Attaching The Gauge Set To The Tractor

WARNING

To avoid personal injury, stop the tractor engine during connection of the manifold gauge set.

1. Check that the gauge set shut off valves are closed (turned fully clockwise).
2. Connect the high side gauge hose (normally red) to the high pressure side service valve and the low side gauge hose (normally blue) to the low pressure side service valve on the tractor, Figure 19. Ensure the hose connections are fully tightened.

IMPORTANT: *Prior to connection of the manifold gauge set, identify the suction (low pressure) and discharge (high pressure) service gauge ports. The high pressure service valve is always in the line from the compressor to the condenser.*

The high and low pressure service valves on the tractor are spring loaded valve and will be automatically opened when the test hose is connected.

NOTE: *The test hose must incorporate a valve depressor to actuate this type of valve.*

The service valves have a protective cap. This cap must be removed for test gauge connections and replaced when service operations are completed.

Test Procedure

After the manifold gauge set has been connected and before pressure tests can be made, the system must be stabilized as follows:

1. Re-check that both the high and low side shut off valves on the manifold gauge set are fully **closed.**
2. Apply the parking brake, check the gear shift levers are in neutral and close the cab windows and doors.
3. Run the engine at 1000-1200 rev/min.
4. Turn the heater temperature control 'off'
5. Operate the system at maximum cooling, with the blower fan at high speed for 10 minutes to stabilize all components.
6. Check the manifold low pressure gauge reading is within the specified range of approximately 4-36 lbf/in^2 (0.28-2.48 bar) (0.28-2.53 kgf/cm^2).
7. Check the manifold high pressure gauge reading and compare the reading to the pressure indicated on the pressure temperature chart below.
8. Measure and compare the temperature of conditioned air entering the cab through the louvered air vents with the ambient air at the air intake filters on the outside of the cab.

   If the system is operating correctly the conditioned air entering the cab should be 6-9° C (10-15° F) cooler than the ambient temperature of the outside air.
9. If it is confirmed that the system is not operating correctly refer to the fault diagnostic charts and performance test gauge reading examples on the following pages for possible corrective action.

WARNING

A significant amount of refrigerant vapour may have condensed to a liquid at the service fitting at the high side of the compressor. Use a cloth or other protective material when disconnecting the manifold hose from this fitting to prevent personal injury to hands and face.

APPROXIMATE HIGH PRESSURE GAUGE READINGS

Ambient Air Temperature		High Pressure Gauge Reading		
Degrees F	Degrees C	bar	kgf/cm^2	lbf/in^2
59	15	9.5	9.7	140
68	20	13	13.3	191
77	25	15	15.3	221
86	30	18	18.4	265
95	35	20	20.5	294
104	40	22	22.5	323
113	45	23	23.5	338

PERFORMANCE TEST DIAGNOSIS

Gauge Readings:- Low Pressure - Low
High Pressure - Low

PROBLEM	POSSIBLE CAUSES	CORRECTION
Evaporator air not cold (Refer to Example 1)	Low refrigerant charge.	Perform leak tests and repair Evacuate system Charge system, re-test system
Evaporator air warm	Extremely low refrigerant charge.	Perform leak tests and repair Evacuate system Charge system, re-test system
Evaporator air cool but not sufficiently cold. Low pressure switch cutting out Expansion valve to evaporator tube shows considerable condensation or frost. Too cold to touch	Expansion valve not permitting sufficient flow. Stuck valve	Check expansion valve as follows: Set a max. cooling Low pressure gauge should drop slowly If expansion valve is defective: Discharge system Replace expansion valve Evacuate system Charge system Re-test

PERFORMANCE TEST DIAGNOSIS CHART

Gauge Readings:- Low Pressure - High
High Pressure - High

PROBLEM	POSSIBLE CAUSES	CORRECTION
Evaporator air warm	Improper operation of condenser	Inspect for dirty condenser restricting air flow and cooling
Liquid line hot (condenser outlet to expansion valve tube)	Overcharged with refrigerant	Check operation of condenser cooling fans. Repair or replace as needed.
High pressure switch cutting out	Air in system	Check for overcharge as follows: Stop the engine. Recover and recycle the charge using correct recovery equipment. Recharge the the system with the correct quantity of refrigerant, replacing any lost lubricant. Recheck performance of air conditioning system.
Evaporator air not cold	Expansion valve allowing too much refrigerant to flow through the evaporator	Check expansion valve as follows: Set for Maximum cooling. Low pressure gauge should drop slowly If expansion valve is defective: Discharge System Replace Expansion Valve Evacuate System Charge System Re-test

PERFORMANCE TEST DIAGNOSIS CHART

Gauge Readings:- Low Pressure - Low
High Pressure - High

PROBLEM	POSSIBLE CAUSES	CORRECTION
Insufficient cooling	Restriction in liquid line	Discharge the system Replace the receiver/drier Inspect all lines and tubing from compressor outlet to expansion valve. Replace if needed. Evacuate the system Charge the system Re-test

PERFORMANCE TEST DIAGNOSIS CHART

Gauge Readings:- Low Pressure - High
High Pressure - Low

PROBLEM	POSSIBLE CAUSES	CORRECTION
Evaporator air not cold	Internal leak in compressor. (reed valves, gasket, worn or scored piston rings or cylinder)	Discharge the system Replace the compressor Evacuate the system Charge the system Re-test

PERFORMANCE TEST DIAGNOSIS CHART

Gauge Readings:- Low Pressure - Normal
High Pressure - Normal

PROBLEM	POSSIBLE CAUSES	CORRECTION
Insufficient cooling Low pressure reading does not fluctuate with changes in temperature control switch (pressure should drop until compressor cycles) Evaporator air not cold.	System low on charge Air or moisture present in system	Perform leak test Discharge system Repair leaks Replace receiver/drier Check oil level Evacuate system Charge the system Re-test

PERFORMANCE TEST DIAGNOSIS CHART

Gauge Readings:- Low Pressure - High
High Pressure - Normal

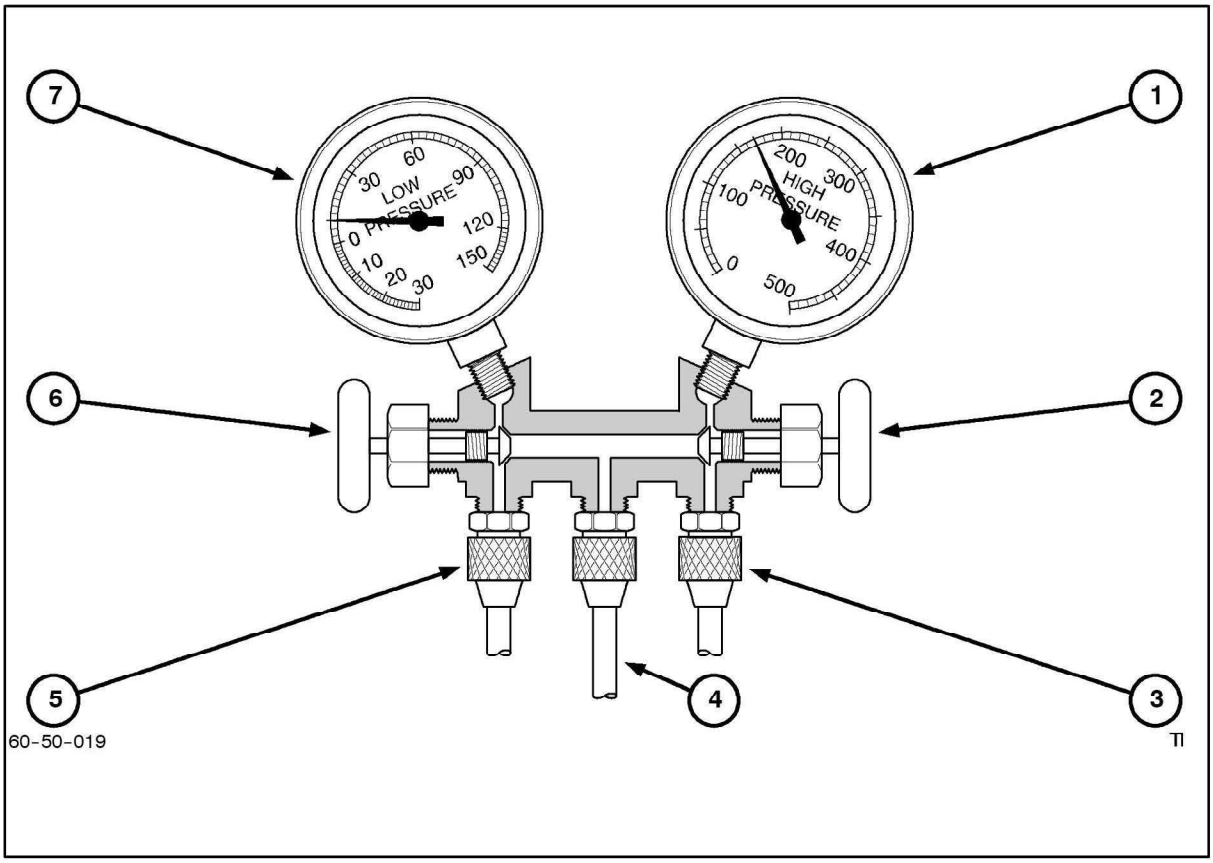
PROBLEM	POSSIBLE CAUSES	CORRECTION
Compressor cycles “on” and “off” too frequently	Defective temperature control (thermostatic) switch	Stop engine and shut off A/C Replace temperature control switch Re-test system and check compressor cycling

EXAMPLES OF MANIFOLD GAUGE READINGS AND INTERPRETATIONS

The following examples show typical low and high pressure gauge readings obtained when performance testing the air conditioning system with an ambient temperature of 35° C (95° F).

The recommended corrective action is based on a similar fault as identified in the performance test diagnosis charts.

PERFORMANCE TEST EXAMPLE 1



20

Performance Test Example 1

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Low

PROBLEM:

Little or no cooling.

CAUSE:

Refrigerant slightly low.

CONDITIONS*

Low side pressure too low.
Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low.
Gauge should read 19-21 bar
(275-305 lbf/in^2).

Evaporator air not cold.

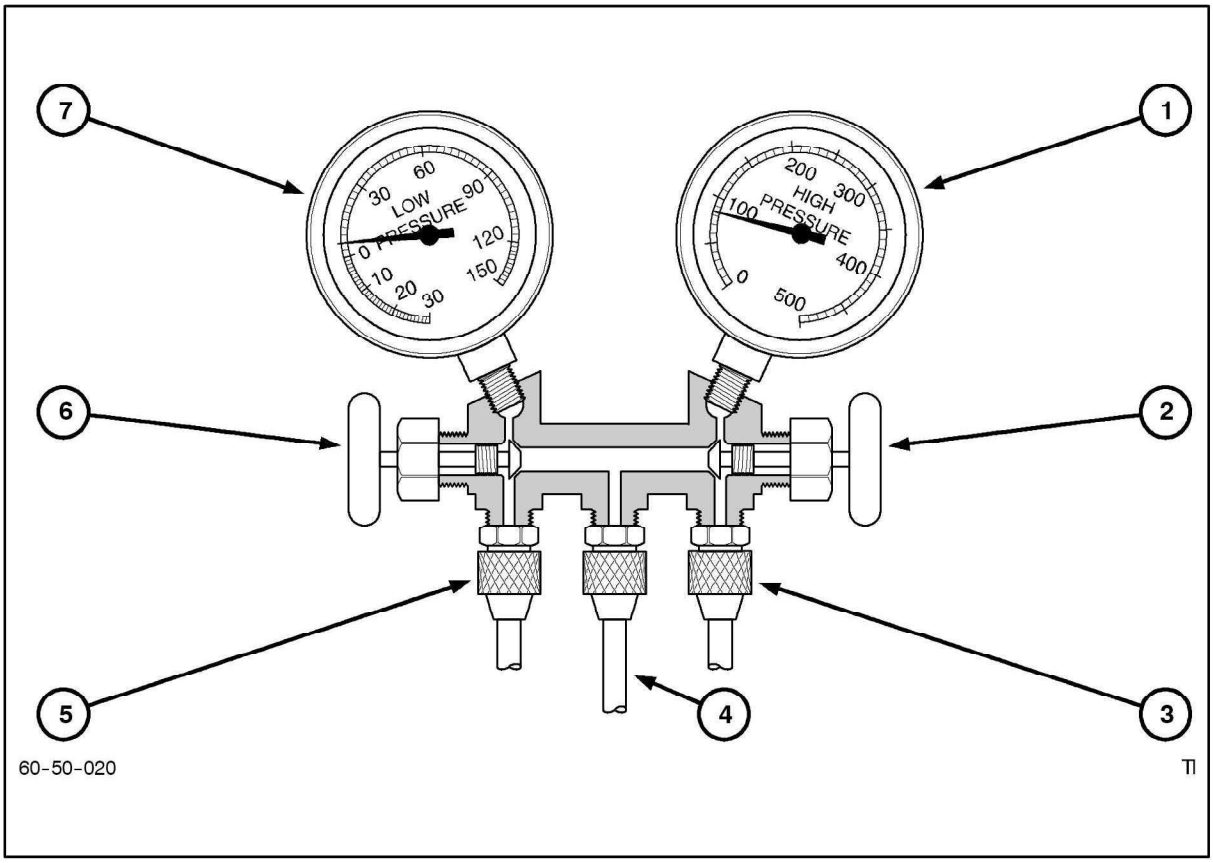
CORRECTIVE PROCEDURES

1. Leak test the system.
2. Repair leaks. (Discharge and recover the refrigerant from the system; replace lines or components).
3. Check compressor oil to ensure no loss.
4. Evacuate the system.
5. Charge the system.
6. Performance test the system.

DIAGNOSIS: *System refrigerant is low. May be caused by a small leak.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95° F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 2



21

Performance Test Example 2

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected t Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Low

PROBLEM:

Insufficient cooling.

CAUSE:

Refrigerant excessively low.

CONDITIONS*

Low side pressure very low.
Gauge should read 1-2 bar (15-30 lbf/in^2)

High side pressure too low.
Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air warm.

Low pressure switch cutting out

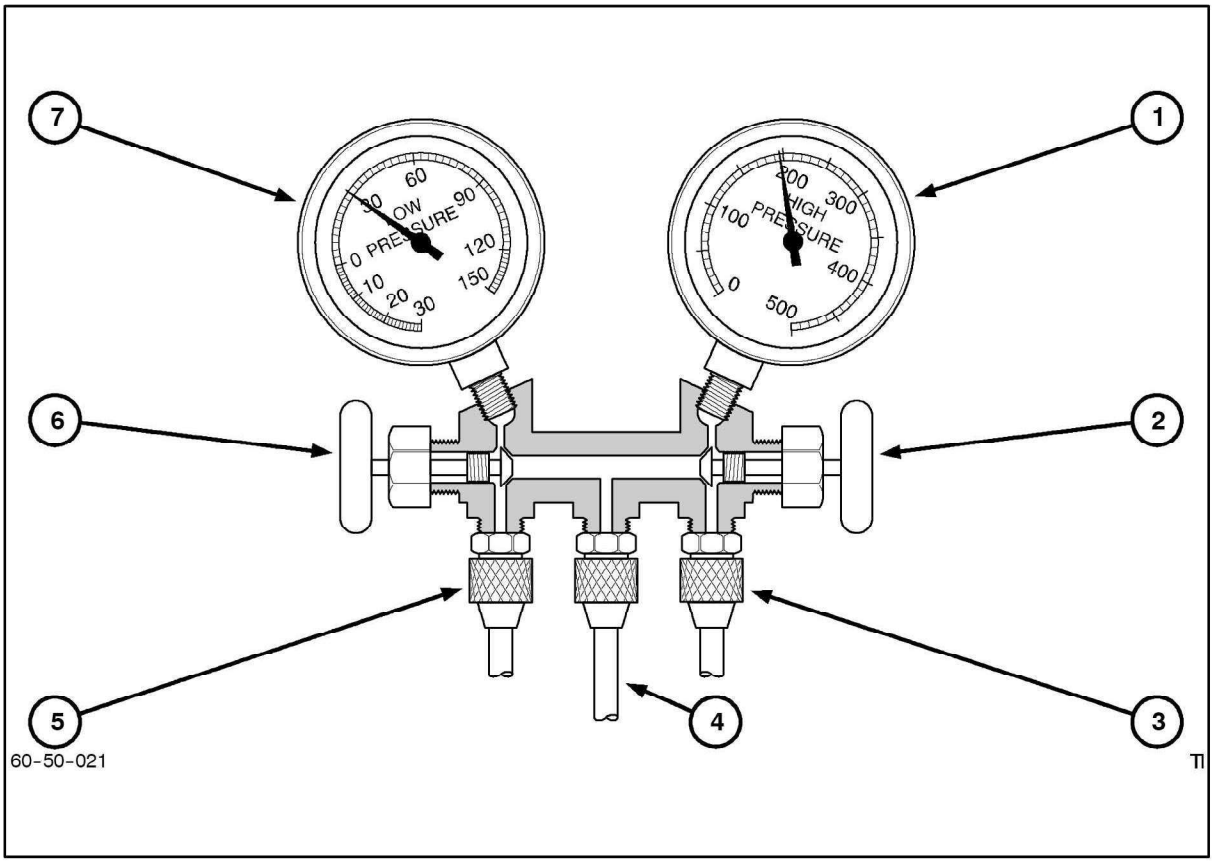
CORRECTIVE PROCEDURES

1. Leak test the system.
2. Discharge and recover the refrigerant from the system.
3. Repair leaks.
4. Check compressor oil to ensure no loss.
5. Evacuate the system.
6. Charge the system.
7. Performance test the system.

DIAGNOSIS: *System refrigerant is extremely low. A serious leak is indicated.*

NOTE: *Test procedure based upon ambient temperature of 95° F. For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 3



22

Performance Test Example 3

1. High Side Normal
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Low

PROBLEM:

Insufficient cooling.

CAUSE:

Air in system.

CONDITIONS*

Low side pressure reading does not change when compressor cycles “on” and “off”.

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air not cold.

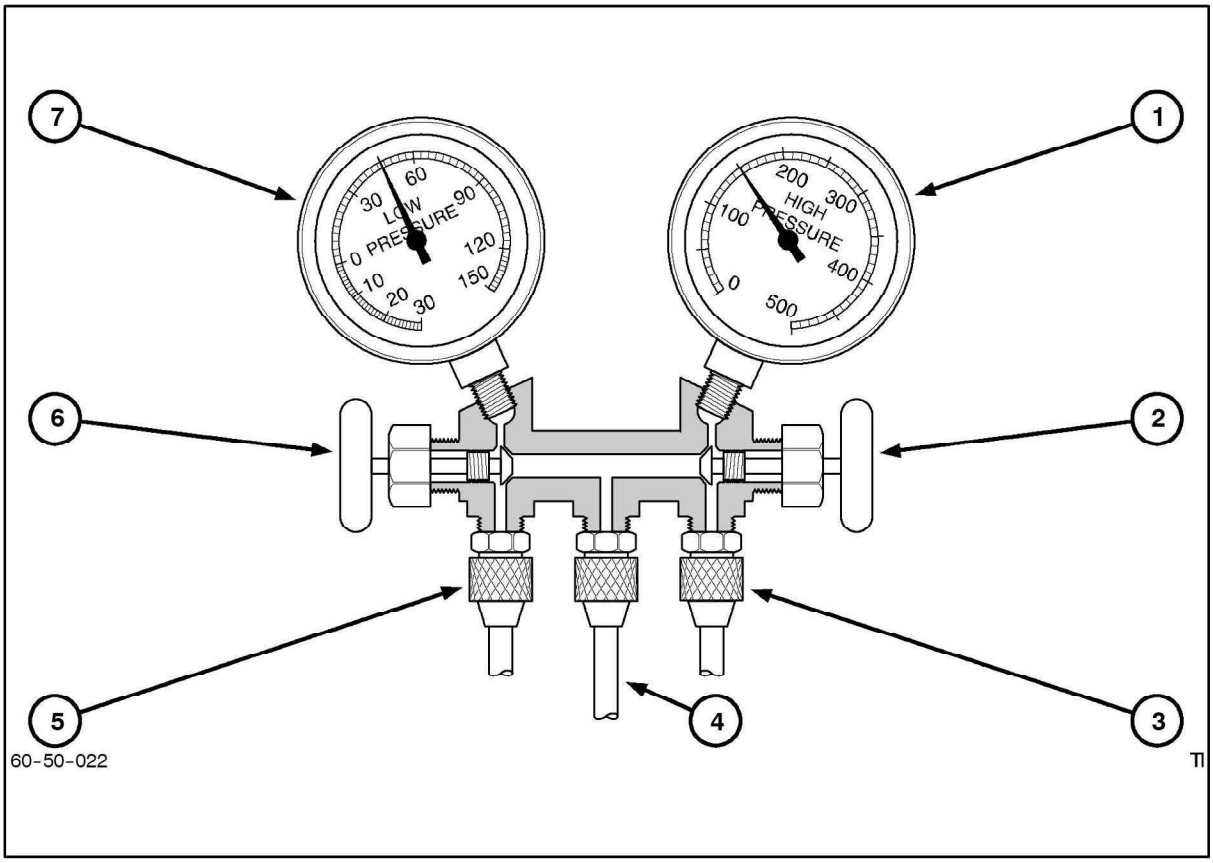
CORRECTIVE PROCEDURES

1. Leak test the system. Give special attention to the compressor seal area.
2. Discharge and recover the refrigerant from the system.
3. Repair leaks.
4. Replace the receiver/dryer.
5. Check compressor oil to ensure no loss.
6. Evacuate the system.
7. Charge the system.
8. Performance test the system.

DIAGNOSIS: *Air or moisture in system. System not fully charged.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 4



23

Performance Test Example 4

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side High

PROBLEM:

Insufficient cooling.

CAUSE:

Compressor malfunction.

CONDITIONS*

Low side pressure too high. Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air not cold.

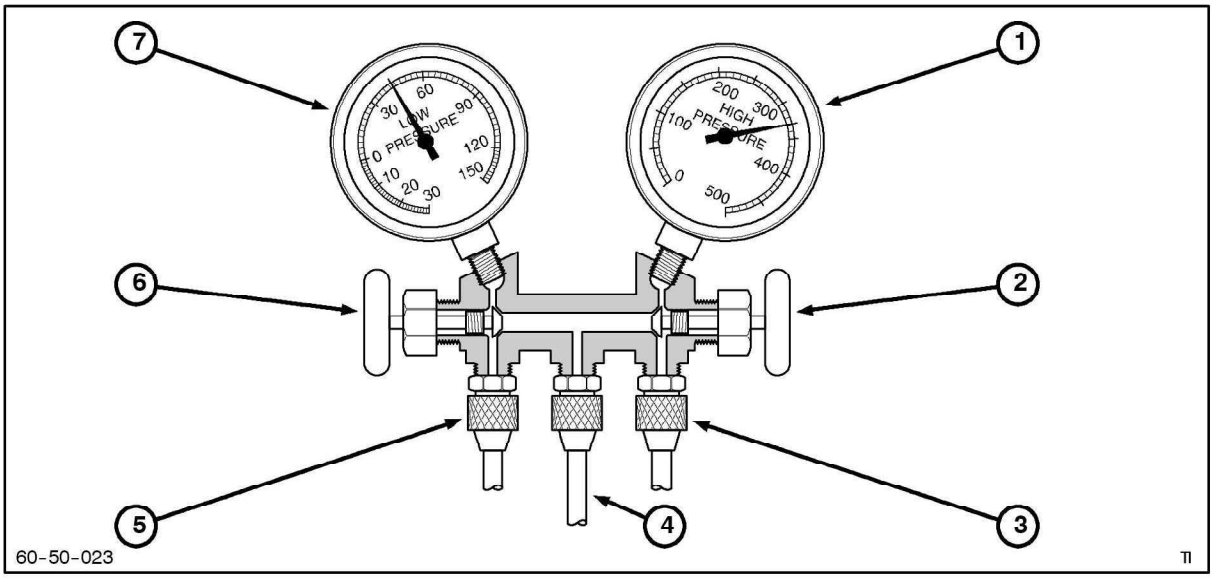
CORRECTIVE PROCEDURES

1. Replace the compressor.

DIAGNOSIS: *Internal leak in compressor caused by worn or scored pistons, rings, or cylinders.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95° F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 5



24

Performance Test Example 5

1. High Side High
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side High

PROBLEM:

Insufficient or no cooling. Engine overheats in some cases.

CAUSE:

Condenser not functioning properly.

CONDITIONS*

Low side pressure too high. Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Liquid line hot.

Evaporator air warm.

High pressure switch cutting out.

CORRECTIVE PROCEDURES

1. Check belt. Loose or worn drive belts could cause excessive pressures in the compressor head.
2. Look for clogged passages between the condenser fins and coil, or other obstructions that could reduce condenser airflow.
3. If engine is overheating replace engine thermostat and radiator pressure cap.

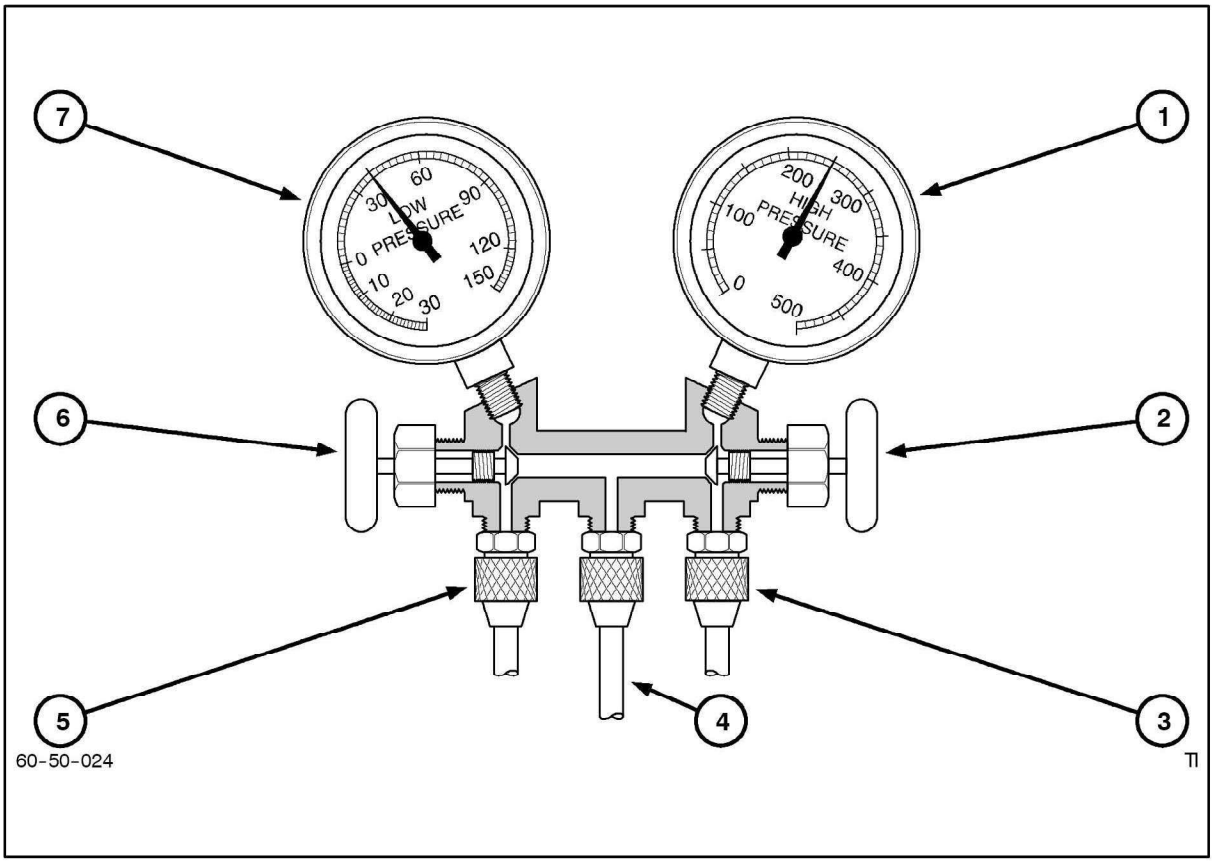
At this point, operate the system and check its performance. If still unsatisfactory, proceed as follows:-

1. Discharge and recover the refrigerant from the system.
2. Remove the condenser and clean and flush it to ensure a free flow of refrigerant. Or, if the condenser appears to be unduly dirty or plugged, replace it.
3. Replace the receiver/dryer.
4. Evacuate the system, and recharge it with the correct quantity of refrigerant.
5. Performance test the system.

DIAGNOSIS: *Lack of cooling caused by pressure that is too high on the high side, resulting from improper operation of condenser. (Refrigerant charge may be normal or excessive).*

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 6



25

Performance Test Example 6

1. High Side Normal
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Normal

PROBLEM:

Insufficient or no cooling.

CAUSE:

Large amount of air in system.

CONDITIONS*

Low side pressure too high. Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air not cool.

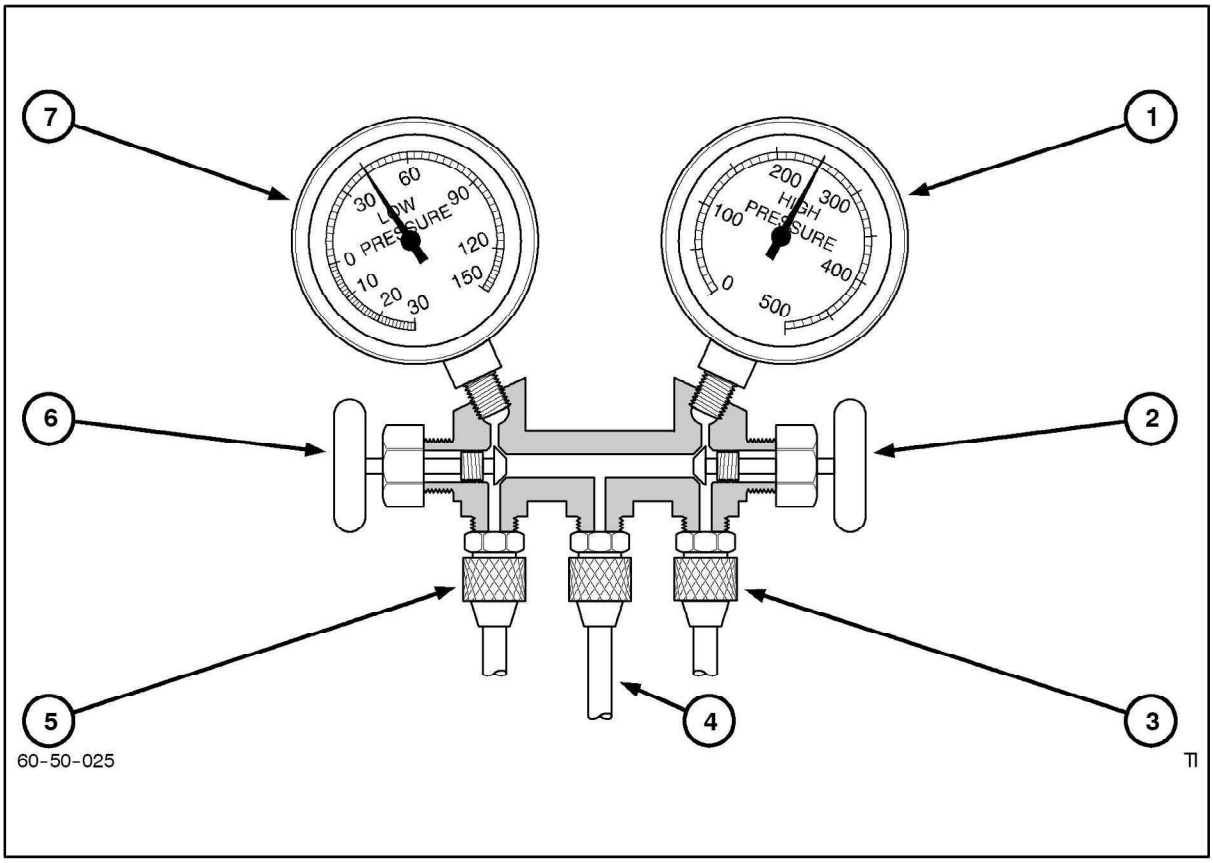
CORRECTIVE PROCEDURES

1. Discharge and recover the refrigerant from the system.
2. Replace the receiver/dryer.
3. Evacuate the system.
4. Charge the system.
5. Performance test the system.

DIAGNOSIS: *Air in system. This, and the moisture in the air, is contaminating the refrigerant, causing the system to operate improperly.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 7



26

Performance Test Example 7

1. High Side High
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Hide

PROBLEM:

Insufficient or no cooling.

CAUSE:

Improper operation of thermostatic expansion valve (stuck open)

CONDITIONS*

Low side pressure too high. gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air warm.

Evaporator and suction hose (to compressor) surfaces show considerable moisture.

CORRECTIVE PROCEDURES

1. Check for sticking expansion valve as follows:-

   Operate the system at maximum cooling.

   Check the low side gauge. The pressure should drop slowly.

2. If the test indicates that the expansion valve is defective, proceed as follows:

   Discharge and recover the refrigerant from the system.

   Replace the expansion valve.

   Evacuate the system.

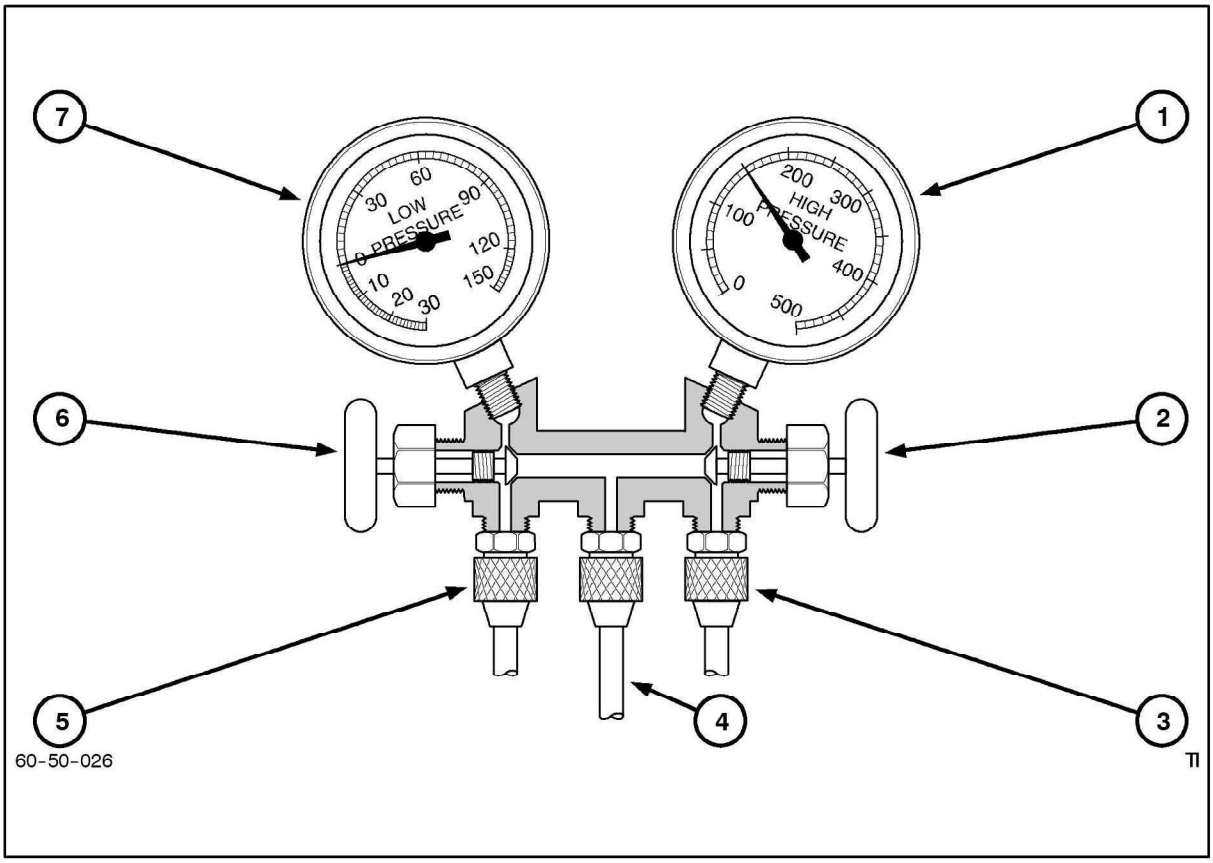
   Charge the system.

   Performance test the system.

DIAGNOSIS: *Thermostatic expansion valve is allowing too much refrigerant to flow through the evaporator coils. Valve may be stuck open.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 8



27

Performance Test Example 8

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Low

PROBLEM: *Insufficient cooling.*

CAUSE: *Improper operation of thermostatic expansion valve (stuck closed).*

CONDITIONS*

Low side pressure too low (zero or vacuum). Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

Evaporator air cool, but not sufficiently cold.

Evaporator inlet pipe surface shows considerable moisture or frost.

Low pressure switch cutting out.

CORRECTIVE PROCEDURES

1. Place finger on expansion valve to evaporator tube. If too cold to touch, proceed as follows:

   Operate the system at maximum cooling.

   Check the low side gauge. The pressure should drop slowly.
2. If the procedure outlined in Step 1 shows that the expansion valve is defective, proceed as follows:

   Discharge system

   Replace expansion valve

   Evacuate the system.

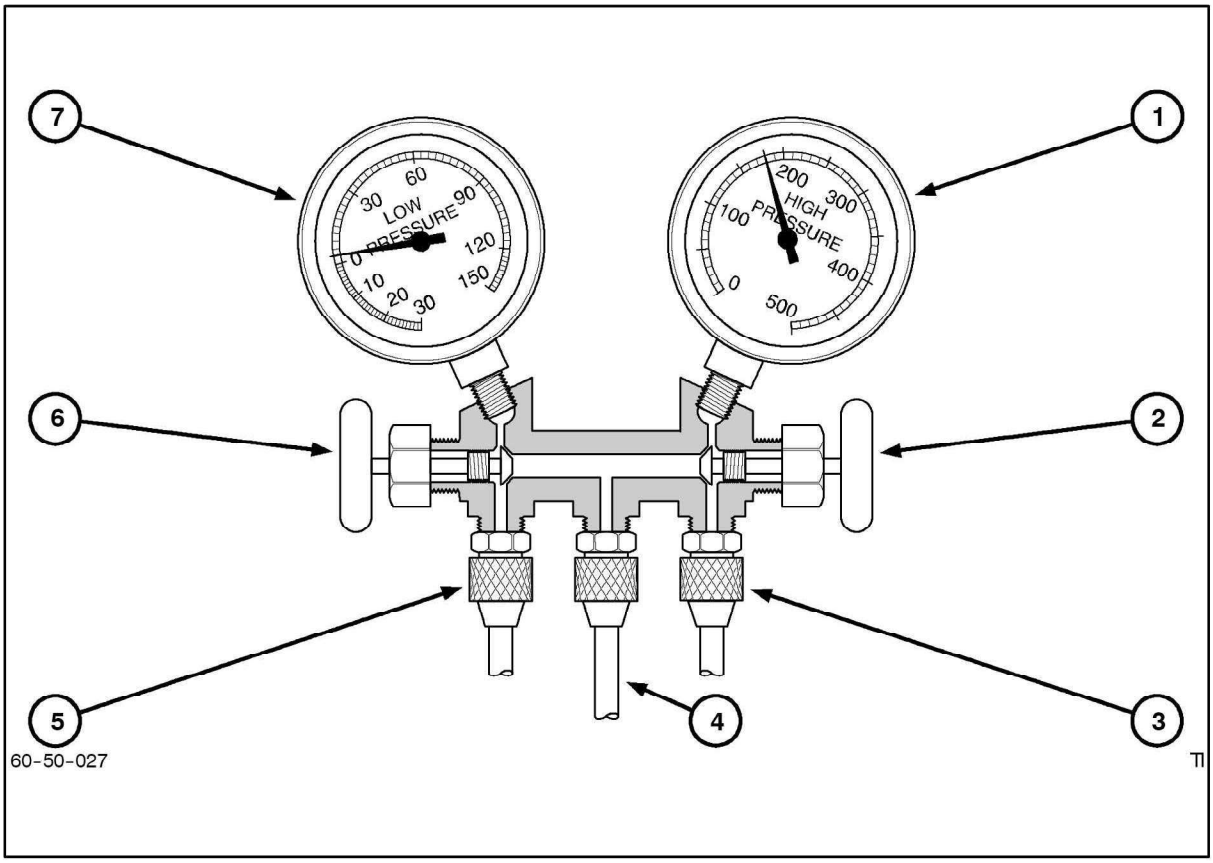
   Charge the system.

   Performance test the system.

DIAGNOSIS: *Expansion valve is not permitting a sufficient flow of refrigerant. May be caused by valve stuck in restricted or closed position.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 9



28

Performance Test Example 9

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Low

PROBLEM:

Insufficient cooling.

CAUSE:

Restriction in high side of system.

CONDITIONS*

Low side pressure too low. Gauge should read 1-2 bar (15-30 lbf/in^2).

High side pressure too low. Gauge should read 19-21 bar (275-305 lbf/in^2).

NOTE: *A normal or high reading of the high side pressure gauge under these conditions indicates the system is overcharged or the condenser or receiver/dryer is too small.*

Evaporator only slightly cool.

Liquid line and receiver/dryer are cool to touch and show frost or considerable moisture.

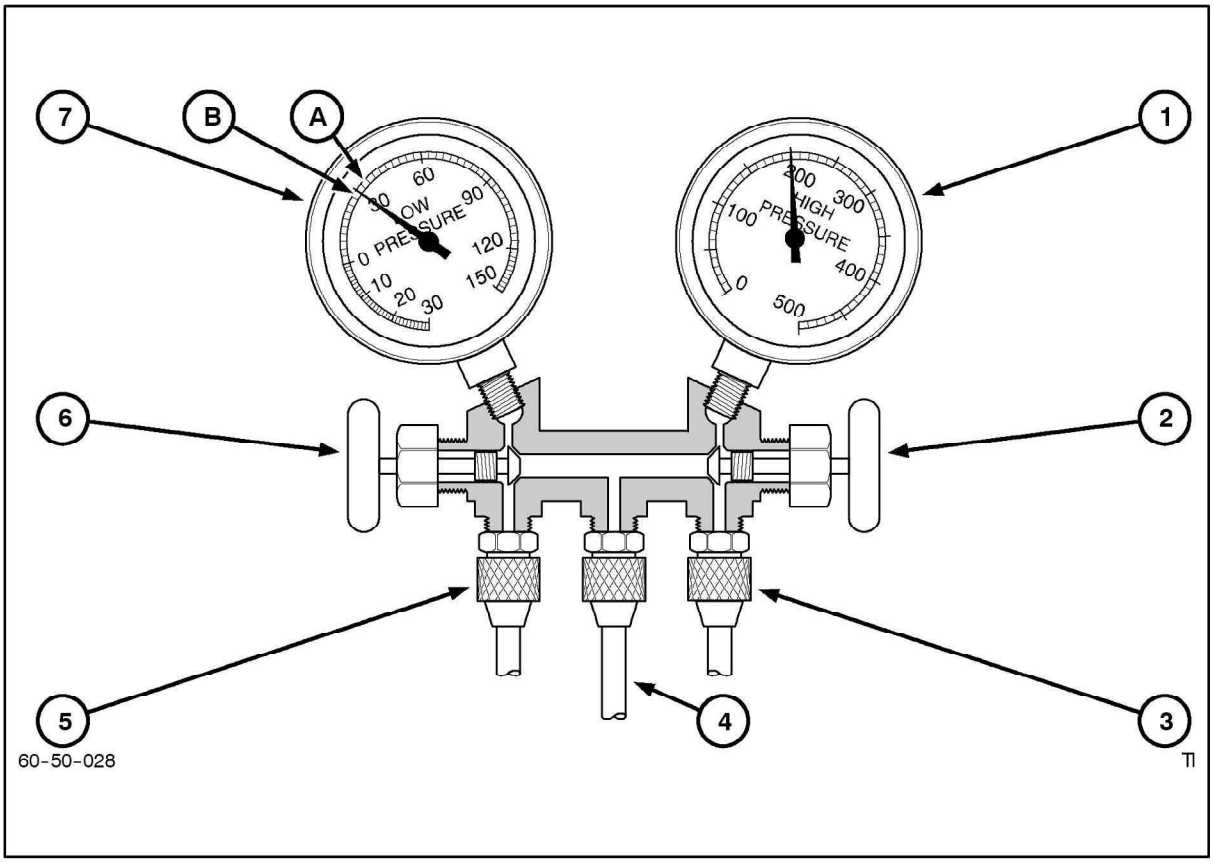
CORRECTIVE PROCEDURES

1. Discharge and recover the refrigerant from the system.
2. Replace the liquid lines, receiver/dryer, or other obstructed components.
3. Evacuate the system.
4. Charge the system.
5. Performance test the system.

DIAGNOSIS: *Restriction in the liquid line and/or receiver/dryer resulting in a "starved" evaporator (compressor moving refrigerant from the evaporator faster than it can enter).*

NOTE: *Test procedure based upon ambient temperature of 95° F. For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 10



29

Performance Test Example 10

1. High Side Normal
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Gauge
   Compressor Cycles on at 34 lbf/in^2 (2.3 bar)
   Compressor Cycles off at 28 lbf/in^2 (1.9 bar)

PROBLEM:

Compressor cycles (cuts in and out) too rapidly.

CAUSE:

Thermostatic switch defective.

CONDITIONS*

Low side pressure readings too high during both "on" and "off" compressor cycles and between cycles. Readings should be:

0.8-1.0 bar (12-15 lbf/in^2) - cycle "off"

2.5-2.7 bar (36-39 lbf/in^2) - cycle "on"

1.7-1.9 bar (24-27 lbf/in^2) - between cycles

High side pressure normal. Gauge should read 16-18 bar (230-260 lbf/in^2).

CORRECTIVE PROCEDURES

1. Stop the engine and shut off A/C system.
2. Replace thermostatic switch with switch of same type.
3. Make sure the switch's temperature sensor is installed in the same position and depth (in evaporator core) as previous.
4. Performance test the system.

DIAGNOSIS: *Defective thermostatic switch.*

NOTE: *Test procedure based upon ambient temperature of 35°C (95° F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

LEAK TESTING, DISCHARGING and CHARGING THE AIR CONDITIONING SYSTEM

Leak Testing

To perform a leak test if refrigerant leakage is suspected, use an electronic leak detector, Figure 30 following manufacturer's instructions.

Electronic leak detectors use flashing lights or sound to alert the operator to a leak. If the leak detector's sensitivity is adjustable, be sure you calibrate the detector according to the manufacturer's instructions before use.

When using a leak detector, keep in mind that a very slight amount of leakage in the compressor pulley area is normal and does not necessarily indicate a repair is required.

When a leak is located, follow these steps.

- Discharge the system using a certified freon recovery system.
- Repair the leak.
- Evacuate the system.
- Partially charge system with 400 grammes (14 ozs) of refrigerant.
- Check system for leaks.
- Fully charge the system.

Always check the system for leaks as a final test after evacuating and before recharging. Refer to Evacuating the system.

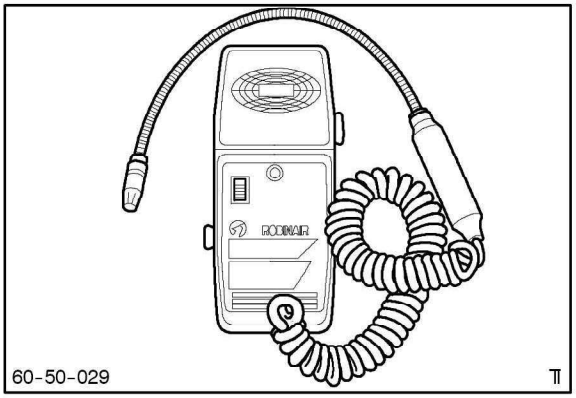
Discharging The System

Legislation has been introduced banning the release of refrigerant into the atmosphere.

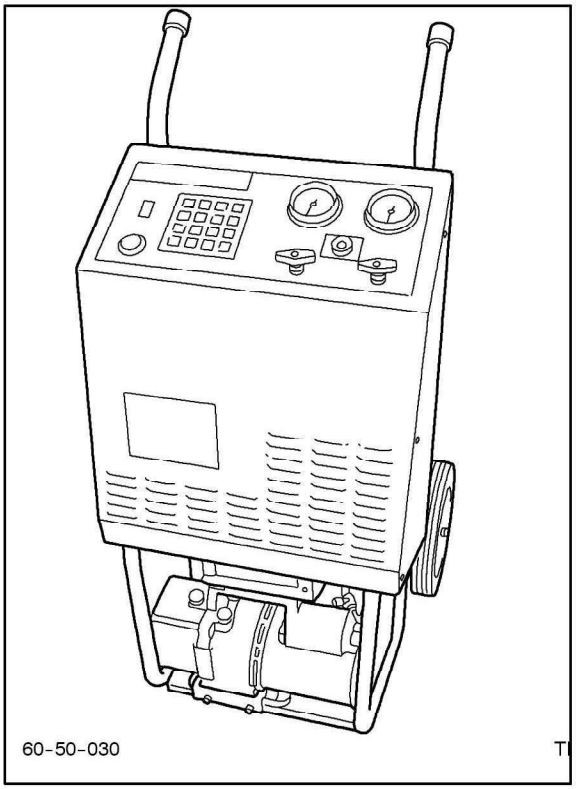
Whenever overhauling the air conditioning system or performing other tasks which require the air conditioning system to be dismantled it is necessary to discharge the refrigerant gas before commencing repair.

Before you can dismantle an air conditioning system for repairs, you must discharge and recover the refrigerant using a **certified** recovery unit in accordance with the manufacturers instructions.

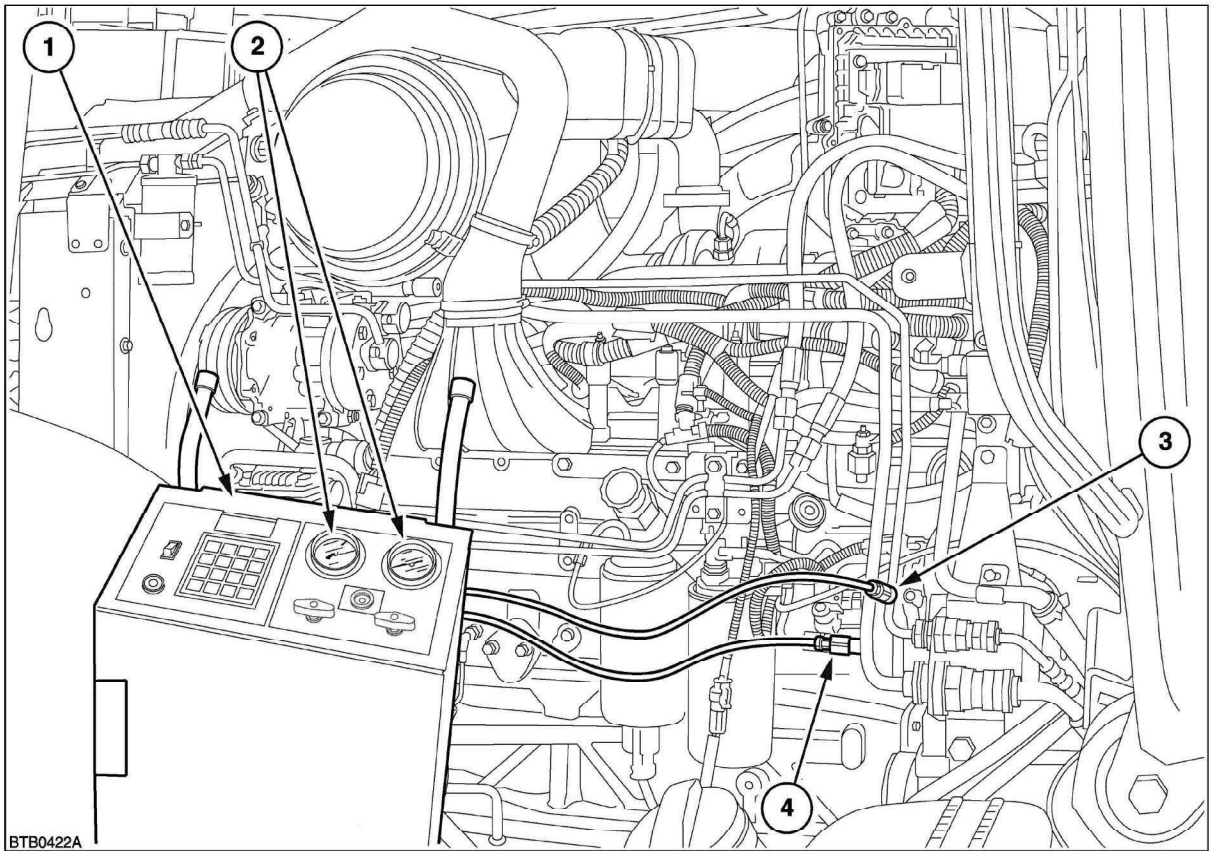
Figure 31 shows a combined refrigerant recovery, evacuation and recycling/charging station. This equipment removes R-134a refrigerant from the air conditioning system, recycles and recharges all in one hook up. The unit is designed to be used with the manifold gauge set built into the control panel.



30



31



32

Connecting Recovery Evacuation and recycling/Charging Station to the Tractor

1. Recovery/Recharging Unit
2. Built In Manifold Gauge Set
3. High Side Service Valve (Red Hose)
4. Low Side Service Valve (Blue Hose)

Other recovery systems are available where the manifold gauges are not an integral part of the machine. When this type of equipment is used a separate manifold gauge set must be used.

The following is a summary of the steps for discharging the system using a recovery/recycling unit

⚠ WARNING ⚠

Never *discharge refrigerant gas into the atmosphere. Always where safety goggles and gloves when working with refrigerant. Only use authorised refrigerant tanks.*

IMPORTANT: *Always follow the manufactures instructions when operating recovery equipment.*

1. Run the vehicle's air conditioning system for a few minutes.
2. Set up the recovery unit following manufacturer's instructions. Ensure that the units red (high side) hose is connected to the high side fitting and the blue (low side) hose to the low side fitting, Figure 32.

NOTE: *If a unit requiring the manifold gauge set is being used, the low and high sides of the manifold set are connected to the low and high sides of the tractor air conditioning system. The hose from the recovery unit is then connected to the manifold centre port. Refer to Figure 33.*

3. To recover refrigerant, open both high and low side valves on the control panel or the valves on the manifold gauge set if being used, Figure 33.
4. Open the valves labeled "gas" and "liquid" on the recovery unit refrigerant tank, Figure 34.
5. Plug in the units power cord
6. Operate the recovery system in accordance with the manufacturers instructions.

The compressor will shut off automatically when the recovery is complete.