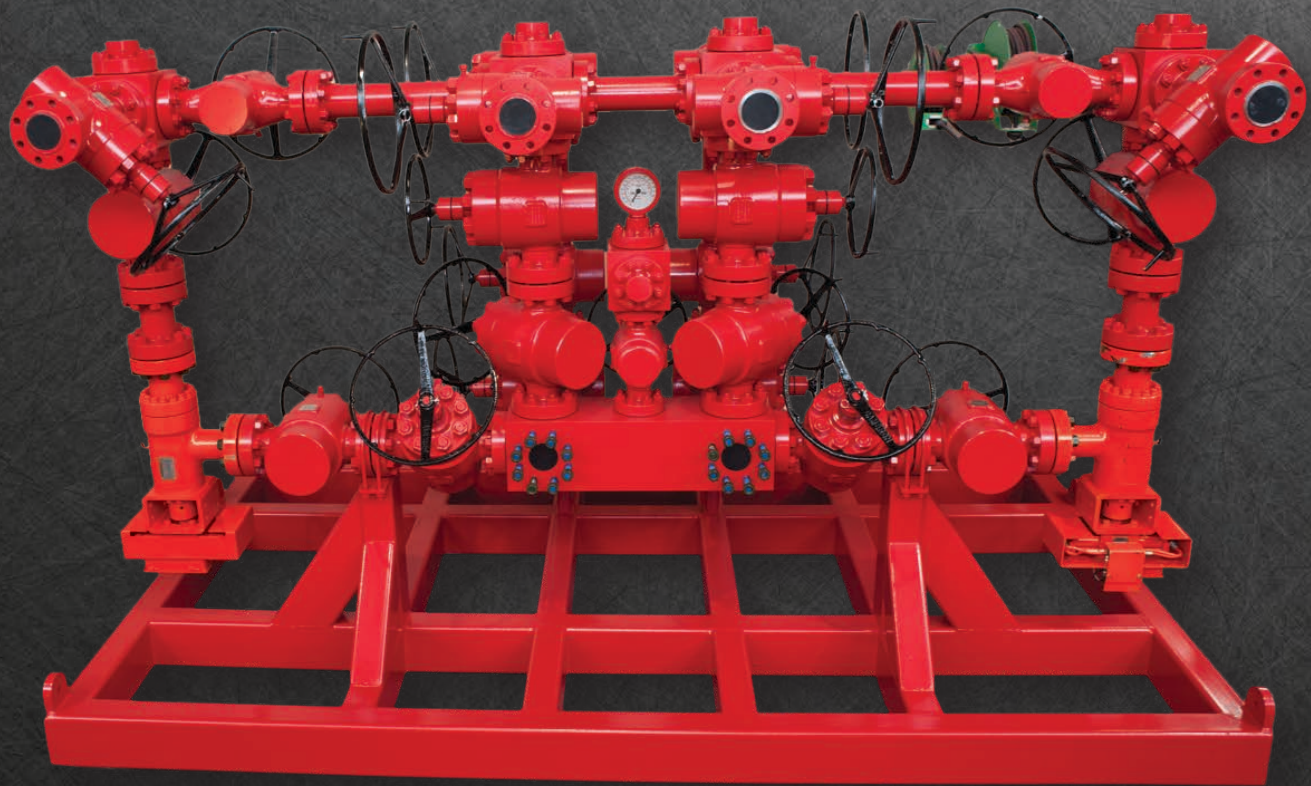


# Choke and Kill Manifold Systems

Premier Pressure and Flow Control

TECHNOLOGY







# CHOKE AND KILL MANIFOLD DESIGN



While drilling demands have changed to operate under more extreme temperatures, higher pressure environments, and more severe service applications, one thing remains the same: the need for reliable pressure-control equipment. Look no further than Cameron for choke and kill manifolds that meet the requirements of any operation.

Cameron's choke and kill manifold provides control of flowback or treatment fluids. The choke and kill manifold system consists of high-pressure valves, chokes, pressure sensors, connecting blocks, spool spacers, buffer tanks, flanges, and instrumentation configured together. Each system is designed to meet the customer's specific operational needs and international standards.

With a commitment to offer the highest quality, safest, and most reliable products on the market, Cameron's choke and kill manifolds undergo design, development, and production processes that adhere to our rigorous OEM protocol. Every element of the choke and kill manifold, from gate valves to chokes, must meet meticulous design standards, qualification testing, and material selection. The manufacturing of each manifold system is done in-house by our trained employees. This attention to detail is what you can expect from the best-in-class pressure-control equipment provider.

## QUALITY

- Compliance with API Standard 53 and API Spec 16C
- ABS and DNV certification
- API 6A monogrammed components
- Material Class DD-0.5 to EE-NL
- Temperature Class L to X (-50° F to 350° F [-45° C to 176° C])
- Product specification level: PSL 2 or 3
- Inconel® 625 inlay available

## RELIABILITY

- Components including chokes and valves are designed and manufactured to rigorous standards to ensure long service life
- Reduced leaks, repairs, and failures contribute to less maintenance and downtime

## SAFETY AND EASE OF OPERATION

- Hydraulically actuated components allow for remote operation
- Recertification available onsite, at a customer facility or at a Cameron facility
- Global aftermarket presence

## OEM ADVANTAGE

- OEM-trained employees and staff
- OEM-certified drawings, procedures, and methods
- OEM design status and control
- OEM documentation and Certification of Conformance
- OEM inspection and testing
- Access to all of Cameron's resources and aftermarket services, including metallurgy, design, welding, engineering, quality, R&D, and recertification and repair support

## OPTIONS

- Standard or custom configurations
- Instrumentation for pressure readings
- Ports for glycol injections
- Various structural components to operate chokes and valves



## DRILLING CHOKES



Cameron's drilling choke product range consists of two main choke types: the CAMERON® DR gate & seat type and the WILLIS® Multiple Orifice Valve (MOV) rotating disc type.

These chokes control the pressure in the well bore during drilling, circulate out any kicks of gas encountered during drilling, and prevent loss of well control by maintaining a satisfactory column of drilling mud. With several options and configurations, Cameron's drilling chokes offer proven performance within diverse drilling applications on a global scale.

### CAMERON DR-Type Gate & Seat Drilling Chokes

- Available in 2" and 3" nominal sizes (DR20 and DR30 models).
- Working pressures: 10,000 psi to 15,000 psi models as standard. High pressure models also available, up to 25,000 psi.



#### Features and Benefits:

- Design includes reversible gate & seat components, allowing up to twice the service life of a normal non-reversible drilling choke trim.
- Gate & seat trim design is highly blockage resistant, with potential to perform a flushing stroke in the event of large solid material to flush through any debris and restore normal operation.
- Controlling components (gate & seat) are made from solid tungsten carbide for maximum durability.
- Available in manual and hydraulically actuated configurations.
- Actuated configuration includes a pneumatic pressure-type position indicator as standard. A digital position sensor option is also available.
- DR20 provides a 1.75" orifice diameter.
- DR30 provides a 3.00" orifice diameter.

## Cameron's WILLIS MOV-Type Rotating Disc Drilling Chokes

As the original patented rotating disc-type choke, the WILLIS MOV became part of Cameron's product range in 1987, having been supplied to drilling, production, and various other applications since the 1950s. Building upon extensive field experience, Cameron offers the M3D choke for drilling services.

- Available in 3" nominal size (M3D).
- Working pressures: 10,000 psi and 15,000 psi as standard.



### Features and Benefits:

- MOV disc-type trim design features a 180-degree rotation from open to close.
- Half-moon (or D-shaped) flow area for drilling applications gives accurate control.
- Disc components are made from solid tungsten carbide for maximum durability and may also be rotated in the reverse direction, giving what amounts to a new set of controlling faces, which extends the service life.
- Highly resistant to blockage by allowing large solids to pass through.
- Precise diamond-lapped discs are within two light bands of flatness, ensuring reliable shut-off performance.
- Differential pressure across the trim provides a strong retention force between the two discs, ensuring accurate flow rate control and reducing the risk of trim vibration.
- Wiping action keeps disc surfaces clean, reducing trim wear and deterioration.
- The choke outlet spool has a replaceable outlet wear sleeve.
- Available in hydraulically and manually operated configurations.
- Actuated configuration with a pneumatic pressure-type position indicator as standard.

## Drilling Choke Control Panels

Cameron also supplies a range of drilling choke control panels to suit various choke types and configurations. The control panels are comprised of a rugged stainless steel enclosure to withstand harsh environments. They require no calibration and little to no maintenance over an extended service life.



### Features:

- Standpipe pressure gauge
- Hydraulic pressure gauge
- Actual choke position gauge(s)
- Rig air pressure gauge
- Choke manifold pressure gauge
- Manual choke control levers
- Pump stroke counter



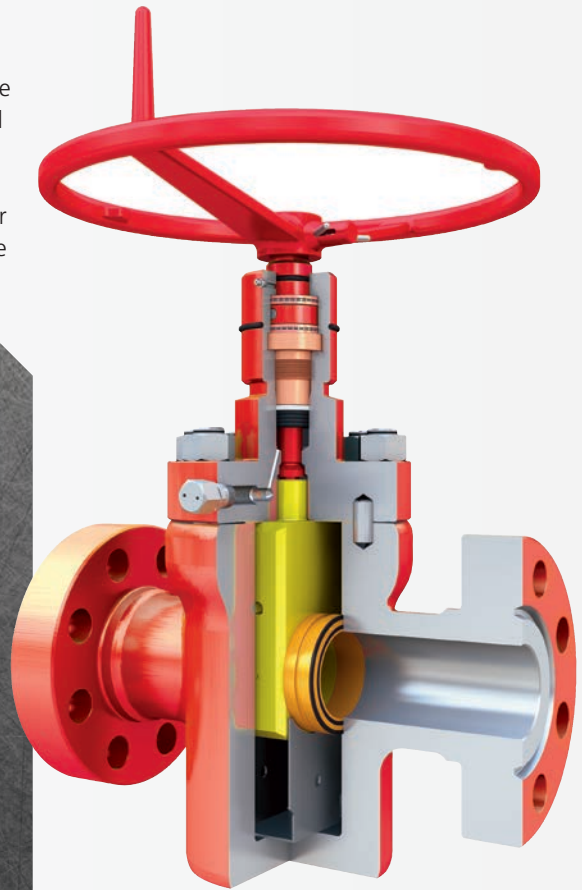
## VALVES



Cameron's gate valves are designed with experience, manufactured with painstaking attention to detail, and tested to API's and Cameron's approved quality plan. The choke and kill manifold incorporates Cameron's FLS™ and/or FLS-R™ gate valves, which are slab gate style and utilize a solid, single-piece slab gate that simplifies the design. The resulting valve is rugged, yet easy to assemble and maintain.

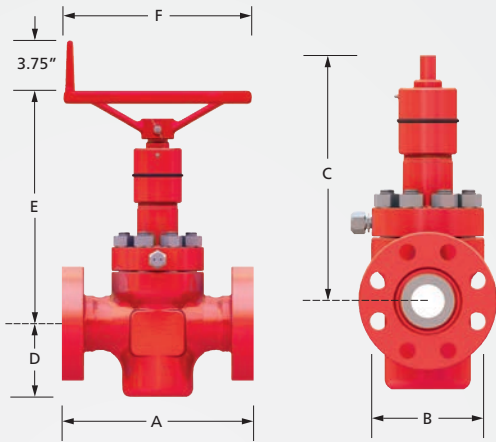
### FLS Gate Valve

Cameron's FLS gate valve is widely recognized as a high-quality valve for severe applications. The FLS is a full-bore, through-conduit valve available in standard double-flange, threaded-end, and special block body configurations. It is a forged valve available in pressure ratings from 2000 to 20,000 psi and bore sizes from 1-13/16" to 11". The FLS gate valve is Cameron's standard valve for critical requirements, including extreme sour and subsea applications. It can be fitted with a wide range of Cameron's actuators.



#### Features and Benefits:

- Bi-directional design provides flow direction versatility and increased service life.
- Includes positive metal-to-metal sealing (gate-to-seat and seat-to-body).
- Simple, reliable gate and seat designs promote ease of field service and minimal spare parts inventory.
- Two spring-loaded, pressure-energized, non-elastomeric lip seals between each seat and body, which assist in low-pressure sealing and protect against intrusion of particle contaminants into the body cavity and seal areas.
- Stem seal design covers a wide range of pressures, temperatures, and fluids encountered in wellhead and manifold service.
- Features metal-to-metal bonnet seal.
- Stem can be backseated to allow stem seal replacement with the valve under pressure.
- Grease injection fitting located downstream of stem back seat increases safety, while the fitting in bonnet helps eliminate body penetration.
- Bearing cap grease fitting allows positive bearing lubrication.
- Easy closing and sealing with reduced torque.



FLS Gate Valve – Side View

FLS Gate Valve – End View

### FLS Valve Trim Chart

API 6A Classification	Body and Bonnet Material	Stem Material	Gate Material / Coating	Seat Material / Coating
DD – Sour Service*	Alloy Steel	Alloy Steel	Alloy Steel / Hard-faced	Stainless Steel / Hard-faced
EE – Sour Service*	Alloy Steel	Stainless Steel**	Stainless Steel / Hard-faced	Stainless Steel / Hard-faced

\*As defined by NACE Standard MR0175 / ISO 15156

\*\*CRA for applications below -20° F (-29° C)

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

### FLS Operating and Dimensional Data (inches and pounds)

Nominal Size (in.)	Working Pressure (psi)	Dimensions (in)						Weight (lb)	Number of Turns
		A	B	C	D	E	F		
1-13/16	10,000	18.25	9.00	15.00	5.75	17.25	14.00	241	12-1/3
	15,000	18.00	9.50	15.00	5.88	17.38	14.00	296	12-1/3
	20,000	21.00	11.38	16.25	7.88	18.00	18.50	565	14-3/4
2-1/16	2000	11.62	6.09	13.00	5.28	14.25	10.00	95	12-1/3
	3000	14.62	7.00	15.00	5.50	17.25	14.00	169	12-1/3
	5000	14.62	7.00	15.00	5.50	17.25	14.00	169	12-1/3
	10,000	20.50	9.00	15.00	5.62	16.75	18.50	256	12-1/3
	15,000	19.00	9.62	15.12	5.88	16.88	18.50	306	12-1/3
	20,000	23.00	11.75	17.00	7.50	18.75	18.50	773	15-7/8
2-9/16	2000	13.12	7.00	13.88	6.00	15.00	10.00	138	15-1/8
	3000	16.62	7.88	15.88	6.00	18.12	14.00	232	15-1/8
	5000	16.62	7.88	15.88	6.00	18.12	14.00	232	15-1/8
	10,000	22.25	9.38	15.88	6.75	17.62	18.50	365	15-1/8
	15,000	21.00	11.25	17.25	7.75	19.00	18.50	555	15-3/4
	20,000	26.50	14.62	20.25	10.00	23.88	24.00	1188	19-1/2
3-1/8	2000	14.12	7.88	14.75	7.12	17.00	14.00	205	18-1/8
	3000	17.12	8.38	16.75	7.25	19.00	14.00	271	18-1/8
	5000	18.62	9.12	16.75	7.25	18.50	18.50	316	18-1/8
3-1/16	10,000	24.38	10.12	18.00	8.12	21.62	24.00	515	18-1/8
	15,000	23.56	13.75	18.50	9.75	22.00	24.00	895	22-7/8
4-1/8	2000	17.12	9.62	18.38	9.00	20.12	14.00	341	23-1/4
	3000	20.12	10.38	18.38	8.75	20.12	18.50	410	23-1/4
	5000	21.62	10.75	18.38	9.88	20.12	18.50	537	23-1/4
4-1/16	10,000	26.38	12.75	19.62	10.25	23.25	24.00	879	23-1/4
	15,000	29.00	14.50	32.88	11.62	34.38	24.00	1506	29-1/4
5-1/8	2000	22.12	11.00	21.25	12.62	23.00	18.50	933	27-1/2
	3000	24.12	13.00	21.25	12.75	24.75	24.00	987	27-1/2
	5000	28.62	11.50	21.25	12.62	24.75	24.00	1131	27-1/2
	10,000	29.00	14.50	23.25	13.25	26.75	24.00	1239	29
6-1/8	2000	22.12	12.38	22.75	12.88	26.25	18.00	895	33-3/4
	3000	24.12	12.62	22.75	12.88	26.38	24.00	999	33-3/4
	5000	29.00	14.12	22.75	12.88	26.38	24.00	1186	33-3/4
6-3/8	2000	22.12	12.38	22.75	12.88	26.25	18.00	895	33-3/4
	3000	24.12	12.62	22.75	12.88	26.38	24.00	999	33-3/4
	5000	29.00	14.12	22.75	12.88	26.38	24.00	1184	33-1/4
	10,000	35.00	18.00	39.25	14.62	41.25	34.00	2660	43-1/8
7-1/16	5000	32.00	17.38	37.12	14.75	39.12	28.00	2673	46-1/2
9	5000	41.00	23.12	40.62	20.00	42.62	40.00	4557	59-1/4

### FLS Operating and Dimensional Data (millimeters and kilograms)

Nominal Size (in.)	Working Pressure (psi)	Dimensions (mm)						Weight (kg)	Number of Turns
		A	B	C	D	E	F		
1-13/16	10,000	463.6	228.6	381.0	146.1	438.2	355.6	109	12-1/3
	15,000	457.2	241.3	381.0	149.4	441.5	355.6	134	12-1/3
	20,000	533.4	289.1	412.8	200.2	457.2	469.9	256	14-3/4
2-1/16	2000	295.1	154.7	330.2	134.1	362.0	254.0	43	12-1/3
	3000	371.3	177.8	381.0	139.7	438.2	355.6	77	12-1/3
	5000	371.3	177.8	381.0	139.7	438.2	355.6	77	12-1/3
	10,000	520.7	228.6	381.0	142.7	425.5	469.9	116	12-1/3
	15,000	482.6	244.3	384.0	149.4	428.8	469.9	139	12-1/3
	20,000	584.2	298.5	431.8	190.5	476.3	469.9	351	15-7/8
2-9/16	2000	333.2	177.8	352.6	152.4	381.0	254.0	63	15-1/8
	3000	422.1	200.2	403.4	152.4	460.2	355.6	105	15-1/8
	5000	422.1	200.2	403.4	152.4	460.2	355.6	105	15-1/8
	10,000	565.2	238.3	403.4	171.5	447.5	469.9	165	15-1/8
	15,000	533.4	285.8	438.2	196.9	482.6	469.9	252	15-3/4
	20,000	673.1	371.3	514.4	254.0	606.6	609.6	539	19-1/2
3-1/8	2000	358.6	200.2	374.7	180.8	431.8	355.6	93	18-1/8
	3000	434.8	212.9	425.5	184.2	482.6	355.6	123	18-1/8
	5000	472.9	231.6	425.5	184.2	469.9	469.9	143	18-1/8
3-1/16	10,000	619.3	257.0	457.2	206.2	549.1	609.6	234	18-1/8
	15,000	598.4	349.3	469.9	247.7	558.8	609.6	406	22-7/8
4-1/8	2000	434.8	244.3	466.9	228.6	511.0	355.6	155	23-1/4
	3000	511.0	263.7	466.9	222.3	511.0	469.9	186	23-1/4
	5000	549.1	273.1	466.9	251.0	511.0	469.9	243	23-1/4
4-1/16	10,000	670.1	323.9	498.3	260.4	590.6	609.6	399	23-1/4
	15,000	736.6	368.3	835.2	295.1	873.3	609.6	683	29-1/4
5-1/8	2000	561.8	279.4	539.8	320.5	542.2	469.9	423	27-1/2
	3000	612.6	330.2	539.8	323.9	628.7	609.6	447	27-1/2
	5000	726.9	292.1	539.8	320.5	628.7	609.6	513	27-1/2
	10,000	736.6	368.3	590.6	336.6	679.5	609.6	562	29
6-1/8	2000	561.8	314.5	577.9	327.2	666.8	457.2	406	33-3/4
	3000	612.6	320.5	577.9	327.2	670.1	609.6	453	33-3/4
	5000	736.6	358.6	577.9	327.2	670.1	609.6	538	33-3/4
6-3/8	2000	561.8	314.5	577.9	327.2	666.8	457.2	406	33-3/4
	3000	612.6	320.5	577.9	327.2	670.1	609.6	453	33-3/4
	5000	736.6	358.6	577.9	327.2	670.1	609.6	537	33-1/4
	10,000	889.0	457.2	997.0	371.3	1047.8	863.6	1206	43-1/8
7-1/16	5000	812.8	441.5	942.8	374.7	993.6	711.2	1212	46-1/2
9	5000	1041.4	587.2	1031.7	508.0	1082.5	1016.0	2066	59-1/4

Additional sizes and pressures are available upon request.

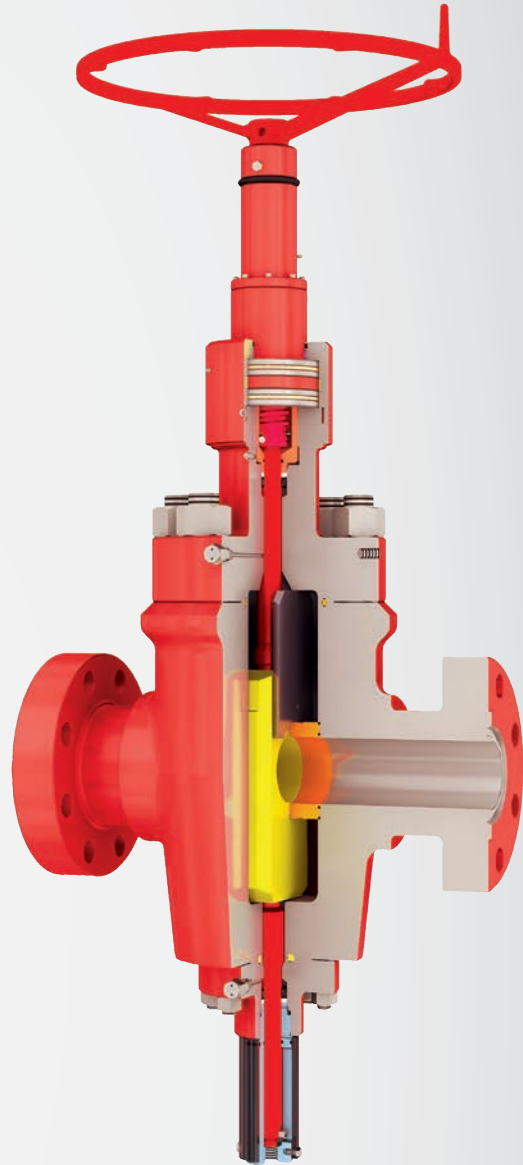


## FLS-R Gate Valve

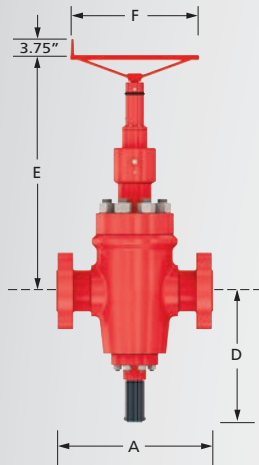
Cameron's FLS-R gate valve was designed for use as a manual valve in large-bore applications with pressure ratings up to 30,000 psi. This valve incorporates a lower balancing stem and unique ball-screw mechanism for ease of operation in the field. The FLS-R valve is value-engineered for reliability, low torque, and ease of operation and service. The FLS-R valve has many of the same features as the FLS version including the gate and seat design.

### Features and Benefits:

- Bi-directional design provides flow direction versatility and increased service life.
- Includes positive metal-to-metal sealing (gate-to-seat and seat-to-body).
- Simple, reliable gate and seat designs promote ease of field service and minimal spare parts inventory.
- Two spring-loaded, pressure-energized, non-elastomeric lip seals between each seat and body assist in low-pressure sealing and protect against intrusion of particle contaminants into the body cavity and seal areas.
- Lower stem balances pressure thrust on upper stem to reduce operating torque, prevents body cavity pressure buildup during operation, and provides position indication.
- Spring-loaded, pressure-energized, non-elastomeric stem seal covers a wide range of pressures, temperatures, and fluids.
- Features pressure-energized metal-to-metal bonnet seal.
- Either stem can be backseated to allow stem seal replacement with valve under pressure.
- Grease injection fittings are located on the downstream side of the stem and the balancing stem back seat for safety.







FLS-R Gate Valve – Side View

### FLS-R Operating and Dimensional Data (inches and pounds)

Nominal Size (in.)	Working Pressure (psi)	Dimensions (in.)						Weight (lb)	Number of Turns
		FLG	B	C	D	E	F		
1-13/16	30,000	26.00	13.50	33.50	22.50	37.12	24.00	1477	13-1/2
2-9/16	30,000	31.00	15.38	35.88	25.00	37.88	28.00	2073	15
3-1/16	20,000	30.50	16.00	32.00	19.25	35.75	24.00	2178	15-3/4
4-1/16	15,000	29.00	15.88	39.75	24.88	41.12	24.00	1592	19
	20,000	35.50	18.75	38.25	23.50	40.25	34.00	3447	21
5-1/8	10,000	29.00	15.94	40.44	27.12	41.75	24.00	1575	23-1/4
	15,000	35.00	17.75	40.50	24.62	42.50	28.00	3198	24
6-3/8	10,000	35.00	18.00	45.75	32.62	47.75	34.00	2699	28-3/4
	15,000	41.00	23.88	59.50	33.75	61.50	40.00	7024	15-1/4
7-1/16	10,000	35.00	18.88	47.62	29.50	49.62	34.00	3619	31
	15,000	41.00	24.00	60.38	35.00	62.38	40.00	7017	16-5/8
9	5000	41.00	23.00	53.12	33.50	55.12	28.00	4526	38-1/4

Additional sizes and working pressures are available upon request.



FLS-R Gate Valve – End View

### FLS-R Operating and Dimensional Data (millimeters and kilograms)

Nominal Size (in.)	Working Pressure (psi)	Dimensions (mm)						Weight (kg)	Number of Turns
		FLG	B	C	D	E	F		
1-13/16	30,000	660.4	342.9	850.9	571.5	942.8	609.6	670	13-1/2
2-9/16	30,000	787.4	390.7	911.4	635.0	962.2	711.2	940	15
3-1/16	20,000	774.7	406.4	812.8	489.0	908.1	609.6	988	15-3/4
4-1/16	15,000	736.6	403.4	1009.7	632.0	1044.4	609.6	722	19
	20,000	901.7	476.3	971.6	596.9	1022.4	863.6	1563	21
5-1/8	10,000	736.6	404.9	1027.2	688.8	1060.5	609.6	714	23-1/4
	15,000	889.0	450.9	1028.7	625.3	1079.5	711.2	1450	24
6-3/8	10,000	889.0	457.2	1162.1	828.5	1212.9	863.6	1224	28-3/4
	15,000	1041.4	606.6	1511.3	857.3	1562.1	1016.0	3185	15-1/4
7-1/16	10,000	889.0	479.6	1209.5	749.3	1260.3	863.6	1641	31
	15,000	1041.4	609.6	1533.7	889.0	1584.5	1016.0	3182	16-5/8
9	5000	1041.4	584.2	1349.2	850.9	1400.0	711.2	2053	38-1/4

Additional sizes and working pressures are available upon request.

### FLS-R Valve Trim Chart

API 6A Classification	Body and Bonnet Material	Stem Material	Gate Material/Coating	Seat Material/Coating
DD – Sour Service*	Alloy Steel	CRA or Stainless Steel	Alloy Steel / Hard-faced	Stainless Steel / Hard-faced
EE – Sour Service*	Alloy Steel	CRA or Stainless Steel	Stainless Steel / Hard-faced	Stainless Steel / Hard-faced

\*As defined by NACE Standard MR0175 / ISO 15156.

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

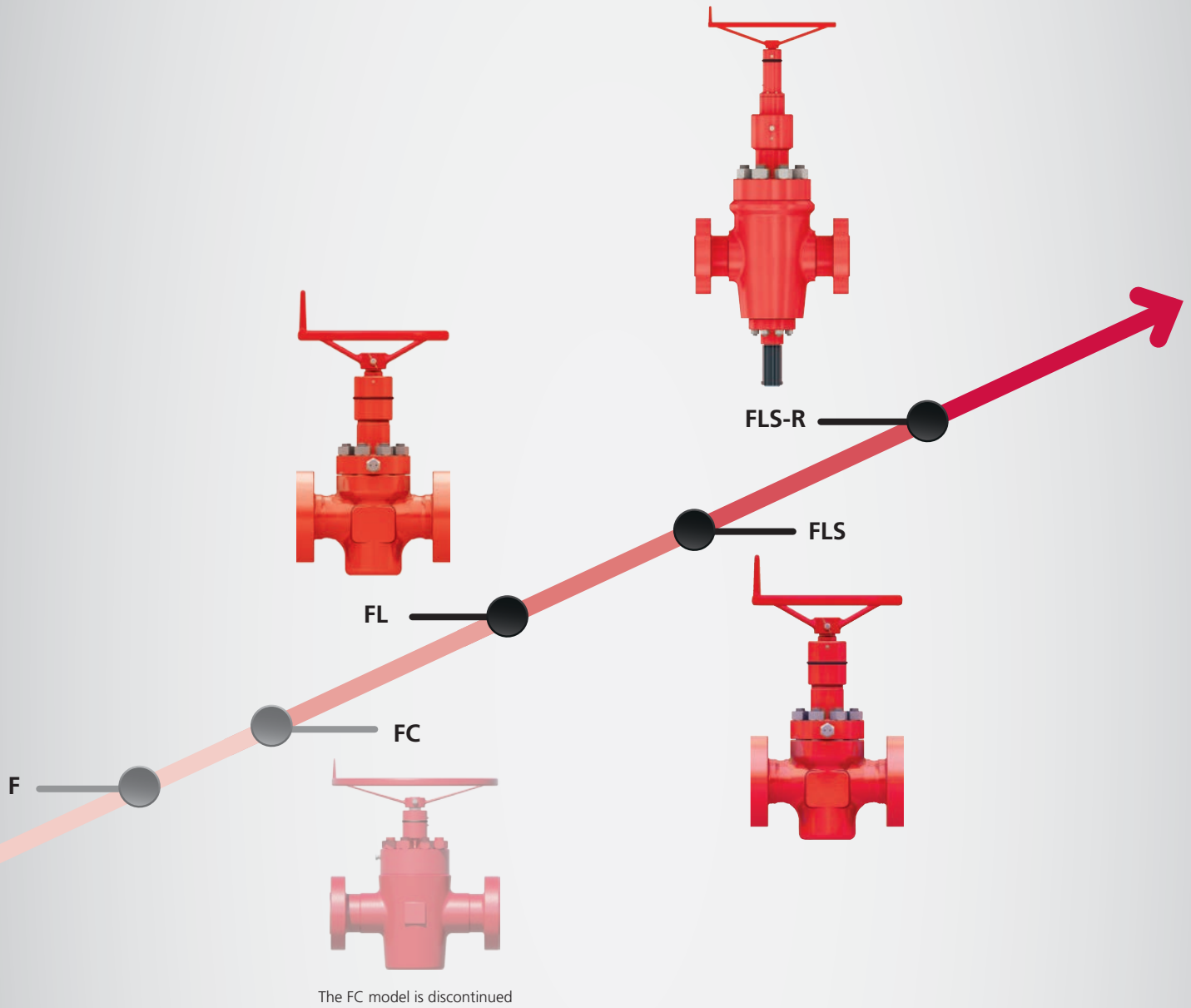
## FC Style Gate Valve vs. FLS/FLS-R Gate Valve

With a commitment to innovation and best-in-class products, Cameron's FLS and FLS-R gate valves improve upon the older FC-style design with a more efficient design that reduces leak paths. Because of the separate body brushing and seat ring seals, the FC-style gate valve design has more sealing surfaces than the FLS and FLS-R gate valves, which means more potential leak paths. The newer FLS and FLS-R one-piece seat design, with fewer parts and fewer sealing surfaces, increases service life and decreases the number of leak paths. Their dual spring-loaded, pressure energized, non-elastomeric lip-seals between the body and seat protect from damage and assist in sealing to offer reliable service.

Features	FC Style	FLS and FLS-R	FLS and FLS-R Design Benefits
Seat Design	Two-piece	One-piece	<ul style="list-style-type: none"> <li>• Simplified design with fewer bushings, seal rings and seal interfaces</li> <li>• Minimizes possible leak locations</li> <li>• Protects seat, gate and body from damage</li> </ul>
Number of Sealing Surfaces	6	4	<ul style="list-style-type: none"> <li>• Eliminates seat to body bushing leak path</li> </ul>
Seat Seals	Separate body bushing and seat ring seals	Dual spring-loaded, pressure energized, non-elastomeric lip-seals between seat and body	<ul style="list-style-type: none"> <li>• Protects from damage</li> <li>• Assists in quality low pressure sealing</li> </ul>
Stem Seal	Elastomer with Teflon® shell as standard	Non-elastomer stem seal as standard	<ul style="list-style-type: none"> <li>• Enhanced environmental protection</li> <li>• Longer life</li> </ul>
Valve Assembly	ACME thread gate movement Gate guides and body bushings	Acme thread gate movement (FLS only) Eliminated gate guides More efficient one-piece seat reduces leak paths FLS-R: <ul style="list-style-type: none"> <li>• Ball screw design</li> <li>• Balancing stem</li> </ul>	<ul style="list-style-type: none"> <li>• Gate floats with less restriction</li> <li>• Fewer leak paths</li> </ul> FLS-R: <ul style="list-style-type: none"> <li>• Reduced thread friction</li> <li>• Reduced torque</li> <li>• Balanced body cavity</li> <li>• Position indication</li> </ul>



## Gate Valve Design Timeline



Cameron offers an array of manifolds for various applications, including standpipe manifolds and cement manifolds. Contact your Cameron representative for more information.

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Houston, TX 77041  
USA  
Tel 713 939 2211

11327 Tanner Rd.  
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USA  
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Edmonton, Alberta T6E 5S9  
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Tel 780 434 3476  
Toll free 1 800 315 7215

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Aghafad  
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Learn more about Cameron's choke and kill manifold systems at:  
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#### **HSE Policy Statement**

At Cameron, we are committed ethically, financially and personally to a working environment where no one gets hurt and nothing gets harmed.