

F61 Series Flow Switches

The F61 Series Flow Switches respond to fluid flow in lines carrying water, ethylene glycol, or other nonhazardous fluids. Two subseries are available.

F61 Series Sensitive Flow Switches respond to low fluid flow rates in applications with pipe sizes under 1-inch trade size. (See Figure 1.)

F61 Series Standard Flow Switches use a variety of paddle sizes to respond to fluid flow rates in applications with pipe sizes greater than 1-inch trade size. (See Figure 2.)

Single-Pole, Double-Throw (SPDT) and Single-Pole, Single-Throw (SPST) open-low versions of these flow switches are available.



Figure 1: F61MD (Left) and F61KD (Right) Sensitive Flow Switches



Figure 2: F61KB Standard Flow Switch

Features and Benefits	
<input type="checkbox"/> NEMA 3 or NEMA 3R Enclosure on Selected Models	Allows use in indoor or outdoor applications
<input type="checkbox"/> Stainless Steel Bellows on Selected Models	Allow use in fluid lines carrying chlorinated water, treated water, or other nonhazardous fluids
<input type="checkbox"/> Low-Flow Operation on Selected (Sensitive) Models	Actuates switch with less than 1.0 GPM (3.8 L/min) flow for water applications or 9.0 GPM (34.1 L/min) flow for steam applications
<input type="checkbox"/> Gold-Plated Contacts on MG Models	Reduces intermittent contact problems in low-voltage and low-current circuits
<input type="checkbox"/> Maximum Fluid Pressure of 150 psig (1034 kPa)	Permits use in a wide range of pressure flow conditions

Application

IMPORTANT: All F61 Series Flow Switches are intended to control equipment under normal operating conditions. Where failure or malfunction of an F61 Flow Switch could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of, or protect against, failure or malfunction of the F61 Flow Switch must be incorporated into and maintained as part of the control system.



CAUTION: Risk of Equipment Damage.

Do not use F61 Series Flow Switches with hazardous fluids or in hazardous atmospheres. Use in these conditions may cause malfunction or improper operation.

IMPORTANT: F61 Series Flow Switches must not be used where the fluid in the pipes drops below the fluid's freezing point, causing an internal freeze-up.

Sensitive Flow Switches

The F61 Series Sensitive Flow Switches have 1/2 in. Female NPTF or 3/4 in. Female NPTF inlet and outlet connections.

Use F61 Sensitive Flow Switches in applications where flow rates are low, such as:

- water purification and treatment systems
- booster pumps
- cooling systems for electronic tubes, bearings, and compressors
- rapid recovery water heaters (starting the water heater when water is withdrawn)
- control of food waste disposal units (starting motor when a predetermined amount of water is flowing through the unit and stops when the flow decreases to a predetermined rate)
- switch to shut down the refrigeration compressor on a fluid chiller system if flow stops, reducing chances of chiller freeze-ups

Standard Flow Switches

Use F61 Series Standard Flow Switches in applications with fluid pressures up to 150 psig (1034 kPa). A typical application for a standard F61 flow switch is to shut down the refrigeration compressor on a fluid chiller system if flow stops, reducing chances of chiller freeze-ups.

NEMA 1 Enclosures

Use models with NEMA 1 enclosures for indoor applications where they are protected from weather and splashing water. Use these models with pipes carrying fluids at temperatures in the range of 32 to 250°F (0 to 121°C) where fluid temperatures are above ambient dew point.

NEMA 3/NEMA 3R Enclosures

Use models with NEMA 3/NEMA 3R (rain-tight) enclosures for indoor or outdoor applications in high-humidity environments. Use these models in applications with pipes carrying fluids at temperatures below dew point temperature or below 32°F (0°C) but above -20°F (-29°C). Do not use these models in applications or environments where the temperature may cause the fluid to freeze.

Gold Contacts

Models with gold-plated contacts provide improved electrical performance in low-voltage, low-current circuits. Use these models for low-energy loads to operate small relays, solenoid valves, and electronic control circuits.

Operation

The flow switch responds to pressure exerted on the fluid paddle by the flowing fluid. A range adjustment screw adjusts the rate of flow required to actuate the switch.

Table 1: SPDT Switch Wiring

Types	Switch Wiring
F61KB, F61KD, F61LB	color-coded terminals
F61MB, F61MD, F61MG	four color-coded wire leads

The red terminal or wire is the Common. The green wire is Ground. Red to Yellow closes on flow increase. Red to Blue closes on flow decrease. See Table 4 through Table 8 for flow rates.

Dimensions

NEMA1 Enclosures

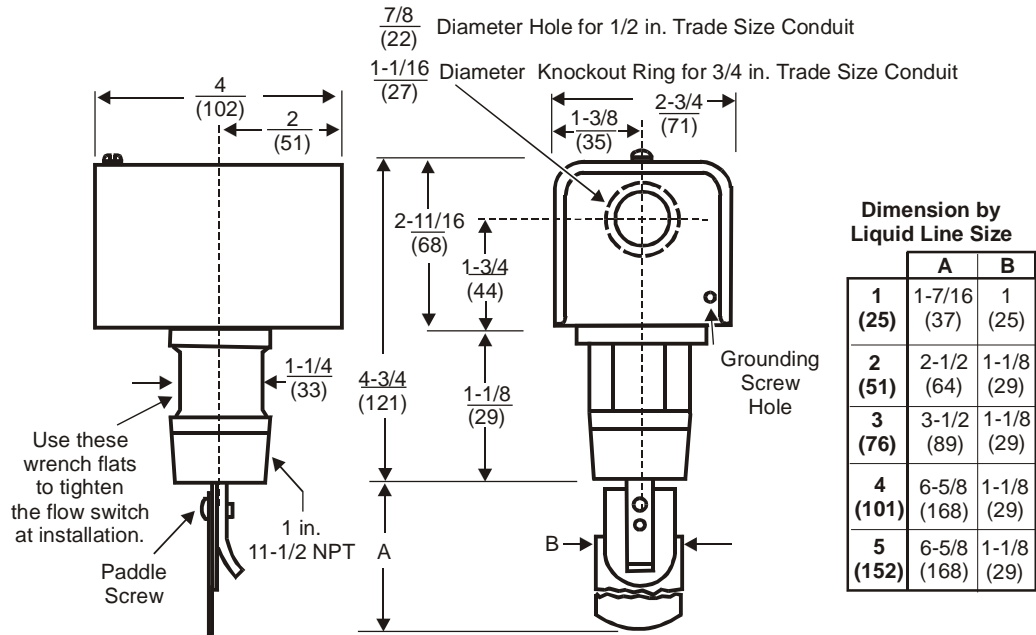


Figure 3: Standard Flow Switch (F61KB Type), in./mm

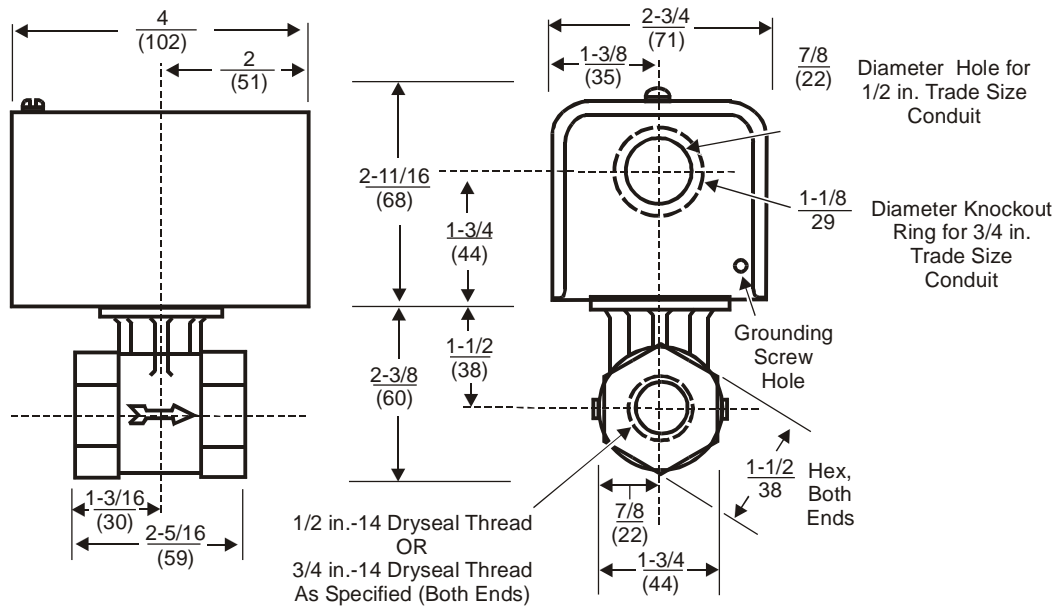


Figure 4: Sensitive Flow Switch (F61KD Type), in./mm

NEMA 3/NEMA 3R Enclosures

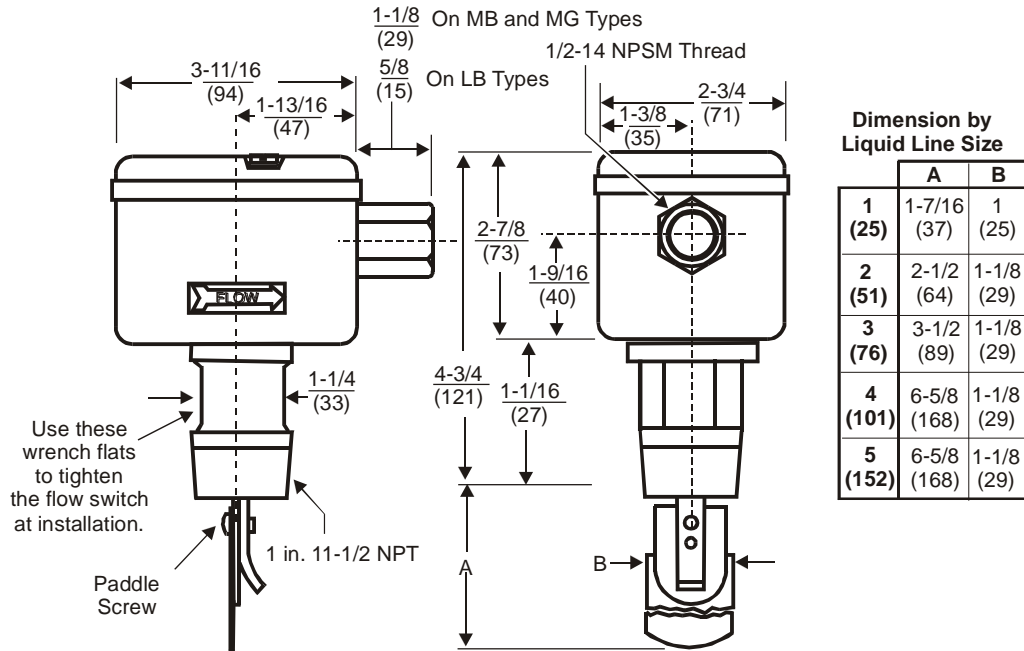


Figure 5: Standard Flow Switch (F61LB, F61MB, F61MG Types), in./mm

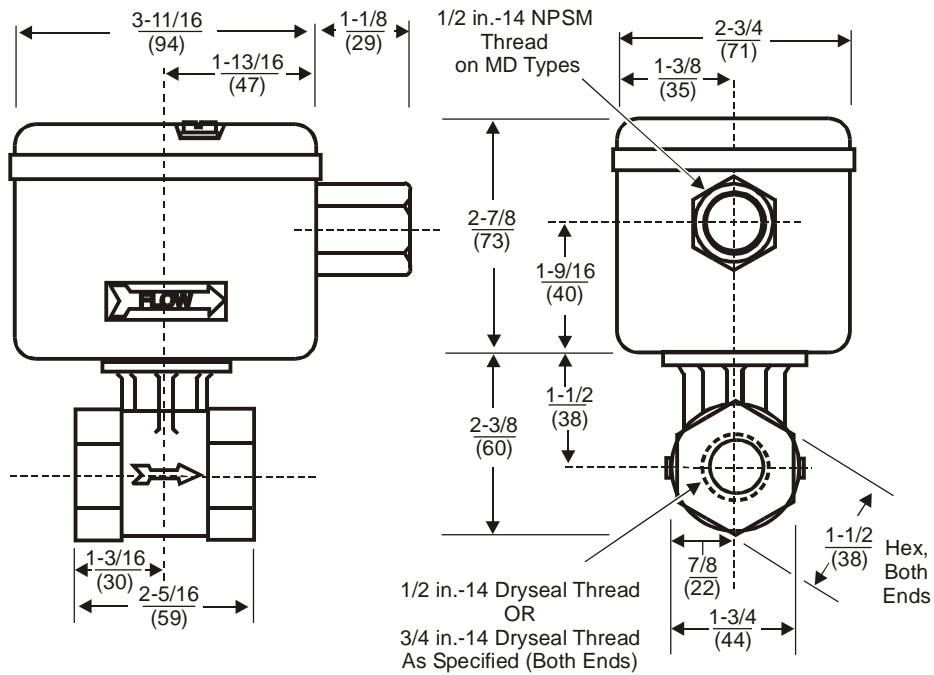


Figure 6: Sensitive Flow Switch (F61MD Type), in./mm

Installation

F61 Series Sensitive Flow Switches do not require adjustment or installation of paddles prior to mounting the flow switch.

Some models of the F61 Series Standard Flow Switches require installation or adjustment of paddles prior to mounting. See *Installing the Flow Paddles*.

Parts Included

F61 Series Standard Flow Switches have a three-piece flow paddle installed at the factory. Some models also include a large flow paddle for large pipe sizes.

Table 2: Replacement Parts

Kit Number	Description
KIT21A-600	Stainless Steel three-piece Paddle (3 in., 2 in., and 1 in. Segments)
KIT21A-601	Stainless Steel 6 in. Paddle
PLT52A-600R	Stainless Steel three-piece Paddle (3 in., 2 in., and 1 in. Segments) and 6 in. Paddle
CVR62A-600R	Replacement Cover Assembly for LB, MB, MD, and MG Types

Installing the Flow Paddles

IMPORTANT: To allow the switch to detect changes in the fluid flow, the flow paddle must not touch the pipe or any restrictions in the pipe.

Adjust flow paddles to the size of the pipe used. Install the large flow paddle, if needed. Trim the flow paddle at the arc corresponding to the pipe size (see Figure 7 and Figure 8).

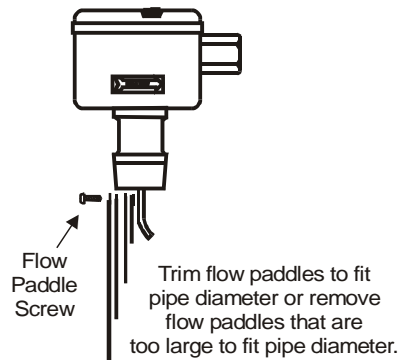


Figure 7: Installing the Paddles

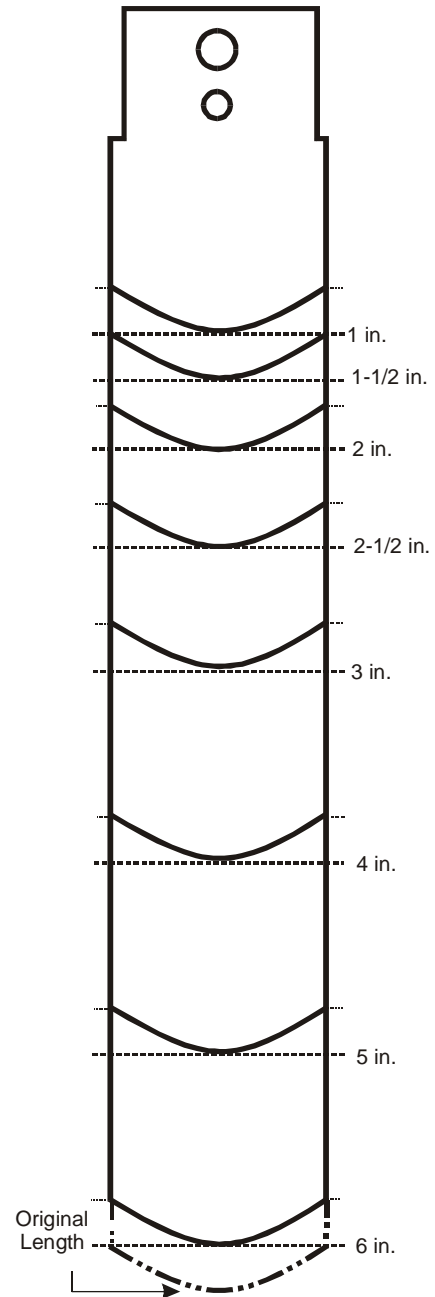


Figure 8: Trimming Diagram for Large Flow Paddle

Mounting



CAUTION: Risk of Equipment Damage.

To avoid damaging the switch, do not tighten the switch to the tee by grasping the switch enclosure. Use only the wrench flats provided.

Mount the F61 Series Flow Switches using the following guidelines:

- Install the switch so that the cover and interior are accessible.
- Mount the switch so that the flow of fluid is in the direction of the arrow on the switch casing.
- Use a pipe union on each side of the flow switch to allow easy removal or replacement.
- Do not allow the pipe to extend too far into the flow switch casing.
- Use pipe thread sealer on male threads only.
- Do not remove the cover gasket or the wire grommet from the conduit opening.

For 1 in. pipe installation, mount the F61 flow switch in a standard 1 in. x 1 in. x 1 in. tee. For larger sizes of pipe, use a reducing tee to keep the flow switch close to the pipe and provide adequate paddle length in the flow stream.

Example: Use a 2 in. x 2 in. x 1 in. tee for a 2 in. pipe. If a standard 2 in. x 2 in. x 2 in. tee is used, install a face or hex bushing in the top opening to reduce it to 1 in.

Mount the flow switch so the terminals or wire leads are easily accessible for wiring. Screw the flow switch in position so the flat of the paddle is at a right angle to the flow. The arrow on the side of the case must point in the direction of the flow.

Location Considerations

Mount the F61 flow switch in a horizontal pipeline or a vertical pipeline with upward fluid flow. Do not use in a vertical pipeline with downward flow. When mounted in a vertical pipe with upward flow, the switch trips at a slightly higher flow than shown in Table 4 through Table 8, due to the effect of gravity on the switch mechanism.

Mount the F61 flow switch in a section of pipe where there is a straight run of at least five pipe diameters on each side of the flow switch from the nearest elbow, valve, or other pipe restriction. See Figure 9.

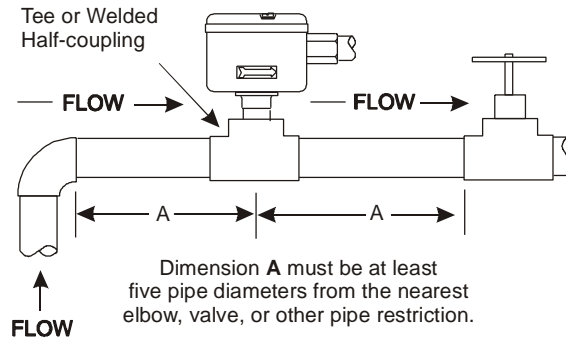


Figure 9: Required Piping Distance

Do not subject the flow switches to water hammer. Use a suitable water hammer arrester if a fast-closing valve is located downstream of the flow switch. See Figure 10.

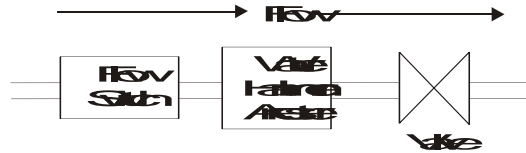


Figure 10: Water Hammer Arrester Location Schematic

Wiring



WARNING: Risk of Electrical Shock.

Disconnect power supply before making electrical connections. Failure to follow this precaution may result in equipment damage, electrical shock or death.



CAUTION: Risk of Equipment Damage.

Using terminal screws other than those provided will void the warranty and may damage the switch. Use only the terminal screws furnished.

IMPORTANT: To prevent moisture from entering and condensate forming inside the NEMA 3R enclosure, do not remove the cover gasket or the wire grommet from the conduit opening.

IMPORTANT: Install all wiring in accordance with the National Electrical Code and local regulations. Make all wiring connections using copper conductors only. Do not exceed the control's electrical rating.

CAUTION: Risk of Equipment Damage. Sealed settings (screws marked with black paint) are not intended to be changed. Adjustment attempts may damage the control or cause loss of calibration, voiding the warranty.

Models of the F61KB, F61KD, and F61LB types have three color-coded terminals. Red is common. See Table 3 and Figure 11. Models of the F61MB, F61MD and F61MG types have four color-coded wire leads. Red is common; green is ground. See Table 3.

Table 3: Switch Action

Flow Action	Switch Closure
Increase	Red to Yellow
Decrease	Red to Blue

To adjust the setting of the flow switch:

1. Disconnect power supply before making electrical connections.
2. Remove the F61 flow switch cover.
3. Turn the adjusting screw **clockwise** to **raise** the flow rate. Turn the adjusting screw **counterclockwise** to **lower** the flow rate. See Figure 12.
4. Replace the cover after completing adjustments. Tighten the cover screws to 12 in-lbs of torque.

Note: Do **not** lower the flow rate unless it has been raised from the factory setting.

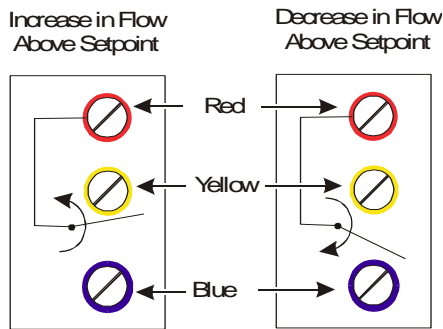


Figure 11: Switch Action

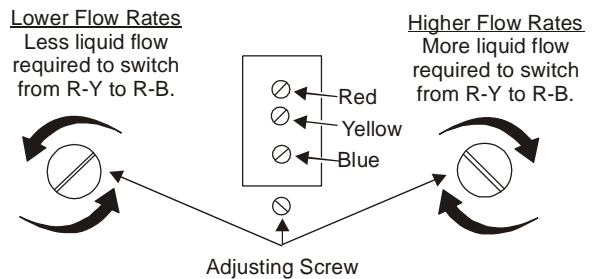


Figure 12: Flow Rate Adjustment

Adjustment

WARNING: Risk of Electrical Shock. Disconnect power supply before making electrical connections. Failure to follow this precaution may result in equipment damage, electrical shock or death.

CAUTION: Risk of Improper Operation. The switch is factory set at approximately the minimum flow rate (see Table 4 through Table 8). Do not set lower than the factory setting as this may result in the switch failing to return to a "no flow" position.

To verify that the flow rate is set above the factory minimum (see Figure 13):

1. Depress the main lever numerous times. If the lever fails to click upon return at any time, the flow rate is set below the factory-set minimum.
2. Raise the flow rate to approximately the factory minimum by turning the adjusting screw clockwise until the lever clicks upon return every time.

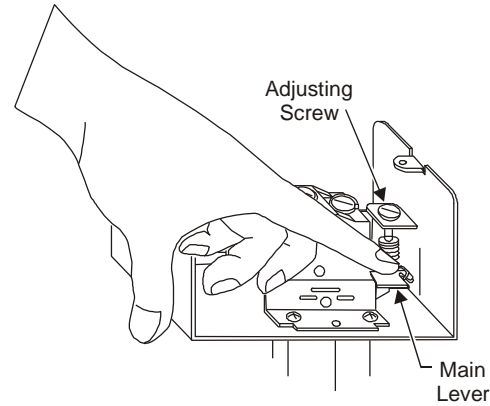


Figure 13: Minimum Adjustment

Typical Flow Rates for F61 Series Standard Flow Switches

Table 4: F61KB, F61LB, and F61MB Types, 1-3 in. Paddles

Pipe Size (in.)		GPM (m ³ /hr) Required to Actuate Switch									
		1	1-1/4 ¹	1-1/2 ¹	2	2-1/2 ²	3	4 ³	5 ³	6 ³	8 ³
Minimum Adjustment	Flow Increase (R to Y Closes)	4.20 (0.95)	5.80 (1.32)	7.50 (1.70)	13.7 (3.11)	18.0 (4.09)	27.5 (6.24)	65.0 (14.8)	125 (28.4)	190 (43.2)	375 (85.2)
	Flow Decrease (R to B Closes)	2.50 (0.57)	3.70 (0.84)	5.00 (1.14)	9.50 (2.16)	12.5 (2.84)	19.0 (4.32)	50.0 (11.4)	101 (22.9)	158 (35.9)	320 (72.7)
Maximum Adjustment	Flow Increase (R to Y Closes)	8.80 (2.00)	13.3 (3.02)	19.2 (4.36)	29.0 (6.59)	34.5 (7.84)	53.0 (12.0)	128 (29.1)	245 (55.6)	375 (85.2)	760 (173)
	Flow Decrease (R to B Closes)	8.50 (1.93)	12.5 (2.84)	18.0 (4.01)	27.0 (6.13)	32.0 (7.27)	50.0 (11.4)	122 (27.7)	235 (53.4)	360 (81.8)	730 (166)

1. Values for 2 in. paddle trimmed to fit pipe.
2. Values for 3 in. paddle trimmed to fit pipe.
3. Values calculated for factory-installed set of 1, 2, and 3 in. paddles.

Table 5: F61KB, F61LB, and F61MB Types, 6 in. Paddles*

Pipe Size (in.)		GPM (m ³ /hr) Required to Actuate Switch			
		4	5	6	8
Minimum Adjustment	Flow Increase (R to Y Closes)	37.0 (8.40)	57.0 (12.9)	74.0 (16.8)	205 (46.6)
	Flow Decrease (R to B Closes)	27.0 (6.13)	41.0 (9.31)	54.0 (12.3)	170 (38.6)
Maximum Adjustment	Flow Increase (R to Y Closes)	81.0 (18.4)	118 (26.8)	144 (32.7)	415 (94.3)
	Flow Decrease (R to B Closes)	76.0 (17.3)	111 (25.2)	135 (30.7)	400 (90.8)

* Where paddle size is larger than pipe size, values are for 6 in. paddle trimmed to fit pipe.

Table 6: F61MG Types, 1-3 in. Paddles

		GPM (m³/hr) Required to Actuate Switch									
Pipe Size (in.)		1	1-1/4¹	1-1/2¹	2	2-1/2²	3	4³	5³	6³	8³
Minimum Adjustment	Flow Increase (R to Y Closes)	3.80 (0.86)	5.30 (1.20)	6.90 (1.57)	12.7 (2.88)	16.7 (3.79)	24.3 (5.52)	61.0 (13.8)	118 (26.8)	183 (41.6)	362 (82.2)
	Flow Decrease (R to B Closes)	2.50 (0.57)	3.70 (0.84)	5.00 (1.14)	9.50 (2.16)	12.5 (2.84)	19.0 (4.32)	50.0 (11.4)	101 (22.9)	158 (35.9)	320 (72.7)
Maximum Adjustment	Flow Increase (R to Y Closes)	8.70 (1.98)	13.1 (2.98)	18.8 (4.27)	28.9 (6.56)	33.7 (7.65)	52.1 (11.8)	126 (28.6)	243 (55.2)	372 (84.5)	753 (171)
	Flow Decrease (R to B Closes)	8.50 (1.93)	12.5 (2.84)	18.0 (4.09)	27.0 (6.13)	32.0 (7.27)	50.0 (11.4)	122 (27.7)	235 (53.4)	360 (81.8)	730 (166)

1. Values for 2 in. paddle trimmed to fit pipe.
2. Values for 3 in. paddle trimmed to fit pipe.
3. Values calculated for factory-installed set of 1, 2, and 3 in. paddles.

Table 7: F61MG Types, 6 in. Paddles*

		GPM (m³/hr) Required to Actuate Switch			
Pipe Size (in.)		4	5	6	8
Minimum Adjustment	Flow Increase (R to Y Closes)	35.0 (7.95)	53.0 (12.0)	69.0 (15.7)	197 (44.7)
	Flow Decrease (R to B Closes)	27.0 (6.13)	41.0 (9.31)	54.0 (12.3)	170 (38.6)
Maximum Adjustment	Flow Increase (R to Y Closes)	80.0 (18.2)	116 (26.3)	142 (32.2)	412 (93.6)
	Flow Decrease (R to B Closes)	76.0 (17.3)	111 (25.2)	135 (30.7)	400 (90.8)

* Where paddle size is larger than pipe size, values are for 6 in. paddle trimmed to fit pipe.

Typical Flow Rates for F61 Series Sensitive Flow Switches

Table 8: F61 Series Sensitive Flow Switches

GPM (L/Min) Required to Actuate Switch			
Pipe Size (in.)		1/2 in. x 1/2 in. Female NPTF ¹ 3/4 in. x 3/4 in. Female NPTF ²	3/4 in. x 3/4 in. Female NPTF ³
Minimum Adjustment	Flow Increase (R to Y Closes)	0.60 (2.27)	8.50 (32.2)
	Flow Decrease (R to B Closes)	0.30 (1.14)	4.50 (17.1)
Maximum Adjustment	Flow Increase (R to Y Closes)	1.10 (4.17)	9.00 (34.1)
	Flow Decrease (R to B Closes)	0.90 (3.41)	6.30 (23.9)

1. F61KD-3C, F61MD-1C
2. F61KD-4C, F61MD-2C
3. F61KD-8C (designed for steam applications)

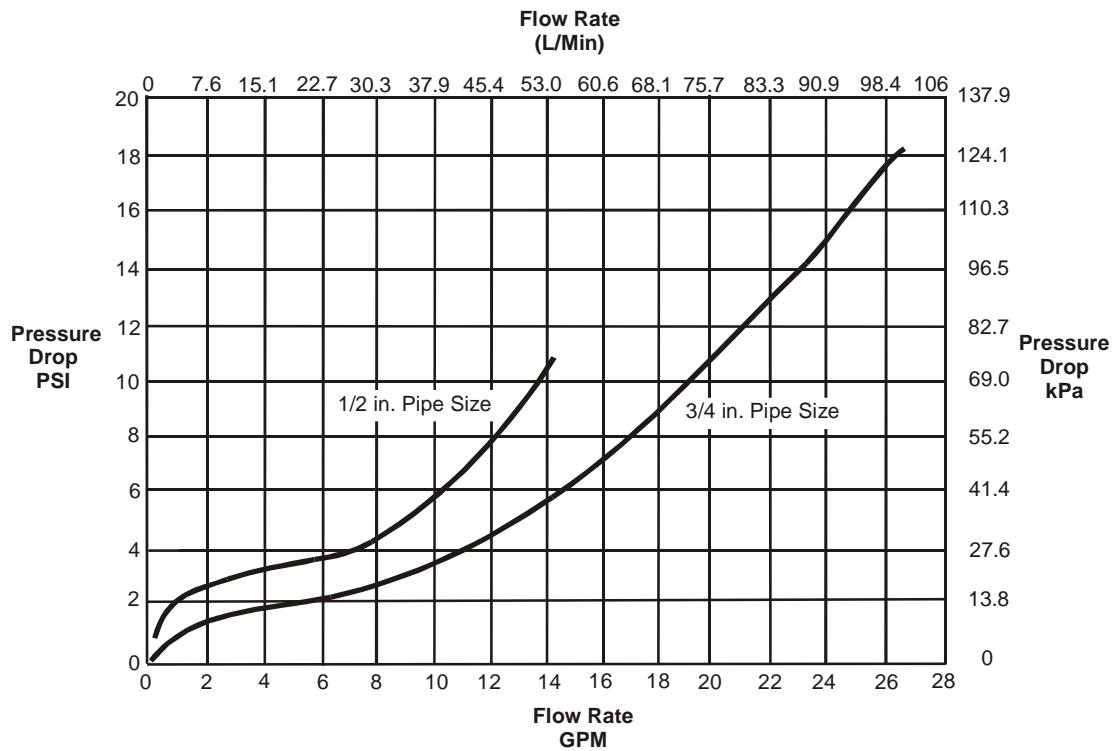


Figure 14: Pressure Drop versus Flow Rate, F61 Series Sensitive Flow Switches (F61KD and F61MD Types)

Checkout

IMPORTANT: Ensure installation, wiring and control settings are according to the application requirements. Refer to the controlled system's manufacturer specifications for the proper settings when adjusting these controls.

Apply power to the control and controlled equipment. Cycle the controlled system at least three times at normal operating conditions.

The circuit between the red and the yellow leads (terminals) closes when sufficient fluid flows through the pipe to trip the F61 flow switch.

Troubleshooting

Table 9: Troubleshooting

Symptom/Problem	Solution
Water (condensate) is within the enclosure.	Use a model with a NEMA 3R enclosure. If using a model with a NEMA 3R enclosure, inspect the grommet in the conduit fitting. Replace grommet if defective.
Fluid from the tank is leaking into enclosure due to bellows failure.	Replace flow switch.
Switch does not activate due to debris caught within the switch mechanism.	Clear any debris within the switch mechanism. Test the operation of switch several times for proper operation.
Control switch action is reversed.	Ensure connections follow wiring diagrams.
Control does not switch.	Check connections.
Switch fails to return to the no flow position.	Switch is set lower than the factory setting. Increase the setting. On vertical pipes, ensure that direction of flow is up. The arrow on switch must point in direction of flow (up).
Control does not switch on flow increase.	Check for cracked/broken paddle. Replace if necessary.

Repairs and Replacement

Field repairs, except for replacement of the cover and paddles, must not be made. For a replacement flow switch, paddle kit or cover, contact the nearest Johnson Controls/PENN™ distributor. For more information, contact Refrigeration Application Engineering at (800) 275-5676.

Ordering Information

Table 10: F61 Series Standard Flow Switch Models

Product Code Number	Enclosure	Bellows	Paddle
F61KB-11C	NEMA 1	Phosphor Bronze	Stainless Steel; three-piece Paddle (3 in., 2 in., and 1 in. Segments) Installed; 6 in. Paddle Supplied Uninstalled
F61LB-1C	NEMA 3/ NEMA 3R (Rain-Tight)		Stainless Steel; three-piece Paddle (3 in., 2 in., and 1 in. Segments) Installed
F61MB-1C		Stainless Steel	Stainless Steel; three-piece Paddle (3 in., 2 in., and 1 in. Segments) Installed; 6 in. Paddle Supplied Uninstalled
F61MB-5C			
F61MG-1C*		Phosphor Bronze	

* Gold-Plated Contacts

Table 11: F61 Series Sensitive Flow Switch Models

Product Code Number	Enclosure	Bellows	Inlet and Outlet
F61KD-3C	NEMA 1	Phosphor Bronze	1/2 in. x 1/2 in. Female NPTF
F61KD-4C			3/4 in. x 3/4 in. Female NPTF
F61KD-8C			
F61MD-1C	NEMA 3/3R (Rain-Tight)	Stainless Steel	1/2 in. x 1/2 in. Female NPTF
F61MD-2C			3/4 in. x 3/4 in. Female NPTF

Table 12: Replacement Paddle Kits

Product Code Number	Description
KIT21A-600	Stainless Steel three-piece Paddle (3 in., 2 in., and 1 in. Segments)
KIT21A-601	Stainless Steel 6 in. Paddle
PLT52A-600R	Stainless Steel three-piece Paddle (3 in., 2 in., and 1 in. Segments) and 6 in. Paddle
CVR62A-600R	Replacement Cover Assembly for LB, MB, MD and MG types

Electrical Ratings

Table 13: Electrical Ratings for F61KB, F61 KD, F61LB, F61MB and F61MD Types

Electrical Ratings	120 VAC	208 VAC	240 VAC	277 VAC
Horsepower	1	1	1	-
Full Load Amperes	16.0	8.8	8.0	-
Locked Rotor Amperes	96.0	52.8	48.0	-
Non-inductive Amperes	16.0	16.0	16.0	16.0
Pilot Duty	125 VA at 24/277 VAC			

Table 14: Electrical Ratings for F61MG Types

Electrical Ratings	120 VAC
Full Load Amperes	1
Locked Rotor Amperes	6
Non-inductive Amperes	2
Pilot Duty	125 VA at 24/277 VAC

Technical Specifications

Product	F61 Series Flow Switches
Maximum Fluid Pressure	150 psig (1034 kPa)
Minimum Fluid Temperature	32°F (0°C) (F61KB, F61KD, F61LB) -20°F (-29°C) (F61MB, F61MD, F61MG)
Maximum Fluid Temperature	250°F (121°C)
Switch	SPDT
Wiring Connections	Screw Type Terminals (F61KB, F61KD, F61LB) Four Color-coded No. 14 AWG Solid Conductor Wire Leads, 7 in. (178 mm) (F61MB, F61MD, F61MG)
Pipe Connector	Standard 1 in. 11-1/2 NPT Threads Sensitive See Table 11.
Conduit Connection	One 7/8 in. (22 mm) Hole for 1/2 in. Conduit with 1-1/8 in. (29 mm) Knockout Ring for 3/4 in. Conduit (F61KB) Female Hub for 1/2 in. Conduit, 1/2-14 NPSM Threads (F61LB, F61MB, F61MG)
UL Listed	E5368, CCN NMFT
Agency Listings	LR948, Class 3211 06, Class 4813 02, Class 1222 01 (F61KB, F61KD) (F61LB - Not CSA Certified) LR948, Class 3211 06 (F61MB, F61MD, F61MG)
Shipping Weight	2.8 lb (1.3 kg)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls/Penn Application Engineering at 1-800-275-5676. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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Printed in U.S.A.
www.johnsoncontrols.com