



Service Data

SD-08-2412

Bendix® AD-9™ Air Dryer

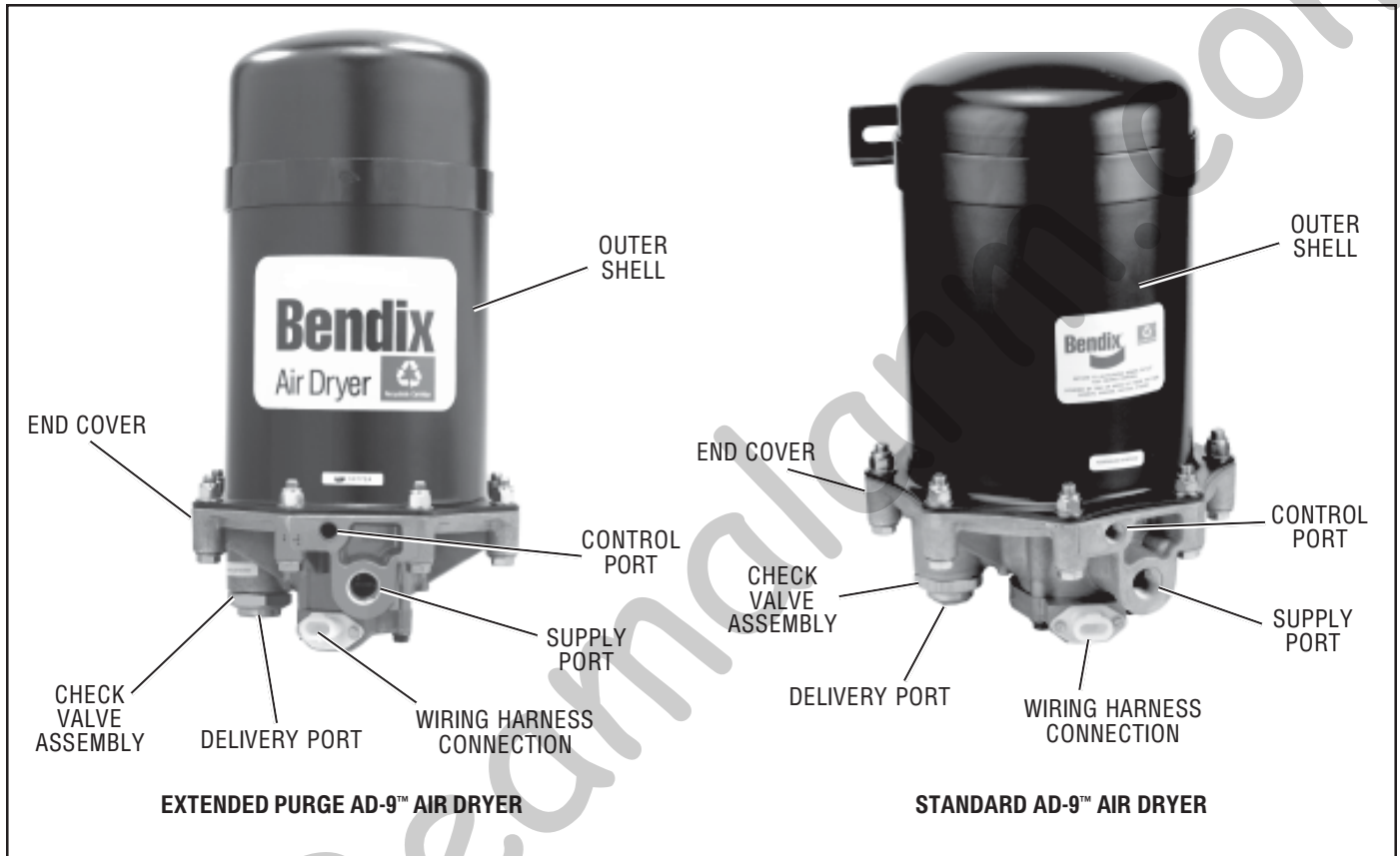


FIGURE 1 - AD-9™ AIR DRYER MODELS

DESCRIPTION

The function of the AD-9™ 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 AD-9™ 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, three threaded air connections and the purge valve housing assembly. The removable purge valve housing assembly incorporates a purge valve mechanism and a turbo charger cut-off feature that is designed to prevent loss of engine “turbo” boost pressure during the purge cycle of the AD-9™

air dryer. For ease of serviceability, the desiccant cartridge and discharge check valve assembly are screw in type. The purge valve housing assembly, which includes the heater and thermostat assembly, and the discharge check valve assembly, is serviceable from the exterior of the air dryer, while servicing the screw-in desiccant cartridge requires removal of the air dryer assembly from the vehicle.

The AD-9™ air dryer has three female pipe thread air connections and each is identified as follows:

Port I.D.	Function/Connection
CON 4	Control Port (purge valve control and turbo cut-off).
SUP 11	Supply Port (air in).
DEL 2	Delivery Port (air out).

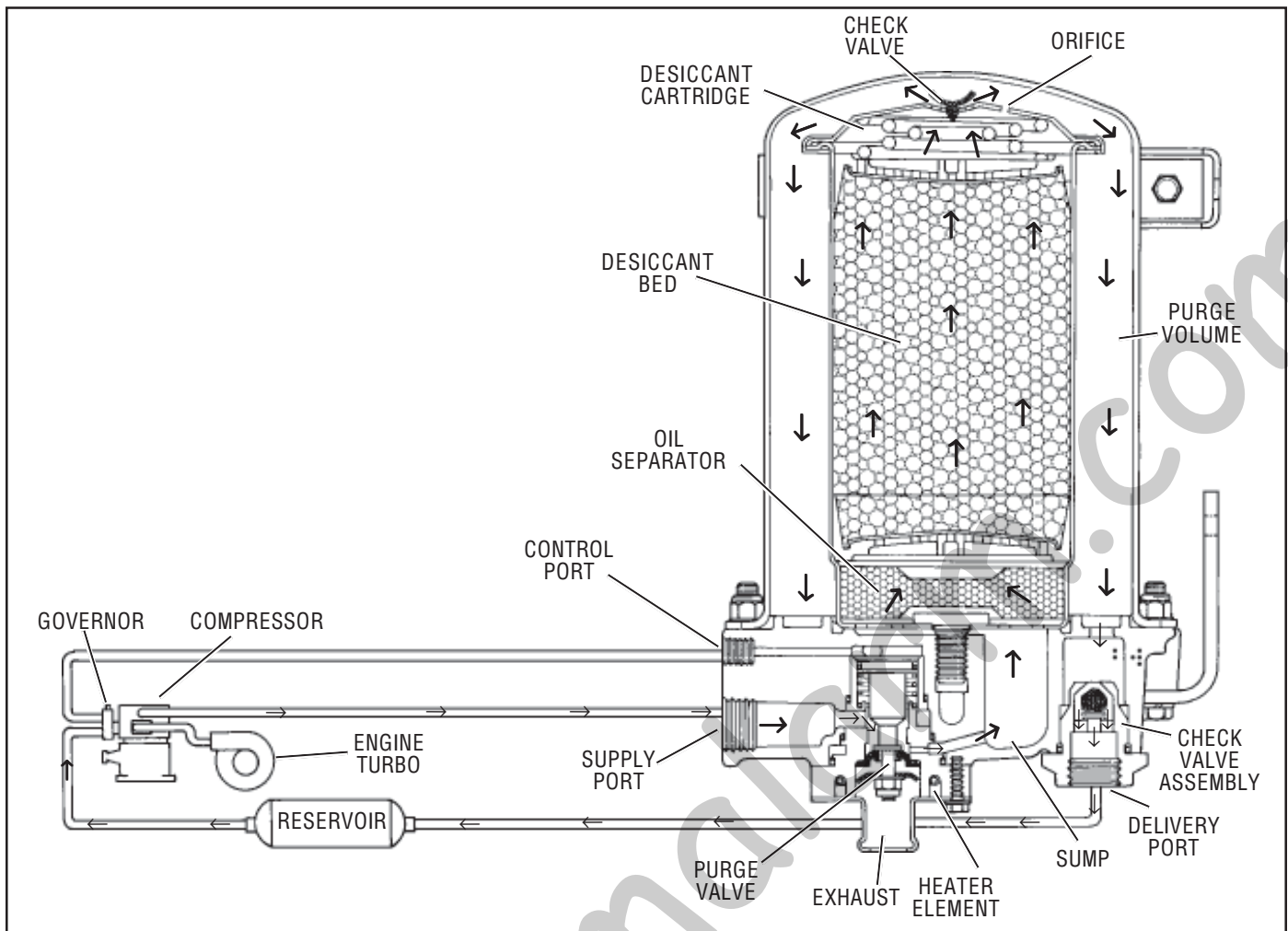


FIGURE 2 - AD-9™ AIR DRYER CHARGE CYCLE

OPERATION OF THE AD-9™ AIR DRYER

The AD-9™ 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. As air travels through the end cover assembly, its direction of flow changes 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, 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 and solid contaminants.

Air exits the oil separator and enters the desiccant drying bed. Air flowing through the column of desiccant becomes

progressively drier 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. When the governor unloads the compressor, it pressurizes the compressor unloader mechanism and line connecting the

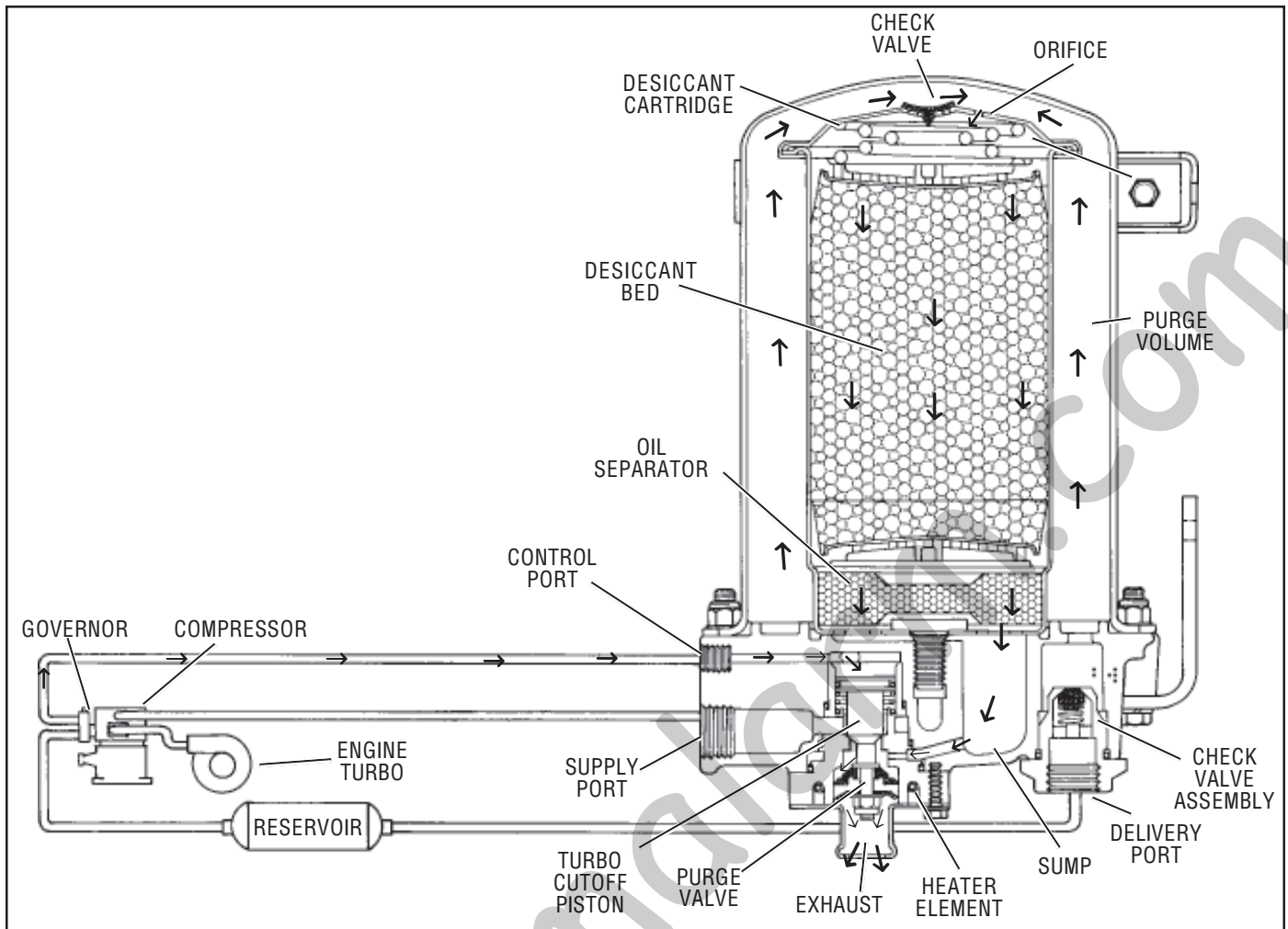


FIGURE 3 - AD-9™ AIR DRYER PURGE CYCLE

governor unloader port to the AD-9™ air dryer end cover control port. The purge piston moves in response to air pressure causing the purge valve to open to atmosphere and (partially) closing off the supply of air from the compressor, this will be further discussed in the section covering the turbo cut-off feature. 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 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 AD-9™ air dryer 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 AD-9™ 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.

TURBO CUT-OFF FEATURE (Refer to Figure 4)

The primary function of the turbo cut-off valve is to prevent loss of engine turbocharger air pressure through the AD-9™ air dryer in systems where the compressor intake is connected to the engine turbocharger. The turbo cut-off valve also reduces the “puffing” of air out the open exhaust when a naturally aspirated, single cylinder compressor equipped with an inlet check valve is in use.

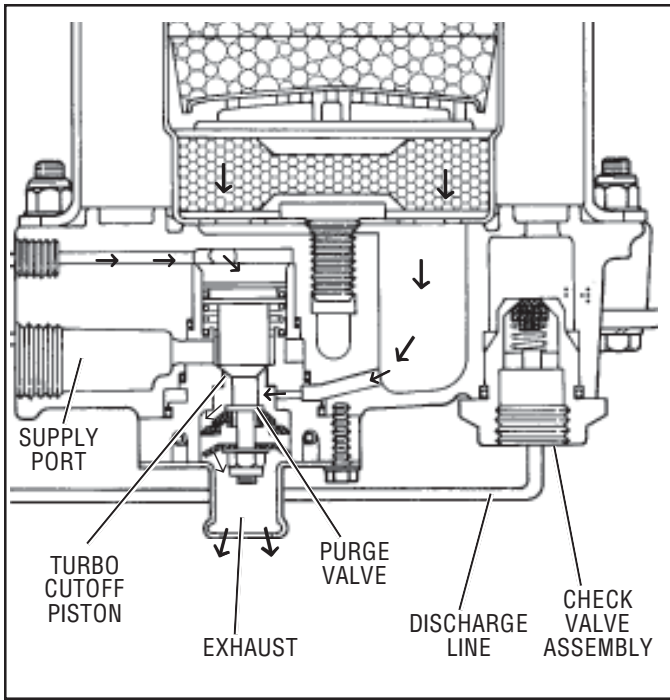


FIGURE 4 - AD-9™ AIR DRYER TURBO CUTOFF

At the onset of the purge cycle, the downward travel of the purge piston is stopped when the turbo cut-off valve (tapered portion of purge piston) contacts its mating metal seat in the purge valve housing. With the turbo cut-off valve seated (closed position), air in the discharge line and AD-9™ air dryer inlet port is restricted from entering the air dryer. While the turbo cut-off effectively prevents loss of turbo charger boost pressure to the engine, some “seepage” of air may be detected under certain conditions of compressor engine and turbo charger operation, even so there will always be low pressure trapped in the discharge line.

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. Note: It is acceptable for the purge valve to be maintained as necessary, i.e., the installation of a purge valve maintenance kit, without voiding the warranty.

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.

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:

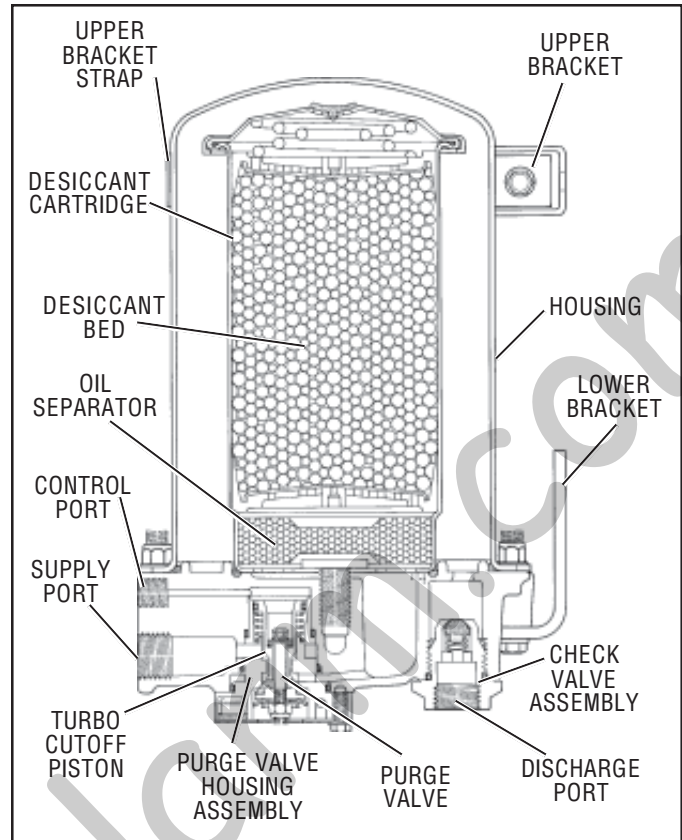


FIGURE 5 - AD-9™ AIR DRYER SECTIONAL VIEW

- 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. If the vehicle vocation has changed it may be necessary to upgrade the compressor size. Refer to Appendix A, Table A and the column entitled Vehicle Vocation.
- C. The air dryer has been installed in a system that has been previously used without an air dryer. This type of 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 AD-9™ Air Dryer On Vehicle* section and Appendix A, Table A, column 2 for discharge line length.
- 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; 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 #1 reservoir. A rapid loss of pressure could indicate a failed outlet port check valve. This can be confirmed by bleeding the system down, removing the check valve assembly from the end cover, subject air pressure to the unit and apply a soap solution to the check valve side. Leakage should not exceed a 1" 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" 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 AD-9™ air dryer 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 AD-9™ air dryer purge.

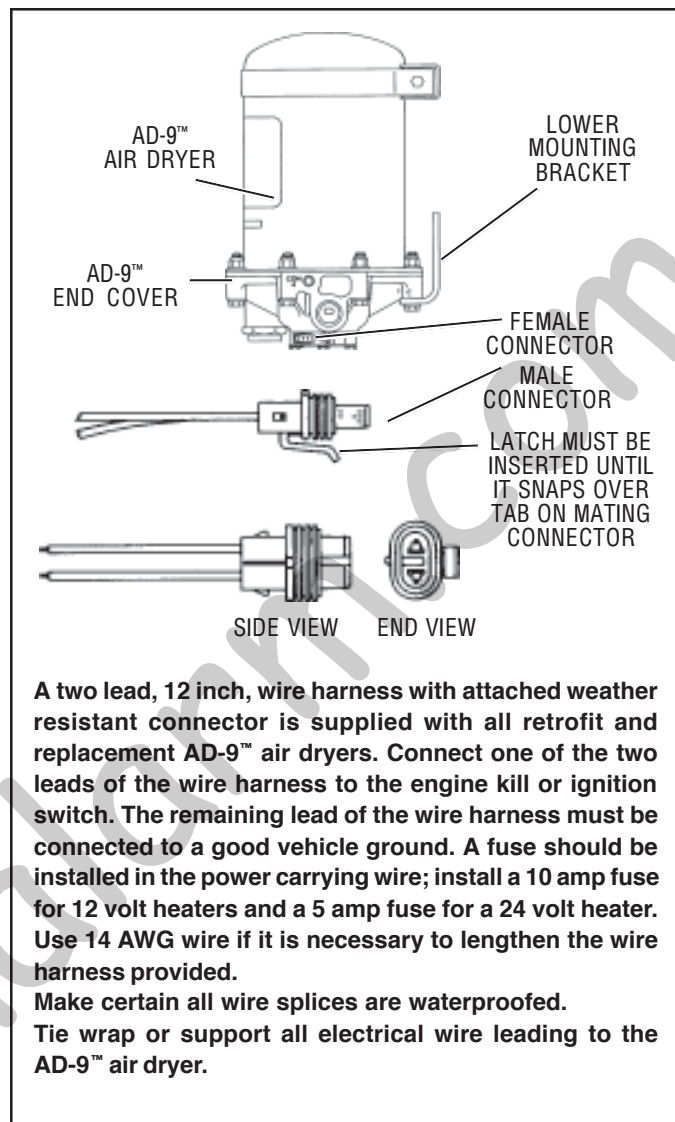


FIGURE 6 - HEATER AND THERMOSTAT CONNECTOR

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 re-seat 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 voltage to the heater and thermostat assembly using a voltmeter or test light. Unplug the electrical connector at the air dryer and place the test leads on each of the pins of the male connector. If there is no voltage, 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 pins in the female connector. The resistance should be 1.5 to 3.0 ohms for the 12 volt heater assembly and 6.8 to 9.0 ohms for the 24 volt heater assembly. **Note:** *Some early models of the AD-9™ air dryer will have resistance readings of 1.0 to 2.5 ohms for the 12 volt heater assembly and 4.8 to 7.2 ohms for the 24 volt heater assembly. If the resistance is higher than the maximum stated, replace the purge valve housing assembly, which includes the heater and thermostat assembly.*

Warm the end cover assembly to over 90 degrees Fahrenheit and again check the resistance. The resistance should exceed 1000 ohms. 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, replace the purge valve housing assembly, which includes the heater and thermostat assembly.

REBUILDING THE AD-9™ 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 Bendix parts. For ease in servicing the AD-9™ air dryer desiccant cartridge assembly, it is recommended that the air dryer be removed from the vehicle.

MAINTENANCE KITS AVAILABLE:

- 5005037 Hard Seat Purge Valve Housing Maintenance Kit
5005893 Soft Seat Purge Valve Housing Maintenance Kit
These kits contain the parts necessary to rebuild the air portion of the purge valve housing and do not include the heater and thermostat.
- 107796 Remanufactured Desiccant Cartridge Replacement Kit
This kit contains the parts necessary to change the desiccant cartridge only.
- 107794 Desiccant Cartridge Replacement Kit
This kit contains the parts necessary to change the desiccant cartridge only.
- 107799 End Cover Check Valve Assembly Replacement
3/4 inch thread size.
- 107800 End Cover Check Valve Assembly Replacement
1/2 inch thread size.

800405 Service New Purge Valve Housing Assembly - Soft Seat (w/heater and thermo.) 12 volt system.

5004341 Remanufactured Exchange Purge Valve Housing Assembly - Soft Seat (w/heater and thermo.) 12 volt system.

5004479 Service New Purge Valve Housing Assembly - Hard Seat (w/heater and thermo.) 12 volt system.

5004339 Service New Purge Valve Housing Assembly - DLU (w/heater and thermo.) 12 volt system.

5004338 Service New Purge Valve Housing Assembly - Soft Seat (w/heater and thermo.) 24 volt system.

5004342 Remanufactured Exchange Purge Valve Housing Assembly - Soft Seat (w/heater and thermo.) 24 volt system.

5004480 Service New Valve Housing Assembly - Hard Seat (w/heater and thermo.) 24 volt system.

5004340 Service New Purge Valve Housing Assembly - DLU (w/heater and thermo.) 24 volt system.

107695 Complete Mounting Bracket Kit

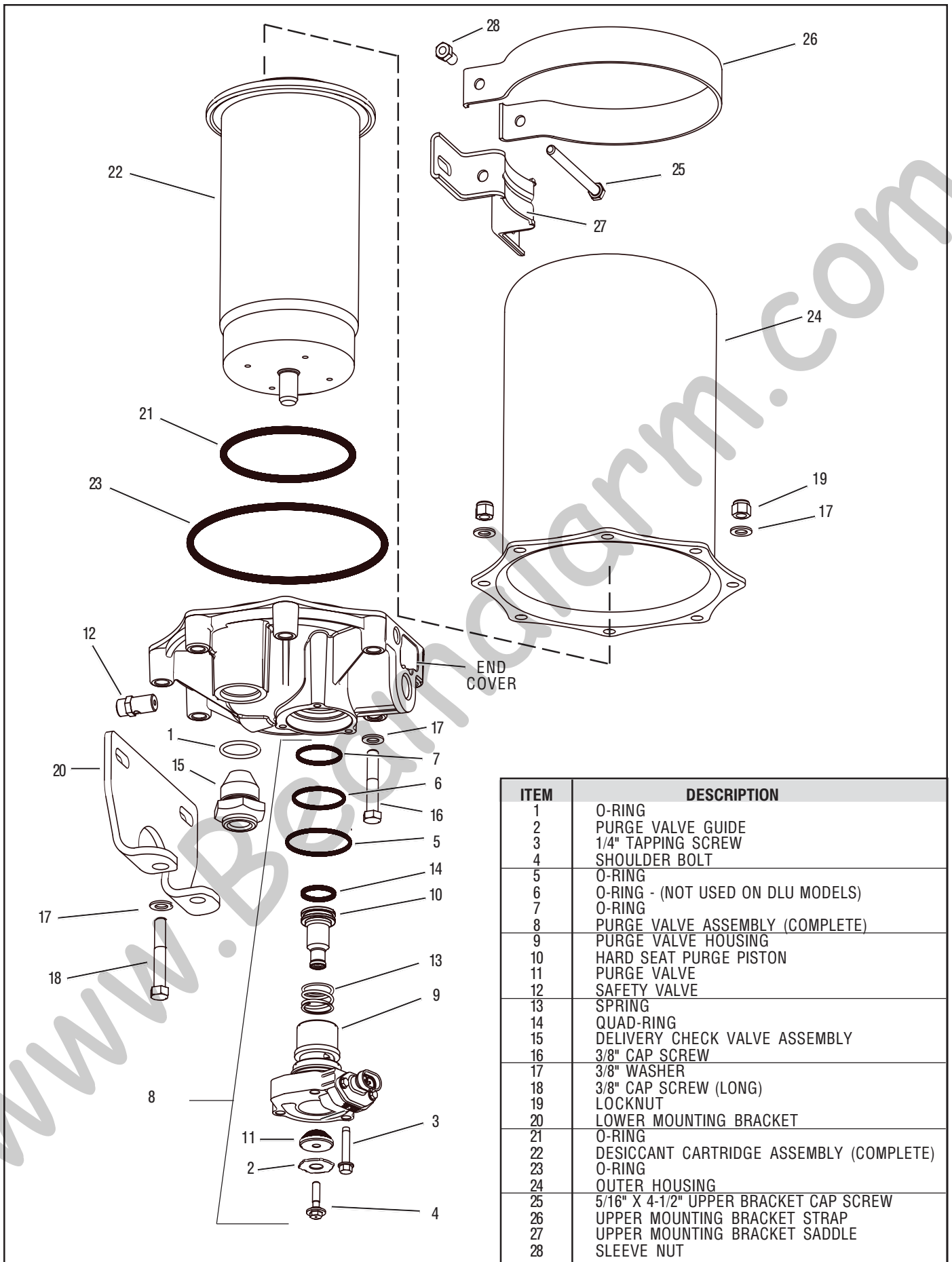
This kit contains the upper and lower brackets as well as the necessary hardware items to mount them.

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed **at all times**.

1. Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.
2. Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. 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.
3. 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.
4. If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning **ANY** work on the vehicle. If the vehicle is equipped with an AD-IS® air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.



ITEM	DESCRIPTION
1	O-RING
2	PURGE VALVE GUIDE
3	1/4" TAPPING SCREW
4	SHOULDER BOLT
5	O-RING
6	O-RING - (NOT USED ON DLU MODELS)
7	O-RING
8	PURGE VALVE ASSEMBLY (COMPLETE)
9	PURGE VALVE HOUSING
10	HARD SEAT PURGE PISTON
11	PURGE VALVE
12	SAFETY VALVE
13	SPRING
14	QUAD-RING
15	DELIVERY CHECK VALVE ASSEMBLY
16	3/8" CAP SCREW
17	3/8" WASHER
18	3/8" CAP SCREW (LONG)
19	LOCKNUT
20	LOWER MOUNTING BRACKET
21	O-RING
22	DESICCANT CARTRIDGE ASSEMBLY (COMPLETE)
23	O-RING
24	OUTER HOUSING
25	5/16" X 4-1/2" UPPER BRACKET CAP SCREW
26	UPPER MOUNTING BRACKET STRAP
27	UPPER MOUNTING BRACKET SADDLE
28	SLEEVE NUT

FIGURE 7 - AD-9™ AIR DRYER ASSEMBLY

5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
6. Never exceed manufacturer's recommended pressures.
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. Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
9. Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
10. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
11. For vehicles with Antilock Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.

AD-9™ AIR DRYER 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. Unplug the vehicle wiring harness from the heater and thermostat assembly connector on the purge valve housing assembly.
5. Loosen the 5/16" X 4-1/2" hex cap screw (25) securing the upper mounting strap (26).
6. Remove, retain and mark the two 3/8" end cover cap screws (18), lock nuts (19) and four special washers (17) that retain the lower mounting bracket (20) 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 AD-9™ air dryer from its mounting brackets on the vehicle.

DISASSEMBLY

The following disassembly and assembly procedure is presented for reference purposes and presupposes that a major rebuild of the AD-9™ 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 7 during disassembly.

Caution: While performing service on the AD-9™ 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. Using an adjustable wrench or an 1-3/4" socket, remove the delivery check valve assembly (15) and o-ring (1). Remove the o-ring (1) from the check valve assembly.
2. Remove the three 1/4" self tapping screws (3) that secure the purge valve housing assembly to the end cover assembly. Pull the purge valve housing assembly (8) out of the end cover assembly. Remove the o-rings (5, 6 & 7) from the exterior of the purge valve housing assembly. (O-ring item 6 is not included in DLU models.) **Note:** the o-rings may be lodged in the end cover bores, if so, they must be removed.

3. Purge Valve (8) Disassembly:

Note: Removal of the piston from the purge valve housing assembly requires a tool to hold the head of the purge piston while unscrewing the purge valve shoulder bolt (4). If an extended type exhaust cover is in use to accommodate the attachment of an exhaust hose, the exhaust cover must be carefully peeled off of the purge valve housing (9). **Use a thin flat blade to pry the exhaust cover off, taking care not to damage the potting material (RTV sealant) under the cover.** To remove the piston (10) from the purge valve housing assembly (9)(9) use a twelve point 1/4" socket to hold the head of the shoulder bolt (4).

- A. Remove the shoulder bolt (4) from the bottom of the purge valve housing assembly (8) while securing the top of the purge piston (10) using the two opposing cast indentations and a tool. Remove the purge guide (2) and purge valve (11) from the purge valve housing.
- B. Remove the purge piston (10) and return spring (13) from the opposite end of the purge valve housing. Remove the quad ring (14) from the purge piston (10).
- C. Heater and Thermostat Assembly Replacement. **Caution:** Do not attempt to remove this assembly, as it will be damaged during the removal process and is **not available as a service part**. If the heater and thermostat are defective, replace the entire purge valve housing assembly which includes these items.

4. Remove the remaining six 3/8" cap screws (16), lock nuts (19) and twelve special washers (17) that secure the end cover to the housing (24). Separate the end cover and desiccant cartridge (22) from the housing (24).
5. Remove the end cover to outer housing o-ring (23).
6. Do not remove the safety valve (12) from the end cover unless it has been proven defective. If replacement is required, apply thread sealant or Teflon® tape on the threads of the replacement valve and torque to 120-400 in. lbs.
7. Place a strap or chain wrench around the desiccant cartridge (22) so that it is approximately 2-3 inches away from the end cover. Rotate the cartridge counterclockwise until it completely separates from the end cover. **Note:** A substantial torque (up to 50 lb. ft.) may be required to perform this disassembly.
8. Remove the desiccant cartridge o-ring (21) from the end cover.

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 and the purge valve housing 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.
6. Inspect the purge valve housing bore and seats 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 the lubricant included in the maintenance kit. Refer to Figure 7 during assembly unless otherwise advised.

1. Purge Valve Housing Assembly
 - A. Install the quad-ring (14) in its groove on the O.D. of the purge piston (10). Place the return spring (13) in

the bore of the purge valve housing. Insert the purge piston (10) into the I.D. of the return spring. Place the purge valve guide (2) onto the shoulder bolt (4) followed by the purge valve (11). Using a ratchet or wrench, screw the purge valve, purge valve guide and shoulder bolt into the purge housing until it bottoms. This will require a tool to hold the top of the purge piston from rotating as the shoulder bolt is screwed into the bottom of the purge piston to complete the purge valve assembly (8). Torque the shoulder bolt to 60-90 in. lbs.

- B. Install the o-rings (5, 6 and 7) on the purge valve housing placing each in its appropriate location. Note o-ring (6) is not used on DLU models. If the exhaust cover was removed during disassembly, install it on the purge valve housing assembly (8) making certain the "bubble" portion is positioned over the thermostat. Install the assembled purge valve housing (8) in the end cover making certain to orient both parts such that the connector is approximately 10 degrees clockwise from the supply port, while making certain the purge valve housing is fully seated against the end cover. Secure the purge valve housing to the end cover using the three 1/4" self-tapping screws (3). Start all three screws by hand then torque to 50-80 in. lbs.
2. Install the o-ring (1) on the check valve assembly (15), then install the assembly in the end cover.

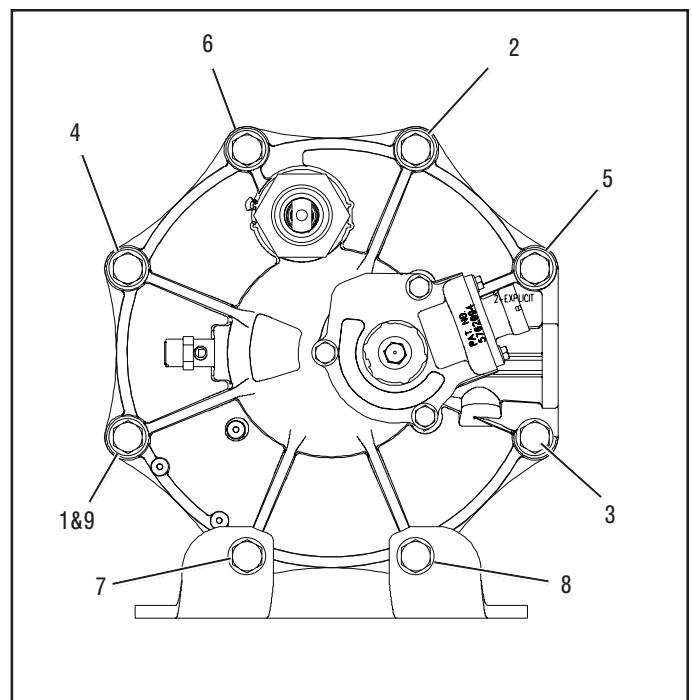


FIGURE 8 - END COVER TO HOUSING TORQUE PATTERN

3. Install the desiccant cartridge o-ring (21) in its groove in the end cover. Using a light coat of lubricant (included in kit), lubricate the bottom of the desiccant cartridge in the area that will contact the o-ring (21) and end cover. Screw the desiccant cartridge into the end cover until contact is made between it and the o-ring. Using a strap or chain wrench positioned 2-3" from the bottom of the cartridge, turn the desiccant cartridge clockwise 180-225 degrees beyond the position where initial contact was made between the cartridge and end cover o-ring. Torque should not exceed 50 ft. lbs.
4. Install the end cover outer housing o-ring (23) on the shoulder in the end cover. Place the housing (24) over the desiccant cartridge and align the holes. Install the six 3/8" cap screws (16), lock nuts (19) and twelve special washers (17) making certain they are in the proper position as marked during disassembly. The two longer 3/8" cap screws (18) will be used to secure the AD-9™ air dryer to its mounting bracket. Tighten the six cap screws and nuts in a star pattern in a fashion similar to Figure 8; depending on lower bracket location. Torque to 270-385 in. lbs. (Refer to Fig. 8.) **Note:** The two remaining bolt holes in the end cover and two 3/8" cap screws must be the ones marked during disassembly to assure proper orientation of the ports and adequate length of the cap screws.

INSTALLATION

1. Install the assembled AD-9™ air dryer back onto the vehicle by slipping it into the upper mounting bracket. Align the two unused holes in the end cover with the bottom mounting bracket such that the bottom bracket supports the air dryer. The AD-9™ air dryer end cover should rest on the bracket. Using the remaining two 3/8" cap screws (18), four special washers (17), and two lock nuts (19), secure the air dryer to the lower bracket. Tighten, then torque the two remaining cap screws to 270-385 in. lbs.
2. Tighten the 5/16" X 4-1/2" hex cap screw (25) and nut (28) on the upper mounting bracket saddle (27) and strap (26). Torque to 80-120 in. lbs.
3. Reconnect the three air lines to the proper ports on the end cover (identified during disassembly).
4. Reconnect the vehicle wiring harness to the AD-9™ air dryer heater and thermostat assembly connector by plugging it into the air dryer connector until its lock tab snaps in place.
5. Before placing vehicle back into service, perform the *Operation and Leakage Tests* stated elsewhere in this manual.

RETROFITTING THE AD-9™ AIR DRYER

GENERAL

The following retrofit instructions are presented for reference purposes only since Bendix aftermarket retrofit and replacement air dryers are packaged with the most up-to-date installation instructions. The instructions packaged with the AD-9™ air dryer should be followed in lieu of those presented here.

The preceding portion of this manual deals with "in-service" repair and/or replacement of the AD-9™ air dryer. The portion of the manual that follows is concerned with installing an AD-9™ air dryer on a vehicle not previously equipped with one.

VEHICLE APPLICATION REQUIREMENTS

The basic application requirements presented here apply to a standard air dryer installation. The majority of highway vehicles in use today will meet these basic requirements however, some may not. Examples of vehicles that may not meet the requirements include, bulk trailer unloading operations and other high air consumption/continuous flow systems. While the AD-9™ air dryer can be used on these vehicles the standard installation procedure presented in this manual may require modification to assure proper operation and service life. Consult your local authorized Bendix parts outlet or sales representative for additional information.

1. Charge Cycle Time - The AD-9™ 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 RPMs 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. Consult your local authorized Bendix parts outlet or sales representative for additional information.
2. Purge Cycle Time - During normal vehicle operation, the air compressor **must remain unloaded for a minimum of 20 seconds for the standard AD-9™ air dryer or 30 seconds for the Extended Purge model.** These minimum purge times are required to ensure complete regeneration of the desiccant material. If the purge time is occasionally shorter than the times specified, no permanent ill effect should be expected, however, if the purge time is consistently less than the minimum, an accessory by-pass system must be installed.
3. European Air Brake Systems - Brake systems that incorporate compressors without integral unloading

mechanisms and/or utilize a compressor discharge line unloader valve have special AD-9™ air dryer installation requirements. Consult your local authorized Bendix parts outlet or sales representative for additional information.

4. Air Compressor Size - Although the AD-9™ 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 AD-9™ air dryer with a compressor which has a rated displacement exceeding 17 CFM that an authorized Bendix parts outlet or Bendix marketing representative be contacted for assistance.
5. Holset "E or QE" Type Air Compressors - In order for the AD-9™ air dryer to function properly when installed with the Holset Type "E or QE" compressor, several specialized Holset components are required. Consult your local authorized Holset parts outlet or sales representative for additional information.
6. Use of Standard or Extended Purge AD-9™ Air Dryer - Use the following guidelines:

Total Vehicle Reservoir

Volume	Requirement
Less than 9,000 cu. in.	Standard AD-9™ Air Dryer
9,000 - 12,500 cu. in.	Extended Purge AD-9™ Air Dryer
Greater than 12,500 cu. in.	Contact Bendix Rep. or Bendix Engineering

VEHICLE PREPARATION

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).

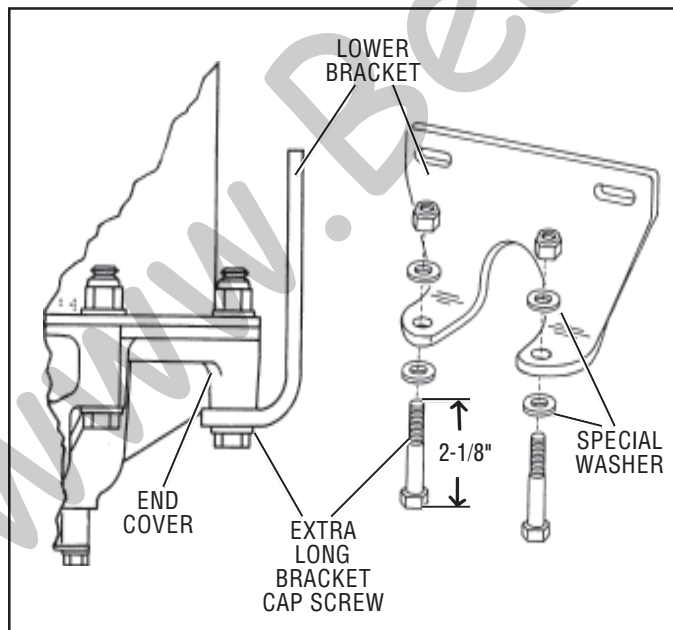


FIGURE 9 - LOWER BRACKET INSTALLATION

LOCATING AD-9™ AIR DRYER ON VEHICLE

1. The AD-9™ air dryer must be mounted vertically (purge exhaust toward road surface) outside the engine compartment in an area of air flow while the vehicle is in motion. The AD-9™ air dryer must not be exposed to direct wheel splash (located behind axle mud flap is acceptable).
2. Locate the AD-9™ air dryer as close to the first (supply) reservoir as possible.
3. Do not locate the AD-9™ air dryer near heat producing components such as the vehicle exhaust and make certain adequate clearance from moving components (e.g. drive shaft, suspension, pitman arm, etc.) is provided.
4. Locate the AD-9™ air dryer on vehicle so that a minimum of 11 inches (28 cm) clearance below the end cover is available to allow servicing. Alternatively, provide access to the bracket bolts so the unit may be removed for servicing.
5. When choosing the mounting location for the AD-9™ air dryer, note the discharge line length requirements stated under the heading *Connecting the Air Lines*, elsewhere in this instruction sheet.

Important Note: Under normal operating conditions, the maximum inlet air temperature for the AD-9™ air dryer is 160 degrees Fahrenheit.

MOUNTING THE AD-9™ AIR DRYER

1. To install the lower mounting bracket on the AD-9™ air dryer, it will be necessary to remove and discard two of the end cover bolts and lock nuts. To determine which end cover bolts to utilize to attach the lower bracket, take into consideration the piping connections required to install the AD-9™ air dryer and use those that will best

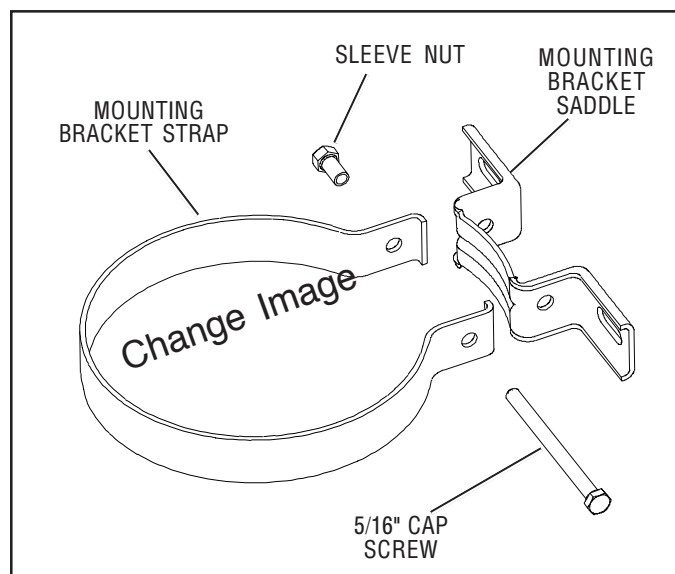


FIGURE 10 - UPPER MOUNTING BRACKET AND STRAP

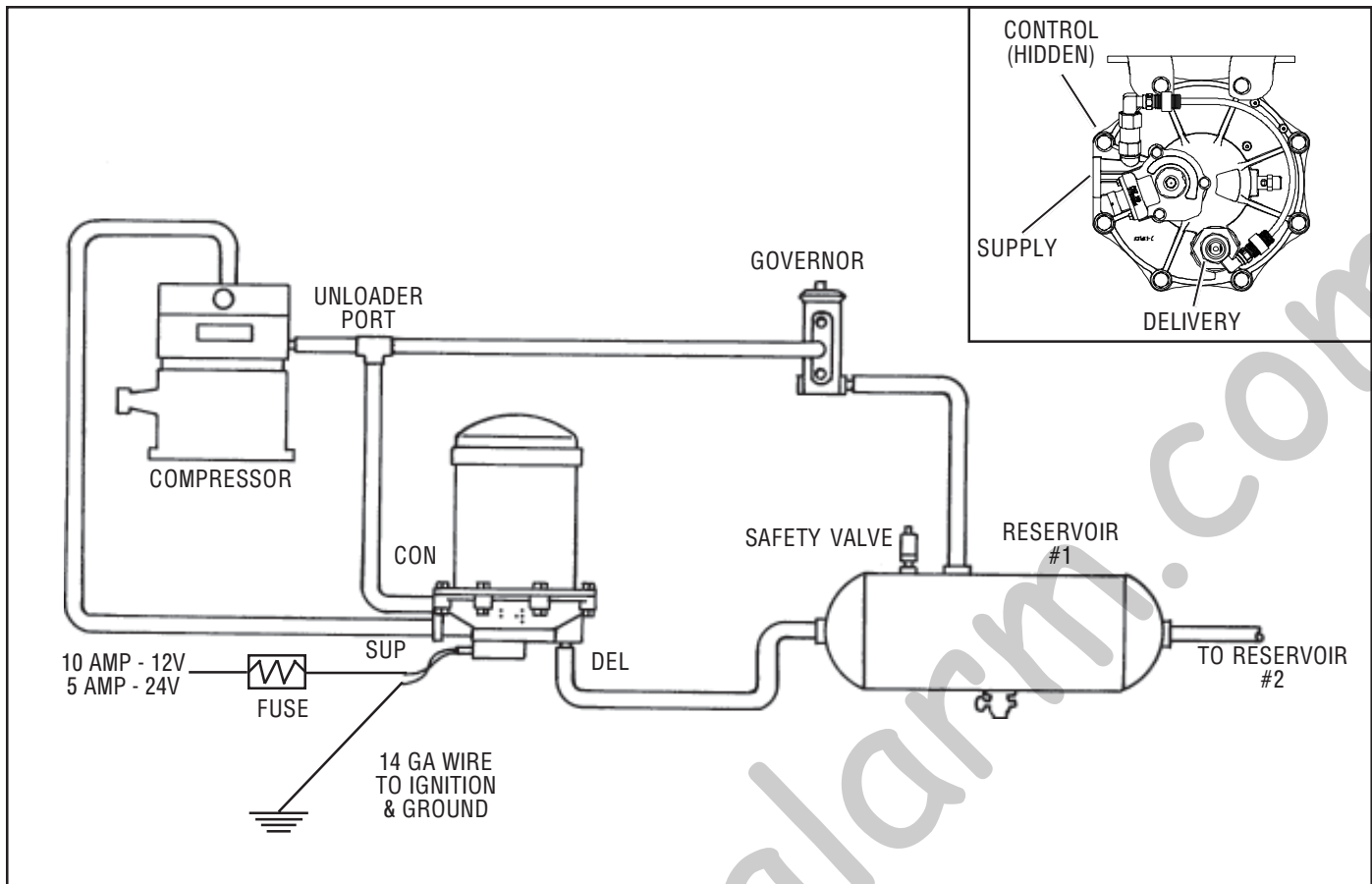


FIGURE 11 - AD-9™ AIR DRYER CHARGE CYCLE

- position the unit for ease of installation. Locate the bracket such that it cradles the end cover as shown in Figure 9. Utilizing the two 2-3/8" long cap screws, lock nuts and special washers provided with the AD-9™ air dryer retrofit unit, attach the lower mounting bracket and torque to 270-385 in. lbs.
- Assemble the mounting strap and upper mounting bracket as illustrated in Figure 10, by utilizing the 5/16" cap screw (25) and sleeve nut (28).
- Place the upper bracket assembly onto the shell of the AD-9™ air dryer and orient it so that it bears entirely on the cylindrical surface and does not extend onto the domed top. The slot spacing between the upper and lower bracket should be a minimum of 5.5 inches apart. Do not tighten strap onto the shell at this time.
- Mount the AD-9™ air dryer on the vehicle using 3/8" bolts (grade 5 min.) and washers. Torque to 25 ft. lbs. (300 inch pounds.) After positioning and mounting the upper bracket assembly according to the installation requirements, torque the 5/16" nut to 80-120 in. lbs. to tighten strap onto the shell.

CONNECTING THE AIR LINES

PURGE CONTROL LINE

- Install a purge control air line having a minimum inside diameter of 3/16 inches between the AD-9™ air dryer end cover control port and an unused unloader port on the governor. The control line must be plumbed direct to the governor and not in series with automatic drain valves, lubrication systems, etc.
- The control line should slope downward to the end cover without forming potential water traps.

DISCHARGE LINE

General:

Refer to Appendix A, Table A for recommended discharge line lengths and sizes for various vehicle applications and vocations.

PURGE EXHAUST LINE

- If it is necessary to direct AD-9™ air dryer discharge contaminants away from vehicle components it may be necessary to purchase a special exhaust cover for the AD-9™ air dryer (Pc. No. 5003838). A one inch (25.4 mm) I.D. hose can be clamped on the special AD-9™ air dryer exhaust cover.

WIRING THE HEATER/THERMOSTAT

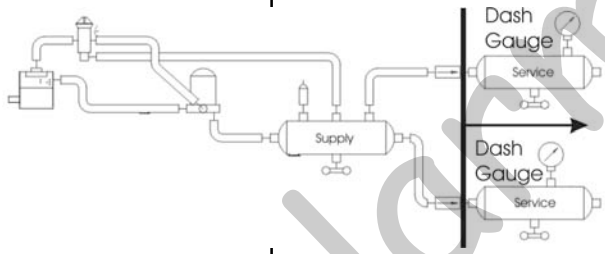
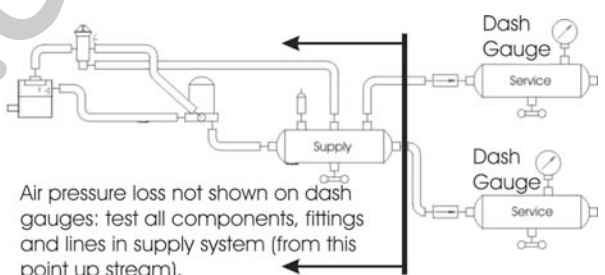
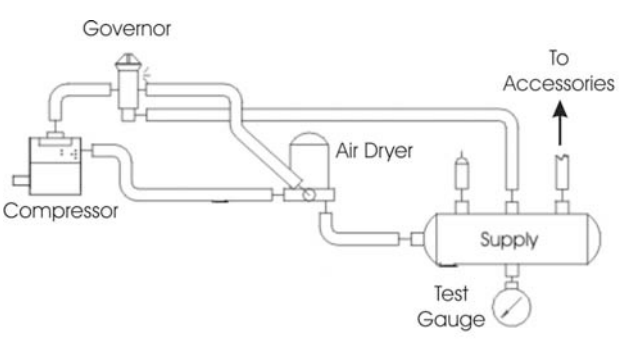
1. Determine the vehicle's electrical system voltage and make certain that the AD-9™ air dryer that is to be installed contains the same voltage heater. Use the AD-9™ air dryer part number to confirm the proper voltage. The AD-9™ air dryer is available with either a 12 or 24 volt heater which uses 75 watts of power.
2. A two lead, 12 inch, wire harness with attached weather resistant connector is supplied with all retrofit and replacement AD-9™ air dryers. Connect one of the two leads of the wire harness to the engine kill or ignition switch. The remaining lead of the wire harness must be connected to a good vehicle ground (not to the air dryer or its mounting bracket). A fuse should be installed in the power carrying wire; install a 10 amp fuse for 12 volt heaters and a 5 amp fuse for a 24 volt heater.
3. Use 14 GA wire if it is necessary to lengthen the wire harness provided with the AD-9™ air dryer. Make certain all wire splices are waterproofed.
4. Tie wrap or support all electrical wire leading to the AD-9™ air dryer at 6 - 8 inch intervals. **Note:** Wires should have sufficient slack and not completely taught.

TESTING THE AD-9™ AIR DRYER

Before placing the vehicle in service, perform the following tests:

1. Close all reservoir drain cocks.
2. Build up system pressure to governor cut-out and note that the AD-9™ air dryer purges with an audible escape of air.
3. "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 a purge at the AD-9™ air dryer exhaust.
4. It is recommended that the following items be tested for leakage to assure that the AD-9™ air dryer will not cycle excessively.
 - (A) Total air system leakage (See Bendix publication BW-5057 "Air Brake Handbook").
 - (B) Compressor unloader mechanism.
 - (C) Governor.
 - (D) Drain cock and safety valve in first (supply) reservoir.
 - (E) All air connections leading to and from the first (supply) reservoir.

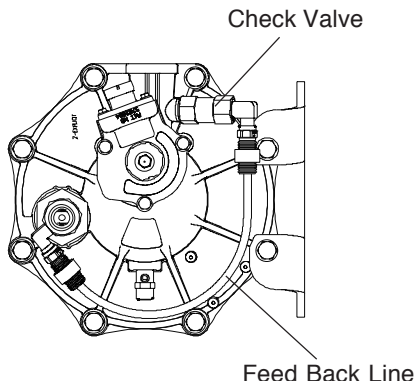
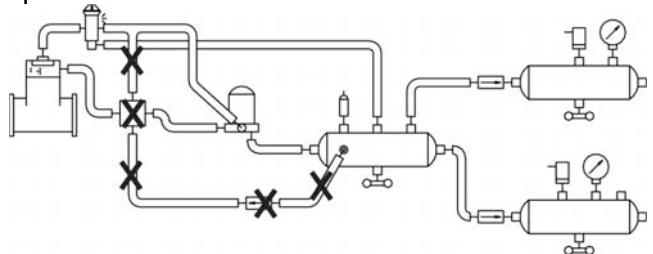
AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
<p>1. Dryer is constantly “cycling” or purging. Dryer purges frequently (every 4 minutes or less while vehicle is idling).</p>	<p>A. Excessive system leakage. IMPORTANT: Note whether air pressure loss is shown on dash gauge(s). Pressure loss shown on gauges is caused by service brake system or component leakage. Pressure loss NOT SHOWN on gauges is caused by supply system or component leakage.</p>	<p>A. If leakage IS SHOWN on gauges test for excessive service brake 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. Repair and retest as required.</p> <div style="text-align: center;">  <p style="font-size: small;">Air pressure loss shown on dash gauges: test all components, fittings and lines in service brake system (from this point down stream).</p> </div> <p>If leakage is NOT SHOWN on gauges test for excessive supply system leakage.</p> <div style="text-align: center;">  <p style="font-size: small;">Air pressure loss not shown on dash gauges: test all components, fittings and lines in supply system (from this point up stream).</p> </div> <p>Remove drain cock or valve in supply reservoir (wet tank) and install air gauge. Build system pressure, allow air dryer to purge and observe air gauge in supply reservoir. Pressure drop should not exceed 1 psi per minute. Perform tests 1 to 6 in the order presented.</p> <div style="text-align: center;">  </div>

AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
		<ol style="list-style-type: none"> 1. Test fittings, hoses, lines and connections. Apply soap solution to detect excessive leakage. Tighten or replace as needed then repeat the air dryer charge-purge cycle and observe the gauge installed in the supply reservoir. If leakage is within limits remove gauge from reservoir and replace drain cock or valve. If excessive leakage is detected, continue testing. 2. Test accessories connected to supply reservoir. Drain all air pressure from system, disconnect all air lines leading to accessories (fan clutch, wipers, air seats, etc.) and plug the reservoir at disconnection point. Build air system pressure until air dryer purges and observe supply reservoir gauge. If leakage is no longer excessive, repair or replace leaking accessory. If excessive leakage is detected, continue testing. 3. Test governor leakage. Build system pressure to governor cut-out turn off engine and apply soap solution to governor exhaust port and around cap. Leakage should not exceed a 1" bubble in 5 seconds. Reduce system pressure to 80 psi or less, and reapply soap solution. Leakage should not exceed a 1" bubble in 5 seconds. If excessive leakage is detected in either test, repair or replace governor. 4. Test compressor unloader leakage. Drain all air pressure from system and remove the governor from the compressor. Temporarily plug the governor unloader port or air line that mated with, or connected to, the compressor. Build air system pressure until air dryer purges then IMMEDIATELY SHUT OFF THE ENGINE. Observe the air gauge in the supply reservoir. If leakage is within limits, replace the compressor unloaders. Reconnect the governor to the compressor (after removing plug installed in governor) and retest while observing supply reservoir gauge. If excessive leakage is detected, continue testing. 5. Test air dryer purge valve and outlet (delivery) check valve. Drain all air pressure from system, remove the control line connection at the air dryer and plug the end of the air line leading to the governor (not the air dryer control port). Build system pressure to governor cut-out and observe air gauge. If little or no pressure drop is observed replace the air dryer check valve. If pressure drop continues apply soap

AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
		<p>solution to air dryer purge exhaust and purge control port (where the control line was removed). Leakage should not exceed a 1" bubble in 5 seconds. If leakage is excessive repair or replace purge valve assembly.</p> <p>6. 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.</p>
	B. Leaking purge valve housing assembly and/or o-rings in AD-9™ air dryer end cover.	B. With the supply port open to atmosphere, apply 120 psi at the control port. Apply a soap solution to the supply port and exhaust port (purge valve seat area). Permissible leakage - 1" bubble in 5 seconds.
	C. Holset "E" type compressor.	<p>C. Test the Holset E Compressor unloader system with feedback line and check valve for proper operation. Make certain Holset ECON is not in use with the drop-in version of the air dryer, if so, remove and retest.</p> <div style="text-align: center;">  <p style="margin-left: 100px;">Check Valve</p> <p style="margin-left: 100px;">Feed Back Line</p> <p style="margin-left: 100px;">Typical Drop-In Air Dryer End Cover</p> </div> <p>When installing a Bendix Drop-In air dryer in a system equipped with a Holset E or QE compressor, remove the Holset ECON valve along with its feed back and governor control line.</p> <div style="text-align: center;">  </div>

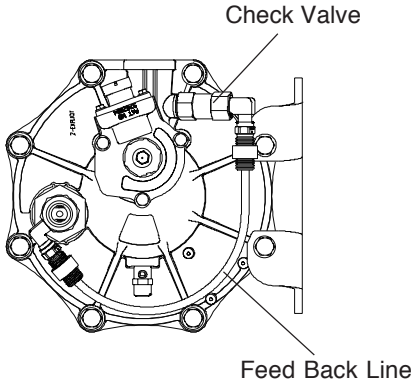
AD-9™ AIR DRYER TROUBLESHOOTING CHART

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. Maximum air dryer inlet temperature is exceeded.	B. Refer to section entitled "Connecting the Air Lines" as well as Appendix A, Table A columns 1 & 2 then check 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. This practice should be minimized.
	D. Air dryer not purging (see Symptom #5).	D. See 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, duty cycle too high - Air dryer not compatible with vehicle air system requirement (Improper air dryer/vehicle application). NOTE: Duty Cycle is the ratio of time the compressor spends building air to total engine running time. Air compressors are designed to build air (run "loaded") up to 25% of the time. Higher duty cycles cause conditions that affect air brake charging system performance which may require additional maintenance. Factors that add to the duty cycle are: air suspension, additional air accessories, use of an undersized compressor, frequent stops, excessive leakage from fittings, connections, lines, chambers or valves, etc.	F. See Appendix A, Table A, column 1, for recommended compressor sizes. If the compressor is "too small" for the vehicle vocation (for example, where a vehicle's vocation has changed or service conditions exceed the original vehicle or engine OE spec's) then upgrade the compressor. Note: The costs incurred (e.g. installing a larger capacity compressor, etc.) are not covered under original compressor warranty. <u>Charge Cycle Time</u> - The AD-9™ 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 Bendix parts outlet or sales representative for additional information.

AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
		<p><u>Purge Cycle Time</u> - During normal vehicle operation, the air compressor must remain unloaded for a minimum of 20 seconds for the standard AD-9™ air dryer or 30 seconds for the Extended Purge Model. 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 Bendix parts outlet or sales representative for additional information.</p> <p><u>European Air Brake Systems</u> - 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 Bendix parts outlet or sales representative for additional information.</p> <p><u>Air Compressor Size</u> - Although the AD-9™ 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 AD-9™ air dryer with a compressor which has a rated displacement exceeding 17 CFM that an authorized Bendix parts outlet or Bendix marketing representative be contacted for assistance.</p>
	G. Air compressor discharge and/or air dryer inlet temperature too high.	<p>G. Restricted discharge line. See Appendix A, Table A, column 1 & 2 for recommended sizes. If discharge line is restricted or more than 1/16" carbon build up is found, replace the discharge line. Replace as necessary.</p> <p>Discharge Line Freeze-Up. The discharge line must maintain a constant slope down from the compressor to the air dryer inlet fitting to avoid low points where ice may form and block the flow. If, instead, ice blockages occur at the air dryer inlet, insulation may be added here, or if the inlet fitting is a typical 90 degree fitting, it may be changed to a straight or 45 degree fitting. For more information on how to help prevent discharge line freeze-ups, see Bendix Bulletins TCH-08-21 and TCH-08-22. Shorter discharge line lengths or insulation may be required in cold climates.</p> <p>Insufficient coolant flow through compressor. Inspect coolant line. Replace as necessary (I.D. is 1/2" min.). Inspect the coolant lines for kinks and restrictions and fittings for restrictions. Replace as necessary. Verify coolant lines go from engine block to compressor and back to the water pump. Repair as necessary.</p>

AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
		<p>Restricted air inlet (not enough air to compressor). Check compressor air inlet line for restrictions, brittleness, soft or sagging hose conditions, etc. Repair as necessary. Inlet line size is 3/4 ID. Maximum restriction requirement for compressors is 25 inches of water. Check the engine air filter and service if necessary (if possible, check the air filter usage indicator).</p> <p>Poorly filtered inlet air (poor air quality to compressor). Check for leaking, damaged or malfunctioning compressor air inlet components (e.g. induction line, fittings, gaskets, filter bodies, etc.). Repair inlet components as needed. Note: Dirt ingestion will damage compressor and is not covered under warranty.</p> <p>If you found excessive oil present in the service reservoir and you did not find any issues above, the compressor may be passing oil.</p> <p>Replace compressor. If still under warranty, follow normal warranty process.</p>
	H. Compressor malfunction.	<p>H. If you found excessive oil present in the service reservoir and you did not find any issues above, the compressor may be passing oil. Test the compressor using the BASIC cup method as described in the Bendix compressor service manual and referred to in Appendix A, Table A, column 5.</p> <p>Replace compressor. If still under warranty, follow normal warranty process.</p>
	I. Air by-passes desiccant cartridge assembly.	<p>I. If vehicle uses Holset compressor, inspect feedback check valve for proper installation and operation.</p> <p>When replacing the desiccant cartridge, make sure desiccant cartridge assembly is properly installed and sealing rings are in place on mounting surface of desiccant cartridge.</p> <div style="text-align: center;">  <p style="text-align: center;">Typical Drop-In Air Dryer End Cover</p> </div>

AD-9™ AIR DRYER TROUBLESHOOTING CHART

SYMPTOMS	CAUSE	REMEDY
	J. Desiccant requires replacement.	J. Replace desiccant cartridge assembly. Refer to Appendix A, Table A columns 3 & 4 for recommended intervals.
3. Oil present at air dryer purge exhaust or cartridge during maintenance.	A. Air brake charging system is functioning normally.	A. Air dryers remove water and oil from the air brake charging system. A small amount of oil is normal. Check that regular maintenance is being performed and that the amount of oil in the air tanks (reservoirs) is within the acceptable range shown on the BASIC cup (see also column 5 of Appendix A, Table A.) Replace the air dryer cartridge as needed and return the vehicle to service.
4. Safety valve on air dryer "popping off" or exhausting air.	A. Restriction between air dryer and supply (first) reservoir.	A. Check to determine if air is reaching supply reservoir. Inspect for kinked tubing or hose. Check for undrilled or restricted hose or tubing fittings and repair or replace as needed.
	B. Air dryer safety valve malfunction.	B. Verify relief pressure is at vehicle or component manufacturer specifications. Replace if malfunctioning.
	C. Desiccant cartridge maintenance required.	C. Refer to Appendix A Table A and column 3. Check compressor for excessive oil passing and/or correct compressor installation. Repair or replace as necessary. Replace desiccant cartridge.
	D. Malfunctioning defective discharge check valve in end cover of the AD-9™ air dryer.	D. Test to determine if air is passing through check valve. Repair or replace.
	E. Excessive pressure pulsations from compressor. (Typical single cylinder type).	E. Increase volume in discharge line by increasing length or diameter. Add a ping tank (small reservoir).
	F. Governor malfunction. Missing or restricted governor control line installation.	F. Test governor operation and/or inspect the control line leading from the governor UNL (unloader) port to the air dryer control port.
5. Constant exhaust of air at air dryer purge valve exhaust. (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. Compressor fails to unload (stop compressing air) and air dryer purge exhaust makes "sputtering" or "popping" sound.	B. Confirm failure to unload by increasing & decreasing engine RPM and noting change in the rate of leakage and intensity of accompanying leakage sound. Repair/replace compressor unloaders.

AD-9™ AIR DRYER TROUBLESHOOTING CHART (Continued)

SYMPTOMS	CAUSE	REMEDY
	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 - malfunctioning heater and thermostat, wiring, blown fuse.	D. Test heater and thermostat as described in Preventative Maintenance Section.
	E. Excessive system leakage.	E. See Symptom #1.
	F. Purge valve stays open - supply air leaks to control side.	F. Repair purge valve and housing.
6. Can not build system air pressure.	A. Inlet and outlet air connections reversed.	A. Connect compressor discharge to air dryer supply port. Reconnect lines properly.
	B. Check valve between air dryer and first reservoir.	B. Test check valve for proper operation. Repair or replace as necessary.
	C. Kinked or blocked (plugged) discharge line.	C. Check to determine if air passes through discharge line. Check for kinks, bends, excessive carbon deposits, or ice blockage.
	D. Excessive bends in discharge line (water collects and freezes).	D. Discharge line should be constantly sloping from compressor to air dryer with as few bends as possible.
	E. Refer to Symptom 4, Causes E & F.	E. Refer to Symptom #4, Remedies E & F.
7. Air dryer does not purge or exhaust air.	A. Missing, broken, kinked, frozen, plugged or disconnected purge control line.	A. Inspect control line from governor UNL (unloader) port to control port of air dryer. 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, G for Symptom #4.	C. See Causes, B, E, G for Symptom #4.
8. 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.
	C. Malfunctioning or saturated desiccant cartridge.	C. Replace desiccant cartridge assembly.
	D. Compressor passing excessive oil.	D. Check for proper compressor installation; if symptoms persist, replace compressor.




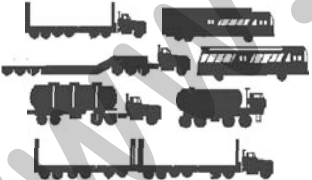
AD-9™ AIR DRYER TROUBLESHOOTING CHART (Continued)

SYMPTOMS	CAUSE	REMEDY
	E. Desiccant cartridge not assembled properly to end cover. (Loose attachment)	E. Check the torque on the desiccant cartridge to end cover attachment. Refer to assembly section of this service data sheet.
9. "Pinging" noise excessive during compressor loaded cycle.	A. Defective check valve assembly in AD-9™ air dryer end cover.	A. Refer to Remedy C, Symptom #1.
	B. Leaking Turbo Cutoff valve.	B. Repair or replace purge valve assembly.
	C. Leaking purge valve control piston o-ring.	C. Repair or replace purge valve assembly.
10. Constant seepage of air at air dryer purge valve exhaust (non-charging mode.)	A. Defective check valve assembly in AD-9™ air dryer end cover.	A. Refer to Remedy C, Symptom #1.
	B. Leaking Turbo Cutoff valve.	B. Repair or replace purge valve assembly.
	C. Leaking purge valve control piston o-ring.	C. Repair or replace purge valve assembly.
11. The air dryer purge piston cycles rapidly in the compressor unloaded (non-compressing) 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.

Appendix A

Table A: Maintenance Schedule and Usage Guidelines

Regularly scheduled maintenance is the single most important factor in maintaining the air brake charging system.

Vehicle Used for:	No. of Axles	Column 1	Column 2		Column 3	Column 4	Column 5
		Typical Compressors Spec'd	I.D.	Length	Recommended Air Dryer Cartridge Replacement ¹	Recommended Reservoir Drain Schedule ²	Acceptable Reservoir Oil Contents ³ at Regular Drain Interval
Low Air Use		Bendix® BA-921® air compressor Bendix® Tu-Flo® 550 air compressor	1/2 in.	6 ft.	Every 3 Years	Recommended Every Month - Max of every 90 days	BASIC test acceptable range: 3 oil units per month. See appendix A.
Compressor with less than 15% duty cycle e.g. Line haul single trailer w/o air suspension, air over hydraulic brakes. 	5 or less		For oil carry-over control ⁴ suggested upgrades: 5/8 in. 9 ft.				
Compressor with up to 25% duty cycle e.g. Line haul single trailer with air suspension, school bus. 	5 or less		1/2 in.	9 ft.			
			For oil carry-over control ⁴ suggested upgrades: 5/8 in. 12 ft.				
High Air Use		Bendix® Tu-Flo® 750 air compressor Bendix® BA-922®, or DuraFlo™ 596 air compressor	1/2 in.	12 ft.	Every 2 Years	Every Month	BASIC test acceptable range: 5 oil units per month. See appendix A.
Compressor with up to 25% duty cycle e.g. Double/triple trailer, open highway coach/RV, (most) pick-up & delivery, yard or terminal jockey, off-highway, construction, loggers, concrete mixer, dump truck, fire truck. 	8 or less		For oil carry-over control ⁴ suggested upgrades: 5/8 in. 15 ft.				
Compressor with up to 25% duty cycle e.g. City transit bus, refuse, bulk unloaders, low boys, urban region coach, central tire inflation. 	12 or less		5/8 in.	12 ft.			
		For oil carry-over control ⁴ suggested upgrades: 3/4 in. 15 ft.		Every Year			

Footnotes:

- 1 With increased air demand the air dryer cartridge needs to be replaced more often.
- 2 Use the drain valves to slowly drain all reservoirs to zero psi.
- 3 Allow the oil/water mixture to fully settle before measuring oil quantity.
- 4 To counter above normal temperatures at the air dryer inlet, (and resultant oil-vapor passing upstream in the air system) replace the discharge line with one of a larger diameter and/or longer length. This helps reduce the air's temperature. If sufficient cooling occurs, the oil-vapor condenses and can be removed by the air dryer. Discharge line upgrades are not covered under warranty. Note: To help prevent discharge line freeze-ups, shorter discharge line lengths or insulation may be required in cold climates. (See Bendix Bulletins TCH-08-21 and TCH-08-22.)
- 5 For certain vehicles/applications, where turbo-charged inlet air is used, a smaller size compressor may be permissible.

Note: Compressor and/or air dryer upgrades are recommended in cases where duty cycle is greater than the normal range (for the examples above).

For Bendix® Tu-Flo® 550 and 750 compressors, unloader service is recommended every 250,000 miles.

Appendix B

Additional Troubleshooting Information

The troubleshooting procedure presented on the following pages has been excerpted from a troubleshooting card entitled: Troubleshooting Charging and Air Supply Systems. The complete card can be obtained from authorized Bendix parts outlets under literature number BW1779. It is presented here because of the air dryers connection to the supply air system and for convenience. The procedure is not all inclusive but rather represents the most commonly encountered complaints.

