

INSTALLATION & SERVICE INSTRUCTIONS



DISCHARGE BYPASS VALVES

ADRI(E)-11/4, ADRS(E)-2, DRS(E)-2, ADRP(E)-3, DRP(E)-3, ADRH(E)-6, DRH(E)-6

To insure proper performance, discharge bypass valves must be selected and applied correctly. However, proper installation procedures are equally as important. Complete selection and application information on the adjustable models are covered in Bulletin 90-40. For this type of information on non-adjustable models, contact your Sporlan Representative.

VALVE LOCATION - Sporlan discharge bypass valves (DBV) can be installed in horizontal or vertical lines, whichever best suits the application and permits easy accessibility of the valves. However, consideration should be given to locating these valves so they do not act as oil traps or so that solder cannot run into the internal parts during brazing.

The discharge bypass valve should always be installed at the compressor unit rather than at the evaporator section. Not only will this insure the rated bypass capacity of the discharge bypass valve but it will eliminate the possibility of hot gas condensing in the bypass line (especially on remote systems). In all cases it is important that some precautions be taken in mounting the valves. While the heaviest valve only weighs 3-1/2 pounds, it is suggested that it be adequately supported to prevent excessive stress on the connections. See the **PIPING** section for additional piping suggestions.

When externally equalized valves are used, the equalizer connection must be connected to the suction line where it will sense the desired operating pressure.

If the **remote bulb** type bypass valve is used, the bulb must be located in a fairly constant ambient temperature because the element-bulb assembly is air charged. Since these valves are set at the factory in an 80°F ambient temperature, any appreciable variation from this temperature will cause the pressure setting to vary from the factory setting. For a non-adjustable valve the remote bulb may be located in an ambient of 80°F ± 10°F while the adjustable **remote bulb** model can be adjusted to operate in a temperature of 80°F ± 30°F. On many units the manufacturer will have altered the pressure setting to compensate for an ambient temperature appreciably different than 80°F. Therefore on some units, it may be necessary to consult with the equipment manufacturer for the proper opening pressure setting of the bypass valve.

There are numerous places on a system where the remote bulb can be located. Two possible locations are the return air stream and a structural member of the unit if it is located in a conditioned space. Other locations, where the temperature is fairly constant but different than 80°F, are also available. These include the return water line on a chiller, the compressor suction line, or the main liquid line. As mentioned above, the pressure setting may be altered to compensate for the ambient temperature of the remote bulb.

A bulb strap with bolts and nuts is supplied with each remote bulb type DBV to use in fastening the bulb in place.

PIPING - Sporlan recommends that recognized piping references, such as equipment manufacturers' literature and the ASHRAE Handbook, be consulted for assistance with proper piping procedures. Sporlan is not responsible for system design, any damage arising from faulty system design, or for misapplication of its products. If these valves are applied in any manner other than as described in this bulletin, Bulletin 90-40, and other Sporlan product literature, the Sporlan warranty is void.

Actual system piping must be done so as to protect the compressor at all times. This includes protection against over-heating, slugging with liquid refrigerant, and trapping of oil in various system locations. A few piping guidelines plus some other installation details are given below for the various components involved.

Piping Guidelines - Since the DBV is applied in a bypass line between the discharge line and the low side of a system, the valve may be subjected to compressor vibrations which result from discharge gas pulses and inertia forces associated with the moving parts. Pulsations are best handled by a good muffler placed as close to the compressor as possible. Vibrations from the moving parts of the compressor are best isolated by flexible loops or coils (discharge lines 1/2" or smaller), or flexible metal hoses for larger lines. For best results, the hoses should be installed as close to the compressor as possible, and mounted horizontal and parallel to the crankshaft **or** vertically upwards. The hoses should **never** be mounted horizontal **and** 90° from the crankshaft. A rigid brace should be placed on the outlet end of the hose to prevent vibrations beyond the hose.

Discharge Bypass Valve - Most piping instructions for DBV's are covered in the section **VALVE LOCATION**.

However, some suggestions are given here to cover piping the DBV with other pressure regulating valves that may be used on a system for other purposes.

If a DBV is applied on a system with an evaporator pressure regulating valve (ORIT or other type), the DBV may bypass either into the evaporator inlet or the suction line depending on the specific system. The function of each valve and the best piping method to adequately protect the compressor should be the deciding factors.

If the DBV is required on a system with a crankcase pressure regulating valve (CRO or other type), the bypass valve can bypass to the low side at the evaporator inlet or the suction line without difficulties. The only decision necessary is whether an internally or externally equalized valve is required and this depends on where the hot gas enters the low side. The pressure setting of the DBV **must** be lower than the CRO setting for each valve to function properly.

Hot Gas Solenoid Valve - If a solenoid valve is applied with the DBV, it should be located **upstream** of the bypass valve.

FOR USE ON REFRIGERATION and/or AIR CONDITIONING SYSTEMS ONLY

Bulletin 90-41, August 2003, supersedes Bulletin 90-41, dated August 1999 and all other prior publications.

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If the solenoid valve is installed downstream of the DBV, the possibility of trapping oil and/or liquid refrigerant between the two valves exists. And depending on the ambient temperatures surrounding the valves and piping, this could be dangerous.

If the hot gas solenoid valve is required for pump down control, it should be wired in parallel with the liquid line solenoid valve(s) so they are de-energized by a thermostat or any of the compressor safety devices.

If the hot gas solenoid valve is used for protection against high superheat conditions because the compressor does not have an integral temperature protection device, the solenoid valve is wired in series with a bi-metal thermostat fastened to the discharge line close to the compressor.

Additional installation instructions are packed with each solenoid valve.

Desuperheating Thermostatic Expansion Valve - When the desuperheating TEV is used in conjunction with the bypass valve, piping the two valves to get good mixing before reaching the TEV bulb location is vital. This can be accomplished several ways but the simplest is to tee the liquid-vapor mixture from the TEV and the hot gas from the DBV together before connecting a common line to the suction line. The thermostatic bulb of the TEV should be located downstream of this common suction connection as near to the compressor as possible.

When an externally equalized TEV is used, the equalizer line should be connected to the suction line between the bulb and the compressor.

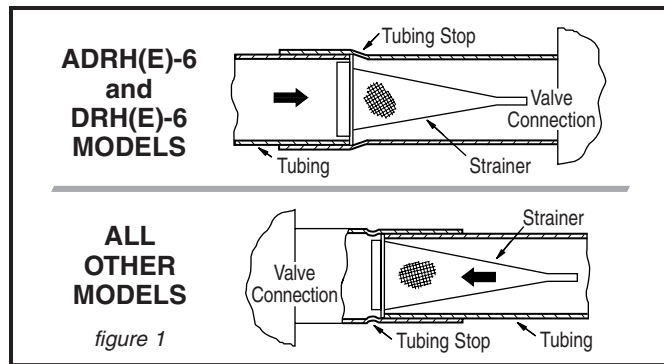
Depending on whether pump down control is necessary on the system and if it is, where the main liquid line solenoid valve is located, a small solenoid valve may be necessary in the desuperheating TEV liquid line, ahead of the expansion valve. This solenoid valve should be wired in parallel with the hot gas solenoid valve and the other liquid line solenoid valve(s).

Refrigerant Distributor with Auxiliary Side Connection or Auxiliary Side Connector - When hot gas is bypassed to the evaporator inlet for capacity control, two piping methods are available: bypass to the 1650R series distributor's side connection or to the auxiliary side connection of the ASC series connector. Complete application data on these devices is given in Bulletin 90-40. The major concern in piping either component is that the piping does *not* form a trap between the bypass valve and the side connection. For example when the distributor or ASC is installed in a horizontal position, the side connection should be located on top to prevent trapping.

When installing an ASC connector, the nozzle *must* be removed from the standard distributor and inserted in the ASC. This places the nozzle in its proper location upstream of the hot gas bypass connection.

STRAINER - CATCH-ALL FILTER-DRIER - SEE-ALL MOISTURE and LIQUID INDICATOR - Just as with any refrigerant flow control device, the need for an inlet strainer is a function of system cleanliness and proper installation procedures. When the strainer is used, the tubing is inserted in the valve connection until the tubing and the strainer flange ring are up against the tubing stop, thus locking the strainer in place. See Figure 1. Moisture and particles too small for the inlet strainer are harmful to the system and must be removed. Therefore, it is recommended that a *Catch-All Filter-Drier* be installed according to the application recommendations in Bulletin 40-10.

Further system protection is easily and inexpensively provided with the installation of a *See-All Moisture and Liquid Indicator* on every system. Complete information is given in Bulletin 70-10.



BRAZING PROCEDURES - Any of the commonly used brazing alloys for high side usage are satisfactory. However, when soldering or brazing, it is very important that the internal parts be protected by wrapping the valve with a *WET* cloth to keep the body temperature below 300°F. While the ADRI(E)-1-1/4, ADRS(E)-2, DRS(E)-2, ADRP(E)-3, and DRP(E)-3 models have metal-to-metal seating material, the ADRH(E)-6 and DRH(E)-6 valves use synthetic-to-metal seating material and must be protected from overheating. The extended fittings on the latter models will adequately protect the synthetic material under normal conditions. However, when using high temperature solders, the torch tip should be large enough to avoid prolonged heating of the copper connections. Always direct the flame away from the valve body.

TEST and OPERATING PROCEDURES - Inert dry gases such as nitrogen, CO₂ or helium are often used for leak detection. Excessive leak testing or operating pressures may damage these valves and reduce the life of the operating components. Since a high side test pressure differential of approximately 350 psig or higher will force the DBV valve open, the maximum allowable test pressures for our DBV valves are the same for the high and the low side of the system. If greater high side test pressures than the values given in the table below are to be used, some method must be used to isolate the DBV valve from these high pressures.

CAUTION: Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

The table below lists the maximum values each valve can withstand without damage. Precautions must be taken to keep test or operating pressures below these values.

VALVE TYPE	MAXIMUM ALLOWABLE PRESSURE - psig
ADRI(E)-1-1/4	450
DRS(E)-2	
ADRS(E)-2	
DRP(E)-3	425
ADRP(E)-3	
DRH(E)-6	425
ADRH(E)-6	

VALVE SETTING and ADJUSTMENT - A complete discussion on valve settings is given in the Application Section of Bulletin 90-40. To determine the proper setting for a specific system, that section should be reviewed. For application information on non-adjustable discharge bypass valves, contact your Sporlan Representative.

See the following table for standard factory settings and the average psi change in setting per one turn of adjustment.

**STANDARD PRESSURE SETTINGS
AVERAGE psi CHANGE PER TURN**

ADJUSTABLE MODELS			
VALVE	ADJUSTMENT RANGE	STANDARD SETTING	AVERAGE psi CHANGE PER TURN
ADRI(E)	0/55	28	9
	0/75	38	13.5
	0/100	50	16
ADRS(E)-2 ADRP(E)-3 ADRH(E)-6	0/30	20	3
	0/80	60	7.5
ADJUSTABLE REMOTE BULB TYPE (AR MODELS) ON AIR CONDITIONING SYSTEMS			
VALVE	ADJUSTMENT RANGE	STANDARD SETTING*	AVERAGE psi CHANGE PER TURN
DRH(E)-6	25/35	30	0.5
	32/44	38	0.75
	55/70	60	1
	65/80	70	1

To adjust these valves, remove the cap and turn the adjustment nut with a 5/16" hex wrench for fully adjustable models (ADRS(E)-2, ADRP(E)-3, ADRH(E)-6) and 3/16" hex wrench for the **AR** models. The fully adjustable model ADRI(E)-1-1/4 has a 3/8" adjustment screw on top of the adjustment housing. A clockwise rotation increases the setting and a counterclockwise rotation decreases the setting.

CAUTION: Because of possible damage to the adjustment assembly (AR type), do not force the adjustment screw beyond the stops. Also, due to the air charge in the AR models, the remote bulb must be properly located. See the discussion on VALVE LOCATION.

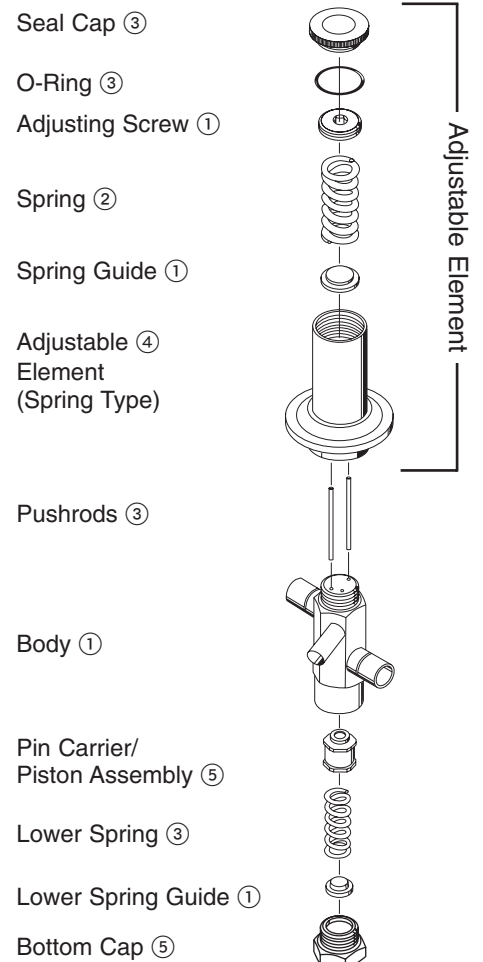
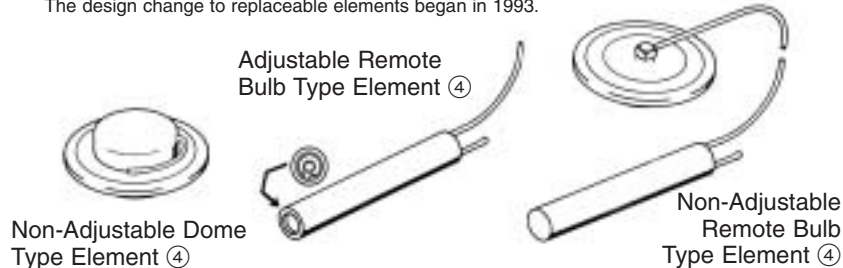
Adjusting these valves can be complicated because the load must be varied during the setting procedure and it is difficult to determine exactly when the bypass valve opens unless a pressure gauge can be located at the valve outlet.

Therefore, sufficient load must be available in some form to raise the suction pressure above the desired valve setting. Once this is accomplished, the load can be slowly decreased until the DBV opens (a hissing sound and/or an accompanying pressure rise at the **outlet** connection will indicate that the bypass valve has opened).

REPLACEMENTS PARTS AND PARTS KITS

PART NUMBER	PART DESCRIPTION	VALVE TYPE						
		(A)DRI(E)	(A)DRS(E) - 2	(A)DRP(E) - 3	(A)DRH(E) - 6	DRS(E) - 2	DRP(E) - 3	DRH(E) - 6
QUANTITY REQUIRED								
REPLACEMENT PARTS SOLD SEPARATELY								
621-024	O-Ring		1	1	1			
1373-000	Seal Cap		1	1	1			
558-000					1			1
559-000				1				
561-000	Lower Spring						1	
696-000			1			1		
1031-000			1					
1524-000	Inlet Str. 3/8 ODF	1						
877-003	Inlet Str. 3/8 ODF		1			1		
877-004	Inlet Str. 1/2 ODF		1	1		1	1	
877-005	Inlet Str. 5/8 ODF		1	1	1	1	1	1
877-007	Inlet Str. 7/8 ODF				1			1
877-009	Inlet Str. 1-1/8 ODF				1			1
REPLACEMENT SPRING KITS (FOR ADJUSTABLE ELEMENTS)								
K-1800E-1	0/30 Adj. Range		1	1	1			
K-1800E-2	0/80 Adj. Range		1	1	1			
REPLACEMENT ELEMENTS								
A-4-****		1						
A-8-*	Adjustable		1					
A-3-*					1			
B-3P-**AR	Adjustable Remote Bulb						1	
B-3H-**AR								1
D-8-***	Non-Adjustable Dome					1		
D-3P-***							1	
D-3H-***								1
R-8-***	Non-Adjustable Bulb					1		
R-3P-***							1	
R-3H-***								1
REPLACEMENT INTERNAL PARTS KITS								
KH-6	Includes: Pushrods, Piston Assy., Lower Spring, Bottom Cap				1			1

* Specify 0/30 or 0/80 adjustment range.
 ** Specify 25/35, 32/44, 55/70, 50/65 or 65/80 adjustment range.
 *** Specify pressure setting.
 **** Specify 0/55, 0/75 or 0/100 adjustment range. Available for replaceable element style valves only. The design change to replaceable elements began in 1993.



- ① Replacement part **not** available.
- ② Part is **not** available separately, but is included with the Replacement Springs Kits.
- ③ Part is available separately. See chart above.
- ④ Part is available as a replacement element. See chart above.
- ⑤ Part available for (A)DRHE-6 only in KH-6 kit.

SERVICE INSTRUCTIONS

There are several possible causes for system malfunction when hot gas bypass for capacity controls is used. As with any form of troubleshooting, it is essential to know the existing operating temperatures and pressures before the malfunction can be determined. Once the actual malfunction is pinpointed, it is easier to isolate the cause and then take appropriate corrective action.

There are two basic malfunctions of a discharge bypass valve: failure to open and failure to close. And since all Sporlan DBV's can be disassembled, many "causes" can be easily remedied. Replacement elements are available for all types. ADRI(E)-1-1/4 models manufactured prior to July 1994 do not have a replaceable element. The entire valve must be replaced.

Due to the design of each valve type, it is easiest to consider them separately. The table below shows the various valve types, the possible causes, and the remedies for the two possible malfunctions.

Hot gas may be required for other system functions besides hot gas bypass capacity control, e.g., hot gas defrost and head pressure control. Normally, these functions will not interfere with each other. However, compressor cycling on low suction pressure may be experienced on system start-up when the discharge bypass valve is operating and other functions require hot gas. For example, the head pressure control valve (e.g., Sporlan ORD-4 type) requires hot gas to adequately pressurize the receiver and liquid line to get the thermostatic expansion valve operating properly. In this case, the discharge bypass valve should be prevented from functioning by keeping the hot gas solenoid valve closed until adequate liquid line or suction pressure is obtained.

SERVICE TIPS

FULLY ADJUSTABLE MODELS - ADR TYPE

VALVE TYPE	MALFUNCTION	CAUSE	REMEDY
ADRI-1-1/4 ADRIE-1-1/4 ADRS-2 ADRSE-2 ADRP-3 ADRPE-3	Failure to open	1. Dirt or foreign material in valve	1. Disassemble valve and clean
	Failure to close	1. Dirt or foreign material in valve 2. Diaphragm failure 3. Equalizer passageway plugged 4. External equalizer not connected or equalizer line pinched shut 5. Internal spring overheated	1. Disassemble valve and clean 2. Replace element only 3. Disassemble valve and clean 4. Connect or replace equalizer line 5. Replace valve
ADRH-6 ADRHE-6		Failure to open	1. Dirt or foreign material in valve 2. Equalizer passageway plugged 3. External equalizer not connected or equalizer line pinched shut
	Failure to close	1. Dirt or foreign material in valve 2. Diaphragm failure	1. Disassemble valve and clean 2. Replace element only

"LIMITED" ADJUSTABLE MODELS - DR - AR TYPE

DRP-3-AR DRPE-3-AR	Failure to open	1. Dirt or foreign material in valve 2. Diaphragm failure 3. Air charge in element lost	1. Disassemble valve and clean 2. Replace element only 3. Replace element only
	Failure to close	1. Dirt or foreign material in valve 2. Equalizer passageway plugged 3. External equalizer not connected or equalizer line pinched shut 4. Internal spring overheated	1. Disassemble valve and clean 2. Disassemble valve and clean 3. Connect or replace equalizer line 4. Replace valve
DRH-6-AR DRHE-6-AR	Failure to open	1. Dirt or foreign material in valve 2. Diaphragm failure 3. Equalizer passageway plugged 4. External equalizer not connected or equalizer line pinched shut 5. Air charge in element lost	1. Disassemble valve and clean 2. Replace element only 3. Disassemble valve and clean 4. Connect or replace equalizer line 5. Replace element only
	Failure to close	1. Dirt or foreign material in valve	1. Disassemble valve and clean

NON-ADJUSTABLE MODELS - REMOTE BULB and DOME TYPE

DRS-2 DRSE-2 DRP-3 DRPE-3	Failure to open	1. Dirt or foreign material in valve 2. Diaphragm failure 3. Air charge in element lost	1. Disassemble valve and clean 2. Replace element only 3. Replace element only
	Failure to close	1. Dirt or foreign material in valve 2. Equalizer passageway plugged 3. External equalizer not connected or equalizer line pinched shut 4. Internal spring overheated	1. Disassemble valve and clean 2. Disassemble valve and clean 3. Connect or replace equalizer line 4. Replace valve
DRH-6 DRHE-6	Failure to open	1. Dirt or foreign material in valve 2. Diaphragm failure 3. Equalizer passageway plugged 4. External equalizer not connected or equalizer line pinched shut 5. Air charge in element lost	1. Disassemble valve and clean 2. Replace element only 3. Disassemble valve and clean 4. Connect or replace equalizer line 5. Replace element only
	Failure to close	1. Dirt or foreign material in valve	1. Disassemble valve and clean

WARNING: Serious injury could result from an explosion caused by the rapid expansion of trapped liquid refrigerant subjected to high temperature. ALWAYS REMOVE THE REFRIGERANT FROM THE SYSTEM BY USING REFRIGERANT RECOVERY/RECYCLING EQUIPMENT BEFORE APPLYING HEAT TO REMOVE SYSTEM COMPONENTS. Break the element charging cap tube on valve dome by hand or with a clean cut tool to eliminate any trapped refrigerant. DO NOT use side cutters which may seal the opening.

