

GENERAL VALVE Four-way Diverter Valve

TECHNOLOGY



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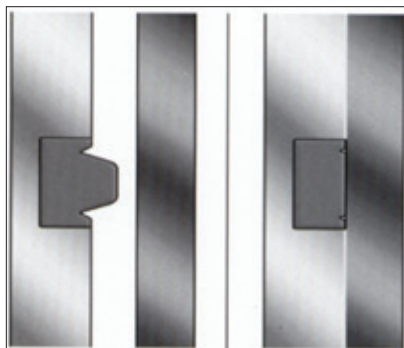
GENERAL VALVE FOUR-WAY DIVERTER VALVE

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GENERAL VALVE Four-way Diverter Valve

FEATURES AND BENEFITS

Cameron's GENERAL VALVE® Four-way Diverter Valve does not rely on line pressure or external hydraulic pressure for positive sealing. The seating elements, or slips, move perpendicularly against the face of the ports. The seals themselves are highly resilient elastomers which are either bonded or mechanically retained in the slips. Retraction of the slips, away from the body prior to cycling, prevents friction and abrasion, which can damage seals. There is never any sliding or rubbing of the seals against the valve body or ports. Metal-to-metal secondary seating prevents over-compression of the resilient primary seal. Mechanical retraction and compression ensures no-leak stream separation and longer life.



Resilient seal
before compression

Resilient seal
after compression

In-line Maintenance



In-line maintenance cuts operating and downtime costs. Because the seating segments are mounted via dovetailed connections to the plug, they can be removed from the top or the bottom and examined without having to take the

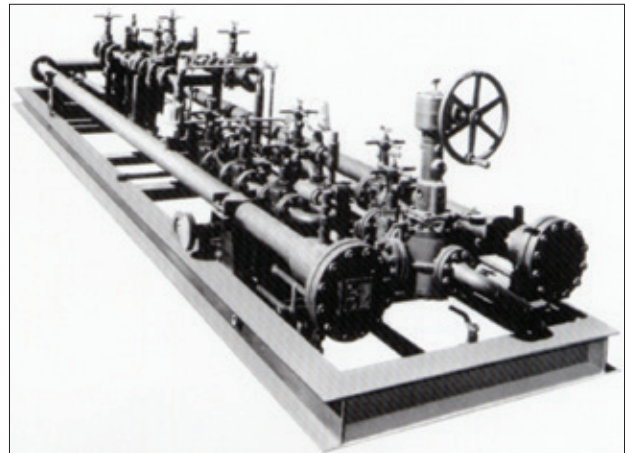
valve from the line or disturbing the actuator. This added flexibility allows the valve to be installed upside-down for easy access to actuator and slips.

Fast-cycling

Fast and easy operation by hand or automatically with electric motor or hydraulic actuators is possible. Lower cycling torque permits use of smaller and less expensive power actuators.

The standard gear-operated four-way diverter valve is not self locking, therefore it is recommended that all manually operated four-way diverter valves be equipped with a latching device to maintain seating position when the valve is unattended.

This item is available as an option (see page 8). When sold as a motor adapted valve, be sure to select only self-locking actuators.

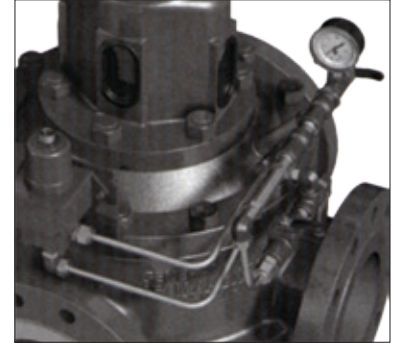


Automatic Pressure Gauge

The automatic pressure gauge is used for quick check of seal integrity. The four-way diverter valve uses the reliable pressure gauge method of checking for positive sealing to ensure metering accuracy. The gauge automatically indicates seal condition each time the valve is seated during proving, even in low-differential operating conditions.

The pressure gauge connects to the body cavity between the valve slips. As the slips expand in the diverted position, the resilient seals contact the valve body, trapping the fluid between them. Further expansion of the slips during valve seating compresses the seals further. The resulting increase in volumetric space between the slips, without an increase in the amount of fluid, will cause a drop in pressure.

Any leakage through either seal permits additional fluid to enter the body cavity, causing an immediate increase in cavity pressure back to line pressure. Even the most minimal fluid leak will register on the gauge immediately.



A pressure switch can be used to supplement the gauge method as an option (see page 9).

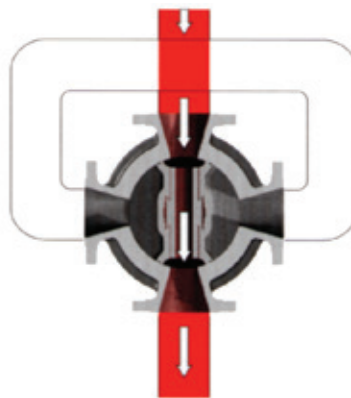
Continuous Flow Circulation Maintained Through Cycling



Seated in "R/L-Close - CCW" Position

Here, the valve is seated and the flow streams are completely separated. Pressure gauge in the body indicates reduced pressure.

As the valve is unseated, the plug is raised and both slips are retracted, causing the plug and slips to begin to turn. Then the slips and resilient seals are fully retracted away from the body. The pressure gauge indicates line pressure.



Neutral - Fully Unseated Position

At this point in the cycle, the hole through the plug allows the flow to pass directly from the inlet port to the outlet port. Both the slips and the plug are designed so that the flow is not appreciably restricted when cycling. The pressure gauge indicates line pressure.



Seated in "L/R-Open - CW" Position

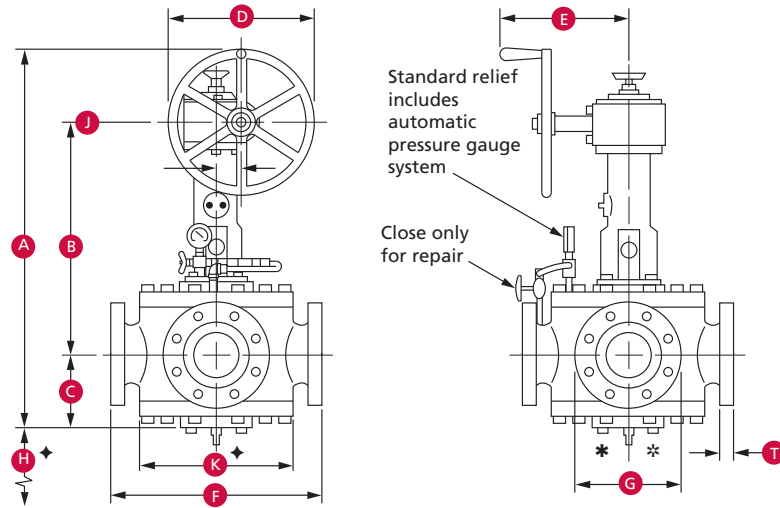
The plug and slips are in a fully rotated position. The plug moves down, expanding the slips against the body. Here, the flow streams are completely separated. As the seals trap fluid between them, and volumetric space increases, the body pressure gauge once again indicates less than line pressure.

Note: Valve position is quickly identified with a top-mounted flag. Position-indicator switches are available for remote locations (see page 8).

Types of Operation

GEAR OPERATED

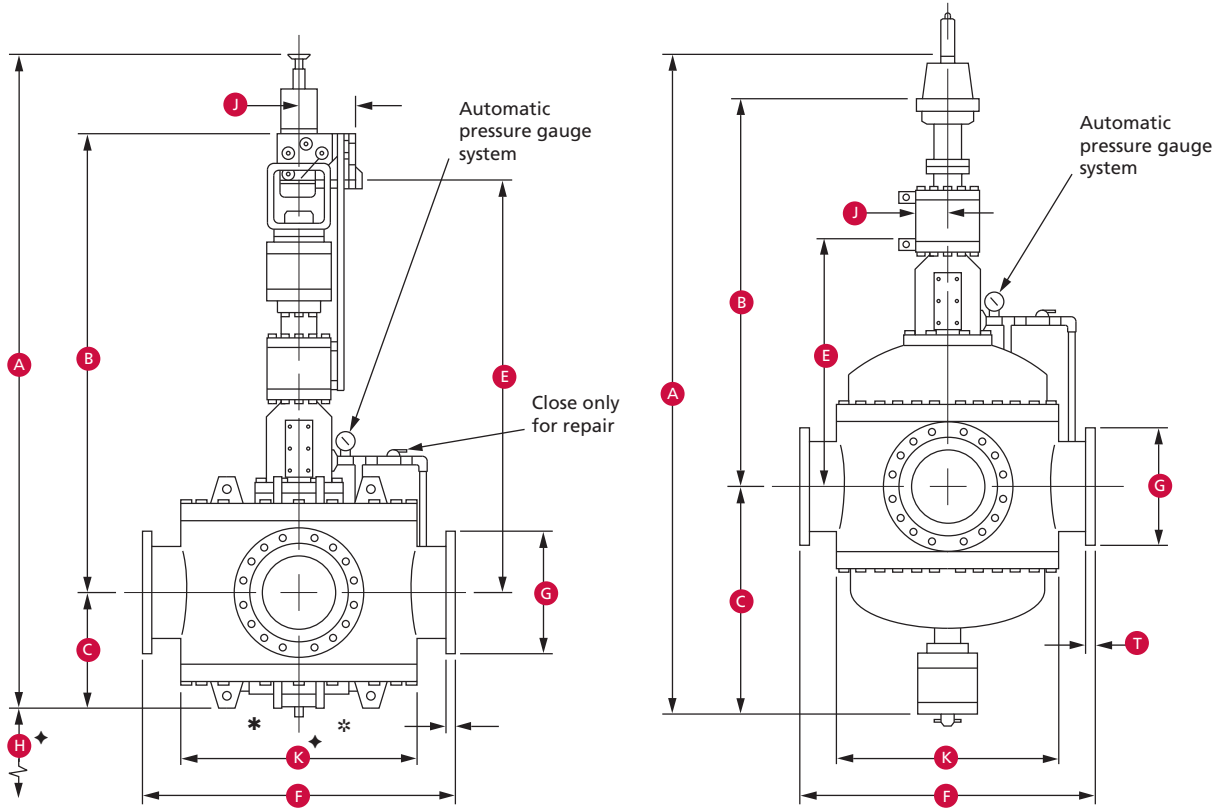
- * This bleed valve allows for a pressure-balanced plug condition and must remain open.
- * NPT drain provided.
- ◆ H and K are minimum clearance required to replace slips.



Dimensions

ASME Class	Size in. (mm)	Valve Model	Four-way Op.	A	B	C	D	E	F	G	H	J	K	T	Weight lb (kg)
150	12 (300)	B4711	1251	59-1/2 (1511)	37 (940)	15 (381)	20 (508)	14-1/4 (362)	44 (1118)	19 (483)	11 (279)	5 (127)	25 (635)	1-5/16 (33)	2800 (1270)
	12 (300)	CA4711	1277	84-1/2 (2146)	48-1/2 (1232)	20 (508)	32 (813)	16-1/4 (413)	42 (1067)	19 (483)	13 (330)	9 (229)	35-1/2 (902)	1-15/16 (49)	6200 (2812)
	16 (400)	B4711	1500	89-1/2 (2273)	61-1/2 (1562)	18-1/2 (470)	32 (813)	16 (406)	60 (1524)	23-1/2 (597)	22 (559)	9 (229)	35 (889)	1-7/16 (37)	7000 (3175)
300	2 (50)	C4721	625	35-1/2 (902)	22 (559)	6 (152)	14 (356)	12-1/2 (318)	14 (356)	6-1/2 (165)	5 (127)	3 (76)	11 (279)	15-1/16 (24)	335 (152)
	3 (80)	C4721	625	35-1/2 (902)	22 (559)	6 (152)	14 (356)	12-1/2 (318)	15 (381)	8-1/4 (210)	5 (127)	3 (76)	11 (279)	1-3/16 (30)	350 (159)
	4 (100)	C4721	325	37 (940)	23 (584)	7 (178)	14 (356)	12-1/2 (318)	20 (508)	10 (254)	7 (178)	3 (76)	15-1/2 (394)	1-5/16 (49)	650 (295)
	6 (150)	C4721	750	47 (1194)	28 (711)	9 (229)	20 (508)	12-1/2 (318)	24 (610)	12-1/2 (318)	9-1/2 (241)	3-1/2 (89)	18-1/2 (470)	1-7/16 (37)	1050 (476)
	8 (200)	C4721	1251	54 (1372)	34-1/2 (876)	9-1/2 (241)	20 (508)	14-1/2 (368)	28 (711)	15 (381)	10 (254)	5 (127)	22 (559)	1-11/16 (43)	1700 (771)
	10 (250)	C4721	1251	57 (1448)	35-1/2 (902)	11 (279)	20 (508)	14-1/2 (368)	32 (813)	17-1/2 (445)	12 (305)	5 (127)	25-1/2 (648)	1-15/16 (49)	2490 (1129)
	12 (300)	B4721	1251	59-1/2 (1511)	37 (940)	15 (381)	20 (508)	14-1/4 (362)	44 (1118)	20-1/2 (521)	11 (279)	5 (127)	25 (635)	2-1/16 (52)	3000 (1361)
	12 (300)	CA4721	1277	84-1/2 (2146)	48-1/2 (1232)	20 (508)	32 (813)	16-1/4 (413)	42 (1067)	20-1/2 (521)	13 (330)	9 (229)	35-1/2 (902)	2-1/16 (52)	6500 (2948)
	16 (400)	B4721	1500	89-1/2 (2273)	61 (1549)	18-1/2 (470)	32 (813)	16 (406)	60 (1524)	25-1/2 (648)	22 (559)	9 (229)	35 (889)	2-1/4 (57)	7500 (3402)
	600	2 (50)	C4741	625	35 (889)	22 (559)	6 (152)	14 (356)	12-1/2 (318)	14-1/2 (368)	6-1/2 (165)	5 (127)	3 (76)	11 (279)	1 (25)
3 (80)		C4741	625	35 (889)	22 (559)	6 (152)	14 (356)	12-1/2 (318)	15-3/4 (400)	8-1/4 (210)	5 (127)	3 (76)	11 (279)	1-1/4 (32)	360 (163)
4 (100)		C4741	750	44-1/2 (1130)	27 (686)	7-1/2 (191)	20 (508)	12-1/2 (318)	20-7/8 (530)	10-3/4 (273)	8 (203)	3-1/2 (89)	15-1/2 (394)	1-1/2 (38)	810 (367)
6 (150)		C4741	1251	53 (1346)	34 (864)	9 (229)	20 (508)	14-1/2 (368)	25-3/8 (645)	14 (356)	10 (254)	5 (127)	18-1/2 (470)	1-7/8 (48)	1460 (662)
8 (200)		C4741	1251	54 (1372)	34-1/2 (876)	9-1/2 (241)	20 (508)	14-1/2 (368)	29-5/8 (753)	16-1/2 (419)	10 (254)	5 (127)	22 (559)	2-3/16 (56)	2010 (912)
10 (250)		C4741	1251	56-1/2 (1435)	35-1/2 (902)	11 (279)	20 (508)	14-1/2 (368)	33-5/8 (854)	20 (508)	12 (305)	5 (127)	25-1/2 (648)	2-1/2 (64)	2850 (1293)
12 (300)		CA4741	1277	82-5/8 (2099)	50 (1270)	24 (610)	32 (813)	16-1/2 (419)	48 (1219)	22 (559)	10 (254)	9 (229)	36-1/4 (921)	2-5/8 (67)	8875 (4026)
900	3 (80)	C4751	625	34-1/16 (865)	21-11/16 (551)	5-3/8 (137)	14 (356)	12-1/2 (318)	12 (305)	-	5 (127)	3 (76)	10-3/8 (264)	-	510 (231)
	4 (100)	C4751	750	44 (1118)	27 (686)	7 (178)	20 (508)	12-1/2 (318)	21-1/2 (546)	11-1/2 (292)	7-1/2 (191)	3-1/2 (89)	16 (406)	1-13/16 (46)	1050 (476)
	6 (150)	C4751	1251	53 (1346)	34 (864)	9 (229)	20 (508)	14 (356)	28 (711)	15 (381)	9 (229)	5 (127)	18-1/2 (470)	2-1/4 (57)	1700 (771)
	8 (200)	C4751	1251	55-1/2 (1410)	35 (889)	10-1/2 (267)	20 (508)	14 (356)	32 (813)	18-1/2 (470)	10 (254)	5 (127)	23 (584)	2-9/16 (65)	2250 (1021)
	10 (250)	C4751	1277	74-1/2 (1892)	46-1/2 (1181)	12 (305)	32 (813)	16-1/2 (419)	37 (940)	21-1/2 (546)	12 (305)	9 (229)	27 (686)	2-3/4 (70)	3500 (1588)

HYDRAULIC OPERATED



- * This bleed valve allows for a pressure-balanced plug condition and must remain open.
- * NPT drain provided.
- ◆ H and K are minimum clearance required to replace slips.

Dimensions

ASME Class	Size in. (mm)	Valve Model	Four-way Op.	A	B	C	E	F	G	H	J	K	T	Weight lb (kg)
150	12 (300)	CA4711	4W-110A	114-3/8 (2905)	80-3/16 (2037)	20 (508)	66-1/2 (1689)	42 (1067)	19 (483)	13 (330)	8 (203)	34-1/4 (870)	1-15/16 (49)	7500 (3402)
	16 (400)	B4711	4W-110A	114-1/2 (2908)	61 (1549)	18-1/2 (470)	50 (1270)	60 (1524)	23-1/2 (597)	22 (559)	8 (203)	35 (889)	1-1/2 (38)	8500 (3856)
	20 (500)	C4711	4W-110A-20	134 (3404)	88-11/16 (2253)	29-1/2 (749)	75 (1905)	62 (1575)	27-1/2 (699)	20 (508)	8 (203)	50-5/8 (1286)	1-3/4 (44)	13,000 (5897)
300	12 (300)	CA4721	4W-110A	114-3/8 (2905)	80-3/16 (2037)	20 (508)	66-1/2 (1689)	42 (1067)	20-1/2 (521)	13 (330)	8 (203)	34-1/4 (870)	2-1/16 (52)	7800 (3538)
	16 (400)	B4721	4W-110A	114-1/2 (2908)	61 (1549)	18-1/2 (470)	50 (1270)	60 (1524)	25-1/2 (648)	22 (559)	8 (203)	35 (889)	2-5/16 (59)	8800 (3992)
	20 (500)	C4721	4W-110A-20	134 (3404)	88-11/16 (2253)	29-1/2 (749)	75 (1905)	32 (813)	30-1/2 (775)	20 (508)	8 (203)	50-5/8 (1286)	2-9/16 (65)	15,150 (6872)
600	12 (300)	CA4741	4W-110A	115 (2921)	75 (1905)	20 (508)	65 (1651)	48 (1219)	24 (610)	10 (254)	8 (203)	36-1/2 (927)	2-5/8 (67)	11,000 (4990)
900	10 (250)	C4751	4W-110A	104 (2642)	77-7/8 (1978)	12 (305)	64-3/16 (1630)	37 (940)	21-1/2 (546)	12 (305)	8 (203)	26 (660)	2-3/4 (70)	3500 (1588)

Note: See page 11 for performance data.

Actuators

HYDRAULIC ACTUATOR HGO

The four-way diverter valve can be supplied with hydraulically powered gear operators.

Cameron's GENERAL VALVE hydraulic gear operator (HGO) is custom designed and engineered to improve reliability while reducing installation and maintenance costs.

All actuating components are contained in a rugged, compact, explosion-proof module designed to withstand rough handling and hostile environments. The system operates efficiently and quietly and can be installed or retrofitted on any existing gear-operated four-way diverter valve.

The self-locking HGO can operate at speeds of up to 900 rpm. See page 10 for performance data.



HYDRAULIC POWER SUPPLIES HPU

Electric or air-driven power supplies are specifically designed and manufactured to power hydraulic actuators.

Using standard components as building blocks, the power supplies satisfy a wide range of operating parameters, both reliably and economically.

Standard Hydraulic Features

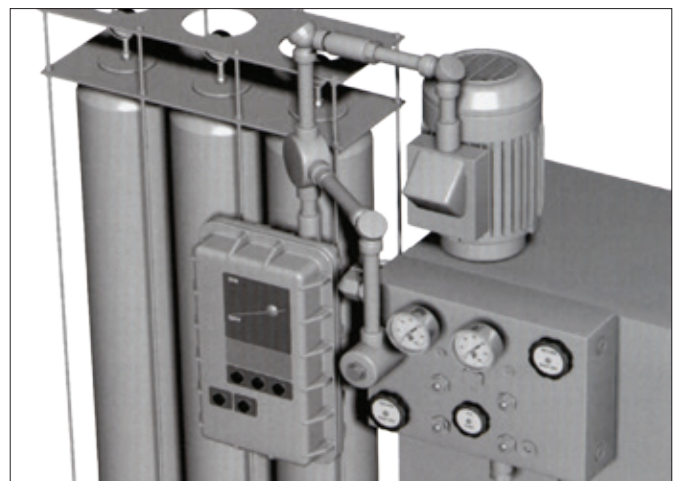
Each hydraulic power unit (HPU) supply features an integrated hydraulic control module composed of cartridge-type components, many of which are interchangeable.

This safe, easy-to-maintain module reduces exposed piping joints and costly parts inventory.

Standard Electric Features

- Explosion-proof motor and the motor control panel both are UL-approved for hazardous location
- Low fluid level shut-off switch
- Off/auto pressure switch

Having the ability to provide valve, actuator and power supply enhances the dependability of our equipment and improves your engineering, procurement and service.



ELECTRIC MOTOR ACTUATOR

When ordering electric motor operators, specify the following data:

Installation

1. Mounting style
2. Valve installation orientation

Type of Valve

3. Valve figure number
4. Size
5. ASME rating

Operating Conditions

6. Flow rate
7. Operating time in seconds
(See page 10 for fast self-locking time)

Electrical Data

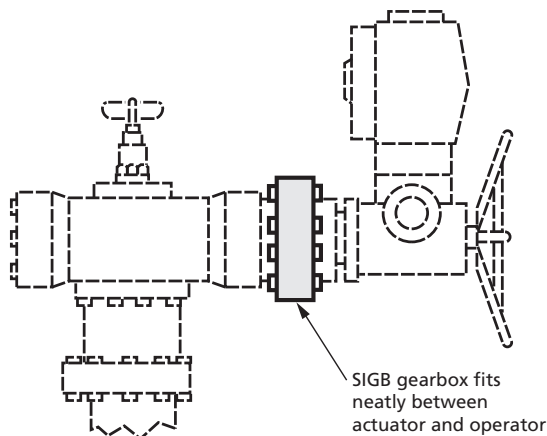
8. Hazardous area enclosure requirement
9. Power voltage, phase and frequency



HIGH-SPEED ELECTRIC MOTOR ACTUATOR

Typical self-locking electric motor-operated valve speeds are limited. Therefore, by reducing the number of turns required with the speed increasing gearbox (SIGB), we can significantly decrease actuation time.

Note: Torque requirements increase proportionately.

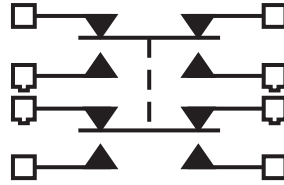


Note: See page 10 for performance data.



REMOTE ELECTRICAL POSITION INDICATORS GOSP

Cameron's gear-operated switch package (GOSP) is designed to perform reliably in the toughest environments.



All electrical components are contained in one housing with no external wiring, and the housing is explosion-proof for use in hazardous locations.

The standard switching arrangement is one switch in each position, fully open and fully closed. Each switch is DPDT-DB (form ZZ). Current capability is 10 amps resistive, 7 amps inductive. Also standard is a space heater to prevent buildup of condensation. Please provide us with your required voltage (standard voltage is 110 V).



MANUAL GEAR-OPERATED LATCHING DEVICE

The standard gear-operated four-way diverter valve is not self-locking, therefore it is recommended that all manually operated four-way diverter valves be equipped with a latching device to maintain seating position when the valve is unattended.

This item is available as an option. The device uses a reversible latching pawl, which can be dented in mid-position to allow free handwheel spin. At the end of operation, simply release the pawl to latch the valve in either seated position.



PORTABLE PROVER ACTUATORS DCGO

Cameron's 12-V direct current gear operator (DCGO) is ideal for repeatable proves with portable meter provers. It has no belts, so there is no bounce-back.

The DCGO is battery-powered. The actuator and control systems are available with an optional power pack.

The DCGO is designed to be mounted on 2" through 6" ASME 300/600/900 four-way diverter valve gear operators and to operate the four-way diverter valve with DC power. DCGOs are capable of self-locking speeds in excess of 500 rpm. See page 11 for performance data.

Having the ability to provide the valve, actuator and power pack enhances the dependability of our equipment and simplifies your engineering procurement and service.

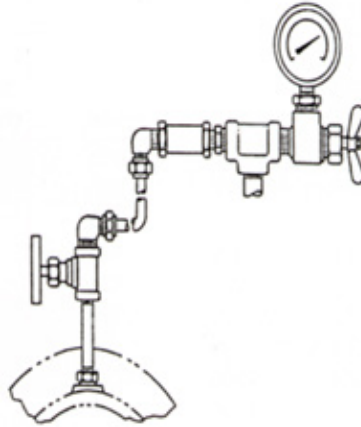


Seal Integrity

TWO METHODS OF CHECKING FOR SEAL INTEGRITY

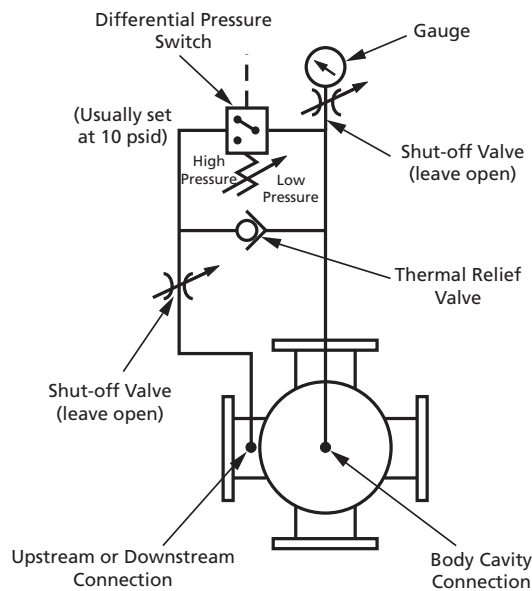
1) Local Monitoring Method with Automatic Pressure Gauge

The four-way diverter valve uses the pressure gauge method of checking for positive sealing to ensure metering accuracy. This method is useful when in close proximity to the valve, which is described fully in the beginning of this brochure. (See page 3 for details.)



2) Remote Monitoring Method with Differential Pressure Switch

A differential pressure switch can be added, which provides the user with the ability to monitor the body cavity pressure from a remote location and/or interface with other electrical devices.



Notes:

1. Shut-off valves are provided for repair only and must remain open during normal operation.
2. Thermal relief valve will allow pressure trapped in the body cavity to be relieved to line, should there be an increase in pressure above line pressure.
3. For satisfactory valve operation, the line operating conditions must remain constant during seal integrity check.
4. Do not attempt to verify seal integrity by bleeding body cavity pressure to atmosphere.
5. Cavity pressure need not drop to zero while seated.
6. Dissimilar pressure drop can be expected in each seated position.



Technical Data

Size in. (mm)	VALVE		Max Flow (GPM)	Pressure Drop at Max Flow (psig)(1)(2)	C _v (1)	GEAR OPERATED (3)						
	Model	ASME Rating				Model	Torque (ft-lb)	Total Turns (rev)	Turn Distribution (rev)			
									Close	Divert	Open	
2 (50)	C4721	300	550	2.8	300	625	20	9	3.5	2.0	3.5	
	C4741	600	550	2.8	300	625	30	9	3.5	2.0	3.5	
3 (80)	C4721	300	550	2.8	300	625	30	9	3.5	2.0	3.5	
	C4741G	600	550	2.8	300	625	30	9	3.5	2.0	3.5	
	C4751	900	550	2.8	300	625	30	9	3.5	2.0	3.5	
4 (100)	C4721	300	1000	2.4	600	625	55	11	4.5	2.0	4.5	
	C4741	600	1000	2.4	600	750	55	14	5.5	2.5	5.5	
	C4751	900	1000	2.4	600	750	55	14	5.5	2.5	5.5	
6 (150)	C4721	300	2300	3.1	1200	750	70	15	3.6	2.5	6.3	
	C4741	600	2300	3.1	1200	1251	60	18	8.3	3.4	5.6	
	C4751	900	2300	2.7	1300	1521	60	18	8.3	3.4	5.6	
8 (200)	C4721	300	4000	3.1	2100	1251	100	21	10.4	3.4	7.0	
	24741	600	4000	3.1	2100	1251	100	21	10.4	3.4	7.0	
	C4751	900	4000	2.8	2200	1521	100	23	11.5	3.4	7.8	
10 (250)	C4721	300	6200	2.1	3900	1251	160	24	12.2	3.4	8.2	
	C4741	600	6200	2.1	3900	1251	160	24	12.2	3.4	8.2	
	C4751	900	6200	2.1	3900	1277	299	37	18.9	5.3	12.7	
12 (300)	B4711	150	6400	1.9	4300	1251	190	22	10.7	3.4	7.2	
	B4721	300	6400	1.9	4300	1251	190	22	10.7	3.4	7.2	
	CA4711	150	7100	1.5	5300	1277	200	40	20.6	5.3	13.8	
	CA4721	300	7100	1.5	5300	1277	200	40	20.6	5.3	13.8	
	CA4741	600	7100	1.5	5300	1277	200	40	20.6	5.3	13.8	
16 (400)	B4711	150	10,000	1.6	7300	1500	240	36	18.1	5.3	12.1	
	B4721	300	10,000	1.6	7300	1500	240	36	18.1	5.3	12.1	
						ELECTROHYDRAULIC OPERATED (4)						
						Model	Pressure (psd)	Volume (gal)	Total Time (sec)	Time Distribution (sec)		
										Close	Divert	Open
10 (250)	C4751	900	6800	2.6	3900	4W-110A	800	1.6	5	1	3	1
12 (300)	CA4711	150	8800	2.3	5300	4W-110A	800	1.6	6	1	4	1
	CA4721	300	8800	2.3	5300	4W-110A	800	1.6	6	1	4	1
	CA4741	600	8800	2.3	5300	4W-110A	800	1.6	6	1	4	1
16 (400)	B4711	150	13,000	2.7	7300	4W-110A	900	1.8	8	1	6	1
	B4721	300	13,000	2.7	7300	4W-110A	900	1.81	8	1	6	1
	C4741	600	15,000	3.7	7200	4W-110A	1200	0.9	10	1.5	7	1.5
20 (500)	C4711	150	17,800	2.0	11,500	4W-110A-20	1700	2.2	12	2	8	2
	C4721	300	17,800	2.0	11,500	4W-110A-20	1700	2.2	12	2	8	2

$$V = \frac{Q \times .4}{D^2} = \text{Approximate velocity} \left[\frac{\text{ft}}{\text{sec}} \right]$$

$$\Delta P = \left[\frac{Q}{C_v} \right]^2 \times S = \text{Pressure drop across one side of valve}$$

Q = Flow GPM

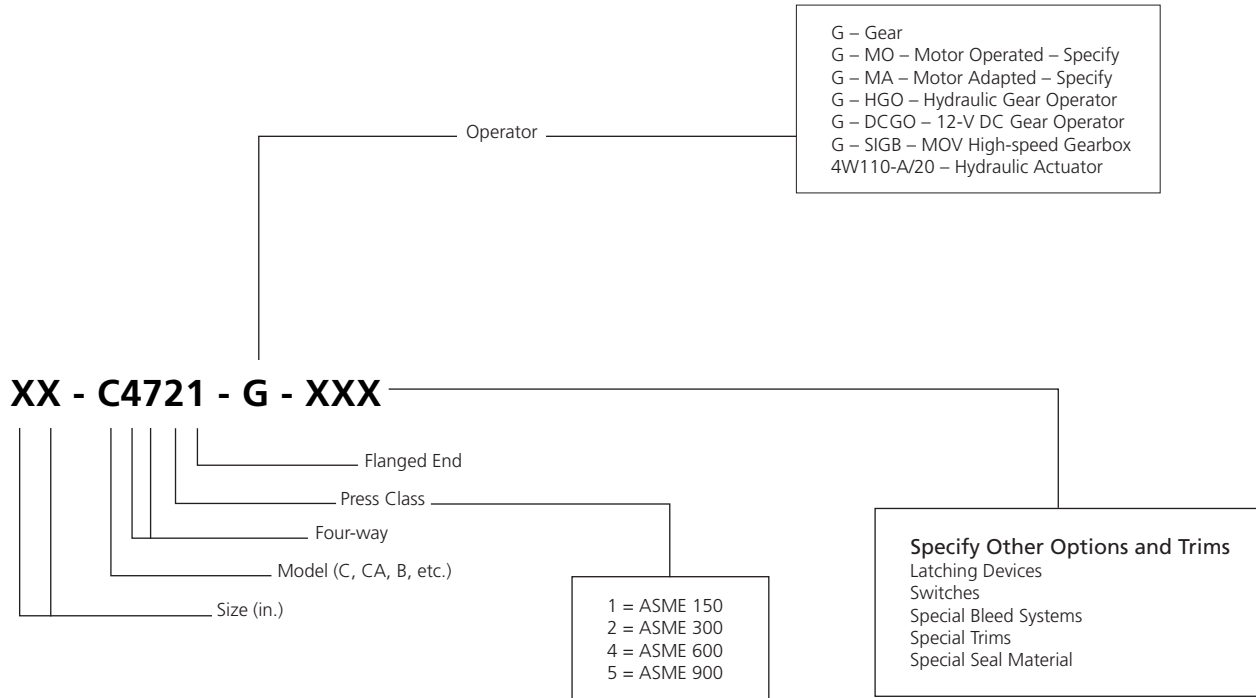
C_v = Valve flow coefficient

S = Specific gravity

D = Nominal pipe diameter (in.)

- Note:
- (1) Through one side of valve.
 - (2) Values indicated are with 0.85 sq. qr. crude oil.
 - (3) See page 4 for dimensions.
 - (4) See page 5 for dimensions.

How to Order



Standard Materials

Body	Cast Carbon Steel ASTM A216-WCB Chrome-plated
Bonnet/Lower Plate	Cast Carbon Steel ASTM A216-WCB, or Carbon Steel ASTM A36/A516 Grd 70 Plate
Plug	Cast Carbon Steel ASTM A216-WCB Chrome-plated
Slips	Cast Ductile Iron ASTM A536-80-55-06
Packing Gland	Type 2 NI-resistant or ASTM A487-CA6NM
Packing	Graphite-type
O-rings and Slip Seals	Viton

Useful Conversions (Approximate)

Flow	Pressure
1 BPH = 0.7007 GPM	1 bar (atmosphere) = 14.7 psi
1 IMP gal/min = 1.20 GPM	1 kg/cm ² = 14.2 psi
1 M3/hr = 4.40 GPM	1 kp (kilopascal) = 0.145 psi

CAMSERV Services for Actuation and Valves

WE BUILD IT. WE BACK IT.



Startup and Commissioning

Our experts understand that each project is unique. That's why Cameron's CAMSERV™ Services help facilitate commissioning and startup activities.

- Integrated solutions, onsite or at our global service centers
- Increased equipment and product performance
- The shortest possible trouble-free startup for your critical assets



Spare Parts and Asset Management

Cameron offers the assets and expertise to cover all aspects of valve management.

- Full inventory of quality exact OEM parts and spares
- Complete asset risk and criticality assessments
- Comprehensive inventory of your assets, including a complete recommended spare valves and parts list



Operational Support

Cameron's ability to address valve requirements in the field is a reflection of our commitment to life-of-asset support.

- Innovative asset management solutions
- Trouble-free installation, startup and operations
- Support from commission to operation – extending through all phases of a valve's life cycle
- Extensive inventory of spare valves and parts

Cameron's CAMSERV site management mitigates the risk of project delays by identifying issues in the construction process prior to valve installation to ensure valve integrity.



Trademark Information

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www.c-a-m.com/valves



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.