

MF SERIES
Mini-Flowmeters
for Low Flow Applications

USER'S MANUAL



HP-210
January 2013

HOFFER
Flow Controls
Perfecting Measurement™

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During installation, care must be taken to select the correct interconnecting wiring drawing. The choice of an incorrect connection drawing may result in damage to the system and/or one of the components.

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1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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1 Introduction

We are proud that you have selected a Hoffer Turbine Mini-Flowmeter, the finest precision flow transducer on the market.

The Hoffer MF Series of Mini-Flowmeters are designed to meet the need for a high quality low flow measurement device for service in low to moderate viscosity clean liquids and for gas applications.

The information in this manual is provided to assist in the proper installation, use, and maintenance of your instrument.

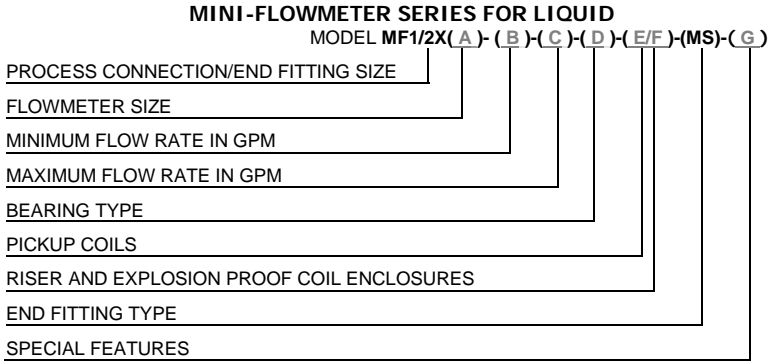
Please take a few minutes to read through this manual before installing and operating your meter. If you have any problems with the meter, refer to the maintenance and troubleshooting sections of this manual.

If you need further assistance, contact your local Hoffer Representative or contact the Hoffer Flow Controls customer service department by telephone, fax, or email for advice.

We welcome you to our growing family of satisfied customers. If you are not completely satisfied with either our product or service, we encourage you to let us know. We want to improve!

1.1 Model Number Designation

The model number of the meter describes various fittings and options.



PROCESS CONNECTION

ALL MINI-FLOWMETERS ARE 1/2", 37 DEG. MALE FLARE PER MS33656

MODEL MF1/2X(A)-()-()-()-(/)-()-()

END FITTING X (A)

- MF1/2X20B
- MF1/2X30B
- MF1/2X40B
- MF1/2X50B
- MF1/2X60B
- MF1/2X70B
- MF1/2X80B
- MF1/2X90B
- MF1/2X100B
- MF1/2X125B
- MF1/2X150B
- MF1/2X175B

MINIMUM FLOW AND MAXIMUM FLOW RATE IN GPM (LINEAR RANGE)

MODEL MF1/2X()-(B)-(C)-()-(/)-()-()

(B) <u>FLOWMETER SIZE</u>	(C) <u>MINIMUM FLOW</u>	TO	<u>MAXIMUM FLOW</u>
MF20	.015 GPM		.049 GPM
MF30	.017 GPM		.120 GPM
MF40	.020 GPM		.150 GPM
MF50	.023 GPM		.2 GPM
MF60	.025 GPM		.25 GPM
MF70	.050 GPM		.5 GPM
MF80	.075 GPM		.75 GPM
MF90	.085 GPM		.85 GPM
MF100	.1 GPM		1 GPM
MF125	.13 GPM		1.3 GPM
MF150	.2 GPM		2 GPM
MF175	.3 GPM		3 GPM

BEARING TYPE

MODEL MF1/2X()-()-()-(D)-(/)-()-()
 TURBINE SIZES OPTION (D)

MF1/2X20B	(PB) (C) (T)	CERAMIC HYBRID BALL BEARING, SELF LUBRICATING HARD CARBON COMPOSITE SLEEVE BEARING TUNGSTEN CARBIDE SLEEVE BEARING
MF1/2X30B	(BP) (C) (T)	CERAMIC HYBRID BALL BEARING, SELF LUBRICATING HARD CARBON COMPOSITE SLEEVE BEARING TUNGSTEN CARBIDE SLEEVE BEARING
MF1/2X40B	(BP) (C) (T)	CERAMIC HYBRID BALL BEARING, SELF LUBRICATING HARD CARBON COMPOSITE SLEEVE BEARING TUNGSTEN CARBIDE SLEEVE BEARING
MF1/2X50B	(BP)	CERAMIC HYBRID BALL BEARING, SELF LUBRICATING
MF1/2X60B	(C)	HARD CARBON COMPOSITE SLEEVE BEARING
MF1/2X70B	(T)	TUNGSTEN CARBIDE SLEEVE BEARING
MF1/2X80B	(BP)	CERAMIC HYBRID BALL BEARING, SELF LUBRICATING
MF1/2X90B	(C)	HARD CARBON COMPOSITE SLEEVE BEARING
MF1/2X100B	(T)	TUNGSTEN CARBIDE SLEEVE BEARING
MF1/2X125B		
MF1/2X150B		
MF1/2X175B		

PICKUP COILS

MODEL MF1/2X()-()-()-()-(E/)-()-()
 OPTION (E)

(1M)	ONE MAG COIL
(1MC3PA)	ONE RF COIL
(1MC2PAHT)	ONE HIGH TEMP RF COIL
(1HTM)	HIGH TEMP MAG COIL
(1ISM)	ONE INTRINSICALLY SAFE MAG COIL, NORTH AMERICA
(1ISM-ATEX)	ONE ISM ATEX COIL
(1RPMXXX)	ONE REDI-PULSE MAG COIL
(1RPRXXX)	ONE REDI-PULSE RF COIL
(1DMXXX)	ONE REDI-PULSE INTRINSICALLY SAFE MAG COIL
(1DRXXX)	ONE REDI-PULSE INTRINSICALLY SAFE RF COIL
(-ATEX)*	WHEN ANY COIL IS GOING TO HAVE AN ATEX ENCLOSURE MOUNTED ON THE FLOWMETER ADD (-ATEX) AFTER THE COIL PART NUMBER. (THE COIL NEEDS TO BE MODIFIED TO FIT INTO A 3/4" RISER WELDED TO THE BODY REQUIRED BY ATEX)
	<u>*OPTIONAL SPECIAL TOOL</u> IN ORDER TO REPLACE THE COIL IN THE FIELD, A SPECIAL WRENCH IS REQUIRED TO REPLACE THE COIL.
(-P*)	PIGTAIL OR FLYING LEADS, ADD -P AND THE *LENGTH OF LEADS AFTER ANY COIL EXCEPT THE HIGH TEMPERATURE COILS.

RISER AND EXPLOSION PROOF COIL ENCLOSURES

MODEL MF1/2X()-()-()-()-(/E)-()-()

OPTION (F)

- (X) 1" MNPT RISER, WELDED TO BODY
- (X-ATEX) 3/4" MNPT RISER, WELDED TO BODY
- (XE2) 1" MNPT RISER WITH E2 ENCLOSURE*
INCLUDES STOCK #300-8375 1"X3/4" ADAPTER
- (X-ATEX)E2 3/4" MNPT RISER WITH E2 ENCLOSURE*
- (X8S) 8" LONG S/S 1" MNPT RISER
FOR FLUID TEMPERATURES BELOW-40°F (-40°C) OR ABOVE
+140°F (+60°C)
- (X8S-ATEX) 8" LONG S/S 3/4" MNPT RISER FOR FLUID TEMPERATURES BELOW-40°F
(-40°C) OR ABOVE +140°F (+60°C)

*NOTES: EXPLOSION-PROOF/FLAME-PROOF ENCLOSURE WITH 3/4" FNPT MOUNT AND 3/4" CABLE ENTRY

- FM: CLASS I, DIV. 1, GR. ABCD, CLASS II/III, DIV. 1, GR. EFG, TYPE 4X
- CSA: CLASS I, DIV. 1, GR. ABCD, CLASS II, DIV 1, GR. EFG, CLASS III,
TYPE 4X EX D IIC, CLASS I, ZONE 1, IP 66
- ATEX: EX II 2GD Ex d tD IIC, IP66/68
- IEC: EX D IIC IP68

FOR UL LISTED ENCLOSURE CONTACT FACTORY

PROCESS CONNECTION/END FITTING TYPE

MODEL MF1/2X()-()-()-()-(/)-(MS)-()

OPTION

- (MS) ALL MINI-FLOWMETERS ARE 1/2", 37 DEG. MALE FLARE PER MS33656
- (1/4-TS) 1/4" TUBE STUB
- (1/2-TS) 1/2" TUBE STUB

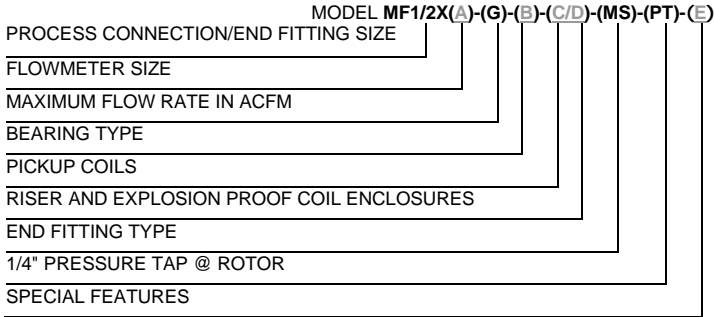
SPECIAL FEATURES

MODEL MF1/2X()-()-()-()-(/)-()-(G)

OPTION (G)

- (6W) HIGH PRESSURE UNITS, OVER 1000 PSIG TO MAX OF 6000 PSIG*
- (6CW) CRYOGENIC SERVICE
RATED TO 6000 PSIG AND CLEANED FOR LOX SERVICE*
- (CE) CE MARK REQUIRED FOR EUROPE
- (PED-CE) PED REQUIRES THAT BOTH THE OPERATING PRESSURE AND TEMPERATURE
MUST BE KNOWN AND ENTERED ON THE ORDER. THIS INFORMATION
WILL BE MARKED ON THE HOUSING TO MEET PED REQUIREMENTS.
- (SEP-CE) SOUND ENGINEERING PRACTICE.
- (SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL
NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP.
*WELDED CAP-MINI MUST BE RETURNED TO THE FACTORY FOR
REPAIR – **NOT FIELD REPAIRABLE.**

MINI-FLOWMETER SERIES FOR GAS



PROCESS CONNECTION

ALL MINI-FLOWMETERS ARE 1/2", 37 DEG. MALE FLARE PER MS33656

MODEL MF1/2X(A)-()-()-(/)-()-()

END FITTING X (A)

- MF1/2X30B
- MF1/2X50B
- MF1/2X80B
- MF1/2X90B
- MF1/2X125B
- MF1/2X175B

MAXIMUM FLOW RATE IN ACFM

MODEL MF1/2X()-(G)-()-(/)-()-()

OPTION

(G) RATE IS DETERMINED BY THE GAS SIZING PROGRAM BY SALES

BEARING TYPE

MODEL MF1/2X()-()-(B)-(/)-()-()

TURBINE SIZES OPTION (B)

- MF1/2X30B (SB) STAINLESS STEEL BALL BEARING, SELF LUBRICATING
- MF1/2X50B (SB) STAINLESS STEEL BALL BEARING, SELF LUBRICATING
- MF1/2X80B (SB) STAINLESS STEEL BALL BEARING, SELF LUBRICATING
- MF1/2X90B (SB) STAINLESS STEEL BALL BEARING, SELF LUBRICATING
- MF1/2X125B
- MF1/2X175B

PICKUP COILS

MODEL MF1/2X()-()-()-(C /)-()-()-()

OPTION (C)

- (1M) ONE MAG COIL
- (1MC3PA) ONE RF COIL
- (1MC2PAHT) ONE HIGH TEMP RF COIL
- (1ISM) ONE INTRINSICALLY SAFE MAG COIL, NORTH AMERICA
- (1ISM-ATEX) ONE ISM ATEX COIL
- (1RPRXXX) ONE REDI-PULSE RF COIL
- (1DRXXX) ONE REDI-PULSE INTRINSICALLY SAFE RF COIL
- (-ATEX)* WHEN ANY COIL IS GOING TO HAVE AN ATEX ENCLOSURE MOUNTED ON THE FLOWMETER ADD (-ATEX) AFTER THE COIL PART NUMBER. **(THE COIL NEEDS TO BE MODIFIED TO FIT INTO A 3/4" RISER WELDED TO THE BODY REQUIRED BY ATEX)**
- *OPTIONAL SPECIAL TOOL
IN ORDER TO REPLACE THE COIL IN THE FIELD, A SPECIAL WRENCH IS REQUIRED TO REPLACE THE COIL.
- (-P*) PIGTAIL OR FLYING LEADS, ADD -P AND THE *LENGTH OF LEADS AFTER ANY COIL EXCEPT THE HIGH TEMPERATURE COILS.

RISER AND EXPLOSION PROOF COIL ENCLOSURES

MODEL MF1/2X()-()-()-(/ D)-()-()-()

OPTION (D)

- (X) 1" MNPT RISER, WELDED TO BODY
- (X-ATEX) 3/4" MNPT RISER, WELDED TO BODY
- (XE2) 1" MNPT RISER WITH E2 ENCLOSURE*
INCLUDES STOCK #300-8375 1"X3/4" ADAPTER
- (X-ATEX)E2 3/4" MNPT RISER WITH E2 ENCLOSURE*
- (X8S) 8" LONG S/S 1" MNPT RISER
FOR FLUID TEMPERATURES BELOW-40°F (-40°C) OR ABOVE +140°F (+60°C)
- (X8S-ATEX) 8" LONG S/S 3/4" MNPT RISER FOR FLUID TEMPERATURES BELOW-40°F (-40°C) OR ABOVE +140°F (+60°C)
- *NOTES: EXPLOSION-PROOF/FLAME-PROOF ENCLOSURE WITH 3/4" FNPT MOUNT AND 3/4" CABLE ENTRY
- FM: CLASS I, DIV. 1, GR. ABCD, CLASS II/III, DIV. 1, GR. EFG, TYPE 4X
- CSA: CLASS I, DIV. 1, GR. ABCD, CLASS II, DIV 1, GR. EFG, CLASS III, TYPE 4X EX D IIC, CLASS I, ZONE 1, IP 66
- ATEX: EX II 2GD Ex d tD IIC, IP66/68
- IEC: EX D IIC IP68

FOR UL LISTED ENCLOSURE CONTACT FACTORY

PROCESS CONNECTION/END FITTING TYPE

MODEL MF1/2X()-()-()-()-(/)-(MS)-()-()

OPTION

(MS) ALL MINI-FLOWMETERS ARE 1/2", 37 DEG. MALE FLARE PER MS33656
 (1/4-TS) 1/4" TUBE STUB
 (1/2-TS) 1/2" TUBE STUB

PRESSURE TAP @ ROTOR

MODEL MF1/2X()-()-()-()-(/)-()-(PT)-()

OPTION

(PT) 1/4" PRESSURE TAP @ ROTOR

SPECIAL FEATURES

MODEL MF1/2X()-()-()-()-(/)-()-()-(E)

OPTION (E)

(6W) HIGH PRESSURE UNITS, OVER 1000 PSIG TO MAX OF 6000 PSIG*
 (6CW) CRYOGENIC SERVICE RATED TO 6000 PSIG AND CLEANED FOR LOX SERVICE.*
 (CE) CE MARK REQUIRED FOR EUROPE (PED-CE)
 (PED-CE) PED REQUIRES THAT BOTH THE OPERATING PRESSURE AND TEMPERATURE MUST BE KNOWN AND ENTERED ON THE ORDER. THIS INFORMATION WILL BE MARKED ON THE HOUSING TO MEET PED REQUIREMENTS.
 (SEP-CE) SOUND ENGINEERING PRACTICE
 (SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP.
 *WELDED CAP-MINI MUST BE RETURNED TO THE FACTORY FOR REPAIR – **NOT FIELD REPAIRABLE.**

1.2 Specification

Linearity: $\pm 1.0\%$ of reading over 10:1 flow rangeRepeatability: $\pm 0.25\%$ of reading

Flow Ranges:

Liquid Applications: 0.02 to 3.5 GPM w/ MAG pickup in 10:1 turndown
 0.007 to 3.5 GPM w/ MCP pickup in 25:1 turndown

Gas Applications: 0.005 to 1 ACFM w/ MCP pickup; turndown
 dependent on gas density

Temperature Range: -450 °F to +450 °F

Output: Dependent on pickup coil selected

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2 Operation

2.1 Principle

The Hoffer MF Series has been developed to meet the need for a low flow measurement device for use with low to moderate viscosity clean liquids and for gas measurement applications.

The MF Series is a family of low flow rate measurement devices whose design is based on a Pelton Wheel-like rotor. The measured fluid is directed tangentially through a velocity nozzle against the rotor causing it to spin. The pickup coil senses the spinning motion of the rotor through the housing and converts it into a pulsing electrical signal. Summation of the pulsing electrical signal relates directly to the total flow, while the frequency is related to the flow rate.

2.2 Precautions

- ◆ Do not drop the meter. Dropping the meter may result in damage to the meter housing and/or internals.
- ◆ Do not operate the meter at flowrates greater than the maximum flowrate marked on the meter. Operating at flowrates greater than the maximum flowrate may over-spin the meter. Over-spinning may result in damage to the meter.

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

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3 Installation

Upon receipt of the flowmeter carefully inspected it, checking for any indications of damage which may have occurred during shipment. Inspect all packing material carefully for parts or components which may have been packed with the shipment. Refer to the packing list/invoice for a detailed list of items included in the shipment.

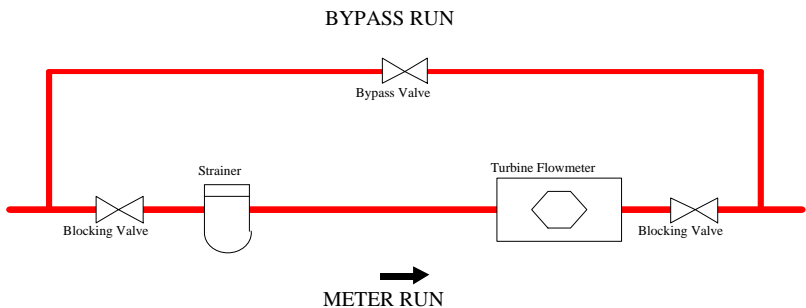
3.1 General Piping

The MF Series Flowmeters are capable of sensing fluid flow in one direction only. The meter housing is marked by a flow direction arrow to indicate the direction of flow through the meter. The meter must be installed in the piping in the correct orientation to ensure the most accurate and reliable operation. Care should be taken in the proper selection of the mating fittings. Size, type of material, and pressure rating should be the same as the flowmeter supplied.

When it is expected that flow will be intermittent, the meter should not be mounted at a low point in the piping system. Solids which settle or congeal in the meter may affect meter performance.

In order to achieve optimum electrical signal output from the flowmeter, due consideration must be given to its isolation from ambient electrical interference such as nearby motors, transformers, and solenoids.

A typical flowmeter installation is shown below:



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 are closed allowing the flow to continue while removing the turbine flowmeter for service.

12 Installation

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. In applications where meter flushing is required after meter service, care should be taken as to not over-spin the meter, as severe meter damage may occur.

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

3.2 Strainers/Filters

The MF Series 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.

METER SIZE	MESH SIZE	PARTICLE SIZE (Maximum)
MF Series	100	.0055
¼" to ½"	100	.0055
⅝" to 1¼"	70	.008
1½" to 3"	40	.015

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.

3.3 Installation Kits

Installation kits for the Hoffer MF Series Flowmeter consist of two lengths of appropriate tubing cut to a length appropriate for the upstream and downstream straight pipe run with appropriate end fittings.

4 Maintenance

4.1 General

Preventive maintenance for the MF Series mini-flowmeter consists of a thorough general inspection. Remove the meter from the service line and take to a clean work area. Use the following procedures and exploded component views to remove, inspect, and reinsert the flowmeter internals.

4.2 Disassembly

1. Hold the Mini-Flowmeter securely using a vise. Meter orientation should be such that the threaded plug is facing up. Use extreme care not to damage the meter housing or piping connections when placing in the vise.
2. Using a large-blade screwdriver, turn the plug counterclockwise to remove.
3. To remove the shaft assembly, carefully thread a 10-32 screw into the hole provided in insert. Thread the screw into the insert until it bottoms out (finger tight only).
4. Turn the housing over and slowly and carefully pull the shaft assembly and internals out of the housing. Take care not to damage the shaft, rotor, and/or bearings.
5. Remove and discard the gasket/seal.

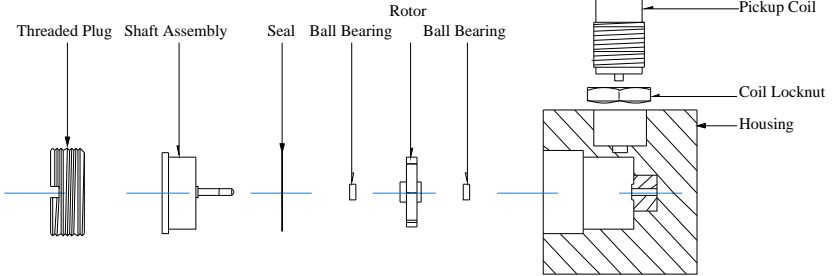
4.3 Inspection & Repair

1. Examine the flowmeter internals for signs of corrosion or fouling by foreign materials.
2. Examine the shaft, rotor, and bearings for signs of wear and/or damage.
3. If wear or damage is present, replace with new parts.

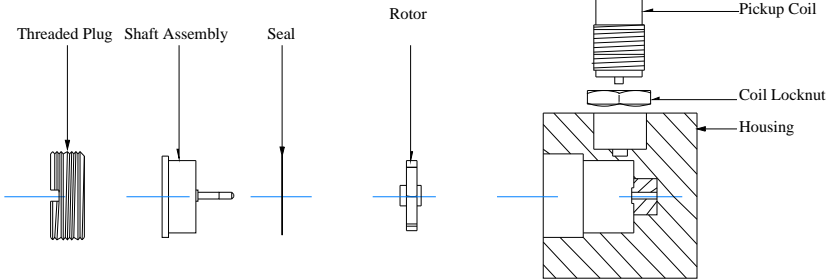
NOTE: *Clean all of the internals in an approved cleaning solution.*

14 Maintenance

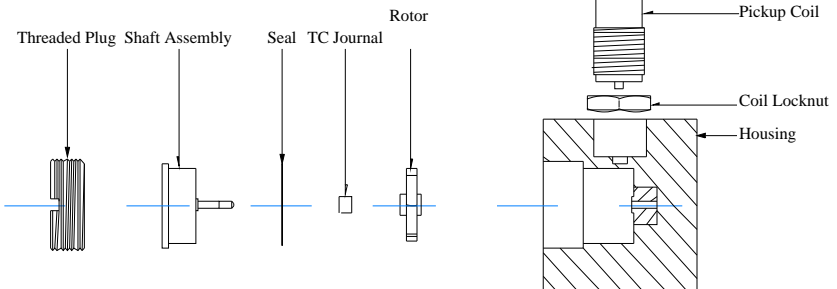
Exploded View: BB - Ball Bearing Models



Exploded View: C – Hard Carbon Bearing Models



Exploded View: TC - Tungsten Carbide Sleeve Models



4.4 Assembly

1. Install any new parts.
2. Guide the rotor and bearing assembly onto the shaft. Make sure the rotor is installed with the cup side of the Pelton wheel facing the "IN" side of the housing.
3. Place a new gasket on the insert. *Always use a new gasket.*
4. Place the shaft assembly insert, gasket, and rotor assembly back into housing by inverting the housing to keep gasket and rotor assembly in place.
5. Install the threaded plug and tighten to 50 ft-lb.

4.5 Pickup Coil Testing

Testing the MAG and MCP (RF) coils consists of measuring the resistance with an ohmmeter. Resistance measurements are to be made when there is no flow through the meter or with the coil removed from the meter housing.

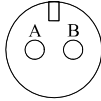
1. Measure the resistance between pin A and pin B. The resistance should be approximately as listed in the following table of some common coils.
2. The resistance from any pin to the case should be greater than 1 Mohm.

COIL*	DC RESISTANCE (Ohms)
MC2PAHT	15.0 ±10%
MCP3A	11.5 ±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%

* For specific coils not listed contact the HFC Customer Service Department for the approximate resistance readings.

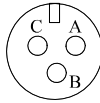
If either resistance measurement fails, replace the pickup coil. Firmly seat the new coil in the flowmeter and tighten the locking nut.

Pickup Connections



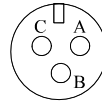
MAG

A - Signal (+)
B - Common (-)



MCP (RF)

A - Signal (+)
B - Common (-)
C - N/C



RediPulse

A - 8 - 30 Vdc
B - Common (-)
C - Pulse Output

4.6 Troubleshooting

Refer to the following troubleshooting guide for assistance with possible meter malfunctions:

TROUBLE	CAUSE	REMEDY
Fluid will not flow through the meter	<ul style="list-style-type: none"> ▪ Meter clogged. ▪ Line to meter blocked. 	Clear meter. Clear line to meter.
Reduced flow through the meter	<ul style="list-style-type: none"> ▪ Meter partially clogged. ▪ Line to meter partially blocked. 	Clear meter. Clear line to meter.
Meter readings inaccurate	<ul style="list-style-type: none"> ▪ Fluid flowrate is not within meter flow range. ▪ Meter drag due to worn or damaged parts. 	See "Specifications" for min and max flowrates. Replace worn or damaged parts.
Meter not giving pulse signal	<ul style="list-style-type: none"> ▪ Faulty pickup coil. ▪ Meter internals not turning due to worn or damaged parts. 	Replace pickup coil. Replace worn or damaged parts.

4.7 Spare Parts

The following table contains the suggested spare parts for the Hoffer MF Series flowmeters:

Item No.	Qty	Part No.	Part Description
1	1	300-#### ¹	Pickup Coil
1	1	300-#### ²	Seal/Gasket
1	1	300-#### ²	Rotor Assembly
1	1	300-#### ²	Bearings
1	1	300-#### ²	Shaft Assembly

Specific meter parts are dependent upon the meter size and model, always have the complete meter model number or serial number available when consulting the factory.

¹ Specific pick-up coil is application dependent. Consult with the factory for the correct part number. Have complete meter model number or pick-up coil model number available.

² Meter internals are ordered by the size of the meter. Consult with the factory for the correct part number. Have complete meter model number available.