



# Safety Shutdown Valves Control System

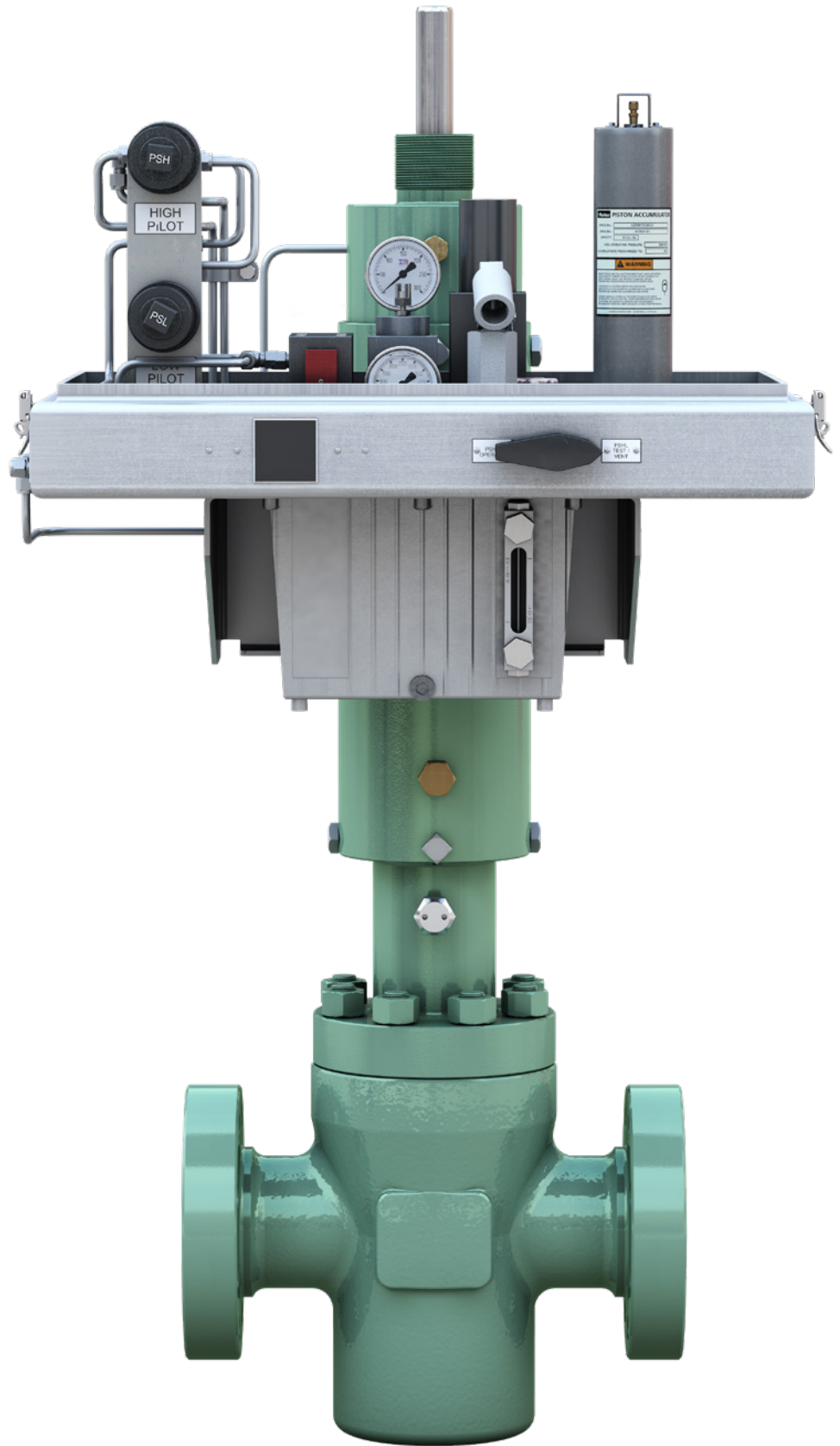
Delivering reliable safety and protection to wells and flowlines

# Safety Shutdown Valves Control System

Safeguarding wells and flowlines is a constant concern for operators no matter what the environment. The operator must have total control of the well at all times, being able to close the fail position of the valve upon hydraulic pressure loss or to perform an emergency shutdown.

The Cameron Safety Shutdown Valve Control (SSV) system's self-contained control unit, which can be adapted to work with other components in various configurations, is designed with field service and minimal downtime in mind. When an abnormal condition occurs, the SSV and controls must be manually reset to be put back into service.

A protective enclosure protects the system against the elements.

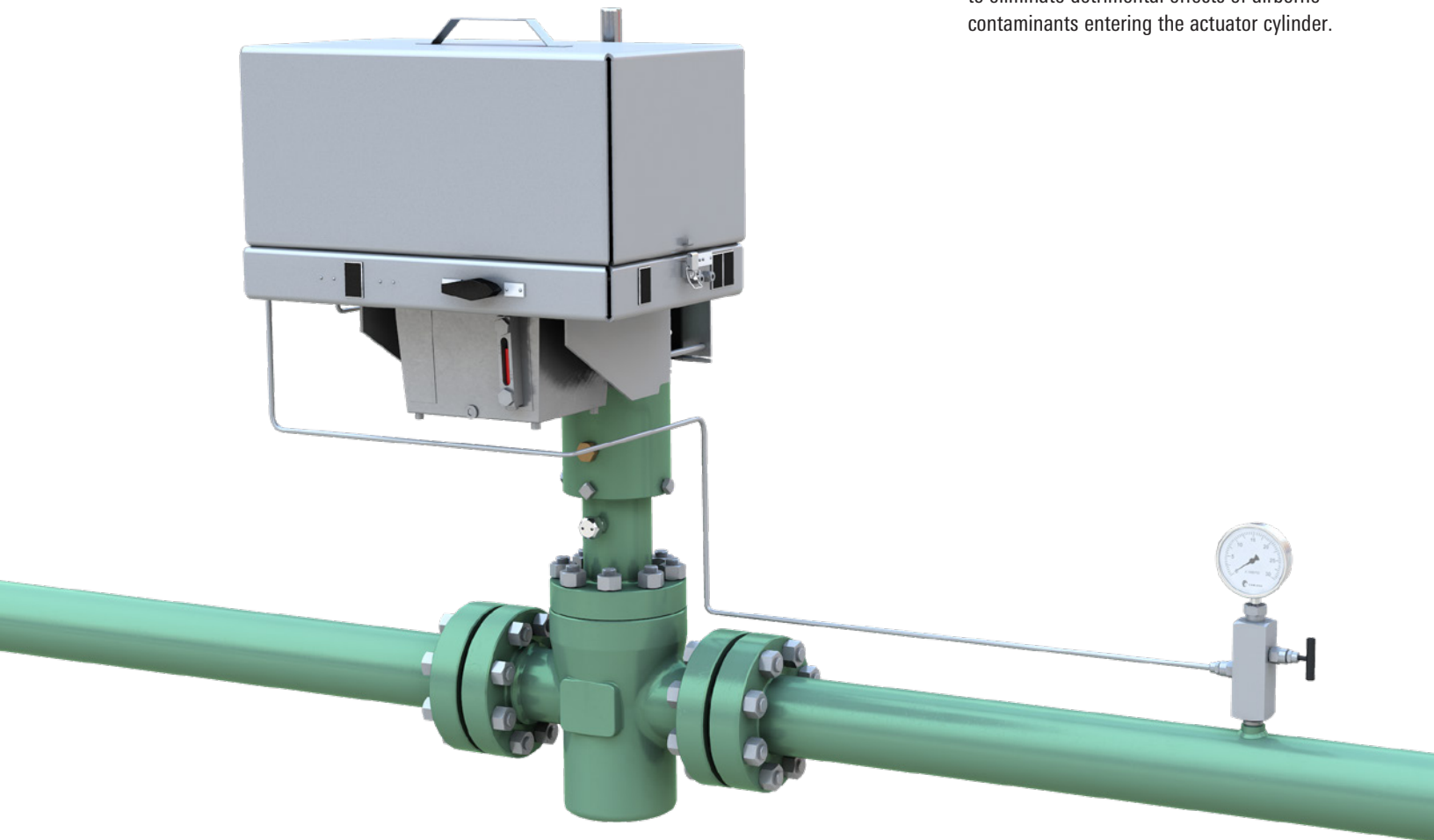


*The self-contained control unit is shown on a linear actuator, which helps to operate a 3 1/8-in API 6A gate valve. The control is displayed as if the optional pilot valve (not illustrated) were installed on the pipeline. Custom tubing connections made between the control and pilot valve are required.*



## Standard Features

- Manifold design subplate provides a robust foundation for integration of all standard and optional control system components.
- Subplate and control components are constructed of corrosion-resistant anodized aluminum with stainless steel internals.
- Oil reservoir is a rugged fabrication of stainless steel to withstand harsh working environments and provide a corrosion-free environment for the fluid.
- Hand pump available in 5,000 psig [345 barg] output pressure to minimize actuator sizing and reduce necessary fluid capacities.
- Manual arming valve arms the system and provides quick fail-safe manual response in the event of an emergency.
- Bright red-colored handle on manual arming valve provides highly visible local verification of system status being armed or tripped.
- Dual filtration within hydraulic circuit ensures only contaminant-free hydraulic fluid is moving within the system to extend zero-leak performance.
- Reduced pressure control system provides access to a broad range of low-pressure, zero-leakage control options (e.g., pilot valves, low-wattage solenoids, fusible plugs, etc.).
- Temperature compensation of a high-pressure actuator circuit and a low-pressure control circuit is accomplished with two separate accumulators. This assures system stability by reducing relief valve operation and eliminating valve creep due to extreme temperature changes.
- Overpressure protection of a high-pressure actuator circuit and a low-pressure control circuit is provided with two separately designated relief valves. This isolates the relief valve operation to abnormally excessive pressure, which reduces potential leak points that result in valve drift.
- Seal material is selected to exceed ambient conditions of the end destination to assure zero-leakage integrity throughout a range of  $-50$  to  $212$  degF [ $-46$  to  $100$  degC].
- Stainless steel pressure gauges with dual-scale indication ensures easy verification of high- and low- pressure circuit operating pressure.
- Liquid level gauge easily confirms proper operating level of hydraulic fluid in oil reservoir.
- Manifold porting provides spring return actuators with a closed-loop exhaust circuit to eliminate detrimental effects of airborne contaminants entering the actuator cylinder.



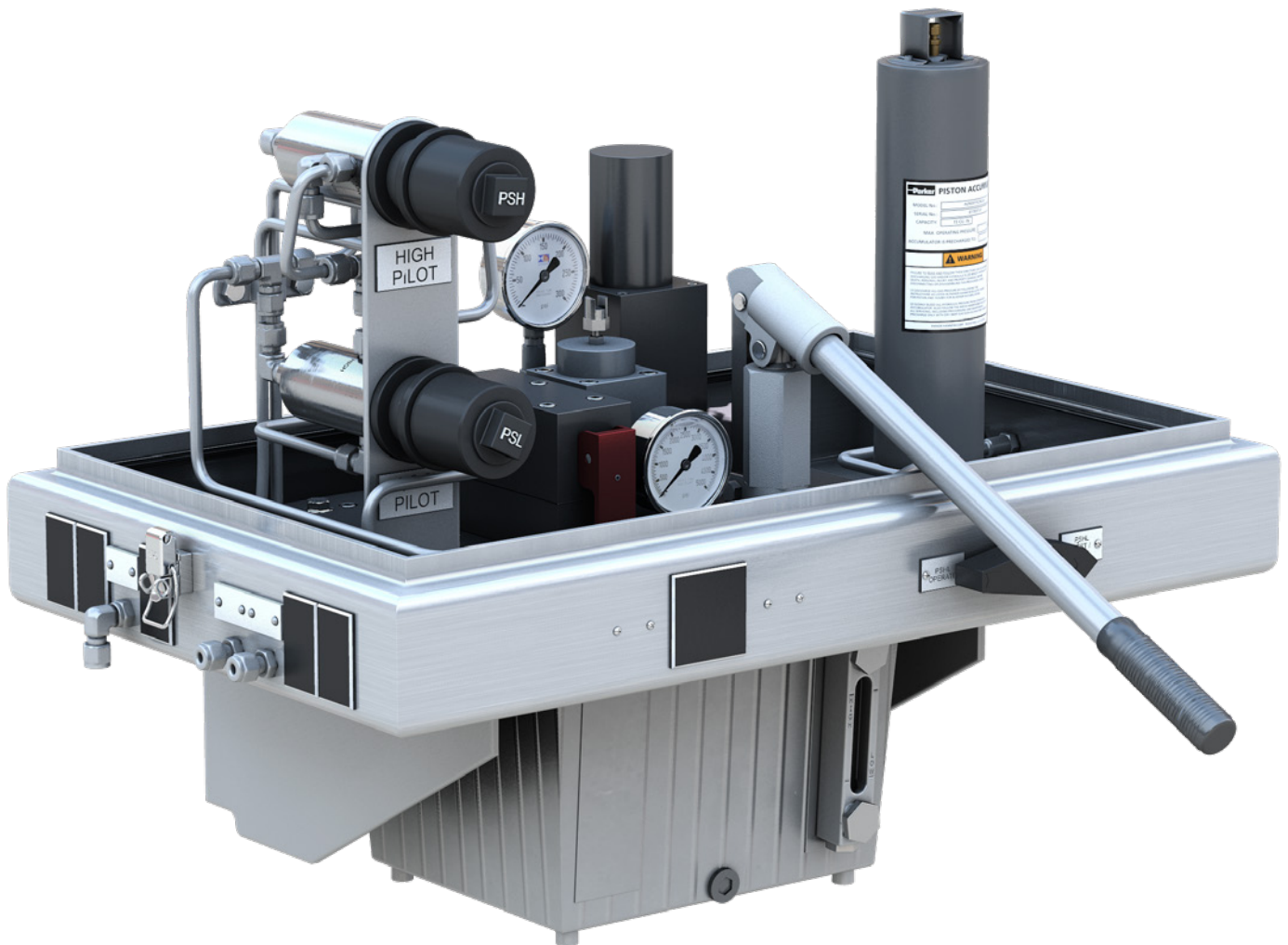
# Self-Contained Control

Utilizing a hand pump with various control components, a zero-leakage circuit is maintained to ensure valve movement does not inadvertently occur until a fail-safe signal is received. Controls are typically pilot tripped, but solenoids also can be utilized for remote control where electricity is available. The control must be manually reset after a fail-safe operation has occurred.

## Simple operation

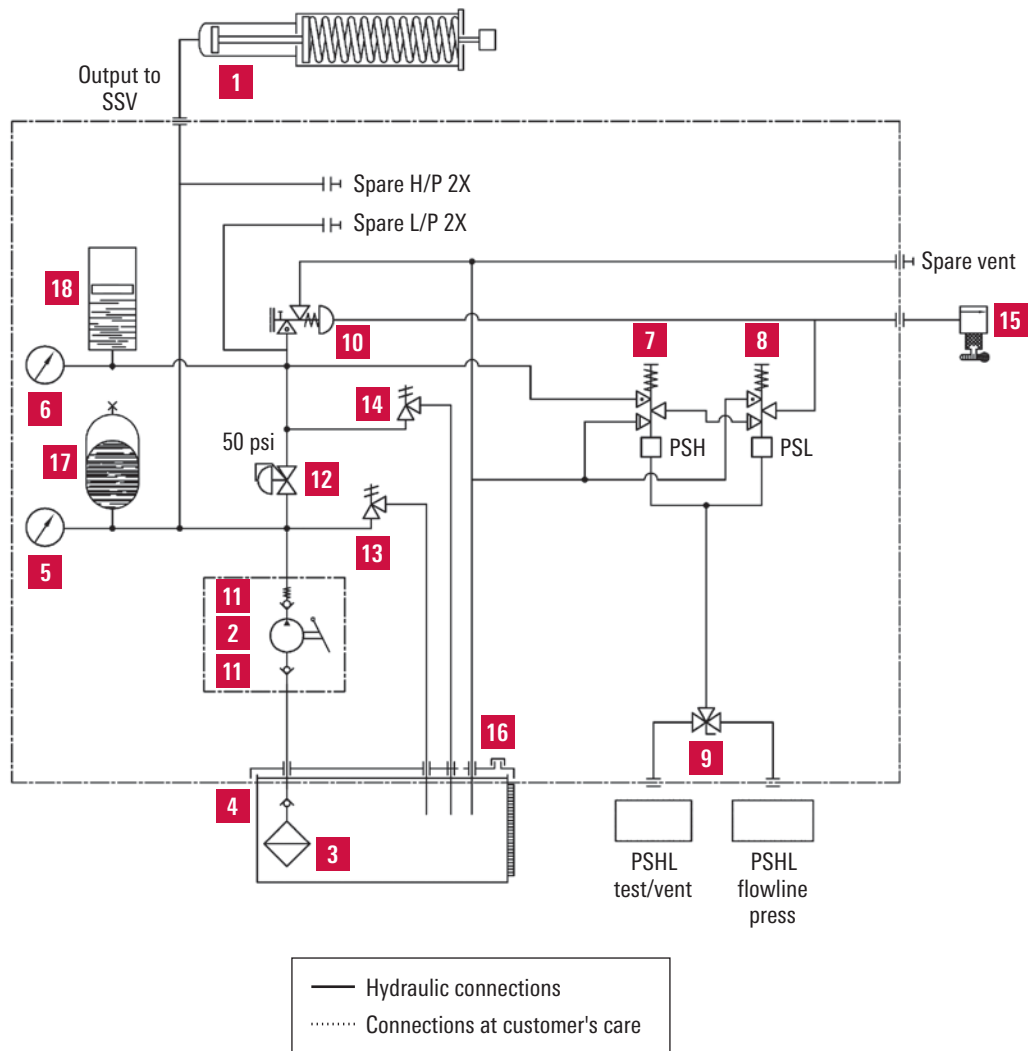
**To open:** Set arming valve to ready position and operate hand pump until actuator has reached full open position. For remote option, solenoid valve also must be energized prior to hand pumping. For automatic option, a normal sensing pressure also must be available to pilot valve prior to hand pumping.

**To close:** For local operation, manually trip arming valve to fail position. For remote option, de-energizing solenoid valve will trip arming valve to fail position. For automatic option, any abnormal increase or decrease of pilot sensing pressure will trip arming valve to fail position.



*SSV self-contained control unit.*

# Schematic Diagram



The schematic diagram is shown with the valve in closed position and without hydraulic power.

- |                             |   |   |
|-----------------------------|---|---|
| 1. Hydraulic cylinder       | 7. Hydraulic press sensor (PSH)                           | 13. Valve (PSV) set 5,500 psi <sup>†</sup>      |
| 2. Hand pump                | 8. Hydraulic press sensor (PSL)                           | 14. Safety valve (PSV) set 100 psi <sup>†</sup> |
| 3. Oil filter <sup>†</sup>  | 9. 3-way ball valve 6,000 psi                             | 15. Fusible plug                                |
| 4. Oil tank                 | 10. Hydraulic piloted valve                               | 16. Fill/vent cap                               |
| 5. Pressure gauge 5,000 psi | 11. Check valves (pump suction & discharge)               | 17. Accumulator (high pressure)                 |
| 6. Pressure gauge 300 psi   | 12. Pressure regulator 6,000 psi inlet,<br>250 psi outlet | 18. Accumulator (low pressure)                  |

<sup>†</sup> Components installed inside tank

## Available Options

### Control enclosure

Lockable, stainless steel fabrication allows unrestricted access for local emergency trip function while ensuring only authorized personnel have access to the entire control system.

### Transparent reservoir

Made of UV and impact-resistant materials suitable for a broad temperature range of  $-50$  to  $140$  degF [ $-45$  to  $60$  degC] to provide full visual verification of available oil.

### Pilot valve

Customer-preferred models can be readily connected into the circuit onboard the manifold or pipeline to provide automatic operation of the shutdown system.

### Solenoid valve

Subplate or in-line mounted for easy field retrofit with low-power consumption coils provides efficient remote control of the shutdown system.

### Fusible plug

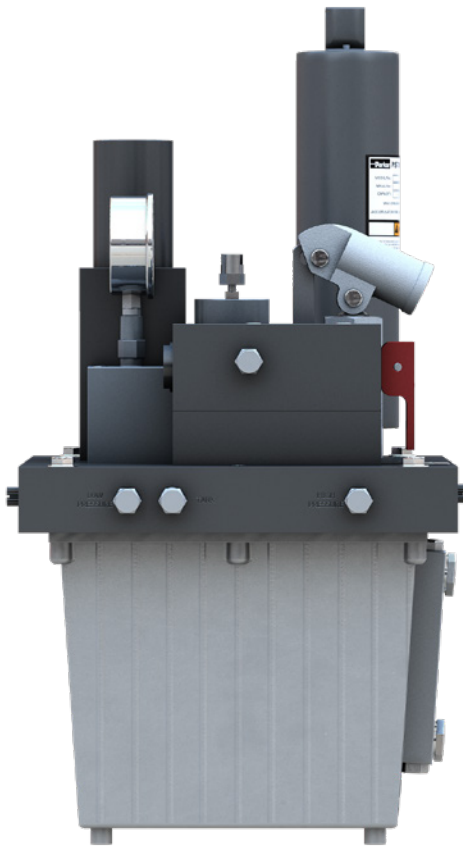
Quickly trips circuit to shutdown position when exposed to the rising temperature of a fire.

### Instrumentation kit

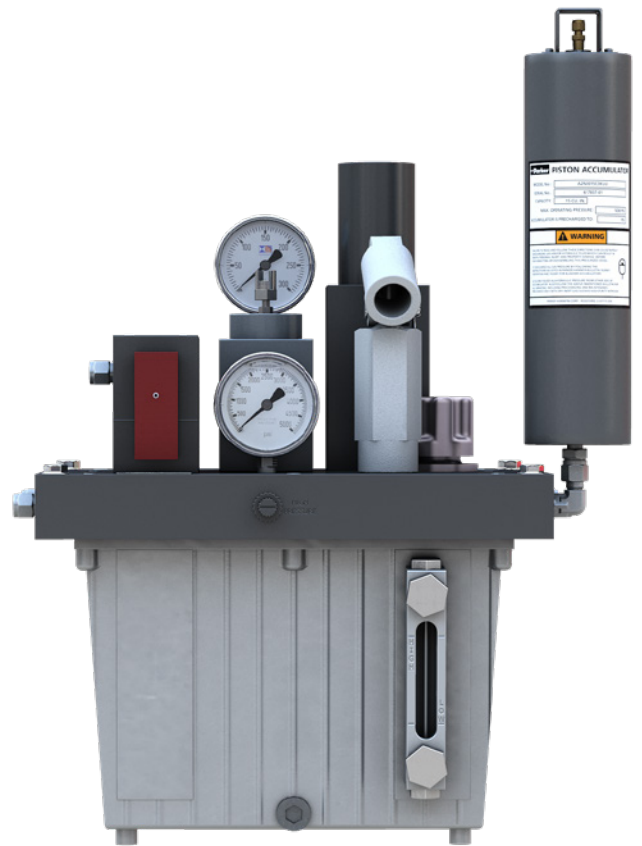
All tube fittings, tubing, and fasteners are required to easily mount and connect any pilot or solenoid valve into the shutdown system (shipped loose).

### Instrumentation manifold

Provides a rugged transition from the pipeline when direct mounting of pilot valve(s) to the pipeline is desired (shipped loose).



*Rugged stainless steel oil reservoir to withstand harsh working environments*



*Bright red-colored handle on manual arming valve for highly visible verification of local system status.*

# Hydraulic Actuator

## Fail-safe design

Upon loss of hydraulic pressure, the actuator will position the gate of the valve in the required position. The fail-closed and fail-open positions are determined by whether a reverse- or direct-acting gate is installed. All Cameron MH70 actuators are designed to provide adequate spring force to return the valve to the fail position without the assistance of the valve's working pressure.

## Rising and non-rising stem designs

MH70 actuators are available in both rising and non-rising stem designs. Both designs visually indicate the position of the valve. The rising stem design features an external shaft that provides the visual indication. The non-rising stem design, which has a shorter profile than the rising stem design, features a viewing window inside the housing that provides visual indication.

## Head and housing orientation

MH70 actuators provide a full 360° rotation of both the head and housing. This feature allows the hydraulic inlet port, viewing window, and housing mounted proximity switches to be located where desired, thus offering flexibility during field installation of the controls.

## Non-pressurized housing

All MH70 actuators feature a non-pressurized housing. The piston is conveniently located at the top of the actuator assembly, which allows for easy and timely seal replacement.

## Superior piston design

Our MH70 actuators feature a stainless steel piston. Most variations of the rising stem design include a single-piece piston and top shaft. This layout, when combined with T-seals, provides positive sealing and extended service. All pistons have been engineered to reduce the required swept volumes and to provide faster closing times.

## Cameron sealing technology

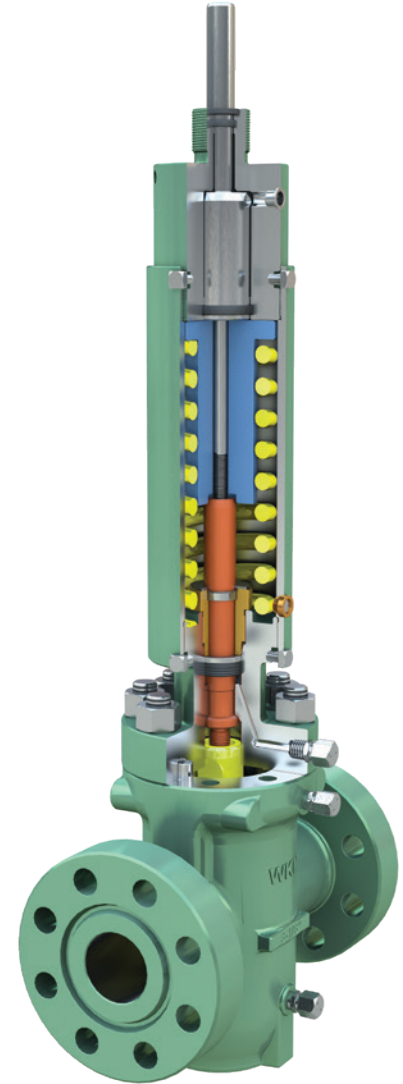
All MH70 actuator bonnet and valve stem assemblies utilize Cameron advanced valve stem seal designs.

## Fixed drift adjustment

Stainless steel spacers are installed during the initial manufacturing stage and provide a secondary means of setting the valve drift. Subsequent removal and replacement of the actuator does not affect the drift setting.

## Corrosion-resistant materials

Excluding the springs, all non-stainless components are externally coated with Ever-Slik<sup>†</sup> corrosion-resistant coating. Springs are provided with a superior Semagard corrosion-resistant coating.



*All MH70 actuators utilize a superior design to provide faster closing times, extended service and resist corrosion.*

### Standard actuator data

- API 6A actuators available for use with 1<sup>3</sup>/<sub>16</sub>- through 9-in nominal gate valves
- API 6A, Appendix F, PR2 qualified
- -20 to 250 degF [-29 to 121 degC] standard temperature rating
- 3- to 10-in standard piston sizes for above referenced valve groups
- 6,000-psi maximum operating pressure
- 9,000-psi test pressure
- Standard 1/2-in NPT inlet port
- Wide range of options and accessories available

### Standard bonnet data

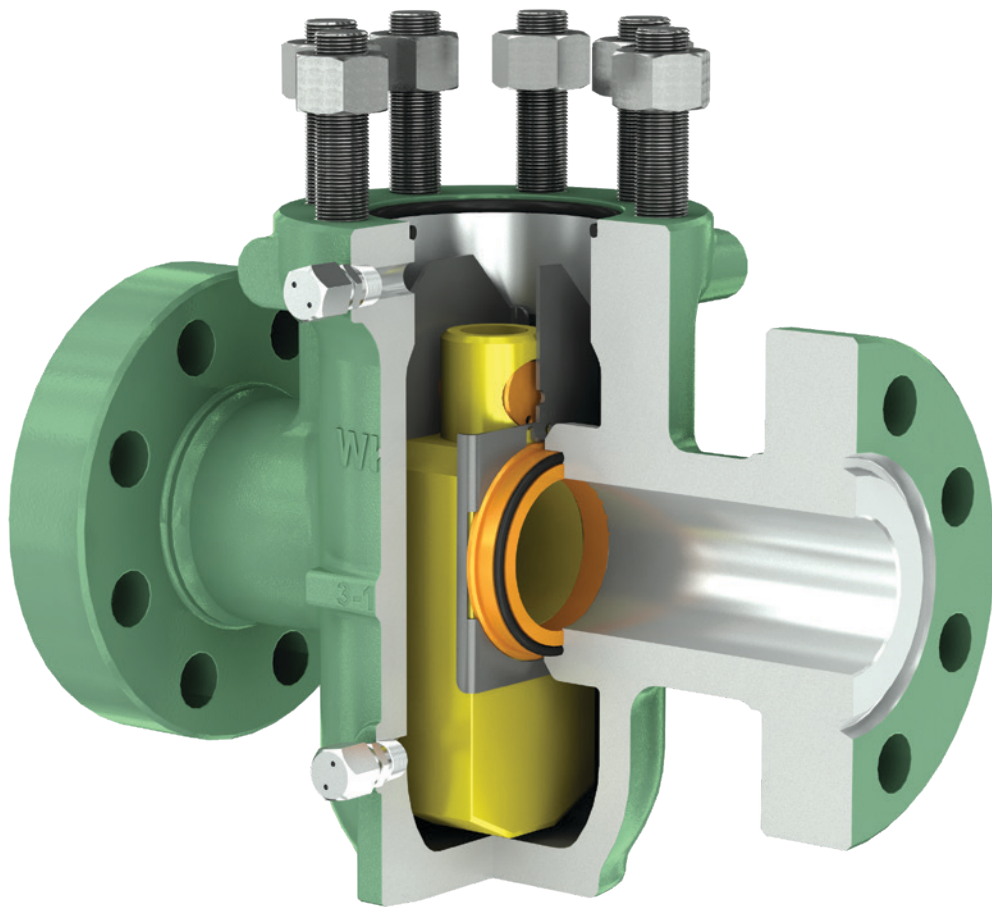
- Standard stem and bonnet materials are API material/temperature class dependent
- PSL 1, 2, 3, and 3G available
- Standard bonnet backseat test port provided
- Standard packing leak indicator port provided

**Note:** See MH70 actuator product data sheet for product data and control pressure information.



# M Saf-T-Seal Actuated Gate Valve

The M Saf-T-Seal\* API 6A power-actuated fullbore through-conduit gate valve is the power-actuated version of the Model M gate valve. It features a cast body and slab-style gate and is readily adapted to multiple actuator designs. The M Saf-T-Seal gate valve is available in 2 $\frac{1}{16}$ - through 4 $\frac{1}{16}$ -in nominal sizes; in 2,000- to 5,000-psi WP; and with either flanged, threaded, or clamp-hub end connections.



*M Saf-T-Seal actuated gate valve.*

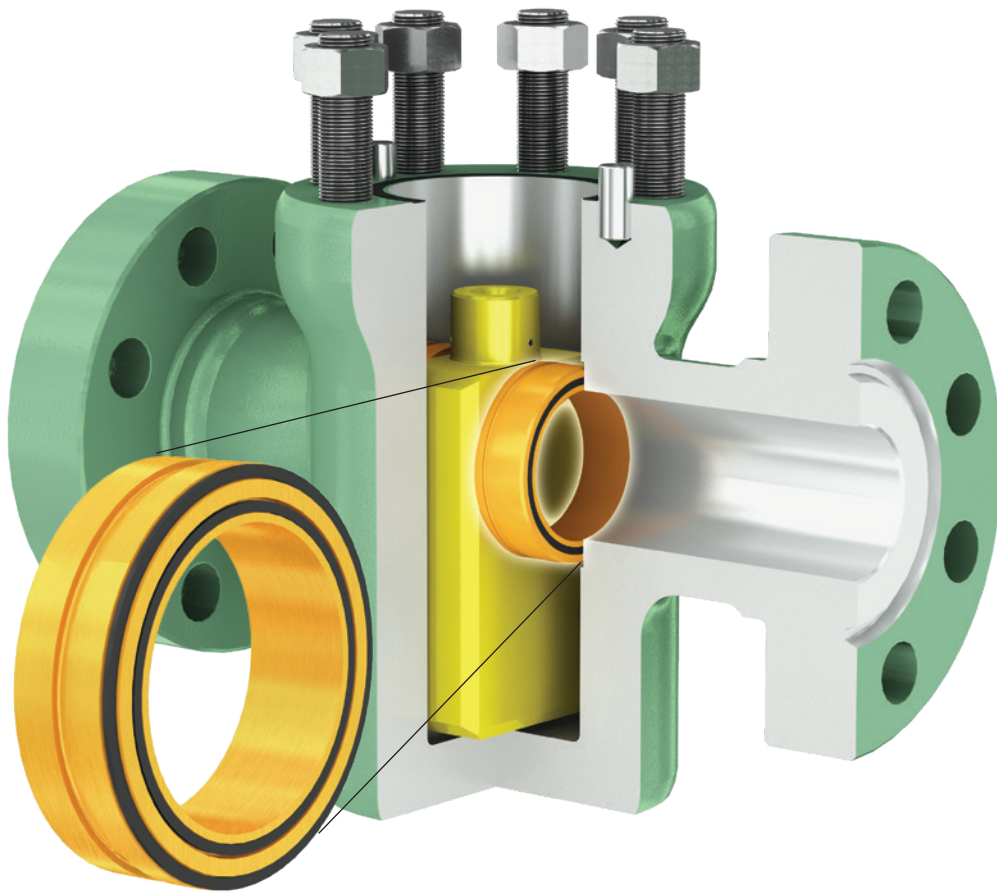
## **Features and benefits**

- Metal-to-metal sealing (e.g., gate-to-seat and seat-to-body), with PTFE soft-seal backup ring between the gate and seat surface
- Bi-directional design with simple, reliable slab gate and disk seats
- Full-bore, through-conduit design eliminates turbulence and pressure drop
- Seat skirts reduce loss of body filler grease
- Metal-to-metal bonnet seal



# FL/FLS Power Actuated Gate Valves

The FL\* API 6A slab-style gate valve and FLS\* extreme service API 6A slab-style gate valve feature a forged body and slab-style gate and are readily adapted to multiple actuator designs. They are both available with either flanged, threaded, or clamp-hub end connections. The FL power actuated gate valve is available in 2 $\frac{1}{16}$ - through 4 $\frac{1}{16}$ -in nominal sizes, from 2,000 to 5,000 psi WP, while the FLS power-actuated gate valve is available in pressure ratings from 2,000 to 20,000 psi and bore sizes from 1 $\frac{3}{16}$  to 11 in. The FLS gate valve is our standard valve for critical requirements, including extreme sour and subsea applications.



*FLS gate valve design incorporates two spring-loaded, pressure-energized, non elastomeric lip seals.*

## Features and benefits

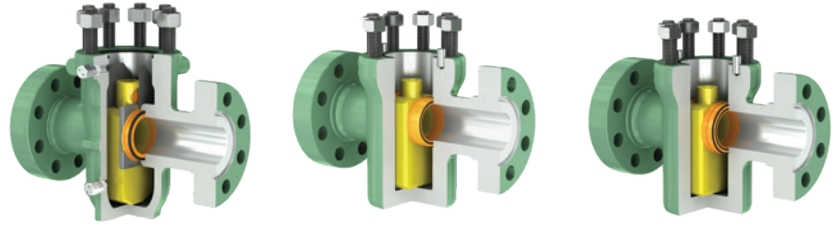
- Bi-directional design provides flow-direction versatility and increased service life
- Positive metal-to-metal sealing (e.g., gate-to-seat and seat-to-body)
- Simple, reliable gate, and seat designs promote ease of field service and minimal spare parts inventory
- The FL gate valve incorporates one lip seal and FLS gate valve incorporates two lip seals between the seat and body. These lip seals are spring-loaded, pressure-energized, non-elastomeric seals that assist in low-pressure sealing and protect intrusion of particle contaminants into the body cavity and seal areas
- Metal-to-metal bonnet seal

**Gate Valve Application**

**M Saf-T-Seal**

**FL**

**FLS**



**API 6A temperature ranges**

-20 to 250 degF [-29 to 121 degC]	●	●	●
-50 to 250 degF [-46 to 121 degC]	●	●	●
-75 to 250 degF [-60 to 121 degC]			●

**API 6A material class**

AA—general service	●	●	●
BB—general service	●	●	●
CC—general service	●	●	●
DD—sour service <sup>†</sup>	●	●	●
EE—sour service <sup>†</sup>	●	●	●
FF—sour service <sup>†</sup>	●	●	●
HH—sour service <sup>†</sup>			●

**API 6A product specification level**

PSL 1	●	●	●
PSL 2	●	●	●
PSL 3		●	●
PSL 3G		●	●

<sup>†</sup> As defined by NACE Standard MR0175/ISO 15156.

**M Saf-T-Seal Gate Valve Trim Materials**

API 6A material class	Body material	Gate material/coating	Seat material/coating
AA—general service	Alloy steel	Alloy steel/nitrided	Alloy steel/nitrided
BB—general service	Alloy steel	Stainless steel/nitrided	Stainless steel/nitrided
CC—general service	Stainless steel	Stainless steel/nitrided	Stainless steel/nitrided
DD—sour service <sup>†</sup>	Alloy steel	Alloy steel/nitrided	Alloy steel/nitrided
EE—sour service <sup>†</sup>	Alloy steel	Stainless steel/nitrided	Stainless steel/nitrided
FF—sour service <sup>†</sup>	Stainless steel	Stainless steel/hard-faced	Stainless steel/hard-faced

<sup>†</sup> As defined by NACE Standard MR0175/ISO 15156.

**Note:** Specifications are subject to change without notice. Special trims are available upon request.

**M Saf-T-Seal Gate Valve (Prepped for Actuator) Dimensional Data**

Nominal size, in	Working pressure, psi	End connection	Dimensions, in [mm]				Weight—flange, lbm [kg]
			End to end	Body width	Bore to bonnet face	Bore to bottom	
2 <sup>1</sup> / <sub>16</sub>	2,000	Flange	11.62 [295.1]	6.12 [155.4]	4.84 [123.0]	4.94 [125.5]	80 [36]
	3,000	Flange	14.62 [371.3]	7.25 [184.2]	4.84 [123.0]	5.06 [128.5]	135 [61]
	5,000	Flange	14.62 [371.3]	7.25 [184.2]	4.84 [123.0]	5.06 [128.5]	135 [61]
2 <sup>9</sup> / <sub>16</sub>	2,000	Flange	13.12 [333.2]	7.12 [180.8]	5.63 [142.9]	5.75 [146.1]	110 [50]
	3,000	Flange	16.62 [422.1]	7.88 [200.2]	5.63 [142.9]	5.94 [150.9]	180 [82]
	5,000	Flange	16.62 [422.1]	7.88 [200.2]	5.63 [142.9]	5.94 [150.9]	180 [82]
3 <sup>1</sup> / <sub>16</sub>	2,000	Flange	14.12 [358.6]	8.50 [215.9]	7.13 [181.0]	7.06 [179.3]	150 [68]
	3,000	Flange	17.12 [434.8]	9.25 [235.0]	7.13 [181.0]	7.31 [185.7]	215 [98]
	5,000	Flange	18.62 [472.9]	9.25 [235.0]	7.13 [181.0]	7.31 [185.7]	240 [109]
4 <sup>1</sup> / <sub>16</sub>	2,000	Flange	17.12 [434.8]	10.75 [273.1]	8.38 [212.7]	8.94 [227.1]	290 [132]
	3,000	Flange	20.12 [511.0]	12.25 [311.2]	8.38 [212.7]	9.06 [230.1]	410 [186]
	5,000	Flange	21.62 [549.1]	12.25 [311.2]	8.38 [212.7]	9.06 [230.1]	445 [202]

**FL/FLS Gate Valve Trim Materials**

API 6A material class	Body material	Gate material/coating	Seat material/coating
AA—general service	Alloy steel	Alloy steel/nitrided	Alloy steel/nitrided
BB—general service	Alloy steel	Stainless steel/hard-faced	Stainless steel/hard-faced
CC—general service	Stainless steel	Stainless steel/hard-faced	Stainless steel/hard-faced
DD—sour service <sup>†</sup>	Alloy steel	Alloy steel/hard-faced	Stainless steel/hard-faced
EE—sour service <sup>†</sup>	Alloy steel	Stainless steel/hard-faced	Stainless steel/hard-faced
FF—sour service <sup>†</sup>	Stainless steel	Stainless steel/hard-faced	Stainless steel/hard-faced
HH—sour service <sup>†</sup> (FLS only)	Alloy steel clad with alloy 625 or solid CRA	CRA/hard-faced	Solid colbalt alloy steel or CRA/hard-faced

<sup>†</sup> As defined by NACE Standard MR0175/ISO 15156.

**Note:** Specifications are subject to change without notice. Special trims are available upon request.

**FL and FLS Gate Valves (Prepped for Actuator) Dimensional Data**

Nominal size, in	Working pressure, psi	Dimensions, in [mm]				Weight, lbm [kg]
		End to end	Body width	Bore to bonnet face	Bore to bottom	
1 <sup>13</sup> / <sub>16</sub>	10,000	18.25 [463.6]	9.00 [228.6]	3.88 [98.6]	5.75 [146.1]	180 [82]
	15,000	18.00 [457.2]	9.50 [241.3]	3.88 [98.6]	5.88 [149.4]	230 [104]
	20,000	21.00 [533.4]	11.38 [289.1]	3.88 [98.6]	7.88 [200.2]	450 [204]
2 <sup>1</sup> / <sub>16</sub>	2,000	11.62 [295.1]	6.09 [154.7]	3.85 [97.8]	5.28 [134.1]	74 [34]
	3,000	14.62 [371.3]	7.00 [177.8]	3.85 [97.8]	5.50 [139.7]	127 [58]
	5,000	14.62 [371.3]	7.00 [177.8]	3.85 [97.8]	5.50 [139.7]	127 [58]
	10,000	20.50 [520.7]	9.00 [228.6]	3.88 [98.6]	5.62 [142.7]	197 [89]
	15,000	19.00 [482.6]	9.62 [244.3]	3.88 [98.6]	5.88 [149.4]	244 [111]
	20,000	23.00 [584.2]	11.75 [298.5]	4.55 [115.6]	7.50 [190.5]	661 [300]
2 <sup>9</sup> / <sub>16</sub>	2,000	13.12 [333.2]	7.00 [177.8]	4.66 [118.5]	6.00 [152.4]	109 [50]
	3,000	16.62 [422.1]	7.88 [200.2]	4.66 [118.5]	6.00 [152.4]	184 [84]
	5,000	16.62 [422.1]	7.88 [200.2]	4.66 [118.5]	6.00 [152.4]	184 [84]
	10,000	22.25 [565.2]	9.38 [238.3]	4.70 [119.3]	6.75 [171.5]	301 [136]
	15,000	21.00 [533.4]	11.25 [285.8]	4.88 [124.0]	7.75 [196.9]	449 [204]
	20,000	26.50 [673.1]	14.62 [371.3]	6.50 [165.1]	10.00 [254.0]	988 [448]
3 <sup>1</sup> / <sub>16</sub>	10,000	24.38 [619.3]	10.12 [257.0]	5.60 [142.3]	8.12 [206.2]	408 [185]
	15,000	23.56 [598.4]	13.75 [349.3]	6.13 [155.8]	9.75 [247.7]	726 [329]
	20,000	30.50 [774.7]	16.00 [406.4]	8.94 [227.0]	11.52 [292.7]	1,837 [833]
3 <sup>3</sup> / <sub>8</sub>	2,000	14.12 [358.6]	7.88 [200.2]	5.57 [141.5]	7.12 [180.8]	173 [79]
	3,000	17.12 [434.8]	8.38 [212.9]	5.57 [141.5]	7.25 [184.2]	213 [96]
	5,000	18.62 [472.9]	9.12 [231.6]	5.57 [141.5]	7.25 [184.2]	260 [118]
4 <sup>1</sup> / <sub>16</sub>	10,000	26.38 [670.1]	12.75 [323.9]	7.23 [183.6]	10.25 [260.4]	713 [324]
	15,000	29.00 [736.6]	14.50 [368.3]	7.70 [195.5]	11.62 [295.1]	1,136 [515]
	20,000	35.50 [901.7]	18.75 [476.3]	8.92 [226.6]	14.62 [371.3]	2,868 [1,301]
4 <sup>1</sup> / <sub>8</sub>	2,000	17.12 [434.8]	9.62 [244.3]	7.20 [182.8]	9.00 [228.6]	292 [132]
	3,000	20.12 [511.0]	10.38 [263.7]	7.20 [182.8]	8.75 [222.3]	351 [159]
	5,000	21.62 [549.1]	10.75 [273.1]	7.20 [182.8]	9.88 [251.0]	468 [212]
5 <sup>1</sup> / <sub>8</sub>	2,000	22.12 [561.8]	11.00 [279.4]	8.85 [224.8]	12.62 [320.5]	831 [377]
	3,000	24.12 [612.6]	13.00 [330.2]	8.85 [224.8]	12.75 [323.9]	852 [387]
	5,000	28.62 [726.9]	11.50 [292.1]	8.85 [224.8]	12.62 [320.5]	984 [446]
	10,000	29.00 [736.6]	14.50 [368.3]	9.44 [239.7]	13.25 [336.6]	1,013 [459]
	15,000	35.00 [889.0]	17.75 [450.9]	10.69 [271.5]	15.00 [381.0]	2,136 [969]
6 <sup>1</sup> / <sub>8</sub>	5,000	29.00 [736.6]	14.12 [358.6]	10.32 [262.1]	12.88 [327.2]	1,021 [463]
6 <sup>3</sup> / <sub>8</sub>	2,000	22.12 [561.8]	12.38 [314.5]	10.32 [262.1]	12.88 [327.2]	785 [356]
	3,000	24.12 [612.6]	12.62 [320.5]	10.32 [262.1]	12.88 [327.2]	864 [392]
	5,000	29.00 [736.6]	14.12 [358.6]	10.32 [262.1]	12.88 [327.2]	997 [452]
	10,000	35.00 [889.0]	18.00 [457.2]	10.00 [254.0]	14.62 [371.3]	2,118 [960]
	15,000	41.00 [1,041.4]	23.88 [606.6]	12.00 [304.8]	21.50 [546.1]	5,691 [2,581]
7 <sup>1</sup> / <sub>16</sub>	5,000	32.00 [812.8]	17.38 [441.5]	11.88 [301.6]	14.75 [374.7]	2,243 [1,017]
	10,000	35.00 [889.0]	18.88 [479.6]	13.35 [339.1]	18.07 [459.0]	3,121 [1,416]
	15,000	41.00 [1,041.4]	24.00 [609.6]	12.00 [304.8]	22.75 [577.9]	5,663 [2,568]
9	5,000	41.00 [1,041.4]	23.12 [587.2]	9.75 [247.7]	9.75 [247.7]	3,784 [1,716]



# Safety Shutdown Valves Control System



[cameron.slb.com/ssv](http://cameron.slb.com/ssv)

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