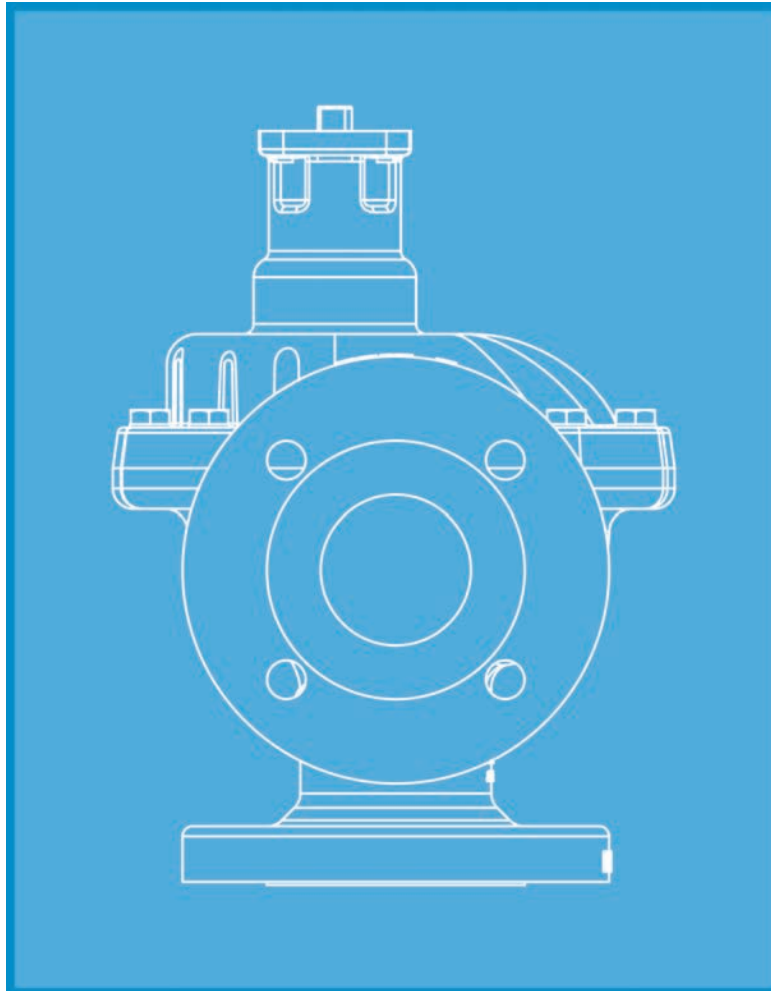




## Hot/Cold Water Mixing Valve - Model F4



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## Introduction

Congratulations on selecting the Emech™ product from Armstrong. Armstrong devotes considerable care and attention to the design of its products. To obtain the best performance from them, the customer should read this manual from cover to cover. It contains important installation and operating instructions.

The customer must strictly adhere to the safety tips, trouble shooting advice, cautions and warnings appearing throughout this manual. Along with the warnings, instructions and procedures in this manual, the customer should also observe such other procedures generally applicable to equipment of the same type.

If the customer does not follow these and other such warnings, instructions and procedures, the product may not perform as expected. More seriously, it may cause property damage, personal injury, production down-time and other losses.

The customer should train its employees and contractors in the safe use of Armstrong products in relation to the customer's specific application. If the customer does not understand a point in this manual, contact Armstrong or its authorised representative.

## F4 Valve General Features

The F4 3 port valve utilizes a unique shear action disc technology and swirl-mix body geometry to provide high performance dynamic fluid mixing.

The nature of the valve seat design minimizes disc wear, outperforming conventionally seated valves, minimizing seal replacement and plant downtime.

High performance closed loop temperature control is achieved when fitted with the Emech G13 electronic actuator. The integrated system includes temperature probe, controller and positioner enabling stand alone operation. Set points can be entered locally through an integrated display and keypad, or remotely via 4-20mA signal.

## Valve Features

- Configurable HOT/COLD inlet ports for temperature control
- Constructed of CF8M (316) stainless steel
- Design Code ASME B16.34
- 180° rotational stroke
- End connections: ASME B16.5 Class 150
- Elastomer seal material options
- Top entry allows in line access to internal valve parts
- Port size: 3" (80mm) nominal bore
- Standard seal temperature range : -13°F to 257°F (-25°C to 125°C)
- Rated pressure 232 psi at 212°F (16 bar at 100°C)
- ISO 5211, 5210 actuator flange mounting
- 780 US gpm @ 29 psi (2950 Lpm @ 2 Bar dP) pressure drop across the valve

## Emech Electronic Mixing Control

The Emech F4 3-port valve comes fitted with the Emech G13 electronic actuator, mounting kit, and Emech temperature probe (part of the package).

The calibrated Emech temperature probe (NTC) is fitted into a pipework tapping 12" downstream of the outlet port, and connects via a plug and cable to the G1 actuator. With this temperature feedback signal, the G1 actuator typically provides temperature control accuracy of +/-0.9°F (0.5°C) over 32°-212°F (0°-100°C) control range.

Even with sudden changes of inlet pressure and temperature to the F4 valve, the G1 controller aggressively minimizes outlet temperature variations.

## OPTIONAL ACCESSORIES INCLUDE:

- DIN rail mounted power supply (110/230 Vac to 24 Vdc-5 amp).
- Weather proof remote selector switch with 6 preset (adjustable) temperature or position set points.



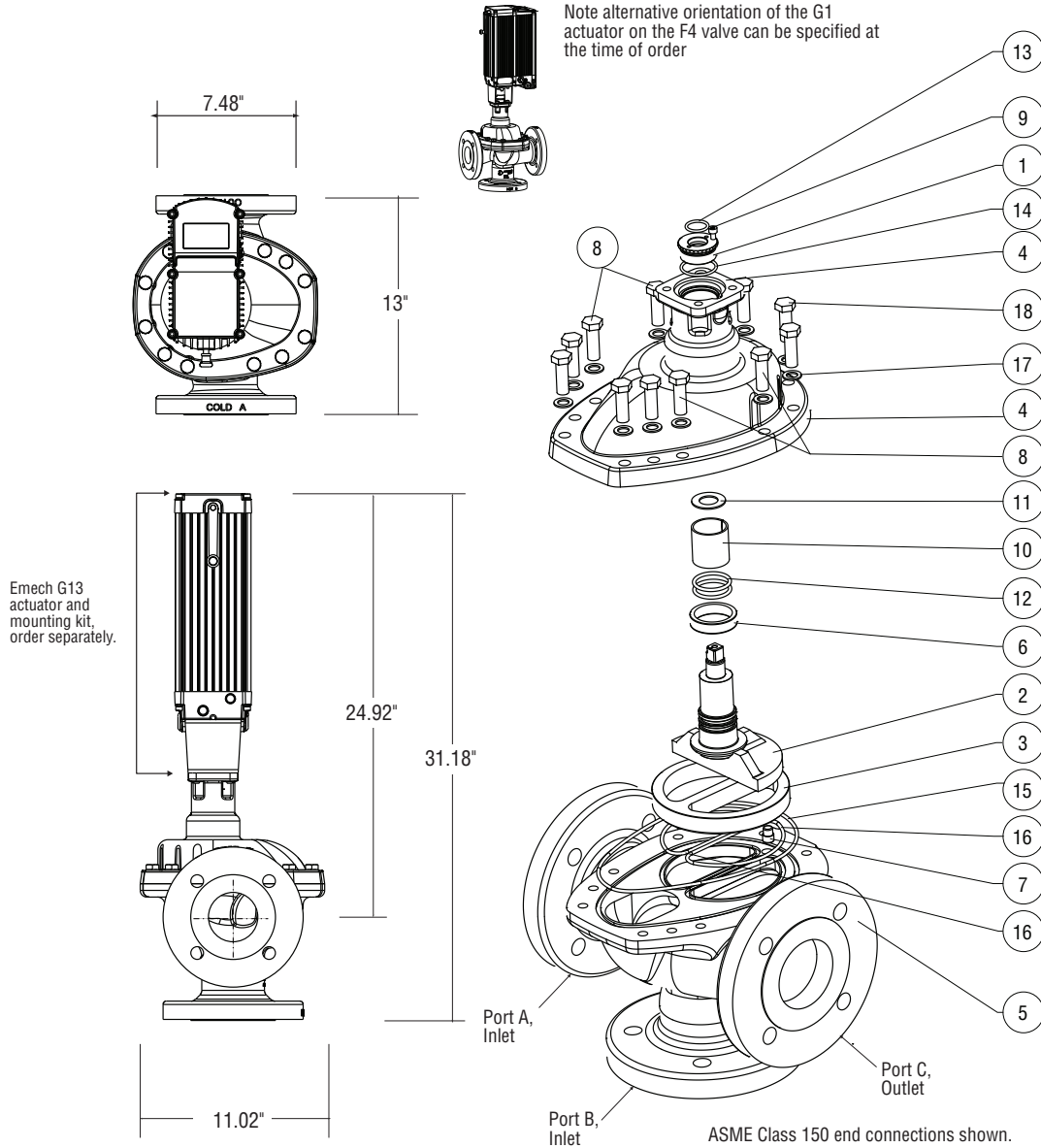
**The Emech F4 Valve fitted with the G13 Actuator.**

## Features of the Emech G13 Actuator

- Analog (4-20mA input and output ports)
- Electrical stepper motor control
- Speed, position, and acceleration control
- User defined '2-speed' stroke can eliminate water hammer
- Precise positioning achieving 0.03° valve seat placement
- Local closed loop control of temperature
- External RS232 connection (cable supplied) communication for special mode configuration.
- Local/remote control options
- Two operating modes: Stand alone control via onboard keypad or Remote control via external 4-20mA
- Failsafe position feedback (non-contact absolute encoder)
- Keypad: 4 membrane switches with 'dual touch' safety features
- Display: 3.5 digit LCD display with back light
- Push button power switch providing soft start electronic control

## Patents Pending

*See separate document for details about the Emech G1 Electronic Actuator.*



F4 SPARE PARTS AND ACCESSORIES	
Part Number	Description
CPSK0069	Bearing and Seal Kit (Trim **EE*)
CPSK0079	Disc Set (Trim *N**)
CPME0088	Locating pin
CPEL0116	930mm Temperature sensor assembly only
CPAC0022	NTC Temperature Sensor Assembly, 930 mm long, NPS thread, Pipework weld thread adaptor
MECO0041	Aux Input Cable (M8, 4 Pole, Female, 5m Lead)

NOTE: For Emech G1 actuator and mounting accessory details refer to the G1 IOM-440-CPAC0002.

ITEM NO.	QTY.	MATERIAL	DESCRIPTION
1	1	Stainless Steel 316	Nut Top F4 080
2	1	Cast CF8M (316)	Spindle-Disc F4 080
3	1	Cast CF8M (316)	Disc-Fixed F4 080
4	1	Cast CF8M (316)	Bonnet F4 080
5	1	Cast CF8M (316)	Body F4 080
6	1	Carbon PTFE	Wear Ring 40.65 ID x 50 x 12
7	1	Stainless Steel 316	Pin 12.0 OD x 16 SS
8	4	Stainless Steel 316	Hex Bolt 1/2" x 1 1/2" UNC
9	1	Stainless Steel 304	Screw-Hex Skt Cap SS 304 3/16" x 5/16"
10	1	Bronze-Teflon	DU Bush ID35 x OD39 x 40 Long-Bronze
11	1	Bronze-Teflon	DU Thrust Washer ID20 x OD36 x 1.5 Bronze
12	2	EP75	322 ID 31.12 x W 5.33 O-Ring
13	1	EP75	117 ID 20.29 x W 2.62 O-Ring
14	1	EP75	126 ID 34.59 x W 2.62 O-Ring
15	1	EP75	264 ID 190.09 x W 3.53 O-Ring
16	2	EP75	237 ID 85.32 x W 3.53 O-Ring
17	12	Stainless Steel 316	Washer M12 Spring SS
18	8	Stainless Steel 316	Hex Bolt 1/2" x 2"

**Flow characteristics:**

Cv: USgpm at dP=1 psi, 68°F, water (Kv: m3/hr at dP=1 bar, 20°C, water)		144 (125)
Flow @ 29 psi dP	USgpm (lpm)	780 (2950)
Operational Stroke	(°rotational)	180°
Flange size:		3" ASME B16.5 Class 150 standard. (Cl. 300 option available)

**Leakage Characteristics:**

Across port leakage when closed is 0.8% of the open Cv.

**Pressure Temperature Ratings (body only):**

Temperature	Allowable Pressure
-20°F (-29°C)	275 psi (19.0 bar)
100°F (38°C)	275 psi (19.0 bar)
200°F (93°C)	235 psi (16.2 bar)
300°F (149°C)	215 psi (14.8 bar)
400°F (204°C)	195 psi (13.4 bar)
500°F (260°C)	170 psi (11.7 bar)

**Weight(approximate):**

Valve only	lb (kg)	100 (45.5)
Valve and Emech G1.3 Actuator	lb (kg)	117 (58.0)

**Notes:**

- All fluid specifications are for water.
- Flows are quoted without restrictors, or non-return valves on the inlets. Non-return valves are recommended.
- If operating at more than one maximum rated condition, contact Armstrong to confirm the application is appropriate.
- Operating pressure temperature ratings are subject to seal trim limitations.

**Seal Trim Selection**

The following table is Emech Control's recommendation for trim selection

Compound	Maximum recommended fluid temperature in Emech valves	Application	Compound Compatibility recommendations
EPDM	-13 to +257°F (-25 to +125°C)	All water and Glycol applications.	Water, hydroxides, solvents, alcohols, several acids, ketone & silicon oils.

CAUTION: Contact Armstrong for all applications with fluids other than water.

**Emech-Standard Model Codes**

Valve Model Codes	Description	End Connection	Hot/Cold Water Mixing Unit Codes
F080R	F4 VALVE 3" (75mm) FLG	Flanged ASME CL150	E80WR

The Hot/Cold Water Mixing Units includes Valve, Actuator, Mounting Kit, Serial Cable, Temperature Sensor, CD, Spanner and all relevant IOM's.

**Recommended for water applications.**

### 2.0 Valve - Installation - Model F4

When installing the E80WR valve and actuator assembly, be sure to use safe methods for handling heavy equipment. Slings and hoists are recommended.

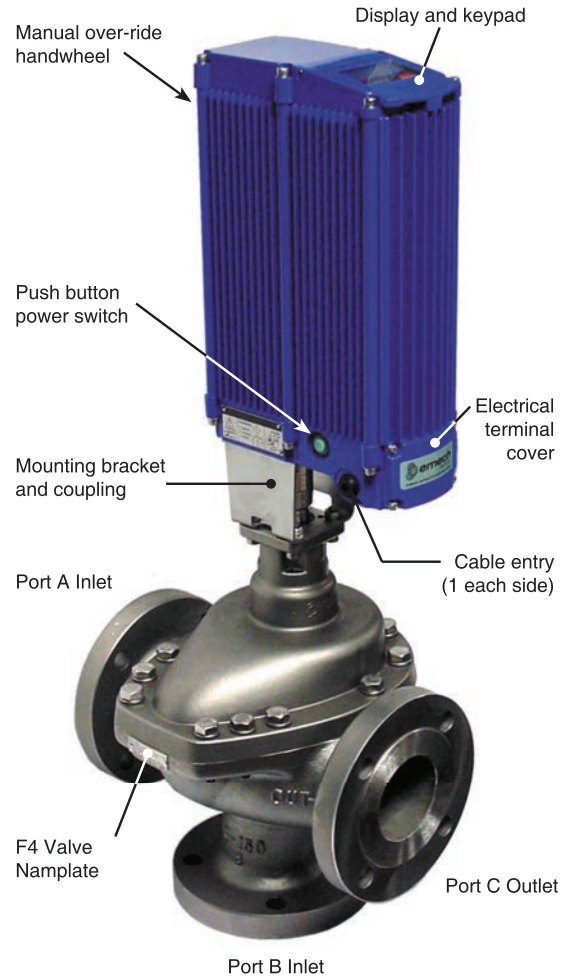
#### 2.1 Considerations:

Consider equipment operation and maintenance requirements when choosing the installation arrangement. Ensure there is access to:

- The actuator display and keypad.
- The actuator manual over-ride handle.
- The electrical connection terminals.
- The Emech temperature sensor. See Figure 4 for installation of the sensor.

#### CAUTIONS:

- The F4 valve seat is designed with very light contact pressure between the disc-spindle and the fixed-disc. This results in non tight shut-off and there is no all ports closed position in the F4 valve. If the fluid the F4 is operating with has significant pipe scale, filters ought to be fitted upstream.
- The F4 can withstand high pressure drops across the valve seat. However conditions where cavitation occurs are not recommended. Cavitation can lead to erosion of the valve and or pipework. In extreme cases this may lead to erosion through pressure retaining parts.
- Ensure isolation valves and non-return valves are fitted 5 to 10 pipe diameters upstream of the F4 inlet ports.
- Ensure the sections of straight pipe to the F4 inlets are as long as practicable. Elbows prior to the inlet ought to be the long 'sweep' style, and no closer than 6 pipe diameters from the inlet.
- Take care not to damage the faces of the F4 flanges when handling.
- Use appropriate flange gaskets and flange bolts to meet the site standards.
- Tighten the flange bolts to the manufacturers recommended torques.



The Emech™ Water Temperature Mixing Unit - Model E80WR

- Ensure all equipment and pipework is appropriately supported.
- Ensure any flow meters that are installed downstream of the F4 valve are at least 50 pipe diameters from the outlet. There are strong rotational flows generated by the F4 to enhance fluid mixing. It is recommended that all flow meters are re-calibrated after installing the F4 upstream.
- Ensure nozzle loads on the F4 valve do not exceed the values in the Table 2.2, page 9.

## 2.2 Configure Inlet Port Orientation

Usually the E80WR (incorporating the G13 actuator and F4 valve) system is supplied configured as per the customers request. If a change is required, follow the instructions below.

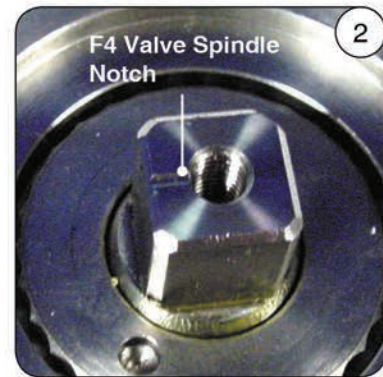
For ease of installation the Emech F4 can have either inlet port configured as HOT or COLD. All F4 and actuator assemblies are shipped to the customers requirements specified at time of purchase. The standard configuration has Port A as the COLD inlet, Port B as the HOT inlet. There is an alternative configuration where the supplies can be reversed as indicated in Table 2.1.

To configure the valve, the actuator must first be removed. Before removing the actuator, ensure the actuator is in the 'zero' position. To do so power on the actuator (a 24V DC regulated power supply is required). Ensure the actuator is in Temperature Controller mode (hold **mode** + press **down** (-) on the actuator keypad).

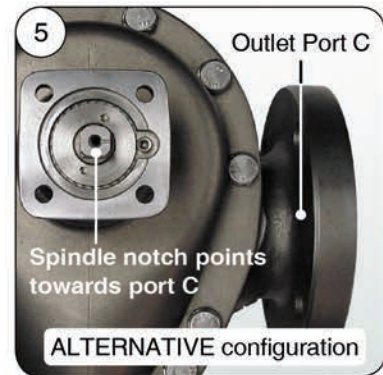
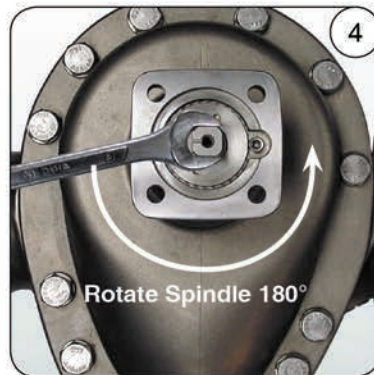
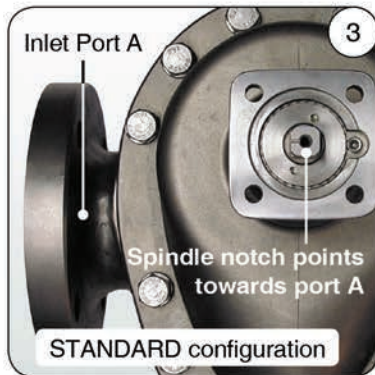
Disconnect the temperature probe from the actuator. The actuator will move automatically to the 'zero' position and the keypad display will show "E2". After ensuring the actuator is in the 'zero' position, isolate the power from the actuator.

Remove the actuator bracket bolts, and lift the actuator off the valve. Take care to retain the 3-piece actuator shaft coupling. Set and secure the actuator to one side. Refer below to consider which configuration is best suited for the valve installation; STANDARD or ALTERNATIVE.

STANDARD	ALTERNATIVE
Port A - Cold fluid	Port A - Hot fluid
Port B - Hot fluid	Port B - Cold fluid
Spindle Notch - Point to Port A	Spindle Notch - Point to Port C



Set the valve 0° spindle position by rotating the spindle (image 2) to point towards the appropriate port indicated in Table 2.1. Images 3 and 5 show how to configure the F4 valve from the STANDARD configuration to the ALTERNATIVE.

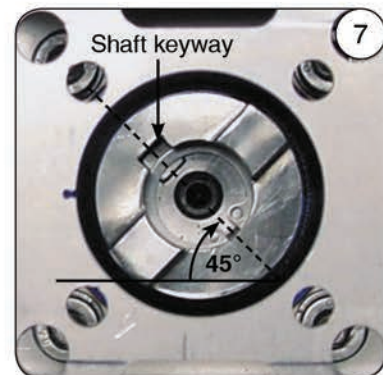
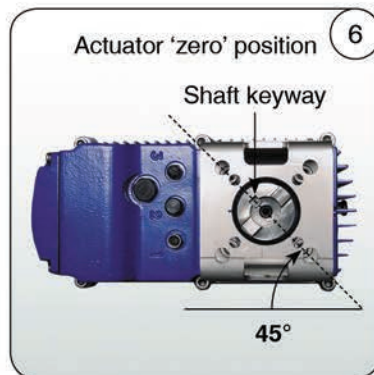


### Re-mounting The Actuator

Ensure the actuator is in the 'zero' position (see above). If there is no power available to 'zero' the actuator it is possible to use the manual override handle. The actuator 'zero' is achieved when the shaft keyway is 45° as indicated in images 6 and 7.

*Actuator Configuration for the F4*

Select "Set defaults E80WR" from the Tools > Standard Config menu of the Armstrong EmechConfig software.





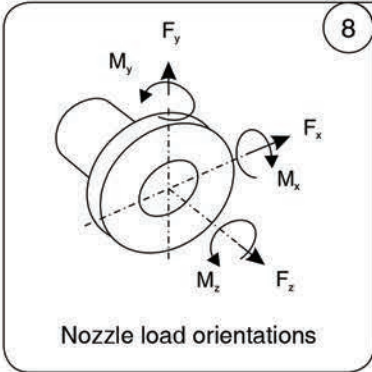


Table 2.2: Maximum Nozzle Forces and Moments

Force/ Moment Direction	Load
Force - $F_x$ $F_y$ $F_z$	5940 lbf. (2700 N)
Moment - $M_x$ $M_y$ $M_z$	8850 lbf.in (1000 Nm)

### 2.3 Temperature Probe Installation

Drill and tap a 1/2" tapered thread 12" (300 mm) downstream of the F4 outlet flange. Ensure the sensor is placed through the underside of the pipe (image 10).

Using a socket spinner in the 1/8" allen socket plug, screw the sensor adapter into the threaded hole in the pipe work. Allow for the pipe wall thickness, and set the adapter engagement so the sensor probe tip will protrude into the fluid flow at least 5/8" (15 mm) (image 11).

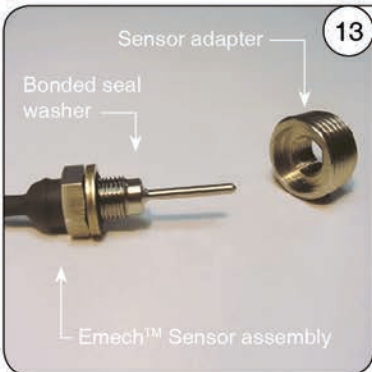
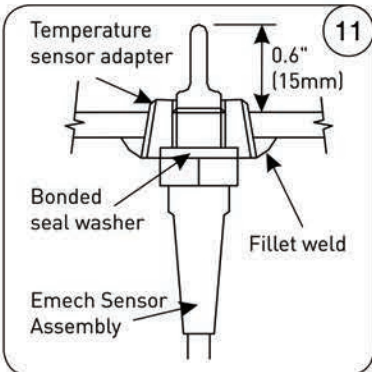
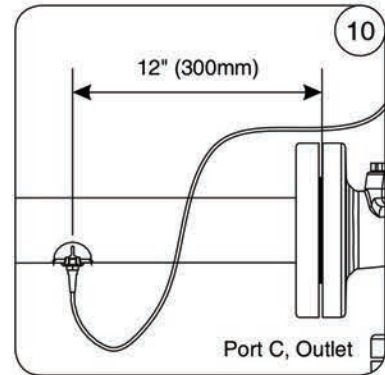
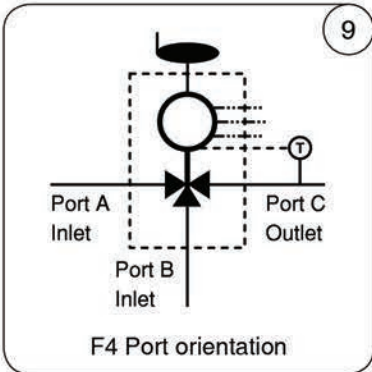
Once the adapter is set correctly, fillet weld in place (image 11). Alternatively if the pipe wall thickness is appropriate, a thread seal adhesive may be used instead.

Remove the 1/8" allen socket plug (see image 12). Ensure the bonded seal washer is in place on the sensor assembly.

Screw the temperature sensor assembly into the adapter.

Screw the M8 electrical connection plug on the sensor cable into the Emech™ actuator connection port labelled '1'.

For further details on installation and operation of the Emech actuator, refer to the supplied actuator Installation and Operation Manual.

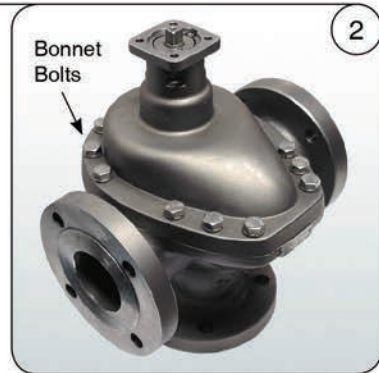


#### CAUTION!

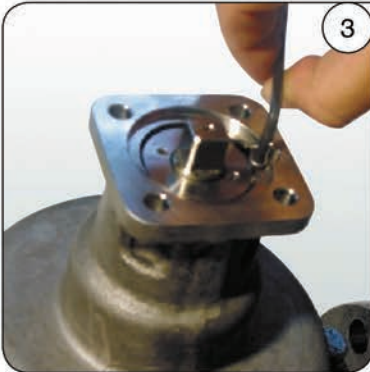
- All pressure vessels (including pipe lines and valves) must be treated with caution! Maintenance of such equipment must only be carried out by persons with appropriate training! SEVERE personal injury, and damage to equipment may result from inappropriate action! Use safe working practices, including fitting of warning signs on pipe lines and the locking of isolation valves during installation or maintenance.
- Prior to installation of the F4, the associated pipe lines ought to be flushed to ensure no debris or dirt damage the valve. After installation, the pipe lines ought to be flushed again. Flush with the valve in the 0° open position, and in the 180° open position. This will ensure both the inlet lines are cleared.
- Ensure all personnel are safe from possible leaks of hot water! Prior to flushing the pipe lines, ensure all flange connections and pipe support fasteners are secure!

**CAUTION!**

- Before dismantling the Emech™ valve, ensure all upstream and downstream pressurized pipe work is isolated appropriately.
- Ensure the pressure and fluids are drained from the valve and pipework.
- Ensure the valve is in the 0° position and isolate power from the actuator.
- Remove the temperature sensor cable plug from the actuator.
- Remove the actuator bracket bolts, and lift the actuator off the valve.
- Take care to retain the 3-piece actuator shaft coupling.
- Set and secure the actuator to one side.

**1**

**2**

 Bonnet  
Bolts

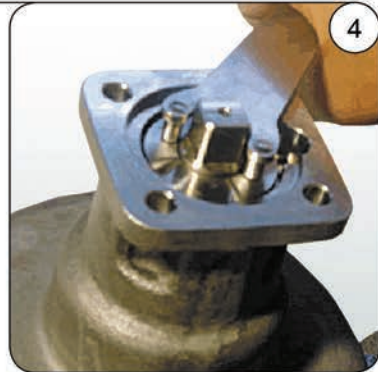
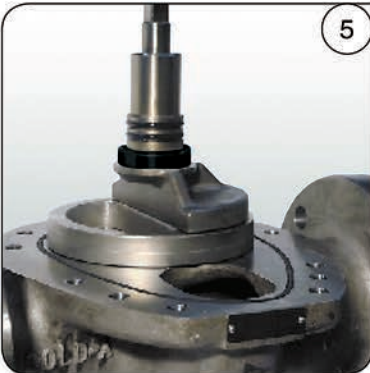
**3**


Remove the bonnet bolts (image 2).

Remove the gland nut locking screw with an alien key (image 3).

Fit the gland nut spanner (supplied), and turn counterclockwise to remove the gland nut (image 4).

The DU thrust washer may come out with the gland nut, but if not it can be removed at the next step below.

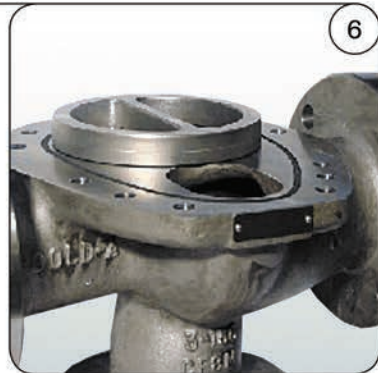
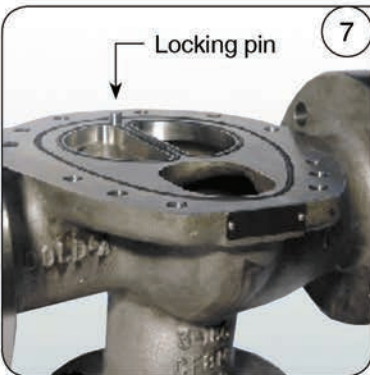
**4**

**5**


Remove the bonnet while pressing down on the disc-spindle (image 6).

If the face of the disc-spindle and fixed discs are free from damage, clean the components, and replace the seals and wear ring.

Lightly grease the seals and seal surfaces with the lubricant provided in the spares kit.

Replace the discs only if the face or seal grooves are badly damaged. Minor damage to the faces can be hand lapped with a fine whetstone.

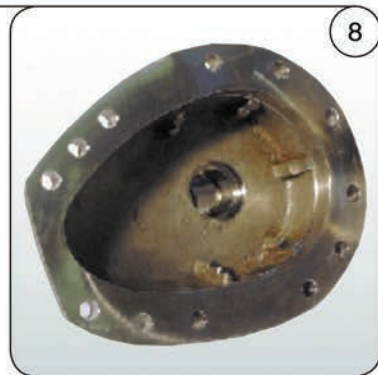
**6**

**7**


Locking pin

Remove and discard the body seals, and clean the valve body, particularly the seal grooves. Examine the locking pin to ensure there is no damage. The pin is a light press fit into the body, and can be replaced if necessary (image 7).

Lightly grease the seals and seal surfaces with the lubricant provided in the spares kit. Fit the new seals into the body.

Clean and examine the bonnet. Lightly grease the DU bush, and bonnet bore (image 8).

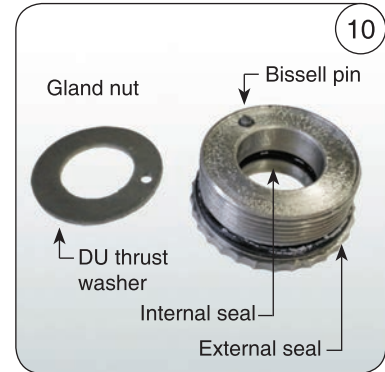
**8**




The seal kits have full descriptions, so ensure the correct seal materials are being fitted (image 9).

Remove the old seals and DU thrust washer from the gland nut. Clean the gland nut threads thoroughly. Insert the internal and external o-rings into the gland nut (image 10).

Apply grease to the o-rings and also to the bottom surface of the nut to help retain the thrust washer.



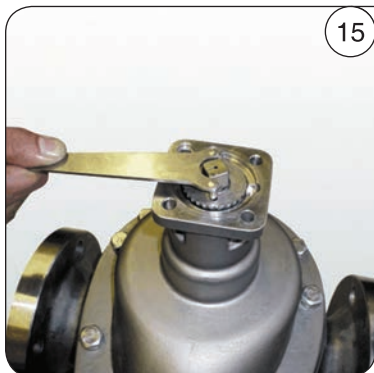
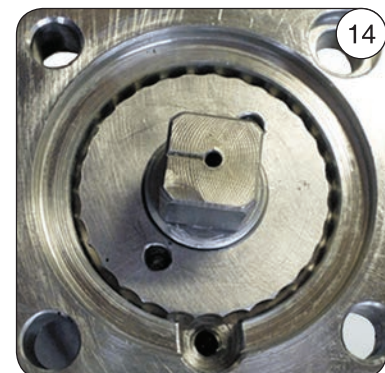
Fit the thrust washer ensuring the bearing surface is facing outwards. Apply grease to the thread (image 11).

Having fitted all the body and spindle seals, reassemble the fixed-disc and spindle-disc. Ensure the spindle is in the 0° position as shown (image 12).



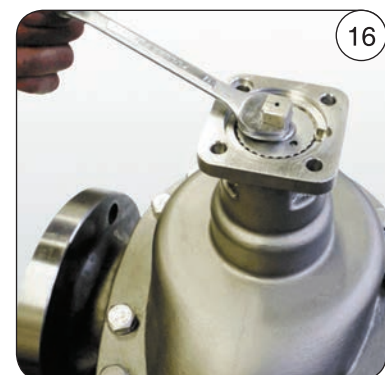
Gently lower the bonnet over the assembly. Care must be taken when the bonnet is lowered over the fixed disc so that the bonnet does not move the disc off the locking pin. Fit the 12 bonnet bolts and spring washers. Ensure a liberal amount of an appropriate anti-seize lubricant is put on the bolt threads prior to the fitting. Screw the bolts down so they are fully engaged, but not tight (image 13).

Screw the gland nut into the bonnet only a few turns. Rotate the spindle a few times (image 14).



Use a symmetrical tightening sequence, so that the bonnet bolts evenly clamp the bonnet flange down. Use a Torque wrench to finally tighten the bolts to approximately 1000 in.lb (112 Nm). Now turn the gland nut until it bottoms out (image 15). **DO NOT APPLY EXCESSIVE TORQUE!** Back the gland nut off 1 to 2 notches.

Rotate the spindle and although the two disc surfaces may touch in places, the spindle ought to rotate freely (image 16).

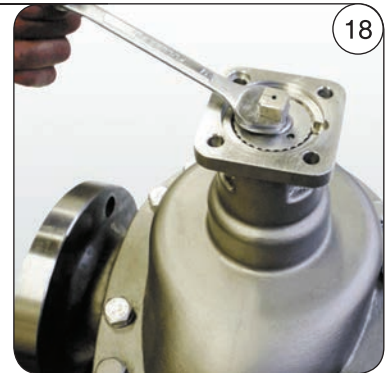




17 Apply a thread locking adhesive to the gland nut locking screw (e.g. Loctite 262).

Fit the gland nut locking screw into the bonnet and tighten to 24 in.lb (3 Nm) (image 17).

Again rotate the valve spindle. The actuation torque with no fluid pressure ought to be <70 in.lb (8 Nm). If the torque is high, loosen then repeat the gland tightening process (image 18).



19 Refit the Emech™ actuator taking care to assemble the coupling and spindle parts in the correct orientation (see Section 4 for mounting Emech actuators on to Emech F4 valves).

Refit the temperature sensor cable plug to the actuator.

Review the installation to ensure it is correct. Remove warning signs and locks from the isolation valves. Open the isolation valves carefully to ensure any unexpected leaks can be observed.

Re-power the actuator, and confirm the installation is correct.

Table 4.1: Nominal Tightening Torques for Lubricated Stainless Steel Socket Head Cap Screws

Metric Cap Screw			UNC Cap Screw		
Size	Torque (Nm)	Torque (inlb)	Size	Torque (Nm)	Torque (inlb)
M3	1.3	12			
M4	2.9	26	#8-32	3	27
M5	5.7	50	#10-24	5.5	49
M6	10	89	1/4"	11	97
M8	25	221	5/16"	22	195
M10	47	416	3/8"	39	345
M12	82	726	1/2"	95	841

Table 4.2: Recommended Lubricants and Thread Adhesives

Description	Manufacturer/Model Code	Used for:
Food Safe Teflon Lubricant*	Klubersynth UH1 14-151	Ceramic discs; o-rings; wear rings; bonnet bore lubrication; roller thrust bearing lubricant
Thread Locking Adhesive	Loctite 262	Gland Nut Locking Screw

\*Sachets of this lubricant are included in Seal Kits.

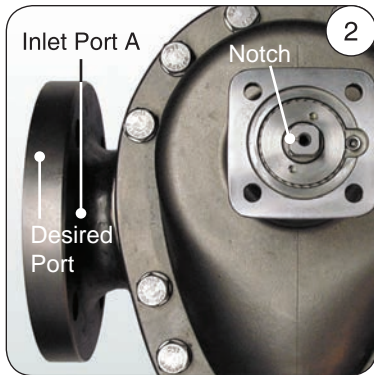
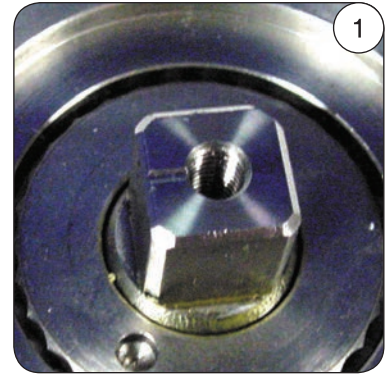


Note: The actuator may be mounted in any one of four positions.

The instructions below may explain how to mount the actuator facing the outlet port as per image 7 page 7.

To ensure the actuator is in the 'zero' position, power on the actuator (a 24V DC regulated power supply is required). Ensure the actuator is in Temperature Controller mode (see section 2.2, page 8). Disconnect the temperature probe from the actuator. The actuator will move automatically to the 'zero' position and the keypad display will show "E2".

Set the valve position to the 0° position. Ensure the notch on spindle (image 1) points towards the correct port for the desired port configuration (image 2). See section 2.2, page 8.



Place the graduated coupling (image 3) on the spindle & ensure that zero points to the outlet port (image 4)

If the actuator is to be mounted in one of the other three positions, rotate the zero graduation to the desired position BEFORE placing on spindle.



Place the centre coupling (image 5) on the graduated coupling (image 6).

Continued...

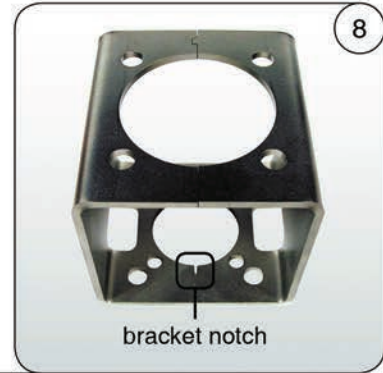




7

Place the actuator on the valve in the desired position (image 7). The zero mark on the coupling (image 4) should align with the notch on the bracket (image 8).

Insert one M9 X 20 socket cap screw into one of the mounting holes with M8 Spring Washer and Nut. Insert the remaining three cap screws and fasten.



8

bracket notch



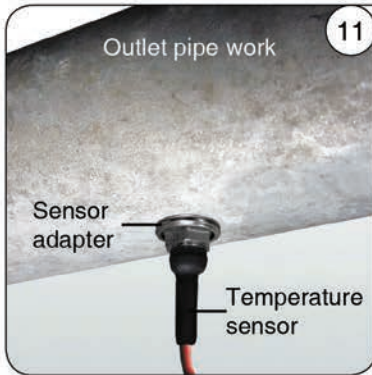
9

Ensure the bonded washer (image 9) is on the temperature sensor as per image 10.

Bonded washer



10



11

Screw the temperature sensor into the sensor adapter (image 11) and tighten.

Plug the sensor connector into the actuator input port labelled "1" and hand tighten (image 12). **WARNING! DO NOT USE A WRENCH TO SCREW THE SENSOR INTO THE ACTUATOR!**

The actuator is now assembled correctly. For checking the actuator software configuration see the actuator Installation, Operation and Maintenance manual.



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**THE ACTUATOR MUST NOT BE INSTALLED UPSIDE DOWN**

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