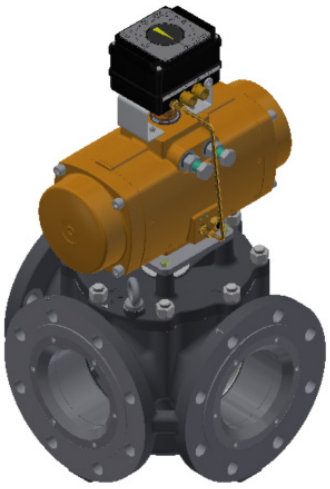
3-Way Temperature Control Valve

ANSI Class IV Model G Valve and Accessories

Minimize seat leakage and maximize performance

Built with the same compact durability and precise temperature capabilities as the standard actuated Model G valve, our new ANSI Class IV compliant valve eliminates bypass leakage, increases cooling capacity, and decreases fuel consumption.

6” Electric G valve



6” Pneumatic G valve

Key benefits

- ANSI Class IV rating eliminates bypass leakage or leakage to cooler
- Minimize energy waste during pre-heat and heat loss at low engine load
- Maximize cooling to support higher engine output power or to operate in high ambient temperatures
- Decrease warm up times
- Improve heat recovery efficiency
- Flexible port configuration
- Compact size for flow capability
- Flange to flange compatible with G valve

Typical applications

For engines, turbines, gearboxes and heat exchangers:

- Charge air cooling
- Engine jacket water cooling
- Lube oil cooling
- Secondary cooling systems
- Fuel and lube oil preheating
- Co-generation

For refineries, chemical plants and oil reproduction:

- Waste heat boilers
- Product coolers
- Product heaters
- Product condensers

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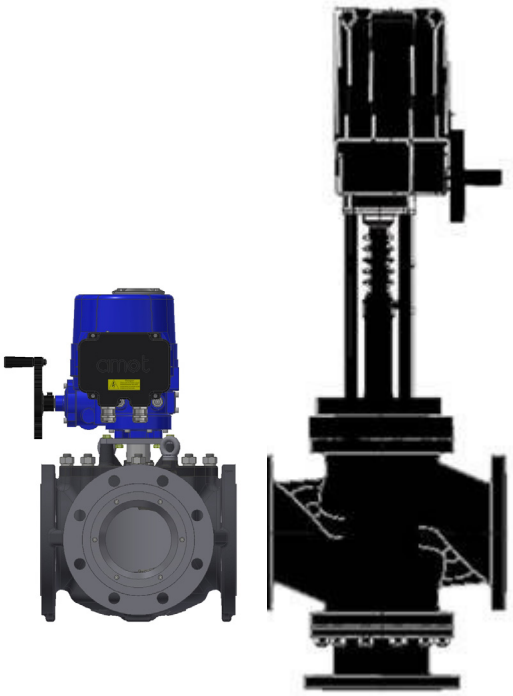


Size comparison of the ANSI Class IV Model G Valve with globe valve technology and a comparable flow coefficient

Contents

Overview

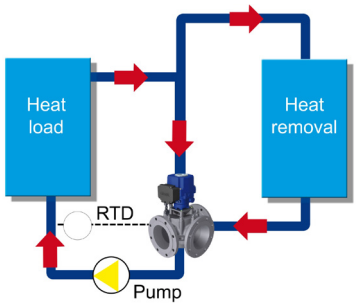
The AMOT valve is a next generation 3-way rotary control valve with a unique rotor design capable of meeting ANSI Class IV leakage. The Class IV G Valve maintains flange to flange compatibility with the whole AMOT G Valve range and offers the same high degree of accuracy and repeatability to ensure precise flow and temperature control.

With a high Kv for its size and fully configurable port layout the valve is equally capable in mixing and diverting service over a wide flow range.

The valve is compatible with the full AMOT range of actuators, including high vibration actuators for on engine applications or something similar

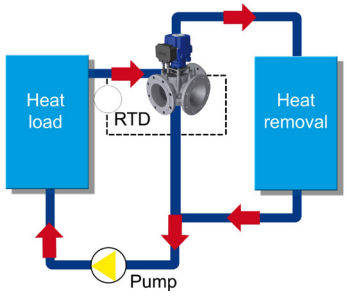
Applications

Mixing Applications



Lubricating oil temperature control is normally configured in a mixing application controlling the return temperature to the heat load. The temperature is normally measured as close as possible to the sump return.

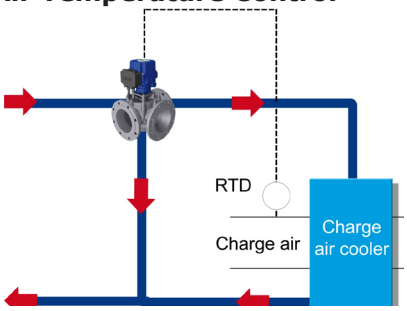
Diverting Applications



Jacket water cooling in diverting applications regulates the outlet coolant water temperature from a diesel or gas engine. The valve either sends water to a cooler or bypass loop, accurately maintaining the temperature.

The temperature is normally measured at the outlet from the heat source.

Charge Air Temperature Control

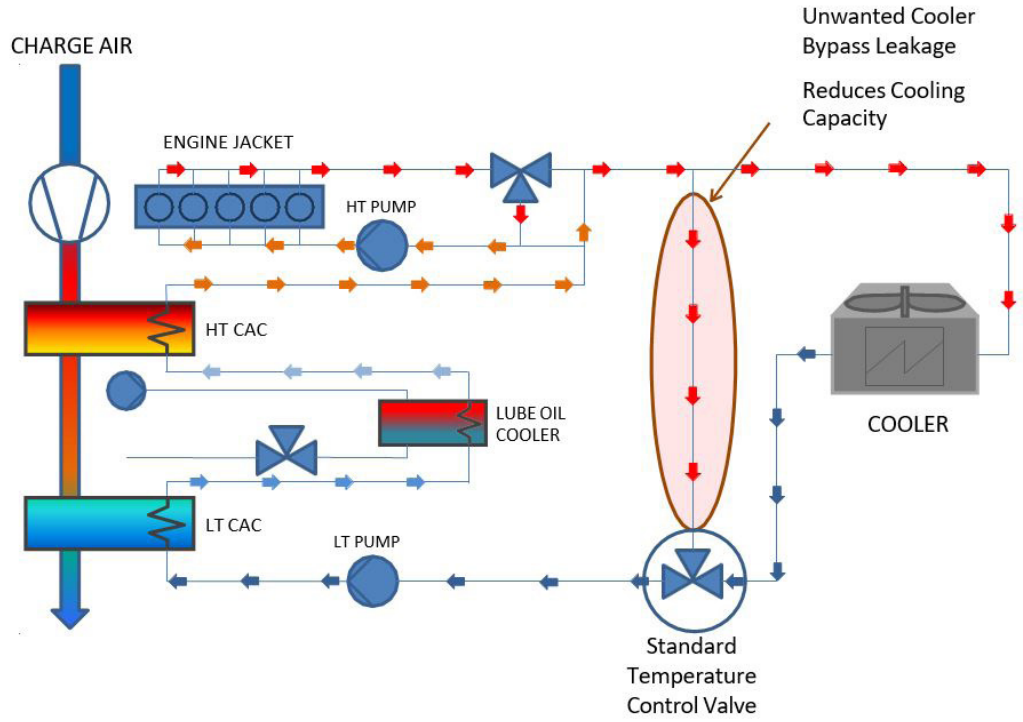


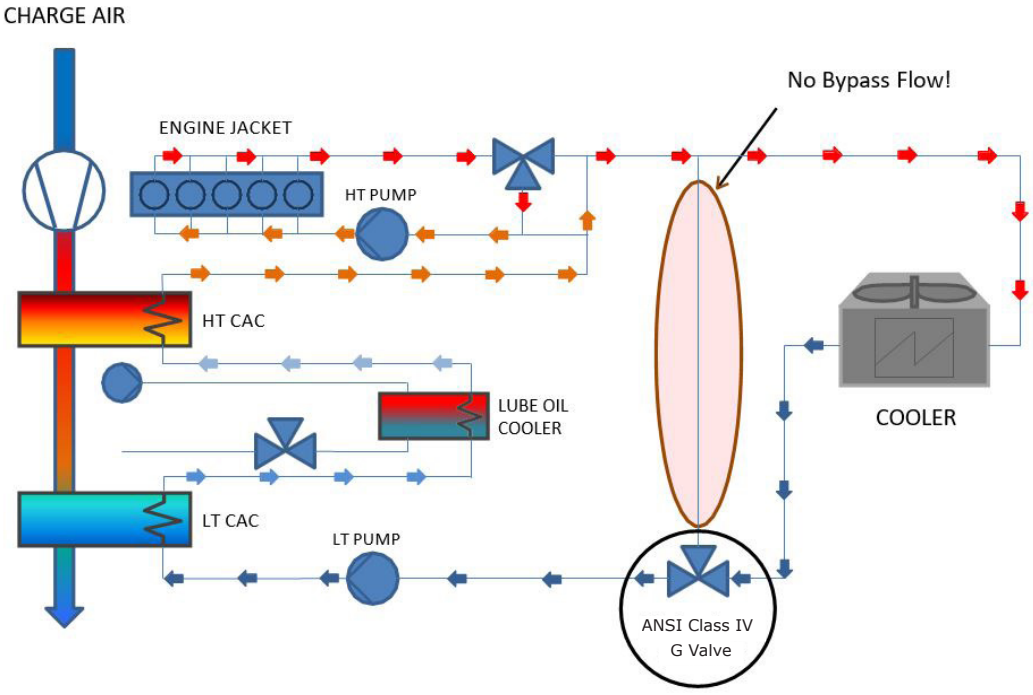
The intercooler is used to cool high temperature turbo charger air.

In this application the G Valve regulates the flow of cooling water through an intercooler, increasing efficiency, enhancing performance and helping to meet today's environmental requirements.

Precise condition based temperature control can be used to minimize unwanted charge air condensation and maximize fuel efficiency.

Increase Cooling Capacity with ANSI Class IV Model G





Overview of Valve Body

Valve Body

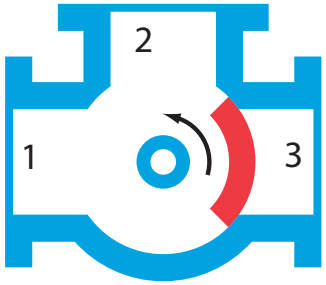
Key features and benefits

- Lightweight and compact
- Configurable ports - allowing flexibility on installation
- Low pressure drop - enables savings on either valve or pump size
- High accuracy providing better temperature control

Specification

Design standard:	EN12516	
Leakage level:	ANSI/FCI 70-2-2006 Class IV	
Flow to:	483m³/hr	2,127 US gpm
Sizes:	**Standard flow**	
	100mm, 150mm, 200mm (4”, 6”, 8”)	
Body material:	Ductile iron	
Rotor assembly material:	Stainless steel	
Seal material:	Shaft/cover seal of flourocarbon (Viton) Port seal of PTFE	
Flanges:	EN 1092, ASME and JIS standards.	
Maximum internal valve pressure:	10 bar	(145 psi)
Maximum temperature of fluid:	125°C	(257°F)
Range of ambient temperature:	-20 to 70°C	
Vibration:	Lloyd’s Register Type Approval System – Test Specification Number 1 (February 2015) - Vibration Test 2	

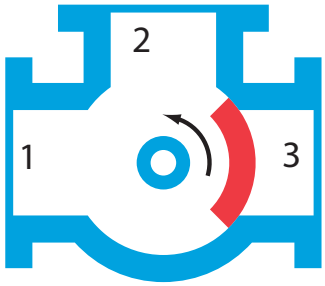
Modes of Operation - Electrically Actuated



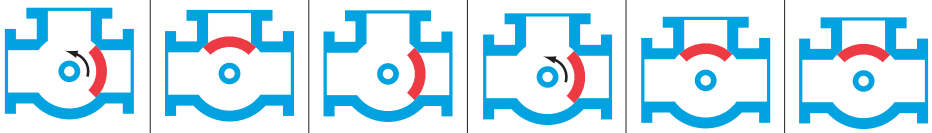
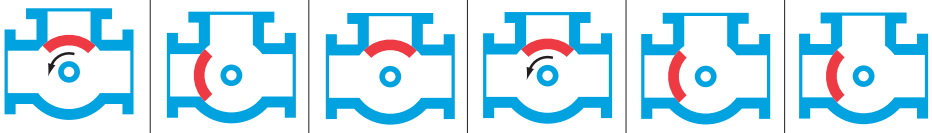
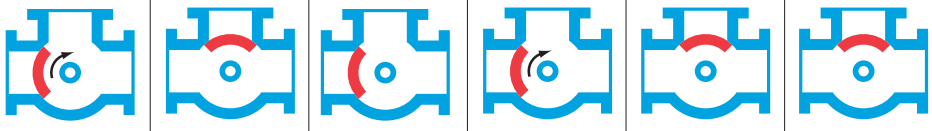
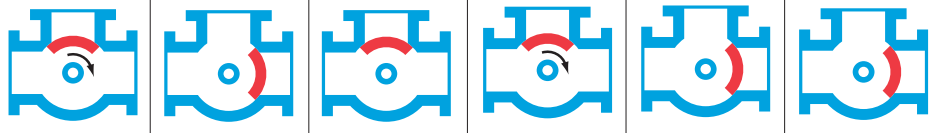
The unique construction of the AMOT G valve provides total flexibility by allowing you to select the valve port positions most ideally suited to meet your application requirements. There are two main types of mode of operation: 90° rotor that allows either ports 1 or 3 to be selected as the common port; and 180° rotor that requires port 2 to be the common port. Arrow indicates valve movement with increasing temperature or mA, as viewed from above (see diagram). For electrically actuated valves, on loss of signal the actuator is set up by default to stop in its current position. For electrically actuated valves, on loss of signal the actuator is set up by default to stop in its current position, but other actions can be configured.

	Electric actuator (switched live input)		**Electric actuator direct acting (4-20mA input)**		**Electric actuator reverse acting (20-4mA input)**	
	Cold position	Hot position	4mA (cold)	20mA (hot)	20mA (cold)	4mA (hot)
Mode 32						
Mode 21						
Mode 12						
Mode 23						

Modes of Operation - Pneumatically Actuated

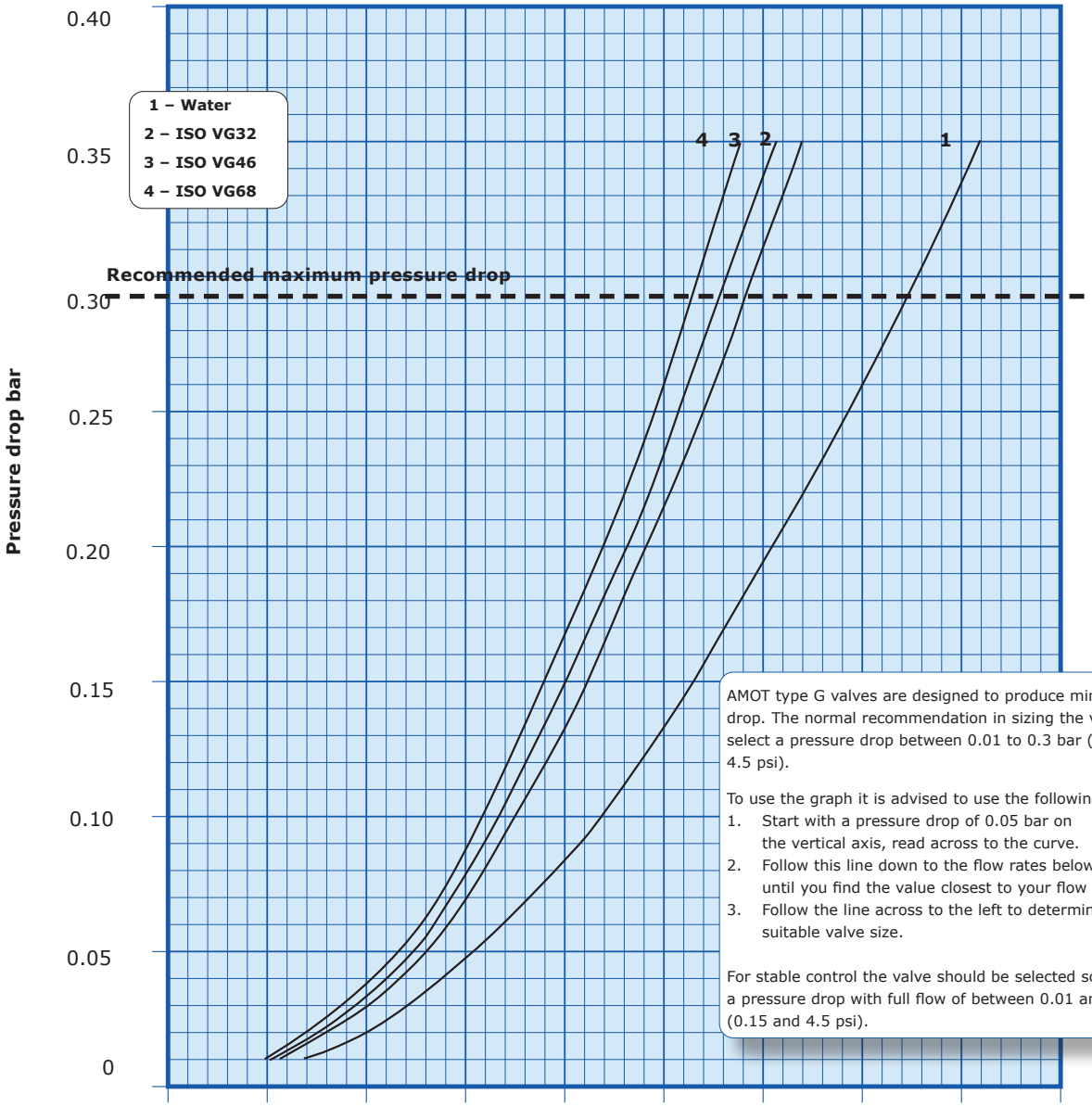


The unique construction of the AMOT LLGG valve provides total flexibility by allowing you to select the valve port positions most ideally suited to meet your application requirements. There are two main types of mode of operation: 90° rotor that allows either ports 1 or 3 to be selected as the common port; and 180° rotor that requires port 2 to be the common port. Arrow indicates valve movement with increasing temperature or mA, as viewed from above (see diagram).

	Pneumatic actuator direct acting			**Pneumatic actuator reverse acting**		
	3 PSI (cold)	15 PSI (hot)	No signal	15 PSI (cold)	3 PSI (hot)	No signal
Mode 32						
Mode 21						
Mode 12						
Mode 23						

Valve Sizing (Metric units)

Valve Flowrate Selection (Flowrate m^3/hr)



AMOT type G valves are designed to produce minimal pressure drop. The normal recommendation in sizing the valves is to select a pressure drop between 0.01 to 0.3 bar (0.15 and 4.5 psi).

To use the graph it is advised to use the following method:

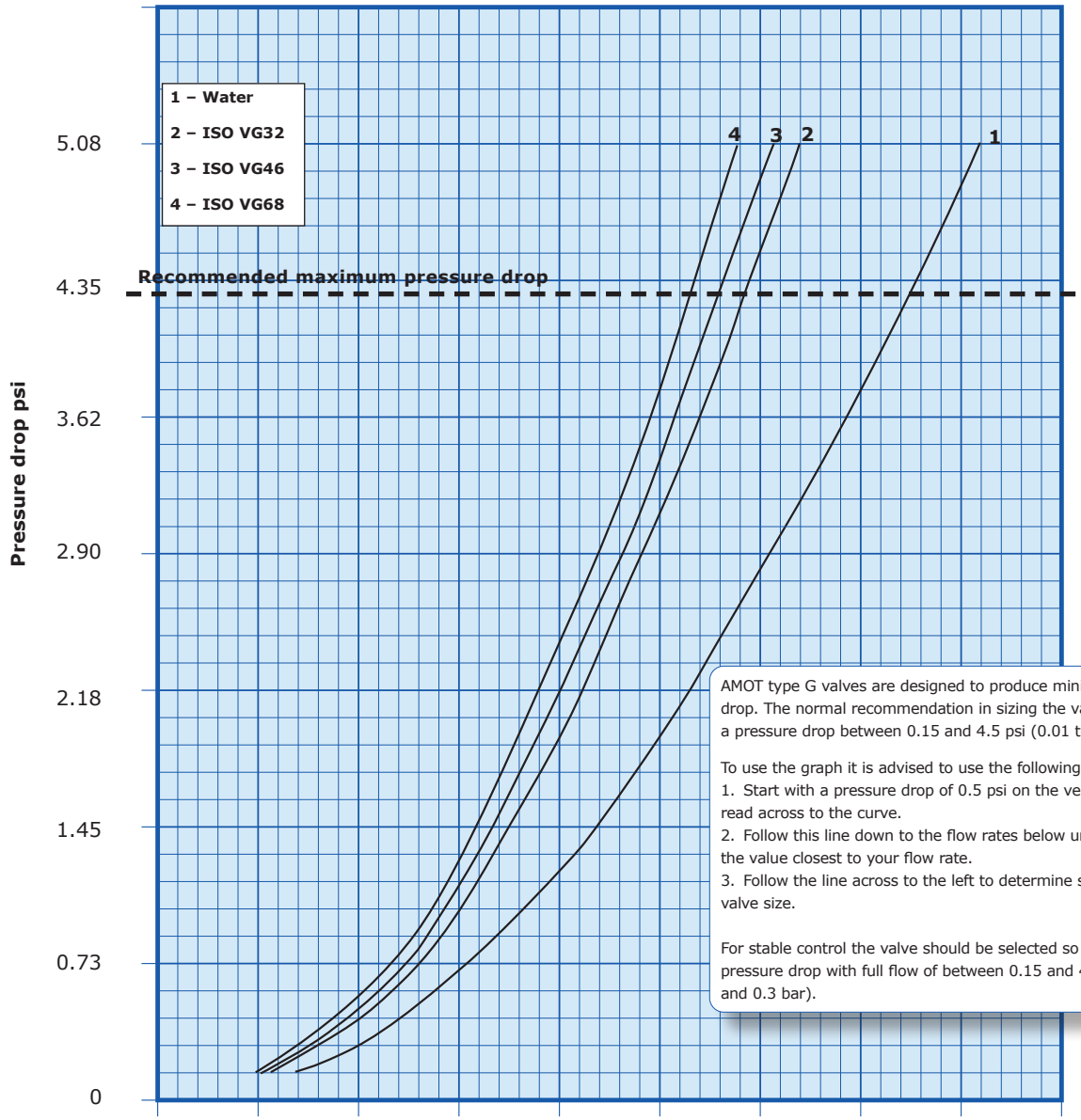
1. Start with a pressure drop of 0.05 bar on the vertical axis, read across to the curve.
2. Follow this line down to the flow rates below until you find the value closest to your flow rate.
3. Follow the line across to the left to determine suitable valve size.

For stable control the valve should be selected so as to provide a pressure drop with full flow of between 0.01 and 0.3 bar (0.15 and 4.5 psi).

Size DN (Inches)	Standard Flow								
	100 (4)	24	45	66	87	108	129	149	170
	150 (6)	43	80	117	155	191	229	266	302
	200 (8)	70	139	209	279	319	418	488	557

Valve Sizing (English units)

Valve Flowrate Selection (Flowrate USg/m)



AMOT type G valves are designed to produce minimal pressure drop. The normal recommendation in sizing the valves is to select a pressure drop between 0.15 and 4.5 psi (0.01 to 0.3 bar).

To use the graph it is advised to use the following method:
1. Start with a pressure drop of 0.5 psi on the vertical axis, read across to the curve.
2. Follow this line down to the flow rates below until you find the value closest to your flow rate.
3. Follow the line across to the left to determine suitable valve size.

For stable control the valve should be selected so as to provide a pressure drop with full flow of between 0.15 and 4.5 psi (0.01 and 0.3 bar).

Size inches (DN)	Standard Flow								
	4 (100)	108	199	290	383	474	566	657	749
	6 (150)	191	354	515	681	843	1007	1169	1331
	8 (200)	307	615	922	1229	1537	1844	2151	2458

Valve Sizing

Viscosity Correction

Example:

From the graph below:

100 cSt = correction factor of 0.68

0.68 x flow coefficient = corrected flow coefficient (Kv or Cv)

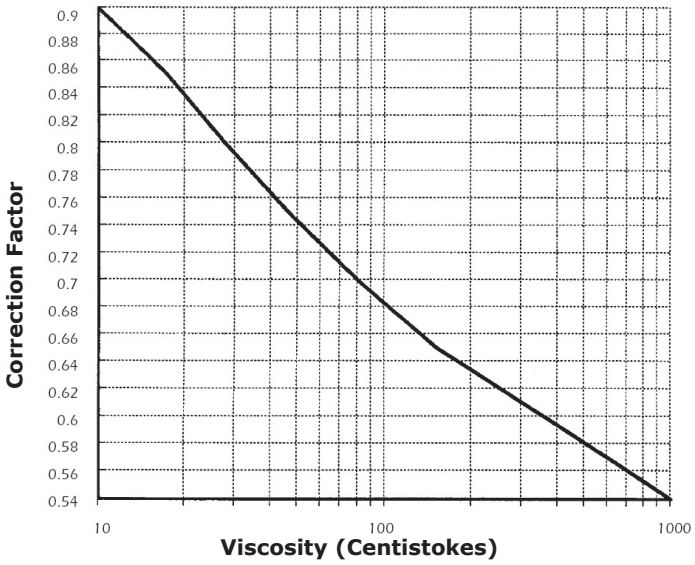
Some approximate viscosities (cSt) of SAE oils at 40°C (110°F) are shown below, based on leading oil manufacturers published data.

For the selection of valves for more viscous fluids than water, the following must be calculated:

Viscosity: Find the viscosity of the fluid in which the valve is to operate. The viscosity is normally expressed in centistokes. Where ISO oil is used, the grade number is also the viscosity eg ISO VG46 is 46 centistokes at 40°C (104°F).

Viscosity correction: By using the correction graph below, the flow coefficient correction factor can be established. The correction figure obtained from the graph should then be multiplied by the original flow coefficient which can then be used in the standard valve sizing formulae.

Viscosity Correction Curve (Fv)



Some approximate viscosities (cSt) of SAE oils at 40°C (104°F) are shown below, based on leading oil manufacturers' published data.

SAE Oil Viscosities

Engine oils	
Oil	**cSt**
SAE 5W	6.8
SAE 10W	32
SAE 20	46
SAE 20W	68
SAE 30	100
SAE 40	150
SAE 50	220

Gear oils	
Oil	**cSt**
SAE 75W	22
SAE 80W	46
SAE 85W	100
SAE 90	150
SAE 140	460

Valve Sizing

Valve Sizing Calculations

Valve Flowrate

See the table below for examples of Kv and Cv:

Size DN (in)	Standard flow	100 (4)	150 (6)	200 (8)
Kv		270	480	882
Cv		312	555	1020

Pressure Drop

The Class IV G valve is designed to produce minimal pressure drop. The normal recommendation when determining the size of an AMOT G valve is a pressure drop between 0.01 and 0.3 bar (0.15 and 4.5 psi).

Kv is the flow coefficient in metric units. It is defined as the flow rate in cubic meters per hour (m^3/h) of water at a temperature of 16º celsius with a pressure drop across the valve of 1 bar. Cv is the imperial coefficient. It is defined as the flow rate in US Gallons per minute [gpm] of water at a temperature of 60º fahrenheit with a pressure drop across the valve of 1 psi. (Kv = 0.865 Cv / Cv = 1.156 Kv)

The basic formula to determine the Kv of a valve is:

$$Kv = Q\sqrt{\frac{SG}{Dp}}$$

Q = Flow (m^3/h)
Dp = Pressure drop (bar)
SG = Specific gravity of fluid
Kv = Valve flow coefficient

There are two other ways that this formula can be used to find the flow in m^3/h or pressure drop of a valve in bar:

$$Q = Kv\sqrt{\frac{Dp}{SG}} \qquad Dp = \left[\frac{Q}{Kv}\right]^2 SG$$

The basic formula to determine the Cv of a valve is:

$$Cv = Q\sqrt{\frac{SG}{Dp}}$$

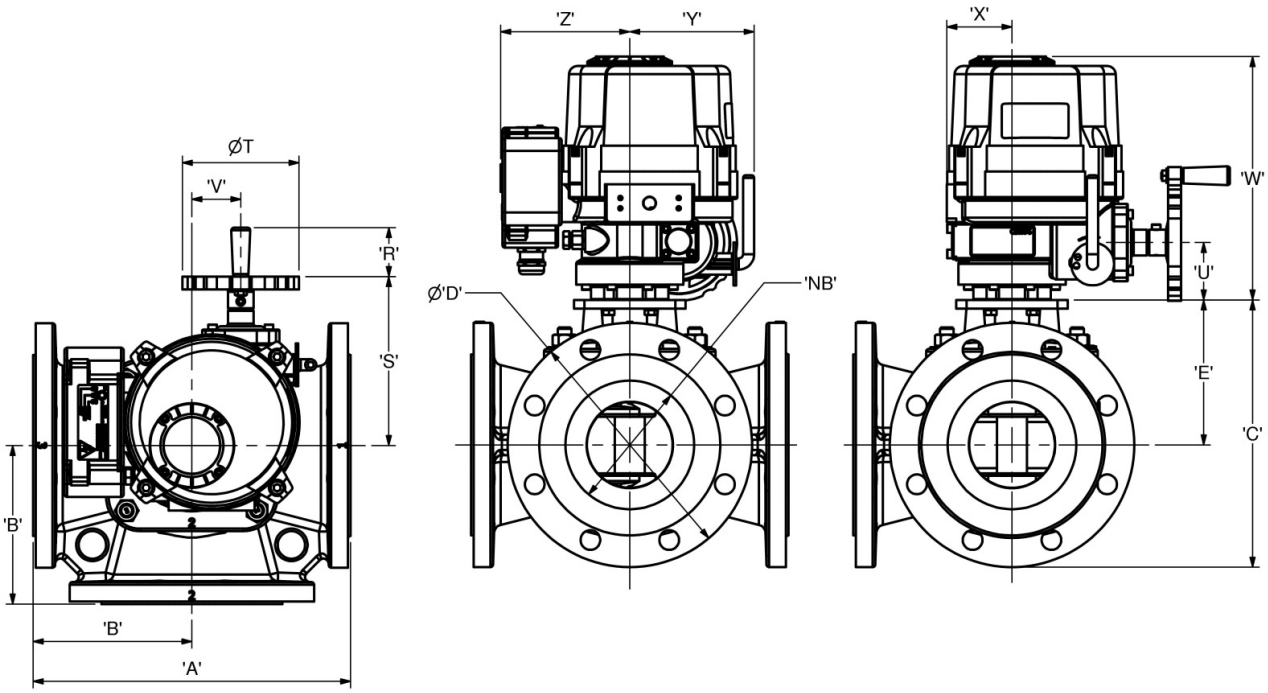
Q = Flow (US gallons/min)
Dp = Pressure drop (psi)
SG = Specific gravity of fluid
Cv = Valve flow coefficient

There are two other ways that this formula can be used to find the flow in US gallons/minute or pressure drop of a valve in PSI:

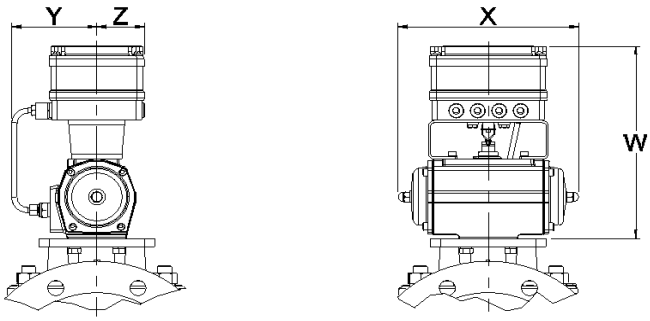
$$Q = Cv\sqrt{\frac{Dp}{SG}} \qquad Dp = \left[\frac{Q}{Cv}\right]^2 SG$$

Dimensions

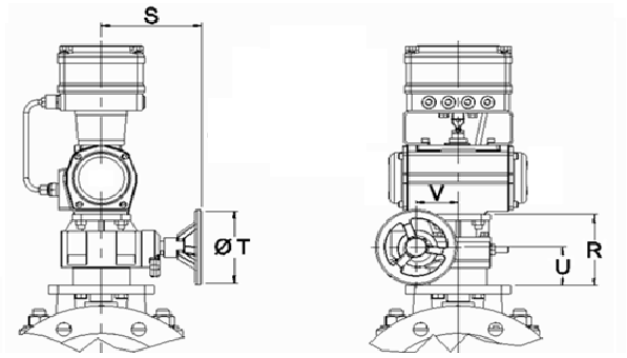
Electrically Actuated with Manual Override



Pneumatically Actuated



Pneumatically Actuated with Manual Override



See page 13 for dimensions

Dimensions continued

Dimensions in mm

Valve Type	Valve Body						Electrically Actuated									Pneumatically Actuated									Valve Type
	NB	A	B	C	D	E	R	S	T	U	V	W	X	Y	Z	R*	S*	T*	U*	V*	W	X	Y	Z	
04GGS	100	300	150	281	224	169	57	197	136	67	57	284	76	145	151	100	156	179	45	79	391	304	110	53	04GGS
06GGS	150	370	185	346	285	191										236	298	400	156	137	581	385	133	53	06GGS
08GGS	200	450	225	407	343	235	57	205	160	70	59	290	91	148	159	236	298	400	156	137	627	476	153	53	08GGS

Dimensions in inches

Valve Type	Valve Body						Electrically Actuated									Pneumatically Actuated									Valve Type
	NB	A	B	C	D	E	R	S	T	U	V	W	X	Y	Z	R*	S*	T*	U*	V*	W	X	Y	Z	
04GGS	4.0	11.8	5.9	11	8.8	6.6	2.2	7.6	5.4	2.6	2.2	11.2	3.0	5.7	5.9	3.9	6.1	7.0	1.8	3.1	15.4	12.0	4.3	2.1	04GGS
06GGS	6.0	14.6	7.3	13.6	11.2	7.5										9.3	11.7	15.7	6.1	5.4	22.9	15.2	5.2	2.1	06GGS
08GGS	8.0	17.7	8.9	16	13.5	9.3	2.2	8.1	6.3	2.8	2.3	11.4	3.6	5.8	6.3	9.3	11.7	15.7	6.1	5.4	24.7	18.7	6.0	2.1	08GGS

* Relevant only to pneumatic actuator with manual override version.

Bolthole dimensions are as per the relevant specification chosen in the model coding. Full dimensional details can be provided on request.

The EA actuator is powered by an AC electric motor driving a worm-type gear which prevents reverse drive due to fluid forces, even under power loss. The actuator is available with a switched live control input, or when a Positioner is fitted, a 4-20mA input and a configurable 4-20mA output.

EA Actuator Specification

Power supply 110V/220V ac ± 10% 50/60Hz single phase	**Motor thermal protection** Trip @ 150°C nominal Reset @ 97°C nominal	**Potentiometer** 1 k Ω standard, 5 k Ω option Life: 10 million revolutions Linearity: < ± 2%
Limit switches Two open/close SPDT 250V AC, 10A	**Operating angle** 110°C max	**Duty cycle** 65% at 20°C
Conduit entry CM25 x 1.5 mm	**Mechanical stop** Two adjustable screws	**Manual override** Automated declutching mechanism
Materials Steel, aluminum, alloy bronze, polycarbonate	**External coating** Dry powder polyester	**Weatherproof enclosure** IP67, NEMA 4 and 6
Ambient temperature -20°C to +85°C	**Ambient humidity** 90% RH max (no-condensing)	**Anti-condensation heater** 7-10 W
Vibration 5-100 Hz 100-300 Hz	 4 g (for defined test time) 1 g (for defined test time)	
Cable entry	2 x M25 x 1.5	

Performance	**Stroke time (seconds)** **90 degree regulation**	**Max current (Amps)**
EA100 (220V 50 Hz)	25	0.88
EA100 (110V 60 Hz)	21	1.70
EA200 (220V 50 Hz)	31	0.92
EA200 (110V 60Hz)	26	1.85

The EB actuator is a more robust version of the EA actuator and offers excellent vibration resistance making it suitable for direct engine mounting.

An external IP67 terminal box simplifies wiring connections and houses the Positioner electronics, when fitted.

EB Actuator Specification

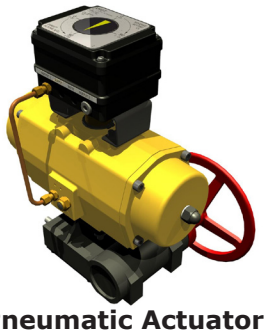
Power supply 110V/220V ac ± 10% 50/60Hz single phase	**Motor thermal protection** Trip @ 150°C nominal Reset @ 97°C nominal	**Hall sensor** 5 V dc power supply Linear voltage output
Limit switches Two open/close SPDT 250V AC, 10A	**Operating angle** 110°C max	**Duty cycle** 100% at 20°C
Conduit entry M25 x 1.5 mm	**Mechanical stop** Two adjustable screws	**Manual override** Automated declutching mechanism
Materials Steel, aluminum, alloy bronze, polycarbonate	**External coating** Dry powder polyester	**Weatherproof enclosure** IP67, NEMA 4 and 6
Ambient temperature -20°C to +70°C	**Ambient humidity** 90% RH max (no-condensing)	**Anti-condensation heater** 7-10 W (including thermal protection; Open 75°C nominal; Close 54°C nominal)

Vibration
DNV-GL type approved
Meets IACS marine class test specifications

5-100 Hz	4 g (for defined test time)
100-300 Hz	1 g (for defined test time)
5-300 Hz	1 g (continuous)

Performance	**Stroke time (seconds)** **90 degree regulation**	**Max current (Amps)**
EB100 (220V 50 Hz)	25	0.88
EB100 (110V 60 Hz)	21	1.70
EB200 (220V 50 Hz)	31	0.92
EB200 (110V 60Hz)	26	1.85

Overview of Pneumatic Actuation



Pneumatic Actuator

Key features and benefits

- A rugged quarter turn, double piston, rack and pinion pneumatic actuator with spring return and valve positioner as standard.
- Can be configured fail-safe

Specification

Housing	Cast aluminum base, steel cover and two part Polyurethane paint finish.	
Supply pressure	6 to 8 bar	(90 to 115 psi)
Signal pressure	0.21 to 1.03 bar	(3 to 15 psi)
Pressure connections	G 1/4	(1/4 NPT)
Manual override	Optional	

3-Way Temperature Control Valve - ANSI Class IV

How to Order

Use the table below to select the unique specification of your Class IV valve:

Example	6	GG	S	D	B	L	32	E	B	B	C	A	AA	Description		
Size	4													4 in (DN100)		
	6													6 in (DN150)		
	8													8 in (DN200)		
Model		GG												Model G valve		
Flow type			S											Standard flow		
Valve body/rotor material				D										Ductile iron		
Valve flange connection standard and class														Flange class	Flange standard	
					A									PN6	EN 1092	
					B									PN10	EN 1092	
					C									PN16	EN 1092	
					F									125	ASME	
					J									150	ASME	
					L									10K	JIS	
					M									5K	JIS	
Rotor type						L								ANSI Class IV		
Valve mode of operation							12							Cold Process	Hot Process	Starting from Cold
							12							Port 1	Port 2	Clockwise
							23							Port 2	Port 3	
							21							Port 2	Port 1	Anticlockwise
							32							Port 3	Port 2	
Valve actuation type								F						Electric - EA actuator		
								E						Electric - EB actuator		
								P1						Pneumatic - W/O gear box, G ¼"		
								P2						Pneumatic - W/O gear box, ¼" NPT		
								P3						Pneumatic - G ¼"		
								P4						Pneumatic - ¼" NPT		
Actuator power supply									A					100-120 Vac 50/60Hz		
									B					200-240 Vac 50/60Hz		
Actuator control input signal										A				Relays, switched live supply	Standard rotor	
										B				4-20mA (Cold to hot)		
										C				20-4mA (Cold to hot)		
										100				3-15 psi (Cold ot hot)		
										200				15-3 psi (Cold to hot)		
Actuator feedback signal											A			None	Standard rotor	
											C			4-20mA (Cold to hot) position		
											E			20-4mA (Cold to hot) position		
Advanced features												A		None		
Special options													-AA	Standard product		
													***	Customer special code assigned		

Accessories

PID Valve Controllers 8071/8072D and Solid State Relays 47581L001

PID Controller 8072D

Solid State Relay 47581L001

PID Controller 8071D

Key features and benefits

- Fully programmable PID-based control - allows easy system configuration
- Universal inputs; RTD's, thermocouple, or standard 4-20mA signal gives maximum system design flexibility
- Can be operated in manual mode - easy maintenance and set up

For further information and how to order these products see Datasheet_8071_2_D_47851.pdf

3-Wire PT100 Temperature Sensor - 8060

Temperature Sensor 8060

Key features and benefits

- 3 wire RTDs - accurate temperature measurement
- Excellent long term stability
- Good linearity
- Can use standard 3-core cable

For further information and how to order this product see Datasheet_8060_temp_sensor.pdf

Accessories

Solid State Relay Module - 8073C

Relay Module

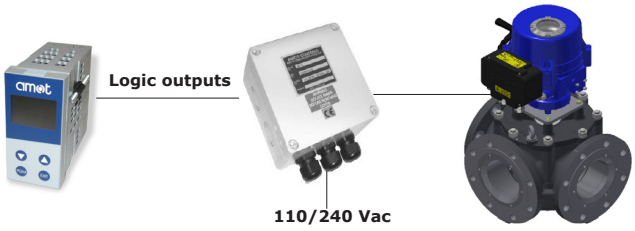
8073C

Key features and benefits

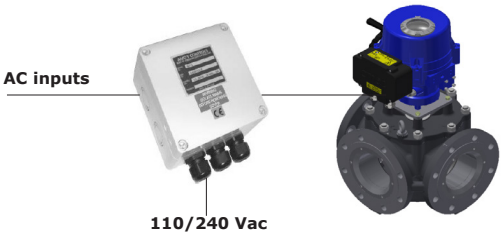
- IP67 enclosure
- Alternative to using two SSRs type 47581L001
- Good linearity
- Can use standard 3-core cable

The 8073C relay module incorporates two solid state relays with terminations in an IP67 enclosure. The 8073C is designed to be used with the 8071D controller logic outputs to drive voltages for the electrically actuated G valve. Features include: zero-crossing switching, relay and logic level inputs and IP67 enclosure.

Typical Applications



Interface with 8071D controller



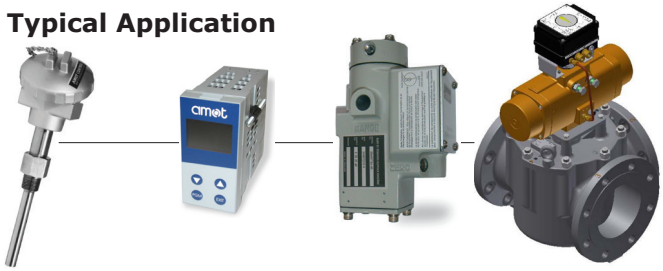
Interface with AC input signals

For further information and how to order this product see Datasheet_8073C_SSR.pdf

Electro-Pneumatic Converter - 8064A

Electro-Pneumatic Converter - 8064A

Typical Application



Temperature Probe 8060 | Temperature Controller 8071D | Electro-Pneumatic Converter 8064A | G Valve

Key features and benefits

- High vibration resistance - Lloyds 4G
- Suitable for longer pipe runs
- Fully adjustable for optimised system operation
- ATEX hazardous area certification

For further information and how to order this product see Datasheet_8064A_C_elect_pneu_converter.pdf

Accessories

Electro-Pneumatic Converter - 8064C

Typical Application

Electro-Pneumatic Converter - 8064C

Key features and benefits

- Accepts high supply pressure - avoids use of additional regulator
- Factory set for ease of installation
- Low cost alternative to 8064A
- ATEX hazardous area certification

Electro-pneumatic system

Temperature probe 8060 | Temperature controller 8071D | Electro-pneumatic converter 8064C | G valve

For further information and how to order this product see Datasheet_8064A_C_elect_pneu_converter.pdf

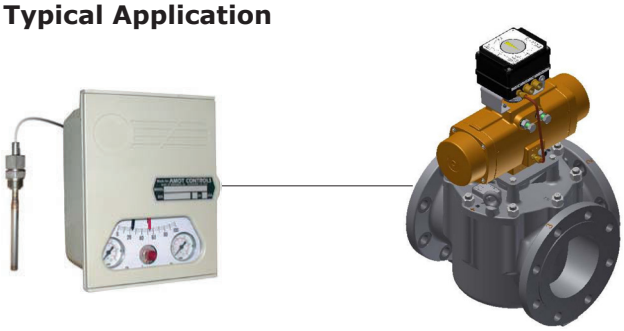
Pneumatic Indicator Controller - SG80

Pneumatic Indicator Controller SG80

Key features and benefits

- Complete stand alone controller, no other control components required - reduced system cost
- Easily removable components - low maintenance
- Good dynamic response - gives optimum engine performance
- Compatible with every type of pneumatic valve - flexible

Typical Application



SG80 Temperature Controller and Sensor | G Valve

For further information and how to order this product see Datasheet_SG80_Pneu_Ind_Controller.pdf

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⚠ WARNING

This product can expose you to chemicals including Lead, which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

www.amot.com