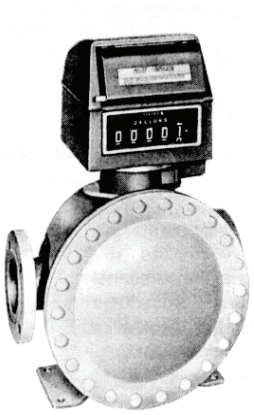
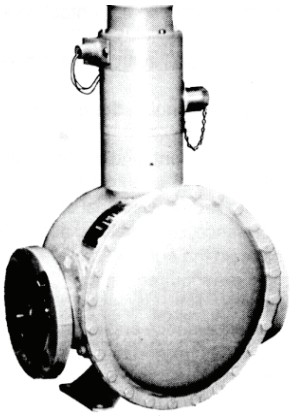
BiRotor Meters B060, B070, B080, & B090.





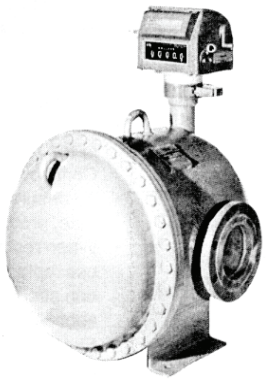


Table of Contents

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.

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. 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 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. Goods are warranted for twelve (12) months from the date of installation and 18 months from date of shipment, whichever occurs 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, 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 LIABILTY: 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 Introduction

General

The Brodie BiRotor Meter is a precision made, accurate flow measurement device which utilizes the positive displacement principle of operation. It is designed to measure crude and refined petroleum products as well as many industrial liquids.

The standard meter consists of a measuring unit installed in an outer housing or case, an adjustor for calibration and selected registration equipment. As product enters the intake of the measurement element, two finely timed rotors divide the liquid into precise segments of known volume and return those segments to the flowing stream. During this transition, the rotation of the two rotors is directly proportional to volumetric throughput. The rotors are always dynamically balanced, but hydraulically unbalanced, and have no metal-to-metal contact with one another or the measuring unit housing. Volume indication is determined by either mechanical output gearing leading to registration devices, or by an electrical output signal to remote registration equipment.

The accuracy adjustor, located on the output shaft of the counter drive gearing of the mechanical meter, permits the operator to adjust output registration to read in exact units of volume. It allows for adjustments up to +/-3% of meter throughput in determining accurate measurement. The meter may be supplied with any of several accessory items including two stage electric valves, preset counters, high frequency pulse generators, impulse contactors, etc. These units provide various functions for local and/or remote control and readout.

8 Specifications

Materials of Construction

Housing: Welded Steel construction combining castings and drawn steel plates.

Measuring Unit

Rotors: Heat Treated Aluminum (Standard)
6" Series 90 and 92 uses Cast Iron 3-Tooth Rotor
Rotor Shafts: E.T.D.150
Rotor Bearings: Stainless Steel
Body and End Covers: Cast Iron

Counter Base Plate (Not used on P-Series)

Body: Steel
O-Rings: VitonTM (Standard)
Counter Base Drive Gears: Stainless Steel
Drive Shafts: Stainless Steel
Drive Shaft Ball Bearings: Stainless Steel
Optional: All Ferrous Materials of Construction

NOTE: Before placing the meter into service reference the appropriate instruction manuals for all accessories. This includes hook-up, electrical wiring, and specification requirements and restrictions.

9 Installation

General

The following is a general outline for the proper storage, shipment, installation, and start up of any Brodie BiRotor meter. Additional information on the proper use of Positive Displacement Meters can be obtained from API Standard 1101 -Measurement of Petroleum Liquid Hydrocarbons by Positive Displacement Meter.

Installation

WARNING

Compounds used in the making of elastomer gaskets, O-Rings and seals will, by nature, deteriorate over an extended period of time. This is dependent on elastomer material, frequency of operation and the product being measured. Extreme caution should be used when measuring volatile liquids or when using a meter that has been stored for an extended period of time. Loss of seal integrity can result in leakage, damage to the equipment and/or personal injury.

1. The BiRotor meter should be mounted on a secure foundation. Considerations for placement of a right angle adaptor and meter weight must be made when vertical installation is required.

2. Care should be taken to insure that the drain plug remains accessible. A valve may be installed on the drain line to facilitate draining of water and sediment from the meter. A lockable valve is recommended to reduce the chance of accidentally draining the meter. **Any product drained from the meter, either manually or through a centralized drain system, must be disposed of in accordance with all local, state, and federal laws.**

3. Skid foundations and process piping must be properly secured in order to minimize line vibration at the meter.

4. Process piping should not place strain on the meter.

5. Provisions should be made to insure that thermal explansion does not raise line pressure above the maximum pressure rating of the meter.

6. All process piping should be clean and free of debris to insure foreign material does not enter the meter.

7. A flow limiting valve should be installed downstream of the meter to maintain adequate back pressure and to protect the meter from excessive flow rates.

8. If require, an air eliminator should be installed upstream of the meter.

9. Do not allow water to remain in the meter. If water has entered the meter remove the inner unit and clean it with a light lubricating oil.

10. Standard flow through the meter is from left to right. If right to left flow is required, consult your local Brodie agent or an authorized repair center.

11. The bolt pattern on the meter accessories allows the meter accessory stack to be rotated in 90 degree increments. The required position should be selected prior to installing electrical service to the meter. Care should be taken not to damage the capillary tube on the temperature compensator if so equipped.

12. Isolation valves should be installed on both ends of the meter run to minimize product loss when removing any of the components from the line.

10 Operation

CAUTION
Do not operate this meter in excess of the values stated in Specifications.

Brodie Meter Co., LLC has highly qualified service technicians who are available to provide start up assistance. Contact Brodie or your local Brodie Authorized Repair Center if service assistance is required.

The following recommendations should be considered when the meter is first put into operation or any time that the meter has been drained.

1. If large volumes of debris are expected in the process piping during start up it is recommended that the measuring element be removed from the meter until the lines are free of pipe scale, weld beads and other types of foreign material. A spool piece may be used as a temporary replacement for the meter. **The strainer basket should be removed to eliminate the possibility of rupturing.**

2. Slowly introduce product into the meter. Open the upstream valve while the downstream valve remains closed.

3. Slowly bleed air from the system through the high point vent.

4. Once all air has been eliminated, slowly open the downstream valve. Allow the meter to run at approximately 20 percent of the maximum rated flow for two minutes. Observe the rotation of the counter wheels to insure the meter is operating smoothly. Continue opening the downstream valve until it is fully open. **Care should be taken to insure the maximum flow rate of the meter is not exceeded.** Confirm that the setting on the flow control valve is properly fixed and is in control of the system.

5. Do not close valves quickly. This can cause a pressure spike which can damage the meter.

6. Do not make adjustments to the meter or its accessories while the meter is turning. When adjuster settings are changed, a small batch should be run through the meter prior to making the next proving run. This allows the adjuster components to shift to the new setting.

7. Prove the meter in order to establish a meter factor under actual operating conditions. Proving records and other pertinent meter data should be retained in order to establish a performance history for the meter.

11 Maintenance

WARNING
Extreme care must be exercised when the measuring chamber is exposed and handled. Hands must be kept clear of the timing gears, rotors and measuring chamber or serious personal injury can occur. Due to the precision balance of the rotors and timing gears, they can be set in motion easily. Keep hands clear of these parts at all times! At no time should hands be used to brace these.

General

The amount of maintenance necessary for efficient meter performance depends upon such factors as:

1. Continuity of Operation - A meter which operates almost continuously, obviously will require more attention than one on intermittent duty.

2. Rate of Flow - The practical life of any piece of equipment is proportional to its speed of operation. A meter operating at, or close to, its maximum rating will naturally have a shorter life than one operating at a reduced rate.

3. Lubricating Value of Product - Other factors being equal, a meter handling a light lubricating oil will have a longer life than one measuring a dry motor fuel.

4. Cleanliness of Product - Abrasive solid matter accelerates meter wear.

Meters that are given a little attention regularly will deliver better performance and have a longer life than those that are not given any attention until they have failed. Frequently, a meter's performance will depend, to a considerable extent, upon the proper functioning of the accessory equipment in the piping system. Following are listed some of the conditions and factors influencing meter performance:

1. A meter should be kept filled with the liquid it is measuring. Draining results in the formation of deposits and gums which increase the mechanical friction. Any leaky shut-off valves or check valves which would permit the meter to drain should be repaired or replaced.

2. A petroleum meter should be kept free of water. Usually, regular inspection and draining of storage tanks are sufficient protection.

3. Clean the strainer basket frequently.

4. Soft closing loading valves or shock chambers for eliminating water hammer should be kept in good working order.

5. The valves and operating mechanism of an air eliminator should be inspected on a routine basis. Thisis especially true where a critical air condition exists. For this reason meter performance is dependent on proper air elimination. Factors leading to difficult valve and air eliminator operating conditions include: gum formationscaused by alternate wetting and drying, formation of corrosive vapors, and presence of salt air.

6. The counter of the meter should be given some protection during extreme weather conditions.

7. A meter taken out of service for any length of time should be filled with light lubricating oil.

8. Keep Brodie manuals available for reference.

11.1 General Meter Disassembly

CAUTION
Before performing any disassembly or reassembly procedures, all flow to meter should be off. All electrical connections to accessories should be disconnected. Service should be performed by trained and qualified personnel only.

Cleanliness is of prime importance when working on a precision instrument. The work area should be clean and the meter parts thoroughly washed. All gaskets and O-rings should be removed and replaced. This policy will assure maximum performance from your Brodie BiRotor Meter at less expense and with greater accuracy.

WARNING
Verify that all pipeline/process fluid has been removed from the meter. Failure to release pressure prior to servicing meter may result in personal injury and/or damage to meter.

11.2 Removing Measuring Unit

1. Remove drain plug and completely drain meter and replace plug.
2. Remove the Accuracy Adjustor and Counter Base Plate Assembly.
3. Remove Hex Nuts and Housing Cover from the Meter Housing.
4. Disconnect the Measuring Unit from the Meter Housing by first removing the Screws, Washers and Seal Washers from the unit.
5. Carefully lift the Measuring Unit away from the meter body and place on a clean dry surface.
6. The measuring unit may now be inspected. In some cases, a thorough washing in a cleaning solvent or kerosene will be sufficient to free the rotors of corrosion or foreign material and the unit may be reinstalled without further disassembly. In the event the rotors are blocked with solid matter, it will be necessary to remove the rotors and gear box assembly for further cleaning.

11.3 Disassembly of Measuring Units

WARNING
Extreme care must be exercised when the measuring chamber is exposed and handled. Hands must be kept clear of the timing gears, rotors and measuring chamber or serious personal injury can occur. Due to the precision balance of the rotors and timing gears, they can be set in motion easily. Keep hands clear of these parts at all times! At no time should hands be used to brace these

1. Position the Measuring Unit with the Front End Plate facing out in such away as to afford easy access. This will vary according to the size of the meter being serviced. It is recommended that a cradle type structure be used for the disassembly of most models.
2. Remove the two front Bearing Retainer Caps.
3. Remove the Drive Gear Assembly, Retainer Ring and Key (if applicable) and Bearings from the 3-Tooth Rotor.
4. Remove the Screw, Washer, Bearing Key and Bearings from the 4-Tooth Rotor. **DO NOT remove the Front End Plate at this time.**
5. Rotate the Measuring Unit, remove Screws from the Rear End Cover and separate from the Measuring Unit Body.
6. The Rotors and Rear End Cover can now be washed thoroughly with solvent or kerosene and inspected. If the Rotors show no evidence of contact with each other, and if the Timing Gears appear satisfactory, further disassembly will not be required.

11.4 Removing Timing Gears and Rotors

Severe scoring of the Rotors, or grit in the Bearings, may necessitate removal of the Rotors from the Rear End Cover.

1. Remove Lock Nut Retainer and Washer.

2. Using a small piece of rubber, or nylon stock, block the Timing Gears.

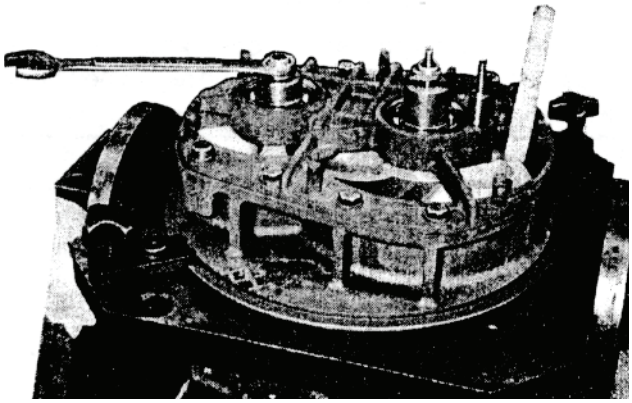


Figure 11-1 Proper Method for blocking

3. Timing Gears are taper fitted to the shafts and can be removed one at a time by striking the inside face of the gear (do not strike teeth) with a rubber mallet. **Care should be taken not to damage the Rotor Shaft threads when removing the Timing Gears.**

4. Remove the Bearing Spacers and Bearings from the Rear Cover. **NOTE: Ball Bearings can be removed from the End Covers by gently tapping or pressing on the inner race of the Bearings from the inside of the End Cover.**

5. Separate the Rotors from the Rear End Cover.

6. Remove the Front End Cover and Bearings.

11.5 Cleaning Measuring Unit

1. Scored metal should be removed with a scraper or file. Remove only the high points and do not remove any more metal than necessary.

2. Polish rotors with crocus cloth and wash carefully in solvent or kerosene to remove all particles of grit or metal.

3. File lightly the end plates to remove any burrs or high spots. Use fine sandpaper to remove corrosion and burrs from the surface of the bores that carry the bearings.

4. Ball bearings should be cleaned and inspected for wear. Excessive wear dictates the need for bearing replacement.

5. All gears and shafts in the gear box assembly should be inspected. Check all O-rings for wear and replace if necessary.

CAUTION
All parts should be thoroughly cleaned in solvent, light fuel oil, kerosene or a suitable cleaning agent compatible with the metallurgy of the meter and the liquid being measured.

11.6 Reassembly of Measuring Unit

1. Lubricate all Bearings and O-Rings with a light weight oil.

2. Position the Measuring Unit Body and attach the Front End Plate by installing Screws.

3. Rotate the Measuring Unit Body and replace the Rotors in the proper slots with the tapered end of the Rotors upward.

4. Position and attach the Rear End Plate using the Screws previously removed.

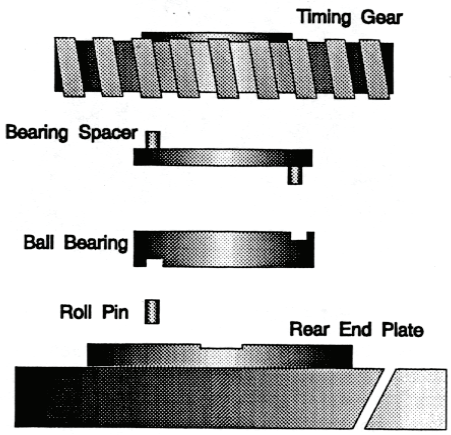
5. Install the Bearings within the bearing bore of the Rear End Plate. **NOTE: The slot on the outer race of the Ball Bearing must align with the Roll Pin in the bottom of the bearing bore.**

6. Position a Bearing Retainer (B090) or Spacer over each Bearing and attach by installing Lock Washers and Screws.

7. Replace the Spacer Key (if applicable), Timing Gears, Lock Nut Retainer, Lock Washer and Screws. **NOTE: The large Timing Gear fits on the 4-tooth Rotor. The short tab on the Spacer Key fits in the inner race of the Ball Bearings and the longer tab seats into the slot on the Timing Gear.**

8. Replace Lock Washers and Lock Nuts. The tab on the Lock Washer must seat into the slot on the Timing Gear.

9. Rotate the body and install Bearings, Bearing Key, Snap Ring, Lock Washer and Screws onto the Front End Cover. **NOTE: The tab on the Bearing Key must seat into the slot on the inner race of the Bearing.**



11.7 Setting End Clearance

Note: End rotor clearance is not required on all models. Units requiring end rotor clearance can be identified by the presence of set screws on the face of Timing Gears.

1. Adjust the two Set Screws located on the face of the Timing Gears until both Rotors are flush with the back side of the Rear End Plate.

2. Insert a shim into the outlet port, located on the Front End Plate, and determine the total distance between the backside of the Front End Plate and the 3-tooth Rotor. Repeat this procedure for the 4-tooth Rotor.

3. Adjust the two Set Screws located on the small Timing Gear until the distance between the back side of the Front End Plate and the 3-tooth Rotor is one-half the distance previously determined. Repeat this procedure for the 4-tooth Rotor and the large Timing Gear.

4. If the end clearance is adjusted properly, the Rotors will spin freely in any position. If the Rotors fail to spin freely, repeat procedure for setting end clearance.

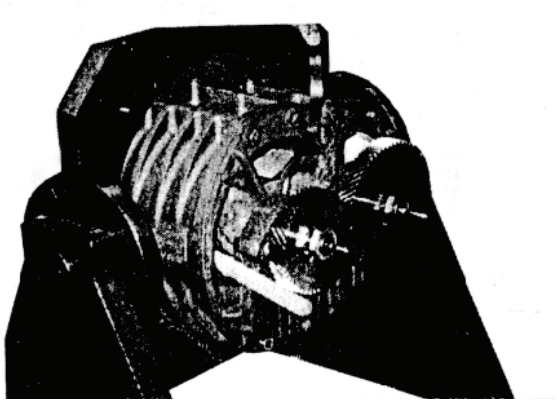


Figure 11-3 Proper Method for Timing

11.8 Timing Gear Adjustment

1. Loosen the Jam Nut on the large Timing Gear and with a feeler gauge or shims, carefully centralize a lobe of theb 3-toothed Rotor in a flute of the 4-toothed Rotor. Determine the distance between the lobe and the flute of the two Rotors and shim the Rotors one-half of the determined distance between them. **NOTE: This may be done through the inlet and outlet openings of the unit.**

2. Position the Measuring Unit into the Meter Housing so that the inlet on the Measuring Unit couples with the inlet on the Meter Housing.

3. Replace Screws, Washers and Seal Washers attaching the Measuring Unit to the Meter Housing.

4. Replace the Meter Cover Housing and the Front Dome Gasket. A light film of grease will aid in holding the Gasket in place.

5. Rotate the Coupling Tube on the Pinion Shaft Assembly of the Counter Base Plate Assembly until the Drive Pin is positioned the same as the slot of the Coupling Jaw on the Counter Drive Gear Train.

6. Install the Adjustor and all other accessories. Operation for Start-up recommendations

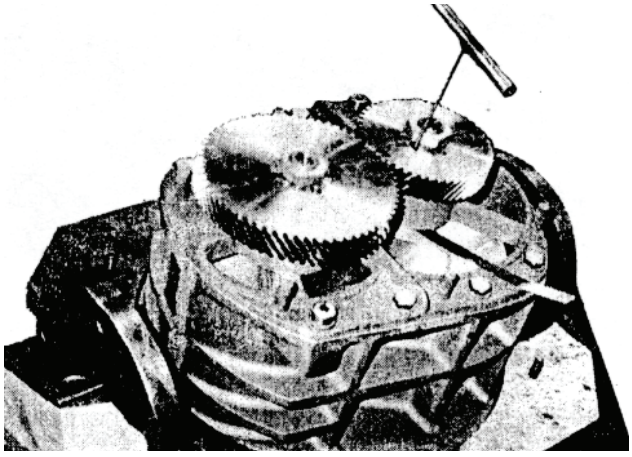


Figure 11-4 Proper Method for Setting Rotor End

11.9 Meter Adjustment

The standard mechanical BiRotor meter is supplied with a Series 4200 Adjustor whereby incremental changes can be made to calibrate meter output with registration equipment. This is accomplished by changing the gear ratio between the meter packing Shaft and the Counter. To make adjustments:

1. Remove the protective security cover of the Adjustor.
2. Lift the Adjustor Locking Plate.
3. Adjust the meter as required.

Adjustment Knobs are labeled for COARSE and FINE adjustment. Each groove of the COARSE adjustment equals 0.6% of the volume delivered. Each groove of the FINE adjustment is equal to 0.05% of the volume delivered.

NOTE: Pushing the adjustment knobs IN decreases the counter reading. Pulling the adjustment knobs OUT increases the counter reading.

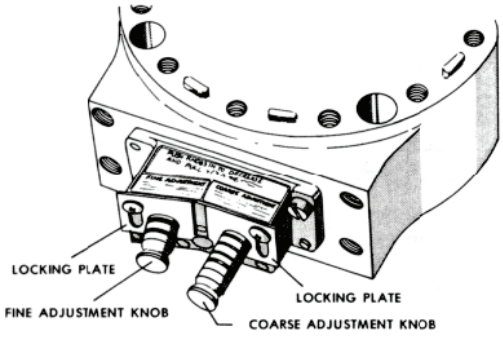


Figure 11-5 Model 4200 Accuracy

P-Style BiRotor meters are adjusted electronically at the point of registration using meter factor information and require no mechanical adjustor. Reference Instruction Manual X-PS01 for complete adjustment details.

11.10 Torque Specifications

Meter	Thread Size	Qty	Torque	
			ft-lbs	N-m
B060A	3/8"-16	22	31	42
B070A	1/2"-13	22	75	102
B080A	5/8"-11	22	150	203
B090A	3/4"-10	32	266	360

12 Parts List

Reference Figures 11-1 through 11-9 and Tables 11-1 through 11-9 for complete parts list information for the basic Brodie BiRotor Meter B060-B090. Reference Instruction Manual X-PS01 for parts pertaining to the P-Style Meter. For parts not listed, or for additional information, consult factory.

When ordering, the following information must be furnished.

1. Part Number and Description
2. Model Number of Flow meter
3. Serial Number of Flow meter
4. Quantity Required

When ordering items of a material or special construction not indicated in the parts list, the Specific Material of Construction must be included.

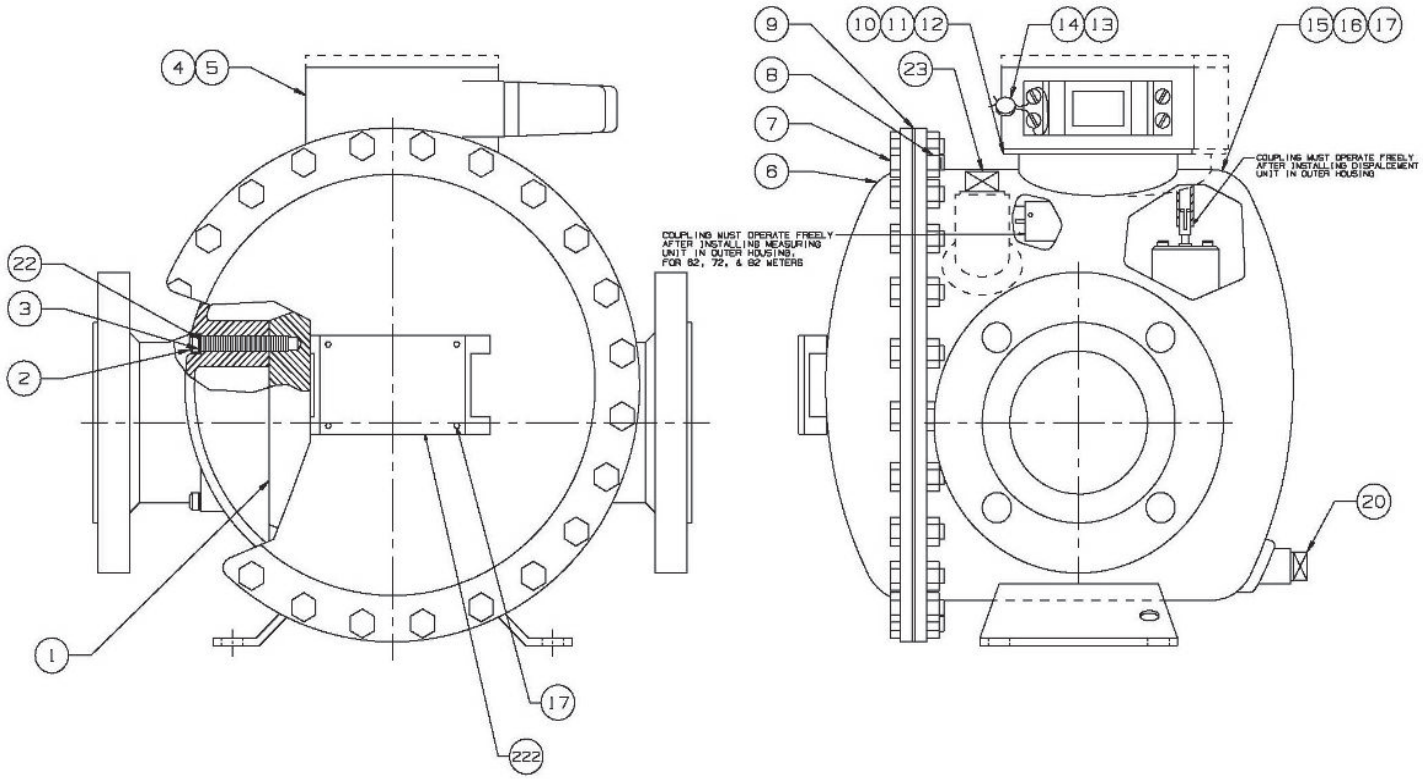


Figure 12-1 Complete Meter Assembly - B060, B070, B080, & B090

Table 12-1A Complete Meter Assembly - B060

Item	Description	Qty	B060 Meter Model					
			Standard Metallurgy			All Ferrous		
			1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution	1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution
1	Measuring Unit Assembly	1	62305-000	62305-010	62305-020	62305-001	62305-011	62305-021
2	Screw	4	151026M	151026M	151026M	151026M	151026M	151026M
3	Stat-O-Seal	4	152027	152027	152027	152027	152027	152027
4*	Adjuster assembly	1	4200	4200	4200	4200	4200	4200
5	Screw	4	150565	150565	150565	150565	150565	150565
6	Cover	1	62430M	62430M	62430M	62430M	62430M	62430M
7	Screw	22	150767M	150767M	150767M	150767M	150767M	150767M
8	Nut	22	151545M	151545M	151545M	151545M	151545M	151545M
9*	Gasket	1	60434	60434	60434	60434	60434	60434
10	Counter Base Plate Assembly	1	51750-526M	51750-526M	82750-526M	51790-011M	51790-011M	82750-010
11*	Gasket	1	51156	51156	51156	51156	51156	51156
12	Screw	9	151012M	151012M	151012M	151012M	151012M	151012M
13	Seal	1	151831	151831	151831	151831	151831	151831
14	Seal wire	1	155051	155051	155051	155051	155051	155051
15	Housing Assembly	1	62415-500M	62415-500M	62415-500M	62415-500M	62415-500M	62415-500M
16	Nameplate	1	30202-001	30202-001	30202-001	30202-001	30202-001	30202-001
17	Screw	8	153991	153991	153991	153991	153991	153991
20	Plug	1	154707M	154707M	154707M	154707M	154707M	154707M
22	Washer	4	151882	151882	151882	151882	151882	151882
23	Thermowell (if applicable)	1	4658M	4658M	4658M	4658M	4658M	4658M
222	Warning Plate	1	2200-087	2200-087	2200-087	2200-087	2200-087	2200-087

* Recommended Spare Part.

Table 12-1B Complete Meter Assembly - B070

Item	Description	Qty	B070 Meter Model					
			Standard Metallurgy			All Ferrous		
			1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution	1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution
1	Measuring Unit Assembly	1	72505-000	72505-010	72505-020	72505-001	72505-011	72505-021
2	Screw	4	151026M	151026M	151026M	151026M	151026M	151026M
3	Stat-O-Seal	4	152034	152034	152034	152034	152034	152034
4*	Adjuster assembly	1	4200	4200	4200	4200	4200	4200
5	Screw	4	150565	150565	150565	150565	150565	150565
6	Cover	1	62890M	62890M	62890M	62890M	62890M	62890M
7	Screw	22	150804M	150804M	150804M	150804M	150804M	150804M
8	Nut	22	151555M	151555M	151555M	151555M	151555M	151555M
9*	Gasket	1	178709	178709	178709	178709	178709	178709
10	Counter Base Plate Assembly	1	51750-526M	51750-526M	82750-526M	51790-011M	51790-011M	82750-010
11*	Gasket	1	51156	51156	51156	51156	51156	51156
12	Screw	9	151010M	151010M	151010M	151010M	151010M	151010M
13	Seal	1	151831	151831	151831	151831	151831	151831
14	Seal wire	1	155051	155051	155051	155051	155051	155051
15	Housing Assembly	1	72925-009M	72925-009M	72925-009M	72925-009M	72925-009M	72925-009M
16	Nameplate	1	30202-001	30202-001	30202-001	30202-001	30202-001	30202-001
17	Screw	8	153991	153991	153991	153991	153991	153991
20	Plug	1	154718-074M	154718-074M	154718-074M	154718-074M	154718-074M	154718-074M
22	Washer	4	151882	151882	151882	151882	151882	151882
23	Thermowell (if applicable)	1	4658M	4658M	4658M	4658M	4658M	4658M
222	Warning Plate	1	2200-087	2200-087	2200-087	2200-087	2200-087	2200-087

* Recommended Spare Part.

Table 11-1C Complete Meter Assembly - B080

Item	Description	Qty	B080 Meter Model			
			Standard Metallurgy		All Ferrous	
			10 Gal. per Revolution	10 Liters per Revolution	10 Gal. per Revolution	10 Liters per Revolution
1	Measuring Unit Assembly	1	82805-012	82805-022	82805-022	82805-022
2	Screw	4	151070M	151070M	151070M	151070M
3	Stat-O-Seal	4	152033	152033	152033	152033
4*	Adjuster assembly	1	4200	4200	4200	4200
5	Screw	4	150565	150565	150565	150565
6	Cover	1	82890M	82890M	82890M	82890M
8	Screw	22	150832M	150832M	150832M	150832M
9*	Gasket	1	82884	82884	82884	82884
10	Counter Base Plate Assembly	1	51750-526M	82750-526M	51790-011M	82750-010
11*	Gasket	1	51156	51156	51156	51156
12	Screw	9	151010M	151010M	151010M	151010M
13	Seal	1	151831	151831	151831	151831
14	Seal wire	1	155051	155051	155051	155051
15	Housing Assembly	1	82925M	82925M	82925M	82925M
16	Nameplate	1	92802	92802	92802	92802
17	Screw	8	153974	153974	153974	153974
20	Plug	1	154711M	154711M	154711M	154711M
22	Washer	4	151872	151872	151872	151872
23	Thermowell (if applicable)	1	4658M	4658M	4658M	4658M
222	Warning Plate	1	2200-087	2200-087	2200-087	2200-087

* Recommended Spare Part.

Table 11-2 Complete Meter Assembly - B090

Item	Description	Qty	B090 Meter Model		
			10 Gal. per Revolution	100 Liters per Revolution	1 BBL per Revolution
1	Measuring Unit Assembly	1	92205-010	92205-044	92205-030
2	Screw	7	151482M	151482M	151482M
3	Stat-O-Seal	7	152031	152031	152031
4*	Adjuster assembly	1	4200	4200	4200
5	Screw	4	150565	150565	150565
6	Cover	1	92430M	92430M	92430M
7	Screw	32	150847M	150847M	150847M
8	Nut	32	151558M	151558M	151558M
9*	Gasket	1	92434	92434	92434
10	Counter Base Plate Assembly	1	92150-500M	92150-500M	92150-500M
11*	Gasket	1	51156	51156	51156
12	Screw	9	151010M	151010M	151010M
13	Seal	1	151831	151831	151831
14	Seal wire	1	155051	155051	155051
15	Housing Assembly	1	92540-415M	92540-415M	92540-415M
16	Nameplate	1	92802	92802	92802
17	Screw	4	153974	153974	153974
20	Plug	1	154711M	154711M	154711M
22	Washer	7	151903	151903	151903
23	Thermowell (if applicable)	1	4658M	4658M	4658M
222	Warning Plate	1	2200-087	2200-087	2200-087

* Recommended Spare Part.

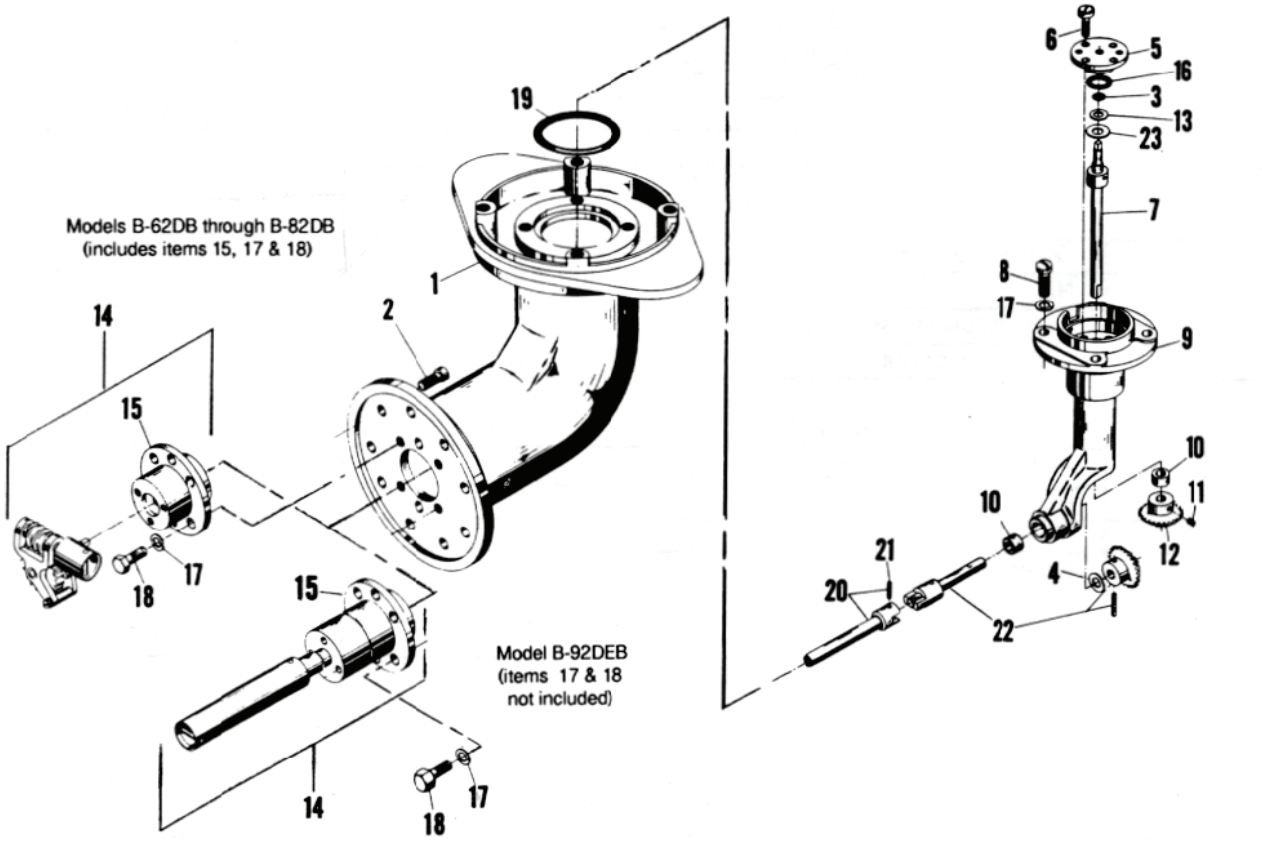


Figure 11-3 Right Angle Counter Base Plate Assembly

Table 11-3 Right Angle Counter Base Plate Assembly

Item	Description	Qty Rqd	Complete Right Angle Counter Base Plate Model	
			Part Number 72700-007	Part Number 72700-008
1	Base Plate Housing	1	72701M	72701M
2	Screw	9	151012M	151012M
3	O-Ring	1	152064-022	152064-022
4	Thrust Washer	1	72728	72728
5	Packing Gland	1	43176M	43176M
6	Screw	4	151029-419M	151029-419M
7	Packing Shaft	1	72725-003	72725-003
8	Screw	4	151010-019M	151010-019M
9	Gear Bracket	1	72721M	72721M
10	Bushing	3	92027-005	92027-005
11	Set Screw	2	150975	150975
12	Miter Gear	1	72729-003	72729-003
13	Washer	1	151894	151894
14	Worm and Gear Bracket Assembly	1	W51785-007*	W51675-002*
15	Bracket Retainer	1	72710-007	72710-007
16	O-Ring	1	152070-022	152070-022
17	Lock Washer	8	152264	152264
18	Screw	4	150725	150725
19	O-Ring	1	152073-022	152073-022
20	Coupling and Shaft with item 21	1	72736	72736
21	Groove Pin	1	153515	153515
22	Gear and Shaft Assembly	1	72730-003	72730-003
23	Thrust Bearing	1	155171	155171

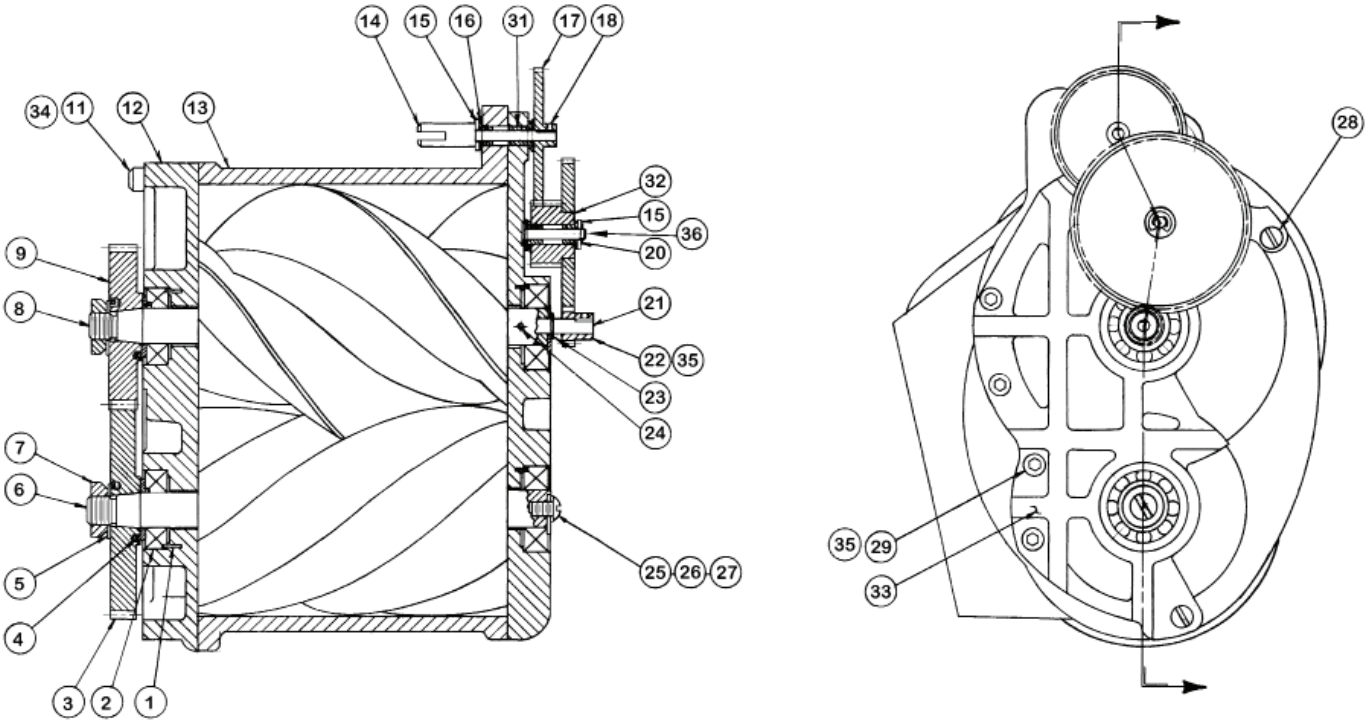


Figure 11-4 Measuring Unit Assembly - B060

Table 11-4 Measuring Unit Assembly - B060

Item	Description	Qty	B060 Meter Model					
			Standard Metallurgy			All Ferrous		
			1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution	1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution
	Measuring Unit Assembly		62305-000	62305-010	62305-020	62305-001	62305-011	62305-021
1	PIN - Roll	4	153547	153547	153547	153547	153547	153547
2	BEARING BALL	4	***	***	***	***	***	***
3	GEAR - DRIVE 4T ROTOR	1	***	***	***	***	***	***
4	KEY - Bearing Spacing	2	60294	60294	60294	60294	60294	60294
5*	LOCKWASHER	2	51593	51593	51593	51593	51593	51593
6	ROTOR 4T	1	**	**	**	**	**	**
7	LOCKNUT	2	60592	60592	60592	60592	60592	60592
8	ROTOR 3T	1	**	**	**	**	**	**
9	GEAR - DRIVE 3T ROTOR	1	***	***	***	***	***	***
11	SCREW	8	151033M	151033M	151033M	151033M	151033M	151033M
12	REAR END PLATE	1	60266-015	60266-015	60266-015	60266-015	60266-015	60266-015
13	BODY - MEASURING UNIT	1	62212-000	62212-000	62212-000	62212-000	62212-000	62212-000
14	SHAFT, COUPLING JAW	1	72542	72542	72542	72542	72542	72542
15	WASHER	4	151907	151907	151907	151907	151907	151907
16	BEARING	3	155151	155151	155151	155151	155151	155151
17*	DRIVE GEAR	1	62328 (50T)	62328 (50T)	62329 (53T)	62328 (50T)	62328 (50T)	62329 (53T)
18	SCREW - Set	2	151212	151212	151212	151212	151212	151212
20	RING - Retaining	1	156484	156484	156484	156484	156484	156484
21*	SHAFT - STUB	1	51579	51579	51579	51579	51579	51579
22*	DRIVE GEAR	1	60537 (55T)	60542 (14T)	60542 (14T)	60537 (55T)	60542 (14T)	60542 (14T)
23	RING - Retaining	1	153953	153953	153953	153953	153953	153953
24	GROOVE PIN	1	153636-019	153636-019	153636-019	153636-019	153636-019	153636-019
25	SCREW	1	150156	150156	150156	150156	150156	150156
26	WASHER	1	152270-019	152270-019	152270-019	152270-019	152270-019	152270-019
27	KEY - Bearing	2	60238	60238	60238	60238	60238	60238
28	SCREW - Dowel	4	51567	51567	51567	51567	51567	51567
29	SCREW	5	151010M	151010M	151010M	151010M	151010M	151010M
31	BEARING	1	155152	155152	155152	155152	155152	155152
32*	COMPOUND GEAR ASSEMBLY	1	62330 (27T-24T)	62335 (69T-24T)	62335 (69T-24T)	62330 (27T-24T)	62335 (69T-24T)	62335 (69T-24T)
33	FRONT END PLATE	1	60231-001	60231-001	60231-001	60231-001	60231-001	60231-001
34	WASHER	13	152113	152113	152113	152113	152113	152113
35	SCREW-SET	2	150975	150975	150975	150975	150975	150975
36	STUD - IDLER	1	60538-000	60538-000	60538-000	60538-000	60538-000	60538-000
37	GEAR COVER (NOT SHOWN)	1	616101	616101	616101	616101	616101	616101

*Recommended Spare Part.
**Items 4 and 5 are supplied as a set.
***Timing gears are sold in matched sets and are included in the following service kits.

W60591	Kit - Timing Gear Set for B-60DB & B-60CB Meters
W60591-029	Kit - Timing Gear Set for B-63DEB Meter

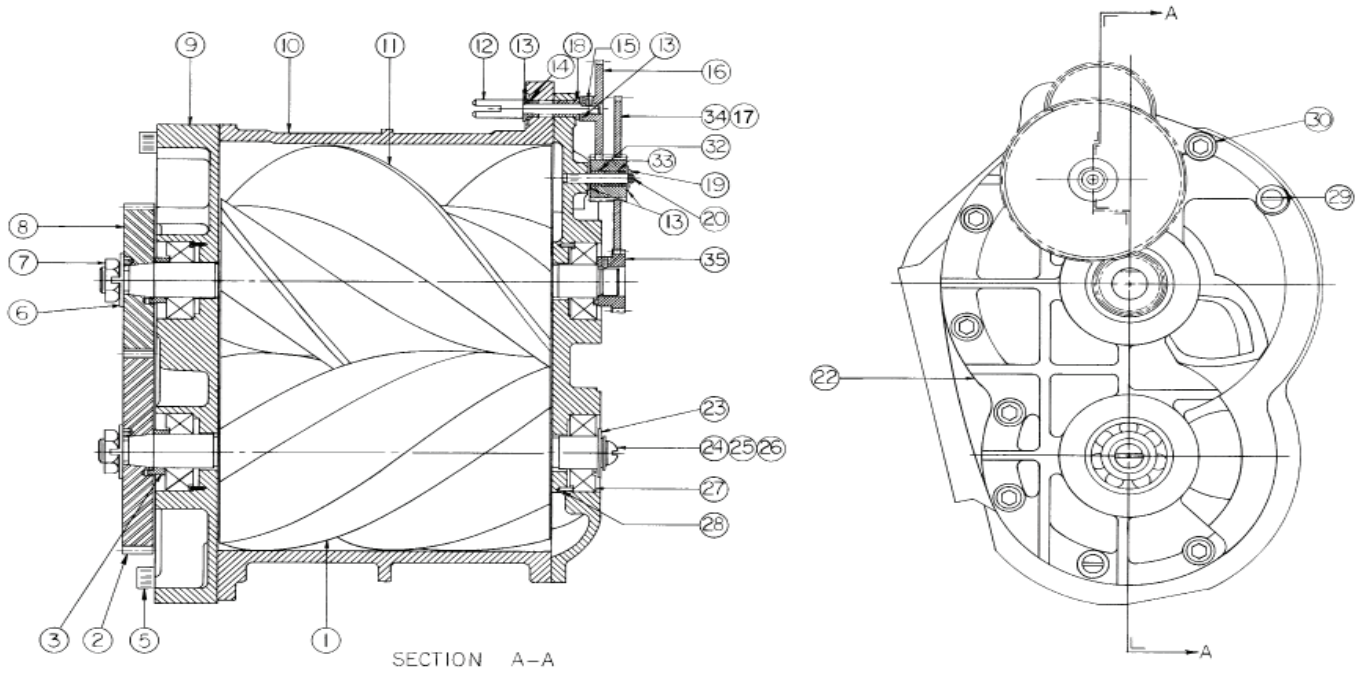


Figure 11-5 Measuring Unit Assembly - B070

Table 11-5 Measuring Unit Assembly - B070

Item	Description	Qty	B070 Meter Model					
			Standard Metallurgy			All Ferrous		
			1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution	1 Gal. per Revolution	10 Gal. per Revolution	10 Liters per Revolution
			72505-000	72505-010	72505-020	72505-001	72505-011	72505-021
1	ROTOR - 4 Tooth	1	**	**	**	**	**	**
2	GEAR, Drive (4T Rotor)	1	***	***	***	***	***	***
3	SPACER ASSEMBLY - Rotor	2	72295	72295	72295	72295	72295	72295
5	SCREW	8	151460	151460	151460	151460	151460	151460
6*	LOCKWASHER - Gear Retainer	2	51593	51593	51593	51593	51593	51593
7	LOCKNUT	2	60592	60592	60592	60592	60592	60592
8	GEAR, DRIVE (3T ROTOR)	1	***	***	***	***	***	***
9	PLATE - REAR END	1	72267	72267	72267	72267	72267	72267
10	BODY - Measuring Unit	1	72211-001	72211-001	72211-001	72211-001	72211-001	72211-001
11	ROTOR - 3T	1	**	**	**	**	**	**
12	SHAFT, COUPLING JAW	1	72542	72542	72542	72542	72542	72542
13	WASHER	4	151907-019	151907-019	151907-019	151907-019	151907-019	151907-019
14	BEARING	1	155151	155151	155151	155151	155151	155151
15	SCREW - Set	4	151212	151212	151212	151212	151212	151212
16*	GEAR	1	72543 (32T)	72544 (46T)	72546 (48T)	72543 (32T)	72544 (46T)	72546 (48T)
17*	GEAR	1	72548 (36T)	72549 (21T)	72549 (21T)	72548 (36T)	72549 (21T)	72549 (21T)
18	BEARING	1	155152	155152	155152	155152	155152	155152
19	RING - Retaining	1	156484	156484	156484	156484	156484	156484
20*	SHAFT - Idler	1	50244	50244	50244	50244	50244	50244
22	FRONT END PLATE	1	72818-002	72818-002	72818-002	72818-002	72818-002	72818-002
23	KEY - Bearing	1	72238	72238	72238	72238	72238	72238
24	WASHER	1	151902	151902	151902	151902	151902	151902
25	WASHER - Lock Spring	1	152108	152108	152108	152108	152108	152108
26	SCREW	1	150156	150156	150156	150156	150156	150156
27	BEARING - Ball	4	***	***	***	***	***	***
28	PIN - Roll	4	153548	153548	153548	153548	153548	153548
29	SCREW - Dowel	4	51567	51567	51567	51567	51567	51567
30	SCREW	6	151037	151037	151037	151037	151037	151037
32	BEARING SLEEVE	1	155142	155142	155142	155142	155142	155142
33	BEARING SLEEVE	1	155143	155143	155143	155143	155143	155143
34*	GEAR	1	72547 (78T)	72551-001 (79T)	72551-001 (79T)	72547 (78T)	72551-001 (79T)	72551-001 (79T)
35*	GEAR	1	72554 (29T)	72554 (29T)	72554 (29T)	72554 (29T)	72554 (29T)	72554 (29T)
	REAR GEAR COVER (NOT SHOWN)	1	71601	71601	71601	71601-001	71601-001	71601-001

*Recommended Spare Part.
**Items 4 and 5 are supplied as a set.
***Timing gears are sold in matched sets and are included in the following service kits:

W72291	Kit - Timing Gear Set for B-70DB & B-70CB Meters
W72291-029	Kit - Timing Gear Set for B-73DEB Meter

W72211 Measuring Unit Housing
(includes Body and End Plates)

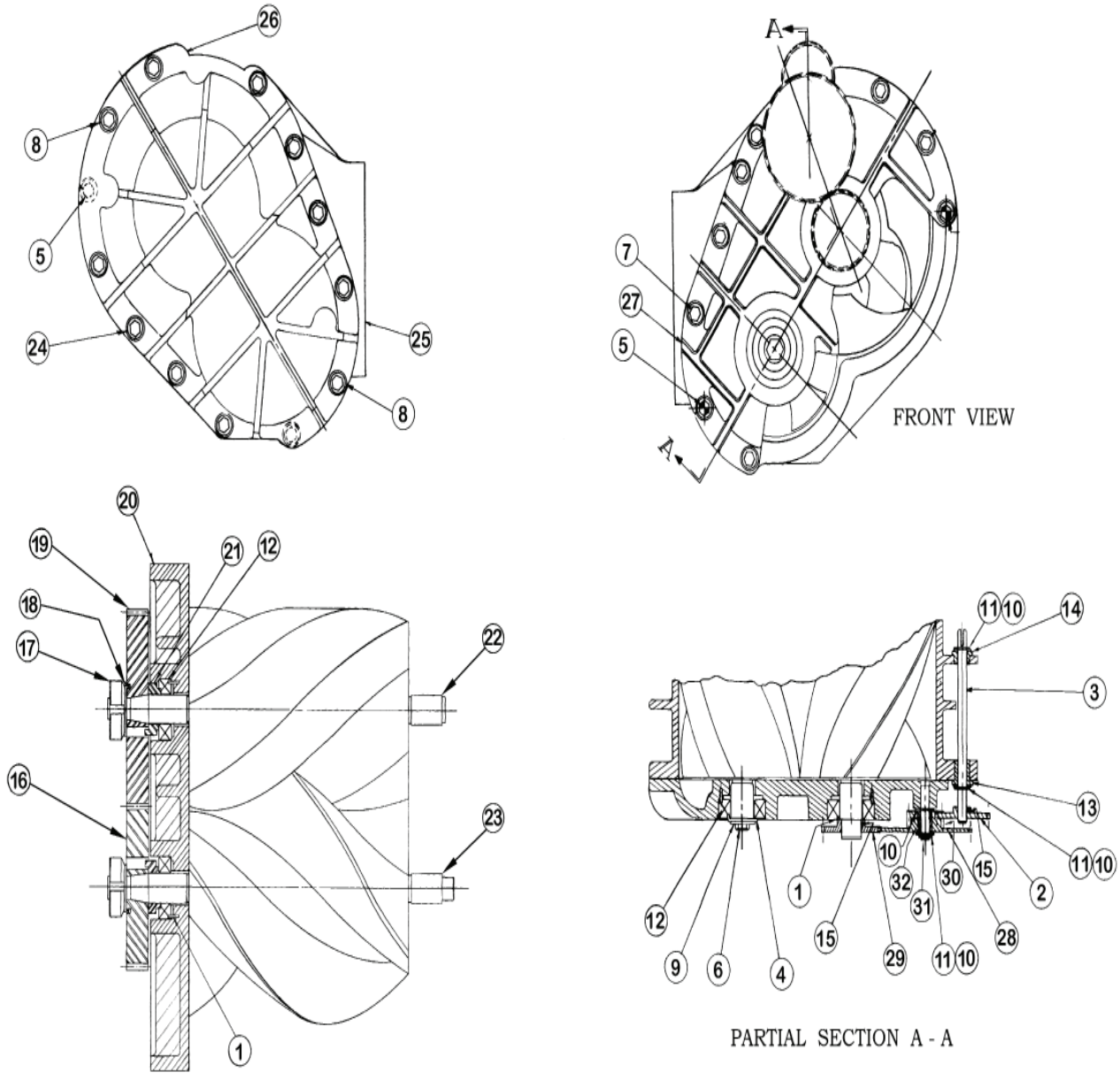


Figure 11-6 Measuring Unit Assembly - B080

Table 11-6 Measuring Unit Assembly - B080

Item	Description	Qty	B080 Meter Model			
			Standard Metallurgy		All Ferrous	
			10 Gal. per Revolution	10 Liters per Revolution	10 Gal. per Revolution	10 Liters per Revolution
			82805-012	82805-022	82805-014	82805-024
1	DOWEL - Bearing	5	102268	102268	102268	102268
2*	GEAR	1	82827 (53T)	82843 (56T)	82827 (53T)	82843 (56T)
3	COUPLING SHAFT	1	82802-001	82802-001	82802-001	82802-001
4	KEY - Bearing	1	82238	82238	82238	82238
5	SCREW - Dowel	4	92567	92567	92567	92567
6	SCREW	1	150765-014	150765-014	150765-014	150765-014
7	SCREW	7	151017M	151017M	151017M	151017M
8	SCREW	2	151028	151028	151028	151028
9	WASHER	1	151883	151883	151883	151883
10	WASHER	4	151938	151938	151938	151938
11	RING - Retaining	3	156514	156514	156514	156514
12	BEARING BALL	4	***	***	***	***
13	BEARING FLANGE RUL	1	155147	155147	155147	155147
14	BEARING FLANGE RUL	1	155148	155148	155148	155148
15	SCREW SET	4	150974	150974	150974	150974
16	GEAR - 3T DRIVE	1	***	***	***	***
17	GEAR LOCKNUT	2	82592	82592	82592	82592
18*	LOCKWASHER	2	82593	82593	82593	82593
19	GEAR - DRIVE (4T)	1	***	***	***	***
20	PLATE - Rear End	1	82267-002	82267-002	82267-002	82267-002
21	SPACER-BEARING	2	82833	82833	82295	82833
22	ROTOR - 4 Tooth	1	**	**	**	**
23	ROTOR - 3T	1	**	**	**	**
24	SCREW	9	151467M	151467M	151467M	151467M
25	BODY - Measuring Unit	1	82211-002	82211-002	82211-002	82211-002
26	REAR GEAR COVER	1	82601	82601	82601	82601
27	PLATE - Front End	1	82818-002	82818-002	82818-002	82818-002
28*	GEAR - 95T	1	82829	82829	82829	82829
29*	GEAR - 58T	1	82828	82828	82828	82828
30*	GEAR - 35T	1	82826	82826	82826	82826
31	SHAFT - IDLER	1	82836	82836	82836	82836
32	BEARING	1	155146	155146	155146	155146

*Recommended Spare Part.
**Items 4 and 5 are supplied as a set.
***Measuring Unit 82805-XXX above are used on meters having serial numbers 7805-18601 and above.
****Timing gears are sold in matched sets and are included in the following service kits:

W82291	Kit - Timing Gear Set for B080A, BE81A/BE83A Meters
W82291-600	Kit - Timing Gear Set for B080A P-Style Meter

W82211 Measuring Unit Housing
(includes Body and End Plates)

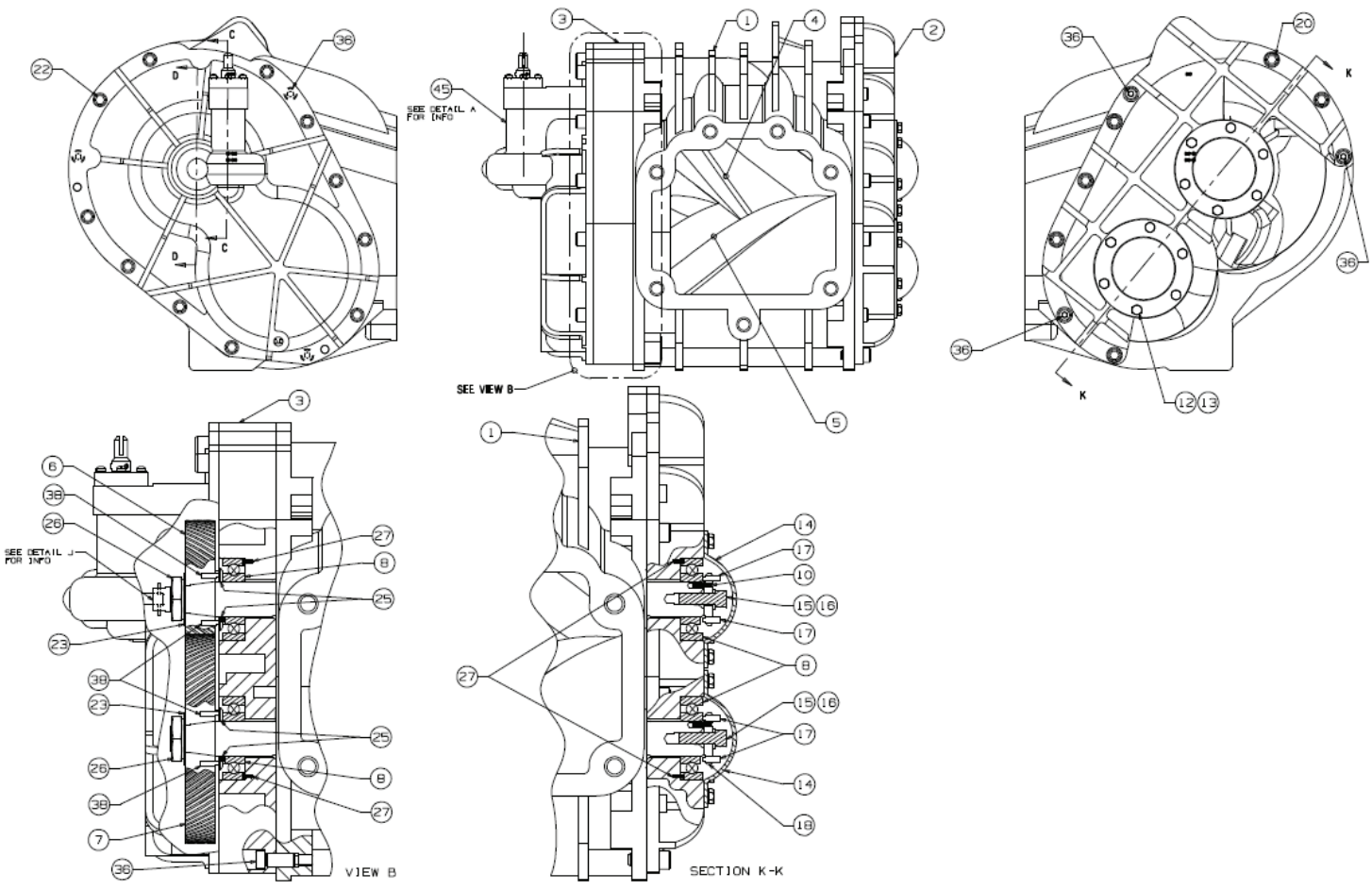


Figure 11-7A Measuring Unit Assembly - B090

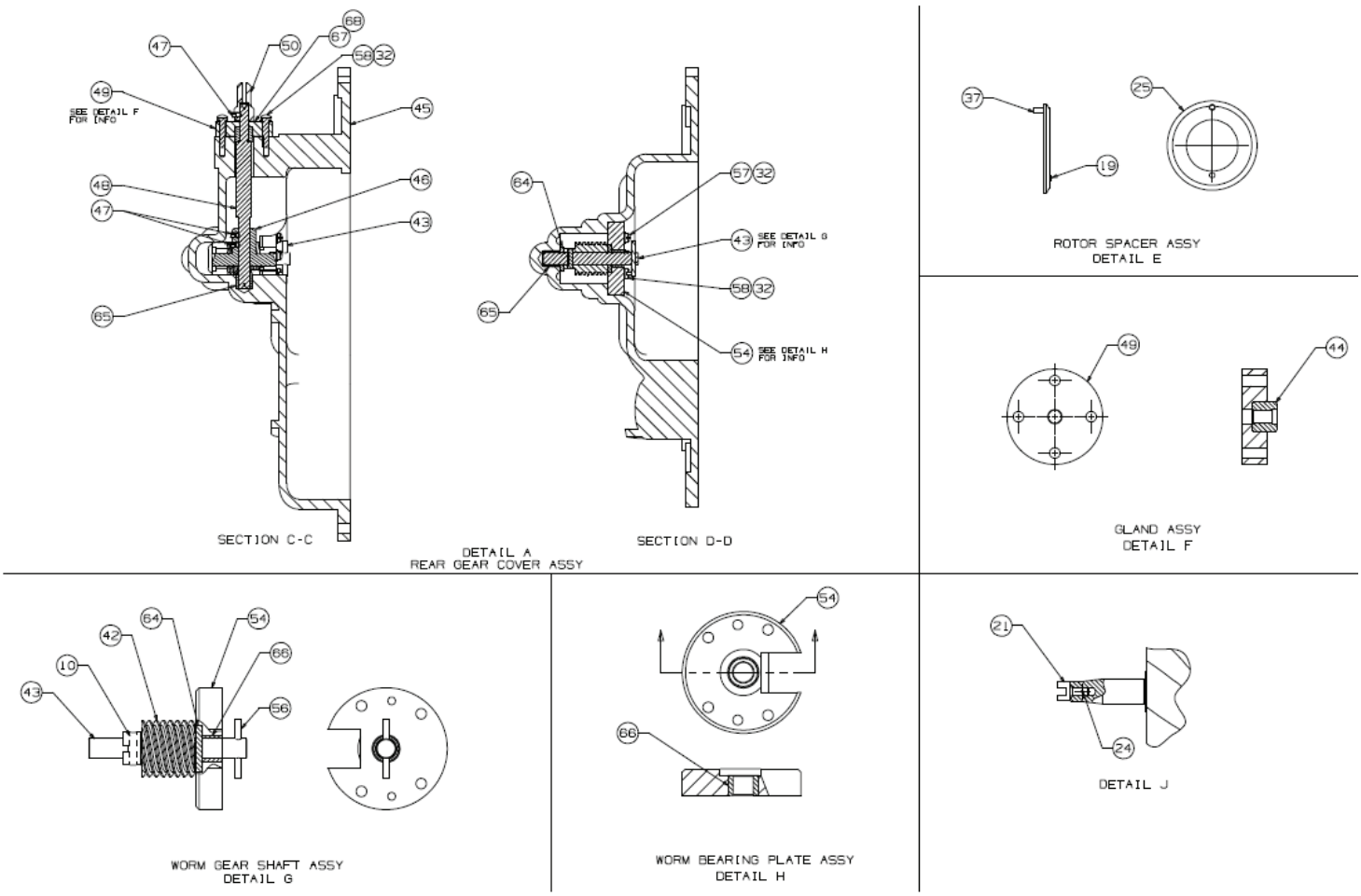


Figure 11-7B Measuring Unit Assembly - B090

Table 11-6.1 Measuring Unit Assembly - B090

Item	Description	Qty	B090 Meter Model		
			10 Gal. per Revolution	100 Liters per Revolution	1 Barrel per Revolution
			92205-010	92205-044	92205-030
1	BODY - Measuring Unit	1	92211	92211	92211
2	PLATE - Front End	1	92231-006	92231-006	92231-006
3	PLATE - Rear End	1	92266-006	92266-006	92266-006
4	ROTOR - 3 Tooth	1	**	**	**
5	ROTOR - 4 Tooth	1	**	**	**
6	GEAR - 66T 3T ROTOR TIMING	1	***	***	***
7	GEAR - TIMING	1	***	***	***
8	BEARING BALL	4	154957	154957	154957
10	PIN - Roll	3	153524	153524	153524
12	WASHER - Lock	12	152108	152108	152108
13	SCREW	12	150726	150726	150726
14	CAP - Front Bearing	2	92239-005	92239-005	92239-005
15	SCREW	2	151055-014	151055-014	151055-014
16	WASHER	2	152110	152110	152110
17	SCREW SET	4	150989	150989	150989
18	RETAINER - Bearing	2	192602	192602	192602
19	BEARING LOCK PIN	2	192292	192292	192292
20	SCREW	6	151040M	151040M	151040M
21	COUPLING JAW	1	92279	92279	92279
22	SCREW	11	151044	151044	151044
23*	GEAR RET LOCKWASHER	2	92593	92593	92593
24	PIN - Roll	1	153523	153523	153523
25	SPACER - Rotor	2	192293	192293	192293
26	LOCKNUT - Gear	2	92592	92592	92592
27	PIN - Roll	4	153512	153512	153512
32	WASHER - Lock	10	152259	152259	152259
36	SCREW - Dowel	6	92567	92567	92567
37	PIN, Roll	2	153539	153539	153539
38	SCREW SET	4	150986	150986	150986
42	WORM	1	92668-006	92668-007	92678
43	WORM SHAFT	1	92667	92667	92667
44	UPPER BUSHING	1	92662	92662	92662
45	COVER - Rear Gear	1	193601	193601	193601
46	WORM WHEE	1	92686-006	92686-007	92676
47	SCREW SET	6	150975	150975	150975

Table 11-6.2 Measuring Unit Assembly - B090

Item	Description	Qty	B090 Meter Model		
			10 Gal. per Revolution	100 Liters per Revolution	1 Barrel per Revolution
			92205-010	92205-044	92205-030
48	SHAFT - WORM WHEEL	1	92689	92689	92689
49	GLAND	1	92661	92661	92661
50	COUPLING JAW	1	92663	92663	92663
54	WORM BEARING PLATE	1	182666	182666	182666
56	PIN - Roll	1	153525	153525	153525
57	SCREW	2	150581	150581	150581
58	SCREW	8	150538	150538	150538
64	THRUST WASHER	2	92669	92669	92669
65	BUSHING	2	92657	92657	92657
66	BEARING	1	155168	155168	155168
67	SHIM	1	152541	152541	152541
68	WASHER	1	151901	151901	151901

Table 11-6 Measuring Unit Assembly - B090 Continues

Item	Description	Qty	B090 Meter Model		
			10 Gal. per Revolution	100 Liters per Revolution	1 Barrel per Revolution
46	WORM WHEE	1	92686-006	92686-007	92676
47	SCREW SET	6	150975	150975	150975
48	SHAFT - WORM WHEEL	1	92689	92689	92689
49	GLAND	1	92661	92661	92661
50	COUPLING JAW	1	92663	92663	92663
54	WORM BEARING PLATE	1	182666	182666	182666
56	PIN - Roll	1	153525	153525	153525
57	SCREW	2	150581	150581	150581
58	SCREW	8	150538	150538	150538
64	THRUST WASHER	2	92669	92669	92669
65	BUSHING	2	92657	92657	92657
66	BEARING	1	155168	155168	155168
67	SHIM	1	152541	152541	152541
68	WASHER	1	151901	151901	151901

*Recommended Spare Part.
**Items 4 and 5 are supplied as a set.
Standard: W92275-001
Cast Iron: 92276-001 & 92286-001
***Timing gears are sold in matched sets and are included in the following service kits.

W92291 Kit - Timing Gear Set for B-92/B & B-192DEB Meters

W92211 Measuring Unit Housing
(includes Body and End Plates)

Table 11-8 Counter Base Plate Assembly

Item	Description	Qty	Counter Base Plate Part Number			
			51750-500M	51790-011M	82750-010M	82750-500M
1	Counter Base Plate Assembly	1	51775-501M	51775-501M	51775-501M	51775-501M
2	Gasket / O-ring	1	157303-022	52176-500	52176-500	157303-022
3	Mounting Block	1	51761-300	51761-501	51761-501	51761-300
4	Bevel Gear and Pinion Gear Assembly	1	W51760-500	W51760-011	W82750-011	W82750-501

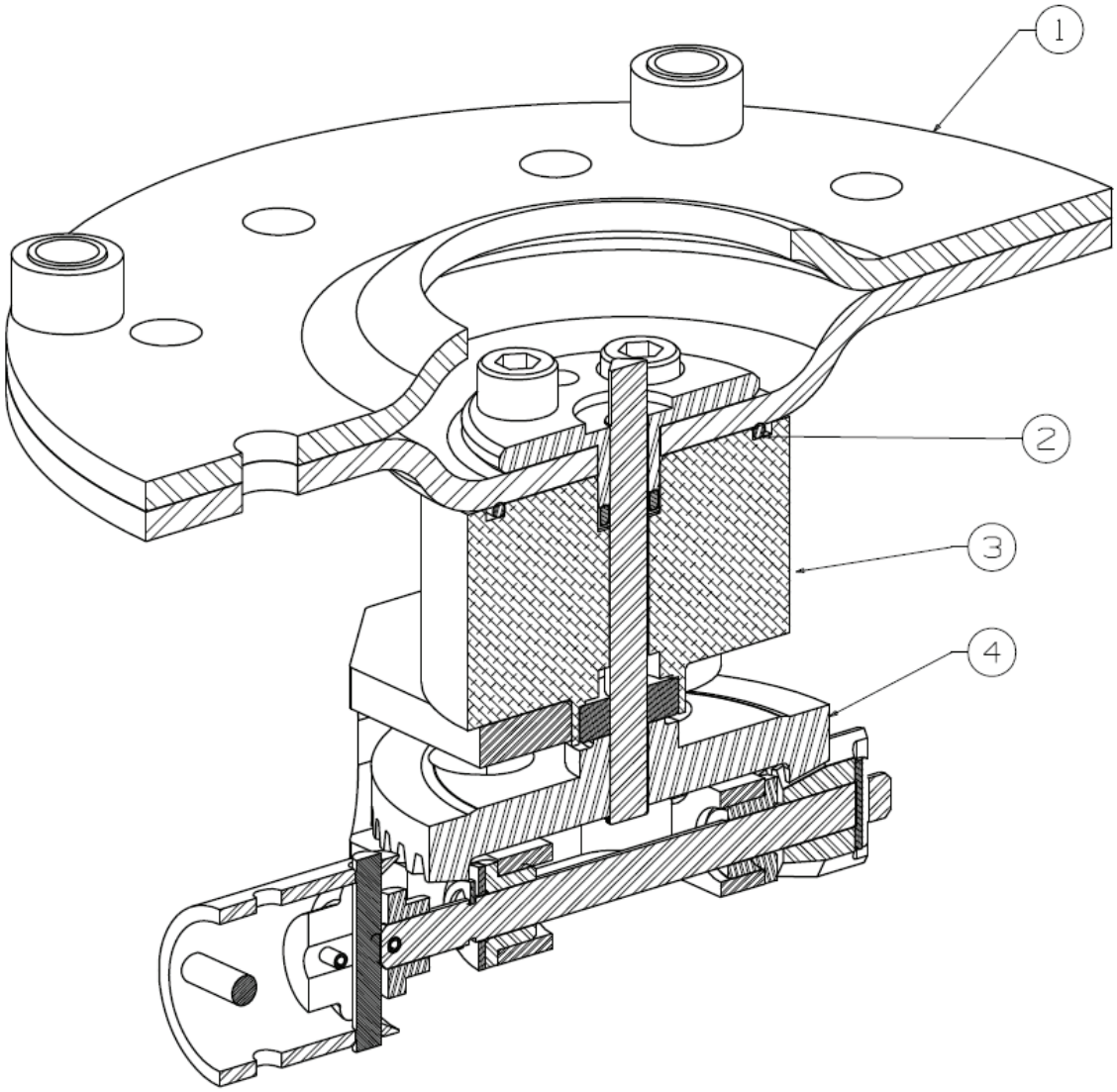


Figure 11-8 Counter Base Plate Assembly

Table 11-9 Counter Base Plate Assembly

Item	Description	Qty	Part Number
1	PLATE - Counter Base	1	51775-501M
2	SCREW	4	151001-019M
3	GLAND - Packing	1	52153-011M
4*	WASHER	1	151891M
5	COUPLING TUBE ASSEMBLY	1	92155-500
6	SCREW	3	150537
7	WASHER - Lock	3	152259
8	O-RING	1	157303-022
9	POSITIONER - PACKING SHAFT	1	92152
10	SPACER	1	74166
11	HOUSING - Bearing	1	194177
12	SCREW SET	2	150969
13	O-RING	1	152064-022
14	BLOCK, Mounting	1	51761-601
15	BEARING BALL	1	155195
16	O-RING	1	157063-022
17	GASKET	1	194178

* Recommended Spare Part.

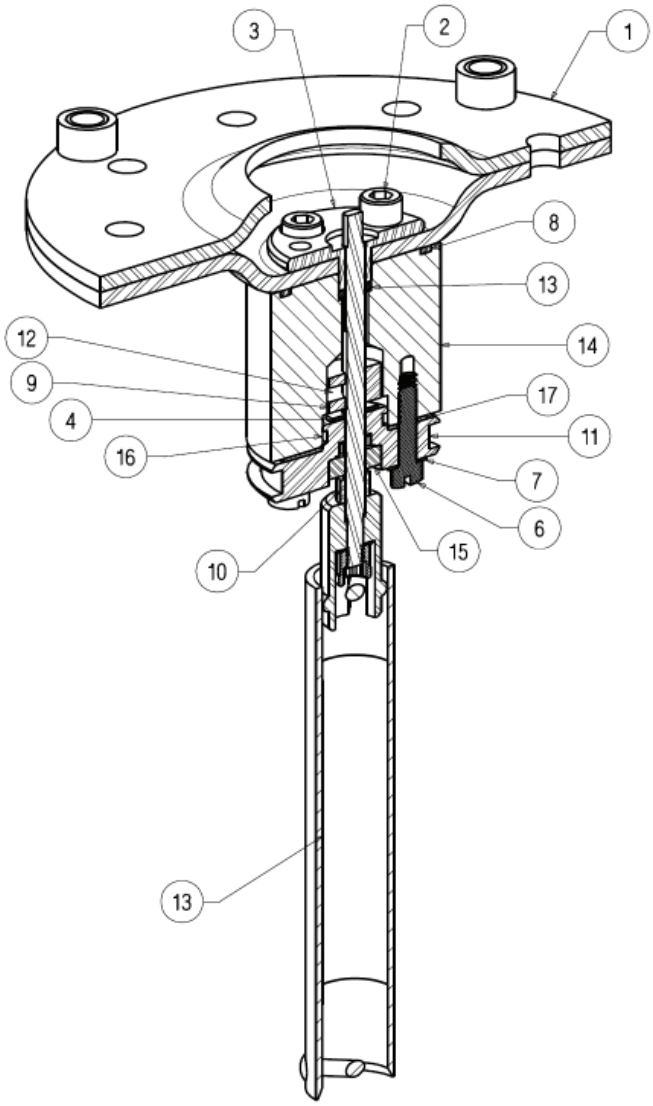


Figure 11-9 Counter Base Plate Assembly

13 Troubleshooting

Table 12.1 has been provided to aid in basic troubleshooting. Disassembly procedures are covered in Section 11 Maintenance. If the flowmeter is found to be in need of repair, it is important that servicing be performed by trained and qualified service personnel and it is recommended the user contact the Brodie Meter Co., LLC Repair Department.

Symptom	Possible Cause	Service Required
Meter runs but counter does not register.	Faulty Register.	Remove register and see if output shaft on adjustor rotates with metered fluid flow. If output shaft on adjustor rotates, replace register.
	Faulty adjustor or broken coupling between adjustor and counter base plate.	Remove adjustor and verify if output shaft on counter base plate rotates with metered fluid flow. If output shaft of counter base plate assembly rotates, then inspect the following: Check coupling on input shaft of adjustor to see if it's broken. If broken, replace coupling. If coupling is not broken, replace adjustor.
Meter runs but is noisy.	Meter is not timed properly.	Check rotor clearances as described in Section 11-8. If discrepancy is found, re-time rotors.
	Damaged rotors.	Remove rotors as described in Section 11.5. If rotors are scored or galled, clean them as described in Section 11.6. If rotors are damaged beyond repair, replace with a new set. Install rotors as described in Section 11.7.
	Worn ball bearings.	Remove ball bearings as described in Section 11.5. Check to see if ball bearings turn freely with no free play. If discrepancy is found, replace ball bearings and install as described.
	Damaged gears in counter base plate assembly.	Disassemble counter base plate assembly. Check for worn or damaged gears. Replace gears as necessary and re-assemble.

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.

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

Brodie International

P.O. Box 450 (30459-0450)
19267 Highway 301 North
Statesboro, GA 30461,
USA

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