

## AD-1 AND AD-2 AIR DRYERS

\*Formerly SD-08-2

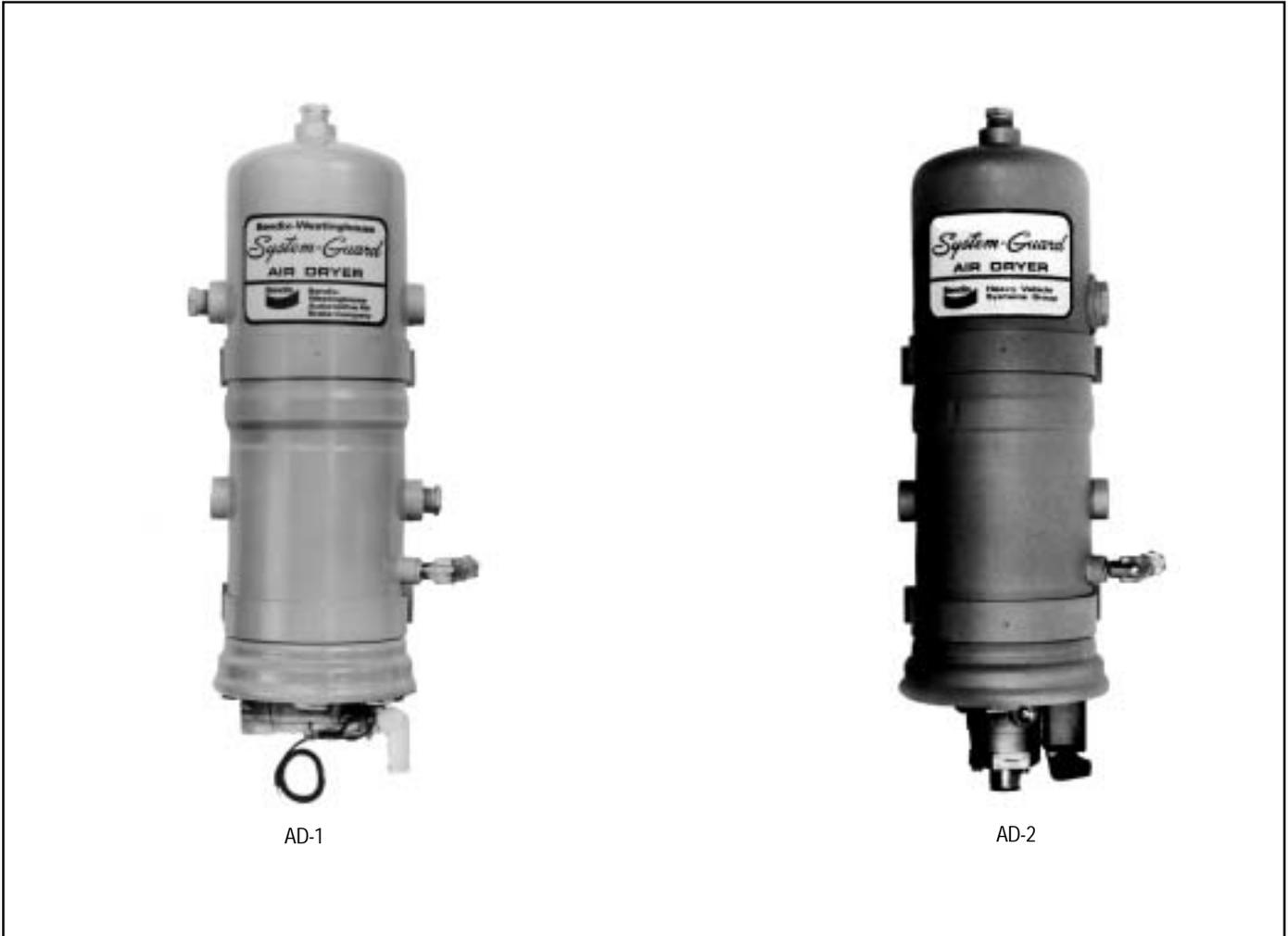


FIGURE 1

The air dryer collects and removes moisture and contaminants before the air reaches the first reservoir. It is distinctly different than a reservoir drain valve or aftercooler in that it provides “dry air” for the air brake system. The daily draining of the system’s reservoirs is no longer necessary, thus reducing maintenance considerably when compared to an air brake system without an Air Dryer.

In a system without an Air Dryer, the life of air brake components is substantially reduced because of contact with water and oil in the system and since the Air Dryer removes water and oil in vapor form, life of the component devices is substantially increased when the Air Dryer is used.

The Air Dryer can be used on most highway vehicles where normal compressor loaded time is 90 seconds or less and unloaded time is 30 seconds or more. If the compressor remains loaded for long periods of time, such as on a transit bus, certain changes in the purge volume of the dryer must be made. For more information regarding increase of the purge volume, contact our Engineering Department, in Elyria, Ohio.

The Air Dryer is installed in the discharge line between the compressor and the first reservoir. The unit must be mounted vertically and mounting brackets are provided and can be adjusted to meet installation requirements.

The housing assembly consists of two cylindrical steel stampings welded together. For piping convenience, two inlet ports, one reservoir port and one purge volume port are provided in the AD-2 Air Dryer. The side outlet port of the AD-2 incorporates an integral single check valve with the top port used for the addition of purge volume. (Refer to Figure 1)

A Safety Valve mounted in the housing assembly protects against excessive pressure build-up within the housing.

The desiccant sealing plate assembly is located mid-way in the housing assembly and houses a replaceable ball-type single check. Also located in the plate assembly is the purge orifice.

The desiccant cartridge and aluminum oil separator filter are removable and comprise a complete serviceable unit.

The desiccant beads, which are referred to as the “drying bed”, are a drying substance that has the unique property of exposing a tremendous surface area in proportion to its bulk. One pound of the desiccant beads has about two million square feet of adsorbive area made up of a large number of submicroscopic cavities in each bead. Each desiccant bead adsorbs or collects moisture.

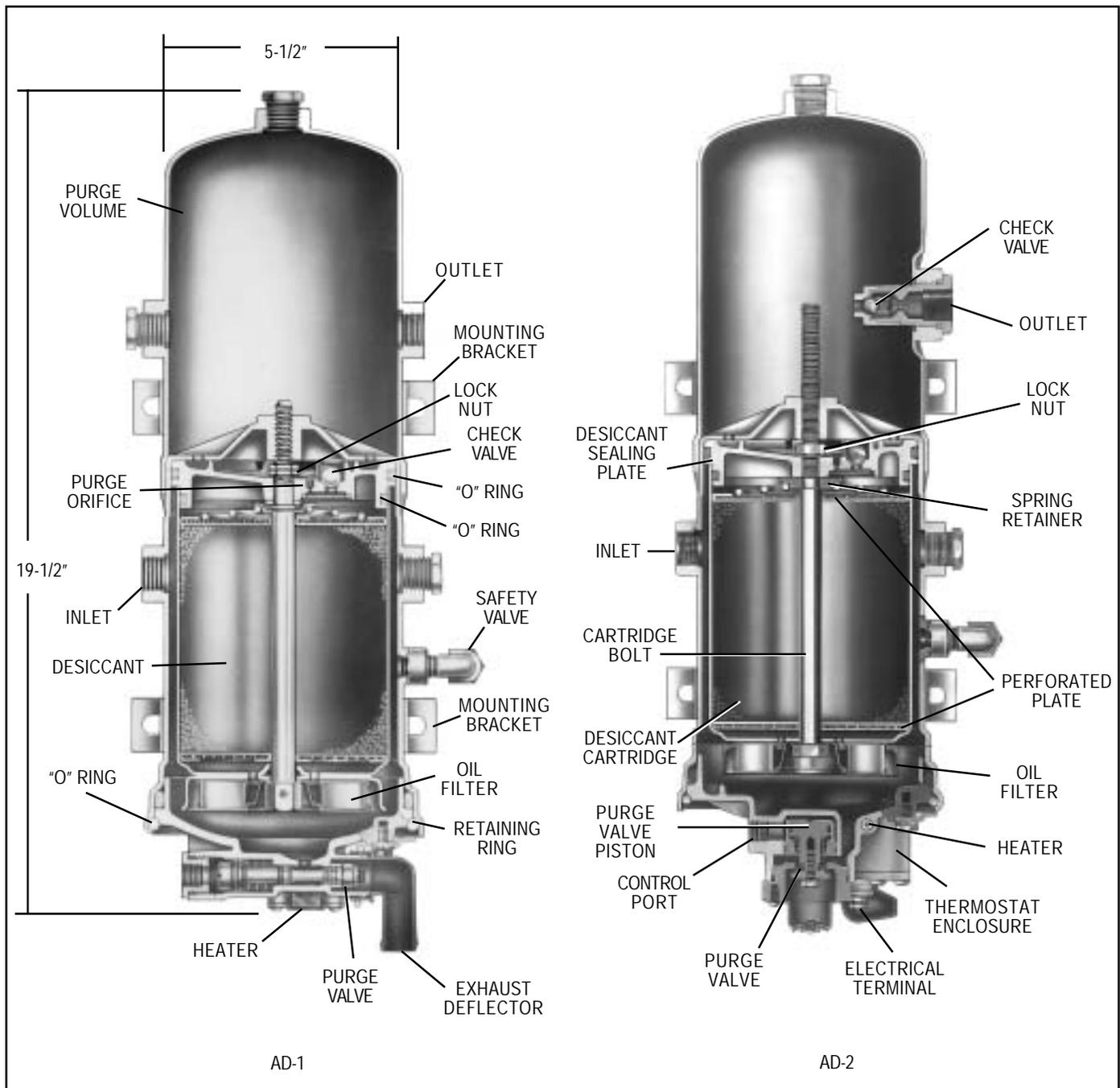


FIGURE 2 - SECTIONAL VIEWS

The desiccant beads are held in place by steel perforated plates and filter cloths. The top plate is held in place by a spring, and the bottom plate rests on a shoulder approximately 1/8" from the bottom of cartridge housing.

The end cover assembly is retained by a lock ring, cap screws and retainers and houses the purge valve and heater assembly if so equipped.

The heater and thermostat assembly prevent freeze-up in the purge drain valve when the dryer is used in severe winter conditions. The heater and thermostat assembly is standard in the AD-2 and was optional equipment for the AD-1. The 12 volt, 60 watt and 24 volt, 60 or 120 watt DC heater and thermostat assembly has an operating range between 45°F and 85°F.

NOTE: The heater and thermostat assembly provided with the AD-2 has a 3/16" diameter threaded electrical terminal protected by a boot. The AD-1 assembly incorporates a #16 gauge lead wire. Both types are serviceable. The heater and thermostat assembly should be connected to the "on" position of the engine control or ignition switch and protected with the proper size fuse. For details on installation, please refer to the "Installation" section.

## OPERATION

The operation of the Air Dryer can best be described by separating the operation into two cycles; the charge cycle and the purge cycle.

Charge Cycle (Figure 3) Compressor in Compressing Cycle - With the compressor in its "loaded" or compressing cycle, air from the compressor enters the Air Dryer through the discharge line. When the air, along with the water and contaminants, enter the Air Dryer, the velocity or speed of the air reduces substantially and much of the entrained liquid drops to the bottom or sump of the Air Dryer. The initial air flow is toward the bottom of the dryer, but air flow direction changes 180° at the bottom of the Air Dryer, dropping some water and oil.

The air now passes through the oil separator filter which removes oil and foreign material but does not remove water vapor. At this point, the air remains saturated with water.

The filtered air and vapors penetrate the desiccant drying bed and the adsorption process begins. Water vapor is removed from the air by the desiccant.

The unsaturated "dry" air passes through the ball check valve and purge orifice into the purge volume. From the purge volume air flows through an outlet check valve, and into the first reservoir.

NOTE: The AD-1 Air Dryer does not incorporate an integral outlet check valve. The single check valve in an AD-1 installation would be located in the line between the AD-1 outlet port and the first reservoir.

Purge Cycle; (Figure 4) When desired system pressure is reached, the governor cuts out, pressurizing the unloader cavity of the compressor which unloads the compressor (non-compressing cycle). The line connecting the governor unloader port to the end cover purge valve port (bottom of the Air Dryer) is also pressurized, opening the exhaust of the purge valve to atmosphere. With the exhaust of the purge valve open, contaminants in the discharge line and dryer sump are purged, or forced past the open exhaust out to atmosphere.

The reverse air flows across the desiccant and starts the removal process of moisture from the desiccant surface. Dry air flowing from the purge volume through the purge orifice and across the drying bed further dries the desiccant.

The combination of these reverse flows strips the water vapor from the desiccant (drying bed). This normally takes between 15- 30 seconds.

The desiccant becomes activated from this cycle and is now ready for another charge cycle, which occurs when the compressor returns to the compressing cycle. It is for this reason the air dryer must be purged for 30 seconds, after receiving moisture saturated air for a maximum of 90 seconds from a 12 CFM compressor.

## 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.

## PREVENTIVE MAINTENANCE AND CHECKING SERVICEABILITY

**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.

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:

AD-2 OPERATIONAL CHARGE CYCLE

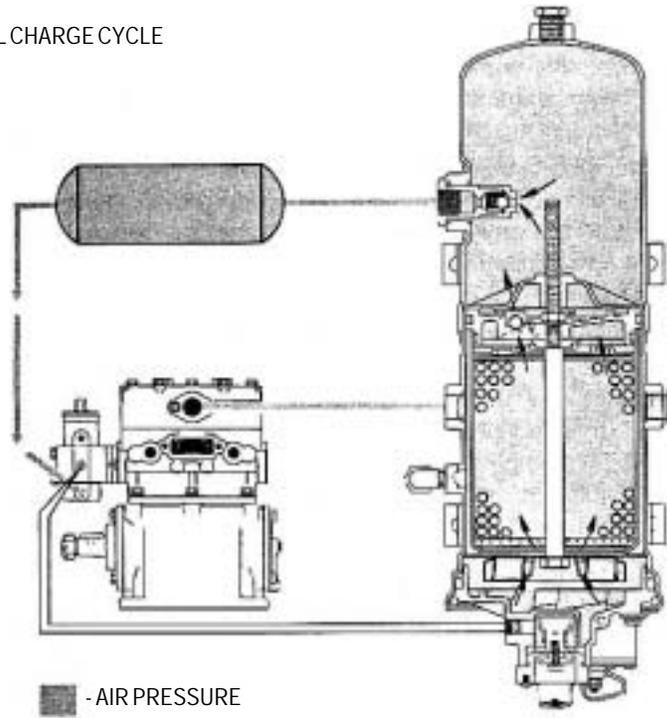


FIGURE 3

AD-2 OPERATIONAL PURGE CYCLE

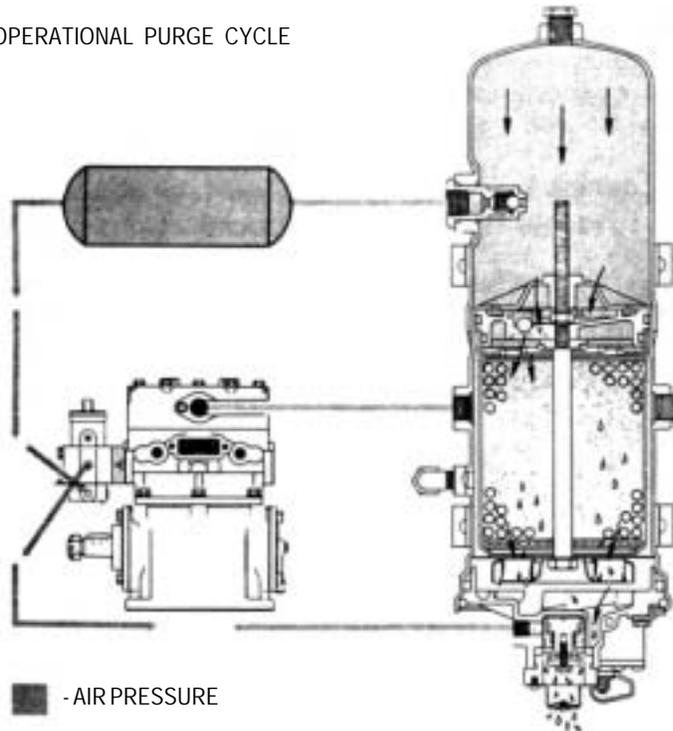


FIGURE 4

- 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 "Installation" section.
- E. In areas where more than a 30° 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 also that 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 often function adequately.

- 2. Check mounting bolts for tightness.
- 3. Check the operation of the integral single check valve in the AD-2 or the "in line" check valve used with the AD-1. Build the air system to governor cut-out and observe the test air gauge installed in the #1 reservoir. A rapid loss of pressure could indicate a failed check valve. This can



FIGURE 5

be confirmed by checking at the purge valve exhaust. (Note: Purge valve will be open when governor cut-out pressure is reached. Allow two minutes for purge cycle before testing the check valve.)

- 4. Check for excessive leakage at the purge valve by coating the exhaust with a soap solution while the compressor is loaded. (compressing air)
- 5. 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.
- 6. Check all lines and fittings leading to and from the air dryer for leakage and integrity.
- 7. 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 control "on", check for power at the dryer's electrical terminal (see Figure 16) with a voltmeter or test light. If there is no voltage, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness.

**B. Thermostat and Heater**

- 1. Turn off the ignition switch and cool the end cover assembly to below 40°F. With an ohmmeter check the resistance between the electrical terminal and the aluminum of the end cover (see Figure 16). This resistance should be 2.0 - 4.0 ohms for a 12 volt end cover, 8.1 - 13 ohms for a 24 volt, 60 watt end cover, and 4.0 - 7.0 ohms for a 24 volt, 120 watt end cover.

- 2. Warm the end cover assembly to over 90°F. and check the resistance as above. This resistance should exceed 1,000 ohms.

If these resistances are within the limits, the thermostat and heater are operating properly.

If these resistances are outside the limits, proceed to Step C to determine the cause.

**C. Heater Element**

With the ignition or engine control switch "off", remove the thermostat cover (see Figure 17). With an ohmmeter check the resistance between the aluminum of the end cover and the heater post (see Figure 17). For a 12 volt end cover, the resistance should be 2.0 - 2.8 ohms. For a 24 volt, 60 watt end cover, 8.1 - 11.1 ohms, and for a 24 volt, 120 watt end cover, 4.0 - 4.6 ohms. If the heater resistance is outside these ranges, a new or remanufactured end cover should be installed, since the heater element cannot be serviced.

If the heater resistance is within the limits the thermostat should be replaced (Kit Number 102637) or a new or remanufactured end cover installed.

**D. Reassembly**

Reinstall the thermostat cover according to Figure 17. Take special care to assure the rubber spacer and the gasket are correctly installed, to assure proper operation.

8. Every 7200 hours; 200,000 miles or every 24 months, change the desiccant cartridge.

NOTE: The desiccant change interval may vary from vehicle to vehicle. Although typical desiccant cartridge life is two years, many will perform adequately for three to four years. In order to take maximum advantage of desiccant life and assure that replacement occurs only when necessary, it is important that Serviceability Checks 1 - 7 be performed.

### **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. Drain all reservoirs completely.
3. Stop the engine when working around the vehicle.
4. 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.
5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that removes all electrical power from the vehicle.
6. 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.
7. 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.
8. Never exceed recommended pressures and always wear safety glasses.
9. 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.
10. Use only genuine Bendix 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.

11. 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.

12. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

## **REPLACING OR REBUILDING THE AD-1 AND AD-2 AIR DRYER**

### **GENERAL**

If, after completing the routine serviceability tests, it has been determined that one or more components of the air dryer requires replacement or maintenance, refer to page 13 to ascertain the appropriate kit(s) needed. When rebuilding or replacing components of the air dryer use only genuine Bendix replacement parts or kits.

### **REMOVAL OF DESICCANT CARTRIDGE AD-1 & AD-2**

#### **CAUTION!**

1. Loosen the air line to the control port of air dryer and allow the trapped air to escape to atmosphere. After the air escapes, remove the control line from the air dryer.
2. Loosen the delivery line from the delivery port or outlet of the air dryer. After the pressure drops, remove the delivery line. Loosen the delivery check valve from this port to relieve any trapped air above the desiccant plate assembly. If the AD-1 air dryer has an external check valve at the delivery port loosen it to relieve air pressure.
3. Disconnect the heater wire.
4. Remove any exhaust silencers or the exhaust check valve cover from the base of the air dryer. Using a hex socket and wrench, loosen the purge valve assembly and allow any trapped air to escape. Slowly unscrew the purge valve and remove it.
5. Check all ports to insure that air is not trapped in the air dryer by powdered desiccant material.

### **Air Dryer End Cover Removal Procedure**

**Warning** - The AD-2 Air Dryer cartridge contains a high spring load. When replacing the AD-2 Air Dryer cartridge or performing any maintenance requiring end cover removal follow the procedure outlined below.

#### **End Cover Removal**

1. Loosen the three cap screws on the end cover and turn the retaining clamps aside (cap screws may be left finger tight).

2. Locate the notch in the air dryer shell. While pushing the end cover up into the dryer, insert the blade of a screwdriver in the notch and slowly pry out the retaining ring. If the cartridge bolt has loosened the cartridge spring may exert a force on the end cover retaining ring making removal of the retaining ring and end cover difficult. This spring force will prohibit the end cover moving up into the dryer shell when pushed up. **Warning:** This same force can also cause the end cover to come out of the air dryer shell unexpectedly during the removal process. Exercise extreme caution to prevent bodily injury.
3. Do not stand or lay directly under the end cover while servicing. Assure adequate clearance between the end cover and other surfaces to prevent hand injury if the end cover dislodges rapidly during removal. **NOTE: BE CERTAIN THE DESICCANT SEALING PLATE ASSEMBLY COMES OUT WITH THE CARTRIDGE.**

**CAUTION:** Before attempting to remove the desiccant sealing plate, measure the cartridge bolt from the top of the desiccant plate lock nut to the end of the bolt threads. If that measurement is approximately 3-3/16 inches, proceed with the disassembly.

If the bolt measures approximately 1-9/16 inches, disassemble using **CAUTION**. Approximately **75 pounds of spring force** will remain against the desiccant plate when the lock nut reaches the end of the bolt thread and is removed.

### REMOVING AND REBUILDING THE AD-1 AND AD-2 DESICCANT SEALING PLATE

Before the desiccant cartridge can be replaced or rebuilt the desiccant sealing plate must be removed. It is recommended that all non-metallic parts be replaced when the plate is removed. In the past, three methods have been employed, to secure the desiccant sealing plate to the desiccant

cartridge: a Tru Arc retaining ring, two special thin nuts, and the latest method, a single hex lock nut. Removing the securing device will permit the desiccant plate to be separated from the desiccant cartridge. After removing the desiccant cartridge:

1. Remove the two O-rings from the desiccant plate and discard them.
2. Remove the ball check valve retaining clip and remove and discard the rubber ball valve.
3. Clean the desiccant plate thoroughly using a quality commercial solvent, making sure the purge orifice and check valve seat are clean.
4. Install a new ball check valve and replace the retaining clip and screw (Figure 5).
5. Thoroughly lubricate the two new O-rings and install them in their respective grooves in the purge plate (Figure 6).
6. Set the desiccant sealing plate aside for reinstallation on the desiccant cartridge.



FIGURE 6 - DESICCANT SEALING PLATE



FIGURE 7 - REPLACEMENT DESICCANT CARTRIDGE

## REINSTALLING THE DESICCANT CARTRIDGE AD-1 AND AD-2

If the desiccant cartridge is to be replaced as an assembly rather than rebuilt (see desiccant cartridge rebuilding instructions), the cartridge removed from the air dryer

The current revision replacement desiccant cartridge is shown in Figure 7. All prior revisions of the cartridge will interchange with no modifications to either air dryer.

Prior to installing the new replacement cartridge in the air dryer, the following steps must be followed:

1. Carefully remove the lock nut from the cartridge bolt using an 11/16 in. open end or box wrench. **IMPORTANT:** Care **must** be taken not to allow the cartridge bolt to slip out of the cartridge when the lock nut is removed. Loss of desiccant material will occur should this happen.
2. Install the previously rebuilt desiccant sealing plate on the cartridge bolt so that the ball check retaining clip remains visible (see Figure 15-1 & 15-2).
3. While holding the cartridge bolt reinstall the lock nut on the cartridge bolt. **IMPORTANT:** Before tightening the lock nut down make certain that the shoulder (the unthreaded portion) of the cartridge bolt extends slightly above the perforated desiccant plate (see Figure 12).
4. By tightening the lock nut, draw the desiccant sealing plate down into the desiccant cartridge until the shoulder of the desiccant sealing plate is against the cartridge shell. (See Figure 15)

## REBUILDING THE DESICCANT CARTRIDGE

**IMPORTANT:** Only the current revision desiccant cartridges (See Figure 7) can be rebuilt. Current revision desiccant cartridges are identified positively by the Bendix trademark BW stamped in the hex head of the cartridge bolt, and by the letters and number AD-2 displayed on the bottom face of the oil filter. **If an old revision desiccant cartridge is**

removed from the air dryer, it should be replaced with a complete current revision desiccant cartridge.

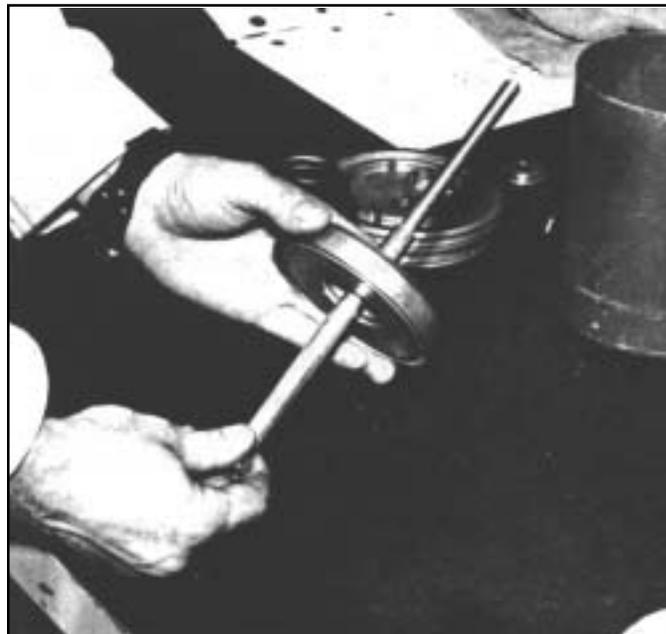


FIGURE 9

## DISASSEMBLY OF DESICCANT CARTRIDGE

1. Carefully remove and discard the lock nut on top of the desiccant sealing plate. (The plate is spring loaded; see "Caution" note in "Removal of Desiccant Cartridge" section.)
2. Remove the desiccant sealing plate and rebuild it as outlined under the Removing and Rebuilding the Desiccant Sealing Plate section of this manual.



FIGURE 8 - ASSEMBLY OF DESICCANT CARTRIDGE



FIGURE 10

- Remove and retain the spring, spring seat, bolt, and cartridge shell. Discard the oil separator filter, the two perforated plates and desiccant material.



FIGURE 11

- Insert one of the perforated plates into the cartridge, **cloth side up**, and tap it firmly to the bottom. (Cloth always faces desiccant material.) (See Figure 8)
- Slide oil separator filter over the cartridge bolt with the gasket surface next to the shell. (See Figure 9)
- Install the bolt with the oil separator into the bottom of the shell and through center hole of the perforated plate in the bottom of the shell. (See Figure 10)
- Pour the **entire package** of desiccant material into the shell, making **sure none is lost**. Handle carefully so that the bolt does not fall out. (See Figure 11)
- Level the desiccant material and install second perforated plate **cloth side down**. (Make sure the shoulder of the bolt is centered, and extends slightly above the top of the perforated plate.) (See Figure 12) NOTE: If the shoulder of the bolt does not extend above the perforated plate tap the side of the desiccant container.
- Set the conical spring on top of the perforated plate (large diameter down - small diameter up.)
- Place the spring retainer on top of the spring (See Figure 13)
- Install the previously rebuilt desiccant sealing plate on the cartridge bolt so that the ball check retaining clip is in view.
- Using the lock nut draw the assembly together to approximately half of the spring's free height. While slowly turning the cartridge, tap the side of the shell with a

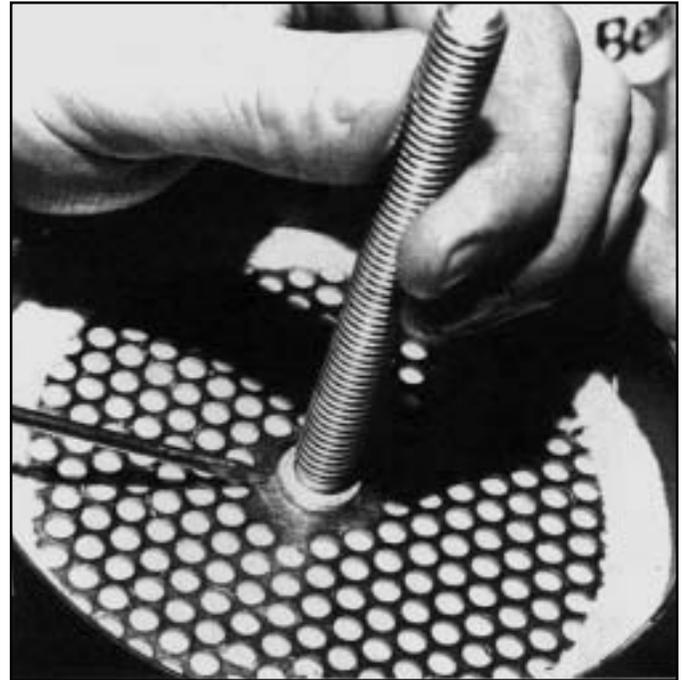


FIGURE 12

plastic mallet (See Figure 14). This allows the desiccant material to settle properly into place. Continue to tighten the nut, making sure all items are properly aligned. Tighten nut firmly using an 11/16" socket or box wrench. (See Figures 15-1, 15-2)



FIGURE 13

## DISASSEMBLY

### REBUILDING THE AD-1 END COVER ASSEMBLY

To remove the end cover assembly from the air dryer follow steps 1-6 under the section of this manual entitled Removal of Desiccant Cartridge AD-1 and AD-2. Before rebuilding the end cover, clean the exterior thoroughly using a quality commercial solvent.

1. Remove and discard the large O-ring around the end cover.
2. Remove the exhaust elbow and clamp.
3. Remove the cap nut and discard the cap nut O-ring.
4. Place the handle of a large screwdriver in a vise and secure it.
5. Place the slot in the plunger (cap nut end) over the blade of the screwdriver, hold it securely and remove the nut from the plunger using a 1/2" socket wrench.
6. Remove the plunger, spring and valve. Discard the valve.
7. Clean and inspect the plunger bore and the valve seat.
8. Remove and discard the three O-rings from the plunger. Clean the plunger.

NOTE: If during the serviceability checks it was determined that the heater and thermostat were defective, use the following procedure. It is not necessary to replace this assembly each time the purge valve is rebuilt.



FIGURE 14

9. Remove the two screws that secure the shield or thermostat retaining clip to the end cover.
10. Remove the shield or clip and the thermostat and inspect the bore for corrosion.



FIGURE 15-1



FIGURE 15-2

11. Remove the square cut seal ring at the bottom of the thermostat bore.
12. Remove the screw, retaining clip, O-ring, and the heater element. Inspect the bore for corrosion and if necessary, clean it.

### ASSEMBLY

13. Install the heater element, securing it in the end cover with the retainer clip and screw.
14. Install the square cut seal ring in the thermostat bore.

15. Install the thermostat metal side down in the end cover bore and secure it in place using the retaining clip or shield and the two screws.
16. Lubricate and install the O-rings on the plunger and cap nut.
17. Lubricate the plunger bore and install the spring and plunger (through the cap nut end).
18. Install the valve on the plunger, making certain the chamfered end of the valve is in contact with the metal seat of the body.
19. Using the screwdriver held in the vise, as described in Steps 4 & 5, compress the plunger into the bore while installing and tightening the nut.
20. Install the cap nut and tighten it.
21. Lubricate and install the large diameter O-ring around the end cover assembly.

## REBUILDING THE AD-2 END COVER

### ASSEMBLY

To remove the end cover assembly from the air dryer follow steps 1-6 under the section of this manual entitled Removal of Desiccant Cartridge AD-1 and AD-2. Before rebuilding the end cover, clean the exterior thoroughly using a quality commercial solvent.

### DISASSEMBLY

1. Remove and discard the large O-ring around the end cover assembly.
2. Remove the single #6-32 screw securing the exhaust diaphragm and separate the diaphragm, washer and screw. Discard the diaphragm.
3. Remove the three #6-32 screws securing the exhaust cover and remove the exhaust cover.
4. Remove the purge valve assembly, the large hex cap nut, from the end cover and discard both O-rings around the cap nut.
5. Using a 7/16" socket wrench and a large screwdriver, remove the 1/4"-20 hex head cap screw which holds the assembly together.
6. Separate cap screw, purge valve, purge valve piston and the piston return spring.
7. Discard the piston O-ring, the purge valve, and the piston return spring.
8. Wash all remaining parts in a commercial solvent, making sure all surfaces, bores, ports, and passages are clean and dry before assembly.

NOTE: If during the serviceability checks it was determined that the thermostat was defective, use the following procedure. It is not necessary to replace this unit each

time the end cover is rebuilt. Use thermostat kit. (See Figure 17)

9. Remove nut(2), then lockwasher(3), plain washer(4) and O-ring(5). Discard O-ring and retain other parts.
10. Remove and retain four Phillips head screws(7) and cover(6).
11. Remove and discard gasket(10).
12. Remove and retain spacer(11).
13. Cut uninsulated thermostat wire at Point B. (Figure 17), remove and discard thermostat and terminal assembly(1).
14. Clean remaining wire attached to heater terminal.
15. Clean thermostat "pocket" in end cover(9).

### ASSEMBLY

16. Cut uninsulated lead of new thermostat(1) at Point A (Figure 17).
17. Install thermostat in end cover "pocket" and position uninsulated leads next to each other.
18. Using a soldering heat sink, clamp uninsula-leads at Point B and solder leads with straight rosin core solder. DO NOT USE ACID CORE SOLDER. Clean excess solder off end cover.
19. Install thermostat terminal(1) in cover(6).
20. Install O-ring(5), washer(4), lockwasher(3) and nut(2). Torque nut to 20-30 inch pounds.
21. Install spacer(11) over thermostat(1).
22. Install gasket(7) and cover(6) and secure cover to end cover(9) using screws(7) and lockwashers(8).
23. Torque to 30-40 inch pounds.
24. Test thermostat as follows:
  - A. At a temperature above 85°F. check resistance between thermostat terminal(1) and end cover(9). Resistance should be 200,000 ohms or greater; if not, check for solder "path" short.
  - B. Chill entire end cover assembly to 35°F. or below and check resistance again. Resistance should be 2-15 ohms.
25. Lubricate the piston O-ring and install it on the piston.
26. Lubricate the piston bore.
27. Install the purge piston return spring and piston.
28. Install the purge valve in the large cap nut so that the rubber portion rests on the metal seat of the cap nut.
29. Secure the valve to the piston using the 1/4"-20 cap screw and lockwasher and torque to 50 inch pounds.
30. Lubricate and install the two cap nut O-rings.
31. Lubricate the cap nut threads and the cap nut bore of the end cover and install the cap nut, torquing it to 180-250 inch pounds.

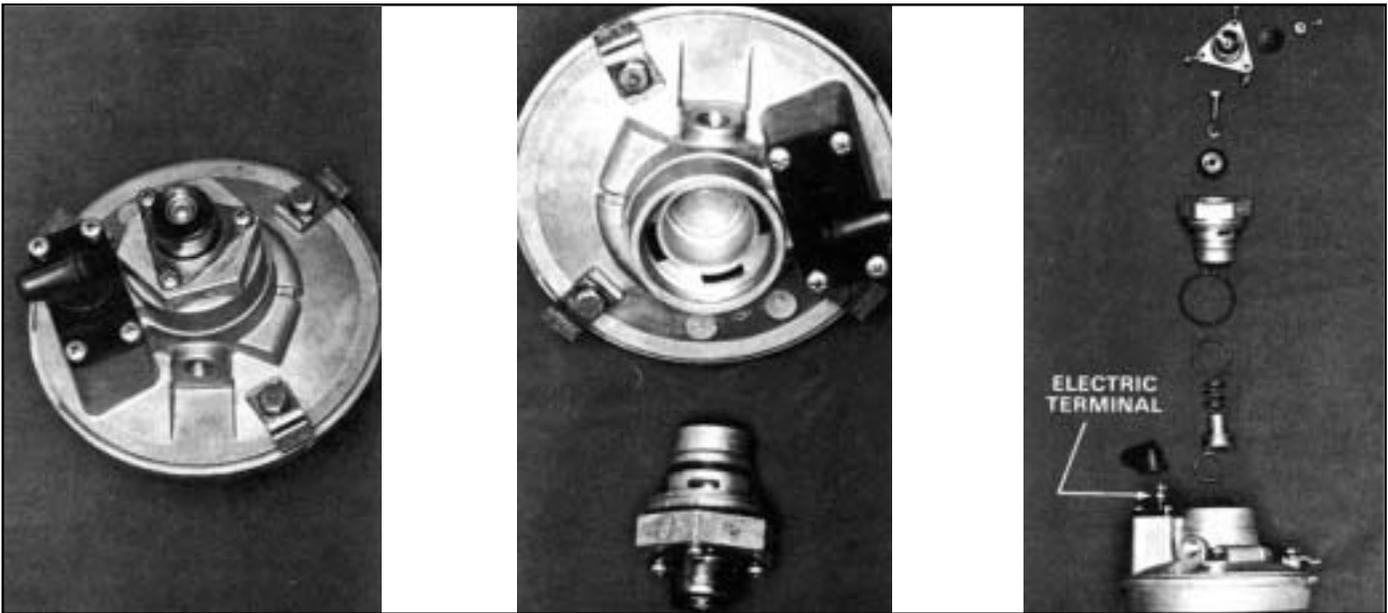


FIGURE 16 - AD-2 END COVER

32. Secure the exhaust diaphragm to the exhaust cover using the #6-32 Phillips head screw and diaphragm washer.
33. Secure the exhaust cover to the purge valve hex head cap nut using the #6-32 Phillips head screws.
34. Lubricate and install the large diameter O-ring around the end cover assembly.

### REBUILDING THE AD-2 OUTLET PORT CHECK VALVE

1. Make certain the vehicle is safely parked. Block the wheels if necessary.
2. Locate and remove the line connected to the outlet port of the AD-2.
3. Remove the check valve from the outlet port. (See Figure 2)
4. Remove the rubber sealing ring from the external threaded portion of the body and discard it.

5. Disassemble the check valve by unscrewing the body halves and note the order of the removal of the parts.
6. Discard and replace the check valve, valve spring and metal seal washer.
7. Wash all parts in a quality commercial solvent, making sure all surfaces are clean and dry prior to reassembly.
8. Coat all parts with a film of barium base lubricant such as Bendix piece number 246671 which is supplied with the maintenance kit.
9. Reassemble the check valve and torque the body halves to between 200 and 225 inch pounds.
10. Reinstall the check valve in the AD-2 outlet port and reconnect the line leading to the first reservoir.

### REINSTALLING THE DESICCANT CARTRIDGE AD-1 AND AD-2

1. Wipe the inside of the dryer clean. If a solvent is used, be certain that no residue is left in the shell.
2. Check to be certain a film of barium base grease is present on the O-rings and install the cartridge and purge plate assembly into the body. Engage the bolt and tighten to 375 inch pounds or 32 foot pounds torque.
3. Check the end cover O-ring to be certain it is clean and lubricate the O-ring with a barium base lubricant such as Bendix 246671. Install the O-ring on the end cover and install the end cover in the dryer body.

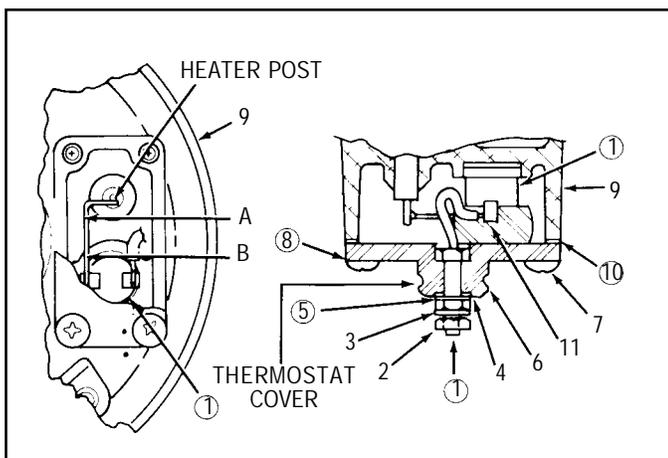


FIGURE 17

4. Position the end cover as marked during removal and install the retainer ring so that the gap in the ring is within an inch of the notch in the body.
5. Grease the threads on the three cap screws and reinstall them with their retainers in the end cover.
6. Reconnect the air control line to the purge valve port in the end cover.
7. Reconnect the thermostat and heater wire.
8. Test the air dryer as outlined under the Preventive Maintenance and Checking Serviceability Section of this manual.

## INSTALLATION OF AD-1 AND AD-2

1. Install the air dryer in the compressor discharge line as close to the supply (first) reservoir as possible. The discharge line between the compressor and air dryer must not exceed 20 feet in length nor less than six feet in length for a two cylinder compressor or ten feet in length for a single cylinder compressor. Six feet of discharge line and a 90 cubic inch reservoir can be used in lieu of ten feet of discharge line for single cylinder compressors.

The discharge line should slope downward from the compressor to the air dryer inlet to avoid water traps and to allow drainage to the air dryer. (If the 90 cubic inch reservoir is used, it should also be mounted and plumbed to avoid water traps and to allow drainage into the air dryer.) Discharge lines may be either be copper tubing or high temperature hose. However, Bendix compressors require a minimum of four feet of copper tubing extending from the discharge port. The balance of the discharge line may be either copper tubing or high temperature hose.

2. Locate outside the engine compartment in an area of air flow when the vehicle is in motion. Do not mount near exhaust system or other heat-producing components and avoid road- splash areas. Provide 20 cm (8 in.) clearance below dryer for servicing.
3. Mount vertically, with purge valve exhaust toward the ground, away from the frame and other components. Connect a hose to the exhaust cover if necessary, since this valve may expel rust and scale particles as well as condensate and oil collected in the dryer.
4. Connect the purge valve control port to one of the governor unloader ports. This line should be routed such that no water traps are formed.
5. For the dryers with a 3/4-14 or 1 - 11-1/2 dryseal outlet port, a check valve must be placed between the purge volume and the first downstream reservoir. (Dryers with 1/2-14 dryseal outlet ports have a built-in check valve.)
6. Connect a fused #16 gauge wire from the "on" position of the engine control or ignition switch to the heater terminal.

This connection must be waterproof. Use an 8 to 10 amp. fuse with 12 volt end covers and with 24 volt end covers identified with the marking "24V 120W." Use a 4 to 5 amp. fuse with 24 volt end covers identified with the marking "24V."

**IMPORTANT NOTE: A new 24 volt heater was introduced in 1983. The new heater version draws 120 watts of power and requires an 8 to 10 amp fuse. End covers with the new heater are identified with the marking "24V 120W" cast on the identification boss of the end cover. The previous identification was "24V".**

## MAINTENANCE KIT FOR THE AIR DRYER

- 286718 DESICCANT CARTRIDGE REFILL KIT  
This kit can only be used on new revision cartridges. See the cartridge rebuild section of this manual for proper identification of current revision cartridge. This kit contains the necessary parts to rebuild the cartridge and the desiccant sealing plate.
- 287313 DESICCANT CARTRIDGE REPLACEMENT KIT  
This kit contains a factory replacement desiccant cartridge and the parts necessary to rebuild the desiccant sealing plate.
- 285519 AD-1 PURGE VALVE MAINTENANCE KIT  
This kit contains the parts necessary to rebuild the AD-1 end cover purge valve only.
- 287053 AD-2 PURGE VALVE MAINTENANCE KIT  
This kit contains the parts necessary to rebuild the AD-2 end cover purge valve.
- 287298 AD-2 CHECK VALVE MAINTENANCE KIT  
This kit contains the components necessary to rebuild the inline single check valve that is used in AD-1 installations must be serviced separately.
- 288918 THERMOSTAT COVER REPLACEMENT KIT  
This kit contains the parts required to replace the non-metallic thermostat cover only. This kit is used to replace a damaged cover and does not contain thermostat parts.
- 102657 THERMOSTAT MAINTENANCE KIT  
This kit contains the necessary components to rebuild the thermostat assembly in the AD-2 Air Dryer.
- 101900 REMANUFACTURED DESICCANT CARTRIDGE AND DESICCANT SEALING PLATE.  
This unit allows for complete exchange, as a unit, of the cartridge and desiccant plate.

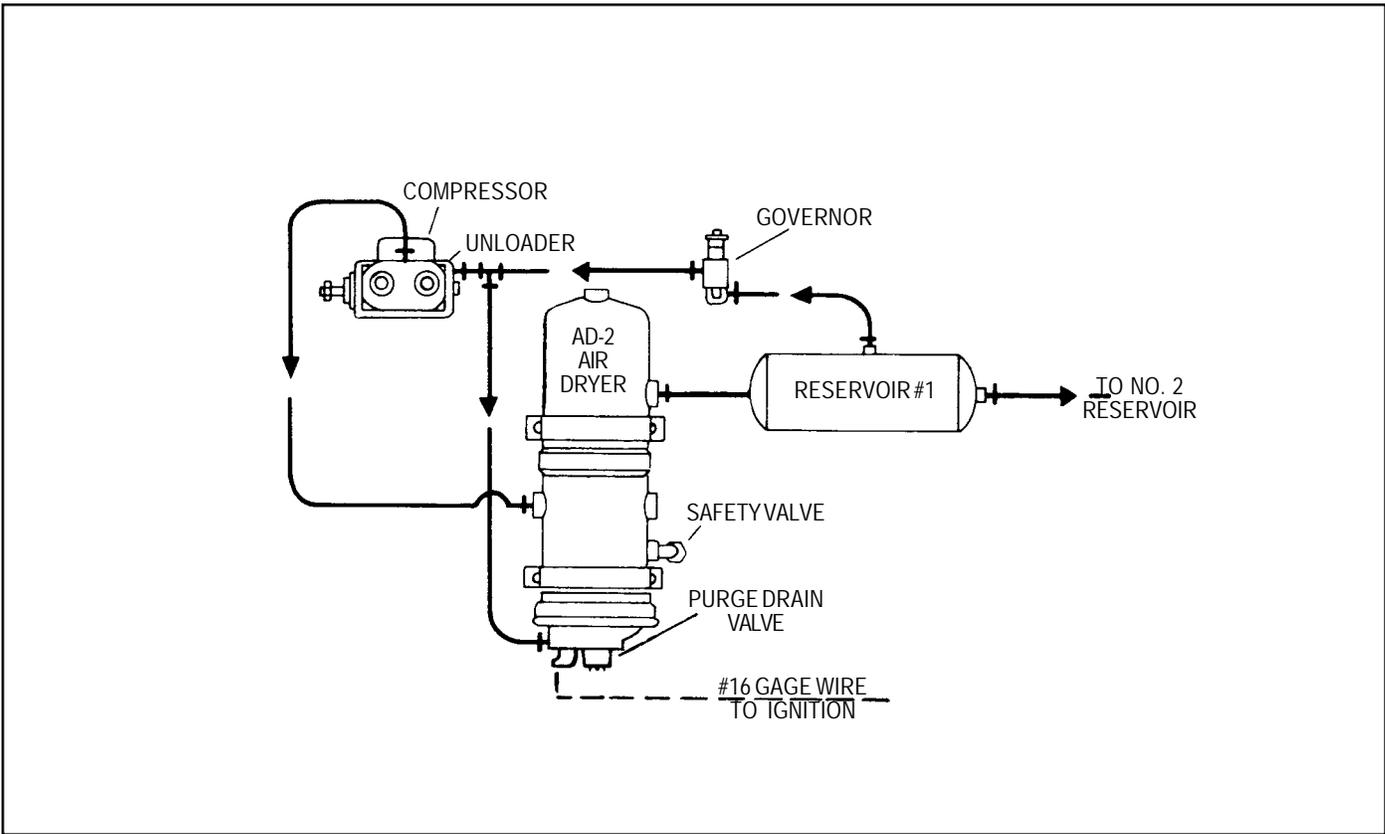


FIGURE 18 - TYPICAL INSTALLATION FOR THE AD-2

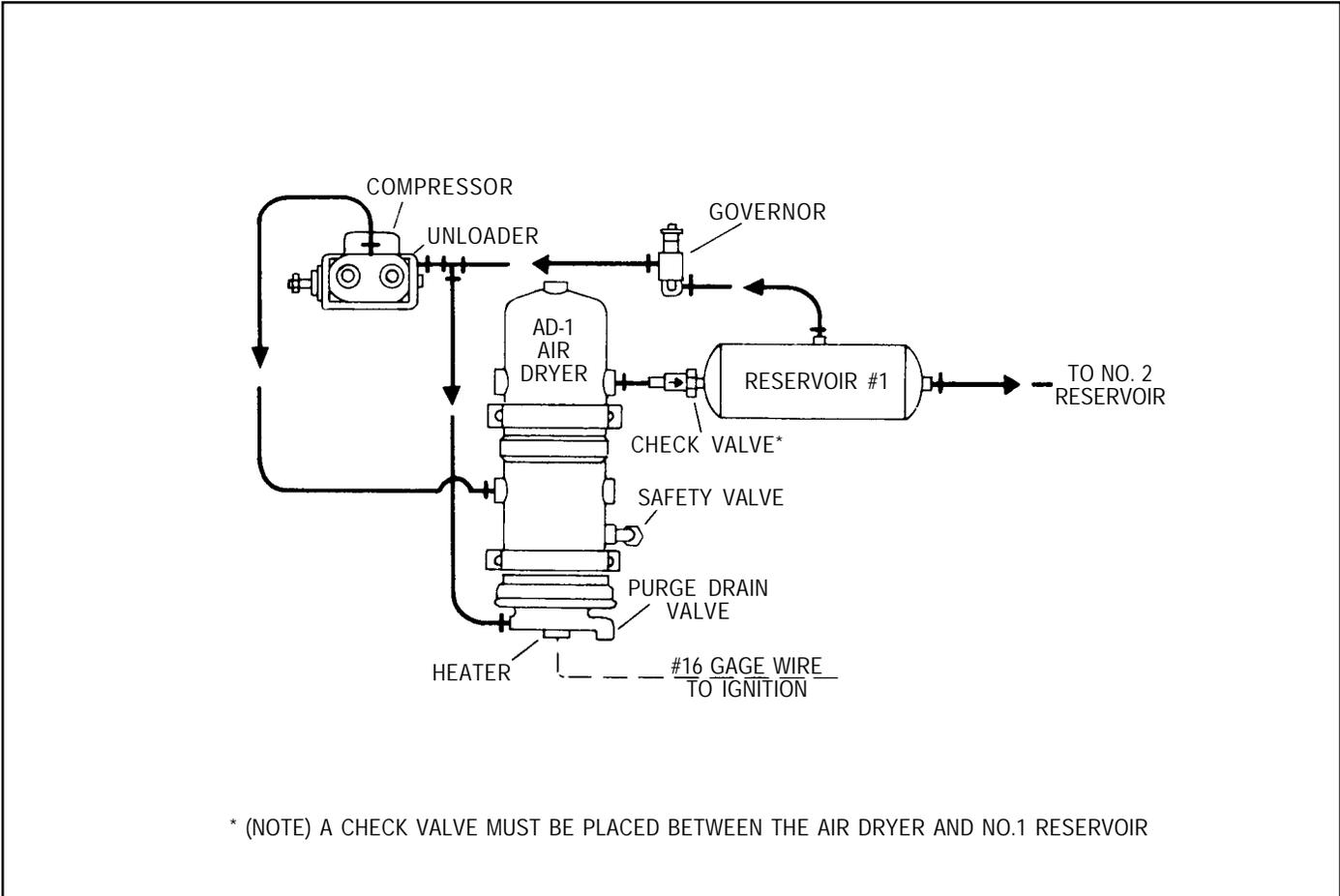


FIGURE 19 - TYPICAL INSTALLATION FOR THE AD-1

## AD-2 AIR DRYER TROUBLESHOOTING CHART

SYMPTOM	CAUSE	REMEDY
1. Dryer is constantly "cycling" or purging.	A. Excessive system leakage.	A. Test for excessive leakage and repair. Allowable leakage: Pre-121 vehicles, single vehicle - 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 fittings, hoses and tubing connected to 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 between air dryer and first reservoir. (In standard AD-2, check valve to outlet port.)	C. Test check valve. Leakage should not exceed 1" soap bubble in five seconds. It may be necessary to remove check valve to test. Repair or replace as necessary.
	D. Defective governor.	D. Test governor for proper cut-in or 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. (Permissible leakage - 1" bubble in 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. Slight leakage permissible.
2. Water in vehicle reservoirs.	A. Dessicant requires replacement.	A. Replace dessicant cartridge.
	B. Improper discharge line length or improper line material.	B. Minimum of six-foot metal tubing for two-cylinder compressor; ten-foot for one-cylinder compressor. Flex hose can be substituted at ratio of 1-1/2' flex hose for each 1' of metal.
	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. (Unused inlet on air dryer can be used.) <b>Use of this 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. Air dryer/vehicle application requires additional purge volume.	F. When compressor is loaded (compressing) longer than 90 seconds during normal operation, additional purge volume may be needed. (Before proceeding, contact Bendix representation for consultation.)
	G. Air dryer not compatible with vehicle air system requirement - (Improper air dryer/vehicle application).	G. Air dryer requires <b>minimum purge time of 30</b> seconds. If compressor stays loaded longer than 90 seconds and additional purge volume is added, longer purge time is required. Air dryer efficiency will decrease as compressor loaded time increases beyond 120 seconds, during normal operation of the vehicle. (This limitation assumes a compressor of approximately 12 CFM and engine operation at 1600-1900 RPM.) The air dryer will accommodate occasional longer loaded times, such as initial system build-up.
3. Safety valve on air dryer "popping off" or exhausting air.	A. Desiccant cartridge plugged or saturated.	A. Check compressor for excessive oil passing and/or correct compressor installation. Repair or replace as necessary. Rebuild or replace cartridge.
	B. Defective check valve between air dryer outlet port and first reservoir. (in standard AD-2, check valve in outlet port.)	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.

SYMPTOM	CAUSE	REMEDY
4. Constant exhaust of air at air dryer purge valve exhaust or unable to build system pressure.	<ul style="list-style-type: none"> <li>A. Air dryer purge valve leaking excessively.</li> <li>B. Defective governor.</li> <li>C. Purge control line connected to reservoir or exhaust port of governor.</li> <li>D. Purge valve frozen open - faulty heater and thermostat, wiring, blown fuse.</li> <li>E. Inlet and outlet air connections reversed.</li> <li>F. Check valve between air dryer and first reservoir defective.</li> <li>G. Kinked or blocked (plugged) discharge line.</li> <li>H. Excessive bends in discharge line (water collects and freezes).</li> <li>I. Excessive system leakage.</li> </ul>	<ul style="list-style-type: none"> <li>A. With compressor <b>loaded</b>, apply soap solution on purge valve exhaust, to test for excessive leakage. Repair purge valve as necessary.</li> <li>B. Check governor for proper "cut-in", "cut-out" pressure and excessive leakage in both positions. Repair or replace as necessary.</li> <li>C. Purge control line must be connected to unloader port of governor.</li> <li>D. Test heater and thermostat as described in Step 7 of Preventive Maintenance Section.</li> <li>E. Compressor discharge to inlet port. Reconnect lines properly.</li> <li>F. Test check valve for proper operation (see Symptom #3, Remedy B).</li> <li>G. Check to determine if air passes through discharge line. Check for kinks, bends, excessive carbon deposits.</li> <li>H. Discharge line should be constantly sloping from compressor to air dryer with as few bends as possible.</li> <li>I. See Symptom #1's Causes and Remedies.</li> </ul>
5. Air dryer does not purge or exhaust air.	<ul style="list-style-type: none"> <li>A. Broken, kinked, frozen, plugged or disconnected purge control line.</li> <li>B. Faulty air dryer purge valve.</li> <li>C. See Causes B,E,F,G,H, for Symptom #4.</li> </ul>	<ul style="list-style-type: none"> <li>A. Test to determine air flows through purge control line when compressor unloaded. Check for undrilled fittings. (See Symptom #4, Remedy C.)</li> <li>B. After determining air reaches purge valve (Remedy A above), repair purge valve.</li> <li>C. Refer to Remedies B, E, F, G, H, for Symptom #4.</li> </ul>
6. Desiccant material being expelled from air dryer purge valve exhaust (may look like whitish liquid or paste or small beads).	<ul style="list-style-type: none"> <li>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.</li> <li>B. Air dryer not securely mounted. (Excessive vibration).</li> </ul>	<p>See Causes and Remedies for Symptoms 1,2,3,4 and 5.</p>
OR Unsatisfactory dessicant life.	<ul style="list-style-type: none"> <li>C. Defective cloth covered perforated plate in air dryer dessicant cartridge or improperly rebuilt desiccant cartridge.</li> <li>D. Compressor passing excessive oil.</li> <li>E. Faulty heater and thermostat, wiring, fuse not allowing purge. (Cold weather operation only.)</li> </ul>	<ul style="list-style-type: none"> <li>B. Vibration should be held to minimum. Add bracket supports or change air dryer mounting location if necessary.</li> <li>C. Replace or rebuild desiccant cartridge. NOTE: If rebuilding cartridge, carefully follow instructions packed with cartridge rebuild kit.</li> <li>D. Check for proper compressor installation; if symptoms persist, replace compressor.</li> <li>E. Refer to Remedy D under Symptom #4.</li> </ul>
7. Unable to remove end cover, or unable to install new desiccant cartridge.	<ul style="list-style-type: none"> <li>A. Result of reversing the inlet and outlet connections. (See Symptom #4, Cause E.)</li> </ul>	<ul style="list-style-type: none"> <li>A. Refer to Symptom #4, Cause E.</li> </ul>
8. Air dryer end cover separates from air dryer housing during operation.	<ul style="list-style-type: none"> <li>A. Excessive system pressure build up within air dryer; caused by either plugged desiccant, check valve failure, frozen or obstructed discharge line (between air dryer and first reservoir) or governor failure in conjunction with safety valve failure.</li> </ul>	<ul style="list-style-type: none"> <li>A. Because it is difficult to determine extent of internal damage to air dryer, it is recommended that the air dryer be replaced.</li> </ul> <p>NOTE: This type of failure can be prevented by checking the dryer for proper operation every three (3) months.</p>