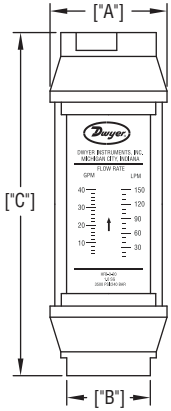
Series HF IN-LINE Flow Monitors

Specifications - Installation and Operating Instructions



Valve Size	"A" Reference	"B" Wrench Flats	"C" Reference
1/8 NPT	1.25	0.875	4.813
1/4 to 1/2 NPT	1.875	1.250	6.562
3/4 to 1 NPT	2.375	1.750	7.125
1-1/4 to 1-1/2 NPT	3.500	2.250	10.125
2 NPT	3.500	2.250	12.625

Series HF Flow Monitors combine the simplicity of a sharp edged orifice disk with a variable area flow monitor to provide a low cost way to measure flow at high pressures. These monitors are tubular, with all internal wetted parts sealed within the body casing. Running through the body is a tapered shaft which is centered in the bore by pilot disks at each end. Surrounding the shaft are a sharp-edged floating orifice disk, a transfer magnet and return spring. The disk and transfer magnet are held in the "no flow" position by a biased return spring. As flow moves through the monitor, it creates a differential pressure at the orifice disk forcing the disk and transfer magnet against the return spring. As flow increases, the differential pressure at the disk increases, forcing the disk and transfer magnet to move along the tapered center shaft. As flow decreases, the biased return spring forces the disk and transfer magnet down the center shaft, returning to the "no flow" position. In metal casing monitors, disk and magnet movement are not visible so a magnet follower is located outside the body casing, magnetically coupled to the internal transfer magnet. As flow increases, motion of the internal magnet moves the magnet follower outside the body casing, under the scale.

SPECIFICATIONS
Service: Compatible gases or liquids.
Wetted Materials: Body: Aluminum, brass or 304 SS; Seals: Buna-N or Fluoroelastomer; Magnet: PTFE coated Alnico; Other internal parts: 304 SS.
Maximum Viscosity: 500 SSU.
Temperature Limits: HFA, HFL, HFB and HFS Models: 240°F (116° C); HFH Models: 400°F (204°C).
Pressure Limits: HFA Models: 600 psig (41 bar); HFL, HFB and HFH Models: 3500 psig (240 bar); HFS Models: 6000 psig (413 bar).
Accuracy: ±2% FS over entire range.
Repeatability: ±1% of full scale.
Shipping Weight: 1/8 to 1/2" female NPT Models; 2 lb (0.9 kg); 3/4 to 1" female NPT Models: 3.5 lb (1.59 kg); 1-1/2" female NPT Models: 11 lb (5 kg); 2" female NPT Models: 13.5 lb (6.12 kg).

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Aluminum body for air or other non-corrosive gases:
Wetted Parts: Aluminum, PTFE coated Alnico, 304 SS and Buna-N

Model	Connection Size	Range, Air SCFM	Max. Pressure Drop, PSID
HFA-0-01	1/8″ female NPT	2-12	3.32
HFA-1-12	1/4″ female NPT	2-12	3.32
HFA-1-22	1/4″ female NPT	4-23	3.61

Aluminum body for oil based fluids:
Wetted Parts: Aluminum, PTFE coated Alnico, 304 SS and Buna-N

Model	Connection Size	Range, GPM Oil	Range, LPM Oil	Max. Pressure Drop, PSID
HFL-2-05	1/2″ female NPT	0.5-5	1-19	6.08
HFL-4-25	1″ female NPT	2-25	7.5-95	8.41

Brass body for water based fluids (non-steam):
Wetted Parts: Brass, PTFE coated Alnico, 304 SS and Buna-N

Model	Connection Size	Range, GPM Water	Range, LPM Water	Max. Pressure Drop, PSID
HFB-0-01	1/8″ female NPT	0.05-1	.19-3.8	1.98
HFB-0-02	1/8″ female NPT	0.2-2	.75-7.5	5.58
HFB-2-05	1/2″ female NPT	0.5-5	1-19	7.18
HFB-3-15	3/4″ female NPT	2-15	7.5-55	10.2
HFB-3-20	3/4″ female NPT	2-20	7.5-75	6.2
HFB-4-35	1″ female NPT	4-40	19-130	15.2
HFB-5-50	1-1/2″ female NPT	5-50	19-189	9.25
HFB-5-100	1-1/2″ female NPT	10-100	38-379	25.59
HFB-6-75	2″ female NPT	8-75	31-284	14.95
HFB-6-150	2″ female NPT	20-150	76-568	39.86

304 Stainless Steel body for high-pressure fluids:
Wetted Parts: 304 SS, Fluoroelastomer and PTFE

Model	Connection Size	Range, GPM Water	Range, LPM Water	Max. Pressure Drop, PSID
HFS-0-01	1/8″ female NPT	0.05-1	0.19-3.8	1.98
HFS-2-02	1/2″ female NPT	0.2-2	0.75-7.5	5.58
HFS-2-10	1/2″ female NPT	0.5-10	1.9-38	8.68

Brass Body High Temperature 400˚F for water based fluids:
Wetted Parts: Brass, PTFE coated Alnico, 304 SS and Fluoroelastomer

Model	Connection Size	Range, GPM Water	Range, LPM Water	Max. Pressure Drop, PSID
HFH-2-05	1/2″ female NPT	0.5-5	1-19	7.18
HFH-2-10	1/2″ female NPT	1-10	3.8-38	8.68
HFH-4-35	1″ female NPT	5-35	19-130	13.46

READING THE MONITOR
Note the red reference line running 360° around the white magnet follower. This line moves in direct proportion to the movement of the internal orifice disk. When fluid is flowing, the flow rate is read by aligning the red reference line with the closest scale graduation.

SPECIFIC GRAVITY OR DENSITY EFFECT
Standard water monitors are calibrated with water and oil monitors are calibrated with .873 S.G. oil. Flow indication will read high for heavier fluids and low for lighter fluids. A correction factor for other specific gravities can be established using the following formulas.

For Water Monitors use:
Actual = Observed Reading $\times \sqrt{\frac{1.0}{S.G.}}$

For Oil Monitors use:
Actual = Observed Reading $\times \sqrt{\frac{0.873}{S.G.}}$

VISCOSITY EFFECT
The Series HF Flow Monitor incorporates a unique floating sharp-edged orifice disk which provides greater operating stability and accuracy over wide ranging viscosities up to 500 SSU.

BASIC APPLICATION INFORMATION
The flow monitor can be installed directly in the fluid line without flow straightening or special piping. They are suitable for measuring the flow rate of most liquids which do not contain particles larger than 74 microns.

1. The magnetic follower is sealed inside the Lexan tube to allow use in areas where the unit might be sprayed or washed with soap water.
2. Mount the monitor in a location allowing easy access for reading and maintenance.
3. The monitor should not be located near hot pipes or equipment which could damage the window tube and/or scale.
4. Mount the monitor at least 1 ft (.3 m) from large electric motors which can weaken or demagnetize the internal magnet.
5. Aluminum should not be used for water.

WARNINGS AND PRECAUTIONS

1. These monitors are designed to operate in systems that flow only in one direction, matching the direction indicated by the arrow on the flow scale. Operation in the reverse direction can damage the monitor or other system components.
2. The window tube is made of polycarbonate which can be safely cleaned with soap and water. many other cleaning agents can damage this material, causing discoloration or crazing. To check compatibility, call General Electric's polycarbonate Compatibility Reference Line at 1(800)845-0600, USA.
3. To maintain accuracy and repeatability, many internal parts are precision machined and thus require filtration or at least 74 micron or 200 mesh screen.
4. All monitors are tested and calibrated using a light hydraulic oil. Units are well drained, but some oil residue may remain. Please check compatibility with your fluid. Cleaning may be required before use. See "Cleaning and Inspection."
5. When installing aluminum or brass monitors onto steel pipe, take caution not to over tighten connections. Threads could strip if over tightened.
6. Aluminum and brass monitors should not be used in systems where piping is not supported. Heavy weight can cause the monitor to bend and malfunction.
7. Do not exceed the maximum operating pressure or temperature limit.
8. Pressure and flow surges can disengage the outer magnet follower from the transfer magnet. If this occurs, a shock suppressor should be used to avoid repetitive malfunctions.
9. Caution should be used when using Teflon® thread tape on joints. Leave at least 1/8″ (3 mm) of exposed pipe on the end.
10. These monitors use an internal transfer magnet in their design. Because of this be aware of the following:
    a. Keep computer disks or tapes away from these units.
    b. If metal particles are flowing through this device, a magnetic filter may be required.

BASIC INSTALLATION
Series HF Flow Monitors are installed in-line and are direct reading. They can be mounted in a vertical or horizontal position as long as flow is in the direction of the arrow on the side. No straight pipe is required before or after the monitor. If necessary, 90° elbows can be installed on both ends without significant flow variation. When installing, apply a small amount of pipe thread sealant tape or pipe thread sealant to assure a good seal. Locate filter, if used, in front of monitor and in a location allowing easy access for routine maintenance. Refer to Warnings and Precautions for additional information.

FLUID FLOW IN REVERSE DIRECTION
These monitors will not allow flow in the reverse direction, opposite to the arrow on the scale. In the reverse direction unit will act like a leaky check valve. If the application requires occasional reverse flow, install a check valve in parallel with the monitor which will force flow around the unit when reversed. This type of check valve can be obtained from your local fluid component distributor.

WARNING: Do not remove monitor from system without proper and adequate safety measures if fluid or gas is toxic, corrosive or flammable. Shut down system and relieve pressure before removing flow monitor from system.

DISASSEMBLY
Important: It is not necessary to remove the window tube or window seals to clean the monitor. Note how the unit is disassembled to aid in reassembly.
Warning - Shut down system and relieve pressure before removing monitor from flow line.

1. Use a clean, dry cloth to remove all foreign matter from exterior of monitor, especially around threaded connections.
2. Remove monitor from flow line.
3. With the arrow on the scale pointing upward, secure the unit in a vice using the flats on the inlet connection. DO NOT apply wrench or vice to Lexan tube.
4. Use a wrench on the flats provided on the outlet connection and turn counter-clockwise to loosen. Either port may come loose. Do not remove end connection at this time.
5. Remove monitor from vice. Hold unit so the end connection that has been loosened is on top. Remove loose connection.
6. Tilt open end of monitor over a clean cloth to expose inner cartridge. Remove inner cartridge assembly from body casing. NOTE: Because the transfer magnet is coupled magnetically to the magnet follower, you will notice a light resistance when removing the cartridge. If cartridge does not slide out, insert a wooden dowl in opposite end of monitor and push or rap lightly on dowel until cartridge breaks free. IMPORTANT: If inner cartridge does slide out freely, it may be a sign of contamination. Locate and remove the source of contamination before returning monitor to service or the problem will reoccur. It may be necessary to install finer filtration or a magnetic filter in the system. The transfer magnet is a powerful Alnico magnet. Keep it away from metal chips and filings. They can be difficult to remove when reassembling and will cause premature failure.
7. Examine inner cartridge assembly for contamination. If the inner cartridge assembly has no contamination and is working properly, reassemble unit and return to service. If contamination is found, proceed to Cleaning and Inspection.

CLEANING AND INSPECTION

1. Soak inner cartridge assembly in a suitable cleaning solvent or soap and water. **Caution:** When using a compressed air hose, wear proper eye protection.
2. Remove parts from solvent. Use compressed air and/or scrub lightly with a soft brush to remove any remaining contaminants. Remove any magnetized particles from transfer magnet.
3. Remove any contaminants from inside body casing.
4. If inner cartridge assembly or body casing cannot be cleaned, is scored, pitted or damaged beyond repair, replace monitor.
5. Clean polycarbonate window with soap and water or a compatible cleaning solvent.
6. Clean and inspect O-ring assemblies for nicks and cuts. Replace as necessary.
7. After monitor is cleaned, reassemble in reverse order of disassembly.
8. Clean and inspect monitor every six months. Properly filtered monitor will provide years of trouble free service. If unit is not properly protected by a filter, damage and malfunction can occur. Damage caused by excessive contamination is not covered by warranty.
9. If the cartridge clip is removed or lost, a new clip should be used. Cartridge retainer clips are Waldes No. 5105-12H for 1/4″ and 1/2″ models, No. 5105-18H for 3/4″, 1″, 1-1/2″, and 2″ models.

RECOMMENDED FILTRATION

The manufacturer recommends system filtration of at least a 74 micron filter or a 200 mesh screen. If inadequate filtration has caused monitor failure, it will normally fail in the open position. Some systems may require a magnetic filter. **Important:** Monitor damage caused by excessive contamination is not covered by warranty.

STABILIZED CONTAMINATION

The goal of filtration is to create effective protection from system contamination. Proper filtration stabilizes contamination to allow fluid components to function properly. A fluid system is considered stabilized when "contamination in" equals "contamination out." Proper filtration must reduce initial contamination to a stabilized level within an acceptable time period. The entire system should be stabilized in time to prevent premature wear or damage to monitor components.

CONTAMINATION SOURCES

Fresh Fluid - When new or fresh fluid is stored inside holding tanks, the fluid may be contaminated with scale or metal flakes from inside the tank. To prevent this type of contamination, filter fresh fluid before adding to the system.

New Machinery - When building new machines, a certain amount of built-in contamination is unavoidable. Typical built-in contamination might include dust, dirt, chips, fibers, sand, flushing solutions, moisture, weld splatters and pipe sealants. Flushing the system before operation can reduce contamination but cannot eliminate it entirely. Unless the system is flushed at a high velocity some contamination will not be dislodged until the system is in operation. System contamination can cause fluid component malfunction.

Environmental Contamination - When performing routine maintenance, the systems fluid is commonly exposed to environmental contamination. Exercise caution during routine maintenance to prevent this type of contamination. Change breather filter and system air filter regularly.

Self-Generated Contamination - Self-generated contamination is a product of wear, cavitation, fluid breakdown and corrosion. Systems that are carefully flushed, maintained and have fresh fluids added, mainly have self-generated contamination. In this case, proper filtration can help prevent fluid component malfunction.

COMPRESSIBILITY OF AIR AND GASES

Air and gases are extremely compressible. Gas density increases as pressure increases. In most cases, correction factors should be used to obtain accurate readings. See correction factors below.

CALIBRATION

All standard Dwyer Instruments,Inc. air flow monitors are calibrated for air with a specific gravity of 1.0 at 100 psig and 70°F (6.89 bar and 21.1°C). Monitors are calibrated in SCFM, Standard Cubic Feet per Minute. A standard cubic foot or air is defined as a cubic foot of air at 70°F at atmospheric pressure, 14.7 PSI at sea level. Since most industrial pneumatic systems typically operate at 90-100 PSI, standard Dwyer Instruments, Inc. Monitors are calibrated for inlet conditions of 100 PSI at 70°F. When operating the monitor at other pressures or temperatures, a correction factor should be used to maintain the original design accuracy of the monitor. When inlet pressure of the monitor is at or near 100 PSI, the air flow can be read directly from the monitor scale. When pressure is other than 100 PSI, use the following correction factor tables.

CORRECTION FACTORS FOR AIR AND GASES

SCFM (indicated) x (CF) = SCFM (actual)

CF = (f_1) x (f_2) x (f_3)

Note: It is not necessary to use all correction factors.

TABLE 1
(f_1) PRESSURE CORRECTION FACTORS

$$f_1 = \sqrt{\frac{14.7 + psig}{114.7\ psia}}$$

TABLE 2
(f_2) TEMPERATURE CORRECTION FACTORS

$$f_2 = \sqrt{\frac{530}{460 + °F}}$$

TABLE 3
(f_3) SPECIFIC GRAVITY CORRECTION FACTOR

$$f_3 = \sqrt{\frac{1}{Sp.\ Gr.}}$$

INTERNAL GAGE PRESSURE

System pressure will vary from location to location in a typical dynamic air or gas system. Because of this, it is important that an accurate pressure gage be used to determine flow conditions as close as possible to the inlet port of the flow monitor.

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