

BiRotor 8" to 16" Positive Displacement Meter

B101A through B135A [Standard]
 HCB101A through HCB125A [High Capacity]
 B201A through B235A [APL]



Version	PSI	Lb ANSI	8"	10"	12"	16"
Standard	285	150	B101A	B111A	B121A	B131A
	300	300	B103A	B113A	B123A	B133A
	740	300	B104A	B114A	B124A	B134A
	900	600				B135A
	1480	600	B105A	B115A	B125A	
High Capacity	285	150	HCB101A	HCB111A	HCB121A	
	300	300	HCB103A	HCB113A	HCB123A	
	740	300	HCB104A	HCB114A	HCB124A	
	1480	600	HCB105A	HCB115A	HCB125A	
	APL	285	150	B201A	B211A	B221A
300		300	B203A	B213A	B223A	B233A
740		300	B204A	B214A	B224A	B234A
900		600				B235A
1480		600	B205A	B215A	B225A	

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1 Read Me First

Notice

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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 people 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 persons, to prevent electrical shock and personal injury.

When installing this equipment, 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.

It is the customer's responsibility to ensure that piping or other attachments connected to the valve do not place adverse stresses on the valve. The design of the valve has not been assessed for the effects of traffic, wind, or earthquake loading.

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

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

Although measurement transducers are not specifically included in the MID regulations as they do not form a complete measuring instrument system, in accordance with Article 1 and 4, Annex I and Annex MI-005, Brodie Meter Co., LLC implements the same stringent regulations for all products and tests to the same standards which are used for complete 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 2004/108/EC and 2004/22/EC)

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 2004/108/EC and MID 2004/22/EC 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 97/23/EC)

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

Although it is not expected for the device to be used in a service where it would come in to contact with unstable fluids, it is the end 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 94/9/EC)

Any Hazardous area approval applies to equipment without cable glands. When mounting the flame-proof 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 marks 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 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 meter 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.

4 Return of Equipment

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

RMR forms may be obtained from your sales representative or from the Product Service Department. In addition to the RMR, 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 meter 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 RMR 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 RMR 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

5 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 measuring element. Caution must be used to insure 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 valve is removed from service for an extended period of time it should be flushed with a light oil before being placed into storage.

6 Description

General

The Brodie BiRotor Meter, hereafter called meter, is a precision made, accurate instrument that uses the positive displacement metering principle to measure flow and is designed to meter all petroleum products, crude and refined, as well as industrial liquids.

6.1 - Models B101A through B135A [Standard]

The meter generally consists of three basic components: a measuring unit installed in an outer housing or case, an adjuster for calibrating the meter, and the necessary counter equipment for registering the amount of liquid throughput.

The principle of operation of the meter is embodied in the function of the two rotors, which are the only moving parts within the measuring unit. They are always dynamically balanced but hydraulically unbalanced. The rotors are not in metal-to-metal contact with one another or with the housing in which they rotate. They are maintained in proper timed relationship with one another by helical gears. They divide the volume being measured into segments, separate each segment from the flowing stream momentarily, then return them to the stream. The segments of flow are counted and the results are transferred to a totalizing register or other flow recording device by means of a gear train.



The BiRotor Meter is unique in that it does not use any sliding vanes or reciprocating parts, nor are there any shock loads on the mechanism during operation resulting from the shifting of off balance masses.

An accuracy adjuster, located on the output of the counter drive gearing, permits the operator, at the time of installation, to adjust the output of the measuring unit to read in an exact number of units of volume. Thus, the accuracy adjuster acts as a variable gear changer (similar to the speeding up or slowing down of the timing of a watch) and allows an adjustment of +/- 3% of meter throughput.

The meter may be supplied with any of several accessory items such as a high frequency pulse generator, automatic temperature compensator (ATC), etc. The units provide various functions for local and/or remote control and local and/or remote readout.

6.2 - Models B201A through B235A [APL]

The Brodie Automatic Pressure Lubricated (APL) BiRotor Meter is designed to meter liquids with low lubricity such as butane, propane, ethane, natural gasoline or liquids with entrained solids such as crude oil.

Long life and low maintenance are assured with the integral automatic pressure lubricating system, hereafter called APL, which provides constant clean lubricant to the ball bearings, timing gears, and register drive gears of the measuring unit. Bearings and gears are isolated from the flowing stream by mechanical seals.

The two rotors are the only moving parts subject to the flowing stream. The APL system, as illustrated in Figure 6-1, is composed of a hydraulic cylinder, needle valve, filling fittings, and mechanical isolating seals.

The meter generally consists of four basic components: a measuring unit installed in an outer housing case, the APL unit to provide bearing and gear lubrication, an adjuster for calibrating the meter, and the necessary counter equipment for registering the amount of liquid throughput.

WARNING

Before placing the meter into service, refer to the appropriate instruction manual for these accessory units if the meter is so equipped.

Hydraulic Cylinder

The hydraulic cylinder incorporated in the APL

unit acts as a lubricant reservoir and a segregating element between the product being metered and the lubricant. It contains a piston and a rod that extends through the cylinder top for visual indication of the lubricant level. Upstream pipeline pressure (meter inlet) is applied to the side of the piston opposite the lubricant supply, thus pressurizing the lubricant to a value equal to or slightly greater than the internal meter pressure.

Crane Seals

Mechanical seals located on the rotor shaft between the rotor and rotor bearings segregate the lubricant from the product being metered. They are characterized by their ability to remain effective seals with little or no differential pressure and by their low torque requirement. The low torque characteristic is an important factor in providing accurate metering.

Needle Valve and Lubricant Fitting

The needle valve is utilized only when necessary to refill the APL with lubricant. A hand pump may be attached to the lubricant fitting, located upstream of the needle valve, for recharging the system with lubricant oil. This may be accomplished while the system is under pressure.

Meter Model Number

The model number, serial number, flow range and operating pressure appear on the nameplate attached to the meter body.

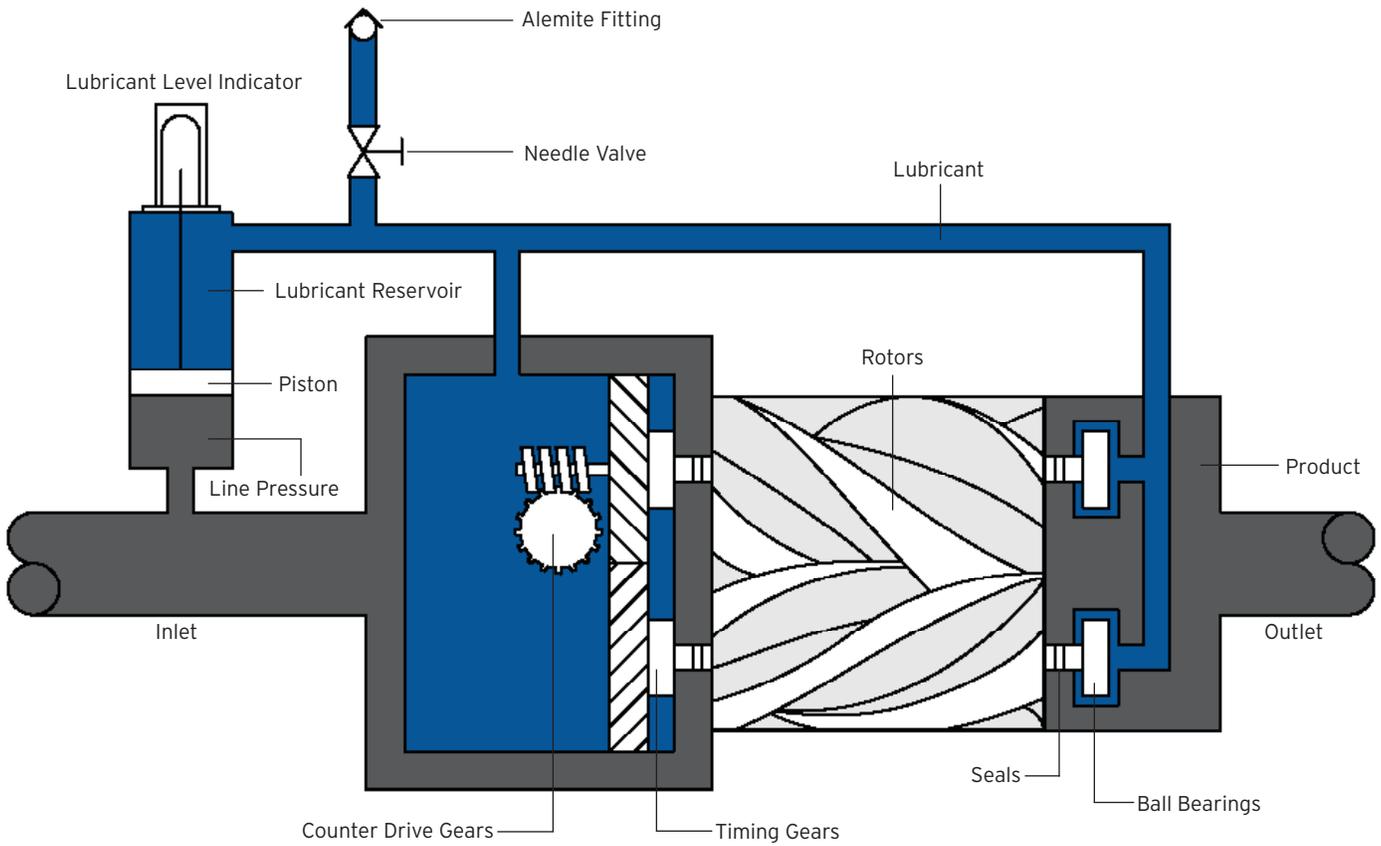


Figure 6-1 APL Lubricating System Schematic

7 Specifications

NOTE

The following specifications apply to the meter unless otherwise noted.

WARNING

Do NOT operate this instrument in excess of the specifications listed. Failure to heed this warning could result in serious injury and/or damage to the equipment.

Capacities

Model	US GPM	IMP GPM	Bbls/Hr	Cubic Mtr/Hr
B101A B103A B104A B105A	150 to 1500	125 to 1249	214 to 2143	34 to 340
B111A B113A B114A B115A	250 to 2500	208 to 2082	357 to 3571	57 to 568
B121A B123A B124A B125A	350 to 3500	291 to 2914	500 to 5000	79 to 795
B131A B133A B134A B135A	875 to 8,750	729 to 7,290	1,250 to 12,500	199 to 1,986
B201A B203A B204A B205A	210 to 2100	175 to 1750	300 to 3000	47 to 470
B211A B213A B214A B215A	330 to 3300	275 to 2750	470 to 4700	75 to 750
B221A B223A B224A B225A	437 to 4375	364 to 3640	625 to 6250	99 to 999
B231A B233A B234A B235A	910 to 9,100	758 to 7,580	1,300 to 13,000	207 to 2,070

Materials of Construction

Material		
Housing	Welded steel construction combining steel castings and draw steel plate.	
Measuring Unit	Rotors	Three lobe, cast iron or four fluted, heat treated aluminum.
	Rotor Shafts	Ground and polished ETD 150
	Rotor Bearings	Stainless Steel
	Body and End Covers	Nickel cast iron
Counter Base Plate	Body	Steel
	O-Ring	Viton standard
	Counter Base Drive Gears	Stainless Steel
	Drive Shafts	Stainless Steel
	Drive Shaft Ball Bearing	Stainless Steel
Connections	8", 10", 12", or 16" ANSI Flange	

8 Installation and Operation

General

The following is a general outline for the proper 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.

8.1 - 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 adapter and meter weight must be made when vertical installation is required.
2. Care should be taken to ensure 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 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 undue strain on the meter.
5. Provisions should be made to ensure that thermal expansion 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 ensure 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 required, 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.

8.3 - Starting Flow Through the Meter

CAUTION

Do not operate this meter in excess of the values stated in Chapter 7, 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.
5. Observe the rotation of the counter wheels to ensure 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.
6. Do not close valves quickly. This can cause a pressure spike which can damage the meter.
7. 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.
8. 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.

9 Maintenance

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 given occasional inspection. This is especially true where a critical air condition exists and for this reason, meter performance is very dependent upon proper air elimination. The valves and operating mechanism of an air eliminator are subject to very difficult operating conditions. With some products, alternate wetting and drying results in gum formations. The vapors of most petroleum products are more corrosive than the liquids. In some installations, salt air is a corrosive factor.
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.

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 parts while servicing.

9.1 - 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.

9.2 - Removing Measuring Unit - Models B101A-B135A

1. Remove drain plug, drain meter and replace plug.
 2. Remove all accessories, including adjuster and counter base plate by removing screws.
 3. Remove meter from line to allow for further disassembly.
 4. Remove nuts and bolts to allow separation of housing end cover from the meter housing.
 5. Disconnect the measuring unit from the end cover by removing socket head screws.
 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.
-

9.3 - Removing Measuring Unit - Models B201A-B235A

1. Remove drain plug, drain meter and replace plug.
 2. Remove all accessories, including adjuster and counter base plate by removing screws.
 3. Lift out static seal tube with attached o-ring from meter housing. Disconnect tubing connected to APL Unit. Remove APL Unit from meter by unscrewing nipple.
 4. Remove nuts and bolts to allow separation of housing end cover from the meter housing.
 5. Remove tubing attached to measuring unit and meter housing by disconnecting tubing at the connectors.
 6. Disconnect the measuring unit from the end cover by removing socket head screws.
 7. 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.
-

9.4.1 - Disassembly of Measuring Unit - 103505-030 and 123505-030

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 parts while servicing.

1. Position measuring unit assembly in a wooden support block with the gear box assembly downward.
2. Remove screws and washers then remove front bearing caps.
3. Block rotors with a plastic or wooden rod as illustrated in Figure 9-1.
4. Remove screws or nuts and bearing retainer. Do not remove front end plate at this time.
5. Rotate measuring unit body so that front of housing rests on wooden support blocks and Gear box assembly is upward.
6. Remove gear box assembly by removing screws.
7. Remove drive gears from each rotor shaft by removing jam nut. To aid in removal, lightly tap the gears on a flat surface with a plastic or rubber mallet.

NOTE:

Avoid hitting the teeth of the gears. The center hole of each timing gear is a tapered bore which fits the tapered end of the rotor shafts. Tapping the gears will break the "taper lock" and release the gears from the rotor shaft.



Figure 9-1 Proper Method for Blocking Rotors

8. Remove the rotor spacers used to separate the drive gears from the mounting plate.
9. Remove screw and separate mounting plate from the end plate.
10. The rotors and gear box assembly 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 necessary. To completely disassemble, go on to Step 11.

11. Remove end plate from measuring unit body by removing dowel screws and socket head screws.

NOTE:

It may be necessary to lightly tap the edge of the end plate to assist removal. Light tapping on opposite end of rotor shafts will assist removal of end plate.

12. Ball bearings can be removed from end plate by gently tapping or pressing on the inner race of the ball bearings from inside the end plate.

13. Remove the two rotors from the measuring unit body.

14. To completely disassemble, rotate the body and remove ball bearings. Remove screws and disassemble end plate from body.

9.4.2 - Disassembly of Measuring Unit - 113505-030 and 133505-030

1. Position measuring unit assembly in a wooden support block with the gear box assembly upward.

2. Remove screws and washers, then remove front bearing caps and gear box assembly.

3. Block rotors with a plastic or wooden rod as illustrated in Figure 9-1.

4. Remove screws and bearing retainer. On the 113505-030 measuring unit, remove the drive adapter. Do not remove front end plate at this time.

9.4.3 - Disassembly of Measuring Unit - 203505-030 and 223505-030

1. Position measuring unit assembly in a wooden support block with the gear box assembly downward.
 2. Disconnect and remove tubing attached between the front bearing caps and the rear gear box assembly.
 3. Remove screws and washers then remove front bearing caps.
 4. Remove screws or nuts and bearing retainer.
- NOTE:**
Do not remove front end plate at this time.
5. Rotate measuring unit body so that front of housing rests on wooden support blocks and gear box assembly is upward.
 6. Remove screws attaching rear gear box assembly to rear end plate.
 7. Bend tab on lockwasher, remove jam nut and lockwasher from shaft of each rotor.
- NOTE:**
Block rotors as illustrated in Figure 9-1.
8. Remove timing gears from each rotor shaft by tapping the gears lightly on a flat surface with a plastic or rubber mallet.
- NOTE:**
Avoid hitting the teeth of the gears. The center hole of each timing gear is a tapered bore which fits the tapered end of the rotor shafts. Tapping the gears will break the "taper lock" and release the gears from the rotor shaft.
9. Remove the rotor spacers from each rotor shaft.
 10. Remove screws and separate mounting plate from the end plate.
 11. The rotors and gear box assembly 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 necessary. To completely disassemble, go on to Step 12.
 12. Remove end plate from measuring unit body by removing dowel screws and socket head screws.
- NOTE:**
It may be necessary to lightly tap the edge of the end plate to assist removal. Light tapping on opposite end of rotor shafts will assist removal of end plate.
13. Ball bearings can be removed from end plate by gently tapping or pressing on the inner race of the ball bearings from inside the end plate.
- NOTE:**
Use care not to damage crane seals when removing ball bearings.
14. Carefully remove crane seals from end plate.
 15. Remove the two rotors from the measuring unit body.
 16. To completely disassemble, rotate the body and remove ball bearings and crane seals from end plate. Remove screws and disassemble plate from body.

9.4.4 - Disassembly of Measuring Unit - 213505-030 and 223505-030

1. Position measuring unit assembly in a wooden support block with the gear box assembly upward.
2. Disconnect and remove tubing attached between the front bearing caps and the rear gear box assembly.
3. Remove screws, washers then remove front bearing caps and gear box assembly.
4. Remove screws and bearing retainer. On the 213505-030 measuring unit, remove the drive adapter.

NOTE:

Do not remove front end plate at this time.

5. Rotate measuring unit body.
6. Remove screws and top gear cover.
7. Bend tab on lockwasher, remove jam nut and lockwasher from shaft of each rotor.

NOTE:

Block rotors as illustrated in Figure 9-1.

8. Remove timing gears from each rotor shaft by tapping the gears lightly on a flat surface with a plastic or rubber mallet.

NOTE:

Avoid hitting the teeth of the gears. The center hole of each timing gear is a tapered bore which fits the tapered end of the rotor shafts. Tapping the gears will break the "taper lock" and release the gears from the rotor shaft.

9. Remove the rotor spacers from each rotor shaft.
10. Remove screws and separate mounting plate from the end plate.
11. The rotors and gear box assembly 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 necessary. To completely disassemble, go on to Step 12.
12. Remove end plate from measuring unit body by removing dowel screws and socket head screws.

NOTE:

It may be necessary to lightly tap the edge of the end plate to assist removal. Light tapping on opposite end of rotor shafts will assist removal of end plate.

13. Ball bearings can be removed from end plate by gently tapping or pressing on the inner race of the ball bearings from inside the end plate.

NOTE:

Use care not to damage crane seals when removing ball bearings.

14. Carefully remove crane seals from end plate.
15. Remove the two rotors from the measuring unit body.
16. To completely disassemble, rotate the body and remove ball bearings and crane seals from end plate. Remove screws and disassemble end plate from body.

9.5 - 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.

9.6.1 - Reassembly of Measuring Unit - Models B101A-135A

1. Lubricate all bearings and O-rings with a light-weight oil.
2. Oil and replace dowel screws using care to align the two locating dowel screws with their corresponding holes (Figure 9-2). Replace front end plate on opposite end from timing gears.
3. Rotate housing body and replace rotors in proper slots with the taper ends of the rotors up.
4. Replace rear end plate. Oil dowel screws and screws before replacing.
5. Install bearings into bearing bore provided in end plate (Figure 9-3).



Figure 9-2 Align Two Dowel Screws with Their Corresponding Holes



Figure 9-3 Install Ball Bearings into Bearing Bore Provided in End Plate

NOTE:

Slot on outer race of ball bearing must engage with roll pin in the end plate.

6. Replace mounting plate and screws.

NOTE:

The wide end of the mounting plate mounts over the 4T Rotor.

7. Replace rotor spacer and timing gears (Figure 9-4).

NOTE:

Bearing dowel on the rotor spacer fits on the inner race of the ball bearing and outer dowel

must seat into slot located on the timing gear.

NOTE:

The large timing gear fits on the 4T Rotor and the small timing gear fits on the 3T Rotor.



Figure 9-4 Install Rotor Spacer and Slide Timing Gears onto Proper Shaft Before Replacing Loackwashers

8. Replace lock washers and jam nuts.

NOTE:

Tab on washer must seat into slot on timing gears. (Figure 9-5).



Figure 9-5 Tab on Washer Must Seat Into Slot on Timing Gear

9. Rotate body and install the ball bearings into bearing bore in the end plate.

NOTE:

Slot on outer race of ball bearing must engage with roll pin in the end plate.

10. Replace bearing retainer. Measuring unit 113505-030 will use one bearing retainer and one drive adapter on the three tooth rotor. The rest require two bearing retainers each.

NOTE:

The dowel on the bearing retainer or the drive adapter will fit on the inner race of the ball bearing.

11. Measuring unit 103505-030 will require two screws and two washers to hold bearing retainer in place.

NOTE:

Measuring unit 113505-030 will require replacing one screw on the 3T Rotor and one screw and washer on the four tooth rotor.

Measuring unit 123505-030 has two nuts.

Measuring unit 133505-030 has two different size screws. The four tooth rotor has four screws and washers. Place two opposite each other on the three tooth rotor. Now replace the two long screws, drive keys and washers.

9.6.2 - Reassembly of Measuring Unit - Models B201A-235A

1. Lubricate all bearings and O-rings with a light-weight oil.
2. Replace front end plate on opposite end from timing gears. Align the port openings of the front end plate with those of the meter body using care to align the two locating dowel screws with their corresponding holes (Figure 9-2).
3. Secure the front end plate to the body by the two dowel screws and install the socket head screws, alternating from one side to another when tightening.
4. Replace crane seal with rubber face downward.

NOTE:

The polished steel ring portion of the crane seal can be installed more conveniently in a later operation.

5. Position bearing thrust washer over the crane seal.

NOTE:

The inside holes of the thrust washer fit onto the dowels of the crane seal and the outside hole fits over the roll pin as shown in Figure 9-6.

6. Install ball bearing within bearing bore of the end plate (Figure 10-3). Press into place using a sleeve or deep socket until ball bearings are bottomed.

NOTE:

Slot on outer race of ball bearing must align with roll pin in the end plate. A special adapter can be made to fit over the bearings to hold in place.

7. Rotate the housing body. Slide on each end of the rotors the polished steel ring (Figure 9-6) that goes to the crane seal.
8. Insert the rotors into their proper slots so that the threaded, tapered rotor shafts protrude from the open end of the measuring unit body as seen in Figure 9-7.
9. Align the port openings of the end plate with those of the measuring unit body using care to align the two locating dowel screws with their corresponding holes (Figure 9-2). Secure the end plate to the measuring unit body by the two dowel screws and install the socket head screws alternating from one side to another when tightening (Figures 9-8 and 9-9).

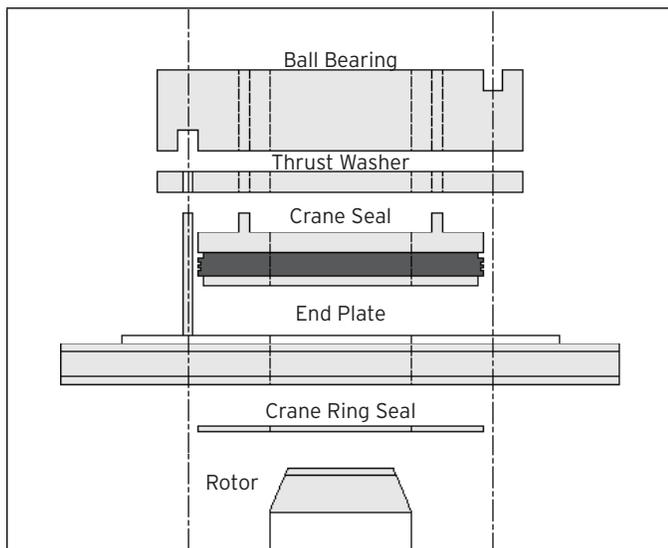


Figure 9-6 Crane Seal Assembly Detail



Figure 9-7 Position the Rotors and Lower into the Appropriate Cavity

10. Rotate measuring unit and replace crane seal with rubber face downward.
11. Position bearing thrust washer over the crane seal.

NOTE:

The inner holes on the thrust washer fits over the dowels on the crane seal and the outer hole fits into the roll pin as illustrated in Figure 9-6.

12. Install ball bearing within bearing bore of the end plate (Figure 9-3). Press into place using a sleeve or deep socket until ball bearings are bottomed.

NOTE:

Slot on outer race of ball bearing must align with roll pin in the end plate.

13. Replace mounting plate, secure with screws and washers (Figure 9-10).

NOTE:

The wide end of the mounting plate mounts over the four tooth (4T) Rotor.



Figure 9-8 Position and Lower Rear End Plate in Place



Figure 10-10 Replace and Secure Mounting Plate With Screws and Washers



Figure 9-9 Secure End Plate to Measuring Unit Body

14. Replace rotor spacer (Figure 9-4).

NOTE:

Make certain the short roll pin on the rotor spacer mates properly into the slot on the inner race of the ball bearing.

15. Place the small timing gear on the threaded shaft of the three-tooth (3T) rotor and the large timing gear on the threaded shaft of the 4T rotor. The rotor shafts and timing gear bores are tapered allowing only one manner of assembly.

NOTE:

Back out the set screws so that the timing gears will be flushed when installed. The long roll pin on the rotor spacer mates with the hole in the timing gear.

16. Install lockwasher over rotor shafts engaging bent tab of lockwasher with hole in the flat side of timing gears. Secure lockwasher by installing jam nuts (Figure 9-5).
17. The measuring unit can now be laid on its side for better access or further reassembly.
18. Replace bearing retainer on the 4T and 3T rotors. All measuring units will require two bearing retainers except the measuring unit

assembly number 213505-030 which has one bearing retainer and one drive adapter on the 3T rotor.

NOTE:

The dowel on the bearing retainer or drive adapter will mate with the slot on the inner race of the ball bearings.

19. To secure the bearing dowels, each measuring unit is listed below:
 - A. Measuring unit 203505-030 has two screws and two washers.
 - B. Measuring unit 213505-030 will require replacing one screw on the 3T rotor and one screw and one washer on the 4T rotor.
 - C. Measuring unit 223505-030 has two nuts.
 - D. Measuring unit 233505-030 has two different size screws. The 4T rotor has four screws and washers. Place two screws and washers opposite each other on the 3T rotor. Now replace the two long screws, drive key and washers.

9.7.1 - Setting End Clearance - Models B101A-B135A

The following procedure is applicable if clearance between the rotors and end plate requires adjustment.

1. Loosen set screws in the bearing retainer and tighten screws or nuts, pulling the rotors against the front end plate.

NOTE:

Refer to correct measuring unit assembly for the correct nut or screw.

2. Determine the clearance between the rotors and rear end cover with a feeler gauge. For example, .0008.
3. With timing gear jam nuts tight, tighten set screws in each timing gear unit until a clearance of .0004 is obtained between each rotor and rear end plate (Figure 9-11).
4. With bearing retainer screws or nuts tight, tighten the set screws in the retainers to obtain a clearance of .0004 between each rotor and end plate.



Figure 9-11 Proper Method for Setting Rotor End Clearance

NOTE:

Measuring unit 113505-030 will have one retainer and one drive adapter.

NOTE:

Bend two tabs of lock washer against side of jam nut to secure jam nut.

9.7.2 - Setting End Clearance - Models B201A-B235A

1. Adjust the two set screws located on each of the drive gears until both rotors are flush with the backside 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 3T rotor. Repeat this procedure for the 4T rotor.
3. Adjust the two set screws located on the small drive gear until the distance between the backside of the front end plate and the 3T rotor is half of the total distance determined. Repeat this procedure for the large drive gear and the 4T rotor.
4. If end clearance is adjusted properly, rotors will spin freely with the meter in any position. If rotors fail to spin freely, repeat procedure for setting end clearance.

9.8.1 - Timing Gear Adjustment - Models B101A-B135A

1. Loosen the jam nut on the large timing gear and with feeler gauge or shims, carefully centralize a lobe of the three tooth rotor in a flute of the four tooth rotor. This may be done through the inlet and outlet openings of the unit (Figure 9-12).
2. Using a small piece of rubber between the timing gears, tighten the jam nut, remove shims and check for freeness of operation.
3. If the rotors contact one another, the timing operation must be repeated.



Figure 9-12 Proper Method For Timing Gear Adjustment

4. If the rotors were damaged, it will sometimes be found that all of the high spots were not removed. In such cases, it is necessary to find these spots and remove them.

9.8.2 - Timing Gear Adjustment - Models B201A-B235A

1. Loosen the jam nut on the large timing gear and, with feeler gauge or shims, carefully centralize the lobe of the 3T rotor in a flute of the 4T rotor (Figure 9-12).
2. Determine the total distance between the lobe and flute of the two rotors. Set the rotor clearance to one half of the total distance using the appropriate shim.
3. Using a piece of rubber between the timing gears, tighten the jam nut, remove shim and check for freeness of operation. If the rotors contact one another, the timing operation must be repeated.
4. If the rotors were damaged, it will sometimes be found that all of the high spots were not removed. In such cases, it is necessary to find these spots and remove them.

NOTE:

This may be done through the inlet and outlet openings of the unit.

5. When rotor timing is completed, bend two tabs of lockwasher against side of jam nut. This will secure the jam nut.

9.9.1 Completion of Measuring Unit Reassembly and Installing in Meter - Models B101A-B135A

1. Replace gear box assembly.

NOTE:

Roll pin on gear box assembly must engage with coupling jaw or the drive key.

2. Replace front bearing caps, washers and screws. The 113505-030 and 133505-030 measuring units use screws on the four tooth rotor gearing cap.
3. Connect the measuring unit to the end cover with socket head screws.

NOTE:

A light film of grease will aid in holding O-ring in place.

4. Replace meter housing and O-ring.
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 gear box assembly.
6. Reinstall other accessories.

9.9.2 - Completion of Measuring Unit Reassembly and Installing in Meter - Models B201A-B235A

Measuring unit 213505-030 and 233505-030:

1. Replace top gear cover, secure with screws (Figure 9-13).
2. Replace gear box assembly gasket and front bearing cap. Secure on the rotors with screws and washers.



9-13 Top Gear Cover and Ball Bearings

NOTE:

The gear box assembly must mate correctly with the connection on the 3T rotor.

Measuring unit 203505-030 and 223505-030:

1. Replace gear box assembly and gasket and secure with screws.
2. Replace front bearing caps, gasket and secure with screws and washers.
3. Attach piping to the measuring unit.
4. Connect the measuring unit to the end cover with socket head screws (Figure 9-14). Replace meter housing and O-ring. Secure with nuts and bolts (Figure 9-15).

NOTE:

A light film of grease will aid in holding O-ring in place.



Figure 9-14 Connect Measuring Unit to End Cover and Secure all Nuts to Their Proper Torque

NOTE:

Torque Specifications can be found in Section 9.12 on Page 43.

5. Replace static seal tube with attached O-ring.
6. Replace the counter base plate.

NOTE:

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 gear box assembly.



Figure 9-15 Position Meter Housing and Replace all Bolts To Proper Torque

7. Replace tubing and connect the APL unit to meter housing.
8. Reinstall other accessories.
9. Refill APL unit with lubricating oil.

9.10 - Servicing APL Unit Lubricating Oil

NOTE:

The indication rod is now at the bottom marked groove located on the hydraulic cylinder. This indicates that the APL unit is full of lubricating oil. The APL unit is low of lubricating oil when the indication rod is located near the top marked groove on the hydraulic cylinder and should be refilled as described below.

Lubricating oil used in the APL unit should be a good quality, SAE 10W, non-detergent, oil. Select a hand oil pump with a mating connection able to connect to the alemite fitting on the APL unit.

1. Connect oil pump to alemite fitting on the APL unit. Open the needle valve.
2. Fill the APL unit until the external relief valve opens and allows lubricating oil to be expelled to the atmosphere.

NOTE:

The APL unit can be filled with lubricating oil wether the meter system is in service or not.

3. Close relief valve and disconnect oil pump from alemite fitting.

NOTE:

The indication rod is now at the bottom marked groove located on the hydraulic cylinder. This indicates the APL unit is full of lubricating oil. When the indication rod is located near the top marked groove on the hydraulic cylinder the APL unit is low of lubricating oil and should be refilled as described above.

9.11 Torque Specifications

Meter	Number	Torque (ft/lbs)
B101, B201	2	110
	36	110
B103, B203	2	110
	36	110
B104, B204	2	300
	36	110
B105, B205	2	800
	36	110
B111, B211	2	110
	36	110
B113, B213	2	110
	36	110
B114, B214	2	300
	36	110
B115, B215	2	800
	36	110
B111, B221	2	235
	36	400
B113, B223	2	235
	36	400
B124, B224	2	635
	36	400
B125, B225	2	C/F
	36	C/F
B133, B233	2	300
	36	1500
B131, B231	2	300
	36	1500
B134, B234	2	725
	36	1500
B135, B235	2	900
	36	1500

10 Troubleshooting

A table has been provided to aid in basic troubleshooting. Disassembly procedures are covered in Chapter 9, 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 adjuster rotates with metered fluid flow. If output shaft on adjuster rotates, replace register.
	Faulty adjuster or broken coupling between adjuster and counter base plate.	Remove adjuster 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: <ol style="list-style-type: none"> 1. Check coupling on input shaft of adjuster to see if it's broken. If broken, replace coupling. 2. If coupling is not broken, replace adjuster.
Meter runs but is noisy.	Meter is not timed properly.	Check rotor clearances as described in Section 9.7. If discrepancy is found, re-time rotors.
	Damaged rotors.	Remove rotors as described in Section 9.4. If rotors are scored or galled, clean them as described in Section 9.5. If rotors are damaged beyond repair, replace with a new set. Install rotors as described in Section 9.6.
	Worn ball bearings.	Remove ball bearings as described in Section 9.4. 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.

11 Warranty Claim Procedures

11.1 Limited Warranty

Subject to the limitations contained in Section 2 herein and except as otherwise expressly provided herein, Brodie International, a Brodie Meter Co., LLC Company ("Brodie") warrants that the firm will execute the programming instructions provided by Brodie, and that the Goods manufactured, or Services provided, by "Brodie" will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period.

Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by "Brodie", whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services.

Products purchased by "Brodie" from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.

Buyer agrees that "Brodie" has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies "Brodie" thereof in writing during the applicable warranty period, "Brodie" shall, at its option, promptly correct any errors that are found by "Brodie" in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by "Brodie" to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of "Brodie" are not covered by this limited warranty, and shall be at Buyer's expense.

"Brodie" shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized "Brodie" representative.

All costs of dismantling, reinstallation, and freight and the time and expenses of "Brodie's" personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by "Brodie".

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Brodie and can be amended only in a writing signed by an authorized representative of "Brodie".

Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

It is understood that corrosion, or erosion, of materials is not covered by our guarantee.

11.2 Limitation of Remedy and Liability

Brodie International, a Brodie Meter Co., LLC Company ("Brodie") shall not be liable for damages caused by delay in performance.

The sole and exclusive remedy for breach of warranty hereunder shall be limited to repair, correction, replacement or refund of purchase price under the limited warranty clause in Section 1 herein.

In no event, regardless of the form of the claim or cause of action (whether based in contract, infringement, negligence, strict liability, other tort or otherwise), shall "Brodie's" liability to buyer and/or its customers exceed the price to buyer of the specific goods manufactured or services provided by Brodie giving rise to the claim or cause of action.

Buyer agrees that in no event shall Brodie's liability to buyer and/or its customers extend to include incidental, consequential or punitive damages.

The term "consequential damages" shall include, but not be limited to, loss of anticipated profits, loss of use, loss of revenue and cost of capital.

Brodie International
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Statesboro, GA 30461, USA

www.brodieintl.com
Phone: +1 (912) 489-0200

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: _____ If Warranty, Unit S/N: _____

RepairPO#: _____

Invoice Address: _____

Shipping Address: _____

ReturnShippingMethod: _____ S/N: _____

Equipment Model #: _____ Failure Date: _____

Description of Problem: _____

What was happening at time of failure: _____

Additonal Comments: _____

Report Prepared by: _____ Title: _____