



# Turbine Flow Meter

FloClean Sanitary Turbine Flow Meter



**Badger Meter**

TUR-UM-00288-EN-01 (November 2013)

# User Manual



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## INTRODUCTION

The Blancett FloClean turbine flow meter is designed with wear resistant moving parts to provide trouble-free operation and long service life. The durable 316L stainless steel construction provides a cost efficient flow measurement system that offers excellent accuracy and repeatability. The FloClean turbine meter repair kit is designed for easy field service of a damaged flow meter, rather than replacing the entire flow meter. See [Repair Kits on page 12](#) for information.

## THEORY OF OPERATION

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 turbine flow meter.

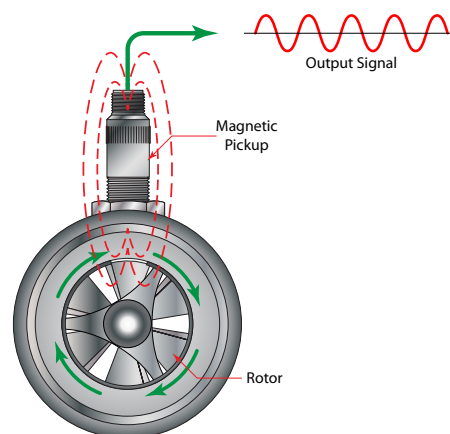

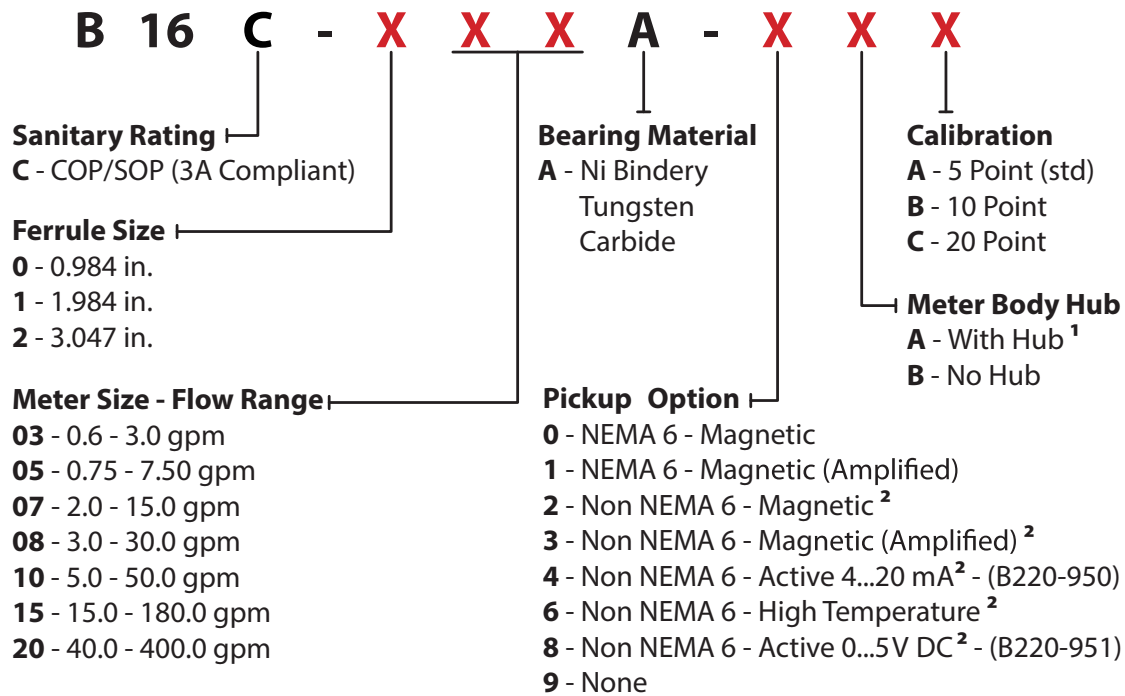


Figure 1: Theory of operation

## SPECIFICATIONS

<b>Physical</b>	
Body/Internal Wetted Parts	316L stainless steel.
Bearings	Nickel bindery tungsten carbide.
Turbine	Nickel plated CD4MCU stainless steel.
Shaft	Nickel bindery tungsten carbide.
Connections	Sanitary clamp ends.
<b>Electrical</b>	
Pickup (option 0)	NEMA 6; -150...300° F (-100...149° C).
<b>Accuracy</b>	
Accuracy	±1% of reading.
Repeatability	±0.1%.
<b>Certifications</b>	
	
<b>Construction</b>	
Temperature	-150...300° F (-101...149° C).
Pressure Rating	1000 psi maximum (rating based on Tri-Clamp sanitary connection).
Corrosion	Contact Blancett to determine if operating liquid is compatible with materials of construction.

## MODEL NUMBERS



<sup>1</sup>1/2 in. hub for body size 0; 1 in. hub for body sizes 1 and 2.

<sup>2</sup> Indoor use only.

Figure 2: Model construction schema

## FloClean Flow Rate Chart

Ferrule Size	Flow Ranges		K factor Pulses/Gal
	gpm	lpm	
0.984 in.	0.6...3.0	2.3...11.4	20,000
0.984 in.	0.75...7.5	2.8...28.4	13,000
0.984 in.	2.0...15.0	7.5...56.8	2750
1.984 in.	0.75...7.5	2.8...28.4	13,000
1.984 in.	2.0...15.0	7.5...56.8	2750
1.984 in.	3.0...30.0	11.4...113.5	2686
1.984 in.	5.0...50.0	19.0...190.0	870
1.984 in.	15.0...180.0	56.8...681.4	330
3.047 in.	40.0...400.0	151.4...1514.2	52

Table 1: FloClean flow rates

## INSTALLATION

### **⚠ CAUTION**

**THE METER SHOULD NOT BE SUBJECTED TO TEMPERATURES ABOVE 300° F (149° C), OR BELOW –150° F (–101° C) OR THE FREEZING POINT OF THE METERED LIQUID. HIGH TEMPERATURES WILL DAMAGE THE MAGNETIC PICKUP, WHILE LOWER TEMPERATURES WILL LIMIT THE ROTATION OF THE ROTOR.**

### **⚠ CAUTION**

**INCOMPATIBLE FLUIDS COULD DETERIORATE INTERNAL PARTS AND CAUSE THE METER TO READ INACCURATELY.**

### Plumbing

The flow meter must be installed with the flow arrow, etched on the exterior of the meter body, pointing in the direction of fluid flow. Though the meter is designed to function in any position, it is recommended, where possible, to install horizontally with the magnetic pickup facing upward.

The liquid being measured must be free of any large particles that may obstruct spinning of the rotor. If particles are present, a mesh strainer should be installed.

If small particles are present in the fluid, Blancett recommends that a strainer be installed upstream of the meter. See [Table 2](#) for filtration recommendations.

Bore Size	Ferrule Size	Strainer Size	Clearance
3/8 in.	0.984 in.	60 × 60	0.0092 in.
1/2 in.	0.984 in.	60 × 60	0.0092 in.
3/4 in.	0.984 in.	60 × 60	0.0092 in.
1/2 in.	1.984 in.	60 × 60	0.0090 in.
3/4 in.	1.984 in.	60 × 60	0.0092 in.
7/8 in.	1.984 in.	60 × 60	0.0092 in.
1 in.	1.984 in.	60 × 60	0.0092 in.
1-1/2 in.	1.984 in.	20 × 20	0.0340 in.
2 in.	3.047 in.	10 × 10	0.0650 in.

Table 2: Filtration recommendations

Severe pulsation and mechanical vibration will affect accuracy and shorten the life of the meter.

The preferred plumbing setup is one containing a bypass line that allows meter inspection and repair without interrupting flow. See [Figure 3](#). If a bypass line is not utilized, it is important that all control valves be located downstream of the flow meter. See [Figure 4](#).

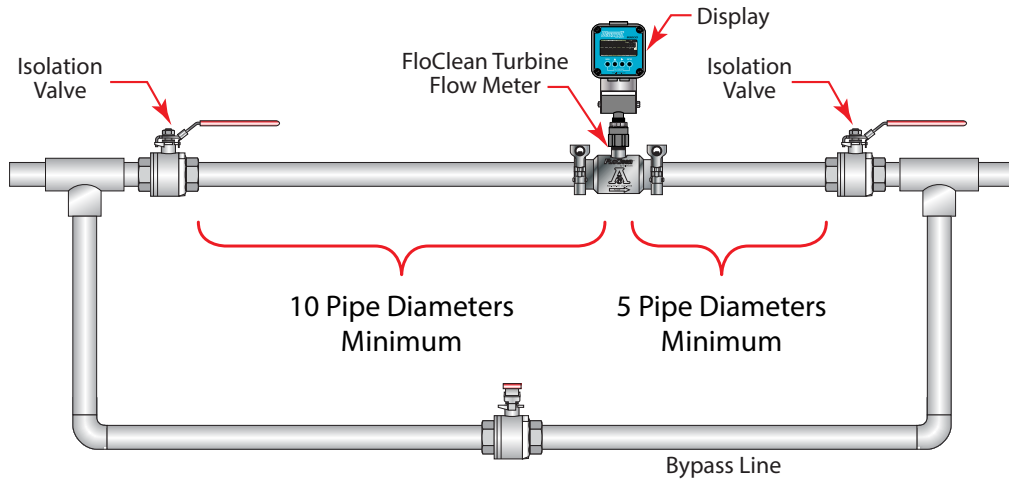


Figure 3: Installation with bypass line

This is true with any restriction in the flow line that may cause the liquid to flash. If necessary, air eliminators should be installed to ensure that the meter is not incorrectly measuring entrained air or gas.

It is recommended that a minimum length, equal to ten (10) pipe diameters of straight pipe, be installed 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.

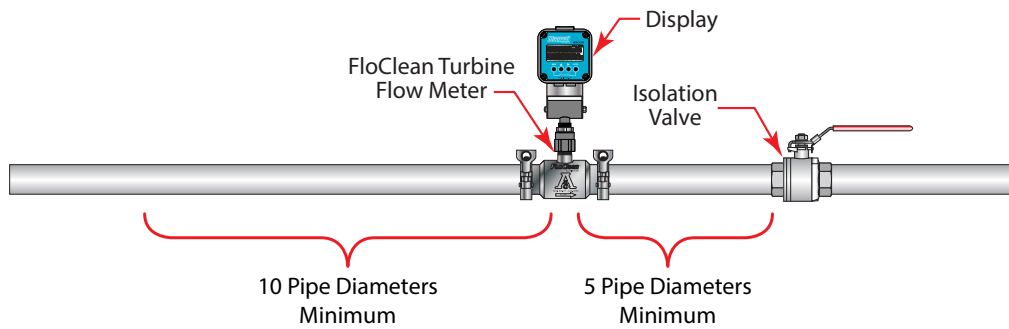


Figure 4: Installation without a bypass line

Do not locate the flow 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 flow meter coil or cable causing the meter to read inaccurately.

**CAUTION**

**DAMAGE CAN BE CAUSED BY STRIKING AN EMPTY METER WITH A HIGH VELOCITY FLOW STREAM.**

If problems arise with the flow meter and monitor, consult the [TROUBLESHOOTING GUIDE on page 16](#). If further problems arise, consult the factory.

If the internal components of the turbine flow meter are damaged, turbine meter repair kits are available. Information pertaining to the turbine meter repair kits is referenced in [Repair Kits on page 12](#).



## Wiring

Typical wiring configurations for the available pickup options are shown in [Figure 5](#), [Figure 6](#), and [Figure 7](#).

Option Number	Description	Number of Pins
0	NEMA 6 – Magnetic	3
1	NEMA 6 – Magnetic (Amplified)	3
2	Non-NEMA 6 – Magnetic	2
3	Non-NEMA 6 – Magnetic (Amplified)	3
4	Non-NEMA 6 – Active (4...20 mA)	5
6	Non-NEMA 6 – Magnetic (High Temperature)	2
8	Non-NEMA 6 – Active (0...5V DC)	5
9	No Pickup	N/A

Table 3: Pickup options

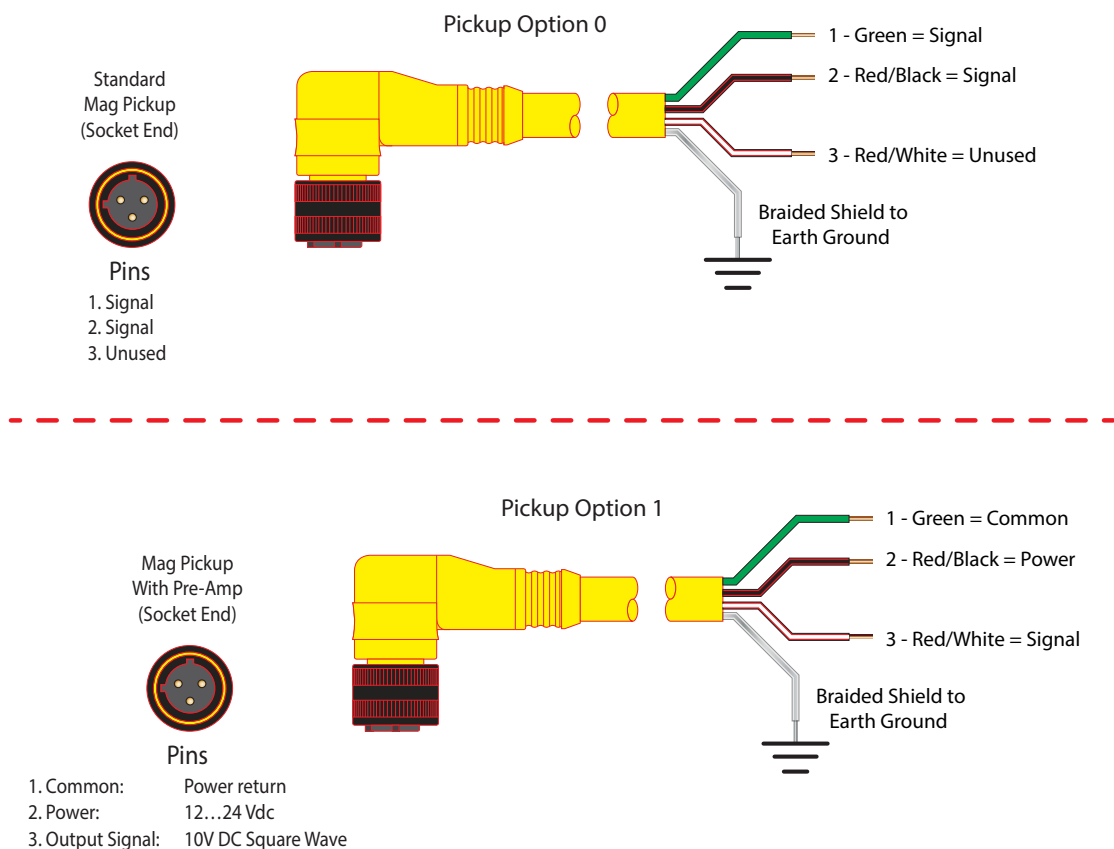


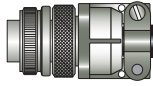
Figure 5: Wiring for NEMA 6 magnetic pickups

Standard  
Mag Pickup  
(Socket End)



Pins  
A = Signal  
B = Signal

Pickup Option 2 & 6



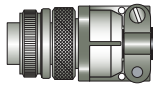
B - Yellow (-) = Signal  
A - Blue (+) = Signal

Amplified  
Mag Pickup  
(Socket End)



Pins  
A = Power  
B = Common  
C = Output Signal

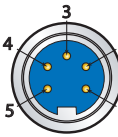
Pickup Option 3



A - Red = Power (5...30V DC)  
B - Black = Common  
C - Green = Output Pulse  
or (0...10V DC)  
Clear

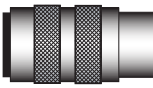
Figure 6: Wiring for non-NEMA 6 magnetic pickups

Active Sensor  
4...20 mA  
(Socket End)



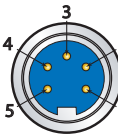
Pins  
1 = Loop (+)  
2 = Loop (-)  
3 = N/C  
4 = N/C  
5 = N/C

Pickup Option 4



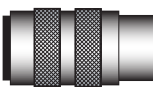
1 - Red = +4...20 mA  
2 - Black = -4...20 mA  
3 - White = Not Used

Active Sensor  
0...5V DC  
(Socket End)



Pins  
1 = 10...30V DC  
2 = 0...5V DC Output  
3 = Ground  
4 = N/C  
5 = N/C

Pickup Option 8



1 - Red = 10...30V DC  
2 - Black = 0...5V DC Output  
3 - White = Ground

Figure 7: Wiring for active magnetic pickups

## Operational Startup

The following steps should be followed when installing and starting the meter.

### ⚠ WARNING

**MAKE SURE THAT FLUID FLOW HAS BEEN SHUT OFF AND PRESSURE IN THE LINE RELEASED BEFORE ATTEMPTING TO INSTALL THE METER IN AN EXISTING SYSTEM.**

1. After meter installation, close the isolation valves and open the bypass valve. Flow liquid through the bypass valve for sufficient time to eliminate any air or gas in the flow line.
2. Open upstream isolating valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.

### ⚠ CAUTION

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

3. Open downstream isolating valve to permit meter to operate.
4. Close the bypass valve to a full closed position.
5. Adjust the downstream valve to provide the required flow rate through the meter.

**NOTE:** The downstream valve may be used as a control valve.

## DIMENSIONS/DRAWINGS

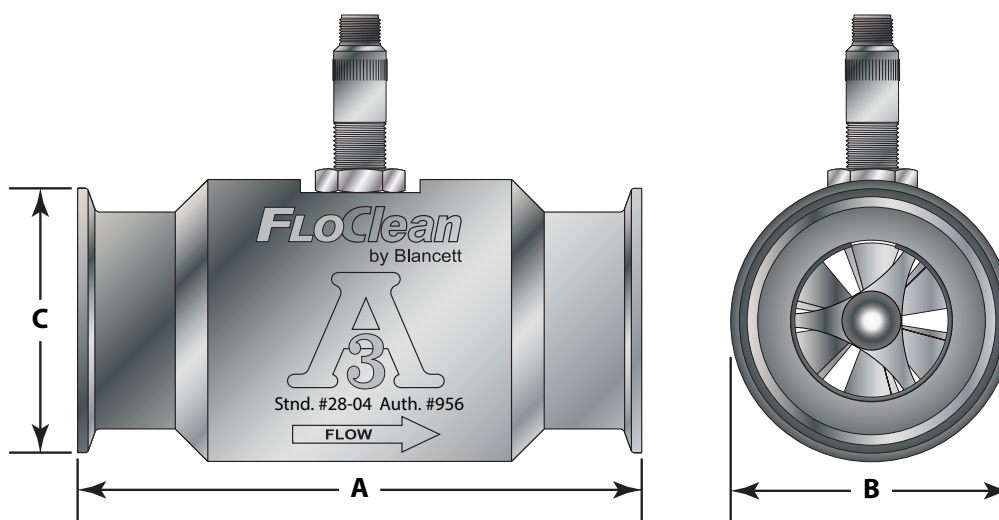
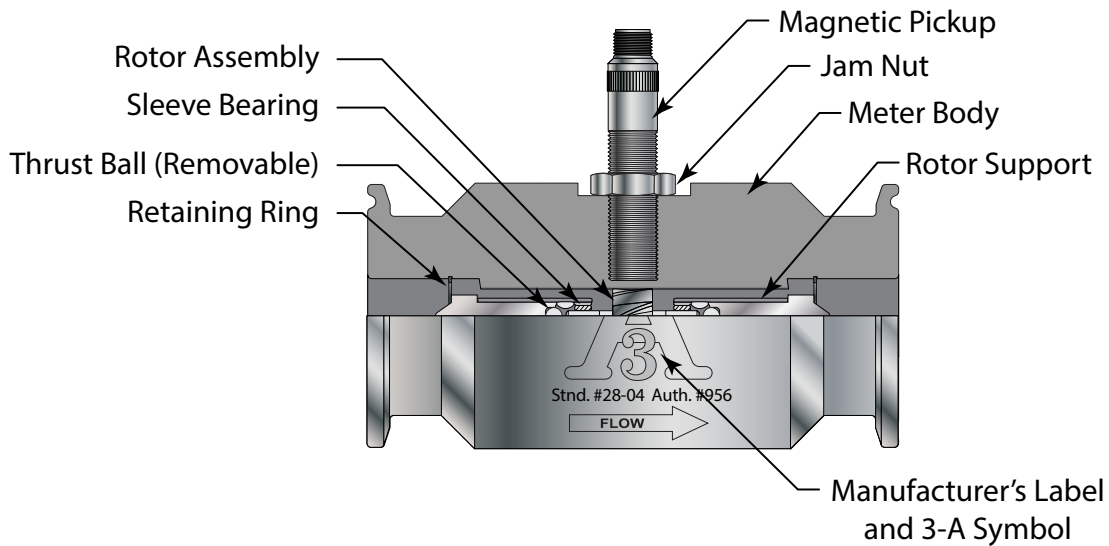


Figure 8: Dimensions

Part No.	A	B	C – Ferrule Size
B16C-0XXA-XXX	3.00 in. (76.2 mm)	1.46 in. (37.1 mm)	0.984 in. (25.0 mm)
B16C-1XXA-XXX	4.00 in. (101.6 mm)	2.00 in. (50.8 mm)	1.984 in. (50.4 mm)
B16C-1XXA-XXX <sup>1</sup>	6.25 in. (158.8 mm)	2.33 in. (59.2 mm)	1.984 in. (50.4 mm)
B16C-2XXA-XXX	6.50 in. (165.1 mm)	3.20 in. (81.3 mm)	3.047 in. (77.4 mm)

<sup>1</sup> 15.0...180.0 gpm flow range only.

Table 4: Dimensions



### B16C 3-A Series (COP/SOP) FloClean Meters

Figure 9: FloClean cross sections

## METER REPAIR AND CLEANING

### Repair Kits

Each FloClean repair kit is factory calibrated to ensure 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. This K factor will be used to recalibrate the monitor or other electronics to provide accurate output data.

### Turbine Repair Kits Part Numbers

Bore Size	Ferrule Size	Repair Kit Fits Meter Part Number	Repair Kit Part Number
3/8 in.	0.984 in.	B16C-003A-XXX	B16C-K03A
1/2 in.	0.984 in.	B16C-005A-XXX	B16C-K05A
3/4 in.	0.984 in.	B16C-007A-XXX	B16C-K07A
1/2 in.	1.984 in.	B16C-105A-XXX	B16C-K05A
3/4 in.	1.984 in.	B16C-107A-XXX	B16C-K07A
7/8 in.	1.984 in.	B16C-108A-XXX	B16C-K08A
1 in.	1.984 in.	B16C-110A-XXX	B16C-K10A
1-1/2 in.	1.984 in.	B16C-115A-XXX	B16C-K15A
2 in.	3.047 in.	B16C-220A-XXX	B16C-K20A

Table 5: B16C 3-A series (COP/SOP) FloClean meters

## Service Procedures

### **WARNING**

**HIGH-PRESSURE LEAKS ARE DANGEROUS AND CAUSE PERSONAL INJURY. MAKE SURE THAT FLUID FLOW HAS BEEN SHUT OFF AND PRESSURE IN THE LINE RELEASED BEFORE ATTEMPTING TO REMOVE THE METER.**

### 3-A Turbine Disassembly and Cleaning Procedure

**NOTE:** Refer to *Figure 10* for relative positions of repair kit components.

1. Remove the magnetic pickup from the meter body to avoid damage during procedure.
2. Remove the retaining ring from one end of the meter.
3. Keeping the meter upright (pickup port at the top), remove the rotor support from the body, taking care not to rotate it in the process. If the rotor support is jammed in the body, use a pair of pliers or vice grips to break it free.
4. Hold the rotor support over a suitable container and rotate it through 180°. The thrust ball will drop out. Take care not to lose the ball.
5. Remove the rotor assembly.
6. Remove the second retaining ring from the opposite side of the meter.
7. Repeat steps 3 and 4 for the remaining rotor support.
8. Identify parts and flow direction to match with original meter body.
9. Clean and/or sanitize parts to meet appropriate sanitary standards.

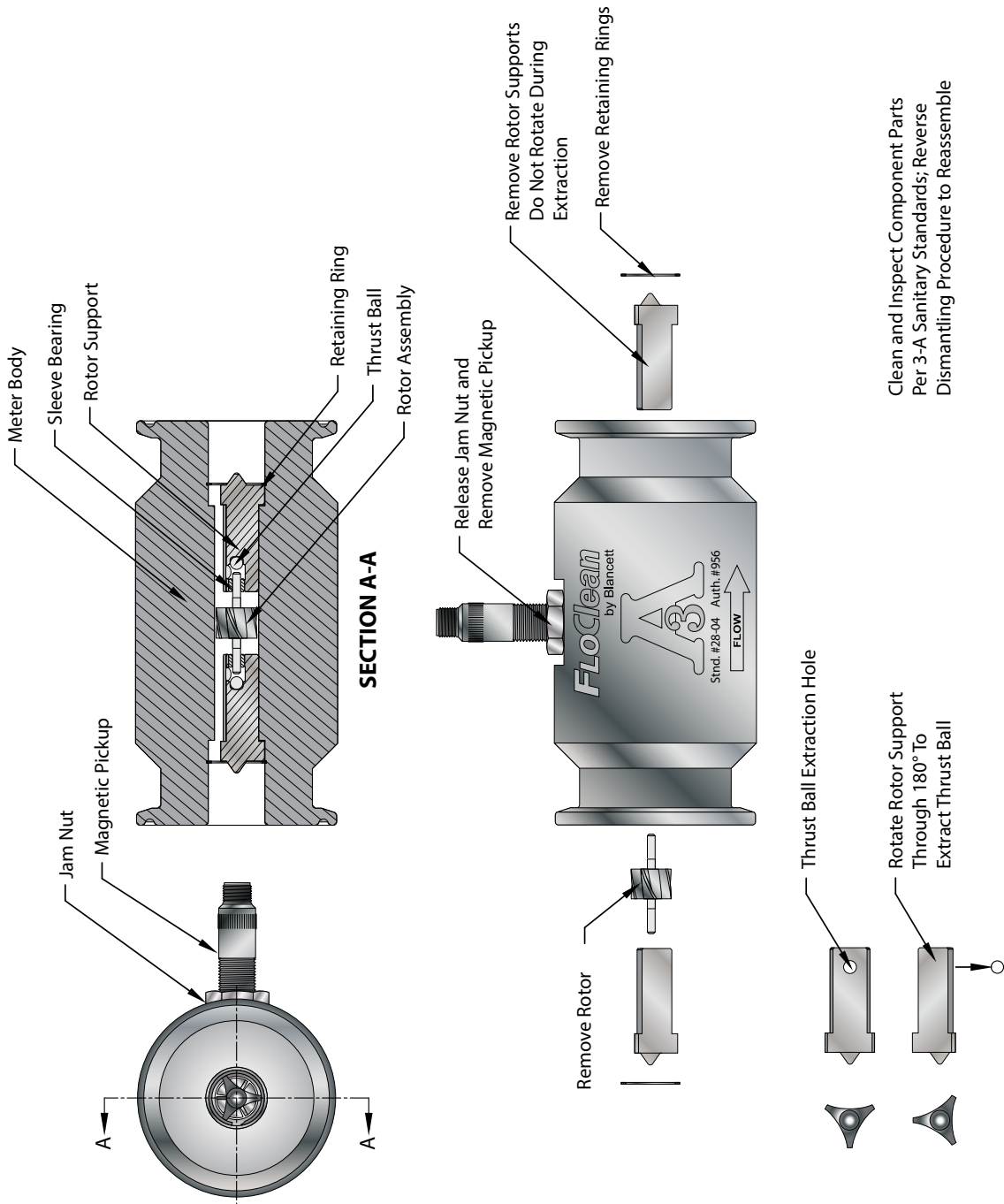


Figure 10: B16C 3-A series FloClean exploded view

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## B16C SERIES (COP/SOP) – 3-A TURBINE INSTALLATION

**NOTE:** This procedure applies to installation of replacement turbine repair kits and re-installation of cleaned or sanitized turbine.

### IMPORTANT

*Before reassembly, note there are weep holes on each rotor support. These weep holes must be facing down toward the bottom of the meter body when installed.*

The meter must be reassembled with the arrowheads on the rotor pointed in the direction of fluid flow. The magnetic pickup side of the body signifies the up position. This is the position that the repair kit was calibrated, and this is the position to be used to ensure meter accuracy. Due to the polished surfaces, there are no arrows on the rotor support to indicate which rotor support is to be placed upstream or downstream. Please install the repair kit as it was received in the box, using the arrow on the rotor to determine the placement of the rotor support.

1. If required by process procedures, the meter should be cleaned prior to installation into the piping system.
2. Drop a thrust ball into a rotor support through the hole provided in the side. Insert rotor support into the meter body. Keep the thrust bearing hole pointed upwards to keep the ball in place.
3. Secure a retaining ring in the groove provided. Be sure that the retaining ring is completely installed in the groove.
4. Drop a thrust ball into second rotor support through the hole provided in the side. Locate the rotor in the support sleeve bearing. Insert rotor support and rotor into the meter body and the first support sleeve bearing. Keep the thrust bearing hole pointed upwards to keep the ball in place.
5. Secure the second retaining ring in the groove provided. Be sure that the retaining ring is completely installed in the groove.

### CAUTION

**EXCESS AIR PRESSURE MAY DAMAGE THE ROTOR AND BEARINGS BY OVER-SPIN.**

6. Check the meter by blowing air through the assembly. If the rotor does not turn freely, the meter should be disassembled and checked for anything that would obstruct movement of the rotor.
7. Install the magnetic pickup.

**NOTE:** After installing the new repair kit, the electronics will need re-calibration. Refer to the electronics' installation and operation manual. If there are any questions on re-calibration, contact Blancett at 1.800.235.1638 or contact the manufacturer of the associated electronics.


## TROUBLESHOOTING GUIDE

Trouble	Possible Cause	Remedy
Meter indicates higher than actual flow rate	<ul style="list-style-type: none"> <li>• Cavitation</li> <li>• Debris on rotor support</li> <li>• Build up of foreign material on meter bore</li> <li>• Gas in liquid</li> </ul>	<ul style="list-style-type: none"> <li>• Increase back pressure</li> <li>• Clean meter</li> <li>• Clean meter</li> <li>• Install gas eliminator ahead of meter</li> </ul>
Meter indicates lower than actual flow rate	<ul style="list-style-type: none"> <li>• Debris on rotor</li> <li>• Worn bearing</li> <li>• Viscosity higher than calibrated</li> </ul>	<ul style="list-style-type: none"> <li>• Clean meter and add filter</li> <li>• Install new repair kit</li> <li>• Recalibrate monitor</li> </ul>
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	Bypass 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
Opposite effects of above	Viscosity lower than calibrated	Change temperature, change fluid or recalibrate meter



## 3-A CERTIFICATE

Initially Issued: 3/19/1998 Authorization No.: 956



**This Is To Certify That**

Blancett Division of Racine Federated, Inc.  
8635 Washington Avenue, Racine, WI 53406

Is hereby authorized to continue to apply the 3-A Symbol to the models of equipment, conforming to 3-A Sanitary Standards for:

**Flow Meters, Number: 28-04, set forth below:**

**B16C-003A-xxx, B16C-005A-xxx, B16C-007A-xxx, B16C-105A-xxx, B16C-107A-xxx,  
B16C-108A-xxx, B16C-110A-xxx, B16C-115A-xxx, B16C-220A-xxx.**

Valid through: **December 31, 2012**

Executive Director, 3-A Sanitary Standards, Inc.

Timothy R. Rugh \_\_\_\_\_ \*\*\*\*\*

The issuance of this authorization for the use of the 3-A Symbol is based upon the voluntary certification, by the applicant for it, that the equipment listed above complies fully with the 3-A Sanitary Standards designated. Legal responsibility for compliance is solely that of the holder of this Certificate of Authorization, and 3-A Sanitary Standards, Inc. does not warrant that the holder of an authorization at all times complies with the provisions of the said 3-A Sanitary Standards. This in no way affects the responsibility of 3-A Sanitary Standards, Inc. to take appropriate action in such cases in which evidence of nonconformance has been established.

Next TPV Inspection/Report due: March 2016

Figure 11: 3-A Certificate

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