



## **Step Motor Expansion Valves Installation Instructions**



### **Operation**

The ESX valves are step motor operated electric expansion valves. Step motors are designed to provide discrete segments of angular motion, or rotation, in response to an electronically generated signal. The advantages of step motors in valve applications are high resolution, repeatability and reliability with low hysteresis. Feedback loops are not required, simplifying controller design and circuitry.

The step motor used in the ESX valve is a 12-volt DC, four phase, unipolar, permanent magnet rotor type. Each step creates a  $3.75^\circ$  rotation of the rotor. Final rotation is converted to linear motion by the use of a threaded shaft. Forward motion of the motor extends the pin, which moves the valve to the closed position. Backward rotation of the motor retracts the pin, modulating the valve in the opening direction. Full forward or backward travel is limited by the valve seat in the closed position or an upper stop in the open direction. A slight clicking sound may be heard at either of these two positions and does no harm to the valve or drive mechanism.

The valve will operate only when connected to a properly designed controller. The controller must supply the necessary square wave step signal at 12-volts DC and 30 to 83.5 PPS for the valve to control properly. Various Sporlan and third party controllers are available for use with the valve. Questions of suitability of a specific controller should be directed to Sporlan, Attention: Electronic Expansion Valve Product Group. Control algorithms for the valve include a initialization sequence that will first over-drive the valve in the closing direction. This is to assure that the valve is completely shut and to establish the "zero" open position. The controller then keeps track of the valve's position for normal operation. During this initialization phase, a light clicking sound may be heard, which will serve as proof of the valves operation and closure.

The valves have metallic seating for tight shutoff and uniquely characterized pin and port combinations for exceptional control of refrigerant flow. The seats require no service and are not replaceable. The stator may be easily replaced without removing the valve body from the system.

### **Installation**

The ESX valves are electronically controlled Step Motor Expansion Valves, and are installed before the distributor and evaporator just as one would install a Thermostatic Expansion Valve. Location should be planned to provide serviceability and to allow controller installation within the maximum cable length of forty feet. The valve may be installed in the refrigerated space and may be mounted in any position except with the motor housing below the liquid line. Cable routing should avoid any sharp edges or other sources of potential physical damage such as defrost heaters and fan blades. For neatness and protection, the cable may be fastened to the suction or liquid lines with nylon wire ties.

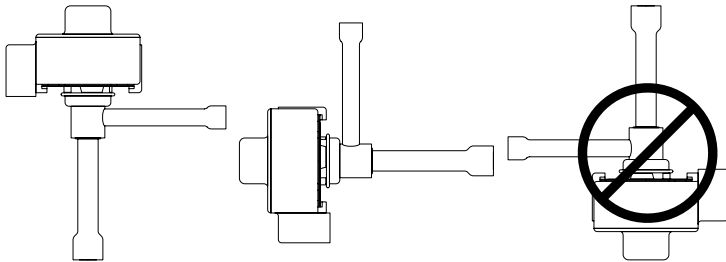


## Valve Installation Procedure

The installation of the ESX Step Motor Valve utilizes most of the same techniques and precautions used for assembly of other refrigeration components. As with any refrigerant system, safety and cleanliness must be a priority. Use of an upstream Sporlan filter-drier is highly recommended to prevent contamination of the expansion valve.

1. Properly reduce system pressure to atmospheric pressure using accepted industry guidelines.
2. Choose an installation location that is easily accessible, and minimizes external contamination from the environment. The ESX should be located downstream of any liquid line accessories (e.g. receiver, sight glass, service valve, etc...) and located as close to the evaporator/heat exchanger as possible.
3. For most installations the recommended flow direction utilizes the side fitting for liquid inlet; bottom fitting feeding the evaporator. If using the valve in reverse flow (bottom inlet) or in bi-flow operation; special controller settings must be used to ensure adequate valve shutoff. See Valve Operation section.
4. Disassemble stator from valve body prior to brazing. The ESX valve is not position sensitive; however, it is recommended that the valve be installed with the stator at or above the body elevation to prevent accumulation of system contaminants within the valve (Figure 1). Installation should be such that valve weight or system vibration will not cause mechanical failure. Properly protect and restrain electrical connections.

Figure 1 - ESX Installation Orientation



5. Silver or phosphorous bearing copper brazing alloys can be used during installation. Minimal flux should be applied for copper-brass or copper-steel joints using silver bearing alloys; use flux on the joint exterior only. Clean all refrigerant lines and fittings as necessary prior to valve installation.
6. Minimize the heat applied to the valve by wrapping the valve with wet cloths and directing the heat away from the valve. The use of conductive paste or chill blocks should be considered for original equipment installations. **The valve body temperature must be limited to 250°F during installation.** Use of flowing dry nitrogen during installation is recommended to prevent the formation of toxic gasses and copper oxides.
7. Once valve has cooled, replace stator and orient at one of the 10 available detent positions. Both tabs at base of stator must engage retaining ring on valve body.
8. Make electrical connections taking care to protect and secure all electrical connections from moisture, contamination, stress, etc. Extension wires may be attached to stator wiring provided that proper connections are made with 18 AWG or heavier stranded copper wire. Extension length should not exceed 100 feet between valve and step motor controller.
9. Connect wiring to controller. Refer to controller manufacturer's instructions for proper wiring connections.
10. Refer to ESX Technical Specifications and Valve Operation sections in Bulletin 100-20-2 to aid in configuring controller.

## Field Service Instructions

The ESX valves bodies are hermetic and cannot be disassembled for installation or during service, however, the stator can be removed if required. See parts list on page 4.

Note: If the valve is to be removed from the system, be sure the refrigerant has been reduced to a safe level (0 psig).

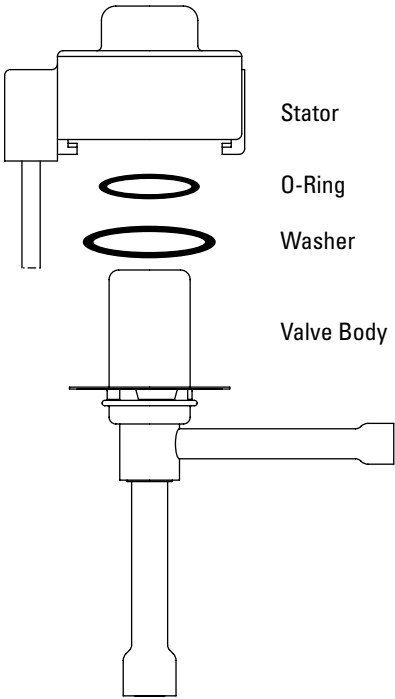
1. Disconnect the line voltage to the valve controller.
2. If the motor fails to operate properly, check the resistance of each motor phase. Resistance between any colored lead and gray should be  $46 \pm 4$  ohms. Differences of more than 10% between phases indicate a defective motor. Resistance between any lead and piping should be infinite or "open". Any resistance reading will indicate a shorted winding and the valve will need to be replaced.
3. If you have access to an SMA-12 test instrument (Part Number 958737), operation of the valve may be proven. Connect the motor leads to the color-coded connector on the SMA-12. As shown below:

ESX leads	SMA-12 Terminals
Yellow	Black
Black	White
Orange	Green
Red	Red
Gray	No connection

4. Set the rate to 50 PPS and toggle in the "OPEN" position. Pressure downstream of the valve should rise indicating valve opening and flow. **NOTE: Care should be taken to assure that floodback and compressor damage does not occur during the test.** Toggle the SMA-12 to the "CLOSE" position and the pressure downstream of the valve should fall, indicating valve closure. If the valve does not open and close during the procedure, the valve is either full of debris or defective, and must be removed for cleaning or replacement.
5. If the valve responds to the above procedure the failure is in the controller or wiring. The control manufacturer should be consulted for their preferred procedure. In the absence of that information, the output of the controller to the valve may usually be tested with the following procedure.
  - a. Disconnect supply voltage to the controller.
  - b. Place a digital voltmeter, on 20-volt AC scale, across the Gray (common) and Yellow terminals on the controller. Restore power to the controller. For at least 7 seconds, the voltmeter should read approximately 12 to 14 volts. Significant differences mean the controller is defective or not properly configured for the ESX valve.
  - c. Repeat the procedure above connecting Gray to the Red, Orange and Black terminals on the controller.
  - d. If the controller responds properly to the above, the wiring may be damaged or the valve may be plugged with debris or otherwise obstructed.

## Valve Replacement

The valve may be replaced by unsoldering or cutting the piping. A tubing cutter must be used to prevent creating contaminants in the piping. See the Installation section on procedures to use during valve installation.



Parts		Part Number
Stator	5' Leads	10200-000
	10' Leads	10200-001
Washer		10203-000
O-Ring		10201-000
Valve	14A	10202-000
	14B	10202-001
	18A	10202-002
	18B	10202-003
	24A	10202-004
	24B	10202-005
	SMA-12	958737



Sporlan Division  
 Parker Hannifin Corporation  
 206 Lange Drive  
 Washington, MO 63090  
 636-239-1111 • FAX 636-239-9130  
[www.sporlan.com](http://www.sporlan.com)

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