

Flow Switches – Liquid

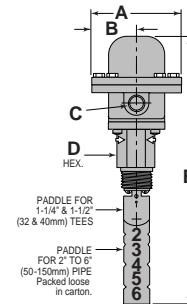
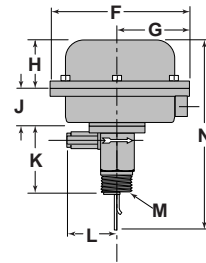
Series FS7-4E

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 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~~ **All BSPT models discontinued**
- 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 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 15/16 (50)	3 7/16 (87)	2 5/8 (67)	1 1/4	9 1/16 (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)

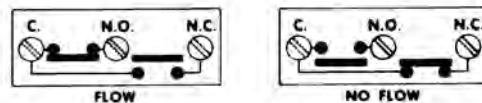
NOTE: DO NOT USE LIQUID FLOW SWITCHES ON SYSTEMS WITH FLOW GREATER THAN 10 FEET (3M) PER SECOND.

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.

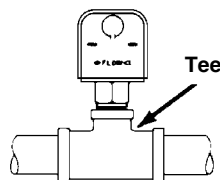
Class II, Division I, Group F – Atmospheres containing carbon black, coal or coke dust.

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

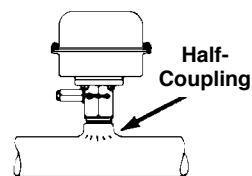
Note: For other listings contact the factory.

Mounting Methods

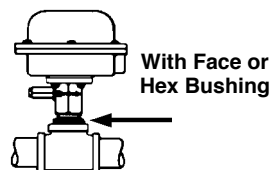
With Tee



With Welded Half-Coupling



Hex or Face Bushing
FS7-4W

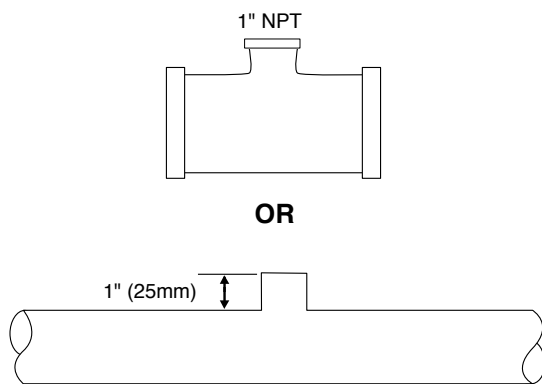


With Body Tapped for Direct Installation
(Series FS1, FS5 and FS6)
FS6



Flow Switch Installation

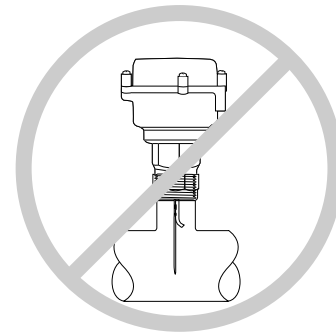
For best operation, the paddle type flow switches should be installed in a horizontal pipe in the upright position. They should be installed in a threaded pipe tee on 2" or smaller pipe or a welded half coupling when installing on larger welded pipe.



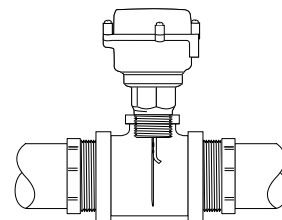
Installation in copper pipe requires special attention. The use of thread to sweat adapters to install the flow switch can cause the paddle arm to be out of the flow of water. It is critical that the paddle and paddle arm be in the run of the pipe for proper operation.

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.

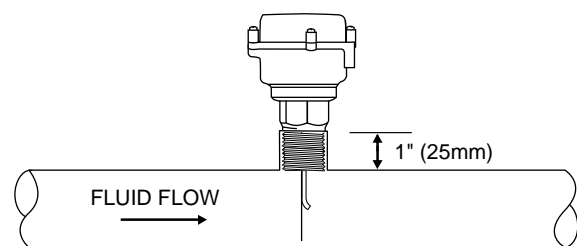
If the flow switch is installed in 2" or smaller copper pipe, the use of a threaded reducing tee and thread to sweat adapters on the main run tee connections would be best (B). Larger pipe may require cutting down the 1" thread to sweat adapter to just below the threads and brazing this piece to a hole 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

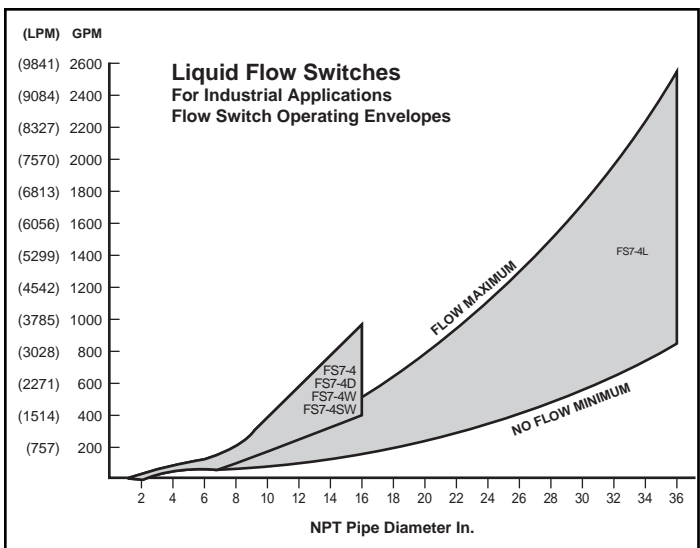
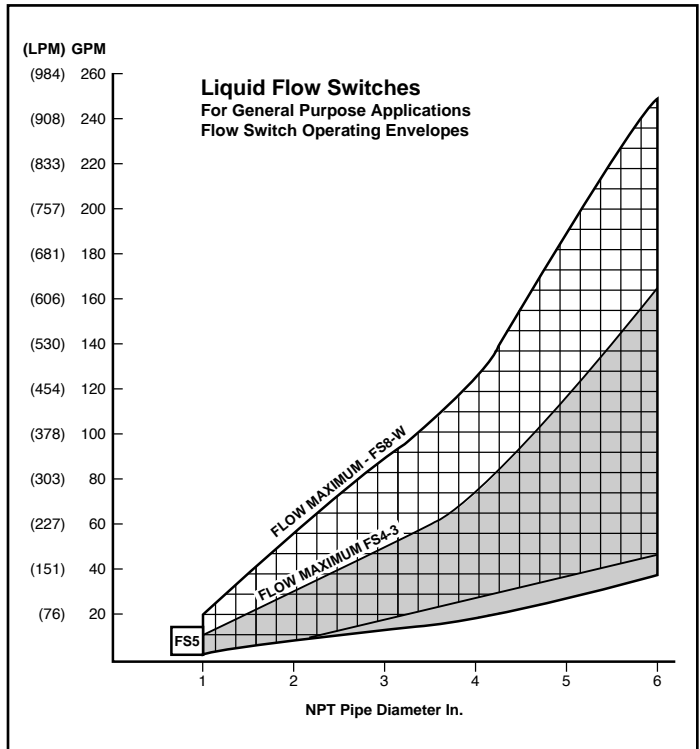
Determine the liquid and ambient atmospheric temperature when selecting the flow switch model. Various McDonnell & Miller Flow Switches can be used at ambient temperatures from 32°F (0°C) and liquid temperatures up to 300°F (149°C). If ambient temperatures are lower than 32°F (0°C) use the FS7-4W.

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.



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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.

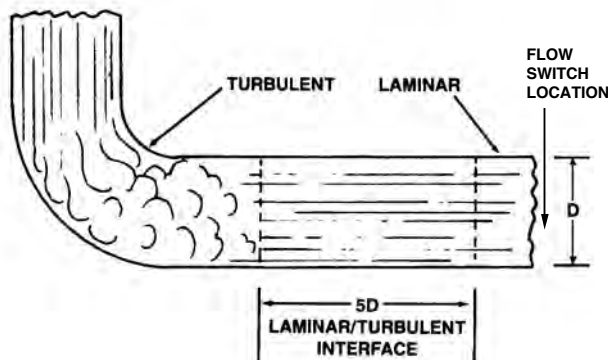
In any flow problem, the flow rate in either feet per second (fps) or gallons per minute (gpm) must be established. For your convenience, we have provided the formulas for determining flow in your application. Use the table (below right) to quickly determine the inside area of standard pipes. For nonstandard 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 Temp. °F (°C)	Switch Enclosure
				psi	kg/cm ²	Min.	Max.								
	in.	NPT	BSPT	Brass	Stainless Steel	Monel	Buna N	Viton	Solder						
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
				psi	kg/cm ²	Min.	Max.							
	in.	NPT	BSPT	Brass	Stainless Steel	Bronze	PTFE	Solder						
FS7-4	1 1/4 - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4D ¹	1 1/4 - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4E	1 1/4 - 16	•		•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4EJ	1 1/4 - 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	1 1/4 - 16		•	•	•	•	•	4	300	21	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DJ ¹	1 1/4 - 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	1 1/4 - 16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4DS ¹	1 1/4 - 16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SE	1 1/4 - 16	•			•		•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SEJ	1 1/4 - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	NEMA 7, 9
FS7-4SJ	1 1/4 - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SDJ	1 1/4 - 16		•		•		•	4	1000	70	32 (0)	300 (149)	32 (0)	General Purpose
FS7-4SW	1 1/4 - 16	•			•		•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4SWJ	1 1/4 - 16		•		•		•	4	1000	70	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4W	1 1/4 - 16	•		•	•	•	•	4	300	21	-65 (-54)	300 (149)	-65 (-54)	NEMA 4-X
FS7-4WJ	1 1/4 - 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

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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

Flow Switches

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