

BiRotor Plus
Positive Displacement Flow Meter



B through F Series Meters

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1 Read Me First

Notice

Brodie International, a Brodie Meter Co., LLC Company ("Brodie") shall not be liable for technical or editorial errors in this manual or omissions from this manual.

Brodie makes no warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose with respect to this manual and, in no event, shall Brodie be liable for any special or consequential damages including, but not limited to, loss of production, loss of profits, etc.

Product names used herein are for manufacturer or supplier identification only and may be trademarks/registered trademarks of these companies. The contents of this publication are presented for informational purposes only, and

while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, expressed or implied, regarding the products or services described herein or their use or applicability. We reserve the right to modify or improve the designs or specifications of such products at any time.

Brodie does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Brodie product remains solely with the purchaser and end-user.

No part of this work may be reproduced or copied in any form or by any means - graphic, electronic or mechanical - without first receiving the written permission of Brodie International.

2 Essential Instructions

General

Brodie International 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, and servicing the product. If this instruction manual is not the correct manual, telephone +1 912 489 0200 and the requested manual will be provided.

Save this instruction manual for future reference. If you do not understand any of the instructions, contact your Brodie representative for clarification.

Follow all warnings, cautions, and instructions marked on and supplied with the product. Inform and educate your personnel in the proper installation, operation, and maintenance of the product. Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.

To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product. When replacement parts are required, ensure that qualified personnel use replacement parts specified by the manufacturer.

Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards, or improper operation.

Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified personnel, to prevent electrical shock and personal injury.

It is the customer's responsibility to provide fire prevention measures and equipment per local regulations.

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

Essential Instructions for Measuring Equipment, Including the European Union (Directive 2014/32/EU MID)

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

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

user's 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. The custody transfer 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 Electrical Equipment, Including the European Union (Directive 2014/30/EU and 2014/32/EU)

This unit contains Electrostatic sensitive circuit boards. Electrostatic safety precautions should be taken to prevent damage.

When connecting wiring it is good practice to use shielded cable. The shield should be connected to earth at the read out or control systems end of the cable; the other end of the shield should not be connected.

This wiring practice is mandatory in order to comply with the requirements for electromagnetic compatibility as per the EMC directive 2014/30/EU and MID 2014/32/EU of the council of the European Union.

It is the end user's responsibility to ensure that all protective covers are in place to prevent electrical shock and/or personnel injury.

Essential Instructions for Pressure Containing Equipment, Including the European Union (Directive 2014/68/EU)

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 user's responsibility to assess any risks and take any precautions necessary.

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

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

It is the end user's 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 have 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 user's responsibility to ensure that the device is warmed to an appropriated temperature before being pressurized.

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 user's responsibility to provide fire protection measures and equipment in accordance with the local regulations.

Essential Instructions for Equipment to be Used in Hazardous Locations, Including the European Union (Directive 2014/34/EU)

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. Cable glands and cable must be suitable for the operating temperature of the device under its rated conditions, this is especially important if the device has an operating temperature above 1580F (700C). It is the end user's responsibility to ensure this happens.

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 user's 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 user's responsibility to ensure, when the instrument is located in a hazardous area, that all cable glands and conduit seals are installed in accordance with all local codes and regulations.

It is the end user's responsibility to ensure that before opening an electronic enclosure in a flammable atmosphere that all the electrical circuits have been 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 M6-1x16 (6g) mm hex head socket 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 inch lbs. upon installation. It is the end user's responsibility to ensure this happens.

It is the end user's 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 Aluminum; 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 dust from forming a possible source of ignition.

The power supply requirements for this product are specified within the operating and maintenance manual, it is the end user's responsibility to operate the product within these specified limits.

The instrument may contain surfaces that constitute flames paths, these surfaces should not contain any mars or scratches. Damaged flamepath surfaces may not be repaired. If any damage is 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 and must be replaced. It is the end user's responsibility to inspect these surfaces every time the enclosure is opened.

When flanged flame paths are reassembled the gap between them should be less than 0.0015" (0.038 mm) such that a 1/2" (12.5mm) wide 0.0015" (0.038 mm) feeler gauge will not enter the gap more than 1/8" (3mm). It is the end user's responsibility to ensure this happens each time the enclosure is reassembled.

3 Warranty Claim Procedures

These terms and conditions, the attendant quotation or the acknowledgement, and all documents incorporated by reference therein, binds Brodie Meter Co., LLC, who issues the quotation or acknowledgment for the provision of services and/or the sale of goods (except as provided in Section 11), to be provided hereunder by seller (Brodie Meter Co., LLC) hereinafter Seller, and the buyer, hereinafter Buyer, and constitute the entire agreement (Agreement) between Buyer and Seller regarding such sale and/or provision. To the extent not in conflict with the superseding terms of the Sales Order, these terms and conditions will be in force.

1. **PRICES:** Unless otherwise specified by Seller, Seller's price for the Goods and/or Services shall remain in effect for thirty (30) days after the date of Seller's quotation or acceptance of the order for the Goods/Services, whichever is delivered first, provided an unconditional, complete authorization for the immediate manufacture and shipment of the Goods and/or provision of Services pursuant to Seller's standard order processing procedures is received and accepted by Seller within such time period. If such authorization is not received by Seller within such thirty (30) day period, Seller shall exercise the right to change the price for the Goods/Services to Seller's price in effect for the Goods/Services at the time the order is released to final manufacture. Notwithstanding any of the foregoing to the contrary, the price for Goods/Services sold by Seller, but manufactured by others, shall be Seller's price in effect at the time of shipment to Buyer.

2. **DELIVERY, PASSING OF RISK, RETENTION OF TITLE, AND DOCUMENTATION:** All shipping dates are approximate and are based upon Seller's prompt receipt of all necessary information from Buyer to properly process the order. Any agreed

trade term shall be construed in accordance with the INCOTERMS® in force at the formulation of the contract. If no trade term has been specifically agreed, the delivery shall be F.O.B. Brodie Factory, FCA Brodie Factory, or EXWORKS Brodie Factory. Notwithstanding, any provisions to the contrary in this or other documents related to this transaction, the passing of risk of loss thereto shall transfer to Buyer upon delivery to the first freight carrier at the shipping point. The Goods shall remain the property of the Seller until paid for in full to the extent that such retention of title is valid under the relevant law. The retention of title shall not affect the passing of risk. The Seller shall provide Buyer with that data/documentation which is specifically identified in the contract. If additional copies of data / documentation or non-standard data/documentation are to be provided by Seller, they shall be provided to Buyer at Seller's price then in effect.

3. **EXCUSE OF PERFORMANCE:** Seller shall not be liable for delays in performance or for non-performance due to acts of God, war, riot, fire, labor trouble, unavailability of materials or components, explosion, accident, compliance with governmental requests, laws, regulations, orders or actions, or other unforeseen circumstances or causes beyond Seller's reasonable control.

4. **CHANGE, CANCELLATION AND RESTOCKING CHARGES:** Once an order has been acknowledged by the Seller, any changes requested by the Buyer must be communicated to the Seller. The Seller will notify the Buyer of any fees associated with the requested change. Buyer may terminate or suspend its non-shipped order for any or all of the Goods/Services covered by the Agreement, provided that Buyer gives Seller reasonable advance written notice of such termination or suspension and reimburses Seller accordingly:

25% of Net Order after Release to Engineering, 50% of Net Order after Release to Manufacturing, 75% of Net order after 50% Manufacture Complete and 100% of Net Order once Manufacturing is complete. Any request for return of product already shipped to Buyer will be at the discretion of Brodie. If so approved, a Return Authorization will be provided and a restocking fee assessed.

5. LIMITED WARRANTY: Subject to the limitations contained in Section 2 herein and except as otherwise expressly provided herein, Brodie Meter Co., LLC ("Brodie") warrants the Goods-manufactured by Brodie will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. The specifics of these warranties are as follows: Goods are warranted for twelve (12) months from the date of installation and 18 months from date of shipment, whichever occurs first; Assemblies and fabricated parts manufactured by Brodie and sold as spares are warranted for 12 months from the date of shipment; Consumables and Field/Factory Services are warranted for a period of 90 days from the date of shipment or completion of the services; Services performed on products still under the original warranty will continue to be covered under the original warranty period or 90 days, whichever is longer; 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. Should Buyer discover any warranty defects and notifies Brodie thereof in writing during the applicable warranty period, Brodie shall, at its option, repair or replace, that portion of the Goods 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. Brodie is not responsible for damages that incur during shipment to Buyer for shipments that are F.O.B. Brodie Factory, FCA Brodie Factory, or EXWORKS Brodie Factory. Shipping charges for goods returned to Brodie under warranty will be at Buyer's expense. Products found not to be warranted can be repaired and returned at Buyer's expense and return charges born by Brodie will be added to the cost of repair or returned to Buyer "as received" at Buyer's expense. Insurance for returned products will be at Buyer's expense. For all returned products please package to prevent damage, or future damage during shipment. Make sure the products are cleaned, free from grease oil, chemicals and other materials that may hamper defect detection and impede repair. All returned items must be accompanied with a MSDS for the products that have been in contact with the equipment, including cleaning agents. A decontamination statement, RMA, and Customer Problem Report must also accompany equipment returned. Product received in an unsuitable condition will be returned at Buyer's expense without being examined. 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, expressed or implied, as to merchantability, fitness for a 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 unless the Buyer has notified the Seller the product will be used in an environment conducive to corrosion and/or erosion and the product has been coated with Brodie's recommended method of protection against corrosion / erosion.

6. LIMITATION OF REMEDY AND LIABILITY: Brodie shall not be liable for damages caused in 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 5. 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.

7. PATENTS: Subject to the limitations contained in Section 6, Seller shall defend any suits brought against Buyer based on a claim that use of the Goods manufactured by Seller constitutes an infringement of a valid patent of the United States, and shall pay any damages awarded therein against Buyer, provided that Buyer: promptly notifies Seller in writing of the filing of such suit or the threat thereof; permits Seller to control completely the defense or compromise of such claim of infringement; and provides all reasonable assistance and cooperation requested by Seller for the defense of such suit. In the event that only the Goods manufactured by Seller are held to be infringing in such suit and their use is enjoined, Seller shall, at its sole option and expense, provide a commercially reasonable alternative, including, but not limited to, procuring for Buyer the right to continue using the Goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that

Seller shall not be liable for infringement, and that Buyer shall fully indemnify Seller therefore, if infringement is based upon the use of Goods in connection with Goods not manufactured by Seller or in a manner for which the Goods were not designed by the Seller or if the Goods were not designed by the Seller or if the Goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.

8. INSTALLATION: Buyer shall be responsible for receiving, storing, installing, starting up and maintaining all Goods. Seller shall provide a quotation for services to assist Buyer in these functions if requested.

9. TAXES: Any tax or governmental charge payable by the Seller because of the manufacture, sale or delivery of the Goods, or provision of Services, may at Seller's option be added to the price herein specified. The foregoing shall not apply to taxes based upon Seller's net income.

10. TERMS OF SHIPMENT AND PAYMENT: Subject to the approval of Seller's Credit Department, shipping terms are F.O.B. Brodie Factory, FCA Brodie Factory, or EXWORKS Brodie Factory. Payment terms are subject to the approval of Seller's Credit Department and may vary based on Buyer's creditworthiness. Payment is expected, in U.S. currency, as per the prearranged agreement between the Buyer and Seller stated on the sales order. In the absence of such agreement, payment, in U.S. currency, is due Net30 days from the date of invoice. If any payment owed to Seller hereunder is not paid when due, it shall bear interest, at a rate to be determined by Seller which shall not exceed the maximum rate permitted by law, from the date on which it is due until it is received. Seller shall have the right, among other remedies, either to terminate the Agreement or to suspend further deliveries under this and/or other agreements with Buyer in the event Buyer fails to make any payment hereunder when due. Buyer shall be liable for all expenses incurred for collection of past due amounts, including attorneys' fees.

11. STORAGE FEES

1. Per diem charges are applicable when equipment is held beyond the acknowledged ready for shipment date.

Per diem storage charges will be assessed on each calendar day excluding the date of readiness.

The customer shall indemnify and hold Brodie International harmless from any and all liability and expense for such damages that might result from extended storage beyond six months. Brodie may place the cargo in another warehouse facility with all charges associated with the transfer and storage to be paid by the customer.

12. SOFTWARE AND FIRMWARE: Notwithstanding any other provision herein to the contrary, Seller or applicable third-party owner shall retain all rights of ownership and title in its respective firmware and software, including all copyrights relating to such firmware and software and all copies of such firmware and software. Except as otherwise provided herein, Buyer is hereby granted a nonexclusive, royalty free license to use firmware and software, and copies of firmware and software, incorporated into the Goods only in conjunction with such Goods and only at the Buyer's plant site where the Goods are first used. Buyer may negotiate with Seller separate licenses to use such copies and firmware and software at other plant sites. Buyer's use of certain firmware (as specified by Seller) and all other software shall be governed exclusively by Seller's and/or third-party owner's applicable license terms.

13. BUYER SUPPLIED DATA: To the extent that Seller has relied upon any specifications, information, representation of operating conditions or other data or information supplied by Buyer to Seller in the selection or design of the Goods and/or provision of the Services and the preparation of Seller's quotation, and in the event that the specifications or information is inaccurate or actual operating conditions differ, any warranties or other provisions contained herein which are affected by such conditions shall be null and void, unless otherwise mutually agreed upon in writing.

14. GENERAL PROVISIONS: (a) Buyer shall not assign its rights or obligations under the Agreement without Seller's prior written consent. (b) There are no understandings, agreements or representations, express or implied, not specified in the Agreement. (c) No action, regardless of form, arising out of transactions under the Agreement, may be brought by either party more than two (2) years after the cause of action has accrued. (d) Any modification of these terms and conditions must be set forth in a written instrument signed by a duly authorized representative of Seller. (e) The Agreement is formed and shall be construed, performed and enforced under the laws of the state of Georgia. However, Buyer and Seller agree that the proper venue for all actions arising under the Agreement shall be only in the State where the Goods involved in such actions were manufactured. (f) GOODS AND SERVICES PROVIDED HEREUNDER ARE NOT SOLD OR INTENDED FOR USE IN ANY NUCLEAR OR NUCLEAR RELATED APPLICATIONS. Buyer (i) accepts Goods and Services in accordance with the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from any and all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from use of Goods and Services in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability. (g) The 1980 United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement. (h) If any provision of the Agreement is invalid under any statute or rule of law, such provision, to that extent only, shall be deemed to be omitted without affecting the validity of the remainder of the Agreement.

4 Receipt of Shipment

When you receive your equipment inspect the outside of the packing case for damage which may have incurred during shipping. Damage incurred during shipment is the responsibility of the carrier and is not part of the factory warranty. If the packing case is damaged, notify the local carrier immediately.

If the package is in good condition remove the envelope containing the packing list and carefully

remove the equipment and all components included in the shipment from the packing case. Inspect for damaged or missing parts, referring to the packing list, and prior to discarding the packing material.

If Items are missing from your shipment, contact your sales representative. Your sales order number will be required.

5 Return of Equipment

If the equipment must be returned to the factory for repair or replacement, a Returned Materials Authorization (RMA) must be included with the components.

RMA forms may be obtained from your sales representative or from the Product Service Department.

In addition to the RMA, a Material Safety Data Sheet and a Decontamination Statement must be included with Items being returned to the factory. A Decontamination Statement is included in the back of this manual.

If the equipment is removed from service it must be thoroughly drained and neutralized before it is packed for shipment. Care must be taken to ensure that product removed from the equipment is disposed of in accordance with all applicable local, state and federal regulations.

The flanges should be sealed to keep residual fluid from leaking out of the meter during transport. The type of flange seal required will vary with the form of transportation used. Contact the carrier for specific instructions.

The equipment should be securely mounted on a wooden skid for shipment. The original container or a solid wooden box should be used to protect the exterior of the components.

When packing the components for return to the factory, place the RMA and a copy of the packing list that was delivered with the equipment inside an envelope. Place the envelope inside the shipping container with the Item being returned and reference the RMA number on the outside of the shipping container.

Equipment returned to the factory without the proper documentation will be returned to sender at their expense.

Ship the container to:
Brodie Meter Co., LLC
Product Service Department
19267 Highway 301 North
Statesboro, GA 30461, USA

Phone: +1 (912) 489-0200
Fax: +1 (912) 489-0294
service@brodieintl.com

6 Storage

Brodie International instruments are precision devices and should be handled and stored with care. They should not be subjected to rough or improper handling or stored in an environment where moisture, extreme temperatures, or foreign material can damage the meter.

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

If extended storage is required it is recommended that the instrument be placed in an environmentally controlled warehouse.

If this is not possible the instrument should be stored in a waterproof 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 on the equipment and accessories. Caution must be used to ensure desiccant packs are removed prior to installation.

Depending on the storage time it may also be preferable to use a compatible corrosion inhibitor.

If the meter is removed from service for an extended period of time it should be flushed with a light oil before being placed into storage.

7 Description

General

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

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

The BiRotor Plus (models B27X, B28X, B29X, B30X, B31X, B32X, B33X, B34X, B35X, B36X, B38X, SB25X, LB27X, LB28X, LB29X) electrical enclosure comprises of a cast aluminum body and a plain lid containing a PCB which consists of an inductive proximity sensor which detects metallic objects without coming in direct contact. Two entry holes are provided on one face of the enclosure to allow the fitment of suitable cable entry devices. A closed cell silicon rubber compound sponge gas-



ket is fitted around the top of the enclosure, onto which the lid is fitted. The lid is held in position with four socket head screws. A warning label is fitted on the lid and held in place with four rivets secured into blind holes.

The model type is identified by the model code. Eg. B27X:

B, SB, LB - symbolizes that it is a model of BiRotor Plus series.

25 through 38 - indicates meter size in inches.

X - represents maximum working pressure of:

1 for 16 bar (DIN) / 285 p.s.i. (ANSI), OR

2 for 40 bar (DIN) / 740 p.s.i. (ANSI), OR

5 for 100 bar (DIN) / 1480 p.s.i. (ANSI), OR

6 for 200 p.s.i (Victaulic) for B27, B28, or B29 only.

The BiRotor Plus meter can be supplied with the following approvals and certifications:

CSA 2142875

Class I, Division 1, Groups C & D T6

-40 °C ≤ Ta ≤ 60 °C

Class I, Division 1, Groups C & D T4

-40 °C ≤ Ta ≤ 60 °C

IECEX ITS 08.0021X

Ex db IIB T6 Gb IP65

-40 °C ≤ Ta ≤ +60 °C

Ex db IIB T4 Gb IP65

-40 °C ≤ Ta ≤ +60 °C

Tested to standards:

IEC 60079-0:2017

IEC 60079-1:2014

ITS 08 ATEX 15842X

ITS 22 UKEX 0503X

⊕ II 2 G Ex db IIB T6 Gb IP65

-40°C ≤ Ta ≤ +60°C

⊕ II 2 G Ex db IIB T4 Gb IP65

-40°C ≤ Ta ≤ +60°C

Tested to standards:

EN IEC 60079-0:2018

EN 60079-1:2014

Specific Conditions of Use / Schedule Limitations / Special Conditions for Safe Use / Special Considerations of Certification:

- On assembly the gap between the lid and the enclosure must be less than 0.0381mm (0.0015") in accordance with drawing ENG-7617-300.

- The Flameproof Joints are not intended to be repaired or changed without the manufacturer's consent.

- The SB25X enclosure is to be routine pressure tested at 170.1 psi / 11.73 bar.

General Note:

Temperature class is based on process temperature range.

T6: 75°C Maximum Standard Process Temperature

T4: 110°C Maximum High Process Temperature

8 Installation and Operation

General

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 the housing in which they rotate. Clearances between moving components are maintained with the use of 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.



8.1 - Installation Requirements

1. The instrument should be mounted on a secure foundation. Provisions should be made for vertically mounting the meter to ensure stability.
2. The process piping should not place any undue strain on the instrument.
3. Precautions should be taken to ensure that thermal fluid expansion does not raise the line pressure above the maximum working pressure of the instrument.
4. Process piping must be clean and free of any foreign matter.
5. A strainer should be installed upstream of the instrument.
6. An air eliminator should be installed upstream of the instrument if the process fluid is expected to contain entrained air.
7. A flow limiting valve should be installed downstream of the instrument, this will maintain a back pressure on the instrument and prevent excessive flow rates.
8. 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.

8.2 - Installing the Instrument

1. Remove the inlet and outlet protection covers.
2. Install the instrument into 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.
3. Connect the instrument wiring, refer to Figures 9-1 and 9-2. Cable entry into the electrical enclosure is by two 3/4-14 NPT female threads. All flame paths must be protected from damage during work.
4. Use wiring appropriate for the location and operating conditions. Wiring glands and/or conduits must conform to local electrical codes and regulations if wiring is to be installed in a hazardous area.

NOTE:

For additional requirements on installation please refer to Chapter 2, Essential Instructions, at the beginning of this manual.

If the instrument is being installed with additional accessories, the instructions for those 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. Refer to Figure 8-1 for their configurations.

The UMB housing may be rotated in 90° increments to accommodate the mounting of accessories. If the UMB housing is removed for any reason, the flame path at the base must not be damaged. No repair is allowed if the surface is damaged. Care must also be taken to disconnect the sensor wires to prevent damage. It is essential that the four retaining screws used to secure the UMB housing to the meter body be torqued to 55 in/lbs.

Internal grounding terminal must be used for the equipment grounding connection, and the external terminal is for supplementary bonding connection. Grounding symbol congruent to IEC 60417 number 5019 located on the grounding connection to UMB.

DUAL CHANNEL PREAMP JUMPER LOCATIONS
(FACTORY SETTINGS SHOWN)

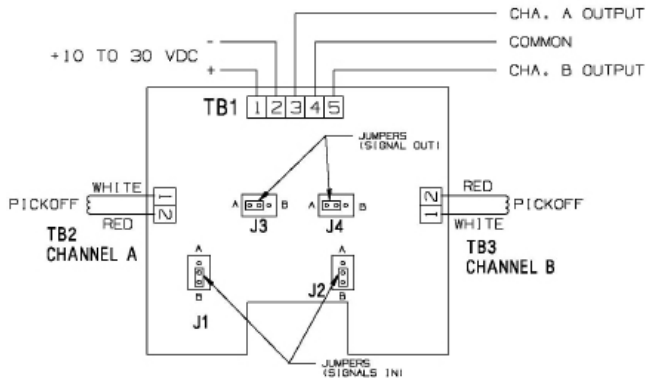


Figure 8-1 Wiring Connections

TB1	Function
1	9-28 VDC Supply
2	V Comm
3	Channel A Signal
4	Channel A and B Common
5	Channel B Signal

Jumper	Position	
J1 (Channel A)	B ¹	
J2 (Channel B)	B ¹	
	5 VDC Pulse	V Supply Pulse ²
J3 (Channel A)	A	B
J4 (Channel B)	A	B

NOTE:

¹ Do not Change without consulting factory.

² V Supply Pulse = Input V minus approximately 2 volts

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

Care should be taken not to locate the instrument near any source of electromagnetic interference, such as those produced by electric motors, transformers, solenoids, etc.

Either of these factors could induce a signal into the flow sensing pickoff and interfere with the accuracy of line product measurement.

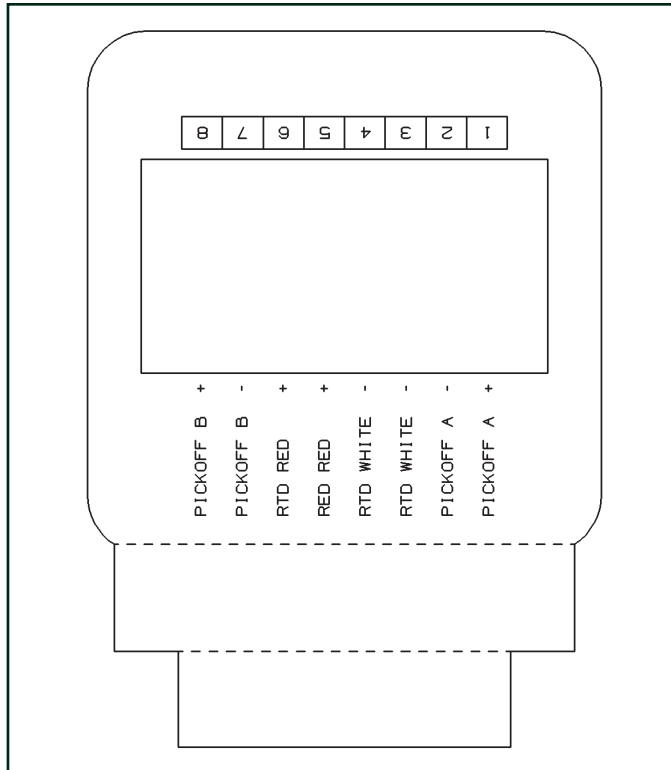


Figure 8-2 Wiring Connections

Integral Brodie Electronic Rate Totalizer (BERT-E)

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

8.3 - Meter Start Up and Operation

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

1. To pressurize the system, slowly open the inlet valve so as to prevent system shock. Slowly allow product to enter the system while keeping the downstream isolation valve closed.
2. Open the downstream valve (10%) to allow any air to be flushed from the system. Do not overspeed the instrument.
3. Once the air has been flushed from the system, close the downstream isolation valve and check for any leaks. If leaks are found, check all seals and retighten connections.
4. Fully open the upstream isolation valve to pressurize the system.

Flow start up can commence once the system has been pressurized.

1. Turn on all electronic circuits and check for proper function.
2. Open flow control valves and allow the instrument to run at 20% of its rated flow for 5 minutes.
3. During this initial run, check all other components in the system for functionality.
4. Once this run is complete, set the flow control valve to the required flow and ensure that the maximum flow for the instrument is not exceeded.

8.4 - Higher Temperature Start Up

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

$$t_h = [(C_{nom}) \cdot (OT_{of} - 212)]/100$$

t_h = Warm Up Time in Hours
 C_{nom} = Nominal Connection Size
 OT_{of} = Operating Temperature in °F

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

8.5 - Custody Transfer

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

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

Typical Horizontal Installation with Associated Accessories

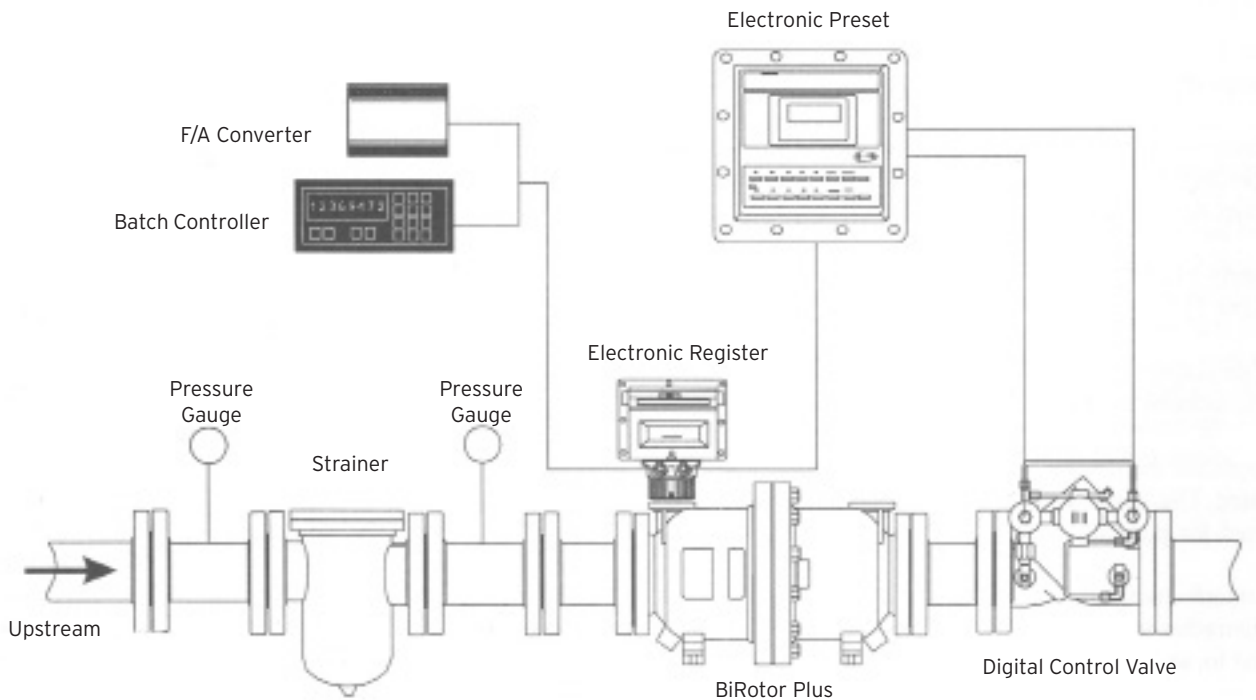


Figure 8-3 Horizontal Installation

Truck Loading - Vertical Installation for Marketing Terminal Applications

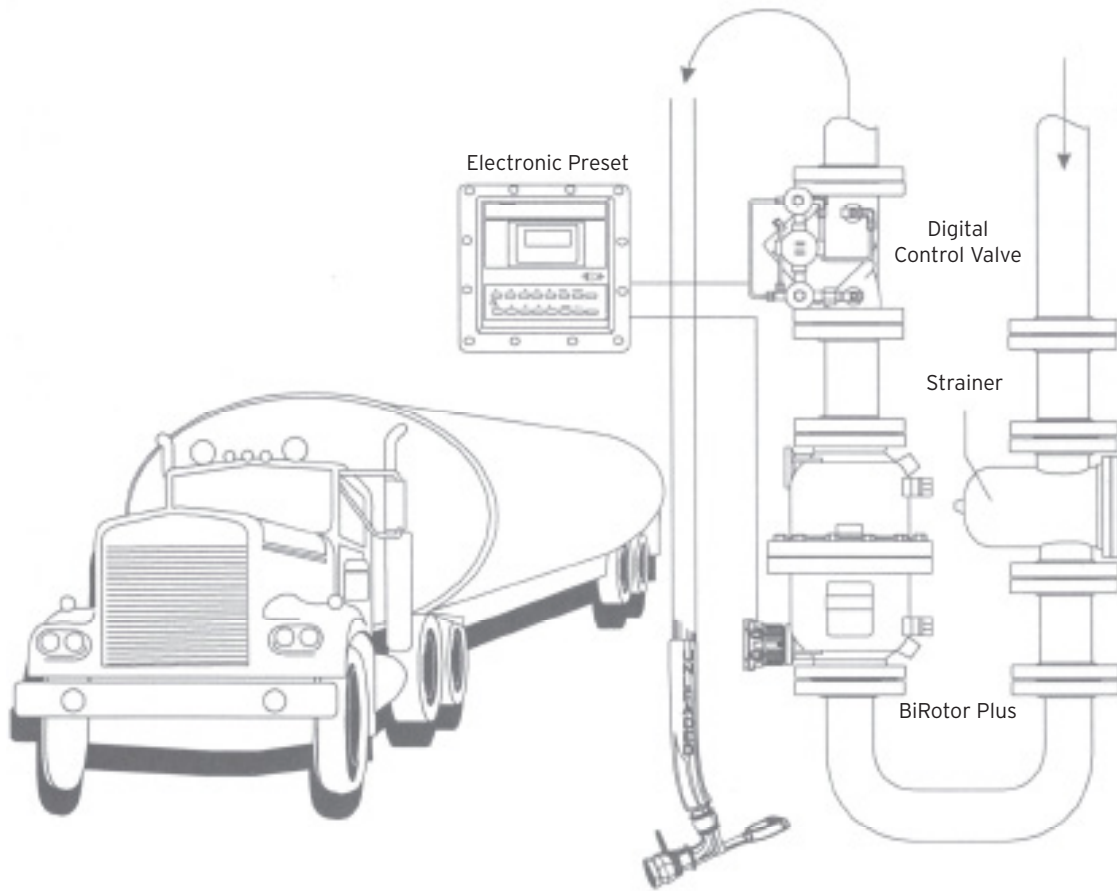


Figure 8-4 Vertical Installation

8.6 Electrical - Symbols and Definitions



ISO 7000-0434A : Caution Risk of Danger or Attention, Consult Accompanying Documents



IEC 60417-5019 : Protective Earth (Ground)



IEC 60417-5032 : Alternating Current



IEC 60417-5007 : "ON" (Power)



IEC 60417-5008 : "OFF" (Power)

9 Maintenance

General

The Brodie BiRotor Plus 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 instrument's service life.

The instrument should be kept filled with the process fluid 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 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 unit.

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

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

NOTE:

If the instrument is being used in hazardous areas, 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.

NOTE:

All Item Numbers referenced in this section can be found on Figure 11-1 in Chapter 12, Parts Lists.

Performance Considerations

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

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

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

Lubricity: The lower the lubrication properties of the process fluid being measured then the lower the life expectancy should be.

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

Electronics

This 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.

9.1 - Removal/Replacement of Circuit Board

1. Disconnect all power to the instrument.
2. Remove the electronics cover, or electronics register, if one is fitted, by removing four Allen screws.
3. Disconnect terminals and wiring to the circuit board.
4. Remove circuit board by removing the screws that attach it to the housing.

To reinstall, reverse the removal instructions and torque the four Allen screws to 55 in/lbs.

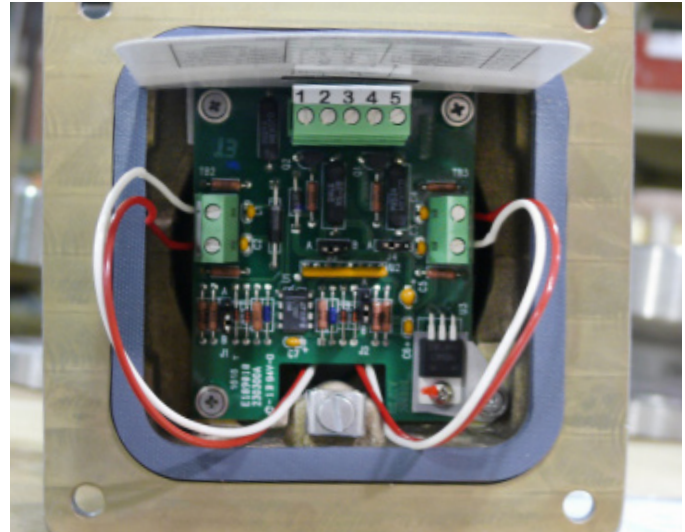


Figure 9-1 Circuit Board and Housing

9.2 - Removal/Replacement of Pick Off Sensors

1. Remove the circuit board as detailed above.
2. Remove the center screw from the sensor housing and lift off the hold down washer.
3. Lift out the inductive sensor(s) and spring.

Resistance between sensor leads:

For Sensor P/N 899-00-201-00 or P/N 899-00-201-01:
1000 Ohms +/-15%

For Sensor P/N 899-00-201-00-B or
P/N 899-00-201-01-B: 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 sensor in the sensor housing. If only one pick off sensor is present it should be inserted in the hole labeled 'A'. Secure with the hold down washer and Allen screws and replace the circuit board (Item 38).

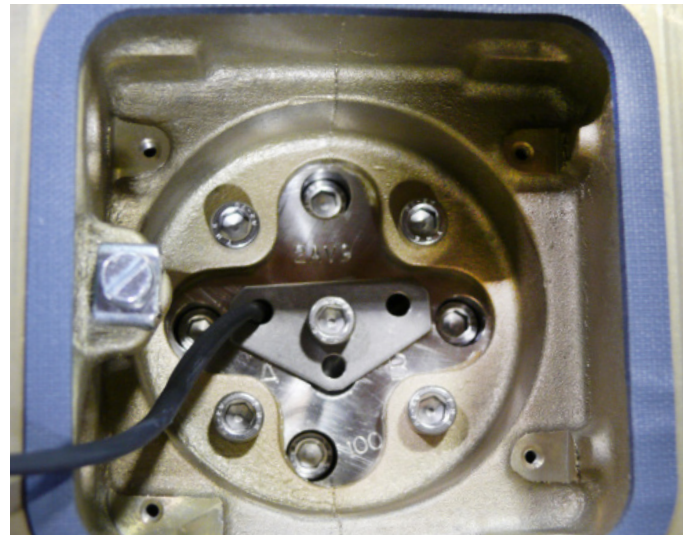


Figure 9-2 Pick Off Sensor Installation

9.3 - 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 from the electronics unit.
4. Unbolt the instrument from the process piping and remove to a workshop for further disassembly.

NOTE:

Care should be exercised to prevent the intrusion of foreign material into the instrument end connections.

9.4 - Removal of the Measuring Unit from the Instrument Body (B27 thru B32)

1. Turn the meter on end so that it stands on its inlet flange, this will also facilitate in fully draining the instrument of process fluid.
2. Remove fasteners and lift off the outlet housing.
3. Remove housing O-ring.
4. Holding the measuring unit assembly by the ribs, carefully lift straight up until the assembly clears the inlet housing.
5. Place the measuring unit in the horizontal position.

At this stage the assembly can be inspected for wear or damage. If the assembly had jammed it may be possible to unblock the rotors by flushing it with a cleaning solvent or kerosene without the need for further disassembly.

Further disassembly of the measuring unit for cleaning or inspection can be achieved while maintaining clearance settings. This procedure is covered in the next section. To fully disassemble the measuring unit proceed to Section 9.6.

9.4 - Removal of the Measuring Unit from the Instrument Body (B33 thru B38)

1. Turn the meter on end so that it stands on its outlet flange, this will also facilitate in fully draining the instrument of process fluid.
2. Remove fasteners and lift off the inlet housing.
3. Remove housing O-ring.
4. Remove 2 fasteners from the Measuring Unit Assembly and replace with eyebolts. Carefully lift the measuring unit assembly straight up until the measuring unit assembly clears the outlet housing. USE CAUTION NOT TO HIT THE PULSE WHEEL WITH THE CHAIN OR STRAPS.
5. Place the measuring unit in the horizontal position.

At this stage the assembly can be inspected for wear or damage. If the assembly had jammed it may be possible to unblock the rotors by flushing it with a cleaning solvent or kerosene without the need for further disassembly.

Further disassembly of the measuring unit for cleaning or inspection can be achieved while maintaining clearance settings. This procedure is covered in the next section. To fully disassemble the measuring unit proceed to Section 9.6.

9.5 - Measuring Unit Disassembly While Maintaining Clearance Settings

1. Place a folded rag between the timing gears to prevent the rotors from turning during disassembly.
2. Remove the pulse wheel by removing the screw, washer, and retaining washer.
3. Remove the screw from the end plate at the timing gear end of the measuring unit assembly.

NOTE: (B27 thru B34)

A flat head screwdriver may be used in conjunction with the slots on the end plate to aid in its removal. Excessive force is not required. (B35 thru B38) Loosen Set Screws on each bearing nut (2 screws for each nut). Remove the bearing nuts. (B38 only) Remove the 4 outside screws on bearing plate. Remove the 2 inside screws and screw them hand tight in the bearing plate holes on the opposite side of the center rib. Slowly; in sequence tighten the screws to remove the bearing plate.

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

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

At this stage the meter can be reassembled by reversing the disassembly procedures without the need to reset any clearances.

NOTE:

Any elastomers that have been removed should be replaced with new parts during reassembly.

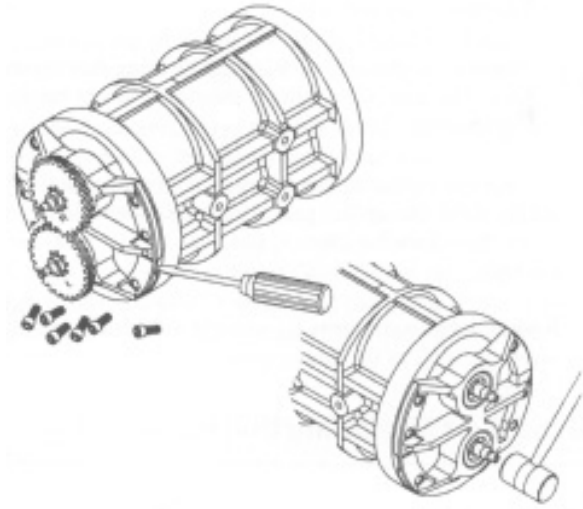


Figure 9-3 Measuring Unit Disassembly

9.6 - Complete Disassembly of the Measuring Unit (B27 thru B34)

1. Place a folded rag between the timing gears to prevent the rotors from turning during disassembly.
2. Remove the pulse wheel by removing the screw, washer, and retaining washer.
3. Remove the screws from the end plate at

the timing gear end of the measuring unit assembly.

NOTE:

A flat head screwdriver may be used in conjunction with the slots on the end plate 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 the removal of the rotor assembly.
 5. Fold down the lock washer tabs to enable the nuts to be undone and remove them from the rotor shafts. The timing gears can be released from the shaft by striking them with a plastic or rubber mallet.
 6. Remove the rotors from the end plate by gently tapping the rotor shafts with a plastic or rubber mallet.
 7. Remove the O-rings from the rotor shafts.
 8. A flat head screwdriver may be used in conjunction with the slots on the end plate to aid in its removal. Excessive force is not required.
 9. (B38 only) Screw 2 of the screws into the bearing plate. Slowly tighten the screws sequencing to remove the bearing plate.

Caution: Care must be taken not to damage the bearing nut threads when removing the bearing plates and rotors.
 10. Remove the rotors from the end plate by gently tapping the rotor shafts with a plastic or rubber mallet.
 11. (B33 and B34 only) Remove the O-Rings from the rotor shafts.
-

9.7 - Complete Disassembly of the Measuring Unit (B35 thru B38)

1. Place a folded rag between the timing gears to prevent the rotors from turning during disassembly.
2. Remove the pulse wheel by removing the screw, washer, and retaining washer.
3. Remove the screws from the end plate at the pulse wheel end of the measuring unit.
4. On the pulse wheel end loosen Set Screws on each bearing nut. (2 screws for each nut). Remove the bearing nuts.
5. On the timing gear side of the measuring unit fold down the lock washer tabs to enable the nuts to be undone and remove them from the rotor shafts. The timing gears can be release from the shaft by striking them with a plastic or rubber mallet.
6. Loosen Set Screws on each bearing nut. (2 screws for each nut). Remove bearing nuts.
7. (B27 thru B36) Remove the pulse wheel side bearing plate.

12. The bearings 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, then they must be replaced. Timing gears must be replaced whenever bearings are replaced.
13. Remove the other end plate from the measuring element housing and remove the bearings.
14. Remove the sensor housing from the inlet housing by removing found Allen screws located in the counter sunk holes under the circuit board.

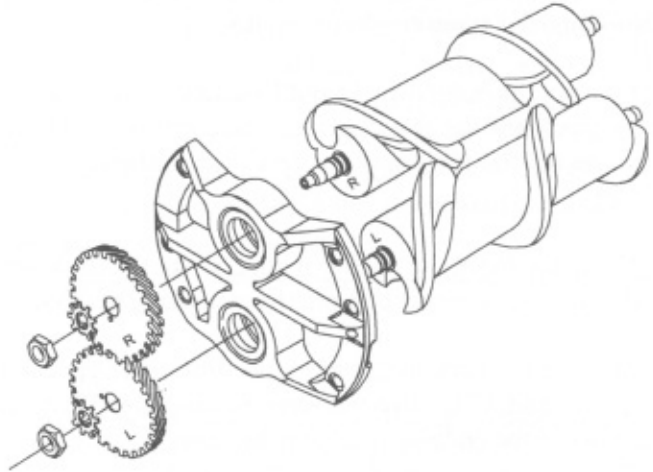


Figure 9-4 Rotor and Gear Orientation

9.7 - Complete Reassembly (B27 thru B34)

1. Ensure all parts are clean and free of debris.
2. Lubricate all bearings and internal O-rings with a light oil.

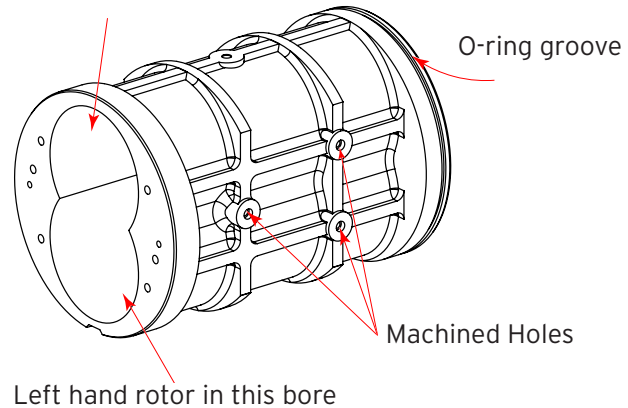
NOTE:

All O-rings should be replaced with new ones during reassembly.

3. Press bearings into the end plates. Use a hand press and ensure that the bearing is pressed on the outer race to avoid damage. 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 to the measuring unit body at the end opposite the O-ring groove in the measuring unit body. Align the dowel pins and gently tap into place with a plastic or rubber mallet. Once fully seated secure the end plate with screws.
5. Each rotor and timing gear is marked with an 'R' or an 'L'. During assembly the inscriptions need to be matched. To orientate the rotors during assembly the measuring element

body 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 O-ring groove is closest to you. With the housing in this position the rotor marked with an 'R' goes in the right hand cavity and the rotor marked with an 'L' goes in the left hand cavity.

Right hand rotor in this bore



Left hand rotor in this bore

Figure 9-5 Measuring element body

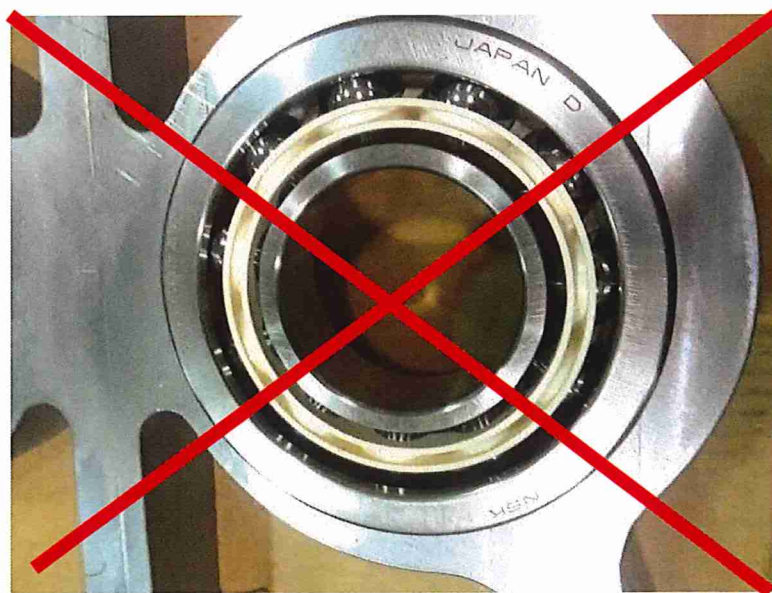
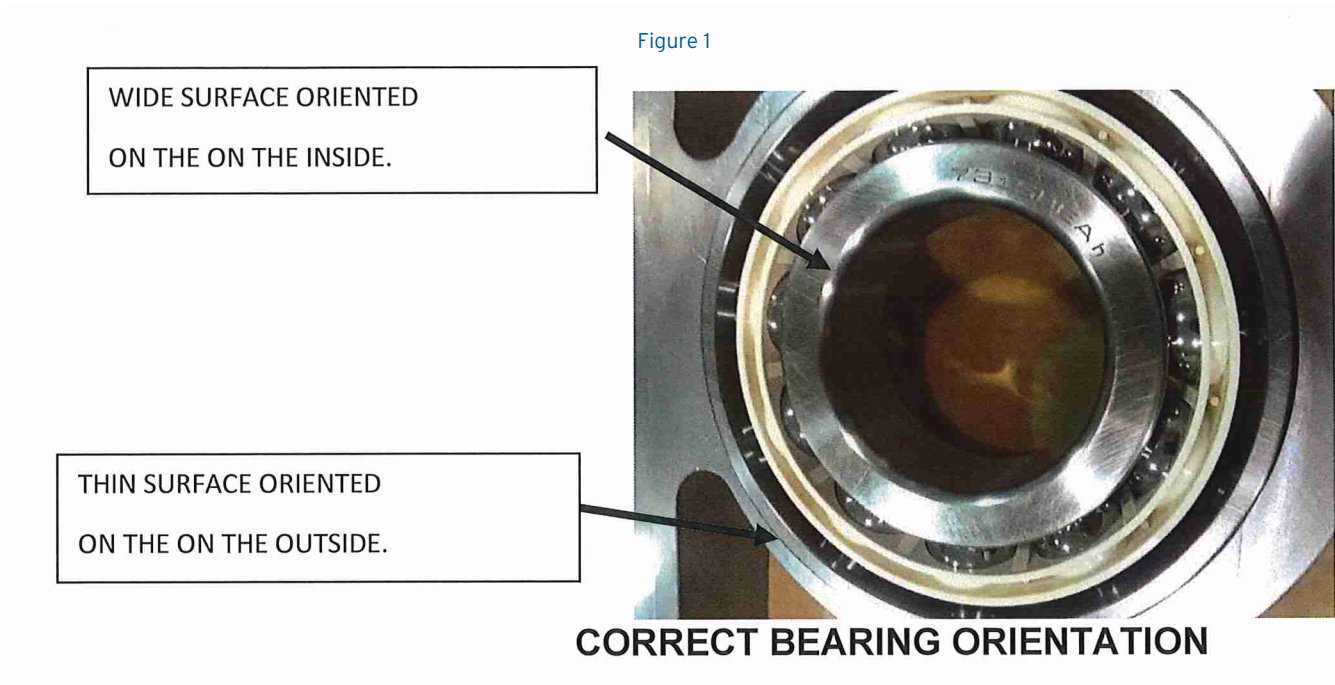
-
6. Lubricate O-rings and install on the rotor shafts. Mesh the two rotors together ensuring that the tapered shafts are at the same ends. The rotors should be held together with the tapered end of the shaft facing the end plate which is attached to the measuring element housing. While keeping the rotors meshed and even, insert them into the measuring chamber. Use a plastic or rubber mallet to gently seat the rotor shafts into the bearings.
 7. Install the other end plate and screws on to the other end of measuring element body ensuring that the rotor shafts seat within the bearings.
 8. Place the timing gears onto the respective tapered rotor shaft. The timing gears have a small hole for the location of the lock washer tab; this should be facing outward from the measuring element.
 9. Install the lock washer ensuring the 90° tab locates in the hole of the timing gears and nuts to the rotor shafts. Tighten these only finger tight until the clearances have been correctly set. (Refer to section 9.8 Setting clearances)
 10. Replace the pulse wheel on the right hand rotor. Use thread locking compound on the threads and secure with the retaining washer, washer and screw.
 11. Lower the complete measuring unit assembly into the inlet housing by aligning on to the dowel pins.
 12. Position the main housing O-ring in the groove on the inlet housing and position O-ring on timing gear end of the measuring element body.
 13. Lower the outlet housing onto the inlet housing, aligning the dowel pins to ensure correct installation. Avoid damage to the O-rings.
 14. Complete the assembly by securing all screws and tightening them to their required torque value. (Table 9.7)
 15. Install the O-ring on the sensor housing and insert the assembly into the inlet housing. Secure with four Allen screws and torque to 55 in/lbs.

9.8 - Complete Reassembly (B35 thru B38)

1. USE ARBOR PRESS TO CAREFULLY PRESS (QTY 2) TIMING GEAR SIDE BEARING INTO THE OUTLET BEARING PLATE

NOTE:

Direction of Bearing is Critical. (See Figure 1)
DO NOT PRESS ON INNER RACE OF BEARING



INCORRECT BEARING ORIENTATION

2. Place preload washers in the bore of the inlet bearing plate. Use arbor press to carefully press (qty 2) pulse wheel side bearing into the inlet bearing plate.
- NOTE:** Bearings are slip fit and may not fit flat with the top surface of the bearing plate. The bearings will need to be held in bores during handling and assembly of the bearing plate.
3. Attach outlet bearing plate to measuring unit housing by aligning dowel pins and holes. Tap into place. Secure with socket head cap screws.
 4. Insert right hand rotor and left hand rotor into measuring unit housing (See Figure 9.5 for installation orientation)
 5. Attach inlet bearing plate and preload washers to measuring unit housing by aligning dowel pins and holes. Tap into place. Secure with socket head cap screws.
 6. Apply anti seize lubricant to the threads on both sides of the shafts. Screw on all the bearing nuts and secure with wrench. Tighten all set screws on the bearing nuts.
 7. Place the timing gears onto the respective tapered rotor shaft. The timing gears have 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 ensuring the 90 ° tab locates in the hole of the timing gears and nuts to the rotor shafts. Tighten these only finger tight until the clearances have been correctly set. (Refer to section 9.8 Setting clearances)
 9. Replace the pulse wheel on the right hand rotor. Use thread locking compound on the threads and secure with the retaining washer, washer and screw.
 10. Position the main housing O-ring in the groove on the outlet housing and position O-ring on timing gear end of the measuring element body.
 11. Lower the complete measuring unit assembly into the outlet housing by aligning on to the dowel pins.
 12. Lower the inlet housing onto the outlet housing, aligning the dowel pins to ensure correct installation. Avoid damage to the O-rings.
 13. Complete the assembly by securing all screws and tightening them to their required torque value. (Table 9.7)
 14. Install the O-ring on the sensor housing and insert the assembly into the inlet housing. Secure with four Allen screws and torque to 55 in/lbs.

Table 9.7

MODEL NUMBER	TORQUE VALUE (ft-lbs)	MODEL NUMBER	TORQUE VALUE (ft-lbs)	MODEL NUMBER	TORQUE VALUE (ft-lbs)	MODEL NUMBER	TORQUE VALUE (ft-lbs)
B271	106	*B301	596	*B325	1230	*B354	1230
B274	423	*B304	596	*B331	1670	*B355	2839
B281	212	*B305	1230	*B334	1670	*B361	1230
B284	682	*B311	596	*B335	1670	*B364	1230
B285	702	*B314	596	*B341	1670	*B365	2839
B291	212	*B315	1230	*B344	1670	*B381	2203
B294	682	*B321	596	*B345	1670	*B384	2203
		*B324	596	*B351	1230	*B385	2203

* Using K-factor of .15 for "lubricated" condition

9.9 - Setting Clearances

With gear movement restricted:

1. Torque the nut on the right hand timing gear to (For B27X, B28X, & B29X) 15-20 ft/lbs. For B30X thru B38X 45-50 ft/lbs
2. Loosen the nut on the left hand timing gear.
3. Place a
0.005" shim for B27X, B28X, B29X,
0.008" shim for B30X, B31X, B32X
0.016" shim for B38X
0.015" shim for B33X, B34X
0.015" shim for B35X, B36X

in front of, and behind, the tooth of the left hand rotor. Once the shims are in place, and with the rotor movement still restricted, torque the nut on the left hand timing gear to 15-20 ft/lbs for B27X, B28X, & B29X or 45-50 ft/lbs for B30X thru B38X.
4. Remove the shims and folded rag and check for correct clearance by slowly rotating the rotors. Listen for sounds of binding, rotors should turn freely and not make contact at any point.
5. If the rotors bind, or make noise, repeat this procedure. This time loosening the right hand rotor instead of the left.
6. Once clearances are set use a small flat head screw driver to bend up one tab on each of the timing gear lock washers to secure the location of the nut.

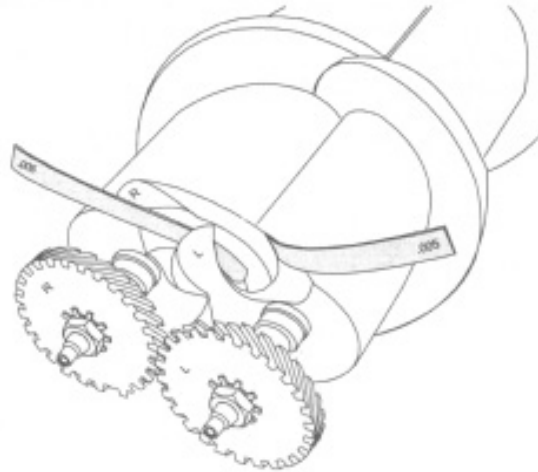


Figure 9-6 Shim Placement for Setting Rotor Clearance

10 Troubleshooting

General

The information in this section has been provided as an aid for basic troubleshooting. Disassembly procedures have been outlined in Chapter 10, Maintenance. If the BiRotor Plus has been found to be in need of repair it is recommended the user contact the nearest Brodie Service Office or Representative. It is important that servicing is performed by trained and qualified personnel.

Condition	Probable Cause	Corrective Actions
No Pulse Output is present	No flow through meter.	Ensure the pipeline has flow.
	Improper electrical connection.	Ensure proper wiring connections have been made.
	Insufficient voltage to preamplifier (if fitted).	Supply sufficient voltage to the pre-amplifier board (reference Section 8, Specifications).
	Power failure.	Ensure power is connected to the device and all associated accessories.
	Meter rotors jammed with debris.	Remove debris from rotors, and check for damage to rotors, timing gears, and bearings (reference Section 9.4).
	Damaged pick off/amplifier board.	Replace pick offs/preamplifier board (reference Sections 9.1 and 9.2).
Erratic or Nonuniform Pulse Signal	Improper electrical connection.	Ensure proper wiring connections have been made.
	Insufficient or fluctuating voltage to the preamplifier board (if fitted).	Supply sufficient voltage to the pre-amplifier board (reference Section 8, Specifications).
	Improper grounding or shielding of connection cable.	Replace wiring and/or grounds and shielding.
	Power failure/damaged pick offs or pre-amplifier board.	Ensure power supply and/or pick offs and preamplifier board are functioning as required (reference Sections 9.1 and 9.2).
	Damaged/worn bearings or timing gears.	Replace bearings and/or timing gears (reference Sections 9.6 and 9.7).

11 Strainers

Strainers are installed in pipe lines ahead of pumps, meters, valves, etc., to protect such equipment against intrusion of pipe scale, welding spatter and other foreign material.

The use of the proper size strainer together with a basket of suitable mesh pays dividends in reduced maintenance on mechanisms which are in contact with flowing liquids. When it is known that comparatively large amounts of lint or iron oxide are present in a stream, a large strainer should be used as these materials clog up basket screens rapidly-especially if resins, gums or varnishes are also present.

Larger size foreign matter such as pebbles, welding beads, etc., should be removed at frequent intervals to prevent their abrasive action from damaging the basket screen.

There is a Brodie Strainer of the proper size and pressure rating to accommodate the full line of Brodie Flow Meters.

Model Strainer	Screen				Pipe Line		Ratio	
	Mesh of screen	Total screen area Sq. in.	Percent Open area	Open Area sq. in.	Size	Area Sq. In.	Toal Area to pipe Area	Open Area to Pipe Area
D-3	20	113	46.2 %	52.2	3"	7.39	15.3 : 1	7.1 : 1
DA-3	40		38.2 %	43.4				5.9 : 1
DA-3A	60		30.5 %	34.5				4.7 : 1
	80		31.4 %	35.5				4.8 : 1
D-3-4	20	113	46.2 %	52.2	4"	12.73	8.9 : 1	4.1 : 1
DA-3-4	40		38.4 %	43.4				3.4 : 1
DA-3-4-A	60		30.5 %	34.5				2.7 : 1
	80		31.4 %	35.5				2.8 : 1
D-6-4	20	314	46.2 %	145.1	4"	12.73	24.7 : 1	11.4 : 1
	40		38.2 %	120.6				9.5 : 1
	60		30.5 %	95.8				7.5 : 1
	80		31.4 %	98.6				7.7 : 1
D-6	20	314	46.2 %	145.1	6"	28.89	10.9 : 1	5.0 : 1
	40		38.2 %	120.6				4.2 : 1
	60		30.5 %	95.8				3.3 : 1
	80		31.4 %	98.6				3.4 : 1

Strainer Baskets

To be efficient, strainer baskets must be kept clean. A buildup of sediment increases pressure drop and decreases flow. If a basket is allowed to become completely clogged, damage will result. A regular procedure should be set up for cleaning strainer baskets-the frequency depending on amount and character of foreign material in the stream. It is advisable to keep a spare basket (or inner screen) on hand.

Recommended Screen Mesh For Various Liquids:

Product	Strainer Mesh
Gasoline and Similar Liquids	60 or 80
Jet-A, Kerosene, JP4, JP5, JP8	60
Diesel Oil, #2 Fuel Oil, etc	40 or 60
Heating Oils- No. 5 or No. 6, etc.	20

12 Parts Lists

General

This chapter contains the necessary parts required for routine maintenance and service of the Brodie BiRotor Plus. Each parts list contains recommended spare and replacement parts denoted by an asterisk. For items not listed, or additional information, consult the factory. When ordering, the following information must be furnished:

- Model Number

- Serial Number
- Part Number
- Quantity

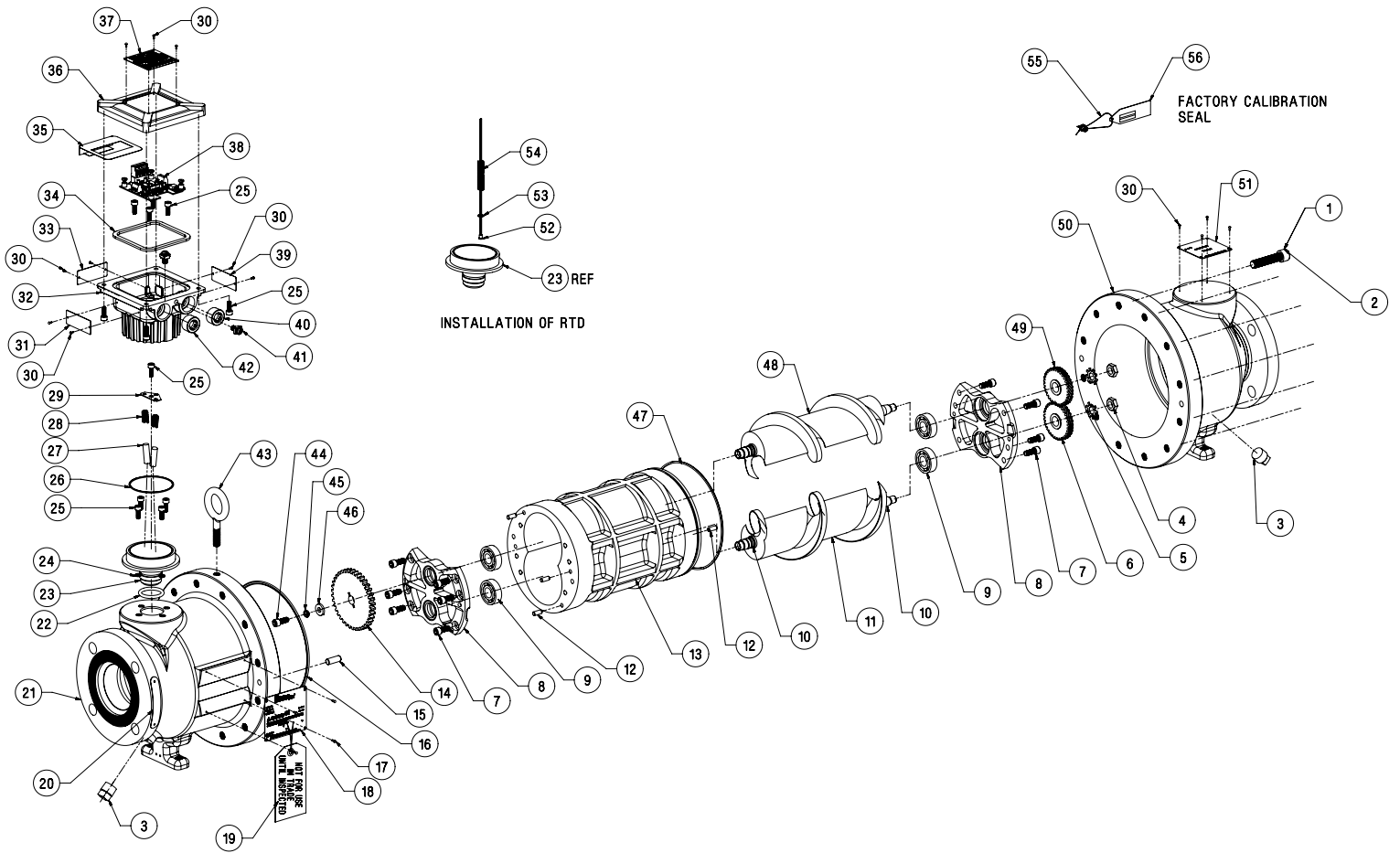
NOTES:

LH and RH Rotors are only available as a matched set.

SERIES NUMBER													
MODEL NUMBER		BR+A2	BR+B3	BR+C4	BR+C6	BR+D6	BR+D8	BR+D10	BR+E1 10	BR+E1 12	BR+E2 10	BR+E2 12	BR+F16
	SB25X	2"											
	B27X		3"										
	B28X			4"									
	B29X				6"								
	B30X					6"							
	B31X						8"						
	B32X							10"					
	B33X								10"				
	B34X									12"			
	B35X										10"		
	B36X											12"	
B38X												16"	

O-ring Suffix	O-ring Material
-023	Low Temp Viton 1289
-120	Low Swell Nitrile
-026	Viton F
-016	FluoroSilicon

12.1. - BiRotor Plus Illustrated Parts List B & C Series



12.1. - BiRotor Plus Illustrated Parts List A-D Series

Item #	Description	Model			Qty
		B271	LB271	B274	
1*	Bolt with Seal Hole	151070-024M	1500985-024M	151080-024M	2
2*	Main Body Bolt	151070M (QTY 14)	1500985 (QTY 14)	151080M (QTY 14)	
3	Pipe Plug, MTRs	154704-024M			C/F
	Pipe Plug, MTRs and NACE	154704-024N			C/F
4	Locknut	60592			2
5	Gear Retaining Washer	51593			2
6	LH Rotor Gear	76291			NOTE
7	Endplate Screws	151042			12
8	Endplate	76825-100			2
9*	Bearings, Stainless Steel	155204			4
	Bearings, Ceramic	155204-001CER			4
10*	O-ring	157063-XXX			4
11	LH Rotor	76276-000			1
12	Element Dowel Pin	1559983			6
13	Element Body	76211-100			1
14	Pulse Wheel	76031-043			1
15	Body Dowel Pin	154097			2
16*	O-ring	152057-XXX			1
17	Drive Screw	153966			4
21	ANSI Inlet Housing, MTRs	76828-100M	76838-100M	76828-300P	C/F
	ANSI Inlet Housing, MTRs and NACE	76828-100N	76838-100N	76828-300R	C/F
	DIN Inlet Housing, MTRs	76828-016M	76838-016M	76828-040P	C/F
	DIN Inlet Housing, MTRs and NACE	76828-016N	N/A	76828-040R	C/F
22*	O-ring	157360-XXX			1
23	Sensor Housing, MTRs	86820-500M		86820-500P	C/F
	Sensor Housing, MTRs and NACE	86820-500N		86820-500R	C/F
24*	Weather Seal	152066-026			4
25*	UMB Screws	151496M			13
26*	Weather Seal	1500093-026			1
27*	Pick Off, Standard	899-00-201-00			1
	Pick Off, High Temp	899-00-201-01			1
28	Spring	1500418			1
29	Hold Down	86030-001			1
30	Drive Screw	153991			2
32	UMB Housing	899-00-100-00			C/F
34*	UMB Gasket	CA-375Z-259-XXA			1
36	UMB Cover	CC-219Z-633-EBG			C/F
38*	Pre Amp Board	230-00-300-00			1
	Terminal Board	230-10-300-50			1
40*	Approved Stopping Plug	1500909D			1
43	Lifting Hook	1500468			1
44	Pulse Wheel Screw	1500668			1
45	Lockwasher, Stainless Steel	1500667			1
46	Retainer Washer	86033			1
47*	O-ring	1500810-XXX			1
48	RH Rotor	76286-000			1
49	RH Rotor Gear	76296			NOTE
50	ANSI Outlet Housing, MTRs	76829-100M	76839-100M	76829-300P	C/F
	ANSI Outlet Housing, MTRs and NACE	76829-100N	76839-100N	76829-300R	C/F
	DIN Outlet Housing, MTRs	76829-016M	76839-016M	76829-040P	C/F
	DIN Outlet Housing, MTRs and NACE	76829-016N	N/A	76829-040R	C/F
52	RTD Sensor	1500574			1
53	RTD Lockwasher	151845-019			1
54	Compression Spring	1500609			1

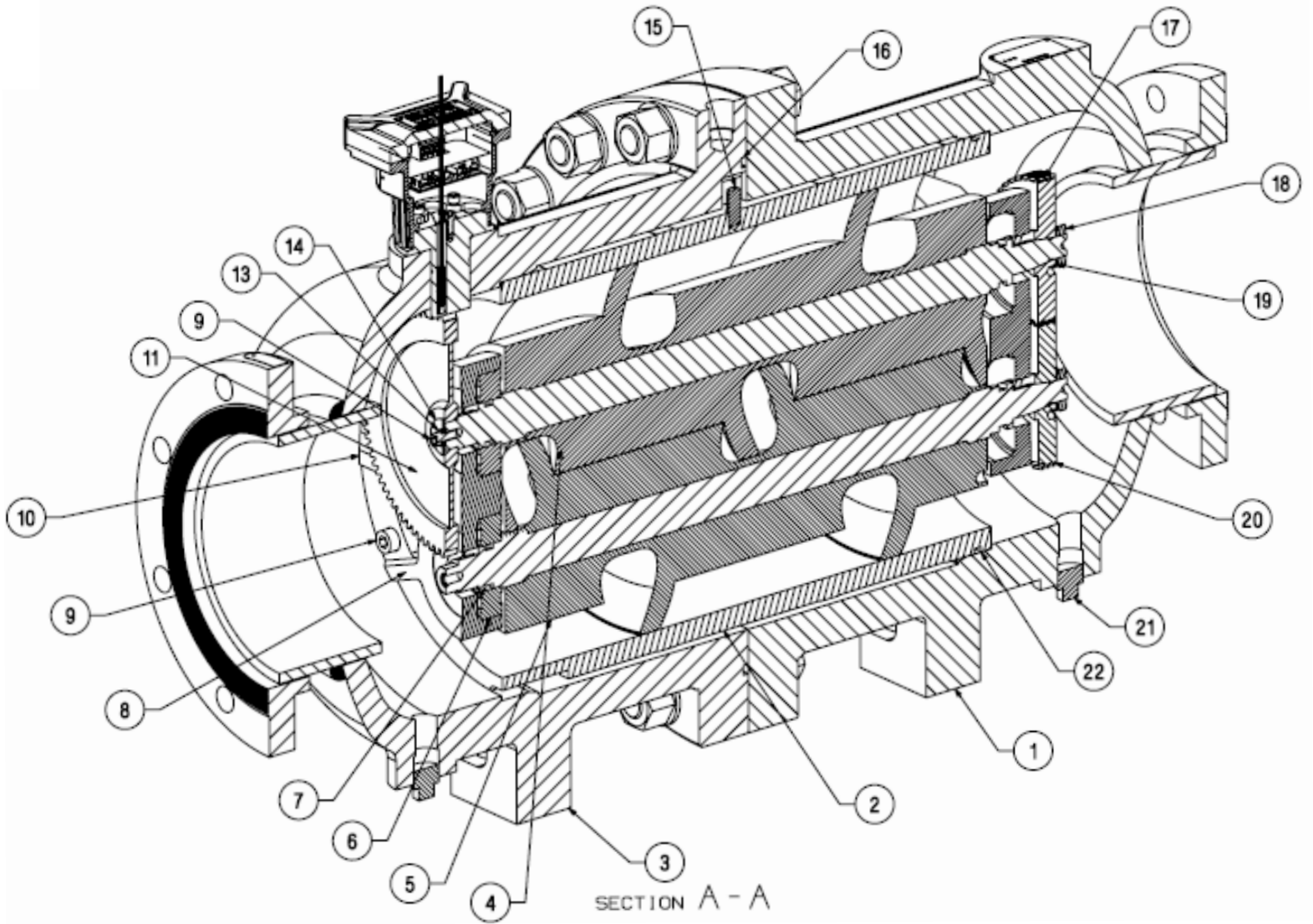
12.1. - BiRotor Plus Illustrated Parts List A - D Series

Item #	Description	Model			Qty
		B281	LB281	B284	
1*	Bolt with Seal Hole	151482-024M	1500987-024M	1500132-024M	2
2*	Main Body Bolt	151482M (QTY 10)	1500987M (QTY 10)	1500132M (QTY 14)	
3	Pipe Plug, MTRs	154704-024M			C/F
	Pipe Plug, MTRs and NACE	154704-024N			C/F
4	Locknut	60592			2
5	Gear Retaining Washer	51593			2
6	LH Rotor Gear	86291			NOTE
7	Endplate Screws	151042			12
8	Endplate	86825-100			2
9*	Bearings, Stainless Steel	155197			4
	Bearings, Ceramic	155197-001CER			4
10*	O-ring	152071-XXX			4
11	LH Rotor	86276-000			1
12	Element Dowel Pin	1559983			6
13	Element Body	86211-100			1
14	Pulse Wheel	86031-043			1
15	Body Dowel Pin	154097			2
16*	O-ring	152088-XXX			1
17	Drive Screw	153966			4
21	ANSI Inlet Housing, MTRs	86828-100M	86838-100M	86828-300P	C/F
	ANSI Inlet Housing, MTRs and NACE	86828-100N	86838-100N	86828-300R	C/F
	DIN Inlet Housing, MTRs	86828-016M	86838-016M	86828-040P	C/F
	DIN Inlet Housing, MTRs and NACE	86828-016N	N/A	86828-040R	C/F
22*	O-ring	157360-XXX			1
23	Sensor Housing, MTRs	86820-500M		86820-500P	C/F
	Sensor Housing, MTRs and NACE	86820-500N		86820-500R	C/F
24*	Weather Seal	152066-026			4
25*	UMB Screws	151496M			13
26*	Weather Seal	1500093-026			1
27*	Pick Off, Standard	899-00-201-00			1
	Pick Off, High Temp	899-00-201-01			1
28	Spring	1500418			1
29	Hold Down	86030-001			1
30	Drive Screw	153991			2
32	UMB Housing	899-00-100-00			C/F
34*	UMB Gasket	CA-375Z-259-XXA			1
36	UMB Cover	CC-219Z-633-EBG			C/F
38*	Pre Amp Board	230-00-300-00			1
	Terminal Board	230-10-300-50			1
40*	Approved Stopping Plug	1500909D			1
43	Lifting Hook	1500468			1
44	Pulse Wheel Screw	1500668			1
45	Lockwasher, Stainless Steel	1500667			1
46	Retainer Washer	86033			1
47*	O-ring	159678-XXX			1
48	RH Rotor	86286-000			1
49	RH Rotor Gear	86296			NOTE
50	ANSI Outlet Housing, MTRs	86829-100M	86839-100M	86829-300P	C/F
	ANSI Outlet Housing, MTRs and NACE	86829-100N	86839-100N	86829-300R	C/F
	DIN Outlet Housing, MTRs	86829-016M	86839-016M	86829-040P	C/F
	DIN Outlet Housing, MTRs and NACE	86829-016N	N/A	86829-040R	C/F
52	RTD Sensor	1500574			1
53	RTD Lockwasher	151845-019			1
54	Compression Spring	1500609			1

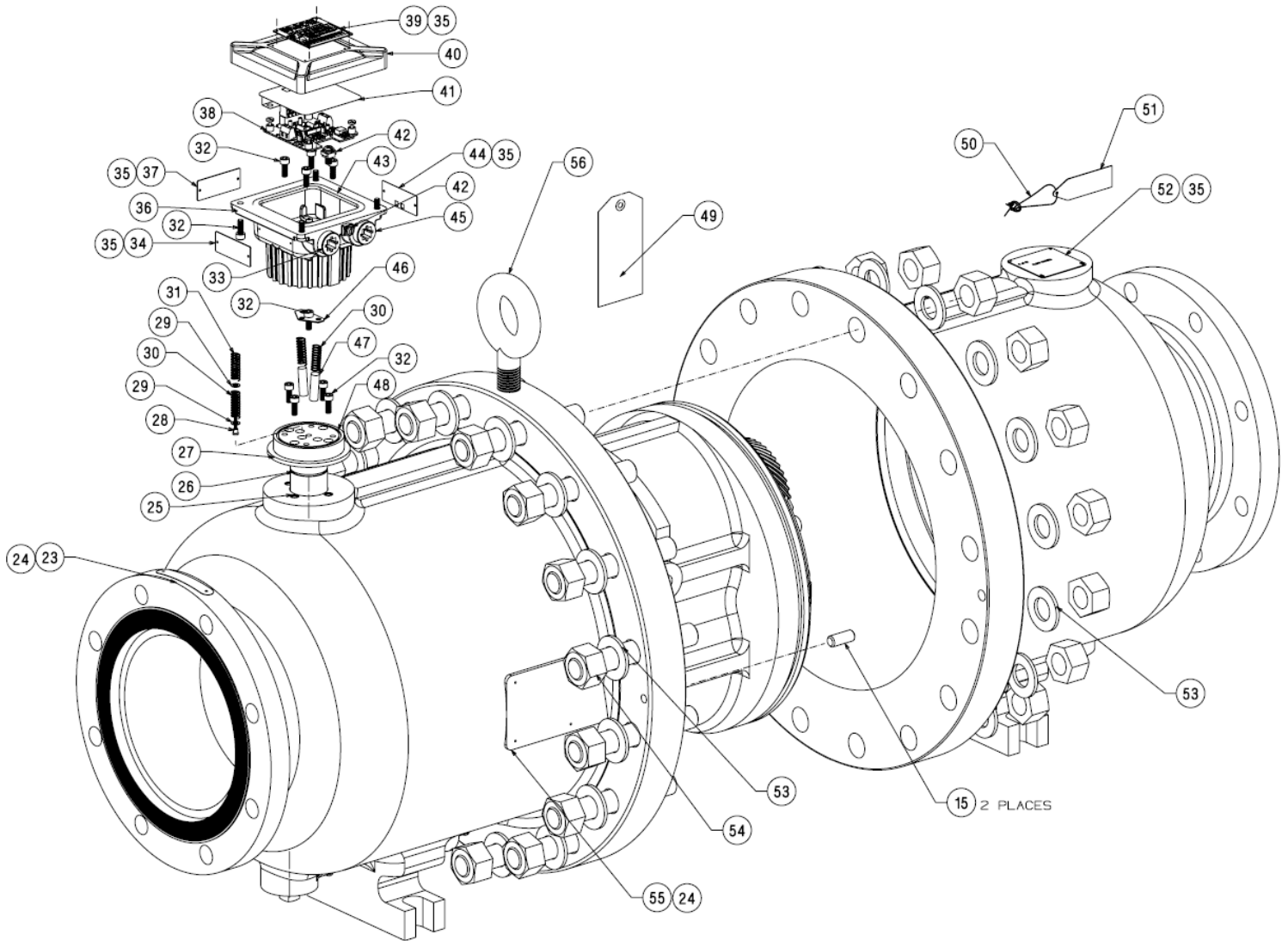
Item #	Description	Model B285	Qty
1	Stud and Nut with Seal Hole	1501306M-024	1
2	Stud and Nut	1501306	11
3	Pipe Plug	154711M	2
4	Locknut	60592	2
5	Gear Retaining Washer	51593	2
6	LH Rotor Gear	86291	NOTE
7	Endplate Screws	151042	12
8	Endplate	86825-100	2
9	Bearing	155197	4
10	O-ring	152071-XXX	4
11	LH Rotor	86276-000	1
12	Element Dowel Pin	1559983	6
13	Element Body	86211-100	1
14	Pulse Wheel	86031-043	1
15	Body Dowel Pin	154097	2
16	O-ring	152088-XXX	1
17	Drive Screw	153966	4
21	ANSI Inlet Housing	86868-600M	1
22	O-ring	157360-XXX	1
23	Sensor Housing, MTRs	86820-600M	1
24	Weather Seal	152066-026	4
25	UMB Screws	151496M	13
26	Weather Seal	1500093-026	1
27	Pick Off, Standard	899-00-201-00	1
	Pick Off, High Temp	899-00-201-01	1
28	Spring	1500418	1
29	Hold Down	86030-001	1
30	Drive Screw	153991	2
32	UMB Housing	899-00-100-00	1
34*	UMB Gasket	CA-375Z-259-XXA	1
36	UMB Cover	CC-219Z-633-EBG	1
38*	Pre Amp Board	230-00-300-00	1
	Terminal Board	230-10-300-50	1
40*	Approved Stopping Plug	1500909D	1
43	Lifting Hook	1500468	1
44	Pulse Wheel Screw	1500668	1
45	Lockwasher, Stainless Steel	1500667	1
46	Retainer Washer	86033	1
47*	O-ring	159678-XXX	1
48	RH Rotor	86286-000	1
49	RH Rotor Gear	86296	NOTE
50	Outlet Housing	86869-600M	1
52	RTD Sensor	1500574	1
53	RTD Lockwasher	151845-019	1
54	Compression Spring	1500609	1

Item #	Description	Model B291	Qty
1*	Bolt with Seal Hole	151482-024M	2
2*	Main Body Bolt	151482M	14
3	Pipe Plug, MTRs	154704-024M	C/F
	Pipe Plug, MTRs and NACE	154704-024N	C/F
4	Locknut	60592	2
5	Gear Retaining Washer	51593	2
6	LH Rotor Gear	86291	NOTE
7	Endplate Screws	151042	12
8	Endplate	86825-100	2
9*	Bearings, Stainless Steel	155197	4
	Bearings, Ceramic	155197-001CER	4
10*	O-ring	152071-XXX	4
11	LH Rotor	86276-000	1
12	Element Dowel Pin	1559983	6
13	Element Body	86211-100	1
14	Pulse Wheel	86031-043	1
15	Body Dowel Pin	154097	2
16*	O-ring	152088-XXX	1
17	Drive Screw	153966	4
21	ANSI Inlet Housing, MTRs	86868-300P	C/F
	ANSI Inlet Housing, MTRs and NACE	86868-300R	C/F
	DIN Inlet Housing, MTRs	86868-040P	C/F
	DIN Inlet Housing, MTRs and NACE	86868-040R	C/F
22*	O-ring	157360-XXX	1
23	Sensor Housing, MTRs	86820-500M	C/F
	Sensor Housing, MTRs and NACE	86820-500N	C/F
24*	Weather Seal	152066-026	4
25*	UMB Screws	151496M	13
26*	Weather Seal	150093-026	1
27*	Pick Off, Standard	899-00-201-00	1
	Pick Off, High Temp	899-00-201-01	1
28	Spring	1500418	1
29	Hold Down	86030-001	1
30	Drive Screw	153991	2
32	UMB Housing	899-00-100-00	C/F
34*	UMB Gasket	CA-375Z-259-XXA	1
36	UMB Cover	CC-219Z-633-EBG	C/F
38*	Pre Amp Board	230-00-300-00	1
	Terminal Board	230-10-300-50	1
40*	Approved Stopping Plug	1500909D	1
43	Lifting Hook	1500468	1
44	Pulse Wheel Screw	1500668	1
45	Lockwasher, Stainless Steel	1500667	1
46	Retainer Washer	86033	1
47*	O-ring	159678-XXX	1
48	RH Rotor	86286-000	1
49	RH Rotor Gear	86296	NOTE
50	ANSI Outlet Housing, MTRs	86869-100M	C/F
	ANSI Outlet Housing, MTRs and NACE	86869-100N	C/F
	DIN Outlet Housing, MTRs	86869-016M	C/F
	DIN Outlet Housing, MTRs and NACE	86869-016N	C/F
52	RTD Sensor	1500574	1
53	RTD Lockwasher	151845-019	1
54	Compression Spring	1500609	1

12.2 - BiRotor Plus Illustrated Parts List D Series [B3XX]



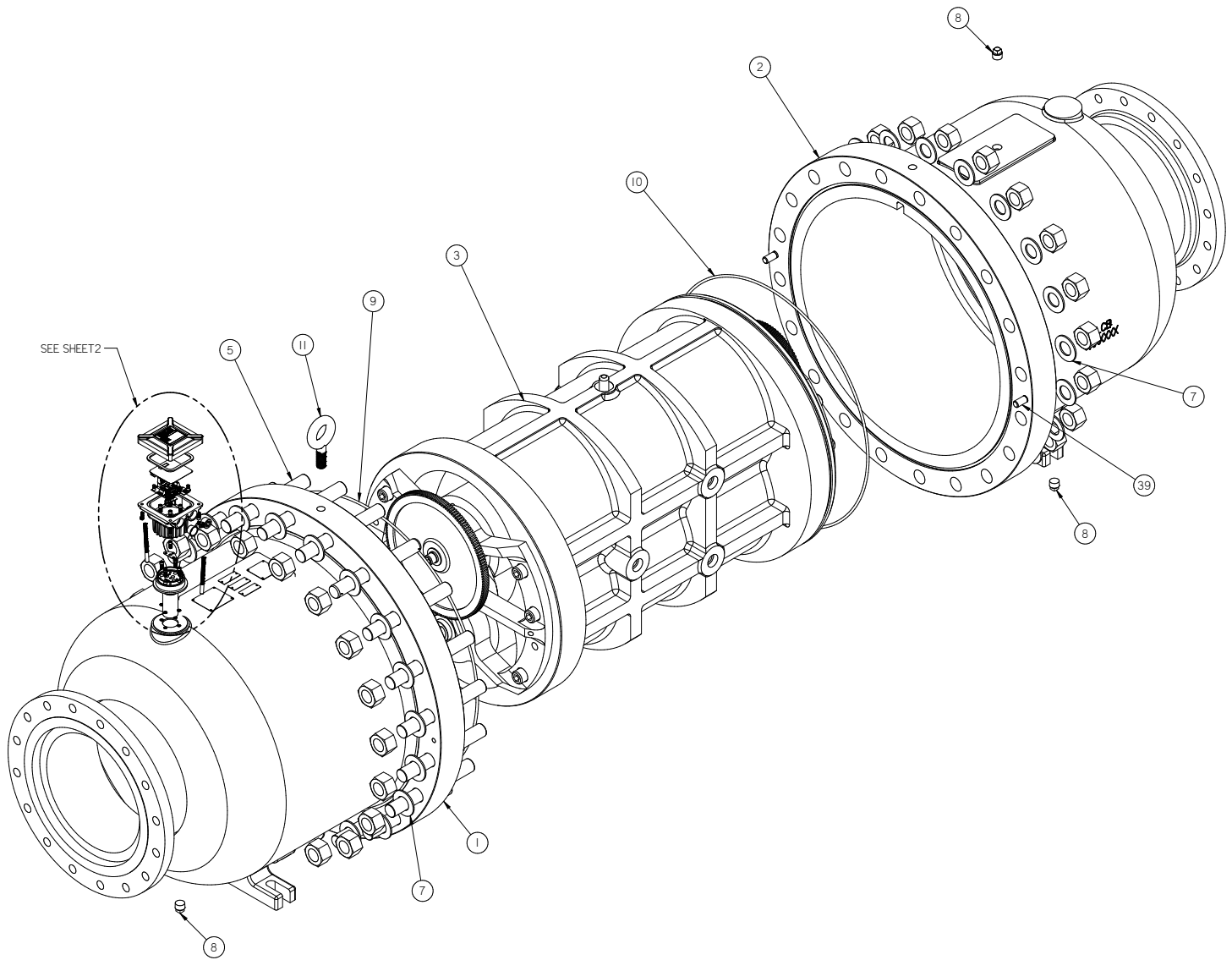
12.3 - BiRotor Plus Illustrated Parts List D Series [B3XX]



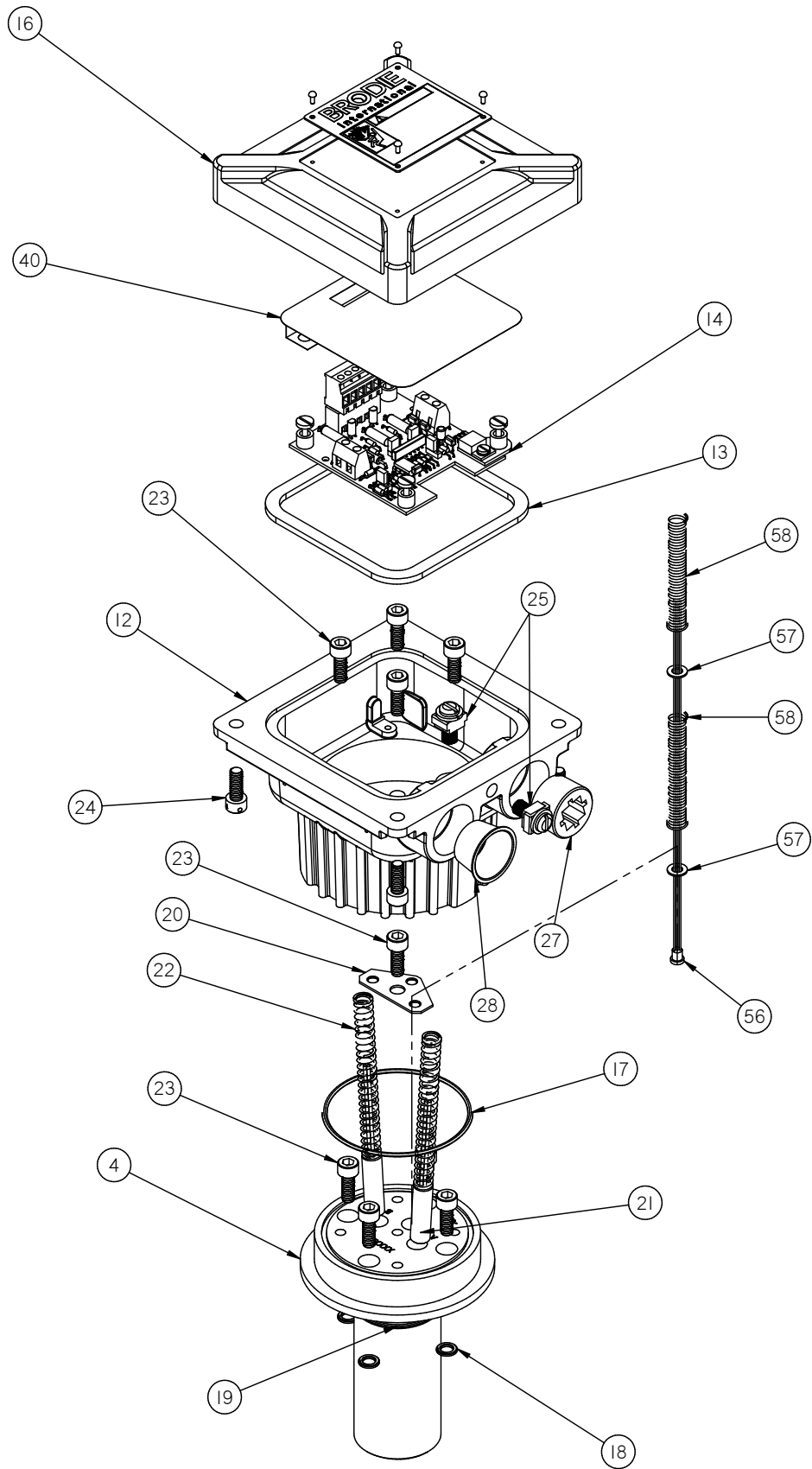
12.4 - BiRotor Plus Illustrated Parts List D Series [B30X, B31X, B32X]

Item	Description	Model	Qty	Item	Description	Model	Qty
1	HOUSING ASSEMBLY	108819-XXX	1	30	SPRING	1500609	2
2	MEASURING UNIT BODY	108211-100	1	31	SPRING	1500418	0
3	HOUSING	108818-XXX	1	32	SCREW	151496M	13
4	RIGHT HAND ROTOR	108286-000	1	33	CAPLUG	SD442	1
5	LEFT HAND ROTOR	108276-000	1	34	NAMEPLATE	86902	1
6*	BEARING BALL	1501099-CER	4	35	SCREW	153991	14
7*	O-RING	1501101-XXX	4	36	UMB	899-00-100-00	1
8	PLATE	108825	2	37	NAMEPLATE	86901	1
9	SCREW	151024-019	13	38	BOARD ASSEMBLY	230-00-300-00	1
10	DOWEL PIN	1501106	4	39	TAG	899-01-228-04	1
11	WHEEL	108031	1	40	COVER	CC-219Z-633	1
13	WASHER	152125	1	41	INSTRUCTIONS	899-00-228	1
14	WASHER	1501090	1	42	CLAMP	B18934-004	2
15	DOWEL PIN,	1501103	3	43	GASKET	CA-375Z-259	1
16*	O-RING	1501100-XXX	1	44	NAMEPLATE	86903	1
17	GEAR	108296	1	45	PLUG	1500909D	1
18	GEAR LOCKNUT	82592	2	46	WASHER	86030-001	1
19	LOCKWASHER,	82593	2	47	PICKOFF	899-00-201-00	2
20	GEAR	108291	1	48	WEATHER SEAL	1500093-026	1
21	PLUG	154711M	2	49	TAG	76800	0
22*	O-RING	1501102-XXX	1	50	SEAL	1500931	1
23	TAG	015-16-090-02	1	51	TAG	76810	1
24	SCREW	153966	6	52	NAMEPLATE	76801	0
25*	WEATHER SEAL	152066-026	4	53	WASHER	1501015-419	32
26*	O-RING	157079-XXX	1	54	STUD & NUT SET	1501104M	16
27	HOUSING	108820P	1	55	NAMEPLATE	86803	1
28	RTD - Miniature	1500574	0	56	EYE BOLT	1501128	1
29	WASHER	151854-019	0				

12.5 - BiRotor Plus Illustrated Parts List E and F Series [B33X] to [B38X]



12.6 - BiRotor Plus Illustrated Parts List E and F Series [B33X to B38X]



12.7 - BiRotor Plus Illustrated Parts List E1 Series [B33X]

Item	Description	Model		Qty	Model	
		B331	B334		B335	
1	Housing, Inlet	101818-110P	101818-310P	1	101818-610M	1
2	Housing, Outlet	101819-110P	101819-310P	1	101819-610M	1
3	Measuring Unit Assy	101200-000		1	101200-000	1
4	Sensor Housing	101820P		1	110820-500M	1
5	Stud and Nut Set [1 stud, 2 nuts]	1501319M		16	1501319M	20
7	Washer	1501320		32	1501320	40
8	Drain Plug	154711P		3	154711M	3
9	O-Ring	159809-XXX		1	159809-XXX	1
10	O-Ring	159810-XXX		1	159810-XXX	1
11	Eyebolt	1501128		1	1501128	1
12	UMB Housing	899-00-100-00		1	899-00-100-00	1
13	Gasket	CA-375Z-259-XXA		1	CA-375Z-259-XXA	1
14	Pre-Amp Board	230-00-300-00		1	230-00-300-00	1
16	UMB Cover	CC-219Z-633-EBG		1	CC-219Z-633-EBG	1
17	O-Ring	1500093-XXX		1	1500093-XXX	1
18	O-Ring	152066-XXX		4	152066-XXX	8
19	O-Ring	157079-XXX		1	157079-XXX	1
20	Washer	86030-001		1	86030-001	1
21	Pick Off, Standard	899-00-201-00		2	899-00-201-00	2
22	Spring	1501201		2	1501201	2
22a	Spring	1500418		2	1500418	2
22b	Washer	151854-019		2	151854-019	2
23	Screw	151496		11	151496	15
24	Screw	151496-324		2	151496-324	2
25	Ground Clamp	B18934-004		2	B18934-004	2
27	Plug	1500909		1	1500909	1
28	Cap Plug	SD442		1	SD442	1
39	Dowel Pin	1501103		2	1501103	2
40	Wiring Instructions	899-00-228-07		1	899-00-228-07	1
56	Optional RTD	1500574		1	1500574	1
57	Washer	151854-019		2	151854-019	2
58	Spring	1500609		2	1500609	1
58a	Spring				1501217	1
	Repair Kit	WB33C-RK-XXX				
	Seal Kit	WB33C-SK-XXX				

12.8 - BiRotor Plus Illustrated Parts List E1 Series [B34X]

Item	Description	Model		Qty	Model	
		B341	B344		B345	Qty
1	Housing, Inlet	121818-120P	121818-312P	1	121818-610M	1
2	Housing, Outlet	121819-120P	121819-312P	1	121819-610M	1
3	Measuring Unit Assy	101200-000		1	110200-000	1
4	Sensor Housing	101820P		1	101820-500M	1
5	Stud and Nut Set [1 stud, 2 nuts]	1501319M		16	1501319M	20
7	Washer	1501320		32	1501320	40
8	Drain Plug	154711P		3	154711M	3
9	O-Ring	159809-XXX		1	159809-XXX	1
10	O-Ring	159810-XXX		1	159810-XXX	1
11	Eyebolt	1501128		1	1501128	1
12	UMB Housing	899-00-100-00		1	899-00-100-00	1
13	Gasket	CA-375Z-259-XXA		1	CA-375Z-259-XXA	1
14	Pre-Amp Board	230-00-300-00		1	230-00-300-00	1
16	UMB Cover	CC-219Z-633-EBG		1	CC-219Z-633-EBG	1
17	O-Ring	1500093-XXX		1	1500093-XXX	1
18	O-Ring	152066-XXX		4	152066-XXX	8
19	O-Ring	157079-XXX		1	157079-XXX	1
20	Washer	86030-001		1	86030-001	1
21	Pick Off, Standard	899-00-201-00		2	899-00-201-00	2
22	Spring	1501201		2	1501201	2
22a	Spring	1500418		2	1500418	2
22b	Washer	151854-019		2	151854-019	2
23	Screw	151496		11	151496	15
24	Screw	151496-324		2	151496-324	2
25	Ground Clamp	B18934-004		2	B18934-004	2
27	Plug	1500909		1	1500909	1
28	Cap Plug	SD442		1	SD442	1
39	Dowel Pin	1501103		2	1501103	2
40	Wiring Instructions	899-00-228-07		1	899-00-228-07	1
56	Optional RTD	1500574		1	1500574	1
57	Washer	151854-019		2	151854-019	2
58	Spring	1500609		2	1500609	1
58a	Spring				1501217	1
	Repair Kit	WB33C-RK-XXX				
	Seal Kit	WB33C-SK-XXX				

12.9 - BiRotor Plus Illustrated Parts List E2 Series [B35X]

Item	Description	Model		Qty	Model	
		B351	B354		B355	Qty
1	Housing, Inlet	110818-000P	110818-300P	1	110818-600M	1
2	Housing, Outlet	110819-000P	110819-300P	1	110819-600M	1
3	Measuring Unit Assy	110200-000		1	110200-000	1
4	Sensor Housing	110820P		1	110820-500M	1
5	Stud and Nut Set [1 stud, 2 nuts]	1500597M		20	1500966M	20
7	Washer	1501233		40	1501123	40
8	Drain Plug	154711P		3	154711M	3
9	O-Ring	159806-XXX		1	159806-XXX	1
10	O-Ring	159807-XXX		1	159807-XXX	1
11	Eyebolt	1501128		1	1501128	1
12	UMB Housing	899-00-100-00		1	899-00-100-00	1
13	Gasket	CA-375Z-259-XXA		1	CA-375Z-259-XXA	1
14	Pre-Amp Board	230-00-300-00		1	230-00-300-00	1
16	UMB Cover	CC-219Z-633-EBG		1	CC-219Z-633-EBG	1
17	O-Ring	1500093-XXX		1	1500093-XXX	1
18	O-Ring	152066-XXX		4	152066-XXX	8
19	O-Ring	157079-XXX		1	157079-XXX	1
20	Washer	86030-001		1	86030-001	1
21	Pick Off, Standard	899-00-201-00		2	899-00-201-00	2
22	Spring	1501201		2	1501201	2
22a	Spring	1500418		2	1500418	2
22b	Washer	151854-019		2	151854-019	2
23	Screw	151496		11	151496	15
24	Screw	151496-324		2	151496-324	2
25	Ground Clamp	B18934-004		2	B18934-004	2
27	Plug	1500909		1	1500909	1
28	Cap Plug	SD442		1	SD442	1
39	Dowel Pin	1501193		2	1501193	2
40	Wiring Instructions	899-00-228-07		1	899-00-228-07	1
56	Optional RTD	1500574		1	1500574	1
57	Washer	151854-019		2	151854-019	2
58	Spring	1500609		2	1500609	1
58a	Spring				1501217	1
	Repair Kit	WB36C-RK-XXX				
	Seal Kit	WB36C-SK-XXX				

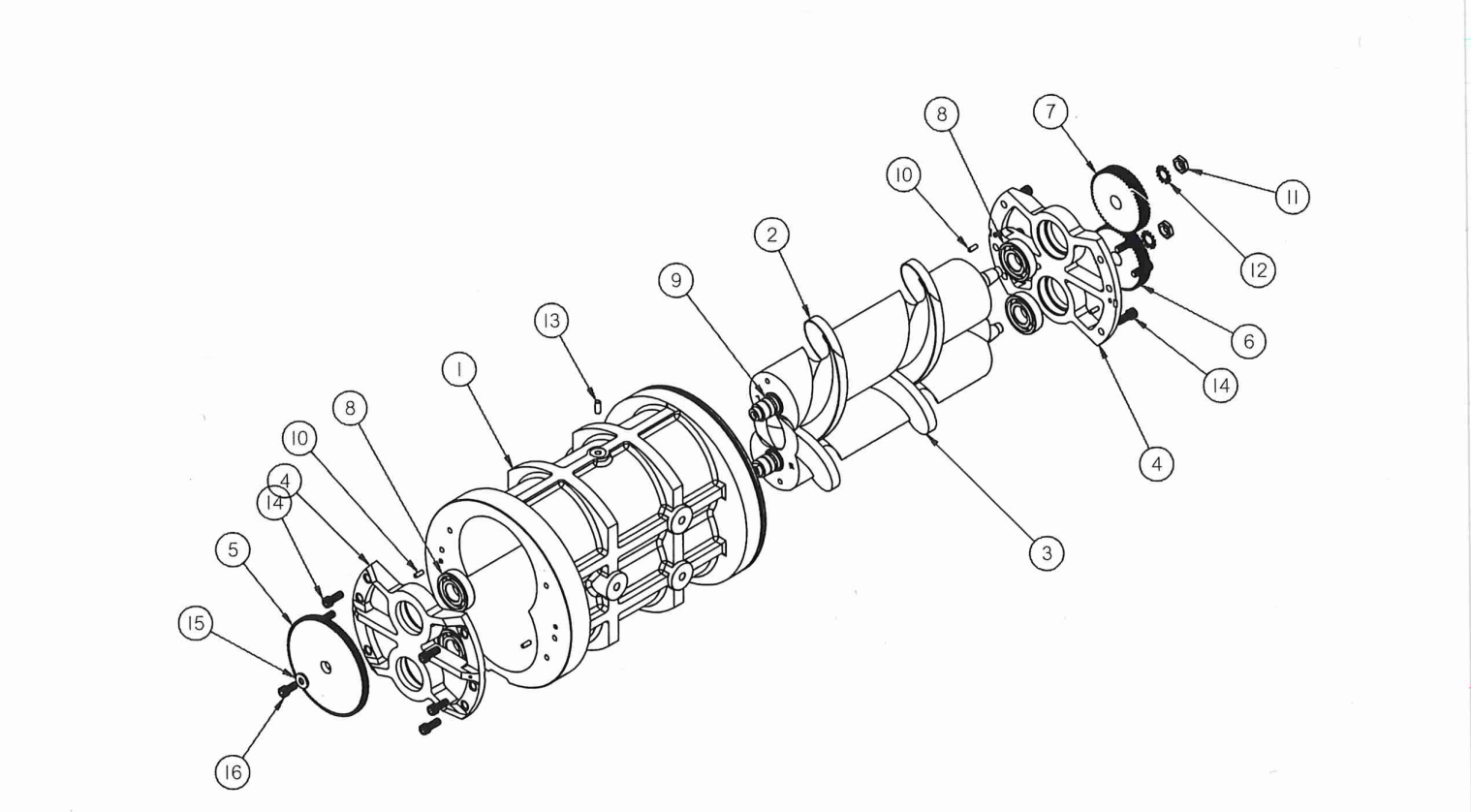
13.1 - BiRotor Plus Illustrated Parts List E2 Series [B36X]

Item	Description	Model		Qty	Model	
		B361	B364		B365	Qty
1	Housing, Inlet	112818-000P	112818-300P	1	112818-600M	1
2	Housing, Outlet	112819-000P	112819-300P	1	112819-600M	1
3	Measuring Unit Assy	110200-000		1	110200-000	1
4	Sensor Housing	110820P		1	110820-500M	1
5	Stud and Nut Set [1 stud, 2 nuts]	1500597M		20	1500966M	20
7	Washer	1501233		40	1501123	40
8	Drain Plug	154711P		3	154711M	3
9	O-Ring	159806-XXX		1	159806-XXX	1
10	O-Ring	159807-XXX		1	159807-XXX	1
11	Eyebolt	1501128		1	1501128	1
12	UMB Housing	899-00-100-00		1	899-00-100-00	1
13	Gasket	CA-375Z-259-XXA		1	CA-375Z-259-XXA	1
14	Pre-Amp Board	230-00-300-00		1	230-00-300-00	1
16	UMB Cover	CC-219Z-633-EBG		1	CC-219Z-633-EBG	1
17	O-Ring	1500093-XXX		1	1500093-XXX	1
18	O-Ring	152066-XXX		4	152066-XXX	8
19	O-Ring	157079-XXX		1	157079-XXX	1
20	Washer	86030-001		1	86030-001	1
21	Pick Off, Standard	899-00-201-00		2	899-00-201-00	2
22	Spring	1501201		2	1501201	2
22a	Spring				1500418	2
22b	Washer				151854-019	2
23	Screw	151496		11	151496	15
24	Screw	151496-324		2	151496-324	2
25	Ground Clamp	B18934-004		2	B18934-004	2
27	Plug	1500909		1	1500909	1
28	Cap Plug	SD442		1	SD442	1
39	Dowel Pin	1501193		2	1501193	2
40	Wiring Instructions	899-00-228-07		1	899-00-228-07	1
56	Optional RTD	1500574		1	1500574	1
57	Washer	151854-019		2	151854-019	2
58	Spring	1500609		2	1500609	1
58a	Spring				1501217	1
	Repair Kit	WB36-RK-XXX				
	Seal Kit	WB36-SK-XXX				

13.2 - BiRotor Plus Illustrated Parts List F Series [B38X]

Item	Description	Model		Qty	Model	
		B381	B384		B385	Qty
1	Housing, Inlet	116818-110P	116818-310P	1	116818-610M	1
2	Housing, Outlet	116819-110P	116819-310P	1	116819-610M	1
3	Measuring Unit Assy	116200-000		1	116200-000	1
4	Sensor Housing	116820P		1	116820-501M	1
5	Stud and Nut Set [1 stud, 2 nuts]	1501021M		20	1501252M	24
7	Washer	1501183-419		40	1501253	48
8	Drain Plug	154711P		3	154711M	3
9	O-Ring	1501194-XXX		1	1501194-XXX	1
10	O-Ring	1501195-XXX		1	1501195-XXX	1
11	Eyebolt	1501128		1	1501128	1
12	UMB Housing	899-00-100-00		1	899-00-100-00	1
13	Gasket	CA-375Z-259-XXA		1	CA-375Z-259-XXA	1
14	Pre-Amp Board	230-00-300-00		1	230-00-300-00	1
16	UMB Cover	CC-219Z-633-EBG		1	CC-219Z-633-EBG	1
17	O-Ring	1500093-XXX		1	1500093-XXX	1
18	O-Ring	152066-XXX		4	152066-XXX	8
19	O-Ring	157079-XXX		1	157079-XXX	1
20	Washer	86030-001		1	86030-001	1
21	Pick Off, Standard	899-00-201-00		2	899-00-201-00	2
22	Spring	1501201		2	1501201	2
22a	Spring				1500418	2
22b	Washer				151854-019	2
23	Screw	151496		11	151496	15
24	Screw	151496-324		2	151496-324	2
25	Ground Clamp	B18934-004		2	B18934-004	2
27	Plug	1500909		1	1500909	1
28	Cap Plug	SD442		1	SD442	1
39	Dowel Pin	1501193		2	1501193	2
40	Wiring Instructions	899-00-228-07		1	899-00-228-07	1
56	Optional RTD	1500574		1	1500574	1
57	Washer	151854-019		2	151854-019	2
58	Spring	1500609		2	1500609	1
58a	Spring				1501217	1

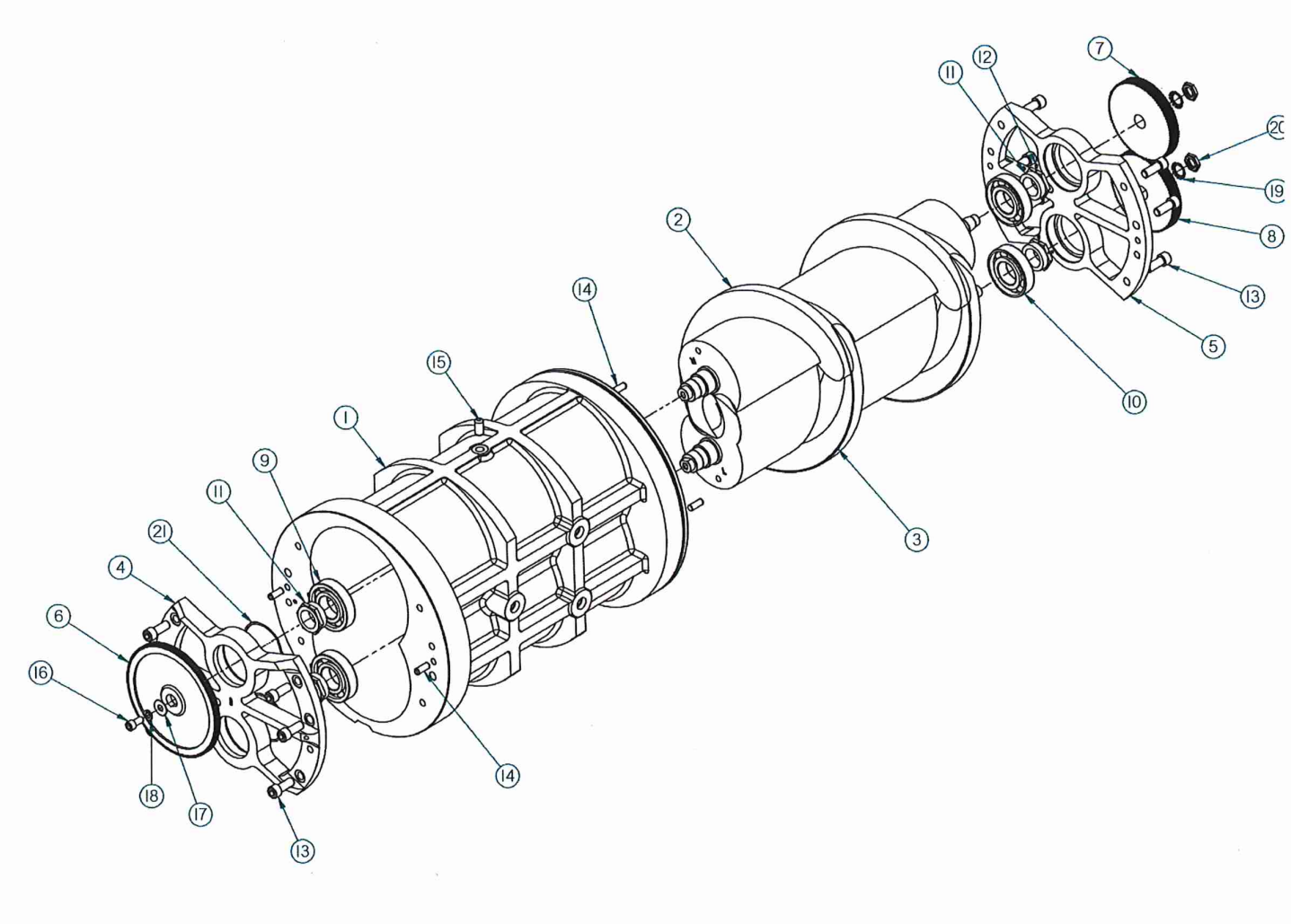
13.3 - BiRotor Plus Illustrated Parts List E1 Series [B33X and B34X]



13.4 - BiRotor Plus Illustrated Parts List E1 Series [B33X to B34X]

Item	Description	Part Number	Qty
	Measuring Unit Assembly	101200-00	
1	Measuring Unit Body	101210-100	1
2	Rotor Set R	W101286	1
3	Rotor Set L	W101286	1
4	End Plate	101285	2
5	Pulse Wheel	101083	1
6	Timing Gear Set R	W101296	1
7	Timing Gear Set L	W101296	1
8	Bearing	154959-CER	4
9	O-Ring	159808-XXX	4
10	Dowel Pin	1501106	4
11	Gear Locknut	92592	2
12	Gear Retaining Washer	92593	2
13	Dowel Pin	1501103	1
14	Screw	1501323	12
15	Washer	1501295	1
16	Screw	1501294	1
	Bearing Kit	WB33C-BK-001	

13.5 - BiRotor Plus Illustrated Parts List E2 and F Series [B35X to B38X]



13.6 - BiRotor Plus Illustrated Parts List E2 Series [B35X and B36X]

Item	Description	Part Number	Qty
	Measuring Unit Assembly	110200-000	
1	Measuring Unit Body	110211-100	1
2	Rotor Set R	W110286	1
3	Rotor Set L	W110286	1
4	End Plate (Inlet)	110285	1
5	End Plate (Outlet)	110824	1
6	Pulse Wheel	110083	1
7	Timing Gear Set R	W110296	1
8	Timing Gear Set L	W110296	1
9	Bearing (Inlet)	1501188	2
10	Bearing (Outlet)	1501189	2
11	Nut	110821	4
12	Set Screw	150982	8
13	Screw	15001296	12
14	Dowel Pin	1501106	4
15	Dowel Pin	1501193	1
16	Screw	1501294	1
17	Washer	1501295	1
18	Gear Lockwasher	112293	2
19	Gear Locknut	112292	2
20	Bearing Spring	1501196	4
	Bearing Kit	WB36C-BK-001	1

13.7 - BiRotor Plus Illustrated Parts List F Series [B38X]

Item	Description	Part Number	Qty
	Measuring Unit Assembly	116200-000	
1	Measuring Unit Body	116211-100	1
2	Rotor Set R	W116286	1
3	Rotor Set L	W116286	1
4	End Plate (Inlet)	116825	1
5	End Plate (Outlet)	116826	1
6	Pulse Wheel	116083	1
7	Timing Gear Set R	W116296	1
8	Timing Gear Set L	W116296	1
9	Bearing (Inlet)	1501184	2
10	Bearing (Outlet)	1501185	2
11	Nut	116821	4
12	Set Screw	150982	8
13	Screw	1501187-019	12
14	Dowel Pin	1501188	4
15	Dowel Pin	1501189	1
16	Screw	1501190-019	1
17	Washer	1501191	1
18	Lock Washer	1501192	1
19	Gear Lockwasher	112293	2
20	Gear Locknut	112292	2
21	Bearing Spring	1501196	4
	Complete Repair Kit	WB38C-BK-001	1

Appendix A

Decontamination Statement

RMA Number: _____

Item Being Returned: _____

List all chemicals, process fluids and gases 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.

Appendix B

Customer Problem Report

For faster service, complete this form and return it along with the affected equipment to customer service at the address indicated below. If you require technical assistance, please contact the Product Service Department at the phone number listed below.

Company Name: _____ Phone: _____

Technical Contact: _____

Repair PO#: _____

Invoice Address: _____

Shipping Address: _____

Return Shipping Method: _____ S/N: _____

Equipment Model #: _____ Failure Date: _____

Description of Problem: _____

What was happening at time of failure: _____

Additional Comments: _____

Report Prepared by: _____ Title: _____

Brodie International

P.O. Box 450 (30459-0450)
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Statesboro, GA, 30461
USA

Email: sales@brodieintl.com
Phone: +1 (912) 489-0200
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