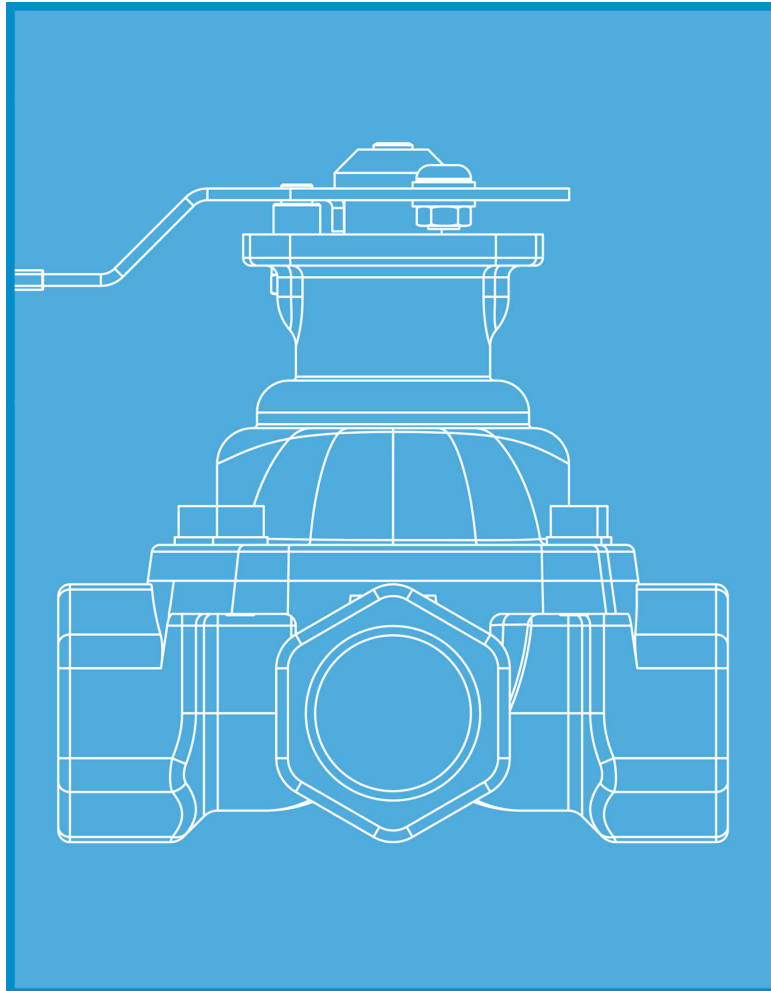




## Steam Water Mixing Valve - Model F5



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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, troubleshooting 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.

## F5 Valve General Features

Emech's patented shear action disc design provides precise control mixing of steam and water.

Fitted with the Emech G1 electronic actuator, and integrated temperature sensor results in fast, accurate and stable temperature control.

As a single compact assembly installation is simplified. The independence of this stand alone unit provides a reliable solution for hot water supply.

## Valve Features

- ISO 5211, 5210 actuator flange mounting
- Constructed of CF8M (316) stainless steel
- Hard coated stainless steel discs
- Standard end connections: NPT, (contact Armstrong for other end connection options e.g. flanged)
- Top entry allows inline access to internal valve parts
- Size range: 1", 1 1/2" and 2"
- Maximum inlet steam temperature 482°F (250°C)
- Rated pressure 145 psi (10 bar)
- Maximum dynamic pressure drop of 130 psi (9.6 bar)
- Manual handle option can be locked in both open and the closed position
- Manual handle kit includes stroke limiting feature to set the maximum opening of the steam port
- Design verification to ASME B16.34
- US Patent Approved

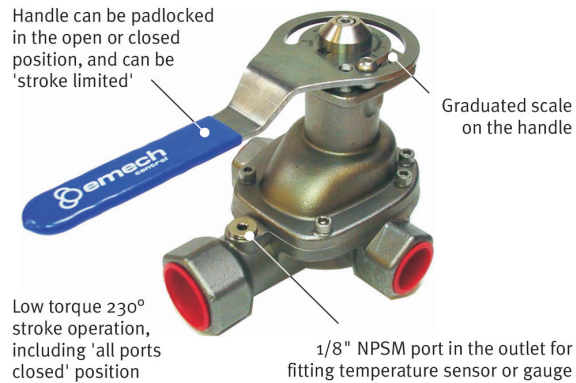
## Emech Electronic Steam-Water Mixer

The Emech F5 3-port valve can be fitted with the Emech G1 electronic actuator, and Emech temperature probe.

The calibrated temperature probe fits the tapping in the outlet port, and connects via cable to the G1 actuator. With this temperature feedback signal, the G1 actuator can provide temperature control accuracy of +/-1°F and up to 200°F (95°C) control range.

Even with sudden changes of inlet pressure and temperature to the F5 valve, the G1 controller aggressively minimizes outlet temperature variations. Contact Armstrong for this and other mix control options.

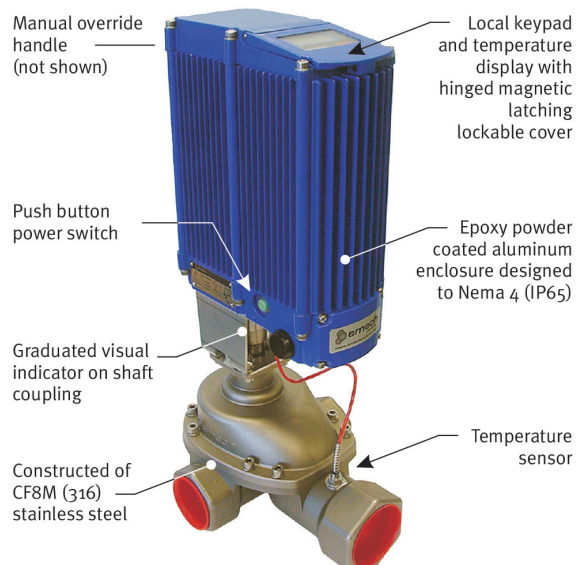
(See CPAC0002 for details about the Emech G1 Electronic Actuator.)



F5 Valve with Handle Kit

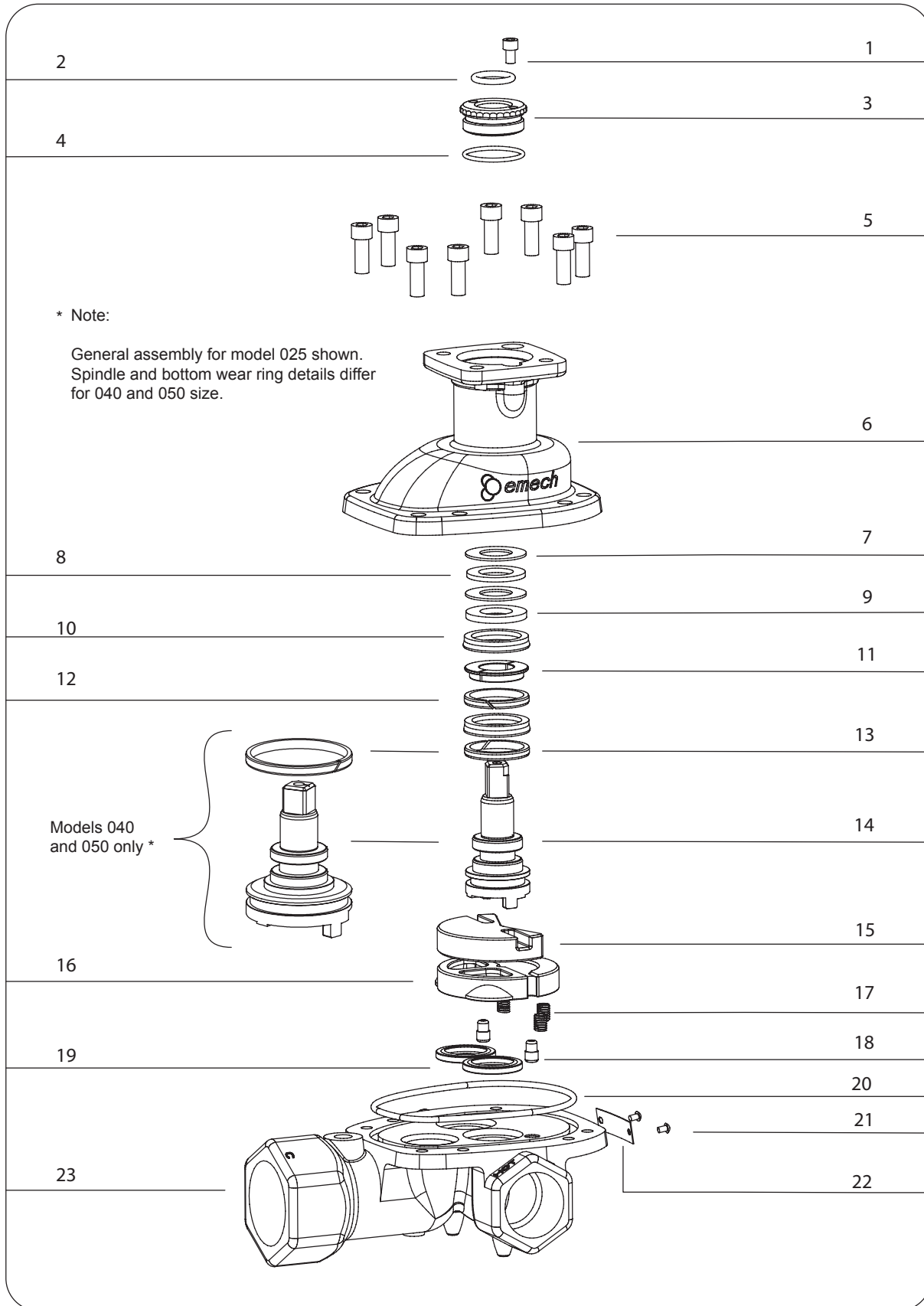
## Features of the Emech G1 Actuated Electronic Mixer

- 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



## The Emech Steam-Water Mixing system. Consisting of the F5 steam water mixer and G1 electronic actuator.

Designs, materials, weights and performance ratings are approximate and subject to change without notice. Visit [armstronginternational.com/emech](http://armstronginternational.com/emech) for up-to-date information.



Part	Description	Quantity	Material	Included in Seal and Bearing Kit
1	Locking screw	1	316 Stainless Steel	
2	O-Ring Gland Internal	1	EPDM	X
3	Gland Nut	1	316 Stainless Steel	
4	O-Ring Gland External	1	EPDM	X
5	Screw Body/Bonnet	8	304 Stainless Steel	
7	Bonnet	1	316 Stainless Steel	
8	Thrust washer	1	C-Cr Steel	X
9	Needle Roller Bearing	1	C-Cr Steel	X
10	Support Washer	1	316 Stainless Steel	X
11	Cup Seals	2	Carbon PTFE	X
12	Split Ring	1	316 Stainless Steel	
13	Wear Ring	2	Carbon PTFE	X
14	Spindle	1	316 Stainless Steel	
15	Moving Disc	1	316 Stainless Steel	O
16	Fixed Disc	1	316 Stainless Steel	O
17	Spring	*	Stainless Spring Steel	X
18	Pins	2	316 Stainless Steel	
19	Face Seals	2	Carbon PTFE	X
20	O-Ring Bonnet to Body`	1	Aflas	X
21	U Hammer Drive Screw	2	316 Stainless Steel	
22	Name Plate	1	316 Stainless Steel	
23	Body	1	316 Stainless Steel	

\* 025: 3, 040: 4, 050: 5

X Included in Seal and Bearing Spares Kits

O Included in Disc Set Spares Kits

**Note:** A2-80 grade high tensile strength stainless steel fasteners used on the 050 valve size.

## Spares

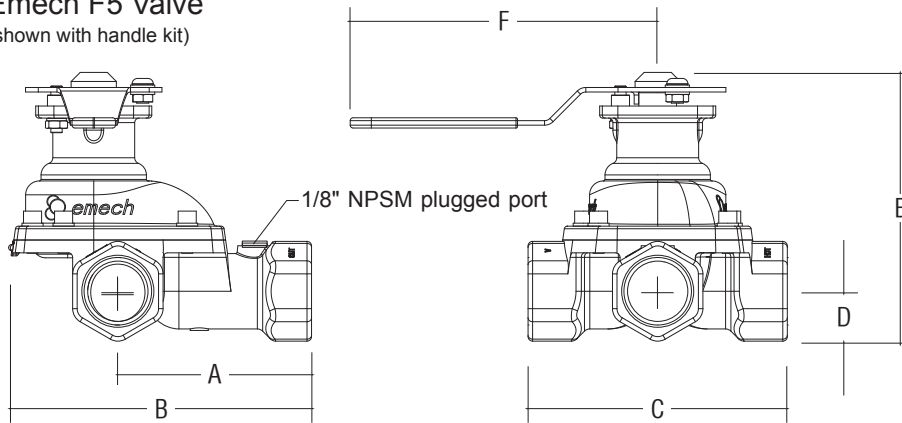
<b>Seal and Bearing Spares Kits:</b>	025 F5	040 F5	050 F5
<b>Part Number:</b>	CPSK0071	CPSK0072	CPSK0073
<b>Disc Set Spares Kits:</b>	025 F5	040 F5	050 F5
<b>Part Number:</b>	CPSK0074	CPSK0075	CPSK0076
<b>Locating Pins</b>			
<b>Part Number:</b>	CPME0059	CPME0081	CPME0088
<b>Actuation options:</b>			
<b>Electric actuators:</b>	<b>F5 Valve Size</b>	<b>Recommended Emech Actuator Model</b>	
	025, 040	G12	
	050	G13	
<b>Handle kits:</b>	<b>F5 Valve Size</b>	<b>Part Number</b>	
	025	CPSK0003	
	040, 050	CPSK0004	

## Emech™ F5 Standard Valve Model Codes

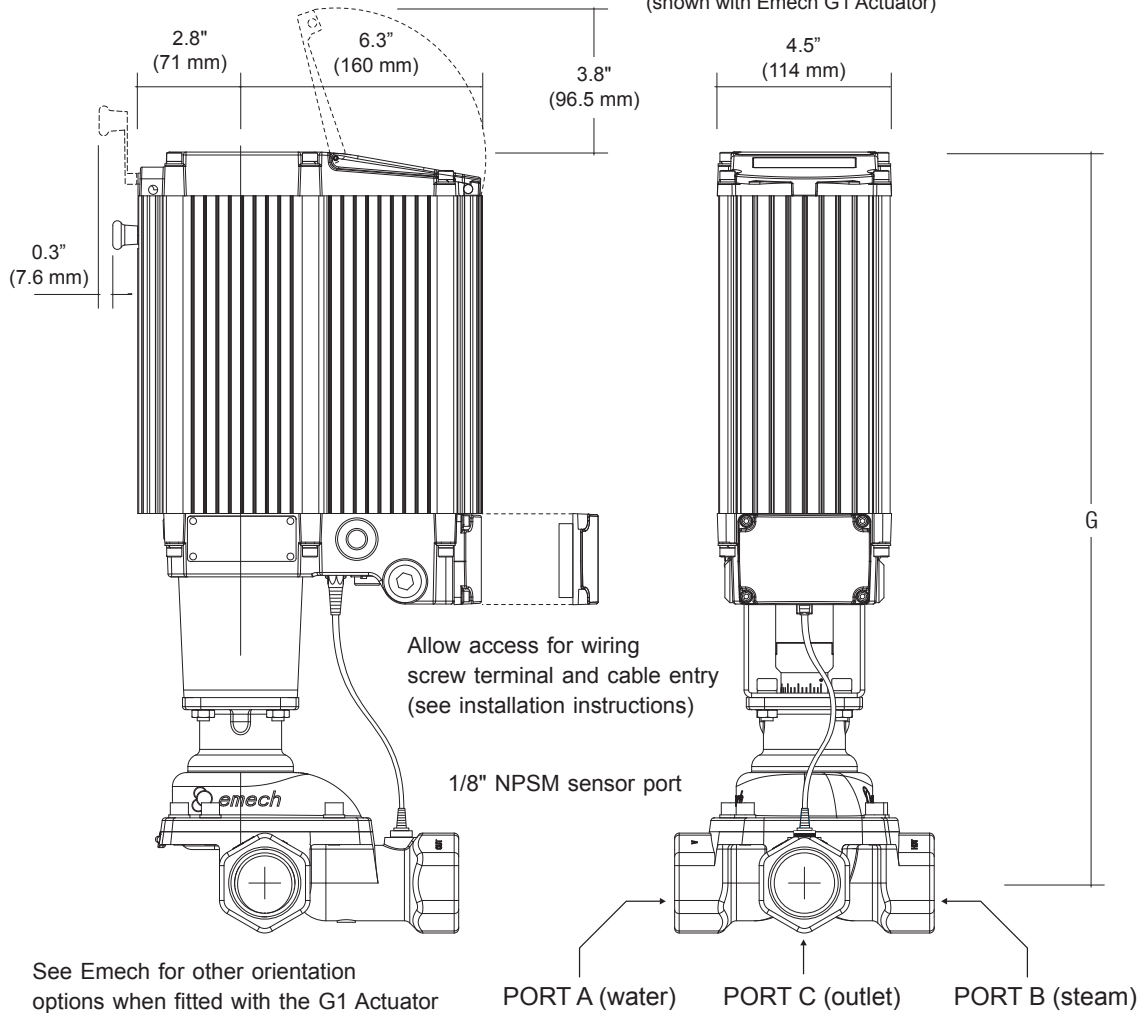
Model Codes	Description	End Connection	Steam Water Mixing Units Codes
F5025	F5 VALVE 1" (25mm) NPT	Screwed NPT	E25S
F5040	F5 VALVE 1-1/2" (40mm) NPT	Screwed NPT	E40S
F5050	F5 VALVE 2" (50mm) NPT	Screwed NPT	E50S

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

**Emech F5 Valve**  
(shown with handle kit)



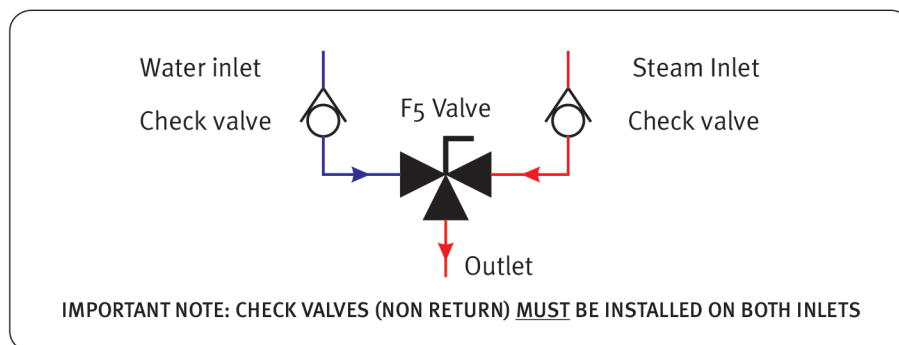
**Emech F5 Valve**  
(shown with Emech G1 Actuator)



Nominal Valve Size <sup>(1)</sup>		1" (25 mm)	1 1/2" (40 mm)	2" (50 mm)
A		4.25" (108 mm)	5.16" (131 mm)	.01" (178 mm)
B		6.42" (163 mm)	7.83" (199 mm)	10.67" (271 mm)
C		4.72" (120 mm)	6.77" (172 mm)	8.66" (220 mm)
D		1.14" (29 mm)	1.30" (33 mm)	1.89" (48 mm)
E		5.71" (145 mm)	7.09" (180 mm)	8.39" (213 mm)
F		6.50" (165 mm)	8.03" (204 mm)	8.03" (204 mm)
G		17.91" (455 mm)	19.06" (484 mm)	22.24" (503 mm)
Operational Stroke °rotational	with Handle kit	230	230	230
	with G1 Actuator	180	180	180
Thread size : Inlet NPT	(inch)	1"	1 1/2"	2"
Thread size : Outlet NPT	(inch)	1 1/4"	1 1/2"	2 1/2"
Cold water port flow characteristics ( 90° open )				
Cv: USgpm at dP=1 psi, 68°F (m3/h at dP=1 bar, 20°C)		8.0 (6.8)	13.3 (11.9)	26.6 (23.0)
Flow @ 30psi dP	U.S.Gpm (lpm)	44 (162)	74 (280)	146 (543)
Shutoff Leakage:	Leakage is approximately 0.05% of rated valve capacity			
Body Pressure Rating, Designed to ASME B16.34				
dPmax		As per the operating pressure		
Operating Pressure @ <482°F	psi (g) (bar)	145 (10)	145 (10)	145 (10)
Physical Characteristics Weight (approx)				
Valve only	lb (kg)	5.5 (2.5)	11.0 (5.0)	22.0 (10.0)
Valve and Emech G1 Actuator	lb (kg)	24.5 (11.030.0)	49.0 (18.0)	
Valve Topworks Dimensions For Actuator Mounting ( Spigot / bolts as per ISO 5210 / ISO 5211 )				
Shaft / stem connection	sq.std (mm)	0.39" (10 mm)	0.55" (14 mm)	0.55" (14 mm)
Topworks, 4 holes	PCD (mm)	1.97" (50 mm)	2.76" (70 mm)	2.76" (70 mm)
Topworks, PCD hole Ø	(mm)	0.26" (6.5 mm)	0.33" (8.5 mm)	0.33" (8.5 mm)
Topworks, Spigot diameter	(mm)	1.38" (35.1 mm)	2.17" (55.1 mm)	2.17" (55.1 mm)
Valve mounting restrictions		none	none	none

### Notes:

- <sup>(1)</sup> Note G12 actuator is recommended for 1" (25 mm), 1 1/2" (40 mm) F5 sizes. The G13 is recommended for the F5 size 2" (50 mm) valve.
- All specifications are for water and steam mixing.
- Flows are without terminal fittings, restrictors, or non-return valves on the inlets.
- If operating at more than one maximum rated condition, contact Armstrong to confirm the application is appropriate.



### Definitions:

dP	Differential pressure across the valve from inlet to outlet.
dP max.	Maximum allowable valve closed differential pressure across the valve from inlet to outlet.
Operating pressure	Valve body pressure rating.



## Checklist for sizing the F5 steam water mixer

### Information Required to Size the Valve:

- Running water pressure drop\*(psi)
- Steam pressure drop\*\* (psi)
- Water temperature rise required (dT) °Fahrenheit.
- Required flow (U.S. gpm)

### NOTES:

\* The 'Water Pressure Drop' is the difference between the running water pressure at the water inlet port and the outlet port.

\*\* The 'Steam Pressure Drop' is the difference between the running steam pressure at the steam inlet port and the pressure at the outlet port.

### To Size the Valve:

1. Determine the cold water capacity of the valve using the "Cold Water Capacity" column with the 'Water Pressure Drop' column.
2. Using the 'Steam Pressure Drop' column, locate the steam pressure available at the valve steam inlet port. Determine the 'Temperature Rise' required by subtracting the inlet water temperature from the desired water temperature desired. Go across the columns to locate the temperature rise required to find the flow (U.S. gpm) the F5 can heat to the required temperature..
3. Compare the capacities found in steps 1 and 2. The LOWER of these two capacities is the maximum amount of hot water that size valve can produce to the desired temperature.

NOTE: A minimum flow rate must be established for there to be effective mixing, and temperature control. The approximate minimum flows for effective stream water mixing are:

F5025	4 (15)	U.S. gpm (lpm)
F5040	6 (23)	U.S. gpm (lpm)
F5050	20 (100)	U.S. gpm (lpm)

### EXAMPLE:

Using the 1" size valve (F5025).

Assume the running water pressure drop is 60 psi (4.0 bar), and the steam pressure drop is 40 psi (2.5 bar). The 1" (25 mm) valve can pass 72 U.S. gpm (268 lpm) of cold water, but can only heat 14 U.S. gpm (54 lpm) with a 100°F (50°C) temperature rise.

Therefore the capacity of the mixer for this case is only 14 U.S. gpm (54 lpm).

If the steam pressure could be raised to 100 psi, the capacity of the same unit would be 35 U.S. gpm (152 lpm), 100°F (50°C) temperature rise.

### Safety features of the F5 valve when coupled with the Emech™ G1 actuator:

- If the cold water supply fails the valve will be closed within approximately two seconds.
- If the temperature sensor fails the valve will be closed within approximately two seconds.
- The G1 has a manual override handle enabling operation of the valve when there is no power supply.

1" F5 Valve														
Water Pressure Drop (psi)	Steam Pressure Drop (psi)	Cold Water Capacity (U.S. gpm)	Capacity (U.S. gpm) at Temperature Rise (°F)											
			5	10	15	20	30	40	60	80	100	120	140	160
5	5	21	21	18	12	9	6	4	3	2	2	1	1	1
10	10	29	29	29	24	18	12	9	6	4	4	3	3	2
15	15	36	36	36	36	27	18	13	9	7	5	5	4	3
20	20	41	41	41	41	36	24	18	12	9	7	6	5	4
30	30	51	51	51	51	51	36	27	18	13	11	9	8	7
40	40	59	59	59	59	59	48	36	24	18	14	12	10	9
50	50	65	65	65	65	65	59	45	30	22	18	15	13	11
60	60	72	72	72	72	72	72	53	36	27	21	18	15	13
70	70	77	77	77	77	77	77	62	41	31	25	21	18	16
80	80	83	83	83	83	83	83	71	47	36	28	24	20	18
90	90	88	88	88	88	88	88	80	53	40	32	27	23	20
100	100	93	93	93	93	93	93	89	59	44	35	30	25	22
110	110	97	97	97	97	97	97	97	65	49	39	33	28	24
120	120	101	101	101	101	101	101	101	71	53	43	35	30	27
130	130	106	106	106	106	106	106	106	77	58	46	38	33	29

1 1/2" F5 Valve														
Water Pressure Drop (psi)	Steam Pressure Drop (psi)	Cold Water Capacity (U.S. gpm)	Capacity (U.S. gpm) at Temperature Rise (°F)											
			5	10	15	20	30	40	60	80	100	120	140	160
5	5	32	32	30	20	15	10	7	5	4	3	2	2	2
10	10	45	45	45	39	29	19	14	10	7	6	5	4	4
15	15	55	55	55	55	44	29	22	14	11	9	7	6	5
20	20	63	63	63	63	58	39	29	19	14	11	10	8	7
30	30	77	77	77	77	77	58	43	29	21	17	14	12	11
40	40	89	89	89	89	89	77	58	38	29	23	19	16	14
50	50	100	100	100	100	100	96	72	48	36	29	24	20	18
60	60	109	109	109	109	109	109	86	57	43	34	29	24	21
70	70	118	118	118	118	118	118	100	67	50	40	33	29	25
80	80	126	126	126	126	126	126	115	76	57	46	38	33	28
90	90	134	134	134	134	134	134	130	86	64	51	43	37	32
100	100	141	141	141	141	141	141	141	95	71	57	48	41	36
110	110	148	148	148	148	148	148	148	105	79	63	52	45	39
120	120	155	155	155	155	155	155	155	115	86	69	57	49	43
130	130	161	161	161	161	161	161	161	124	93	74	62	53	46

2" F5 Valve														
Water Pressure Drop (psi)	Steam Pressure Drop (psi)	Cold Water Capacity (U.S. gpm)	Capacity (U.S. gpm) at Temperature Rise (°F)											
			5	10	15	20	30	40	60	80	100	120	140	160
5	5	86	86	86	59	46	31	24	16	12	10	8	7	6
10	10	121	121	121	119	91	62	47	32	24	19	16	14	12
15	15	149	149	149	149	137	93	71	48	36	29	24	21	18
20	20	172	172	172	172	172	124	94	63	48	38	32	28	24
30	30	210	210	210	210	210	186	141	95	72	58	48	41	36
40	40	243	243	243	243	243	243	188	127	96	77	64	55	48
50	50	272	272	272	272	272	272	235	158	120	96	80	69	60
60	60	297	297	297	297	297	297	282	190	143	115	96	83	72
70	70	321	321	321	321	321	321	321	222	167	134	112	96	84
80	80	343	343	343	343	343	343	343	253	191	153	128	110	96
90	90	364	364	364	364	364	364	364	285	215	173	144	124	108
100	100	384	384	384	384	384	384	384	317	239	192	160	138	120
110	110	403	403	403	403	403	403	403	349	263	211	176	151	133
120	120	421	421	421	421	421	421	421	380	287	230	192	165	145
130	130	438	438	438	438	438	438	438	412	311	249	208	179	157

NOTES: • Contact Armstrong (or an authorized Rep) for operation in the shaded conditions indicated above.  
 • Armstrong recommends hard facing on the bonnet and spindle assembly for extended duty in high pressure drop applications. See the F5 valve model code descriptions on page 3 for valve selection.



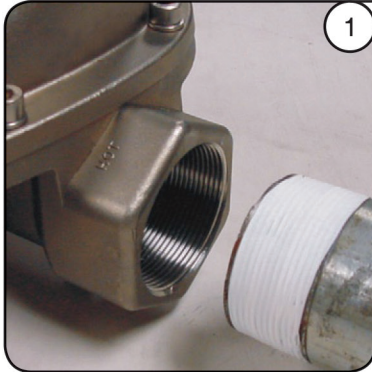
25mm F5 Valve	Water Pressure Drop (bar)	Steam Pressure Drop (bar)	Cold Water Capacity (Lpm)	Capacity (Lpm) at Temperature Rise (°C)									
				5	10	15	20	25	30	40	50	60	70
0.25	0.25	67	54	27	18	14	11	9	7	5	5	4	3
0.50	0.50	95	95	54	36	27	22	18	14	11	9	8	7
0.75	0.75	116	116	81	54	41	33	27	20	16	14	12	10
1.00	1.00	134	134	108	72	54	43	36	27	22	18	16	14
1.25	1.25	150	150	135	90	68	54	45	34	27	23	19	17
1.50	1.50	164	164	163	108	81	65	54	41	33	27	23	20
2.00	2.00	190	190	190	144	108	87	72	54	43	36	31	27
2.50	2.50	212	212	212	180	135	108	90	68	54	45	39	34
3.00	3.00	232	232	232	216	163	130	108	81	65	54	46	41
3.50	3.50	251	251	251	251	190	152	126	95	76	63	54	47
4.00	4.00	268	268	268	268	216	173	144	108	87	72	62	54
5.00	5.00	300	300	300	300	271	217	181	125	108	90	77	68
6.00	6.00	328	328	328	328	325	260	217	163	130	108	93	81
7.00	7.00	355	355	355	355	355	303	253	190	152	126	108	95
8.00	8.00	379	379	379	379	379	347	289	217	173	144	124	108
9.00	9.00	402	402	402	402	402	390	325	244	195	163	139	122
10.00	10.00	424	424	424	424	424	424	360	271	217	181	155	135

40mm F5 Valve	Water Pressure Drop (bar)	Steam Pressure Drop (bar)	Cold Water Capacity (Lpm)	Capacity (Lpm) at Temperature Rise (°C)									
				5	10	15	20	25	30	40	50	60	70
0.25	0.25	102	87	43	29	22	17	15	11	9	7	6	5
0.50	0.50	145	145	87	58	43	35	29	22	17	14	12	11
0.75	0.75	177	177	130	87	65	52	43	33	26	22	19	16
1.00	1.00	205	205	174	116	87	70	58	43	35	29	25	22
1.25	1.25	229	229	217	145	109	87	72	54	43	36	31	27
1.50	1.50	251	251	251	174	130	104	87	65	52	43	37	33
2.00	2.00	289	289	289	232	174	139	116	87	70	58	50	43
2.50	2.50	323	323	323	290	217	174	145	109	87	72	62	54
3.00	3.00	354	354	354	347	261	209	174	130	104	87	75	65
3.50	3.50	383	383	383	383	304	243	203	152	122	101	87	76
4.00	4.00	409	409	409	409	347	278	232	174	139	116	99	87
5.00	5.00	457	457	457	457	434	347	290	217	174	145	124	109
6.00	6.00	501	501	501	501	501	417	347	261	208	174	149	130
7.00	7.00	541	541	541	541	541	486	405	304	243	203	174	152
8.00	8.00	579	579	579	579	579	556	463	347	278	232	199	174
9.00	9.00	614	614	614	614	614	614	521	391	313	261	223	195
10.00	10.00	647	647	647	647	647	647	579	434	347	290	248	217

50mm F5 Valve	Water Pressure Drop (bar)	Steam Pressure Drop (bar)	Cold Water Capacity (Lpm)	Capacity (Lpm) at Temperature Rise (°C)									
				5	10	15	20	25	30	40	50	60	70
0.25	0.25	278	278	149	99	74	60	50	37	30	25	21	19
0.50	0.50	393	393	298	198	149	119	99	74	60	50	43	37
0.75	0.75	482	482	446	298	223	179	149	112	89	74	64	56
1.00	1.00	556	556	556	397	298	238	198	149	119	99	85	74
1.25	1.25	622	622	622	496	372	298	248	186	149	124	106	93
1.50	1.50	681	681	681	595	446	357	298	223	179	149	128	112
2.00	2.00	787	787	787	787	595	476	397	298	238	198	170	149
2.50	2.50	880	880	880	880	744	595	496	372	298	248	213	186
3.00	3.00	964	964	964	964	893	714	595	446	357	298	255	223
3.50	3.50	1041	1041	1041	1041	1041	833	694	521	417	347	298	260
4.00	4.00	1113	1113	1113	1113	1113	952	793	595	476	397	340	298
5.00	5.00	1244	1244	1244	1244	1244	1190	992	744	595	496	425	372
6.00	6.00	1363	1363	1363	1363	1363	1363	1190	893	714	595	510	446
7.00	7.00	1472	1472	1472	1472	1472	1472	1388	1041	833	694	595	521
8.00	8.00	1574	1574	1574	1574	1574	1574	1574	1190	952	793	680	595
9.00	9.00	1669	1669	1669	1669	1669	1669	1669	1339	1071	893	765	669
10.00	10.00	1759	1759	1759	1759	1759	1759	1759	1488	1190	992	850	744

NOTES: • Contact Armstrong (or an authorized Rep) for operation in the shaded conditions indicated above.  
 • Armstrong recommends hard facing on the bonnet and spindle assembly for extended duty in high pressure drop applications. See the F5 valve model code descriptions on page 3 for valve selection.

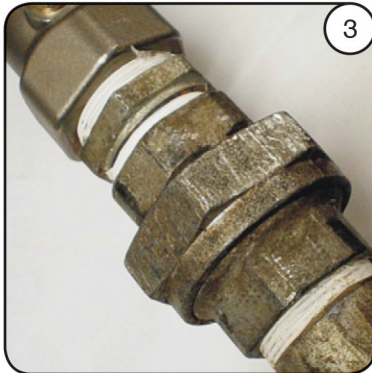
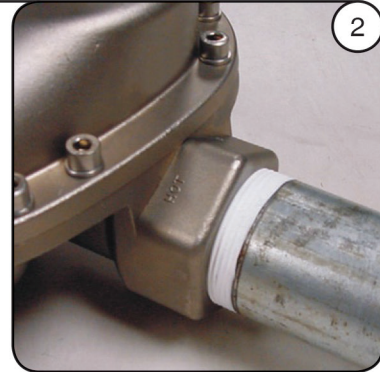




1 When installing the valve in line, be sure to follow good practice using either sealing tape or thread adhesive in the joints.

The valve may be attached straight to the pipe work.

**Note:** Be sure to consider the ease of removing the valve should this become necessary in the future. See images 3 and 4 for typical installation methods.



3 **Note:** For valve maintenance, the bonnet screws can be removed and full access to the internal components is possible.

The valve may be connected to the pipe work with a union style of fitting (image 3).

**CAUTION:** Prior to installation ensure that the pipes leading to the valve are clear from debris which may block or damage the valve on commissioning.

**WARNING:** Only trained personnel familiar with pipe work and pressure systems should install and maintain Emech equipment. Failure to do so may result in serious personal injury!

**WARNING:** Depressurize pipe work to atmospheric pressure and drain all fluids from the pipe work before working on the valve. Failure to do so may result in serious personal injury!

**WARNING:** Ensure that the intended maximum operating pressure of the line does not exceed the pressure rating of the valve. Failure to do so may result in serious personal injury!

**WARNING:** Non return valves are strongly recommended upstream of the valve inlets. Failure to install them may cause undesirable back-flow and may result in serious personal injury and or equipment damage!

**WARNING:** The valve must be supported adequately so as not to over stress the pipe work and or the valve body. See Figure 5 and Table 1 below for the maximum nozzle loads on the valves. Application of loads above these values may result in serious personal injury and or equipment damage!

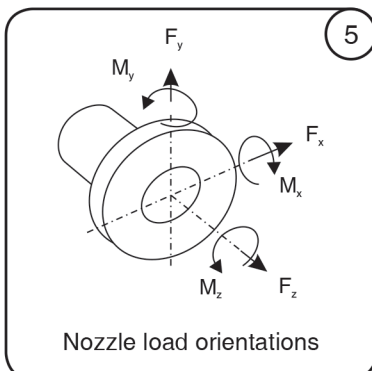


Table 2.1: Maximum Nozzle Forces and Moments

Valve Size	Force - $F_x F_y F_z$	Moment - $M_x M_y M_z$
025	90 lbf.	1150 lbf.in
040	180 lbf.	2655 lbf.in
050	450 lbf.	5310 lbf.in

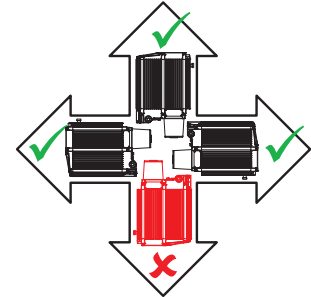
### 2.1 Recommended Installation

**NOTE:** All Emech valves and actuators are shipped fully assembled and factory set to Factory Default Settings as a standard. Any requirement for customised Settings or Software settings will need to be communicated at the time of order placement on the Factory.

#### Step 1: Location Considerations

For F5 valves mounted with an Emech G1 electronic actuator ensure the installation locations offers suitable access to the electrical connection terminals, the manual override handle, actuator power switch, display and keypad.

Do not install the actuator near or in high pressure wash down areas. The units must NOT be installed upside down. For manually operated F5 valves ensure suitable access to the handle for safe operation.



#### Step 2: Recommended Installation

See Figure 2.6 (page 14) for a recommended F5 valve installation schematic.

#### MUST HAVE

- Check valves (poppet style) MUST be fitted upstream of the valve inlet ports and as close as practicable to the inlets.
- Pipe work adequately supported.
- A 24Vdc regulated power supply.



#### RECOMMENDED

- Isolation valves are RECOMMENDED on the supply lines.
- A failsafe solenoid operated spring to close isolation valve is highly RECOMMENDED for over temperature
- failure modes (see item 2 on figure 2.6).
- Ensure mechanical protection of the wiring (e.g. use armour conduit).
- It is RECOMMENDED to place wiring in screened conduit or cables.
- Ensure pipe works are straight for as long as practicable to the Emech valve inlets and any cable conduit is fully sealed on both ends against water ingress.
- Use appropriate inlet pipe diameters and supply pressure to cope with required application flows.

#### CONSIDERATIONS

- Consider strainers if water supply carries pipe scale or other particulates that may damage valve seat and seals.
- Consider gauge points for temperature and pressure on inlets and outlets.

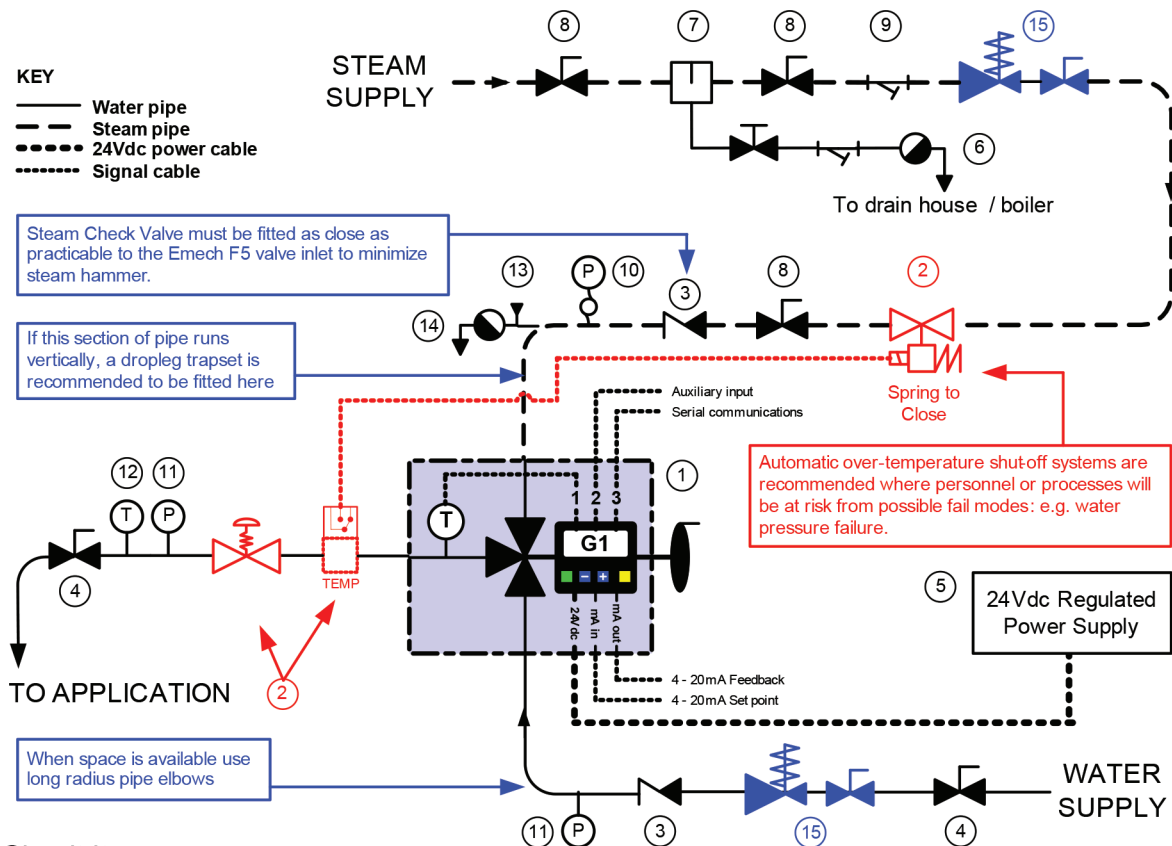
#### Manual Operations Considerations

- By setting the position of the “stroke limiting” stop, an approximate maximum temperature setting can be made. This is a safety feature to minimize the possibility of operator injury. Handle kits are supplied with fitting instructions (CPMI0029).
- The flow rate control can be achieved by either a throttle valve on the inlets or outlet, or by presetting the supply pressures. For most circuits throttle valves at the mixing valve inlets work best.



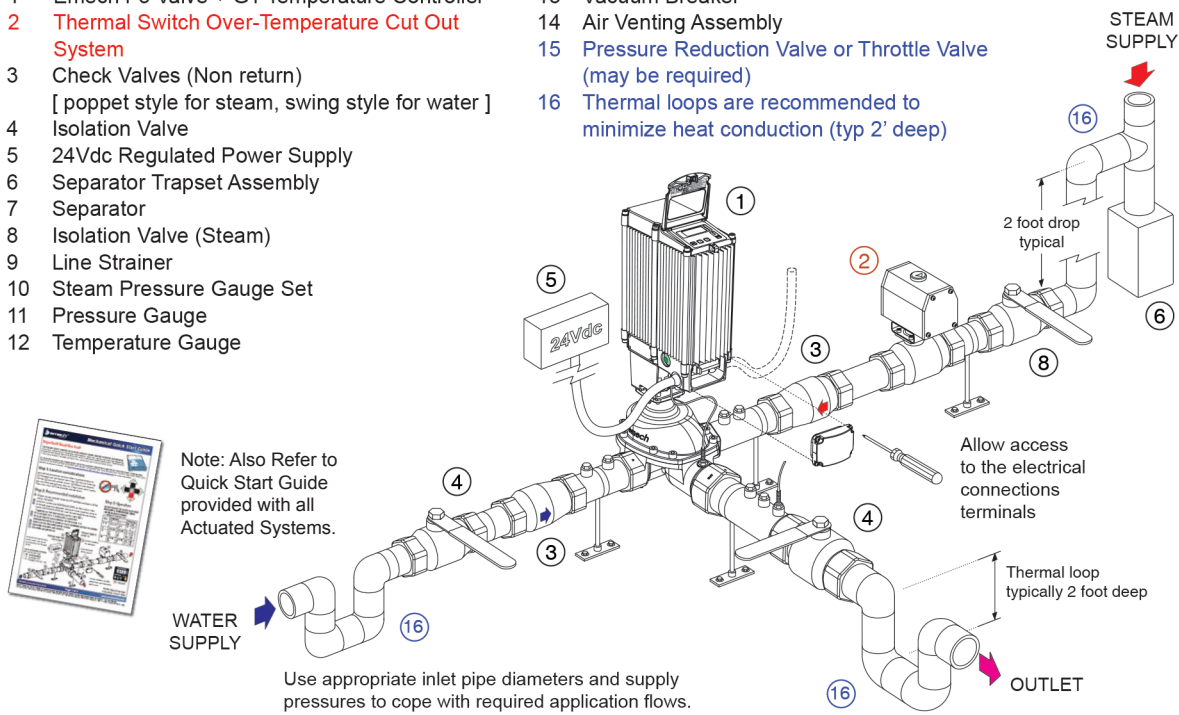
**IMPORTANT:** Users must consider safety implications when designing their installations using manually operated F5's. Emech recommend a spring to close isolation valve prior to the steam inlet of the F5 valve triggered by a failsafe temperature switch near the valve outlet. (See items highlighted red in Figure 2.6 on page 14).

Figure 2.6: Recommended F5 valve installation schematic.

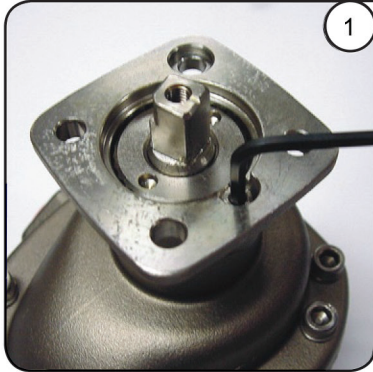


Circuit Items

- |  |  |
|--|--|
| 1 Emech F5 Valve + G1 Temperature Controller                                     | 13 Vacuum Breaker  |
| 2 Thermal Switch Over-Temperature Cut Out System                                 | 14 Air Venting Assembly  |
| 3 Check Valves (Non return)<br>[ poppet style for steam, swing style for water ] | 15 Pressure Reduction Valve or Throttle Valve (may be required)            |
| 4 Isolation Valve  | 16 Thermal loops are recommended to minimize heat conduction (typ 2' deep) |
| 5 24Vdc Regulated Power Supply   |  |
| 6 Separator Trapset Assembly   |  |
| 7 Separator  |  |
| 8 Isolation Valve (Steam)  |  |
| 9 Line Strainer  |  |
| 10 Steam Pressure Gauge Set  |  |
| 11 Pressure Gauge  |  |
| 12 Temperature Gauge   |  |



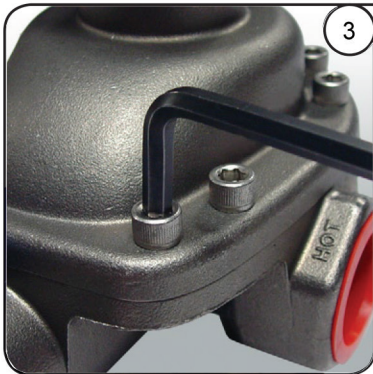
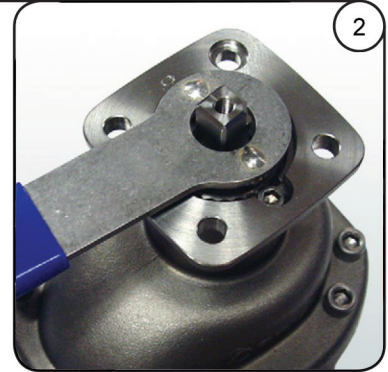
Note: Also Refer to Quick Start Guide provided with all Actuated Systems.



**CAUTION!**

Before dismantling the valve, ensure all upstream and downstream pressurized pipe work is isolated appropriately. Ensure the pressure and fluids are drained from the valve and pipework.

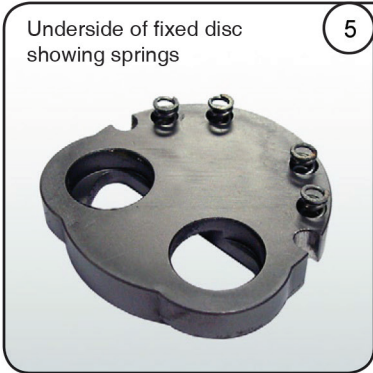
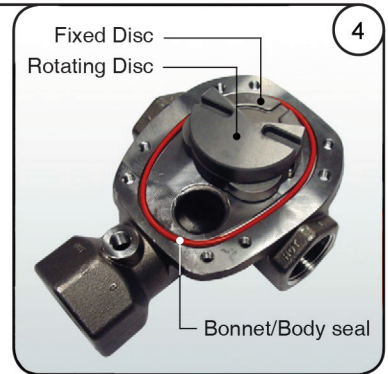
Remove the gland nut locking screw (image 1). Fit the gland nut wrench into the two holes provided in the top of the gland nut (image 2) and unwind counterclockwise to remove the gland nut from the bonnet.



Use an allen wrench to remove the bonnet bolts that fasten the bonnet to the body (image 3).

Carefully remove the bonnet from the body particularly if the valve is mounted in a vertical position.

Note that the moving disc is not fastened to the spindle. Take care that the moving disc is not dropped as the bonnet assembly is removed.



Underside of fixed disc showing springs

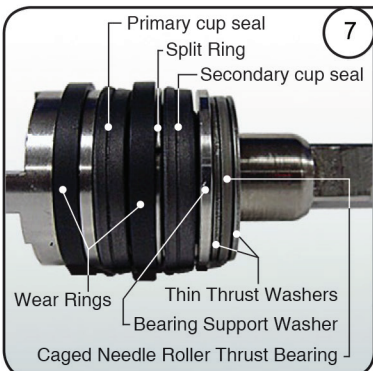
Set the rotating disc aside.

Remove the fixed disc being careful not to lose any of the springs from the back face.

Remove the bonnet/body seal and 2 face seals. Inspect the pins and check for wear. Replace if worn. See page 6 Item 3 for replacement pins (image 6).

Remove the spindle from the bonnet by pushing down on the spindle end.

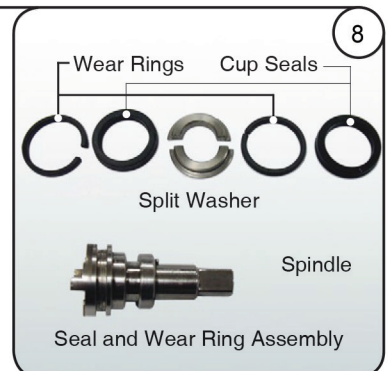
Check that the secondary cup seal and thrust bearing assembly is on the spindle. You may have to remove these from the bonnet store.

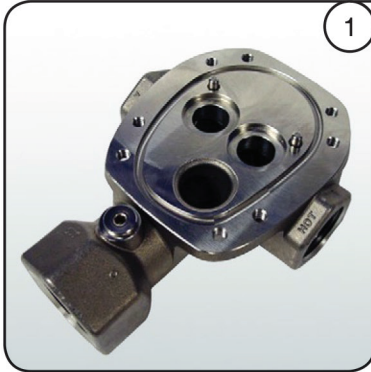


Remove the thrust bearing assembly, wear rings, cup seals and split ring from the spindle.

Clean all grease and dirt from parts not being replaced.

Ensure that the spindle seal surfaces are protected from damage while the valve is disassembled.





1

**PREPARATION:** Ensure the assembly area is completely dirt free. Ensure also that the valve parts are clean and ready to be re assembled. Check all valve parts for damage or wear and insert pins image 1.

In the valve body fit the 2 face seals and the bonnet/body seal. Check the disc locating pins are in and secure (Image 2).



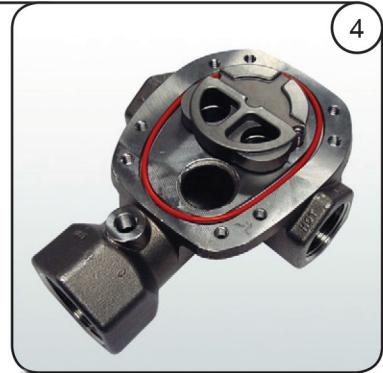
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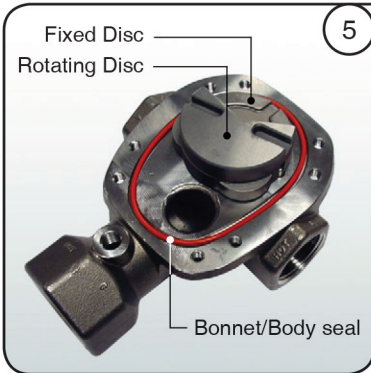
3

Take the fixed disc and check the seal surface is clean and that all springs are in place. Add grease to the springs to retain them in the disc (image 3) and assemble onto the valve body and locating pins (image 4).

Take the rotating disc, check the seal surface is clean, smooth and undamaged. Apply a light layer of Kluber grease supplied in the Seal Kit. Place the moving disc onto the fixed disc as shown (image 5), then rotate several times to bed discs together.



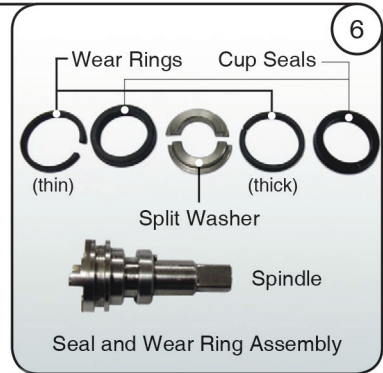
4



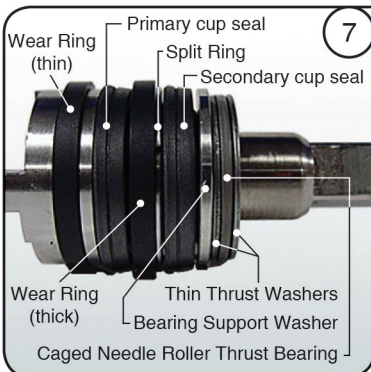
5

Push on the primary cup seal to the spindle. Ensure the orientation is correct! (See image 7). Fit the split washer and thick wear ring before fitting the secondary cup seal.

Smear on a liberal quantity of the Kluber grease to the bearing support washer and needle roller bearing making sure all surfaces are coated and approximately 60% of the bearing void is filled.



6



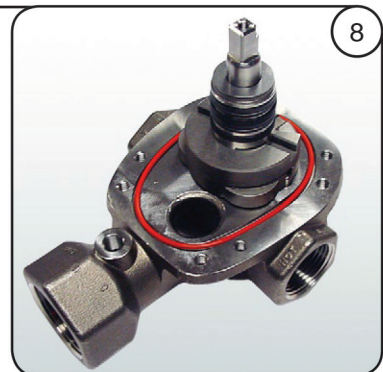
7

Fit the bearing support washer, thin washer and then the needle roller bearing onto the spindle.

Slide on the thin top washer.

Smear a liberal amount of grease onto the spindle seal and wear ring surfaces.

Locate the spindle assembly onto the top disc (image 8).



8





9 Fit the internal and external o-rings into the gland nut (image 9). Apply a coating of grease to the o-ring surfaces and thread. Wind the gland nut into the body 2 or 3 revolutions by hand (image 10). Apply a coat of grease inside the bonnet bores.

Check the lightly greased bonnet/body seal is in its groove, and place the bonnet over the spindle. Push down gently so that the spindle seals slide into the bore.

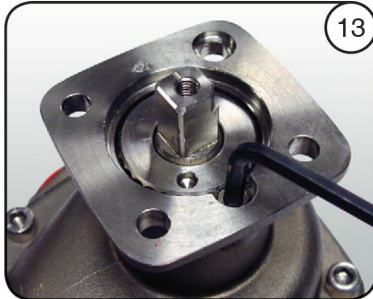
The bonnet should be able to be pushed all the way so that the flange contacts the body. Use 4 fasteners (2 front and 2 rear) to hold the bonnet in place against the spring and o-ring pressure. Insert the remaining fasteners and tighten evenly (image 11).



11 Rotate the gland nut all the way down so that the spindle and disc assembly are clamped (image 12). The spindle should be difficult to rotate or even locked.

Back off the gland nut 1-2 notches and rotate the spindle clockwise and counter-clockwise several times to evenly spread the applied lubricants.

Insert the locking screw after applying a thread locking adhesive and tighten (see image 13).



13 **Note:** Rotate the spindle 1-2 times to ensure the operating torque is constant and the rotating action is smooth.

See section 5.0 for Emech G1 actuator mounting. **Note:** handle kits are supplied with separate assembly instructions.

**Note:** Rotate the spindle 1-2 times to ensure the operating torque is constant, and the rotating action is smooth.

**NOTE:** The valve **MUST** be in the **CLOSED** position before mounting the actuator or handle kit (image 14).

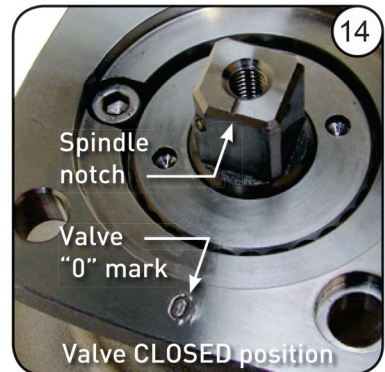
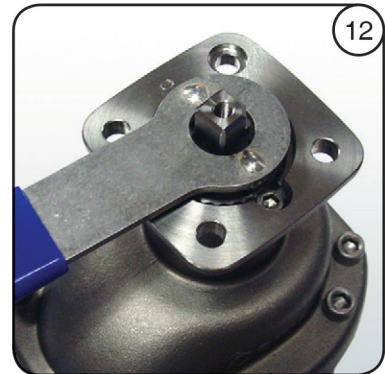
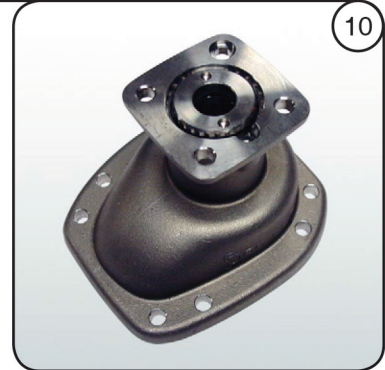


Table 4.1: Nominal Tightening Torques for Lubricated Stainless Steel Socket Head Cap Screws

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

Table 4.2: Recommended Lubricants and Thread Adhesives

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

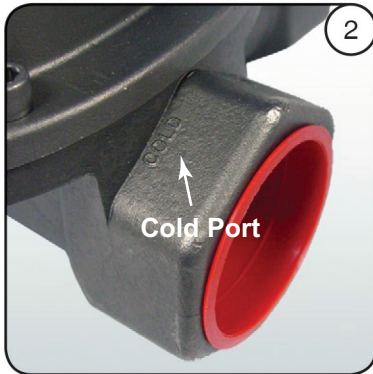
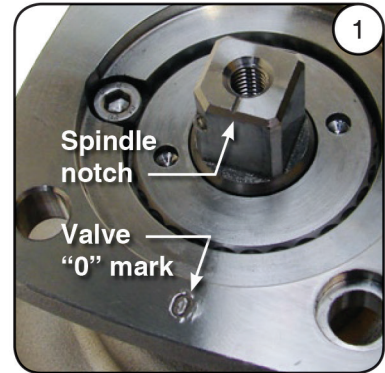
\*Sachets of lubricant are included in Seal Kits.



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

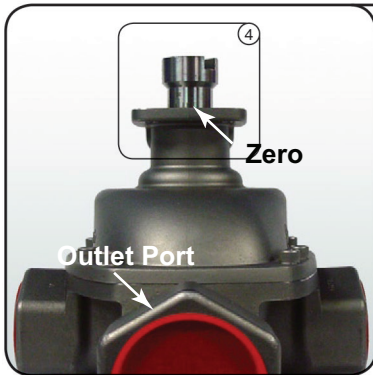
The instructions below explain how to mount the actuator facing the outlet port as per image on page 7.

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 - hold mode and press down (-) on the actuator keypad to toggle between Temperature and Positioner mode.



Once in temperature mode, disconnect the temperature probe from the actuator. The actuator will move automatically to the 'zero' position and the keypad display will show "E2".

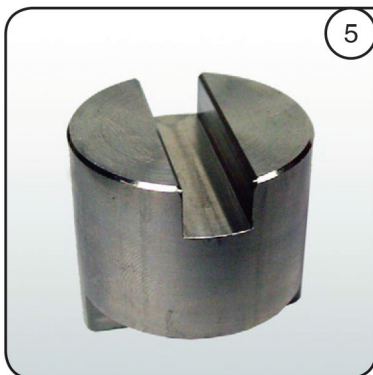
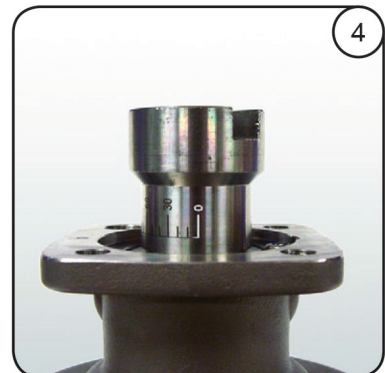
Set the Valve position to closed. Ensure the notch on the spindle (image 1) points towards the valve "0" mark and the cold port (image 2) which is the fully closed position for the valve seats and the default cold port (image 2).



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

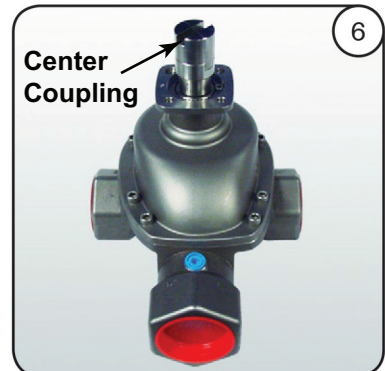
If the actuator is to be mounted in one of the other three positions, rotate the graduated coupling so that the "ZERO" mark will line up with the notch in the bracket (image 8) of the actuator, when valve is fully coupled to actuator.

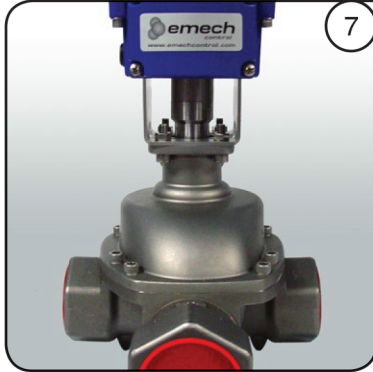
**DO NOT MOVE THE SPINDLE FROM ITS ZERO POSITION WHEN USING ONE OF THE OTHER POSITIONS FOR THE ACTUATOR.**



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

Continued...

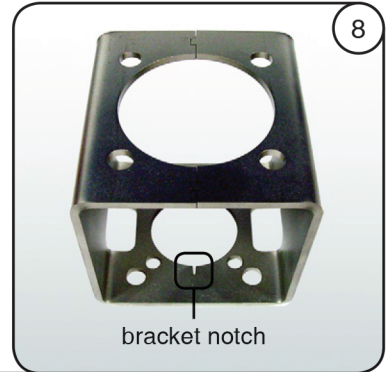




7

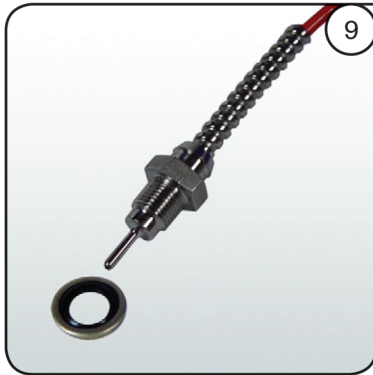
Place the actuator on the valve in the desired position (image 7). The zero mark on the coupling (image 4) should align with the notch on the bracket (image B).

Insert one M8 X 25 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 0) is on the sensor (image 10).



10



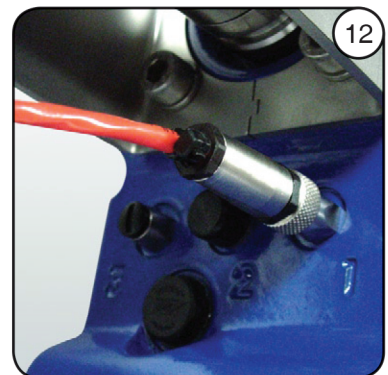
11

Screw the sensor into the outlet port of the valve (image 11) and tighten before connecting the the sensor to the actuator.

Plug the sensor connector into the actuator input port labelled "1" and hand tighten . The actuator is now assembled correctly (image 12).

**WARNING!! DO NOT USE A WRENCH TO SCREW THE SENSOR INTO THE ACTUATOR.**

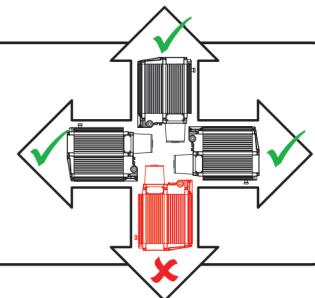
See section 5.0 of the actuator Installation, Operation and Maintenance manual for software configuration.



12



**THE ACTUATOR MUST NOT BE INSTALLED UPSIDE DOWN OR SUBJECT TO HIGH PRESSURE WASH DOWN**



## 6.1 Commissioning Overview

Operating the F5 valve with excessive steam pressure can cause early wear and failure of the valve body and components. Reducing the steam pressure will decrease relative to water pressure the decibel rating, reduce the likelihood of pitting from cavitation and prolong the life of the valve.

Before beginning the commissioning process, note the operating angle of the valve on the actuator shaft during normal operation. The ideal operating angle depends on the application but generally should be around 140 - 150 degrees. If the valve is already operating within this range, reducing the steam supply could adversely affect the flow rate and temperature at the outlet and thus the unit sized, may not be applicable for your application.

This method involves reducing the steam supply. To do this an appropriate device will need to be in line on the steam supply side before the inlet of the F5 valve. Armstrong recommends a pressure regulating valve, ut a steam restriction/isolation or throttling valve may suffice.

**! WARNING: This commissioning technique will result in out of spec water. To avoid injury to personnel and disturbance to sensitive processes Armstrong recommends diverting the F5 outlet flow to non-sensitive processes, re-circulation or dump (if appropriate).**

### DECIBEL WARNING

A very loud noise emitting from an operating F5 valve is indicative of extreme operating conditions. These conditions are likely to be caused by excessive cavitation during the mixing process.

Unprotected prolonged exposure to this noise level will cause permanent damage to hearing; >85 dB(A) decibels at 1m (3 ft) distance.

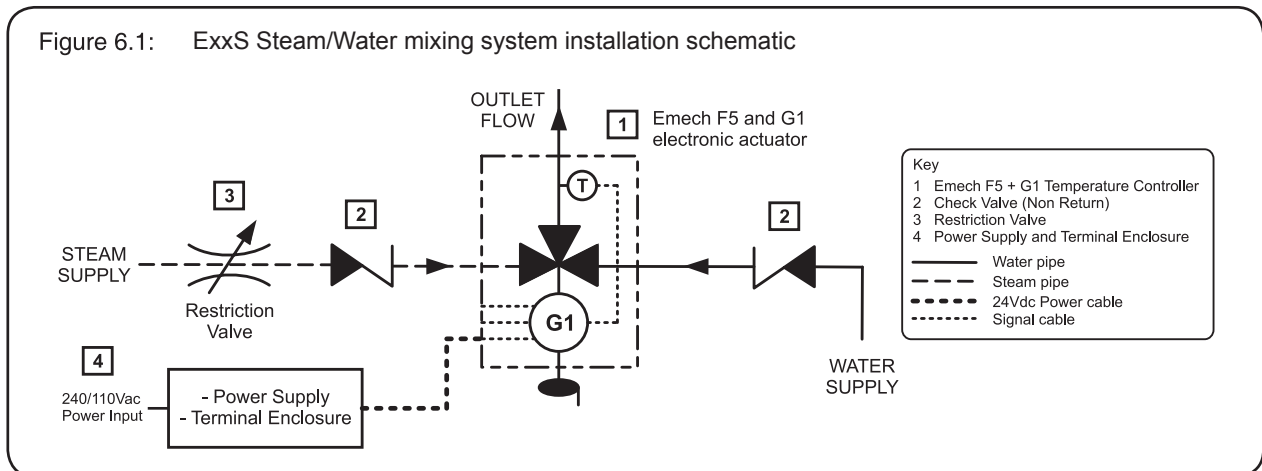
If the valve is continuously operating in these conditions it will produce accelerated wear on the internal components and can dramatically shorten the lifetime of the valve, possibly even leading to catastrophic failure.

The commissioning process should eliminate extreme cavitation symptoms. However if there is no improvement by lowering the steam pressure, please contact Armstrong for an engineered solution.

Solutions include:

- i) Hydraulic circuit review
- ii) Pressurized hot water loop
- iii) Valve material options to minimize cavitation erosion damage
- iv) Lagging of equipment to reduce noise

Figure 6.1: ExxS Steam/Water mixing system installation schematic



## 6.2 Commissioning Process

- Step 1: Take appropriate action to ensure the safety of others in the immediate area. Ensure personnel down stream are notified of the commissioning process.
- Step 2: Set the actuator to control at the highest desired set point and maximum required flow rate. For best practice two operatives will be required. One located at the keypad to view the outlet temperature and observe the actuator shaft and the other at the steam restriction valve.
- Step 3: Allow a few minutes for the supply pressures and outlet flows to stabilise at the conditions outlined in step 2. Note the temperature and operating angle of the actuator shaft.
- Step 4: Slowly reduce the steam pressure. Continue to reduce the steam pressure until the valve cannot meet the required temperature rise. This is indicated on figure 6.2 when “out of spec water” is seen at the outlet of the valve. To compensate for the loss of steam the valve operating angle will increase to allow more of the steam to be used in the mixing process. After 140 degrees the top disc will start to restrict the water orifice and begin to reduce the flow rate of the valve (see figure 6.3).

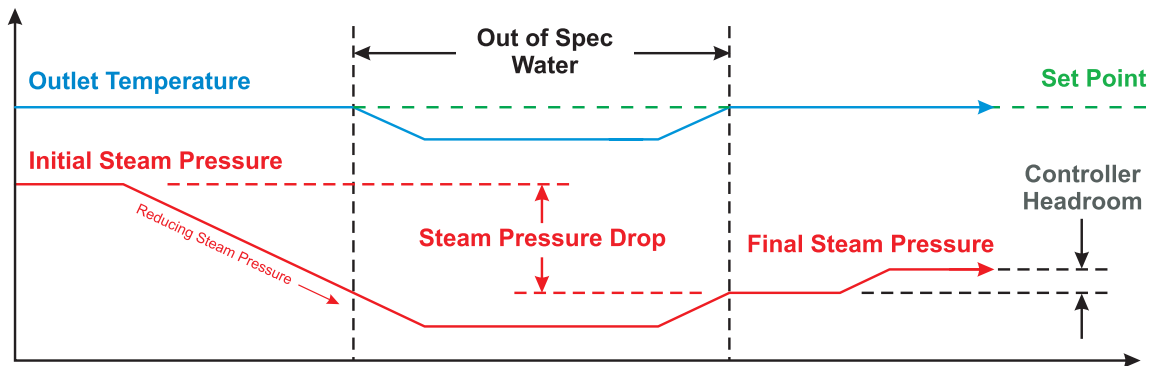


Figure 6.2: Pressure and temperature response curves

- Step 5: Slowly increase the steam pressure. Continue to do so until the valve can again control to the set point. Allow the flow to stabilise and ensure the outlet temperature corresponds to the set point. The operating angle should be around the 140-150 degree mark for optimal mixing.
- Step 6: Now increase the steam pressure again by 10% of the overall steam pressure drop. This will give the controller a little headroom to control with fluctuations of the steam supply. These new operating conditions will ensure the longevity of the valve. The commissioning process is now complete.

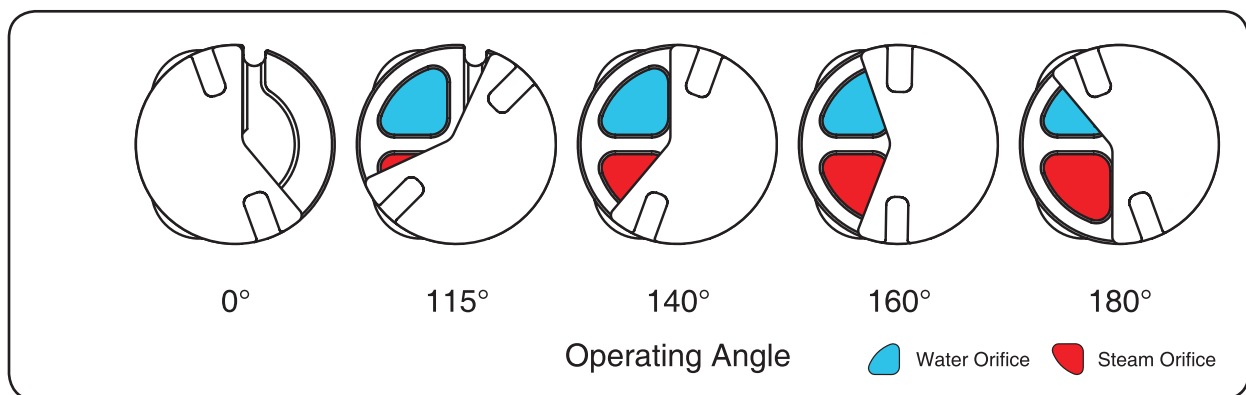


Figure 6.3: Valve operating angles and corresponding orifice restrictions.

Armstrong Hot Water Group, Inc. (“Armstrong”) warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended, that such products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation, but not longer than 15 months from the date of shipment from the factory [unless a Special Warranty Period applies, as listed below]. This warranty does not extend to any product that has been subject to misuse, neglect, or alteration after shipment from the Armstrong factory. Except as may be expressly provided in a written agreement between Armstrong and the user, which is signed by both parties, Armstrong **DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

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**Armstrong** International  
Emech™ Steam Water Mixing Valve - Model F5  
IOM-444 - CPAC0027

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