

ケイヒン自動弁 総合カタログ

Cat. No. 210

KEIHIN AUTOMATIC VALVES



ACL

KS

KS-B·
TCLW

NSPW·
NFFW

FPC

RSP

NR

NR2-S

C1

FL-J1

TX2
TX350

MK II

P2·P3

ADF

PFC

WDO·C

マイレイン

フランジ
基準寸法

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KEIHIN

Automatic Valves

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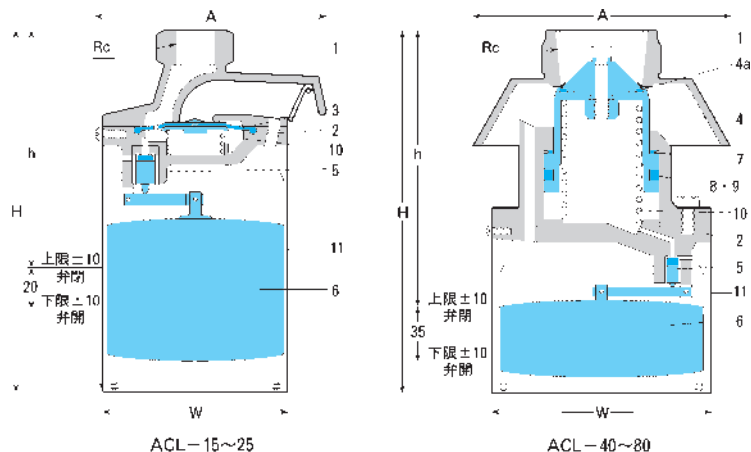
ACLシリーズ

水

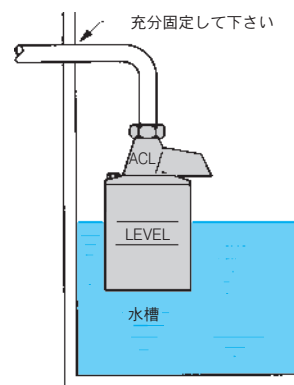
定水位弁 直接取付型

Level Control Valve Direct Installation Type

- 貯水槽、その他の液面を常に一定の水位に制御する場合に極めて好適です。
- 液面制御に比較的多く使われているボールタップの欠点を補い、電磁弁等の併用をしなくても大流量が得られます。
- Suitable for controlling water tank and other liquid level to a fixed water level consistently.
- This valve makes up for the fault of the ball tap which is used comparatively frequent for surface control and can provide high flow without solenoid valves.



標準取付例 Standard Installation



主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials			
		15〜25A		40〜80A	
		常温用 MAX60℃	高温用 MAX100℃	常温用 MAX60℃	高温用 MAX100℃
1	ボデー Valve Body	CAC406			
2	カバー Cover	CAC406+SUS304		CAC406+SUS304	
3	ダイヤフラムAss'y Diaphragm Ass'y	FKM+C2801+SUS304		—	
4	メインバルブAss'y Main Valve Ass'y	—		CAC406+C3604 ※1	
4a	メインシート Main Seat	—		PTFE	
5	フロートバルブ Float Valve	SUS304+NBR	SUS304+FKM	SUS304+NBR	SUS304+FKM
6	フロートAss'y Float Ass'y	SUS304			
7	Vリング V Ring	—		FKM	—
7	Kリング+リリーススプリング K Ring+Relieve Spring	—			PTFE+SUS304
8	プレーンリング Plane Ring	—		PTFE	
9	テンションリング Tension Ring	—		SUS304	
10	スプリング Spring	SUS304			
11	パイプ Pipe	C2700 ※2		SUS304	

※1 40~50Aの材質です。70~80AはCAC406です。

※2 SUS304へ順次切り換えを進めています。

※1 Material indicates for the size 40 and 50. For the size 70 and 80 is CAC406.

※2 We will push forward the change over of the material (from C2700 to SUS304) in sequence.

共通仕様 Common Specification

項目 Item	内容 Description	
流体 Fluid	水 Water	温水 Hot Water
流体温度 Fluid Temperature	MAX60℃	MAX100℃
レベル幅 Level Range	15~25A : 20mm、40~80A : 35mm	
レベル精度 Level Limit	±10mm	
オプション Option	レベル幅 : 150mm、 ボデー材質 : SUS304 (15~50A) Level Range : 150mm Body Materials : SUS304 (15~50A)	

製品の型式記号 Model Type

ACLWF-□□WK
 口径 W : 水 WK : 温水 WF : 船舶用
 接続 無記号 : ネジ込 F : フランジ (JIS5KFF / JIS10KFF)
 レベル幅 無記号 : 標準 W : 150mm
 シリーズ
 ACL : ボデー材質 CAC406
 SSACL : ボデー材質 SUS304

仕様 Valve Specification

型式 Model	接続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸法 [mm] Dimensions				質量 Weight [kg]
	口径 Size	形状 Type			A	H	h ※	W	
ACL-15	1/2	ネジ込 Rc	0.01~1	5.3	115	189	129	90	1.4
ACL-20	3/4			8.4	115	189	129	90	1.5
ACL-25	1			12	120	203	143	90	1.6
ACL-40	1 1/2		0.03~1	33	165	260	182	133	7
ACL-50	2			53	165	260	182	133	7
ACL-70	2 1/2			99	200	297	223	133	12.1
ACL-80	3			134	200	297	223	133	12.1
ACL-15	1/2	フランジ JIS5KFF JIS10KFF	JIS5KFF : 0.01~0.5 JIS10KFF : 0.01~1	5.3	115	189	129	90	2.3
ACL-20	3/4			8.4	115	189	129	90	2.4
ACL-25	1			12	120	203	143	90	3
ACL-40	1 1/2		JIS5KFF : 0.03~0.5 JIS10KFF : 0.03~1	33	165	266	188	133	9
ACL-50	2			53	165	266	188	133	9
ACL-70	2 1/2			99	200	297	223	133	16
ACL-80	3			134	200	297	223	133	16
ACL-15	1/2		JIS5KFF : 0.01~0.5 JIS10KFF : 0.01~1	5.3	115	189	129	90	2.3
ACL-20	3/4			8.4	115	189	129	90	2.4
ACL-25	1			12	120	203	143	90	3
ACL-40	1 1/2			33	165	266	188	133	9
ACL-50	2			53	165	266	188	133	9
ACL-70	2 1/2			99	200	297	223	133	16
ACL-80	3			134	200	297	223	133	16

※ 液面位置hは、流体圧力0.5MPaの場合の参考寸法です。流体圧力及び水槽の表面積によって、液面位置は多少上下します。

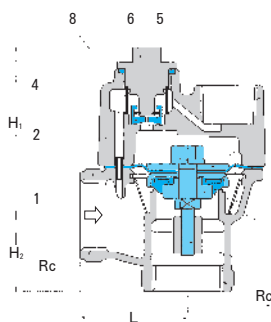
※ Highness h_l = Dimension at 0.5MPa Pressure. By fluid pressure and surface area of water tank, liquid level point goes up and down in some degrees.

受水槽用定水位弁 親弁

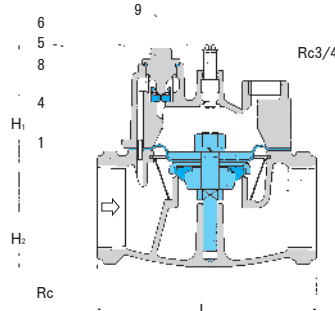
Level Control Valve



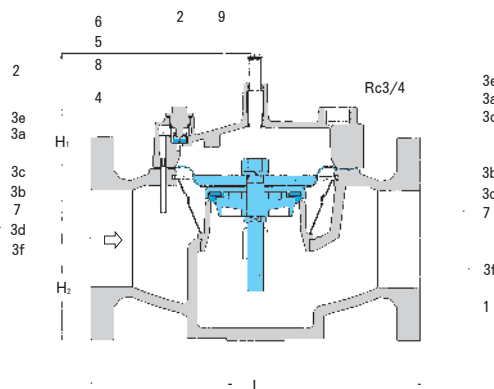
- 貯水槽、その他の液面を常に一定の水位に制御する場合に極めて好適です。
- ボールタップ等の子弁と併せてご使用いただきます。
- Suitable for controlling water tank and other liquid level to a fixed water level consistently.
- Use with the ball taps.



アングル形 Angle



ストレート形 Straight



フランジ形 Flange

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials		
		25~32A	40~50A	65~100A
1	ボデー Valve Body	CAC406		FC200
2	カバー Cover	CAC406		
	ダイヤフラムAssy Diaphragm Assy	組立品		
a	ダイヤフラム Diaphragm	EPR		
b	メインシート Main Seat	CR		
c	シートボデー Seat Body	C2600		
d	シートホルダー Seat Holder	C3771		CAC202
e	リテナープレート Retainer Plate	C3602		
f	ステム Stem	SUS303		
4	フローワッシャー Flow Washer	NBR		
5	バイパスボデーパッキン By-Pass Body Packing	NBR		
6	バイパスボデー By-Pass Body	C3771		
7	メインストレーナー Main Strainer	SUS304		
8	バイパスストレーナー By-Pass Strainer	SUS304		
9	スピンドル Spindle	—	SUS303	

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 Water
流体温度 Fluid Temperature	MAX50℃
使用圧力範囲 Pressure Range	0.03~0.75MPa

■ 製品の型式記号 Model Type

K S - □ □ L

シリーズ 口径 形状

無記号：ストレート形

L：アングル形

J：JIS10Kフランジ

■ 仕様 Valve Specification

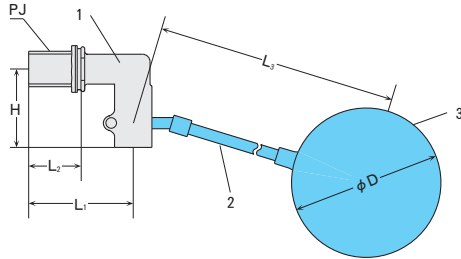
型 式 Model	接 続 Connection		弁形状 Valve Type	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type			L	H ₁	H ₂	
KS-25	1	ネジ込 Rc	ストレート Straight	8.5	95	78	25	1.4
KS-30	1 1/4			12.5	101	84	27	1.6
KS-40	1 1/2			17	135	92	35	3.2
KS-50	2			34	157	117	43	5.0
KS-25L	1	ネジ込 Rc	アングル Angle	8.5	50	78	35	1.3
KS-30L	1 1/4			12.5	53	84	37	1.5
KS-40L	1 1/2			17	71	92	45	3.0
KS-50L	2			34	81	117	60	4.5
KS-65J	2 1/2	フランジ JIS10KFF	ストレート Straight	55	270	146	75	18.5
KS-75J	3			68	290	153	78	19.0
KS-100J	4			110	340	191	103	24.5

受水槽用定水位弁 子弁

Level Control Valve

- 間接型定水位弁（親弁）と併用し子弁としてご使用いただいたり、単品で小タンクの液面制御をする場合に好適です。
- Suitable for using in conjunction with in direct level control valve, and also for water level control of small tank alone.

KS-Bシリーズ



仕様 Valve Specification

型 式 Model	接 続 Connection		寸 法 [mm] Dimensions					質 量 Weight [kg]
	口径 Size	形状 Type	L ₁	L ₂	L ₃	H	φ D	
KS-B20N	3/4	ネジ込 PJ	80	40	340	60	115	0.5

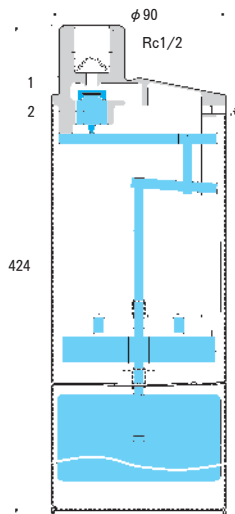
主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	CAC406
2	フロートロッド Float Rod	C3771
3	ボール Ball	Polyethylene

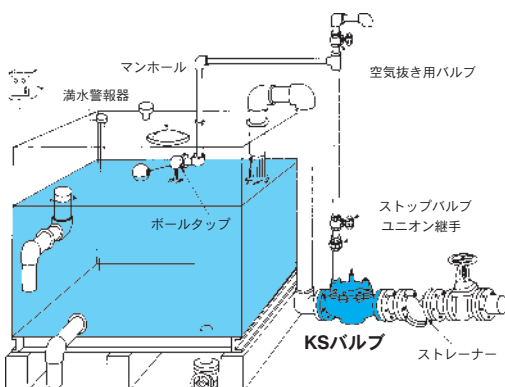
共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 Water
流体温度 Fluid Temperature	MAX50℃
使用圧力範囲 Pressure Range	0~0.75MPa

TCLWシリーズ



標準取付例 Standard Installation



型式 Model

TCLW-15W

主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	CAC406
2	フロートバルブ Float Valve	C3604+NBR
3	カップAss'y Cup Assy	SUS304
4	リングフロート Ring Float	NBR
5	フロートAss'y Float Assy	NBR+SUS304
6	パイプ Pipe	SUS304

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 Water
流体温度 Fluid Temperature	MAX50℃
使用圧力範囲 Pressure Range	0~1MPa
レベル幅 Level Renge	150mm
レベル精度 Level Limit	±10mm
質量 Weight	1.9kg

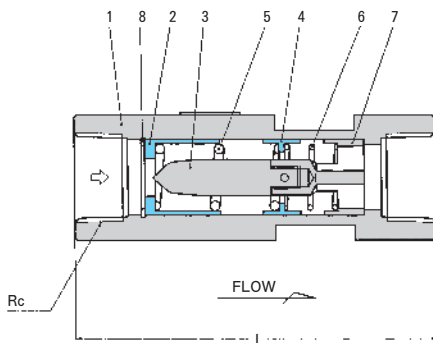
1. KSバルブを取付ける場合は、取付例図を参考にして下さい。
2. 取付けの前に、充分放水し管内にある配管時ゴミ、屑などを清掃した後に取付けて下さい。
3. 万一、バイパストレーナーのゴミ詰まりが生じた場合、水が止まらないことがありますので、必ず満水警報器を備えて下さい。
4. 子弁配管の接続には、ユニオン継手を必ず使用して下さい。また、子弁配管途中にストップバルブを付けて下さい。保守点検に便利です。
5. 子弁配管はできるだけ屈曲を少なくし、最高部には空気抜き用バルブを付けて下さい。
6. 配管は振動をおこさないよう確実に固定して下さい。
7. 子弁配管の接続には、ユニオン継手を必ず使用して下さい。また、子弁配管途中にストップバルブを付けて下さい。保守点検に便利です。
8. 子弁配管は20mm又は13mmサイズの錆にくい塩ビライニング鋼管や塩ビ管、銅管を使用して下さい。又子弁にポールタップを使用する場合は、マンホールの近くなど点検しやすい位置に取付けて下さい。
9. KSバルブの吐水側を立上げる場合、給水圧から立上げ高さを差引いた水圧が最低必要水圧0.03MPa以上確保できる範囲で立上げて下さい。（配管立上げ高さ1mで0.01MPaです）
10. バキュームブレーカーは、地方によって取付けを必要とする場合があります。



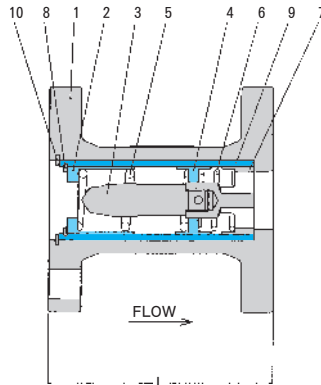
ニードル型定流量弁

Needle Type Constant Flow Control Valve

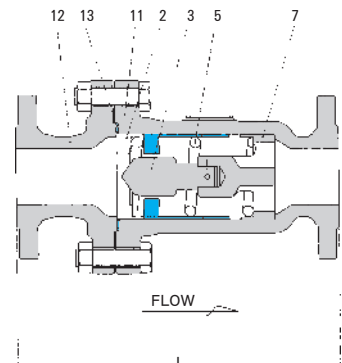
- 一次側の流体圧力の変動があっても二次側の流量を一定に保つバルブです。
- 長寿命で耐久性が高くメンテナンスフリーです。
- Despite the fluctuation of primary fluid pressure, this valve keeps constant flow of secondary side.
- Longer life and high durability, also it's maintenance free.



NSPWシリーズ



NFFWシリーズ



油用NFFW-Sシリーズ

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials			
			NSPW	NFFW	NFF	NFF-S
1	ボデー	Valve Body	CAC406	FC250		—
2	ピストン	Piston	SUS403			SCS2
3	ニードル	Needle	SUS403			
4	スプリングホルダー	Spring Holder	C3604	C3604 or SUS403 ※		—
5	スプリングA	Spring A	SUS304	SUS304 or SUP9 ※		
6	スプリングB	Spring B	SUS304			—
7	ニードルホルダー	Needle Holder	SUS403	S25C or FCD400 ※		FCD400
8	ストップリング	Stop Ring	SUS304			—
9	スリーブ	Sleeve	—	CAC406	—	
10	ストップリング	Stop Ring	—	SUS304	—	
11	ローボデー	Lower Body	—			FC250
12	アッパーボデー	Upeer Body	—			FC250
13	ボデーパッキン	Body Packing	—			NON-ASBESTOS

※ 口径により材質が異なります。

※ Materials are different by valve size.

■ 共通仕様 Common Specification

項目 Item	内容 Description
流体 Fluid	水 Water その他の液体 Other Liquid 油 Oil
流体温度 Fluid Temperature	MAX80℃
流量精度 Flow rate Accuracy	5~20L/min : ±15% 22~850L/min : ±10%
オプション Option	ボデー材質: SUS304, SCPH2 JIS10KFF以外のフランジ規格 900L/min以上及び100A以上の製品 Body Materials: SUS304, SCPH2 Except Flange Rating other JIS10KFF Over 850L/min flow rate and over 100A size

※ 接続口径100A以上及び流量設定 900L/min以上の製品につきましては、流量確認テストは出来ません。

※ About the products of the following condition, it's impossible to test the flow rate.

Size→over 100A

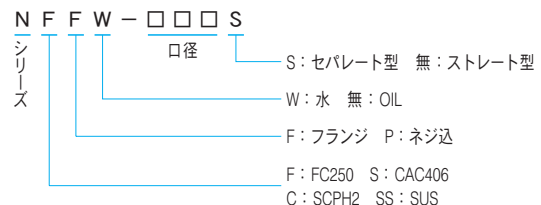
Flow rate→over 900L/min

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		制御圧力差 Control Pressure Difference [MPa]	寸法 [mm] Dimensions	質 量 Weight [kg]
	口径 Size	形状 Type		L	
NSPW-10	3/8	ネジ込 Rc	0.03~1 ※	85	0.4
NSPW-15	1/2			95	0.4
NSPW-20	3/4			110	0.7
NSPW-25	1			135	1.3
NFFW-32	1 1/4	フランジ JIS10KFF	0.03~1 ※	120	4.6
NFFW-40	1 1/2			140	5.4
NFFW-50	2			160	7
NFFW-65	2 1/2			190	11.3
NFFW-80	3	フランジ JIS10KFF	0.05~0.7 ※	220	16.1
NFF-50S	2			300	15
NFF-80S	3			350	30

※ 制御圧力差は、設定流量によって異なります。
流量表をご参照下さい。※ Control pressure difference depends on setting flow rate.
Please refer to flow chart.

■ 製品の型式記号 Model Type

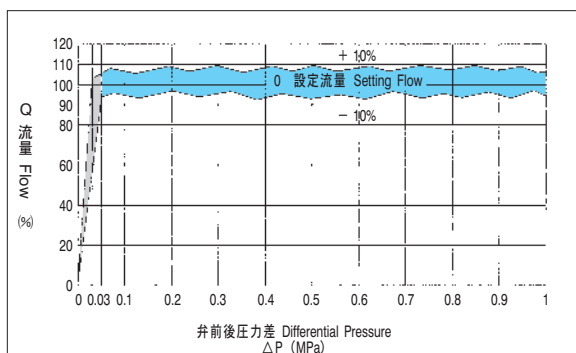


■ 注意事項 Precaution Statement

- 定流量弁の前後には、定流量弁と同じ口径の直管部を設けて下さい。
一次側: 口径×5 [mm] 以上、二次側: 口径×10 [mm] 以上
 - ご使用状況や配管方法、ポンプ特性により、振動や騒音が生じる場合があります。
 - 出荷検査は、水にて行います。
 - 弊社流量設定は水換算流量になります。
1. Set same size of straight run of pipe with constant flow valve in back and forth of it.
Primary side→over Size×5 [mm] Secondary side→over Size×10 [mm]
2. Vibrations and noise may occur by usage situation, piping configuration and pump characteristics.
3. Delivery inspection is done with water.
4. Flow setting is in water conversion.

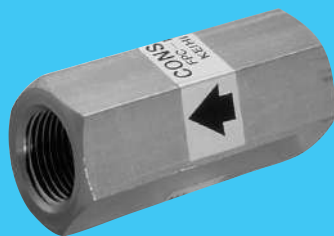
■ 流量表 Capacity for Water

標準流量 Standard Flow												オプション流量 Option Flow ※ 流量確認テストは出来ません。											
接続 Connection		ネジ込 Rc				フランジ Flange								接続 Connection		フランジ Flange							
流量 L/min	口径 Size	10	15	20	25	32	40	50	50S	65	80	80S	流量 L/min	口径 Size	80S	100	100S 125	150	150s 200	200S 250	250S 300		
5		○	○										200			○							
6		○	○										220			○							
7		○	○										250			○							
8		○	○										260			○							
9		○	○										280			○							
10		△	○	○									300			○							
11		△	○	○									330			○							
12		△	○	○									360			○							
14			△	○									400			○							
16			△	○	○								450			○							
18			△	○	○								500			○							
20			△	○	○								550			○		▲					
22				○	○								600			△							
25				○	○								650			△							
28				△	○								700			△	▲	▲					
30				△	○	○	○						750			△	▲	▲					
33				△	○	○	○						800			△	▲						
36				△	○	○	○						850			△	▲						
40					○	○	○						900	0.06~		△	▲	▲					
45					△	○	○						950	0.07~	0.06~	▲	▲						
50					△	○	○						1000	0.08~	0.07~	▲	▲	▲					
55					△	○	○						1050			0.07~	▲						
60						○	○						1100				▲	▲	▲				
65						○	○						1150	0.10~	0.08~		▲						
70						○	○						1200	0.10~	0.10~		▲	▲					
80						△	○						1250			0.12~							
90						△	○	○		○			1300	0.10~	0.12~		▲						
100							△	○		○			1350			0.12~							
110							△	○		○			1400				▲	▲	▲				
120							△	○		○			1500				▲	▲					
140							△	○		○			1600				0.06~	▲	▲				
150								○					1700				0.07~						
160								○		○			1800				0.08~	▲	▲				
170								△	▲				1900				0.08~						
180								△	▲	△	○		1950				0.08~						
190								△	▲				2000				0.10~	▲					
200								△	▲	○	○		2100				0.11~						
210									▲				2200				0.12~	▲	▲				
220								△	▲	○	○		2400					▲	▲				
230									▲				2500					0.08~	▲				
240									▲				2650					▲	▲				
250								0.06~	▲	△	○		2800					0.10~	▲				
260									▲				3000					0.10~	▲	▲			
270									▲				3300						▲	▲			
280									▲	△	○		3600						▲	▲			
300									▲	△	○		3800						▲	▲			
330										△	○		4000						▲	▲	▲		
340									▲				4500					0.07~	▲	▲			
360											○		5000							▲			
400									▲	0.1~	△	▲	5500							0.07~			
425											△		6000							0.07~	▲		
450									0.1~		△	▲	6500								▲		
500											△		7000								▲		
550											0.07~	▲	8000								▲		
600											0.08~	▲	8500								0.06~		
650											0.09~	▲	9000								0.07~		
700											0.10~	▲	10000								0.08~		
750											0.12~	▲											
800												▲											
850											0.15~	0.06~											
面間寸法 Face-to-Face Dimensions m/m		85	95	110	135	120	140	160	300	190	220	350	面間寸法 Face-to-Face Dimensions m/m		350	270	400 270	300	530 380	620 460	740 550		
表の見方 最小制御差圧 ○印 0.03MPa △▲印 0.05MPa How to understand the "chart" Min. controlled differential pressure : ○ mark : 0.03MPa △▲ mark : 0.05MPa 最大制御差圧 無色欄 1MPa 色刷欄 0.7MPa Max. controlled differential pressure. non coloured column : 1MPa coloured column : 0.7MPa 水以外の流体の場合は、比重換算表によって選定して下さい。 Except water, please refer to specific gravity conversion table.																							



- 水（密度：1g/cm³）の場合は上記表より選定して下さい。
- 油その他の特殊流体の場合は密度により補正されます。
- 粘度補正について
動粘度 $5 \times 10^{-5} \text{ m}^2/\text{s}$ （50cst）以下の粘度では、流体に対する粘度の影響はほとんどありません。粘度による変化は、流量と圧力（流速）により大幅に変わります。流量が少ない場合、圧力（流速）が低い場合、粘度の影響を受けやす高粘度で少流量の場合はご相談下さい。
- Select from the chart above in case of water (density : 1g/cm³). Oil and other special liquids require correction with density.
- Viscosity correction. In case of dynamic viscosity : less than $5 \times 10^{-5} \text{ m}^2/\text{s}$ (50cst), almost no influence of viscosity to fluid can be seen. Change by viscosity is well affected by fluid amount and pressure (flow speed). In case of small amount of flow and low pressure, fluid get influence of viscosity. So please consult with us in case of high viscosity and small amount of flow.

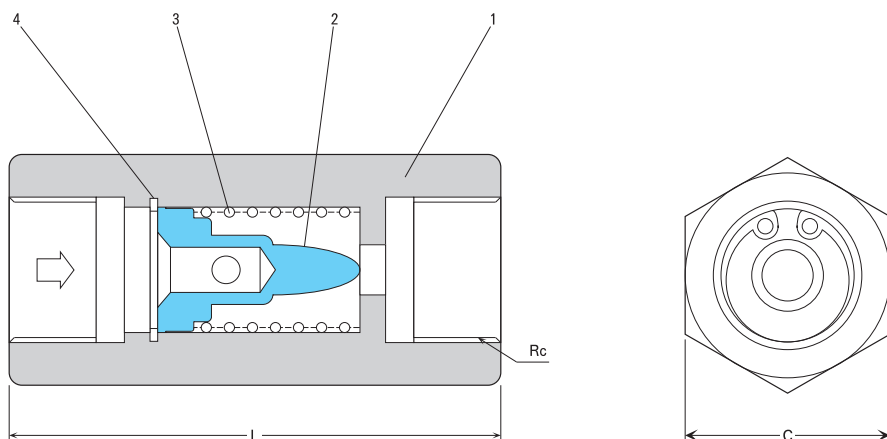
【例】油900 ℓ/min 比重：0.9 最終頁比重換算表より1.054を読み $900 \div 1.054 \approx 854 \text{ ℓ/min}$ となり上記表より近似値850 ℓ、口径80S、又は100を選択いたします。



ニードル型定流量弁

Needle Type Constant Flow Control Valve

- 一次側の圧力変動に関係なく二次側の流量を一定に保つバルブです。
- 少流量制御に最適です。
- Keep secondary flow rate constant regardless of primary pressure fluctuation.
- Suitable for control of small flow rate.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	SUS304
2	ニードル Needle	SUS304
3	スプリング Spring	SUS304
4	C-リング C-Ring	SUS304

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 Water
流体温度 Fluid Temperature	MAX100°C
流体精度 Flow rate Accuracy	±10%
オプション Option	その他液体 Other Liquid

■ 製品の型式記号 Model Type

F P C - N □ □ P - 0.7
シリーズ 口径 流量

■ 仕様 Valve Specification

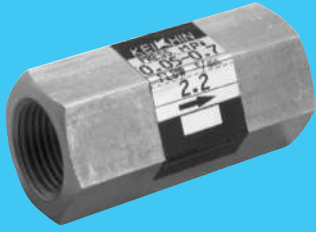
型 式 Model	接 続 Connection		制御圧力差 Control Pressure Difference [MPa]	最高使用圧力 MAX Pressure	寸 法 [mm] Dimensions		流 量 Flow [L/min]	質 量 Weight [kg]
	口径 Size	形状 Type			L	C		
FPC-N8P	1/4	ネジ込 Rc	0.05~0.7	1	50	19	0.7 1.0 1.5 2.0	0.2
FPC-N10P	3/8				55	23	1.5 2.0 2.5 3.0 4.0 5.0	0.2
FPC-N15P	1/2				65	26	4.0 5.0 7.0	0.3

■ 注意事項 Precaution Statement

- 定流量弁の前後には、定流量弁と同じ口径の直管部を設けて下さい。
一次側：口径×5 [mm] 以上、二次側：口径×10 [mm] 以上
- ご使用状況や配管方法、ポンプ特性により、振動や騒音が生じる場合があります。

1. Set same size of straight run of pipe with constant flow valve in back and forth of it.
Primary side→over Size×5 [mm] Secondary side→over Size×10 [mm]

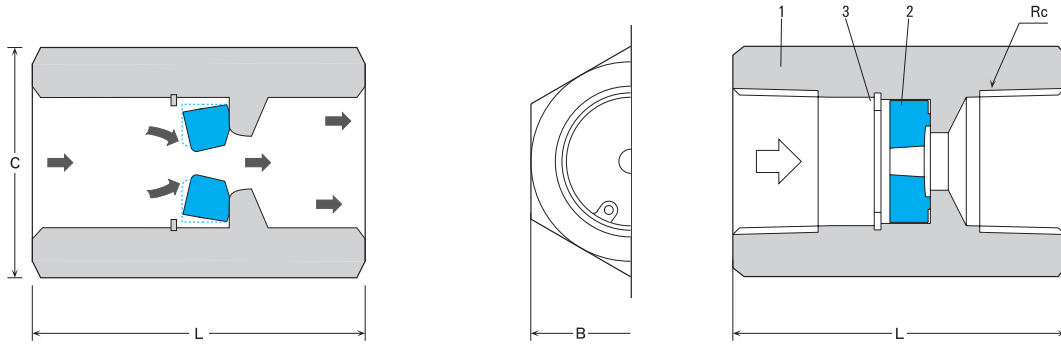
2. Vibrations and noise may occur by usage situation, piping configuration and pump characteristics.



ワッシャー式定流量弁

Constant Flow Control Valve

- ゴム（フローワッシャー）の弾性を利用して、一次側の圧力変動に関係なく二次側の流量を一定に保つバルブです。
- 軽量コンパクトで機器組み込み用に最適です。
- Keep secondary flow rate constant regardless of primary pressure fluctuation utilizing rubber elasticity (flow washer).
- Suitable for built-in use due to light weight and compact design.



主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	C3604
2	フローワッシャー ※ Flow Washer	NBR or NR
3	ストップリング Stop Ring	SUS304

※ 流量によって、材質が異なります。
※ Materials are different by flow quantity.

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 Water
流体温度 Fluid Temperature	MAX35°C
流体精度 Flow rate Accuracy	±20%
オプション Option	ボデー材質 : SUS304 Body Materials : SUS304

製品の型式記号 Model Type

R S P - □ □
| 口径

シリーズ

RSP : ボデー材質 C3604

RSSP : ボデー材質 SUS304

仕様 Valve Specification

型 式 Model	接 続 Connection		制御圧力差 Control Pressure Difference [MPa]	最高使用圧力 MAX Pressure	寸 法 [mm] Dimensions			流 量 Flow [L / min]								質 量 Weight [kg]
	口径 Size	形状 Type			L	B	C	0.6	0.8	1.2	1.5	1.8	2.2	2.5	2.6	
RSP-12	3/8	ネジ込	0.05~0.7	0.7	50	23	26.6	0.6	0.8	1.2	1.5	1.8	2.2	2.5	2.6	0.15
RSP-15	1/2	Rc			55	26	30	3.0	3.5	4.0	5.0	5.5	8.5	9.0		0.20

注意事項 Precaution Statement

- 定流量弁の前には、定流量弁と同じ口径の直管部を設けて下さい。
一次側：口径×5 [mm] 以上、二次側：口径×10 [mm] 以上
- ご使用状況や配管方法、ポンプ特性により、振動や騒音が生じる場合があります。

1. Set same size of straight run of pipe with constant flow valve in back and forth of it.
Primary side→over Size×5 [mm] Secondary side→over Size×10 [mm]

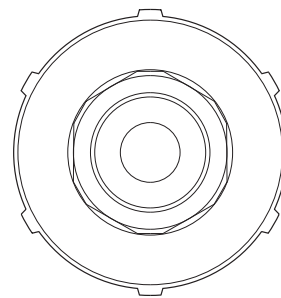
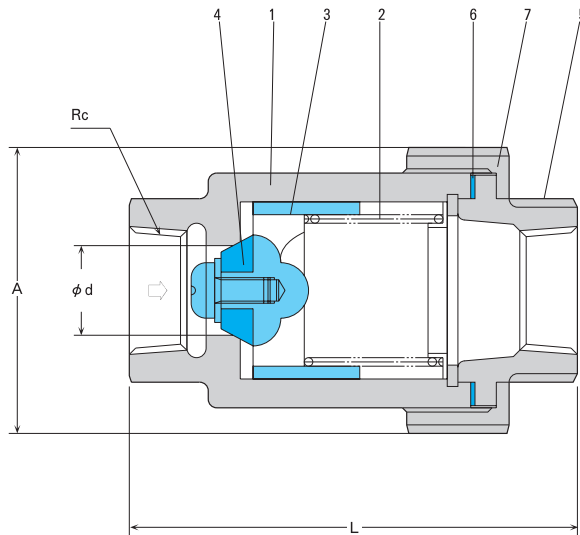
2. Vibrations and noise may occur by usage situation, piping configuration and pump characteristics.



インライン型逆止弁

Check Valve

- 様々な流体のライン制御に最適なインライン型コンパクト設計の逆止弁です。
- ユニオン構造のため、配管の歪みなどの修正が可能です。
- In-line check valve with compact design suitable for line control of various fluid.
- Since this model is union end type it's possible to fix pipe distortion.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデーA Valve Body A	CAC406
2	スプリング Spring	SUS304W
3	バルブ Valve	CAC406
4	バルブディスク Valve Disk	CR or PTFE
5	ボデーB Valve Body B	CAC406
6	ボデーパッキン Body Packing	PTFE
7	ユニオンナット Union Nut	CAC406

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス 蒸気 Water Oil Air Gas Steam
流体温度 Fluid Temperature	CR : 0~60℃、TEFLON : -15~200℃
使用圧力 Pressure Range	0~1MPa
取付姿勢 Installation	自由 Universal
オプション Option	開弁最小圧力 Cracking Pressure

※ 長期間動作しない状態にあった場合、開弁最小圧力が設定圧力よりも高くなる場合があります。

※ If the valve was not operated for a long time, cracking pressure may become higher than set pressure.

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		開弁最小圧力 [kPa] Cracking Pressure			Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形 状 Type	流れ方向 FLOW				φ d	L	A	
			↓	⇒	↑					
NR－15	1/2	ネジ込 Rc	1.0	3.55	6.0	4.5	14	70	48	0.35
NR－20	3/4		±	±	±	8.0	20	80	58	0.60
NR－25	1		50%	50%	50%	12.0	25	90	68	0.80

※ お引き合い、ご注文の際には、シート材質 (CR or PTFE) をご指定下さい。

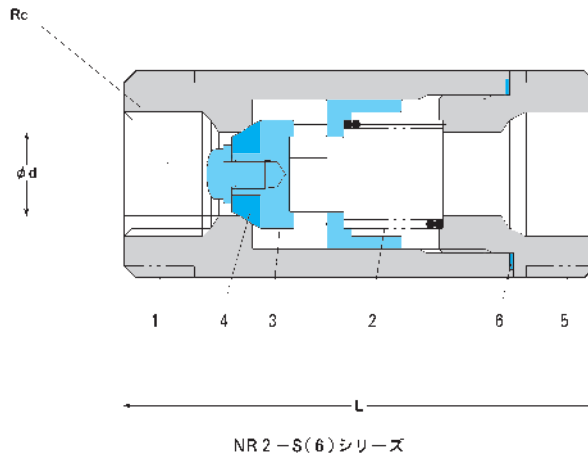
※ Please specify seat material (CR or PTFE) at time of inquiry and order.



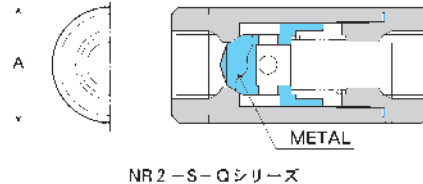
インライン型逆止弁

Check Valve

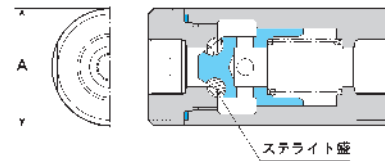
- 一般流体から特殊流体まで広範囲に使用出来るインライン型逆止弁です。
- 低圧・中圧・高圧のそれぞれの圧力仕様をラインナップしています。
- In-line check valve available for wide range fluid from ordinary to special.
- Provide each pressure specs from low pressure to high pressure.



NR2-S(6)シリーズ



NR2-S-Qシリーズ



NR-S-Uシリーズ

主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials		
1	ボデーA	Valve Body A	SUS304	
2	スプリング	Spring	SUS304W	
3	バルブ	Valve	SUS304	
4	バルブジスク	Valve Disk	CR or PTFE	SUS304 SUS304+Stellite
5	ボデーB	Valve Body B	SUS304	
6	ボデーパッキン	Body Packing	PTFE	FKM

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス 蒸気 Water Oil Air Gas Steam
流体温度 Fluid Temperature	CR: 0~60°C、TEFLON: -40~200°C
取付姿勢 Installation	自由 Universal
オプション Option	開弁最小圧力、ボデー材質: SUS316、SUS316L、 シート材質: FKM、 スプリング材質: SUS316、ハステロイ Cracking Pressure, Body Materials: SUS316、SUS316L、 Seat Materials: FKM, Spring Materials: SUS316, Hastelloy

製品の型式記号 Model Type

NR2-S6L-□□Q

シリーズ

ボデー材質

S : SUS304
S6 : SUS316
S6L : SUS316L

口径

圧力仕様

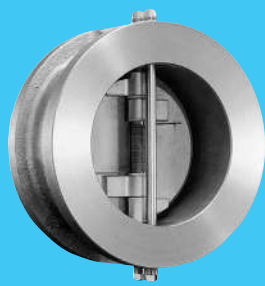
無記号: 2MPa以下
Q : 3MPa
U : 10MPa

仕様 Valve Specification

型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	開弁最小圧力 [kPa] Cracking Pressure			Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形 状 Type		流れ方向 FLOW				φ d	L	A	
				↓	⇄	↑					
NR2-S-8	1/4	ネジ込 Rc	CR : V~1 PTFE : V~2	1.0 ± 30%	3.2 ± 30%	5.3 ± 30%	0.7	8.5	60	25	0.18
NR2-S-10	3/8						2.0	12.5	70	30	0.30
NR2-S-15	1/2						3.5	14	80	35	0.45
NR2-S-20	3/4						6.5	20	90	40	0.55
NR2-S-25	1						11.0	25	100	50	0.90
NR2-S-8Q	1/4	ネジ込 Rc	0~3	1.0 ± 30%	3.2 ± 30%	5.3 ± 30%	0.7	8.5	60	25	0.18
NR2-S-10Q	3/8						2.0	12.5	70	30	0.30
NR2-S-15Q	1/2						3.5	14	80	35	0.45
NR2-S-20Q	3/4						6.5	20	90	40	0.55
NR2-S-25Q	1						11.0	25	100	50	0.90
NR-S-8U	1/4	ネジ込 Rc	0~10	6.6 ± 50%	7.0 ± 50%	7.4 ± 50%	0.7	8.5	90	42	0.75
NR-S-10U	3/8						2.0	12.5	90	42	0.75
NR-S-15U	1/2						3.5	14	90	42	0.75
NR-S-20U	3/4						6.5	20	120	60	1.97
NR-S-25U	1						11.0	25	150	70	3.25

※ お引き合い、ご注文の際には、シート材質 (CR or PTFE) をご指定下さい。

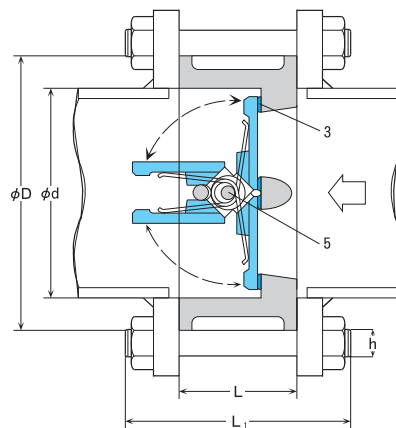
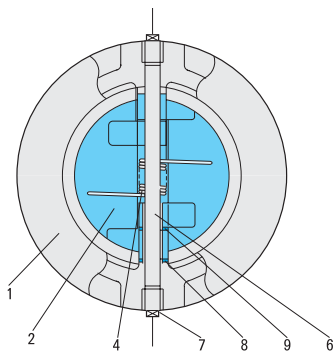
※ Please specify seat material (CR or PTFE) at time of inquiry and order.



スーパーチェック弁

Super Check Valve

- ウェハー型で軽量コンパクトな逆止弁です。メンテナンスも容易です。
- 様々な仕様に対応した製品選定が可能です。
- Wafer type check valve with lightweight and compact design. And maintenance is easy.
- Possible to select the product corresponding to various specifications.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		C1J1F/CA-NS	C1J3R/S3S3-OS
1	ボデー Valve Body	FC250	SCS13
2	弁体 Plate	CAC703	SCS13
3	シート Seat	NBR	SCS13
4	スプリング Spring	SUS316	SUS316
5	ヒンジピン Hinge Pin	SUS304	
6	ストップピン Stop Pin	SUS304	
7	プラグ Plug	S25C	SUS304
8	ボデーベアリング Body Bearing	PTFE	
9	プレートベアリング Plate Bearing	PTFE	

■ 共通仕様 Common Specification

項 目 Item	内 容 Description		
		C1J1F/CA-NS	C1J3R/S3S3-OS
流体 Fluid	水 油 空気 ガス 蒸気 Water Oil Air Gas Steam		
使用圧力範囲 Pressure Range	0~1MPa		
流体温度 Fluid Temperature	MAX80℃ MAX121℃		
取付姿勢 Installation	水平配管 or 垂直配管 Horizontal Piping or Vertical Piping		
適用フランジ Applied Flange	JIS10K		
オプション Option	その他材質、高圧仕様、高温仕様 JIS10K以外のフランジ規格 (ASME, JPI) 接続口径：1200Aまで製作可 Other Materials, High Pressure, High Temperature Except Flange Rating other JIS10K (ASME, JPI) Possible to make up to size 1200A		

■ 製品の型式記号 Model Type

□ □ A - C 1 J 1 F / C A - N S L

口径 シリーズ スプリングトルク 無：標準 M：ミニトルク L：ロートルク H：高トルク

圧力 スプリング材質 S：SUS316 X：インコネルX

J1・J3：JIS10K シート材質 N：NBR F：FPM O：メタルシート

フランジ面粗さ 弁体材質 A：CAC703 S3：SCS13 S4：SCS14

F：フラットフェース プレート材質 C：FC250 S3：SCS13 S4：SCS14

R：レーズドフェース

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		開閉圧力(水平) Cracking Pressure [kPa]	Cv値 Cv Value	寸 法 [mm] Dimensions						質 量 Weight [kg]		
	口径 Size	形 状 Type			φ D	L	φ d	スタッドボルトサイズ					
								h	L ₁	数量			
40 A－C1J1F/CA－NS	1 1/2	フランジ Flange JIS10K	1.483	46	86	54	60	M16		145	4	1.8	
50 A－C1J1F/CA－NS	2		0.980	72	101	54	60			145	4	2.0	
65 A－C1J1F/CA－NS	2 1/2		0.860	132	121	54	73			150	4	2.5	
80 A－C1J1F/CA－NS	3		1.201	180	131	57	89			155	8	3.0	
100 A－C1J1F/CA－NS	4		0.934	380	156	64	114			160	8	4.7	
125 A－C1J1F/CA－NS	5		0.695	635	187	70	141	M20		180	8	6.7	
150 A－C1J1F/CA－NS	6		1.311	864	217	76	168			200	8	8.0	
200 A－C1J1F/CA－NS	8		1.876	1,650	267	95	219			210	12	15.6	
250 A－C1J1F/CA－NS	10		1.546	3,017	330	108	273		M22		235	12	26.6
300 A－C1J1F/CA－NS	12		2.545	4,280	375	143	324				270	16	49.0



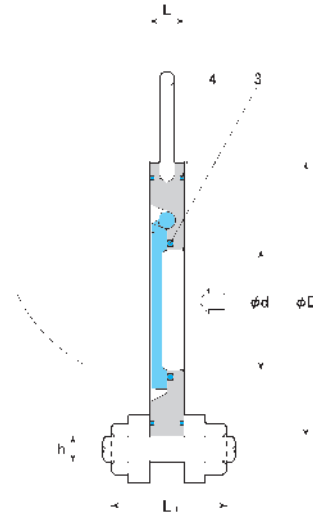
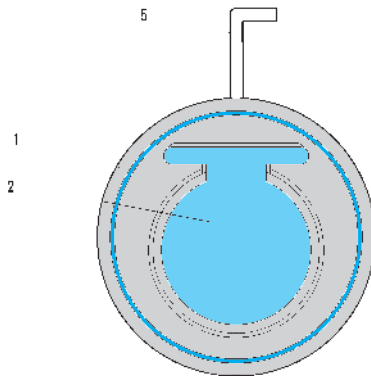
FL-J1 シリーズ

空気

スーパーライト逆止弁

Super-Lite Check Valve

- 低圧空気用ウェハー型スイングチャッキ弁です。
- 主にブローア装置にご使用いただけます。
- Wafer type swing check valve for low-pressure air.
- Usable for blowers.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		WS3-N	S3S3-F
1	ボデー Valve Body	S25C + MFCr	SCS13
2	弁体 Clapper	SCS13	
3	シール Clapper Seal	NBR	FPM
4	ガスケット Gasket	NBR	FPM
5	吊りボルト L-Bolt	SC400	

■ 共通仕様 Common Specification

項 目 Item	内 容 Description	
	WS3-N	S3S3-F
流体 Fluid	空気 Air	
使用圧力範囲 Pressure Range	0.1MPa未満 Less Than 0.1MPa	
流体温度 Fluid Temperature	MAX80°C	MAX150°C
取付姿勢 Installation	水平配管のみ Horizontal Piping	
適用フランジ Applied Flange	JIS10K	

■ 製品の型式記号 Model Type

□ □ A - F L - J 1 / W S 3 - N
 口径 シリーズ
 シート材質 N : NBR F : FPM
 弁体材質 S3 : SCS13
 ボデー材質 W : S25C S3 : SCS13

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		Cv値 Cv Value	寸 法 [mm] Dimensions						質 量 Weight [kg]
	口 径 Size	形 状 Type		φ D	L	φ d	スタッドボルトサイズ			
							h	L ₁	数量	
50A－FL－J1/WS3－N	2	フランジ Flange JIS10K	42	104	19	27	M16	110	4	1.2
65A－FL－J1/WS3－N	2 1/2		73	124	19	38			4	1.6
80A－FL－J1/WS3－N	3		107	134	19	48		120	8	1.8
100A－FL－J1/WS3－N	4		329	159	19	69			8	2.5
125A－FL－J1/WS3－N	5		646	190	21	90	M20	130	8	3.7
150A－FL－J1/WS3－N	6		747	220	24	110			8	5.5
200A－FL－J1/WS3－N	8		1338	270	29	140		140	12	11.0

■ 配管上の注意 Piping Instruction

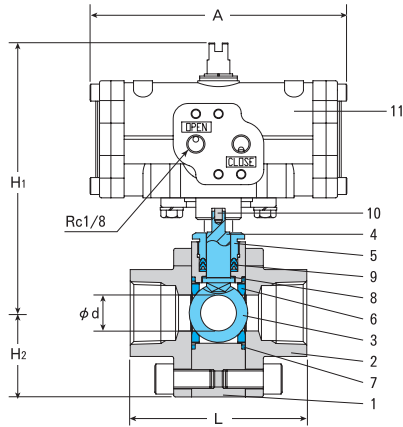
- 必ず水平配管で使用して下さい。吊りボルトは垂直上向きの状態にして下さい。
- 出口側配管フランジは、JIS10K溶接フランジを使用して下さい。
- Horizontal Installation of piping is essential to use. "L-Bolt" must be installed in vertical position.
- Flange at outlet piping should be used in JIS10K welded flange.

複動型空気圧操作式ボール弁

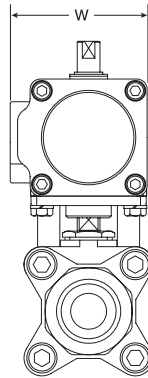
Air Operating Ball Valve —Double Acting—



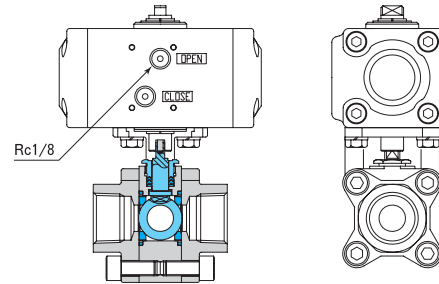
- 耐久性の高いSCS14ボデーを採用した中・高圧仕様の空気圧操作弁です。
- 洗浄装置、食品機械、半導体関連装置、工場設備等のご使用に最適です。
- Air operating ball valve for medium and high pressure which adopt the material SCS14 body of high durability.
- Suitable for washing apparatus, food machinery, semiconductor device and plant facilities, etc.



TX2-DAシリーズ



TX350-MDAシリーズ



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	SCS14
2	エンドアダプター End Adapter	SCS14
3	ボール Ball	SUS316
4	ステム Stem	SUS316
5	グランド Gland	SUS303
6	ボールシート Ball Seat	PTFE
7	ボディシール Body Seal	PTFE
8	スラストワッシャー Thrust Washer	PTFE
9	Vリングセット V-Ring Set	PTFE
10	センターピン Pin	SUS
11	アクチュエーター Actuator	組立品

■ 共通仕様 Common Specification

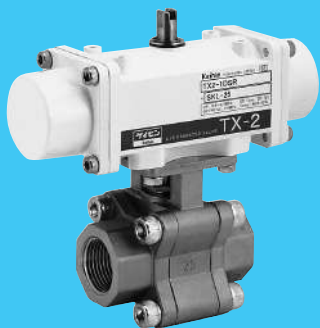
項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	−15〜80℃
操作圧力 Operating Pressure	0.4〜0.7MPa
取付姿勢 Installation	自由 Universal
周囲温度 Ambient Temp	0〜50℃
オプション Option	電磁弁 (AC100V, AC200V, DC24V) スピードコントローラー、リミットスイッチ 高温仕様 Solenoid Valve (AC100V, AC200V, DC24V) Speed Controller, Limit Switch, High Temperature

■ 製品の型式記号 Model Type

TX2-1DA-NO-VN-SV01-A100-2LS01-2SP05+SKL-□□	シリーズ	複動	電源 A100: AC100V A200: AC200V D024: DC24V	ボデー型式	口径
動作	無記号: 通電時開型 (N.C) NO: 通電時閉型 (N.O) (電磁弁付のときのみ)	オプション1 電磁弁 SV01: リード線タイプ SV02: DIN端子箱付	オプション2 リミットスイッチ 2LS01: 開閉2個付 OLS01: 開側1個付 CLS01: 閉側1個付	オプション3 スピードコントローラー 2SP05: 開閉2個付 OSP05: 開側1個付 CSP05: 閉側1個付	
温度	無記号: 標準仕様 −15〜80℃ VN: 高温仕様 0〜120℃				

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸 法 [mm] Dimensions						エア供給口 Air Inlet	質 量 Weight [kg]
	口径 Size	形状 Type			φd	L	H ₁	H ₂	A	W		
TX350-MDA+SKL-8	1/4	ネジ込 Rc	0~1.0	4.8	11	65	104.5	21.7	107	58	Rc 1/8	1.4
TX350-MDA+SKL-10	3/8			6.0	11	65	104.5	21.7	107	58		1.4
TX350-MDA+SKL-15	1/2			8.0	11	65	104.5	21.7	107	58		1.4
TX350-MDA+SKL-20	3/4			12.0	14	71	112.5	26.3	107	58		1.7
TX2-1DA+SKL-8	1/4			4.8	11	65	121.3	21.7	136	72.5		1.7
TX2-1DA+SKL-10	3/8	ネジ込 Rc	0~3.0	6.0	11	65	121.3	21.7	136	72.5	Rc 1/8	1.7
TX2-1DA+SKL-15	1/2			8.0	11	65	121.3	21.7	136	72.5		1.7
TX2-1DA+SKL-20	3/4			12.0	14	71	129	26.5	136	72.5		2.0
TX2-1DA+SKL-25	1			29.0	19	93.5	143	34.5	136	72.5		2.8
TX2-2DA+SKL-32	1 1/4			50.0	29	107	186	41	182	95.5		5.7
TX2-2DA+SKL-40	1 1/2		0~2.5	60.0	29	116	186	41	182	95.5		5.7
TX2-2DA+SKL-50	2			110.0	38	126	200	50.5	182	95.5		7.7



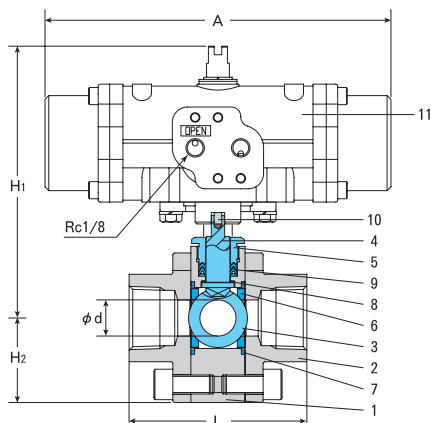
TX2・TX350 シリーズ (単動)

水・油・空気

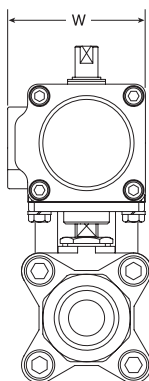
スプリングリターン型空気圧操作式ボール弁

Air Operating Ball Valve —Spring Return—

- 耐久性の高いSCS14ボデーを採用した中・高圧仕様の空気圧操作弁です。
- 洗浄装置、食品機械、半導体関連装置、工場設備等のご使用に最適です。
- Air operating ball valve for medium and high pressure which adopt the material SCS14 body of high durability.
- Suitable for washing apparatus, food machinery, semiconductor device and plant facilities, etc.



TX2-SRシリーズ



TX350-MSRシリーズ

主要部品表 Main Parts List

No.	名称 Name of Parts	材質 Materials
1	ボデー Valve Body	SCS14
2	エンドアダプター End Adapter	SCS14
3	ボール Ball	SUS316
4	ステム Stem	SUS316
5	グランド Gland	SUS303
6	ボールシート Ball Seat	PTFE
7	ボディシール Body Seal	PTFE
8	スラストワッシャー Thrust Washer	PTFE
9	Vリングセット V-Ring Set	PTFE
10	センターピン Pin	SUS
11	アクチュエーター Actuator	組立品

共通仕様 Common Specification

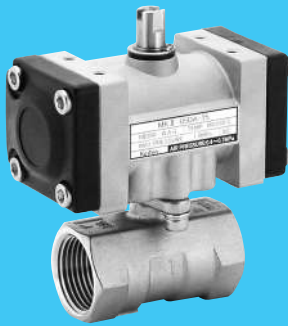
項目 Item	内容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	−15~80℃
操作圧力 Operating Pressure	0.4~0.7MPa
取付姿勢 Installation	自由 Universal
周囲温度 Ambient Temp	0~50℃
オプション Option	電磁弁 (AC100V, AC200V, DC24V) スピードコントローラー、リミットスイッチ 高温仕様 Solenoid Valve (AC100V, AC200V, DC24V) Speed Controller, Limit Switch, High Temperature

製品の型式記号 Model Type

TX2-1	DSR	NO	VN	SV01	A100	2LS01	2SP05	SKL	□□
シリーズ	単動			電源	ボデー型式	口径			
アクチュエーターサイズ				オプション1 電磁弁 SV01: リード線タイプ SV02: DIN端子箱付	オプション2 リミットスイッチ 2LS01: 開閉2個付 OLS01: 開側1個付 CLS01: 閉側1個付	オプション3 スピードコントローラー 2SP05: 開閉2個付 OSP05: 開側1個付 CSP05: 閉側1個付			
動作									
無記号: AIR IN OPEN or 通電時開型 (N.C.) NO: AIR IN CLOSE or 通電時閉型 (N.O.)									
温度									
無記号: 標準仕様 −15~80℃ VN: 高温仕様 0~120℃									

仕様 Valve Specification

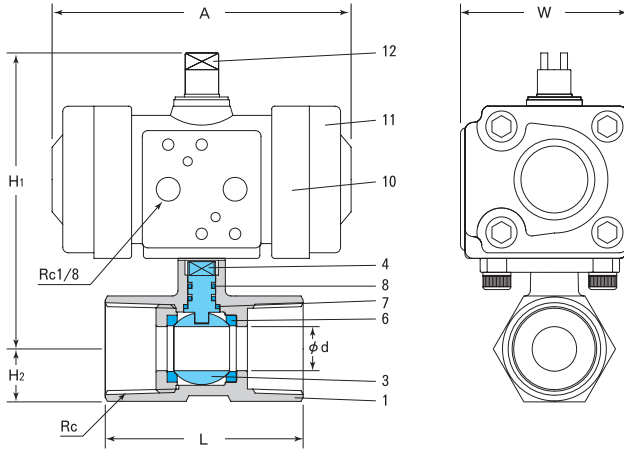
型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸 法 [mm] Dimensions						エア供給口 Air Inlet	質 量 Weight [kg]
	口径 Size	形状 Type			φd	L	H ₁	H ₂	A	W		
TX350-MSR+SKL-8	1/4	ネジ込 Rc	0~1.0	4.8	11	65	104.5	21.7	107	58	Rc 1/8	1.4
TX350-MSR+SKL-10	3/8			6.0	11	65	104.5	21.7	107	58		1.4
TX350-MSR+SKL-15	1/2			8.0	11	65	104.5	21.7	107	58		1.4
TX350-MSR+SKL-20	3/4			12.0	14	71	112.5	26.3	107	58		1.7
TX2-1DSR+SKL-8	1/4	ネジ込 Rc	0~2.0	4.8	11	65	121.3	21.7	182	72.5	Rc 1/8	2.0
TX2-1DSR+SKL-10	3/8			6.0	11	65	121.3	21.7	182	72.5		2.0
TX2-1DSR+SKL-15	1/2			8.0	11	65	121.3	21.7	182	72.5		2.0
TX2-1DSR+SKL-20	3/4			12.0	14	71	129	26.5	182	72.5		2.3
TX2-1DSR+SKL-25	1		0~2.0	29.0	19	93.5	143	34.5	182	72.5		3.1
TX2-2DSR+SKL-32	1 1/4			50.0	29	107	175.5	41	226	95.5		6.4
TX2-2DSR+SKL-40	1 1/2			60.0	29	116	175.5	41	226	95.5		6.4
TX2-2DSR+SKL-50	2			110.0	38	126	189.5	50.5	226	95.5		8.4



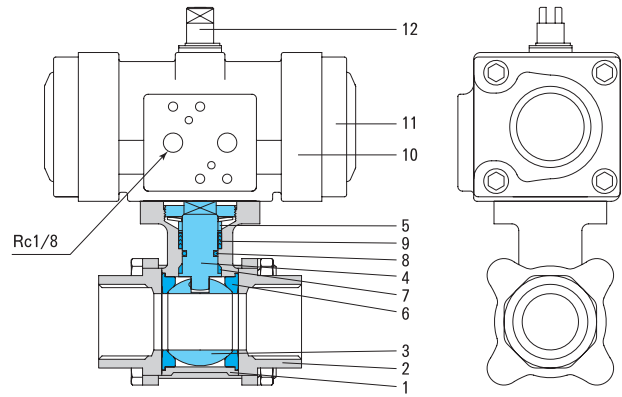
空気圧操作式ボール弁

Air Operating Ball Valve —Double Acting—

- 軽量コンパクト設計のローコスト空気圧操作弁です。
- 耐蝕性の高いSCS14ボデーを採用し、装置組込に最適です。
- Low cost valve with light-weight and compact design.
- Adopt SCS14 body which is high corrosion resistance and it's suitable for built-in use.



MK II シリーズ



MK II-FB シリーズ

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		MK II	MK II-FB
1	ボデー	SCS14A	
2	エンドアダプター	—	
3	ボール ※	SUS316 or SCS14A	
4	ステム	SUS316	
5	グラッド	—	SUS304
6	ボールシート	PTFE	
7	スラストワッシャー	PTFE	
8	Oリング	FKM	
9	パッキン	—	PTFE
10	アクチュエーター	ADC12	
11	カバー	Nylon 30%GF	ADC12
12	スピンドル	S45C	

※ 口径によって材質が異なります。

※ Materials are different by size.

■ 製品の型式記号 Model Type

MK II - 0 5 DA - □ □ FB - S V - A 1 0 0

シリーズ

口径

オプション

電源

アクチュエーターサイズ

ボア径

無記号：レデュースドボア

FB：フルボア

A100：AC100V

A200：AC200V

D024：DC24V

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体	水 油 空気 Water Oil Air
流体温度	0~80℃
使用圧力範囲	0~1MPa
操作圧力	0.4~0.7MPa
取付姿勢	自由 Universal
周囲温度	0~50℃
オプション	電磁弁 (AC100V, AC200V, DC24V) Solenoid Valve (AC100V, AC200V, DC24V)

■ 仕様 Valve Specification

動 作 Acting	型 式 Model	接 続 Connection		Cv値 Cv Value	寸 法 [mm] Dimensions						エア供給口 Air Inlet	質 量 Weight [kg]
		口径 Size	形状 Type		φd	H ₁	H ₂	L	A	W		
複 動 Double Acting	MK II-02DA-8	1/4	ネジ込 Rc	1.5	5	91	8.5	39	86	55	Rc 1/8	0.7
	MK II-02DA-10	3/8		2.2	7	92	9.5	44	86	55		0.7
	MK II-02DA-15	1/2		4.7	9.2	91	12.5	57	86	55		0.8
	MK II-03DA-20	3/4		10.0	12.5	93	16.0	59	99	55		0.9
	MK II-05DA-25	1		12.3	15	107	19.0	71	108	60		1.1
	MK II-10DA-32	1 1/4		20.4	20	122	24.5	78	138	72		2.1
	MK II-10DA-40	1 1/2		30.0	25	128	27	83	138	72		2.3
	MK II-10DA-50	2		64.8	32	133	32	100	138	72		2.6
	MK II-05DA-8FB	1/4		4.8	11.5	111	23	63.5	108	60		1.3
	MK II-05DA-10FB	3/8		8	12.5	111	23	63.5	108	60		1.3
複 動 Double Acting	MK II-05DA-15FB	1/2	ネジ込 Rc	18	15	111	23	75	108	60	Rc 1/8	1.2
	MK II-10DA-20FB	3/4		27	20	130	26	80	138	72		2.0
	MK II-10DA-25FB	1		43	25	140	29	90	138	72		2.4
	MK II-20DA-32FB	1 1/4		80	32	159	34	110	187	90		4.3
	MK II-20DA-40FB	1 1/2		130	38	166	38	120	187	90		5.1
	MK II-20DA-50FB	2		220	50	175	47	140	187	90		6.4



P2・P3 シリーズ

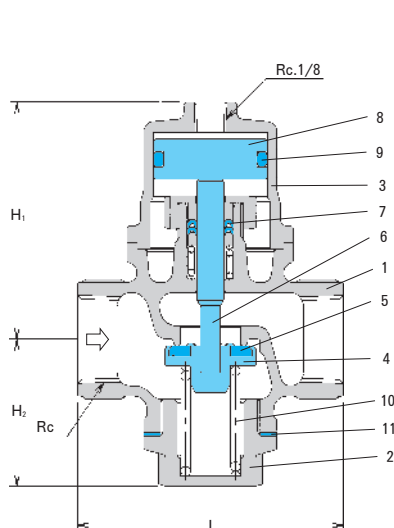
水・油・空気

蒸気

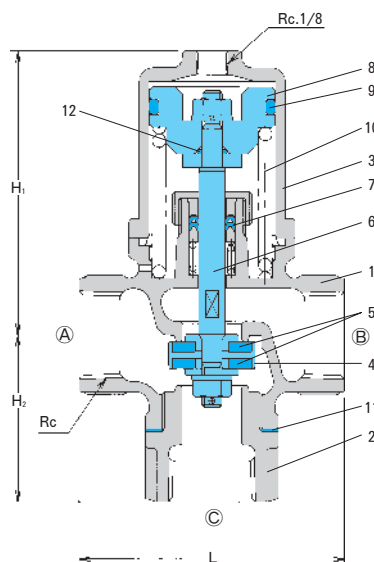
小型汎用空気圧操作式ピストン弁

Small Air Operating Piston Valve

- コンパクトで高耐久な空気圧操作弁です。
- Air operating piston valve which is compact design and high durability.



P3シリーズ



P3-Tシリーズ

主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials		
			P2	P3-15,20	P3-25T,40T
1	ボデー	Valve Body	CAC406		
2	ボトムカバー	Bottom Cover	CAC406	—	
	ボトムシート	Bottom Seat	—	CAC406	
3	シリンダー	Cylinder	CAC406		
4	バルブ	Valve	C3604B	SUS304	C3604B
5	バルブジスク	Valve Disk	PTFE		FPM
6	ステム	Stem	SUS304		
7	ステムパッキン	Stem Packing	PTFE		FPM
8	ピストン	Piston	C3604B		
9	ピストンパッキン	Piston Packing	FPM		NBR
10	スプリング	Spring	SUS304		SWP A
11	ボデーパッキン	Body Packing	NON・ASBESTOS		PTFE
12	Oリング	O-Ring	—		NBR
13	Oリング	O-Ring	—		FPM
14	Oリング	O-Ring	—		FPM

共通仕様 Common Specification

項 目 Item	内 容 Description		
	P2	P3-15,20	P3-25T,40T
流体 Fluid	蒸気 水 Steam Water	油 空気 Oil Air	水 油 空気 Water Oil Air
流体温度 Fluid Temperature	MAX180℃		MAX80℃
操作圧力 Operating Pressure	0.4~0.6MPa	0.5~0.7MPa	0.5~0.6MPa
取付姿勢 Installation	原則として正立		
作動 Action	Air In Open	Air In	Air In
		①→②	②→①
		Air Out	Air Out
		①→③	②→③

製品の型式記号 Model Type

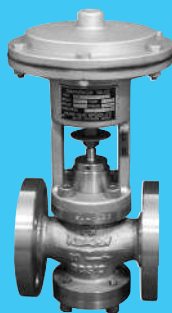
P 2 - □ □
シリーズ □ 口径
P2 : 2方弁
P3 : 3方弁

仕様 Valve Specification

構 造 Const- ruction	型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
		口径 Size	形状 Type			L	H ₁	H ₂	
二 方 弁 2-way	P2-15	1/2	ネジ込 Rc	0~0.7	4.5	70	68	42	1.0
	P2-20	3/4			5.6	80	71	44	1.1
	P2-25	1			7.4	90	80	52	1.7
三 方 弁 3-way	P3-15	1/2		0~0.7	4.1	70	82	45	1.2
	P3-20	3/4			5.1	80	85	50	1.3
	P3-25T	1			12.0	90	75	40	2.0
	P3-40T	1 1/2		0~0.3	28.0	120	90	50	3.5

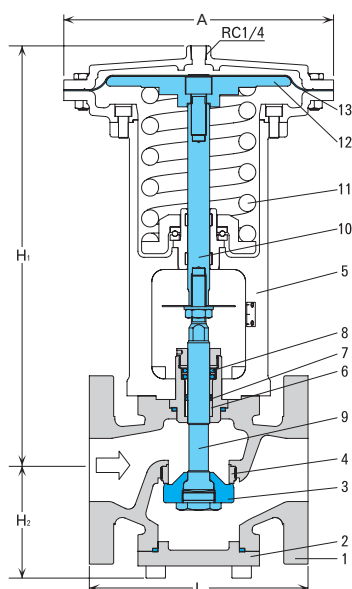
ダイヤフラム式空気圧操作弁

Air Operating Valve

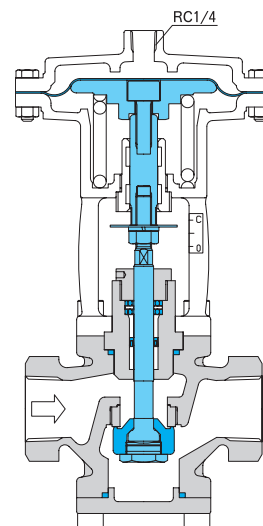


●計装・機械設備用に最適です。

●Suitable for measuring device and mechanical equipment.



フランジ ADF2シリーズ



ネジ込 ADP2シリーズ

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials		
		15～20A	25A	32～80A
1	ボデー Valve Body	FCD400	FC200	
2	ボトムカバー Bottom Cover	FCD400	FC200	
3	バルブ Main Valve	SUS420J2		
4	バルブシート Valve Seat	SUS420J2		
5	ヨーク Yoke	FC200		
6	スリーブ Sleeve	PTFE		
7	メカニカルシール Mechanical Seal	PTFE/SUS		
8	ロッドシール Rod Seal	PTFE/FKM		
9	ステム Stem	SUS304		
10	スピンドル Spindle	SUS304		
11	スプリング Spring	SWP	SUP	
12	ダイヤフラムプレート Diaphragm Plate	FC200		
13	ダイヤフラム Diaphragm	NBR	CR	

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	蒸気 水 油 Steam Water Oil
流体温度 Fluid Temperature	MAX200℃
操作圧力 Operating Pressure	0.3~0.5MPa
取付姿勢 Installation	原則として正立
作動 Action	Air In Open

■ 仕様 Valve Specification

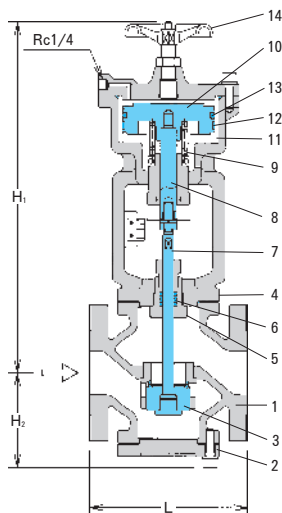
型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸 法 [mm] Dimensions				質 量 Weight [kg]
	口 径 Size	形 状 Type			L	H ₁	H ₂	A	
ADP2-15R	1/2	ネジ込 Rc	0~1	4.0	90	195	60	130	4.2
ADP2-20R	3/4			6.0	100	195	60	130	4.2
ADP2-25R	1			9.0	120	195	65	130	4.6
ADF2-15R	1/2	フランジ JIS10KFF	0~1	4.0	110	195	60	130	5.4
ADF2-20R	3/4			6.0	115	195	60	130	5.6
ADF2-25R	1			9.0	130	195	65	130	7.5
ADF2-32R	1 1/4			18.0	150	270	75	222	15.7
ADF2-40R	1 1/2			22.0	150	270	75	222	16.4
ADF2-50R	2			35.0	180	350	90	222	25.9
ADF2-65R	2 1/2			67.0	250	500	120	260	51.4
ADF2-80R	3		0~0.8	80.0	260	500	120	260	56.5



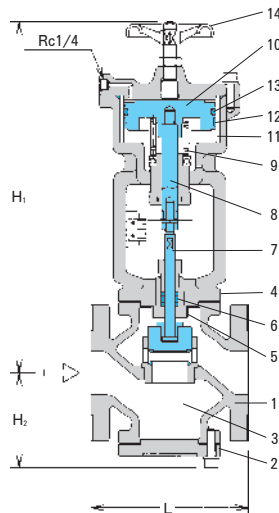
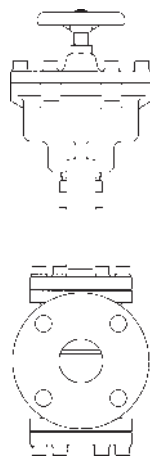
ピストン式空気圧操作弁

Piston Type Air Operating Valve

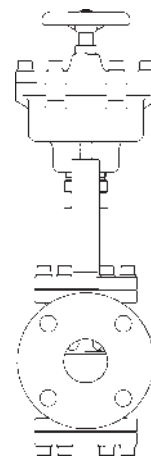
- 手動開閉ハンドルを標準装備した高温・高圧用空気圧操作弁です。
- Pneumatic valve for high temperature and pressure which include manual switching handle as standard equipment.



PFC-2SHKシリーズ
(AIR IN OPEN)



PFC-2SHCKシリーズ
(AIR IN CLOSE)



主要部品表 Main Parts List

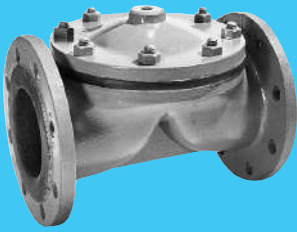
No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	FCD400
2	ボトムカバー Bottom Cover	FCD400
3	弁体 Main Valve	SUS304 + Stellite
4	ヨーク Yoke	FC200
5	パッキンボックス Packing Box	C3604B
6	パッキン Packing	T / # 2950
7	弁棒 Stem	SUS304
8	スピンドル Spindle	SUS303
9	スプリング Spring	SUP
10	ピストン Piston	SS400 + Znメッキ
11	シリンダ Cylinder	SUS304
12	スライドラング Slide Ring	PTFE
13	Oリング O-Ring	NBR
14	ハンドル Handle	ADC12

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	蒸気 水 油 Steam Water Oil
流体温度 Fluid Temperature	MAX220°C
操作圧力 Operating Pressure	0.5~0.9MPa
取付姿勢 Installation	原則として正立
標準機能 Standard Feature	手動開閉 Manual Operation
オプション Option	リミットスイッチ、電磁弁、スピードコントローラー、フィルターレギュレーター Limit Switch, Solenoid Valve, Speed Controller Filter Regulator

仕様 Valve Specification

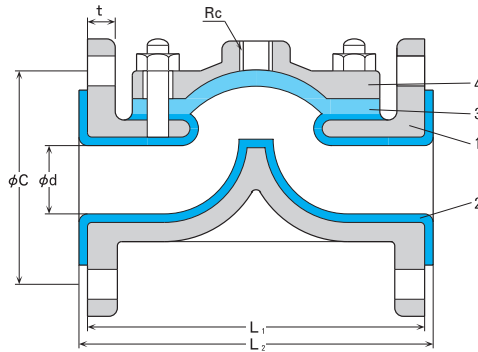
作 動 Model	型 式 Model	接 続 Connection		使用圧力範囲 Pressure Range [MPa]	Cv値 Cv Value	寸 法 [mm] Dimensions				質 量 Weight [kg]
		口径 Size	形状 Type			L	H ₁	H ₂	K	
AIR IN OPEN	PFC-2SHK-20	3/4	フランジ JIS20KRF	0~2	7.0	170	375	95	160	19.0
	PFC-2SHK-25	1			11.0	170	375	95	160	20.0
	PFC-2SHK-32	1 1/4			16.0	180	395	105	160	21.0
	PFC-2SHK-40	1 1/2			24.0	180	395	105	160	22.0
	PFC-2SHK-50	2			40.0	210	400	110	160	24.0
	PFC-2SHK-65	2 1/2			70.0	240	429	133	185	37.0
AIR IN CLOSE	PFC-2SHCK-20	3/4	フランジ JIS20KRF	0~2	7.0	170	375	95	160	19.0
	PFC-2SHCK-25	1			11.0	170	375	95	160	20.0
	PFC-2SHCK-32	1 1/4			16.0	180	395	105	160	21.0
	PFC-2SHCK-40	1 1/2			24.0	180	395	105	160	22.0
	PFC-2SHCK-50	2			40.0	210	400	110	160	24.0
	PFC-2SHCK-65	2 1/2			70.0	240	429	133	185	37.0



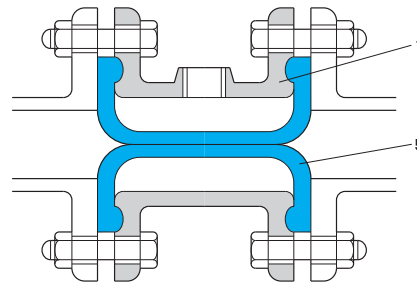
ダイアフラム・ピンチ型空気圧操作弁

Air Operating Valve

- スラリー、ソリューション、腐蝕性流体に最適です。
- Suitable for corrosive fluid, solution and slurry.



ダイアフラム型 Diaphragm Valve
(WDOシリーズ)



ピンチ型 Pinch Valve
(Cシリーズ)

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		WDO	C
1	ボデー Valve Body	FC200	
2	ゴムライニング Rubber Lining	CR or NR	—
3	ダイヤフラム Diaphragm	CR or NR	—
4	カバー Cover	FC200	—
5	スリーブ Sleeve	—	CR or NR

■ 共通仕様 Common Specification

項 目 Item		内 容 Description	
		WDO	C
流体	Fluid	スラリー ソリューション Slurry Solution	腐食性流体 Corrosive Fluid
使用圧力範囲	Pressure Range	0~0.5MPa	0~0.3MPa
操作圧力	Operationg Pressure	流体圧力+0.1MPa Fluid Pressure+0.1MPa	
流体温度	Fluid Temperature	MAX90℃	MAX65℃
取付姿勢	Installation	自由 Universal ※	

※ Cシリーズを液体でご使用いただく場合、
縦配管では流体圧力+液体自重が加わるため、
ゴムスリーブの耐久性が極端に落ちる場合があります。

※ When you use the model C type for liquid, durability of elastic sleeve may extremely drops because fluid pressure and its own weight add in vertical piping.

■仕様 Valve Specification

型 式 Model	接 続 Connection		寸 法 (m/m) Dimensions					エアー供給口 Air Inlet	質 量 Weight kg
	口径 Size	形状 Type	φ d	L ₁	L ₂	φ C	t		
WDO-1	1	フランジ Flange JIS 10K 相当	25	125	131	90	10	Rc 1/4	4.5
WDO-1 1/2	1 1/2		40	194	200	105	12	Rc 3/8	6.6
WDO-2	2		50	194	200	120	12		8.2
WDO-2 1/2	2 1/2		65	240	246	140	14		13.0
WDO-3	3		80	240	246	150	14		16.5
WDO-4	4		100	290	296	175	16		25.0
C-1	1	フランジ JIS 10K 相当	26	75	85	90	10	Rc 1/4	2.0
C-2	2		52	140	155	120	12	Rc 3/8	4.5
C-3	3		80	195	217	150	16		9.0
C-4	4	フランジ Flange	110	275	301	202	18		17.0
C-5	5		130	330	358	232	18		25.0
C-6	6	特殊規格	155	380	418	274	20	Rc 1/2	35.0

マイレイン — 太陽光利用自動散水システム

Automatic Sprinkler System

マイレインは太陽電池を電源としたコンピュータ内蔵の小型制御器と、パルス作動の電磁弁をセットした省電力、工事費節約型の自動散水システムです。

My-Rain is the automatic sprinkler system featuring the saving electricity and reduction of the installation expenses integrating small size of control unit with a built-in computer utilizing solar battery as a power source and solenoid valve by pulse control.



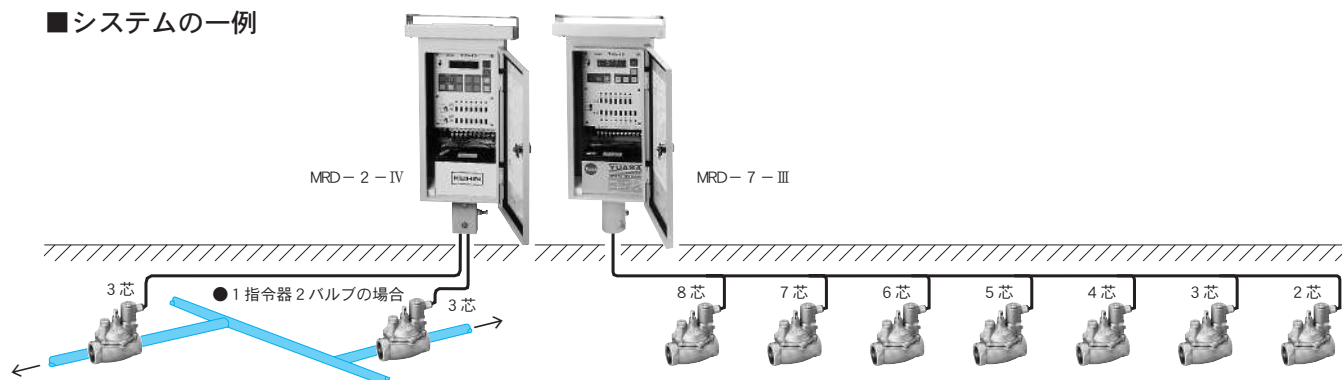
■仕様

- 安い費用で自動散水ができます。
電磁弁を設置し、これを指令器とケーブルで結ぶだけで自動化は完了です。
- 操作や維持管理は容易です。
散水日の設定などは、スイッチの入・切だけの簡単な操作ででき、特別な技術はまったく必要ありません。
- ローテーションは自由にセットできます。
個別のセット毎に正確な繰返しのローテーションや、天候、作物の状態などに合わせて、キャンセル、変更など思いのままです。
- 雷害に強いシステムです。
電源を内蔵し、配線も短いので雷害をほとんど受けません。
万一直撃を受けても、他の機器へ影響を及ぼしません。

■用途

畑地かんがい・果樹園・牧草地・温室・ゴルフ場・公園・広域緑地・運動場などの自動散水

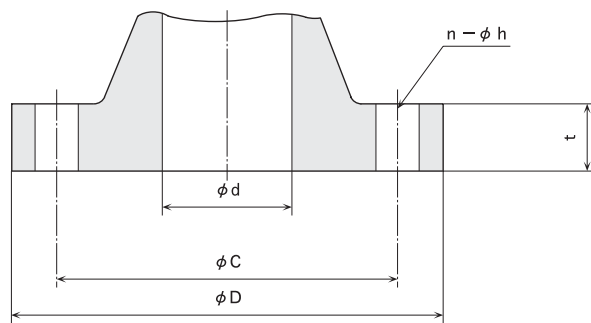
■システムの一例



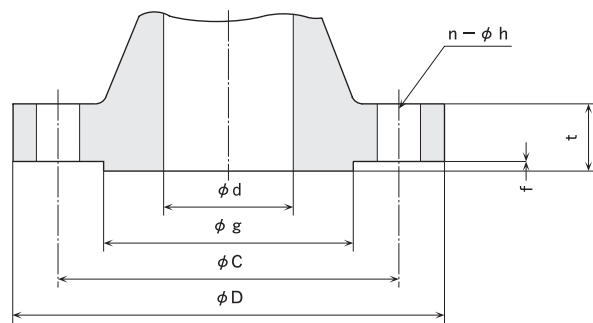
■仕様

型 式	MRD-2-IV	MRD-7-III
電 磁 弁 支 配 数	2 台	7 台
電 源 ・ 電 圧	太陽電池+小型シール鉛電池・DC12V	
電 磁 弁 へ の 指 示	約 1 秒間の通電で開・閉するロック式電磁式	
自動散水設定	散 水 時 間 設 定	1 日 各 2 回 の 任 意 の 時 刻 に 任 意 の 時 間 散 水 可 能
	間 断 設 定	1 日 1 回 任 意 の 時 刻 に 任 意 の 時 間 7 台 の 電 磁 弁 を 次 々 に 散 水 可 能
手 動 散 水	6・7 日 の 間 断 で 散 水 日 を 自 由 に 設 定 可 能	
	何 時 で も スイ ッ チ 一 つ の 操 作 で 自 由 に 散 水 で き ま す。	
	時 間 を 設 定 す れ ば 手 動 で 散 水 開 始 ・ 自 動 停 止 も で き ま す。	不 可

フランジ基準寸法 (単位mm)



FF (Flat Face) フランジ



RF (Raised Face) フランジ

JIS 5K

B2238-1996

呼び径	フランジ の外径 D	フランジ の厚さ t	ボルト穴			ボルトのね じの呼び
			中心円 の径C	数	径 h	
10	75	9	55	4	12	M10
15	80	9	60	4	12	M10
20	85	10	65	4	12	M10
25	95	10	75	4	12	M10
32	115	12	90	4	15	M12
40	120	12	95	4	15	M12
50	130	14	105	4	15	M12
65	155	14	130	4	15	M12
80	180	14	145	4	19	M16

JIS 16K

B2238-1996

呼び径	フランジ の外径 D	フランジの各部寸法			ボルト穴			ボルトの ねじの呼び
		t	f	径 g	中心円 の径C	数	径 h	
10	90	12	1	46	65	4	15	M12
15	95	12	1	51	70	4	15	M12
20	100	14	1	56	75	4	15	M12
25	125	14	1	67	90	4	19	M16
32	135	16	2	76	100	4	19	M16
40	140	16	2	81	105	4	19	M16
50	155	16	2	96	120	8	19	M16
65	175	18	2	116	140	8	19	M16
80	200	20	2	132	160	8	23	M20

JIS 10K (並形フランジ)

B2238・2239-1996

呼び径	フランジ の外径 D	フランジの各部寸法				ボルト穴			ボルト のねじ の呼び
		t		f	g	中心円 の径C	数	径 h	
		ねずみ 鋳鉄以外	ねずみ 鋳 鉄						
10	90	12	14	1	46	65	4	15	M12
15	95	12	16	1	51	70	4	15	M12
20	100	14	18	1	56	75	4	15	M12
25	125	14	18	1	67	90	4	19	M16
32	135	16	20	2	76	100	4	19	M16
40	140	16	20	2	81	105	4	19	M16
50	155	16	20	2	96	120	4	19	M16
65	175	18	22	2	116	140	4	19	M16
80	185	18	22	2	126	150	8	19	M16
100	210	18	24	2	151	175	8	19	M16
125	250	20	24	2	182	210	8	23	M20
150	280	22	26	2	212	240	8	23	M20
200	330	22	26	2	262	290	12	23	M20
250	400	24	30	2	324	355	12	25	M22
300	445	24	32	3	368	400	16	25	M22
350	490	26	34	3	413	445	16	25	M22
400	560	28	36	3	475	510	16	27	M24
450	620	30	38	3	530	565	20	27	M24
500	675	30	40	3	585	620	20	27	M24

JIS 20K

B・2238-1996

呼び径	フランジ の外径 D	フランジの各部寸法			ボルト穴			ボルトの ねじの呼び
		t	f	径 g	中心円 の径C	数	径 h	
10	90	14	1	46	65	4	15	M12
15	95	14	1	51	70	4	15	M12
20	100	16	1	56	75	4	15	M12
25	125	16	1	67	90	4	19	M16
32	135	18	2	76	100	4	19	M16
40	140	18	2	81	105	4	19	M16
50	155	18	2	96	120	8	19	M16
65	175	20	2	116	140	8	19	M16
80	200	22	2	132	160	8	23	M20
100	225	24	2	160	185	8	23	M20
125	270	26	2	195	225	8	25	M22
150	305	28	2	230	260	12	25	M22
200	350	30	2	275	305	12	25	M22
250	430	34	2	345	380	12	27	M24
300	480	36	3	395	430	16	27	M24
350	540	40	3	440	480	16	33	M30×3
400	605	46	3	495	540	16	33	M30×3
450	675	48	3	560	605	20	33	M30×3
500	730	50	3	615	660	20	33	M30×3

注 CAC406 (青銅) の場合は、全てFFフランジになります

FLANGE DIMENSIONS

JIS 30K

B・2238—1996

呼び径	フランジ の外径 D	フランジの各部寸法			ボルト穴			ボルトの ねじの呼び
		t	f	径 g	中心円 の径C	数	径 h	
10	110	16	1	52	75	4	19	M16
15	115	18	1	55	80	4	19	M16
20	120	18	1	60	85	4	19	M16
25	130	20	1	70	95	4	19	M16
32	140	22	2	80	105	4	19	M16
40	160	22	2	90	120	4	23	M20
50	165	22	2	105	130	8	19	M16
65	200	26	2	130	160	8	23	M20
80	210	28	2	140	170	8	23	M20

ANSI 125

呼び径	口 径 d*	フランジ の外径D	フランジの各部寸法		ボルト穴		ボルトの 呼び半径
			t	中心円 の径C	数	径 h	
1B	25	110	14.7	79.4	4	16	UNC1/2
1 1/4B	32	115	16.3	88.9	4	16	UNC1/2
1 1/2B	40	125	17.9	98.4	4	16	UNC1/2
2B	50	150	19.5	120.7	4	19	UNC5/8
2 1/2B	65	180	22.7	139.7	4	19	UNC5/8
3B	80	190	24.3	152.4	4	19	UNC5/8
4B	100	230	24.3	190.5	8	19	UNC5/8
5B	125	255	24.3	215.9	8	22	UNC3/4
6B	150	280	25.9	241.3	8	22	UNC3/4
8B	200	345	29.0	298.5	8	22	UNC3/4
10B	250	405	30.6	362.0	12	26	UNC7/8
12B	300	485	32.2	431.8	12	26	UNC7/8

ANSI 150

呼び径	口 径 d*	フラン ジの外 径 D	フランジの各部寸法			ボルト穴			ボルトの 呼び半径
			t	f	径 g	中心円 の径C	数	径 h	
1/2B	15	90	11.6	2.0	34.9	60.3	4	16	UNC1/2
3/4B	20	100	13.2	2.0	42.9	69.9	4	16	UNC1/2
1B	25	110	14.7	2.0	50.8	79.4	4	16	UNC1/2
1 1/4B	32	115	16.3	2.0	63.5	88.9	4	16	UNC1/2
1 1/2B	40	125	17.9	2.0	73.0	98.4	4	16	UNC1/2
2B	50	150	19.5	2.0	92.1	120.7	4	19	UNC5/8
2 1/2B	65	180	22.7	2.0	104.8	139.7	4	19	UNC5/8
3B	80	190	24.3	2.0	127.0	152.4	4	19	UNC5/8
4B	100	230	24.3	2.0	157.2	190.5	8	19	UNC5/8
5B	125	255	24.3	2.0	185.7	215.9	8	22	UNC3/4
6B	150	280	25.9	2.0	215.9	241.3	8	22	UNC3/4
8B	200	345	29.0	2.0	269.9	298.5	8	22	UNC3/4
10B	250	405	30.6	2.0	323.8	362.0	12	26	UNC7/8
12B	300	485	32.2	2.0	381.0	431.8	12	26	UNC7/8

ANSI 300

呼び径	口 径 d*	フラン ジの外 径 D	フランジの各部寸法				ボルト穴		ボルトの 呼び半径
			径 g	t	f	中心円 の径C	数	径 h	
1/2B	15	95	34.9	14.7	2.0	66.7	4	16	UNC1/2
3/4B	20	115	42.9	16.3	2.0	82.6	4	19	UNC5/8
1B	25	125	50.8	17.9	2.0	88.9	4	19	UNC5/8
1 1/4B	32	135	63.5	19.5	2.0	98.4	4	19	UNC5/8
1 1/2B	40	155	73.0	21.1	2.0	114.3	4	22	UNC3/4
2B	50	165	92.1	22.7	2.0	127.0	8	19	UNC5/8
2 1/2B	65	190	104.8	25.9	2.0	149.0	8	22	UNC3/4
3B	80	210	127.0	29.0	2.0	168.3	8	22	UNC3/4
4B	100	255	157.2	32.2	2.0	200.0	8	22	UNC3/4
5B	125	280	185.7	35.4	2.0	235.0	8	22	UNC3/4
6B	150	320	215.9	37.0	2.0	269.9	12	22	UNC3/4
8B	200	380	269.9	41.7	2.0	330.2	12	26	UNC7/8
10B	250	445	323.8	48.1	2.0	387.4	16	29	UNC1
12B	300	520	381.0	51.3	2.0	450.8	16	32	UNC11/8

* 印についてはJPI-7S-15-93の石油工業用フランジ寸法許容差表を参照

比重換算表 Conversion of Specific Gravity

その他のもの

$$g = \frac{1}{\sqrt{G}}$$

g	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
0.00	1.580	1.414	1.292	1.197	1.119	1.054	1.000	0.953	0.913	0.877	0.845	0.816	0.791
0.01	1.560	1.400	1.280	1.188	1.112	1.048	0.995	0.949	0.910	0.873	0.842	0.814	0.788
0.02	1.545	1.390	1.270	1.180	1.104	1.044	0.990	0.945	0.907	0.870	0.839	0.811	0.786
0.03	1.530	1.375	1.260	1.172	1.097	1.038	0.986	0.941	0.903	0.867	0.836	0.808	0.783
0.04	1.515	1.360	1.250	1.162	1.091	1.032	0.982	0.937	0.899	0.864	0.833	0.806	0.781
0.05	1.485	1.350	1.240	1.155	1.085	1.026	0.977	0.933	0.895	0.861	0.830	0.803	0.778
0.06	1.472	1.337	1.230	1.147	1.079	1.021	0.972	0.929	0.892	0.858	0.828	0.801	0.776
0.07	1.460	1.325	1.222	1.140	1.073	1.016	0.967	0.925	0.888	0.855	0.825	0.798	0.774
0.08	1.447	1.313	1.212	1.133	1.065	1.010	0.963	0.921	0.885	0.852	0.822	0.796	0.772
0.09	1.430	1.303	1.205	1.126	1.060	1.005	0.958	0.917	0.881	0.849	0.819	0.793	0.769

ACL

KS

KS-B-
TCLW

NSPW-
NFFW

FPC

RSP

NR

NR2-S

C1

FL-J1

TX2
TX350

MK II

P2・P3

ADF

PFC

WDO・C

マイルイン

フランジ
基準寸法



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お問合せ、ご用命は

ケイヒン電磁弁 総合カタログ

Cat. No. 107

KEIHIN SOLENOID VALVES



MSD

M3P

ZFD

VSPD

VSPD-
LN2M

VSD

GVD

VD

VKD

VKK

VKK-
SSP

ME6-
SSP

ME6-
LN2HM

Y

TEN

SSPD

SSAP

VHTD-
VHT

SP・SR・
SR-T

原子力用
電磁弁

アクセサリ

結線方法
直流コイルと
交流コイル

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と注意事項

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ZFD	ZFD シリーズ 小型燃焼用電磁弁 Compact Type Solenoid Valve for Burner	3
VSPD	VSPD シリーズ 低・中・高圧汎用電磁弁 Wide Pressure Type Solenoid Valve	4
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KEIHIN Solenoid Valves INDEX



MSD シリーズ

水・油・空気

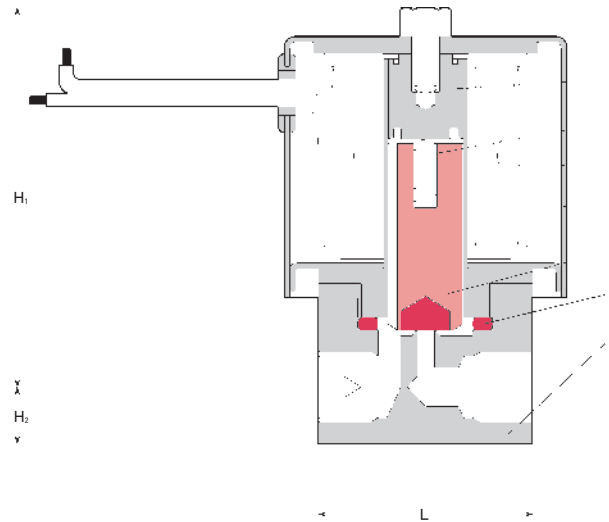
小型汎用電磁弁

Compact Type Solenoid Valve

2WAY

動作(Operation) :
通電時開型(Normally Closed)

- コンパクトな汎用機器とのセットに好適です。
- Suitable for general compact appliance.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	C3604
2	プランジャー Plunger	SUS410+NBR
3	バックレスAss'y Packless Ass'y	SUS410+SUS304
4	バックレスパッキン Packless Packing	NBR
5	プランジャースプリング Plunger Spring	SUS304
6	コイル Coil	PEW
7	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	MAX60°C
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	0.7 : E class, 1 : F class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50°C RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス、 ボデー材質 : SUS304、その他の電源 Drip-proof Type, Terminal Box, Body Materials : SUS304, Other above Power Source

■ 製品の型式記号 Model Type

M S D - 1 0 3 0 - □ □ W A G M J	
シリーズ MSD : C3604製 MSSD : SUS304製	口径 オリフィス径 20 : φ2 30 : φ3 40 : φ4 50 : φ5
コイルサイズ 07 : 0.7 型 10 : 1 型	オプション M : 防滴 J : ターミナルボックス BT : 耐圧防爆d2G3
	流体 W : 水 A : 油 G : 空気・ガス

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]		
	口径 Size	形状 Type				E Class	F Class		L	H ₁	H ₂			
MSD-0750-4	1/8	ネジ込 Rc	5.0	0.7	0～0.1	10	—	0.49	38	58	10	0.35		
MSD-0750-8	1/4								38	58	10	0.35		
MSD-0720-4	1/8		2.0		0～0.7			0.15	38	58	10	0.35		
MSD-0720-8	1/4								38	58	10	0.35		
MSD-1050-8	1/4		5.0	1.0	0～0.25	—	26	0.49	38	66	10	0.53		
MSD-1050-10	3/8								42	66	12	0.65		
MSD-1040-8	1/4		4.0		0～0.5			0.41	38	66	10	0.53		
MSD-1040-10	3/8								42	66	12	0.65		
MSD-1030-8	1/4		3.0		0～1			0.24	38	66	10	0.53		
MSD-1030-10	3/8								42	66	12	0.65		

MSD
M3P
ZFD
VSPD
VSPD-LN2M
VSD
GVD
VD
VKD
VKK-SSP
ME6-SSP
ME6-LN2HM
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M3P シリーズ

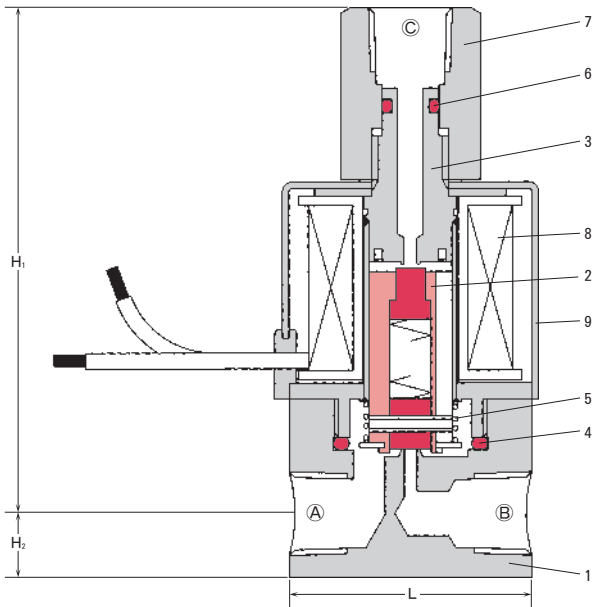
水・油・空気

小型3方向汎用電磁弁 Compact Type 3way Solenoid Valve

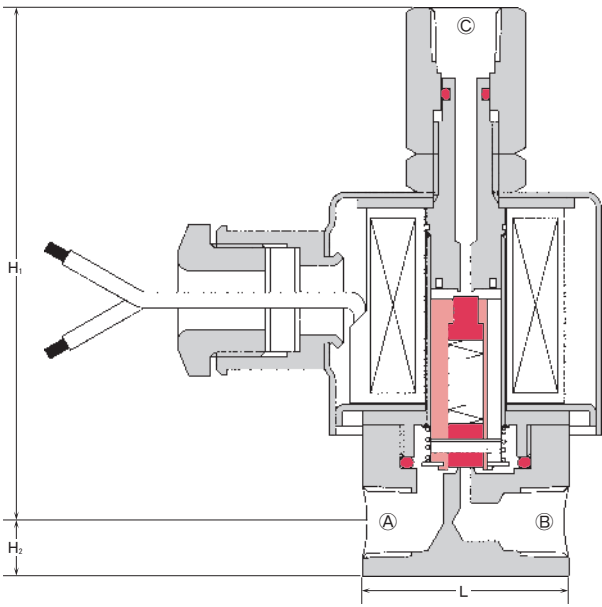
3WAY

動作 (Operation) :
流れ方向自由 (Universal)

- 自動機器などの操作用に最適なコンパクトタイプの電磁弁です。
- Best compact type to operate auto-machines.



M3P-0712-□□WAG



M3P-10□□-□□WAGTB

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	C3604
2	プランジャー Plunger	SUS410+NBR
3	パッキンAss'y Packless Ass'y	SUS410+SUS304
4	パッキンパッキン Packless Packing	NBR
5	プランジャースプリング Plunger Spring	SUS304
6	ニップルパッキン Nipple Packing	NBR
7	ニップル Nipple	S15C
8	コイル Coil	PEW
9	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	MAX60℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	0.7 : E class, 1 : B class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時 A ↔ B 非通電時 A ↔ C Energization Non-Energization
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	ターミナルボックス、耐圧防爆 (d2G3) ボデー材質 : SUS304、その他の電源 Terminal Box, Explosion-proof Type Body Materials : SUS304, Other above Power Source

■ 製品の型式記号 Model Type

M 3 P - 1 0 3 0 - □ □ W A G J	
シリーズ M3P : 真鍮性 MSS3P : SUS304製	口径 オリフィス径 12 : φ1.2 20 : φ2 30 : φ3
コイルサイズ 07 : 0.7 型 10 : 1 型	オプション J : ターミナルボックス TB : ボス付コイルボンネット BT : 耐圧防爆d2G3
流体 W : 水 A : 油 G : 空気・ガス	

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]		皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type			Air	Water・Oil	E Class	F Class		L	H ₁	H ₂	
M3P-0712-4	1/8	ネジ込 Rc	1.2	0.7	0～1	0～1	10	—	0.042	38	80	10	0.4
M3P-0712-8	1/4				—	—	—	—	—	—	38	80	10
M3P-1030-8	1/4		3.0	1.0	0～0.4	0～0.2	—	20	0.21	38	97	10	0.56
M3P-1030-10	3/8				—	—			42	97	12	0.72	
M3P-1020-8	1/4		2.0	—	0～1	0～0.7			0.105	38	97	10	0.56
M3P-1020-10	3/8				—	—			—	42	97	12	0.72



ZFD シリーズ

油

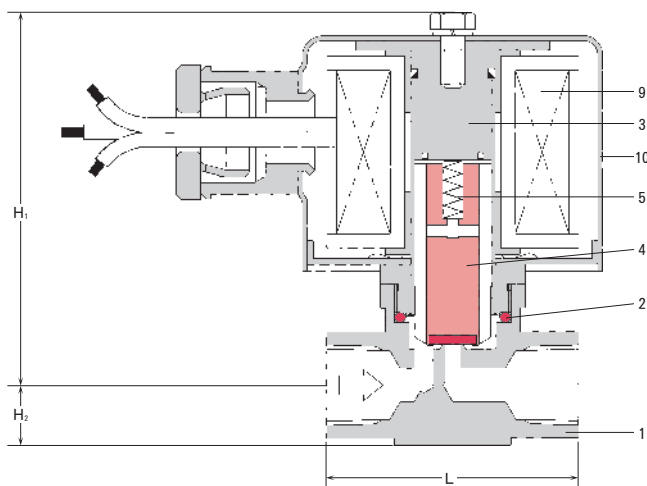
小型燃焼用電磁弁

Compact Type Solenoid Valve for Burner

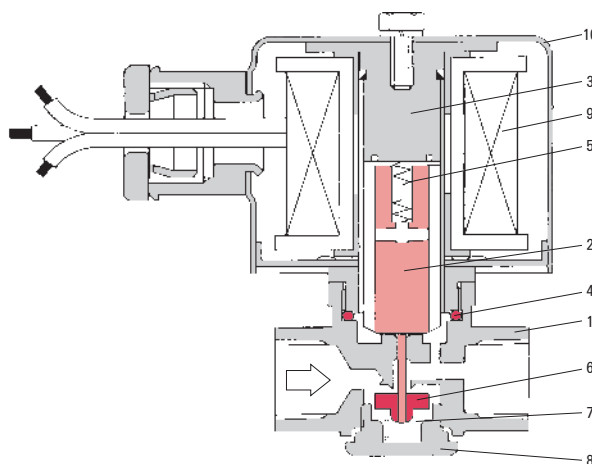
2WAY

動作(Operation) :
通電時閉型(Normally Closed)
通電時開型(Normally Open)

- 小型オイルバーナー制御用電磁弁として好適です。
- Solenoid Valve for control small oil burner.



通電時閉型 Normally Closed



通電時開型 Normally Open

主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		通電時閉型 Normally Closed	通電時開型 Normally Open
1	ボデー Valve Body	C3771	
2	プランジャー Plunger	SUS410 + FKM	SUS410
3	バックレスAss'y Packless Ass'y	SUS410 + SUS304	
4	バックレスパッキン Packless Packing	FKM	
5	プランジャースプリング Plunger Spring	SUS304	
6	ニードルバルブAss'y Needle Valve Ass'y	—	SUS304 + FKM
7	ニードルバルブスプリング Needle Valve Spring	—	SUS304
8	ボトムプラグ Bottom Plug	—	C3771
9	コイル Coil	PEW	
10	コイルボンネット Coil Bonnet	SPC + 塗装 (Coating)	

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	油 (A・B・C 重油、軽油、灯油 etc.) Oil (A・B・C Heavy Oil, Light Oil, Kerosen)
電源 Power Source	AC100V 50/60Hz or AC200V 50/60Hz
絶縁種別 Class	1 : F class, 1.5 : H class
流体粘度 Fluid Viscosity	150mm ² /s (150cst)
取付姿勢 Installation	鉛直 ±90° A Coil Vertical ±90°
動作 Operation	通電時閉型 or 通電時開型 Normally Closed or Normally Open
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス、その他の電源 Drip-proof Type, Terminal Box, Other above Power Source

製品の型式記号 Model Type

Z F D - 1 0 3 2 - □ □ A U K C J

シリーズ 口径 オプション

コイルサイズ
10 : 1.0 型
15 : 1.5 型

M : 防滴 J : ターミナルボックス

動作
無記号 : 通電時閉型 (N.C) C : 通電時開型 (N.O)

仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice	コイル Coil No.	使用圧力範囲 Pressure Range	流体温度 Fluid Temperature	皮相電力 Apparent Power	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight			
	口径 Size	形状 Type	φ [mm]		[MPa]	[℃]	[VA±10%]		L	H ₁	H ₂	[kg]			
ZFD-1032-8AUK	1/4	ネジ込 Rc	3.2	1.0	0～2.1	100	30	0.26	52	73	13	0.65			
ZFD-1032-10AUK	3/8					52			73	13	0.65				
ZFD-1532-8AUK	1/4			1.5		120			52	78	13	0.7			
ZFD-1532-10AUK	3/8								52	78	13	0.7			
ZFD-1032-8AUKC	1/4		3.2	1.0	0～2.1	100	30	0.26	52	73	16	0.65			
ZFD-1032-10AUKC	3/8					52			73	16	0.65				
ZFD-1532-8AUKC	1/4			1.5		120			52	78	17	0.7			
ZFD-1532-10AUKC	3/8								52	78	17	0.7			



低・中・高圧汎用電磁弁

Wide Pressure Type Solenoid Valve

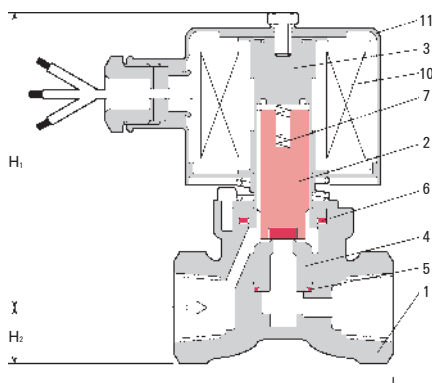
2WAY

動作 (Operation) :

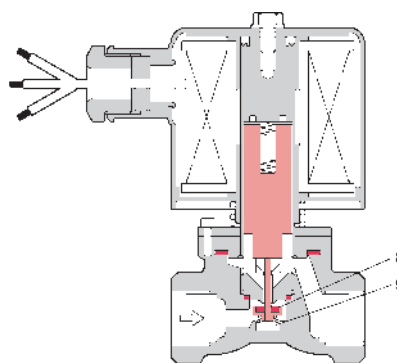
通電時開型 (Normally Closed)

通電時閉型 (Normally Open)

- 低圧 (0.5MPa, 0.7MPa, 1MPa)、中圧 (2.5MPa, 3.5MPa)、高圧 (5MPa) と圧力仕様のバリエーションが豊富です。
 ● Wide pressure variations, Low pressure (0.5MPa, 0.7MPa, 1MPa), Middle pressure (2.5MPa, 3.5MPa), High pressure (5MPa).



通電時開型 Normally Closed



通電時閉型 Normally Open

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials			
			通電時開型 Normally Closed		通電時閉型 Normally Open	
			常温用 MAX60℃	高温用 MAX200℃	常温用 MAX60℃	高温用 MAX200℃
1	ボデー	Valve Body	CAC406			
2	プランジャー	Plunger	SUS410+FKM※1	SUS410+PTFE	SUS410	
3	バックレスAss'y	Packless Ass'y	SUS410+SUS304			
4	バイパスシート	By-pass Seat	SUS304			
5	バイパスシートパッキン	By-pass Seat Packing	PTFE			
6	バックレスパッキン	Packless Packing	PTFE			
7	プランジャースプリング	Plunger Spring	SUS304			
8	ニードルバルブAss'y	Needle Valve Ass'y	—	SUS304+FKM※2	SUS304+PTFE	
9	ニードルバルブスプリング	Needle Valve Spring	—	SUS304		
10	コイル	Coil	PEW			
11	コイルボンネット	Coil Bonnet	SPC+塗装 (Coating)			

※ 1 プランジャーのシート材質は、流体・圧力によって異なります。2.5MPa以下は流体に限らずシート材質：FKM、3.5MPa以上は水・油用はメタルシート、空気用はPTFEシートです。

※ 2 ニードルバルブのシート材質は、圧力によって異なります。2.5MPa以下はシート材質：FKM、3.5MPa以上はシート材質：PTFEです。

※ 1 The seat materials of the plunger are different by a fluid and pressure, Less than 2.5MPa→FKM, More than 3.5MPa→Water&Oil: Metal, Air: PTFE

※ 2 The seat materials of the needle valve are different by a pressure, Less than 2.5MPa→FKM, More than 3.5MPa→PTFE

■ 製品の型式記号 Model Type

V S P D - 2 0 2 0 - □ □ W A G U K C M J

シリーズ

口径

コイルサイズ

15: 1.5 型

20: 2.0 型

オリフィス径

20: φ2

25: φ2.5

30: φ3

40: φ4

50: φ5

60: φ6

オプション M: 防滴 J: ターミナルボックス BT: 耐圧防爆d2G3

動作 無記号: 通電時開型 (N.C) C: 通電時閉型 (N.O)

温度仕様 無記号: 60℃以下及び蒸気用 K: 61℃以上

圧力仕様 無記号: 1MPa以下 H: 1~2MPa U: 2.1MPa以上

流体 W: 水 A: 油 G: 空気・ガス S: 蒸気

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice	コイル Coil No.	使用圧力範囲 Pressure Range	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions						質 量 Weight
	口径 Size	形状 Type	φ [mm]		[MPa]	F Class	H Class		10A (Rc3/8)			15A (Rc1/2)			
									L	H ₁	H ₂	L	H ₁	H ₂	
VSPD-1540-□□	3/8 or 1/2	ネジ込 Rc	4.0	1.5	0~0.5	31	25	0.41	60	95	13	70	95	17	1.0
VSPD-1530-□□	3/8 or 1/2		3.0		0~1.0			0.31	60	95	13	70	95	17	1.0
VSPD-1520-□□	3/8 or 1/2		2.0		0~2.5 ※3			0.15	60	95	13	70	95	17	1.0
VSPD-2060-□□	3/8 or 1/2	ネジ込 Rc	6.0	2.0	0~0.5	40	46	0.58	60	115	13	70	115	17	1.5
VSPD-2050-□□	3/8 or 1/2		5.0		0~0.7			0.53	60	115	13	70	115	17	1.5
VSPD-2040-□□	3/8 or 1/2		4.0		0~1.0			0.41	60	115	13	70	115	17	1.5
VSPD-2030-□□	3/8 or 1/2		3.0		0~2.5 ※3			0.31	60	115	13	70	115	17	1.5
VSPD-2025-□□	3/8 or 1/2		2.5		0~3.5			0.22	60	115	13	70	115	17	1.5
VSPD-2020-□□	3/8 or 1/2		2.0		0~5.0			0.15	60	115	13	70	115	17	1.5

※ 3 蒸気仕様の場合、使用圧力範囲: 0~1.6MPaです。また、蒸気以外の流体の高温仕様 (61℃以上) ・通電時開型の場合、使用圧力範囲: 0~2.0MPaです。

※ 3 Pressure range for steam is 0~1.6MPa. Also pressure range for the fluid of high temperature (over 61℃) except steam and in case of N.C.type, is 0~2.0MPa.



低圧汎用電磁弁

Low Pressure Type Solenoid Valve

2WAY

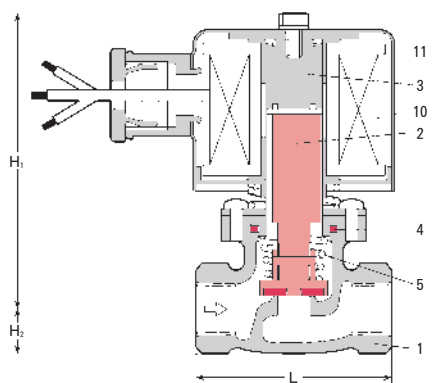
動作(Operation) :

通電時開型(Normally Closed)

通電時閉型(Normally Open)

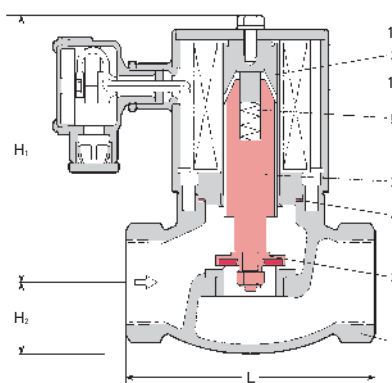
●低圧力で流量特性の良い直動型電磁弁です。

●Direct control valve with high flow rate at low pressure.



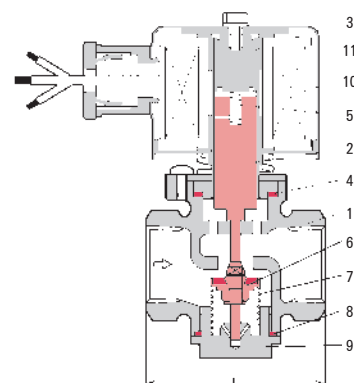
12A~25A

通電時開型 Normally Closed



35A~50A

通電時閉型 Normally Open



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials			
			通電時開型 Normally Closed		通電時閉型 Normally Open	
			常温用 MAX90℃	高温用 MAX200℃	常温用 MAX90℃	高温用 MAX200℃
1	ボデー	Valve Body	CAC406			
2	プランジャー	Plunger	SUS410+FKM	SUS410+PTFE	SUS410	
3	バックレスAss'y	Packless Ass'y	SUS410 + SUS304			
4	バックレスパッキン	Packless Packing	NBR	PTFE	NBR	PTFE
5	プランジャースプリング	Plunger Spring	SUS304			
6	ニードルバルブAss'y	Needle Valve Ass'y	－		SUS304+C3604+FKM	SUS304+PTFE
7	ニードルバルブスプリング	Needle Valve Spring	－		SUS304	
8	ボトムプラグパッキン	Bottom Plug Packing	－		NBR	PTFE
9	ボトムプラグ	Bottom Plug	－		CAC406	
10	コイル	Coil	PEW			
11	コイルボンネット	Coil Bonnet	SPC+塗装 (Coating)			

■ 製品の型式記号 Model Type

V S D F - □ □ W A G H C M J

シリーズ

口径

接続

無記号：ネジ込

F：フランジ

オプション

M：防滴 J：ターミナルボックス

D：整流器内蔵型ターミナルボックス BT：耐圧防爆型 (d2G3)

動作 無記号：通電時開型 (N.C) C：通電時閉型 (N.O)

流体圧力 無記号：0~0.05MPa H：0~0.1MPa

流体 W：水 A：油 G：空気・ガス S：蒸気

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		使用圧力範囲と オリフィスφ [mm] Pressure Range & Orifice		コイル Coil No.	皮相電力 [VA±10%] Apparent Power			Cv値 Cv Value		寸 法 [mm] Dimensions			質 量 Weight
	口 径 Size	形 状 Type	0~0.05MPa	0~0.1MPa		F Class	H Class	B Class	0~0.05MPa	0~0.1MPa	L	H ₁	H ₂	[kg]
VSDー12	3/8	ネジ込 Rc	10	7	1.5	31	24	ー	2.5	1.5	60	93	13	1.4
VSDー15	1/2		15	10	2.0	40	48	ー	3.4	1.6	70	116	17	1.7
VSDー20	3/4		17								80	116	20	1.8
VSDー25	1		20	15	4.0	40	65	ー	5.1	3.8	80	118	25	1.9
VSDー35D	1 1/4		30	20	7.0	ー	31	31	9.8	7.0	125	150	36	3.0
VSDー40D	1 1/2										140	150	40	3.5
VSDー50D	2										150	150	45	4.5
VSDFー35D	1 1/4	150									150	67	6.3	
VSDFー40D	1 1/2	フランジ JIS10KFF	30	20	7.0	ー	31	31	9.8	7.0	150	150	70	6.8
VSDFー50D	2										150	150	77	8.2



GVD シリーズ

空気・ガス

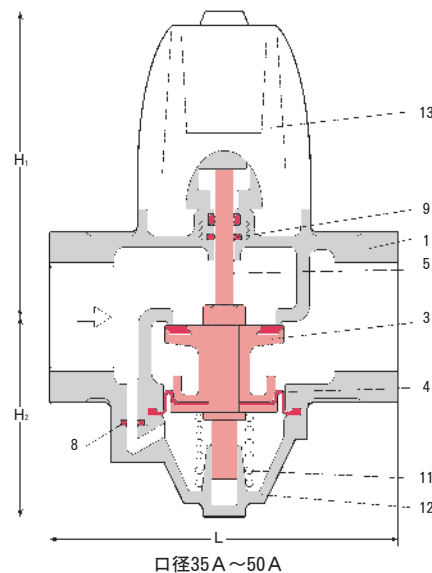
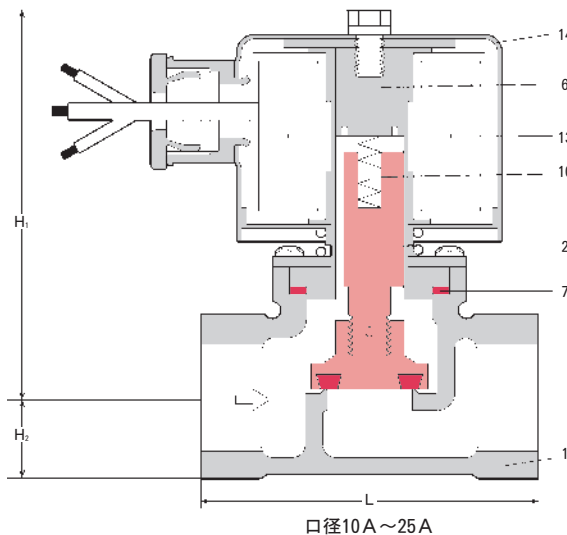
ガス汎用電磁弁

Standard Gas Type Solenoid Valve

2WAY

動作(Operation) :
通電時開型(Normally Closed)

- 低圧ガスバーナー、ガス機器とのセットに好適です。
- Used for low pressure gas burner and other gas appliances.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials		
		10A	15~25A	32~50A
1	ボデー Valve Body	ZDC	AC4A	
2	プランジャー Plunger	SUS410 + FKM		—
3	シートボデー Seat Body	—		AC4A + NBR
4	ベロフラム Bellowsphragm	—		NBR
5	ステム Stem	—		SUS304
6	バックレスAss'y Packless Ass'y	SUS410 + SUS304		—
7	バックレスパッキン Packless Packing	NBR		—
8	バイパスチューブパッキン By-Pass Tube Packing	—		NBR
9	Oリング O-Ring	—		NBR
10	プランジャースプリング Plunger Spring	SUS304		—
11	シートスプリング Seat Spring	—		SUS304
12	ボトムカバー Bottom Cover	—		AC4A
13	コイル Coil	PEW		組立品
14	コイルボンネット Coil Bonnet	SPC + 塗装 (Coating)		—

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	空気 ガス(都市ガス、LPガス、天然ガス) Air Gas (Natural Gas)
流体温度 Fluid Temperature	MAX60°C
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	10~25A : F class, 32~50A : B class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50°C RH90%以下 RH90% or less
オプション Option	防滴(10~25Aのみ)、ターミナルボックス その他の電源(10~25Aのみ) Drip-proof Type(10~25A), Terminal Box Other above Power Source

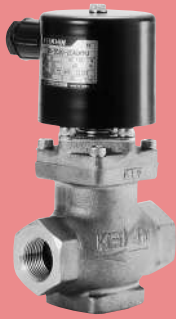
■ 製品の型式記号 Model Type

G V D - □ □ G M J

シリーズ 口径 オプション M: 防滴 J: ターミナルボックス

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type				F Class	B Class		L	H ₁	H ₂	
GVD-1010-10G	3/8	ネジ込 Rc	10	1.0	0~0.1	10	—	1.7	50	75	13	0.5
GVD-15G	1/2		15	1.5		31	—	3.6	70	90	19.6	0.8
GVD-20G	3/4		20	2.0		40	—	6.5	80	92	19	0.9
GVD-25G	1		25	2.0		—	55	10.2	100	119	24	1.5
GVD-35G	1 1/4		40	4A		—	55	24	130	130	82	2.0
GVD-40G	1 1/2		50	4A		—	55	26	130	130	82	2.0
GVD-50G	2		50	4A		—	55	41	150	148	96	2.9



中高圧キック式電磁弁

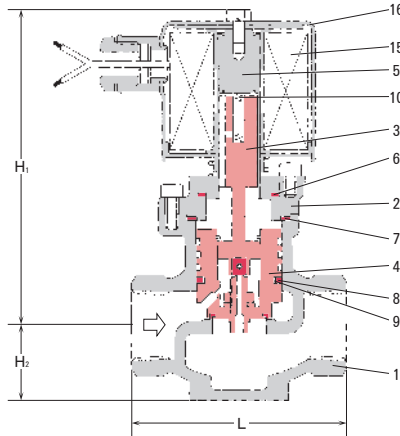
High Pressure Kick Type Solenoid Valve

2WAY

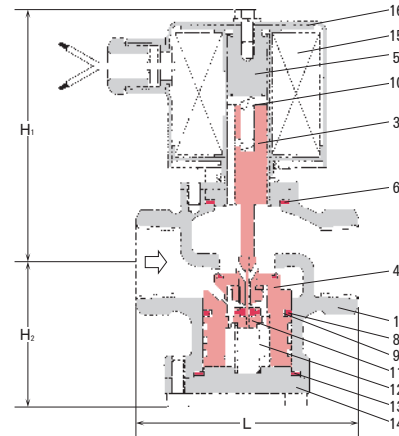
動作(Operation) :
 通電時開型(Normally Closed)
 通電時閉型(Normally Open)

●高い圧力で大流量を得たい大型オイルバーナーに好適です。

●Large quantity of flow at high pressure for big oil burner, try this type.



通電時開型 Normally Closed



通電時閉型 Normally Open

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials		
		通電時開型 Normally Closed		通電時閉型 Normally Open
		10~15A	20~25A	
1	ボデー Valve Body	CAC406		
2	バルブボンネット Valve Bonnet	—	CAC406	—
3	プランジャー Plunger	SUS410+FKM		SUS410
4	メインバルブAss'y Main Valve Ass'y	SUS304+PTFE		
5	バックレスAss'y Packless Ass'y	SUS410+SUS304		
6	バックレスパッキン Packless Packing	PTFE		
7	ボデーパッキン Body Packing	—	PTFE	—
8	プレーンリング Plane Ring	PTFE		
9	テンションリング Tension Ring	SUS304		
10	プランジャースプリング Plunger Spring	SUS304		
11	ニードルバルブAss'y Needle Valve Ass'y	—		SUS304+FKM
12	ニードルバルブスプリング Needle Valve Spring	—		SUS304
13	ボトムカバーパッキン Bottom Cover Packing	—		PTFE
14	ボトムカバー Bottom Cover	—		CAC406
15	コイル Coil	PEW		
16	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)		

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	油 (A・B・C 重油、軽油、灯油etc.) 水 Water Oil (A・B・C Heavy Oil, Light Oil, Kerosen)
流体温度 Fluid Temperature	MAX120℃ MAX100℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	400mm ² /s (400cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 or 通電時閉型 Normally Closed or Normally Open
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス、耐圧防爆 (d2G3) その他の電源 Drip-proof Type, Terminal Box, Explosion-proof Type Other above Power Source

■ 製品の型式記号 Model Type

VD - 2010 - □□ A U K C J

シリーズ

口径

オプション M : 防滴 J : ターミナルボックス BT : 耐圧防爆 (d2G3)

動作 無記号 : 通電時開型 (N.C) C : 通電時閉型 (N.O)

流体温度 無記号 : 60℃以下 K : 61℃以上

流体圧力 H : 1.6MPa U : 2.5Ma

流体 A : 油 W : 水

オリフィス径
 10 : φ10
 20 : φ20

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value		寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type					H	U	L	H ₁	H ₂	
VD-2010-10	3/8	ネジ込 Rc	10	2.0	H : 0~1.6 U : 0~2.5	48	2.4	2.1	80	125	44	2.3
VD-2010-15	1/2		10						80	125	44	2.4
VD-2020-20	3/4		20				6.7	5.2	100	149	46	3.4
VD-2020-25	1		20						100	149	46	3.6
VD-2010-10C	3/8	ネジ込 Rc	10	2.0	H : 0~1.6 U : 0~2.5	48	2.4	2.1	80	113	56	2.4
VD-2010-15C	1/2		10						80	113	56	2.5
VD-2020-20C	3/4		20				6.7	5.2	100	115	65	3.5
VD-2020-25C	1		20						100	115	65	3.7



VKD シリーズ

水・空気

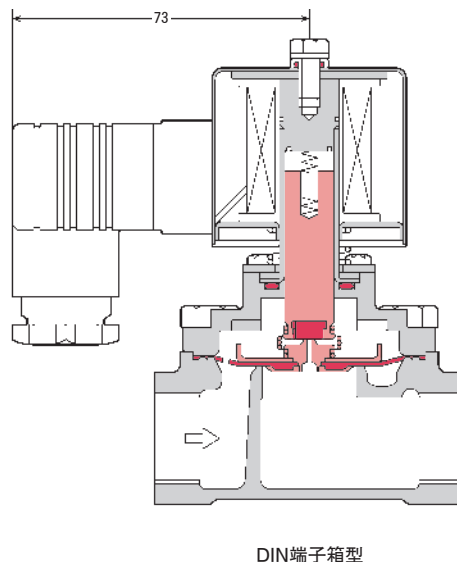
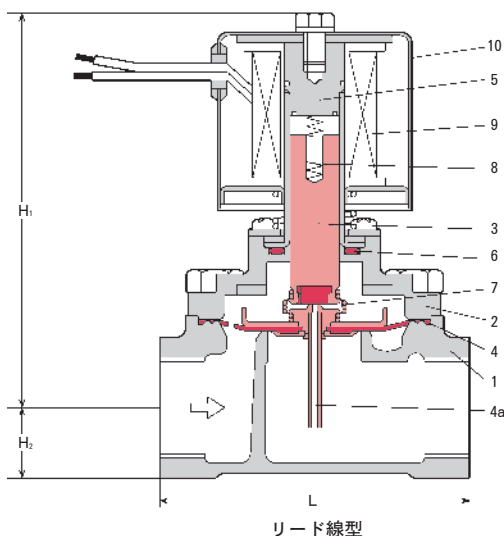
ダイヤフラム式直動電磁弁

Diaphragm Type Solenoid Valve

2WAY

動作(Operation) :
通電時開型(Normally Closed)

- メイン流路に摺動面が無いので、ゴミ・水アカ・異物に強く、作動が安定しています。
- Diaphragm will protect the valve from dust, impurity and scale.



主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	CAC406
2	バルブボンネット Valve Bonnet	C3771
3	プランジャー Plunger	SUS410+NBR
4	ダイヤフラムAss'y Diaphragm Ass'y	NBR
4a	ピン ※ Pin (Nozzle)	SUS304
5	バックレスAss'y Packless Ass'y	SUS410+SUS304
6	バックレスパッキン Packless Packing	FKM
7	ジョイントスプリング Joint Spring	SUS304
8	プランジャースプリング Plunger Spring	SUS304
9	コイル Coil	PEW
10	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)

※ 20, 25A のダイヤフラムAss'y に付いている部品です。15Aには付いていません。

※ Above Nozzle is on the Diaphragm Ass'y of the size 20A and 25A.
Not under the size of 15A.

共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	水 空気 Water Gas
流体温度 Fluid Temperature	MAX60°C
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz or DC24V
絶縁種別 Class	F class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50°C RH90%以下 RH90% or less
オプション Option	防滴、DIN端子箱 ランプ付DIN端子箱(サージキラー付) Drip-proof Type, DIN Joint Box Lamp Indicator DIN Joint Box(Surge Killer)

製品の型式記号 Model Type

V K D - □ □ W G M J

シリーズ

口径

オプション

M : 防滴 J : DIN端子箱

仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type						L	H ₁	H ₂	
VKD-15WG	1/2	ネジ込 Rc	16	1.0	0~1 ※	27	4.4	70	96	14.5	0.9
VKD-20WG	3/4		23				8.1	80	99	17.5	1.2
VKD-25WG	1		28				11.5	90	107	22.5	1.5
VKD-15WGMJ	1/2		16				4.4	70	98	14.5	0.9
VKD-20WGMJ	3/4		23				8.1	80	101	17.5	1.2
VKD-25WGMJ	1		28				11.5	90	109	22.5	1.5

※ DC24V仕様の場合、使用圧力範囲：0~0.6MPaです。

※ When used in DC24V, pressure range is: 0~0.6MPa

MSD
M3P
ZFD
VSPD
VSPD-LN2M
VSD
GVD
VD
VKD
VKK
VKK-SSP
ME6-SSP
ME6-LN2HM
Y
TEN
SSPD
VHTD-VHT
SP-SR-SR-T
原子力用電磁弁
アクセサリ
結線方法
直流コイルと
交流コイル
の取付け方
コイル・バルブ
電気的接続
の取付け方
流量表
Cv値計算式
主なS単位
の換算表
電磁弁の構造
と注意事項
バルブの
主要材料表
材料の
耐蝕性



VKK シリーズ

水・油・空気

蒸気

高性能キック式電磁弁

High Power Kick Pilot Type Solenoid Valve

2WAY

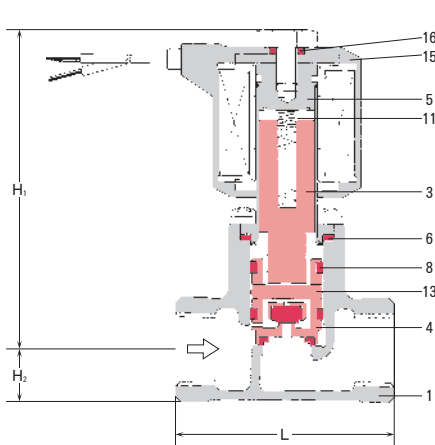
動作 (Operation) :
通電時開型 (Normally Closed)

- 密閉シールが摺動して蒸気スケールや水垢の付着を防ぎます。
- Seal ring sleeve will protect valve from steam scale and fur.

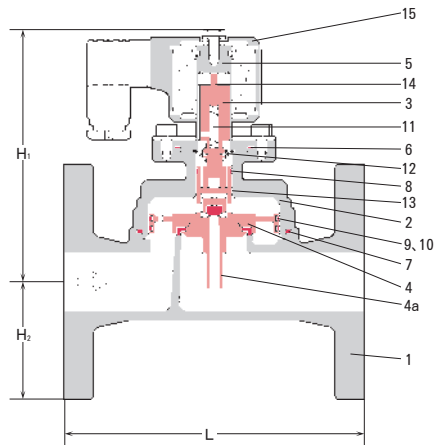
VKK3シリーズ
(10~25A)

RoHS 準拠品
RoHS compliant

DC24V
CEマーキング取得
CE Marking



10A~25A



32A~50A

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials			
			VKK-WAG		VKK-S	
			常温用	MAX60℃	高温用	MAX180℃
1	ボデー	Valve Body	10~25A	32~50A	10~25A	32~50A
2	バルブボンネット	Valve Bonnet	CAC407	CAC406	CAC407	CAC406
3	プランジャー	Plunger	—	CAC406	—	CAC406
4	メインバルブAss'y	Main Valve Assy	SUS403+PTFE	SUS303+PTFE	SUS304+PTFE	SUS303+PTFE
4a	ピン	Pin (Nozzie)	—	SUS303	—	SUS303
5	バックレスAss'y	Packless Assy	SUS403+SUS304			
6	バックレスパッキン	Packless Packing	NBR	—	PTFE	—
7	ボデーパッキン	Body Packing	—	FKM	—	PTFE
8	シールリング A	SealRing A	XE-4 (トニメタル)			
9	シールリング B	SealRing B	—	PTFE	—	PTFE
10	テンションリング	Tension Ring	—	SUS304	—	SUS304
11	プランジャースプリング	Plunger Spring	SUS304			
12	ジョイントスプリング	Joint Spring	—	SUS304	—	SUS304
13	平行ピン	Pin	SUS420			
14	プッシュロッド	Push Rod	—	SUS304	—	SUS304
15	コイル	Coil	EIW			
16	リング	O-Ring	NBR	—	NBR	—

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice	コイル Coil No.	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]	
	口径 Size	形状 Type	φ [mm]				L	H ₁	H ₂		
VKK3-10	3/8	ネジ込 Rc	13.8	1.5	36	2.2	53	92	12	0.7	
VKK3-15	1/2					3.5	63	94	15	0.8	
VKK3-20	3/4					6.7	74	107	17	1.5	
VKK3-25	1		25	2.0	45	8.0	88	107	21	1.7	
VKK-32	1 1/4					36	23.0	125	145	26	3.7
VKK-40	1 1/2						140	145	30	3.9	
VKK-50	2	53	35.0				160	155	35	5.7	
VKKF-32	1 1/4	フランジ JIS10KFF	36			23.0	170	145	67.5	7.6	
VKKF-40	1 1/2						180	145	70	8.2	
VKKF-50	2			53	35.0		200	155	77.5	10.5	

- ※ 口径32~50Aの使用圧力範囲につきまして、垂直配管及び水平配管にてコイル部が横向きになる場合は、差圧ΔP=0.03MPa以上が必要になります。
※ About pressure range of the size 32-50A, it needs differential pressure of over ΔP=0.03MPa when the coil turns sideways in vertical and horizontal plumbings.
※ DC24V 消費電力 10~15A : 18W 20~25A : 24W
※ DC24V Power Consumption 10~15A : 18W 20~25A : 24W

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
電源	Power Source
絶縁種別	Class
流体粘度	Fluid Viscosity
取付姿勢	Installation
動作	Operation
周囲温度・湿度	Ambient Temp./Humidity
オプション	Option

■ 製品の型式記号 Model Type

V K K F - □ □ W A G M J

シリーズ 口径 オプション
接続 流体 M : 防滴
無記号 : ネジ込 W : 水 J : DIN端子箱
F : フランジ A : 油 G : 空気・ガス
S : 蒸気・温水

シリーズ Series	口径 Size	流体 Fluid	使用圧力範囲 Pressure Range [MPa]	流体温度 Fluid Temperature MAX[℃]
VKK3-□□WAG	10~25A	水	0~0.8	60
		油	0~0.7	
		空気 ガス	0~0.5	
VKK-□□WAG	32~50A	水	0~1	90
		油	0~1	
		空気 ガス	0~1	
VKK3-□□S	10~25A	蒸気	0~1	180
		温水	0~0.8	160
VKK-□□S	32~50A	蒸気	0~1	180



VKK-SSP シリーズ

水・油・空気

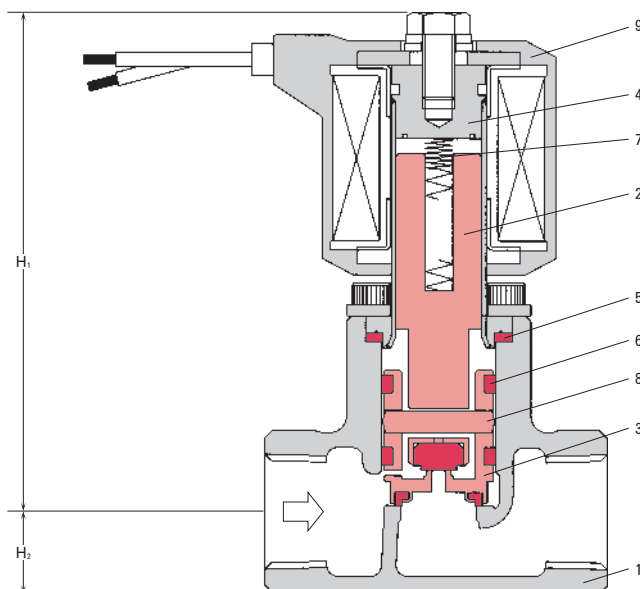
ステンレス製キック式電磁弁

Stainless Kick Pilot Type Solenoid Valve

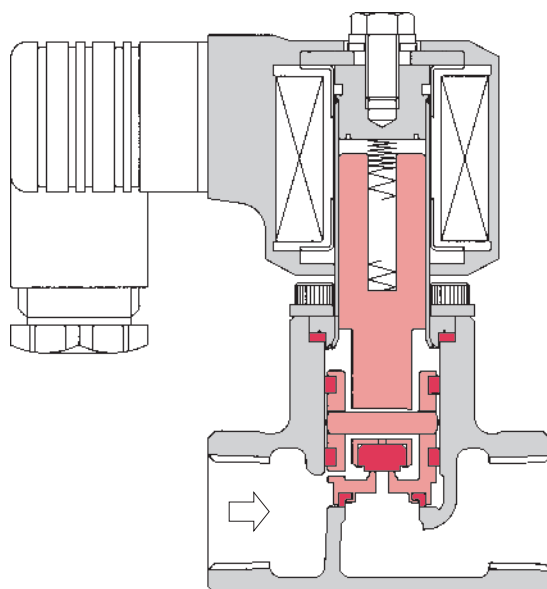
2WAY

動作(Operation) :
通電時開型(Normally Closed)

- 密閉シールが摺動して蒸気スケールや水垢の付着を防ぎます。
- Seal ring sleeve will protect valve from steam scale and fur.



リード線型



DIN端子箱型

■ 主要部品表 Main Parts List

No.	名称 Name of Parts	材質 Materials
1	ボデー Valve Body	SCS13A
2	プランジャー Plunger	SUS410 + FKM
3	メインバルブAss'y Main Valve Ass'y	SUS304 + PTFE
4	バックレスAss'y Packless Ass'y	SUS410 + SUS304
5	バックレスパッキン Packless Packing	PTFE
6	シールリング Seal Ring	XE-4 (トニメタル)
7	プランジャースプリング Plunger Spring	SUS304
8	平行ピン Pin	SUS420
9	コイル Coil	EIW

■ 共通仕様 Common Specification

項目 Item	内容 Description
流体 Fluid	水 空気 ガス 油 Water Air Gas oil
流体温度 Fluid Temperature	MAX90℃ MAX120℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、DIN端子箱 ランプ付DIN端子箱(サージキラー付) Drip-proof Type, DIN Joint Box Lamp Indicator DIN Joint Box(Surge Killer)

■ 製品の型式記号 Model Type

V K K - S S P - □ □ W A G K M J

シリーズ 口径 流体 オプション

W : 水 M : 防滴 J : DIN端子箱

A : 油

G : 空気・ガス

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形 状 Type						L	H ₁	H ₂	
VKK—SSP—15WAGK	1/2	ネジ込 Rc	13.8	1.5	W : 0~0.8	36	3.5	63	94	15	0.8
VKK—SSP—20WAGK	3/4		25	2.0	A : 0~0.7 G : 0~0.5	45	6.7	74	107	17	1.5
VKK—SSP—25WAGK	1		88	107	21	1.7					

MSD
M3P
ZFD
VSPD
VSPD-LN2M
VSD
GVD
VD
VKD
VKK
VKK-SSP
ME6-SSP
ME6-LN2HM
Y
TEN
SSPD
SSAP
VHTD・VHT
SP・SR・SR-T
原子力用電磁弁
アクセサリ
結線方法
直流コイルと
交流コイル
コイル・バルブ
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の注意
流量表
Cv値計算式
主なS単位
への換算率表
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と注意事項
バルブの
主要材料表
材料の
耐蝕性



ME6-SSP シリーズ

水・油・空気

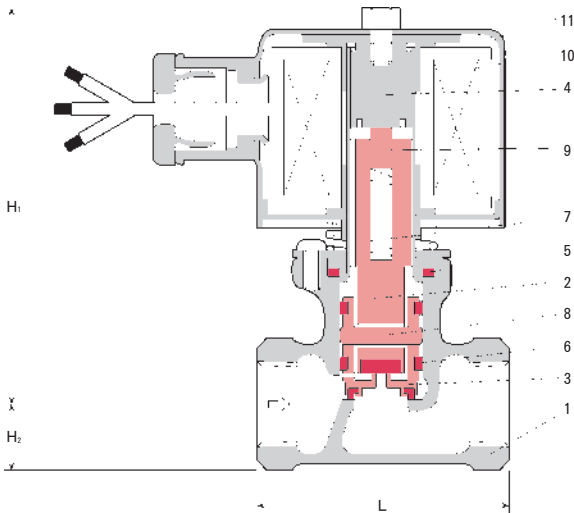
蒸気

ステンレス製キック式電磁弁 Stainless Kick Pilot Type Solenoid Valve

2WAY

動作 (Operation) :
通電時開型 (Normally Closed)

- 密閉シールが摺動して蒸気スケールや水垢の付着を防ぎます。
- Seal ring sleeve will protect valve from steam scale and fur.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		常温用 MAX60℃	高温用 MAX200℃
1	ボデー Valve Body	SCS13	
2	プランジャー Plunger	SUS410 + FKM	SUS410 + PTFE
3	メインバルブAss'y Main Valve Ass'y	SUS304 + PTFE	
4	パッキンAss'y Packless Ass'y	SUS410 + SUS304	
5	パッキンパッキン Packless Packing	PTFE	
6	シールリング Seal Ring	XE-4 (トニメタル)	
7	プランジャースプリング Plunger Spring	SUS304	
8	平行ピン Pin	SUS420	
9	プッシュロッド Push Rod	SUS304	
10	コイル Coil	PEW	
11	コイルボンネット Coil Bonnet	SPC + 塗装 (Coating)	

■ 共通仕様 Common Specification

項 目 Item		内 容 Description		
流体	Fluid	水 油 空気 ガス Water Oil Air Gas	蒸気 Steam	熱水 Hot Water
流体温度	Fluid Temperature	MAX60℃	MAX180℃	MAX200℃
電源	Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz		
絶縁種別	Class	F class	H class	
流体粘度	Fluid Viscosity	50mm ² /s (50cst)		
取付姿勢	Installation	鉛直±90° A Coil Vertical ±90°		
動作	Operation	通電時開型 Normally Closed		
周囲温度・湿度	Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less		
オプション	Option	防滴、ターミナルボックス、耐圧防爆 (d2G3) その他の電源 Drip-proof Type, Terminal Box, Explosion-proof Type Other above Power Source		

■ 製品の型式記号 Model Type

ME6-SSP-□□WHKMJ

シリーズ

口径

オプション

M: 防滴 J: ターミナルボックス BT: 耐圧防爆 (d2G3)

流体

W: 水
A: 油
G: 空気・ガス
S: 蒸気

温度仕様

無記号: 60℃以下及び蒸気用 K: 61℃以上 (蒸気以外の流体)

圧力仕様

無記号: 1MPa以下 H: 1.6MPa

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type				F Class	H Class		L	H ₁	H ₂	
ME6-SSP-10	3/8	ネジ込 Rc	10	1.0	W: 0~0.8 A: 0~0.7 G: 0~0.5 S: 0~1	25	25	1.3	53	84	13	0.7
ME6-SSP-15	1/2		13.8	1.5		36	36	3.0	63	94	17	1.0
ME6-SSP-20	3/4		19	2.0		43	45	4.9	74	126	19	1.6
ME6-SSP-25	1		25	2.0	0~1.6	—	45 86	6.2	88	126	24	1.9
ME6-SSP-15WHK	1/2		13.8	2.0				3.0	63	120	18	1.5
ME6-SSP-20WHK	3/4		19	4.0				4.9	74	127	20	2.0
ME6-SSP-25WHK	1		25	4.0				6.2	88	127	25	2.2



ME6-LN2HM シリーズ

液体窒素

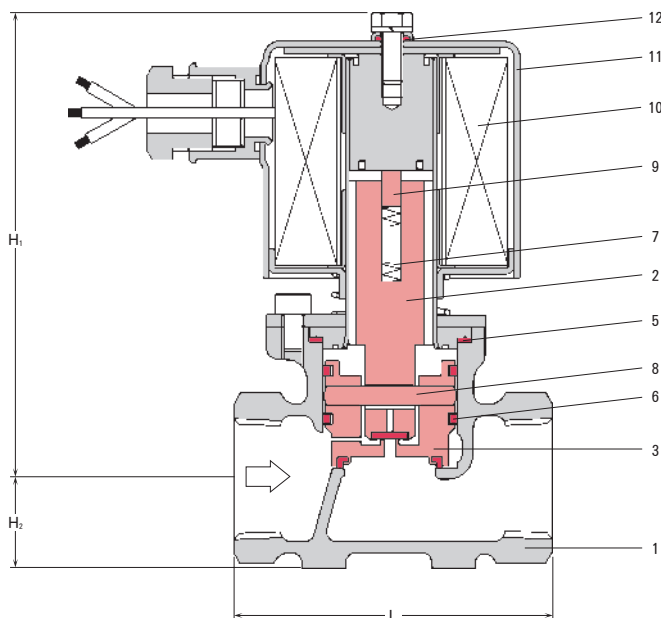
ステンレス製液体窒素用電磁弁

Stainless Cryogenic Solenoid Valve for Liquid Nitrogen

2WAY

動作(Operation) :
通電時開型(Normally Closed)

- 1.6MPa、大流量で使用出来るキックパイロット式液体窒素用電磁弁です。
- High flow rate cryogenic solenoid valve for liquid nitrogen up to 1.6MPa.



■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials
1	ボデー Valve Body	SCS13
2	プランジャー Plunger	SUS410 + PTFE
3	メインバルブ Ass'y Main Valve Ass'y	SUS304 + PTFE
4	バックレス Ass'y Packless Ass'y	SUS410 + SUS304
5	バックレスパッキン Packless Packing	PTFE
6	シールリング Seal Ring	XE-4 (トニメタル)
7	プランジャースプリング Plunger Spring	SUS304
8	平行ピン Pin	SUS420
9	プッシュロッド Push Rod	SUS304
10	コイル Coil	PEW
11	コイルボンネット Coil Bonnet	SPC + 塗装 (Coating)
12	防滴部品 Drip Proof Parts	SUS304 + NBR

■ 共通仕様 Common Specification

項 目 Item	内 容 Description
流体 Fluid	液体窒素 Liquid Nitrogen (LN2)
流体温度 Fluid Temperature	-196°C
電源 Power Source	AC100V 50/60Hz or AC200V 50/60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50°C RH90%以下 RH90% or less
標準付属品 Standard Accessories	防滴部品 Drip-proof Parts

■ 製品の型式記号 Model Type

ME6 - SSP - □□ LN2HM
シリーズ 口径

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power H Class	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type	φ [mm]					L	H ₁	H ₂	
ME6-SSP-15LN2HM	1/2	ネジ込	13.8	4.0	0~1.6	86	3.0	63	125	18	1.9
ME6-SSP-20LN2HM	3/4	Rc	19				4.9	74	130	20	2.0



高性能パイロット型電磁弁

High Quality, Long Life Type Solenoid Valve

2WAY

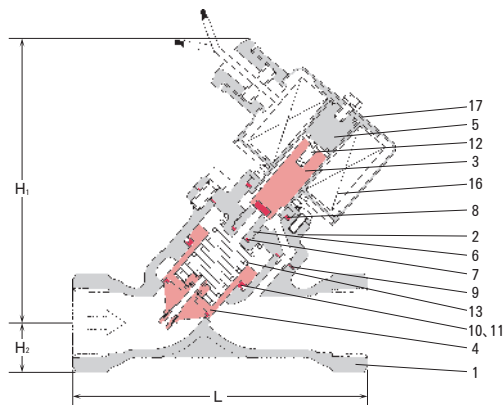
動作 (Operation) :

通電時開型 (Normally Closed)

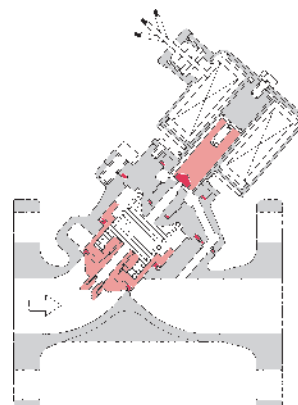
通電時閉型 (Normally Open)

●大流量、中高圧ラインの制御に最適です。

●Best type for large quantity of flow & mid-high pressure control.

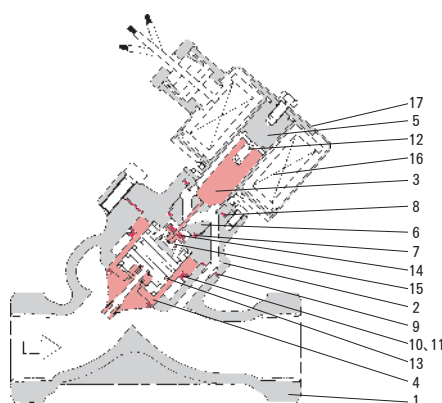


ネジ込み型 Screw Type



フランジ型 Flange Type

通電時開型 Normally Closed



通電時閉型 Normally Open



タフシート付 Stainless Seat

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts		材 質 Materials							
			通電時開型 Normally Closed				通電時閉型 Normally Open			
			常温用 MAX60℃		高温用 MAX200℃		常温用 MAX60℃		高温用 MAX200℃	
			10～25A	32～80A	10～25A	32～80A	10～25A	32～80A	10～25A	32～80A
1	ボデー	Valve Body	CAC406							
1a	タフシート	Stainless Seat	SUS304 ※							
2	バルブボンネット	Valve Bonnet	CAC406							
3	プランジャー	Plunger	SUS410 + FKM		SUS410 + PTFE		SUS410			
4	メインバルブAss'y	Main Valve Ass'y	SUS304 + PTFE	CAC406 + PTFE	SUS304 + PTFE	CAC406 + PTFE	SUS304 + PTFE	CAC406 + PTFE	SUS304 + PTFE	CAC406 + PTFE
5	バックレスAss'y	Packless Ass'y	SUS410 + SUS304							
6	バイパスシート	By-pass Seat	SUS304							
7	バイパスシートパッキン	By-pass Seat Packing	NBR		PTFE		NBR		PTFE	
8	バックレスパッキン	Packless Packing	NBR		PTFE		NBR		PTFE	
9	ボデーパッキン	Body Packing	NBR		PTFE		NBR		PTFE	
10	V リング	VRing	FKM		－		FKM		－	
11	Kリング+リリーフスプリング	KRing+Relieve Spring	－		PTFE + SUS304		－		PTFE + SUS304	
12	プランジャースプリング	Plunger Spring	SUS304							
13	メインバルブスプリング	Main Valve Spring	SUS304							
14	ニードルバルブAss'y	Needle Valve Ass'y	－				SUS304 + FKM		SUS304 + PTFE	
15	ニードルバルブスプリング	Needle Valve Spring	－				SUS304			
16	コイル	Coil	PEW							
17	コイルボンネット	Coil Bonnet	SPC+塗装 (Coating)							

※ タフシートはタフシート付製品にのみ、ボデー弁座部に埋め込まれております。10~50Aまでの製作となります。

※ Stainless seat is embedded in the valve seat of the body only for the product with the Stainless seat. And the available size is from 10A to 50A.

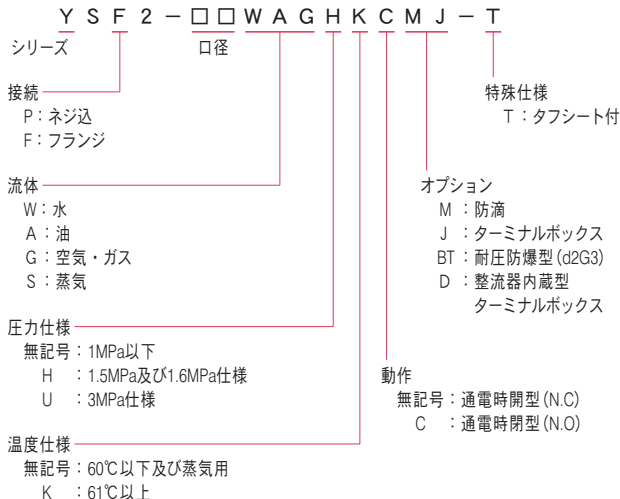
■ 共通仕様 Common Specification

項目 Item	内容 Description
流体 Fluid	水 油 空気 ガス 蒸気 Water Oil Air Gas Steam
流体温度 Fluid Temperature	MAX60℃ MAX200℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	F class H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 or 通電時閉型 Normally Closed or Normally Open ※
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス、耐圧防爆 (d2G3) その他の電源 Drip-proof Type, Terminal Box, Explosion-proof Type Other above Power Source

※ 通電時閉型につきまして、圧力0.1~3MPa仕様の製作は10~25Aまでとなります。32A以上は製作しておりません。

※ About normally open type, the fabrication of pressure range (0.1~3MPa) is for the size 10A to 25A. Not manufactured for over 32A.

■ 製品の型式記号 Model Type



■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.		最低作動差圧 Min.Operating Pressure Δ P [MPa]	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]				
	口径 Size	形状 Type		Water Oil	Air・Gas Steam			F Class	H Class		L	H ₁	H ₂					
YSP2-12	3/8	ネジ込 Rc	14.6	1.0		0.03	0.03～1	22	22	5.7	110	125	17	1.5				
YSP2-15	1/2		20	1.5				26	26	9.0	110	125	17	1.5				
YSP2-20	3/4									14.0	125	135	20	2.0				
YSP2-25	1		25								140	150	26	3.0				
YSF2-12	3/8	フランジ JIS10KFF	15	1.0		0.03	0.03～1	22	22	5.7	125	125	45	2.5				
YSF2-15	1/2		20	1.5				26	26	9.0	125	125	47.5	2.5				
YSF2-20	3/4									14.0	130	135	50	3.0				
YSF2-25	1									25.0	145	150	62.5	5.0				
YSF2-32	1 1/4		35	2.0				42	42	25.0	170	180	67.5	8.0				
YSF2-40	1 1/2		40							51.0	220	210	77.5	13.0				
YSF2-50	2		50	2.0 4.0				42	79	96.0	250	235	87.5	23.0				
YSF2-65	2 1/2		70							131.0	280	250	92.5	28.0				
YSF2-80	3		80															
YSP2-12H	3/8	ネジ込 Rc	15	1.5		0.03	WAG：0.03～2 S：0.03～1.6	30	26	5.7	110	125	17	1.5				
YSP2-15H	1/2		20							9.0	110	125	17	1.5				
YSP2-20H	3/4		34					34	14.0	125	135	20	2.0					
YSP2-25H	1								25		140	150	26	3.0				
YSF2-12H	3/8	フランジ JIS16KFF	14.6	1.5		0.03	0.03～1.6	30	26	5.7	125	125	45	2.5				
YSF2-15H	1/2		20							34	34	9.0	125	125	47.5	2.5		
YSF2-20H	3/4							14.0	130			135	50	3.0				
YSF2-25H	1		25					25.0	145			150	62.5	5.0				
YSF2-32H	1 1/4		35	4.0			WAG：0.03～1.5 S：0.03～1.6	79	42	32.0	170	180	67.5	8.0				
YSF2-40H	1 1/2		40							51.0	220	210	77.5	13.0				
YSF2-50H	2		50	1.5			0.03～1.6	26	26	96.0	250	235	87.5	23.0				
YSF2-70H	2 1/2		70							131.0	284	250	100	28.0				
YSF2-80H	3		80															
YSP2-12U	3/8	ネジ込 Rc	15	2.0		0.1	0.1～3 ※	29	42	5.7	110	125	17	1.5				
YSP2-15U	1/2		20					42	79	9.0	110	125	17	1.5				
YSP2-20U	3/4									14.0	125	135	20	2.0				
YSP2-25U	1		25								140	150	26	3.0				
YSF2-12U	3/8	フランジ JIS30KFF	14.6	2.0		0.1	0.1～3 ※	29	42	5.7	133	135	55	2.5				
YSF2-15U	1/2		20					42	79	9.0	137	135	57.5	2.5				
YSF2-20U	3/4									14.0	138	180	60	3.0				
YSF2-25U	1		25							25.0	140	157	65	5.0				
YSF2-35U	1 1/4		35	4.0				79	79	32.0	182	180	70	8.0				
YSF2-40U	1 1/2		40							51.0	192	185	80	9.0				
YSF2-50UD	2		50	7.0				32	33	96.0	232	255	82.5	13.0				
YSF2-70U	2 1/2		70							272	272	235	100	23.0				
YSF2-80U	3		80					26	26	131.0	306	250	105	28.0				

※ Y-Uタイプ (圧力0.1~3MPa仕様) につきまして、蒸気用は製作しておりません。

※ Y-Uタイプ (圧力0.1~3MPa仕様) につきまして、空気用の製作は10~25Aまでとなります。32A以上は製作しておりません。

※ About Y-U type (pressure 0.1~0.3MPa):

・ Not manufactured for steam.

・ The fabrication for air is for the size 10A to 25A, not manufactured for over 32A.

MSD
M3P
ZFD
VSPD
VSPD-LN2M
VSD
GVD
VD
VKD
VKK
VKK-SSP
ME6-SSP
ME6-LN2HM
Y
TEN
SSPD
SSAP
VHTD・VHT
SP・SR・SR-T
原子力用電磁弁
アクセサリ
結線方法
直流コイルと
交流コイル
の接続方法
図に示す通り
コイル・バルブ
電線の色とコイル
の接続方法
図に示す通り
流量表
Cv値計算式
主なS単位への
換算率表
電磁弁の構造
と注意事項
バルブの
主要材料表
材料の
耐蝕性



TEN シリーズ

水・油・空気

蒸気

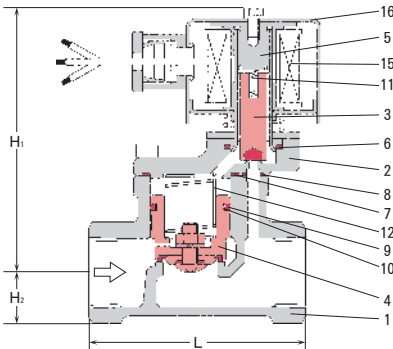
ローコスト汎用型電磁弁

Low Cost Type Solenoid Valve

2WAY

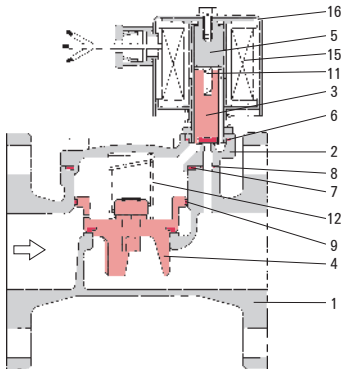
動作 (Operation) :
通電時開型 (Normally Closed)
通電時閉型 (Normally Open)

- 信頼性の高いローコスト電磁弁です。
- Reliable low-cost solenoid valve.

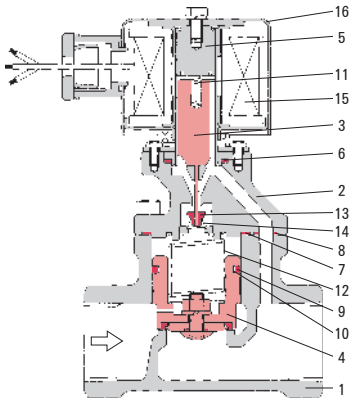


10~25A

通電時開型 Normally Closed



32~50A



通電時開型 Normally Open

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials							
		通電時開型 Normally Closed				通電時閉型 Normally Open			
		常温用 MAX60℃		高温用 MAX200℃		常温用 MAX60℃		高温用 MAX200℃	
		10~25A	32~50A	10~25A	32~50A	10~25A	32~50A	10~25A	32~50A
1	ボデー Valve Body	CAC406							
2	バルブボンネット Valve Bonnet	CAC406							
3	プランジャー Plunger	SUS410+FKM		SUS410+PTFE		SUS410			
4	メインバルブAss'y Main Valve Assy	C3771 + PTFE	CAC201 + PTFE	C3771 + PTFE	CAC201 + PTFE	C3771 + PTFE	CAC201 + PTFE	C3771 + PTFE	CAC201 + PTFE
5	バックレスAss'y Packless Assy	SUS410+SUS304							
6	バックレスパッキン Packless Packing	NBR	PTFE			NBR	PTFE		
7	ボデーパッキン Body Packing	NBR		PTFE		NBR		PTFE	
8	バイパスチューブパッキン By-Pass Tube Packing	NBR		PTFE		NBR		PTFE	
9	シールリング Seal Ring	PTFE	XE-4	PTFE		PTFE	XE-4	PTFE	
10	テンションリング Tension Ring	SUS304	—	SUS304	—	SUS304	—	SUS304	—
11	プランジャースプリング Plunger Spring	SUS304							
12	メインバルブスプリング Main Valve Spring	SUS304							
13	ニードルバルブAss'y Needle Valve Assy	—				SUS304+FKM		SUS304+PTFE	
14	ニードルバルブスプリング Needle Valve Spring	—				SUS304			
15	コイル Coil	PEW							
16	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)							

■ 共通仕様 Common Specification

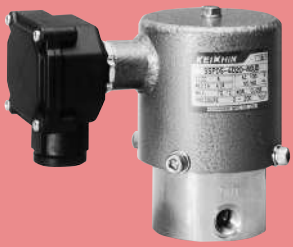
項 目 Item	内 容 Description
流体 Fluid	水 油 空気 ガス 蒸気 Water Oil Air Gas Steam
流体温度 Fluid Temperature	MAX60℃ MAX200℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	F class H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 or 通電時閉型 Normally Closed or Normally Open
周囲温度・湿度 Ambient Temp./ Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス、耐圧防爆 (d2G3) その他の電源 Drip-proof Type, Terminal Box, Explosion-proof Type Other above Power Source

■ 製品の型式記号 Model Type

T E N F - □ □ W A G C M J
シリーズ | 口径
接続 | 無記号：ネジ込
F：フランジ
流体 | W：水 A：油
G：空気・ガス
S：蒸気
オプション
M：防滴
J：ターミナルボックス
D：整流器内蔵型
ターミナルボックス
BT：耐圧防爆型 (d2G3)
動作
無記号：通電時開型 (N.C)
C：通電時閉型 (N.O)

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	最低作動差圧 Min.Operating Pressure ΔP [MPa]	使用圧力範囲 Pressure Range [MPa]	皮相電力 [VA±10%] Apparent Power		Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type					F Class	H Class		L	H ₁	H ₂	
TEN-10	3/8	ネジ込 Rc	15	1.0	0.03	WGS：0.03~1 A：0.03~0.7	25	25	3.2	70	105	17	1.1
TEN-15	1/2		20	1.5			36	36	4.1	70	105	17	1.1
TEN-20	3/4		25	2.0			43	43	7.4	80	120	19	1.7
TEN-25	1		32	2.0			43	43	12.0	100	130	24	2.2
TEN-32	1 1/4		40	2.0			43	43	17.5	110	150	28	2.8
TEN-40	1 1/2		50	2.0			43	43	22.4	120	155	31	3.4
TEN-50	2	フランジ JIS10KFF	32	2.0	0.03	WGS：0.03~1 A：0.03~0.7	43	43	37.0	140	165	38	4.4
TENF-32	1 1/4		40	2.0			43	43	17.5	150	150	68	6.8
TENF-40	1 1/2		50	2.0			43	43	22.4	160	155	70	7.6
TENF-50	2		50	2.0			43	43	37.0	170	165	78	9.7



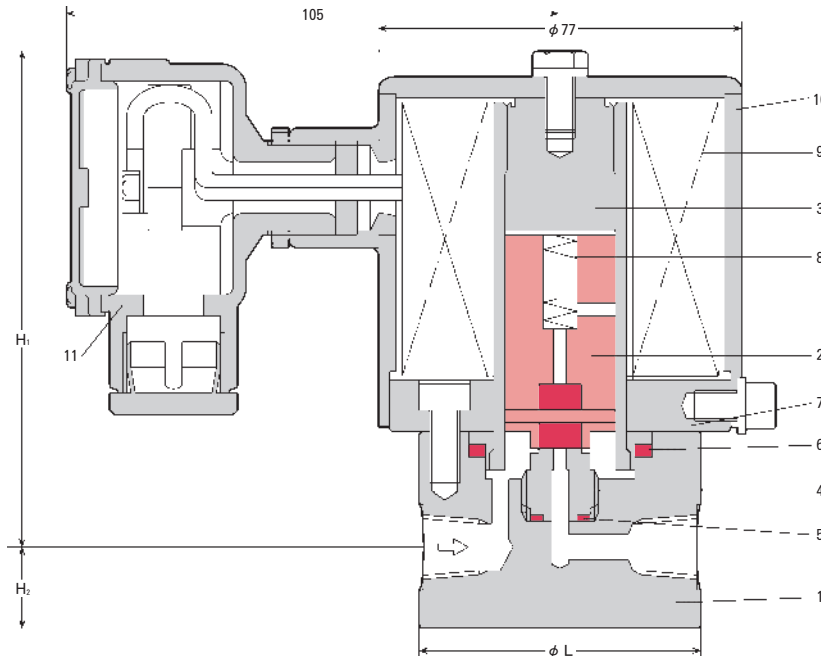
超高压用直動型電磁弁

Ultra High Pressure Type Solenoid Valve

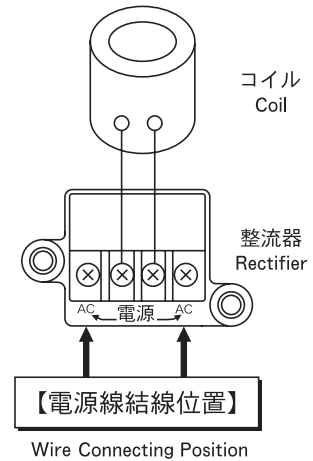
2WAY

動作(Operation) :
通電時開型(Normally Closed)

- 超高压20MPaまで使用出来る電磁弁です。
- Ultra high pressure type solenoid valve up to 20MPa.



■ 結線図 Wiring Chart



■ 主要部品表 Main Parts List

No.	名称 Name of Parts	材質 Materials
1	ボデー Valve Body	SUS304
2	プランジャー Plunger	SUS410+ PTFE
3	バックレスAss'y Packless Ass'y	SUS410+ SUS304
4	バイパスシート By-pass Seat	SUS304
5	バイパスシートパッキン By-pass Seat Packing	FKM
6	バックレスパッキン Packless Packing	FKM
7	セットプレート Set Plate	S15C
8	プランジャースプリング Plunger Spring	SUS304
9	コイル Coil	PEW
10	コイルボンネット Coil Bonnet	SPC+塗装(Coating)
11	整流器内蔵型ターミナルボックス Terminal Box with built-in Rectifier	組立品

■ 共通仕様 Common Specification

項目 Item	内容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	MAX70℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、その他の電源 Drip-proof Type, Other above Power Source
標準付属品 Standard Accessories	整流器内蔵型ターミナルボックス (DC コイル使用のため) Terminal Box with built-in Rectifier

■ 製品の型式記号 Model Type

SSPD-□□GUKD-01

シリーズ

口径

オプション

流体

W: 水 A: 油 G: 空気・ガス

D: 整流器内蔵型ターミナルボックス M: 防滴 J: ターミナルボックス

■ 仕様 Valve Specification

型式 Model	接続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	使用圧力範囲 Pressure Range [MPa]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸法 [mm] Dimensions			質量 Weight [kg]
	口径 Size	形状 Type						L	H ₁	H ₂	
SSPD-8	1/4	ネジ込 Rc	2	4.0	0~20	29	0.12	60	109	16	4.0
SSPD-12	3/8							60	108	17	4.0
SSPD-15	1/2							60	109	21	4.0
SSPD-20	3/4							70	113	22	4.5
SSPD-25	1							70	114	26	4.5

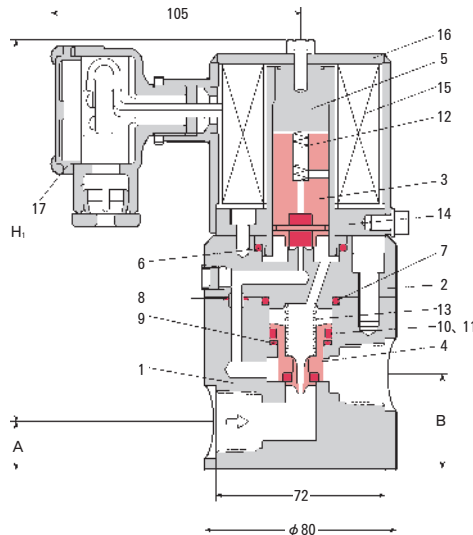
SSAP シリーズ

2WAY

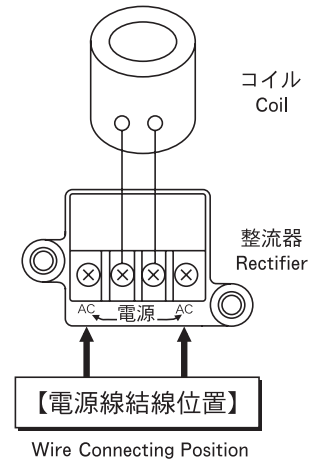
動作(Operation):
通電時開型(Normally Closed)超高压用パイロット型電磁弁
Ultra High Pressure Type Solenoid Valve

●超高压20MPaまで使用出来る大流量電磁弁です。

●Ultra high pressure and big flow rate valve used up to 20MPa.



■ 結線図 Wiring Chart



■ 主要部品表 Main Parts List

No.	名称 Name of Parts	材質 Materials
1	ボデー Valve Body	SUS304
2	バルブボンネット Valve Bonnet	SUS304
3	プランジャー Plunger	SUS410+PTFE
4	メインバルブAss'y Main Valve Ass'y	SUS403+PTFE
5	バックレスAss'y Packless Ass'y	SUS410+SUS304
6	バックレスパッキン Packless Packing	FKM
7	ボデーパッキン Body Packing	FKM
8	バイパスチューブパッキン By-Pass Tube Packing	FKM
9	メインバルブパッキン Main Valve Packing	FKM
10	ブレーンリング Seal Ring	PTFE
11	テンションリング Tension Ring	SUS304
12	プランジャースプリング Plunger Spring	SUS304
13	メインバルブスプリング Main Valve Spring	SUS304
14	セットプレート Set Plate	S15C
15	コイル Coil	PEW
16	コイルボンネット Coil Bonnet	SPC+塗装(Coating)
17	整流器内蔵型ターミナルボックス Terminal Box with built-in Rectifier	組立品

■ 共通仕様 Common Specification

項目 Item	内容 Description
流体 Fluid	水 油 空気 ガス Water Oil Air Gas
流体温度 Fluid Temperature	MAX70℃
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、その他の電源 Drip-proof Type, Other above Power Source
標準付属品 Standard Accessories	整流器内蔵型ターミナルボックス (DC コイル使用のため) Terminal Box with built-in Rectifier

■ 製品の型式記号 Model Type

S S A P - □ □ G U K D

シリーズ 口径

オプション

D: 整流器内蔵型ターミナルボックス
M: 防滴 J: ターミナルボックス

流体

W: 水 A: 油 G: 空気・ガス

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	最低作動差圧 Min. Operating Pressure ΔP [MPa]	使用圧力範囲 Pressure Range [MPa]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸 法 [mm] Dimensions			質 量 Weight [kg]
	口径 Size	形状 Type							H	A	B	
SSAP-8	1/4	ネジ込 Rc	8	4.0	0.2	0.2~20	29	1.0	153	15	28	5.0
SSAP-12	3/8		8						153	15	28	5.0
SSAP-15	1/2		13					2.6	160	20	40	5.0
SSAP-20	3/4		13						160	20	40	5.0
SSAP-25	1		20						170	23	40	5.0



VHTD・VHTシリーズ

水・蒸気

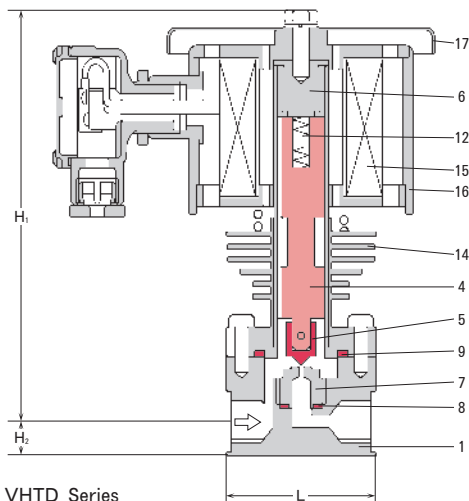
高温・高圧用電磁弁

High Temperature, High Pressure Type Solenoid Valve

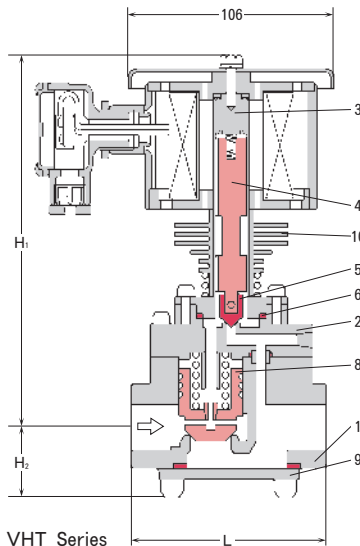
2WAY

動作(Operation) :
通電時開型(Normally Closed)

- 250℃までの高温流体制御に好適です。
- Good for high temperature fluid control up to 250℃.



VHTD Series



VHT Series

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		VHTD	VHT
1	ボデー Valve Body	SUS304	
2	バルブボンネット Valve Bonnet	—	SUS304
3	ボトムカバー Bottom Cover	—	SUS304
4	プランジャー Plunger	SUS410	
5	メインバルブAss'y Main Valve Ass'y	—	SUS304+stellite
6	バックレスAss'y Packless Ass'y	SUS410+SUS304	
7	バイパスシート By-pass Seat	SUS304+stellite	—
8	バイパスシートパッキン By-pass Seat Packing	PTFE	—
9	バックレスパッキン Packless Packing	PTFE	
10	ボデーパッキン Body Packing	—	PTFE
11	ボトムカバーパッキン Bottom Cover Packing	—	PTFE
12	プランジャースプリング Plunger Spring	SUS304	
13	メインバルブスプリング Main Valve Spring	—	PTFE
14	フィン Fin	C3602	
15	コイル Coil	PEW	
16	コイルボンネット Coil Bonnet	SPC+塗装 (Coating)	
17	コイルカバー Coil Cover	SPC+塗装 (Coating)	

■ 共通仕様 Common Specification

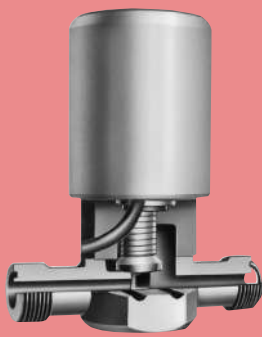
項 目 Item	内 容 Description
流体 Fluid	水 蒸気 Water Steam
電源 Power Source	AC100V 50/60Hz, AC110V 60Hz or AC200V 50/60Hz, AC220V 60Hz
絶縁種別 Class	H class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)
取付姿勢 Installation	鉛直±90° A Coil Vertical ±90°
動作 Operation	通電時開型 Normally Closed
周囲温度・湿度 Ambient Temp./Humidity	0~50℃ RH90%以下 RH90% or less
オプション Option	防滴、ターミナルボックス Drip-proof Type, Terminal Box

■ 製品の型式記号 Model Type

V H T D - □ □ S W U K J
シリーズ 口径 オプション
M: 防滴 J: ターミナルボックス
流体 W: 水 S: 蒸気

■ 仕様 Valve Specification

型 式 Model	接 続 Connection		オリフィス Orifice φ [mm]	コイル Coil No.	最低作動差圧 Min. Operating Pressure ΔP [MPa]	使用圧力範囲 Pressure Range [MPa]	液体温度 Fluid Temperature [℃]	皮相電力 Apparent Power [VA±10%]	Cv値 Cv Value	寸 法 [mm] Dimensions			質量 Weight [kg]
	口径 Size	形状 Type								L	H ₁	H ₂	
VHTD-8SWUKJ	1/4	ネジ込 Rc	3.5	2.0	0	0~3.5	250	48	0.35	60	160	13	5.7
VHTD-12SWUKJ	3/8									60	160	13	5.7
VHTD-15SWUKJ	1/2									60	160	16	5.7
VHTD-25SWUKJ-X	1									80	170	26	6.0
VHT-20SWUKJ	3/4	ネジ込 Rc	20.0	2.0	0.1	0.1~3.5	250	48	4.0	100	190	17	7.0
VHT-25SWUKJ	1									100	190	17	7.0



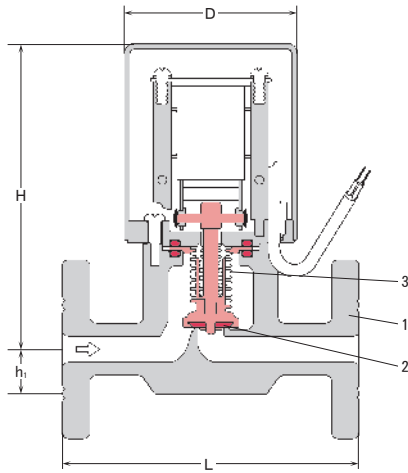
樹脂製耐蝕電磁弁

Anticorrosion Plastioc Type Solenoid Valve

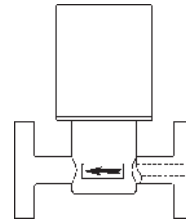
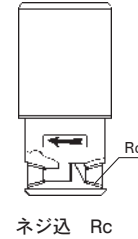
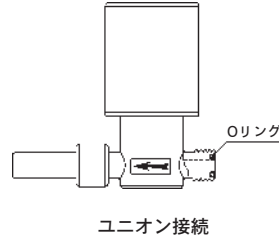
2WAY 3WAY

動作 (Operation) :
通電時開型 (Normally Closed)
通電時閉型 (Normally Open)

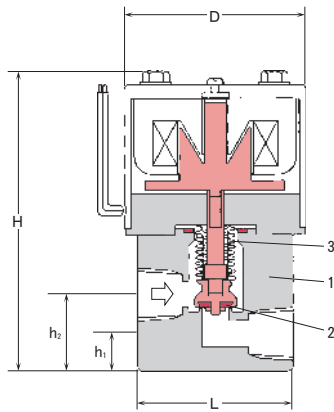
- 純水・酸・アルカリ・塩類など特殊流体に最適。
- Best for special fluid like acid, alkali and salts.



SP型 (2方弁)



フランジ

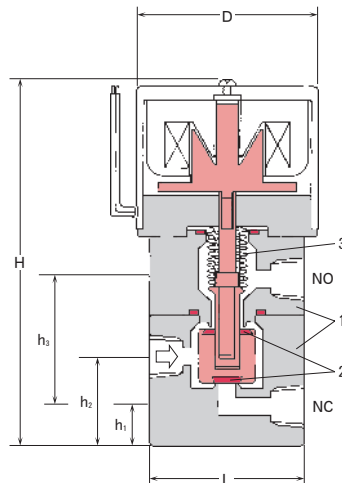


SR型 (2方弁)

SR流れ方向 (2方弁)

Sタイプ

Lタイプ



SR-T型 (3方弁)

SR-T流れ方向 (3方弁)

Y1タイプ

Y2タイプ

Y3タイプ

Y4タイプ

■ 製品の型式記号 Model Type

S P □ C U 接続形状 電源 Oリング材質

オプション U: ターミナルボックス

作動 無記号: 通電時開型 (N.C)
C: 通電時閉型 (N.O)

サイズ

ボデー材質 P: PP T: PTFE V: PVC E: PE

S R □ T C U 接続口径 材質 電源 流れ方向

オプション U: ターミナルボックス

作動 無記号: 通電時開型 (N.C)
C: 通電時閉型 (N.O)

構造 無記号: 2方弁
T: 3方弁

サイズ

■ 主要部品表 Main Parts List

No.	名 称 Name of Parts	材 質 Materials	
		SP	SR
1	ボデー Valve Body	PP or PTFE or PVC or PE	PP or PTFE
2	シート Seat	FEPM or EPDM	
3	ベローズ Bellows	PTFE	

■ 共通仕様 Common Specification

項 目 Item	内 容 Description	
	SP	SR
流体 Fluid	純水 酸 アルカリ 塩類 特殊流体 Deionized Water Acid Alkali Salt Special Liquid	
流体温度 Fluid Temperature	MAX105℃	MAX80℃
電源 Power Source	AC100V 50/60Hz or AC200V 50/60Hz	AC100V 50/60Hz or AC200V 50/60Hz or DC24V or DC12V
絶縁種別 Class	B class	E class
流体粘度 Fluid Viscosity	50mm ² /s (50cst)	
取付姿勢 Installation	正立 Erection	
動作 Operation	通電時開型 or 通電時閉型 Normally Closed or Normally Open	
周囲温度・湿度 Ambient Temp./Humidity	0~40℃ RH90%以下 RH90% or less	
オプション Option	ターミナルボックス Terminal Box	

■ 仕様 Valve Specification

型式 Model	接 続 Connection		オリフィス Orifice φ [mm]	使用圧力範囲 Pressure Range [MPa]				消費電力 [VA±10%] Power Consumption		Cv値 Cv Value	寸 法 [mm] Dimensions						
	口径 Size	形状 Type		通電時開型		通電時閉型		通電時開型	通電時閉型		L				H	h ₁	D
				一次側	二次側	一次側	二次側				ネジ	ユニオン	JIS5KFF	JIS10KFF			
S□2	1/4	ユニオン or フランジ JIS10K or JIS5K or ネジ込 Rc	6.0	0.117	0.147	0.12	0.2	42以下	40以下	0.7	60	100	120	120	130.5	18	78
S□3	3/8		9.0					60	100	120	120						
S□4	1/2		12.0					43以下	44以下	1.9	70	130	130	130			
S□6	3/4		18.0	0.078	0.039	0.06	0.05	58以下	58以下	3.9	89	150	150	150	193	24	100
S□8	1		24.0	0.039	0.019	0.05	0.02			6.8	100	170	170	170	210	30	
S□12	1 1/4	フランジ JIS10K or JIS5K	32.0	0.031	0.01	—	—	96以下	—	12.6	—	—	—	220	267	32	135
S□15	1 1/2		40.0	0.024	0.002			168以下	—	16.5	—	—	240	240	308.5	40	160

構造 Port	型式 Model	接 続 Connection		オリフィス Orifice φ [mm]	最高使用圧力 Max Pressure [MPa]	消費電流 [mA±10%] Current Consumption				Cv値 Cv Value	寸 法 [mm] Dimensions					
		口径 Size	形状 Type			AC100V	AC200V	DC24V	DC12V		L	H	h _i	h _e	h _s	D
2方弁 2WAY	SR2	1/8	ネジ込 Rc	2.0	0.078	56	42	199	377	0.06	35	62.4 ※	7	16	—	39
	SR4	1/8 or 1/4		4.0	0.098	103	79	387	764	0.32	45	89 ※	9	20	—	56
	SR5	1/4 or 3/8		6.0	0.118	172	119	628	1262	1.07	55	105.5 ※	13	27	—	65
				9.0							55	105.5 ※	13	27	—	65
3方弁 3WAY	SR4T	1/8	ネジ込 Rc	4.0	0.098	103	79	387	628	0.37 / 0.38	45	123	9	26	42	56
	SR5T	1/4 or 3/8		6.0	0.098	172	119	628	1262	0.85 / 0.82	55	140.5	13	31	45	65

※ 通電時開型の寸法です。通電時閉型の場合は、SR2C H=68.5、SR4C : H=99、SR5C H=117.5となります。

※ Dimensions of normally open type : SR2C H=68.5, SR4C H=99, SR5C H=117.5

■ 標準適用材質表 Applicable Materials

流体名	濃度%	ボデー材質	ゴム材質	流体名	濃度%	ボデー材質	ゴム材質	流体名	濃度%	ボデー材質	ゴム材質
亜硫酸ガス	各濃度	PP	FEPM	酢酸	50	PP	EPDM	ふっ酸	50	PP	FEPM
アンモニアガス			EPDM	酢			EPDM	硫酸	59以下		EPDM
アンモニア水	28			硝酸	20			FEPM	60以上	PE	FEPM
塩化カルシウム	10			30	PVC	硫化ソーダ	各濃度	PP	EPDM		
塩化第二鉄	各濃度			PVC		重炭酸ソーダ				硫化カリ	各濃度
塩素水		重亜硫酸ソーダ					硫酸アルミ			各濃度	
塩酸	各濃度	PP	FEPM	次亜塩素酸ソーダ	各濃度	硫酸銅	15				
苛性ソーダ	25		EPDM	次亜塩素酸カリ	各濃度	硫化第一鉄					
	50			次亜塩素酸カルシウム	各濃度	硫酸ニッケル					
苛性カリ	各濃度			炭酸		PP	EPDM	磷酸	85	PTFE	FEPM
クローム酸	10		FEPM	炭酸ソーダ				トリクレン	各濃度		

■ 注意事項 Precaution Statement

- 御注文及びお引き合いの際は、使用流体、濃度、圧力、温度、電源、接続口径及び形状をお知らせ下さい。
- ご希望の材質があればご指定下さい。
- SRシリーズは、流れ方向をご指定下さい。また、接続口径をご指定下さい。
- When order or inquiry, please inform us the fluid, pressure, temperature, power source, concentration, connecting size and type.
- Please specify the desired materials if you have.
- About SR series, please specify flow direction and connecting size.

原子力用電磁弁 (ヒラタ・ケイヒングループ)

Solenoid Valve for Atomic Power

特 長

●品質保証

原子力用弁として要求される高信頼性(高品質)を確保するために、原子力弁製作管理体制のもとに、素材から、製造、検査、出荷、アフターサービスまで一貫した管理を行っています。

●グランドレス(バックレス)構造

外部との気密確保はペローズや、バックレスを用いて、完全に内部と外部とが隔離される構造です。

●用途に応じた豊富なバリエーション

- ①水及び空気の流体仕様に合わせて型式を選べます。
- ②通電時開型、通電時閉型の両機種があります。

●シート材の選定

流体仕様、即ち、空気N₂等のガス体にはゴムシート、水、熱水にはステライトシートと、用途に応じて適切なシート材質が選べます。

●作動圧力範囲

最低作動差圧0MPaから高圧まで使用できます。

●電源、定格

AC、DC共に製作できます。

連続通電してもコイルが焼けることなく安定して作動する連続定格です。

●絶縁種別

コイルの絶縁種別はJIS規格に基づくH種(高温)及びB種(常温)です。

●電氣的耐水性

電気部の耐水性は「NEMAIV」規格に準じており安心して使用できます。

●耐圧防爆型

アクチュエータは耐圧防爆型(JIS合格)も製作できます。

●正確な作動(AH型のみ)

直動型キック方式電磁弁なので作動不良等の事故発生がありません。

●完全な気密性(AHB型のみ)

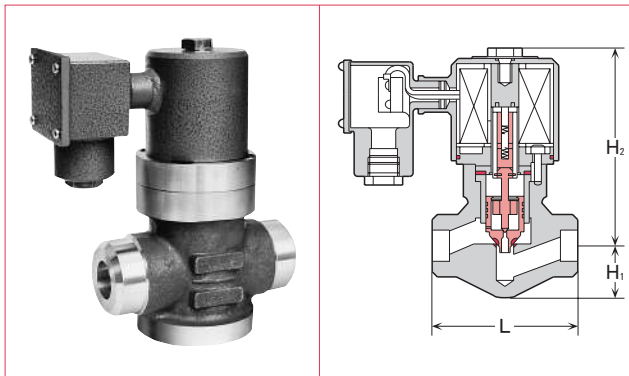
ステムシールは特殊溶接ペローズを使用しているので気密性の保持は完全です。

●主弁動作の確認(AHB型のみ)

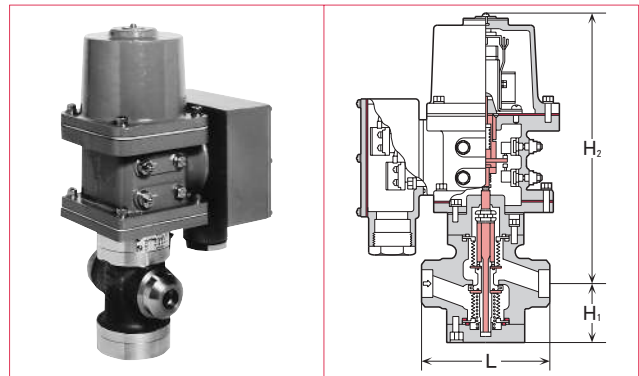
リミットスイッチにより、主弁の動作の状態が直接機械的に電気信号として確認できます。

リミットスイッチは、2回路双断スイッチが開側2ヶ、閉側2ヶセットされています。開・閉確認および他の機器への指示ができます。

AHシリーズ



AHBシリーズ

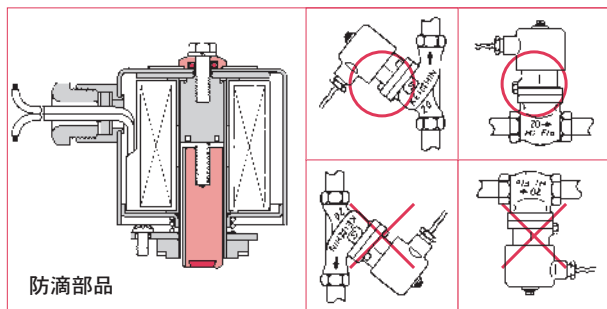


■仕様 Valve Specification

タイプ		型 名 Model				接 続 Conne- ction JISB2306 SW呼び	動作 (通電時)	流体	要部材質		作動圧力 MPa	温度 Max℃	Cv値 Cv Value	寸 法 (m/m) Dimensions		
		型 名 Model	コイル Coil No.	オリフィス Orifice m / m φ	口 径 Size (in.)				本体	シート				H ₁	H ₂	L
キックタイプ	標準型	AH	20	15	8	1/4	開 及 び 閉	空気 窒素ガス その他 ガス体 水	S25C SUSF304 SUSF316	気体 EPDM 液体 ステライト	0 ~ 0.98	気体 150 流体 200	1.4	40(60)	145(130)	110
		AH	20	15	10	3/8							2.5	40(60)	145(130)	110
		AH	20	15	15	1/2							3.5	40(60)	145(130)	110
		AH	20	25	20	3/4							5.0	50(75)	175(150)	152
		AH	20	25	25	1							5.0	50(75)	175(150)	152
	高圧型	AH	20	25	20H	3/4	開 及 び 閉	水	S25C SUSF304 SUSF316	ステライト	0 ~ 1.56	200	5.0	50(75)	175(160)	152
		AH	20	25	20U	1							5.0	50(75)	175(160)	152
		AH	20	25	25H	3/4					0 ~ 3.92		5.0	50(75)	175(160)	152
		AH	20	25	25U	1							5.0	50(75)	175(160)	152
	高温高圧	AHT	40	15	15	1/2	開 及 び 閉	蒸気	S25C SUSF304 SUSF316	ステライト	0 ~ 8.62	302	1.5	50	250(240)	152
		AHT	40	15	20	3/4							1.5	50	250(240)	152
		AHT	40	15	25	1							1.5	50	250(240)	152
ペローズタイプ	AHB	8A	32	15	1/2	開 及 び 閉	空気 窒素ガス その他 ガス体	S25C SUSF304 SUSF316	EPDM	0 ~ 0.98	150	5.0	70(80)	325(315)	152	
	AHB	8A	32	20	3/4							7.0	70(80)	325(315)	152	
	AHB	8A	32	25	1							7.0	70(80)	325(315)	152	

上記のほか、原子力用の2方口弁、3方口弁、方向制御弁など多数製作しております。() は通電時閉型の寸法です。

防滴型

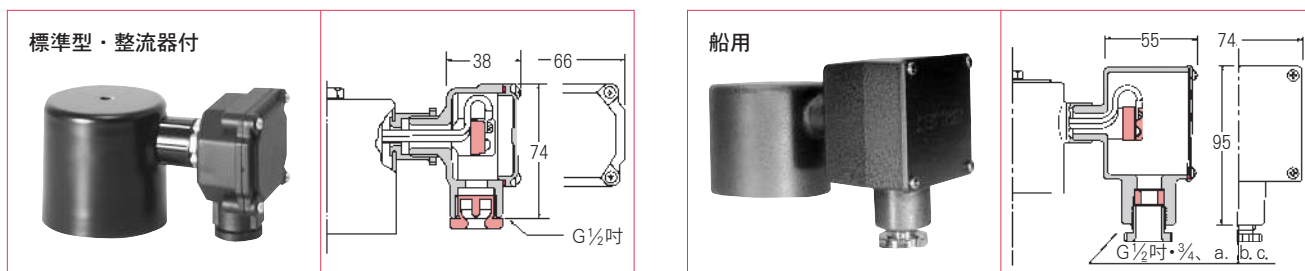


防滴構造は上部からの水滴によるコイル部のトラブルを未然に防ぐ構造になっています。従って、吹き上げ等による下からの水滴の侵入には対応しておりません。
防滴型に限り、取付姿勢は、コイルハウジング部が本体の上部にある必要があります。

水滴が入らないよう上部にOリングの入ったキャップを取付けています。
ターミナルBOXとの組合せもできます。

ターミナルBOX付

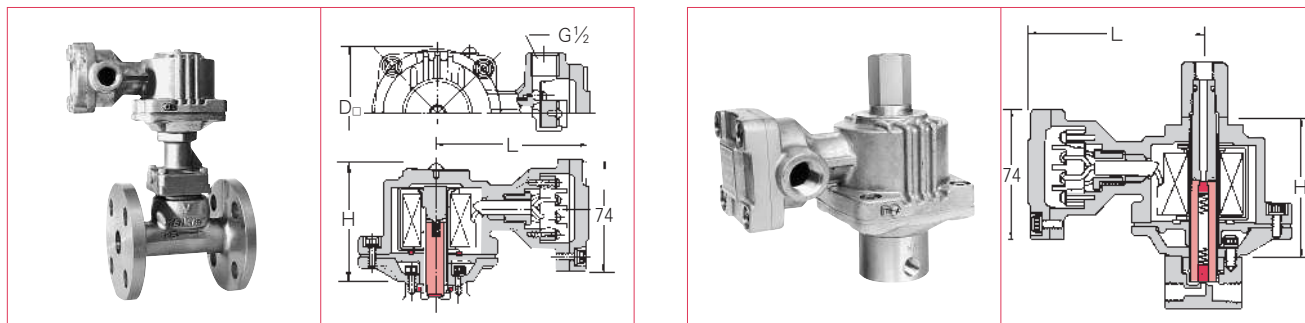
ターミナルBOXには、標準型、整流器付、船用型、船用整流器付の4種あり、いずれのタイプもコイルハウジングのリード線出口に、端子を内蔵したBOXをセットし、電気配線が容易にできます。



耐圧防爆型

可熱性ガスや、引火性のある液体の気化ガスで爆発の危険のある使用環境では、爆発や火災の発生を防止するために、防爆構造の電磁弁を使用することが義務づけられています。

耐圧防爆構造とは、爆発性ガスにより容器内部で爆発が起った場合に、容器がその爆発圧力に耐え、しかも容器の外部の爆発性ガスに引火しない構造です。



■労働省産業安全研究所認可品……d2G3

コイルの種類	常温用（流体温度90℃以下）		高温用（流体温度150℃以下）	
流 体	液 体 ・ 気 体		スチーム・液 体 ・ 気 体	
電 源 ・ サイクル	DC24V、100V、200V、AC100-50/60、AC200-50/60			
	DV48V、AC110-50、AC110-60 AC220-50、AC220-60		DV12V、AC110-50、AC110-60 AC220-50、AC220-60	

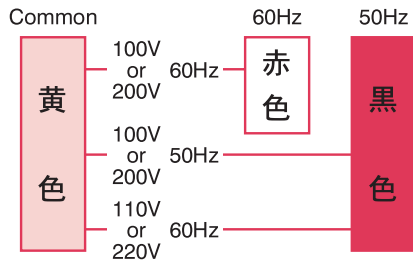
コイル型式	2方向 (m/m)			3方向 (m/m)		
	D ₀	H	L	D ₀	H	L
1.0	78	84	107	78	87	107
1.5	92	88	114	92	91	114
2.0	98	105	118			

■爆発性ガスの爆発等級、発火度、比重 (抜萃)

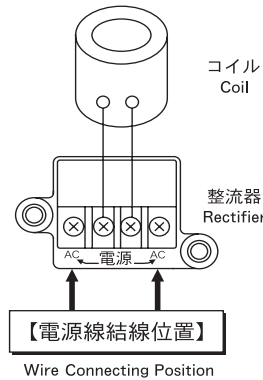
物質名	爆発等級	発火度	比重 (空気=1)	物質名	爆発等級	発火度	比重 (空気=1)	物質名	爆発等級	発火度	比重 (空気=1)	物質名	爆発等級	発火度	比重 (空気=1)
アセチレン	3	G2	0.90	一酸化炭素	1	G1	0.97	クロロベンゼン	1	G1	3.88	ブタン	1	G2	2.05
アセトアルデヒド	1	G4	1.52	エタン	1	G1	1.04	酢酸	1	G1	2.07	プロパン	1	G1	1.56
エチルエーテル	1	G4	2.55	エタノール	1	G2	1.59	酢酸エチル	1	G1	3.04	ヘキサン	1	G3	2.79
水素	3	G1	0.07	エチレンオキシド	2	G2	1.52	酢酸ビニル	1	G2	2.97	ベンゼン	1	G1	2.70
水性ガス	3	G1	—	エチレン	2	G2	0.97	シクロヘキサン	1	G3	2.90	ペンタン	1	G3	2.49
アセトン	1	G1	2.00	オクタン	1	G3	3.94	シアン化水素	1	G1	0.93	メタン	1	G1	0.55
アンモニア	1	G1	0.59	ガソリン C5H12~C9H20	1	G3	3~4	スチレン	1	G1	3.59	メタノール	1	G1	1.10
イソブレン	2	G3	2.35	O・M・Pキシレン	1	G1	3.66	トルエン	1	G1	3.18	硫化水素	1	G3	1.19

〈3本リード線のサイクル色区分〉

コイルからリード線が3本出ている電磁弁の場合、下記のように周波数によって2本のリード線を選び結線して下さい。その際、残った1本のリード線は絶縁処理をして下さい。

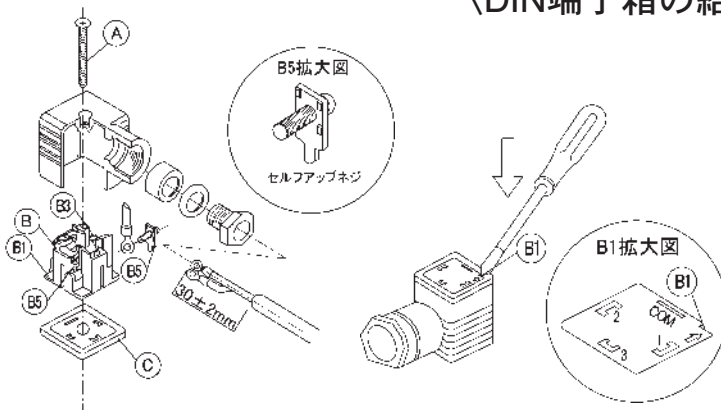


〈整流器内蔵型ターミナルボックスの結線〉



- ・銘板記載電圧と電源電圧をご確認下さい。
- ・交流電源との接続は両端のAC【電源線結線位置】に行ってください。
- ・コイルのリード線が結線されている端子には繋がないで下さい。
- ・間違って中央2個所に接続すると整流器が焼けてしまいます。

〈DIN端子箱の結線〉



1. DIN端子箱の分解

- ①ネジAを弛めて、DIN端子箱を取り外して下さい。
- ②端子台Bの底の部分に切り欠き部B1（矢印の表示有り）がありますので、隙間に小型マイナスドライバー等を差し込みこじると、端子台Bが外れます。

2. 端子台Bへ電源線配線

- ①端子台Bの裏に数字の記載があります。この数字の「1」「2」（B3及びB5のネジ）に電源線を結線して下さい。

3. DIN端子箱の組立

- ①DIN端子箱に結線した端子台Bを戻して下さい。（パチンと音がするまで押して下さい。）
- ②ガスケットCを端子台Bの底の部分とコイルボーンネットに付いているプラグの間に入れ、端子箱をプラグに差し込んで下さい。
- ③ネジAを締め、取付完了です。

直流コイルと交流コイル

Direct Current Coil & Alternate Current Coil

直流は常に一定の強さで、一定の方向に流れる電流です。

一方、交流は時間と共に電流の流れる強さが変わり、方向が逆に変わります。

直流と交流の違いは下図のように表せます。

交流は、横軸が電流ゼロ、上の山と下の山では逆方向への電流の流れを表しています。

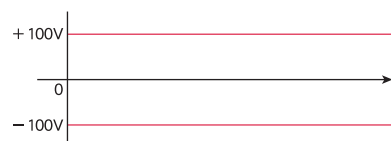
電流ゼロでは吸引力が無くなってしまいます。これを解消するために、交流コイルを使用する電磁弁では、バックレスのプランジャー吸着面に隔取リングを入れて波形の位相をずらし、吸引力ゼロ位置を無くして出来る限り同じ強さの流れ（吸引力）にしています。しかし、直流のように完全に一定の強さには出来ないため、吸引力の強さの変化がプランジャーとバックレスの吸着面間の微小振動となっており音が発生する場合があります。また、吸着面に異物等が混入しますと隔取リングの効果が無くなり、うなり音が大きくなって騒音を発生します。ちなみに、うなり音の振動は電源周波数の2倍の周波数で振動しています。

なお、交流コイルの場合、プランジャーとバックレスが異物などにより完全に吸着しないと自己誘導作用で磁束が増加して電流が増し（吸着力を増すために電流値が高くなり）、コイルの温度上昇値が正常値を超えてしまい、コイルが焼損するおそれがあります。発電所から家庭等に送られてくるのは全て交流のため、直流コイルを使用する場合にはバッテリー等の専用の電源を用意するか、ダイオード等で交流から直流に変換する必要があります。

直流：Direct Current (DC) 交流：Alternate Current (AC)

周波数：1秒間に繰り返される波の数のことで、ヘルツ [Hz] という単位で表されます。

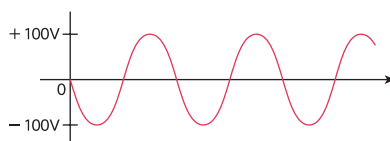
直流 (DC)



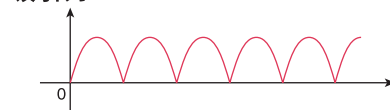
吸引力



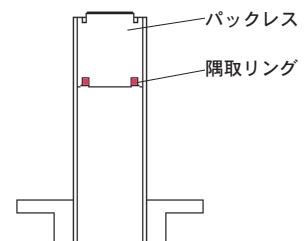
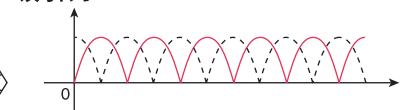
交流 (AC)



吸引力

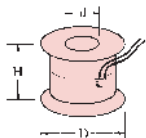
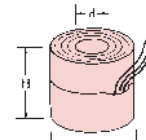


吸引力



コイル表

Coil Type Table

コイル型式 Coil Type	コイル 形 状	絶縁 種別	寸 法			AC2方向			AC3方向			DC W	コイル形状と仕様 2本リード線はサイクル共用 3本リード線はサイクルごとに結線
			dφ	H (m/m)	Dφ	定格電力		出力 W	定格電力		出力 W		
						保持時 VA	起動時 VA		保持時 VA	起動時 VA			
0.7	I	E 種	15	29	35	10	40	6	13	52	8	8	I) ボビン巻コイル  AC 100、110、200、220V 2本線、3本線
	II	B 種	15	29	30								
1.0	I	E 種	15	36	36	17	68	10	20	80	12	9 ~ 13	E 種 エポキシコーティング仕上げ 0.5mm ² 耐熱ビニール電線 ℓ=200m/m F 種 エポキシコーティング仕上げ 0.5mm ² ℓ=300m/m ポリエチレン電線 H 種 ガラスシリコン仕上げ 0.5mm ² シリコンゴム ガラス編組線
	II	B 種	15	36	40								
	I	F 種	15	36	42	25	100	15					
	I・III	H 種	16	38	46	20	80	12	23	92	14		
1.5	II	B 種	21	40	52	24	96	15	28	112	17	14 ~ 19	
	I	F 種	21	40	56	36	144	22					
	I・III	H 種	21	40	56	28	112	17	32	128	19		
2.0	II	B 種	23.5	55	57	48	192	34	55	220	39	14 ~ 18	
	I	F 種	23.5	55	64	43	172	30					
	I・III	H 種	23.5	55	65	48	192	34	55	220	39		
4.0	III	H 種	28	58	65	66	264	46	85	340	60	14 ~ 29	
7.0	II	B 種	34	74	68							25 ~ 31	
	III	H 種	34	72	76								
8.0	III	H 種	51	96	84							70	III) 層間紙巻コイル  AC 100、110、200、220V 0.5mm ² ℓ=300m/m テフロンチューブに ガラス編組被覆線 2本線、3本線

●電磁弁に使用する開閉器、スイッチ類について
コイル表の0.7~7.0型を使用しているAC電源の場合は、もっともポピュラーな250V 接点容量3~5A(汎用品)をお使い下さい。

ソレノイド表

Solenoid Type Table

ソレノイド 型 式 Solenoid Type	形 状 寸 法 (m/m)	定格電力 (VA)				標 準 使 用		絶 縁				そ の 他
		50HZ		60HZ		電 圧	リード線	種別	定格	抵 抗	耐 圧	
		保持時 VA	起動時 VA	保持時 VA	起動時 VA							
3A		40	400	42	460	AC 100V 50/60HZ	耐熱ビニール線 3本 0.75mm ℓ=285m/m 赤 色=COMMON 灰色=60HZ 緑色=50HZ	B 種	連続	500Vメガー 50MΩ以上	1500V 1分間保持	手動フッ シユビン付
4A		56	520	64	620	AC 200V 50/60HZ						
5A		54	700	76	820	+10% -15%						
6A		68	800	78	920							

電気絶縁の耐熱クラス及びコイルについて

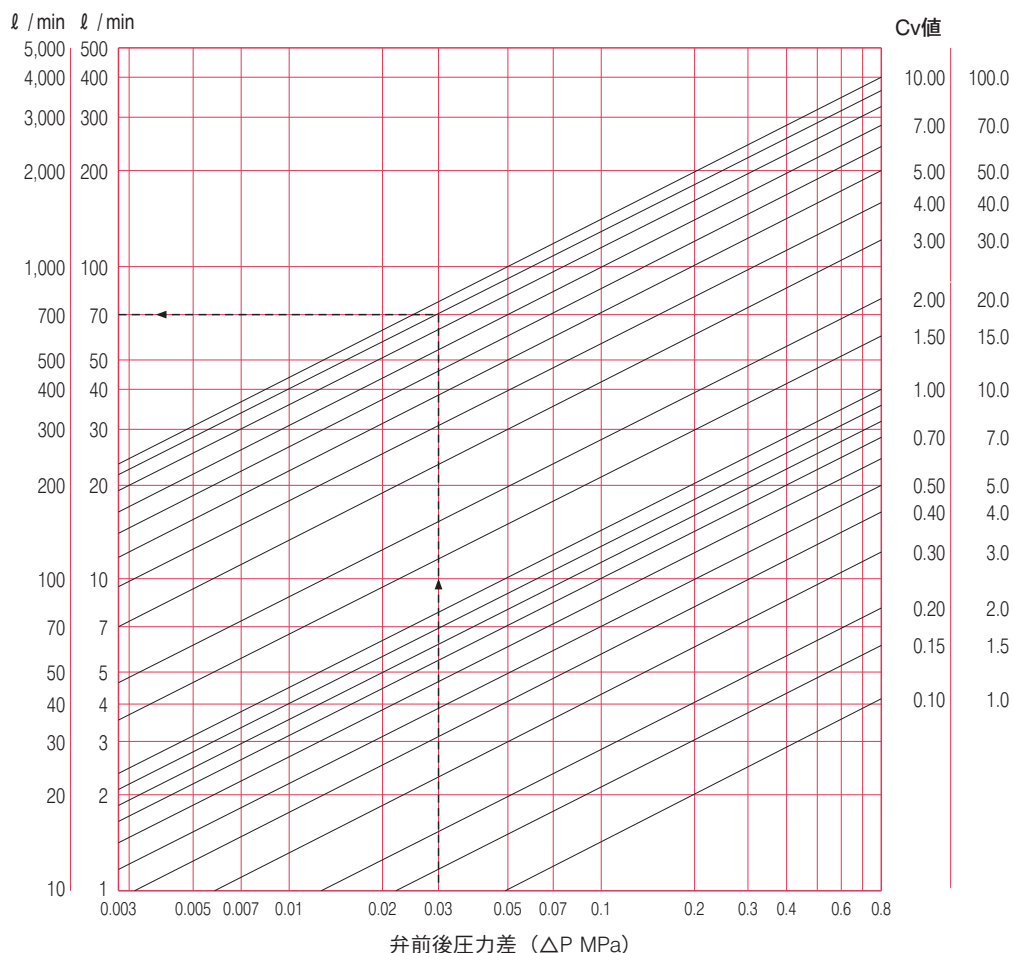
Solenoid Coil and Classification of Electrical Insulation

耐熱クラス Thermal Class	温度 °C Temperature
Y	90
A	105
E	120
B	130
F	155
H	180
200	200
220	220
250	250

電磁弁は通電しますと、コイルが発熱します。
コイルは「雰囲気温度+コイル発熱温度」が左記表の耐熱温度を越えないように設計されています。
例えば、H種コイルを使用している場合、耐熱温度180℃-雰囲気温度50℃=130℃以上コイルが温度上昇しないようになっています。
電磁弁を通電後は、コイルボンネットがかなり熱くなりやけどする恐れがありますので、触らないで下さい。

電気絶縁 (Electrical Insulation) : 電気製品に使用されている絶縁材料及び絶縁システム。電磁弁の場合、コイル部分。
耐熱クラス (Thermal Class) : 電気製品を定格負荷で運転した時に許容出来る最高温度を基にして決めた電気絶縁の耐熱クラス。

水流量表



サイズの選定と流量

一般にバルブサイズの選定は、使用する配管口径に合わせて決定される傾向が強いようですが、自動弁は、その型式や種類により最適な流量や圧力がそれぞれ異なっています。

従って、最適バルブの種類と口径以外の自動弁を選定すると、不経済だけでなく、流量の過不足や作動不安定が発生し、装置や設備が計画通りの性能を発揮出来ないことになります。

これらの不具合を無くすため、Cv値により最適なバルブを選定していただけるように、各製品のCv値、流量表及びCv値計算式を掲載しました。

Cv値とは

バルブの流体通過抵抗、バルブの流量（容量）を表す数値です。

次の方法で計測されたものです。

バルブ前後の圧力差を1psi（=1Lb/in²≒0.07kg/cm²）に保ち、このとき通過する水（清水15.6℃）の量を

米gallon/min（1米gal≒3.8L）で表した数値です。

一つの目安として、流体が水の場合、比重を1とすれば、そのバルブのCv値×10が圧力差0.5kg/cm²のときの流量 [L/min] とほぼイコールとなります。

〔注意〕流体の圧力を利用して作動させるパイロット構造のバルブは最低作動差圧を確保していただく必要があります。

	SI単位 (MPa)	旧単位 (kg/cm ²)
液体 (水・油・その他)	$Cv = 0.02194Q \sqrt{\frac{G}{\Delta P}}$ $Q = 45.58Cv \sqrt{\frac{\Delta P}{G}}$ $\Delta P = \frac{0.02194^2 \times Q^2 \times G}{Cv^2}$	$Cv = 0.07Q \sqrt{\frac{G}{\Delta P}}$ $Q = 14.28Cv \sqrt{\frac{\Delta P}{G}}$ $\Delta P = \frac{0.07^2 \times Q^2 \times G}{Cv^2}$
	Q : 流量 L/min ΔP : 圧力降下 MPa (P ₁ - P ₂) G : 比重 (水を1とする)	Q : 流量 L/min ΔP : 圧力降下 kg/cm ² (P ₁ - P ₂) G : 比重 (水を1とする)
気体 (空気・その他ガス)	$Cv = \frac{Q}{2,916} \sqrt{\frac{G(273+t)}{\Delta P(P_1+P_2)}}$ $Q = 2,916Cv \sqrt{\frac{\Delta P(P_1+P_2)}{G(273+t)}}$ $P_2 = \sqrt{P_1^2 - \frac{Q^2 \times G(273+t)}{2,916^2 \times Cv^2}}$	$Cv = \frac{Q}{2,519P_1} \sqrt{\frac{G(273+t)}{\Delta P}}$ $Q = \frac{2,519 \times Cv \times P_1}{\sqrt{G(273+t)}}$ $P_1 = \frac{Q}{2,519Cv} \sqrt{\frac{G(273+t)}{\Delta P}}$
	Q : 流量 m ³ /Hr (1気圧15.6℃における) P ₁ : 弁入口圧力 MPa abs. P ₂ : 弁出口圧力 MPa abs. ΔP : 圧力降下 (P ₁ - P ₂) MPa G : 比重 (空気を1とする) t : 温度 ℃	Q : 流量 m ³ /Hr (1気圧15.6℃における) P ₁ : 弁入口圧力 kg/cm ² abs. P ₂ : 弁出口圧力 kg/cm ² abs. ΔP : 圧力降下 (P ₁ - P ₂) kg/cm ² G : 比重 (空気を1とする) t : 温度 ℃
水蒸気	$Cv = \frac{(1+0.0013S)Q}{138.7 \sqrt{\Delta P(P_1+P_2)}}$ $Q = \frac{138.7 \times Cv \sqrt{\Delta P(P_1+P_2)}}{(1+0.0013S)}$ $P_2 = \sqrt{P_1^2 - \frac{Q^2 \times (1+0.0013S)^2}{138.7^2 \times Cv^2}}$	$Cv = \frac{(1+0.0013S)Q}{120.3P_1}$ $Q = \frac{120.3P_1 \times Cv}{(1+0.0013S)}$ $P_1 = \frac{(1+0.0013S)Q}{120.3Cv}$
	Q : 流量 kg/Hr P ₁ : 弁入口圧力 MPa abs. P ₂ : 弁出口圧力 MPa abs. ΔP : 圧力降下 (P ₁ - P ₂) MPa S : 過熱度 ℃ (過熱蒸気温度 - 飽和蒸気温度 : 飽和蒸気の時S=0)	Q : 流量 kg/Hr P ₁ : 弁入口圧力 kg/cm ² abs. P ₂ : 弁出口圧力 kg/cm ² abs. ΔP : 圧力降下 (P ₁ - P ₂) kg/cm ² S : 過熱度 ℃ (過熱蒸気温度 - 飽和蒸気温度 : 飽和蒸気の時S=0)

注 1. 液体粘度が20cstを越える時は、粘度による補正係数を考慮すること。

2. 気体及び水蒸気の時、P₁、P₂は絶対圧力 (abs.) なので、(ゲージ圧MPa+0.098) とすること。

主なSI単位への換算率表

Conversion Table to SI Unit

	旧単位	国際単位 SI単位	旧単位→SI単位 換算率	SI単位→旧単位 換算率
力（荷重）	kgf	N（ニュートン）	1 kgf=9.80665 N	1 N=0.101972kgf
トルク	kgf・m	Nm（ニュートン・メートル）	1 kgf・m=9.80665Nm	1 Nm=0.101972kgf・m
圧力	kgf/cm ²	MPa（メガ・パスカル） （キロ）kPa	1 kgf/cm ² =0.0980665MP	1 MPa=10.1972kgf/cm ²
	mmHg		1 kgf/cm ² =98.0665kPa	1 kPa=0.0101972kgf/cm ²
	mmH ₂ O（mmAq）	Pa	1 mmHg=0.133322kPa	1 kPa=7.50062mmHg
			1 mmH ₂ O（mmAq）=9.80665Pa	1 Pa=0.101972mmH ₂ O
仕事 エネルギー 熱量	kcal	J （ジュール）	1 kcal=4,186.05J	1 J=0.000238889kcal
	kW・h		1 kW・h=3,600,000J	1 J=0.000000277778kW・h
	kgf・m		1 kgf・m=9.80665J	1 J=0.101972kgf・m
仕事率 工率 働力	kcal/h	W （ワット）	1 kcal/h=1.16279W	1 W=0.86000kcal/h
	PS		1 PS=735.5W	1 W=0.00135962PS
	kgf・m/s		1 kgf・m/s=9.80665W	1 W=0.101972kgf・m/s

注(1) SI単位の詳細は、「国際単位系(SI)及びその使い方」JIS Z 8203-1985を参照ください。(特殊な分野では、従来単位の使用が許可されています。特殊な例 医療分 血圧はmmHg)

SI接頭語（10の整数倍を表示する記号）

	記 号	指数表示	単位に乘じる倍数
メガ	M	1 × 10 ⁶	1,000,000
キロ	k	1 × 10 ³	1,000
—	—	(1 × 10 ⁰)	10
センチ	c	1 × 10 ⁻²	0.01
ミリ	m	1 × 10 ⁻³	0.001

注(2) 質量…従来の重量kgは、質量kgと名称が変更されています。また、重量（質量）と表示する場合もあります。従来はkgだった荷重や力はNとなります。

SI単位とは 1960年の国際度量衡総会で世界共通の実用的な計量単位として使用することが決まった国際単位系をいう。
SIは、Le Systeme International d'Unitesの略。

新計量法 日本の計量単位を定めた法律
1993年11月1日施行され、99年10月1日をもってSI単位に移行となりました。

圧力単位換算表

	Pa	kPa	MPa	bar	kgf/cm ²	atm	mmH ₂ O	mmHg (Torr)	lbf/in (psi)
1 Pa =	1	1 × 10 ⁻³	1 × 10 ⁻⁶	1 × 10 ⁻⁵	1.020 × 10 ⁻⁵	9.869 × 10 ⁻⁶	1.020 × 10 ⁻¹	7.501 × 10 ⁻³	1.450 × 10 ⁻⁴
1 kPa =	1 × 10 ³	1	1 × 10 ⁻³	1 × 10 ⁻²	1.020 × 10 ⁻²	9.869 × 10 ⁻³	1.020 × 10 ²	7.501	1.450 × 10 ⁻¹
1 MPa =	1 × 10 ⁶	1 × 10 ³	1	1 × 10	1.020 × 10	9.869	1.020 × 10 ⁵	7.501 × 10 ³	1.450 × 10 ⁵
1 bar =	1 × 10 ⁵	1 × 10 ²	1 × 10 ⁻¹	1	1.020	9.869 × 10 ⁻¹	1.020 × 10 ⁴	7.501 × 10 ²	1.450 × 10
1 kgf/cm ² =	9.807 × 10 ⁴	9.807 × 10	9.807 × 10 ⁻²	9.807 × 10 ⁻¹	1	9.678 × 10 ⁻¹	1.000 × 10 ⁴	7.356 × 10 ²	1.422 × 10
1 atm =	1.013 × 10 ⁵	1.013 × 10 ²	1.013 × 10 ⁻¹	1.013	1.033	1	1.033 × 10 ⁴	7.600 × 10 ²	1.470 × 10
1 mmH ₂ O =	9.807	9.807 × 10 ⁻³	9.807 × 10 ⁻⁶	9.807 × 10 ⁻⁵	1.000 × 10 ⁻⁴	9.678 × 10 ⁻⁵	1	7.356 × 10 ⁻²	1.422
1 mmHg =	1.333 × 10 ²	1.333 × 10 ⁻¹	1.333 × 10 ⁻⁴	1.333 × 10 ⁻³	1.360 × 10 ⁻³	1.316 × 10 ⁻³	1.366 × 10	1	1.934 × 10 ⁻²
1 lbf/in =	6.895 × 10 ³	6.895	6.895 × 10 ⁻³	6.895 × 10 ⁻²	7.301 × 10 ⁻²	6.805 × 10 ⁻²	7.031 × 10 ⁻¹	5.172 × 10	1

粘度単位換算表

〈粘度〉						〈動粘度〉					
	P	cP	kg/m・s	Pa・s	lb/ft・s		St	cSt	m ² /s	cm ² /s	ft ² /s
1 P =	1	1 × 10 ²	1 × 10 ⁻¹	1 × 10 ⁻¹	6.72 × 10 ⁻²	1 St =	1	1 × 10 ²	1 × 10 ⁻⁴	1	1.076 × 10 ⁻³
1 cP =	1 × 10 ⁻²	1	1 × 10 ⁻³	1 × 10 ⁻³	6.72 × 10 ⁻⁴	1 cSt =	1 × 10 ⁻²	1	1 × 10 ⁻⁶	1 × 10 ⁻²	1.076 × 10 ⁻⁵
1 kg/m・s =	1 × 10	1 × 10 ³	1	1	6.72 × 10 ⁻¹	1 m ² /s =	1 × 10 ⁴	1 × 10 ⁶	1	1 × 10 ⁴	1.076 × 10
1 Pa・s =	1 × 10	1 × 10 ³	1	1	6.72 × 10 ⁻¹	1 cm ² /s =	1	1 × 10 ²	1 × 10 ⁻⁴	1	1.076 × 10 ⁻³
1 lb/ft・s =	1.488 × 10	1.488 × 10 ³	1.488	1.488	1	1 ft ² /s =	9.29 × 10 ²	9.29 × 10 ⁴	9.29 × 10 ⁻¹	9.29 × 10 ²	1

※ 粘度には、粘度と動粘度があります。動粘度は粘度を密度で割ったものです。

（参考） St=1P (=g/cm・s) / (g/cm³)=cm²/s

電磁弁とは

電磁石（ソレノイドコイル）の力を利用して電源のON/OFFにより流体の流路の開閉（もしくは切り替え）を行うバルブです。

構造	直動式	プランジャー（可動鉄心）と呼ばれる磁性体が直接流路を塞ぐ構造のバルブです。 ソレノイドの吸引力だけで弁の開閉をするもので、小口径のものが多く、一般的に動作が確実であり構造が簡単です。	・電気を入れれば必ず動作する。 ・差圧が必要ない。 ・流量が少ない。
	パイロット式	プランジャーとメインバルブ（主弁）により流路を塞ぐ構造のバルブです。 プランジャーとメインバルブは独立しており、プランジャーはソレノイドの吸引力により作動しますが、メインバルブは流体圧力により作動するため、最低作動差圧が必要となります。直動式に比べやや構造は複雑になります。差圧ゼロでは作動しません。	・差圧が必要。 ・大流量が流せる。
	キックパイロット式	直動式とパイロット式を組み合わせたもので、プランジャーとメインバルブがピンやジョイントスプリング等によって繋がっているバルブです。そのため、差圧ゼロでも作動します。	・差圧が必要ない。 ・中流量が流せる。

選定に当たって

下記仕様の確認が必要です。

- ・流体（水、空気以外の場合は比重も）
- ・圧力（一次側、二次側）
- ・温度
- ・流量
- ・接続（フランジの場合は規格も）
- ・口径
- ・電源（AC電源では周波数も）
- ・材質（希望があれば）

左記仕様から、P.26～27よりCv値を求め、バルブのCv値が同じもしくは多少大きな電磁弁を選定します。

パイロット弁の場合、最低作動差圧 ΔP 以上の差圧が必要です。差圧を保持するためには、流量が必要になりますので、選定したバルブのCv値と ΔP から流量を計算し、求めた流量以上が流せるかどうか確認して下さい。

流量が少ない場合、バルブのサイズダウンをするか、キックパイロット式への切り換えが必要です。

⚠ご使用に当たって

- ① ご使用の仕様と銘板の記載内容に相違が無いことを確認して下さい。
- ① バルブを取り付ける前に、配管内のゴミ・異物を除去して下さい。
- ① バルブを取り付ける際、弁の一次側と二次側を間違えないように御注意下さい。
- ① 流体中のゴミ・異物が流入しないように電磁弁の一次側（入口側）には、必ず80メッシュ以上のストレーナーを設置して下さい。
- ① バルブの上下には十分な空間をとり、分解・保守点検を行えるようにして下さい。
- ① 保守点検に備え、バイパス回路を設置して下さい。
- ① コイルを本体から取り外した状態で通電しないで下さい。コイル焼損の原因となります。
- ① 電源の結線は、回路上正しい接続をして下さい。
- ① 雰囲気温度が50℃を超える場所に電磁弁を設置しないで下さい。
- ① 通電中及び電気を切った直後はコイルボンネットに触れないで下さい。
長時間通電しますとコイルボンネットの温度がかなり高くなる場合があります。
コイル及びコイルボンネットが熱くなることは異常ではありません。
- ① バルブの仕様範囲（流体、流体圧力、流体温度、雰囲気温度）を守ってご使用下さい。
- ① 使用電圧および周波数範囲を守って下さい。
- ① 保守する前には、必ず電源を切り、流体及び圧力を抜いて下さい。
- ① 電磁弁を長期間故障無く最良な状態でご使用いただくため、定期的に保守点検をして下さい。

通常 1 年間に 1 度の点検

表示マーク	意 味
 警告	この表示を無視して誤った取り扱いをすると、人が死亡または重傷を負う可能性が想定される内容、及び物質的損害の発生が想定される内容を示しています。
 注意	この表示を無視して誤った取り扱いをすると、人が傷害を負う可能性が想定される内容、及び物質的損害のみの発生が想定される内容を示しています。

表示マーク	意 味
	必ず実行していただく「強制」の内容です。
	行ってはいけない「禁止」の内容です。

バルブの主要材料表

Main Material Table

名 称	代表例	特 徴
ネズミ鋳鉄	FC200	鋳造性、加工性に優れ、価格が安い大型弁のボデー材料として使用される。
球状黒鉛鋳鉄	FCD400	鋳造性がよく、ネズミ鋳鉄より強度、耐熱性に優れる。通称ダクタイル鋳鉄。
高温高圧用鋳鋼	SCPH2	鋳造性が良く、強度、衝撃力が強い。高温、高圧流体用のボデー材料として使用される。
ステンレス鋼 (オーステナイト系)	SUS303 SUS304 SUS316	クロムを約11%以上含み、耐食性を目的とした鋼。 オーステナイト系はニッケル・クロム系で非磁性。 303は快削鋼、304は通称18-8ステンレス。
ステンレス鋼 (マルテンサイト系)	SUS410 SUS420J2	マルテンサイト系は、クロム系で高炭素濃度として、焼き入れを行う。
電磁ステンレス鋼	K-M31	磁気特性に優れた13クロム系のステンレス鋼。 K-M31は東北特殊鋼社の商品規格番号。
ステンレス鋼鋳鋼	SCS13 SCS14	SCS13はSUS304、SCS14はSUS316相当のステンレス鋳物、耐食性に優れ低温から高温まで幅広く使用できる。
青銅鋳物	CAC406	耐食性、耐摩耗性に優れる。鋳造性、加工性に優れ、バルブボデー材質に適する。
アルミニウム青銅鋳物	CAC703	大型鋳物に適し、強さが特に高く、耐食性、耐摩耗性がよい。
黄銅	C2700 C3604 C3771	冷間鍛造性、転造性がよい。 快削黄銅で、被削性に優れる。 鍛造用黄銅で、熱間鍛造性がよく、精密鍛造に適する。
天然ゴム	NR	機械的性質がよく、弾性の優れたゴム。耐熱性、圧縮ひずみ、耐油性が悪い。
クロロプレンゴム	CR	機械的強度、耐候性がよく、適度の耐油性、耐薬品性、耐熱性を有しバランスのとれたゴム材料であるが、低温時の動的用途には不向き。
ニトリルゴム	NBR	加工性、機械的強度がよく、一般用用途のシール材料として使用される。耐候性は良くない。
ふっ素ゴム	FKM	使用温度範囲が広く、耐薬品性、耐溶剤性が抜群で、真空にも適する。バイトン は、デュポン社の商品名。
エチレン・プロピレン ゴム	EPDM EPT	耐熱性、耐寒性に優れ、リン酸エステル系、グリコール系の作動油に対する耐油性が非常に優れるが、一般の鉱油には全く耐性がない。
ポリエチレン	PE	エチレンの重合体。電気絶縁性、耐水性、耐寒性に優れた熱可塑性樹脂。
ポリプロピレン	PP	プロピレンの重合体。安価に製造される代表的な熱可塑性樹脂。耐薬品性、電気絶縁性に優れ、摩擦係数が低い。
ポリブチレンテレフタ レート	PBT樹脂	テレフタル酸とブチレングリコールを主原料として製造される熱可塑性樹脂。耐薬品性、耐熱性、強靱性に優れ、良好な電気特性のエンジニアリングプラスチック。
四ふっ化エチレン樹脂	PTFE	溶解アルカリ金属、高温高圧下のふっ素、アルカリ金属の液体溶液、および一部のふっ素化合物には侵されるが、他のあらゆる薬品、溶剤に侵されない。テフロンはデュポン社の商品名。
ポリ塩化ビニル	PVC	塩化ビニルの重合体。可塑剤を含まない硬質塩化ビニル樹脂と、可塑剤を混入または酢酸ビニルを共重合した軟質塩化ビニル樹脂がある。

この表は耐蝕性材料の選定を行う場合の参考資料として下さい。それぞれの流体は、濃度、圧力、温度、かくはんの程度、あるいは不純物の存在が腐蝕に影響します。実際の使用にあたっては、さまざまな状況を十分考慮の上、決定してください。

【評価の説明】 A：優 B：良 C：可（おそらく不適当） D：不可 空欄は資料なし

流 体 名	常 温 での 状態	沸 点	比 重	青 銅	黄 銅	鋳 鉄	炭 素 銅	ス テ ン レ ス 304	ス テ ン レ ス 316	天 然 ゴ ム	ネ オ プ レ ン	ニ ト リ ル	バ イ ト ン	E P T	テ フ ロ ン
アセチレン（エチン）	気体	－81.8	0.90	B	D	A	A	A	A	A	B	A	A		A
アセトアルデヒド	液体	20.8	0.783	D	D	C	C	A	A	B	D	D	C	A	A
アセトン	液体	56.1	0.79	A	A	A	A	A	A	B	C	D	D	A	A
アニリン	液体	184	1.027	C	B	A	A	A	A	B	C	D	B	A	A
アミン				A	B	B	B	A	A			D	D		A
アンモニア	気体	－33.4	0.596	D	C	C	B	A	A	C	B	B	D	A	A
アルコール（エチル）	液体	78.3	0.789	B	B	B	B	B	B	A	A	A	A	A	A
アルコール（メチル）	液体	64.65	0.793	B	B	B	B	B	B	A	A	A	A	A	A
安息香酸	液体	249.2	1.266	B	B	D	D	A	A		B	B	A		A
亜硫酸ガス（乾）（二酸化硫黄）	気体	－10	2.26			A	A	A	A	C	B	C	C	A	A
亜硫酸ガス（湿）				C		D	D	B	B		B	C	C	A	A
エーテル				B	A	B	A	A	A	D	C	C	C	D	A
エチレンオキシド	気体	10.73	0.897（液体）	A	B	B	B	B	B		D	D	D		A
エチレングリコール	液体	197.6	1.113	B	B	A	A	A	A	A	A	A	A	A	A
エタン	気体	－89	1.049	A	B	B	B	B	B		B	A	A		A
塩化亜鉛	粉体	732	2.9	D	D	D	D	D	D	A	C	B	A	A	A
塩化アンモニウム	固体			C	D	D	D	D	C		B	B	A		A
塩化アンモニウム	固体		1.53	D	D	D	D	C	C		A	C	A		A
塩化エチル	気体	12.3	0.921（液体）	B		D	D	A	A		C	C			A
塩化カルシウム	固体	1,600	2.15	B	D	C	C	C	B	A	A	A	A	A	A
塩化ナトリウム	固体	1,413	2.16	B	B	C	C	B	B	A	A	A	A	A	A
塩化バリウム	固体	1,560	3.86	B	C	C	C	C	C		A	A	A		A
塩化マグネシウム	固体	1,412	1.56	B	C	D	C	B	B	A	A	A	A	A	A
塩化メチル	気体	－23.7	0.920（液体）	A	B	B	B	B	B		C	C			A
塩化第一鉄	固体			C	D	D	D	D	D		A	A	A		A
塩化第二鉄	固体			D	D	D	D	D	D		A	A	A		A
塩酸	液体		1.19	D	D	D	D	D	D	D	C	B	A	B	A
塩素ガス（乾）	気体	－34.5	2.486	C	B	B	B	B	B	D	C	C	B	B	A
塩素ガス（湿）				D	D	D	D	D	D	D	D	D		D	A
塩素酸カリウム	固体		2.33	B	B	B	B	B	B		A	A	A		A
海水	液体			B	C	D	D	B	B		B	A	A		A
過酸化水素	液体	152	1.46	D	C	D	D	B	B	D	D	D		A	A
ガソリン（無鉛）	液体		0.74	A	A	A	A	A	A	D	D	C	A	D	A
過酸化ナトリウム	固体		2.81	D		C	C	B	B		C	A	A		A
過マンガン酸カリウム	固体		2.7	B	B	B	B	B	B		B	A	A		A
キシレン	液体		0.861～0.880	A		B	B	A	A	D	A	B	A	D	A
空気	気体		1	A	A	A	A	A	A		A	A	A		A
クエン酸				D	D	D	D	B	A		A	B			A

材料の耐蝕性

Anticorrosion of Material

流体名	常温での状態	沸点	比重	青銅	黄銅	鋳鉄	炭素鋼	ステンレス304	ステンレス316	天然ゴム	ネオプレン	ニトリル	バイトン	EPT	テフロン
クレオソート	液体			C	C	B	B	B	B		C	C	A		A
クロム酸	固体			D	D	D	D	C	C	D	D	D	C	B	A
クロム酸ナトリウム				C		B	B	A	A		A	A	A		A
クロロホルム	液体	61.2		B	B	B	B	B	A		D	D	B		A
グリセリン	液体	290.5	1.261	B	B	B	B	A	A	C	A	A	A	A	A
ケイ酸ナトリウム	固体			B	B	B	B	B	B		A	A	A		A
酢酸10%				D	D	D	D	A	A	C	D	D	D	A	A
酢酸20%				D	D	D	D	A	A	D	D	D	D	A	A
酢酸50%				D	D	D	D	A	A	D	D	D	D	B	A
酢酸80%	液体	118	1.049	D	D	D	D	A	A	D	D	D	D	D	A
酢酸アルミ				C	C	C	C	B	B	D	D	D	D	C	A
酢酸鉛	固体			C		D	D	B	B		A	A	A		A
酢酸ナトリウム	固体		2.228~3.251	B	B	C	C	B	B		B	B	A		A
酸素	気体	-183	1.105	A		B	B	A	A	B	A	B	A	A	A
サリチル酸	固体	221		C	D	D	D	A	A		A	A	A		A
臭素	液体	59.5	3.12	B	D	D	D	D	D	B	D	D	B	A	A
次亜塩素酸カルシウム				D	D	D	D	C	C		C	C	A		A
次亜塩素酸ナトリウム	固体			D	D	D	D	C	C		D	C	A		A
四塩化炭素	液体	76.7		D	C	C	C	C	B		D	D	B		A
硝酸1%				D	D	D	D	A	A						A
硝酸10%				D	D	D	D	A	A	D	B	C	A	A	A
硝酸30%				D	D	D	D	A	A	D	C	C	A	B	A
硝酸50%				D	D	D	D	A	A	D	D	D	B	C	A
硝酸80%				D	D	D	D	B	B	D	D	D	B	D	A
硝酸100%	液体	82.6	1.5	D	D	A	A	A	A	D	D	D	B	D	A
硝酸カリウム	固体		2.1	B	B	B	B	B	B		A	A	A		A
硝酸銀	固体		4.35	D	D	D	D	B	B		C	C	A		A
硝酸ナトリウム	固体			B	B	B	B	B	B	A	B	C	A	A	A
シアン化カリウム（青酸カリ）	固体		1.52	D	D	B	B	B	B		A	A	A		A
シアン化ナトリウム	固体	1,496		D	D	B	B	B	B		A	A	A		A
水酸化カリウム	固体	1,320	2.04	D	D	B	B	A	A		C	C	A		A
水酸化マグネシウム	固体		2.36	B	B	B	B	A	A		A	A	A		A
水酸化ナトリウム20%				B	C	B	B	A	A	A	B	B	C	A	A
水酸化ナトリウム50%				C	C	B	B	A	A	A	B	B	C	A	A
水酸化ナトリウム70%	(固体)	(1,390)	(2.13)	C	C	C	C	B	B	A			C	A	A
水銀	液体	357	13.55	D	C	A	A	A	A		A	A	A		A
青酸（シアン化水素）	液体	25.7	0.688	D	D	C	C	B	B		B				A
炭酸アンモニウム	固体			B	C	B	B	B	B	A	B	C	B	A	A
炭酸カルシウム	固体		2.94	C	B	C	C	B	B		A	A	A		A
炭酸				D	C	D	D	B	B		A	A	A		A
炭酸カリウム	固体		2.29	C	B	B	B	B	B		A	A	A		A
炭酸ナトリウム	固体		2.53	B	B	B	B	B	B		A	A	A		A
タールおよびタール油	液体			A		A	A	A	A		C	B	A	D	A

流 体 名	常 温 での 状態	沸点	比 重	青 銅	黄 銅	鋳 鉄	炭 素 銅	ス テ ン レ ス 304	ス テ ン レ ス 316	天 然 ゴ ム	ネ オ プ レ ン	ニ ト リ ル	バ イ ト ン	E P T	テ フ ロ ン
チオ硫酸ナトリウム（ハイホ）	固体		1.73	B		C	C	A	A		A	A	A		A
トルエン	液体	110.6	0.867	A		A	A	A	A		D	D	B		A
トリクロロエチレン	液体	87	1.465	B		C	B	B	B		D	D	B		A
灯油	液体	150～	0.79	A	A	A	A	A	A	D	C	A	A	D	A
ナフサ	液体	40～		B	B	B	B	B	B	D	C	A	A	D	A
ニトロベンゼン	液体	210.6	1.197	D		B	B	A	A		D	D	C		A
二酸化炭素（炭酸ガス）	気体		1.53	A		B	B	A	A		B	C	A		A
二硫化炭素	液体	46.3	1.293	C	D	B	B	B	B		C	C	A		A
乳酸	液体			D	D	D	D	B	A		C	C			A
フッ酸（フッ化水素酸）				D	D	D	D	C	C		C				
フレオン（乾）				B	A	B	B	A	A		C	C	C		A
フレオン（湿）				C	B	C	C	B	B						
ブタン	気体	-0.5	2.048	A		B	B	B	B		B	B	A		A
プロパン	気体	-42.1	1.56	A		B	B	B	B		B	A	A		A
プロピレングリコール	液体	187.9	1.038	B		B	B	B	B		A	A	A		A
ベンゼン	液体	80.1	0.879	B		B	B	B	B	D	D	D	B	D	A
ホウ酸	固体			B		D	D	B	B		A	A	A		A
ホルムアルデヒド	気体	-19.5	0.859	B		B	B	A	A	D	B	B		A	A
無水酢酸	液体	140	1.085	C		D	D	B	B	D	C	C	D	B	A
硫化水素	気体	-60.7	1.19	D		D	C	B	B		A	C	A		A
硫酸第一鉄	固体		4.7	B		D	D	B	B		A	A	A		A
硫酸第二鉄	固体		4.3	D		D	D	B	B		A	A	A		A
硫酸5%				C	D	D	D	C	B	A	A	B	A	A	A
硫酸20%				C		D	D	D	D	A	B	C	A	A	A
硫酸50%				C		D	D	D	D	D	C	C	A	A	A
硫酸98%以上	流体	315～	1.84	B		B	B	A	A	D	D	D	B	D	A
硫酸アンモニウム	固体		1.77	B	D	C	C	B	B	A	A	A	A	A	A
硫酸アルミニウム	固体		2.67	C	D	D	D	C	B		A	A	A		A
硫酸カリウム	固体		2.66	B	B	C	C	B	B		A	A	A		A
硫酸カルシウム	固体		2.96	C	B	C	C	B	B		A	A	A		A
硫酸ナトリウム	固体		2.66	B	C	C	C	B	A	A	A	A	A	A	A
硫酸ニッケル	固体			D	D	D	D	C	B	A	A	A	A	A	A
硫酸亜鉛				B	B	D	D	B	B	A	A	A	A	A	A
硫酸銅	固体	2.29		D	D	D	D	B	B	A	A	A	A	A	A
硫酸マグネシウム	固体		2.66	B	B	B	B	B	B		A	A	A		A
磷酸10%冷				D		D	D	B	B	A	A	B	A	A	A
磷酸10%熱				D		D	D	D	D	D	A	B	A	A	A
磷酸50%冷				D		D	D	B	B	A	B	B	A	A	A
磷酸50%熱				D		D	D	D	D	D	B	B	A	A	A
磷酸85%冷				D		C	C	A	A	A	B	C		A	A
磷酸85%熱	(固体)			D		C	C	A	A	D	B	C		A	A
ワニス				A	B	C	C	A	A		A	C			A

MSD

M3P

ZFD

VSPD

VSPD-
LN2M

VSD

GVD

VD

VKD

VKK

VKK-
SSPME6-
SSPME6-
LN2HM

Y

TEN

SSPD

SSAP

VHTD-
VHTSP・SR・
SR-T原子力用
電磁弁

アクセサリ

結線方法
直流コイルと
交流コイルフィルム・リノイド等
電磁弁の耐腐食性
及びコイルについて

流量表

Cy値計算式

主なSI単位へ
の換算率表電磁弁の構造
と注意事項バルブの
主要材料表材料の
耐蝕性



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お問合せ、ご用命は



McDonnell & Miller® General Catalog

MM-825M



McDonnell & Miller
a **xylem** brand

HOW TO USE THIS CATALOG

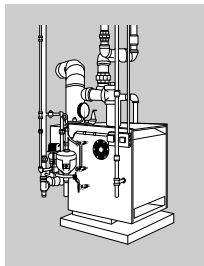
This guide will assist you in your tour of the McDonnell & Miller General Catalog. The information contained in the catalog is organized into 5 key categories:

- System Selection Chart
- Product Selection Guide
- Basic System Operation
- Products
- Technical Information and Specifications

Easy to identify symbols and product icons will help you specify and select the product that meets your requirements.

BASIC SYSTEM OPERATION...

...the encyclopedia of boiler operation. An easy-to-read, informative guide to all the basic elements that make steam and hot water boiler systems work.



PRODUCTS...

...the complete McDonnell & Miller product line, divided into 3 primary groups:

Boiler Controls

Liquid Level Controls

Flow Switches

Just check the **CONTENTS** pages for the associated product icons to quickly find the control you need.

TECHNICAL INFORMATION AND SPECIFICATIONS...

...full of helpful data to assure your selection is the right one.

Glossary of Terms

... a detailed description of all terms that appear in this catalog.



Approval Agencies



MAINTENANCE & REPLACEMENT INTERVAL GUIDELINES...

...the easy to read guides will help keep you on track with suggested product maintenance and replacement intervals.

Recommended Replacement Intervals

Product	Series	Recommended Maintenance	Recommended Replacement Interval (Maximum)
Low Water Cut-Offs	150, 157, 158, 159, 160S, 157, 158S, 159S	Blow down and test daily Inspect annually	15 years
	69, 169, 269, 369, 469	Inspect and test annually	10 years
	67, 767	Blow down weekly. Inspect and test annually	10 years
	61, 63, 64, 764	Blow down weekly. Inspect and test annually	10 years
	42	Blow down daily. Inspect and test annually	10 years

APPLICATIONS...



Industrial applications



Residential applications



Commercial applications

Warranty & Return Policy



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<i>Liquid Level Controls</i>	70
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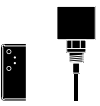
Technical Information and Specifications

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BOILER CONTROLS

LOW WATER CUT-OFFS

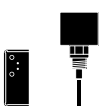
• For Hot Water Boilers

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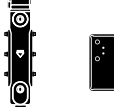
LOW WATER CUT-OFFS

• For Steam Boilers

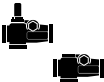
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Steam Boilers

They've been with us for over two hundred years, and most of the time, they're so reliable most folks don't give them much thought. They sit in buildings all over the world, transferring heat from fuel to water, allowing us to warm our buildings or complete our processes.

Steam boilers are simple, efficient and reliable. No machine does a better job of moving BTUs from one place to another. We've used them for space heating since before the United States Civil War in 1861.

Even before the Civil War, we used steam boilers for industrial processes. Today we use them to run factories, press clothes, wash dishes, pasteurize milk, sterilize medical equipment, and to heat entire cities! Their capabilities seem endless.

But despite its simplicity, any steam boiler can run into trouble if its control system doesn't act properly. If the energy you put into the boiler exceeds what the boiler can absorb, the boiler can rupture. So you must always be on guard.

A simple safety relief valve of the right capacity and relief-pressure setting protects the boiler from over pressure. But over pressure isn't the only thing that can threaten a steam boiler. There are also the dangers of dry firing.

Should the internal water level drop too low, the boiler can burn out. So here too, you must always be on guard. You see, a steam boiler needs its water to move the heat away from its metal surfaces. Without the right internal level of water, heat quickly accumulates. Too much heat creates a very dangerous operating condition.

Boiler manufacturers have always set up minimum safe water level requirements for their equipment. Our controls help enforce those requirements in two ways:

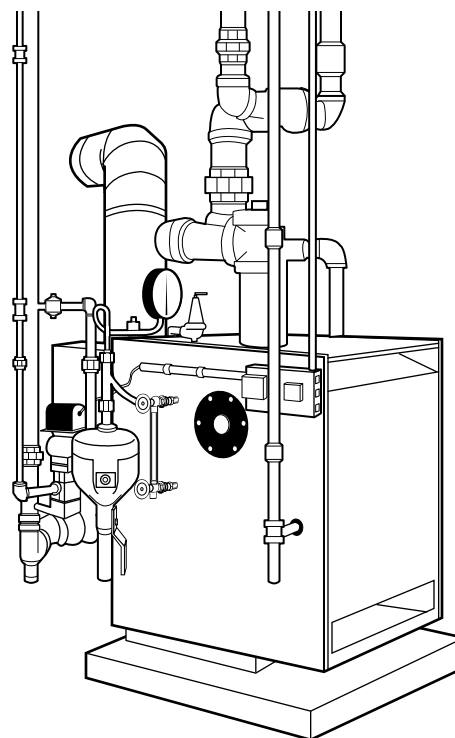
- By maintaining a minimum safe water level in the boiler.
- By signaling the burner to stop should the water level drop below that point.

In this brief Systems Guide we will explain how we do these two very important jobs.

What's a "Normal" Water Level?

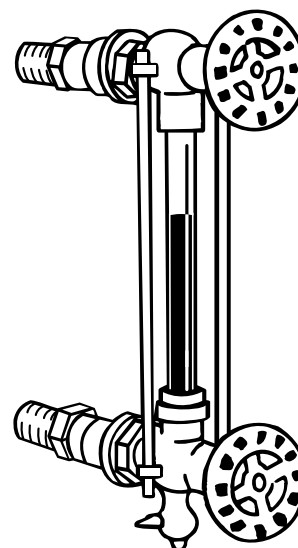
The proper steam boiler water level varies from manufacturer to manufacturer, but generally, we can say that it's "normal" to start by manually filling the boiler to the two-thirds-full point on the gauge glass. As the boiler operates, the water will quickly turn to steam and head out toward the system (Fig. B).

Steaming takes place at a constant rate of about one-half gpm per 240,000 BTU/HR (D.O.E. Heating Capacity



Steam Boiler

Fig. A



Gauge Glass Two-Thirds Full

Fig. B

Rating). This is a law of physics so it doesn't vary from manufacturer to manufacturer. If you're working with a boiler with a rating of, say, 1,000,000 BTU/HR, you can be assured the water is turning to steam and leaving that boiler at the rate of about two gpm. And it's leaving at speeds measured in miles per hour (sometimes exceeding 60 mph!). So it's very important for your near-boiler piping to be correct. If it's not, the fast moving steam will pull water out of the boiler and create problems for you in the system and the boiler.

As the water (in the form of steam) heads out toward the system, the water level in the boiler will, of course, drop. How far it drops, depends a lot on the size and condition of your piping system. You see, *ideally*, the water should begin to return to the boiler before the boiler's internal water line drops to a critical point. That's the point at which the low water cut-off will cut power to the burner, or an automatic water feeder will open.

Because the water is in the system piping and radiating during operation, the "normal" water level becomes a point that's somewhere in the lower-third of the gauge glass (Fig. C).

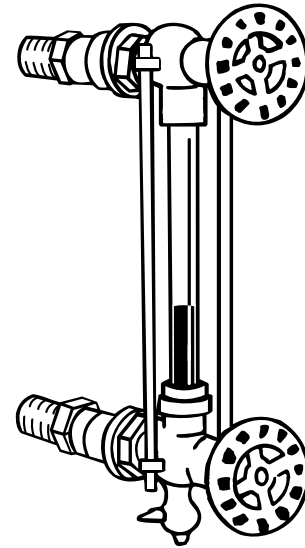
Remember, you're working with a *range* of operation here, not a fixed point. If the water were to stay at the top of the gauge glass all the while the burner was firing, you probably wouldn't be making steam! So don't get too caught up with the word "normal" because the only thing that's normal is that the water level will rise and fall.

Boiler manufacturers, as we said before, *do* establish a minimum safe water level for their boilers, however. That point is usually just out of sight of the bottom of the gauge glass. Should the water level drop to this point, the boiler may be in danger of overheating. We have to find a way to protect the boiler from itself (Fig. D).

All leading authorities and insurance companies recognize this need. The ASME Code for Low Pressure Heating Boilers, for instance, specifies, "*Each automatically fired steam or vapor steam boiler shall be equipped with an automatic low water fuel cut-off.*" The device the code refers to is what most people in the field commonly call a "low water cut-off." Its job is to stop the burner and protect the boiler.

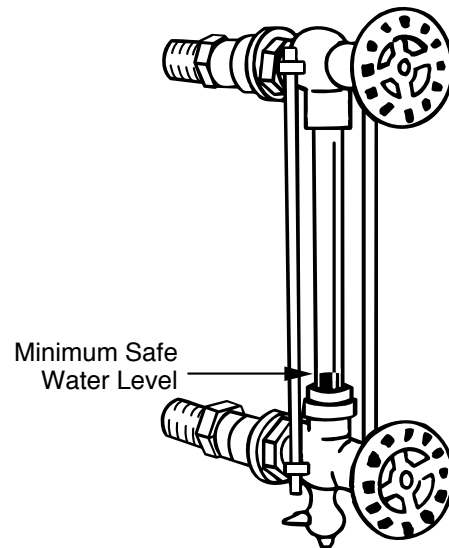
What Causes a Low Water Condition?

Because it's an open system, some evaporative water loss is normal for a steam system. How much depends on the size and condition of the system. If you're losing too much water, however, it's time to begin troubleshooting. There are many places to look.



Gauge Glass One-Third Full

Fig. C



Gauge Glass Minimum Safe Water Level

Fig. D

Here are a few good places to start:

- The air vents are dirty, not seating properly, and passing steam to the atmosphere.
- Someone left the boiler blowdown valve partially open.
- Someone, for whatever reason, has been drawing hot water from the boiler.
- The relief valve has discharged.
- The condensate pump isn't working as it should.
 - The float may have come loose.
 - The condensate may be too hot to pump.
(Check those steam traps!)
- Improper near-boiler piping may be throwing water up into the system, or causing the waterline to tilt during operation.
- The wet returns may be leaking. (Always suspect *any* buried pipe).
- A check valve may be stuck closed or partially closed.
- The boiler may be foaming and priming.
 - Check the pH of the water. It should be between 7 and 9.
 - Check the condition of the water. Dirty water will prime and foam.
 - Check the burner's firing rate. Over-firing can cause priming.
- The pipes may not be properly pitched.
- The automatic feeder may not be working properly.
 - Its chamber may be filled with sediment.
 - Its feed line may be clogged.
- All of the condensate may not be returning from the system (a common problem with process applications).
- The boiler metal may be corroded and leaking at the water line.
 - Flood the boiler to its header to check for leaks.

Good troubleshooters take the time to look over the entire system before deciding what's wrong. Take the time to do it right, and you'll be the person with the answers.

Watching the Water Level

The best way to prevent overheating damage to a boiler is to stop the burner if the water level falls too low. This is the low water cut-off's job. There are several types of low water cut-offs you can use. Let's look at them.

Float Operated Low Water Cut-Offs

Float operated low water cut-offs have been around (Fig. E) since the 1920s and have earned a reputation worldwide for reliability. Usually, you'll mount this type of low water cut-off directly in the boiler's gauge glass tappings. We make "quick hook-up" fittings for these units to simplify installation.



Series 67 Float Type Low Water Cut-Off

Fig. E

The water level in the low water cut-off's chamber will mimic the water level in the boiler. As the water level drops in the boiler during steaming, the level in the chamber, and the cut-off's float drops with it. Should the float drop to the boiler's critical low water cut-off point, the float will trip an electrical switch that's wired in series with the burner. The burner instantly stops firing. It will stay off until the water level rises to a safe operating point.

This happens when the condensate returns from the system or when an automatic water feeder or a boiler attendant adds water to the boiler. When the level reaches a safe position, the low water cut-off will make its electrical connection and the burner will restart.

When a steam system is well balanced, the low water cut-off's job is to stand by and wait. The situation we just described suggests that there's something out of balance in that system. We'll look at this again in a few minutes.

Probe and Float Type Built-In Low Water Cut-Offs

There are some jacketed boilers that don't easily accept quick hook-up fittings. These boilers will often have a tapping for a built-in low water cut-off. These built-in units do the same thing as the external units we just looked at, but instead of being in a chamber, the "built-ins" are right inside the boiler where they can sense the water level directly.

We make two types of built-in low water cut-offs:

Probes – The boiler manufacturer will specify the point where they'd like to have this type of low water cut-off inserted. It will usually sit just below the water line, at a point above the boiler's crown. A probe uses the boiler's water to complete an electrical circuit past an insulator (the center portion of the probe) back to a ground (the threaded portion of the probe). As long as water covers the probe an electronic "go" signal will travel to the burner. When water drops off the probe for a continuous ten seconds, an electronic "stop" signal goes to the burner, shutting it down and protecting the boiler from a low water condition.

At McDonnell & Miller, we manufacture several different types of probe low water cut-offs to meet any of your job applications (Fig. F).

One of those applications might involve the boiler's water level. The water capacity of today's boilers is considerably less than that of boilers from decades ago. Along with this, the water level operating range of today's boilers is smaller. Further, the amplitude of surging water levels is increasing. As a result, the low water cut-off must be "smart" enough to recognize these variations and react appropriately. We have done this by



Series PSE-800 Probe Type Low Water Cut-Off

Fig. F

incorporating delay features in the probe's operating logic. These include a delay on break feature (DOB) which keeps the burner lit for 10 seconds after water leaves the probe. This minimizes the effects of a surging water line. Another addition – the delay on make feature (DOM) – allows an additional feed time of 30 seconds once water comes in contact with the probe. This minimizes rapid burner and feeder cycling by slightly elevating the water level so that water lost to steaming will return (in the form of condensate) before the water level drops below the probe.

Float Type – In operation, these are similar to the external, float operated low water cut-offs we looked at before. The difference is that instead of sensing a duplicated water level *outside* the boiler, these units sense the level directly inside the boiler.

We make them for you in five mounting-barrel sizes (Series 69) to accommodate different boiler insulation thicknesses. When you select a built-in, float type control make sure it fits as far as possible into the boiler, without the float shield coming contact with the boiler.

When a low water cut-off stops a burner, it also stops the entire heating system. Nothing will happen until the water in the boiler returns to a safe operating level.

While this is very good for the boiler, it may not be the best thing for the system. If the heat in the building is off for too long a time, water pipes may begin to freeze.

This is where automatic water feeders come in. An automatic feeder will maintain a safe minimum water level in the boiler and keep it operating, even if the system is leaking. It keeps the system operating automatically until you can make the repairs.

Combination Low Water Cut-Offs and Automatic Water Feeders

Two of our most popular and versatile feeders are the Uni-Match® and the 101A (Fig. G and H). These are ideal for use in residential or small commercial applications. They are versatile in that they are compact and they are easily installed to operate with either a probe type OR a float type low water cut-off. These feeders are always ready to add water when given the signal from the low water cut-off. The benefits they offer are the convenience of not having to manually add water – and most importantly – they will protect the boiler from a dry fire condition by maintaining a safe minimum water level in the boiler should a system leak occur.

If you use a mechanical automatic water feeder, you can keep your burner operating even during a power failure.



Series WFE Uni-Match® Water Feeder

Fig. G



Series 101-A Water Feeder

Fig. H

Basic System Operation

A mechanical feeder can also protect a boiler (Fig. I) should a fuel-regulating device malfunction, causing the burner to lock in and stay there. Or suppose someone jumps-out a control, putting the burner on continuous operation. A mechanical automatic water feeder will continue to feed the boiler whenever the level drops to the “feed” point.

Under normal circumstances, the electrical low water cut-off (the second part of the feeder/cut-off combination) is always standing by, ready to shut off the burner should something go wrong with the automatic feeder.

An automatic water feeder doesn’t feed at the two-thirds full point on the gauge glass. You set this by hand when you first start the system. As we said before, the “normal” level will range up and down as the system operates. An automatic feeder will maintain a safe *minimum* water line only. By doing this, it will lessen the possibility of human error.

Consider this. A boiler attendant might put too much water in a steam boiler. He doesn’t have an automatic feeder and he’s tired of checking the water level every day so he fills the boiler to the two-thirds full point while it’s operating. When the condensate returns, the boiler floods. By adding water the attendant has limited the boiler’s steam-making space. Without enough room to break free of the water, the steam will now carry water up into the system piping. This leads to higher fuel bills, uneven heating, water hammer, scale formation in the boiler and burner short-cycling. Suddenly, problems plague this system, and no one is sure why.

Automatic water feeders help you avoid these problems. They watch that water level, maintaining a safe *minimum*. They allow the boiler water line to rise and fall naturally through its normal operating range.

How a Feeder/Cut-Off Combination Works

During Normal Operation – This is how a McDonnell & Miller feeder/cut-off combination looks on a steam boiler (Fig. J). Notice how we have it installed well below the boiler’s “normal” start-up operating range (that’s about two-thirds up the gauge glass). We don’t want it to feed while the water is out in the system as steam.

Remember, the automatic water feeder is there to maintain a safe minimum water line, not a “normal,” start-up water line.

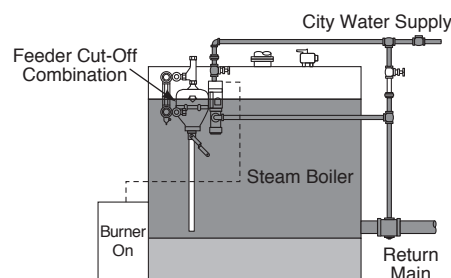
As you now see it in the drawing, the feeder is closed and the burner is firing. The boiler is working, sending steam out to the building, and both the automatic water feeder and low water cut-off are standing by.

The Feeder Opens – If the boiler’s water line drops to the feeder/cut-off combination’s feeder-operating point (which is very near the bottom of the gauge glass) (Fig. K), the feed valve will open mechanically and add water to the



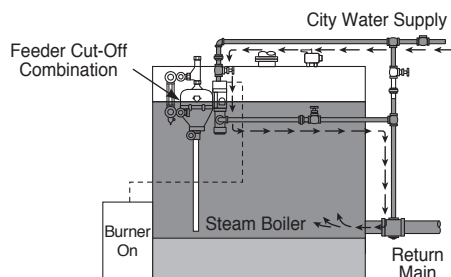
Series 47-2 Combination Mechanical Water Feeder/Low Water Cut-Off

Fig. I



Normal Operation

Fig. J



Feeder Open & Burner On

Fig. K

Basic System Operation

boiler. How much water will enter the boiler depends on several things, but there will always be enough to keep the boiler operating at a safe *minimum* water level. Once it has added the right amount of water, the feeder closes.

While this is happening, the burner continues to run because the feeder keeps the boiler from dropping to its low water cut-off point.

The Low Water Cut-Off Stops the Burner – But suppose something happens and the automatic water feeder can't keep up with the rate at which the boiler is losing water. Suppose, for instance, that a pipe breaks or someone opens a boiler drain, causing the boiler to suddenly lose water. Should this happen, the water level will drop to a preset point, and the automatic feeder/cut-off combination will instantly cut power to the burner, shutting it down and protecting the boiler from a dry-firing condition. Though the burner is off, the automatic feeder will continue to add water to the boiler in an attempt to restore a safe minimum water level (Fig. L).

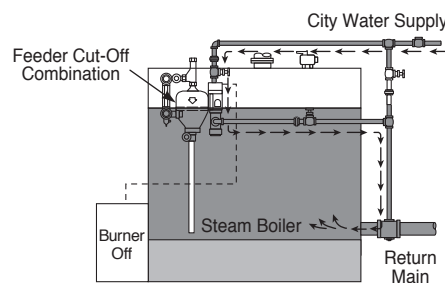
As you can see, a combination *mechanical* water feeder and *electrical* low water cut-off provides you with boiler protection even if the power fails or something goes wrong in the burner circuitry.

Combination Water Feeders and Low Water Cut-Offs for Larger Boilers

As we said earlier, all steam boilers evaporate water at the rate of one-half gpm per 1,000 square feet EDR (240,000 BTU/HR). To satisfy a larger boiler's needs, an automatic water feeder must be able to match the boiler's higher steaming rate. If the feeder can't keep up, the burner will suffer from nuisance low water shutdowns. To avoid this problem, we make automatic feeder/cut-off combinations with wider flow orifices to meet the special needs of larger boilers. The operation of these larger units is the same as the ones we just looked at. The key difference is the increased flow rate (Fig. M).

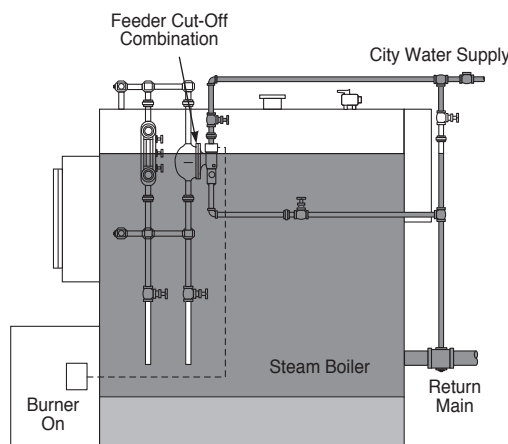
Once the larger feeder/cut-off combination satisfies the boiler's minimum water line needs, it has to be able to close against the force of the city water pressure moving through that extra wide orifice. This calls for considerable float and lever power, and it explains why our feeder/cut-off combinations for larger boilers are bigger than those for smaller boilers. We've carefully engineered them to get the maximum closing force in the space we have to work with. This ensures the unit will close tightly once it's done its job (Fig. N).

Codes call for larger boilers to have their gauge glasses mounted on water columns, rather than directly into the boiler. Consequently, we make our larger automatic



Feeder Open & Burner Off

Fig. L



Large Boilers

Fig. M



Series 51-2 Mechanical Water Feeder

Fig. N

water feeders and feeder/cut-off combinations without “quick hook-up” fittings. Instead, we give these larger combinations one-inch (25mm), float chamber tappings so you can mount them directly on an equalizing line.

Watching the Water Level in Process/ Space-Heating Boilers

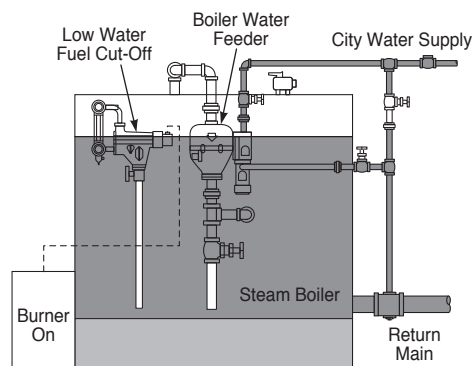
Now let’s suppose you’re installing a steam boiler in a factory. Some of the total steam load will travel to unit heaters where it will keep the workers warm. The rest of the steam will go to a steam table in the cafeteria, a dishwasher, an oil preheater on the boiler, a few sterilizing cabinets on the plant floor, and a half dozen other process applications.

This job offers a special challenge because a good portion of the condensate won’t be working its way back to the boiler. Some of this condensate is tainted in the process and we need to handle it specially. Because of this, you’re going to have to consistently add feed water to keep this process/space heating boiler operating.

If you use a combination feeder/cut-off on this job you may run into a problem because the vertical space on the control between its “feed” point and its “cut-off” point is relatively small. The feeder might not be able to keep up with the system’s process needs, and if it can’t, the boiler might drop into a low water condition and shutdown.

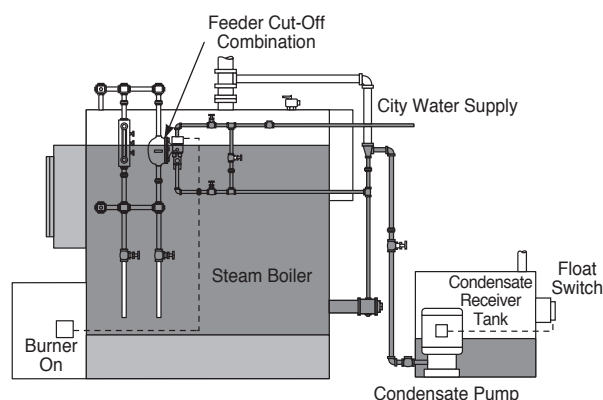
It’s best to install a *separate* automatic feeder and low water cut-off on a job such as this when you know some condensate won’t be returning (Fig. O). Set up this way, the feeder can open fully and deliver its maximum capacity to the boiler before the low water cut-off (installed at a lower level) goes into action. By piping the system like this, you eliminate nuisance burner cut-offs while meeting both your heating and process needs.

When you select the water feeder and low water cut-off for your process/space heating application, always check to make sure the operating pressure of your system doesn’t exceed the maximum operating pressure of either control.



Separate Water Feeder
Process/Semi-Process System

Fig. O



Single Boiler
Balanced System

Fig. P

The Importance of System Balance

Steam Systems With Condensate Pumps

Most two-pipe steam systems, and some one-pipe steam systems, need help returning condensate to the boiler (Fig. P). The pump’s job is to provide the “push” the water needs to get back into the boiler. The water leaves the boiler as steam, condenses into a liquid in the radiators and piping, and flows by gravity into a

condensate receiver. When the water level inside the receiver reaches a certain point, an electrical float switch turns the pump on. The pump quickly moves the water out of the receiver and back into the boiler.

Steam boilers served by condensate pumps also need low water protection, and our low water cut-offs serve that purpose well. You can also use an automatic water feeder or a combination feeder/cut-off on these systems. But before you do, make sure the system is well balanced. What we mean by “well balanced” is that the condensate pump should be able to return the water to the boiler before the boiler’s water level drops to a point where the low water cut-off or automatic feeder goes into action.

If the automatic water feeder adds water to the boiler (to maintain a safe minimum operating level), and *then* the condensate pump returns its water to the boiler, the boiler will most likely wind up with too much water. This excess water limits the boiler’s steam making space. Without enough room to break free of the water, the steam can carry water up into the system piping. That leads to higher fuel bills, uneven heating, water hammer, scale formation in the boiler and burner short cycling.

So before you use an automatic water feeder on a steam boiler that’s served by a condensate pump, check to see if the system is well balanced. It should run through its cycles without going off on low water. In other words, the condensate pump should balance the flow of water back into the boiler before the level drops to the critical, low water point. Keep in mind that a system with a condensate pump can become unbalanced if the returns clog with sediment or if any steam traps fail in an open position.

Good troubleshooters always keep their eyes wide open.

Steam Systems with Boiler-Feed Pumps

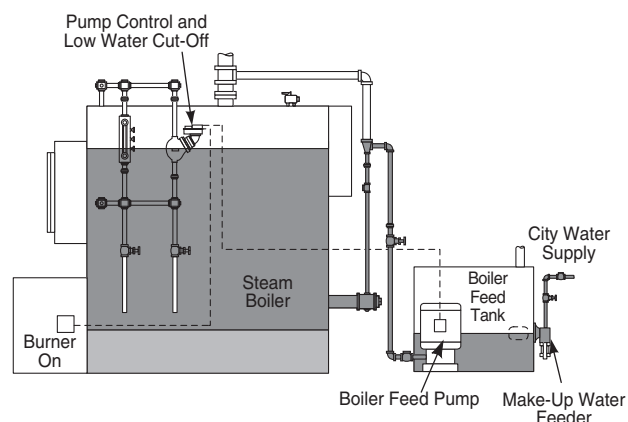
If you have a system where some steam is going for process (meaning, it won’t be coming back), or if your system isn’t well balanced, you should consider using a boiler feed pump instead of a condensate pump.

A boiler feed pump serves the same purpose as a condensate pump (Fig. Q). It provides the “push” the water needs to get back into the boiler. The difference between a condensate pump and a boiler feed pump, however, lies in the way we control the two units. Instead of having an electrical float switch inside the condensate receiver, a boiler feed pump takes its orders from a McDonnell & Miller pump controller mounted directly on the boiler.

The pump controller has two switches. The first switch (set at the higher of the two levels) operates the boiler feed pump. When the boiler needs water, the pump

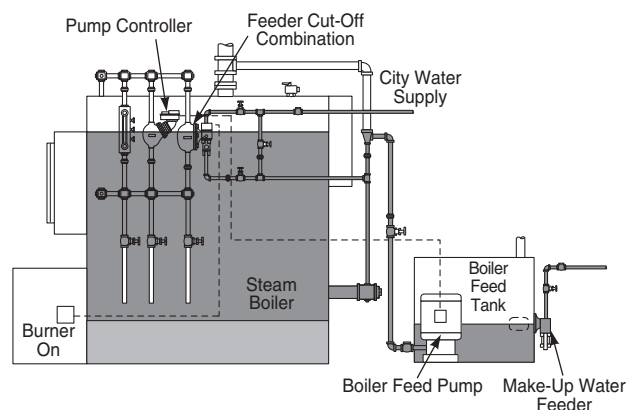
controller recognizes the need and starts the pump. When the boiler water returns to the proper level in the gauge glass, the pump controller stops the pump. Should the pump not be able to keep up with the boiler’s need for water, the pump controller will sense this as well. The second switch (set at the lower of the two levels) will cut the electricity to the burner and protect the boiler from a low water condition (Fig. R).

Feed water enters the system through a make-up water feeder in the boiler feed pump’s receiver. If you wish, you can add a feeder/cut-off combination to operate at a level a bit lower than the pump controller. This will give you a mechanically operated feeder, which will act as a back-up should something go wrong with the pump controller. It will also give you a secondary low water cut-off. It’s like having a belt *and* suspenders for your boiler!



Single Boiler
Unbalanced System

Fig. Q



Single Boiler
Feeder/Cut-Off Combination – Unbalanced System

Fig. R

Meeting the Needs of Systems with Multiple Steam Boilers

(Fig. S, T U)

The boiler on the right may be a stand-by to the boiler on the left. Every week or so, a boiler attendant might switch them, making this one the operating boiler and the other the stand by.

It's a good idea, one we've used for years in larger boiler rooms. By having more than one boiler, each is able to supply the entire needs of the system. Your chances of getting caught without steam are much less.

Some systems have multiple steam boilers. The idea here is to let several boilers join forces to meet the total needs of the system. The goal is energy conservation. You steam all the boilers on start-up, and then shut a few down after you've heated the system and satisfied the piping pick-up load. In other words, you put the system on "simmer" after you've heated it completely.

Steam systems with more than one boiler often have problems if the installer fails to realize that steam is dynamic and not static. By this, we mean that steam is always moving *very* quickly from the boiler to the system, and as it moves, it loses pressure. And since one ounce of pressure represents a water column 1³/₄ in. (45mm) high, the slightest difference in pressure between any two boilers interconnected on their return sides can make a big difference in the individual water levels.

A slight burr in a pipe or fitting can create a drop in pressure. You can never tune two burners to produce the same flame. One boiler will always be closer to the system take-off than another. These things speak loudly for proper piping and thoughtful management of the boiler water line so that's what we'll look at next.

Multiple Boiler Systems with a Boiler Feed Pump and Motorized Return Valves

Here we have two boilers served by a single boiler feed pump (Fig. S). One boiler may be a stand by to the other, or they may be sharing the total load. For piping purposes, we'd handle either application the same way.

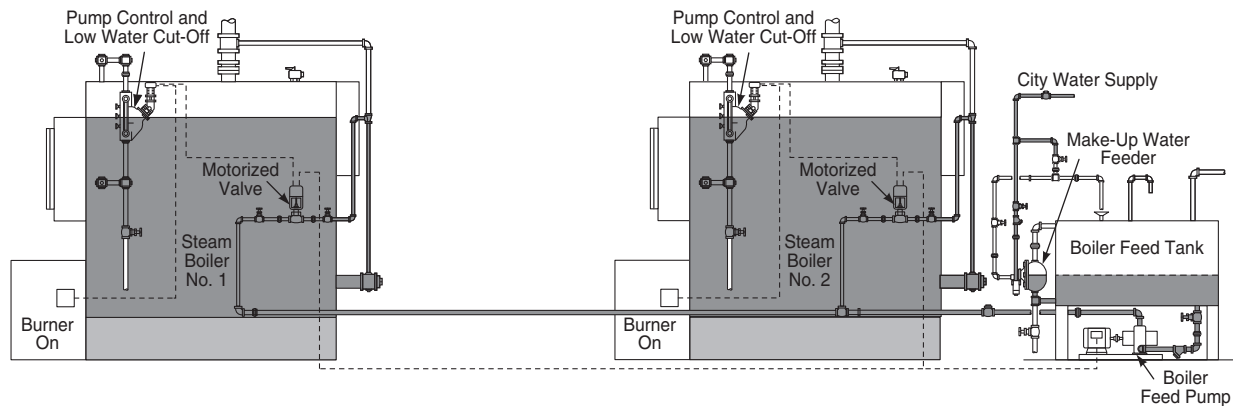
Notice how the condensate returns are independent. Each flows from the boiler feed pump receiver to the boiler through a motorized valve. This is an important detail. If you were to interconnect the returns, the water from one boiler would flow into the other.

Steam Moves – Remember, steam is dynamic, not static. Water doesn't "seek its own" level when the steam is moving out of the boiler. The slightest difference in firing rate or piping pressure drop between the two boilers will cause one to flood and the other to shut down due to a low water condition. This is why those independent returns are important. We're using motorized valves on this installation (Fig. S) to isolate one boiler from the other. When either boiler needs water, the McDonnell & Miller pump controller on that boiler will drop to a point where it will close the higher of its two switches. That switch will power that boiler's motorized valve, causing it to open. When it's fully opened, the motorized valve will trip an end switch and start the boiler feed pump. Water will flow only to the boiler that needs it. The float in the pump controller will sense the rising water. When the water reaches the proper level, the pump controller will break the electrical connection to the motorized valve. The valve will begin to close, shutting off the boiler feed pump as it does.

As you can see, when we pipe multiple boilers this way it doesn't matter how big or small each is. The boiler feed pump, although sized for the *total* needs of all the boilers, will satisfy the needs of each in turn, no matter what size.

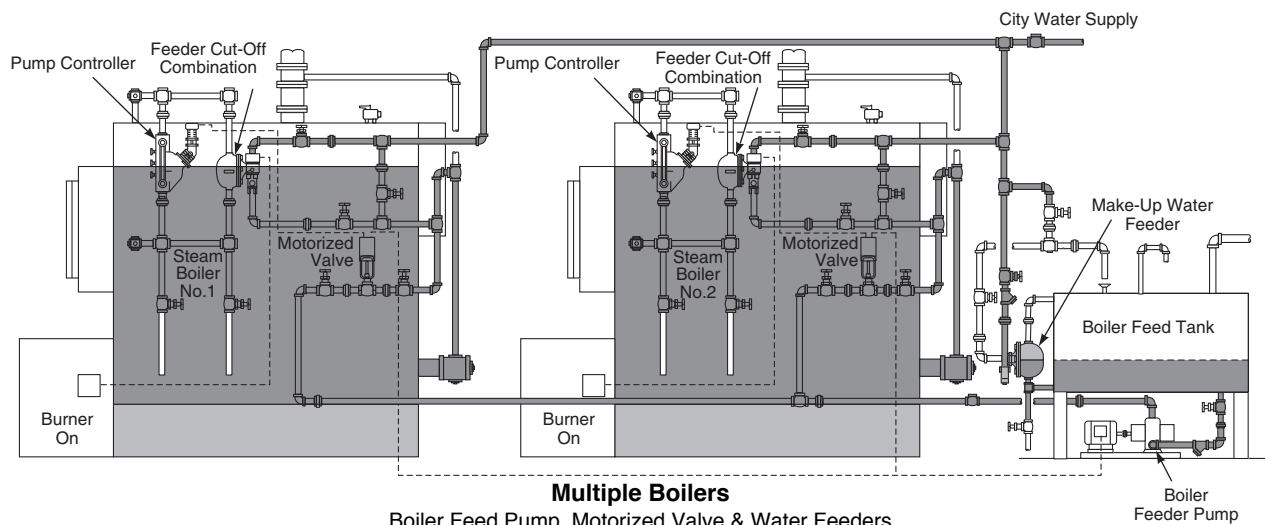
Keeping the Water Flowing – We've installed a make-up water feeder in the boiler feed pump's receiver tank. It's job is to maintain a minimum water line in the tank so the pump will always have a reservoir from which it can draw feed water. In this system, all the water will enter the boilers through the boiler feed pump. If, for any reason, the boiler feed pump can't keep up with the boiler's rate of evaporation, the water line in the boiler will drop. The lower switch in the McDonnell & Miller pump controller will stop the burner.

Basic System Operation



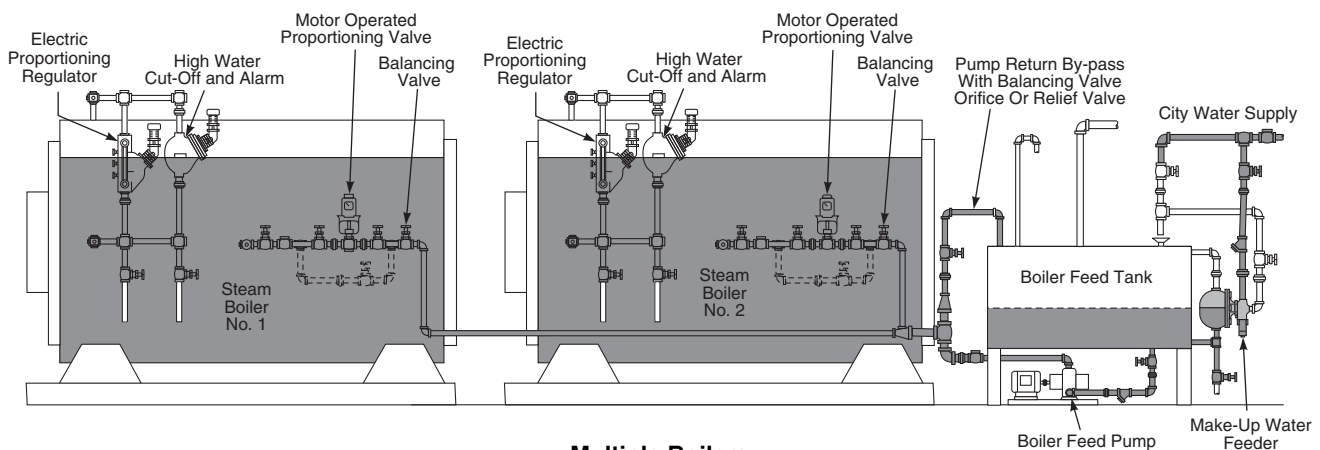
Multiple Boilers
Boiler Feed Pump and Motorized Valves

Fig. S



Multiple Boilers
Boiler Feed Pump, Motorized Valve & Water Feeders

Fig. T



Multiple Boilers
Boiler Feed Pump, Electric Proportioning Regulators and Motorized Valves

Fig. U

If you find the pump suddenly can't keep up with the boiler's needs, check the temperature of the returning condensate. As thermostatic radiator steam traps and end of main F&T traps age and fail, they pass steam into the returns. That can make the condensate hot enough to "flash" when it hits the pump's impeller. Boiler feed pumps can't move water once it has flashed to steam. The pump will turn and cavitate, but it won't satisfy the boiler.

Ideally, in a low pressure steam heating system, the condensate in the pump's receiver shouldn't be hotter than 180°F (82°C).

Multiple Boiler Systems with a Boiler Feed Pump, Motorized Return Valves and Boiler Water Feeders (Fig. T)

This is the same system we just looked at, except we've added a combination automatic water feeder and low water cut-off to a point just below the pump controller. The feeder/cut-off's job will be to add water mechanically to the boiler should something happen to the boiler feed pump (for instance, if it's cavitating because the return condensate is too hot).

Think of the feeder/cut-off as a back-up device to keep the boiler in operation should something go wrong elsewhere. The low water cut-off will back up the pump controller's primary low water cut-off should something go wrong there, or if the feeder can't keep up with the boiler's rate of evaporation for some reason.

Multiple Boiler Systems with a Boiler Feed Pump, Motorized Return Valves and Electric Proportioning Regulator (Fig. U)

Here we're controlling the water lines with electric proportioning regulators. We're matching the incoming feed water to the exact amount of water that's leaving as steam. By doing this, we're able to maintain a precise water line in both boilers and take advantage of each boiler's full steaming space.

There are times when steaming loads will vary tremendously. This is especially true of steam heating systems in larger buildings. We often set up these buildings to operate on outdoor air temperature sensors and night set-back devices. When the system first starts in the morning the boilers will steam longer than they will during the day when the pipes and radiators are hot. This is also true of seasonal operation when you run the heating system less often.

This is when proportioning regulators can make a big difference. By closely monitoring the water line, regardless of varying system conditions, you improve the quality of steam leaving the boiler and allow the system to operate more efficiently.

Receiver Tank Control

If you size a boiler feed pump's receiver properly it will be able to hold the right amount of water to keep the boiler operating during the start-up cycles. It will also be able to receive the returning condensate without overflowing.

Receiver sizing is more an art than a science. You have to look closely at the entire system to figure out how long it will take the condensate to return from the building. There are many variables to consider: The type and condition of steam traps, the pitch and cleanliness of steam mains and returns, the pipe insulation or lack of it, the shape of the building and how people use it.

There are also the times when you'll have to deal with condensate transfer pumps, or maybe a vacuum/condensate pump. These pumps collect and relay return water back to the boiler feed pump. There are many things that can affect how quickly these secondary pumps move condensate back to the primary boiler feed pump. You have to consider them all when you're sizing a feed pump receiver.

One thing will be a constant, however. There must always be enough water in the receiver for the boiler to draw from during the start-up cycle (the time between initial steaming and the return of condensate from the building). A McDonnell & Miller make-up feeder, set at the one-third full point on the receiver tank, will meet the boiler's needs during this crucial start-up time. Let's take a closer look at these.

Receiver Tank Make-Up Water Feeders

Here, we've mounted a McDonnell & Miller make-up water feeder on a one-inch NPT equalizing line that extends from the top of the tank to the bottom. The level in the feeder's chamber will be the same as the level in the tank. As the pump moves water out of the tank and into the boiler, the float inside the feeder's chamber will open and constantly replenish the tank's reservoir.

We've designed our feeders with the right amount of float and lever power to close tightly against city water pressure. This ensures that there will always be enough tank space to receive the returning condensate without having it overflow.

If the tank you're using doesn't have tapings for an equalizing line, you can use our internal feeder (Fig. V). As you can see, it mounts directly inside the tank and feeds water through its integral strainer. We make this unit with two flange sizes for both new and retrofit installations.

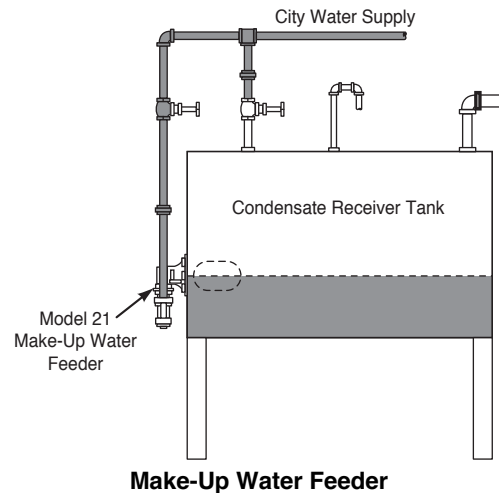


Fig. V

A Make-Up Water Feeder Used as a Pilot Valve (Fig. W)

When you have multiple boilers, the boiler feed pump has to be able to meet the needs of *all* the boilers should they need water simultaneously. During the start-up cycle, the draw from the feed pump's receiver can be very heavy and the make-up feeder has to be able to match that flow.

When we run into this situation, we often use a make-up water feeder as a pilot valve to operate a high capacity diaphragm valve with "dead-end" service. When the feeder opens it signals the diaphragm valve to snap into action. The larger valve quickly maintains the receiver at the one-third full point. Once the feed pump shuts off the dead-end service valve closes tightly to prevent over filling. If returned condensate fills the receiver, the feed valve, of course, stays closed. This piping arrangement also gives you a lot of freedom because you can put the diaphragm valve in a remote location, if you'd like, for easier service.

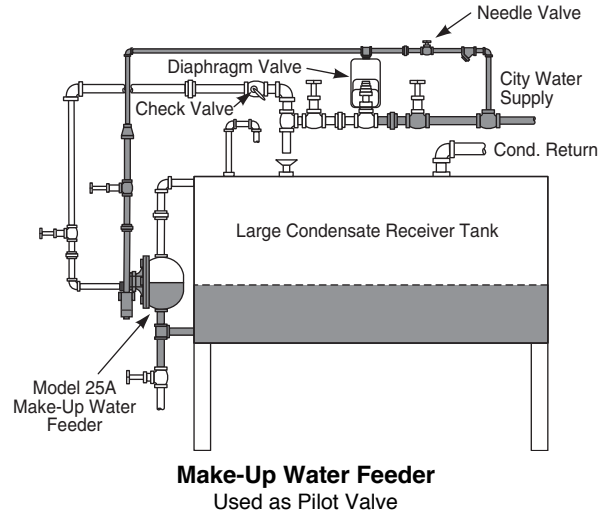


Fig. W

A Make-Up Water Feeder with a Motorized Valve (Fig. X)

Here's another way you can quickly fill the receiver. Use a McDonnell & Miller controller to sense the tank's water line. As the level rises and falls, the controller will electrically operate a high capacity motorized valve. This is another piping arrangement that gives you a lot of freedom. You can place that motorized valve anywhere you'd like.

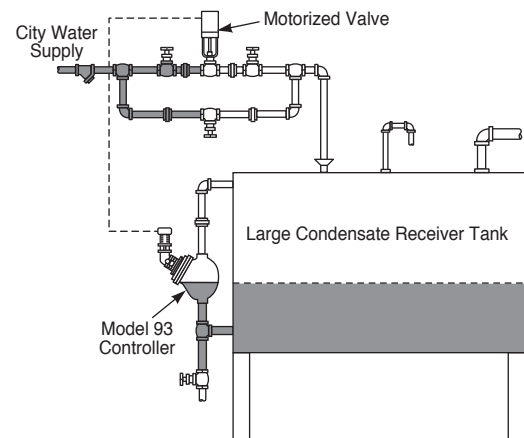
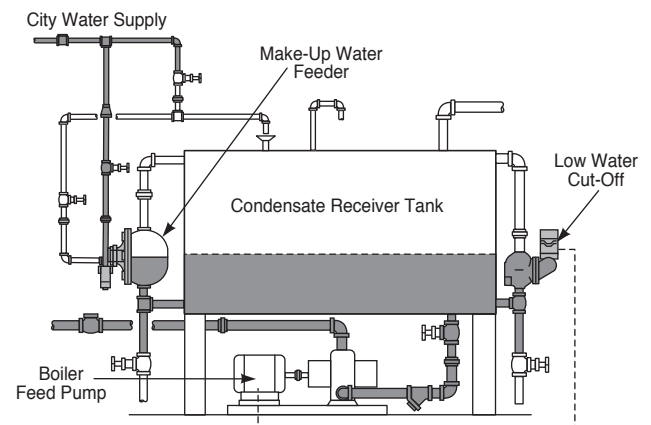


Fig. X

Low Water Cut-Offs for Receiver Tanks (Fig. Y)

There's always the possibility for human error on any job. For instance, suppose someone decides to turn off the water supply to your receiver tank. The pump controller on the boiler will still start the pump, but once the receiver goes dry there won't be any water to pump because of the closed valve. Or suppose the building loses water pressure and the feed pump suddenly finds itself moving more water than the water feeder can replace. If the pump runs dry, it will cavitate and its mechanical seal will quickly heat and break. That leaves you with a costly repair and system down time.

If you install a low water cut-off in an equalizing line around the tank, the cut-off will protect the pump no matter what happens.



**Low Water Cut-Off
on Receiver Tank**

Fig. Y

Hot Water Boilers

Low water protection isn't just for steam boilers. Hot water boilers face the same perils of overheating damage if the water line drops too low. Many people don't think of this as often as they should because hot water boilers serve "closed" systems. They have pressure reducing valves that are supposed to feed water automatically should a leak develop.

The truth, however, is that a pressure reducing valve is no substitute for a low water cut-off. Pressure reducing, or "feed" valves, often clog with sediment and wind up not feeding at all. A buried pipe can corrode and spring a leak that flows faster than a "feed" valve can satisfy. Relief valves can pop and, while dumping water at a great rate, actually prevent the feed valve from operating.

Let's take a closer look at how we can protect these boilers.

Hot Water Systems (Fig. Z)

As we said, the things that affect steam boilers also affect hot water boilers. If you run them with too much water the relief valve will open. If you run them with too little water they'll overheat and suffer damage.

A low water cut-off is the only sure way of protecting a hot water boiler from sudden loss of water. The ASME boiler code recognizes this by requiring all hot water boilers of 400,000 BTU/HR or more input to have low water fuel cut-off devices.

ASME doesn't call for low water cut-offs on smaller, residential boilers, but we think *all* hot water boilers, regardless of their size, must have protection. However, the International Mechanical Code requires low water cut-offs on **ALL** hot water and steam boilers. McDonnell & Miller make several devices, both float and probe type, that protect and meet the needs of any boiler whether it's cast iron, steel, or copper construction (Fig. AA, BB, CC).

Hot water systems regularly lose water through faulty air vents, loose valve stem packing, cracked boiler sections, loose nipples, corroded pipes, broken or loose pump seals, leaking gaskets, dripping relief valves, to name just a few places. Most installers depend on their pressure reducing or feed valve, to replace the lost water automatically. But feed valves often clog with sediment, especially in hard water areas. And it's very easy to close the supply valve to a feed valve and forget to open it again.

On systems with buried pipes (say, a radiant heating system) a feed valve will open if a pipe breaks. It will feed fresh water continuously until it either clogs (and stops feeding) or destroys the ferrous components of the system with oxygen corrosion. A simple feed valve can wind up costing a lot more than its purchase price. This is why major suppliers of feed valves, such as Bell & Gossett, recommend you close the feed valve once you've established your initial fill pressure.

This is also why we strongly recommend you use a low water cut-off on every hot water boiler. Feed valves are not a substitute for low water cut-offs. They can't protect your boilers from a low water condition. Feed valves are fine for filling the system initially, and for helping you vent air from the radiators. But once the system is up and running, you shouldn't look to them for protection.

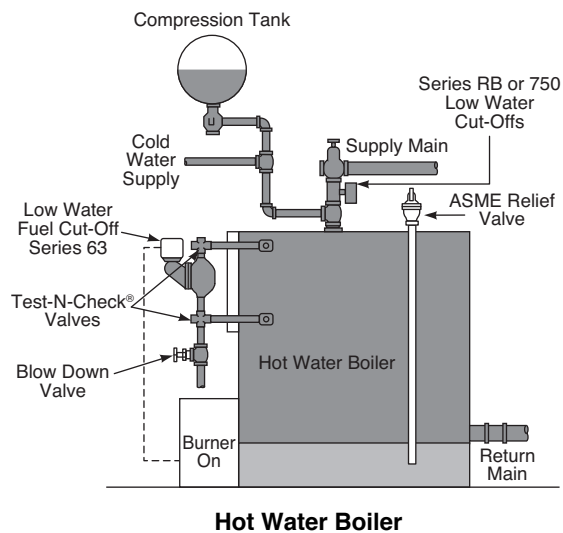


Fig. Z

Over firing

There are times when hot water boilers don't lock-out on safety. Whether by control failure or human error, things go wrong. And when they go wrong in a hot water heating system, the water temperature can rise quickly to a point where the compression tank can't take up the expansion of the water. This causes the relief valve to discharge.

When the relief valve opens, there's a sudden drop in system pressure. The water, which at this point is probably much hotter than 212°F (100°C), will flash into steam. This is why ASME insists that relief valves for hot water boilers carry steam-discharge ratings.

If a feed valve doesn't open to replace this rapidly exiting water, a low water condition will quickly result. The only thing that can protect the boiler at this point is a low water cut-off. The feed valve can't protect the boiler because its typical setting is 12 psig (.83 bar). In other words, the system pressure must drop below 12 psig (.83 bar) before the feed valve will open.

The trouble is that while the relief valve is open and flashing steam to atmosphere, the internal system pressure never drops anywhere near 12 psig (.83 bar). A relief valve with a 30 psig (2.1 bar) setting, for instance, will open at 30 psig (2.1 bar), and close again when the pressure drops to about 26 psig (1.79 bar). The result is a loss of water with no make-up. Repeat this cycle enough times and the boiler will be in a dangerous, low water condition. Keep in mind, steam exerts pressure. It can easily fool a feed valve, and that's why feed valves offer very little protection at all against low water.



Series 67 Float Type Low Water Cut-Off

Fig. AA



Series 751P/752P Probe Type Low Water Cut-Off

Fig. BB



Series RB-24E Probe Type Low Water Cut-Off

Fig. CC

Feeder/Cut-Off Combinations for Cast Iron and Steel Hot Water Boilers (Fig. DD)

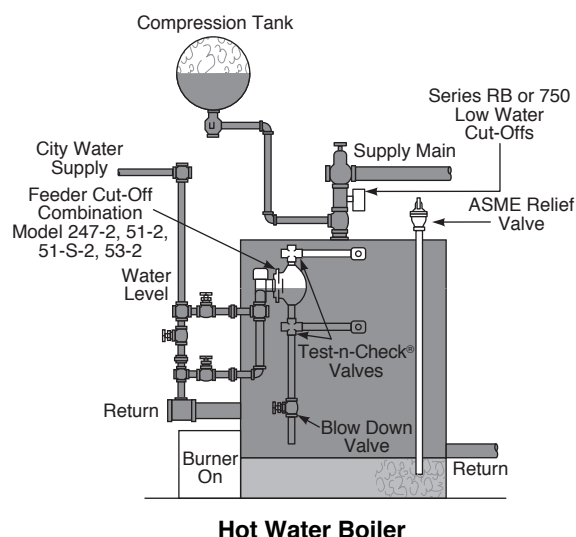
To protect a boiler from dry firing, the low water cut-off must be located above the boiler's crown. After the low water cut-off shuts off the burner, you should have a way to add water to the system to ensure the crown stays under water.

A combination water feeder and low water cut-off can do this for you. If you position the feeder above the boiler's crown, it will mechanically feed water if the level should drop to that point. This is an important consideration because, even if the electricity is cut off, it's possible for the firing cycle to continue if the fuel feed valve is mechanically locked open. The combination unit's cut-off switch will act as a back-up to the primary low water cut-off, providing the boiler with additional protection.

Protecting Copper Fin Tube Boilers (Fig. EE)

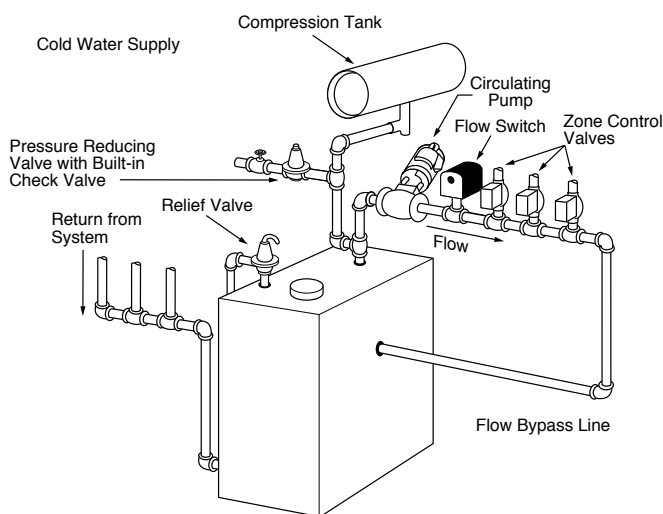
Copper fin tube boilers move heat from the flame to the water almost instantly. This type of boiler depends on the proper flow of water across its heat exchanger to move the heat quickly out of the boiler and into the system. Should flow stop while the burner is operating, heat will quickly build and cause the water in the heat exchanger to flash into steam. This condition is similar to a dry firing in a cast iron or steel boiler.

A McDonnell & Miller flow switch, installed on the copper fin tube boiler's hot water outlet, protects it from this danger (Fig. FF). The burner cannot fire unless water is moving across the flow switch. When the flow stops, for whatever reason, the McDonnell & Miller flow switch immediately cuts electrical power to the burner and protects the boiler from overheating.



Hot Water Boiler

Fig. DD



Copper Fin Tube Boiler

Fig. EE



Series FS4-3 Flow Switch
(shown without paddle)

Fig. FF

Pressure Relief Valves

(Fig. GG, HH)

Good engineering practice calls for every hot water boiler to have a pressure relief valve. This spring-loaded valve must be able to release the boiler's entire load at the boiler's maximum operating pressure.

Here are some things that can cause a relief valve to open in a hot water heating system:

- The automatic feed valve fails, allowing higher than normal pressure to enter the system.
- Someone leaves a hand bypass line open after filling the system.
- Someone hydrostatically tests the system at a pressure greater than the relief valve's setting.
- The air cushion in the diaphragm type compression tank doesn't match the system's static fill pressure. Keep in mind, most tanks come from the factory precharged at 12 psig (.83 bar). If the system needs more than 12 psig (.83 bar) pressure, you have to add more air to the tank, and you have to do this while you have the tank disconnected from the system.
- The compression tank may be too small for the system.
- The boiler's aquastat is in a well without heat transfer grease. When this happens, the boiler's temperature will quickly exceed the aquastat's setting, causing rapid rise in system pressure.
- The circulator may be on the return side of the system with the compression tank at its suction. If it is, the circulator's head pressure will appear inside the boiler as a net increase. It may be enough to open the relief valve.
- The burner limit may be jumped-out or stuck in a manual position.

The main thing to keep in mind when you're troubleshooting this one is that relief valves pop when any of these three things happen:

- The compression tank loses its air cushion
- The system takes on more water.
- The system temperature increases.

Think methodically, and keep your eyes wide open!

We hope this Basic System Operation Guide has given you insight into the systems on which you're now working or will face in the future. We welcome any questions or comments you may have about the Guide, or about our products.

Thanks for your support, and for your continuing business.



Series 250 Pressure Relief Valve

Fig. GG



Series 260 Pressure Relief Valve

Fig. HH

Hot Water Boilers

McDonnell & Miller Low Water cut-offs are specially designed to protect hot water boilers from the hazards of a low water condition. In operation they will interrupt the electrical current to the firing device, if the water in the system drops below the boiler manufacturer's minimum safe water level.

Our low water cut-offs also provide an additional circuit for a low water alarm, should you desire to install one, for additional protection.

How to Select Low Water Cut-Offs for Hot Water Boilers

Boiler pressure and the method of mounting are the primary factors to consider when selecting a low water cut-off.

Product Series	Size NPT	Maximum Boiler Pressure psi (kg/cm ²)	Method of Installation		Blow Down Valve	
			Directly into Boiler Tappings OR on the Boiler Supply Riser*	To Piping Above the Boiler with 1" (25mm) Equalizing Piping	Required	Provided with Low Water Cut-Off
RB-24E	¾	50 (3.5)	X		No	N/A
63	1			X	Yes	No
64	1			X	Yes	No
64-A	½		X		Yes	Yes
764	2½		X		Yes	No
751P/752P	¾	160 (11)	X		No	N/A
RB-122E	¾		X		No	N/A
750	¾ - 1	160 - 250 (11-18)	X		No	N/A

* Use the tapping designated by the boiler manufacturer for low water cut-off installation.

Steam Boilers

McDonnell & Miller Low Water Cut-offs are specially designed to protect steam boilers from the hazards of a low water condition. In operation they will interrupt the electrical current to the firing device, if the water in the system drops below the boiler manufacturers' minimum safe water level.

Our low water cut-offs also provide an additional circuit for a water feeder or a low water alarm, should you desire to install one, for additional protection.

We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.

How to Select Low Water Cut-Offs for Steam Boilers

Boiler pressure and the method of installation are the primary factors to consider when selecting a low water cut-off.

Product Series	Size NPT	Maximum Boiler Pressure psi (kg/cm ²)	Method of Installation		Blow Down Valve	
			Directly into Boiler Tappings*	Connect to the Boiler with 1" Equalizing Piping	Required	Provided with Low Water Cut-Off
PSE-800	¾	15 (1)	X		No	N/A
750	¾		X		No	N/A
61	1	20 (1.4)		X	Yes	No
67	½		X		Yes	Yes
767	2½		X		Yes	Yes
69	2½		X		No	N/A
42S	1	50 (3.5)		X	Yes	No
42S-A	½		X		Yes	Yes
63	1			X	Yes	No
64	1			X	Yes	No
64-A	½		X		Yes	Yes
764	2½		X		Yes	No
93/193	1	150 (10.5)		X	Yes	No
150S	1			X	Yes	No
157S	1			X	Yes	No
94/194	1¼	250 (18)		1¼	Yes	No
750B-C3/C4	1			X	Yes	No

* Use the tapping designated by the boiler manufacturer for low water cut-off installation.

How to Select Controls

STEAM BOILERS

Steam Heating Boilers are classified as boilers in closed heating systems where all condensate is returned to the boiler. Best recommendation for all automatically fired boilers is a feeder cut-off combination. It adds water as needed to maintain a safe operating level, and stands by to interrupt circuit to burner if water level drops into emergency zone.

Steam Process Boilers are classified as boilers in systems where not all the condensate is returned, and some make-up water is needed. A separate feeder and separate cut-off are recommended, so operating levels can be set for the wider differential required in such service.

Selection of the correct feeder cut-off combination, or feeder depends upon:

1. Maximum boiler pressure.
2. Differential between water supply pressure and the pressure setting of the steam safety valve.
3. Boiler size

HOT WATER BOILERS

Best recommendation for all automatically fired boilers is a feeder cut-off combination. It adds water if needed to match the discharge capacity of the relief valve, and stands by to interrupt circuit to burner if water level drops into emergency zone.

Selection of the correct feeder cut-off combination, or feeder depends upon:

1. Maximum boiler pressure.
2. Differential between water supply pressure and the pressure setting of the safety relief valve.
3. Boiler size

Boiler Rating			
BTU	HP	EDR	Cond. Lb./Hr
33,475	1	140	34.5
66,950	2	280	69
167,375	5	700	173
251,063	7.5	1,050	259
334,750	10	1,400	345
418,438	12.5	1,750	431
502,125	15	2,100	518
585,813	17.5	2,450	604
669,500	20	2,800	690
836,875	25	3,500	863
1,004,250	30	4,200	1,035
1,171,625	35	4,900	1,208
1,339,000	40	5,600	1,380
1,506,375	45	6,300	1,553
1,673,750	50	7,000	1,725

Conversion Factors

$$\text{Boiler Horsepower (BHP)} = \frac{\text{EDR}}{139}$$

$$\text{Gallons of Water} = \frac{\text{Lbs. of Water}}{8.33}$$

$$\text{BTUH} = \text{EDR} \times 240$$

$$\text{EDR} = \frac{\text{BTUH}}{240}$$

$$\text{BTUH} = \text{BHP} \times 33,479$$

Boiler Steaming Rate (Gallons Per Minute)

$$\text{GPM} = \frac{\text{EDR}}{2000}$$

$$\text{GPM} = (\text{BHP}) \times 0.069$$

$$\text{GPM} = \frac{\text{BTU}}{480,000}$$

$$\text{GPM} = \text{EDR} \times 0.000496$$

$$\text{Pounds of condensate per hour} = \frac{\text{EDR}}{4}$$

Water Feeders and Combination Water Feeders/Low Water Cut-Offs

McDonnell & Miller Boiler Water Feeders and Feeder Cut-Off Combinations are used to provide automatic operation, and to safeguard steam and hot water boilers against the hazards of a low water condition.

A feeder cut-off combination mechanically adds water as needed to maintain the required minimum water level, and electrically stops the firing device in case of an emergency.

How to Select Water Feeders (continued)

Steam Boilers

Series	Characteristics	Maximum Boiler Pressure psi (kg/cm ²)	Boiler Size (Mfr. Gross Rating Sq. Ft. of EDR)						
			*Differential Pressure psi (kg/cm ²)						
			10 (.7)	20 (1.4)	30 (2.1)	40 (2.8)	50 (3.5)	60 (4.2)	70 (4.9)
Uni-Match®	For Automatic Fired Heating Boilers	15 (1.0)	All Boilers up to 5,000 sq. ft.						
101A	For Automatic Fired Heating Boilers	25 (1.8)	All Boilers up to 5,000 sq. ft.						
47	For Heating or Process Boilers	25 (1.8)	All Boilers up to 5,000 sq. ft.						
47-2	For Automatic Fired Heating Boilers	25 (1.8)	All Boilers up to 5,000 sq. ft.						
247	For Heating or Process Boilers	30 (2.1)	All Boilers up to 5,000 sq. ft.						
247-2	For Automatic Fired Heating Boilers	30 (2.1)	All Boilers up to 5,000 sq. ft.						
51	For Heating or Process Boilers	35 (2.5)	8,600	12,000	15,000	17,600	20,000	21,800	23,400
51-2	For Automatic Fired Heating Boilers	35 (2.5)	8,600	12,000	15,000	17,600	20,000	21,800	23,400
51S	For Heating or Process Boilers	35 (2.5)	10,500	17,500	22,400	26,500	30,000	32,600	35,000
51S-2	For Automatic Fired Heating Boilers	35 (2.5)	10,500	17,500	22,400	26,500	30,000	32,600	35,000
53	For Heating or Process Boilers	75 (5.3)	8,600	11,600	14,600	17,000	18,800	20,600	22,100
53-2	For Automatic Fired Heating Boilers	75 (5.3)	8,600	11,600	14,600	17,000	18,800	20,600	22,100

*Differential pressure should be based on water supply pressure at boiler, minus pressure setting of steam safety valve

Low Water Cut-Offs – Electronic For Hot Water and Steam Boilers

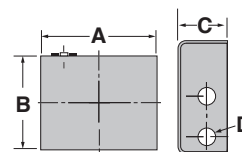
Series 750



- For commercial or industrial applications
- Primary or secondary control on hot water boilers
- Secondary control (manual reset models only) on steam boilers
- Manual reset models meet the requirements of **ASME Standard CSD-1**. If the control is in a low water condition when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe to allow the burner to fire.



Series 750
Control Unit



Standard Features

- Green LED indicating power is on
- Red LED indicating low water condition
- Test button
- No lock out with loss of power if probe is in water
- 20,000 ohms sensitivity

Control Unit

Temperature Ratings:

Temperature:

Storage: -40°F to 120°F (-40°C to 49°C)

Ambient: 32°F to 120°F (0°C to 49°C)

Humidity: 85% (non-condensing)

Electrical Enclosure Rating: NEMA 1 General Purpose

Hz: 50/60

Control Power Consumption: 3 VA (max.)

Model 750-HW-MT-120

The 750-HW-MT-120 control provides continuous protection against a **HIGH WATER** condition in steam boilers and other water level applications. The manual reset function will require the unit be reset after water has risen above the level of the probe.

Electrical Ratings

Model	Voltage	Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
24 VAC	24 VAC	—	—	50 VA at 24 VAC
120 VAC	120 VAC	7.5	43.2	125 VA at 120 VAC 50 or 60 Hz

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
750-T-24	176294	LWCO - 24V Auto Reset	2 (.9)
750-MT-24	176293	LWCO - 24V Manual Reset	2 (.9)
750-T-120	176206	LWCO - 120V Auto Reset	2 (.9)
750-MT-120	176207	LWCO - 120V Manual Reset	2 (.9)
750-HW-MT-120	176236	HWCO - 120V Manual Reset	2 (.9)

(Remote sensor and probe rod must be ordered separately, see page 70-72)

Dimensions, in. (mm)

A	B	C	D
6 $\frac{3}{8}$ (162)	5 $\frac{1}{8}$ (130)	2 $\frac{9}{16}$ (65)	1 $\frac{9}{16}$ (40)

Low Water Cut-Offs – Electronic For Hot Water and Steam Boilers

Series 751P/752P



- For commercial or industrial applications
- Primary or secondary control on hot water boilers
- Secondary control (manual reset models only) on steam boilers
- Manual reset models meet the requirements of **ASME Standard CSD-1**. If the control is in a low water condition when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe to allow the burner to fire.

Standard Features

- Green LED indicating power is on
- Red LED indicating low water condition
- Test button
- Self cleaning probe
- No lock out with loss of power if probe is in water
- 20,000 ohms sensitivity

Electrical Ratings

Model	Voltage	Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
24 VAC	24 VAC	—	—	50 VA at 24 VAC
120 VAC	120 VAC	7.5	43.2	125 VA at 120 VAC 50 or 60 Hz

Ordering Information

(Remote sensor must be ordered separately (see page 70-74))

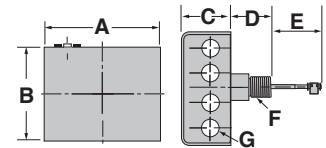
Model Number	Part Number	Description	Weight lbs. (kg)
752P-MT-24	176296	LWCO - 24V w/standard probe	2.5 (1.1)
752P-MT-U-24	176298	LWCO - 24V w/ext. barrel probe ('U')	2.5 (1.1)
752P-MT-SP-24	176297	LWCO - 24V w/short probe ('SP')	2.5 (1.1)
751P-MT-120	176234	LWCO - 120V w/standard probe	2.5 (1.1)
751P-MT-U-120	176214	LWCO - 120V w/ext. barrel probe ('U')	2.5 (1.1)
751P-MT-SP-120	176295	LWCO - 120V w/short probe ('SP')	2.5 (1.1)

Dimensions, in. (mm)

A	B	C	D			E			F	G
			Std.	SP	U	Std.	SP	U		
6 ⁵ / ₈ (168)	5 ⁵ / ₁₆ (135)	2 ³ / ₄ (70)	1 ⁹ / ₁₆ (40)	3 ¹ / ₁₆ (78)	1 ⁹ / ₁₆ (40)	2 ¹ / ₈ (54)	1 ⁵ / ₁₆ (33)	1 ⁹ / ₁₆ (40)	3/4	7/8 (22)



Series 751P/752P



Probe Specifications

Maximum Steam Pressure: 15 psi (1.0 kg/cm²)
Maximum Water Pressure: 160 psi (11.2 kg/cm²)
Maximum Water Temperature: 250°F (121°C)
Probe Sensitivity: 20,000 ohm

Control Unit

Temperature Ratings:

Temperature:

Storage: -40°F to 120°F (-40°C to 49°C)

Ambient: 32°F to 120°F (0°C to 49°C)

Humidity: 85% (non-condensing)

Electrical Enclosure Rating: NEMA 1 General Purpose

Hz: 50/60

Control Power Consumption: 3 VA (max.)

Low Water Cut-Offs – Electronic For Steam Boilers

Series PSE-800

For commercial steam boiler applications

The Series PSE-800 probe type LWCO uses patented technology to monitor changes in water conductivity. When defined parameters are exceeded the new PSE-800 makes a decision to shut the burner off based on the volatility/variability of the resistance settings. This new patented technology provides the best protection possible without turning off the boiler unless a low water condition exists. As an added measure of safety, the control will turn off the boiler if it recognizes an out-of-water condition when the sensitivity threshold is exceeded.

Standard Features

- Green LED indicating power is on
- Red LED indicating low water condition
- 30 second DOM
- Test button
- Self-Cleaning probe
- No lock out with loss of power if probe is in water
- Provisions to add water feeder of alarm

Models available with:

- 120 VAC
- 24 VAC
- 'U' probe (extended barrel)
- 'RX2' probe (remote)

Electrical Ratings

Model	Voltage	Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
24 VAC	24 VAC	—	—	50 VA at 24 VAC
120 VAC	120 VAC	7.5	43.2	125 VA at 120 VAC 50 or 60 Hz

Ordering Information

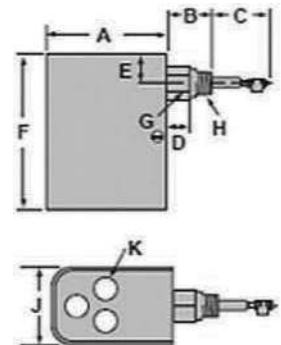
Model Number	Part Number	Description	Weight lbs. (kg)
PSE-801-120	153827	LWCO - 120V	2.7 (1.2)
PSE-801-U-120	153828	PSE-801-120 w/ext. barrel ('U' probe)	2.7 (1.2)
PSE-802-24	153927	LWCO - 24V	2.7 (1.2)
PSE-802-U-24	153928	PSE-802-24 w/ext barrel ('U' probe)	2.7 (1.2)
PSE-802-RX2-24	153929	PSE-802-24 w/remote sensor ('RX2' probe)	2.7 (1.2)

Dimensions, in. (mm)

A	B		C				D	E	F	G	H		J	K
	All	U	Std	SP	RX2	U					All	RX		
4¼ (108)	1⅞ (40)	3⅞ (78)	2⅞ (54)	1⅞ (35)	2⅞ (54)	1⅞ (40)	¾ (20)	1⅞ (21)	5⅞ (148)	1⅞ (35)	¾ (20)	½ (25)	2⅞ (73)	⅞ (22)



Series PSE-800



Probe Specifications

Maximum Steam Pressure: 15 psi (1.0 kg/cm²)

Maximum Water Pressure: 160 psi (11.2 kg/cm²)

Maximum Water Temperature: 250°F (121°C)

Probe Sensitivity: 7,000 ohm

Control Unit

Temperature:

Storage: -40°F to 120°F (-40°C to 49°C)

Ambient: 32°F to 120°F (0°C to 49°C)

Humidity: 85% (non-condensing)

Low Water Cut-Offs – Electronic For Steam Boilers

PSE-800-M Manual Reset LWCO

- Primary or Secondary control on hot water boilers
- Secondary control on steam boilers
- Manual reset models meet requirements of **ASME Standard CSD-1**. If the control is in a low water condition when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe to allow the burner to fire.

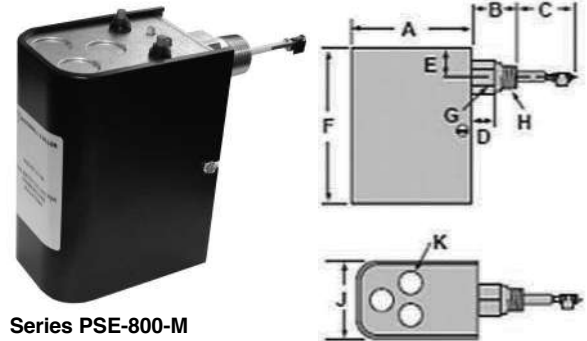
Standard Features

- Green LED indicating power is on
- Red LED indicating low water condition
- 60-second delay before lockout.
- Test button
- Self-Cleaning probe
- No lock out with loss of power if probe is in water

Electrical Ratings

Model	Voltage	Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
24 VAC	24 VAC	—	—	50 VA at 24 VAC
120 VAC	120 VAC	7.5	43.2	125 VA at 120 VAC 50 or 60 Hz

- Probe Sensitivity: 7,000 ohms
- Probe Consumption: 1.7 VA @ 24 VAC
3.6 VA @ 120 VAC
- Enclosure Rating: NEMA 1 General Purpose



Series PSE-800-M

Probe Specifications

Maximum Steam Pressure: 15 psi (1.0 kg/cm²)
Maximum Water Pressure: 160 psi (11.2 kg/cm²)
Maximum Water Temperature: 250°F (121°C)
Probe Sensitivity: 7,000 ohm

Control Unit

Temperature:

Storage: -40°F to 120°F (-40°C to 49°C)

Ambient: 32°F to 120°F (0°C to 49°C)

Humidity: 85% (non-condensing)



Do not use “manual reset” models with electric automatic water feeders.
Failure to follow this caution can cause flooding and property damage.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
PSE-801-M-120	153601	120V Manual Reset w/standard probe	2.7 (1.2)
PSE-801-M-U-120	153603	120V Manual Reset w/ext. barrel probe ('U')	2.7 (1.2)
PSE-802-M-24	153602	24V Manual Reset w/standard probe	2.7 (1.2)
PSE-802-M-U-24	153604	24V Manual Reset w/ext. barrel probe ('U')	2.7 (1.2)

Dimensions, in. (mm)

A	B		C		D	E	F	G	H	J	K
	All	U	Std	U							
4¼ (108)	1½ (40)	3½ (78)	2½ (54)	1½ (40)	1¼ (20)	1¾ (21)	5¼ (148)	1 (35)	¾ (20)	2½ (73)	¾ (22)

Low Water Cut-Offs – Electronic



RB-24E

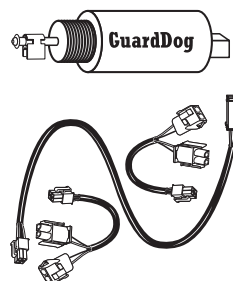
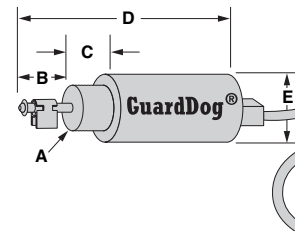
Low Water Cut-Offs



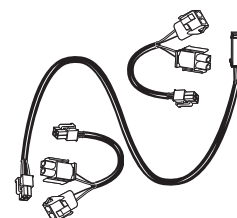
- Brass threads enable a secure and trouble-free installation
- Test button to confirm proper operation
- Universal wiring harness fits 100% of today's gas boilers
- -S, -A, -B and -L models provide “plug & play” installation with most residential boilers
- Compact size
- Easy to install and wire
- Automatic reset feature resumes operations after a power outage when water is on probe
- Green LED indicating power is on
- Red LED indicating low water condition
- Solid state operation
- 15,000 ohms probe sensitivity
- Maximum ambient temperature 120°F (49°C)
- Maximum water temperature 250°F (121°C)
- Maximum water pressure of 160 psi (11.2 kg/cm²)



RB-24E



RB-24E-S



UWH-RB-24S

Electrical Ratings

Voltage	Power Consumption	Load Switching
24 VAC	2.5 VA	2 A at 24 VAC

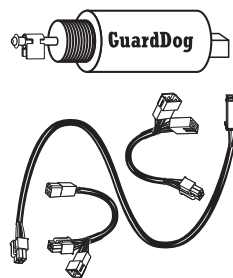
Note: A 15 mA minimum current draw is required.

Dimensions, in. (mm)

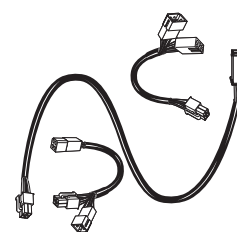
A NPT	B	C	D	E
3/4	1 3/16 (30.2)	1 3/16 (30.2)	5 3/4 (180)	1 7/8 (47.6)

Ordering Information

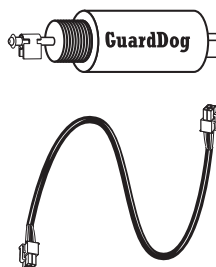
Model Number	Part Number	Description
RB-24E	144692	Residential LWCO
RB-24E-A	144694	Residential LWCO w/vent damper harness
RB-24E-B	144696	Residential LWCO w/burner control harness
RB-24E-S	144693	Residential LWCO w/control board harness
RB-24E-L	144690	Residential LWCO w/burner control harness
UWH-RB-24A	144681	Replacement cable for RB-24E-A
UWH-RB-24B	144695	Replacement cable for RB-24E-B
UWH-RB-24S	144682	Replacement cable for RB-24E-S
UWH-RB-24L	144691	Replacement cable for RB-24E-L



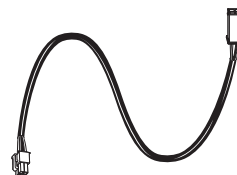
RB-24E-A



UWH-RB-24A



RB-24E-B
RB-24E-L



UWH-RB-24B
UWH-RB-24L

Low Water Cut-Offs – Electronic For Hot Water Boilers

RB-122-E

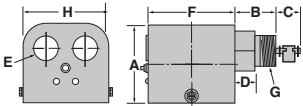
Low Water Cut-Offs



- For residential and commercial applications
- Electronic operation
- Easy to install and wire
- Red LED indicating low water condition
- Green LED indicating power is on
- Test button
- Automatic reset
- No blow down required
- 20,000 ohms probe sensitivity
- Maximum ambient temperature 120°F (49°C)
- Maximum water temperature 250°F (121°C)
- Maximum water pressure 160 psi (11.2 kg/cm²)



RB-122-E



Electrical Ratings

Voltage	Power Consumption	Load Switching
120 VAC	3.1 VA	5.8 A at 120 VAC

Dimensions, in. (mm)

A	B	C	D	E	F	G NPT	H
2 ³ / ₄ (70)	1 ⁵ / ₈ (51)	1 ³ / ₈ (35)	3/ ₄ (20)	7/ ₈ (22)	3 ¹³ / ₁₆ (99)	3/ ₄	3 ³ / ₁₆ (81)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
RB-122-E	144676	Low water cut-off	1.7 (.78)

Notes

Boiler Controls

[illegible]

[illegible]

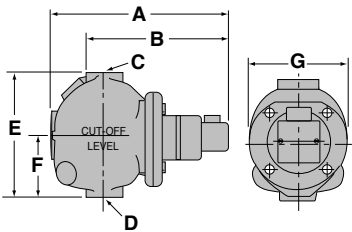
Low Water Cut-Offs – Mechanical For Steam Boilers

Series 61 Low Water Cut-Offs

- For residential and commercial low pressure steam boiler applications
- For boilers of any steaming capacity
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and alarm or electric water feeder
- Packless bellows
- 1" NPT equalizing pipes and blow down valve required
- Maximum steam pressure 20 psi (1.4 kg/cm²)



Series 61



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D NPT	E	F	G
9 ¹⁵ / ₁₆ (252)	7 ⁷ / ₁₆ (189)	1	1	6 ¹ / ₂ (165)	3 ¹ / ₈ (79)	5 ¹ / ₈ (130)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
61	140100	Low water cut-off	13.5 (6.1)

Low Water Cut-Offs – Mechanical For Steam and Hot Water Boilers

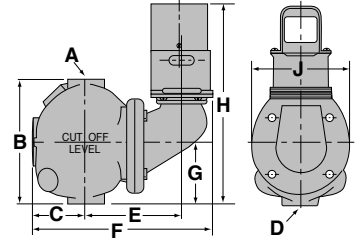
Series 63

Low Water Cut-Offs

- For residential, commercial, and industrial applications
- Heavy duty
- Includes No. 2 switch
- Optional manual reset available
- Maximum boiler pressure 50 psi (3.5 kg/cm²)
- Use with TC-4 on hot water systems



Series 63



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

Dimensions, in. (mm)

A NPT	B	C	D NPT	E	F	G	H	J
1	6½ (165)	2⅞ (65)	1	5⅝ (131)	9⅜ (238)	3⅞ (79)	10½ (267)	5⅞ (130)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
63	142400	Low water cut-off	13.5 (6.1)
63-B	142700	63 w/ float block	15.0 (6.8)
63-BM	143300	63 w/float block & manual reset	15.0 (6.8)
63-M	143100	63 w/manual reset	14.0 (6.4)

Low Water Cut-Offs – Mechanical For Steam and Hot Water Boilers

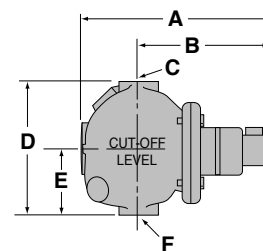
Series 64

Low Water Cut-Offs

- For residential, commercial, and industrial boiler applications of any steaming capacity
- Heavy Duty
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and alarm or electric water feeder
- Packless bellows
- Optional manual reset available (manual reset switch must be ordered separately)
- 1" (25mm) NPT equalizing pipes required
- Maximum boiler pressure 50 psi (3.5 kg/cm²)
- Use with TC-4 on hot water systems



SERIES 64



Dimensions, in. (mm)

A	B	C NPT	D	E	F NPT
9 ¹⁵ / ₁₆ (252)	7 ⁷ / ₁₆ (65)	1	6 ¹ / ₂ (165)	3 ³ / ₈ (79)	1

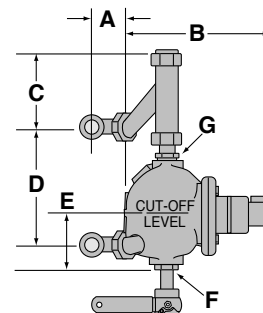
Model 64-A

Low Water Cut-Offs

- Quick hook-up fittings provided for installation directly into gauge glass tapings



Model 64-A



Dimensions, in. (mm)

A	B	C	D		E	F NPT	G NPT
			min.	max.			
2 ⁵ / ₈ (66)	9 ¹⁵ / ₁₆ (252)	4 ¹ / ₂ (113)	6 ⁷ / ₈ (172)	13 ³ / ₈ (339)	3 ¹ / ₈ (79)	1	1

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
64	143600	Low water cut-off	11.3 (5.1)
64-A	143700	64 w/quick hook-up fittings	18.3 (8.3)
64-B	143800	64 w/float block	11.5 (5.2)

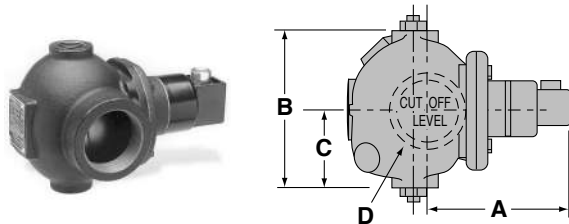
Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Low Water Cut-Offs – Mechanical For Steam and Hot Water Boilers

Series 764 Low Water Cut-Offs

- For residential, commercial, and industrial boiler applications of any steaming capacity
- Heavy duty
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and alarm or electric water feeder
- Packless bellows
- 2½" NPT side tapping provided for installation with close nipple
- Maximum boiler pressure 50 psi (3.5 kg/cm²)



Series 764

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D NPT
6⅞ (175)	6½ (165)	3⅞ (79)	2½

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
764	144500	Low water cut-off	12.5 (5.7)

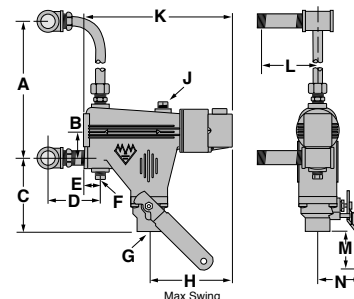
Low Water Cut-Offs – Mechanical For Steam Boilers

Series 67 Low Water Cut-Offs

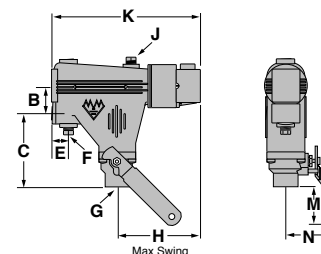
- For residential and commercial applications
- For boilers of any steaming capacity
- Quick hook-up fittings provided
- Lever-operated, full port ball valve for easy blow down
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and alarm or electric water feeder
- Optional features
 - Low voltage switches for self-generating millivolt circuits
 - Manual reset switch (manual reset switch must be ordered separately)
- Large float chamber
- Maximum steam pressure 20 psi (1.4 kg/cm²)



Series 67



Model 67-LQHU
(without quick
hook-up fittings)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A		B	C	D	E	F	G	H	J	K	L	M	N
min.	max.					NPT	NPT		NPT				
6½ (165)	14 (356)	1¾ (45)	4¾ (121)	3⅝ (86)	1⅛ (29)	⅜	¾	5½ (140)	¼	9 ²³ / ₃₂ (247)	3⅞ (90)	2½ (64)	2 ¹³ / ₁₆ (71)

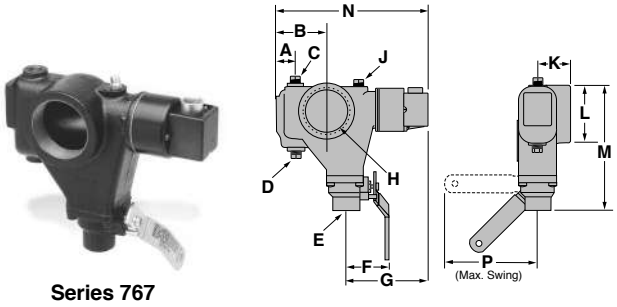
Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
67	149400	Low water cut-off	10 (4.5)
67-G	149600	67 for millivolt service	10 (4.5)
67-LQHU	149500	67 without quick hook-up fittings	8 (3.6)

Low Water Cut-Offs – Mechanical For Steam Boilers

Series 767 Low Water Cut-Offs

- For residential and commercial low pressure boiler applications
- For boilers of any steaming capacity
- 2½" NPT body tapping for side mounting on boilers
- Lever-operated, full port ball valve for easy blow down
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and alarm or electric water feeder
- Large float chamber
- Maximum steam pressure 20 psi (1.4 kg/cm²)



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D NPT	E NPT	F	G	H NPT	J NPT	K	L	M	N	P
1½ (38.1)	3½ (89.1)	¾	¾	¾	2½ (63.5)	5 (127)	2½	¼	2½ (63.5)	3½ (89.1)	8½ (215.9)	9½ (241.3)	5½ (139.7)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
767	153700	Low water cut-off	8.5 (3.9)

Low Water Cut-Offs – Mechanical For Steam Boilers

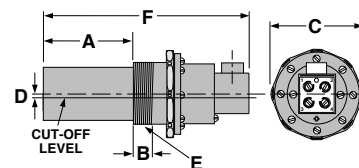
Series 69

Built-in Low Water Cut-Offs

- For residential and commercial low pressure steam boiler applications
- For boilers of any steaming capacity
- For mounting in 2½" NPT boiler side tapings
- Insertion lengths available in 1⅜" - 4⅞" (30-105mm)
- Packless bellows
- Adjustable BX outlet for easy installation
- Dual precision switches for dependable operation of the low water cut-off and an alarm or electric water feeder
- Optional low voltage switches for self-generating millivolt circuits
- Maximum steam pressure 20 psi (1.4 kg/cm²)



Series 69



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A		B	C	D	E	F
Model	Insertion Length					
69	4⅞ (105)	1 (25)	4⅞ (105)	⅞ (3)	2½	9½ (241)
169	3⅞ (79)					
269	2¼ (57)					
369	1¾ (45)					
469, 569	1⅜ (30)					

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
69	153900	Low water cut-off w/4⅞" (105mm) insertion length	3.7 (1.7)
69-MV-P	155000	69 w/millivolt switch	4.0 (1.8)
169	155100	69 w/3⅞" (79mm) insertion length	4.0 (1.8)
269	155200	69 w/2¼" (57mm) insertion length	4.0 (1.8)
369	155300	69 w/1¾" (45mm) insertion length	4.0 (1.8)
369-MV	155400	369 w/millivolt switch	4.0 (1.8)
469	155500	69 w/1⅜" (30mm) insertion length	4.0 (1.8)
569	155700	469 w/1⅜" (30mm) insertion length w/¼" NPT tapping	4.0 (1.8)

Low Water Cut-Offs

Combination Low Water Cut-Off/Pump Controllers for Steam Boilers

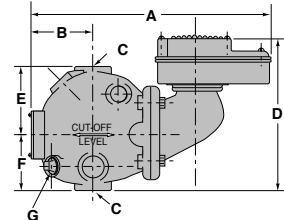
Series 42S

Low Water Cut-Off/Pump Controllers

- For residential, commercial, and industrial low and medium pressure steam boilers with a separate water column
- For boilers of any steaming capacity
- Monel bellows provides corrosion resistance
- Single pole, single throw snap action switches
- Enclosed junction box protects switches
- Optional features
 - Quick hook-up fittings
 - Gauge glass connector
- Maximum pressure 50 psi (3.5 kg/cm²)



SERIES 42S



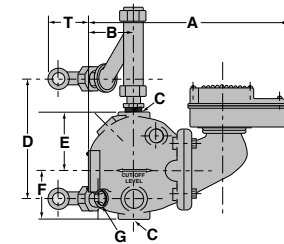
Electrical Ratings

Voltage	Pump Circuit Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	345 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Alarm Circuit Rating (Amperes)	
Voltage	Amps
120 VAC	1
240 VAC	1/2



MODEL 42S-A

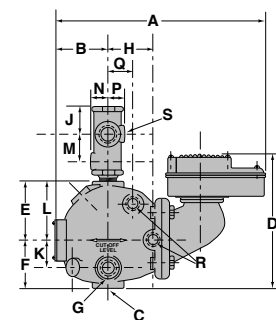


Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
42S	129302	Combination low water cut-off/pump controller	15.5 (7.0)
42S-A	129702	42S w/quick hook-up fittings	21.3 (9.7)
42S-N	129802	42S w/glass connector	21.3 (9.7)



MODEL 42S-N



Dimensions, in. (mm)

Model	A	B	C NPT	D	E	F	G NPT
42S	12¼ (311)	2 ⁹ / ₁₆ (65)	1	8 ⁷ / ₈ (225)	3 ¹¹ / ₁₆ (94)	3 ¹ / ₈ (79)	½
42S-A	12¼ (311)	2 ⁹ / ₁₆ (65)	1	7¼-16 ¹¹ / ₁₆ (184-347)	2 ³ / ₄ (45)	3 ¹ / ₈ (79)	½
42S-N	12¼ (311)	2 ⁹ / ₁₆ (65)	1	8 ⁷ / ₈ (225)	3 ¹¹ / ₁₆ (94)	3 ¹ / ₈ (79)	½

Model	H	J	K	L	M	N	P	Q	R NPT	S NPT	T
42S-N	2 ⁹ / ₁₆ (65)	2 ⁹ / ₁₆ (65)	1¾ (45)	3 ¹¹ / ₁₆ (94)	1 ¹³ / ₁₆ (46)	1 ¹ / ₁₆ (27)	1 ¹ / ₁₆ (27)	1½ (38)	¾	¼	2 ⁵ / ₈ (67)

Low Water Cut-Offs – Mechanical For Steam Boilers

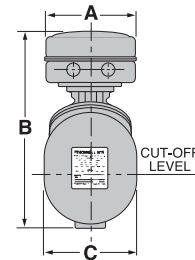
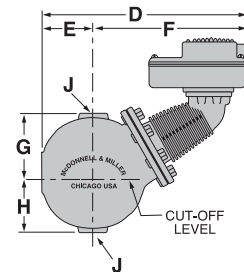
Series 150S

Low Water Cut-Off/Pump Controllers

- For commercial and industrial low or high pressure boiler applications
- For boilers of any steaming capacity
- Monel bellows provides corrosion resistance
- Snap action switches for high temperature service
 - 1 Single pole, single throw switch for pump control
 - 1 Single pole, double throw switch for low water cut-off and alarm actuation
- Optional features
 - Manual reset
 - 2 Single pole, single throw switches
 - 2 Single pole, double throw switches
 - Float block
 - BSPT threads
- Maximum pressure 150 psi (10.5 kg/cm²)



Series 150S



Model 150S-MD

Maximum differential operation

- Prevents nuisance burner shutdowns in **low pressure** applications operating less than 50 psi (3.5 kg/cm²)
- For additional information see page 46

Electrical Ratings

Voltage	Pump Circuit Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	345 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Alarm Circuit Rating (Amperes)	
Voltage	Amps
120 VAC	1
240 VAC	1/2

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
150S	171702	Combination low water cut-off/pump controller	24.7 (11.2)
150S-B	171903	150S w/float block	24.7 (11.2)
150S-B-M	172803	150S-B w/manual reset	24.7 (11.2)
150S-BMD	172002	150S w/float block and max. dif.	24.7 (11.2)
150S-BM-MD	172805	150S-BMD w/manual reset	24.7 (11.2)
150S-MD	171802	150S w/maximum differential	24.7 (11.2)
150S-M	172806	150S w/manual reset	24.7 (11.2)
150S-M-MD	172807	150S-M w/maximum differential	24.7 (11.2)
158S	178402	150S w/2 SPDT switches	26.3 (11.9)
158S-M	172819	158S w/manual reset	27.3 (12.4)
159S	178802	150S w/2 SPST switches	26.0 (11.8)

Dimensions, in. (mm)

A	B	C	D
5 ⁷ / ₈ (149)	12 ⁷ / ₁₆ (316)	6 (152)	13 ¹ / ₄ (337)

E	F	G	H	J
3 ⁵ / ₁₆ (84)	9 ¹⁵ / ₁₆ (252)	4 ¹ / ₈ (107.5)	3 ⁷ / ₁₆ (91.5)	1 NPT

Low Water Cut-Offs – Mechanical For Steam Boilers

Series 157S

Low Water Cut-Off/Pump Controllers

- For residential, commercial and industrial low or high pressure boiler applications
- For boilers of any steaming capacity
- Monel bellows provides corrosion resistance
- Float chamber with integral water column provided
- Snap action for high temperature service
 - 1 Single pole, single throw switch for pump control
 - 1 Single pole, double throw switch for low water cut-off and alarm actuation
- Optional features
 - Manual reset
 - Integral conductance probes for additional levels and greater operating differential-Model 157S-RBP-MD
 - 1" or 1 1/4" NPT equalizing tapplings
 - 1/2" or 3/4" NPT tapplings for gauge glass/tri-cock installations
 - BSPT threads
- Maximum pressure 150 psi (10.5 kg/cm²)

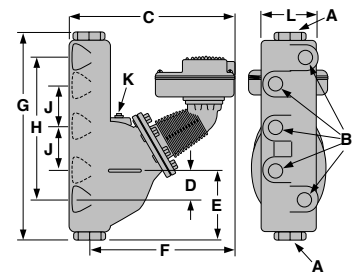
Model 157S-MD

Maximum differential operation

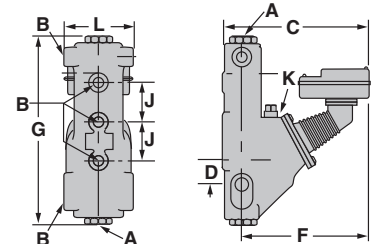
- Prevents nuisance burner shutdowns in **low pressure** applications operating less than 50 psi (3.5 kg/cm²)
- For additional information see page 46



Series 157S



Model 157S-R



Electrical Ratings

Voltage	Cut-off and Pump Circuits Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	345 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Alarm Circuit Rating (Amperes)	
Voltage	Amps
120 VAC	1
240 VAC	1/2

Dimensions, in. (mm)

Model	A NPT	B NPT	C	D	E	F	G	H	J	K NPT	L
157S	1	1/2	13 3/8 (339)	2 5/16 (59)	4 15/16 (125)	11 3/4 (298)	16 (406)	11 1/2 (292)	3 1/2 (89)	3/4	5 7/8 (149)
157S-A	1 1/4	3/4	13 3/8 (339)	2 5/16 (59)	4 15/16 (125)	11 3/4 (298)	16 (406)	11 1/2 (292)	3 1/2 (89)	3/4	5 7/8 (149)
157S-R	1	1/2	13 3/8 (339)	2 1/4 (57)	5 7/8 (149)	11 3/4 (298)	17 (432)	11 1/2 (292)	3 1/2 (89)	3/4	6 1/4 (159)
157S-RL	1 1/4	1/2	13 3/8 (345)	3 1/2 (89)	5 7/8 (149)	11 3/4 (298)	17 (432)	12 3/4 (324)	3 1/2 (89)	3/4	6 1/4 (159)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
157S	173502	150S low water cut-off w/water column	39.7 (18.0)
157S-MD	173603	157S w/maximum differential	39.7 (18.0)
157S-A	173702	157S w/alternate tapplings	39.5 (17.9)
157S-A-M	172811	157S-A w/manual reset	39.5 (17.9)
157S-M	172812	157S w/manual reset	39.7 (18.0)
157S-M-MD	172813	157S-M w/maximum differential	39.7 (18.0)
157S-R	176220	157S w/alternate tapplings	42.0 (19.0)
157S-R-M	172817	157S-R w/manual reset	42.0 (19.0)
157S-RBP-MD	176503	157S w/2 integral conductance probes	51.0 (23.1)
157S-RL	176902	157S w/alternate tapplings	42.0 (19.0)
157S-RL-M	172815	157S-RL w/manual reset	42.0 (19.0)

MD Model Setpoints

The bellows on the 150 units are sensitive to pressure. At higher pressures the bellows is stiffer requiring more force to move it. At lower pressures the bellows is more pliable (less stiff) requiring less force to move it. Consequently, the on/off points tend to narrow at lower pressures. (Less distance between on and off).

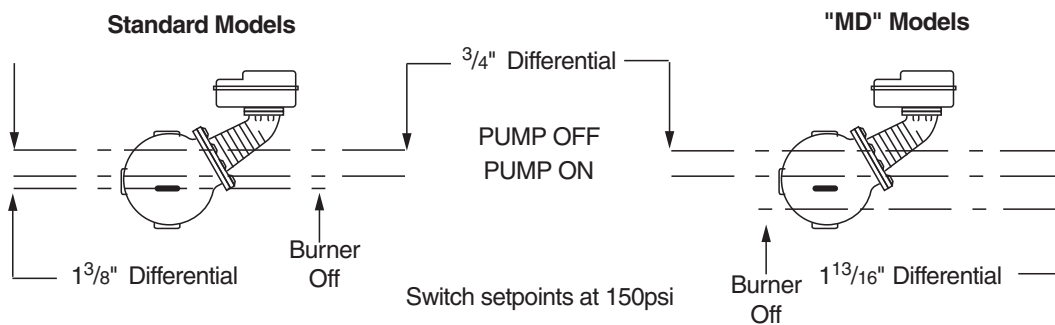
Early versions of the 150 units with mercury bulb switches were able to be adjusted. These units had knurled adjustment screws that could be used to raise, lower or widen the setpoints. Although the available adjustment was small (usually $\frac{1}{16}$ " to $\frac{1}{8}$ " total), it was enough to compensate in the field for lower pressure systems.

Later versions of the 150 with mercury bulb switches and all snap switch units are not adjustable in the field. The 'MD' models were created to provide a 150 control with factory settings to compensate for the narrowing of setpoints on new and existing installations.

On 'MD' models the distance between pump off and burner off is increased by approximately $\frac{7}{16}$ ". Note that the pump on/off differential on both standard and 'MD' models is set at $\frac{3}{4}$ "

This larger differential is accomplished by lowering the burner off setpoint $\frac{3}{8}$ " below the casting line on 'MD' models when setting the burner on/off points at 150 psi. This compensates for the narrowing of the setpoints at lower operating pressures because the burner off point will move upward (closer to the casting line) at lower pressures.

Operating Levels
Series 150/157 & Series 150S/157S

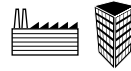


Low Water Cut-Offs – Mechanical For Steam Boilers

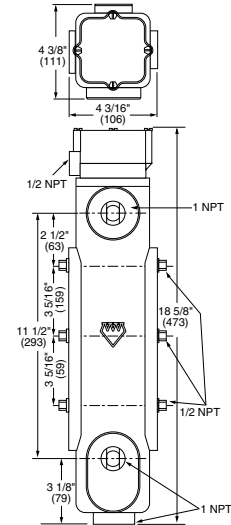
Series 1575

Low Water Cut-Off/Pump Controllers

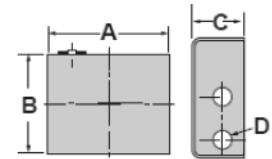
- Primary low water fuel cut-off protection and pump control for commercial and industrial steam boilers
- Motorized valve controller, low water cut-off and alarm actuator for boilers, vessels and tanks
- Set points and differential remain constant throughout pressure range
- Diagnostic features incorporated in the control include:
 - High ambient temperature protection
 - Internal LEDs that indicate water position and condition
 - External LEDs that indicate control activity
- Adjustable pump differentials by cutting probes to desired set points
- Control unit mounted remotely from probe chamber for maximum flexibility
- Adjustable 60-second burner-off time delay
- 1 HP burner and pump relays
- Solid state operation
- Redundant low-water and pump-off circuitry
- 60,000 ohms probe sensitivity
- Test button to quickly confirm proper operation
- Probe chamber with 3 probes and gauge glass tapplings
- 4th probe can be added for high water control
- NEMA1 electrical control unit enclosure
- NEMA4X probe chamber enclosure
- Maximum ambient temperature 135°F (57°C)
- Maximum water temperature 406°F (208°C) at probes
- Maximum water pressure of 250 psi (17.6 kg/cm²)



**Probe Chamber
(with 3 probes standard)**



**Electrical Control Unit
(for remote mounting)**



Dimensions, in. (mm)

Probe Chamber

A	B	C	D	E	F	G	H NPT	J NPT
18 ⁵ / ₈ (473)	11 ¹ / ₂ (292)	3 ¹ / ₈ (79)	2 ¹ / ₂ (64)	3 ¹ / ₄ (82)	4 ³ / ₈ (111)	4 ³ / ₁₆ (106)	1	1

Electrical Control Unit

A	B	C	D
6 ¹ / ₂ (159)	5 ³ / ₁₆ (132)	2 ³ / ₄ (70)	3 ⁴ / ₄ (20)

Electrical Rating and Switch Ratings

Supply Voltage	Probe Voltage	Full load (Amps) NO (NC), (VAC)	Locked Rotor (Amps) NO (NC), (VAC)	Pilot Duty (VA) NO (NC), (VAC)	Motor (HP) NO (NC), (VAC)
120 VAC	5 VAC	16 (5.8), 120	96 (34.8), 120	470 (290), 120	1 (1/4), 120
50/60Hz	Maximum	8 (4.9), 240	48 (17.4), 240	470 (290), 240	2 (1/2), 240

Ordering Information

Model Number	Part Number	Description
1575	171907	Combination LWCO/pump controller

Low Water Cut-Offs – Mechanical Combination Low Water Cut-Off/Pump Controllers for Steam Boilers

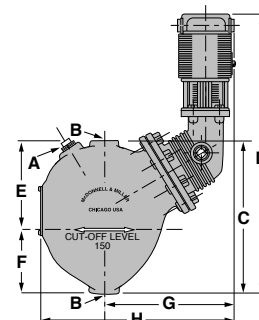
Series 93

Low Water Cut-Off/Pump Controllers

- For commercial and industrial low or high pressure steam boilers
- Maintains consistent water level regardless of pressure
- For boilers of any steaming capacity
- No. 5 Switch included
- Magnetic repulsion eliminates need for bellows
- Optional features
 - Manual reset
- 7B switch (135ohm proportional control signal) to maintain constant boiler water level
- 1" NPT connections
- Maximum pressure 150 psi (10.5 kg/cm²)



SERIES 93



Electrical Ratings

345 VA at 120 or 240 VAC

Dimensions, in. (mm)

A NPT	B NPT	C	D	E	F	G	H
3/4	1	10 1/16 (256)	18 5/8 (473)	5 19/32 (142)	4 15/32 (113.5)	8 7/8 (225)	12 7/8 (327)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
93	162300	Combination low water cut-off/pump controller w/No. 5 switch	35.0 (15.9)
93-M	162500	93 w/manual reset	35.0 (15.9)
93-7B	163000	93 w/No. 7B switch	35.5 (16.0)
93-7B-M	163100	93-7B W/manual reset	35.5 (16.0)

Low Water Cut-Offs – Mechanical Combination Low Water Cut-Off/Pump Controllers for Steam Boilers

Series 193

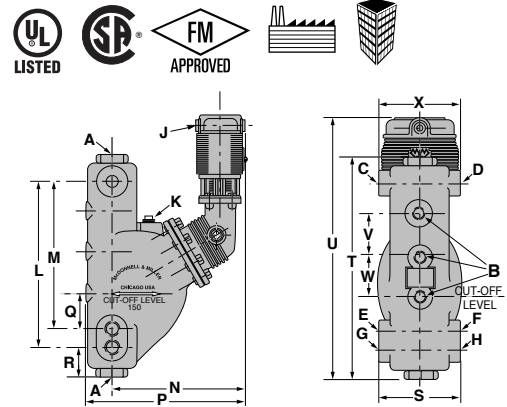
Low Water Cut-Off/Pump Controllers

- For commercial and industrial low or high pressure steam boilers
- Maintains consistent water level regardless of pressure
- Water column with integral tapplings for gauge glass and tri-cock installations
- For boilers of any steaming capacity
- No. 5 Switch included
- Magnetic repulsion eliminates need for bellows
- Optional features
 - Manual reset
- 7B switch (135ohm proportional control signal) to maintain constant boiler water level
- 1" NPT connections
- Maximum pressure 150 psi (10.5 kg/cm²)

Electrical Ratings

345 VA at 120 or 240 VAC

Dimensions, in. (mm)



SERIES 193

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
193	163400	Combination low water cut-off/pump controller w/No. 5 switch	52.5 (23.8)
193-A	163500	193 w/alternate tapplings	52.5 (23.8)
193-A-7B	164500	193-A w/No. 7B switch	52.5 (23.8)
193-A-7BM	164600	193-A-7B w/manual reset	52.5 (23.8)
193-A-M	164200	193-A w/manual reset	52.5 (23.8)
193-B	163600	193 w/alternate tapplings	52.5 (23.8)
193-B-M	164300	193-B w/manual reset	52.5 (23.8)
193-B-7B	164700	193-B w/No. 7B switch	52.5 (23.8)
193-D	163900	193 w/alternate tapplings	52.5 (23.8)
193-D-7B	163903	193-D w/No. 7B switch	52.5 (23.8)
193-M	164100	193 w/manual reset	52.5 (23.8)
193-7B	164400	193 w/No. 7B switch	52.5 (23.8)
193-7BM	164525	193-7B w/manual reset	52.5 (23.8)
193-D-M	163902	193-D w/manual reset	52.5 (23.8)
193-G	164760	193 w/alternate tapplings	52.5 (23.8)

Model	A NPT	B NPT	C NPT	D NPT	E NPT	F NPT	G NPT	H NPT	J NPT	K NPT
193	1	1/2	1/2	1/2	–	–	1/2	1/2	1/2	3/4
193-A	1	1/2	1/2	1/2	1/2	1/2	–	–	1/2	3/4
193-B	1 1/4	3/4	3/4	3/4	–	–	3/4	3/4	1/2	3/4
193-D	1	1/2	1	1/2	1	1/2	–	–	1/2	3/4
193-G	1	1/2	–	1/2	1	1/2	–	–	1/2	3/4

Model	L	M	N	P	Q	R
193	12 3/4 (324)	–	10 13/16 (274)	13 (330)	–	2 7/8 (73)
193-A	–	11 1/2 (292)	10 13/16 (274)	13 (330)	2 1/4 (57)	–
193-B	12 3/4 (324)	–	10 13/16 (274)	13 (330)	–	2 7/8 (73)
193-D	–	11 1/2 (292)	10 13/16 (274)	13 (330)	2 1/4 (57)	–
193-G	–	11 1/2 (292)	10 13/16 (274)	13 (330)	2 1/4 (57)	–

Model	S	T	U	V	W	X
193	6 3/4 (171.4)	17 1/2 (445)	20 1/2 (521)	3 1/2 (89)	3 1/2 (89)	6 (152)
193-A	6 3/4 (171.4)	17 1/2 (445)	20 1/2 (521)	3 1/2 (89)	3 1/2 (89)	6 (152)
193-B	6 3/4 (171.4)	17 1/2 (445)	20 1/2 (521)	3 1/2 (89)	3 1/2 (89)	6 (152)
193-D	6 3/4 (171.4)	17 1/2 (445)	20 1/2 (521)	3 1/2 (89)	3 1/2 (89)	6 (152)
193-G	6 3/4 (171.4)	17 1/2 (445)	20 1/2 (521)	3 1/2 (89)	3 1/2 (89)	6 (152)

Low Water Cut-Offs – Mechanical Combination Low Water Cut-Off/Pump Controllers for Steam Boilers

Series 94

Low Water Cut-Off/Pump Controllers

- For commercial and industrial low or high pressure steam boilers
- Maintains consistent water level regardless of pressure
- For boilers of any steaming capacity
- No. 5 Switch included
- Magnetic repulsion eliminates need for bellows
- Optional features
 - Manual reset
- 7B switch (135ohm proportional control signal) to maintain constant boiler water level
 - BSPT threads
- 1 $\frac{1}{4}$ " NPT connections
- Maximum pressure 250 psi (17.6 kg/cm²)
- Ten bolt flange

Electrical Ratings

345 VA at 120 or 240 VAC

Ordering Information

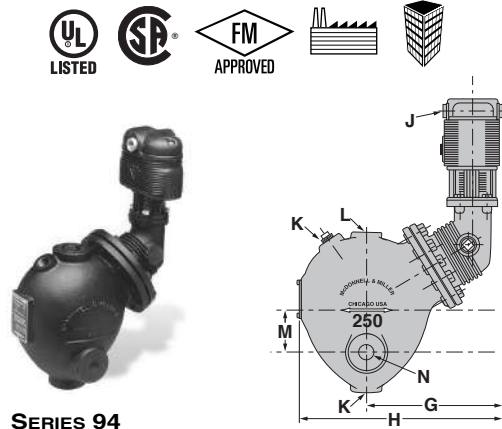
Model Number	Part Number	Description	Weight lbs. (kg)
94	165200	Combination low water cut-off/pump controller w/No. 5 switch	52.5 (23.8)
94-A	165500	94 w/alternate tapings	50.3 (22.8)
94-AM	165800	94-A w/manual reset	50.3 (22.8)
94-A-7B	165700	94-AM w/No. 7B switch	52.5 (23.8)
94-M	165900	94 w/manual reset	52.5 (23.8)
94-7B	166300	94 w/No. 7B switch	52.0 (23.6)

Dimensions, in. (mm)

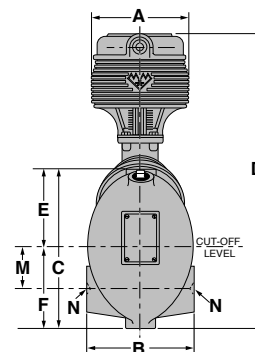
Model	A	B	C	D
94	6 (152)	7 (178)	10 $\frac{9}{16}$ (268)	18 $\frac{13}{16}$ (478)
94-A	6 (152)	7 (178)	10 $\frac{9}{16}$ (268)	18 $\frac{13}{16}$ (478)

Model	E	F	G	H
94	5 $\frac{7}{8}$ (149)	4 $\frac{11}{16}$ (119)	8 $\frac{3}{4}$ (222)	12 $\frac{15}{16}$ (328.6)
94-A	5 $\frac{7}{8}$ (149)	4 $\frac{11}{16}$ (119)	8 $\frac{3}{4}$ (222)	12 $\frac{15}{16}$ (328.6)

Model	J	K NPT	L NPT	M	N
94	$\frac{1}{2}$ (15)	1 $\frac{1}{4}$	1 $\frac{1}{4}$	–	–
94-A	$\frac{1}{2}$ (15)	1 $\frac{1}{4}$	1 $\frac{1}{4}$	2 $\frac{1}{16}$ (52)	1 $\frac{1}{4}$ (32)



SERIES 94



Low Water Cut-Offs – Mechanical Combination Low Water Cut-Off/Pump Controllers for Steam Boilers

Series 194

Low Water Cut-Off/Pump Controllers

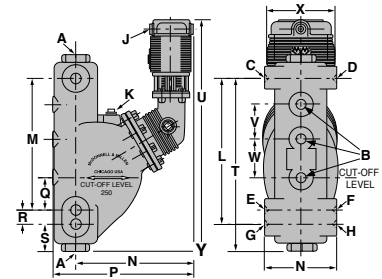
- For commercial, and industrial low or high pressure steam boilers
- Maintains consistent water level regardless of pressure
- For boilers of any steaming capacity
- Water column with integral tapplings for gauge glass and tri-cock installations
- No. 5 Switch included
- Magnetic repulsion eliminates need for bellows
- Optional features
 - Manual reset
- 7B switch (135 ohm proportional signal) control to maintain constant boiler water level
- 1 1/4" NPT connections
- Maximum pressure 250 psi (17.6 kg/cm²)
- Ten bolt flange

Electrical Ratings

345 VA at 120 or 240 VAC



SERIES 194



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
194	166600	Combination low water cut-off/pump controller w/ Series 5 switch	72.0 (32.7)
194-A	166700	194 w/alternate tapplings	72.0 (32.7)
194-A-7B	167100	194-A w/ Series 7B switch	72.0 (32.7)
194-M	166900	194 w/manual reset	72.0 (32.7)
194-7B	167200	194 w/ Series 7B switch	72.0 (32.7)
194-7BM	167300	194-7B w/manual reset	72.0 (32.7)
194-B	166701	194 w/alternate tapplings	72.0 (32.7)

Dimensions, in. (mm)

Model	A NPT	B NPT	C NPT	D NPT	E NPT	F NPT	G NPT	H NPT	J NPT	K NPT
194	1 1/4	1/2	1/2	1/2	1/2	1/2	–	–	1/2	3/4
194-A	1 1/4	1/2	1/2	1/2	–	–	1/2	1/2	1/2	3/4
194-B	1 1/4	3/4	3/4	3/4	–	–	3/4	3/4	1/2	3/4

Model	L	M	N	P	Q	R	S
194	–	11 5/8 (295)	6 3/4 (171.4)	13 1/16 (332)	2 13/16 (71)	1 1/4 (32)	2 3/8 (60)
194-A	12 7/8 (327)	–	6 3/4 (171.4)	13 1/16 (332)	2 13/16 (71)	1 1/4 (32)	2 3/8 (60)
194-B	12 7/8 (327)	–	6 3/4 (171.4)	13 1/16 (332)	2 13/16 (71)	1 1/4 (32)	2 3/8 (60)

Model	T	U	V	W	X	Y
194	17 1/4 (438)	20 1/2 (521)	3 (76)	3 (76)	6 (152)	10 13/16 (274)
194-A	17 1/4 (438)	20 1/2 (521)	3 (76)	3 (76)	6 (152)	10 13/16 (274)
194-B	17 1/4 (438)	20 1/2 (521)	3 (76)	3 (76)	6 (152)	10 13/16 (274)

Water Feeders – Electronic

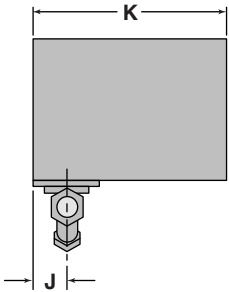
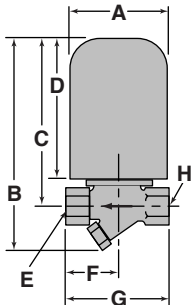
Series WFE Uni-Match®



- Field-adjustable dwell-feed cycles
- Multi-Color LED status indicator
- Manual feed button
- Hard-stop limit to minimize chances of flooding the boiler
- Compatible with all electronic & mechanical Low Water Cut-Offs
- Includes adapters for connection to 1/2" copper tubing
- Removable strainer (replace after cleaning)
- Maximum water pressure 150 psi (10.5 kg/cm²)
- Maximum boiler pressure 15 psi (1 kg/cm²)
- Maximum water temperature 120°F (49°C)
- Maximum ambient temperature 100°F (38°C)
- Maximum power consumption (during water feed only)
 - 15 VA at 24 VAC
 - 20 VA at 120 VAC (50 or 60 Hz)



Series WFE



Dimensions, in. (mm)

A	B	C	D	E NPT	F	G	H NPT	J	K
2 ⁷ / ₈ (73)	6 ¹ / ₄ (159)	4 ⁷ / ₈ (124)	4 ¹ / ₄ (108)	³ / ₈	1 ¹⁷ / ₃₂ (39)	3 ¹ / ₁₆ (78)	³ / ₈	1 ¹ / ₃₂ (26)	5 ¹³ / ₁₆ (148)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
WFE-24	169550	Electric Water Feeder, 24V	2.8 (1.3)
WFE-120	169560	Electric Water Feeder, 120V	2.8 (1.3)

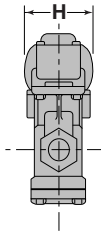
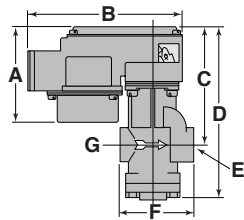
Water Feeders – Electric

Series 101-A Electric Water Feeders

- For low pressure steam boilers with **cold water feed**
- Eliminates necessity to manually add water to the boiler
- Can be used with mechanical or electronic low water cut-off controls
- Quick-change replaceable cartridge valve and strainer
- Manual feed button
- Model 101-A features a 120 VAC solenoid
- Model 101-A-24 features a 24 VAC solenoid and a separate 50VA transformer
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum boiler pressure 25 psi (1.8 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum power consumption
 - 40 VA at 24 VAC
 - 40 VA at 120 VAC



Series 101-A



Flow Data

Pressure Differential psi (kg/cm ²)		Flow Rate gpm (lpm)	
5	(.4)	1.4	(5.3)
10	(.7)	1.7	(6.4)
20	(1.4)	2.1	(7.9)
40	(2.8)	2.9	(11.0)
60	(4.2)	3.4	(12.9)
80	(5.6)	4.0	(15.1)

Dimensions, in. (mm)

A	B	C	D	E NPT	F	G NPT	H
4 ¹ / ₁₆ (103)	6 ⁷ / ₈ (175)	5 ¹ / ₈ (130)	7 ⁹ / ₁₆ (192)	1 ¹ / ₂	3 ⁵ / ₁₆	1 ¹ / ₂	3 (76)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
101A	169400	Electric water feeder, 120V	2.8 (1.3)
101A-24V	169500	Electric water feeder, 24V	2.8 (1.3)

Water Feeders – Mechanical

Series 47/47-2

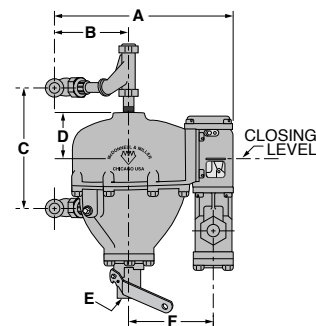
Mechanical Water Feeders/Low Water Cut-Offs



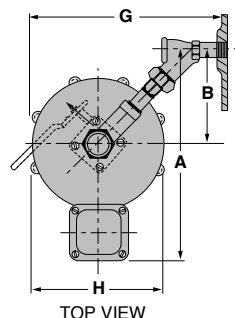
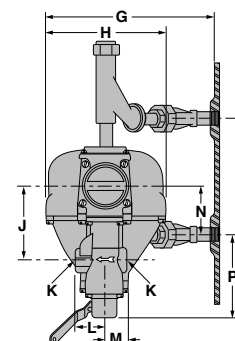
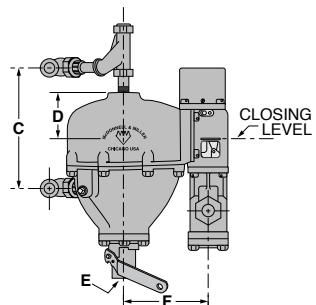
- For steam and hot water boilers with **cold water feed**
- Continuous maintenance of **minimum safe water level**, independent of electrical service
- Proportional feed action
- Quick hook-up fittings provided
- Quick-change replaceable cartridge valve and strainer
- Optional features
 - No. 2 switch
 - Manual reset
- Model 47 can be field upgraded with a No. 2 switch to add low water cut-off function
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum boiler pressure 25 psi (1.8 kg/cm²)



Series 47



Series 47-2



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

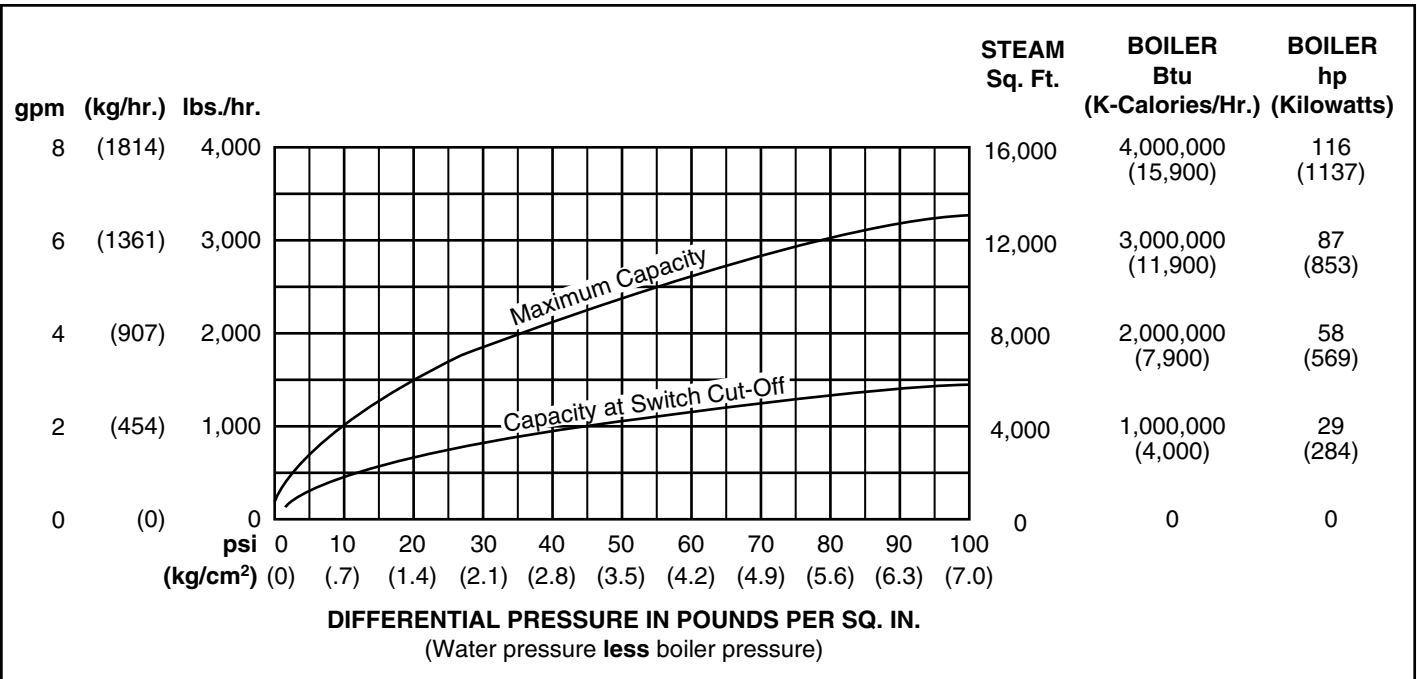
Dimensions, in. (mm)

A	B	C	D	E NPT	F	G
11 ⁷ / ₈ (302)	5 ¹ / ₄ (133)	7 ³ / ₈ (187) min. 14 (356) max.	2 ⁵ / ₈ (67)	³ / ₄	5 ¹ / ₈ (130)	10 ⁵ / ₈ (270)
H	J	K NPT	L	M	N	P
7 ⁵ / ₁₆ (186)	4 ⁵ / ₈ (117)	¹ / ₂	1 ²⁹ / ₃₂ (58.4)	1 ¹³ / ₃₂ (35.7)	3 (76)	5 ⁵ / ₁₆ (135)

Water Feeders – Mechanical

Series 47 (continued) Mechanical Water Feeders

Capacities



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
47	132700	Mechanical water feeder	27.5 (12.5)
47-2	132800	47 w/No. 2 switch	28.5 (13.0)
47-2-M	132900	47-2 w/manual reset	28.5 (13.0)
47-X	133400	47 w/o quick hook-up fittings	25.0 (11.4)
47-2X	176212	47-2 w/o quick hook-up fittings	26.0 (11.8)

Water Feeders – Mechanical

Series 247/247-2

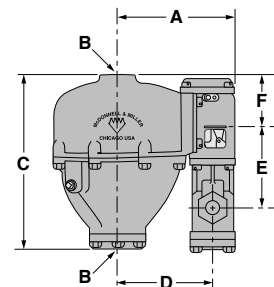
Mechanical Water Feeders/Low Water Cut-Offs



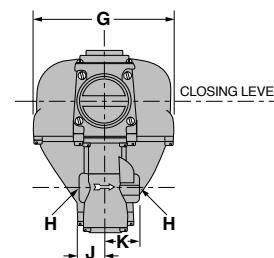
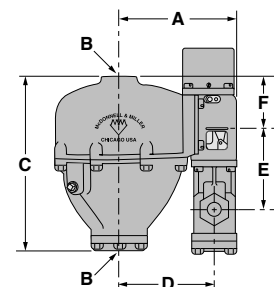
- For steam and hot water boilers with **cold water feed**
- Continuous maintenance of **minimum safe water level**, independent of electrical service
- Proportional feed action
- Quick-change replaceable cartridge valve and strainer
- Quiet, durable operation
- Isolated feed valve minimizes lime and scale build-up
- Optional features
 - No. 2 switch
 - Manual reset
- Model 247 can be field upgraded with a No. 2 switch to add low water cut-off function
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 30 psi (2.1 kg/cm²)



Series 247



Series 247-2



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

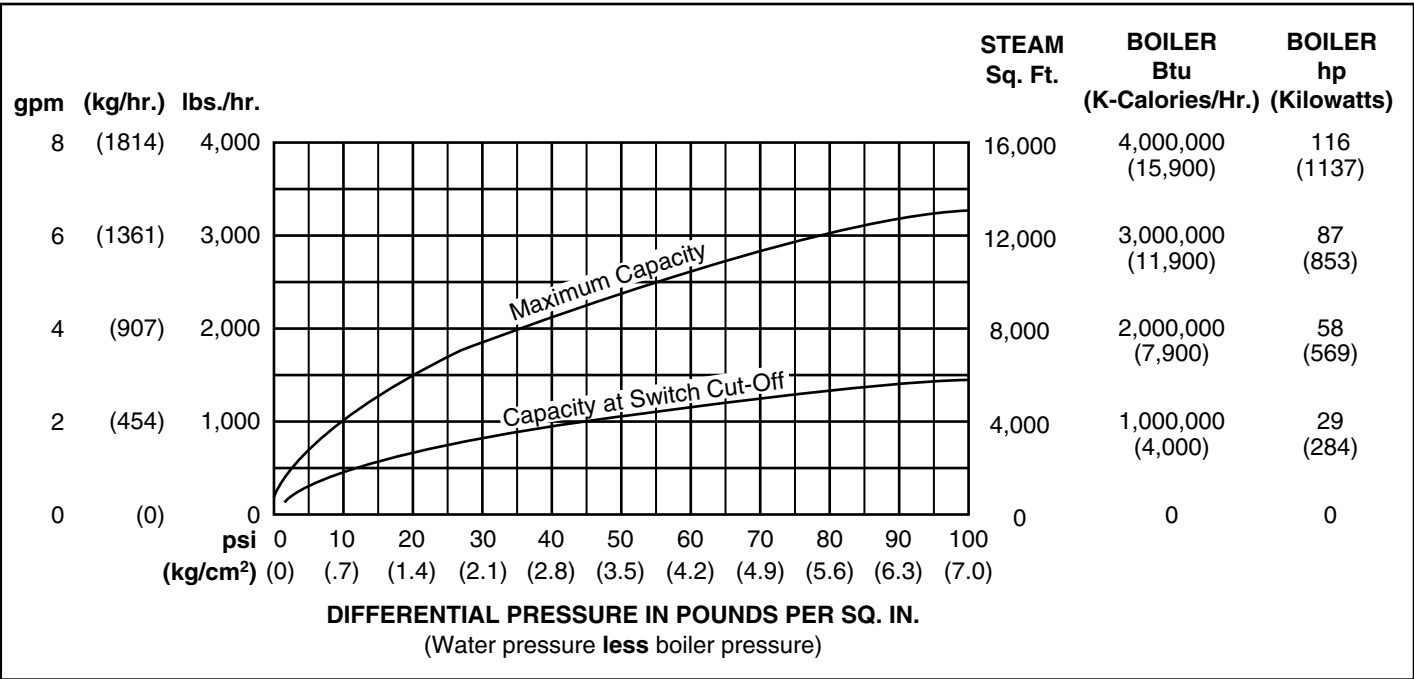
Dimensions, in. (mm)

A	B NPT	C	D	E	F	G	H NPT	J	K
6½ (165)	1	9½ (232)	5½ (130)	4⅝ (117)	2⅝ (67)	7⅝ (186)	½	1⅜ (35.7)	1⅞ (48.4)

Water Feeders – Mechanical

Series 247 (continued) Mechanical Water Feeders

Capacities



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
247	133700	Mechanical water feeder	22.0 (10.0)
247-2	133800	247 w/No. 2 switch	22.5 (10.2)
247-2-M	133900	247-2 w/manual reset	22.5 (10.2)

Water Feeders – Mechanical

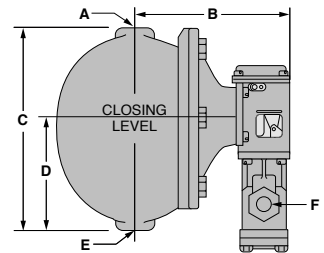
Series 51/51-2

Mechanical Water Feeders/Low Water Cut-Offs

- For low pressure steam and hot water boilers larger than 5,000 sq. ft. (465m²) capacity with **cold water feed**
- Quick-change replaceable cartridge valve and strainer
- Optional features
 - No. 2 switch
 - Manual reset
 - Float block
- Proportional feed action
- Model 51 can be field upgraded with a No. 2 switch to add low water cut-off function
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 35 psi (2.5 kg/cm²)



Series 51



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

Dimensions, in. (mm)

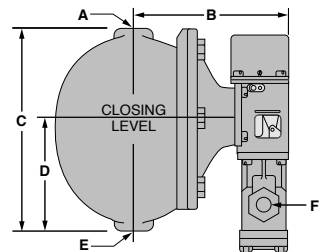
A NPT	B	C	D	E NPT	F NPT
1	8 (203)	10 ³ / ₈ (264)	5 ³ / ₄ (146)	1	³ / ₄

Ordering Information

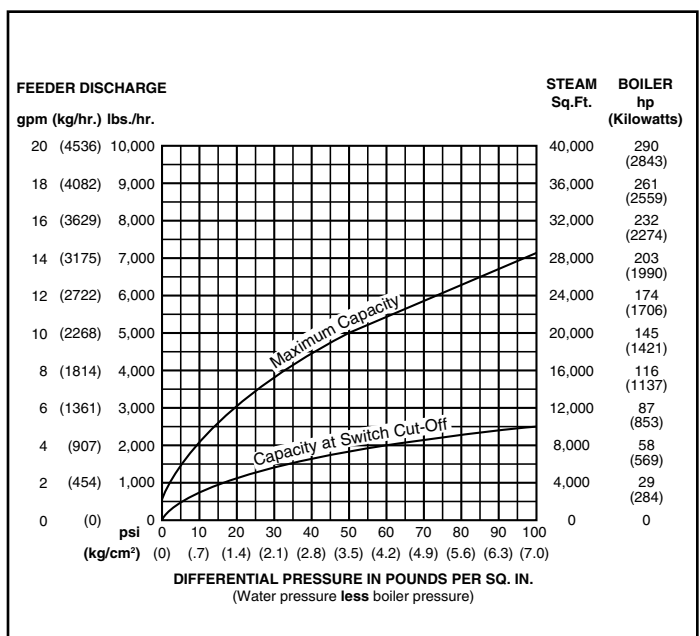
Model Number	Part Number	Description	Weight lbs. (kg)
51	134700	Mechanical water feeder	35.3 (16.0)
51-B	134800	51 w/float block	38.5 (17.5)
51-B-2	135400	51-B w/Series 2 switch	38.3 (17.4)
51-B-2-M	135500	51-B-2 w/manual reset	38.3 (17.4)
51-2	135000	51 w/Series 2 switch	35.8 (16.2)
51-2-M	135200	51-2 w/manual reset	35.7 (16.2)



Series 51-2



Capacities



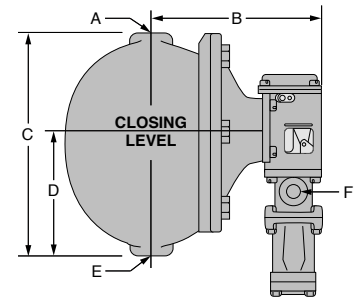
Water Feeders – Mechanical

Series 51-S/51-S-2 Mechanical Water Feeders/Low Water Cut-Offs

- For high capacity [up to 35,000 sq. ft. (3250m²)] low pressure steam and hot water boilers with **cold water feed**
- Optional features
 - No. 2 switch
 - Manual reset
 - Float block
- Proportional feed action
- Maximum water supply pressure 100 psi (7 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 35 psi (2.5 kg/cm²)



Series 51-S



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

Dimensions, in. (mm)

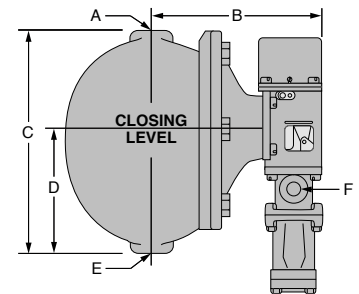
A NPT	B	C	D	E NPT	F NPT
1	8 ¹ / ₈ (203)	10 ³ / ₈ (264)	5 ³ / ₄ (146)	1	³ / ₄

Ordering Information

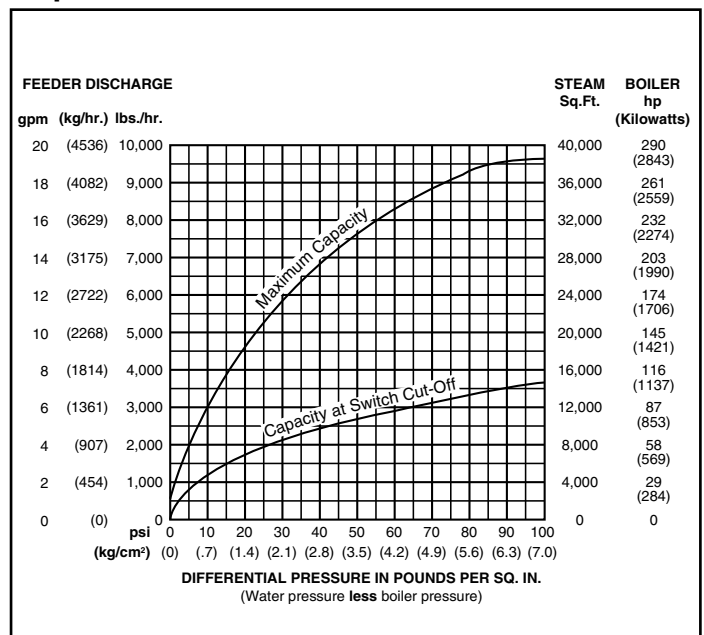
Model Number	Part Number	Description	Weight lbs. (kg)
51-S	135600	Mechanical water feeder	36.5 (16.6)
51-S-2	135900	51-S w/No. 2 switch	37.3 (16.9)
51-S-2-M	136000	51-S-2 w/manual reset	37.3 (16.9)
51-SB	135700	51-S w/float block	41.8 (19.0)
51-SB-2	136300	51-SB w/No. 2 switch	41.8 (19.0)
51-SB-2-M	136100	51-SB-2 w/manual reset	43.7 (19.8)



Series 51-S-2



Capacities



Water Feeders – Mechanical

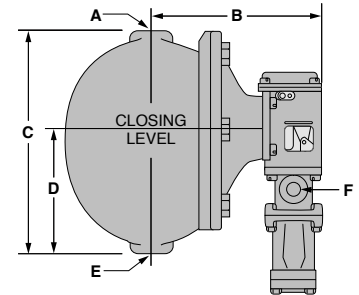
Series 53/53-2

Mechanical Water Feeders/Low Water Cut-Offs

- For low pressure steam and hot water boilers larger than 5,000 sq. ft. (465m²) with hot or cold water feed
- Optional features
 - No. 2 switch
 - Manual reset
 - Float block
- Proportional feed action
- Model 53 can be field upgraded with a No. 2 switch to add low water cut-off function
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 75 psi (5.3 kg/cm²)



Series 53



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	10.2	61.2	125 VA at 120 or 240 VAC 60 Hz
240 VAC	5.1	30.6	

Dimensions, in. (mm)

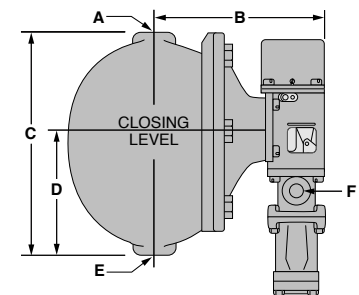
A	B	C	D	E	F
NPT				NPT	NPT
1	8 ¹ / ₈ (206)	10 ³ / ₈ (264)	5 ³ / ₄ (146)	1	³ / ₄

Ordering Information

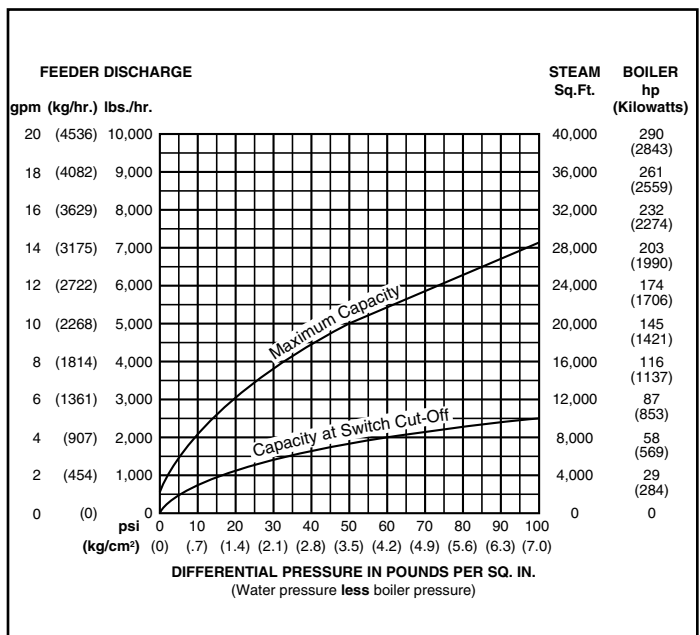
Model Number	Part Number	Description	Weight lbs. (kg)
53	136900	Mechanical water feeder	38.0 (17.2)
53-B	137400	53 w/float block	42.0 (19.0)
53-B-2	137500	53-B w/No. 2 switch	42.0 (19.0)
53-B-2-M	137600	53-B w/No. 2 switch & manual reset	42.0 (19.0)
53-2	137100	53 w/No. 2 switch	38.5 (17.5)
53-2-M	137200	53-2 w/manual reset	38.5 (17.5)



Series 53-2



Capacities



Make-Up Water Feeders

In boiler feed systems with higher pressures, a make-up feeder is usually provided on the condensate receiver. It adds water to the receiver when necessary so there is always an adequate supply for boiler demand.

McDonnell & Miller Make-up feeders provide large feeding capacity. Unless otherwise stated, valves and seats are of stainless steel and protected by a large integral strainer. Positive alignment of the valve is assured by cam & roller, straight thrust action. These feeders can be used for many other liquid control applications such as:

- Pharmaceutical
- Laboratory
- Industrial
- Distillation equipment
- Receiver tanks
- Evaporative coolers
- Humidifiers
- Aquariums
- Steam baths
- Wet and dry hygrometers

Water Feeding Capacity lbs./hr. (kg/hr.)

Model Number	City Water Supply Pressure with 3/4" NPT Pipe and No Tank Pressure, 0 psi (kg/cm ²)								
	10 (.7)	20 (1.4)	30 (2.1)	40 (2.8)	50 (3.5)	60 (4.1)	70 (4.8)	80 (5.5)	90 (6.2)
25-A	3100 (1406)	4500 (2041)	5600 (2540)	6550 (2971)	7400 (3357)	8150 (3697)	8800 (3992)	9400 (4264)	10200 (4627)
21 & 221	4100 (1860)	6000 (2722)	7500 (3402)	8600 (3901)	9600 (4355)	10500 (4763)	11300 (5126)	12000 (5443)	13200 (5988)
847	1000 (454)	1500 (680)	1800 (816)	2100 (953)	2400 (1089)	2600 (1179)	2800 (1270)	3000 (1361)	3300 (1497)
851	2000 (907)	3000 (1361)	3700 (1678)	4300 (1850)	4800 (2177)	—	—	—	—
851-S	3000 (1361)	4000 (1814)	5000 (2268)	6200 (2812)	—	—	—	—	—
551-S	2500 (1134)	3600 (1633)	4500 (2041)	5200 (2359)	5800 (2631)	6500 (2948)	7000 (3175)	7600 (3447)	8800 (3992)

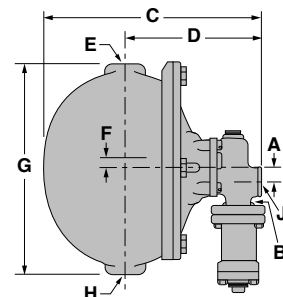
Water Feeders – Make-Up

Series 25-A Make-Up Water Feeder

- For boiler receiver tanks
- Float operated
- Proportional feed action
- Soft seat provides positive seal
- Seal between float chamber and valve chamber is not a positive seal
- Maximum water supply pressure 100 psi (7 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 35 psi (2.5 kg/cm²)



Series 25-A



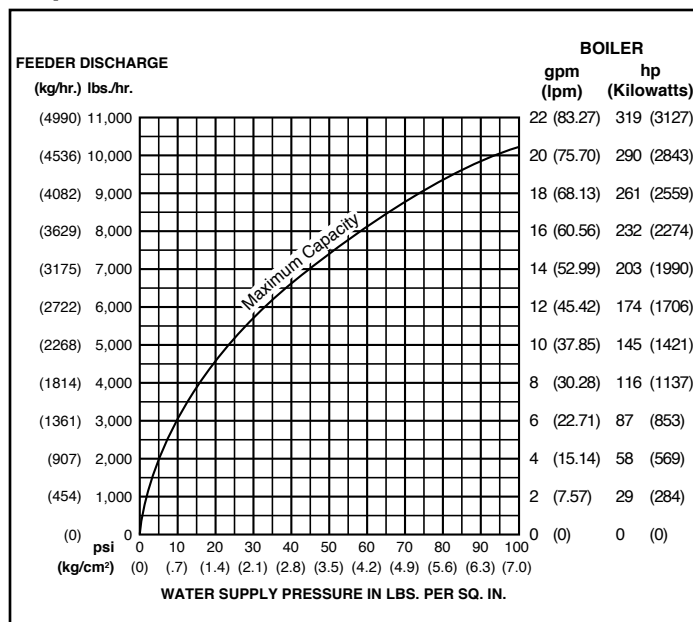
Dimensions, in. (mm)

A	B NPT	C	D	E NPT	F	G	H NPT	J NPT
1 ³ / ₁₆ (21)	3/4	12 ¹ / ₄ (311)	8 ¹ / ₈ (206)	1	1/2 (12.7)	10 ³ / ₈ (264)	1	3/4

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
25-A	126800	Make-up water feeder	37.5 (17)
25-AB	126900	25-A w/float block	41.8 (19)

Capacities



Water Feeders – Make-Up

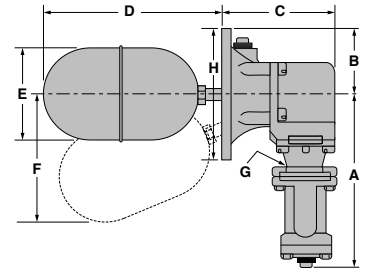
Series 21

Make-Up Water Feeder

- For boiler receiver tanks
- Direct mounting eliminates need for equalizing connections
- Proportional feed action
- Mounting Flange – six $\frac{7}{16}$ " (11.1mm) bolt holes on a $5\frac{3}{4}$ " (146mm) bolt circle
- Soft seat provides positive seal
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 35 psi (2.5 kg/cm²)



Series 21



Dimensions, in. (mm)

A	B	C	D	E	F	G NPT	H
8½ (216)	3⅝ (84)	5⅝ (143)	8⅓ (224)	4¾ (121)	6¼ (159)	¾	7⅝ (186)

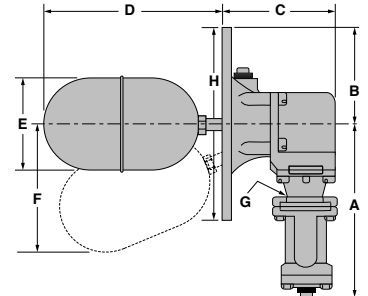
Series 221

Make-Up Water Feeder

- For boiler receiver tanks
- Direct mounting eliminates need for equalizing connections
- Proportional feed action
- Mounting Flange – six $1\frac{7}{32}$ " (13.5mm) bolt holes on a $8\frac{1}{2}$ " (216mm) bolt circle
- Soft seat provides positive seal
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 35 psi (2.5 kg/cm²)



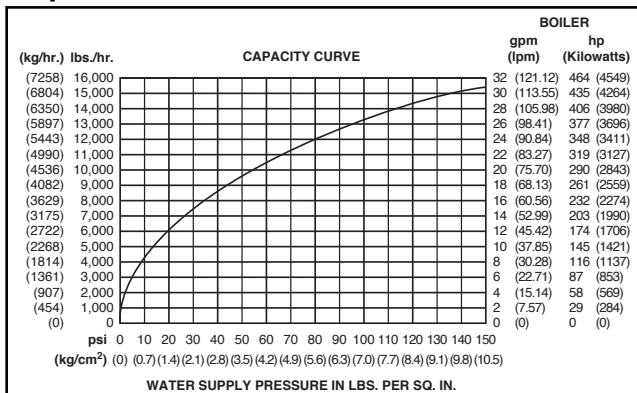
Series 221



Dimensions, in. (mm)

A	B	C	D	E	F	G NPT	H
8½ (216)	4⅛ (84)	5⅝ (143)	8⅓ (224)	4¾ (121)	6¼ (159)	¾ (20)	9½ (241)

Capacities



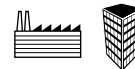
Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
21	126400	Make-up water feeder	15.3 (6.9)
221	126600	Make-up water feeder	21.3 (9.7)

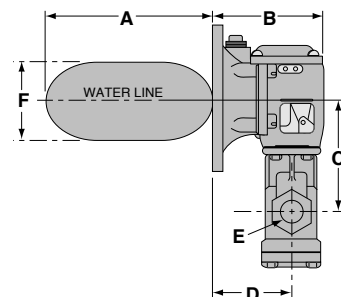
Water Feeders – Make-Up

Series 847 Make-Up Water Feeder

- For receiver tanks in commercial or industrial applications
- Mounts directly on the receiver, eliminating need for equalizing connections
- Quick-change replaceable cartridge valve and strainer
- Proportional feed action
- Mounting Flange – six $\frac{7}{16}$ " (11.1mm) bolt holes on a $5\frac{3}{4}$ " (146mm) bolt circle
- Optional features
 - No. 2 switch
 - Alternate valve orientation
- Maximum supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum receiver pressure 25 psi (1.8 kg/cm²)



Series 847



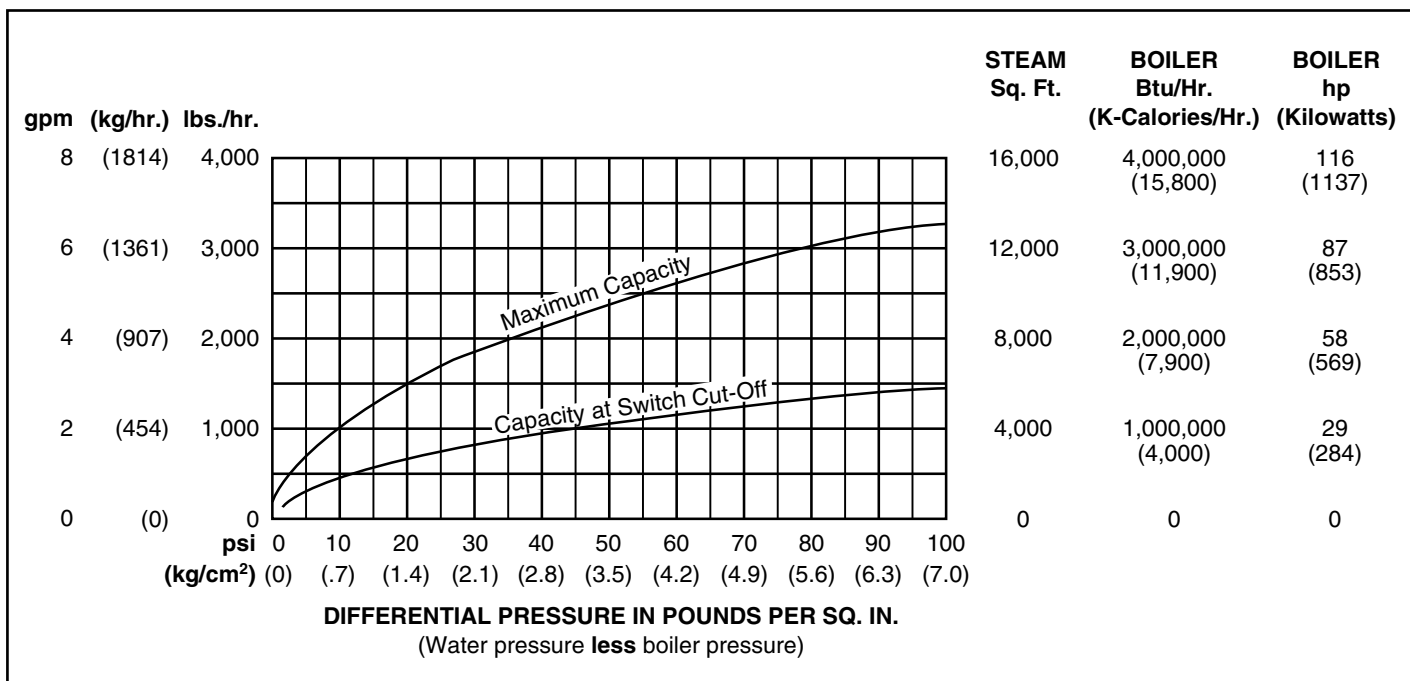
Dimensions, in. (mm)

A	B	C	D	E NPT	F
$7\frac{5}{16}$ (186)	$4\frac{15}{16}$ (125)	$4\frac{5}{8}$ (117)	$3\frac{9}{16}$ (90)	$\frac{1}{2}$	$3\frac{7}{16}$ (87)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
847	134300	Make-up water feeder	11 (5.0)
847-C	134350	847 w/alternate valve orientation	12 (5.4)
847-C-2	134400	847-C w/No. 2 switch	12 (5.4)

Capacities



Water Feeders – Make-Up

Series 851 Make-Up Water Feeder

- For receiver tanks in commercial or industrial applications
- Mounts directly on the receiver, eliminating need for equalizing connections
- Quick-change replaceable cartridge valve and strainer
- Proportional feed action
- Mounting Flange – six $\frac{7}{16}$ " (11.1mm) bolt holes on a $5\frac{3}{4}$ " (146mm) bolt circle
- Maximum water supply pressure 150 psi (10.5 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum receiver pressure 35 psi (2.5 kg/cm²)

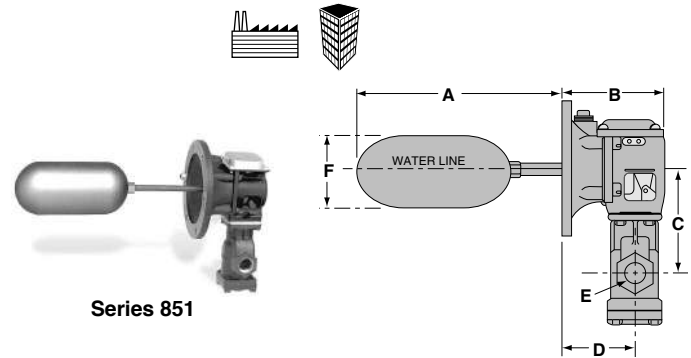
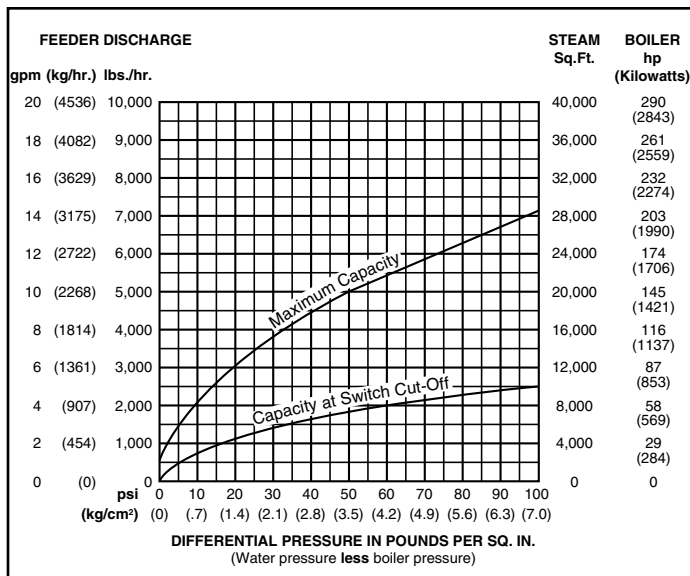
Model 851-S Make-Up Water Feeder

- Extended float and rod assembly
- Wider operating range
- Maximum water supply pressure 100 psi (7 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum receiver pressure 35 psi (2.5 kg/cm²)

Ordering Information

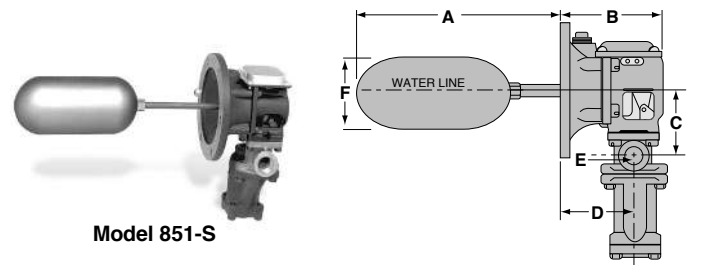
Model Number	Part Number	Description	Weight lbs. (kg)
851	136700	Make-up water feeder	14 (6.4)
851-S	136800	851 w/extended float & rod assy.	16 (7.3)

Capacities – Model 851



Dimensions, in. (mm)

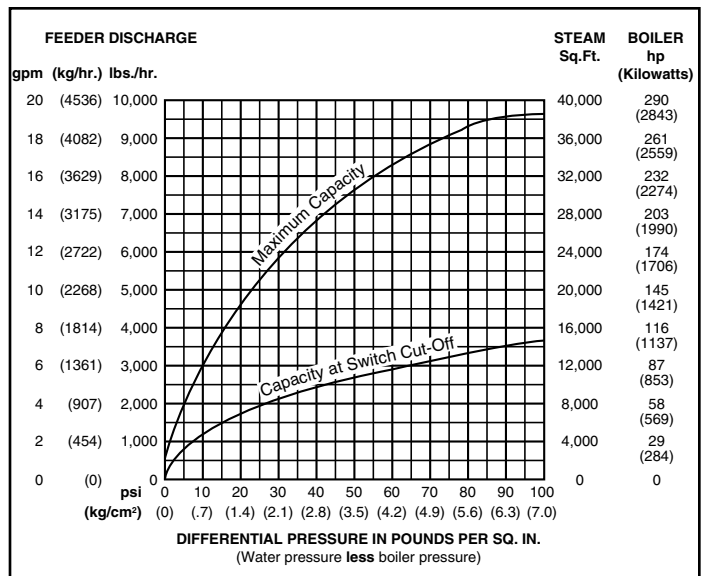
A	B	C	D	E NPT	F
11 $\frac{3}{4}$ (298)	4 $\frac{15}{16}$ (125)	4 $\frac{5}{8}$ (117)	3 $\frac{9}{16}$ (90)	$\frac{3}{4}$	3 $\frac{7}{16}$ (87)



Dimensions, in. (mm)

A	B	C	D	E NPT	F
12 $\frac{3}{4}$ (324)	4 $\frac{15}{16}$ (125)	3 $\frac{3}{16}$ (81)	3 $\frac{9}{16}$ (90)	$\frac{3}{4}$	3 $\frac{7}{16}$ (87)

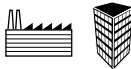
Capacities – Model 851-S



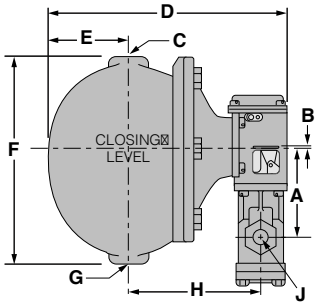
Water Feeders – Make-Up

Series 551-S
Make-Up Water Feeder

- For applications where water is added to steam separators, receivers, tanks, or other vessels
- Proportional feed action
- Quick-change replaceable cartridge valve and strainer
- Optional features
 - Float Block
- Maximum water supply pressure 75 psi (5.3 kg/cm²)
- Maximum inlet water temperature 120°F (49°C)
- Maximum vessel pressure 25 psi (1.8 kg/cm²)



551-S



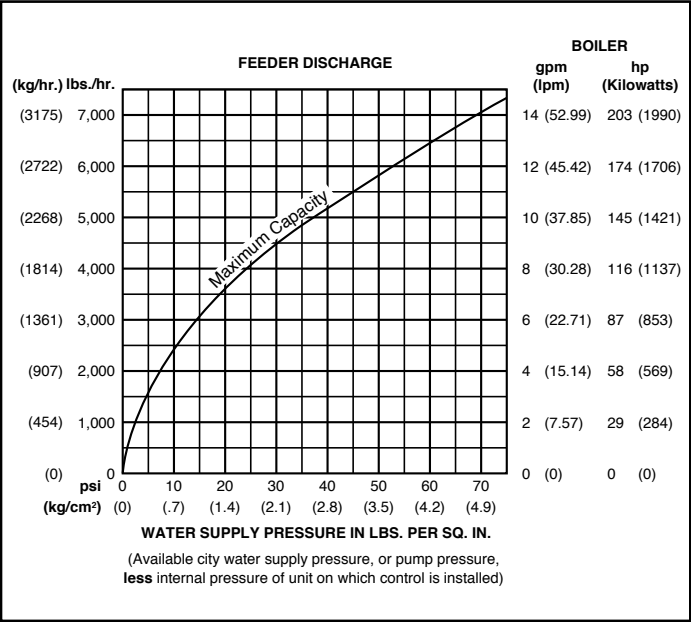
Dimensions, in. (mm)

A	B	C NPT	D	E	F	G NPT	H	J NPT
4 ⁵ / ₈ (117)	1 ¹ / ₈ (3.2)	1	12 ¹ / ₄ (311)	4 ¹ / ₈ (105)	10 ³ / ₈ (264)	1	6 ¹¹ / ₁₆ (170)	3 ³ / ₄

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
551-S	136400	Make-up water feeder	35.8 (16.2)
551-SB	136500	551-S w/float block	35.8 (16.2)

Capacities



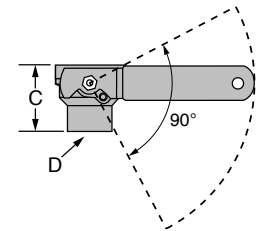
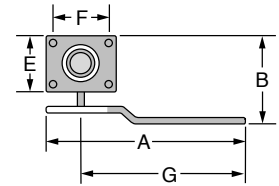
Valves

Series 14-B Ball Type Blow Down Valve

- For McDonnell & Miller Series 47 and 67 boiler control blow down valve replacement
- Full-ported ball action valve
- PTFE seats provide bind free, leak tight ball movement
- Easy open handle keeps hands away from hot water and steam
- Gasket and mounting screws included
- Maximum pressure 30 psi (1.8 kg/cm²)
- See page 121 for blow-down information



Series 14-B



Dimensions, in. (mm)

A	B	C	D NPT	E	F	G
6 ³ / ₄ (171.4)	4 (102)	2 ¹ / ₄ (57)	³ / ₄	2 ¹ / ₂ (64)	2 ¹ / ₂ (64)	5 ³ / ₄ (146)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
14-B	310447	Blow down valve	1 (.5)

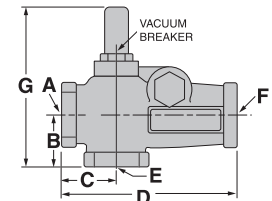
Series TC-4 Test-N-Check® Valves



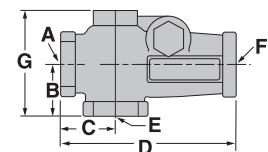
- For hot water boilers
- Simplifies ASME CSD-1 code mandated testing of low water cut-offs by eliminating the need to drain the system
- Includes one upper and one lower valve for mounting at crosses in equalizing lines
- Restricts water flow when the low water cut-off's blow down valve is open
- Adjustable built-in vacuum breaker in upper valve provides rapid evacuation of water from the float chamber
- 1" NPT
- Maximum temperature 250°F (121°C)
- Maximum pressure 160 psi (11 kg/cm²)



Series TC-4
Upper Valve



Series TC-4
Lower Valve



Dimensions, in. (mm)

A NPT	B	C	D
1	1 ¹ / ₂ (38)	1 ¹ / ₂ (38)	5 (125)

E NPT	F NPT	G	
		Upper	Lower
1	1	5 ¹ / ₄ (133)	3 ¹ / ₁₆ (78)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
TC-4	195000	Test-N-Check Valves, set of 2	5.3 (.4)

Valves

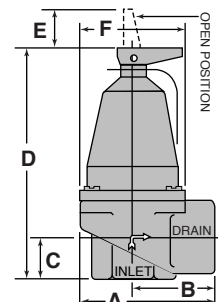


Series 250 Pressure Relief Valves

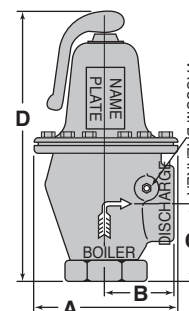
- For tanks and hydronic heating systems
- Protects against over-pressure
- Minimizes hammering with flash steam
- Low differential pressure – 3 psi (.21 kg/cm²) between opening and closing
- Meets ASME Pressure Vessel and Boiler Code, Section IV
- Sizes and material
 - 3/4" - 1" NPT – bronze body and seat
 - 2" NPT – cast iron body, brass seat
- EPDM rubber diaphragm and seat disc
- Maximum temperature 250°F (121°C)
- Maximum operating pressure range
 - 30 - 125 psig (2.1 - 8.8 kg/cm²)



Series 250
3/4" - 1" (20-25mm) NPT



Series 250
2" (50mm) NPT



Dimensions, in. (mm)

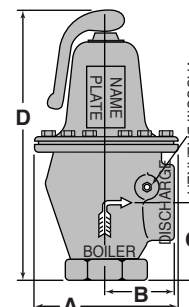
Size NPT	A	B	C	D	E	F
3/4	2 9/16 (65)	1 1/2 (38)	3/4 (20)	4 9/16 (116)	1 1/32 (26)	2 3/32 (53.2)
1	2 7/8 (73)	1 3/4 (45)	7/8 (22)	4 15/16 (125)	1 1/32 (26)	2 1/4 (57)
2	6 (152)	2 7/8 (73)	3 1/4 (83)	11 (279)	—	—

Series 260 Pressure Relief Valves

- For water tanks and hydronic heating systems
- Protects against over-pressure
- Minimizes hammering with flash steam
- Low differential pressure – 3 psi (.21 kg/cm²) between opening and closing
- Meets ASME Pressure Vessel and Boiler Code, Section IV
- Sealed spring chamber prevents scale or sediment build-up around seal
- 1 1/2" NPT Inlet and 2" NPT Discharge
- Cast iron body, brass seat
- Maximum temperature 250°F (121°C)
- Maximum operating pressure range
 - 30 - 50 psig (2.1 - 3.5 kg/cm²)



Series 260



Dimensions, in. (mm)

Size		A	B	C	D
NPT Inlet	NPT Outlet				
1 1/2	2	6 (152)	2 7/8 (73)	3 1/4 (83)	11 (279)

Series 250 Pressure Relief Valves

Performance

Model Number	Opening Pressure psig (kg/cm ²)	ASME Rating BTUH (K-Calories)
250-3/4IN-15	15 (1)	515,000 (2,043)
250-3/4IN-30	30 (2.1)	790,000 (3,134)
250-3/4IN-36	36 (2.5)	900,000 (3,571)
250-3/4IN-40	40 (2.8)	973,000 (3,861)
250-3/4IN-45	45 (3.2)	1,065,000 (4,226)
250-3/4IN-50	50 (3.5)	1,160,000 (4,603)
250-3/4IN-60	60 (4.2)	1,252,000 (4,968)
250-3/4IN-75	75 (5.3)	1,615,000 (6,409)
250-3/4IN-100	100 (7)	2,075,000 (8,234)
250-3/4IN-125	125 (8.8)	2,535,000 (11,059)
250-1IN-15	15 (1)	770,000 (3,056)
250-1IN-30	30 (2.1)	1,170,000 (4,642)
250-1IN-36	36 (2.5)	1,330,000 (5,278)
250-1IN-40	40 (2.8)	1,437,000 (5,702)
250-1IN-45	45 (3.2)	1,575,000 (6,250)
250-1IN-50	50 (3.5)	1,710,000 (6,786)
250-1IN-65	65 (4.6)	2,110,000 (8,373)
250-1IN-75	75 (5.3)	2,385,000 (9,464)
250-1IN-100	100 (7)	3,060,000 (12,142)
250-1IN-125	125 (8.8)	3,735,000 (14,821)
250-2IN-30	30 (2.1)	4,100,000 (16,270)
250-2IN-36	36 (2.5)	4,600,000 (18,254)
250-2IN-40	40 (2.8)	5,000,000 (19,841)
250-2IN-45	45 (3.2)	5,500,000 (21,825)
250-2IN-50	50 (3.5)	5,900,000 (23,412)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
250-3/4IN-15	181220	Relief Valve 3/4 NPT, 15 psi (1 kg/cm ²)	1.3 (.6)
250-3/4IN-30	181225	Relief Valve 3/4 NPT, 30 psi (2.1 kg/cm ²)	1.3 (.6)
250-3/4IN-36	181325	Relief Valve 3/4 NPT, 36 psi (2.5 kg/cm ²)	1.3 (.6)
250-3/4IN-40	181405	Relief Valve 3/4 NPT, 40 psi (2.8 kg/cm ²)	1.3 (.6)
250-3/4IN-45	181425	Relief Valve 3/4 NPT, 45 psi (3.2 kg/cm ²)	1.3 (.6)
250-3/4IN-50	181525	Relief Valve 3/4 NPT, 50 psi (3.5 kg/cm ²)	1.3 (.6)
250-3/4IN-60	181905	Relief Valve 3/4 NPT, 60 psi (4.2 kg/cm ²)	1.3 (.6)
250-3/4IN-75	181625	Relief Valve 3/4 NPT, 75 psi (5.3 kg/cm ²)	1.3 (.6)
250-3/4IN-100	181725	Relief Valve 3/4 NPT, 100 psi (7 kg/cm ²)	1.3 (.6)
250-3/4IN-125	181825	Relief Valve 3/4 NPT, 125 psi (8.8 kg/cm ²)	1.3 (.6)
250-1IN-15	181920	Relief Valve 1 NPT, 15 psi (1 kg/cm ²)	1.5 (.7)
250-1IN-30	181925	Relief Valve 1 NPT, 30 psi (2.1 kg/cm ²)	1.5 (.7)
250-1IN-36	182025	Relief Valve 1 NPT, 36 psi (2.5 kg/cm ²)	1.5 (.7)
250-1IN-40	182030	Relief Valve 1 NPT, 40 psi (2.8 kg/cm ²)	1.5 (.7)
250-1IN-45	182125	Relief Valve 1 NPT, 45 psi (3.2 kg/cm ²)	1.5 (.7)
250-1IN-50	182225	Relief Valve 1 NPT, 50 psi (3.5 kg/cm ²)	1.5 (.7)
250-1IN-65	182235	Relief Valve 1 NPT, 65 psi (4.6 kg/cm ²)	1.5 (.7)
250-1IN-75	182325	Relief Valve 1 NPT, 75 psi (5.3 kg/cm ²)	1.5 (.7)
250-1IN-100	182425	Relief Valve 1 NPT, 100 psi (7 kg/cm ²)	1.5 (.7)
250-1IN-125	182525	Relief Valve 1 NPT, 125 psi (8.8 kg/cm ²)	1.5 (.7)
250-2IN-30	183025	Relief Valve 2 NPT, 30 psi (2.1 kg/cm ²)	17.3 (7.8)
250-2IN-36	183125	Relief Valve 2 NPT, 36 psi (2.5 kg/cm ²)	17.3 (7.8)
250-2IN-40	183175	Relief Valve 2 NPT, 40 psi (2.8 kg/cm ²)	17.3 (7.8)
250-2IN-45	183225	Relief Valve 2 NPT, 45 psi (3.2 kg/cm ²)	17.3 (7.8)
250-2IN-50	183325	Relief Valve 2 NPT, 50 psi (3.5 kg/cm ²)	17.3 (7.8)

Series 260 Pressure Relief Valves

Performance

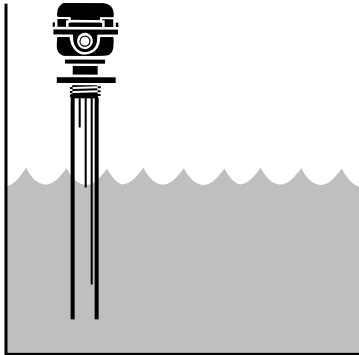
Model Number	Opening Pressure psig (kg/cm ²)	ASME Rating BTUH (K-Calories)
260-1 1/2IN-30	30 (2.1)	3,300,000 (13,095)
260-1 1/2IN-36	36 (2.5)	3,800,000 (15,079)
260-1 1/2IN-40	40 (2.8)	4,100,000 (16,270)
260-1 1/2IN-45	45 (3.2)	4,500,000 (17,857)
260-1 1/2IN-50	50 (3.5)	4,900,000 (19,444)

Ordering Information

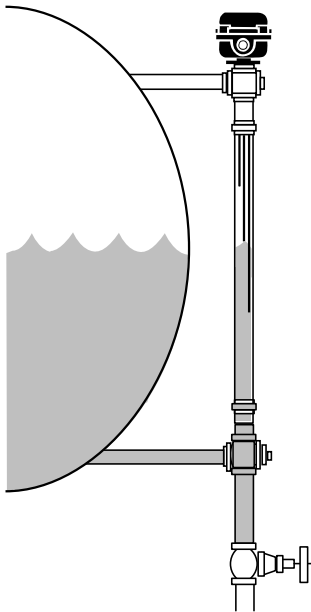
Model Number	Part Number	Description	Weight lbs. (kg)
260-1 1/2IN-30	182625	Relief Valve 1 1/2 NPT, 30 psi (2.1 kg/cm ²)	17.3 (7.8)
260-1 1/2IN-36	182725	Relief Valve 1 1/2 NPT, 36 psi (2.5 kg/cm ²)	17.3 (7.8)
260-1 1/2IN-40	182730	Relief Valve 1 1/2 NPT, 40 psi (2.8 kg/cm ²)	17.3 (7.8)
260-1 1/2IN-45	182825	Relief Valve 1 1/2 NPT, 45 psi (3.2 kg/cm ²)	17.3 (7.8)
260-1 1/2IN-50	182925	Relief Valve 1 1/2 NPT, 50 psi (3.5 kg/cm ²)	17.3 (7.8)

Remote Sensor Location

The location of the remote sensor is not limited to mounting on top of a tank. Depending on the application, it may be decided to mount the remote sensor in a stillwell or equalizing line. The following diagrams show typical locations for several applications.



Open tanks or vessels will probably require mounting the remote sensor on a stillwell to dampen the liquids' wave action. Use 3" or 4" perforated plastic drain pipe with a flange to thread connection at the top. The stillwell can rest on the bottom of the tank or be suspended and secured with brackets.



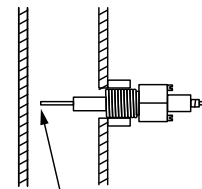
Mounting the remote sensor in an equalizing pipe is an alternative to top mounting. The equalizing pipe should be at least a 2" pipe and have a drain valve at the bottom for flushing.

Probe Installation

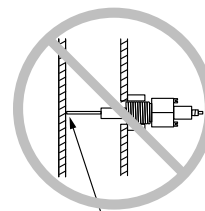
All boiler manufacturers designate the preferred (and sometimes secondary) location for installation of the probe on their boiler. They have determined that this location is above the minimum safe water level and provides the 1/4" clearance needed to ensure the probe is not grounded. Always install the probe in these locations, especially on a hot water boiler. If installed in other locations on a hot water boiler, this area could be prone to develop an air pocket.

Installation in piping external to the boiler on hot water systems has pitfalls. If the probe is too long and touches the wall of the pipe, the circuit is completed and the control "thinks" there is water in the system. If the water level drops below the level of the probe in this situation, the burner circuit will never be interrupted and a dry-fire could occur.

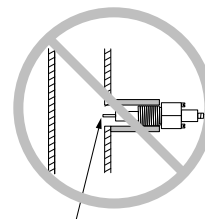
The most common problem with installation on hot water systems occurs when installing the probe in copper pipe. The sweat to thread adapters installed could result in the probe not being inserted in the pipe. An air pocket could develop or scale bridging could occur. While an air pocket causes nuisance shutdown of the boiler, scale bridging can result in a dry-fire if the water drops below the level of the probe. Always make sure at least 1/2 the length of the probe is in the run of the pipe to ensure proper operation.



Make sure tip of probe is in pipe with 1/4" clearance from wall of pipe.



If probe is installed too close to boiler wall, an electrical short could occur.

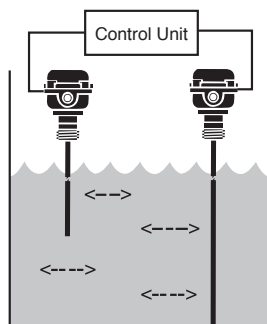


If probe is installed with extensions, an air pocket could develop shutting down the boiler. Debris could develop which can cause an electric short, rendering the low water cut-off ineffective.

Operation and Selection

A conductance-type control, Series 1575 will sense liquids up to 60,000 ohms resistivity. It can be used to activate a low level alarm, high level alarm, pumps to fill/drain a tank or any combination thereof. Typical applications include, but are not limited to, cooling towers, storage tanks, water fountains and condensate receivers.

The control utilizes the conductivity of a liquid to make or break circuits. Some liquids may be more resistive than the control can sense (above 60,000 ohms). The resistive and conductive properties of a liquid depend on several factors, including the amount of soluble material, temperature of the liquid, and placement of the probes. A TDS tester, which can be purchased from a supply house carrying boiler chemicals, is required to accurately measure a liquid's resistivity.



For many applications, water is the liquid being sensed. Raw or tap water usually has naturally occurring salts, chlorides and minerals that make it conductive enough to operate the control. Condensate receiver and cooling tower water are also very conductive due to evaporation. Ultrapure water (RO, deionized, demineralized, etc.) is highly resistive and is not able to conduct the current needed to operate the control.

Refer to the following charts to determine the resistivity of the liquid in an application. If it is above the 60,000 ohm rating, another type of control will be required.

Conductivity Values of Water

Liquid	Resistivity (Ohms/cm)	Conductivity (Micromhos/cm)
Water - Deionized	2,000,000	0.5
Water - Distilled	450,000	2
Water - Condensate	18,000	50
Water - Chlorinated	5,000	200
Water - Hard/Natural	5,000	200
Water - Sewage	5,000	200
Water - Salt	2,200	450

Converting Total Dissolved Solids to Resistivity and Conductivity

Total Dissolved Solids (ppm)	Resistivity (Ohms/cm)	Conductivity (Micromhos/cm)
0.0277	18,000,000	0.056
0.0417	12,000,000	0.084
0.0833	6,000,000	0.167
0.500	1,000,000	1.00
1.25	400,000	2.50
10.0	50,000	20.0
100	5,000	200
1,000	500	2,000
10,000	50	20,000

Series RS – High Pressure Sensors & Probes For Conductance Actuated Controls

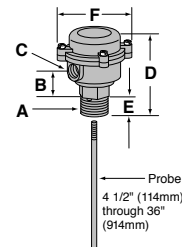
Series RS Sensors

Series-RS-X-BR-1:

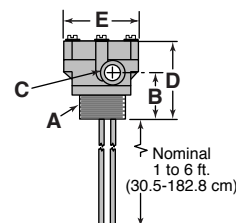
- NEMA 4X Enclosure
- For sophisticated multi-level control in tanks, boilers and hydronic systems
- Remote sensors, which thread into the top of the boiler or tank, are available with 1, 2, 3, 4 or 5 probes of varying lengths that can easily be cut to desired set points
- Probe lengths 12 - 72" (2.5 - 183cm) in 12" (2.5cm) increments (purchased separately)
- **Control, remote sensor and probe(s) must be ordered separately. Order Spacer S-4 when 2 or more probes greater than 36" (914mm) will be used**
- No blow down required
- Maximum Temperature 406°F (208°C)
- Maximum Pressure 250 psig (17.6 kg/cm²)



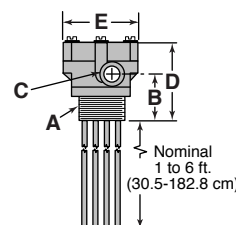
High Pressure
Remote Sensor
Model RS-1-BR-1



High Pressure
Remote Sensor
Model RS-2-BR-1
Model RS-3-BR-1



High Pressure
Remote Sensor
Model RS-4-BR-1
Model RS-5-BR-1



High Pressure Remote Sensors and Probes

Model Number	Part Number	Description	Weight lbs. (kg)
RS-1-BR-1	179524	Remote Sensor; 1 level	1.7 (.8)
RS-2-BR-1	179525	Remote Sensor; 2 levels	3.3 (1.5)
RS-3-BR-1	179526	Remote Sensor; 3 levels	3.3 (1.5)
RS-4-BR-1	179527	Remote Sensor; 4 levels	4.0 (1.8)
RS-5-BR-1	179528	Remote Sensor; 4 levels for non-metallic tanks	4.3 (1.95)

See page 74 for probe rods.

Dimensions, in. (mm)

Remote Sensor	A	B	C
1 Probe	1 NPT	1 1/16 (43)	1/2 NPT
2 or 3 Probes	2 NPT	2 11/32 (59.5)	1/2 NPT
4 or 5 Probes	2 1/2 NPT	2 15/32 (63)	1/2 NPT

Remote Sensor	D	E	F
1 Probe	4 9/16 (116)	1 1/4 (32)	3 1/4 (83)
2 or 3 Probes	3 7/8 (98)	4 (102)	–
4 or 5 Probes	4 (102)	4 (102)	–

Sensors – Low Pressure

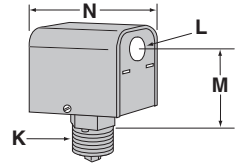
RS-1-HP

Series-RS High Pressure Remote Sensor:

- NEMA 1 Enclosure
- Maximum Temperature 406°F (208°C)
- Maximum Pressure 250 psig (17.6 kg/cm²)
- For single sensor applications with high-pressure environments. Requires additional probe rod. See page 71.



Remote Sensor
Model RS-1-HP



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
RS-1-HP	176199	High pressure remote sensor	0.5 (.23)

Dimensions, in. (mm)

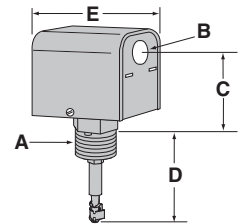
Model	K	L	M	N
RS-1-HP Remote Sensor	3/4 NPT	7/8 (22)	3 (80)	3 3/8 (86)

RS-1-LP

- Maximum Water Temperature: 250°F (121°C) Model RS-1-LP
- Maximum Water Pressure: 160 psi (11.2kg/cm²) Model RS-1-LP
- Maximum Steam Pressure: 15 psig (1.0 kg/cm²)
- Can be installed in horizontal orientation



Remote Sensor
Model RS-1-LP



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
RS-1-LP	176203	Remote Sensor	3.0 (1.4)
RS-1-LP-S	176218	Remote Sensor w/short probe	3.0 (1.4)

Dimensions, in. (mm)

A	B	C	D	E
NPT				
3/4	7/8 (22)	3 (80)	2 3/4 (70)	3 3/8 (86)

Sensors – High Pressure

Series 750B-C3 Chamber with 3 Probes

Series 750B-C4 Chamber with 4 Probes

Specifications Chamber

- NEMA 4X chamber enclosure
- Maximum steam pressure 250 psig (17.6 kg/cm²)
- Designed for use with a remotely mounted controller to make a complete system for level control in a boiler or other vessel.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
750B-C3	176316	Cast iron chamber w/3 probes	26 (11.8)
750B-C4	176317	Cast iron chamber w/4 probes	26 (11.8)

Probe Rods

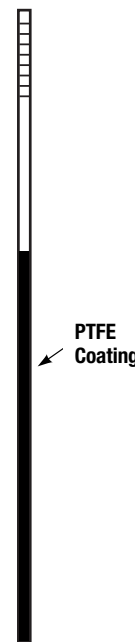
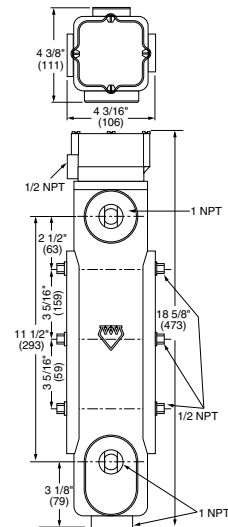
- Stainless steel - Series 316 material
- PTFE coated probe ends provide protection from false signals [available on 24-72" (610 - 1829mm) probes]
- For use with RS sensors

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
G-2-SS	179156	24" (610mm) Ground Probe	1.0 (.5)
G-3-SS	179157	36" (914mm) Ground Probe	1.5 (.7)
G-4-SS	179158	48" (1219mm) Ground Probe	2.0 (.9)
G-5-SS	179159	60" (1524mm) Ground Probe	2.5 (1.1)
G-6-SS	179160	72" (1829mm) Ground Probe	3.0 (1.4)
P-1/3 SS	176208	4 1/2" (114mm) Probe	0.5 (.23)
P-1-SS	179530	12" (305mm) Probe	0.5 (.23)
P-2-SS	179535	24" (610mm) Probe w/PTFE	1.0 (.5)
P-3-SS	179540	36" (914mm) Probe w/PTFE	1.5 (.7)
P-4-SS	179545	48" (1219mm) Probe w/PTFE	2.0 (.9)
P-5-SS	179550	60" (1524mm) Probe w/PTFE	2.5 (1.1)
P-6-SS	179555	72" (1829mm) Probe w/PTFE	3.0 (1.4)



Remote Chamber



P-SS Probes



G-SS Probes

Selecting control according to anticipated use, the sensor should be selected according to the number of probes required. The probe rods are ordered separately according to length needed. The control, sensor and each probe rod must be specified separately, using the appropriate model and part numbers.

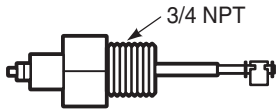
Liquid Level Controls

PA-800 Series Low Pressure

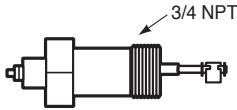
- Maximum Ambient Temperature: 120°F (49°C)
- Maximum Water Temperature: 250°F (121°C)
- Maximum Water Pressure: 160 psi (11.2 kg/cm²)

Ordering Information

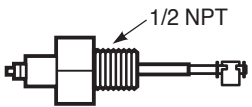
Model Number	Part Number	Control/Sensor Used On	Rod Req.	Weight lbs. (kg)
PA-800	354081	PS-800 Series & RS-1-LP		0.5 (.23)
PA-RB-122	354083	RB-122, RS-1-LP-S & RB-120		0.5 (.23)
PA-800-RX2	354140	PS-800-RX Series		0.5 (.23)
PA-800-U	354141	PS-800-U Series		0.5 (.23)



PA-800/SP/PA-RB Series



PA-800-U



PA-800-RX2

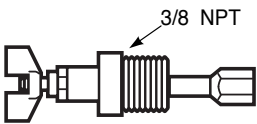
PA-750 Series

Operating Range:

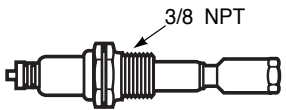
- Maximum System Pressure: 250 psig (17.6 kg/cm²) - High Pressure
- Maximum System Pressure: 15 psig (1.0 kg/cm²) - Low Pressure
- Maximum Temperature at Electrode: 406°F (121°C)

Ordering Information

Model Number	Part Number	Control/Sensor Used On	Rod Req.	Weight lbs. (kg)
PA-750-LP	176318	750P Series	X	0.5 (.23)
PA-750-HP	176319	750B-C & RS-BR Series	X	0.5 (.23)



PA-750-LP

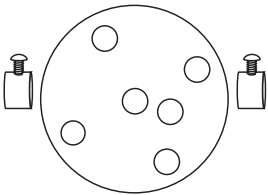


PA-750-HP

Accessories

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
S-4	179529	Spacer use with RS sensors and P&G probes	3.0 (1.4)



Spacer and Collar

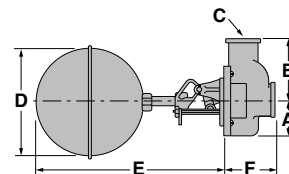
Valve

Series 27-W Liquid Level Controls

- For commercial and industrial liquid level open tank applications
- Materials of construction
 - Brass
 - Monel valve seat, EPDM disc
- Maximum pressure 35 psi (2.5 kg/cm²)
- Maximum supply pressure 100 psi (7 kg/cm²)
- Minimum liquid temperature 40°F (4.4°C)
- Maximum liquid temperature 212°F (100°C)



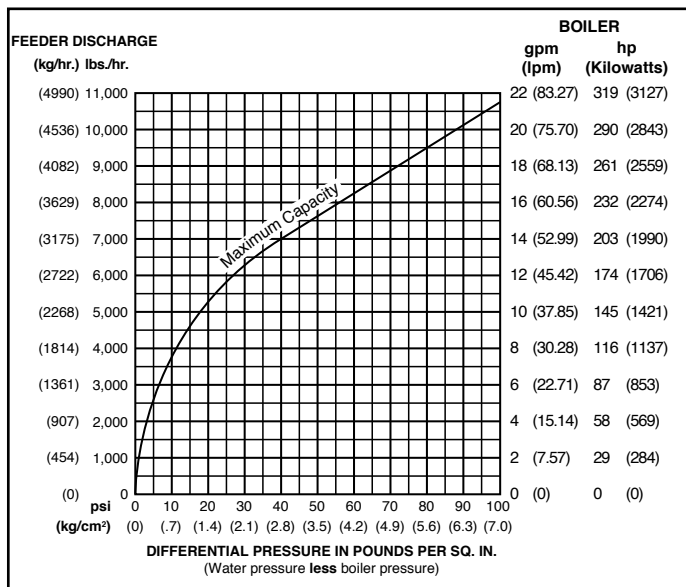
Series 27-W



Dimensions, in. (mm)

A	B	C NPT	D	E	F
1 ⁹ / ₁₆ (40)	2 ⁷ / ₈ (73)	³ / ₄	5 (127)	8 ⁵ / ₈ (219)	2 ⁷ / ₁₆ (62)

Capacities



Ordering Information

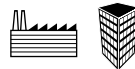
Model Number	Part Number	Description	Weight lbs. (kg)
27-W	127200	Liquid level control	5 (2.3)

Liquid Level Controls

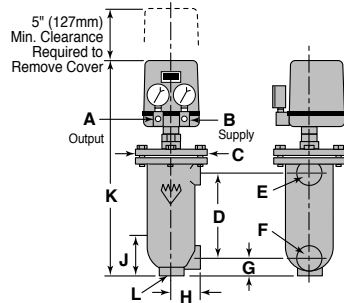
Float Actuated Pneumatic

Series PFC Liquid Level Controls

- For the actuation of pneumatic valves or relays in heating, air conditioning and process systems in hazardous or non-hazardous locations
- Provides an air pressure signal proportional to the liquid level
- Available as Direct Acting or Reverse Acting
- A float operated armature senses the liquid level
- Switch mechanism is completely sealed from the liquid
- Two gauges are provided to display the supply and output pressures
- Alternate air connection tappings are provided for greater flexibility in piping
- Operating range: 1 - 2" (25 - 51mm)
- Air pressure
 - Supply 20 psi (1.4 kg/cm²)
 - Output 3 - 15 psi (.2 - 1 kg/cm²)
- Maximum water temperature 406°F (208°C)
- Maximum pressure 250 psig (17.6 kg/cm²)



Series PFC



Dimensions, in. (mm)

A NPT	B NPT	C	D	E NPT	F NPT	G	H	J	K	L NPT
1/8	1/8	7 (178)	8 (203)	1	1	1 3/4 (45)	2 5/8 (67)	4 (102)	20 3/4 (527)	1

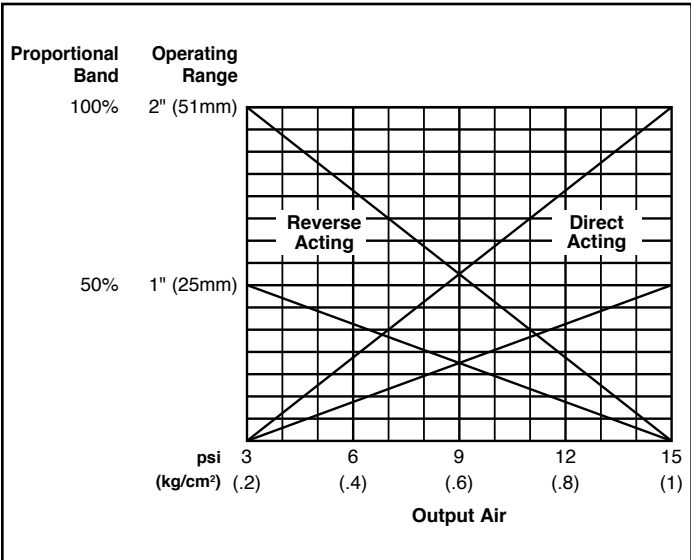
Water Level Adjustment

Model	Type	Level Adjustment Range in. (mm)
PFC-1-G	Direct Acting	1 - 2 (25 - 51)
PFC-1-GR	Reverse Acting	1 - 2 (25 - 51)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
PFC-1-G	180800	Direct acting pneumatic liquid level control	38.5 (17.5)
PFC-1-GR	180801	Reverse acting pneumatic liquid level control	38.5 (17.5)

Output Air

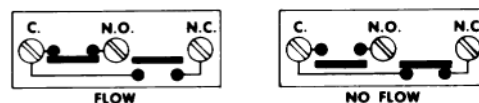


Liquid Flow Switches

The flow of liquids in pipelines plays an important role in industry and commerce. Under most circumstances it is essential to know whether or not there is a flow in a pipeline, and to act upon that knowledge. That is the reason for, and the function of, McDonnell & Miller Flow Switches.

A complete line of Liquid Flow Switches has been developed for a wide range of applications and literally hundreds of uses, including:

- Air Conditioning
- Hot Water Space Heating Systems
- Hot Water Supply Systems
- Pump Systems
- Water Cooled Equipment
- Blending or Additive Systems
- Liquid Transfer Systems
- Fire Sprinkler Systems
- Water Treatment Systems
- Swimming Pool Chlorination
- Industrial Laser Coolant System



In the tables of flow rates included in this catalog the word “Flow” means that switch will close one circuit and open the other, when flow rate is increased to the rate shown.

The words “No-Flow” mean the switch will reverse position—open first circuit and close the second—when flow rate is decreased to the rate shown.

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches	NEMA Enclosure
All Models	Type 1—General purpose indoor
FS-254, FS1W, FS6W, FS7-4W, FS8W	Type 4X—Watertight, Dust tight and Corrosion resistant
FS7-4E	Type 7—Hazardous Location (Class 1—Group C or D) Type 9—Hazardous Location (Class 2—Group E, F or G)

Models FS74E, FS74SE Flow Switches are Underwriters Laboratories Inc. Listed for use in these hazardous locations:

Class I, Division I, Group C – Atmospheres containing ethylether vapors, ethylene or cyclopropane.

Class I, Division I, Group D – Atmospheres containing gasoline, petroleum, naphtha, benzene, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors or natural gas.

Class II, Division I, Group E – Atmospheres containing dust of aluminum, magnesium or their commercial alloys.

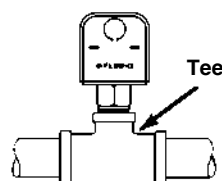
Class II, Division I, Group F – Atmospheres containing carbon black, coal or coke dust.

Class II, Division I, Group G – Atmospheres containing flour, starch or grain dusts.

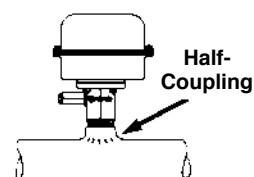
Note: For other listings contact the factory.

Mounting Methods

With Tee



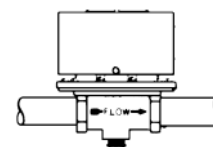
With Welded Half-Coupling



Hex or Face Bushing
FS7-4W

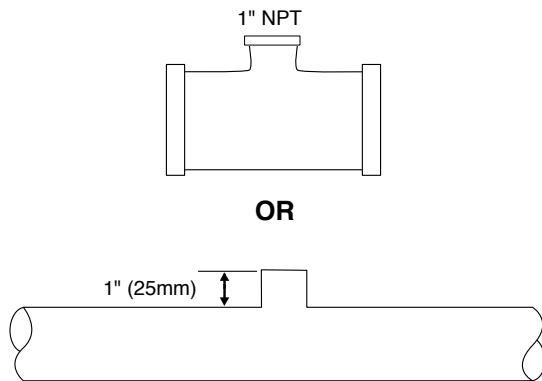


With Body Tapped for Direct Installation
(Series FS1, FS5 and FS6)
FS6



Flow Switch Installation

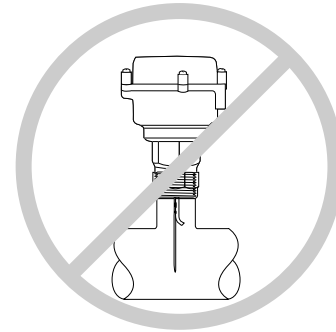
For best operation, the paddle type flow switches should be installed in a horizontal pipe in the upright position. They should be installed in a threaded pipe tee on 2" or smaller pipe or a welded half coupling when installing on larger welded pipe.



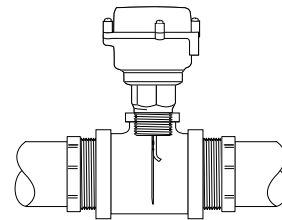
Installation in copper pipe requires special attention. The use of thread to sweat adapters to install the flow switch can cause the paddle arm to be out of the flow of water. It is critical that the paddle and paddle arm be in the run of the pipe for proper operation.

We have found that a paddle type flow switch may not work properly when installed using a thread to sweat adapter. The width of the paddle needs to be reduced in order to fit through the adapter. The additional height locates the paddle arm and a portion of the paddle above the flow of the water **(A)**. This changes the fulcrum point of the mechanism and can result in the paddle hitting the wall of the adapter before it proves. Because the flow switch does not work when first installed, the adjustment screw is turned one way or the other to get it to trip. The combination of trimmed paddle, paddle arm out of flow and attempted adjustment will keep the flow switch from operating properly.

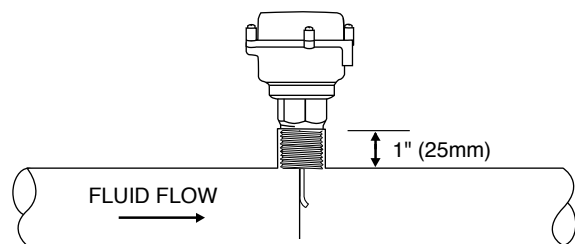
If the flow switch is installed in 2" or smaller copper pipe, the use of a threaded reducing tee and thread to sweat adapters on the main run tee connections would be best **(B)**. Larger pipe may require cutting down the 1" thread to sweat adapter to just below the threads and brazing this piece to a hole in the larger pipe **(C)**. The intention is to maintain the 1" or less distance from the wall of the pipe to the top of the thread adapter. Keeping this distance to less than 1" ensures the paddle arm and paddles are in the flow of water.



A. Incorrect Installation



B. Suggested Installation



C. Suggested Installation

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

How To Select Liquid Flow Switches

1. What function will the flow switch perform?

McDonnell & Miller Flow Switches are equipped with either one or two SPDT switches. They can make or break an electrical circuit when flow starts or when flow stops, and can be used to:

- Actuate a signal when flow stops
- Start a motor with flow
- Shut off an alarm when flow is adequate
- Stop a motor with no flow

2. Size of pipe

McDonnell & Miller Flow Switches may be used on pipe sizes 1/2" - 36" NPT.

3. How much flow is present?

The flow rate at which the flow switch is to respond should be determined next. McDonnell & Miller Flow Switches are actuated (make or break) with an increase in flow. The term "Flow" represents the actual movement (velocity) of liquid within a pipe sufficient to actuate the switch. The term "No-Flow" represents a decrease in velocity, or total flow stoppage, which will permit the switch to return to its original position.

IMPORTANT: In operation, the switch must be actuated by "Flow" before it can be reversed again by "No-Flow". All McDonnell & Miller Flow Switches can easily be adjusted in the field to require a higher actuating "Flow" or "No-Flow".

4. Maximum liquid pressure in pipe

The maximum pipeline pressure should be considered when selecting a particular model. Different flow switch models can accommodate a range of pipeline pressures up to 1000 psi (70kg/cm²).

5. Maximum temperature

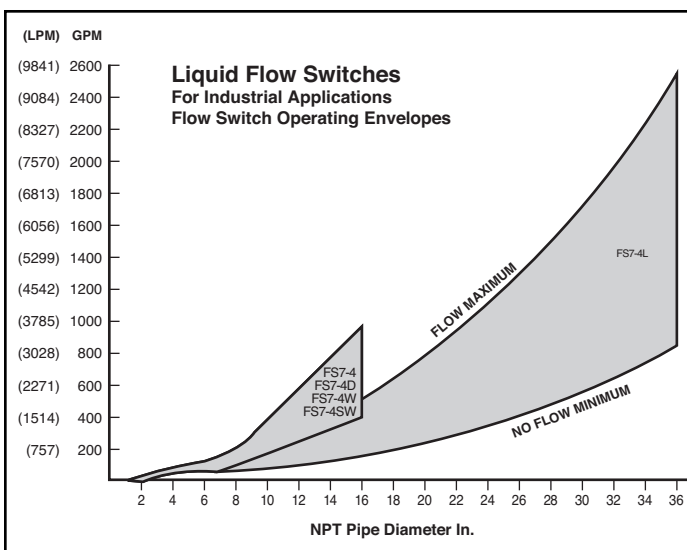
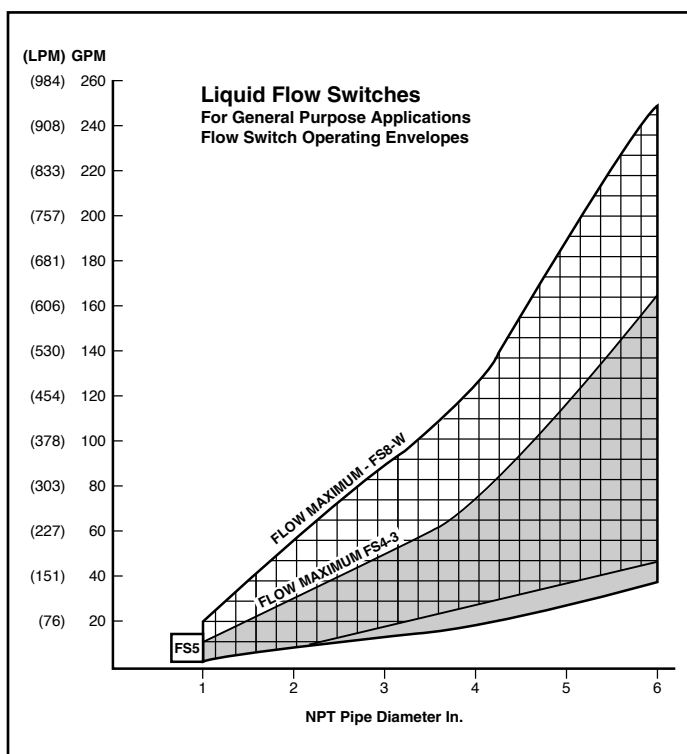
Determine the liquid and ambient atmospheric temperature when selecting the flow switch model. Various McDonnell & Miller Flow Switches can be used at ambient temperatures from 32°F (0°C) and liquid temperatures up to 300°F (149°C). If ambient temperatures are lower than 32°F (0°C) use the FS7-4W.

6. Type of liquid

McDonnell & Miller Flow Switch models have wetted parts of brass, monel or stainless steel. Depending on the particular model they may be used with water, certain light viscous fluids, some oils, various caustic solutions and other fluids.

7. Atmosphere surrounding flow switch

It should be determined if the location will be subject to high humidity, weather conditions or explosive atmospheres. Standard, water tight and hazardous duty flow switch models are available.



NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

8. Incompressible fluids

Fluid flow within a pipe contains both laminar and turbulent flow. The desired placement of any flow switch is in the more predictable laminar flow regions. Turbulent flow is unpredictable, can cause false indications of flow speed and can cause damage to the flow sensing device. An obstruction of flow such as an elbow, fitting or inlet generates a turbulent wave or wake. For that reason placement is recommend at least 5 pipe diameters downstream for liquid flow switches.

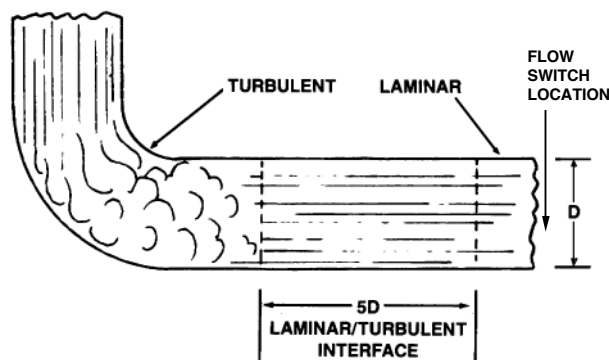
In any flow problem, the flow rate in either feet per second (fps) or gallons per minute (gpm) must be established. For your convenience, we have provided the formulas for determining flow in your application. Use the table (below right) to quickly determine the inside area of standard pipes. For nonstandard pipe schedules, determine the inside area by finding the inside diameter and applying the formula to the right.

Position of the Flow Switch

Installing the flow switch in a horizontal run of pipe is recommended. However because of space limitations, the only available installation may be in a vertical section of pipe. The Series FS4-3, FS8-W and FS5 may be used in this situation as they will generally operate satisfactorily when installed in a vertical pipe with either upward or downward flow (upward flow is preferable) **PROVIDED THERE IS NO UNUSUAL AMOUNT OF DIRT OR SEDIMENT IN THE WATER.**

Flow rates required to actuate the Series FS4-3, FS8W and FS5 are not available for vertical pipe installation. A "factory adjusted" flow switch normally does not require any field adjustment for upward or downward flow. But to make sure, it is advisable to hold flow switch in position to be installed and check for "no flow" switch operation by hand operation of the paddle.

The Series FS7-4, FS6, and FS1 must be mounted on upperside of horizontal pipe. These units will not operate properly on a vertical pipe.



Formulas

$$\begin{aligned} \text{Area} &= D^2\pi/4 \\ D &= \text{Inside Diameter} \\ \pi &= 3.14 \end{aligned}$$

Formula for large pipe, higher velocities

$$1. \text{ Velocity in ft. per sec. (FPS)} = \frac{\text{GPM} \times 0.321}{\text{Pipe Area in sq. in.}}$$

Example: With a flow of 1200 GPM through an 8" pipe, determine velocity.

$$\text{Velocity} = \frac{1200 \times 0.321}{50.0} \text{ or } 7.7 \text{ ft. per sec.}$$

$$2. \text{ GPM} = \frac{\text{Velocity in ft. per sec.} \times \text{Pipe Area sq. in.}}{0.321}$$

Example: With a flow of 6.5 ft. per sec. through a 10" pipe, determine GPM.

$$\text{GPM} = \frac{6.5 \times 78.9}{0.321} \text{ or } 1600 \text{ GPM}$$

3. LPM = Liters per Minute

$$\text{Velocity in meters per sec. (MPS)} = \frac{\text{LPM} \times .163}{\text{Pipe Area in cm}^2}$$

$$\text{LPM} = \frac{\text{Velocity in meters per sec.} \times \text{Pipe Area in cm}^2}{.163}$$

$$\text{GPM} = \text{LPM} \times .264 \quad \text{LPM} = \frac{\text{GPM}}{.264}$$

Nominal Standard Pipe Size in.	Pipe Schedule No.	Inside Area Sq. in. (cm ²) "A"	
1/2	40	.304	(1.96)
3/4	40	.533	(3.44)
1	40	.864	(5.57)
1 1/4	40	1.496	(9.65)
1 1/2	40	2.036	(13.14)
2	40	3.36	(21.68)
2 1/2	40	4.79	(30.90)
3	40	7.39	(47.68)
3 1/2	40	9.89	(63.81)
4	40	12.73	(82.13)
5	40	20.01	(129)
6	40	28.89	(186)
8	40	50.0	(322)
10	40	78.9	(509)
12	30	113.1	(730)
14	30	137.9	(890)
16	30	182.6	(1181)

Liquid Flow Switch Specification Chart

General Purpose Applications															
Model Number	Use on NPT Pipe Sizes	Connection		Wetted Parts						Maximum Pressure		Fluid Temperature °F (°C)		Minimum Ambient	Switch Enclosure
				Brass	Stainless Steel	Monel	Buna N	Viton	Solder						
	in.	NPT	BSPT							psi	kg/cm ²	Min.	Max.	Temp. °F (°C)	
FS4-3	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS251	1-6	•		•	•	•	2		•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3D ¹	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3J	1-6		•	•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3RPT	1-6	•		•	•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS4-3S	1-6	•			•	•			•	160	11.3	32 (0)	300 (149)	32 (0)	General Purpose
FS5-3/4	³ / ₄	•		•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-1	1	•		•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-D-3/4 ¹	³ / ₄	•		•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-D-1 ¹	1	•		•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-J-1	1		•	•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-DJ-3/4 ¹	³ / ₄		•	•			3			150	10.5	32 (0)	250 (121)	32 (0)	General Purpose
FS5-S-1	1	•			•		•			150	10.5	32 (0)	225 (107)	32 (0)	General Purpose
FS5-DS-1 ¹	1	•			•		•			150	10.5	32 (0)	225 (107)	32 (0)	General Purpose
FS254	1-6	•		•	•	•	2		•	160	11.3	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS8-W	1-6	•		•	•	•			•	160	11.3	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS8-WJ	1-6		•	•	•	•			•	160	11.3	32 (0)	225 (107)	32 (0)	NEMA 4-X
High Sensitivity Applications															
FS6-3/4	³ / ₄	•		•				•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-1	1	•		•				•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-J-3/4	³ / ₄		•	•				•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-J-1	1		•	•				•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS6-W-3/4	³ / ₄	•		•				•		100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-W-1	1	•		•				•		100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-WJ-3/4	³ / ₄		•	•				•		100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS6-WJ-1	1		•	•				•		100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X
FS1	¹ / ₂	•		•	•			•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS1-J	¹ / ₂		•	•	•			•		100	7	32 (0)	225 (107)	32 (0)	General Purpose
FS1-W	¹ / ₂	•		•	•			•		100	7	32 (0)	225 (107)	32 (0)	NEMA 4-X

¹ "D" Denotes 2 SPDT Switches

² EPDM O-ring

³ Ethylene-Propylene Elastomer

⁴ Brazed

NEMA 4X flow switches are water tight, dust tight and corrosion resistant

NEMA7, 9 flow switches are rated for hazardous duty

**NOTE: DO NOT USE LIQUID FLOW SWITCHES
ON SYSTEMS WITH FLOW GREATER
THAN 10 FEET (3M) PER SECOND.**

Liquid Flow Switch Specification Chart (continued)

Industrial/Heavy Duty Applications														
Model Number	Use on NPT Pipe Sizes	Connection		Wetted Parts					Maximum Pressure		Fluid Temperature °F (°C)		Minimum Ambient Temp. °F (°C)	Switch Enclosure
				Brass	Stainless Steel	Bronze	PTFE	Solder			Min.	Max.		
FS7-4	1¼ - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4D ¹	1¼ - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4E	1¼ - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4EJ	1¼ - 16		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4EL	8 - 32	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4ELJ	8 - 32		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4J	1¼ - 16		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DJ ¹	1¼ - 16		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4L	8 - 32	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4LJ	8 - 32		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4S	1¼ - 16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DS ¹	1¼ - 16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SE	1¼ -16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SEJ	1¼ - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SJ	1¼ - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SDJ	1¼ - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SW	1¼ - 16	•			•		•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4SWJ	1¼- 16		•		•		•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4W	1¼ -16	•		•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WJ	1¼ - 16		•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WL	8 - 32	•		•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WLJ	8 - 32		•	•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X

1 "D" Denotes 2 SPDT Switches

2 EPDM O-ring

3 Ethylene-Propylene Elastomer

4 Brazed

NEMA 4X flow switches are water tight, dust tight and corrosion resistant

NEMA 7, 9 flow switches are rated for hazardous duty

**NOTE: DO NOT USE LIQUID FLOW SWITCHES
ON SYSTEMS WITH FLOW GREATER
THAN 10 FEET (3M) PER SECOND.**

Flow Velocities

Gallons Per Minute (GPM)

Velocity FPS	Pipe Size (NPT)											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
	GPM											
.2	.19	.33	.54	.94	1.27	2.1	3.0	4.8	6.2	7.9	12.5	18
.4	.38	.66	1.08	1.88	2.54	4.2	6.0	9.6	12.4	15.8	25.0	36
.6	.57	.99	1.62	2.92	3.81	6.2	8.9	13.4	18.6	23.7	37.5	54
.8	.76	1.32	2.16	3.76	5.08	8.3	11.9	19.2	24.8	31.6	50.0	72
1.0	.95	1.66	2.70	4.70	6.30	10.5	14.9	23.0	30.8	39.7	65.4	90
1.5	1.42	2.50	4.05	7.10	9.48	15.8	22.4	34.5	46.2	59.6	98.1	135
2.0	1.89	3.32	5.40	9.40	12.6	21.0	29.8	46.0	61.6	79.4	131	180
2.5	2.37	4.16	6.75	11.8	15.8	26.3	37.3	57.5	77.0	99.3	164	225
3.0	2.84	4.94	8.10	14.1	19.0	31.5	44.7	69.0	92.4	119	196	270
3.5	3.31	5.82	9.45	16.5	22.1	36.8	52.2	80.5	108	139	229	315
4.0	3.78	6.65	10.8	18.8	25.3	42.0	59.6	92.0	123	159	262	360
4.5	4.26	7.48	12.2	21.2	28.4	47.3	67.1	104	139	179	294	405
5.0	4.74	8.32	13.5	23.5	31.6	52.5	74.5	115	154	199	327	450
6.0	5.68	9.99	16.2	28.2	37.9	63.0	89.4	138	185	238	392	540
7.0	6.62	11.61	18.9	32.9	44.2	73.5	104	161	216	278	458	630
8.0	7.56	13.32	21.6	37.6	50.5	84.0	119	184	246	318	523	720
9.0	8.52	15.02	24.3	42.3	56.8	94.5	134	207	277	357	589	810
10.0	9.48	16.62	27.0	47.0	63.0	105	149	230	308	397	654	900

Liters Per Minute (LPM)

Velocity MPS	Pipe Size (NPT)											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
	LPM											
.06	.72	1.25	2.04	3.56	4.81	7.95	11.4	18.2	23.5	29.9	47.3	68.1
.12	1.44	2.5	4.09	7.12	9.61	15.9	22.7	36.3	46.9	60	94.6	136.2
.18	2.16	3.75	6.13	11.1	14.4	23.5	33.7	50.7	70.4	89.7	141.6	204.4
.24	2.88	5	8.18	14.2	19.2	31.4	45	72	93.9	119.6	189.2	272.5
.30	3.6	6.3	10.2	17.8	23.9	39.7	56.4	87	116.6	150.3	247.5	340.7
.46	5.4	9.5	15.3	26.9	35.9	59.8	84.8	130.6	174.9	225.6	371.3	511
.61	7.2	12.6	20.5	35.4	47.6	79.5	112.8	174.1	233.2	300.5	495.8	681.3
.76	9	15.8	25.6	44.7	59.8	99.6	141.2	217.6	291.5	375.9	620.8	851.6
.91	10.8	18.7	30.7	53.4	71.9	119.2	169.2	261.2	349.7	450.4	741.9	1021.9
1.07	12.6	22	35.8	62.5	83.7	139.3	197.6	304.7	408.8	526.1	866.8	1192.3
1.22	14.3	25.2	40.9	71.2	95.8	159	225.6	348.2	465.6	601.8	991.7	1362.6
1.37	16.1	28.3	46.2	81.2	107.5	179	254	393.6	526.2	677.5	1112.8	1532.9
1.52	17.9	31.5	51.1	89	119.6	198.7	282	435.3	582.9	752.2	1237.7	1703.3
1.83	21.5	37.8	61.3	106.7	143.5	238.5	338.4	522.3	700.2	900.8	1483.7	2043.9
2.13	25.1	43.9	71.5	124.5	167.3	278.2	393.6	609.4	817.6	1052.2	1733.5	2384.6
2.44	28.6	50.4	81.8	144.3	191.1	317.9	450.4	696.4	931.1	1203.6	1979.6	2725.2
2.74	32.3	56.9	92	160.1	215	357.7	507.2	783.5	1048.5	1351.3	2229.4	3065.3
3.05	35.9	62.9	102.2	177.9	238.5	397.4	564	870.6	1165.8	1502.7	2475.4	3406.5

Pressure Drop

PSI

Pipe Size NPT (in.)	Series	Flow Rate (GPM)															
		.2	.5	1.0	2.0	4.0	8.0	10.0	15.0	20.0	25.0	30.0	50.0	75.0	100.0	150.0	200.0
1/2	FS1	.26	.32	.47	.72	2.74	9.74	14.4									
3/4 & 1	FS6	.01	.02	.03	.04	.36	1.44	2.16	4.86	7.94	12.3	18	50				
3/4	FS5 3/4"				1.75	2.25	2.80	3.10	8.05	6.3							
1	FS5 1"				1.75	2.25	2.80	3.10									
1	FS4-3					.15	.32	.54	1.26	2.20							
1	FS8-W				.01	.05	.20	.33	.74	1.30							
1 1/4	FS7-4					.03	.08	.17	.39	.72							
2	FS7-4						.02	.02	.04	.09	.13	.19	.51	.90			
3	FS4-3									.01	.01	.02	.05	.10	.18	.40	.79
3	FS8-W									.01	.01	.02	.06	.10	.13	.17	.19
4	FS7-4												.01	.02	.03	.05	.06
6	FS7-4													.01	.01	.02	.02

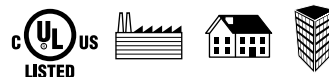
kPa

Pipe Size NPT (in.)	Series	Flow Rate (LPM)															
		.76	1.89	3.79	7.57	15.1	30.3	37.9	56.8	75.7	94.6	113.6	189.3	283.9	378.5	567.8	757
1/2	FS1	1.79	2.21	3.24	4.96	18.89	67.15	99.28									
3/4 & 1	FS6	0.07	0.14	0.21	0.28	2.48	9.93	14.89	33.51	54.74	84.81	124.11	344.74				
3/4	FS5 3/4"				12.07	15.51	19.31	21.37	55.50	43.44							
1	FS5 1"				12.07	15.51	19.31	21.37									
1	FS4-3					1.03	2.21	3.72	8.69	15.17							
1	FS8-W				0.07	0.34	1.38	2.28	5.10	8.96							
1 1/4	FS7-4					0.21	0.55	1.17	2.69	4.96							
2	FS7-4						0.14	0.14	0.28	0.62	0.90	1.31	3.52	6.21			
3	FS4-3									0.07	0.07	0.14	0.34	0.69	1.24	2.76	5.45
3	FS8-W									0.07	0.07	0.14	0.41	0.69	0.90	1.17	1.31
4	FS7-4												0.07	0.14	0.21	0.34	0.41
6	FS7-4													0.07	0.07	0.14	0.14

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

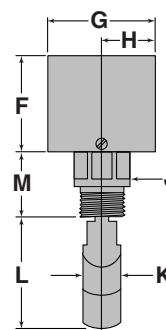
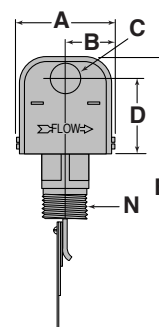
Series FS4-3 General Purpose Liquid Flow Switches



- Universal design serves the widest variety of applications
- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- Replacement for common flow switches from Johnson/Penn, Potter/Taco, Watts, Hydrolevel and other manufacturers
- 1" NPT
- Two electrical knock-outs allows connection from either end
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- Hardened stainless steel bearings minimize friction
- Sealed Monel bellows
- Four stainless steel paddles included - 1", 2", 3" & 6" (25, 50, 80, & 150mm)
- Optional features
 - Two SPDT switches to make or break two separate circuits
 - Materials of construction suitable for corrosive liquids
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum pressure 160 psi (11.3 kg/cm²)



Series FS4-3



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
3 (76)	1½ (38)	7⁄8 (22)	27⁄32 (56)	87⁄16 (211)	215⁄16 (75)	33⁄8 (86)
H	J	K	L	M	N NPT	
11⁄16 (43)	17⁄16 (37)	1½ (29)	37⁄16 (87)	21⁄16 (52)	1	

Flow Switches – Liquid

Series FS4-3 (continued) General Purpose Liquid Flow Switches

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1	Factory or Minimum	6 (22.7)	3.6 (13.6)	27 (102.2)
	Maximum	10.2 (38.6)	9.2 (34.8)	
1¼	Factory or Minimum	9.8 (37.1)	5.6 (21.2)	47 (177.9)
	Maximum	16.8 (63.6)	15 (56.8)	
1½	Factory or Minimum	12.7 (48.1)	7 (26.5)	63 (238.5)
	Maximum	23 (87.1)	19.5 (73.8)	
2	Factory or Minimum	18.8 (71.2)	9.4 (35.6)	105 (397.4)
	Maximum	32.8 (124.1)	24 (90.8)	
2½	Factory or Minimum	24.3 (92)	11.6 (43.9)	149 (564)
	Maximum	42.4 (160.5)	37.5 (141.9)	
3	Factory or Minimum	30 (113.6)	12 (45.4)	230 (870.6)
	Maximum	52.1 (197.2)	46.1 (174.5)	
4	Factory or Minimum	39.7 (150.3)	19.8 (74.9)	397 (1502.7)
	Maximum	73.5 (278.2)	64.2 (242)	
5	Factory or Minimum	58.7 (222.2)	29.3 (110.9)	654 (2415.4)
	Maximum	115 (435.3)	92 (348.2)	
6	Factory or Minimum	79.2 (300)	39.6 (150)	900 (3406.5)
	Maximum	166 (628.3)	123 (465.6)	

Values are ± 10%

**NOTE: DO NOT USE LIQUID FLOW SWITCHES
ON SYSTEMS WITH FLOW GREATER
THAN 10 FEET (3M) PER SECOND.**

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3	114400	General purpose flow switch	1.9 (0.9)
FS4-3J	114610	FS4-3 w/BSPT connections	1.9 (0.9)
FS4-3-RPT	114639	FS4-3 w/test button	1.9 (0.9)
FS4-3Z	114410	FS4-3 w/ANSI terminal connections	1.9 (0.86)
FS4-3D	114550	FS4-3 w/2 SPDT switches	2.3 (1.0)
FS4-3S	114641	FS4-3 w/SS body, monel bellows	1.9 (0.9)
FS4-3SJ	176216	FS4-3S w/BSPT connections	1.9 (0.9)
FS4-3DS	114642	FS4-3S w/2 SPDT switches	3.3 (1.5)

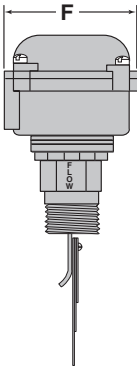
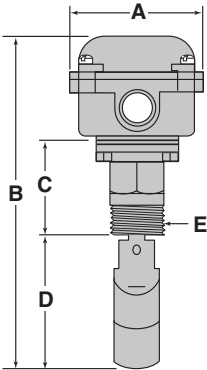
Flow Switches – Liquid

Series FS8-W
General Purpose Liquid Flow Switches

- For general purpose applications with environmental exposure, or those requiring a water-tight, dust tight, or a NEMA 4X rated flow switch
- 1" NPT
- Sealed Monel bellows
- Single pole, double throw snap switch
- Four stainless steel paddles included - 1", 2", 3" and 6" (25, 50, 80 and 150mm)
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 160 psi (11.3 kg/cm²)
- Replacement for NEMA 4X-style flow switches from Potter/Taco, Watts, Penn and other manufacturers



Series FS8-W



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E NPT	F
3¼ (83)	8⅜ (213)	2⅝ (59)	3⅞ (87)	1	3¼ (83)

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation				Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	Velocity fps (mps)	No Flow gpm (lpm)	Velocity fps (mps)	
1	Factory or Minimum	4.9 (18.5)	1.82 (.55)	3.4 (12.9)	1.25 (.38)	27
	Maximum	17.6 (66.6)	6.53 (2.00)	15 (56.8)	5.56 (1.69)	(102.2)
1¼	Factory or Minimum	7.5 (28.4)	1.60 (.49)	5.3 (20.1)	1.14 (.35)	47
	Maximum	29 (110)	6.23 (1.9)	24.6 (93.1)	5.28 (1.61)	(177.9)
1½	Factory or Minimum	9.4 (35.6)	1.48 (.45)	6.7 (25.4)	1.05 (.32)	63
	Maximum	37.8 (143)	5.95 (1.81)	32.2 (122)	5.07 (1.54)	(238.5)
2	Factory or Minimum	13.7 (51.8)	1.31 (.4)	9.4 (35.6)	.9 (.27)	105
	Maximum	56.4 (214)	5.39 (1.64)	47.4 (179)	4.53 (1.38)	(397.4)
2½	Factory or Minimum	17.9 (67.8)	1.20 (.36)	12.1 (45.8)	.81 (.25)	149
	Maximum	71.3 (270)	4.78 (1.46)	59.2 (224)	3.97 (1.21)	(564)
3	Factory or Minimum	24.2 (91.6)	1.05 (.32)	16.4 (62.1)	.71 (.22)	230
	Maximum	89 (337)	3.87 (1.18)	72.5 (274)	3.15 (.96)	(870.6)
4	Factory or Minimum	35.3 (134)	.89 (.27)	27 (102)	.68 (.21)	397
	Maximum	118 (446)	2.89 (.91)	105 (397)	2.64 (.8)	(1502.7)
5	Factory or Minimum	48.6 (184)	.78 (.24)	37.4 (142)	.6 (.18)	654
	Maximum	178 (674)	2.86 (.87)	160 (606)	2.57 (.78)	(2475.4)
6	Factory or Minimum	60.3 (228)	.67 (.20)	46.8 (177)	.52 (.16)	900
	Maximum	245 (927)	2.72 (.83)	225 (852)	2.5 (.76)	(3406.5)

Values are ± 10%

Ordering Information

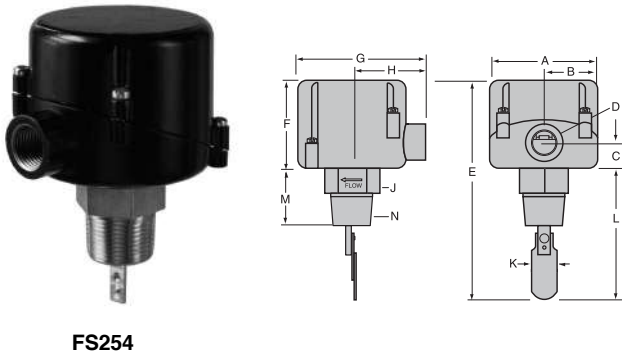
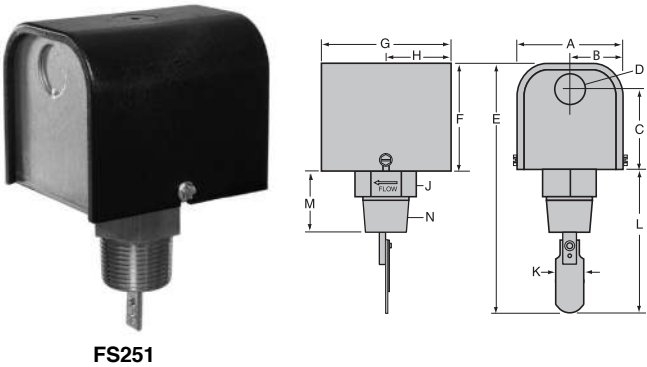
Model Number	Part Number	Description	Weight lbs. (kg)
FS8-W	120601	General purpose flow switch w/NEMA 4X enclosure	2.0 (0.9)
FS8-WJ	120602	FS8-W w/BSPT connections	2.0 (0.9)
FS8-WZ	120605	FS8-W w/ANSI terminal connections	2.0 (0.9)
FS8-WJA	120751	FS8-WJ w/adjusting indicator	2.3 (1.0)

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

Series 250 General Purpose Liquid Flow Switches

- Universal design serves the widest variety of applications
- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- Replacement for common flow switches from Johnson/Penn, Potter/Taco, Watts, Hydrolevel and other manufacturers
- 1" NPTM Pipe Connection
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- EPDM O-ring sealed
- Four stainless steel paddles included - 1", 2", 3" and 6" (25, 50, 80 and 150mm)
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 160 psi (11.3 kg/cm²)
- **Models:**
FS251 - NEMA1 enclosure
FS254 - NEMA4 enclosure



Dimensions, in. (mm)

	A	B	C	D	E	F	G
FS251	3 (76)	1½ (38)	2⅞ (56)	⅞ (22)	8⅞ (211)	2⅝ (75)	3⅞ (86)
FS254	3¼ (83)	1⅝ (41)	¾ (19)	½ NPTF	8⅜ (213)	2¾ (70)	3⅞ (98)

	H	J	K	L	M	N	⁰ Turn-in Radius (not shown)
FS251	1⅞ (43)	1½ (38)	1⅞ (29)	3⅞ (87)	2⅞ (52)	1" NPTM	2⅝ (59)
FS254	2¼ (57)	1½ (38)	1⅞ (29)	3⅞ (87)	1⅞ (48)	1" NPTM	2⅝ (59)

Flow Switches – Liquid

Series 250 (continued) General Purpose Liquid Flow Switches

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1	Factory or Minimum	5.8 (22)	5.1 (19)	27
	Maximum	17.6 (66.6)	6.53 (2.00)	(102)
1¼	Factory or Minimum	6.7 (25)	6.0 (23)	47
	Maximum	19.1 (72)	18.0 (68)	(178)
1½	Factory or Minimum	8.4 (32)	7.0 (26)	63
	Maximum	25.3 (96)	24.1 (91)	(242)
2	Factory or Minimum	12.9 (49)	11.2 (42)	105
	Maximum	31.5 (119)	30.2 (114)	(397)
2½	Factory or Minimum	17.9 (68)	14.5 (55)	149
	Maximum	43.2 (164)	40.0 (151)	(564)
3	Factory or Minimum	26.2 (99)	20.2 (76)	230
	Maximum	54.9 (208)	49.8 (188)	(871)
4	Factory or Minimum	42.0 (159)	33.7 (128)	397
	Maximum	75.6 (286)	68.0 (257)	(1503)
5	Factory or Minimum	54.6 (207)	46.7 (177)	654
	Maximum	109.4 (414)	98.4 (372)	(2475)
6	Factory or Minimum	67.7 (256)	60.2 (228)	900
	Maximum	131.1 (496)	123.5 (467)	(3407)

Values are ± 10%

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS-251	120611	General purpose flow switch – NEMA 1	1.9 (0.9)
FS-254	120610	General purpose flow switch – NEMA 4	1.9 (0.9)

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

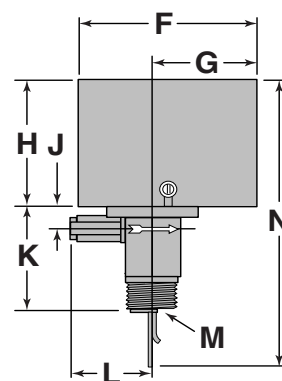
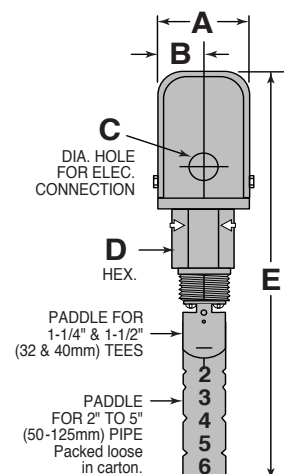
Series FS7-4 Industrial Liquid Flow Switches



- Universal design serves the widest variety of large pipe applications, including heating and hydronic systems, air conditioning, refrigeration and process work
- 1 1/4" NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm - Model FS7-4L
 - Two SPDT switches to make or break two separate circuits
 - Stainless steel body and paddles
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models



Series FS7-4



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
2 7/8 (73)	1 7/16 (37)	7/8 (22)	1 3/4 (45)	13 9/16 (345)	5 13/16 (148)	3 3/8 (86)

H	J	K	L	M	N
4 1/8 (105)	15 1/16 (24)	3 7/16 (87)	2 5/8 (67)	1 1/4 NPT	9 1/2 (241)

Flow Switches

Flow Rates

Model	Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
			Flow gpm (lpm)	No Flow gpm (lpm)	
FS7-4	1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
		Maximum	7.7 (29.1)	5.9 (22.3)	
	1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
		Maximum	10 (37.9)	7 (26.5)	
	2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
		Maximum	15.8 (59.8)	11 (41.6)	
	2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
		Maximum	23.7 (89.7)	17 (64.3)	
	3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
		Maximum	35.5(134.4)	29.2(110.5)	
	4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
		Maximum	61.4(232.4)	37.7(142.7)	
	5	Factory or Minimum	44.4(168.1)	31 (117.3)	654 (2475.4)
		Maximum	84 (317.9)	51 (193)	
	6	Factory or Minimum	56.3(213.1)	48.7(184.3)	900 (3406.5)
		Maximum	114.8(434.5)	71 (270.6)	
FS7-4L	8	Factory or Minimum	104(393.6)	89 (336.9)	1,500 (5677.5)
		Maximum	210(794.9)	131(495.8)	
	10	Factory or Minimum	184(696.4)	157(594.2)	2,500 (9462.5)
		Maximum	369 (1397)	231(874.3)	
	12	Factory or Minimum	289 (1094)	247(934.9)	3,500 (13,247.5)
		Maximum	582 (2203)	363 (1374)	
	14	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)
		Maximum	753 (2850)	495 (1874)	
	16	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)
		Maximum	998 (3777)	656 (2483)	
	20	Factory or Minimum	520 (1968)	260 (984)	8,000 (30,280)
		Maximum	780 (2952)	693 (2623)	
	24	Factory or Minimum	752 (2846)	376 (1423)	12,000 (45,420)
		Maximum	1128(4269)	1002(3793)	
	30	Factory or Minimum	1177(4455)	589 (2229)	20,200 (76,457)
		Maximum	1766(6684)	1570(5950)	
	36	Factory or Minimum	1723(6522)	861 (3259)	28,270 (107,002)
		Maximum	2584(9870)	2297(8694)	

Values are ± 10%

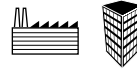
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4	119700	Industrial flow switch	5.5 (2.5)
FS7-4D	119750	FS7-4 w/2 SPDT switches	5.5 (2.5)
FS7-4S	120160	FS7-4 w/SS body	5.0 (2.3)
FS7-4DS	119760	FS7-4S w/2 SPDT switches	5.0 (2.3)
FS7-4J	120060	FS7-4 w/ BSPT connections	5.5 (2.5)
FS7-4SJ	120171	FS7-4J w/SS body	5.0 (2.3)
FS7-4SDJ	120174	FS7-4SJ w/2 SPDT switches	5.0 (2.3)
FS7-4L	119900	FS7-4 w/extended paddle and paddle arm	5.5 (2.5)
FS7-4LJ	119980	FS7-4L w/ BSPT connections	5.7 (2.6)

Flow Switches – Liquid

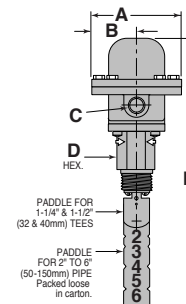
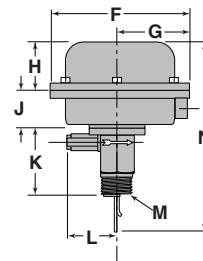
Series FS7-4E Industrial Liquid Flow Switches



- For hazardous environment applications requiring a **NEMA 7 (Class I, Group C or D) or NEMA 9 Class II, Group E, F, or G)** rated flow switch
- 1 $\frac{1}{4}$ " NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm
 - Stainless steel body and paddles
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models



Series FS7-4E



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D	E	F	G
4 $\frac{5}{8}$ (117)	2 $\frac{5}{16}$ (59)	$\frac{1}{2}$	1 $\frac{3}{4}$ (45)	13 $\frac{3}{4}$ (350)	7 $\frac{1}{4}$ (184)	3 $\frac{25}{32}$ (96)
H	J	K	L	M NPT	N	
2 $\frac{7}{16}$ (62)	1 $\frac{15}{16}$ (50)	3 $\frac{7}{16}$ (87)	2 $\frac{5}{8}$ (67)	1 $\frac{1}{4}$	9 $\frac{11}{16}$ (246.6)	

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
	Maximum	7.7 (29.1)	5.9 (22.3)	
1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
	Maximum	10 (37.9)	7 (26.5)	
2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
	Maximum	15.8 (59.8)	11 (41.6)	
2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
	Maximum	23.7 (89.7)	17 (64.3)	
3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
	Maximum	35.5 (134.4)	29.2 (110.5)	
4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
	Maximum	61.4 (232.4)	37.7 (142.7)	
5	Factory or Minimum	44.4 (168.1)	31 (117.3)	654 (2475.4)
	Maximum	84 (317.9)	51 (193)	
6	Factory or Minimum	56.3 (213.1)	48.7 (184.3)	900 (3406.5)
	Maximum	114.8 (434.5)	71 (270.6)	
8*	Factory or Minimum	104 (393.6)	89 (336.9)	1,500 (5677.5)
	Maximum	210 (794.9)	131 (495.8)	
10*	Factory or Minimum	184 (696.4)	157 (594.2)	2,500 (9462.5)
	Maximum	369 (1397)	231 (874.3)	
12*	Factory or Minimum	289 (1094)	247 (934.9)	3,500 (13,247.5)
	Maximum	582 (2203)	363 (1374)	
14*	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)
	Maximum	753 (2850)	495 (1874)	
16*	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)
	Maximum	998 (3777)	656 (2483)	

Values are ± 10%

* Equipped with a 6" paddle

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4E	120100	FS7-4 w/NEMA 7 & 9 enclosure	12.3 (5.6)
FS7-4EJ	120135	FS7-4E w/BSPT connections	12.7 (5.8)
FS7-4EL	120150	FS7-4E w/extended paddle & paddle arm	12.3 (5.6)
FS7-4ELJ	120158	FS7-4EL w/BSPT connections	12.7 (5.8)
FS7-4SE	120175	FS7-4S w/NEMA 7 & 9 enclosure	11.7 (5.3)
FS7-4SEJ	120186	FS7-4SE w/BSPT connections	12.0 (5.4)

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

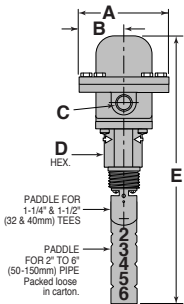
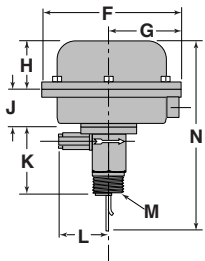
Series FS7-4W Industrial Liquid Flow Switches



- For applications requiring a water-tight, dust-tight or a **NEMA 4X** rated flow switch
- 1 1/4" NPT
- Brass with sealed tube construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Paddles can be trimmed to suit application needs
- Optional features
 - Extended paddle arm
 - Stainless steel body and paddles
 - BSPT threads
- Minimum temperature (fluid or ambient) -65°F (-54°C)
- Maximum temperature 300°F (149°C)
- Maximum operating pressure
 - 300 psi (21 kg/cm²)
 - 1000 psi (70 kg/cm²) – Stainless Steel models



Series FS7-4W



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C NPT	D	E	F	G
4 5/8 (117)	2 5/16 (59)	1/2	1 3/4 (45)	13 3/4 (350)	7 1/4 (184)	3 25/32 (96)
H	J	K	L	M NPT	N	
2 7/16 (62)	1 5/16 (50)	3 7/16 (87)	2 5/8 (67)	1 1/4	9 11/16 (246.6)	

Flow Switches

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
1¼	Factory or Minimum	4.8 (18.2)	3 (11.4)	47 (177.9)
	Maximum	7.7 (29.1)	5.9 (22.3)	
1½	Factory or Minimum	6.3 (23.8)	3.6 (13.6)	63 (238.5)
	Maximum	10 (37.9)	7 (26.5)	
2	Factory or Minimum	9.9 (37.5)	5.9 (22.3)	105 (397.4)
	Maximum	15.8 (59.8)	11 (41.6)	
2½	Factory or Minimum	15.3 (57.9)	9.5 (36)	149 (564)
	Maximum	23.7 (89.7)	17 (64.3)	
3	Factory or Minimum	24.4 (92.4)	15.4 (58.3)	230 (870.6)
	Maximum	35.5 (134.4)	29.2 (110.5)	
4	Factory or Minimum	33.3 (126)	21.1 (79.9)	397 (1502.7)
	Maximum	61.4 (232.4)	37.7 (142.7)	
5	Factory or Minimum	44.4 (168.1)	31 (117.3)	654 (2475.4)
	Maximum	84 (317.9)	51 (193)	
6	Factory or Minimum	56.3 (213.1)	48.7 (184.3)	900 (3406.5)
	Maximum	114.8 (434.5)	71 (270.6)	
8*	Factory or Minimum	104 (393.6)	89 (336.9)	1,500 (5677.5)
	Maximum	210 (794.9)	131 (495.8)	
10*	Factory or Minimum	184 (696.4)	157 (594.2)	2,500 (9462.5)
	Maximum	369 (1397)	231 (874.3)	
12*	Factory or Minimum	289 (1094)	247 (934.9)	3,500 (13,247.5)
	Maximum	582 (2203)	363 (1374)	
14*	Factory or Minimum	387 (1465)	323 (1223)	4,000 (15,140)
	Maximum	753 (2850)	495 (1874)	
16*	Factory or Minimum	513 (1942)	428 (1620)	5,000 (18,925)
	Maximum	998 (3777)	656 (2483)	

Values are ± 10%

* Equipped with a 6" paddle

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS7-4W	120201	FS7-4 w/NEMA 4X enclosure	12.3 (5.6)
FS7-4SW	120191	FS7-4W w/SS body	11.7 (5.3)
FS7-4WJ	120261	FS7-4W w/BSPT connections	12.3 (5.6)
FS7-4SWJ	120197	FS7-4SW w/BSPT connections	11.7 (5.3)
FS7-4WL	120301	FS7-4W w/extended paddle & paddle arm	12.7 (5.8)
FS7-4WLJ	120361	FS7-4WL w/BSPT connections	12.7 (5.8)

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

“K” Factors – adjusting paddle length

If the flow rate in the pipe exceeds the maximum adjustment on the Flow Switch a change can be made in the paddle length. Modifying the paddle length is a simple procedure that will adapt this equipment to a broader range of applications. Use the following formula as a guide when changing paddle lengths

$$\text{Paddle Length} = \frac{K}{\text{Flow Rate (GPM)}}$$

FS4-3 Example A

Calculate paddle length to provide switch action when flow in a 3 inch pipe increases to 100 GPM (366 LPM)

Use Maximum Adjustment Flow

$$L = \frac{162.5}{100} = 1.625 \text{ in. (41.27mm)}$$

FS7-4 Example B

Calculate paddle length to provide switch action when flow in a 3 inch pipe increases to 100 GPM (366 LPM)

Use Maximum Adjustment Flow

$$L = \frac{92.94}{100} = .93 \text{ in. (23.62mm)}$$

FS7-4 Example C

Calculate paddle length to provide switch action when flow in a 12 inch pipe decreases to 1200 GPM (4392 LPM)

Use Maximum Adjustment No-Flow

$$L = \frac{2439.8}{1200} = 2.033 \text{ in. (51.63mm)}$$

FS8W Example D

Calculate paddle length to provide switch action when flow in a 4 inch pipe increases to 200 GPM (732 LPM)

Use Maximum Adjustment Flow

$$L = \frac{442}{200} = 2.21 \text{ in. (56.13mm)}$$

FS4-3 “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	69.2	50.3
2½	102.2	81.0
3	162.5	143.5
4	276.0	241.0
5	550.0	440.0
6	977.0	728.0

FS7-4 “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	34.63	30.43
2½	54.00	47.46
3	92.94	81.69
3½	133.67	117.49
4	183.35	161.15
5	322.61	283.55
6	510.70	448.87
7	705.05	619.67
8	1014.47	891.62
9	1302.47	1144.79
10	1791.70	1574.74
12	2776.04	2439.88
14	3729.02	3255.02
16	4869.81	4250.81
18	6164.08	5380.57
20	7661.11	6687.31
30	18202.0	15888.0

FS8-W “K” Factor

Pipe Size NPT in.	Flow Maximum Adjustment	No-Flow Maximum Adjustment
2	118.5	99.5
2½	168.9	141.8
3	278.0	227.0
4	442.0	391.0
5	847.0	762.0
6	1440.0	1325.0

Flow Switches – Liquid

Series FS5

General Purpose Liquid Flow Switches

- For general purpose applications requiring low flow rate sensitivity
- In-line configuration eliminates need for a pipe tee
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Materials of construction
 - Brass, carbon & EPDM elastomer (for water); Models FS5 & FS5-D
 - Stainless steel, carbon & Buna N (for water or water and petroleum base compounds) Models FS5-S & FS5-DS
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature
 - 225°F (107°C) – Stainless Steel models
 - 250°F (121°C) – Brass
- Maximum operating pressure 150 psi (10.5 kg/cm²)

Electrical Ratings

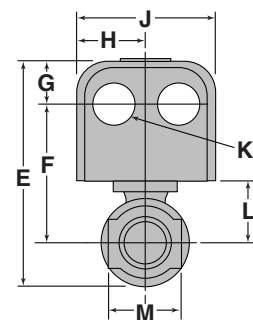
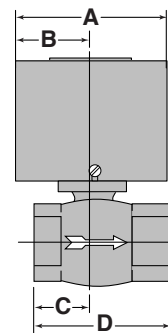
Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS5-3/4	114760	General purpose flow switch 3/4" NPT	2.5 (1.1)
FS5-D-3/4	114763	FS5-3/4 w/2 SPDT switches	2.5 (1.1)
FS5-J-3/4	114765	FS5-3/4 w/BSPT connections	2.5 (1.1)
FS5-1	114780	General purpose flow switch 1" NPT	2.5 (1.1)
FS5-D-1	114783	FS5-1 w/2 SPDT switches	2.5 (1.1)
FS5-J-1	114785	FS5-1 w/BSPT connections	2.5 (1.1)
FS5-S-1	114795	FS5-1 w/SS body	2.3 (1.0)
FS5-DS-1	114793	FS5-1 w/SS body, 2 SPDT switches	2.5 (1.1)



Series FS5



Dimensions, in. (mm)

A	B	C	D
3 7/16 (87)	1 9/16 (40)	1 5/16 (33)	3 3/16 (56)

E	F	G	H
5 1/16 (129)	3 1/4 (83)	7/8 (22)	1 19/32 (40.5)

J	K	L	M
3 3/16 (81)	7/8 (22)	1 3/8 (35)	1 11/16 (43)

Flow Rates

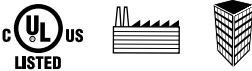
Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	No Flow gpm (lpm)	
3/4 or 1	Factory or Minimum	1.5 (5.7)	1.1 (4.2)	16.62 (62.9)
	Maximum	15 (56.8)	10 (37.9)	27 (102.2)

Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Flow Switches – Liquid

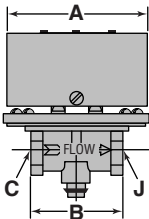
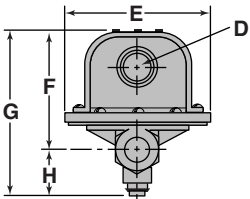
Series FS1
High Sensitivity Liquid Flow Switches



- For general purpose applications where high sensitivity is required and moderate or low flow rates are encountered such as air conditioning, heating and hydronic systems, water, fuel oil, some viscous liquids and oils in process work
- In-line configuration eliminates need for a pipe tee
- High flow capacity
- 1/2" NPT
- Single pole, double throw snap switch
- Switch compartment is completely sealed to protect it from the liquid
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 100 psi (7 kg/cm²)



Series FS1



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

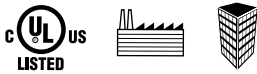
A	B	C NPT	D	E	F	G	H	J NPT
3 3/4 (95)	2 5/8 (67)	1/2	7/8 (22)	3 13/16 (97)	3 3/16 (81)	4 7/16 (113)	1 1/4 (32)	1/2

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

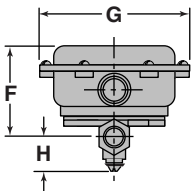
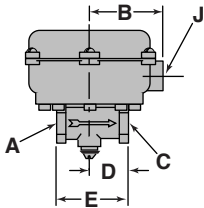
Flow Switches – Liquid

Model FS1-W High Sensitivity Liquid Flow Switches

- For applications requiring a water-tight, dust-tight, or a NEMA 4X rated flow switch



Model FS1-W



Dimensions, in. (mm)

A NPT	B	C NPT	D	E
1/2	2 5/8 (67)	1/2	1 3/8 (35)	2 5/8 (67)
F	G	H	J NPT	
3 7/16 (87)	5 1/2 (140)	1 1/4 (32)	1/2 (15)	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS1	113200	High sensitivity flow switch - 1/2" NPT body	3.0 (1.4)
FS1-J	113550	FS1 w/BSPT connections	3.3 (1.5)
FS1-W	113601	FS1 w/NEMA 4X enclosure	3.5 (1.6)

Flow Rates

Settings	Mode of Operation		Max. Flow Rate gpm (lpm)
	Flow gpm (lpm)	No Flow gpm (lpm)	
Factory or Minimum	0.41 (1.55)	0.24 (.91)	25 (95)
Maximum	1.81 (6.85)	1.28 (4.84)	

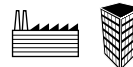
Values are ± 10%

NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

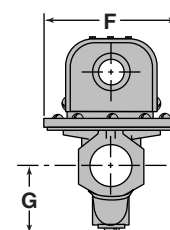
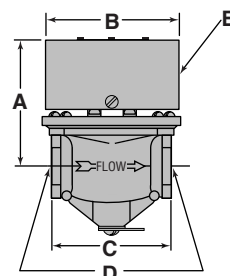
Flow Switches – Liquid

Series FS6 High Sensitivity Liquid Flow Switches

- For heavy duty applications where high sensitivity is required, such as water treatment systems, cooling systems for electronic circuits, compressors, booster pumps, and bearings, and other applications that need instant switching
- In-line configuration eliminates need for a pipe tee
- Very high flow capacity
- Actuates at extremely low flow rate
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Single pole, double throw snap switch
- Switch compartment is completely sealed to protect it from the liquid
- Sensitivity adjusting screw makes flow adjustment easy
- Optional feature
 - BSPT threads
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 225°F (107°C)
- Maximum operating pressure 100 psi (7 kg/cm²)



Series FS6



Dimensions, in. (mm)

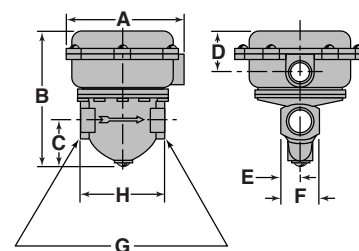
A	B	C	D NPT	E	F	G
3 1/2 (89)	3 23/32 (94.4)	3 3/8 (86)	3/4 or 1	7/8 (22)	3 3/4 (95)	2 (51)

Model FS6-W High Sensitivity Liquid Flow Switches

- For applications requiring a water-tight, dust-tight, or a NEMA 4X rated flow switch



Model FS6-W



Dimensions, in. (mm)

A	B	C	D	E	F	G NPT	H
5 (127)	5 3/4 (146)	2 (51)	1 5/8 (41)	2 9/32 (23)	1 13/16 (46)	3/4 or 1	3 3/8 (86)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Flow Rates

Pipe Size NPT in.	Settings	Mode of Operation		Max. Flow Rate gpm (lpm)
		Flow gpm (lpm)	No Flow gpm (lpm)	
3/4 or 1	Factory or			
	Minimum	.12 (.45)	.06 (.23)	16.62 (629)
	Maximum	2.5 (9.46)	1.5 (5.68)	27 (102.2)

Values are $\pm 10\%$

Ordering Information

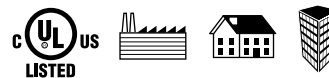
Model Number	Part Number	Description	Weight lbs. (kg)
FS6-3/4	115400	High sensitivity flow switch 3/4" NPT body	4.5 (2)
FS6-J-3/4	115550	FS6-3/4 w/BSPT pipe threads	4.5 (2)
FS6-1	115600	High sensitivity flow switch 1" NPT body	4.5 (2)
FS6-J-1	115650	FS6-1 w/BSPT pipe threads	4.5 (2)
FS6-W-3/4	115651	FS6-3/4 w/NEMA 4X enclosure	4.5 (2)
FS6-WJ-3/4	115653	FS6-W-3/4 w/BSPT connections	4.5 (2)
FS6-W-1	115652	FS6-1 w/NEMA 4X enclosure	4.5 (2)
FS6-WJ-1	115654	FS6-W-1 w/BSPT connections	4.5 (2)

**NOTE: DO NOT USE LIQUID FLOW SWITCHES
ON SYSTEMS WITH FLOW GREATER
THAN 10 FEET (3M) PER SECOND.**

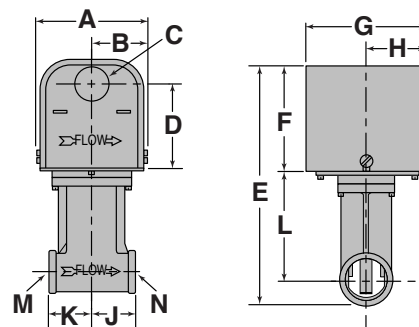
Flow Switches – Liquid

Series FS4-3T General Purpose Liquid Flow Switches

- For starting or stopping electrically operated equipment such as signal lights, alarms, motors, automatic burners, metering devices and others
- In-line configuration eliminates need for a pipe tee
- Sizes available
 - 3/4" NPT
 - 1" NPT
- Paddles available for low, medium or high flow
- Two electrical knock-outs allows connection from either end
- Sensitivity adjusting screw makes flow adjustment easy
- Single pole, double throw snap switch
- Hardened stainless steel bearings minimize friction
- Sealed Monel bellows
- Minimum temperature (fluid or ambient) 32°F (0°C)
- Maximum temperature 300°F (149°C)
- Maximum pressure 160 psi (11.3 kg/cm²)



Series FS4-3T



NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
FS4-3T1-3/4	114800	3/4" NPT body - high flow rate	3 (1.4)
FS4-3T2-3/4	114900	3/4" NPT body - medium flow rate	3 (1.4)
FS4-3T3-3/4	115000	3/4" NPT body - low flow rate	3 (1.4)
FS4-3T1-1	115100	1" NPT body - high flow rate	3 (1.4)
FS4-3T2-1	115200	1" NPT body - medium flow rate	3 (1.4)
FS4-3T3-1	115300	1" NPT body - low flow rate	3 (1.4)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F	G
3 (76)	1 1/2 (38)	7/8 (22)	2 7/32 (56)	6 7/8 (175)	2 15/16 (75)	3 3/8 (86)
H	J	K	L	M NPT	N NPT	
1 11/16 (43)	1 5/16 (33)	1 1/8 (29)	3 1/16 (78)	3/4 or 1	3/4 or 1	

Flow Rates

Pipe Model Number	Size NPT in.	Settings	Mode of Operation Flow gpm (lpm) No Flow gpm (lpm)	Max. Flow Rate gpm (lpm) w/o Paddle Damage
FS4-3T1-3/4	3/4	Factory or Minimum	4.4 (16.7)	2.6 (9.8)
		Maximum	10.5(39.7)	9.8(37.1)
FS4-3T2-3/4	3/4	Factory or Minimum	3.7 (14)	2.2 (8.3)
		Maximum	8.9 (33.7)	8.3(31.4)
FS4-3T3-3/4	3/4	Factory or Minimum	2 (7.6)	1.2 (4.5)
		Maximum	4.5 (17)	4.1(15.5)
FS4-3T1-1	1	Factory or Minimum	5 (18.9)	3.2(12.1)
		Maximum	11.5(43.5)	11(41.6)
FS4-3T2-1	1	Factory or Minimum	4.8 (18.1)	2.9 (11)
		Maximum	10.1(38.2)	9.4(35.6)
FS4-3T3-1	1	Factory or Minimum	2 (7.6)	1.2 (4.5)
		Maximum	4.5 (17)	4.1(15.5)

Values are ± 10%

[illegible]

Air Flow Switches

McDonnell & Miller Air Flow Switches sense air flow or no air flow by responding only to velocity of air movement. They provide a positive and economical way to detect change or loss of air flow velocity caused by closed damper or fan inlet, a loose fan wheel, a slipped or broken fanbelt, a dirty or clogged filter, or an overload on a fan motor switch.

The Series AF1 flow switches are designed for medium and higher velocity systems. Models AF2 and AF3 are for systems with lower air flow velocities.

Air flow switches can be used for a variety of applications such as, but not limited to:

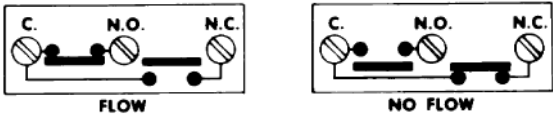
- Clean Room Filter Systems
- Duct Type Heating
- Exhaust Ventilating
- Air Supply System
- Air Treatment Systems

Flow Switches	NEMA Enclosure
All Models	Type 1—General purpose indoor
AFE1	Type 7—Hazardous Location (Class 1—Group C or D) Type 9—Hazardous Location (Class 2—Group E,F or G)

Model AFE1 Flow Switches are Underwriters Laboratories Inc. Listed for use in these hazardous locations:

- Class I, Division I, Group C** – Atmospheres containing ethylether vapors, ethylene or cyclopropane.
- Class I, Division I, Group D** – Atmospheres containing gasoline, petroleum. naphtha, benzene, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors or natural gas.
- Class II, Division I, Group E** – Atmospheres containing dust of aluminum, magnesium or their commercial alloys.
- Class II, Division I, Group F** – Atmospheres containing carbon black, coal or coke dust.
- Class II, Division I, Group G** – Atmospheres containing flour, starch or grain dusts.

Note: For other listings contact the factory.



In the tables of flow rates included in this catalog, the word “Flow” means that switch will close one circuit and open the other, when flow rate is increased to the rate shown.

The words “No-Flow” mean the switch will reverse position—open first circuit and close the second—when flow rate is decreased to the rate shown.

Air Flow

Cubic Feet Per Minute (CFM) Duct Area x FPM

FPM $\frac{\text{CFM}}{\text{Duct Area}}$

One Square Foot = (12" x 12" = 144 sq. In.)

How To Select Air Flow Switches

1. What function will the flow switch perform?

McDonnell & Miller Air Flow Switches are equipped with single pole double throw switches; consequently, they can be used to make or break an electrical circuit either when flow starts or when flow stops. For example, the Flow Switch can be used to:

- Actuate a signal when flow stops
- Start a motor with flow
- Shut off an alarm when flow is adequate
- Stop a motor with no flow

2. How much flow is present?

The air flow velocity at which the Air Flow Switch is to respond should be determined first. McDonnell & Miller Air Flow Switches are actuated (make or break) with an increase in velocity and will reverse switch position (break or make) with a decrease in velocity. The term “Flow” represents the actual movement of air (velocity) within a duct sufficient to actuate the switch. The term “No Flow” represents a decrease in velocity or a total air flow stoppage, which will permit the switch to return back to the original position.

IMPORTANT: In operation the switch must be actuated by “Flow” before it can be reversed again by “No-Flow”. All McDonnell Flow Switches can easily be adjusted to require a higher actuating “Flow” or “No-Flow”.

3. Size of duct

McDonnell & Miller Air Flow Switches are designed for installation in ducts six inches (150mm) and larger.

4. Maximum temperature

Air temperature inside and outside of the duct should be considered. Different McDonnell & Miller Air Flow Switches can be used at temperatures from 32°F (0°C) up to 300°F (149°C).

5. Maximum Velocities

The Series AF1 is designed for medium and higher velocity applications up to 2500 fpm (12.7mps). The Models AF2, AF3, and AF3-D are designed for lower air flow velocities with a maximum of 2000 fpm (10.2mps).

6. Type of air

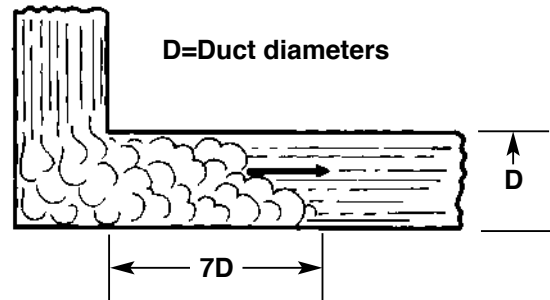
Depending on the model, McDonnell & Miller Air Flow Switches have brass, steel, aluminum, stainless steel, Viton and PTFE parts exposed to the inside of the duct. In addition to use with normal air, they may be used in applications where certain chemical fumes or other air-borne elements are present.

7. Installation

It is recommended that all models be located in a horizontal duct, 10 duct diameters downstream from fan or 7 duct diameters downstream from an elbow, junction or other cause of turbulence.

Often the actual flow rates in the duct appreciably exceed the flow rate required to actuate the switch. If the flow switch must be located closer than 10 duct diameters from a fan, it is recommended that the flow switch be installed on the suction side of the fan.

For air flow applications, the air flow switch should be mounted 7 duct diameters downstream of a flow obstruction like an elbow; 10 duct diameters downstream of a blower.

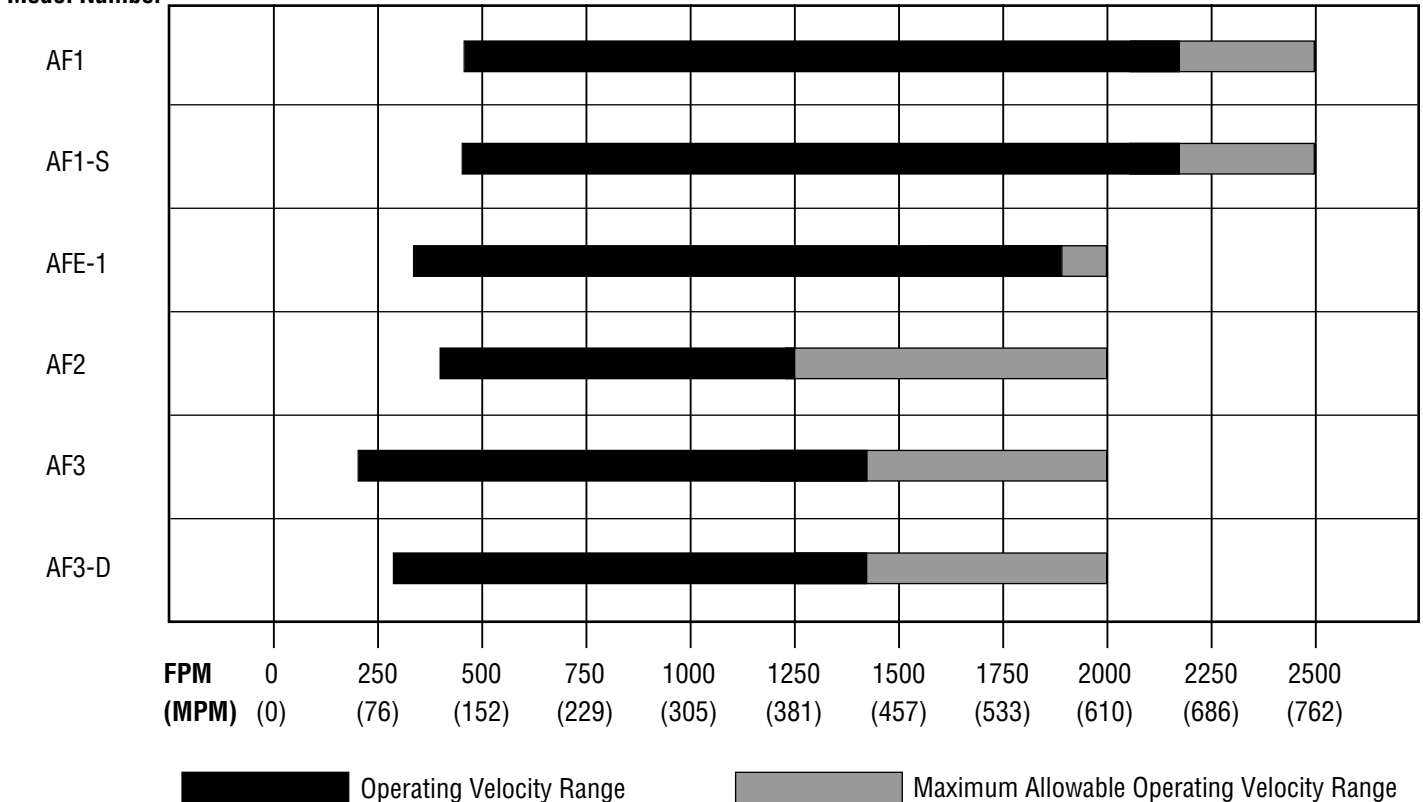


Air Flow Switch Specifications – Horizontal Mounting

Model Number	Operating Velocity Range for Horizontal Installation fpm (mpm)	Maximum Allowable Operating Velocity fpm (mpm)	Vane Material	Seal Material	Seal Strength	Enclosure	Switch	Maximum Air Temperature °F (°C)
AF1	480 - 2230 (146 - 680)	2500 (762)	Brass, Steel	Chrome PTFE	Low	General Purpose Indoor	SPDT	300 (149)
AF1-S	480 - 2230 (146 - 680)	2500 (762)	Stainless Steel 18-8, 302 & 316	Viton	Medium	General Purpose Indoor	SPDT	300 (149)
AFE-1	350-1900 (107 - 579)	2000 (610)	Brass, Stainless Steel, Aluminum	Magnetic Insulation	High	Hazardous Duty Class I & II	SPDT	275 (135)
AF2	380-1250 (116 - 381)	2000 (610)	Brass, Steel, Aluminum	Chrome PTFE	Low	General Purpose Indoor	SPDT	300 (149)
AF3	235-1445 (72 - 440)	2000 (610)	Brass, Steel, Aluminum	Chrome PTFE	Low	General Purpose Indoor	SPDT	275 (135)
AF3-D	295-1445 (90 - 440)	2000 (610)	Brass, Steel, Aluminum	Chrome PTFE	Low	General Purpose Indoor	DPDT	275 (135)

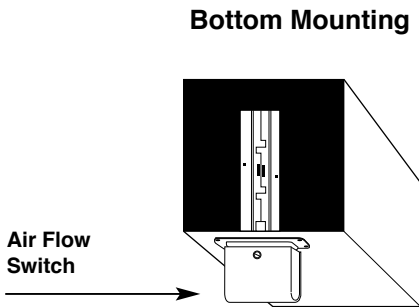
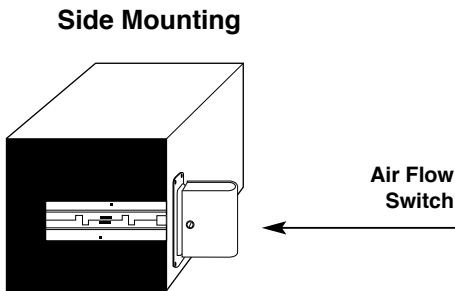
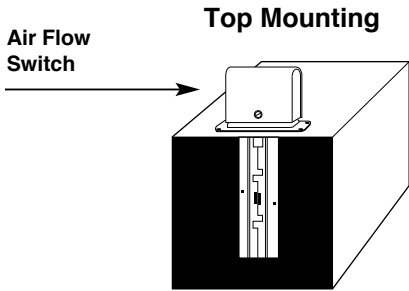
Flow Velocities

Model Number



How to Select Air Flow Switches (continued)

Mounting Methods – Horizontal Ducts



Installing the air flow switch in a horizontal duct is recommended. However, if the velocity of air flow exceeds the flow rates shown in the Vertical Duct Chart to the right, the air flow switch may be installed in a vertical duct with **upward** air flow.

Vertical Duct (Upward Flow)

Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF1 Standard 7 1/4" (184mm)	Factory or Minimum	910 (277)	785 (239)
	Maximum	1610 (491)	1460 (445)
AF1 Trimmed 2" (51mm) 5 1/4" (133)	Factory or Minimum	1235 (376)	1050 (320)
	Maximum	2560 (780)	2410 (735)
AF3	Factory or Minimum	450 (137)	430 (131)
	Maximum	1470 (448)	1395 (425)
AF3-D	Factory or Minimum	560 (171)	540 (165)
	Maximum	1470 (448)	1030 (314)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%
Consult factory for downward flow

Density of Air as a Function of Temperature

Based on Standard Air			
Temperature		Density	
°F	°C	lbs./ft ³	kg/m ³
-40	-40	.094	1.515
-4	-20	.087	1.395
32	0	.080	1.293
50	10	.078	1.248
68	20	.075	1.205
86	30	.072	1.165
104	40	.070	1.128
140	60	.066	1.060
176	80	.062	1.000
212	100	.059	.946
392	200	.046	.746

Flow Switches – Air

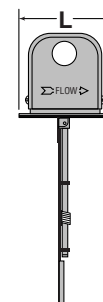
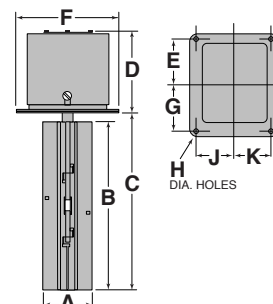
Series AF1

Air Flow Switches

- For general purpose applications with medium and high velocity requirements
- Paddle fits 8" (203mm) minimum duct size, or 6" (152mm) if trimmed
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Two electrical knock-outs allow connection from either end
- Can be equipped with a time delay relay
- Optional features
 - Stainless steel
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 300°F (149°C)



Series AF1



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF1	122800	Air flow switch	2.0 (.9)
AF1-S	123000	AF1 w/SS paddle	2.0 (.9)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E	F
2 1/8 (54)	7 5/16 (186)	7 23/32 (196)	3 7/16 (16)	1 29/32 (48.4)	4 3/8 (111)
G	H	J	K	L	
1 29/32 (48.4)	3/16 (4.8)	1 19/32 (40.5)	1 19/32 (40.5)	3 13/16 (48.4)	

Flow Rates – feet per minute (meters per minute)

Horizontal Duct (Recommended Installation)

Paddle Length	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Standard 7 1/4" (184mm)	Factory or Minimum	480 (146)	185 (56)
	Maximum	1385 (422)	1160 (354)
Trimmed 2" (51mm) 5 1/4" (133mm)	Factory or Minimum	700 (213)	220 (67)
	Maximum	2230 (680)	1820 (555)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Vertical Duct (Upward Flow)

Paddle Length	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Standard 7 1/4" (184mm)	Factory or Minimum	910 (277)	785 (239)
	Maximum	1610 (491)	1460 (445)
Trimmed 2" (51mm) 5 1/4" (133mm)	Factory or Minimum	1235 (376)	1050 (320)
	Maximum	2560 (780)	2410 (735)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Flow Switches

Flow Switches – Air

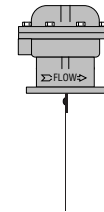
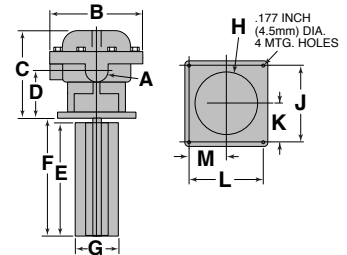
Series AFE-1

Air Flow Switches

- For industrial hazardous environment applications requiring a **NEMA 7 (Class I, Division I, Group C and D) or NEMA 9 (Class II, Division I, Group E, F, and G)** rated flow switch for medium velocity
- ½" NPT conduit connection
- Paddle fits 8" (203mm) minimum duct size
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Magnetic switching mechanism eliminates need for bellows
- Sensitivity adjusting screw makes flow adjustment easy
- Maximum ambient temperature 120°F (49°C)
- Maximum duct temperature 275°F (135°C)



Series AFE-1



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AFE-1	123010	Air flow switch w/NEMA 7 & 9 enclosure	6 (2.7)

Dimensions, in. (mm)

A NPT	B	C	D	E	F
½	5¾ (146)	5 ¹³ / ₃₂ (137.3)	2 ²⁹ / ₃₂ (74)	7 ¹ / ₈ (181)	7½ (191)
G	H	J	K	L	M
2¾ (70)	3 ⁵ / ₈ (92)	4 ³ / ₈ (111)	2 ³ / ₁₆ (56)	4 ³ / ₈ (111)	2 ¹³ / ₁₆ (56)

Flow Rates – feet per minute (meters per minute)

Horizontal Duct (Recommended Installation)

Mounting/ Duct	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
Top (Recommended)	Factory or Minimum	300 (91)	100 (30)
	Maximum	1900 (579)	500 (152)
Side	Factory or Minimum	350 (107)	100 (30)
	Maximum	1950 (594)	900 (274)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
 Values are ± 10%

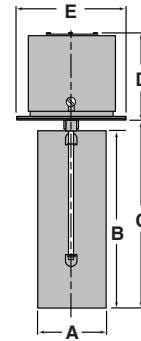
Flow Switches – Air

Series AF2 Air Flow Switches

- For low velocity applications
- Paddle fits 8" (203mm) minimum duct size
- Two electrical knock-outs allow connection from either end
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Can be equipped with a time delay relay
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 300°F (149°C)



Series AF2



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

A	B	C	D	E
2 ³ / ₄ (70)	7 ¹ / ₄ (184)	7 ²¹ / ₃₂ (194)	3 ⁷ / ₁₆ (87)	4 ³ / ₈ (111)

Flow Rates – feet per minute (meters per minute) using standard paddle

Horizontal Duct

Settings	Mode of Operation	
	Flow fpm (mpm)	No Flow fpm (mpm)
Factory or Minimum	380 (115)	210 (63)
Maximum	1250 (380)	1000 (304)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF2	123200	Air flow switch - low velocity	2.0 (.9)

Flow Switches – Air

Series AF3 Air Flow Switches

- For general purpose low velocity applications where the most economical flow switch is desired
- Paddle fits 8" (203mm) minimum duct size
- Two electrical knock-outs allow connection from either end
- Brass, steel and aluminum construction
- Single pole, double throw snap switch
- Sensitivity adjusting screw makes flow adjustment easy
- Can be equipped with a time delay relay
- Optional feature
 - Two SPDT snap switches
- Minimum ambient temperature 32°F (0°C)
- Maximum duct temperature 275°F (135°C)

Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	125 VA at 120 or 240 VAC 50 or 60 cycles
240 VAC	3.7	22.2	

Dimensions, in. (mm)

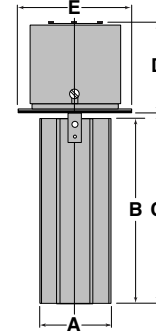
A	B	C	D	E
2 ³ / ₄ (70)	7 ¹ / ₈ (181)	7 ¹¹ / ₃₂ (186.5)	3 ⁷ / ₁₆ (87)	4 ³ / ₈ (111)

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
AF3	123400	Air flow switch - medium velocity	1.7 (.8)
AF3-D	123450	AF3 w/2 SPDT switches	2.0 (.9)



Series AF3



Flow Rates – feet per minute (meters per minute) using standard paddle

Horizontal Duct (Recommended Installation)

Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF3	Factory or Minimum	235 (72)	175 (53)
	Maximum	1445 (440)	1365 (416)
AF3-D	Factory or Minimum	295 (90)	220 (67)
	Maximum	1445 (440)	1000 (305)

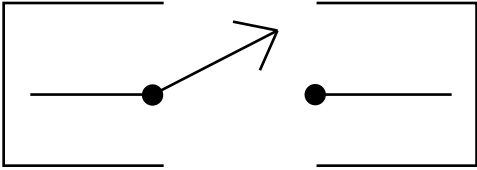
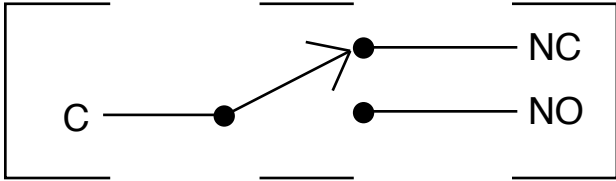
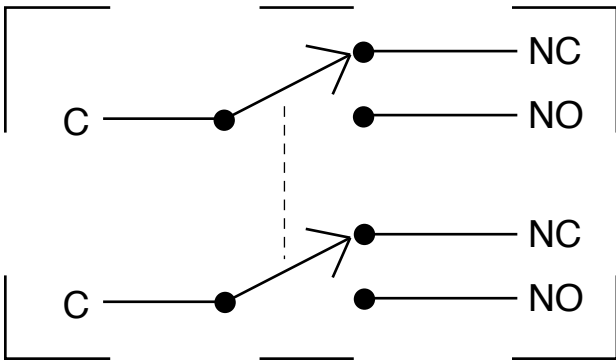
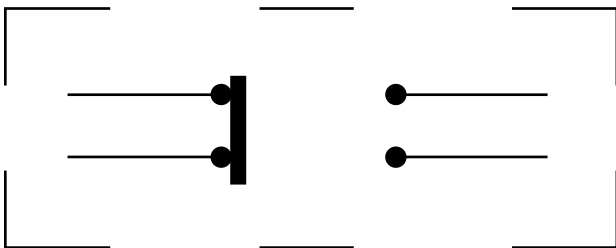
Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Vertical Duct (Upward Flow)

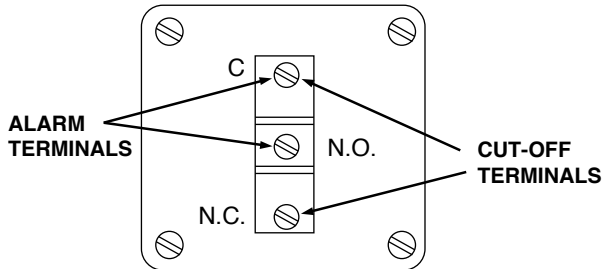
Model Number	Settings	Mode of Operation	
		Flow fpm (mpm)	No Flow fpm (mpm)
AF3	Factory or Minimum	450 (137)	430 (131)
	Maximum	1470 (448)	1395 (425)
AF3-D	Factory or Minimum	560 (171)	540 (165)
	Maximum	1470 (448)	1030 (314)

Based on Standard Air 0.075 pounds per Cubic Foot (1.205 kg/m³)
Values are ± 10%

Types of Electrical Switches

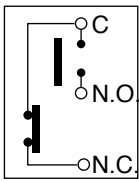
Type	Description	Where Used
 SPST (Single Pole, Single Throw)	Make or break one circuit.	Series 150S boiler control pump switch Series 11 switch
 SPDT (Single Pole, Double Throw)	Make one circuit and break one circuit with common terminal.	Series 2 switch Series 150S boiler control burner switch & alarm All flow switches Series 150E pump & burner switches
 DPDT (Double Pole, Double Throw)	Make two circuits and break two circuits with two common terminals.	Series FS7-4D flow switch Series FS4-3D flow switch Series AF3-D flow switch Series FS5-D flow switch
 SPDB (Single Pole, Double Break)	Make one circuit and break one circuit with no common terminals.	Series 5 switch

Switch Operation

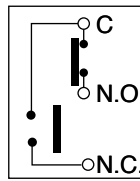


No. 2 Switch

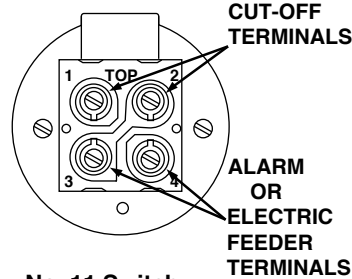
Used on McDonnell No. 47-2,
No. 247-2, No. 51-2, No. 51-S-2,
No. 53-2 and No. 63



Water level normal.
Burner on—alarm off.

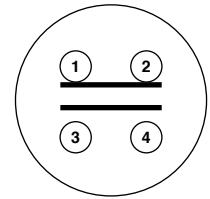


Low water level. Burner
off—alarm on.

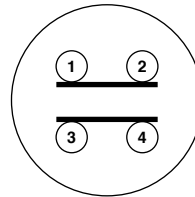


No. 11 Switch

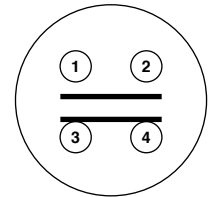
Used on McDonnell No. 64,
No. 67, No. 61 and all "Built-
in" type Low Water Cut-offs.



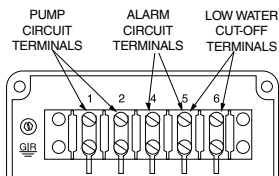
Water level normal.
Burner on—electric
feed valve or alarm
off.



Water level dropped to
electric feed valve or alarm
operating level. Burner on.

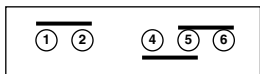


Low water level.
Burner off—electric
feed valve or alarm
on.

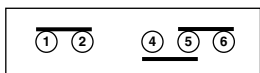


Series 150S Switch

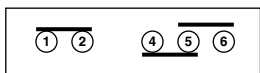
Used on No. 150S and 157S
Series.



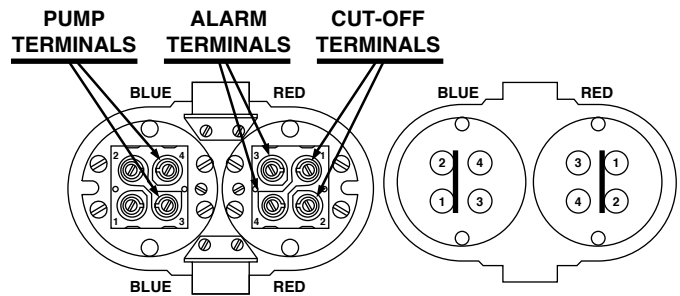
At Normal Operating Level
Boiler feed pump off—burner
on—alarm off.



As Water Level Drops
Boiler feed pump on—burner
on—alarm off.



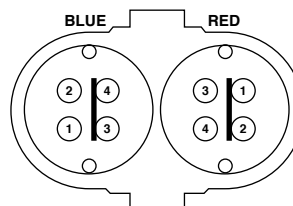
At Low Water Cut-Off Level
Boiler feed pump on—burner
off—alarm on.



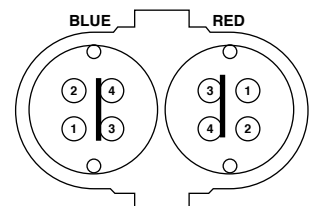
No. 5 Switch

Used on 93, 193, 94 and
194 Series.

At Normal Operating Level
Boiler feed pump off—
burner on—alarm off.



Boiler feed pump
on—burner on—alarm off.



At Low Water Cut-Off Level
Boiler feed pump on—burner
off—alarm on.

The definitions given in this section are only those that apply to heating and as referenced in this catalog. It is realized that some do not define the terms for all usages, but in the interest of clearance and space this sacrifice was made.

Absolute Pressure

Actual pressure above zero, which is the atmospheric pressure added to the gauge pressure. It is expressed as a unit pressure such as lbs. per sq. in. absolute.

Atmospheric Pressure

The weight of a column of air, one square inch in cross section and extending from the earth to the upper level of the blanket of air surrounding the earth. This air exerts a pressure of 14.7 pounds per square inch at sea level, where water will boil at 212 degrees F. High altitudes have lower atmospheric pressure with correspondingly lower boiler point temperatures.

Blow Down Valve

Also referred to as a blowoff valve. A valve which permits a boiler control to be flushed out, and the function of same to be checked.

Boiler

A closed vessel in which steam is generated or in which water is heated by fire or electricity.

Boiler Crown

The part of a boiler which forms the top of the furnace in a fire box boiler, or the equivalent surface in other types of boilers.

Boiler Feed Pump

A pump that is governed by a control that monitors the actual boiler water level; and only adds water to the boiler when the boiler needs it. The pump controller is mounted on the boiler.

Boiler Heating Surface

The area of the heat transmitting surfaces in contact with the water (or steam) in the boiler on one side and the fire or hot gases on the other.

Boiler Horse Power

The equivalent evaporation of 34.5 lbs of water per hour at 212 degrees F to steam at 212 degrees F. This is equal to a heat output of 33,475 BTU per hour, which is equal to approximately 140 sq. ft. of steam radiation (EDR).

British Thermal Unit (BTU)

The quantity of heat required to raise the temperature of 1 lb. of water 1 degree F. This is somewhat approximate but sufficiently accurate for any work discussed in this catalog.

BSPT

British Standard Pipe Thread

Built-Ins

A float-type control that screws directly into the boiler, such as the Series 69 and Series 70 low water cutoffs.

Condensate

In steam heating, the water formed by cooling steam as in a radiator. The capacity of traps, pumps, etc., is sometimes expressed in lbs. of condensate they will handle per hour. One pound of condensate per hour is equal to approximately 4 sq. ft. of steam heating surface (240 BTU per hour per sq. ft.).

Condensate Pump

A pump that is controlled by a switch mounted on the condensate tank. It adds water to the boiler when the condensate tank becomes full, whether the boiler needs water or not.

Dry Fire

Insufficient water in a boiler to carry off the heat of combustion. It causes dry fire which results in cracked cast iron sections, and melted fire tubes.

Dry Saturated Steam

Saturated steam containing no water in suspension.

EDR – (Equivalent Direct Radiation)

The amount of heating surface that will give off 240 BTU per hour when filled with a liquid that is heated to 215°F and surrounded by 70°F air. It may not have a direct relation to the actual surface area.

Fire Tube Boiler

This type of boiler has the water on the external side of the tube and the heat (fire) on the internal side of the tube.

Flash (Steam)

The rapid passing into steam of water at a high temperature when the pressure it is under is reduced so that its temperature is above that of its boiling point for the reduced pressure. For example: if hot condensate is discharged by a trap into a low pressure return or into the atmosphere, a certain percentage of the water will be immediately transformed into steam. It is also called re-evaporation.

Foaming

A condition that occurs when an organic substance, usually oil, is floating on the surface of the water in a boiler. When the boiler is fired, a layer of foam develops on the surface of the water. This generally is indicated in the gauge glass by large swings in water level.

Freeze Up

This refers to a structure that has lost its heating system, and the water in the piping freezes.

Furnace

That part of a boiler or warm air heating plant in which combustion takes place. Sometimes also the complete heating unit of a warm air heating system.

Gauge Glass

Sometimes called water glass or sight glass. It is a device that gives a visual means of the water level in a boiler. By code, all steam boilers are required to have one.

Head

Unit pressure usually expressed ft. of water or mil-inches of water.

Heat

That form of energy into which all other forms may be changed. Heat always flows from a body of higher temperature to a body of lower temperature. *See also: Latent Heat, Sensible Heat, Specific Heat, Total Heat, Heat of the Liquid.*

Heat of the Liquid

The heat (BTU) contained in a liquid due to its temperature. The heat of the liquid for water is zero at 32 degrees F, and increases 1 BTU: approximately for every degree rise in temperature.

Heat Unit

In the foot-pound-second system, the British Thermal Unit (BTU).

Heating Medium

A substance such as water, steam, or air used to convey heat from the boiler, furnace, or other source of heat to the heating units from which the heat is dissipated.

Hot Water Heating System

A heating system in which water is used as the medium by which heat is carried through pipes from the boiler to the heating units.

Latent Heat of Evaporation

The heat (BTU of pound) necessary to change 1 pound of liquid into vapor without raising its temperature. In round numbers, this is equal to 960 BTU per pound of water.

Low Pressure Steam

As defined by ASME, low pressure steam is 15 PSIG or less.

Make-Up Water

Fresh water added to the system, by various means, to replace normal and abnormal water losses.

Manual Reset

A control that has to have human input before the burner will come back on after a low water condition.

Maximum Differential (MD)

A control with this designation has a greater spread between pump on and burner off.

Minimum Safe Water Level

Also known as the minimum safe operating level. The minimum level of water in a boiler where the burner will still operate. Below this level, the burner should be off due to low water.

NPT

National Pipe Thread.

Overfiring

A situation where the burner does not turn off, for a number of reasons. The pressure of the system rises and the safety relief valve opens.

Pilot Valve

A valve that uses a small valve to control a large valve.

Pressure

Force per unit area such lb. per sq. inch.

Pressure Reducing Valve

A piece of equipment for changing the pressure of a gas or liquid from a higher to a lower one.

Priming

When the steam leaving the boiler carries large amounts of water with it, this is called priming. Insufficient heat, water hammer, and a flooded boiler, if the system has an automatic water feeder are some of the symptoms. It is generally caused by a high water level in the boiler, and near boiler piping.

Radiator

A heating unit located within the room to be heated and exposed to view. A radiator transfers heat by radiation to objects "it can see" and by conduction to the surrounding air which in turn is circulated by natural convection.

Sensible Heat

Heat which only increases the temperature of objects as opposed to latent heat.

Skimming

A procedure for cleaning the surface of the water in a boiler. This procedure should be done on all new boiler installations, and when there is a foaming condition.

Steam

Water in the vapor phase. The vapor formed when water has been heated to its boiling point, corresponding to the pressure it is under. *See also Dry Saturated Steam, Wet Saturated Steam, Super Heated Steam*

Steam Heating System

A heating system in which the heating units give up their heat to the room by condensing the steam furnished to them by a boiler or other source.

Steam Pop Safety Valve (Relief Valve)

A device to prevent over pressure in a boiler. It should be set for 15 psi on low pressure steam boilers. On high pressure boilers, it should be set at the maximum working pressure of the boiler, or lower if the boiler is not going to be operated at its maximum pressure.

Steam Trap

A device for allowing the passage of condensate and air but preventing the passage of steam.

Supply Mains

The pipes through which the heating medium flows from the boiler or source of supply to the run-outs and riser leading to the heating units.

Two-Pipe System (Steam or Water)

A heating system in which one pipe is used for the supply main and another for the return main. The essential feature of a two-pipe hot water system is that each heating unit receives a direct supply of the heating medium which cannot have served a preceding heating unit.

Tube Bundle

A single tube (pipe) formed into a tight array so as to present a large surface area in a small space.

Vacuum Heating System (Steam)

A one or two-pipe heating system equipped with the necessary accessory apparatus to permit the pressure in the system to go below atmospheric.

Vapor

Any substance in the gaseous state.

Vapor Heating System (Steam)

A two-pipe heating system which operates under pressure at or near atmospheric and which returns the condensation to the boiler or receiver by gravity.

Vent Valve (Steam)

A device for permitting air to be forced out of a heating unit or pipe and which closes against water and steam.

Vent Valve (Water)

A device permitting air to be pushed out of a pipe or heating unit but which closes against water.

Water Tube Boilers

This type of boiler has the water circulated through a tube bundle with the heat applied on the external side of the tube.

Wet Return (Steam)

That part of a return main of a steam heating system which is completely filled with water of condensation.

Approval Agencies



Underwriters Laboratories Listed
This product has been UL Listed.



Factory Mutual

This product is approved for used in an “accepted” system installation. Such installations where the product falls into one of the following categories:

- Is used for the control or prevention of property damage.
- Those items that are improperly designed would pose serious hazards.



Underwriters Laboratories Listed – Canada and the United States
This product has been UL Listed.



Canadian Standards Association
This product meets or exceeds the Canadian Standards Association requirements.



Underwriters Laboratories Recognized Component – Canada and the United States

This product has been UL Recognized.

AGENCY LISTINGS

Underwriters Laboratories

File	UL Category Code	Description	M&M Products
MP918	MBPR	CONTROLS, LIMIT	750, 751P, 752P, PS Series, PSE Series, RB Series, 42S, 150S, 93, 94, 61, 63, 64, 67, 69, 47, 247, 51, 51-S, 53, WFE, 1575, RS Series
MP918	MBPR2	CONTROLS, LIMIT - COMPONENT	PA Series, 750B-C3/4
MP918	MBPR7	CONTROLS, LIMIT - CANADA	750, 751P, 752P, PS Series, PSE Series, RB-Series, WFE
MP918	MBPR8	CONTROLS, LIMIT - COMPONENT - CANADA	PA Series, 750B-C3/4
MH2725	MFHX	SWITCHES	AF Series, FS1 Series, FS4 Series, FS5 Series, FS6 Series, FS7 Series, FS8 Series, FS-250 Series
MH2725	MFHX7	SWITCHES - CANADA	AF Series, FS1 Series, FS4 Series, FS5 Series, FS6 Series, FS7 Series, FS8 Series, FS-250 Series
MH16430	MJAT	SPECIALTY, HEATING AND HEATING-COOLING APPLIANCE ACCESSORIES	TC-4
MH16430	MJAT7	SPECIALTY, HEATING AND HEATING-COOLING APPLIANCE ACCESSORIES - CANADA	TC-4
E33646	NMFT	MOTOR CONTROLLERS, MISCELLANEOUS	FS7-4, FS7-4W
E33646	NMFT7	MOTOR CONTROLLERS, MISCELLANEOUS - CANADA	FS7-4, FS7-4W
E33552	NQLX	MISCELLANEOUS MOTOR CONTROLLERS, FOR USE IN HAZARDOUS LOCATIONS	FS7-4E, AFE-1
E33552	NQLX7	MISCELLANEOUS MOTOR CONTROLLERS, FOR USE IN HAZARDOUS LOCATIONS - CANADA	FS7-4E
MP1197	YIOZ	VALVES, ELECTRICALLY OPERATED	101A

Canadian Standards Association

File	CSA Class Code	Description	M&M Products
5545	3211-07	INDUSTRIAL CONTROL EQUIPMENT	42S, 150S, 93, 94, 61, 63, 64, 67, 69, 47, 247, 51, 51S, 53, 101A, 1575, 750B-C3/4

IMPORTANT

- Previously used controls should never be installed on a new system. Always install new controls on a new boiler or system.
- A more frequent replacement interval may be necessary based on the condition of the unit at time of inspection. McDonnell & Miller's warranty is one (1) year from date of installation or two (2) years from the date of manufacture.
- Visually inspect the inside of the float chamber during the annual inspection. Partial disassembly may be required.

Inspect all controls annually, and replace, repair or clean, as needed. All chambered units are to be blown down per manufacturers instructions and local code requirements. These requirements are to be determined by the local service company, and are based on water quality and system operation variables.

Refer to the installation instructions provided with the product for specific assembly and test procedures.

McDonnell & Miller products must also be maintained in accordance with the following ASME Code.

ASME Boiler and Pressure Vessel Code – Section VI Paragraph 7.07 G

Low-Water Fuel Cut-Off and Water Feeder Maintenance. Low-water fuel cut-offs and water feeders should be dismantled annually, by qualified personnel, to the extent necessary to insure freedom from obstructions and proper functioning of the working parts. Inspect connecting lines to boiler for accumulation of mud, scale, etc., and clean as required. Examine all visible wiring for brittle or worn insulation and make sure electrical contacts are clean and that they function properly. Give

special attention to solder joints on bellows and float when this type of control is used. Check float for evidence of collapse and check mercury bulb (where applicable) for mercury separation or discoloration. Do not attempt to repair mechanisms in the field. Complete replacement mechanisms, including necessary gaskets and installation instructions are available from the manufacturer. After reassembly, test as per 7.05H.

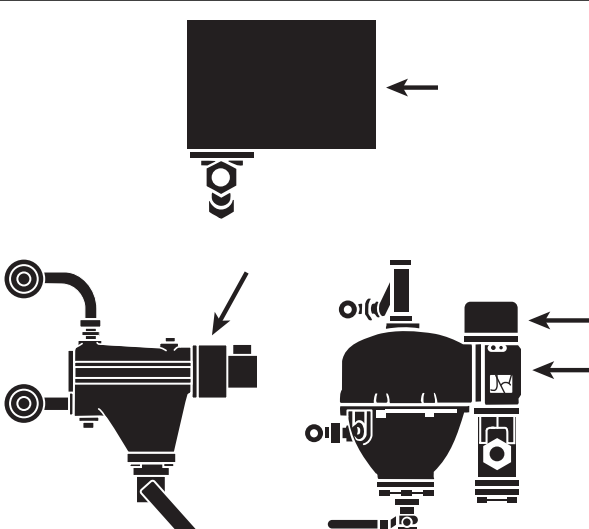
McDonnell & Miller controls manufactured after 1972 feature a stamped date code, so you can easily check the life expectancy and recommended replacement intervals. **If a control has no date stamp or does not have a logo on it – replace it!**

See the chart (next page) for more specific information on maintenance and replacement intervals. Below are guides to help you quickly locate and translate the date code on McDonnell & Miller controls.

WHERE TO FIND

 **McDonnell & Miller**
a xylem brand

DATE CODES



 McDonnell & Miller a xylem brand Product Date Code Translation		
Month	Year	Example
A = January	W = 1979 X = 1980 Y = 1981	K09 Translates to October 1990
B = February	Z = 1982 38 = 1983 48 = 1984	
C = March	58 = 1985 68 = 1986 78 = 1987	
D = April	88 = 1988 98 = 1989 09 = 1990	
E = May	19 = 1991 29 = 1992 39 = 1993	
F = June	49 = 1994 59 = 1995	
G = July		
H = August		
J = September	96 = 1996 97 = 1997 98 = 1998	
K = October	99 = 1999 00 = 2000 01 = 2001	
L = November	02 = 2002 03 = 2003 04 = 2004	Between 1996 and 2008 the month designator proceeds year 96K equals October 1996
M = December	05 = 2005 06 = 2006 07 = 2007 08 = 2008	
	09 = 2009 01 = 2010 11 = 2011	
	21 = 2012 31 = 2013 41 = 2014	
	51 = 2015 61 = 2016 71 = 2017	
	81 = 2018 91 = 2019 02 = 2020	
	12 = 2021 22 = 2022 32 = 2023	
	42 = 2024 52 = 2025 62 = 2026	
	72 = 2027 82 = 2028 92 = 2029	
	03 = 2030	
		Beginning in 2009 the month designator proceeds the year and the year is reversed K61 equals October 2016

Recommended Replacement Intervals

Product	Series	Recommended Maintenance	Recommended Replacement Interval (Maximum)
Low Water Cut-Offs	1575, 150S, 157S, 158S, 159S	Blow down and test daily inspect annually.	15 years
	69, 169, 269, 369, 469	Inspect and test annually.	10 years
	67, 767	Blow down weekly. Inspect and test annually.	10 years
	61, 63, 64, 764	Blow down weekly. Inspect and test annually.	10 years
	42S	Blow down daily. Inspect and test annually.	10 years
	93, 94, 193, 194	Blow down and test daily. Inspect and test annually.	15 years
	750, 751P/752P, PSE-800, RB-122E	Inspect and test annually.	15 years
	RB-24	Inspect and test annually.	10 years
Water Feeders	WFE/Uni-Match®	Inspect and test annually. Replace filter annually.	10 years
	101-A	Inspect, test, and replace cartridge valve annually.	10 years
	21, 221, 25-A, 51-S, 53, 851-S, 3155	Inspect and test annually. Blow down weekly.	15 years
	101-A, 47, 51, 247, 847, 551-S, 851	Blow down weekly. Inspect and replace cartridge valve annually.	10 years
Liquid Level Controls	PFC	Inspect and test annually. Blow down weekly.	15 years
	27-W	Inspect and test annually.	5 years
Replacement Blow Down Valves	14-B	Inspect and test annually.	10 years
	14	Replace with 14-B blow down valve.	3 years
Replacement Probes	751P/752P, PSE-800, RB-122E	Self cleaning probes. inspect 5 yrs.	10 years
Replacement Head Mechanisms for Commercial/Industrial Applications	25-A, 42, 42S, 51, 51-S, 53, 61, 63, 64, 67, 93, 94, 150, 150S, 150E, 157, 157S, 193, 194	Inspect and test annually.	5 years
Flow Switches	FS1, FS4-3, FS5 FS43T, FS6, FS7-4 FS8W, AF, FS-250	Inspect and test annually.	10 years

Commercial Warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other “wear parts” or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or two (2) years from the date of manufacture, whichever shall occur first, unless a longer period is specified in the product documentation (the “Warranty”).

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

LIMITED CONSUMER WARRANTY

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other “wear parts” or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of one (1) year from the date of installation or two (2) years from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the “Warranty”).

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE (1) YEAR FROM THE DATE OF INSTALLATION OR TWO (2) YEARS FROM THE PRODUCT DATE CODE, WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or call +1-847-966-3700 for the name and location of the nearest dealer providing warranty service.

Return Goods Policy

Unused material may be returned for credit only with the written or oral consent of McDonnell & Miller. This consent is in the form of an RGA number issued by McDonnell & Miller, and is subject to the following conditions.

1. Materials must be unused, of current design, and in original cartons.
2. Credit will be issued based upon either a referenced invoice or product date code if an invoice is not referenced. Requester is to supply copy of the referenced invoice if requested.
3. A 25% restocking charge will apply.
4. Unauthorized material returned to McDonnell & Miller will be either refused or sent back to the sender freight collect by a carrier chosen by McDonnell & Miller.
5. If material is received but subsequently found not to have met the above conditions, it will be sent back to the sender freight collect by a carrier chosen by McDonnell & Miller.
6. Products which are obsolete or made to special order are not returnable.

[illegible]

Notes

[illegible]

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

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