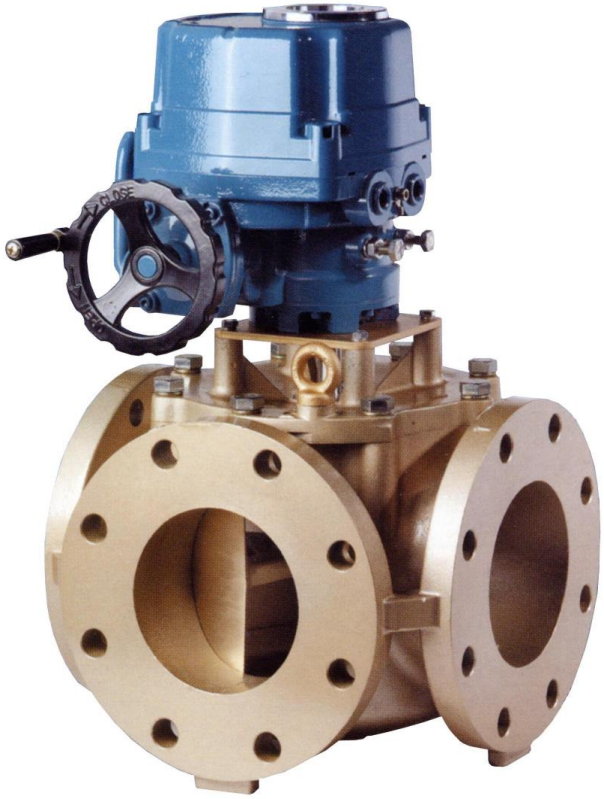
G-Valve (electric actuator)

Operation and Maintenance Manual



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Section 1

Introduction

Contents

1.1 Scope

This Manual details the installation, operation and maintenance of the AMOT electrically actuated G-Valve system.

Each item of equipment is described in a separate section as follows:

Actuator		Section 4 & OMM47962X00013
Valve Body		Section 3
PID Controller		Section 5 & OMM807100043
Temperature Sensor		Section 6

1.2 Safety

Certain operations within this manual are potentially hazardous and could cause injury to personnel or damage to equipment if the instructions are not carried exactly as described. Where a significant, potential hazard exists, the following text appears immediately before steps in the procedure that present a particular hazard:

WARNING

A Warning identifies a hazard that could cause injury to personnel. The text of the warning describes the hazard and details the precautions that must be applied before the next step of the procedure is carried out.

CAUTION

A Caution identifies a hazard that could cause damage to equipment. The text of the caution describes the hazard and details the precautions that must be applied before the next step of the procedure is carried out.

Note

A Note contains supplementary information that may be useful to the Operator before the next step of the procedure is carried out.

1.3 Maintenance

Maintenance of the valve and actuator should only be carried out by suitable trained and competent persons, and only after they have read and understood all applicable sections of this manual. Failure to observe this may result in damage to equipment or to injury of personnel.

1.4 Product Support

All necessary settings and, where appropriate, alterations inside the equipment are described in this Operating Manual. If any difficulties arise during start-up, you are asked not to carry out any unauthorised actions on the unit. You could endanger your rights under the equipment warranty.

For spares and service support, call the telephone number listed on the back cover of this Manual.

1.5 Typographical Conventions

Footnotes

Where space in the text or figures to place a note is restricted, a footnote is used. They consist of two parts:

- A mark indicating which part of the text or figure is affected by the note. This takes the form of a superscript number eg. abc [1].
- A note in smaller font at the bottom of the affected page beginning with the corresponding number in the text or figure eg:

1. This footnote applies to the part of the text or figure, marked with a superscript number 1

1.6 European Union Directives

1.6.1 EU Machinery Directive

The AMOT Model G Valve, as a component, is not considered to be a machine. To fully comply with the Directive however, the machine into which the valve is installed must comply with the requirements of the machinery directive before the valve is put into operation.

1.6.2 EU Low Voltage Directive

All versions of Electric actuator described in this manual have been assessed against the requirements of the Low Voltage Directive, and have found to be in conformance.

1.6.3 EU EMC Directive

All versions of Electric actuator described in this manual have been assessed against the requirements of the EMC Directive, and have found to be in conformance.

1.6.4 EU Pressure Equipment Directive

In its design application of a temperature control valve, the AMOT Model G Valve is defined as a Pressure Accessory under the terms of the EU Pressure Equipment Directive (PED).

Valves used with fluids defined as Group 2 in the Directive (such as water and lubricating oil) fall into the Sound Engineering Practice (SEP) category.

Some valves are also rated for use with Group 1 liquids under the SEP category.

Table 1 contains details of the groups each valve type falls into and the associated maximum working pressure of the valve.

Table 1 Pressure Equipment Directive Table

Valve Material	Valve Type	Flange Class	Maximum Working Pressure (BAR)	(PED) suitable for liquids to group(s):
Cast Iron, Ductile Iron and Bronze	2GEF 3GEF 4GEF 6GEF	PN6	6	1 & 2 (SEP)
		5K	7	
		PN10	10	
		PN16		
		10K		
		125lb		
		150lb		
	8GEF 10GEF 12GEF 14GEF 16GEF	PN6	6	2 (SEP)
		5K	7	
		PN10	10	
		PN16		
		10K		
		125lb		
		150lb		
Steel and Stainless Steel	2GEF 3GEF 4GEF	PN6	6	1 & 2 (SEP)
		5K	7	
		PN10	10	
		10K	14	
		PN16	15	
		150lb		
	6GEF 8GEF 10GEF 12GEF 14GEF 16GEF	PN6	6	2 (SEP)
		5K	7	
		PN10	10	
		10K	14	
		PN16	15	
		150lb		

Users who are uncertain as to the applicability of the Directive should contact AMOT before installation, particularly if using more hazardous (Group 1) fluids.

Section 2

System Overview

Contents

2.1 Description

The G Valve and its supporting equipment are designed for the control of fluid temperature by 'diverting' or 'mixing' control techniques.

The valves can be used for fresh and sea water, most lubricating oils and other liquids.

The compact construction of the G Valve enables unobstructed, full-bore flow, thus minimising pressure losses.

2.1.1 Features

The G Valve system has the following main features:

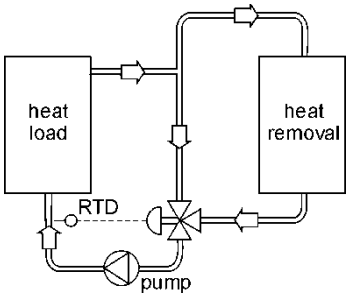
- Any direction of rotation.
- Any rotor-port configuration (most models).
- Compact construction.
- Low pressure drop.
- High accuracy (± 1° C or better).
- Mount in any position.
- Manual override.
- Temperature up to 100° C (212° F).
- Local valve position indication.

2.1.2 Typical Applications

Lubricating Oil Temperature Control

Lubrication oil temperature control is normally configured in a mixing application controlling the return temperature to the heat load.

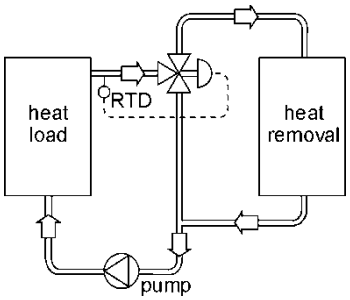
The temperature is normally measured as close as possible to the sump return.



Jacket Water Cooling

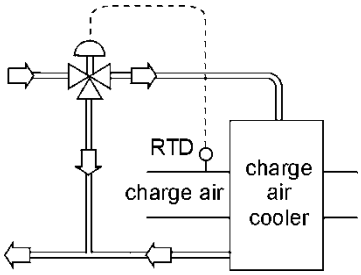
Jacket water cooling in diverting applications regulates the outlet coolant water temperature from a diesel or gas engine. The valve either sends water to a cooler or bypass loop, accurately maintaining the temperature.

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



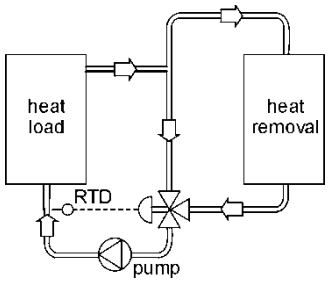
Charge Air Temperature Control

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, which can increase efficiency, enhance performance and help meet stringent environmental requirements



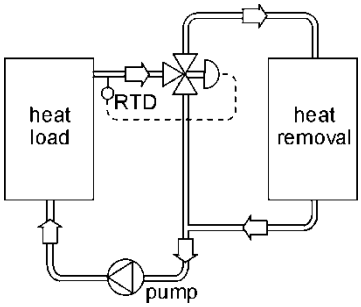
Central Cooling

For large flow central cooling, mixing or diverting applications where accurate temperature control is required. The capabilities of the G Valve provide the ideal solution.



Sea Water Cooling

On sea water cooling applications, bronze G Valves are recommended. These can be used for mixing and diverting applications.



2.2 Identification of Model Number

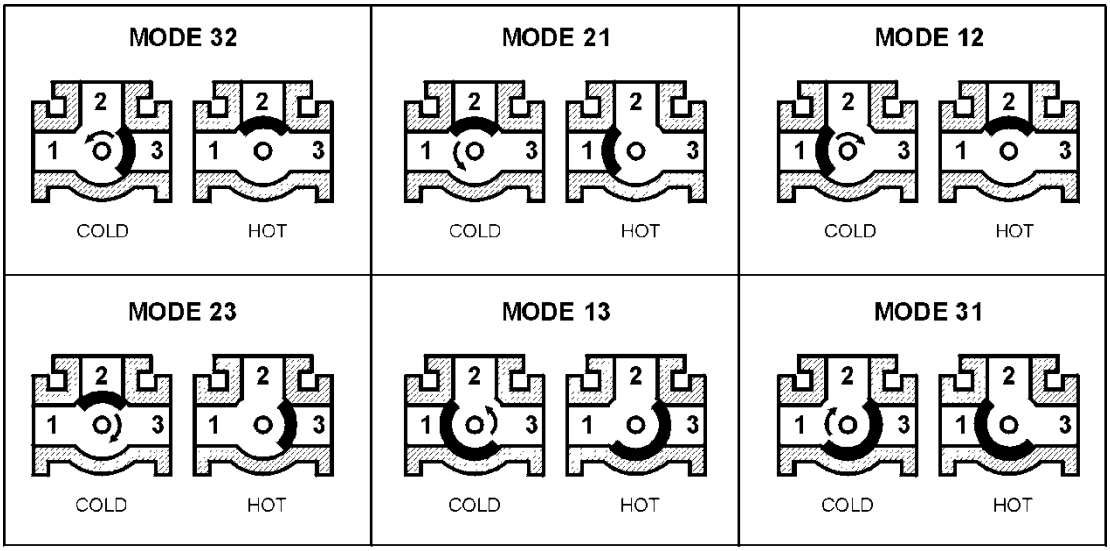
	4	GEF	C	B	A	0	32	-AA
Size								
2 inch (DN50)	2							
3 inch (DN80)	3							
4 inch (DN100)	4							
6 inch (DN150)	6							
8 inch (DN200)	8							
10 inch (DN250)	10							
12 inch (DN300)	12							
14 inch (DN350)	14							
16 inch (DN400)	16							
Type								
Electric actuation		GEF						
Materials								
Bronze			B					
Cast Iron			C					
Ductile Iron			D					
Steel			S					
Stainless Steel			R					
Connections								
Flanged PN6				A				
Flanged PN10				B				
Flanged PN16				C				
Flanged ASME 125lb				F				
Flanged ASME 150lb				J				
JIS 10K				L				
JIS 5K				M				
Basic Actuator								
220/240 V ac					A			
110/120 V ac					B			
Actuator Options								
Standard (1 kΩ potentiometer)						0		
Standard (5 kΩ potentiometer)						1		
Standard with positioner port.						2		
Direct Mode (Clockwise rotation with increasing demand current)								
4 – 20 mA electronic positioner with position re-transmit						A		
4 – 20 mA electronic positioner with input re-transmit						B		
4 – 20 mA electronic positioner with position error output (4 mA ref)						C		
4 – 20 mA electronic positioner with position error output (12 mA ref)						D		
Reverse Mode (Anti-clockwise rotation with increasing demand current)								
4 – 20 mA electronic positioner with position re-transmit						E		
4 – 20 mA electronic positioner with input re-transmit						F		
4 – 20 mA electronic positioner with position error output (4 mA ref)						G		
4 – 20 mA electronic positioner with position error output (12 mA ref)						H		
Electronic positioner for re-transmission only						J		
Electronic positioner for re-transmission only (reverse acting)						K		

Modes of Operation (refer to para 2.3)

Movement with rising temperature	**Rotor type**	
Anti-clockwise Port 3 to Port 2	Standard 90°	32
Anti-clockwise Port 2 to Port 1	Standard 90°	21
Clockwise Port 1 to Port 2	Standard 90°	12
Clockwise Port 2 to Port 3	Standard 90°	23
Anti-clockwise Port 1 to Port 3	180° (2”, 3”, 4”, 6”, 8” & 10” only)	13
Clockwise Port 3 to Port 1	180° (2”, 3”, 4”, 6”, 8” & 10” only)	31

Special Features (consult Manufacturer)

2.3 Modes of Operation



Note
Modes 13 and 31 are not available for 12", 14" & 16".
Arrow indicates valve movement with increasing temperature, as viewed from above.

Fig 1 Modes of Operation

2.4 Conversion between Modes of Operation

The mode of operation is defined in the model code section "Rotor Type" on the previous page. It is possible to change the mode of operation in some circumstances, as follows:

Table 2 Mode Conversion – See notes

From / To	Mode 12	Mode 13	Mode 21	Mode 23	Mode 31	Mode 32
Mode 12		5	3	2	1	4
Mode 13	5		1	5	3	1
Mode 21	3	1		4	5	2
Mode 23	2	5	4		1	3
Mode 31	1	3	5	1		5
Mode 32	4	1	2	3	5	

1 = Requires a different rotor. See section 3.4, page 16.

2 = Rotor needs to be turned with respect to the actuator. See section 3.4, page 16.

3 = Direction of operation needs to be changed with a Configurator if a Positioner is fitted, or connections to terminals 11 and 12 swapped for switched live versions. See section 4.6, page 34.

4 = Both 2 and 3 above apply.

5 = Both 1 and 3 above apply.

2.5 System Components

The system comprises the following main components which are described in other sections of this manual:

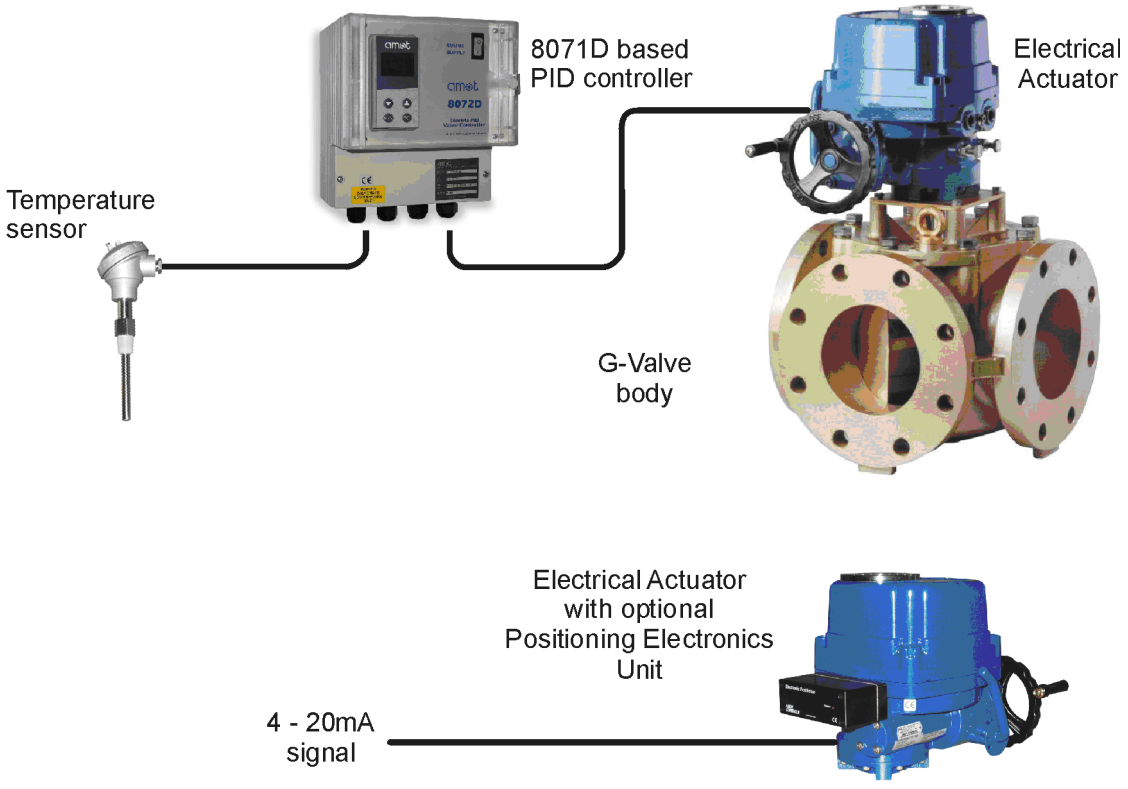


Fig 2 System Components

- Valve Body – Section 3
- Electric Actuator – Section 4
- PID Controller and accessories – Section 5
- Temperature Sensor – Section 6
- System Integration – Section 7

Section 3

Valve Body

Contents

3.1 Description

The G Valve is a compact and rugged 3-way control valve designed for temperature control using 'diverting' or 'mixing' techniques.

The valve can be constructed from a variety of materials making it suitable for sea and fresh water, most lubricating oils and other liquids (see Section 2.2 "Identification of model code").

3.2 Installation

WARNING

The valve body is heavy, refer to Section 9 (Technical Data) Sect 9.1.3 – page 76. The appropriate manual handling precautions must be applied to avoid personnel injury.

When installing the valve, the following factors must be considered:

- Position the valve as close as possible to the point where it can best effect control.
- Install a minimum of 6 pipe diameters in length from any intersection to ensure a good mix of fluids. Too great a distance may induce unnecessary time lags into the system affecting accuracy and stability of temperature control.
- Future maintenance is simplified if the valve is installed in the upright position in an accessible location.
- Do not install the valve in a position that inhibits the operation of the manual override handle (if fitted).
- If possible, avoid installation in areas with a risk of water spray or extreme dirt.

3.3 Operation

CAUTION

Damage can be caused to the valve assembly if a cheater or extension bar is used on the handwheel. Do not use any mechanical aid to turn the handwheel.

Under normal conditions, the valve is operated electrically by the actuator. Manual operation is possible at any time by disengaging electrical drive with the actuator declutching lever and turning the handwheel.

On failure of the valve to operate correctly, refer to the troubleshooting guide in 0.

3.4 Maintenance

3.4.1 Dismantle and Assemble 2 and 3 inch Valves

Dismantle Valve (refer to Fig 3, page 16)

It is possible to dismantle the valve without the need to remove it from the pipework as follows:

WARNING

The valve may contain hot/pressurised fluid. Ensure the valve is isolated, drained and allowed to cool to a safe working level before dismantling.

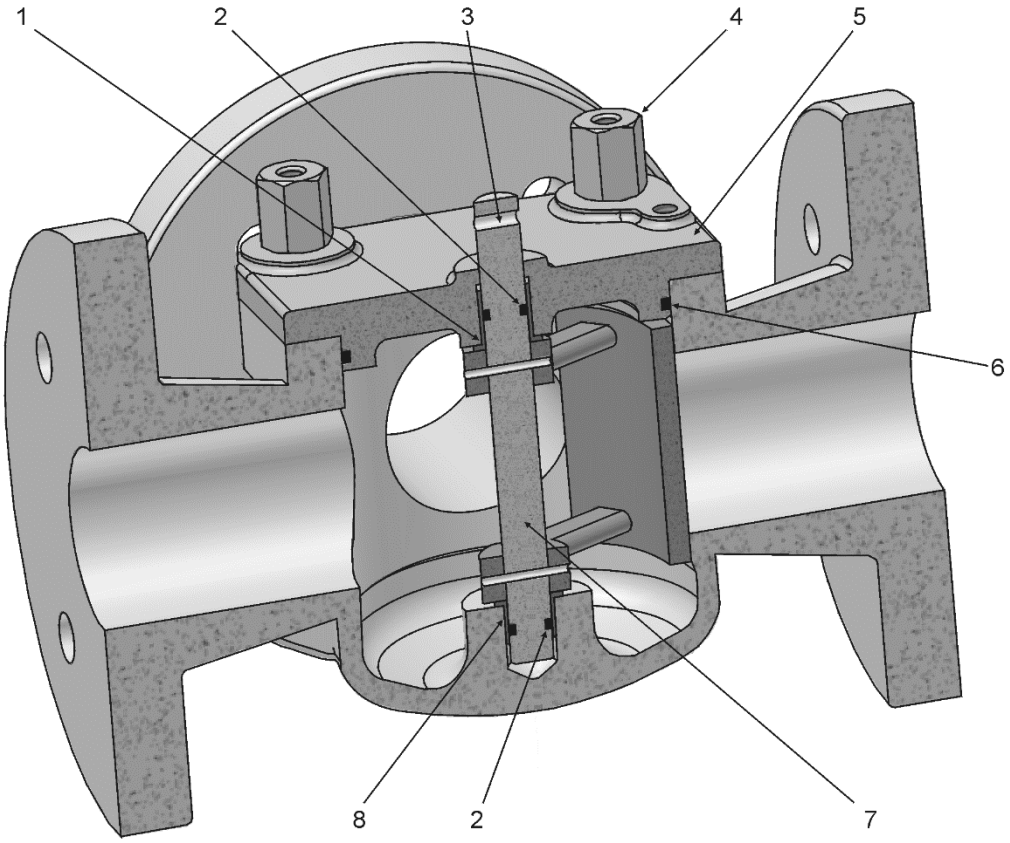


Fig 3 2 and 3 inch Valves

1 Switch off and isolate power to the actuator.

2 Using the handwheel, turn the valve to the low temperature position.

3 Mark adjacent points on the actuator and coupling and also on the coupling and cover (5) to aid reassembly.

WARNING

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

4 Remove the actuator from the valve body in accordance with Sect 4.8.1 (page 36).

5 Mark adjacent points on the valve body and cover to aid reassembly.

6 Remove the pillars (4) and washers securing the valve cover (5).

Note

There are two jacking holes in the valve cover to aid removal.

7 Taking care that the rotor is not lifted with the cover, carefully lift off the cover.

8 Remove and discard the cover O ring (6).

9 Remove the rotor assembly from the valve body.

10 Remove and discard the upper and lower shaft O rings (2).

11 Inspect the valve internals for wear, damage and cleanliness. Clean and replace if necessary.

Note

It is recommended that the bearings (1 and 8) are replaced at this stage.

Reassemble Valve (refer to Fig 3, page 16)

1 Fit two, new shaft O rings (2) to the shaft.

2 Carefully insert the rotor assembly into the valve body with the rotor in the low temperature position.

3 Fit a new cover O ring (6) to the cover (5) and position the cover on the valve, aligning the marks made during disassembly.

4 Fit the pillars (4) and washers and tighten to 54 Nm (2 " valve) or 80 Nm (3" valve).

5 Install the actuator onto the valve body in accordance with para 4.8.1 (page 36).

3.4.2 Dismantle and Assemble 4, 6 and 8 inch Valves

Dismantle Valve (refer to Fig 4, page 18)

If the valve is installed in the upright position, it is possible to dismantle the valve whilst still installed in the pipework as follows:

WARNING

The valve may contain hot/pressurised fluid. Ensure the valve is isolated, drained and allowed to cool to a safe working level before dismantling.

1 Switch off and isolate power to the actuator.

2 Using the handwheel, turn the valve to the low temperature position.

3 Mark adjacent points on the actuator and coupling and also on the coupling, retaining plate (5) and cover (7) to aid reassembly.

WARNING

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

4 Remove the actuator from the valve body in accordance with Sect 4.8.1 (page 36).

5 Remove the retaining plate (5) and discard the O ring (3).

6 Mark adjacent points on the valve body and cover to aid reassembly.

7 Remove the bolts (1) and washers securing the valve cover (7).

Note

There are two jacking holes in the valve cover to aid removal.

8 Taking care that the rotor is not lifted with the cover, carefully lift off the cover.

9 Remove and discard the cover O ring (8).

10 Remove the rotor assembly from the valve body.

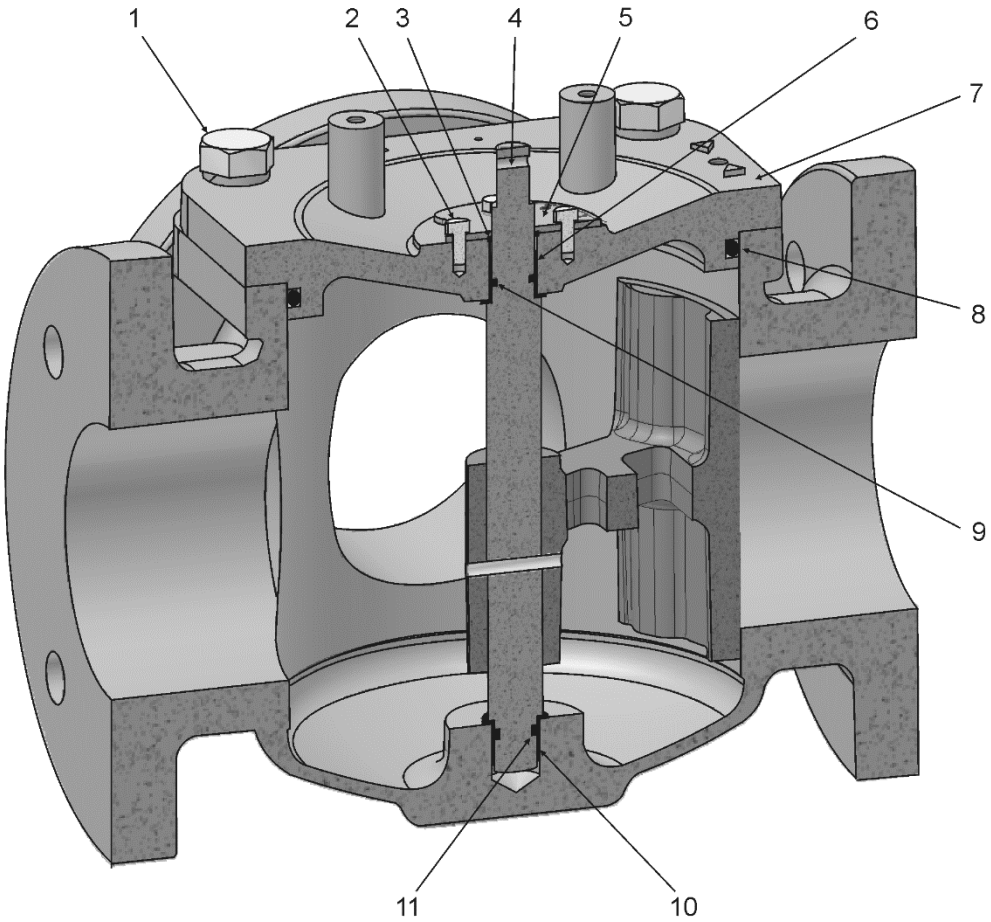


Fig 4 4, 6 and 8 inch Valve

11 Remove and discard the upper and lower shaft O rings (9 & 11).

12 Inspect the valve internals for wear, damage and cleanliness. Clean and replace if necessary.

Note

It is recommended that the upper and lower composite bearings (6 & 10) are replaced at this stage.

Reassemble Valve (refer to Fig 4, page 18)

1 Fit new upper and lower shaft O rings (9 & 11) to the rotor shaft.

2 Carefully insert the rotor assembly into the valve body with the rotor in the low temperature position.

3 Fit a new cover O ring (8) to the cover and position the cover on the valve, aligning the marks made during disassembly.

4 Fit the cover bolts (1) and washers and tighten to a torque of 244 Nm (4" & 6" valves) or 476 Nm (8" valve).

5 Fit the retaining plate (5) and new O ring (3).

6 Install the actuator onto the valve body in accordance with Sect 4.8.1 (page 36).

3.4.3 Dismantle and Assemble 10 and 12 inch Valves

Dismantle Valve (refer to Fig 5, page 20)

If the valve is installed in the upright position, it is possible to dismantle the valve whilst still installed in the pipework as follows:

WARNING

The valve may contain hot/pressurised fluid. Ensure the valve is isolated, drained and allowed to cool to a safe working level before dismantling.

1 Switch off and isolate power to the actuator.

2 Using the handwheel, turn the valve to the low temperature position.

3 Mark adjacent points on the actuator and coupling and also on the coupling and cover (6) to aid reassembly.

WARNING

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

4 Remove the actuator from the valve body in accordance with Sect 4.8.1 (page 36).

5 Remove the bolts (2) and retaining plate (5).

6 Remove and discard the O ring (3).

7 Mark adjacent points on the valve body and cover to aid reassembly.

8 Remove the bolts (1) and washers securing the valve cover.

Note

There are two jacking holes in the valve cover to aid removal.

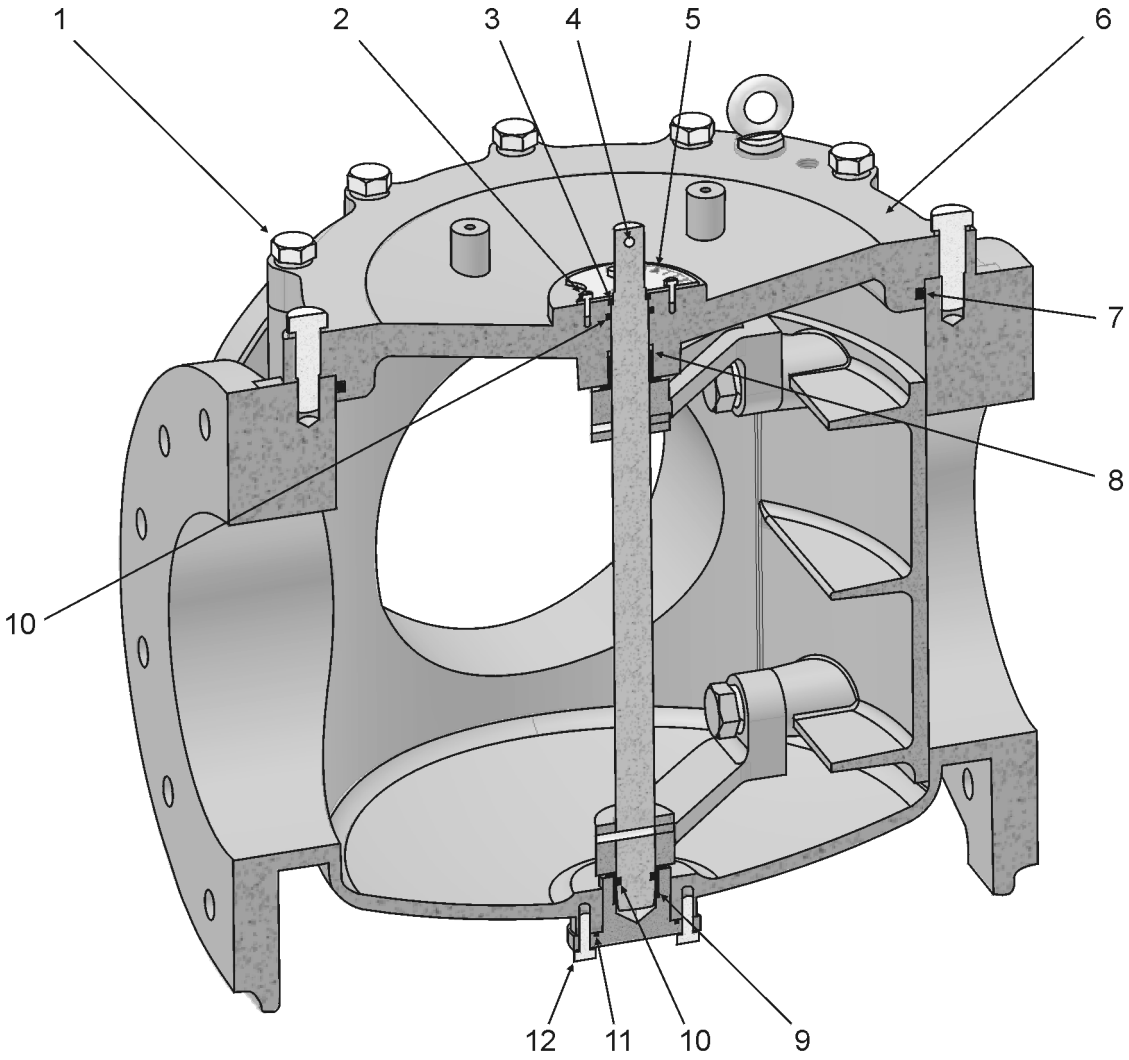


Fig 5 10 and 12 inch Valves

9 Taking care that the rotor is not lifted with the cover, carefully lift off the cover (6).

10 Remove and discard the cover O ring (7).

11 Remove the rotor assembly from the valve body.

12 Remove and discard the upper and lower shaft O rings (10).

13 Inspect the valve internals for wear, damage and cleanliness. Clean and replace if necessary.

Note

It is recommended that the upper and lower composite bearings (8 & 9) are replaced at this stage. The lower bearing is more accessible if the end cover is removed. When refitting the end cover, a new O ring (11) must be fitted.

Reassemble Valve (refer to Fig 5, page 20)

1 Fit new upper and lower shaft O rings (10) to the shaft.

2 Carefully insert the rotor assembly into the valve body with the rotor in the low temperature position.

3 Fit a new cover O ring (7) to the cover (6) and position the cover on the valve, aligning the marks made during disassembly.

4 Fit the cover bolts (1) and washers and tighten to a torque of 244 Nm.

5 Fit the retaining plate (5) and new O ring (3).

6 Install the actuator onto the valve body in accordance with Sect 4.8.1 (page 36).

3.4.4 Recommended Spares

It is recommended that all the spares listed below are replaced each time the valve is disassembled.

Note

All O rings are Viton, indicated by the last four characters of part number being "L002".

2 and 3 inch Valves (Fig 3, page 16)

- **Service Kit** Part No. 47961X102 (2 inch valve)
- **Service Kit** Part No. 47961X103 (3 inch valve)

Comprising:

Ref	Description	2 inch (qty)	3 inch (qty)
6	O Ring, Cover	43630L002 (1)	43630L002 (1)
2	O Ring, Shaft	43635L002 (2)	43625L002 (2)
1	Composite Bearing, Upper	46457L012 (1)	46457L016 (1)
8	Composite Bearing, Lower	46457L012 (1)	46457L016 (1)
3	Coupling pin	43419L022 (1)	43419L022 (1)

4, 6 and 8 inch Valves (Fig 4, page 18)

- **Service Kit** Part No. 47961X104 (4 inch valve)
- Service Kit Part No. 47961X106 (6 inch valve)
- Service Kit Part No. 47961X108 (8 inch valve)

Comprising:

Ref	Description	4 inch (qty)	6 inch (qty)	8 inch (qty)
9	O Ring, Shaft Upper	43625L002 (1)	43617L002 (1)	43617L002 (1)
11	O Ring, Shaft Lower	43625L002 (1)	43615L002 (1)	43615L002 (1)
8	O Ring, Cover	46980L002 (1)	43638L002 (1)	43603L002 (1)
3	O Ring, Retainer Plate	43615L002 (1)	43617L002 (1)	43617L002 (1)
10	Composite Bearing, Lower	46457L016 (1)	46457L220 (1)	46457L220 (1)

6	Composite Bearing, Upper	46457L016 (1)	46457L025 (1) 46457L120 (1)	46457L025 (1) 46457L120 (1)
4	Coupling Pin	43419L022 (1)	43406L035 (1)	43406L035 (1)

10 and 12 inch Valves (Fig 5, page 20)

- **Service Kit** Part No. 47961X110 (10 inch valve)
- **Service Kit** Part No. 47961X112 (12 inch valve)

Comprising:

Ref	Description	10 inch (qty)	12 inch (qty)
10	O Ring, Shaft Upper	43600L002 (1)	43600L002 (1)
10	O Ring, Shaft Lower	43617L002 (1)	43617L002 (1)
7	O Ring, Cover	43648L002 (1)	43648L002 (1)
3	O Ring, Retainer Plate	43617L002 (1)	43617L002 (1)
11	O Ring, End Cover	43619L002 (1)	43619L002 (1)
9	Composite Bearing, Lower	46457L125 (1)	46457L125 (1)
8	Composite Bearing, Upper	46457L125 (1)	46457L125 (1)
4	Coupling Pin	43406L035 (1)	43406L040 (1)

14 and 16 inch Valves (not illustrated)

- **Service Kit** Part No. 47961X114 (14 inch valve)
- **Service Kit** Part No. 47961X116 (16 inch valve)

Comprising:

Description	14 inch (qty)	16 inch (qty)
O Ring, Shaft Upper	43611L002 (2)	43611L002 (2)
O Ring, Shaft Lower	43611L002 (1)	43611L002 (1)
O Ring, Cover	43610L002 (1)	43612L002 (1)
O Ring, Retainer Plate	43608L002 (2)	43608L002 (2)
O Ring, End Cover	43608L002 (2)	43608L002 (2)
Composite Bearing, Lower	41627 (1)	41627 (1)
Composite Bearing, Upper	41627 (1)	41627 (1)
Coupling Pin	43402L055 (1)	43402L055 (1)

Section 4

Electric Actuator

Contents

4.1 Description

4.1.1 Mechanical

The Electric Actuator is a rugged, compact and lightweight quarter-turn actuator providing enclosure protection to IP67. The actuator is powered by an electric induction motor driving a double-worm gear chain. The double-worm drive construction of the gearbox provides high reliability gearing whilst

preventing fluid forces in the valve from reverse – driving the actuator. Manual override is fitted as standard, enabling valve operation without electrical power. The manual override is automatically disengaged when electrical power is re-applied, preventing risk of injury from the handwheel.

4.1.2 Electrical

The actuator contains the following electrical equipment:

- Electric motor with integral bi-metallic cut-outs which disconnect the power to the motor if the temperature exceeds 150° C and reset when the motor cools to approx 97° C.
- End of travel micro switches disconnect power to the motor when the end of travel is reached.
- Auxiliary micro switches operate just before the end of travel to provide indication signals.
- Torque limit micro switches disconnect power to the motor if a factory set torque is exceeded.
- Anti-condensation heater. Wired in when condensation can form due to fluctuating temperatures.
- Terminal strip for external connections.

The internal wiring for the standard actuator is illustrated in Fig 7(page26).

The external wiring is illustrated in the system wiring diagrams of Section 7 (System Integration).

4.1.3 Versions

The actuator is available in 115V ac and 230V ac, single phase. All versions have the option of a Positioner, which is fitted to the side of the actuator (see section 4.1.4).

The internal wiring for the various options are illustrated in Fig 7 (page 26) to Fig 9 (page 28).

The external wiring is illustrated in the system wiring diagrams of Section 7 (System Integration).

4.1.4 Optional Positioner

An optional Positioner Unit is available to control the actuator from a 4-20mA input signal.

Fig 6 External Positioner

The Positioner is a versatile, micro-processor controlled unit which is fully configurable for various control functions. The configuration of the unit is detailed in section 4.6.

The main features of the Positioner are:

- Control of the actuator by an externally generated 4 – 20 mA signal.
- Actuator position indication available as 4 – 20 mA output (position re-transmission).
- Status indicator LED.
- Error voltage signal to indicate actuator status:
  - Grounded for normal operation.
  - Pulled to input voltage by open collector during fault condition.

CAUTION

The error voltage signal must not exceed any one of the following parameters:
30V or 100mA or 200mW.

4.1.5 Actuator Internal Wiring

For versions with a Positioner, versions are available with either 4-20mA position control or switched live control. The internal and suggested external wiring for each is shown in the following figures.

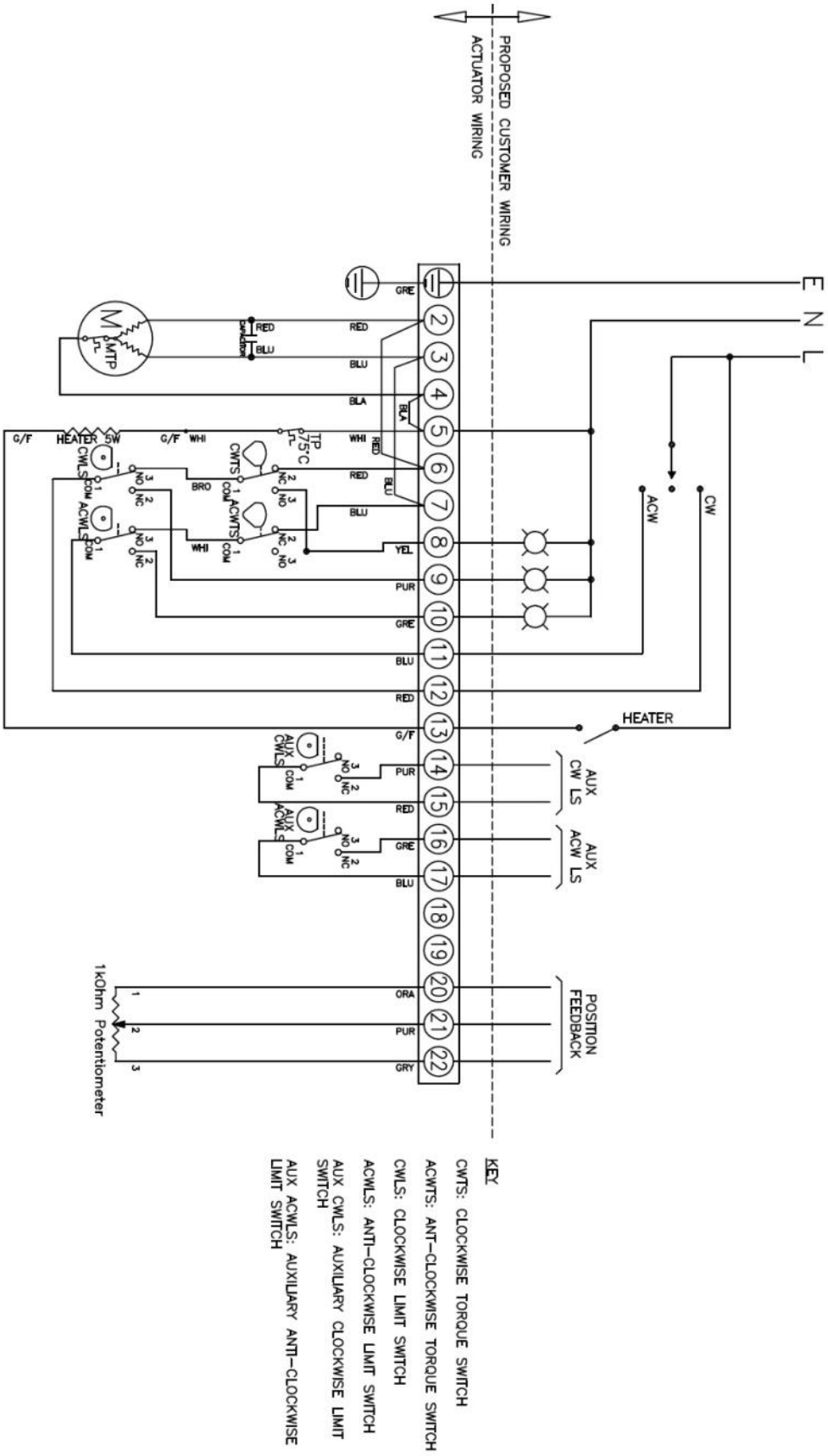


Fig 7 EA Actuator Internal Wiring – Without Positioner

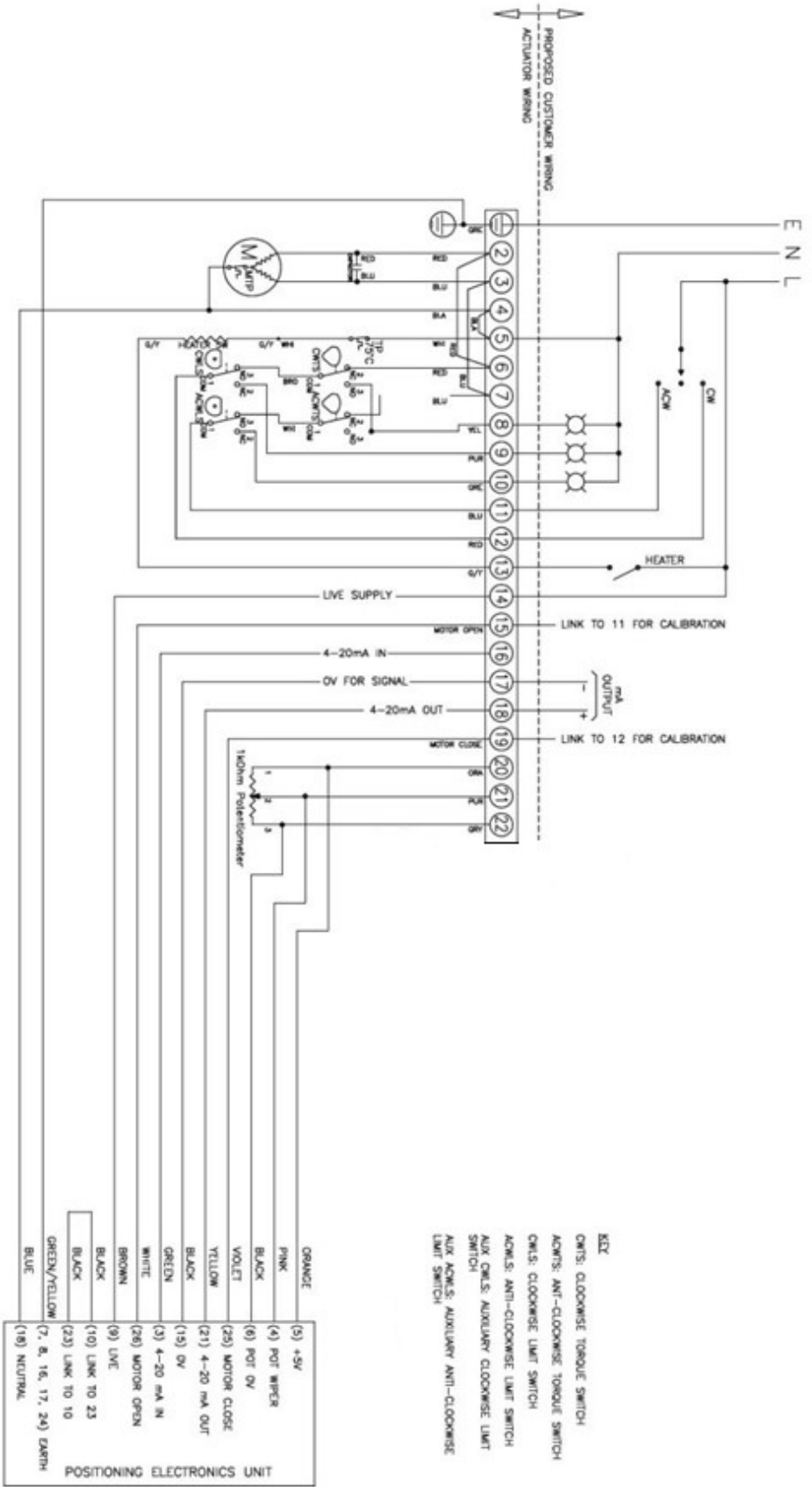


Fig 8 EA Actuator Internal Wiring – With Positioner for Switched Live Control

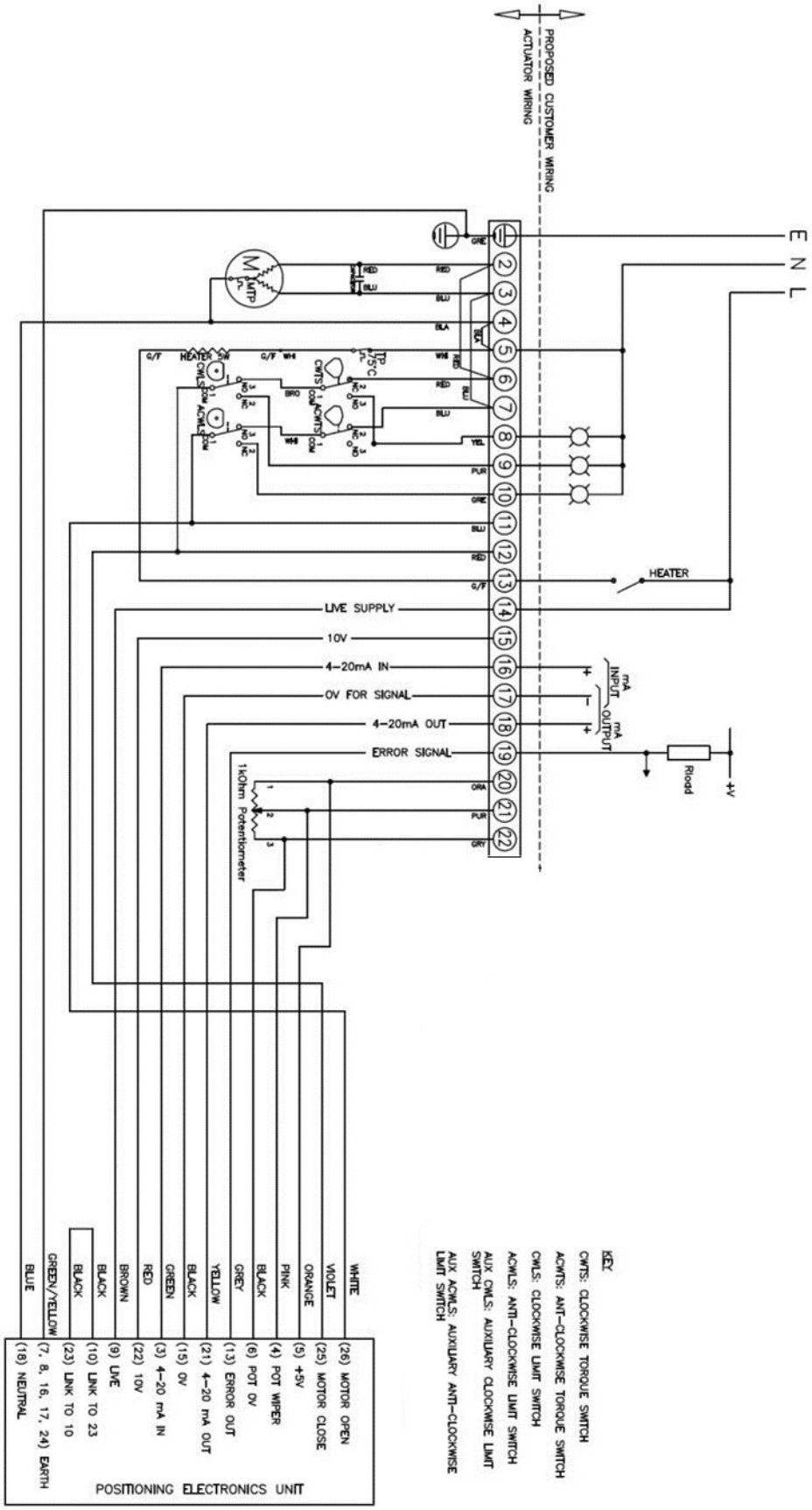


Fig 9 EA Actuator Internal Wiring – With Positioner

4.2 Identification of Model Number

EA	100	17S	220	0	-AA

Size/Nominal Torque	
100 Nm	100
200 Nm	200
Shaft Connection	
17 mm square (EA 100 only)	17S
22 mm square (EA 200 only)	22S
Supply Voltage	
110 V ac	110
220 V ac	220
Features	
Standard (1 kΩ potentiometer)	0
Standard (5 kΩ potentiometer)	1
Standard with positioner port	2
Direct Mode (Clockwise rotation with increasing demand current)	
4 – 20 mA electronic positioner with position re-transmission	A
4 – 20 mA electronic positioner with demand re-transmission	B
4 – 20 mA electronic positioner with position error output (4 mA ref)	C
4 – 20 mA electronic positioner with position error output (12 mA ref)	D
Reverse Mode (Anti-clockwise rotation with increasing demand current)	
4 – 20 mA electronic positioner with position re-transmission	E
4 – 20 mA electronic positioner with demand re-transmission	F
4 – 20 mA electronic positioner with position error output (4 mA ref)	G
4 – 20 mA electronic positioner with position error output (12 mA ref)	H
With electronic positioner for 4-20 mA position retransmission only	J
As for "J" above but reverse acting	K
Special Features (consult Manufacturer)	

4.3 Mechanical Installation

The installation of the actuator to the valve body is achieved by the use of a mounting plate. It is attached to the underside of the actuator with bolts. The mounting plate, complete with actuator is then secured with bolts to the valve body.

In the case of the 2 in and 4 in valve, the mounting plate must be attached to the valve before the actuator is positioned and secured to the mounting plate.

WARNING

The actuator is heavy (EA100 – 16.6 kg and EA200 – 22 kg). The appropriate manual handling precautions must be applied to prevent personnel injury.

Mount the actuator onto the valve body in accordance with Sect 4.8.1 (page 36).

4.4 Actuator Re-orientation

As standard, actuators are mounted to the valve body with the cable entries over the cold port. For some installations it could be more convenient to have the actuator rotated to a different position. The actuator can be orientated in any of four positions in 90 degree steps. To rotate the actuator, proceed as follows:

WARNING

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

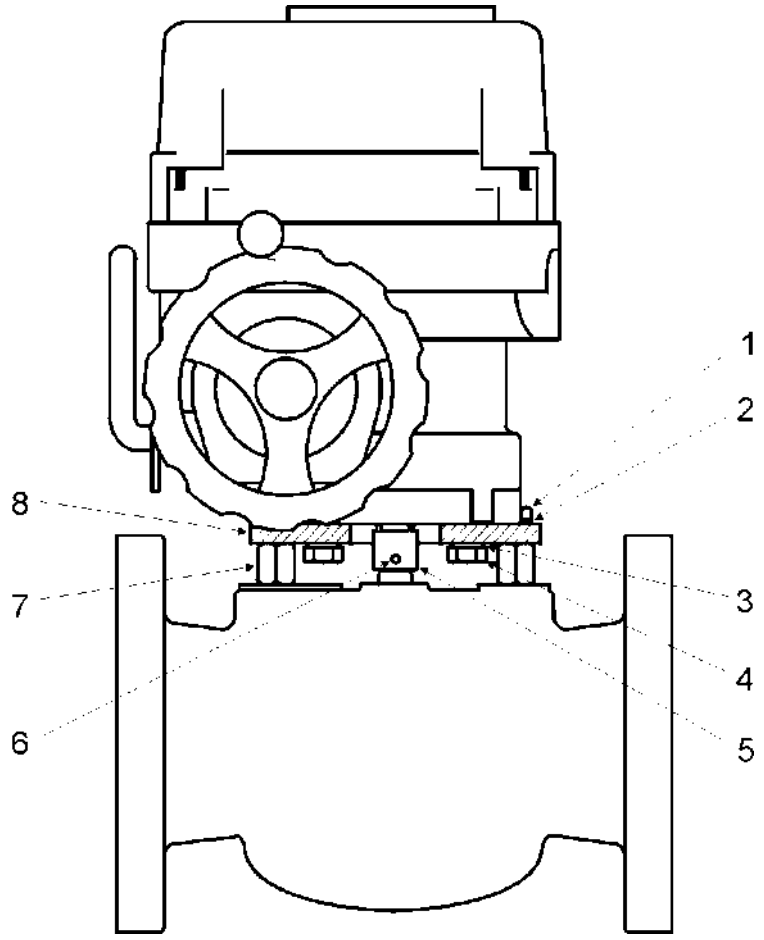


Fig 10 Actuator to Valve Body Assembly (typical)

1. Ensure that there is no flow through the valve before proceeding.
2. Switch off power to the actuator.
3. Use the lever and handwheel to rotate the valve to one end of stroke. It does not matter which end.
4. Look at the coupling (item 5, Fig 10, page 30) and note what position it is in relative to the valve body. If a letter 'R' or a vertical line is present on the coupling, use that for ease of reference.
5. Look at the top of the actuator, and note the position of the indicator disc. This will be re-aligned later to correspond with the rotor position.
6. On versions 2GEF and 4GEF, slacken four bolts (item 4, Fig 10, page 30) to release the actuator from the mounting plate. For all other versions, slacken four bolts (item 1, Fig 10, page 30).

CAUTION

If the valve is mounted with the actuator below it, take great care in slackening these bolts. Once freed, the actuator will drop from the valve.

7. Completely remove the bolts (section 6) and lift the actuator off the coupling so that it is completely disengaged.
8. Re-orientate the actuator to the desired position and lower it back onto the coupling, ensuring that the coupling has not rotated from the previously noted position.
9. Re-fit the bolts (with Loctite 2400 on their threads).
10. Tighten bolts to the value stated in Table 3, page 36.
11. Slacken the four screws which hold the ring around the viewing window. Lift the ring off and carefully lift off the viewing window.

CAUTION

The edges of the metal indicator disc can have sharp edges. Take care when rotating the disc.

12. Rotate the position indicator disc to match the rotor position, as noted earlier.
13. Ensure that the sealing rings are still present and re-fit the ring.

4.5 Electrical Installation

The following precautions and limitations must be observed before electrical connection of the actuator.

CAUTION

Electrical power must not be supplied to both the open and close motor windings at the same time or overheating will occur. When power is applied to either the open or close windings, the other must be isolated.

If multiple actuators are controlled from the same DPDT control switch, it is possible that the first actuator to reach end of travel will reverse direction due to the supply being available from the common control switch. When several actuators need to be controlled in parallel with one 3 position control switch, each actuator must have separate contacts.

- Power supply must be free from excessive voltage transients (spikes).
- The power supply must be fused at 1.5 to 2 times the rated current.
- Check the motor nameplate and ensure the actuator voltage is correct for the local power supply.
- Use wire with the correct gauge and insulation (Follow standards prescribed by the relevant electrical regulations).
- The actuator chassis must be correctly grounded.
- Use the appropriate cable glands for weather proof or explosion proof environments.
- All unused electrical entries must be blanked off with the appropriate plug.
- Make all splices or connections using the correct pin connector of terminal strip.
- Ensure the connections comply with the system wiring diagram (Section 7).
- Control lines must be correctly shielded.
- Keep the motor compartment clean and dry at all times.
- Cable must be routed inside the actuator as illustrated in Fig 10 to avoid the possibility of interfering with moving parts.
- When the 4-20mA input and output signals are used, it is recommended that these signals are protected with 50mA quick blow fuses.

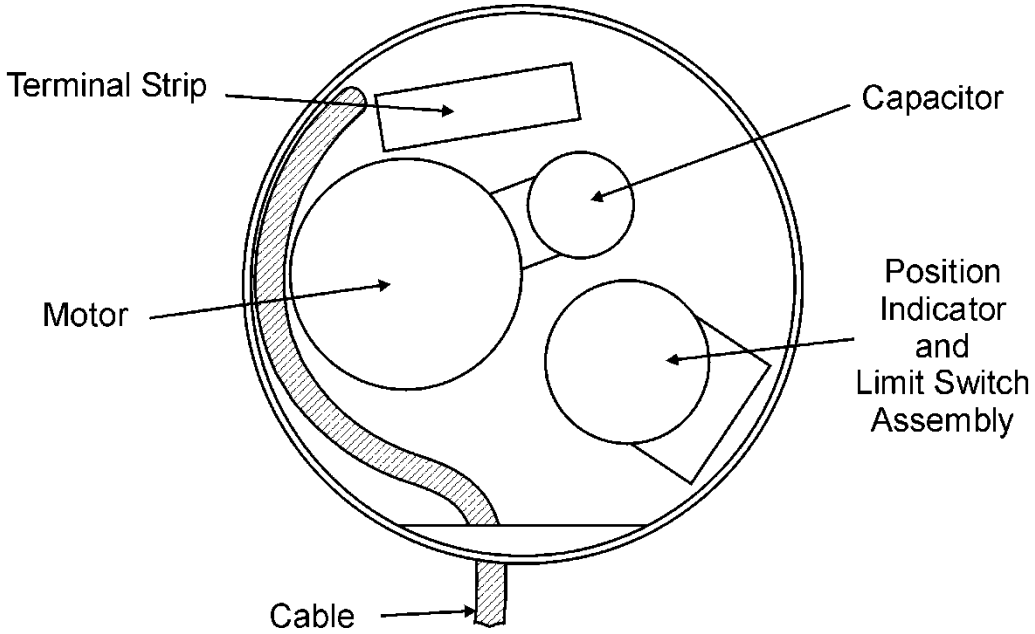


Fig 11 Actuator Internal Cable Routing

Electrically connect the actuator in accordance with the system wiring diagrams in Section 7 (System Integration). Schedule a periodic maintenance check to ensure proper performance and long service life. It is recommended that the actuator is checked for correct operation at least once per month.

Note

The terminal strip employs spring loaded connections. Apply pressure to the top of the terminal with a small, flat blade screwdriver to open the connector. Insert the wire and release the pressure on the screwdriver. The wire is then held in the connector by the spring.

4.5.1 Electrical Position Feedback

A potentiometer is fitted as standard, to all versions of the EA actuator. Where a Positioner is also fitted, the Positioner uses the potentiometer to determine the position of the actuator. With a Positioner fitted, 5V dc is applied across the track connections of the potentiometer, giving a voltage out of the wiper contact. This voltage is fed into the Positioner, but may also be used to give an external position indication, provided that the signal is not loaded significantly. An impedance to 0V of not less than 100k ohms is recommended.

When no Positioner is fitted, the three potentiometer terminals are not electrically connected to anything in the actuator, and may be used with any external circuit to give position indication.

The potentiometer is geared to the actuator output shaft such that it rotates about 270 degrees for a full quarter turn of the valve. This means that the wiper contact of the potentiometer will never get fully to either end of the potentiometer track.

4.6 Positioner Configuration and Calibration

The Positioner is provided fully calibrated and configured according to the model code of the valve that the actuator is fitted to. Changes can be made if required by means of a Configurator box connected between the positioner and the actuator to access calibration and configuration options. The following parameters can be accessed:

The options within each parameter are:

- CW / ACW on increasing mA
    - CW on increasing mA
    - ACW on increasing mA
- Action on loss of mA demand signal
    - Move to 4mA position
    - Move to 20mA position
    - No actuator movement (default)
- Initiate actuator calibration
    - Start actuator calibration
- Deadband
    - 1% to 9% in 1% steps
- 4-20mA output
    - Output equals current position
    - Output equals demand input
    - Output is scaled position error, 4mA is no position error
    - Output is scaled position error, 12mA is no position error

4.6.1 Configurator

Refer to OMM47962X00013 for details of how to use the 47962X Configurator to access and change the above parameters.

4.7 Operation

CAUTION

Damage can be caused to the valve assembly if a cheater or extension bar is used on the handwheel. Do not use any lever / mechanical aid to turn the handwheel.

The actuator operates as soon as electrical power is applied. Versions with a Positioner can be controlled by an 8071D PID controller based system or an externally generated 4 – 20 mA. Versions without a Positioner, and those where the Positioner is only provided to give a 4-20mA output signal are controlled directly by switching the power supply to either of the two switched live inputs.

Manual operation is possible at any time by disengaging electrical drive by pulling the actuator declutching lever and turning the handwheel. Once in Manual mode, the actuator returns to automatic mode as soon as the declutching lever is released and the motor starts.

On failure of the actuator to operate correctly, refer to the troubleshooting guide in Section 8.

4.8 Maintenance

The following maintenance tasks are described in this section:

- Removal and installation onto valve body (4.8.1 – page 36)
- Lubrication (4.8.2 – page 38)
- Limit switch replacement (4.8.3 – page 39)
- Limit switch adjustment (4.8.4 – page 41)
- Potentiometer replacement (4.8.5 – page 43)
- Potentiometer adjustment (4.8.7 – page 46)
- Anti-condensation heater replacement (4.8.8 – page 48)
- Capacitor replacement (4.8.9 – page 49)

Note

The torque switches are set by the manufacturer and require no adjustment.

4.8.1 Removal and Installation onto Valve Body

The size of bolts and associated torque setting is dependent on the size of the valve. Throughout the removal and installation procedure, refer to Table 3 and Fig 12 (page 37) for the relevant bolt sizes and torque settings:

Table 3 Actuator mounting bolt size and torque settings

Valve Size	Mounting Plate to Actuator Fig 12 (4)		Mounting Plate to Valve Body Fig 12 (1)	
	Bolt Size	Torque Setting	Bolt Size	Torque Setting
2 inch	M8 x 20	22 Nm	M8 x 20	22 Nm
3 inch	M10 x 25	31 Nm	M8 x 20	22 Nm
4 inch	M8 x 20	22 Nm	M8 x 20	22 Nm
6 inch	M10 x 25	31 Nm	M8 x 25	22 Nm
8 inch	M10 x 25	31 Nm	M8 x 25	22 Nm
10 inch	M10 x 25	31 Nm	M8 x 25	22 Nm
12 inch	M12 x 25	45 Nm	M8 x 25	22 Nm
14 inch	M12 x 25	45 Nm	M10 x 25	45 Nm
16 inch	M12 x 25	45 Nm	M10 x 25	45 Nm

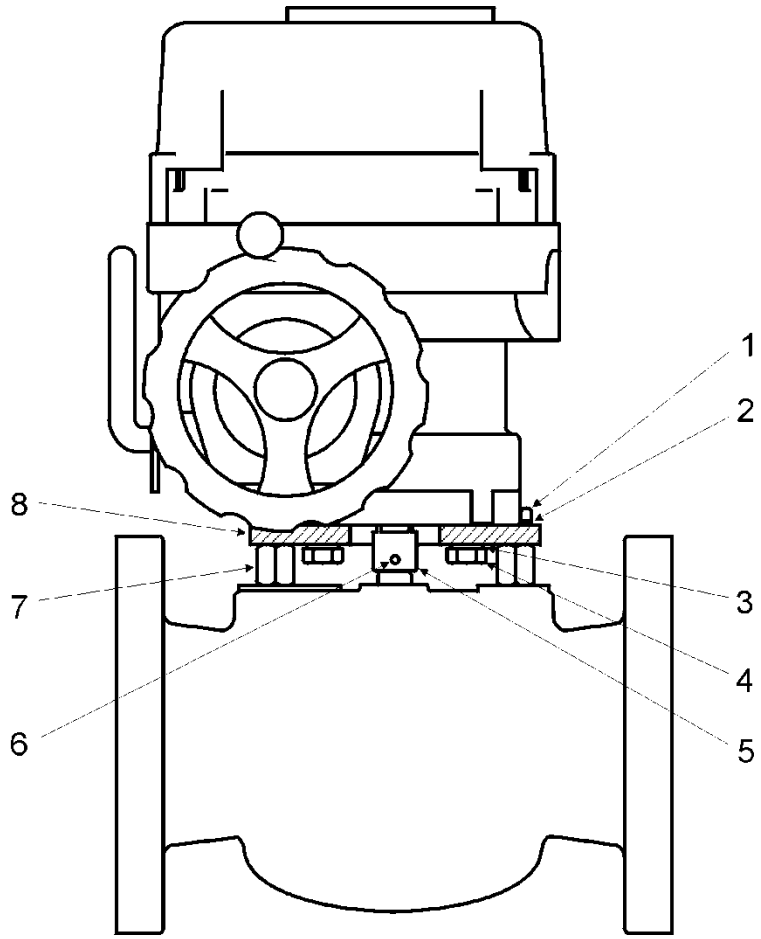


Fig 12 Actuator mounting

Removal

WARNINGS

Lethal voltages are present in the actuator presenting a shock hazard to personnel. Ensure the power supply to the actuator is isolated before the cover is removed.

If an actuator is removed from a valve fitted in a live system, the valve rotor may rotate uncontrollably in the body. An actuator must never be removed from a valve installed in a live system.

The actuator case can be hotter than the ambient temperature. Care must be taken when handling the actuator to prevent burn injuries to personnel.

1 Switch off and isolate the actuator electrical supplies.

2 Manually operate the actuator to the low temperature position.

3 Remove the actuator cover.

4 Label the wires to aid reassembly, disconnect from the terminal strip and pull the cables clear from cable entries.

5 Remove the four bolts and spring washers (Fig 12 items 1 and 2) securing the actuator mounting plate to the valve.

WARNING

The actuator is heavy (EA100 – 16.6 kg and EA200 – 22 kg). The appropriate manual handling precautions must be applied to prevent personnel injury.

6 Carefully lift the actuator complete with mounting plate from the valve.

Installation

1 Ensure that the mounting plate is secured to the underside the actuator with the four bolts tightened to the relevant torque setting detailed in Table 3 page 36.

2 Manually operate the actuator to the low temperature position.

3 Mount the actuator, complete with mounting plate onto the valve body and secure with the four bolts and washers (Fig 12 items 1 and 2). Tighten the bolts to the relevant torque setting detailed in Table 3 page 36.

WARNING

The actuator wires carry lethal mains voltages. Actuator wiring must be isolated before feeding and connecting it to the actuator.

4 Ensure the actuator electrical power supplies are switched off and isolated.

5 Feed the electrical wiring through the required cable entry in the actuator.

6 Route the wiring around the motor to the terminal strip, avoiding the actuator moving parts (refer to Fig 11 page 33).

7 Connect the wires to the terminal strip in accordance with the relevant system wiring diagram in Section 7 (System Integration).

8 Examine the actuator cover O ring for damage, replace if necessary.

9 Fit the actuator cover and secure with the socket headed screws.

10 Wind the handwheel and ensure that movement is free and smooth over its full range of operation.

11 Energise the actuator power supply and control circuits and check for correct operation.

4.8.2 Lubrication

To enable the actuator to be mounted in any position, a totally sealed and permanently lubricated gear case is used. During long periods of storage, it is not unusual for a very small amount of lubricant to weep from shaft seals. In this event, wipe up the weeping lubricant with a clean cloth. During operation, the weeping should disappear.

4.8.3 Limit Switch Replacement

CAUTION

During replacement of the limit switches, the actuator must be manually positioned. If the actuator is mounted on a valve which is installed in the pipework, it will affect the process flow of the system.

Replace the limit switches as follows (refer to Fig 13, page 40)

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Remove the socket head cap screws and carefully lift off the cover.

2 Unscrew the motor strap (16), pull apart and remove to clear the upper limit switch cam (11).

3 Unscrew the screw in the centre of the position indicator (1) and remove the indicator from the position indicator shaft (17).

4 Remove the cable ties securing the potentiometer wiring to the potentiometer bracket (3) and potentiometer bracket mounting pillar (18).

5 Remove the screw (30) and split washer (29) and pull off the potentiometer bracket (3) from the position indicator shaft.

6 Undo the grubscrew (8) and pull off the large spur gear (7) from the position indicator shaft.

7 Turn the manual drive handle as necessary to access the grubscrews (10 and 23) in both the upper and lower limit switch cams (11 and 13).

8 Undo the grubscrews to loosen both upper and lower limit switch cams on the shaft.

CAUTION

When the two screws (22) securing the lower limit switch bracket (21) are unscrewed, they can damage the lower limit switch cam (13). The screws (22) must be undone evenly and in small increments whilst raising the limit switch assembly and cams to prevent the screws applying pressure to the underside of the cam.

9 Turn the cams to access the lower limit switch bracket screws (21). Undo the screws evenly and in small increments whilst raising the limit switch assembly and cams together to prevent the screws damaging the lower cam.

10 Remove the two screws (21) and slide the limit switch assembly, both cams and cam spacer (12) from the shaft.

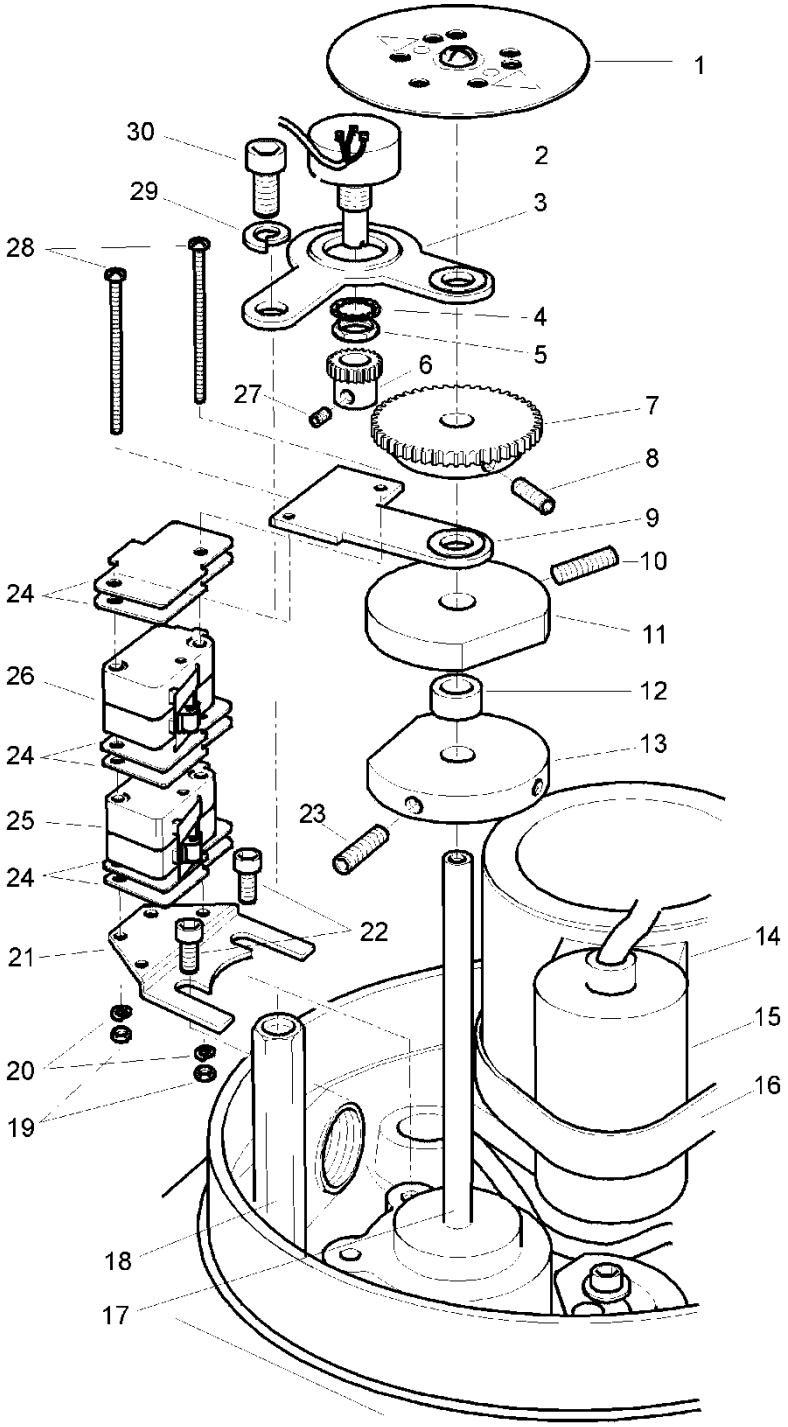


Fig 13 Limit Switch assembly

11 Disconnect the limit switch pair wires from the terminal strip (the switches identified as item 25 are the open switches and item 26 are the close switches).

12 Remove the two screws (28), nuts (19) and washers (20) and remove the switch pair to be replaced.

13 Reassemble the limit switches complete with limit switch spacers (24) and secure with the two screws (28), washers (20) and nuts (19).

14 Connect the replacement limit switch pair wires to the terminal strip.

15 Slide the cams and cam spacer (12) onto the position indicator shaft. Whilst viewing the actuator as illustrated, ensure the cam grubscrews are facing you when the flats face the switches.

16 Position the upper limit switch bracket (9) and slide down the shaft with the cams.

17 Secure the limit switch assembly with the two screws (22).

18 Slide the large spur gear (7) onto the shaft. Do not tighten the grubscrew at this point.

19 Slide the potentiometer bracket (3) onto the shaft and secure with screw (30) and washer (29).

20 Refit the motor strap (16) through the slot in the terminal strip bracket and around the motor and capacitor. Ensure the capacitor sits snugly against the motor on the anti-vibration block (14).

21 Refit the position indicator to the top of shaft. Manually wind the actuator to each end of travel and ensure the indicator aligns with the scale on the cover.

22 Use new cable ties to secure the potentiometer wires to the potentiometer bracket and potentiometer bracket mounting pillar.

23 Carry out limit switch adjustment in accordance with Sect 4.8.4

24 Carry out potentiometer adjustment in accordance with Sect 4.8.7.

4.8.4 Limit Switch Adjustment – Rotor Not Visible

The limit switches and mechanical end stops are set by the manufacturer and should not need adjustment unless the cams or switches are replaced or disturbed. During manufacture, the limit switches are set up relative to the valve fully open and closed positions. The mechanical end stops are then set in position, a further two complete turns of the manual operating handle.

This procedure assumes that observation of the valve rotor is not possible (installed in pipework) and sets the limit switches relative to the factory set mechanical end stop positions.

CAUTION

During adjustment of the limit switches, the actuator must be manually positioned. If the actuator is mounted on a valve which is installed in the pipework, it will affect the process flow of the system.

Adjust the limit switches as follows (refer to Fig 13, page 40):

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Remove the socket head cap screws and carefully lift off the cover.

Note

The cams are adjusted until the limit switches operate (indicated by an audible click). In conditions of high noise levels, an electrical continuity circuit should be connected across the relevant switch to give a visible indication of switch operation (refer to Fig 7, page 26 for terminal numbers).

3 **Open limit switch adjustment**:

3.1 Manually wind the actuator fully counter-clockwise to the mechanical end stop.

3.2 Wind the manual handle clockwise to take up backlash (approx ¼ turn).

3.3 Wind the manual handle clockwise a further two complete turns.

3.4 Loosen the grubscrew (23) in the lower limit switch cam (13).

3.5 Turn the cam until the limit switch is on the flat of the cam (switch not pressed).

3.6 Slowly turn the cam clockwise until the first switch (Open limit switch 'OLS') just operates.

3.7 Tighten the grubscrew (23).

3.8 Repeat from step 3.1 without loosening the cam grubscrew to check that the first switch operates when the manual handle is turned two complete turns (after take-up of backlash).

3.9 Check that the second switch on the same cam (Aux open limit switch 'AOLS') operates after a further clockwise ½ turn of the manual handle.

Note

It is not possible to adjust the AOLS separately from the OLS.

4 **Close limit switch adjustment:**

4.1 Manually wind the actuator fully clockwise to the mechanical end stop.

4.2 Wind the manual handle counter-clockwise to take up backlash (approx ¼ turn).

4.3 Wind the manual handle counter-clockwise a further two complete turns.

4.4 Loosen the grubscrew (10) in the upper limit switch cam (11).

4.5 Turn the cam until the limit switch is on the flat of the cam (switch not pressed).

4.6 Slowly turn the cam counter-clockwise until the first switch (Close limit switch 'CLS') just operates.

4.7 Tighten the grubscrew (10).

4.8 Repeat from step 4.1 without loosening the cam grubscrew to check that the first switch operates when the manual handle is turned two complete turns (after take-up of backlash).

4.9 Check that the second switch on the same cam (Aux close limit switch 'ACLS') operates after a further counter-clockwise ½ turn of the manual handle.

Note

It is not possible to adjust the ACLS separately from the CLS.

5 Remove any electrical continuity circuits connected to the terminal strip.

6 Ensure that the actuator cover O ring is correctly fitted and undamaged.

7 Refit the actuator cover and secure with the socket head cap screws.

CAUTION

Adjustment of the limit switches affects the calibration of the optional Positioning Electronics Unit. If fitted, it must be re-calibrated before the actuator is brought into service (refer to OMM47962X00013).

8 If fitted, calibrate the positioning electronics unit (refer to the Positioning Electronics Unit Manual).

9 Energise the actuator power supply and control circuits and check for correct operation.

4.8.5 Limit Switch Adjustment – Rotor Visible

The limit switches and mechanical end stops are set by the manufacturer and should not need adjustment unless the cams or switches are replaced or disturbed. During manufacture, the limit switches are set up relative to the valve fully open and closed positions. The mechanical end stops are then set in position, a further two complete turns of the manual operating handle.

This procedure assumes that observation of the valve rotor is not possible (installed in pipework) and sets the limit switches relative to the factory set mechanical end stop positions.

Adjust the limit switches as follows (refer to Fig 13, page 40):

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Remove the socket head cap screws and carefully lift off the cover.

Note

The cams are adjusted until the limit switches operate (indicated by an audible click). In conditions of high noise levels, an electrical continuity

circuit should be connected across the relevant switch to give a visible indication of switch operation (refer to Fig 7, page 26 for terminal numbers).

3 **Open limit switch and end stop adjustment**:

3.1 Manually wind the actuator fully counter-clockwise until the rotor just covers the valve port.

3.2 If the actuator has Positioner fitted, turn the handwheel a further ¾ of a turn.

3.3 Loosen the grubscrew (23) in the lower limit switch cam (13)

3.4 Turn the cam until the limit switch is on the flat of the cam (switch not pressed).

3.5 Slowly turn the cam clockwise until the first switch (Open limit switch 'OLS') just operates.

3.6 Tighten the grubscrew (23).

Note

It is not possible to adjust the AOLS separately from the OLS.

3.7 Slacken the nut on the mechanical end stop screw nearest to the handwheel, and turn the screw counter-clockwise by approximately 10 turns.

3.8 Turn the handwheel 2 turns counter-clockwise, and check that the port has not started to open. If it has, then turn the handwheel clockwise until the port is just closed.

3.9 On the mechanical end stop adjuster nearest to the handwheel, turn the screw clockwise until it stops.

4 **Close limit switch adjustment:**

4.1 Manually wind the actuator fully clockwise until the rotor just covers the valve port.

4.2 If the actuator has a Positioner fitted, turn the handwheel a further ¾ of a turn.

4.3 Loosen the grubscrew (10) in the upper limit switch cam (11).

4.4 Turn the cam until the limit switch is on the flat of the cam (switch not pressed).

4.5 Slowly turn the cam counter-clockwise until the first switch (Close limit switch 'OLS') just operates.

4.6 Tighten the grubscrew (10).

Note

It is not possible to adjust the AOLS separately from the CLS.

4.7 Slacken the nut on the mechanical end stop screw furthest from the handwheel, and turn the screw counter-clockwise by approximately 10 turns.

4.8 Turn the handwheel 2 turns clockwise, and check that the port has not started to open. If it has, then turn the handwheel counter-clockwise until the port is just closed.

4.9 On the mechanical end stop adjuster furthest from the handwheel, turn the screw clockwise until it stops. Tighten the nut.

CAUTION

Adjustment of the limit switches affects the calibration of the optional Positioning Electronics Unit. If fitted, it must be re-calibrated before the actuator is brought into service (refer to OMM47962X00013).

5 If fitted, calibrate the positioning electronics unit (refer to the Positioning Electronics Unit Manual).

6 Energise the actuator power supply and control circuits and check for correct operation.

4.8.6 Potentiometer Replacement

Replace the potentiometer as follows (refer to Fig 14, page 45):

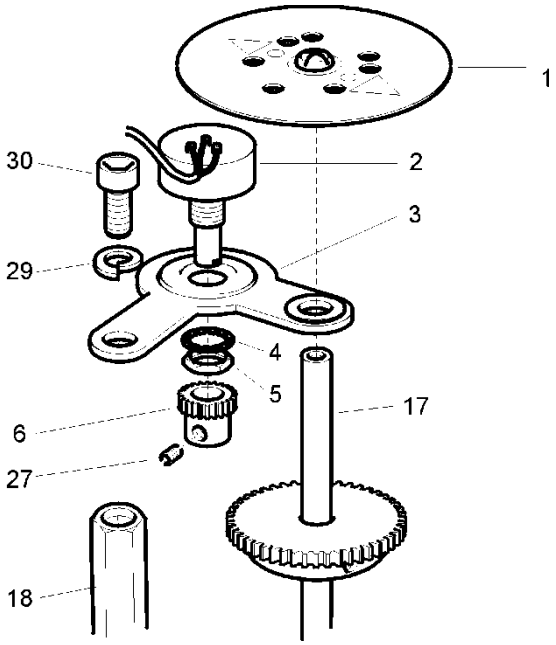


Fig 14 Potentiometer Assembly

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Remove the socket head cap screws and carefully lift off the cover.

3 Release the potentiometer wires from the cable ties and disconnect from the terminal strip.

Note

To access the potentiometer connections on the terminal strip, it may be necessary to release the terminal strip bracket as described in the anti-condensation heater replacement procedure (Sect 4.8.8 – page 48).

4 Unscrew the screw in the centre of the position indicator (1) and remove the indicator from the position indicator shaft (17).

5 Remove screw (30) and washer (29) and slide potentiometer bracket (3) off the position indicator shaft (17).

6 Loosen grubscrew (27) and withdraw the small spur gear (6) from the potentiometer shaft.

7 Remove nut (5) and washer (4) then remove the potentiometer (2) from the bracket.

8 Insert replacement potentiometer into the bracket with the connections orientated as illustrated and secure with washer (4) and nut (5).

9 Connect the potentiometer wires into the terminal strip (refer to Fig 7, page 26).

10 Slide the small spur gear (6) onto the potentiometer shaft and tighten the grubscrew (27).

11 Slide the potentiometer bracket onto the position indicator shaft and secure to the potentiometer bracket mounting pillar (18) with screw (30) and washer (29).

12 Refit the position indicator (1) to the top of the shaft. Manually wind the actuator to each end of travel and ensure the indicator aligns with the scale on the cover.

13 Use new cable ties to secure the potentiometer wires to the potentiometer bracket and potentiometer bracket mounting pillar.

14 Carry out the potentiometer adjustment procedure (Sect 4.8.7).

4.8.7 Potentiometer Adjustment

The purpose of this procedure is to position the potentiometer gears so the potentiometer wiper operates over the centre section of the track.

Set the potentiometer as follows (refer to Fig 15, page 47):

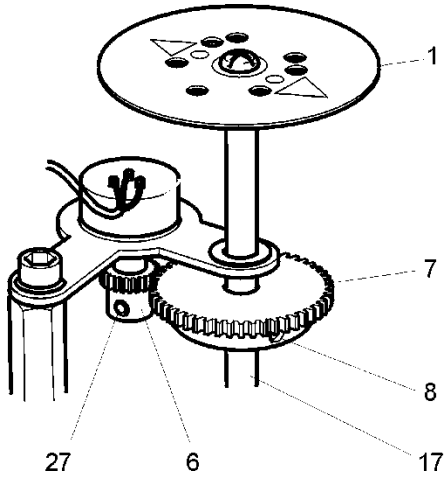


Fig 15 Potentiometer Adjustment

1 Loosen the grubscrew (8) of the large spur gear (7) and slide the gear down the shaft (17) to disengage from the small spur gear (6).

2 Manually wind the actuator to mid position determined by counting the turns between the mechanical end stops and then winding the total number of turns divided by 2.

3 Connect an ohmmeter to terminals 20 and 22 on the terminal strip (whole track of potentiometer).

4 Determine the centre value of the potentiometer track by dividing the reading on the ohmmeter by two.

5 Connect the ohmmeter to terminals 21 and 22 on the terminal strip (pot wiper to end of track).

6 Rotate the potentiometer shaft until the ohmmeter indicates the centre value determined at step 4.

7 Rotate the large spur gear (7) on the shaft until the grubscrew (8) is in an accessible position for tightening.

8 Slide the gear up the shaft until it engages with the small spur gear (6).

9 Ensure the ohmmeter still indicates the centre value. Adjust by rotating the large spur gear on the shaft as necessary.

10 Tighten the grubscrew (8).

11 Manually wind the actuator to each end stop and record the ohmmeter indication.

12 Ensure that the centre section of the potentiometer track is being used by checking the ohmmeter readings at each end of travel eg. 40 Ω and 960 Ω readings indicate an even distribution on a 1 kΩ track.

13 Remove the ohmmeter connections.

14 Ensure that the actuator cover O ring is correctly fitted and undamaged.

15 Refit the actuator cover and secure with the socket head cap screws.

CAUTION

Adjustment of the limit switches affects the calibration of the optional Positioner. If fitted, it must be re-calibrated before the actuator is brought into service (refer to OMM47962X00013).

16 If fitted, calibrate the Positioner (refer to the Positioner Manual).

17 Energise the actuator power supply and control circuits and check for correct operation.

4.8.8 Anti-Condensation Heater Replacement

Replace the anti-condensation heater as follows (Refer to Fig 16, page 49):

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator electrical power supply.

2 Remove the socket head cap screws and carefully lift off the actuator cover.

3 Unscrew the motor strap, pull apart and unthread from the slot in the terminal strip bracket.

4 Slacken the two screws (2) securing the terminal strip bracket to the actuator base.

5 Slide the terminal strip bracket off the screws and raise to access the heater (3).

6 Disconnect the heater wires from the terminal strip (refer to Fig 7, page 26).

7 Undo the two screws (4) enough to withdraw the heater (3) from its mounting bracket (5).

8 Replace the heater in the mounting bracket and secure with the two screws (4).

9 Connect the heater wires to the terminal strip (refer to Fig 7, page 26).

10 Slide the terminal strip bracket under the two screws (2) and tighten.

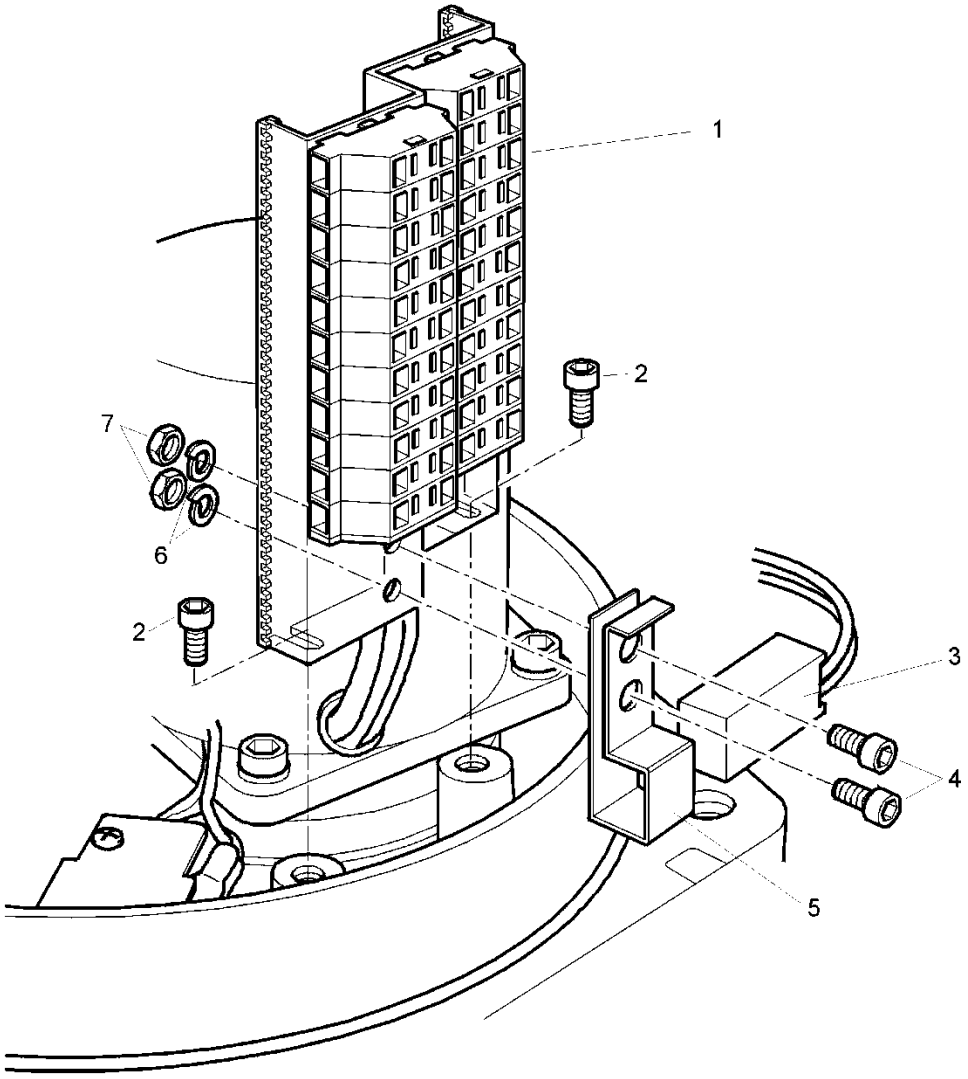


Fig 16 Anti-Condensation Heater

11 Refit the motor strap through the slot in the terminal strip bracket and around the motor and capacitor. Ensure the capacitor sits snugly against the motor on the anti-vibration block.

12 Ensure that the actuator cover O ring is correctly fitted and undamaged.

13 Refit the actuator cover and secure with the socket head cap screws.

14 Energise the actuator power supply and control circuits and check for correct operation.

4.8.9 Capacitor Replacement

WARNING

Lethal voltages are exposed when the actuator cover is removed, presenting an electric shock hazard to personnel. Electrical power supplies must be isolated from the actuator before the cover is removed.

1 Switch off and isolate the actuator power supply.

2 Remove the socket head cap screws and carefully lift off the actuator cover.

3 Disconnect the capacitor wires from the terminal strip.

4 Slacken the motor strap from around the motor and capacitor.

5 Remove the capacitor and the anti-vibration block.

6 Fit a new capacitor and position against the motor ensuring that it sits snugly on the anti-vibration block against the motor.

7 Connect the capacitor wires to the terminal strip.

8 Tighten the motor strap ensuring that it does not obstruct the upper limit switch cam.

9 Ensure that the actuator cover O ring is correctly fitted and undamaged.

10 Refit the actuator cover and secure with the socket head cap screws.

11 Energise the actuator power supply and control circuits and check for correct operation.

4.9 Storage

4.9.1 On-Site Storage

The following conditions must be applied when storing the actuator on site:

- Storage location must be clean, dry and free from excessive vibration and rapid temperature change.
- Permitted temperature range -20° C to +70° C.
- All covers must be fitted and secured.
- If electrical power is not connected, place a packet of desiccant in the motor compartment as follows:
    - Ensure that electrical power to the actuator is isolated.
    - Loosen the socket headed cap screws and carefully lift off the cover.
    - Place a packet of desiccant in the motor compartment.
    - Refit the cover and tighten the socket headed cap screws.
- Replace plastic conduit plugs with appropriate pipe plugs.

4.9.2 Warehouse Storage

The following conditions must be applied when storing the actuator in a warehouse:

- Storage location must be clean, dry and free from excessive vibration and rapid temperature change.
- All covers must be fitted and secured.
- Actuators must not be stored on any floor surface.
- Actuators must be stored upright with the motor compartment facing upwards.

- In areas if high humidity, place a packet of desiccant in the motor compartment as follows:
    - Ensure that electrical power to the actuator is isolated.
    - Loosen the socket headed cap screws and carefully lift off the cover.
    - Place a packet of desiccant in the motor compartment.
    - Refit the cover and tighten the socket headed cap screws.

4.10 Recommended Spares

The following is a list of recommended spares for the actuator.

Description	Part Number
Actuator lid O ring – EA100	82434X001
Actuator lid O ring – EA200	82434X002
Potentiometer, 1k	82434X003
Potentiometer, 5k	82434X004
Heater (115V)	82434X006
Heater (230V)	82434X007
Capacitor (115V)	82434X011
Capacitor (230V)	82434X009
Torque and position limit switch set (pre-wired)	82434X014
Handwheel kit – EA100	82434X015
Handwheel kit – EA200	82434X016

Section 5

PID Controller

Contents

5.1 Controller Systems

The standard control systems for the electrically actuated G-Valve are based upon the 8071D PID controller.

The 8071D is a compact, powerful and versatile PID controller. The inputs, outputs and internal functions are fully configurable and it is capable of meeting the needs of a wide variety of temperature control systems.

The 8071D can be used in a number of ways:

In conjunction with 2 solid state relays	
In conjunction with an 8073C solid state relay module	
Incorporated along with 2 solid state relays in an 8072D controller	

The installation, operation and maintenance of the 8071D and related equipment is fully detailed in AMOT publication OMM807100043.

The actuator can also be controlled by an external 4 – 20 mA generated signal applied to an optional Positioning Electronics Unit. Refer to OMM47962X00013 for full installation, operation and maintenance details.

Section 6

Temperature Sensor

Contents

6.1 Description

The 8060A temperature sensor is ideal for use with the 8071C and 8072C PID controllers and other PT100 applications. It is a 3 wire RTD with stainless steel thermal well and IP54 aluminium connection head. It is able to use standard 3-core cable and operates in the range –100 to 350° C (-150 to 600° F).

6.1.1 Identification of Model Number

8060A	1	2
Conduit Thread		
M20	1	
PG 13.5	2	
PG 16	3	
½” NPT	4	
Installation Thread		
½” BSPTr		2
½” NPT		3

6.2 Installation

When installing the temperature sensor, comply with the following:

- Position the sensor as close as possible to the point of control.
- Ensure the sensor is positioned at least 6 pipe diameters in length from any junction.
- Ensure the end 40mm of probe is a close as possible to the centre of the flow path.
- Minimum recommended wire size 24Awg.
- Do not run cables in very hot areas which can cause cable failure and inaccurate measurement.
- Avoid installation in areas of high vibration.
- Avoid installation into potential air pockets.

- Position the sensor in an accessible location for future maintenance access.
- Use heat transfer compound in thermal well.

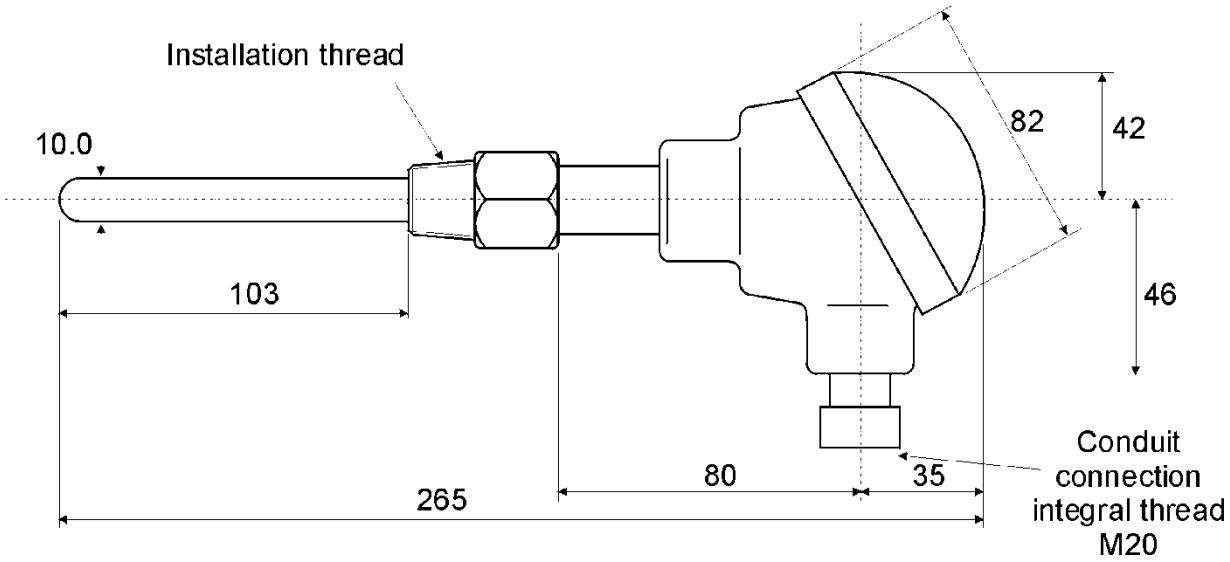


Fig 17 Temperature Sensor

Fig 18 Temperature Sensor Connections

6.3 Maintenance

No maintenance is possible, in the event of failure of the temperature sensor, replace with new item.

Section 7

System Integration

Contents

7.1 Installation Guidance Notes

The following section gives valve installation guidance notes, and manual operational instructions.

Prior to Installation

The AMOT G Valve should be checked upon receipt for damage sustained during shipping. Contact AMOT (refer back page for contact details) in case of any concerns regarding the valve's integrity.

Handling Devices

WARNING

The valve, its components and its actuator are heavy. All lifting and moving equipment including cranes/hoists, lifting hooks, harnesses and slings etc. must be suitably rated to ensure safe handling.

Suitable support of the valve during lifting must be given to ensure safe relocation of the equipment.

Lifting provision for the larger valve assemblies is provided by means of a number of eyebolts on the valve cover.

The rotor itself can be lifted using a sling fed under the triangular web joining the rotor shaft boss to the rotor face.

Installation Recommendations

When installing the valve, the following factors must be considered:

- Position the valve as close as possible to the point where it can best effect control.
- Install a minimum of 6 pipe diameters in length from any intersection to ensure a good mix of fluids. Too great a distance may induce unnecessary time lags into the system affecting accuracy and stability of temperature control.
- Future maintenance is simplified if the valve is installed in the upright position in an accessible location. Ensure valve access is not limited for future maintenance.

- Do not install the valve in a position that inhibits the operation of the manual override handle or access to any electrical/pneumatic actuator connections.
- If possible, avoid installation in areas with a risk of water spray or extreme dirt.

Valve Installation

CAUTIONS

To ensure correct operation of the valve, the valve must not be subject to stresses from misaligned pipe attachment. Ensure that each valve flange is attached to one pipe at a time, and that the flange face to face, and centre to face dimensions are observed. If the pipework cannot be joined to the valve without causing stress to the valve, the pipe positions must be adjusted to suit.

Valve assemblies should be suitably supported back to a solid structure capable of bearing the load when installed into system. It is not recommended that the weight of the valve assembly is supported by the adjoining pipework alone.

Ensure that any relevant information from the flange standard of the flange specification chosen are followed. e.g. bolting and gasket material requirements.

In situations where the valve has been subject to prolonged low temperatures, such as on-site or warehouse storage, great care must be taken to raise the temperature of the valve at a controlled rate of not more than 1°C/minute, in order to prevent damage to the component parts.

Contaminants such as large grit particles or swarf could damage the rotor or even prevent it from rotating in extreme cases. System fluid flowing through the G Valve must be suitably filtered to ensure uninterrupted functionality.

- If it is not already installed onto the valve, install the valve actuator as per the actuator installation instructions in Section 4.8.1.
- Ensure all flange faces, and valve internals are clean and free from any debris.
- For correct operation, ensure no debris is present on any of the valve externals.
- Insert one bolt (and washer, if fitting) through each hole of the connecting pipe flange.
- Centre the ring gasket on the flange face; the gasket OD should sit comfortably in the circumference created by the fitted bolts.
- Using suitable lifting and supporting equipment, fit the valve to the flanged pipe, ensuring the correct valve port is fitted.

- Use a suitable lubricant on the flange bolt threads to achieve the required coefficient of friction.
- Ensuring the flange gasket is seated correctly on the flange faces, fit the remaining washers to each bolt (if fitting), and fit and tighten the remaining nuts as per the relevant pattern shown in Fig 19, in at least 4 stages to compress the flange gasket uniformly. Note, stages 2 – 5 should be completed with a suitable calibrated torque wrench.
- The recommended final torque value should be based upon the bolt material, the bolt lubricant used, and the material and specification of the flange gasket used. See relevant flange standards for further information.

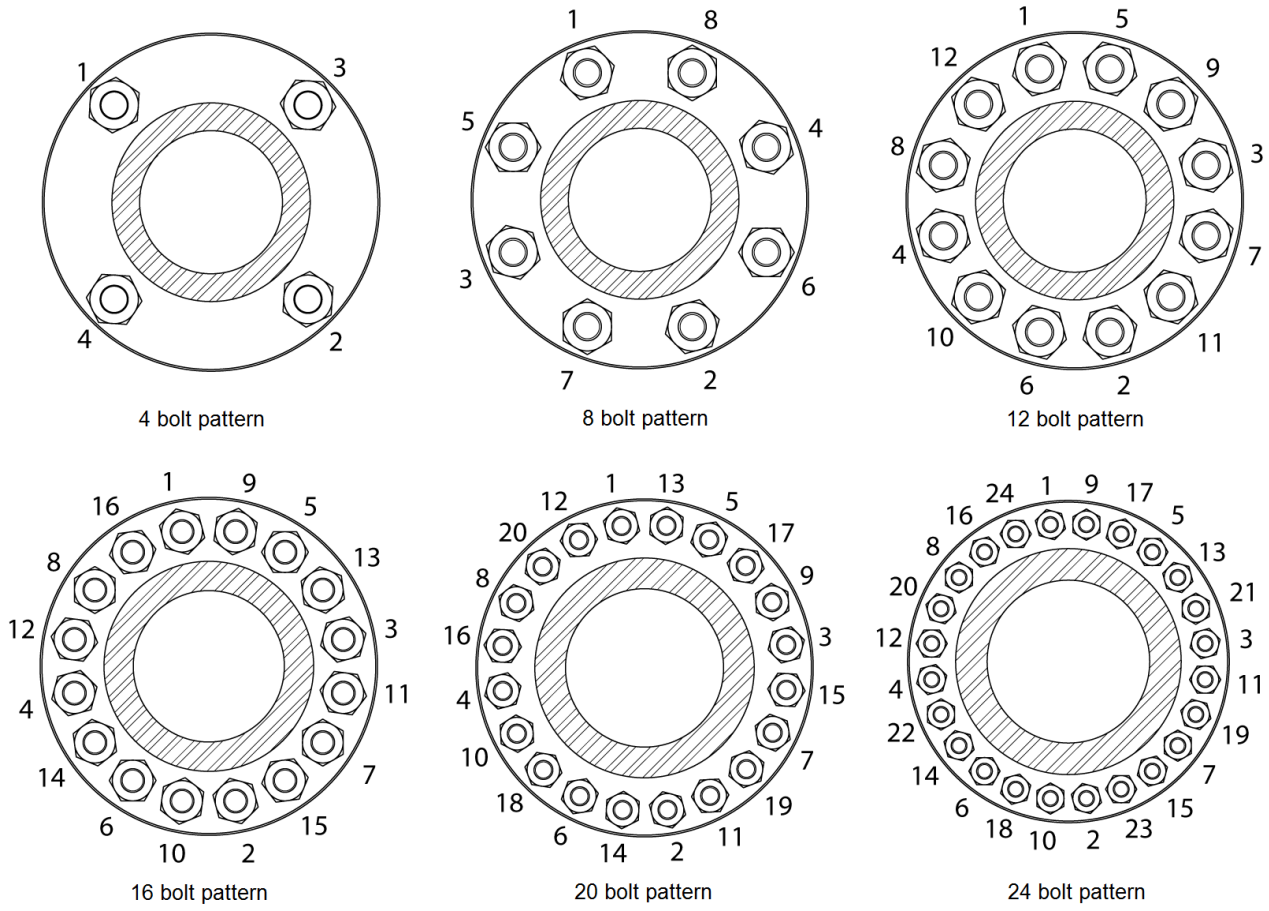


Fig 19 Bolt Tightening Pattern

Temperature Sensor Installation

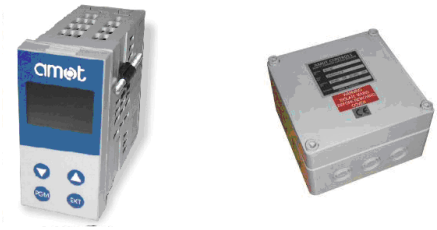
- Position as close as possible to the point of control.
- Ensure positioned at least 6 pipe diameters in length from any junction.
- Ensure the end 40 mm of probe is a close as possible to the centre of the flow path.
- Do not run cables in very hot areas which can cause cable failure and inaccurate measurement.
- Avoid installation in areas of high vibration.
- Avoid installation into potential air pockets.
- Position in an accessible location for future maintenance access.
- Use heat transfer compound in thermal well.

Controller Installation

The installation will be affected by the choice of controller components. Refer to manual OMM807100043 (PID Controllers) for specific installation details.

7.2 System Wiring Diagrams

The system wiring depends on the controller components selected for use. The following options are available:

8071D controller with 2 solid state relays		Fig 20, page 62
8071D controller with an 8073C solid state relay module		Fig 21, page 63
8072D controller		Fig 22, page 64
Positioning Electronics Unit (4 – 20 mA input)		Fig 23, page 65
Positioning Electronics Unit (switched mains voltage input, retransmission only)		Fig 24, page 66

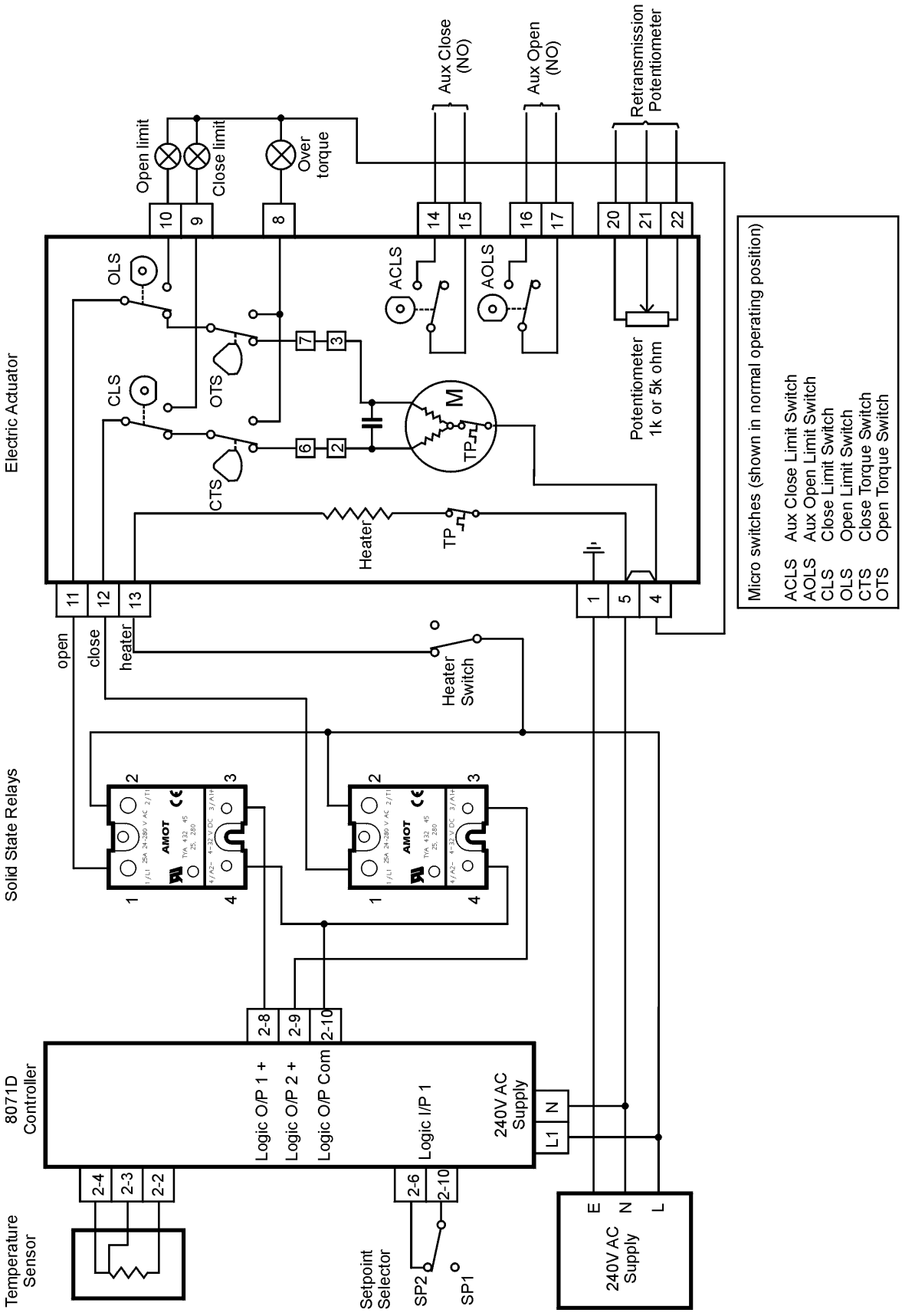


Fig 20 System Wiring Diagram 8071D Controller with two Solid State Relays

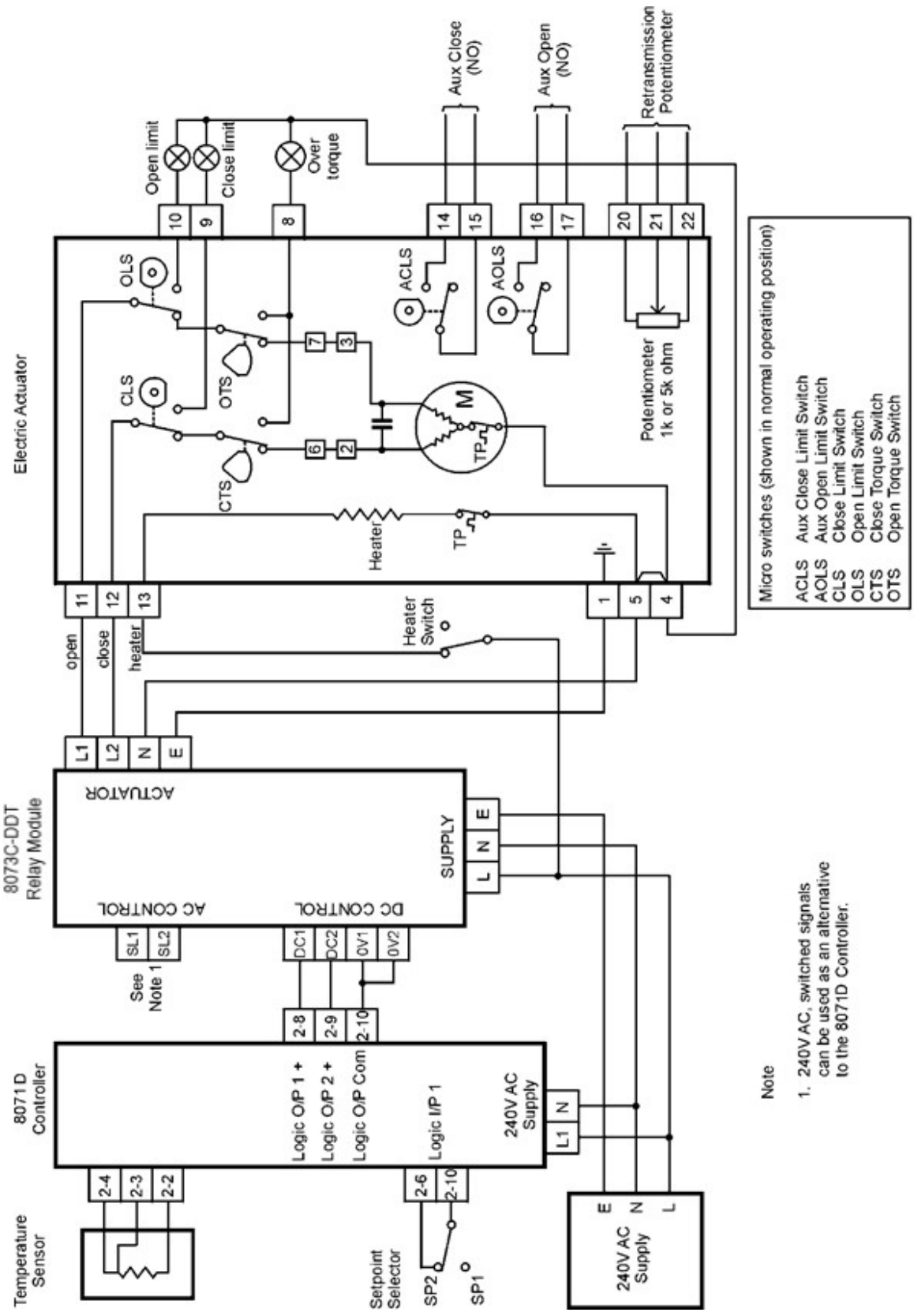


Fig 21 System Wiring Diagram 8071D Controller with 8073C Relay Module

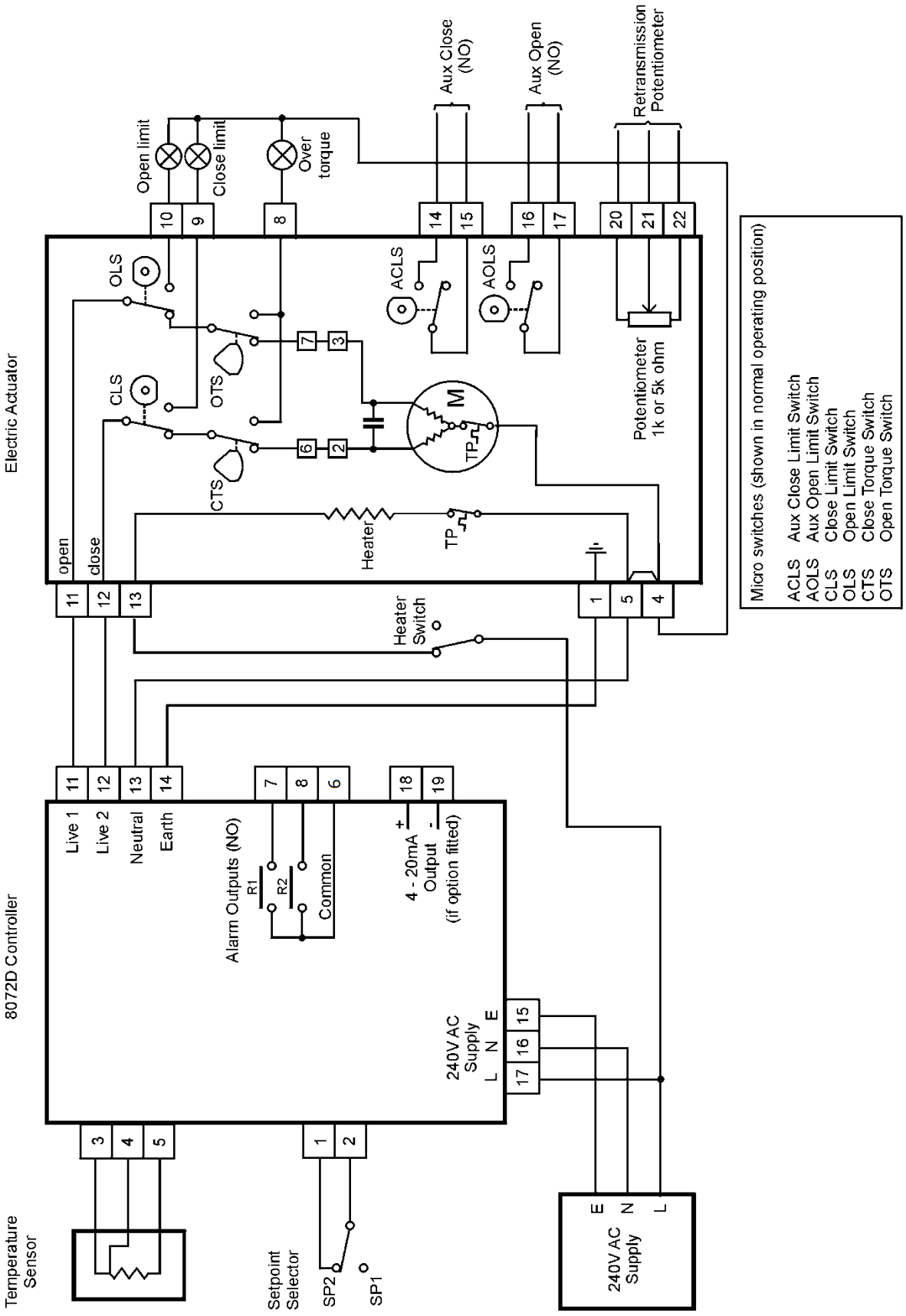


Fig 22 System Wiring Diagram 8072D Controller

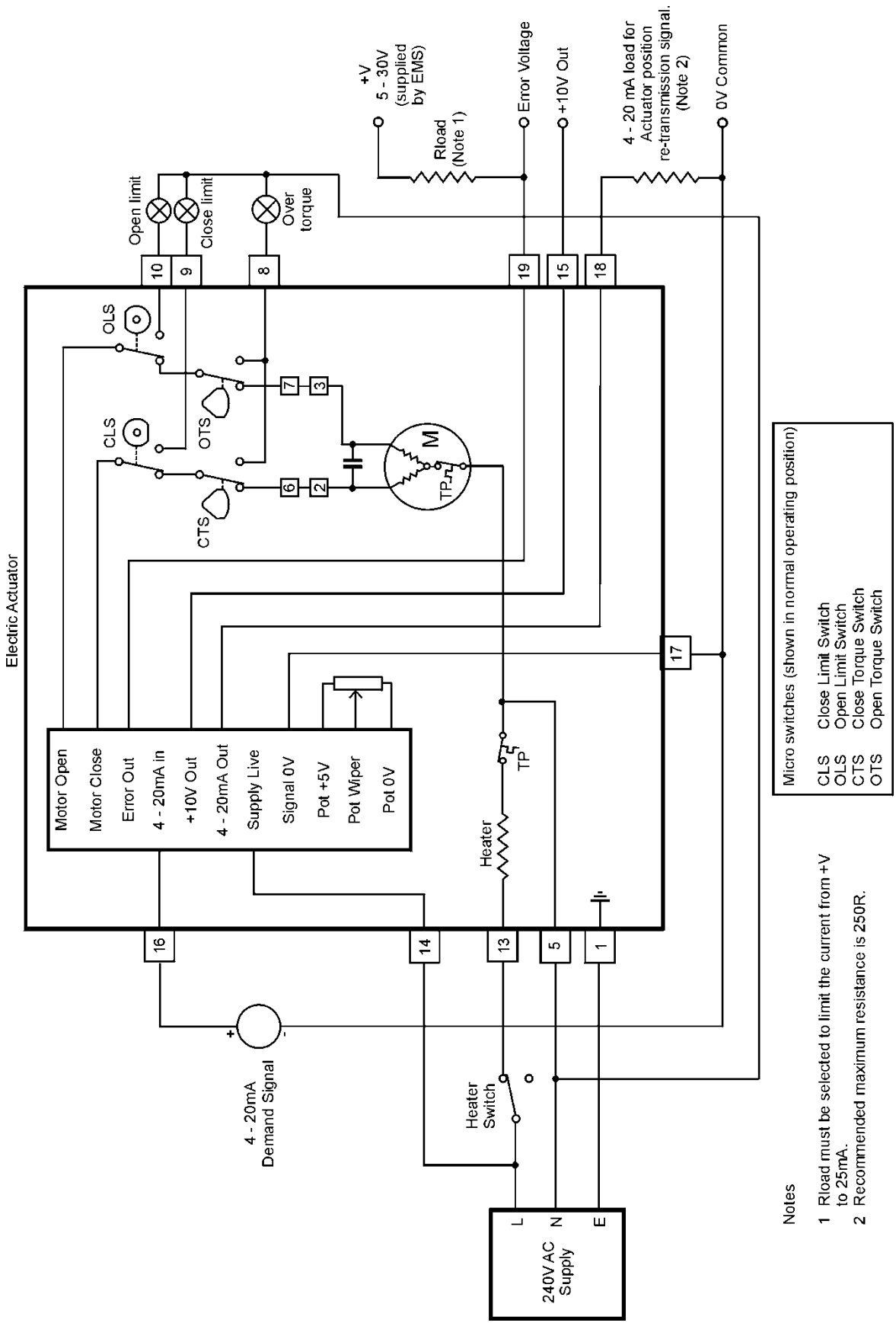


Fig 23 System Wiring Diagram Electronic Positioning Unit 4-20 mA input

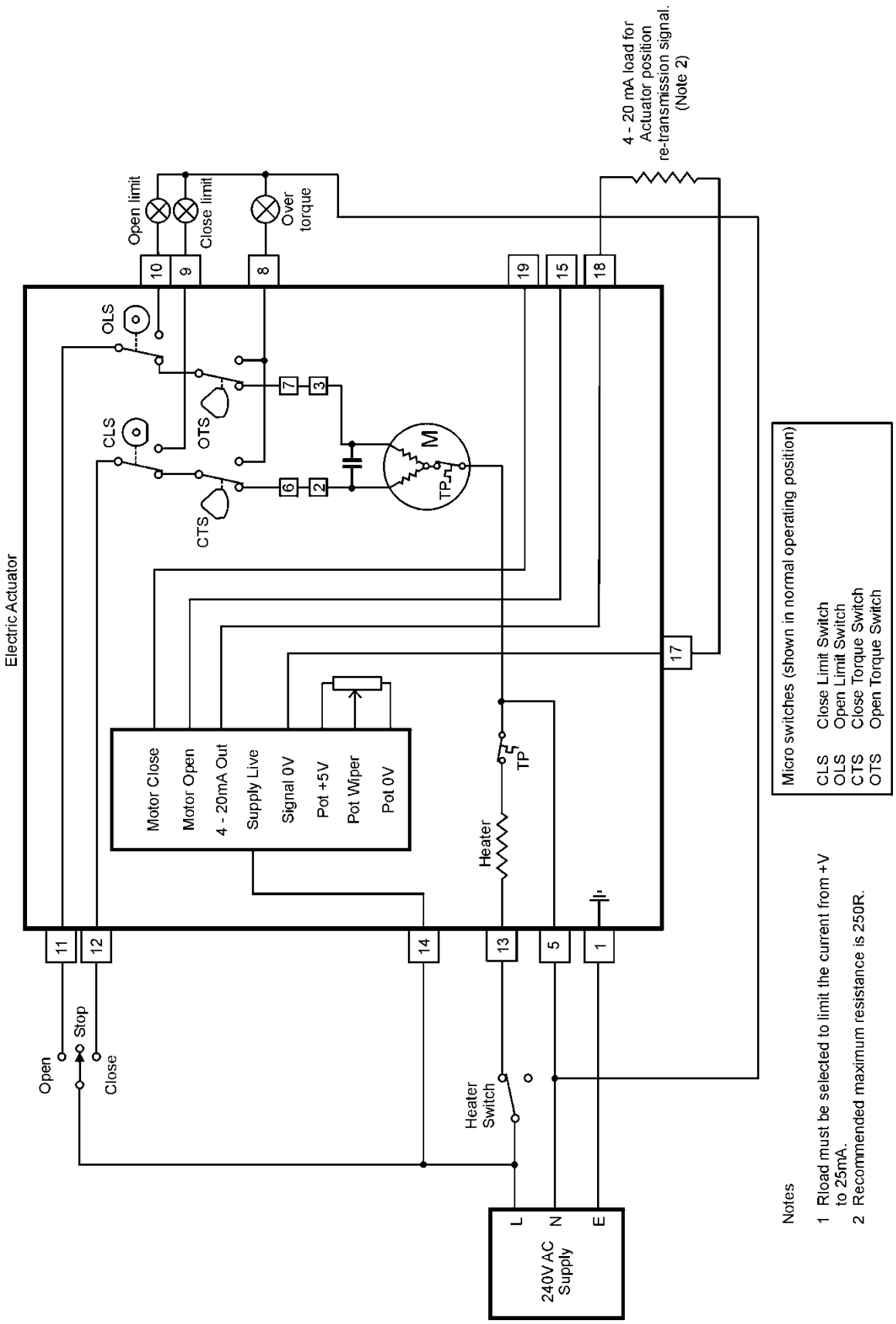


Fig 24 System Wiring Diagram Electronic Positioning Unit switched mains voltage input

Section 8

Troubleshooting

Contents

8.1 Checklist

The following table lists a number of possible faults that could be observed in the system, with the relevant diagnostic and remedial actions.

Fault Indication	Diagnostic Action	Remedial Action
Valve is oscillating or moving in large steps	Check PID values on PID Controller	Adjust PID values
	Check dead band settings on PID Controller	Adjust dead band settings
	Check location of temperature sensor is away from bends and junctions (section 7.1, page 57)	Move temperature sensor
	Check deadband setting of the actuator (section 4.6, page 34)	Adjust deadband setting
	Switch off power, remove actuator lid, and check that gears are tight (Fig 13, page 40)	Adjust gears
	Check coupling pin (Fig 10, page 30, item 6)	Replace pin
Valve drives in one direction only	Check electrical connections	
	Check operation of relays	Replace relay
	Check power to actuator	
	Check control system and temperature sensor	
	Check setting of Potentiometer (4.8.7, page 46)	Adjust position feedback sensor

	On Actuators with a Positioner, Check status of LED	
Valve will not drive in either direction	Check power supply	
	Check actuator motor running	If motor running, replace shear pin between valve and actuator
		If not running, ensure local power supply is compatible with nameplate voltage and current rating.
	Check if motor overheated	Refer to "Motor overheating" below
	Check motor run capacitor	Replace capacitor
	Check Positioner	Replace Positioner
Valve operates slowly	Check mains voltage matches rating plate	
Incomplete travel	Check limit switch setting	Adjust
	Check for obstructions in valve	Clear obstructions
	Check mechanical stops on actuator	Adjust
	Check setting of Potentiometer (4.8.7, page 46)	Adjust position feedback sensor
	Check 4-20mA input resistance (terminals 16 & 17)	If not 200 ohms, use Configurator to check incoming demand data (OMM47962X00013).
	Check data output from Configurator on PC	If 2nd column % does not match 4-20mA input, replace Positioner
Motor overheating	Check if valve is oscillating	See "Valve is oscillating" above
	Check for obstructions in valve	Clear obstructions
	Check ambient temperature	Reduce ambient temperature
	Ensure local power supply is compatible with nameplate voltage and current rating.	
	Check electrical connections	
Moisture/Condensation	Check heater in actuator connected	Connect heater

	Check heater continually powered, not just when motor is running	Provide separate power supply
	Check actuator cover seal	Replace if required
	Check indicator window and seal	Replace if required
	Check all cable entries	Tighten if loose
	Ensure unused cable entries are plugged	Plug as required

8.1.1 Positioner Status Indicator

The status indicator on the Positioner indicates the status of the Positioner and Actuator as follows. Further diagnostic checks are described in OMM47962X00013.

Status Indication	Probable Cause	Diagnostic Action
Not lit	Normal operation	None required
Flashing at 2 Hz	Input 4 – 20 mA signal out of range	Check that 4 – 20 mA input signal is connected and operating within limits.
	Internal actuator fault	Investigate
Flashing at 10 Hz	Actuator cannot meet input demand	Check that motor thermal trip not operated
	Internal actuator fault	Investigate

8.1.2 Positioner Error Signal

The error signal indicates the status of the positioner and actuator. It is an open collector output which switches as follows:

- **Normal operation** – Error signal connection is connected to 0 V common.
- **Fault condition** – Error signal rises to input voltage supplied by the EMS.

CAUTION

Failure to observe the current and voltage restrictions on the Error output terminal will most likely result in permanent damage to the Error function.

Maximum sink current 25mA

Maximum voltage 30V dc

See wiring diagram Fig 23 on page 65 for connection details.

8.2 Positioner Replacement

If it is determined from the diagnostics steps above that the Positioner is faulty, a replacement Positioner can be fitted. However, it must be calibrated to match the actuator, and this requires a Configurator. See manual number OMM47962X00013 for details. The Positioner is a sealed part which cannot be repaired.

Section 9

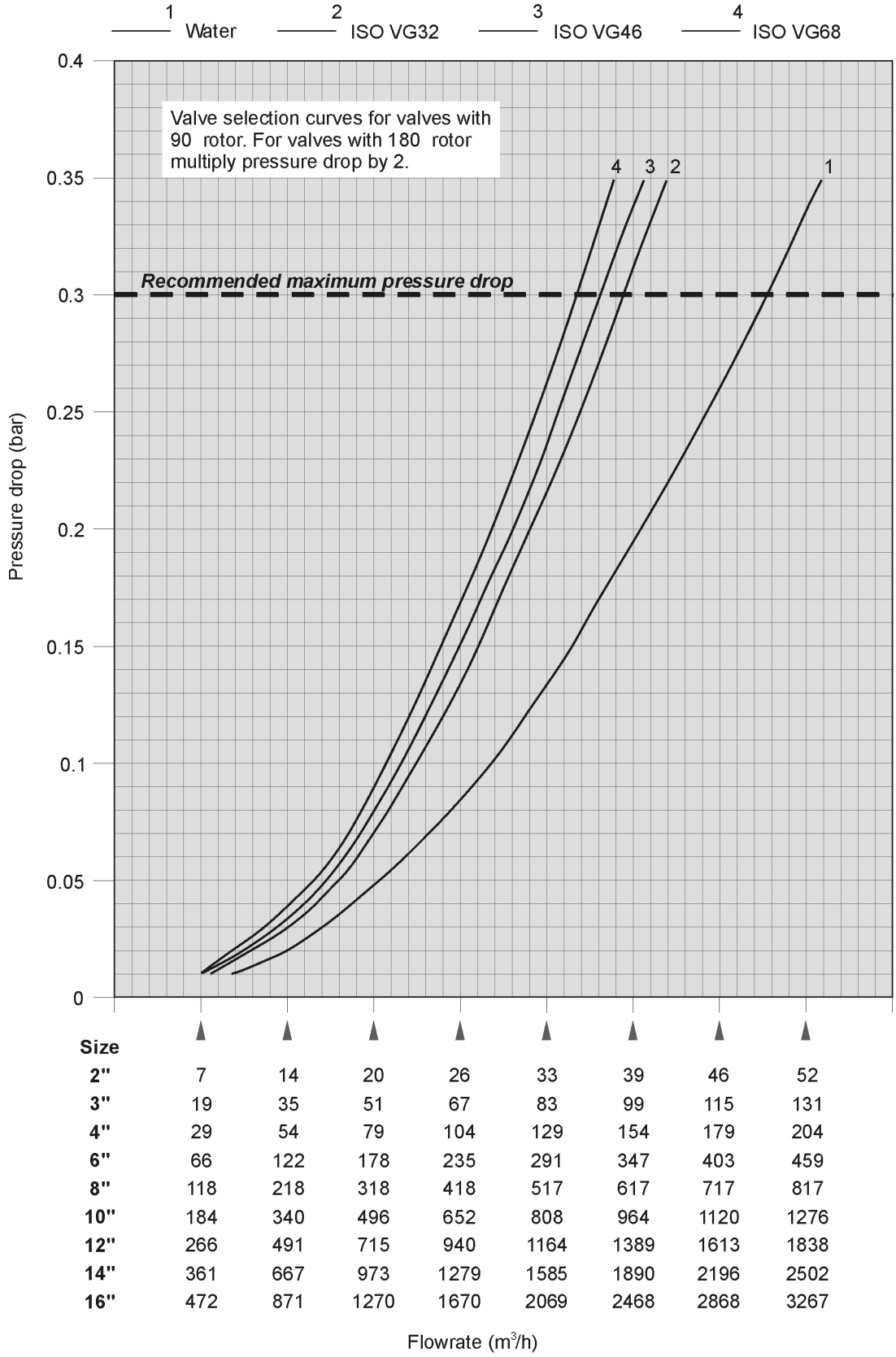
Technical Data

Contents

9.1 Selection of G-Valve options

The selection of the G-Valve for a particular application will have been done during the original customers purchasing procedure. The following information is included in this manual as a quick reference guide to G-Valve selection options.

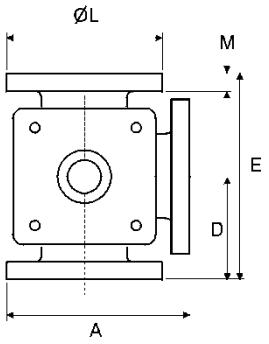
9.1.1 Valve Bore

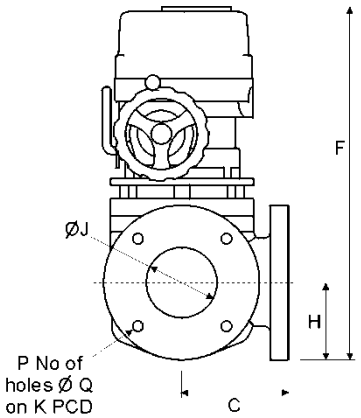


Size							
2"	7	14	20	26	33	39	46	52
3"	19	35	51	67	83	99	115	131
4"	29	54	79	104	129	154	179	204
6"	66	122	178	235	291	347	403	459
8"	118	218	318	418	517	617	717	817
10"	184	340	496	652	808	964	1120	1276
12"	266	491	715	940	1164	1389	1613	1838
14"	361	667	973	1279	1585	1890	2196	2502
16"	472	871	1270	1670	2069	2468	2868	3267

Fig 25 Valve Selection Curve

9.1.2 Valve Dimensions





Sizes in mm (inches)

Dimension/Connection		2 in	3 in	4 in	6 in	8 in	10 in	12 in	14 in	16 in
A		197.5 (7.776)	240 (9.449)	260 (10.236)	327 (12.874)	395 (15.551)	469 (18.465)	574 (22.598)	624 (24.567)	706 (27.795)
C		115 (4.528)	140 (5.512)	150 (5.906)	185 (7.284)	225 (8.858)	260 (10.236)	300 (11.811)	340 (13.386)	385 (15.158)
D		115 (4.528)	140 (5.512)	150 (5.906)	185 (7.284)	225 (8.858)	260 (10.236)	300 (11.811)	340 (13.386)	385 (15.158)
E		230 (9.055)	280 (11.024)	300 (11.811)	370 (14.567)	450 (17.717)	520 (20.472)	600 (23.622)	680 (26.772)	770 (30.315)
F		430 (16.929)	465 (18.307)	519 (20.433)	609 (23.976)	678 (26.923)	756 (29.764)	883 (34.764)	1017 (40.039)	1093 (43.031)
H		82.5 (3.248)	100 (3.937)	126 (4.961)	142 (5.590)	170 (6.692)	252 (9.921)	297 (11.693)	339 (13.347)	378 (14.882)
ØJ		50 (1.969)	80 (3.150)	100 (3.937)	150 (5.906)	200 (7.874)	250 (9.843)	300 (11.811)	350 (13.780)	400 (15.748)
K	ND6	110 (4.3)	150 (5.9)	170 (6.7)	225 (8.8)	280 (11)	335 (13)	395 (15.5)	445 (17.5)	495 (19.4)
	ND10	125 (4.921)	160 (6.299)	180 (7.087)	240 (9.449)	295 (11.614)	350 (13.714)	400 (15.748)	460 (18.110)	515 (20.276)
	ND16	125 (4.921)	160 (6.299)	180 (7.087)	240 (9.449)	295 (11.614)	355 (13.967)	410 (16.142)	470 (18.504)	525 (20.670)
	ASA 125 lb	120.6 (4.748)	152.4 (6.000)	190.5 (7.500)	241.3 (9.500)	298.5 (11.750)	361.95 (14.250)	431.8 (17.00)	467.3 (18.750)	539.75 (21.250)
	JIS 5K	-	-	165 (6.5)	230 (9)	280 (11)	-	390 (15.3)	-	-
	JIS 10K	-	-	175 (6.9)	240 (9.4)	290 (11.4)	-	-	-	-
ØL		165 (6.496)	200 (7.878)	220 (8.661)	285 (11.220)	340 (13.386)	405 (15.945)	483 (19.016)	520 (20.472)	580 (22.835)
M		20 (0.787)	22 (0.866)	24 (0.945)	27 (1.062)	28 (1.102)	28 (1.102)	28 (1.102)	30 (1.181)	32 (1.260)
P	ND6	4	4	4	8	8	12	12	12	16
	ND10	4	8	8	8	8	12	12	16	16
	ND16	4	8	8	8	12	12	12	16	16
	ASA 125 lb	4	4	8	8	8	12	12	12	16
	JIS 5K	-	-	8	8	8	-	12	-	-
	JIS 10K	-	-	8	8	8	-	-	-	-
Q	ND6	14 (0.5)	19 (0.7)	19 (0.7)	19 (0.7)	19 (0.7)	18 (0.7)	22 (0.9)	22 (0.9)	22 (0.9)
	ND10	18 (0.709)	18 (0.709)	18 (0.709)	23 (0.905)	23 (0.905)	22 (0.866)	22 (0.866)	22 (0.866)	26 (1.024)
	ND16	18 (0.709)	18 (0.709)	18 (0.709)	23 (0.905)	23 (0.905)	26 (1.024)	26 (1.024)	26 (1.024)	30 (1.181)
	ASA 125 lb	19 (0.748)	19 (0.748)	19 (0.748)	23 (0.905)	23 (0.905)	25.4 (1.000)	25.4 (1.000)	28.6 (1.125)	28.6 (1.125)
	JIS 5K	-	-	19 (0.7)	19 (0.7)	23 (0.9)	-	23 (0.9)	-	-
	JIS 10K	-	-	19 (0.7)	23 (0.9)	23 (0.9)	-	-	-	-

9.1.3 Valve Weights

The approximate weights of the valve/actuator are as follows in kg (lb):

	2 in	3 in	4 in	6 in	8 in	10 in	12 in	14 in	16 in
Cast Iron	32 (71)	48 (106)	60 (132)	86 (193)	146 (328)	187 (420)	295 (663)	435 (977)	575 (1292)
Bronze	34 (75)	51 (112)	67 (148)	100 (225)	164 (368)	209 (470)	319 (717)	485 (1089)	671 (1507)

9.1.4 Viscosity Correction

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 Centistrokes. Where ISO oil is used, the grade number is also the viscosity eg: ISO VG46 is 46 Centistrokes at 40° C (110° 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 (Sect 9.1.5).

Example: From the graph below, 100CST = correction factor of 0.68

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

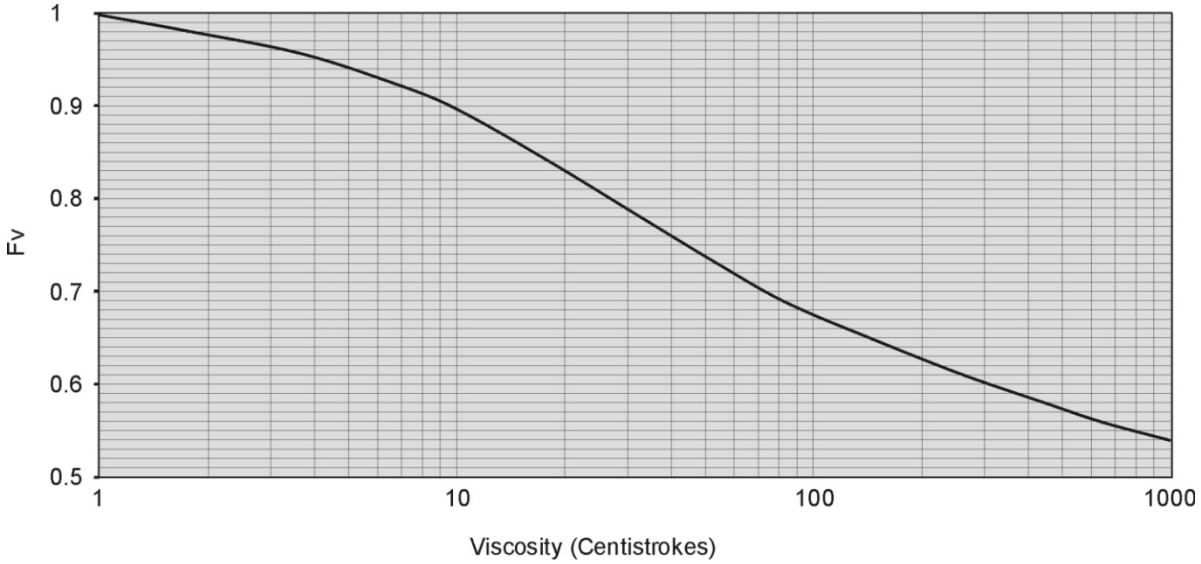


Fig 26 Viscosity Correction Graph

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

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

9.1.5 Valve Sizing Calculations

Pressure Drop

The 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 0.1 bar (0.145 and 1.45 psi).

Valve Flowrate

A Kv is the valve's flow coefficient. It is defined as the number of cubic metres of room temperature water that flows through the valve with a pressure drop of 0.069 bar (Cv is the imperial coefficient). See the table below for examples of Kv and Cv for the G valves:

	2"	**3"**	**4"**	**6"**	**8"**	**10"**	**12"**	**14"**	**16"**
Kv	82	207	323	729	1296	2025	2918	3972	5187
Cv	96	242	378	851	1513	2364	3405	4635	6053

Note

Cvs are applicable to 90° rotor versions only. For 180° versions:

$$Kv180 = \frac{Kv90}{2}$$

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
Kv fluid
= Valve flow coefficient

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

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

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

The formulae for finding flow (m^3/h) or pressure drop (bar) are shown below:

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

The formulae for finding flow (US gallons/min) or pressure drop (psi) are shown below:

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

9.1.6 Bypass Flowrates

The AMOT G Valve is not a tight shutoff valve. When used in a reasonably balanced pressure system there will be some small amounts of leakage between ports. The actual amount of leakage will vary with the pressure difference between these ports. Consult AMOT for further information if the application is sensitive to leakage rates or if high pressure differences are likely to occur.

9.2 Technical Specifications

9.2.1 Actuator

Power supply	**Motor thermal protection**	**Potentiometer**
115 V ac ± 10% 230 V ac ± 10% 50/60 Hz single phase	Open 150° nominal	1 kΩ standard, 5 kΩ option Life: 10 million revolutions Linearity: <± 2%
Limit Switches	**Operating angle**	**Duty cycle**
Two x open/close SPDT 250 V ac, 10 A	110° max	65% at 20° C
Conduit entry	**Mechanical stop**	**Manual override**
CM25 x 1.5 mm	Two adjustable screws	Automated declutching mechanism
Materials	**External coating**	**Weatherproof enclosure**
Steel, Aluminium alloy, Bronze, Polycarbonate	Dry powder polyester	IP67, NEMA 4 and 6
Ambient temperature	**Ambient humidity**	**Anti-condensation heater**
-20° C to +70° C	90% RH max (non-condensing)	5 – 10 W

Performance

Model	Valve size	Max output torque	Stroke time (seconds)		Max current (Amps)	
			50 Hz	60 Hz	220 V	110 V
EA100	2, 3, 4, 6, 8, 10 in	100 Nm	25	21	0.88	1.7
EA200	12, 14 in	200 Nm	31	26	0.92	1.9
EA400	16 in	400 Nm	31	26	1.62	3.65

Mechanical

Model	Valve size	Mounting		Weight (kg)	Drive interface (ISO 5211) mm
		PCD	Thread		
EA100	3, 6, 8,10 in	102 mm	M10	16.6	17 mm square
	2, 4 in	70 mm	M8	16.6	17 mm square
EA200	12, 14 in	125 mm	M12	22	22 mm square
EA400	16 in	125 mm	M12	23	27 mm square

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