Turbine Fuel Shut Off Valve
Model 4420F

Typical Applications

- Fuel shut off valve for gas turbines in the 5-50 MW size range

Key Features and Benefits

- Less than 100 millisecond close time
- Integrated mechanical “vent” port that eliminates the need for separate bleed valves
- (Open, Closed, or Open/Closed position sensor) options (Contactless Sensor)
- Can be used with natural gas, ammonia, and hydrogen gases

Model 4420F30 Turbine Fuel Shut Off Valve

Accreditations Available

- **Hazardous Area**
  - 4420F IECEx, ATEX, CCCEx - Exh IIC T6...T4 Ga/Gb
  - Position sensor IECEx, ATEX - Ex db IIC T4 Gb
- **Pressure Piping Safety**
  - EU PED - Category IV safety accessory
  - China - Special equipment type approval with manufacturing license
- **Sour Service**
  - Meets the requirements of ISO 15156/NACE MR0175
- **Valve & Piping Systems**
  - Meets the requirements of ASME B16.34

Model 4420F20 Turbine Fuel Shut Off Valve

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Turbine Fuel Shut Off Valve - Model 4420F

Contents

Overview 3
Operation 3
Flow Charts 4
- 3IN Valve (4420F30) Flow Chart 4
- 2IN Valve (4420F20) Flow Chart 5

Specification 6
- Technical Performance 6
- Operating Conditions 6
- Valve Mechanical Specifications 6

How to Order 7
Pilot Accessories 8
Allowable Main Seat Leakage 9
Dimensions 10
- 4420F30 Outline 10
- 4420F20 Outline 11

Contact 12

Turbine Fuel Shut Off Valve - Model 4420F

Overview

The Model 4420F has been specifically designed as a fuel shutoff valve in gas turbine applications. Its compact size and quick close time make it ideal for use in gas turbines in the 5 - 50 MW range.

The 4420F is a stainless steel, single acting, fail-safe, pneumatically actuated valve.

Operation

2-way vented

When pressure is applied to the pilot port, the valve is opened to allow flow to travel from the IN port to the OUT port. The VENT port is closed. When the pilot pressure is released, the IN port closes while the VENT port opens to the OUT port. This venting relieves pressure within the valve and in the down stream piping.

The 2-way vented is ideal for gas turbine applications because, upon shutdown, it relieves and vents pressure on the down stream side. This action eliminates the need for a separate bleed valve, providing a cost savings and simplified piping.

Each 4420F valve assembly includes a hex head pipe plug fitting. To allow for venting, this plug fitting is simply removed. Appropriate piping should be securely installed to allow venting to safe area. If venting is not required, the plug can remain installed and no connection is necessary.

Flow Charts

Flow coefficient

Flow coefficient (calculated)		
Size	**Kv**	**Cv**
3”	99	115
2”	69	79

Cv is the imperial coefficient. It is defined as the flow rate of water (in gallons per minute) that flows through a valve with 1 psi pressure drop at standard conditions (typically 60°F and 14.7 psia.) Use the formulas below to determine the gas flow capacity of the appropriate 4420F for the application. Gas flow capacity is determined by inlet pressure, pressure differential between valve inlet and outlet, inlet gas temperature, and properties of the gas.

Determine gas expansion factor:

$$Expansion\ factor\text{: } Y = 1 - \frac{\Delta P}{2.22 P_1 F_\gamma}$$

Gas flow capacity formula is only applicable if:

$$.667 < Y < 1.0$$

Gas flow capacity:

$$Q = 1360 C_v P_1 Y \sqrt{\frac{\Delta P}{P_1 G_g T_1 Z}}$$

Pressure differential:

$$\Delta P = \left(\frac{Q}{1360 C_v P_1 Y}\right)^2 P_1 G_g T_1 Z$$

Where:

ΔP = *Pressure differential between valve inlet and outlet (psi)*

P_1 = *Absolute pressure at valve inlet (psia)*

F_γ = *Specific heat ratio factor* $\left(\text{dimensionless, } \frac{K \text{ ratio of specific heats}}{1.4}\right)$

(0.907 *typical for natural gas*)

(1.007 *typical for hydrogen*)

(0.943 *typical for ammonia*)

C_v = *Flow coefficient* *“(gal/min of water at 60°F with a 1 psi pressure differential between valve inlet and outlet)”*

T_1 = *Gas temperature (°R=°F+459.7)*

G_g = *Gas specific gravity (dimensionless)*

(0.612 *typical for natural gas*)

(0.07 *typical for hydrogen*)

(0.589 *typical for ammonia*)

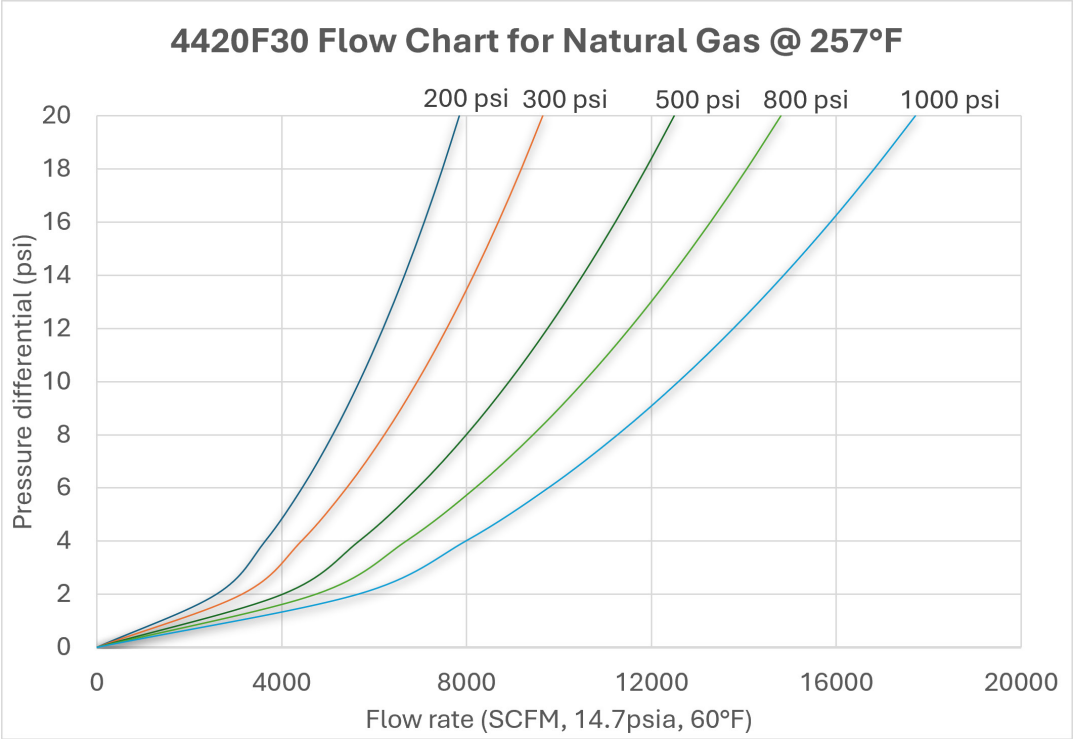
Z = *Gas compressibility factor (dimensionless, can be approximated as 1.0)*

Q = *Volumetric flow rate (SCFH: 14.7 psia, 60°F)*

WARNING: Gas expansion factor (y) below 0.667 indicates excessive pressure drop through shutoff valve

Flow Charts

3IN valve



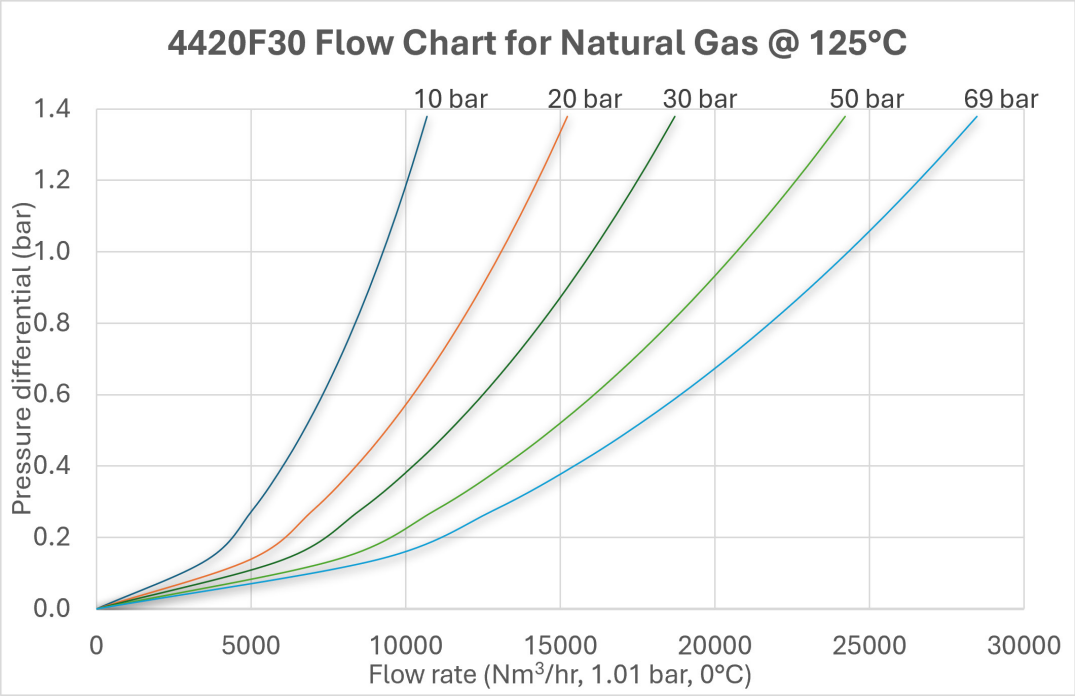
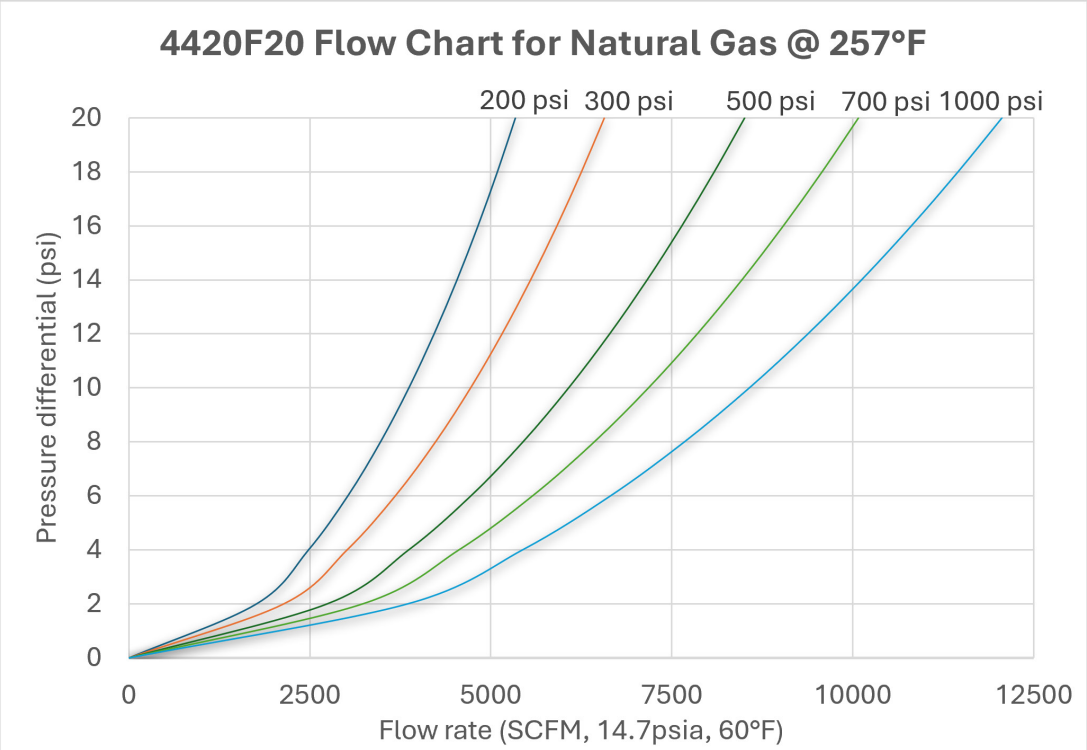


Figure 1: 4420F30 Flow Charts for Natural Gas

Flow Charts

2IN valve



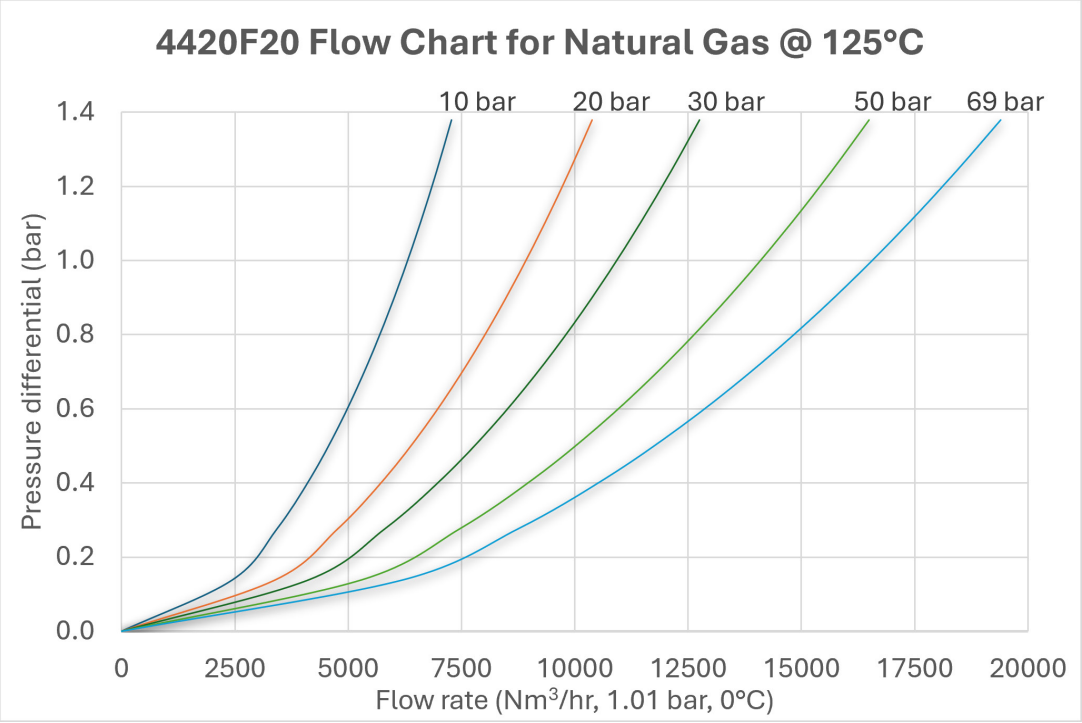


Figure 2: 4420F20 Flow Charts for Natural Gas

Turbine Fuel Shut Off Valve - Model 4420F

Specifications

Technical Performance

Closing Time [1]	Less than 100 ms @ 69 bar (1000 psi) supply pressure, room temp
Opening Time	Less than 1 sec @ 5 bar (73 psi) at room temperature
Main Seat Leakage Rating	ANSI/FCI 70-2 Class VI @ 3.45 bar (50 psi), Room temp [See page 7], forward and reverse
Maximum Allowed Seal Drain Leakage [2]	15 SCCM [4] (Greater than -20°C [-4°F]) 100 SCCM (Below -20°C [-4°F]) These leakages may degrade over cycle life
Cycle Life [3]	10,000 Cycles

Operating Conditions

Fuel Compatibility	Natural gas, propane, ethane, methane, or most typical gas fuels, suitable for group 1 & 2 gases Options for fuels with hydrogen blend up to 100% and ammonia blend up to 100% available
Valve Fuel Temperature Range	-40°C to +125°C (-40°F to +257°F)
Ambient Temperature Range	-40°C to +125°C (Code "00") -20°C to +90°C (Code "01" or "03") -40°C to +60°C (Code "02" or "04")
Storage Temperature Range	-51°C to +125°C (Code "00") -20°C to +90°C (Code "01" or "03") -40°C to +60°C (Code "02" or "04")
Maximum Valve Fuel Supply Pressure	69 bar (1000 psi)
Fuel Solid Particle Contaminant	Less than 10 µm diameter
Pilot Solenoid Filtration	Less than 50 µm
Pilot Actuation Pressure	5-10.3 bar (73-150 psi)

Valve Mechanical Specifications

Nominal Pipe/Flange Size	DN(80) 3 inch Class 600, Raised Face per ASME B16.5, DN(50) 2 inch Class 600, Raised Face per ASME B16.5
Valve Weight	75 kg (165 lb)
Travel Indicator Switches	2X Hall effect sensor, 8-28 VDC, output pulled up to supply
Materials	CF3M Stainless Steel Body; Electroless Nickel Plated Stainless Steel Spindle, PTFE seals/Nitrile Seals, Inconel/Elgiloy Springs
Vent Port Connection	1" NPT for 3IN, 3/4" for 2IN
Seal Drain Connections	3/8" NPT

Notes:

1) Closing time measured with no restriction in the pressure line, pilot accessories, and seal drain connections. 4420F30 pilot accessories include quick exhaust valve and 3/2 solenoid valve, and 4420F20 pilot accessories includes 3/2 solenoid.

2) Continuous monitoring of seal drain leakage can provide early warning of seal degradation. If the leakage exceeds 600 SCCM, the valve should be considered at end of life.

3) Above specifications are guaranteed for 10,000 cycles if installed in accordance with AMOT guidelines and operated within its design limits. Higher cycle numbers may degrade performance beyond documented limits.

4) SCCM stands for standard cubic centimeters per minute, which represents the volume (cc) of gas that flows for one minute at 25°C temperature and 1 ATM pressure.

Turbine Fuel Shut Off Valve - Model 4420F

How to Order

Use the table below to select the unique specification of your Model 4420 Turbine Fuel Shut Off Valve.

Example	4420F	20	J	K	1	4	N	00	-AA	**Code description**		
										Valve Model		
Valve Model	4420F									4420F		
										Nominal Bore Size		
Valve Size		20								2 inch (DN50)		
		30								3 inch (DN80)		
										Valve Flow		
Valve Flow Type			J							High		
										Flange Class	**Flange Standard**	**Flange Facing**
End Connection Types				K						600	ASME	Raised
										NACE Options		
NACE Certification					1					Compliant		
										Media		
Media Compatibility						4				Natural Gas		
						5				Hydrogen (Blend up to 100%)		
						6				Ammonia (Blend up to 100%)		
										Position Switches		
Position Switch Options							N			None Fitted		
							G			Hall sensors at open & closed positions with 1/2” NPT Housing Port		
							P			Hall Sensors at Open & Closed positions with M20 Housing Port		
										Pilot Options		
Pilot Options								00		None Fitted (-40°C to +125°C)		
								01		3-Way E4QE5 Solenoid, 24VDC (-20°C to +90°C)		
								02		3-Way E4QE5 Solenoid, 24VDC (-40°C to +60°C)		
								03		3-Way E4QE3 Solenoid, 24VDC, Quick Exhaust Valve (-20°C to +90°C)		
								04		3-Way E4QE3 Solenoid, 24VDC, Quick Exhaust Valve (-40°C to +60°C)		
										Options		
Customer Special Options									-AA	Standard product		
									-***	Customer special code assigned		

* Contact AMOT for full specification details of switch & pilot solenoid options

Pilot Accessories

(4420F30 Code "03" and "04" accessories, See table on page 7)

Solenoid Valve Type - 3-Way, Direct Acting

Port Sizes	Inlet – 1/4" NPT Outlet – 1/4" NPT Exhaust – 3/8" NPT
Operating Pressure	5 to 10.3 bar (72 to 150 psi)
Voltage Range	21.6V - 26.4VDC
Power Consumption	1.8W
Conduit Thread	1/2" NPT (F)

Quick Exhaust - Cylinder port exhaust with inlet port pressure loss

Port Sizes	Inlet – 3/4" NPT Outlet – 3/4" NPT Exhaust – 1" NPT

(4420F20 Code "01" and "02" accessories, See table on page 7)

Solenoid Valve Type - 3-Way, Direct Acting

Port Sizes	Inlet – 1/4" NPT Outlet – 1/4" NPT Exhaust – 3/4" NPT
Operating Pressure	5 to 10.3 bar (72 to 150 psi)
Voltage Range	21.6V - 26.4VDC
Power Consumption	1.8W
Conduit Thread	1/2" NPT (F)

Allowable Main Seat Leakage

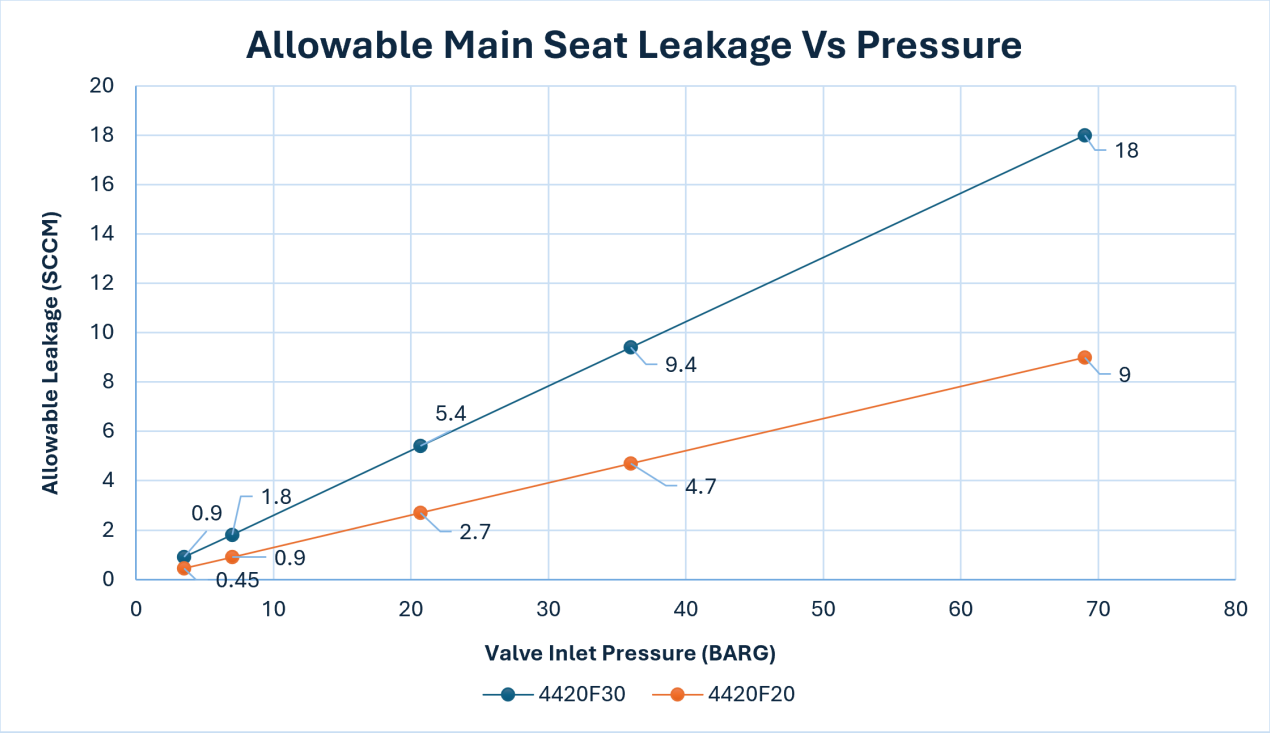


Figure 3: 4420F Main Seat Leakage Vs Pressure

The main seat is designed to provide ANSI/FCI 70.2 Class VI leakage capability up to 10,000 cycles. If the leakage exceeds Class VI limits, the valve should be replaced. 4420F main seat leakage rates are specified for Air. Leakage rates for other fuel may vary from above graph.

Turbine Fuel Shut Off Valve - Model 4420F

Outline Dimensions

(With code 'G' switch options & code "04" pilot option shown)

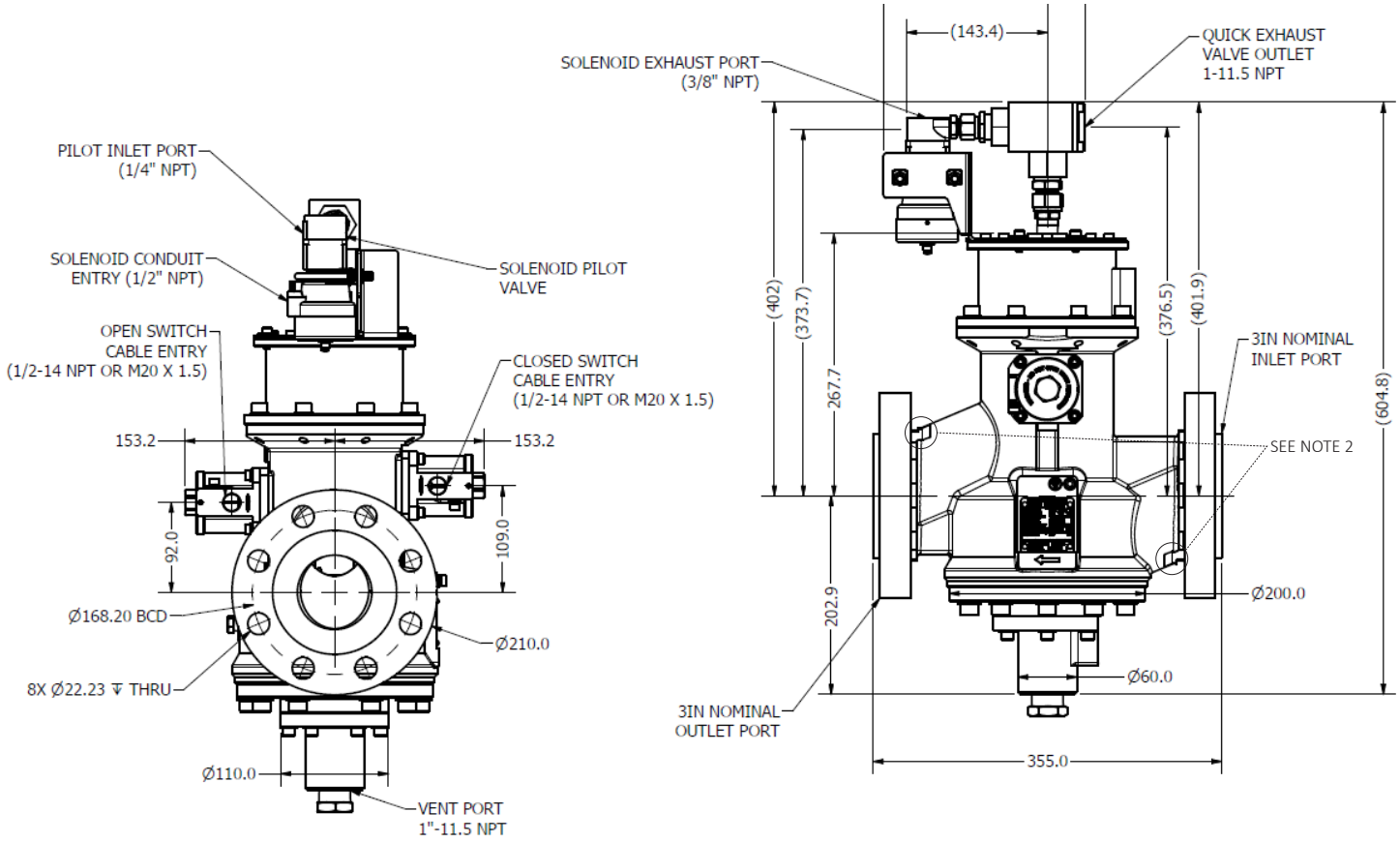


Figure 4: 4420F30 Outline Dimensions

Notes:

1) Standard hex nuts per ASME B18.2.2 with Stud Bolts per ASME B16.5 are recommended for flange connections

2) Heavy hex nuts per ASME B18.2 can be used but have limitations at two holes on each flange per the location shown above.

Turbine Fuel Shut Off Valve - Model 4420F

Outline Dimensions

(With code 'G or P' switch options & code "02" pilot option shown)

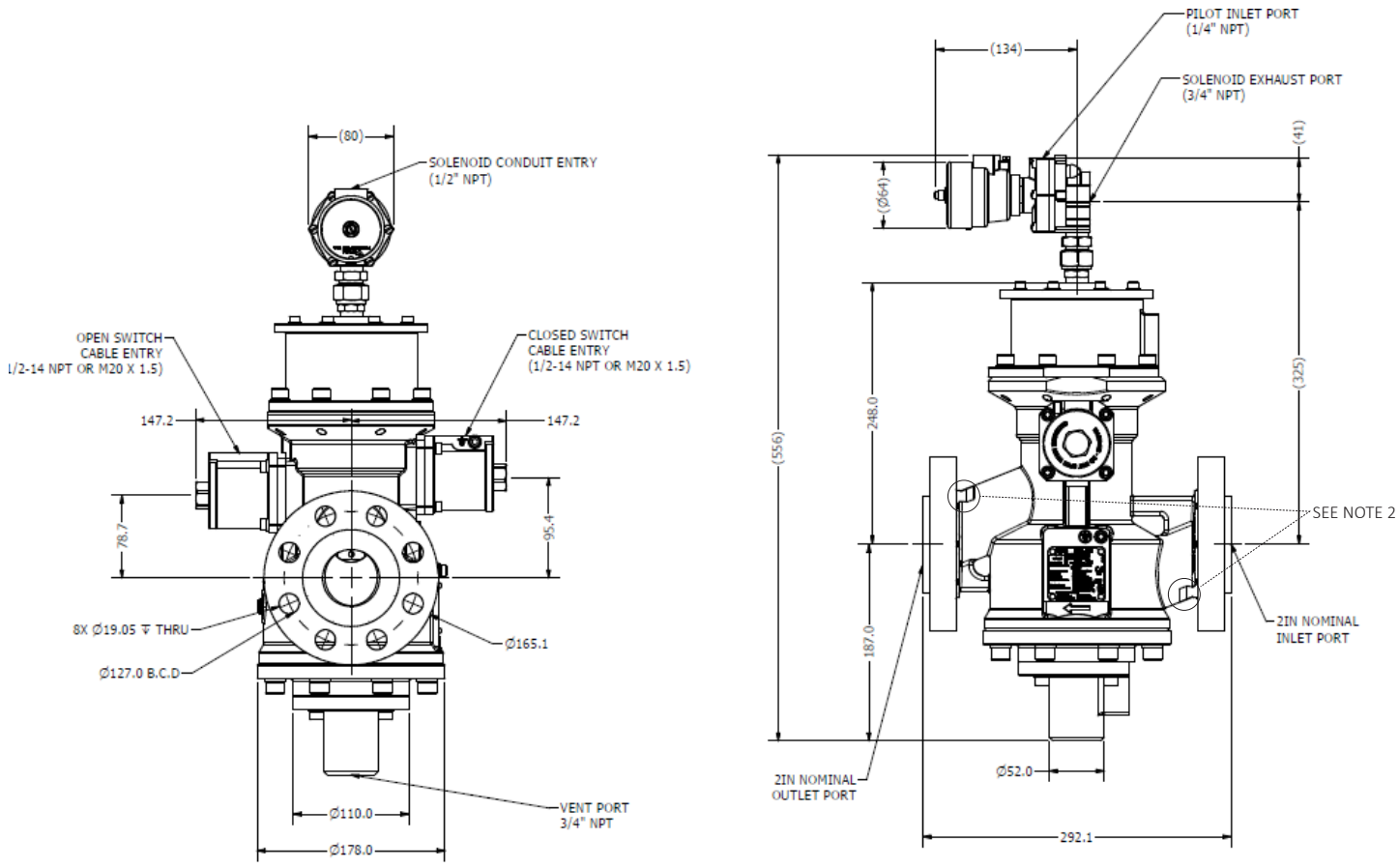


Figure 5: 4420F20 Outline Dimensions

Notes:

1) Standard hex nuts per ASME B18.2.2 with Stud Bolts per ASME B16.5 are recommended for flange connections

2) Heavy hex nuts per ASME B18.2 can be used but have limitations at two holes on each flange per the location shown above.

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