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CONTENTS

1. Introduction

The following information is provided for the proper installation and maintenance of your instrument.

2. Specifications

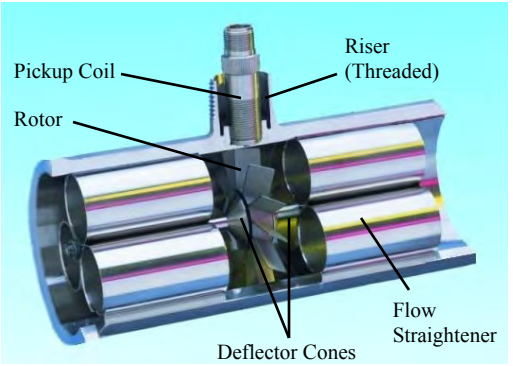
Over-range:	150% of maximum flow (intermittently)
Turn Down Range:	10:1
Linearity:	±0.5% of reading typical
Repeatability:	±0.1% of reading over repeatable range
Temperature Range:	-268 to 232°C (-450 to 450°F)
End Fittings:	Standard: NPT
	Optional: MS flared and flanged styles
Bearing Styles:	Self lubricating, ceramic hybrid ballbearings
Materials:	316/316L dual rated stainless steel with 17.4 pH rotor.
	Consult OMEGA Flow Engineering for other available materials.

3. Model Number

Model No.	Fittings	Linear Flow Range Water		Max Operating Pressure	Max Pressure Drop	Length mm (in)	Nominal K-Factor Pulses/Gal	Weight kg (lb)
		LPM	GPM					
FTB-101	½ MNPT	1.32 to 13.2	0.35 to 3.5	5000 psig	3.0 psid	62 (2.45)	13,000	0.4 (1)
FTB-102	½ MNPT	2.84 to 28.4	0.75 to 7.5	5000 psig	5.0 psid	62 (2.45)	10,000	0.4 (1)
FTB-103	½ MNPT	4.73 to 36	1.25 to 9.5	5000 psig	5.2 psid	62 (2.45)	6,000	0.4 (1)
FTB-104	¾ MNPT	6.62 to 61	1.75 to 16	5000 psig	3.0 psid	70 (2.75)	4,100	0.4 (1)
FTB-105	¾ MNPT	9.5 to 110	2.5 to 29	4250 psig	5.0 psid	83 (3.25)	2,200	0.4 (1)
FTB-106	1 MNPT	15 to 227	4 to 60	3850 psig	5.1 psid	89 (3.5)	640	0.9 (2)
FTB-107	1¼ MNPT	23 to 352	6 to 93	3850 psig	4.3 psid	99 (3.88)	410	0.9 (2)
FTB-108	1½ MNPT	30 to 492	8 to 130	3000 psig	3.0 psid	111 (4.38)	230	1.4 (3)
FTB-109	2 MNPT	57 to 852	15 to 225	2500 psig	3.3 psid	121 (4.75)	120	1.8 (4)
FTB-110	2½ MNPT	95 to 1514	25 to 400	2250 psig	4.0 psid	154 (6.06)	62	2.3 (5)
FTB-111	3 MNPT	151 to 2460	40 to 650	2000 psig	4.0 psid	191 (7.50)	55	3.2 (7)

Model No.	37° Flare Fitting Size	Linear Range Water	Max Operating Pressure	Length	Nominal K-Factor pulses/gal	Weight kg (lb)
FTB-201	3/4-16 UNF-3A	0.35 to 3.5 GPM	5000 psi	62 mm (2.45")	13,000	0.4 kg (1 lb)
FTB-202	3/4-16 UNF-3A	0.75 to 7.5 GPM	5000 psi	62 mm (2.45")	10,000	0.4 kg (1 lb)
FTB-203	3/4-16 UNF-3A	1.25 to 9.5 GPM	5000 psi	62 mm (2.45")	6,000	0.4 kg (1 lb)
FTB-204	7/8-14 UNF-3A	1.75 to 16 GPM	5000 psi	70 mm (2.75")	4,100	0.4 kg (1 lb)
FTB-205	1-1/16-12 UNF-3A	2.5 to 29 GPM	5000 psi	83 mm (3.25")	2,200	0.4 kg (1 lb)
FTB-206	1-15/16-12 UNF-3A	4 to 60 GPM	3500 psi	89 mm (3.50")	640	0.9 kg (2 lb)
FTB-207	1-5/8-12 UNF-3A	6 to 93 GPM	3000 psi	99 mm (3.88")	410	0.9 kg (2 lb)
FTB-208	1-7/8-12 UNF-3A	8 to 130 GPM	2250 psi	111 mm (4.38")	230	1.4 kg (3 lb)
FTB-209	2-1/2-12 UNF-3A	15 to 225 GPM	1750 psi	121 mm (4.75")	120	1.8 kg (4 lb)

4. Principal of Operation



The turbine flow sensor consists of a rotor assembly which is supported on a shaft held in place by triple tube clusters and secured with locking nuts within the flowmeter housing.

The rotor is free to spin on a self lubricated ceramic ball bearing. A magnetic type pickup coil is attached on the exterior of the flowmeter housing.

A low mass rotor design allows for rapid dynamic response. The deflector cones eliminate downstream thrust on the rotor and allows for dynamic positioning of the rotor between deflector cones.

The dynamic positioning of the low mass rotor provides wider rangeability and longer bearing life than that of conventional turbine flowmeters. Integral flow straightening tubes minimize the effects of upstream flow turbulence.

As the liquid flows through the flowmeter the rotor spins at rate proportional to the volumetric liquid flowrate.

Each rotor blade passing through the pickup coil generates an electrical pulse. The frequency of the pulses is proportional to flowrate. The summation of pulses represents total amount of liquid volume passed through the meter.

The number of pulses generated per unit of volume is called the calibration factor or K-Factor. This calibration factor is used to calculate flowrate and total amount of flow.

Material Selection and Construction

The housing is made of 316 stainless steel. The rotor is made of 17.4 pH stainless steel. Bearings are shielded, ceramic hybrid ball bearings and are made of 440C stainless steel. Bearings are self lubricating type and do not require any external lubrication.

Flowmeter Calibrations

The standard calibration provided with an Omega turbine flowmeter consists of a 10-point water calibration that is traceable to NIST. Based on this water calibration, we derive an average k-factor for water for the flowmeter

The uncertainty of this calibration is typically 0.1%.

The K-factor on turbine flowmeters used on liquid service is NOT density dependent.

5. Installation

Inspect all packages for any indications of damage which may have occurred during shipment.

Verify that all meter parts or auxiliary components have arrived with the shipment. Refer to the packing list/invoice for a detailed list of items included in the shipment.

The flowmeter may be installed horizontally or vertically for liquid service without affecting the meter calibration.

It is required to install meter with a minimum straight run of pipe approximately 10 pipe diameters ahead of the inlet and 5 pipe diameters following the outlet.

The meter housing is marked by a flow direction arrow and the inlet is marked 'IN' and the outlet is marked 'OUT'. The meter must be installed in the piping in the correct orientation to ensure the most accurate operation.

Install meter with adequate distance and isolation from electric motors, transformers, welding equipment and solenoids to avoid any electromagnetic interference from ambient electrical field.

A typical flowmeter installation is shown below:

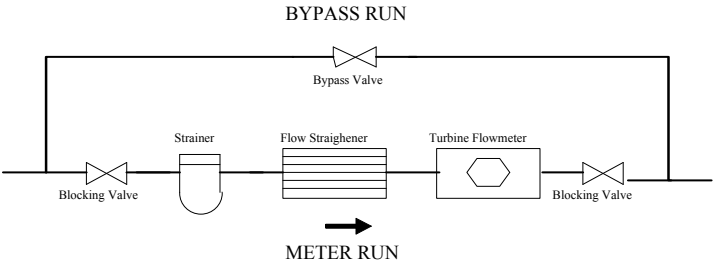


Figure 1: Typical Flowmeter Installation

Blocking and Bypass valves should be installed if it is necessary to do preventive maintenance on the flowmeter without shutting down the flow system. The Bypass valve can be opened before the Blocking valves allowing the flow to continue while removing the turbine flowmeter for service.

IMPORTANT:	*All flow lines should be purged prior to installing the meter. To prevent possible damage to the meter, install the meter **ONLY** in flow lines that are clean and free of debris.*

Upon initial start-up of the system a spool piece should be installed in place of the flowmeter so that purging of the system can be performed to remove all particle debris which could cause damage to the meter internals.

CAUTION:	*Avoid over-spinning the meter. Over-spinning the meter may cause damage to the meter internals and lead to needless meter failure.*

To maintain an accurate flow measurement it is necessary to maintain a downstream pressure sufficient to prevent flashing/cavitation. Flashing of the liquid will result in an indication of flow significantly higher than the actual flow. In order to eliminate this condition adequate downstream pressure must be maintained. The minimum required downstream pressure may be calculated using the following equation:

$$\text{MinimumPressure} = (2 \times \text{PressureDrop}) + (1.25 \times \text{VaporPressure})$$

Downstream pressure may be maintained by a downstream valve that provides the necessary downstream pressure to prevent flashing/cavitation in the metering run.

STRAINERS/FILTERS

Turbine flowmeters are designed for use in a clean fluid service. However, the service fluid may carry some particulate material which would need to be removed before reaching the flowmeter. Under these conditions a strainer/filter may be required to reduce the potential hazard of fouling or damage that may be caused by foreign matter. Strainer/filters are recommended to be used.

METER SIZE	MESH SIZE	PARTICLE SIZE (Maximum)
MF Series	100	.0055
¼" to ½"	100	.0055
$^{5}/_{8}$" to 1¼"	70	.008
1½" to 3"	40	.015
4" to 12"	24	.028

If a strainer/filter is required in the system, it should be located upstream of the flowmeter taking care that the proper minimum distance is kept between the strainer and flowmeter.

6. Maintenance and Troubleshooting

Pickup Coil Testing

Testing the pickup coil requires measuring the resistance with an ohmmeter.

1. Measure the resistance between pin A and pin B. The resistance should be approximately as listed in the following table.

2. The resistance from any pin to the case should be greater than 1 mega Ohm.

Table A - DC Resistance of some common coils

COIL	DC RESISTANCE (Ohms)
PC13-110G	1800 ±10%
PC13-70G	1800 ±10%
PC13-74G	1800 ±10%
PC13-74S	1850 ±15%
PC24-45G	1350 ±10%
PC24-45S	1850 ±15%
PC28-13G	120 ±20%
PC28-14G	180 ±20%

If either resistance measurement fails, replace the pickup coil. When installing a coil, make sure to firmly seat the coil in the flowmeter housing.

Bearing Testing

It is recommended that the bearings be replaced if any signs of wear are apparent. An unexplained shift in the output accuracy could be a sign of worn bearings.

CAUTION: *If bearings are allowed to operate without replacement at the recommended interval, the accuracy of the device may drift from the original calibration and if left long enough severe damage to the rotor and/or internals may occur.*

The shielded, self lubricating 440c SS ball bearings may be changed in the field.

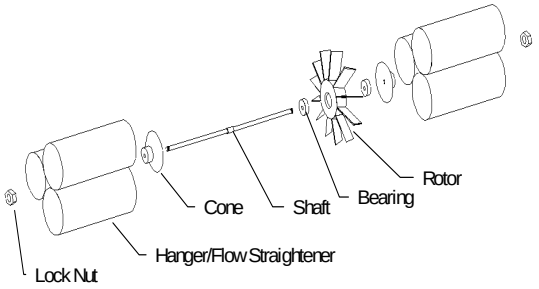


Figure 1 Exploded View - Flowmeter Internals

Bearing Replacement

1. Move the flowmeter to a clean stable work surface.
2. Using two “Spin-Tite” wrenches, remove one lock nut from the shaft.
3. Place a small head stove bolt in a vise. Guide the bolt head gently through one of the hanger/flow straightener tubes and in a smooth firm stroke remove the hanger from the housing.
4. With the shaft placed vertically downward, carefully remove a cone, two bearings, and the rotor.
5. Remove the other hanger in a similar manner.
6. Examine the shaft and cones for scoring. If scoring is present, replacement is necessary.
7. Obtain new bearings of the same type from stock or the manufacturer. Discard old bearings.
8. Reassemble one hanger in the housing with the shaft, a cone, and lock nut.
9. Place the bearings into the rotor. Guide the bearings and rotor onto the shaft making sure to reassemble with the “IN” side of rotor facing the “IN” side of the housing.
10. Place the remaining cone on the shaft. Gently “rattle” the flowmeter to seat the internals on the shaft.
11. When properly seated, gently push the hanger onto the shaft. Be sure to properly align the hanger on the shaft. The hangers seat against a shoulder machined into the housing.
12. Gently tighten the self-locking lock nuts until they make contact with the spring clip hanger. “Two Finger” tight on a “Spin-Tite” is more than adequate.
13. Holding the meter horizontally, gently blow into it (DO NOT use compressed air). The rotor should turn freely. With a magnetic coil the rotor should gradually slow down and then “quiver” to a stop with one of its blades aligning with the pickup coil. With a MCP (RF) coil the rotor should “coast” smoothly to a stop.
14. Clean the flowmeter assembly with ISOPROPYL ALCOHOL or an alternately approved cleaning solution.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

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

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

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

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

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of theproduct, and
3. Repair instructions and/or specific problems relative to the product.

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