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INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

MODEL T4606F

SKOTCH® TRIFECTA VALVE SYSTEM

WARNING

Industrial & BioPharm Group Valves are designed and manufactured using good workmanship and materials, and they meet all applicable industry standards. These valves are manufactured with various materials, and they should be used only in services recommended by a company engineer.

Misapplication of the product may result in injuries or property damage. A selection of valve components of the proper material and consistent with the particular performance requirement is important for proper application.

Examples of misapplication or misuse of any Industrial & BioPharm Group products include use in an application in which the pressure/temperature rating is exceeded or failure to maintain valve as recommended and use of products to handle caustic and/or hazardous substances when not designed for that purpose.

If valve exhibits any indication of leakage, do not operate. Isolate valve and either repair or replace.

Technical Manual No. IOT4606F **Effective 07/14/05**

Industrial & BioPharm Group, a unit of ITT Industries, Inc.

REV LEVEL G

Record of Revisions

Revision	Description	Date
	First Issue	11/30/88
A	Revised format and text. Added Sections VI - Leak Testing & VII - POC Switch Setting	10/20/94
B	Changed minimum pressure required to operate from 60 to 70 psi	6/19/95
C	Revised Section V to include floating bushing in actuator top cap.	10/02/95
D	Removed paragraph in section II.C referring to speed control. It can not be used with fail closed valves. Refer to ECN 759.	2/8/96
E	Removed reference to CGA in the Description. Refer to ECN 1171	4/22/96
F	Revised for new solenoid design, Ref ECN 2515: Revised reference drawing list. Revised Section II.C Revised Section III.A & C	10/28/97
G	Added Section VII.C (Open switch testing)	7/14/05

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DRAWINGS

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REV LEVEL G

I. DESCRIPTION

The Model T4606F Trifecta Burner Valve System provides all the isolation and venting functions necessary for automated operation of gas-fired burners in utility and industrial power plants. These include double block of the main gas line and venting the chamber between blocks to atmosphere. Hence, the term "Double Block and Vent" or “Double Block and Bleed”. The vents are sized in accordance to IRI and NFPA recommended vent sizes.

Valves incorporating specific options may be Factory Mutual approved for Natural Gas Safety Shutoff Valves per FM Approval Standard Class 7400. Valves meeting the requirements of FM are tagged as such.

The Model T4606F utilizes a single operated spring return pilot valve for pneumatic operation and requires compressed air and electric power to open. The system closes on loss of air or electric power.

II. OPERATION

Refer to solenoid assembly nameplate or purchase order specifications to determine appropriate line voltage and type. Operation is in accordance with referenced drawings.

A. Open Block Valves (Close Vent)

With pneumatic supply pressure regulated to a minimum of 70 psig and a maximum of 120 psig, apply line voltage across terminal points 1 and 2 for AC solenoids (Terminal points 18 and 19 for DC Solenoids) located in the junction box. This energizes the pilot solenoid, allowing pneumatic pressure into the cylinder.

As pressure is admitted to the cylinder, the outlet valve return spring is compressed and the outlet valve plug moves out of its seat ring. Concurrently, a cage slides down over a post until first a soft seal, then a metal back-up seal is made, closing the vent.

Upon vent closure, the piston continues to stroke. This pushes the inlet valve plug

out of its seat ring, compressing the inlet valve return spring. Stroking stops when the piston contacts a travel stop in the actuator section. Flow commences only after the inlet plug clears its seat. Thus, no flow occurs until the vent is positively closed.

B. Close Block Valves (Open Vent)

Deleting voltage across terminals 1 and 2 for AC Solenoids (Terminals 18 and 19 for DC solenoids) de-energizes the pilot solenoid and exhausts pneumatic pressure from the cylinder.

Upon exhausting the cylinder, both inlet and outlet return springs move their respective plugs toward their seat rings. First the inlet valve soft seal makes, halting flow through the assembly, then its metal back-up. Next the vent cage moves off its post, opening the vent and relieving downstream piping. Finally, the outlet valve soft seal, followed by its metal back-up close, completing the cycle. Two independent blocks are formed between system inlet and outlet, with the chamber between the block valves ported to vent.

C. Notes

The standard Versa solenoid assembly is equipped with a built in speed control valve. It is located directly above the cylinder exhaust port and can be adjusted with a small straight blade screwdriver. Turning the adjustment inward or clockwise slows the opening speed. The speed control function has no effect on closing speed.

The solenoid pilot valve is a maintained contact type, rated for continuous duty at the service voltage. Note that terminal number is not supplied as solenoid is a single coil spring return versus a dual coil design.

Proof of closure switches are installed for both the inlet and outlet valves. The outlet valve POC is located on the top or actuator side and the inlet valve POC is located on the bottom of the valve assembly. Logic is shown on the referenced wiring diagram. Switches change state prior to actual commencement of flow.

Note: Assemblies supplied with DPDT Switches provide all terminal points noted on Wiring Diagram. Valves supplied with SPDT switches have a reduce number of terminals. Reference drawing (60-018 - AC, 60-024 - DC) for details.

III. INSTALLATION

A. Unpacking

Do not remove protective plastic plugs until ready to install.

Verify no debris or foreign objects are inside the valve.

Transporting - use proper hoisting procedures to avoid damage to valve. If using a sling, it should be placed on the body, not the actuator cylinder.

Purge all air lines prior to connecting solenoids.

Do not lift or pull on the electrical conduit lines. Doing so may cause the POC switches to come out of calibration.

B. Valve Installation

The Model T4606F Trifecta Valve System is typically supplied with a female NPT vent connection and flanged end connections. (Note: Other end configurations available upon request.) Refer to order specification or purchase order specifications for type supplied. Valve installation should be in accordance with standard practices for end connection provided. Flanges are raised face carbon steel per ANSI B16.5. Threads are per ANSI B2.1. Ensure the weight of the system is properly supported to prevent excessive stresses. Valve should not be supported by actuator tie rods. Valve may be installed in any orientation. Ensure flow direction is appropriate for intended installation.

CAUTION

Vent pipe size should be equivalent to the vent fitting size supplied. Reducing vent size may result in insufficient flow capacity. *Under NO circumstance should the vent be blocked or plugged.*

NOTE:

Prior to installation and/or start-up, piping should be verified as being free of dirt, grit, welding slag, or other particulate contamination. Failure to do so may result in damage to valve internals.

C. Pneumatic/Electrical Hook Up

Utilities required for operation are electrical power and clean dry compressed air. Wiring should be in accordance with referenced drawings and all applicable codes. Supply air should be connected to the 1/4" NPT inlet port on the solenoid quick exhaust module. Purge all pneumatic lines before connecting to the solenoid assembly. The control air lines should be filtered to 40 microns minimum. Supply air pressure should be 70 to 120 psig at all times.

Note: Some assemblies may include a pre-set filter regulator (Optional).

Use suitable thread sealing compound only. Do not use PTFE tape.

The exhaust side of the solenoid is equipped with a muffler and should not be removed. If the muffler is damaged, dirty, etc. consult the factory for replacement. Changing muffler style will influence valve performance.

IV. COMMISSIONING

After installation, connections should be tested to confirm integrity. T4606F Systems include a 1/4" NPT test port in the protruding end of the outlet/vent shaft. See drawing 03-010. This port is directly connected to the valve's vent chamber and may be used to confirm seal integrity on start-up and during operation.

V. DISASSEMBLY AND MAINTENANCE INSTRUCTIONS

All T4000F Systems may be completely disassembled without removal from the piping. However, it is recommended that it be rebuilt in a shop with suitable fixturing, hoisting equipment and tools.

Item numbers refer to referenced drawing, 03-010. Ensure all manual isolation valves are closed and tagged out, all electrical circuits are de-energized and that the pneumatic supply and valve are isolated and depressurized.

A. Disassembly

> ***WARNING***
>
> **Individual valve components can be very heavy and difficult to remove. Use proper caution.**

A clean dry area should be provided for valve disassembly. Before disassembling the valves, the location of the junction box, vent and flange sub-assemblies should be marked to facilitate ease of reassembly. Commence system disassembly by removing accessories such as solenoids, switches and junction boxes from mounting surfaces on the top and bottom of the valve. Uncouple the vent connection piping.

Continue as follows (Reference drawing 03-010):

Unscrew Hex Nuts (Item 13) from Tie Rods (Item 27) and remove Rods.

Slide off Actuator Top Cap (Item 24).

Remove Actuator Shaft Wiper (Item 32), Actuator Shaft Seal (Item 33), Cylinder O-Ring Seal (Item 36), Snap Ring (Item 38), Bushing (Item 39) and O-ring (Item 37) from Top Cap.

Grasp the wall and vent port of the Cylinder (Item 23), slide it over the Piston (Item 18) and off the assembly. Remove Cylinder Seal (Item 36) from valve body.

Unscrew top Piston Nut (Item 22) from Outlet Valve Sub-Assembly (Item 8).

Slowly unscrew bottom Piston Nut (Item 22), relieving spring compression. The spring will completely relax prior to Piston Nut removal. Do not allow the outlet shaft to rotate during nut removal. Hold on flats of actuator shaft to keep from turning

CAUTION

After removing the bottom Piston Nut it is possible for the Outlet Valve Subassembly to fall from the bottom of the valve. Properly support the Outlet Valve until it is removed.

Slide Piston off Shaft.

Discard old Piston Gasket (Item 19) and clean surfaces.

Remove Piston Seals (Item 35) and Piston Bearing Strip (Item 20).

Remove Outlet Valve Return Spring (Item 17).

Remove Spring Bucket Sub-Assembly (Item 14) by unscrewing Mounting Screws (Item 16) and sliding over Outlet Valve Shaft. Remove Spring Bucket Gasket (Item 15). Remove Vent Shaft Seals (Item 34) from Spring Bucket Sub Assembly. Caution should be taken not to damage the bushing.

Unscrew Hex Nuts (Item 13) from Flange Studs (Item 12) and slip Bottom Flange Sub-Assembly (Item 10) out of Body Sub-Assembly (Item 2). Care should be taken to unscrew the nuts evenly around the bolt circle, so inlet valve spring does not bind during disassembly. The spring will completely relax before the nuts are unscrewed.

WARNING

When removing the Hex Nuts (Item 13) from the Flange Studs (Item 12), remove the nuts from the long end of the exposed threads. Removing them from the <u>short end will not</u> properly unload the spring.

Remove the Inlet Valve Return Spring (Item 9).

Grasp the shaft of the Inlet Valve Sub-Assembly (Item 7) and pull it out of Inlet Seat Ring (Item 3).

Remove Vent Seal from Inlet Valve Subassembly (Item 30).

Remove Shaft Wiper (Item 32) and Shaft Seal (Item 33) from Bottom Flange Sub-Assembly (Item 10). Care should be used not to scratch the bearing.

Unscrew seal retainer screws and remove seal and retainer from Inlet Valve Sub-Assembly (Item 7).

Unscrew Inlet Valve Seat Ring (Item 3) from Body.

Discard old Gasket (Item 5) and clean surfaces.

Remove the Outlet Valve Sub-Assembly (Item 8) through the bottom of the valve body.

Unscrew the Outlet Seat Ring (Item 4) through the bottom of the body.

Discard old Gasket (Item 5) and clean surfaces.

After removing the Retainer Screws from the Outlet Valve Subassembly (Item 8), lift off Retainer and remove Seal from Outlet Valve Sub-Assembly.

B. Maintenance

Periodic leak testing of both block valves and verification of proper operation of both proof of closure switches is recommended per applicable codes. See Section VI for leak testing and Section VII for switch setting techniques.

Upon disassembly, all sealing and bearing surfaces, including metal back-up seats, should be inspected for nicks or other surface finish damage. Damaged items should be replaced. Prior to reassembly, scrape any remaining gasket material from mating surfaces. Clean gasket surfaces with a good quality solvent.

C. Reassembly

To reassemble system, reverse steps of Section A, installing new gaskets. Lubricate o-rings and seals with a suitable lubricant, such as, Dow Corning 55. Use as a suitable gasket compound on all gaskets, except bottom bearing holder, such as, Permatex Blue Adhesive Sealant (RTV). After reassembly, the valve and switches should be tested per the following procedures in Sections VI and VII.

VI. LEAK TESTING

It is necessary to leak test each block valve and the vent valve individually to properly qualify the status of each seal. The valves are named in accordance to their position and function within the valve system.

A. Inlet Valve

1. Verify the valve is in the closed position.

2. Seal the outlet of the valve.

3. Remove the outlet valve switch cover on top of the actuator to gain access to the vent test port.

4. Remove the test port and connect a suitable leak testing device.

5. Pressurize the inlet with a maximum of 50 psig clean dry air, while monitoring the leak rate from the vent test port. FM specifies a leak rate of 1 ft^3/hr or less.

B. Outlet Valve

1. Verify the valve is in the closed position.

2. Seal the inlet side of the valve.

3. Connect a suitable leak testing device to the outlet.

4. Pressurize the vent port with a maximum of 20 psig clean dry air, while monitoring the leak rate from the outlet valve. FM specifies a leak rate of 1 ft^3/hr or less.

5. Replace the test port using suitable thread sealing compound (Do not use PTFE tape) and proceed with proof of closure switch testing.

C. Vent Valve

1. Verify the valve is in the full open position.

2. Seal the outlet side of the valve.

3. Pressurize the inlet with a maximum of 50 psig clean dry air, while monitoring the leak rate from the vent or test port. FM specifies a leak rate of 1 ft^3/hr or less.

4. Replace the test port using suitable thread sealing compound (Do not use PTFE tape) and proceed with proof of closure switch testing.

VII. PROOF OF CLOSURE SWITCH TESTING

The intent of the POC switch is to trip during the closure overtravel (flow < 1 ft^3/hr) portion of the stroke. The switches should change contact state before flow commences from each individual valve. The Skotch Trifecta® Gas valve consist of two block valves with a corresponding proof of closure switch that must be tested individually.

The POC switches should be tested after the valve has been leak tested.

A. Inlet Valve POC Switch

1. Testing

    a) With the valve in the closed position, verify the normally closed contacts are made.

    b) Very slowly open the valve until the normally closed contacts are open. At this point stop the movement of the actuator and verify that flow has not commenced by pressurizing the inlet with a maximum pressure of 50 psig and monitoring flow from the outlet. The actuator can be opened slowly by regulating the air pressure to the actuator.

    c) If there is evidence of flow the inlet valve switch needs to be adjusted.

2. Setting

    a) Remove the inlet valve switch cover.

    b) Loosen the roller switch lever.

    c) Place a 1/8" shim between the inlet valve shaft and roller switch lever.

d) While holding the roller firmly against the shim and shaft, rotate the switch actuator shaft until the normally closed contacts of the switch break. At this point, securely fasten the lever to the switch actuator shaft.

e) Remove the spacer. The roller switch lever should be firmly resting on the inlet valve shaft and the normally closed contacts should be made. Note that the centerline of the roller should be aligned with the centerline of the inlet valve shaft.

f) Stroke the valve to the open position. Allow the valve to close slowly while monitoring the flow rate from the outlet of the valve. Flow should cease (<1 ft^3/hr) before the normally closed contacts make. If the normally closed contacts do not make, repeat starting at Section VII.A.2.b, but increase the shim thickness by 1/32". If the switch trips before flow commences, repeat starting at Section VII.A.2.b, but decrease the shim thickness by 1/32".

g) Cycle the valve though several complete cycles while monitoring the switch contacts making certain they trip and reset.

h) Replace the inlet valve switch cover.

B. Outlet Valve POC Switch

1. Testing

a) Remove the outlet valve switch cover.

b) With the valve in the closed position, verify the normally open contacts are made.

c) Very slowly open the valve until the normally open contacts are open. At this point stop the movement of the actuator and verify that flow has not commenced by pressurizing the vent with a maximum pressure of 20 psig and monitoring flow from the outlet. The actuator can be opened slowly by regulating the air pressure to the actuator.

d) If there is evidence of flow the outlet valve switch needs to be adjusted.

2. Setting

a) Verify the valve is in the closed position.

b) Loosen the two screws that hold the POC switch to the L-shaped bracket.

c) While monitoring the normally open contacts, move the switch downward towards the actuator top cap until the contacts are made. From this point, move the switch an additional 1/32" to 1/16" and tighten the switch mounting screws.

d) Cycle the valve open several times and confirm that the normally open contacts are made when the valve is in the closed position. If the contacts do not reset, then it is necessary to move switch downward an additional 1/32". Repeat until the switch resets.

e) Open the valve fully and allow the actuator to close slowly while monitoring the normally open contacts. When the switch trips, verify that there is no flow across the outlet valve by pressurizing the vent to 10 psig and monitoring flow out the outlet valve. If there is evidence of flow before the normally open contacts are made, then the switch will have to be adjusted upward. If an adjustment is necessary, repeat procedure starting at section VII.B.2.d

C. Open Limit Switch (If equipped)

1. Testing

   a) Verify the valve is in the closed position.

   b) Slowly open the valve paying particular attention to when the open limit switch contacts change state (trip). They should trip when the valve is at or near full open or ≥ 70% of inlet valve stroke.

   c) Slowly close the valve making certain the switch resets prior to the inlet valve POC switch tripping.

2. Setting

   a) The switch setting is adjusted by repositioning the switch roller on the switch. Loosen the clamp screw and reposition as required.

   b) When desired position is achieved tighten the clamp screw until the tab can not be moved.

VIII. MISCELLANEOUS INSTRUCTIONS FOR SPECIAL OPTIONS

Due to customer requirements, some T4000 Systems incorporate special options. Any special procedures not covered in the above material can be found in the Reference Section of this manual as addenda.

IX. SPARE PARTS ORDERING INFORMATION

Orders for T4000F Systems Spare Parts should be placed with

ITT Industries Inc.
Engineered Valves Group
33 Centerville Road
Lancaster, PA 17603-2064

Please be advised that such items as solenoids and switches should not be ordered directly from their manufacturers as materials may be specially designed for Trifecta System service. Other replacements parts, although they may be similar in function, will void the FM rating. *To ensure FM rating and/or proper operation, replacement components should be purchased through ITT Industries Inc.*

X. REFERENCE INFORMATION

The following pages contain drawings and reference information alluded to in above sections.