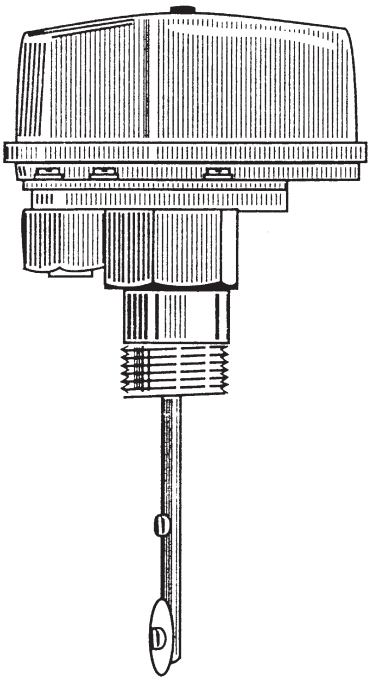
User's Guide



FSW-40 Series
Fluid Flow Switches

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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1. Purchase Order number to cover the COST of the repair,
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General Description

The OMEGA® FSW-40 Series Flow Switches feature 15A SPDT switches with an internal screw adjustment which provides continuous switch point adjustment while in operation in-line. Multiple drag disks and drag strips are supplied with each unit to provide incremental switch point adjustment. Their non-magnetic design makes them ideal for applications where rust is a problem. The FSW-40 Series Switches come standard in a brass construction. An optional 316 stainless steel construction is also available.

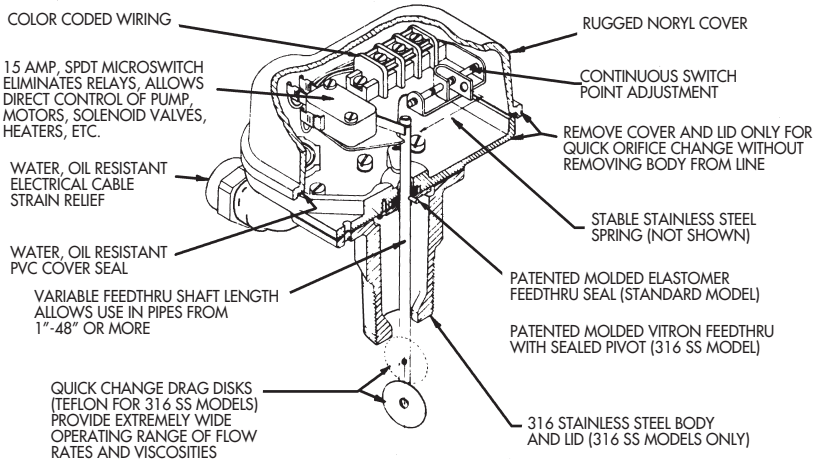
The FSW-40 Series also features a filter boot to protect the swinging arm from particle clogging, making this ideal for medium slurries, machine cutting oils, and certain sewage applications where large objects will not get caught on the drag disks.

Installation tees are recommended for installing switches for 2" pipe size and below. For other pipe sizes, a tee fitting or weld coupling can be used. Model FSW-40 is for use with 1" pipe; FSW-41 is for use with 1½" to 2½" pipe; FSW-42 is for use with 3" to 10" pipe; and FSW-43 is for use with 10" to 48" pipe.

DO NOT USE with flammable liquids or in hazardous areas. These flow switches are not explosion-proof. They can be made intrinsically safe when used with intrinsically safe relays, such as OMEGA's LVC550 Series, and installed in accordance with the National Electrical Code by personnel familiar with intrinsic safety wiring.

Features

- Rugged Industrial Design
- Switch Point Adjustable While Unit is Operating
- 15A SPDT Switch Directly Controls Pump
- Responds to Flow, Independent of a Broad Range of Environmental Conditions
- Maintains Calibration Limits When Subjected to Reasonable Line Hydraulic Hammer or Surge Pulses



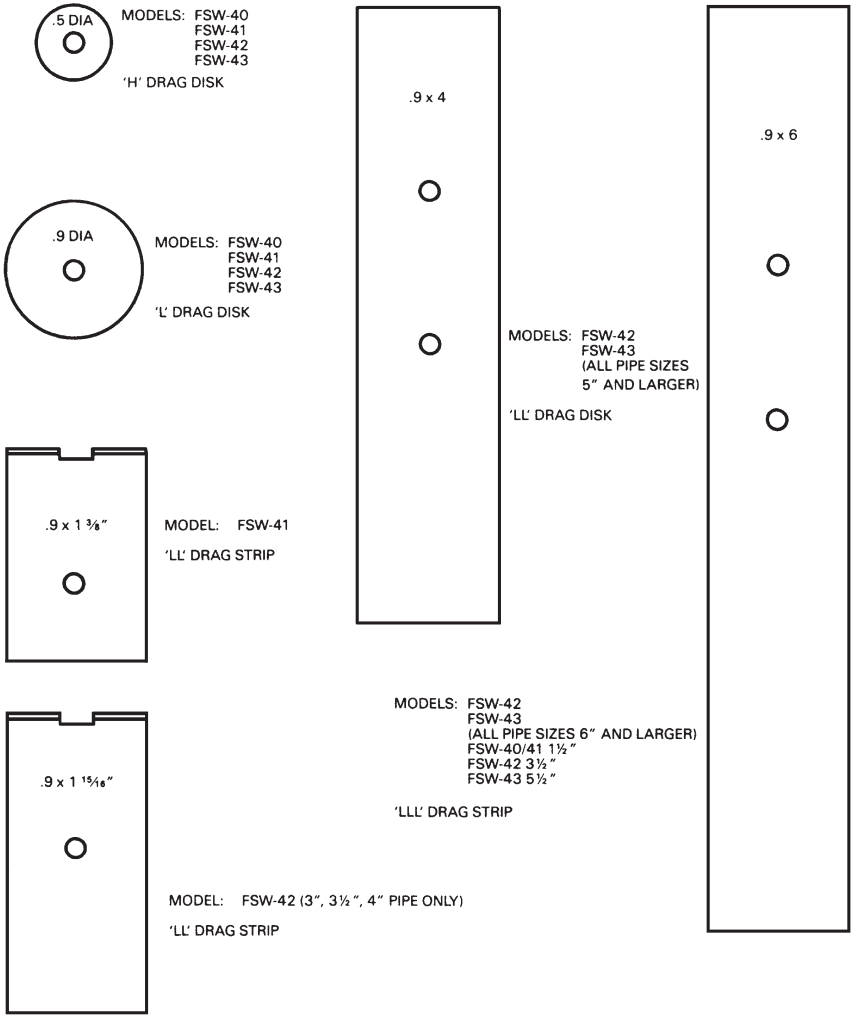
FSW-40 Series Switch

Drag Disks/Strips Supplied

Different Drag Disks are supplied with the various models of the FSW-40 Series Switches. All of the switches come with the L Drag Disk installed. The other drag disks supplied are as follows (refer to the Drag Disk Diagram, and Table 1 and 2):

MODEL	DRAG DISKS SUPPLIED
FSW-40	H, L (installed)
FSW-41	H, L (installed), LL
FSW-42	H, L (installed), LL (3, 3½, 4"), LL (5" and larger), LLL (6" and larger)
FSW-43	H, L (installed), LL (5" and larger), LLL (6" and larger)

DRAG DISKS/STRIPS



Specifications

Flow Range:
(Water Calibrated @ 70˚F): Refer to Tables 1 and 2. Note that using different drag disks and drag strips changes the flow ranges.

Sensitivity (% Flow Change to Activate Switch): 10% at upper end of flow range; 30% at lower end of flow range

Differential Pressure Drop Across Unit: (Under normal operating conditions) 1 to 3" pipe, less than 1 PSI; 4 to 48" pipe, negligible

Working Line Pressure: Standard Models: 400 PSIG @ 180˚F max (proof tested to 1200 PSIG @ 180˚F); 316SS Models; 300 PSIG max. @ 75˚F

Minimum Temperature: 40˚F

Maximum Temperature: 180˚F continuous

Relay Switch: SPDT 15A @ 125 or 250 Vac, 10,000,000 operations median; switch may be overloaded to 20 amps @ 125 or 250 Vac for a minimum of 20,000 operations

TABLE 1
RANGES AVAILABLE WITH THE STANDARD FSW-40 SERIES USING VARIOUS DRAG DISKS/STRIPS

Model	Super Low Range LLL (GPM)	Very Low Range LL (GPM)	Low Range (GPM) L	Pipe Size (Inches)	High Range (GPM) H
FSW-40	–	–	5-15	1	12-36
FSW-41	–	7-21	10-30	1½	25-75
	–	14-42	20-60	2	50-150
	–	21-63	30-90	2½	70-210
FSW-42	–	27-81	45-135	3	110-330
	–	36-108	60-180	3½	150-450
	–	45-135	75-225	4	200-600
	–	51-153	120-360	5	300-900
	65-195	80-240	190-570	6	450-1350
	103-309	126-378	300-900	8	800-2400
	172-516	211-633	500-1500	10	1200-3600
FSW-43	172-516	211-633	500-1500	10	1200-3600
	240-720	295-885	700-2100	12	1800-5400
	343-1029	421-1263	1000-3000	14	2500-7500
	412-1239	505-1515	1200-3600	16	3000-9000
	515-2058	632-1896	1500-4500	18	4000-12,000
	686-2058	842-2526	2000-6000	20	5000-15,000
	1029-3087	1263-3789	3000-9000	24	7000-12,000
	1544-4632	1895-5685	4500-13,500	30	11,000-33,000
	2058-6174	2526-5578	6000-18,000	36	16,000-48,000
	3773-11,319	4631-13,893	11,000-33,000	48	28,000-85,000

TABLE 2
RANGES AVAILABLE WITH THE 316 SS FSW-40 SERIES USING VARIOUS DRAG DISKS/STRIPS

Model	Super Low Range LLL (GPM)	Very Low Range LL (GPM)	Low Range (GPM) L	Pipe Size (Inches)	High Range (GPM) H
316 SS FSW-40	–	–	10-20	1	20-60
316 SS FSW-41	– – –	14-42 21-63 36-108	20-60 30-90 50-150	1 1/2 2 2 1/2	30-90 60-180 90-270
316 SS FSW-42	– – – – 103-309 189-567 292-876	45-135 56-168 77-231 84-252 126-378 232-696 358-1074	75-225 95-285 130-390 200-600 300-900 550-1650 850-2550	3 3 1/2 4 5 6 8 10	130-390 180-540 235-705 350-1050 550-1650 950-2850 1450-4350
316 SS FSW-43	274-822 395-1185 549-1647 686-2058 858-2574 1200-3600 1715-5145 2573-7719 3773-11,319 6517-19,551	337-1111 484-1452 674-2022 842-2526 1053-3159 1474-4422 2105-6315 3158-9474 4631-13,893 8000-24,000	800-2400 1150-3450 1600-4800 2000-6000 2500-7500 3500-10,500 5000-15,000 7500-22,500 11,000-33,000 19,000-57,000	10 12 14 16 18 20 24 30 36 48	1400-4200 2100-6300 3000-9000 3500-10,500 5000-15,000 6000-18,000 8500-25,500 13,500-40,5000 19,000-57,000 34,000-102,000

Option 'D': Dual SPDT relays; nominal difference flow between the two relay actuation points is 5%

Electrical Cable Fitting: Water resistant for cable diameter .250" ±.025"

Materials, Standard Models: Wetted Parts: brass, stainless steel, phosphor bronze, EPDM, and cork-rubber: Other materials of construction: brass body, Noryl cover, stainless steel and plastic hardware

Materials, 316 SS Models: Wetted Parts: 316 stainles steel, Viton, and Teflon

Weight: 3.5 lb

Installation and Operation

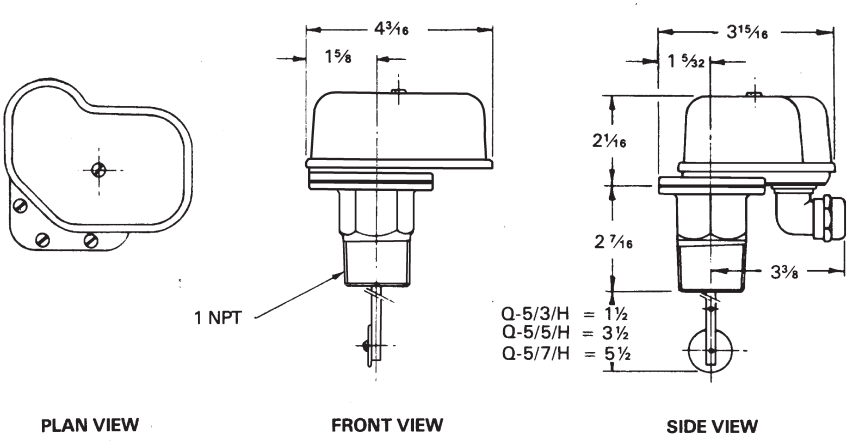
Installation

WARNING

THE GASKET SEAL LOCATED BETWEEN THE MAIN BODY CASTING AND THE LID CASTING IS A CORK-RUBBER COMPOSITION WHICH IS SUBJECT TO A SLIGHT CREEP FOR A SHORT PERIOD OF TIME AFTER APPLICATION OF INITIAL CLAMPING LOAD. ALL GASKETS ARE PROPERLY CLAMPED BEFORE SHIPMENT, HOWEVER, DURING SHIPPING AND STORAGE, THE GASKET MAY COMPRESS ALLOWING THE BODY-LID CLAMP BOLTS TO BECOME SLIGHTLY LOOSE. TIGHTEN THESE BOLTS BEFORE ASSEMBLING THE FLOW SWITCH IN THE SYSTEM. NO FURTHER CREEP OF GASKET WILL OCCUR AFTER SECOND TIGHTENING.

The FSW-40 Series Switches are supplied with a male 1″ NPT which is threaded into an appropriate pipe tee, large pipe with reducer bushing, or directly into a hole threaded 1″ NPT in the wall of the pipe. Turn until tight and the arrow on the body casting is pointed in the direction of flow.

Installation Dimensions:



Terminal Strip Wiring

1. Loosen the round gland nut located on the strain relief cable connector.
2. Insert the cable through the grommet in the strain relief cable connector and tighten the gland nut sufficiently to seal the cable in place.
3. Strip the conductor end approximately $^{3}/_{16}$″.
4. Loosen the appropraite terminal strip screw and remove the empty terminal. Insert the bare wire into the terminal barrel and crimp. Place the terminal on the strip in the same orientation as received. This is important since terminals and wires may interfere with the cover if the orientation is changed.

Electrical Wiring Schematics

Figure 1: Wiring Schematic for power applied to load when the flow is GREATER than set point (power to load interrupted when flow is LESS than set point).

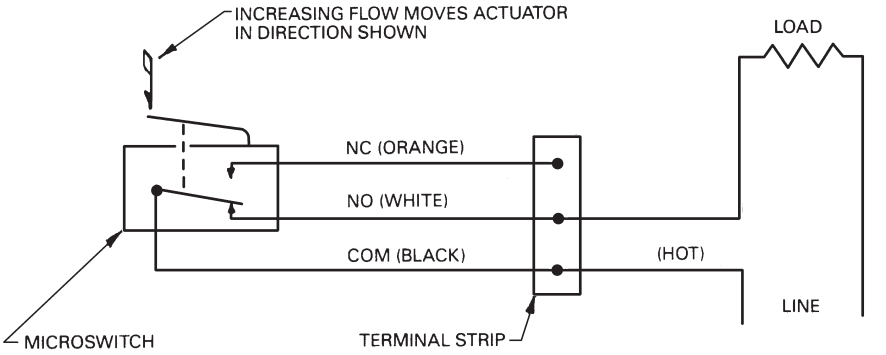
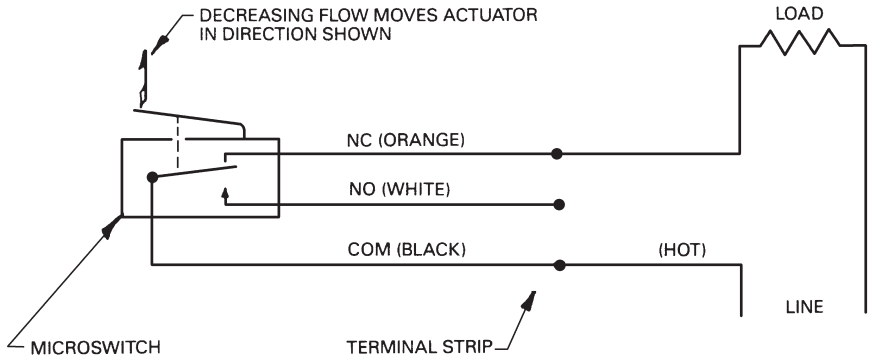


Figure 2: Wiring Schematic for power applied to load when the flow is LESS than set point (power to load interrupted when flow is GREATER than set point).



Switch Point Adjustment

1. Remove the cover.
2. Adjust the fluid flow in the system without regard to the units switch point setting.
3. The switch point adjusting mechanism consists of an adjusting screw (leadscrew), a 'U' shaped leadscrew nut, and a helical spring. Refer to Parts List Diagrams.

   CLOCKWISE rotation of the adjusting screw changes the microswitch actuation point toward HIGHER flow rates (COUNTERCLOCKWISE towards LOWER flow rates).

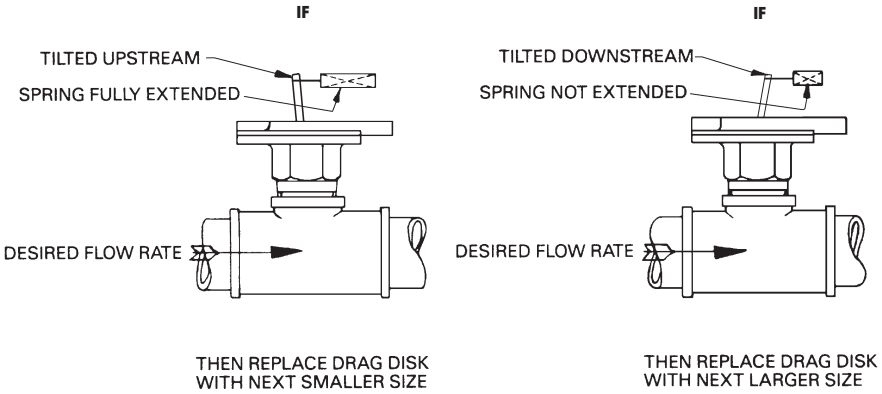
NOTES

All FSW-40 Series units are factory set at the lower end of the flow range, i.e., the adjusting screw is set at the low flow COUNTERCLOCKWISE position.
The leadscrew nut locks the adjusting screw in position, maintaining the flow switch set point under all environmental conditions.

4. Turn the adjusting screw in a clockwise direction until the microswitch is actuated while maintaining the desired fluid flow rate in the system. Turn the adjusting screw two additional turns in the clockwise direction and then slowly back off in a counterclockwise direction until the microswitch is again actuated. The flow switch is now set for maximum sensitivity for detecting small flow changes.
5. Microswitch actuation point may be monitored during the adjustment procedure detailed in Step 4 above by an audible click or with an Ohm meter before connecting line power to the terminal strip or by monitoring the voltage supplied to the load through the microswitch.
6. If the system flow rate is changed, the FSW-40 Series Switch can be adjusted to monitor the new flow rate by turning the adjusting screw in a counterclockwise direction to the minimum flow position and then proceeding as in Step 4 above.
7. In the event that the system flow is at the deisred rate and the adjustment mechanism runs out of travel, i.e., the leadscrew nut is at either end of the support bracket before the microswitch is actuated, then the drag disk must be changed to shift the flow switch flow range so that it straddles the system flow rate.

EXAMPLE: If the FSW-40 Series Switch is fitted with an 'H' Drag Disk and; the procedure in Step 4 has been followed, the adjusting screw has been turned clockwise until the leadscrew nut is at the extreme end of the support bracket and the microswitch still has not been actuated, then the flow is too low and an 'L' Drag Disk will have to be substituted for the 'H' Disk and the procedure in Step 4 repeated.

General Rules for Selecting New Drag Disk



Drag Disk Change

NOTE

It is not necessary to remove the main body of the switch from the line to change the drag disk.

1. Remove the cover.
2. Remove the lid casting from the main body casting.
3. Change the drag disk/strip on the end of the feedthru shaft.

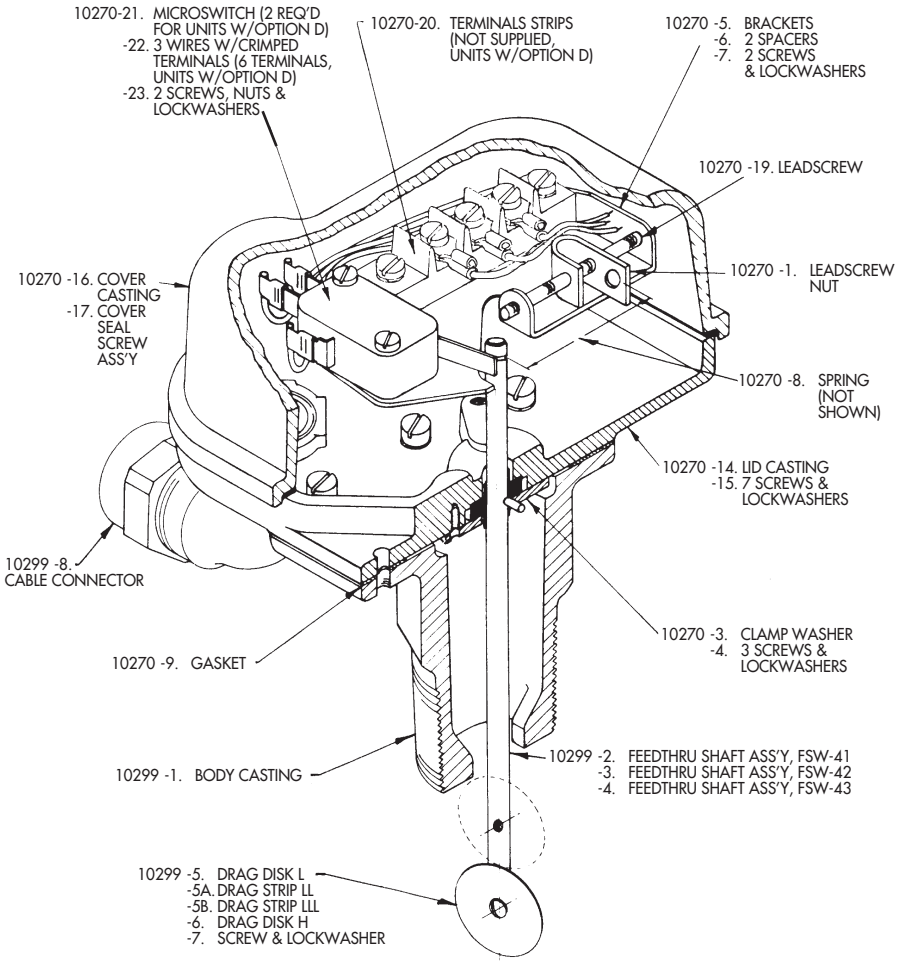
Flow Turbulence Effects

The FSW-40 Series Flow Switches are sensitive and fast acting. They respond to pipe system steady state flow and also to local time variable turbulent flow caused by valves, pumps, elbows, orifices, etc. For instance, the average steady state flow in a 4" line immediately downstream of a gate valve may produce turbulence which rapidly changes the downstream flow in a random fashion in the range 90 to 110 GPM. A flow switch set at 100 GPM steady state will chatter in the 90 to 110 GPM turbulent environment. Several different procedures can be employed to correct the chatter condition.

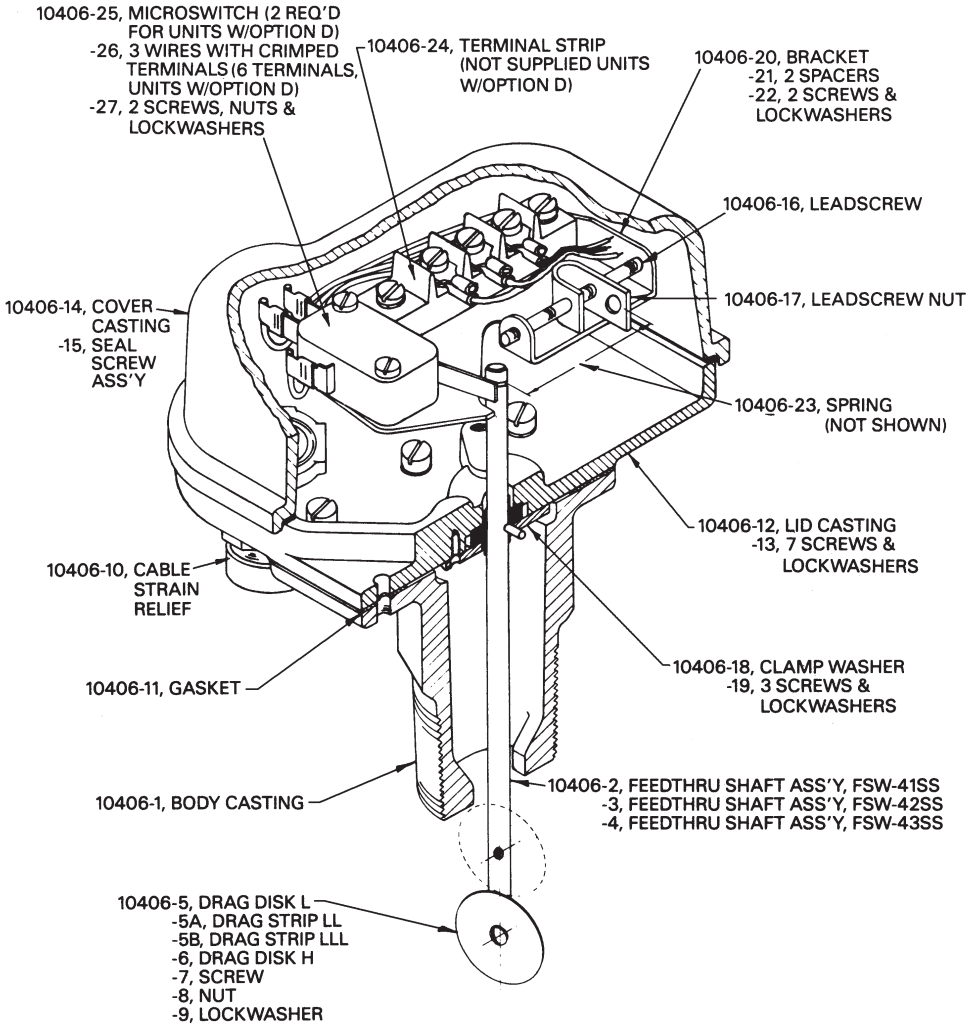
1. Locate the flow switch at lest 5 (and preferably 10) pipe diameters downstream of the source of turbulence.
2. Place a turbulence reducing section between the turbulent source and flow switch, eg. fill the main pipe with a bundle of small diameter thin wall tubes for 1 or 2 pipe diameters, or fill the pipe for 1 or 2 diameters with a metal or plastic gauze similar to a scouring pad. Both techniques reduce turbulence effects by breaking large intense flow swirls into a multitude of small less intense flow swirls. A suitable screen will have to be employed to retain the tubes or gauze. Consideration will have to be given to pressure loss effects.
3. Another approach is to 'de-tune' the flow switch, i.e., set it to operate below the lower turbulence induced flow rate. In the 4" example cited above, the adjusting spring could be relaxed so that the switch is activated at 90 GPM or slightly lower. In any given field situation, this is simply accomplished by relaxing the adjusting spring until the chattering ceases.

NOTE

To retain proper sensitivity, some spring tension is required, i.e. approximately 25% extension minimum (approximately $^1/_4$"). If this 25% spring extension condition is reached and chattering still occurs, then the next size larger drag disk or strip will have to be used.



Standard FSW-40 Series Parts List Diagram



316 SS FSW-40 Series Parts List Diagram

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