BI-NFBRPLUS
Revision 03
Feb 2017

Model Non-Ferrous BiRotor Plus

Installation and Operation Manual



BRODIE™
International
Engineering the Future

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1.0 Read Me First

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BRODIE™ International

Essential Instructions General

Brodie Meter Co., LLC designs, manufactures and tests its products to meet many international standards. As the instruments are sophisticated technical products they must be installed, used and maintained properly to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and incorporated into onsite safety programs where possible.

Read all instructions prior to installing, operating or servicing the product. If the instruction manual is not the correct one, telephone +1 912 489 0200. Retain the instruction manual for future reference.

If you do not understand any of the instructions, contact your local Brodie representative for clarification.

Follow all warnings, cautions and instructions marked on or supplied with the product. It is the end users responsibility to operate the instrument with in the specifications as defined with in the instruction manual or marked on the instruments name plates.

Install the equipment as specified in the installation instructions of the appropriate manual and in accordance to local and national codes.

To ensure proper performance, use qualified personnel to install, operate, program and maintain the product.

Some types of equipment contain Carbon Steel, Cast Iron and/or Aluminium wetted parts, these instruments are not for use on water service.

It is the end users responsibility to assess the surface temperature of the device when it is in service, and if required take the necessary precautions to avoid personnel injury or damage to other equipment.

When replacement parts are required, ensure that qualified people use replacement parts specified by the manufacturer. Unauthorised parts and procedures can affect the products performance and place the safe operation of the process at risk. Look alike substitution may result in explosion, fire, electrical hazards, improper operation or personnel injury.

Use of this equipment for any other purpose than it is intended for may result in property damage and/or serious personal injury or death.

Essential Instructions for Measuring Equipment Including the European Union (Directive 2004/22/EC MID)

Although measurement transducers are not specifically included in the MID regulations as they do not form a complete measuring (system) instrument ref Article 1 and 4, Annex I and Annex MI-005. Brodie Meter Co., LLC implements the same stringent regulations for all products and tests to the same standards which are used for complete (systems) instruments.

The complete system must contain all the necessary components to meet the requirements of the local regulations. These components may include, pumps, air eliminators, strainers, valves, flow computers, etc.

The unit must be sealed in accordance with the local regulations; it is the end users responsibility to ensure this happens

Flow measuring devices are provided with two labels which specify flow ranges. The name plate label which includes the factory serial number; details the operating flow range, this is the flow range the device will operate within without causing damage, and the custody transfer label; this label details the working flow range associated with a particular weights and measures approval. It should be noted that these may not be the same; therefore in trade applications the flow ranges specified on the custody transfer label should be followed.

Essential Instructions for Pressure Containing Equipment, Including the European Union (Directive 97/23/EC)

When installing the equipment the bolting must conform to the requirements of ASME B16.5 paragraph 5.3 and to the material requirements of ASME B16.5 Table 1B. Gaskets must conform to the requirements of ASME B16.20.

Although it is not expected for the device to be used in a service where it would come in to contact with unstable fluids, it is the end users responsibility to assess any risks and take any precautions necessary.

It is the end users responsibility to ensure that piping and other attachments connected to the Brodie instrument do not place adverse stresses upon it, the design of the instrument has not been assessed for the effects of traffic, wind or earthquake loadings.

It is the end users responsibility to ensure that the instrument is mounted when required on suitable supporting foundations.

It is the end users responsibility to install the device in a well designed system to avoid potential hazards such as water hammer, vacuum collapse or uncontrolled chemical reactions.

It is the end users responsibility to provide fire protection measures and equipment in accordance with the local regulations.

It is the end users responsibility to install suitable straining and air/gas elimination systems.

The instrument has been designed without allowance for corrosion or other chemical attack. The end user should implement a periodic inspection and maintenance program to ensure that none of the instruments pressure containing components has been subject to any corrosion. It is possible to examine the instrument for evidence of corrosion through the inlet and the outlet.

When the ambient temperature is below the minimum operating temperature specified on the device, it is the end users responsibility to ensure that the devise is warmed to an appropriated temperature before being pressurised.

Do not exceed the operating pressure and temperature limits of the instrument as stamped on the nameplates.

It is the customer's responsibility to install this equipment in a system that provides adequate over pressure protection, and that limit pressure surges to 10% of the maximum allowable working pressure of the instrument.

It is the end users responsibility to provide fire protection measures and equipment in accordance with the local regulations.

Essential Instruction When Equipments Is To Be Used In Hazardous Locations, Including the European Union (Directive 94/9/EC)

Any Hazardous area approval applies to equipment without cable glands. When mounting the flameproof enclosure in a hazardous area only cable glands / conduit seals certified to meet or exceed the rating of the equipment should be used, refer to the type approval documentation for further details. It is the end users responsibility to ensure this happens.

Cable glands and cable must be suitable for the operating temperature of the device under its rated conditions, this is especially important is the device has an operating temperature above 700C (1580F)

The meter has been provided with an approved sealing device in one of the cable entries, the other entry has been closed with a plastic cap plug. It is the end users responsibility to remove the cap plug and replace it with a suitable cable gland or conduit seal before the equipment is put into service.

It is the end users responsibility to ensure when the instrument is located in a hazardous area that all Cable glands and conduit seals must be installed in accordance with the local codes and regulations.

It is the end users responsibility to ensure that before opening an electronic enclosure in a flammable atmosphere; all the electrical circuits must be interrupted.

If replacement of the screws which secure the sensor housing, the UMB cover of the electronic register and its cover are required, they must be replaced with either factory direct parts or M6-1 x 16 (6g) mm hex socket head screws of equal length. The screws must be made from stainless steel grade A1-70 or A2-70 and be torqued to a value of 55 in lbs upon installation, its is the end users responsibility to ensure this happens.

It is the end users responsibility to assess the maximum surface temperature of the device and the equipment the device is attached to and located next to as this may exceed the temperature ratings of the device itself. If this happens, additional safety precautions will need to be implemented by the end user.

Flame proof housings contain Aluminium; although the composition of these enclosures is carefully maintained to prevent any risk of an ignition source it is the end users responsibility to ensure that the housing is not struck by rusty tools or objects.

If the equipment is to be installed in an area where dust deposits and build up are to be expected, a maintenance plan should be arranged to include regular removal of the dust build up. This will prevent the dusts forming a possible source of ignition.

The power supply requirements for this product are specified with in the operating and maintenance manual, it is the end users responsibility to operate the product with in these specified limits.

The instrument contains surfaces that constitute flames paths, these surfaces should not contain any mars or scratches, and if any are present the factory or the local representative should be contacted immediately to obtain a new housing as the safety of the enclosure may be impaired. It is the end users responsibility to inspect these surfaces every time the enclosure is opened.

When flanged flame paths are re assembled the gap between them should be less than 0.0015" (0.038 mm) such that a ½" (12.5mm) wide feeler 0.0015" (0.038mm) gauge will not enter the gap more than 1/8" (3mm). It is the end users responsibility to ensure this happens each time the enclosure is reassembled.

2.0 Receipt of Shipment

When the instrument is received, inspect the outside of the packing case for any damage that may have occurred during shipment.

Any damage incurred during shipment is the carrier's responsibility and is not part of the factory warranty. If the packing case is damaged notify the carrier immediately and follow their claim procedures.

If the packaging is undamaged locate the envelope containing the packing list, this will generally be on the outside of the box. Carefully remove all the contents from the packaging checking for any damage, Check the items off against the packing list for correct parts and quantities. If any items are incorrect or damage please contact your sales representative immediately, quoting the sales order reference number.

3.0 Return Shipment

If any item is returned to the factory, a returned material report (RMR) will need to be completed, The RMR forms can be obtained from the local sales representative or the Brodie Meter Co., LLC product service department.

If an instrument has been used with process fluid, then in addition to the RMR a decontamination statement will also be required..

A decontamination form is included in section 13 of this manual.

Note: When an instrument is being removed from service is must be thoroughly drained and any hazardous substances neutralised. Care must be taken to ensure any substance removed from the instrument is disposed of in accordance to the local regulations, Placing the instrument on its inlet flange will aid drainage.

The process connections should be sealed to prevent any residual substances leaking from the meter during shipment. The type of seal will depend on the mode of transport, the local carrier should be contacted for details.

Any item should be securely packed, the larger instruments should be mounted on wooden pallets or skids for shipment, The exterior of pallet mounted items should be protected but suitable means, such as a solid wooden crate.

When packaging the instrument for return to the factory, make two copies of the RMR and decontamination statement, place one copy inside the packaging and one copy on the outside of the packaging,

Any equipment returned to the factory with out the correct documentation will be returned to the sender at their own expense.

Return shipping address:

Brodie International
Product Service Department
19267 Hwy. 301 North
Statesboro, GA 30461
Phone: 001.912.489.0200
Fax: 001.912.489.0294
service@brodieintl.com

4.0 Storage

Brodie International instruments are precision devices and should be handled and stored with care.

The inlet and outlet covers should remain in the instrument until the unit is ready for installation.

If extended storage is required it is recommend that the instrument be placed in an environmentally controlled warehouse, if this is not possible the instrument should be stored in a water proof lined wooden box, desiccant packs should be taped to the inside of the instrument end connections before they are sealed to reduce the effect of humidity, depending on the storage time is may also be preferable to use a compatible corrosion inhibitor. Care should be taken to remove any storage protection items before installing the instrument.

If an instrument is removed from service for an extended period of time it should be flushed with an appropriate corrosion inhibitor before being place in long term storage as mentioned above.

5.0 Introduction

Description

The BiRotor Plus is an extremely accurate dual cased flow measuring device. It produces via the use of non wetted pickoffs a high resolution signal which is directly proportional to the rate of liquid flow through the meter. These signals can be shaped by a simple internal pre-amplifier for transmission to ancillary equipment.

The BiRotor Plus Meter utilizes the exclusive BiRotor principle. There are no sliding, oscillating, or reciprocating parts.

Principle of Operation

The operation of the meter is embodied in the function of the measuring rotors; they are always dynamically balanced but hydraulically unbalanced during operation. The rotors have no metal to metal contact with each other or with the housing with in which they rotate. Clearances between moving components are maintained with timing gears.

The BiRotor Plus is a positive displacement (PD) meter. A PD meter uses a mechanical principle that measures flow by continuously dividing the flowing stream into known volumetric segments, isolating those segments momentarily, and then returning them to the flowing stream while counting the number of displacements. This is a direct volume measurement, there is no inferred or software generated measurement.

6.0 Specifications

Materials of Construction

Meter Housing: Cast Aluminum A356-T6

Measuring Unit

End Plates and Body:	Cast Aluminium A356-T6
Rotors:	Cast Aluminium ALCO-319, Hard Coat Anodized
Rotor Shafts:	17-4 Ph Stainless Steel
Timing Gears:	416 Stainless Steel
Bearings:	Stainless Steel (Ceramic Optional)
Elastomers:	Viton A®, Low swell Nitrile, Viton F®, or Fluoro Silicon are standard (other options available)

UMB Housing*: A356 T6 Cast Aluminium

* This part is not wetted.

Electrical Details

Pick off:
Non Wetted Reluctance Type
Sine Wave Amplitude: 40 mV P-P, min.

Preamplifier

Supply Voltage: 9 to 28 VDC

Outputs (Jumper selectable):
Square wave: 0 to 5 KHz

5 V Powered Pulse: 0 – 5 VDC, 20 mA Max

Variable Voltage Pulses:
0 to Supply Voltage Less 5%
70 mA max

Open Collector:
Max voltage: 30 VDC
Max current: 125 mA
Max power: 0.5 W

Performance

AB29X Linearity, Standard Rotors

+/- 0.10% or Better Over 20:1 Flow Range

Repeatability: +/- 0.01%

Operating Temperatures Limits:
Dependant on pick off type and O-Ring seals used, see Table 1.

Table 1: Operating Temperature Limits

Pick Off Type	Seal Material	Minimum Operating Temp		Maximum Operating Temp	
		Degree F	Degree C	Degree F	Degree C
Standard	Viton A	-15	-25	167	75
Standard	Low Swell Nitrile	-20	-29	167	75
Standard	Viton F	-15	-25	167	75
Standard	Fluoro Silicon	-20	-29	167	75
High Temp	Viton A	14	-10	230	110
High Temp	Low Swell Nitrile	14	-10	212	100
High Temp	Viton F	14	-10	230	110
High Temp	Fluoro Silicon	14	-10	230	110

Table 2: Maximum Working Pressure at 100 deg F, 38 deg C

Flange Ratings	PSI	Kpa
4" and 6" Victaulic	200	1378

Table 3: Flow Ranges

Meter Size	Flow Rate		Nominal K-Factor
	US GPM	L/MIN	
4" Victaulic	1000*	3785*	96 PUL/ US GAL +/- 10%
	800	3028	
	40	151	
	40*	151*	
6" Victaulic	1200*	4542*	96 PUL/ US GAL +/- 10%
	1000	3785	
	40	151	
	40*	151*	

* Rates are in Extended Flow Ranges

Table 4: Shipping Weights and Volume

Model	Size	Unit	Weight
AB295	4" Victaulic	Lb	138
		Kg	62.6
AB296	6" Victaulic	Lb	140
		Kg	63.5

To convert pressure drop value to the actual process fluid, use the following equation:

$\Delta P_A = (cP_A)^{0.25} X (SG_A)^{0.75} X \Delta P_m$

ΔP_A = Pressure Drop on Actual Fluid in PSI

cP_A = Viscosity of Actual Fluid in cP

SG_A = Density of Actual Fluid in SG

ΔP_m = Pressure Drop on Mineral Spirits (See Graphs 1 and 2 on Page 6 for Reference)

Figure 1: Non-Ferrous BiRotor Plus Dimensions

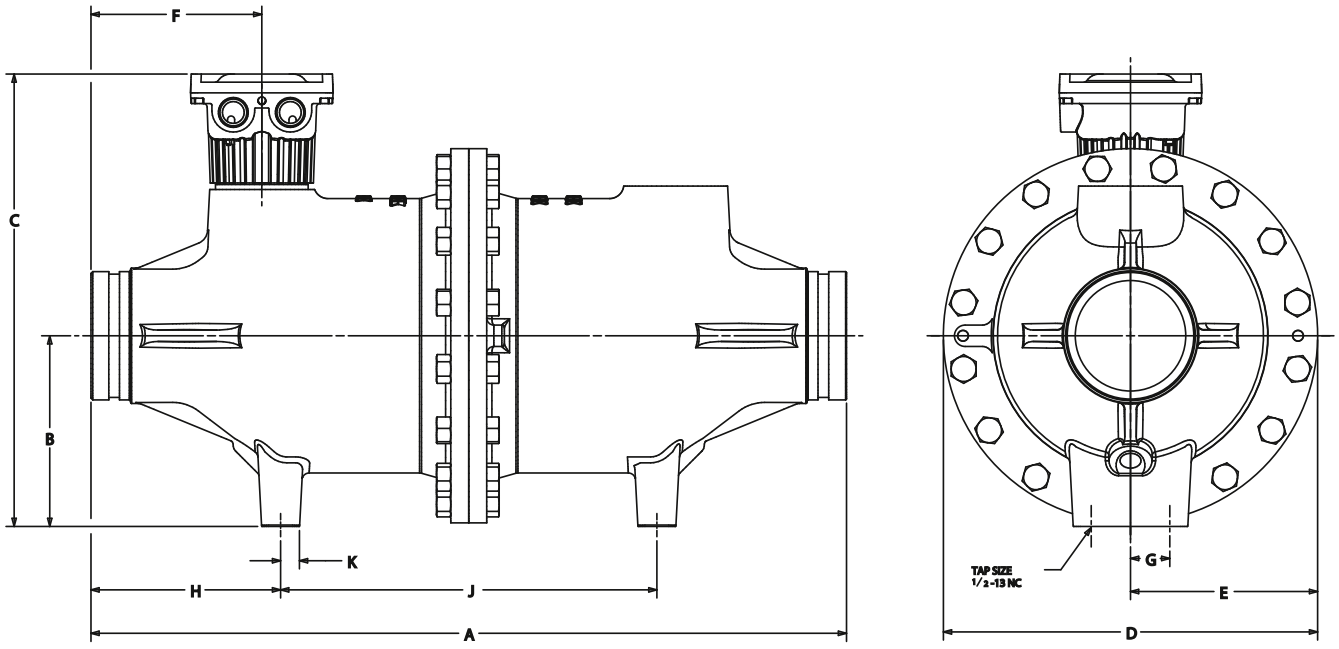


Table 5: Non-Ferrous BiRotor Plus Dimensions [Tolerance +/- 1/8" (3mm)]

Model	Size	Unit	A	B	C	D	E	F	G	H	J
AB295	4"Victaulic	inch	26 1/2	6 5/8	15 7/8	13 1/4	6 5/8	6 1/4	1 3/8	6 11/16	13 1/8
		mm	173	168	403	337	168	159	35	170	333
AB296	6"Victaulic	inch	25 5/8	6 11/16	15 7/8	13 1/8	6 9/16	5 9/16	1 3/8	6 1/4	13 1/8
		mm	651	170	403	333	167	141	35	168	333

7.0 Installation

General Requirements

The instrument should be mounted on a secure foundation, If vertically mounted provisions should be taken to ensure stability.

The process piping should not place any undue stress on the instrument

Precautions should be taken to ensure that thermal fluid expansion does not raise the line pressure above the maximum allowable working pressure of the instrument

Process piping needs to be clean and free of any foreign matter.

A strainer should be installed upstream of the instrument.

If the process fluid is expected to contain entrained air, an air eliminator should be installed upstream of the instrument

A flow limiting valve should be installed downstream of the instrument, this will maintain a back pressure and prevent excessive flow rates.

Isolation valves should be located at either ends of the instrument run and a bypass section installed, this will facilitate ease of component removal when required and reduce loss of product.

Interference

The instrument should not be installed in a location where excessive vibration is expected.

The instrument should not be located close to any electromagnetic fields, for example those produced by electric motors, transformers, solenoids etc.

Either of these factors could induce a signal into the flow sensing pick off and interfere with the measurement.

Installing the Instrument

Remove the inlet and outlet protection covers.

Install the instrument in to the pipe work using suitable hardware as specified in the local codes and regulations, ensure that the connections are made tight and torqued to the correct values.

Connections the instrument wiring, refer to Figure 2 or Figure 3. Cable entry into the electrical enclosure is by two 3/4-14 NPT female threads.

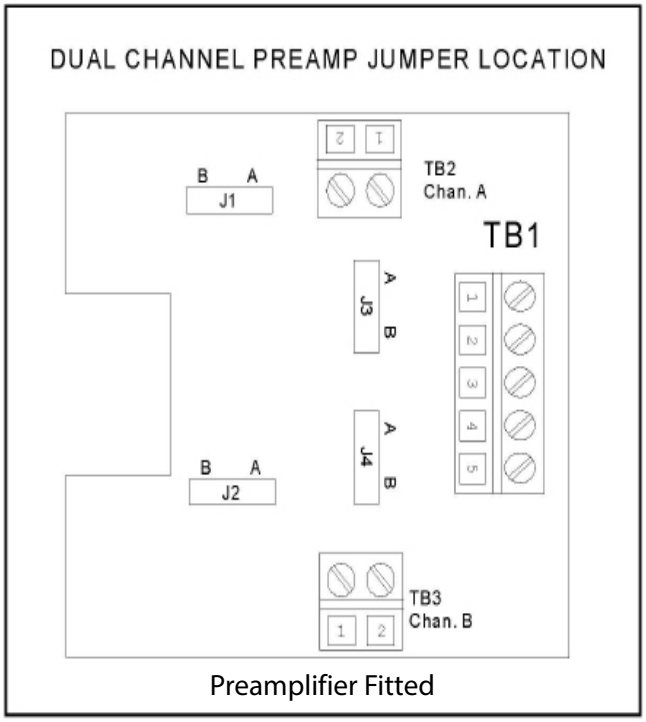
Use wiring appropriate for the location and operating conditions, If the instrument is being installed in a hazardous area wiring glands and/ or conduits must conform to the local electrical code regulations.

Note: For additional requirements on installation please refer to the essential instruction at the beginning of this manual.

Attachment to Additional Accessories

If the instrument is being used with additional accessories, the instructions for these accessories should be read and understood before continuing with the installation. The output signal from the preamplifier, if one is fitted can be altered to interface with most electronic accessories. This is accomplished by the use of jumpers on the circuit board, Table 6 shows their configurations.

Figure 2: Wiring Connections



Preamplifier Fitted

TB1
1 = V Supp 9-28 Vdc
2 = V Comm
3 = Channel A Signal
4 = Channel A & B Common
5 = Channel B Signal

Table 6: Input Settings

Jumper	Position
J1 (Channel A)	B
J2 (Channel B)	B

Table 7: Output Settings

Jumper	Open Collector	5 VDC Pulse	V Supply Pulse
J3 (Channel A)	OUT	A	B
J4 (Channel B)	OUT	A	B

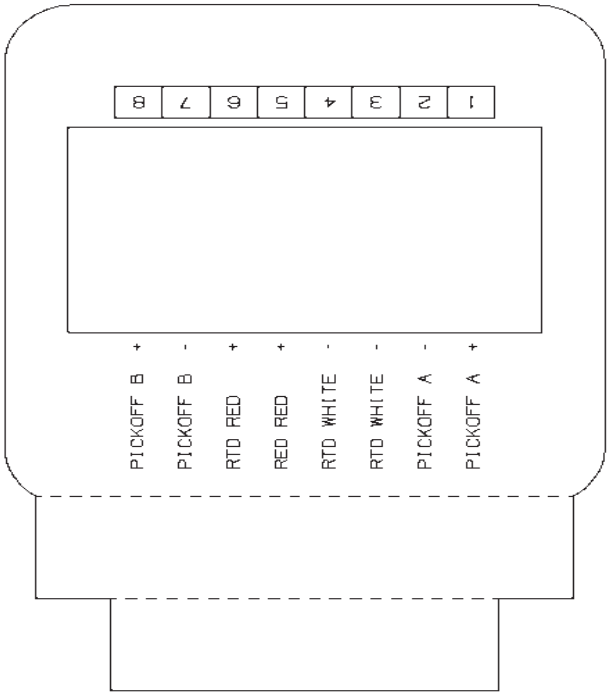
Integral Brodie Electronic Rate Totalizer (BERT)

If the instrument has been supplied with an integral electronic register, the internal connection wiring will already be in place. For additional functions and wiring possibilities please refer to the BERT's instruction manual, BI-BERT.

Start up and Operation

Review the system to ensure all the components are in proper sequence, all isolation valves are closed, all electrical connections are complete and all covers are in place.

Figure 3: Wiring Connections



No Preamplifier Fitted

To Pressurize the System

Slowly open the inlet valve so as to prevent system shock. Slowly allow product to enter the system whilst keeping the downstream isolation valve closed.

Open the down stream valve (10 percent) to allow any air to be flushed from the system. Do not over speed the instrument.

Once the air has been flushed from the system close the down stream isolation valve, and check for any leaks. If any leaks are found check seals and retighten connections.

To pressurize the system fully open the upstream isolation valve.

Flow Start Up

Once the system is pressurized:

Turn on all electronic circuits and check function.

Open flow control valves and allow the instrument to run at 20% of its rated flow for a minimum of 5 minutes.

During this initial run in, check all other components in the system for functionality.

Once this run in is complete set the flow control valve to the required flow, ensure that the maximum flow for the instrument is not exceeded.

Higher Temperature Start Up

On higher temperature service above 212 Deg F, 100 Deg C, (based on an ambient of 70 Deg F, 21 Deg C) special start-up procedures are required to prevent damage to the flowmeter components. The following equation may be used to determine the approximate flowmeter warn up time. A similar procedure should be followed on any thermal shock in excess of 176 Deg F, 80 Deg C.

Warm up time (Hrs) = [Nom Connection Size (in) X (Oper temp (Deg F) – 212)]/100

During this warm up time the meter should be operated at approx 5% of Max flow to allow the temperature to stabilize.

Custody Transfer

If the instrument is being used for custody transfer

applications, A meter factor will need to be established under the actual operating conditions. This initial proving run should be carried out following the completion of the meter start up and in accordance with the local regulations.

Note: There are no user adjustable parts in these instruments, however the instrument housing is provided with two cross drilled bolts and cross drilled drain plugs to facilitate sealing if required by the local weights and measures regulations.

Performance Considerations

The instrument will give many years of consistent performance with little need for maintenance or service. There are however several recommendations which if followed will further extend the instruments service life.

The instrument should be kept filled with the process fluids it is measuring. This prevents the exposure to any product vapor, which in the case of petroleum products are more corrosive than their liquids. In addition this also prevents the formation and build up of deposits or gums which would cause increased mechanical friction.

The instrument should always be kept free of water, keeping it full of the process fluid will accomplish this, but if this is not possible a regular inspection program should be set up and any water drained from the measuring system.

Filter and strainers baskets should be cleaned frequently; Debris and foreign matter are the biggest cause of meter wear and damage.

All other associated equipment with in the system should be regularly maintained and checked for functionality.

Maintenance Considerations

The amount of maintenance necessary for efficient instrument performance is dependant on many factors; some of these are listed below.

Continuity of Operation: An instrument that operates continuously will required more attention than one used intermittently

Working flow rate: The life of the instrument is proportional to the speed of it operation. If the instrument is operating at or near to it maximum flow rate it will have a shorter life expectancy than if it where operating at its minimum flow rate.

Lubricity: The lower the lubrication properties of the fluid being measured than the lower the life expectance will be.

Cleanliness: A product contaminated with abrasive particulate will accelerate the wear of the instrument.

8.0 Maintenance

Notes:

If instrument is being used in hazardous area, all instructions on the labels and in this manual must be followed before the start of any maintenance.

If the instrument is removed from the process line, the line should be sealed with suitable blanking flanges to prevent any possible leakage of product.

WARNING: The internal measuring element contains closely meshed moving parts, care should be taken not to insert fingers into the rotors or timing gears as this will cause injury.

Electronics

The instrument can be provided with up to two inductive pick off sensors and an optional preamplifier.

Maintenance of the electronics does not require the system line pressure to be drained or the instrument to be removed from the system.

ESD precautions must be followed.

Removal/Replacement of Circuit Boards

1. Disconnect all power to the instrument.
2. Remove the electronics lid (36), or electronic register if one is fitted by undoing 4 Allen screws item (25).
3. Disconnect terminals and wiring to the circuit board.
4. Remove circuit board (38) by undoing the screws that attach it to the housing.

To re-assemble reverse the removal instructions, Torque the 4 Allen screws (25) to 55 in-lb.

Removal/Replacement of Pick-off Sensors

1. Remove the circuits boards as detailed above.
2. Remove the centre screw (25) from the sensor housing (23) and lift off the hold down washer (29).
3. Lift out the inductive sensor/s (27) and spring (28).

Resistance between sensor leads:

For Sensor with ident marker on Sheath = 1000 Ohms +/-15%

For Sensor with ident marker on sensor = 750 Ohms +/-15%

Resistance between leads and housing when installed: 10 M Ohms

If any of this is not the case the pick off should be replaced.

To reassemble, replace the pick off into the sensor housing, If only one pick-off is present it should be inserted in the hole labelled A. Secure with the hold down washer (29) and Allen screw (25) and replace the circuit board (38).

Mechanical

Removal of the Measuring Unit from the Process Line

1. Disconnect all power to the instrument.
2. Relieve all system pressure and drain the meter.
3. Disconnect all external wiring form the electronics unit.
4. Unbolt the instrument form the process piping and remove to a work shop for further disassembly. Care should be exercised to prevent the intrusion of foreign material into the instrument end connections.

Removing the Measuring Element from the Instrument Body

1. Turn the meter on end so that it stands in its inlet flange (this will also finalize draining).
2. Remove screws (1 and 2) and lift of the outlet housing (50). Remove O-ring (16).
3. Holding the measuring unit assemble by the ribs, carefully lift straight up until the assembly clears the inlet housing. Place the measuring unit assembly in the horizontal position.

At this stage the assembly can be inspected for wear or damage, If the assembly had jammed it may also be possible to unblock the rotors by flushing with cleaning solvent or kerosene with out the need for further disassembly.

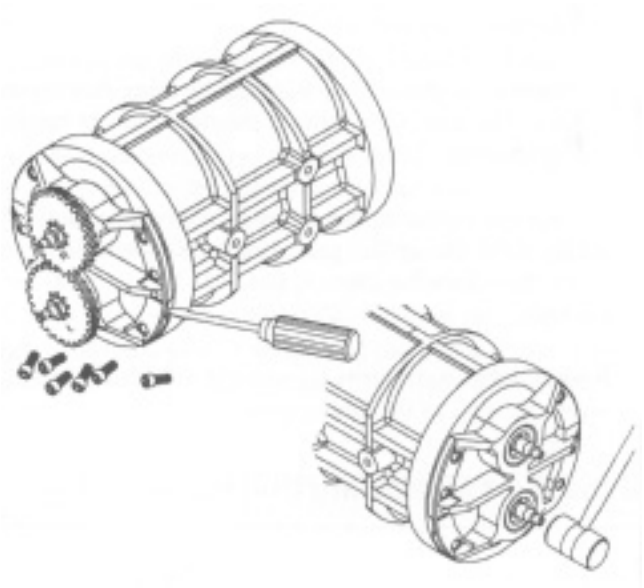
Disassembly of the Measuring Unit for Inspection and Cleaning

Disassembling of the measuring unit can be achieved by two methods, removal of the mechanism while maintaining the clearance settings or complete disassembly.

Disassembly While Maintaining the Clearance Setting

1. Place a folded rag between the timing gears (6 and 49) to prevent the rotors turning during the disassembly.
2. Remove the pulse wheel (14) be removing the screw (44) and washer (45) and retaining washer (46).
3. Remove the screws (7) form end plate (8) at the timing gear (6 and 49) end of measuring assembly.

Figure 5: Measuring Unit Disassembly



A flat head screw driver may be used in conjunction with the slots on the endplate to aid in its removal; Excessive force is not required.

4. Use a plastic or rubber mallet and strike the rotor shafts at the pulse wheel end of the housing to aid in removal of the rotor assembly.

Once the rotor assembly has been removed from the housing any blockages or foreign material can be cleaned away.

At this stage the meter can be reassembled reversing the disassembly procedure without the need to reset any clearances. Note: all elastomers that have been removed should be replaced with new parts during reassembly

Complete Disassembly

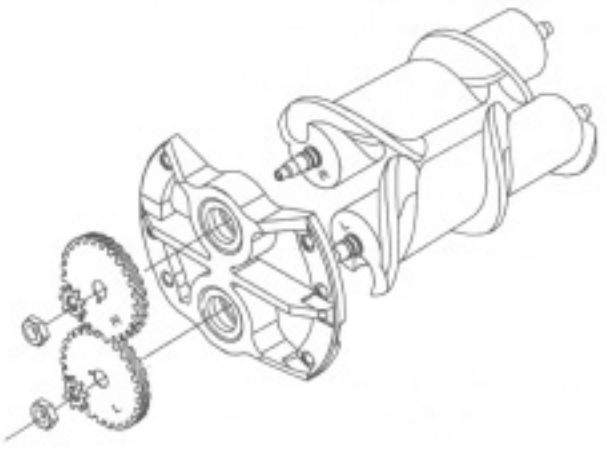
Continuing from part 4 above.

1. Restrict the rotor movement by placing a folded rag between the timing gears (6 and 49).
2. Fold down the lock washer (5) tabs to enable the nuts (4) to be undone then remove them and the lock washers from the rotor shafts. The timing gears (6 and 49) can be released from the shaft by striking them on the flat surface with a plastic or rubber mallet.
3. Remove the rotors (11 and 48) from the end plate by gently tapping the rotor shafts with a plastic or rubber mallet. Remove the O-rings (10) from the rotor shafts.
4. The bearings (9) can be removed from the end plates by pressing on the inner race of the bearings from the outside of the plate. If the bearings are removed from the endplates, they must be replaced.
5. Remove the other end plate from the measuring element housing and remove bearings.
6. Remove the sensor housing (23) from the inlet housing (21) be removing the 4 Allen screws (25) located in the counter sunk holes under the circuit board (35).

Complete Reassembly

1. Ensure all parts are clean and free of debris.
2. Lubricate all bearings and internal o-ring with a light oil, Note all O-rings should be replace with new ones during reassembly, all O-rings should be lubricated with a compatible lubrication compound.
3. Press bearings (9) in to the end plates (8), use a hand press and ensure that the bearing is pressed on the outer race to avoid damage.

Figure 6: Rotor/Gear Orientation



The bearing races should be flush with the bottom of the end plate once the bearings have been pressed in correctly. The outer race of an old bearing can be used to assist in proper seating.

4. Attach one end plate (8) to the measuring unit body (13) at the end with two dowel pins (12). Align the dowel pins and gently tap into place with a plastic mallet. Once fully seated secure the end plate with screws (7).

Each rotor (11 and 48) and timing gear (6 and 49) is marked with a R or an L, During assembly the inscriptions need to be matched. To orientate the rotors during assembly the measuring element body (13) has three holes machined into it for manufacturing purposes. These holes should be positioned so that they face upwards. With these holes facing upwards turn the housing so that the end with the 'two' dowel pins faces away from you. With the housing in this position the rotor marked with an 'R' (48) goes in the right hand cavity and the rotor marked with an 'L' (11) goes in the left hand cavity.

5. Lubricate O-rings (10) and install on the rotor shafts. Mesh the two rotors together (11 and 48) ensuring that the tapered shafts are at the same ends. The rotors should be held together with the tapered end of the shaft facing the end plate which is attached to the measuring element housing. While keeping the rotors meshed and even, insert them into the measuring chamber, use a plastic or rubber mallet to gently seat the rotor shafts into the bearings.
6. Install the other end plate (8) and screws (7) on to the other end of measuring element body, ensure that the rotor shafts seat within the bearings.
7. Place the timing gears (6 and 49) onto the respective tapered rotor shaft, the timing gear has a small hole for the location of the lock washer tab; this should be facing outward from the measuring element.
8. Install the lock washer (5) ensuring the 90 Degree tab locates in the hole of the timing gears (6 and 49) and nuts (4) to the rotor shafts, tighten these only finger tight until the clearances have been correctly set. Refer to the setting clearance section.
9. Replace the pulse wheel (14) on the right hand rotor, Use thread locking compound on the threads and secure with the retaining washer (46) , washer (45) and screw (43).
10. Lower the complete measuring unit assembly into the inlet housing (21), align the dowel pins (12) and ensure they are fully located.
11. Position the main housing o-ring (16) in the groove in the inlet housing, and position the o-ring (47) on timing gear (6 and 49) end of the measuring element body.
12. Lower the outlet housing (50) into the inlet housing (21), the dowel pins (15) are used to ensure correct location. Avoid damage to the O-rings.
13. Complete the assembly be securing all the screws (1 and 2) and tightening them to the required torque value.

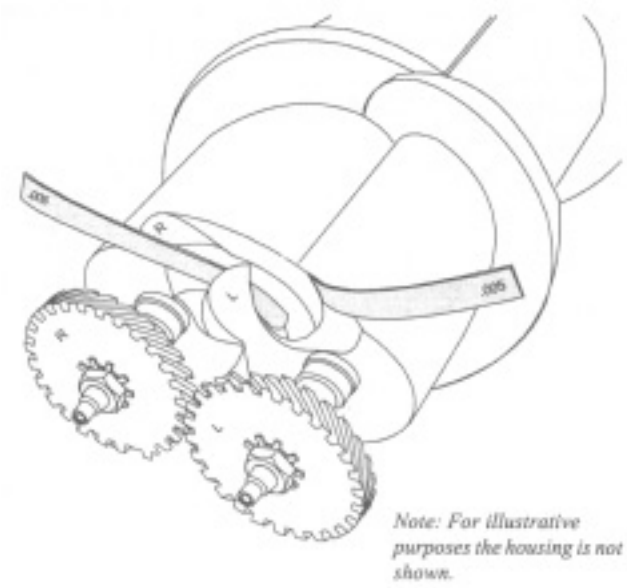
Torque (150# and PN16 - 80 ft-lbs., 300# and PN40 - 150 ft-lbs.), ensure the two cross drilled screws (1) are located in the top two holes of the flange.

14. Install the o-ring (22) on the sensor housing (23) and insert the assembly into the inlet housing (21) secure with the 4 Allen screws (24), torque to 55 in-lbs.

Setting Clearances

1. Restrict the gear movement by placing a folded rag between the timing gears (6 and 49).
2. Tighten the nut (4) of the right hand timing gear (49) to a torque setting of 15 – 20 ft-lbs.
3. Loosen the nut (4) of the left hand timing gear (6).
4. Place 0.005" shims in front and behind the tooth of the left hand rotor (11) (See Figure 7). Once the shims are in place and with the rotor movement still restricted tighten the nut (4) on the left hand timing gear (6) to a torque of 15 – 20 ft-lbs.
5. Remove the shims and folded rag. Check to rotors for correct clearance by rotating them. The rotors should turn freely and not make contact at any point, listen for sounds of the rotors touching.
6. If the rotors bind or make noise repeat the procedure but this time loosen the right hand rotor instead of the left.
7. Once clearances are set use, a small flat head screw driver to bend up one tab on each timing gear lock washer (5) to secure the location of the nut (4).

Figure 7: Setting Clearances



Note: For illustrative purposes the housing is not shown.

9.0 Troubleshooting

This information has been provided as an aid to basic troubleshooting. Disassembly procedures have been outlined in section 9 of this manual. If the BiRotor Plus is found to be in need of repair it is recommended the user contact the nearest Brodie International Service Office or Representative. It is important that servicing be performed by trained and qualified personnel.

Condition A: No Pulse Output is Present

Probable Cause:

1. No flow through meter.
2. Improper electrical connection.
3. Insufficient voltage to the preamplifier (if fitted).
4. Power failure.
5. Meter rotors jammed with debris.
6. Damaged pickoff/amplifier board.

Corrective Actions:

1. Ensure the pipe line has flow.
2. Ensure proper wiring connections have been made.
3. Supply sufficient voltage to the preamplifier board, see specifications in Section 6.
4. Ensure power is connected to the device and all it associated ancillaries.
5. Remove debris from rotors (check for damage to rotors, timing gears and bearings).
6. Replace pickoffs/preamplifier board.

Condition B: Erratic or Non Uniform Pulse Signal

Probable Cause:

1. Improper electrical connection.
2. Insufficient or fluctuating voltage to the preamplifier board (if fitted).
3. Improper ground or shielding of connection cable.
4. Power failure/damaged pickoffs or circuit board.
5. Damaged/worn bearings or timing gears.

Corrective Actions

1. Ensure proper wiring connections have been made.
2. Supply sufficient voltage to the preamplifier board, see specifications Section 6.
3. Replace and/or wiring ground and shield.
4. Ensure power supply is functioning or pickoffs/ board as required.
5. Replace bearings or timing gears.

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10.0 Parts List

Figure 8: Exploded View of Non-Ferrous BiRotor Plus, Model AB29X

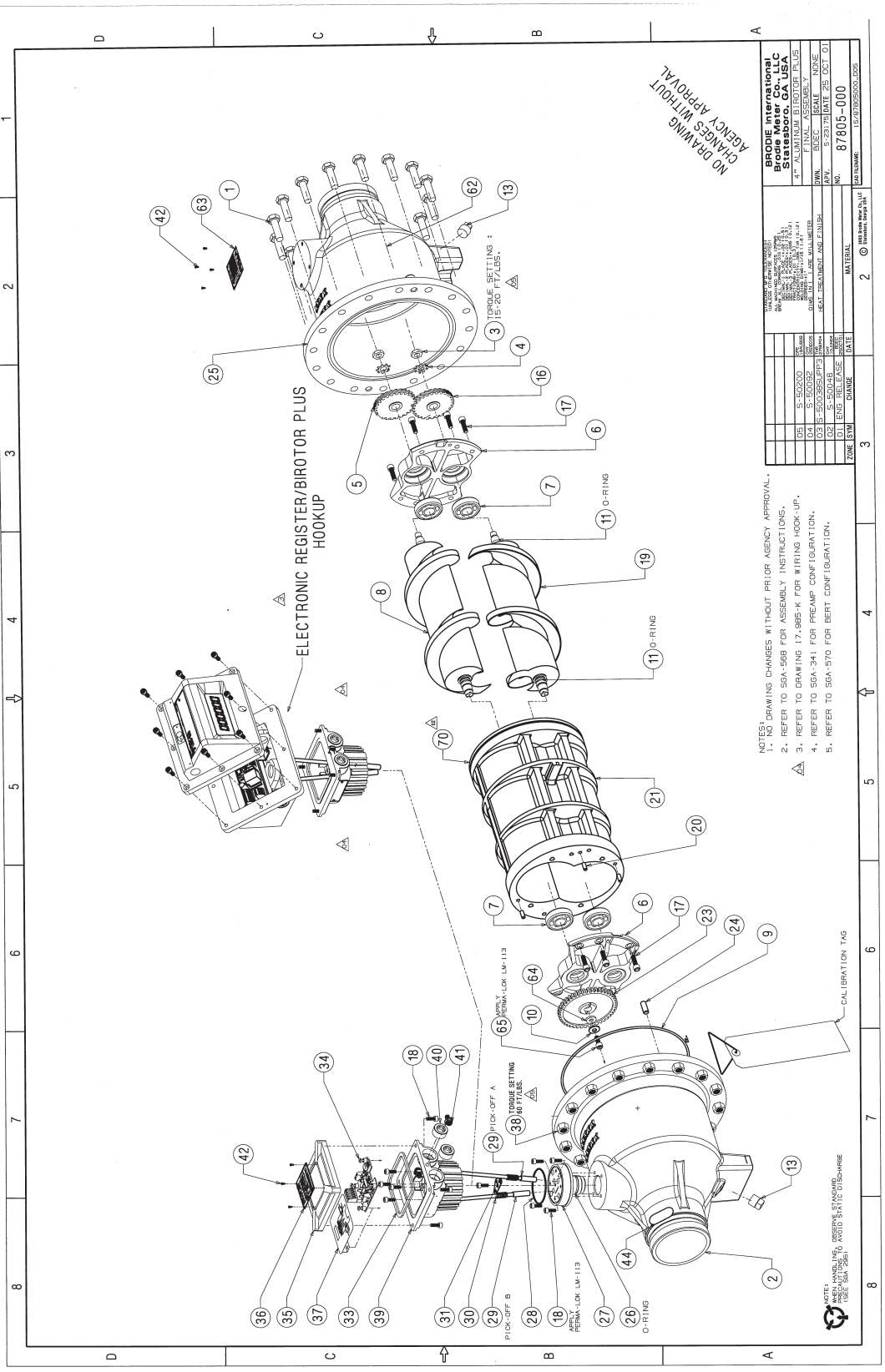


Table: Parts List of Non-Ferrous BiRotor Plus, Model AB29X

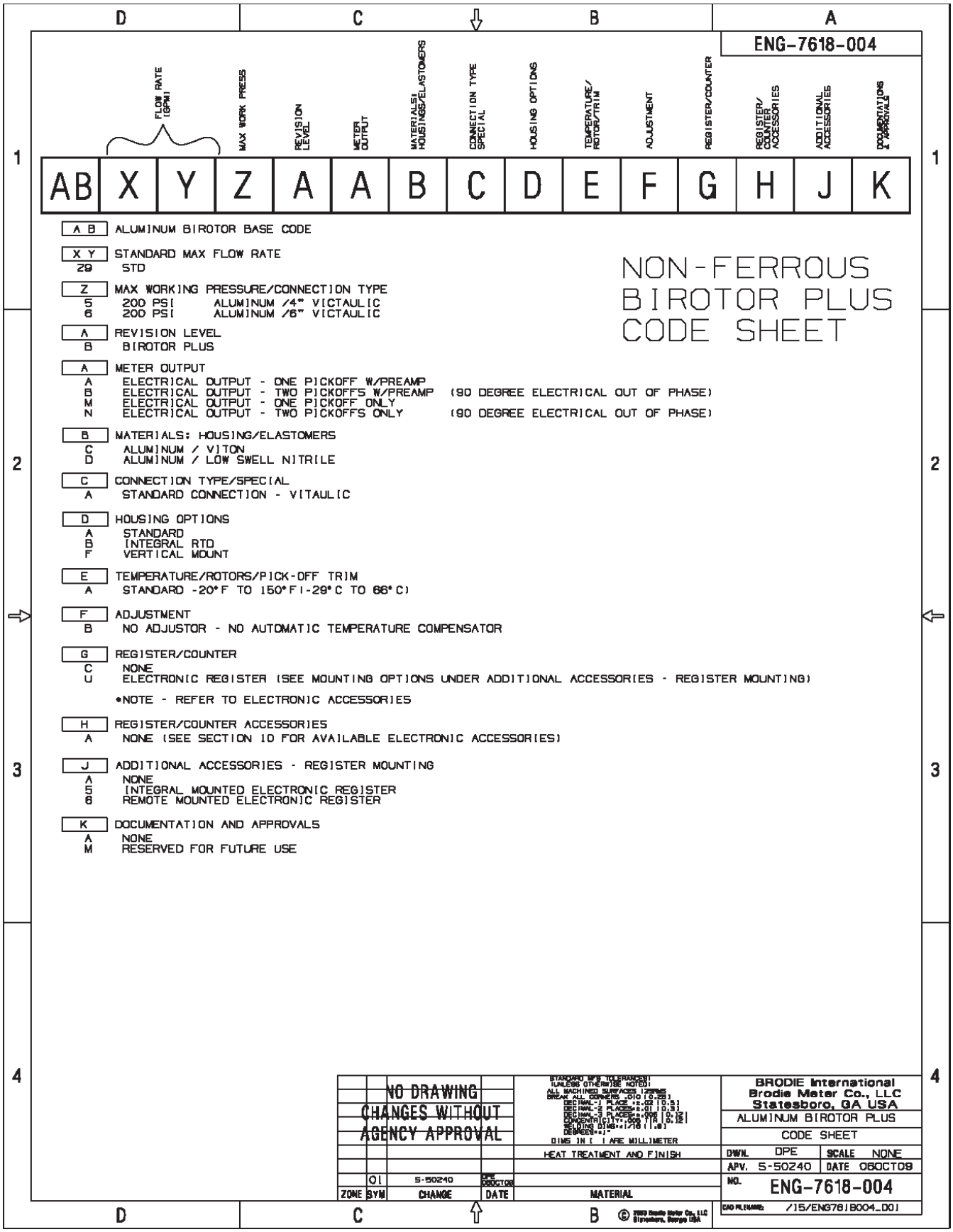
Item	Description	Model		Quantity
		4" Victaulic	6" Victaulic	
1	Screws	150807M		16
2	Housing (inlet)	87818-200	97818-200	1
3	Nut	60592		2
4	Lockwasher	51593		2
5	Rotor Gear Set	W86296		1
6	End Plate	86825-100		2
7	Roller Bearing	155197		4
8	Rotor Set	W86200-000		1
9	O-Ring	152088-XXX		1
10	Washer	1500667		1
11	O-Ring	152071-XXX		4
13	Pipe Plug	154704-419M		2
17	Screws	151042		12
*18	Screws	151496M		13
20	Dowel Pin	1559983		6
21	Measuring Unit Housing	86211-100		1
23	Pulse Wheel	86031-043		1
24	Dowel Pin	154097		2
25	Housing (Outlet)	87819-200	97819-200	1
26	O-Ring	157360-XXX		1
27	Sensor Housing	86820-100M		1
28	O-Ring	1500093-XXX		1
29	Magnetic Sensor (Pick-off)	W899-00-201-00		2
30	Spring	1500418		2
31	Hold Down Washer	86030-001		1
33	Gasket	CA-375Z-259-XXA		1
34	Circuit Board	230-00-300-00		1
35	UMB Cover	899-00-101-00		1
37	Wiring Instructions	899-00-228-07		1
38	Nut	151555M		16
39	Universal Mounting	899-00-100-00		1
40	Pipe Plug	1500909D		2
41	Grounding Lug	B18934-004		2
64	Retaining Washer	86033		1
65	Screw	1500668		1
70	O-Ring	159678-XXX		1

Notes:

*Items marked with a * are recommended spare parts.

1. These items are only available as a matched set, part number W86296.
2. O-ring material suffix is as follows:
   - -022 : Viton A
   - -120 : Low swell nitrile
   - -026 : Viton F
   - -016 : FluoroSilicon
3. When ordering the following information must be provided: Part number, Model Number, Serial Number, and Quantity Required. This information is a necessary for items marked C/F (Consult Factory).

11.0 Model Code



12.0 Warranty Claim Procedures

1. Limited Warranty:

Subject to the limitations contained in Section 2 herein and except as otherwise expressly provided herein, Brodie International, a Brodie Meter Co., LLC Company ("Brodie") warrants that the firmware will execute the programming instructions provided by Brodie, and that the Goods-manufactured or Services provided by "Brodie" will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by "Brodie", whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by "Brodie" from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that "Brodie" has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies "Brodie" thereof in writing during the applicable warranty period, "Brodie" shall, at its option, promptly correct any errors that are found by "Brodie" in the firmware or Services, or repair or replace F. O. B. point of manufacture that portion of the Goods or firmware found by "Brodie" to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of "Brodie" are not covered by this limited warranty, and shall be at Buyer's expense. "Brodie" shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized "Brodie" representative. All costs of dismantling, reinstallation and freight and the time and expenses of "Brodie's" personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by "Brodie". Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Brodie and can be amended only in a writing signed by an authorized representative of "Brodie". Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES. It is understood that - corrosion or erosion of materials is not covered by our guarantee.

2. Limitation Of Remedy And Liability:

Brodie International, a Brodie Meter Co., LLC Company ("Brodie") Shall Not Be Liable For Damages Caused By Delay In Performance. The Sole And Exclusive Remedy For Breach Of Warranty Hereunder Shall Be Limited To Repair, Correction, Replacement Or Refund Of Purchase Price Under The Limited Warranty Clause In Section 1 Herein. In No Event, Regardless Of The Form Of The Claim Or Cause Of Action (Whether Based In Contract, Infringement, Negligence, Strict Liability, Other Tort Or Otherwise), Shall "Brodie's" Liability To Buyer And/Or Its Customers Exceed The Price To Buyer Of The Specific Goods Manufactured Or Services Provided By Brodie Giving Rise To The Claim Or Cause Of Action. Buyer Agrees That In No Event Shall Brodie's Liability To Buyer And/Or Its Customers Extend To Include Incidental, Consequential Or Punitive Damages. The Term "Consequential Damages" Shall Include, But Not Be Limited To, Loss Of Anticipated Profits, Loss Of Use, Loss Of Revenue And Cost Of Capital.

Decontamination Statement

RMA Number: _____

Item Being Returned: _____

List all chemicals and process fluids and gasses that have come in contact with the equipment including cleaning agents. Attach additional pages of information if necessary. A Material Safety Data Sheet (MSDS) is required if non-food grade products have been used with the item being returned.

Information Required	Product 1	Product 2
Chemical Name		
Health and Safety Hazards		
Precautions, First Aid		

I hereby certify the equipment being returned has been cleaned and decontaminated in accordance with good industrial practices and in compliance with OSHA and DOT regulations. This equipment poses no health or safety risks due to contamination.

Signature: _____

Name (Please Print): _____

Title: _____

Company Name: _____

Phone Number: _____

Fax: _____

E-mail: _____

Reason for Return: _____

Reminder:
All items being returned must be packaged separately. This decontamination statement and the MSDS sheet(s) must be placed on the outside of the shipping container.

BRODIE™ International

19267 Highway 301 North (30461)
PO Box 450 • Statesboro, GA 30459-0450
Phone: 001.912.489.0200 • Fax: 001.912.489-0294
www.brodieintl.com

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Engineering the Future

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