

Installation Guide

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Haldex



Haldex ModulAir®

Installation / Service Manual



Technical Service
and
Engineering Support

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IMPORTANT NOTICE

The description and specifications contained in this Installation Manual are current at the time of printing. Haldex Brake Products Corp. reserves the right to discontinue or modify its models and/or procedure and to change specifications at any time without notice.



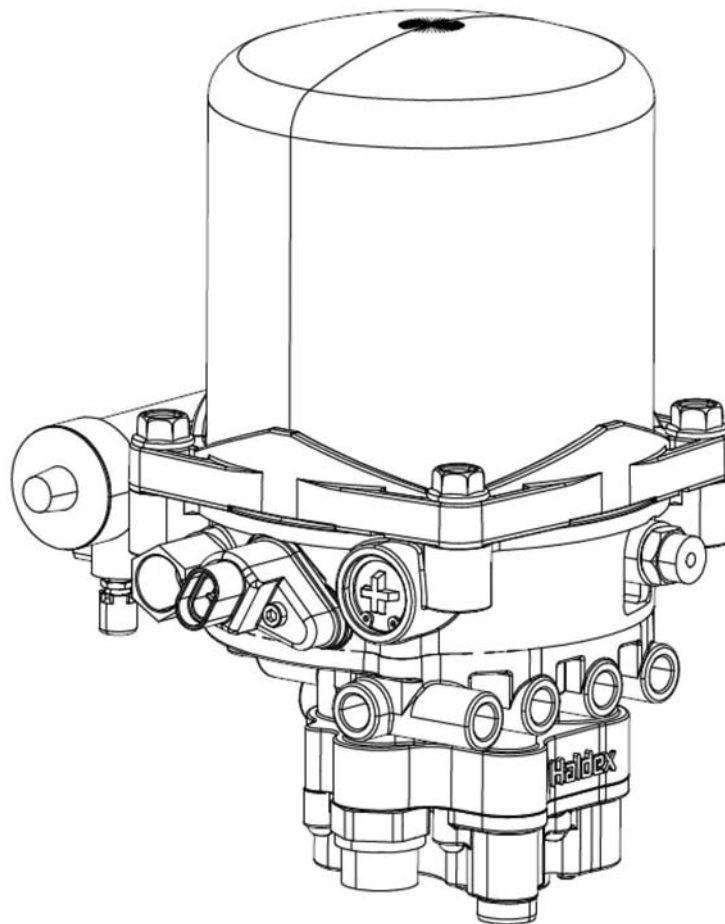
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ModulAir® Dryer Product Purpose

In its most basic form, ModulAir® is an air dryer intended to remove water and other contaminants from a commercial vehicle's air brake system. The ModulAir® air dryer is a desiccant style dryer that removes moisture from compressed air delivered to a vehicle's braking system by an air compressor.

Additionally, ModulAir® contains a number of other additional valves that further help dry, clean, distribute and control air to an air braked vehicle, including the braking, suspension and auxiliary systems.



ModulAir® Dryer Product Anatomy

The ModulAir® dryer consists of three main modules; the Dryer Module, for drying; the Distribution Module to deliver air to brake circuits; and the Control Module to control air production and dryer purge operation

Dryer Module

The Dryer Module holds the turbo protection valve, check valve, safety valve, desiccant cartridge with canister and heater assembly.

Distribution Module

The Distribution Module for the ModulAir® 4-Circuit version contains four pressure protection valves that are set at different pressure settings to give a priority to the primary, secondary and remaining two circuits. Although the dryer purges contaminants through a hole in the Distribution Module it does not contain valves or components that control the dryer purge cycle.

Control Module

The Control Module on the standard version of ModulAir® consists of a typical piston air governor that is pre-set to cut-in and cut-out pressures. Other versions of the ModulAir® Control Module include various electronic controls for governor, circuit pressure monitoring and control, and air dryer purge cycle.

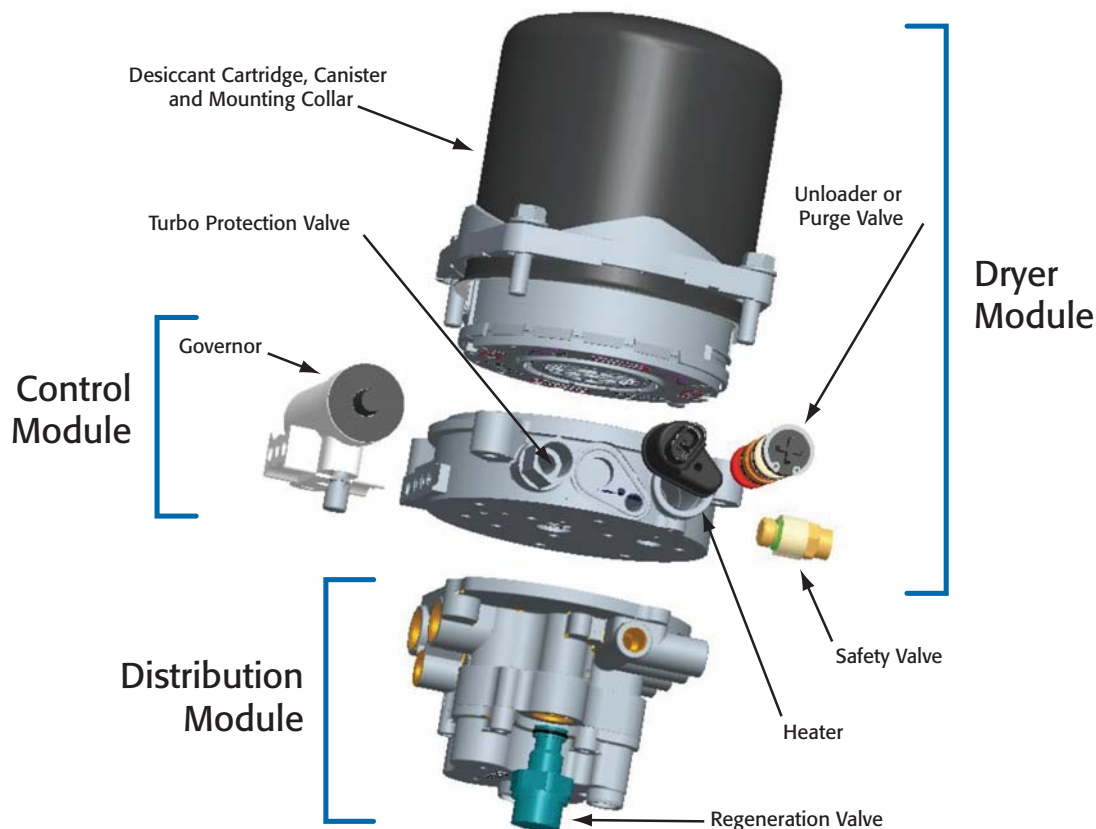


Figure 1: ModulAir® Exploded View

Desiccant Cartridge, Canister and Mounting Collar

The desiccant cartridge is where all drying and contaminant removal occur in the air dryer. The Haldex ModulAir® dryer contains the Haldex patented MTC cartridge design which has five separate stages of drying. The desiccant cartridge is covered by the canister and affixed to the dryer base with the mounting collar and four bolts.

Turbo Protection Valve

The turbo protection valve, located at the dryer inlet, prevents turbo pressure loss on turbocharged compressor applications when compressor is unloaded.

Governor

A standard pneumatic piston-style governor is used in ModulAir® to control the cut in and cut out pressures in the air system. The governor signals the compressor to load or unload.

Safety Valve

The safety, or pop off valve, is designed to relieve system pressure if it reaches a level higher than normal operating pressures. This protects other brake system components from high pressures that could cause system damage or failure.

Unloader/Purge Valve

The unloader/purge valve in ModulAir® is essentially a purge valve. When the dryer is ready to purge, the unloader/purge valve opens to allow all contaminants collected within the dryer and cartridge to be flushed out through the purge port on the dryer.

Regeneration Valve

The regeneration valve serves as a timer to allow a designated amount of air to flow from the air brake system back through the ModulAir® dryer in order for it to purge and regenerate the desiccant.

Heater

A heater helps prevent moisture collected within the air dryer from freezing. The integrated thermostat on the heater controls when the heater is energized.

ModulAir® Dryer Product Function

In an unpressurized state, all valves internal to the ModulAir® assembly should be in the closed position as shown in Figure 2. This includes the turbo protection valve (T), safety valve (S), unloader valve (U), check valve (C), regeneration valve (R) and all pressure protection valves (O1...O4).

Diagram Key:

- C ... Check valve
- D ... Air dryer cartridge
- G ... Governor
- O1 ... Pressure protection valve circuit 21
- O2 ... Pressure protection valve circuit 22
- O3 ... Pressure protection valve circuit 23
- O4 ... Pressure protection valve circuit 24
- R ... Regeneration valve
- S ... Safety valve
- T ... Turbo protection valve
- U ... Unloader valve

- 11 ... Incoming air from compressor
- 21 ... Primary circuit
- 22 ... Secondary circuit
- 23 ... Auxiliary 1
- 24 ... Auxiliary 2
- 3 ... Exhaust
- 4 ... Control

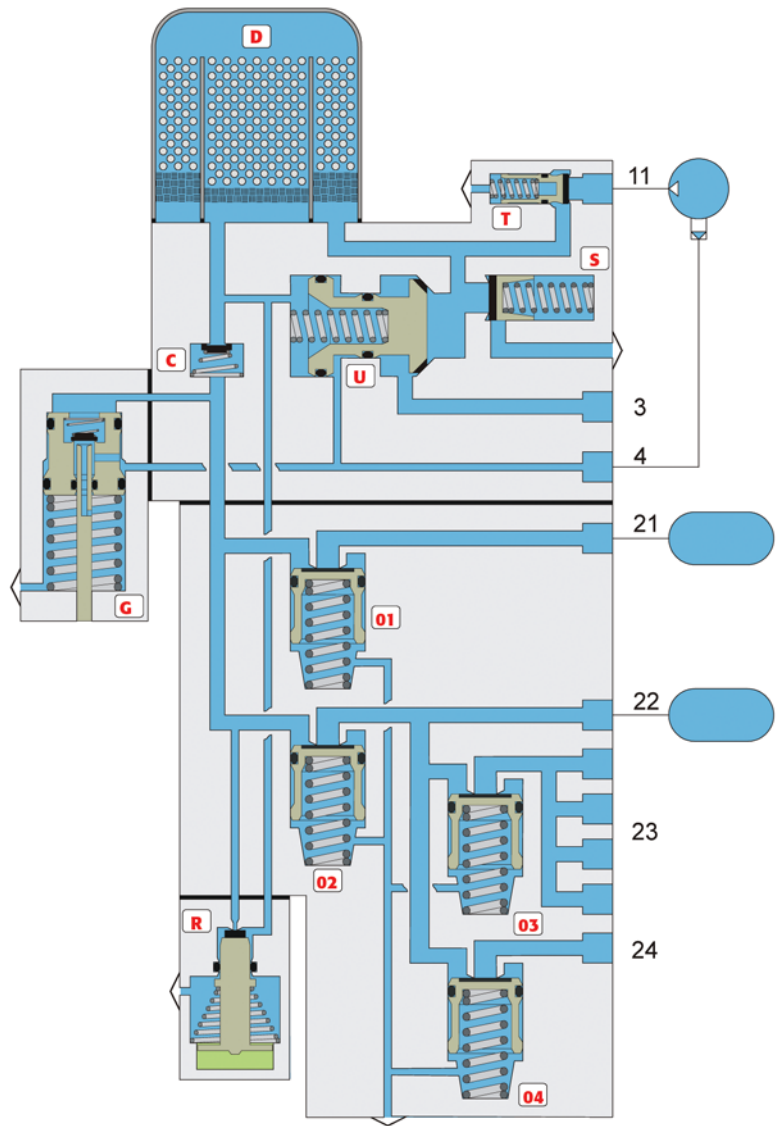


Figure 2: ModulAir® dryer and air system with no pressure in the dryer or the air brake circuits

Start of Air System Fill

When the engine is first started, compressed air from the air compressor flows through the discharge line to the inlet port marked 11 on ModulAir®. When the inlet pressure gets to about 44 psi, the turbo protection valve (T) opens and allows air to flow through the desiccant cartridge (D) and the check valve (C) opens as seen in Figure 3.

Filling of Primary, Secondary, and Auxiliary Circuits

As the pressure within the ModulAir® dryer continues to build, the pressure protection valves that control air to the primary, secondary and auxiliary circuits begin to open in sequence according to their factory preset opening pressures (see Technical Data section page 9). Each pressure protection valve is set at different opening pressure to give filling preference to one or more circuits versus others. Typically, the primary circuit is filled first, so its pressure protection valve would be set to open before all others.

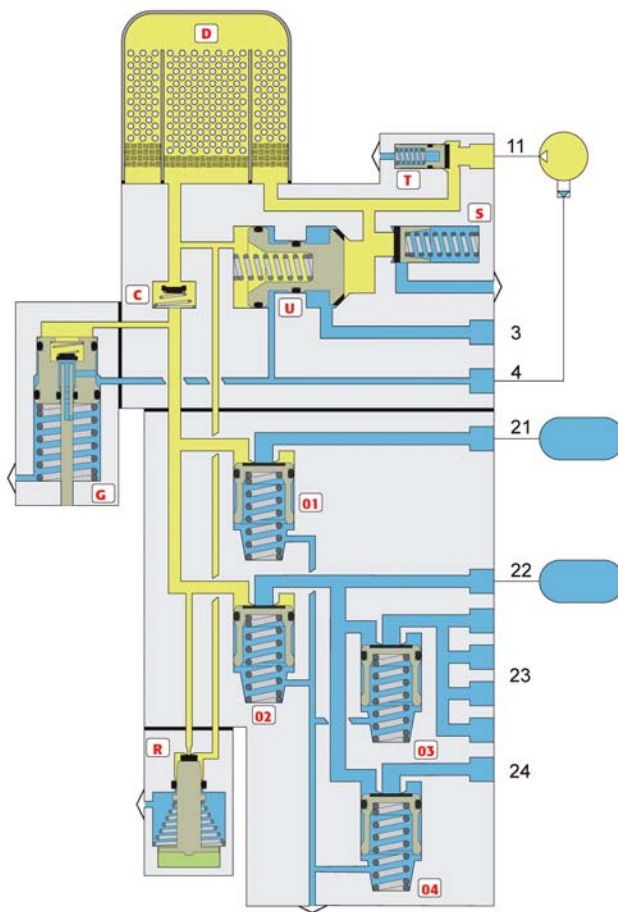


Figure 3: Turbo protection valve (T) and check valve (C) open

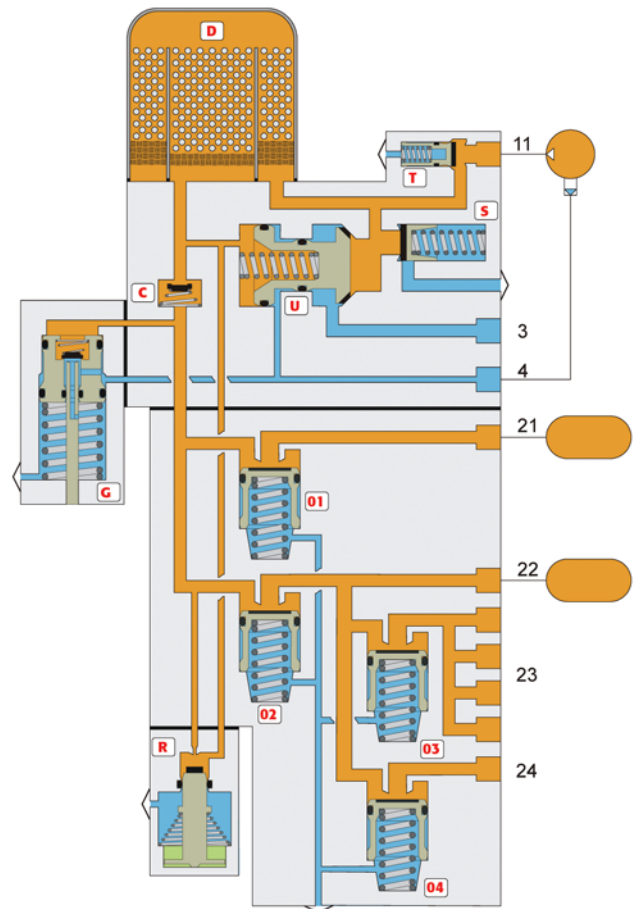


Figure 4: All pressure protection valves (01...04) open and filling primary brake circuits

Compressor Cut-out and ModulAir® Dryer Regeneration

When the system pressure has reached the set cut-out pressure, the governor (G) sends a control signal through port 4 to the compressor so that it will unload. At the same time, the unloader valve (U) receives this control line pressure, causing it to open and allow air to backflow from the air brake circuits (figure 5). The regeneration valve (R) serves as a timer that will allow sufficient air to backflow from the brake circuits before closing as seen in figure 6.

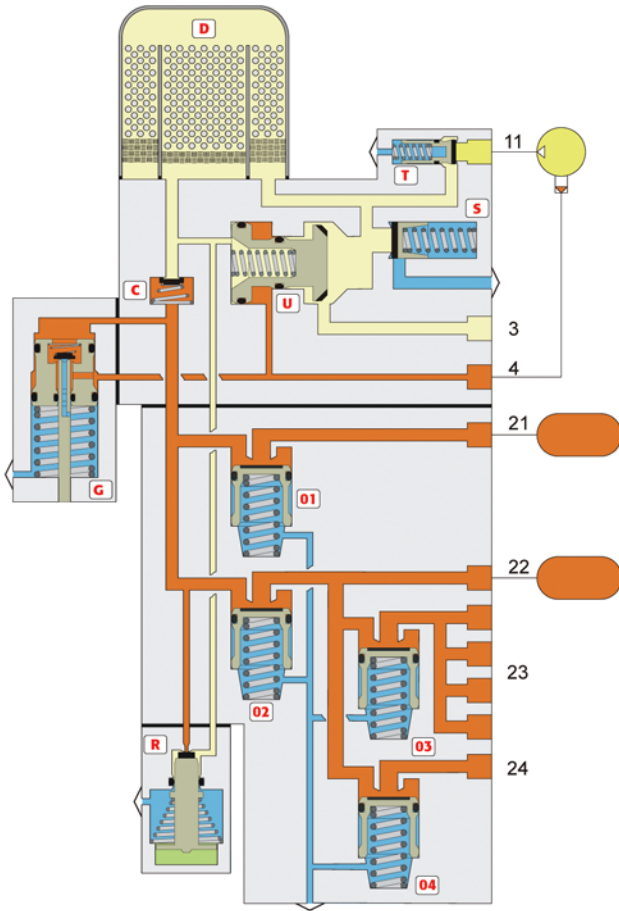


Figure 5: Unloader valve (U) open and regeneration valve (R) allowing air to backflow through dryer for purge cycle

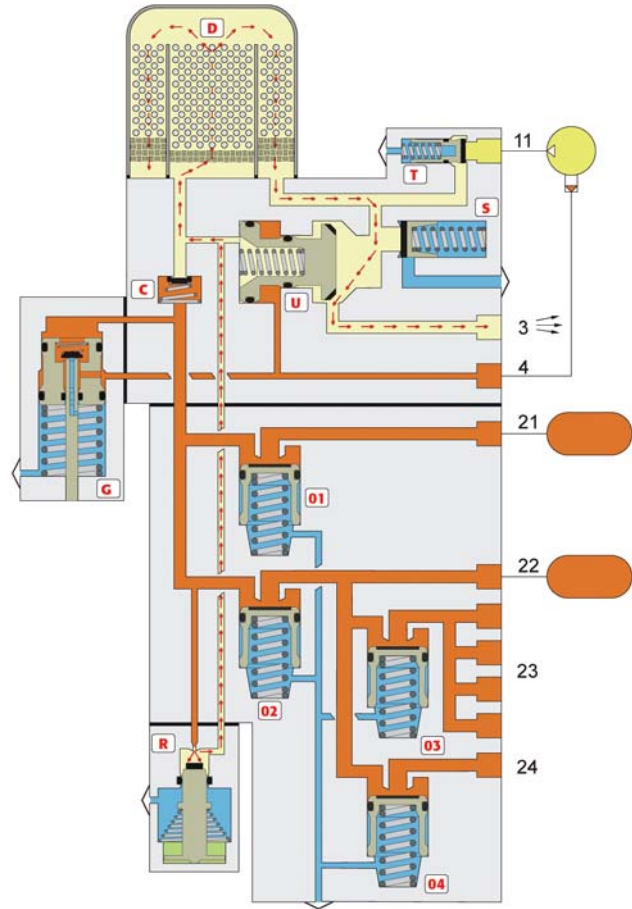


Figure 6: All pressure protection valves (O1...O4) open and filling primary brake circuits

Technical Data for ModulAir® Dryer

Air Flow

Maximum inlet airflow	=	35 scfm (991 slpm)
Typical inlet airflow	=	12 scfm @ 125 psi, 160° F (340 slpm @ 8.6 bar, 71°C)

Temperature

Maximum operating range	=	-40°F to +175°F (-40°C to +80°C)
Recommended operating range	=	+40°F to +150°F (+5°C to +65°C)

Pressure

Governor settings		
Cut-in pressure	=	105 ± 5 psi (7.25 ± 0.35 bar)
Pressure range	=	22.5 ± 7.5 psi (1.55 ± 0.5 bar)
Safety valve opening pressure	=	175 + 14 psi (12 + 1 bar)
Burst pressure	=	360 psi (25 bar)
Turbo protection valve		
Opening pressure	=	44 ± 8 psi (3 ± 0.5 bar)
Closing pressure	=	22 ± 3 psi (1.5 ± 0.2 bar)
Pressure protection valves		
Opening pressure primary circuit (21)	=	103 ± 3 psi (7.1 ± 0.2 bar)
Closing pressure primary circuit (21)	=	82 psi (5.7 bar)
Opening pressure secondary circuit (22)	=	109 ± 3 psi (7.5 ± 0.2 bar)
Closing pressure secondary circuit (22)	=	87 psi (6.0 bar)
Opening pressure auxiliary circuit 1 (23)	=	55 ± 3 psi (3.8 ± 0.2 bar)
Closing pressure auxiliary circuit 1 (23)	=	42 psi (2.9 bar)
Opening pressure auxiliary circuit 2 (24)	=	84 ± 3 psi (5.8 ± 0.2 bar)
Closing pressure auxiliary circuit 2 (24)	=	66 psi (4.6 bar)
Maximum Inlet Airflow	=	about 35 SCFM (about 990 SLPM)

Electrical

Nominal voltage	=	12 or 24 V DC
Power consumption	=	90 Watt
Resistance Amperage	=	8 amps @ 12V / 4 amps @ 24V

Weights

Assembly weight	=	about 20.0 lbs (about 9.1 Kg)
Desiccant cartridge weight	=	about 3.5 lbs (about 1.6 Kg)

Torque Values

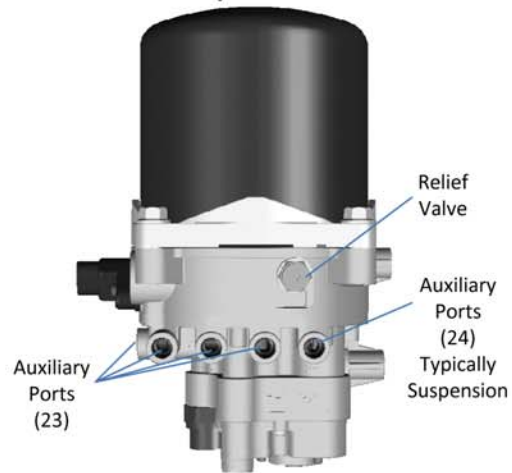
Cannister bolts	=	32 - 35 lb _f - ft (43 - 47 Nm)
Governor bolts	=	110 - 150 lb _f - in (11.5 - 13.8 Nm)
Heater screw	=	45 - 55 lb _f - in (5.1 - 6.2 Nm)

Loctite Note: Loctite blue should be used very sparingly and Loctite red should never be used.

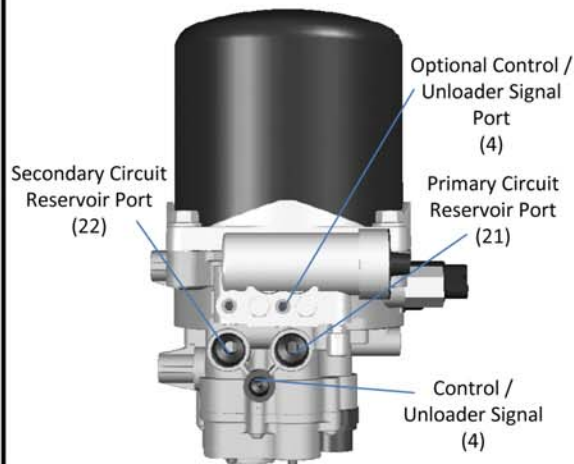
ModulAir Port and Part Identifications

- 11 Air inlet from compressor or compressor discharge line
- 21 Primary circuit port supplying air to primary reservoir
- 22 Secondary circuit port supplying air to secondary reservoir
- 23 Auxiliary circuit ports
- 24 Auxiliary circuit port, typically supplying air to suspension system
- 3 Exhaust port, dryer purge port
- 4 Control, or unloader signal port.
Only one control port should be used.

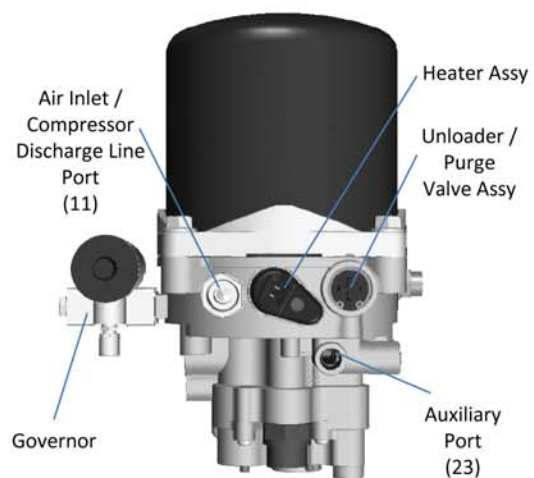
Auxiliary Side View



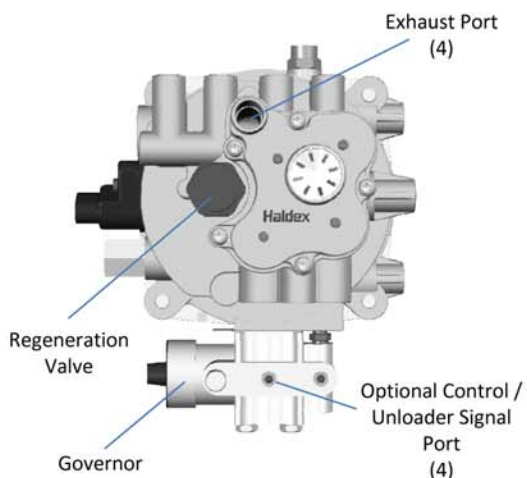
Governor Side View



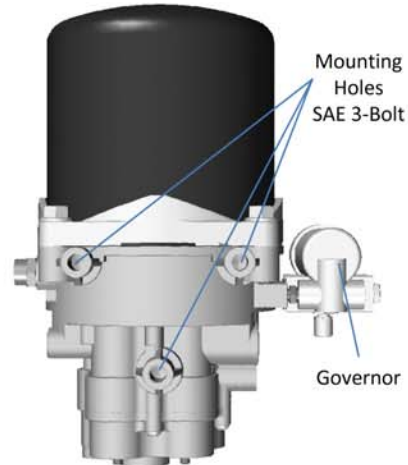
Front View



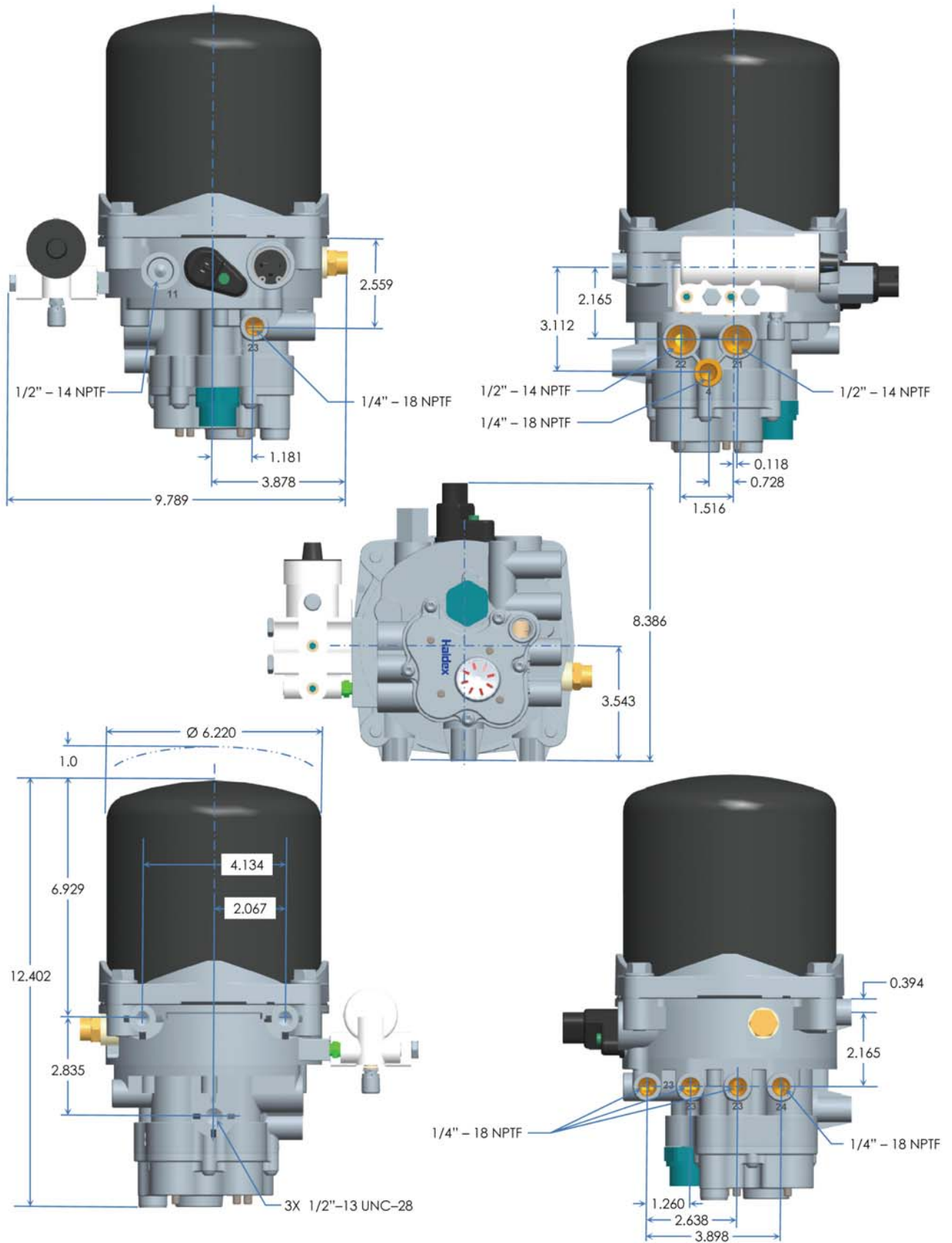
Bottom View



Mounting View



Dimensions



ModulAir® Dryer Installation Guidelines

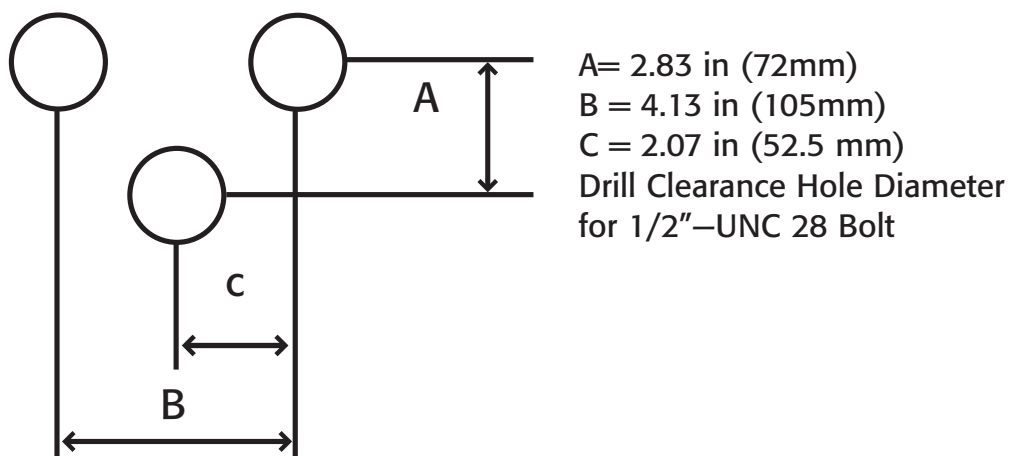
Haldex recommends that all installations follow SAE standard J2383 and much of the following information is extracted from SAE J2383, with certain unique requirements specific to the ModulAir® dryer family.

Mounting Position

- The air dryer should be mounted in a location with sufficient space around it to facilitate service and to provide visual access for periodic inspection.
- The air dryer should be mounted in an area where it is protected from tire or wheel road splash.
- The air dryer, including mounting brackets, lines and fittings should be mounted in a protected location such that minor mechanical damage to the vehicle will not damage the air system integrity.
- The air dryer must be mounted with the exhaust port pointed downward.
- The air dryer must be mounted to avoid excessive heat sources (175° F max).
- The air dryer mounting method must be rigid enough to avoid vibration which could damage the desiccant or dryer.
- The air dryer must not incline in any direction more than 15° from vertical position.
- The air dryer must have at least 0.5 in (12.5 mm) free space above the cartridge canister to allow for removal during service.

Mounting Method

- The ModulAir® dryer uses the standard 3-bolt pattern shown in the figure below.



Air Lines and Fittings

Air Lines

- To prevent moisture accumulation, the compressor discharge line should slope continuously downhill from the compressor to the dryer without any dips which exceed $\frac{1}{2}$ the line diameter. If this is not possible, the line should run vertically straight upward at the compressor to a height that will permit a downhill sloping run to the dryer.
- The compressor discharge line size, length, and material must be such that the inlet temperature is typically no more than 160°F (71°C), and no less than 77°F (25°C) above the lowest ambient temperature. Lower dryer inlet temperatures should be avoided to minimize the risk of freeze-ups in the discharge line or dryer inlet fitting. Higher dryer inlet temperatures should be avoided to minimize the risk of heat damage to the dryer seals and/or to avoid loss of drying performance.

Fittings

- The use of restrictive fittings in the compressor discharge line should be avoided. These restrictive fittings impede the airflow and contribute to increased freezing potential. Avoid the use of 90° elbows where possible
- The air dryer must not incline in any direction more than 15° from vertical position.
- The air dryer must have at least 0.5 in (12.5 mm) free space above the cartridge canister to allow for removal during service.
- Use Teflon tape on fittings very sparingly, keeping in mind that it could break loose and contaminate the air valve seals.

ModulAir® Dryer Installation Guidelines

Important Precautions and Preparations

- All company and vehicle manufacturer's safety procedures must be followed when installing the ModulAir® dryer.
- Always wear proper personal protective equipment, including approved eye glasses.
- Never work on or under a vehicle unless it is parked on a level surface and its wheels are blocked to prevent it from moving.
- Never work on a vehicle air brake system when the engine is running. 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.
- Drain all air pressure from the air system before beginning any installation, service, or repair.
- Never connect or disconnect a hose or line containing pressure. Never remove a component plug unless it is certain that all system pressure has been depleted.
- Never exceed recommended component or system pressures.
- Do not attempt to install, remove, disassemble or assemble a component until all recommended procedures have been read and are fully understood. Use only the proper tools and observe all precautions pertaining to the use of those tools.
- Use only genuine Haldex replacement parts, components and kits. Replacement hardware, tubing, fitting, etc should be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- Components with stripped threads or damaged part 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.
- Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.

Mounting Guidelines

1. Locate ModulAir® dryer in an area with sufficient space that will allow for service and visual access for inspection.
2. Dryer should be mounted away from direct tire splash.
3. The dryer exhaust, or purge port must point downward. Reference page 10.
4. Mounting location must be selected to avoid excessive heat.
5. Mounting location must be rigid and not susceptible to excess vibration.
6. Compressor discharge line must slope downward, without dips and 90° fittings should be avoided.
7. Mounted dryer should not have more than 15° inclination from vertical.
8. Ensure that there is a minimum of ½" above dryer for serviceability of the desiccant cartridge.
9. The ModulAir® dryer has a standard SAEJ2383 3-bolt mounting pattern and can be used to mount directly to a frame member. However, a mounting bracket can be used if necessary.

Basic Installation Steps

Mounting

1. Park the vehicle on a level surface, apply the parking brakes and always block the wheels.
2. Stop the engine.
3. Drain the air pressure from all reservoirs before beginning any work on the vehicle.
4. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that removes all electrical power from the vehicle.
5. Locate the dryer to the intended mounting position in accordance with the above mounting guidelines and install ½" - 28 minimum grade 5 bolt with lock washer, tightening to 45-55 ft-lb of torque.

Electrical

6. For those dryers with a heater, it must be connected to the vehicle power supply. Locate a circuit with the correct voltage that is energized, or "hot," when the ignition is "ON." The current draw is 8 amps at 12 V and 4 amps at 24 V. A 10-15 amp fuse is recommended in this line. Connect the one heater lead to this "hot" wire.
7. Connect the other heater lead to a good electrical ground on the vehicle chassis or within an electrical junction box. Care should be taken to protect the grounding connection from the water and other contaminant ingress.

Connecting Air Lines

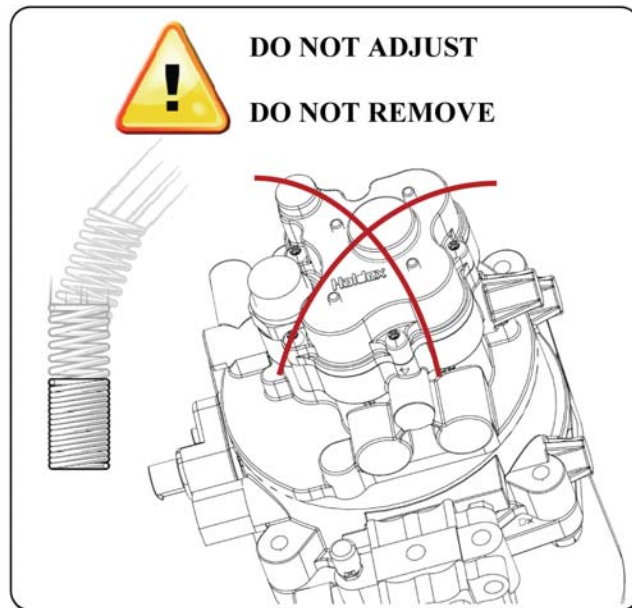
8. Connect a suitable compressor discharge line to the 1/2" NPT dryer inlet port marked 11, making sure that the line slopes down from the compressor to the air dryer. The compressor discharge line material should be wire braided "Teflon" hose, copper tubing or a combination of both. The length of compressor discharge line should be selected so that the dryer inlet does not exceed 170°F (77°C). This can generally be accomplished with 12 to 15 feet of air compressor discharge length. Excessive discharge length should also be avoided to prevent moisture from freezing. The dryer inlet must be greater than 40°F (5°C).
9. From both the primary and secondary reservoirs connect suitable 1/2" NPT line to the air dryer ports for the primary (21) and secondary (22) circuits.
10. Connect a 1/4" NPT fitting with nylon line or equivalent to the control port (4) of the dryer. The other end of the control line will typically be connected back to the compressor.
11. Connect 1/4" NPT line to those auxiliary circuits desired. Any additional ports not used can be plugged with the appropriate 1/4" NPT pipe plug. Teflon tape or other approved sealant should be used sparingly on the pipe plug to prevent leakage.

Installation Tip: While minimum diameters are specified, larger line diameters generally improve performance, service life, and reduce operating temperatures, particularly in severe applications.

WARNING

Do not attempt to adjust or service the pressure protection valve, as this could cause system pressure loss and automatic parking brake application.

Pressure protection valve springs are under load and could cause serious personal injury if distribution housing is removed.



Testing the ModulAir® Dryer

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

1. Close all reservoir drain valves and ensure all lines are connected properly.
2. Assure transmission is in neutral, start engine. Build up system air pressure to governor cut-out and note that the air dryer purges with an audible exhaust of air. Air should continue to flow from the dryer exhaust as the dryer purges and regenerates the desiccant for approximately 20 - 30 seconds.

Testing Tip: The pressure gauges for the primary, secondary and auxiliary circuits will begin to fill at different pressures. Typically, the primary will fill first, with the secondary and auxiliaries to follow shortly after.

3. Actuate the service brakes a number of times to reduce system air pressure to governor cut-in. Ensure that the system once again builds to full required system pressure and that the dryer purges when the compressor cuts out (compressor unloads).
4. It is recommended that the vehicle be tested for leakage using the following procedure to assure that the air dryer will not cycle excessively:
 - A. Apply the parking brakes, run engine to build system pressure to governor cut-out and allow pressure to stabilize for at least 1 minute at idle.
 - B. Observe the dash gauge pressures for 2 minutes and note any pressure drop. Pressure drop should not exceed 4 psi with brake pedal released and 6 psi with brakes applied. Any noticeable leakage must be repaired to avoid excessive cycling.
 - C. On vehicles using "system regeneration," which is how the ModulAir® dryer functions, the vehicle air gauges will drop slightly as the dryer purges.
5. Charge cycle time: during normal, daily operation, the compressor should recover from governor cut-in to governor cut-out in 90 seconds or less depending upon the engine RPM and vehicle vocation.
6. Purge cycle interval: During normal vehicle operation, the air compressor must remain unloaded for a minimum of 30 seconds between charge cycles. This minimum purge time is required to ensure complete regeneration of the desiccant.

ModulAir® Dryer Troubleshooting Guide

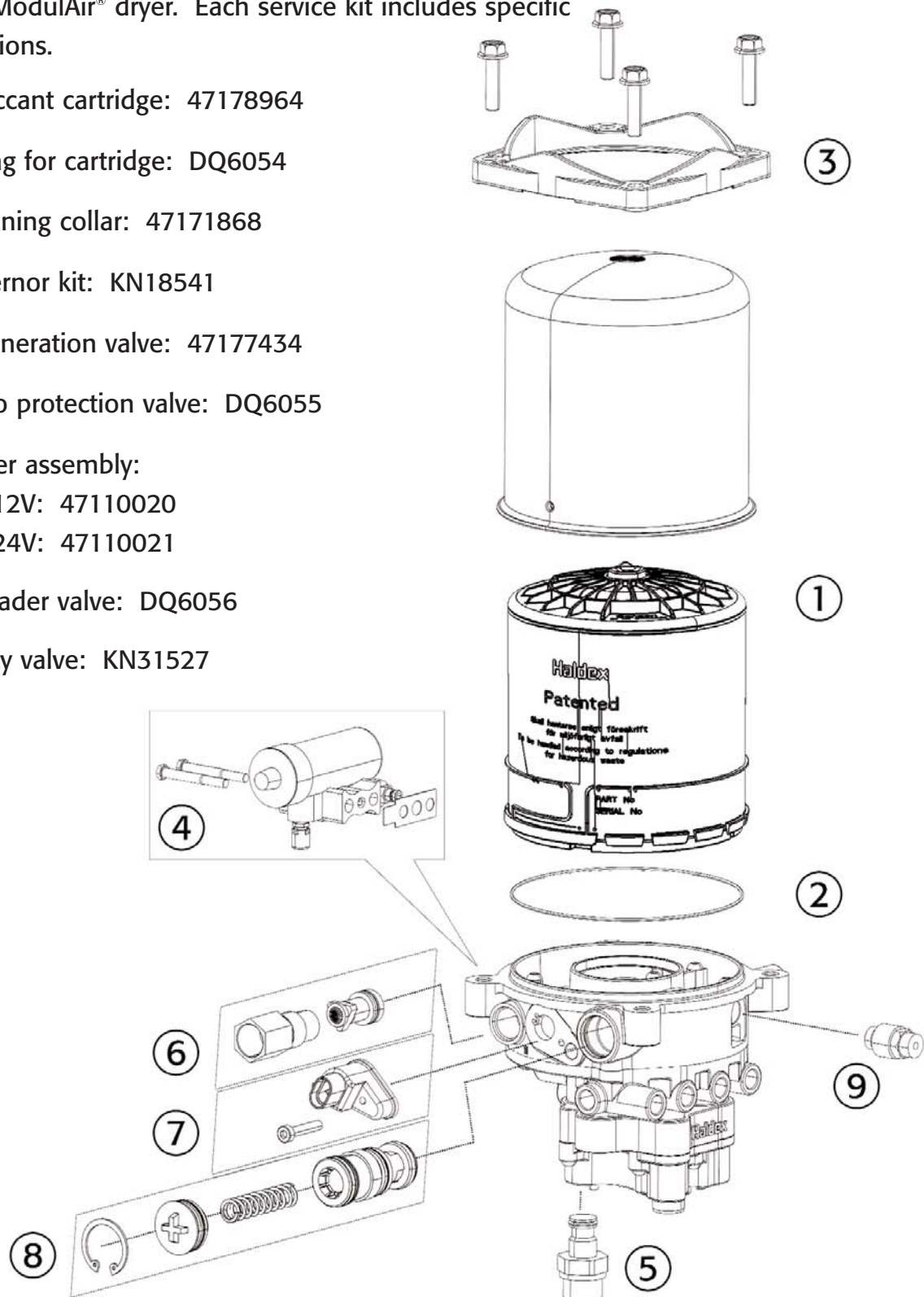
Problem	Cause	Solution
Water in air system	<ol style="list-style-type: none"> 1. Desiccant contaminated (oil) or over saturated. 2. Leaks in air system. 3. Governor loose or not functioning properly. 	<ol style="list-style-type: none"> 1. Replace desiccant cartridge. Wipe dryer base clean. Check compressor for excessive oil passage. 2. Tighten air connections. Use soapy water to recheck for leaks following the Testing the ModulAir® Dryer section. 3. Check governor gasket for damage and replace if necessary. Reassemble governor and tighten governor bolts to recommended manufacturer's torque specifications.
Constant exhaust of air at air dryer	<ol style="list-style-type: none"> 1. Dryer unloader valve not closing. 2. Governor loose or not functioning properly. 3. Compressor unloader not functioning (compressor not unloading). 	<ol style="list-style-type: none"> 1. At compressor cut-out there must be a slight blow of regenerated air from the exhaust port of the dryer for approx. 20 -30 seconds. If air flow continues, after purge cycle, remove and inspect unloader valve of the dryer for obstruction or damage. If damaged, then replace. If obstructed or dirty, then clean and reinstall. 2. Check governor gasket for damage and replace if necessary. Reassemble governor and tighten governor bolts to recommended manufacturer's torque specifications 110 - 150 lb in. 3. Repair or replace compressor unloader.
Excessive compressor cycling	<ol style="list-style-type: none"> 1. Excessive leaks in air system. 2. Broken, contaminated or defective unloader valve. 3. Undersized compressor, duty cycle of compressor should not exceed 25%. 	<ol style="list-style-type: none"> 1. Tighten air connections, soap connection and recheck for leaks. 2. Clean or replace compressor unloader valve. 3. Reduce air demand or use a compressor with greater air output.
Safety valve is open	<ol style="list-style-type: none"> 1. Desiccant cartridge is plugged or overly contaminated. 2. Ice blockage inside dryer. 3. Excessive system pressure. 	<ol style="list-style-type: none"> 1. Excessive oil passage from compressor or high amount of carbon buildup. Check for worn compressor (piston rings, gaskets, etc.). Replace desiccant cartridge. 2. Check heater function. 3. Repair or replace governor.
Short life of dryer or desiccant cartridge	<ol style="list-style-type: none"> 1. Air at inlet of dryer exceeds 170°F (77°C). 	<ol style="list-style-type: none"> 1. Extend length of compressor discharge line; see Installation Guidelines and Installation Procedure sections. The 170°F (77°C) dryer inlet temperature can usually be achieved with 12' to 15' of compressor discharge line.
Short purge cycle of dryer (less than 12 seconds)	<ol style="list-style-type: none"> 1. Loose governor or poor gasket seal. 2. Regeneration valve not functioning. 	<ol style="list-style-type: none"> 1. Tighten governor bolts. If leakage still occurs, then replace gasket or complete governor. 2. Replace regeneration valve.

ModulAir® Dryer Service Parts Kit Information

General Instructions

The following parts are available for service and maintenance of the ModulAir® dryer. Each service kit includes specific instructions.

1. Desiccant cartridge: 47178964
2. O-ring for cartridge: DQ6054
3. Retaining collar: 47171868
4. Governor kit: KN18541
5. Regeneration valve: 47177434
6. Turbo protection valve: DQ6055
7. Heater assembly:
12V: 47110020
24V: 47110021
8. Unloader valve: DQ6056
9. Safety valve: KN31527



Notes:

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Haldex offers proprietary vehicle technology solutions to the global vehicle industry within specific niches. We focus on products to improve safety, the environment and vehicle dynamics.

We are enhancing our competitive capabilities and building long-term customer relationships through high performance, low total costs to the customer through the product's service life, ethical business practices and commitment to long-term partnerships. Haldex operations are divided into four business areas: Commercial Vehicle Systems, Hydraulic Systems, Garphyttan Wire and Traction Systems.

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