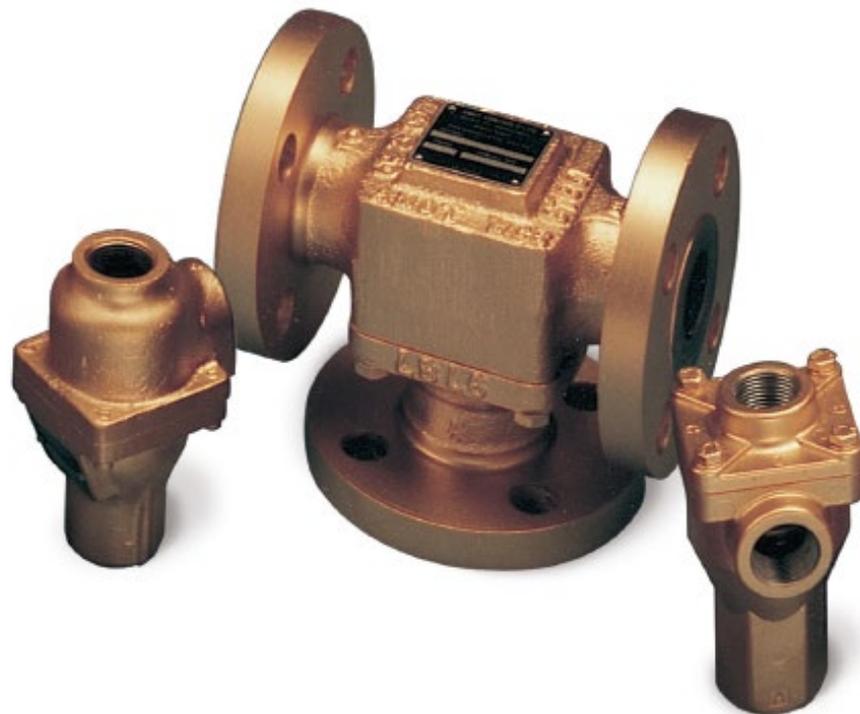




Model C Valve Thermostatic valve for diverting and mixing applications

Installation, Operation and Maintenance Manual



Original instructions

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Section 2 Introduction

2.1 Scope

This manual details the installation, operation and maintenance of the AMOT Model C Valve range.

2.2 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.

2.3 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 unauthorized 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.

Section 3 Description

3.1 Overview

The Model C Valve is designed to provide fully automatic, 3-way fluid temperature control for diverting or mixing applications. Typical applications include engine water jackets, lubricating oil cooling systems, and mixing and diverting of fluids in process control and industrial applications.

The thermostatic element (also referred to as 'element') in a Model C Valve is fully enclosed and factory set, providing tamper-proof operation. For maintenance, or to achieve a different set temperature, the element can be changed, although this does require removal of the valve from the adjoining pipework. Elements are available with set temperatures from 18 to 113°C (65 to 235°F). Valves are available in five sizes, and a variety of materials to suit different fluids.

3.1.1 Manual override

Model C Valves do not have manual override capability.

3.2 Features

Typical applications

- Lubricating oil temperature control
- Jacket water high temperature (HT)
- Secondary water low temperature (LT)
- Heat recovery
- Water saving applications.
- Boiler inlet temperature control
- Co-generation, cooling towers
- Temperature mixing or diverting
- Engine and compressor cooling system

Key benefits

- No external power source required – simple low cost installation
- No user setting needed – 'fit and forget' solution
- Small number of parts – simple maintenance and low cost ownership
- Robust design capable of high vibration and shock applications
- Easy installation operates in any mounting position
- Automatic self-sensing control with positive proportional valve action

3.3 Valve Selection

A wide range of valve sizes and materials of construction are available, covering the applications in Section 3.2. An AMOT C Valve datasheet containing information on selection of the appropriate valve type is available, contact AMOT for a copy.

It is the responsibility of the end user to ensure suitability of the valve with its intended use. The valve, element, and seal materials in particular should be carefully selected to ensure compatibility with the process fluid and the installation.

For further help in selecting the correct valve for the application, contact AMOT (contact details available on the back cover of this manual).

3.4 Identification of Model Number

Example Code	1	CF	B	J	075	01	-0	0	-XXX	Code Description	
Valve Size										Nominal Bore Size	Number of Elements
	1/2									1/2 inch (DN15)	1
	3/4									3/4 inch (DN20)	1
	1									1 inch (DN25)	1
	1 1/4									1 1/4 inch (DN32)	1 (2 for CCM valves)
	1 1/2									1 1/2 inch (DN40)	1
Valve Model										Model	
	CM									Threaded valve	
	CCM									High flow valve (1 1/4" valve only, with 2 elements)	
	CL									Low flow rate	
	CF									Flanged connection (1 1/2" valve only)	
Valve Material										Valve Material	
	A									Aluminium (CM, 3/4" and 1" only)	
	B									Bronze (CM and CL)	
	C									Cast Iron (CM, CCM, CF and CL)	
	S									Steel (1/2", 3/4" and 1" CM & CL, 1 1/2" CF only)	
	R									Stainless steel (1/2", 3/4" and 1" CM & CL, 1 1/2" CF only)	
Port Connection										Port Connection	
	C									Flanged EN-1092, PN10, PN16	
	F									Flanged ANSI 125 lb	
	H									Flanged ANSI 300 lb (steel and stainless steel only)	
	J									Flanged 150 lb (steel and stainless steel only)	
	K									Flanged ANSI 600 lb (steel and stainless steel only)	
	M									Socket weld (1 1/4" and 1" steel & stainless steel CM valves)	
	T									Threaded NPT to USAS B2.1	
	U									Threaded BSP (PL) to BS 21	
	V									Threaded BSP (TR) Japanese (JIS)	
	W									Threaded to SAE J5 14H (straight thread, O-Ring seal)	
	R									Threaded BSP (PL), boss faced, DIN 3852 Form X (Bronze, cast iron and ductile iron only)	
Control Temperature (°F)										Control Temperature (°F)	
										*** See Element Temperatures, Table 2	
Element Type										Element Type	
										** See Element / Seal Types, Table 3	
Leakhole sizes										Leakhole sizes inches	
	O									None	
	B									1/32" Dia	
	C									1/16" Dia	
	D									3/32" Dia	
	F									1/8" Dia	
	G									1/4" Dia	
	H									3/16" Dia	
Leakhole Quantity*										No. of elements with Leakhole	
	0									None (Specified on CCM only)	
	1									One (Specified on CCM only)	
	2									Two (Specified on CCM only)	
Customer Special Requirements										Customer Special Requirements	
										-AA Standard Product	
										-*** Customer special code assigned	

Table 1– Model Identification

*Note: Leakhole quantity character is not used for CM, CL, CF type valves, only CCM

Other Flange connections are available. Contact AMOT for details.

Description

Code	Control Temp		Rated Range				Max Temp Continuous		Max Temp Short Period	
			Crack Open		Full Open					
	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
065	18	65	15	59	25	77	47	116	55	131
075	24	75	20	68	29	85	60	140	68	154
085	30	85	24	75	34	93	63	145	71	160
095	35	95	30	86	40	104	73	163	81	178
100	38	100	33	91	42	108	61	143	70	158
110	43	110	38	100	47	117	82	180	90	194
120	49	120	43	110	55	131	86	187	94	201
130	54	130	49	120	60	140	95	203	105	221
140	60	140	54	130	65	150	95	203	105	221
150	65	150	60	140	71	160	100	212	110	230
160	71	160	65	150	76	170	100	212	110	230
170	76	170	72	163	82	180	100	212	110	230
175	80	175	76	170	85	185	105	221	115	239
180	82	180	79	175	88	190	110	230	120	248
185	85	185	82	180	91	196	112	230	120	248
190	87	190	85	185	93	200	110	230	120	248
200	93	200	90	194	100	212	110	230	120	248
215	101	215	96	205	107	225	115	239	125	257
225	107	225	101	214	114	237	120	248	130	266
235	113	235	107	225	133	253	124	255	134	273

Table 2 – Element Temperatures

Code	Element and Valve Seal Material			
	Valve model	Element type	Element construction	Seals
01	CM/CCM/CF	1125X	Standard element	Nitrile (Buna N)
	CL	10765X		
06	CM/CCM/CF	1125X	Standard element	FKM (Viton)
	CL	10765X		
99	CM/CCM/CF	3362U	Standard element	Neoprene
	CL	10765U		
09	CM/CCM/CF	1125P	Nickel plated	Nitrile (Buna N)
	CL	10765P		
02	CM/CCM/CF	1125P	Nickel plated	FKM (Viton)
	CL	10765P		
82	CM/CCM/CF	9778C	Nickel plated	Neoprene
	CL	10765K		
86	CM/CCM/CF	44844X	Salt water – Stainless steel	FKM (Viton)
	CL			

Table 3 – Element/Seal Types

Other Elements and Seals are available. Contact AMOT for details.

Section 4

Use within the European Union (EU)

4.1 Pressure Equipment Directive (PED)

The Pressure Equipment Directive (PED) is applicable to the design, manufacture and conformity of pressure equipment and assemblies of pressure equipment with a maximum allowable pressure greater than 0.5 bar.

In its design application of a thermostatic valve, this equipment is defined as a Pressure Accessory under the terms of the EU Pressure Equipment Directive (PED).

The Model C Valve, when suitable for use within the European Community, carries a nameplate, an example of which is shown in Figure 1. The nameplate contains the following information pertinent to the Pressure Equipment Directive requirements:

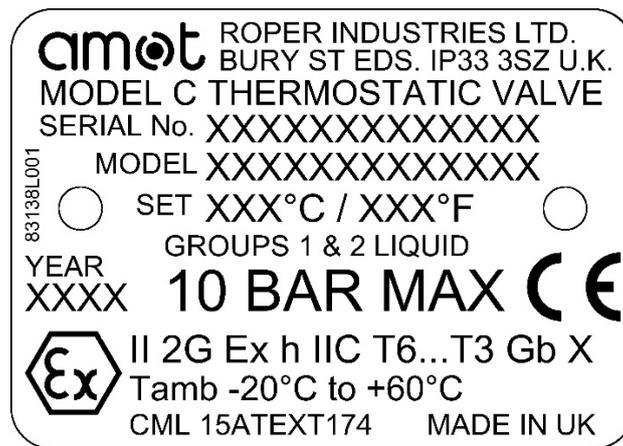


Figure 1 – C Valve Nameplate

- Model** An alphanumeric text identifier stamped onto the nameplate that fully describes the type of equipment.
- Serial No** A unique serial number stamped on the nameplate to allow traceability of manufacture.
- Year** The year in which the equipment was manufactured is stamped here.
- ** BAR MAX** The maximum pressure that the equipment is permitted to see in service (refer to Section 9.1.2 for value).

Name and address

Equipment complying with the Pressure Equipment Directive must be marked with the name and address of the manufacturer and where appropriate, of his authorised representative established with the European Community.

Suitable for liquids to Groups 1 & 2

When used with liquids defined as Groups 1 or 2, the Model C Valve falls into the PED Sound Engineering Practice (SEP) category. Units must not be CE marked in the SEP category (although are CE marked for compliance with the ATEX Directive (see Section 4.2)).

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

4.2 Hazardous Areas**4.2.1 Hazardous Area Directive (ATEX)**

The ATEX Directive is applicable to all equipment both electrical and mechanical that is put into service in a designated hazardous area.

The Model C Valve, as mechanical equipment, has been assessed in accordance with EN ISO 80079-36 and has been designated as Group II equipment. Group II equipment is suitable for use in places where a potentially explosive atmosphere may be present. Group II equipment shall not be used underground in mines, or in the surface installations of such mines that are susceptible to firedamp or combustible dust.

The Model C Valve has been assessed for use in places designated as containing hazardous gas; they shall not be used in places designated as containing hazardous dust.

The Model C Valve, when suitable for use within the European Community, carries a nameplate, an example of which is shown in Figure 1. The nameplate contains the following information pertinent to the ATEX Hazardous Area Directive requirements:

Model	An alphanumeric text identifier stamped onto the nameplate that fully describes the type of equipment.
Serial No	A unique serial number stamped on the nameplate to allow traceability of manufacture.

Year	The year in which the equipment was manufactured is stamped here.
Ex Symbol	The Distinctive Community Mark for hazardous area application.
Equipment designation:	
II	Equipment Group (non-mining applications).
2	Equipment Category (high protection level).
G	Hazardous Area Type (hazardous gas environments).
h	Protection of non-electrical equipment.
IIC	Equipment Group Subdivision (for gas group limitations).
T6...T3	Max surface temp (maximum surface temperature depends on not on the equipment itself but on the operating conditions, and a single temperature class cannot be marked by the manufacturer).
Gb	Equipment Protection Level (EPL) (high protection level).
X	Specific Conditions of Use apply, including the Ambient Temperature Range below, see Section 4.2.2.
CML 15ATEXT174	Confidential Technical File reference (c/o Notified Body).
CE Marking	All equipment used in a hazardous area under the ATEX Directive must be CE marked. Mechanical equipment in Group II Category 2 is self-assessed, and a confidential Technical File lodged with a Notified Body (per Technical File ref. above). Equipment that is CE marked must comply with all relevant EU Directives. The CE mark on the AMOT C Valve only represents compliance to the ATEX Directive and not to other EU Directives.
Name and address	Equipment complying with the Hazardous Area Directive must be marked with the name and address of the manufacturer and where appropriate, of his authorised representative established with the European Community.

For safe and trouble-free use within hazardous areas the instructions within this Operating and Maintenance Manual must be strictly adhered to.

The maximum temperature and internal pressure that this equipment is permitted to work at is contained within Section 9.1.

The conditions for safe installation and commissioning of this equipment are contained in 4.

The equipment must be maintained in accordance with Section 7, and between maintenance periods it should be kept clean in accordance with Section 4.2.2.

Users who are uncertain as to the applicability of the ATEX Directive should contact AMOT for further advice.

4.2.2 Specific Conditions of Use

1. The equipment is designed for use in an extended ambient temperature range of -20°C to +60°C.
2. The equipment contains no heat generating parts and assumes the temperature of the fluid inside it, as denoted by the "T6...T3" marking. The fluid temperature must remain within the limit specified in Section 9.1.3.
3. Cleaning of equipment must only be completed using a damp cloth or anti-static cloth.
4. Process fluids capable of generating ionising radiation (such as radioactive substances) are not suitable for use with the equipment.
5. The equipment is not suitable for use with process fluids that could cause exothermic reactions within the equipment or with the equipment and its materials.

4.3 Machinery Directive

The Model C Valve supplied by AMOT is classified as a component. The equipment falls outside the scope of the machinery directive. Components are only intended to be incorporated into or assembled with other machinery or equipment thereby forming Machinery.

Section 5 Installation

WARNING

The valve is heavy; refer to 9.1.4. The appropriate manual handling precautions must be applied to avoid personnel injury.

5.1 Installing the valve

5.1.1 Before starting installation

1. Upon receipt, the valve should be checked for damage sustained in shipping. All AMOT valves have nameplates attached, which are stamped with the valve model number and serial number.
2. Understand the intended use of the valve as described in Section 3.
3. Before installation, ensure that the valve is suitable for the purpose, checking temperature, pressure and material parameters, and any special approval requirements (refer to Section 3.3). Check that the intended pipe fittings are suitable for the application.
4. Check that the valve size has been selected in accordance with the anticipated flow rate through the valve (refer to Section 3.3). To maintain good temperature regulation the pressure drop across the valve should be in the 0.14 to 0.5 bar (2 to 7 psi) range.
5. If the valve is to be fitted at a high point in the system, the system should be vented to prevent trapped air around the temperature elements.
6. For optimum temperature regulation the system should be designed so that the element is in the mid-position under nominal conditions. To achieve this, it may be necessary to balance the fluid flow by inserting an orifice in the by-pass circuit.
7. If appropriate, read and understand the legal requirements of installing the valve within the European Union as described in Section 4.

5.1.2 Mounting the Valve in the Pipe

The valve may be mounted in any orientation; but should be adequately supported and not subjected to excessive bending and/or stress. Ensure the pipe flange connections are correctly aligned to avoid stressing the valve body.

For the main flanged ports, bolting and gaskets should comply with the relevant standard.

All relevant local regulations must also be observed.

5.1.3 Start up

Upon installation and on start-up of the system, all parts of the circuit should be closely monitored to ensure correct performance. A system in which the valve has been properly selected for the anticipated flows should operate very closely to the valve's nominal temperature rating.

Water cooling systems will usually operate at or slightly below the nominal temperature. Lubricating oils and most other higher viscosity fluids will operate at or slightly above the nominal temperature.

In any system where the indicated temperatures are more than 2.7°C (5°F) from the nominal temperature, then effort should be made to locate the cause.

Any system operating at an indicated 5.5°C (10°F) or more from the nominal anticipated temperatures may well be malfunctioning and the cause should be located and rectified immediately. See troubleshooting section for possible causes.

Section 6 Operation

6.1 Operation

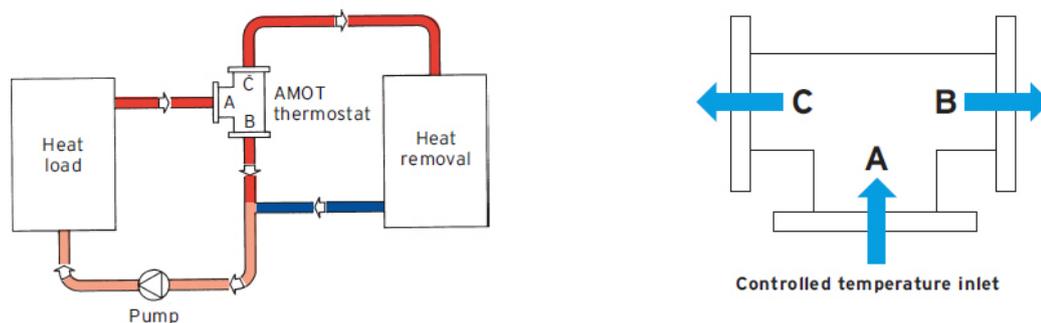
The Model C valve is completely automatic in operation and needs no power supply.

Temperature control is achieved by the automatic movement of a sliding valve, regulating the fluid flow between ports. Upon an increase in fluid temperature, large forces are created by a highly temperature sensitive expanding wax mixture in the element bulb, in turn acting upon the sliding valve.

6.1.1 Diverting applications

(controls outlet temp from load source)

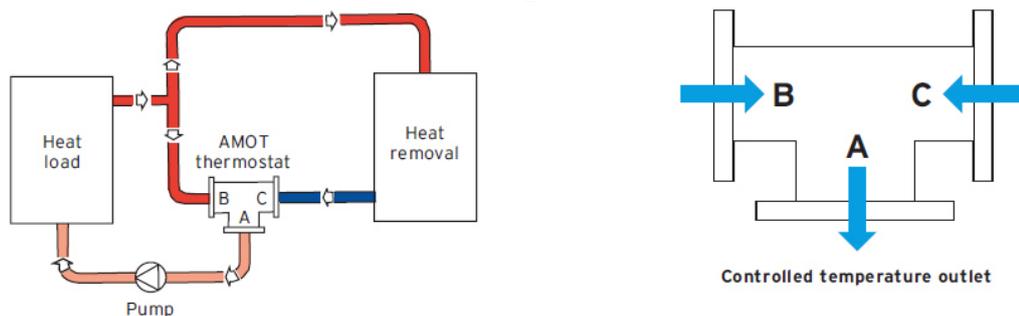
When valves are used for diverting service, the inlet port A (temperature sensing port), with Port C being connected to the cooler, and Port B connected to the cooler by-pass line.



6.1.2 Mixing applications

(controls inlet temp to load source)

When valves are used for mixing service, Port C is the cold fluid inlet port from the cooler, Port B is the hot by-pass fluid inlet, and Port A the common outlet. Port A is the temperature sensing port and will mix the hot and cold fluids in the correct proportion so as to produce the desired outlet temperature leaving Port A.



Section 7 Maintenance

To obtain maximum service life from the valve, periodic inspection and cleaning should be incorporated into a normal preventative maintenance program. Properly applied and installed AMOT thermostatic valves require minimal maintenance. Inspection at 2 year intervals is adequate to detect normal wear.

CAUTION

Before starting any maintenance, understand the intended use of the valve as described in Section 3.

If appropriate, read and understand the requirements associated with use of the valve within the European Union as described in Section 4.

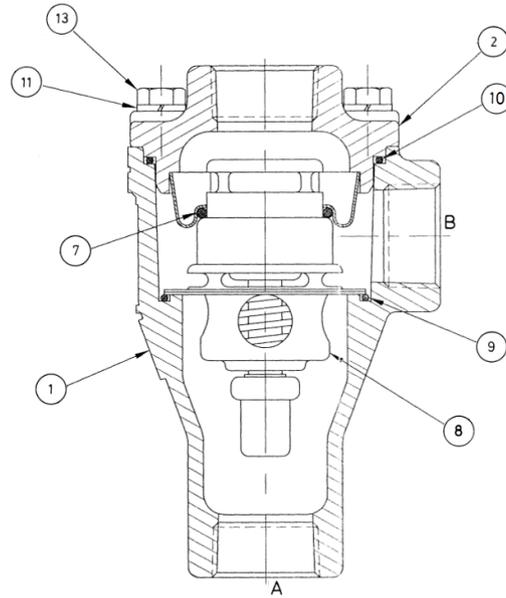
Valves must be removed from the system pipework before commencement of maintenance.

Ensure replacement seal kits (Section 7.3, Table 7) are available before maintenance begins.

WARNING

Ensure that all pressure is relieved from within the valve and ancillary equipment and drain system (or isolate valve) before commencing any maintenance work.

7.1 Dismantling the valve



Valve Types CLA, CLR, CLS, CMA, CMR & CMS

Figure 2 - Cross Sectional View, Types CL/CM A/R/S

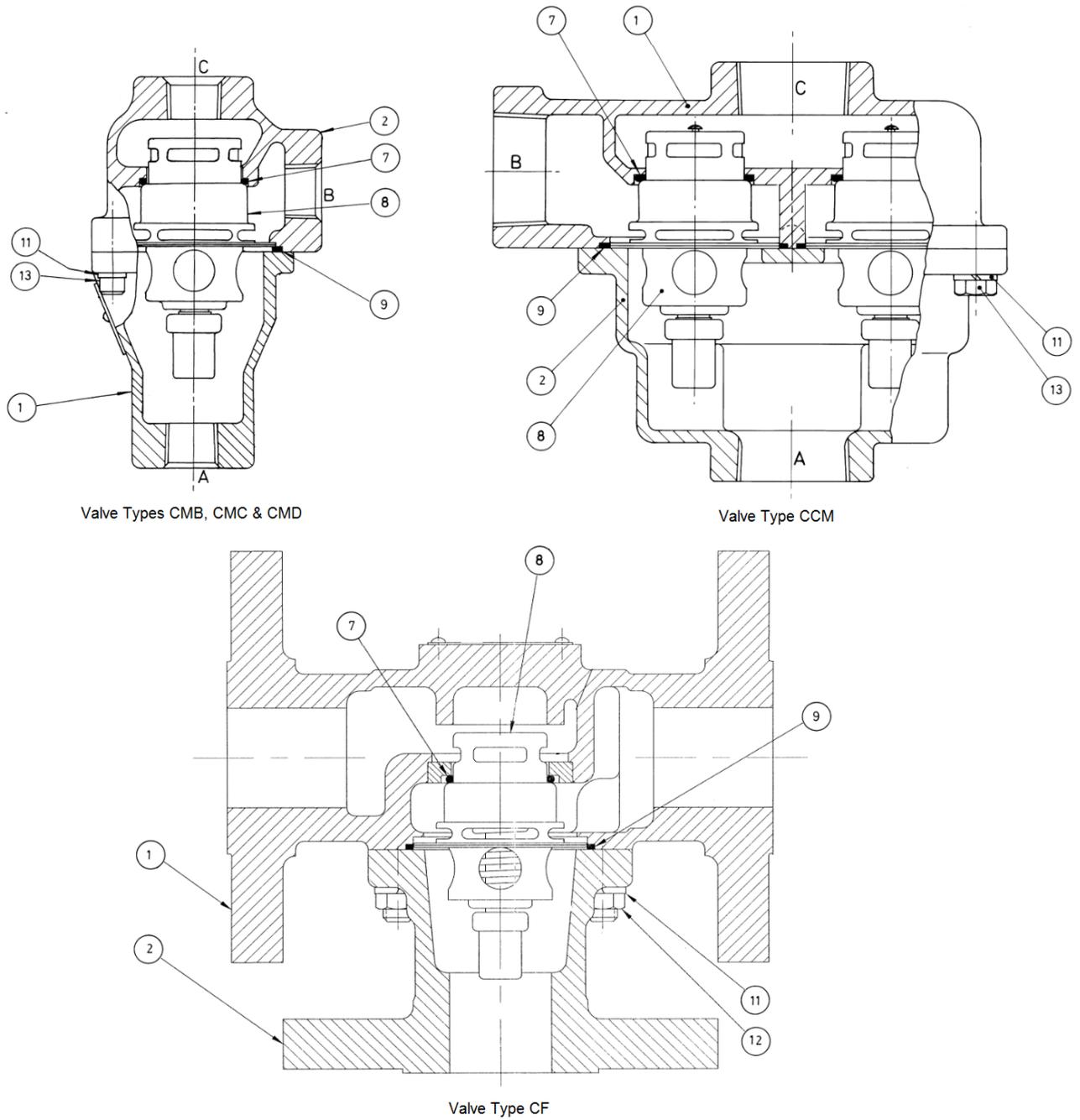


Figure 3 - Cross Sectional View, Other Types

For valve types CLA, CLR, CLS, CMA, CMR & CMS:

1. Refer to Figure 2.
2. Remove housing screws (Item 13) and carefully remove the valve cover assembly (Item 2), taking care not to damage the element (Item 8). Remove and discard the cover 'O' Ring seal (Item 10) and element seal (Item 7).
3. Remove the element (Item 8) by simply pulling free from the lower housing (Item 2). Remove and discard the lower 'O' Ring seal (Item 9).
4. Inspect valve internals for wear or damage. Worn or damaged valves must not be returned to service. Where required, contact AMOT for a replacement valve.

For all other valve types:

1. Refer to Figure 3.
2. Remove housing nuts (Item 12) or screws (Item 13) and split the valve. Remove the lower housing (Item 2) taking care not to damage the element(s) (Item 8). Remove and discard housing 'O' Ring seal(s) (Item 9).
3. Remove the element(s) (Item 8) by simply pulling free from the upper housing (Item 1).
4. Remove element seal(s) (Item 7).
5. Inspect valve internals for wear or damage. Worn or damaged valves must not be returned to service. Where required, contact AMOT for a replacement valve.

7.2 Reassembling the valve

For valve types CMA, CMS, CMR, CLA, CLS & CLR:

1. Refer to Figure 2.
2. Grease the replacement 'O' ring (Item 9) with a good grade of petroleum grease and fit into lower housing (Item 2) recess.
3. Replace element (Item 8) into valve, ensuring it is centrally located.
4. Lightly grease replacement seals (Item 7 & 10) and fit to housing cover assembly (Item 2).
5. Replace cover assembly, ensuring element (Item 8) is fully located in the upper housing assembly, and refit housing washers and screws (Items 11 & 13). See Table 4 for required torque values.

For all other valve types:

1. Refer to Figure 3.
2. Lightly grease replacement element seal(s) (Item 7) and locate in upper housing (Item 1).
3. Replace element (Item 8) into valve, ensuring it is centrally located.
4. Lightly grease replacement 'O' ring (Item 9) and fit into upper housing (Item 1) recess.
5. Replace lower housing (Item 2), and refit housing washers and screws/nuts (Items 11 & 13/12). See Table 4 for required torque values.

Type	Torque (lb ft.)	Torque (Nm)
1/2CM	6	8
1CMA	6	8
1CMB	12	16
1CMC	12	16
1 1/4CM	12	16
1 1/2CF	12	16
1 1/4CCM	12	16
CMS	20	27
CMR	20	27

Table 4 – Tightening torques on housing bolts

7.3 User maintenance parts

Table 5 gives part numbers for spare element assemblies.

Part Number	Description	Qty
1125X(°F)	Standard element assembly for CF/CM valves	See Table 1
10765X(°F)	Standard element assembly for CL valves	
1125P(°F)	Plated element assembly for CF/CM valves	
10765P(°F)	Plated element assembly for CL valves	
9778L(°F)	Element assembly, high over-temperature, reduced stroke	
44844X(°F)	Element assembly, 'Saltwater' plated	

Table 5 – Element assembly part numbers

Other Elements are available. Contact AMOT for details. See Table 1, "Element Type" row.

Table 6 gives the part numbers for spare seal kits, containing the required seals for the models shown. Kits include Items 7 & 9, and 10, where required.

Seal Kits					
Element Assembly Code	Valve Type Code				
	CF/CMB/CMC	CMA/CMR/CMS	CCM	CLB/CLC/CLSH/CLSJ	CLA/CLR/CLS
01	81964X101	81964X201	81964X301	81964X101	81964X201
02	81964X102	81964X202	81964X302	81964X102	81964X202
06	81964X102	81964X202	81964X302	81964X102	81964X202
09	81964X101	81964X201	81964X301	81964X101	81964X201
82	81964X105	81964X205	81964X305	81964X105	81964X205
86	81964X102	81964X202	81964X302	N/A	
99	81964X105	81964X205	81964X305	81964X105	81964X205

Table 6 – Seal kit part numbers

Kits for other element types are available. Contact AMOT for details.

Section 8

Trouble shooting

In the event that the cooling system does not operate close to the desired temperature, the following guide may help to identify or locate the problem.

8.1 System temperature too cold

1. Insufficient heat rejected to coolant to maintain temperature.
2. Wrong nominal element temperature selected.
3. Thermostatic valve greatly oversized or cooling capacity of system much greater than required.
4. Thermostatic valve installed backwards, thus sending water to cooler at low temperatures.
5. Worn or leaking O-Rings allowing leakage to cooler.
6. Excessive pressure drops across valve.
7. Foreign matter preventing closure of elements.
8. Bimetallic type thermometers will indicate low if calibrated in oil.

8.2 System temperature too hot

1. Cooling capacity of system inadequate.
2. Thermostatic valve too small for flow rate causing high pressure drops and possible cavitation problems.
3. Valve installed backwards, reducing flow to cooler as temperature increases.
4. Bypass will not close due to worn or pitted seats, sliding valve, seals etc.
5. Elements may have seen sufficient over-temperature to prevent full movement, thus preventing full cooling.
6. Solids building up on element sliding valve preventing correct operation.
7. Foreign matter stuck between sliding valve and seat.

Section 9 Technical Specification

9.1 General valve specification

9.1.1 Materials

Body materials..... Aluminium, Bronze, Cast Iron,
Steel, Stainless steel
Internal materials (elements)..... Stainless Steel and Bronze
Option: Nickel plating
Seal material Buna Nitrile, FKM (Viton), Neoprene

9.1.2 Maximum working pressure

Type	Max working pressure
Cast Iron	10 bar (150 psi)
Bronze	10 bar (150 psi)
Aluminium	24 bar (350 psi)
Steel / Stainless Steel, Threaded	48 bar (700 psi)
Steel / Stainless Steel, 150lb flanged	16 bar (230 psi)
Steel / Stainless Steel, 300lb flanged	45 bar (655 psi)
Steel / Stainless Steel, 600lb flanged	72 bar (1050 psi)

Table 7 - Maximum Working Pressure

9.1.3 Maximum working temperature

The maximum continuous temperature that the valve can operate at is determined by the temperature element(s) fitted to the valve. This information is contained in Section 3.4, Table 2.

The element(s) in the valve may be subjected to slightly higher maximum temperature for a short term period, the value for which is also stated in Section 3.4, Table 2. The process fluid must be reduced to the maximum continuous temperature within 30 minutes however, or permanent damage to the element(s) may occur.

9.1.4 Valve handling

Suitable care must be taken to avoid injury when handling valves. The mass of the units varies between 1.2 kg (3 lb) and 16.3kg (36 lb), depending on size and material. See Table 8 for details of all variations (weights in kg (lbs)).

Type	Bronze	Cast Iron	Steel / Stainless	Aluminium
1 1/2CM, CL, 3/4CM, CL, 1CM, CL	2 (4)	2 (4)		
3/4CMA, CL, 1CMA, CL				1.2 (3)
1/2, 3/4, 1CM, CL			3.6 (8)	
1 1/4CM, 1 1/2CM, 1 1/2CL	3 (6)	3 (6)		
1 1/4CCM		4.3 (9.5)		
1 1/2CFCF		11 (24)		
1 1/2CFSJ, 1 1/2CFRJ			9 (20)	
1 1/2CFSH, 1 1/2CFRH			13.5 (30)	
1 1/2CFSK, 1/1/2CFSRK			16.3 (36)	

Table 8 – Model C Valve Weights

9.1.5 Storage

Protect stored valves against ingress of dirt and airborne contaminants and avoid frost or direct sunlight. Do not allow the temperature of the storage area to rise above the maximum continuous temperature rating of the selected element (refer to Section 9.1.3).

Storage is permitted down to -40°C (-40°F) for valves containing Nitrile, EPDM, Neoprene 'O' rings and down to -26°C (-14.8°F) for valves containing FKM (Viton) 'O' rings but this must be followed by a slow increase of no higher than 1°C per minute.

Valves must be kept dry and not subjected to any shock loads or abrasion. Valves may be stored in any position and will not deteriorate with time, with the exception of the 'O' rings, which must be replaced after 7 years.

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