

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.

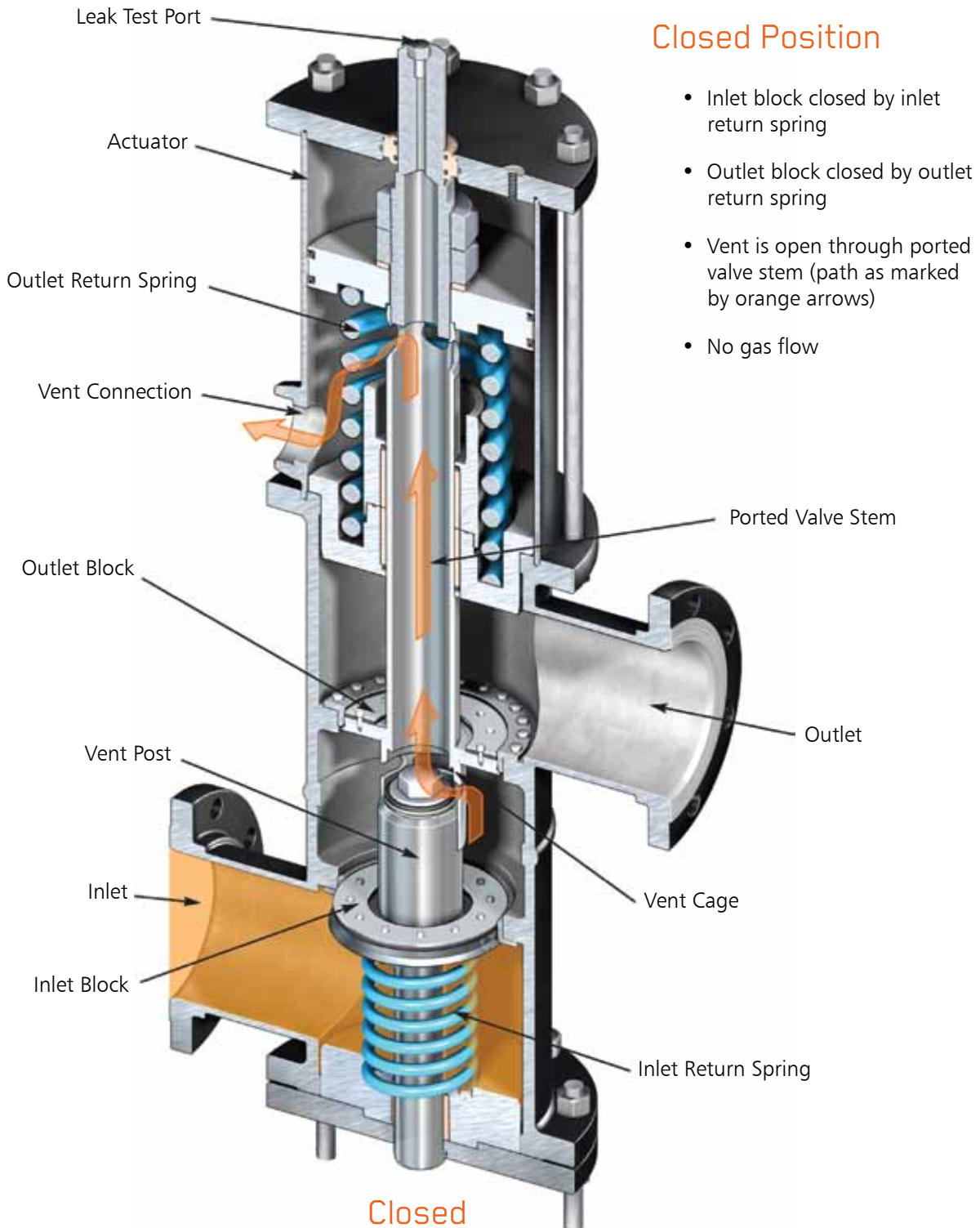
Features and Benefits

- 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



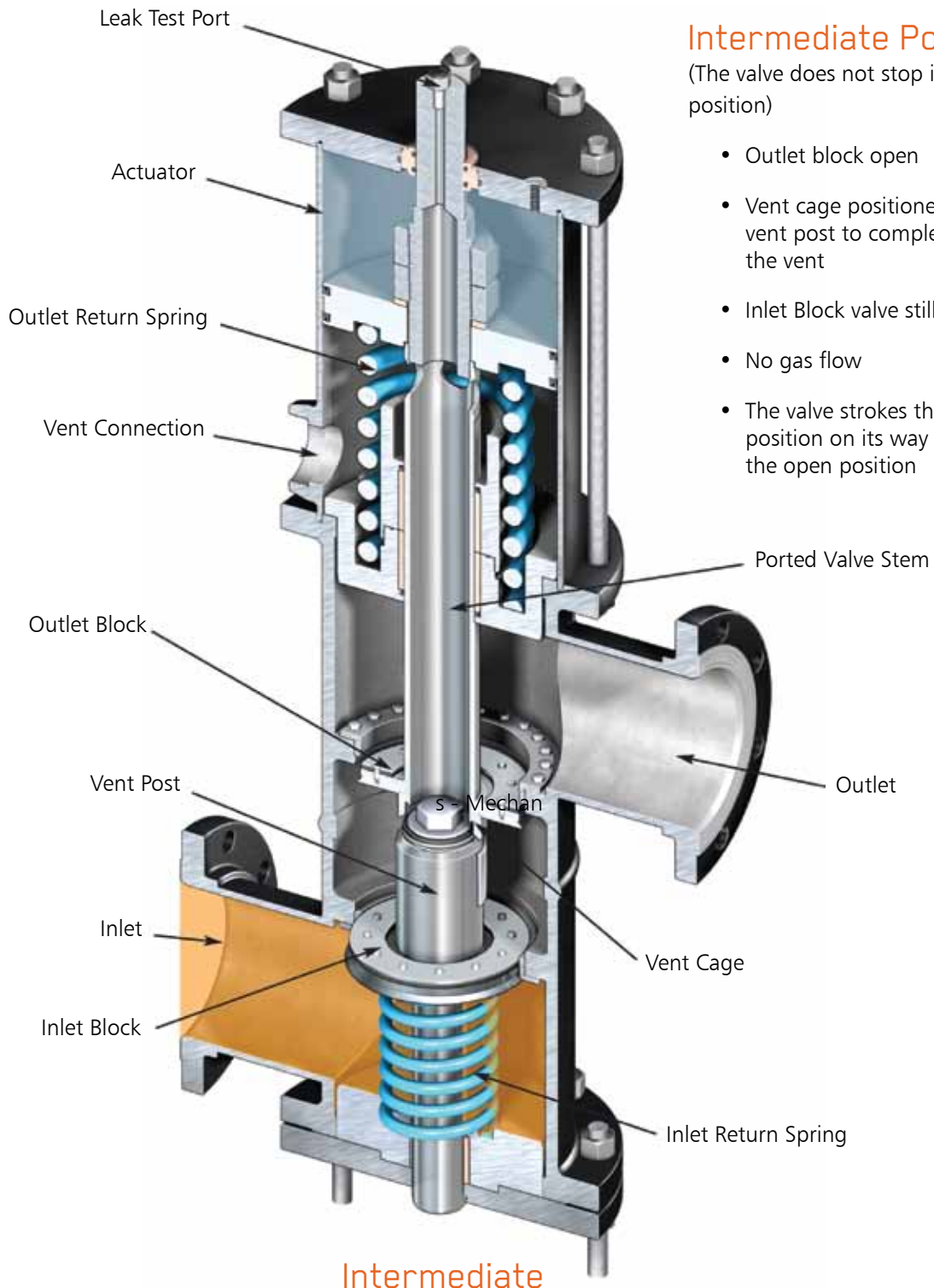
Skotch® Trifecta T4000F

Operating Sequence for the T4000F in the Closed Position



Skotch® Trifecta T4000F

Operating Sequence for the T4000F in the Intermediate Position

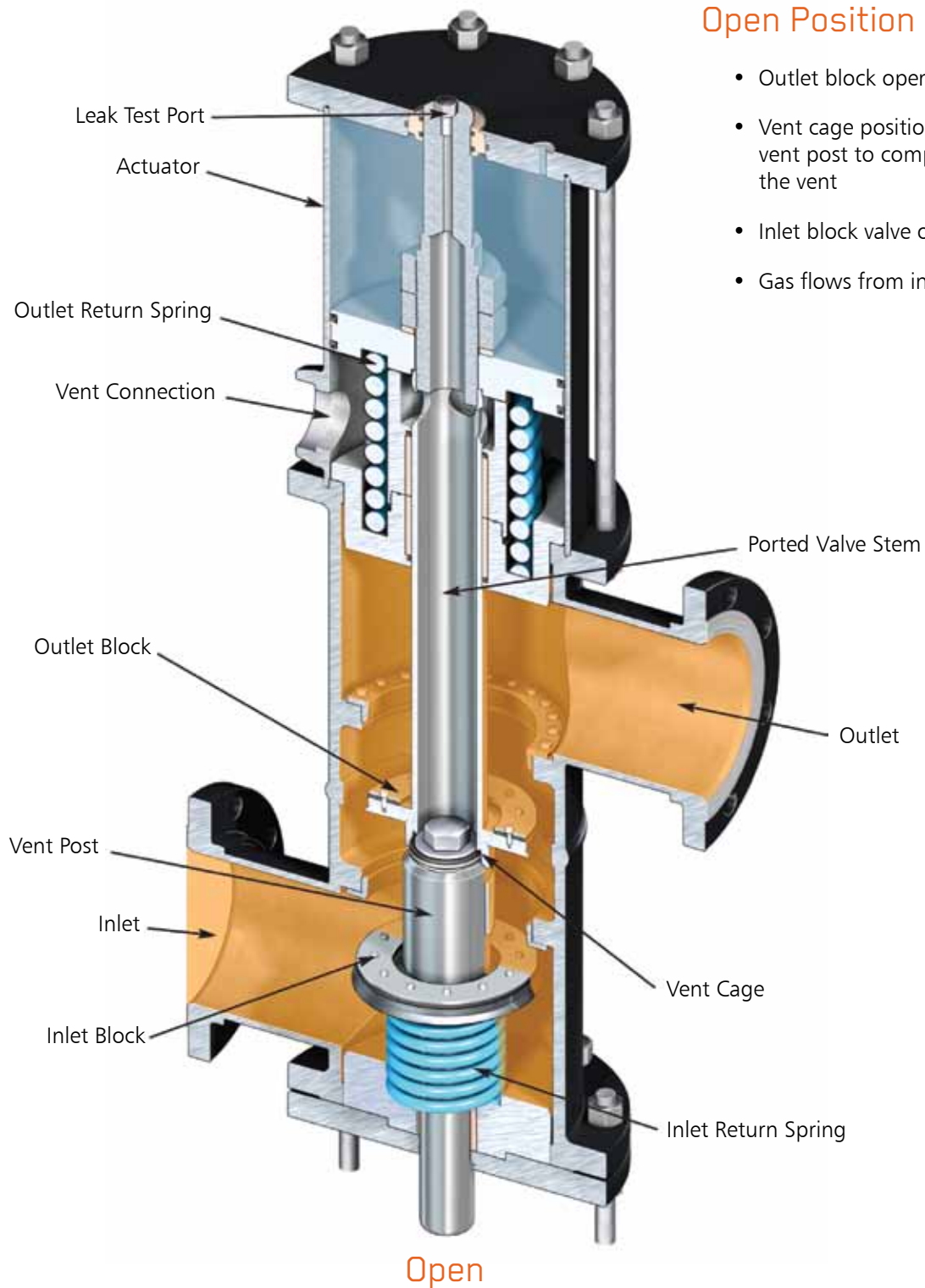


Intermediate Position (The valve does not stop in this position)

- 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"

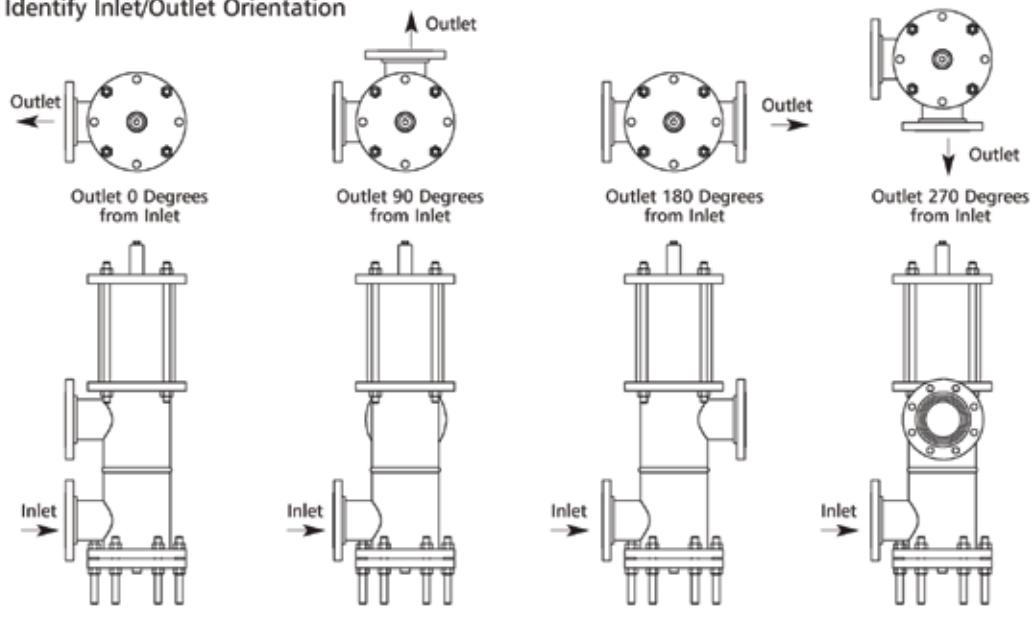
T4000F Body Configurations

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

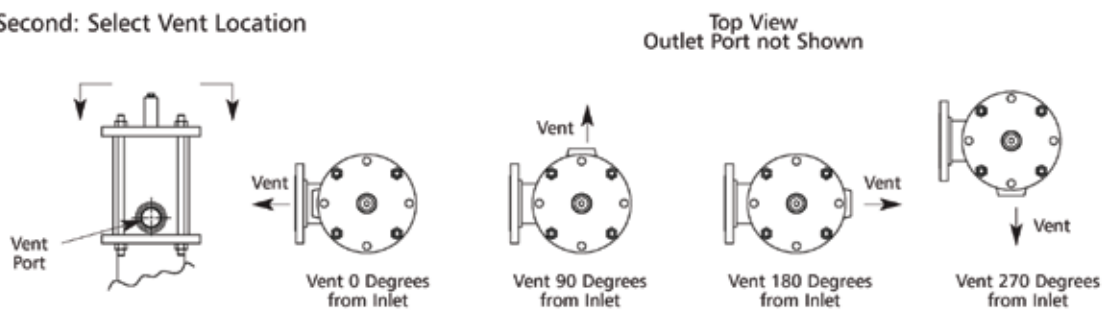
any point in 90° in relation to the inlet connection. Listed here are standard orientations from which to choose.

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

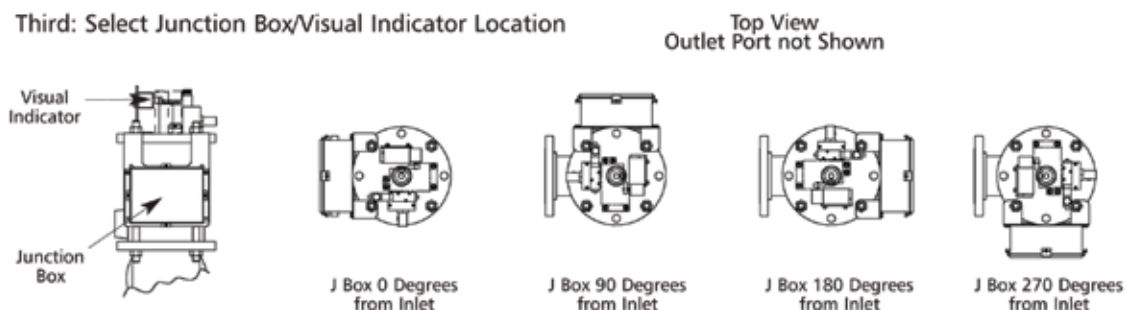
First: Identify Inlet/Outlet Orientation



Second: Select Vent Location

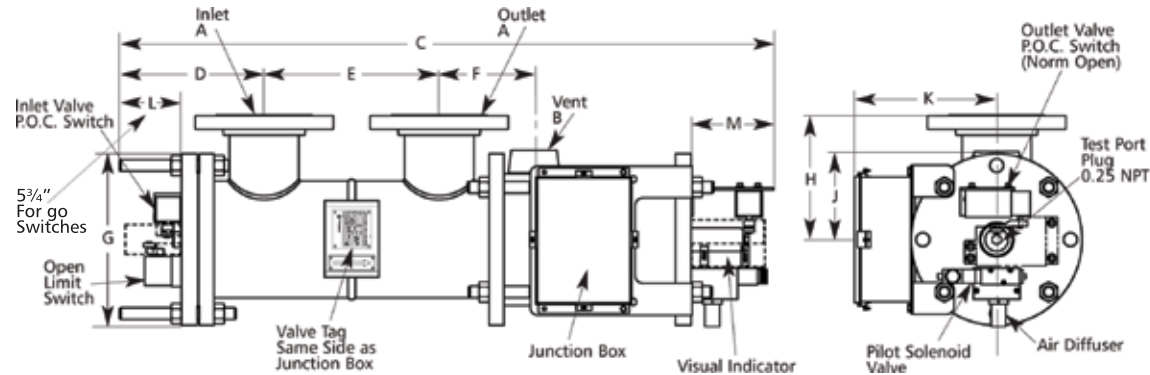


Third: Select Junction Box/Visual Indicator Location



Scotch® 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"

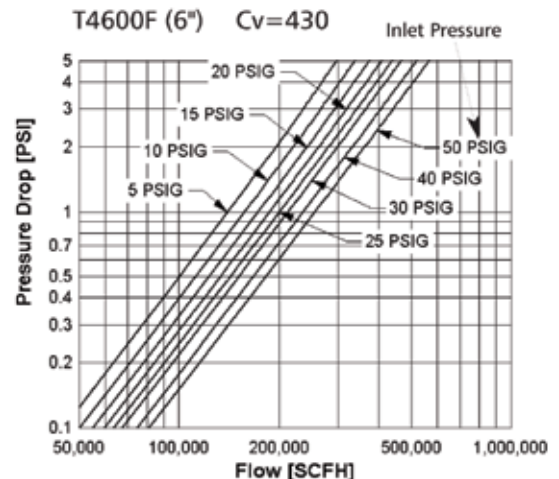
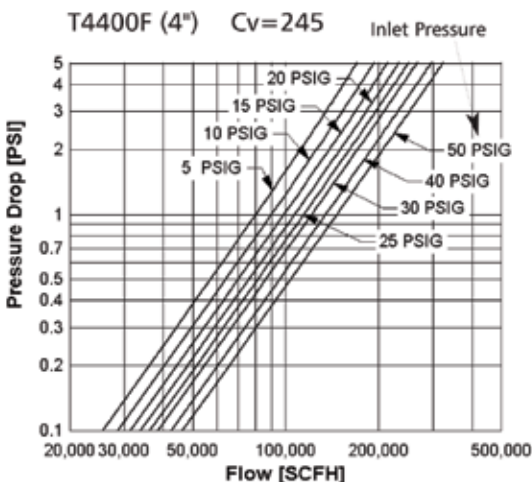
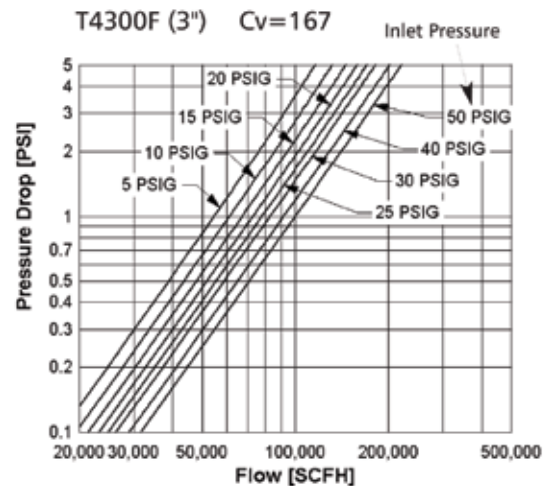
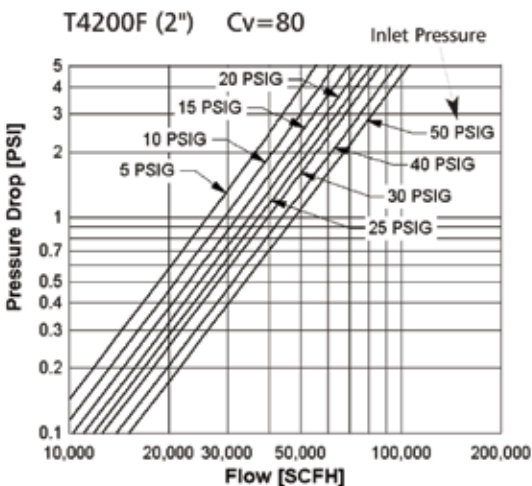
The following charts depict the relationship between flow (SCFH) and pressure drop (PSI) for 2 inch through 6 inch Trifecta valves. Data is given at various inlet pressures (PSIG). Follow known flow up the chart until you intersect the known operating pressure. Where the two lines intersect, look to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

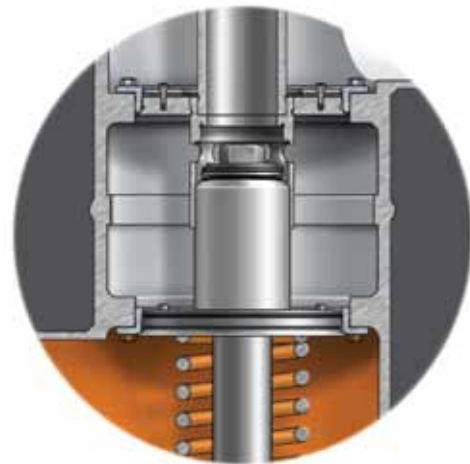


Figure 1

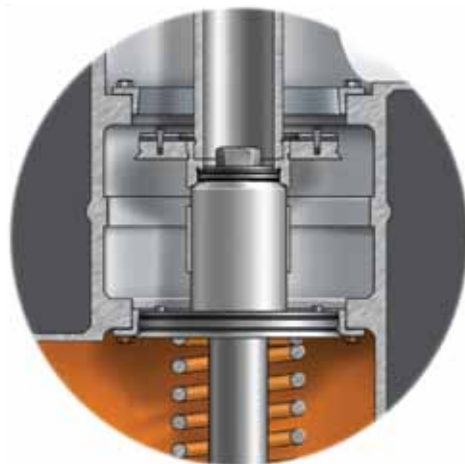


Figure 2

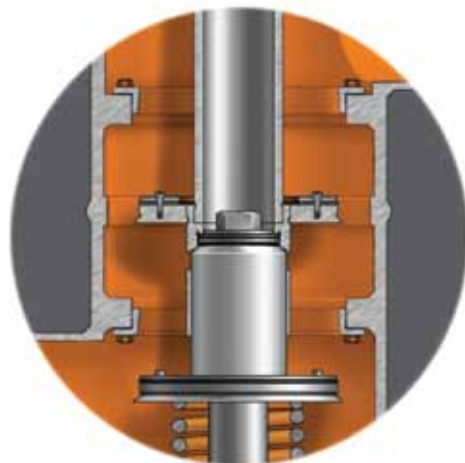


Figure 3

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.



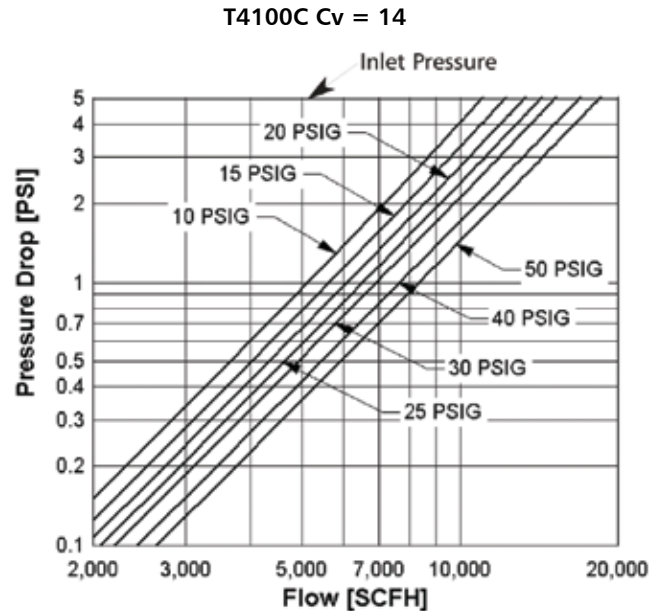
Scotch[®] Trifecta T4000C

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"

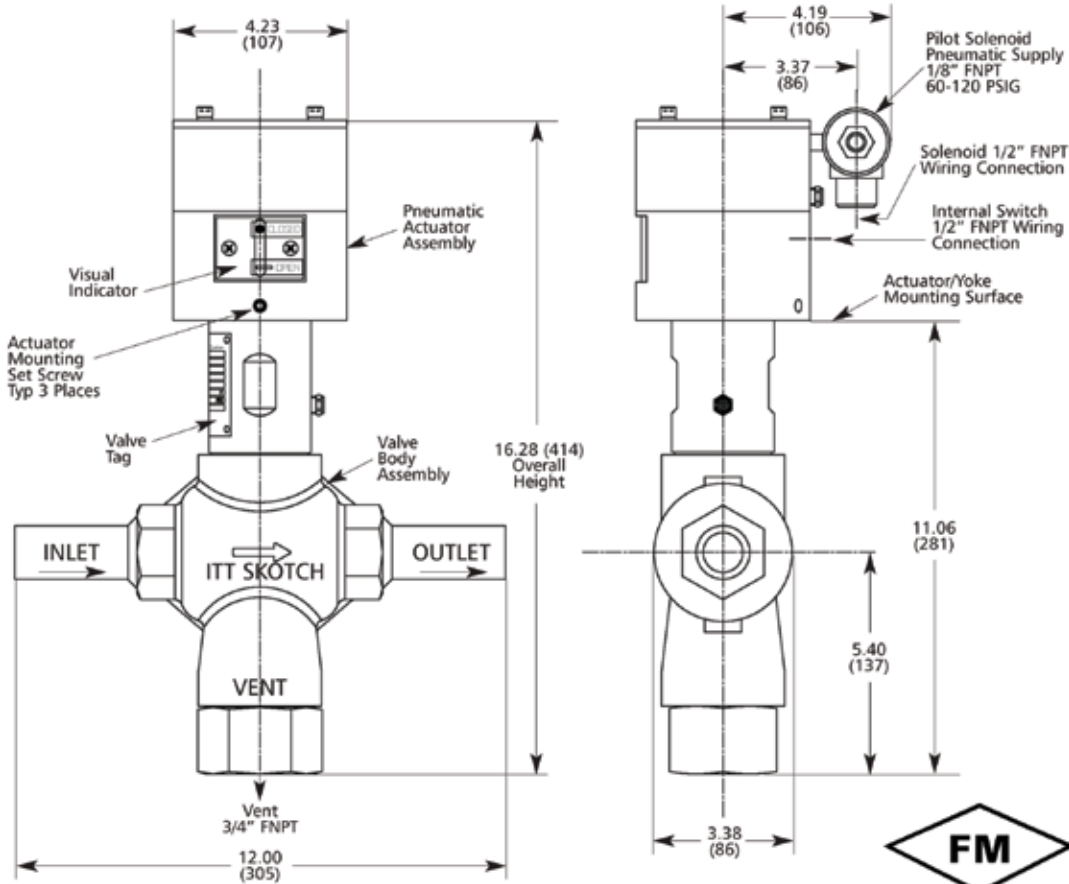
Orientation: May be installed in any orientation



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

Skotch[®] Trifecta T4000C

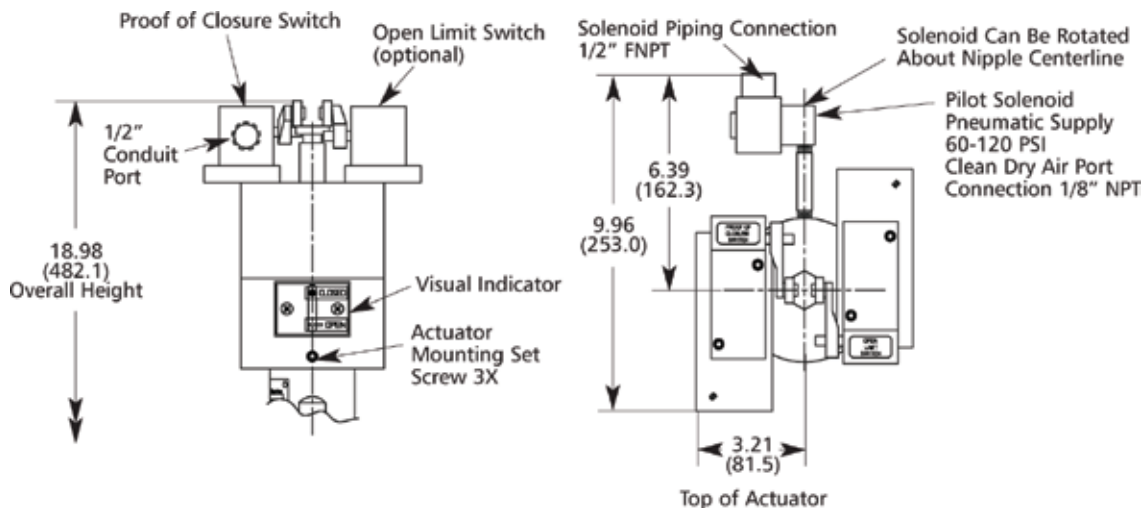
Dimensional Specifications for the T4100C



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

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

Externally Mounted Limit Switch Option



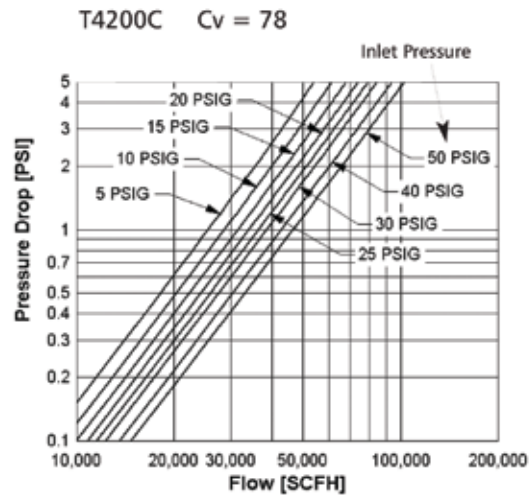
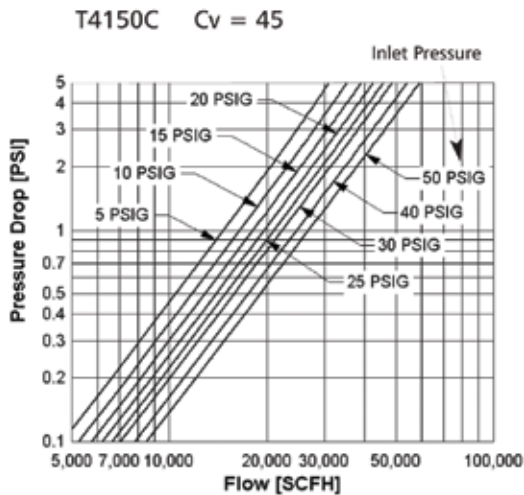
Scotch[®] Trifecta T4000C

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"

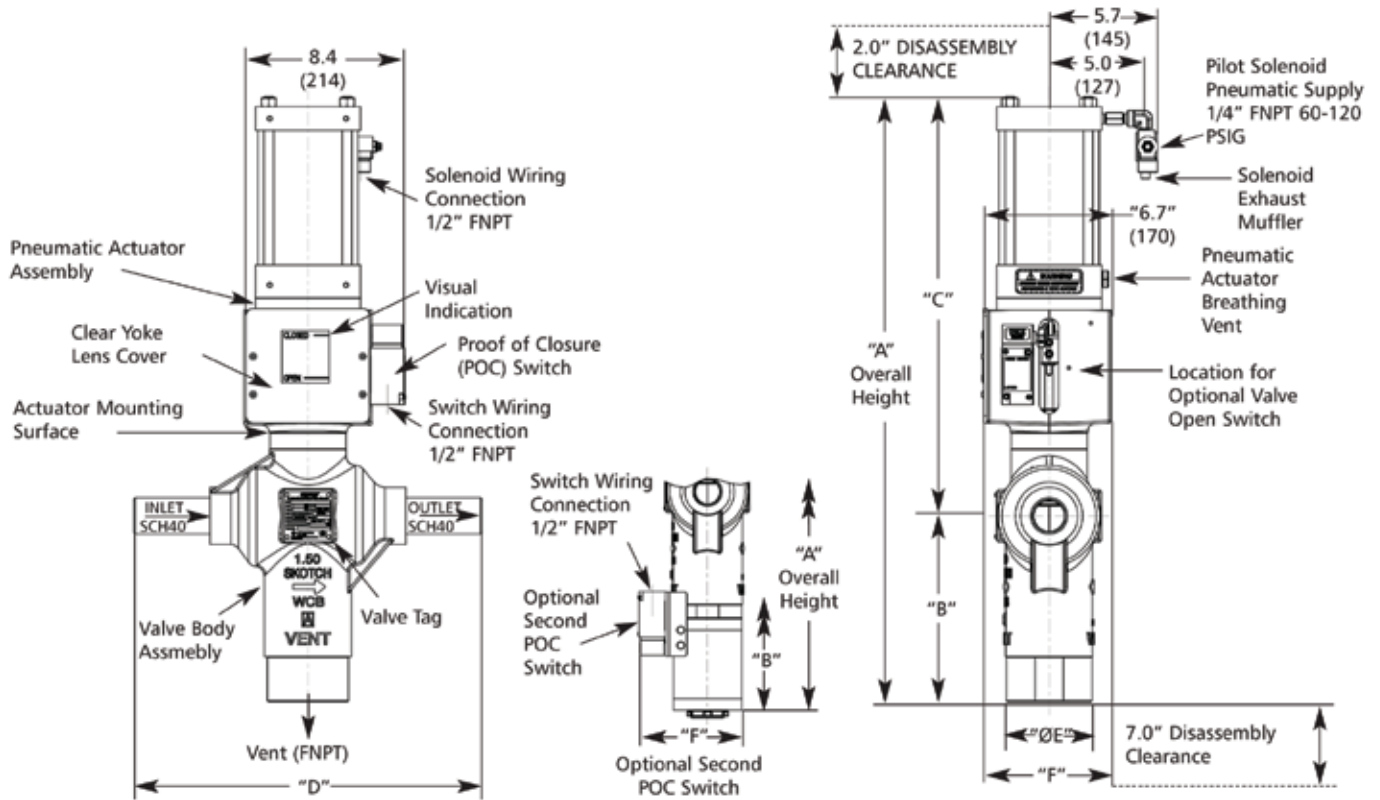
Orientation:

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.

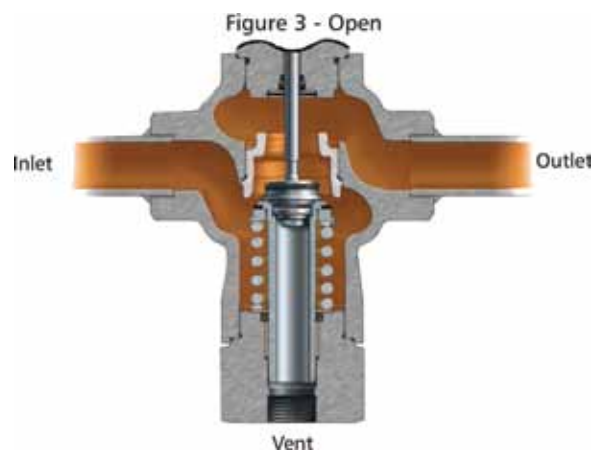
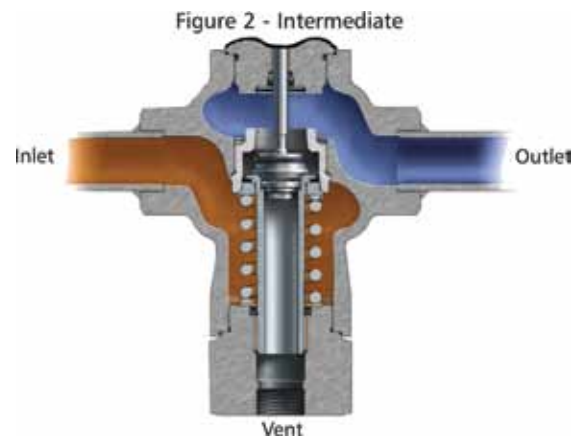
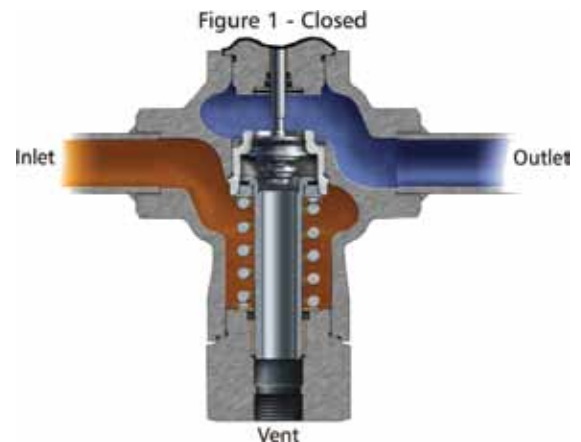
4. When the inlet plug's soft seal clears the seat ring, both blocks are open, the vent is closed, and gas moves from the inlet port to the outlet port. The valve stops at full open. (Figure 3)

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)



Oil Valve Systems



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Skotch[®] Trifecta Oil Valve System

A compact high-performance valve system for firing and purging oil-fired burners and igniters.

Need a reliable, cost-effective solution for firing and purging oil burners and igniters? Engineered Valves has the answer. Our Trifecta valve systems offer a number of advantages over conventional valves, and work with all types of burners and igniters - including steam, air, or mechanically atomized.

The result is elimination of performance problems and a device that offers continuous, reliable, trouble-free service in your most important applications.

Strings of separate valves and packaged multiple valve systems are commonly used with oil burners and igniters. Problems inherent in such systems include the possibility of out-of-sequence operation, atomizing media contamination, leakage, or flame out. Additionally, multiple valve packages require more space and may be costly to install and maintain. Burner management logic may be more complex, increasing the cost of the system.

The Skotch Trifecta is a valve system with all components housed within a single valve body. Conventional systems require at least three valves and actuators to accomplish what we provide with a single valve system. We perform all key functions including fuel sequencing, atomizing and purging of the down stream piping. They are designed to comply with NFPA and IRI guidelines. This unique arrangement has been proven in years of trouble-free service on installations worldwide.

Engineered Valves offers a complete line of Skotch valves for every application. In retrofits, each model can be configured to match the valve operating logic of existing burner management systems. These valve systems are compatible with any type fuel oil. We have installations utilizing #2, Bunker C, Crude, and waste oils.

When incorporating appropriate options/accessories, models T1003, T1006, and T506 are Factory Mutual approved for use as a "combination oil safety shut off, atomizing, and purge valve."



The Skotch Trifecta is a complete valve system that provides oil shutoff, purging and atomizing in a single valve

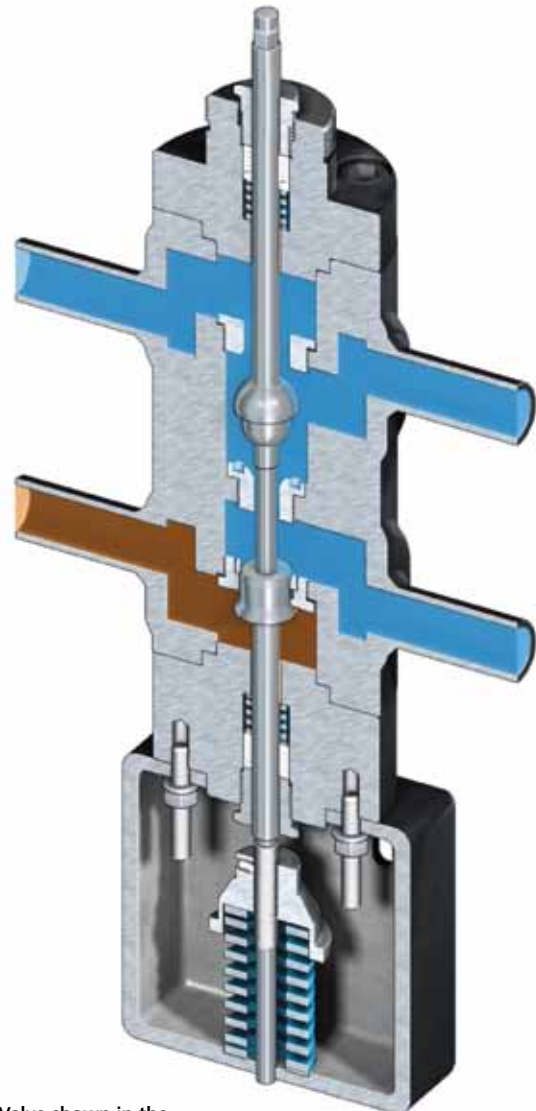


FM Approved for valves which fail in the closed position and incorporate appropriate options.

Scotch[®] Trifecta Oil Valve System

The Scotch Trifecta Valve Systems offer these proven benefits:

- Designed to comply with NFPA and IRI guidelines
- Purge sequence is an integral part of oil valve closure, allowing almost instantaneous switching from firing to purge modes
- Prevents out-of-sequence operation, eliminating contamination of the atomizing or purging media
- Only four piping connections required to install
- Class VI soft seat and metal-to-metal back up seat on the oil side
- Simplified design – no precision adjustments required
- Flexibility in designs to accommodate either retrofits or new installations
- Compact unit takes less space
- Quick and easy installation reduces time and labor cost
- Unit can be completely disassembled in-line for ease of maintenance
- Oil valve over travel allows positive proof of closure
- Models that fail close and contain appropriate accessories are Factory Mutual approved



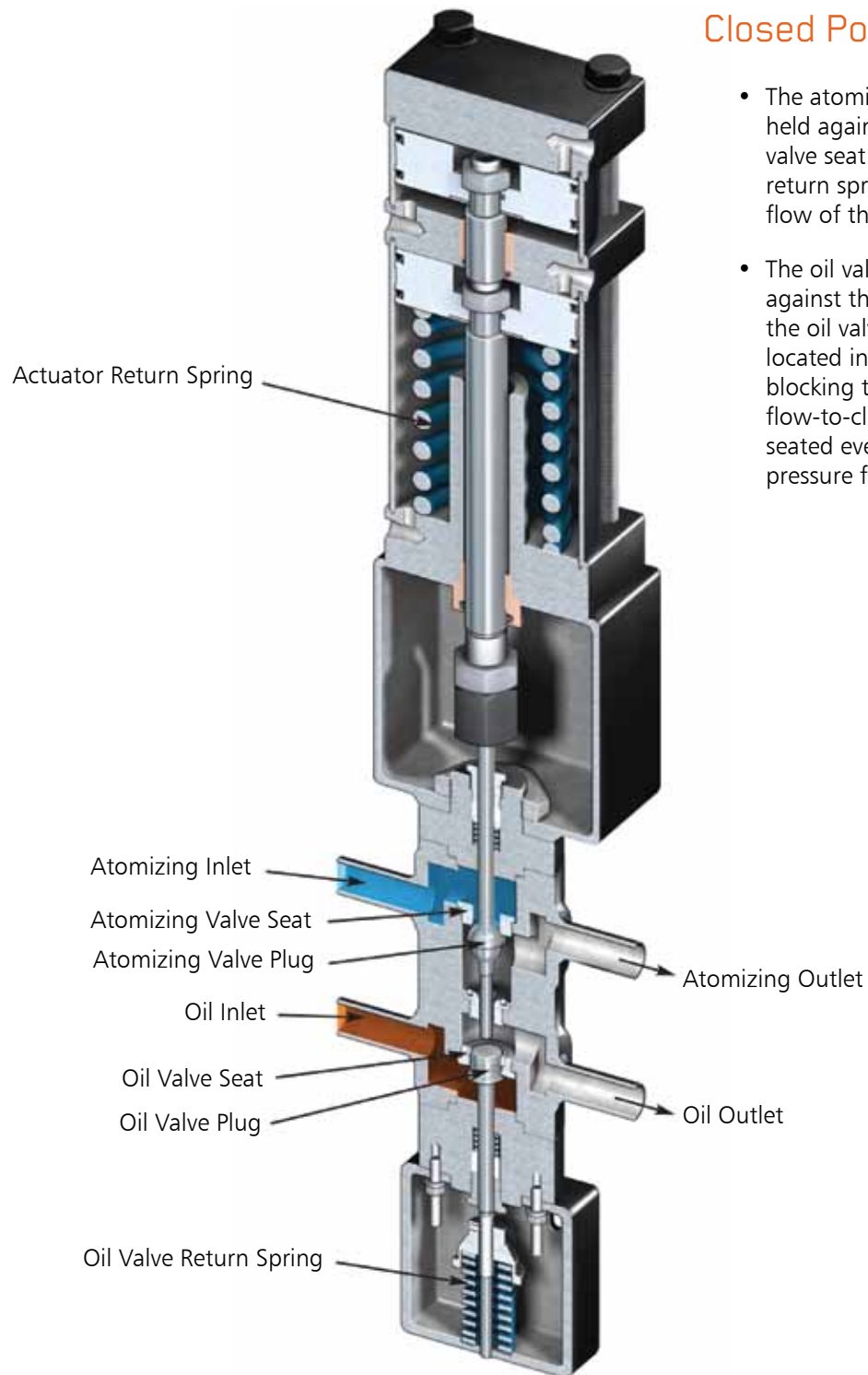
Scotch Valve shown in the purge (or scavenge) mode.



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

Skotch® Trifecta Oil Valve System

Operating Sequence for the T1000 and T500 in Closed Position

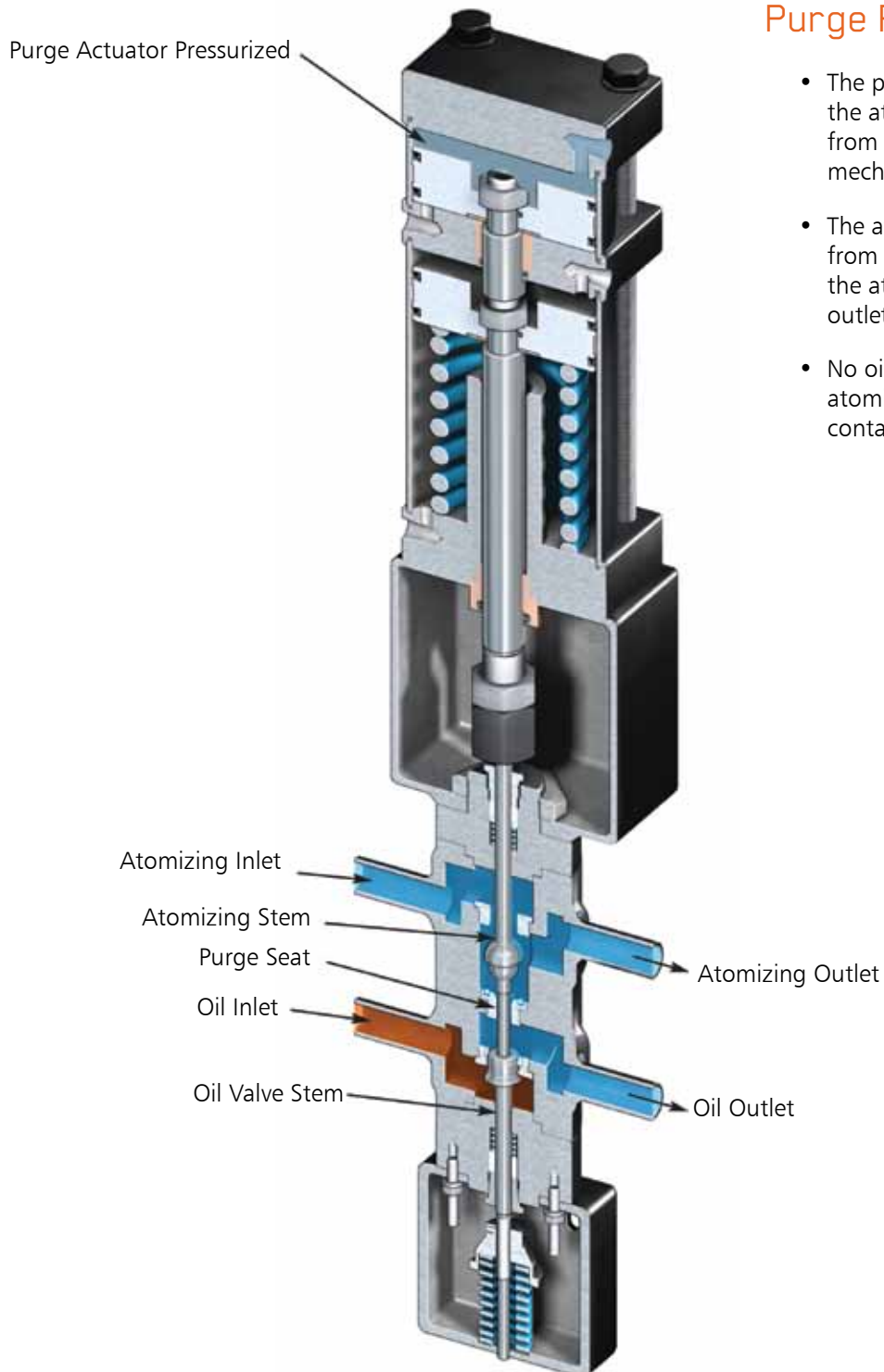


Closed Position

- The atomizing valve plug is held against the atomizing valve seat by the actuator return spring, blocking the flow of the atomizing media.
- The oil valve plug is held against the oil valve seat by the oil valve return spring located in the lower box, blocking the flow of oil. The flow-to-close plug valve is seated even tighter by the oil pressure from the oil inlet.

Skotch[®] Trifecta Oil Valve System

Operating Sequence for the T1000 and T500 in Purge Position

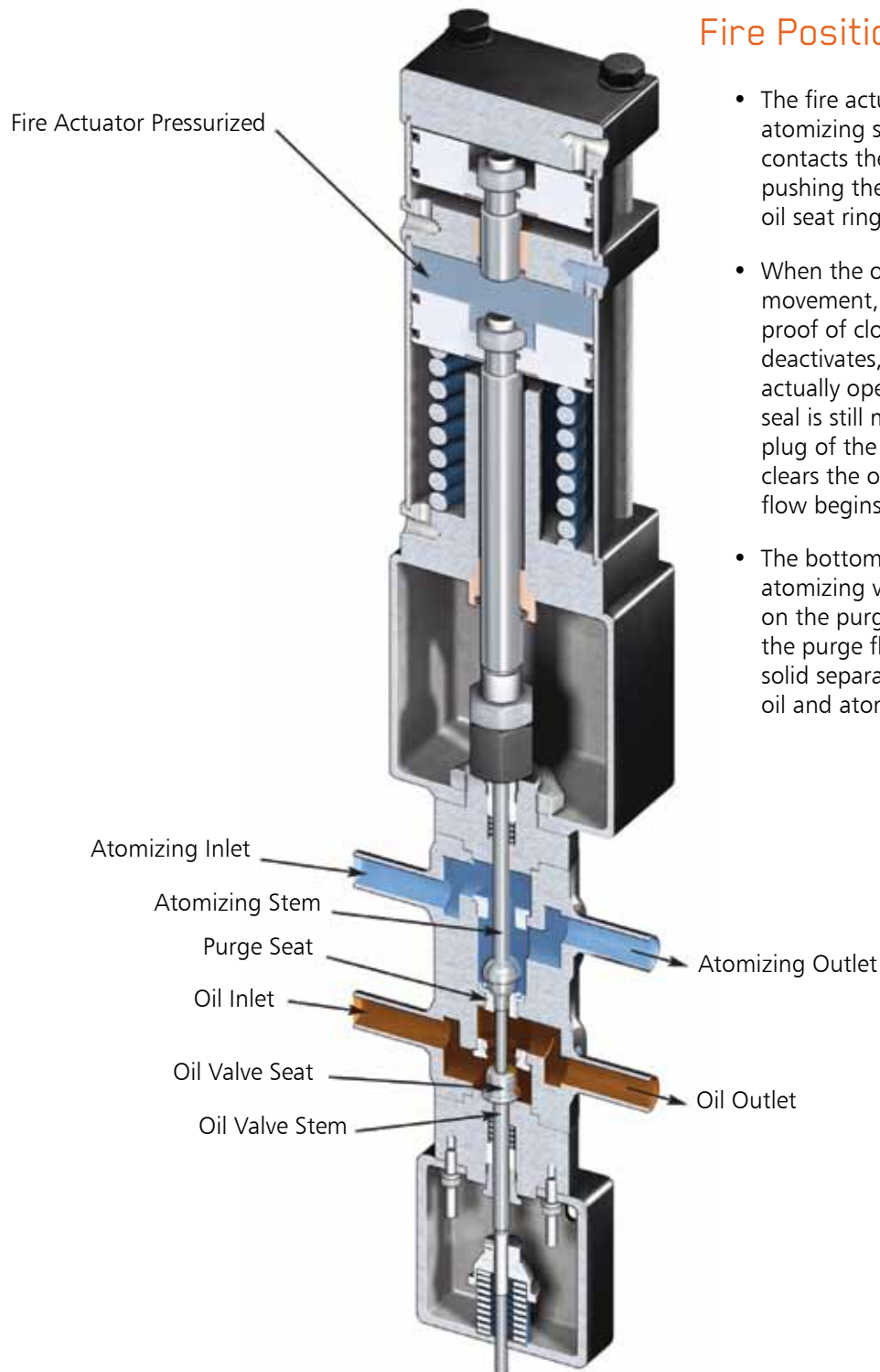


Purge Position

- The purge actuator pushes the atomizing stem down from the closed position to a mechanical stop position.
- The atomizing medium flows from the atomizing inlet to the atomizing outlet and oil outlet (scavenge/purge).
- No oil flow occurs since the atomizing stem has not yet contacted the oil valve stem.

Skotch[®] Trifecta Oil Valve System

Operating Sequence for the T1000 and T500 in Fire Position



Fire Position

- The fire actuator pushes the atomizing stem down and contacts the oil valve stem, pushing the plug out of its oil seat ring.
- When the oil stem begins movement, the oil valve proof of closure switch deactivates, prior to the port actually opening. The soft seal is still made. When the plug of the oil valve stem clears the oil soft seal, oil flow begins.
- The bottom side of the atomizing valve plug seats on the purge seat, stopping the purge flow and provides solid separation between the oil and atomizing medium.

Skotch[®] Trifecta Oil Valve System

Principles of Operation

Closed

- The atomizing valve plug is held against the atomizing valve seat by the actuator return spring, blocking the flow of the atomizing media. (Figure 1)
- The oil valve plug is held against the oil valve seat by the oil valve return spring located in the lower box, blocking the flow of oil. The flow to close plug valve is seated even tighter by the oil pressure from the oil inlet. (Figure 1)
- The oil valve plug and seat consist of two independent seals. A soft seal provides the required overtravel for positive proof of closure indication and class VI shutoff. A flow-to-close metal to metal seal provides a backup to the soft seal for further safety and Class IV shutoff. (Figure 1)

Purge (Scavenge)

- The purge actuator pushes the atomizing stem down from the closed position. (Figure 2)
- The atomizing medium flows from the atomizing inlet through the open atomizing valve seat to the atomizing outlet. It also passes through the open purge seat to the oil outlet providing a full purge from the center of the valve out.
- The purge flow purges the valve and downstream piping of residual fuel during burner shutdown. It can also be used for downstream warm up when used before light off.
- There is no oil flow since the oil valve stem is still fully seated in the oil valve seat. The oil valve proof of closure switch provides positive indication of oil valve closure.

Fire

- The fire actuator pushes the atomizing stem down. The atomizing stem contacts the oil valve stem, pushing the plug out of its oil seat ring.
- The bottom side of the atomizing valve plug seats on the purge seat, stopping the purge flow. When the plug of the oil valve stem clears the oil soft seat, oil flow begins. (Figure 3)
- When the oil stem begins movement, the oil valve proof of closure switch deactivates, prior to the port actually opening. The soft seal is still made.
- The full force of the fire actuator pushes the atomizing valve plug against the purge seat, providing solid separation between the oil and atomizing medium.

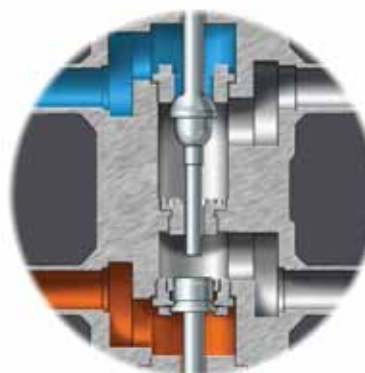


Figure 1



Figure 2

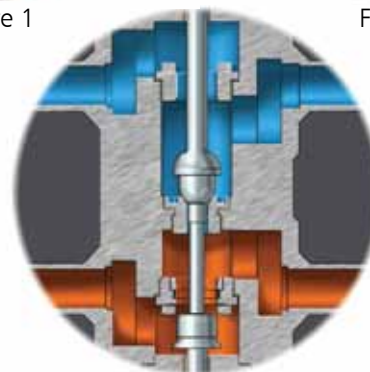


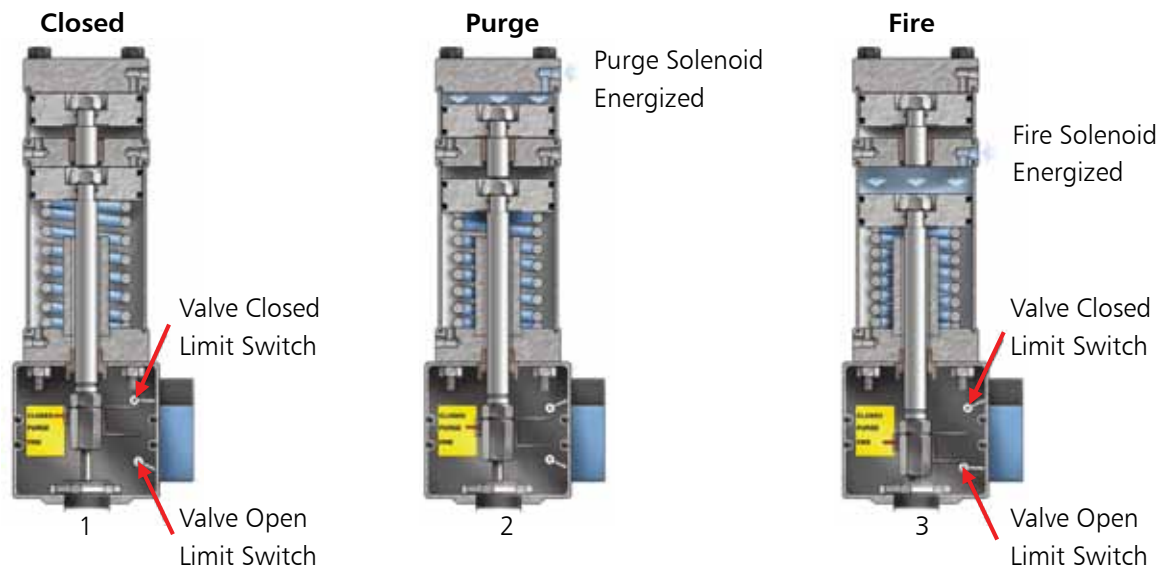
Figure 3



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

Skotch® Trifecta Oil Valve System

Pneumatic Actuation / Limit Switches



Actuation

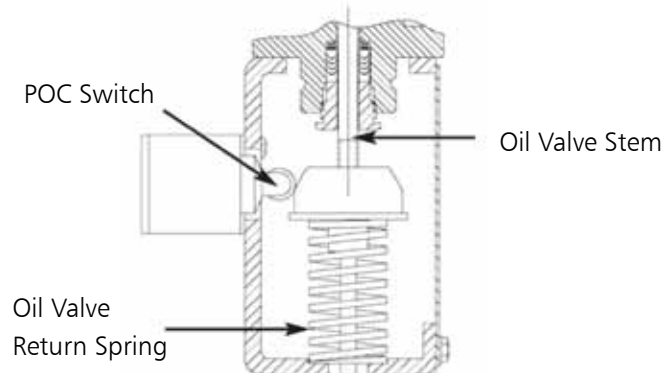
The T505/T506/T507, T1005/T1006/T1007, and T2005/T2006/T2007 valves use a spring-return tandem cylinder for electropneumatic operation with an air supply of 70 to 120 PSI as follows:

- Pressurizing the upper cylinder (Position 2) strokes the Trifecta valve 1/4" to the purge position. No adjustment is needed to achieve proper purging.
- Pressurizing the lower cylinder (Position 3) strokes the valve until the purge plug contacts the purge seat, putting the system in the fire position.
- Exhausting both cylinders (Position 1) allows the actuator spring to return the valve to the closed position. Two pilot solenoid valves control cylinder pressurization.
- Model T505/T1005/T2005 uses dual-coil momentary contact solenoids for energize-to-trip, fail-in-last position operation.
- Model T506/T1006/ uses single-coil, spring return maintained contact solenoids for de-energize to trip, failed-closed operation, and is Factory Mutual approved, when incorporating appropriate accessories. T507/T1007/T2006/T2007 are non-FM.

Valve Limit Switches

1. Position (1) shows valve in closed position. Valve closed limit switch is activated.
2. Position (2) shows valve in purge position. Neither the valve closed limit switch or valve open limit switch are activated.
3. Position (3) shows valve in fire position. Valve open limit switch is activated.

Note: Additionally, Oil "Proof of Closure (POC)" switch is indicated from oil valve stem and would be activated while in position (1). See section of main oil stem below.



Skotch[®] Trifecta Oil Valve System

Custom Engineered Solutions

Specialty Components

ITT Corporation, Engineered Valves has been an industry leader in providing customized solutions to meet the changing requirements of our customers. Since Skotch Trifecta systems are custom built for each project, we are able to accommodate most non-standard requests.

Oil Valve Rack Systems

Oil valve rack systems provide greater savings in installation time and money. The Skotch valve system is attached to the free-standing rack such that the height can be adjusted in the field. The base is drilled for bolt mounting or welding to decking. Engineered Valves can provide strainers, manual shut-off valves, gauges, check valves, and recirculation valves as required. As a result the full system can be hydrotested and all welds verified at the factory.

In addition to rack systems, Engineered Valves can provide specialty materials to suit your specific needs. Specialty components such as proximity switches, feedback position transmitters and components utilized in corrosive and hazardous conditions are also available.

Cooling Steam Option

A cooling steam option provides drilled orifices in the atomizing seat ring providing a constant cooling steam (or air) flow requirement while a burner is not in service. While the valve is closed a small amount of atomizing media flows through the atomizing and oil outlets, as shown in the view to the right. Our patented cooling steam option was a result of a custom-engineered design that removed the need for an extra valve and/or operator interface.

Please consult our factory for your custom-engineered design application.



Skotch® Trifecta T505 / T506 / T507 Oil

Pneumatic Actuated - Igniter and Smaller Main Oil Burner Systems

System Description

The Skotch Trifecta is a valve system with all components housed within a single valve body. Conventional systems require at least three valves and actuators to accomplish what we provide with a single valve system. We perform all key functions including fuel sequencing, atomizing, and purging of the down stream piping.

Model T505 is a fail-in-last-position precision-built switching valve system, while Models T506/T507 are designed to fail in the closed position. Both offer Trifecta's proven performance advantages over separate valves or packaged multiple valve systems, including:

- Prevention of out-of-sequence operation, eliminating contamination of the atomizing or purging media.
- Purge sequence is an integral part of our valve closure, allowing almost instantaneous switching from firing to purging modes.

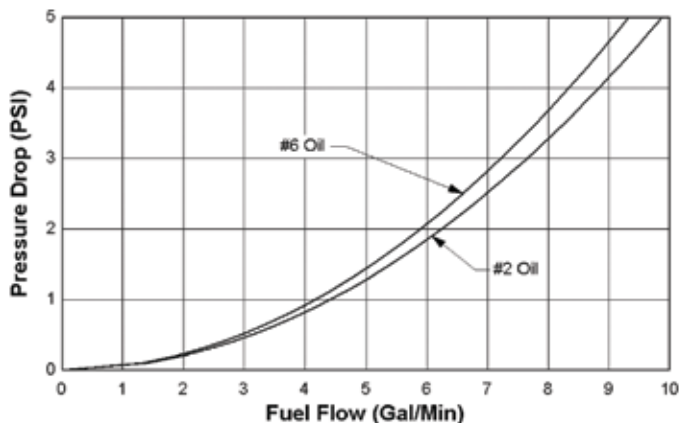
Application

The compact T500 valves are used with oil fired igniters and smaller main burners requiring steam or air atomization. All models are completely self contained, and all necessary accessories are provided, including position indication switches and junction box.

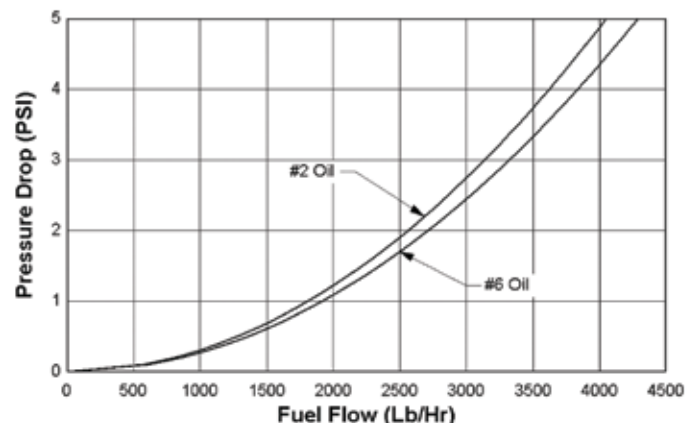
When incorporating appropriate options/accessories, model T506 is Factory Mutual approved for use as a "combination oil safety shutoff, atomizing, and purge valve."



T505/T506/T507 Valve Systems

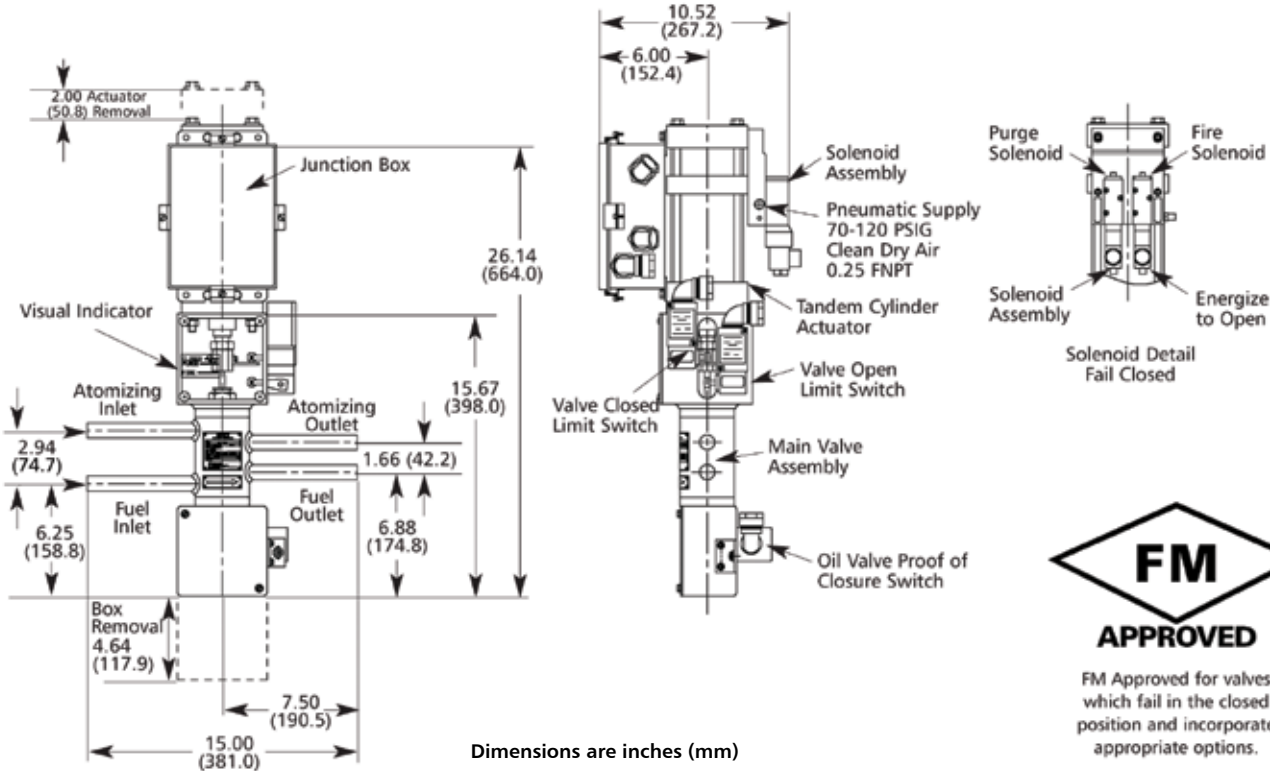


T505/T506/T507 Valve Systems



Skotch® Trifecta T505 / T506 / T507

Dimensional Specifications for the T505/T506/T507



Specifications for the T505 / T506 / T507

Design Pressure and Temperature:

Standard Valve: 300 PSIG @ 450°F

Shutoff Classification:

Per ANSI/FCI 70-2

Atomizing seat – Meets or exceeds CL. IV

Purge seat – Meets or exceeds CL. IV

Fuel seat – Meets or exceeds CL. VI

Durability: Meets or exceeds FM 7400 standard for safety shutoff valves (SSOV)

Weight: Approximately 42 lbs per valve assembly

CV Rating:

Atomizing Cv – 4.2

Purge Cv* – 1.8

Fuel Cv – 4.0

End Connections:

Sch. 40 or 80 Spigot, Butt Weld,

Male NPT in Sch. 80, Socketweld

Actuation:

T505: Fail Last (non-FM approved)

T506: Fail Closed (FM approved)

T507: Fail Closed (non-FM approved)

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

Field reversible (consult factory)

Air Supply Pressure: 70-120 PSIG – Clean, dry air

Ambient Temperature Rating:

Standard: 140°F (FM approved)

Optional: 180°F (FM Approved)

Switch / Solenoid Electrical Ratings:

Standard: Nema 1, 3, 4, 13

Optional: Nema 7, (Class Div 2, consult factory)

Solenoid Supply Voltages:

110 VAC, 220 VAC, 50/60 Hz

12, 24, 48, 125 VDC

Switch Rating:

10 Amps at 125 VAC

Ingress Protection: Nema 4, 4X

Stroke: 7/8" for both models

Operating Speed:

Opening – Approximately 0.6 seconds, maximum determined by speed control option.

Closing – Oil valve closure in approximately 1 second, full closure in approximately 2 seconds

Failure Mode:

Closed or last position upon electric or pneumatic failure.

*Note: Total Atomizing flow in Purge position is limited to the atomizing Cv.

Skotch® Trifecta T1005 / T1006 / T1007 Oil

Pneumatic Actuated - Main Burner Oil Valve Systems

System Description

The Skotch Trifecta is a valve system with all components housed within a single valve body. Conventional systems require at least three valves and actuators to accomplish what we provide with a single valve system. We perform all key functions including fuel sequencing, atomizing and purging of the down stream piping.

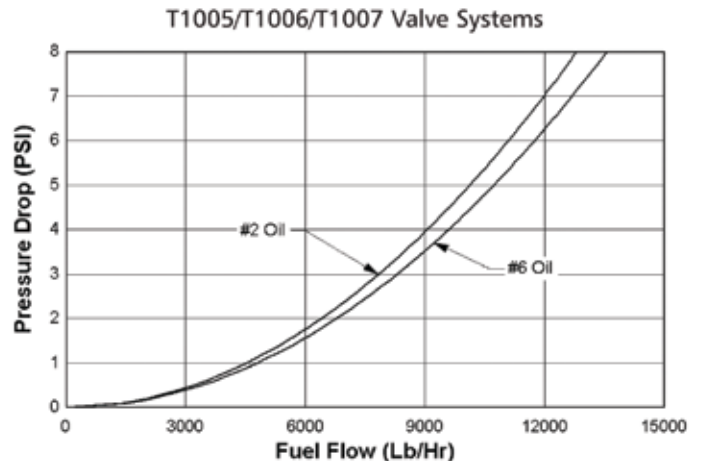
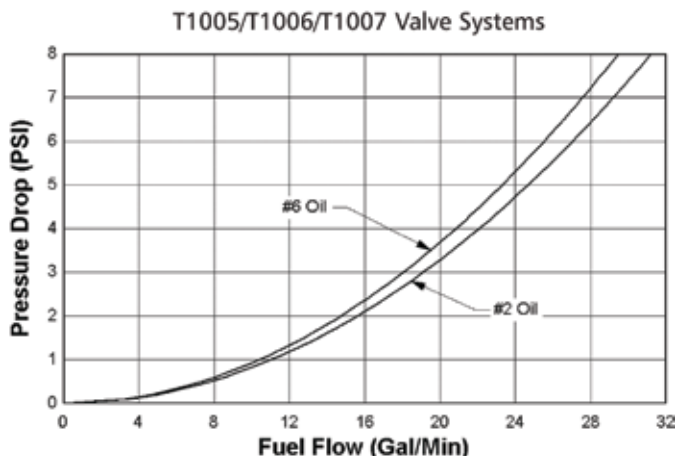
Model T1005 is a fail-in-last-position precision switching valve system, while Models T1006 and T1007 are designed to fail in the closed position. Both offer Trifecta's proven performance advantages over separate valves or packaged multiple valve systems, including:

- Prevention of out-of-sequence operation, eliminating contamination of the atomizing or purging media.
- Purge sequence is an integral part of our valve closure, allowing almost instantaneous switching from firing to purging modes.

Application

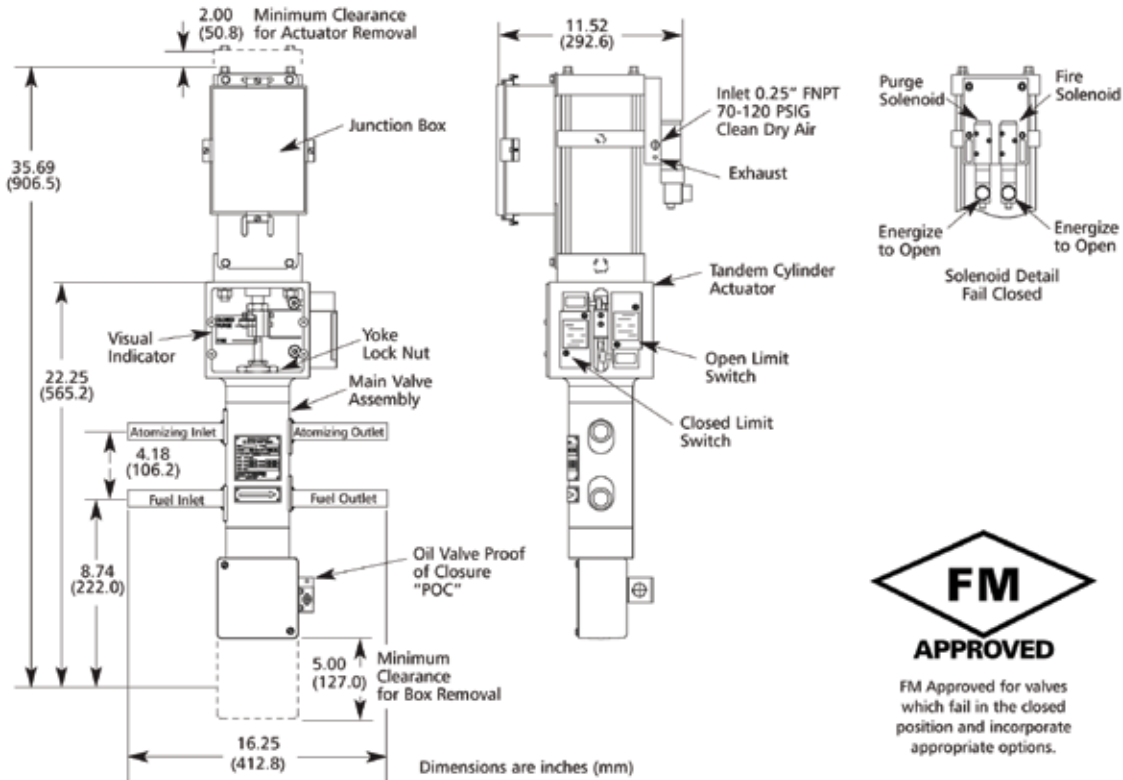
The T1005/T1006/T1007 valves are used with oil fired burners requiring steam or air atomization. All models are completely self contained, and all necessary accessories are provided, including position indication switches and junction box.

When incorporating appropriate options/accessories, model T1006 is Factory Mutual approved for use as a "combination oil safety shutoff, atomizing, and purge valve."



Scotch® Trifecta T1005 / T1006 / T1007

Dimensional Specifications for the T1005 / T1006 / T1007



Specifications for the T1005 / T1006 / T1007

Design Pressure and Temperature:

Standard Valve: 300 PSIG @ 450°F

Optional: 600 PSIG (fuel) @ 450°F

Shutoff Classification:

Per ANSI/FCI 70-2

Atomizing seat – Meets or exceeds CL. IV

Purge seat – Meets or exceeds CL. IV

Fuel seat – Meets or exceeds CL. VI

Durability: Meets or exceeds FM 7400 standard for safety shutoff valves (SSOV)

Size: 3/4" or 1"

Weight: Approximately 85 lbs per valve assembly

CV Rating:

Atomizing Cv – 10.2

Purge Cv* – 3.5

Fuel Cv – 10.0

End Connections:

Sch. 40 or 80 Spigot, Butt Weld, ANSI CL. 300

Raised Face Flange, socketweld,

Male NPT in Sch. 80

Actuation:

T105: Fail Last (non-FM approved)

T106: Fail Closed (FM approved)

T107: Fail Closed (non-FM approved)

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

Field reversible (consult factory)

Air Supply Pressure: 70-120 PSIG – Clean, dry air

Ambient Temperature Rating:

Standard: 140°F (FM approved)

Optional: 180°F (FM Approved)

Switch / Solenoid Electrical Ratings:

Standard: Nema 1, 3, 4, 13

Optional: Nema 7 Class 1 Div 2

Nema 7 Class 1 Div 1 (consult factory)

Solenoid Supply Voltages:

110 VAC, 220 VAC, 50/60 Hz

12, 24, 48, 125 VDC

Switch Rating:

10 Amps at 125 VAC

Ingress Protection: Nema 4, 4X

Stroke: 1 1/4" for both models

Operating Speed:

Opening – Approximately 0.8 seconds, maximum determined by speed control option.

Closing – Oil valve closure in approximately 1 second, full closure in approximately 2 seconds

Failure Mode:

Closed or last position upon electric or pneumatic failure.

Maximum Differential Pressure: Equal to design rating

Skotch® Trifecta T1001 / T1003 / T1004 Oil

Electrohydraulic Actuated - Main Burner Oil Valve Systems

System Description

The Skotch Trifecta is a valve system with all components housed within a single body utilized with oil fired burners requiring steam or air atomization. Model T1001 is a fail-in-last-position precision built switching valve system, while Models T1003 and T1004 are designed to fail in the closed position. Both offer Trifecta's proven performance advantages over separate valves or packaged multiple valve systems, including:

- Prevention of out-of-sequence operation, eliminating contamination of the atomizing or purging media.
- Purge sequence is an integral part of our valve closure, allowing almost instantaneous switching from firing to purging modes.

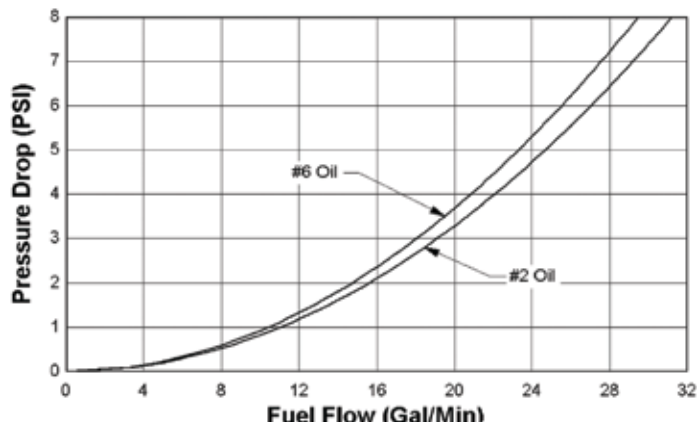


Application

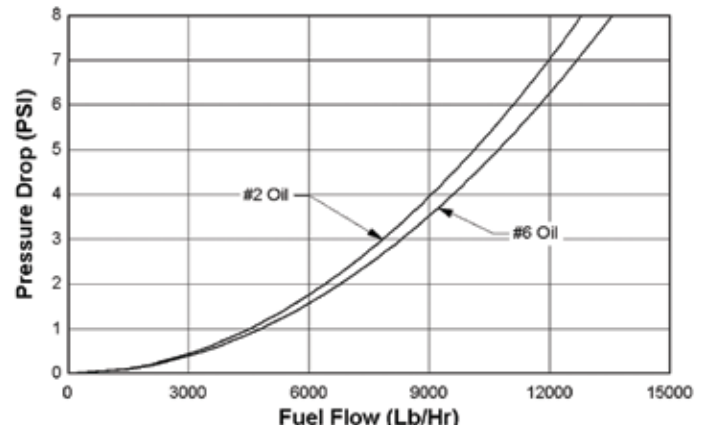
The T1001/T1003/T1004 valves use an electrohydraulic actuator requiring only 110VAC power. Operation is as follows:

- Signaling the valve to move from closed to purge or fire causes an internal pump to pressurize a cylinder and push the atomizing valve stem down.
- A force limit stops the actuator when the atomizing valve contacts the purge seat and the valve is in the fire position.
- Signaling the valve to move from fire to purge or closed causes two dump valves to open, relieving hydraulic pressure and allowing a spring to move the valve stem up.
- Model T1001 uses normally closed dump valves for energize to trip, fail-in-last-position operation.
- Model T1003 uses normally open dump valves for deenergize to trip, fail closed operation. This version is Factory Mutual approved, when incorporating appropriate accessories.

T1001/T1003/T1004 Valve Systems

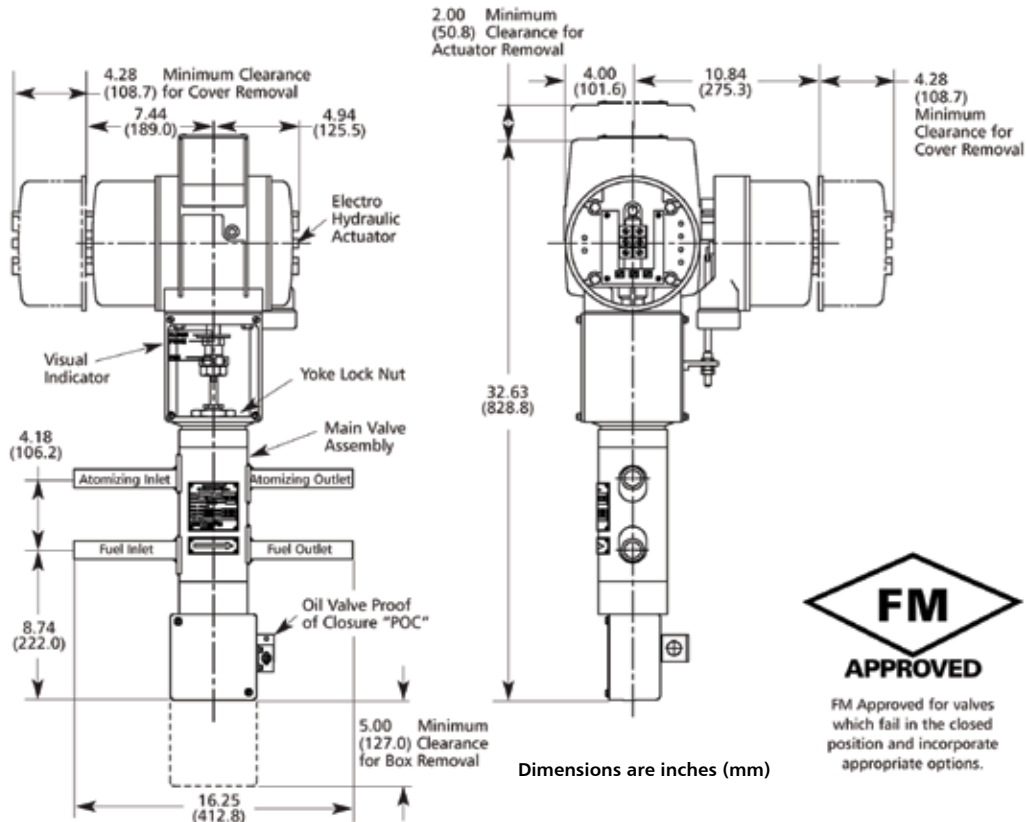


T1001/T1003/T1004 Valve Systems



Scotch® Trifecta T1001 / T1003 / T1004

Dimensional Specifications for the T1001 / T1003 / T1004



Specifications for the T1001 / T1003 / T1004

Design Pressure and Temperature:

Standard Valve: 300 PSIG @ 450°F

Optional: 1100 PSIG (fuel) @ 450°F

Shutoff Classification:

Per ANSI/FCI 70-2

Atomizing seat – Meets or exceeds CL. IV

Purge seat – Meets or exceeds CL. IV

Fuel seat – Meets or exceeds CL. VI

Durability: Meets or exceeds FM 7400 standard for safety shutoff valves (SSOV)

Size: 3/4" or 1"

Weight: Approximately 85 lbs per valve assembly

CV Rating:

Atomizing Cv – 10.0

Purge Cv* – 3.5

Fuel Cv – 10.0

End Connections:

Sch. 40 or 80 Spigot, Butt Weld, ANSI CL. 300

Raised Face Flange, socketweld,

Male NPT in Sch. 80

Actuation:

T1001: Fail Last (non-FM approved)

T1003: Fail Closed (FM approved)

T1004: Fail Closed (non-FM approved)

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

Field reversible (consult factory)

Ambient Temperature Rating: Standard: 175°F (FM approved)

Switch / Solenoid Electrical Ratings: Nema 4 and 13 standard

Solenoid Supply Voltages:

Auxiliary Switches SPDT – 15 Amps @ 125 VAC

Proof of Closure Switch – 10 Amps @ 125 VAC

Ingress Protection: Nema 4, 4X

Stroke: 1 1/4" for both models

Operating Speed:

Opening – Approximately 25 seconds

Closing – Oil valve closure in approximately 1 second, full closure in approximately 2 seconds

Failure Mode:

Closed or last position upon electric or pneumatic failure.

Maximum Differential Pressure: Equal to design rating

Voltages: 110 VAC, 50/60 Hz

*Note: Total Atomizing flow in Purge position is limited to the atomizing Cv.

Scotch® Trifecta T2005 / T2006 / T2007 Oil

Mechanically Atomized Main Burner Oil Valve System with Pneumatic Actuator

System Description

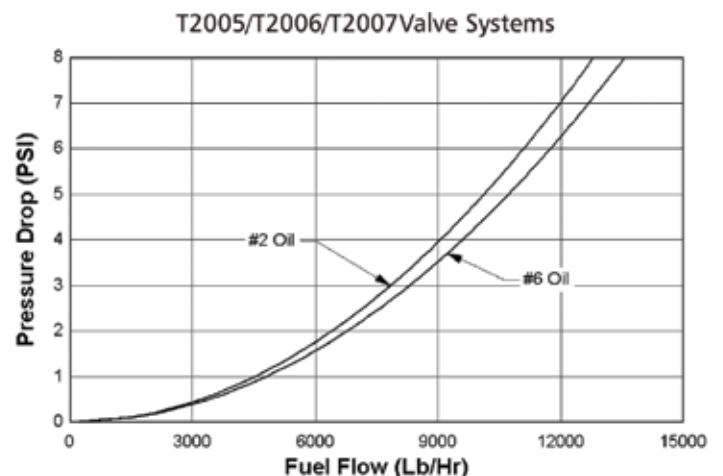
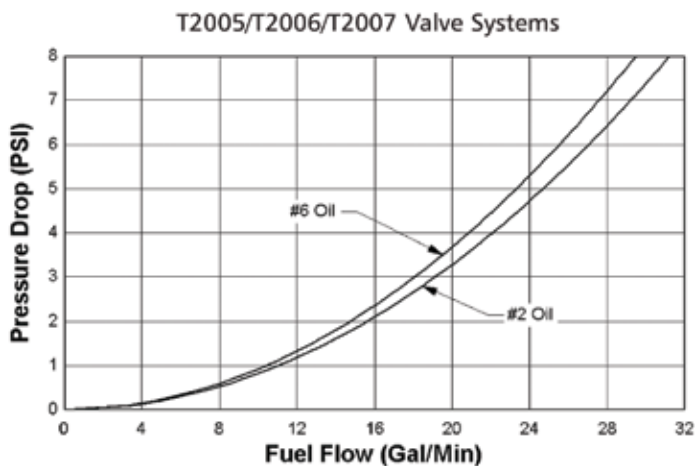
The Scotch Trifecta is a valve system with all components housed within a single valve body. Conventional systems require multiple valves and actuators to accomplish what we provide with a single valve system. We perform all key functions including fuel sequencing and purging of the down stream piping.

An extension of the successful T1005/T1006/T1007 series, the T2000 valve system provides the same proven performance advantages over separate valves, or packaged multiple valve systems, including:

- Prevention of out-of-sequence operation, eliminating contamination of the purging media.
- Purge sequence is an integral part of our valve closure, allowing almost instantaneous switching from firing to purging modes.

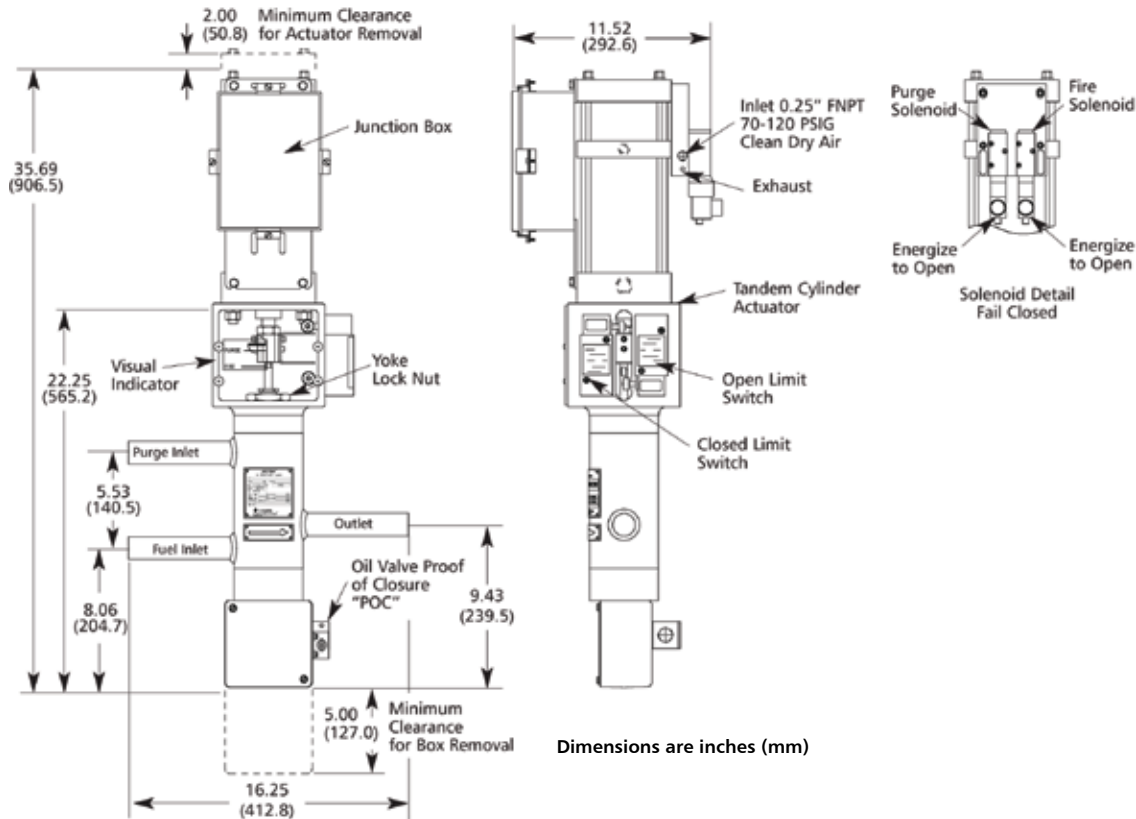
Application

The T2000 valve systems are used with oil fired burners requiring straight Mechanical Atomization. These valve systems are completely self contained, and Engineered Valves provides all necessary accessories, such as indicator switches and junction boxes. While the straight mechanically atomized system is shown here, we can also provide systems for Wide Range Tip Return systems employing return and recirculation of the oil. Please consult factory for more information.



Scotch® Trifecta T2005 / T2006 / T2007

Dimensional Specifications for the T2005 / T2006 / T2007



Specifications for the T2005 / T2006 / T2007

Design Pressure and Temperature:

Standard Valve: 300 PSIG @ 450°F

Optional: 600 PSIG (fuel) @ 450°F

Shutoff Classification:

Per ANSI/FCI 70-2

Atomizing seat – Meets or exceeds CL. IV

Purge seat – Meets or exceeds CL. IV

Fuel seat – Meets or exceeds CL. VI

Size: 3/4" or 1"

Weight: Approximately 85 lbs per valve assembly

CV Rating:

Purge Cv – 3.5

Fuel Cv – 10.0

End Connections:

Sch. 40 or 80 Spigot, Butt Weld, ANSI CL. 300

Raised Face Flange, socketweld,

Male NPT in Sch. 80

Actuation:

T2005: Fail Last (non-FM approved)

T2007: Fail Closed (non-FM approved)

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

Field reversible (consult factory)

Air Supply Pressure: 70-120 PSIG – Clean, dry air

Ambient Temperature Rating:

Standard: 140°F (non-FM approved)

Optional: 180°F (non-FM Approved)

Switch / Solenoid Electrical Ratings:

Standard: Nema 1, 3, 4, 13

Optional: Nema 7, Class 1 Div 2

Nema 7, Class 1 Div (consult factory)

Solenoid Supply Voltages:

110 VAC, 220 VAC, 50/60 Hz

12, 24, 48, 125 VDC

Switch Rating: 10 Amps at 125 VAC

Ingress Protection: Nema 4, 4X

Stroke: 1 1/4" for both models

Operating Speed:

Opening – Approximately .8 seconds, maximum determined by speed control.

Closing – Oil valve closure in approximately 1 second, full closure in approximately 2 seconds

Failure Mode:

Closed or last position upon electric or pneumatic failure.

Maximum Differential Pressure: Equal to design rating

Scotch® Trifecta T2001 / T2003 / T2004 Oil

Mechanically Atomized Main Burner Oil Valve System with Electrohydraulic Actuator

System Description

The Scotch Trifecta is a valve system with all components housed within a single valve body. Conventional systems require multiple valves and actuators to accomplish what we provide with a single valve system. We perform all key functions including fuel sequencing and purging of the down stream piping.

An extension of the successful T1005/T1006/T1007 series, the T2000 valve system provides the same proven performance advantages over separate valves, or packaged multiple valve systems, including:

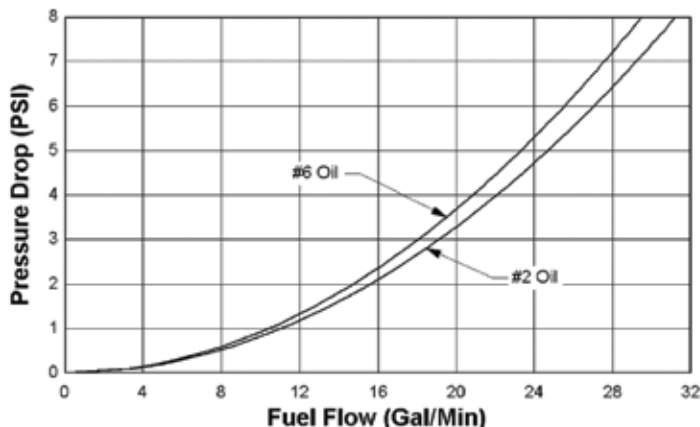
- Prevention of out-of-sequence operation, eliminating contamination of the purging media.
- Purge sequence is an integral part of our valve closure, allowing almost instantaneous switching from firing to purging modes.

Application

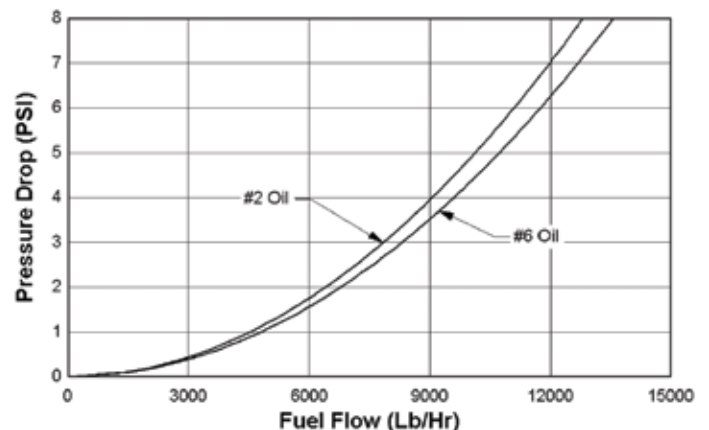
The T2000 valve systems are used with oil fired burners requiring straight Mechanical Atomization. These valve systems are completely self contained, and all necessary accessories are provided, such as indicator switches and junction boxes. While the straight mechanically atomized system is shown here, we can also provide systems for Wide Range Tip Return systems employing return and recirculation of the oil. Please consult factory for more information.



T2001/T2003/T2004 Valve Systems

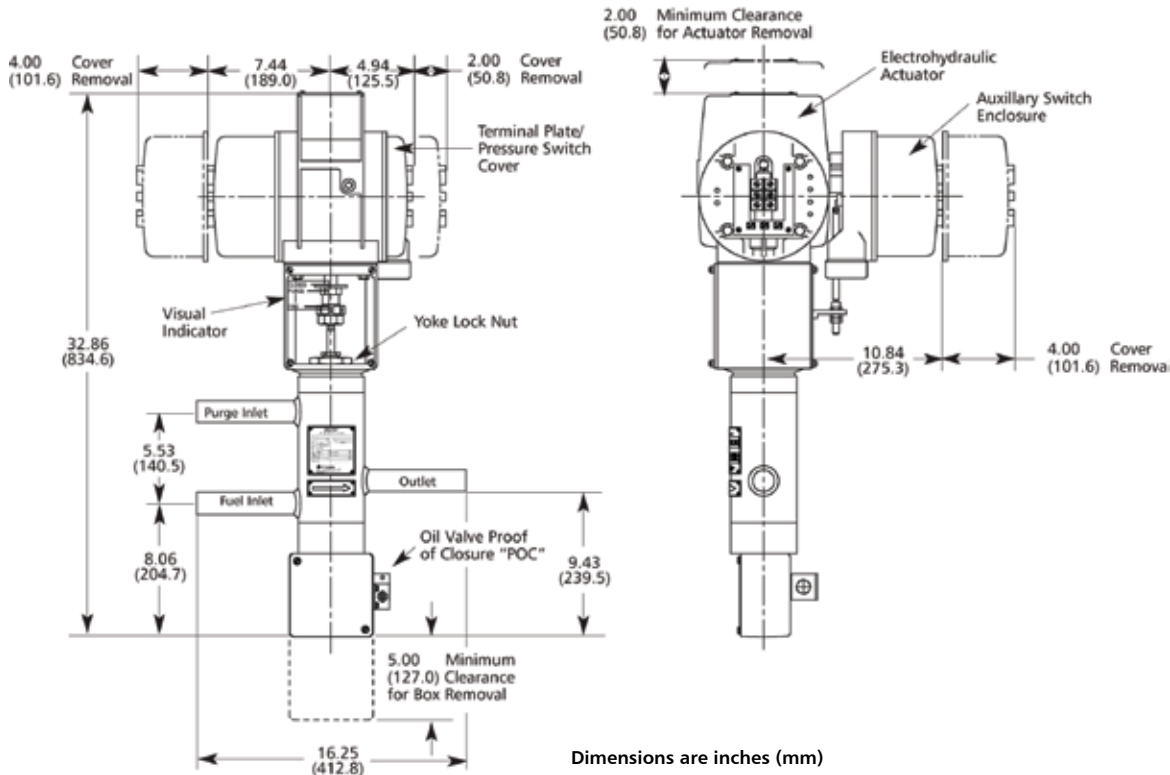


T2001/T2003/T2004 Valve Systems



Skotch[®] Trifecta T2001 / T2003 / T2004

Dimensional Specifications for the T2001 / T2003 / T2004



Specifications for the T2001 / T2003 / T2004

Design Pressure and Temperature:

Standard Valve: 300 PSIG @ 450°F

Optional: 1400 PSIG (fuel) @ 450°F

Shutoff Classification:

Per ANSI/FCI 70-2

Atomizing seat – Meets or exceeds CL. IV

Purge seat – Meets or exceeds CL. IV

Fuel seat – Meets or exceeds CL. VI

Size: 3/4" or 1"

Weight: Approximately 85 lbs per valve assembly

CV Rating:

Purge Cv – 3.5

Fuel Cv – 10.0

End Connections:

Sch. 40 or 80 Spigot, Butt Weld, ANSI CL. 300

Raised Face Flange, socketweld,

Male NPT in Sch. 80

Actuation:

T2001: Fail Last (non-FM approved)

T2004: Fail Closed (non-FM approved)

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

Field reversible (consult factory)

Ambient Temperature Rating: Standard: 175°F (non-FM approved)

Switch / Solenoid Electrical Ratings: Standard: Nema 4, 13

Solenoid Supply Voltages:

110 VAC, 220 VAC, 50/60 Hz

12, 24, 48, 120 VDC

Switch Rating: 10 Amps at 125 VAC

Ingress Protection: Nema 4, 4X

Stroke: 1 1/4" for both models

Operating Speed:

Opening – Approximately 25 seconds

Closing – Oil valve closure in approximately 1 second,
full closure in approximately 2 seconds

Failure Mode:

Closed or last position upon electric or pneumatic failure.

Maximum Differential Pressure: Equal to design rating