Blancett®
Turbine Flow Meters

Turbine Flow Meter

Top Load 1 in. and 2 in. Meters

Badger Meter®

TRB-UM-02597-EN-01 (September 2018)

User Manual

CONTENTS

UNPACKING AND INSPECTION

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

INTRODUCTION

Designed to withstand the demands of the most rigorous flow measurement applications, the Top Load Turbine Flow Meter is reliable, rugged and cost effective. Originally developed for the secondary oil recovery market, the Top Load Turbine Flow Meter is an ideal meter for liquid flow measurement on or off the oil field.

The meter features a rugged 316 stainless steel housing, rotor shaft, and rotor support assemblies, a Buna-N O-ring, C17-4PH stainless steel rotor, and hybrid ceramic ball bearings with AMS 5898 duplex stainless steel race and stainless steel retainer.

OPERATING PRINCIPLE

Fluid entering the meter passes through the inlet flow straightener which reduces its turbulent flow pattern and improves the fluid's velocity profile. Fluid then passes through the turbine, causing it to rotate at a speed proportional to the fluid velocity. As each turbine blade passes through the magnetic field, the blade generates an AC voltage pulse in the pickup coil at the base of the magnetic pickup (see *Figure 1*). These pulses produce an output frequency proportional to the volumetric flow through the meter. The output frequency represents flow rate and/or totalization of fluid passing through the meter.

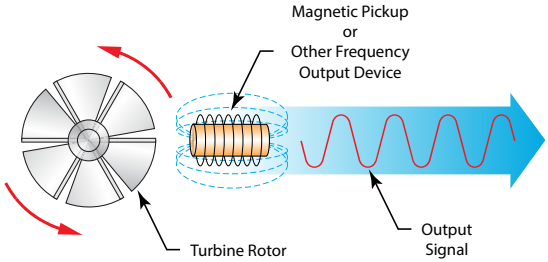

Figure 1: Schematic illustration of electric signal generated by rotor movement

PREINSTALLATION CONSIDERATIONS

All Badger Meter® Top Load Turbine Flow Meters use stainless steel construction materials. Make sure the operating fluid is compatible with these materials. Incompatible fluids can cause deterioration of internal components and cause a reduction in meter accuracy.

The measured liquid should be free of any large particles that may inhibit rotation of the turbine blades. If particles are present, install a mesh strainer upstream before operating the meter. See *Table 1* for strainer recommendations.

Part Number	Strainer Mesh	Clearance	Filter Size
B411-110	60	0.0092 in.	260 µm
B411-120	10	0.0650 in.	1.6 mm

Table 1: Strainer mesh installation details

The preferred plumbing setup is one containing a bypass line (see *Figure 2 on page 6*) that allows meter inspection and repair without interrupting flow. If a bypass line is not used, it is important that all control valves be located downstream of the flow meter (see *Figure 3 on page 6*).

⚠CAUTION

STRIKING AN EMPTY METER WITH HIGH VELOCITY FLOW STREAM CAN CAUSE DAMAGE.

⚠ATTENTION

DES DOMMAGES PEUVENT ÊTRE PROVOQUÉS EN FRAPPANT UN MÈTRE VIDE AVEC UN JET D'ÉCOULEMENT DE VITESSE ÉLEVÉE.

Remove any restriction in the flow line that may cause the liquid to flash. If necessary, install air eliminators so the meter is not incorrectly measuring entrained air or gas.

Badger Meter recommends installation of a minimum length, equal to ten (10) pipe diameters of straight pipe on the upstream side and five (5) diameters on the downstream side of the flow meter. Otherwise meter accuracy may be affected. Piping should be the same size as the meter bore or threaded port size.

Severe pulsation and mechanical vibration affect accuracy and shorten the life of the meter. If this condition is present, consider using a meter possessing superior resistance to pulsation and vibration like the Badger Meter QuikSert Inline Flow Meter. Do not locate the meter or connection cable close to electric motors, transformers, sparking devices, high voltage lines, or place connecting cable in conduit with wires furnishing power for such devices. These devices can induce false signals in the meter coil or cable, causing the meter to read inaccurately.

If problems arise with the meter, consult the *"Troubleshooting Guide" on page 11*. If further problems arise, consult the factory.

If the internal components of the meter are damaged, replace them with a turbine meter repair kit available from Badger Meter. For information pertaining to the repair kits, see *"Turbine Assembly Replacement" on page 8*.

INSTALLATION

⚠WARNING

PRESSURE IN EXCESS OF ALLOWABLE RATING MAY CAUSE THE HOUSING TO BURST AND CAUSE SERIOUS PERSONAL INJURY.

⚠ AVERTISSEMENT

LA PRESSION AU-DESSUS DE L'ESTIMATION PERMISE PEUT FAIRE ÉCLATER ET CAUSER LE LOGEMENT LE DOMMAGE CORPOREL SÉRIEUX.

1. Check the inside of the flow meter for any foreign material. Make sure the turbine rotor spins freely prior to installation. Also, check fluid lines and remove any debris found.
2. Install the flow meter with the flow arrow, etched onto the exterior of the meter body, pointing in the direction of fluid flow. Though the meter is designed to function in any position, where possible, install it horizontally with the conduit adapter facing upward.
3. Thread a magnetic pickup into the conduit adapter completely, finger tight without forcing it.
4. Install conduit or other fittings suitable for the installation area onto the conduit adapter hub on the flow meter.

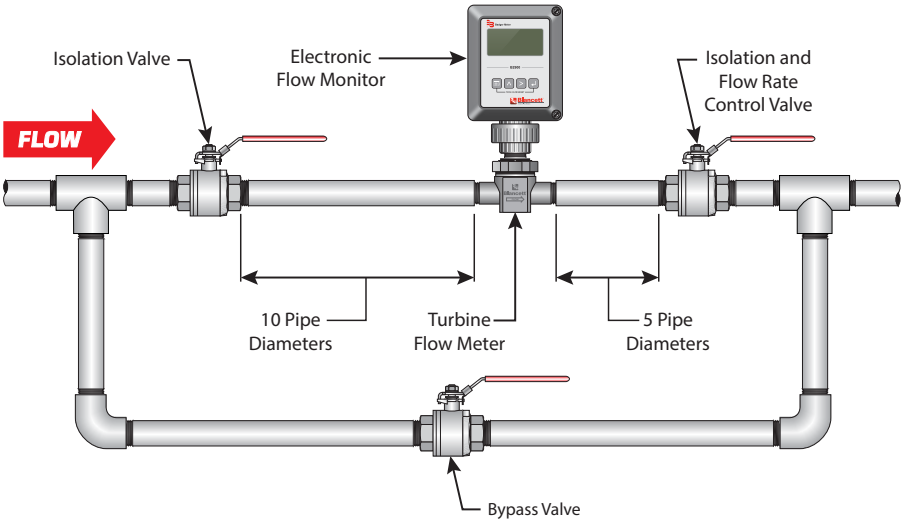

Figure 2: Meter installation with a bypass line

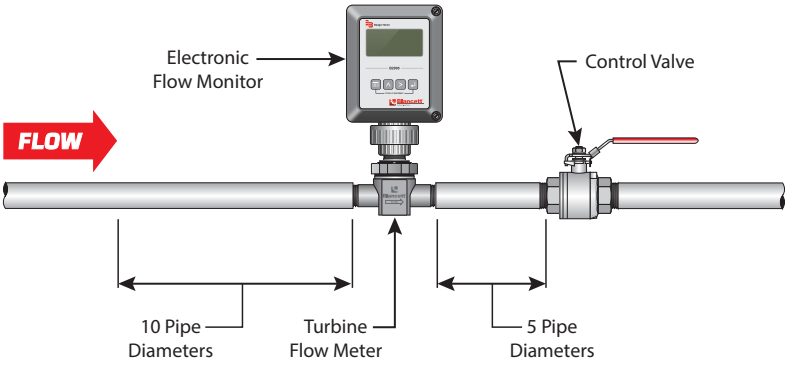

Figure 3: Meter installation without a bypass line

PRESSURE DROP CHART

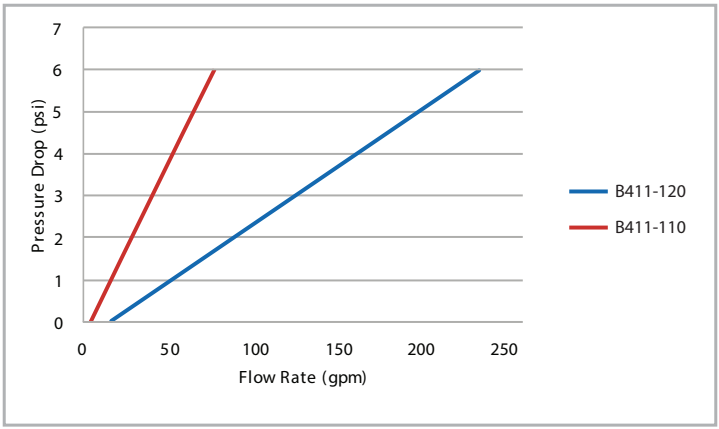

Figure 4: Pressure drop

OPERATIONAL STARTUP

Follow these steps when installing and starting the meter. After meter installation, close the isolation valves and open the bypass valve. Allow liquid to flow through the bypass valve for sufficient time to eliminate any air or gas in the flow line.

⚠WARNING

MAKE SURE TO SHUT OFF FLUID FLOW AND RELEASE PRESSURE IN THE LINE BEFORE ATTEMPTING TO INSTALL THE METER IN AN EXISTING SYSTEM.

⚠AVERTISSEMENT

ASSUREZ-VOUS QUE LE FLUX DE FLUIDE A ÉTÉ COUPÉ ET DE LA PRESSION DANS LA LIGNE A ÉTÉ LIBÉRÉE AVANT D'ESSAYER D'INSTALLER LE MÈTRE DANS UN SYSTÈME ACTUEL.

⚠CAUTION

HIGH VELOCITY AIR OR GAS MAY DAMAGE THE INTERNAL COMPONENTS OF THE METER.

⚠ATTENTION

DES DOMMAGES PEUVENT ÊTRE PROVOQUÉS EN FRAPPANT UN MÈTRE VIDE AVEC UN JET D'ÉCOULEMENT DE VITESSE ÉLEVÉE.

1. Open the upstream isolating valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.
2. Open the downstream isolating valve to permit the meter to operate.
3. Close the bypass valve to a fully closed position.
4. Adjust the downstream valve to provide the required flow rate through the meter.

NOTE: If necessary, use the downstream valve as a control valve.

TURBINE ASSEMBLY REPLACEMENT

The meter uses wear-resistant moving parts to provide trouble-free operation and long service life. Designed for easy field service of a damaged turbine assembly, the repair kits replace only the internal parts, rather than replacing the entire meter. The turbine assembly uses stainless steel alloy construction materials.

Each repair kit assembly is factory calibrated to provide accuracy throughout the entire flow range. Each kit is complete and includes a new K-factor, which is the calibrated number of pulses generated by each gallon of liquid. Recalibration of the monitor or other electronics use the K-factor to provide accurate output data.

Turbine Assembly Repair Kit Part Number

Meter Size	Repair Kit Fits Meter Part Number	Repair Kit Part Number
1 in.	B411-110	B411005
2 in.	B411-120	B411006

Table 2: Repair kits

For 1 in. Meter B411-110	For 2 in. Meter B411-120	Description
Repair Part Number		
B251-610	B251-620	Complete turbine assembly replacement kit, with magnetic pickup
B251-611	B251-621	Turbine assembly replacement kit, without pickup
B411005	B411006	Insert, with pickup
B411026	B411027	Insert, without pickup
B411007	B411008	External retainer ring
B411003	B411004	Retainer nut
B251-610 TI	B251-620 TI	Turbine assembly replacement kit for TI meters

Table 3: Turbine assembly repair kit components

Turbine Assembly Replacement Procedure

⚠WARNING

HIGH-PRESSURE LEAKS ARE DANGEROUS AND MAY CAUSE PERSONAL INJURY. MAKE SURE TO SHUT OFF FLUID FLOW AND RELEASE RESIDUAL PRESSURE IN THE LINE BEFORE ATTEMPTING TO REMOVE THE METER.

⚠AVERTISSEMENT

LES FUITES À HAUTE PRESSION SONT DANGEREUSES ET PEUVENT CAUSER LE DOMMAGE CORPOREL. ASSUREZ-VOUS QUE LE FLUX DE FLUIDE A ÉTÉ COUPÉ ET DE LA PRESSION DANS LA LIGNE A ÉTÉ LIBÉRÉE AVANT D'ESSAYER D'ENLEVER LE MÈTRE.

IMPORTANT

Before installing the new turbine assembly, note that an arrow is cast or engraved on each component. The arrow indicates the primary flow direction. When reassembled, the arrowheads must point in the direction of the fluid flow. The arrows must also be oriented in the UP position on both rotor supports. The magnetic pickup side of the body signifies the UP position. Performance of repair kit calibration is in the UP position. Reinstalling the repair kit in the UP position provides continuation of accurate measurements.

1. Shut off the fluid flow and release any residual pressure in the line.
2. Remove the wiring from the magnetic pickup.
3. Remove the external retainer ring from the meter. Set it aside for re-use.
4. Unscrew and remove the large retainer nut. Set it aside for re-use.
5. Remove and discard the turbine assembly.
6. Insert the replacement turbine assembly into the meter housing, aligning the cutout in the assembly with the key in the housing.
7. Screw on the large retainer nut you set aside in step 4. Tighten it enough to clear the lip in the meter body.
8. Insert the external retainer ring you set aside in step 3. It fits just below the lip in the meter body.
9. Reconnect the monitor to the magnetic pickup.

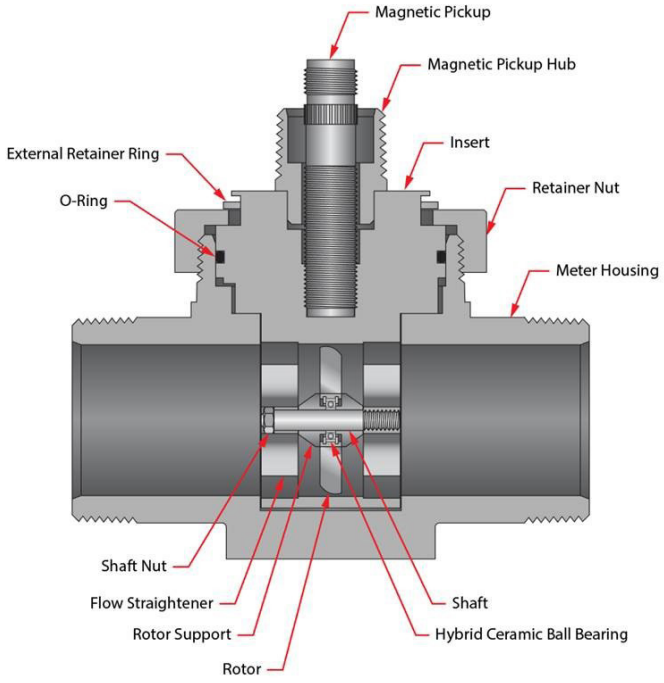

Figure 5: Typical cross-section of B411-110 and B411-120 meters

SPECIFICATIONS

Materials of Construction	**Body**	316 stainless steel
	Rotor	C17-4PH stainless steel
	Bearing	Hybrid ceramic ball bearing with AMS 5898 duplex stainless steel race and stainless steel retainer
	Rotor Shaft	316 stainless steel
	Rotor Support	316 stainless steel
	O-Ring	Buna-N
Operating Temperature	–150…350° F (–101…177° C)	
Pressure Rating	1500 psi max.	
End Connections	NPT	
Turndown Ratio	15:1	
Flow Accuracy	±1% of reading	
Repeatability	±0.1%	
Calibration	Water (NIST traceable calibration)	
Pickup	B111129	
Certifications	—	

PART NUMBER INFORMATION

[1]Part Number	Bore Size	End Connections	Max. PSI	Flow Ranges	Strainer Mesh	Approx. K-factor Pulse/Gal	Meter Weight (lb)	End to End Length
B411-110	1 in. (25.4 mm)	1 in. male NPT	1500	See *"Flow Ranges"*	40	870	2	6 in. (152.4 mm)
B411-120	2 in. (50.8 mm)	2 in. male NPT	1500		20	52	14	6 in. (152.4 mm)

[1] Includes Standard Mag Pickup, p/n B111129, -150…330° F (-101…165° C), suitable for all mounting styles

Flow Ranges

Part Number	Flow Ranges		
	gpm (lpm)	bpd	m^3/d
B411-110	5…75 (18.9…283.91)	171.43…2571.43	27.26…408.82
B411-120	15…225 (56.78…851.72)	514.29…7714.29	81.76…1226.47

TROUBLESHOOTING GUIDE

Issue	Possible Cause	Remedy
Meter indicates higher than actual flow rate.	Cavitation.	Increase back pressure.
	Debris on rotor support.	Clean meter.
	Build up of foreign material on meter bore.	Clean meter.
	Gas in liquid.	Install gas eliminator ahead of meter.
Meter indicates lower than actual flow rate.	Debris on rotor.	Clean meter and add filter.
	Worn bearing.	Clean meter and add filter.
	Viscosity higher than calibrated.	Recalibrate monitor.
Erratic system indication, meter alone works well (remote monitor application only).	Ground loop in shielding.	Ground shield one place only. Look for internal electronic instrument ground. Reroute cables away from electrical noise.
Indicator shows flow when shut off.	Mechanical vibration causes rotor to oscillate without turning.	Isolate meter.
No flow indication. Full or partial open position.	Fluid shock, full flow into dry meter or impact caused bearing separation or broken rotor shaft.	Rebuild meter with repair kit and recalibrate monitor. Move to location where meter is full on startup or add downstream flow control valve.
Erratic indication at low flow, good indication at high flow.	Rotor has foreign material wrapped around it.	Clean meter and add filter.
No flow indication.	Faulty pickup.	Replace pickup.
System works perfect, except indicates lower flow over entire range.	By-pass flow, leak.	Repair or replace bypass valves, or faulty solenoid valves.
Meter indicating high flow, upstream piping at meter smaller than meter bore.	Fluid jet impingement on rotor.	Change piping.
Meter indicating low flow, upstream piping at meter smaller than meter bore.	Viscosity lower than calibrated.	Change temperature, change fluid or recalibrate meter.

Control. Manage. Optimize.

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