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DECATHLON and HIGH PRESSURE SERIES POSITIVE DISPLACEMENT FLOWMETERS

Installation, Operation and Maintenance Manual

SERIAL NUMBER_____

The specifications contained in this manual are subject to change without notice and any user of these specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications that have been changed and are no longer in effect.

DC & HP SERIES
PD FLOWMETERS
Installation, Operation and Maintenance Manual

TM-66050 REV. F

PUBLISHED BY FLOW TECHNOLOGY, INC. – January 2007

Thank you for selecting a FLOW TECHNOLOGY, INC. product for your flow measurement application.

Virtually every major commercial, government, and scientific organization is making use of our products, expertise and extensive technical support. This is a culmination of years of refinement in our flowmeter and calibrator designs resulting in Flow Technology, Inc. enjoying technological leadership in the flow measurements field.

We are proud of our quality products, our courteous service and welcome you, as a valued customer, to our growing family.

WARRANTY

Limited Warranty. Seller warrants that goods delivered hereunder will at delivery be free from defects in materials and workmanship and will conform to seller's operating specifications. Seller makes no other warranties, express or implied, and specifically makes NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability. Seller's obligation under the warranty shall be limited to replacing or repairing at Seller's option, the defective goods within twelve (12) months from the date of shipment, or eighteen (18) months from the date of shipment for destination outside of the United States, provided that Buyer gives Seller proper notice of any defect or failure and satisfactory proof thereof. Defective goods must be returned to Seller's plant or to a designated Seller's service center for inspection. Buyer will prepay all freight charges to return any products to Seller's plant, or other facility designated by Seller. Seller will deliver replacements for defective goods to Buyer freight prepaid. The warranty on said replacements shall be limited to the unexpired portion of the original warranty. Goods returned to Seller for which Seller provides replacement under the above warranty shall become the property of the Seller.

The limited warranty does not apply to failures caused by mishandling or misapplication. Seller's warranty obligations shall not apply to any goods that (a) are normally consumed in operation or (b) have a normal life inherently shorter than the warranty period stated herein.

In the event that goods are altered or repaired by the Buyer without prior written approval by the Seller, all warranties are void. Equipment and accessories not manufactured by Seller are warranted only to the extent of and by the original manufacturer's warranty. Repair or replacement goods furnished pursuant to the above warranty shall remain under warranty only for the unexpired portion of the original warranty period.

Should Seller fail to manufacture or deliver goods other than standard products appearing in Seller's catalog, Seller's exclusive liability and Buyer's exclusive remedy shall be release of the Buyer from the obligation to pay purchase price therefore.

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The total liability of Seller (including its subcontractors) on any claim whether in contract, tort (including negligence whether sole or concurrent) or otherwise, arising out of or connected with, or resulting from the manufacture, sales, delivery, resale, repair, replacement or use of any goods or the furnishing of any service hereunder shall not exceed the price allocable to the product or service or part thereof which gives rise to the claim.

TM-66050
REVISIONS

DATE	REVISION	ECO NUMBER	APPROVAL
	A	New Release, ECO 17621	
3/28/05	B	ECO 17876	J Blasius
10/25/05	C	ECO 18331	J Blasius
4/24/06	D	ECO 18598	J Blasius
5/25/06	E	ECO 18648	J Blasius
1/7/07	F	ECO 19001	R. REED

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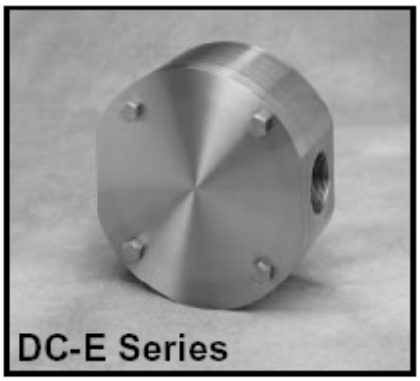
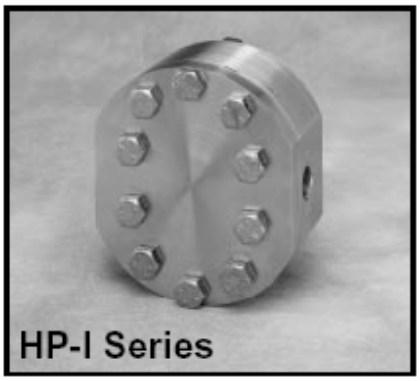
INTRODUCTION

This manual has been prepared specifically to assist with the installation and maintenance of your Flow Technology Positive Displacement (PD) flowmeter and pickoff. Flow Technology PD flowmeters are reliable, easy to install, and simple to disassemble and reassemble. **Please read this manual carefully**. Call your sales representative or Flow Technology if assistance is needed.

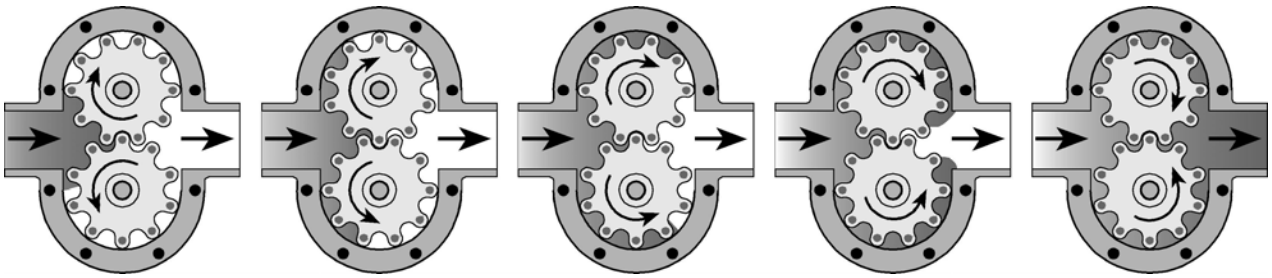
Flowmeter Description: Each Flow Technology PD flowmeter has a model number stamped on its nameplate. The Flowmeter Ordering chart for the meter explains what each digit of that number represents.

Replacement Parts: The Assembly Diagrams display the individual parts that make up each flowmeter. Refer to the Replacement Pickoff Part Ordering Chart if a replacement is needed. When ordering parts, include the flowmeter model number and serial number and any application changes.





Principle of Operation



Flow Technology positive displacement flowmeters use two rotating impellers being driven by the flowing liquid. Magnets imbedded in the impellers activate a non-intrusive pickoff generating a pulsed output signal. Each pulse represents a known volume of liquid that is captured between the teeth of the impellers. A K-Factor converts the pulses into engineering units for remote data collection and digital display.

Installation and Orientation Notes

Flowmeter

Environment – Flow Technology PD flowmeters will operate in normal environmental conditions. The temperature must be kept within the specified operating range for the pickoff (see Page 12) and electronics (refer to the spec sheets and technical manuals that come with the electronics). For meters constructed of 300 Series stainless steel, note that the rated pressure must be reduced as the temperature increases, as shown in the following chart.

300 Series Stainless Steel Body Rating						
TEMP (°F)	PRESSURE (PSIG) Published Rating & Rating at Temperature					
	250	1000	1500	3000	6000	10000
100	250	1000	1500	3000	6000	10000
200	215	862	1293	2585	5170	8617
300	194	777	1165	2330	4660	7767
400	178	713	1069	2138	4277	7128
500	166	665	997	1994	3989	6648
600	157	628	942	1883	3766	6277

Note that the temperature is only one of the many parameters that affect pressure rating. Contact Flow Technology for information on special high temperature designs. Vibrations do not affect the meter performance, however a jam nut may be required to keep the pickoff in place.

Orientation –The **normal** mounting configuration is in the vertical position with the inlet and outlet in the horizontal plane. If the inlet and outlet are oriented vertically, make certain that back pressure on the outlet side is maintained. The meter may be mounted with vertical flow up, however a vertical flow downward installation is **NOT** recommended.

Inlet and Outlet – These meters MUST be installed correctly with regards to the inlet and outlet. They are NOT interchangeable. The words “IN” and “OUT” are stamped on the meters to identify the inlet and the outlet. If bidirectional flowmeters are required, they may be ordered.

Mounting – Pipe hangers attached around the fittings of the flowmeter or on the adjacent piping will usually be adequate at holding the flowmeter in place (Refer to the Weight specifications in Disassembly/Reassembly).

Instrumentation

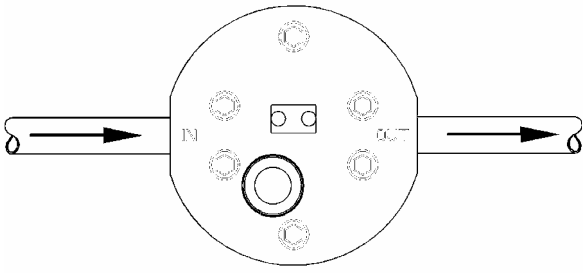
Pickoffs – A Flow Technology pickoff should be used with each Flow Technology flowmeter. Several types of pickoffs are available to handle a variety of applications. The pickoff must be screwed **COMPLETELY** into the mounting hole of the flowmeter in order to operate properly. **FINGER TIGHTEN ONLY; the pickoff and flowmeter can be damaged by over-tightening.** For more pickoff information see specifications and wiring information provided with the pickoff.

Flow Controllers and Accessories – Flow Controllers, Signal Conditioners, Transmitters and other accessories are available from Flow Technology. Refer to the manuals that came with these devices for proper wiring and installation.

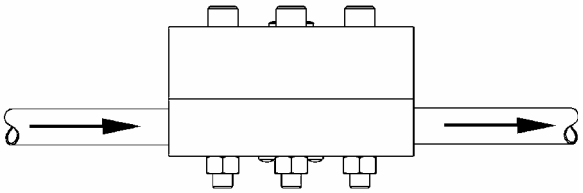
Installation and Orientation Notes

HORIZONTAL LINE INSTALLATION

If Back Pressure After Meter ≥ 5 PSI



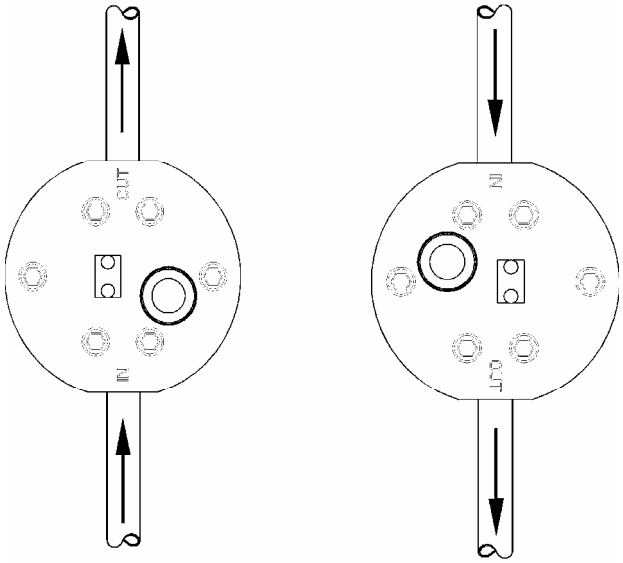
RECOMMENDED



***ACCEPTABLE**

**Note: Clean liquids only*
K-factor will be altered
Not recommended for abrasive liquids

VERTICLE OR OFF HORIZONTAL LINE INSTALLATION

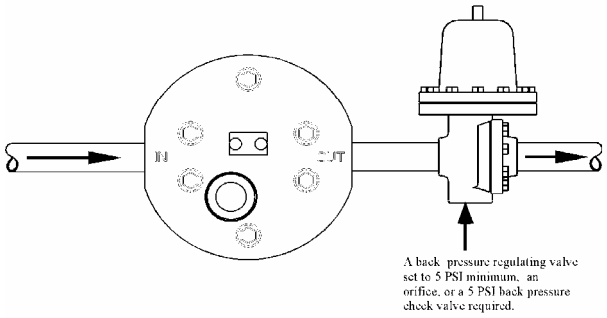


RECOMMENDED **NOT RECOMMENDED**

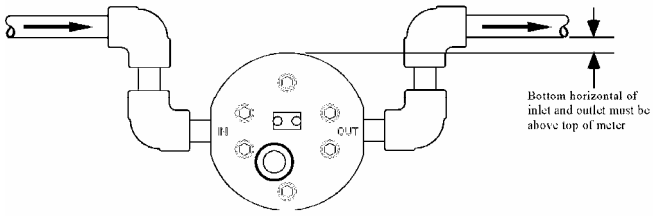
Installation and Orientation Notes

HORIZONTAL LINE INSTALLATION

If Back Pressure After Meter < 5 PSI



RECOMMENDATION # 1



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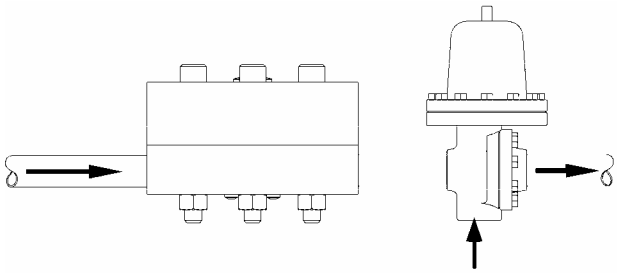

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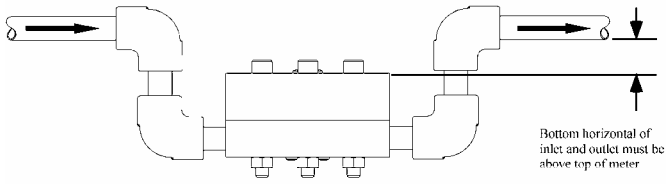


ACCEPTABLE

**Note: Clean liquids only*
K-factor will be altered
Not recommended for abrasive liquids

Pickoff Specifications and Reordering

A Flow Technology Pickoff should be used with each Flow Technology PD Flowmeter. Only the pickoff specified with your flowmeter should be used. Several types of pickoffs are available to handle a wide variety of applications. Consult your sales representative or Flow Technology BEFORE you use your flowmeter in an application for which the flowmeter and pickoff were not originally specified.

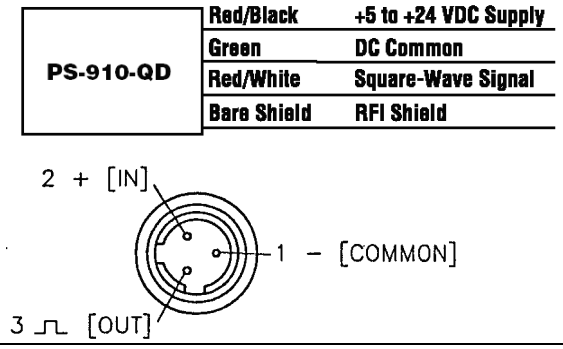
Note: *A pickoff is a recommended spare part.*

Hall Effect Pickoff Specifications: PS-910-QD

Supply Voltage:	+5 to +24 VDC
Supply Current:	7 mA
Operating Frequency:	0 to 20 KHz
Output Type:	NPN open collector w/2.2 kΩ resistor for pull-up to supply

Temp Range:	**Min**	**Max**
Sensor	-40°F	250°F
Cable	-76°F	221°F

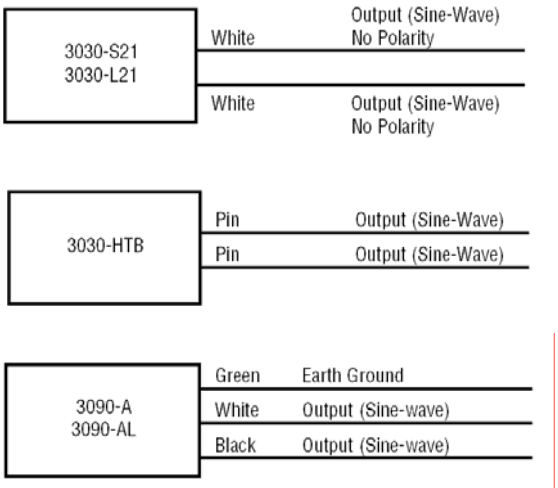
Installation



Magnetic Pickoff Specifications: 3030-S21 / 3030-L21, 3030-HTB & 3090-A / 3090-AL

Output Voltage:	20 mV (P-P min.)	
Maximum Resistance:		
3030-S21 / 3030-L21	5000 Ω	
3030-HTB	3000 Ω	
3090-A / 3090-AL	260 Ω	
Maximum Inductance:		
3030-S21 / 3030-L21	2500 mH	
3030-HTB	1500 mH	
3090-A / 3090-AL	115 mH	
Temperature Range:	**Min**	**Max**
3030-S21 / 3030-L21	-150 °F	300 °F
3030-HTB	-450 °F	450 °F
3090-A / 3090-AL	-100 °F	225 °F
Ordering:		
3030-S21 / 3030-L21		
3030-HTB		
3090-A / 3090-AL		

Installation



Assembly and Operation Notes

IMPORTANT – READ CAREFULLY

Back Pressure (5psi min) – Enough back pressure must be maintained on the outlet side of the flowmeter so that the meter remains completely filled during operation. Back pressure can be maintained with check valves or by locating the flowmeter away from any unpressurized openings in the piping. If the flowmeter is located close to a pump, place it on the discharge side, since it is difficult to maintain back pressure on the suction side.

Bolt Torque – Guidelines for all flow meter bolts are provided in the model specs on page 7.

Clean-In-Place (CIP) – The cleaning fluid used must be chemically compatible with the flowmeter construction materials. The temperature of the cleaning fluid must not exceed the temperature rating of the impellers. Some pickoffs must be removed from the flowmeter during a CIP cycle to avoid being damaged by high temperatures. Caution: Do not remove pickoff under high pressure. Do not exceed the flowmeter's maximum flow rate at any time (see Flow Rate below.)

Filters – Flow Technology highly recommends that filters be installed up and down stream from the flowmeter. The recommended mesh size for these filters is listed with the Model Specs chart on the following pages. An upstream filter will prevent large particles in the liquid from jamming or damaging the flowmeter. A downstream filter will keep large particles from back-flowing into the flowmeter, and if the flowmeter is damaged, it will prevent broken parts from traveling downstream.

Flow Rate – DO NOT exceed the maximum flow rate of the flowmeter. The Model Specs chart on the following pages lists the maximum flow rate for each meter size. Do not exceed the maximum flow rate during cleaning cycles (See Clean-In-Place (CIP) this page).

Heavy Wear Conditions – If the application fluid is abrasive or contains a high percentage of solids, the impellers and/or body may prematurely wear. This may be more apt to occur when the flowmeter is not in the normal installation orientation. Normal orientation is when the inlet, outlet, and the impeller shafts are all parallel to the ground. A reduced flow rate may also help to reduce the effect of heavy wear conditions. Special flowmeter configurations are available for heavy wear conditions. Consult Flow Technology before running an abrasive fluid through a standard flowmeter.

Impeller Magnets – The *magnet side* of the impeller must be facing the side of the flowmeter on which the pickoff is installed. The serial numbers on the impellers should face away from the pickoff port.

Impeller Set – The impellers are manufactured as a matched set. These mating impellers are marked with matching serial numbers. Keep the set of impellers with the flowmeter with which they were shipped from the factory. *Handle the impellers carefully*. They can be damaged if dropped.

K-Factor – The K-Factor, expressed in units of pulses per gallon (PPG) or in customer requested units, is stamped on the flowmeter nameplate. This represents the number of pulses per gallon of a reference liquid at ambient conditions (70 F), which will pass through that particular meter. This factor should match the K-Factor of the liquid you are measuring. Minor adjustments to this factor may be necessary after initial testing. See Trouble-Shooting, page 6 if the K-Factor needs to be adjusted.

Liquid Condition – For the meter to function properly and produce the best possible accuracy, the incoming liquid must be free of air or gas. Solids in the liquid should be filtered (See Filters this page).

Operating Conditions – Your Flow Technology flowmeter and pickoff are specified for your particular application. Operating your flowmeter with liquids or conditions other than those specified can reduce its accuracy, can damage the flowmeter, and may void your warranty. Consult your sales representative or Flow Technology BEFORE changing the operating conditions.

Pressure – DO NOT exceed the rated working pressure as stamped on the flowmeter nameplate.

Pressure Drop – DO NOT exceed a 100 psi pressure drop across the flowmeter. Note that excessive pressure drop, caused either by a problem in the piping system or the impellers jamming, may lead to the extrusion and destruction of the plastic impellers. Flowmeters capable of handling higher pressure drops may be ordered.

Pickoff – When installing the pickoff, FINGER TIGHTEN ONLY. The pickoff and the flowmeter can be damaged from over tightening.

Temperature – DO NOT exceed the temperature rating as stamped on the flowmeter nameplate.

Welding – If the meter is to have any welding performed on it, the impellers and O-ring seal must be removed. Note that welding on a flowmeter without written approval from Flow Technology voids all warranties.

WARNING

The pickoff must be installed anytime the flowmeter is pressurized to prevent damage to the pickoff hole from any sudden bursts of pressure or high system pressure.
Do not remove the pickoff from the flow meter until the pressure has been completely reduced.

Model Numbering System

DC□□I-□ □ □ □-□ □ □□ □□□

Basic Model No.

Nominal Size
- 01 = 1/8”
- 02 = 1/4”
- 05 = 1/2”
- 10 = 1”
- 15 = 1 1/2”
- 20 = 2”

Case Material
- 6 = 316 SS * √
- 0 = Specify

Shaft Material
- 1 = 316 SS * √
- C = Tungsten Carbide
- 0 = Specify

O-Ring Material
- 1 = Viton® *
- 2 = Buna N
- 3 = Chemraz®
- 4 = Kalrez®
- 6 = EPDM
- 9 = Teflon® √ *
- 0 = Specify

Special Designator
- 000 = Standard Meter *

Connection Size
- 01 = 1/8”
- 02 = 1/4”
- 05 = 1/2”
- 10 = 1”
- 15 = 1 1/2”
- 20 = 2”
- 00 = Specify

Connection Type
- 1 = NPT (Female) §
- 2 = 150# RF Flange †
- 6 = 300# RF Flange
- 0 = Specify

Impeller Style (See Chart)
- 5 = Normal Temperature
- A = Normal Temp. Grooved +
- 0 = Specify

Impeller Material
- 3 = UHMWPE + √
- 5 = PPS
- 9 = PTFE
- 0 = Specify

Impeller Normal Temperature Chart

Impeller Material	Operating Temperature	CIP Temperature
PPS	-20 F to +400 F (-29 C to +204 C)	400 F (204 C)
PTFE	-20 F to +250 F (-29 C to +121 C)	250 F (121 C)
UHMWPE	-20 F to +150 F (-29 C to +66 C)	185 F (85 C)

Key

*	Standard Configuration
√	FDA Compliant
CIP	“Clean in Place,” a brief cleaning cycle
+	Not available in size 01 and 02 meters
§	Standard on size 01 thru 20 meters

Material Guide

Name	Description
316 SS √	316 Stainless Steel, 316L has reduced carbon
Buna N	Nitrile
Chemrez®	Elastomeric PTFE
EPDM	Ethylene Propylene
Kalrez®	Perfluorinated Elastomer
PPS	Polyphenylene Sulfide
PTFE	Polytetrafluoroehtylene, Teflon (Impeller)
Teflon® √ *	Polytetrafluoroehtylene (O-Ring Material)
UHMWPE √	Ultra High Molecular Weight Polyethylene
Viton® *	Fluorocarbon

Specifications are for reference only and are subject to change without notice

Specifications:

DC-I Industrial In-line Flowmeters

Process Temperature: Up to 400°F (204°C) (Based on impeller materials)
Higher temperatures available

Operating Pressure: 250 psig maximum (1724 kPa), standard
Up to 1000 psig (6895 kPa), optional

Turndown Ratio: (Ratios based on maximum rated flow)
10:1 standard on low viscosity fluids
100:1 standard on medium viscosity fluids
Up to 1000:1 on high viscosity fluids

Reference Accuracy: ±0.05% of rate (repeatability)

Linearity: ±0.5% of rate over upper 80% of full span, typical
Up to ±0.1% of rate over full turndown range with enhanced signal conditioning

Output:

Sensors: (1 required per meter)

Hall Effect Sensor: 5 to 24 VDC square-wave pulse depending on supply voltage, 3-wire.
FM Approved, Intrinsically Safe w/IS Barriers.

Magnetic Pick-up Sensor: 10 mV to 10 V sinewave pulse depending on flow rate, 2-wire,
explosion proof optional.

Signal Conditioners and Transmitters:
Refer to the individual product sheets, available from Flow Technology, Inc.

Materials Of Construction:

Integral Body (Case), Cover(s): 316 stainless steel
Shafts: 316 stainless steel
Impellers: UHMWPE, PTFE, PPS standard. See Model Numbering System
O-rings: Viton® or Teflon® standard; other materials available
Bolts and Nuts: 18-8 or 316 Stainless Steel

Model Specifications

Basic Model	*Nominal Size*	*Maximum Flow Rate*		*Recommended Mesh Size*		*Weight*				*Bolt Torque*	
						NPT		*150# RF Flange*			
	Standard Connection	*GPM*	*L/min*	*Mesh*	*Particle Dia.*	*lbs*	*kg*	*lbs*	*kg*	*ft-lb*	*N-m*
DC01I	1/8” NPT	1	3.79	100	0.006”	2.1	1.0	-	-	6-7	8-10
DC02I	1/4” NPT	3	11.40	100	0.006”	3.4	1.5	-	-	6-7	8-10
DC05I	1/2” NPT	12	45.40	80	0.007”	8.5	3.9	11	4.8	6-7	8-10
DC10I	1” NPT	25	94.60	60	0.009”	15	6.7	18	8.3	6-7	8-10
DC15I	1-1/2” NPT	50	189	60	0.009”	26	12	32	15	14-16	19-22
DC20I	2” NPT	100	379	40	0.015”	55	25	67	30	33-40	45-54

Flowmeter Disassembly/Reassembly
Models: DC01I, DC02I

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** – Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts** - While holding the front cover in place, loosen and remove the case bolts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover** - Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the edge of the integral body. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out. Handle the front cover carefully, the impeller shafts can be damaged if it is dropped.
5. **Remove Case O-ring** - If the case o-ring is still set in the body, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them off the shafts. Handle the impellers carefully. They can be damaged if dropped.

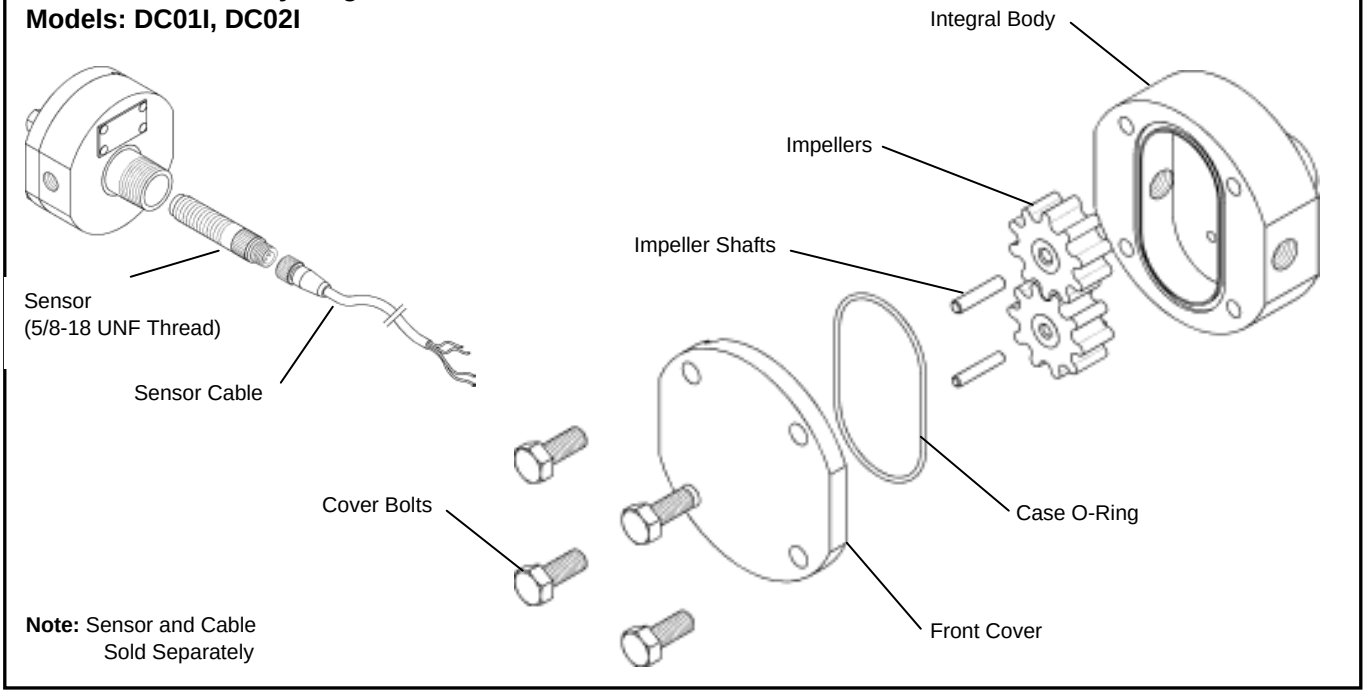
Note: Do not remove the impeller shafts from the front cover.

Reassembly

1. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. The shafts are different sizes, so the impellers will only fit onto them one way. **The magnet side of the impellers must be facing the side of the meter on which the sensor is mounted. The side of the impeller without the serial numbers is the magnet side.**
2. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the body. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover** - The front cover will only fit onto the integral body one way. Use the dowel pins to properly align it. Carefully mount the front cover/shaft assembly onto the integral body. Hold the case o-ring in the groove. Do not install the cap screws until the case o-ring is set properly to keep from damaging the o-ring.
4. **Install Case Bolts** - Install the case bolts into the front cover. Tighten to torque specifications below. To help ensure equal tension, tighten one screw, tighten the one diagonal to it, and then tighten the other two screws.
5. **Install Sensor** - Screw the sensor into the sensor opening on the back of the flowmeter. **FINGER TIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
6. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

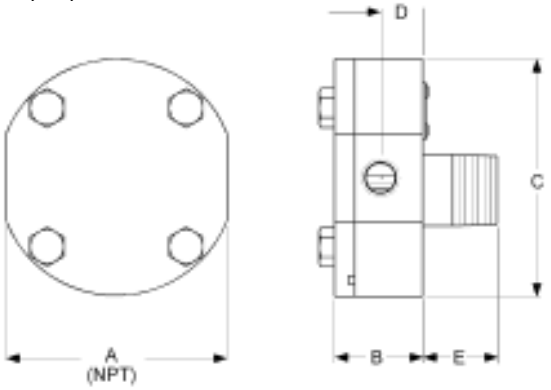
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight NPT		Weight 150# RF Flange		Bolt Torque	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	lbs	kg	ft-lb	N-m
DC01I	1/8" NPT	1	3.79	100	0.006"	2.1	1.0	-	-	6-7	8-10
DC02I	1/4" NPT	3	11.40	100	0.006"	3.4	1.5	-	-	6-7	8-10

Flowmeter Assembly Diagram
Models: DC01I, DC02I



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	B	C	D	E
DC01I	2.9 [74]	1.1 [28]	3.0 [76]	0.5 [12]	1.1 [28]
DC02I	3.3 [84]	1.4 [36]	3.5 [89]	0.6 [16]	1.1 [28]

Replacement Part Ordering
Models: DC01I, DC02I

Front Cover
w/ Shafts **DC □□ I - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5BW – □□ - □□□

Nominal Size
01
02
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts (qty=4)
01	55-033-□□	50-15C22H-58
02	55-036-□□	50-15C22H-58

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Flowmeter Disassembly/Reassembly
Models: DC05I, DC10I, DC15I, DC20I

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** - Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts** - While holding the front cover in place, loosen and remove the case bolts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover** - Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the top and bottom edge of the front cover. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out.
5. **Remove Case O-ring** - If the case o-ring is still set in the body, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them out. Handle the impellers carefully. They can be damaged if dropped.

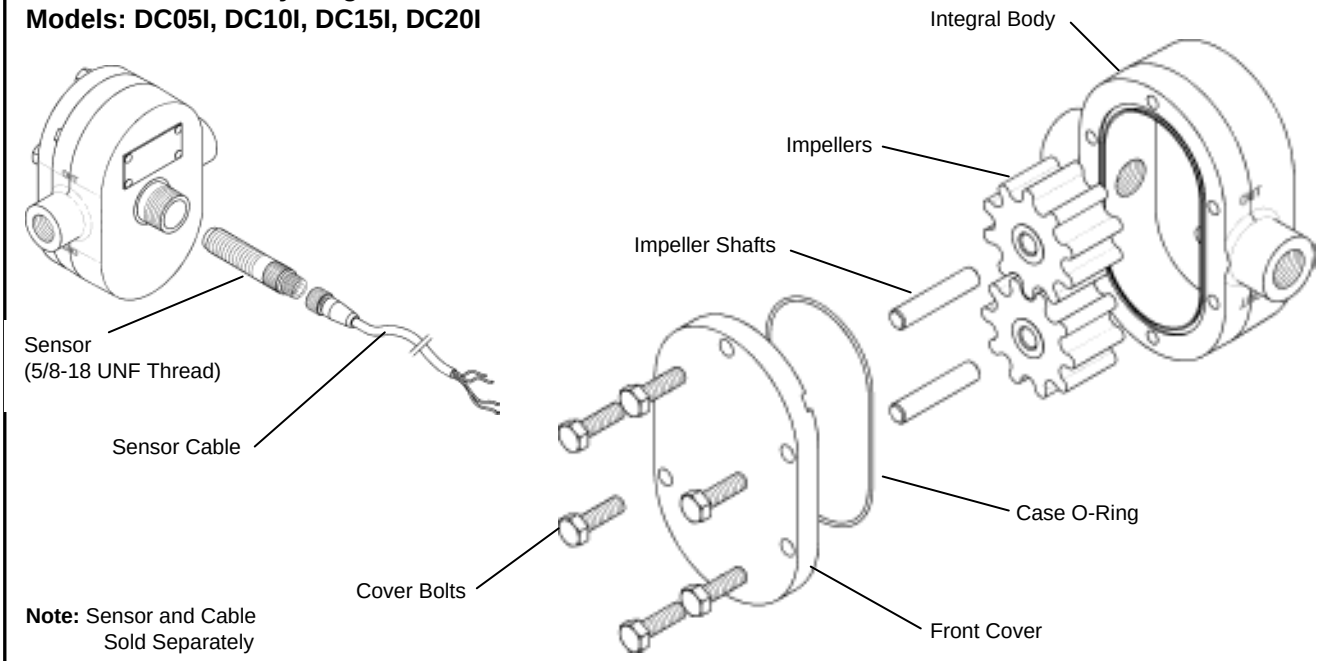
Note: Do not remove the shafts from the front cover.

Reassembly

1. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. **The magnet side of the impellers, the side with serial numbers, must be facing the side of the meter on which the sensor is mounted.**
2. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the body. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover** - Carefully mount the front cover/shaft assembly onto the integral body making sure the impeller shafts set properly into the rear of the integral body. Hold the case o-ring in the groove. Do not install the case bolts until the case o-ring is set properly; damage will occur to the case o-ring if it is not.
4. **Install Case Bolts** - Install the case nuts onto the threaded studs. Tighten to torque specifications below. To help ensure equal tension, go around the face of the meter tightening every other nut; then tighten remaining nuts.
5. **Install Sensor** - Screw the sensor into the sensor opening on the back of the flowmeter. **FINGERTIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
6. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

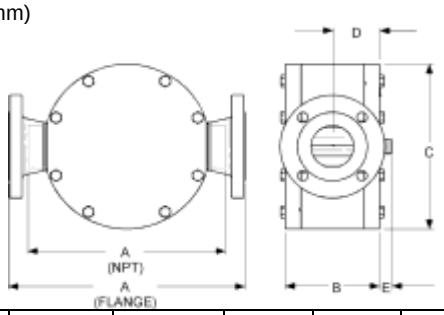
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight NPT		Weight 150# RF Flange		Bolt Torque	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	lbs	kg	ft-lb	N-m
DC05I	1/2” NPT	12	45.40	80	0.007”	8.5	3.9	11	4.8	6-7	8-10
DC10I	1” NPT	25	94.60	60	0.009”	15	6.7	18	8.3	6-7	8-10
DC15I	1-1/2” NPT	50	189	60	0.009”	26	12	32	15	14-16	19-22
DC20I	2” NPT	100	379	40	0.015”	55	25	67	30	33-40	45-54

Flowmeter Assembly Diagram
Models: DC05I, DC10I, DC15I, DC20I



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	A (RFF)	B	C	D	E
DC05I	5.4 [137]	7.4 [188]	2.2 [56]	5.6 [142]	1.1 [27]	0.8 [20]
DC10I	7.0 [178]	8.8 [224]	2.7 [69]	6.9 [175]	1.4 [35]	0.8 [20]
DC15I	6.9 [175]	10 [254]	3.4 [86]	8.2 [208]	1.7 [44]	0.8 [20]
DC20I	9.5 [241]	11.8 [300]	4.5 [114]	10.8 [274]	2.3 [58]	0.8 [20]

Replacement Part Ordering
Models: DC05I thru DC20I

Front Cover
w/ Shafts **DC □□ I - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5NS – □□ - □□□

Nominal Size
05 15
10 20
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts (qty=6)
05	55-044-□□	50-15C26H-58
10	55-048-□□	50-15C26H-58
15	55-162-□□	50-16C28H-58
20	55-169-□□	50-17C30H-58

Material No.
(See Material Guide)

Model Numbering System

DC□□E-□ □ □ □-□ □ □□ □□□

Basic Model No.

Nominal Size
01 = 1/8”
02 = 1/4”
05 = 1/2”
10 = 1”
15 = 1 1/2”

Case Material
4 = 300 Series SS

Shaft Material
1 = 316 SS

O-Ring Material
1 = Viton® *
9 = Teflon® √

Impeller Material
3 = UHMWPE +
9 = PTFE

Impeller Style (See Chart)
5 = Normal Temperature

Connection Type
1 = NPT (Female)

Connection Size
01 = 1/8”
02 = 1/4”
05 = 1/2”
10 = 1”
15 = 1 1/2”

Special Designator
000 = Standard Meter *

Impeller Normal Temperature Chart

Impeller Material	*Operating Temperature*	*CIP Temperature*
PTFE	-20 F to +250 F (-29 C to +121 C)	250 F (121 C)
UHMWPE	-20 F to +150 F (-29 C to +66 C)	185 F (85 C)

Key

*	Standard Configuration
√	FDA Compliant
CIP	“Clean in Place,” a brief cleaning cycle
+	Not available in size 01 and 02 meters

Material Guide

Name	*Description*
300 Series SS	Any industrial grade Stainless Steel, typically 303 or 304
316 SS	316 Stainless Steel, 316L has reduced carbon
PTFE	Polytetrafluoroehtylene, Teflon (Impeller)
Teflon®	Polytetrafluoroehtylene (O-Ring Material)
UHMWPE	Ultra High Molecular Weight Polyethylene
Viton®	Fluorocarbon

Specifications are for reference only and are subject to change without notice

Specifications:

DC-E Economical In-line Flowmeters

Process Temperature: -20°F to 250°F (-29°C to 121°C)
Operating Pressure: 250psig (1724 kPa), std.
Turndown Ratio: (Ratios based on maximum rated flow)
10:1 standard on low viscosity fluids
100:1 standard on medium viscosity fluids
Reference Accuracy: ±0.1% of rate (repeatability)
Linearity: ±2% of rate on 1cP liquids
±1% of rate to 2% on 100cP and higher liquids
Output:

Sensors:

Hall Effect Sensor: 5 to 24 VDC square- -wave pulse depending on supply, 3-wire.
FM Approved, Intrinsically Safe.
Magnetic Pick-up Sensor: 10 mV to 10 V sine-wave pulse depending on flow rate, 2-wire, explosion-proof optional.

Signal Conditioners and Transmitters:
Refer to the individual product sheets, available from Flow Technology, Inc.

Materials Of Construction:

Flowmeter Body: Model DC01E and DC02E: 300 Series Stainless Steel
Model DC05E thru DC15E:1010/1020 Carbon Steel or 300 Series Stainless Steel
Shafts: 316 Stainless Steel
Impellers: PTFE or UHMWPE standard. See Model Numbering System
O-ring: Viton® standard or Teflon®
Bolts and Nuts: Grade 8 Zinc plated Alloy Steel

Model Specifications

Basic Model	***Nominal Size***	***Maximum Flow Rate***		***Recommended Mesh Size***		***Weight***				***Bolt Torque***	
						NPT		***150# RF Flange***			
	Standard Connection	***GPM***	***L/min***	***Mesh***	***Particle Dia.***	***lbs***	***kg***	***lbs***	***kg***	***ft-lb***	***N-m***
DC01E	1/8” NPT	1	3.79	100	0.006”	2.1	1.0	-	-	6-7	8-10
DC02E	1/4” NPT	3	11.40	100	0.006”	3.4	1.5	-	-	6-7	8-10
DC05E	1/2” NPT	12	45.40	80	0.007”	9.5	4.3	-	-	14-16	19-22
DC10E	1” NPT	25	94.60	60	0.009”	15	6.7	-	-	14-16	19-22
DC15E	1-1/2” NPT	50	189	60	0.009”	29	13	-	-	15-19	20-26

Flowmeter Disassembly/Reassembly
Models: DC01E, DC02E

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** – Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts** - While holding the front cover in place, loosen and remove the case bolts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover** - Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the edge of the integral body. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out. Handle the front cover carefully, the impeller shafts can be damaged if it is dropped.
5. **Remove Case O-ring** - If the case o-ring is still set in the body, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them off the shafts. Handle the impellers carefully. They can be damaged if dropped.

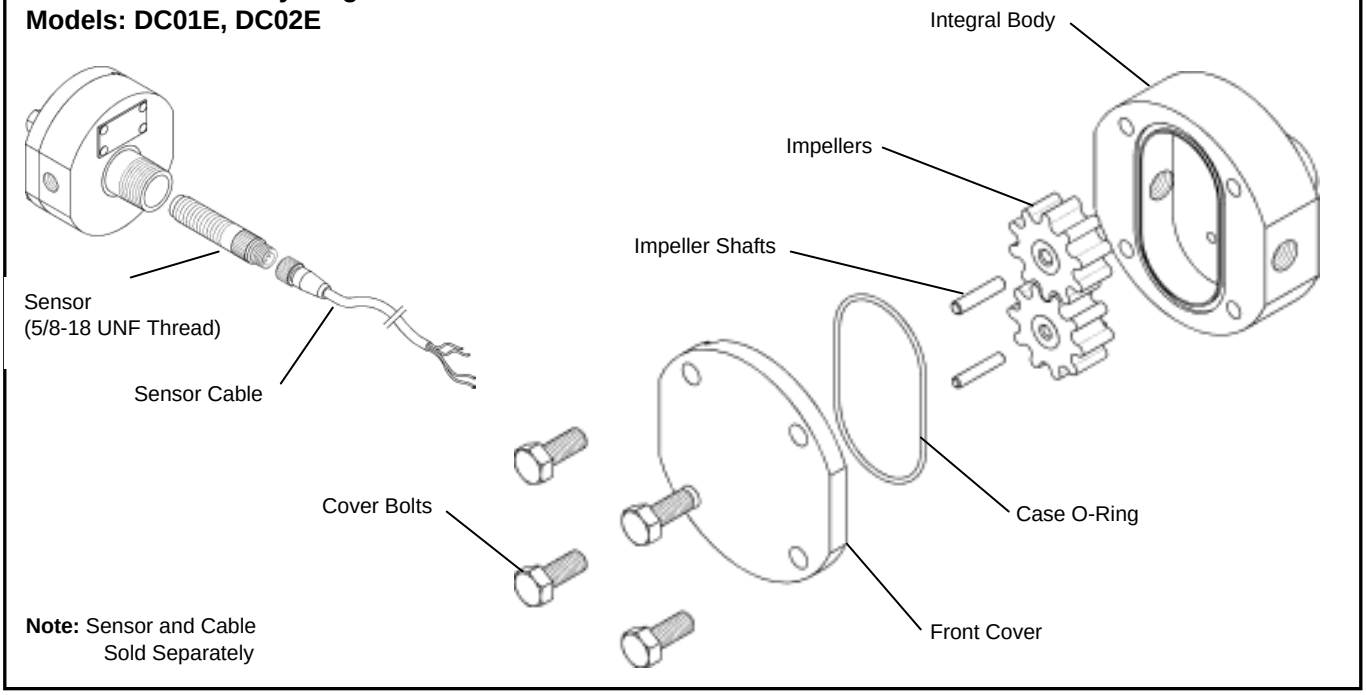
Note: Do not remove the impeller shafts from the front cover.

Reassembly

1. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. The shafts are different sizes, so the impellers will only fit onto them one way. **The magnet side of the impellers, the side with serial numbers, must be facing the side of the meter on which the sensor is mounted.**
2. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the body. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover** - The front cover will only fit onto the integral body one way. Use the dowel pins to properly align it. Carefully mount the front cover/shaft assembly onto the integral body. Hold the case o-ring in the groove. Do not install the cap screws until the case o-ring is set properly to keep from damaging the o-ring.
4. **Install Case Bolts** - Install the case bolts into the front cover. Tighten to torque specifications below. To help ensure equal tension, tighten one screw, tighten the one diagonal to it, and then tighten the other two screws.
5. **Install Sensor** - Screw the sensor into the sensor opening on the back of the flowmeter. **FINGERTIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
6. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

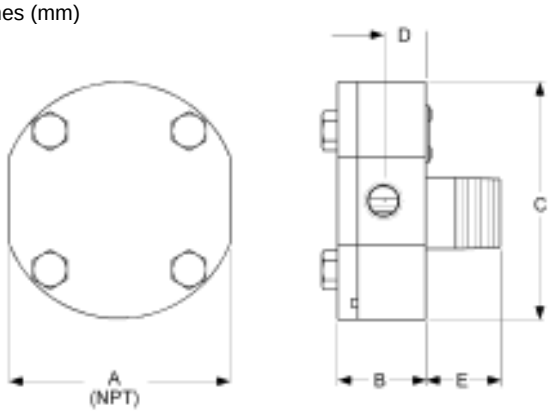
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight NPT		Weight 150# RF Flange		Bolt Torque	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	lbs	kg	ft-lb	N-m
DC01E	1/8" NPT	1	3.79	100	0.006"	2.1	1.0	-	-	6-7	8-10
DC02E	1/4" NPT	3	11.40	100	0.006"	3.4	1.5	-	-	6-7	8-10

Flowmeter Assembly Diagram
Models: DC01E, DC02E



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	B	C	D	E
DC01E	2.9 [74]	1.1 [28]	3.0 [76]	0.5 [12]	1.1 [28]
DC02E	3.3 [84]	1.4 [36]	3.5 [89]	0.6 [16]	1.1 [28]

Replacement Part Ordering
Models: DC01E, DC02E

Front Cover
w/ Shafts **DC □□ E - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5BW – □□ - □□□

Nominal Size
01
02
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts (qty=4)
01	55-033-□□	50-15C22H-55
02	55-036-□□	50-15C22H-55

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Flowmeter Disassembly/Reassembly
Models: DC05E, DC10E, DC15E

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** - Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts** - While holding the front cover in place, loosen and remove the case bolts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover** - Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the top and bottom edge of the front cover. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out.
5. **Remove Case O-ring** - If the case o-ring is still set in the body, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them out. Handle the impellers carefully. They can be damaged if dropped.

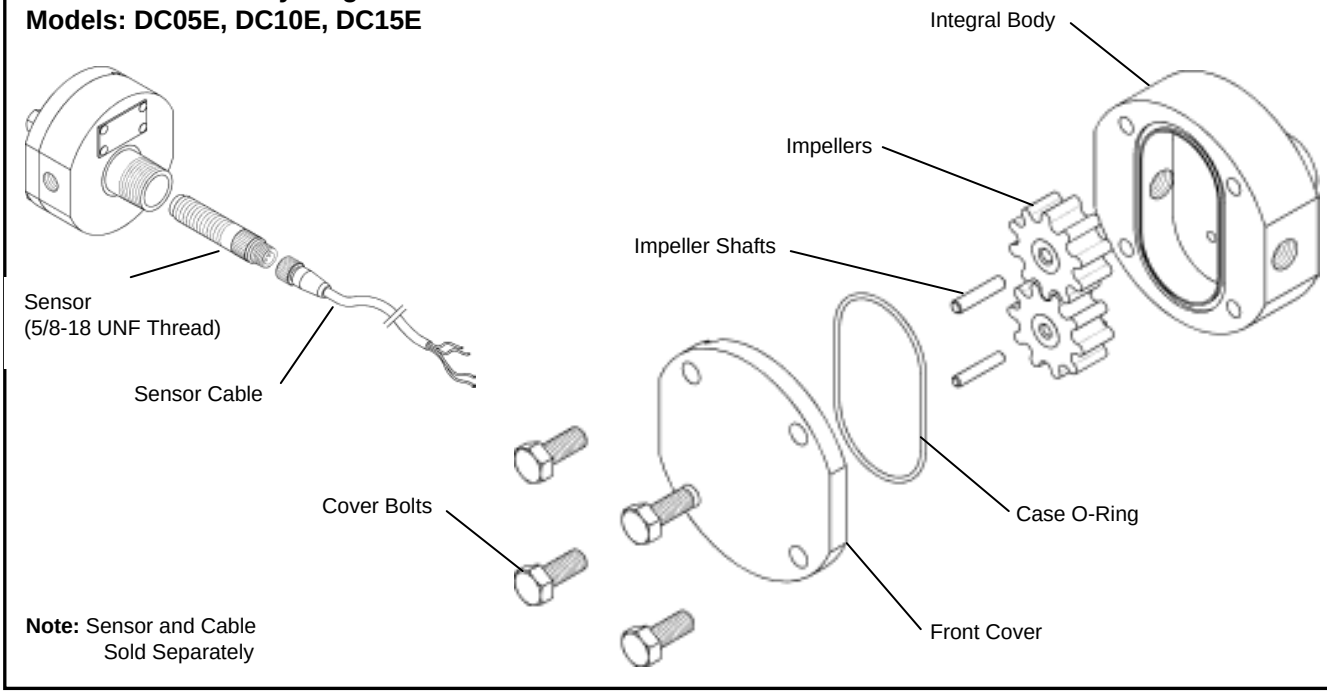
Note: Do not remove the shafts from the front cover.

Reassembly

1. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. **The magnet side of the impellers, the side with serial numbers, must be facing the side of the meter on which the sensor is mounted.**
2. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the body. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover** - Carefully mount the front cover/shaft assembly onto the integral body making sure the impeller shafts set properly into the rear of the integral body. Hold the case o-ring in the groove. Do not install the case bolts until the case o-ring is set properly; damage will occur to the case o-ring if it is not.
4. **Install Case Bolts** - Install the case nuts onto the threaded studs. Tighten to torque specifications below. To help ensure equal tension, go around the face of the meter tightening every other nut; then tighten remaining nuts.
5. **Install Sensor** - Screw the sensor into the sensor opening on the back of the flowmeter. **FINGERTIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
6. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

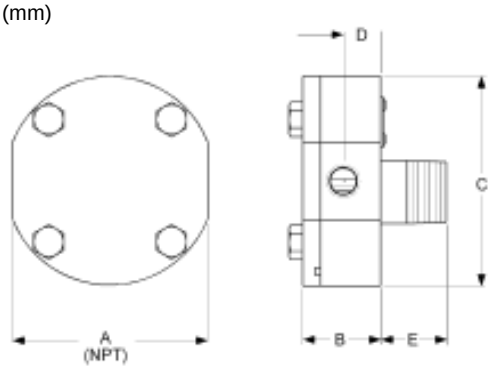
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight NPT		Weight 150# RF Flange		Bolt Torque	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	lbs	kg	ft-lb	N-m
DC05E	1/2" NPT	12	45.40	80	0.007"	9.5	4.3	-	-	14-16	19-22
DC10E	1" NPT	25	94.60	60	0.009"	15	6.7	-	-	14-16	19-22
DC15E	1-1/2" NPT	50	189	60	0.009"	29	13	-	-	15-19	20-26

Flowmeter Assembly Diagram
Models: DC05E, DC10E, DC15E



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	B	C	D	E
DC05E	4.8 [121]	2.2 [56]	5.0 [127]	1.1 [27]	1.4 [35]
DC10E	5.5 [140]	2.7 [69]	6.0 [152]	1.3 [34]	1.4 [35]
DC15E	7.0 [178]	3.4 [86]	7.5 [191]	1.6 [41]	1.3 [33]

Replacement Part Ordering
Models: DC05E thru DC15E

Front Cover
w/ Shafts **DC □□ E - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5NS – □□ - □□□

Nominal Size
05 15
10
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts (qty=6)
05	55-044-□□	50-15C28H-55
10	55-048-□□	50-15C28H-55
15	55-162-□□	50-16C30H-55

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Model Numbering System

DC□□F-□ □ □ □-□ □ □□ □□□

Basic Model No.

Nominal Size
01 = 1/8”
02 = 1/4”
05 = 1/2”
10 = 1”
15 = 1 1/2”
20 = 2”

Case Material
6 = 316 SS * √
0 = Specify

Shaft Material
1 = 316 SS * √
0 = Specify

O-Ring Material
1 = Viton® * √
2 = Buna N √
6 = EPDM √
9 = Teflon® √
0 = Specify

Impeller Material
3 = UHMWPE + √
6 = HTC § √
0 = Specify

Impeller Style (See Chart)
5 = Normal Temperature
A = Normal Temp. Grooved +
0 = Specify

Connection Type
4 = Sanitary Clamp *
0 = Specify

Connection Size
05 = 1/2”
10 = 1”
15 = 1 1/2”
20 = 2”
00= Specify

Special Designator
000 = Standard Meter *

Impeller Normal Temperature Chart

Impeller Material	*Operating Temperature*	*CIP Temperature*
HTC	-20 F to +400 F (-29 C to +204 C)	400 F (204 C)
UHMWPE	-20 F to +150 F (-29 C to +66 C)	185 F (85 C)

Key

*	Standard Configuration
√	FDA Compliant
CIP	“Clean in Place,” a brief cleaning cycle
+	Not available in size 01 and 02 meters
§	Standard on size 01 thru 20 meters

Material Guide

Name	*Description*
316 SS √	316 Stainless Steel
Buna N	Nitrile
EPDM	Elastomeric PTFE Ethylene Propylene
HTC	Proprietary Sanitary Thermoplastic
Teflon® √	Polytetrafluoroehtylene (O-Ring Material)
UHMWPE √	Ultra High Molecular Weight Polyethylene
Viton®	Fluorocarbon

OEM Versions – On approved projects, the Flow Technology flowmeters can be modified to meet the specific needs of an OEM application.

Specifications are for reference only and are subject to change without notice

Specifications:

DC-F Sanitary In-line Flowmeters

Process Temperature: Up to 400°F (204°C) (Based on impeller materials) Higher temperatures available

Operating Pressure: 250 psig maximum (1724 kPa), standard
Up to 1000 psig (6895 kPa), optional
Higher pressure ratings available upon request

Turndown Ratio: (Ratios based on maximum rated flow)
10:1 standard on low viscosity fluids
100:1 standard on medium viscosity fluids
Up to 1000:1 on high viscosity fluids

Reference Accuracy: ±0.05% of rate (repeatability)

Linearity: ±0.5% of rate over upper 80% of full span, typical
Up to ±0.1% of rate over full turndown range with enhanced signal conditioning

Output:

Sensors: (1 required per meter)

Hall Effect Sensor: 5 to 24 VDC square-wave pulse depending on supply voltage, 3-wire.
FM Approved, Intrinsically Safe w/IS Barriers.

Magnetic Pick-up Sensor: 10 mV to 10 V sine-wave pulse depending on flow rate, 2-wire, explosion proof optional.

Signal Conditioners and Transmitters:
Refer to the individual product sheets, available from Flow Technology, Inc.

Materials Of Construction:

Integral Body (Case), Cover(s): 316 stainless steel

Shafts: 316 stainless steel

Impellers: UHMWPE, HTC standard. See Model Numbering System.

O-rings: Viton®, standard; other materials available

Studs and Wing-Nuts: 316 Stainless Steel

Model Specifications

Basic Model	***Nominal Size***	***Standard Connection***	***Maximum Flow Rate***		***Recommended Mesh Size***		***Weight***		***Nut Torque***	
			GPM	***L/min***	***Mesh***	***Particle Dia.***	***lbs***	***kg***	***ft-lb***	***N-m***
DC01F	1/8”	1/2” Clamp	1	3.79	100	0.006”	2.9	1.3	6-7	8-10
DC02F	1/4”	1/2” Clamp	3	11.40	100	0.006”	3.3	1.5	6-7	8-10
DC05F	1/2”	1” Clamp	12	45.40	80	0.007”	8.3	3.8	6-7	8-10
DC10F	1”	1” Clamp	25	94.60	60	0.009”	14	6.3	6-7	8-10
DC15F	1-1/2”	1-1/2” Clamp	50	189	60	0.009”	24	11	14-16	19-22
DC20F	2”	2” Clamp	100	379	40	0.015”	53	24	33-40	45-54

Flowmeter Disassembly/Reassembly
Models: DC01F, DC02F

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** - Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Wing Nuts** - While holding the front cover in place, loosen and remove the case nuts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover** - Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the top and bottom edge of the front cover. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out.
5. **Remove Case O-ring** - If the case o-ring is still set in the front cover, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them out. Handle the impellers carefully. They can be damaged if dropped.

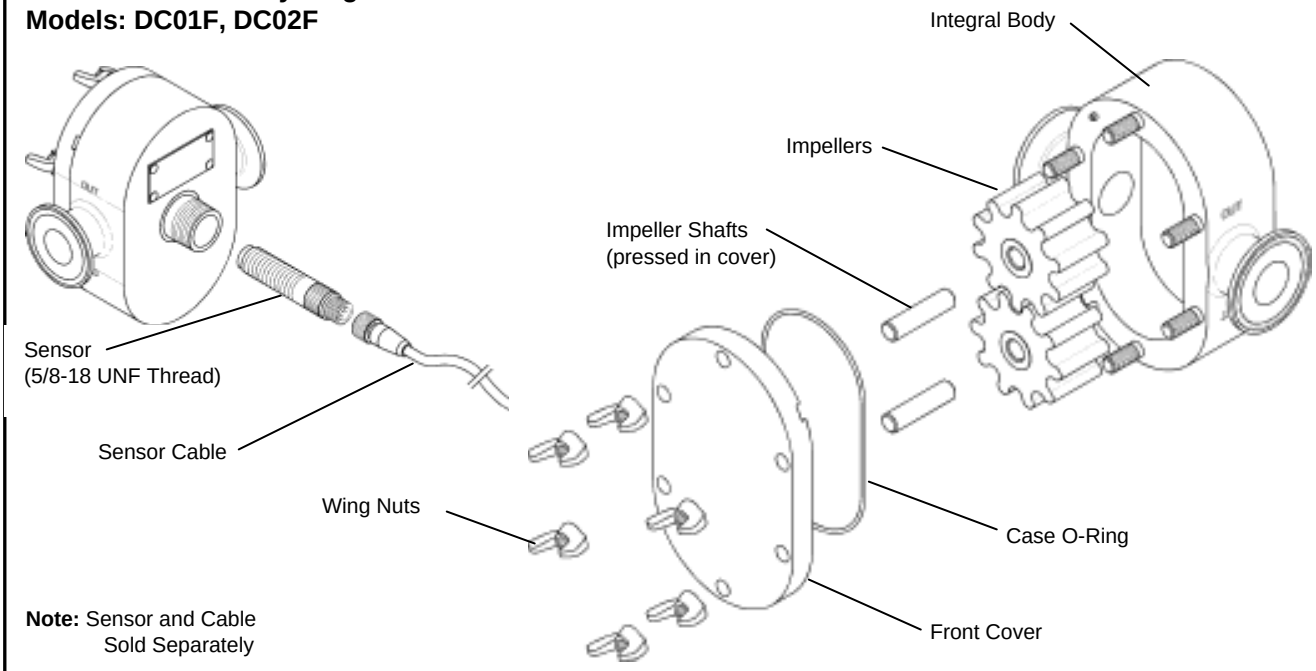
Note: Do not remove the threaded studs from the integral body or the shafts from the front cover.

Reassembly

1. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. **Orient the impellers so the serial numbers are facing into the front cover.** The magnet side of the impellers must be facing the side of the meter on which the sensor is mounted.
2. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the front cover. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover** - Carefully mount the front cover/shaft assembly onto the integral body making sure the impeller shafts seat properly into the rear of the integral body. Hold the case o-ring in the groove. Do not install the case nuts until the case o-ring is set properly; damage will occur to the case o-ring if it is not.
4. **Install Wing Nuts** - Install the case nuts onto the threaded studs. Tighten to torque specifications below. To help ensure equal tension, go around the face of the meter tightening every other nut; then tighten remaining nuts.
5. **Install Sensor** - Screw the sensor into the sensor opening on the back of the flowmeter. **FINGERTIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
6. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

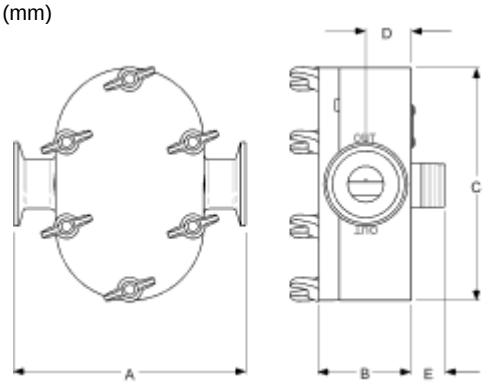
Basic Model	Nominal Size	Standard Connection	Maximum Flow Rate		Recommended Mesh Size		Weight		Bolt Torque	
			GPM	L/min	Mesh	Particle Dia.	lbs	kg	ft-lb	N-m
DC01F	1/8”	1/2” Clamp	1	3.79	100	0.006”	2.9	1.3	6-7	8-10
DC02F	1/4”	1/2” Clamp	3	11.40	100	0.006”	3.3	1.5	6-7	8-10

Flowmeter Assembly Diagram
Models: DC01F, DC02F



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A	B	C	D	E
DC01F	4.0 [102]	1.1 [28]	3.9 [99]	0.5 [12]	1.1 [28]
DC02F	4.0 [102]	1.4 [36]	3.9 [99]	0.7 [17]	1.1 [28]

Replacement Part Ordering
Models: DC01F, DC02F

Front Cover
w/ Shafts **DC □□ F - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5BW – □□ - □□□

Nominal Size
01
02
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Wing nuts (qty=4)
01	55-032-□□	51-15CW-06
02	55-036-□□	51-15CW-06

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Flowmeter Disassembly/Reassembly
Models: DC05F, DC10F, DC15F, DC20F

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Disassembly

1. **Disconnect Sensor Cable (If applicable)** – Unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor** - Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Wing Nuts** - While holding the front cover in place, loosen and remove the wing nuts. A small amount of process fluid may leak out; take any necessary precautions.
4. **Remove Front Cover** - Carefully remove the front cover. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out.
5. **Remove Case O-ring** - If the case o-ring is still set in the front cover, remove it by hand.
6. **Remove Impellers** - Carefully remove the impellers by hand. Do not use any type of object to pry them off the shafts. Handle the impellers carefully. They can be damaged if dropped.
7. **Remove Impeller Shafts** - While holding the shafts in place, loosen and remove each shaft nut. Remove the shaft from the rear cover. Catch the shaft o-rings if they fall out.
8. **Remove Shaft O-rings** - If the shaft o-rings remain on the impeller shaft or in the groove in the integral body, remove them by hand.

Note: Do not remove the threaded studs from the integral body.

Reassembly

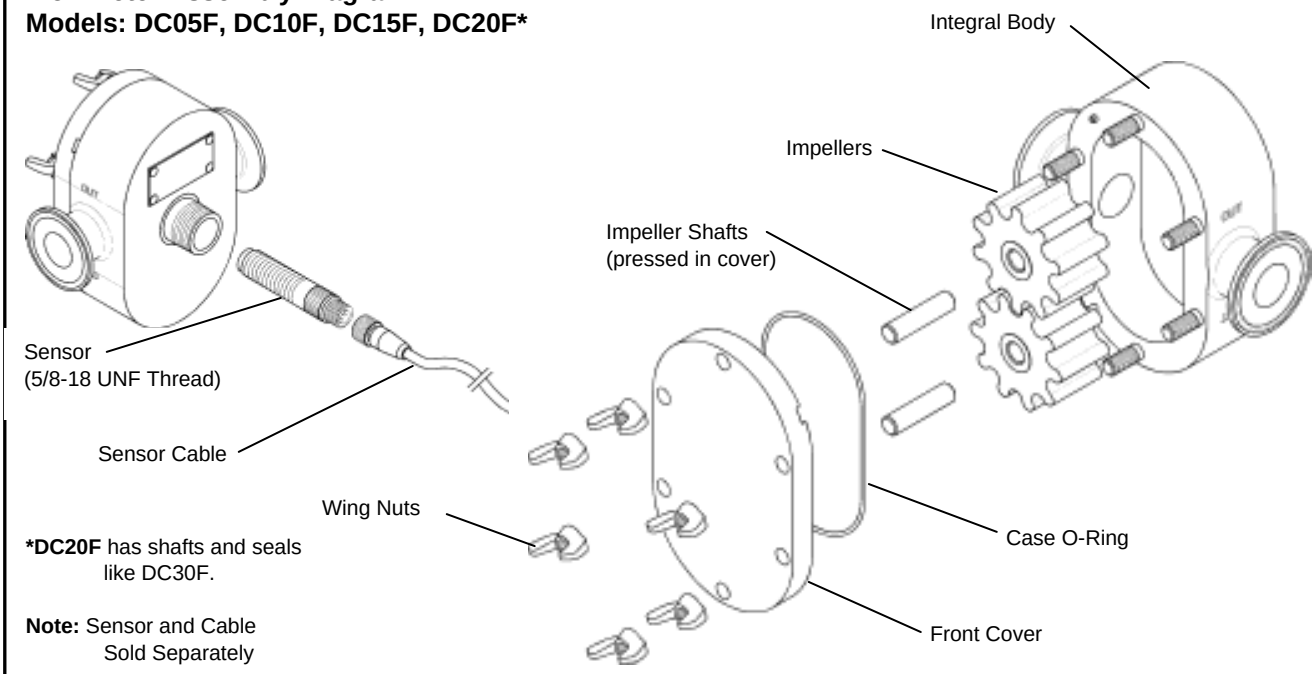
1. **Install Shaft O-rings** - Slide each shaft o-ring over the threaded end of the impeller shaft.
2. **Install Impeller Shafts** - Slide the threaded end of the impeller shafts into the holes in the integral body. Make certain that the shaft o-rings stay completely within the grooves in the integral body.
3. **Install Shaft Nuts** - Place one nut on each shaft and tighten to the torque specifications below. **Note:** The FD20F uses two nuts on each shaft.
4. **Install Impellers** - Carefully slide the impellers onto the impeller shafts. **Orient the impellers so that the side with the counter bore slides over the shoulder on the shaft.** The serial numbers on the impellers should face out of the integral body. The magnet side of the impellers must be facing the sensor side of the meter.
5. **Install Case O-ring** - Insert the case o-ring into the o-ring groove in the front cover. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the o-ring material and process fluid, may be used to help keep the o-ring in the groove during assembly.
6. **Mount Front Cover** - Carefully slide the front cover over the threaded studs onto the integral body. Hold the case o-ring in the groove. Do not install the wing nuts until the case o-ring is captured completely in its groove.

Note: For DC20F, see DC30F/DC40F Instructions for shaft seal installation.

7. **Install Wing Nuts** - Install the wing nuts onto the threaded studs. Tighten to torque specifications below. To help ensure equal tension, tighten every other wing nut going around the face of the meter. Then, tighten remaining wing nuts.
8. **Install Sensor** - Screw the sensor into the sensor opening in the rear of the integral body. **FINGER TIGHTEN ONLY** or damage to the sensor or flowmeter will occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly.
9. **Attach Sensor Cable (If applicable)** - Plug the cable into sensor and tighten.

Basic Model	Nominal Size	Standard Connection	Maximum Flow Rate		Recommended Mesh Size		Weight		Bolt Torque	
			GPM	L/min	Mesh	Particle Dia.	lbs	kg	ft-lb	N-m
DC05F	1/2"	1" Clamp	12	45.40	80	0.007"	8.3	3.8	6-7	8-10
DC10F	1"	1" Clamp	25	94.60	60	0.009"	14	6.3	6-7	8-10
DC15F	1-1/2"	1-1/2" Clamp	50	189	60	0.009"	24	11	14-16	19-22
DC20F	2"	2" Clamp	100	379	40	0.015"	53	24	33-40	45-54

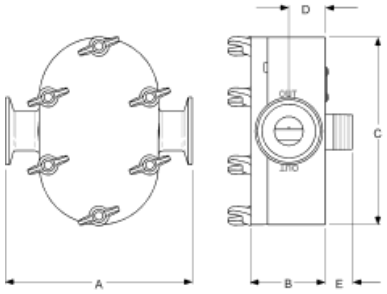
Flowmeter Assembly Diagram
Models: DC05F, DC10F, DC15F, DC20F*



***DC20F** has shafts and seals like DC30F.

Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A	B	C	D	E
DC05F	5.5 [40]	2.2 [56]	5.5 [140]	1.1 [27]	0.8 [20]
DC10F	7.0 [178]	2.7 [69]	6.7 [170]	1.4 [35]	0.8 [20]
DC15F	6.9 [175]	3.4 [86]	7.9 [201]	1.7 [44]	0.8 [20]
DC20F	9.5 [241]	4.5 [114]	10.6 [269]	2.3 [58]	0.8 [20]

Replacement Part Ordering
Models: DC05F, thru DC20F

Front Cover
w/ Shafts **DC □□ F - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5NS – □□ - □□□

Nominal Size
05 15
10 20
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Wing nuts (qty=4)
05	55-044-□□	51-15CW-06
10	55-048-□□	51-15CW-06
15	55-161-□□	51-16CW-06
20	55-169-□□	51-17CW-06

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Model Numbering System

HP□□I-□ □ □ □-□ □ □□ □□□

Basic Model No.

Nominal Size
- 01 = 1/8”
- 02 = 1/4”
- 05 = 1/2”
- 10 = 1”

Case Material
- 6 = 316 SS * √
- 0 = Specify

Shaft Material
- 1 = 316 SS * √
- C = Tungsten Carbide √
- 0 = Specify

O-Ring Material
- 1 = Viton® *
- 2 = Buna N √
- 3 = Chemraz® √
- 4 = Kalrez® √
- 6 = EPDM
- 9 = Teflon® √
- 0 = Specify

Impeller Material
- 3 = UHMWPE + √
- 5 = PPS
- 9 = PTFE
- 0 = Specify

Impeller Style (See Chart)
- 5 = Normal Temperature *
- A = Normal Temp. Grooved +
- 0 = Specify

Connection Type
- 1 = NPT (Female) *
- 0 = Specify

Connection Size
- 01 = 1/8”
- 02 = 1/4”
- 05 = 1/2”
- 10 = 1”
- 00 = Specify

Special Designator
- 000 = Standard Meter *

Impeller Normal Temperature Chart

Impeller Material	Operating Temperature	CIP Temperature
PPS	-20 F to +400 F (-29 C to +204 C)	400 F (204 C)
PTFE	-20 F to +250 F (-29 C to +121 C)	250 F (121 C)
UHMWPE	-20 F to +150 F (-29 C to +66 C)	185 F (85 C)

Key

*	Standard Configuration
√	FDA Compliant
CIP	“Clean in Place,” a brief cleaning cycle
+	Not available in size 01 and 02 meters
CF	Consult Factory

Material Guide

Name	Description
316 SS √	316 Stainless Steel, 316L has reduced carbon
Buna N √	Nitrile
Chemrez®	Elastomeric PTFE
EPDM	Ethylene Propylene
Kalrez®	Perfluorinated Elastomer
PPS	Polyphenylene Sulfide
PTFE	Polytetrafluoroehtylene, Teflon (Impeller)
Teflon® √	Polytetrafluoroehtylene (O-Ring Material)
UHMWPE √	Ultra High Molecular Weight Polyethylene
Viton® √	Fluorocarbon

Specifications are for reference only and are subject to change without notice

Specifications:

HP-I High Pressure In-line Flowmeters

Process Temperature: Up to 400°F (204°C) (Based on impeller materials)
Higher temperatures available
Operating Pressure: 3000 psig maximum (20.68 Mpa) std.
Turndown Ratio: (Ratios based on maximum rated flow)
10:1 standard on low viscosity fluids
100:1 standard on medium viscosity fluids
Up to 1000:1 on high viscosity fluids
Reference Accuracy : ±0.05% of rate (repeatability)
Linearity: ±0.5% of rate over upper 80% of full span, typical
Up to ±0.1% of rate over full turndown range with enhanced signal conditioning

Output:

Sensors: (1 required per meter)

Hall Effect Sensor: 5 to 24 VDC square-wave pulse depending on supply voltage, 3-wire.
FM Approved, Intrinsically Safe w/IS Barriers.
Magnetic Pick-up Sensor: 10 mV to 10 V sine-wave pulse depending on flow rate,
2-wire, explosion proof optional.

Signal Conditioners and Transmitters:
Refer to the individual product sheets, available from Flow Technology, Inc.

Materials Of Construction:

Integral Body (Case), Cover(s): 316 stainless steel standard; other materials available.
Shafts: 316 stainless steel
Impellers: PPS, PTFE, UHMWPE standard. See Model Numbering System.
O-rings: Viton®, std. Other materials available.
Bolts and Nuts: Grade 8 Zinc plated Alloy Steel, standard. A286 SS available.

Model Specifications

Basic Model	***Nominal Size***	***Maximum Flow Rate***		***Recommended Mesh Size***		***Weight***		***Bolt Torque 3000 psi***	
	Standard Connection	***GPM***	***L/min***	***Mesh***	***Particle Dia.***	***lbs***	***kg***	***ft-lb***	***N-m***
HP01I	1/8” NPT	1	3.79	100	0.006”	2	0.9	8	11
HP02I	1/4” NPT	3	11.40	100	0.006”	8	3.6	11.5	15.6
HP05I	1/2” NPT	12	45.40	80	0.007”	22	10	29	39.4
HP10I	1” NPT	25	94.60	60	0.009”	45	20	48	65

Flowmeter Disassembly/Reassembly
Models: HP01I, HP02I

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury. Flow Technology's HP Series flowmeters are available as specials in pressure ratings up to 10,000 PSI. Special care must be taken with meters in such high pressure environments. All of Flow technology's flowmeters use a single elastomeric o-ring to seal the pressure cavity. There is no backup seal should the o-ring fail. Proper assembly and care of o-ring and its seal surface is therefore very important. Flow Technology recommends establishing a weekly preventative maintenance inspection routine to check for any signs of leaks, cracks or external damage. If the working fluid is flammable or otherwise hazardous, the use of drip pans, shields or other logical safety precautions is recommended.

Disassembly

1. **Disconnect Sensor Cable (If applicable) –** Carefully unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor -** Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts and Nuts -** While holding the front cover in place, loosen and remove the case nuts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover -** Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the top and bottom edge of the front cover. Take care not to scratch the sealing surfaces. More process fluid may flow out. Catch the impellers and the case o-ring, if they slide out. Handle the front cover carefully. Dropping it can damage the impeller shafts.
5. **Remove Case O-ring -** If the case o-ring is still set in the front cover, remove it by hand.
6. **Remove Impellers -** Carefully remove the impellers by hand. Do not use any type of object to pry them out. Handle the impellers carefully. They can be damaged if dropped.

Note: Do not remove the shafts from the front cover.

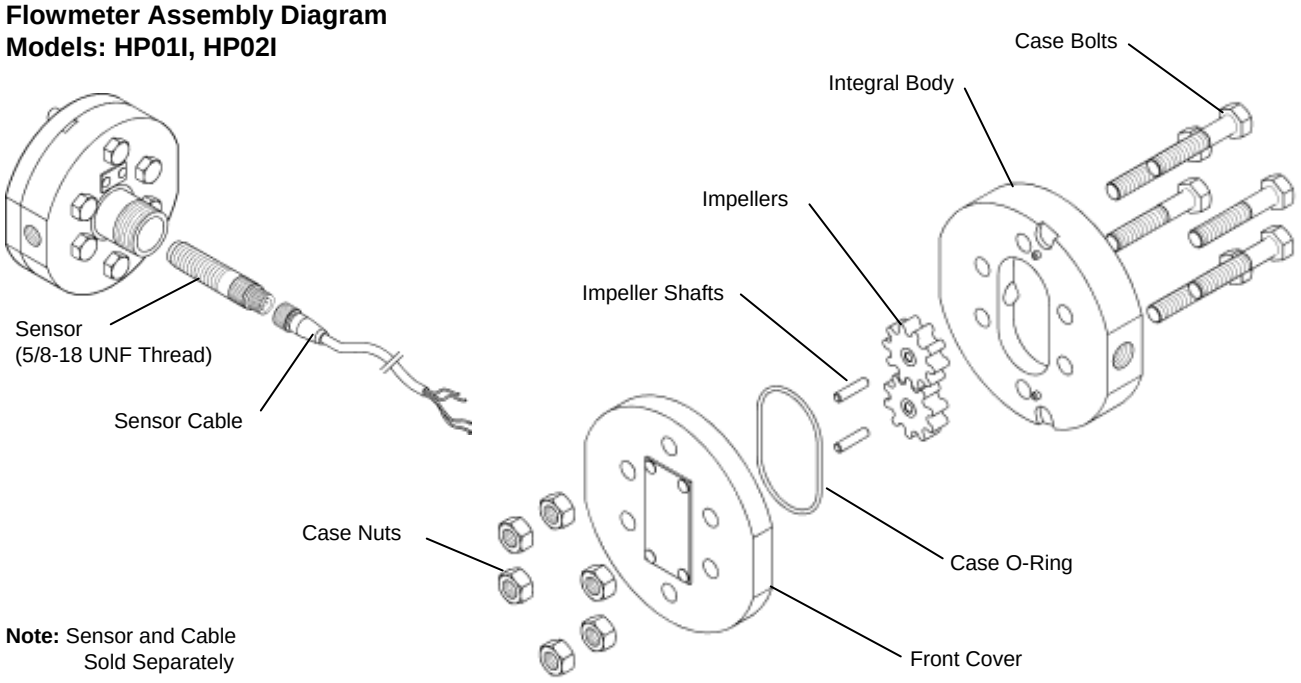
WARNING
Completely assemble the flowmeter AND install the sensor before pressurizing the lines.

Reassembly

1. **Install Impellers -** Carefully slide the impellers onto the impeller shafts. **The shafts are different sizes, so the impellers will only fit onto them one way. Orient the impellers so the serial numbers are facing into the front cover.** The magnet side of the impellers must be facing the side of the meter on which the sensor is mounted.
2. **Install Case O-ring -** Insert a NEW case o-ring into the o-ring groove in the front cover. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover -** The front cover will only fit onto the integral body one way. Use the aligning pins to properly align it. Carefully mount the front cover/shaft assembly onto the integral body. Hold the case o-ring in the groove. Do not install the case bolts until the case o-ring is set properly to avoid damaging the o-ring.
4. **Install Case Bolts and Nuts -** Slide the case bolts into the flowmeter. Tighten the case nuts to torque specifications below. To help ensure equal tension, go around the face of the meter tightening every other nut; then tighten remaining nuts. For standard 3000 psi meters, see torque values listed below. For other pressures and all specials, use the torque value engraved on the meter's nameplate.
5. **Install Sensor -** Screw the sensor into the sensor opening on the back of the flowmeter. **FINGER TIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly. **The sensor should remain in place any time the meter is pressurized.**
6. **Attach Sensor Cable (If applicable) -** Plug the cable into sensor and tighten.
7. **Inspect for leaks -** Test the system for leaks. If the process fluid is of a hazardous nature, consider using a different fluid during initial leak testing.

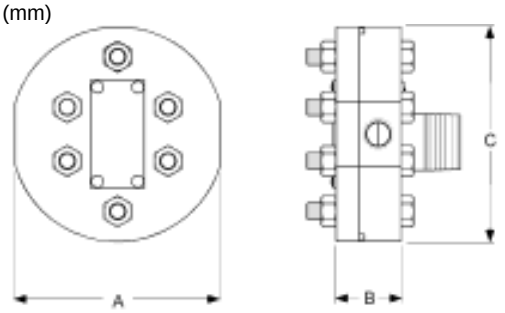
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight		Bolt Torque			
								3000 psi		6000 psi	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	ft-lb	N-m	ft-lb	N-m
HP01I	1/8" NPT	1	3.79	100	0.006"	2	0.9	8	11	-	-
HP02I	1/4" NPT	3	11.40	100	0.006"	8	3.6	11.5	15.6	-	-

Flowmeter Assembly Diagram
Models: HP01I, HP02I



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	B	C
HP01I	3.8 [97]	1.2 [30]	4.0 [102]
HP02I	3.8 [97]	1.8 [46]	4.0 [102]

Replacement Part Ordering
Models: HP01I, HP02I

Front Cover
w/ Shafts **HP □□ I - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5BW – □□ - □□□

Nominal Size
01
02
Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts	& Case Nuts
01	55-032-□□	50-15C32H-55	51-15CS-55 (qty=6)
02	55-036-□□	50-16C35H-55	51-16CS-55 (qty=8)

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Flowmeter Disassembly/Reassembly
Models: HP05I, HP10I

WARNING
Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury. Flow Technology's HP Series flowmeters are available as specials in pressure ratings up to 10,000 PSI. Special care must be taken with meters in such high pressure environments. All of Flow Technology's flowmeters use a single elastomeric o-ring to seal the pressure cavity. There is no backup seal should the o-ring fail. Proper assembly and care of o-ring and its seal surface is therefore very important. Flow Technology recommends establishing a weekly preventative maintenance inspection routine to check for any signs of leaks, cracks or external damage. If the working fluid is flammable or otherwise hazardous, the use of drip pans, shields or other logical safety precautions is recommended.

Disassembly

1. **Disconnect Sensor Cable (If applicable) –** Carefully unscrew and unplug the sensor cable from the sensor.
2. **Remove Sensor -** Unscrew the sensor from the flowmeter. DO NOT DROP THE SENSOR; it can be damaged by a sudden jolt. Do not allow the wires on sensors with integral cables to become severely twisted during disassembly.
3. **Remove Case Bolts and Nuts -** While holding the front cover in place, loosen and remove the case nuts. A small amount of process fluid may leak out; take any precautions necessary.
4. **Remove Front Cover -** Carefully remove the front cover. If needed, LIGHTLY pry the cover loose. Pry slots are located on the top and bottom edge of the front cover. Take care not to scratch the sealing surfaces. More process fluid will flow out. Catch the impellers and the case o-ring, if they slide out. Handle the front cover carefully. Dropping it can damage the impeller shafts.
5. **Remove Case O-ring -** If the case o-ring is still set in the front cover, remove it by hand.
6. **Remove Impellers -** Carefully remove the impellers by hand. Do not use any type of object to pry them out. Handle the impellers carefully. They can be damaged if dropped.

Note: Do not remove the shafts from the front cover.

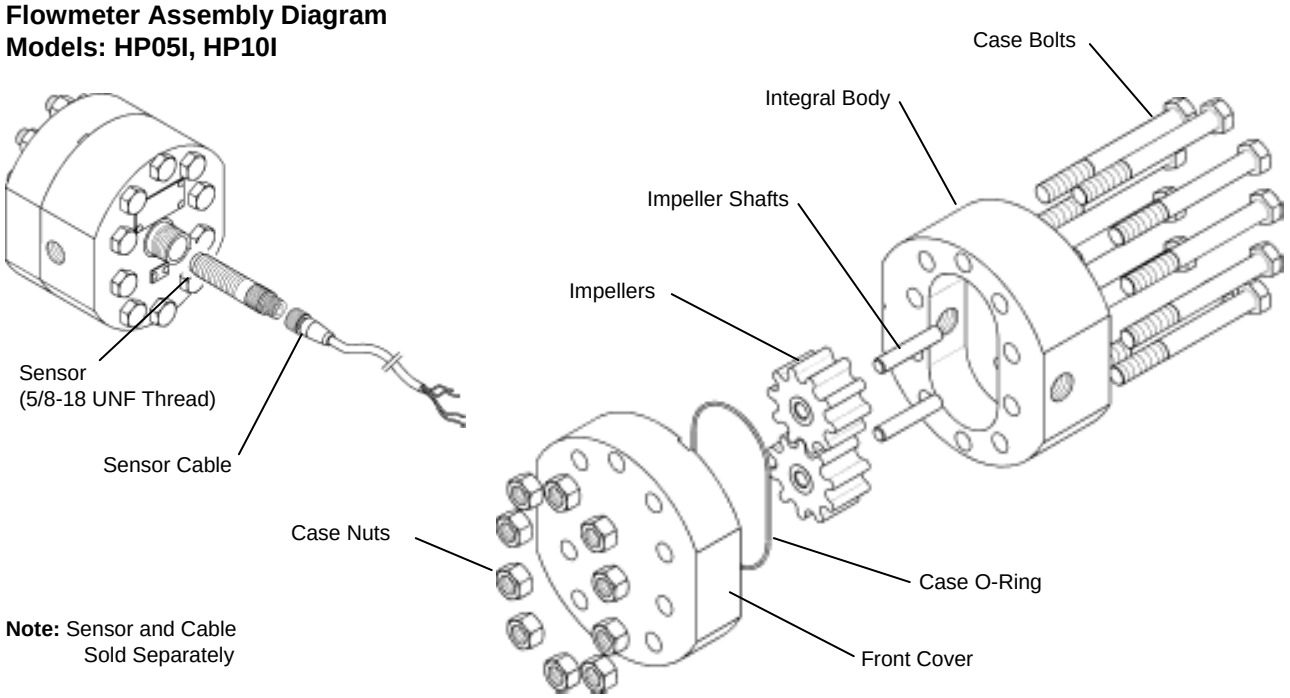
WARNING
Completely assemble the flowmeter AND install the sensor before pressurizing the lines.

Reassembly

1. **Install Impellers -** Carefully slide the impellers onto the impeller shafts. **Orient the impellers so the serial numbers are facing into the front cover.** The magnet side of the impellers must be facing the sensor side of the meter.
2. **Install Case O-ring -** Insert a NEW case o-ring into the o-ring groove in the front cover. Make sure the case o-ring is completely set in the groove. A lubricant, which is compatible with both the case o-ring material and process fluid, may be used to help the case o-ring stay in the groove during assembly.
3. **Mount Front Cover -** Carefully mount the front cover/shaft assembly onto the integral body making sure the impeller shafts set properly into the rear of the integral body. Hold the case o-ring in the groove. Do not install the case bolts until the case o-ring is set properly to avoid damaging the o-ring.
4. **Install Case Bolts and Nuts -** Slide the case bolts into the flowmeter. Tighten the case nuts to torque specifications below. To help ensure equal tension, go around the face of the meter tightening every other nut; then tighten remaining nuts. For standard 3000 psi meters, see torque values listed below. For other pressures and all specials, use the torque value engraved on the meter's nameplate.
5. **Install Sensor -** Screw the sensor into the sensor opening on the back of the flowmeter. **FINGER TIGHTEN ONLY** or damage to the sensor or flowmeter may occur. Do not allow the wires on sensors with integral cables to become severely twisted during assembly. **The sensor should remain in place any time the meter is pressurized.**
6. **Attach Sensor Cable (If applicable) -** Plug the cable into sensor and tighten.
7. **Inspect for leaks -** Test the system for leaks. If the process fluid is of a hazardous nature, consider using a different fluid during initial leak testing.

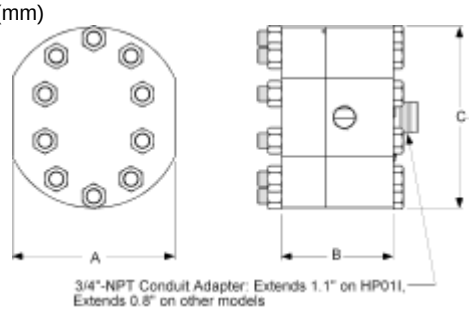
Basic Model	Nominal Size	Maximum Flow Rate		Recommended Mesh Size		Weight		Bolt Torque			
								3000 psi		6000 psi	
	Standard Connection	GPM	L/min	Mesh	Particle Dia.	lbs	kg	ft-lb	N-m	ft-lb	N-m
HP05I	1/2" NPT	12	45.40	80	0.007"	22	10	29	39.4	58.6	79.4
HP10I	1" NPT	25	94.60	60	0.009"	45	20	48	65	90	122

Flowmeter Assembly Diagram
Models: HP05I, HP10I



Note: Sensor and Cable Sold Separately

Dimensions
Inches (mm)



Model	A (NPT)	B	C
HP05I	5.4 [137]	2.7 [69]	6.0 [152]
HP10I	7.0 [178]	3.9 [99]	7.5 [191]

Replacement Part Ordering
Models: HP05I, HP10I

Front Cover
w/ Shafts **HP □□ I - 2AF – □□ - □□□**

Impeller Sets (serial number required)
DC □□ G - 4S5NS – □□ - □□□

Nominal Size
05 10

Material No. (See Material Guide)
Special Designator (000 for Standard)

Hardware

Nom. Size	O-Ring	Case Bolts & Case Nuts	
05	55-044-□□	50-18C39H-55	51-18CS-55 (qty=10)
10	55-048-□□	50-18C44H-55	51-18CS-55 (qty=10)

Material No.
(See Material Guide)

Consult factory for nonstandard specifications

Troubleshooting

Most flowmeter operation problems can be solved by carefully reviewing this manual. Some specific problems are listed below. Review all of the possible causes and solutions since some difficulties are caused by a combination of problems and may require multiple solutions. **Operating your flowmeter with liquids or conditions other than those specified can reduce its accuracy, can damage the flowmeter and may void your warranty.** Consult your sales representative **BEFORE** changing operating conditions.

If your problem is beyond the scope of this manual, or if you need assistance of any kind, contact your sales representative or Flow Technology at **1-800-528-4225**. When calling for technical please have the following information available so we may better assist you:

- Flowmeter model number and serial number (See nameplate)
- Date of flowmeter purchase and installation
- Current fluid application
- Flow controls used

WARNING: Before disassembling the flowmeter, depressurize any of the lines connected to the meter. A small amount of fluid will remain in the flowmeter and will leak out when it is opened. Take any precautions necessary to deal with this fluid. Failure to heed this warning may result in serious bodily injury.

Symptom	Possible Cause	Solution
Flow is restricted.	Impellers are jammed.	Debris may be caught in the impellers. If so, open the flowmeter and remove it. Also, make sure that an appropriately sized filter is located upstream from the flowmeter. Temperature changes or chemical incompatibility may cause the impellers to jam. If you suspect this, call Flow Technology.
	Pressure drop across flowmeter is too high.	Call sales representative or Flow Technology for assistance. Flowmeter size may need to be increased. Pump pressure may be increased as long as the pressure rating of the meter is not exceeded and the pressure drop is less than 100psi.
	Too much torque on bolts.	Refer to the Torque Tables. Depressurize meter and take precautions to deal with leaks. Reduce torque until impellers spin freely.
Fluid flowing but there is no output signal	Bent Impeller shafts.	Consult Flow Technology for replacement part(s).
	Instrumentation is improperly setup.	First, confirm that all wiring is properly connected. Then, review the technical manual(s) supplied with the instrumentation for trouble-shooting procedures.
	Pickoff is not screwed into the flowmeter properly	Unscrew the pickoff and make sure that the pickoff hole is clear of any dirt and debris. Screw the pickoff back in. **FINGER TIGHTEN ONLY**; over tightening can damage the pickoff and/or the flowmeter.
	Pickoff is malfunctioning.	Install spare pickoff, if available. Call your sales representative or Flow Technology. Improper wiring, jolts or extreme temperatures can damage the pickoff.
	Impellers installed backwards.	Confirm that the impellers are oriented properly. The magnets imbedded in the impellers must be facing the pickoff side of the flowmeter.
	Flow rate is too low.	Increase flow rate or check to see if the fluid application has changed. If the application has changed, consult with your sales representative or Flow Technology.
	No back pressure.	Verify that there is at least 5psi back pressure on the flowmeter. See Flowmeter Orientation.
Flowmeter is giving inaccurate readings.	Instrumentation is improperly set up.	Review the technical manual(s) supplied with the instrumentation to verify setup. Confirm that instrumentation is using K-Factor stamped on the nameplate of the flowmeter.
	K-Factor is not correct.	If error is consistent, use this formula to calculate new/corrected K-Factor. (Indicated Flow)/(Actual Flow) x (K-Factor) = (New K-Factor)
	Pickoff wire is receiving interference.	Interference can be caused by electrical devices placed too close to the pickoff wire or by not properly grounding the shield on the pickoff cable or pickoff shield wire.
	Impellers are dragging.	Too much torque may be on bolts (*refer to Flow is restricted*). Temperature changes or chemical incompatibility may cause the impellers to drag. If you suspect this, call Flow Technology.
Flow rate is not steady through the flowmeter	Flowmeter outlet is not pressurized.	Pressurize the downstream side of the flowmeter or lengthen the pipe between the flowmeter and the pipe outlet.
	Reciprocating pump, or pump producing an unsteady flow.	Lengthen the pipe between the flowmeter and the pump, move the flowmeter to a different location in the system, add mechanical dampeners between the pump and flowmeter, incorporate the Flow Technology Dampening System or change the pump type.
	The flow rate is too low	Change controller window time to a higher number or reduce the significant figures being displayed on the controller (for Flow Technology controls).

Material Guide		
	Material	**Code**
Shaft	316 Stainless Steel	06
	Tungsten Carbide	54
O-Ring	Viton (food grade)	20
	Viton (industrial)	21
	Buna N (food grade)	25
	Buna N (industrial	26
	Chemraz	29
	EPDM	23
	Teflon (PTFE)	24
Impeller	UHMWPE	10
	PPS	42
	Teflon (PTFE)	90
	HTC	49

Flowmeter Notes

Flowmeter Model No.: _____ Installation Date: _____

Flowmeter Serial No.: _____

Flowmeter Tag No.:_____

Liquid Description:_____

Viscosity: _____ cP / cstk / SSU at _____ F Specific Gravity_____

PH _____ % Solids _____ which pass through _____ mesh screen

Flow Rate (gal/min): Min _____ Max Norm _____ ☐ Steady ☐ Variable

Temperature (F): Min _____ Max _____ Norm _____ Time at Max_____

Pressure (psig): Min _____ Max Norm _____ Max allowable drop _____

Clean-in-Place: ☐ Yes ☐ No Liquid _____ Rate (gal/min) _____ Temp (F)_____ Time_____

Piping Size _____ Material_____ End Fitting _____ Sch_____

Flow Source: ☐ Positive Displacement Pump ☐ Centrifugal Pump ☐ Metering Pump

(please check) ☐ Tank (Gravity feed) ☐ Diaphragm Pump ☐ Other _____

Intended use of output signal: ☐ Rate Display ☐ Batch Control ☐ Totalize ☐ Mass Flow Control

(please check) ☐ Record ☐ Transmit 4-20 mA ☐ Transmit (Specify)_____

☐ Computer Interfacce (Specify) _____

Enclosure: NEMA Type # _____ ☐ Panel ☐ Wall Mount

Hazardous Environment: ☐ Yes ☐ No Class _____ Div _____

Comments:

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