

# Service - Air Dryer

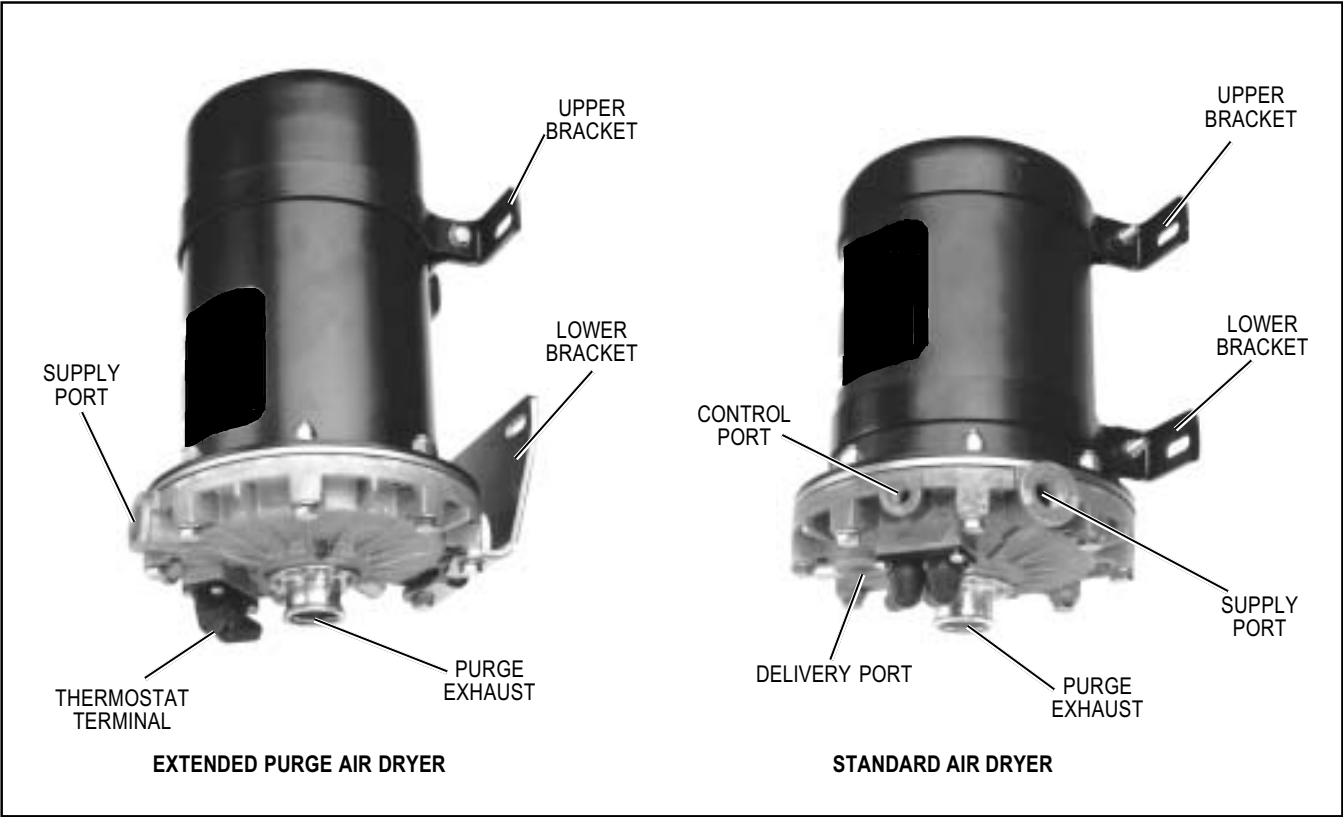


FIGURE 1 - AIR DRYER MODELS

## DESCRIPTION

The function of the **Air Dryer** is to collect and remove air system contaminants in solid, liquid and vapor form before they enter the brake system. It provides clean, dry air to the components of the brake system which increases the life of the system and reduces maintenance costs. Daily manual draining of the reservoirs is eliminated.

The Air Dryer consists of a desiccant cartridge and a die cast aluminum end cover secured to a cylindrical steel outer shell with eight cap screws and nuts. The end cover contains a check valve assembly, a safety valve, purge valve mechanism, a cast-in heater element with a replaceable thermostat assembly and three threaded air connections.

The three air connections are identified with embossed numbers and lettering. The identification and function of each is as follows:

Port I.D.	Function/Connection
CON 4 .....	Control Port (from unloader port on governor).
SUP 11 .....	Supply Port (air in).
DEL 2 .....	Delivery Port (air out).

A cast-in heater element and replaceable thermostat with an external terminal are provided.

The voltage and wattage requirements of the heater and thermostat are shown with embossed numbers and letters in the recess adjacent to the control port marked "CON"

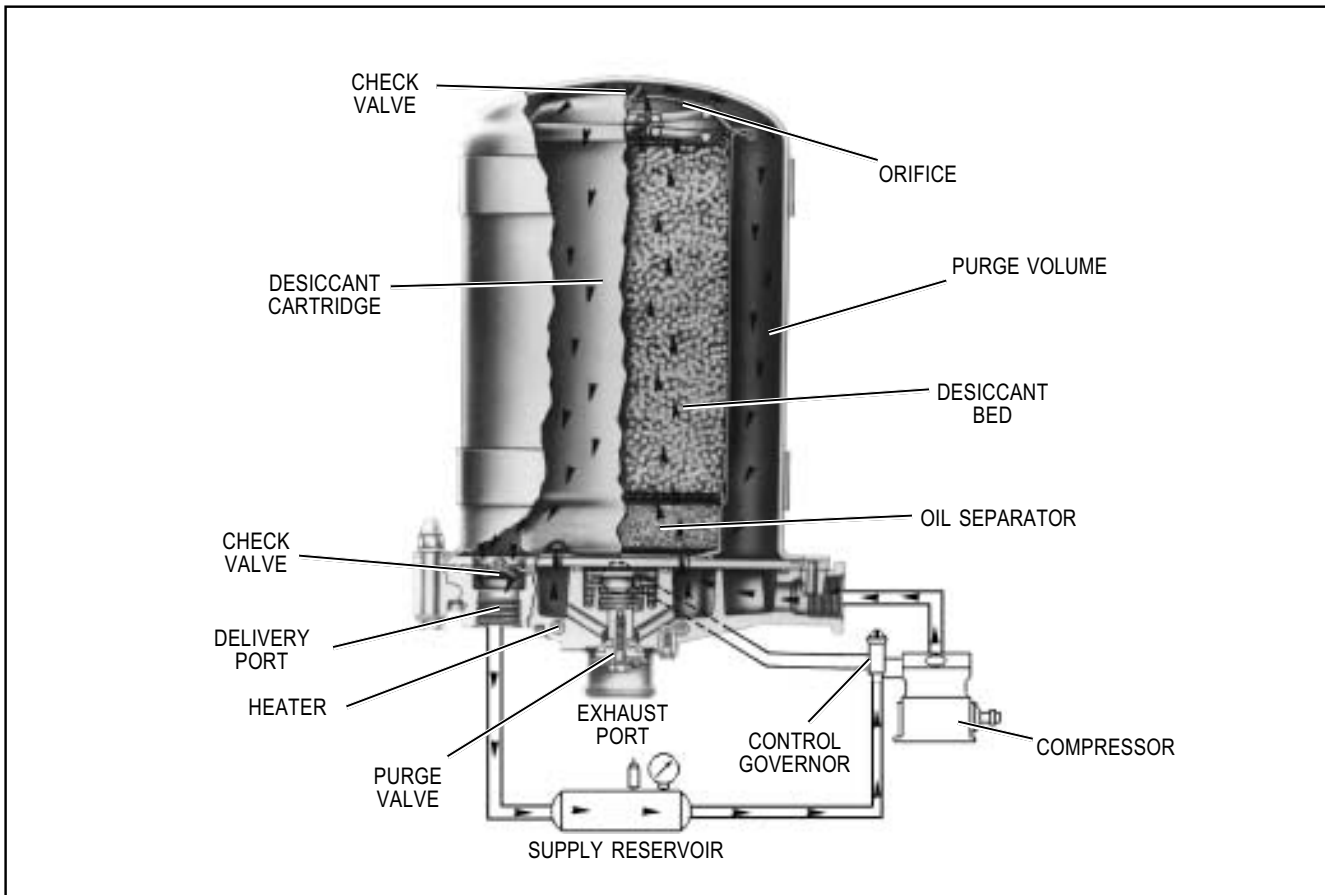


FIGURE 2 - CHARGE CYCLE

## OPERATION OF THE AIR DRYER

The air dryer alternates between two operational modes or “cycles” during operation: the *charge cycle* and the *purge cycle*. The following description of operation is separated into these “cycles” of operation.

### CHARGE CYCLE (refer to Figure 2)

When the compressor is loaded (compressing air) compressed air, along with oil, oil vapor, water and water vapor flows through the compressor discharge line to the supply port of the air dryer end cover. The flow velocity or the speed at which the air and its contaminants travel down the discharge line is reduced substantially as it enters the air dryer end cover baffle system behind the supply port. As air travels through the baffle system, its direction of flow changes by 180 degrees several times, reducing the temperature, causing contaminants to condense and drop to the bottom or sump of the air dryer end cover.

After exiting the end cover baffle system, the air flows into the desiccant cartridge. Once in the desiccant cartridge air first flows through an oil separator which removes water in liquid form as well as oil, oil vapor and solid contaminants.

Air exits the oil separator and enters the desiccant drying bed. Air flowing through the column of desiccant becomes progressively dryer as water vapor adheres to the desiccant material in a process known as “*adsorption*”. The desiccant cartridge using the adsorption process typically removes 95% of the water vapor from the pressurized air.

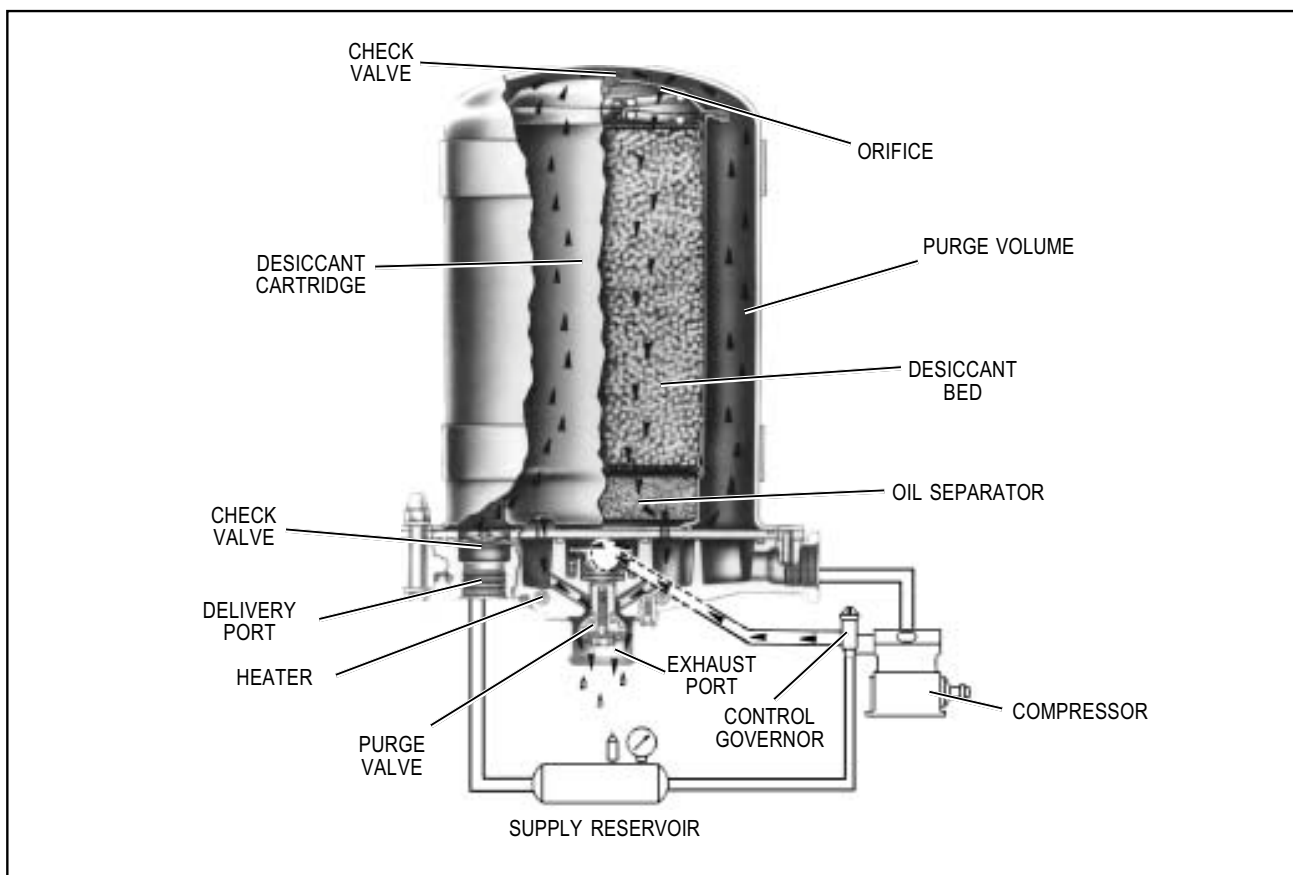
The majority of dry air exits the desiccant cartridge through its integral single check valve to fill the purge volume between the desiccant cartridge and outer shell. Some air will also exit the desiccant cartridge through the purge orifice adjacent to the check valve.

Dry air flows out of the purge volume through the single check valve assembly and out the delivery port to the first (supply) reservoir of the air system.

The air dryer will remain in the charge cycle until air brake system pressure builds to the governor cutout setting.

### PURGE CYCLE (refer to Figure 3)

When air brake system pressure reaches the cutout setting of the governor, the compressor unloads (air compression stopped) and the purge cycle of the air dryer begins. The



**FIGURE 3 - PURGE CYCLE**

line connecting the governor unloader port to the end cover control port is pressurized when the governor unloads the compressor. Air pressure at the end cover control port is also present on the purge valve piston. The purge piston moves in response to air pressure causing the purge valve to open to atmosphere. Contaminants in the end cover sump are expelled immediately when the purge valve opens. Also, air which was flowing through the desiccant cartridge changes direction and begins to flow toward the open purge valve. Oil, water and solid contaminants collected by the oil separator are removed by air flowing from the desiccant drying bed to the open purge valve.

The initial purge and desiccant cartridge decompression lasts only a few seconds and is evidenced by an audible burst of air at the exhaust.

The actual reactivation of the desiccant drying bed begins as dry air flows from the purge volume through the desiccant cartridge purge orifice and into the desiccant drying bed. Pressurized air from the purge volume expands after passing through the purge orifice; its pressure is lowered and its volume increased. The flow of dry air through the drying bed reactivates the desiccant material by removing the water

vapor adhering to it. Generally 15-30 seconds are required for the entire purge volume of a standard air dryer to flow through the desiccant drying bed.

The end cover single check valve assembly prevents air pressure in the brake system from returning to the air dryer during the purge cycle. After the 30 second purge cycle is complete, the air dryer is ready for the next charge cycle to begin.

The purge valve will remain open after the purge cycle is complete and will not close until air brake system pressure is reduced and the governor signals the compressor to charge.

## PREVENTIVE MAINTENANCE

**Important:** Review the warranty policy before performing any intrusive maintenance procedures. An extended warranty may be voided if intrusive maintenance is performed during this period.

Because no two vehicles operate under identical conditions, maintenance and maintenance intervals will vary. Experience is a valuable guide in determining the best maintenance interval for any one particular operation.

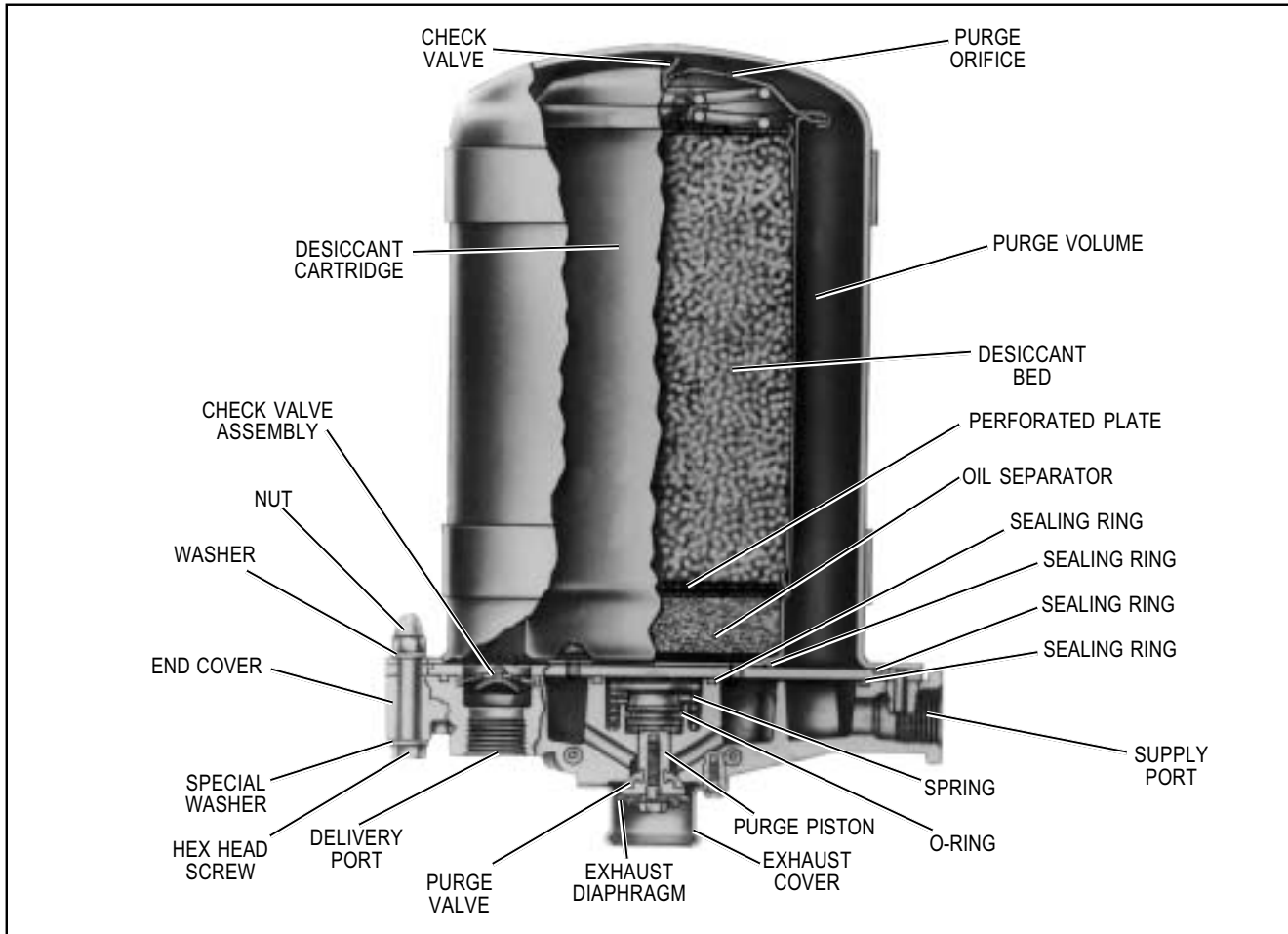


FIGURE 4 - AIR DRYER SECTIONAL VIEW

**Every 900 operating hours or 25,000 miles or every three (3) months:**

1. Check for moisture in the air brake system by opening reservoirs, drain cocks, or valves and checking for presence of water. If moisture is present, the desiccant may require replacement; however, the following conditions can also cause water accumulation and should be considered before replacing the desiccant:
  - A. An outside air source has been used to charge the system. This air did not pass through the drying bed.
  - B. Air usage is exceptionally high and not normal for a highway vehicle. This may be due to accessory air demands or some unusual air requirement that does not allow the compressor to load and unload (compressing and non-compressing cycle) in a normal fashion. Check for high air system leakage.
  - C. The air dryer has been installed in a system that has been previously used without an air dryer. This type system will be saturated with moisture and several weeks of operation may be required to dry it out.

- D. Location of the air dryer is too close to the air compressor. Refer to *Locating Air Dryer On Vehicle* section.
- E. In areas where more than a 30 degree range of temperature occurs in one day, small amounts of water can accumulate in the air brake system due to condensation. Under these conditions, the presence of small amounts of moisture is normal and should not be considered as an indication that the dryer is not performing properly.

**Note:** A small amount of oil in the system may be normal and should not, in itself, be considered a reason to replace the desiccant; oil stained desiccant can function adequately.

2. Check mounting bolts for tightness. Retorque to 270-385 inch pounds.
3. Perform the *Operation & Leakage Tests* listed in this publication.

**Every 10,800 hours or 300,000 miles or 36 months:**

1. Rebuild the air dryer including the desiccant cartridge.

**Note:** The desiccant change interval may vary from vehicle to vehicle. Although typical desiccant cartridge life is three years, many will perform adequately for a longer period of time. In order to take maximum advantage of desiccant life and assure that replacement occurs only when necessary, it is important that *Operation & Leakage Tests* be performed.

### WARNING!

This air dryer is intended to remove moisture and other contaminants normally found in the air brake system. Do not inject alcohol, anti-freeze, or other de-icing substances into or upstream of the air dryer. Alcohol is removed by the dryer, but reduces the effectiveness of the device to dry air. Use of other substances can damage the air dryer and may void the warranty.

### OPERATION & LEAKAGE TESTS

1. Test the outlet port check valve assembly by building the air system to governor cut-out and observing a test air gauge installed in the supply reservoir. A rapid loss of pressure could indicate a failed outlet port check valve. (**Note:** Purge valve will be open when governor cut-out pressure is reached. Allow 45 seconds after governor cut-out occurs to complete the purge cycle before testing the check valve.) Coat the exhaust with a soap solution. Leakage should not exceed a 1 inch bubble in 1 second.
2. Check for excessive leakage around the purge valve. With the compressor in loaded mode (compressing air), apply a soap solution to the purge valve housing assembly exhaust port and observe that leakage does not exceed a 1 inch bubble in 1 second. If the leakage exceeds the maximum specified, service the purge valve housing assembly.
3. Close all reservoir drain cocks. Build up system pressure to governor cut-out and note that purges with an audible escape of air. "Fan" the service brakes to reduce system air pressure to governor cut-in. Note that the system once again builds to full pressure and is followed by an purge.
4. Check the operation of the safety valve by pulling the exposed stem while the compressor is loaded (compressing air). There must be an exhaust of air while the stem is held and the valve should reseat when the stem is released.
5. Check all lines and fittings leading to and from the air dryer for leakage and integrity.
6. Check the operation of the end cover heater and thermostat assembly during cold weather operation as follows:

#### A. Electric Power to the Dryer

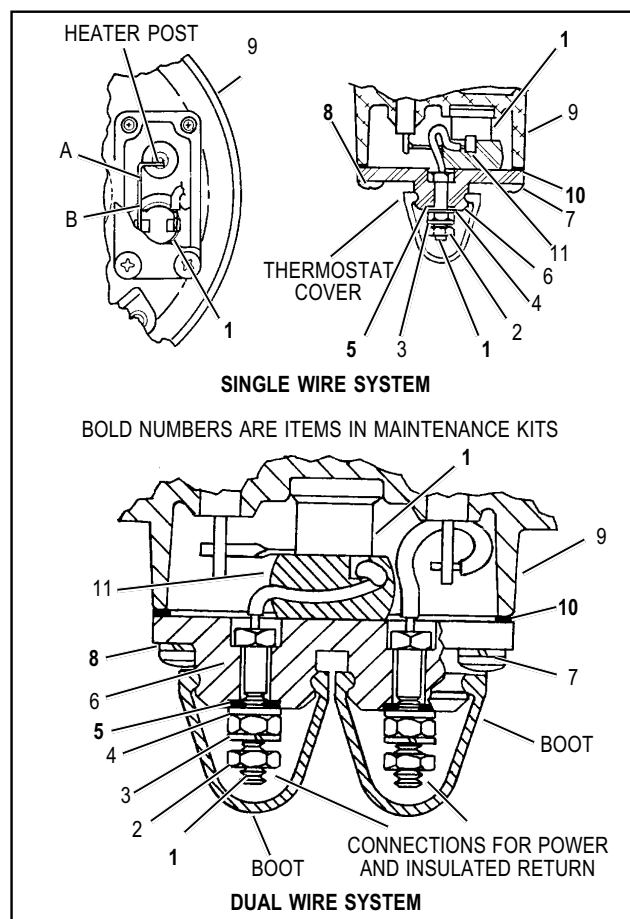
With the ignition or engine kill switch in the ON position, check for power at the dryer's electrical terminal using a voltmeter or test light. On a single

terminal disconnect the lead wire at the end cover terminal post. Place the test leads on the lead wire and a GOOD vehicle ground. On dual terminal disconnect both lead wires at the end cover terminal posts. If there is no voltage indicated, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness. Check to see if a good ground path exists.

#### B. Thermostat and Heater Operation

Turn off the ignition switch and cool the end cover assembly to below 40 degrees Fahrenheit. Using an ohmmeter, check the resistance between the electrical terminal and the metal end cover (see Figure 5). (**Note:** On the dual terminal end cover, check the resistance between the two terminals.) The resistance should be 2.0 to 4.0 ohms for the 12 volt, 60 watt end cover and 4.0 - 7.0 ohms for the 24 volt, 120 watt end cover. These resistance values apply to either single or dual terminal air dryer end covers.

Warm the end cover assembly to over 90 degrees Fahrenheit and again check the resistance as above. The resistance should exceed 1000 ohms for both



**FIGURE 5 - AIR DRYER SINGLE AND DUAL TERMINAL THERMOSTAT ASSEMBLIES**

single and dual terminal air dryers. If the resistance values obtained are within the stated limits, the thermostat and heater assembly is operating properly. If the resistance values obtained are outside the stated limits, proceed to Step C to determine the cause.

#### C. Heater Element Inspection

With the ignition or engine control switch "off", remove the thermostat cover (see Figure 5). Using an ohmmeter, check the resistance between the metal end cover and the heater post (see Figure 5). (**Note:** On the dual terminal end cover, check the resistance between the two terminals.) For a 12 volt, 60 watt end cover, the resistance should be 2.0 - 2.8 ohms and for a 24 volt, 120 watt end cover, 4.0 - 5.6 ohms. These resistance values apply to either single or dual terminal air dryer end covers. If the heater resistance value obtained is outside the stated limits, a new or remanufactured end cover should be installed, since the heater element cannot be serviced. Check that a good ground path exists between the air dryer end cover casting and the vehicle chassis. Correct if needed. If the heater resistance value obtained is within the stated limits the thermostat should be replaced (Kit Number 231544) or a new or remanufactured end cover installed.

#### D. Reassembly

Reinstall the thermostat cover as illustrated in Figure 5. Take special care to assure the rubber spacer and the gasket are correctly installed, to assure proper operation.

## REBUILDING THE AIR DRYER

### GENERAL

If, after completing the routine operation and leakage tests, it has been determined that one or more components of the air dryer requires replacement or maintenance, refer to the following list to find the appropriate kit(s).

When rebuilding or replacing components of the air dryer use only genuine parts. For ease in servicing the desiccant cartridge assembly, it is recommended that the air dryer be removed from the vehicle.

### MAINTENANCE KITS AVAILABLE:

#### 231539 Major Maintenance Kit

This kit contains the parts necessary to completely rebuild the Air Dryer (desiccant cartridge included) and includes kit 231541.

#### 231543 Purge Valve Maintenance Kit

This kit contains the parts necessary to rebuild the end cover purge valve only.

#### 231542 Seal Kit

This kit contains the outlet port check valve and the o-rings and seals required when removing the end cover assembly. This kit is included with kits 231541 and 231540.

#### 231541 End Cover Maintenance Kit

This kit contains the parts necessary to rebuild the end cover of the Air Dryer and includes kit 231543.

#### 231540 Desiccant Cartridge Replacement Kit

This kit contains the parts necessary to change the desiccant cartridge only.

#### 231544 Thermostat Maintenance Kit (single terminal models)

This kit contains the parts necessary to rebuild a single terminal thermostat assembly in the Air Dryer.

Thermostat Maintenance Kit (dual terminal models)

This kit contains the parts necessary to rebuild a two terminal thermostat assembly (insulated ground).

Thermostat Cover Replacement Kit (single terminal models)

This kit contains the necessary components for replacing the non-metallic thermostat cover.

Thermostat Cover Replacement Kit (dual terminal models)

This kit contains the necessary components for replacing the non-metallic thermostat cover.

## IMPORTANT! PLEASE READ

**When working on or around a vehicle, the following general precautions should be observed:**

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels.**
2. **Stop the engine when working around the vehicle.**
3. **If the vehicle is equipped with air brakes, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle.**
4. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that removes all electrical power from the vehicle.**
5. **When working in the engine compartment the engine should be shut off. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated, or electrically charged components.**
6. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**

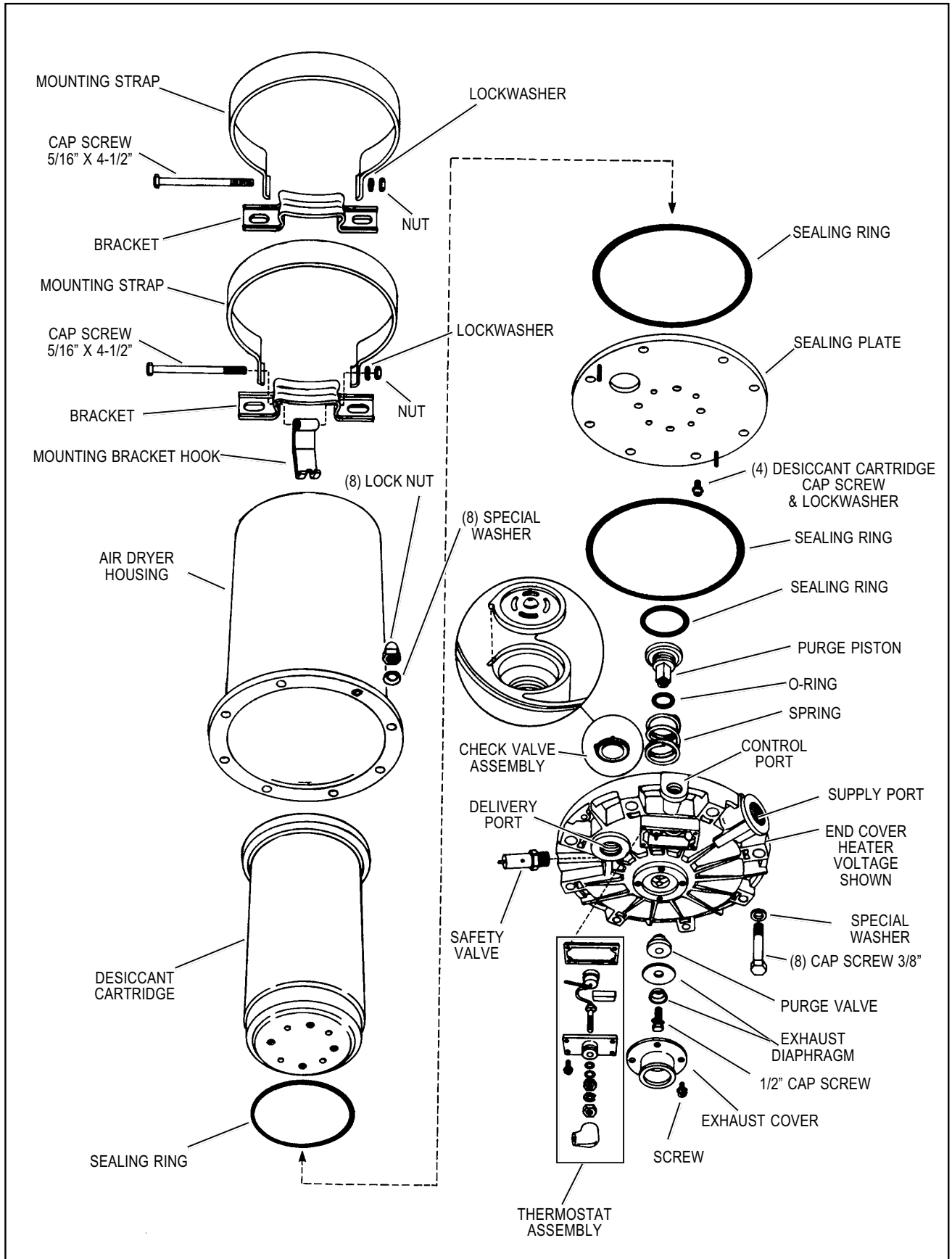


FIGURE 6 - AIR DRYER ASSEMBLY



7. Never exceed recommended pressures and always wear safety glasses.
8. Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
9. Use only genuine replacement parts, components, and kits. Replacement hardware, tubing, hose, fittings, etc. should be of equivalent size, type, and strength as original equipment and be designed specifically for such applications and systems.
10. Components with stripped threads or damaged parts should be replaced rather than repaired. Repairs requiring machining or welding should not be attempted unless specifically approved and stated by the vehicle or component manufacturer.
11. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

## REMOVAL

1. Park the vehicle on a level surface and prevent movement by means other than the brakes.
2. Drain all reservoirs to 0 p.s.i. (0 kPa).— Caution: Compressor discharge line may still contain residual pressure.
3. Identify and disconnect the three air lines from the end cover and note the position of end cover ports relative to the vehicle.
4. Pull boot from the thermostat and heater cover and slide it onto the wire to expose the connection. Remove nut and disconnect electrical wire from the terminal. **Note:** Vehicles with insulated ground (2 wire) system will have two boots and two terminals to be disconnected. (See Figures 5 & 8.)
5. Loosen the 5/16" X 4-1/2" hex bolt securing the upper and lower mounting straps. Disengage the mounting bracket hook from the end cover (Refer to Figure 6.) **Note:** If the air dryer being serviced has a right angle bracket instead of a lower mounting strap and safety hook, proceed to step 6, otherwise proceed to step 7.
6. Remove, retain and mark the two 3/8" end cover cap screws, lock nuts and four special washers that retain the lower mounting bracket to the end cover, also mark these two holes of the end cover. (These bolts are longer than the other 6 bolts.)
7. Remove the air dryer from its mounting brackets on the vehicle.

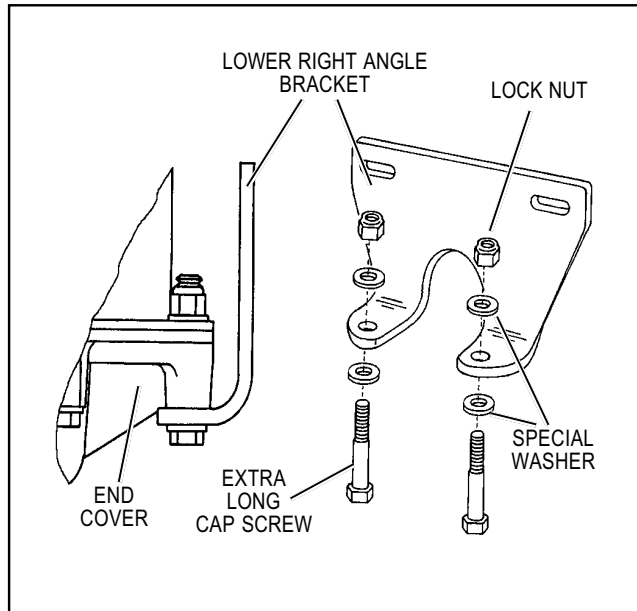


FIGURE 7 - LOWER BRACKET INSTALLATION

## DISASSEMBLY

The following disassembly and assembly procedure is presented for reference purposes and presupposes that a major rebuild of the air dryer is being undertaken. Several replacement parts and maintenance kits are available which do not require full disassembly. The instructions provided with these parts and kits should be followed in lieu of the instructions presented here. Refer to Figure 6 during disassembly.

**Caution:** While performing service on the air dryer, it is not recommended that a clamping device (vise, C-clamp, etc.) be used to hold any die cast aluminum component as damage may result. To hold the end cover, install a pipe nipple in the supply port and clamp the nipple into a vise.

1. Remove the remaining 3/8" lock nuts, special washers and cap screws from the flange of the air dryer and separate the end cover from the air dryer outer housing. Separate the desiccant cartridge and sealing plate from the end cover. Remove and discard the three sealing rings. One sealing ring is located in the groove on the sealing plate and the other two are in grooves in the end cover.
2. Remove 1/4" cap screw from the bottom of the purge valve and remove the diaphragm washer, exhaust diaphragm and purge valve. Discard the exhaust diaphragm and purge valve. Remove purge piston. **Note:** Hold piston down when removing cap screw due to spring tension.
3. Remove and discard the check valve assembly in the recess at the delivery port of the end cover.



4. Remove the safety valve from the end cover (only if it has been determined that it needs replacement during service checks).
5. To remove the thermostat see the appropriate section in this manual (only if it has been determined that it needs replacement during service checks).
6. Remove purge piston and spring from the top side of the cover.
7. Remove o-ring from the purge piston and discard the o-ring.
8. Remove the four 1/4" cap screws and lockwashers that secure the sealing plate to the desiccant cartridge. Separate the sealing plate from the desiccant cartridge and discard the sealing ring at the base of the cartridge.

### CLEANING & INSPECTION

1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all metal parts.
2. Inspect the interior and exterior of all metal parts that will be reused for severe corrosion, pitting and cracks. Superficial corrosion and or pitting on the exterior portion of the upper and lower body halves is acceptable.
3. Inspect the bores of both the end cover for deep scuffing or gouges.
4. Make certain that all purge valve housing and end cover passages are open and free of obstructions.
5. Inspect the pipe threads in the end cover. Make certain they are clean and free of thread sealant.

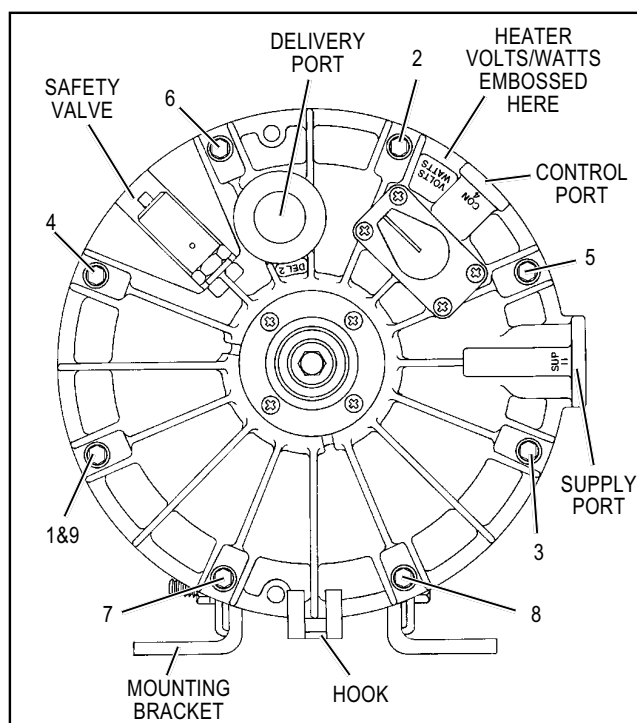


FIGURE 8- END COVER WITH TORQUE PATTERN

6. Inspect the purge valve housing bore and seat for excessive wear and scuffing.
7. Inspect the purge valve piston seat for excessive wear.
8. Inspect all air line fittings for corrosion. Clean all old thread sealant from the pipe threads.
9. All o-rings removed should be discarded and replaced with new o-rings provided in appropriate kit(s).

Any component exhibiting a condition described in step 1 to 8 should be replaced.

### ASSEMBLY

Prior to assembly, coat all o-rings, o-ring grooves, and bores with a generous amount of barium base lubricant.

**Important Note:** The single exception to prelubrication is the sealing ring between the desiccant cartridge and sealing plate. Refer to step number 8 for proper installation of this sealing ring. Refer to Figure 6 during assembly unless otherwise advised.

1. Place return spring into cavity in the center of top side of end cover.
2. Install the purge piston o-ring on the purge piston and place the purge piston inside the return spring installed in Step 2.
3. Turn end cover over on a flat clean surface (making sure purge piston and return spring remain in proper position.) Compress the return spring by pushing down on the end cover and align square shank of purge piston into mating hole in the end cover.
4. Place the diaphragm washer, diaphragm, and purge valve onto the 1/4" cap screw.
5. Install the 1/4" cap screw with parts on it into exhaust cover and torque to 60-80 inch pounds.
6. Install safety valve (if removed) and torque to 120-400 inch pounds, making sure that the exhaust hole is pointed downward when the dryer is installed.
7. Install thermostat (if removed). Refer to instructions pertaining to thermostat installation under section *Thermostat Assembly*.
8. Place sealing ring on bottom of desiccant cartridge. The desiccant cartridge, sealing ring and sealing plate should be wiped and free of lubricant prior to this assembly procedure. Attach cartridge to plate (smooth side of plate opposite cartridge) with four 1/4" socket head cap screws and lockwashers. Torque to 80-100 inch pounds.
9. Install the two sealing rings in the recesses of the end cover.
10. Install the check valve assembly into the end cover making sure the tang on the check valve assembly fits into the mating recess in the end cover.

11. Place desiccant cartridge and sealing plate assembly onto end cover. (Taking care not to displace sealing rings.) The large hole in the sealing plate must line up with the check valve and spiral pins in the sealing plate must enter corresponding holes in the end cover.
  12. Install the outer sealing ring on the sealing plate. Place the outer housing over the desiccant cartridge (lining up marks made on the outer housing and end cover prior to disassembly) and retain with eight 3/8" hex head bolts, special washers, and lock nuts. Refer to Figure 8 for torque pattern. Torque to 270-385 inch pounds. **Note:** If 3/8" bolts require replacement, insure that the replacement bolts are grade 5 minimum and the same length as the original bolts. Use of inferior bolts can compromise the integrity of the air dryer and lead to premature failure. Where a lower, right angle mounting bracket (instead of a lower mounting strap) is used; line up the marks made on the outer housing and end cover. Install the six (standard) 3/8" cap screws, lock nuts and twelve special washers. The two longer 3/8" cap screws will be used to secure the air dryer to the right angle mounting bracket.  
**Note:** If during the *Operation & Leakage Tests* it was determined that the thermostat was inoperative, use the following procedure for repair or replacement. It is not necessary to replace this unit each time the end cover is rebuilt. Use thermostat maintenance kit 102657 for single terminal application. For dual terminal application, use kit #103982. (See Figure 5.)
4. Install thermostat terminal (1) in cover (6).
  5. Install o-ring (5), washer (4), and nut (2). Torque nut to 20-30 inch pounds. Then install lockwasher (3) and nut (2) finger tight to allow for reconnection of electrical wire when reinstalled on vehicle.
  6. Install spacer (11) over thermostat (1).
  7. Install gasket (7) and thermostat cover (6) and secure thermostat cover to end cover (9) using screws (7) and lockwashers (8).
  8. Torque to 20-30 inch pounds.
  9. Test thermostat as follows:
    - A. At a temperature above 90 degrees Fahrenheit, check resistance between thermostat terminal (1) and end cover (9). Resistance should be 1,000 ohms or greater; if not, check for solder "path" short.
    - B. Chill entire end cover assembly to 40 degrees Fahrenheit or below and check resistance again. Resistance should be 2-4 ohms for a 12 volt, 60 watt end cover and 4-7 ohms for a 24 volt, 120 watt end cover.

#### **THERMOSTAT DISASSEMBLY (Refer to Figures 5 and 8)**

1. Remove nut (2), then lockwasher (3), plain washer (4), nut (2) and o-rings (5). Discard o-ring and retain other parts.
2. Remove and retain four Phillips head screws (7) and cover (6).
3. Remove and discard gasket (10).
4. Remove and retain spacer (11).
5. Cut uninsulated thermostat wire at Point B, remove and discard thermostat and terminal assembly (1).
6. Clean remaining wire attached to heater terminal.
7. Clean thermostat "pocket" in end cover (9).

#### **THERMOSTAT ASSEMBLY (Refer to Figure 5)**

1. Cut uninsulated lead of new thermostat (1) at Point A.
2. Install thermostat in end cover pocket and position uninsulated leads next to each other.
3. Using a soldering heat sink, clamp uninsulated leads at Point B and solder leads with straight rosin core solder. Do not use acid core solder as corrosion can result. Clean excess solder off end cover.

**AIR DRYER TROUBLESHOOTING CHART**

<b>SYMPTOMS</b>	<b>CAUSE</b>	<b>REMEDY</b>
1. Dryer is constantly "cycling" or purging.	A. Excessive system leakage.	A. Test for excessive system leakage. Allowable leakage: Pre-121 vehicles, single vehicles - 2 psi/minute. Tractor trailer - 3 psi/minute. 121 vehicles, single vehicle - 1 psi/minute per service reservoir. Tractor trailer - 3 psi/minute per service reservoir.
	B. Excessive leakage in fitting, hoses and tubing connected to the compressor, air dryer and first reservoir.	B. Using soap solution, test for leakage at fittings, drain valve (if any) and safety valve in first reservoir. Repair or replace as necessary.
	C. Defective check valve assembly in air dryer end cover.	C. Test check valve. Build system pressure to governor cut-out. Wait 2 minutes for completion of purge cycle. Using soap solution at exhaust of purge valve, leakage should not exceed a 1 inch bubble in five seconds. Replace as necessary.
	D. Defective governor.	D. Test governor for proper cut-in and cut-out pressures and excessive leakage in both positions.
	E. Leaking purge valve in air dryer end cover (control side).	E. Remove end cover. Apply 120 psi at control port. Soap both sides around purge valve to test for control piston leakage. Leakage should not exceed a 1 inch bubble in less than five seconds.
	F. Compressor unloader mechanism leaking excessively.	F. Remove air strainer or fitting from compressor inlet cavity. With compressor <b>unloaded</b> , check for unloader piston leakage. <b>Slight</b> leakage permissible.
	G. Holset "E" type compressor.	G. Test Air Dryer system using Product Bulletin.
	H. Rapid cycling of the governor due to air starvation at the RES port of the governor.	H. With gauge installed at RES port of governor, pressure should not drop below "Cut-In" pressure at the onset of the compressor "Unloaded" cycle. If pressure drops, check for "kinks" or restrictions in line connected to RES port. Line connected to RES port on governor must be same diameter, or preferably larger than, lines connected to UNL port(s) on governor.

## AIR DRYER TROUBLESHOOTING CHART (Continued)

SYMPTOMS	CAUSE	REMEDY
2. Water in vehicle reservoir.	A. Desiccant requires replacement - excessive contaminants in desiccant cartridge assembly.	A. Replace desiccant cartridge.
	B. Improper discharge line length or improper line material.	B. Refer to section entitled <i>Connecting the Air Lines</i> and check discharge line size and length.
	C. Air system charged from outside air source (outside air not passing through air dryer).	C. If system must have outside air fill provision, outside air should pass through air dryer. <b>This practice should be minimized.</b>
	D. Air dryer not purging (see Symptom #5).	D. See cause and remedy for Symptom #5.
	E. Purge (air exhaust) time insufficient due to excessive system leakage (see causes for Symptom #1).	E. Check causes and remedies for Symptom #1.
	F. Excessive air usage - Air dryer/vehicle application requires additional purge volume. Air dryer not compatible with vehicle air system requirement (Improper air dryer/ vehicle application).	F. Charge Cycle Time - The air dryer is designed to provide clean, dry air for the brake system. When a vehicle's air system is used to operate non-brake air accessories it is necessary to determine that during normal, daily operation the compressor should recover from governor "cut-in" to governor "cut-out" (usually 100 psi to 120 psi) in 90 seconds or less at engine RPM's commensurate with the vehicle vocation. If the recovery time consistently exceeds this limit, it may be necessary to "bypass" the air accessory responsible for the high air usage. An example of where a by-pass system would be required is when the compressor is used to pressurize a tank trailer for purposes of off-loading product. Consult your local authorized parts outlet or sales representative for additional information.  Purge Cycle Time - During normal vehicle operation, the air compressor <b>must remain unloaded for a minimum of 20 seconds for the standard air dryer or 30 seconds for the Extended Purge Model</b> . These minimum purge times are required to ensure complete regeneration of the desiccant material. If the purge time is consistently less than the minimum, an accessory by-pass system must be installed. Consult your local authorized parts outlet or sales representative for additional information.

**AIR DRYER TROUBLESHOOTING CHART (Continued)**

<b>SYMPTOMS</b>	<b>CAUSE</b>	<b>REMEDY</b>
2. Water in vehicle reservoir (continued).		European Air Brake Systems - Brake systems that incorporate compressors without integral unloading mechanisms and/or utilize a compressor discharge line unloader valve have special air dryer installation requirements. Consult your local authorized parts outlet or sales representative for additional information.  Air Compressor Size - Although the air dryer can be used in conjunction with larger compressors, it was designed primarily for units rated for up to 17 CFM. It is recommended that when using the air dryer with a compressor which has a rated displacement exceeding 17 CFM that an authorized parts outlet or marketing representative be contacted for assistance.
	G. Air by-passes desiccant cartridge assembly.	G. Replace desiccant cartridge/end cover/o-ring. Check to make sure desiccant cartridge assembly is properly installed.
	H. Purge time is significantly less than minimum allowable.	H. Replace desiccant cartridge sealing plate sealing ring.  Check to make sure desiccant cartridge assembly is properly installed.  Replace desiccant cartridge assembly.
3. Safety valve on air dryer "popping off" or exhausting air.	A. Desiccant cartridge plugged.	A. Check compressor for excessive oil passing and/or correct compressor installation. Repair or replace as necessary. Rebuild or replace cartridge.
	B. Defective discharge check valve in end cover of the air dryer.	B. Test to determine if air is passing through check valve. Repair or replace.
	C. Defective fittings, hose or tubing between air dryer and first reservoir.	C. Check to determine if air is reaching first reservoir. Inspect for kinked tubing or hose. Check for undrilled or restricted hose or tubing fittings.
	D. Excessive pressure pulsations from compressor. (Typical single cylinder type).	D. Increase volume in discharge line. Added length or size of line, or add a ping tank.
	E. Safety valve setting lower than the maximum system pressure.	E. Reduce system pressure or obtain a higher setting safety valve.

## AIR DRYER TROUBLESHOOTING CHART (Continued)

SYMPTOMS	CAUSE	REMEDY
4. Constant exhaust of air at air dryer purge valve exhaust <b>or</b> unable to build system pressure. (Charge mode.)	A. Air dryer purge valve leaking excessively.	A. With compressor loaded, apply soap solution on purge valve exhaust, to test for excessive leakage. Repair purge valve as necessary.
	B. Defective governor.	B. Check governor for proper "cut-in", "cut-out" pressure and excessive leakage in both positions. Repair or replace as necessary.
	C. Purge control line connected to reservoir or exhaust port of governor.	C. Purge control line must be connected to unloader port of governor.
	D. Purge valve frozen open - faulty heater and thermostat, wiring, blown fuse.	D. Test heater and thermostat as described in Step 7 of <i>Preventative Maintenance</i> Section.
	E. Inlet and outlet air connections reversed.	E. Compressor discharge to inlet port. Reconnect lines properly.
	F. Check valve between air dryer and first reservoir defective.	F. Test check valve for proper operation (see Symptom #3, Remedy B).
	G. Kinked or blocked (plugged) discharge line.	G. Check to determine if air passes through discharge line. Check for kinks, bends, excessive carbon deposits.
	H. Excessive bends in discharge line (water collects and freezes).	H. Discharge line should be constantly sloping from compressor to air dryer with as few bends as possible.
5. Air dryer does not purge or exhaust air.	A. Broken, kinked, frozen, plugged or disconnected purge control line.	A. Test to determine air flows through purge control line when compressor unloaded. Check for undrilled fittings. (See Symptom #4, Remedy C.)
	B. Faulty air dryer purge valve.	B. After determining air reaches purge valve (Remedy A above), repair purge valve.
	C. See Causes, B, E, F, G, H, for Symptom #4.	C. Refer to Remedies B, E, F, G, H, for Symptom #4.
6. Desiccant material being expelled from air dryer purge valve exhaust (may look like whitish liquid or paste or small beads.)  - OR -  Unsatisfactory desiccant life.	A. This symptom is almost always accompanied by one or more of Symptoms 1, 2, 3, 4 and 5. See related causes for these Symptoms above.	A. See Causes and Remedies for Symptoms 1, 2, 3, 4 and 5.
	B. Air dryer not securely mounted. (Excessive vibration.)	B. Vibration should be held to minimum. Add bracket supports or change air dryer mounting location if necessary.

**AIR DRYER TROUBLESHOOTING CHART (Continued)**

<b>SYMPTOMS</b>	<b>CAUSE</b>	<b>REMEDY</b>
6. (Continued.)	C. Defective cloth covered perforated plate in air dryer desiccant cartridge or improperly rebuilt desiccant cartridge.	C. Replace desiccant cartridge assembly.
	D. Compressor passing excessive oil.	D. Check for proper compressor installation; if symptoms persist, replace compressor.
	E. Faulty heater and thermostat, wiring, fuse not allowing purge. (Cold weather operation only.)	E. Refer to Remedy D under Symptom #4.
7. "Pinging" noise excessive during compressor loaded cycle.	A. Single cylinder compressor with high pulse cycles.	A. A slight "pinging" sound may be heard during system build up when a single cylinder compressor is used. If this sound is deemed objectionable, it can be reduced substantially by increasing the discharge line volume.  This can be accomplished by adding an additional four feet of discharge line or adding a 90 cubic inch reservoir between the compressor and the air dryer.
8. Constant seepage of air at air dryer purge valve exhaust (non-charging mode.)	A. Defective check valve assembly in air dryer end cover.	A. Refer to Remedy C, Symptom #1.
9. The air dryer purge piston cycles rapidly in the compressor unloaded (noncompressing) mode.	A. Compressor fails to "unload".	A. Faulty governor installation; no air line from governor to compressor or line is "kinked" or restricted. Install or repair air line.