

Fabricated Body Gas Valve Systems



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Skotch® Trifecta Gas Valve Systems

A safer, more reliable engineered system for automated burner shutoff of gas service in your plant.

When you are burning flammable or fuel gases, you need an automated shutoff system you can count on for safe, reliable performance – every time. No leaks. No out-of-sequence operation.

And that's where Engineered Valves Group can help. Skotch valves are unique gas burner shutoff valve systems designed and manufactured with innovative technology.

The Skotch Trifecta T4000F valve systems offer a superior alternative to conventional multiple-valve packages. The Skotch Trifecta is a complete valve system contained within a single housing. Fail-closed models, which include

appropriate accessories, are Factory Mutual (FM) approved as automatic gas safety shutoff valves. Ruggedly constructed, the Trifecta system provides all the blocking and venting functions needed for safe automated gas burner operation.

Engineered Valves offers T4000 series valve systems in a broad range of sizes to meet the needs of any capacity gas burner or igniter. When necessary, valves can be specially configured to address specific requirements for piping design and support, and hazardous location classifications.



Shown are eight T4300F (3 inch) Skotch Trifecta gas valve systems replacing the need for twenty-four independently actuated valves. Installation time and space are reduced considerably.

Skotch® Trifecta Gas Valve Systems

A Look at the Problem

Strings of separate valves or multiple valve manifolds are frequently used to provide automated burner shutoff in fuel gas applications. Such arrangements often consist of a vent valve and two block valves, with each valve being driven by a separate actuator.

Failure of all actuators to operate in sequence is a concern. Sometimes a single operator is mechanically linked to drive both block valves in tandem. In such a configuration, obstruction or linkage problems that affect one valve will prevent the other from closing, so the advantage of using a double block is lost.

In many systems, vent valves are direct solenoid operated, with no provision for ensuring positive closure. The result can be continuous leakage into vent piping when the block valves are open. Installation of the conventional three-valve system can require as many as nine different connections. The Skotch Trifecta system requires only three simple connections; inlet, outlet, and vent. In addition, the Trifecta automatically gives you the correct vent size based on the recommendations of NFPA and IRI.

Engineered Valves created the T4000 series as a fully integrated system engineered for gas burner shutoff applications. The result is elimination of performance problems and a device that offers continuous, reliable, trouble-free service in your most critical applications.



T4600F (6 inch) Skotch Trifecta gas valves are installed above the burner level in the horizontal position, which reduces burner front clutter.

Skotch[®] Trifecta T4000F Series Gas Valves

The patented Skotch Trifecta T4000F series fabricated body valve system is a safe, cost-effective, reliable alternative to multiple valves and manifolds found in fuel gas systems. Used in applications where double block and vent is required, the T4000F combines the function of two independent block valves with a normally open vent valve in a single, compact unit. This makes it ideal for boilers, furnaces and process heating equipment firing natural gas, propane, and other fuel gas.

A single actuator mechanically opens the two block valves and closes the vent, assuring that the valves operate in sequence. Use of independent spring-to-close block valves ensures that obstructing one valve does not prevent the other from closing. The Trifecta valve system has no exposed linkage that can be damaged and requires no adjustments for proper operation.

Because Skotch Trifecta valve systems are custom built for each application, we are able to modify our standard offerings to suit customer needs. Installation flexibility is increased since the outlet and vent ports can be rotated at 90° increments, and the valves can be mounted in any orientation. The valve system is completely self-contained and all necessary accessories are provided, including position indication switches and junction box.

Skotch Trifecta gas valve systems have been proven as a superior alternative to multiple valves systems by decreasing installation space, time, and costs while increasing safety and reliability.

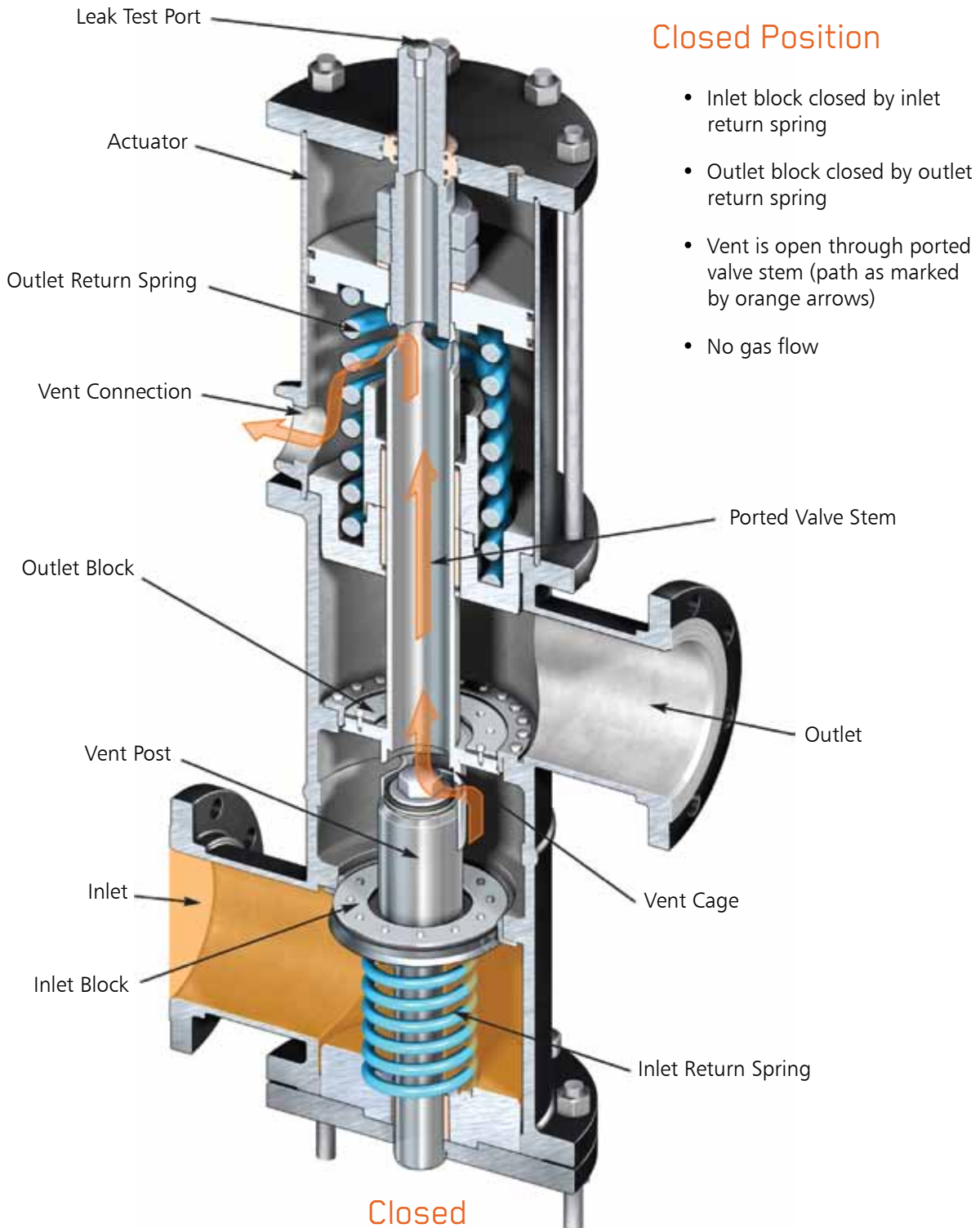
Features and Benefits

- Provides all necessary block and vent functions in a single integral unit
- Use of a single actuator ensures reliable in sequence operation. Block valve closure springs are independent for reliable closure
- Fabricated design allows for installation flexibility
- Compact design saves space
- All three valves provide ANSI/FCI 70-2 Class VI shutoff with over-travel and metal-to-metal back up seats
- Complies with NFPA and IRI's recommended good design practices for vent port size
- Outlet and vent ports can be rotated at 90° increments, and the valves can be mounted in any orientation
- Built in test port to allow leakage testing while valve is in line
- No external linkage; rugged enclosure protects all components
- Designed for in-line maintenance



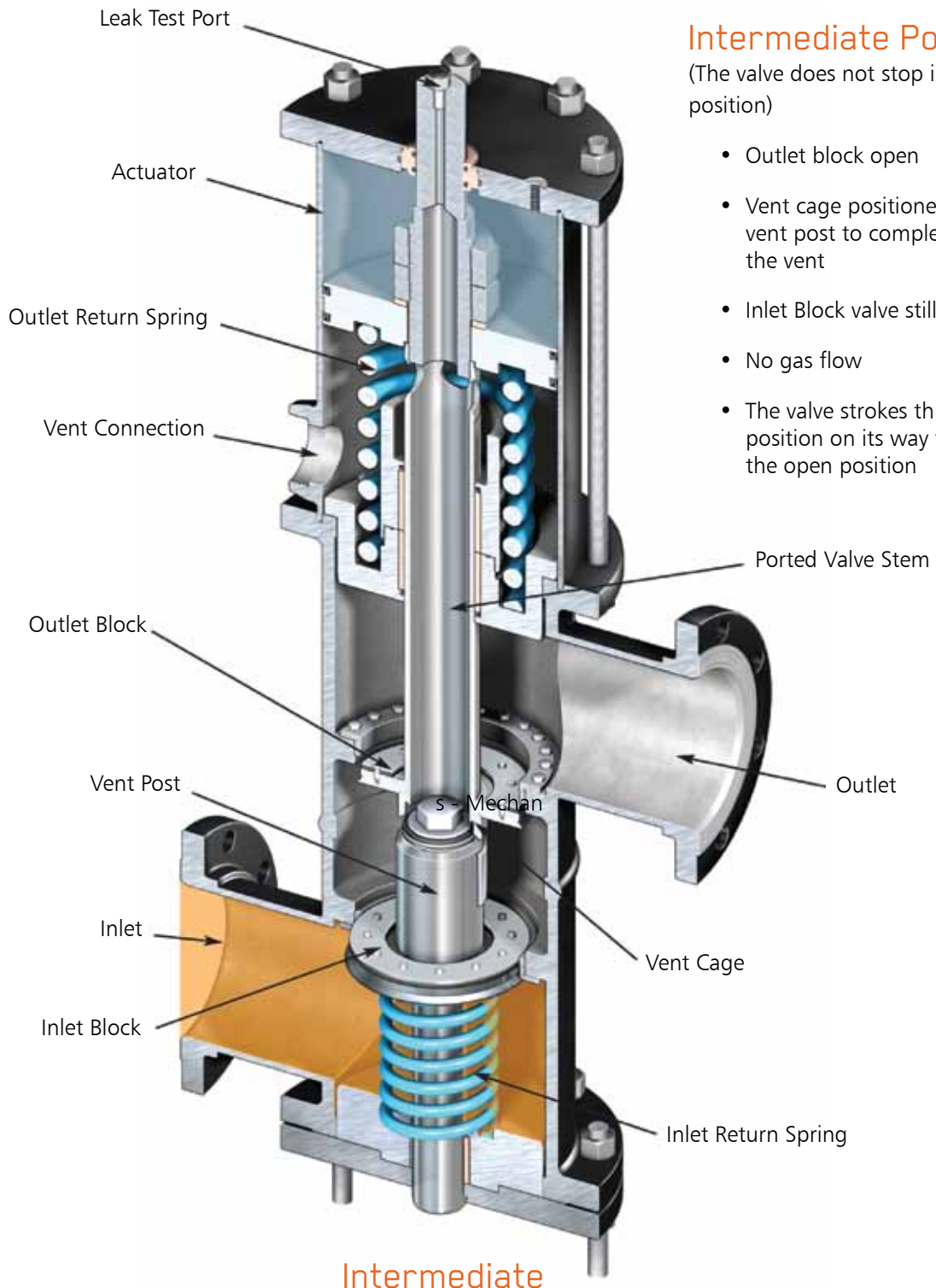
Skotch[®] Trifecta T4000F

Operating Sequence for the T4000F in the Closed Position



Skotch® Trifecta T4000F

Operating Sequence for the T4000F in the Intermediate Position

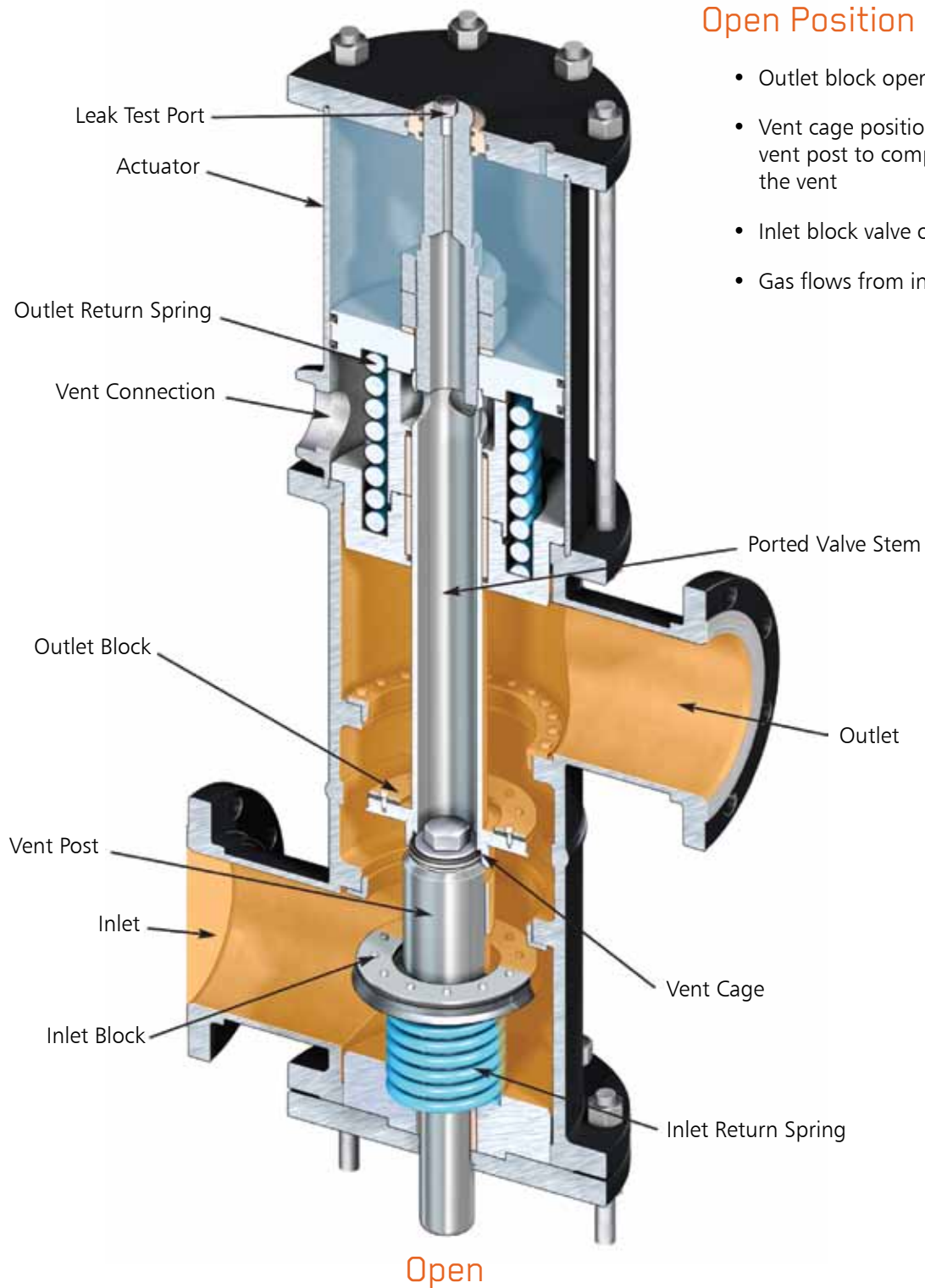


Intermediate Position (The valve does not stop in this position)

- Outlet block open
- Vent cage positioned over vent post to completely close the vent
- Inlet Block valve still closed
- No gas flow
- The valve strokes through this position on its way toward the open position

Skotch[®] Trifecta T4000F

Operating Sequence for the T4000F in the Open Position



Open Position

- Outlet block open
- Vent cage positioned over vent post to completely close the vent
- Inlet block valve open
- Gas flows from inlet to outlet

Skotch® Trifecta T4000F

Specifying Configurations 2" through 6"

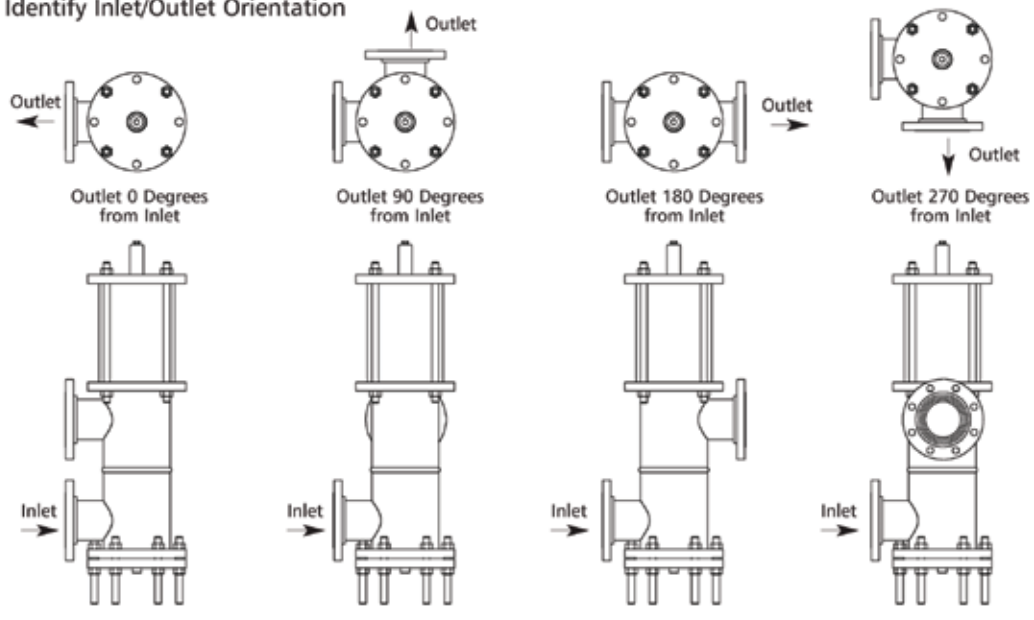
T4000F Body Configurations

The two-inch (T4200F) through six-inch (T4600F) valve systems are fabricated design. As a result, outlet and vent connections as well as the junction box can be located at

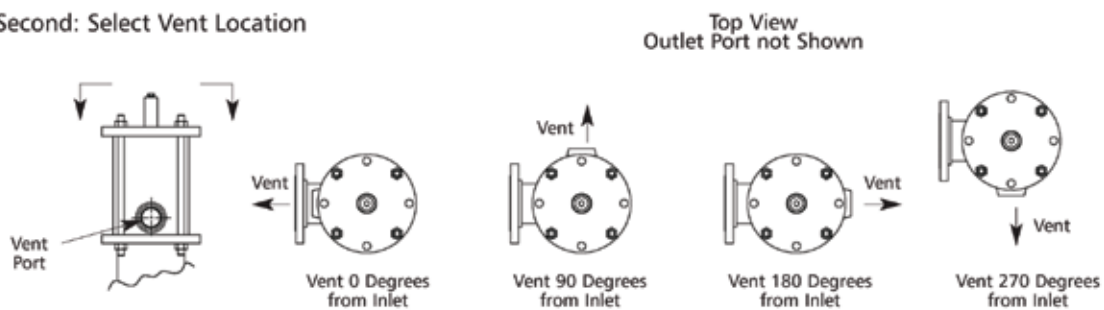
any point in 90° in relation to the inlet connection. Listed here are standard orientations from which to choose.

Note: Vent and junction box should not be in the same location.

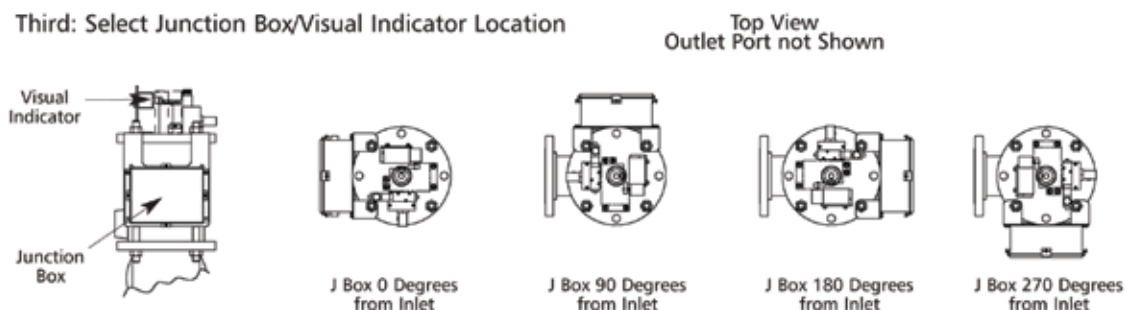
First: Identify Inlet/Outlet Orientation



Second: Select Vent Location

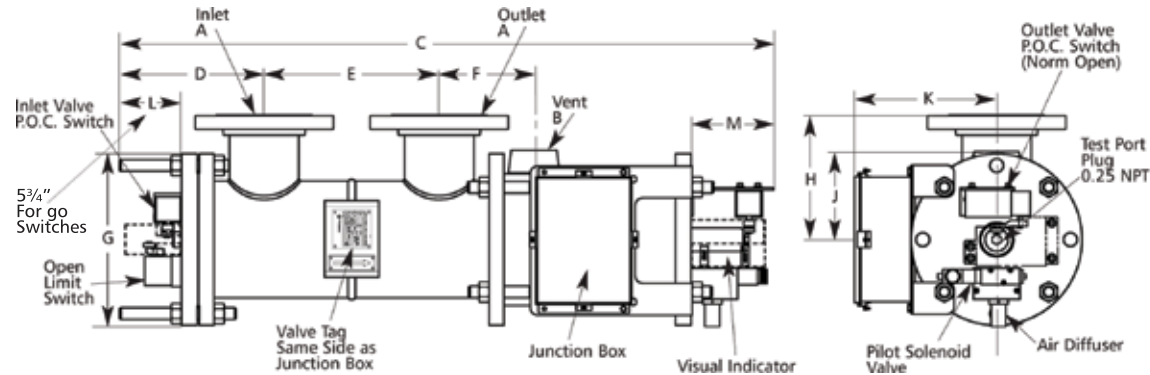


Third: Select Junction Box/Visual Indicator Location



Skotch® Trifecta T4000F

Dimensional Information



T4000F Systems are covered under U.S. Patent No. 4,798,223 and other foreign patents.

General Dimensions (Inches)

Valve Series	Line Size A	Vent Size B	C	D	E	F	G	H	J	K	L	M
T4200F	2.00 R.F. Flange	1.00 FNPT	36.81	9.11	7.50	5.02	9.00	6.00	3.93	9.42	4.50	5.30
T4300F	3.00 R.F. Flange	1.25 FNPT	40.79	8.69	10.12	5.53	11.00	7.50	5.54	9.63	4.00	5.30
T4400F	4.00 R.F. Flange	2.00 FNPT	42.08	9.31	11.27	6.10	11.00	7.93	5.63	9.63	4.00	5.30
T4600F	6.00 R.F. Flange	2.50 FNPT	55.38	11.06	15.00	8.13	13.50	11.00	7.38	11.42	5.25	5.88

General Dimensions (Metric)

Valve Series	C	D	E	F	G	H	J	K	L	M
T4200F	935.0	231.4	190.5	127.5	228.6	152.4	99.8	239.3	114.3	134.6
T4300F	1036.1	220.7	257.0	140.5	279.4	190.5	140.7	244.6	101.6	134.6
T4400F	1068.83	236.5	286.3	154.9	279.4	201.4	143.0	244.6	101.6	134.6
T4600F	1406.65	280.93	381.0	206.5	342.9	279.4	187.5	290.1	133.35	149.4

Specifications for the T4000F

Design Pressure and Temperature:

Max. operating pressure – 50 PSIG

Max operating temperature – 180°F

Shutoff Classification:

All ports soft seated with metal to metal backup

New valve: meets or exceeds ANSI/FCI 70-2

Class VI

Durability: meets or exceeds FM 7400 standard for Safety Shutoff Valves (SSOV)

Sizes & Weights:

Series	Line Size	Vent Size	Weight*
T4200F	2"	1"	137 lbs
T4300F	3"	1 1/4"	240 lbs
T4400F	4"	2"	265 lbs
T4600F	6"	2 1/2"	515 lbs

*Approximate depending on options selected

Cv Ratings:

T4200F – 80

T4300F – 167

T4400F – 245

T4600F – 430

End Connections:

Inlet/Outlet: ANSI B16.5 Cl 150 Raised Face Flange

Vent: ANSI B2.1 Female NPT, Sch 40 or 80 Spigot, Butt weld (CL 150 Raised face flange optional)

Actuation:

T4x05 – Fail in last position

T4x06 – Fail closed, FM approved

T4x07 – Fail closed, non-FM approved

Pneumatic Supply: 70 to 120 PSIG clean, dry air

Ambient Temperature Rating:

Standard: 140°F (FM approved)

Optional: 180°F (non-FM approved)

Construction Materials:

Body: ASTM A105 Carbon Steel

Trim: 6061 – T6 Aluminum, ASTM AS11 Type 316SS

Seals: Buna-N standard; Consult factory for Viton options

Electrical Rating:

Standard – Nema 1, 3, 4, 13

Optional – Nema 7, 9 (Class 1 Div 2 Gr B, C, D)

Pilot Solenoid Voltages:

110 VAC, 220 VAC 50/60 Hz

12, 24, 48, 125 VDC

Switch Rating: 10 Amps at 125 VAC

Ingress Protection: 4, 4X, 6P

Stroke:

T4200: 3"

T4300: 3.5"

T4400: 4"

T4600: 5"

Orientation: May be installed in any orientation



FM Approved for valves which fail in the closed position and incorporate appropriate options.

Skotch® Trifecta T4000F

Flow Capacity Charts

2" through 6"

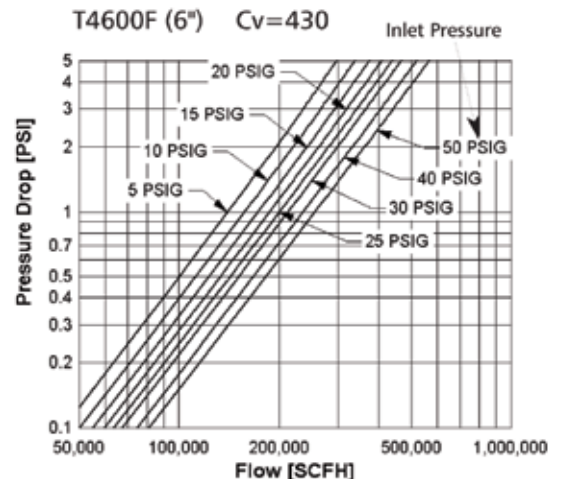
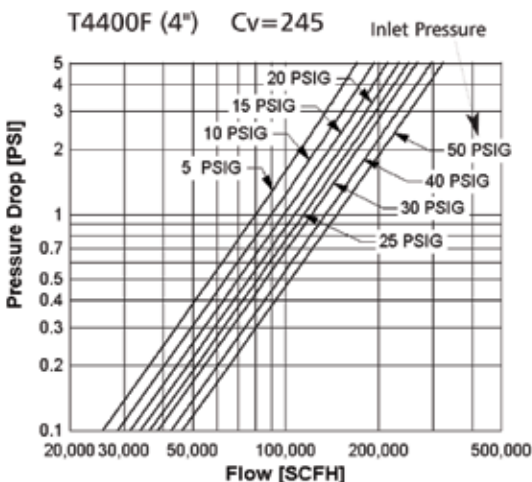
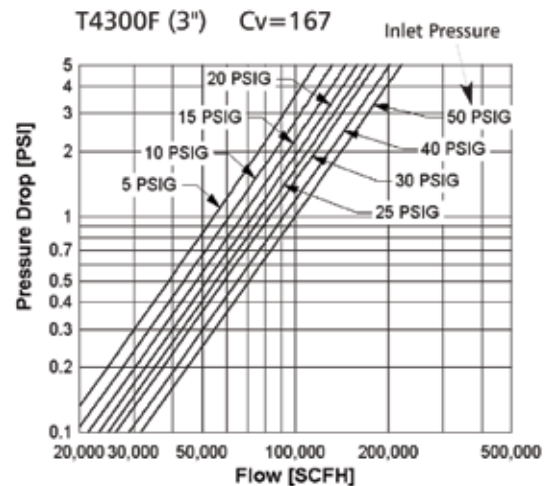
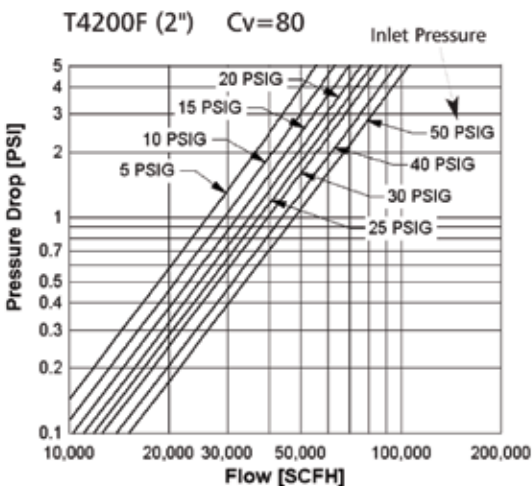
The following charts depict the relationship between flow (SCFH) and pressure drop (PSI) for 2 inch through 6 inch Trifecta valves. Data is given at various inlet pressures (PSIG). Follow known flow up the chart until you intersect the known operating pressure. Where the two lines intersect, look to the left for the pressure drop.

Example: 3" valve system with 100,000 SCFH natural gas flow operating at 15 PSIG inlet pressure the pressure drop will be 2.3 PSI. Selecting a 4" valve system with the same conditions will result in a pressure drop of 1.0 PSI

Estimated pressure drops are reported for the entire Trifecta double block and vent system.

Figures can be used to compare relative performance of the various valve sizes. Please note that calculations do not take into effect external piping elements, such as reducers, tees, and elbows. When comparing this data with that of other manufacturers, please ensure any comparison figure estimates the performance over two block valves closely-coupled and not just a single valve.

For other process conditions, calculations may be performed using the Cv values noted in valve specification data, or contacting the factory. Calculations are based on natural gas at 0.65 specific gravity, 60 degrees F.



Calculations are based on natural gas at 0.65 specific gravity, 60 degrees F.

Scotch® Trifecta T4000F

Principles of Operation

Opening

1. With the block valves closed and the vent open, gas enters the inlet port and is blocked by two flow-to-close plugs (the inlet and outlet block). To positively prevent fuel leakage into an idle burner, the chamber between is vented to atmosphere through the ported outlet valve stem. (Figure 1)

2. Pneumatic pressure at the top of the actuator cylinder moves the piston downward, compressing the outlet return spring and forcing the outlet block open. The cage slides down over the post until the machined surfaces inside the cage come in contact first with a spring-energized soft seal, and then with a metal back-up seat, closing the vent. (Figure 2)

3. With the vent closed, the system continues to stroke, pushing the inlet block open, so that gas begins to flow. A travel stop halts valve movement after full stroke is achieved. (Figure 3)

Closing

1. To close the valve and open the vent, pilot air is exhausted from the actuator. Return springs drive the inlet and outlet valves toward their seats. (Figure 3)

2. As the inlet valve enters its seat ring, gas flow is isolated. The inlet block moves through its overtravel until contact is made with the metal back-up seat to fully close the inlet valve (Figure 2)

3. As the outlet valve continues moving toward its seat, the cage separates from the post, opening the vent. The outlet block enters the seat ring, isolating the vent from downstream piping. When the outlet block contacts the metal back-up seat, the system is fully closed. (Figure 1)

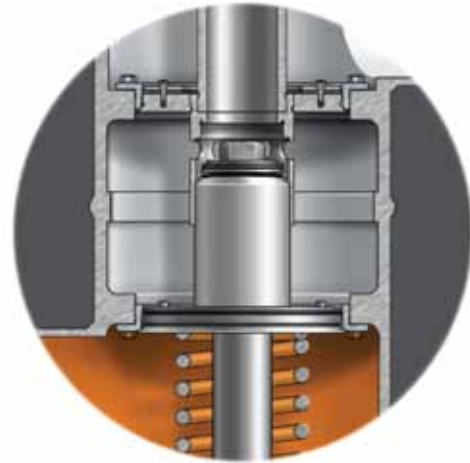


Figure 1

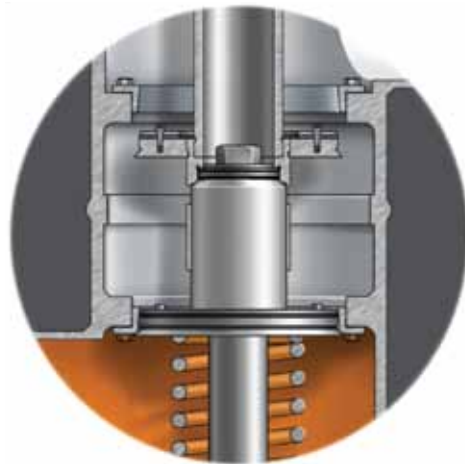


Figure 2

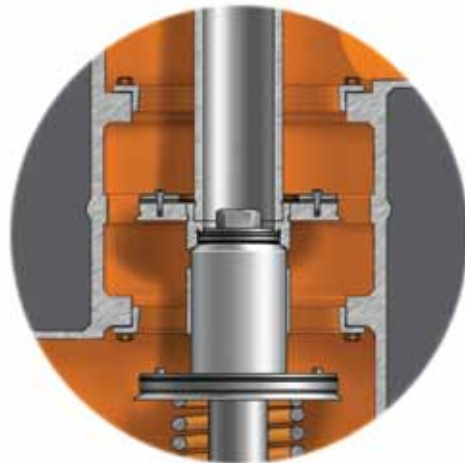


Figure 3

Cast Body Gas Valve Systems



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Skotch® Trifecta T4000C Series Gas

For larger igniters and smaller main burners, the patented Skotch Trifecta T4000C series cast-body valve system is a safe, cost-effective, reliable alternative to the multiple valves and manifolds found in fuel gas systems.

Used in applications where double block and vent is required, the T4000C combines the functions of two independent block valves with a normally open vent valve in a single, compact unit making it ideal for boilers, furnaces, and process heating equipment firing natural gas, propane, or other fuel gas. The unique design includes three ports: inlet, outlet, and vent. The cast steel body contains two valve plugs – an inlet and outlet block. The chamber between is open to vent through the ported inlet stem.

Flow-to-close inlet and outlet blocks are sized for full flow to minimize pressure loss; increasing inlet pressure forces the blocks tighter on their seats. Soft seals with over-travel and metal-to-metal back up seats ensure positive ANSI/FCI 70-2 Class VI closure. Proof-of closure (POC) switch is standard.

Advantages of using the T4000C valve system vs. conventional multiple valve and manifold setups include:

- Compact for easier installation
- Less maintenance and lower cost of ownership
- Available Factory Mutual (FM) approved configurations (fail closed only)
- No out-of-sequence operation
- Can be installed in any orientation

Because the T4000C valves operate using a single actuator, problems such as out-of-sequence operation, jamming, and maladjustment of linkage drive systems are eliminated.



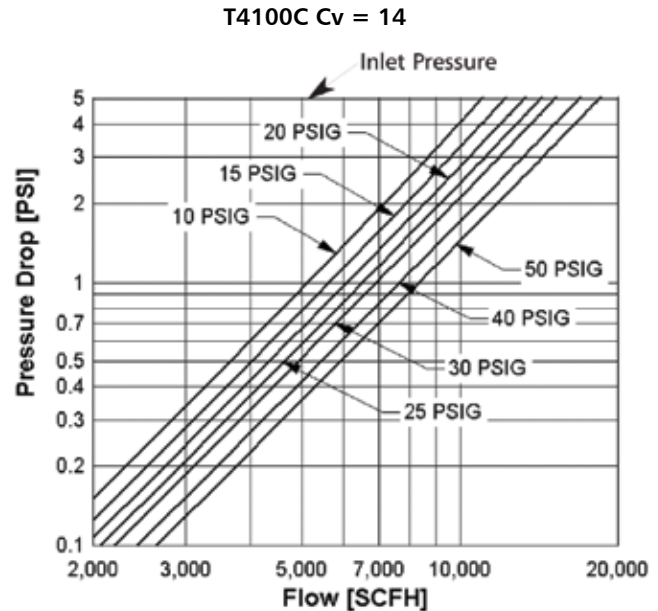
Scotch[®] Trifecta T4000C

Flow Capacity for the T4100C

The following chart depicts the relationship between flow (SCFH) and pressure drop (PSI) for the T4100C Scotch Trifecta valve system. Data is given at various inlet pressures (PSIG). Follow known flow up the chart until you intersect the known operating pressure. Where the two lines intersect, look to the left for the calculated pressure drop.

T4100C example: With 10,000 SCFH flow operating at 15 PSI the calculated pressure drop will be 3.3 PSI.

Calculations are based on natural gas at 0.65 specific gravity, at 60° F.



Specifications for the T4100C

Design Pressure and Temperature:

Max. operating pressure: 50 PSIG

Operating temperature range: -20°F to 150°F

Shutoff Classification:

All ports soft seated with metal to metal backup

New valve: meets or exceeds ANSI/FCI 70-2
Class VI

Durability: meets or exceeds FM 7400 standard
for Safety Shutoff Valves (SSOV)

Inlet/Outlet Size: 1" Sch. 40 (Sch. 80 optional)

Weight: Approximately 35 lbs depending on options selected

CV Rating: 14

End Connections:

Inlet/Outlet: Sch. 40 or 80 Spigot; Butt Weld;
ANSI Class 150 Raised-Face Flange;
Male NPT in Sch. 80; Socketweld

Vent: ANSI B2.1 FNPT

Actuation:

Electropneumatic

T4105C- Fail Last Position

T4106C- Fail Closed (Safe), FM Approved

T4107C- Fail Closed, non-FM Approved

Flow Direction: Left-to-right or right-to-left. Field reversible

Pneumatic Supply: Clean, dry air at 60 to 120 PSIG

Ambient Temperature Rating:

Standard: 140°F (FM approved)

Optional: 180°F (non-FM Approved)

Construction Materials:

Body: ANSI B16.34 compliant; cast carbon steel
per ASTM A216 Gr. WCB

Flanges: ASTM A479 Type 304, ASTM A108 1018

Trim: ASTM Type 300 series stainless steels

Seals: Buna-N standard; Consult factory for
Viton options

Switch / Solenoid Electrical Ratings:

Standard: Nema 1, 3, 4, 13

Optional: Nema 7, 9 (Class 1 Div 2 Gr. B, C, D)

Solenoid Supply Voltages:

110 VAC, 220 VAC 50/60 Hz

12, 24, 48, 125 VDC

Switch Rating:

Internal Switches - 7 Amps @ 120 VAC

External Switches - 10 Amps @ 125 VAC

Ingress Protection:

Standard: Nema 4

Optional: Nema 4X

Stroke: ~ 1"

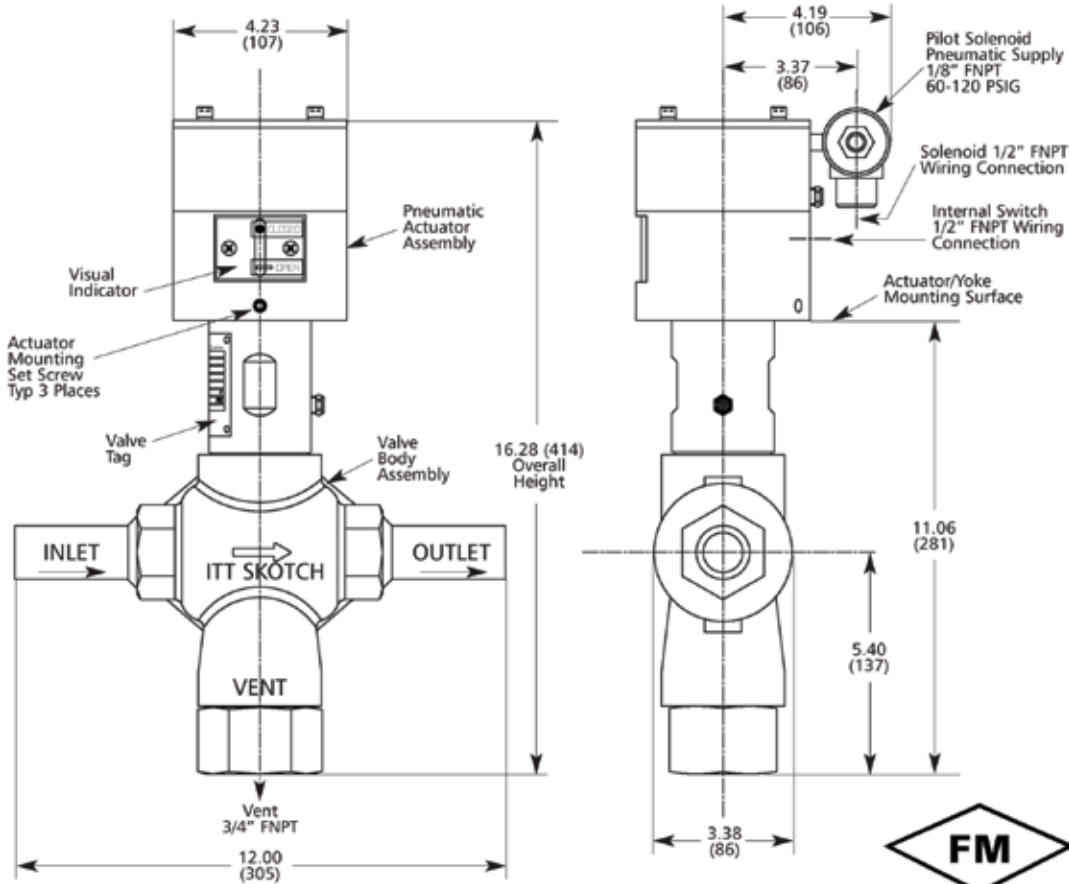
Orientation: May be installed in any orientation



FM Approved for valves which fail in the closed position and incorporate appropriate options.

Skotch[®] Trifecta T4000C

Dimensional Specifications for the T4100C

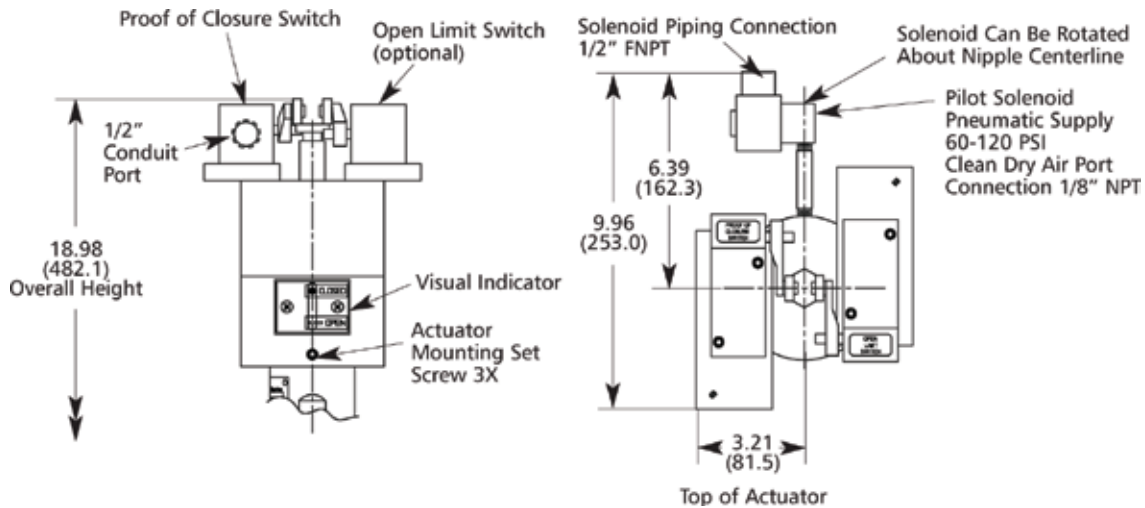


T4000C systems are covered under U.S. Patent No. 5,165,443 and other foreign patents.
Dimensions are inches (mm)

FM
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FM Approved for valves which fail in the closed position and incorporate appropriate options.

Externally Mounted Limit Switch Option



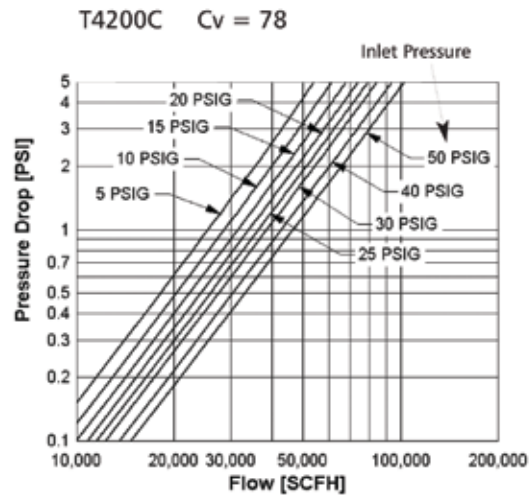
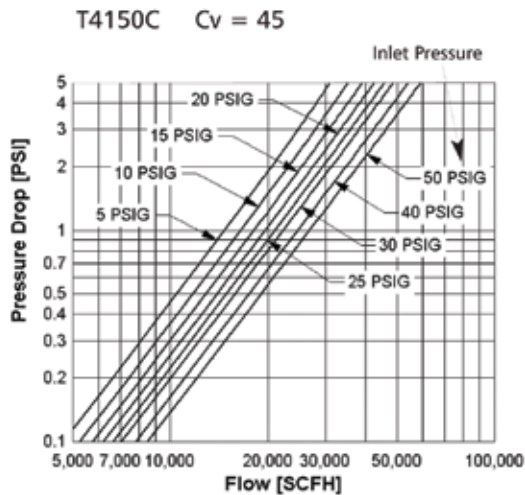
Scotch[®] Trifecta T4000C

Flow Capacity for the T4150C and T4200C

The following chart depicts the relationship between flow (SCFH) and pressure drop (PSI) for the T4150C and T4200C Trifecta valve systems. Data is given at various inlet pressures (PSIG). Follow known flow up the chart until you intersect the known operating pressure. Where the two lines intersect, look to the left for the calculated pressure drop.

T4150C example: With 20,000 SCFH flow operating at 15 PSI the calculated pressure drop will be 1.2 PSI.

Calculations are based on natural gas at 0.65 specific gravity, at 60° F.



Specifications for the T4150C and T4200C

Design Pressure and Temperature:

Max. operating pressure: 60 PSIG
Operating temperature range: -20°F to 180°F

Shutoff Classification:

All ports soft seated with metal to metal backup
New valve: meets or exceeds ANSI/FCI 70-2
Class VI

Durability: meets or exceeds FM 7400 standard
for Safety Shutoff Valves (SSOV)

Sizes & Weights:

Series	Line Size	Vent Size	Weight*
T4150C	1.5"	3/4"	111 lbs
T4200C	2.0"	1"	162 lbs

*Approximate depending on options selected

End Connections:

Inlet/Outlet: ANSI B16.5 Cl 150 Raised Face Flange
Vent: ANSI B2.1 Female NPT, Sch 40 or 80 Spigot, Butt weld
(CL 150 Raised face flange optional)

Actuation:

T4xx5 – Fail in last position
T4xx6 – Fail closed (safe), FM approved
T4xx7 – Fail closed, non-FM approved

Flow Direction:

Left-to-right or right-to-left
Field reversible (consult factory)

Pneumatic Supply: 70 to 120 PSIG clean, dry air

Ambient Temperature Rating:

Standard: 140°F (FM approved)
Optional: 180°F (non-FM Approved)

Construction Materials:

Body: ANSI B16.34 compliant; cast carbon steel per ASTM A216 Gr. WCB
Flanges: ASTM A479 Type 304, ASTM A108 1018
Trim: ASTM Type 300 series stainless steels
Seals: Buna-N standard; Consult factory for Viton options

Switch / Solenoid Electrical Ratings:

Standard: Nema 1, 3, 4, 13
Optional: Nema 7, 9 (Class 1 Div. 2 Gr. B,C,D)

Solenoid Supply Voltages:

110 VAC, 220 VAC 50/60 Hz
12, 24, 48, 125 VDC

Switch Rating: 10 Amps at 125 VAC

Ingress Protection:

Standard: Nema 4
Optional: Nema 4X

Stroke:

~2.3"

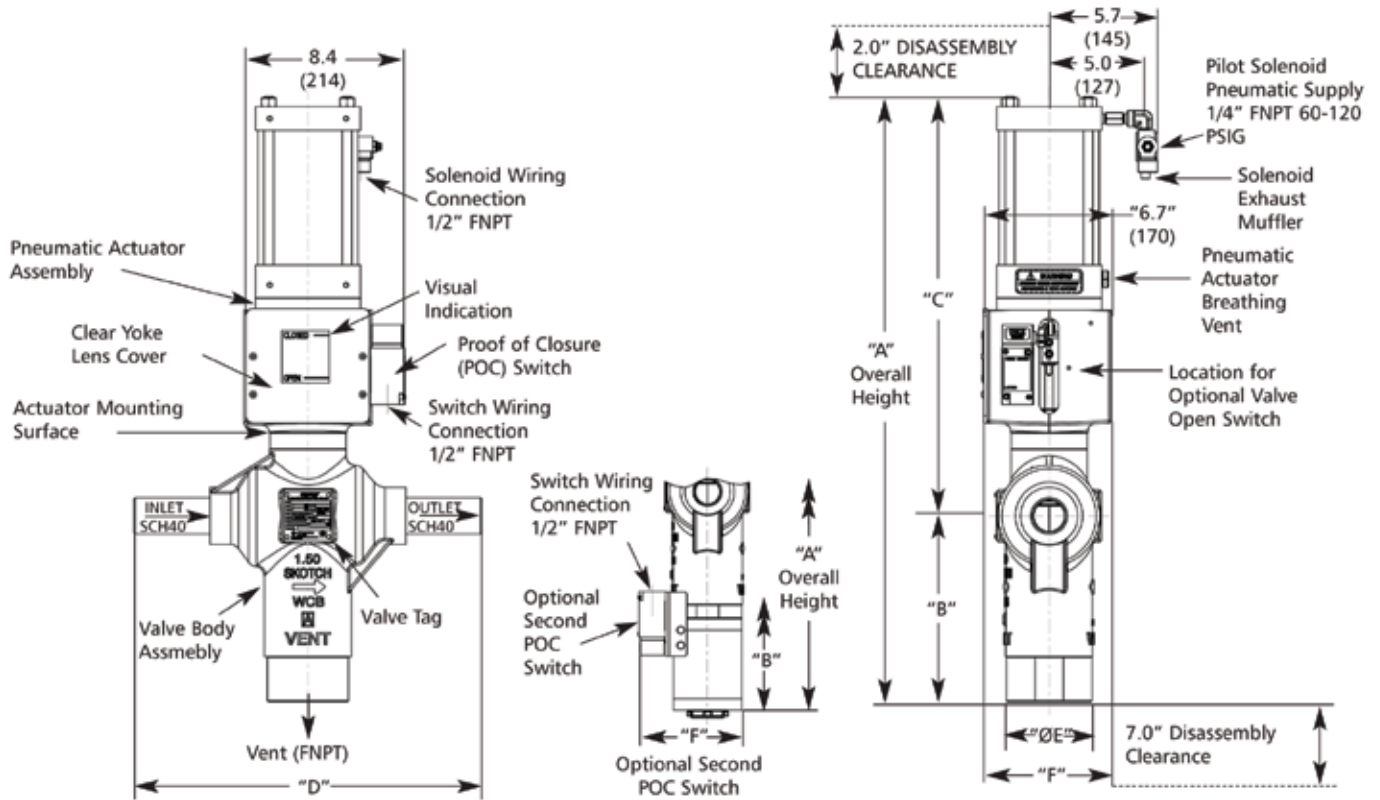
Orientation:

May be installed in any orientation



Skotch® Trifecta T4000C

Dimensional Specifications for the T4150C and T4200C



Model	Pipe Run Size	Vent Connection	Dim "A"	Dim "B"	Dim "C"	Dim "D"	Dim "E" Ø	Dim "F"
T4150C Base	1.5"	0.75" FNPT	31.8 (808)	9.8 (249)	22.0 (559)	18.3 (465)	4.6 (117)	5.6 (142)
T4150C w/ 2nd POC	1.5"	0.75" FNPT	36.9 (937)	14.9 (378)	22.0 (559)	18.3 (465)	4.6 (117)	7.2 (183)
T4200C Base	2.0"	1.0" FNPT	33.5 (851)	10.1 (257)	23.4 (594)	21.8 (554)	5.4 (137)	7.1 (180)
T4200C w/ 2nd POC	2.0"	1.0" FNPT	39.0 (991)	15.5 (394)	23.4 (594)	21.8 (554)	5.4 (137)	8.3 (211)

Dimensions are inches (mm)

T4000C systems are covered under U.S. Patent No. 5,165,443 and other foreign patents.



FM Approved for valves which fall in the close position and incorporate appropriate options.

Scotch® Trifecta T4000C

Principles of Operation

Opening

1. Energizing the actuator extends its output shaft, forcing the valve's outlet stem down to open the outlet block and compress the Actuator spring.

2. As the system opens, a soft vent seal on the bottom of the outlet plug contacts a flat surface on the inside of the inlet plug stem. The spring energized vent seal is compressed until a metal to metal backup seat is made. At this point the outlet is open and the vent is fully closed. (Figure 2)

3. The valve continues to travel through vent closure, driving the inlet plug out of its seat and compressing the inlet spring.

4. When the inlet plug's soft seal clears the seat ring, both blocks are open, the vent is closed, and gas moves from the inlet port to the outlet port. The valve stops at full open. (Figure 3)

Closing

1. For valve shutoff, the actuator is deenergized, causing the valve's two independent return springs to close the block valves. (Inlet block spring and actuator return spring)

2. First, the inlet block closes, making first a soft seal, halting the flow of gas, and then over traveling to make a metal to metal backup seat. Next, the vent opens, relieving down-stream pressure. Finally, the outlet block closes, making a soft seal and then over traveling to make a metal to metal backup seat, isolating the vent from the burner.

3. With the inlet and outlet blocks closed and the vent open, any potential leakage past the inlet valve escapes to vent through the ported inlet stem. This positively ensures no leakage into the burner. (Figure 1)

