



**TRANSICOLD**

# **Bus Air Conditioning Unit**

**DM-4  
Power Pack**

**OPERATION  
AND SERVICE**



**TRANSICOLD**

# OPERATION AND SERVICE MANUAL

**BUS AIR CONDITIONING UNIT**

## DM-4 POWER PACK



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# SECTION 1

## DESCRIPTION

### 1.1 INTRODUCTION

This manual contains Operating Data, Electrical Data and Service instructions for the DM-4 Power Pack.

#### WARNING

**Beware of V-belts and drive components as the unit may be started remotely. Make sure the control switch is in the OFF position.**

The unit is a one piece, self contained, pre-wired diesel powered compressor/alternator drive unit. When connected to a specific evaporator - condenser section it will form a complete self powered bus air-conditioning system.

The unit consists of an engine compressor assembly, belt driven heavy duty alternator, radiator and fan assembly, electrical control panel and associated components.

The compressor is equipped with unloaders as standard equipment. Unloaders are used as a compressor capacity control to unload the compressor during periods of reduced loads. This provides closer temperature control, and reduces power required to operate the compressor, thus reducing fuel consumption.

The engine gives excellent fuel economy and has easy starting characteristics. The engine is equipped with spin-on lube oil and fuel filters for easier filter changes.

#### NOTE

Throughout this manual, whenever the "left" or "right" hand side of the engine is referred to, it is the side as viewed from the flywheel end of the engine.

The diesel engine drives the compressor directly through a nylon drive gear and adapter. The adapter also includes a V-belt sheave which drives the system alternator.

Electrical power for the control system and for starting the engine is provided by the bus 12-volt batteries. The unit may be started from the main control panel located on the Power Pack frame or from the driver's control panel. As a safety precaution the driver's start switch is rendered inoperative whenever the unit switch on the main panel is in the OFF position.

### 1.2 ENGINE DATA

Engine Model:	CT-134TV
Displacement:	2.2liters (134 in <sup>3</sup> )
No. of cylinders:	4
Horsepower:	34 @ 1900rpm 25 @ 1350rpm
Coolant capacity:	7.6 liters (2-1/2 gal.)
Oil capacity w/filter:	14 liters (15 qts.)
Operating speeds:	High-1900 rpm Low-1350 rpm
Injector setting:	140-150 km/cm <sup>2</sup> )
Fuel type:	Diesel #1 or #2
Firing order:	1-3-4-2
Glow plug amperage:	7.0 amps/plug
Valve clearance cold:	0.0071 to 0.0087

### 1.3 ENGINE SCREW THREADS

All threads used on the diesel engine are metric.

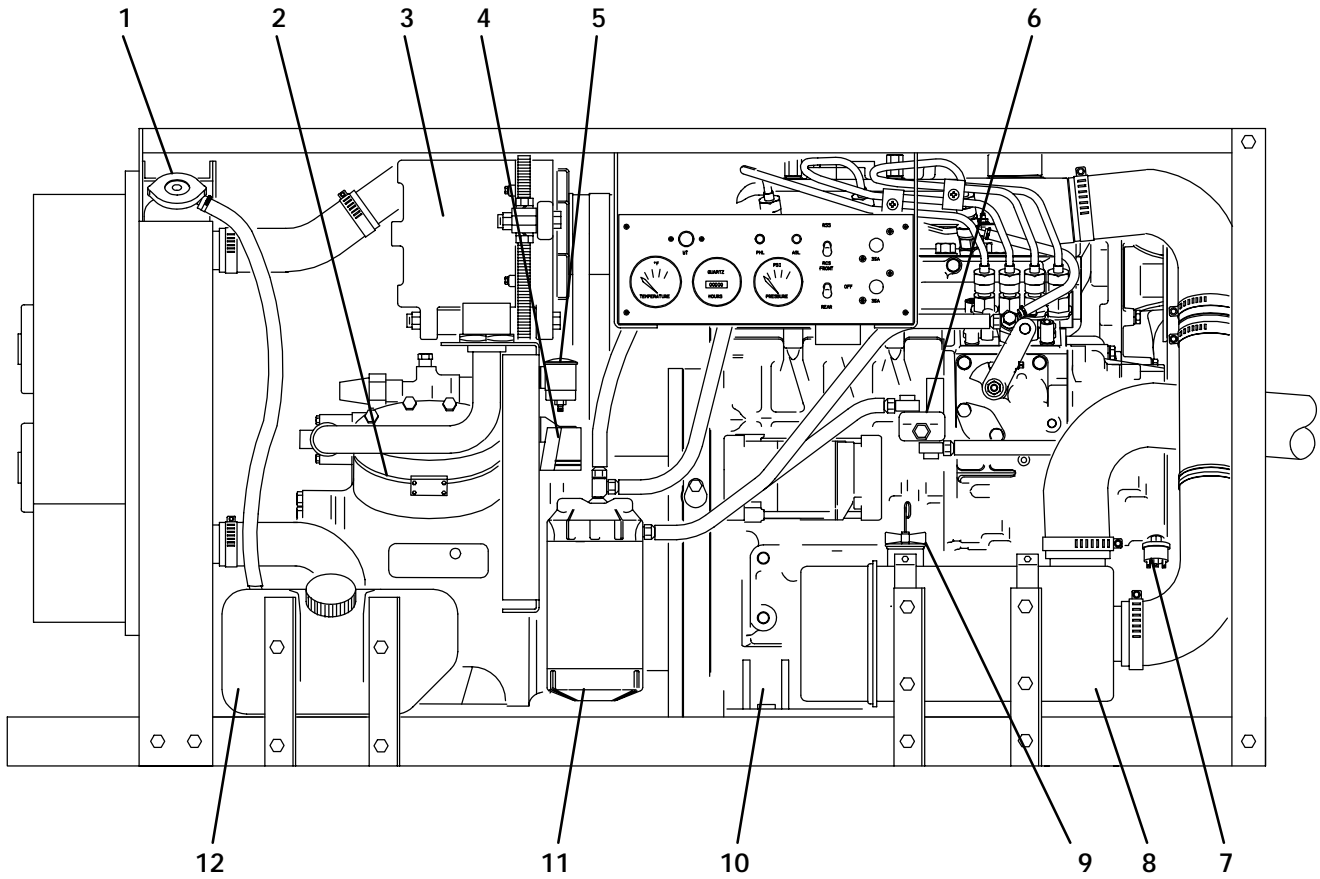
### 1.4 LUBRICATION SYSTEM

Oil pressure: 40-60 psig (Engine in high speed)
Oil pressure safety switch: Opens @10(± 3)psig
Lube Oil Viscosity: 30W or 15W40
Oil change interval: First 400 Hours, thereafter as listed below.

#### CAUTION

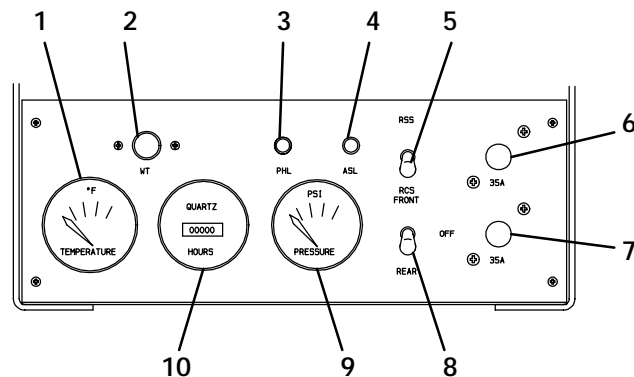
**The maximum oil change interval is 1 year (for either approved oil) The only approved synthetic oil is Mobil Delvac 1. The normal oil change intervals (listed below) should be reduced if the engine is operated under extreme conditions such as in dirty environments.**

Oil Type:	API Class CD	Mobil Delvac1
Change Interval:	1500 hrs.	3000 hrs.



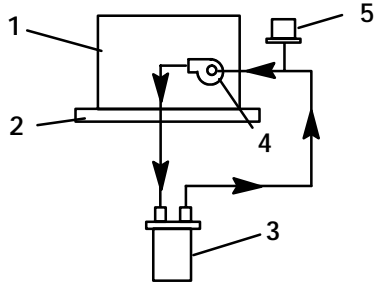
- |                         |                                 |
|-------------------------|---------------------------------|
| 1. Radiator Cap         | 7. Oil Pressure Switch (OP)     |
| 2. Compressor – 05K     | 8. Air Cleaner                  |
| 3. Alternator           | 9. Lube Oil Fill                |
| 4. Glow Plug Control    | 10. Diesel Engine – CT4-134-TV  |
| 5. Power Relay (PR)     | 11. Fuel Filter                 |
| 6. Mechanical Fuel Pump | 12. Radiator Overflow Reservoir |

**Figure 1-1. Power Pack DM-4 – Front View**



- |   |                              |
|---|------------------------------|
| 1. Water Temperature Switch Gauge (WT)    | 6. Circuit Breaker 35A (CB1) |
| 2. High Temperature Coolant Lockout (HTL) | 7. Circuit Breaker 35A (CB2) |
| 3. Preheat Light (PHL)                    | 8. Rear Control Switch (RCS) |
| 4. A/C Stop Light (ASL)                   | 9. Oil Pressure Gauge        |
| 5. Rear Start Switch (RSS)                | 10. Hour Meter (HM)          |

**Figure 1-2. Power Pack DM-4 – Control Panel**



1. Engine Block
2. Oil Pan
3. Full Flow Oil Filter
4. Engine Oil Connection
5. Oil Pressure Switch

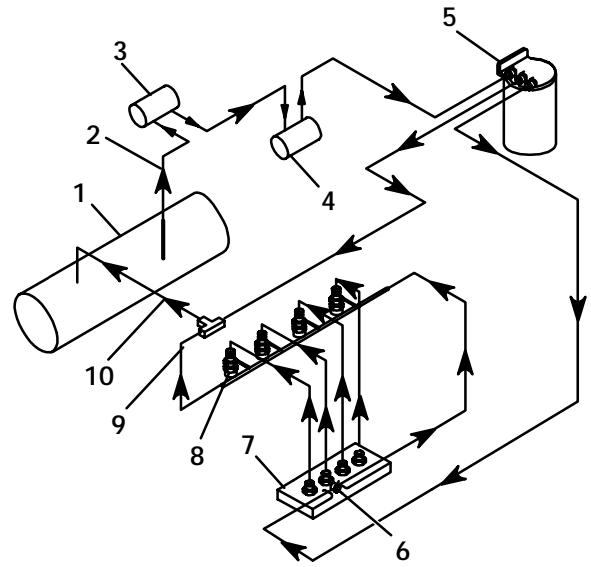
**Figure 1-3. Lube Oil Flow Diagram**

### 1.5 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatically shutting down the engine when such conditions occur. This is accomplished by the safety devices listed in Table 1-1.

### 1.6 ENGINE AIR SYSTEM

The air cleaner is put on the engine to prolong its life and performance by preventing dirt and grit from getting into the engine causing excessive wear on all operating parts. However, it is the responsibility of the operator to give the air cleaner regular and consistent attention in accordance with the instructions. If the air cleaner is allowed to become dirty, the operation of the engine would be impaired.



1. Fuel Tank
2. Fuel Supply Line
3. Fuel Pump
4. Mechanical Lift Pump
5. Fuel Filter
6. Fuel Bleed Valve
7. Injection Pump
8. Injector Nozzles
9. Fuel Leak-off Line
10. Fuel Return Line

**Figure 1-4. Fuel System Diagram**

### 1.7 COMPRESSOR DATA

- Compressor Model: Carrier 05K  
 No. of cylinders: 4  
 No. of unloaders: 1  
 Oil charge: 2.6 liters (5.5 pints)  
 Oil type: Sunisco 3GS (R22)  
 Castrol Icematic SW-68 (R134a)

**Table 1-1. Safety Devices**

Unsafe Conditions	Safety Devices	Device Setting
Low engine oil pressure	Oil pressure safety switch	Opens below 10 ± 3 psig
High engine coolant temperature	Coolant temperature sensor (switch gauge)	Opens shutdown circuit above 220 ± 5_F
Excessive current draw by glow plug circuit	Manual reset circuit breaker (CB1)	Opens @ 35 amps.
Excessive current in control circuit	Manual reset circuit breaker (CB2)	Opens @ 35 amps.
Excessive compressor discharge pressure	High pressure cutout switch	Opens @ 425 ± 10 psig Closes @ 300 ± 10 psig
Low compressor suction pressure	Low pressure cutout switch	Opens @ 10 ± 3 psig Closes @ 27 ± 3 psig

## 1.8 COMPRESSOR UNLOADER

### a. Unloaded Operation (Refer to Figure 1-5)

Pressure from the discharge manifold (15) passes through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7). Unless bled away, this pressure would tend to close the piston (6) against the piston spring (5) pressure.

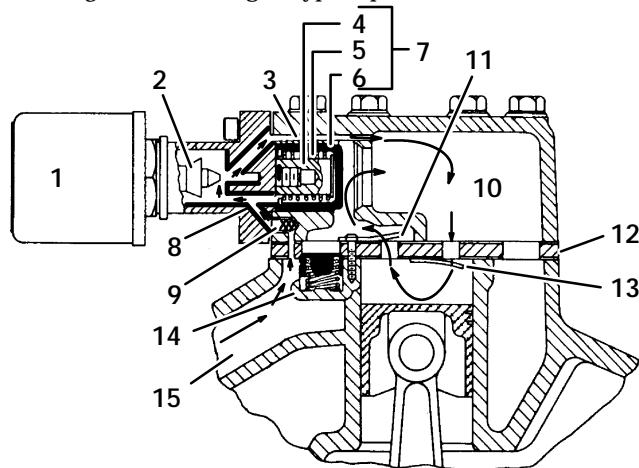
With the solenoid valve (1) energized the solenoid valve stem (2) will open the gas bypass port (3).

Refrigerant pressure will be bled to the suction manifold (10) through the opened gas bypass port. A reduction in pressure on the piston bypass valve will take place because the rate of bleed through the gas bypass port is greater than the rate of bleed through the bleed orifice (8).

When the pressure behind the piston has been reduced sufficiently, the valve spring will force the piston bypass valve back, opening the gas bypass from the discharge manifold to the suction manifold.

Discharge pressure in the discharge manifold will close the discharge piston check valve assembly (14) isolating the compressor discharge manifold from the individual cylinder bank manifold.

The unloaded cylinder bank will continue to operate fully unloaded until the solenoid valve control device is de-energized and the gas bypass port is closed.



- |                        |   |
|------------------------|---|
| 1. Solenoid Valve      | 11. Cylinder Discharge Valve              |
| 2. Valve Stem          | 12. Valve Plate                           |
| 3. Gas Bypass Port     | 13. Cylinder Suction Valve                |
| 4. Spring Guide        | 14. Discharge Piston Check Valve Assembly |
| 5. Spring              | 15. Discharge Manifold                    |
| 6. Piston              |   |
| 7. Piston Bypass Valve |   |
| 8. Bleed Orifice       |   |
| 9. Strainer            |   |
| 10. Suction Manifold   |   |

**Figure 1-5. Compressor Cylinder Head Unloaded**

### b. Loaded Operation (Refer to Figure 1-6)

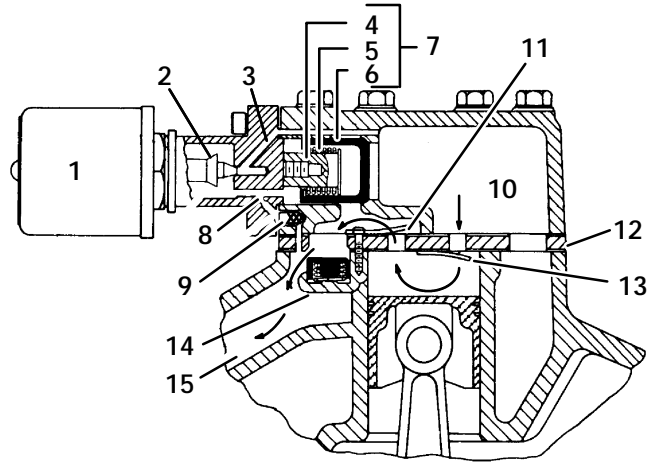
Discharge pressure bleeds from the discharge manifold (15) through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7).

(8) to the solenoid valve stem chamber (2) and the back of the piston bypass valve (7).

With the solenoid valve (1) de-energized the solenoid valve stem will close the bypass port (3).

Refrigerant pressure will overcome the bypass valve spring (5) tension and force the piston (6) forward closing the gas bypass from the discharge manifold to the suction manifold.

The loaded cylinder bank will continue to operate fully loaded until the solenoid valve control device is energized and the gas bypass port is opened.



- |                        |   |
|------------------------|---|
| 1. Solenoid Valve      | 11. Cylinder Discharge Valve              |
| 2. Valve Stem          | 12. Valve Plate                           |
| 3. Gas Bypass Port     | 13. Cylinder Suction Valve                |
| 4. Spring Guide        | 14. Discharge Piston Check Valve Assembly |
| 5. Spring              | 15. Discharge Manifold                    |
| 6. Piston              |   |
| 7. Piston Bypass Valve |   |
| 8. Bleed Orifice       |   |
| 9. Strainer            |   |
| 10. Suction Manifold   |   |

**Figure 1-6. Compressor Cylinder Head Loaded**

## 1.9 SWITCHES AND CONTROLS

### 1.9.1 Introduction

Components required for monitoring and controlling the diesel engine are located on the main control and gauge panel (located in the Power Pack) and the driver's control panel.

### 1.9.2 Main Control and Gauge Panel

#### a. Switches

##### 1. Rear Control Switch (RCS)

When placed in the FRONT position the unit is controlled from the driver's switch panel. When placed in the REAR position the unit is controlled from the main panel only. When placed in the OFF position the unit cannot be controlled from either panel.



## 2. Rear Starter Switch (RSS)

This switch is active only when the (RCS) switch is in the REAR position. Depressing this switch energizes the starter circuit.

### b. Gauges and Indicators

#### 1. Oil Pressure Gauge (OP)

The oil pressure gauge is used to monitor the engine oil pressure. Normal oil pressure is 40-60 psig with engine running at high speed and at operating temperature.

#### 2. Water Temperature Switch Gauge (WT)

This gauge serves a dual function. It is used to monitor engine coolant temperature as well as serving as the switch for the high temperature cut out. Normal engine operating temperature is 180 to 210\_F. The switch function should be set to close at 220-230\_F.

#### 3. Hour Meter (HM)

The unit Hour Meter will total unit operating hours and is useful for scheduling maintenance intervals.

#### 4. Preheat Light (PHL)

The preheat light will illuminate to indicate that the glow plug circuit has been energized. This function is controlled automatically by the Preheat controller. The light will go out when the glow plugs have been energized long enough to reach their required temperature for starting the engine.

#### 5. A/C Stop Light (ASL)

The AC stop light is activated by the oil pressure cut out switch. Its purpose is to indicate to the operator that the unit has stopped.

### 1.9.3 Driver's Control Panel

#### a. Switches

##### 1. Front A/C Switch (FAS)

This switch allows the unit to be turned on or off from the driver's panel. It is active only when the (RCS) switch on the unit panel is in the "front" position.

##### 2. Front Starter Switch (FSS)

This switch is active only when the (RCS) switch is in the FRONT position. Depressing this switch will energize the engine starter circuit.

##### 3. Preheat Light (PHL) (Same as on main panel)

##### 4. A/C Stop Light (ASL) (Same as on Main Panel)

### 1.10 ALTERNATOR

The Power Pack is equipped with a 28 volt-140 amp. alternator. The alternator is connected in parallel with the air conditioning alternator driven by the main engine. Both of these alternators are used to independently power the air conditioning system.

#### NOTE:

The Power Pack engine controls and starter are 12 volt and receive power from the bus 12 volt batteries.

### CAUTION

**Observe proper polarity when installing battery. Negative battery terminal MUST be grounded. Reverse polarity will destroy the rectifier diodes in the alternator. As a precautionary measure, disconnect positive battery terminal when charging batteries. Connecting charger in reverse will destroy the rectifier diodes in the alternator.**

The alternator converts mechanical and magnetic energy to alternating current (A.C.) and voltage, by the rotation of an electromagnetic field (rotor) inside a three-phase stator assembly. The alternating current and voltage are changed to direct current and voltage, by passing the A.C. energy through a three-phase, full wave rectifier system. Six silicon rectifier diodes are used.

#### 1.10.1 Integral Voltage Regulator

The regulator is an electronic transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The electronic circuitry should never need adjustment and the solid state active elements used have proved reliable enough to warrant a sealed unit. The system is temperature compensated to permit a constant voltage rate at all conditions.

The regulator is an electronic switching device. It senses the system voltage level and switches the voltage applied to the field in order to maintain proper system voltage.

#### 1.11 Starter Lockout (SLO)

The starter lockout (SLO) is an electronically controlled relay that opens the starter motor circuit when a preset engine speed is reached. The signal source for the control is the A.C. output of the unit alternator. Frequency directly proportional to engine speed is monitored electronically within the control. When the speed or frequency reaches the desired setting or setpoint the output relay within the control circuit is switched.

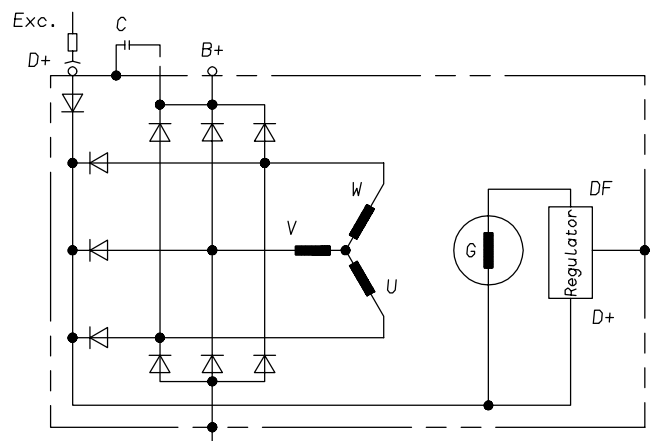


Figure 1-7. Alternator Schematic Diagram

## SECTION 2

### OPERATION

#### 2.1 PRE-TRIP INSPECTION

##### a. Before Starting engine

1. Drain water and sediment from fuel tank sump.
2. Check radiator coolant level. (Add pre-mixed 50/50 permanent anti-freeze and water as required.)  
USE ETHYLENE GLYCOL ONLY.
3. Check engine lubrication and fuel filter lines and connections for leaks. (Tighten connections and/or replace gaskets.)
4. Check engine oil level (refer to section 1.2).
5. Check V-belts for proper tension, fraying or cracking. Adjust or replace as necessary (refer to section 4.4).
6. Check battery connections for cleanliness and tightness. Clean and coat with protectant.
7. Check engine air cleaner and condition of air cleaner hose.

##### b. After Starting Unit

1. Check water temperature. (Should be 180-220\_F after running for 20 minutes)
2. Check oil pressure (refer to section 1.4).
3. Listen for abnormal noises.
4. Check compressor oil level (refer to section 4.6).
5. Observe any signs of fuel or oil leaks.
6. Check radiator hoses and connections for leaks.

#### 2.2 STARTING AND STOPPING INSTRUCTIONS.

##### a. Starting Instructions, Main Control Panel

1. Place the Rear Control Switch (RCS) in the REAR position. Observe that the pre heat light is illuminated indicating that the glow plug controller is functioning. The light will go out when the glow plugs have reached the proper temperature for starting. (The time required to heat the glow plugs will vary depending on the temperature of the engine).
2. When the preheat light has gone out, depress the start switch to crank the engine.

##### CAUTION:

**If the engine should fail to start after 20-30 seconds of cranking. Place the Rear Control Switch (RCS) in the OFF position and wait several minutes for the starter motor to cool down before attempting to restart the unit.**

##### b. To Stop The Unit From The Main Control Panel

Place the Rear Control Switch (RCS) in the OFF position to stop the unit

##### c. To Start The Unit From The Driver's Panel

##### NOTE:

The Rear Control Switch (RCS) located on the unit main control panel must be in the FRONT position for the driver's panel to be active.

1. Place the A/C Switch (ACS) in the ON position. Observe that the preheat light is illuminated indicating that that glow plug controller is functioning. The light will go out when the glow plugs have reached the proper temperature for starting. (The time required to heat the glow plugs will vary depending on the temperature of the engine.)
2. When the preheat light has gone out, depress the start switch to crank the engine.

##### CAUTION

**If the engine should fail to start after 20-30 seconds of cranking. Place the A/C switch in the OFF position and wait several minutes for the starter motor to cool down before attempting to restart the engine.**

##### d. To Stop The Unit From the Driver's Panel

Place the A/C switch (ACS) in the OFF position to stop the unit.

##### NOTE:

If the power pack should malfunction and be shut down by one of the safety cutouts the A/C stop light will illuminate. Do not attempt to operate the unit until the cause for the shutdown has been identified and corrected.

## SECTION 3

### TROUBLE SHOOTING

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
<b>3.1 DIESEL ENGINE</b>		
<b>3.1.1 Engine Will Not Start</b>		
Starter motor will not crank or low cranking speed	Battery insufficiently charged	Check
	Battery posts dirty or defective	Check
	Bad electrical connections at starter	Check
	Starter motor malfunctions	3.1.3
	Starter solenoid defective	Engine Manual
	Open starting circuit	3.1.4
	Incorrect grade of lubricating oil	1.4
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	4.2
	Water in fuel system	Drain sump
	Plugged fuel filter	Replace
	Plugged fuel lines to injectors	Check
	Fuel control operation erratic	Engine Manual
	Glow plugs defective	4.3.8
	Fuel solenoid defective	Engine Manual
Fuel pump malfunction	4.2 or 4.3.7	
Starter cranks, engages, but dies after a few seconds	Engine lube oil too heavy	1.4
	Voltage drop in starter cable(s)	Check
<b>3.1.2 Engine Starts Then Stops</b>		
Engine stops after several rotations	Fuel supply restricted	Check
	No fuel in tank	Check
	Leak in fuel system	Check
	Faulty fuel control system	Engine Manual
	Fuel filter restricted	Replace
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual
	Air cleaner or hose restricted	4.3.5
	Safety device open	1.5
	Open circuit to run solenoid	Check
Fuel pump malfunction	4.2 or 4.3.7	
<b>3.1.3 Starter Motor Malfunction</b>		
Starter motor will not crank or turns slowly	Battery insufficiently charged	Check
	Battery cable connections loose or oxidized	Check
	Battery cables defective	Replace
	Starter brushes shorted out	Engine Manual
	Starter brushes hang up or do not make contact	Engine Manual
	Starter solenoid defective	Engine Manual
	Switch defective	Replace
	Engine lube to heavy	1.4

INDICATION/TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
<b>3.1.3 Starter Motor Malfunction (CONTINUED)</b>		
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace; apply grease
Starter motor does not disengage after switch was depressed	Start switch defective Starter solenoid defective	Replace Engine Manual
Pinion does not disengage after engine is running	Defective starter	Engine Manual
<b>3.1.4 Malfunction in the Engine Starting Circuit</b>		
No power to starter motor solenoid	Battery Defective Loose electrical connections	Check Tighten
Fuel solenoid does not energize or does not remain energized	Battery Defective Loose electrical connections Oil pressure safety switch defective Run relay defective Water temperature cut out defective Fuel solenoid defective FRONT-OFF-REAR switch defective	Check Tighten Replace Replace Replace Engine Manual Replace
<b>3.2 ALTERNATOR</b>		
Alternator fails to charge	Battery condition Alternator belt loose or broken Loose, dirty, corroded terminals, or broken leads Excessively worn, open or defective brushes Open blocking diode Regulator faulty Open isolation diode Open field coil	Check 4.4 Check/Repair Check Check Check Check Replace
Low or unsteady charging rate	Alternator belt loose Loose, dirty, corroded terminals, or broken leads Excessively worn, sticky or intermittent brushes Faulty regulator Grounded or shorted turns in rotor Open, grounded or turns in stator	4.4 Check/Repair Check Check Check Replace
Excessive charging rate (as evidenced by batteries requiring to frequent refilling) or fans noisy due to excessive speed	Regulator leads loose, dirty, corroded terminals, or wires broken Defective regulator	Clean/Repair Check
Noisy alternator	Defective or badly worn V-belt Worn bearings Misaligned belt or pulley Loose pulley	4.4 Replace 4.4 Tighten

## SECTION 4

### SERVICE

#### WARNING

**Beware of V-belts and belt driven components as the unit can be started remotely. Before servicing unit, make sure that the Front-Off-Rear switch is in the “OFF” position Also disconnect the negative battery cable.**

#### NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerant you must comply with all government environmental laws, EPA section 608

#### 4.1 MAINTENANCE SCHEDULE

UNIT		OPERATION	REFERENCE SECTION
ON	OFF		
<b>a. Daily Maintenance</b>			
	X	1. Pre-trip inspection – before starting	2.1.a
X		2. Pre-trip inspection – after starting	2.1.b
X		3. Check engine hours	Run 10 min.
<b>b. First 400 Hour Maintenance</b>			
	X	1. Pre-trip inspection – before starting	2.1.a
	X	2. Change lube oil and filter	4.3.2
X		3. Pre-trip inspection – after starting	2.1.b
X		4. Check engine hours	Run 10 min.
<b>c. Every 1500 Hour Maintenance (Normal Operating Conditions)</b>			
X	X	1. Complete 400 Hour Maintenance (Refer to section 1.4 for oil change interval)	4.1.b
	X	2. Tighten Engine, compressor and unit mounting bolts	None
	X	3. Tighten all electrical connections	Tighten
	X	4. Replace air cleaner element, check hoses and connections	4.3.4
	X	5. Check water pump bearing for end play	None
	X	6. Check alternator brushes	None
	X	7. Replace fuel filter	4.3.6
<b>d. Every 3000 Hour Maintenance</b>			
X	X	1. Complete 1500 Hour maintenance	4.1.c
	X	2. Clean crankcase breather	4.3.5
	X	3. Replace all V-belts	4.4
	X	4. Check starter condition	Engine manual
	X	5. Check and adjust injector nozzles	Engine manual
<b>e. Every 6000 Hours or 2 Years Maintenance</b>			
	X	1. Check and adjust injector nozzles	Engine manual
	X	2. Check engine compression	Engine manual
	X	3. Adjust engine valves	Engine manual
X	X	4. Drain and flush cooling system	4.3.1

## 4.2 PRIMING THE FUEL SYSTEM

The engine is equipped with a mechanical fuel lift pump, it is mounted on the engine next to the injection pump. This pump has a manual plunger for bleeding fuel when the fuel tank has been run dry.

Since the unit employs a closed fuel circuit, the following steps are recommended:

1. Turn bleed valve (Red) counter-clockwise until fully opened.
2. Turn the top of the manual plunger counter-clockwise to unlock it. Then rapidly hand pump the hand plunger until positive pressure (resistance) is felt, which will indicate fuel flow.
3. Depress and turn the top of the manual plunger clockwise to lock it in place.
4. Start engine.
5. When engine is running properly, turn bleed valve clockwise until fully closed.

## 4.3 ENGINE SERVICE AND COMPONENTS

### 4.3.1 Cooling System

Air flows through the radiator by using the electric fans. The radiator, externally and internally must be clean for adequate cooling. The water pump V-belt must be adjusted periodically to provide maximum efficiency. (Refer to section 4.4.1)

*Do the following service to the cooling system*

#### CAUTION

**Use only ethylene glycol coolant (with inhibitors) in system as glycol by itself will damage the system. Always add pre-mixed 50/50 coolant and water to radiator/engine. Never exceed more than 50% concentration of coolant. Use a low silicate coolant meeting GM specification GM 6038M or equal.**

1. Remove all foreign matter from the radiator coil by reversing the normal air flow. Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial detergent. Rinse with fresh water if a detergent is used.
2. Drain coolant completely by removing lower radiator hose and radiator cap.
3. Install hose and fill system with clean, untreated water to which three to five percent of an alkaline base radiator cleaner should be added (6 oz. dry to one gallon)
4. Run engine 6 to 12 hours and drain system while warm. Rinse system three times after it has cooled down. Refill system with water.
5. Run engine to operating temperature. Drain system again and fill with treated water/coolant. (see Caution Note and refer to section 1.2) NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

### 4.3.2 Lube Oil Filter

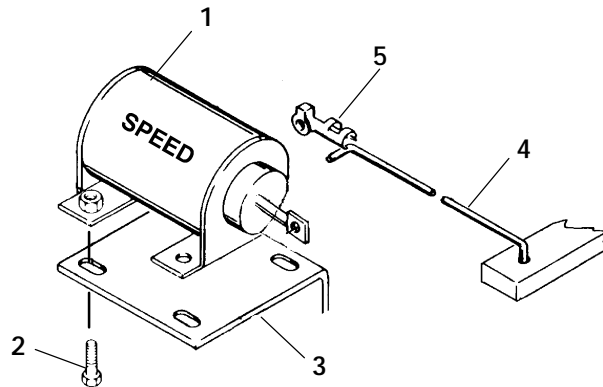
After warming up the engine, stop engine, remove drain plug from the reservoir and drain engine lube oil. Lightly oil gasket on filter before installing.

#### CAUTION

**When changing oil filter, the new filter should be primed with clean oil, if the filter is not primed, the engine may operate for a period with no oil supplied to the bearings.**

Replace filter and add lube oil. (Refer to section 1.4) Warm up engine and check for leaks.

### 4.3.3 Servicing the Speed Control Solenoid and Linkage



- |                     |                    |
|---------------------|--------------------|
| 1. Solenoid         | 4. Linkage (Speed) |
| 2. Bolt             | 5. Clip            |
| 3. Solenoid Bracket |                    |

**Figure 4-1. Speed Control Solenoid**

1. Disconnect wiring to solenoid. Disconnect linkage arm (item 4) from solenoid. Remove mounting hardware from solenoid and then remove solenoid.
2. Install replacement solenoid and mounting hardware. Do not tighten at this time.
3. Attach linkage to solenoid and install the clip to the solenoid arm.
4. Hold the speed lever against the high speed stop and check the rpm (refer to section 1-2) Adjust the low speed stop screw stop if necessary.
5. Check engine speed. With the engine stopped, place a mark on the crankshaft sheave (white paint for example). Speed may be verified by a Strobette model 964 (strobe tachometer) Carrier Transicold P/N 07-00206.
6. Hold the speed lever against the high speed stop and check the rpm (refer to section 1-2). Adjust the high speed stop screw if necessary.
7. Energize the speed solenoid. Push the solenoid so that the speed arm rests against the high speed stop screw and tighten the solenoid mounting bolts. Connect wires to solenoid.

### 4.3.4 Adjusting Engine Speed

Refer to section 1.2 for correct engine speed.

#### To Check Engine Speed:

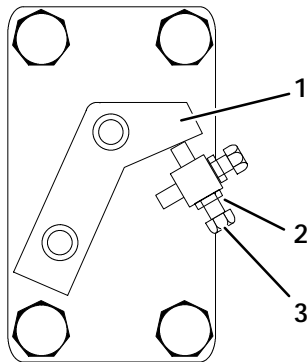
With the engine stopped, place a mark (white paint for example) on the crankshaft sheave. Start engine and verify engine speed by using a Strobette-model 964 (Strobetachometer), Carrier Transicold Part No. 07-00206.

#### To Increase Speed:

Loosen jam nut "B." Turn capscrew "B" clockwise until correct speed is achieved, then tighten jam nut "B" and check engine speed (see Figure 4-2).

#### To Decrease Speed:

Loosen jam nut "B." Turn capscrew "B" counter-clockwise until correct speed is achieved, then tighten jam nut "B" and check engine speed (see Figure 4-2).



- 1. Speed Lever
- 2. Jam Nut "B"
- 3. Capscrew "B"

**Figure 4-2. Engine Speed Adjustment**

### 4.3.5 Engine Air Cleaner

#### a. Inspection

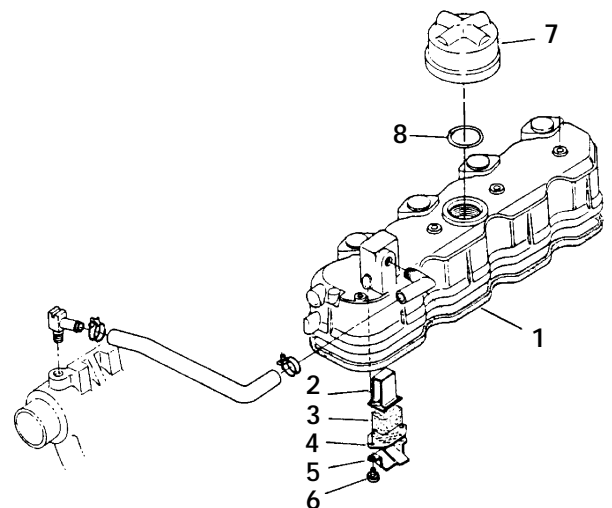
The dry type air cleaner should be inspected regularly for leaks. A damaged air cleaner or hose can seriously affect the performance and life of the engine. The air cleaner is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of these contaminants in the air cleaner will impair its operation, therefore, a service must be set up and followed. Remember that the air cleaner cleans the air, but the air cleaner requires cleaning. The following simple service steps are easily made while the engine is being serviced.

1. Check all connections for mechanical tightness. Be sure air cleaner outlet pipe is not fractured.

2. In case of leakage and if adjustment does not correct the problem, replace necessary parts or gaskets. *Swelled or distorted gaskets must always be replaced.*

### 4.3.6 Engine crankcase breather

The engine uses a closed type breather with the breather line attached to the cylinder head cover. The breather assembly should be cleaned once a year or at every 3000 hour maintenance interval (which ever comes first).



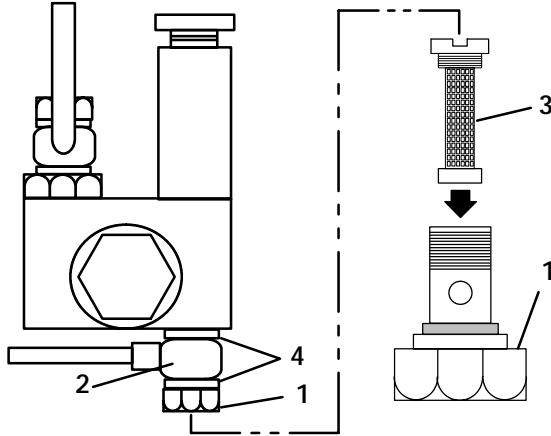
- 1. Cylinder Head Cover
- 2. Breather Cover
- 3. Breather Element
- 4. Plate
- 5. Breather Oil Shield
- 6. Bolt
- 7. Breather Assembly
- 8. O-Ring

**Figure 4-3. Engine Crankcase Breather**

### 4.3.7 Servicing Fuel Pump

Due to foreign particles in the fuel, the fuel filter may become plugged or restricted, and the engine will lose capacity. The filter must be cleaned on a regular schedule such as unit pre-trip or when the oil and fuel filters are changed.

1. Turn the nut counter-clockwise to loosen and remove (item 1, Figure 4-3)
2. Remove banjo fitting (item 2) and let it hang loose, making sure to keep copper rings (item 4) for replacement.
3. Turn filter (item 3) counter-clockwise and remove. Check and clean.
4. To install reverse steps 1 through 3.



1. Nut
2. Banjo
3. Filter
4. Copper Rings

**Figure 4-4. Mechanical Fuel Pump**

### 4.3.8 Servicing Glow Plugs

When energized, the glow plugs draw a nominal 7.0 amps at 10.5 volts. When servicing, the glow plug is fitted carefully in the cylinder head to prevent damage to glow plug. Torque value for the glow plug is 14 to 18 ft-lbs (1.9 to 2.5 mkg).

- a. Checking for defective glow plug
  1. One method is to place an ammeter (clip on type ammeter) in series with each glow plug and energize the glow plugs. Each plug (if good) should show 7 to 10 amps draw.

2. A second method is to disconnect the wire connection to each plug and test the resistance from the plug to ground on the engine block. Threading should be 0.7 to 1.2 ohms if the plug is good.

## 4.4 SERVICING AND ADJUSTING V-BELTS

### WARNING

**Beware of V-belts and belt driven components as the unit can be started remotely**

### 4.4.1 Water Pump V-Belt

The water pump V-belt is driven by a sheave on the engine crankshaft. Frayed, cracked or worn belts must be replaced. Adjustment is achieved by altering the position of the front side idler.

When replacing the V-belt avoid excessive force when applying tension to the V-belt to prevent damage to the water pump bearings. Refer to NO TAG for correct belt tension.

### 4.4.2 Alternator V-Belts

- a. To Replace V-Belts

1. Disconnect negative battery cable and loosen V-belt tension

2. Match mark adapter to engine flywheel (see figure 4-4-A) for ease of assembly.

3. Remove six bolts (5/16-18 x 1) securing adapter drive sheave to engine flywheel, Figure 4-4-A.

4. Insert 2 of the six bolts (5/16-18 x 1) into the threaded holes (jacking holes) provided on engine adapter. Jack adapter from engine flywheel. Remove the 2 bolts from adapter. Insert a pry bar between engine flywheel and adapter, Figure 4-4-A and slide the adapter-sheave toward the compressor enough to change the V-belts as shown in Figure 4-4-B. Replace V-belts.

5. Pry the adapter back toward the flywheel or use 5/16-18 x 2-1/2 bolts (3) in every other hole of the adapter and take up evenly on the bolts until the 5/16-18 x 1 bolts will start in the engine flywheel. Apply thread sealer (Loctite #262) to the bolts used to secure the adapter to the flywheel. Take up on all bolts evenly and then torque to a value of 28 ft-lb (3.87mkg).

6. Place V-belts on the alternator sheave and adjust tension. Refer to Table 4-1 for correct belt tension. *Using excessive tension may damage alternator bearings.*

7. Reconnect battery ground cable and start unit. Allow to run for 10 minutes to allow belts to seat.



8. Turn off and check belt tension.

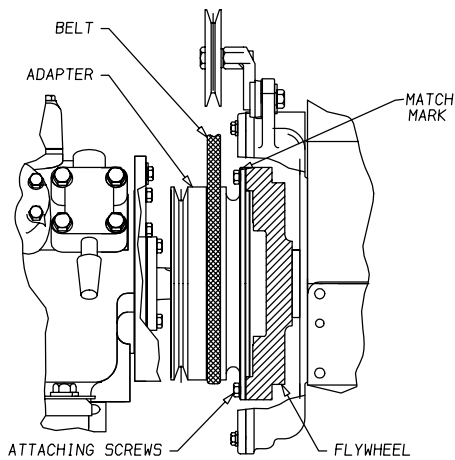


Figure A

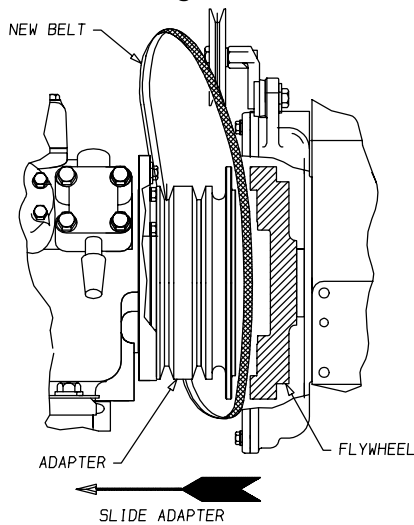


Figure B

Figure 4-5. Removing V-Belt from Engine Adapter Drive Sheave

Table 4-1. V-Belt Tension

Belt	Tension
Water Pump	35 – 40 foot pounds
Alternator	70 – 80 foot pounds

#### 4.5 REPLACING THE COMPRESSOR

If compressor is inoperative and unit still has refrigerant pressure, frontseat suction and discharge service valves to trap most of the refrigerant in the unit.

If compressor runs, pump down the unit.

1. Remove the two rear compressor mounting bracket bolts (compressor shock mounts).
2. Block up engine.
3. Slowly release compressor pressure into a recovery system.
4. Remove bolts from suction and discharge service flanges.
5. Remove oil filter and bracket.

6. Disconnect battery ground cable. Unbolt power relay and move out of the way.

7. Disconnect wiring to unloader valve assembly and high and low pressure cutouts.

8. Remove ten bolts from engine compressor spacer.

9. Disconnect ground strap from frame.

10. Attach sling or other device to compressor.

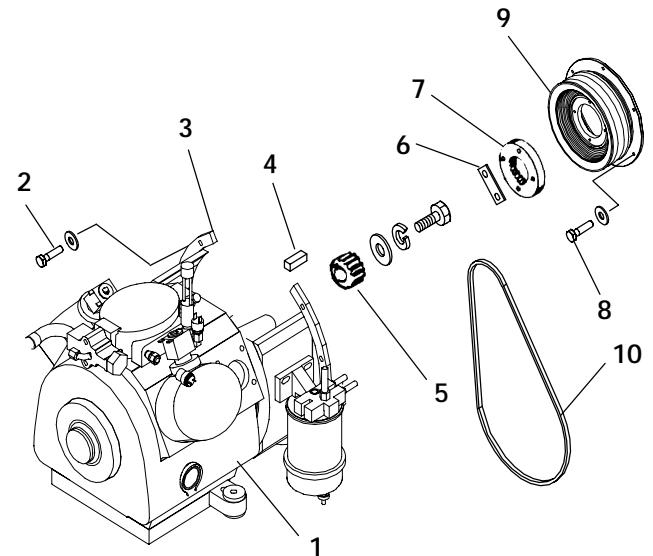
11. Slide compressor enough to clear nylon drive gear, Figure 4-4 and remove compressor from unit.

12. Drain oil from defective compressor before shipping.

13. The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head cap screw into top of piston. A small Teflon seat ring at bottom of piston must be removed.

#### NOTES

The service replacement compressor is sold without shutoff valves (but with valve pads). Customer should retain the original unloader valve for use on the replacement compressor. Check oil level in service replacement compressor. (Refer to section 1.7)



1. Compressor
2. Bolts
3. Spacer
4. Key
5. Compressor Drive Gear
6. Locking Tab
7. Nylon Drive Gear
8. Drive Sheave Bolts
9. Engine adapter-Drive Sheave
10. Alternator Belt

Figure 4-6. Compressor Drive Assembly

14. Remove the high and low pressure switches and install on new compressor after checking switch settings. Install compressor frame to new compressor (if removed with defective compressor).

15. Install compressor in unit by reversing steps 1 through 14. It is recommended using new locknuts when replacing compressor. Torque bolts to a value of 46 ft/lb (6.4 mkg). Install new gaskets on service valves and tighten bolts uniformly.

16. Attach service gauge manifold lines to the suction and discharge service valves. Connect manifold to vacuum pump. Evacuate compressor to 500 microns (29.90" Hg vacuum 75.9 cm Hg vacuum) . When completed, close gauge valves and disconnect vacuum pump.

17. Fully open (backseat) both suction and discharge service valves and partially open to activate gauges.

18. Start unit and check refrigerant level. Also check for noncondensibles.

19. Check compressor oil level. Add oil as necessary.

20. Check compressor unloader operation and check refrigerant cycle.

#### 4.6 CHECKING COMPRESSOR OIL LEVEL

##### a. To Check the Oil Level in the Compressor

1. Operate the unit in fully loaded high speed cool for at least 20 minutes.

2. Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before proceeding.

3. Check the level of oil in the sight glass with the compressor operating. The correct level should be 1/2 of the sight glass. If the level is above 1/2, oil must be removed from the compressor. To remove oil from the compressor, follow step d. If the level is below the sight glass, add oil to the compressor following step b.

##### b. Adding Oil with Compressor in System

###### 1. Oil Pump Method

One compressor oil pump that may be purchased is a Robinair, part no. 14388. This oil pump adapts to a one U.S. gallon (3.785 liters) metal refrigeration oil container and pumps 2-1/2 ounces (0.0725 liters) per stroke when connected to the oil fill (item 4, Figure 4-5). Also there is no need to remove pump from can after each use.

When the compressor is in operation, the pump check valve prevents the loss of refrigerant, while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil as necessary.

###### 2. Closed system method

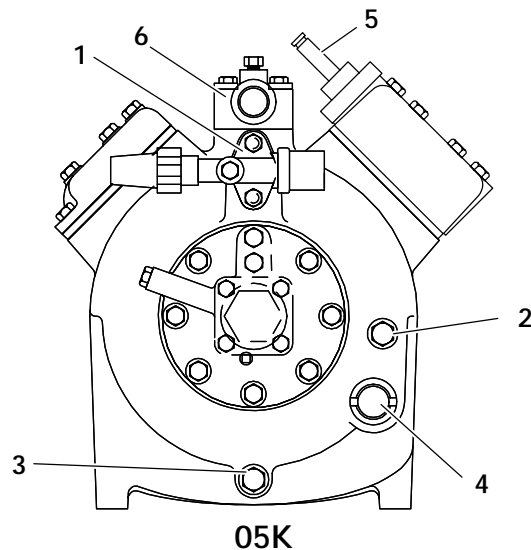
In an emergency where an oil pump is not available, oil may be drawn into the compressor through the suction service valve.

#### CAUTION

**Extreme care must be taken to ensure the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.**

Connect the suction connection of the gauge manifold to the compressor suction service valve port, and immerse the common connection of the gauge manifold in an open container of refrigerant oil. Crack the suction service valve and gauge valve to vent a small amount of refrigerant through the common connection and the oil to purge the lines of air. Close the gauge manifold valve.

With the unit running, frontseat the suction service and pull a partial vacuum in the compressor crankcase. SLOWLY crack the suction gauge manifold valve and oil will flow into the compressor. Add oil as necessary.



1. Suction Service Valve
2. Oil Fill Plug
3. Oil Drain Plug
4. Oil Level Sight Glass
5. Unloader Solenoid
6. Discharge Service Valve

**Figure 4-7. Compressor**

##### c. Adding Oil to Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If compressor is without oil

Add correct oil charge (refer to section 1.3) through the suction service valve flange cavity or by removing the oil fill plug. (See Figure 4-7)

##### d. To Remove Oil from the Compressor

1. Close suction service valve (frontseat) and pump unit down to 2 to 4 psig (0.1 to 0.3 kg/cm<sup>2</sup>). STOP unit frontseat discharge service valve and slowly reclaim remaining refrigerant.

2. Remove oil drain plug from the compressor and drain the proper amount of oil. Replace the plug securely in the compressor.

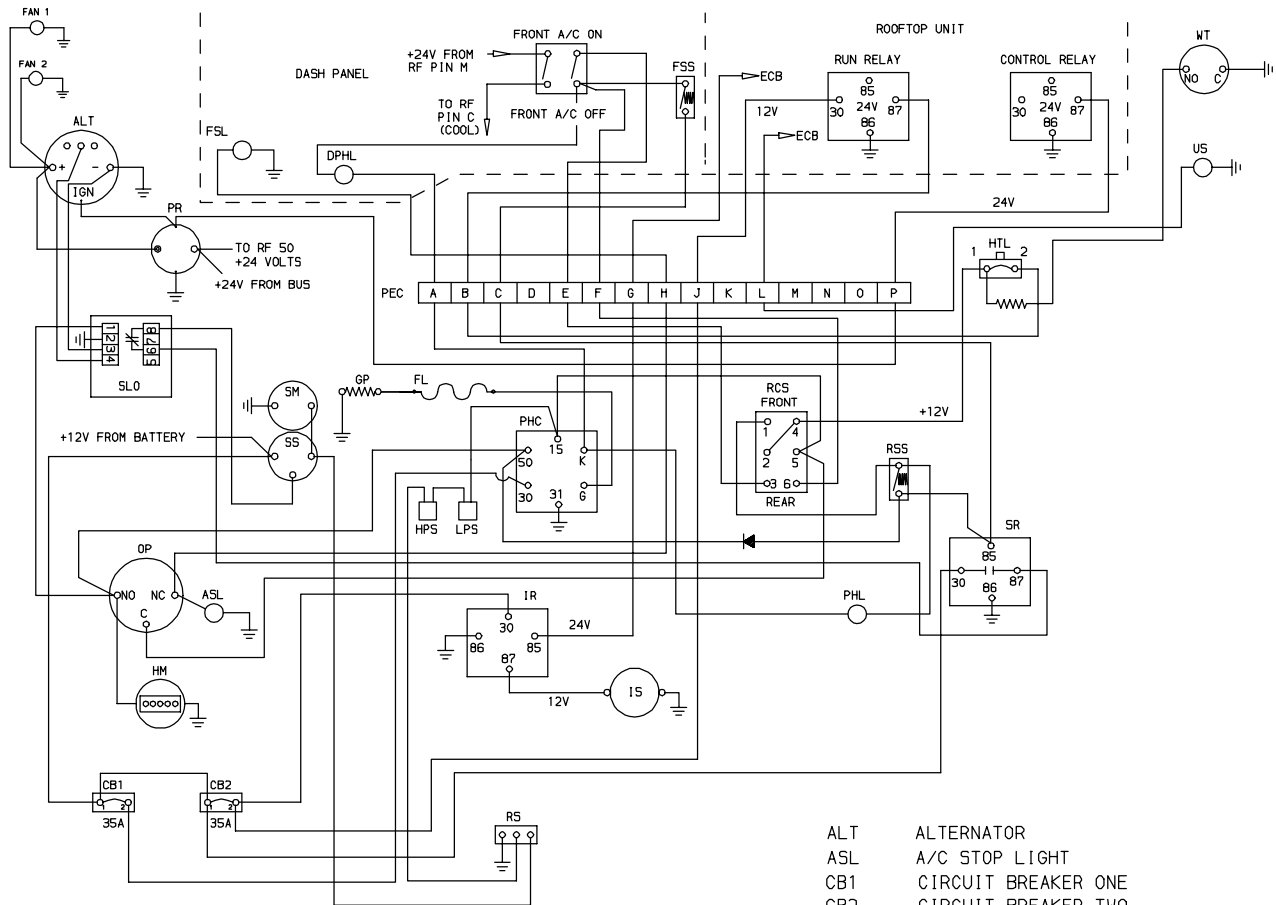
3. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.

## **SECTION 5**

### **ELECTRICAL**

#### **5.1 INTRODUCTION**

This section includes the electrical wiring schematic for the DM-4 Power Pack.



- ALT ALTERNATOR
- ASL A/C STOP LIGHT
- CB1 CIRCUIT BREAKER ONE
- CB2 CIRCUIT BREAKER TWO
- DPHL DASH PREHEAT LIGHT
- ECB ELECTRONIC CONTROL BOX
- FL FUSIBLE LINK (WIRE)
- FSS FRONT STARTER SWITCH
- FSL FRONT A/C STOP LIGHT
- GP GLOW PLUGS
- HPS HIGH PRESSURE SWITCH
- HTL HIGH TEMPERATURE LOCKOUT
- IGN ALTERNATOR IGNITION (FIELD)
- IR IDLE RELAY
- IS IDLE SOLENOID
- LPS LOW PRESSURE SWITCH
- OP OIL PRESSURE
- PEC POWERPACK ELECTRICAL CONNECTOR
- PHC PREHEAT CONTROL
- PHL PREHEAT LIGHT
- PR POWER RELAY
- RCS REAR CONTROL SWITCH
- RS RUN SOLENOID
- RSS REAR STARTER SWITCH
- SLO STARTER LOCKOUT
- SM STARTER MOTOR
- SR STARTER RELAY
- SS STARTER SOLENOID
- WT WATER TEMPERATURE SWITCHGAUGE
- US UNLOADER SOLENOID

**Figure 5-1. Electrical Wiring Schematic Diagram – DM-4 Power Pack  
Dwg. No. 061-287 Rev C**