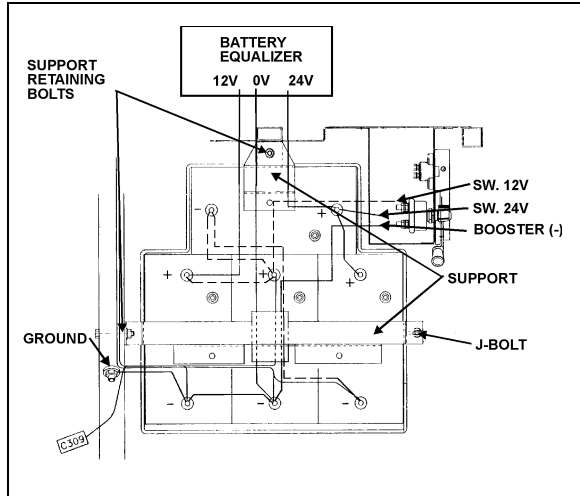


FIGURE 55: BATTERY (XL-45 CONVERTED VEHICLE) 06138

Note: When the battery cables have been removed from the batteries, wrap the battery terminals and cable ends with electric tape to prevent accidental grounding. The ground cables should always be disconnected first and replaced last.

6. Remove defective batteries.

5.6.2 Installation

Reverse removal procedure to reinstall the batteries.

Note: In replacing batteries, only batteries of the same specification should be used. Refer to "Specifications" at the end of this section for further details.

Caution: Ensure that connections are not reversed when reinstalling batteries, since damage to electrical system components will result.

When reinstalling batteries, battery connections must be torqued to 10-15 lbf•ft (13-20 N•m). A torque wrench is required to ensure an accurate tightening torque.

Note: In engine R.H. side compartment two protective coatings should be applied. On battery terminals we recommend the Nyogel grease (Prévost part #681095). On all other electrical connections that have been disconnected in this compartment, we recommend the protective coating (Prévost part #680745).

5.7 Battery Rating

Each of the 12 volt batteries used on the vehicle has the following rating:

- Reserve capacity: 180 minutes
- Cold cranking (amps): 625 @ 0 °F (-18 °C)
- Cold cranking (amps): 490 @ -20 °F (-29 °C)
- Weight filled: 59 lb. (26,7 kg)

The reserve capacity is defined as the number of minutes a new, fully charged battery at 80 °F (26,6 °C) can be discharged at 25 amperes and maintain a minimum of 1.75 volts per cell (10.5 volts total for one 12 volts battery). This rating can be used as a basis for determining how long a vehicle might run after an alternator failure.

The cold cranking rating is defined as the minimum discharge current a battery will deliver in amperes for 30 seconds at 0 °F (-18 °C) while maintaining a minimum of 1.2 volts per cell (7.2 volts total for one 12 volts battery). This rating can be used as a basis for comparing starting performance.

5.8 Battery Testing

The maintenance-free battery has a strong ability to withstand the damaging effects of overcharge. The test indicator in the cover is used only to determine if the battery can be tested in case of a cranking problem.

The test indicator in the battery cover is to be used with accepted diagnostic procedures only (Fig. 56). It must not be used to determine if the battery is good or bad, or charged or discharged. The test indicator is a built-in hydrometer in one cell which provides visual information for battery testing.

It is important when observing the test indicator, that the battery be relatively level and has a clean indicator top to see the correct indication. A light may be required in some poorly lit areas. Under normal operation, two indications can be observed.

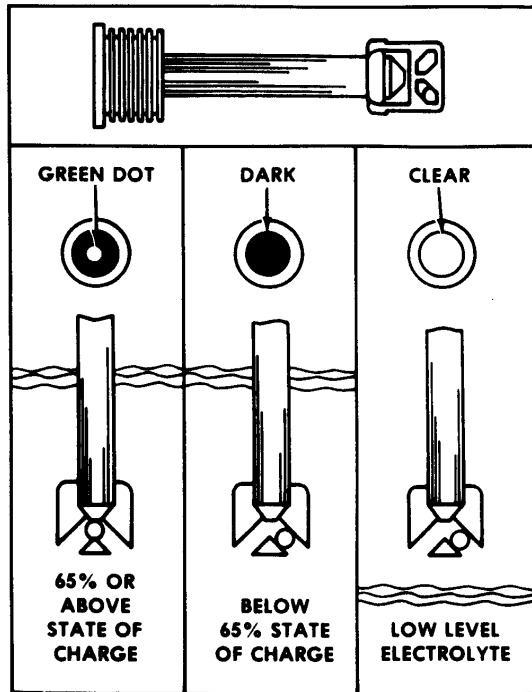


FIGURE 56: TEST INDICATOR 06096

Green Dot Visible

Any green appearance is interpreted as a "green dot", and the battery is ready for testing. On rare occasions, following prolonged cranking, the green dot may still be visible when the battery is obviously discharged. Should this occur, charge the battery as described under "Charging Procedure" in "Battery Charging" later in this section.

Dark - Green Dot Not Visible

If a cranking complaint is encountered, the battery should be tested as described in this section. On rare occasions, the test indicator may turn light yellow. In this case, the integral charging system should be checked. Normally, the battery is capable of further service; however, if a cranking complaint has been reported, replace the battery. **DO NOT CHARGE, TEST, OR JUMP-START.**

5.8.1 Visual Inspection

1. Check the outside of the battery for a broken or cracked cover or case that could permit loss of electrolyte. If obvious physical damage is noted, replace the battery.
2. Check for loose terminal posts, cable connections, damaged cables, and for evidence of corrosion; correct conditions as required before proceeding with tests.

5.8.2 Removing Surface Charge

Disconnect cables from the battery and attach alligator clamps to the contact lead pad on the battery as shown in figure 58. Connect a 300 amperes load across the terminal for 15 seconds to remove surface charge from the battery.

5.8.3 Load Test

This test is one means of checking the battery to determine its ability to function as required in the vehicle.

To make this test, use test equipment that will withstand a heavy electrical load from the battery, such as a carbon pile resistor or other suitable means.

1. Connect a voltmeter, ammeter, and a variable load resistance as illustrated in figure 57.

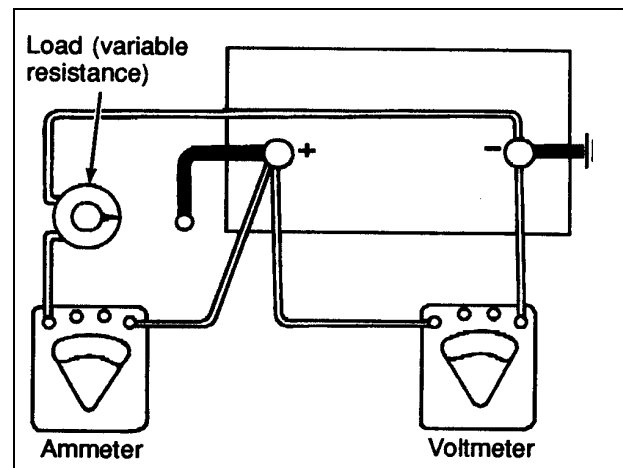


FIGURE 57: LOAD TEST 06064

Caution: Observe polarity of the meters and the battery when making connections, and select the correct meter range.

2. Apply a 290 amperes load to the battery for 15 seconds.
3. With an ammeter reading specified load, read voltage. The voltage should be at least 9.6 volts. Disconnect the load. If the voltmeter indicates 9.6 volts or more, the battery is good. If the voltmeter reading is less than 9.6 volts, replace the battery. This voltage is to be used for battery ambient temperatures of 70 °F (21 °C) and above. For temperatures below 70 °F (21 °C), refer to the following "Voltage and Temperature Chart".

Voltage and Temperature Chart

Ambient Temperature	Minimum Voltage
70 °F (21 °C) and above	9.6
60 °F (16 °C)	9.5
50 °F (10 °C)	9.4
40 °F (4 °C)	9.3
30 °F (-1 °C)	9.1
20 °F (-7 °C)	8.9
10 °F (-12 °C)	8.7
0 °F (-18 °C)	8.5

Note: The accuracy of this test procedure is dependent upon close adherence to the proper load, time and temperature specifications.

5.8.4 Testing Battery Cables

Check all cable ring terminals and connections to determine if they are in good condition. Excessive resistance, generally caused by poor connections, produces an abnormal voltage drop which may lower voltage at the starting motor to such a low value that normal operation of the starting motor will not be obtained. An abnormal voltage drop can be detected with a low-reading voltmeter as follows:

Warning: To prevent the engine from starting, the DDEC engine circuits, which are protected by breakers (CB-19, CB-20 and CB-21) located in the engine rear compartment (rear junction box), must be deenergized during these tests; afterwards, depress black button to close circuit.

1. Check voltage drop between grounded (negative) battery terminal and vehicle frame by placing one prod of the voltmeter on the battery terminal and the other on a good ground (unpainted surface) on the vehicle. With the starting motor cranking the engine at a temperature of 70 °F (21 °C), voltage reading should be less than 0.3 volt. If the voltage reading exceeds 0.3 volt, there is excessive resistance in this circuit.
2. Check voltage drop between the positive battery terminal and the starting motor positive terminal stud while the motor is operated. If the reading is more than 2.5 volts, there is excessive resistance in this circuit.

Note: If it is necessary to extend the voltmeter lead for this test, use a #16 (AWG) or larger wire.

3. Check voltage drop between the starting motor housing and a good ground on the vehicle. The reading should be less than 0.2 volt.

Warning: Any procedure other than the following could cause personal injuries or damages to the charging system resulting from battery explosion or electrical burns.

Wear adequate eye protection when working on or near the batteries. Ensure that metal tools or jumper cables do not contact the positive battery terminal (or a metal surface in contact with it) as a short circuit will result.

Do not attempt to jump start a vehicle suspected of having a frozen battery because the battery may rupture or explode.

Both the booster and discharged batteries must be treated carefully when using jumper cables. Follow exactly the procedure outlined later in this section, being careful not to cause sparks.

5.9 Battery Charging

Warning: During charging of the batteries, an explosive gas mixture forms in each cell. Part of this gas escapes through the vent holes and may form an explosive atmosphere around the battery itself if ventilation is poor. This explosive gas may remain in or around the battery for several hours after it has been charged. Sparks or flames can ignite this gas causing an internal explosion which may shatter the battery.

Do not smoke near a battery which is being charged or which has been recently charged.

Do not break live circuits at battery terminals because a spark usually occurs at the point where a live circuit is broken. Care must always be taken when connecting or disconnecting booster leads or cable clamps on chargers. Poor connections are a common cause of electric arcs which cause explosions.

The electrical system on this vehicle is negative ground. Installing the batteries with the positive terminals grounded or incorrect use of the booster battery and jumper cables will result in serious damage to the alternator, batteries and battery cables.

5.9.1 Charging Procedure

The batteries used on this vehicle can be charged either on or off the vehicle; however, when they are removed from the vehicle, it is recommended that an adapter kit, which is available from any "A/C DELCO" dealer, be used in charging sealed-terminal batteries. To remove batteries, see paragraph "5. Batteries" in this section.

The alligator clamps of the tester or charger must be placed between the terminal nuts and the lead pads of the terminal studs (Fig. 58) after the vehicle cables are detached.

The alligator clamps should make firm contact with the lead pads.

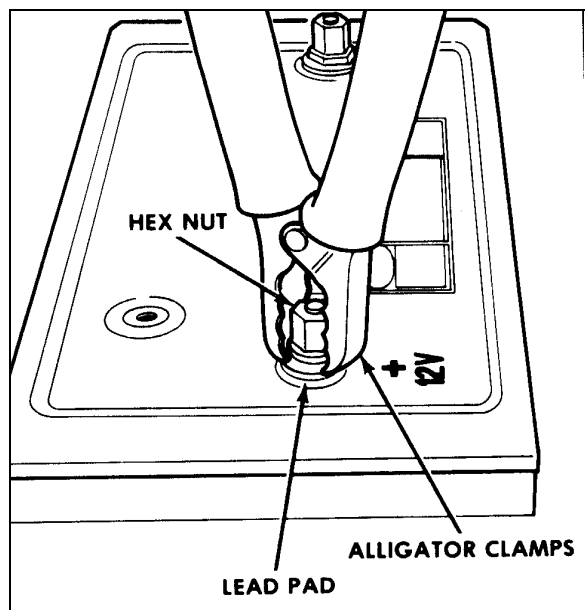


FIGURE 58: ALLIGATOR CLAMPS & BATTERY 06065

Note: If this connection cannot be made because of the alligator clamp design, the load value for testing must be reduced from 290 to 260 amperes.

On rare occasions, such as those that occur following prolonged cranking, the green dot in the test indicator may still be visible when the battery is obviously discharged. Should this occur, a boost charge of 20 amperes-hour is recommended. Under normal operating conditions, do not charge battery if the green dot is visible. The battery should never be charged if the test indicator (hydrometer) is clear or light yellow. If this occurs, replace the battery.

A charge rate between 3 and 50 amperes is generally satisfactory for any maintenance-free battery as long as spewing of electrolyte does not occur or the battery does not feel excessively hot (over 125 °F

(52 °C)). If spewing or violent gassing of electrolyte occurs or battery temperature exceeds 125 °F (52 °C), the charging rate must be reduced or temporarily stopped to allow cooling and to avoid damaging the battery.

Battery temperature can be estimated by touching or feeling the battery case. The battery is sufficiently charged when the green dot in the built-in hydrometer is visible. No further charging is required. Shake or tilt the battery at hourly intervals during charging to mix the electrolyte and see if the green dot appears.

Warning: Always turn off the charger before connecting or disconnecting it to or from a battery.

Note: The charge rate must be doubled when the batteries are charged by the booster block, since we have a series-parallel circuit.

Battery charging consists of a charge current in amperes for a period of time in hours. Thus, a 25 amperes charging rate for 2 hours would be a 50 amperes-hour charge to the battery. Most batteries, whose load test values are greater than 200 amperes, will have the green dot visible after at least a 75 amperes-hour charge. In the event that the green dot does not appear, replace the battery.

Use the booster block to charge the batteries when they are left on vehicle.

Set to the "On" position the:

- Main battery disconnect switch (XL-40 coach);
- Toggles switch and the battery master switch (XL-45 coach);
- 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).

Refer to paragraph "4. Electrical Compartments" for booster block locations.

5.9.2 Battery Charging Guide

Fast Charging Rate

20 amps @ 3-3/4 hours
 30 amps @ 2-1/2 hours
 40 amps @ 2 hours
 50 amps @ 1-1/2 hours

Slow Charging Rate

5 amps @ 15 hours
 10 amps @ 7-1/2 hours

The time required for a charge will vary according to the following factors:

Size of Battery

For example, a completely discharged large heavy-duty battery requires more than twice the recharging time of a completely discharged small passenger car battery.

Temperature

For example, a longer time will be needed to charge any battery at 0 °F (-18 °C) than at 80 °F (27 °C). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first, then in time, the battery will accept a higher rate as it warms.

State of Charge

For example, a completely discharged battery requires more than twice as much charge than a half-charged battery. Since the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

Charger Capacity

For example, a charger which can supply only 5 amperes will require a much longer period of charging than a charger that can supply 30 amperes or more.

5.9.3 Emergency Jump Starting With Auxiliary (Booster) Battery

Whenever it becomes necessary to start the engine while batteries are discharged, use another power source of the same voltage (24 volt DC), negative grounded and proper jumper cables.

Warning:

- ***Jump starting may be dangerous and should be attempted only if the following conditions are met.***
- ***Never connect to the negative post of the discharged battery.***
- ***Never allow the two vehicles or the jumper cable clamps to touch each other.***
- ***Never attempt to jump start a vehicle if the discharged battery fluid is frozen or if the battery fluid level is low, as the battery may rupture or explode.***

- ***Do not jump start vehicles equipped with maintenance-free batteries if the test indicator is light yellow.***
- ***Turn off all lights, heaters and other electrical accessories. Make sure the parking brake is applied and the transmission is set to "NEUTRAL" before attempting to jump start the engine.***
- ***The booster battery or the battery in the other vehicle must be of the same voltage as the battery in the vehicle being started, and must be negative grounded.***
- ***If the booster battery is a sealed-type battery without filler openings or caps, its test indicator must be dark or a green dot must be visible. Do not attempt jump starting if the test indicator of the booster battery or the discharged battery has a light or bright center.***
- ***Wear eye protection and remove rings, watches with metal bands and other metal jewelry.***
- ***Follow exactly the procedure outlined below, being careful not to cause sparks***
- ***Procedures other than the one outlined below could cause injury or damage from battery acid spray, explosion, or charging system overload.***

1. Connect one end of the red jumper cable to the positive (+) post of the booster power source.
2. On **XL-40 & XL-45E CONVERTED VEHICLES**, remove the grey protective sealant from the 24 volt battery disconnect switch post, then connect the other end of the red jumper cable to this post according to the figure 59 (it may be necessary to also remove the insulating varnish on the battery switch disconnect post).

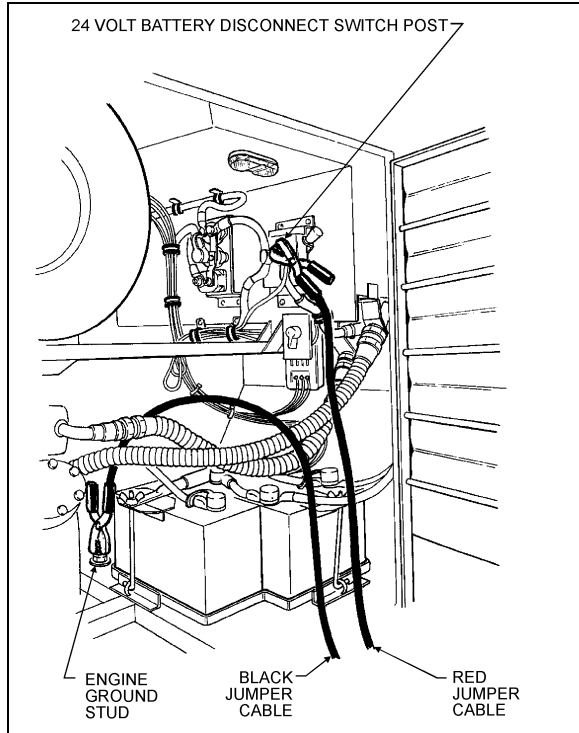


FIGURE 59: BOOSTER BLOCK (XL-40 and XL-45E CONVERTED VEHICLES) 06046

2. On, **XL-40 COACH, XL-45 COACH AND XL-45 CONVERTED VEHICLE**. Remove the red protective cap from Booster Block's Positive Stud, then connect the other end of the red jumper cable to this stud (see illustrations on this page).

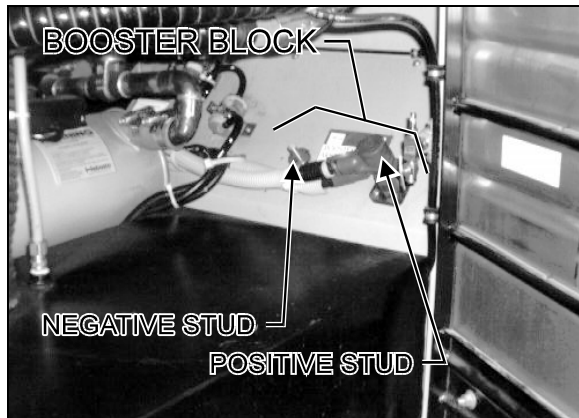


FIGURE 60: BOOSTER BLOCK (XL-40 COACH) 06098

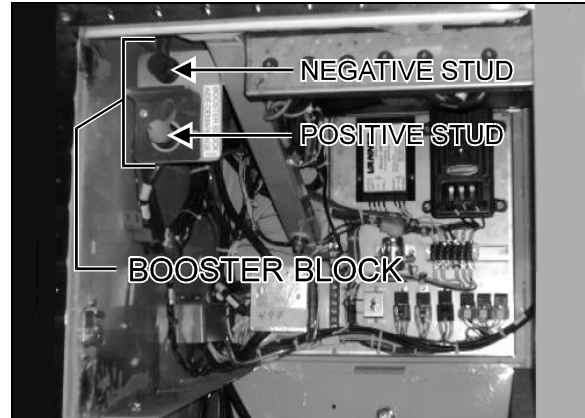


FIGURE 61: BOOSTER BLOCK (XL-45 COACH) 06097

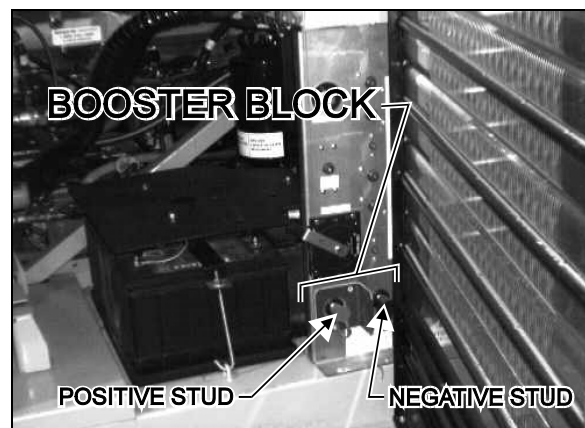


FIGURE 62: BOOSTER BLOCK (XL-45 CONVERTED VEHICLE) 06045

3. Connect one end of the black jumper cable to the negative (-) post of the booster power source.

4. On **XL-40 & XL-45E CONVERTED VEHICLES**, remove the grey protective sealant from the engine ground stud fixed on frame, then connect the other end of the black jumper cable to this stud as shown on figure 59.

5. On **XL-45 CONVERTED VEHICLE, XL-40 AND XL-45 COACHES**. Remove the black protective cap from Booster Block's Negative Stud, then connect the other end of the black jumper cable to this stud (see illustration on this page).

6. Start the engine in the vehicle that is providing the jump start. Let the engine run for a few minutes, then start the engine in the vehicle that has the discharged batteries.

Warning: Do not engage starter for more than 15 seconds. Allow starter time to cool before engaging again. This will prevent starter from overheating and will allow time delay relay to cool.

7. To remove the cables, perform the above procedure in reverse order, then replace the protective sealant, if possible.

Note: Jumper cables must withstand 500 cranking amperes. If cable length is 20 feet (6 m) or less, use 2/0 (AWG) gage wires. If cable length is between 20-30 feet (6-9 m), use 3/0 (AWG) gage wires.

Note: If, after doing this procedure, Starter turns but Engine still doesn't run; (with Jumper Cables in place) wait approximately 15 minutes (to give battery equalizers time to balance 12V and 24V charges), then try again. If engine still doesn't run, repeat procedure once again.

5.10 Cleaning and Inspection

The external condition of the battery and the battery cables should be checked periodically. The top of the battery should be kept clean and the battery hold-down clamp bolts should be kept properly tightened. For best results when cleaning the battery, wash first with a diluted solution of ammonia or soda to neutralize any acid present, then wash out with clean water. The battery hold-down bolts should be kept tight enough to prevent the batteries from moving, but they should not be tightened to the point that excessive strain is placed on the battery hold-down cover (proper tightening torque: 45-55 lbf•ft (5-6 N•m)).

To insure good contact, the battery cable ring terminals should be tight on the battery posts. If the posts or cable ring terminals are corroded, the cables should be disconnected and the posts and clamps cleaned separately with a soda solution and a wire brush (refer to paragraph "5. Batteries" in this section for battery removal and installation. Install cable ring terminals on battery posts and tighten to a torque of 10-15 lbf•ft (13-20 N•m), then replace protective caps to prevent corrosion and sparks.

5.11 Common Causes of Battery Failure

When a battery fails, the cause of failure may be linked to something other than the battery. For this reason, when a battery failure is encountered, do not be satisfied with merely recharging or replacing battery. Locate and correct the cause of the failure to prevent recurrence. Some common external causes of battery failure are as follows:

1. Defect in charging system such as high resistance or a faulty alternator or regulator.
2. A malfunction within the 12 volts system (equalizer).
3. Overloads caused by a defective starter or excessive use of accessories.
4. Dirt and electrolyte on top of the batteries causing a constant drain.
5. Hardened battery plates, due to battery being in a low state of charge over a long period of time.
6. Shorted cells, loss of active material from plates.
7. Driving conditions or requirements under which the vehicle is used only for short drives.
8. A constant drain caused by a shorted circuit such as an exposed wire or water infiltration in junction boxes causing ground fault.
9. Extended operation of preheating system without engine running.
10. Omission of closing disconnect switches for an extended period of time.

5.12 Troubleshooting

If a battery has tested good and then has not performed satisfactorily in service for no apparent reason, the following factors may point to the cause of trouble:

1. Vehicle accessories and the following disconnect switch, inadvertently left on overnight :
 - Main battery disconnect switch (XL-40 coach);
 - Toggles switch and the battery master switch (XL-45 coach);
 - 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).
2. Defects in the charging system, such as high wiring resistance, faulty alternator, regulator or battery equalizer.

3. A vehicle electrical load exceeding the alternator (or battery equalizer) capacity, with the addition of electrical devices, such as CB radio equipment, a cellular phone or additional lighting system.
4. Defects in the electrical system, such as shorted or pinched wires.
5. Extended slow speed driving with many accessories turned on.
6. Loose or poor battery cable-to-post connections, previous improper charging of a run-down battery, or loose hold-down clamp bolts.
7. High-resistance connections or defects in the cranking system.

6. ELECTRICAL SYSTEM MONITOR

This vehicle is equipped with an electronic device that monitors and detects abnormal alternator, voltage regulator, battery banks or battery equalizers conditions. Refer to paragraph "4. Electrical compartment" for monitor location. The "Battery balance" and "Battery Hi/Lo" warning lamps connected to this module are mounted in dashboard (refer to "Operator's Manual" for location). If a malfunction should occur, the monitor sends a signal to the driver by means of the appropriate warning light according to the malfunctioning component. If the "Battery Hi/Lo" warning light is illuminated, check the 24 volt voltmeter to determine if battery voltage is too high or too low.

Note: According to battery charging condition, it is normal that "Battery Hi/Lo" warning light illuminates upon starting the engine and stays illuminated a few seconds. This is caused by the battery normal voltage drop during starting.

6.1 Warning Lamp Definitions

6.1.1 Battery Hi/Lo

Voltmeter drops below 24 V dc

- Check alternator output
- Check voltage regulator
- Check battery connections
- Check battery cells
- Check battery equalizers connections

Voltmeter exceeds 30 V dc

- Check alternator output
- Check voltage regulator
- Check battery connections

6.1.2 Battery Balance

Note: Allow at least 15 minutes to balance batteries after corrective measure has been taken.

1. Batteries out of balance (difference greater than 1.5 volts between the two battery banks)
 - Check battery equalizer connections
 - Check equalizer cables for proper gauge
 - Check battery connections
2. Demand for 12 volts power exceeding rated amperage output of battery equalizers causing batteries to go out of balance
 - Reduce 12 volts load or install additional battery equalizer(s)

6.1.3 "Battery" Warning Light

This warning light is not controlled by the electronic monitor, but by the "R" terminal of the alternator using the normally-closed contact of the relay R-33. If a voltage drop should develop in the charging system, the "Battery" warning light will immediately light up to warn the driver and will be followed by the illumination of the "Battery Hi/Lo" warning light if the voltage drops below 24 V dc.

Refer to heading "Diagnosis of charging system problems" later in this section, to determine whether the alternator or the voltage regulator is defective. Should the "Battery" warning light illuminate while the 24 volts voltmeter keeps on giving a normal reading and the "Battery Hi/Lo" warning light does not illuminate, the relay R-33 or its wiring is probably defective.

Caution: The relay R-33 should never be replaced with a relay provided with a suppressor diode on its coil as the output current (between 12 and 14 volts) at the alternator "R" terminal is not rectified, thus rendering relay inoperative.

Note: When the "Battery" warning light illuminates, the "A/C & Heating" system shuts off in order to prevent battery discharge.

7. ALTERNATOR

The battery-charging alternator(s) are introduced into the electrical system to provide a source of electrical current for maintaining the storage battery in a charged condition and to supply sufficient current to carry any other electrical load requirements up to the rated capacity of the alternator(s).

The battery-charging circuit consists of alternator(s), voltage regulator, batteries, battery equalizer(s) and the connecting wiring. They are described under the applicable headings hereafter.

7.1 Gear Driven Alternator-Oil Cooled (24V-270 Amps)

The gear driven alternator-oil cooled is located in engine compartment and mounted on the engine (Fig. 63).

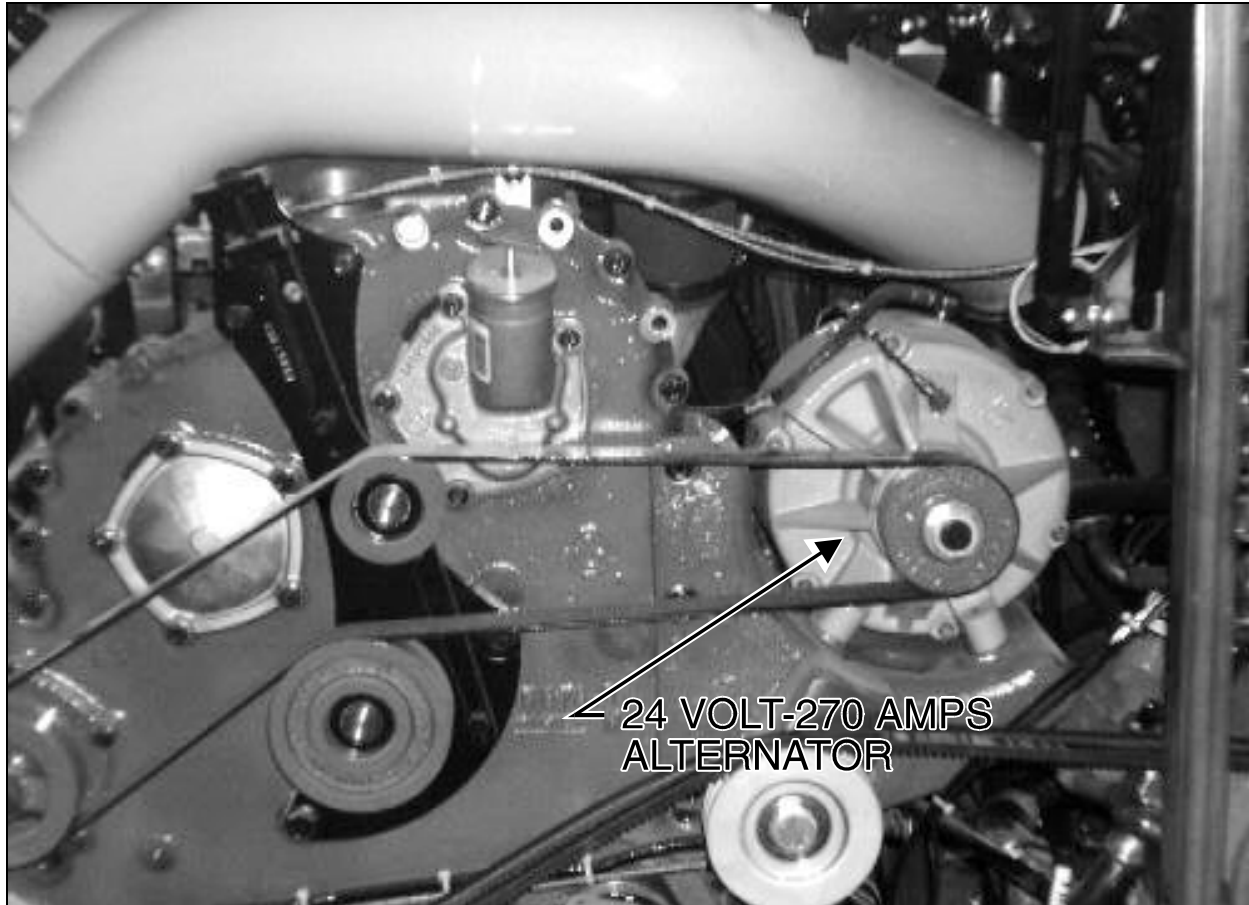


FIGURE 63: ENGINE REAR COMPARTMENT (ALTERNATOR)

06139

Caution: The electrical system is **NEGATIVE GROUND**. Connecting the batteries or a battery charger with the positive terminal grounded will endanger the alternator diodes and vehicle wiring by a high current flow. Burned wiring harness and burned "open" diodes will result. Always ensure that the alternator and battery polarities are matched prior to installation. **THE ALTERNATOR WILL NOT REVERSE TO ACCEPT INVERSE POLARITY.** Also, do not ground or short across any of the alternator or regulator terminals.

Since there are no brushes, slip rings, or rubbing seals, the alternator requires no periodic maintenance other than the following:

1. Check alternator-to-engine mounting bolts for looseness and tighten to the proper torque.
2. Check all electrical connections for tightness and corrosion. Clean and tighten connections as necessary. Be sure wiring insulation is in good condition and that all wiring is securely clipped to prevent chafing the insulation.

3. With the engine running, listen for noise and check the alternator for vibration. If the alternator is noisy or vibrates excessively, it should be removed for inspection and repair.

4. Ensure that battery terminals are clean and tight.

7.2 Diagnosis of Charging System Problems

The troubleshooting of the charging system is made easier by the use of a 12 and a 24 volts voltmeters, "Battery", "Battery balance" and "Battery Hi/Lo" warning lights mounted in dashboard (for location refer to the "Operator's Manual"). The definition of each warning light is explained under the paragraph "6. Electrical System Monitor".

7.2.1 Alternator or Voltage Regulator

To determine which unit is faulty, proceed as follows:

1. Start the engine and momentarily connect a jumper from the "F1" field terminal to "DC (+)" terminal. For connections, refer to figure 66.

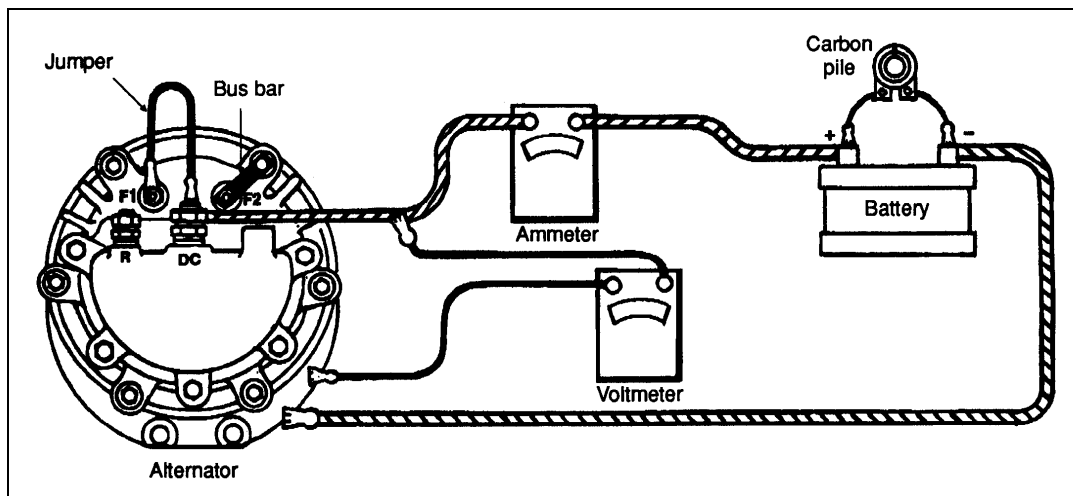


FIGURE 66: ALTERNATOR

06068

Caution: Do not feed the alternator field "F1" terminal for more than 10 seconds. High voltage could burn out the wires and components of charging system, and seriously damage the alternator.

Do not jump the "F2 (-)" terminal with the "DC (+)" terminal on the alternator. This will result in a direct short circuit.

- a) If the voltmeter readings increase, trouble is located in the 24 volts regulator or wiring. Check the regulator as explained under "Voltage regulator" later in this section.
- b) If the voltmeter readings do not increase, the problem may be in the alternator.

7.3 Alternator Diagnosis

Caution: Before checking the alternator, TURN OFF the:

- Main battery disconnect switch (XL-40 coach);
- Toggles switch and the battery master switch (XL-45 coach);
- 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).

It is not necessary to disassemble completely the alternator to make electrical checks. All electrical checks are made at the diode end of the assembly without having to remove the rotor, drive end frame or bearing. If the electrical components are not defective, but bearing replacement is necessary, this can be done at the drive end without having to disassemble the diode end of the unit.

The components in the alternator which require electrical checks are the field winding, the six diodes, and the stator winding.

7.3.1 Diode Checks

Each diode may be checked for shorts and opens as follows:

Caution: Before checking diodes, TURN OFF the:

- Main battery disconnect switch (XL-40 coach);
- Toggles switch and the battery master switch (XL-45 coach);
- 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).

1. Remove the pipe plug from underneath the end housing to drain the oil in the rectifier engine oil supply.
2. Remove the cap screws (7) and lock washers which attach the diode end cover to the end housing. Remove the end cover from the end housing.

Note: Do not operate the alternator unless this unit is completely reassembled.

3. Remove seal from the end housing, detach and remove "DC" and relay terminals, stud, insulating sleeves and O-rings.
4. Disconnect all diode flexible leads, i.e. three from the output terminal stud and three from the diode supports. See figure 67 for more details.

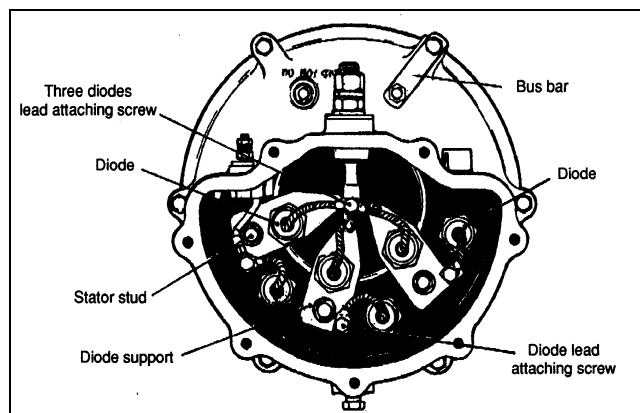


FIGURE 67: ALTERNATOR FLEXIBLE LEADS

06069

Each diode may be checked for shorts and opens with an ohmmeter.

Note: The ohmmeter polarity may be determined by connecting its leads to the voltmeter leads. The voltmeter will read up-scale when the negative leads are connected together and the positive leads are connected together. The polarity of the voltmeter leads may be determined by connecting the leads to the identified terminals on a battery.

Note: Use an ohmmeter with a single 1.5 volts cell. Most accurate reading will be determined when the 300 ohms value is calibrated to the center one-third of the scale. DO NOT USE high voltage, such as a 110 volts test lamp to check diodes.

To check diodes mounted in the supports for shorts, connect the positive ohmmeter lead to each diode lead and the ohmmeter negative lead to each support as shown in "A", "B", and "C" of figure 68. To check diodes mounted in the end frame for shorts, connect the ohmmeter positive lead to each diode lead and the ohmmeter negative lead to the end frame as shown in parts "D", "E", "F". The ohmmeter readings may vary considerably when checking diodes for shorts, but if the reading is 300 ohms or less, the diode is likely defective and should be replaced. If the diode reads 300 ohms or less, it will allow excessive reverse current from the battery. Replace defective diodes as explained later in this section.

To check the diodes mounted in the diode supports for opens, connect the ohmmeter negative lead to each diode lead and the ohmmeter positive lead to each support as shown in parts "A", "B", and "C" of figure 69. To check the diodes mounted in end frame for shorts, connect the ohmmeter negative lead to each diode lead and the ohmmeter positive lead to the end frame as shown in parts "D", "E" and "F". An infinite resistance reading indicates an open diode. Diodes can be replaced by following the procedure outlined under the paragraph "7.4 Diode Replacement".

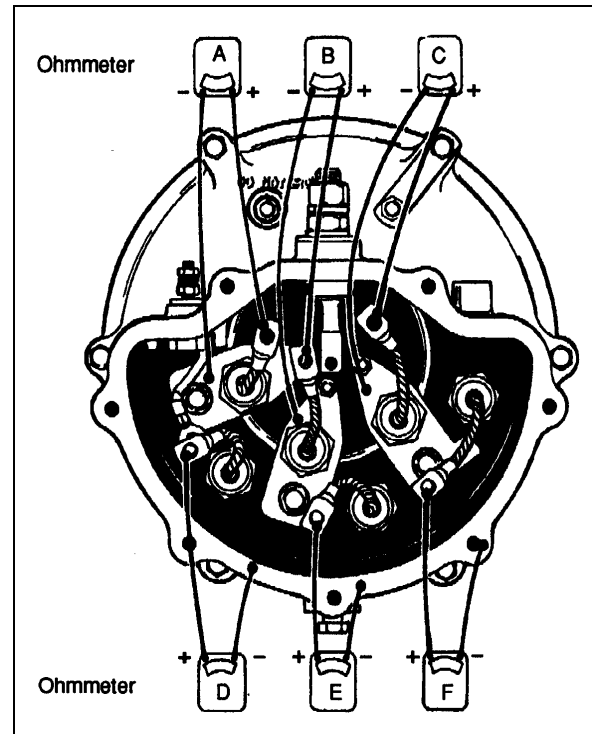


FIGURE 68: DIODES TEST

06070

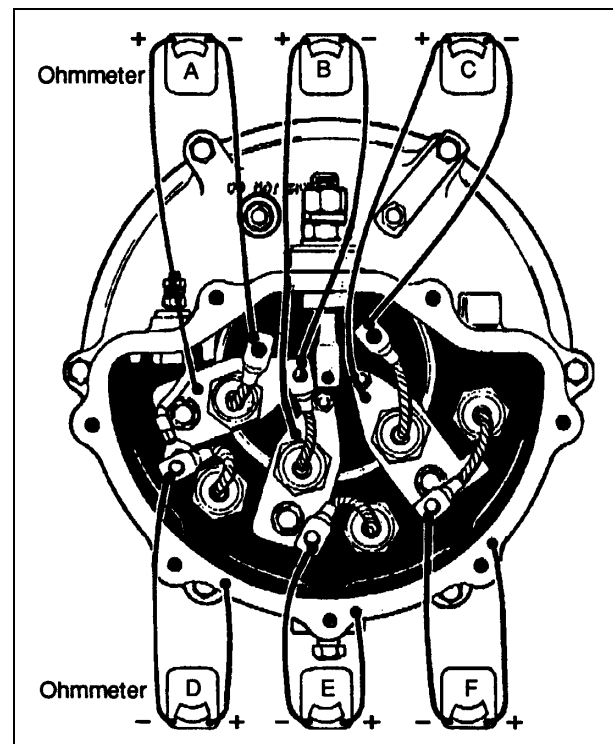


FIGURE 69: DIODES TEST

06071

When reinstalling diodes, torque to 9-11 lbf•ft (12-15 N•m). Re-stake next to the threads in an arbor press with an 1/8 inch (3,2 mm) round punch. Press the punch with gradual pressure; do not strike as the shock may damage the diodes.

7.3.2 Field Winding Checks

The field winding may be checked for shorts and opens with an ohmmeter. To check the field winding, connect the ohmmeter to field terminal and to ground. A resistance reading above normal indicates an open, and a reading less than normal indicates a short. The normal resistance value is 3.0 to 3.3 ohms at 80 °F (27 °C). An alternate method of checking is to place a battery of specified voltage, and an ammeter in series with the field winding. The current should register 7.2 to 8.3 amperes at 24 volts. Coil resistance is approximately 3.1 ohms. Amperage readings, other than the above, indicate an open, grounded, or shorted field. A defective field coil can be replaced by removing the end frame on which the field terminal is located and then removing the four field coil mounting screws. See the paragraph "7.5 Field Winding Replacement".

7.3.3 Stator Winding Checks

The stator winding may be checked for opens and shorts with an ohmmeter as follows:

Opens

Connect the ohmmeter leads to two pairs of diode supports as shown in parts "A", "B", and "C" of figure 70. Polarity of the leads must be observed. The ohmmeter should indicate a low resistance. If an infinite or a high resistance is measured in either one or both checks, the stator windings are open.

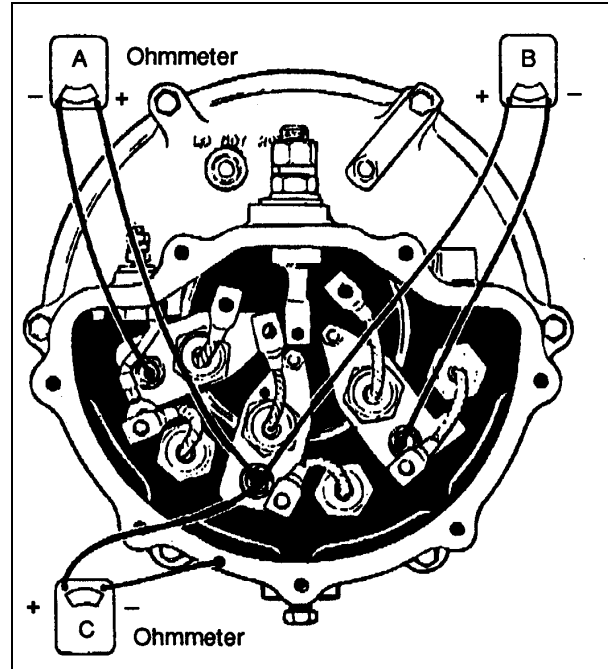


FIGURE 70: STATOR WINDING TEST

06072

Grounds

To check the stator windings for grounds, connect an ohmmeter to the diode support and diode end frame as shown in part "C" of figure 69. The ohmmeter should indicate a very high or infinite resistance. If zero, or a very low resistance is measured, the windings are grounded.

Shorts

The stator windings are difficult to check for shorts without finely calibrated laboratory test equipment due to the very low resistance values of the windings. However, if all other alternator checks are satisfactory, yet the unit fails to perform to specifications, shorted stator windings are likely.

7.4 Diode Replacement

The following replacement procedures are based on the assumption that the diode end cover is still removed and diode leads were disconnected as explained earlier in this section.

Note: *When replacing a diode, make sure it is designed for a negative ground system. The diode can be identified by the symbol stamped on the diode case. The arrow must point toward the diode flexible lead.*

To replace the three diodes which are mounted in the supports attached to the stator lead studs, it is necessary to remove the diode and support assembly. The two outer diode and support assemblies are identical and can be installed on either side. The center unit has a different support, with 2 inches (50,8 mm) between the mounting hole centers.

Note: *The outer supports are provided with 2 1/4" (57,15 mm) center holes.*

7.4.1 Diode (in Support) Replacement

1. Remove nut with lock washer attaching the diode support to the stator lead stud.
2. Remove nut, lock washer, and flat washer attaching support to the small stud in the end frame.
3. Remove the diode and support assembly, then remove insert from small hole in support or from small stud in the end frame.
4. Remove nut and flat washer from diode mounting stud, then remove diode from the support.
5. Place a new diode in the support and install a flat washer and nut on the diode mounting stud. Hold the diode with a wrench placed over flats on the diode, while tightening nut on the mounting stud to a torque of 160-180 lbf•in (18-20 N•m).
6. Place diode and support assembly over the stator lead stud and the small mounting stud. Place insert over small stud inside the hole in the support. Install flat washer, lock washer, and nut on the small stud, and tighten to a torque of 22-25 lbf•in (2-3 N•m). Install nut with lock washer on stator lead stud and tighten firmly.

7.4.2 Diode (in End Frame) Replacement

To remove diode, use a thin 1 inch open end wrench on flats of the diode case to unscrew diode from the end frame. Thread the new diode into the end frame

and tighten to a torque of 160-180 lbf•in (18-20 N•m). If no other parts are to be replaced, refer to "Diode end cover installation" later in this section.

7.5 Field Winding Replacement

7.5.1 Removal

1. Remove three diode and support assemblies from the end frame to provide access to the two lower field to end frame bolts.
2. Remove nut with lock washer and flat washer from three stator lead studs.
3. Remove the six bolts and lock washers attaching the diode end frame to the stator frame.
4. Separate the end frame from the stator frame, and remove the end frame and field assembly from the rotor while pushing the stator lead studs out of the end frame.
5. Remove nut, lock washer, flat washer, and insulating washer which secure the field lead terminal stud in the end frame. Push the stud out of the end frame.
6. Remove field terminal stud insulating bushing and seal from the end frame. Remove insulating sleeve from the field terminal stud.
7. Remove the four bolts and lock washers attaching the field to the end frame.
8. To separate the field from the end frame, install four 3/8-24 x 3 inch bolts in place of the 3/8-24 x 2 inch bolts removed in step 7. Thread bolts in to equal heights. Support the end frame in an arbor press, then using a suitable press plate to exert pressure on all four bolt heads, press the field out of the end frame.

7.5.2 Installation

1. Position the field assembly on the end frame, insert four 3/8-24 x 3 inch bolts through the end frame and thread into the field to keep holes aligned.
2. Support the end frame on an arbor press bed in such a manner that the diodes will not be damaged, and press the field into the end frame. Press in until shoulder on field coil bottoms against the end frame.
3. Remove the four guide bolts. Install four 3/8-24 x 2 inch bolts, using new lock washers to attach the field to the end frame. Tighten bolts securely.
4. Place insulating sleeve in inner side of the field terminal stud hole in the end frame, and insert

the terminal stud through the sleeve. Place two O-rings and insulating bushing over the terminal stud and push into hole in the end frame. Install insulating washer, flat washer, toothed lock washer, and nut on terminal stud and tighten firmly.

5. Install each stator lead stud in the end frame as follows: Place insulating washer over the stud and insert the stud through the end frame. Place the insulating bushing over the stud and position in end frame hole. Install flat washer, lock washer, and nut on the stud, and tighten firmly.
6. Install three diode and support assemblies on the end frame as previously directed under "Diode replacement".
7. Install a new seal in notch around end of the stator frame. Insert field into the rotor and position the end frame against the stator frame. Attach end frame to the stator frame with six bolts and lock washers. Tighten bolts firmly.
8. If no other parts require replacement, refer to "Diode end cover installation" later in this section to complete the assembly.

7.6 Stator Winding Replacement

If tests performed under *paragraph "7.3.3 Stator Winding Checks"* earlier in this section indicated an open circuit or short in the stator, the stator and frame assembly must be replaced.

7.6.1 Removal

1. Remove diode end frame and field assembly as previously directed in steps 1 through 4 under paragraph "7.5.1 Removal" procedure.
2. Remove the six bolts and lock washers attaching the stator frame to the drive end frame.
3. Separate the stator frame from the drive end frame and remove the stator frame from the end frame and rotor.

7.6.2 Soldering Stator Terminal Leads

1. Using a wire brush, thoroughly clean the wire and terminal.
2. Silver solder the stator lead to the terminal using a torch.
3. Thoroughly clean the silver solder connection with a wire brush.
4. Using a high grade energized rosin flux, coat the silver soldered connection with a 80-20 tin-lead

solder or pure tin solder to prevent deterioration of the silver solder by engine oil.

Note: *The silver solder will provide the required mechanical strength which will not be affected by temperature. The tin-lead solder will protect the silver solder connection from deterioration by engine oil.*

7.6.3 Installation

1. Position new seal in notch around the drive end of the stator frame.
2. Position the stator and frame assembly over the rotor against the drive end frame. Attach the stator frame to the drive end frame with six bolts and lock washers. Tighten bolts firmly.
3. Install diode end frame and field assembly as directed in steps 5, 6 and 7 under paragraph "7.5.2 Installation" procedure.
4. Install rectifier end cover as directed later.

7.7 Diode End Cover Installation

1. Make sure all diodes are properly installed and securely tightened. Leads from diodes threaded into the end frame must be securely attached to the diode supports. The relay terminal lead must also be attached to the left diode support.
2. Connect leads from the three diodes mounted in supports to the output terminal stud. Tighten the attachment screw firmly. Place insulating bushing over relay terminal stud.
3. Place a new seal in the diode end frame.
4. With the end cover in place against the end frame, install the cap screws (7) and lock washers. Tighten the cap screws evenly and firmly.
5. Make sure the drain plug was installed in bottom of the end cover and was securely tightened.

7.8 Alternator Replacement

7.8.1 Removal

1. Place "Starter selector switch" in engine compartment to the "Off" position.
2. Place to the "Off" position the:
 - Main battery disconnect switch (XL-40 coach);
 - Toggles switch and the battery master switch (XL-45 coach);

- 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).
3. Remove alternator driving belt (refer to appropriate heading later in this section).

Note: When reinstalling drive belt, it is important that the belt tension is correctly set (refer to the appropriate heading later in this section).

4. Scratch off protective sealer from electrical connections (relay, field and positive terminals). Refer to figure 71.

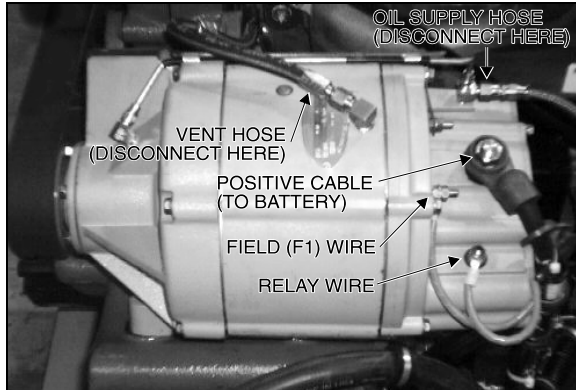


FIGURE 71: ALTERNATOR (HOSES AND WIRES) 06073

Note: After connecting electrical wires back, it is important to cover terminals with protective sealant (Prévost part #680745).

5. Disconnect wires #25 from the relay terminal, #107 from the field "F1" terminal and disconnect battery cable from the positive "+" terminal on the diode end cover. Tag wires removed to ease identification at time of installation. Refer to figure 71.
6. Disconnect oil supply line and vent hose from top of alternator (Fig. 71) and tape lines to prevent admission of foreign matter. Disconnect oil drain hose from bottom of alternator (Fig. 72) and tape line to prevent admission of foreign matter.

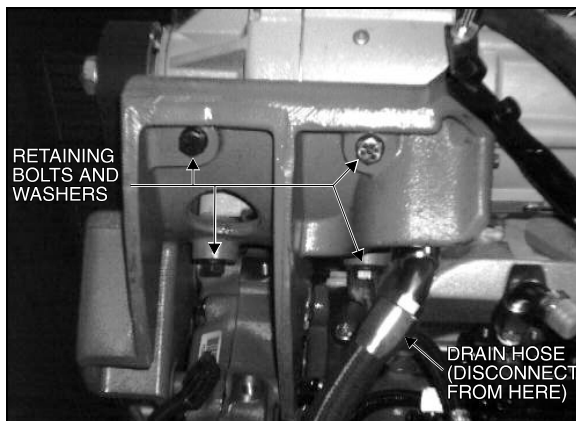


FIGURE 72: ALTERNATOR 06074

7. Remove the four bolts and lock washer retaining alternator (Fig. 72).

Warning: Alternator weight is approximately 150 lb. (70 kg), so another person is required to help in taking alternator out of engine compartment.

8. Take the alternator out of engine compartment.

7.8.2 Disassembly

After diode, field or stator winding checks, the alternator can be disassembled to repair a faulty component, such as field, stator, or to proceed with bearing or rotor replacement. The alternator may be disassembled by following the steps hereafter:

1. Remove nuts and washers from "DC" terminal on diode end frame.
2. Separate the diode cover plate from the diode end frame by removing the mounting screws.
3. Remove the washer, nut and lock washer attaching the diode supports to the end frame, the three screws connecting the diode leads to the diode supports, and the three nuts which attach the stator studs to the diode supports.
4. Separate the diode support assemblies from the diode end frame, and the three nuts which connect the studs to the diode end frame.
5. Mark the position of the drive end frame and diode frame with respect to the stator assembly so that the parts can be reassembled in the same position.
6. Detach the diode end frame and field assembly from the stator assembly by removing the attachment screws.
7. Separate the field assembly from the diode end frame by removing the four attachment screws.
8. Separate the rotor assembly and drive end frame from the stator assembly by removing the attachment screws.
9. Remove the shaft nut and washer, and the pulley. Press the rotor shaft out of the drive end frame.
10. Remove the retainer plate and pull the bearings from the drive end frame.

7.8.3 Alternator Cleaning and Inspection

Whenever the alternator is disassembled, it should be cleaned and inspected as follows:

Cleaning

If sludge has accumulated on the stator, a light mineral oil should be used to clean the stator.

Inspection

When the alternator has been disassembled to a point that the stator is exposed, the stator should be checked for the following:

- a) Adequate varnish.
- b) Proper spacing of conductors so that "near shorts" do not exist.
- c) Proper phase lead placement.
- d) Strong conductor and cross-over welds.

7.8.4 Bearing or Rotor Replacement

Whenever the rotor and drive end frame are disassembled for any reason, the single-row ball bearing must be replaced with a new one due to the probability of its being damaged during disassembly.

Removal and Disassembly

1. If the pulley was not removed from the rotor shaft at time of alternator removal, remove the nut and flat washer from the shaft and pull the pulley off the shaft.
2. Remove the six bolts and lock washers attaching the drive end frame to the stator frame. Separate the drive end frame from the stator frame, then remove the drive end frame and support assembly.
3. Support the drive end frame in an arbor press in such a manner that the rotor can be pressed down out of the end frame. Using a suitable adapter against the end of the rotor shaft which will pass through the inner race of the double-row ball bearing, press the rotor down out of the end frame and bearings. Since the single-row bearing outer race is held in the end frame by the retainer plate, and the inner race is a press fit on the rotor shaft, the bearing is likely to be damaged when the shaft is pressed out and must be replaced with a new part.
4. Remove the six screws attaching the bearing retainer plate to the drive end frame. Remove the retainer plate, the single-row bearing and the bearing spacer from the end frame.
5. Support the drive end frame in an arbor press with the double-row bearing down, in such a manner that the bearing can be pressed down out of the end frame. Using a suitable driver which will exert a force on the bearing outer race, press the bearing out of the end frame.
6. Remove the rubber bearing clamp from groove in the end frame.

Assembly and Installation

1. Install a new single-row ball bearing into inner side of the drive end frame. Install the bearing retainer plate and attach with six screws. Stake screws in place after tightening.
2. Position the rubber bearing clamp in groove in bearing bore of the drive end frame. Lubricate the clamp to permit the bearing to be pressed in without dislodging or damaging the clamp.
3. Position the rotor in an arbor press with the shaft end up. Install the drive end frame and single-row bearing assembly over the rotor shaft. Using a driver over the rotor shaft which will exert a force on the bearing inner race, press the bearing onto the shaft until it bottoms against the rotor.
4. Install bearing spacer over the rotor shaft. Position the double-row bearing over the rotor shaft at end frame bore. Using an adapter which will exert a force on both the inner and outer races of the bearing, press the bearing onto the shaft and into the end frame until the inner race bottoms against the bearing spacer.
5. Place a new seal around the drive end of the stator frame.
6. Insert the rotor between the stator and field, and position the drive end frame against the stator frame. Attach the end frame to the stator frame with six bolts and lock washers. Tighten the bolts to a torque of 5 to 5.4 lbf•ft (6-7 N•m).

Caution: *When replacing the alternator on vehicle, ensure that an alternator with the proper drive ratio is used. Installation of an alternator with any other drive ratio will result in severe and costly damage to the alternator and engine.*

7.8.5 Reassembly

Reassembly is the reverse of disassembly.

Note: *When tightening the outside nut on the "DC" output terminal, torque the nut to 30-35 lbf•ft (41-47 N•m). The lower nut should be supported while tightening the top nut.*

When reinstalling diodes, tighten to a torque of 9-11 lbf•ft (12-15 N•m).

7.8.6 Output check

When removed from the engine, the alternator may be checked on a test bench without circulating oil, providing the output is limited to 100 amperes or less. The alternator may be bench tested without circulating oil at outputs exceeding 100 amperes, as

long as the period of operation is limited to less than 15 seconds.

Caution: *Operating the alternator at outputs greater than 100 amperes for periods exceeding 15 seconds without adequate oil circulation, will cause the alternator to overheat, resulting in damage to the winding and diodes.*

If the alternator is to be operated at an output greater than 100 amperes for longer than 15 seconds, circulating oil must be provided. SAE 30 engine oil must be supplied to the connection on the diode end cover at a pressure of 35 psi and at a temperature of 60 °F to 220 °F (16 °C to 104 °C). This will provide an oil flow of about one gallon per minute.

To check the alternator on a test bench, make electrical connections as shown in figure 66. Be sure to connect the negative battery terminal to the alternator frame.

7.9 Alternator Drive Belt

7.9.1 Removal and Installation

Removal

1. Loosen the two bolts retaining the tensioning arm (Fig. 73).

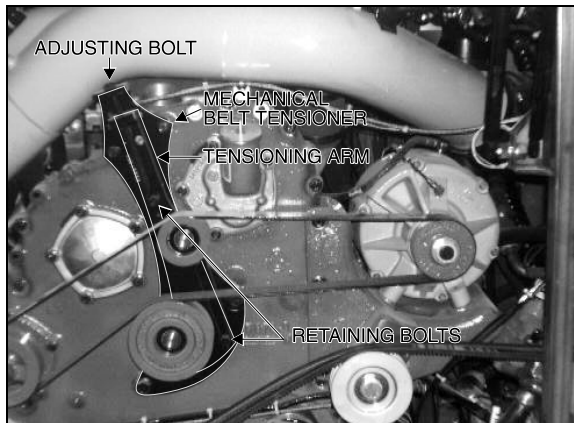


FIGURE 73: ALTERNATOR DRIVE BELT 06075

2. Unscrew the adjusting bolt to slacken belt.
3. Remove belt.

Installation

Reverse removal procedure to reinstall alternator drive belt.

Note: *After belt installation, it is important to tension belt as per paragraph "7.9.2 Adjustment".*

7.9.2 Adjustment

Periodic retensioning on the belt is required to maximize belt life. The belt tension should be measured every 6.250 miles (10 000 km) or twice a year, whichever comes first. The following procedure describes proper tensioning practices.

Note: *Steps 1 and 2 should only be performed on new belts.*

1. Loosen the two bolts retaining tensioning arm, then use the adjusting bolt to tension belt to 300 pounds.

Note: *A belt tension gauge (Prévost kit #011742) is available and is supplied with an instruction sheet. Refer to its procedure to use belt tension gauge correctly.*

2. Run engine for 10 minutes, and allow the belt to cool 10-15 minutes.
3. Measure the belt tension. If tension on the belt is greater or equal to 200 pounds, no retensioning is required. If tension on the belt is less than 200 pounds, retension the belt to 200 pounds.

7.10 Alternator (24 Volts-75 Amps)

This alternator is located in the engine rear compartment, on the starter side of engine (Fig. 74).

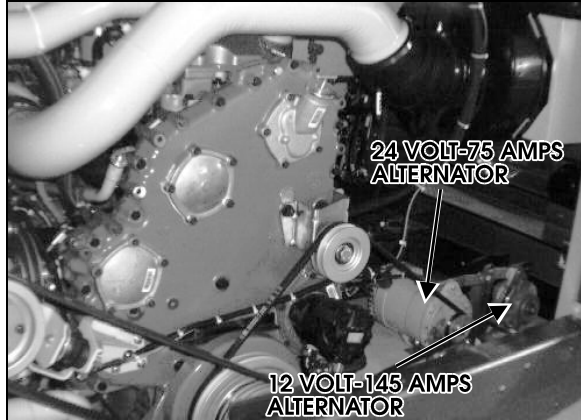


FIGURE 74: ENGINE REAR COMPARTMENT (ALTERNATOR)

06140

The alternator bearings are permanently lubricated. There are no external provisions for alternator bearing lubrication.

7.10.1 Alternator Wiring Test

The output of the alternator must reach the batteries and accessory loads with a minimum amount of voltage loss. Any loss slows the rate of charge to the batteries and could cause the batteries to be in some state of discharge. This voltage loss can appear to the technician as a faulty alternator or voltage regulator.

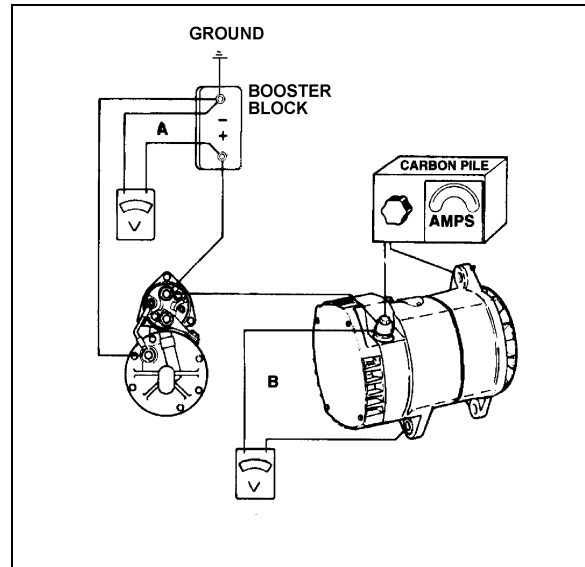
Before a suspected bad alternator or regulator is replaced or removed for service, the cables and connections between the alternator and the storage batteries should be checked for high resistance as follows:

7.10.2 Charging Circuit Voltage Drop Test

Before the charging circuit voltage drop test is performed, the batteries should be load-tested to ensure they are suitable for service. Refer to the appropriate battery manufacturer's service instruction for load test information. Replace any batteries that fail a load test. All battery terminals should be cleaned and tightened. Then proceed as follows:

1. With the engine NOT running, connect a carbon pile to the alternator output terminal

and the alternator housing as shown in Figure 75.



06141

FIGURE 75: CHARGING CIRCUIT VOLTAGE DROP TEST

Note: Use care when connecting the carbon pile to the alternator output terminal, not to allow the pile clamp to touch ground. The output terminal is at battery voltage.

2. Connect a voltmeter across one of the batteries, red lead to positive and black lead to negative as shown at "A" in Figure 75.
3. With the engine NOT running, turn the knob of the carbon pile until the gage on the carbon pile reads the alternator rated output in amps.

Note: The alternator's rated output is typically stamped on the alternator housing or on a name tag located on the alternator housing.

4. Read and record the battery voltage. Turn the carbon pile off.
5. Move the voltmeter to the alternator. Connect the red voltmeter lead to the alternator output terminal and the black voltmeter lead to the alternator housing as shown at "B" in Figure 75.

Note: Do not connect the voltmeter leads to the carbon pile leads.

6. Turn the carbon pile knob until the meter again reads alternator rated output in amps.
7. Read and record the voltage at the alternator. Turn the carbon pile off.

8. Subtract the voltage reading recorded at the alternator from the voltage reading obtained at the battery.

$$\begin{array}{r} \text{VOLTAGE READING AT BATT.} \\ - \text{VOLTAGE READING AT ALT.} \\ \hline = \text{TOTAL VOLTAGE DROP} \end{array}$$

9. The result is measure of the charging circuit voltage drop. Maximum allowable charging circuit voltage drop is 0.5 volts for a 12-volt system (1.0 volts for a 24-volt system).
10. If the voltage drop reading was below specification, the system is satisfactory. Go to the ALTERNATOR OUTPUT TEST. If the reading was more than allowed it will be necessary to determine if the voltage drop is located in the positive or negative side of the charging circuit. Go the next step.
11. With the carbon pile still connected, connect a low scale voltmeter (digital preferred) as shown in Figure 76.

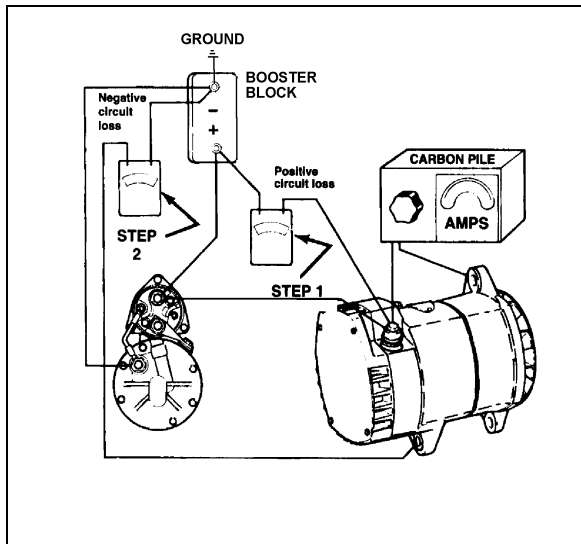


FIGURE 76: CHARGING CIRCUIT VOLTAGE DROP TEST
06142

12. Connect the red lead of the voltmeter to a battery positive terminal. Connect the black voltmeter lead to the alternator output terminal as shown in Step 1, Figure 76 (you may need a jumper wire to extend your voltmeter leads).
13. Turn the carbon pile knob until the gage on the carbon pile reads the alternator rated output in amps.

14. Read and record the voltmeter reading. Turn the carbon pile off.
15. Connect the voltmeter leads to the negative side of the charging circuit as shown in step 2, Figure 76.
16. Connect the red voltmeter lead to the alternator housing and the black voltmeter lead to the battery negative terminal.
17. Turn the carbon pile knob until the gage on the carbon pile reads the alternator rated output in amps.
18. Read and record the voltmeter reading. Turn the carbon pile off.

$$\begin{array}{r} \text{19. POSITIVE CIRCUIT LOSS} \\ - \text{NEGATIVE CIRCUIT LOSS} \\ \hline = \text{TOTAL SYSTEM LOSS} \end{array}$$

12-volt system-0.5 volts maximum
24-volt system-1.0 volts maximum

20. The above procedure should show which circuit has the excessive voltage loss. Remove the carbon pile and voltmeter. Repair or replace the problem portion of the circuit.

7.10.3 Alternator Output Test

Tighten both the alternator mounting bolts (adjusting rod and pivot point) and be sure all the charging circuit cables and connections are clean and tight. Then test the alternator output as follows:

1. The engine must be at shop temperature. Connect a charging-starting system analyzer, with a voltmeter and ammeter, to the vehicle. Connect the voltmeter leads to one of the batteries, observing proper polarity. If the analyzer has an inductive pickup, place it around the alternator output wire (Fig. 77).
2. If the charging-starting system analyzer does not have a carbon pile, connect a carbon pile across one of the batteries.

Note: On 24-volt vehicles, connect the carbon pile across one 12-volt battery. Connect the voltmeter across the normal 24-volt battery connection.

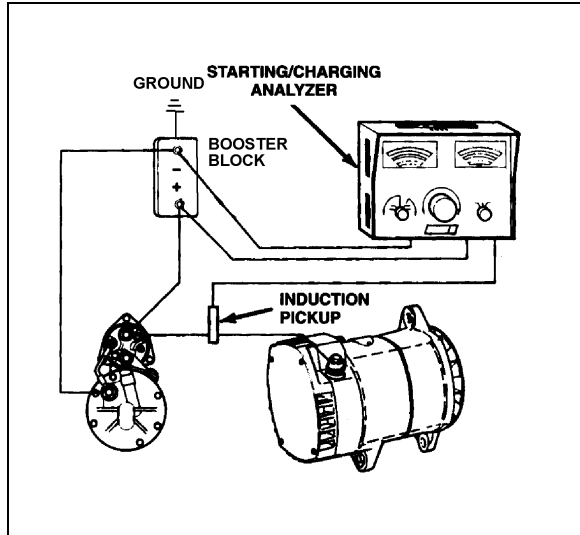


FIGURE 77: ALTERNATOR OUTPUT TEST 06143

3. With NO electrical loads turned on, start the engine and accelerate to a fast idle. Observe the voltmeter. When the voltage stabilizes (does not increase) for two minutes, read and record the voltage. Voltage should not exceed 15 volts (30 volts for a 24-volt system). If the voltage exceeds the maximum allowable by one volt, the voltage regulator is defective. Remove the alternator for repair.
4. If the voltage was acceptable, accelerate the engine to approximately 1800 rpm and turn the carbon pile knob until the ammeter shows the output has reached the highest value. Record this reading (amps). Turn off the carbon pile. Allow the engine to idle down for at least 30 seconds. Turn off the engine.
5. The alternator rated output is stamped on the alternator case or on a name tag on the alternator housing. Compare the reading obtained in step 4 above, to the alternator's rated output. If the current measured is not within 10% of the rated output, remove the alternator for repair.

7.11 Alternator (12 & 24 Volts) Removal and Installation

7.11.1 Removal

It doesn't matter what type of installation and alternators are installed (12V-145 AMPS & 24V-75 AMPS) on vehicle, the removal and installation are the same.

See typical installation in the following figures:

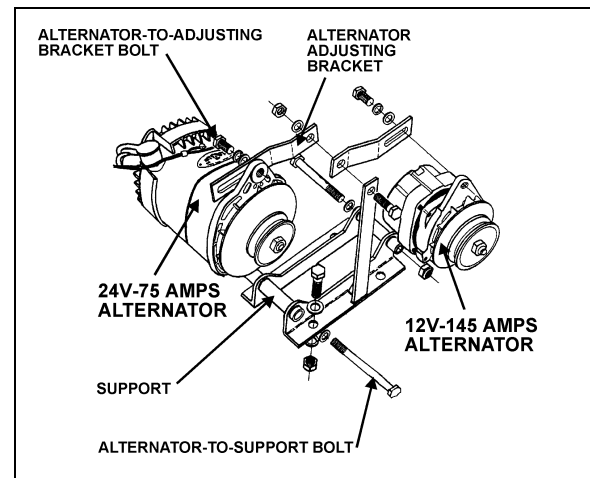


FIGURE 78: 12V-145 AMPS AND 24V-75 AMPS ALTERNATORS 06144

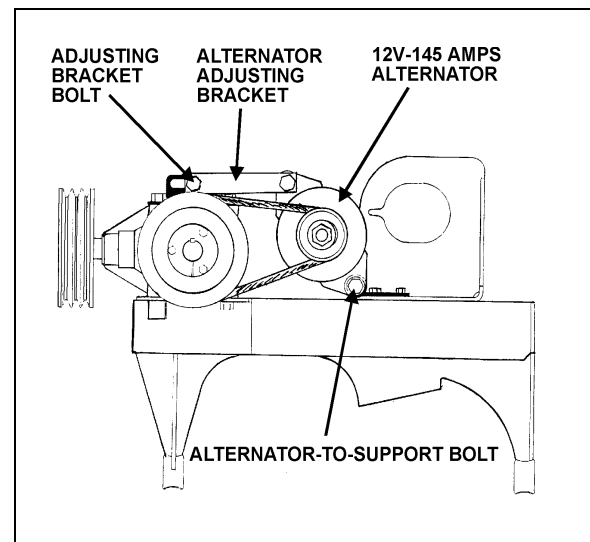


FIGURE 79: FAN CLUTCH SUPPORT 06145

Caution: Never attempt to service the engine electrical system until the batteries have been disconnected.

1. Disconnect the cables at the batteries. If the alternator has more than the output cable lead, disconnect all other leads from the alternator and tag each one to ensure correct re-installation. Remove the alternator output cable.
 2. Loosen the alternator-to-adjusting bracket bolt to allow slack in the belt. Remove the belt.
 3. While supporting the alternator, remove the alternator-to-adjusting bracket bolt and washer(s).
 4. Loosen and remove the nut and washer at the rear alternator mounting flange. Remove the alternator-to-support bolt while supporting the alternator to prevent it from falling.
 5. Remove the alternator carefully to prevent costly physical damage.
 6. Remove and retain the alternator pulley lock nut, alternator pulley and locknut, alternator pulley and fan from the unit if it is to be replaced.
2. Install the alternator-to-support bolt and lock nut. Insert the alternator-to-adjusting bracket bolt with washer installed through the alternator adjusting bracket and into the threaded hole in the alternator end frame. Tighten both bolts finger tight.
 3. Install the drive belt in the groove of the alternator drive pulley.
 4. Adjust the alternator belt tension to 45-55 lbf•ft (61-75N•m). Tighten the alternator-to-support bolt and nut and the alternator-to-adjusting bracket bolt to 60-70 lbf•ft (81-95 N•m) torque.
 5. Attach the wires and cables to the alternator. Be sure that each one is correctly installed to the location it was removed from. Keep all connection clean and tight.

New standard V-belt will stretch after the first few hours of operation. Run the engine for 10 to 15 minutes at approximately 1200 rpm to seat the belts, then allow the engine to idle for at least 30 seconds before stopping the engine. Recheck the alternator belt tension and adjust if necessary after 15 miles and again after 250 miles (420 km) of operation. Thereafter, check the tension of the drive belts every 6,250 miles (10 000 km) or twice a year, whichever comes first and adjust, if necessary. Belt should be neither too tight nor too loose. Belt that are too tight impose excess loads on the crankshaft, alternator bearings, shortening both belt and bearing life. Excessively overtightened belt can result in crankshaft breakage. A loose belt will slip and may cause damage to accessory components. If a belt tension gage is not available, adjust the belt tension so that a firm push with the thumb, at a point midway between the two pulleys, will depress the belt 0.500-0.750 inch (12.70-19.05 mm).

Note: *When installing or adjusting the drive belt, be sure the bolt at the accessory adjusting pivot point is properly tightened, as well as the bolt in the adjusting slot.*

Note: *Drive belts (V and Poly) should be replaced every 100,000 miles (160 000 km).*

7.11.2 Alternator Service

Repair and overhaul work on alternators should be referred to an authorized repair station of the manufacturer of the alternator. Replacement parts for alternators should be ordered through the equipment manufacturer's outlets. For alternators manufactured by Delco-Remy Division, repair service and parts are available through AC Delco branches and repair stations.

7.11.3 Alternator Installation

Note: *Check the pulley retaining nut to 70-80 lbf•ft (95-108 N•m) torque.*

1. Position the alternator on the support and align the holes in the alternator mounting flanges with the tube in the support.

Note: *There are two holes in the front alternator end frame flanges. One is threaded and one is plain. The threaded hole is positioned up and is used to secure the alternator to the adjusting rod.*

8. VOLTAGE REGULATOR

Refer to paragraph "4. Electrical Compartments" in this section, for the 24 volt regulator location.

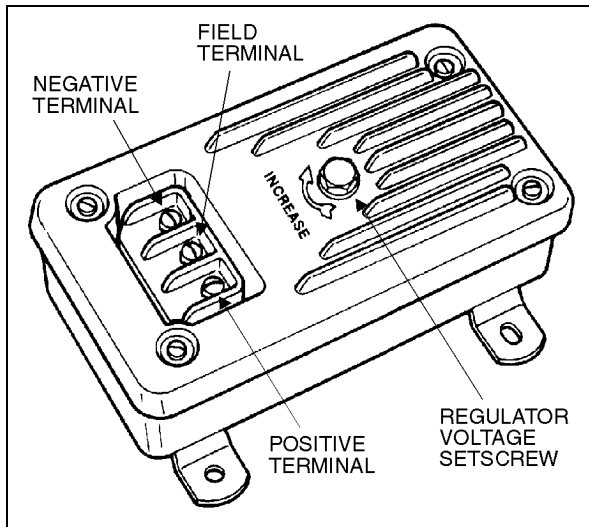


FIGURE 80: VOLTAGE REGULATOR

06076

8.1 Description

The transistor regulator illustrated in figure 80 is an assembly consisting mainly of diodes, capacitors, resistors and transistors. These components are mounted on a printed circuit panel board to form a completely static unit containing no moving parts. Regulators of this type have only **three** terminals which are identified "NEG." (ground), "FLD" (field) and "POS." (battery).

The regulator components work together to limit the alternator voltage to the preset value by controlling the alternator field current. This is the only function that the regulator performs in the charging system.

The voltage at which the alternator operates is determined by the regulator adjustment. Once adjusted, the alternator voltage remains constant, since the regulator is unaffected by length of service, changes in temperature, or changes in alternator output and speed.

A typical wiring diagram of a negative ground system is illustrated in figure 81. This diagram shows only the basic charging system components, and does not show any components such as the control relays. Refer to "Charging system" wiring diagram, page 4 in "Wiring diagrams" for the electric circuits and connections.

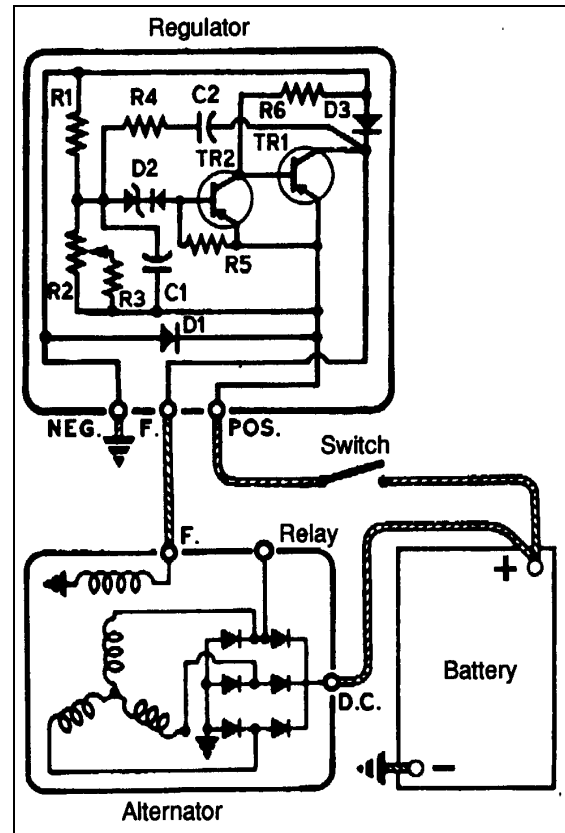


FIGURE 81: TYPICAL WIRING DIAGRAM OF NEGATIVE GROUND SYSTEM 0

6077

8.2 Troubleshooting Procedures

Trouble in the electrical system will usually be indicated by one of these two conditions: an undercharged or an overcharged battery. Either condition can result from an improper voltage regulator setting.

The absence of gassing at the continuous appearance of the green dot in the battery built-in hydrometer indicates that the voltage setting is satisfactory.

8.3 Checking Regulator Voltage Setting

1. To check the voltage setting, connect a voltmeter across the "POS." and "NEG." terminals on the regulator, and an ammeter to the "DC" terminal on the alternator. Refer to figure 82.

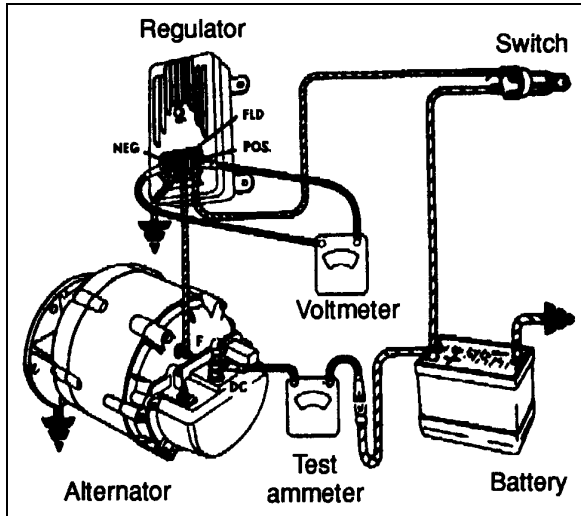


FIGURE 82: REGULATOR VOLTAGE TEST 06078

2. Operate the engine at approximately 1000 rpm (about 2300 alternator rpm) with accessories turned on to obtain an alternator output of 20-200 amperes.
3. Note the voltage setting; it should be steady at 27.5 volts.
4. If not, the desired setting can be obtained by removing the plug from the voltage regulator cover and turning lightly the adjusting screw inside the regulator; clockwise to increase or counterclockwise to decrease the voltage setting. See figure 83 for details.

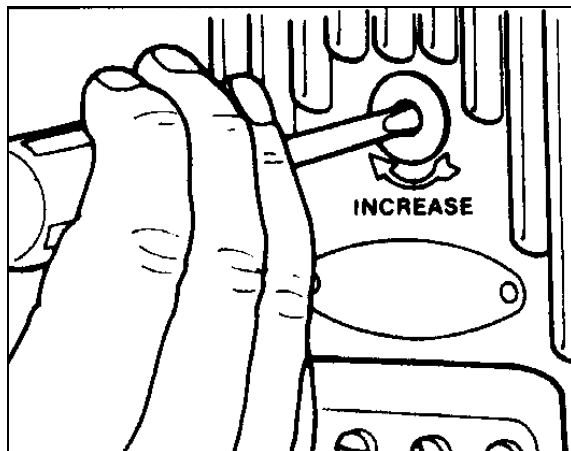


FIGURE 83: REGULATOR VOLTAGE ADJUSTMENT 06079

Note: If regulator voltage cannot be adjusted to the specified setting, remove the regulator, repair and/or replace it.

8.3.1 Undercharged Battery

If the voltage setting as checked above is steady and reasonably close to the specified value and the battery is undercharged, raise the setting by 0.3 volt, then check for an improved battery condition over a minimum service period of 48 hours. If the voltage cannot be adjusted to the desired value, the alternator should be checked as follows:

1. Stop alternator, turn off all accessories and disconnect battery ground cable.
2. Disconnect all leads from the regulator and from the alternator field. **Do not allow leads to touch ground.**
3. Connect a voltmeter and an ammeter in the circuit at the alternator "DC" terminal.
4. Connect a jumper lead from the alternator "DC" terminal to the alternator field terminal.
5. Connect a carbon pile resistor load across the battery. Turn to the "Off" position.
6. See figure 84 for wiring connections.

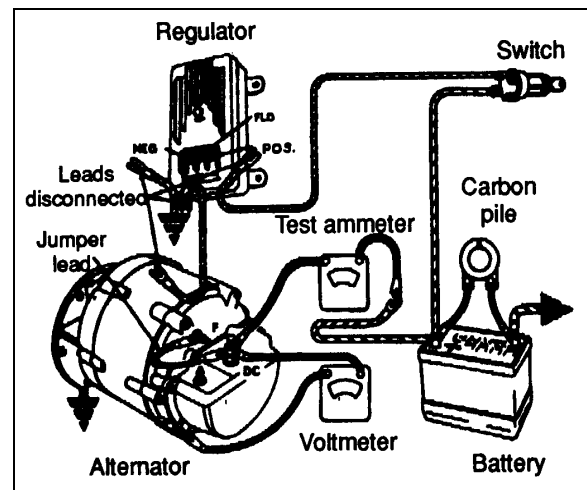


FIGURE 84: REGULATOR VOLTAGE TEST (UNDERCHARGED BATTERY) 06080

7. Reconnect battery ground cable.
8. Turn on all vehicle accessories.
9. Operate alternator and adjust carbon pile resistor load as required to check for rated output as given in Delco-Remy Service Bulletin 1G-187 or 1G-188.
10. Check the alternator field winding as follows:

Disconnect the lead from the field terminal and connect an ohmmeter from the field terminal to ground. A resistance reading above normal indicates an open, and a resistance reading less than normal indicates a short or ground. The normal resistance can be calculated by dividing the voltage by the field current published in Delco-Remy Service Bulletin 1G-186, 1G-187, or 1G-188. The normal resistance value should be at or near midscale on the ohmmeter for accuracy. An alternate method of checking is to connect a battery of specified voltage and an ammeter in series with the field winding, and compare readings with published specifications in Delco-Remy Service Bulletin 1G-186, 1G-187, or 1G-188. An alternator is defective if it does not produce rated output or if field windings are faulty. If the alternator provides rated output, and field windings check satisfactorily, the regulator should be checked as covered under paragraph "8.4 Regulator Checks".

8.3.2 Overcharged Battery

If the voltage setting as checked above is steady and reasonably close to the specified value, lower the setting by 0.3 volt and check for an improved battery condition over a minimum service period of 48 hours. If the voltage cannot be adjusted to the desired value, proceed as follows: where the alternator field is grounded internally in the alternator as shown in figure 81, a shorted or grounded field or a defective regulator can cause an overcharged battery. The field winding can be checked as covered in "Undercharged battery" section. If the field winding is found not to be defective, the alternator is not defective, and the regulator should be checked as covered under paragraph "8.4 Regulator Checks".

8.4 Regulator Checks

Separate the cover from the base, and then remove the panel assembly from the cover. Carefully note the location of all washers and lock washers.

The component parts are keyed to figure 81. Before making electrical checks, visually inspect the components and make sure all soldered connections are secure. Various electrical checks with an ohmmeter can be made to determine which components are defective.

The ohmmeter **must** be accurate, and should be a scale-type meter with a 1.5 or 3 volt cell. Most digital ohmmeters can not be used to check semiconductors; however, some digital ohmmeters are specially designed to test semiconductors and can be used to test components in the regulator. Consult the ohm-

meter manufacturer concerning the capabilities of his meter.

It is important that all of the following checks be made. If a defective part is found, replace it before proceeding with the remaining checks. Be sure to make all the checks as more than one component may be defective.

A defective regulator can be repaired according to the following methods:

- A) By changing the printed circuit board into the regulator. Unscrew the retaining screws on printed circuit and remove it. Then, install a new printed circuit board. This method is the most commonly used.
- B) By removing any retaining screws involved and unsoldering the connections. When resoldering, limit solder time to a minimum as excessive heat may damage the printed circuit and component parts. However, good soldered connections are essential for satisfactory operation. A resin core 63% tin 37% lead solder with a 360 °F (182 °C) melting point is recommended along with a soldering iron rated at 50 watts or less. Use extreme care to avoid overheating. Before checking the printed circuit board, remove transistor TR1, which must be checked separately. Connect the ohmmeter as shown in figure 85, and then reverse the ohmmeter leads to obtain two readings on the same component. Use the middle scale on scale-type meters where the 300 ohms value should be within, or nearly within, the middle third of scale.

Capacitors C1 and C2 = The ohmmeter should read high and low on each capacitor. If not, replace capacitor.

Diodes D1, D2, and D3 = Each diode should give one high and one low reading. If not, replace diode.

Resistor R2 = Turn voltage adjustment screw (identified in figure 83) with ohmmeter connecting each way. Reading should change as slotted screw is turned. If not, replace R2.

Transistor TR1 = See figure 85. Use the low scale. Each of the three checks should read low and high. If not replace TR1.

Transistor TR2 = Change the ohmmeter to use the low scale. Check EB should read low and high. Check BC should read low and high. Check EC should both read high. If not replace TR2. See figure 86.

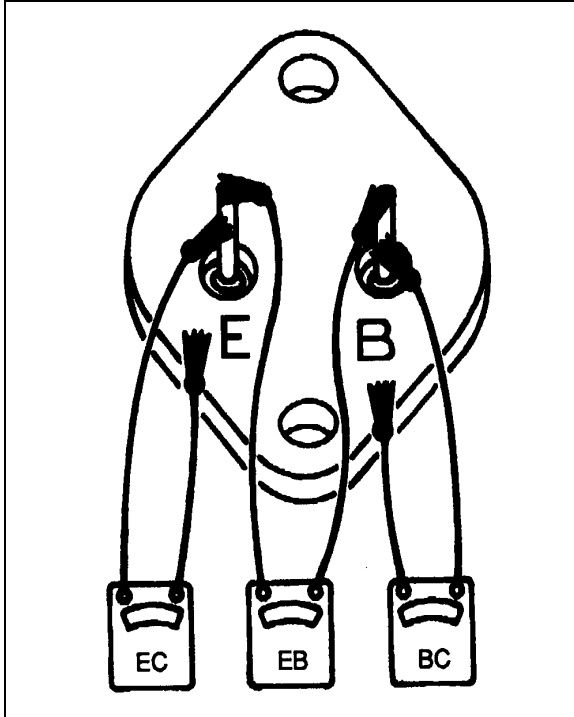


FIGURE 85: TRANSISTOR TEST

06081

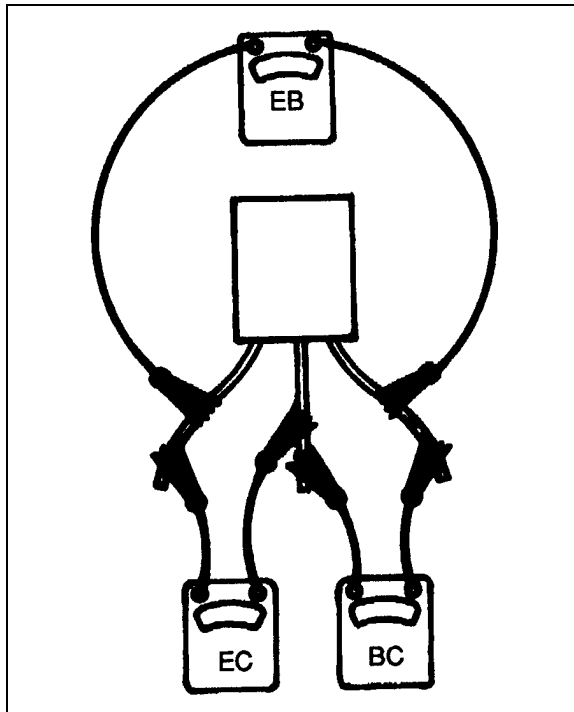


FIGURE 86: TRANSISTOR TEST

06082

8.5 Adjusting Voltage

After repair, the regulator must be adjusted to the desired voltage setting. Follow the procedure under previous paragraph "8.3 Checking Regulator Voltage

Setting". Turn **slowly** the adjusting screw full range and observe the voltmeter to insure that the voltage is being controlled, then adjust, **always slowly**, to the desired setting.

9. BATTERY EQUALIZER

Troubleshooting guide and owner manual on the battery equalizer are annexed at the end of this section.

Refer to paragraph "4. Electrical Compartments" of this section, for location.

10. STARTING MOTOR

10.1 Description

The cranking motor is bolted to the flywheel housing as illustrated in figure 87.

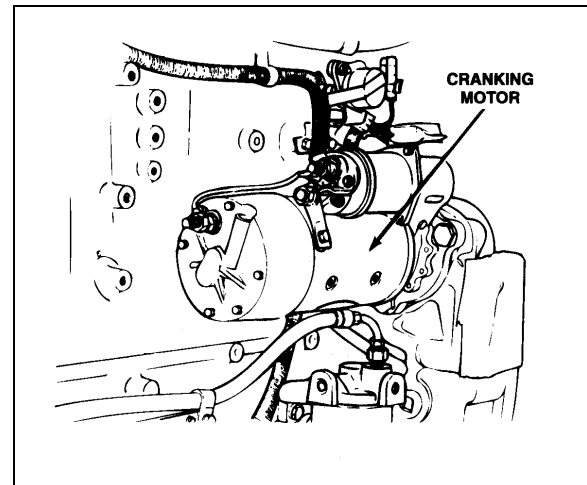


FIGURE 87: CRANKING MOTOR MOUNTING

06146

The starting motor has the shift lever and solenoid plunger that are totally enclosed to protect them from exposure to dirt, icing conditions and splash.

Positive lubrication is provided to the bronze bushing located in the commutator end frame, in the lever housing and in the nose housing, by an oil-saturated wick that projects through each bushing and contacts the armature shaft.

The clutch is a "Positork" drive type, moved into mesh with the ring gear by the action of the solenoid. Once engaged, the clutch will not disengage during intermittent engine firing, which prevents damage to pinion and ring gear teeth. The pinion remains engaged until starting is assured and the solenoid circuit is interrupted. Refer to figure 88 for more details.

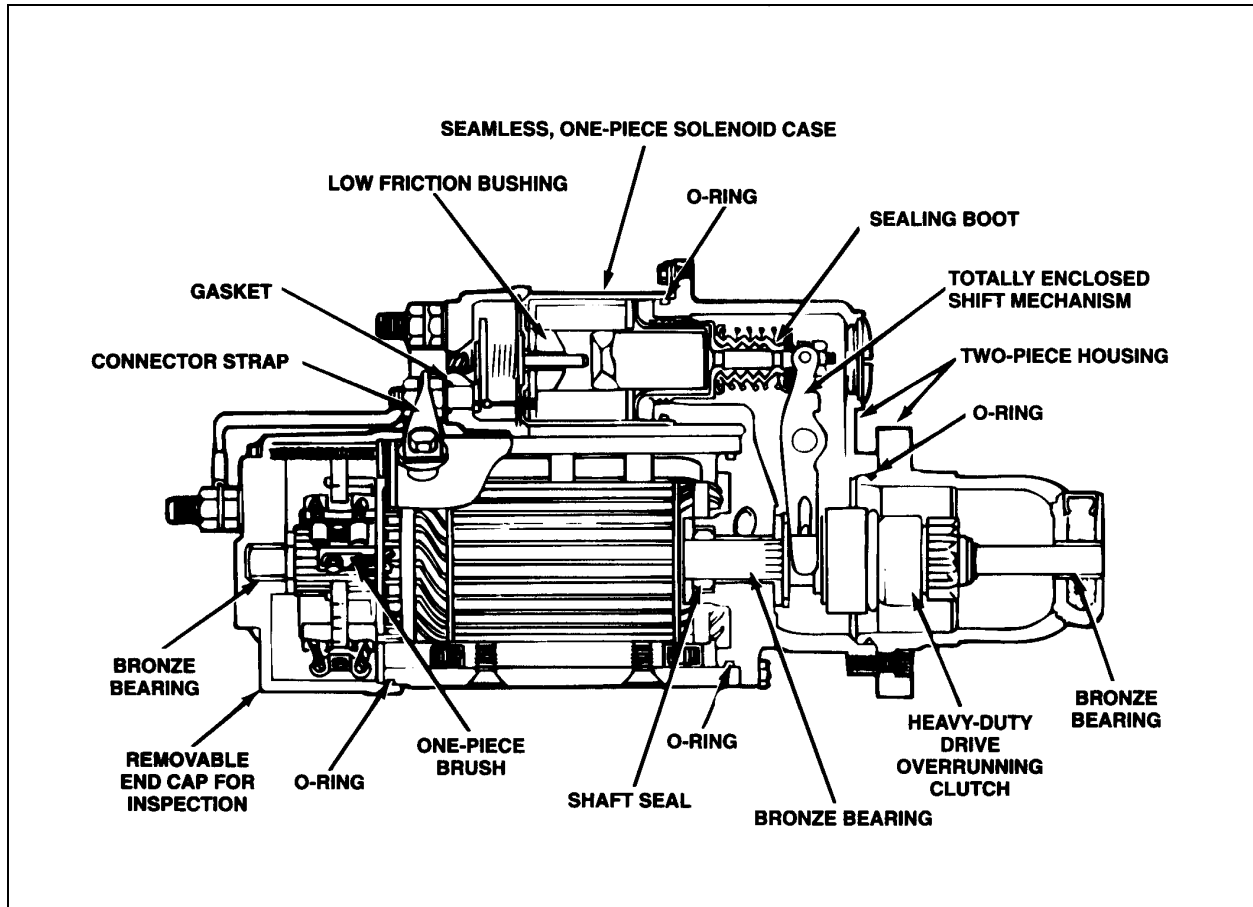


FIGURE 88: TYPICAL CRANKING MOTOR CROSS-SECTION

06147

10.2 Maintenance

All wicks and oil reservoirs should be saturated with SAE 10 oil, and the splines underneath the clutch should be lubricated with a light coating of SAE 10 oil. Other than normal periodic lubrication and keeping cable connections clean and tight, the starting motor should require no periodic maintenance. However, under normal operating conditions, the starting motor should be disassembled, inspected, cleaned and tested at time of engine overhaul.

10.3 Cranking Motor Replacement Determination

Failure of the cranking motor to crank the engine at normal cranking speed may be due to a defective battery, worn battery cables, poor connections in the cranking circuit, defective engine starting switch, low temperature, condition of the engine or a defective cranking motor.

To determine if the cranking motor is the problem, it will first be necessary to check the batteries, the cranking circuit, the magnetic switch, the solenoid

and the control switch. If the batteries pass a load test, and a visual inspection of the cranking circuit does not reveal an obvious problem, use the following guidelines.

Circuit using a magnetic switch can also fail to "hold in" during cold weather cranking and low voltage even though the switches and circuit test OK. This will sound as though the cranking motor is failing to stay engaged. It is caused by the low voltage of the system releasing the electrical connection of the magnetic switch.

If this condition exists, have an assistant clamp a heavy battery jumper cable between the two large studs of the magnetic switch while cranking.

Caution: *The magnetic switch studs are at battery voltage and the engine should crank when the jumper is connected.*

Remove the jumper to stop cranking. If the engine cranks normally with this jumper in place, replace the magnetic switch.

If the batteries, switches, and wiring have been checked and the cranking motor still cranks slowly, check for available voltage at the cranking motor solenoid while cranking (Fig. 89).

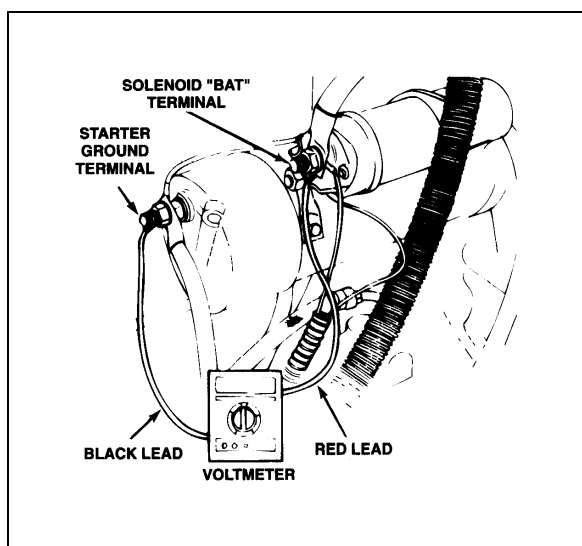


FIGURE 89: CRANKING MOTOR AVAILABLE VOLTAGE TEST

06148

Place the red lead of a voltmeter to the solenoid "BAT" terminal, and the black voltmeter lead to the starter ground terminal as shown in figure 89. Engage the starter switch and read the voltage on the meter. If the voltage is 9.0 volts or less while cranking (18.0 volts if it is a 24-volt system) at room temperature, check the interconnecting cables between batteries.

To check the interconnecting battery cables, quickly measure the terminal voltage of each battery **while cranking**. Touch voltmeter leads to the post or stud nut of each battery. If the difference between any two battery readings is more than 0.5 volt, or any cable or connection feels warm to the touch, check or replace the interconnecting cable.

If, after making all of the checks described above, the vehicle still does not crank properly, there is either an internal engine problem, or the cranking motor should be removed for repair.

Caution: *Never operate the starting motor more than 30 seconds at a time without pausing to allow it to cool for at least 2 minutes. Overheating, caused by excessive starting, will seriously damage the starter.*

10.4 Removal

Caution: *Never attempt to service engine electrical systems (except DDEC) until the batteries have been disconnected.*

Normally, the starting motor should be removed and disassembled only so far as is necessary to make repair or replacement of the defective parts. As a precaution, it is suggested that safety glasses be worn when disassembling or assembling the cranking motor.

1. Remove the ground strap or negative cable(s) from the battery(s).
2. Disconnect the cranking motor cables and solenoid wiring.
3. Support the motor and remove the three bolts which secure it to the flywheel housing. Pull the motor out to remove it from flywheel housing.

Note: *Tag each lead to ensure correct connections when the cranking motor is reinstalled.*

10.5 Cleaning

The driving mechanism armature and fields should not be cleaned in any degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricants in the drive mechanism and damage the insulation in the armature and field coils. All parts, except the drive, should be cleaned with mineral spirits and a brush. The drive can be wiped with a clean cloth.

If the commutator is dirty, it may be cleaned with No. 00 sandpaper.

Caution: *Never use emery cloth to clean commutator.*

10.6 Armature Servicing

If the armature commutator is worn, dirty, out of round, or has high insulation, the armature should be put in a lathe so the commutator can be turned down. The insulation should then be cut 1/32" (0,79 mm) wide and 1/32" (0,79 mm) deep, and the slots cleaned out to remove any trace of dirt or copper dust. As a final step in this procedure, the commutators should be sanded lightly with No. 00 sandpaper to remove any burrs left as a result of the undercutting procedures.

The armature should be checked for opens, short circuits and grounds as follows:

Opens Circuit Test

Opens are usually caused by excessively long starting periods. The most likely place for an open to occur is at the commutator riser bars. Inspect the points where the conductors are joined to the com-

mutator bars for loose connections. The poor connections cause arcing and burning of the commutator bars as the starting motor is used. If the bars are not too badly burned, repair can often be performed by resoldering the leads in the riser bars (using rosin flux), and turning down the commutator in a lathe to remove the burned material. The insulation should then be undercut.

Caution: *Do not undercut the insulation between the commutator segments after turning down the commutator.*

Short Circuit Test

Short circuits in the armature are located by means of a growler. When the armature is revolved in the growler with a steel strip such as a hacksaw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located. Shorts between bars are sometimes produced by brush dust or copper between the bars. These shorts can be eliminated by cleaning out the slots.

Ground Test

Grounds in the armature can be detected by the use of a 110 volts test lamp and test points. If the lamp lights when one test point is placed on the commutator with the other point on the core or shaft, the armature is grounded. Grounds occur as a result of insulation failure, which is often brought about by overheating of the starting motor produced by excessively long starting periods, or by accumulation of brush dust between the commutator bars and the steel commutator ring.

10.7 Field Coil Checks

The field coils may be checked for grounds and opens by using a test lamp.

Grounds

If the motor has one or more coils normally connected to ground, the ground connections must be disconnected during this check. Connect one lead of the 110 volts test lamp to the field frame and the other lead to the field connector. If the lamp lights, at least one field coil is grounded, and it must be repaired or replaced.

Opens

Connect test lamp leads to ends of field coils. If lamp does not light, the field coils are open.

10.8 Field Coil Removal

Field coils can be removed from the field frame assembly by using a pole shoe screwdriver. A pole shoe spreader should also be used to prevent distortion of the field frame. Careful installation of the field coils is necessary to prevent shorting or grounding of the field coils as the pole shoe is tightened into place. Where the pole shoe has a long lip on one side and a short lip on the other, the long lip should be assembled in the direction of armature rotation so it becomes the trailing (not leading) edge of the pole shoe.

10.9 Nose Housing Relocation

The nose housing on the sprag clutch-type cranking motor on some starters can be rotated to obtain a number of different solenoid positions with respect to the mounting flange. When repositioning of the solenoid is required on service replacement cranking motor, proceed as follows:

The nose housing is attached to the lever housing by six bolts located around the outside of the housing. Relocate the nose housing as follows:

1. Remove the six socket head screws (1 short and 5 long) and six neoprene plugs from the unused holes if a twelve-hole mounting flange is used.
2. Turn the nose housing to the required position.
3. Install the six socket head screws, with the short screw in the shallow hole nearest the solenoid, and six neoprene plugs, if a twelve hole mounting flange is used.
4. Tighten the screws to 13-17 lbf•ft (18-23 N•m) torque.

Note: *Solenoid should not be located below the centerline of the cranking motor or dust, oil, moisture and foreign material can collect and cause solenoid failure.*

10.10 Installation

To install the cranking motor, reverse the procedure outlined for removal. Tighten the cranking motor attaching bolts to 138-154 lbf•ft (187-209 N•m) torque.

Keep all of the electrical connections clean and tight. Install wiring terminal leads to the cranking motor and the solenoid switch, tighten the smaller connections to 16-30 lbf•in (1.8-3.4 N•m) torque and the larger connections to 20-25 lbf•ft (27-34 N•m) torque.

Note: If a cast iron flywheel housing is used, the cranking motor attaching bolts should be tightened to 181-226 lbf•ft (245-306 N•m) torque

10.11 Pinion Clearance

Pinion clearance should be checked after reassembly of motor to ensure the clearance is within specifications. To check pinion clearance (starting motor off engine), first disconnect the motor field connector from the solenoid motor terminal. Connect 24 volt battery with the positive battery lead to the solenoid switch terminal (5), and the negative battery lead to the grounded (G) solenoid terminal. Momentarily flash a jumper lead from the solenoid motor terminal to the grounded (G) solenoid terminal. The pinion gear will now shift into cranking position and remain so until the battery is disconnected. Push the pinion or drive back towards the commutator end to eliminate slack movement. Measure the distance between pinion and pinion stop. This should be $23/64" \pm 1/32"$ (9,5 mm \pm 0,79 mm). Pinion clearance is adjusted to these limits by turning the solenoid shaft nut after removing access plug in shift housing. See figure 90.

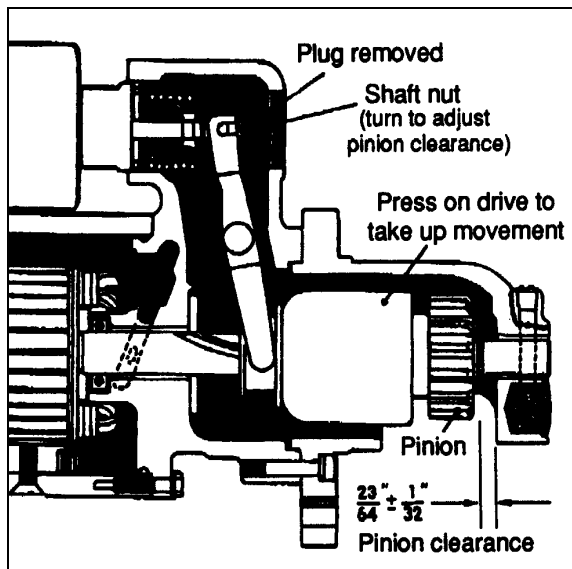


FIGURE 90: PINION CLEARANCE

06085

10.12 Starter Solenoid

10.12.1 Description

The starting motor solenoid shifts the starting motor pinion into mesh with the flywheel ring gear and also

closes the electric circuit to energize the starting motor.

There are two windings in the solenoid: a pull-in winding and a hold-in winding. Both windings are energized when the external control switch is closed. They produce a magnetic field which pulls the plunger in so that the drive pinion is shifted into mesh, and the main contacts in the solenoid switch are closed to connect the battery directly to the starting motor. Closing of the main switch contacts shorts out the pull-in winding since this winding is connected across the main contacts. The magnetism produced by the hold-in winding is sufficient to hold the plunger in, and shorting out the pull-in winding reduces drain on the battery. When the control switch is opened momentarily, the pull-in winding and the hold-in winding are connected in series between the battery and common ground.

The polarity of the pull-in winding is reversed and opposes the magnetic pull of the hold-in winding. All magnetic holding force on the solenoid plunger is thus canceled. The return spring then quickly pulls the solenoid plunger back, opening the solenoid switch contacts and at the same time withdrawing the pinion gear from the meshing position. Proper operation of the switch depends on maintaining a definite balance between the magnetic strength of the pull-in and hold-in windings.

This balance is established in the design by the size of wire and the number of turns specified. An open circuit in the hold-in winding or attempts to start with a discharged battery may cause the switch to chatter.

10.12.2 Disassembly

To disassemble the solenoid, remove nuts, washers, and insulators from the switch terminal and battery terminal. Unscrew cover screws and remove cover. Take out the contact disk assembly.

10.12.3 Solenoid Maintenance

The solenoid requires no periodic maintenance other than keeping the terminals clean and tight. Always check action of the solenoid if it has been removed. If the unit fails to function, first check wiring before condemning the solenoid. Solenoid windings can be checked for current draw, open circuit, or shorts.

10.12.4 Solenoid Tests

Two tests must be made to determine the current draw of (1) both windings in parallel and (2) the hold-in winding alone. The solenoid windings can be tested with the solenoid either off or on the starting

motor. However, when the solenoid is checked on the starting motor, it is necessary to disconnect both leads at the main solenoid terminals to prevent interference. The main solenoid terminal which is normally connected to the starting motor must then be grounded to the solenoid base by means of a jumper lead. For the first test, connect a source of variable voltage (battery and a variable resistance) in series with an ammeter between the solenoid base and the solenoid small switch terminal. Connect a voltmeter between the same two points. Slowly increase voltage and note the current draw. This should be 55-63 amps at 24 volts. Disconnect the jumper lead grounding the main solenoid terminal and readjust the variable resistance to obtain the specified voltage of 24 volts. This should not exceed 6.8 amperes.

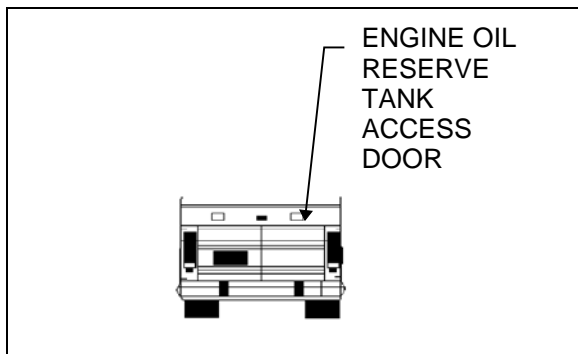
When the solenoid has been removed from the starting motor for repair or replacement, the linkage must be adjusted to provide the correct pinion clearance when the solenoid is remounted on the starting motor. See paragraph "10.11 Pinion Clearance" earlier in this section for correct adjustment.

10.12.5 Recommendations

1. Tag each lead to ensure correct connections when the starting motor is reinstalled.
2. Tighten the 5/8"-11 starter attachment bolts to a torque of 137-147 lbf•ft (186-200 N•m).
3. Keep all the electrical connections clean and tight.
4. When installing wiring terminal leads to the starting motor and the solenoid switch, torque the No. 10-32 connections to 16-30 lbf•in (2-3 N•m) and the 1/2"-13 connections to 20-25 lbf•ft (27-34 N•m).

11. ENGINE BLOCK HEATER

The vehicle may be equipped with an engine immersion-type electric block heater to assist cold weather starting. The heater male electric plug is easily accessible through the engine oil reserve tank access door (Fig. 91). To use it, connect the female plug of an electrical extension cord to the heater plug. Some converted vehicles may have the heater connected to the coach AC power system. The extension cord must be plugged into a 110-120 V AC power source only. The engine block heater should be used whenever the vehicle is parked for an extended period of time in cold weather and a suitable power source is available.



06149

FIGURE 91: HEATER MALE ELECTRIC PLUG LOCATION

CAUTION: Use only a 110-120 V AC power source. Extension cord must be of the grounded type (three prongs) and have a minimum rated capacity of 15 amps. Be sure to disconnect cord before starting and/or moving the vehicle.

11.1 Maintenance

This heater is non-serviceable except for the cord, and if faulty, must be replaced as a unit.

12. EXTERIOR LIGHTING EQUIPMENT

Circuit for exterior lights as well as their control switches, relays and circuit breakers are shown on the applicable wiring diagrams, annexed in the technical publication box provided with the vehicle.

12.1 Headlight

Each headlight consists of a 12 volts halogen unit.

12.1.1 Headlight Dimmer Switch

The multifunction lever located on the steering column is used to select proper lighting. High beams or low beams can be selected by respectively pushing the lever towards the dashboard or pulling it towards the driver. A high beam indicator on the central dashboard panel is illuminated when the high beam circuit is energized.

Note: High beams can be flashed momentarily by pulling the lever completely towards the driver and then releasing it.

12.1.2 Maintenance

Clean with soap and water and a good glass cleaner whenever dirty. For maximum illumination, headlight connections must be coated with a dielectric grease to prevent oxidation and proper voltage must be maintained. Low battery voltage, loose or dirty contacts in wiring system and poor ground contribute to a decrease in voltage. Check wiring and connections regularly and keep battery properly charged. When a headlight bulb burns out, a new bulb must be installed. Do not perform headlight aiming after a bulb replacement.

Headlight aim can be checked if necessary (after reparation on headlight assembly). Headlights must be properly aimed to provide maximum allowable road illumination. When using mechanical aimers, follow manufacturer's instructions.

Aiming can be performed by removing headlight bezels. Horizontal and vertical aiming of each headlight provided by two adjuster screws (Fig. 92). There is no adjustment for focus.

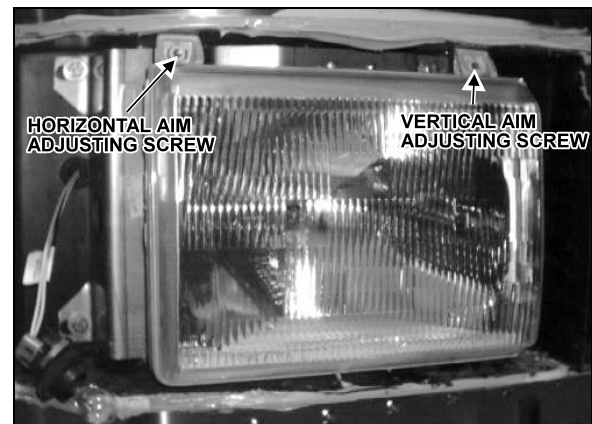


FIGURE 92: RIGHT HEADLIGHT

06150

12.1.3 Headlight Adjustment

The following is a general procedure for headlight adjustment using a mechanical equipment, such as a "Bear 47-132 headlight aligner". If your mechanical equipment is different, refer to the manufacturer's instruction manual.

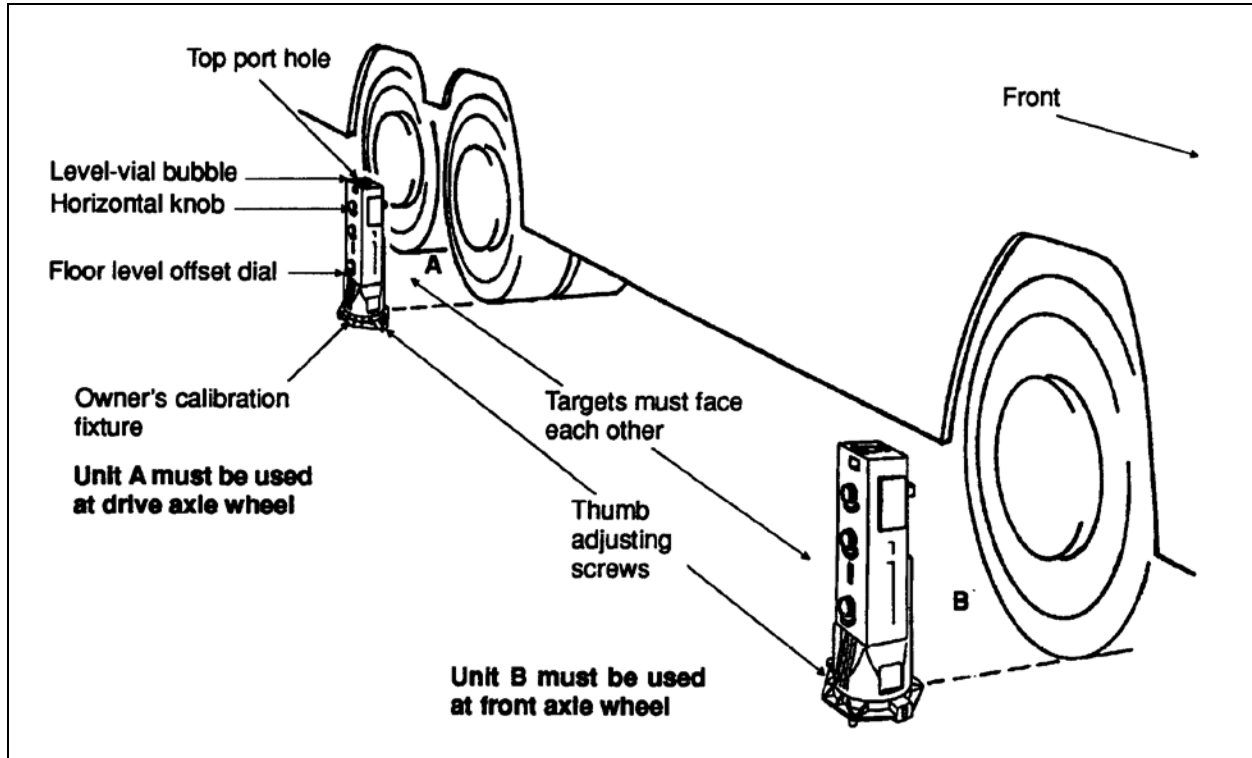


FIGURE 93: HEADLIGHT ALIGNER

06087

Setting aligner according to slope

The floor level offset dial must match with slope to ensure a precise alignment.

1. Park vehicle on a level floor.
2. Fix one (1) calibration fixture to each aligner.
3. Install aligner in center of each wheel on one side of vehicle. Unit B must be installed besides the front axle wheel with its viewing port facing rearward, and unit A besides the drive axle wheel with its viewing port facing forward. See figure 93 for more details.

Note: Check that the three indicators on each module are set to the zero point.

4. Level each unit by means of the thumb adjusting screw on the fixture until level-vial bubble is centered.
5. Look through the top port hole of unit A, and turn horizontal knob until split images are aligned. See figure 94.

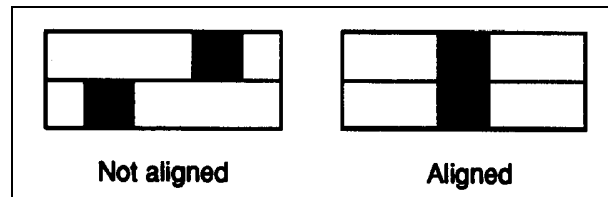


FIGURE 94: HEADLIGHT ALIGNER

06088

6. Set according to floor slope. Transfer positive (+) or negative (-) reading of horizontal dial to the floor level offset dial to offset floor slope on each aligner (Fig. 95). Push on the floor level offset dial to register reading.

7. Remove calibration fixture from each unit.

Note: If vehicle remains stationary during the headlight alignment procedure, avoid checking floor slope each time.

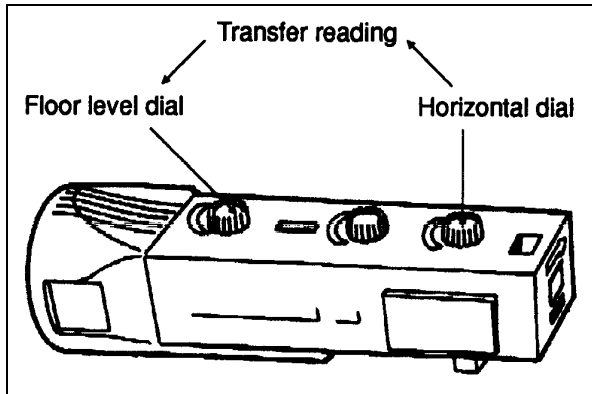


FIGURE 95: HEADLIGHT ALIGNER

06089

Headlight alignment

1. To gain access to horizontal and vertical aim adjusting screw, remove screws attaching headlight bezel to front panel ("Phillips" screws). Remove bezel.

Note: The aligner is provided with adapters for different sizes of headlights which are always aligned in pairs.

2. Fix the adequate adapter on each headlight.

Note: The adapters are equipped with steel inserts, thus providing a good seating for a precise headlight adjustment.

3. Install aligners on headlights (unit A on driver's side and unit B on other side with the sight openings facing each other), by pushing the handle forward to secure rubber suction disc, then pull handle until it locks. Refer to fig. 96.

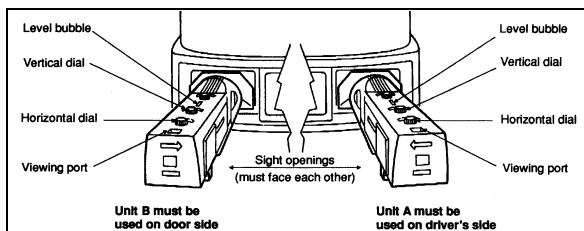


FIGURE 96: HEADLIGHT ALIGNER

06090

Note: Ensure that floor level offset dial is set adequately before aligning headlights.

Horizontal alignment

1. Reset horizontal dial to zero.
2. Check that split image is visible in the viewing port. If not, replace aligner by turning it.
3. Turn the horizontal aim adjusting screw of each headlight with a six-point standard socket until split image is aligned (Fig. 97).

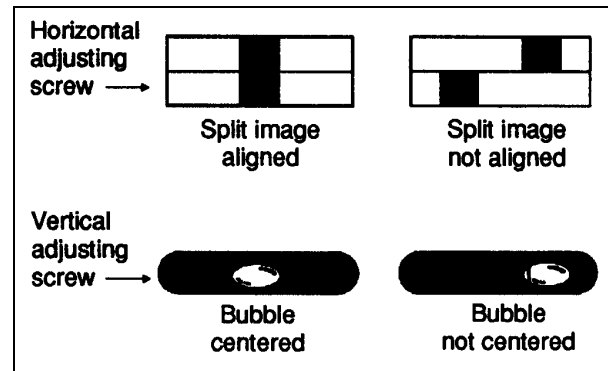


FIGURE 97: HEADLIGHT ALIGNER

06091

Vertical alignment

1. Reset vertical dial to zero.
2. Turn the adjusting screw of the headlight vertical aim with a six-point standard socket until bubble is centered (see fig. 97). Repeat operation on other headlight.

3. Recheck the horizontal alignment.

Remove aligners by pressing on vacuum release button.

Repeat the same procedure for the high beams.

If mechanical equipment is not available, perform adjustments as described below:

1. Park vehicle on level floor so headlights are 25 feet (7,6 m) from a smooth surface preferably of light color. A door or wall is suitable. Center line of vehicle should be perpendicular to this vertical surface.
2. Draw a horizontal line on vertical surface at height of light center. Locate point on this horizontal line at which projected centerline of vehicle intersects. Measure distance between light centers and divide this distance equally on either side of center mark. Then draw two vertical lines directly ahead of each light center.
3. Switch on high beams and cover one headlight while adjusting the other.
4. When aiming headlights, beam may appear distorted. A new sealed-beam unit must be installed to correct this condition.
5. After headlight is properly aligned, cover it and proceed in the same manner as above with opposite headlight.

12.1.4 Bulb Replacement

Replace headlight bulb as follows (Fig. 98):

1. Remove screws attaching headlight bezel to front panel ("Phillips" screws) and remove bezel.

2. Remove the three (3) cap screws and the two (2) "Phillips" screws attaching headlight to headlight casing.
3. Pull wiring connector off back of unit.
4. Remove headlight unit from its casing.
5. Remove the bulb retainer. Remove the bulb from headlight.
6. Replace the new bulb.
7. To reassemble headlight assembly, do the previous step of this procedure in a reverse sequence.

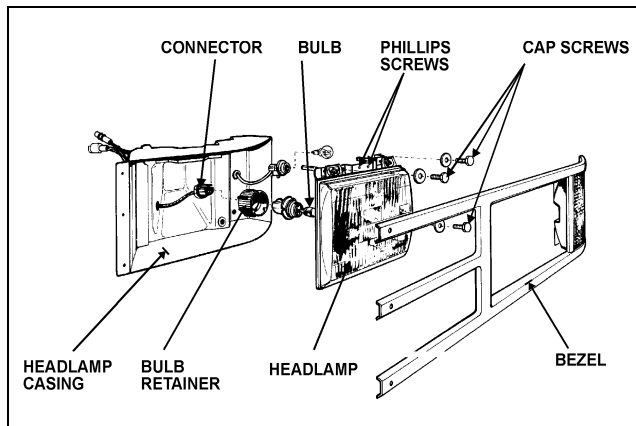


FIGURE 98: HEADLIGHT ASSEMBLY

06151

Note: Do not adjust headlight after a simple bulb replacement.

Note: Uses silicone (Prevost #680027) to seal the bezel.

12.2 Front Turn Signal

The front turn signal is a part of the front headlight cluster. The turn signal lens is located on each front corner and shares a common bezel with the headlights. Turn signal is visible from both front and side.

12.2.1 Bulb Removal and Replacement

Replace front turn signal bulb as follows:

1. Remove the "Phillips" screws attaching the headlight bezel, then remove it.
2. Remove socket from headlight bezel.
3. Pull the bulb out of the socket.
4. To reassemble front turn signal assembly, do the previous step of this procedure in a reverse sequence.

12.3 Stop, Tail, Rear Directional, Back-up, and Hazard Warning Lights

A combination stoplight, taillight, rear directional signal light and back-up light assembly is mounted on each side at rear of vehicle. Furthermore, when braking, a center stoplight will illuminate simultaneously with the stoplights for increased safety.

The stop, tail, directional signal and back-up lights consist of individual bulbs mounted in a common housing, and each light is serviced individually as a complete unit and need only to be plugged into or unplugged from socket after removing proper light lens.

The hazard warning flashing system uses simultaneously the front, side, and rear directional lights. This system is energized by a switch on the R.H. lower switch panel.

12.3.1 Bulb Removal and Replacement

1. Unscrew the retaining lens screws (2), then remove the lens.
2. Remove the bulb by pushing and twisting off from its socket.
3. Place the new bulb. To reassemble, do the previous step of this procedure in a reverse sequence.

Note: Taillights are provided with a different candle power bulb. Be sure to replace defective bulb by the appropriate one.

12.4 License Plate Light

Two sealed units are mounted above the rear license plate(s) of vehicle. In case of burn out, the sealed unit must be changed according to the following procedure (Fig. 99).

1. Pry out the rubber seal with a little screwdriver, then pull on the sealed unit and disconnect it.
2. Reconnect new sealed unit, place rubber seal, and press on it until it is seated in its former position.

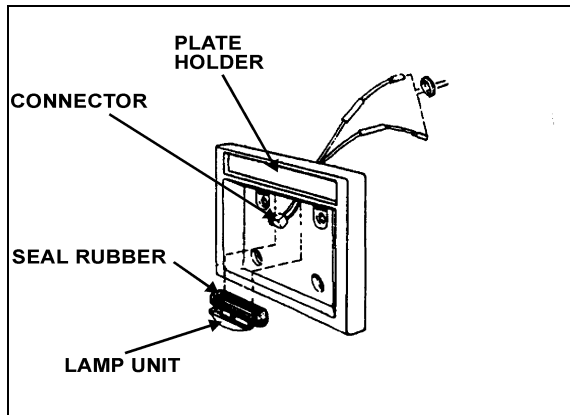


FIGURE 99: LICENSE PLATE HOLDER

06152

12.5 Clearance, Identification and Marker Lights - Bulb Removal and Replacement

XL vehicles are equipped with marker, identification and clearance lights. The clearance lights are mounted at each corner of the coach near the top and the identification lights in upper center of rear and front sections. They are red at the rear and yellow at the front.

The yellow marker lights are mounted along the sides of vehicle.

12.6 Marker / Side Directional Lights - Bulb Removal and Replacement

The side marker light and side directional light bulb should be replaced as per the following procedure (Fig. 100):

1. Unscrew both "Phillips" lens screws, then remove the lens.
2. Push in and twist off the bulb from its socket.
3. Place the new bulb.
4. Position lens on housing, then place and screw the "Phillips" screws.

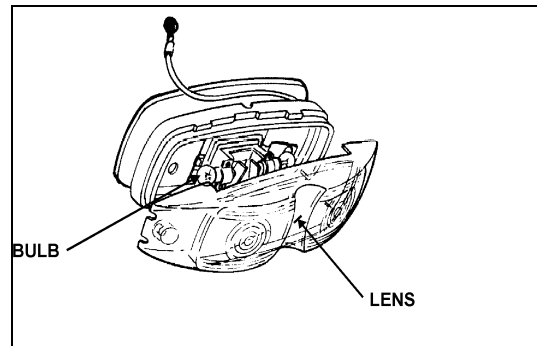


FIGURE 100: MARKER LIGHT / SIDE DIRECTIONAL LIGHT

06153

12.7 Clearance / Identification Lights - Bulb Removal and Replacement

Two types of clearance lights can be installed on your vehicle (type "A" & "B").

Replace type "A" bulb light as per the following procedure (Fig. 101):

1. Unscrew the "Phillips" lens screws. Remove the lens.
2. Pull the bulb straight out to remove it from its socket. Do not try to turn the bulb to remove it.
3. Place the new bulb by pushing it in socket.
4. Position lens on housing, then place and screw the "Phillips" screws.

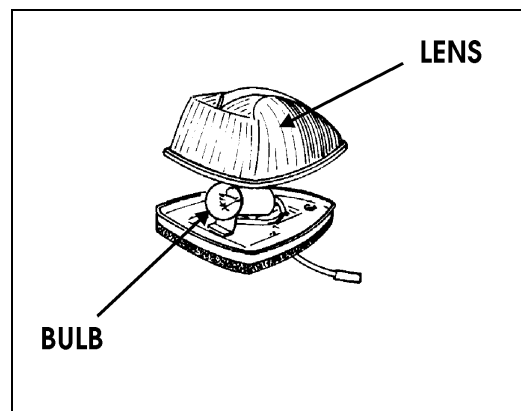


FIGURE 101: TYPE "A" LIGHT BULB

06154

Replace type "B" bulb light as per the following procedure (Fig. 102):

1. Unscrew both "Phillips" lens screws, then remove the lens and housing.
2. Twist the bulb socket and pull out.

3. Pull the bulb straight out to remove it from its socket. Do not try to turn the bulb to remove it.
4. Place the new bulb by pushing it in socket.
5. Position lens on housing, then place and screw the "Phillips" screws.

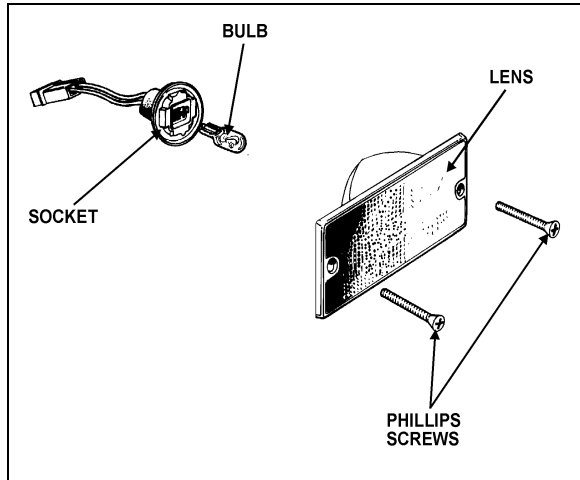


FIGURE 102: TYPE "B" LIGHT BULB 06155

Identification Bulb Removal and Replacement

Replace the identification light bulb as per the clearance bulb Removal and Replacement procedure of type "B".

12.8 Docking / Cornering Lights - Bulb Removal and Replacement

XL converted vehicles are provided with two halogen headlights that serve as cornering lights. They are mounted on the vehicle as follows: One is mounted on the front L.H. side steering compartment door, while the other is located on entrance door on the R.H. side.

Two additional halogen headlights are installed on both side off the vehicle (between drive wheels and the last baggage compartment). These lights are used as docking lights.

The main function of docking and cornering lights is to increase lateral visibility when turning a corner.

When the rocker switch located on console with central A/C system is set to the "Docking" position, the four (4) lamps light simultaneously in order to facilitate "Docking" procedure.

When the switch is set to the "Cornering" position and the left or right turn signal is selected, the

corresponding cornering light will illuminate to increase visibility.

Both docking and cornering headlights can be changed according to the following procedure (Fig. 103):

1. Unscrew the two "Phillips" screws of the retaining ring.
2. Disconnect the light unit connection.
3. Press on each tab of retaining clip, bring both tabs together, then lift the retaining clip.
4. Remove the bulb.
5. Position new bulb, place the retaining clip, then bring both tabs together; when the retaining clip is in position, release the tabs.

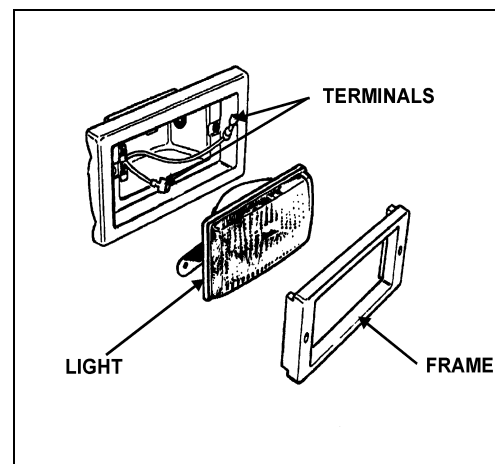


FIGURE 103: DOCKING AND CORNERING 06156

Caution: During this step, avoid contacting the bulb with your fingers, otherwise this could alter the bulb life.

6. Connect and then position the light unit.
7. Finally, place and screw the retaining ring.

12.9 Fog Light - Bulb Removal and Replacement

Optional halogen fog lights can be mounted on this vehicle to allow the driver a better visibility in foggy weather, or to improve the range of vision just ahead of the coach.

Replace fog lights as per the following procedure (Fig. 104):

Warning: Care should be taken when opening this compartment since bumper weighs 100 lb. (45 kg).

Caution: The two (2) bumper retaining bolts should be checked to make sure they are tightly fastened.

1. Carefully remove the large bolt at each end of the front bumper using the wheel nut wrench, then slowly lower down the front bumper.
2. Remove the cover on light unit (if so equipped), then unscrew the light unit retainer screw and slide upward the retainer.
3. Remove the light unit, then disconnect the light unit connection.
4. Move the tabs of retaining clip out of its notches, then lift the retaining clip and remove the bulb.
5. Place the new bulb, then replace the retaining tab of clip to its position into the notches.

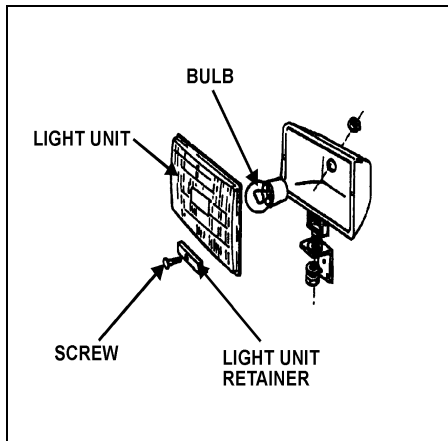


FIGURE 104: FOG LIGHT

06157

Caution: During this step, avoid contacting the bulb with your fingers, otherwise this could alter the bulb life.

6. Reconnect the light unit connection, then place the light unit to its proper position.
7. Replace the retainer and screw it.
8. Replace the light unit cover (if so equipped).

13. INTERIOR LIGHTING EQUIPMENT

13.1 Control Panels Lightning

The instrument gauges and switches mounted on all control panels are energized whenever the exterior light switch is pushed to the first position. A control dimmer located on the dashboard is used to vary progressively the brightness of the panel gauges switches and indicator lights as the control knob is rotated clockwise.

The gauge lights, panel lights, switch lights and indicator lights have a different bulb arrangement. Thus, the procedure to change a defective bulb can vary according to the application.

13.1.1 Switch Bulb Replacement

Replace switch light bulb as per following procedure (Fig. 105):

1. Remove the defective switch bulb control panel by removing "Phillips" screws.
2. The light bulb socket may be removed by pulling it away from behind control panel. Remove the defective bulb.
3. Push the new bulb into the socket to install it.
4. Place the light socket and push to its former position.
5. Replace the control panel.

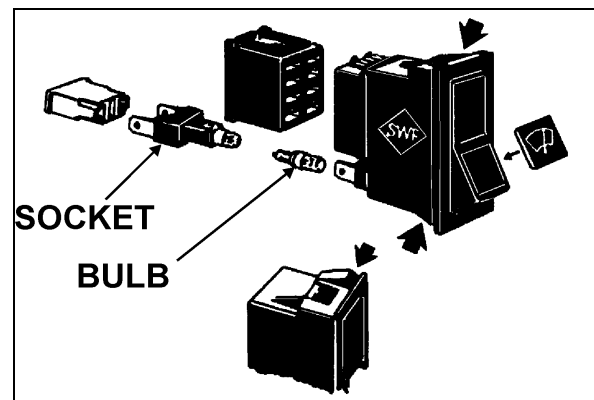


FIGURE 105: SWITCH

06092

13.1.2 Indicator Light Bulb Replacement

Replace indicator light bulb as per following procedure (Fig. 106):

1. Remove dashboard panel by removing the five (5) "Phillips" screws.
2. Locate the defective light.

3. Access bulb by pulling out socket while applying lateral pressure.
4. Pull out defective bulb from socket and replace it with a new one.
5. Replace socket in light housing.
6. Replace dashboard panel.

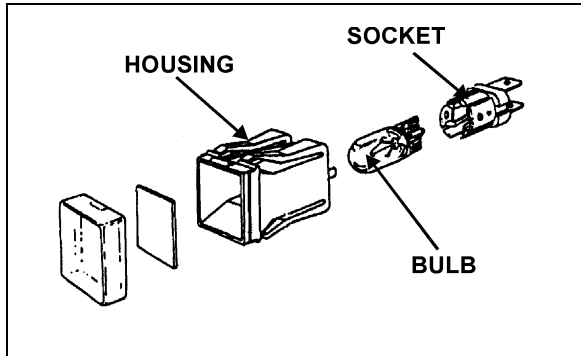


FIGURE 106: INDICATOR

06158

Note: The bulbs of the "Check engine" and "Stop engine" warning lights as well as those for the flasher indicator lights are 12 volts instead of 24 volts as in the case of all other indicator/warning lights.

13.1.3 Gauge Light Bulb Replacement

Replace gauge light bulb as per the following procedure (Fig. 107):

1. For any gauge light bulb replacement, the dashboard panel must be removed in order to have access to the rear of gauges.
2. Remove bulb socket from the gauge, turn the defective bulb counterclockwise and pull it out of the socket.
3. Push a new bulb into the socket and turn it clockwise to lock the bulb in place.
4. Replace bulb socket in gauge and replace the dashboard panel.

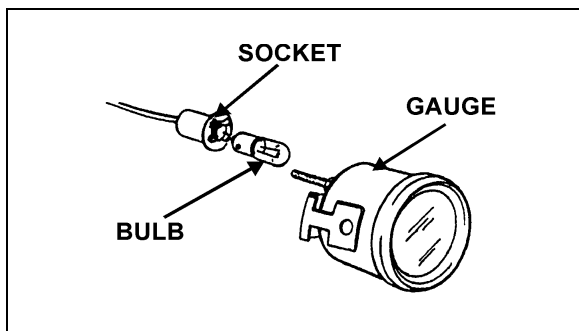


FIGURE 107: GAUGE LIGHT BULB

06159

13.1.4 Panel Light Bulb Replacement

Panel light bulbs are mounted on the R.H. console and serve to illuminate control switches such as the heating system control switches.

Replace the panel light bulb as per the following procedure:

1. Unscrew the bulb light holder from the console.
2. Remove the bulb light from its holder.
3. Place the new bulb into the holder, then screw in the holder on the console.

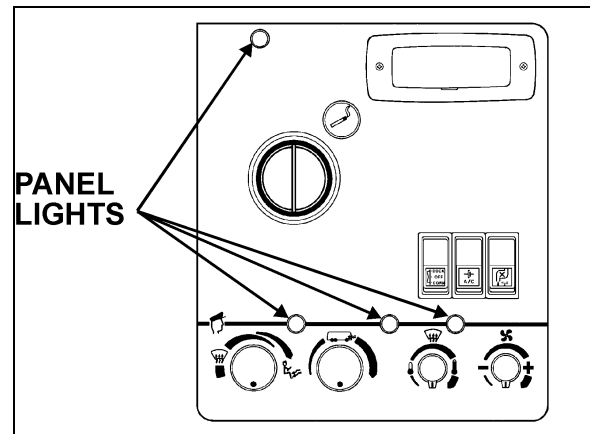


FIGURE 108: A/C STANDARD CONSOLE

06160

13.2 Stepwell Light

Stepwell lights are illuminated when the door opening system is activated. The light bulbs are accessible after removal of the light lens which is held to the housing with two Phillips-head screws.

13.2.1 Bulb Removal and Replacement

Replace stepwell lights bulb as per the following procedure (Fig. 108):

1. With the light lens removed, pull out bulb from the lamp while applying lateral pressure.
2. Place the new bulb into the lamp.
3. Place the light lens and screw it in place.

13.3 Dome, Rear Roof and Lavatory Lights

Two dome lights (each provided with two bulbs) are installed over the stepwell and in driver's compart-

ment. These lights are frequently used for nighttime operation when passengers board or leave coach.

This type of light is also install in the lavatory and on the rear roof.

13.3.1 Bulb Removal and Replacement

Replace dome, rear roof and lavatory lights bulb as per the following procedure:

1. Unsnap the lens with a flat head screwdriver and remove it.
2. Push and turn the defective bulb counterclockwise, then pull it out of the socket.
3. Place the new bulb, push and turn clockwise until it locks in position.
4. Replace the lens and snap it back in place.

13.4 Passenger Section Lightning

The passenger's section of vehicle is lighted by two types of fluorescent tube lamps installed on parcel racks. The aisle fluorescent lights are located on front of parcel racks, while fluorescent lights for general and in-station lighting are located under the parcel racks (Fig. 109). A dual power system is available for this lighting either from the 24 volt vehicle power supply or from a 110 volt outlet supply. In order to save batteries during extended periods of in-station lighting, no current is drawn from the batteries as soon as the 110 volt circuit is connected. Moreover, adjustable reading lamps are installed under parcel racks for passenger accommodation.

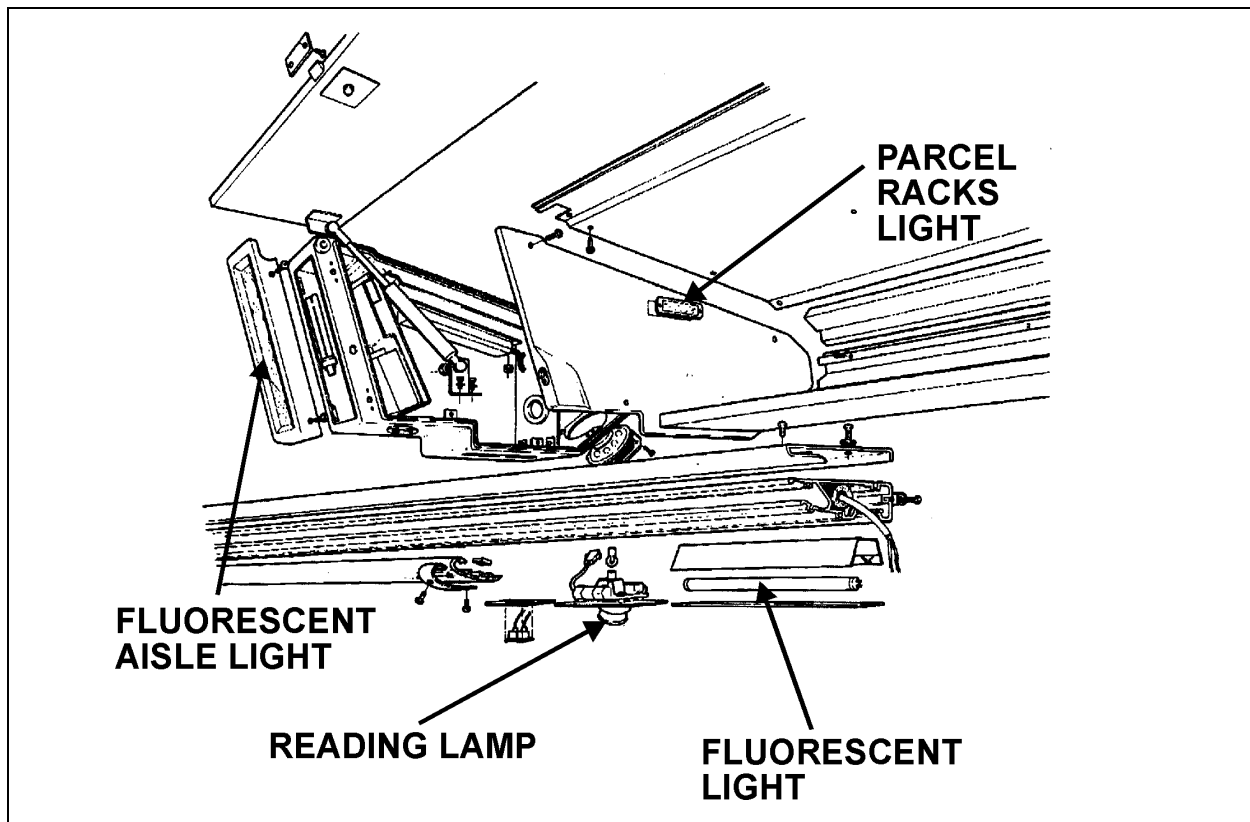


FIGURE 109: PARCEL RACK₀₆₀₉

13.4.1 Removal and Replacement of Aisle Fluorescent Light

Replace aisle fluorescent light as per the following procedure (Fig. 109):

1. Remove the front bezel by unscrewing the four "Phillips" side screws (two each side), then the lens.
2. Pull out the fluorescent from its base.
3. Place a new fluorescent and push on until the proper position is reached.
4. Replace lens bezel, and screw it.

13.4.2 Removal and Replacement of Fluorescent Light

Replace fluorescent light as per the following procedure (Fig. 109):

1. Push on the screen lens of fluorescent in order to unsnap it.
2. Rotate and pull out the fluorescent tube from its socket.
3. Place the new fluorescent tube and rotate the tube to secure it in its socket.

12.4.3 Reading Lamp - Bulb Removal and Replacement

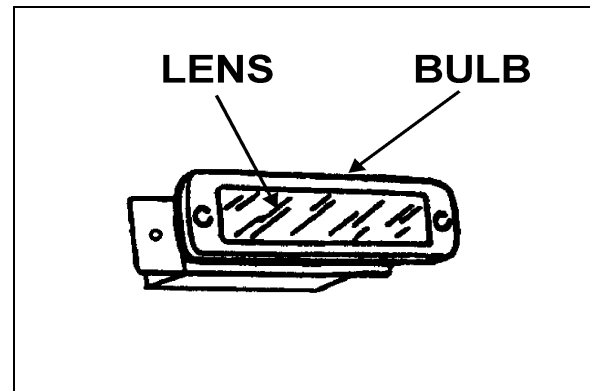
Replace reading lamp bulb as per the following procedure (Fig. 109):

1. Slide lightly the reading lamp and pull in order to unsnap it.
2. Turn over the reading lamp and unscrew both screws of the retaining socket support.
3. Push and turn bulb counterclockwise, then pull it out of the socket.
4. Place new bulb into the socket, then push and turn clockwise to lock bulb in position.
5. Place retaining socket support and screw in place.
6. Position the reading lamp and press until it snaps.

13.4.4 Parcel Rack / Lavatory Night Light - Bulb Removal and Replacement

Replace parcel rack bulb light and Lavatory night light bulb as per the following procedure (Fig. 109 and 110):

1. Unscrew the two (2) "Phillips" lens screws.
2. Push and turn the defective bulb counterclockwise, then pull it out of the socket.
3. Place the new bulb, push and turn clockwise until it lock in position.
4. Replace the lens on housing, then place and screw the "Phillips" screws.



06161

FIGURE 110: PARCEL RACK / LAVATORY NIGHT LIGHT

13.4.5 Lavatory "Occupied" Light - Bulb Removal and Replacement

Replace lavatory "occupied" light bulb as per the following procedure (Fig. 111):

1. Unsnap the lens with a flat head screwdriver and remove it.
2. Push and turn the defective bulb counterclockwise, then pull it out of the socket.
3. Place the new bulb, push and turn clockwise until it locks in position.
4. Replace the lens and snap it back in place.

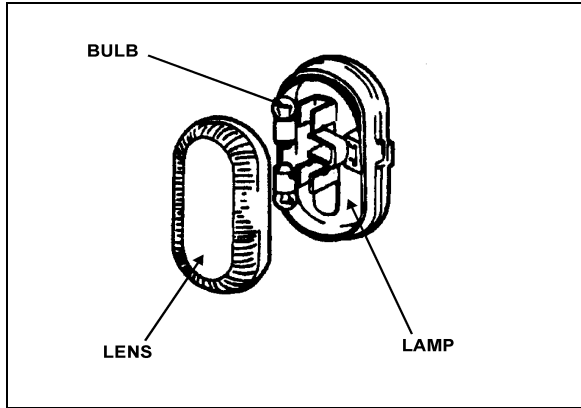


FIGURE 111: LAVATORY "OCCUPIED" LIGHT

06162

13.4.6 Emergency Exit Light - Bulb Removal and Replacement

This blue tinted light is located in the upper section of emergency side window.

Replace emergency exit light bulb as per the following procedure (Fig. 112):

1. (If applicable) remove the venetian blind by removing is four (4) "Phillips" screws.
2. Remove the plastic panel by unscrewing the five (5) "Phillips" screws.
3. Change the bulb.

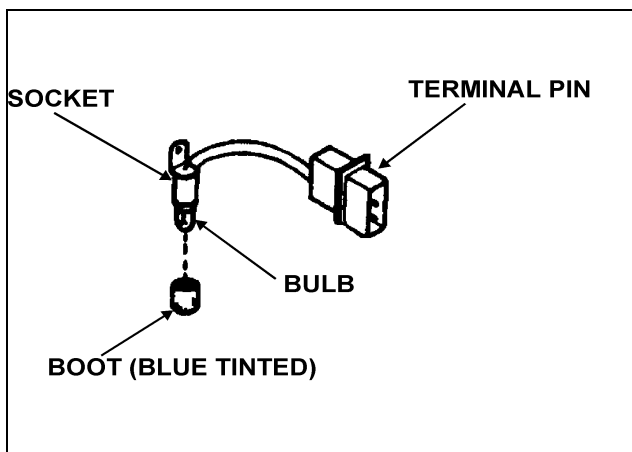


FIGURE 112: EMERGENCY EXIT LIGHT

06163

13.4.7 Destination Sign Light - Bulb Removal and Replacement

Replace destination sign light bulb as per the following procedure:

1. Raise the destination sign panel.
2. Push and turn the defective bulb counterclockwise, then pull it out of the socket.
3. Place the new bulb into the socket, then push and turn clockwise to lock bulb in position.

13.4.8 Destination Sign - Fluorescent Removal and Replacement

Replace destination sign fluorescent as per the following procedure:

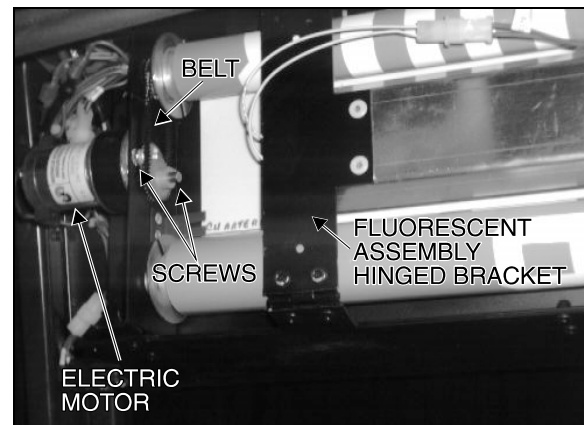


FIGURE 113: DESTINATION SIGN

23034

1. Remove the six Phillips-head screws and washers retaining the destination sign cover, then carefully remove the cover from its location.
2. Remove both Phillips-head screws, one on each fluorescent assembly hinged bracket (Fig. 8), then lower assembly.
3. Push on tab located on each fluorescent pin receptacle while removing fluorescent.
4. Install new fluorescent, then reinstall the assembly by reversing the above procedure.

13.4.9 Aisle Light - Bulb Removal and Replacement

To locate this type of light see under passenger seats. Replace aisle light bulb as per the following procedure (Fig. 113):

1. Remove the cap protector.
2. Pull out the defective bulb.
3. Place a new bulb and boot and push on until the proper position is reached.
4. Replace the cap protector.

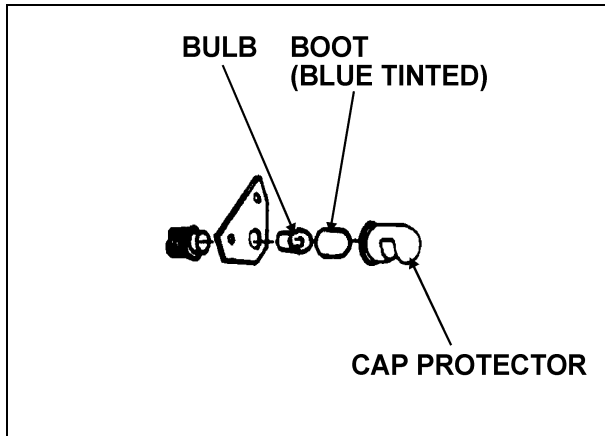


FIGURE 114: AISLE LIGHT

06164

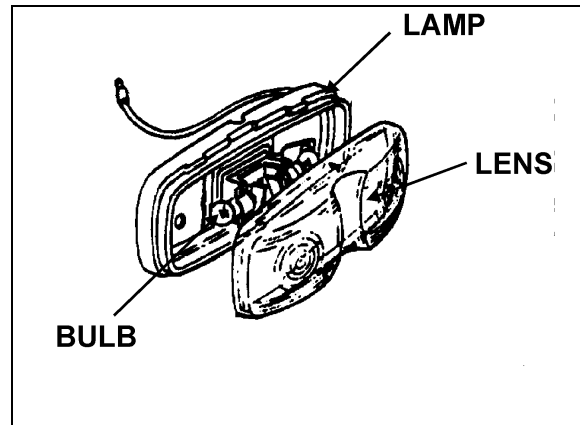
13.5 Engine and Front Electrical Compartment Lightning

A switch located on R.H. side of rear junction box can be used to actuate the engine compartment lights.

The front electrical compartment light is controlled by a microswitch upon opening of the door.

Each light is provided with two bulbs which can be replaced as follows (Fig. 114):

1. Remove the lens by the use of a flat screwdriver to pry the lens out.
2. Push and turn the defective bulb counterclockwise, then pull it out of the socket.
3. Place the new bulb into the socket, then push and turn clockwise to lock bulb in position.
4. Place the lens, and snap it in place.



06165

FIGURE 115: ENGINE AND FRONT ELECTRICAL LIGHT

13.6 Exterior Compartment Lights (Except Engine And Front Electrical Compartment)

Replace exterior compartment lights as per the following procedure:

1. Unscrew the two (2) "Phillips screws" located on both side of the bulb housing.
2. Push on both retaining bulb clips and remove the bulb.
3. Place new bulb between the retaining bulb clips.
4. Position housing, then place and screw the "Phillips" screws.

14. LIGHT BULB DATA

When replacing a light bulb, special attention must be paid to the voltage rating (refer to light bulb data hereafter).

Note: Note that all exterior lights are 12 volts, except exterior compartment which are 24 volts. All interior lighting are 24 volts, except for the "Check engine" and "Stop engine" warning lights and flasher indicator lights which are also on 12 volt system.

LIGHT BULB DATA							
APPLICATION	PREVOST PART NO.	TRADE OR SAE NUMBER	WATTS OR CANDLE POWER	VOLTS	QTY XL-40 COACH	QTY XL-45 COACH	QTY CONVERTED VEHICLE
EXTERIOR LIGHTING							
Headlight Hi/Lo	930291	9004	65 W/45 W	12	2	2	2
Docking & cornering	561882	H3(Osram)	55 W	12	---	---	4
Fog (Optional)	561882	H3(Osram)	55 W	12	2	2	2
License plate (sealed)	930266	---	12 W	12	2	2	2
Side directional	561917	1893	2 cp.	12	12	12	12
Side marker	561917	1893	2 cp.	12	12	12	12
Identification	562059	194	2 cp.	12	6	6	6
Clearance	562059	194	2 cp.	12	8	8	8
Front directional (hazard & marker)	562135	3057	32/3 cp.	12	2	2	2
Rear directional	560589	1156	32 cp.	12	8	8	8
Stop	560589	1156	32 cp.	12	8	8	8
Back-up	560589	1156	32 cp.	12	4	4	4
Center stop	560589	1156	32 cp.	12	2	2	2
Tail	560123	67	4 cp.	12	8	8	8
Exterior compartment (except engine)	562278	6429 (78207)	10 W	24	12	12	12
Engine compartment	560601	456	2 cp.	24	8	6	6
INTERIOR LIGHTING							

Section 6: ELECTRICAL SYSTEM

LIGHT BULB DATA							
APPLICATION	PREVOST PART NO.	TRADE OR SAE NUMBER	WATTS OR CANDLE POWER	VOLTS	QTY XL-40 COACH	QTY XL-45 COACH	QTY CONVERTED VEHICLE
Check engine	562048	E-9 (Norma)	2 W	12	1	1	1
Stop engine	562048	E-9 (Norma)	2 W	12	1	1	1
Flasher indicator	562048	E-9 (Norma)	2 W	12	2	2	2
Other indicator - 1/unit	562049	(Osram)	2 W	24	AR	AR	AR
Speedometer	560145	1829	1 cp.	24	2	2	2
Pyrometer (Opt)	560601	456	2 W	24	1	1	1
Tachometer	560145	1829	1 cp.	24	2	2	2
Turbo boost (Opt)	561167	3899 (Osram)	3 W	24	1	1	1
Tachograph (Opt)	561006	1-405-804	1.2 cp.	24	3	3	3
Other instrument - 1/unit	560144	1820	1.6 cp.	24	AR	AR	AR
Step	562278	6429 (78207)	10 W	24	3	3	3
Driver's area	561553	78236	10 W	24	4	4	4
Lavatory	561553	78236	10 W	24	2	2	---
Lavatory night light	560601	456	2 cp.	24	2	1	---
Lavatory "Occupied"	560702	1843	0.2 cp.	24	2	2	---
Parcel racks	560144	1820	1.6 cp.	24	14	12	---
"Emergency exit"	560601	456	2 cp.	24	20	14	---
Aisle	560141	1251	3 cp.	24	7	6	---
Switch 1/unit	561123	2741 (Osram)	1 W	24	AR	AR	---
Reading	562033	961-4940	8 W	24	AR	AR	---
Fluorescent	830102	F15T8 CW	15 W	---	27	21	---
Destination sign bulb	560141	1251	3 cp.	24	6	6	---

LIGHT BULB DATA							
APPLICATION	PREVOST PART NO.	TRADE OR SAE NUMBER	WATTS OR CANDLE POWER	VOLTS	QTY XL-40 COACH	QTY XL-45 COACH	QTY CONVERTED VEHICLE
Destination sign fluorescent tube	830120	F30TBCW4	20 W	24	1	1	---
Parcel rack front neon	830108	PL7	7 W	---	16	14	---
Rear roof	561553	78236	10 W	24	2	2	--
R.H. lateral console	562278	6429 (78207)	10 W	24	1	1	1

15. SPECIFICATIONS

BATTERY

Make	Delco-Remy
Model	1150
Type	Maintenance-free
Terminal type	Top Stud
Group size	31
Volts	12
Load test amperage *	290
Reserve capacity (minutes)	180
Cold cranking (in amps)	
- At 0 °F (-18 °C)	625 (each battery)
- At -20 °F (-29 °C)	490 (each battery)

Maximum dimensions (inches/mm)

- Length (including flange)	13.0/330,2
- Width	6.8/172,7
- Height (including top posts)	9.4/238,8
- Approximate weight (lb./kg)	60/27,2

* *Battery tester cable clamps should be between terminal nuts and lead pads of terminals. If not possible, load value should be 210 amperes.*

Torque specifications

Battery cable to post	10-15 lbf·ft (13-20 N·m)
Battery cover	45-50 lbf·in (5-6 N·m)

ELECTRICAL SYSTEM MONITOR

Make	Vanner
Model	EM-70
Input	24 V dc
System high	greater than 30 V dc
System low	less than 24 V dc
Trip level	± 0.75 V dc
Prévost number	562058

ALTERNATOR 24V.-270 AMPS

Make	Delco-Remy
Model Number	1117863
Prévost Number	562235

ALTERNATOR 12V.-300 AMPS

Make	Delco-Remy
Model Number	1117860
Prévost Number	562355

ALTERNATOR 24V.-75 AMPS

Make	Delco-Remy
Model Number	19010000
Prévost Number	562326

ALTERNATOR 12V.-130 AMPS

Make	Delco-Remy
Model Number	1117921
Prévost Number	561265

REGULATOR

Make	Delco-Remy
Model Number	1118447
Type	Transistor

Voltage adjustment	External screw
Prévost Number	560030

BATTERY EQUALIZER (50 AMPS)

Make	Vanner
Model	60-50A
Amperes	50 amps
Prévost Number	561016

BATTERY EQUALIZER (100 AMPS)

Make	Vanner
Model	60-100C
Amperes	100 amps
Prévost Number	562332

STARTING MOTOR

Make	Delco-Remy
Model Number	1990269
Series	50 MT
Type	400
Rotation (viewing drive end)	CW
Brush tension	5 lb. (2,2 kg) Min.
Voltage	24

No-load test

- Volts	23
- Min. current draw	60 amperes
- Max. current draw	90 amperes
- Min. rpm	7000 rpm
Prévost Number	510485

STARTING MOTOR SOLENOID

Make	Delco-Remy
Model Number	1115557
Current Draw 80 °F (27 °C)	
- Hold-in winding	7.35 - 8.2 amps
- Pull-in winding	48 - 54.5 amps
Volts	24

SECTION 07: TRANSMISSION

CONTENTS

1. DESCRIPTION	7 - 3
1.1 Manual Transmission	7 - 3
1.2 Automatic Transmission.....	7 - 3
1.2.1 Retarder.....	7 - 3
2. WELDING PROCEDURES	7 - 3
3. MAINTENANCE.....	7 - 4
3.1 Manual Transmission.....	7 - 4
3.1.1 Oil Recommendations	7 - 4
3.1.2 Oil Check.....	7 - 4
3.1.3 Oil Change.....	7 - 5
3.1.4 Metal Particles	7 - 5
3.2 Automatic Transmission.....	7 - 5
3.2.1 Cold Check	7 - 6
3.2.2 Hot Check.....	7 - 6
3.2.3 Readout of the Oil Level Sensor	7 - 7
3.2.4 Keeping Oil Clean.....	7 - 7
3.2.5 Oil Recommendations	7 - 8
3.2.6 Oil Contamination	7 - 9
3.2.7 Metal Particles	7 - 9
3.2.8 Coolant Leakage	7 - 9
3.2.9 Oil and Filter Change.....	7 - 9
4. GEAR SHIFT LINKAGE (Manual Transmission).....	7 - 10
4.1 Adjustment.....	7 - 10
4.2 Lubrication.....	7 - 11
5. TRANSMISSION REMOVAL	7 - 11
5.1 Automatic Transmission	7 - 11
5.2 Manual Transmission.....	7 - 12
6. MANUAL TRANSMISSION DISASSEMBLY AND REASSEMBLY	7 - 13
7. CLEANING AND INSPECTION OF THE TRANSMISSION.....	7 - 13
7.1 Automatic Transmission.....	7 - 13
7.1.1 Breather	7 - 13
7.2 Manual Transmission.....	7 - 13
7.2.1 Cleaning.....	7 - 13
8. TRANSMISSION INSTALLATION	7 - 13
8.1 Automatic Transmission	7 - 13
8.2 Manual Transmission.....	7 - 15
9. ALLISON TRANSMISSION PRINCIPLES OF OPERATION.....	7 - 16
10. TROUBLESHOOTING	7 - 16
10.1 Manual Transmission.....	7 - 16
10.2 Automatic Transmission.....	7 - 16
10.2.1 Diagnostic Code Memory.....	7 - 16
11. SPECIFICATIONS.....	7 - 31

LIST OF ILLUSTRATIONS

FIG. 1: PLUGS.....	7 - 4
FIG. 2: OIL LEVEL DIPSTICK (AUTO. TRANS.).....	7 - 5
FIG. 3: DIPSTICK	7 - 6
FIG. 4: PLUG AND FILTERS	7 - 10
FIG. 5: GEAR SHIFT LINKAGE	7 - 10
FIG. 6: NUT TOLERANCE	7 - 14
FIG. 7: AIR PRESSURE REGULATOR.....	7 - 15

1. DESCRIPTION

XL vehicles may be provided with either a manual or an automatic transmission.

1.1 Manual Transmission

The Spicer PS130-6B, 6-speed, has 6 forward speeds and 1 reverse speed.

The Spicer PS145-7A, 7-speed, has 7 forward speeds and 1 reverse speed.

1.2 Automatic Transmission

The B500(R) World Transmission has 6 speeds with two top range (fifth and sixth) overdrives. Total coverage is determined by dividing the highest gear ratio by the lowest gear ratio. Total coverage expresses the transmission gear ratio versatility. Transmissions with larger total coverage number have a wider variety of available ratios.

An electronic control allows the transmission to shift at exactly the right point on the engine's fuel consumption curve for best economy. Early lockup maintains the highest possible mechanical efficiency through the closely-spaced gear steps, culminating in two overdrive ratios. This combination allows progressive shifting techniques, where engine speeds are reduced for higher efficiency and lower fuel consumption.

Gear selection and torque converter modes are controlled by a microcomputer-based electronic transmission management system. It is fed information regarding throttle position, operator range selection, engine speed, turbine speed, transmission output speed and various system pressures from special electronic sensors. With this information, it computes shift points and clutch pressures to meet immediate needs. Using closed loop adaptive logic, the electronic control looks at a number of parameters during the shift, and makes minute adjustments to match the shift to desired profile stored in its memory. It then looks at these adjustments and resets the parameters which allow the transmission to quickly

compensate for variations in load, terrain or environment, and to adjust for clutch wear and engine power changes. A Diagnostic Data Reader can be connected to the electronic control unit to provide a self-check of all systems in the transmission. Four-digit trouble codes greatly reduce the time it takes to pinpoint potential problems. (Refer to heading "10. TROUBLESHOOTING" in this section).

1.2.1 Retarder (if applicable)

This optional auxiliary braking device for the automatic transmission is integrated into the basic envelope of the transmission and transmits its braking force directly to the propeller shaft. It requires no additional length and adds only 75 pounds (34 kg) of weight. Operation of the retarder is controlled electronically by the driver's use of the brake and/or by hand control lever. When activated, fluid enters a cavity and provides resistance to the turning of rotor blades revolving with the output shaft. This effectively slows the vehicle to the point where the service brakes are needed only for final stopping. The retarder is fully modulated and is compatible with ABS.

2. WELDING PROCEDURES

These procedures are intended only for vehicles equipped with transmission electronic controls. When frame or other welding is required on the vehicle, the following precautions are to be taken to protect the electronic control components:

1. Disconnect the wiring harness connectors at the transmission electronic control unit.
2. Disconnect the positive and negative battery connections, and any electronic control ground wires connected to the frame or chassis.
3. Cover electronic control components and wiring to protect them from hot sparks, etc.
4. Do not connect welding cables to electronic control components.

3. MAINTENANCE

3.1 Manual Transmission

3.1.1 Oil Recommendations

The following lubricants are recommended in order of preference.

TEMPERATURE	GRADE	TYPE
Above 0°F (-18°C) Below 0°F (-18°C)	SAE 30, 40, or 50 SAE 30	Heavy Duty Engine Oil meeting MIL-L-2104D or MIL-L-46152 B, API-SF or API-CD specifications (MIL-L-2104 B & C, OR 46152 are also acceptable)
Above 0°F (-18°C) Below 0°F (-18°C)	SAE 90 SAE 80	Straight Mineral Gear Oil R & O Type API-GL-1
Above 0°F (-18°C) Below 0°F (-18°C)	SAE 90 SAE 80	* Mild EP Gear Oil MIL-L-2105 or API-GL-4
All	CD SAE 50 CD SAE 30	Synthetic Engine Oil meeting MIL-L-2104 D or MIL-L-46152 B, API-SF or API-CD specifications
All	EP SAE 75W90 EP SAE 75W140	* Synthetic Gear Oil meeting MIL-L-2105C or API-GL5 specifications

*EP gear oils are not recommended when lubricant operating temperatures are above 230°F (110°C).

3.1.2 Oil Check

Manual transmission oil should be checked when engine is stopped and cold. Check level, and add if necessary, every 6,250 miles (10 000 km) or twice a year, whichever comes first.

Warning: Before servicing the coach, park safely over a repair pit, apply parking brake, stop engine and set main battery disconnect switch (XL-40) or battery master switch (XL-45) to the "OFF" position.

Unscrew the fill plug and check if the oil level is at plug thread level (Fig. 1).

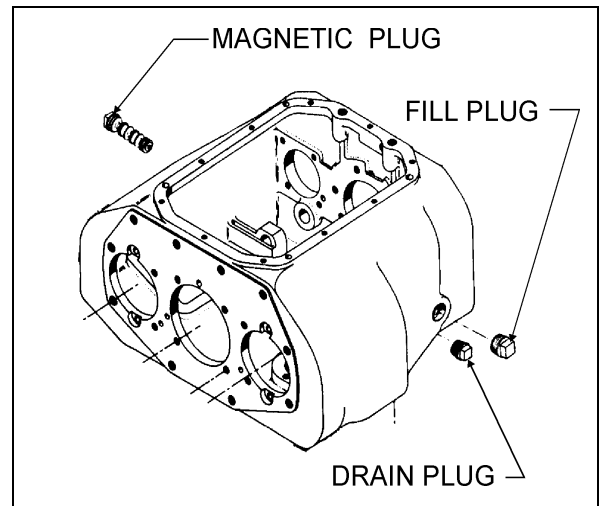


FIGURE 1: PLUGS

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3.1.3 Oil Change

OIL CHANGE INTERVALS
Change break-in oil after 3,000 miles (4 800 km) of initial operation, then every 50,000 miles (80 000 km) or once a year, whichever comes first.

Drain manual transmission as follows :

1. Unscrew the drain plug (Fig.1) and allow the oil to drain into a suitable container.
2. Inspect plug and replace if necessary. Reinstall plug.

Refill manual transmission as follows :

1. Remove fill plug.
2. Add oil until it overflows through fill plug opening.
3. Clean oil from the transmission case and the fill plug.
4. Reinstall plug.

Caution: Do not overfill transmission. Oil breakdown due to excessive heat and/or sludge deposits impairing proper operation of transmission may result.

3.1.4 Metal Particles

The magnetic plug attracts metal particles. When metal particles are of abnormal size, the transmission must be disassembled. See Spicer "Service Manuals" annexed to this section.

3.2 Automatic Transmission

To gain access to the dipstick, open the engine compartment rear door; dipstick is located on your L.H. side (Fig. 2).

To check the transmission oil level, a cold check and a hot check must be performed. A cold check must be made between 60°F (16°C) and 140°F (60°C). The transmission oil temperature gauge indicates the operating temperature; it is located on the central dashboard.

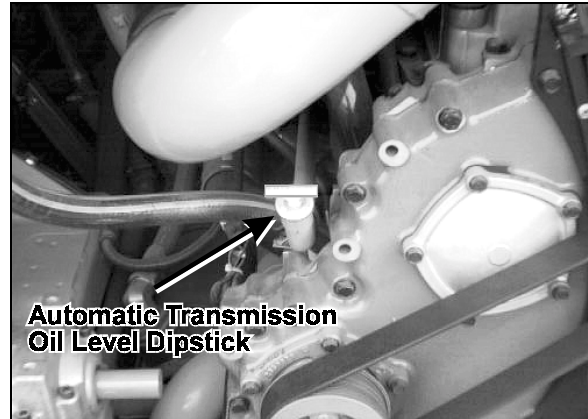


FIGURE 2: OIL LEVEL DIPSTICK

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Note: Perform the cold check first to verify the transmission oil level before performing the hot check.

The hot check can be performed when the transmission oil reaches the normal operating temperature of 160°F (71°C) to 200°F (93°C).

Clean all dirt from around the end of the oil fill tube before removing the dipstick. Dirt or foreign matter must not be permitted to enter the oil system since it will cause valves to stick, undue wear of transmission parts, and clogged passages. Check the oil level in accordance with the following procedures and record any abnormal level on your "Maintenance Records".

Warning: When checking the oil level, be sure that the parking brake and/or emergency brakes are set and properly engaged, and the wheels are chocked. Unexpected and possible sudden vehicle movement may occur if these precautions are not taken.

Special care must be taken not to touch the engine coolant tubing and/or exhaust pipe, since this could cause severe burns.

Section 07: TRANSMISSION

Do not wear loose clothing and, stay away from rotating parts during procedure; personal injury could occur.

Always check the oil level reading at least twice when the engine is running. Consistency is important in maintaining the accuracy of the reading. If inconsistent readings persist, check the transmission breather to ensure it is clean and free of debris.

3.2.1 Cold Check

The purpose of the **Cold Check** is to determine if the transmission has enough fluid to be operated safely until a **Hot Check** can be made.

1. If the engine has been shut down for an extended period of time, park the vehicle on a level surface and apply the parking brake.

Caution: *The oil level rises as sump temperature increases. DO NOT fill above the "Cold Run" band if the transmission oil is below normal operating temperature.*

2. Run the engine for at least one minute. Shift to Drive (D) and operate the engine for 30 seconds at 1000-1500 rpm; then shift to Reverse (R) to clear the hydraulic system of air. Then shift to Neutral (N) and allow the engine to idle (500 - 800 rpm).
3. While the engine is running, remove the dipstick from the tube and wipe it clean (Figs. 2 & 3).

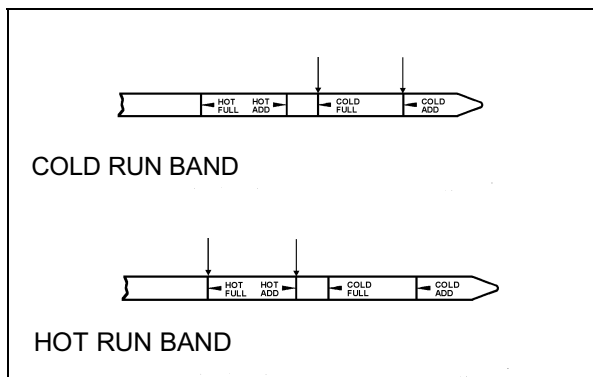


FIGURE 3: DIPSTICK

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4. Insert the dipstick into the tube and then remove, checking the oil level reading (Fig. 3). Repeat the check procedure to verify the reading. If the oil reading is within the "Cold Run" band, the level is satisfactory for operating the transmission until the oil is hot enough to perform a "Hot Run" check. If the oil reading is not within the "Cold Run" band, add or drain oil as necessary to bring the level within the "Cold Run" band.
5. Perform a **Hot Check** at the first opportunity after the normal operating temperature of 160°F (71°C) to 200°F (93°C) is attained.

Caution: *An accurate fluid level check cannot be made unless the engine is idling (500-800 rpm) in Neutral, the transmission fluid is at the proper temperature, and the vehicle is on a level surface.*

3.2.2 Hot Check

Caution: *The oil must be hot to ensure an accurate check for this procedure. The oil level rises as temperature increases.*

1. Operate the transmission in Drive (D) range until normal operating temperature is reached 160°F (71°C) to 200°F (93°C).
2. Park the vehicle on a level surface and shift to Neutral (N). Apply the parking brake and allow the engine to idle (500 - 800 rpm).
3. While the engine is running, remove the dipstick from the tube and wipe it clean.
4. Insert the dipstick into the tube and then remove, checking the oil level reading. Repeat the check procedure to verify the reading.

The safe operating level is anywhere within the "Hot Run" band on the dipstick (Fig. 3).

- If the oil level is not within the "Hot Run" band, add or drain oil as necessary to bring the oil level within the band.

Note: The Cold Check is more appropriate for verifying the oil level after the first fill-up. In case of conflict, the Hot Check has priority over the Cold Check; the automatic system of verification via the shift selector has priority over the Hot Check.

3.2.3 Readout of the Oil Level Sensor

The Oil Level Sensor (OLS) is designed to measure transmission oil level only when the following combination of operating conditions exist:

- Engine must be at idle;
- NEUTRAL** must be selected;
- Zero output speed;
- Transmission oil must be within a "normal" temperature band (160-250°F; 70-120°C); and
- Once the first four (4) conditions are met, there must be a "waiting" period (approx. 2 min., to facilitate consistent oil drainback) before oil level measurement begins.

To enter OLS readout mode (after meeting the conditions noted above), simultaneously press the UPSHIFT and DOWNSHIFT arrows on the shifter.

If the five (5) conditions noted above are present, the display will immediately enter the reading mode. If the "waiting" period has not elapsed, the left digit of the display will become a "chasing" digit and the right digit will count down from (8) to (1) until the waiting period is complete.

After attaining the reading mode, the display will flash "OL-OK", "LO-01", "HI-02", etc., where the suffix "01" or "02" indicates the volume of oil (in quarts) either low or high.

At any time in this sequence, simultaneously pressing the UPSHIFT and DOWNSHIFT arrows

directs the ECU to enter the transmission diagnostic mode as described under "10. Troubleshooting" in this section. D, N, or R may also be selected on the shifter at any time - the OLS mode will abort and normal transmission will commence. Shifts are not inhibited.

Oil Level Sensor (OLS) Codes

<u>CODE</u>	<u>CAUSE OF CODE</u>
OL-OK	Oil Level Is Correct
LO-01	One Quart Low
LO-02	Two Quarts Low
HI-01	One Quart High
HI-02	Two Quarts High
OL-50	Engine Speed (RPM) Too Low
OL-59	Engine Speed (RPM) Too High
OL-65	Neutral Must Be Selected
OL-70	Sump Oil Temperature Too Low
OL-79	Sump Oil Temperature Too High
OL-89	Output Shaft Rotation
OL-95	Sensor Failure

3.2.4 Keeping Oil Clean

Oil must be handled in clean containers, fillers, etc., to prevent foreign material from entering the transmission. Place the dipstick in a clean surface area while filling the transmission.

Caution: Containers or fillers that have been used to handle antifreeze or engine coolant must NEVER be used for handling transmission fluid. Antifreeze and coolant solutions contain ethylene glycol which, if introduced into the transmission, can cause the clutch plates to fail.

3.2.5 Oil Recommendations

Hydraulic oils used in the transmission have an important influence on transmission reliability and durability. In order of preference DEXRON-III and DEXRON-IIIE, MIL-L-2104D, and type C-4 oils (Allison approved SAE 10W or SAE 30) are recommended. Type C-4 oil is the only oil approved for use in off-highway applications. Use type SAE 30 where ambient temperature is consistently above 86°F (30°C). Some DEXRON-II oils are also qualified as type C-4 oils and may be used in off-highway applications. However, a DEXRON-II fluid which is not a qualified type C-4 oil must never be used in off-highway applications. Consult your local Allison dealer or distributor to determine if a DEXRON-II oil is also a qualified type C-4 oil.

Before using type C-4 oils, consult the vehicle manufacturer to ensure that materials used in tubes, hoses, seals, etc., are compatible with type C-4 oils. Also, consult your local Allison dealer or distributor to determine if the oil you have selected is an approved type C-4 oil. Ford Motor Company specification oils M2C33-F, M2C138-CJ and M2C166-H may be used and may be intermixed with DEXRON-II oil.

OIL SPECIFICATIONS AND AMBIENT TEMPERATURE OPERATING CONDITIONS	
Oil type	Ambient temperature
MIL-L-2104D, DEXRON-II, C-4	120°F (48°C) to -25°F (-32 °C)
MIL-L-46167	-25°F (-32°C) to -60°F (-51°C)

The use of an arctic preheat kit is recommended at temperatures below -25°F (-32°C). If a preheat kit is not available, the ECU will restrict full operation until the sump temperature is increased. The chart below shows the temperature ranges in which the transmission will operate. It should be noted that at lower sump temperature, the transmission's operation may be restricted.

Transmission Oil Temperature	"DO NOT SHIFT" Light	Operation
Below -26°F (-32°C)	ON	Neutral only
-24°F (-31°C) to +19°F (-7°C)	OFF	Start with neutral and reverse, normal upshifts
+20°F (-6°C) to 260°F (126°C)	OFF	Full operation in all ranges
Above 260°F (126°C)	ON	Inhibits 5th and 6th ranges

3.2.6 Oil Contamination

At each oil change, examine the drained oil for evidence of dirt or water. A nominal amount of condensation will emulsify during operation of the transmission. However, if there is evidence of water, check the cooler (heat exchanger) for other signs of leakage. This, however, may also indicate leakage from the engine oil system.

3.2.7 Metal Particles

Metal particles in the oil (except for minute particles normally trapped in the oil filter) indicate damage has occurred in the transmission. When these particles are found in the sump, the transmission must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the transmission and cleaning of all internal and external circuits, coolers, and all other areas where the particles could lodge.

Caution: *If excessive metal contamination has occurred, replacement of the oil cooler and replacement of all bearings within the transmission is recommended.*

3.2.8 Coolant Leakage

If engine coolant leaks into the transmission oil system, immediate action must be taken to prevent malfunction and possible serious damage. The transmission must be completely disassembled, inspected, and cleaned. All traces of the coolant contamination must be removed. Friction clutch plates contaminated with ethylene glycol must be replaced.

3.2.9 Oil and Filter Change

Transmission oil change must be performed with the vehicle on a flat and level surface and with parking brake applied. Oil and oil filter change frequency is determined by the severity of service and operating conditions of the transmission and by the filter equipment installed. See "Table 1" for oil and filter change intervals.

More frequent changes may be required when operations are subject to high levels of contamination or overheating.

TABLE 1: OIL AND OIL FILTER CHANGE INTERVALS

Change break-in oil after 3,000 miles (4 800 km) of initial operation and subsequently every 25,000 miles (40 000 km) or once a year, whichever comes first.
--

The procedure for changing the transmission oil filters is as follows:

Drain

1. The transmission should be at an operating temperature of 160°F (71°C) to 200°F (93°C) when the oil is drained. This will ensure quicker and more complete fluid drainage.
2. Remove the drain plug from under the transmission (Fig. 4) and allow the oil to drain into a suitable container. Check the condition of the oil as described previously.
3. To replace the integral filters, remove twelve bolts (6 on each cover), two filter covers, two O-rings, two square cut seals and the two filters from the bottom of the control module (Fig. 4).
4. To install filters, pre-lube and install the two O-rings, the two square cut seals followed by the filters (lube the O-ring in filter cartridge only) into the filter compartment. Index each filter/cover assembly to holes in channel plate/sump. Push the cover assembly in by hand to seat the seals.

Caution: *Do not use bolts to draw the cover to sump. This can damage the cover, seal, or sump.*

5. Install twelve bolts and both covers, and then tighten to 38-45 lbf•ft (51-61 N•m).
6. Inspect the drain plug and O-ring. Replace if necessary. Reinstall the drain plug and tighten to 18-24 lbf•ft (25-32 N•m).

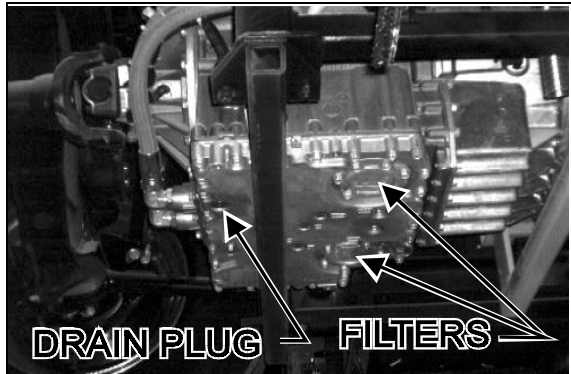


FIGURE 4: PLUG AND FILTERS

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Refill

Refill with 37 US qts (39 liters) and check the oil level using the previously described procedure. The refill amount is less than the initial fill because some of the oil remains in the external circuits and transmission cavities.

4. GEAR SHIFT LINKAGE ADJUSTMENT (Manual Transmission)

4.1 Adjustment

1. Put the transmission lever in "NEUTRAL" position.
2. Loosen nuts (1, Fig. 5) and nuts (2, Fig. 5).
3. Adjust the gear shift lever in neutral position:
 - a. Put the shifter lever in first gear and measure the distance A on the gear shaft (Fig. 5).
 - b. Put the shifter lever in second gear and measure the distance B on the gear shaft (Fig. 5).
4. Put the shifter lever in neutral. (The middle position between points A and B is the "NEUTRAL FRONT REAR" position).
5. Hold the lever at approximately 2 1/2" from the seat transverswise.
6. Adjust tolerance at shift lever pivot to the 1-1/5" (31 mm).
7. Rotate the rear shaft "C" to get the rear U-joint "D" at horizontal position.
8. Tighten all loose nuts (1) and (2).

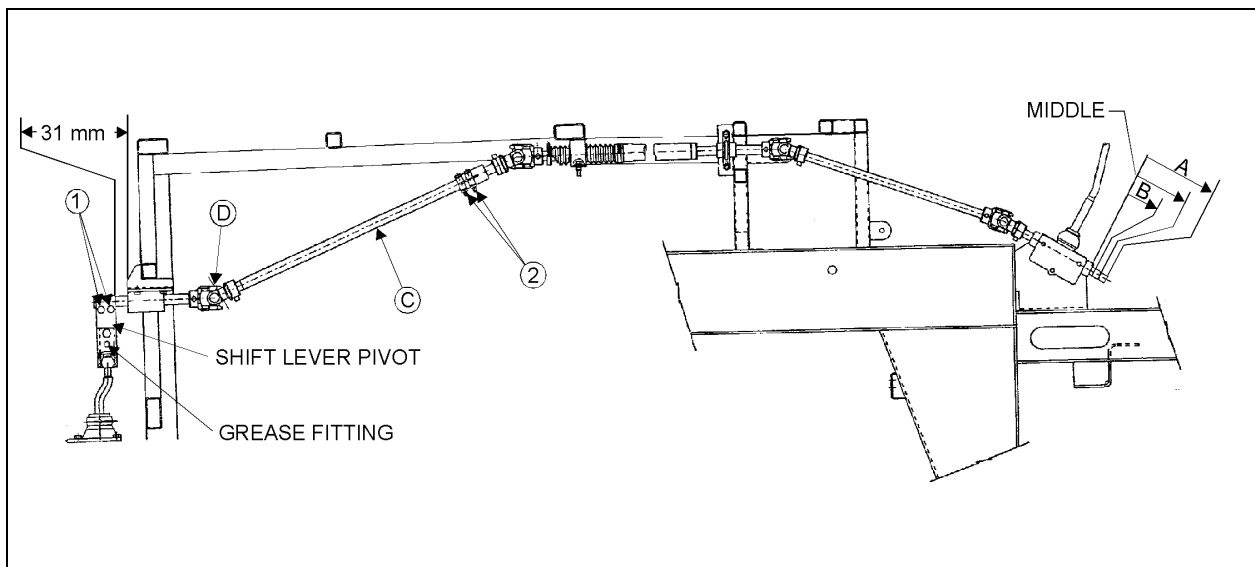


FIGURE 5: GEAR SHIFT LINKAGE

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4.2 Lubrication

Grease with good quality lithium-base grease NLGI No. 1 (Fig. 5):

- The shift lever pivot: service every 6,250 miles (10 000 km), grease 1 fitting.
- Shift control rod universal joints: service every 25,000 miles (40 000 km); grease 4 fittings.

Only during disassembly: grease the following with NLGI No. 1:

1. The shift lever housing;
2. Transmission lever ball; and
3. Axle bearing.

5. TRANSMISSION REMOVAL

5.1 Automatic Transmission

The following procedure deals with the removal of the transmission without removing the power plant cradle from vehicle. The methods used to support the transmission and engine depend upon conditions and available equipment.

1. Select transmission's "NEUTRAL" position, apply parking brake, then set main battery disconnect switch (XL-40) or battery master switch (XL-45) to the "OFF" position.
2. Jack up vehicle, then place safety supports underneath body.

Caution: *Only the recommended jacking points must be used as outlined in Section 18, "BODY".*

Note: *For more clearance between the tag axle and transmission, the tag axle may be unloaded and jacked up or retracted (if applicable).*

3. Remove engine splash guards surrounding transmission.

4. Remove cross member from under transmission.
5. Remove the transmission drain plug and allow oil to drain. Inspect the drain plug washer and replace it if necessary. Reinstall the drain plug and tighten to 33-41 lbf•ft (45-56 N•m) (see "3.2.9 Oil and Filter Change" in this section.

Warning: *It is better to drain oil when it is still warm. Avoid contact with oil since it can be very hot and cause personal injury.*

6. Remove transmission dipstick and filler tube.
7. Disconnect propeller shaft from transmission and remove its safety guard. Refer to Section 09, "PROPELLER SHAFT".
8. Disconnect the two oil cooler hoses from transmission. Cover hose ends and fittings to prevent fluid contamination.

Warning: *A significant amount of oil may drain from oil lines when they are disconnected.*

9. Disconnect all sensors on L.H. side of the transmission.
10. Disconnect main wiring harness.
11. Disconnect the air supply line (steel-braided hose) from retarder control valve (if applicable).
12. Remove any locking tie, clamp and bracket that may interfere with the removal of transmission.
13. Support transmission using a suitable transmission jack.

Section 07: TRANSMISSION

14. Remove the access plug from the flywheel housing on the R.H. side below starter. From access plug, remove the 12 converter-to-flexible plate attaching screws. Turn the converter to gain access to the attaching screws.

Caution: *Do not rotate crankshaft counterclockwise to avoid loosening the crankshaft pulley retaining screw.*

15. Remove the 12 screws retaining the torque converter housing to the flywheel housing.

Caution: *Make sure transmission-to-engine alignment is maintained when removing screws to avoid damaging torque converter housing.*

16. Remove the transmission rubber mount above transmission by removing the nut, bolt and washer over the rubber and its support. Remove the bracket from transmission (only if the vehicle is equipped with a retarder).
17. Slowly pull transmission straight out to clear engine.
18. Remove the transmission.

5.2 Manual Transmission

The following procedures deal with the removal of the transmission without removing the power plant cradle from vehicle. The method used to support the transmission depends upon conditions and available equipment.

1. Set transmission shift lever to "Neutral" position, apply parking brake, then set main battery disconnect switch (XL-40) or battery master switch (XL-45) to the "OFF" position.
2. Jack up vehicle, then place safety supports underneath body.

Caution: *Only the recommended jacking points must be used as outlined in Section 18, "Body".*

Note: *For more clearance between the tag axle and transmission, the tag axle may be unloaded and jacked up or retracted (if applicable).*

3. Remove engine splash guards surrounding transmission.
4. Remove cross member from under transmission.
5. Remove the transmission drain plug and allow oil to drain. Reinstall drain plug.

Warning: *It is better to drain oil when it is still warm. Avoid contact with oil since it can be very hot and cause personal injury.*

6. Disconnect propeller shaft from transmission and remove its safety guard. Refer to Section 09, "PROPELLER SHAFT".
7. Remove fiberglass transmission protection.
8. Disconnect gear shift linkage as follows:
 - a. Remove the two bolts that secure the coupling lever to the shift rod (1, Fig. 5).
 - b. Push the shift rod all the way into bushing.
9. Remove return spring and disconnect yoke. Remove clutch slave cylinder from transmission without disconnecting hoses.
10. Disconnect speedometer sensor, back-up signal switch and neutral start switch.

Note: *Removing clutch slave cylinder will enable the release yoke to turn up and pull free from the release bearing thrust pads.*

11. Remove any locking tie, clamp and bracket that may interfere with the removal of transmission.
12. Support transmission using a suitable transmission jack, then remove the twelve clutch/engine mounting screws.

Caution: *Make sure transmission-to-engine alignment is maintained when removing transmission. Do not let the rear end of transmission drop down and hang unsupported in the spline hubs of the clutch discs to avoid bending or distorting the friction discs.*

13. Slowly pull transmission straight out to clear the input shaft.
14. Remove the transmission.

6. MANUAL TRANSMISSION DISASSEMBLY AND REASSEMBLY

Refer to Spicer "Service Manuals" annexed to this section.

7. CLEANING AND INSPECTION OF THE TRANSMISSION

7.1 Automatic Transmission

The exterior of the transmission should be cleaned and inspected at regular intervals. The length of service and severity of operating conditions will determine the frequency of such inspections. Inspect the transmission for:

1. Loose bolts (transmission and mounting components);
2. Oil leaks (correct immediately);

3. Loose, dirty, or improperly adjusted throttle sensor linkage;
4. Damaged or loose oil lines;
5. Worn or frayed electrical harnesses, improper routing; and
6. Worn or out of phase drive line U-joint and slip fittings.

Caution: *DO NOT pressure wash the transmission electrical connectors. Water and detergent will cause the contacts to corrode or become faulty.*

7.1.1 Breather

The breather is located at the top of the transmission. It serves to prevent pressure build-up within the transmission and must be cleaned to keep the passage opened. The prevalence of dust and dirt will determine the frequency at which the breather requires cleaning. Use care when cleaning the transmission. Spraying steam, water or cleaning solution directly at the breather can force the water or solution into the transmission. Always use a wrench of proper size to remove or replace the breather. Pliers or pipe wrench can crush or damage the stem and produce metal chips which could enter the transmission.

7.2 Manual Transmission

7.2.1 Cleaning

Warning: *Use a petroleum-based solvent.*

Warning: *Do not use gasoline to clean parts. Gasoline can explode, causing serious physical injury.*

Caution: *Do not use water or steam to clean internal components, it could corrode them.*

8. TRANSMISSION INSTALLATION

8.1 Automatic Transmission

Note: For more clearance between the tag axle and transmission, the tag axle may be unloaded and jacked up, or retracted (if applicable).

1. With the access plug removed, align one of the 12 attaching screw holes in the flexible plate with the access opening (starter side).
2. Place the transmission on a transmission jack.
3. Install a headless guide bolt into one of the 12 threaded holes for flexible plate attaching screws in the flywheel.
4. Lubricate the flywheel center pilot boss with molybdenum disulfide grease (Molycote G, or equivalent).
5. Raise transmission and position the flywheel pilot boss into the flexible plate adapter. Align the guide bolt previously installed in the flywheel with the flexible plate hole facing the access opening in the flywheel housing.

Warning: Severe damages and/or personal injury can occur if transmission is not adequately supported.

6. Seat the transmission against the engine flywheel housing. NO FORCE IS REQUIRED. If interference is encountered, move the transmission away from engine, then investigate the cause.

Caution: The torque converter housing must be seated against the flywheel housing prior to tightening any screws. DO NOT USE SCREWS TO SEAT THE HOUSING.

7. Start all torque converter housing screws, then tighten four of them gradually and in a criss-cross sequence around the housing. Tighten the 12 remaining screws. Recommended torque is between 42-50 lbf•ft (57-68 N•m).
8. Remove the guide bolt through the access opening in the flywheel housing. Replace it with a self-locking screw, finger-tighten then start the remaining screws; tighten to 17-21 lbf•ft (23-28 N•m). Place a wrench on crankshaft pulley attaching screw to turn the converter to gain access to the threaded holes.
9. Reinstall the access plug.
10. If the vehicle is equipped with a retarder; install the bracket on the transmission and tighten the bolt to 71-81 lbf•ft (96-110 N•m). Install the transmission rubber mount between the rubber support and the frame with a bolt, nut and washer. Tighten the nut until the tolerance of 58 ± 2 mm is met (Fig. 6).

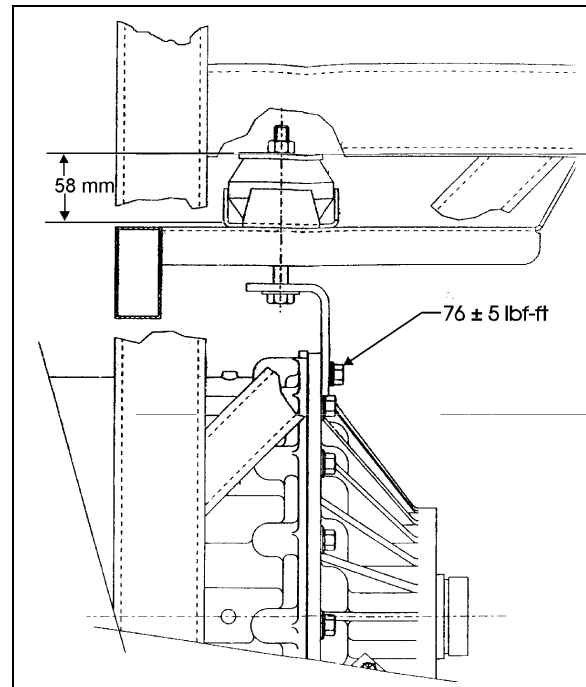


FIGURE 6: NUT TOLERANCE

07014

11. Remove jack from under transmission.

12. Connect all sensors.
13. Connect the main wiring harness.

Note: For proper adjustment, refer to paragraph "4. GEAR SHIFT LINKAGE ADJUSTMENT", in this section.

14. Connect the air supply line (steel-braided hose) to the retarder control valve (if applicable).
15. Connect the two transmission oil cooler hoses as they were previously.
16. Reinstall clamps and brackets, and replace locking ties previously removed during removal procedure.
17. Install propeller shaft and its safety guard. Refer to Section 09, "PROPELLER SHAFT".
18. Install transmission dipstick and filler tube.
19. Install cross member under transmission.
20. Install engine splash guards.
21. Adjust the retarder pressure to 80 ± 3 psi with the air pressure regulator. For more information refer to Section 12, "BRAKE AND AIR SYSTEM", under heading "AIR PRESSURE REGULATOR". The air pressure regulator is located at back of engine compartment, on R.H. side (Fig. 7).



FIGURE 7: AIR PRESSURE REGULATOR

07016

22. Make sure that the drain plug is in place, then remove the transmission dipstick and pour approximately 37 US qts (39 L) of DEXRON-IIIE or DEXRON-III automatic transmission fluid through the filler tube. Check and adjust oil level.

Caution: Do not overfill the transmission. Overfilling can cause oil aeration (milky appearance) and overheating. If overfilling occurs, drain oil as required to bring it to the proper level.

8.2 Manual Transmission

Note: For more clearance between the tag axle and transmission, the tag axle may be unloaded and jacked up or retracted (if applicable).

1. Place the transmission on a transmission jack.
2. Ensure clutch brake is in position on transmission input shaft.
3. Position the clutch release bearing with the flat section on top.
4. Shift transmission into 5th gear, then raise it and position the input shaft into clutch discs. Align input shaft splines with those on clutch discs by rotating the output shaft. As the input shaft enters the clutch discs, rotate the clutch release yoke backwards until the release yoke fingers clear the pads on release bearing housing. Rotate the clutch release yoke into proper position as transmission is pushed into place.

Caution: Avoid hanging the weight of the transmission on the clutch or forcing the transmission into the clutch or flywheel housing. This can cause bent or sprung clutch discs and prevent the clutch from releasing.

Caution: The clutch housing must be seated against the flywheel housing prior to tightening any screw. Do not use screws to seat the housing.

Section 07: TRANSMISSION

5. Install all clutch/engine screws, then tighten them gradually in a criss-cross manner around the housing. Recommended torque is 44-50 lbf•ft (60-68 N•m).
6. Remove jack from under transmission.
7. Install clutch slave cylinder and its return spring.

Note: Refer to Section 02, "CLUTCH" for adjustment.

8. Connect speedometer sensor, back-up signal switch and neutral start switch.
9. Reinstall clamps, brackets, and replace locking ties previously removed during removal procedure.
10. Shift transmission to neutral, then secure the coupling lever bolts.

Note: Refer to paragraph "4. GEAR SHIFT LINKAGE ADJUSTMENT" of this section, for proper adjustment.

11. Install fiberglass transmission protection.
12. Install propeller shaft and its safety guard. Refer to Section 09, "PROPELLER SHAFT".
13. Install cross member under transmission.
14. Install engine splash guards.
15. Install tag axle wheels (if previously removed).

10.2.1 Diagnostic Code Memory

Diagnostic codes are logged in a list in memory (sometimes referred to as the queue), positioning the most recently occurring code first and containing up to five codes. The codes contained in the list have the information recorded as shown in the chart below. Access to the code list position, main code, sub code and active indicator is available through either the shifter display or the Pro-Link Diagnostic Data Reader (DDR). Access to the ignition cycle counter and event counter is obtained through the DDR only.

Code List Position	Main Code	Sub Code	Active Indicator	Ignition Cycle Counter	Event Counter
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16. Make sure that the drain plug is in place, then refill transmission. Check and adjust oil level.
17. Adjust the servo clutch pressure to 40 psi with the air pressure regulator. For more information, refer to Section 12, "BRAKE AND AIR SYSTEM", under heading "AIR PRESSURE REGULATOR". The regulator is located at back of engine compartment, on R.H. side (Fig. 7).

9. ALLISON TRANSMISSIONS PRINCIPLES OF OPERATION

Refer to "Allison Transmission, MD Series, Principles of Operation, SA 2454".

10. TROUBLESHOOTING

10.1 Manual Transmission

Refer to the Troubleshooting section in the Spicer "Service Manual PS130-6B (6-speed)" or "PS145-7A (7-speed)" depending on which transmission is installed on your vehicle. Manuals are annexed to this section.

10.2 Automatic Transmission

Refer to "Allison Transmission, MD Series, Troubleshooting Manual, SA 2158A".

d1	21	12	YES	00	10
d2	41	12	YES	00	04
d3	23	12	NO	08	02
d4	34	12	NO	13	01
d5	56	11	NO	22	02
Displayed on shifter display and DDR			YES= ACTIVE= "MODE ON"	Ignition cycle counter and event counter are not available on shifter display	

Note: All information is available with a diagnostic tool (DDR).

The following paragraphs define the different parts of the code list.

Code List Position

The position (1 through 5) which a code occupies in the code list in memory. Positions are shown as "d1" (Diagnostic Code #1) through "d5."

Main Code

The general condition or area of fault detected by ECU.

Sub Code

The specific area or condition under the main code in which the condition was detected.

Active Indicator

Will be turned "On" when a fault condition is active (shifter will display "MODE ON" or the DDR will display "YES"). Will be set to "Off" when conditions exist to indicate fault condition is gone.

Ignition Cycle Counter

Used to clear diagnostic codes that are inactive from the code list in memory. A counter is incremented each time a normal ECU power down occurs following clearing of the Active Indicator. A code will be cleared from the list when the counter exceeds 25.

Event Counter

Used to count the number of occurrences of a diagnostic code that occurs prior to the incident being cleared from the code list. The most recent code will be in position "d1". If the most recent code is one which is already in the code list, that code will be moved to position "d1", the Active Indicator will be turned "On" (shifter will display "MODE ON" or the DDR will display "YES"), the Ignition Cycle Counter is cleared and "1" is added to the Event Counter.

Clearing the Active Indicator and code Records from the Code List in Memory

If the conditions causing a diagnostic code to be set are cleared, the Active Indicator can be manually cleared by holding the "MODE" button down continuously for 3 seconds until a tone is heard from the shifter.

To clear code records from the list, hold the "MODE" button down continuously for ten seconds until a second tone sounds. All diagnostic records in the list that are not active will then be cleared and the remaining records will be moved up the list.

Code Reading and Code Clearing Procedures

Diagnostic codes can be read and cleared by two methods: by using the Pro-Link 9000 DDR

Section 07: TRANSMISSION

plugged in the receptacle located on L.H. lateral console (Shells)/L.H. side control panel (Coaches) or by using the shifter display. The use of the Pro-Link 9000 DDR is described in the instruction manual supplied with each tool. The method for reading and clearing codes described in this section refers only to entering of the Diagnostic Display Mode by the proper button selection.

The Diagnostic Display Mode may be entered for viewing of codes at any speed. Codes can only be cleared when the output speed = 0 and no output speed sensor failure is active.

The following descriptions explain how to use the shifter to read and clear codes.

Reading Codes

1. Enter the diagnostic display mode by pressing the "↑" and "↓" (upshift and downshift arrows) buttons at the same time on the pushbutton shifter.

Note: *If a "DO NOT SHIFT" condition is present at this time, the lever should be in the same position as it was at the time of code detection. If not, this shifter tone will sound continuously.*

Note: *If an Oil Level Sensor (OLS) is present, the oil level will be displayed first. Diagnostic code display is achieved by depressing the UPSHIFT and DOWNSHIFT arrows or display MODE button a second time.*

2. Read the first code in the first of five code positions on the digital display of the shifter. For example, we will read code 25 11 in the first position. The display will change every two seconds as follows:

- a. Code list position --"d1";
- b. Main code --"25";
- c. Sub code --"11"; and
- d. Display will repeat cycle of a., b. and c. above.

3. Press the "MODE" button momentarily to view the second position (d2) in the same way as 2. above.

4. To view the third, fourth and fifth positions (d3, d4 and d5), momentarily press the "MODE" button as explained above.

5. Pressing the "MODE" button momentarily after the fifth position is displayed will cause the sequence of code positions to start over with the first position.

6. Any code which is active will be indicated by the "MODE ON" indicator (Active Indicator) being turned on while in that code position (while in the normal operation).

7. Any code position in the list which does not have a diagnostic code logged will display "- -" for both the main and sub code displays. All positions after a code codes.

Clearing Codes

1. Clearing of the active indicator is automatically done at ECU power down on all but code 69 34.

2. Some codes will clear the active indicator automatically when the condition causing the code is no longer detected by the ECU (see Diagnostic Code List and Description, page 7 - 19).

3. Manual clearing is possible while in the diagnostic display mode and after the condition causing the code is corrected (output speed must be zero).

- a. To clear all active indicators, hold the "MODE" button down continuously for 3 seconds until the shifter tone sounds for 0.5 seconds.

- b. Release the "MODE" button to return to normal operating mode. If the condition causing the code was not active at the time, the active indicator will turn off.

Caution: *If clearing a code while locked in a Forward or Reverse position (fail-to-range), the transmission will still be in Drive or Reverse when the clearing procedure is completed. Neutral must be selected manually.*

Exiting the Diagnostic Display Mode

The diagnostic display mode can be exited by any of the following procedures:

1. Press the "↑" and "↓" (upshift and downshift) buttons at the same time on the pushbutton shifter.
2. Press any range button, "D", "N" or "R", on the pushbutton shifter (the shift will be commanded if it is not inhibited by an active code).
3. Do nothing and wait until the calibrated time (approximately 10 minutes) has passed and the system automatically returns to the normal operating mode.
4. Turn off power to the ECU (turn off the vehicle at the ignition switch).
5. After the clearing of a code, the active indicator procedure described above has been performed.

Clearing Records from the Code List in Memory

If the requirements for Manual Clearing the Active Indicator have been satisfied, and the "MODE" button is held down continuously for ten seconds while in the display mode until a tone sounds, all diagnostic records in the code list that are not active will be cleared and the remaining records will be moved up in the code list.

Abbreviations Found in the Code Chart

The following responses are used throughout the following chart to command safe operation when diagnostic codes are set.

1. **DNS (Do Not Shift)** Response
 - a. Turn off lockup clutch and inhibit lockup operation.
 - b. Inhibit all shifts.
 - c. Turn on *DO NOT SHIFT* light.
 - d. Pulse the tone generator for 8 seconds when the condition is first detected.
 - e. Blank the select digit in the display.
 - f. Ignore any range selection inputs and disable the button feedback tone for the pushbutton shifter.
2. **SOL OFF (Solenoid Off)** Response
 - a. All solenoids are commanded off (turning solenoids "A" and "B" off electrically causes them to be on hydraulically).
3. **RPR (Return to Previous Range)** Response
 - a. When the ratio or C3 pressure switch tests associated with a shift are not passed, the ECU commands the same range as commanded at the beginning of the shift.
4. **NNC (Neutral No Clutches)** Response
 - a. When certain ratio or C3 pressure switch tests are not passed, the ECU commands a neutral condition with no clutches applied.

Diagnostic code list and description

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
12	12	Oil level, low	No	No upshift above a calibration range

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
12	23	Oil level, high	No	No upshift above a calibration range
13	12	ECU input voltage, low	Yes	DNS, SOL OFF (Hydraulic default)
13	13	ECU input voltage, medium low	No	None: Shift adaptive feature will not function.
13	23	ECU input voltage, high	Yes	DNS, SOL OFF (Hydraulic default)
14	12	Oil level sensor, low	No	None
14	23	Oil level sensor, high	No	None
21	12	Throttle position sensor, low	No	Use Throttle default value
21	23	Throttle position sensor, high	No	Use Throttle default value
22	14	Engine speed sensor reasonableness test	No	Use default engine speed
22	15	Turbine speed sensor reasonableness test	Yes	DNS, Lock in current range
22	16	Output speed sensor reasonableness or rapid decel test	Yes	DNS, Lock in current range
23	12	Primary Shifter or RSI Link Fault	No	Hold in last valid direction
23	13	Primary Shifter Mode Function Fault	No	Mode change not permitted
23	14	Secondary Shifter or RSI Link Fault	No	Hold in last valid direction
23	15	Secondary Shifter Mode Function Fault	No	Mode change not permitted
24	12	Sump oil temperature, cold	Yes	DNS
24	23	Sump oil temperature, hot	No	No upshifts above a calibration range
25	00	Output speed reasonableness test, detected at 0 speed, (L)	Yes	DNS, Lock in current range (L)
25	11	Output speed reasonableness test, detected at 0 speed, (1st)	Yes	DNS, Lock in current range (1 st)
25	22	Output speed reasonableness test, detected at 0 speed 2nd	Yes	DNS, Lock in current range (2nd)

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
25	33	Output speed reasonableness test, detected at 0 speed, 3rd	Yes	DNS, Lock in current range (3rd)
25	44	Output speed reasonableness test, detected at 0 speed, 4th	Yes	DNS, Lock in current range (4th)
25	55	Output speed reasonableness test, detected at 0 speed, 5th	Yes	DNS, Lock in current range (5th)
25	66	Output speed reasonableness test, detected at 0 speed, 6th	Yes	DNS, Lock in current range (6th)
25	77	Output speed reasonableness test, detected at 0 speed, R	Yes	DNS, Lock in current range (R)
32	00	C3 pressure switch open, L range	Yes	DNS, Lock in current range (L)
32	33	C3 pressure switch open, 3rd range	Yes	DNS, Lock in current range (3rd)
32	55	C3 pressure switch open, 5th range	Yes	DNS, Lock in current range (5th)
32	77	C3 pressure switch open, R range	Yes	DNS, Lock in current range (R)
33	12	Sump oil temperature sensor, low	No	Use default value of 200° F (93° C)
33	23	Sump oil temperature sensor, high	No	Use default value of 200° F (93° C)
34	12	EEPROM, factory cal. compatibility number wrong	Yes	DNS, SOL OFF (Hydraulic default)
34	13	EEPROM, factory calibration block checksum	Yes	DNS, SOL OFF (Hydraulic default)
34	14	EEPROM, Power Off Block checksum	Yes	Use previous location, or factory calibration and reset adaptive
34	15	EEPROM, Diagnostic Queue Block Checksum	Yes	Use previous location, or clear diagnostic queue
34	16	EEPROM, Real Time Block Checksum	Yes	DNS, SOL OFF (Hydraulic default)
35	00	Power interruption (Code set after power restored)	No	NONE (Hydraulic default during interruption)

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
35	16	Real Time EEPROM Write Interruption	Yes	DNS, SOL OFF (Hydraulic default)
36	00	Hardware/Software not compatible	Yes	DNS, SOL OFF (Hydraulic default)
41	12	Open or short to ground, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	13	Open or short to ground, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	14	Open or short to ground, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	15	Open or short to ground, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	16	Open or short to ground, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	21	Open or short to ground, F solenoid circuit	No	Lock-up inhibited
41	22	Open or short to ground, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
41	23	Open or short to ground, H solenoid circuit	No	Retarder allowed, differential lock inhibited
41	24	Open or short to ground, J solenoid circuit	No	Low and 1st inhibited
41	25	Open or short to ground, K solenoid circuit	No	K solenoid operation inhibited
41	26	Open or short to ground, N solenoid circuit	No	Low and 1st inhibited
42	12	Short to battery, A solenoid circuit	Yes	DNS, Lock in a range
42	13	Short to battery, B solenoid circuit	Yes	DNS, Lock in a range
42	14	Short to battery, C solenoid circuit	Yes	DNS, Lock in a range
42	15	Short to battery, D solenoid circuit	Yes	DNS, Lock in a range

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
42	16	Short to battery, E solenoid circuit	Yes	DNS, Lock in a range
42	21	Short to battery, F solenoid circuit	No	Lock-up inhibited
42	22	Short to battery, G solenoid circuit	Yes	DNS, Lock in a range
42	23	Short to battery, H solenoid circuit	No	Retarder allowed, differential lock inhibited
42	24	Short to battery, J solenoid circuit	No	Low and 1st inhibited
42	25	Short to battery, K solenoid circuit	No	K solenoid operation inhibited
42	26	Short to battery, N solenoid circuit	No	Low and 1st inhibited
43	21	Low side driver, F solenoid circuit	No	Lock-up inhibited
43	25	Low side driver, K solenoid circuit	No	K solenoid operation inhibited
43	26	Low side driver, N solenoid circuit	No	Low and 1st inhibited
44	12	Short to ground, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
44	13	Short to ground, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
44	14	Short to ground, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
44	15	Short to ground, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
44	16	Short to ground, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
44	21	Short to ground, F solenoid circuit	No	Lock-up inhibited
44	22	Short to ground, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
44	23	Short to ground, H solenoid circuit	No	Retarder allowed. differential lock inhibited
44	24	Short to ground, J solenoid circuit	No	Low and 1st inhibited
44	25	Short to ground, K solenoid circuit	No	K solenoid operation inhibited
44	26	Short to ground, N solenoid circuit	No	Low and 1st inhibited
45	12	Open circuit, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	13	Open circuit, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	14	Open circuit, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	15	Open circuit, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	16	Open circuit, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	21	Open circuit, F solenoid circuit	No	Lock-up inhibited
45	22	Open circuit, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default)
45	23	Open circuit, H solenoid circuit	No	Retarder allowed differential lock inhibited
45	24	Open circuit, J solenoid circuit	No	Low and 1st inhibited
45	25	Open circuit, K solenoid circuit	No	K solenoid operation inhibited
45	26	Open circuit, N solenoid circuit	No	Low and 1st inhibited
51	10	Offgoing ratio test (during shift), 1 to L	Yes	Low and 1st inhibited
51	12	Offgoing ratio test (during shift), 1 to 2	Yes	DNS, RPR

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
51	21	Offgoing ratio test (during shift), 2 to 1	Yes	DNS, RPR
51	23	Offgoing ratio test (during shift), 2 to 3	Yes	DNS, RPR
51	43	Offgoing ratio test (during shift), 4 to 3	Yes	DNS, RPR
51	45	Offgoing ratio test (during shift), 4 to 5	Yes	DNS, RPR
51	65	Offgoing ratio test (during shift), 6 to 5	Yes	DNS, RPR
52	01	Offgoing C3PS test (during shift), L to 1	Yes	DNS, RPR
52	08	Offgoing C3PS test (during shift), L to N1	Yes	DNS, NNC
52	32	Offgoing C3PS test (during shift), 3 to 2	Yes	DNS, RPR
52	34	Offgoing C3PS test (during shift), 3 to 4	Yes	DNS, RPR
52	54	Offgoing C3PS test (during shift), 5 to 4	Yes	DNS, RPR
52	56	Offgoing C3PS test (during shift), 5 to 6	Yes	DNS, RPR
52	71	Offgoing C3PS test (during shift), R to 1	Yes	DNS, NNC
52	72	Offgoing C3PS test (during shift), R to 2	Yes	DNS, NNC
52	78	Offgoing C3PS test (during shift), R to N1	Yes	DNS, NNC
52	79	Offgoing C3PS test (during shift), R to 2 (R to NNC to 2)	Yes	DNS, NNC
52	99	Offgoing C3PS test (during shift), N3 to N2	Yes	DNS, RPR
53	08	Offgoing speed test (during shift), L to N1	Yes	DNS, NNC

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
53	18	Offgoing speed test (during shift), 1 to N1	Yes	DNS, NNC
53	28	Offgoing speed test (during shift), 2 to N1	Yes	DNS, NNC
53	29	Offgoing speed test (during shift), 2 to N2	Yes	DNS, RPR
53	38	Offgoing speed test (during shift), 3 to N1	Yes	DNS, NNC
53	39	Offgoing speed test (during shift), 3 to N3	Yes	DNS, RPR
53	48	Offgoing speed test (during shift), 4 to N1	Yes	DNS, NNC
53	49	Offgoing speed test (during shift), 4 to N3	Yes	DNS, RPR
53	58	Offgoing speed test (during shift), 5 to N1	Yes	DNS, NNC
53	59	Offgoing speed test (during shift), 5 to N3	Yes	DNS, RPR
53	68	Offgoing speed test (during shift), 6 to N1	Yes	DNS, NNC
53	69	Offgoing speed test (during shift), 6 to N4	Yes	DNS, RPR
53	78	Offgoing speed test (during shift), R to N1	Yes	DNS, NNC
53	99	Offgoing speed test (during shift), N2 to N3 or N3 to N2	Yes	DNS, RPR
54	01	Oncoming ratio test (after shift), L to 1	Yes	DNS, RPR
54	07	Oncoming ratio test (after shift), L to R	Yes	DNS, NNC
54	10	Oncoming ratio test (after shift), 1 to L	Yes	DNS, RPR
54	12	Oncoming ratio test (after shift), 1 to 2	Yes	DNS, RPR

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
54	17	Oncoming ratio test (after shift), 1 to R	Yes	DNS, NNC
54	21	Oncoming ratio test (after shift), 2 to 1	Yes	DNS, RPR
54	23	Oncoming ratio test (after shift), 2 to 3	Yes	DNS, RPR
54	27	Oncoming ratio test (after shift), 2 to R	Yes	DNS, NNC
54	32	Oncoming ratio test (after shift), 3 to 2	Yes	DNS, RPR
54	34	Oncoming ratio test (after shift), 3 to 4	Yes	DNS, RPR
54	43	Oncoming ratio test (after shift), 4 to 3	Yes	DNS, RPR
54	45	Oncoming ratio test (after shift), 4 to 5	Yes	DNS, RPR or SOL OFF (Hydraulic default)
54	54	Oncoming ratio test (after shift), 5 to 4	Yes	DNS,RPR
54	56	Oncoming ratio test (after shift), 5 to 6	Yes	DNS,RPR
54	65	Oncoming ratio test (after shift), 6 to 5	Yes	DNS,RPR
54	70	Oncoming ratio test (after shift), R to L	Yes	DNS,NNC
54	71	Oncoming ratio test (after shift), R to 1	Yes	DNS,NNC
54	72	Oncoming ratio test (after shift), R to 2	Yes	DNS,NNC
54	80	Oncoming ratio test (after shift), N1 to L	Yes	DNS,RPR
54	81	Oncoming ratio test (after shift), N1 to 1	Yes	DNS,RPR
54	82	Oncoming ratio test (after shift), N1 to 2	Yes	DNS,RPR

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
54	83	Oncoming ratio test (after shift), N1 to 3	Yes	DNS,RPR
54	85	Oncoming ratio test (after shift), N1 to 5	Yes	DNS,RPR
54	86	Oncoming ratio test (after shift), N1 to 6	Yes	DNS, RPR
54	92	Oncoming ratio test (after shift), R to 2 (R to NNC to 2)	Yes	DNS, NNC
54	92	Oncoming ratio test (after shift), N1 to 2 (N1 to NNC to 2)	Yes	DNS, RPR
54	92	Oncoming ratio test (after shift), N2 to 2	Yes	DNS, RPR
54	93	Oncoming ratio test (after shift), N3 to 3	Yes	DNS, RPR
54	95	Oncoming ratio test (after shift), N3 to 5	Yes	DNS, RPR
54	96	Oncoming ratio test (after shift), N4 to 6	Yes	DNS, RPR
54	97	Oncoming ratio test (after shift), 2 to R (2 to NNC to R)	Yes	DNS, NNC
55	17	Oncoming C3PS test (after shift), 1 to R	Yes	DNS, NNC
55	27	Oncoming C3PS test (after shift), 2 to R	Yes	DNS, NNC
55	80	Oncoming C3PS test (after shift), N1 to L	Yes	DNS, RPR
55	87	Oncoming C3PS test (after shift), N1 to R	Yes	DNS, RPR
55	97	Oncoming C3PS test (after shift), 2 to R or NVL to R (2 to NNC to R)	Yes	DNS, NNC
56	00	Range verification test, L	Yes	DNS, 1st, Low, or SOL OFF (Low)
56	11	Range verification test, 1st	Yes	DNS, 6th
56	22	Range verification test, 2nd	Yes	DNS, 6th or 5th

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
56	33	Range verification test, 3rd	Yes	DNS, 5th or SOL
56	44	Range verification test, 4th	Yes	DNS, 3rd or 5th
56	55	Range verification test, 5th	Yes	DNS, SOL OFF (5th) or 3rd
56	66	Range verification test, 6th	Yes	DNS, 5th, 3rd, or SOL OFF (3rd)
56	77	Range verification test, R	Yes	DNS, N2 or N3
57	11	Range verification C3PS test, 1st	Yes	DNS, SOL OFF (3rd)
57	22	Range verification C3PS test, 2nd	Yes	DNS, 3rd
57	44	Range verification C3PS test, 4th	Yes	DNS, 5th or SOL OFF (3rd)
57	66	Range verification C3PS test, 6th	Yes	SOL OFF (5th), DNS
57	88	Range verification C3PS test, N1	Yes	DNS, N3
57	99	Range verification C3PS test, N2 or N4	Yes	DNS, N3
61	00	Retarder oil temperature, hot	No	None
62	12	Retarder oil temperature sensor, low	No	None
62	23	Retarder oil temperature sensor, high	No	None
63	00	Special function input	No	Depends on special function
64	12	Retarder modulation request sensor, low	No	Retarder operation inhibited
64	23	Retarder modulation request sensor, high	No	Retarder operation inhibited
65	00	Engine rating too high	Yes	DNS
66	00	Serial communications interface fault	No	Use default throttle values
69	12	ECU, A solenoid driver open	Yes	DNS, SOL OFF (hydraulic default)
69	13	ECU, B solenoid driver open	Yes	DNS, SOL OFF (hydraulic default)
69	14	ECU, C solenoid driver open	Yes	DNS, SOL OFF (hydraulic default)
69	15	ECU, D solenoid driver open	Yes	DNS, SOL OFF (hydraulic default)

Section 07: TRANSMISSION

MAIN CODE	SUB CODE	DESCRIPTION	DO NOT SHIFT LIGHT	INHIBITED OPERATION DESCRIPTION
69	16	ECU, E solenoid driver open	Yes	DNS, SOL OFF (hydraulic default)
69	21	ECU, F solenoid driver open	No	Lock-up inhibited
69	22	ECU, G solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default)
69	23	ECU, H solenoid driver open	No	Retarder allowed, differential lock inhibited
69	24	ECU, J solenoid driver open	No	Low and 1 st inhibited
69	25	ECU, K solenoid driver open	No	K solenoid operation inhibited
69	26	ECU, N solenoid driver open	No	Low and 1st inhibited
69	32	ECU, SPI communications link fault	No	Hold in last valid direction
69	33	ECU, Central Operating Processor (COP) time-out	Yes	Reset ECU, Shutdown ECU on 2nd occurrence (power loss: hydraulic defaults)
69	34	ECU, EEPROM write time-out	Yes	DNS, SOL OFF (Hydraulic default)
69	35	ECU, EEPROM checksum	Yes	Induce COP time-out (reset ECU)
69	36	ECU, RAM self test	Yes	Induce COP time-out (reset ECU)
69	41	ECU, I/O ASIC addressing test	Yes	Induce COP time-out (reset ECU)
70	35	Software, minor loop overrun	Yes	Induce COP time-out (reset ECU)
70	35	Software, illegal write to access \$0000	Yes	Induce COP time-out (reset ECU)
70	35	Software, major loop overrun	Yes	Induce COP time-out (reset ECU)

11. SPECIFICATIONS

AUTOMATIC TRANSMISSION WITH OR WITHOUT RETARDER

Gross input power (maximum)450 hp (335 kW)
 Gross input torque (maximum) 1460 lbf•ft (1978 N•m)
 Rated input speed (minimum-maximum) 1600-2300 rpm

Mounting

Engine SAE #1 flywheel housing, flex disk drive

Torque converter

TypeOne stage, three element, polyphase
 Stall torque ratio TC 521-2.4;TC 531-2.3;TC 541-1.9;TC 551-1.8;TC 561-1.6
 Lockup clutch with torsional damper Integral/standard

Gearing

Type Patented, constant mesh, helical, planetary

	Ratio*
First	3.51:1
Second	1.91:1
Third	1.43:1
Fourth	1.00:1
Fifth.....	0.74:1
Sixth	0.64:1
Reverse.....	4.80:1

Ratio coverage

6 speed.....5.48:1

* Gear ratios do not include torque converter multiplication.

Oil System

Oil typeDEXRON-IIIE OR DEXRON III
 Capacity (excluding external circuits)Initial fill 47 US qts (45 liters)
 Oil change 37 US qts (39 liters)

Oil Filters

Make..... Allison Transmission
 Type Disposable cartridge
 Supplier number..... 29503829
 Prévost number..... 57-1687

MANUAL TRANSMISSION

SIX-SPEED

Make..... Spicer
Model..... PS130-6B

Ratio:

LO..... 8.53:1
1st..... 4.87:1
2nd 3.00:1
3rd 1.90:1
4th..... 1.33:1
5th..... 1.00:1
Rev 8.53:1

Fluid:

Type Same as engine oil
Capacity 41 Pints (19.4 liters) at 0° Installation
Torque Capacity..... 1300 lbf•ft (1761 N•m)

SEVEN-SPEED

Make..... Spicer
Model..... PS145-7A

Ratio:

LO..... 10.13:1
1st..... 5.99:1
2nd 3.56:1
3rd 2.57:1
4th..... 1.84:1
5th..... 1.33:1
6th..... 1.00:1
Rev 10.13:1

Fluid:

Type Same as engine oil
Capacity 48 Pints (22.7 liters) at 0° Installation
Torque Capacity..... 1450 lbf•ft (1964 N•m)

SECTION 09: PROPELLER SHAFT

CONTENTS

1. PROPELLER SHAFT	9 - 2
1.1 Description.....	9 - 2
2. REMOVAL, DISASSEMBLY, REASSEMBLY AND INSTALLATION	9 - 2
3. CLEANING, INSPECTION AND LUBRICATION	9 - 3
3.1 Cleaning and Inspection	9 - 3
3.2 Lubrication.....	9 - 3
4. EXPLANATION OF COMMON DAMAGES.....	9 - 3
5. TROUBLESHOOTING	9 - 3
6. SPECIFICATIONS.....	9 - 4

LIST OF ILLUSTRATIONS

FIG. 1: PROPELLER SHAFT ASSEMBLY	9 - 2
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1. PROPELLER SHAFT

1.1 Description

The propeller shaft transmits power from the transmission to the differential (Fig. 1). Depending on the vehicle's transmission type, two lengths of propeller shafts are available. Refer to paragraph "6. SPECIFICATIONS" at the end of this section for details. Both propeller shafts are "Dana 1810" type with tubular shafts. They are provided with two heavy-duty universal joints (Fig. 1).

The propeller shaft has a full round end yoke at each end. The tube yoke is connected to the differential by a full round end yoke with four needle bearings.

The other extremity (slip yoke assembly) is connected to the transmission by a half round end yoke with two needle bearings.

Furthermore, a slip joint on the propeller shaft compensates for variations in distance between the transmission (manual or automatic) and the differential, or between the output retarder (optional on the automatic transmission) and differential.

These variations are brought about by the rise and fall of the drive axle as the vehicle passes over uneven surfaces. The slip joint also eases removal of the transmission or the drive axle.

2. REMOVAL, DISASSEMBLY, REASSEMBLY AND INSTALLATION

Refer to "SPICER UNIVERSAL JOINTS AND DRIVESHAFTS" annexed to this section, under headings "Heavy Duty - removal, disassembly, reassembly and installation".

Where applicable:

- Remove or install propeller shaft safety guard.
- Screw bolts to the specified torque (Fig. 1).

Note: Disregard the procedure on "Lock straps" mentioned in the "Spicer Universal Joints and Driveshafts Manual".

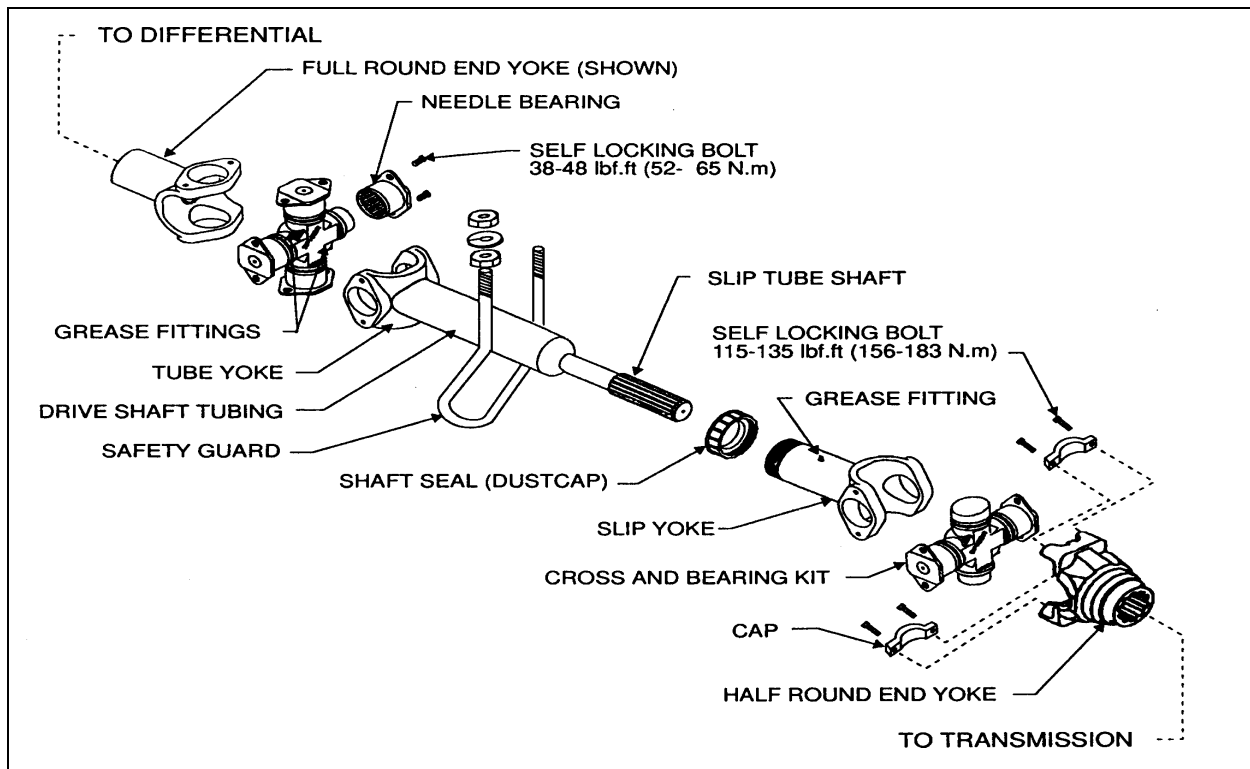


FIGURE 1: PROPELLER SHAFT ASSEMBLY

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3. CLEANING, INSPECTION AND LUBRICATION

3.1 Cleaning and Inspection

Thoroughly clean grease from bearings, journal, lubricating grease fittings and other parts. Needle bearing assemblies may be soaked in a cleaning solution to soften hard grease particles. It is extremely important that bearing assemblies be absolutely clean and blown out with compressed air, since small particles of dirt or grit can cause rapid bearing wear. Do not attempt to disassemble needle bearings.

Bearing journal areas should be inspected for roughness or grooving. If light honing does not remove roughness, the entire bearing assembly should be replaced. Excessive wear of the needle bearing is indicated if the needles drop out of the retainer, or if marks are present on the journal bearing surface. In such case, replace bearing assembly. Finally, inspect yokes for cracks, wear or distortion.

Note: *Repair kits are available for overhaul of the propeller shaft assembly. Refer to the paragraph "6. Specifications" of this section.*

3.2 Lubrication

Lubricate propeller shaft universal joints and slip yoke periodically, every 6,250 miles (10 000 km) or twice a year, whichever comes first. Apply grease gun pressure to the lube fitting. Use a good quality lithium-base grease such as: NLGI No.2 (suitable for most temperatures) or NLGI No.1 (suitable for extremely low temperatures). Refer to "Spicer Universal Joints and Driveshafts, Service Manual", under heading, "Inspection and Lubrication". See lubrication procedures for U-joints and lubrication for slip splines.

NOTE: *Do not assume that bearing cavities have been filled with new grease unless it has expelled around all seals.*

4. EXPLANATION OF COMMON DAMAGES

1. Cracks: Stress lines due to metal fatigue. Severe and numerous cracks will weaken the metal until it breaks.

2. Galling: Scraping off of metal or metal displacement due to friction between surfaces. This is commonly found on trunnion ends.

3. Spalling (surface fatigue): Breaking off of chips, scales, or flakes of metal due to fatigue rather than wear. It is usually found on splines and U-joint bearings.

4. Pitting: Small pits or craters in metal surfaces due to corrosion. If excessive, pitting can lead to surface wear and eventual failure.

5. Brinelling: Surface wear failure due to the wearing of grooves in metal. It is often caused by improper installation procedures. Do not confuse the polishing of a surface (false brinelling), where no structural damage occurs, with actual brinelling.

6. Structural Overloading: Failure caused by a load greater than the component can stand. A structural overload may cause propeller shaft tubing to twist under strain or it may cause cracks or breaks in U-joints and spline plugs.

5. TROUBLESHOOTING

Refer to "*Spicer Service Manual - Universal Joints and Driveshafts*" under heading "*Troubleshooting*".

6. SPECIFICATIONS

PROPELLER SHAFT

XL-40 Coach

With Series 60 Engine and World or 7 Speed Transmission

Make..... Hayes-Dana Inc.
Series1810
Supplier number..... 819299-1
Prevost number..... 580075

With Series 60 Engine and 6 Speed Transmission

Make..... Hayes-Dana Inc.
Series1810
Supplier number..... 908024-1
Prevost number..... 580035

With Series 50 Engine and World or 6 Speed Transmission

Make..... Hayes-Dana Inc.
Series1810
Supplier number..... 905116-1000
Prevost number..... 580041

XL-40 & 45E Converted Vehicle (Shell)

Make..... Hayes-Dana Inc.
Series1810
Supplier number..... 819299-1
Prevost number..... 580075

XL-45 Vehicles

Make..... Hayes-Dana Inc.
Series1810
Supplier number..... 819325-2200
Prevost number..... 580070

Repair kits

Make	Hayes-Dana Inc.
U-joint kit (tube yoke), Supplier number	5-281X
U-joint kit (tube yoke), Prevost number	580043
U-joint kit (slip yoke), Supplier number	5-510X
U-joint kit (slip yoke), Prevost number	580062
Cap and bolt kit, bolt torque 115-135 lbf•ft (156-183 N•m), Supplier number	6.5-70-18X
Cap and bolt kit, bolt torque 115-135 lbf•ft (156-183 N•m), Prevost number	580063
Bolts kit, bolt torque 38-48 lbf•ft (52-65 N•m), Supplier number	6-73-209
Bolts kit, bolt torque 38-48 lbf•ft (52-65 N•m), Prevost number	580071

Half Round End Yoke

Make.....	Hayes-Dana Inc
(6 speed, Series 50 or 7 speed, Series 60), Supplier number.....	6.5-4-3021-1
(6 speed, Series 50 or 7 speed, Series 60), Prevost number.....	580072

Make.....	Dana-Spicer
(7 speed, Series 60), Supplier number.....	6.5-4-3821-1
(7 speed, Series 60), Prevost number.....	571690

Note: *U-joint kits will come equipped with the serrated bolt and lock patch and will no longer contain a lock strap.*

SECTION 10: FRONT AXLE

CONTENTS

1. DESCRIPTION	10 - 2
2. MAINTENANCE.....	10 - 2
3. LUBRICATION.....	10 - 3
4. REMOVAL	10 - 3
5. REPLACEMENT.....	10 - 3
6. OVERHAUL	10 - 4
7. FRONT END ALIGNMENT	10 - 4
7.1 Front End Inspection.....	10 - 4
7.2 Front Wheel Camber.....	10 - 4
7.3 Front Wheel Toe-in	10 - 4
7.4 Front Axle Caster	10 - 7
7.5 Steering Geometry	10 - 7
8. WHEEL BEARING MAINTENANCE.....	10 - 9
9. TROUBLESHOOTING	10 - 9
10. SPECIFICATIONS.....	10 - 9
11. FRONT WHEEL ALIGNMENT.....	10 - 9
12. TORQUE SPECIFICATIONS.....	10 - 9

LIST OF ILLUSTRATIONS

FIG. 1: FRONT AXLE ASSEMBLY	10 - 2
FIG. 2: FRONT END ALIGNMENT CHART	10 - 5
FIG. 3: POSITION PIN.....	10 - 6
FIG. 4: POSITION PIN INSTALLATION	10 - 6
FIG. 5: TOE-IN MEASUREMENT	10 - 6
FIG. 6: CASTER	10 - 7

1. DESCRIPTION

The front axle is of the tubular-type, and consists of a tempered seamless steel rectangular beam to which steering knuckles are fixed with heat-treated, forged steel pins. Both the steering knuckles upper and lower pin bores are supplied with "Easy Steer" bushings. A thrust bearing, installed between the lower end of the axle and each steering knuckle, supports the load of the axle.

A tie rod arm, to which the tie rod is attached is installed on each steering knuckle. The tie rod is supplied with R.H. and L.H. threads to simplify toe-in adjustment. The maximum turning angle is set through the two steering stop screws installed on the axle center.

2. MAINTENANCE

Front axle maintenance consists of periodic inspections and lubrication. Check all parts for damage or distortion, paying particular notice to the tie rod, tie rod ends, tie rod arms,

the steering arm and stop screws. Make sure all fasteners are tight (refer to heading "Specifications" for recommended tightening torques). Check condition of steering knuckle pins, bushings and thrust bearings, and replace if excessive looseness is found.

Looseness in steering linkage, under normal steering loads, is sufficient cause to immediately check all pivot points for wear, regardless of accumulated mileage. Steering linkage pivot points should be checked each time the front axle assembly is lubricated. Any looseness can be visually detected while rotating the steering wheel in both directions.

Steering knuckles can be overhauled or replaced without removing the axle from the vehicle. However, if extensive overhaul work is necessary, the axle assembly may be removed.

Caution: Should removal of a locking device be required when undergoing repairs, disassembly or adjustments, always replace with a new one.

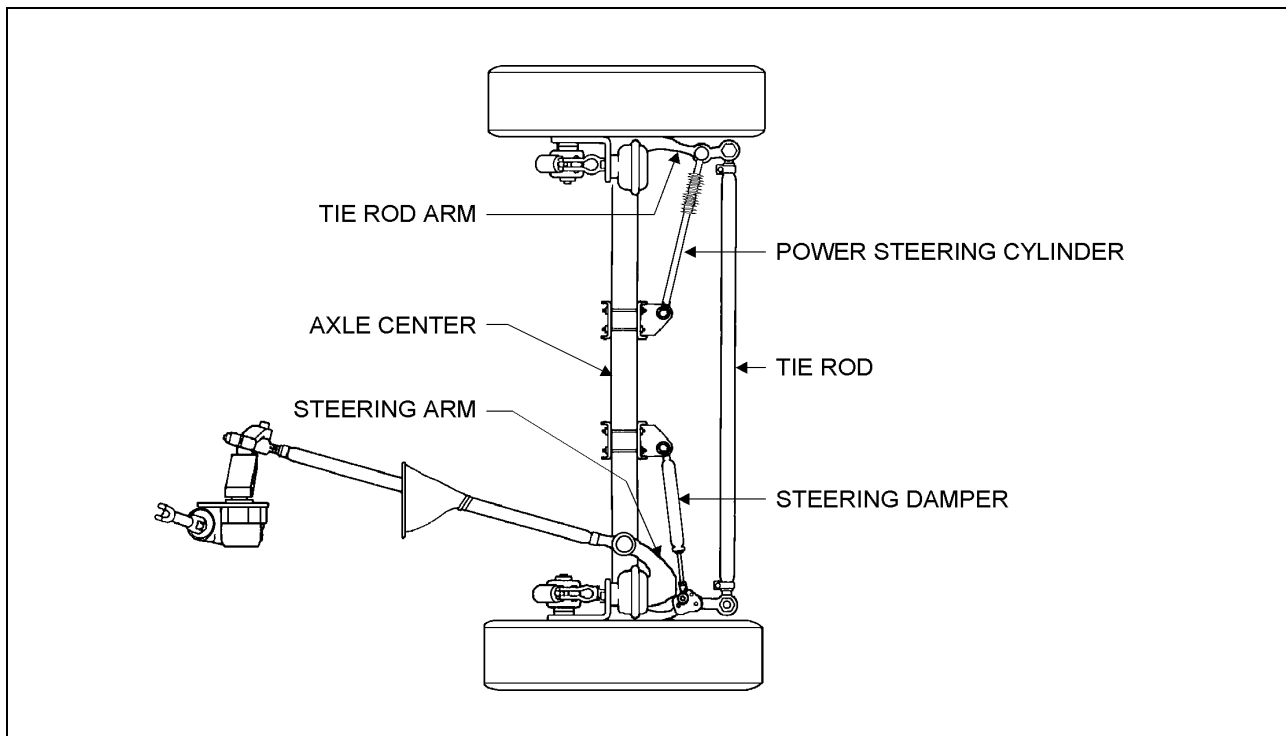


FIGURE 1: FRONT AXLE ASSEMBLY

10011

3. LUBRICATION

Perform lubrication according to “*Rockwell Maintenance Manual No.2: Front Non-Drive Steering Axles*” annexed to this section.

Tie rod ends and drag link ends are supplied with grease fittings, which should be serviced every 6,250 miles (10 000 km) or twice a year, whichever comes first. Steering knuckle pins are also supplied with grease fittings, which should be serviced every 50,000 miles (80 000 km) or once every year, whichever comes first. A good quality lithium-base grease is recommended (refer to section 24 “*LUBRICATION*”).

4. REMOVAL

The following procedure deals with the removal of the front axle assembly. The method used to support the axle assembly and suspension components during removal and disassembly depends upon local conditions and available equipment.

1. Jack-up vehicle until its body is approximately 30" (760 mm) from the floor. Place safety supports underneath body.

Caution: Use only the recommended jacking points as outlined in section 18 “*BODY*”.

2. Support the axle with suitable hydraulic floor jacks at the recommended jacking points.

Warning: To help prevent injury caused by the axle rolling off the jacks, these should be equipped with U-adapters, or similar precautions must be taken.

3. Remove the wheels (if required) (refer to Section 13, “*WHEELS, HUBS AND TIRES*”).

4. Exhaust compressed air from the air supply system by opening the drain valve at each air reservoir.
5. Disconnect the height control valve link from the axle and pull down the overtravel lever to ensure all air is exhausted from air springs.
6. Disconnect air lines from front brake chambers, and cover line ends and fittings to prevent the entry of foreign matter.
7. Remove the ABS sensors from their location in hubs (if applicable), and disconnect the remaining sensor(s) in left wheel hub.

Caution: Position the air lines and electric wires so they will not be damaged while removing the front axle assembly.

8. Disconnect the drag link from steering arm.
9. Proceed with steps a, b and c, while referring to “*SUSPENSION*”, section 16.
 - a) Disconnect sway bar links from axle brackets.
 - b) Remove shock absorbers.
 - c) Disconnect the five radius rods: transversal and lower rods from subframe, and upper rods from axle.
10. Remove the two air spring lower nuts from each suspension support.
11. Slowly lower the axle assembly, and carefully remove from underneath vehicle.

5. REPLACEMENT

Reverse “*Front Axle Removal*” procedure. Ensure cleanliness of air spring mounting plates.

Note: Refer to Section 16, “*SUSPENSION*” and at the end of this section for applicable checks and recommended tightening torques.

6. OVERHAUL

Refer to “*Rockwell Maintenance Manual No.2 - Front Non-Drive Steering Axles*” annexed to this section.

7. FRONT END ALIGNMENT

Front end alignment is essential for steering comfort and satisfactory tire life. Road shocks and vibrations, as well as normal stresses and strains, under normal operating conditions, can put the front end out of alignment. If a misalignment is suspected, inspect all components which could be involved as outlined under heading “*Front End Inspection*” next.

7.1 Front End Inspection

Before checking front end alignment, first check the following points:

1. Make sure the vehicle is at normal ride height (refer to “*Suspension Height Adjustment*” procedure under heading “*Height Control Valve*”, in section 16 “*Suspension*”).
2. Make sure that front wheels are not generating the problem (refer to section 13 “*Wheels, Hubs and Tires*”).
 - a) Check tire air pressure.
 - b) Check wheel installation and straightness.
 - c) Check wheel and tire balance.
3. Check wheel bearing adjustment.
4. Check steering linkage for bending, and pivot points for looseness.

5. Check knuckle pins for evidence of excessive wear.

6. Check radius rods for bending and rubber bushings for evidence of excessive wear.

7.2 Front Wheel Camber

Wheel camber is the number of degrees the top of the wheel tilts outward (positive) or inward (negative) from a vertical plane.

The camber angle is not adjustable. Camber variations may be caused by wear at wheel bearings, steering knuckle pins, or by bent knuckles or sagging axle center. Steering effort is affected by improper camber, and uneven tire wear will result. Excessive positive camber results in irregular wear of tire at outer shoulder, and excessive negative camber causes wear at inner shoulder.

Specifications

Camber $-1/8^{\circ} \pm 7/16^{\circ}$

Inspection

Position front wheels on turning plates in a straight ahead position. Install alignment gauges, record the camber reading for each wheel (Fig. 2) and compare with specifications.

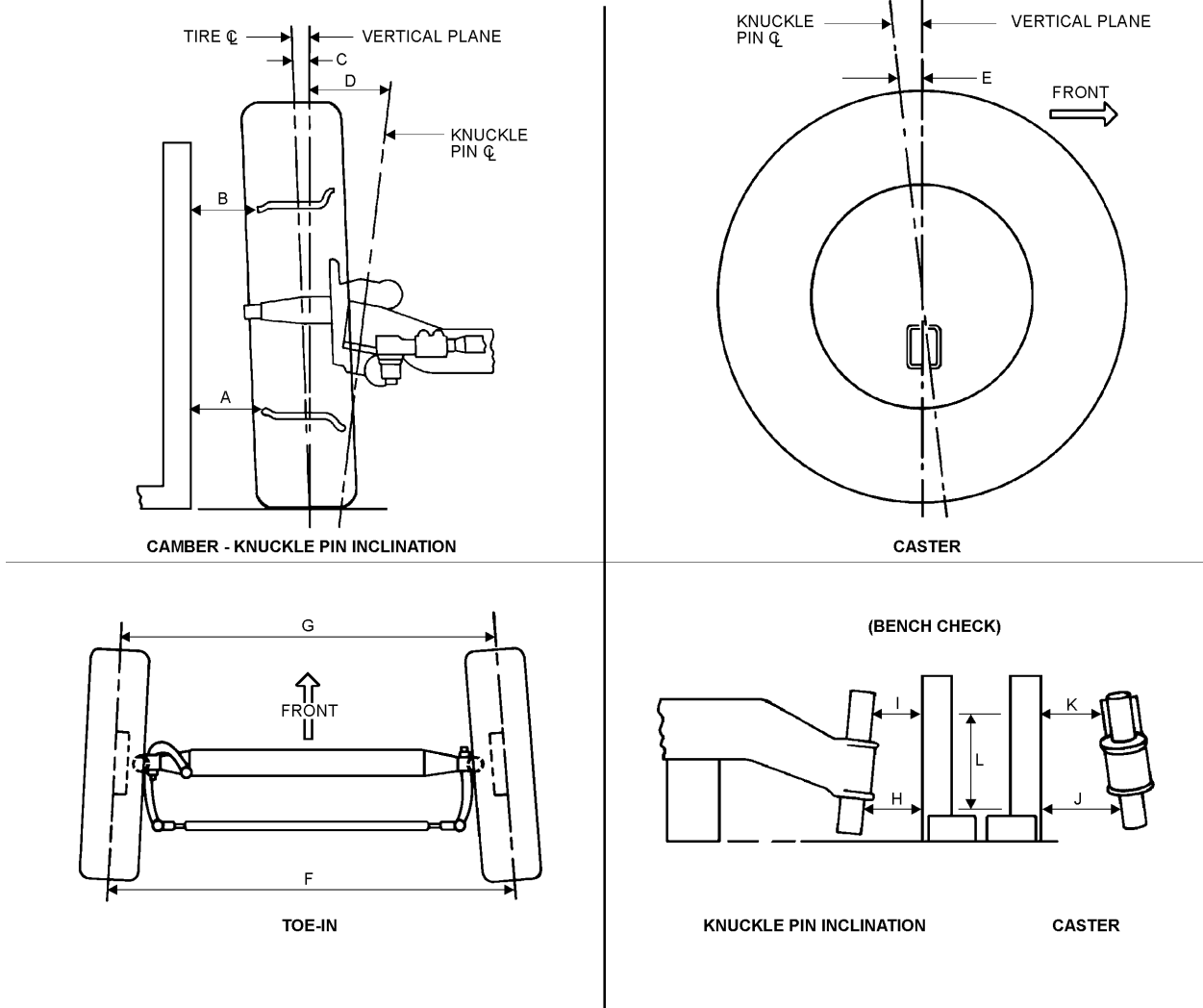
7.3 Front Wheel Toe-In

Wheel toe-in is the distance, measured at spindle height with the wheels in the normal, straight ahead position; both front wheels are closer together at front than at rear of axle.

Incorrect toe-in results in excessive tire wear caused by side slippage. Steering instability with a tendency to wander may result.

Specifications

Toe-in $3/32" \pm 1/32"$ ($2,4 \pm 0,8$ mm)



A minus B.....Camber (in (mm))
 0.025" (0,64 mm) = 1/16°
 C.....Camber angle (deg.)
 D.....Knuckle pin inclination (deg.)
 E.....Caster angle (deg.)

F minus G Toe-in (in(mm))
 H minus I.....Knuckle pin inclination (in(mm))
 ..0.035" (0,89 mm) = 0°15' (for L = 8" (203,2 mm))
 J minus K.....Caster (in(mm))
 ..0.035" (0,89 mm) = 0°15' (for L = 8" (203,2 mm))

Note: Refer to heading "Specifications" for numerical values.

FIGURE 2: FRONT END ALIGNMENT CHART

10012

Section 10: FRONT AXLE

Inspection and Adjustment

Before checking front wheel toe-in, first check the camber angles and make the necessary corrections.

1. With the vehicle on a flat and level surface, jack up front of vehicle until the tires clear the ground, and place safety supports underneath axle.

Caution: Use only the recommended jacking points as outlined in section 18 "BODY".

2. Use paint or chalk and whiten the center area of both front tires around the complete outer surface of the tire.
3. Position front wheels in a straight ahead position as follows:
 - a) Install two pins, of the same size and known to be straight, with conical nuts in the existing holes at axle center (Figs. 3 & 4).

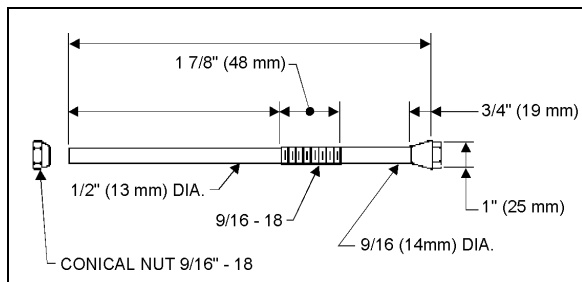


FIGURE 3: POSITION PIN

10013



FIGURE 4: POSITION PIN INSTALLATION

10014

- b) Measure the distance between the pin and wheel for each wheel, and position them in order to obtain the same reading e.g.: If L.H. side = $7 \frac{1}{2}$ " (191 mm) and R.H. side = $7 \frac{3}{4}$ " (197 mm) in the straight ahead position, the final reading should be $7 \frac{5}{8}$ " (194 mm) on each side.

4. With the wheels in a straight ahead position, mark the center line of each tire tread using a scribe or similar instrument. Apply sufficient pressure on scribe to obtain a single, straight line all around the tire.
5. Lower the vehicle to the floor, and move it forwards and backwards approximately 10' (3 m) in order to neutralize front suspension.
6. Put a trammel bar at the back of tires, adjust pointers to spindle height and align them with the marks on the tires. Measure and record the distance between the pointers.
7. Measure and record the distance between the marks at front of tires as per step 6.
8. To get the toe-in measurement, subtract the reading taken at front of tires (G) from the one taken at back (F) (Fig. 5). Compare with specifications.

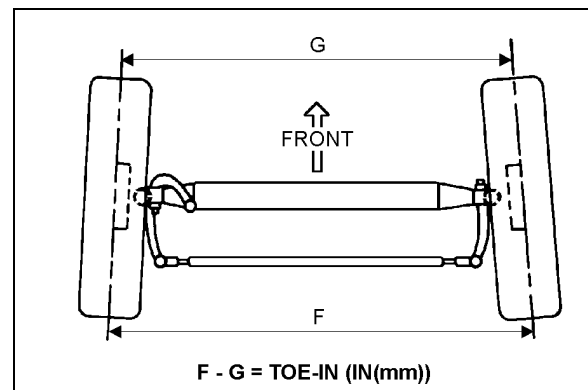


FIGURE 5: TOE-IN MEASUREMENT

10015

Note: A steel measuring tape can also be used to check toe-in.

9. If toe-in needs adjustment, proceed as follows:
 - a) Loosen the clamp nut on each end of the tie rod.
 - b) Turn the tie rod until the specified toe-in distance is obtained.

Note: The tie rod is supplied with R.H. and L.H. threads to simplify toe-in adjustment.

- c) Tighten tie-rod clamp nuts to 40/60 lbf•ft (55/80 N•m).
10. Recheck toe-in as outlined in steps 1-8.

7.4 Front Axle Caster

Positive caster is the rearward tilt from the vertical of the knuckle pin. Negative caster is the forward tilt from the vertical of the knuckle pin (Fig. 2). This vehicle is designed with a positive caster. The purpose of the caster angle is to give a trailing effect. This results in a stabilized steering and a tendency for the wheels to return to the straight-ahead position after taking a turn.

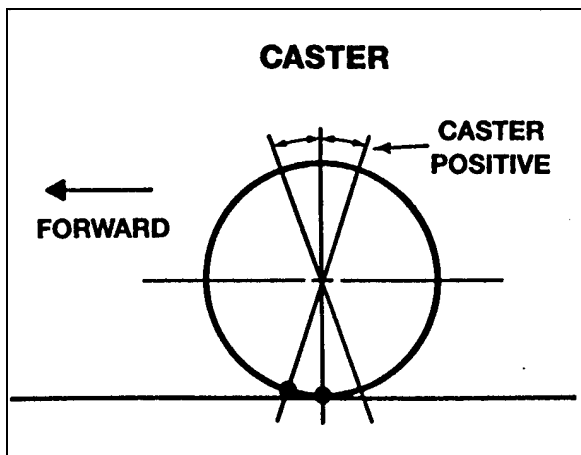


FIGURE 6: CASTER 10007

Excessive caster results in hard steering around corners. A shimmy may also develop when

returning to the straight ahead position (pulling out of curves).

Insufficient caster will cause wandering and steering instability. Caster variations may be caused by a bent axle, tilting or distortion of the side suspension supports, damaged radius rod bushings, or unequal tightening of the front and rear suspension support bolts.

Specifications

Caster (both sides)+2 3/4° ± 3/4

Inspection and Adjustment

Position front wheels on turning plates in a straight ahead position. Install alignment gauges, record caster reading for each wheel (Fig. 2) and compare with specifications.

Shorter and longer radius rods (P/N 121101 (short) & P/N 121313 (long)) are available to correct caster angle by 1.3°. Replace radius rods as necessary to adjust caster angle.

Note: Caster correction radius rods may already have been factory installed to provide correct caster.

7.5 Steering Geometry

The front end is designed to keep the front wheels in the proper relative alignment while turning to the right or left.

Turning Angle Adjustment

The maximum turning angle is set through the two steering stop screws installed on the axle center. Steering stop screws are factory adjusted to accommodate the chassis design, and therefore do not require adjustment on new vehicles. However, these should be checked and adjusted if necessary, when any component of the steering system is repaired, disassembled or adjusted.

Caution: To prevent the steering damper from interfering with the adjustment of turning angles, make sure its fixing bracket is at the correct location on the axle center (refer to section 14 “STEERING”).

Mechanical Stop

R.H. Turn Adjustment

1. Turn steering wheel to the right until the boss on the axle center touches the right stop screw.
2. Measure the closest distance between the drag link and tire.
3. Adjust stop screw to obtain a distance of 3/4” (19 mm). Unscrew the jam nut, turn the stop screw accordingly, then tighten jam nut to 50/65 lbf•ft (70/85 N•m).

L.H. Turn Adjustment

1. Turn steering wheel to the left until the boss on the axle center touches the left stop screw.
2. Measure the rod length protruding from steering damper cylinder; between housing and ball joint jam nut.
3. Adjust stop screw to obtain a length of 12” (305 mm). Unscrew the jam nut, turn the stop screw accordingly, then tighten the jam nut to 50/65 lbf•ft (70/85 N•m).

Caution: Reduce or shut off the power steering hydraulic pressure before the boss on the axle center touches the stop screw. If not, the components of the front axle will be damaged (refer to “TAS Service Manual” annexed to section 14 “STEERING” under heading “Poppet Readjustment”).

Caution: Never maintain the relief pressure for more than 5 seconds, since damage to the power steering pump may occur.

8. WHEEL BEARING MAINTENANCE

Refer to “Rockwell Maintenance Manual No. 2 - Front Non-Drive Steering Axle” annexed to this section.

9. TROUBLESHOOTING

Refer to “Rockwell Maintenance Manual No. 2 - Front Non-Drive Steering Axle” annexed to this section.

10. SPECIFICATIONS

Make.....	Rockwell International
Model.....	FG952
Rated load capacity	14,600 lb (6 600 kg)
Gross axle weight rating (G.A.W.R.)	14,400 lb (6 480 kg) or 14,600 (6570 kg) depending on wheel size
Track	85.66” (2 175,8 mm)

11. FRONT WHEEL ALIGNMENT

Camber (under load).....	-1/8° ± 7/16°
Knuckle pin inclination, R.H. side	6°15'
Knuckle pin inclination, L.H. side	5°45'
Toe-in	3/32 ± 1/32” (2,4 ± 0,8 mm)
Caster (both sides).....	+2 3/4° ± 3/4
Caster correction radius rod (1.3°), 22 7/8” C/C (short)	Prévost P/N = 121101
Caster correction radius rod (1.3°), 23 7/8” C/C (long)	Prévost P/N = 121313

12. TORQUE SPECIFICATIONS

Drag link end nut (steering arm)	160/300 lbf•ft (220/405 N•m)
Steering arm nut.....	775/1,450 lbf•ft (1 050/1 965 N•m)
Tie rod arm nut.....	550/1,025 lbf•ft (750/1 390 N•m)
Tie rod end nut.....	160/300 lbf•ft (220/405 N•m)
Tie rod clamp nut	40/60 lbf•ft (55/80 N•m)
Stop screw jam nut	50/65 lbf•ft (70/85 N•m)

SECTION 11: REAR AXLES

CONTENTS

1. DRIVE AXLE	11 - 3
1.1 Description.....	11 - 3
1.2 Drive Axle Lubrication	11 - 3
1.3 Maintenance.....	11 - 3
1.3.1 Checking and Adjusting the Oil Level	11 - 3
1.3.2 Draining and Replacing the Oil.....	11 - 4
1.3.3 Differential Oil Sensor (If applicable)	11 - 4
1.4 Removal and Replacement.....	11 - 4
1.4.1 Removal.....	11 - 4
1.4.2 Replacement.....	11 - 5
1.5 Disassembly and reassembly	11 - 5
1.6 Gear Set Identification.....	11 - 5
1.7 Adjustments.....	11 - 5
1.8 Fastener Torque Chart.....	11 - 5
1.9 Tire Matching.....	11 - 5
1.10 Drive Axle Alignment.....	11 - 6
1.10.1 Description.....	11 - 6
1.10.2 Procedure	11 - 6
1.11 Axle Shaft Sealing Method.....	11 - 8
2. TAG AXLE	11 - 8
2.1 Description.....	11 - 8
2.2 Lubrication.....	11 - 8
2.2.1 Oil Lubricated Wheel Bearings.....	11 - 8
2.2.2 Grease Lubricated Oil Bearings	11 - 8
2.3 Removal and Replacement.....	11 - 9
2.3.1 Removal.....	11 - 9
2.3.2 Replacement.....	11 - 9
2.4 Tag Axle Alignment	11 - 9
2.4.1 Description	11 - 9
2.4.2 Procedure	11 - 10
3. SPECIFICATIONS.....	11 - 11

LIST OF ILLUSTRATIONS

FIG. 1: DIFFERENTIAL AXLE HOUSING BOWL	11 - 3
FIG. 2: XL-40 & 45E DRIVE AXLE ALIGNMENT	11 - 6
FIG. 3: AXLE SHAFT INSTALLATION.....	11 - 7
FIG. 4: OIL FILL CAP	11 - 8
FIG. 5: TAG AXLE ALIGNMENT.....	11 - 11

1. DRIVE AXLE

1.1 Description

The Rockwell drive axle is equipped with a single reduction standard carrier mounted in front of the axle housing. The carrier has a hypoid drive pinion, a ring gear set and gears in the differential assembly.

A straight roller bearing (spigot) is mounted on the head of the drive pinion. All other bearings in the carrier are tapered roller bearings. When the carrier operates, there is a normal differential action between the wheels all the time.

Several speed ratios are available for the drive axle. These ratios depend upon the motor and transmission. Also, special applications may suggest slightly different gear ratios.

1.2 Drive Axle Lubrication

Additional lubrication information is covered in the Rockwell *"Maintenance Manual No. 5"* annexed to this section. During initial stage of normal operation, tiny metal particles originating from moving parts can be found on mating surfaces. These particles are carried by the lubricant through the assembly and act as lapping compound which accelerates wear of all parts. To ensure maximum life of the differential and prevent premature failure, the original "factory fill" lubricant should be drained. Change break-in oil before 3,000 miles (4 800 km) of initial operation (drain the unit while it is still warm from operation), in accordance with the lubrication and servicing schedule.

Change differential oil and clean the breathers, the magnetic fill and drain plug, every 100,000 miles (160 000 km) or once every two years, whichever comes first. Use Multigrade gear oil MIL-L-2105-D. Use the 75W90 gear oil for northern climates and the 80W140 for southern climates. In extreme conditions, or for better performance, full synthetic gear oil can be used.

Check oil level and add (if necessary) every 6,250 miles (10 000 km) or twice a year, whichever comes first (Fig. 1).

Note: Drive axle wheel bearings may be lubricated by the differential oil. If this is the case on your vehicle, maintain differential oil level to ensure adequate lubrication of drive axle wheel bearings at all times.

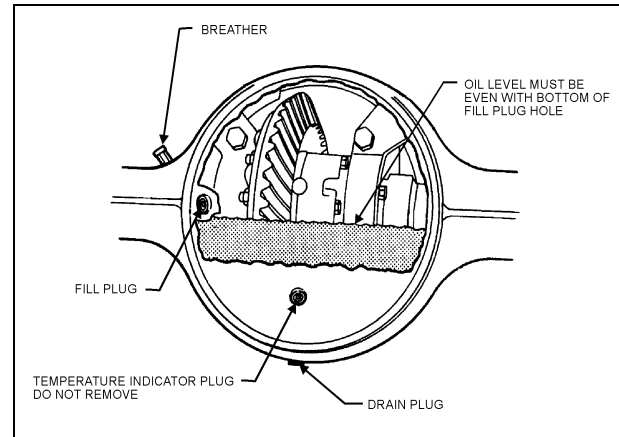


FIGURE 1: DIFFERENTIAL AXLE HOUSING BOWL 11007

1.3 Maintenance

Proper vehicle operation begins with preventive maintenance, such as good differential use. The most common types of drive axle carrier failures are spinout, shock, fatigue, overheating and lubrication. Avoid neglecting these points since they would be the first steps to improper maintenance, expensive repairs, and excessive downtime.

Inspect the pinion oil seal, axle shaft flange and carrier housing gaskets for evidence of lubricant leakage. Tighten the bolts and nuts, or replace the gaskets and seals to correct leaks. Maintenance of the axle mountings consists primarily in a regular and systematic inspection of the air suspension units and radius rods, as directed in Section 16, "SUSPENSION".

1.3.1 Checking and Adjusting the Oil Level

Warning: Before servicing, park safely over a repair pit, apply parking brake, stop engine and set main battery disconnect switch (XL-40

Section 11: REAR AXLES

& 45E) or battery master switch (XL-45) to the "OFF" position.

1. Make sure the vehicle is parked on a level surface.

Caution: Check the oil level when the axle is at room temperature. When hot, the oil temperature may be 190°F (88°C) or more and can cause burns. Also, a correct reading is not obtained when the axle is warm or hot.

2. Make sure the axle is "cold" or at room temperature.
3. Clean the area around the fill plug. Remove the fill plug from the differential axle housing bowl (Fig. 1).
4. The oil level must be even with the bottom of the hole of the fill plug.
 - a. If oil flows from the hole when the plug is loosened, the oil level is high. Drain the oil to the correct level.
 - b. If the oil level is below the bottom of the hole of the fill plug, add the specified oil.
5. Install and tighten the fill plug to 35-50 lbf•ft (48-67 N•m).

1.3.2 Draining and Replacing the Oil

Warning: Before servicing, park safely over a repair pit, apply parking brake, stop engine and set main battery disconnect switch (XL-40 & 45E) or battery master switch (XL-45) to the "OFF" position.

1. Make sure the vehicle is parked on a level surface. Put a large container under the axle's drain plug.

Note: Drain the oil when the axle is warm.

2. Remove the drain plug from the bottom of the axle. Drain and discard the oil in an environment friendly manner.
3. Install and tighten the drain plug to 35-50 lbf•ft (48-67 N•m).
4. Clean the area around the fill plug. Remove the fill plug from the differential housing bowl.
5. Add the specified oil until the oil level is even with the bottom of the hole of the fill plug. Allow the oil to flow through the axle and check the oil level again (lube capacity 41 pints [13,3 liters]).
6. Install and tighten the fill plug to 35-50 lbf•ft (48-67 N•m).

1.3.3 Differential Oil Sensor (if applicable)

An oil temperature sensor is located in the housing bowl and its gauge is located on the central dashboard. The normal operating temperature is below 250°F (120°C).

Caution: The differential overheats when the oil temperature rises above 250°F (120°C).

1.4 Removal and Replacement

The following procedure deals with the removal of the drive axle assembly and its attachments as a unit. The method used to support the axle during removal and disassembly depends upon local conditions and available equipment.

1.4.1 Removal

1. Raise vehicle by its jacking points on the body (see Section 18, "BODY" under heading "VEHICLE JACKING POINTS"). Place jack stands under frame. Remove drive axle wheels (if required, refer to

Section 13, "WHEELS, HUBS AND TIRES".

2. Exhaust compressed air from the air supply system by opening the drain cock on each air reservoir.
3. Disconnect the propeller shaft as directed in Section 9, "PROPELLER SHAFT", in this manual.
4. On both sides of the vehicle, unscrew fasteners retaining front wheelhouse plastic guards, and remove them from vehicle.
5. Disconnect both height control valve links from air spring mounting plate brackets.
6. Remove cable ties securing the ABS cables (if vehicle is so equipped) to service brake chamber hoses. Disconnect the ABS cable connectors located at the opposite extremity of the sensor ends.
7. Disconnect the brake chamber hoses.
12. Remove the two retaining nuts from each of the four air bellows' lower mounting supports.
13. Use the jacks to lower axle. Carefully pull away the jacks axle assembly from underneath vehicle.

Note: When you remove cable ties for ease of operation, remember to replace them afterwards.

7. Disconnect the brake chamber hoses.

Note: Position the hoses so they will not be damaged when removing the axle.

8. Install jacks under the axle jacking points to support the axle weight.
9. Remove the four shock absorbers as outlined in Section 16, "SUSPENSION" under heading "SHOCK ABSORBER REMOVAL".
10. Remove the lower and upper longitudinal radius rod supports from vehicle subframe as outlined in Section 16, "SUSPENSION", under heading "RADIUS ROD REMOVAL".
11. Remove the transversal radius rod support from the vehicle subframe.

1.4.2 Replacement

Reverse removal procedure to reinstall drive axle.

Note: Refer to Section 16, "SUSPENSION" for suspension components' proper tightening torques.

Note: Refer to section 13 "WHEELS HUBS AND TIRES" for correct wheel bearing adjustment procedure.

1.5 Disassembly and Reassembly

Disassembly and reassembly procedures are covered under applicable headings in Rockwell's "MAINTENANCE MANUAL, NO. 5", annexed to this section.

1.6 Gear Set Identification

Gear set identification is covered under applicable heading in Rockwell's "MAINTENANCE MANUAL NO. 5", annexed to this section.

1.7 Adjustments

Adjustments are covered under applicable headings in Rockwell's "MAINTENANCE MANUAL NO. 5", annexed to this section.

1.8 Fastener Torque Chart

A differential fastener torque chart is provided in Rockwell's "MAINTENANCE MANUAL NO. 5", annexed to this section.

Section 11: REAR AXLES

1.9 Tire Matching

Drive axle tire matching is covered under the applicable heading in Section 13, "WHEELS, HUBS AND TIRES", of this manual.

1.10 Drive Axle Alignment

1.10.1 Description

The drive axle alignment consists in aligning the axle according to the frame. The axle must be perpendicular to the frame. The alignment is achieved with the use of shims inserted between the lower longitudinal radius rod supports and the frame.

Drive axle alignment is factory set and is not subject to any change, except if the vehicle has been damaged by an accident or if there are requirements for replacement.

Caution: *If this setting is significantly altered, the vehicle will produce offset tracking (dog tracking).*

If the axle has been removed for repairs or servicing and if all the parts are reinstalled exactly in the same place, the axle alignment is not necessary. However, if the suspension supports have been replaced or altered, proceed with the following instructions to verify or adjust the drive axle alignment.

1.10.2 Procedure

1. Park vehicle on a level surface, then chock front vehicle wheels.
2. Using two jacking points (which are at least 30 inches [76 cm] apart) on drive axle, raise the vehicle sufficiently so that wheels can turn freely at about ½ inch from ground. Secure in this position with safety stands, and release parking brake.
3. Using an optical toe and tracking system installed on each side of the drive axle, fix and position the projector in the center of the wheel. Measure the distance on each side of projector mounting rods. Distance should be equal on both sides. If not, adjust the projector.

4. Place target boards against the front wall of the rear baggage compartment (Fig. 2).
5. Connect the projectors and set to zero. Rotate the wheel and set projectors to zero at four opposite positions.

Note: *It is important to have a zero marking when rotating the wheel in order to eliminate wheel run-out.*

6. Aim projector on the target board. Measure distance between target center line (provided by the projector) and the frame post located immediately adjacent to the target board. Record measurement, then repeat procedure on the other side (Fig. 2). Dimensions obtained are identified RR on rear right-hand side and RL on rear left-hand side.
7. Move the target boards to the front of vehicle: On XL-40 & 45 vehicles, place target boards against the front wall of the first baggage compartment - on XL-45E vehicles, place target boards against the front wall of the second baggage compartment.

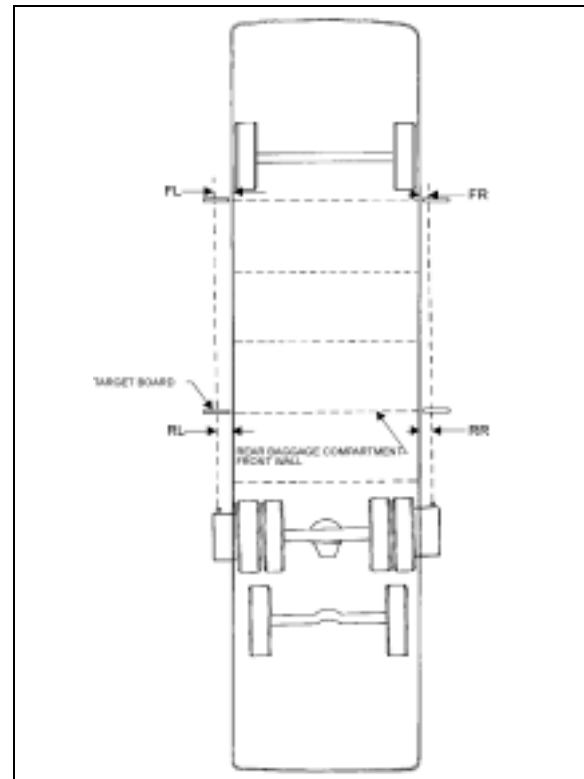


FIGURE 2: XL-40 & 45 DRIVE AXLE ALIGNMENT (XL-45E SIMILAR - SEE STEP 7)

11008XL

8. Aim the projector on the target board, then measure the distance between target centerline (provided by the projector) and the frame post adjacent to the target board. Record measurement, then repeat on the other side. Dimensions obtained are identified FR on front right-hand side and FL on front left-hand side.
9. Subtract measurement taken at rear of the vehicle from measurement taken at front of the vehicle on the same side. Record results. Repeat previous operation on other side of vehicle. Record results.
 $FR - RR = \text{RESULT "A"}$
 $FL - RL = \text{RESULT "B"}$
10. The results on either side must be less than or equal to 5/8 inch (16 mm) on XL-40 & 45E vehicles and 9/16 inch (14 mm) on XL-45 vehicles. If one or both results exceed the value specified for the vehicle, corrective action should be taken with respect to axle position. If difference is excessive, inspect for probable cause by checking for worn or damaged bushings, bent radius rods and/or brackets. Prior to V.I.N. 2P9M33494S1001524 drive axle alignments are factory set and are otherwise not adjustable.
11. Starting with V.I.N. 2P9M33494S1001524 drive axles are adjustable. Correct axle position by inserting a shim between the lower longitudinal radius rod support and the axle, on right or left side of vehicle, according to the previous results.

Note: Refer to Section 16, "SUSPENSION", for proper torque tightening of the longitudinal radius rod support nuts.

12. Repeat steps 6 to 10 to ensure that axle is truly perpendicular to the frame.

1.11 Axle Shaft Sealing Method

The following method is to be used to ensure that axle shaft installation is fluid-tight:

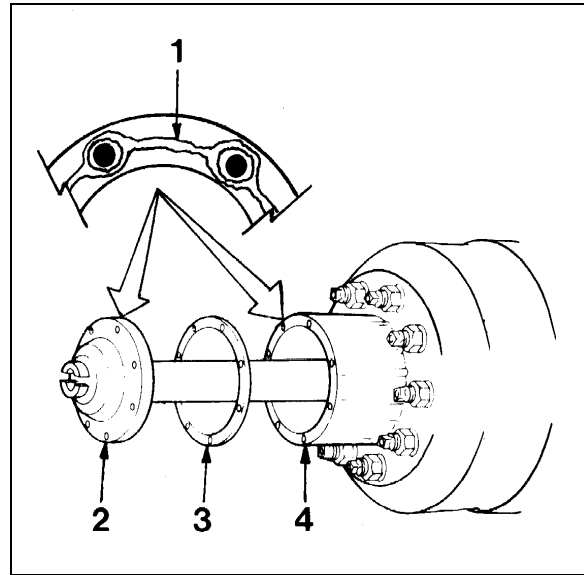


FIGURE 3: AXLE SHAFT INSTALLATION 11003

- 1Silicone sealant*
- 2Axle shaft
- 3Gasket
- 4 Wheel hub

1. Clean the mounting surfaces of both the axle shaft flange and wheel hub where silicone sealant will be applied. Remove all old silicone sealant, oil, grease, dirt and moisture. Dry both surfaces.
2. Apply a continuous thin bead of silicone sealant* (Prévost P/N 680053) on the mounting surfaces and around the edge of all fastener holes of both the axle shaft flange and wheel hub.

Warning: Carefully read cautions and instructions on the tube of silicone sealant and its packing.

* GENERAL ELECTRIC Silicone Rubber Adhesive Sealant RTV 103 Black.

3. Assemble components immediately to permit the silicone sealant to compress evenly between parts.
 - a. Place a new gasket, then install the axle shaft into the wheel hub and differential carrier. The gasket and flange of the axle shaft must fit flat against the wheel hub.

Section 11: REAR AXLES

- b. Install the tapered dowels at each stud and into the flange of the axle shaft. Use a punch or drift and hammer if needed.
- c. Install the lock washers and nuts on the studs. Tighten nuts to the correct torque value.

Note: Torque values are for fasteners that have a light application of oil on the threads (refer to Rockwell Maintenance Manual).

9/16-18 plain nut: 110 - 165 lbf•ft (149 - 224 N•m)
5/8-18 plain nut: 150 - 230 lbf•ft (203 - 312 N•m)

2. TAG AXLE

2.1 Description

The tag axle is located behind the drive axle. It carries a single wheel and tire on each side. The standard system allows unloading of the tag axle air springs without raising the axle, while the optional system enables unloading and raising of the tag axle (refer to the "OPERATOR'S MANUAL" for location of controls). Both these systems have been designed for the following purposes:

1. Shortening of wheelbase, thus allowing tighter turning in tight maneuvering areas such in a parking lot or when making a sharp turn.
2. Transferring extra weight and additional traction to the drive wheels on slippery surfaces.

Caution: Never exceed 30 mph (50 km/h) with tag axle up or unloaded and resume normal driving as soon as possible.

The tag axle service brakes operate only when the axle is in normal driving (loaded) position.

2.2 Lubrication

2.2.1 Oil Lubricated Wheel Bearings

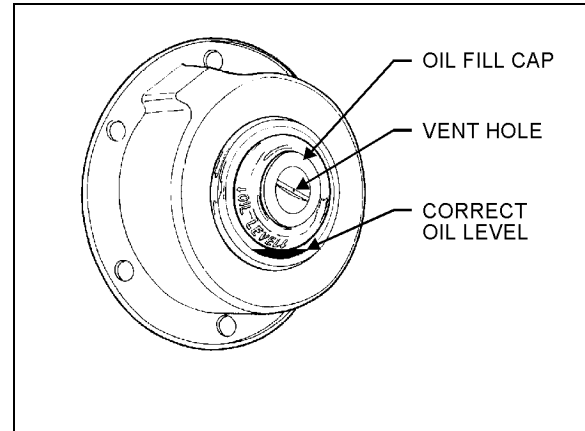


FIGURE 4: Oil Fill Cap

13003

The oil level on the tag axle wheel bearings must be maintained to the level mark in the cap. The level is determined by a line, indicated by arrows, that is incorporated to the plastic lens and passes underneath the words "OIL LEVEL" (Fig. 4). To check oil level after vehicle has been driven, wait at least 15 minutes to ensure that oil has settled.

2.2.2 Grease Lubricated Wheel Bearings

Repack the tag axle wheel bearing with multipurpose grease every 50,000 miles (80 000 km) or once a year, whichever comes first. Use a good quality lithium-base grease: NLGI No. 2 (suitable for most temperatures) or NLGI No. 1, (suitable for extremely low temperatures).

2.3 Removal and Replacement

The following procedure deals with the removal of the tag axle assembly along with the suspension components. The method used to support the axle and suspension components during removal and disassembly depends upon local conditions and available equipment.

2.3.1 Removal

1. Raise vehicle by its jacking points on the body (see Section 18, "BODY" under heading "VEHICLE JACKING POINTS"). Place jack under frame. Remove drive axle wheels (if required, refer to Section 13, "WHEELS, HUBS AND TIRES").
2. Exhaust compressed air from the air supply system by opening the drain cock on each air reservoir.
3. Install jacks under tag axle jacking points to support the axle weight.
4. Applies only to vehicles equipped with retractable tag axles: Disconnect tag axle lifting chain collars from lower longitudinal radius rods.
5. Remove the propeller shaft as directed in Section 9, "PROPELLER SHAFT", in this manual.
6. Disconnect the tag axle brake chamber hoses.

Caution: Position the hoses so they will not be damaged when removing axle.

7. Disconnect hose from the air spring upper mounting plate.
8. Remove the two shock absorbers as outlined in Section 16, "SUSPENSION", under "SHOCK ABSORBER REMOVAL".
9. Disconnect the lower longitudinal radius rods as outlined in Section 16, "SUSPENSION", under "RADIUS ROD REMOVAL".
10. Disconnect the transversal radius rod.
11. Disconnect the upper longitudinal radius rod.

12. Remove the retaining nuts of the air bellows from each of the two upper mounting plates.
13. Use the jacks to move the axle forward to clear the axle of the transmission. Lower the axle.

Caution: On vehicles equipped with an automatic transmission (with or without the output retarder), move tag assembly very carefully. Pay special attention to the U-shaped section, as the transmission end components may be easily damaged through a false maneuver.

2.3.2 Replacement

Reverse removal procedure to reinstall tag axle.

Note: Refer to Section 16, "SUSPENSION", for proper torque tightening of suspension components.

Note: Refer to section 13 "WHEELS HUBS AND TIRES" for correct wheel bearing adjustment procedure.

2.4 Tag Axle Alignment & Toe

2.4.1 Description

The tag axle alignment consists in aligning the tag axle parallel to the drive axle position. Before aligning the tag axle, proceed with the drive axle alignment (paragraph 1.10). Tag axle alignment is achieved with the use of shims inserted between the lower longitudinal radius rod supports and axle. Tag axle alignment is factory set and is not subject to any change, except if vehicle has been damaged by an accident or if there are requirements for parts replacement.

Section 11: REAR AXLES

Note: *It may be necessary to adjust the axle TOE as well as its alignment. In this case, insert shims (7 min. - P/N 121203 or 15 min. - P/N 121240) in between mounting plate and spindle, as required.*

Caution: *If this setting is altered significantly, it will cause excessive tire wear.*

If axle has been removed for repair or servicing and if all parts are reinstalled exactly in their previous locations, axle alignment is not necessary. However, if the suspension supports have been replaced or have changed position, proceed with the following instructions to verify or adjust the tag axle alignment.

2.4.2 Procedure

1. Park the vehicle on a level surface. Unload tag axle (or lift, if so equipped) using the appropriate control (refer to the "OPERATOR'S MANUAL" for details). Chock front vehicle wheels.
2. Using two jacking points (which are at least 30 inches [76 cm] apart) on drive axle, raise vehicle sufficiently so that wheels are raised about ½ inch from ground and secure in this position with safety stands.
3. Using jacking points on tag axle, raise axle sufficiently (no more than ½ inch from the ground) to turn tag axle wheels freely.
4. Using an optical toe & tracking system installed on each side of the drive axle, fix and position the projector in center of wheel. Measure the distance on each side of the projector mounting rods. The distance should be equal on both sides. If not, adjust the projector.

5. Install a mirror on each side of vehicle, against the front wall of the rear baggage compartment (Fig. 5).
6. Connect the projector and set it to zero. Rotate the wheel and set projectors to zero at four (4) opposite positions.

Note: *It is important to have a zero marking when rotating the wheel in order to eliminate wheel run-out.*

7. Aim the projector at the mirror, and adjust the mirror to reflect the beam light reflection exactly on the zero position of the projector centering plate.
 8. Move the optical toe and tracking system installed on each side of the drive axle to the tag axle.
 9. Aim the projector on the mirror as indicated in step 7.
 10. The reflected beam of light on the centering plate of the projector should be within $0 \pm 3/64^\circ$.
 11. If necessary, correct tag axle alignment by inserting shims in between the lower longitudinal rod support and the axle or correct tag axle TOE by inserting shims in between mounting plate and spindle (on R.H or L.H. side of vehicle depending on the results obtained).
- Note:** *Refer to Section 16, "SUSPENSION", for proper torque tightening of the longitudinal radius rod support nuts.*
12. Repeat steps 4 to 10 to ensure that axle is truly parallel to the drive axle.

3. SPECIFICATIONS

Drive Axle

Make Rockwell International
 Drive track..... 76.7 inches (1 949 mm)
 Gear type Hypoid
 Axle type Full floating
 Lube capacity.....41 pints (19,3 liters)

Drive axle ratio

w/11.1L - PS130-6B and w/12.7L - PS145-7A
 Standard 3.21:1
 Optional..... 3.07:1

World Transmission

Coaches..... 4.88:1
 Shells 4.56:1

Drive Axle Alignment Specifications

XL-40 5/8" Max.
 XL-45E 5/8" Max.
 XL-45 9/16" Max.

Tag Axle

Axle Beam Manufacturer Prévost
 Hub Manufacturer Rockwell - Disc Brake 1560
 Rear Track 83.6" (2 124 mm)

Tag Axle Alignment Specifications

TOE - All XL Vehicles (Both Sides)

Minimal -3/64"
 Nominal 0
 Maximal +3/64"
 Installation Mirrors

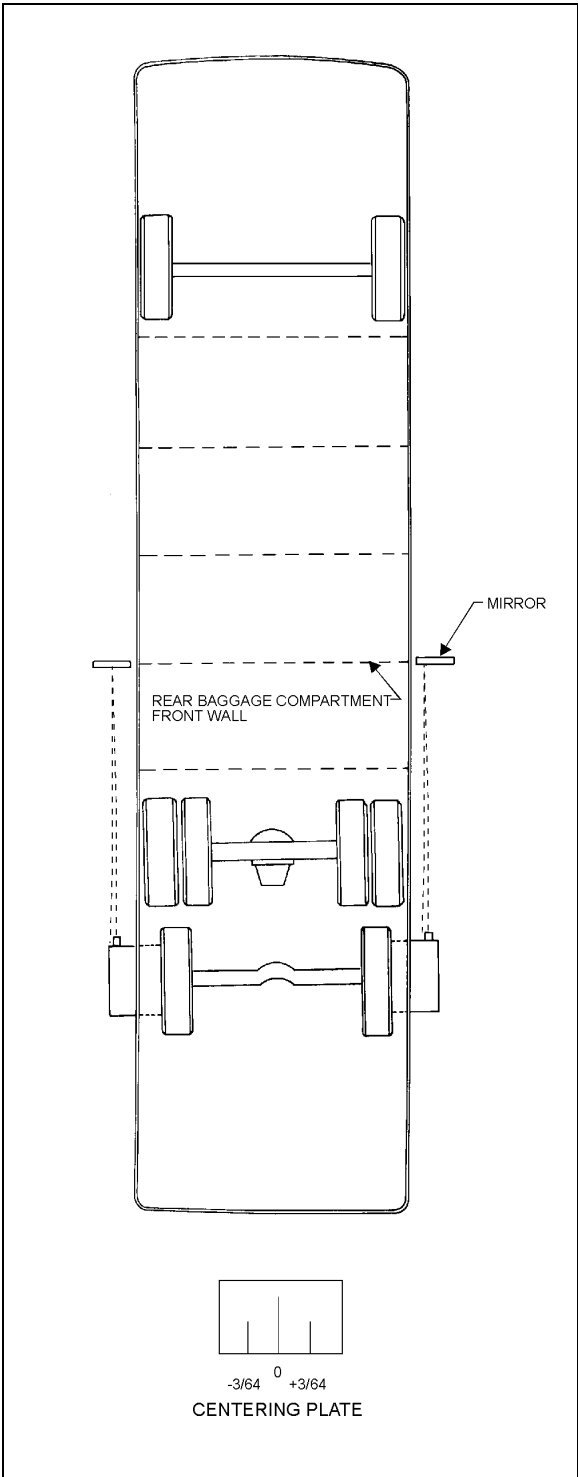


FIGURE 5: TAG AXLE ALIGNMENT 11009XL

SECTION 12: BRAKE AND AIR SYSTEM

CONTENTS

1. DESCRIPTION.....	12-5
1.1 Air System	12-5
1.2 Brakes.....	12-5
2. AIR RESERVOIRS	12-5
2.1 Location and Function	12-5
2.2 Maintenance	12-6
2.2.1 Wet Air Tank	12-6
2.2.2 Primary Air Tank	12-7
2.2.3 Secondary Air Tank	12-7
2.2.4 Accessory Air Tank.....	12-7
2.2.5 Kneeling Air Tank and Emergency/Parking Brake Override Air Tank (If Applicable)	12-7
3. AIR SYSTEM EMERGENCY FILL VALVE	12-7
4. ACCESSORY AIR FILTER.....	12-8
4.1 Element Replacement	12-9
4.2 Cleaning.....	12-9
5. AIR GAUGES (PRIMARY AND SECONDARY)	12-9
6. AIR DRYER (SYSTEM SAVER 1000)	12-9
7. AIR LINES AND HOSES	12-10
7.1 Tubing and Hoses	12-10
7.1.1 Copper Tubing.....	12-10
7.1.2 Nylon Tubing.....	12-10
7.1.3 Flexible Hoses	12-10
7.2 Air Line Serviceability Test	12-10
7.2.1 Operating Test	12-10
7.2.2 Leakage Test.....	12-11
7.3 Maintenance	12-11
8. PRESSURE REGULATING VALVES.....	12-11
8.1 Description	12-11
8.2 Maintenance	12-12
8.3 Pressure Setting Procedure	12-12

Section 12: BRAKE AND AIR SYSTEM

9.	AIR SYSTEM COMPONENTS	12-12
9.1	Air Compressor (TU-FLO 750).....	12-12
9.1.1	Removal and Installation	12-13
9.2	Governor (D-2)	12-13
9.3	Push-Pull Control Valve.....	12-13
9.3.1	Emergency/Parking Brake Control Valve (PP-1).....	12-13
9.3.2	Emergency/Parking Brake overrule control valve (RD-3) (if applicable).....	12-14
9.4	Flip-flop Control Valve (TW-1).....	12-14
9.5	Horn Valve (HV-3)	12-14
9.6	Dual Brake Application Valve (E-15).....	12-14
9.6.1	Brake Pedal Adjustment	12-14
9.6.2	Maintenance	12-15
9.7	Stoplight Switches	12-15
9.8	Parking Brake Alarm Switch (if applicable)	12-15
9.9	Brake Relay Valves (R-12).....	12-16
9.10	Quick Release Valves (QR-1).....	12-16
9.11	Spring Brake Valve (SR-1).....	12-16
9.12	Pressure Protection Valve (PR-2)	12-17
9.13	Low Pressure Indicators (LP-3).....	12-17
9.14	Shuttle-Type Double Check Valve (DC-4)	12-17
10.	AIR SYSTEM TROUBLESHOOTING	12-18
11.	BRAKE OPERATION	12-18
12.	AIR BRAKES.....	12-18
12.1	Disc Brakes.....	12-18
12.1.1	Disc Brake Pads	12-18
12.1.2	Lubrication	12-19
12.2	Drum Brakes.....	12-19
12.2.1	Drum Brake Adjustment.....	12-19
12.2.2	Maintenance	12-20
13.	RECOMMENDED BRAKE SERVICE PROCEDURES TO REDUCE EXPOSURE TO NON-ASBESTOS FIBER DUST	12-20
14.	BRAKE BURNISHING	12-21
15.	AIR BRAKE TROUBLESHOOTING	12-22
15.1	Pressure Build-up / Low Pressure Warning / Cutoff Point / Governor Cutout.....	12-22
15.1.1	High or Low Warning Cutoff Point.....	12-22
15.1.2	High or Low Governor Cutout Point	12-22
15.1.3	More Than 30 Seconds to Build-up Pressure from 85 to 100 psi (585 - 690 kPa) at Full Engine RPM.....	12-22
15.2	Air Supply Reservoir Leakage.....	12-23
15.2.1	Excessive Air Loss	12-23
15.3	Air Brake Leakage	12-23
15.3.1	Excessive Leakage on Brake Service Side	12-23
16.	BRAKE AIR CHAMBER.....	12-23
16.1	Description	12-23
16.2	Maintenance	12-24

16.2.1 Every 6,250 Miles (10 000 km) or Twice a Year, Whichever Comes First Depending On Type Of Operation	12-23
16.2.2 Every 100,000 Miles (160 000 km) or once a year, whichever comes first Depending on Type of Operation.....	12-23
16.2.3 Airtightness Test	12-23
16.3 Emergency/Parking Brake Manual Release	12-23
16.4 Removal, Installation and Disassembly	12-23
16.4.1 Removal.....	12-23
16.4.2 Installation	12-24
16.4.3 Disassembly	12-24
17. ANTI-LOCK BRAKING SYSTEM (ABS)	12-24
17.1 Description	12-24
17.2 Troubleshooting and Testing.....	12-25
18. ABS COMPONENTS.....	12-25
18.1 Electronic Control Unit.....	12-25
18.1.1 Description	12-25
18.1.2 Maintenance	12-25
18.2 ABS Modulator Valve	12-25
18.2.1 Description	12-26
18.2.2 Maintenance	12-26
18.3 Sensors.....	12-26
18.3.1 Description	12-26
18.3.2 Maintenance	12-26
18.3.3 Installation	12-26
18.4 Clamping Bush	12-27
18.4.1 Description.....	12-27
18.4.2 Maintenance	12-27
19. FITTING TIGHTENING TORQUES	12-27
20. SPECIFICATIONS	12-28

LIST OF ILLUSTRATIONS

FIG. 1: AIR RESERVOIRS LOCATION	12-5
FIG. 2: REAR VALVE LOCATION (XL-40 COACH).....	12-6
FIG. 3: REAR VALVE LOCATION (XL-40 & XL-45E CONVERTED VEHICLES).....	12-6
FIG. 4: REAR VALVE LOCATION (ALL XL-45 VEHICLES)	12-6
FIG. 5: STEERING COMPARTMENT	12-7
FIG. 6: REAR VALVE LOCATION (XL-40 & XL-45E CONVERTED VEHICLES).....	12-7
FIG. 7: REAR VALVE LOCATION (XL-40 COACH).....	12-7
FIG. 8: REAR VALVE LOCATION (ALL XL-45 VEHICLES)	12-7
FIG. 9: FRONT VALVE LOCATION (FILL VALVE)	12-8
FIG. 10: ACCESSORY AIR FILTER	12-8
FIG. 11: AIR DRYER	12-9

Section 12: BRAKE AND AIR SYSTEM

FIG. 12: REAR ENGINE COMPARTMENT 12-11

FIG. 13: R.H. SIDE COMPARTMENT (TYPICAL ILLUSTRATION) 12-11

FIG. 14: AIR PRESSURE REGULATING VALVE 12-11

FIG. 15: AIR PRESSURE REGULATING VALVE 12-12

FIG. 16: AIR COMPRESSOR AND GOVERNOR 12-12

FIG. 17: PP-1 12-13

FIG. 18: RD-3 12-13

FIG. 19: TW-1 12-13

FIG. 20: BRAKE PEDAL ADJUSTMENT 12-14

FIG. 21: DELCO SWITCH 12-14

FIG. 22: BENDIX SWITCH 12-14

FIG. 23: R-12 12-15

FIG. 24: QR-1 12-15

FIG. 25: SR-1 12-15

FIG. 26: PR-2 12-16

FIG. 27: LP-3 12-16

FIG. 28: DC-4 12-16

FIG. 29: LINING WEAR INDICATOR..... 12-18

FIG. 30: DRUM BRAKE ASSEMBLY 12-18

FIG. 31: GREASE FITTINGS LOCATION 12-19

FIG. 32: DRUM BRAKE INSIDE DIAMETER 12-19

FIG. 33: DRIVE AND TAG AXLES BRAKE AIR CHAMBERS OPERATION 12-22

FIG. 34: DRIVE AND TAG AXLES BRAKE AIR CHAMBERS ASSEMBLY 12-22

FIG. 35: FRONT AXLE BRAKE AIR CHAMBER 12-23

FIG. 36: STEERING COMPARTMENT 12-27

FIG. 37: ABS MODULATOR VALVE 12-26

FIG. 38: ABS SENSOR LOCATION 12-26

FIG. 39: CLAMPING BUSH..... 12-27

FIG. 40: HOSE FITTINGS 12-27

FIG. 41: HOSE FITTING 12-27

FIG. 42: HOSE FITTING 12-27

FIG. 43: HOSE FITTING 12-27

1. DESCRIPTION

1.1 Air System

The basic air system consists of an air compressor, reservoirs, valves, filters and interconnecting lines and hoses. It provides a means for breaking, operating controls and accessories, and suspension (refer to Section 16, "Suspension", for complete information on suspension description and maintenance). An air system schematic diagram is annexed in the technical publications box provided with the vehicle for better understanding of the system.

1.2 Brakes

This vehicle uses both the service brake and emergency/parking brake. The service brake air system is divided into two independent circuits to isolate front brakes from rear brakes, thus providing safe breaking in the event that one circuit fails. Front axle brakes operate from the secondary air system, while brakes on both the drive axle and tag axle operate from the primary air system.

Note: *The tag axle service brake operates only when the axle is in normal ride position (loaded and down).*

Furthermore, the brake application sequence, which is increased by a pneumatic relay valve (R-12), will start with the rear axles and will be followed by the front axle, thus providing uniform braking on a slippery road. The vehicle may also be equipped with an Anti-Lock Braking System (ABS), which is detailed later in this section.

The drive and tag axles are provided with spring-applied emergency/parking brakes, which are applied automatically whenever the control valve supply pressure drops below 40 psi (275 kPa). The optional emergency/parking brake overrule system allows the driver to release spring brakes, and to move the vehicle to a safe parking place, such as in the case of a self-application of these brakes due to a drop in air pressure

2. AIR RESERVOIRS

2.1 Location and Function

The air coming from the air dryer is first forwarded to the wet air tank, then to the primary (for the primary brake system), secondary (for the secondary brake system), and accessory (for the pneumatic accessories) air tanks (Fig. 1).

Two additional air reservoirs may be installed on the vehicle: the kneeling air tank and emergency/parking brake overrule air tank.

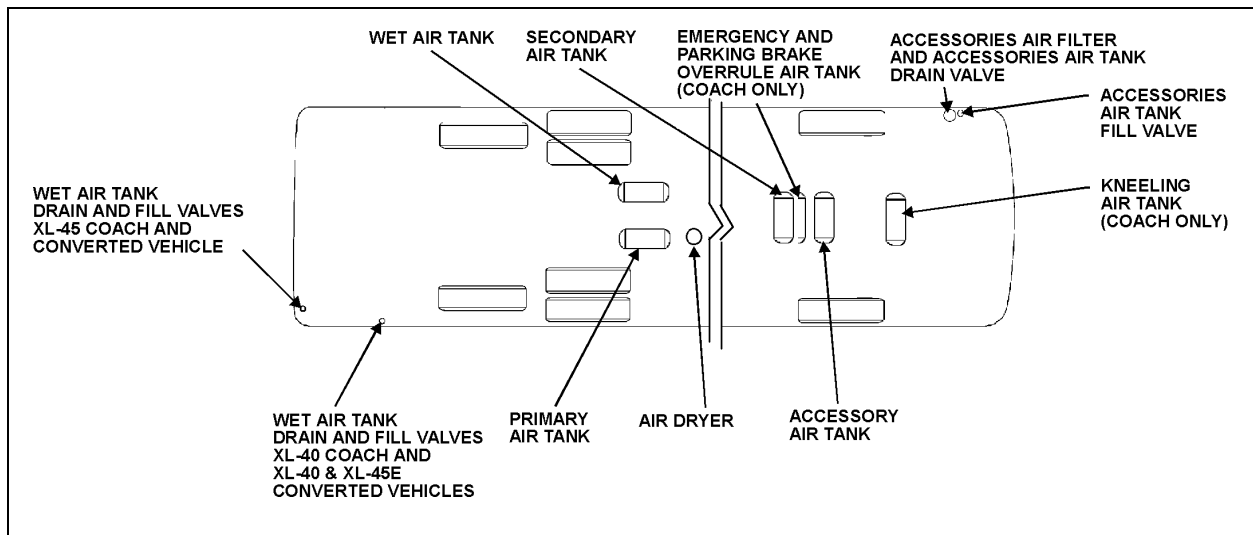


FIGURE 1: AIR RESERVOIRS LOCATION

12064

2.2 Maintenance

Ensure that the accessory air tank is purged during pre-starting inspection. A good practice is to purge this reservoir at the end of every working day by the remote air tank drain valve located in the steering compartment (Fig. 5).

Moreover, purge all reservoirs by their bottom drain valves at specified intervals.

2.2.1 Wet Air Tank

This reservoir is installed above L.H. wheel of drive axle, and is provided with bottom drain valve. It is recommended to **purge** the wet air tank by its bottom drain valve every 12,500 miles (20 000 km), or once a year, whichever comes first.

A remote valve located in engine compartment and accessible through engine R.H. side door is use to **drain** the air dryer. On XL-40 coach, the valve is positioned next to battery booster block, close to door hinge (Fig. 2). On XL-40 & XL-45E converted vehicles, the valve is positioned over battery assembly, close to door hinge (Fig. 3). On all XL-45 vehicles (coach and converted vehicle), the valve is positioned under back up alarm, close to L.H. side of door opening (Fig. 4).

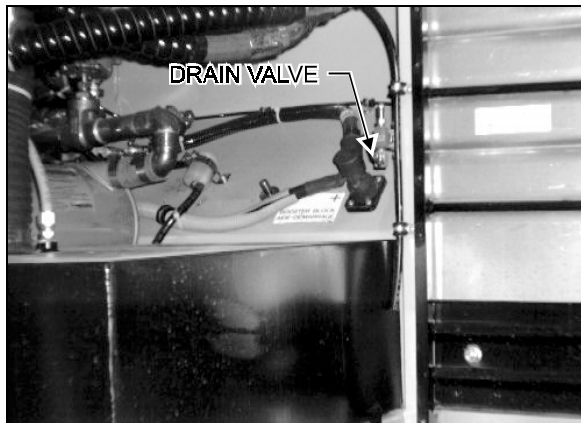


FIGURE 2: REAR VALVE LOCATION (XL-40 COACH) 12057



FIGURE 3: REAR VALVE LOCATION (XL-40 AND XL-45E CONVERTED VEHICLE) 12015

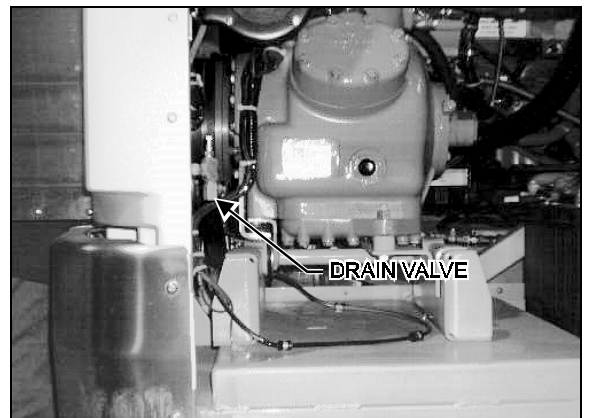


FIGURE 4: REAR VALVE LOCATION (ALL XL-45 VEHICLES) 12016

2.2.2 Primary Air Tank

This reservoir is located above R.H. wheel of drive axle, and is provided with a bottom drain valve (Fig. 1). It is recommended to purge the primary air tank by its bottom drain valve every 12,500 miles (20 000 km) or once a year, whichever comes first.

2.2.3 Secondary Air Tank

This reservoir is located in front wheelhousing, behind steering axle, and is provided with a bottom drain valve (Fig. 1).

It is recommended to purge the reservoir by its bottom drain valve, every 12,500 miles (20 000 km) or once a year, whichever comes first.

2.2.4 Accessory Air Tank

The accessory air tank is installed above front axle and is provided with a bottom drain valve (Fig. 1).

It is recommended to purge the reservoir by its bottom drain valve, every 12,500 miles (20 000 km) or once a year, whichever comes first.

A remote drain valve is located in steering compartment (Fig. 5). Refer to paragraph "4. Accessory Air Filter" of this section for daily purge procedure.

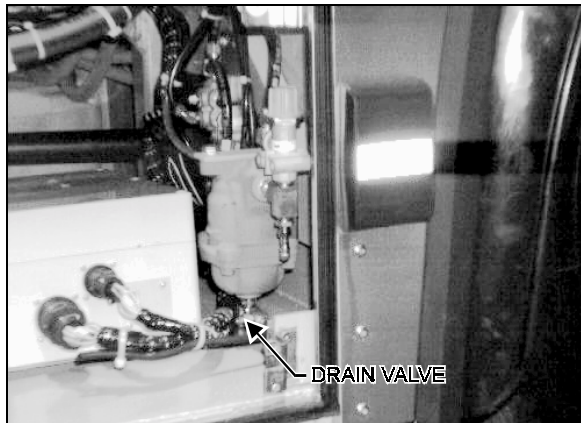


FIGURE 5: STEERING COMPARTMENT

12014

2.2.5 Kneeling Air Tank and Emergency/Parking Brake Overtake Air Tank (If Applicable)

These reservoirs are located in front wheelhousing. The emergency/parking brake overrule air tank is located behind steering axle. The kneeling air tank is located before steering axle. They are provided with a bottom drain valve.

It is recommended to purge them, with all other reservoirs, every 12,500 miles (20 000 km) or once a year, whichever comes first.

3. AIR SYSTEM EMERGENCY FILL VALVES

The vehicle is equipped with two air system emergency fill valves to supplement the air system when air pressure is low and engine cannot be operated.

The rear valve is located in engine compartment and accessible from engine R.H. side door. On XL-40 & XL-45E converted vehicles, the valve is positioned over battery assembly, close to door

hinge (Fig. 6). On XL-40 coaches, the valve is positioned next to battery booster block, close to door hinge (Fig. 7). On all XL-45 vehicles, the valve is positioned under back up alarm, close to L.H. side of door opening (Fig. 8).



FIGURE 6: REAR VALVE LOCATION (XL-40 & XL-45E CONVERTED VEHICLES)

12010

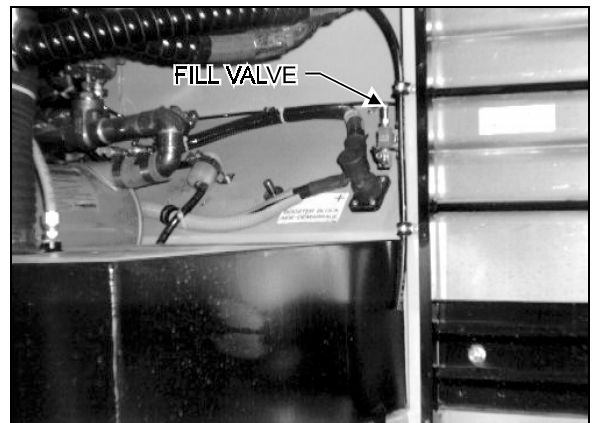


FIGURE 7: REAR VALVE LOCATION (XL-40 COACH)

12057

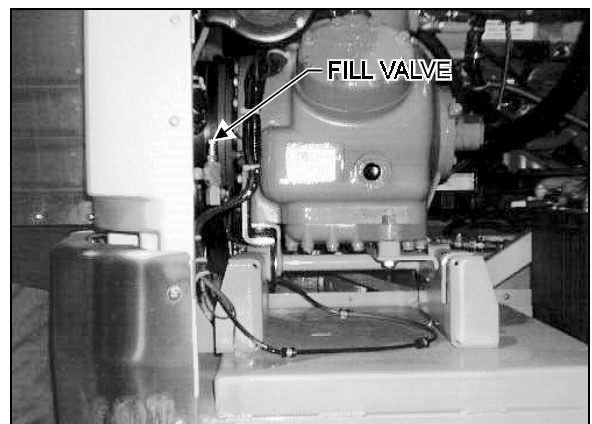


FIGURE 8: REAR VALVE LOCATION (ALL XL-45 VEHICLES)

12011

Caution: No other point should be used to supply air system. The maximum allowable air pressure is 125 psi (860 kPa).

The front valve is located in the steering compartment close to R.H. side of door frame (Fig. 9).

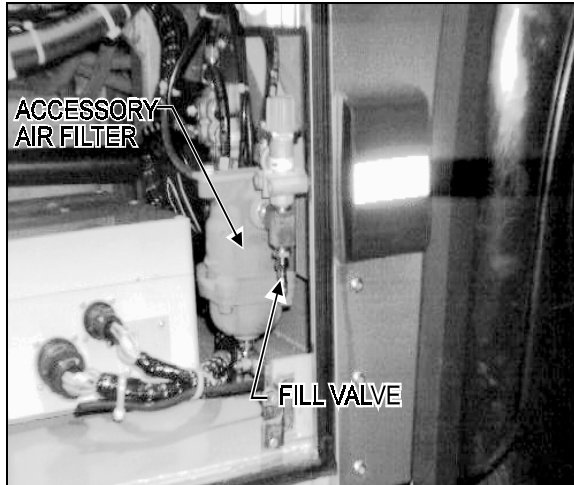


FIGURE 9: FRONT VALVE LOCATION 12012

These two air system emergency fill valves are fitted with the same valve stems as standard tires, and can be filled by any standard external air supply line.

The rear air system emergency fill valve will supply air for all systems (brakes, suspension and accessories) while the front fill valve will supply air for accessories only.

Caution: Air filled through these two points will pass through the standard air filtering system provided by Prevost. Do not fill air through any other points.

4. ACCESSORY AIR FILTER

This filter is located inside the steering compartment (Fig. 9). Its first function consists in straining the air supply of the accessory air tank, when it is connected to an external supply line. Ensure filter is purged whenever supplying the system with an external air line. Its second function is to use the air filter drain valve for daily purge.

Purge the filter and accessory air tank as follows:

1. Take out from vehicle the flexible rubber hose.
2. Open the drain valve and let the moisture come out, then close the drain valve.

4.1 Element Replacement

Replace filter element and gasket every 100,000 miles (160 000 km) or two years, or whenever differential pressure exceeds 15 psi (105 kPa) between both filter inlet and outlet ports, whichever occurs first (Fig. 10).

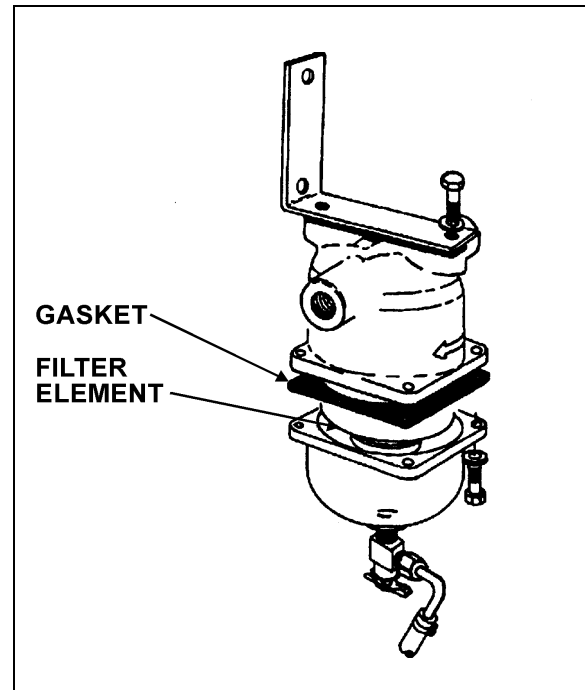


FIGURE 10: ACCESSORY AIR FILTER 12065

4.2 Cleaning

1. Clean filter body and bowl with a warm water and soap solution. Rinse thoroughly with clean water.
2. Blow dry with compressed air making sure the air stream is moisture free and clean. Pay particular attention to the internal passages.
3. Inspect all parts for damage and replace if necessary.

5. AIR GAUGES (PRIMARY AND SECONDARY)

The air pressure gauges, located on the central dashboard panel (see "Operator's Manual"), are connected to the DC-4 double check valve, which is located at ceiling of reclining bumper compartment. The latter is connected to the air lines running from the primary and secondary air

tanks, as shown on the pneumatic system diagram provided in the technical publications box.

The vehicle should never be set in motion until the buzzer alarm and warning lights turn off, i.e. when air pressure registers at least 66 psi (455 kPa). Moreover, if pressure drops below 66 psi (455 kPa), the "Low air pressure" warning lights will turn on, and the "Low air pressure" buzzer will sound. Stop the vehicle immediately, determine and correct the cause(s) of pressure loss. Check the gauges regularly with an accurate test gauge. Replace the gauge with a new unit if there is a variation of 4 psi (27 kPa) or more in the reading.

6. AIR DRYER (SYSTEM SAVER 1000)

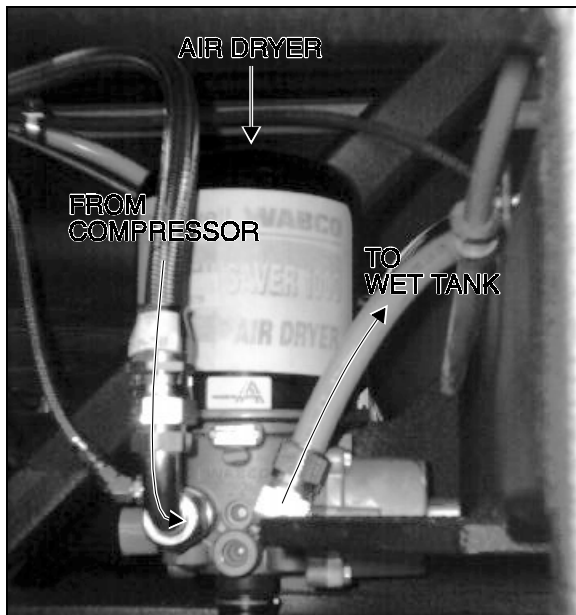


FIGURE 11: AIR DRYER

12035

Air dryer is located above R.H. wheel of drive axle (Fig. 11). The purpose of the air dryer is to remove moisture that could damage the air system before the air enters the system reservoir. The air dryer also filters the air to remove dirt, compressor oil, and other contaminants that can damage the system. Change cartridge every 100,000 miles (160 000 km) or once every two years, whichever comes first.

Maintenance and repair information on the air dryer are supplied in the applicable booklet annexed to this section under reference "Maintenance manual 4CC".

7. AIR LINES AND HOSES

Copper tubing, nylon-reinforced tubing, and flexible hoses are used to connect the units in the pressurized air system, including air brake system, suspension system, and accessory systems such as door, fresh air damper cylinder, air horns etc. Furthermore, the nylon tubing is color coded to ease identification. Refer to the following table for the complete color identification code. Service instructions for each type of air line are also provided under the applicable headings.

Color	Circuit
Red	Secondary
Green	Primary and Delivery
Yellow	Parking Brake
Blue	Suspension
Black	Accessory
White	Entrance Door

7.1 Tubing and Hoses

7.1.1 Copper Tubing

Annealed copper tubing with three-piece compression type fittings are used in the engine compartment where non-flexible hoses are required, but must be heat resistant. Connections should be checked for leakage at least every 6,250 miles (10 000 km) or twice a year, whichever comes first, and tightened or replaced if necessary. When replacing copper tubing, the tubing must be free of burrs, copper cuttings, and dirt. Blow out tubing with compressed air. Any of the above-mentioned particles will destroy sealing seats in air control units. New tubing must be the same size as the old one.

Always use new tubing ring when replacing tubing. When tightening tube connector nuts, tighten to the specified torque to ensure an airtight connection (refer to paragraph "19. Fitting tightening torques" at the end of this section). Overtightening will cause leakage. Apply SAE 10 oil or spray white grease (Prévost part No. 680343) to ball sleeves, tubes, and male threads, then torque to the minimum value and check for leaks. If leaking occurs, back off tube nut about 1/2 turn and retorque to a higher than minimum value.

7.1.2 Nylon Tubing

Nylon tubing is used for air lines in areas where usage of this material is suitable. Nylon tubing is flexible, durable, and weather resistant. When replacing an air line, use nylon tubing only where it has been used previously. Teflon-braided stainless steel hoses used in the engine compartment must be replaced only with similar hoses.

Caution: *Nylon air lines should be used to replace existing nylon lines only, and must comply with the color identification code to ease pneumatic system troubleshooting.*

Nylon air lines must never be routed in areas where temperature could exceed 200 °F (93 °C).

7.1.3 Flexible Hoses

A flexible hose is used normally where it is impractical to use copper or nylon tubing due to constant flexing during operation, such as brake chamber hoses or belt tensioner air cylinder hoses. Hose connections should be tested for leakage at least every 6,250 miles (10 000 km) or twice a year, whichever comes first and tightened or replaced if necessary. Any hose which is chafed, worn or kinked should be replaced.

7.2 Air Line Serviceability Test

7.2.1 Operating Test

If any trouble symptom such as slow brake application or slow brake release indicates a restricted or clogged air line, disconnect the suspected tube or hose at both ends and blow through it to clear the passage. Inspect tubing and hose for partial restriction that may be caused by dents or kinks. If such a condition is found, the tubing or hose should be replaced.

7.2.2 Leakage Test

With air system fully charged and the brakes applied, coat all tubing and hose connections with a soapy solution to check for air leakage. No leakage is permitted. Leakage can sometimes be corrected by tightening the connection. If this fails to correct the leakage, new fittings, nylon tubing,

copper tubing, teflon-braided stainless steel and flexible hoses must be installed as applicable.

7.3 Maintenance

Inspect all lines for cuts, swelling, kinks or other damage or deterioration. Check for lines being pinched by other components. Retaining clips and ties must be in place. Any support or bracket should be in good condition and mounted firmly in position. Hose spring guards should be in usable condition and not distorted. Particular attention should be given to long lines. Any supporting component (clips, ties, grommets, etc.) must be secured to prevent unnecessary vibrations and eventual loosening of connections. Any leak detected should be attended to. Be sure nylon lines are not near areas of intense heat. Check for any missing grommets or loom material where chafing or cutting may occur. Replace with new material as required. In general, lines should be securely located in position and free from any binding condition which would hinder air flow.

8. PRESSURE REGULATING VALVES

8.1 Description

There is one pressure regulating valve for the belt tensioners, and an optional one either for world transmission output retarder or for manual transmission servo-clutch.

The belt tensioner pressure regulating valve controls pressure in belt tensioner cylinders as these latter are parallel mounted. It is located in engine compartment above the door and is used to limit the air pressure in belt tensioners to 50 ± 2 psi (345 ± 15 kPa) for series 60 engines and 70 ± 2 psi (482 ± 15 kPa) for series 50 engines (Fig. 12).

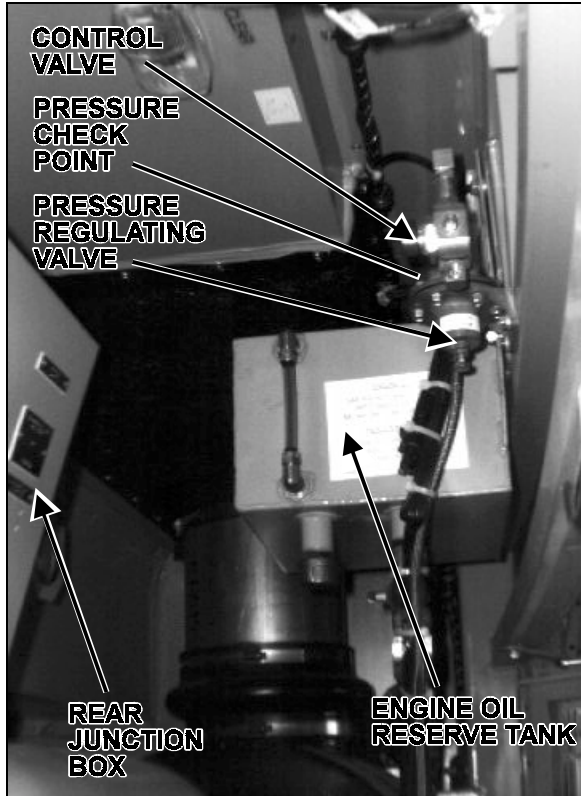


FIGURE 12: REAR ENGINE COMPARTMENT 12066

The optional one is located in engine compartment and is accessible by the service R.H. side door. It could be used for transmission retarder or for servo-clutch. When used with the transmission retarder, it should be adjusted to 80 ± 3 psi (550 ± 20 kPa), and when used with the manual transmission servo-clutch, it should be adjusted to 40 psi (275 kPa) (Fig. 13).



FIGURE 13: R.H. SIDE ENGINE COMPARTMENT (TYPICAL ILLUSTRATION) 12067

	Air Pressure (psi)	Air Pressure (kPa)
Belt Tensioner	series 60 50 ± 2	series 60 345 ± 15
	series 50 70 ± 2	series 50 482 ± 15
Retarder	80 ± 3	550 ± 20
Servo-Clutch	40	275

8.2 Maintenance

Every 100,000 miles (160 000 km) or once every two years, whichever comes first, disassemble valve and wash all metal parts in a cleaning solvent (Fig. 14). Examine the diaphragm; if cracked, worn or damaged, replace with new diaphragm. If the valve is excessively grooved or pitted, it should be replaced. Replace any other parts that appear worn or damaged. After valve is assembled, adjust the valve to the specified pressure setting and check for air leakage.

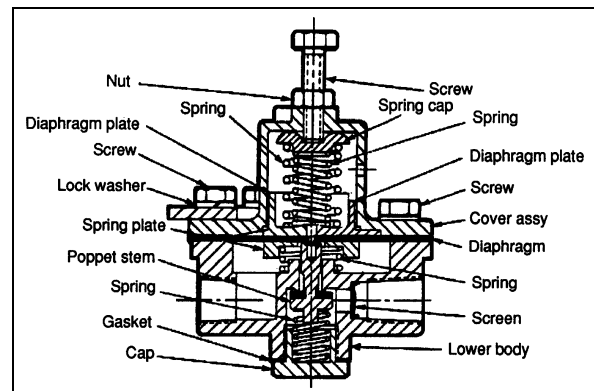


FIGURE 14: AIR PRESSURE REGULATING VALVE 12037

8.3 Pressure Setting Procedure

Remove the dust cap from the pressure check port (Fig. 15). Attach a pressure gauge at this port and check the pressure reading. If the pressure reading is not correct, it can be adjusted by means of the screw on top of the regulating valve as follows:

1. Loosen the lock nut, turn the adjusting screw counterclockwise to decrease pressure approximately 10 psi (70 kPa) below the required pressure.
2. Turn the adjusting screw clockwise to increase the pressure slowly until the required pressure setting is reached. Tighten the locknut.
3. Replace dust cap on the pressure check port.

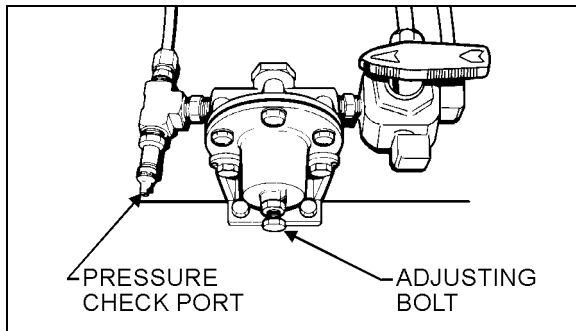


FIGURE 15: AIR PRESSURE REGULATING VALVE 12036

9. AIR SYSTEM COMPONENTS

9.1 Air Compressor (TU-FLO 750)

The air compressor is located on starter side of engine, on the rear of the engine gear case. The function of the compressor is to provide and maintain air under pressure to operate devices in brake and air systems.

This air compressor also drives the engine fuel pump which is bolted to the rear end of the compressor. The compressor crankshaft is designed to accept a drive coupling which is placed between the compressor and fuel pump.

The compressor is driven by the bull gear. The air compressor is water cooled. Engine coolant is fed to the compressor through a flexible hose tapped into the block water jacket and connected to the rear of the compressor. Coolant returns from the right of the compressor (governor side) through a flexible hose to the engine cylinder head. The compressor air inlet is taken from the air intake manifold and entered in the back of the compressor.

The compressed air is pushed in the discharge line located on top of the compressor, which is dispatching air to the air dryer. Lubricating oil is supplied to the compressor by a line from the cylinder block oil gallery that connects to the air

compressor. Lubricating oil returns to the engine crankcase through the air compressor drive assembly.

Maintenance and repair information on the TU-FLO 750 air compressor is supplied in the applicable booklet annexed to this section under reference number SD-01-344.

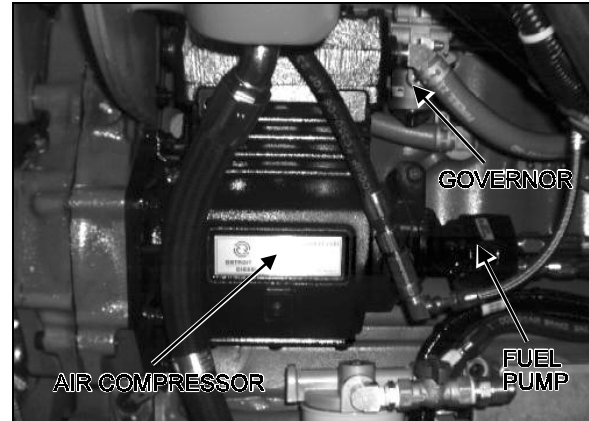


FIGURE 16: AIR COMPRESSOR AND GOVERNOR 12068

9.1.1 Removal and Installation

1. Exhaust compressed air from air system by opening the drain valve of each air tank.
2. Drain the engine cooling system. See Section 5: "Cooling System".
3. Identify and disconnect all air, coolant and oil lines from the compressor and governor assembly.
4. Gain access to the compressor by the engine R.H. side compartment. Remove the four compressor mounting bolts, and the two fuel pump support bracket bolts.
5. Slide air compressor rearward to disengage the hub from coupling. Remove the air compressor.

Reverse removal procedure for installation.

9.2 Governor (D-2)

The governor is mounted on the air compressor (Fig. 16), its function is to maintain the system pressure between a minimum and a maximum value. Maintenance and repair information on D-2 governor is supplied in the applicable booklet annexed to this section under reference number SD-01-16.

9.3 Push-Pull Control Valve

9.3.1 EMERGENCY/PARKING BRAKE CONTROL VALVE (PP-1)

A push-pull control valve mounted on the R.H. lateral console on coach and L.H. lateral console on converted vehicle is provided for parking brake application or release. The spring brakes are self-actuated whenever the control valve supply pressure drops below 40 psi (275 kPa). Maintenance and repair information on this valve is supplied in the applicable booklet annexed to this section under reference number SD-03-61.

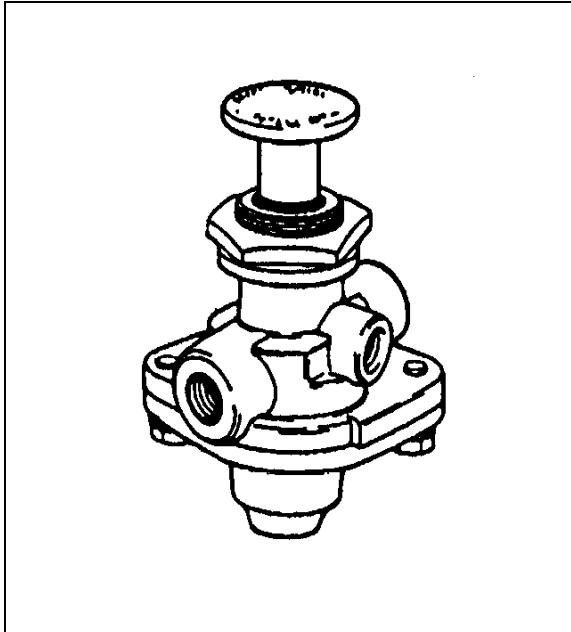


FIGURE 17: PP-1

12069

9.3.2 EMERGENCY/PARKING BRAKE OVERRULE CONTROL VALVE

(RD-3) (if applicable)

A RD-3 control valve is used with the optional parking brake overrule system. This control valve is located on R.H. lateral console (coach only). In the case of self-application of spring brakes due to a pressure drop, the brakes can be released by holding down this control valve.

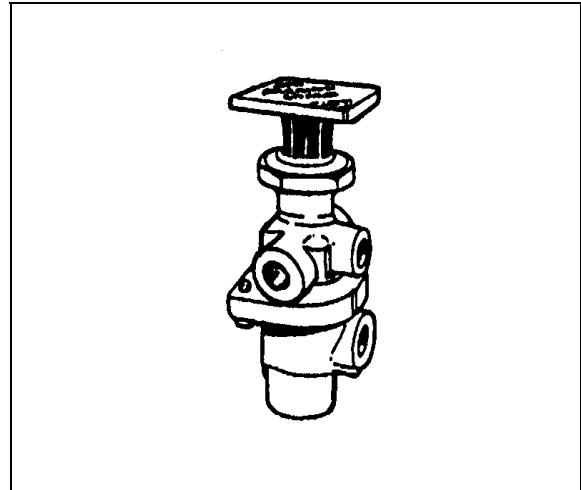


FIGURE 18: RD3

12070

9.4 Flip-flop Control Valve (TW-1)

A flip-flop control valve mounted on the R.H. lateral console on coach and L.H. lateral console on converted vehicle is provided to unload tag axle air springs (and to lift tag axle if vehicle is so equipped) and low-buoy system. It is a manually operated "on-off" valve. Maintenance and repair information on this valve is supplied in the applicable booklet annexed to this section under reference number SD-03-64.

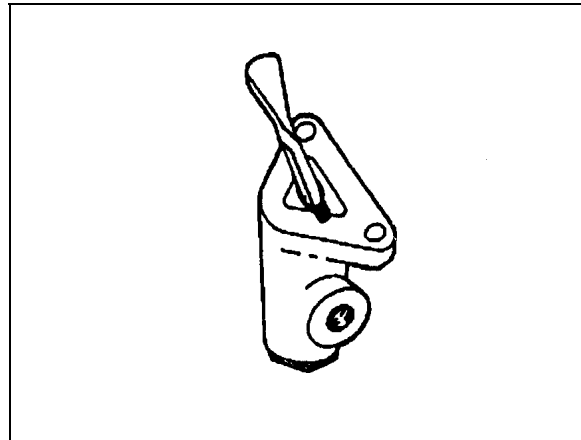


FIGURE 19: TW1

12071

9.5 Horn Valve (HV-3)

The horn valve is a simple "on-off" non-exhausting valve, designed specifically for controlling air horn. The horn valve is designed to return to the off position when application force is removed from it.

9.6 Dual Brake Application Valve (E-15)

The E-15 dual brake valve is floor mounted, treadle operated type brake valve with two separate supply and delivery circuits. This valve is located in steering compartment.

9.6.1 Brake Pedal Adjustment

After brake pedal replacement or repair, adjust the pedal to its proper position according to the following procedure:

Replace the linkage, loosen threaded rod lock nuts, and screw or unscrew the threaded adjustment rod in order to obtain a brake pedal inclination corresponding to 45° (Fig. 20). Tighten threaded rod lock nuts.

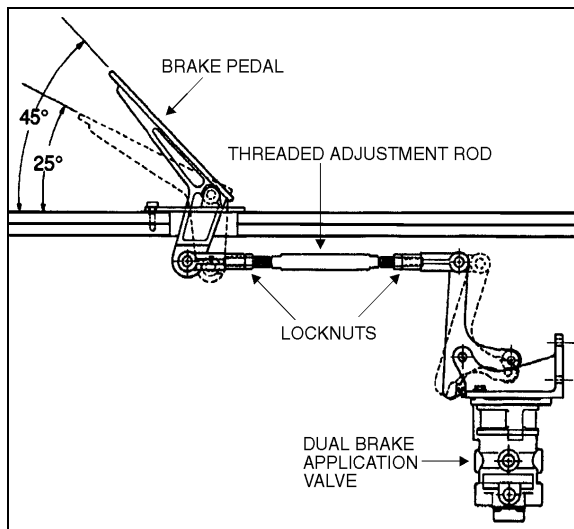


FIGURE 20: BRAKE PEDAL ADJUSTMENT 12040

9.6.2 Maintenance

Maintenance and repair information on the E-15 dual brake application valve is supplied in the applicable booklet annexed to this section under reference number SD-03-826.

9.7 Stoplight Switches

Two electro-pneumatic stoplight switches are mounted on the dual brake application valve (E-15). The upper one is used for the primary air circuit while the lower one is used for the secondary air circuit. Both switches are connected in parallel and have the same purpose, i.e.

completing the electrical circuit and lighting the stoplights when a brake application is made. The upper switch (A.C. Delco) is designed to close its contact between 2 psi and 4 psi (14 kPa to 28 kPa) (Fig. 21), while the lower one (Bendix, SL-5) closes its contact at 4 psi (28 kPa) (Fig. 22). The switches are not a serviceable item; if found defective, the complete unit must be replaced.

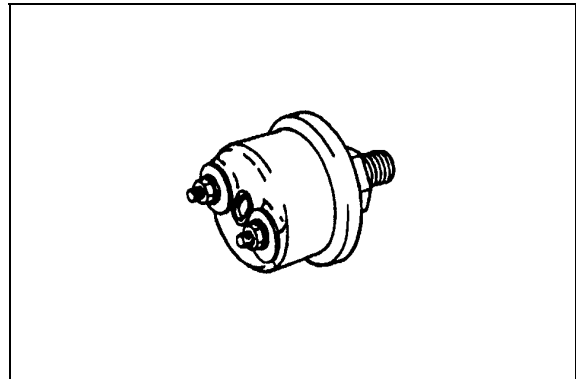


FIGURE 21: DELCO SWITCH 12072

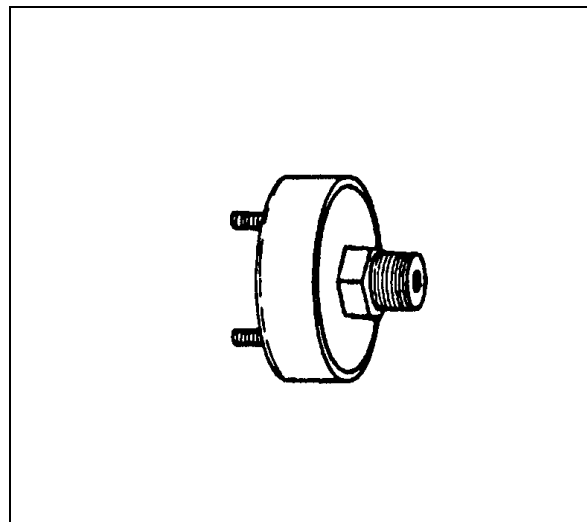


FIGURE 22: BENDIX SWITCH 12073

9.8 Parking Brake Alarm Switch (if applicable)

Refer to the appropriate annexed booklet (Bendix, SL-5 Stop Light Switch; reference no. SD-06-7).

The parking brake alarm uses the same switch as per the stoplights. It is mounted on the spring brake valve and operate in conjunction with a NC relay to sound a warning alarm by completing the electrical circuit when the ignition key is turned OFF with parking brake released.

9.9 Brake Relay Valve (R-12)

The primary air system includes three brakes being supplied by the dual brake valve, and which function is to speed up the application and release of the service brakes.

One valve supplies the drive axle service brake air line, while the other two valves supply independently both the tag axle right and left service brake air line and act as interlock valves. These valves are accessible from under the vehicle at the level of the tag axle. Maintenance and repair information on these valves is supplied in the applicable booklet annexed to this section under reference number SD-03-31.

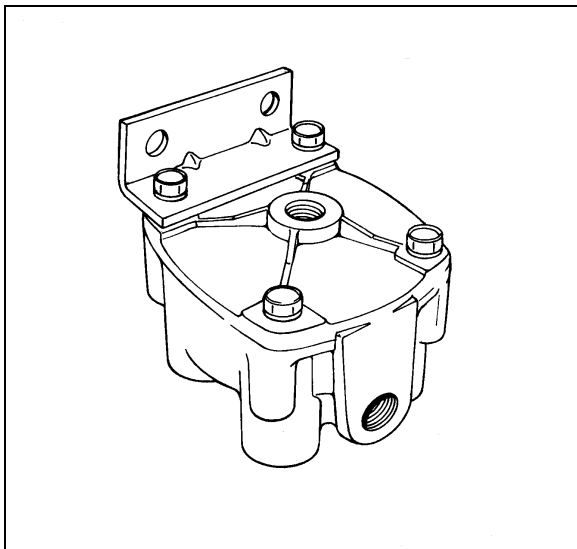


FIGURE 23: R-12

12074

9.10 Quick Release Valves (QR-1)

On XL-40 coach, two quick release valves are provided. One is mounted on the front axle service brake air line and located over the front axle. The other valve is mounted on the drive axle emergency brake air line. These valves are accessible from under the vehicle at the level of the drive axle.

On others XL vehicles, only one quick release valve is provided and located over the front axle. This valve is mounted on the front axle service brake air line.

They are responsible for the rapid exhaust of air pressure from brakes, thus decreasing the brake release time. Maintenance and repair information on these valves is supplied in the applicable booklet annexed to this section under reference number SD-03-69.

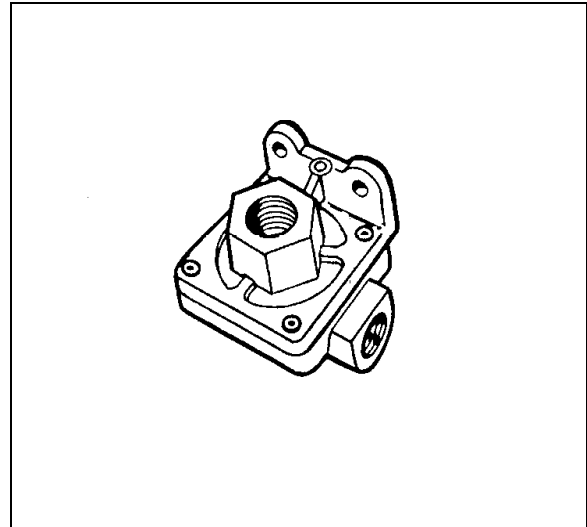


FIGURE 24: QR-1

12075

9.11 Spring Brake Valve (SR-1)

The spring brake valve is located at ceiling of front bumper compartment. The function of the SR-1 is to modulate the spring brake through application of the foot brake valve in the event of loss of service brake pressure. Maintenance and repair information on the spring brake valve is supplied in the applicable booklet annexed to this section under reference number SD-03-87.

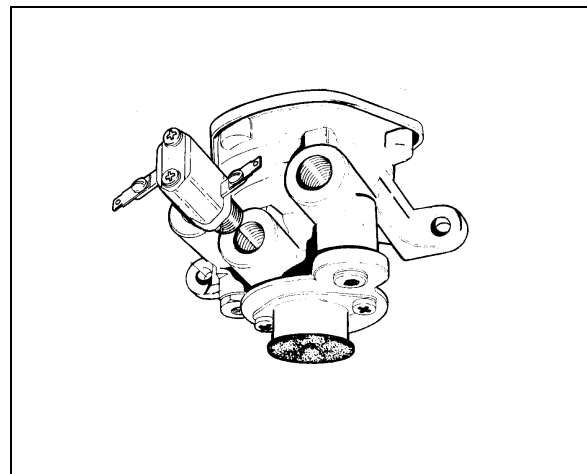


FIGURE 25: SR-1

12076

9.12 Pressure Protection Valve (PR-2)

Maintenance and repair information on the pressure protection valve is supplied in the applicable booklet annexed to this section under reference number SD-03-55.

The air system includes two pressure protection valves (Fig. 26). One valve is installed on the manifold block, and insures at all times a minimum pressure of 75 psi (517 kPa) in the suspension air system in the event that a pressure drop occurs in either the suspension air system or accessory air system. This valve is located in the steering compartment beside the air filter.

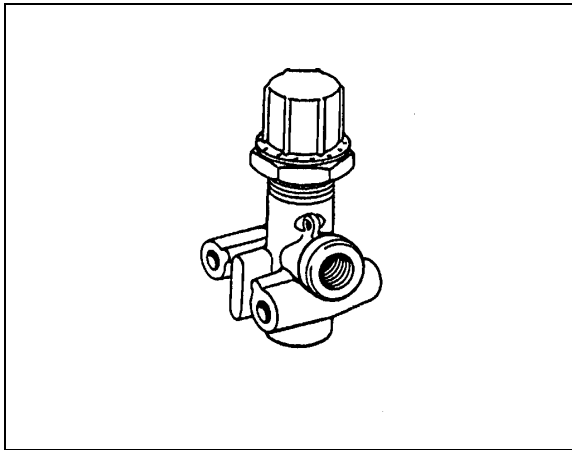


FIGURE 26: PR-2

12077

The other valve is installed on the accessory air tank, and insures a minimum pressure of 75 psi (517 kPa) in the accessory air system in the event that a pressure drop occurs in either the suspension air system or braking air system (Fig. 1 for accessory air tank location).

9.13 Low Pressure Indicators (LP-3)

Maintenance and repair information on the low pressure indicators is supplied in the applicable booklet annexed to this section under reference number SD-06-2.

The air system includes three low pressure switches, all located at ceiling of reclining bumper compartment. Two of them, one on each side of the double check valve, monitor both the primary and secondary air system warning lights along

with a warning alarm (Fig. 28). Their pressure setting is switch is 66 ± 6 psi (455 ± 40 kPa). The remaining pressure switch is mounted on the spring brake valve, and monitors the parking brake pilot lamp. Its pressure setting is 30 psi (205 kPa).

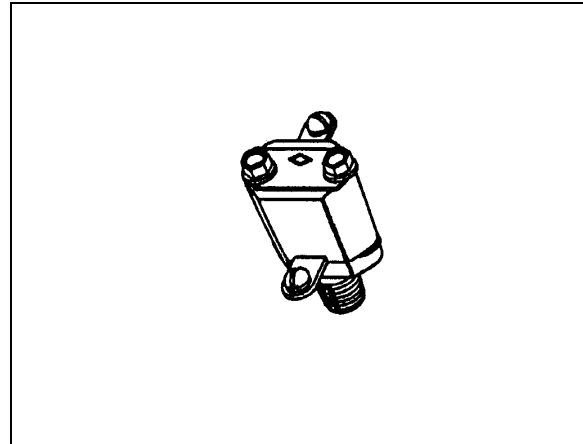


FIGURE 27: LP-3

12078

9.14 Shuttle-Type Double Check Valve (DC-4)

Maintenance and repair information on the shuttle-type double check valve is supplied in the applicable booklet annexed to this section under reference number SD-03-67.

The double check valve is located at ceiling of reclining bumper compartment. In the event of a pressure drop in either the primary or secondary systems, this unit will protect the emergency/parking brake control valve and the intact air system from pressure loss.

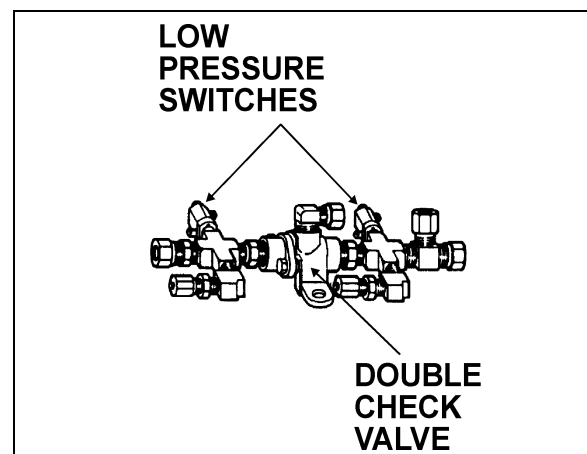


FIGURE 28: DC-4

12079

10. AIR SYSTEM TROUBLESHOOTING

The following list has been designed to help in troubleshooting some of the most common problems in the air system and their main causes. (For air brake troubleshooting, refer to paragraph "15. Air Brake Troubleshooting" later in this section. For other troubleshooting, refer to the manufacturer's brochures annexed to this section.)

1. **Air pressure doesn't rise to, or doesn't maintain, a normal setting**
 - Defective air gauge (registering incorrectly)
 - Excessive leaking in air system
 - Reservoir drain cock open
 - Governor poorly adjusted or defective
 - Defective compressor
 - Worn compressor or excessive wear on piston and/or ring
2. **Air pressure rises to normal setting too slowly**
 - Excessive leaking in air system
 - Clogged engine air cleaner
 - Worn compressor or excessive wear on piston and/or ring
 - Engine speed too low
3. **Air pressure rises above a normal setting**
 - Defective air gauge (registering incorrectly)
 - Governor poorly adjusted or defective
 - Restriction in line between governor and compressor unloading mechanism
4. **Air pressure drops quickly when engine is stopped**
 - Leaks in compressor discharge valve
 - Leaks in governor
 - Leaks in air lines
 - Leaks in air system valves

11. BRAKE OPERATION

The vehicle braking system uses both service and parking air-operated brakes. The air system is divided into two (2) independent circuits to isolate the front axle brakes and the rear axle brakes (drive and tag), thus providing safe brake

operation in the event that one circuit of the system fails. The primary circuit is connected to the drive and tag axle brakes, while the secondary circuit is connected to the front axle brakes. The tag axle service brakes operate only when the axle is in the normal driving (loaded) position. The spring-type emergency brakes are mounted on the drive axle, and will apply automatically if primary system pressure falls below 40 psi (276 kPa). The optional parking brake override system can cancel the parking brakes, enabling the driver to move the vehicle to a safe parking place. To operate this system, push down and hold the control knob located on the R.H. lateral console (See "Operator's Manual" for more details).

Furthermore, the brake application sequence, which is increased by a pneumatic relay valve (R-12), will start with the rear axles and be followed by the front axle, thus providing uniform braking on a slippery surface. The vehicle may also be equipped with an Anti-lock Brake System (ABS), which is detailed later in this section. .

Brake and air system maintenance consist of periodic inspections. Check all parts for damage and brake adjustment (refer to subsequent headings in this section for more details). Ensure all fasteners are tight (refer to paragraph "20. Specifications" for recommended tightening torques).

12. AIR BRAKES

12.1 Disc Brakes

Rockwell duramaster air disc brakes are used on front and tag axles. The front axle discs are actuated by 30 square inch effective area air brake chamber. On tag axle, the brake chambers have a 16 square inch effective area for service brake and a 24 square inch effective area for emergency/parking brake.

12.1.1 Disc Brake Pads

Brake pads have to be checked on a regular basis depending on the vehicle operation. To check pad condition without removing the wheel, verify the position of the inboard bosses of the caliper on the slide pins (Fig. 29).

If the bosses are within ¼ inch (6.4 mm) of the ends of the pins, remove the wheels and tires and inspect the lining. If the bosses are within 1/8 inch (3.2 mm) of the ends of the pins, replace the linings. When replacing the brake pads, all four pads on an axle have to be changed at the same time. There is no inner or outer pad, since all pads are the same.

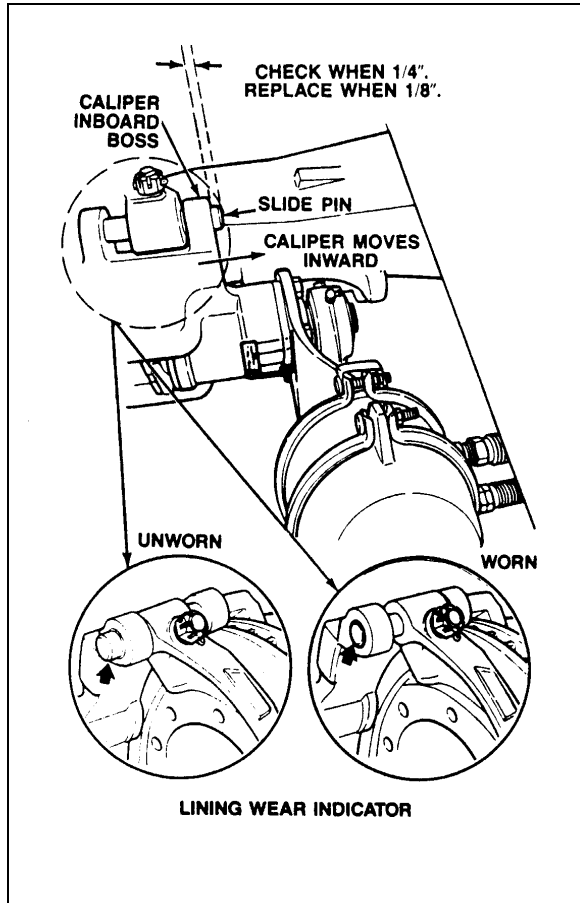


FIGURE 29: LINING WEAR INDICATOR

12080

For information on how to change the brake pads, refer to the manufacturer's brochure, annexed to this section.

Note: While breaking in new brake pads, avoid long brake applications as well as harsh braking.

The Rockwell duramaster air disc brakes are supplied with automatic clearance (slack) adjusters from Rockwell or Haldex which may be installed with these air disc brakes. For information on installation and adjustment of Automatic slack adjusters, refer to *Rockwell* or *Haldex* brochures at the end of this section.

12.1.2 Lubrication

On front and tag axle, brake slack adjusters (one fitting on each slack adjuster) and disc brake calipers (two fittings on each of front and tag axles) should be serviced every 6,250 miles (10 000 km) or twice a year, whichever comes first. Use a good quality base grease NLGI No. 1 (suitable for extremely low temperature) and NLGI No. 2 (suitable for most temperature). Refer to Section 24, "Lubrication".

12.2 Drum Brakes

The drive axle is equipped with Cam-Master, W-Series drum brakes from Rockwell. They're actuated by a 30 square inch effective diaphragm area for service brake, and a 36 square inch area for emergency/parking brake. Automatic slack adjusters from *Rockwell* or *Haldex* may be installed with these brakes (Fig. 30). For information on installation and adjustment of Automatic slack adjusters, refer to *Rockwell* or *Haldex* brochures at the end of this section: "Automatic Brake Adjusters, Installation and Maintenance".



FIGURE 30: DRUM BRAKE ASSEMBLY

12044

12.2.1 Drum Brake Adjustment

Refer to "Rockwell Maintenance Manual no.23B - Bus and Coach Brakes" annexed to this section for drive axle.

12.2.2 Maintenance

Lubricate brake camshaft bushing every 100,000 miles (160 000 km) or once every two years whichever comes first. Grease one fitting on each drive axle drum brake, with good quality lithium-

base grease NLGI no.1 or NLGI no. 2. Lubricate brake slack adjuster every 6,250 miles (10 000 km) or twice a year, whichever comes first. Grease one fitting on each slack adjuster, with good quality lithium-base grease NLGI no.1 or NLGI no.2. Refer to figure 31 for localization of fitting. Lubricate brake spider, camshaft splines, anchor pins and shoe rollers when necessary.

Warning: Care must be taken when lubricating camshaft bushings, anchor pins and shoe rollers. Too much lubrication could cause lubrication saturation of brake linings and possible safety problems.

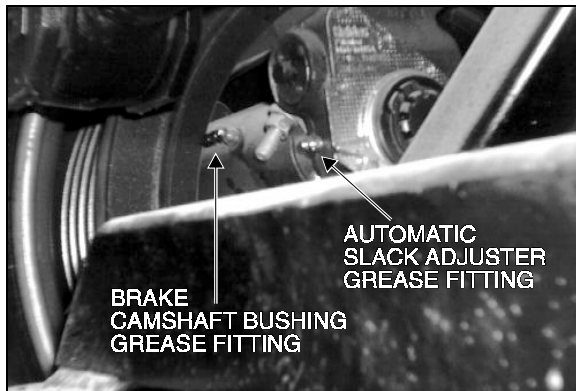


FIGURE 31: GREASE FITTINGS LOCATION 12045

Check brake drums periodically for cracks, severe heat checking, heat spotting, scoring, pitting and distortion. Replace damaged drums. Measure the inside diameter of the drum in several locations with a drum caliper or inside micrometer. Replace the drum if the diameter exceeds the specifications marked on the drum (Fig. 32). For more information on brake drums maintenance, refer to Rockwell's brochure "Field Maintenance Manual Number 23B - Bus and Coach Brakes", annexed to this section.

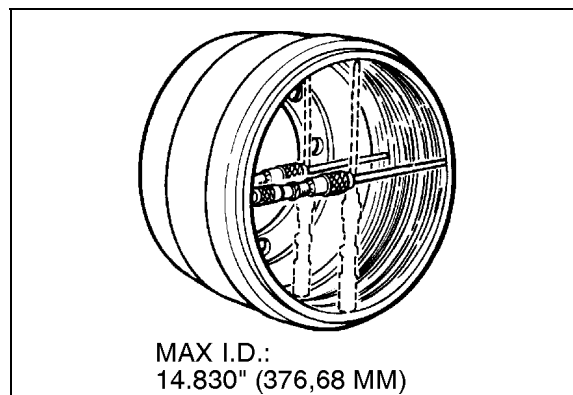


FIGURE 32: DRUM BRAKE INSIDE DIAMETER 12046

Caution: *Prévost does not recommend the turning or reboring of the brake drums because it decreases the strength and heat capacity of the drum. However, if drums must be refaced, the new diameter MUST NOT exceed the maximum inside diameter marked on the drum.*

13. RECOMMENDED BRAKE SERVICE PROCEDURES TO REDUCE EXPOSURE TO NON-ASBESTOS FIBER DUST

Most recently manufactured brake linings no longer contain asbestos fibers. Instead of asbestos, these linings contain a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers, and carbon fibers. At present, OSHA (Occupational Safety and Health Administration) does not specifically regulate these non-asbestos fibers, except as nuisance dust. Medical experts do not agree about the potential long-term risks from working with and inhaling non-asbestos fibers. Nonetheless some experts think that long-term exposure to some non-asbestos fibers could cause diseases of the lung, including pneumoconiosis, fibrosis, and cancer. Therefore, lining suppliers recommend that workers use caution to avoid creating and breathing dust when working on brakes that contain non-asbestos fibers.

Warning:

1. Whenever possible, work on brakes in a separate area away from other operations.
2. Always wear a respirator approved by NIOSH (National Institute of Occupational Safety and Health) or MSHA (Mine Safety and Health Administration) during all brake service procedures. Wear the respirator from removal of the wheels through assembly.
3. NEVER use compressed air or dry brushing to clean brake parts or assemblies. OSHA recommends that you use cylinders that enclose the brake. These cylinders have vacuums with high efficiency (HEPA (Health and Environment Protection Agency)) filters and workmans' arm sleeves. But, if such equipment is not available, carefully clean parts and assemblies in the open air.

4. Clean brake parts and assemblies in the open air. During disassembly, carefully place all parts on the floor to avoid getting dust into the air. Use an industrial vacuum cleaner with an HEPA filter system to clean dust from the brake drums, backing plates and other brake parts. After using the vacuum, remove any remaining dust with a rag soaked in water and wrung until nearly dry.

5. Grinding or machining brake linings. If you must grind or machine brake linings, take additional precautions because contact with fiber dust is higher during these operations. In addition to wearing an approved respirator, do such work in an area with exhaust ventilation.

6. Cleaning the work area. NEVER use compressed air or dry sweeping to clean the work area. Use an industrial vacuum with an HEPA filter and rags soaked in water and wrung until nearly dry. Dispose of used rags with care to avoid getting dust into the air. Use an approved respirator when emptying vacuum cleaners and handling used rags.

7. Worker clean-up. Wash your hands before eating, drinking or smoking. Do not wear your work clothes home. Vacuum your work clothes after use and then launder them separately, without shaking, to prevent fiber dust from getting into the air.

8. Material safety data sheets on this product, as required by OSHA, are available from Rockwell.

14. BRAKE BURNISHING

The following procedure should be followed whenever replacing a brake drum and/or brake linings.

Warning: Proceed with brake lining "burnishing" on a road where there is very light traffic, and only when no vehicle is following behind, to avoid possible accident.

With the transmission in the highest gear, make 10 "snub" brake applications at exactly every ½ mile (0,8 km) regular interval while decelerating from 50 to 30 mph (80 to 50 km/h).

Check drum and rotor temperatures immediately after completing the above burnishing. Any drum or rotor that is significantly cooler than the other

ones indicates a lack of braking effort on this wheel; in this case. repeat burnishing.

Allow all the wheel-end brakes to completely cool, thus having them return to the ambient temperature.

Repeat 10 more brake snubs as described above ½ mile (0,8 km) intervals while reducing speed from 50 to 30 mph (80 to 50 km/h).

Caution: A constant light brake application over a certain distance constitutes a light brake drag. This is not desirable. Depending upon the brake lining condition during the drum/lining contact, this dragging exacerbates pulsating forces which may develop due to the "slip-stick" phenomenon. This condition could "sprag" (violent high amplitude uncontrollable vibration), causing permanent damage to brake components such as spider, air chamber brackets, etc.

Note: A brake lining glazing due to the underutilization of brakes (especially a converted coach equipped with a retarder) may be experienced during winter months when vehicle is in storage or is seldom used. To solve this problem, run the vehicle, observe the previous notices and repeatedly apply the brakes until they produce a light smoke.

15. AIR BRAKE TROUBLESHOOTING

The following tests and check lists have been designed to identify the cause(s) of a sluggish performance and/or leaks in the system. These tests require very little time to perform, and give you a general idea of the system condition. Each test is provided with a corresponding check list, that will guide you to the most common causes of problems.

Prior to performing any test, check all air lines for kinks or dents, and hoses for signs of wear, drying out or overheating.

Warning: When working on or around brake system and its related components, the following precautions should be observed.

1. Always block vehicle wheels. Stop engine when working under a vehicle. Keep hands away from chamber push rods and slack adjusters as they may apply when system pressure drops.

2. Never connect or disconnect a hose or line containing air pressure. It may whip as air escapes. Never remove a component or pipe plug unless you are sure all system pressure has been depleted.

3. Never exceed recommended air pressure and always wear safety glasses when working with air pressure. Never look into air jets or direct them at anyone.

4. Never attempt to disassemble a component until you have read and understood the recommended procedures. Some components contain powerful springs and injury can result if not properly disassembled. Use only proper tools and observe all precautions pertaining to the use of those tools.

5. Always clean connecting piping and/or fittings, and coat pipe threads with teflon pipe sealant before installing any air brake system component.

15.1 Pressure Build-up / Low Pressure Warning / Cutoff Point / Governor Cutout

CONDITION: Vehicle parked, wheels chocked

1. Completely drain air reservoirs.
2. Start engine and run at fast idle. Low pressure warning lights should be "On".
3. Start checking pressure at 50 psi (344 kPa).
4. Low pressure warning lights and buzzer should go off at or above 60 psi (415 kPa).
5. At 85 psi (586 kPa), run engine at full rpm, then check that build up time to 100 psi (690 kPa) is 30 seconds or less.
6. Governor cutout. Cuts out at the correct pressure of 120-125 psi (826-861 kPa).
7. Governor cut-in. Reduce service air pressure to governor cut-in. The difference between cut-in and cut-out pressures should not exceed 25 psi (172 kPa).

For common corrections, refer to the following check list.

15.1.1 High or Low Warning Cutoff Point

1. Check dash gauge with an accurate test gauge.
2. Repair or replace the defective low pressure indicator switches.
3. Repair or replace buzzer or light bulb, and check wiring.

15.1.2 High or Low Governor Cutout Point

1. Check dash gauge with an accurate test gauge.
2. Adjust governor to desired cutout.

OR

3. Repair or replace governor as necessary after checking that compressor unloader mechanism is operating correctly.

15.1.3 More Than 30 Seconds to Build-up Pressure from 85 to 100 psi (585 - 690 kPa) at Full Engine RPM

1. Check air gauges on the dashboard with an accurate test gauge.
2. If compressor strainer or inlet line is restricted, clean or replace element or faulty line.
3. If compressor head or discharge line is carbonized or otherwise restricted, clean or replace.
4. If discharge valves are leaking, pull head and correct or replace cylinder head.
5. If drive is slipping, change gear as indicated.
6. If inlet valves are stuck, open or leaking severely, replace unloader kit, inlet valves and/or seats as necessary.
7. If drain cock is found open, close it.
8. If governor leaks when "unloaded", clean or replace inlet valve or replace governor.
9. Listen for air leaks and repair.

Redo test to check all items repaired or replaced.

15.2 Air Supply Reservoir Leakage

CONDITION: Full pressure, engine stopped, parking brake applied

1. Allow at least 1 minute for pressure to stabilize.
2. Stop engine, then check air pressure gauge for 2 minutes, and note any pressure drop.
3. Pressure drop should not be more than 3 psi (20 kPa) per minute.

For common corrections, refer to the following check list.

15.2.1 Excessive Air Loss:

1. With the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat all air line connections and pneumatic components with a water and soap solution. Bubbles will indicate an air leak, and none should be permissible. Repair or replace defective parts.
2. Listen for leaks and correct as required.

Redo test to check all items repaired or replaced.

15.3 Air Brake Leakage

CONDITION: Full pressure, engine stopped, parking brake released

1. Apply foot brake, allow at least 1 minute for pressure to stabilize.
2. Hold down foot valve for 2 minutes while observing air pressure gauge on the dashboard.
3. Pressure drop should not be more than 4 psi (27 kPa) per minute.

For common corrections, refer to the following check list.

15.3.1 Excessive Leakage on Brake Service Side:

1. With the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)) and foot brake applied, coat all air line connections and brake pneumatic components with a water and soap solution. Bubbles

will indicate an air leak, and none should be permissible. Repair or replace defective parts.

2. Listen for leaks and correct as required.

Redo test to check all items repaired or replaced.

16. BRAKE AIR CHAMBER

16.1 Description

This vehicle is equipped with "Anchorlock" brake chambers on drive and tag axle, used as a service brake chamber, an emergency brake in case of air pressure loss and a spring-applied parking brake. It consists of two separate air chambers, each having its own diaphragm and push rod. Refer to figures 33 and 34.

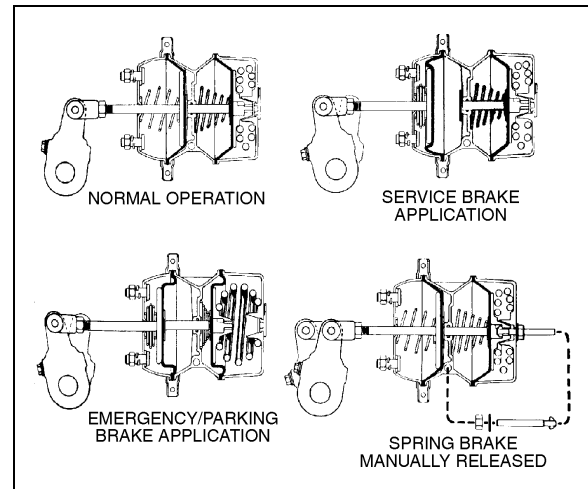


FIGURE 33: DRIVE AND TAG AXLES BRAKE AIR CHAMBERS OPERATION

12047

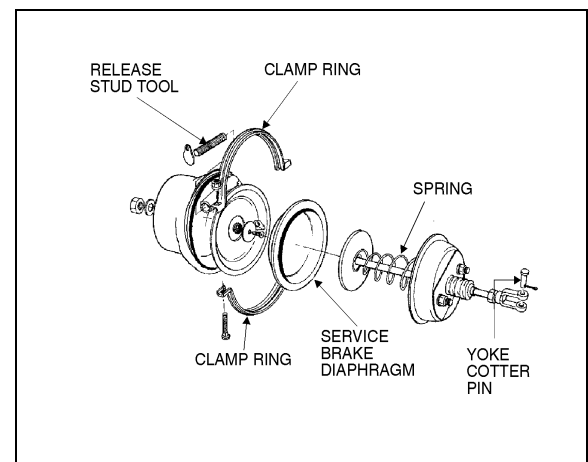


FIGURE 34: DRIVE AND TAG AXLES BRAKE AIR CHAMBERS ASSEMBLY

12081

The front axle is equipped with "Bendix" brake air chambers, used for service brake (Fig. 35).

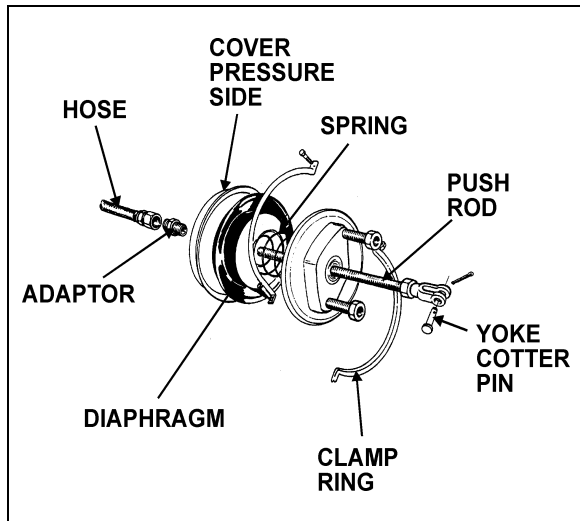


FIGURE 35: FRONT AXLE BRAKE AIR CHAMBER 12082

16.2 Maintenance

16.2.1 Every 6,250 Miles (10 000 km) or twice a year, whichever comes first Depending on Type of Operation

1. Apply brakes and observe that the push rods move out promptly without binding.
2. Release brakes, and observe that the push rods return promptly and without binding to the released position.
3. Check tightness of mounting nuts. Check that cotter pins are in place.
4. Check all hoses and lines. They should be secure and in good condition.

16.2.2 Every 100,000 Miles (160 000 km) or once a year, Whichever comes First Depending on Type of Operation

1. Disassemble and clean all parts.
2. Install new diaphragm or any other part if worn or deteriorated.

Note: When the diaphragm, spring, or both are replaced, they should be replaced with the corresponding chamber on the same axle.

16.2.3 Airtightness Test

1. Make and hold a full brake application.
2. Coat clamping ring(s) with a soapy solution. If leakage is detected, tighten clamping ring only enough to stop leakage. **Do not overtighten** as this can distort sealing surface or clamping ring. Coat area around push rod hole (loosen boot if necessary). No leakage is permitted. If leakage is detected, the diaphragm must be replaced.

16.3 Emergency/Parking Brake Manual Release

Warning: Never stand in the axis line of the spring brake chambers, especially when caging the spring.

1. Block the wheels to prevent the vehicle from moving.
2. Remove the release stud tool from its storage place on brake air chamber.
3. Remove the access plug from the end of the spring chamber, then insert the release stud through the opening. Turn the release stud 1/4 turn (clockwise) to anchor it into the spring plate. Install the flat washer and nut, then turn the nut clockwise to cage the spring. Repeat on the opposite side.

Warning: Make sure the release stud is properly anchored in spring plate receptacle prior to caging the spring.

4. To manually reset the emergency/parking brake, turn the nut counterclockwise. Reinstall access plugs on the spring chambers, and release stud tools in their storage places.

16.4 Removal, Installation and Disassembly

16.4.1 Removal

Warning: To prevent personal injuries, brakes should be inoperative prior to working on any of their components.

1. Block the wheels to prevent the vehicle from moving.

2. Safely support vehicle at the recommended body jacking points.

To gain access to a given brake air chamber, the corresponding wheel can be removed (refer to Section 13: "Wheels, Hubs and Tires").

3. Exhaust compressed air from air system by opening the drain valve of each reservoir.
4. For the drive and tag axles (tag axle on some vehicles only) brake chambers, manually release spring brakes (refer to paragraph "16.3 Emergency/Parking Brake Manual Release" procedure).
5. Disconnect air line(s) from brake chamber.
6. Remove the cotter pin connecting brake chamber and slack adjuster.
7. Unbolt and remove the brake chamber from vehicle.

16.4.2 Installation

Reverse removal procedure, then check brake adjustment.

Caution: Always clean air lines and fittings, and coat pipe threads with teflon pipe sealant before reconnecting air lines.

16.4.3 Disassembly

Warning: Spring brake chambers, on drive and tag axles (tag axle with service and Emergency/Parking brake, on some vehicles only) contain an extremely high compressive force spring, which can possibly cause serious injury if special precautions are not taken when working around this area. To avoid such injury, the following recommendations must be applied:

1. *Prévost recommends the installation of a new spring brake chamber if it is found to be defective.*
2. *Spring brake chamber maintenance and/or repair must be performed by trained and qualified personnel only.*
3. *Before manually releasing spring brakes, visually check spring brake for cracks and/or corrosion.*

4. On "Anchorlock" brake chambers (drive and on some vehicles tag axles), make sure the release stud is properly anchored in spring plate receptacle prior to caging the spring.

5. Never stand in the axis line of the spring brake chambers, especially when caging the spring.

Warning: To prevent personal injury, brakes should be inoperative prior to working on any components.

1. Block the wheels to prevent the vehicle from moving.
2. Safely support vehicle at the recommended body jacking points.

To gain access to a given brake air chamber, the corresponding wheel can be removed (refer to Section 13: "Wheels, Hubs and Tires").

3. Exhaust compressed air from air system by opening the drain valve of each reservoir.
4. For "Anchorlock" brake chambers, manually release spring brakes (refer to paragraph "16.3 Emergency/Parking Brake Manual Release" procedure).
5. Remove clamp ring, and remove and discard the existing diaphragm. Install the new diaphragm squarely on body.
6. Reverse the procedure for assembly. Tap clamp ring to ensure proper seating. Check for proper operation before placing vehicle in service.

17. ANTI-LOCK BRAKING SYSTEM (ABS)

17.1 Description

This device has been designed to ensure stability and steerability of vehicle during braking, and to minimize its stopping distance whatever the road conditions are. On slippery roads and generally in emergency situations, overbraking frequently induces wheel locking. The anti-lock braking system provides maximum braking performance while maintaining adequate steerability on slippery roads.

The ABS continuously monitors the wheel behavior during braking. Sensors on each wheel of front and drive axles transmit data to a four channel electronic processor which senses when any wheel is about to lock. Modulator valves quickly adjust the brake pressure (up to 5 times per second) to prevent wheel locking. Each wheel is therefore controlled according to the grip available between its tire and the road.

With this device, the vehicle is brought to a halt in the shortest possible time, while remaining stable and under the driver's control.

Since the vehicle braking system has dual circuits, the ABS is also provided with a secondary system should a fault develop in the ABS. Anti-lock systems are fail safe. Should the system cut out due to a malfunction, the braking system reverts to normal non anti-lock controlled operation. But since ABS consists of two diagonally related circuits, only the half system which has sustained damage or other fault is switched off (i.e. wheels return to normal non-ABS braking). The other diagonal half remains under full ABS control.

Note: *ABS is active on service brake, transmission retarder, Jake brake, but is inactive on emergency/parking brake.*

17.2 Troubleshooting and Testing

For troubleshooting and testing of the vehicle's anti-lock braking system, refer to "Maintenance Manual No. 28: Anti-Lock Brake Systems For Trucks, Tractors and Buses", at the end of this section.

18. ABS COMPONENTS

The main components of the ABS system are listed hereafter. Refer to each component for its specific function in the system and its maintenance.

18.1 Electronic Control Unit

18.1.1 Description

This control unit is located in the steering compartment (refer to figure 36 for location of

E.C.U. and blinker switch). According to the data transmitted by the sensors (number of pulses/sec is proportional to the speed of each wheel), the electronic control unit determines which wheel is accelerating or decelerating. It then establishes a reference speed (average speed) from each wheel data, and compares the speed of each wheel with this reference speed to determine which wheel is accelerating or decelerating.

As soon as wheel deceleration or wheel slip threshold values are exceeded, the electronic control unit signals a solenoid control valve to limit the excessive brake pressure produced by the driver in the brake chamber.

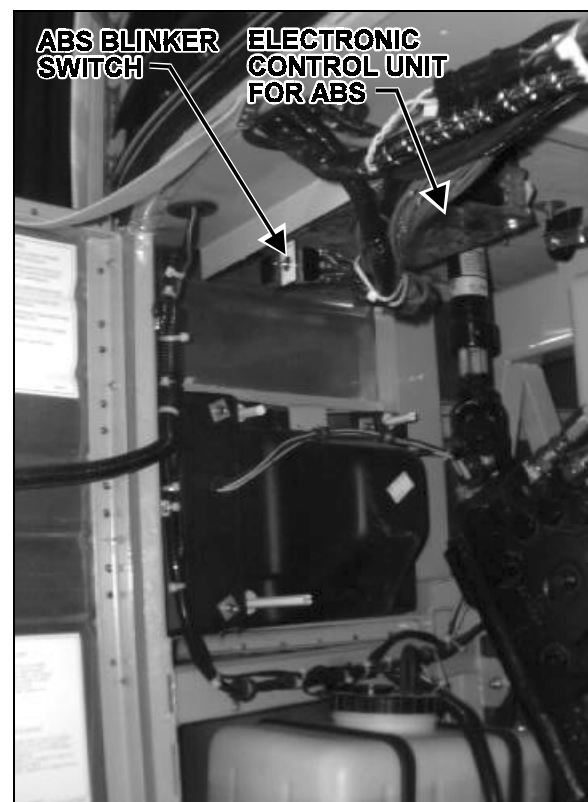


FIGURE 36: STEERING COMPARTMENT

12083

18.1.2 Maintenance

No specific maintenance is required for the electronic control unit. When it is found to be defective, replace it.

Caution: *In order to protect the ABS electronic control unit from voltage surges, always disconnect its connector before performing any welding procedure on vehicle.*

18.2 ABS Modulator Valve

18.2.1 Description

This ABS system is equipped with four modulator valves, located between the brake chamber and the relay valve or quick release valve (Fig. 37). Note that there is only one solenoid valve controlling the drive and tag axle wheels on the same side.

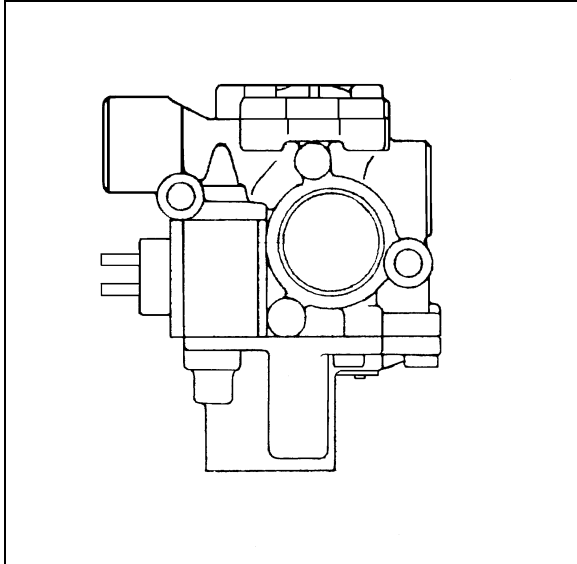


FIGURE 37: ABS MODULATOR VALVE

12084

This is an "On/Off" type valve, i.e., at brake application, the valve exhausts air from the brake chamber when the electronic unit senses that the corresponding wheel speed is decreasing according to the other wheels.

18.2.2 Maintenance

Like the electronic control unit, no specific maintenance is required for the solenoid control valve.

18.3 Sensors

18.3.1 Description

The sensors are mounted on the front and drive axle wheel hubs (Fig. 38). The inductive sensors consist essentially of a permanent magnet with a round pole pin and a coil. The rotation of the toothed wheel alters the magnetic flux picked up by the coil, producing an alternating voltage, the

frequency of which is proportional to the wheel speed. When wheel speed has a tendency to decrease due to the braking coefficient, the magnetic flux produced and sensed afterwards by the electronic control unit will be decreased. Consequently, the electronic control unit will command the solenoid control valve to decrease the pressure at the corresponding brake chamber.

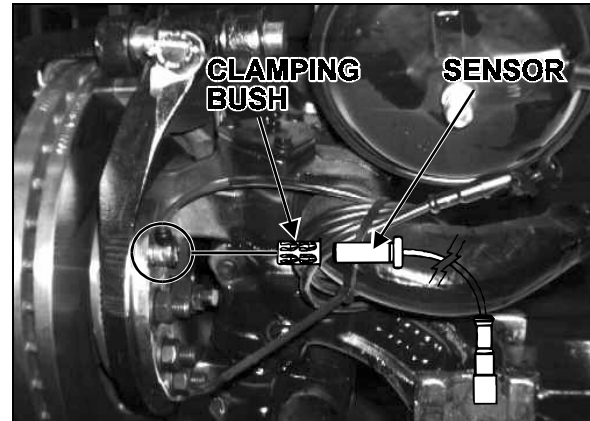


FIGURE 38: ABS SENSOR LOCATION

12085

18.3.2 Maintenance

No specific maintenance is required for sensors, except if the sensors have to be removed for axle servicing. In such a case, sensors should be lubricated with a special grease before their reinstallation. Refer to paragraph "18.3.3 Installation" for details.

Note: *The resistance value, when sensors are checked as a unit, must be equal to 1,75 k ohms. To check the sensors for proper output voltage after the sensors and toothed wheels have been assembled to the axle, connect a suitable AC voltmeter across the output terminals. With the hubs rotating at 30 rpm, the output voltages should read from 50 to 1999 mV to be acceptable.*

18.3.3 Installation

The following procedure deals with sensor installation on the axle wheel hubs. Read procedure carefully before reinstalling a sensor, as its installation must comply with operational tolerances and specifications.

1. Dip clamping bush into the special grease (Prévost part number #680460), press clamping bush and insert in the bushing on hub.

Caution: Use only this type of grease on the sensors.

2. Install sensor inside the clamping bush. Push on assembly to seat it on the pulse wheel. Ensure mounting is rigid, as it is an important criterion for an adequate sensor operation.

Note: This installation should be of the "press fit" type.

18.4 Clamping Bush

18.4.1 Description

The clamping bush retains the sensor in its mounting bracket close to the toothed pulse wheel. The gap between the sensor end and teeth is set automatically by pushing the sensor in its bush hard up against the pole wheel, and the latter knocks back the sensor to its adjusted position (Fig. 39).

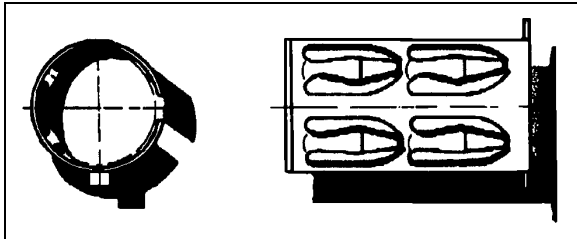


FIGURE 39: CLAMPING BUSH

12052

18.4.2 Maintenance

The clamping bush requires no specific maintenance.

19. FITTING TIGHTENING TORQUES

1. **45° Flare and Inverted Flare:** Tighten assembly with a wrench until a solid feeling is encountered. From that point, tighten 1/6 turn (Fig. 40).

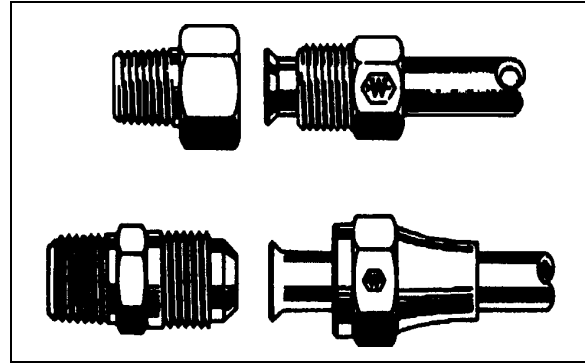


FIGURE 40: HOSE FITTINGS

12053

2. **Compression:** Tighten nut hand tight (Fig. 41). From that point, tighten with a wrench the number of turns indicated in the chart hereafter.

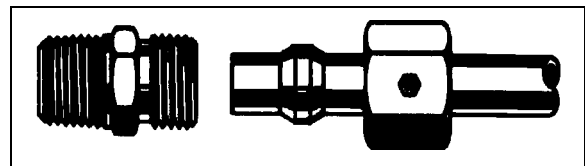


FIGURE 41: HOSE FITTING

12054

Fitting size	Pipe diameter (inch)	Number of additional turns required following manual tightening
2	1/8	1 1/4
3	3/16	1 1/4
4	1/4	1 1/4
5	5/16	1 3/4
6	3/8	2 1/4
8	1/2	2 1/4
10	5/8	2 1/4
12	3/4	2 1/4
16	1	2 1/4

3. **NTA-type Plastic Tubing:** Tighten nut hand tight (Fig. 42). From that point, tighten with a wrench the number of turns indicated in the chart hereafter.

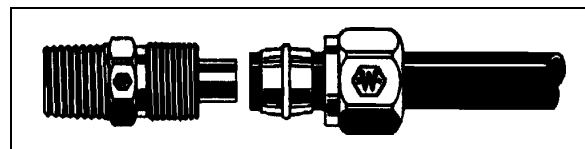


FIGURE 42: HOSE FITTING

12055

Tubing diameter (inch)	Number of additional turns required following manual tightening
1/4	3
3/8 to 1/2	4
5/8 to 3/4	3 1/2

4. AB-type Copper Piping: Tighten nut hand tight (Fig. 43). From that point, tighten with a wrench the number of turns indicated in the chart hereafter.

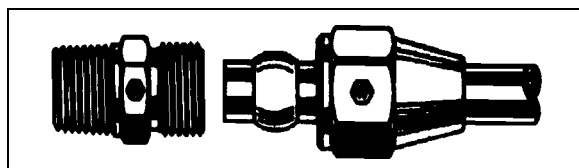


FIGURE 43: HOSE FITTING 12056

Piping diameter (inch)	Number of additional turns required following manual tightening
1/4, 3/8, 1/2	2
5/8, 3/4	3

5. Piping Tightening: All connections must be hand tightened. From that point, tighten a minimum of 2 1/2 additional turns.

Note: Use pipe sealant Loctite (Prévost number 680098) for sealed pipe thread.

20. SPECIFICATIONS

AIR COMPRESSOR

Make.....Bendix Westinghouse
 Model..... Tu-Flo 750
 Capacity (at 1250 rpm)16.5 cfm (0,467 m³/min.)
 Supplier number..... 107812
 Prévost number..... 641190

GOVERNOR

Make.....Bendix Westinghouse
 Model..... D-2
 Cut-in pressure95-105 psi (655-724 kPa)
 Cutout pressure 120-125 psi (827-861 kPa)
 Supplier number.....284358
 Prévost number..... 640964

FLIP-FLOP CONTROL VALVE

Make Bendix Westinghouse
 ModelTW-1
 TypeOn-Off
 Supplier number 229635
 Prévost number 640136

EMERGENCY/PARKING BRAKE CONTROL VALVE

Make Bendix Westinghouse
 Model PP-1
 Automatic release pressure
 40 psi (275 kPa) nominal
 Supplier number 287325
 Prévost number 641128

EMERGENCY/PARKING BRAKE OVERRULE CONTROL VALVE

Make Bendix Westinghouse
 Model RD-3
 Supplier number 281481
 Prévost number 640472

DUAL BRAKE APPLICATION VALVE

Make Bendix Westinghouse
 Model E-15
 Supplier number 109174
 Prévost number 641257

STOPLIGHT SWITCHES/PARKING BRAKE ALARM SWITCH

Make Bendix Westinghouse
 Model SL-5
 Contact close (ascending pressure)
 4 psi and more (28 kPa)
 Supplier number 286392
 Prévost number 640852

STOPLIGHT SWITCHES

Make A.C. Delco
 Contact close (ascending pressure)
 2-4 psi (14-28 kPa)
 Supplier number 1506713
 Prévost number 562052

BRAKE RELAY VALVES

Make Bendix Westinghouse
 Model R-12
 Supplier number 102852
 Prévost number 641088

QUICK RELEASE VALVE

Make Bendix Westinghouse
 Model QR-1
 Supplier number 229859

Prévost number..... 641014

SPRING BRAKE VALVE

Make..... Bendix Westinghouse
 Model..... SR-1
 Supplier number..... 286364
 Prévost number..... 640870

PRESSURE PROTECTION VALVE

Make..... Bendix Westinghouse
 Model..... PR-2
 Nominal closing pressure 75 psi (517 kPa)
 Supplier number..... 277226
 Prévost number..... 640439

LOW PRESSURE INDICATORS

Make..... Bendix Westinghouse
 Model..... LP-3
 Contact close 66 psi (455 kPa)
 Supplier number..... 277227
 Prévost number..... 640975

Make..... Bendix Westinghouse
 Model..... LP-3
 Contact close 30 psi (207 kPa)
 Supplier number..... 276599
 Prévost number..... 641174

SHUTTLE-TYPE DOUBLE CHECK VALVE

Make..... Bendix Westinghouse
 Model..... DC-4
 Supplier number..... 277988
 Prévost number..... 641015

AIR DRYER

Make..... Rockwell Wabco
 Model..... System Saver 1000
 Heater consumption..... 100 watts
 Supplier number..... RWABK-095
 Prévost number..... 641337
 Desiccant cartridge kit supplier number
 R950011
 Desiccant cartridge kit Prévost number
 641278

AIR PRESSURE REGULATOR

Make..... Williams Air Controls
 Adjustable output range
 0-80/85 psi (0-552/586 kPa)
 Recommended pressure setting
 75 psi (517 kPa)
 Supplier number..... WM-279-1
 Prévost number..... 640938

AIR FILTER ELEMENT

Make Bendix
 Model Type E
 Type with manual drain
 Supplier number 221053
 Prévost number 640073

FRONT AXLE BRAKE CHAMBERS

Make Bendix Westinghouse
 Type 30
 Supplier number 288014
 Prévost number 641253

DRIVE AXLE BRAKE CHAMBERS

Make Anchorlock division
 Type 30 as service -36 as emergency
 Supplier number 3036GC164318
 Prévost number 641181

TAG AXLE BRAKE CHAMBERS

Make Bendix Westinghouse
 Type 16 as service
 Supplier number 109832
 Prévost number 641320

Piggy Back

Make Neway Anchorlock
 Type 24 as emergency
 Supplier number 1624GP
 Prévost number 641250

FRONT AXLE BRAKE LINING

Make Rockwell
 Supplier number 15615PM
 Prévost number 621371

DRIVE AXLE BRAKE LINING

Make Rockwell

STANDARD SIZE

Supplier number EX4592 AD
 Prévost number 641086

1-X

Supplier number EX4592 ADX
 Prévost number 641087

2-X

Supplier number EX4592 ADXX
 Prévost number 641225

3-X

Supplier number EX4592 ADXXX
 Prévost number 641226

TAG AXLE BRAKE LINING

Make Rockwell
 Supplier number 15615PM
 Prévost number 621371

FRONT AXLE AUTOMATIC SLACK ADJUSTER

Section 12: BRAKE AND AIR SYSTEM

Make.....Rockwell
Supplier number, R.H. side A43 3275A1145S
L.H. sideA43 3275Z1144S
Prévost number, R.H. side 610880
L.H. side 610881

Make.....Haldex Corporation
Supplier number.....419-10586
Prévost number..... 641266

DRIVE AXLE AUTOMATIC SLACK ADJUSTER

Make.....Rockwell
Supplier number, R.H. sideA2-3275-P-1160S
L.H. sideA2-3275-N-1158S
Prévost number, R.H. side 641273
L.H. side 641272

Make.....Haldex Corporation
Supplier number.....419-10585
Prévost number..... 621523

TAG AXLE AUTOMATIC SLACK ADJUSTER

Make.....Rockwell
Supplier number.....A22-3275-H-1152S
Prévost number..... 641314

Make.....Haldex Corporation
Supplier number.....419-10586
Prévost number..... 641266

ABS ANTILOCK BRAKING SYSTEM (if applicable)

ABS MODULATOR VALVE

Make.....Rockwell Wabco
Voltage24 V
Supplier number.....472 195 006 0
Prévost number..... 641097

SENSOR

Supplier number.....441 032 576 0
Prévost number..... 641095

SECTION 13: WHEELS, HUBS & TIRES

CONTENTS

1. WHEELS AND TIRES	13 - 3
1.1 Description.....	13 - 3
2. WHEEL MAINTENANCE.....	13 - 3
3. SINGLE WHEEL.....	13 - 4
3.1 Removal	13 - 4
3.2 Installation	13 - 4
3.3 Inspection	13 - 4
4. DUAL WHEELS	13 - 4
4.1 Removal	13 - 4
4.1.1 Outer Wheel.....	13 - 4
4.1.2 Inner Wheel	13 - 4
4.2 Installation	13 - 4
4.2.1 Inner Wheel	13 - 4
4.2.2 Outer Wheel.....	13 - 5
4.3 Inspection	13 - 5
5. CORROSION PROTECTION OF ALUMINUM WHEELS.....	13 - 5
6. WHEEL STRAIGHTNESS CHECK.....	13 - 6
7. WHEEL STUDS.....	13 - 6
7.1 Drive Axle	13 - 6
7.2 Front and Tag Axles.....	13 - 6
8. SPARE WHEEL AND TIRE (if applicable).....	13 - 7
9. REMOVING SPARE WHEEL AND TIRE FROM COMPARTMENT.....	13 - 7
9.1 Procedure For Changing Wheel	13 - 8
10. SPARE WHEEL AND TIRE MAINTENANCE.....	13 - 9
11. FRONT AND TAG AXLE WHEEL HUBS	13 - 9
11.1 Grease Lubricated Wheel Hubs.....	13 - 9
11.1.1 Recommended Lubricants	13 - 9
11.1.2 Hub Bearing Inspection	13 - 9
11.1.3 To Remove/Assemble Hub Unit.....	13 - 9
11.2 Oil Lubricated Wheel Hubs	13 - 9
11.2.1 Hub Bearing Maintenance.....	13 - 9
12. DRIVE AXLE WHEEL HUBS	13 - 10
12.1 Description	13 - 10
12.2 Bearing Adjustment.....	13 - 10
12.3 Disassembly and Repair	13 - 10
13. TIRE MAINTENANCE	13 - 11
13.1 Recommended Tire Inflation Pressure (Cold).....	13 - 11
13.2 Tire Matching.....	13 - 12
13.3 Wheel and Tire Balancing.....	13 - 12
13.4 Tire Rotation.....	13 - 12
14. SPECIFICATIONS.....	13 - 13

LIST OF ILLUSTRATIONS

FIG. 1: ALUM/STEEL WHEEL ARG'T	13 - 3
FIG. 2: TIGHTENING SEQUENCE.....	13 - 3
FIG. 3: DUAL WHEEL INSTALLATION	13 - 5
FIG. 4: SUGGESTED DIAL GAUGE INSTALLATION	13 - 6
FIG. 5: SPARE WHEEL & TIRE COMPARTMENT	13 - 7
FIG. 6: FORWARD R.H. SIDE COMPARTMENT	13 - 8
FIG. 7: OIL FILL CAP	13 - 9
FIG. 8: TIRE INFLATION.....	13 - 11
FIG. 9: EFFECTS OF INFLATION PRESSURE ON TIRE LIFE	13 - 12

1. WHEELS AND TIRES

1.1 Description

Where the vehicle is provided with stud-mounted wheels, wheel studs and nuts on the left side of the vehicle have left-hand threads whereas those on the right side have right-hand threads. If equipped with hub-mounted wheels, all studs and nuts have right-hand threads. Either disc steel wheels or optional aluminum-polished wheels may be installed on the vehicle. Both are mounted with radial tubeless tires.

Aluminum wheel dimensions are 22.50 X 9 inches (571.5 X 228.6 mm) and steel wheel dimensions are 22.50 X 8.25 inches (571.5 X 209.6 mm) for 315/80 R 22.5 and 12 R 22.5 tires.

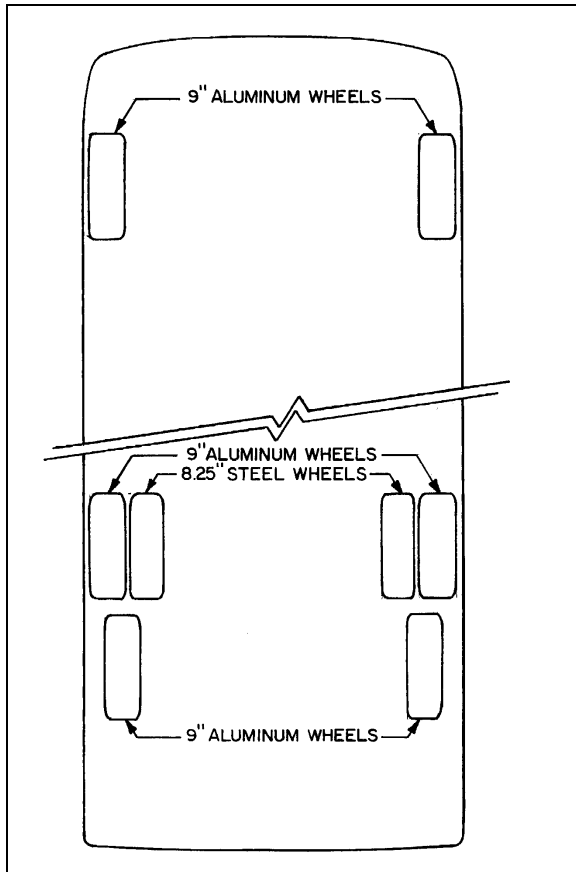


FIGURE 1: ALUM/STEEL WHEEL ARG'T 13001

2. WHEEL MAINTENANCE

Wheel maintenance consists of periodic inspections. Check all parts for damage and ensure that wheel nuts are tightened to the proper torque. In the case of a new vehicle, or after a wheel installation, stud nuts should be tightened every 100 miles (160 km) for the first 500 miles (800 km) to allow setting in of clamping surfaces.

Wheel studs and nuts must be kept free from grease and oil. No lubricant whatsoever should be used. Cleanliness of the wheel and its rotor or brake drum mating surfaces is important for proper wheel mounting.

It is also important that wheel stud nuts be tightened alternately on opposite sides of the wheel. Refer to Figure 2 for the suggested tightening sequence.

However, for hub mounted wheels, it is recommended to add some rust protection lubricant on the pilot diameter of the hub (to facilitate future removal).

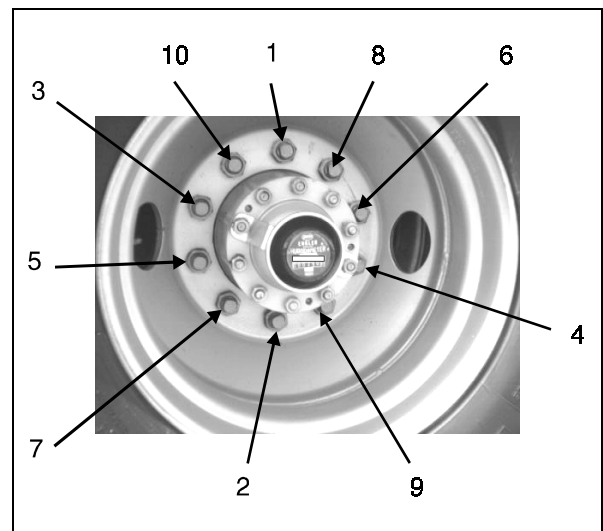


FIGURE 2: TIGHTENING SEQUENCE 13006

3. SINGLE WHEEL

3.1 Removal

1. Stop engine and apply parking brake.
2. Loosen wheel nuts about one turn (do not remove the nuts). (This is not necessary if equipped with hydraulic gun.)

Note: For stud-mounted wheels, turn nuts counterclockwise for R.H. side and clockwise for the L.H. side. For hub-mounted wheels, turn nuts counterclockwise on both sides of the vehicle.

3. Raise the vehicle by its jacking points on the body. See Section 18, "BODY", under heading "VEHICLE JACKING POINTS".
4. Unscrew wheel hex stud nuts and remove the wheel.

3.2 Installation

1. Mount the wheel over studs, being careful not to damage stud threads.
2. Screw in the hex stud nuts (refer to Figure 2 for sequence) so that wheel will position itself concentrically with hub. This is important, otherwise wheel may be eccentric with hub and will not run straight. In this initial step, slightly tighten the nuts to correctly position the wheel.
3. Tighten stud nuts progressively as shown in Figure 2. The final tightening should be done with a torque wrench. Tighten stud nuts to 450 - 500 lbf•ft (610 - 680 N•m) for aluminum as well as steel wheel.

Caution: Insufficient mounting torque can result in damage to parts. Excessive mounting torque can cause studs to break and the wheel to crack in stud hole area.

3.3 Inspection

Repeat "3.2 Installation", step 2.

4. DUAL WHEELS

4.1 Removal

4.1.1 Outer Wheel

Unscrew the hex stud nuts, using the "Single Wheel Removal" procedure described previously in step 3.1.

4.1.2 Inner Wheel

1. Unscrew inner cap nuts.
2. Remove inner wheel.

4.2 Installation

4.2.1 Inner Wheel

1. Mount the wheel over studs, being careful not to damage stud threads.
2. Screw in the inner cap nuts (Fig. 3) and refer to Figure 2 for sequence, so that wheel will position itself concentrically with hub.
3. Tighten inner cap nuts progressively according to sequence shown in Figure 1. The final tightening should be done with a torque wrench. Tighten inner cap nuts to 450 - 500 lbf•ft (610 - 680 N•m) for aluminum as well as steel wheel.

Caution: Insufficient mounting torque can result in damage to parts. Excessive mounting torque can cause studs to break and the wheel to crack in stud hole area.

4.2.2 Outer Wheel

Tighten the hex head nuts (Fig. 3) using the single wheel installation procedure described previously.

Note: *On dual wheel assemblies, position the wheels with the tire valves 180° apart in order to have access to both the inner and outer valves.*

4.3 Inspection

1. Loosen a hex stud nut three turns (Fig. 3).
2. Tighten the inner cap nut to (450 - 500 lbf•ft [610 - 680 N•m]).
3. Tighten the hex stud nut to (450 - 500 lbf•ft [610 - 680 N•m]).
4. Repeat the 3 previous steps for each of the 10 "hex stud nut - inner cap nut assemblies" according to the tightening sequence in Figure 2.

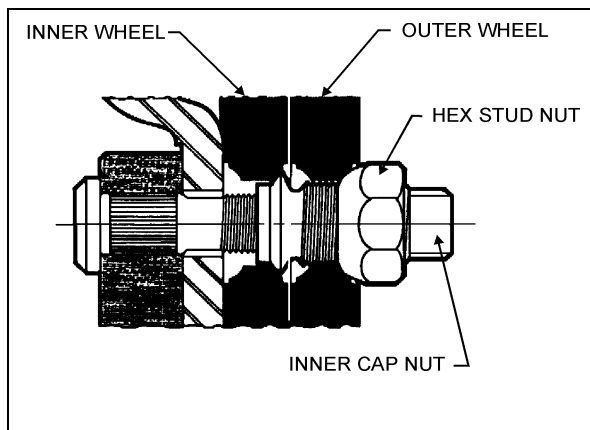


FIGURE 3: DUAL WHEEL INSTALLATION

13007

Caution: *Do not attempt to tighten an inner cap nut without having previously loosened the hex stud nut.*

5. CORROSION PROTECTION OF ALUMINUM WHEELS

1. Clean wheels often by means of a high pressure water jet. Cleaning may be accelerated with mild soap. Do not use concentrated alkaline cleaning products.
2. When tire is removed, clean and inspect wheel thoroughly. Remove dirt and corrosion on rim by means of a wire brush. Do not use a wire brush on the outer surface of the wheel.
3. The following measures should be taken to maintain original appearance of the aluminum wheels:
 - Use a sponge, a soft cloth, or a soft fiber brush, with a mild soap and warm water solution to wash the outer wheel surfaces.
 - Rinse thoroughly with clean water.
 - Wipe and dry thoroughly to prevent water stains.
 - Wax surface with "Simonize Body Guard", "Dupont 7 New Car Wax", or an equivalent product.
 - Clean aluminum wheels as required to maintain original look.

Warning: *Wheel surfaces may have sharp or cutting edges which may cause injury to the hands. To prevent contact with sharp edges, it is strongly recommended to wear rubber gloves when washing or polishing wheels.*

6. WHEEL STRAIGHTNESS TEST

1. Slightly raise axle to be checked and place a safety support underneath.
2. Check wheel lateral runout. Install a dial gauge as shown in Figure 4, then rotate the wheel by hand one full turn. As the wheel turns, note any variation on the dial gauge.

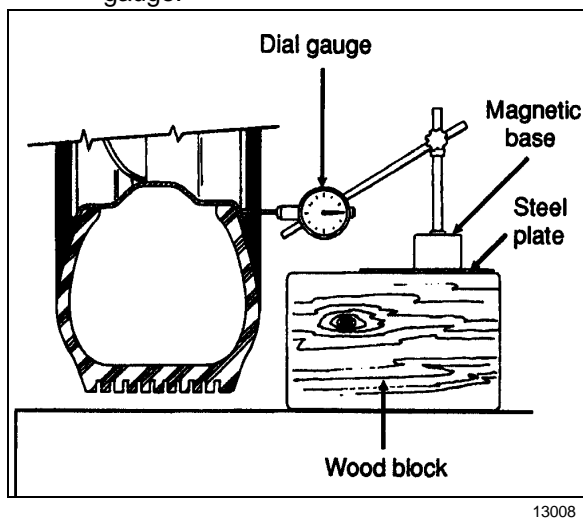


FIGURE 4: SUGGESTED DIAL GAUGE INSTALLATION

Caution: *Damage to the dial gauge could occur if it strikes a wheel balancing weight.*

3. If the variation in lateral runout exceeds 0.125 inch (3,2 mm), the wheel must be replaced.
4. If doubt exists whether wheel or hub is distorted, hub may be checked as follows:
 - Replace the existing wheel with a wheel known to be correct.
 - Check wheel lateral runout as outlined in step 2.
 - If, within specifications, the hub is correct but the suspected wheel must be replaced.

Caution: *NEVER STRAIGHTEN ALUMINUM WHEELS. Never heat aluminum wheels for the purpose of repairing damages incurred after hitting a curb or resulting from other causes. The special alloy in wheels has been heat treated, and any uncontrolled heating could alter the wheel structure. Furthermore, never weld aluminum-forged wheels for any reason whatsoever.*

7. WHEEL STUDS

Stripped threads may be the result of excessive torquing, or may have been damaged during wheel installation, when placing the wheel over the studs. A stud having damaged threads must be replaced. Broken studs are a direct result of operating with loose stud nuts or improperly seated wheels. When a broken stud is replaced, the adjacent studs, on each side of the broken one must also be replaced, since they could have been subjected to excessive strain and may be fatigued.

When installing wheel studs to hubs, check nuts retaining the wheel stud to wheel hub and if they are deformed, damaged or severely corroded, install new parts. Install nut (and washer where applicable) to new stud and torque to 110 - 130 lbf•ft (150 - 177 N•m) for studs mounted on front and tag axle wheel hubs and torque to 450 - 500 lbf•ft (610 - 680 N•m) for those mounted on drive axle wheel hubs.

7.1 Drive Axle

Wheel can be mounted on the drive axle with studs (3/4"-16 thread) or hub mounted (7/8"-14 thread) and with the inner cap nut (1-1/8"-16 thread).

7.2 Front and Tag Axles

Wheel can be mounted on tag axle with studs (1-1/8"-16 thread) or hub mounted (7/8"-14 thread).

Note: *Wheel studs and nuts must be kept free from grease and oil. No lubricant whatsoever should be used.*

8. SPARE WHEEL AND TIRE (if applicable)

Tire failure is a rare event these days, if tires are properly cared for. In case of a flat tire, move vehicle a safe distance away from traffic and apply the parking brake. Remember to switch "ON" the hazard flashers and according to the highway code regulations, set up the triangular reflectors (see "Emergency Warning Reflectors" in the Operator's Manual) at an adequate distance, to warn incoming motorists.

Spare wheel and tire are stored in the spare wheel and tire compartment and are accessible by lowering the reclining front bumper. Use the wheel nut wrench to unscrew the two (2) bumper retaining bolts.

Note: *There is no spare wheel in the case of a converted vehicle. An air shutter is located behind the reclining front bumper. Access is obtained by pressing a latch located in the middle and upper part of the bumper air inlet.*

Warning: *It is recommended that two people perform this operation, since bumper weighs 100 lbs (45 kg).*

Warning: *This compartment has not been designed for storage. Never leave loose objects in this area since it may interfere with steering linkage mechanism. Make sure bumper is safely bolted in place after closing the compartment.*

The condition and pressure of the tires can greatly affect both useful tire life and road safety.

Note: *The recommended tire inflation pressures are given in "SPECIFICATIONS" at the end of this section. Also, cold tire inflation pressures are listed on the Department of Transport's certification plate, affixed below L.H. side control panel in driver's area. Tire pressure must be adjusted according to vehicle loading - see table in "Coach Final Record" (NOT NECESSARILY THE V.I.N. PLATE).*

At regular intervals, verify the tire pressures. Use an accurate tire pressure gauge when checking inflation pressures. Never exceed the maximum tire inflation pressure specified on each tire.

Cold tire inflation pressure means: When a vehicle has not been driven for at least 3 hours or less than 1 mile (1.6 km).

Warning: *Incorrect tire pressures cause increased tire wear and adversely affect road holding of the vehicle, leading to loss of vehicle control.*

Note: *Always include the spare tire during a pressure verification.*

9. REMOVING SPARE WHEEL AND TIRE FROM COMPARTMENT

To pull out spare wheel and tire, open reclining bumper according to the previous instructions, unscrew the wing nut retaining the support and rail extension assembly (stored on R.H. side of wheel), then take out the assembly. Install assembly by matching its two (2) holes to the corresponding mounting pins located in front center of spare tire compartment. Unscrew the retaining brackets T-handle to release the wheel and dolly assembly and pull out bracket. Pull out wheel using strap then remove tire covering. Separate wheel and tire from dolly by unscrewing the two (2) mounting nuts.

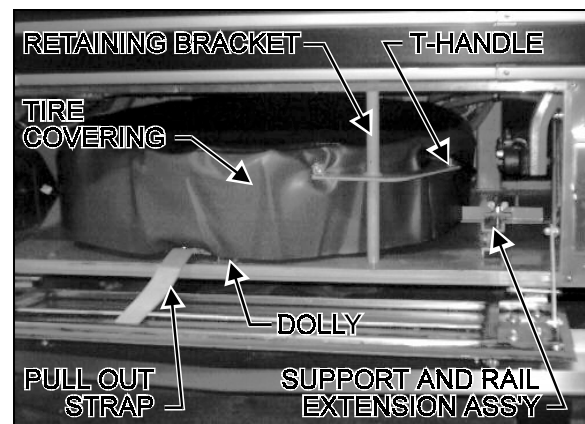


FIGURE 5: SPARE WHEEL & TIRE COMPARTMENT 13005

Section 13: WHEELS, HUBS & TIRES

Caution: After reclining bumper has been secured, the two (2) retaining bolts should be checked to make sure that they are tightly fastened.

Note: Reinstall support and rail extension assembly, then secure tire with retaining bracket before moving vehicle.

Jack and wheel nut wrench are stored at right in forward R.H. side baggage compartment.

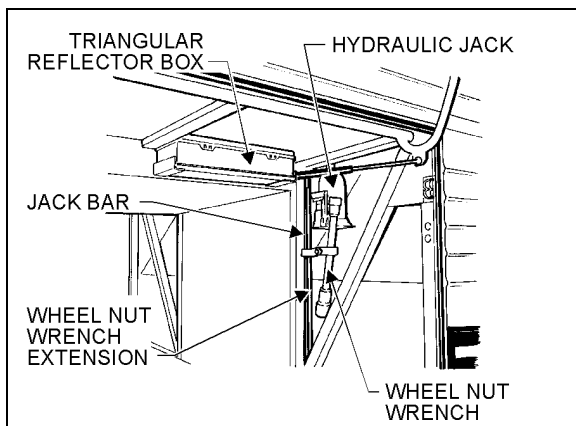


FIGURE 6: FORWARD R.H. SIDE COMPARTMENT 23012

Check the spare tires inflation pressure periodically to keep it ready for use. Inflate spare tire to the pressure of the tire which has the highest pressure on the vehicle.

Also, make sure that retaining bracket is securely fastened in order to prevent it from moving around inside compartment.

9.1 Procedure for Changing Wheel

1. Stop engine, apply parking brake, take out jack and wrench, then remove spare wheel and tire from their compartment.
2. Remove hub cap (with appropriate wrench) or cover from wheel.

3. With supplied wrench, loosen all wheel nuts to about one (1) full turn.

Note: For stud-mounted wheels, turn nuts counterclockwise on R.H. side of vehicle and clockwise on L.H. side. For hub-mounted wheels, turn nuts counterclockwise on both sides of vehicle.

4. Use the hydraulic jack to raise the vehicle. Raise vehicle to the height required to remove wheel.

Note: For hydraulic jack placement, refer to Section 18 "BODY", under heading "VEHICLE JACKING POINTS".

Warning: Place jack on stable and level ground; if necessary, place a board under the jack.

Do not raise the vehicle until you are sure the jack is securely engaged.

Warning: To prevent personal injury and/or equipment damage, use only the recommended jacking points.

Passengers must not remain inside vehicle while wheel is being replaced.

5. Fully unscrew the wheel nuts, then remove nuts and wheel. Install spare wheel with existing nuts, then slightly tighten nuts in a crisscross pattern before lowering the vehicle.
6. Lower vehicle (until tire touches ground) by slowly unscrewing the jack's hydraulic valve.
7. Torque all nuts, in a crisscross pattern, to 450-500 ft•lbs (610-680 N•m).
8. Completely lower the coach and remove jack. Adjust tire pressure according to the cold tire inflation pressures.
9. Store damaged wheel in spare tire compartment. Repair and balance the flat tire as soon as possible.

10. SPARE WHEEL AND TIRE MAINTENANCE

Maintenance of the spare wheel and tire consists in ensuring that tire inflation pressure is the same as the tire on the coach which has the highest inflation pressure (refer to "Recommended Tire Inflation Pressure (Cold)" in this section). Inspect rim to ensure that there is no important corrosion, check if spare wheel cover is in good condition and check that spare tire is securely fastened in compartment.

Caution: *If the spare wheel and tire must be installed, deflate the tire in accordance with recommended pressure.*

11. FRONT AND TAG AXLE WHEEL HUBS

Two types of wheel hubs are available. One is lubricated with grease and the other is lubricated with oil.

11.1 Grease Lubricated Wheel Hubs

Front and tag axle wheel hubs and hub bearings need to be cleaned and greased every 50,000 miles (80 000 km) or once a year, whichever comes first.

11.1.1 Recommended Lubricants

A good quality lithium-base grease NLGI No. 1 or 2 are recommended.

11.1.2 Hub Bearing Inspection

1. An inspection should be made after the first 3,000 miles (4 800 km) and then at intervals of 25,000 miles (40 000 km). When the wheels are raised, they should revolve quite freely without roughness.
2. Hub bearings should have a slight end movement with the limits 0.0005/0.002"

(0.0127/0.0508 mm) when rocked forward and backwards on axle stub. See "To Remove/Assemble Hub Unit" next in this section.

11.1.3 To Remove/Assemble Hub Unit

Refer to "ROCKWELL - MAINTENANCE MANUAL NO. 2)", annexed to Section 10, "FRONT AXLE".

11.2 Oil Lubricated Wheel Hubs

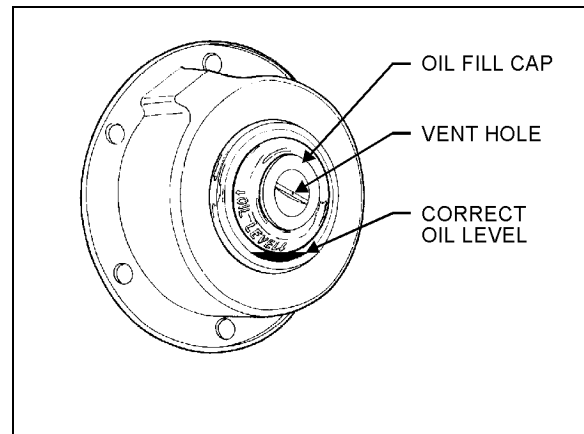


FIGURE 7: OIL FILL CAP

13003

11.2.1 Hub Bearing Maintenance

If applicable, the front and tag axle wheel hubs use oil lubrication which eliminates periodic grease repacking of the hubs. A sight glass is provided for convenient verification of oil level. Oil level should be checked daily and must be maintained to the level mark in the sight glass. If oil is not visible through the sight glass, general purpose gear lubricant SAE 90 (A.P.I. spec. GL5) must be added by removing the oil fill cap in center of hub to bring oil to the correct level. To check oil level after vehicle has been driven, wait at least 15 minutes to ensure that oil has settled.

Caution: *Hub oil fill cap is provided with a very small vent hole in its center. Occasionally insert a small tip (toothpick size) to avoid hole restriction, since it prevents overpressure in bearing housing.*

12. DRIVE AXLE WHEEL HUBS

12.1 Description

Drive wheels use a single oil-seal assembly and are lubricated from the oil supply in the differential housing. Bearings are tapered rollers, adjustable to compensate wear. Maintain differential oil level with general purpose gear lubricant (refer to Section 24 "LUBRICATION" for proper oil grade selection) to ensure adequate oil supply to wheel bearings at all times.

12.2 Bearing Adjustment

To adjust drive wheel bearings, raise vehicle until both dual wheels can be turned freely (approximately 6 inches from the ground). Position jack stands under drive axle, then lower vehicle approximately 2 inches in order to avoid entire weight of the axle being supported by the suspension air bellows and the shock absorber pins.

Remove axle shaft as indicated in "Rockwell - Maintenance Manual No. 5" under heading "Single Reduction Differential Carriers" annexed to "Section 11" of this manual. Remove gaskets. Unscrew lock nut and remove adjusting nut lock ring.

To adjust, tighten adjusting nut until the wheel binds, rotate the wheel while tightening so that all surfaces are in proper contact. Back off adjusting nut approximately 1/4 to 1/3 turn to assure 0.001/0.007" (0.0254/0.1778 mm) end play and to ensure that wheel turns freely. Replace lock ring, and adjust nut dowel pin in one of the holes. The ring may be turned over if necessary to allow more accurate adjustment of bearings.

Tighten lock nut and recheck bearing adjustment. Replace the axle shaft using a new gasket.

12.3 Disassembly and Repair

Jack vehicle as per "12.2 Bearing Adjustment" and remove axle shaft as indicated in "ROCKWELL - MAINTENANCE MANUAL NO. 5" entitled "Single Reduction Differential Carriers"

annexed to Section 11 of this manual. Remove wheels and tires.

Caution: Always mark position of the wheel on the axle prior to removal, to replace wheel at the same location, thus avoiding a new wheel balancing.

Remove lock nut, lock ring and adjusting nut from axle housing to prevent the outer bearing from falling out. Remove outer bearing cone and roller assembly.

Remove screws attaching inner oil seal retainer to hub, and remove inner oil seal assembly. Remove inner bearing cone and roller assembly. Bearing cups can be separated from the hub using a hammer and a long brass drift.

All parts should be thoroughly cleaned. Bearing cone and roller assemblies can be cleaned in a suitable cleaning solvent using a stiff brush to remove old lubricant.

If excessive wear, deterioration, cracking, or pitting are present on the bearing cups, rollers, or cones, the bearings should be replaced. Seals should be replaced each time they are removed from the hub. To install new oil seal, use a suitable adapter and drive the seal into the retainer bore until it bottoms.

When installing wheel on spindle, center the wheel hub with spindle to avoid damaging the seal with the end of the spindle. Push wheel straight over the spindle until inside diameter of seal press fits on wiper ring. Prefill hub cavity with general purpose gear lubricant (refer to Section 24 "LUBRICATION" for proper oil grade selection). Lubricate, and then install outer bearing cone. Adjust bearing and lock. Assemble axle flange to axle using a new gasket. Apply sealant in stud area. After both wheels have been assembled according to above procedure, fill the differential with the recommended lubricant to the proper factory recommended level.

Note: During regular inspection, do not forget to check lubricant level in differential. Clean thoroughly or replace vent as required.

13. TIRE MAINTENANCE

The most critical factor in tire maintenance is proper inflation (Fig. 8). No tire is completely impervious to loss of air pressure. To avoid the hazards of underinflation, always maintain tires to the recommended pressure. Improper inflation decreases tire life.

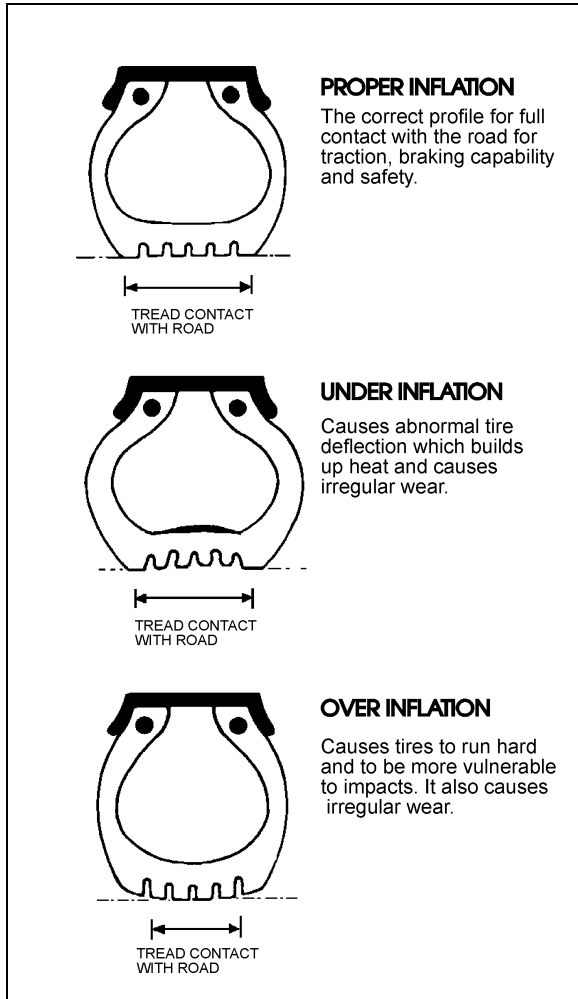


FIGURE 8: TIRE INFLATION

13009

An underinflated tire builds up heat that can cause sudden tire destruction, resulting in improper vehicle handling and possible loss of vehicle control. At least once a week, before driving (when tires are cold), check inflation pressure on all the tires, including the spare tire. This is especially important in cases where vehicle is operated by different drivers.

Warning: Failure to maintain correct tire inflation pressure may result in sudden tire destruction, improper vehicle handling, and will cause rapid and irregular tire wear. Therefore, inflation pressure should be checked weekly and always before long distance trips.

13.1 Recommended Tire Inflation Pressure (Cold)

Inflation pressure should be checked when tires are cold. Driving, even for a short distance, will cause the tire to warm up and the air pressure to increase. Check inflation pressure on all tires using an accurate tire gauge.

The maximum loading tire inflation pressure (cold) for 12 R 22.5 tires are as follows:

Front axle	115 psi (792 kPa)
Drive axle	90 psi (620 kPa)
Tag axle	95 psi (655 kPa)

Note: It is recommended that all tires on coach be of the same type.

Note: Tires are considered cold when the vehicle has not been driven for at least three hours, or driven less than 1 mile (1,6 km). Driving, even for a short distance, causes tires to heat up and air pressure to increase.

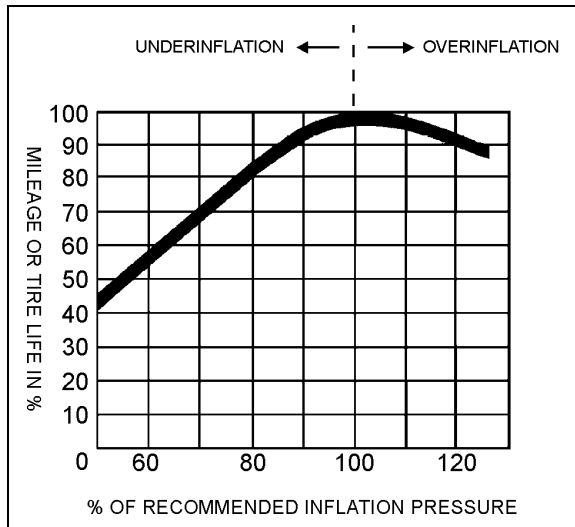
Note: Never bleed air from hot tires as tires will then be underinflated. Use an accurate tire gauge to check pressures. (Do not kick tires as an inflation check. This is an unreliable method).

Caution: In the case of a converted vehicle, weigh vehicle fully loaded and pressurize according to tire manufacturer's recommendations.

Caution: These tire pressures are established in accordance with the maximum allowable load on each axle. A lower pressure is recommended if the axle load is less than the above specifications. Weigh vehicle fully loaded and pressurize according to tire manufacturer's recommendations. For

other tire and wheel specifications, see *Prévost tire pressure tabulation in "Coach Final Record"*.

Warning: All tires on the same axle should always be inflated to the same pressure. There should not be a difference in pressure between right and left tires on the same axle. A 5 psi (35 kPa) underinflation in one front tire can not only destroy ease of steering, but creates steering hazards which can lead to a potential accident.



13010
FIGURE 9: EFFECTS OF INFLATION PRESSURE ON TIRE LIFE

13.2 Tire Matching

Unmatched tires on drive axle will cause tire wear and scuffing, as well as possible damage to the drive unit. Consequently, we recommend that tires be matched within 1/8" (3 mm) of the same rolling radius, and 3/4" (19 mm) of the same rolling circumference.

13.3 Wheel and Tire Balancing

Wheels and tires must be clean and free from all foreign matter. The tires should be in good condition and properly mounted. Unbalanced wheel and tire assembly can be due to a bent wheel or improper mounting. Before removing the wheel and tire assembly from the vehicle, check for swaying movement, and if necessary, check the wheel lateral runout as outlined under heading "*Wheel Straightness Check*".

Warning: When balancing wheel and tire assemblies, it is strongly recommended that instructions covering the operation of wheel balancer being used are closely followed.

Caution: A maximum of 16 oz (450 g) of balancing weight is recommended. If more weight is necessary, check and correct the cause.

13.4 Tire Rotation

Radial tires should be rotated only when necessary. If the tires are wearing evenly, there is no need to rotate. If irregular wear becomes apparent or if the wear rate on the tires is perceptively different (from axle to axle), then tires should be rotated in such a manner as to alleviate the condition.

Note: There is no restriction on criss-cross rotation.

14. SPECIFICATIONS

STEEL WHEELS (including inner drive axle)

Wheel size	8.25" X 22.5"
Wheel nut torque	450 - 500 lbf•ft (610 - 680 N•m)
Tire size	12 R 22.5 315/80 R 22.5

ALUMINUM WHEELS (except inner drive axle)

Wheel size	9" X 22.5"
Wheel nut torque	450 - 500 lbf•ft (610 - 680 N•m)
Tire size	12 R 22.5 315/80 R 22.5

RECOMMENDED TIRE INFLATION PRESSURE AT MAXIMUM LOAD (cold)

Tires 12R22.5

Front axle.....	115 psi (792 kPa)
Drive axle.....	90 psi (620 kPa)
tag axle	95 psi (655 kPa)
Spare tire (if applicable).....	115 psi (792 kPa)

Tires 315/80R22.5

Front axle.....	100 psi (689 kPa)
Drive axle.....	90 psi (620 kPa)
tag axle	80 psi (551 kPa)
Spare tire (if applicable).....	100 psi (689 kPa)

Caution: *In the case of a converted vehicle, weigh it fully loaded and pressurize according to tire manufacturer's recommendations.*

SECTION 14: STEERING

CONTENTS

1. STEERING SYSTEM.....	14 - 3
1.1 Description	14 - 3
2. INTEGRAL POWER STEERING GEAR.....	14 - 4
2.1 Description	14 - 4
2.2 Power Steering Gear Removal.....	14 - 4
2.3 Power Steering Gear Installation.....	14 - 5
3. BLEEDING POWER STEERING HYDRAULIC SYSTEM	14 - 5
4. HYDRAULIC PRESSURE TEST	14 - 5
5. TROUBLESHOOTING	14 - 5
6. POWER STEERING HYDRAULIC PUMP.....	14 - 5
6.1 Description	14 - 5
6.2 Removal and Installation	14 - 5
6.3 Maintenance	14 - 5
7. STEERING WHEEL.....	14 - 6
7.1 Removal	14 - 6
7.2 Installation	14 - 6
8. STEERING COLUMN.....	14 - 6
8.1 Removal and Lubrication	14 - 6
9. TURNING ANGLE ADJUSTMENT	14 - 6
10. STEERING LINKAGE ADJUSTMENT	14 - 7
11. PITMAN ARM	14 - 7
11.1 Removal	14 - 7
11.2 Installation	14 - 8
11.3 Adjustment	14 - 8
12. MAINTENANCE.....	14 - 8
12.1 Power Steering Reservoir and Filter	14 - 9
12.1.1 Oil Level Check Procedure	14 - 9
12.1.2 Filter Replacement	14 - 9
12.2 Steering Stabilizer Cylinder (Damper)	14 - 10
12.3 Hydraulic Cylinder Assembly.....	14 - 10
12.4 Drag Link.....	14 - 10
12.5 Power Steering Hydraulic Pump	14 - 10
13. DRIVING TIP	14 - 10
14. TORQUE SPECIFICATIONS.....	14 - 11
15. SPECIFICATIONS.....	14 - 12

LIST OF ILLUSTRATIONS

FIG. 1: STEERING SYSTEM AXLE SETUP.....	14 - 3
FIG. 2: POWER STEERING SYSTEM	14 - 3
FIG. 3: INTEGRAL POWER STEERING GEAR	14 - 4
FIG. 4: STEERING COMPARTMENT	14 - 4
FIG. 5: STEERING COLUMN	14 - 6
FIG. 6: PITMAN ARM ADJUSTMENT	14 - 7
FIG. 7: ENGINE COMPARTMENT - R.H. SIDE DOOR.....	14 - 9
FIG. 8: ENGINE COMPARTMENT - REAR DOORS	14 - 9
FIG. 9: POWER STEERING FLUID RESERVOIR	14 - 9
FIG. 10: DAMPER BRACKET ADJUSTMENT	14 - 10
FIG. 11: TORQUE REFERENCE NUMBERS	14 - 11

1. STEERING SYSTEM

1.1 Description

the steering system consists of the steering wheel and column assembly, a vane-type hydraulic pump, reservoir, filter, interconnecting system lines and hoses, integral power steering gear, linkage and steering damper (Figs. 1 & 2). The steering linkage includes the pitman arm, drag link, steering arm, tie rod arms and tie rod. Hydraulic components are added to transmit, increase and regulate steering control forces.

These elements are:

1. Hydraulic cylinder ;
2. Steering stabilizer (damper);

3. A vane type hydraulic pump; and
4. Hydraulic reservoir and hoses.

The steering stabilizer reduces road shocks and vibrations in the system. The steering gearbox is self powered and provides movement with power assistance mainly to the left wheel. The hydraulic cylinder provides an added source of assistance and, being connected to the right wheel, makes it such that the total steering forces are produced with minimal stress on mechanical linkages.

Steering stability and tire wear are influenced by wheels, hubs, tires, air suspension, brakes, front suspension and front end alignment which are all covered in their respective sections in this manual.

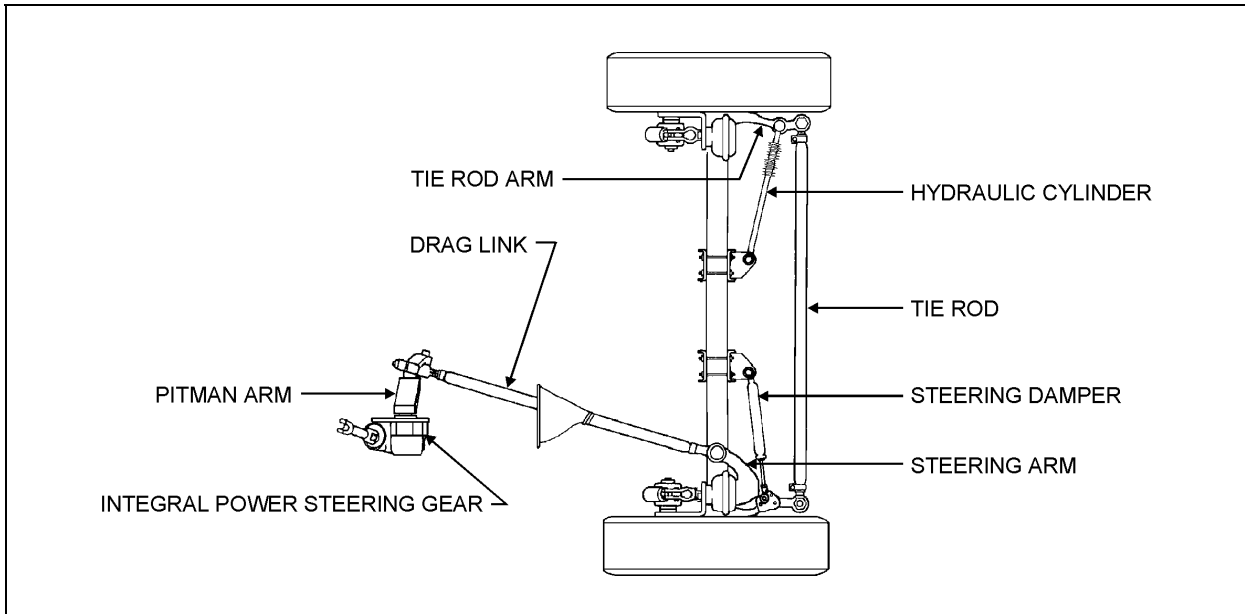


FIGURE 1: STEERING SYSTEM AXLE SETUP

14011

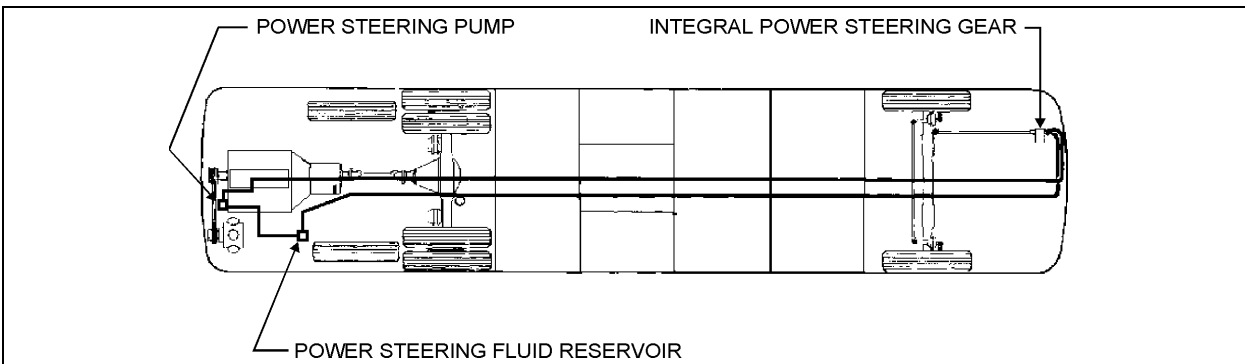


FIGURE 2: POWER STEERING SYSTEM

14012

2. INTEGRAL POWER STEERING GEAR

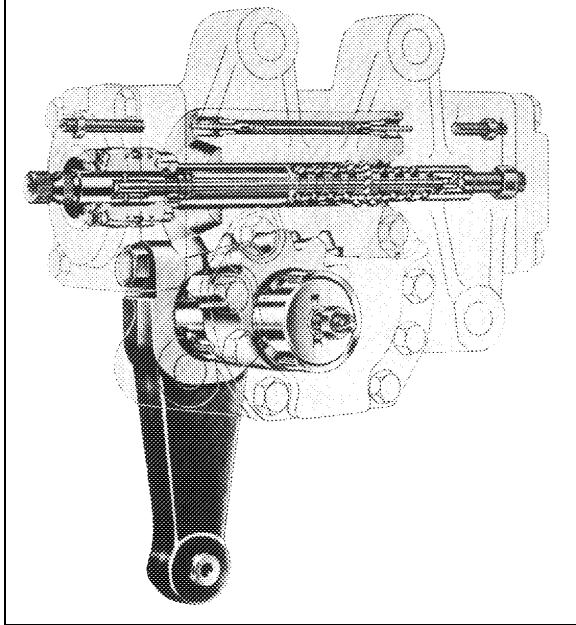


FIGURE 3: INTEGRAL POWER STEERING GEAR 14013

2.1 Description

The power steering gear is located in the steering compartment (Fig. 4). The integral power steering gear (TAS 85) incorporates a manual steering mechanism, a hydraulic control valve and a hydraulic power cylinder.



FIGURE 4: STEERING COMPARTMENT 14014

Force on the steering wheel is transmitted to the steering gear input shaft. The input shaft is connected to the worm shaft by means of a torsion bar. The torsion bar turns with the input

shaft, exerting a rotational force on the worm shaft. The worm shaft in turn transmits the force through a ball nut mechanism to axial force on the rack piston. The rack piston resists this force due to its engagement to the sector shaft. With this resistance, the torsion bar is twisted by the input shaft. Pressurized fluid moves the rack piston axially through the cylinder bore, and the rack piston then turns the sector shaft and steers the vehicle.

If the steered wheels receive a shock load, the shock force is transmitted through the sector shaft to the rack piston and on the worm shaft. This force causes the control valve to send high pressure fluid to the proper cavity to resist the shock force. By hydraulically absorbing the shock, the steering gear prevents kickback at the steering wheel.

The steering gear is equipped with two unloading valves (poppets) at either end of the housing. As the steered wheels approach the axle stop, the corresponding poppet is opened. This reduces heat generated by the pump. The tripped poppet also reduces the load force on the steering linkage. These poppets may be adjusted by the adjusting screw located at bottom of steering gear.

Refer to the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section for the functional aspects and maintenance procedure of the power steering gear.

Caution: Before attempting to adjust the poppet valves of the power steering gear, properly set the steering stop screws as outlined in section 10 "FRONT AXLE", under heading "7.5 Steering Geometry (Turning Angle Adjustment)".

2.2 Power Steering Gear Removal

Warning: The steering gear weighs approximately 112 lbs (51 kg) dry. Exercise caution when maneuvering.

1. Put a container into place, then disconnect both the inlet and outlet hoses from the power steering gear. Cover fittings to prevent fluid contamination.

2. Mark both the pitman arm and sector shaft in line, then remove pitman arm. Refer to "11.1 Pitman Arm Removal" procedure.
3. Mark both the steering shaft universal joint yoke and steering gear input shaft in line, then disconnect universal joint.
4. Unscrew and remove the power steering gear.

2.3 Power Steering Gear Installation

Reverse "Power Steering Gear Removal" procedure paying particular attention to the following:

1. Tighten fasteners as recommended under "14. TORQUE SPECIFICATIONS".
2. Bleed air from the system as per step 3, next.

3. BLEEDING POWER STEERING HYDRAULIC SYSTEM

To bleed the power steering hydraulic system, refer to the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section, under heading "FILLING AND AIR BLEEDING THE SYSTEM".

4. HYDRAULIC PRESSURE TEST

Perform a pressure test as outlined in the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section.

5. TROUBLESHOOTING

Perform troubleshooting of the steering gear as outlined in the "TAS STEERING GEAR SERVICE MANUAL" and the "VICKERS - VANE PUMP OVERHAUL MANUAL" annexed to this section.

6. POWER STEERING HYDRAULIC PUMP

6.1 Description

The power steering pump is a vane type, gear driven, hydraulic unit which supplies hydraulic pressure for the operation of the steering gear. The pump is mounted on the engine, to crankshaft pulleys R.H. side.

6.2 Removal and Installation

The pump is accessible through the engine compartment rear door.

To remove the pump, proceed as follows:

1. Put an empty container directly below pump, then disconnect both the inlet and outlet hoses from the pump. Block fitting cavities to prevent fluid contamination.
2. Remove the two (2) mounting screws, then slowly pry out the pump.
3. Remove and discard gasket.

Caution: *Inspect the drive coupling thoroughly, and replace if necessary (the drive coupling is a fiber component located between the engine and the pump).*

For pump installation, reverse the removal procedure paying particular attention to the following:

Caution: *Insure that drive coupling is correctly positioned before reinstalling the pump.*

1. Install a new gasket (Prévost P/N 510488).
2. Bleed air from the system as per step 3, "Bleeding Power Steering Hydraulic System", on this page.

6.3 Maintenance

Refer to the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section.

7. STEERING WHEEL

7.1 Removal

1. Set the battery main disconnect switches (XL-40) or the battery master switch (XL-45) to the "OFF" position.
2. Using a tool, such as a small flat head screwdriver, pry off the electric horn cap.
3. Loosen the small screw in center of cap and the other retaining the black wire, then disconnect the white terminal. Remove horn cap.
4. Loosen and remove the steering wheel nut.
5. Using a suitable puller, remove the steering wheel.

7.2 Installation

To install, reverse the removal procedure. Torque steering wheel nut to 35-45 lbf•ft (47-60 N•m).

8. STEERING COLUMN

8.1 Removal and Lubrication

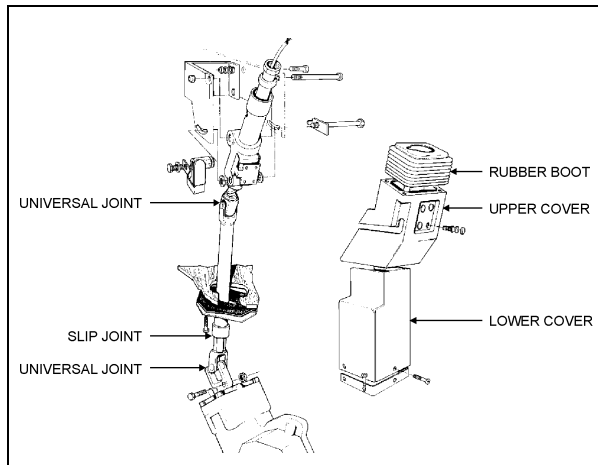


FIGURE 5: STEERING COLUMN

14015

To disassemble the steering column from system, refer to Figure 6. The steering column has three lubrication points which must be serviced only

when needed, using a good quality lithium-base grease NLGI No. 1 and 2. The lower steering column U-joint and slip joint grease fittings are easily accessible through the steering compartment. The upper steering column U-joint grease fitting is accessible from the front driver's area as follows:

1. From the front driver's area, unfasten and lift the steering column boot, then remove the four snap caps on front of upper steering column cover (Fig. 5).
2. Unscrew the four retaining screws on upper steering column cover. Remove the upper cover.
3. Unscrew the three retaining screws on lower steering column cover. Remove the lower cover.
4. Position the steering wheel in order to gain access to the grease fittings.

9. TURNING ANGLE ADJUSTMENT

The maximum turning angle is set through the two (2) steering stop screws installed on the axle center. Steering stop screws are factory adjusted to accommodate the chassis design, and therefore, do not require adjustment on new vehicles. However, these should be checked and adjusted if necessary, any time a steering system component is repaired, disassembled or adjusted. Refer to section 10 "FRONT AXLE" under heading "7. FRONT END ALIGNMENT".

Caution: To prevent the steering damper from interfering with the adjustment of turning angles, make sure its fixing bracket is at correct location on the axle center (refer to "12.2 Steering Stabilizer Cylinder (Damper)").

Hydraulic Stop

Caution reduce or shut off the power steering hydraulic pressure before the boss on the axle center touches the stop screw. If not, the components of the front axle will be damaged (refer to "TAS STEERING GEAR SERVICE MANUAL" annexed to this section, under heading "POPPET RESETTING").

Caution: Never maintain the relief pressure for more than 5 seconds, since damage to the power steering pump may occur.

10. STEERING LINKAGE ADJUSTMENT

The steering linkage includes the pitman arm, drag link, steering arm, tie rod arms and tie rod.

Perform lubrication according to "ROCKWELL MAINTENANCE MANUAL NO. 2 - FRONT NON-DRIVE STEERING AXLES" annexed to section 10 "FRONT AXLE".

Drag link ends are provided with grease fittings. Under normal conditions, these should be serviced every 6,250 miles (10 000 km). Refer to section 24 "LUBRICATION".

Steering linkage pivot points should be checked each time they are lubricated. Looseness can be visually detected while rotating the steering wheel in both directions. Replace defective parts.

Caution: Front end alignment should be checked and adjusted if necessary, any time a component of the steering system is repaired, disassembled or adjusted. Refer to section 10 "FRONT AXLE" under heading "7. FRONT END ALIGNMENT".

11. PITMAN ARM

11.1 Removal

1. Remove cotter pin, nut and washers from drag link ball stud at pitman arm.

2. Disconnect drag link from pitman arm, using jaw style pullers (pressure screw type).

Warning: Always wear approved eye protection when operating pullers.

Caution: Do not drive (hammer in) pitman arm on or off pitman shaft as this can damage the steering gear.

Caution: Heating of components to aid in disassembly is not allowed because it has a detrimental effect on axle components and steering linkages.

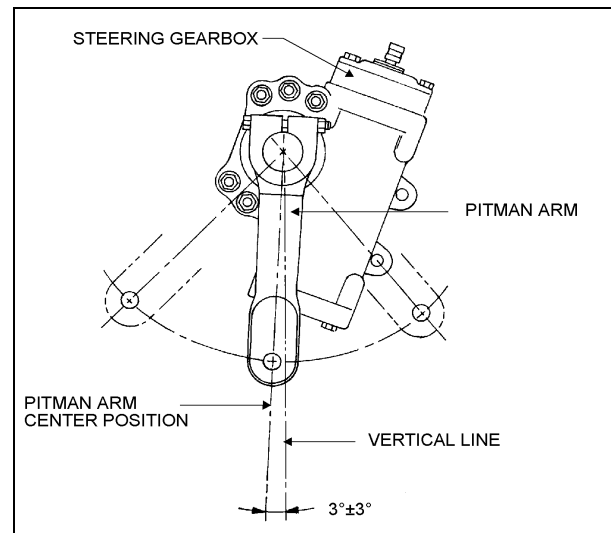


FIGURE 6: PITMAN ARM ADJUSTMENT

14007

3. Remove pitman arm clamp bolt nut, washer and bolt.
4. Check the radial position of the pitman arm in relation to the sector shaft prior to removal of pitman arm.
5. Add reference marks to the arm and shaft if necessary to ensure correct alignment at reassembly.
6. Remove pitman arm. A chisel will help you loosen the pitman arm. Use a puller if you cannot remove the pitman arm manually.

11.2 Installation

1. Position pitman arm on sector gear shaft with reference marks aligned. Ensure that the clamp bolt groove matches.
2. Install bolt, washer and nut. Tighten nut to 280-300 lbf•ft (380-408 N•m).
3. Connect drag link to pitman arm while ensuring that rubber stabilizer is in place on the rod end. Install washers. Tighten nut to 200-220 lbf•ft (272-300 N•m). Afterwards, install a new cotter pin.

11.3 Adjustment

1. Disconnect the drag link from pitman arm. Center steering wheel by dividing the total number of steering wheel turns in two. Scribe a reference mark on steering gearbox at the center previously determined.
2. Using a protractor, check the angle of the pitman arm (refer to Fig. 6 for details).
3. The pitman arm should be adjusted to an angle of $3^{\circ} \pm 3^{\circ}$ in relation with the vertical axis (towards rear of vehicle). If not, unscrew and remove bolt, nut and washer. Remove the pitman arm according to the procedure outlined under previous heading "*Pitman arm removal*". Adjust to the proper angle.
4. When adjustment is achieved, replace bolt, nut and washer, and torque to 280-300 lbf•ft (380-408 N•m).

12. MAINTENANCE

The power steering system requires little maintenance. However, the system should be kept clean to ensure maximum operating performance and troublefree service. Periodic

inspections should also be made to check for leakage and all parts for damage or distortion. Insure all fasteners are tight (see "*14. SPECIFICATIONS*" for recommended tightening torques.

When the slightest evidence of dirt, sludge or water is discovered in the system, disconnect fluid lines at the power steering gear to drain the system. Drain and refill the system with "*Dexron-II* or *Dexron-III*" automatic transmission oil.

Air in the hydraulic system will cause spongy action and noisy operation. When a hose has been disconnected or when fluid has been lost for any reason, the system must be bled. Bleed system as outlined under heading "*3. Bleeding Power Steering Hydraulic System*".

Warning: **Do not operate the pump without fluid in the power steering fluid reservoir.**

If the steering linkage between the steering gear and the two front wheels is not properly adjusted, bent, twisted or worn, the steering of the vehicle will be seriously impaired. Whenever a steering linkage part is repaired, replaced or adjusted, steering geometry and front wheel alignment must be checked and necessary corrections made. Refer to "*7. FRONT END ALIGNMENT*" in section 10 "*FRONT AXLE*".

At regular lubrication intervals, the steering linkage should be thoroughly inspected for worn or loose components.

After the vehicle has been operated continually and high mileage figures have been reached, overhaul of the various steering units will be required. General overhaul procedure normally requires removal of the entire assembly, cleaning and inspection of all parts and final assembly. Careful inspection of all parts during overhaul is very important and must not be neglected.

Lubrication fittings must all be cleaned before applying lubricant. Moreover, always be sure the equipment used in applying lubricant is clean.

Every precaution should be taken to prevent entry of dirt, grit, lint or other foreign matter into lubricant containers. Replace fittings that have become broken or damaged. Lubrication intervals, as well as the recommended lubricants for the steering components, are given in the "LUBRICATION AND SERVICING SCHEDULE" in Section 24 of this manual. The intervals given in the schedule are recommended for normal service. More frequent intervals may be required under severe operating conditions.

12.1 Power Steering Reservoir and Filter

The power steering reservoir is located on R.H. side of engine compartment, on front wall and accessible through either the compartment rear doors or the L.H. side door, depending on vehicle (Figs. 7 & 8).

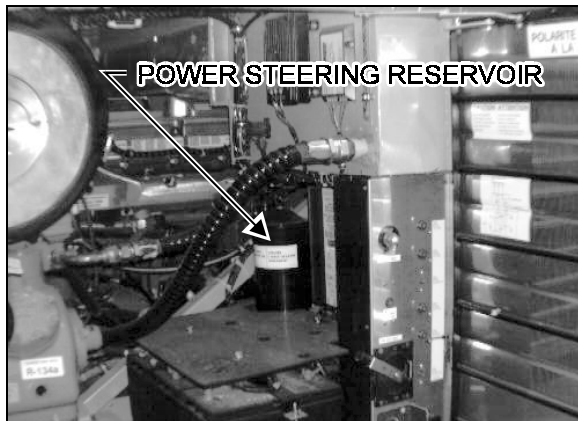


FIGURE 7: ENGINE COMP'T - R.H. SIDE DOOR 14016

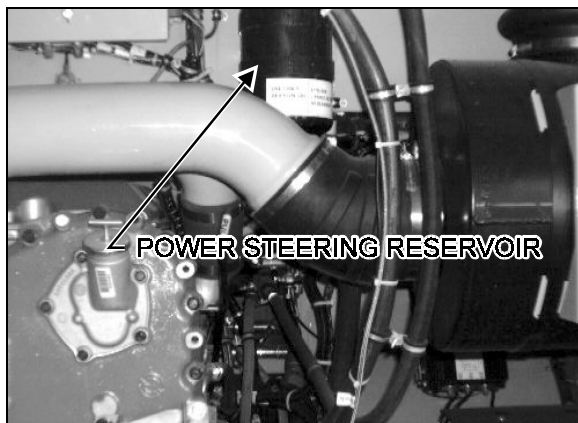


FIGURE 8: ENGINE COMP'T - REAR DOORS 14017

At regular intervals, fluid level should be checked in the reservoir and filter assembly. Furthermore, the oil filter cartridge element in the power steering reservoir should be replaced every 50,000 miles (80 000 km) or once a year, whichever comes first.

12.1.1 Oil Level Check Procedure

1. Stop engine. Open engine compartment door(s) (Figs. 7 & 8).
2. Unscrew and remove the dipstick located on top of reservoir and wipe with a clean rag.
3. Replace dipstick in reservoir. Remove it again to check fluid level.
4. Adjust level to "FULL" mark, using "Dexron-II E or Dexron-III" automatic transmission oil.
5. Replace and tighten the dipstick.

12.1.2 Filter Replacement

1. Unscrew and remove the cover screw located on top of the power steering reservoir.
2. Remove the reservoir cover and gasket.
3. Remove the retaining spring and finally the filter cartridge element.

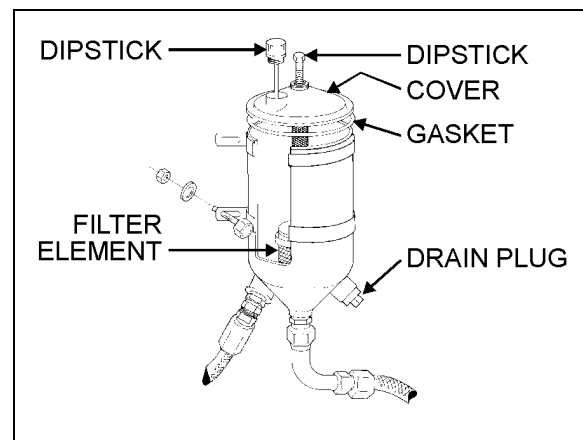


FIGURE 9: POWER STEERING FLUID RESERVOIR 14018

12.2 Steering Stabilizer Cylinder (Damper)

The steering damper is located on L.H. side, at back of front axle center.

The cylinder is nonadjustable and nonrepairable. Check for oil leaks or lack of resistance. Disconnect the cylinder from axle center, then carefully attempt to extend and collapse it manually.

The rod end (ball joint) is provided with a grease fitting. Under normal conditions, it should be serviced every 6,250 miles (10 000 km) or twice a year, whichever comes first. Good quality lithium-base grease NLGI No. 1 and 2 are recommended (refer to section 24 "LUBRICATION"). Check the ball joint for wear, and replace if necessary.

Caution: To prevent the steering damper from interfering with the turning angle adjustment of front wheels, make sure its fitting bracket is at the correct location on the axle center. With front wheels in the straight ahead position, the bracket must be positioned in order to obtain a distance of 26"-26 1/4" (660 - 665 mm) between the center of both steering damper fixing points (Fig. 10).

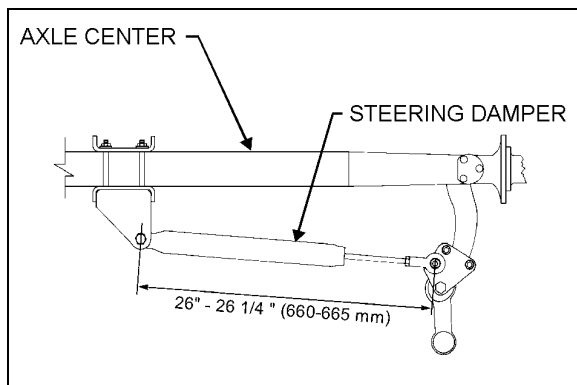


FIGURE 10: DAMPER BRACKET ADJUSTMENT 14019

12.3 Hydraulic Cylinder Assembly

The hydraulic cylinder is located on R.H. side, at back of front axle center. For seal replacement,

use repair kit number 66-0902 (prior V.I.N. 2P9M33490S1001519) or kit number 661003 (from V.I.N. 2P9M33490S1001519). Lubricate the fittings at each cylinder end of the power steering cylinder every 6,250 miles (10 000 km) or twice a year, whichever comes first. Good quality lithium-base grease NLGI No. 1 and 2 are recommended.

12.4 Drag Link

Lubricate the fittings every 6,250 miles (10 000 km) or twice a year, whichever comes first. Good quality lithium-base grease NLGI No. 1 and 2 are recommended (refer to section 24 "LUBRICATION").

12.5 Power Steering Hydraulic Pump

For maintenance of power steering hydraulic pump, refer to the "VICKERS - VANE PUMP OVERHAUL MANUAL" annexed to this section.

13. DRIVING TIP

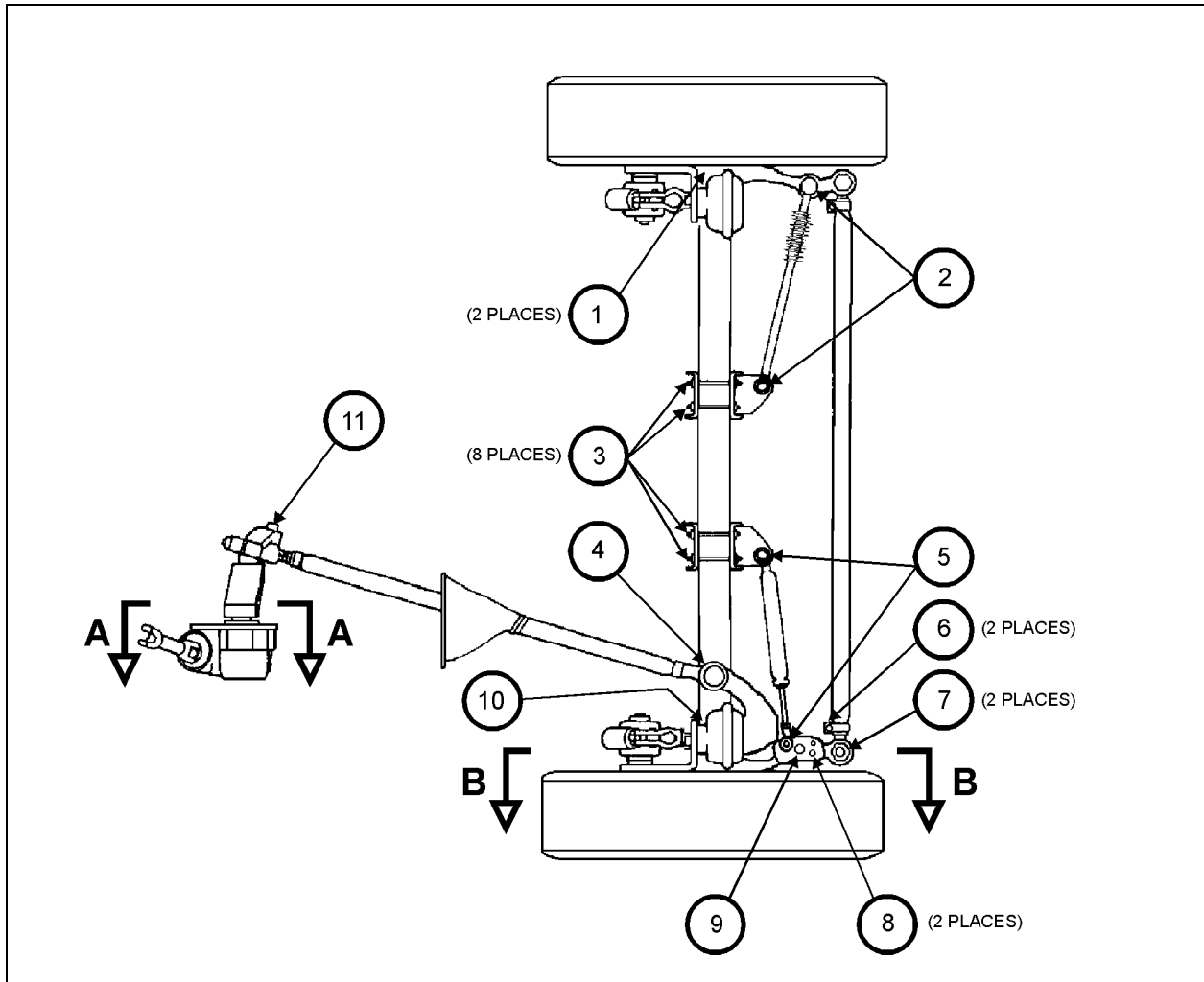
In order to maximize power steering pump service life, do not attempt to turn the steering wheel when the vehicle is stationary, and especially when service brakes are applied (wheel locking will oppose the effect of steering geometry which tends to make the front wheels rotate in opposite directions).

Persisting in turning, or maintaining the steering wheel with an extra effort, could make the hydraulic system work at the relief pressure, and consequently, cause the hydraulic fluid to become overheated.

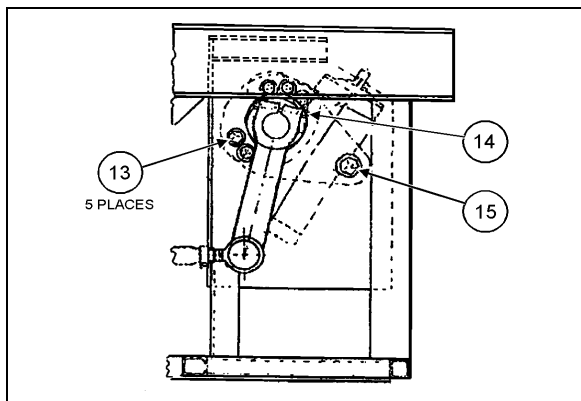
Caution: Never maintain the hydraulic system at the relief pressure for longer than 5/10 seconds to avoid damaging the power steering pump.

Note: Unequal or low tire pressure, oversize tires, and vehicle overloading are some of the causes that may increase steering effort.

14. TORQUE SPECIFICATIONS

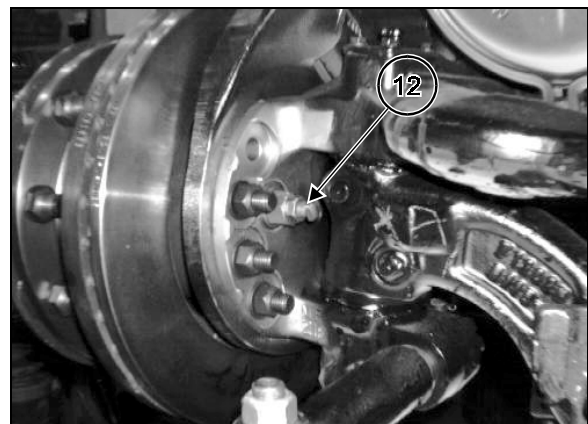


14020A



VIEW A-A

14020B



VIEW B-B

14020C

FIGURE 11: TORQUE REFERENCE NUMBERS

Section 14: STEERING

DRY TORQUES			
Description	Reference	lbf•ft	N•m
Tie Rod Arm Nut	1	550/1025	750/1390
Hydraulic Cylinder Arm Nuts	2	160/300	220/405
Hydraulic Cylinder & Steering Damper Bracket Nuts	3	30/40	41/54
Drag Link End Nut	4	160/300	220/405
Steering Damper	5	100/120	136/163
Tie Rod Clamp Nut	6	40/60	55/80
Tie Rod End Nut	7	160/300	220/405
Stabilizer Support Nuts	8	24/30	33/41
Stabilizer/axle Nut	9	54/60	73/82
Steering Arm Nut	10	775/1450	1050/1965
Pitman Arm Nut	11	300/320	410/435
Stop Screw Jam Nut	12	50/65	70/85
Steering Gear Retaining Bolts	13	250/270	340/367
Steering Gear Retaining Bolt	14	365/385	496/524
Pitman Arm Mounting Bolt	15	250/270	340/367
Fluid Reservoir Cover Screw	-	12	16
Steering Wheel Central Nut	-	35/45	50/60

15. SPECIFICATIONS

Power Steering Gear

Make..... TWR
 Model..... TAS 85
 Supplier number..... TAS85040
 Prevost number..... 660927
 F.E.W. 18,000 lbs (8 200 kg)
 Pressure rating.....2,175 psi (150 Bar)
 Gear ratio23.3:1
 Minimum pump flow for 1.5 hwt/sec3.5 gpm (13.2 lpm)

Power Steering Pump

Make.....	Vickers
Type	V20
Relief valve setting.....	2,000 psi (13 790 kPa)
Capacity	11 GPM/1200 RPM
Controlled flow rate	6 gpm (23 lpm)
Inlet port	1 1/4 NPT
Outlet port.....	3/4-16 straight thread SAE o-ring boss conn.
Supplier number.....	V20NF-1P11T-38C6H22LH
Prevost number.....	660933
Gasket - Supplier number.....	23516100
Gasket - Prevost number.....	510488

Power Steering Reservoir

Make.....	Nelson Muffler
Oil capacity	4 US qts (3.7 liters)
Supplier number.....	91410A
Prevost number.....	66-0982
Make.....	Nelson Muffler
Element filter - Supplier number	83804 E
Element filter - Prevost number	660987

Steering Stabilizer Cylinder (Damper)

Make.....	Gabriel
Extended length	32.73±0.12"
Collapsed length	20.26±0.12"
Stroke	12.47±0.12"
Supplier number.....	651535
Prevost number.....	660979
Dust cap - Prevost number	660980

Hydraulic Cylinder Assembly (Prior 2P9M33490S1001519)

Make.....	Hayes-Dana
Bore.....	1 1/2"
Stroke	17"
Required fluid flow for 1.5 hwt/sec.....	2.1 gpm (8 lpm)
Rod diameter.....	0.875"
Supplier number.....	006-9231-0
Prevost number.....	160886
Repair kit - Supplier number	306-7200-00
Repair kit - Prevost number	660902

Hydraulic Cylinder Assembly (From 2P9M33490S1001519)

Make.....	Hayes-Dana
Bore.....	1 1/2"
Stroke	17"
Rod diameter.....	0.875"
Supplier number.....	006-9231-5
Prevost number.....	661001
Repair kit - Supplier number	106-4016-6
Repair kit - Prevost number	661003

FOR CONVERTED COACH SHELL

REFER TO

SUPPLEMENT INFORMATION ON
INDEPENDENT FRONT SUSPENSION
(IFS)
ANNEXED AT THE END OF SECTION 16

SECTION 16: SUSPENSION

CONTENTS

1. DESCRIPTION.....	16-3
2. AIR SPRING	16-4
2.1 Inspection.....	16-4
2.2 Removal.....	16-4
2.3 Installation.....	16-4
3. SHOCK ABSORBER	16-5
3.1 Inspection.....	16-5
3.2 Removal.....	16-5
3.3 Installation.....	16-6
4. RADIUS ROD.....	16-6
4.1 Inspection.....	16-6
4.2 Removal.....	16-7
4.3 Bushing Removal	16-7
4.4 Bushing Installation.....	16-7
4.5 Installation.....	16-7
5. SWAY BAR 16-8	
5.1 Removal.....	16-8
5.2 Installation.....	16-8
6. SUSPENSION AIR SYSTEM	16-9
6.1 Description	16-9
6.2 Inspection.....	16-9
6.3 Air Line Test.....	16-9
6.4 Air Tank Maintenance.....	16-9
7. SUSPENSION HEIGHT ADJUSTMENT.....	16-9
8. HEIGHT CONTROL VALVE.....	16-10
8.1 Operation	16-10
8.1.1 Loading Position	16-10
8.1.2 Neutral Position.....	16-10
8.1.3 Unloading Position.....	16-10
8.2 Maintenance	16-10
8.2.1 Removal and Installation	16-11
8.2.2 Air Leakage Test.....	16-11
9. FRONT KNEELING AND HI-BUOY SYSTEM (IF APPLICABLE).....	16-12
9.1 Principles of Operation	16-12
9.2 Maintenance	16-12
9.3 Keeling Sense Switch.....	16-13
9.4 Bellows Control and Exhaust Solenoid Valves	16-13
9.4.1 Removal and Installation	16-13
10. HI-BUOY SYSTEM	16-13
10.1 Principles of Operation	16-13

Section 16: SUSPENSION

11. LOW-BUOY SYSTEM	16-13
11.1 Principles of Operation	16-13
12. "LEVEL-LOW" LEVELING SYSTEM (IF APPLICABLE).....	16-14
12.1 Principles of Operation	16-14
13. DRIVE AXLE STABILIZER RESERVOIR (XL-45 CONVERTED VEHICLE)	16-15
13.1 Lubrication (Fig. 17)	16-15
14. TROUBLESHOOTING	16-16
15. PARTS SPECIFICATIONS.....	16-16
16. TORQUE SPECIFICATIONS	16-17

LIST OF ILLUSTRATIONS

FIG. 1: FRONT SUSPENSION COMPONENTS.....	16-3
FIG. 2: REAR SUSPENSION COMPONENTS	16-3
FIG. 3: AIR SPRING	16-4
FIG. 4: SHOCK ABSORBER.....	16-6
FIG. 5: TYPICAL SHOCK ABSORBER SETUP	16-6
FIG. 6: TYPICAL RADIUS ROD SETUP	16-6
FIG. 7: RADIUS ROD BUSHING REMOVAL	16-7
FIG. 8: RADIUS ROD BUSHING INSTALLATION	16-7
FIG. 9: RADIUS ROD INSTALLATION.....	16-7
FIG. 10: SWAY BAR.....	16-8
FIG. 11: HEIGHT CONTROL VALVE	16-9
FIG. 12: TYPICAL AIR SPRING CLEARANCE	16-10
FIG. 13: HEIGHT CONTROL VALVE	16-11
FIG. 14: KNEELING/HI-BUOY PANEL (STEERING COMPARTMENT).....	16-12
FIG. 15: KNEELING SENSE SWITCH.....	16-13
FIG. 16: LEVEL-LOW PANEL (STEERING COMPARTMENT).....	16-14
FIG. 17: DRIVE AXLE STABILIZER RESERVOIR.....	16-15

1. DESCRIPTION

The vehicle is provided with an air suspension system. The system consists of air springs, height control valves, radius rods, sway bars and shock absorbers (Fig. 1 and 2). The system operation is fully automatic and maintains a constant vehicle height regardless of load, or load distribution.

The vehicle can also be equipped with systems such as *Front kneeling & hi-buoy*, *Low-buoy*, *Hi-buoy*, and/or *Level-low*. For a description of all these systems, refer to the appropriate heading in this section.

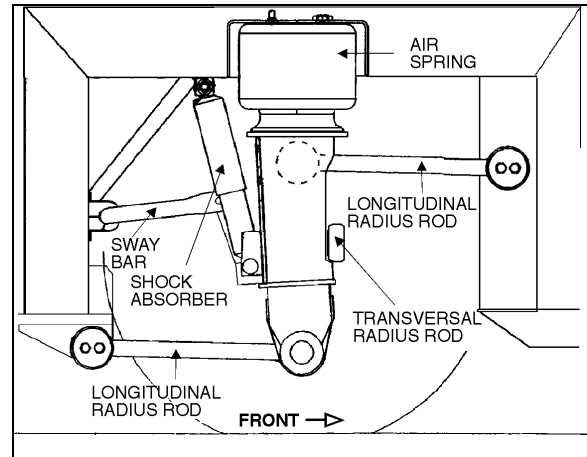


FIGURE 1: FRONT SUSPENSION COMPONENTS 16026

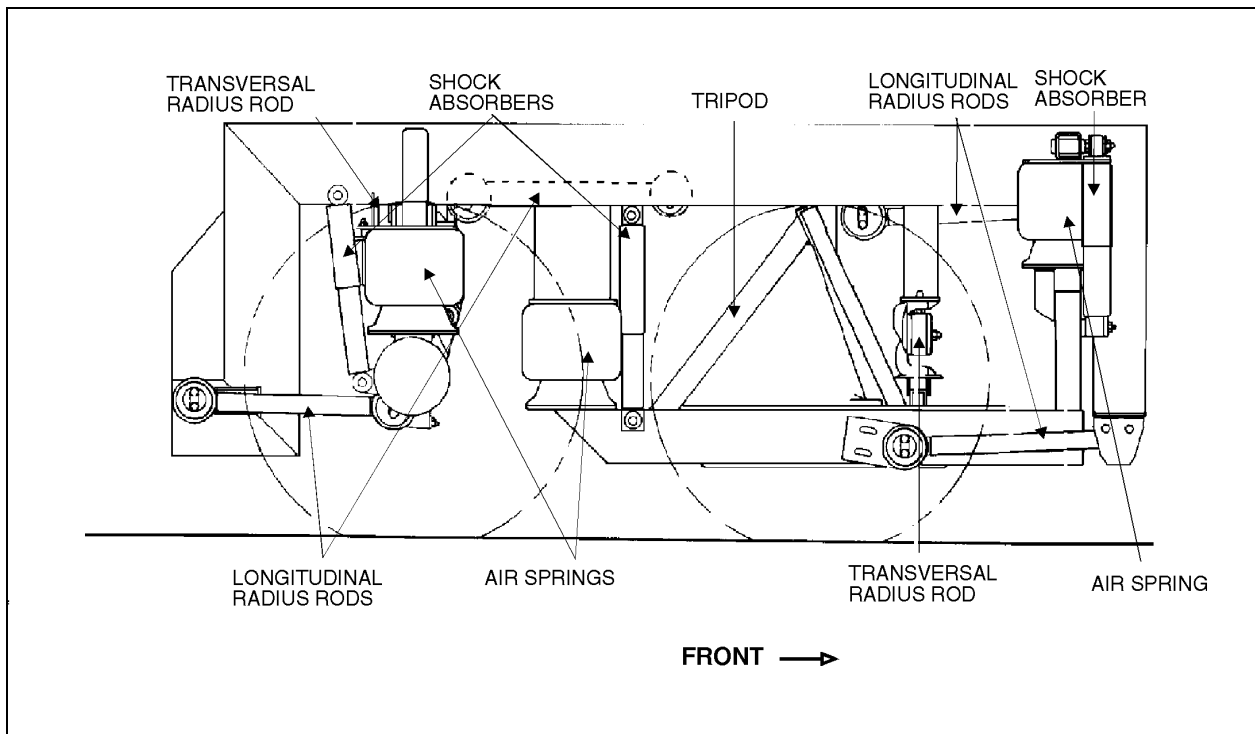


FIGURE 2: REAR SUSPENSION COMPONENTS

16027

2. AIR SPRING

The "rolling lobe" type air springs are made from a special compound rubber molded to the proper contour and dimensions. The entire vertical load of the vehicle is supported by these springs. Each of the three axles is provided with air springs that are attached to the subframe and to the axles.

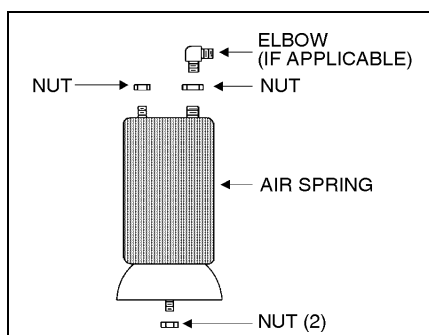


FIGURE 3: AIR SPRING

16007

2.1 Inspection

1. Check operation of bellows.
2. Visually inspect bellows for evidence of cracks, punctures, deterioration, or chafing. Replace the bellows if any damage is evident.
3. With the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat all suspension air line connections and bellows mounting areas with a water and soap solution. Bubbles will indicate an air leak, and none is permissible. Repair or replace defective parts.

Note: If air spring is removed from vehicle, bellows can be lightly inflated and submerged in water to detect any leakage. If any leakage is detected, replace bellows.

Warning: To prevent personal injury, do not apply more than 10 psi (69 kPa) air pressure with the air spring unmounted.

2.2 Removal

Note: Suspension air springs (front, drive, and tag axles) can be removed without removing the entire axle assembly.

1. Safely support vehicle at the recommended body jacking points.

To gain access to a given air spring, the corresponding wheel can be removed as follows:

- a) Jack vehicle until the tire clears the ground, and place safety supports underneath body.

Caution: Only the recommended jacking points must be used as outlined in Section 18, "Body".

- b) Support the axle with a suitable hydraulic floor jack at the recommended jacking point.
 - c) Remove wheel.
2. Exhaust compressed air from accessory air tank by opening drain cock under reservoir.
 3. Disconnect the height control valve link and pull down the overtravel lever to ensure all air is exhausted from air springs.

Note: While performing this step, do not change the height control valve overtravel lever adjustment.

4. Disconnect air line from air spring, remove elbow (if applicable), and cover both the line end and fitting to prevent the entry of foreign matter (Fig. 3).
5. Remove the two air springs upper nuts, and then the two lower nuts (Fig. 3). Remove air spring.

2.3 Installation

1. Compress air spring as necessary, then aligning studs with their holes, position air spring between both the lower and upper supports. Thread the lower nuts and the small upper nut a few turns.
2. Tighten and torque the lower stud nuts, and then the upper one to 20 - 25 lbf-ft (27 - 34 N·m) (Fig. 3).
3. Thread the remaining upper nut (large nut) and tighten to 20 - 25 lbf-ft (27 - 34 N·m) (Fig. 3).
4. Install elbow (if applicable), then connect air line (Fig. 3).
5. Connect the height control valve link.

- Build up air pressure in system.

Note: *To accelerate this operation, air reservoirs can be filled from an exterior air supply connected to the accessory tank fill valve or to the emergency fill valve.*

- Check operation of bellows, and with the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat the air line connections and air spring mounting areas with a water and soap solution. Bubbles will indicate an air leak, and none is permissible. Repair or replace defective parts.
- Remove the hydraulic floor jack from under the axle, then lower vehicle to ground.

3. SHOCK ABSORBER

Double-action, telescoping-type shock absorbers ensure a smooth ride and enhance vehicle stability on the road. All shock absorbers are eye-type mountings. The front and tag axles are each provided with two shock absorbers while the drive axle is provided with four of them (Fig. 1 and 2).

Shock absorbers are non-adjustable and non-repairable. Maintenance requirements involve replacement of the rubber mounting bushings, and tightening of all shock absorber pins at the proper torque (350 - 400 lbf-ft (475 - 545 N-m)) when shock absorber replacement occurs. If a shock absorber becomes inoperative, complete unit must be replaced.

Caution: *When a shock absorber is found defective, always replace with a new set on affected axle, except if there has been a recent replacement of one unit. The following method will help in determining if both shock absorbers on the same axle have to be replaced.*

3.1 Inspection

Loosen lower mounting of both shocks, then carefully attempt to raise and lower the bottom portion of each shock. Note the rate of effort for distance of travel. Replace both shocks if a definite differential rate is found.

The shock must be bench checked in an upright, vertical position. If checked in any other position,

air will enter the cylinder tube and make the shock absorber appear defective.

Proceed as follows to check shock absorbers:

- With the shock absorber in a vertical position (top end up), clamp the bottom mount in a vise.

Caution: *Do not clamp the reservoir tube or the dust tube.*

- Rotate the dust tube. Notice any binding condition (may be compared with new unit). Binding condition indicates a scored rod. Units with scored rods should be replaced.
- Fully extend shocks and check for leaks in the seal cover area. Shock fluid is a very thin hydraulic fluid that has a characteristic odor and dark brown tint. A slight trace of shock fluid around the seal cover area is not a cause for replacement. The shock seal is designed to permit a very slight seepage to lubricate the rod. Units which leak should be replaced.
- Visually check shock for dents that could cause the shock to bind. Also, check for a bent rod.
- Extend and collapse shock to determine that it has control (resistance) in both rebound and compression.
- Visually inspect the shock mountings and vehicle mountings for:
 - Broken mounts;
 - Extreme bushing wear;
 - Shifted bushing or sleeve;
 - Deep cracks in bushing material (shallow surface cracks are normal);
 - Loose shock absorber pins;
 - Presence of convex washers, and their position according to the rubber bushing.

3.2 Removal

- Remove nuts and washers from shock absorbers on upper and lower mounting pins, taking care to identify the inner and outer washers to ease reinstallation. Refer to figure 4 for details.

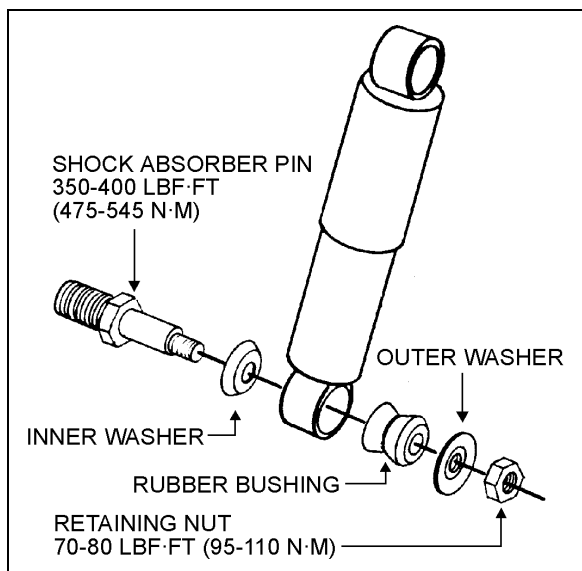


FIGURE 4: SHOCK ABSORBER 16008

2. Remove the shock absorber assembly from pins.
3. Remove the two inner bushings from the shock absorber, and discard them.

3.3 Installation

1. Ensure that the shock absorber mounting pins are tight and that the threads are not stripped.
2. Install new rubber mounting bushings on shock absorbers (upper and lower).
3. Place the inner washers (with washer convex side facing the shock absorber rubber bushing) on each shock absorber pin (Fig. 5).

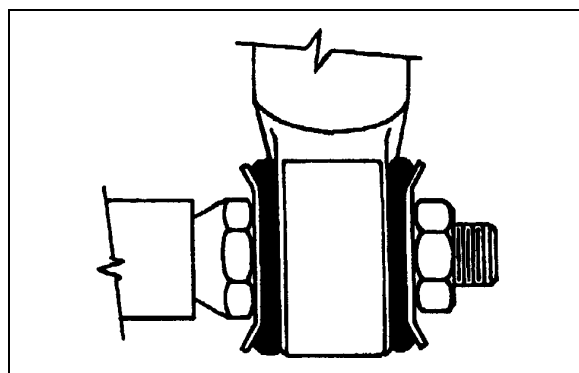


FIGURE 5: TYPICAL SHOCK ABSORBER SETUP 16009

4. Install the shock absorber eyes over the mounting pins, then the outer washers (with washer convex side facing the shock absorber rubber bushing) on each shock extremity.

5. Place the lower and upper mounting pin stud nuts and torque them to 70 - 80 lbf-ft (95 - 110 N·m).

4. RADIUS ROD

Radius rods are used to secure the axles in the proper transversal and longitudinal positions. Four radius rods are provided on the front axle suspension (three longitudinal and one transversal), four on the drive axle suspension (three longitudinal and one transversal) and also four on the tag axle with a layout similar to the drive axle. Refer to figures 1 and 2 for details. These rods transmit both braking and driving forces from the axles to the vehicle body.

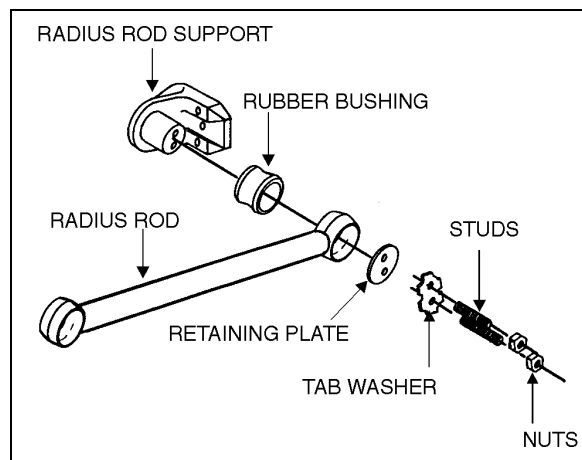


FIGURE 6: TYPICAL RADIUS ROD SETUP 16010

4.1 Inspection

The following instructions apply to all radius rods used on this vehicle:

1. Clean all parts thoroughly.
2. Inspect radius rods for distortion and cracks. We recommend the "Magnaflux" process to detect cracks in the radius rod. Any damaged part should be replaced with a new one.

Note: *New bushings should be used when rods are replaced.*

3. The radius rod bushings should be checked periodically for signs of shearing, deterioration, or damage. Any defective part should be replaced with a new one.

4.2 Removal

1. Flatten the tab washer which secures the two retaining nuts (or bolts), then unscrew the nuts (or bolts) at each extremity of the radius rod (Fig. 6).
2. Remove the tab washer and the retaining plates and radius rod ends from anchor pins, then remove the radius rod.

4.3 Bushing Removal

1. Safely support the radius rod as shown in figure 7.

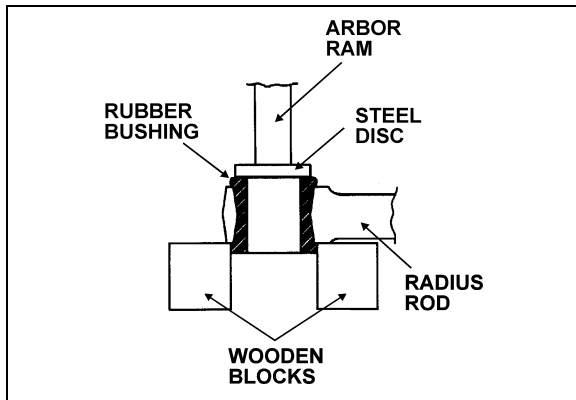


FIGURE 7: RADIUS ROD BUSHING REMOVAL 16011

2. Place a flat steel disc, slightly smaller than the outside diameter of the bushing (Fig. 7).
3. Using an arbor press or a suitable driving tool, press or drive the old bushing out of the rod and discard the bushing.

Caution: Make sure to prevent the steel disc from contacting radius rod end.

4.4 Bushing Installation

1. Lightly Spray the inner and outer surfaces of radius rod bushing with water.

Caution: No lubricant whatsoever is to be used on the rubber bushing.

2. Safely support the radius rod, and place new bushing on top of the radius rod end (Fig. 8).
3. Place a block of wood on top of bushing and press on it manually.

4. If necessary, use an arbor press or a suitable driving tool. Press or drive the bushing into the radius rod end until it extends equally on both sides of the rod.
5. It is also possible to proceed differently. Place radius rod bushing on a plane surface. Spray a light coat of water on the inner and outer surfaces of radius rod bushing.
6. Take radius rod, align the bushing. Tap radius rod on bushing until latter is positioned correctly.

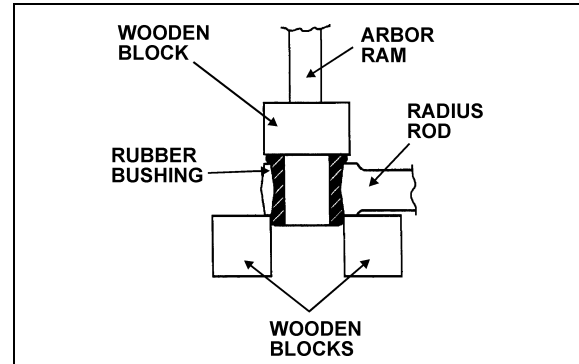


FIGURE 8: RADIUS ROD BUSHING INSTALLATION 16012

4.5 Installation

1. Lightly Spray the anchor pin with water. Place the radius rod end over the anchor pin.

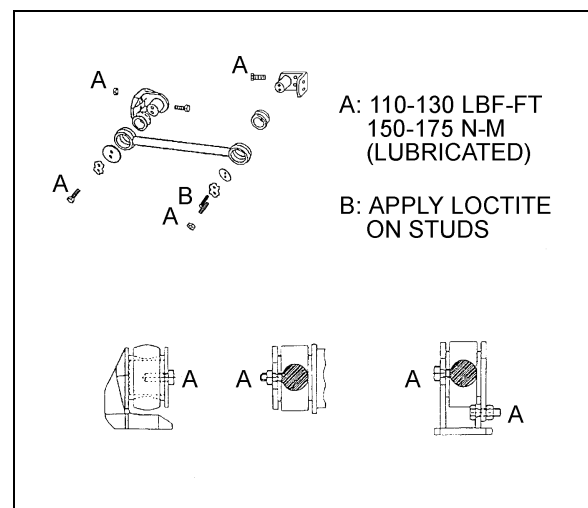


FIGURE 9: RADIUS ROD INSTALLATION 16028

Section 16: SUSPENSION

2. Position the retaining plate. Install the tab washer and nuts (or bolts).

Caution: Always use new tab washers at installation.

3. Tighten the nuts (or bolts) lightly, and repeat at the other end.
4. Refer to heading "Suspension height adjustment" later in this section, and set the vehicle to normal ride height.

5. With the vehicle at normal ride height, apply oil on threads and tighten all radius rod anchor pin nuts or bolts to 110 - 130 lbf·ft (150 - 175 N·m).

Caution: It is extremely important upon re-connection of the rods that the proper clearance height between the axle and body is maintained. Otherwise, the rubber bushings in radius rod ends will become preloaded, thus reducing the life of these parts.

5. SWAY BAR

A sway bar is provided on the front axles to increase vehicle stability (Fig. 1). It controls lateral motion (swaying movement) of vehicle.

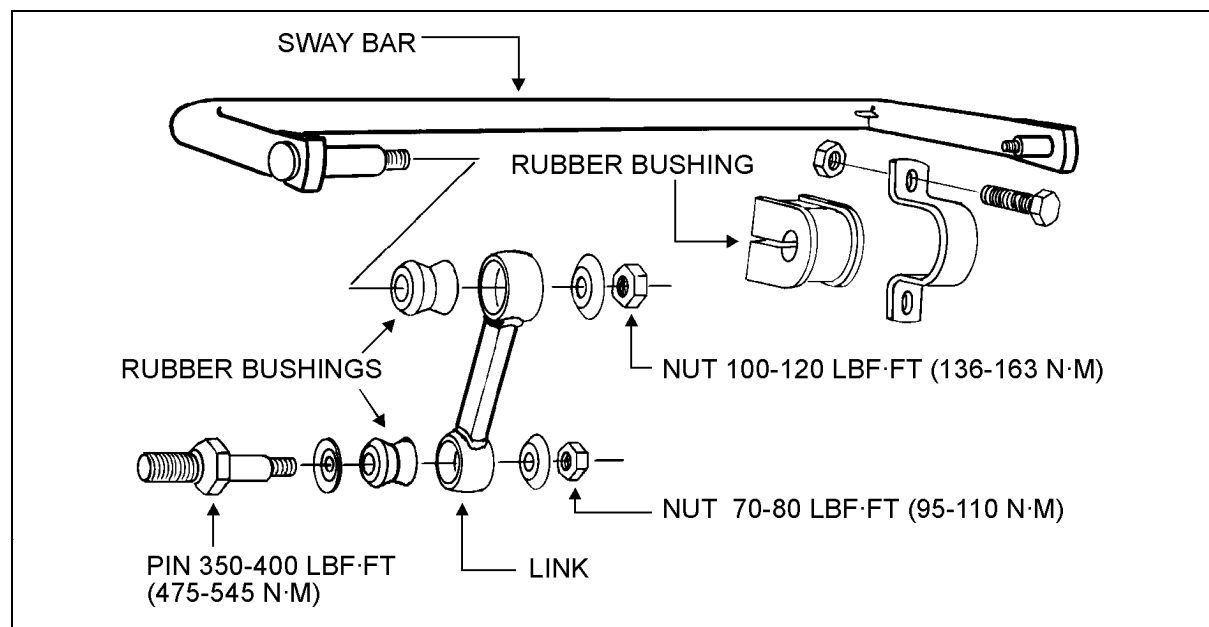


FIGURE 10: SWAY BAR

16014

5.1 Removal

1. Disconnect the two links from sway bar.
2. Safely support the sway bar. Unbolt the four bushing collars from subframe.
3. Remove sway bar.

Note: Sway bar bushings are slitted to ease their removal.

5.2 Installation

1. Loosely install the sway bar.
2. Tighten the eight bushing collar nuts to 70 - 80 lbf·ft (95 - 110 N·m) (Fig. 10).
3. Tighten sway bar link upper nuts to 100 - 120 lbf·ft (136 - 163 N·m) and lower nuts to 70 - 80 lbf·ft (95 - 110 N·m) (Fig. 10).

6. SUSPENSION AIR SYSTEM

6.1 Description

The suspension air system has its own air reservoir (accessory tank) which is located above the front axle. Pressurized air from the main tank (wet tank) flows through a pressure protection valve (PR-2) installed on the accessory air tank, then flows to the accessory air tank.

The pressure protection valve (PR-2) controls the pressure at which compressed air would be delivered to the accessory air tank. The valve remains closed until a preset pressure is reached (approximately 75 psi (517 kPa)). It then opens and passes air out the delivery port.

The main use for this valve is to protect the main air system by ensuring at all times a sufficient air pressure in the main system (i.e. air delivered to the accessories will be shut off in case of a decrease in pressure).

Another protection valve (PR-2) is installed on the manifold block, and insures at all times a minimum pressure of 75 psi (517 kPa) in suspension air system in the event that a pressure drop occurs in either the suspension air system or accessory air system. This valve is located in the steering compartment

Maintenance and repair information on the pressure protection valve is supplied in the applicable booklet, annexed to Section 12, "Brakes and Air System" under reference number SD-03-55.

6.2 Inspection

The following inspection should be performed at established service inspection periods. Performing these procedures will allow substandard performance to be discovered before the condition becomes bad enough to cause operator complaints and failure on a run.

1. Visually inspect the suspension air lines for evidence of chafing on metal parts or other damage.
2. Visually inspect the air springs for cracks, abrasion or other damage.
3. Replace any parts found to be damaged.

6.3 Air Line Test

With the main air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat all suspension air line connections and air spring mountings with a solution of soap and water. Air leakage will produce soap bubbles. Any leak found must be corrected as no air leakage is permissible.

6.4 Air Tank Maintenance

Refer to Section 12, "Brakes and Air System" under paragraph "2.2 Maintenance" for complete instructions on air tank maintenance.

7. SUSPENSION HEIGHT ADJUSTMENT

The flow of pressurized air from the accessory air tank to the air springs is controlled by three height control valves. These valves are mounted to the subframe and connected to the axles through an arm and link connection. This connection allows the valves to apportion air pressure in the springs to the vehicle load, maintaining normal ride height.

Immediate response height control valves increase or decrease the air pressure in the suspension system as required. One height control valve is located at center of front axle, and regulates air to front axle air springs in order to maintain the vehicle at the required height. Two are located at the drive axle, one on each inner side of rear wheelhouse. Refer to figure 11.

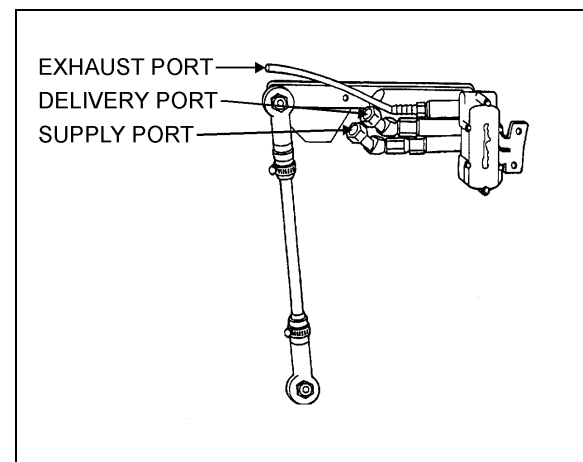


FIGURE 11: HEIGHT CONTROL VALVE

16029

The appropriate vehicle body height is obtained by measuring the clearance of all the air springs installed on the vehicles. All air springs clearance should be 11.5 ± 0.25 " (292 ± 6 mm). Refer to figure 12 to identify the correct location where the measure has to be taken. At this point, it should not be necessary to make an adjustment under normal service conditions. However, if an adjustment is required, change the position of the overtravel lever in relation to the overtravel control body. The lever should be moved up to raise the height of vehicle, and down to lower it. Check that main air pressure is at normal operating pressure and raise the vehicle to the specified height.

Caution: Always adjust on "fill cycle". If it is necessary to lower vehicle height, release sufficient air to be well below height, and adjust to height or fill cycle.

The normal ride height is obtained by adjusting air spring clearance of both front and rear suspensions as follows:

1. With the vehicle at normal operating air pressure (95 - 125 psi (655 - 860 kPa)), measure air spring clearance as illustrated in figure 12. This clearance should be 11.5 ± 0.25 " (292 ± 6 mm) for all the air springs.

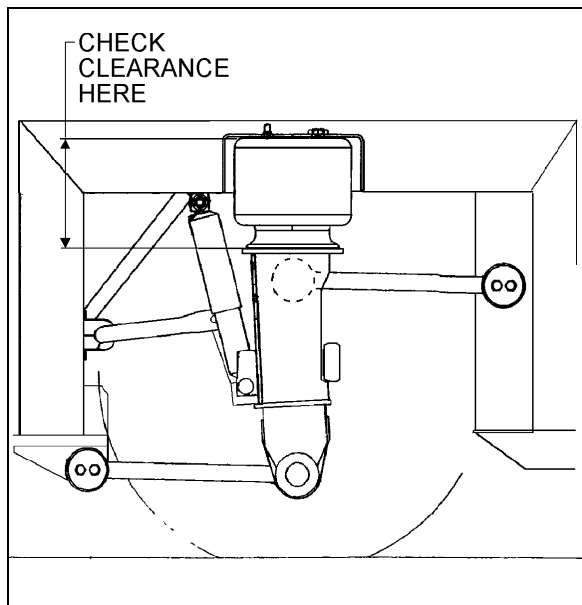


FIGURE 12: TYPICAL AIR SPRING CLEARANCE 16018

Note: The measure should be taken from under the upper air spring support on sub-frame to top of the lower air spring support on axle (refer to fig. 12 for more details). If adjustment is required, begin with the drive axle.

2. Loosen the adjusting nuts on the connecting rod of height control valve to raise or lower the overtravel lever until the desired clearance is reached (Fig. 13).

Note: Allow suspension to stabilize before taking reading.

3. When the desired height is obtained, tighten adjusting lock nuts to 2 - 4 lbf-ft (2,5 - 5 N-m) (Fig. 13).

8. HEIGHT CONTROL VALVE

8.1 Operation

The height control valves automatically add air to, or release air from air springs to maintain constant suspension height regardless of load, or load distribution. Each valve adjusts independently according to the following conditions:

8.1.1 Loading Position

As the load increases and lowers the vehicle body, the overtravel lever commands the height control valve to add air to air springs.

8.1.2 Neutral Position

When vehicle body reaches the normal ride height, the height control valve overtravel lever reaches the "neutral" position and keeps both the supply and exhaust ports closed to ensure normal ride height is maintained. This condition remains static until the vehicle load is altered.

8.1.3 Unloading Position

As the load decreases and raises the vehicle body, the overtravel lever commands the height control valve to release air from air springs.

8.2 Maintenance

The height control valve requires no periodic maintenance. Height control valve linkage operates on rubber bushings and no lubrication should be attempted at this point.

8.2.1 Removal and Installation

Before disconnecting any height control valve air lines, securely support the vehicle by its jacking points on the body, and place safety support underneath body. Refer to paragraph "16. Vehicle Jacking Points" in Section 18, "Body".

Note: The XL-40 coach battery main disconnect switch door gives access to the rear right height control valve.

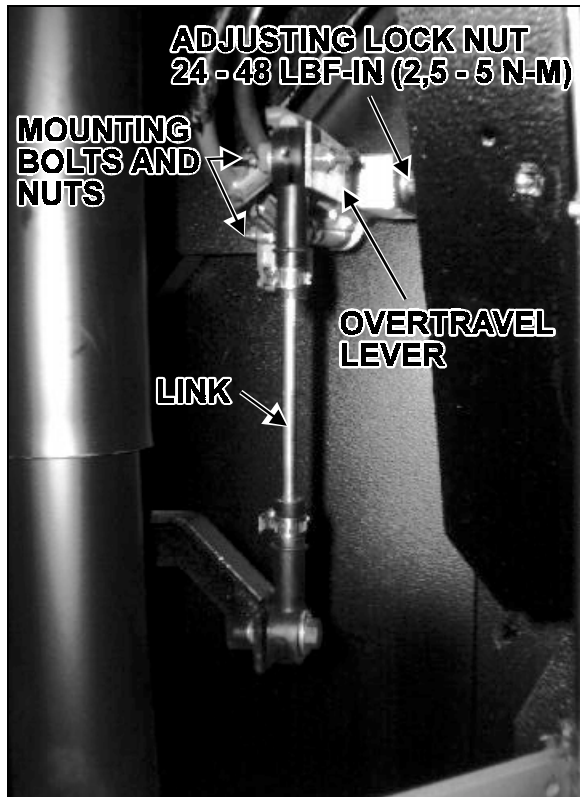


FIGURE 13: HEIGHT CONTROL VALVE

16030

1. To gain access to a rear height control valve, the corresponding wheel and mudguard can be removed.
2. Exhaust air from air system by opening the drain cock of each air reservoir. Remove height control valve.

3. Disconnect overtravel lever from link and pull down lever to exhaust remaining air from air springs.
4. Disconnect air supply and delivery lines from the height control valve. Cover ends of the lines with tape to prevent the entry of foreign matter (Fig. 11).
5. Remove the two nuts retaining the height control valve to the mounting bracket, then remove valve assembly (Fig. 13).

Reverse removal procedure to replace height control valve. After installation, check for leakage using a soap and water solution.

8.2.2 Air Leakage Test

Note: The following procedure applies when valve assembly has been removed from vehicle.

1. Remove the height control valve from vehicle, and clean thoroughly the exterior of valve assembly.
2. Connect air pressure line to air inlet port, then allow air pressure build-up (70- 100 psi (480 - 690 kPa)).
3. Dip the valve assembly in a container of water, and watch for air bubbles when the overtravel lever is in the center position. No air should escape from any point of the valve assembly.
4. If bubbles appear from the air spring port, this is an indication that 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 air spring 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, this is an indication that 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 found, remove valve assembly from water, then with air pressure still connected to the air spring port, actuate overtravel lever to remove any excess water which may have entered exhaust valve chamber. Remove air line, connect it to the air inlet port, and repeat operation to remove water from the air inlet valve chamber.

9. FRONT KNEELING AND HI-BUOY SYSTEM (IF APPLICABLE)

The kneeling system is used to lower front of vehicle. This allows passengers to board the vehicle with greater ease. The kneeling action is achieved by exhausting air from the front air springs (bellows). This system bypasses the height control valve to provide a fast up and down movement of the front suspension. Only five seconds are required to lower vehicle from normal level to the lower position, and approximately nine seconds to raise it. This quick response is achieved by the kneeling air tank installed in front of steering (for exact position, refer to Section 12, paragraph "2.1 Location and Function"). This tank provides sufficient air supply to the kneeling system for some successive operations.

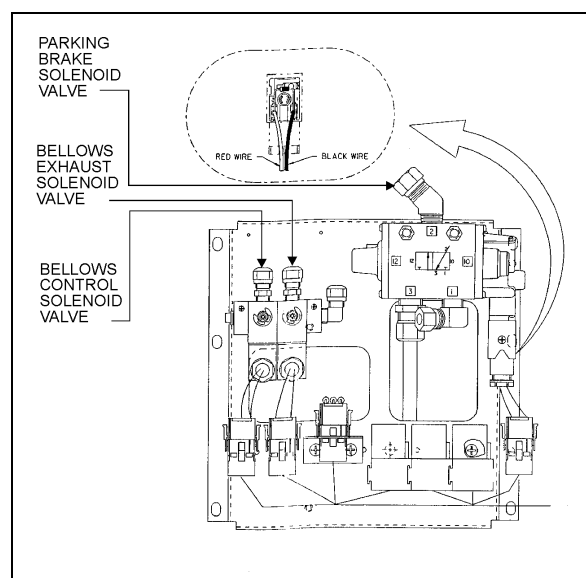


FIGURE 14: KNEELING/HI-BUOY PANEL (STEERING COMPARTMENT) 16031

The system is provided with two safety features; first, a speed switch will enable the kneeling system to work only under 5 mph (8 km/h). Secondly, the parking brake is automatically applied, and a limit switch will keep it applied as long as the vehicle has not returned to a certain height where the driver will be able to manually remove the parking brake.

The purpose of the hi-buoy function in this system is to raise the front end of the vehicle to allow passengers to board the vehicle with greater

ease. It is also used to allow an extra ground clearance for particular situations. In normal conditions, the height control valve is in operation and only the hi-buoy can be operated.

9.1 Principle of Operation

Refer to the system pneumatic diagram annexed in the technical publication box provided with the vehicle.

DOWN:

Both the bellows control and bellows exhaust solenoid valves are energized, so the air control valves release air from front air springs. The height control valve is bypassed to ensure no air is forwarded to air springs while lowering the front suspension (Fig. 14).

UP:

Only the bellows control solenoid valve is energized, so the air coming from the kneeling air tank is routed through air control valves, and up to front air springs (Fig. 14). The height control valve is bypassed until the kneeling proximity switch signals the kneeling module to cut off the bellows control solenoid valve, about 1" (25 mm) below normal ride height. The final height adjustment is achieved by the height control valve.

HI-BUOY FUNCTION:

Only the bellows control solenoid valve is energized, so the air coming from the kneeling air tank is routed through air control valves, and up to front air springs (Fig. 14). The height control valve is bypassed during the up motion. However, the down motion is achieved through the height control valve.

9.2 Maintenance

Since the kneeling action is issued from both the air system and electrical system, refer to Section 12, "Brake and Air System" and Section 06, "Electrical System".

For diagnosis and understanding of the system, refer to wiring diagrams along with the appropriate system pneumatic diagram annexed in the technical publication box provided with the vehicle.

9.3 Kneeling Sense Switch

The kneeling sense switch is bolted to the same bracket as for the front height control valve, right over the steering axle.

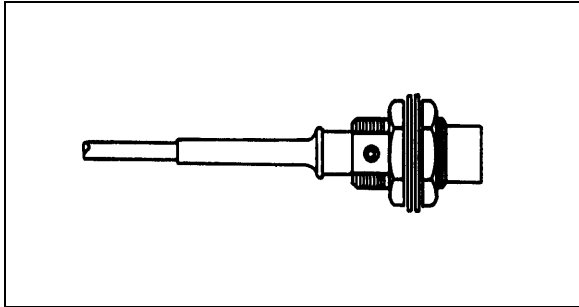


FIGURE 15: KNEELING SENSE SWITCH

16032

9.4 Bellows Control and Bellows Exhaust Solenoid Valves

9.4.1 Removal and Installation

1. On the right wall of steering compartment, locate both the bellows control and bellows exhaust solenoid valves (Fig. 14).
2. Identify hoses and wires to ease reinstallation. Disconnect solenoid wires and the three flexible hoses from solenoid valves.
3. Unscrew and remove the control solenoid valve and exhaust solenoid valve assembly. Place on a clean working place.

Reverse removal procedure to reinstall.

Caution: Any cable tie that has been cut during removal procedure should be replaced with a new one.

10. HI-BUOY SYSTEM

The purpose of the hi-buoy system is the raise vehicle body about 4" (100 mm) in order to increase ground clearance to board a ferryboat, to avoid a curb, etc.. This system can be put into service during normal vehicle operation.

10.1 Principles of Operation

Refer to the system pneumatic diagram annexed in the technical publication box provided with the vehicle.

UP:

The air coming from the control valve on R.H. lateral console, flows through a quick release valve, then through double shuttle valves, to finally supply air springs. The double shuttle valves prevent height control valves from releasing air from air springs.

DOWN:

The control valve, on the dashboard, cuts off air supply, so the double shuttle valves allow height control valves to accomplish their function. Height control valves release air from air springs until suspension reaches the normal ride height.

11. LOW-BUOY SYSTEM

The purpose of the low-buoy system is to lower the whole suspension about 4" (100 mm) in order to reduce the overall height for low clearances. This system can be put into service during normal vehicle operation.

11.1 Principles of Operation

Refer to the system pneumatic diagram annexed in the technical publication box provided with the vehicle.

DOWN:

The control valve, on the R.H. lateral console dashboard, cuts off air supply, so air is released from air springs. A relay valve prevents height control valves from supplying air springs.

UP:

The control valve, on the dashboard, supplies air to close the passage between both the delivery and supply ports. A relay valve opens and provides air springs until the suspension reaches the normal ride height.

12. "LEVEL-LOW" LEVELING SYSTEM (IF APPLICABLE)

The purpose of the "level-low" leveling system is to adjust suspension in three separate points (front, rear right and rear left) in order to level vehicle body. This system can be put into service when the ignition key is turned to the "ON" position, and must be used only when the parking brake is applied. The "level-low" warning light on the dashboard indicates that the selector knob is not in the "DRIVE" position. Level low system controls are located on L.H. side control panel.

12.1 Principles of Operation

Refer to the system pneumatic diagram annexed in the technical publication box provided with the vehicle.

DOWN:

The (front/rear right/rear left) control solenoid valve supplies air to the (front/rear right/rear left) five-way three-position air control valve, which bypasses the (front/rear right/rear left) height control valve, and opens a passage to allow the air control and exhaust valve to release air from (front/rear right/rear left) air springs.

UP:

The (front/rear right/rear left) control solenoid valve supplies air to the (front/rear right/rear left) five-way three-position air control valve, which bypasses the (front/rear right/rear left) height control valve, and opens a passage to allow the air control and exhaust valve to supply air to (front/rear right/rear left) air springs.

DRIVE:

When the ignition key is turned to the "ON" position with selector knob in the "DRIVE" position, the drive control solenoid valve supplies air to all five-way three-position air control valves, each one opening a passage to allow height control valves to accomplish their function.

When the ignition key is turned to the "OFF" position and selector knob to the "DRIVE" position, the air is entrapped between air springs and five-way three-position air control valves to ensure the adjusted level will be kept.

Warning: Never move vehicle with selector knob in any other position than the "DRIVE" position.

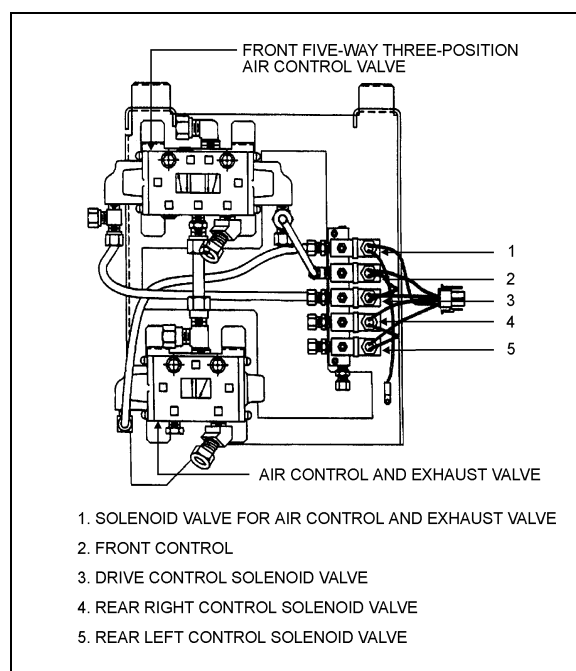


FIGURE 16: LEVEL-LOW PANEL (STEERING COMPARTMENT) 16033

13. DRIVE AXLE STABILIZER RESERVOIR (XL-45 CONVERTED VEHICLE)

The rear stabilizer system makes turning the vehicle easier. The only maintenance is to check oil level in a reservoir. This reservoir is located in the rear wheelhouse, before the drive axle (see under the vehicle). Check oil level every 50,000 miles (80 000 km) or once a year, whichever comes first.

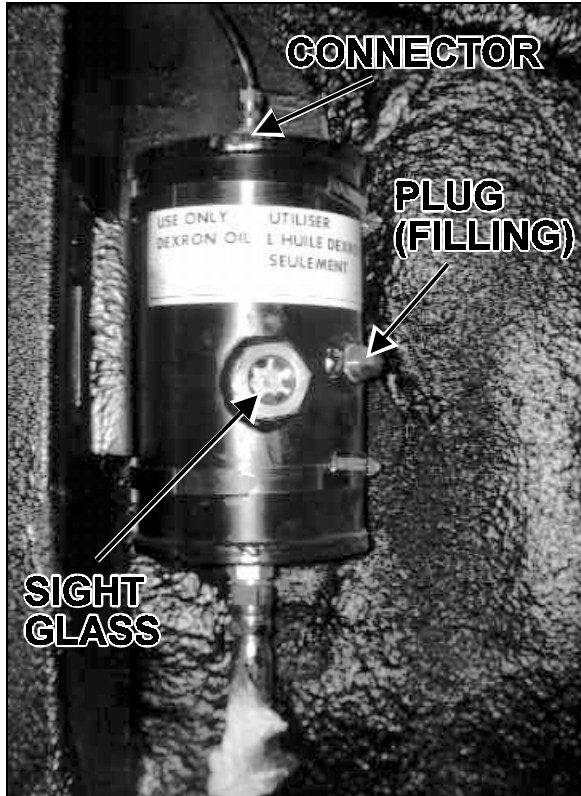


FIGURE 17: DRIVE AXLE STABILIZER RESERVOIR 16034

13.1 Lubrication (Fig. 17)

The sight glass indicates if oil must be added to the reservoir. If the small ball in the sight glass is at the bottom of the sight glass then add oil to the reservoir as per the following procedure:

1. Remove connector tube at the top of the reservoir to permit air to enter.
2. Remove the fill plug.
3. Fill the reservoir with Dexron oil until oil reach the bottom of filling plug.
4. Screw the fill plug and the connector tube on the reservoir.

14. TROUBLESHOOTING

MALFUNCTION	POSSIBLE CAUSE	CORRECTION
Bellows deflate over time	Defective check valve assembly Defective exhaust valve assembly Leak in air line and/or bellows Defective valve cover, rubber O-rings or gasket	Replace check valve assembly Replace exhaust valve assembly Replace air line or bellows Replace valve cover, O-rings or gasket
Bellows raise to full height and fail to exhaust air pressure	A clogged exhaust screen in height control valve assembly A combination clogged exhaust screen and defective air inlet valve assembly	Remove and clean screen Clean exhaust screen and replace air inlet valve assembly
Erratic valve action	Dirt or foreign matter in the air valve lever chamber Defectives valves	Remove valve cover and blow out dirt Install cover using new gasket Overhaul height control valve assembly
Vehicle body fails to level to satisfactory ride height	Improper height control valve over-travel lever adjustment	Adjust lever as directed

15. PARTS SPECIFICATIONS

AIR SPRINGS

Front

XL-40 & XL-45E CONVERTED VEHICLES

Make..... Goodyear Tire and Rubber
Model.....Roll-over volume can
Type 1100
Diameter..... 11" (279 mm)
Supplier number..... 1R11-089
Prévost number..... 630105

ELSE

Make..... Goodyear Tire and Rubber
Model..... M-West Long
Supplier number..... 1R11-096
Prévost number..... 630126

Drive

Make..... Goodyear Tire and Rubber
Model.....Roll-over volume can
Type 1100
Working diameter..... 11.5" (292 mm)
Supplier number..... 1R11-088
Prévost number..... 630104

Tag

Make Goodyear Tire and Rubber
ModelM-West Long
Supplier number 1R11-096
Prévost number 630126

SHOCK ABSORBERS

Front

FRONT ABSORBER - XL-45 COACH AND CONVERTED VEHICLE (ONLY)

Make Gabriel
Collapsed length 15.47" (393 mm)
Extended length..... 24.5" (622 mm)
Prévost number 630134

ELSE

Make Monroe
Type Gas Magnum
Collapsed length 15.38" (390,5 mm)
Extended length..... 23.63" (600,1 mm)
Supplier number 650407
Prévost number 630127

HEIGHT CONTROL VALVE

Make..... Neway
 Quantity used..... 3
 Supplier number..... 905 54 234
 Prévost number..... 630095

BELLOWS CONTROL AND EXHAUST SOLENOID VALVE ASSEMBLY

Make..... Norgren
Solenoid valve manifold
 Supplier number..... D0043B
 Prévost number..... 641130

Coil

Voltage 24 V DC
 Current draw 0.29 ampere
 Supplier number..... 54932-27
 Prévost number..... 641144

VALVE (3 WAYS, 2 POSITIONS)

Supplier number..... K41EAOO-KH1-KS6
 Prévost number..... 63-0081
 Repair kit (spool) Supplier number 54237-65
 Repair kit (spool) Prévost number 641169

RADIUS ROD BUSHING

Make Prévost
 Prévost number 630021

SWAY BAR BUSHING

Make Prévost
 Prévost number 130953

SHOCK ABSORBER AND SWAY BAR LINK BUSHINGS

Make Monroe
 Supplier number 45380
 Prévost number 630062

16. TORQUE SPECIFICATIONS

- 1- Shock absorber pin.....350-400 lbf-ft (475-545 N·m)
- 2- Shock absorber pin nut.....70-80 lbf-ft (95-110 N·m)
- 3- Radius rod stud..... LOCTITE
- 4- Radius rod retaining nut or bolt 110-130 lbf-ft lubricated (150-175 N·m lubricated)
- 5- Radius rod support nut 110-130 lbf-ft lubricated (150-175 N·m lubricated)
- 6- Axle attachment nut425-475 lbf-ft (580-645 N·m)
- 7- Air spring stud nut.....20-25 lbf-ft (27-34 N·m)
- 8- Sway bar link pin stud.....350-400 lbf-ft (475-545 N·m)
- 9- Sway bar link lower nut.....70-80 lbf-ft (95-110 N·m)
- 10- Sway bar link upper nut.....100-120 lbf-ft (136-163 N·m)

Note:

*During assembly, use "Loctite 242" (Prévost number 680038) with item 1, 3 and 8.
 After assembly, apply "anti-seize compound" (Prévost number 680064) on all nuts.*

SECTION 16: SUPPLEMENT INFORMATION ON INDEPENDENT FRONT SUSPENSION (IFS)

CONTENTS

1. INTRODUCTION.....	16-4
2. STEERING LINKAGE	16-4
2.1 General Description	16-4
2.2 Turning Angle.....	16-5
2.3 Steering Linkage Adjustment.....	16-8
2.4 Pitman Arm	16-8
2.4.1 Removal	16-8
2.4.2 Installation	16-8
2.5 Drag Link.....	16-8
2.5.1 Adjustment	16-9
2.6 Bell Crank and Idler Arm.....	16-9
2.6.1 Bell Crank and Idler Arm Removal	16-9
2.6.2 Bell Crank and Idler Arm Ball joint Disassembly	16-9
2.6.3 Bell Crank and Idler Arm Ball joint Reassembly	16-10
2.7 Relay Rod	16-11
2.7.1 Replacement	16-11
2.8 Tie Rods.....	16-11
2.8.1 Description and Maintenance	16-11
2.8.2 Removal	16-11
2.8.3 Installation	16-12
2.9 Steering Arms	16-12
2.9.1 Removal	16-12
2.9.2 Installation	16-12
2.10 Lubrication Fittings.....	16-12
2.11 Power Steering Hydraulic Pump	16-14
3. INDEPENDENT FRONT SUSPENSION JOINTS	16-14
3.1 Lower and Upper A-arm Ball Joint (Bonded Rubber Bush).....	16-14
3.1.1 Instructions	16-14
3.1.2 Stripping Down.....	16-14
3.1.3 Assembly.....	16-14
3.2 Lower A-arm Central Joints (BT-Sectional Bearing System).....	16-16
3.2.1 Instructions	16-16
3.2.2 Stripping Down.....	16-16
3.2.3 Assembly.....	16-16
3.3 Upper A-arm Ball Joints (one-part Bearing System).....	16-18
3.3.1 Instructions	16-18
3.3.2 Stripping Down.....	16-18
3.3.3 Assembly.....	16-18
4. FRONT END ALIGNMENT	16-21
4.1 Definition of Terms.....	16-21
4.1.1 Wheel Camber	16-21
4.1.2 Wheel Toe-In.....	16-21
4.1.3 Front Axle Caster	16-21
4.1.4 King Pin Inclination.....	16-21

Section 16: SUPPLEMENT INFORMATION ON INDEPENDENT FRONT SUSPENSION (IFS)

4.2 Front End Inspection.....	16-21
4.3 Front Wheel Camber	16-21
4.4 Front Wheel Toe-In.....	16-21
4.5 Toe-In Check	16-21
4.6 Toe-In Adjustment	16-22
4.7 Front-Axle Caster.....	16-22
4.8 Major Damage	16-22
5. AIR SPRING MAINTENANCE (FRONT AIR SPRINGS).....	16-24
5.1 Inspection.....	16-24
5.2 Removal.....	16-24
5.3 Installation	16-25
6. SHOCK ABSORBER	16-26
6.1 Shock Absorber Removal.....	16-26
6.2 Shock Absorber Installation.....	16-26
7. SWAY BAR.....	16-26
7.1 Sway Bar (Front Suspension)	16-28
7.1.1 Removal	16-28
7.1.2 Installation	16-28
7.2 Sway Bar (Drive Axle).....	16-28
7.2.1 Removal	16-28
7.2.2 Installation	16-28
8. INDEPENDENT FRONT SUSPENSION ADJUSTMENT.....	16-28
8.1 Suspension Height Adjustment.....	16-28
9. HEIGHT CONTROL VALVE	16-30
9.1 Operation	16-30
9.1.1 Loading Position.....	16-30
9.1.2 Neutral Position	16-30
9.1.3 Unloading Position	16-30
9.2 Maintenance	16-30
9.2.1 Removal and Installation.....	16-30
10. "LEVEL-LOW" LEVELING SYSTEM (IF APPLICABLE).....	16-30
10.1 Principles of Operation	16-30
11. AIR SYSTEM.....	16-30
11.1 Air Tanks' Locations and Functions	16-30
11.2 Air Tank Maintenance.....	16-31
11.2.1 Wet Air Tank.....	16-31
11.2.2 Primary Air Tank	16-32
11.2.3 Secondary Air Tank	16-32
11.2.4 Accessory Air Tank.....	16-32
11.2.5 Expansion Air Tank.....	16-32
11.3 Air System Emergency Fill Valves	16-32
12. AIR BRAKES.....	16-33
12.1 Disc Brakes	16-33
12.1.1 Disc Brake pads.....	16-34
13. BRAKE AIR CHAMBER.....	16-34
13.1 Maintenance	16-34
14. WHEEL AND TIRES	16-34
15. HUB UNIT AND SWIVEL ASSEMBLY MAINTENANCE	16-34
16. TORQUE TABLE	16-35
17. SPECIFICATIONS	16-36

LIST OF ILLUSTRATIONS

FIG. 1: SUSPENSION AND STEERING LINKAGE	16-4
FIG. 2: LOCATION OF CLAMPS.....	16-5
FIG. 3: CLAMP POSITIONING	16-6
FIG. 4: CLAMP POSITIONING	16-6
FIG. 5: CLAMP POSITIONING	16-6
FIG. 6: CLAMPS POSITIONING	16-7
FIG. 7: PITMAN ARM ALIGNMENT	16-8
FIG. 8: BELL CRANK AND IDLER ARM BALL JOINT	16-10
FIG. 9: BELL CRANK	16-10
FIG. 10: BELL CRANK	16-11
FIG. 11: LUBRICATION FITTINGS' LOCATION DIAGRAM	16-13
FIG. 12: BALL JOINT	16-15
FIG. 13: CENTRAL JOINT	16-17
FIG. 14: BALL JOINT	16-19
FIG. 15: STEERING LINKAGE MEASURE.....	16-20
FIG. 16: FRONT END ALIGNMENT DIAGRAM	16-23
FIG. 17: AIR SPRINGS	16-24
FIG. 18: AIR SPRING AND SHOCK ABSORBER	16-25
FIG. 19: SHOCK ABSORBER	16-26
FIG. 20: SWAY BAR (FRONT SUSPENSION).....	16-27
FIG. 21: SWAY BAR (DRIVE AXLE)	16-27
FIG. 22: HEIGHT CONTROL VALVE LOCATION.....	16-29
FIG. 23: TYPICAL AIR SPRING CLEARANCE.....	16-29
FIG. 24: FRONT HEIGHT CONTROL VALVE	16-29
FIG. 25: AIR TANKS' LOCATIONS	16-31
FIG. 26: REAR VALVE LOCATION (XL-40 AND XL-45E)	16-31
FIG. 27: REAR VALVE LOCATION (XL-45).....	16-31
FIG. 28: STEERING COMPARTMENT	16-32
FIG. 29: REAR VALVE LOCATION (XL-40 & XL-45E).....	16-33
FIG. 30: REAR VALVE LOCATION (XL-45).....	16-33
FIG. 31: FRONT VALVE LOCATION	16-33
FIG. 32: DISC BRAKE PADS CHECKING	16-34

1. INTRODUCTION

This supplement contains service procedures and specifications that apply to the PRÉVOST XL converted coach shell vehicles equipped with an independent front suspension.

Where no differences (or minor differences) exist between informations given in XL Maintenance Manual, Section 10, 12, 14 and 16, (for vehicles equipped with beam axle suspension) and informations given in this SUPPLEMENT INFORMATION ON INDEPENDENT FRONT SUSPENSION (for vehicles equipped independent front suspension), no information is given in this section. In those instances, the original material included in the XL Maintenance Manual should be used.

2. STEERING LINKAGE

2.1 General Description

Turning motion of the steering wheel is transferred by the steering gear and steering linkage to the steering arms at the right and

left front wheels. The steering linkage consists of tie rods connected to the bell crank and the steering arm at the left side of the coach, and to the idler arm and steering arm at the right side of the coach. The bell crank and idler arm are connected by a relay rod. A drag link connected to the bell crank and the pitman arm, which is mounted to the steering gear, transfers the turning motion of the steering wheel to the steering arms (Fig. 1).

Lower and upper A-arms are widely spaced. They are mounted on ball joints. Torque rods prevent rotation of the uprights around the lower and upper ball joints.

If the steering linkage is bent, twisted or worn, steering action of the coach will be seriously affected. Any time steering linkage components are replaced or adjusted, steering geometry and front wheel alignment must be checked as explained in this section of supplement.

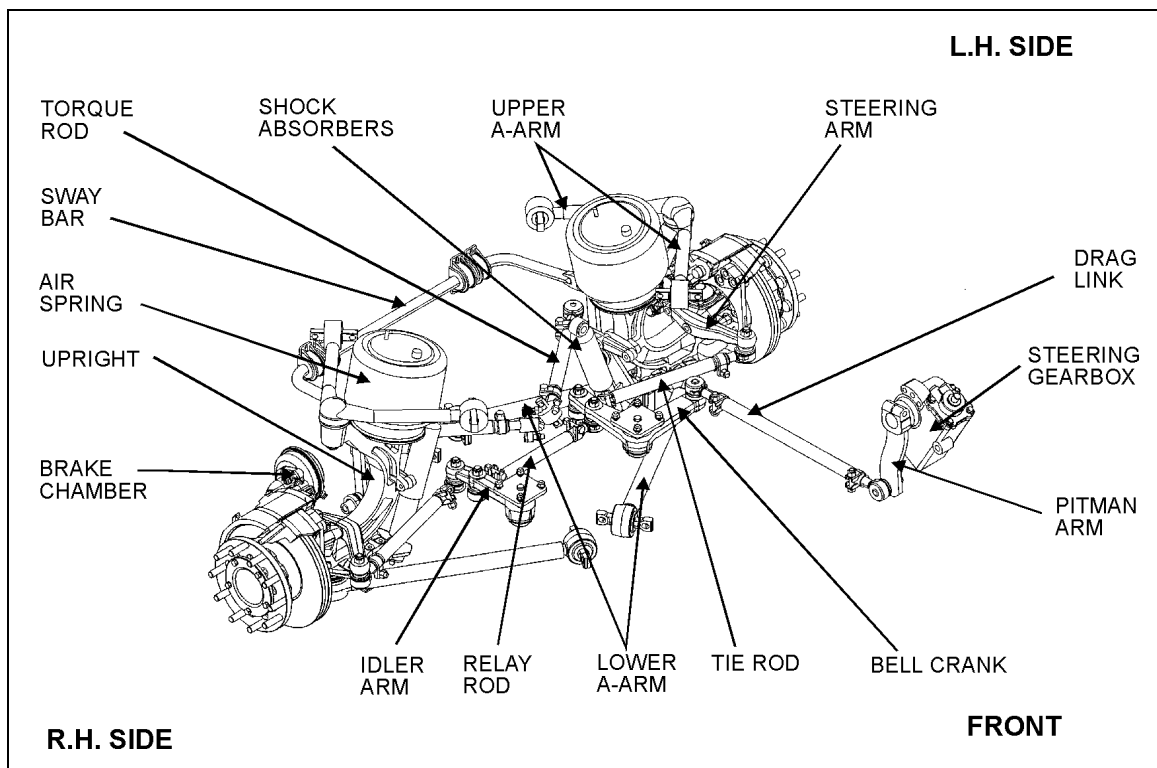


FIGURE 1: SUSPENSION AND STEERING LINKAGE

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2.2 Turning Angle

The maximum turning angle is set mechanically through the two steering stop screws installed on the swivel assembly. The turning angle ($56^{\circ} + 0^{\circ} - 1^{\circ}$) mechanical stop is factory adjusted to accommodate the chassis design, and therefore, does not require adjustment on new vehicles.

However, turning angle should be checked and adjusted hydraulically, if necessary, any time a component of the steering system is repaired, disassembled or adjusted.

Before checking the turning angle, be sure the front end is properly aligned as described under paragraph "4. Front End Alignment" in this supplement.

To check steering maximum turning angle, proceed with the following method :

1. Check if front tires rub against the frame or if the steering gear has been serviced.

Caution: *If clamps are not correctly installed, they can interfere with other parts.*

2. For a full left and right turn, check clamps' position and for interfering parts. Refer to figures 2 to 6 for location and positioning of clamps. If readjustment is required, make the proper adjustment.

Note: *Prior to poppet valve readjustment, verify vehicle wheel alignment, and ensure that oil level is adequate and that air bleeding is done.*

3. If necessary readjust poppet valve. Refer to "TAS Steering Gear Service Manual" annexed to XL Maintenance Manual, Section 14, "Steering", under headings: "Filling and Air Bleeding the System" and "Poppet Readjustment".

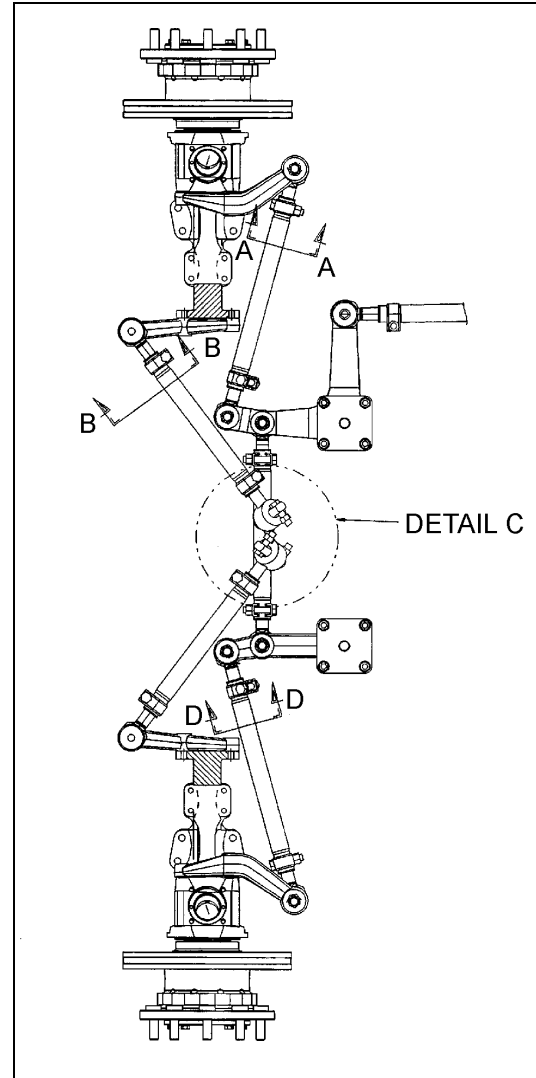


FIGURE 2: LOCATION OF CLAMPS

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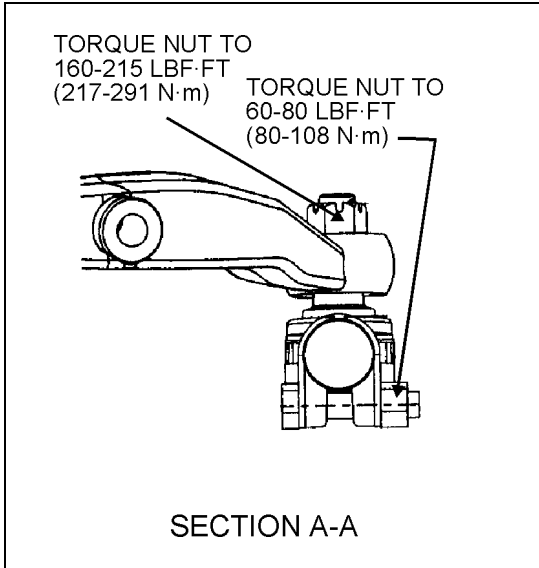


FIGURE 3: CLAMP POSITIONING

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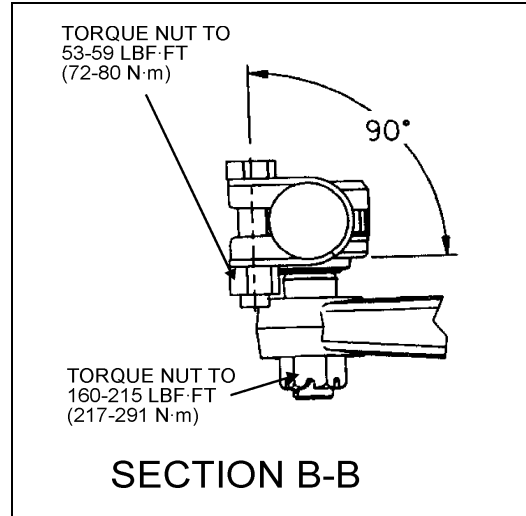


FIGURE 4: CLAMP POSITIONING

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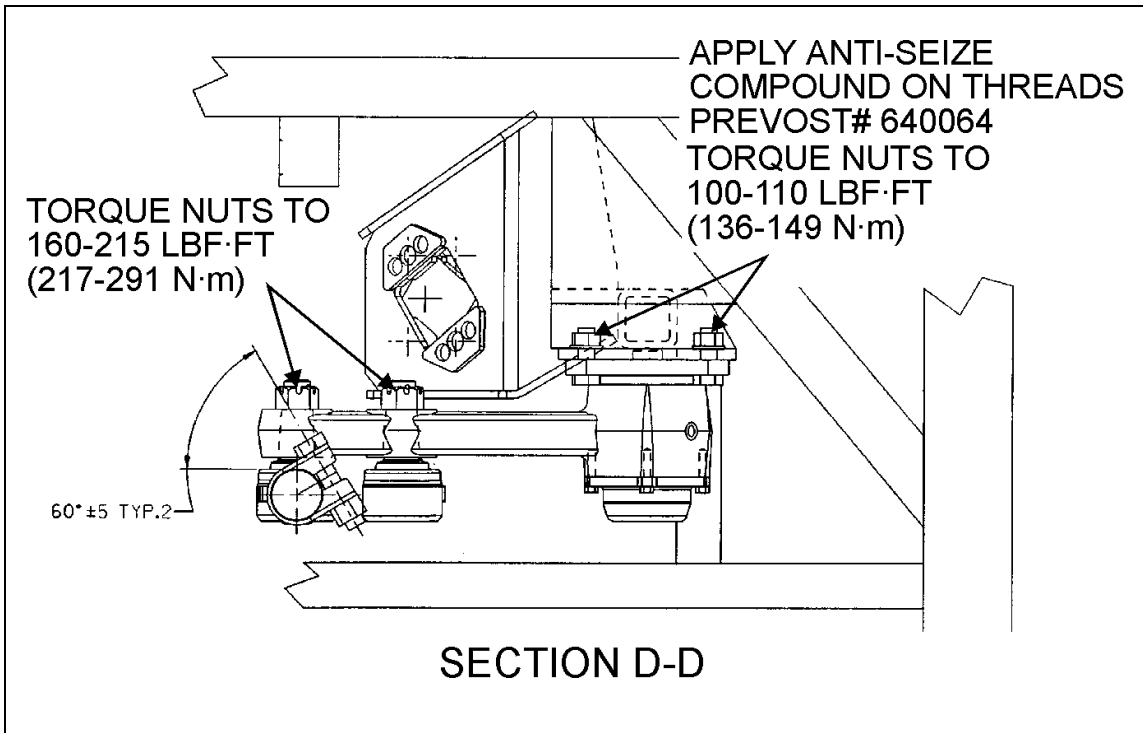


FIGURE 5: CLAMP POSITIONING

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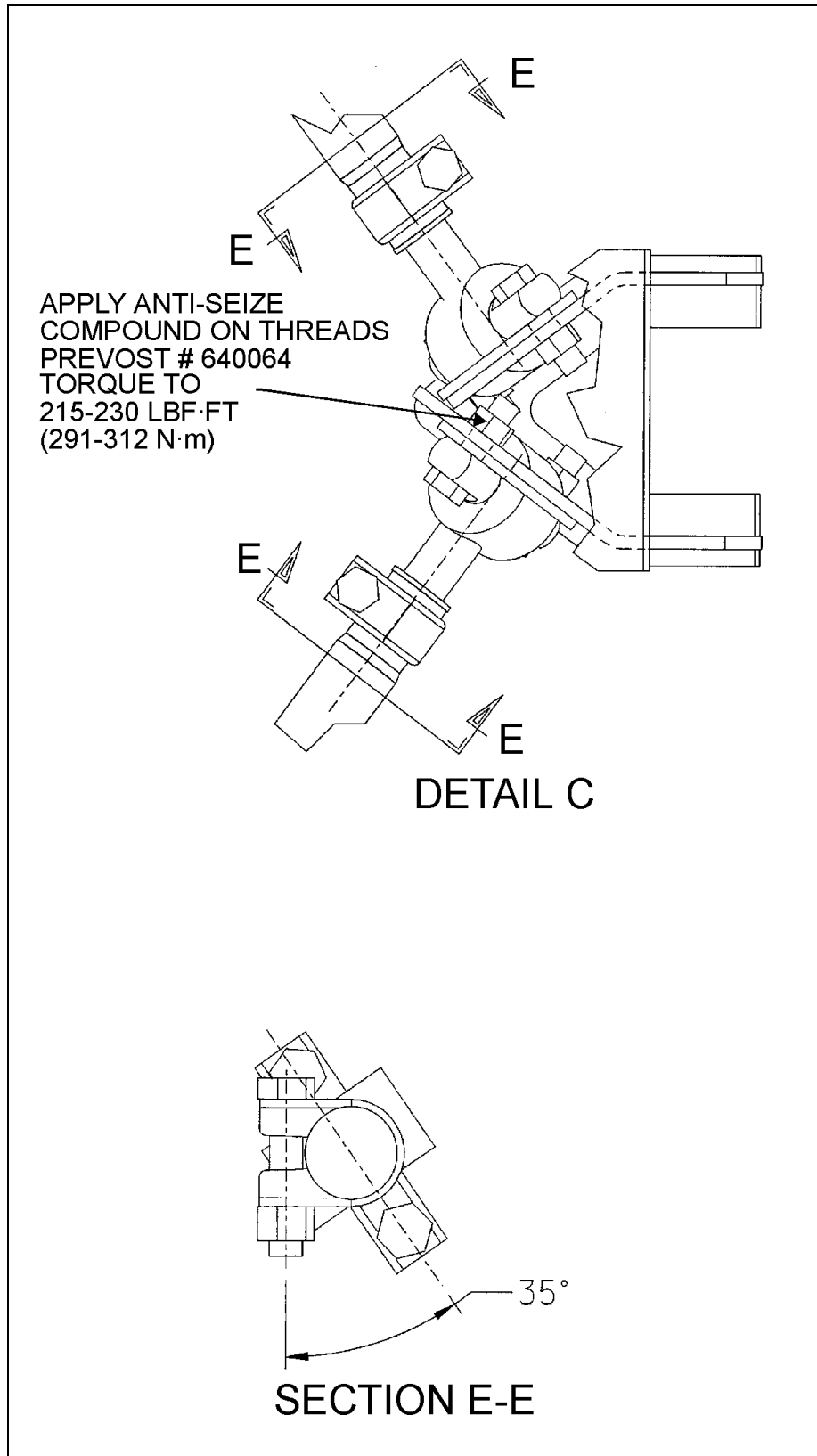


FIGURE 6: CLAMPS POSITIONING

16041

2.3 Steering Linkage Adjustment

Note: Whenever a steering linkage component has been removed and replaced, check steering geometry and front end alignment as directed in this Supplement. Check to insure that all stud nuts and mounting bolts and nuts have been tightened to proper torques listed under "16. TORQUE TABLE" at the end of this supplement.

1. The pitman arm should be adjusted with reference mark aligned or to an angle of 4.5° in relation with the vertical axis (Fig. 7).
2. Locate centerline of vehicle then install relay rod in boss at steering bell crank and idler arm. Align center of relay rod with centerline of vehicle.
3. Install drag link to pitman arm and adjust opposite end of drag link to fit mounting stud hole in bell crank.
4. Install tie rods, then adjust toe-in as per under paragraph "4 FRONT END ALIGNMENT" of this Supplement.

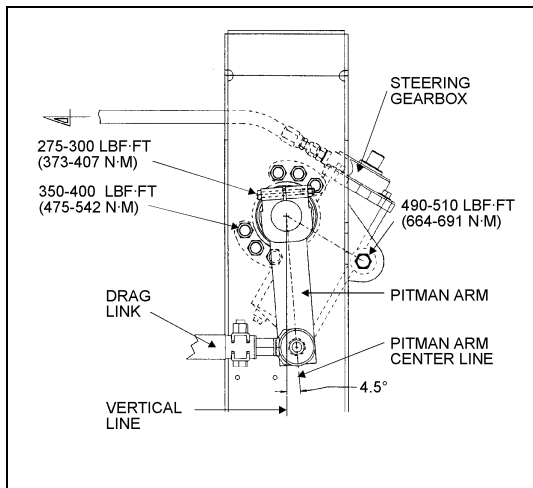


FIGURE 7: PITMAN ARM ALIGNMENT

16042

2.4 Pitman Arm

2.4.1 Removal

1. Remove cotter pin, nut and washer from drag link ball stud at pitman arm.
2. Disconnect drag link from pitman arm, using jaw style pullers (pressure screw type).

Warning: Always wear approved eye protection when operating pullers.

Caution: Do not drive pitman arm on or off pitman shaft as this can damage the steering gear.

Caution: Heating of components to aid in disassembly is not allowed because it has a detrimental effect on axle components and steering linkages.

3. Remove pitman arm clamp bolt nut, washer and bolt.
4. Check the radial position of the pitman arm in relation to the sector shaft prior to removal of pitman arm.
5. Add reference marks to the arm and shaft if necessary to ensure correct alignment at reassembly.
6. Remove pitman arm. A chisel will help you loosen the pitman arm. Use a puller if you cannot remove the pitman arm manually.

2.4.2 INSTALLATION

1. Position pitman arm on sector gear shaft with reference marks aligned. Ensure that the clamp bolt groove matches.
2. Install bolt, washer and nut. Tighten nut to 275-300 lbf·ft (373-408 N·m) (Fig. 7).
3. Connect drag link to pitman arm. Install washers. Tighten nut to 160 lbf·ft (217 N·m). Advance nut to next alignment cotter pin slot and install a new cotter pin.

2.5 Drag Link

Drag link assembly consist of three parts; a drag link and two end assemblies. Both end assemblies are identical and they are retained on the drag link with a clamp bolt and nut.

Stud nuts at the pitman arm and bell crank ends of the drag link must be kept tight or hole at ball stud end of drag link and hole in pitman arm may become enlarged as a result of excessive looseness. Subsequent tightening of stud nuts may draw studs too far into holes and dust cover parts may become damaged which can result in component failure.

Drag link end sockets are equipped with lubrication fittings and should be lubricated as directed in paragraph "2.10 LUBRICATION FITTINGS" in this supplement.

2.5.1 Adjustment

It should not be necessary to alter the length of the drag link except when a new link is installed or when removable end assembly has been replaced. If drag link adjustment is necessary, proceed as follows:

1. Position front wheels in straight ahead position.
2. Center steering gear as previously explained in paragraph "2.3 Steering Linkage Adjustment".
3. Remove cotter pin and stud from drag link at bell crank. Locate centerline of vehicle and center of relay rod. With center of relay rod aligned with centerline of vehicle, loosen clamp bolt at socket end (bell crank end) of drag link and adjust length of socket end assembly to fit in boss of bell crank.

Note: Do not change position of pitman arm.

Install stud nut and torque to 160 lbf•ft (217 N•m). Align nut with cotter pin slot (tighten) and install a new cotter pin.

Torque mounting clamp bolt nut to 60-80 lbf•ft (81-108 N•m), then test the adjustment. Front wheels should turn from right to left extremes without noticeable binding at drag link ends.

2.6 Bell Crank and Idler Arm

Bell crank and idler arm are equipped with one lubrication fitting and should be lubricated as directed in paragraph "2.10 LUBRICATION FITTINGS" at the end of this Supplement.

2.6.1 Bell Crank and Idler Arm Removal

Note: Use a piece of wire to anchor loose end of relay rod and tie rod in order to prevent placing an excessive load on opposite socket end.

- 4.

1. **Bell crank :** Disconnect drag link, tie rod and relay rod from bell crank by removing cotter pins, stud nuts and washers from ball studs. Separate socket assemblies from the bell crank.

Idler arm : Remove cotter pins, nuts and washers from ball studs connecting relay rod and tie rod to idler arm. Separate socket assemblies from idler arm.

2. Remove nuts and washers from bolt attaching bell crank or idler arm mounting bracket to vehicle understructure. Remove bell crank or idler arm mounting bracket.

2.6.2 Bell crank or Idler Arm Ball Joint Disassembly

1. Remove adjacent link assemblies from bell crank or idler arm as previously described.
2. Remove screws attaching the cap to the bell crank or idler arm mounting bracket. Remove the cap and o-ring (Fig. 8).
3. Remove the cotter pin, nut and tongue washer. Remove bearings, grease seal, bearing bushing and the bell crank or idler arm from its mounting bracket stud (Fig. 8).

2.6.3 Bell Crank or Idler Arm Ball Joint Reassembly

Note: For bearing installation use tool Prévost # 110684.

1. Install bearing bushing on bell crank or idler arm mounting bracket stud.
2. Install bearing and grease seal in bell crank or idler arm eye (Fig. 8).

Note : Install grease seal according to figure 8. Grease must be able to exit the bell crank or idler arm mechanism. For grease seal installation use tool Prévost # 110683.

3. Install bell crank or idler arm on its mounting bracket stud (Fig. 8).

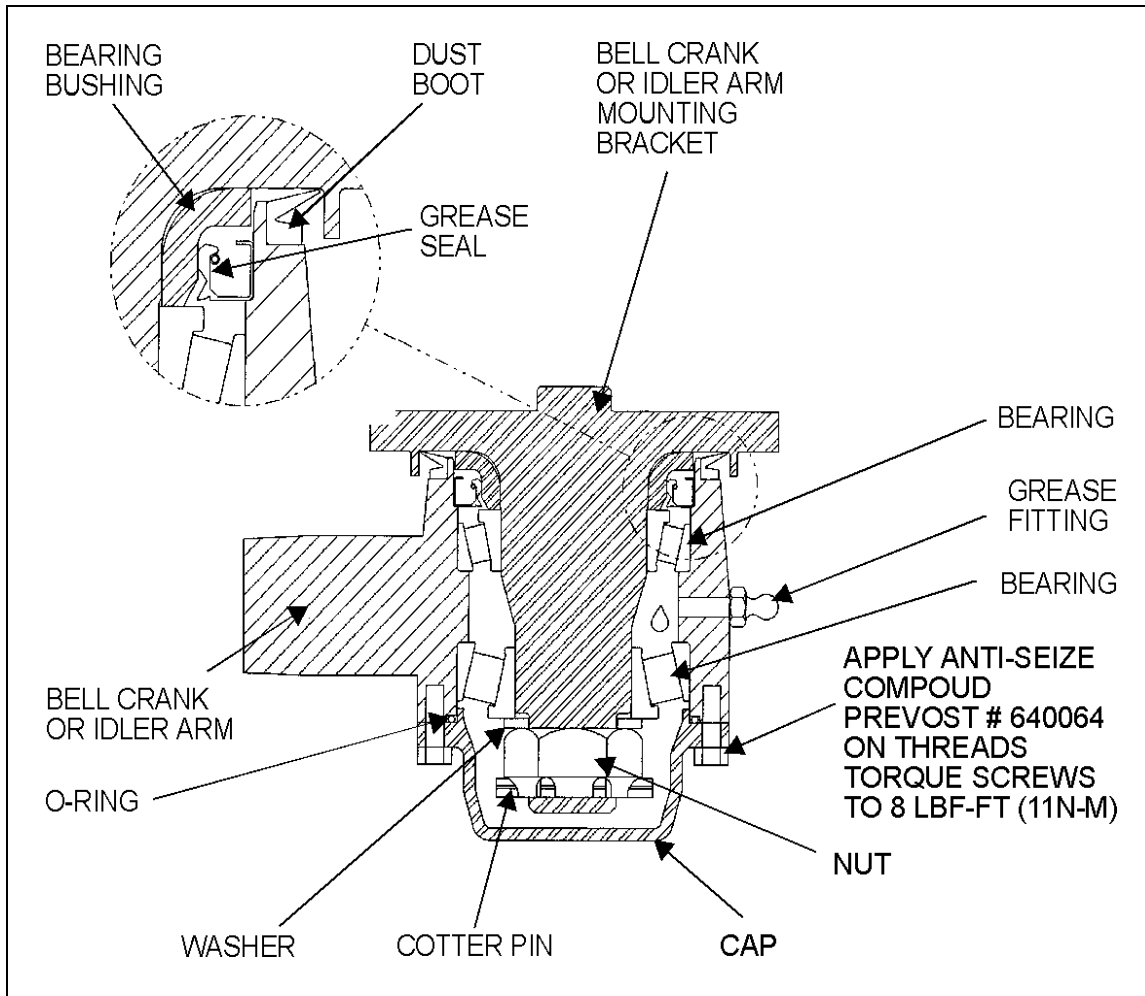


FIGURE 8: BELL CRANK AND IDLER ARM BALL JOINT

16043

5. Install bearing, o-ring and nut.

Note : Apply grease on bearing before installation.

5. Firmly tighten nut (Fig. 9).

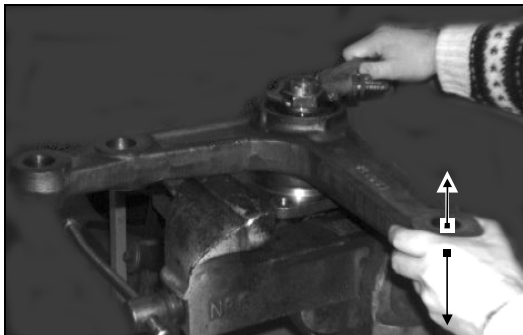


FIGURE 9: BELL CRANK

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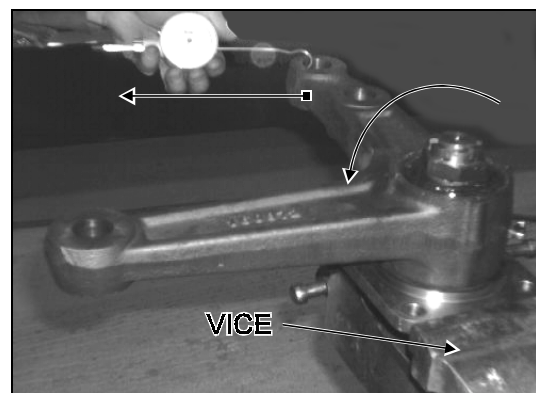


FIGURE 10: BELL CRANK

16045

6. Unscrew nut until bell crank or idler arm start to turn by the application of 1 to 3 pound load (Fig. 10).

7. Check for loose bearings by applying an up and down load on bell crank or idler lever (Fig. 9). The lever is not supposed to move in the vertical axis direction.

- Align nut with cotter pin slot (tighten) and install a new cotter pin.

Note: Bend cotter pin around the nut (Fig. 8). Do not bend the cotter pin in the direction of the cap, because it may interfere with the cap.

- Apply anti-seize compound PREVOST # 640064 on screws' threads. Install the cap screws. Torque cap screws to 8 lbf•ft (11 N•m).
- Bell crank** : Install drag link, tie rod and relay rod as directed herein under each specific subject.
- Idler arm** : Install tie rod and relay rod as directed herein under each specific subject.
- Adjust turning angle as previously directed under paragraph "2.2 Turning Angle" and check front end alignment as specified in paragraph "4. Front End Alignment" of this supplement.

2.7 Relay Rod

Relay rod ends are equipped with lubrication fittings and should be lubricated as directed in paragraph "2.10 LUBRICATION FITTINGS" in this supplement.

2.7.1 Replacement

- Remove cotter pins from bell crank and idler arm end of relay rod. Loosen nuts flush with end of studs.
- Place a sledge hammer behind the adjacent part to absorb shocks. Strike the studs with a brass hammer to loosen end assemblies.
- Remove stud nuts and washers then remove studs.
- Position relay rod studs into bell crank and idler arm then tap stud ends with a brass hammer to seat tapered surfaces.
- Install washers and stud nuts. Tighten nuts to 160 lbf•ft (217 N•m) torque. Align cotter pin slot (tighten) and install a new cotter pin.

2.8 TIE RODS

2.8.1 Description And Maintenance

Tie rod ends are connected to the bell crank and left steering arm, and to the idler arm and right steering arm. Each tie rod assembly consists of three parts; a tube and two socket end assemblies. The tie rod ends are threaded into the tube and secured with clamp bolts. Right and left hand threads are provided to ease toe-in adjustment. Tie rod assemblies are interchangeable from the right to the left side of the coach.

Tie rod end sockets require no maintenance other than periodic lubrication and inspection to see that ball studs are tight. Replace socket ends when there is excessive up and down motion, lost motion or end play at ball end of stud.

- Periodically check bolt nut for tightness.
- Inspect tie rod for bent condition and inspect tube for damaged threads. If tie rod is bent or threads are damaged, replace the assembly.
- Lubricate tie rod end fittings as directed in paragraph "2.10 LUBRICATION FITTINGS" at the end of this section.

2.8.2 Removal

- Remove cotter pins and stud nuts which attach tie rod socket ends to bell crank and left steering arm (or idler arm) and right steering arm.
- Remove tie rod ball stud by tapping on steering arm and bell crank or idler arm with hammer, while using a sledge hammer to absorb shocks.

Note: If tie rod end assemblies are damaged in any way, they must be replaced.

2.8.3 Installation

- Install socket end assemblies on tie rod. Be sure both ends are threaded an equal distance into the tube.
- Make sure threads on stud and in stud nut are clean and not damaged.

3. Position ball studs (socket ends of tie rod) in holes in steering arm and bell crank or idler arm. Install a ball stud nut on each stud and tighten firmly.
4. Torque stud nuts to 160 lbf•ft (217 N•m). Align cotter pin slot (tighten) and install a new cotter pin.

Note: *Adjust toe-in as directed in paragraph "4.6 TOE-IN ADJUSTMENT" of this supplement.*

5. Make sure tie rod ends are properly aligned with ball studs, then torque tie rod end clamp bolts to 60-80 lbf•ft (81-108 N•m).

Note: *If tie rod is properly aligned with stud, binding will result.*

2.9 Steering Arms

The left and right wheel steering arms are secured to a swivel at one end and to a tie rod at the other end.

2.9.1 Removal

1. Remove wheel as directed in Section 13, "WHEELS AND TIRES" of the maintenance manual.
2. Remove cotter pin, washer and nut from stud securing tie rod to steering arm. Remove ball stud from steering arm by tapping on arm with a hammer, Placing a sledge hammer underneath steering arm to absorb shocks.
3. Remove cotter pin and nut securing steering arm to swivel assembly. Remove steering arm from swivel.

2.9.2 Installation

1. Insert steering arm in swivel.
2. Torque steering arm to swivel nut to 190 lbf•ft (258 N•m). Align cotter pin slot (tighten) and install a new cotter pin.
3. Position tie rod ball stud in steering arm and tap with a brass hammer to seat ball stud in steering arm. Install washer and nut on stud. Torque nut to 160 lbf•ft (217 N•m). Tighten nut to nearest cotter pin slot and install a new cotter pin.

4. Install wheel as directed in Section 13, "WHEEL, HUBS AND TIRES" under paragraph "3.2 Installation" of the maintenance manual.

2.10 Lubrication Fittings

All lubrication fittings must be clean before applying lubricant. Also, always be sure equipment used in applying lubricant is clean. Every precaution should be taken to prevent entry of dirt, grit, lint or other foreign matter into lubricant containers. Replace fitting when they become broken or damaged.

Intervals of application given in the following paragraphs are recommended for normal service. More frequent intervals may be applied under severe operating conditions. In selecting proper lubricants, supplier reputation must be considered. The supplier must be responsible for product quality. The diagram (Fig. 11) shows approximate location of steering lubrication fittings.

1. **Drag Link Ends** : Lubricate at two fittings, one at each end of link, every 6,250 miles (10 000 km) with a good quality lithium-base grease NLGI No. 2 (Shell Retinax LX or equivalent).
2. **Steering Column U-Joints** : The steering column has three lubrication points which must be serviced only when needed, using a good quality lithium-base grease NLGI No. 2 (Shell Retinax LX or equivalent). For more information, refer to the XL maintenance manual, Section 14, paragraph "8.1 Removal and Lubrication".
3. **Relay Rod Ends** : Lubricate at two fittings, one at each end of rod, every 6,250 miles (10 000 km) with a good quality lithium-base grease NLGI No. 2 (Shell Retinax LX or equivalent).
4. **Tie Rod Ends** : Lubricate at four fittings, one at each end of both tie rods, every 6,250 miles (10 000 km) with a good quality lithium-base grease NLGI No. 2 (Shell Retinax LX or equivalent).
5. **Hub Unit and Swivel Assembly** : Refer to GKN AXLES LIMITED KIRKSTALL DIVISION, SERVICE MANUAL, paragraph "1. LUBRICATION" annexed at the end of this supplement.

6. **Idler Arm and Crank bell** : Lubricate at two fittings, one on the idler arm and the other on the crank bell, every 6,250 miles (10 000 km) with a good quality lithium-base grease NLGI No. 2 (Shell Retinax

LX or equivalent). Apply grease gun pressure to the fitting until lubricant appears at the top seal.

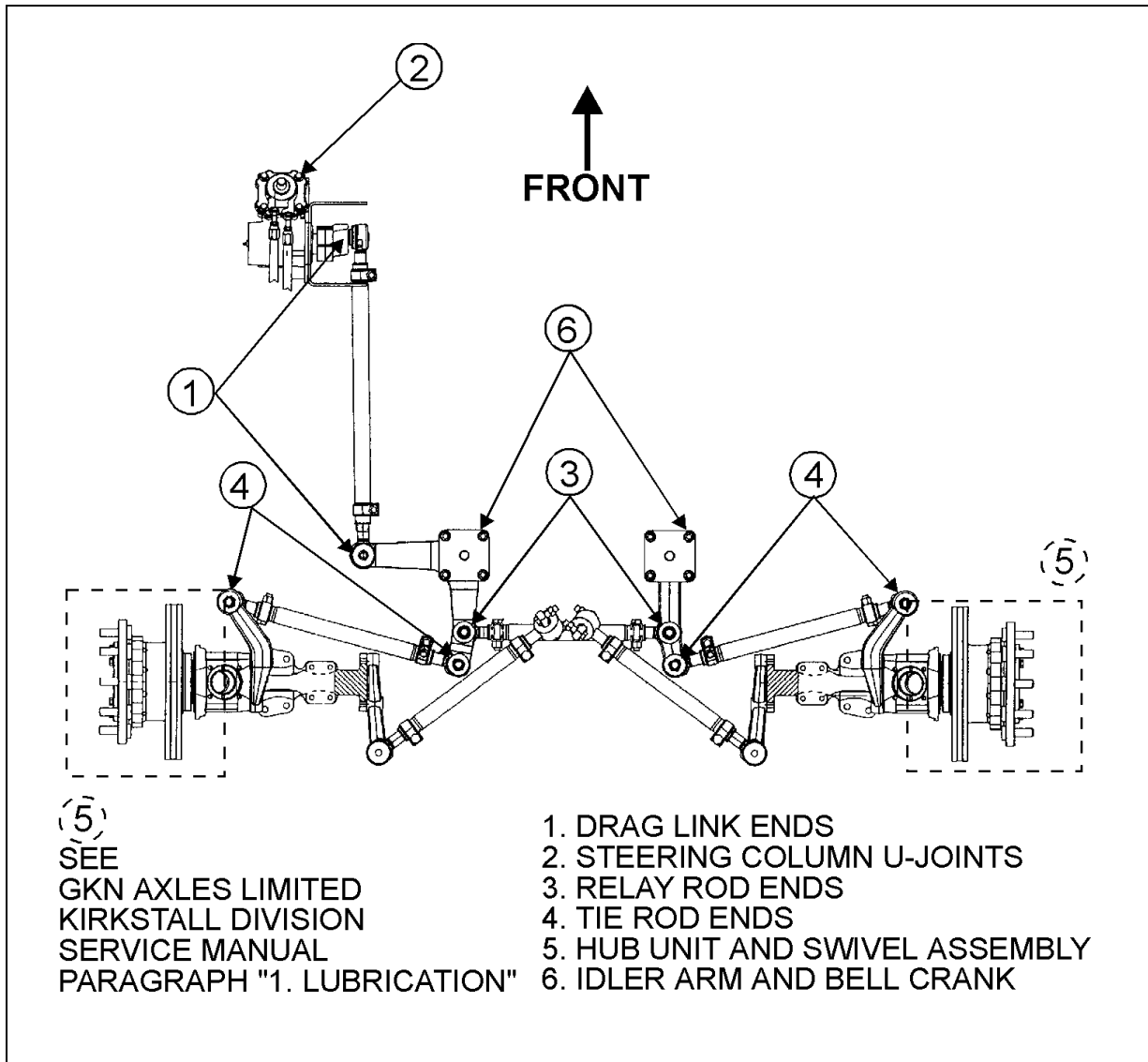


FIGURE 11: LUBRICATION FITTINGS' LOCATION DIAGRAM

16046

2.11 Power Steering Hydraulic Pump

Refer to the "TRW Power Steering Pump Service Manual" annexed at the end of this supplement.

3. INDEPENDENT FRONT SUSPENSION JOINTS

3.1 Lower and Upper A-Arm Ball Joint (Bonded Rubber Bush)

3.1.1 Instructions

The assembly work may be done only by a recognized specialised workshop. Ensure that old and new parts do not get mixed up with each other. It is for this reason that all the old parts are to be scrapped immediately after a joint has been stripped down. A complete repair set must be used for each joint which is repaired, i.e. use of only part of a repair set is not permissible. All numeral or letter designations mentioned below refer to figure 12.

3.1.2 Stripping Down

Strip down the defective joint through removal of locking ring (3), annular spacer (2) and ball pin/bushing, assembly (1) and thereafter clean out housing bore and locking circlip groove.

3.1.3 Assembly

Execute assembly of the new joint parts in the following sequence :

1. Complete moistening of the contact surface between housing bore and ball pin through application of the grease.

Note: Apply grease, only in the case of repair kit (Prévost # 611114).

2. Insert ball pin/bushing, assembly (1). In case of the two-bolt type, ensure that the bolt bores are in the correct position in relation to the axis of the tube.
3. Place joint in receiving fixture (C) and mount annular assembly tool (B) on the housing. Then locate annular spacer (2) and locking circlip (3) in the housing using axial load F with the aid of assembly matrix (A) (For axial load, refer to table 1) (For Prévost tools #, refer to table 2) . If the

ends of the annular spacer are not in contact with each other, the thus formed opening must be located at 180° to the opening of the locking circlip. Pay attention during assembly to ensure that the locking circlip eyelets are located at each side of the housing shaft axis (locking circlip eyelet lug points to tube), and that locking circlip (3) is properly engaged in the groove of the housing.

TABLE 1		
Suitable for repair kits Prévost #	Position	Axial load F (kN)
611111	Upper A-arm	120
611114	Lower A-arm	160

4. When repairing defective ball pin assemblies, the necked down-bolt must regularly be replaced with a new one.

In special cases where it is necessary to repair defective ball pin assemblies with sealing caps the following must be observed : Dismounting of the sealing cap cannot take place without destruction and after repair work is complete it must be replaced with a new one.

TABLE 2			
Suitable for repair kits Prévost #	ORDER PRÉVOST TOOLS # SEE FIGURE 12		
	A	B	C
611111	683108	683109	683110
611114	683111	683112	683112

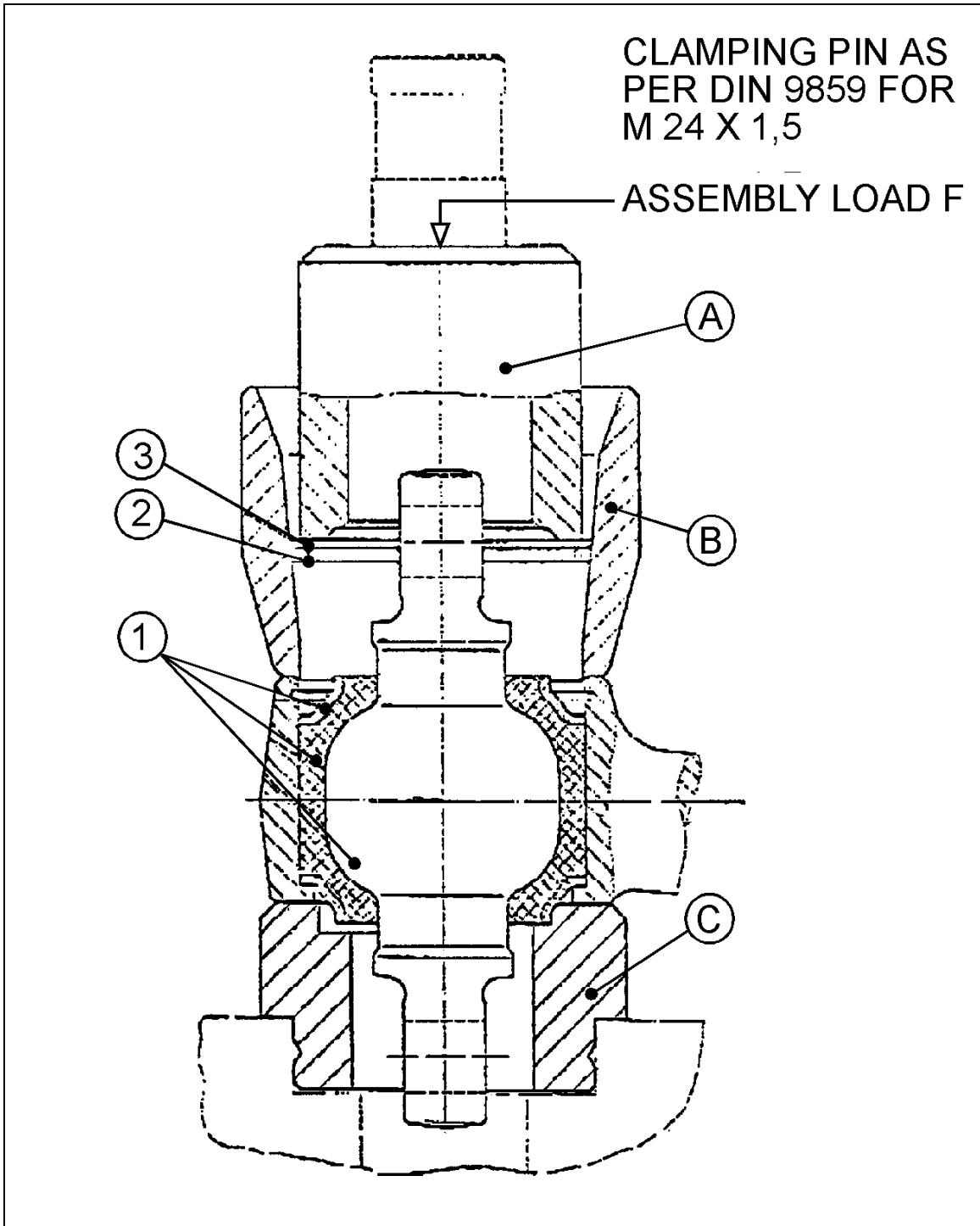


FIGURE 12: BALL JOINT

16047

3.2 Lower A- Arm Central Joints (Bt-Sectional Bearing System)

3.2.1 Instructions

All reference numbers mentioned refer to component parts shown in figure 13.

3.2.2 Stripping Down

1. The joint is to be stripped down in the following sequence :
2. Remove sheet metal-cap (10) with annular seal (11) and then loosen tightening clip (7).
3. Screw out necked down bolt (14) and use hex screw M 24 x 1.5 x 50 (DIN 961) to press bracket (15) out of ball sleeve (1).
4. Remove sealing boot (6) with tightening clip (7) and clamping ring (8).
5. Remove circlip (5) and strip down the bearing elements of the joint (12), (3), (1) and (2). Then clean out the housing bore and the circlip groove.

3.2.3 Assembly

Assemble the new component parts of the joint in the following sequence:

1. Insert into housing lower elements (3) and (2) : ensure that ball surface has first been greased. Then insert bearing element (1) and the upper bearing elements (2) and (3) and finally bearing element (12).
2. Place joint in fixture (C) and mount assembly ring (B) on housing. Thereafter apply axial pressure F1 through press tool (A) to insert circlip (5) in housing groove (For axial load, refer to table 3). Attention is to be paid to ensure that the circlip eye-lets are positioned at approximately 90° to the axis of the tube and that the circlip is properly seated in the housing groove) (For Prévost tools #, refer to table 5).

TABLE 3		
Suitable for repair kits Prévost #	Position	Axial load F1 (kN)
611112	Lower A-arm	200

3. Use assembly sleeve (D) to mount sealing boot (6) including clamping ring (8) on bracket (15). Attention is to be paid to ensure that the clamping ring maintains its correct position in the clamping ring groove.
4. Faultlessly apply grease by mechanical means to bracket-outer core (15) and ball-inner cone (1). Insert bracket outer cone in fixture (E) with distance ring (G) and then use press tool (H) to apply pressure F2 to press mount with ball-inner cone (For axial load, refer to table 4).

TABLE 4		
Suitable for repair kits Prévost #	Position	Axial load F2 (kN)
611112	Lower A-arm	100

3. After lifting out of fixture prematurely mount, torque bolt M 14 x 1.5 between 3 to 4 N•m. Finally use a torque wrench to tighten bolt with a tightening torque of 135 N•m. Ensure that the maximum rotation during tightening does not exceed one complete turn. If the specified tightening torque is not reached during one turn, the bolt is to be replaced with a new one.
4. Fill the cavity under the sealing boot (6) with grease and fix tightly to housing with tightening clip (7).
5. Fill the upper cavity of the joint with grease and then mount annular seal (11) and sheet-metal cap (10).
6. Either fix sheet-metal cap to housing through screwing it into place or through 4 spot i.e. according to individual design specifications.

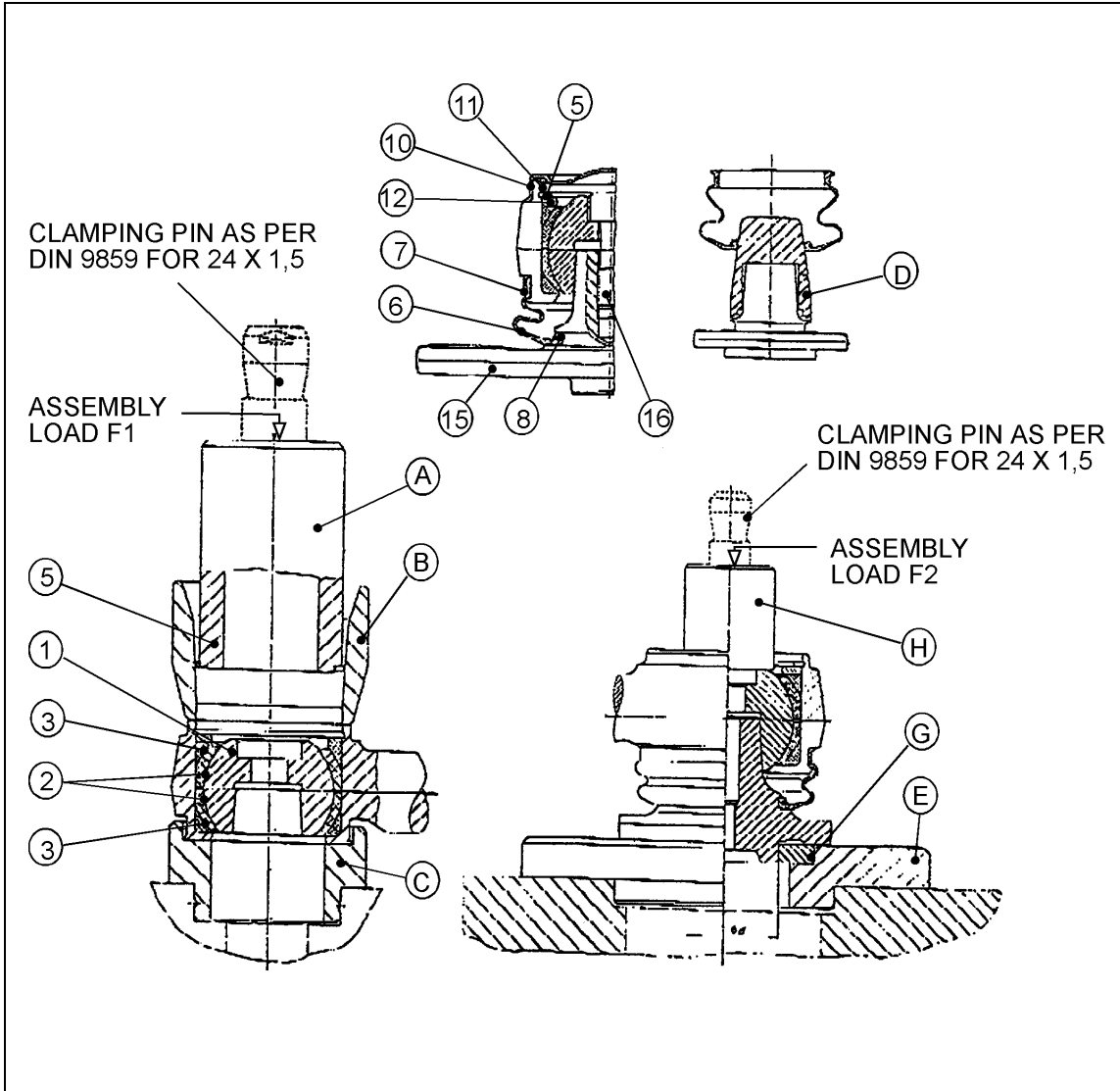


FIGURE 13: CENTRAL JOINT

16048

TABLE 5							
Suitable for repair kits Prévost #	ORDER PRÉVOST TOOLS # SEE FIGURE 13						
	A	B	C	D	E	G	H
611112	683114	683115	683116	683117	683118	683120	683119

3.3 Upper A-Arm Ball Joints (One-Part Bearing System)

3.3.1 Instructions

All reference numbers mentioned below refer to component parts shown in (Fig. 14).

To repair order Prévost kit # 611108.

3.3.2 Stripping Down

Stripping down of the defect joint is to be done in the following sequence:

1. Remove hose clip (6) and clamping ring (7).
2. Take off sealing boot (5).
3. Open up through forcing back peening point and screw out the end ring with hook-spanner (A)) (For Prévost tools #, refer to table 6). Remove joint bearing elements (1 and 2) and thereafter clean out ball shaped-housing.

3.3.3 Assembly

Reassemble the joint with the new component parts in the following sequence :

1. Insert bearing element (1) (with threaded shaft in vertical position) and (2) (preassembled with grease) in ball shaped-housing.
2. Screw end ring onto housing using hook spanner.
3. Fix end ring to housing through peening again at one point.
4. Fit sealing boot (5).
5. Fill space under sealing boot with special LM-grease (20 g ± 1,5 g). Make sure that sealing boot is properly seated in the housing retaining groove and then fit hose clip (6) and clamping ring (7).

TABLE 6	
Suitable for repair kits Prévost #	ORDER PRÉVOST TOOLS # SEE FIGURE 14
	A
611108	683121

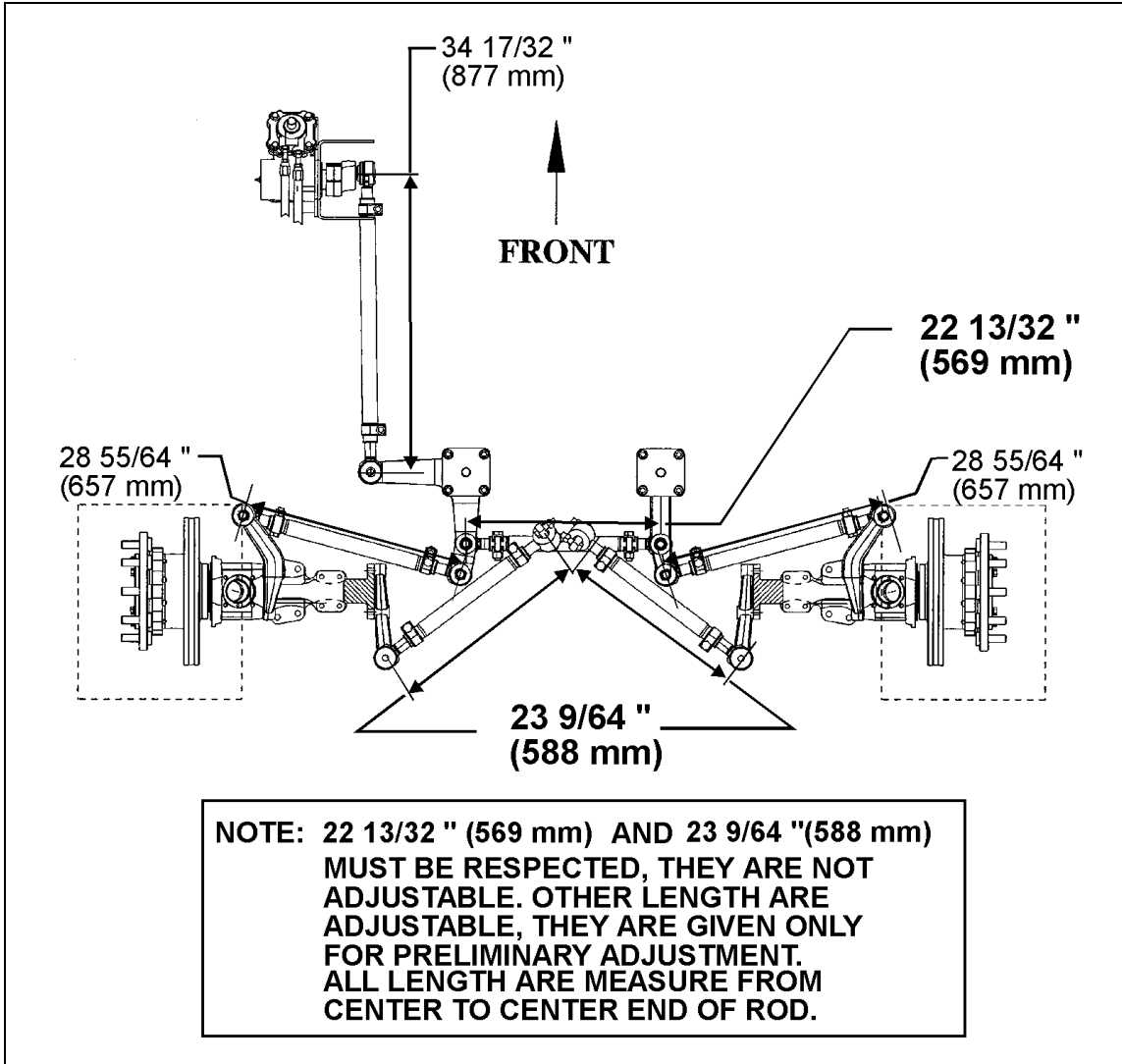


FIGURE 15: STEERING LINKAGE MEASURE

16050

4. FRONT END ALIGNMENT

Proper front end alignment must be maintained to insure ease of steering and provide satisfactory tire life. When making front end alignment inspections, the vehicle must be level and empty with the full weight of the vehicle on the wheels.

Front end alignment inspections fall into two groups : regular service inspections performed at periodic intervals, and inspections to determine the extent of damage after a collision or severe service.

Regular service inspections concern toe-in, camber and caster. Any variation from the specified alignment will indicate either a need for adjustment or a more thorough inspection to determine if parts replacement is required.

4.1 Definition Of Terms

4.1.1 Wheel Camber

The amount the wheels are inclined from the vertical plane (A, Fig. 16).

4.1.2 Wheel Toe-In

The distance the front wheels are closer together at the front than at the rear of the tires (D minus E, Fig. 16).

4.1.3 Front Axle Caster

The inclination of the king pin from vertical in the fore and aft direction (C, Fig. 16).

4.1.4 King Pin Inclination

The inclination of the king pin from vertical toward the center of the vehicle at the top and outward at the bottom (B, Fig. 16).

4.2 Front End Inspection

Before checking front end alignment, make the following inspection :

1. Check that the vehicle is at normal ride height (see paragraph "8. Suspension Height Adjustment").
2. Check the tires for proper inflation.
3. Check wheel installation and run-out.
4. Check wheel bearing adjustment.
5. Check tie rods and drag link ends for looseness.

6. Check king pins for looseness.
7. Check if the length of the torque rod is 23 9/64" (588 mm) (Fig. 15). Check if the length of the relay rod is 22 13/32" (569 mm)

4.3 Front Wheel Camber

Positive camber is the outward inclination of the wheels at the top, negative or reverse camber is the inward inclination of the wheels at the top. Camber variations may be caused by wear at the wheel bearings, wheel spindle bushings, or bent suspension parts.

Check camber, with an accurate gauge. If camber is incorrect, check suspension parts for wear and replace worn parts. If wear is not perceptible, suspension parts may be bent or lower suspension arm may be improperly shimmed.

Check King pin inclination. If King pin inclination is incorrect, readjust the camber and check king pin inclination again.

Note: *Camber is more important than king pin inclination, so adjust camber and verify king pin inclination.*

When shimming the lower suspension arm, an equal number of shims **MUST** be used at each mounting bolt (Fig. 16). This allows the proper clamp load to be maintained at each bolt. If the king pin inclination is incorrect, the wheel king pin assembly may be bent and therefore should be replaced.

Excessive positive camber results in irregular wear of the tires at the outer shoulders. Negative or reverse camber causes wear at the inner shoulders.

Note: *Shim only the lower suspension arm to adjust the front wheel camber.*

4.4 Front Wheel Toe-In

Toe-in is measured from the center of the tire treads. Measurements at the front and rear of the tires must be made at the same height from the floor. Incorrect toe-in results in excessive tire wear and steering instability with a tendency to wander.

4.5 Toe-In Check

1. Check the camber adjustment and adjust if necessary.
2. Hoist the front of the vehicle and spin the wheels marking the centerline of the tire treads.
3. Place the wheels in the straight ahead position and bring the vehicle to rest on the floor.
4. Roll the vehicle ahead several feet. This removes any slack caused by looseness in the wheel bearings or steering connections.
5. Check the distance between the tire centerlines at the front and rear of the front tires. These two measurements must be made at the same height above the floor. The front measurement must be $3/32 \pm 1/32$ of an inch less than the rear measurement.

4.6 Toe-In Adjustment

1. Disconnect the drag link from the bell crank.
2. Loosen the tie rod clamp bolts.
3. Using a pipe wrench, turn the tie rod tubes to obtain the toe-in measurement specified in step 5 under paragraph "4.5 Toe-in Check" of this Supplement.
4. Tighten the tie rod clamp bolts and re-check toe-in.
5. Check that the angular relationship of the pitman arm to the steering gear is as shown in figure 7.
6. Adjust the drag link to mate with the bell crank and install the drag link.

Note: Use only tie rods to adjust toe-in.

4.7 Front Axle Caster

Positive caster is the inclination of the king pins toward the rear of the vehicle. Negative or reverse caster is the inclination of the king pins toward the front of the vehicle. This vehicle is designed with positive caster. The purpose of caster is to provide steering stability

by keeping the wheels in a straight ahead position.

Caster variations may be caused by bent upper suspension arm, lower suspension arm, or king pin housing. Caster can not be adjusted. Incorrect caster must be corrected by replacing the damaged suspension parts. Precision instruments should be used to measure caster.

Variations from the specified caster will affect steering stability, cause wandering, wheel shimmy, and reduce returnability when pulling out of curves.

4.8 Major Damage

If the suspension has major damages, it may be necessary to shim the bell crank and the idler arm to avoid the bump steer or roll steer. Moreover refer to paragraph "4. Front End Alignment".

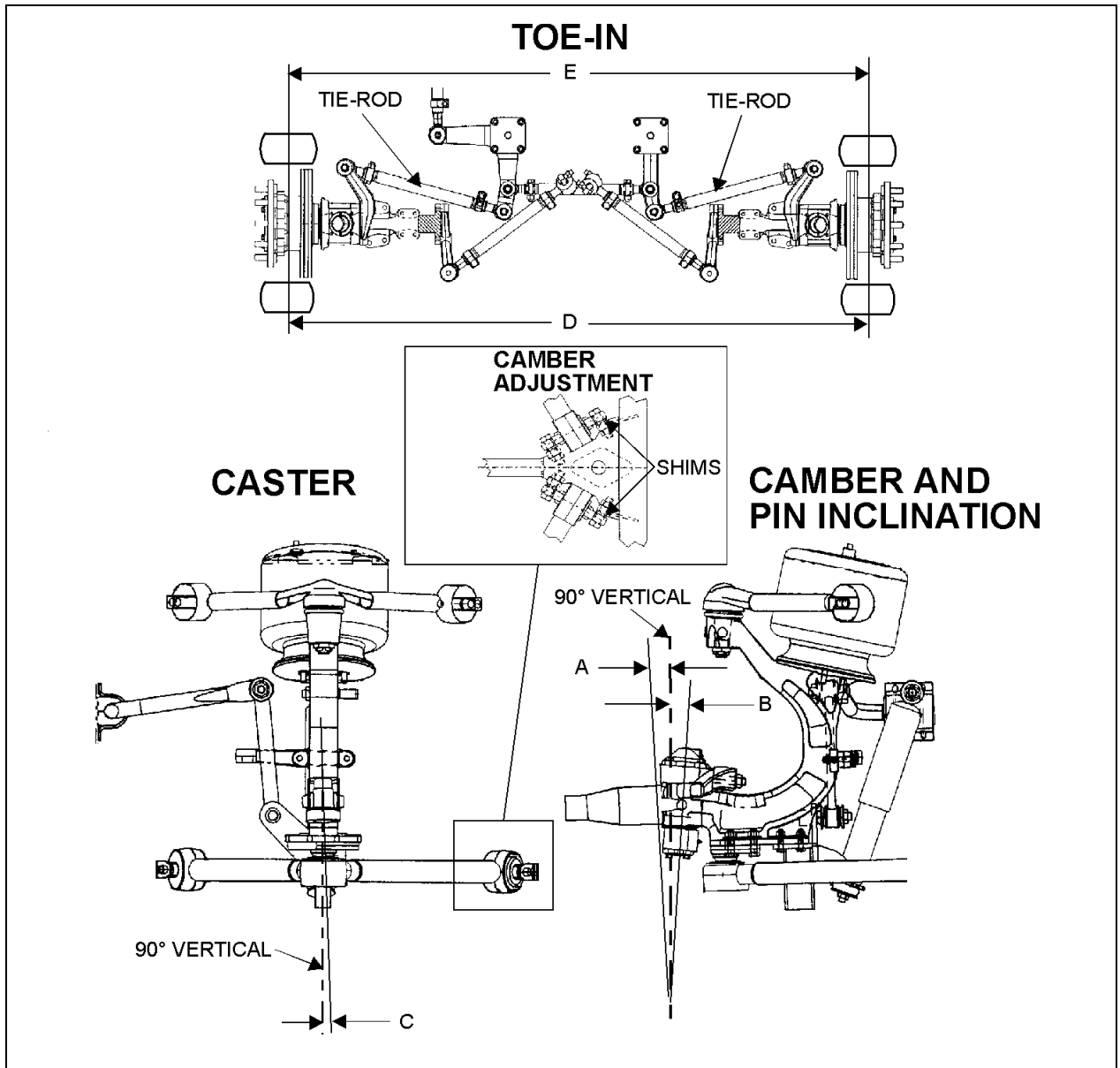


FIGURE 16: FRONT END ALIGNMENT DIAGRAM

16051

DIAGRAM SPECS (SEE FIGURE 16)		
A	WHEEL CAMBER	1/8° ± 1/4°
B	KING PIN INCLINATION	6,5° (not adjustable)
C	CASTER	2° (not adjustable)
D-E	TOE-IN	3/32 ± 1/32 inch.

5. AIR SPRING MAINTENANCE (FRONT AIR SPRINGS)

Two "rolling lobe" type air springs are used with the independent front suspension, one at each wheel. These air springs are special and use the complete piston as an extra reservoir to lower the spring stiffness. Front air springs are attached to the subframe and to uprights.

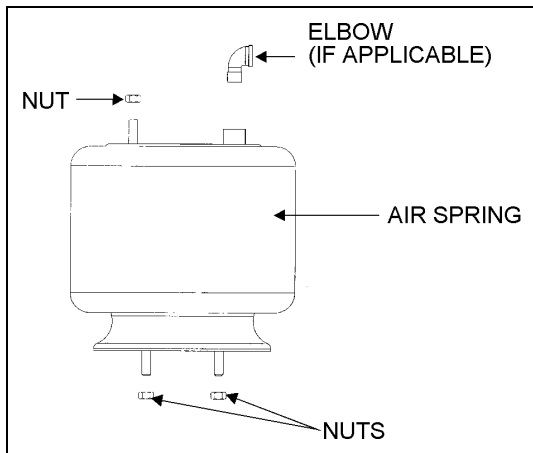


FIGURE 17: AIR SPRINGS

16052

5.1 Inspection

1. Check operation of bellows.
2. Visually inspect bellows for evidence of cracks, punctures, deterioration, or chafing. Replace the bellows if damage is evident.
3. With the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat all suspension air line connections and bellow mounting areas with a water and soap solution. Bubbles will indicate an air leak, and none is permissible. Repair or replace defective parts.

Note: If air spring is removed from vehicle, bellows can be lightly inflated and submerged in water to detect any leakage. If leakage is detected, replace bellow.

Warning: To prevent personal injury, do not apply more than 10 psi (69 kPa) air pressure with the air spring unmounted.

5.2 Removal

Note: Front air springs can be removed without removing the entire suspension assembly.

1. Safely support vehicle at the recommended body jacking points and jack up body understructure.
2. To gain access to a given air spring, the corresponding wheel can be removed.

Caution: Only the recommended jacking points must be used as outlined in Section 18, "Body" in the maintenance manual.

3. Support the assembly with a suitable jack.
See figure 18 for jacking point.
4. Exhaust compressed air from accessory air tank by opening drain cock under reservoir.
5. Disconnect the height control valve link and pull down the overtravel lever to ensure all air is exhausted from air springs.

Note: While performing this step, do not change the height control valve overtravel lever adjustment.

6. Disconnect air line from air spring, remove elbow (if applicable), and cover both the line end and fitting to prevent the entry of foreign matter.
7. Remove the two air springs upper nuts, and then the two lower nuts. Remove air spring and remove the back up plate from the top of the air spring.

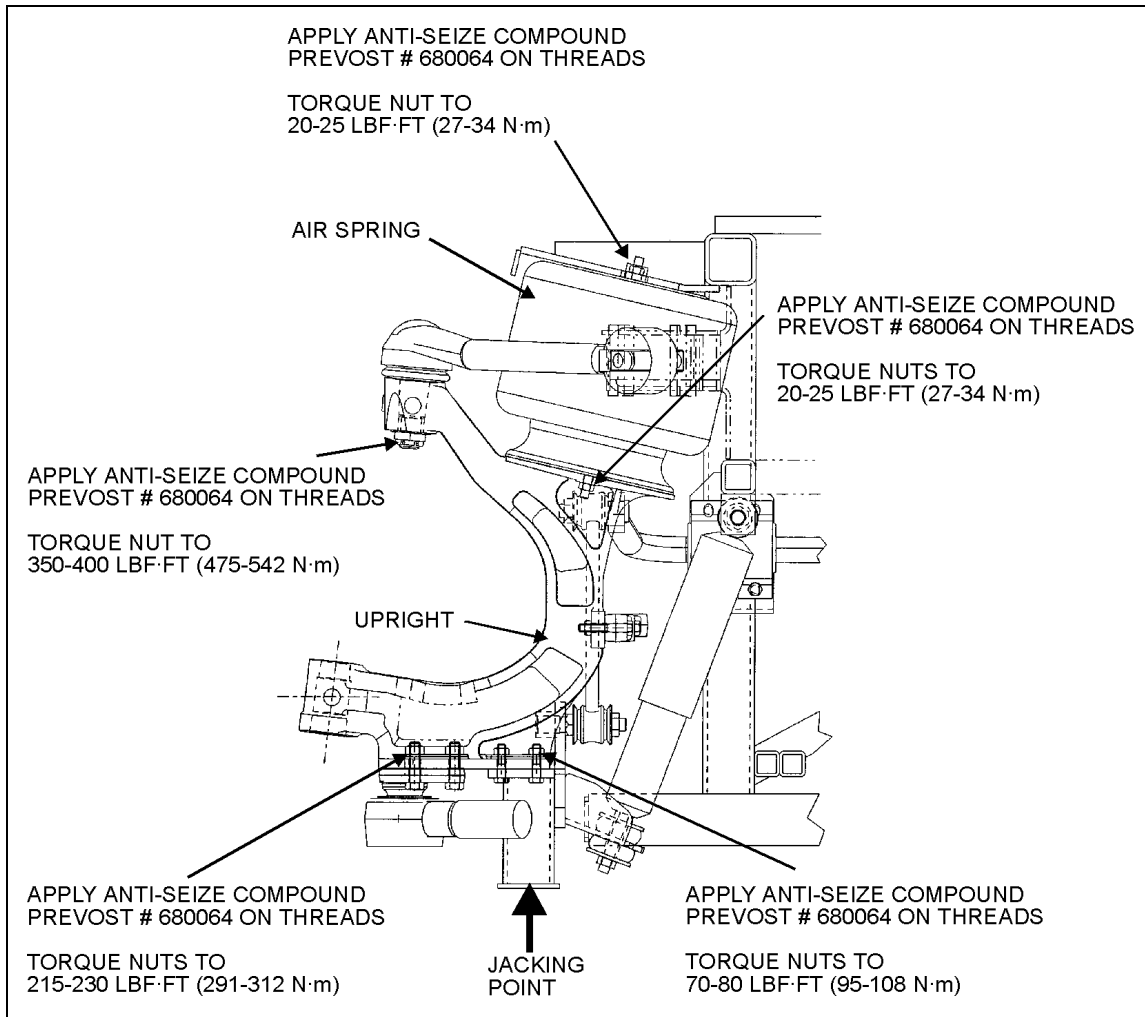


FIGURE 18: AIR SPRING AND SHOCK ABSORBER

16053

5.3 Installation

1. Compress air spring as necessary, then aligning studs with their holes, position air spring between both the lower and upper supports. Thread the lower nuts and the small upper nut a few turns.
2. Tighten and torque the lower stud nuts, and then the upper nut to 20 - 25 lbf·ft (27 - 34 N·m).
3. Install elbow (if applicable), then connect air line.
4. Connect the height control valve link.
5. Build up air pressure in system.

Note: To accelerate this operation, air reservoirs can be filled from an exterior air supply connected to the accessory tank fill valve or to the emergency fill valve.

6. Check operation of bellows, and with the primary air system at normal operating pressure (95 - 125 psi (655 - 860 kPa)), coat the air line connections and air spring mounting areas with a water and soap solution. Bubbles will indicate an air leak, and none is permissible. Repair or replace defective parts.
7. Remove the hydraulic floor jack from underneath shock absorber bracket.

6. SHOCK ABSORBER

The two front shock absorbers are double-acting and telescopic type. Shock absorbers ensure a smooth ride and enhance vehicle stability on the road. Front shock absorbers have eye-type mountings on the upper side and bayonet type on lower side. Shock absorbers are non-adjustable and non-repairable.

Caution: When a shock absorber is found defective, always replace with a new set on affected axle, except if there has been a recent replacement of one unit. The following method will help in determining if both shock absorbers on the same axle have to be replaced.

6.1 Shock Absorber Removal

1. Remove the nut, washer and rubber joint from shock absorber mounting stud. Discard the rubber joints.
2. Remove the nut and washer from shock absorber mounting pin (upper side), taking care to identify the inner and outer washers to ease reinstallation. Refer to figure 19 for details.
3. Remove the shock absorber from the vehicle.
4. Remove inner: washers, rubber joint and bushings from the shock absorber. Discard bushings and rubber joint.

6.2 Shock Absorber Installation

1. Check that the shock absorber mounting pin is properly torqued (350 - 400 lbf-ft (475 - 545 N·m)). Ensure that the stud is clean and not stripped (upper side).
2. Install new rubber (mounting) bushing on shock absorber (upper side).
3. Place the inner washer on shock absorber pin (Fig. 19).
4. Install washer and rubber joint on shock absorber mounting stud (lower side).
5. Install the shock absorber as shown in figure 18 with the mounting stud protruding through the hole in the mounting bracket and the shock absorber eyes over the mounting pins. Install the outer washer.
6. Place a rubber joint and washer on the shock absorber mounting stud. Place the lower shock absorber mounting stud nut and torque to 70 - 80 lbf-ft (95 - 110 N·m).
7. Place the upper mounting pin stud nut and torque to 70 - 80 lbf-ft (95 - 110 N·m).

7. SWAY BAR

A sway bar is provided on the front and drive axles to increase vehicle stability. It controls lateral motion (swaying movement) of vehicle.

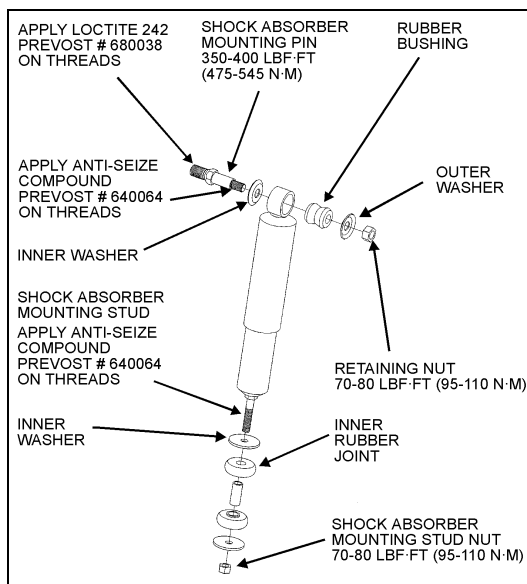


FIGURE 19: SHOCK ABSORBER

16054

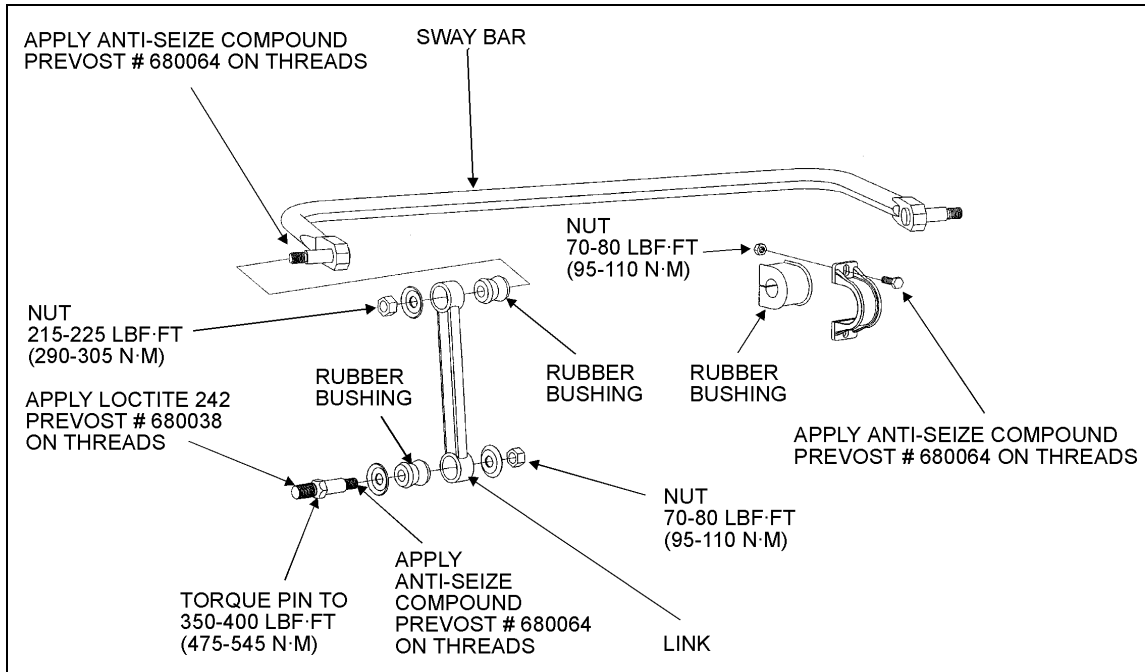


FIGURE 20: SWAY BAR (FRONT SUSPENSION)

16055

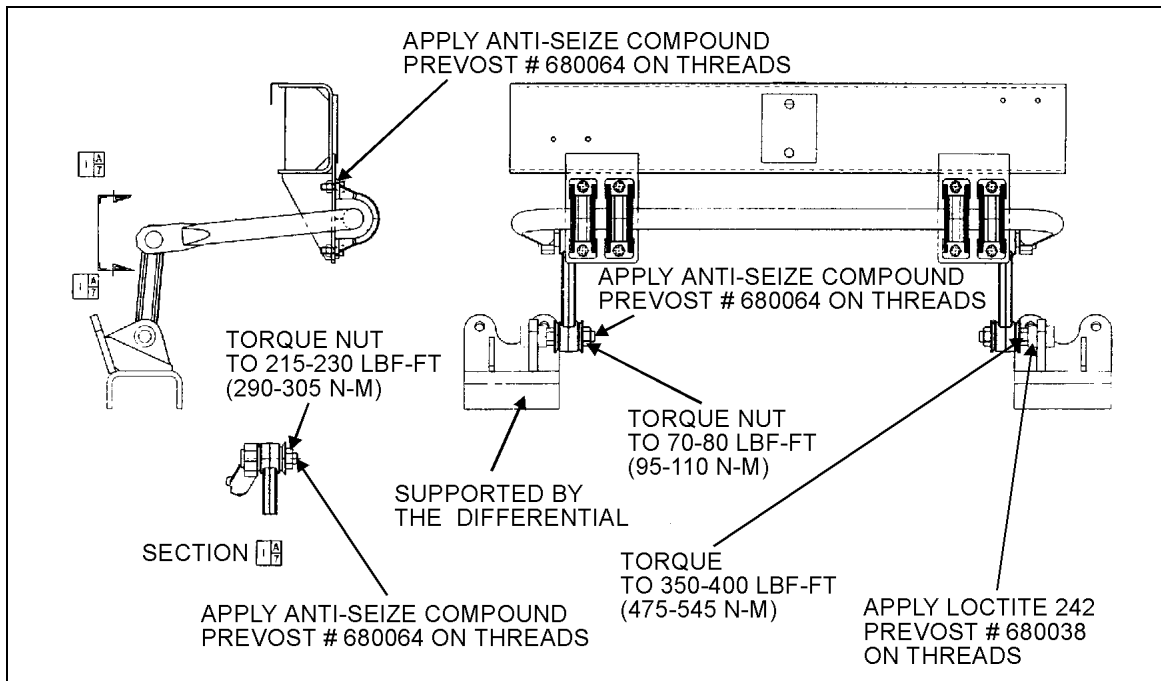


FIGURE 21: SWAY BAR (DRIVE AXLE)

16056

7.1 Sway Bar (Front Suspension)

7.1.1 Removal

1. Disconnect the two links from sway bar.
2. Safely support the sway bar. Unbolt bushing collars from subframe.

3. Remove sway bar.

Note: Sway bar bushings are slitted to ease their removal.

7.1.2 Installation

1. Loosely install the sway bar.

2. Torque bushing collar nuts to 70 - 80 lbf•ft (95 - 110 N•m).
3. Torque sway bar link upper nuts to 215 - 225 lbf•ft (290 - 305 N•m) and lower nuts to 70 - 80 lbf•ft (95 - 110 N•m).

7.2 Sway Bar (Drive Axle)

7.2.1 Removal

1. Disconnect the two links from sway bar.
2. Safely support the sway bar. Unbolt the four bushing collars from subframe.
3. Remove sway bar.

Note: Sway bar bushings are slitted to ease their removal.

7.2.2 Installation

1. Loosely install the sway bar.
2. Torque the eight bushing collar nuts to 70 - 80 lbf•ft (95 - 110 N•m).
3. Torque sway bar link upper nuts to 215 - 230 lbf•ft (290 - 305 N•m) and lower nuts to 70 - 80 lbf•ft (95 - 110 N•m).

8. INDEPENDENT FRONT SUSPENSION ADJUSTMENT

Converted coach shell is equipped with "LEVEL-LOW" leveling system. The purpose of the "LEVEL-LOW" is to adjust suspension in three separate points (front, rear right and rear left air springs) in order to level vehicle body. Three height control valves, automatically control air pressure in the three separate points (air springs) and maintains a constant vehicle height regardless of load, or load distribution. The control solenoid valve supplies air to the five way three-position air control valve, which bypasses the height control valve, and opens a passage to allow the air control and exhaust valve to release/supply air from air springs. To improve road comfort, an expansion air tank is installed in series with each air springs.

In addition to the above suspension components the system also includes : sway bar, upper and lower suspensions, bars and shock absorbers (Fig. 1).

Note: Only for preliminary adjustment, refer to figure 15. Torque rod length must be fixed to 23

9/64" (588 mm) and relay rod to 22 13/32" (569 mm).

Caution : Parts must be replaced by ones with the same part numbers or with equivalent parts, if replacement becomes necessary. Do not use parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

8.1 Suspension Height Adjustment

The flow of pressurized air from the accessory air tank to the air springs is controlled by three height control valves. The two rear valves are mounted to the subframe and connected to the rear axles through an arm and link connection. The front valve is mounted to the subframe and connected to the front air tank support (Fig. 22). These connections allow the valves to apportion air pressure in the springs to the vehicle load, maintaining normal ride height.

Immediate response height control valves increase or decrease the air pressure in the suspension system as required. One height control valve is located **at center of front sway bar**, and regulates air to front suspension air springs in order to maintain the vehicle at the required height. Two are located at the drive axle, one on each inner side of rear wheelhousing.

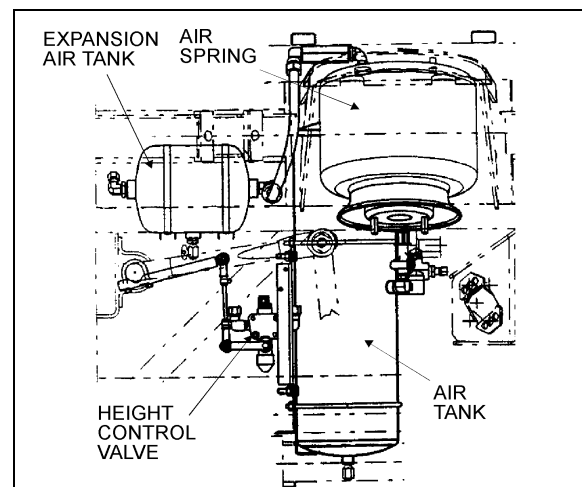


FIGURE 22: HEIGHT CONTROL VALVE LOCATION 16057

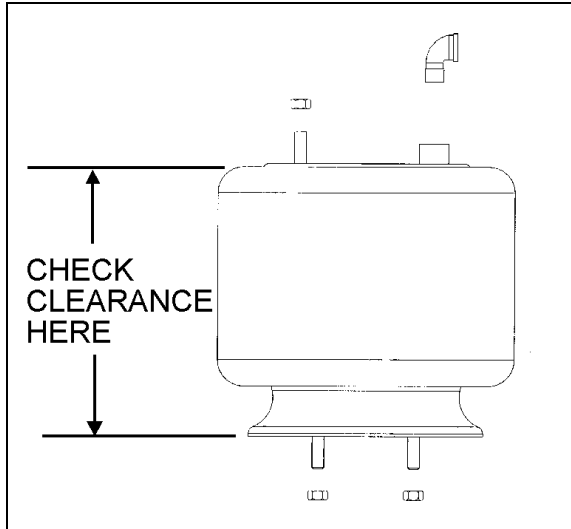


FIGURE 23: TYPICAL AIR SPRING CLEARANCE 16058

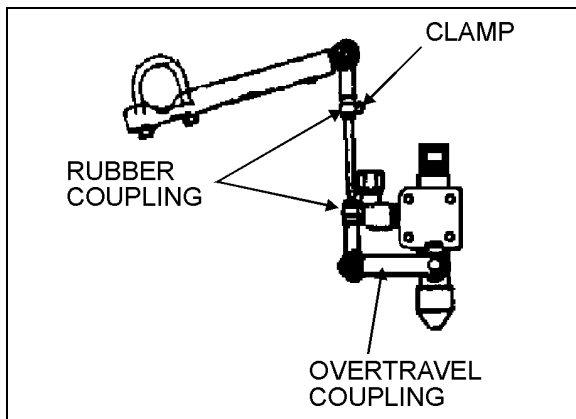


FIGURE 24: FRONT HEIGHT CONTROL VALVE 16059

The appropriate vehicle body height is obtained by measuring the clearance of all the air springs installed on the vehicle. The two front air springs clearance should be 11.7 inches (297.3 mm). Refer to figure 23 to identify the correct area to take measurement. The rear air springs clearance should be 11.5 ± 0.25 " (292 ± 6 mm) (refer to XL Maintenance Manual, Section 16, paragraph "7. SUSPENSION HEIGHT ADJUSTMENT" for rear height control valves' adjustment). At this point, it should not be necessary to make an adjustment under normal service conditions. However, if an adjustment is required, change the position of the overtravel lever in relation to the overtravel control body. The lever should be moved up to raise vehicle height, and down to lower it. Check that main air pressure is at normal operating pressure and raise the vehicle to the specified height.

Caution: Always adjust on "fill cycle". If it is necessary to lower vehicle height, release sufficient air to be well below height, and adjust to height or fill cycle.

The normal ride height is obtained by adjusting air spring clearance of both front and rear suspension as follows:

FRONT AIR SPRING CLEARANCE

1. With the vehicle at normal operating air pressure (95 - 125 psi (655 - 860 kPa)), measure air spring clearance. This clearance should be 11.7 inches (297.3 mm).

Note: The measurement should be taken from underneath the upper air spring support on subframe to top of the lower air spring support on axle (refer to figure 23 for more details). If adjustment is required, begin with the drive axle.

2. Loosen the clamp on the rubber coupling and bring it up or down (Fig. 24).

Note: Allow suspension to stabilize before taking reading.

3. When the desired height is obtained, tighten clamp.

REAR AIR SPRINGS CLEARANCE

1. Refer to XL Maintenance Manual, Section 16, paragraph "7. SUSPENSION HEIGHT ADJUSTMENT".

9. HEIGHT CONTROL VALVE

9.1 Operation

The height control valves automatically add air to, or release air from air springs to maintain constant suspension height regardless of load, or load distribution. Each valve adjusts independently according to the following conditions:

9.1.1 Loading Position

As the load increases and lowers the vehicle body, the overtravel lever commands the height control valve to add air to air springs.

9.1.2 Neutral Position

When vehicle body reaches the normal ride height, the height control valve overtravel lever reaches the "neutral" position and keeps both the supply and exhaust ports closed to ensure normal ride height is maintained. This condition remains static until the vehicle load is altered.

9.1.3 Unloading Position

As the load decreases and raises the vehicle body, the overtravel lever commands the height control valve to release air from air springs.

9.2 Maintenance

The height control valve requires no periodic maintenance. Height control valve linkage operates on rubber bushings and no lubrication should be attempted at this location. Inspect the valve for loose joints, air leaks and worn bushings.

9.2.1 Removal and Installation

Before disconnecting a height control valve air line, securely support the vehicle by its jacking points on the body, and place safety supports underneath body. Refer to paragraph "16. Vehicle Jacking Points" in Section 18, "Body".

1. Exhaust air from air system by opening all air tank drain cocks. Remove height control valves.
2. Disconnect overtravel lever from link and pull down lever to exhaust remaining air from air springs.
3. Disconnect air supply and delivery lines from the height control valve. Cover line ends with tape to prevent entry of foreign matter.
4. Remove the nuts retaining the height control valve to the mounting bracket, then remove valve assembly.

Reverse removal procedure to replace height control valve. After installation, check for leakage using a soap and water solution.

10. "LEVEL-LOW" LEVELING SYSTEM (IF APPLICABLE)

The purpose of the "level-low" leveling system is to adjust suspension in three separate points (front, rear right and rear left) in order to level vehicle body. This system can be put into service when the ignition key is turned to the "ON" position, and must be used only when the parking brake is applied. The "level-low" warning light on the dashboard indicates that the push-button shifter is not in the "DRIVE" position. Level low system controls are located on L.H. side control panel.

10.1 Principles of Operation

Refer to the systems pneumatic diagram annexed at the end of this section.

11. AIR SYSTEM

The basic air system consists of an air compressor, tanks, valves, filters and interconnecting lines and hoses (refer to Section 12, "Brake and Air System" for complete information). It provides a means for braking, operating controls and accessories, and suspension. An air system schematic diagram is annexed at the end of this supplement for better understanding of the system.

11.1 Air Tanks' Locations and Functions

The air coming from the air dryer is first directed to the wet air tank, then to the primary (for the primary brake system), secondary (for the secondary brake system), and accessory (for the pneumatic accessories) air tanks (Fig. 25).

In addition, an expansion air tank is installed in series with each air spring.

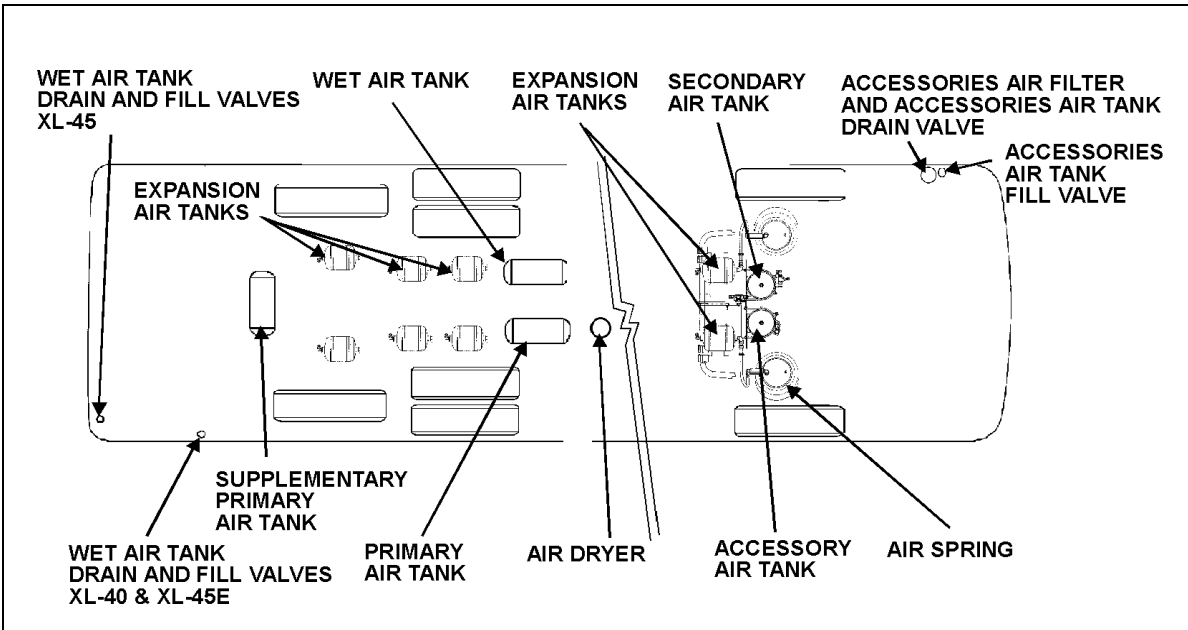


FIGURE 25: AIR TANKS' LOCATIONS

16060

11.2 Air Tank Maintenance

Ensure that the accessory air tank is purged during pre-starting inspection. A good practice is to purge this tank at the end of every working day by the remote air tank drain valve located in the steering compartment (Fig. 28).

Moreover, purge all tanks by their bottom drain valves at specified intervals.

11.2.1 Wet Air Tank

This tank is installed above L.H. wheel of drive axle, and is provided with a bottom drain valve. It is recommended to **purge** the wet air tank by its bottom drain valve every 12,500 miles (20 000 km), or once a year, whichever comes first.

A remote valve located in engine compartment and accessible through engine R.H. side door is used to **drain** the air dryer. On XL-40 & XL-45E converted coach shell vehicles, the valve is positioned over battery assembly, close to door hinge (Fig. 26). On XL-45, the valve is positioned under back up alarm, close to L.H. side of door opening (Fig. 27).



12010M

FIGURE 26: REAR VALVE LOCATION (XL-40 AND XL-45E)

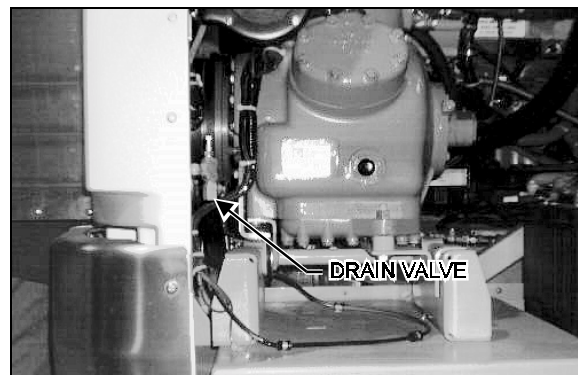


FIGURE 27: REAR VALVE LOCATION (XL-45)

12016M

11.2.2 Primary Air Tank

The primary air tank is located above R.H. wheel of drive axle.

To increase primary air tank volume, a supplementary air tank is added in series to the primary air tank. This supplementary tank is located underneath vehicle forward of tag axle.

These tank are provided with a bottom drain valve (Fig. 25). It is recommended to purge them by their bottom drain valve every 12,500 miles (20 000 km) or once a year, whichever comes first.

11.2.3 Secondary Air Tank

This tank is located in front wheelhousing, between air springs. The tank is installed vertically and is provided with a bottom drain valve (Fig. 25).

It is recommended to purge the tank by its bottom drain valve, every 12,500 miles (20 000 km) or once a year, whichever comes first.

11.2.4 Accessory Air Tank

The accessory air tank is installed next to the secondary air tank. The tank is installed vertically and is provided with a bottom drain valve (Fig. 25).

It is recommended to purge the tank by its bottom drain valve, every 12,500 miles (20 000 km) or once a year, whichever comes first.

A remote drain valve is located in steering compartment (Fig. 28) at bottom of the accessory air filter. Refer to Section 12, paragraph "4. Accessory Air Filter" of the maintenance manual for daily purge procedure.



FIGURE 28: STEERING COMPARTMENT 12089M

11.2.5 Expansion Air Tank

Two expansion tanks are located in front wheelhousing. These air tanks are located behind secondary and accessory air tank. Also, six expansion tanks are located near rear air springs (Fig. 25). Expansion tanks are connected in series with air springs. Expansion tanks are used to lower the stiffness of the air spring. They are provided with a bottom drain valve.

It is recommended to purge them, with all other tanks, every 12,500 miles (20 000 km) or once a year, whichever comes first.

11.3 Air System Emergency Fill Valves

The vehicle is equipped with two air system emergency fill valves to supplement the air system when air pressure is low and engine cannot be operated.

The rear valve is located in engine compartment and accessible from engine R.H. side door. On XL-40 & XL-45E, the valve is positioned over battery assembly, close to door hinge (Fig. 29). On XL-45 vehicles, the valve is positioned under back up alarm, close to L.H. side of door opening (Fig. 30).



FIGURE 29: REAR VALVE LOCATION (XL-40 & XL-45E)
12010

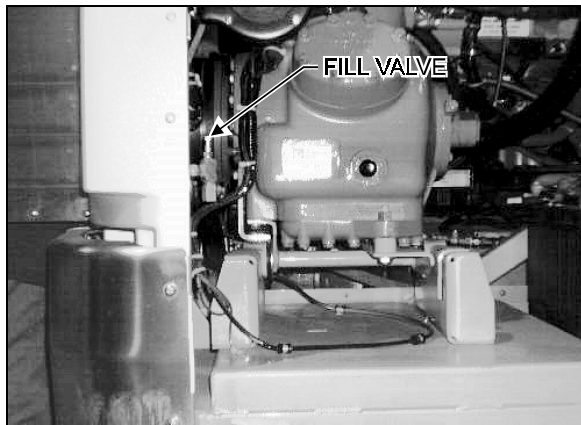


FIGURE 30: REAR VALVE LOCATION (XL-45) 12016

Caution: No other point should be used to supply air system. The maximum allowable air pressure is 125 psi (860 kPa).

The front valve is located in the steering compartment close to accessory air filter (Fig. 31).

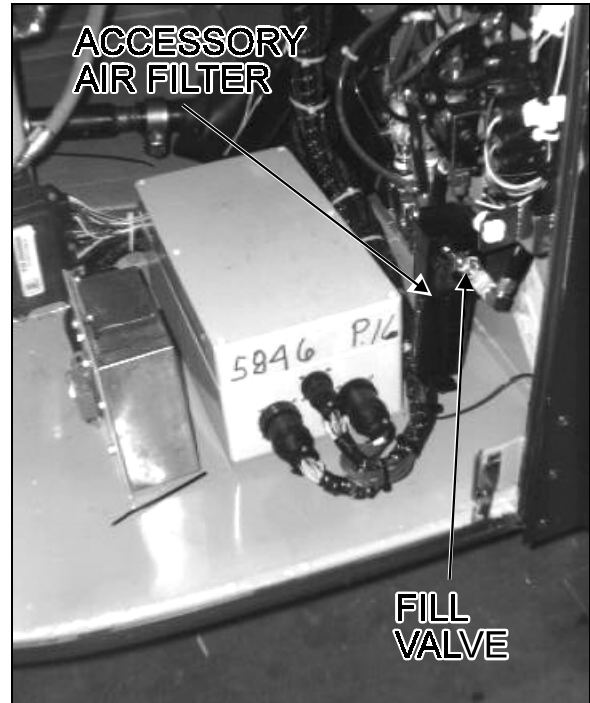


FIGURE 31: FRONT VALVE LOCATION 12089

These two air valves are fitted with the same valve stems as standard tires, and can be filled by any standard external air supply line.

The rear valve will supply air for all systems (brakes, suspension and accessories) while the front valve will supply air for accessories only.

Caution: Air filled through these two points will pass through the standard air filtering system provided by Prévost. Do not fill air through any other points.

12. AIR BRAKES

12.1 Disc Brakes

Knorr-Bremse SB7000 vented-type disc brakes are used on front wheels. The discs are actuated by 24 square inch effective area air brake chamber. The *Knorr-Bremse SB7000* brakes are supplied with automatic clearance (slack) adjusters as standard equipment for easier adjustment. For more information on disc brake components and maintenance, refer to the manufacturer's brochure at the end of this supplement.

12.1.1 Disc Brake Pads

Brake pads have to be checked on a regular basis depending on vehicle operation. The remaining thickness of the pads should never be less than 3/32 in (2 mm). To check pad condition without removing the wheel, verify the position of guide bushing relation to guide sleeve (Fig. 32). When guide sleeve is in alignment with guide bush, brake pad thickness has to be checked more precisely with wheel removed. When replacing the brake pads, all four pads on an axle have to be changed at the same time. There is no inner or outer pad, since all pads are the same.

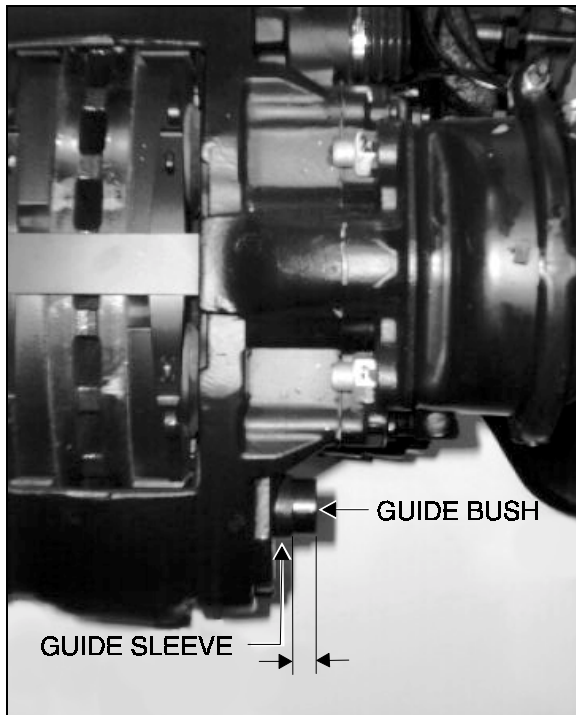


FIGURE 32: DISC BRAKE PADS CHECKING 12043

For information on how to change the brake pads, refer to the manufacturer's brochure, annexed to this supplement.

Note: While braking in new brake pads, avoid long brake applications as well as harsh braking.

13. BRAKE AIR CHAMBER

The front wheels are equipped with "Knorr-Bremse" brake chambers, used for service brake.

13.1 Maintenance

Refer to maintenance manual, Section 12, paragraph "16.2 Maintenance".

Caution: On Knorr-Bremse air chamber (front wheels), do not use molybdenumsulphite combined grease. Use brake chamber with inner sealing, and ensure that the o-ring is in the correct position between the brake caliper and brake chamber.

14. WHEELS AND TIRES

Either disc steel wheels or optional aluminum-polished wheels may be installed on the vehicle. Both are mounted with radial tubeless tires.

Both steel and aluminum wheel dimensions are 22.50 X 9 inches (571.5 X 228.6 mm) except the inner dual wheel dimensions 22.5 X 8.25 inches (571.5 X 209.5 mm).

Recommended tire dimensions (in order of preference):

- 315/80 R 22.5;
- 12.75/80 R 22.5;
- 12.00 R 22.5;
- 295/80 R 22.5;
- 11.00 R 24.5.

15. HUB UNIT AND SWIVEL ASSEMBLY MAINTENANCE

Refer to GKN AXLES LIMITED KIRKSTALL DIVISION, Service Manual, annexed at the end of this Supplement.

16. TORQUE TABLE

DESCRIPTION	QTY	REFERENCE	TORQUE (DRY)	
			lbf•ft	N•m
Steering Gear to Mounting Bracket Bolt Nut	6	8	350-400	475-542
Pitman Arm to Steering Gear Clamp Bolt	1	8	275-300	373-407
Drag Link to Pitman Arm Stud Nut*	1	---	160	217
Drag Link to Bell crank Stud Nut*	1	---	160	217
Drag Link Socket End Clamp Bolt Nut	2	---	60-80	80-108
Relay Rod to Bell crank Stud Nut*	1	---	160	217
Relay Rod to Idler Arm Stud Nut*	1	5	160	217
Tie Rod to Bell crank Stud Nut*	1	---	160	217
Tie Rod to Idler Arm Stud Nut*	1	5	160	217
Tie Rod to Steering Arm Stud Nut*	2	3	160-215	217-291
Tie Rod End Clamp Bolt Nut	4	3	60-80	80-108
Steering Arm to Swivel Nut*	4	---	190-275	258-373
Torque Rod Stud Nut	2	4	160-215	217-291
Idler Arm and Bell Crank Mounting Bracket Nut	8	5	100-110	136-149
Idler Arm and Bell Crank Cap Screws	8	9	8	11
Torque Rod Mounting Bracket Nut	4	6	215-230	291-312
Torque Rod Clamp Nut	4	4	53-59	72-80
Air Spring Nut	3	18	20-25	27-34
Upper A-Arm Stud Nut*	2	18	350-400	475-542
Lower A-Arm Bracket Nut	8	18	215-230	291-312
Jacking Point Bracket Nut	8	19	70-80	95-108
Shock Absorber Pin	2	19	350-400	475-545
Shock Absorber Pin Nut	2	19	70-80	95-110
Shock Absorber Mounting Stud Nut	2	19	70-80	95-110
Bushing Collar Nut	8	20	70-80	95-110
Sway Bar Link Upper Nut	2	20	215-225	290-305
Sway Bar Link Lower Nut	2	20	70-80	95-110
Sway Bar Pin	2	20	350-400	475-545

* Tighten nut to specified torque, then advance to next aligning cotter pin slot and install a new cotter pin.

17. SPECIFICATIONS

Front Axle Brake Chambers

Make..... Knorr-Bremse
Type..... 24
Effective diaphragm area ...24 sq.in. (154,8 sq.cm)
Supplier numberBS 3517 II/31651
Prévost number.....641309

Front Axle Air Springs

Make..... Goodyear Tire and Rubber
Diameter..... 12 inches
Air Inlet 1/2"- 14 NPTF
Supplier number..... 1R12-377
Prévost number.....630151

Shock Absorbers

Collapsed length..... 14.20 inches
Extended Length..... 22.45 inches
Piston diameter 2 1/16 inches
Stroke 8 ¼ inches
Prévost number.....630136

Height Control Valve

Make..... Knorr
Supplier number..... SV1269L 80086
Prévost number.....630139

Steering Gear Box

Make..... TRW
Supplier number..... TAS85081
Prévost number.....661008

Power Steering Hydraulic Pump

Make..... TRW
Supplier number..... PS251615L0200
Prévost number.....661009

Shim (Camber Adjustment)

Thickness3.175 mm
Prévost number..... 160993

Thickness6.35 mm
Prévost number..... 160992

GKN AXLES LIMITED KIRKSTALL DIVISION

SERVICE MANUAL

FOR AXLE TYPE S82

HUB UNIT AND SWIVEL ASSEMBLY

FITTED TO PRÉVOST'S
XL CONVERTED COACH SHELL
WITH INDEPENDENT SUSPENSION

REVISED BY PRÉVOST CAR INC.

CONTENTS

1. LUBRICATION	2
2. Routine Maintenance	3
3. HUB UNIT REMOVAL	3
4. STUB AXLE ASSEMBLY REMOVAL.....	3
4.1 Inspection	4
5. REFITTING STUB AXLE ASSEMBLY	4
6. SWIVEL BEARING ADJUSTMENT	4
7. SWIVEL FINAL ASSEMBLY.....	5
8. HUB UNIT ASSEMBLY	6
9. TORQUE TABLE	8
10. PARTS LIST	9

LIST OF ILLUSTRATIONS

FIG. 1: SWIVEL GREASING POINTS AND HUB OIL LUBRICATION.....	2
FIG. 2: METHOD OF CHECKING SWIVEL BEARING ADJUSTMENT	4
FIG. 3: TOP AND BOTTOM CAP	5
FIG. 4: PART SECTION THRO' TOP OF SWIVEL SHOWING GREASE SEEPAGE POSITION WHEN FULL.....	5
FIG. 5: PART SECTION THRO' BOTTOM OF SWIVEL SHOWING SEEPAGE POSITION WHEN FULL	5
FIG. 6: TO ADJUST HUB 'END FLOAT'	6
FIG. 7: HUB CAP AND HUB MATING FACES.....	7
FIG. 8: HUB UNIT AND STUB AXLE	12

1. LUBRICATION

Lubricate the top swivel bearing and the bottom swivel bush. They are provided with grease fitting for pressure lubrication (Fig. 1). These grease fittings should be serviced every 6,250 miles (10 000 km) or twice a year whichever comes first. Good quality lithium-base grease NLGI No. 2 (Shell Retinax LX or equivalent) is recommended.

Wheel hubs use oil lubrication which eliminates periodic grease repacking of the hubs. A sight glass is provided for convenient check of oil level. Oil level should be checked daily and must be maintained to the level mark in the sight glass. If oil is not visible through the sight glass, general purpose gear lubricant SAE 90 (A.P.I. spec. GL5) must be added by removing the fill plug in center of the hub cap to bring oil to the correct level. To check oil level after vehicle has been driven, wait at least 15 minutes to ensure that oil has settled. For hub unit removal or repairing, drain hub oil from drain plug (Fig. 1).

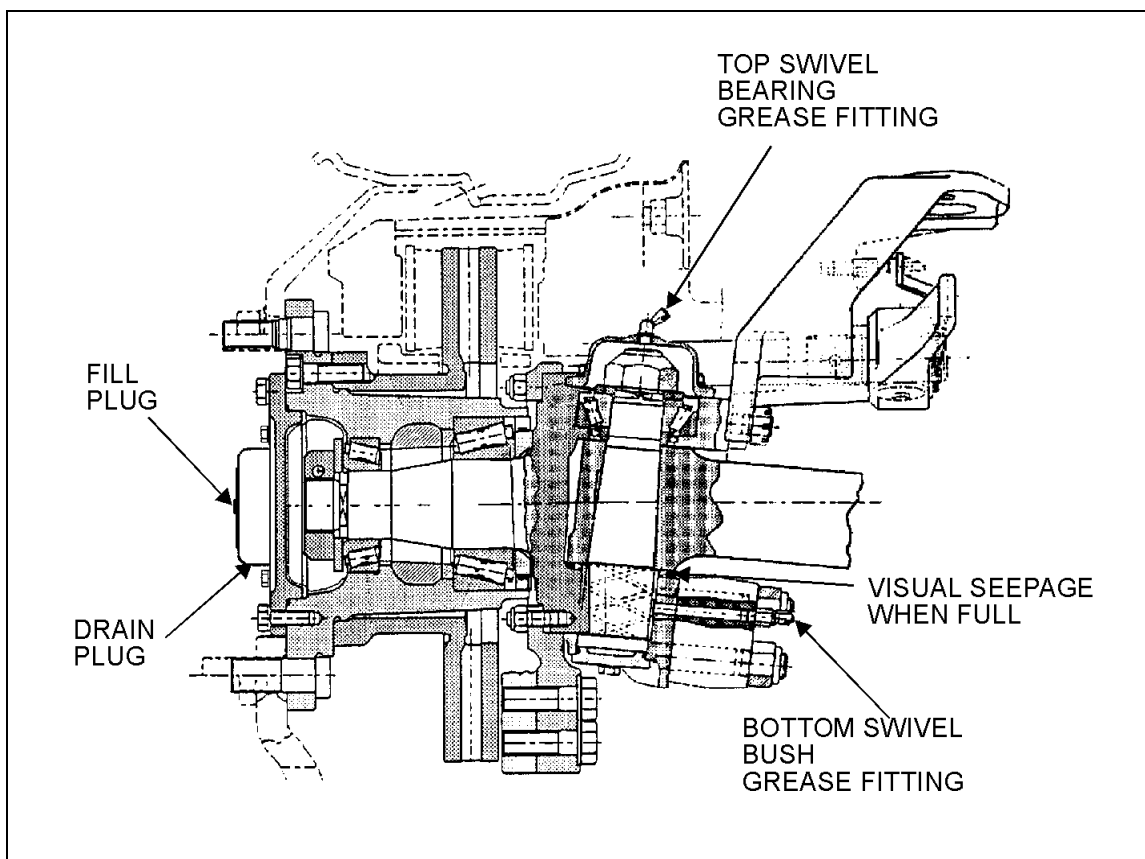


FIGURE 1: SWIVEL GREASING POINTS AND HUB OIL LUBRICATION

10016

2. ROUTINE MAINTENANCE

2.1 Hub Bearing Adjustment

An inspection should be made after the first 3,000 miles (4 800 km) and then at intervals of 25,000 miles (40 000 km). With the wheels raised they should revolve quite freely without roughness.

Hub bearings should have a slight end float movement within the limits 0.0005 to 0.002 inch when rocked forwards and backwards on stub axle. See paragraph "8. HUB UNIT ASSEMBLY", if any adjustment is required.

Caution: *Hub oil fill cap is provided with a very small vent hole. Occasionally insert a small tip to avoid hole restriction, as it prevents over pressure in bearing housing.*

3. HUB UNIT REMOVAL

1. Chock the appropriate wheels.
2. Whilst road wheels are still on ground, loosen wheel nuts slightly.
3. Raise vehicle, remove road wheel nuts and remove road wheels.
4. Disconnect air line from brake caliper (13, Fig. 8).
5. Remove brake caliper setscrews with washers (15 & 16, Fig. 8) then lift off brake caliper assembly (13, Fig. 8).
6. Drain the oil lubricated hub cap.
7. Remove hub cap setscrews and washers (1 & 2, Fig. 8).
8. Remove hub cap (3, Fig. 8) with 'O' ring (4, Fig. 8) then discard 'O' ring.
9. Remove hub bearing pinch bolt nut (5, Fig. 8) and bolt (66, Fig. 8), then remove hub bearing nut (67, Fig. 8) along with hub bearing washer (6, Fig. 8).
10. Remove hub (8, Fig. 8) complete with its bearings (11/11A & 64/64A, Fig. 8) and oil seal (12, Fig. 8) then lift off outer bearing cone (64A, Fig. 8).
11. Remove oil seal (12, Fig. 8) and inner bearing cone (11A, Fig. 8) from hub (8, Fig. 8).
12. Drive out hub bearing cups (11 & 64, Fig. 8) from hub (8, Fig. 8).
13. If hub bearing distance piece (oil seal wear sleeve) (60, Fig. 8) shows signs of wear or corrosion it must be removed and replaced with a new part.

4. STUB AXLE ASSEMBLY REMOVAL

1. Remove cotter pins and stud nuts which attach tie rod socket ends to bell crank and left steering arm (47, Fig. 8) or to idler arm and right steering arm. Remove tie rod ball stud by tapping on steering arm and bell crank or idler arm with a hammer, while using a heavy hammer as a backing.
2. Remove swivel top cap setscrews and washers (25 & 24, Fig. 8), enabling swivel top cap (23, Fig. 8) to be removed.
3. Remove sealant from top cap and swivel mating faces (23 & 58, Fig. 8) using Loctite 'Chisel Gasket Remover' or by carefully scraping sealant from faces.
4. Remove bottom cap setscrews and washers (53 & 54, Fig. 8).
5. Pull off swivel bottom cap (55, Fig. 8) then remove sealant from bottom cap and swivel mating faces (55 & 58, Fig. 8) using Loctite 'Chisel Gasket Remover' or by carefully scraping sealant from faces.
6. Remove swivel pin nut and washer (22 & 21, Fig. 8).
7. Give axle beam (37, Fig. 8) a sharp tap to loosen swivel pin (56, Fig. 8). The swivel pin (56, Fig. 8) can then be driven out downwards, thus releasing it from axle beam.
8. The swivel assembly can be removed from axle beam (56, Fig. 8).
9. Take out swivel pin bearing (20/20A, Fig. 8), swivel bearing adjustment shims (19, Fig. 8), swivel bearing sleeve (17, Fig. 8) and swivel pin oil seal (18, Fig. 8) from top of swivel (58, Fig. 8).
10. Take out swivel bush seal (52, Fig. 8) and swivel pin bush (57, Fig. 8) from bottom of swivel (58, Fig. 8).

11. Check the condition of swivel stop nut (33, Fig. 8), and adjusting washer (32, Fig. 8), removing for replacement if required.

4.1 Inspection

Thoroughly clean all parts, inspect for wear and renew if required.

5. REFITTING STUB AXLE ASSEMBLY

1. Prior to assembly, pack swivel pin bearing (20/20A, Fig. 8) with lithium base grease (Shell Retinax LX or equivalent) using a bearing packer or manually knead grease between rollers, race and cage.
2. Coat all internal surfaces / parts with clean gear oil.
3. Fit swivel pin top oil seal (18, Fig. 8), open side first, into position in top swivel bore (58, Fig. 8).
4. Fit swivel pin bearing cup (20, Fig. 8) into position in swivel bore (58, Fig. 8).
5. Press swivel pin bottom bush (57, Fig. 8) into position in swivel bore (58, Fig. 8) flush with bottom face of swivel.
6. Fit swivel bush seal (52, Fig. 8) onto the protruding diameter of swivel pin bottom bush (57, Fig. 8) then place dirt excluder (78, Fig. 8) into position over seal.
7. Position swivel assembly onto axle beam (37, Fig. 8).

Note: Care must be taken during this operation so as not to roll or trap swivel bush seal (52, Fig. 8). Suggest a thin piece of card or plastic places on seal during this operation. Make sure that swivel pin bore is free of burrs and corrosion, then grease bore with multi purpose chassis grease.

1. Drive swivel pin (56, Fig. 8) through swivel (58, Fig. 8) and axle beam (37, Fig. 8).
2. Lubricate swivel pin bearing sleeve (17, Fig. 8) with clean oil / grease then fit over protruding swivel pin (56, Fig. 8), large chamfer first to locate in oil seal bore (18, Fig. 8) and abut upright (37, Fig. 8).

3. Select swivel bearing adjustment shims (19, Fig. 8) with total thickness of approximately 0.020 inch and place in position on top swivel bearing sleeve (37, Fig. 8).
4. Fit swivel pin cone (20A, Fig. 8) into swivel pin bearing cup (20, Fig. 8).
5. Fit swivel pin washer (21, Fig. 8) and swivel pin nut (22, Fig. 8) then tighten nut to 500-700 lbf•ft (678-949 N•m).
6. Using a 7/14 lb hammer, shock load axle beam (37, Fig. 8) on forged end area.

6. SWIVEL BEARING ADJUSTMENT

With nominal shim (19, Fig. 8) thickness of 0.020 inch placed between bearing (20/20A, Fig. 8) and bearing sleeve (17, Fig. 8), attach a cord and spring balance capable of reading 25 lbs (11,5 kg) to end of stub axle (58, Fig. 8) as shown in figure 2. Pull swivel from lock to lock, noting spring balance reading, ignoring the force needed to start movement. The correct reading should be between 12 to 24 lbs (5,5 to 11 kg) pull giving 10-20 lbf•ft (13,6-27 N•m). If the reading is outside these limits, it will be necessary to alter shim thickness (19, Fig. 8) between bearing cone (20A, Fig. 8) and its sleeve (17, Fig. 8).

To increase the load required, remove shims from nominal pack.

To decrease the force required, add shims to the nominal pack.

Add or subtract shims as required until a reading of 10-20 lbf•ft (13,6-27 N•m) is obtained.

When swivel is set correctly, check that swivel pin nut (22, Fig. 8) is tightened to 500-700 lbf•ft (678-949 N•m) torque.

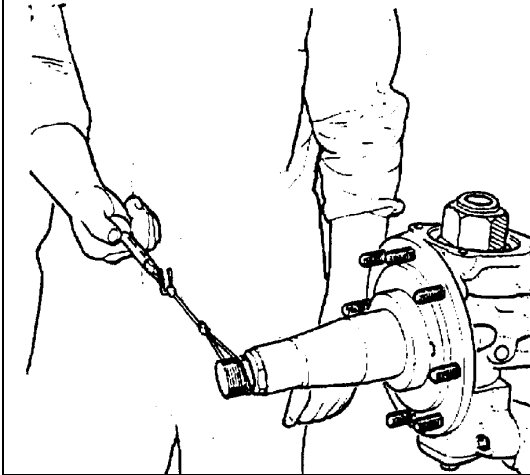


FIGURE 2: METHOD OF CHECKING SWIVEL BEARING ADJUSTMENT 10017

7. SWIVEL FINAL ASSEMBLY

1. Apply a thin layer 1/16" (1,5 mm) of lithium base grease (Shell Retinax LX or equivalent) to the inside of swivel top cap (23, Fig. 8).
2. Clean top cap and swivel mating faces (23 & 58, Fig. 8) with Loctite Superclean safety Solvent no. 706 or other suitable chlorinated solvent then apply a complete 1/8" bead of Loctite Superflex (black) around base of top cap (23, Fig. 8) before fitting to swivel (58, Fig. 8) within 5 minutes of applying Loctite. See figure 3.
3. Secure top cap (23, Fig. 8) with swivel top cap setscrews and washers (25 & 24, Fig. 8) and tighten to 51- 62 lbf•ft (69-84 N•m).
4. Clean bottom cap and swivel mating faces (55 & 58, Fig. 8) with Loctite Superclean Safety Solvent no. 706 or other suitable chlorinated solvent then apply a complete 1/8" bead of Loctite Superflex (black) around base of bottom cap (55, Fig. 8) before fitting to swivel (58, Fig. 8) within 5 minutes of applying Loctite. See figure 3.

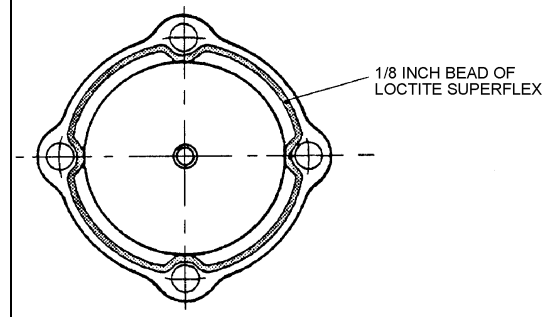


FIGURE 3: TOP AND BOTTOM CAP 10018

5. Secure bottom cap (55, Fig. 8) with swivel bottom cap setscrews and washers (53 & 54, Fig. 8) then tighten to 26-32 lbf•ft (33-35 N•m).
6. Check that tightening torque of top steering arm studs (28, Fig. 8) is between limits of 190-210 lbf•ft (258-285 N•m).
7. Fit top steering arm (29, Fig. 8) onto studs (28, Fig. 8) then fit nuts (30, Fig. 8) and tighten to 190-275 lbf•ft (258-353 N•m).
8. Fit new lubricators (26, Fig. 8) with protective caps (27, Fig. 8) into their respective positions in swivel top cap (23, Fig. 8).
9. Charge swivel assembly with grease. Swivel is full when grease seeps from between upper face of axle beam (37, Fig. 4) and swivel jaw (58, Fig. 4) in top half and from between swivel oil seal (58, Fig. 5) and lower face of axle beam (37, Fig. 5).

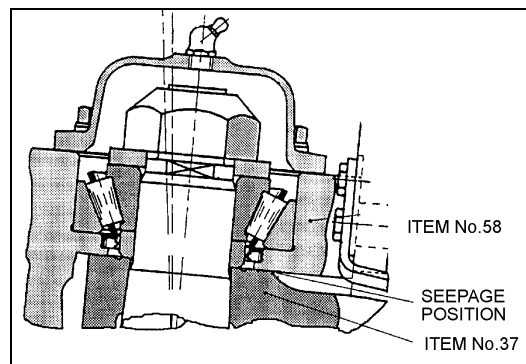


FIGURE 4: PART SECTION THRO' TOP OF SWIVEL SHOWING GREASE SEEPAGE POSITION WHEN FULL 10019

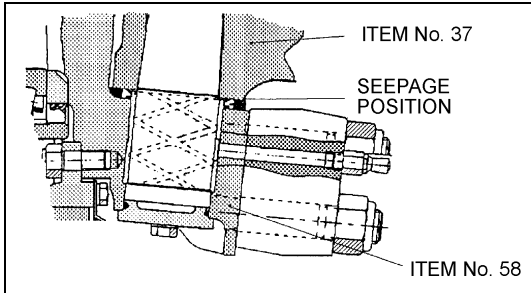


FIGURE 5: PART SECTION THRO' BOTTOM OF SWIVEL SHOWING GREASE SEEPAGE POSITION WHEN FULL
10020

12. Position ball studs on socket ends of tie rod in holes in steering arm and bell crank or idler arm. Install a ball stud nut on each stud and tighten firmly to seat the tapered seat.
13. Use a torque wrench to tighten stud nuts to 160-215 lbf•ft (217-291 N•m) torque. Advance nut to next aligning cotter pin slot and install a new cotter pin.

Note: Adjust toe-in as directed in paragraph "TOE-IN ADJUSTMENT" of the PRÉVOST CAR INC. MAINTENANCE MANUAL.

Note: If tie rod is not properly aligned with stud, binding will result.

8. HUB UNIT ASSEMBLY

1. Fit hub bearing distance piece (60, Fig. 8) onto swivel stub axle (58, Fig. 8).
2. Fit inner and outer hub bearing cups (11 & 64, Fig. 8) onto their bores in hub (8, Fig. 8).
3. Fit inner hub bearing cone (11A, Fig. 8) into its cup in hub (8, Fig. 8).
4. Press hub oil seal (12, Fig. 8) into position in hub (8, Fig. 8) using a suitable bumper tool which locates on outer part of seal to prevent damage on assemble.
5. Fit hub assembly onto swivel stub axle (58, Fig. 8).
6. Fit outer bearing cone (64A, Fig. 8) into its cup (64, Fig. 8).
7. Fit hub bearing washer and hub bearing nut (6 & 67, Fig. 8). Tighten nut hard with the aid of a small tommy bar just enough to take up bearing slack.

8. Fit hub bearing nut pinch bolt and nut (66 & 5, Fig. 8), tighten finger tight.
9. **Adjust 'End Float' as follows :** Rotate hub and using a hide faced mallet, knock hub backwards and forwards along axle arm to 'Shock Load' and thus settle bearings in position.

Note: It is very important to rotate and 'shock load' the hub because :

- ◆ The rotation serves to ensure that bearing rollers settle into running in their correct tracks.
- ◆ The 'Shock Load' is to ensure that bearings are seated correctly up to their abutment shoulders.
- ◆ Test the tightness of hub bearing nut (67, Fig. 8), if loose, re-tighten hard.
- ◆ Rotate and 'Shock Load' the hub again.
- ◆ Continue this procedure until hub bearing nut (67, Fig. 8) cannot be tightened further after hub has been rotated and 'Shock Loaded'.
- ◆ Back off hub bearing nut (67, Fig. 8) by approximately 30° then rotate again and knock hub outward along axle arm to release bearings.
- ◆ Mount a dial indicator on hub flange (8, Fig. 8) and position its pointer on end of axle stub. See figure 6.
- ◆ Rock the hub backwards and forwards along axle arm, taking a reading on dial indicator.
- ◆ The correct 'End Float' is between limits 0.0005 inch to 0.002 inch (0,013 to 0,050 mm).
- ◆ Tighten the hub bearing pinch bolt nut (5, Fig. 8) to 24-26 lbf•ft (33-35 N•m).

- ◆ Check the 'End Float' again, using above procedure, and adjust if outside specified limits.

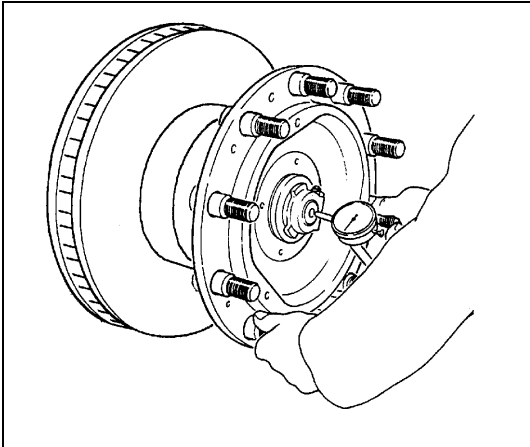


FIGURE 6: TO ADJUST HUB 'END FLOAT' 10021

10. Clean hub cap and hub mating faces (3 & 8, Fig. 8) with Loctite Superclean Safety Solvent no. 706 or other suitable chlorinated solvent then apply a complete 1/8 inch bead of Loctite Superflex (black) around mating face of hub cap (3, Fig. 8). See figure 7.

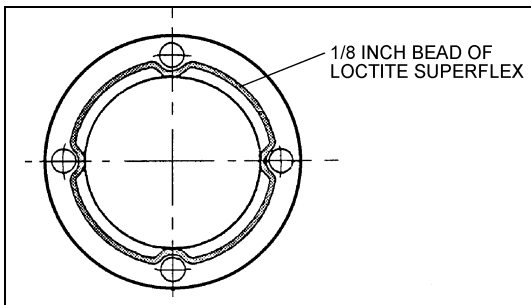


FIGURE 7: HUB CAP AND HUB MATING FACES
10022

12. Fit hub cap along (3, Fig. 8) within 5 minutes of applying sealant then secure with hub cap setscrews and washers (1 & 2, Fig. 8) tightening setscrews to 85-103 lbf•ft (115-140 N•m).
13. Fill the oil lubricated oil cap. See paragraph "1. LUBRICATION" of this manual.

9. TORQUE TABLE

ITEM No	DESCRIPTION	TORQUE (DRY)	
		lbf•ft / N•m	
1	Hub Cap Setscrew	85-103	115-140
5	Hub Pinch Bolt Nut	24-26	33-35
7	Wheel Nut	475-525	644-712
16	Brake Caliper Setscrew	310-340	420-461
22	Swivel Pin Nut	500-700	678-949
25	Top Cap Setscrew	51-62	69-84
28	Top Steering Arm Stud	190-210	258-285
30	Top Steering Arm Nut	190-275	258-373
31	Caliper Bracket Nut	85-103	115-140
47	Ball Socket Nut	160-215	217-291
53	Bottom Cap Setscrew	26-32	35-43
59	Caliper Bracket Stud	51-62	69-84
62	Caliper Bracket Nut	85-103	115-140
65	Brake Disc Capscrew	295-325	400-441

10. PARTS LIST

ITEM No	DESCRIPTION	QTY/AXLE
1	Hub Cap Setscrew	8
2	Hub Cap Spring Washer	8
3	Hub Cap	2
4	Hub Cap 'O' Ring	2
5	Bearing Nut Pinch Nut	2
6	Hub Bearing 'D' Washer	2
7	Wheel Stud Protective Cover	20
8	Hub	2
9	Wheel Stud R.H.	10
	Wheel Stud L.H.	10
10	Pole Wheel	2
11	Hub Outer Bearing Cup	2
11A	Hub Outer Cone	2
12	Hub Oil Seal	2
13	Brake Caliper R.H.	1
	Brake Caliper L.H.	1
14	Caliper Mounting Bracket R.H.	1
	Caliper Mounting Bracket L.H.	1
15	Brake Caliper Retaining Washer	12
16	Brake Caliper Retaining Bolt	12
17	Swivel Pin Bearing Sleeve	2
18	Swivel Pin Oil Seal	2
19	Adjusting Shim (0.005 inch)	as required
	Adjusting Shim (0.010 inch)	as required
	Adjusting Shim (0.015 inch)	as required
	Adjusting Shim (0.008 inch)	as required
	Adjusting Shim (0.006 inch)	as required

20	Swivel Bearing Cup	2
20A	Swivel Bearing Cone	2
21	Swivel Pin 'D' Washer	2
22	Swivel Pin Nut	2
23	Top Cap	2
24	Top Cap Setscrew Spring Washer	8
25	Top Cap Setscrew	8
26	Lubricator	2
27	Lubricator Protective Cap	2
28	Top Steering Arm Stud L.H.	2
	Top Steering Arm Stud R.H.	2
29	Top Steering Arm (L.H.)	1
30	Top Steering Arm Nut	4
31	Brake Caliper Bracket Nut	6
32	Stop Screw Adjusting Washer	as required
33	Swivel Stop Screw L.H.	1
	Swivel Stop Screw R.H.	2
34	Supplied Within Item 58	
35	Clamping Bush	1
36	Sensor	1
37	Upright	1
40	Lubricator	2
41	Lubricator Protective Cap	2
43	Oil Lubricated Hub Cap Setscrew	6
44	Oil Lubricated Hub Cap	1
47	Ball Socket Nut	2
52	Swivel Pin Seal (upper) ('V' ring)	2
53	Bottom Cap Setscrew	4
54	Spring Washer	4

55	Swivel Bottom Cap	2
56	Swivel Pin	2
57	Swivel Pin Bottom Bush	2
58	Swivel Assembly L.H.	1
	Swivel Assembly R.H.	1
59	Brake Caliper Bracket Stud	10
60	Hub Bearing Distance Piece	2
61	Brake Caliper Bracket Bolt	6
62	Brake Caliper Bracket Nut	10
63	Brake Disc	2
64	Hub Inner Bearing Cup	2
64A	Hub Inner Bearing Cone	2
65	Brake Disc Capscrew	20
66	Bearing Nut Pinch Bolt	2
67	Hub Bearing Nut	2

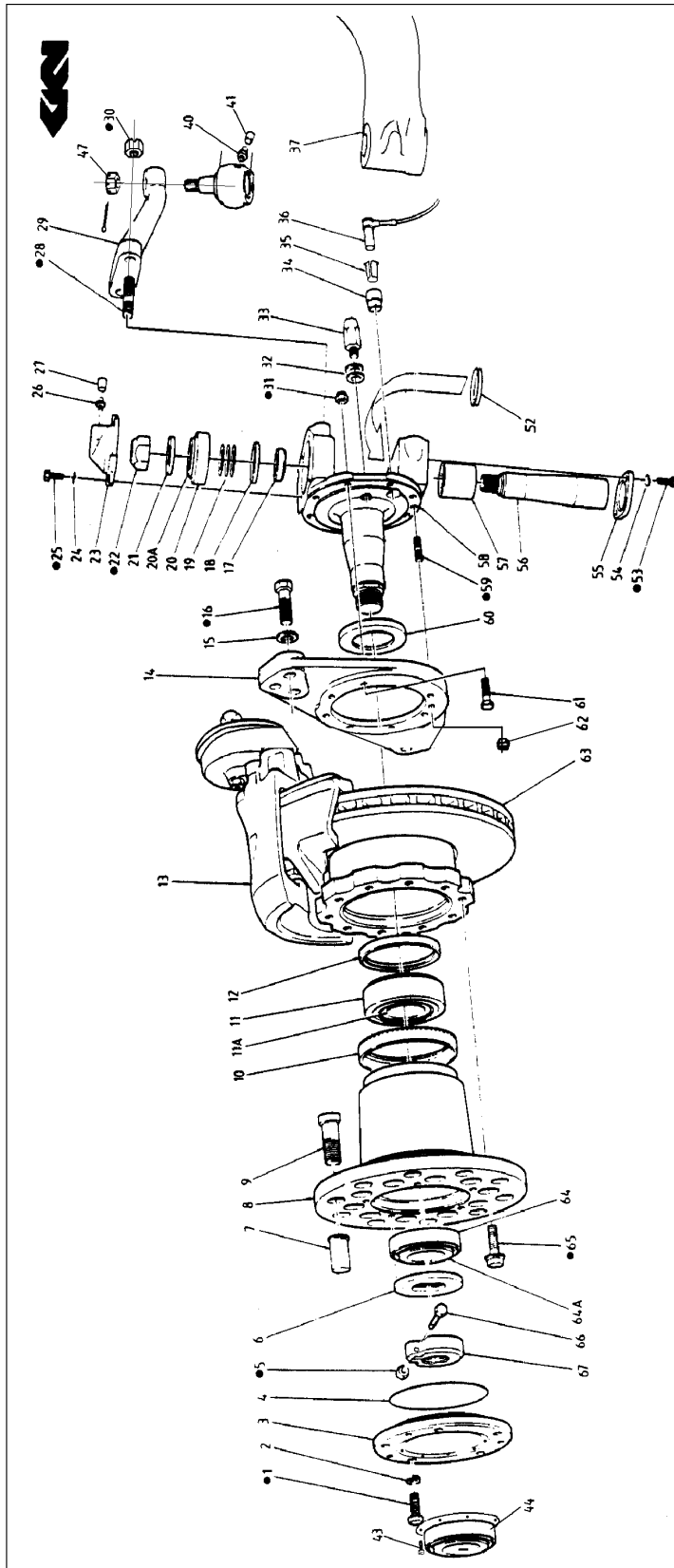


FIGURE 8: HUB UNIT AND STUB AXLE

10023

SECTION 18: BODY

CONTENTS

1. EXTERIOR COMPARTMENT DOORS	18-4
1.1 XL-40 Converted Vehicle	18-4
1.2 XL-45 Converted Vehicle	18-5
1.3 XL-45E Converted Vehicle	18-6
1.4 XL-40 Coach	18-7
1.5 XL-45 Coach	18-8
2. STRUCTURE	18-9
2.1 Description	18-9
2.2 Welding	18-9
3. EXTERIOR MAINTENANCE	18-9
3.1 Corrosion Prevention	18-9
4. FIBERGLASS REPAIR	18-10
4.1 Repair with Fiberglass Cloth	18-10
4.2 Repair with Fiberglass Paste	18-11
4.3 Typical Fiberglass Repair Procedure	18-11
5. PAINTING	18-12
5.1 Safety	18-12
5.2 Surface Preparation	18-12
5.2.1 Aluminum and Stainless Steel Surfaces	18-12
5.2.2 Fiberglass Surface	18-12
5.2.3 Washing	18-13
5.3 Primer Application	18-13
5.3.1 Aluminum and Stainless Steel Surfaces	18-13
5.3.2 Fiberglass Surface	18-13
5.4 Painting	18-13
5.4.1 PPG Paint Application	18-13
5.4.2 PPG Clear Application	18-13
6. DECAL APPLICATION	18-14
7. EXTERIOR REAR VIEW MIRRORS	18-14
7.1 Cleaning	18-14
7.2 Manual Mirror Adjustment	18-15
8. ENTRANCE DOOR	18-15
8.1 Coach Entrance Door	18-15
8.1.1 Operation	18-15
8.1.2 Adjustments	18-16
8.1.3 3-Way Air Valve	18-16
8.1.4 Door Control Rod	18-16
8.1.5 Door Control Handle	18-17
8.1.6 Door Adjustment	18-17
8.2 Converted Vehicle Entrance Door	18-17

Section 18: BODY

8.2.1	Operation	18-17
8.2.2	Door Adjustment	18-17
9.	BAGGAGE COMPARTMENT DOORS.....	18-17
9.1	Door Removal.....	18-18
9.2	Pantograph Arms Removal and Installation.....	18-18
9.3	Door Installation.....	18-18
10.	SIDE WINDOWS	18-19
10.1	Adjustment of Emergency Exit Windows (Coach)	18-19
10.2	Glass Replacement (Converted Vehicle).....	18-20
10.3	Glass Replacement (Coach)	18-20
10.3.1	Removal.....	18-20
10.3.2	Installation	18-20
11.	WINDSHIELD.....	18-21
11.1	Removal.....	18-21
11.2	Installation.....	18-21
12.	ADHESIVE MOUNTED WINDOWS (Driver's & Entrance Door Window - Converted Vehicle)	18-22
12.1	Replacement.....	18-22
13.	ROOF ESCAPE HATCH	18-24
13.1	Maintenance	18-24
13.2	Repair.....	18-24
13.3	Sealing	18-24
13.4	Removal and Installation	18-25
14.	PASSENGER SEATS.....	18-25
14.1	Rotating Seat	18-25
14.2	Removing Fixed Seats	18-25
15.	UPHOLSTERY MAINTENANCE	18-26
15.1	Routine Cleaning	18-26
15.2	Dry Cleaning	18-26
15.3	Cleaning With Covers in Place.....	18-26
16.	VEHICLE JACKING POINTS	18-27
16.1	Body Jacking Point	18-28
16.2	Axle Jacking Points	18-29
16.3	Jacking the Tag Axle	18-29
17.	TOWING THE VEHICLE	18-29
17.1	Lifting and Towing.....	18-29
17.2	Towing Without Lifting	18-30

LIST OF ILLUSTRATIONS

FIG. 1: EXTERIOR COMPARTMENT DOOR (XL-40 CONVERTED VEHICLE)	18-4
FIG. 2: EXTERIOR COMPARTMENT DOOR (XL-45 CONVERTED VEHICLE)	18-5
FIG. 3: EXTERIOR COMPARTMENT DOOR (XL-45E CONVERTED VEHICLE)	18-6
FIG. 4: EXTERIOR COMPARTMENT DOOR (XL-40 COACH).....	18-7
FIG. 5: EXTERIOR COMPARTMENT DOOR (XL-45 COACH).....	18-8
FIG. 6: FIBERGLASS REPAIR	18-11
FIG. 7: FIBERGLASS REPAIR	18-11
FIG. 8: FIBERGLASS REPAIR	18-12
FIG. 9: FIBERGLASS REPAIR	18-12
FIG. 10: FIBERGLASS REPAIR	18-12
FIG. 11: STANDARD MIRROR	18-14
FIG. 12: OPTIONAL "RAMCO" MIRROR	18-14
FIG. 13: MIRROR ASSEMBLY	18-15
FIG. 14: DOOR OPENING HANDLE	18-15
FIG. 15: DOOR LOCK CYLINDER	18-16
FIG. 16: ENTRANCE DOOR.....	18-16
FIG. 17: HINGE	18-17
FIG. 18: DOOR LOCK CYLINDER	18-17
FIG. 19: BAGGAGE COMPARTMENT DOOR.....	18-17
FIG. 20: BAGGAGE COMPARTMENT DOOR.....	18-19
FIG. 21: PULLING BRACKET	18-19
FIG. 22: EMERGENCY EXIT WINDOW	18-19
FIG. 23: LATCH AND ROLLER ASSEMBLY	18-20
FIG. 24: SIDE WINDOW GLASS ASSEMBLY	18-20
FIG. 25: WINDSHIELD	18-21
FIG. 26: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE)	18-22
FIG. 27: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE)	18-23
FIG. 28: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE)	18-23
FIG. 29: ROOF ESCAPE HATCH.....	18-24
FIG. 30: ROOF ESCAPE HATCH.....	28-24
FIG. 31: PASSENGER SEAT FRAME HOLDING	18-26
FIG. 32: PASSENGER SEAT FRAME.....	18-26
FIG. 33: BODY JACKING POINTS (UNDER VEHICLE VIEW)	18-28
FIG. 34: FRONT AXLE	18-29
FIG. 35: DRIVE AXLE.....	18-29
FIG. 36: TAG AXLE	18-29

1. EXTERIOR COMPARTMENT DOORS

The following figures identify all exterior compartments and access doors.

1.1 XL-40 Converted Vehicle

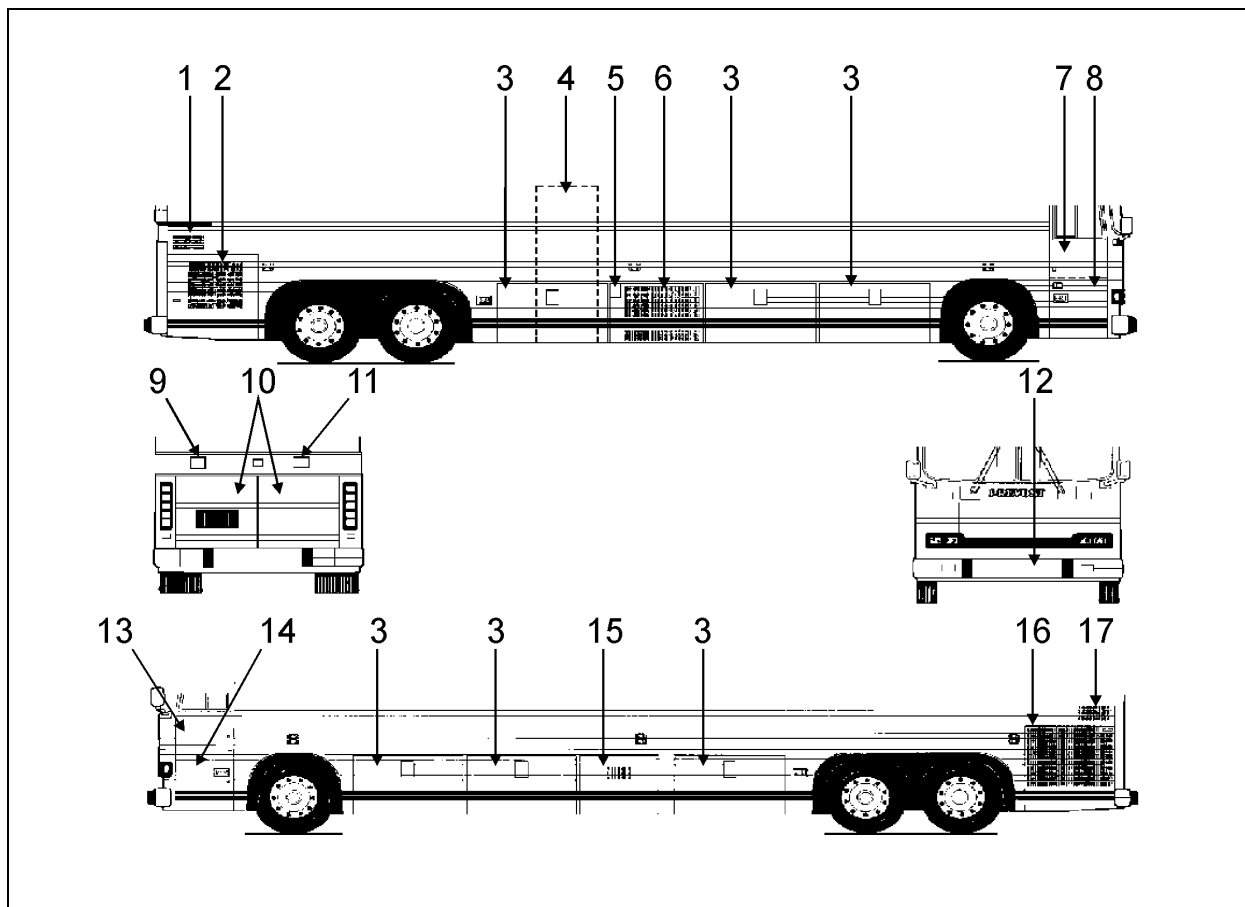


FIGURE 1: EXTERIOR COMPARTMENT DOORS (XL-40 CONVERTED VEHICLE)

18030

- | | |
|--------------------------------------|---|
| 1. Engine air intake duct | 10. Engine rear doors |
| 2. Engine compartment R.H. side door | 11. Engine oil reserve tank filling (block heater plug) |
| 3. Baggage compartment | 12. Reclining bumper compartment |
| 4. Central door (Optional) | 13. Front electrical compartment |
| 5. Fuel tank filling door | 14. Steering compartment |
| 6. Condenser or Baggage compartment | 15. A/C & heating or Baggage compartment |
| 7. Front entrance door | 16. Engine L.H. side door |
| 8. Right front storage compartment * | 17. Engine air intake duct |
| 9. Coolant surge tank filling door | |

* - (Optional) - Only on vehicles equipped with a central door and no entrance door.

1.2 XL-45 Converted Vehicle

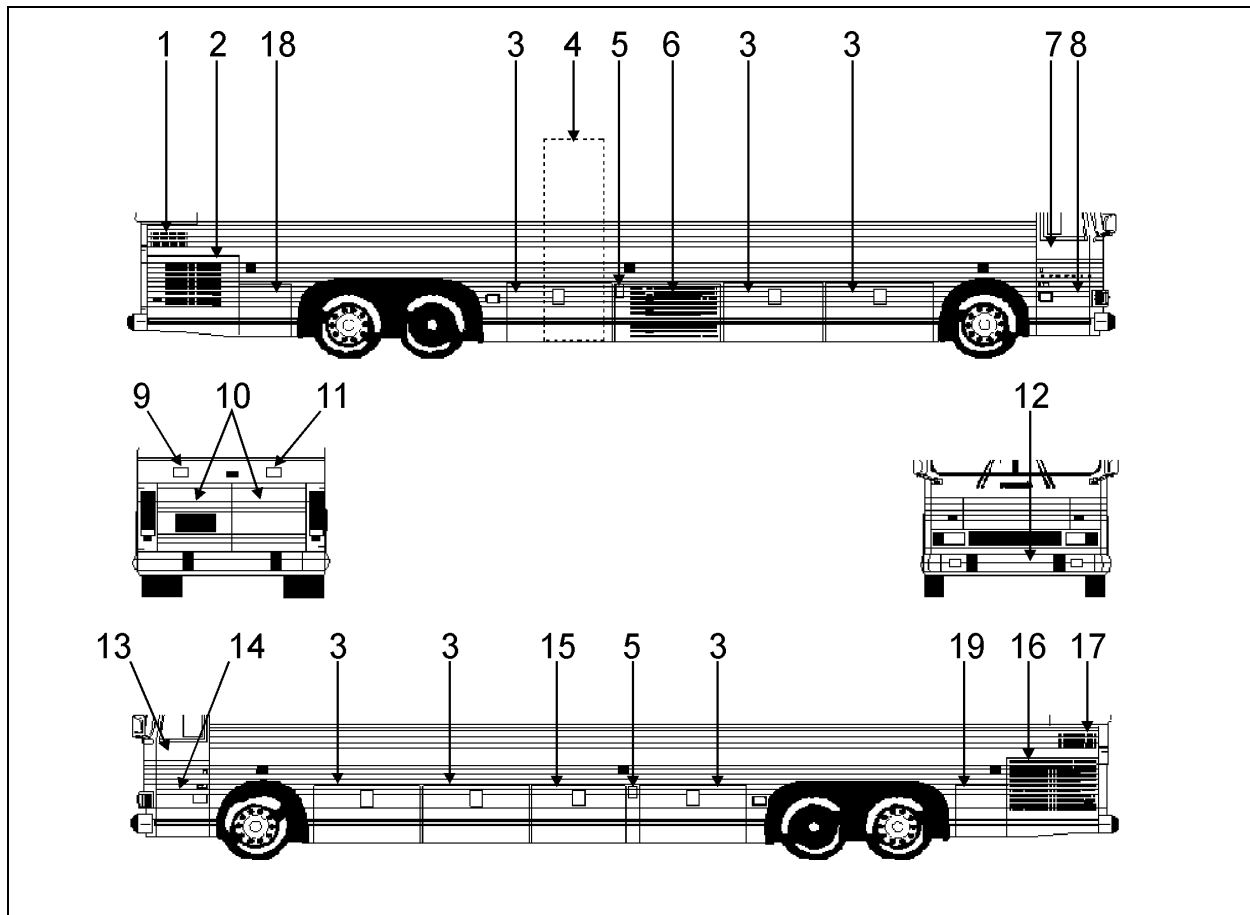


FIGURE 2: EXTERIOR COMPARTMENT DOORS (XL-45 CONVERTED VEHICLE)

18031

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Engine air intake duct 2. Engine R.H. side door 3. Baggage compartment 4. Central door (Optional) 5. Fuel tank filling door 6. Condenser or baggage compartment 7. Front entrance door 8. Right front storage compartment * 9. Coolant surge tank filling door | <ul style="list-style-type: none"> 10. Engine rear doors 11. Engine oil reserve tank filling (block heater plug) 12. Reclining bumper compartment 13. Front electrical compartment 14. Steering compartment 15. A/C & heating or baggage compartment 16. Engine L.H. side door 17. Engine air intake duct 18. R.H. side rear service compartment 19. L.H. side rear service compartment |
|---|---|

* - (Optional) - Only on vehicles equipped with a central door and no entrance door.

1.3 XL-45E Converted Vehicle

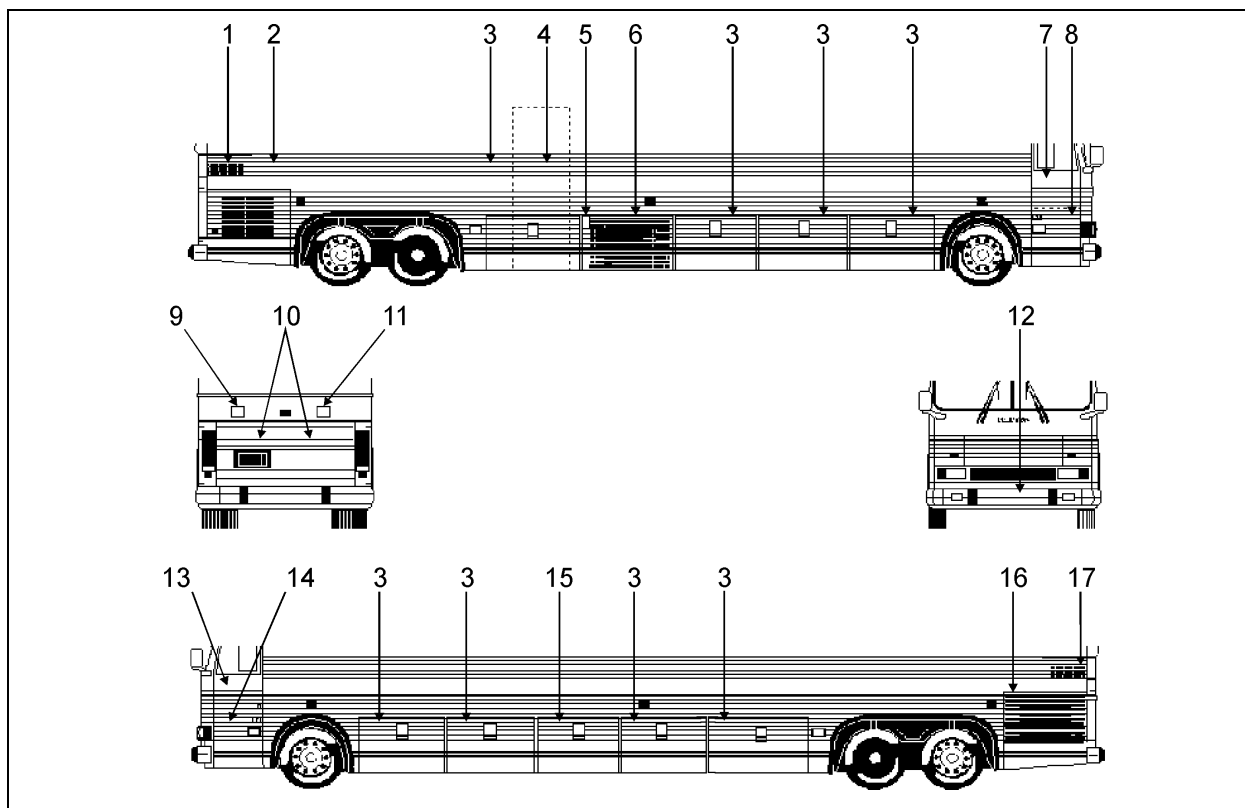


FIGURE 3: EXTERIOR COMPARTMENT DOORS (XL-45E CONVERTED VEHICLE)

18032

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Engine air intake duct 2. Engine R.H. side door 3. Baggage compartment 4. Central door (Optional) 5. Fuel tank filling door 6. Condenser or baggage compartment 7. Front entrance door 8. Right front storage compartment * 9. Coolant surge tank filling door | <ul style="list-style-type: none"> 10. Engine rear doors 11. Engine oil reserve tank filling (block heater plug) 12. Reclining bumper compartment 13. Front electrical compartment 14. Steering compartment 15. A/C & heating or baggage compartment 16. Engine L.H. side door 17. Engine air intake duct |
|---|---|

* - (Optional) - Only on vehicles equipped with a central door and no entrance door.

1.4 XL-40 Coach

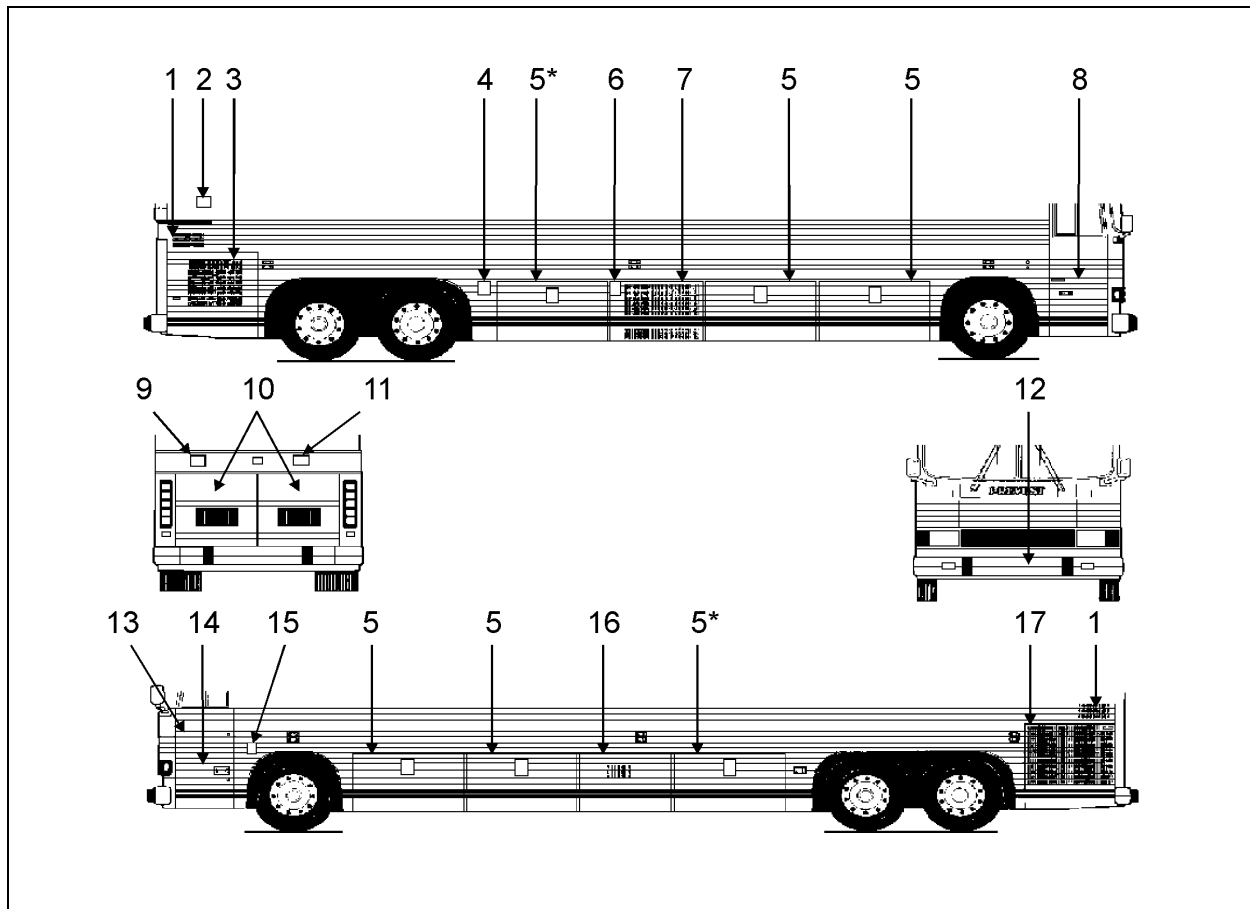


FIGURE 4: EXTERIOR COMPARTMENT DOORS (XL-40 COACH)

18030A

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Engine air intake duct 2. Lavatory access door 3. Engine R.H. side door 4. Main battery disconnect switch door 5. Baggage compartment
(* = Access to battery compartment) 6. Fuel tank filling door 7. Condenser or baggage compartment 8. Entrance door 9. Coolant surge tank filling door | <ul style="list-style-type: none"> 10. Engine rear doors 11. Engine oil reserve tank filling (block heater plug & water heater plug (optional)) 12. Spare wheel & tire compartment 13. Front electrical compartment 14. Steering compartment 15. 100 volts interior lighting (Optional) 16. A/C & Heating or baggage compartment 17. Engine L.H. side door |
|--|--|

1.5 XL-45 Coach

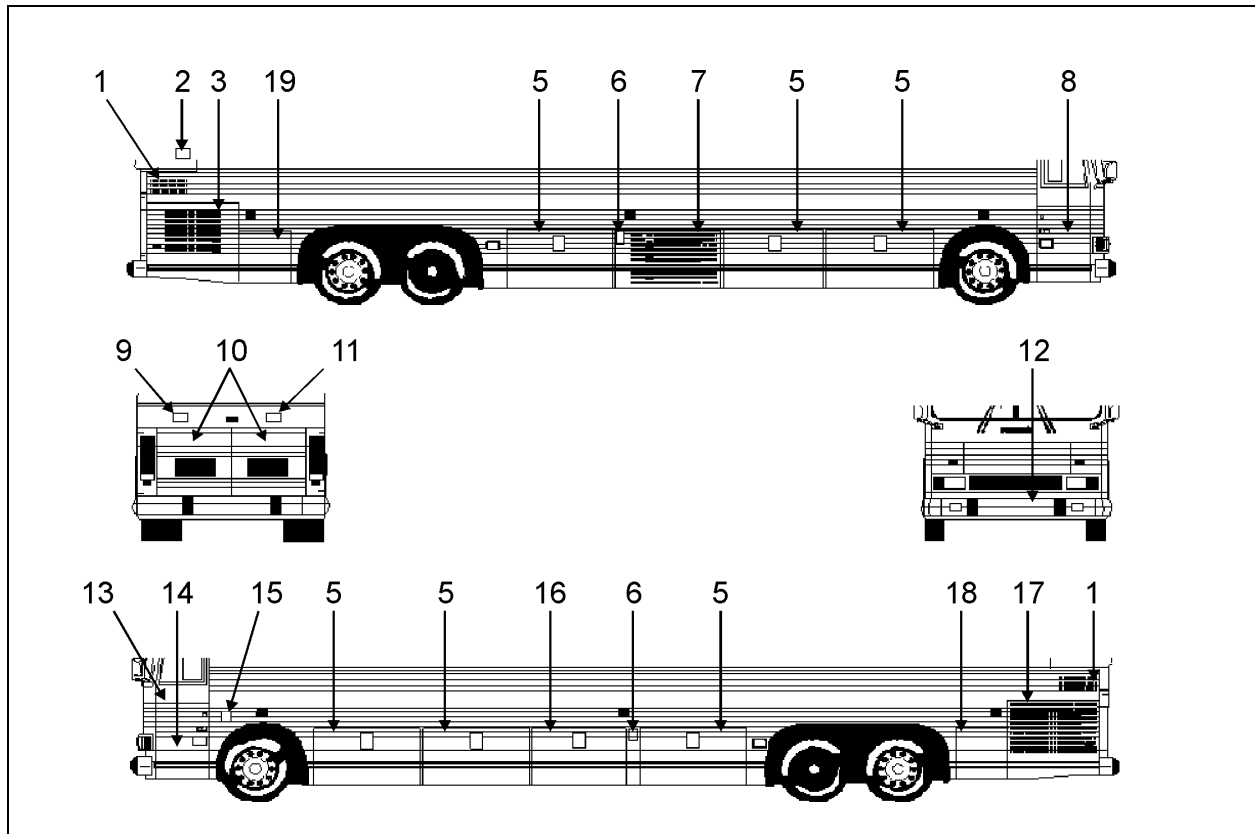


FIGURE 5: EXTERIOR COMPARTMENT DOORS (XL-45 COACH)

18031A

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Engine air intake duct 2. Lavatory access door 3. Engine R.H. side door 4. N/A 5. Baggage compartment 6. Fuel tank filling door 7. Condenser or baggage compartment 8. Entrance door 9. Coolant surge tank filling door | <ul style="list-style-type: none"> 10. Engine rear doors 11. Engine oil reserve tank filling (block heater plug & water heater plug (optional)) 12. Spare wheel & tire compartment 13. Front electric compartment 14. Steering compartment 15. 100 volts interior lighting (Optional) 16. A/C & Heating or baggage compartment 17. Engine L.H. side door 18. L.H. side rear service compartment 19. Main power compartment |
|--|--|

2. STRUCTURE

2.1 Description

The body of all XL vehicles is an integral structure made of 14, 16 and 18 gauge welded and braced high tensile steel and stainless steel members. All stainless exterior panels are riveted to anti-corrosion coated members. The complete structure is protected against corrosion prior to assembly. The front and rear caps are made of molded fiberglass. The main roof is made of high tensile aluminum panels riveted to the roof structure. The floor is made of 2 layers of 1/2" (13 mm) thick plywood separated by a 1/8" (3 mm) insulation to reduce power train and road noises.

2.2 Welding

The following welding rods should be used when making welding repairs to the structure:

Application	Diameter	A.W.S.
Stainless steel to stainless steel or Corten, light gauge	3/32" (2,4 mm)	No 308
Stainless steel to stainless steel or Corten, heavy gauge	1/8-5/32" (3,2-4 mm)	No 308
Corten to Corten, light gauge	3/32-1/8" (2,4-3,2 mm)	No 6011
Corten to Corten, heavy gauge	3/32-5/32" (2,4-4 mm)	No 7018

Since welding is a procedure that may be carried out either as specific instructions from Prévost or by an independent decision of the owner, the following information pertaining to welding should be read before beginning any welding procedure. The prohibitions and requirements outlined below must be followed during welding procedure.

1. Welding must be done only by a qualified and experienced person.
2. Adequate ground contacts and shields must be positioned as required to protect components from damage due to heat, contact by weld splatter, arcing, or other potentially damaging events associated with welding.

3. Set to the "Off" position the:
 - main battery disconnect switch (XL-40 coach);
 - Toggles switch and the battery master switch (XL-45 coach);
 - 12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).
4. Disconnect DDEC, ABS, electronically controlled transmission, and optional preheater control modules in order to protect these systems from voltage surges.
5. Always wear the appropriate safety equipment.
6. Weld in clean and well-ventilated area, and always have an appropriate fire extinguisher within your reach.

3. EXTERIOR MAINTENANCE

Regular washing to remove dust and dirt is recommended. See *"Operator's Manual"* for more details on washing and cleaning your vehicle.

3.1 Corrosion Prevention

Preventive maintenance is a key factor in avoiding corrosion and must be considered as part of the regular service intervals. The entire underside of the vehicle is sprayed with a heavy application of asphalt base undercoating.

The operating environment vehicle is subjected to will largely influence the amount of dirt and corrosion that will accumulate over a given period. Corrosion is one of the most costly factors of part failure and shortened part life. It is, however, an item that can be controlled when it is conscientiously looked after and the proper steps are taken in a timely manner.

Certain areas of the coach are more vulnerable to corrosion than others, and it is these areas that should be addressed. For example, the rear baggage compartment bulkhead in the rear wheelhousing area contains many key components and should be examined regularly for corrosion. Other areas include the front wheelhousing area and engine compartment.

Road splash will affect undercarriage, condenser coil and engine compartment. These areas must

be thoroughly cleaned to remove dirt accumulations from flanges, channels and ledges. These places accumulate dirt and salt and hold it in direct contact with steel and aluminum surfaces. Use an understructure high pressure spray as part of a regular wash. Damaged undercoating or paint should be promptly repaired before corrosion can start.

Frequency of wash periods depends on operating conditions. During periods of exposure to salt, daily washing as described above is recommended. If underbody parts show evidence of rust or corrosion, treat as follows:

1. Remove dirt, grease and oil by solvent washing.
2. Remove corrosion as well as all loose coating by sanding with a wire brush or sandblasting.

Caution: *Sandblasting can be used for cleaning bulkheads, brackets and other structural members. It should not be used for exterior side paneling. Extreme care should be taken not to sandblast excessively.*

3. Apply correct primer, paint and undercoating after removing all corrosion to prevent further damage.

4. FIBERGLASS REPAIR

All repairs to fiberglass parts consist of filling the damaged area with fiberglass cloth and resin or strand fiberglass and resin. The repair is allowed to harden and then the finishing operations are performed. Use of the various materials is determined by the type of repair to be made. Large holes, torn sections and separate joints require the adhesive qualities of the resin and the reinforcing qualities of the fiberglass. Small dents, scratches or pits can be repaired using resin and strand fiberglass and filler mixed into paste. Instructions for either mix are explained under their respective headings in this section.

For best results when making repairs, temperature should be between 70 and 75 °F (21-24 °C). Some people experience a skin reaction to resins. In such cases, wipe skin off with denatured alcohol or a good thinner. Use of protective hand cream is recommended.

Warning: *Always wear a respirator and goggles when grinding or sanding.*

Extreme care must be taken if the sander is electrically operated, as dust from some resins is combustible when subjected to sparks or open flames. The proper tool for sanding resin is a low speed, air driven disc sander with a water attachment or a dry sander having a vacuum bag. Either will eliminate flying glass and resin dust.

The following additional tools and materials will assist in making repairs: hacksaw blade, assorted files, emery paper or cloth (150 or finer), scissors or tin snips, wax paper or cellophane sheets, a 3" (75 mm) paint roller, paint brush, putty knife, acetone and one or more heat lamps.

4.1 Repair With Fiberglass Cloth

Where necessary, sand paint away around damaged area and scrape away undercoating, if any, and wipe clean with solvent. Grind or file the damaged area to form a "V" at the broken or cracked portion. Sides of "V" should have a shallow pitch for maximum bonding area.

Note: *Roughening the surface improves adhesion of resin.*

If part is warped from original shape, use clamping equipment to straighten the surface. Preheat area to be repaired with one or two heat lamps placed 12 to 15 inches (305-380 mm) from repair.

Caution: *Temperature should not exceed 200 °F (93 °C) in order to avoid distortion.*

Cut fiberglass cloth with scissors or tin snips, 1 to 3 inches (25-75 mm) larger than area to be repaired. Build area to desired height.

Mix resin and hardener following instructions on their containers. Saturate layers of fiberglass with mixture and place laminates over damaged area. Smooth out wrinkles and make sure general contour of area is maintained. Bubbles and wrinkles can be eliminated with a roller.

Caution: *The pot life of the mix is approximately 15 minutes. Any accidental contamination to the skin, clothing, tools, etc. must be removed within this period. Use acetone to remove uncured resin.*

Heat resin material again by placing heat lamps 12 to 15 inches (305-380 mm) from repaired area. Allow 12 to 15 minutes for repair to cure. After repair is cured, grind, file or sand to contour. Files other than body files may be more suitable. Featheredge and finish sanding.

If small pits or irregularities appear after making repair, correct by using a liberal amount of chopped strand or filler mixed with resin to form a paste. Refer to heading "Repair with Fiberglass Paste" in this section.

4.2 Repair With Fiberglass Paste

Fiberglass paste is used for repairing small dents, scratches, and pits. Paste is made by mixing resin, hardener and fiberglass strand or filler to the consistency of putty. Where necessary, sand paint away around damaged area. On underside of coach, scrape away undercoating from damaged area, and wipe clean with solvent.

Preheat the area to be repaired using heat lamps. Mix desired quantities of resin and hardener according to manufacturer's instructions. Add powdered fiberglass strand into mixture to thicken it into a putty state.

Note: If repair is made on a vertical surface, adding powdered filler material to mixture will reduce tendency of hot resin to flow or run.

Apply the material with a putty knife or similar object, building material up to the desired contour. For deep filling and on vertical surfaces, several layers of material may be used.

A hacksaw blade, held flat to adjacent contour and then moved in a sawing action across the repair when the resin is in a gel state, will remove excess resin from repair. Finish repair with the same procedure as when using fiberglass cloth.

4.3 Typical Fiberglass Repair Procedure

Remove all loose particles or damaged material using a power sander or rasp. Clean area, overlapping hole approximately 1" to 1-1/2" (25-40 mm) all around. Remove all dirt, grease and paint

from area to ensure good bonding surface. Feather the cleaned area all around (Fig. 6).

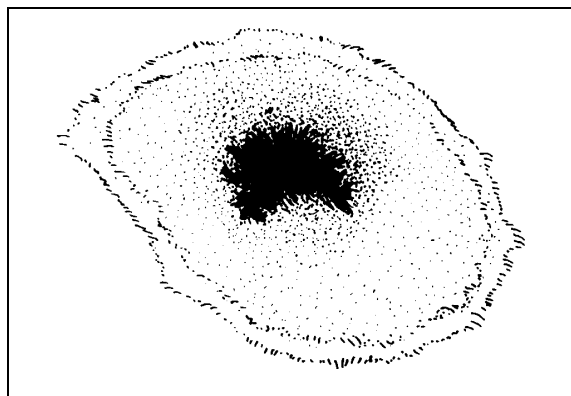


FIGURE 6: FIBERGLASS REPAIR

18089

Cut a piece of fiberglass mat slightly larger than area being repaired. Impregnate mat with general purpose polyester resin catalyzed normally. Use a clean paint brush to apply the polyester resin. Apply impregnated mat over hole and press onto surface with brush to obtain good adherence. Another coat of general purpose polyester resin can be applied at this time (Fig. 7).

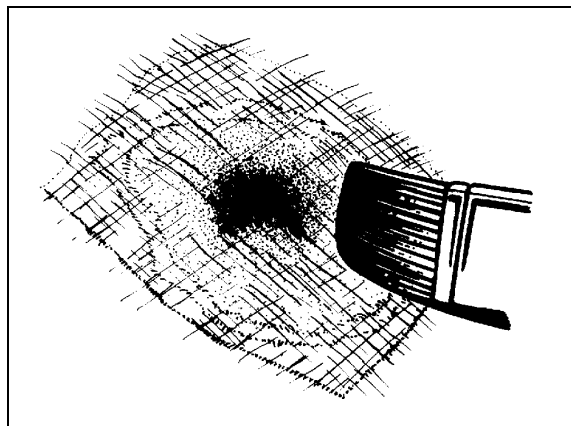


FIGURE 7: FIBERGLASS REPAIR

18090

Note: Remove all air between surfaces being joined. Allow area to harden and sand surface to remove any wax.

Apply another mat, followed by a cloth patch, and another mat. All layers must be thoroughly impregnated with polyester resin, brushed well and free of air. Apply more layers of mat and cloth as required until the desired strength and thickness is obtained, minimum two 1-1/2 oz (43 g) mats and one 9 oz (255 g) cloth (Fig. 8).

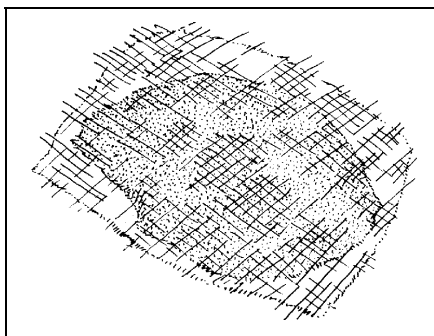


FIGURE 8: FIBERGLASS REPAIR 18091

Allow area to harden and contour the area with coarse sandpaper #100 (Fig. 9).

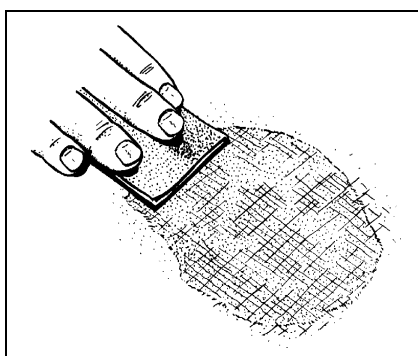


FIGURE 9: FIBERGLASS REPAIR 18092

Cover the area with a layer of resin putty and allow to dry for approximately 15 to 20 minutes (Fig. 10).

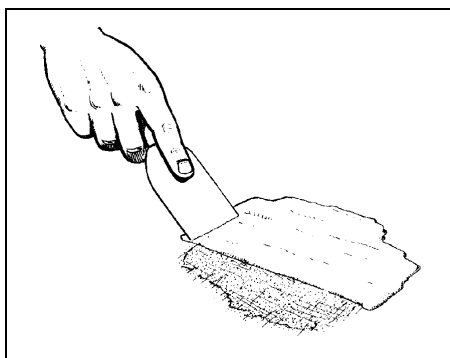


FIGURE 10: FIBERGLASS REPAIR 18093

Smooth off surface with coarse sandpaper #100 to desired shape. Further smooth surface with fine sandpaper #120 until repaired surface matches surrounding area paneling. Prime and paint the area to match surrounding paintwork.

5. PAINTING

The standard paint used on the exterior of the vehicle is Deltron PPG. It is a high gloss polyurethane enamel finish designed for exposure to extreme conditions. Other types of paint may be called for as options by owner but are not dealt with in this section.

5.1 Safety

Care should be exercised in storing, handling, mixing, and applying paint and chemicals listed in this manual. The topcoat, primer, solvent, catalysts, accelerators, and cleaners are highly volatile and/or toxic if not properly used. Observe all safety instructions marked on the different packagings, as well as the following:

1. Do not smoke in the paint room or in adjacent area exposed to residue fumes.
2. Wear respirators approved by the governing safety and health regulations.
3. Maintain adequate ventilation at all times.
4. Dispose of any leftover paint mix properly.
5. Wear rubber gloves, rubber apron, and face shield during all phases of paint and chemical handling.

5.2 Surface Preparation

5.2.1 Aluminum and Stainless Steel Surfaces

Sand large surfaces with P150 grit sandpaper and other surfaces with "Scotch-Brite" or similar abrasive pad.

Note: It is recommended to sandblast stainless steel rivets and panels overlap with Olimag # 35-70. Do not sandblast with steel abrasive.

5.2.2 Fiberglass Surface

Sand large surfaces with P180 grit sandpaper and other surfaces with "Scotch-Brite" or similar abrasive pad.

5.2.3 Washing

1. With an air pressure jet, clean the surface from top to bottom and from front to back.
2. Clean the entire surface with a tag rag.
3. Wash the entire surface with a mix of thinner (2 parts) and isopropyl alcohol (1 part). Wash small zones and wipe before the surface dries by itself.

5.3 Primer Application

Warning: Always prepare primer in well ventilated area.

5.3.1 Aluminum and Stainless Steel Surfaces

1. Stir primer for two minutes.
2. Mix: 1 part PPG epoxy primer DP-40 (Prévost part no 681078).
1 part PPG epoxy activator DP-401 (Prévost part no 681079).
3. Wait 30 minutes before application.
4. Adjust gun pressure to 45 psi (310 kPa).
5. Spray a wet coat uniformly while holding gun at 8" (20 cm) and perpendicular to the surface.
6. Allow 1 hour to dry, and not more than a week before painting.

5.3.2 Fiberglass Surface

1. Stir primer during 2 minutes.
2. Mix: 5 parts PPG high solid primer K-36 (Prévost part no 681927).
1 part PPG activator K-201 (Prévost part no 681928).
1 part PPG thinner DT-895 (Prévost part no 681926).
3. Adjust gun pressure to 45 psi (310 kPa).
4. Spray a wet coat uniformly while holding gun at 8" (20 cm) and perpendicular to the surface.
5. Allow 1 to 2 hours to dry.

5.4 Painting

Sand the entire surface with P320 grit sandpaper. Wash the surface in accordance with the washing procedure described in the surface preparation section.

5.4.1 PPG Paint Application

1. Clean the entire surface with a tag rag.
2. Using a paint gun, apply PPG anti-static DX-103 (Prévost part no 682003) while holding the gun at 12" to 15" (30 to 38 cm) from the surface.
3. Mix: 1 part PPG base color DBU.
1 3/4 parts PPG reactive thinner DRR-1185 (681931).
4. Adjust gun pressure to 45 psi (310 kPa) for solid color or to 55 psi (380 kPa) for metallic color.
5. Spray color uniformly while holding gun 8" to 12" (20 to 30 cm) and perpendicular to the surface. Repeat until you have a good color coverage (3 to 5 coats). Wait 5 to 10 minutes between each coat.
6. Allow 1 hour to dry.

5.4.2 PPG Clear Application

1. Wash the surface with rags and a solution of water (3 parts) and isopropyl alcohol (2 parts).
2. Apply PPG anti-static DX-103 (Prévost part no 682003) while holding the gun at 12" to 15" (30 to 38 cm) from the surface.
3. Clean entire surface with a tag rag.
4. Mix: 2 parts PPG clear DCU-2001 (Prévost part no 681929).
1 part PPG thinner DT-885 (Prévost part no 681925).
1 part PPG activator DU-6 (Prévost part no 681930).
5. Adjust gun pressure to 55 psi (380 kPa).
6. Spray a coat uniformly while holding the gun at 8" (20 cm) and perpendicular to the surface. Wait 5 to 10 minutes and spray a second clear coat.
7. Allow 16 hours to dry.

6. DECAL APPLICATION

Allow paint to dry 3 to 4 days before performing decal application, to prevent blistering when applying decals over new paint. Remove wax and grease over the surface before the application of decals. Apply decals at a temperature between 15 - 30 °C.

7. EXTERIOR REAR VIEW MIRRORS

The standard vehicle is equipped with two manually adjustable exterior rear view mirrors, one on each side of the vehicle (Fig. 11).

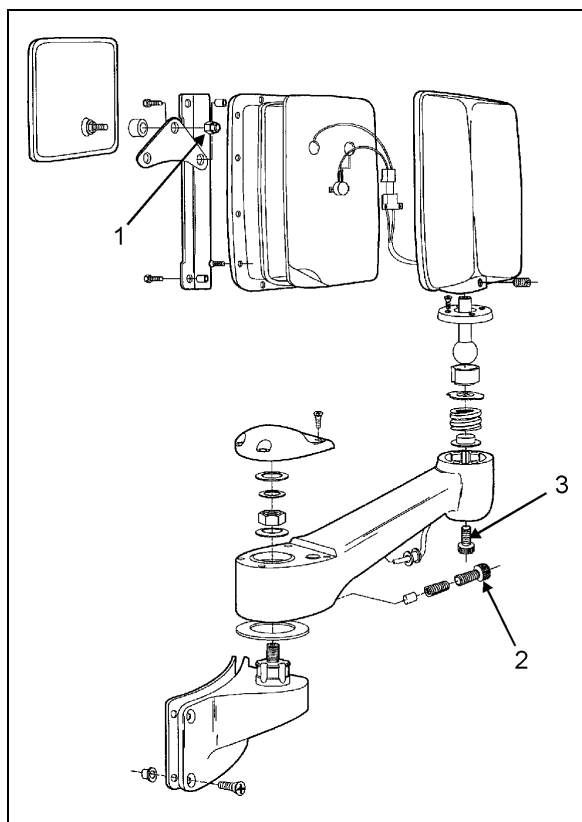


FIGURE 11: STANDARD MIRROR

18137

The mirrors have a replaceable glass which can easily be replaced if damaged or broken, and are equipped with an electric heating element to prevent snow and ice build-up in freezing weather conditions. The heating elements of both mirrors are turned on and off simultaneously by a switch located on the L.H. side control panel and are controlled by thermostats behind the mirror glass.

The vehicle may also be equipped with optional electrically adjustable, dual-glass mirrors (Fig.12).

Convex mirror head can be rotated and/or tilted by loosening the adjusting nut (1, Fig. 11) located at the rear of mirror. Adjust to desired position, then tighten adjusting nut.

The optional "RAMCO" mirrors can easily be adjusted by using the remote controls located on L.H. lateral console.

Caution: Do not overtighten. Do not install a convex mirror on the heated mirror glass. This prevents even distribution of heat in the heated mirror and could cause the glass to break.

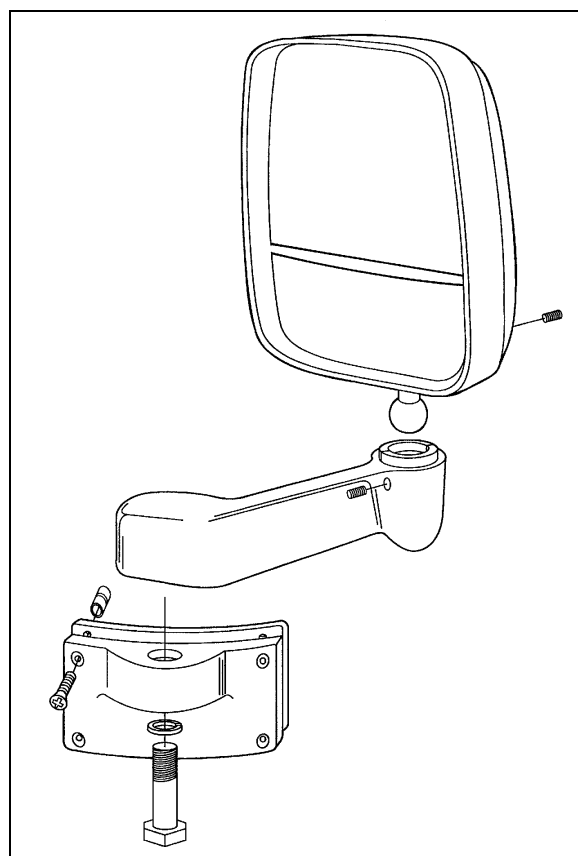


FIGURE 12: OPTIONAL "RAMCO" MIRROR

18138

7.1 Cleaning

Clean the mirrors with a soft cloth and mild detergent and water, or a quality glass cleaner. Do not clean the mirrors with a dry cloth or abrasive materials. Be careful when removing ice from mirrors to avoid damaging the reflective surface.

7.2 Manual Mirror Adjustment

Mirror arm can be moved to a different angle by manually moving the arm to the desired detented position.

Note: A clicking sound may be heard when pin falls in a detent .

The arm must move with relative ease. If arm is hard to move, loosen hex socket cap screw (2, Fig. 11) at the body end of the mirror arm to relieve tension on spring. If arm moves too easily, tighten the hex socket cap screw to increase pressure on the tension spring.

Caution: Do not overtighten hex socket cap screw or spring failure may result. Do not leave the arm between 2 detents (Fig. 13).

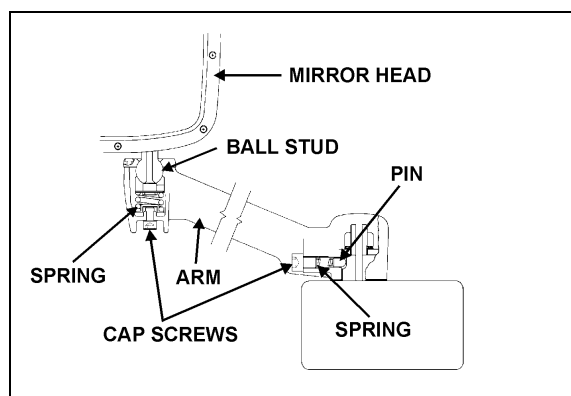


FIGURE 13: MIRROR ASSEMBLY

18139

Change the angle of the mirror head or tilt up or down by manually moving the mirror head with both hands. The hex socket cap screw (3, Fig. 11) at mirror end of arm under the ball stud assembly on the mirror arm can be loosened or tightened to adjust the resistance of the mirror head movement.

Caution: Do not overtighten hex socket cap screw to prevent spring and/or ball stud failure.

8. ENTRANCE DOOR

8.1 Coach Entrance Door

8.1.1 Operation

The major components of the entrance door opening/closing, and locking system are:

- door panel;
- door opening handle;
- 3-way air valve;
- rod assembly;
- door lock cylinder assembly.

The sedan-type entrance door is manually operated. The door is held in the closed position during coach operation by a locking mechanism actuated by a single-acting, spring-loaded pneumatic cylinder. Air flow to the cylinder is controlled by a 3-way air valve located under the dash. The 3-way air valve is actuated by a plate mounted on the rod assembly. The plate moves with the rod assembly as the door is opened or closed, and acts upon a lever on the 3-way valve (Fig. 14).

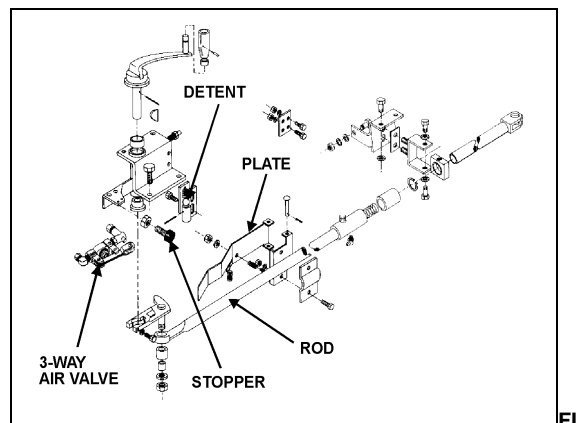


FIGURE 14: DOOR OPENING HANDLE

18140

From the door open position, pulling the door operating handle pulls the rod assembly in and closes the door. When the handle reaches the end of its closing stroke, the plate slides on the roller of the 3-way valve lever and pushes the plunger in the valve to divert air pressure to the piston end of the door lock cylinder. The cylinder extends and pushes the latch in the opening of the door frame to lock the door.

Pulling the operating handle to open the door moves the rod assembly out, and releases the 3-way valve lever allowing the air cylinder to vent through the piston end port. The return spring on the cylinder retracts the rod and releases the latch from the door allowing it to open (Fig. 15).

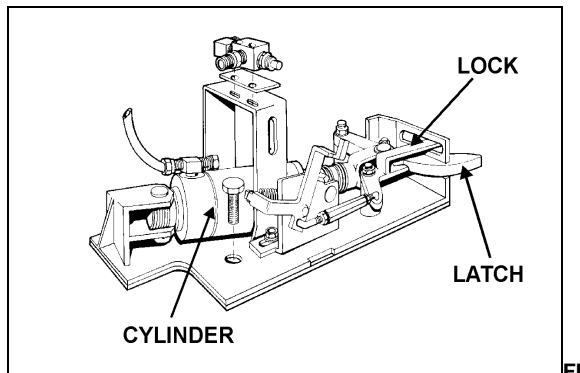


FIGURE 15: DOOR LOCK CYLINDER

18141

A switch located on the R.H. side lateral console allows bypass of the 3-way air valve and opens the control valve circuit to vent the door lock cylinder. It can be used in case of emergency when the door control system does not operate properly.

The door can be locked with the air cylinder from outside the vehicle by simply pushing the door in its portal. The button outside the vehicle next to the door is linked to a valve on top of the lock cylinder. Pushing the button moves the valve to vent the cylinder and releases the door which can then be opened. The outside key lock moves a mechanical stopper mounted on the lock cylinder assembly, which prevents the cylinder rod to retract even if the cylinder is permitted to vent. The stopper can also be accessed from inside the vehicle (Fig. 16).

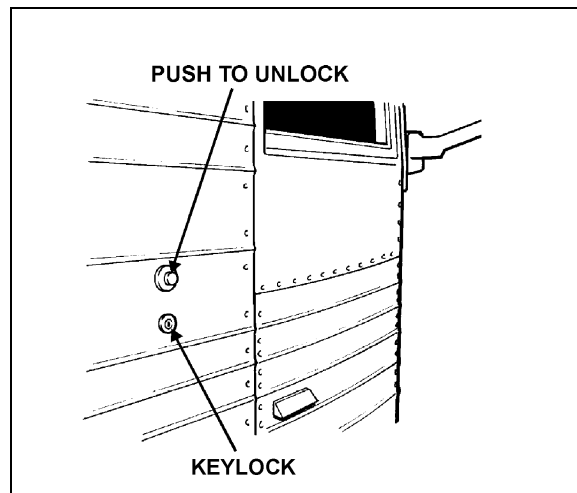


FIGURE 16: ENTRANCE DOOR

18142

8.1.2 Adjustments

The various components of the door opening/closing mechanism can be accessed by removing the dash panel above the entrance door steps. Remove the panel by turning the two fasteners counterclockwise, then lift and remove the panel.

8.1.3 3-Way Air Valve

Proper actuation timing of the 3-way air valve is important for proper operation. Timing is correctly adjusted when the plate seats the plunger fully in the valve body when door is entered in the portal and the door handle detent lever has yet to go over the detent ball.

Caution: *The 3-way air valve must be actuated only when door is fully closed. If the valve actuates too soon, the door lock cylinder will actuate before the door fully closes. If the valve does not actuate when the door closes, the cylinder will not operate to lock the door.*

8.1.4 Door Control Rod

The door control rod links the door to control handle. The larger diameter portion of the rod acts as a cylinder in which the smaller diameter rod can retract approximately 5/8" (16 mm). The cylinder is filled with grease and has a spring that applies pressure to extend the rod out. The cylinder absorbs shock loads on the door opening/closing mechanism when the door is operated.

The entrance door operating control rod is factory adjusted on the vehicle. Field adjustment should not be part of the regular entrance door maintenance schedule. If the control rod is replaced, the length of new control rod can be adjusted by turning the rod in the cylinder to shorten, or out to lengthen. The control rod adjustment should not be altered to compensate for wear of the various pivot points on the assembly.

8.1.5 Door Control Handle

The stroke of the door control handle is adjusted with 2 rubber stoppers on which the handle lever bottoms at the end of each stroke. To adjust, loosen the nut behind the mounting plate, turn the stopper in or out as desired and tighten the nut.

8.1.6 Door Adjustment

The entrance door can be adjusted vertically and laterally, and can be moved in or out. Modifying the height or lateral adjustment of the door can be made by loosening 3 cap screws fastening each of the upper and lower hinges to the door and repositioning the door as desired. Vertical and horizontal adjustments can be made by adding or removing shims between the upper or lower hinge plates and the door accordingly (Fig. 17).

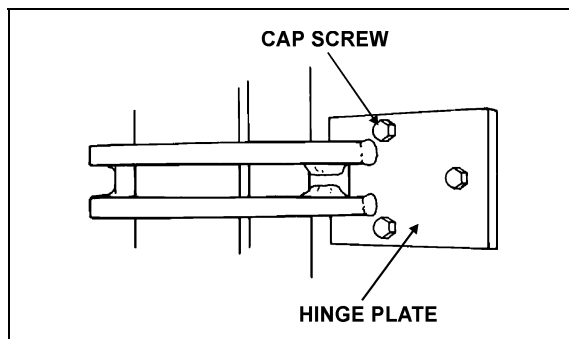


FIGURE 17: HINGE

18143

8.2 Converted Vehicle Entrance Door

8.2.1 Operation

The converted coach entrance door is manually operated with interior door handles controlling a single latch. The door is securely held closed during operation of the vehicle by a single-acting, spring-loaded air cylinder and locking device (Fig. 18).

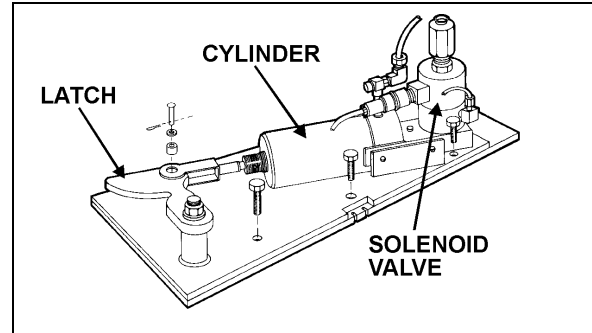


FIGURE 18: DOOR LOCK CYLINDER

18144

The cylinder is operated by a switch on the R.H. lower switch panel. Push down on the switch to lock the door and up to unlock. Pushing down on the switch actuates a 24 volts solenoid valve mounted on the air cylinder, which allows air to enter cylinder and lock the door. Pushing up on the switch allows the cylinder to vent and an internal spring to retract the rod and unlock the door. The door can also be key-locked from outside the vehicle and with the swivel lock from inside the vehicle.

Caution: It is strongly recommended to secure the door closed with the air cylinder locking mechanism when traveling.

8.2.2 Door Adjustment

The entrance door can be adjusted vertically and laterally, and can be moved in or out. Modifying the height or lateral adjustment of the door can be made by loosening 3 cap screws fastening each of the upper and lower hinges to the door and repositioning the door as desired. Vertical and horizontal adjustments can be made by adding or removing shims between the upper or lower hinge plates and the door accordingly (Fig. 17).

9. BAGGAGE COMPARTMENT DOORS

The baggage compartment doors on the vehicle are of identical design. The doors are pantograph, vertical-lift type and are fully sealed. Each door has a flush-mounted latch handle. To open, lift latch handle, then pull door outward and up. The door is held open by 2 gas-charged cylinders. To close, leave latch handle in the open position, pull downward on door and push down on latch to secure door. The door lower arm is spring loaded

to secure effort required to close the door (Fig. 19).

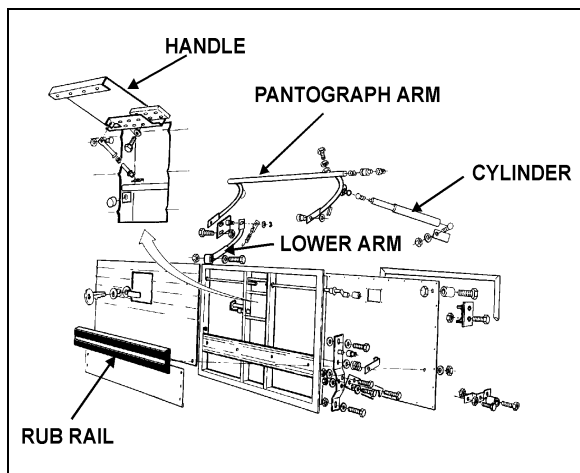


FIGURE 19: BAGGAGE COMPARTMENT 18145

If a door does not remain in the fully open position, one or both cylinders on that door is (are) defective. To test the cylinders, first support the door in the open position with proper equipment. Disconnect the rod end of one cylinder and retract the rod. If strong resistance is felt, the cylinder is in good condition and can be reinstalled. If the rod retracts with little effort, the cylinder is defective and should be replaced at once. Use the same procedure to test the other cylinder on that door.

9.1 Door Removal

Caution: Two people are required to remove the baggage compartment doors.

1. Maintain the door halfway open by placing a wooden block between one of the pantograph arms and the upper frame.
2. Remove cap screw, lock washer and flat washer retaining lower arm to door
3. Remove spring pins and lock washers fastening the pantograph arms to the door.

Warning: Support the door properly to prevent it from falling.

4. Spread the pantograph arms away from the door and remove door.
5. Inspect all pivot points and bushings for wear and damage. Check tension of gas-charged cylinders and replace if necessary.

9.2 Pantograph Arms Removal and Installation

1. Disconnect rod end of gas-charged cylinders from the pantograph arms.
2. Loosen jam nut and cap screw locking the horizontal member of the pantograph to the pivot pin.
3. Slide pantograph assembly to the right and remove assembly from the vehicle.
4. To install, perform the removal instructions in reverse.

9.3 Door Installation

1. Use a wooden block to support the pantograph arms horizontally.
2. Support the door and insert each pantograph arm into the pivot pins on the side of the door.
3. Install washer and spring pin to fasten each arm to its pivot pin.
4. Fasten lower arm to the door with flat washer, lock washer and cap screw.
5. Remove wooden block and close baggage compartment door.

Door should be adjusted to leave a gap of 3/16" (5 cm) above the top edge of the door. To adjust, loosen the bolts retaining lock plate support and position the door correctly. Tighten the bolts after the adjustment.

If the baggage door locks to tightly or too loosely, the position of the catch striker is misadjusted. To adjust, loosen the catch striker retaining bolts, position the striker correctly and tighten the retaining bolts.

If the lower part of the baggage door does not close evenly with the side of the vehicle, adjust the lock plates by loosening their retaining bolts and positioning the locking plates correctly (Fig. 20).

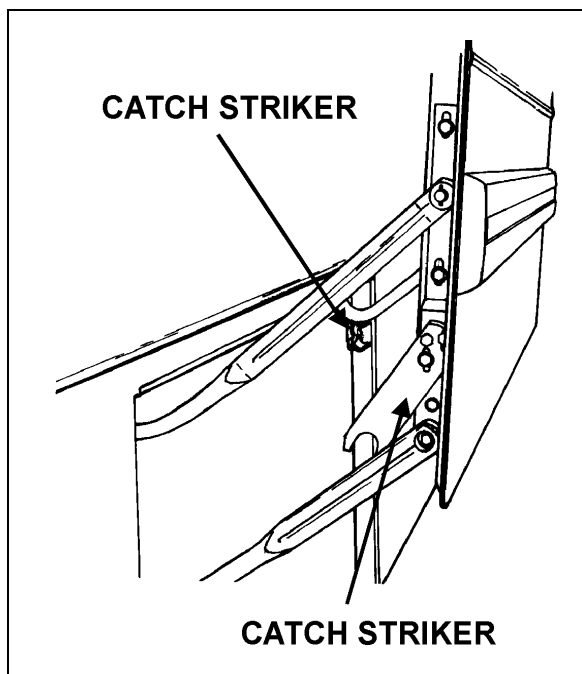


FIGURE 20: BAGGAGE COMPARTMENT DOOR 18146

10. SIDE WINDOWS

10.1 Adjustment of Emergency Exit Windows (Coach)

Some side passenger windows can be opened from the inside for emergency escape purposes (XL-40 = 4 on driver side and 3 on curb side -XL-45 = 4 on driver side and 4 on curb side). A decal indicating location of nearest emergency exit window is affixed at bottom of each side window. The upper section of each emergency side window is equipped with two blue lights that are activated by exterior lighting switch located on R.H. lower switch panel.

Warning: Decals can be ordered separately. Replace any missing or damage decals.

Caution: All emergency exit windows must be kept closed during normal operation. Do not slam the windows closed to avoid impairment of the emergency exit systems.

To open window, slide fingers under release bar, then push out bottom of window. Instruction decals are affixed to the release bar of each emergency exit window.

To close window, lift window release bar and pull window toward you.

Emergency exit windows should be checked periodically for ease of opening and closing. Pulling the release bar with both hands should release both locking mechanisms simultaneously and allow the window to swing out. The maximum effort required to release the window must not exceed 20 lb. (9 kg). Test and adjust as follows.

Note: A pulling bracket similar to the one shown in figure 21 is helpful when testing emergency window release mechanism.

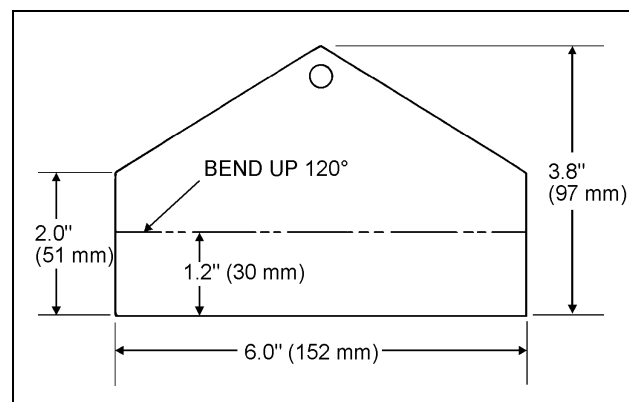


FIGURE 21: PULLING BRACKET 18147

1. Hook up the pulling bracket to the release bar and measure the effort required to release the window with a calibrated tensiometer while holding at 30° angle from horizontal (Fig. 22).

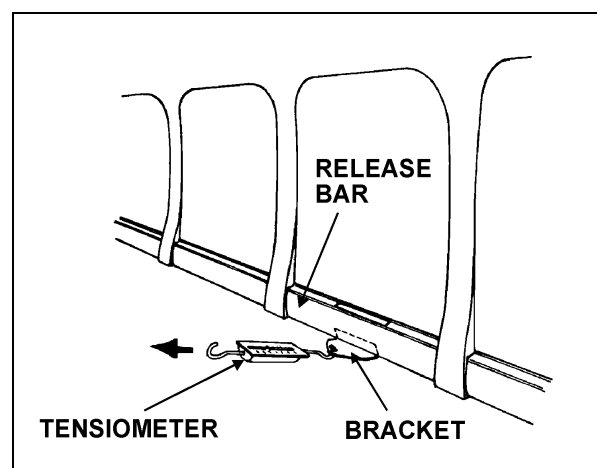


FIGURE 22: EMERGENCY EXIT WINDOW 18148

2. If the effort measured is over 20 lb. (9 kg), go to step 3. If within specification, test the next emergency opening window.

3. Open the window and bend latch and roller assembly out to decrease window release effort.
4. Test adjustment and correct if necessary.

Note: Latch and roller assembly may have to be realigned with the recess in the release bar after changing angle. Loosen 2 cap screws, adjust latch up or down and tighten cap screws (Fig. 23).

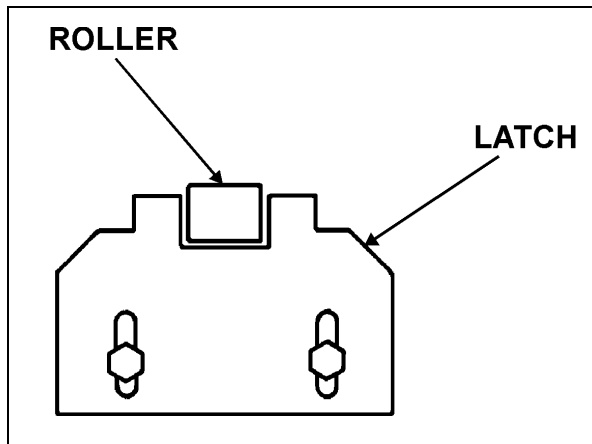


FIGURE 23: LATCH AND ROLLER ASSEMBLY 18149

10.2 Glass Replacement (Converted Vehicle)

Same procedures as windshield removal and installation.

10.3 Glass Replacement (Coach)

Each side window is laced to a fiberglass frame by means of a one-piece black rubber extrusion and fillerstrip, and sealed with Tremshield liquid butyl sealant. Proper installation of the side window glass is important to insure watertightness. Since glass varies in fit depending on the supplier, we recommend installing side window glasses obtained from Prevost Car Inc. to insure proper fit. Window panes obtained from other sources should be checked for proper size and curvature. See the following removal and installation procedure.

10.3.1 Removal

1. Remove interior trim around window. Remove 2 cap screws, brackets and washers from outside the window frame (Fig. 24).

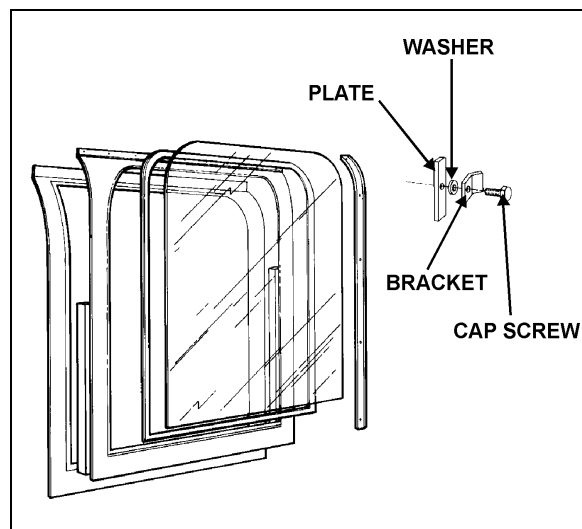


FIGURE 24: SIDE WINDOW GLASS ASSEMBLY 18150

Note: Cap screws are threaded in small plates accessible from inside the vehicle once the trim has been removed. Retain the plates for reinstallation of the brackets.

2. Remove filler strip from rubber extrusion around the window.
3. Remove the window pane and rubber extrusion.
4. Scrape off any remaining material around the window opening.

10.3.2 Installation

1. Clean the rubber extrusion with wiping towels soaked with isopropyl alcohol. Wipe with dry wiping towels and let dry 1 to 2 minutes.
2. Apply Tremshield liquid butyl sealant for single-glass and Sikaflex 255 for double glass, in the outside channel around the rubber extrusion and insert extrusion in the window opening.

Note: Apply sealant on small portions of extrusion at a time and work progressively around the opening.

3. Spray liquid soap and water solution in the channel of the extrusion where the window pane will be installed.
4. Install the glass in the extrusion, bottom first, and work up the sides to the top using a thin and rounded wooden or plastic instrument to force the window in its channel.

Note: *Two persons should be working both sides of the window simultaneously.*

5. Apply Tremshield liquid butyl sealant generously between the glass and extrusion. Scrape excess adhesive from windshield and clean with klene-sol or equivalent solvent.
6. Spray liquid soap and water solution in the V-channel for the filler strip on the rubber extrusion. Cut a single length of filler strip material and install it on the extrusion.

Note: *Filler strips retract with time. Both ends of filler strip should fit as tight as possible.*

7. Install holding brackets with washer and cap screws. Install interior trim.
8. Let dry overnight or at least 8 hours before putting vehicle back into service.

11. WINDSHIELD

The windshields are made of tinted AS-1 laminated safety glass. Each windshield is laced to a flange around an opening in the front structure by means of a one-piece black rubber extrusion and sealed with Tremshield liquid butyl sealant (Fig. 25).

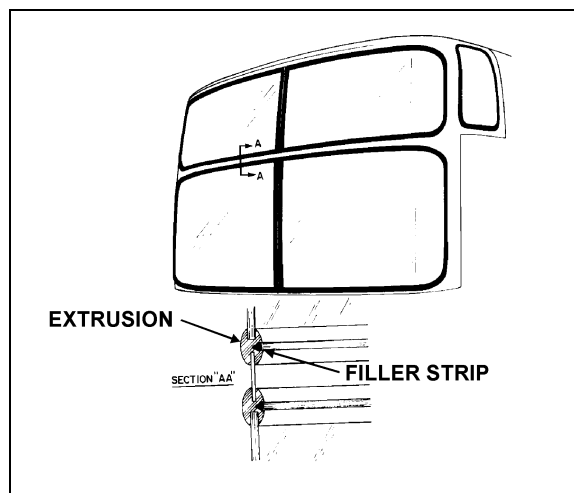


FIGURE 25: WINDSHIELD

18151

The upper and lower windshields and rubber extrusions are interchangeable from side to side. Since glass varies in fit from one supplier to another, we recommend installing replacement windshields obtained from Prevost Car Inc. to insure proper fit. Windshields obtained from other sources should be checked for proper size and curvature. Remove wiper arms of affected windshield when replacing one of the lower windshields. Remove destination sign when replacing upper R.H. side windshield.

11.1 Removal

Warning: *To avoid personal injury, wear protective gloves when handling the windshield glass.*

1. Remove interior trim around the affected windshield.
2. Remove filler strip from the rubber extrusion around the windshield.
3. Pry out the windshield from the extrusion and remove windshield and extrusion.
4. Scrape off any remaining material from the opening and clean with isopropyl alcohol.

11.2 Installation

Warning: *Wear gloves during the procedure. Do not smoke. Dispose of unused toxic material properly. Heed all warnings on containers of the different products used in this procedure.*

1. Clean the new rubber extrusion with wiping towels soaked with isopropyl alcohol. Wipe with dry wiping towels and let dry 1 to 2 minutes.

Note: *Force the soaked towels to the bottom of the channels for good cleaning.*

2. Apply Tremshield liquid butyl sealant, or equivalent, in the outside channel around the rubber extrusion and insert extrusion in the window opening.

Note: *Apply sealant on small portions of extrusion at a time and work progressively around the opening.*

3. Spray liquid soap and water solution in the channel of the extrusion where the window pane will be installed.
4. Install the glass in the extrusion, bottom first, and working up the sides to the top using a thin and rounded wooden or plastic instrument to force the windshield in its channel.
5. Apply Tremshield liquid butyl sealant generously between the glass and extrusion. Scrape excess adhesive from windshield and clean with Klene-Sol or equivalent solvent.
6. Spray liquid soap and water solution in the V-channel for the filler strip in the rubber extrusion.

Note: Filler strips retract with time. Ends of filler strip should fit as tight as possible.

7. Install interior trim. Install windshield wiper arms and destination sign, if applicable.
8. Let dry overnight or at least 8 hours before putting vehicle back into service.

12. ADHESIVE MOUNTED WINDOWS (DRIVER'S & ENTRANCE DOOR WINDOW - CONVERTED VEHICLE)

12.1 Replacement

Items Needed:

Scraper with new blade; Disposable vinyl gloves; Isopropyl alcohol or enamel reducer or NAPA 6383 surface cleaner; Masking tape; Clean rag; Heavy hydrotreated naphta (vanishing oil) (680102); Tremthane Primer (681091); Tremshield Tape (68-1089); Sikaflex 255FC (681092)

Warning: Wear disposable vinyl gloves during the procedure. Do not smoke. Dispose of unused toxic material properly. Heed all warnings on containers of the different products.

1. Remove previous window glass and scrape off all remaining material around the opening.

Note: Hardened adhesive will not remove easily. A new blade works best to remove all adhesive residue using care not to damage the fiber structure.

2. Place the new window glass in the opening and center it to leave an even gap top and bottom, and from side to side.

Note: Use small shims to raise the glass in proper position. Shims can be cut from the tremshield tape (Fig. 26).

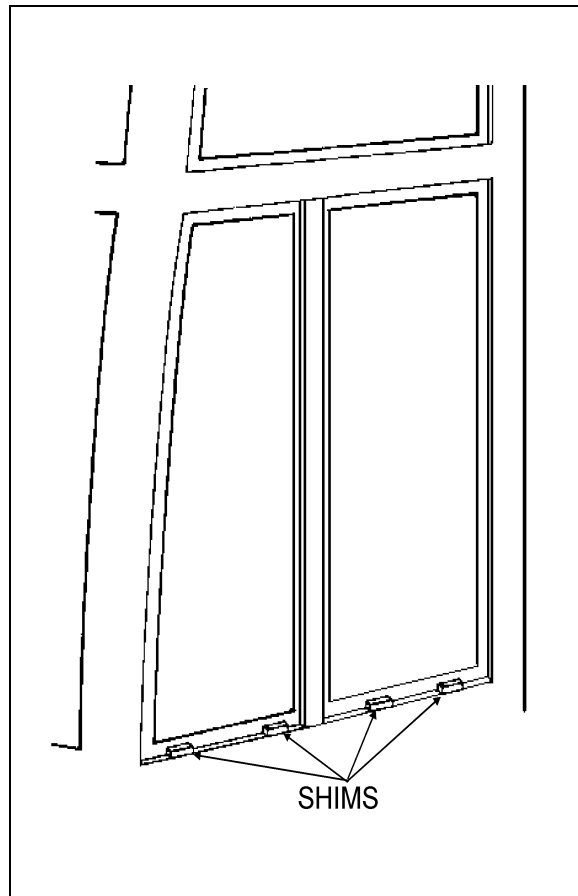


FIGURE 26: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE)

18152

3. Hold the window glass centered and have an assistant mark the inside contour of the opening on the glass with a china pencil. Remove glass and place it on a table with the pencil mark facing up.
4. Place masking tape on the inside surface of the glass to just cover the china pencil mark, leaving the outer surface exposed for the adhesive. This will make cleanup much easier. For ease of removal, do not overlap the tape at corners (Fig. 27).

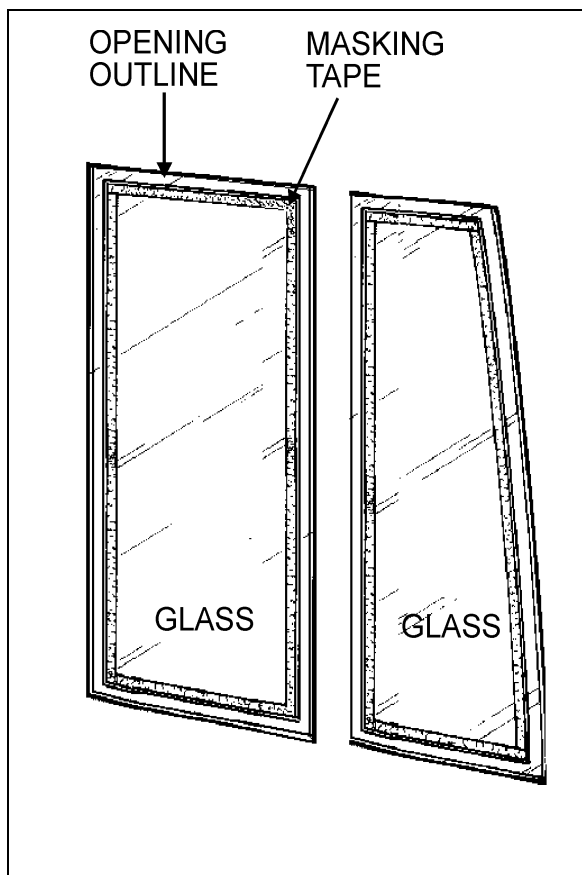


FIGURE 27: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE) 18153

- Clean all around the window opening and the window glass edge with isopropyl alcohol, enamel reducer or NAPA 6383 surface cleaner. Let dry 1 to 2 minutes.

Note: There must be absolutely no silicone on glass or channel or Sikaflex 255 FC will not stick.

- Put masking tape on the inner and outer contour of the window opening on the structure, approximately 1/16" (1,5 mm) from the edges of the contour.
- Apply Tremthane primer (Prévost part no 681091) all around the window opening and the window glass edge.
- Install Tremshield tape (Prévost part no 681089) around the sealing surface of the window opening (Fig. 28).
- Apply a generous bead of Sikaflex-255 FC polyurethane adhesive (681092) on the sealing surface around the window opening from outside the vehicle.

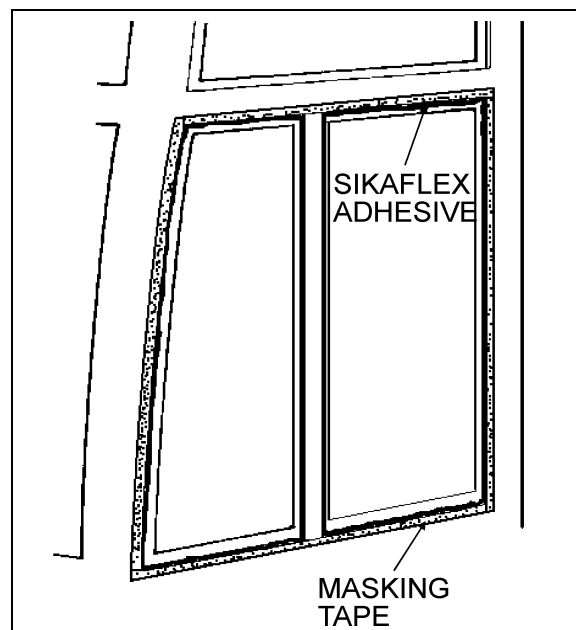


FIGURE 28: DRIVER'S & ENTRANCE DOOR WINDOWS (CONVERTED VEHICLE) 18154

Note: To ease applying of Sikaflex 255 FC, it may be heated to 175 °F (80 °C).

Note: Bead should touch the side surface of the window opening.

- Place shims correctly, and position window glass in the opening. Press firmly and evenly. Excess adhesive should flow out from behind glass.

Note: Add adhesive in areas where overflow is minimal or if air bubbles are present.

- Smooth the adhesive joint using the plastic glove on your finger. Remove excess material around both sides of the window as soon as possible before adhesive dries.

Note: Remove most of the adhesive from the scraper or trowel with a rag, and then dip tool in heavy hydrotreated naphtha (vanishing oil) after each use for cleaning.

Caution: Never use solvent to clean excess adhesive.

- Remove masking tape at once, clamp window glass suitably and let dry overnight or at least 8 hours.

13. ROOF ESCAPE HATCH

13.1 Maintenance

The vehicle can be equipped with one or two escape hatches. The escape hatch is designed to provide years of reliable service with a minimum of maintenance. All components are rust proof, and moving parts are Teflon coated to eliminate need for lubrication. Should water infiltrate the vehicle from the escape hatch, refer to the heading "Sealing" in this section for procedures on how to seal this area.

Caution: Use of lubricants, paints, or other coatings such as graffiti deterring sprays are not recommended.

Suggested maintenance includes periodic inspection of attaching fasteners for evidence of loosening due to tampering, and regular cleaning with mild soap and water.

Although there are other cleaning solutions available, some contain solvents and other chemicals that can attack the high strength materials used in the production of the escape hatch.

Caution: Ensure that cleaning solutions are compatible with the materials used on the escape hatch.

Graffiti removing cleaners often contain acetone, ether, lacquer thinner, or other solvents known to destroy the high strength properties of many plastics. Use of these cleaners must be avoided.

Graffiti-resisting coatings often leave a sticky residue that interferes with smooth up/down movement of the hatch mechanism. Some of these coatings also contain solvents that will reduce the strength of certain components.

Caution: Use of these coatings is at considerable risk and should be avoided.

13.2 Repair

All components used in the production of the escape hatch are available as service parts, except for one hinge that represents a possible hazard when improperly reattached to a hidden tapping plate that is often damaged whenever the

hinge is damaged. The tapping plate is permanently laminated between the inner and outer cover assemblies, and it cannot be inspected or replaced. It is therefore necessary to replace the entire assembly following damage to the hinge (Fig. 29).

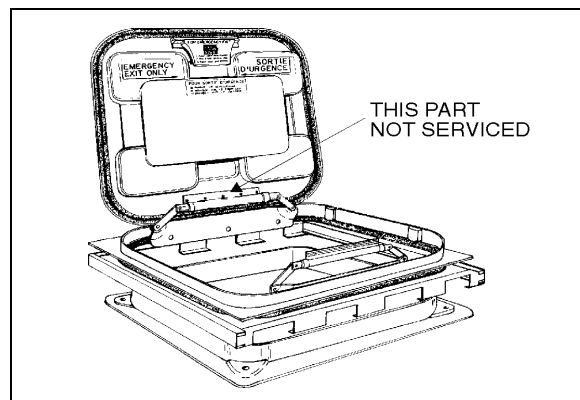


FIGURE 29: ROOF ESCAPE HATCH

18104

Caution: Hinge assembly is critical and hinge should never be removed from cover assembly. Fasteners used in this assembly are special and have critical torque requirements and tamper-resistant heads to discourage tampering.

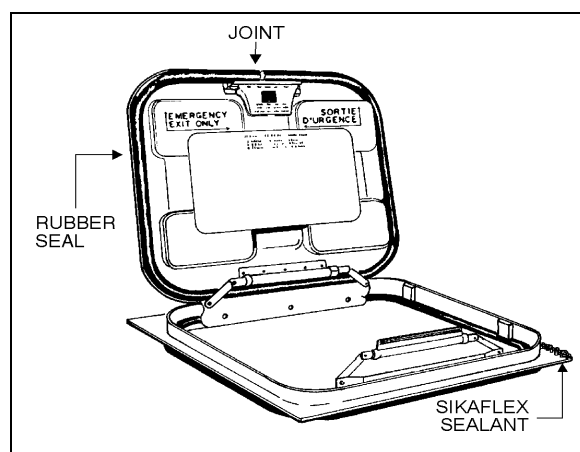


FIGURE 30: ROOF ESCAPE HATCH

18105

13.3 Sealing

1. Open and tilt up the escape hatch cover.
2. Join the 2 ends of the rubber seal (Fig. 30).

Caution: Seal joint should be toward rear of vehicle.

3. Apply rubber adhesive CA-40 (Prévost part no 681285) in the gap between the seal ends.

4. Apply Sikaflex 221 sealant (Prévost part no 680532) along the outline of the escape hatch on the roof of vehicle (Fig. 30).

13.4 Removal and Installation

The frame of the escape hatch is riveted to the roof of the vehicle. The escape hatch panel assembly can be replaced as a unit and a new panel assembly installed in the existing frame. To remove the panel assembly, remove the 4 bolts fastening the 2 hinges to the escape hatch frame and retain the 4 flat washers. Reinstall the panel assembly by fastening the 2 hinges with the 4 bolts and flat washers removed earlier.

Caution: *When installing, roof escape hatch's hinge must be toward the front of vehicle, to prevent the hatch from being ripped out if accidentally opened while vehicle is running.*

14. PASSENGER SEATS

The XL-40 and XL-45 coaches can be equipped with any of 4 basic seat models and installed in a variety of seating arrangements:

- The "Tourismo 2" and "Ultra" seat is the base model and is available in heights of 40" (102 cm) and 42" (107 cm). Seating arrangement includes 2 card tables which can be folded and removed, and pivoting seats ahead of each card table. Each pair of seats is built on a welded steel frame fastened to the side wall and on a track-mounted pedestal.
- The "Silhouette" seat is an optional model with each pair also built on a welded steel frame and mounted the same way as the "Tourismo 2" and "Ultra" seat. Standard seating arrangement with the "Silhouette" seat includes 2 card tables and 2 pivoting seats. Seating capacity is the same as with the "Tourismo 2" seat.
- The "VIP" seat model is an optional seat. "V.I.P." seats are mounted on one row of paired seats built on a common frame on one side of the vehicle, and a row of single seats on the other side of the vehicle with an off-center aisle. Each "V.I.P." seat has its own set of armrests.

Each seat has a removable bottom cushion with snapped-on upholstery for cleaning or replacement. The "Tourismo 2", "Ultra" and "Silhouette" seats have 3 armrests. The aisle armrest is spring loaded to return to its down position when released. The center armrest can be folded up and down manually, while the window armrest is fixed.

14.1 Rotating Seats

1. Remove 1 wing nut holding each seat bottom cushion from under the seat frame.
2. Lift front part of cushions and remove cushions.
3. Remove 4 wing screws fastening seat assembly to seat frame.
4. Pull seat toward aisle and rotate.
5. Align mounting holes and reinstall 4 wing screws.
6. Reinstall seat bottom cushions with wing nuts.

14.2 Removing Fixed Seats

Note: *Seats on one row are not interchangeable with seats of the other row.*

To remove fixed seats, proceed as follows:

1. Remove (1) elastic stop nut holding each seat bottom cushion from under the front part of the seat frame.
2. Lift front part of cushions and remove cushions.
3. Remove (4) finishing screws holding plastic cover between side wall and seat frame.
4. Remove (2) cap screws, nuts, and washers holding seat frame to side wall and retain the (2) holding brackets (Fig. 31).

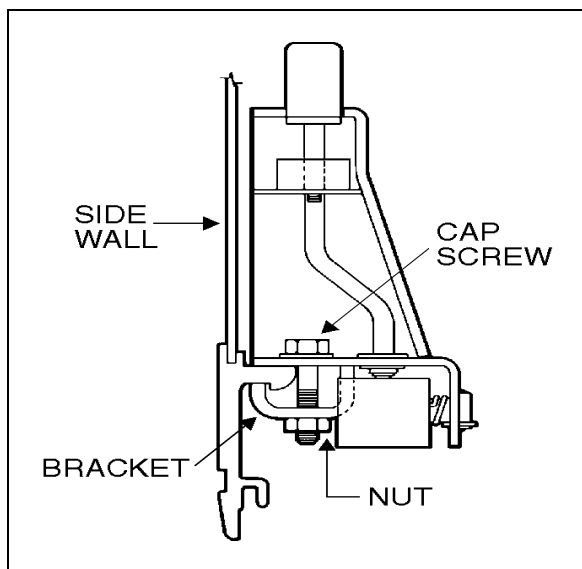


FIGURE 31: PASSENGER SEAT FRAME HOLDING 18106

- Remove (2) nuts and washers holding seat frame to pedestal rods (Fig. 32).

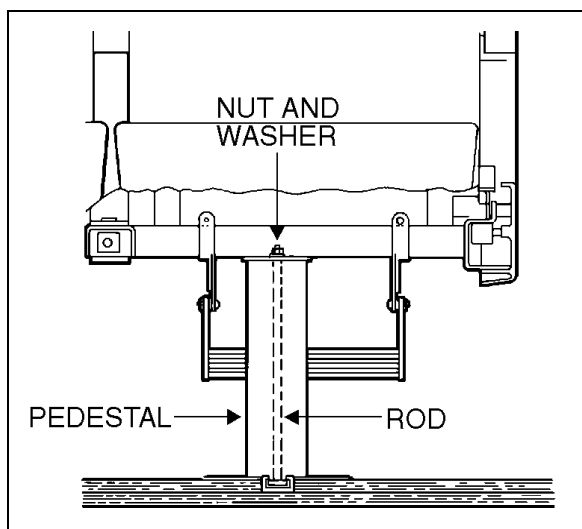


FIGURE 32: PASSENGER SEAT FRAME 18107

Note: Bottom end of rod is coated with Loctite and threaded in a steel block which slides in the floor track. Removal of rod is possible if loosened from block. Otherwise, slide rod and block assembly to the front end of track after removing all other interfering seats.

- Remove seat assembly.
- Reverse the above procedure to install seat assembly.

Note: On newer vehicles, the rod consists of a carriage bolt inserted in a square plate sliding in the floor track. Removal is possible only by the front end of track.

15. UPHOLSTERY MAINTENANCE

15.1 Routine Cleaning

Coach seats are lightweight, with foam-padded backs and cushions. For both appearance and wearability, best results are obtained if upholstery is cleaned at regular intervals before dirt, dust and grit have been ground into the fabric. Seat fabric is made of 50% wool, 33% cotton, 9% nylon, and 8% acrylic.

All that is required to remove the dirt is a gentle beating with the hand or the back of a brush. This will bring the dirt to the surface where it is easily removed with a vacuum or brush in the direction of the pile which can easily be recognized by running a hand lightly over the pile. If the fabric become excessively dirty, particles of grit will cause gradual wear, reducing the life span of the fabric.

15.2 Dry Cleaning

If covers are to be removed for cleaning, dry cleaning is recommended since washing might cause some shrinkage, preventing the covers from being reapplied to the seats without damage. Other than spot cleaning the covers while they are in place, dry cleaning is not recommended, since the resulting fumes could be hazardous in the confines of the coach and the solvent could be detrimental to the foam padding of the seats.

15.3 Cleaning With Covers in Place

The most effective and economical method to clean the fabric seat covers is by washing with either an approved foam upholstery cleaner or with a mild household detergent.

1. Thoroughly vacuum the upholstery. Remove any spots or stains before the seats are washed to avoid a cleaning ring.
2. Dilute household detergent or liquid foam cleaner according to directions on the container. Pour a small quantity into a flat pan and work into a thick foam with a sponge or brush.
3. Apply only the foam to the fabric with a sponge or brush. Clean a small area of the fabric at a time with the foam. DO NOT SOAK. Rub vigorously.
4. Sponge the suds from the fabric with a clean sponge or cloth moistened with water. Rinse the sponge or cloth often and change the water when it becomes dirty.
5. Allow the upholstery to dry completely before the coach goes back into service. To speed up drying, excess moisture can be blown off the fabric with compressed air.

Note: *Oil in the air line will soil the fabric. Blow the line clear and test air discharge against a plain white piece of paper. It is also effective to press the edge of a flat hardwood stick down on the cushion and slowly draw it across the fabric.*

Even very soiled areas can be returned to their original appearance by a thorough cleaning, but a regular schedule of cleaning that keeps the upholstery reasonably clean at all times will add months to the service life of coach upholstery.

16. VEHICLE JACKING POINTS

The vehicle can be jacked by applying pressure under body jacking points or front, drive and tag axles jacking points (Fig. 34, 35 and 36). Equipment for lifting the front of the vehicle must have a combined lifting capacity of 13,000 lb. (5 900 kg). Equipment for lifting the rear of the vehicle must have a combined lifting capacity of 25,000 lb. (11 400 kg).

Warning: *When it is necessary to raise the vehicle, care should be taken to ensure that pressure is applied only at the points indicated in figure 33, 34, 35 and 36.*

Warning: *Extra lift capacity may be required if luggage or any other type of load (e.g. conversion equipment) are onboard the vehicle.*

16.1 Body Jacking Points

Body jacking points are recommended to be use for axle removal. Otherwise use axle jacking points.

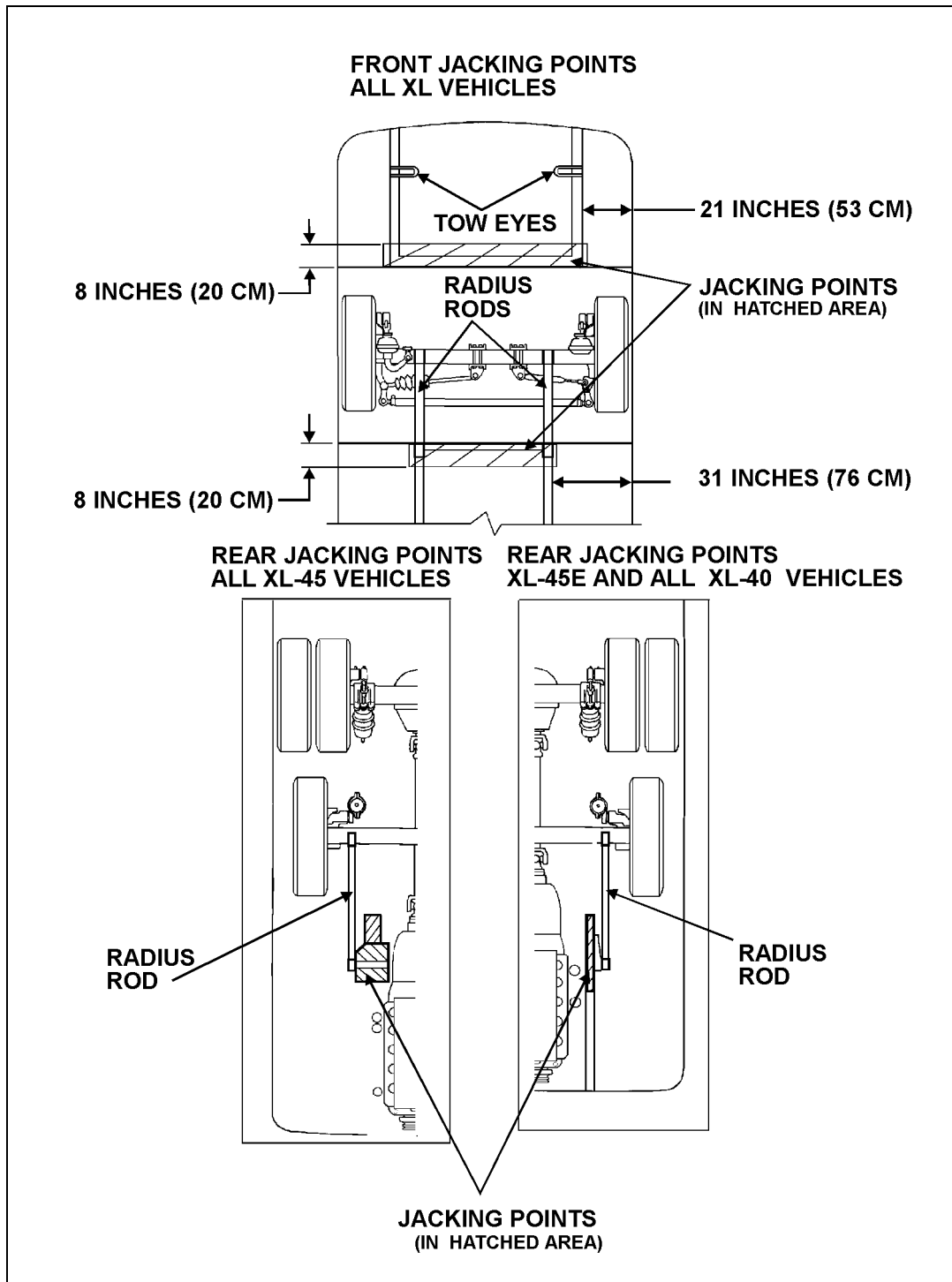


FIGURE 33: BODY JACKING POINTS (UNDER VEHICLE VIEW)

18155

Warning: The suspension of the vehicle must be in the normal ride position before jacking. The "Level Low" system on a motorcoach must be in the "DRIVE" position prior to turning the ignition key "OFF".

16.2 Axle Jacking Points

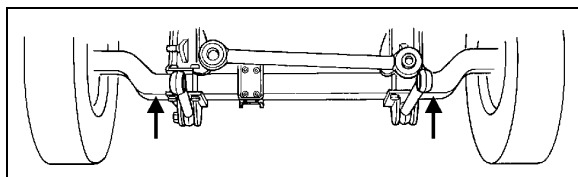


FIGURE 34: FRONT AXLE

18084

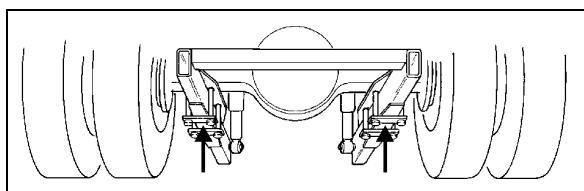


FIGURE 35: DRIVE AXLE

18085

Warning: Always unload or retract the tag axle before jacking the vehicle from the front and drive axle jacking points to prevent damage to suspension components.

16.3 Jacking the Tag Axle

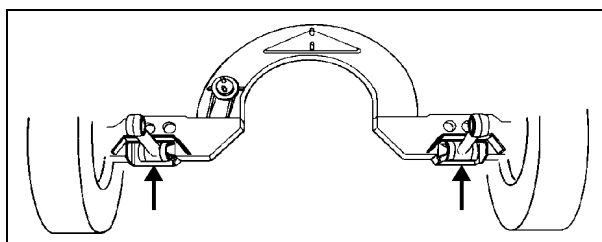


FIGURE 36: TAG AXLE

18086

Warning: The jacking points on the tag axle must be used for raising the tag axle only.

17. TOWING THE VEHICLE

The vehicle can be transported on a low bed semi-trailer of adequate gross axle weight capacity. When transporting a vehicle, apply parking brake and shut down the engine. Block all wheels and secure vehicle with tie-downs. Check that overall height will clear obstacles on the route to follow, and obtain required permits as required.

The vehicle can also be towed by lifting under the front axle or by towing from the front with all wheels on the ground. These 2 methods are described below under their respective headings. Whatever the method used, the vehicle should be towed by truck operators authorized and experienced in towing intercity coaches.

Observe normal precautions including, but not limited to, the ones listed below when towing the vehicle:

1. Make sure the parking brake is released before towing.
2. Do not allow passengers to ride inside the towed vehicle.
3. Tow the vehicle at a safe speed as dictated by road and weather conditions.
4. Accelerate and decelerate slowly with caution.

17.1 Lifting and Towing

The towed vehicle must be lifted from under the front axle only. The tow truck must be equipped with the proper lifting equipment to reach under the front axle since no other lifting points are recommended. Lifting and towing from any other point are unauthorized as it may cause serious damage to the structure. **Do not unload or raise the tag axle when lifting and towing to prevent overloading the drive axle.**

1. Remove both drive axle shafts to prevent damage to the transmission. Plug axle tube to prevent oil loss. Refer to Rockwell's "Maintenance manual no.5" annexed at the end of Section 11, Rear axle, in this manual for correct procedure.

Caution: Transmission lubrication is inadequate when towing. With either automatic or manual transmission, the drive axle shafts must be removed to avoid serious damage to the transmission.

2. Operate the engine of the vehicle when towing to maintain brake system air pressure. If the engine cannot be operated, connect an external air pressure line from the tow truck to the emergency fill valve in the engine compartment. The emergency fill valve in the front service compartment does not supply air pressure to the brake system. The air pressure must be a minimum of 75 psi (520 kPa), and the line should be attached to the air line with a clip-on chuck.

Caution: *Do not tow the vehicle without external air pressure applied to the emergency fill valve if the engine does not operate. Without brake system air pressure, the brakes may apply automatically if system air drops below 40 psi (275 kPa). If failure prevents releasing the parking brakes with air pressure, disengage the parking brakes mechanically.*

3. Lift the vehicle from under the front axle, and adequately secure the underside to the tow vehicle lifting attachment with chains.
4. Observe safety precautions when towing.

17.2 Towing Without Lifting

Caution: *When towing without lifting vehicle, use only a tow truck with a solid link tow bar and related equipment. All other means of towing are unauthorized. Tow only from the front of the vehicle.*

1. Remove both drive axle shafts to prevent damage to the transmission. Plug axle tube to prevent oil loss. Refer to Rockwell's "Maintenance manual no.5" annexed at the end of Section 11, Rear axle, in this manual for correct procedure.

Caution: *Transmission lubrication is inadequate when towing. With either automatic or manual transmission, the drive axle shafts must be removed to avoid serious damage to the transmission.*

2. Operate the engine of the vehicle when towing to maintain brake system air pressure. If the engine cannot be operated, connect an external air pressure line from the tow truck to the emergency fill valve in the engine compartment. The emergency fill valve in the front service compartment does not supply air pressure to the brake system. The air pressure must be a minimum of 75 psi (520 kPa), and the line should be attached to the air line with a clip-on chuck.

Caution: *Do not tow the vehicle without external air pressure applied to the emergency fill valve if the engine does not operate. Without brake system air pressure, the brakes may apply automatically if system air drops below 40 psi (275 kPa). If failure prevents releasing the parking brakes with air pressure, disengage the parking brakes mechanically.*

3. Position the tow truck so that the tow bar contacts the front bumper of the vehicle.
4. Attach the tow truck chains in the tow eyes of the vehicle under the bumper and take up all the slack (Fig. 37).
5. Attach safety chains as applicable.
6. Observe safety precautions when towing.

SECTION 22: HEATING AND AIR CONDITIONING

CONTENTS

1. HEATING AND AIR CONDITIONING.....	22 - 5
1.1 Description.....	22 - 5
2. AIR CIRCULATION	22 - 5
2.1 Driver's Area.....	22 - 5
2.2 Central Section (Passengers/Living)	22 - 7
3. HVAC SYSTEM OPERATION - Driver's System	22 - 7
4. HVAC SYSTEM OPERATION - Central System.....	22 - 7
5. HVAC UNIT MAINTENANCE.....	22 - 8
5.1 Coil Cleaning	22 - 8
5.2 Driver's HVAC Unit Air Filter	22 - 9
5.3 Auxiliary HVAC Unit Air Filter (where applicable).....	22 - 9
5.4 Central HVAC Unit Air Filter.....	22 - 9
6. EVAPORATOR MOTOR (Central System Vehicles Only).....	22 - 10
6.1 Removal	22 - 10
6.2 Installation	22 - 11
6.3 Maintenance.....	22 - 11
6.3.1 Checking Operation of Brush in Holder	22 - 11
6.3.2 Brush Wear Inspection and Replacement	22 - 11
6.3.3 Checking Commutator.....	22 - 11
7. AIR CONDITIONING SYSTEM.....	22 - 11
7.1 Description.....	22 - 11
7.2 Main System A/C Cycle	22 - 12
7.3 Refrigerant.....	22 - 15
7.3.1 Procurement	22 - 15
7.3.2 Precautions in Handling Refrigerant	22 - 15
7.3.3 Treatment in Case of Injury	22 - 16
7.3.4 Precautions in Handling Refrigerant Lines.....	22 - 16
7.4 Pumping Down	22 - 16
7.5 Adding Refrigerant (Vapor State).....	22 - 17
7.6 Evacuating System.....	22 - 18
7.7 Charging System.....	22 - 18
7.8 Refrigerant System Cleanout After Compressor Failure.....	22 - 19
7.8.1 Determining Severity of Failure.....	22 - 19
7.8.2 Cleanout After Minor Compressor Failure	22 - 19
7.8.3 Cleanout After Major Compressor Failure	22 - 19

Section 22: HEATING AND AIR CONDITIONING

8. A/C SYSTEM COMPONENTS..... 22 - 20

- 8.1 Compressor (Central System) 22 - 20
 - 8.1.1 Belt Replacement 22 - 20
 - 8.1.2 Pulley Alignment 22 - 21
 - 8.1.3 Compressor Maintenance 22 - 22
 - 8.1.4 Troubleshooting Guide 22 - 22
 - 8.1.5 Oil Verification..... 22 - 23
- 8.2 Magnetic Clutch..... 22 - 23
- 8.3 Compressor (Driver's system only or auxiliary system) 22 - 23
 - 8.3.1 Clutch Pulley Installation 22 - 23
 - 8.3.2 Clutch Pulley Removal 22 - 23
 - 8.3.3 Clutch Maintenance..... 22 - 23
 - 8.3.4 Belt Replacement 22 - 23
 - 8.3.5 Pulley Alignment 22 - 23
 - 8.3.6 Oil Verification (Tecumseh Compressor) 22 - 24
- 8.4 Condenser (All vehicles except for XL-45 Coach) 22 - 24
 - 8.4.1 Condenser Fan Motor 22 - 25
 - 8.4.2 Motor Removal 22 - 25
 - 8.4.3 Motor Installation 22 - 25
 - 8.4.4 Maintenance 22 - 25
- 8.5 Condenser (XL-45 Coach) 22 - 25
 - 8.5.1 Condenser Fan Motors..... 22 - 25
- 8.6 Receiver Tank 22 - 26
- 8.7 Filter Dryer..... 22 - 26
 - 8.7.1 Description 22 - 26
 - 8.7.2 Replacement..... 22 - 27
 - 8.7.3 Moisture Indicator 22 - 27
- 8.8 Liquid Refrigerant Solenoid Valve..... 22 - 28
 - 8.8.1 Description 22 - 28
 - 8.8.2 Manual Bypass 22 - 28
 - 8.8.3 Coil Replacement 22 - 28
 - 8.8.4 Valve Disassembly 22 - 28
 - 8.8.5 Valve Reassembly..... 22 - 29
- 8.9 By-Pass Valve 22 - 29
- 8.10 Expansion Valve 22 - 29
 - 8.10.1 Central System 22 - 29
 - 8.10.2 Driver's System 22 - 32
- 8.11 Torch Brazing 22 - 32
- 8.12 Troubleshooting..... 22 - 33
 - 8.12.1 Expansion Valve 22 - 33

8.12.2 A/C	22 - 34
8.13 Temperatures and Pressures	22 - 35
8.14 Leak Testing.....	22 - 37
9. HEATING SYSTEM	22 - 37
9.1 Description.....	22 - 37
9.2 Draining Heating System	22 - 40
9.2.1 Driver's Heater Core	22 - 40
9.2.2 Central Main Heater Core	22 - 40
9.3 Filling Heating System	22 - 42
9.4 Bleeding Heating System.....	22 - 42
9.5 Soldering	22 - 42
10. HEATING SYSTEM COMPONENTS	22 - 42
10.1 Driver's Water Solenoid Valve	22 - 42
10.1.1 Description.....	22 - 42
10.1.2 Improper Operation	22 - 43
10.1.3 Coil Replacement	22 - 43
10.1.4 Valve Disassembly	22 - 43
10.1.5 Valve Reassembly.....	22 - 43
10.2 Central Hot Water Solenoid Valve Actuator	22 - 44
10.2.1 Description	22 - 44
10.2.2 Valve Disassembly.....	22 - 45
10.2.3 Valve Reassembly	22 - 46
10.2.4 Valve Troubleshooting	22 - 46
10.3 Water Recirculating Pump	22 - 47
10.3.1 Description.....	22 - 47
10.3.2 Removal.....	22 - 48
10.3.3 Disassembly	22 - 49
10.3.4 Brushes.....	22 - 52
10.3.5 Bearings.....	22 - 52
10.3.6 Commutator.....	22 - 52
10.3.7 Miscellaneous	22 - 53
10.3.8 Assembly	22 - 53
10.3.9 Installation.....	22 - 54
10.4 Coolant Strainer	22 - 54
10.4.1 Description.....	22 - 54
10.4.2 Maintenance	22 - 54
10.4.3 Servicing (Vehicles with central A/C system)	22 - 54
10.4.4 Servicing (Vehicles with driver's A/C system).....	22 - 55
10.5 Bypass Solenoid Water Valve (Optional)	22 - 56
10.5.1 To Remove or Change the Coil.....	22 - 56
10.5.2 To Take The Valve Apart	22 - 56
10.6 Preheating System (Optional).....	22 - 57
10.6.1 Espar.....	22 - 57
10.6.2 Webasto.....	22 - 57
10.6.3 Preheating System Timers - Auxiliary (Optional).....	22 - 58
10.6.4 Troubleshooting and Maintenance.....	22 - 58
11. SPECIFICATIONS.....	22 - 59

LIST OF ILLUSTRATIONS

FIG. 1: ADJUSTABLE AIR DUCT.....	22 - 5
FIG. 2: DRIVER'S AIR CIRCULATION.....	22 - 6
FIG. 3: CENTRAL HVAC SYSTEM AIR CIRCULATION.....	22 - 6
FIG. 4: THERMISTOR SENSOR.....	22 - 7
FIG. 5: EVAPORATOR COIL.....	22 - 8
FIG. 6: CONDENSER COIL.....	22 - 8
FIG. 7: DRIVER'S HVAC UNIT AIR FILTER.....	22 - 9
FIG. 8: ACCESS TO FILTERS (SHELL).....	22 - 9
FIG. 9: ACCESS TO FILTERS (COACH).....	22 - 10
FIG. 10: A/C & HEATING DOOR FILTER.....	22 - 10
FIG. 11: EVAPORATOR MOTOR INSTALLATION.....	22 - 10
FIG. 12: EVAPORATOR MOTOR ASSEMBLY.....	22 - 11
FIG. 13: REFRIGERANT CIRCUIT (CENTRAL & AUXILIARY SYSTEMS).....	22 - 13
FIG. 14: REFRIGERANT CIRCUIT (DRIVER'S SYSTEM).....	22 - 14
FIG. 15: TENSIONING VALVE.....	22 - 20
FIG. 16: TENSIONING AIR BELLOW.....	22 - 20
FIG. 17: COMPRESSOR ORIENTATION.....	22 - 21
FIG. 18: COMPRESSOR ALIGNMENT.....	22 - 21
FIG. 19: PULLEY INSTALLATION.....	22 - 23
FIG. 20: A/C COMPRESSOR (DRIVER'S OR AUXILIARY SYSTEM).....	22 - 24
FIG. 21: A/C JUNCTION BOX.....	22 - 25
FIG. 22: CONDENSER COMPARTMENT (XL VEHICLES, EXCEPT XL-45 COACHES).....	22 - 26
FIG. 23: CONDENSER COMPARTMENT (XL-45 COACHES ONLY).....	22 - 26
FIG. 24: ENGINE COMPARTMENT (RECEIVER FILTER).....	22 - 27
FIG. 25: DRIVER'S LIQUID REFRIGERANT SOLENOID VALVE.....	22 - 28
FIG. 26: REFRIGERANT SOLENOID VALVE.....	22 - 28
FIG. 27: BY-PASS VALVE LOCATION.....	22 - 29
FIG. 28: BY-PASS VALVE.....	22 - 29
FIG. 29: EXPANSION VALVE.....	22 - 30
FIG. 30: SUPERHEAT ADJUSTMENT INSTALLATION.....	22 - 31
FIG. 31: HIGH & LOW SWING TEMPERATURE AT REMOTE BULB.....	22 - 31
FIG. 32: CENTRAL HEATING SYSTEM COMPONENTS.....	22 - 38
FIG. 33: DRIVER'S HEATING SYSTEM COMPONENTS (DRIVER'S SYSTEM ONLY).....	22 - 39
FIG. 34: DRIVER'S WATER SOLENOID VALVE (DRIVER'S SYSTEM ONLY).....	22 - 40
FIG. 35: DRIVER'S WATER SOLENOID VALVE (CENTRAL SYSTEM).....	22 - 40
FIG. 36: DRIVER'S HEATER UNIT.....	22 - 40
FIG. 37: HEATER LINE SHUT-OFF VALVE.....	22 - 41
FIG. 38: HEATER LINE SHUT-OFF VALVE.....	22 - 41
FIG. 39: HEATER LINE SHUT-OFF VALVES.....	22 - 41
FIG. 40: A/C & HEATING COMPARTMENT.....	22 - 41
FIG. 41: DRIVER'S WATER SOLENOID VALVE.....	22 - 43
FIG. 42: CENTRAL WATER SOLENOID VALVE.....	22 - 45
FIG. 43: PUMP LOCATION (COACH).....	22 - 48
FIG. 44: PUMP LOCATION (SHELL).....	22 - 48
FIG. 45: PUMP LOCATION (DRIVER'S A/C ONLY).....	22 - 48
FIG. 46: WATER CIRCULATING PUMP (CONVERTED VEHICLE - CENTRAL A/C).....	22 - 50
FIG. 47: WATER CIRCULATING PUMP (COACH - CENTRAL A/C OR DRIVER'S A/C).....	22 - 51
FIG. 48: COOLANT STRAINER LOCATION.....	22 - 54
FIG. 49: WATER FILTER.....	22 - 55
FIG. 50: BY-PASS VALVE LOCATION.....	22 - 56
FIG. 51: ESPAR (40 000 BTU).....	22 - 58
FIG. 52: WEBASTO (80 000 BTU).....	22 - 58

1. HEATING AND AIR CONDITIONING

1.1 Description

The vehicle's interior is pressurized by the Heating, Ventilation and Air Conditioning (HVAC) system(s). Driver should always try to introduce as much circulation of outside fresh air as possible without hampering HVAC system(s). Vehicles equipped with a Central System are provided with a special air duct which allows a variable percentage of outside fresh air to be drawn into the vehicle and then mixed with recirculated air.

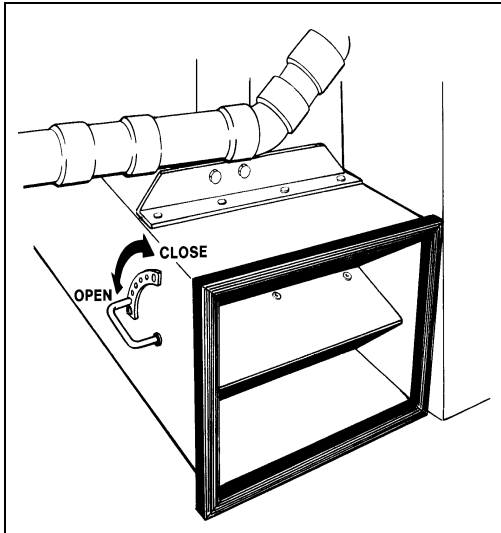


FIGURE 1: ADJUSTABLE AIR DUCT

22004

The adjustable air intake damper is located in the A/C & heating compartment (see "18. BODY" for compartment location). The damper should normally be left open. However, under extreme temperature conditions, it can be closed or partially closed to block the addition of ambient air and heat or cool the air inside vehicle as desired. As soon as extreme heating or cooling is no longer required, the damper should be reopened.

It should be remembered that the inside of vehicle should always be slightly pressurized to minimize the influx of dust and moisture.

The HVAC systems have been designed to allow circulation of some outside fresh air, so windows should be kept closed at all times. In the event of ventilation failure, emergency escape hatch(es) (see "18. BODY") can be used to provide air circulation, by simply pushing hatch upwards.

NOTE: *Auxiliary A/C system (if so equipped) operates independently from main system, it has its own condenser, evaporator and compressor.*

NOTE: *Driver's HVAC system operates independently from main system, even though it uses the same compressor.*

NOTE: *Vehicles equipped with a HGB-1000 Tecumseh compressor (driver's or auxiliary A/C) have a time delay relay installed on the electrical circuit with a reaction time of 48 seconds before magnetic clutch is engaged.*

2. AIR CIRCULATION

2.1 Driver's Area

Fresh air is taken from behind the front bumper and enters the mixing box through an adjustable damper. Returning air is taken through a front dash panel into the mixing box.

The "Driver A/C-Heating Recirc.-Fresh Air" control is located on the R.H. console in driver's area. Mixed air goes through cooling and heating coils, fans and discharge ducts. The L.H. discharge duct, directs air flow to four (4) different locations i.e.: driver's feet, driver's window, driver's chest and L.H. windshield. The R.H. discharge duct also has four (4) outlet's, all of which are directed towards windshield.

Note: *In the case of a converted vehicle, the hose furthest to the right, separates into two (2), directing air flow to the windshield/entrance door and to the entrance steps.*

Section 22: HEATING AND AIR CONDITIONING

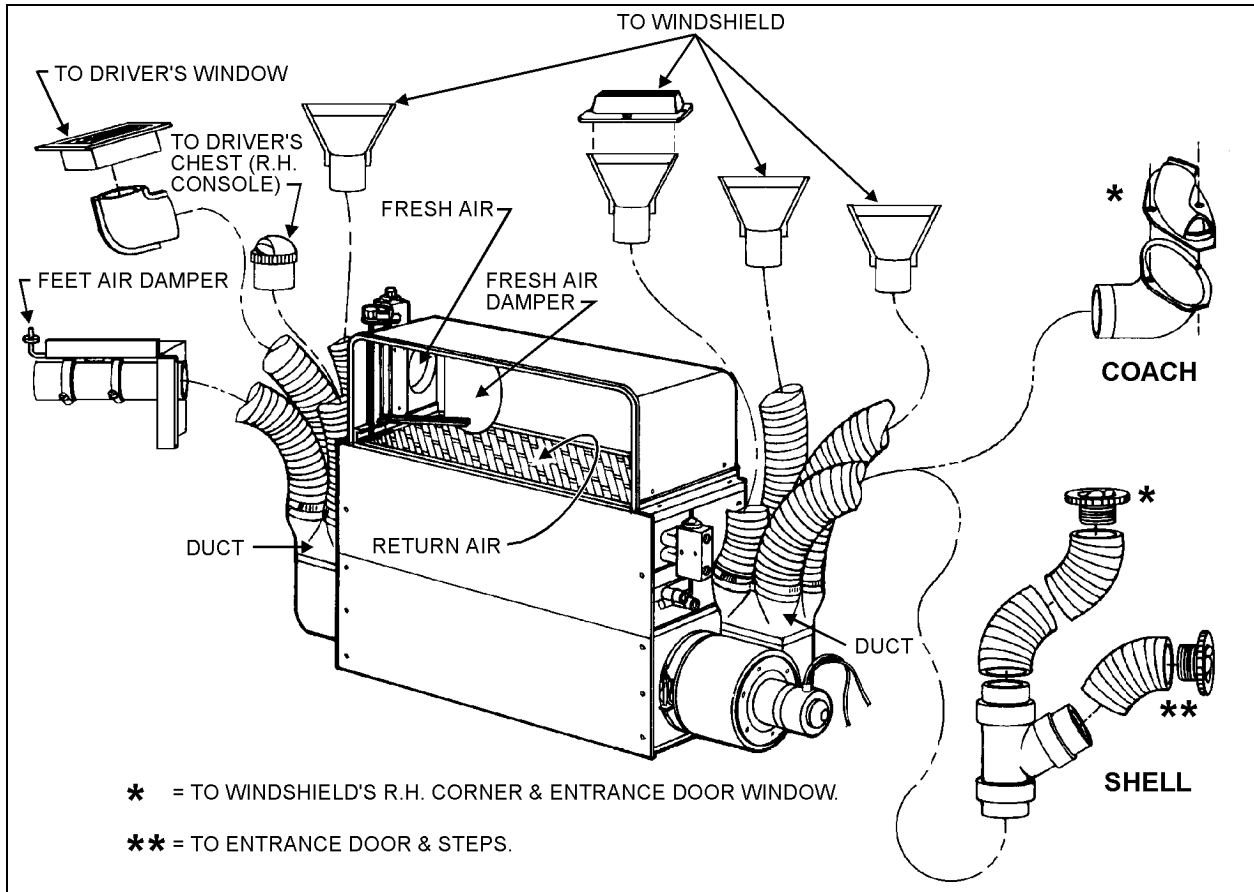


FIGURE 2: DRIVER'S AIR CIRCULATION

22062

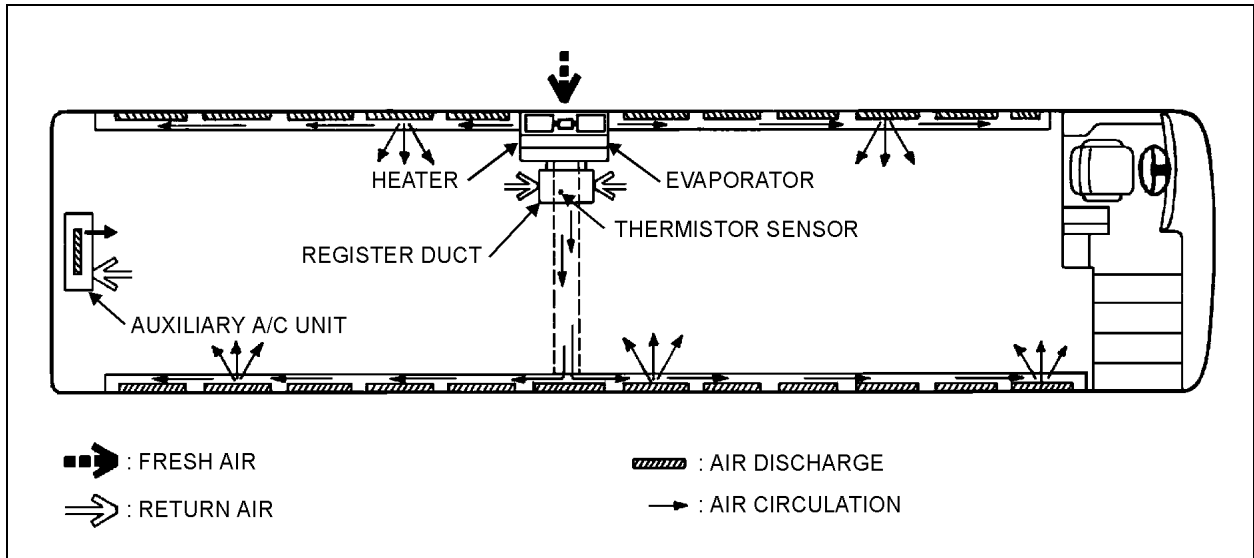


FIGURE 3: CENTRAL HVAC SYSTEM AIR CIRCULATION

22063

2.2 Central Area (Passengers/Living)

Fresh air enters the vehicle on the L.H. side, through the manually adjustable damper (Fig. 1) located in A/C & heating compartment. The damper can be fully opened for normal operation or partially closed for extreme weather or highly polluted areas (Refer to the Operator's Manual for more details). Return air is drawn from inside the vehicle through the register duct (Fig. 3).

A double blower fan unit, which is activated by the evaporator motor, draws mixed air through an air filter, cooling and heating coils, then forces this air in the ventilation ducts along the walls, and finally exhausts it just below side windows.

On vehicles equipped with an auxiliary A/C system, return air is drawn through an air filter into the auxiliary A/C unit at rear of vehicle; discharge air enters the vehicle through the grill just above the unit.

3. HVAC SYSTEM OPERATION - DRIVER'S SYSTEM

Temperature control in the driver's area is provided by the "Temperature" control (which is in fact a potentiometer), mounted on the R.H. console in conjunction with a thermistor sensor located underneath console. At extreme clockwise position, the temperature control will deliver full heat. The "Temperature" control button is protected by a 1.5 amp fuse located just behind it.

Warning: *Excessive high temperature in driver's area could induce drowsiness, affecting driver's ability to operate the coach safely.*

The fan speed is set by the position of the "Fan Speed" control, also mounted on the R.H. console. The clicking noise produced while turning the control activates the heating or A/C system depending on the "Temperature" control's posi-

tion; "Temperature" control also acts as a potentiometer. Consequently, it is possible to gradually increase speed of fan motor from 25% to maximum speed. An electronic module, mounted on the driver's HVAC unit, analyzes the value sent to the potentiometer, and thus sets the motor speed. This installation ensures economical operation, and a wide range of speeds.

The piping for driver's HVAC unit is paralleled with that of main HVAC unit. Both units use the same refrigerant and coolant, and are linked to the same condenser and compressor, but are individually controlled. The A/C compressor magnetic clutch is engaged only when the main HVAC unit is activated. Consequently, the main HVAC unit must be functional in order for the driver's unit to operate in the A/C mode.

4. HVAC SYSTEM OPERATION - CENTRAL SYSTEM

The "A/C - Heat" switch, located on the R.H. console, operates the A/C-heating and ventilation system (HVAC) in the passenger area (or the living space for a converted vehicle). The "Temperature" control, located on the R.H. console, enables you to select the desired temperature in the passenger area (refer to the Operator's Manual for details). This control is protected by a 1.5 amp fuse located just behind it. Temperature control is provided in conjunction with a thermistor sensor inside register duct, located amidships on L.H. side of vehicle (Figs. 3 & 4).

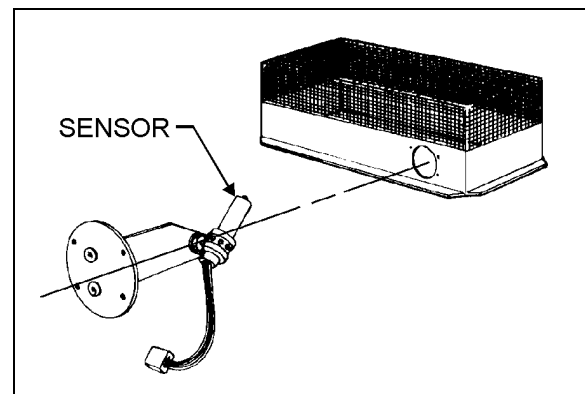


FIGURE 4: THERMISTOR SENSOR

22064

Section 22: HEATING AND AIR CONDITIONING

In addition to the central system, an auxiliary A/C system may be installed as optional equipment. The control switch is located on R.H. lower switch panel while the temperature control is located on the unit itself. Temperature control is factory set and protected by a 1 amp fuse located next to it.

The flow of water to the vehicle's main heater core is controlled by an electric water valve which is open or closed depending on selected temperature. A "Heat" indicator light, located on R.H. console, illuminates when hot water circulates through the valve, no matter what mode was selected. Moreover, an A/C "Warning" light, located next to "Heat" indicator light, illuminates when the main A/C system is not working properly.

The evaporator fan motor, located in A/C & heating compartment, is protected by a 105 amp, manually resettable circuit breaker. The condenser fans, located in the condenser compartment, also have circuit protection via manually resettable circuit breakers. The location of breakers varies with each type of XL vehicle; see "06. ELECTRICAL" for locations on your vehicle.

To operate A/C system when vehicle is stationary, run engine at fast idle. During operation of A/C system, windows should be kept closed and door(s) not left open longer than necessary. In order to prevent battery discharge, A/C & heating system will not operate when charging system is malfunctioning.

The auxiliary A/C system components are separate and completely independent of driver's and central systems.

5. HVAC UNIT MAINTENANCE

No special maintenance is required on the central driver's and auxiliary HVAC units, with the exception of cleaning their respective coils and air filters.

5.1 Coil Cleaning

Note: After cleaning coils with water, squeeze discharge tubes (rubber hoses) located underneath the appropriate compartment, to eliminate the accumulated water and dirt.

Check the external surface of the coil at regular intervals for dirt or any foreign matter.

For the driver's and auxiliary HVAC units, flush the coil from inside. For the evaporator, back flush the coil (Fig. 5) every 12,500 miles (20 000 km) or once a year, whichever comes first.

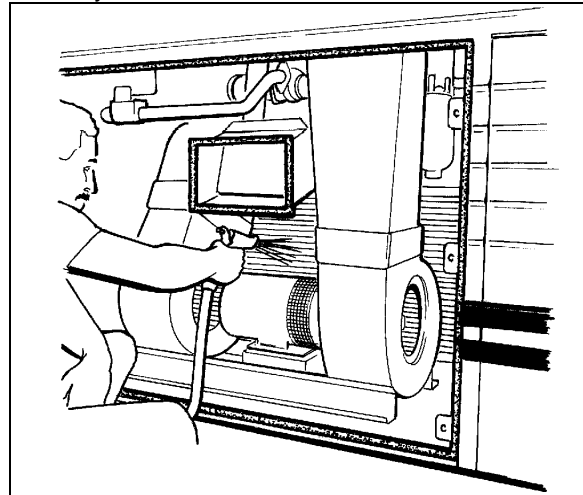


FIGURE 5: EVAPORATOR COIL

22065

For the condenser coil, back flush the coil (Fig. 6) every 6,250 miles (10 000 km) or twice a year, whichever comes first.

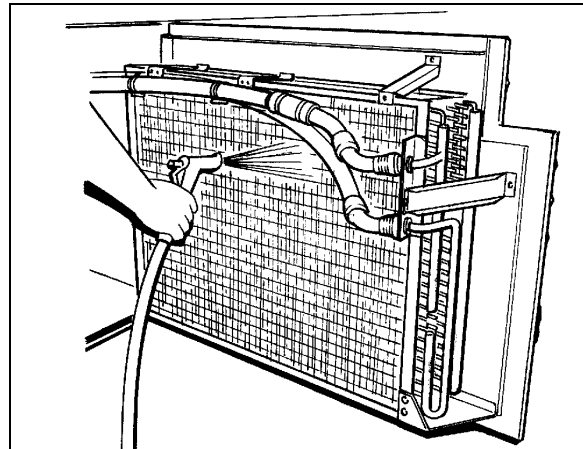


FIGURE 6: CONDENSER COIL

22066

Note: For vehicles with fans installed on condenser, first separate fans from condenser by unscrewing the Phillips screws securing them together, then proceed with the cleaning process.

Use a water jet or water mixed with low air pressure to clean the coil.

Caution: *Direct the pressure straight through the coil to prevent bending of fins and do not use extremely high pressure. Do not use hot water, steam or caustic soap.*

5.2 Driver's HVAC Unit Air Filter

The air filter is located underneath dashboard (Fig. 7). To gain access, turn counterclockwise both 3/4 turn knurled fasteners of A/C & heating unit access panel, located over entrance door steps, then lift and remove panel. Clean filter by first lifting and removing it from unit, then back flush with water, and then dry with air. This procedure should be done every 12,000 miles (20 000 km) or once a year, whichever comes first.

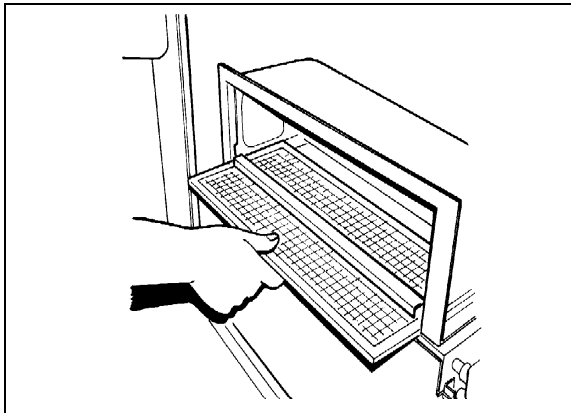


FIGURE 7: DRIVER'S HVAC UNIT AIR FILTER 22011

5.3 Auxiliary HVAC Unit Air Filter (where applicable)

The air filter is located in the rear cap and is accessible from inside the vehicle. To gain access, remove access panel located on back wall, on R.H. side of lavatory. Clean filter by first lifting and removing it from unit, then back flush with water, and then dry with air (Fig. 7). This procedure should be done every 12,000 miles (20 000 km) or once a year, whichever comes first.

5.4 Main HVAC Unit Air Filter

The main HVAC system uses two (2) or three (3) air filters, depending on vehicle.

On converted vehicles (Shells), the three (3) filters are located in A/C & heating compartment. To gain access, open compartment door, and then remove the six (6) outer screws ("Phillips") retaining the air filter panel (Fig. 8). Slide out panel c/w one (1) filter, then slide out the other two (2) filters.

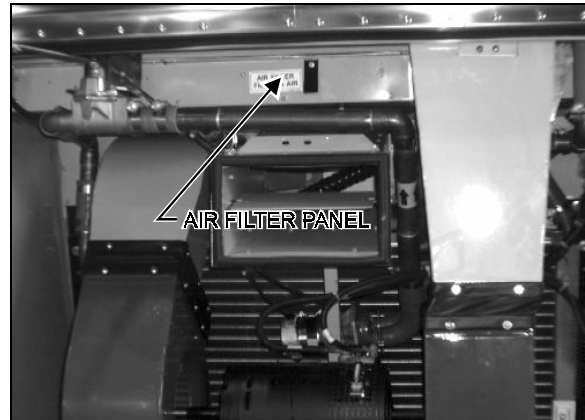


FIGURE 8: ACCESS TO FILTERS (SHELL) 22013

To clean filters, back flush with water, then dry with air every 12,000 miles (20 000 km) or once a year, whichever comes first.

On coaches, the two (2) filters are located in A/C & heating compartment. To gain access, open driver's side baggage compartment, forward of A/C & heating compartment, and open the air filter access panel by unscrewing the three (3) retaining screws (Fig. 9). Slide out the upper filter first, then slide out the other.

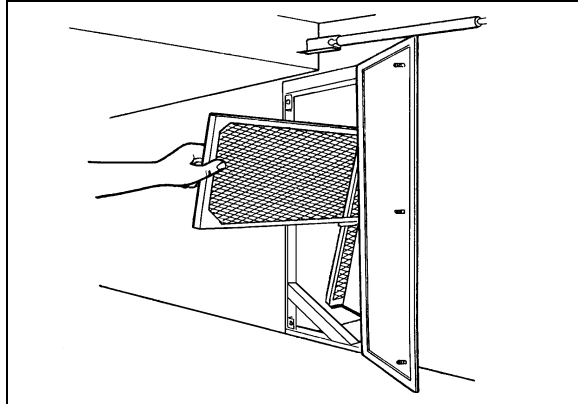


FIGURE 9: ACCESS TO FILTERS (COACH) 22012B

To clean filters, back flush with water, then dry with air every 12,000 miles (20 000 km) or once a year, whichever comes first.

The A/C & heating compartment door is also fitted with an air filter. It should be cleaned in the same manner as the other filters and at the same intervals (Fig. 10).

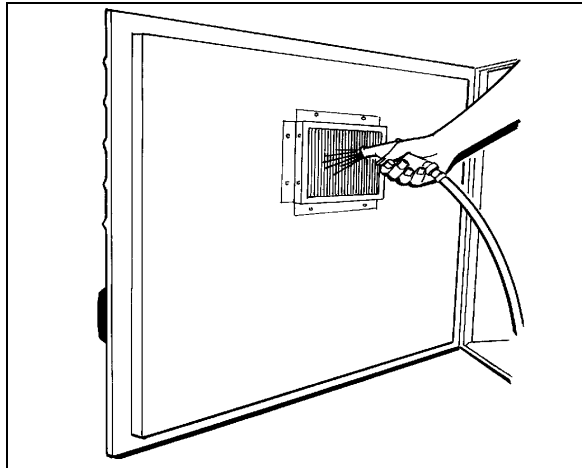


FIGURE 10: A/C & HEATING DOOR FILTER 22068

6. EVAPORATOR MOTOR (Central system vehicles only)

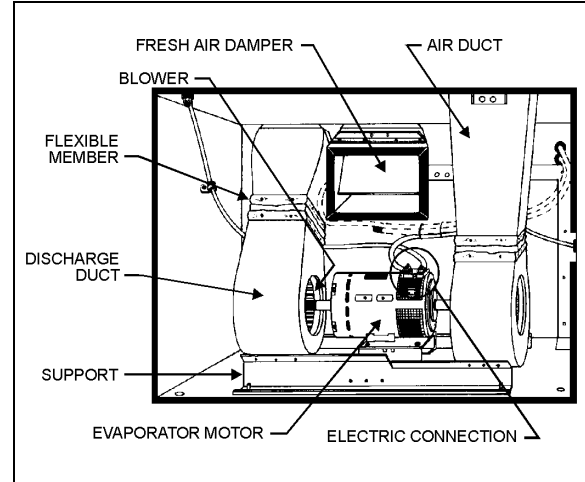


FIGURE 11: EVAPORATOR MOTOR INSTALLATION 22069

The evaporator motor is installed in the A/C & heating compartment (see Operator's Manual) (Fig. 11). It is a 27.5 volt, 1.5 HP motor which activates a double blower fan unit.

6.1 Removal

1. Set main battery disconnect switch(es) to the "OFF" position.
2. Open the evaporator compartment door.
3. Disconnect electric connection on motor plate.
4. Identify the L.H. side discharge duct inside compartment and remove the "Phillips" head screws retaining the flexible member to duct. Repeat procedure for R.H. side.
5. From underneath vehicle, remove the eight (8) bolts retaining the evaporator fan motor support, then remove the complete unit from the compartment.

Caution: Never use the motor output shafts to transport the assembly.

- On a work bench, unscrew the fan set screws, the "Phillips" head screws retaining discharge ducts to supports, then slide out assemblies from the evaporator motor output shaft. Remove support and fan discharge ducts from the unit.

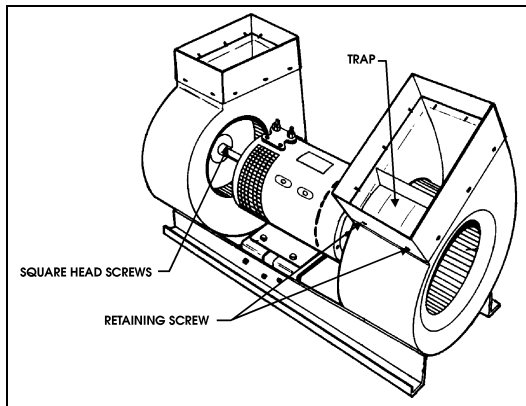


FIGURE 12: EVAPORATOR MOTOR ASSEMBLY 22036

- Separate fan from discharge duct by first removing the two (2) retaining screws, then remove trap and fan from assembly (Fig. 12).

Note: Position of the fans should be indexed with the motor in order to keep proper fan alignment at reassembly.

6.2 Installation

To reinstall the evaporator motor, reverse "Evaporator Motor Removal" procedure.

6.3 Maintenance

6.3.1 Checking Operation of Brush in Holder

Lift brush slightly 1/8" (3 mm) and release it; Brush must produce a dry noise.

6.3.2 Brush Wear Inspection and Replacement

Replace the brushes if less than 3/4" (19 mm). New brush length is 1-1/4" (32 mm). Clean brushes with

a clean cloth impregnated with gasoline or alcohol.

Warning: Cleaning products are flammable and may explode under certain conditions. Always handle in a well ventilated area.

To replace brushes, proceed as follows:

- Set main battery disconnect switch(es) to the "OFF" position.
- Remove the protective screen band from the motor housing by pulling down the spring loaded fastener.
- Remove and replace brushes as per the standard procedure.
- Reverse installation procedure.

6.3.3 Checking Commutator

The surface must be polished. A brown-black colored surface is normal and indicates a good switching. Ensure that there is no evidence of arcing or metal chips.

7. AIR CONDITIONING SYSTEM

7.1 Description

The schematic of Figure 13 shows the central and auxiliary A/C system and its components. The central system is equipped with a 6 cylinder, 05G-134A Carrier compressor with an air conditioning capacity of 9 tons. The receiver tank and filter dryer are mounted inside the condenser compartment.

XL Coaches may be supplied with central and auxiliary A/C system (Fig. 13). XL Converted vehicles (Shells) may be supplied with central or driver's A/C system only (Fig. 13 and 14). Auxiliary and driver's A/C systems come with a 2 cylinder, HGB-1000 Tecumseh compressor with an air conditioning capacity of 2 tons.

7.2 Main System A/C Cycle

Refrigeration may be defined as *"the transfer of heat from a place where it is not wanted to a place where it is unobjectionable"*. Components required for a closed circuit refrigeration system are shown in Figures 13 & 14 .

The air conditioning system used on an XL series vehicle is of the "Closed" type using "R-134a".

1. The refrigerant flowing to the compressor, is compressed to high pressure and reaches a temperature higher than the surrounding air. It is passed through the air-cooled fins and the condenser coil tubes causing the hot, high pressure gas to be condensed into a liquid form.
2. The liquid refrigerant flows to the receiver tank, then through a filter dryer where moisture, acids and dirt are removed. It is passed through a moisture indicator which indicates if any moisture is present in the system.
3. By its own pressure, the liquid refrigerant flows through a thermal expansion valve where the pressure drop vaporizes in a vapor-liquid state at a low temperature pressure.

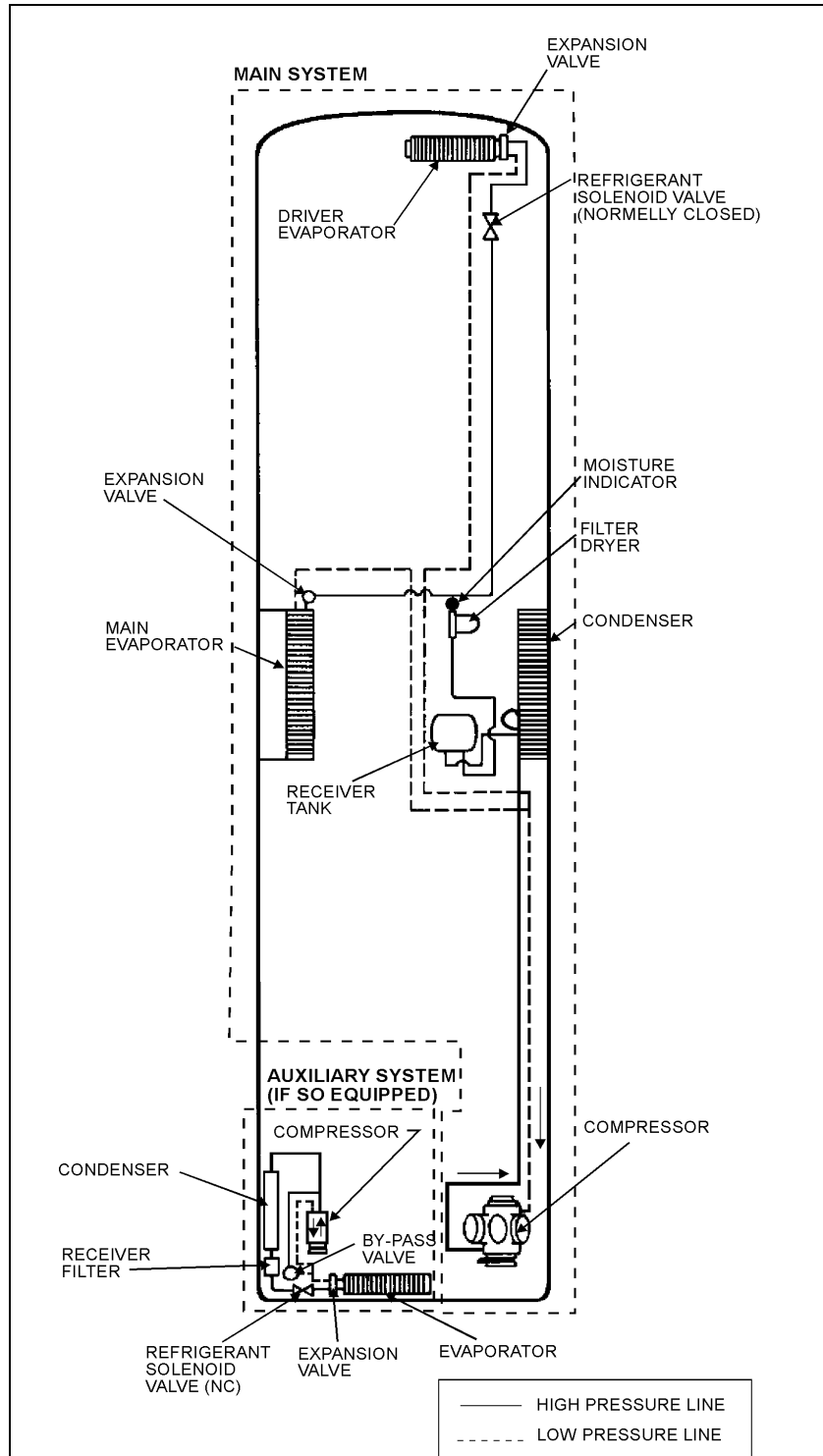


FIGURE 13: REFRIGERANT CIRCUIT (CENTRAL AND AUXILIARY SYSTEMS) 22070

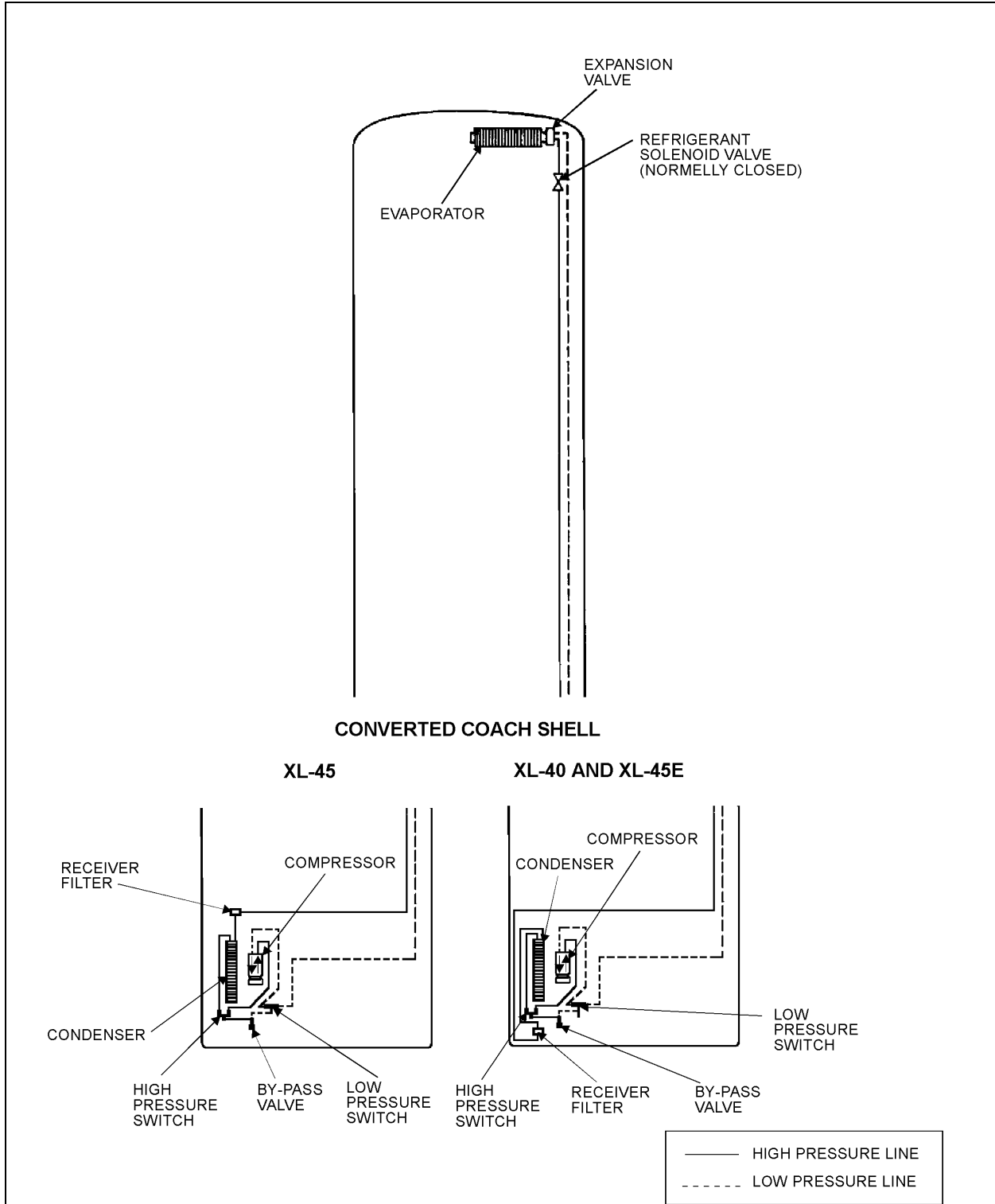


FIGURE 14: REFRIGERANT CIRCUIT (DRIVER'S SYSTEM)

22071

4. The cold low pressure refrigerant passes through the evaporator coil, absorbs heat from the air passing over the fins and tubes, and changes into gas. In this form, the refrigerant is drawn into the compressor to repeat the air conditioning cycle.

The success of the air conditioning system depends on retaining the conditioned air within the vehicle. All windows and intake vents should be closed. An opening of approximately 8 in² (203 mm²) could easily neutralize the total capacity of the system.

Other causes of inadequate cooling are dirty coils or filter. Dirt acts as an insulation and also restricts the air flow.

The refrigeration load is not constant and varies. It is also affected by outside temperature, relative humidity, passenger load, compressor speed, the number of stops, etc. The compressor will load or unload depending on operating conditions.

7.3 Refrigerant

The A/C system in this vehicle has been designed to use Refrigerant 134a as a medium. Regardless of the brand, in this system use R-134a **only**. The chemical name for this refrigerant is Ethane, 1, 1, 1, 2-Tetrafluoro.

Note: *Refrigerant 134a in itself is nonflammable, but if it comes in contact with an open flame, it will decompose.*

7.3.1 Procurement

Refrigerant is shipped and stored in metal cylinders. It is serviced in 30 and 100 pound (13,6 and 45 kg) cylinders. Approximately 24 pounds (10,9 kg) are used in the system. If vehicle is equipped with only a driver's A/C system, then 8 lbs (3,6 kg) are used. Approximately 5 lbs (2,3 kg) are used in an auxiliary A/C system.

It will be impossible to draw all the refrigerant out of the cylinder. However, the use of warm water when charging the system will assure the extraction of a maximum amount of refrigerant from the cylinder.

7.3.2 Precautions in Handling Refrigerant

1. Do not leave refrigerant cylinder uncapped.
2. Do not subject the cylinder to high temperatures.
3. Do not weld or steam clean on or near the system.
4. Do not completely fill cylinder.
5. Do not discharge vapor into an area where a flame is exposed.
6. Do not expose the eyes to liquid refrigerant.

All refrigerant cylinders 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 also good practice to replace the cap after each time the cylinder is used. If the cylinder is exposed to the sun's radiant heat, the resulting pressure increase may cause release of the safety plug or the cylinder may burst. For the same reason, the refrigerant cylinder should never be subjected to excessive temperature when charging a system. The refrigerant cylinder should be heated for charging purposes by placing it in 125°F (52°C) water. Never heat above 125°F (52°C) or use a blowtorch, radiator, or stove to heat the cylinder.

Welding or steam cleaning on or near any refrigerant line or components of the A/C system could build up dangerous and damaging pressures in the system.

If a small cylinder is ever filled from a large one, never fill the cylinder completely. Space should always be allowed above the liquid for expansion. Weighing cylinders before and during the transfer will determine the fullness of the cylinders.

Warning: *One of the most important precautions when handling refrigerant consists in protecting the eyes; liquid refrigerant, which can accidentally escape, is approximately -40°F (-40°C). If refrigerant comes in contact with eyes, serious injury can result. When opening refrigerant connections, always wear goggles to protect your eyes.*

7.3.3 Treatment in Case of Injury

If liquid refrigerant comes in contact with the skin, treat the injury as if the skin was frost-bitten or frozen. If liquid refrigerant comes in contact with the eyes, consult an eye specialist or doctor immediately. Give the following first aid treatment:

1. Do not rub the eyes. Splash eyes with cold water to gradually bring the temperature above the freezing point.
2. Apply drops of sterile mineral oil (obtainable at any drugstore) in the eyes to reduce the possibility of infection. The mineral oil will also help in absorbing the refrigerant.

7.3.4 Precautions in Handling Refrigerant Lines

1. All metal tubing lines should be free of kinks, because of the resulting restrictions on the flow of refrigerant. A single kink can greatly reduce the refrigeration capacity of the entire system.
2. The flexible hose lines should never be allowed to come within a distance of 2-1/2" (6,3 cm) from the exhaust manifold.
3. Use only sealed lines from parts stock.
4. Discharge the system of all refrigerant (with a recovery or reclaiming medium) before disconnecting any fitting in the refrigeration line. However, proceed very cautiously, regardless of gauge readings. If there happens to be liquid refrigerant in the line, disconnect fittings very slowly, keeping face and hands away to prevent injuries. If pressure is noticed when fitting is loosened, allow it to bleed off very slowly.

Warning: Always wear safety goggles when opening refrigerant lines.

5. In the event that a line is opened to the atmosphere, it should be immediately

capped to prevent entrance of moisture and dirt.

6. The use of proper wrenches when making connections on O-ring fittings is important. The use of improper wrenches may damage the connection. The opposing fitting should always be backed up with a wrench to prevent distortion of connection lines or components. When connecting the flexible hose connections, it is important that the swaged fitting and the flare nut, as well as the coupling to which it is attached, be held at the same time using three different wrenches to prevent turning the fitting and damaging the ground seat.
7. The O-rings and seats must be in perfect condition. The slightest burr or piece of dirt may cause a leak.
8. O-rings should be coated with refrigeration oil and installed on the line before the line is inserted into the fitting to prevent damaging the O-ring. If leaks are encountered at the couplings or connectors, no attempt should be made to correct the leaks by tightening the connections beyond the recommended torque. The O-rings are designed to seal at the specified torque and overtightening the connection does not result in a satisfactory and permanently sealed connection. The connection must be disassembled and the cause of the leak (damaged O-ring, defective lines, etc.) corrected. Use new O-ring.

7.4 Pumping Down

This procedure is intended to reduce refrigerant loss, on central system only, by isolating it in the compressor and the receiver tank, as well as in their connecting line, in order to carry out repairs on other sections of the air conditioning system (lines and components).

Note: Before attempting any repairs between compressor and receiver tank, use a recovery unit to remove refrigerant from the system.

On vehicles equipped with an auxiliary or driver's A/C system only, it is not possible to isolate refrigerant except to add oil. See

Tecumseh compressor "Oil Verification", further in this section.

Warning: To prevent injury, when air conditioning system must be opened, refer to previous paragraph "Precautions in Handling Refrigerant".

Caution: The filter dryer must be changed each time a line in the system is opened.

Procedure

run the system 10 minutes, shut it off, then:

1. Close the receiver tank's outlet service valve by turning it clockwise until the valve is frontseated, backseat the suction service valve on the compressor, install an appropriate pressure gauge set, and turn the valve forward 1/4 turn to enable a visual check of the suction pressure.
2. Disconnect the "Low Pressure Switch" connector (mounted near the A/C compressor), and install a jumper wire.

Note: This jumper wire will allow the clutch to remain engaged after pressure drops below 15 psi (103,5 kPa).

3. Start the engine, turn on the "Central A/C - heating switch", then adjust "A/C - heating temperature" controls to maximum A/C position.
4. Run the compressor until pressure reaches approximately -5 psi (-35 kPa).

Note: During this operation, care must be taken not to fill the receiver tank over the upper sight glass. If so, stop process immediately. Always allow refrigerant piping and units to warm up to the ambient air temperature before opening system or sweating will take place inside the lines.

5. Stop engine, and close compressor outlet valve by turning it clockwise until valve is properly seated.
6. Close compressor suction valve by turning it clockwise until it is properly seated.
7. Wait until pressure gauge reaches 1 to 2 psi (7 to 14 kPa). To accelerate procedure, lightly open compressor suction valve until pressure reaches this value.

7.5 Adding Refrigerant (Vapor state)

Use the suction service valve on the compressor to add a small quantity of refrigerant to the system. Backseat the valve and loosely connect a charging line from the refrigerant cylinder to the valve. Tighten connection at level of refrigerant cylinder and open tank end slightly to purge air from the charging line. Tighten the charging line at the compressor. Screw in the suction valve stem approximately two turns. Start the engine and run at fast idle. Add sufficient refrigerant to bring the level in lower sight glass of receiver tank to mid-point. Always charge the system with the cylinder upright and the valve on top to avoid drawing liquid out of the cylinder. When charging an empty system, weigh the amount of refrigerant put into system; this will eliminate any possibility of overfilling. A full charge requires 24 lbs (10.9 kg).

Fill liquid refrigerant at the receiver tank and completely charge, if necessary, using previous procedure.

Note: If the vehicle is equipped with an auxiliary system, a full charge requires 8 lbs (3,6 kg). if the vehicle is equipped with a driver's system only, the system requires 5 lbs (2,3 kg).

7.6 Evacuating System

1. Open both receiver valves by turning "out" (normal position).
2. Remove the caps from the two 90° adapters on the suction and discharge valves, then connect two hoses to the vacuum hose.
3. Place the two compressor valves, suction and discharge, in neutral position by turning each one 3 to 4 turns "in" from the "out" position.
4. Start the vacuum pump. Open the large (suction) shutoff valve and close the small vacuum gauge valve.
5. The pressure will drop to approximately 29" vacuum (14.2 psi or 97,9 kPa) fairly quickly. The dial gauge only gives a general idea of the absolute system pressure.
6. Backseat the compressor valves by turning "out" all the way.
7. Shut down the vacuum pump.
8. Remove the hoses.
9. Reinstall the caps at the suction valve take-off points.

7.7 Charging System

When a system has been opened or if there are any questions about the air or moisture in the system, **evacuate** the system. Charging of an evacuated system may be accomplished by forcing liquid "R-134a" directly into the receiver tank.

This may be accomplished by placing the refrigerant tank upside down on a scale (bathroom type) with the valving at the bottom. This ensures that only liquid enters the reservoir.

When charging an empty system, weigh the amount of refrigerant put into the system. This will eliminate any possibility of overfilling. A full charge requires 24 pounds (10,9 kg). If the vehicle

is equipped with an auxiliary system, a full charge requires 8 lbs (3,6 kg). If the vehicle is equipped with a driver's system only, the system requires 5 lbs (2,3 kg).

1. Backseat the two compressor shutoff valves ("out").
2. Install the test gauges at the shutoff valves noting that the 400 psi (2758 kPa) gauge is connected to the discharge.
3. Turn in the two shutoff valves 3 to 4 turns.
4. Open the lower receiver valve by turning all the way "out".
5. Backseat the upper receiver valve by turning all the way "out".
6. Remove the cover cap from the service fitting in the top receiver valve.
7. Attach a charging hose to the R-134a tank. Open the tank valve slightly permitting R-134a to escape thus purging the hose of air.
8. Connect the charging hose to the service fitting.
9. Open the R-134a tank valve.
10. To build up pressure in the receiver tank, heat the receiver tank with a heating blanket.
11. Turn in the upper receiver valve several turns. The R-134a will now enter the system.
12. The proper charge of R-134a is 24 lbs (10.9 kg). When the scale indicates this amount of charge, backseat the receiver valve and close the R-134a tank valve.
13. Disconnect the charging hose. Replace the cover caps.
14. The system is now ready for operation.

Caution: The evacuation of the system must be done by authorized and qualified personnel only. Refer to local laws for R-134a recuperation.

7.8 Refrigerant System Cleanout After Compressor Failure

Although the vast majority of reciprocating refrigerant compressors manufactured today are extremely reliable, a small percentage do fail. These failures usually result in minor or extensive system contamination depending on the severity of the failure. When an open type compressor becomes damaged internally, this provokes small particles of bearings, steel, brass, copper, and aluminum and, in severe cases, carbonized oil, which could contaminate the system. To prevent repeated failures, the problem which caused the failure should be corrected, and depending upon the severity of the failure, the system should be thoroughly cleaned out using one of the cleanout procedures mentioned.

7.8.1 Determining Severity of Failure

The severity of compressor failure can be categorized as minor or major. A failure is considered minor when the contamination is limited to the compressor with little or no system contamination. A major failure, or burnout, results in extensive system contamination as well as compressor damage. Extensive system contamination can be determined by withdrawing a small sample of compressor oil and checking its color, odor and acidity. A Virginia Chemical "TKO" one step acid test kit is one of several compressor oil test kits that may be used. A high acid content would indicate a major failure or burnout. A small amount of refrigerant gas may be discharged. A characteristic burned odor would also indicate severe system contamination.

7.8.2 Cleanout After Minor Compressor Failure

1. Be sure to correct the problem which caused the failure.
2. Change liquid line filter dryer.
3. Run the unit for two (2) hours on high speed cool only. If a unit with a hot gas heating

system is allowed to operate in heat or defrost, the refrigerant will not all flow through the liquid line filter dryer for cleaning and some parts of the system which were not previously contaminated, may become contaminated.

4. Check compressor oil level to ensure compressor is not overcharged with oil. Sometimes a significant amount of oil is pumped out of the compressor to other parts of the system when a compressor fails. This oil will return to the replacement compressor when it is started, causing an overcharge of oil in the sump of the replacement compressor. In this case, it is important that the oil level be adjusted to the proper level.
5. Withdraw a sample of the compressor oil and check its color, odor, and acidity, using instructions supplied above. If the oil is contaminated, change the oil and filter dryer, and repeat the procedure until the system is clean.

7.8.3 Cleanout After Major Compressor Failure

1. Reclaim the refrigerant into a refrigerant bottle through a filter dryer to filter out contaminants.
2. Remove the failed compressor and repair it if possible.
3. Install new or repaired compressor.
4. Change the filter dryer.
5. Circulate clean R-134a with the reclaimer to clean out many of the contaminants collected in the coil valves, TXV (Thermal Expansion Valve), solenoid valves, check valves, and any other mechanical component that may have collected contaminants.
6. Evacuate and charge the system normally.
7. Run the unit for 8 hours and monitor the pressure drop across the filter dryer. Also check the liquid line dryer for signs of restric-

Section 22: HEATING AND AIR CONDITIONING

tion. If the pressure drop across the filter dryer exceeds 12 to 14 psig (82,75 to 96,5 kPa) with a 40°F (5°C) evaporator coil temperature, stop the unit and change the liquid line and suction line filter dryer. After 4 or 5 hours of operation, stop the unit and replace the filter dryer.

- After 8 hours of operation, stop the unit and remove a sample of the compressor oil and check its color, odor, and acidity, using instructions supplied above. If the oil is contaminated, replace the oil and repeat step 7. If the oil is not contaminated, change the filter dryer again and replace the moisture-liquid indicator.
- After approximately 7 days of operation, recheck the compressor oil for cleanliness and acidity.

8. A/C SYSTEM COMPONENTS

8.1 Compressor (Central System)

8.1.1 Belt Replacement

Warning: Set the main battery disconnect switch to the "Off" position. For greater safety, set the engine starter selector switch in engine compartment to the "Off" position.

- Open engine compartment rear doors and locate the belt tensioner two-way control valve (Fig. 15), mounted above the engine R.H. side door next to the pressure regulating valve, then turn handle counterclockwise in order to release pressure and tension on belts.
- Slip the old belts off and the new ones on.

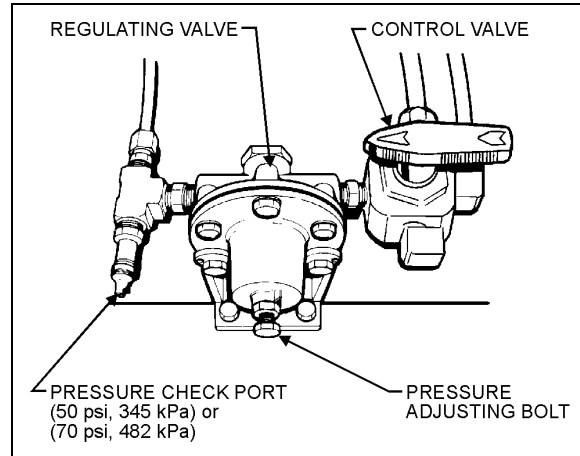


FIGURE 15: TENSIONING VALVE

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Note: Both belts must always be replaced simultaneously to ensure an equal distribution of load on each of them.

- Reset belt tensioning pressure control valve (Fig. 15) to 50 psi (345 kPa) for Series 60 engines and to 70 psi (482 kPa) for Series 50 engines, to apply tension on the new belts as explained in Section 12.

Note: For proper operation of the air bellows, adjust the upper tensioning bracket to provide a 2 3/8"-2 1/2" (60-64 mm) extension with the pneumatic system under normal pressure and the pressure regulating valve set as per item #3 (Fig. 16).

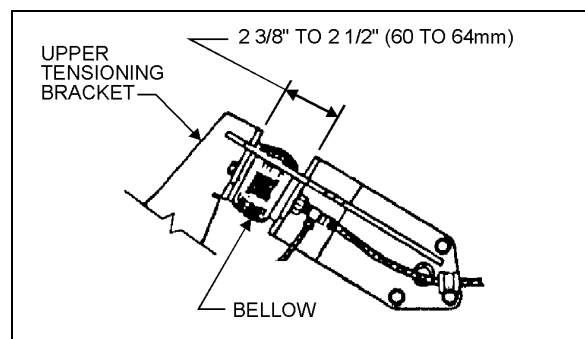


FIGURE 16: TENSIONING AIR BELLOW

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8.1.2 Pulley Alignment

In order to avoid skipping, disengagement and a premature wear of compressor belt, it is necessary to align compressor pulley with the crankshaft pulley. Before performing the following procedure, release air from belt tensioners by means of the two-way control valve, remove belts from radiator fan pulley and crankshaft pulley; then reset belt tensioning pressure control valve to 50 psi (345 kPa) for Series 60 engines and to 70 psi (482 kPa) for Series 50 engines.

Longitudinal Compressor Alignment

1. Rest an extremity of a straight edge of approximately 46 inches (117 cm) against the upper part of the outer face of crankshaft pulley, positioning the other end close to the compressor clutch pulley (Figs. 17 & 18).
2. Check the distance between each extremity of straight edge (1. Fig. 18) and the first drive belt. If they are different, loosen the compressor support bolts and with a hammer, knock support to slide it in order to obtain the same distance; then tighten bolts.

Horizontal Compressor Alignment

1. Rest an extremity of the straight edge against the upper part of the outer face of compressor pulley, positioning the other end close to the crankshaft pulley.
2. Check the distance between each extremity of straight edge (1, Fig. 18) and drive belt. If they are different, loosen the pillow block compressor bolts and with a hammer, knock compressor pillow block to slide it, in order to obtain the same distance; then tighten bolts.

Vertical Compressor Alignment

Rest a short "angle and level indicator" on the outer side face of the crankshaft pulley, adjust the level indicator inclination at 0° and check if the compressor pulley is at same angle (Figs. 17 & 18). If it is not the same, shim under the appropriate pillow block in order to obtain a correct angle.

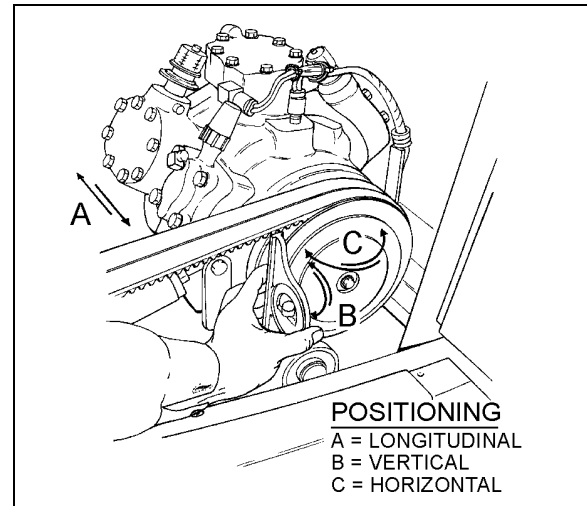


FIGURE 17: COMPRESSOR ORIENTATION

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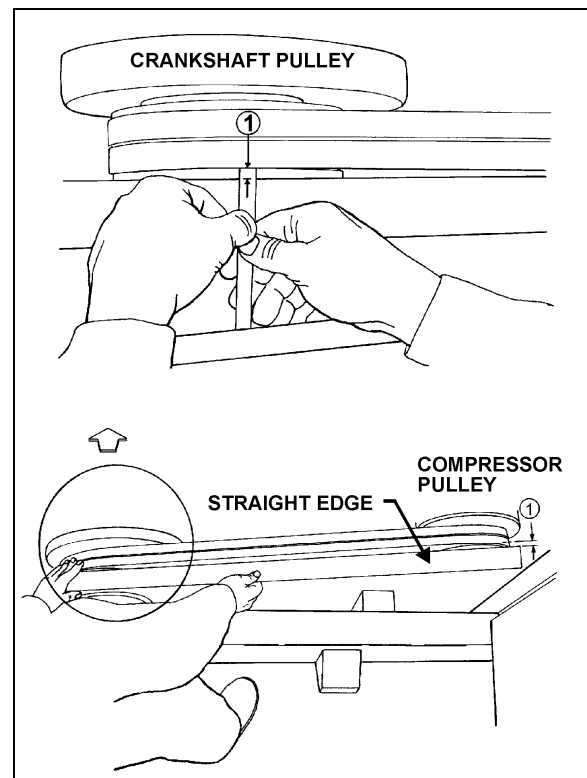


FIGURE 18: COMPRESSOR ALIGNMENT

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Section 22: HEATING AND AIR CONDITIONING

8.1.3 Compressor Maintenance

For A/C compressor maintenance, see "Carrier Compressor - Operation and Service Manual" annexed to this section.

Caution: Use only Castrol SW 68 (POE) oils with refrigerant R-134a.

8.1.4 Troubleshooting Guide

A preliminary check may be made by simply feeling the cylinder heads with the unit in operation at ambient temperatures of 35°F (2°C) and over. The cylinder heads are internally divided into suction and discharge valves; the lower half of the cylinder head is the suction side, and it should be relatively cool to the touch, as opposed to the hot upper discharge side. If a valve plate or head gasket is blown, or a compressor unloader is stuck open, partially compressed refrigerant vapor will be circulated between the suction and discharge sides of the head. The affected cylinder head will then have a relatively even temperature across its surface and be neither as hot as the normal discharge temperature nor as cool as the normal suction temperature.

Broken suction valves are probably the most difficult fault to detect without opening the compressor. Depending on the condition of the cylinder walls and piston rings, a compressor in good condition should be able to pull a vacuum of 20" Hg (9.8 psi - 67,6 kPa) with the suction service valve frontseated. Failure to reach this value would require disassembly of the compressor to determine actual component conditions.

Blown Head Gaskets

Symptom:

- Loss of unit capacity at low temperature.
- Even cylinder head temperature.

Cause:

- Improperly torqued cylinder head bolts.
- Improperly positioned gasket at assembly.
- Warped cylinder head.

- Severe liquid refrigerant floodback.
- #### Blown Valve Plate Gaskets

Symptom:

- Loss of unit capacity at medium and low temperatures.
- Very hot cylinder head surface.
- Higher than normal suction pressure.

Cause:

- Improperly torqued cylinder head bolts.
- Severe liquid refrigerant floodback.
- Oil slugging caused by an overcharge of oil or flood starts.
- Discharge valves not seated properly (liquid drainback during shutdown).

Broken Suction Valves

Symptom:

- Loss of unit capacity at all temperatures.
- Compressor unable to pull extremely low vacuum with suction service valve frontseated.

Cause:

- Repeated liquid refrigerant floodback.
- Flooded starts.
- Overcharge of oil.
- Discharge valves not seated properly (liquid drainback during shutdown).
- Expansion valve not controlling properly.

Unloader Valve Stuck Open

Symptom:

- Loss of unit capacity at all temperatures.
- Higher than normal suction pressure.
- Even cylinder head temperature.

Cause:

- Unloader body stem bent.
- Foreign material binding unloader piston or plunger.

8.1.5 Oil Verification

The level is acceptable when the oil is visible through sight glass on R.H. side of compressor. For an accurate reading, release air in belt tensioning system, then level compressor. The oil level should be in center of sight glass. To add oil, isolate the refrigerant in the receiver tank by following the procedure at step "7.4 Pumping Down".

8.2 Magnetic Clutch

Refer to Carrier service information entitled "Housing-Mounted Electric Clutch" at the end of this section for the description and maintenance of the magnetic clutch.

8.3 Compressor (Driver's system only or auxiliary system)

8.3.1 Clutch Pulley Installation

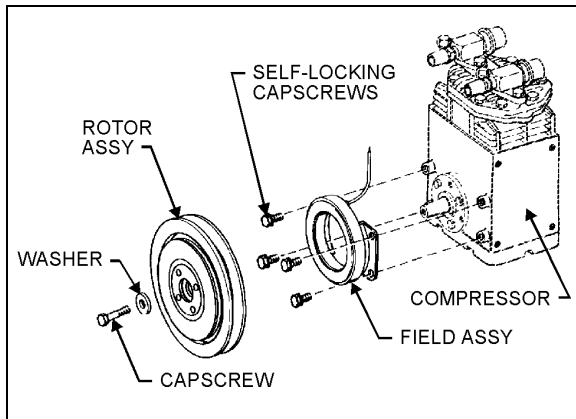


FIGURE 19: PULLEY INSTALLATION

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To install the clutch pulley, proceed as follows:

1. Position the field assembly against the compressor bosses, aligning the field mounting holes with the bolt holes in the bosses. Insert four (4) self-locking cap screws, supplied with the clutch, into the bolt holes of the compressor. Tighten the cap screws to a wrench torque of 7/10 lbf•ft (9,5/13,5 N•m). Take care not to strip the threads in the compressor body.

2. The compressor shaft must be clean and free of burrs. Check the Woodruff key for proper position and seating.
3. Slide the rotor pulley assembly on to the tapered shaft (aligning the keyway with the Woodruff key in the shaft). Secure the rotor pulley assembly with the washer and self-locking cap screw to a wrench torque of 15/20 lbf•ft (20/27 N•m).
4. Rotate the pulley assembly manually to ensure that there is no interference between the field and rotor. If interference is present, a rubbing noise can be heard as the pulley rotates. If interference is present, disassemble the clutch and repeat the installation of the field assembly.

8.3.2 Clutch Pulley Removal

To disassemble the rotor-pulley assembly from the compressor, remove the self-locking cap screw and washer and insert a 5/8-11 UNC-2B cap screw in the threaded portion of the hub. The pressure exerted by the cap screw on the end of the compressor shaft will force off the rotor pulley assembly without damaging the clutch or compressor. **DO NOT USE** a wheel puller on the outer diameter of the pulley, since this can result in damage to the clutch bearing.

8.3.3 Clutch Maintenance

The compressor clutch automatically compensates for wear, requiring no adjustment throughout the life of the clutch. **DO NOT** lubricate the unit. If the clutch should fail to operate, check the electrical circuit.

8.3.4 Belt Replacement

Warning: Set the main battery disconnect switch(es) to the "OFF" position, then for greater safety, set the engine starter selector switch in engine compartment to the "OFF" position.

1. Open engine compartment rear doors.
2. Loosen tension retaining bolt.

Section 22: HEATING AND AIR CONDITIONING

3. Replace compressor belt.
4. Tighten belt to 60/65 lbf•in (6,5/7 N•m) (Fig. 20), using a belt tension gauge, as per "Instruction Sheet IS94056", then tighten tension retaining bolt.

Note: *Since new belts stretch with normal wear, readjust tension after a run-in period of 500 miles (800 km), if necessary.*

8.3.5 Pulley Alignment

In order to avoid skipping, disengagement or premature edge wear of compressor belt, it is necessary to align fan gearbox and compressor pulleys.

1. Rest an extremity of a straight edge on fan gearbox pulley's flat surface, then place the other end of straight edge near compressor clutch pulley.
2. Check the distance between the straight edge and the belt at both pulleys (*Take note that pulleys outer edges do not have the same thickness*). If they do not match, loosen fan gearbox pulley and adjust accordingly.

Note: *Fan gearbox pulley is of the "Tapered" type and will move out 1/16" (2 mm) after tightening.*

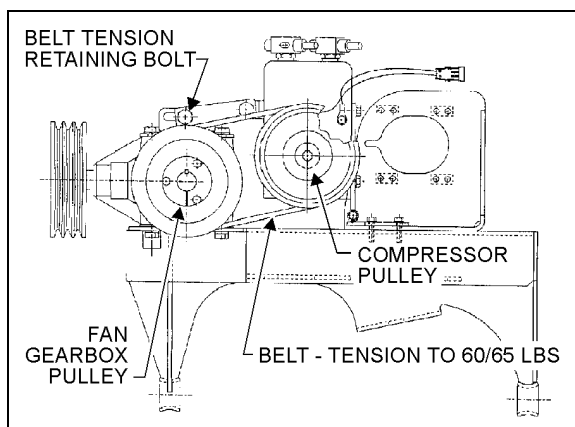


FIGURE 20: A/C COMPRESSOR (DRIVER'S OR AUXILIARY SYSTEM)

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8.3.6 Oil Verification (Tecumseh Compressor)

To add oil, first evacuate the compressor as per the following instructions:

1. Backseat the suction and discharge valves on the compressor, install an appropriate pressure gauge set, then turn the valve clockwise until it is properly seated and also to enable a visual check of the suction pressure.
2. Evacuate the system through the pressure gauge set tube.
3. Unscrew oil fill plug (identified "OIL") and insert a slightly arced, disposable gauge (wood, cardboard, etc.) down to the bottom. The oil level must be 1/2" (13 mm) from the bottom. This level is equivalent to 10 US oz (295 ml) of oil. For more information, see "11. SPECIFICATIONS" at the end of this section.
4. Backseat the suction and discharge valves, remove the pressure gauge set, then turn both valves clockwise, midway between frontseated and backseated position.

8.4 Condenser (All vehicles, except for XL-45 Coach)

The main A/C system's condenser coil is hinge mounted on the inner face of condenser compartment door. The condenser coil for vehicles equipped with an auxiliary or a driver's A/C system only, is mounted on the outer face of engine radiator. Since condenser's purpose is to dissipate heat from the hot refrigerant, it is important to keep the cooling coils and fins clean. A clogged coil will cause high discharge pressure and insufficient cooling.

8.4.1 Condenser Fan Motor (on vehicles with central system)

The central A/C system's condenser motor is located inside condenser compartment. Motor, fans (qty=2) and cages are mounted on a support, fastened to the floor. The receiver-filter is located on the R.H. side wall of the compartment and the receiver tank is affixed to rear wall.

When temperature drops inside condenser, the pressure in the refrigerant line also drops and it is, therefore, no longer required to cool condenser. Consequently, when pressure drops to 90 psi, a pressure switch stops the motor so that fans do not operate needlessly. When pressure rises to 120 psi, the pressure switch reactivates the motor.

8.4.2 Motor Removal

To remove the condenser motor, proceed as follows:

1. Set the main battery disconnect switch(es) to the "OFF" position.
2. Open condenser compartment door, locate motor and disconnect electrical wiring at motor plate.
3. Loosen motor support from the floor then remove the motor assembly from the compartment.
4. On a workbench, remove support and fan cages from the unit; then remove fans.

Note: Position of the fans should be indexed with the motor in order to keep proper fan alignment at reassembly.

Caution: Never use the motor output shafts to transport the assembly.

8.4.3 Motor Installation

To reinstall the condenser motor, reverse the removal procedure.

8.4.4 Maintenance

Refer to "EVAPORATOR MOTOR - 6.3 Maintenance".

8.5 Condenser (XL-45 coach)

The central A/C system's condenser coil is hinge mounted on the inner face of condenser compartment door. The receiver-filter is located on the R.H. side wall of the compartment and the receiver tank is affixed to rear wall. The condenser coil for vehicles equipped with an auxiliary or a driver's A/C system only, is mounted on the outer face of engine radiator. Since condenser's purpose is to dissipate heat from the hot refrigerant, it is important to keep the cooling coils and fins clean. A clogged coil will cause high discharge pressure and insufficient cooling.

8.5.1 Condenser Fan Motors

The four (4) condenser fans are also hinge mounted on condenser compartment door, just behind condenser coil. They are powered by 15 amp-24 volt electrical motors connected directly to four (4) breakers (CB134 to CB137), located inside A/C junction box in condenser compartment (Fig. 21).

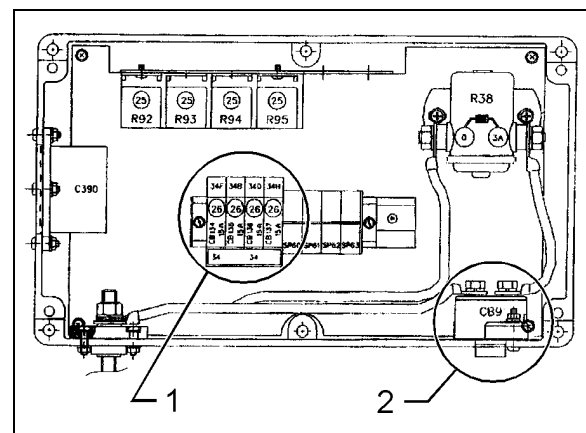


FIGURE 21: A/C JUNCTION BOX

06100

Section 22: HEATING AND AIR CONDITIONING

1.(From left to right)

CB134: Condenser fan motor 15 amps- 24 volts
 CB135: Condenser fan motor 15 amps- 24 volts
 CB136: Condenser fan motor 15 amps- 24 volts
 CB137: Condenser fan motor 15 amps- 24 volts

2.CB9: Evaporator fan motor 105 amps-24 volts

The fans pull outside air through the condenser coil and discharge it through compartment floor opening. When temperature drops inside condenser, the pressure in the refrigerant line also drops and it is, therefore, no longer required to cool condenser. Consequently, when pressure drops to 90 psi, a pressure switch stops the motors so that fans do not operate needlessly. When pressure rises to 120 psi, the pressure switch reactivates the two (2) forward fan motors. When pressure rises above 170 psi the two (2) rear fan motors are activated and are disengaged only when pressure drops below 130 psi.

8.6 Receiver tank

The receiver tank is located in the condenser compartment (Figs. 22 & 23). The function of the receiver tank is to store the liquid refrigerant. During normal operation, the level of the refrigerant should be approximately at the mid-point of the lower sight glass.

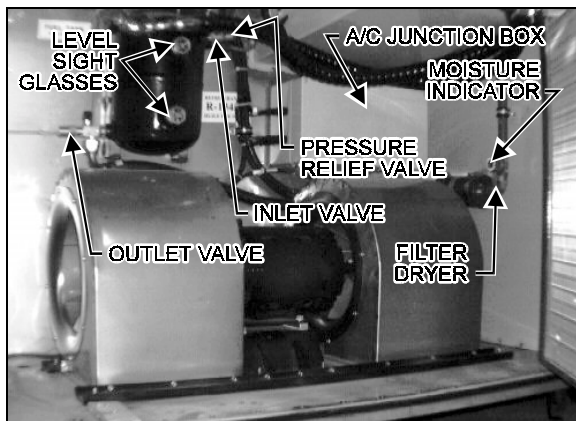


FIGURE 22: CONDENSER COMPARTMENT (XL VEHICLES, EXCEPT FOR XL-45 COACHES)

22074

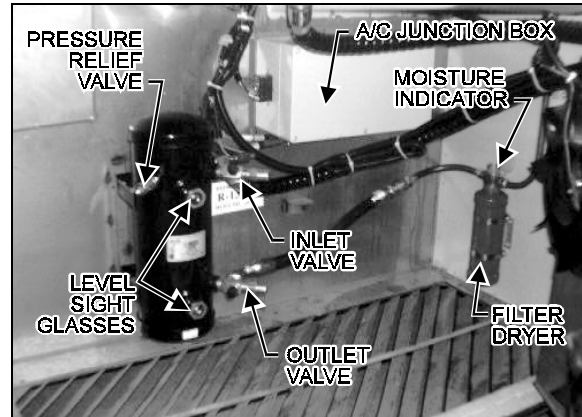


FIGURE 23: CONDENSER COMPARTMENT (XL-45 COACHES ONLY)

22075

In case of extreme pressure rise in the liquid receiver tank, a pressure relief valve will break at 450 psi (3103 kPa) and relieve the receiver tank pressure.

The receiver tank incorporates an inlet valve on the inlet side (upper section) which allows the tank to be isolated or serviced. An outlet valve on the outlet side (lower section) permits complete isolation from the rest of the system.

Note: For vehicles equipped with an auxiliary or driver's A/C system only, see receiver-filter, as described below under "Filter Dryer - 8.7.1 Description".

8.7 Filter Dryer

8.7.1 Description

A filter dryer, located in the condenser compartment, is installed on the liquid refrigerant line after the receiver tank. It is used to absorb moisture and foreign matter from refrigerant before it reaches the expansion valves. The filter should be replaced every time a line in the system is opened (see "7.4 Pumping Down") or after a prolonged exposure, when the moisture indicator sight glass turns to pink.

A receiver-filter, located close to engine compartment L.H. side rear door, is installed on vehicles equipped with an auxiliary A/C system or a

driver's system only. Its function is similar to that of filter and receiver used on main systems. Replace only when system is opened or a problem occurs.

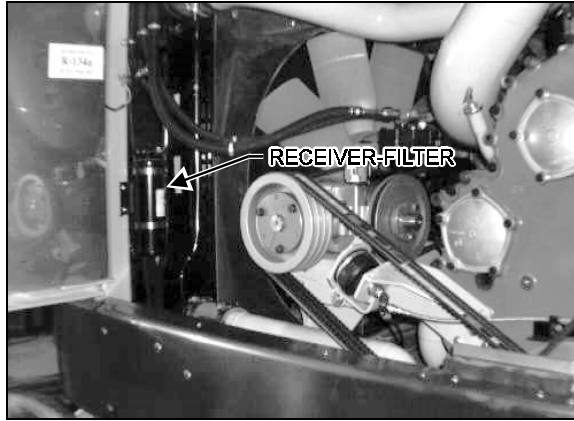


FIGURE 24: ENGINE COMPARTMENT 22076

Note: On XL-45 vehicles, the receiver-filter is installed on wheel housing, inside L.H. side rear service compartment.

8.7.2 Replacement

The filter is of the disposable type. When replacement is required, remove and discard the complete unit and replace with a new unit of the same type according to this procedure:

1. Isolate the refrigerant in the receiver tank by following the procedure in "7.4 Pumping Down".
2. Change the filter dryer as a unit.
3. Add a small quantity of refrigerant R-134a to the low side of the system. Check for leaks. Return the system to normal operation.

Caution: Do not use carbon tetrachloride or similar solvents to clean parts. Do not use steam guns. Use mineral spirits or naphtha. All parts should be thoroughly cleaned. Use a stiff brush to wash dirt from grooves, holes, etc.

Warning: Cleaning products are flammable and may explode under certain conditions. Always handle in a well ventilated area.

8.7.3 Moisture Indicator

The moisture sensitive element consists of a color changing ring which is reversible from pink to blue and vice versa as the moisture content in the refrigerant changes. Pink indicates a wet refrigerant, light violet (caution) and blue indicates a dry refrigerant.

Since temperature changes affect the solubility, color change will also vary with the refrigerant temperature. The following table shows the color change for R-134a at various moisture levels and liquid line refrigerant temperatures.

COLOR INDICATOR			
TEMPERATURE	BLUE (ppm)	LIGHT VIOLET (ppm)	PINK (ppm)
75°F (24°C)	Below 5	5-15	Above 15
100°F (38°C)	Below 10	10-30	Above 30
125°F (52°C)	Below 15	15-45	Above 45
p.p.m.= parts per million (moisture content)			

A moisture level of 15 p.p.m. for R-134a indicated in the blue color range of the above table is generally considered dry and safe. A color indication of light blue to light violet indicates the caution range of moisture level. For positive protection, the drying of the system should be continued until the color of the element turns to deep blue.

The liquid refrigerant is readily visible through the center opening of the moisture element where the presence of bubbles indicates a shortage of refrigerant or restriction in line.

Moisture is one of the main causes of chemical instability or contamination in air conditioning systems. If moisture is present, it can corrode the valves, condenser and evaporator coils, compressor and other components causing a malfunction and eventual failure of the system. Uncontrolled moisture in the system can result in very expensive multiple component replacements if not corrected at an early stage. The moisture indicator permits an early detection of moisture in the system and when corrected by a

desiccant charge, system contamination is greatly minimized.

8.8 Liquid Refrigerant Solenoid Valve

8.8.1 Description

The flow of liquid refrigerant to the driver's evaporator is controlled by a normally closed solenoid valve located at ceiling of spare wheel and tire compartment (reclining bumper compartment for converted vehicles) and is accessible through the reclining bumper (Figs. 13, 14 & 25).

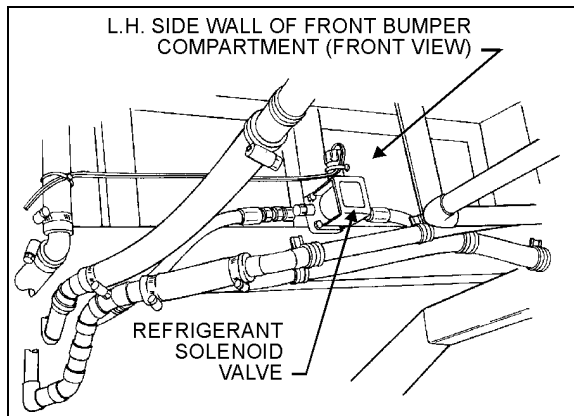


FIGURE 25: DRIVER'S LIQUID REFRIGERANT SOLENOID VALVE 22077

Note: An identical refrigerant solenoid valve is used on the auxiliary A/C system and is located near the auxiliary A/C unit.

8.8.2 Manual Bypass

This type of solenoid valve is equipped with a manual operating stem. The 3/16" square stem located on the bonnet is exposed when the seal cap is removed. To manually open valve, turn stem 1/2 turn counterclockwise. To manually close valve, turn stem clockwise until tight against seat. Manual stem must be in closed position for automatic electric operation.

8.8.3 Coil Replacement

1. Disconnect connector from the coil connector.
2. Take out the retaining screw at the top of the coil housing. The entire coil assembly can then be lifted off the enclosing tube.
3. Place the new coil and yoke assembly on the enclosing tube. Lay data identification plate in place.
4. Insert the coil retaining screw, rotate housing to proper position and tighten screw securely.
5. Connect connector from coil connector.

8.8.4 Valve Disassembly

1. Remove the coil as stated previously.
2. Pump down the system as stated earlier in this section.
3. Remove the four socket head screws which hold the body and bonnet together (Fig. 26).

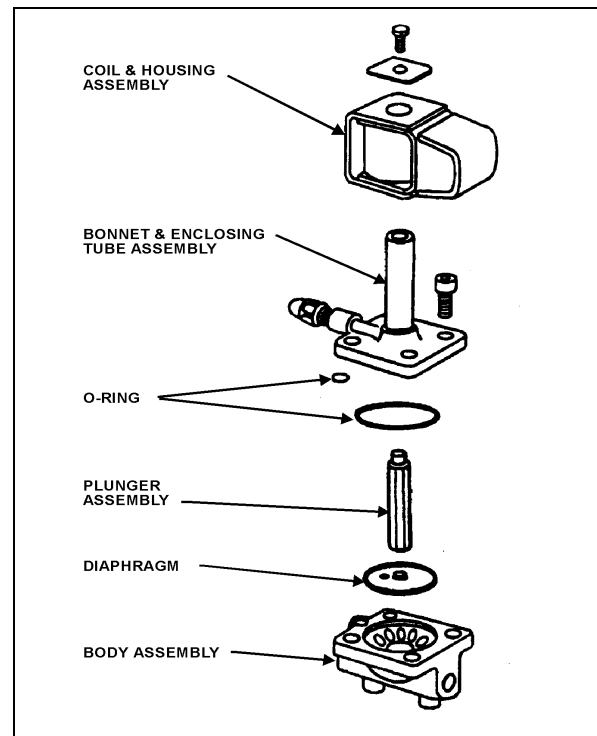


FIGURE 26: REFRIGERANT SOLENOID VALVE 22044

- Carefully lift off the bonnet assembly (upper part of the valve) so that plunger will not fall out. The diaphragm can now be lifted out.

Note: *The above procedure must be followed before brazing solder-type bodies into the line.*

Caution: *Be careful not to damage the machined faces while the valve is apart.*

8.8.5 Valve Reassembly

- Place the diaphragm in the body with the pilot port extension up.
- Hold the plunger with the synthetic seat against the pilot port.
- Make sure the bonnet O-rings are in place. Lower the bonnet assembly over the plunger, making sure that the locating sleeve in the bonnet enters the mating hole in the body.
- Insert the four socket head screws and tighten evenly.
- Replace the coil as stated previously.
- Add a small quantity of refrigerant R-134a to the low side of the system. Check for leaks. Return the system to normal operation.

8.9 By-Pass Valve



FIGURE 27: BY-PASS VALVE LOCATION 22078

A by-pass valve, used on auxiliary or driver's system only, is located just above rear L.H. side door in engine compartment (Fig. 27).

Its function is to balance the Lo-side line and Hi-side line. The by-pass valve is factory adjusted but when valve is replaced, proceed as follows for adjustment:

- Loosen jam nut.
- Tighten adjusting screw flush to jam nut.
- tighten jam nut.

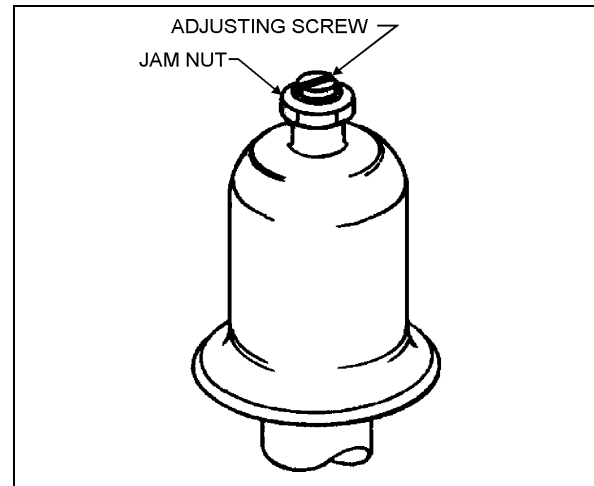


FIGURE 28: BY-PASS VALVE 22079

8.10 Expansion Valve

8.10.1 Central System

The expansion valve for the central system is a thermo-sensitive valve with a remote control bulb head attached to the evaporator outlet line and is accessible by the evaporator filter access door (Figs. 13 & 29). The valve regulates the flow of refrigerant liquid into the evaporator coils and is controlled by the suction gas temperature leaving the evaporator. The bulb head senses the refrigerant gas temperature as it leaves the evaporator. High temperature will cause expansion and pressure on the power head and spring. Such action causes the assembly valve

Section 22: HEATING AND AIR CONDITIONING

to open, allowing a flow of refrigerant liquid into the evaporator.

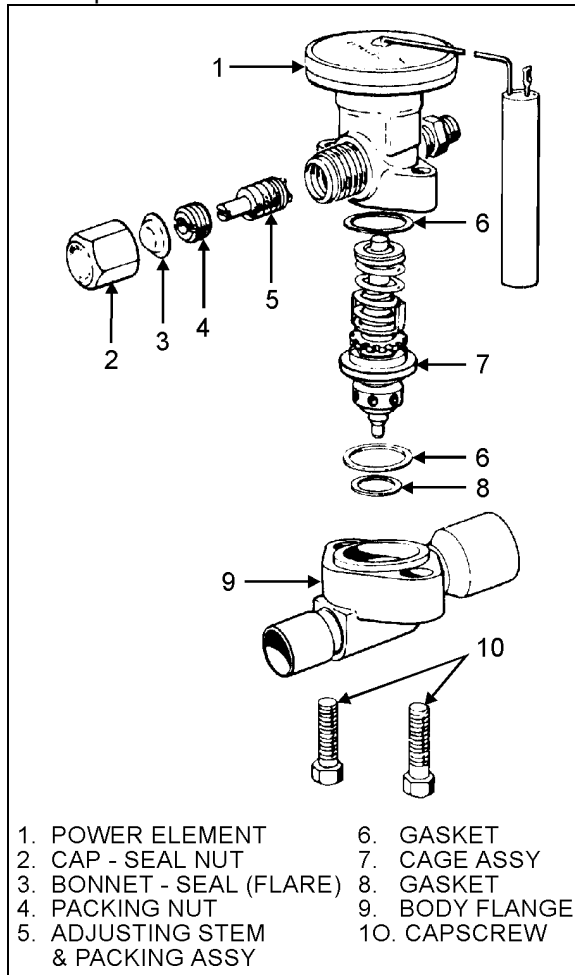


FIGURE 29: EXPANSION VALVE

22045

The remote bulb and power assembly is a closed system. The pressure within the remote bulb and power assembly corresponds to the saturation pressure of the refrigerant temperature leaving the evaporator and moves the valve pin in the opening direction. Opposed to this force, on the under side of the diaphragm and acting in the closing direction, is the force exerted by the superheat spring. As the temperature of the refrigerant gas at the evaporator outlet increases above the saturation temperature corresponding to the evaporator pressure, it becomes superheated. The pressure thus generated in the remote bulb and power assembly surpasses the combined pressures of the evaporator pressure and the superheat spring, causing

the valve pin to move in the opening direction. Conversely, as the temperature of the refrigerant gas leaving the evaporator decreases, the pressure in the remote bulb and power assembly also decreases and the combined evaporator and spring pressures cause the valve pin to move in the closing position.

As the operating superheat is raised, the evaporator capacity decreases, since more of the evaporator surface is required to produce the superheat necessary to open the valve. It is obvious, then, that it is most important to adjust the operating superheat correctly and that a minimum change in superheat to move the valve pin to full open position, is of vital importance because it provides savings in both initial evaporator cost of operation. Accurate and sensitive control of the refrigerant liquid flowing to the evaporator is necessary to provide maximum evaporator capacity under load conditions.

The spring is adjusted to give 8 to 12°F (-13,3 to -11,1°C) of superheat at the evaporator outlet. This ensures that the refrigerant leaving the evaporator is in a completely gaseous state when drawn into the suction side of the compressor. Liquid would damage the compressor valve, piston and heads if allowed to return in the suction line.

A vapor is said to be superheated when its temperature is higher than the saturation temperature corresponding to its pressure. The amount of the superheat is, of course, the temperature increase above the saturation temperature at the existing pressure.

As the refrigerant moves along in the evaporator, the liquid boils off into a vapor and the amount of liquid decreases until all the liquid has evaporated due to the absorption of a quantity of heat from the surrounding atmosphere equal to the latent heat of vaporization of the refrigerant. The gas continues along in the evaporator and remains at the same pressure. However, its temperature increases due to the continued absorption of heat from the surrounding atmosphere. The degree to which the gas refrigerant is superheated is related to the amount of refrigerant being fed to the evaporator and the load to which the evaporator is exposed.

Superheat Adjustment

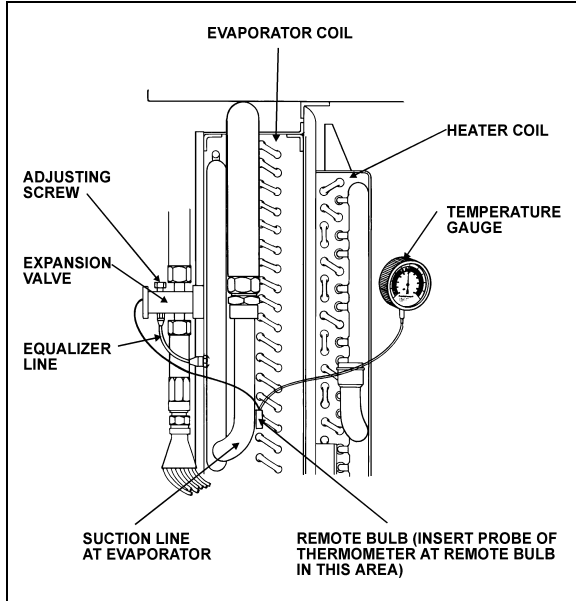


FIGURE 30: SUPERHEAT ADJUSTMENT INSTALLATION
22046

The easiest method of adjusting the superheat is to backseat the main evaporator expansion valve adjusting screw, and screw in 5-1/2 turns clockwise (Fig. 30). If this method does not provide an accurate superheat, the following procedure should be followed:

1. Operate vehicle for at least one-half hour at fast idle with temperature control set at 82°F (27,7°C).
2. Install pressure gauge at the evaporator suction header.
3. Install a remote reading thermometer to the evaporator outlet line near the existing remote bulb (Fig. 30).
4. Apply thermostatic tape around the bulb and evaporator outlet line to get a true reading of the line temperature.

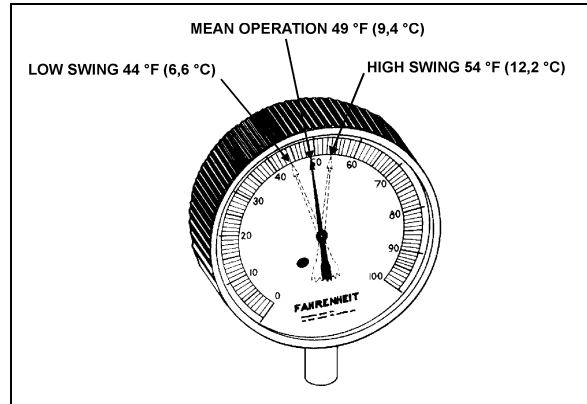


FIGURE 31: HIGH & LOW SWING TEMPERATURE AT REMOTE BULB
22047

EXAMPLE OF READINGS TAKEN AT FIG. 31:

A/C pressure gauge converted to temperature at expansion valve fitting	Temperature on remote bulb	
40°F(4,4°C)	Low swing 44°F (6,6°C)	High swing 54°F (12,2°C)
Formula for superheat 49°F-40°F=9°F (9,4°C-4,4°C=5°C)	Average of low and high swing is 49°F (9,4°C)	

5. Check approximately 5 pressure readings at 2 minute intervals and convert to temperature using chart at "8.13 Temperatures & Pressures". Likewise check the temperature reading at the remote bulb at the same 2 minute intervals and record the low and high swing readings of the needle (Fig. 31).

Note: The low swing of the superheat should be a minimum of 4°F (2,2°C) higher at the remote bulb and have an average of 8 to 12°F (4 to 6°C) higher range at the bulb than the fitting at the expansion valve.

Section 22: HEATING AND AIR CONDITIONING

Note: To lower evaporator temperature or reduce the superheat, flow of refrigerant is increased by turning adjusting screw of expansion valve counterclockwise. To increase temperature or increase superheat, flow of refrigerant is reduced by turning adjustment screw of expansion valve clockwise.

6. Regulate suction pressure to temperature reading according to temperature chart or to the R-134a temperature scale on the pressure gauge.

Example: Suction pressure 30 psi (207 kPa) converted to 32°F (0°C) on chart. If temperature reading is 40°F (4,4°C), subtract 32°F (0°C) and the result will be 8°F (4,4°C) of superheat.

Caution: Before proceeding to the expansion valve adjustment, check for restriction on suction side for plugged filter dryer and partially open valves. These conditions will give a high superheat.

Maintenance

1. Pump down the system as previously indicated in this section.
2. Disconnect the external equalizer line from the under side of the power head, and unclamp the remote control bulb from the evaporator coil outlet line.
3. Remove the two cap screws holding the power assembly to the valve body flange. Lift off the power assembly and remove the cage assembly.

4. When reassembling, replace with the new gaskets in proper location. Make sure the two lugs on the cage assembly fit into grooves provided in the power assembly. **DO NOT** force the valves together. The cage must fit properly before tightening the body flange. Tighten bolts evenly.
5. Check for leaks.

Safety Instructions

1. Make sure the valve is installed with the flow arrow on the valve body corresponding to the flow direction through the piping system.
2. Before opening any system, make sure the pressure in the system is brought to and remains at the atmospheric pressure. Failure to comply may result in system damage and/or personal injury.

8.10.2 Driver's System

The function and operation of the expansion valve for driver's or auxiliary systems are similar to main system's, but no superheat adjustment is required (Figs. 13 & 14).

8.11 Torch Brazing

Use an electrode with 35% silver.

Caution: When using heat near a valve, wrap with a water saturated rag to prevent overheating of vital parts.

Warning: Before welding any part of refrigeration system, make sure the area is well ventilated.

8.12 Troubleshooting

8.12.1 Expansion Valve

PROBABLE CAUSE	PROBABLE REMEDY
LOW SUCTION PRESSURE-HIGH SUPERHEAT	
EXPANSION VALVE LIMITING FLOW:	
Gas in liquid line due to pressure drop in the line or insufficient refrigerant charge.	Locate cause of line flash and correct by use of any of the following methods. Add R-134a. Replace or clean filter dryer.
Inlet pressure too low from excessive vertical lift, undersize liquid line or excessive low condensing temperature. Resulting pressure difference across valve too small.	Increase head pressure. If liquid line is too small, replace with proper size.
Gas in liquid line due to pressure drop in line or insufficient refrigerant charge.	Locate cause of liquid line flash and correct by use of any of the following methods. Add R-134a. Replace or clean filter dryer. Check for proper line size.
Superheat adjustment too high.	Adjust superheat as outlined under "Superheat Adjustment".
Power assembly failure or partial loss of charge.	Replace power assembly or replace valve.
Air filter screen clogged.	Clean or replace air filter screen.
Plugged lines.	Clean, repair or replace lines.
LOW SUCTION PRESSURE-LOW SUPERHEAT	
Uneven or inadequate evaporator loading due to poor air distribution or liquid flow.	Balance evaporator load distribution by providing correct air or liquid distribution.
HIGH SUCTION PRESSURE-HIGH SUPERHEAT	
Compressor discharge valve leaking.	Replace or repair valve.
HIGH SUCTION PRESSURE-LOW SUPERHEAT (DEFECTIVE UNLOADER)	
Valve superheat setting too low.	Adjust superheat as outlined under "Superheat Adjustment".
Compressor discharge valves leaking.	Replace or repair discharge valve.
Incorrect superheat adjustment.	Superheat adjustment 8 to 12°F (4 to 6°C).

Section 22: HEATING AND AIR CONDITIONING

PROBABLE CAUSE	PROBABLE REMEDY
FLUCTUATING DISCHARGE PRESSURE	
Insufficient charge.	Add R-134a to system.
HIGH DISCHARGE PRESSURE	
Air or non-condensable gases in condenser.	Purge and recharge system.
Overcharge or refrigerant.	Bleed to proper charge.
Condenser dirty.	Clean condenser.
Insufficient cooling air distribution over air cooled condenser.	Properly locate condenser to freely dispel hot discharge air.

8.12.2 A/C

TROUBLE	CAUSE
Low suction pressure and frosting at dryer outlet.	Clogged filter.
Low Oil Level.	Check for oil leaks and for leaking oil seal. Do not attempt to check oil level unless system has been stabilized at least 20 minutes.
Excessively cold suction line.	Loss of contact between the expansion valve bulb and the suction line or sticking of the expansion valve. Check for foreign matter and clean, repair or replace the valve.
Excessively cold suction line and noisy compressor.	Check superheat adjustment. Check remote bulb contact. Check expansion valve for sticking.
compressor squeaks or squeals when running.	Check oil level. Replace oil seal.
Noisy or knocking compressor.	Check for broken internal parts. Overhaul if required.
Compressor vibrates.	Check and tighten compressor mounting bolts.
Low refrigerant level	Check for refrigerant leaks and add refrigerant if required.
Suction pressure rises faster than 5 pounds per minute after shutdown.	Check compressor valve for breakage or damage.
Insufficient cooling.	Check for refrigerant leaks. Check condition of filter screens and motors.
Insufficient air flow.	Dirty or iced evaporator. Dirty air filter. Blowers inactive. Clogged ducts.
No flow of refrigerant through expansion valve.	Filter dryer is clogged. Remote bulb has lost charge or expansion valve is defective.
Expansion valve hisses. Bubbles in moisture and liquid indicator.	Gas in liquid line. Add refrigerant.
Loss of capacity	Clogged filter. Obstructed or defective expansion valve.

Section 22: HEATING AND AIR CONDITIONING

TROUBLE	CAUSE
Superheat too high.	Reset superheat adjustment. Check for clogged external equalizer line, or filter dryer.
Reduced air flow: a. Dirty or clogged air filter; b. Evaporator motor inoperative; or c. Plugged return air ducts.	Dirty or iced evaporator coil. Clean air filter screen. Check return ducts for obstructions. Check blower motor.
Frequent startings and stoppings on low pressure control switch.	Lack of refrigerant. Check for leaks. Recharge.
Compressor intermittently starts and stops.	Intermittent contact in electrical control circuit. Compressor valves not in operating position.
<p>The most common problem of air cooled condenser is high head pressure. Most frequent causes are:</p> <p>1. Reduced air quantity. This may be due to:</p> <ul style="list-style-type: none"> • Dirt on the coil; • Restricted air inlet or outlet; • Dirty fan blades; • Incorrect rotation of fan; • Fan speed too low; • Fan motor going out on overload; or • Prevailing winds. <p>2. Non-condensable in the refrigeration system. This may be due to:</p> <p>Leak on low side system, system in vacuum.</p> <p>Specific symptom, pressure in system will not correspond to ambient temperature on shutdown.</p> <p>Only non-condensable will cause this.</p> <p>(Example: Pressure of idle R-134a system in 80°F (26,6°C) room should be 86.4 psi (595.7 kPa). See temperature chart in this section.)</p> <p>An evaporator just does a proper cooling job without sufficient air. Shortage of air can be caused by the following:</p> <ul style="list-style-type: none"> • Dirty filters; or • Dirty coils. 	

8.13 Temperatures & Pressures

VAPOR-PRESSURE			
TEMPERATURE		PRESSURE	
°F	°C	psi	kPa
-100	-73.3	27.8	191.7
-90	-67.8	26.9	185.5
-80	-62.2	25.6	176.5

Section 22: HEATING AND AIR CONDITIONING

VAPOR-PRESSURE			
TEMPERATURE		PRESSURE	
°F	°C	psi	kPa
-70	-56.7	23.8	164.1
-60	-51.1	21.5	148.2
-50	-45.6	18.5	127.6
-40	-40.0	14.7	101.4
-30	-34.4	9.8	67.6
-20	-29	3.8	26.2
-10	-23	1.8	12.4
0	-18	6.3	43.4
10	-12	11.6	80
20	-7	18.0	124.1
30	-1	25.6	176.5
40	4	34.5	237.9
50	10	44.9	309.6
60	16	56.9	392.3
70	21.1	70.7	487.5
80	27	86.4	595.7
90	32.2	104.2	718.5
100	38	124.3	857.0
110	43.3	146.8	1012.2
120	49	171.9	1185.3
130	54.4	199.8	1377.6
140	60	230.5	1589.3
150	65.6	264.4	1823.0
160	71	301.5	2078.8
170	76.7	342.0	2358.1
180	82.2	385.9	2660.8
190	87.8	433.6	2989.7
200	93.3	485.0	3344.1
210	98.9	540.3	3725.4

8.14 Leak Testing

Some methods such as nitrogen pressure and soap, and electronic sniffer can be used for leak testing. However, the most common method used is a "Halide" torch consisting of an acetylene tank, a burner and a suction test hose. Proceed as follows:

Warning: Do not inhale fumes from leak detector.

The flow of acetylene to the burner causes a suction in the test line. Any gas refrigerant present will be drawn through the hose and into the burner where it decomposes into free acids.

These acids come in contact with the hot copper reaction plate in the burner, causing color reaction in the flame. A small concentration is indicated by a green tint and a large concentration by an intense blue. Do not confuse this change in color with the change caused by shutting off the air supply through the hose by holding the end too close to an object.

The procedure for testing is:

1. Adjust flame so that the top of the cone is approximately level or within one-half inch above the plate.
2. Probe end of suction test tube around all joints, valves, etc. When a leak has been found at a soldered joint, that section of the system must be pumped down. **DO NOT** solder as pressure will force hot solder out. If the system is empty, it is more economical to put in just enough R-134a to produce about 15 psi (103 kPa). The pressure can be raised to about 150 psi (1034 kPa) with dry nitrogen.

Note: This gas is put into the suction and discharge shutoff valves at the compressor. The receiver valves must be opened. If no leaks are found, dump this mixture, evacuate the system and fill with refrigerant.

9. HEATING SYSTEM

9.1 Description

The schematics of Figures 32 & 33 show, respectively, the central heating system and the driver's heating system with their components.

In addition to the normal heating provided by the engine, an optional preheating system (40,000 Btu/hr or 80,000 Btu/hr) may have been installed in the vehicle.

Section 22: HEATING AND AIR CONDITIONING

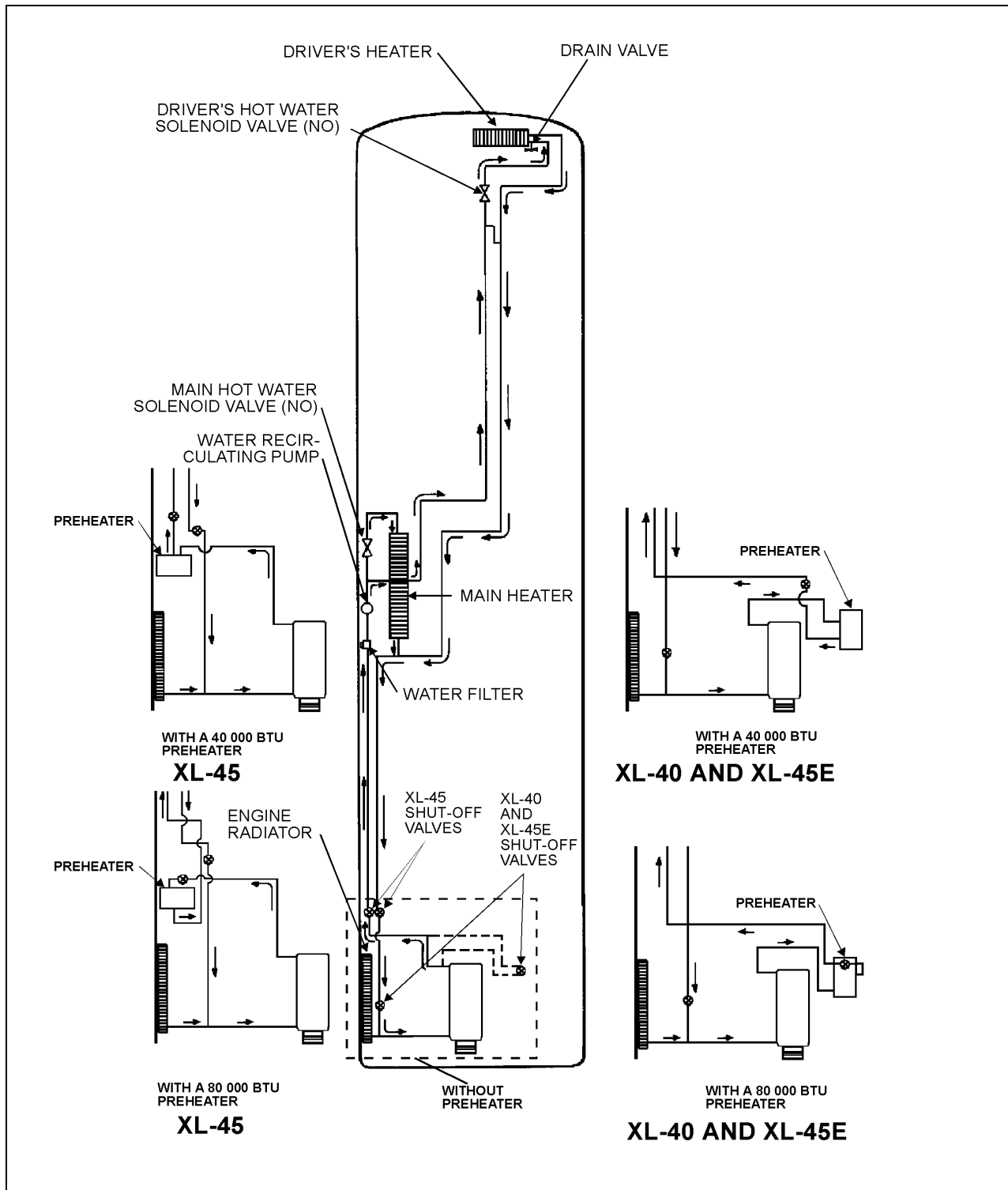


FIGURE 32: CENTRAL HEATING SYSTEM COMPONENTS

22080

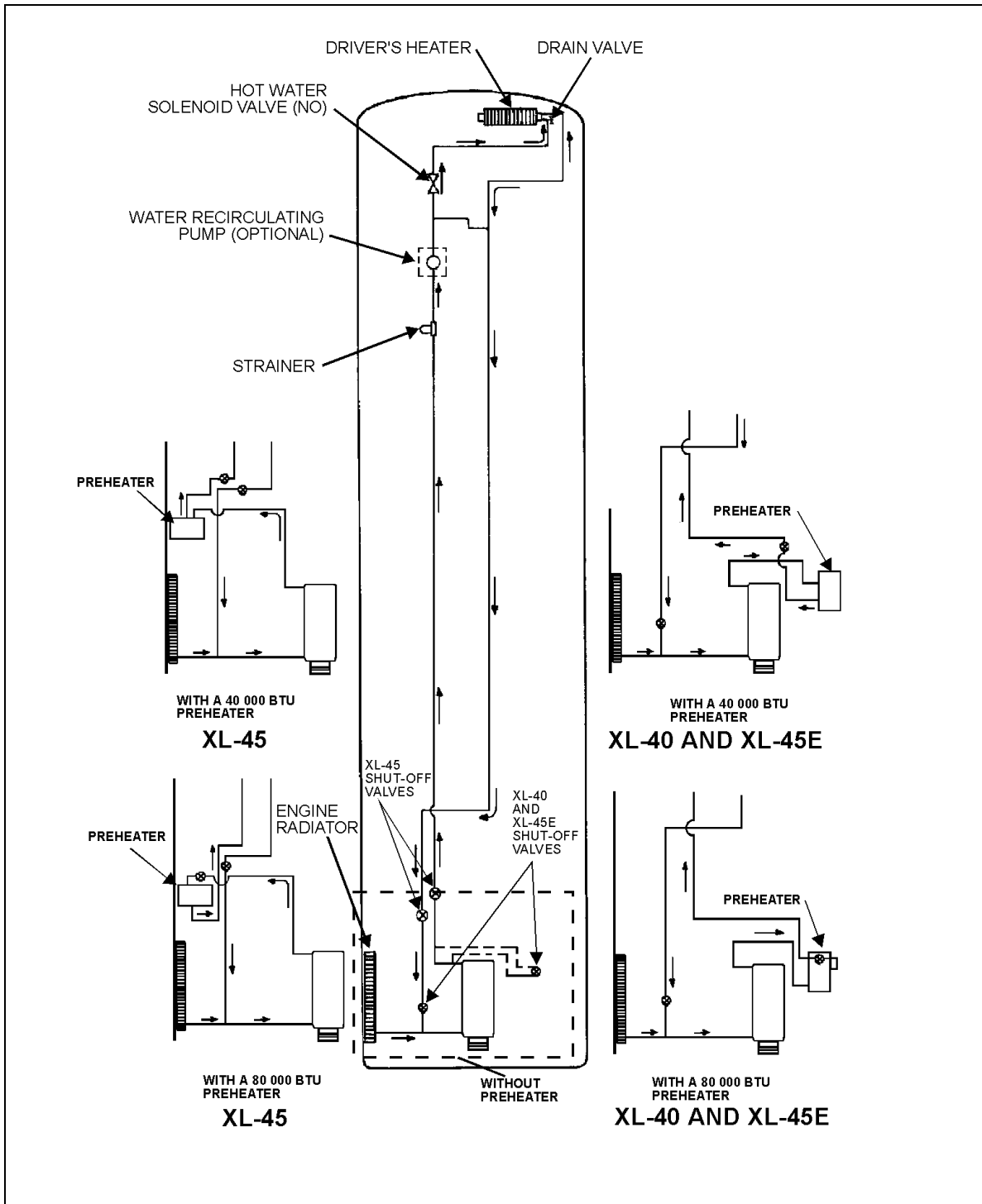


FIGURE 33: DRIVER'S HEATING SYSTEM COMPONENTS (VEHICLES EQUIPPED WITH DRIVER'S SYSTEM ONLY)

22081

9.2 Draining Heating System

To drain the entire system, refer to "05 COOLING" under heading "4.7 Draining Cooling System". If only the driver's or central heater core must be drained, refer to the following instructions.

9.2.1 Driver's Heater Core

1. Stop engine and allow engine coolant time to cool.
2. Locate the normally open water solenoid valve on the ceiling of the spare wheel compartment (Figs. 34 & 35) (reclining bumper compartment for converted vehicles), disconnect its wiring connector, then connect a 24-volt external power source, using jumper cables, to close valve.

Warning: Before proceeding with the following steps, make sure coolant has cooled down. The sudden release of pressure from a heated cooling system can result in loss of coolant and possible personal injury (scalding) from the hot liquid.

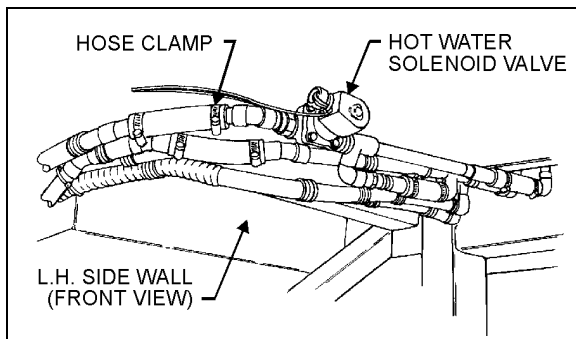


FIGURE 34: DRIVER'S WATER SOLENOID VALVE 22082
(VEHICLES EQUIPPED WITH DRIVER'S SYSTEM ONLY)

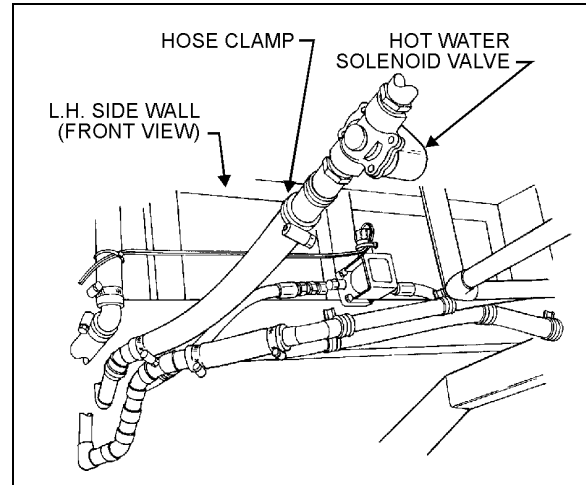


FIGURE 35: DRIVER'S WATER SOLENOID VALVE
(VEHICLES EQUIPPED WITH CENTRAL SYSTEM) 22083

3. Loosen hose clamp, install an appropriate container to recover coolant, and disconnect silicone hose from water solenoid valve.
4. From inside of vehicle, open the manual vent on the coolant inlet line near the driver's unit (Fig. 36) to ensure an efficient draining.

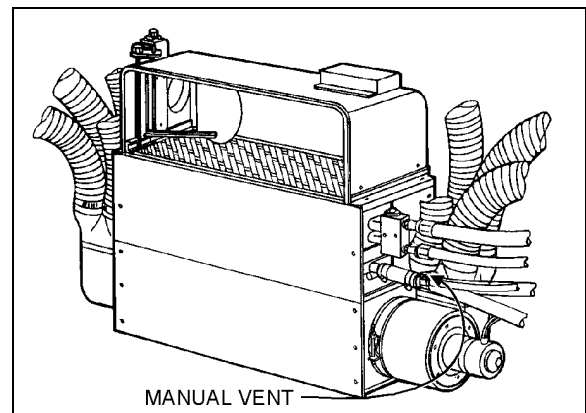


FIGURE 36: DRIVER'S HEATER UNIT 22084

9.2.2 Central Heater Core

1. Stop engine and allow engine coolant time to cool.
2. Close both heater line shutoff valves.

Refer to figures 32 and 33 for heater line shutoff valves location. Valves location change according with vehicle and preheater models.

On XL-40 & 45E vehicles, the valves are located in engine compartment. One is on the R.H. side of compartment and is accessible through engine compartment R.H. side door.

For example see figure 37.

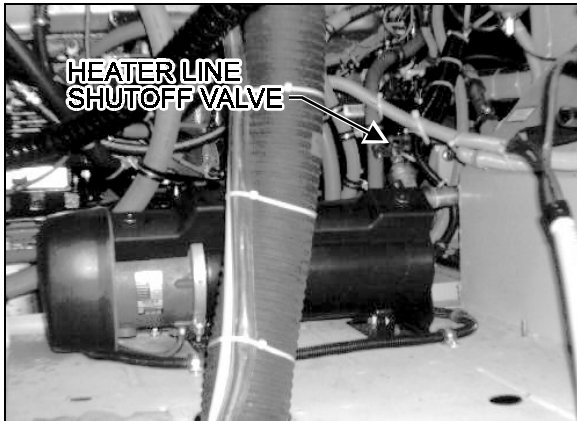


FIGURE 37: HEATER LINE SHUTOFF VALVE WITH A 40000 BTU PREHEATER 05039

The other is located on the L.H. side of engine underneath fan gearbox and is accessible through engine compartment rear doors (Fig. 38).

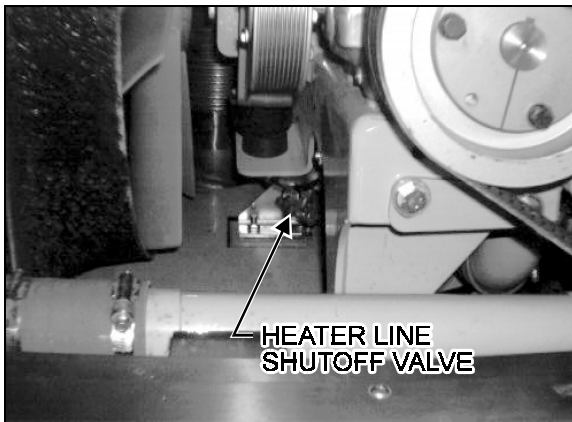


FIGURE 38: HEATER LINE SHUTOFF VALVE 05040

On XL-45 vehicles, the valves are located in engine compartment, on the L.H. side of engine and are accessible through L.H. side rear service compartment.

For example see figure 39.



FIGURE 39: HEATER LINE SHUTOFF VALVES WITHOUT PREHEATER 05041

3. Open the A/C & heating compartment door.

Warning: Before proceeding with the following steps, make sure the coolant has cooled down. The sudden release of pressure from a heated cooling system can result in loss of coolant and possible personal injury (scalding) from the hot liquid.

4. Open drain cock at bottom of heater core, then open manual vent located on top of heater core (Fig. 40) in order to allow air to enter while draining.

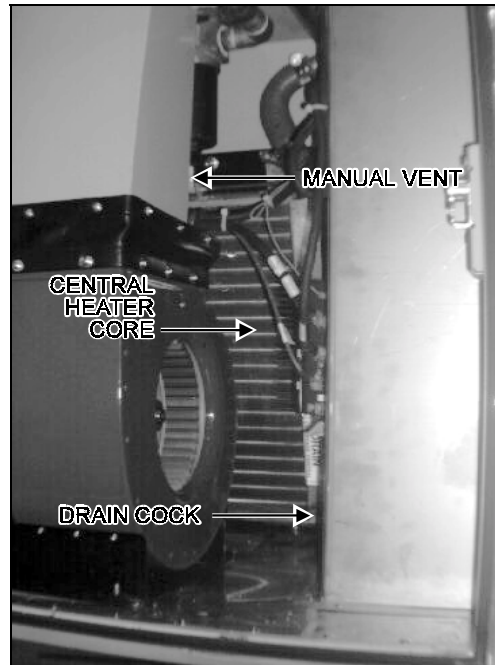


FIGURE 40: A/C & HEATING COMPARTMENT 22085

9.3 Filling Heating System

1. Ensure that the drain hose is reconnected and the manual vents and drain cock are closed.
2. Open the surge tank filler cap and slowly fill the system to level of filler neck.
3. After initial filling, the water valves should be open and the water recirculating pump should be energized to assist in circulating coolant through the heating system. To perform this operation, start the engine, switch on the "*Main A/C-Heating*" switch, and turn the "*Main and Driver's A/C-Heating Temperature*" controls clockwise to their maximum positions in order to request the heating mode in each of these sections.
4. When coolant level drops below the surge tank filler neck, slowly fill the system to level of filler neck.
5. Once the level has been stabilized, replace surge tank filler cap.

9.4 Bleeding Heating System

Whenever the heating system has been drained and refilled, or the system has run low on coolant and coolant has been added, it is necessary to bleed air from heating system. Locate the manual vents illustrated in Figures 36/40, and open them momentarily until no air escapes from the lines.

9.5 Soldering

Before soldering any part of the system, make sure the area is well ventilated. Use (stay clean) flux sparingly and apply solder (95-5 round wire 1/8" [3,1 mm]). After completing repairs, test for leaks.

When using heat at or near a valve, wrap with a water saturated rag to prevent overheating of vital parts.

10. HEATING SYSTEM COMPONENTS

10.1 Driver's Water Solenoid valve

10.1.1 Description

A two-way normally open, internal pilot-operated solenoid valve designed for smooth closing is used to control the coolant flow through the driver's heating unit. The valve is made of forged brass with internal brass or stainless steel parts. It is mounted on the coolant inlet line of the driver's heating unit, and is accessible through the spare wheel compartment (Fig. 41). The valve cannot be manually bypassed.

10.1.2 Improper Operation

1. Faulty control circuit: Check the electric system by energizing the solenoid. A metallic clicking noise indicates that the solenoid is operating. Absence of clicking indicates a loss of power or a defective solenoid. Check for open breaker, open-circuited or grounded coil, broken lead wires.
2. Burned-out coil: Check for open-circuited coil. Replace coil if necessary.
3. Low voltage: Check voltage across the coil leads. Voltage must be at least 21 volts.
4. Excessive leakage: Disassemble valve and clean all parts. For best results, replace worn or damaged parts with a complete spare parts kit.

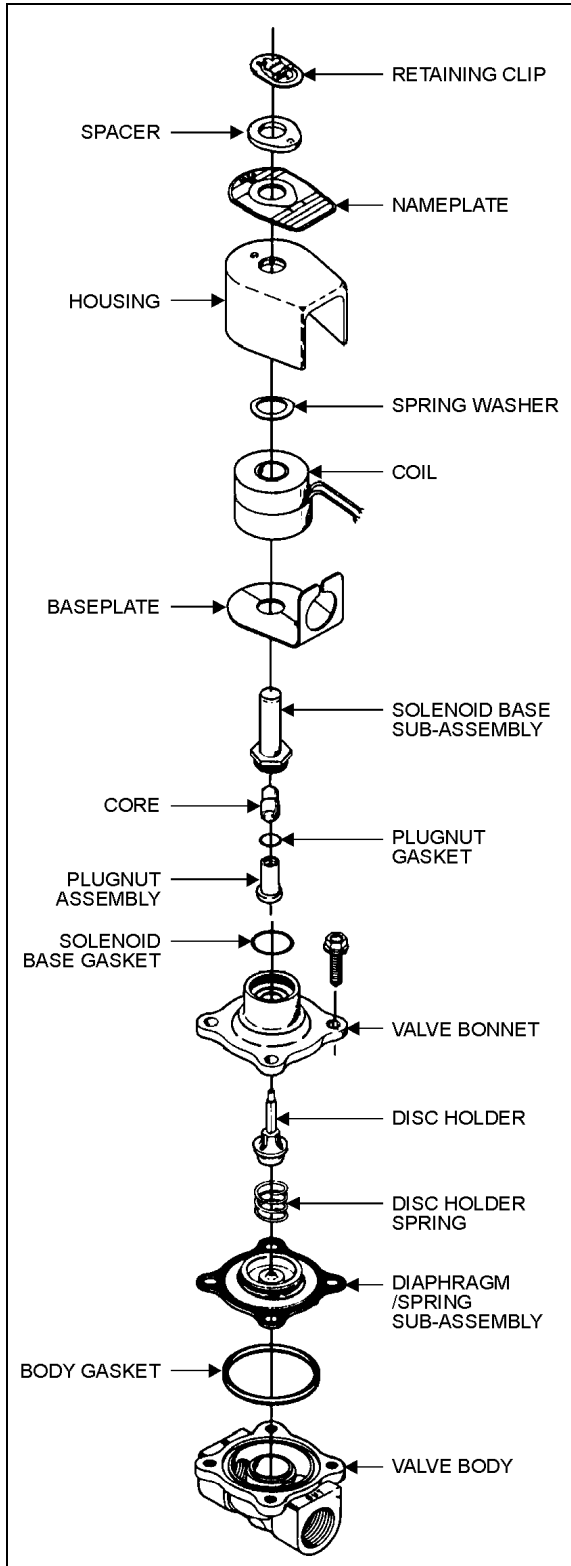


FIGURE 41: DRIVER'S WATER SOLENOID VALVE 22086

10.1.3 Coil Replacement

Turn off electrical power supply and disconnect lead wires. Proceed in the following manner:

1. Remove retaining cap or clip, spacer, name plate and housing.

Warning: When metal retaining clip disengages, it will spring upwards.

2. Slip spring washer, insulating washer, coil and insulating washer off the solenoid base sub-assembly. Insulating washers are omitted when a molded coil is used.
3. Coil is now accessible for replacement. Reassemble by reversing the disassembly sequence. Refer to exploded view (Fig. 41) for identification and location of parts.

Caution: Solenoid must be fully reassembled, since the housing and internal parts are part of, and complete the magnetic circuit. If required, place an insulating washer at both ends of the coil.

10.1.4 Valve Disassembly

1. Drain driver's heating unit as per "9.2 Draining Heating System".
2. Disconnect connector from coil connector.
3. Disassemble valve in an orderly fashion paying careful attention to exploded view (Fig. 41 - provided for identification of parts).
4. Remove retaining cap and slip the entire solenoid enclosure off the solenoid base subassembly.

Warning: When metal retaining clip disengages, it will spring upwards.

Section 22: HEATING AND AIR CONDITIONING

5. Unscrew solenoid base sub-assembly and remove core, plugnut gasket, plugnut assembly and solenoid base gasket.
6. Remove the four bonnet screws and valve bonnet, disc holder subassembly, disc holder spring, diaphragm/spring subassembly and body gasket.
7. All parts are now accessible for cleaning or replacement. For best results, replace worn or damaged parts with a complete spare parts kit.

Caution: *Do not damage valve seat in any manner, since its sealing feature will be affected, thus resulting in continuous leakage.*

10.1.5 Valve Reassembly

1. Reassemble in reverse order of disassembly, paying careful attention to the exploded view (Fig. 41 - *provided for identification and placement of parts*).
2. Replace body gasket and diaphragm/spring subassembly. Locate bleed hole in diaphragm/spring subassembly, approximately 45° from valve outlet.

Note: *Should diaphragm/spring subassembly become disassembled, be sure to replace the diaphragm/spring support with lip facing up, towards the valve bonnet.*

3. Replace disc holder spring and holder subassembly.
4. Replace valve bonnet screws. Torque bonnet screws in a criss-cross manner to 95 ± 10 lbf•in (129 ± 14 N•m).

5. Install solenoid base gasket, plugnut assembly and plugnut gasket. Position core on plugnut assembly. Be sure plugnut assembly and core are installed with mated ends together.
6. Replace solenoid base subassembly and torque to 175 ± 25 lbf•in (237 ± 34 N•m).
7. Replace solenoid enclosure and retaining cap or clip. Reconnect the coil connector.
8. Refill heating system as per "9.3 Filling Heating System", then bleed air from the driver's heating unit as per "9.4 Bleeding Heating System".
9. After reassembly, operate the valve a few times to make sure it opens and closes properly.

10.2 Central Hot Water Solenoid Valve Actuator

10.2.1 Description

The flow of hot water to the vehicle's central heater core is controlled by an electric water valve. The valve, located in the evaporator compartment, is designed so that the pilot valve within the assembly opens and closes a port which directs pressure to either the top or bottom of the valve diaphragm, thereby opening or closing the valve.

A delay action is built into the water valve through an orifice in the valve body and a modulating cup on the diaphragm assembly. When the vehicle is operating with no current to the water valve solenoid, inlet water pressure is directed to the upper side of the diaphragm, thereby keeping it open.

The pilot light closes, water pressure builds up through the orifice to the underside of the diaphragm and keeps the valve in closed position.

The central heater water valve requires a minimum amount of maintenance. The valve should be free of dirt sediment that might interfere with its operation. The diaphragm should be replaced once a year, before the heating season begins. No other maintenance is needed unless a malfunction occurs.

10.2.2 Valve Disassembly

1. Shut off supply pressure and electrical current to valve. The valve need not be removed from the line.
2. Disconnect wires. Unscrew housing nut. The nameplate, coil housing, flux plate, wave spring and coil can be removed (Fig. 42).
3. Unscrew the sleeve flange using a *Skinner wrench nut* while ensuring that wrench nut does not slip out of spanner holes.
4. From the sleeve, remove the retainer and seal assembly, stop assembly, plunger assembly and snubbers.
5. To disassemble the body cover, first remove the flange screws. Remove the spring, diaphragm and seal assembly, and O-ring from the body. If it is necessary to disassemble diaphragm assembly, remove lock nut, seal, diaphragm support plate, O-ring and screw.

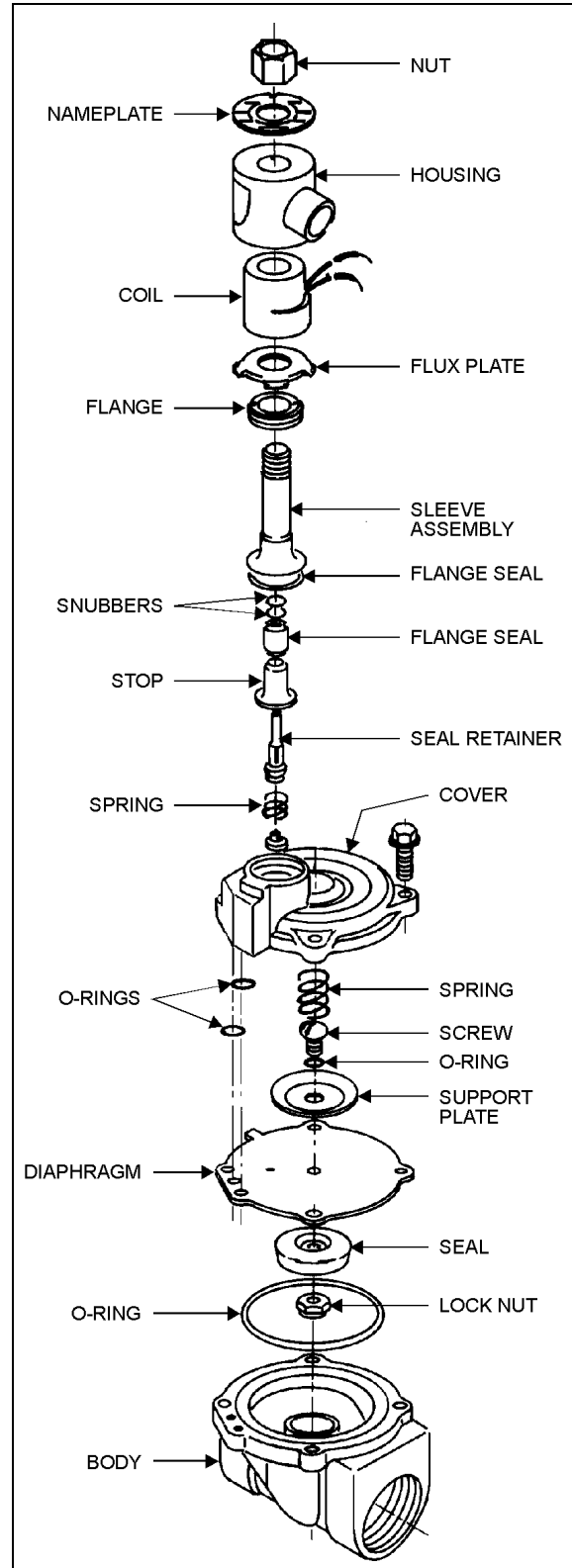


FIGURE 42: CENTRAL WATER SOLENOID VALVE 22087

Section 22: HEATING AND AIR CONDITIONING

10.2.3 Valve Reassembly

Tighten and torque to 30-43 lbf•in (41-58 N•m).

1. Assemble the diaphragm to the seal by placing the O-ring on the screw, then the support plate, the diaphragm and seal (Fig. 42). Add the nut, tighten and torque to 45-55 lbf•in (61-75 N•m).
2. Place the O-ring in the body cavity and add the diaphragm assembly, seal side facing down. Line up the diaphragm with the hole in the body. The diaphragm has three (3) holes in a row; one is a bolt hole, the middle hole is not used and the third hole is used as a passageway on the body. Make sure holes are aligned correctly. The correct position will have the diaphragm tab over the "A" port. Also ensure that O-ring is added to the passageway hole in the diaphragm.
3. Assemble the body cover, while observing pilot passageway: it must line up with diaphragm hole and body passageway. Add the diaphragm spring, ensuring that it sits on the spring seat. Add screws, tighten and torque to 80-110 lbf•in (108-149 N•m). Make sure O-ring is seated over diaphragm passageway hole.
4. Assemble stop, retainer and seal assembly, then add plunger assembly and snubbers. Place assembly in sleeve. Place seal in operator cavity in body cover. Place pilot spring on retainer with seal assembly and place in body cover.
5. Add flange over sleeve and using a wrench and "Skinner" wrench nut, tighten and torque to 130-150 lbf•in (176-203 N•m).
6. Place the coil in the housing. Pull the wires through the conduit. Mate the flux plate to the coil housing and place assembly over sleeve. Add the nameplate and nut.

10.2.4 Valve Troubleshooting

PROBLEM	PROCEDURE
Valve fails to operate.	<ol style="list-style-type: none"> 1. Check electrical supply with a voltmeter. It should agree with nameplate rating. 2. Check coil with an ohmmeter for shorts or open coil. 3. Check pressure at valve inlet. It must be at least equal to the minimum pressure stamped on the nameplate. It should not go below minimum while valve is operating.
Valve is sluggish or inoperative - voltage check out.	<ol style="list-style-type: none"> 1. Check diaphragm for tears or abrasions. Replace if torn or abraded. 2. Check diaphragm for obstructed bleed holes. Wash with mild soap and water. 3. Check for clogged or obstructed bleed passageways. Passageways must be clean and free from all obstructions that restrict internal flow. Clean with solvent and compressed air. Do not put wire into passageway.
External leakage - valve leaks around sleeve assembly.	<ol style="list-style-type: none"> 1. Remove flange seal and check for imperfections. Replace if defective. 2. Tighten and torque sleeve, using a wrench nut, to 130-150 lbf•in (176-203 N•m).
External leakage - valve leaks at flange joint between body and cover.	Retighten cover screws and torque to 80-110 lbf•in (108-149 N•m). If leakage persists, replacement of diaphragm assembly or flange O-ring may be required and/or bodies or covers with damaged sealing surfaces may have to be repaired or replaced.
Internal leakage - sticking valve leaks internally or plunger sticks in energized position.	<ol style="list-style-type: none"> 1. Disassemble valve. Inspect plunger, stop & retainer, and seal assembly. Remove all dirt that may have collected or imbedded. 2. If seal is conspicuously swollen or hardened, replace retainer and seal assembly. (It is possible that a different type of insert material be used on application - submit complete details of application to factory). 3. Inspect diaphragm for dirt or imbedded material. If dirty, remove, wash in warm water and mild soap solution. 4. Inspect pilot and main orifices for leaks. If parts are found to be pitted, nicked or excessively worn, they should be replaced.
Valve fails to close.	<ol style="list-style-type: none"> 1. Check that the plunger assembly, and the retainer & seal assembly, are free to travel. 2. Make sure that the plunger is free to travel to the end of its stroke and apply force on the retainer and seal assembly to seal the pilot orifice.
Buzzing noise.	<ol style="list-style-type: none"> 1. check voltmeter reading to make sure it corresponds with the nameplate rating. 2. Check pressure against nameplate rating. 3. Inspect for loose housing nut. Tighten and torque to 30-43 lbf•in (41-58 N•m). 4. Inspect the face of the plunger assembly and of the stop assembly. If there is a sign of damage, replace both assemblies.

10.3 Water Recirculating Pump

10.3.1 Description

Section 22: HEATING AND AIR CONDITIONING

This vehicle is provided with a water recirculating pump which is located in the A/C & heating compartment (vehicles with central system) (Figs. 43 & 44) or in the reclining bumper compartment (optional with driver's system) (Fig. 45). The water recirculating pump consists of a centrifugal pump and an electric motor which are mounted on a common shaft in a compact assembly. A pilot between the pump end and motor cover ensures proper alignment of the complete assembly.

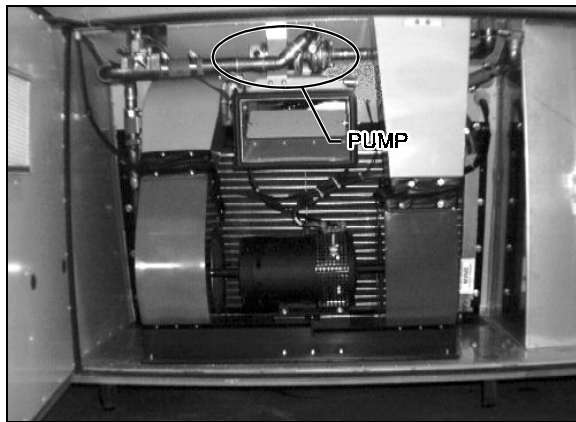


FIGURE 43: PUMP LOCATION (COACH)

22088

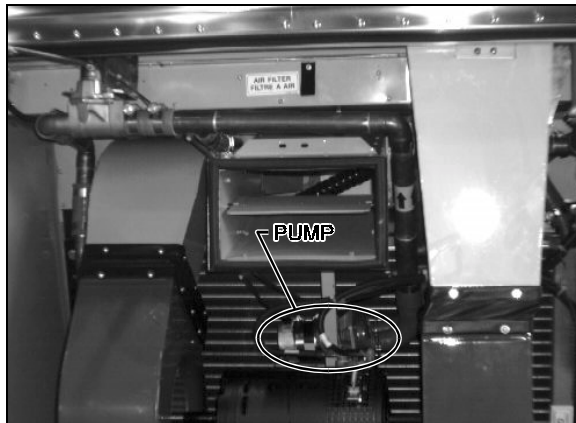


FIGURE 44: PUMP LOCATION (SHELL)

22089

The motor is equipped with prelubricated sealed ball bearings which require no maintenance. A self-adjusting mechanical shaft seal is incorporated in this assembly to prevent coolant leakage between the pump cavity and armature shaft. This seal derives its lubrication from the liquid

pumped, and **it will be destroyed if permitted to operate dry.**

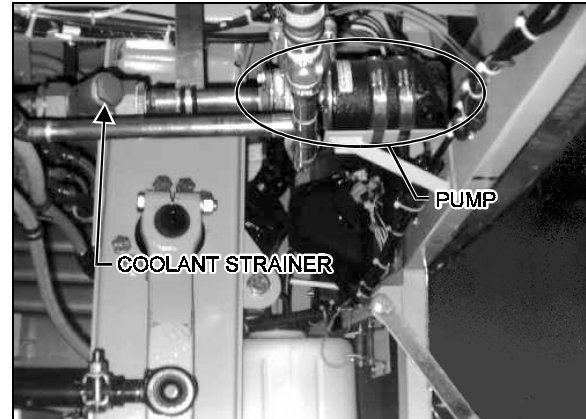


FIGURE 45: PUMP LOCATION (DRIVER'S A/C ONLY)

22090

The pump requires no periodic maintenance other than replacement of motor brushes. Replacement of motor brushes can be performed without removing the pump assembly. Visual inspection of the pump, to determine if the shaft seal is intact, should be made while the pump is in operation. If there is evidence of coolant leakage, the unit must be disassembled for corrective measures. Disassembly of the pump will be necessary only in the case of a seal leak, bearing failure, or motor failure.

10.3.2 Removal

1. Stop engine and allow engine coolant time to cool.
2. Close shutoff valves. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.
3. Disconnect the electrical wiring from the motor.

Warning: Before proceeding with the following steps, make sure that coolant has cooled down.

4. **Fig. 43 only:** Remove the drain plug at rear of pump and place a container to recover the residual coolant in the line.

Note: On driver's A/C system, remove residual coolant through coolant strainer (Fig. 45). Also check strainer's condition; clean or replace if necessary.

5. **Fig. 43:** Disconnect water lines from pump at flange connections.
5. **Fig. 44:** Disconnect water lines from pump at connections between hoses and copper pipes (leave hoses connected to pump).
6. Remove the two clamps holding the pump motor to its mounting bracket. Remove the pump with the motor as an assembly.

10.3.3 Disassembly

-For converted vehicle (shell) central A/C pump, see Fig. 46. -For coach central A/C pump, or driver's A/C pump, see Fig. 47.

1. **Fig. 46:** Remove two brush caps (5) and two brush assemblies (4). When removing brushes, note the position of the brush in the tube. Brush life is significantly decreased if brushes are not replaced properly.
1. **Fig. 47:** Remove two brush caps (16) and two brush assemblies (15). When removing brushes, note the position of the brush in the tube. Brush life is significantly decreased if brushes are not replaced properly.
2. **Fig. 46:** Remove the pump cover (item #11) by first removing the 4 head screws. Remove cover carefully to prevent damaging the O-ring (12) (disconnect hoses from cover only if required).
2. **Fig. 47:** Remove the pump cover (item #2) by first removing the 8 head screws. Remove cover carefully to prevent damaging the gasket (3).
3. **Fig. 46:** Remove O-ring (12).
3. **Fig. 47:** Remove gasket (3).

4. **Fig. 46:** Remove two hex nuts (7) retaining pump assembly to motor.
4. **Fig. 47:** Remove two hex nuts and lock washers (7 & 8) retaining pump assembly to motor.
5. **Fig. 47 only:** Remove the pump from the motor as follows:
 - a. Install puller tool assembly (MP Co. Part No. 24702 or equivalent) to pump body (12) using four screws removed from the pump cover (2).
 - b. Tighten the puller screw to press the motor shaft out of the impeller hub. The pump is now free from the motor.
 - c. Remove the puller tool.
6. **Fig. 46:** Remove acorn nut (9) and gasket (10), then remove impeller (8) and components of the pump seal assembly (14).
6. **Fig. 47:** Remove impeller (4) and components of the pump seal assembly (5).

Caution: Do not scratch or mar the sealing surface of this seat, as its sealing feature will be affected, thus resulting in continuous leakage.

Inspection

Components removed from the recirculating pump and motor assembly should be compared with new parts to determine the degree of wear.

Section 22: HEATING AND AIR CONDITIONING

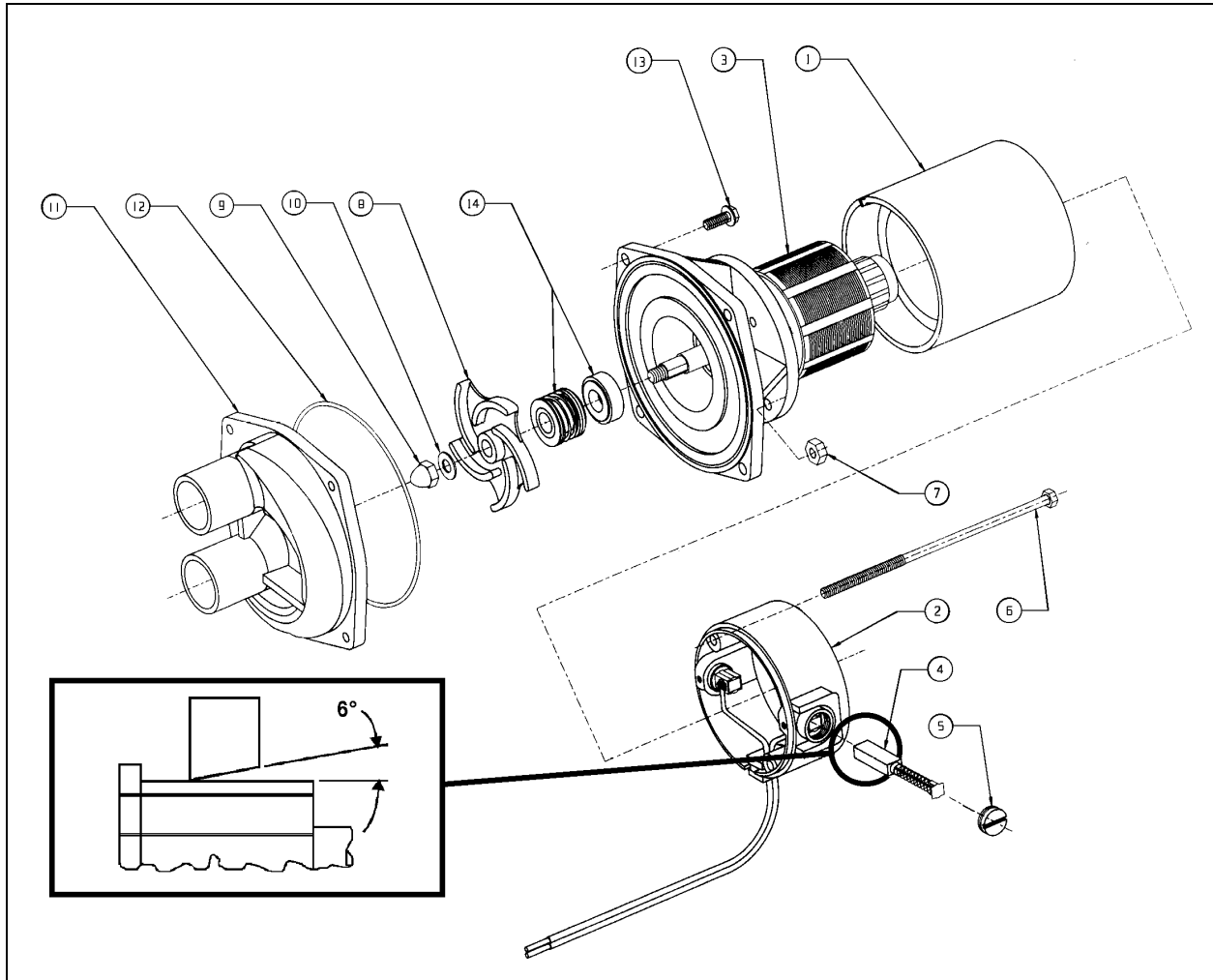


FIGURE 46: WATER CIRCULATING PUMP (CONVERTED VEHICLE - CENTRAL A/C)

22091

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
	MOTOR			IMPELLER	
	Motor Ass'y - Items 1-7	1	8	Impeller	1
1	Stator	1	9	Acorn Nut	1
2	End Frame Ass'y	1	10	Gasket	1
3	Armature adapter Ass'y	1		COVER	
4	Brush Ass'y	2	11	Cover - Housing	1
5	Cap (brush holder)	2	12	O-ring	1
6	Casebolt 10-32 X 5	2	13	Screw	4
7	10-32 Hex Nut	2		SEAL	
			14	Seal Ass'y	1

Section 22: HEATING AND AIR CONDITIONING

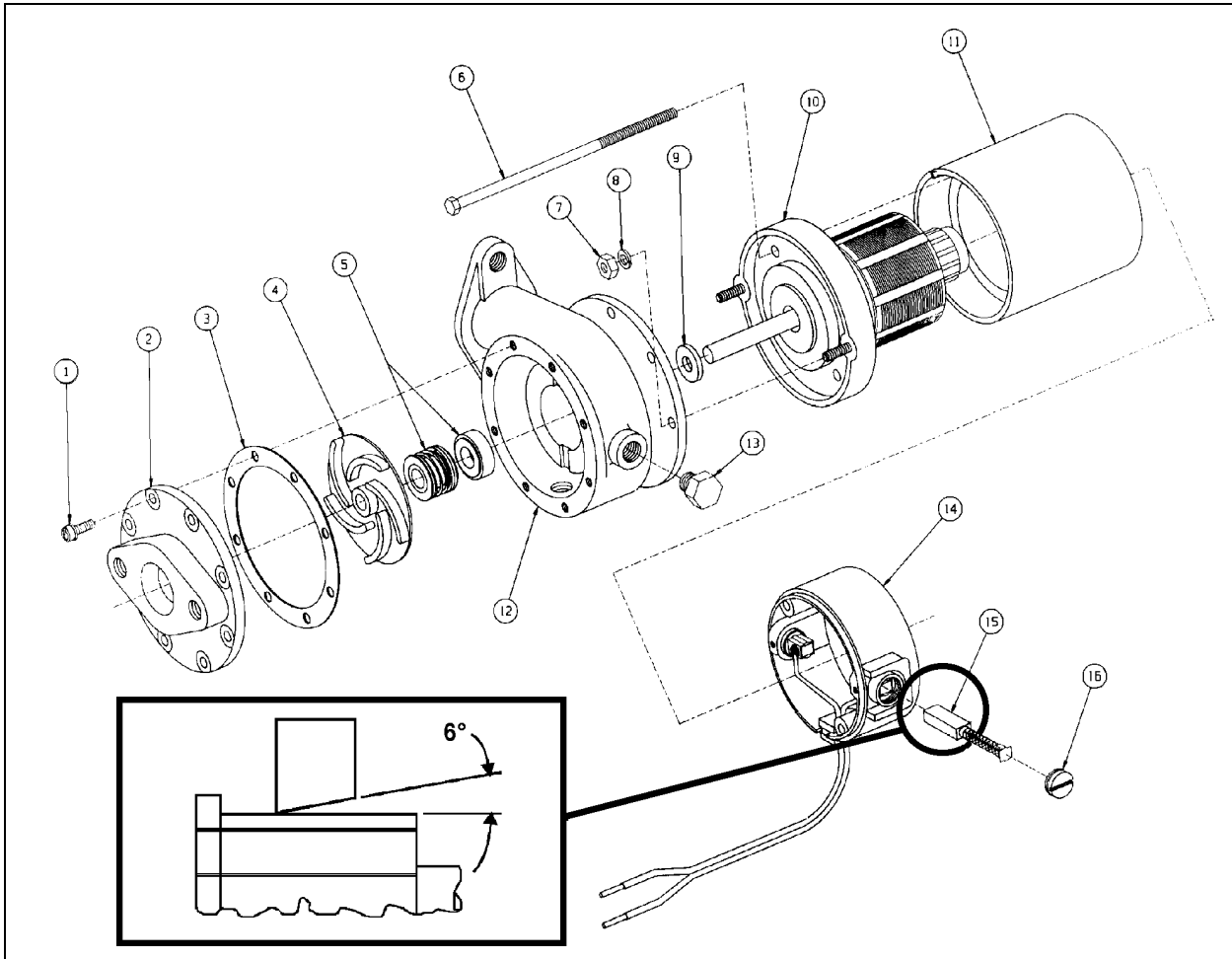


FIGURE 47: WATER CIRCULATING PUMP (COACH - CENTRAL A/C OR DRIVER'S A/C)

22056

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
	MOTOR			IMPELLER	
	Motor Ass'y	1	4	Impeller - Brass	1
11	Stator	1		HOUSING	
14	End Frame Ass'y	1	12	Body - Brass	1
10	Armature adapter Ass'y	1	2	Cover - Brass	1
15	Brush Ass'y	2	1	Screw and Washer Ass'y	8
16	Cap (brush holder)	2	3	Gasket	1
6	Casebolt 10-32 X 5	2	9	Slinger	1
7	10-32 Hex Nut	2	13	Drain Plug - 1/8" NPT Brass	2
8	#10 Lock Washer	2		SEAL	
			5	Seal Ass'y - Silicon Carbide/Carbon	1

Section 22: HEATING AND AIR CONDITIONING

10.3.4 Brushes

1. When removing brushes, note the position of the brush in the tube. Brush life is shortened if the brushes are not replaced properly.
2. Examine brushes for the following:
 - a. Wear
Replace the brushes if less than 25% of the usable brush is left (less than 0.300 inch [8 mm]).
 - b. Chipped edges
Chips can be caused by improper handling or installation. Badly chipped brushes should be replaced regardless of their length.
 - c. Annealed brush spring
This can be detected by noting the resiliency of the spring. Annealing is caused by failing to tighten the brush caps properly, thus not providing a good low resistance contact between the terminal and the brush tube. Replace brushes showing evidence of annealed springs.
 - d. Frayed or broken pigtail
An improperly installed brush may have the pigtail (shunt) pinched under the terminal or between the coils of the spring. If the pigtail is badly frayed or broken, replace the brush.
3. Observe the following factors when replacing brushes:
 - a. The face of a new brush is carefully cut to cause proper seating during the "wear-in" period.
 - b. Improper installation can harm both the brush and the commutator.
 - c. Replacement brushes should be of the proper grade.
 - d. New brushes have a six (6) degree angle. The brush should always be in-

serted so that the angle is open away from the pump end of the assembly (inset, Figs. 46 & 47).

- e. Brush performance will be affected if the spring and terminal are not properly placed in the brush tube. The spring should be free over its entire length and the terminal should make good contact with the metal brush tube insert.

10.3.5 Bearings

1. Rotate the motor shaft. If the ball bearings show evidence of wear, they should be replaced.

Note: *When removing the armature from the motor, the number of washers and their arrangement should be noted. Improper numbers and/or installation of washers can cause improper tracking of brushes, which will result in excessive preloading of bearings and noisy operation.*

2. To help prevent damaging the armature winding and/or the commutator, when removing the bearings, the use of a bearing puller is recommended.
3. Replacement bearings should be pressed into the same exact location as the original bearings.
4. It is recommended that a suitable sealant (such as Loctite or equivalent) be used between the shaft and the bearing, if the fit is not tight enough to prevent the shaft from spinning inside the inner race.
5. After replacing the bearings, check the position of the commutator in the motor by looking down into the brush tube. Neither the riser nor the edge of the commutator should be visible.

10.3.6 Commutator

1. The commutator is a precise assembly. Although it is solidly built and made of a

fairly tough material, it can be easily ruined by careless handling.

2. The commutator should be refinished only on equipment which provides good concentricity and the proper finish.
3. The commutator should be refinished if a micrometer reading shows a difference between "in track" and "off track" diameter of 0.187" (4,7 mm) or more.
4. The commutator should be carefully undercut with a 0.025" (0,6 mm) or less slot width.
5. A 25 to 50 micromesh finish is desirable on a new or refinished commutator.
6. The commutator should not be touched with the fingers since sweat and body oils will rapidly discolor and oxidize its surface.

10.3.7 Miscellaneous

1. **Fig. 47 only:** Check the shaft slinger (9) to make sure it is tight on the motor shaft. If the slinger slips on the shaft, it should be replaced.
2. **Fig. 46:** Inspect seal assemblies (14) to determine wear. If the seal has leaked, or is badly worn, it is recommended that a complete new seal assembly be installed.
2. **Fig. 47:** Inspect seal assemblies (5) to determine wear. If the seal has leaked, or is badly worn, it is recommended that a complete new seal assembly be installed.
3. **Fig. 47 only:** The impeller (4) is a press fit on the armature shaft. This press fit must be maintained to prevent the impeller from slipping. Install a new impeller if necessary.

10.3.8 Assembly

1. **Fig. 47 only:** Install slinger (9) on the motor shaft.
2. **Fig. 47:** Assemble body (12) to the motor.
3. **Fig. 46:** Install seal ass'y (14).
3. **Fig. 47:** Install seal ass'y (5).
4. **Fig. 46:** Insert impeller (8) and secure with acorn nut (9) and gasket (10).
4. **Fig. 47:** Install impeller (4) in the following manner:
 - a. Place the impeller on a flat surface with the vanes against the flat surface.
 - b. Invert the motor and pump body assembly, then pilot the pump shaft into the impeller bore. **DO NOT HAMMER** on the motor shaft extension at rear of motor.
 - c. Press on motor and pump body until the machined face of the pump body is flush with the face of the flat surface on which the impeller is resting. The face of the impeller vanes must now be flush with the machined face of the pump body.
5. **Fig. 46:** Install O-ring (12).
5. **Fig. 47:** Install gasket (3). This gasket serves both to seal the cover and to establish the proper clearance between the face of the impeller and the pump cover.
6. **Fig. 46:** Attach cover (11) to the pump body using four screws (13).
6. **Fig. 47:** Attach cover (2) to the pump body using eight screw and washer ass'y (1).

Section 22: HEATING AND AIR CONDITIONING

7. **Fig. 46:** Install motor brushes assembly (4) and brush caps (5).
7. **Fig. 47:** Install motor brushes assembly (15) and brush caps (16).

10.3.9 Installation

Figure 46 pumps:

1. Connect water lines to pump (hoses to copper pipes). Use a soapy water solution to help insert water lines.
2. Position the pump and motor assembly on the mounting bracket. Position the mounting clamps over the motor and secure with mounting bolts.
3. Connect electrical wiring to the pump motor.
4. Open shutoff valves. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.
5. Fill the cooling system as previously instructed in this section under "9.3 Filling Heating System", then bleed the system as previously instructed in this section under "9.4 Bleeding Heating System".

Figure 47 pumps:

1. Apply gasket cement to the pump body line adapter and to the line flanges, put the two gaskets in place, and connect water lines to the pump at the flange connections. Position the pump and motor assembly on the mounting bracket. Position the mounting clamps over the motor and secure with mounting bolts.
2. Apply pipe sealant on threads of drain plug, and screw it in place.
3. Connect electrical wiring to the pump motor.
4. Open shutoff valve. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.

5. Fill the cooling system as previously instructed in this section under "9.3 Filling Heating System", then bleed the system as previously instructed in this section under "9.4 Bleeding Heating System".

10.4 Coolant Strainer

10.4.1 Description

This vehicle is provided with a cleanable coolant strainer, which is located in the A/C & heating compartment. The strainer uses the micronic principle of filtration which utilizes an accordion-pleated design for a maximum filtering area. A relief valve integrated to the filter element allows bypass of the filter in case of heavy restrictions.



FIGURE 48: COOLANT STRAINER LOCATION

05021

Vehicles equipped with driver's A/C system only are provided with a coolant strainer located in reclining bumper compartment.

10.4.2 Maintenance

Strainer maintenance consists in changing the element at break-in 3000 miles (4 800 km), and subsequently every 50,000 miles (80 000 km) or once a year, whichever comes first.

Note: Service coolant strainer each time soldering is performed at any point on coolant piping; operate heating system a few minutes first, so that soldering residues are routed to the strainer.

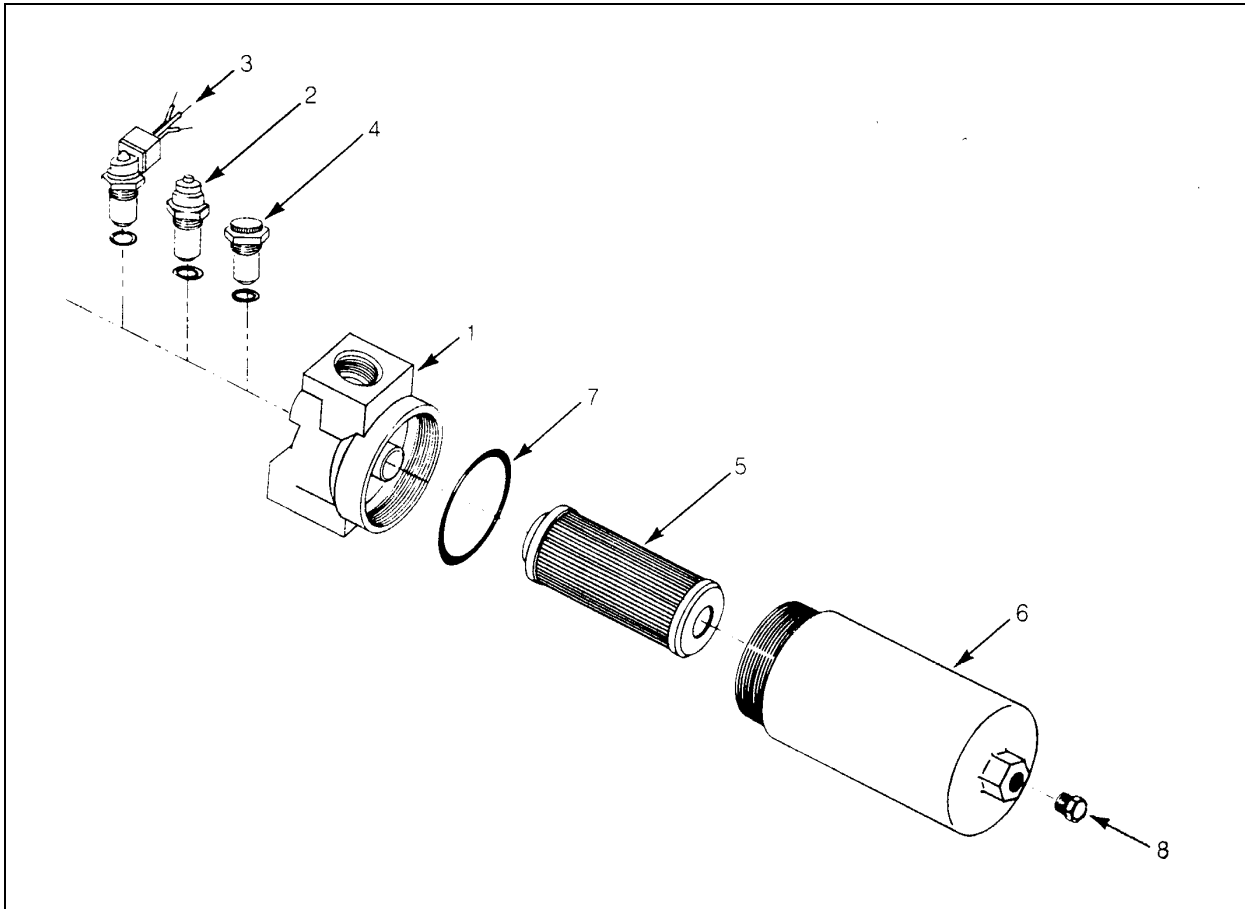


FIGURE 49: WATER FILTER

22057

10.4.3 Servicing (Vehicles with central A/C system)

1. Stop engine and allow engine coolant time to cool.
2. Close shutoff valves. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.

Warning: Before proceeding with the following steps, make sure that coolant has cooled down.

3. Rotate bowl (6, Fig. 49) counterclockwise and remove.
4. Remove element (5, Fig. 49) from housing. Discard all disposable elements. These elements are not cleanable.
5. Place new, clean element in housing, centering it on location in the head.

6. Inspect bowl seal and replace if necessary.
7. Replace bowl. Rotate clockwise and hand tighten.
8. Correct coolant level in surge tank as instructed previously in this section under "Filling Heating System".

10.4.4 Servicing (Vehicles with driver's A/C system)

1. Stop engine and allow engine coolant time to cool.
2. Close shutoff valves. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.

Warning: Before proceeding with the following steps, check that coolant has cooled down.

Section 22: HEATING AND AIR CONDITIONING

3. Unscrew the filter retaining plug.
4. Remove strainer, then clean inside strainer housing.
5. Using water under pressure, flush the strainer from the outside.
6. Reinstall strainer, then tighten the retaining plug.
7. Open shut-off valves.
8. Correct coolant level in surge tank as instructed previously in this section under "9.3 Filling Heating System".

10.5 By-Pass Solenoid Water Valve (Optional)

This valve is optional and is installed only on vehicles equipped with a preheater. The valve is located in the A/C & heating compartment (Fig. 50). This valve is similar to the driver's solenoid valve (refer to Fig. 41 for part names).

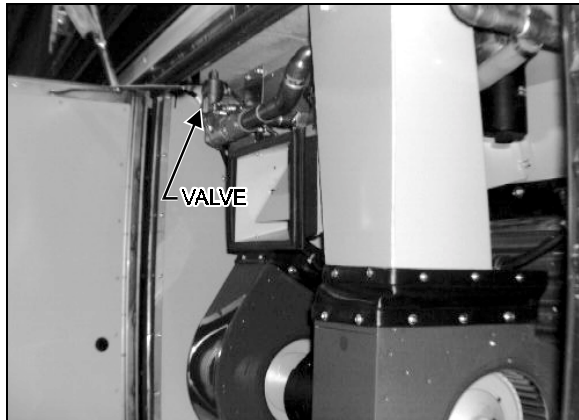


FIGURE 50: BY-PASS VALVE LOCATION

22092

10.5.1 To Remove or Change the Coil

- Stop engine and allow engine coolant time to cool.
 - Close shutoff valves. Refer to "05 COOLING" under heading "4.7 Draining Cooling System" for location of valves.
- To remove the solenoid coil:
- First take out the retaining screw at the top of the coil housing. The entire coil assembly can be lifted off the enclosing tube.
- To reassemble:
- Make sure that the parts are placed on the enclosing tube in the following order:
1. Be sure to change electrical data plate according to coil specifications change.
 2. Place coil and yoke assembly on the enclosing tube. Lay data identification plate in place.
 3. Insert the coil retaining screw, rotate housing to proper position and tighten screw securely.

10.5.2 To Take the Valve Apart

To disassemble:

This valves may be taken apart by removing the socket head screws which hold the body and bonnet together. After removing the screws, carefully lift off the bonnet assembly (upper part of the valve). Don't drop the plunger. The diaphragm can now be lifted out. Be careful not to damage the machined faces while the valve is apart.

Note: *The above procedure must be followed before brazing solder type bodies into the line.*

To reassemble:

Place the diaphragm in the body with the pilot port extension up. Hold the plunger with the synthetic seat against the pilot port. Make sure the bonnet O-rings are in place, the bonnet assembly over the plunger, and that the locating sleeve in the bonnet enters the mating hole in

the body. Insert body screws and tighten uniformly.

10.6 Preheating System (Optional)

On XL-45 vehicles, the preheater is located inside engine compartment and is accessible through L.H. side rear service compartment. On XL-40 and 45E vehicles, the preheater is located next to engine (curb side) and is accessible through engine R.H. side door.

10.6.1 Espar (Eberspächer)

Description of Operations

This Auxiliary Preheating System is used for preheating and retaining the heat of water-cooled engines. It can be used before starting the engine to ease its starting and to provide immediate inside heat upon operation of the heating system. It can also be used with engine running to maintain coolant heat and maintain the set temperature inside vehicle.

The heater operates independently from the vehicle engine. It is connected to the cooling and heating circuits, the fuel system and the electrical system of the vehicle.

The pilot lamp turns on when the heater is switched on. Combustion air flows in to flush out the combustion chamber and the water circulation pump is put into operation. The fuel metering pump conveys fuel in precise doses to the combustion chamber where fuel and combustion air form a combustible mixture which is ignited by the glow plug.

Once the flame sensor has signaled to the control unit that combustion has taken place correctly, the glow spark plug and ignition coil are switched off.

The hot combustion gases are diverted at the end of the flame pipe, then pass through the indirect

heating surfaces of the heat exchanger and transmit their heat to the water passing through the heat exchanger.

The heat is thermostatically controlled and operates intermittently, i.e. the switched-on times of the burner vary depending on the heat requirement. The water temperature depends on the setting of the built-in water thermostat.

The water circulation pump remains in operation as long as the heater is operating, even in the regulation intervals and during the delayed cutout of the switched-off heater. The pump can also be operated independently from the heater by means of an appropriate circuit. The heater can be switched on at any time, even during the delayed cutout period. Ignition takes place once this delay time is over.

When the heater is switched off, the fuel supply is interrupted. The flame goes out, and at the same time a delayed cutout of some 2.5 minutes begins. The combustion air still flowing flushes the remaining combustion gases out of the chamber and cools off the hot parts on the exhaust side of the heat exchanger, while the water circulation pump, still running, transmits the heat present in the heat exchanger, thus preventing local overheats. Once the delayed cutout time is over, both the combustion air blower and the water circulation pump switch off automatically. A cutout will take place in case of any failure of the preheater.

10.6.2 Webasto

Description of Operations

Switch on the heater. The operation indicator lamp comes on and the heater motor and circulating pump begin to run. After about 10-25 seconds the solenoid valve opens and fuel is sprayed into the combustion chamber. At the same time, the electronic ignition unit produces high voltage (8000 V) and the mixture of fuel and air in the combustion chamber is ignited by the spark on the

Section 22: HEATING AND AIR CONDITIONING

ignition electrodes. The flame is indicated by the flame detector, then the electronic ignition unit stops producing high voltage and combustion continues by itself (spark on electrodes is required only to ignite the flame). At this moment, the heater is working and producing heat.

If the heater is switched off by the on/off switch, the solenoid valve interrupts fuel supply, combustion stops and indicator lamp turns off. Combustion air fan still blows air, cleaning the combustion chamber of any fumes and cooling down the combustion chamber. Coolant circulation pumps coolant, making a purge cycle for approximately 2-3 minutes, thus protecting the heater against overheating.

If the heater is not switched off by the on/off switch, the control thermostat will switch off the heater when coolant temperature reaches $165^{\circ} \pm 6^{\circ}\text{F}$ ($75^{\circ} \pm 3^{\circ}\text{C}$) and turns it on at $154^{\circ} \pm 9^{\circ}\text{F}$ ($68^{\circ} \pm 5^{\circ}\text{C}$). During this time, the heater (combustion) is off and the indication lamp and coolant pump are on. Combustion air fan blows air for 2-3 minutes and then turns off.

10.6.3 Preheating System Timers - Auxiliary (Optional)

The timer, located on L.H. lateral is used to program the starting and stopping time of the preheating system. One of two optional Timers may be installed in your vehicle, Espar (40 000 BTU) (Fig. 40) or Webasto (80 000 BTU) (Fig. 41). The system indicator light, located on the dashboard, illuminates when the system is functional. The following offers system descriptions for both timers.

Caution: *The preheating system should not operate for more than one hour before starting engine as this could discharge batteries.*

Warning: *Preheating system must not operate when vehicle is parked inside or during fuel fill stops.*

Note: *Preheating system uses the same fuel as the engine.*

In case of failure:

1. Shut off and turn on again.
2. Check main circuit breaker and overheating switch (Espar) or overheat fuse (Webasto).
3. Have system repaired in a specialized shop.

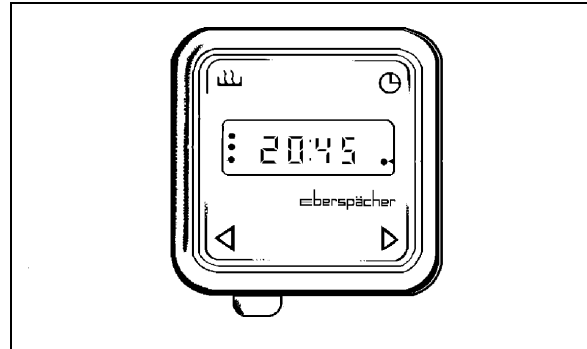


FIGURE 51: ESPAR (40 000 BTU)

18045

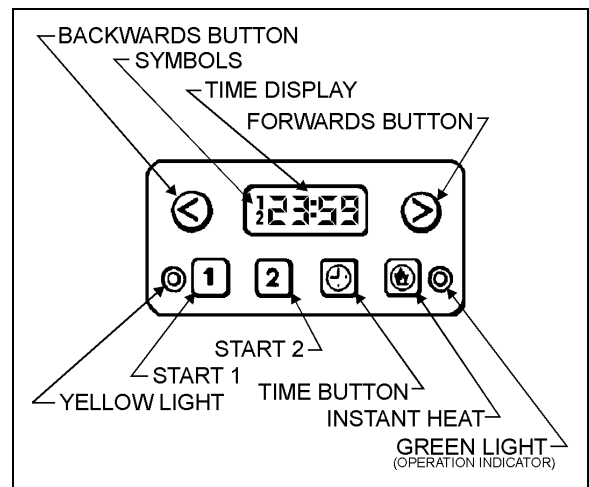


FIGURE 52: WEBASTO (80 000 BTU)

18046

10.6.4 Troubleshooting and Maintenance

Refer to the Webasto and Espar manuals annexed to the end of this section.

Note: *Switch on the preheating system briefly about once a month, even during the warm season.*

Caution: *During welding procedure on the vehicle, disconnect the preheater module*

connector in order to protect this system from voltage surges.

11. SPECIFICATIONS

Evaporator motor (Central system) (Prior 2PCM33495T10125780)

Make	Prevost
Type.....	T-19A
Voltage.....	27.5 V DC
Current draw	57 amps
Horsepower	1.5
Revolution.....	1750 rpm
Insulation	Class F
Motor life	20 000 hours
Brush life.....	10 000 hours
Motor supplier number.....	D599V54APRCAR
Motor Prevost number	561112
Brush supplier number.....	1197
Brush Prevost number	561202

Evaporator motor (Central system) (From 2PCM33495T10125780)

Make	Prevost
Type.....	T-17
Voltage.....	27.5 V DC
Current draw	57 amps
Horsepower	1.5
Revolution.....	1750 rpm
Insulation	Class F
Motor life	20 000 hours
Brush life.....	10 000 hours
Motor supplier number.....	D599V54APRC4
Motor Prevost number	562374
Brush supplier number.....	1197
Brush Prevost number	561202

Condenser fan motor (Central system) (XL-40 and 45E only) (Prior 2PCM33495T10125780)

Make	Prevost
Type.....	T-19A
Voltage.....	27.5 V DC
Current draw	57 amps
Horsepower	1.5
Revolution.....	1750 rpm
Insulation	Class F
Motor life	20 000 hours
Brush life.....	10 000 hours
Motor supplier number.....	D599V54APRCAR
Motor Prevost number	561112

Section 22: HEATING AND AIR CONDITIONING

Brush supplier number..... 1197
Brush Prevost number..... 561202
Condenser fan motor (Central system) (XL-40 and 45E only) (From 2PCM33495T10125780)
MakePrevost
Type..... T-17
Voltage..... 27.5 V DC
Current draw 57 amps
Horsepower 1.5
Revolution..... 1750 rpm
InsulationClass F
Motor life 20 000 hours
Brush life..... 10 000 hours
Motor supplier number..... D599V54APRC4
Motor Prevost number 562374
Brush supplier number..... 1197
Brush Prevost number..... 561202

Condenser fan c/w motor (Central system) (XL-45 Coach)

Make Aurora
Voltage..... 24 V DC
Weight..... 2,5 kg
Max vent 5.286
Quantity 4
Supplier number 134-702-0002
Prevost number 871071

Evaporator air filters (Central system) (Coach)

Make Permatron Corp.
Type..... Polypropylene
Supplier number IN 1X10X37 EXACT
Prevost number All vehicles (Top) 373336
Prevost number XL-40 vehicles (Bottom) 373338
Prevost number XL-45 vehicles (Bottom) 373337

Evaporator air filters (Central system) (Shell)

Make Permatron Corp.
Supplier number IN 13X21X1 NOMINAL
Prevost number (Qty = 3) 871034

Section 22: HEATING AND AIR CONDITIONING

Evaporator motors (Driver's and auxiliary systems)

Make Mobile Climate Control
Voltage..... 24 V DC
Supplier number25-0135
Prevost number 562167

Evaporator air filter (Driver's and auxiliary systems)

Make Permatron
Type..... Washable 8"X18 3/4"X1/4" Polypropylene filter
Supplier number MODEL "R"
Prevost number 871049

A/C Compressor (Central system)

Make Carrier Transicold
Capacity..... 41 CFM
Model..... 05G-134A
No. of cylinders 6
Bore 2" (50,8 mm)
Operating speed 400 to 2200 rpm (1750 rpm, nominal)
Minimum speed (for lubrication) 400 rpm
Nominal horsepower..... 15
Oil pressure at 1750 rpm 15 to 30 psi (103-207 kPa)
Oil capacity 1.13 US gal (4,3 liters)
Weight..... 142 lbs (64,5 kg)
Supplier number 68PD541-104-6
Prevost number 950238

Approved oils

- Castrol SW 68 (POE)
- Mobil Arctic 1 (POE)

Note: The above mentioned oils are suitable for use with reciprocating compressors using refrigerant R-134A and with evaporator temperatures above -40°F (-40°C).

A/C Compressor (Driver's and auxiliary systems)

Make Tecumseh
Model HGB-1000
Factory oil charge* 10 US oz (295 ml)
System oil charge** (driver's system only) 16 US oz (473 ml)
System oil charge** (auxiliary system) 14 US oz (414 ml)
Weight..... 24 lbs (10,9 kg)
Supplier number 99242-5
Prevost number 950219

Approved oils

- Castrol SW 68 (POE)
- Mobil Arctic 1 (POE)

Section 22: HEATING AND AIR CONDITIONING

* - The "Factory oil charge" is the quantity of oil the compressor contains for shipping. This is also the quantity of oil the compressor must contain once the system is in service, when all lines are lubricated.

** - The "System oil charge" is the total quantity of oil needed to fill the compressor and the system lines.

A/C Compressor pulley - includes magnetic clutch (Driver's and auxiliary systems)

Make Warner Electric
Type 1C
Coil 24 Volt
Supplier number 1436-48
Prevost number 950079

A/C Compressor belt (Driver's and auxiliary systems)

Make Gates
Model A35
Supplier number 9002-2035
Prevost number 506685

Compressor unloader valve (Central system)

Make Carrier Transicold
Type Electric (AMC)
Voltage 24 V DC
Watts 15
Supplier number (without coil) 17-40407-20
Prevost number (without coil) 950095
Coil supplier number 22-50030 (1)
Coil Prevost number 950096

Magnetic clutch (Central system)

Make Carrier Transicold
Type Housing mounted 9" dia., 2-B grooves
Voltage 24 V DC
Coil resistance at 68 °F (20 °C) 5.15 - 5.69 ohms
Supplier number 50-01122-90
Prevost number 950204

A/C Compressor belt (Central system)

Make Gates
Model Dayco BX 97
Supplier number 9013-20973
Prevost number 506664
Quantity 2

Refrigerant

Type R-134a
Quantity Central system - 24 lbs (11 kg)
Quantity Driver's system only (XL-40 & 45E) - 6 lbs (2,7 kg)
Quantity Driver's system only (XL-45) - 6.5 lbs (3 kg)

Section 22: HEATING AND AIR CONDITIONING

QuantityAuxiliary system - 24 lbs (11 kg)

Condenser coil (Driver's and auxiliary systems)

Make Harrison division

Supplier number3037438

Prevost number950018

Condenser coil (Central system) (XL-40 vehicles and, XL-45 & 45E Shells)

Make Carrier Transicold

Aluminum

Supplier number 68GF67-194-2

Prevost number870654

Copper

Supplier number 68GF67-194-3

Prevost number870729

Condenser coil (Central system) (XL-45 Coach)

Make Carrier Transicold

Aluminum

Supplier number68BC2-107

Prevost number950259

Copper

Supplier number 68BC2-107-1

Prevost number950260

Evaporator coil (Central system)

Make Carrier Transicold

Supplier number68BE2-105

Prevost number871070

Receiver tank (Central system) (XL-40 vehicles and, XL-45 & 45E Shells)

Make Standard refrigeration

Maximum pressure 450 psig

Material ASTM A-515

Supplier number8409-19M

Prevost number871045

Receiver tank (Central system) (XL-45 Coach)

Make Henry

Maximum pressure 450 psig

Material ASTM A-515

Supplier numberALR1217

Prevost number950261

Receiver - dryer (Driver's and auxiliary systems)

MakeArctic Traveler

Model402566

Supplier number74R1706

Section 22: HEATING AND AIR CONDITIONING

Prevost number 950048

Filter dryer assembly (Central system) (XL-40 vehicles and, XL-45 & 45E Shells)

Make Alco
Supplier number EKH 307S
Prevost number 950231

Filter dryer assembly (Central system) (XL-45 Coach)

Make Henry
Supplier number 815031-XH9
Prevost number 950262

Moisture indicator (Central system)

Make Henry
Supplier number MI-30-7/8S
Prevost number 950232

Thermistor sensor c/w suppresser (Central system)

Make Pocatec Ltée
Supplier number 9000044
Prevost number 870868

Refrigerant liquid solenoid valve (Driver's and auxiliary systems)

Make Parker
Type Normally closed with manual bypass
Nominal Capacity with R-129 Tons
Voltage 24 V DC
Amperage draw 0.67 amps
Watts 16
Supplier number (without coil) RB9MP3-MM
Prevost number (without coil) 950054
Coil supplier number R23MM-CB 24 V DC
Coil Prevost number 950055
Repair kit Prevost number 950056

Hot water solenoid valve (Driver's system)

Make Asco
Type Normally open (without manual bypass)
Voltage 24 V DC
Current draw 0.47 amp.
Watts 11.2
Pressure range 0 to 100 psi
Max. temperature 220°F
Supplier number (with coil) 106-269-1
Prevost number (with coil) 870812
Coil Prevost number 870960
Repair kit Prevost number 870872

Hot water solenoid valve (Central system)

Make Honeywell
 Type.....Normally open
 Voltage..... 24 V DC
 Supplier number LH1C13024VDC
 Previst number 870873
 Coil, supplier number.....AVD-D130-EA22
 Coil, Previst number 870865
 Repair kit, Previst number 870876

Water recirculating pump (Central system - Coach) & (Driver's system - Coach & Shell)

MakeM.P. pumps
 Voltage..... 24 V DC
 Supplier number28689
 Previst number871052

Water recirculating pump (Central system - Shell)

MakeM.P. pumps
 Voltage..... 24 V DC
 Housing..... Aluminum
 Supplier number29232
 Previst number871032

Coolant strainer (Central system)

Make Parker
 Relief valve setting..... 10 psi
 Supplier number (with element)..... 15CN1238WP
 Previst number (with element)..... 871028
 Element type..... Stainless steel
 Element size 238 mesh
 Element supplier number.....92-5566
 Element Previst number 871029

Coolant strainer (Driver's system)

Make Deschênes & fils Ltée
 Type..... Bronze
 Size..... 24 mesh
 Supplier number 13-13-00740
 Previst number 870807

Expansion valve (Driver's and auxiliary systems)

Make Mobile Climate Control
 Supplier number26-0190
 Previst number 950221

Section 22: HEATING AND AIR CONDITIONING

Expansion valve (Central system)

Make Alco
Model TCLE 7-1/2 MW55-65
Supplier number 058613
Prevost number 950237

By-pass valve (Driver's and auxiliary systems)

Make Alco
Model ACP-5
Supplier number 047284
Prevost number (Shell) 452586
Prevost number (Coach) 452512

By-pass solenoid water valve (with preheater only)

Make Parker-Hannifin
Bypass supplier number RB21ME7-MM
Bypass Prevost number 870886
Coil supplier number R-23MM24VDC-CB
Coil Prevost number 870886
Repair kit supplier number 76754
Repair kit Prevost number 870980

Preheating system

Make Espar
Model D 12 W
Capacity 41,000 Btu/h (12 kW)
Heating medium Coolant
Rated voltage 24 V DC
Operating voltage 20-28 V DC
Electric power consumption (without coolant recirc. pump) 55 watts
Fuel consumption 0,4 US gallons/hr (1,65 liters/hr)
Supplier number 25 1656 05 00 00
Prevost number 870969

Preheating system

Make Webasto
Model DBW 2020
Capacity 80 000 Btu/h (23,3 kW)
Heating medium Coolant
Rated voltage 24 V DC
Operating voltage 20-28 V DC
Electric power consumption (without coolant recirc. pump) 120 watts

Section 22: HEATING AND AIR CONDITIONING

Fuel consumption 0,8 US gallons/hr (3 liters/hr)
Supplier number 666.640
Prevost number 871036

Evaporator unit thermostat (Auxiliary system)

Make Thermo King
Supplier number 44-3961
Prevost number 950035

Spacer (Shims) for compressor's vertical adjustment (Central system)

Prevost number (thickness 24 GA - 0,61 mm) 481131
Prevost number (thickness 1/16" - 1,59 mm) 505213
Prevost number (thickness 1/8" - 3,18 mm) 505193

SECTION 23: ACCESSORIES

CONTENTS

1.	HUBODOMETER	23-3
1.1	Description	23-3
1.2	Operation	23-3
1.3	Removal	23-3
1.4	Installation	23-3
2.	SOUND SYSTEM	23-3
2.1	AM/FM Radio Cassette Player	23-3
2.2	Amplifier	23-4
2.3	Public Address System Control Box (PA)	23-4
3.	INVERTER	23-5
4.	COLD-STARTING AID (ETHER)	23-5
4.1	Preventive Maintenance	23-6
4.2	Troubleshooting (If System Is Non-functioning)	23-6
4.3	Thermal Cutout Valve Quick Test	23-7
5.	DESTINATION SIGN	23-7
5.1	Description	23-7
5.2	Maintenance	23-7
5.3	Electric Motor Removal and Installation	23-8
5.4	Destination Sign Light Replacement	23-8
5.5	Sign Curtain Repair	23-8
6.	LAVATORY	23-8
6.1	Description	23-8
6.2	Maintenance	23-11
6.2.1	Fresh Water Reservoir Draining	23-11
6.2.2	Fresh Water Reservoir Filling	23-11
6.2.3	Main Sump Tank Draining	23-11
6.2.4	Main Sump Tank Filling	23-11
6.2.5	Auxiliary Sump Tank Draining	23-11
6.2.6	Cleaning Cabinet	23-11
6.3	Ventilation Fan	23-12
6.3.1	Description	23-12
6.3.2	Maintenance	23-12
6.3.3	Removal and Installation	23-12
6.4	Door Lock	23-13
6.5	Lavatory Light	23-13
6.6	Lavatory Night-light	23-13
6.7	Emergency Buzzer Switch	23-13
6.8	Fresh Water Tank Removal	23-13
6.8.1	Fresh Water Tank Heater	23-14
6.9	Liquid Soap Dispenser	23-14
6.10	Flush Push-button	23-14
6.10.1	Pneumatic Timer Removal and Installation	23-15
6.10.2	Timer Adjustment	23-15
6.11	Flush Pump	23-15
6.11.1	Removal	23-15
7.	WINDSHIELD WIPER MOTOR	23-15
7.1	Removal and Installation	23-15
8.	SPECIFICATIONS	23-17

LIST OF ILLUSTRATIONS

FIG. 1: HUBODOMETER	23-3
FIG. 2: AM/FM RADIO CASSETTE PLAYER.....	23-3
FIG. 3: DRIVER'S FEET - AMPLIFIER AND PUBLIC ADDRESS SYSTEM CONTROL BOX LOCATION.....	23-4
FIG. 4: FIRST PARCEL RACK (BEHIND DRIVER) - AMPLIFIERS LOCATION ON XL-45 COACH.....	23-4
FIG. 5: PUBLIC ADDRESS SYSTEM CONTROL BOX (PA).....	23-5
FIG. 6: REAR L.H. SIDE BAGGAGE COMPARTMENT CEILING	23-5
FIG. 7: ENGINE	23-6
FIG. 8: COLD STARTING AID	23-6
FIG. 9: DESTINATION SIGN - MANUAL.....	23-7
FIG. 10: DESTINATION SIGN - ELECTRICAL	23-7
FIG. 11: DESTINATION SIGN - ELECTRICAL	23-8
FIG. 12: LAVATORY.....	23-8
FIG. 13: FUNCTIONING OF THE LAVATORY	23-10
FIG. 14: ENGINE R.H. SIDE DOOR (SUMP TANK).....	23-11
FIG. 15: LAVATORY ACCESS DOOR	23-12
FIG. 16: VENTILATION FAN.....	23-12
FIG. 17: DOOR LOCK	23-13
FIG. 18: FRESH WATER TANK ACCESS PANEL	23-14
FIG. 19: LIQUID SOAP DISPENSER	23-14
FIG. 20: WINDSHIELD WIPER MOTOR	23-16

1. HUBODOMETER

1.1 Description

An optional wheel hubodometer (Fig. 1) may have been installed on the R.H. side of the drive axle. It indicates the total distance in miles or kilometers covered by the coach since it has left the factory, including road testing.

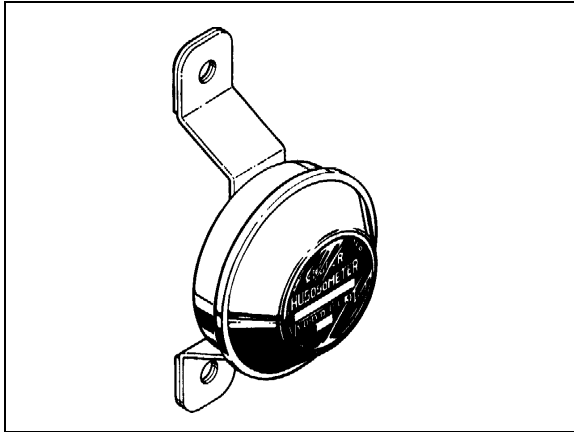


FIGURE 1: HUBODOMETER

23027

1.2 Operation

The hubodometer is calibrated for a specific wheel size (diameter). Wheel rotation causes a mechanism inside the hubodometer to record distance after a predetermined number of rotations. The unit should be serviced at a competent speedometer repair facility.

Note: Do not use paint, solvent or thinner on hubodometer face or on plastic hubcaps. Do not weld on hubodometer.

1.3 Removal

To remove the unit, remove the two lock nuts and washers securing it to the wheel hub, and pull the unit off the studs.

1.4 Installation

Place the hubodometer unit over the wheel hub studs. Replace the lock washers and nuts. Torque stud nuts to 110-165 lbf•ft (150-225 N•m).

2. SOUND SYSTEM

Twelve (XL-40) or fourteen (XL-45) hi-fi speakers in passenger section, a PA system with volume control and one microphone outlet mounted in driver's area are provided as standard equipment. A "Blaupunkt" AM/FM radio cassette player, a 10 disc CD changer, two additional hi-fi speakers in driver's area, as well as different microphone outlets, may have been installed as optional equipment.

Note: Before attempting to solve an electrical problem on the sound system, refer to master wiring diagrams and to the "Sound System Troubleshooting" later in this section.

2.1 AM/FM Radio Cassette Player

Instructions for proper use of the radio are included in the "Blaupunkt Owner's Manual" which is provided in the technical publications box delivered with the vehicle. The radio is a serviceable component and should only be serviced by a qualified electronics technician. Refer to "Blaupunkt Service Centers" guide included in the technical publications box. Before requesting any service from a qualified technician, check the two protection fuses located in the black box behind the radio (refer to "Blaupunkt Owner's Manual" for more information).

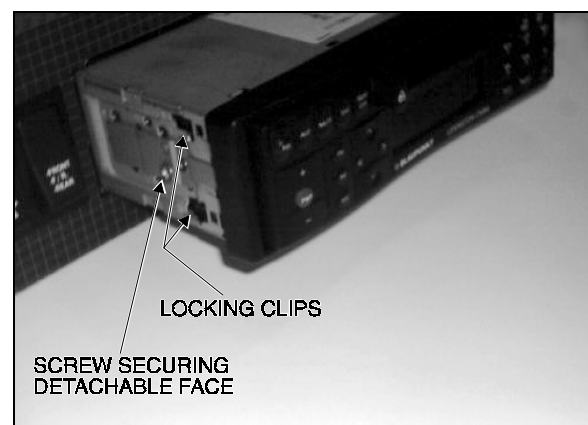


FIGURE 2: AM/FM RADIO CASSETTE PLAYER

23028

To remove the radio from its location, proceed as follows:

1. Remove the four Phillips-head screws retaining the R.H. lower control panel to the dash-board.
2. Carefully pull out panel slightly from dash-board.
3. To unfasten the radio from its support, push in the four locking clips with pens (Fig. 2).
4. Disconnect all wires from radio.
5. If you need to remove face, remove screw securing detachable face (Fig. 2).

To reinstall, reverse removal procedure.

2.2 Amplifier

On XL-40 coach (one) 80 watts amplifier is provided and located at driver's feet. On XL-45 coach (two) 80 watts amplifiers are provided for the sound system and they are located in the first parcel rack (behind driver). Remove the amplifier(s) as follows:

1. Set the battery main disconnect switch to the "OFF" position. Refer to Section 6: "Electrical System" for switch location.

On XL-40 coach: Remove the "Phillips-head" screws retaining the amplifier protector. Remove the amplifier protector (Fig. 3).
On XL-45 coach: Remove the "Phillips-head" screws (Fig. 4) retaining the amplifier plastic cover. Remove the amplifiers plastic cover.

2. Disconnect wiring connectors from both sides of amplifier(s).
3. On XL-40 coach: Remove the four amplifier retaining screws. Then take out amplifier from its location.
On XL-45 coach: Remove the four bolts and nuts retaining mounting bracket to the structure. Then take out amplifiers from their location. Remove the four screws retaining amplifiers to their mounting bracket.
4. Reverse the removal procedure to install the amplifier(s).

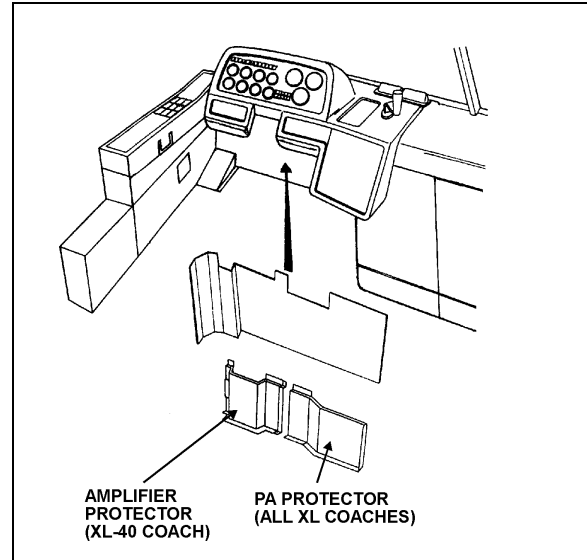


FIGURE 3: DRIVER'S FEET - AMPLIFIER AND PUBLIC ADDRESS SYSTEM CONTROL BOX LOCATION 23046

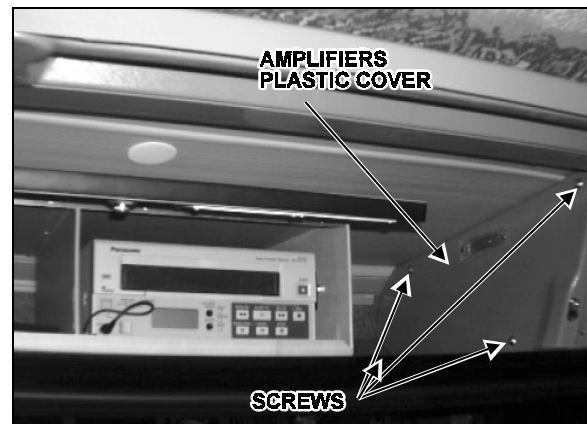


FIGURE 4: FIRST PARCEL RACK (BEHIND DRIVER) - AMPLIFIERS LOCATION ON XL-45 COACH 23047

2.3 Public Address System Control Box (PA)

The public address system control box is located at driver's feet (Fig. 3). A one ampere cartridge-type fuse Prévost # 562129 is mounted in an external holder of the box and may be checked without removing the box from its location (Fig. 5). To remove the fuse, unscrew the fuse cap. Remove the fuse from its holder with the cap as the cap is removed. The fuse may then be pulled out from the cap. Always replace a fuse with a fuse of the same type and rating.

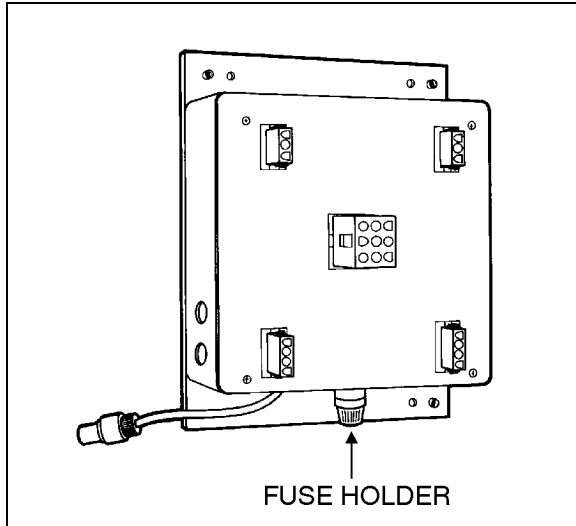


FIGURE 5: PUBLIC ADDRESS SYSTEM CONTROL BOX (PA) 23031

3. INVERTER

The vehicles equipped with the optional video system and TV monitors are provided with an inverter which is recessed in the rear L.H. side baggage compartment ceiling (Fig. 6). The inverter is used to convert the 12 volts DC into 120 volts AC. Two 40 amperes ATO fuses, easily replaceable, are mounted in the front panel external holders. A troubleshooting guide and an internal component wiring diagram of the inverter are included in the leaflets entitled "Powerverter Operating and Installation Instructions", which are included in the technical publications box delivered with the vehicle.

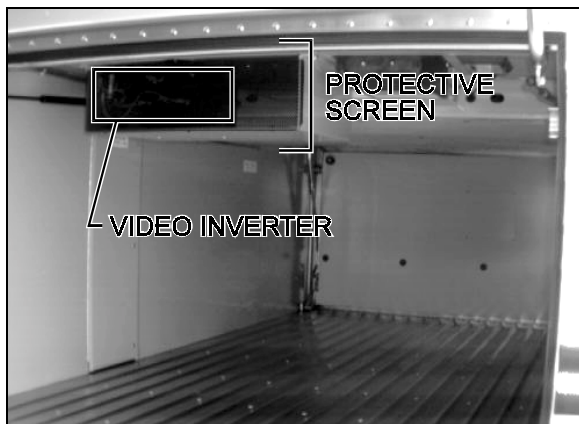


FIGURE 6: REAR L.H. SIDE BAGGAGE COMPARTMENT CEILING (VIDEO INVERTER) 06104

4. COLD STARTING AID (ETHER)

The vehicle can be equipped with an electrically-operated type ether cold starting aid designed to ease engine starting when temperature is below 35 °F (2 °C).

On vehicles equipped with cold starting aid, the system consists of the main following parts:

- Ether starting aid switch
- Ether cylinder
- Solenoid valve (24 V)
- Thermal cutout valve
- Atomizer

The control rocker switch is located near the ignition switch on the L.H. lower switch panel. This switch is provided with a locking mechanism to avoid accidental use when engine is running. To activate the ether starting aid, proceed as follows:

1. Prior to cranking engine, slide down lock tab while pressing rocker switch for three seconds to fill solenoid valve.
2. Release switch to discharge shot.
3. Allow three seconds for shot to discharge.
4. Start engine, use additional shots if necessary to keep engine running.

Caution: This practice should be performed only when absolutely necessary. Excessive use of fluid could result in serious engine damage.

The ether cylinder and solenoid valve assembly are mounted in the engine compartment, above rear doors (see near the engine oil reserve tank).

The thermal cutout valve is mounted on the engine (radiator side). Its function is to prevent discharge of ether when engine is warm (over 90 °F (32 °C)). An atomizer is installed on top of air intake duct (Fig. 7).

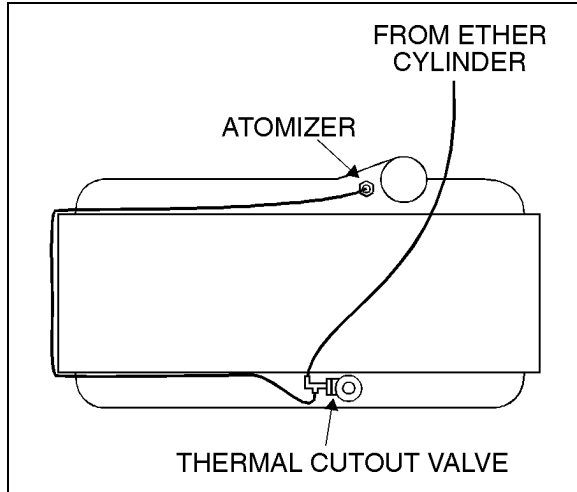


FIGURE 7: ENGINE

23032

4.1 Preventive Maintenance

During the summer months, remove cylinder to avoid high temperature actuation of the cylinder safety relief device. Always screw valve cap into solenoid valve opening to prevent entrance of road dirt. When removing cylinder, be careful to prevent dirt from entering the valve.

4.2 Troubleshooting (If System Is Non-functioning)

Warning: During the following test, direct free end of tube away from personnel and all sources of ignition as this fuel is extremely flammable. Avoid breathing vapors and contacting fuel with skin. Never smoke during test.

1. Check cylinder for hand tightness and fuel supply (Fig. 8). Empty cylinder weight is approximately 17 oz (480 g); full cylinder weight is approximately 35 oz (990 g). If cylinder is empty, replace it. Before replacing cylinder, install new valve gasket in solenoid valve.
2. If still not functioning, disconnect tubing at solenoid valve fitting. Actuate solenoid valve. (Ask an assistant to actuate solenoid valve by means of the rocker switch on the L.H. lower switch panel.)
 - If solenoid valve is non-functioning, check electric circuit, (refer to wiring diagrams). If sound, remove and replace the solenoid valve. If not, repair electric circuit.

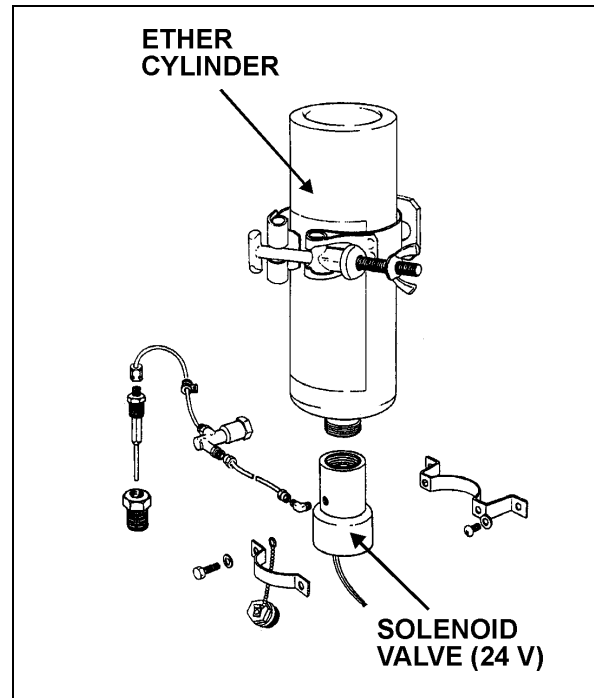


FIGURE 8: COLD STARTING AID

23048

- If valve is functioning, reassemble valve fitting and connect tube. Disconnect tube at thermal cutout valve from port "Tube from valve".
3. Actuate the solenoid valve.
 - If fuel is not discharged from tube, remove tube and blow out or replace.
 - If fuel is discharged, connect tube to thermal cutout valve, and disconnect other tube.
 4. Actuate the solenoid valve.
 - If fuel is not discharged, replace the cutout valve.
- Note:** If engine coolant temperature is 90 °F (32 °C) or over, it is normal that fuel is not discharged as the valve is in closed position.
- If fuel is discharged, connect tube to thermal cutout valve, and disconnect tube from atomizer.
5. Actuate the solenoid valve.
 - If fuel is not discharged from tube, fuel line is clogged. Remove tube and blow out or replace.
 - If fuel is discharged, replace the atomizer.

4.3 Thermal Cutout Valve Quick Test

1. Engine coolant temperature must be below 90 °F (32 °C).
2. Temporarily disconnect tube at thermal cutout valve from port "Tube to atomizer".
3. Actuate solenoid valve (Ask an assistant to actuate solenoid valve by means of the rocker switch on the L.H. lower switch panel). Fuel should be discharged through the thermal cutout valve.

Warning: Avoid breathing vapors and contacting fuel with skin. Never smoke during test.

4. Reconnect tube to thermal cutout valve.
5. Start engine, using cold starting aid if necessary. Stop engine when it reaches operating temperature.
6. Disconnect tube at thermal cutout valve as in step 2, and repeat step 3. No fuel should be discharged.

5. DESTINATION SIGN

5.1 Description

The destination sign is located at upper front of the vehicle. Two models are available.

The first model is manual (Fig. 9). The lighting is provided with bulb light. To change the name on your destination sign simply pull to unlock handle and rotate until sign shows desired destination. Release handle to lock.

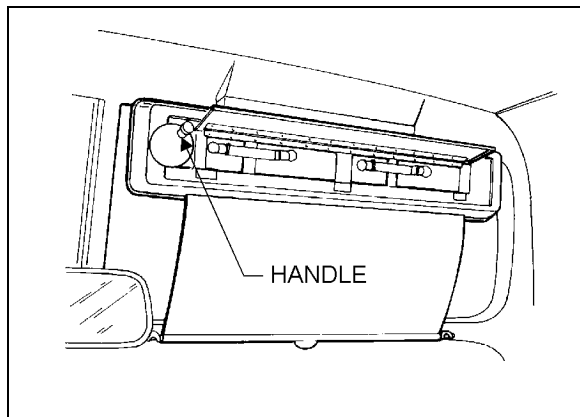


FIGURE 9: DESTINATION SIGN - MANUAL

23017

The second model is electrical (Fig. 10). The lighting is provided with a fluorescent tube. The destination sign is electrically operated. Its motor is controlled by two rocker switches mounted side by side on the destination sign. The small one determines the rolling speed without actuating it. The larger switch (momentary type) controls and actuates the rolling direction (forward or backward).

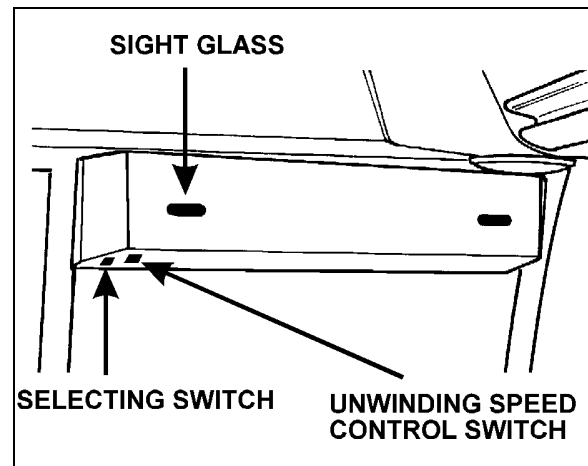


Figure 10: DESTINATION SIGN - ELECTRICAL

23049

Note: Both destination sign model are equipped with lights (bulb light or fluorescent) which illuminates automatically when the headlight or fog light switch is activated.

5.2 Maintenance

Inspect the following items regularly:

1. Check for free and easy mechanism movement.
2. Check for loose items on the sign mechanism, such as wire, loose clips, hanging tape, etc.
3. Check tension and condition of the two drive belts and replace as required.
4. Periodic lubrication is **NOT** recommended.

5.3 Electric Motor Removal and Installation

To remove the electric motor:

1. Remove the six Phillips-head screws and washers retaining the destination sign cover,

then carefully remove the cover from its location.

2. Disconnect wires from electrical motor.
3. Remove both screws retaining motor to destination sign frame (Fig. 11).

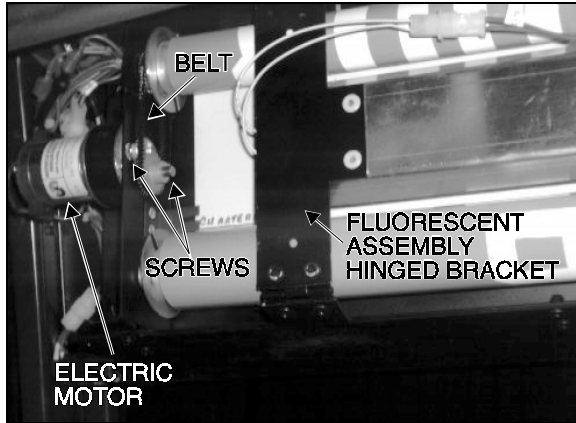


FIGURE 11: DESTINATION SIGN - ELECTRICAL 23034

4. Slide motor upwards, then remove the drive belt.
5. Remove motor through the opening intended for this purpose.
6. Install the motor by reversing the above procedure.

5.4 Destination Sign Light Replacement

Refer to Section 06, Electrical System, paragraph "13.4.7 Destination Sign Light - Bulb Removal and Replacement" and "13.4.8 Destination Sign - Fluorescent Removal and Replacement".

5.5 Sign Curtain Repair

In the event a destination sign curtain is torn, it can be repaired with 3M polyester tape or any equivalent cellophane tape. When repairing a tear, the tape should be used on both sides of the curtain.

6. LAVATORY

6.1 Description

The lavatory is located in the rear R.H. corner of coach and may be equipped with the following items:

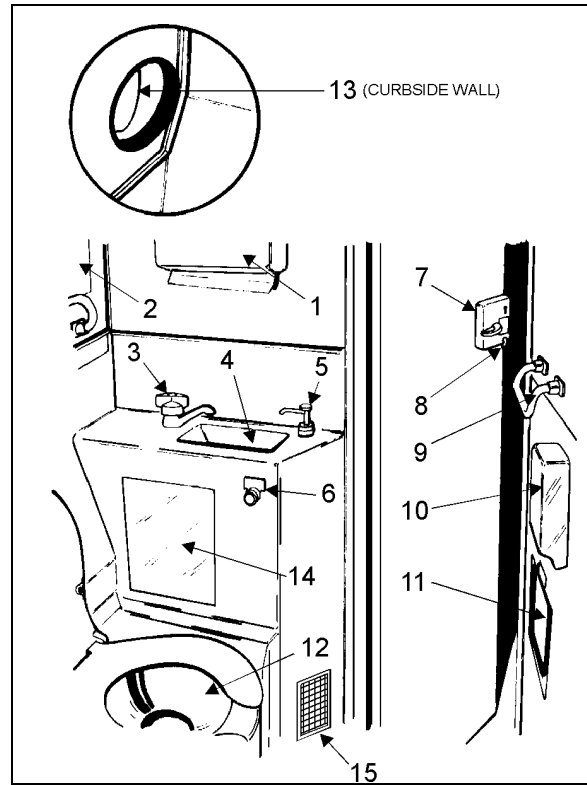


FIGURE 12: LAVATORY 23050

- 01 Towel dispenser
- 02 Mirror
- 03 Water supply valve (faucet)
- 04 Washbasin
- 05 Liquid soap dispenser
- 06 Flush button (timed)
- 07 Door handle
- 08 Door lock
- 09 Grip handle
- 10 Hygienic toilet tissue dispenser
- 11 Waste paper container (trap)
- 12 Toilet

- 13.....Access door (cleaning)
- 14..... Access plate
- 15..... Exhaust grill

An immersion water heater for the lavatory fresh water tank is also available; it can be connected to a 110-120 volt AC power source through an extension cord by the engine oil reserve tank filling door.

Locking the lavatory door from the inside will illuminate the lavatory light, an exterior "occupied" sign and an indicator light on Dashboard. Compartment night-light is lit when vehicle headlights are "ON".

An access door is also provided on curbside wall to facilitate lavatory compartment cleaning (13, Fig. 12). This door can only be opened from the outside.

If emergency assistance is required, the lavatory occupant can actuate a buzzer that will sound in driver's area. The buzzer's push-button (c/w instruction label) is located on the inner curbside wall of lavatory.

Also, a drain hole located on lavatory floor drain water splashed on the floor to the engine R.H. side compartment.

The lavatory has it's own ventilation system that operates only when ignition switch is in the "ON" position.

An auxiliary sump tank (Fig. 14) (optional) allows main tank to be drained by manually opening an interconnecting tank valve (4, Fig. 14). Lavatory can then be operated for longer periods until coach can be serviced at a facility equipped for disposal.

The fresh water tank, located behind compartment mirror (Fig. 13), may be equipped with a thermal drain valve that will drain the tank when water temperature approaches the freezing point preventing damage to the tank (Fig. 13). The fresh water supplies water to the washbasin by gravity. Two tubes are connected on top of the tank. One serves as overflow as well as a vent tube and runs along the curbside wall to the engine R.H. side compartment (7, Fig. 14) while the other tube is connected to the fresh water fill connection which is also located in engine R.H. side compartment (2, Fig. 14). A third tube connected in the bottom of the fresh water tank allows fresh water to flow to the washbasin faucet. Water from washbasin drain tube flow to the main sump tank.

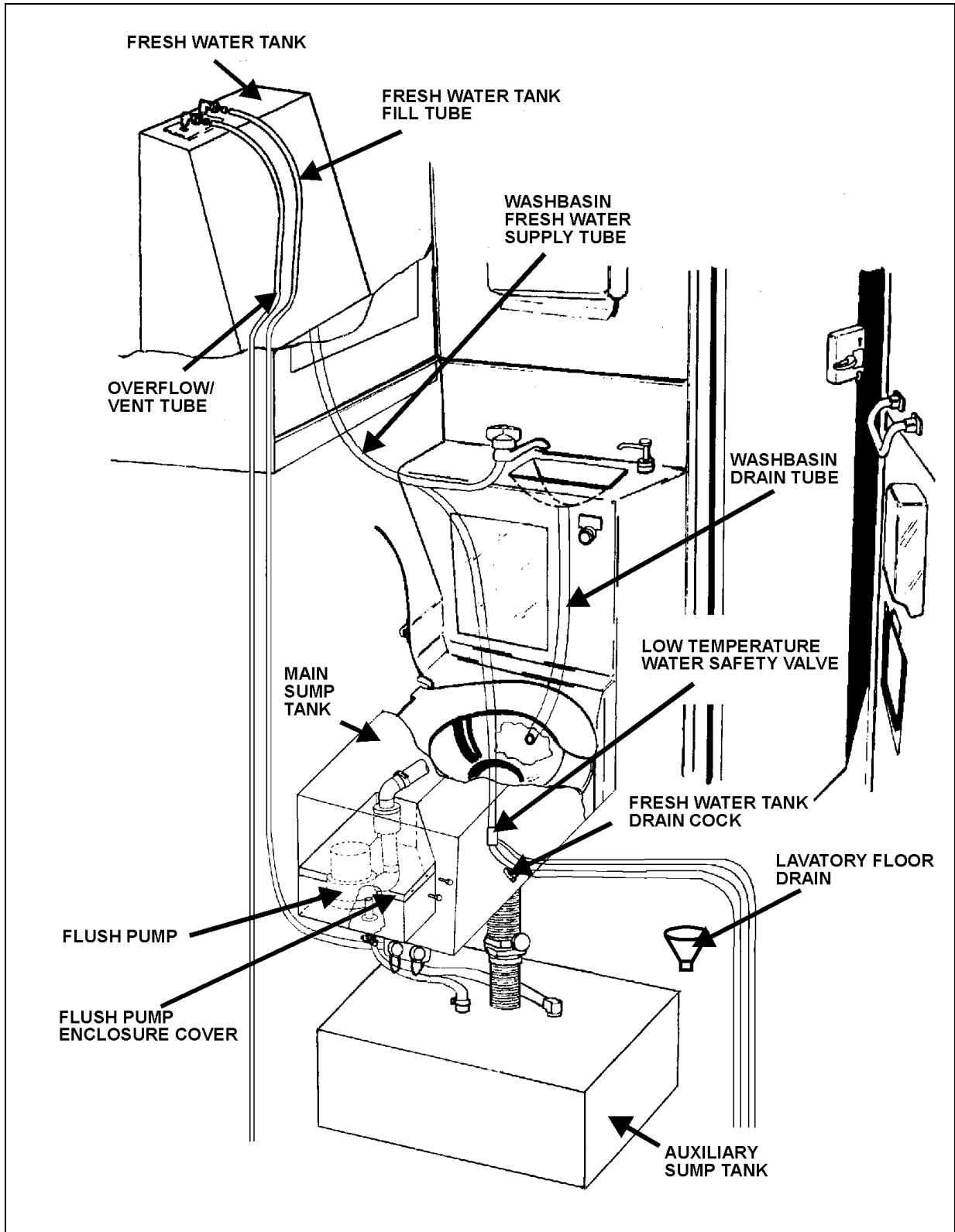


FIGURE 13: FUNCTIONING OF LAVATORY

23051

6.2 Maintenance

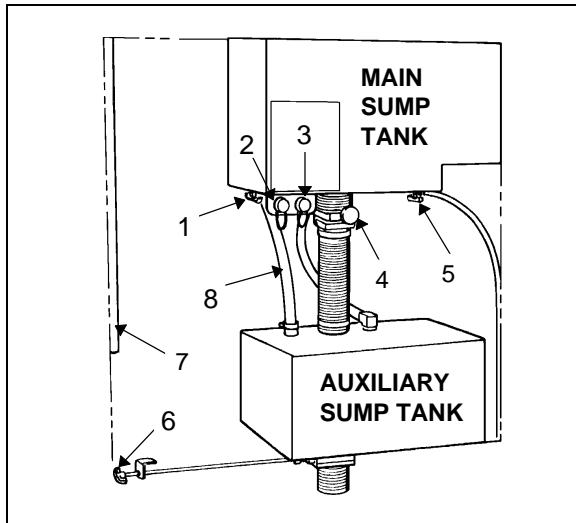


FIGURE 14: ENGINE R.H. SIDE DOOR (SUMP TANK)
23025

- 1..... Main sump tank overflow cock
- 2..... Fresh water tank fill connection
- 3..... Toilet sump tank fill connection
- 4..... Main sump tank drain valve
- 5..... Fresh water tank drain cock
- 6..... Auxiliary sump tank drain valve
(see under vehicle)
- 7..... Fresh water tank vent and overflow indicator
- 8..... Main sump tank overflow tube

Routine draining and filling of lavatory tanks should be performed by maintenance personnel only. Unless an appropriate power source (110-120 volts AC) is available to connect the optional tank heating, and if engine or heating failure occurs in extreme weather conditions, emergency draining of water tanks should be performed under the most suitable conditions and should at all times be supervised by driver.

6.2.1 Fresh Water Reservoir Draining

The fresh water reservoir can be drained by simply opening the fresh water drain cock (5, Fig. 14). Don't forget to close cock when draining is done.

Caution: If fresh water tank heater is inoperative or not installed on your vehicle, water should be drained from reservoir under cold weather conditions since it might freeze and damage both reservoir and connecting links.

6.2.2 Fresh Water Reservoir Filling

Plug the fresh water supply hose to the fresh water tank fill connection (2, Fig. 14); fill the reservoir until the overflow tube leaks, signaling that reservoir is full.

Warning: Never put antifreeze in fresh water reservoir; antifreeze is toxic.

Warning: If reservoir has not been drained for an extended period of time, draining and filling operations must be repeated three (3) times in order to clean reservoir and eliminate contaminated water.

6.2.3 Main Sump Tank Draining

To drain sump tank, simply pull main sump tank drain valve until draining is done (4, Fig. 14).

6.2.4 Main Sump Tank Filling

Open the main sump tank overflow cock (1, Fig. 14) and connect a water supply hose to the toilet sump tank fill connection (3, Fig. 14). The main tank is full when water starts flowing into the auxiliary tank through the main sump tank overflow tube (8, Fig. 14). Close main sump tank overflow cock (1, Fig. 14).

Caution: In cold weather, add 2 gallons (9 liters) of antifreeze (e.g.: ethylene glycol) in the toilet before filling main tank.

6.2.5 Auxiliary Sump Tank Draining

Pull auxiliary sump tank drain valve handle. Close valve when draining is over (8, Fig. 14).

Note: It is unlawful to dump sump tank contents in any location other than those designated as such.

6.2.6 Cleaning Cabinet

The access door, located at rear of coach on R.H. side can ease cleaning of lavatory (Fig. 15). Use this door to introduce electrical cords, vacuum cleaner hoses etc..

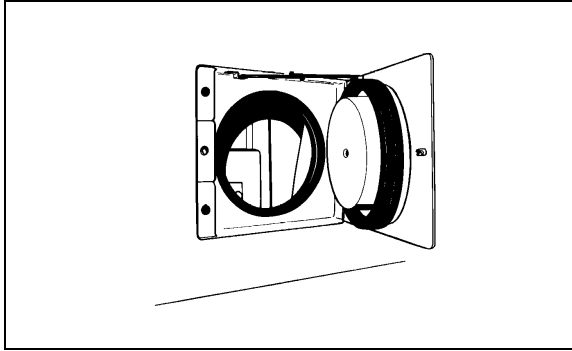


FIGURE 15: LAVATORY ACCESS DOOR

23026

When recirculating water in the toilet is soiled, drain main sump tank into the optional auxiliary tank and perform the filling procedure of the main tank.

When a full draining is required, clean main tank by repeating the draining and filling operations while leaving the auxiliary sump tank drain cock opened. Close cocks and pour a pack of commercial toilet deodorant (Prévost part #900329) in toilet before adding the antifreeze and starting final filling of main tank.

Warning: *The toilet deodorant contains products that can be very irritating to skin. Use rubber gloves when handling and then clean toilet seat.*

Warning: *Antifreeze must comply with the effective environmental act.*

Caution: *When cold weather is expected and there is no antifreeze in the tank, both sump tanks must be drained.*

Note: *If there is no antifreeze solution in the tank, there is less risk of freezing if engine is operating due to the heat it produces.*

New vehicles do not have an antifreeze solution in the sump tanks at time of delivery.

6.3 Ventilation Fan

6.3.1 Description

The lavatory ventilation fan, mounted in engine compartment behind the oil reserve tank (Fig. 16), serves two purposes. It exhausts objectionable odors and provides a constant air circulation in the lavatory compartment by heating or cooling the lavatory with the vehicle ambient air.

Air flows in the lavatory compartment through a vent grill located on the lavatory door and exhausts through a grills located next to the toilet (15, Fig. 12).

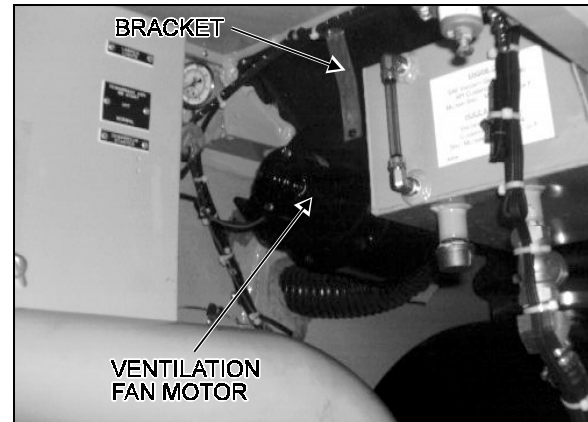


FIGURE 16: VENTILATION FAN

23052

Note: *This fan runs only when ignition switch is in the "On" position.*

6.3.2 Maintenance

The frequency of preventive maintenance should be determined according to vehicle mileage and operating conditions. However, it is recommended to check this item every 50,000 miles (80 000 km) or once a year, whichever comes first.

Remove fan and motor assembly. Check for fan housing wheel and motor free operation. When defective motor occurs, new motor must be installed.

6.3.3 Removal and Installation

1. With the engine compartment rear door opened, remove hose clamp securing duct to ventilator inlet, and disconnect duct.
2. Disconnect the ventilator motor wiring connector.
3. Remove the support bracket screw (Fig. 16). Remove the three ventilator fan housing bolts. Remove the ventilator assembly from its location.
4. The unit can now be disassembled and motor replaced.
5. Reverse previous steps to reinstall ventilator assembly on vehicle.

6.4 Door Lock

Lavatory door lock has inside and outside handles, as well as an inside latch to lock door from inside the compartment. If the lock fails to release, the door can be opened from the outside using a special key which is supplied to the driver. Lock assembly can be removed from the door, then readily disassembled and parts replaced, if necessary (Fig. 17). A thin coat of lubricant on all moving parts will ensure trouble-free operation.

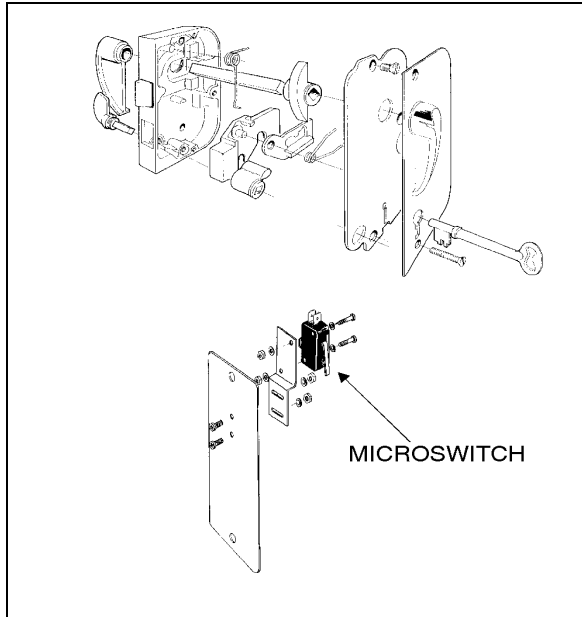


FIGURE 17: DOOR LOCK

23037

6.5 Lavatory Light

The lavatory light is installed on ceiling. A microswitch, which is mounted in the door exterior frame, is activated by the door lock mechanism upon locking to energize the circuit. This switch is readily serviced by removing the two Phillips-head screws securing the mounting plate to the door exterior frame.

Proceed as Section 06, Electrical System, paragraph "13.3 Dome, Rear Roof and Lavatory Lights" for lights replacement.

6.6 Lavatory Night-light

The lavatory night-light is illuminated as soon as the ignition switch is set to the "ON" position. See Section 06, Electrical System, paragraph "13.4.4 Parcel Rack / Lavatory Night Light - "Bulb Removal and Replacement" for lights replacement.

6.7 Emergency Buzzer Switch

The lavatory emergency buzzer is mounted on the inner curb side wall of lavatory and sounds when the emergency call push-button switch in the lavatory compartment is activated. For specific wiring information, refer to wiring diagrams. To remove the emergency call push-button switch, proceed as follows: Pry out the switch with a flat head screwdriver and remove it.

6.8 Fresh Water Tank Removal

Two panels allow access to the fresh water tank. One is located at rear of last R.H. side seats (Fig. 19) and secured in place with Phillips-head screws (if fresh water tank has to be removed use this access). The other access is located behind the toilet mirror. Remove the tank as follows:

1. Remove the mirror and the access panel.
2. Remove the fresh water tank tubings, bolts, fresh water tank heater and different wiring connectors.

3. Remove the tank from the access panel (Fig. 19).
4. Reverse previous steps to reinstall fresh water tank assembly on vehicle.

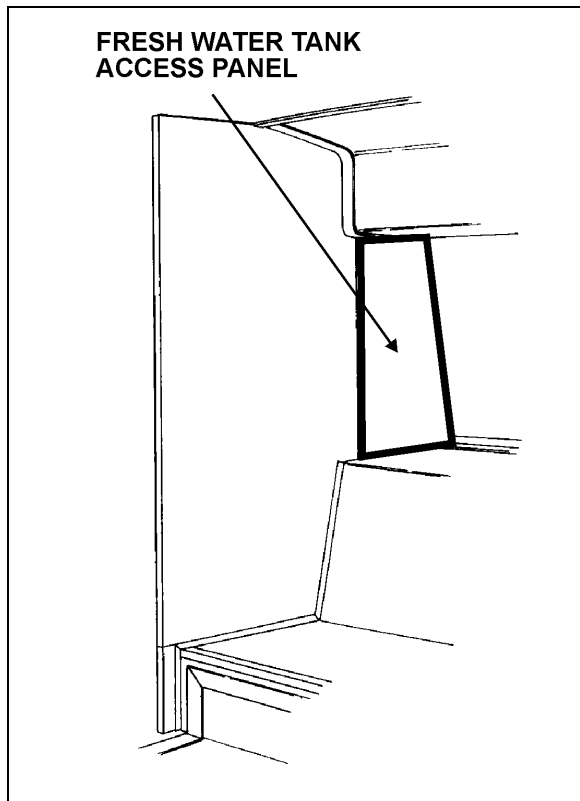


FIGURE 18: FRESH WATER TANK ACCESS PANEL 23054

6.8.1 Fresh Water Tank Heater

A 75 watts, 110 volts AC immersion-type water heater is installed in the bottom of the fresh water tank. The heated portion of element must be immersed at all times to ensure proper heater life. Its power source is provided by the 110 volts in-station connector mounted in the engine oil reservoir tank filling door.

6.9 Liquid Soap Dispenser

A liquid soap dispenser may have been installed as optional equipment. To refill dispenser, proceed as follows:

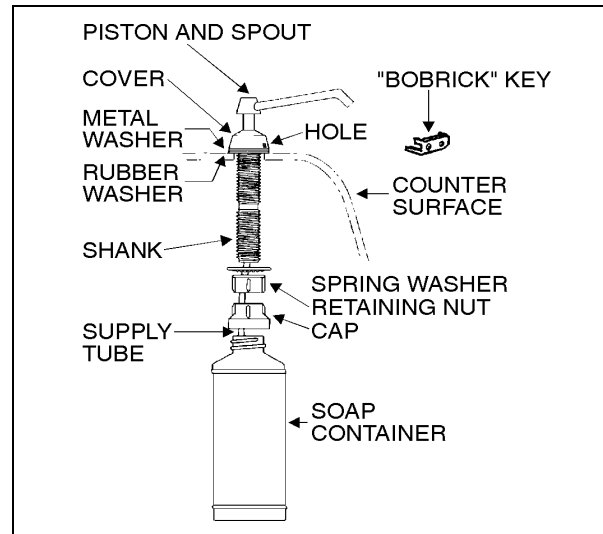


FIGURE 19: LIQUID SOAP DISPENSER 23039

1. Turn cover slightly clockwise until it stops.
2. Insert projection at end of "BOBRICK" key into rectangular hole in cover (Fig. 20). Push straight in. While holding "BOBRICK" key in, turn cover counterclockwise about 1/8 turn.

Caution: Do not use "BOBRICK" key to turn cover.

3. Lift out piston and spout, cover and supply tube.
4. Fill dispenser with soap. This model can dispense vegetable oil soaps, synthetic detergents, and lotion soaps.

Caution: Never use abrasive cleaners.

5. Replace supply tube, piston, and spout mechanism reversing the steps above.
6. Secure the cover by turning clockwise until lock snaps into position.

Note: The dispenser requires priming when extremely viscous lotion soaps are used. Remove piston and spout, cover and supply tube assembly. Pump water into assembly, then replace into dispenser.

6.10 Flush Push-button

The flush push-button is located near the toilet (6, Fig. 12). Press on push-button to actuate a pneumatic timer located on the other side of wall. This timer allows an electric current flow during a preset time to a pump into the sump tank.

6.10.1 Pneumatic Timer Removal and Installation

1. Unscrew and remove the flush push-button lock nut.
2. Remove the access plate (14, Fig. 12).
3. Remove pneumatic timer through this opening, taking care to disconnect electric wires.

Note: *Care must be taken to avoid losing the spacers installed on the mounting sleeve.*

4. Reverse the above procedure to reinstall timer. The recommended torque for the lock nut is 15 lbf•ft (21 N•m).

6.10.2 Timer Adjustment

Timer can be adjusted from 0.2 second to 3 minutes by turning the time adjustment screw clockwise to increase time, and counterclockwise to decrease time. To gain access to the time adjustment screw, repeat steps 2, 3 in the previous paragraph "6.10.1 Pneumatic Timer Removal and Installation".

6.11 Flush Pump

The submersible-type flush pump is mounted inside an enclosure in the sump tank (Fig. 13). The enclosure is provided with a screened side which serves as a strainer to prevent solid matters from entering the pump. The pump requires no periodic maintenance other than cleaning of the strainer side using a water jet introduced through the circular cap opening, once the sump tank is completely drained. The pump can run dry periodically without damage. However, for maximum seal life, the run dry periods should be kept to a minimum.

Caution: *If vehicle is stored for an extended period of time, make sure to clean the strainer as solid matter will tend to pack, and will necessitate replacement of strainer.*

6.11.1 Removal

1. Remove the toilet to gain access to the pump enclosure (12, Fig. 12).
2. Remove the flush pump enclosure cover (Fig. 13).
3. Unsnap the flush pump.

7. WINDSHIELD WIPER MOTOR

The windshield wiper motor is behind the central panel (Fig. 21).

7.1 Removal and Installation

Warning: *Park vehicle safely, apply parking brake, stop engine and prior to working on the vehicle set to the "OFF" position the:*

- **Main battery disconnect switch (XL-40 coach);**
- **Toggles switch and the battery master switch (XL-45 coach).**
- **12 and 24 volts main battery disconnect switch (XL-40, XL-45E and XL-45 converted vehicles).**

Refer to Section 6, paragraph "4. Electrical Compartments" for switch locations.

1. Unscrew the two latches retaining the central panel, and remove it.
2. Disconnect wiring connector from the windshield wiper motor.
3. Loosen the bolt retaining the lever at the end of the motor driving shaft (1, Fig. 21).
4. Remove the three bolts that hold the motor to the steel plate (2, Fig. 21).
5. Remove the windshield wiper motor (Prévost part #800304) and reverse removal procedure to reinstall.

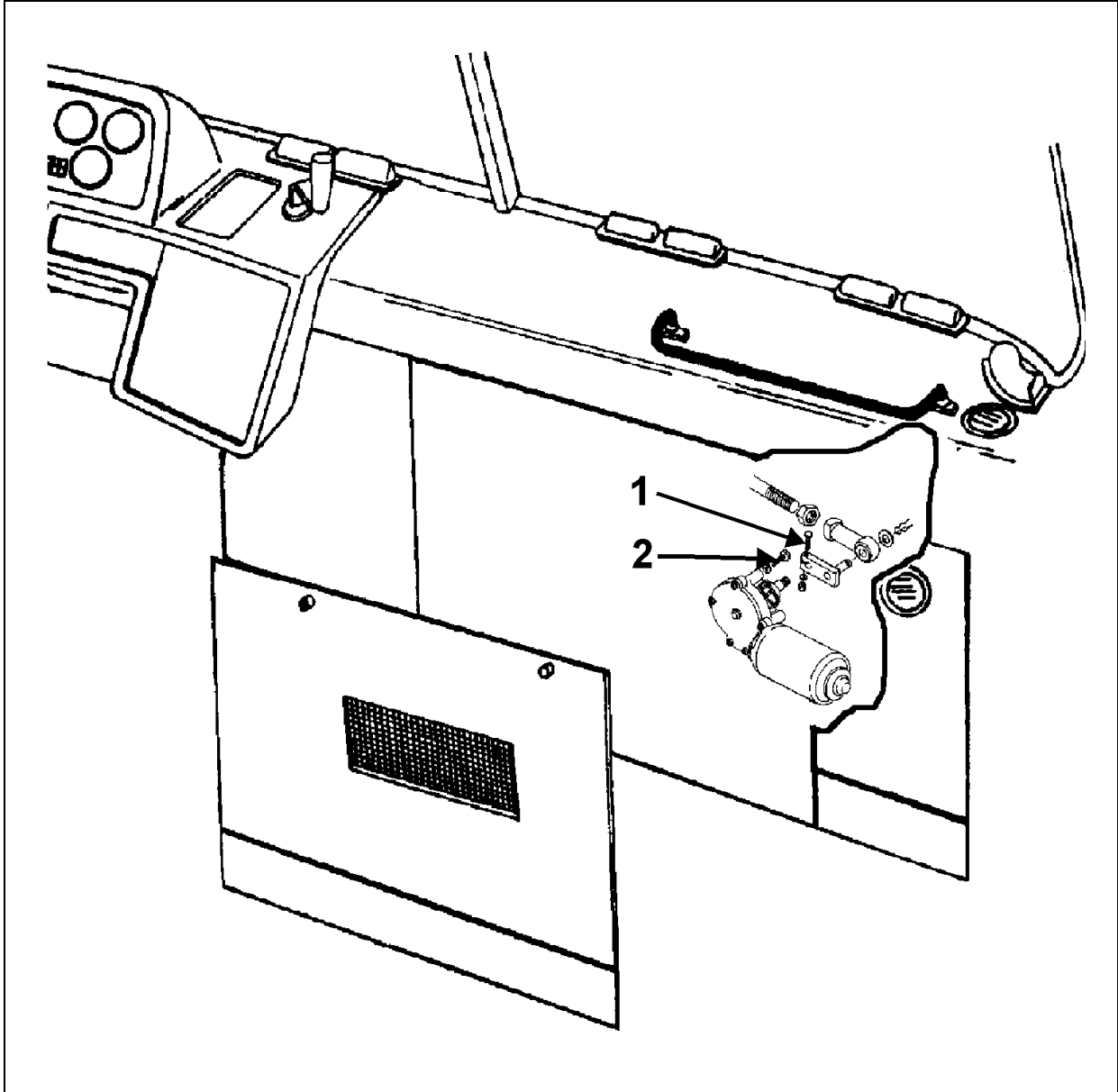


FIGURE 20: WINDSHIELD WIPER MOTOR

23055

8. SPECIFICATIONS

HUBODOMETER (US model: miles)

Make..... Stemco
 Supplier number..... 650-0593
 Prévost number..... 650002

HUBODOMETER (Canada model: km)

Make..... Stemco
 Supplier number..... 650-0025
 Prévost number..... 650117

AM/FM RADIO CASSETTE PLAYER

Make..... Blaupunkt
 Model..... Lexington CM84
 Power source 12 volts
 Maximum output power 4 X 20 watts
 Supplier number..... 9 404 230 228
 Prévost number..... 900730

AM/FM/CD PLAYER

Make..... Blaupunkt
 Model..... Ventura CD 83
 Power source 12 volts
 Maximum output power 4 X 20 watts
 Supplier number..... 9 404 230 281
 Prévost number..... 900764

CD CHANGER

Make..... Blaupunkt
 Model..... CDC-M5
 Power source 12 volts
 Supplier number..... 9 404 230 283
 Prévost number..... 900732

AMPLIFIER

Make..... Sony
 Model..... XM-2042
 Power source 12 volts
 Total output power 80 watts (RMS)
 Supplier number..... XM-2042
 Prévost number..... 900744

SPEAKER

Make..... Blaupunkt
 Max. power..... 90 watts
 RMS power 40 watts
 Freq. response..... 45 Hz - 24 kHz
 Sensitivity 92 dB
 Impedance 4 ohms
 Supplier number..... RPSPKR54
 Prévost number..... 900765

PLAYER LASER DISC KARAOKE

Make Laserlinx international
 Model LK-V35
 Power source..... 24 volts DC
 Supplier number LK-V35
 Prévost number 900740

INVERTER

Make Tripp-Lite
 Model PV-750FC
 Power source..... 12 volts DC
 Output power 750 watts/120 volts AC, 60 Hz
 Prévost number 562292

ELECTRIC DESTINATION SIGN (FLUORESCENT TUBE)

Make General Electric
 Length 30" (76 cm)
 Outside diameter 1" (25 mm)
 Wattage..... 20
 Color Cool white
 Quantity..... 1
 Supplier number F30T8 CW4
 Prévost number 830120

MANUAL DESTINATION SIGN (BULB LIGHT)

Candle power..... 3 cp.
 Voltage..... 24 volts
 Quantity..... 6
 Trade or SAE number 1251
 Prévost number 560125

LAVATORY VENTILATION FAN MOTOR

Make MCC
 Voltage..... 24 volts
 Supplier number 15-6532
 Prévost number 870844

LAVATORY LIGHT BULB

Voltage..... 24 volts
 Wattage..... 10 watts
 Quantity..... 2
 Trade or SAE number 78236
 Prévost number 561553

LAVATORY NIGHT LIGHT BULB

Voltage..... 24 volts
 Wattage..... 2 cp.
 Quantity..... 2
 Trade or SAE number 456
 Prévost number 560601

EMERGENCY BUZZER SWITCH (PUSH BUTTON)

Rating 3 A
Supplier number.....44-532-0
Prévost number..... 401896

FRESH WATER TANK

Make.....Prévost
Capacity 18 US gal (68 liters)
Prévost number..... 401591

FRESH WATER TANK HEATER

Pipe thread adapter 1/4"
Wattage75 watts
Voltage110 volts
Supplier number..... EM 37-5
Prévost number..... 562018

FLUSH PUSH BUTTON PNEUMATIC TIMER

Make..... Furnas
Type Resettable
Time 0,2 to 180 seconds
Supplier number..... 55-AA
Prévost number..... 90-0348

FLUSH PUMP

Make.....Jabsco
Model number 30240-1024 24 V
Power source24 volts
Capacity 1452 gal./h
Prévost number..... 900496

WINDSHIELD WIPER MOTOR

Make..... SWF
Supplier number..... 403.195
Prévost number..... 800304

WIPER (BLADE)

Make..... Sprague device inc.
Supplier number..... S-1147-2-22
Prévost number..... 800284

SECTION 24: LUBRICATION

CONTENTS

1. DESCRIPTION	24 - 2
2. BREAK-IN PERIOD MAINTENANCE.....	24 - 2
3. ENGINE OIL CHANGE	24 - 2
4. AUTOMATIC TRANSMISSION OIL CHANGE.....	24 - 2
5. FLEXIBLE HOSE MAINTENANCE.....	24 - 3
6. DAILY WALK-AROUND INSPECTION	24 - 5
6.1 Outside the Vehicle	24 - 5
6.2 Engine Compartment	24 - 5
6.3 Inside the Vehicle	24 - 6
7. LUBRICATION AND SERVICING SCHEDULE	24 - 7
7.1 Service Every 6,250 Miles (10 000 km) or Twice a Year, Whichever Comes First	24 - 7
7.2 Service Every 12,500 Miles (20 000 km) or Once a Year, Whichever Comes First	24 - 8
7.3 Service Every 25,000 Miles (40 000 km) or Once a Year, Whichever Comes First	24 - 8
7.4 Service Every 50,000 Miles (80 000 km) or Once a Year, Whichever Comes First	24 - 9
7.5 Service Every 100,000 Miles (160 000 km) or Once Every Two Years, Whichever Comes First.....	24 - 9
7.6 Miscellaneous Service.....	24 - 10
8. LUBRICANT SPECIFICATIONS.....	24 - 11
9. PART NUMBER SPECIFICATIONS.....	24 - 12

LIST OF ILLUSTRATIONS

FIG. 1: LUBRICATION AND SERVICING COMPONENTS.....	24 - 4
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1. DESCRIPTION

The efficiency and life of mechanical equipment is largely dependent upon proper lubrication and servicing. All mechanical components rely on a lubrication film between the moving parts to reduce friction, prevent wear, help cool the contacting sliding parts, and keep dirt and wear particles away from mating parts. Proper lubrication depends upon using the right type of lubricant, at proper intervals and filling to proper capacities. Past experience shows that many service problems can be traced to an improper lubricant or to incorrect lubrication procedures.

A comprehensive maintenance and lubrication program is important to ensure the long service life this vehicle was designed for and to avoid costly repairs and associated downtimes caused by premature part failure. The lubrication schedule in this section gives the location of the key service points on the vehicle as well as the lubricant specifications for each component to be serviced. Specific instructions on how to check and service major components are covered in their respective sections in this Maintenance Manual. The recommended lubrication intervals are based on normal operating conditions and mileage accumulation. Shorten the intervals if vehicle operates in more severe conditions. Some parts and equipment referred to in the lubrication schedule are optional and may not be installed on your vehicle. Dispose of used lubricants and filters in an environmentally responsible manner, according to federal and/or local recommendations.

2. BREAK-IN PERIOD MAINTENANCE

Perform the following maintenance after the initial 3,000 miles (4 800 km) of operation. Then perform at the recommended intervals in the lubrication schedule.

1. Drain differential oil and refill with clean oil.*

2. Drain manual transmission oil and refill with clean oil.*
3. Replace or clean standard coolant strainer** and optional coolant filter/conditioner.
4. Replace automatic transmission oil filter and oil.*
5. Lubricate front axle knuckle pins, bushings, tie rod ends, and ball studs of drag link.
6. Drain the radiator fan drive gearbox, preferably while warm, and refill with clean oil.

* Also perform after 3,000 miles (4 800 km) following a major repair.

** Also perform after 3,000 miles (4 800 km) following soldering work done at any point of the cooling system.

3. ENGINE OIL CHANGE

The engine oil change intervals are related to the operating conditions such as vehicle load and speed, and may vary. Prévoist recommends that engine oil and filter change be performed at every 12,500 miles (20 000 km). Check the oil daily with engine stopped. If necessary, add sufficient oil to raise the level to the proper mark on the dipstick.

4. AUTOMATIC TRANSMISSION OIL CHANGE

Change the fluid and internal filters after the first 3,000 miles (4 800 km). Thereafter, oil and filters change should be performed every 25,000 miles (40 000 km) or once a year, whichever comes first. Note that the operating conditions may shorten the oil and filters service intervals. Fluid must be changed whenever there is evidence of dirt or high temperature condition, which would be indicated by discoloration, strong odor, or fluid analysis.

5. FLEXIBLE HOSE MAINTENANCE

The performance of any vehicle is directly related, among other things, to the ability of flexible hoses to supply lubricating oil, air, coolant and fuel. Maintenance of hoses is an important step to ensure efficient, economical and safe operation of the vehicle.

Check hoses daily as part of the walk-around inspection. Examine hoses for leaks, check all fittings, clamps, and ties carefully. Ensure that hoses are not resting or touching shafts, couplings, heated surfaces including exhaust manifold, any sharp edges, or other obviously damaging areas. Since all equipment vibrates to a certain extent, clamps and ties can wear with time. To ensure proper support, inspect fasteners frequently and tighten or replace them as necessary.

Investigate leaks immediately to determine if fittings have loosened or cracked, and if hoses have ruptured or worn through. Take corrective action immediately. Leaks are not only potentially detrimental to vehicle operation, but can also result in added expenses caused by the need to replace fluids.

Warning: Personal injury and/or property damage may result from fire due to the leakage of flammable fluids, such as fuel or lube oil.

The useful service life of a hose is determined by the temperature and pressure of the fluid within it, the time in service, its installation, the ambient temperatures, amount of flexing, and the vibration it is subjected to. With this in mind, we recommend that all hoses be thoroughly inspected at least every 50,000 miles (80 000 km) or once a year for surface damages or indication of damaged, twisted, worn, crimped, brittle, cracked, or leaking lines. Hoses having the outer surface worn through or damaged metal reinforcement should be considered unfit for further service.

It is also recommended that all hoses on this vehicle be replaced during major overhaul and/or after a maximum of five years with hoses of equal or superior quality, compared with the original.

Section 24: LUBRICATION

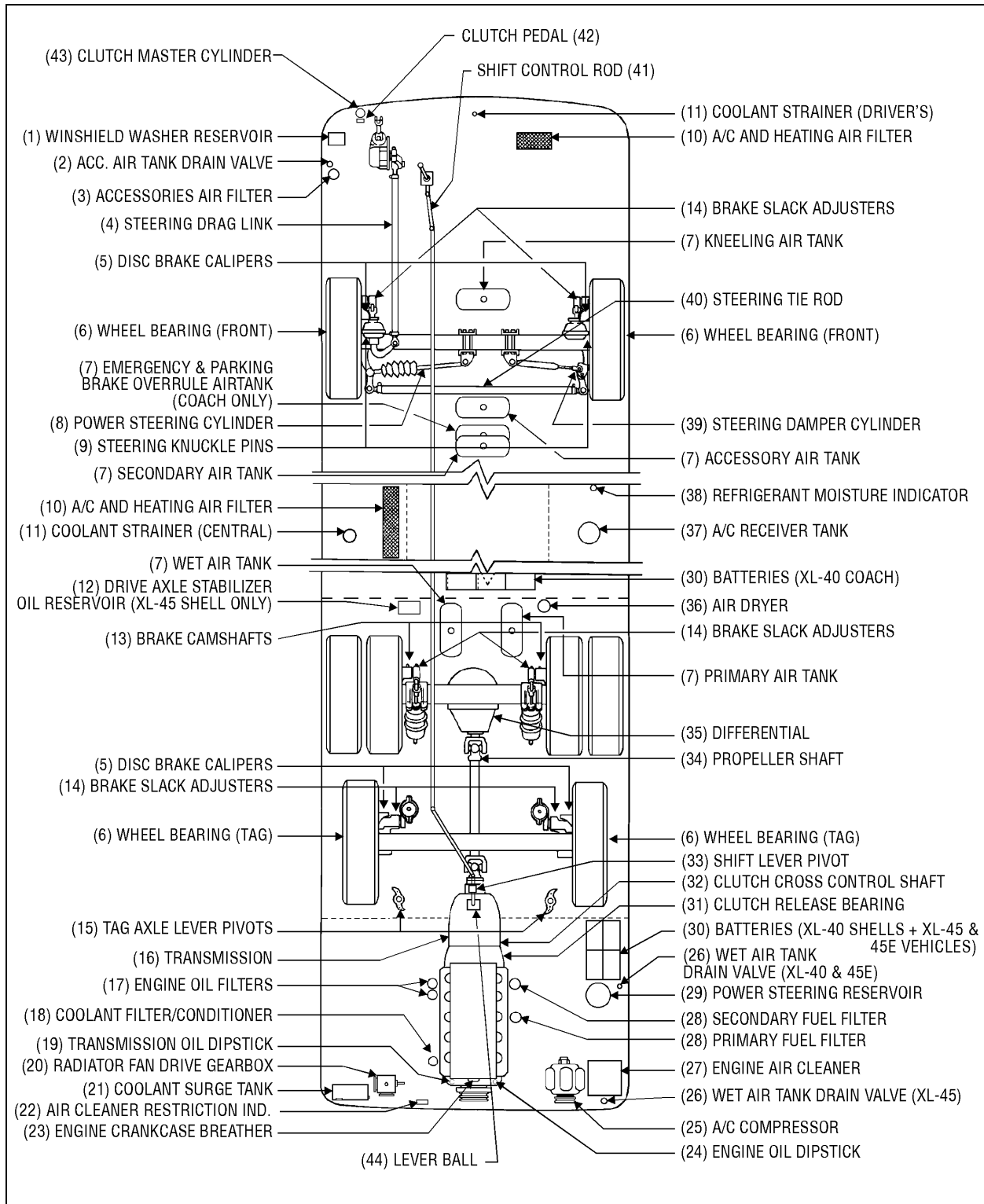


FIGURE 1: LUBRICATION AND SERVICING COMPONENTS

24001B

Note: Before operating vehicle, perform each point listed in section "STARTING AND STOPPING PROCEDURES" under headings "DAILY/ROUTINE INSPECTION" and "RECOMMENDATIONS", starting on page 4-9 in your "OPERATOR'S MANUAL".

6. DAILY WALK-AROUND INSPECTION

It is a good practice to make a basic visual inspection of key areas on the vehicle on a daily basis and to report any problem areas to maintenance personnel for immediate correction. For Converted Vehicles (Shells), perform this walk-around inspection before every trip.

6.1 Outside the Vehicle

ITEM*	DESCRIPTION
---	Check for leaks under vehicle and in engine compartment
---	Check that baggage and service compartment doors close properly
---	Inspect tires and wheels for correct tire pressure, wear or damage, and for missing wheel stud and nuts
1	Check windshield washer fluid level and add if necessary
---	Check condition of windshield wiper blades
---	Verify proper operation of all road lights, signal lights, brake lights, marker lights, and back-up lights; Replace light bulbs as required
2 & 26	Drain accumulated water in accessory and wet air tanks

6.2 Engine Compartment

ITEM*	DESCRIPTION
24	Check engine crankcase oil level; Add if necessary
19	Check transmission oil level (automatic transmission oil level can be checked from pushbutton shift selector); Add if necessary
29	Check power steering reservoir fluid level; Add if necessary
21	Check coolant surge tank fluid level; Add if necessary
28	Drain accumulated water in primary fuel filter/water separator (if equipped)
22 & 27	Check air cleaner restriction indicator, replace air cleaner when red signals locks in full view

* Item numbers refer to Fig. 1.

6.3 Inside the Vehicle

ITEM	DESCRIPTION
---	Check for proper operation of the entrance door
---	Inspect cleanliness in the steps, aisles, seating area, and lavatory (Coach), or driver's area (Shell)
---	Check that emergency exit windows and roof escape hatches can be opened, then close all windows and hatches securely
---	Verify proper operation of windshield wiper/washer
---	Check rear view mirrors for broken glass; Adjust mirrors for adequate rear view vision
---	Start engine and check for proper operation of all gauges and indicator lights
---	Apply brakes and check both primary and secondary pressure gauges
---	Check for proper operation of electric and air horns, and back-up alarm

7. LUBRICATION AND SERVICING SCHEDULE

7.1 Service Every 6,250 Miles (10 000 km) or Twice a Year, Whichever Comes First.

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
27	Engine Air Cleaner	Inspect and clean, replace element if required	Filter: #530197
5	Disc Brake Calipers	Grease two fittings on each front and tag axles	Lithium-base grease
25	A/C Compressor	Check oil level, add if necessary	Polyolester Oil
37	A/C Receiver Tank	Check refrigerant level, add if necessary	HFC 134a
38	Refrigerant Moisture Indicator	Replace filter dryer unit according to moisture indicator	Filter: #452542 c/w Moisture Indicator
35	Differential	Check oil level, add if necessary	Multigrade gear oil
20	Radiator Fan Drive Gearbox	Check oil level, add if necessary	Synthetic oil: ISO VG 460
34	Propeller Shaft	Grease one fitting on each universal joint and one fitting on slip joint	Lithium-base grease
15	Tag Axle Lever Pivot	Grease one fitting on each pivot	Lithium-base grease
14	Brake Slack Adjuster	Grease one fitting on each slack adjuster (all axles)	Lithium-base grease
39	Steering Damper Cylinder	Grease one fitting at cylinder rod end	Lithium-base grease
8	Power Steering Cylinder	Grease one fitting at each cylinder end	Lithium-base grease
4	Steering Drag Link Ends	Grease one fitting at each end	Lithium-base grease
40	Steering Tie Rod Ends	Grease one fitting at each end	Lithium-base grease
16■	Manual Transmission	Check oil level, add if necessary	Engine oil: SAE 30, 40, 50 or Gear oil: SAE 80, 90
44■	Lever Ball	Grease one fitting	Lithium-base grease
32■	Clutch Cross Control Shaft	Grease three fittings	Lithium-base grease
31■	Clutch Release Bearing	Grease one fitting	Lithium-base grease
---	Alternator Drive Belt	Check belt for wear & also check tension on belt. Refer to "06. ELECTRICAL".	-----

* Item numbers refer to Fig. 1.

** See end of this section for lubricant and part number specifications.

■ With manual transmission only.

7.2 Service Every 12,500 Miles (20 000 km) or Once a Year, Whichever Comes First.

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
17	Engine	Change oil and filters	Engine oil: SAE 15W40, API CG4 Filters: #510458
28	Fuel Filters	Change primary and secondary fuel filters (Fill with clean fuel before installation)	Primary: #510137 Prim. w/sep.: #531390 or #531407 Secondary: #510128
18	Coolant Filter/Conditioner	See "7.6 Miscellaneous Service"	-----
21	Coolant Surge Tank	Test coolant solution	-----
7	Air Tanks	Drain accumulated water in all tanks	-----
10	A/C and Heating Air Filters	Clean or replace three elements (Shell) Clean or replace two elements (Coach)	Driver's: #871049 Central: #871034 Driver's: #871049 Central: Top - 373336 Bottom (XL-45) - 373337 Bottom (XL-40) - 373338
43■	Clutch Master Cylinder	Check oil level	Brake Fluid (DOT 3)

7.3 Service Every 25,000 Miles (40 000 km) or Once a Year, Whichever Comes First.

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
16 & 19	Automatic Transmission	Change oil and filters	Dexron-II-E or Dexron-III
42■	Clutch Pedal	Check and adjust if necessary	-----
41■	Shift Control Rod Universal Joints	Grease four fittings	Low Temperature grease
---	Radiator Core	Inspect core exterior. Clean if necessary (dry with compressed air). See "05. COOLING" under "6.1 Maintenance".	Quality grease solvent such as Mineral Spirits

* Item numbers refer to Fig. 1.

** See end of this section for lubricant and part number specifications.

■ With manual transmission only.

7.4 Service Every 50,000 Miles (80 000 km) or Once a Year, Whichever Comes First.

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
16■	Manual Transmission	Change oil	Engine oil: SAE 30, 40, 50 or Gear oil: SAE 80, 90
44■	Shift Lever Pivot	Dismantle and lubricate all components	Low Temperature Grease
20	Radiator Fan Drive Gearbox	Change oil	Synthetic oil: ISO VG 460
29	Power Steering Reservoir	Replace oil filter cartridge element	Cartridge: #660987
6	Front and Tag Axle Bearings	Repack with grease, or refill to level with differential oil	Lithium-base grease or differential oil
11	Coolant Strainer	Check and clean, change cartridge if required	Central: #871029 Driver's: #870807
23	Engine Crankcase Breather	Clean breather steel mesh	-----
9	Steering Knuckle Pins	Grease two fittings on each knuckle	Lithium-base grease
12	Drive Axle Stabilizer Reservoir (XL-45 Shell only)	Check oil level. Refer to "16. SUSPENSION".	Dexron-II or III
---	Preheater (WEBASTO) Fuel Filter	Replace fuel filter. Test coolant solution	Filter : #871037
---	Flexible Hoses	Thoroughly inspect all hoses (see "5. FLEXIBLE HOSE MAINTENANCE").	-----

7.5 Service Every 100,000 Miles (160 000 km) or Once Every Two Years, Whichever Comes First.

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
35	Differential	Change oil; Clean breathers	Multigrade gear oil
3	Accessories Air Filter	Change filter element	Filter: #640073
36	Air Dryer	Change cartridge	Cartridge: #641278
13	Brake Camshaft	Grease one fitting on each drive axle drum brake	Lithium-base grease
43■	Clutch Master Cylinder	Drain oil and refill	Brake Fluid (DOT 3)

* Item numbers refer to Fig. 1.

** See end of this section for lubricant and part number specifications.

■ With manual transmission only.

7.6 Miscellaneous Service

ITEM*	DESCRIPTION	REMARKS	LUBRICANT &/OR PART**
21	Cooling System	Drain, flush and refill every two years or 200,000 miles (320 000 km) whichever comes first	Engine coolant
30	Battery Terminals	Clean and coat terminals yearly	Battery terminal coating
---	Discharge Tubes***	Every three months: Check 2 condenser's discharge tubes Check 6 evaporator's discharge tubes Check 2 front discharge tubes	-----
18	Coolant Filter/Conditioner	Replace Precharge Element Filter with a Maintenance Element Filter after 12,500 miles (20 000 km) or after one year, whichever comes first. Then, install a new Maintenance Element Filter and replace every 200,000 miles (320 000 km) or two years, whichever comes first. Note: Every time the cooling system is flushed, drained & cleaned, you must first install a Precharge Element Filter for its required lifespan: then install a Maintenance Element Filter.	Maintenance Filter: #550630 Precharge Filter: #550629

* Item numbers refer to Fig. 1.

** See end of this section for lubricant and part number specifications.

*** Discharge tubes are rubber tubes located under vehicle.

8. LUBRICANT SPECIFICATIONS

ITEM*	DESCRIPTION	SPECIFICATIONS
17	Engine Oil	SAE Viscosity Grade: 15W40 API Classification: CG4
29	Power Steering Oil	Automatic Transmission Oil (Dexron-IIIE or Dexron-III)
21	Engine Coolant	Low silicate, ethylene glycol coolant 50% antifreeze/water solution is normally used Antifreeze concentration should be between 30% and 67%
25	A/C Compressor Oil	Polyolester Oil, HFC 134a compatible: Castrol SW-68 (POE) or equivalent
35	Differential Oil	Multigrade gear oil meeting MIL-L-2105-D: 75W90 for Northern climate 80W140 for Southern climate (In extreme conditions or for better performance, full synthetic gear oil can be used.)
20	Fan Gearbox Oil	Synthetic oil: ISO VG (viscosity grade) 460 Mobil SHC 634 or equivalent
16 & 19	Automatic Transmission Oil	Dexron-IIIE or Dexron-III
16	Manual Transmission Oil	Heavy-duty engine oil meeting MIL-L-2104-C: SAE 30 (Northern climate), SAE 40, SAE 50 Straight mineral gear oil: SAE 80 (Northern climate), SAE 90
43	Clutch Oil	Heavy-duty brake fluid meeting DOT 3 specifications
---	Low Temperature Grease	Good quality low temperature grease; Prolab AF-100, Grade 1, P/N 682307 or equivalent
---	Lithium-base Grease	Good quality lithium-base grease: NLGI No.2 Grade is suitable for most temperatures NLGI No.1 Grade is suitable for extremely low temperatures

* Item numbers refer to Fig. 1.

9. PART NUMBER SPECIFICATIONS

ITEM*	DESCRIPTION	PRÉVOST NO	SUPPLIER NO
17	Engine Oil Filters	#510458	Detroit Diesel: 25014505 AC Rochester Div. GM: PF2100
29	Power Steering Reservoir Oil Filter	#660528	Garrison Hydraulic: 32516
27	Engine Air Cleaner Filter	#530197	Nelson: 70337-N Baldwin: PA-2839 Donaldson: P52-2874 Fram: CA-7113
38	Refrigerant Filter Dryer Unit	#452542	Alco Controls: EKH 307S (modified)
28	Engine Primary Fuel Filter	#510137	Detroit Diesel: 25014274 AC Rochester Div. GM: TP-915D
28	Engine Primary Fuel Filter with Water Separator (optional)	#531390	Detroit Diesel: 25011910 AC Rochester Div. GM: TP-1057
28	Engine Secondary Fuel Filter	#510128	Detroit Diesel: 25014342 AC Rochester Div. GM: TP-916D
18	Engine Coolant Filter/Conditioner	Maintenance: #550630 Precharge: #550629	Maintenance: Detroit Diesel: 23507545 Nalco Chemical Company: DDF3000 Precharge: Detroit Diesel: 23507189 Nalco Chemical Company: DDF60
10	A/C and Heating Driver's Air Filter	#871049	Permatron Corp.: Model "R"
10	A/C and Heating Central Air Filter	Coach = XL-40: Top - #373336 Bottom: #373338 XL-45's: Top - #373336 Bottom: #373337 Shell = #871034	Permatron Corp.: IN 1X10X37 EXACT Permatron Corp.: Model 13X21X1 IN
16 & 19	Automatic Transmission Oil Filter Kit	#571687	Allison: 29503829
11	Coolant Strainer	Driver's: #870807 Central: #871029	Braukmann: 13-13-00740 Parker: 925566
3	Accessories Air Filter	#640080	Bendix: 222588
36	Air Dryer Cartridge	#641278	Rockwell Wabco: S 432 923 2
---	Preheater (WEBASTO) Fuel Filter	#871037	Webasto: 603.359

* Item numbers refer to Fig. 1.