BI-B12XHC
Revision 01

High Capacity BiRotor Models B121-B124

Installation and Operation Manual

BRODIE™ International
Engineering the Future

Table of Contents

1.0 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, express 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.

Brodie International
Statesboro, Georgia, USA

BRODIE™ International

Essential Instructions General

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Essential Instructions for 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 users 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 users responsibility to assess any risks and take any precautions necessary.

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

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

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

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

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

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

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

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

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

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

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

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

Cable glands and cable must be suitable for the operating temperature of the device under its rated conditions, this is especially important is the device has an operating temperature above 70^{0}C (158^{0}F)

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

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

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

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

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

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

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

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

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

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

2.0 Receipt of Shipment

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

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

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

3.0 Return Shipment

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

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

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

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

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

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

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

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

Return shipping address:

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

4.0 Storage

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

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

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

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

5.0 Introduction

Description

The Brodie BiRotor 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.

Principle of Operation

The meter generally consists of a measuring unit installed in an outer housing or case and 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 high frequency pulse generator, impulse contactor, automatic temperature compensator (ATC), etc. The units provide various functions for local and/or remote control and local and/or remote readout.

6.0 Specifications

Materials of Construction

Meter Housing: Welded steel construction combining steel castings and drawn steel plate

Measuring Unit

End Plates and Body: Cast Iron

Rotors: Three Lobe, Cast Iron
Four Lobe, Heat Treated Aluminum

Rotor Shafts: ETD 150

Timing Gears: 416 Stainless Steel

Bearings: Stainless Steel

Elastomers: Viton A®, standard (other options available)

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

Performance

B12XHC Linearity

+/- 0.15% Over Standard Flow Range

Repeatability: +/- 0.02%

Operating Temperatures Limits:
-20° to 150°F (-29° to 66°C)

Table 2: Flow Ranges

	Flow Rate		Nominal K-Factor
	BPH	M3/HR	
Minimum	945	150	889 PUL/ GAL +/- 10%
Maximum	9450	1500	

Table 3: Shipping Weights and Volume

Model	Weight
B121HC	8,500 lbs. @ 136 Cu. Feet 3,855 kgs. @ 3.85 Cu. Meters
B123HC	8,550 lbs. @ 136 Cu. Feet 3,878 kgs. @ 3.85 Cu. Meters
B124HC	8,800 lbs. @ 136 Cu. Feet 3,991 kgs. @ 3.85 Cu. Meters
B125HC	8,900 lbs. @ 136 Cu. Feet 4,036 kgs. @ 3.85Cu. Meters

Table 1: Connections

Model	Connections	Max Working Pressure @ 100F	DIN Connections	Max Working Pressure
B121HC	12″ 150 # ANSI	285 PSI	DN 300 PN 16	16 Bar
			DN 300 PN 25	19.6 Bar
B123HC	12″ 300# ANSI	300 PSI	DN 300 PN 25	20.7 Bar
B124HC	12″ 300# ANSI	740 PSI	DN 300 PN 25	25 Bar
			DN 300 PN 40	40 Bar
			DN 300 PN 64	51 Bar
B125HC	12″ 600# ANSI	1480 PSI	DN 300 PN 64	62 Bar
			DN 300 PN 100	102 Bar

Temperature Range: -20°F to 150°F (-29°C to 66°C) Optional 325°F (163°C)

7.0 Installation

General Requirements

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

Care should be taken insure the drain plug remains accessible. A valve may be installed on the drain line to facilitate draining water and sediment from the meter. A lockable valve is recommended to reduce the chance of accidently draining the meter.

Any product drained from the meter, either manually or through a centralized drain system, must be disposed of in accordance with local, state, and federal laws.

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

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

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

A strainer should be installed upstream of the instrument.

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

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.

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

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.

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

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

8.0 Operation

Caution: Do not operate this meter in excess of the values stated in Section 6.0 Specifications.

General

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

Starting Flow Through the Meter

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 net close valves quickly. This can cause a pressure spike which can damage the meter.

6. Do net 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 ether pertinent meter data should be retained in order to establish a performance history for the meter.

Brodie International 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.

9.0 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 geras, 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.

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 acces¬sory 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.

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.

General Meter Disassembly

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-ring should be removed and replaced. This policy will assure maximum performance from your Brodie BiRotor Meter at less expense and with greater accuracy.

Removing Measuring Unit

1. Remove drain plug, drain meter and replace plug.

2. Remove all accessories, including adjustor 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.

Removing Measuring Unit

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 4.1.

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.

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.

Cleaning Measuring Unit (Figure 9.x)

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 0-rings for wear and replace if necessary.

Reassembly of Measuring Unit

1. Lubricate all bearings and o-rings with a lightweight oil.

2. Oil dowel screws and replace front end plate on opposite end from timing gears. Replace screws.

3. Rotate housing body and replace rotors in proper slots with the taper ends of the rotors up (Figures 1 and 1).

4. Replace rear end plate. Oil dowel screws and screws before replacing. (Figure 3).

5. Install 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 (Figure 4).

Figure 1: Rotate and Install 3 Tooth Rotor

Figure 2: Install 4 Tooth Rotor

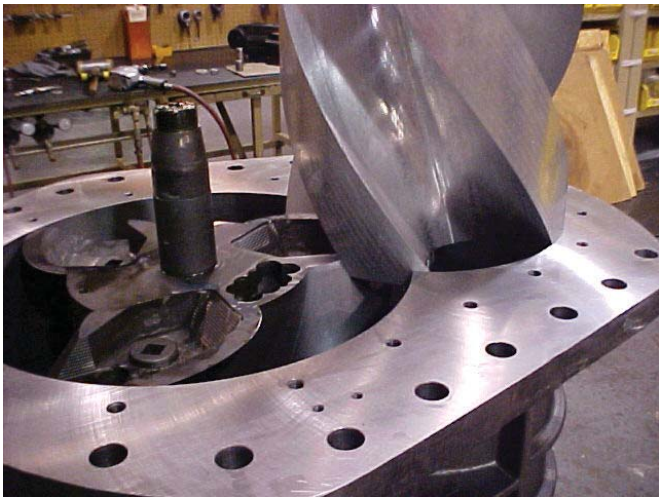
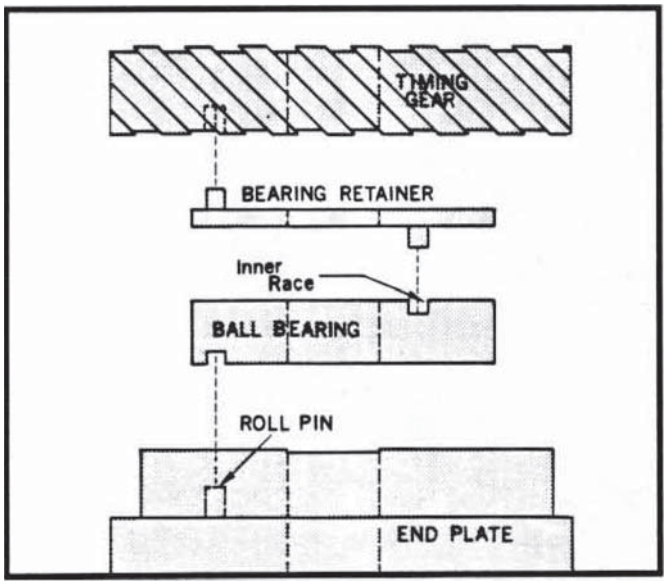


Figure 3: Position Rear End Plate

Figure 4: Replace Rotor Spacer and Timing Gears



7. Replace rotor spacer and timing gears.

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 gera fits on the 4T rotor and the small timing gear fits on the 3T rotor.

8. Replace lock washers and jam nuts.

Note: Tab on washer must seal into slot on timing gears.

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.

Note: The dowel on the bearing retainer or the drive adaptor will fit on the inner race of the ball bearing.

Timing Gear Adjustment

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. Using a small piece of rubber between the timing gears, tighten the jam nut, remove shims and check for freeness of operation. If the rotors contact one another, the timing operation must be repeated.

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.

Completion of Measuring Unit Reassembly and Installing into Meter

1. Replace gear box assembly.

2. Replace front bearing caps, washers and screws.

3. Connect the measuring unit, to the end cover with socket head screws.

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.

10.0 Troubleshooting

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

Condition A: No Pulse Output is Present

Probable Cause:

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

Corrective Actions:

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

Condition B: Erratic or Non Uniform Pulse Signal

Probable Cause:

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

Corrective Actions

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

11.0 Parts List

Figure: Complete Meter Assembly

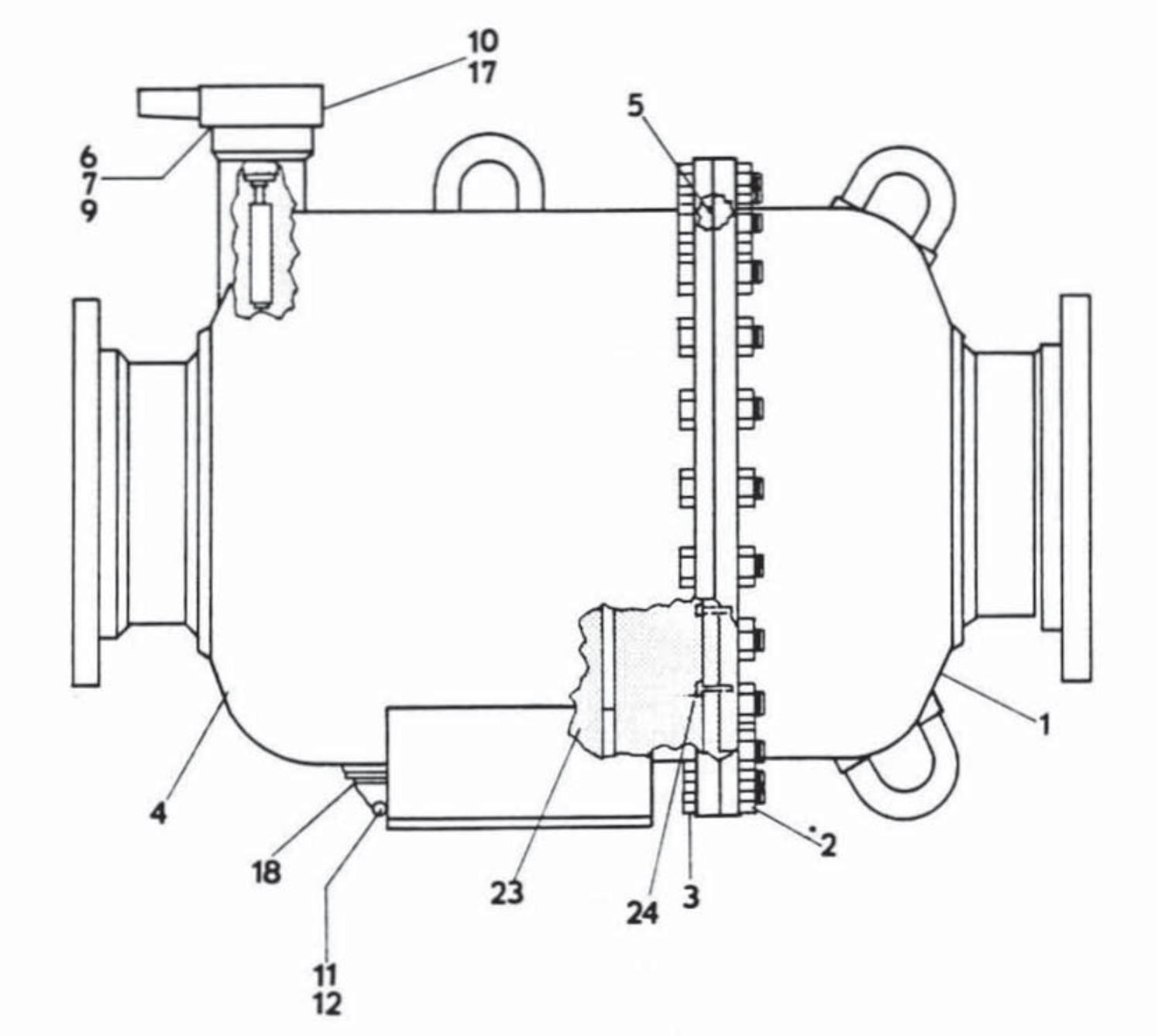


Table: Complete Meter Parts List

Item	Part Number	Description	Quantity
1	Special	300# End Flange & Cover Assembly	1
2	151578M	Hex Nut, CS	48
3	151104M	Hex Socket Head Screw, CS	48
4	Special	300# Meter Housing Assembly	1
5	157324-XXX	Cover O-Ring (specify req'd. material)	1
6	94150-010M	Counter Base Plate (see Figure)	1
7	53156	Counter Base Plate Gasket	1
9	151015M	Standard Allen Head Screw, CS	12
10	4200	Accuracy Adjustor	1
11	151831	Seal	1
12	155051	Seal Wire	1
16	92802	Name Plate (not shown)	1
17	150565	Filister Head Screw-Slotted, SS	4
17	153974	Drive Screws (not shown)	6
18	154782-024M	Piple Plug	1
23	133405-030	Measuring Unit	1
24	151103M	Hex Socket Head Screw, CS	16
28	015-16-090-02	Inlet Plate (not shown)	1

Figure: Counter Base Plate Assembly

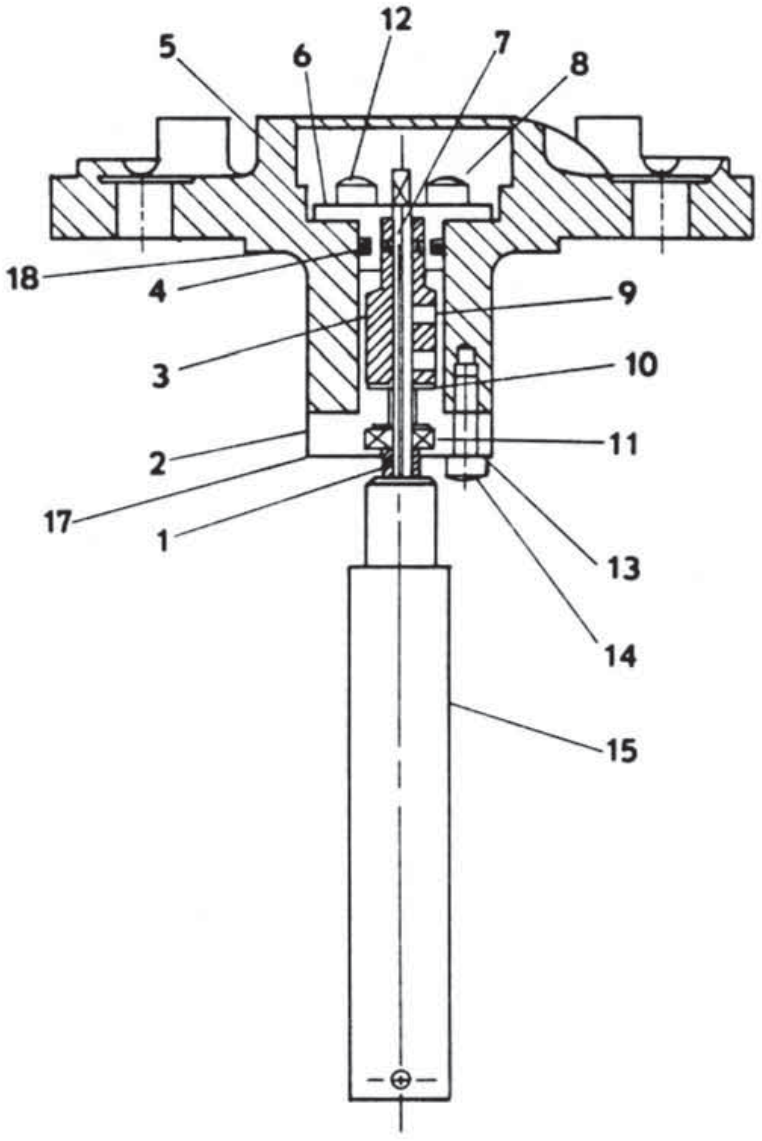


Table: Counter Base Plate Parts List

Item	Part Number	Description	Quantity
1	74166	Spacer	1
2	94177	Bearing Housing	1
3	93152	Packing Shaft Positioner	1
4	152070-XXX	O-Ring (Specify Material Req'd)	1
5	53151M	Base Plate	1
6	43175	Packing Gland Assy.	1
7	152064-XXX	O-Ring (Specify Material Req'd)	1
8	151029-419M	Screw	4
9	150969	Set Screw	2
10	151891	Washer	1
11	155195	Ball Bearing	1
13	152259	Lockwasher	3
14	150537	Set Screw	3
15	92160-010	Coupling Tube Assy.	1

Figure: Gear Box Assembly (1M³/Rev)

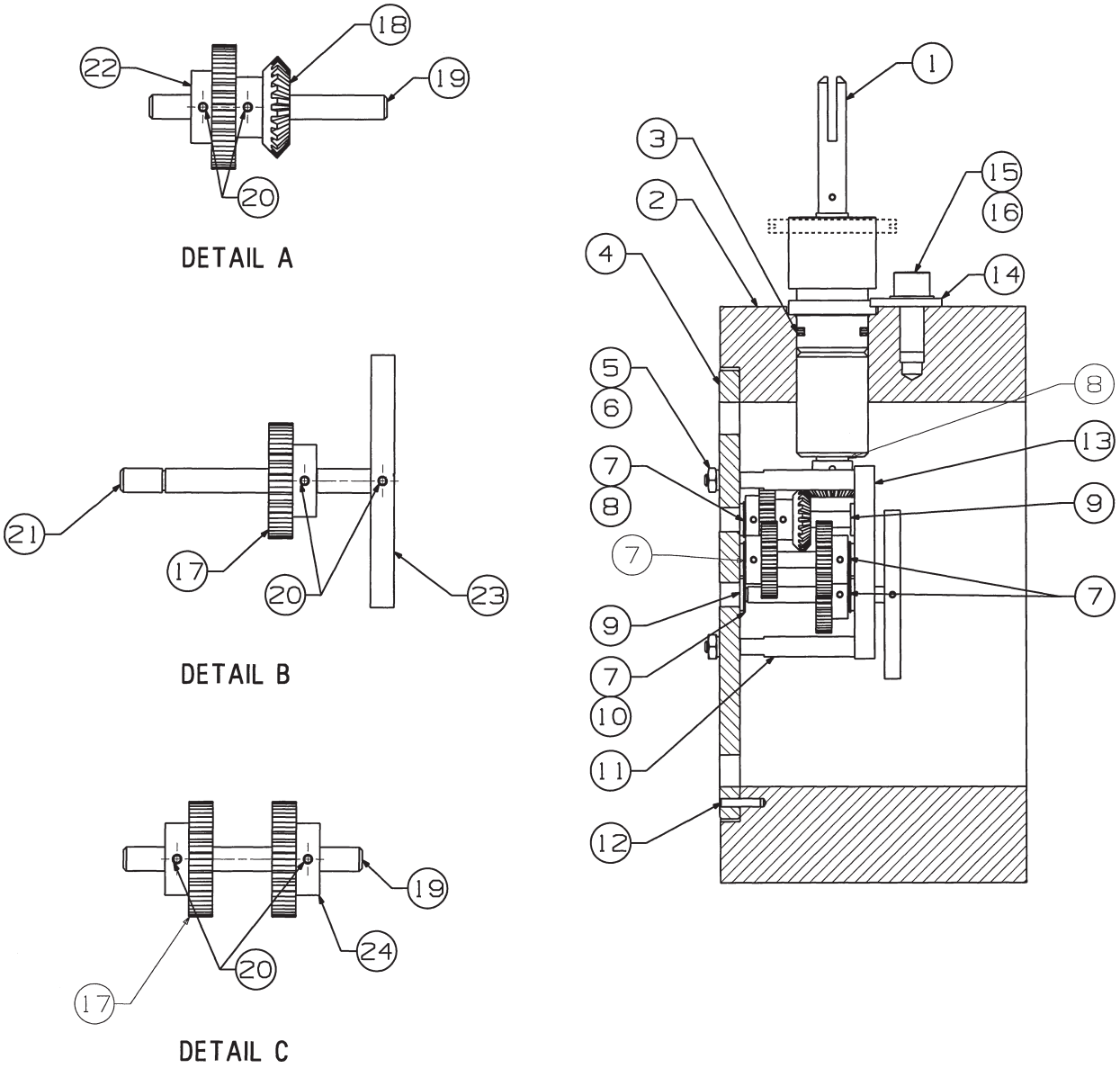


Table: Gear Box Assembly (1M³/Rev) Parts List

Item	Part Number	Description	Quantity
1	133515	Output Shaft Assembly	1
2	133522-001	Gear Housing	1
4	133523-001	Mounting Plate	1
5	152105-019	Lockwasher CS	4
6	151532-019	Hex Nut SS	4
7	151901	Flat Washer SS	5
8	152541	Shim SS	A/R
9	155150	Rulon Bearing	6
10	153943	Spring Clip SS	1
11	133307-001	Pillar	4
12	153524	Roll Pin CS	2
13	133319-001	Bearing Plate	1
14	133524	Retaining Clip	1
15	151043-019	Allen Head Screw CS	1
16	152268	Lockwasher CS	1
17	133526-001	Drive Gear 16T	2
18	72731-003	Driving Gear	1
19	133527-001	Driven Shaft	2
20	153511	Roll Pin SS	6
21	133542-001	Drive Shaft	1
22	133541-001	Drive Gear 41T	1
23	133543	Drive Dog	1
24	133541-002	Drive Gear 42T	1

Figure: Gear Box Assembly (1BBL/Rev)

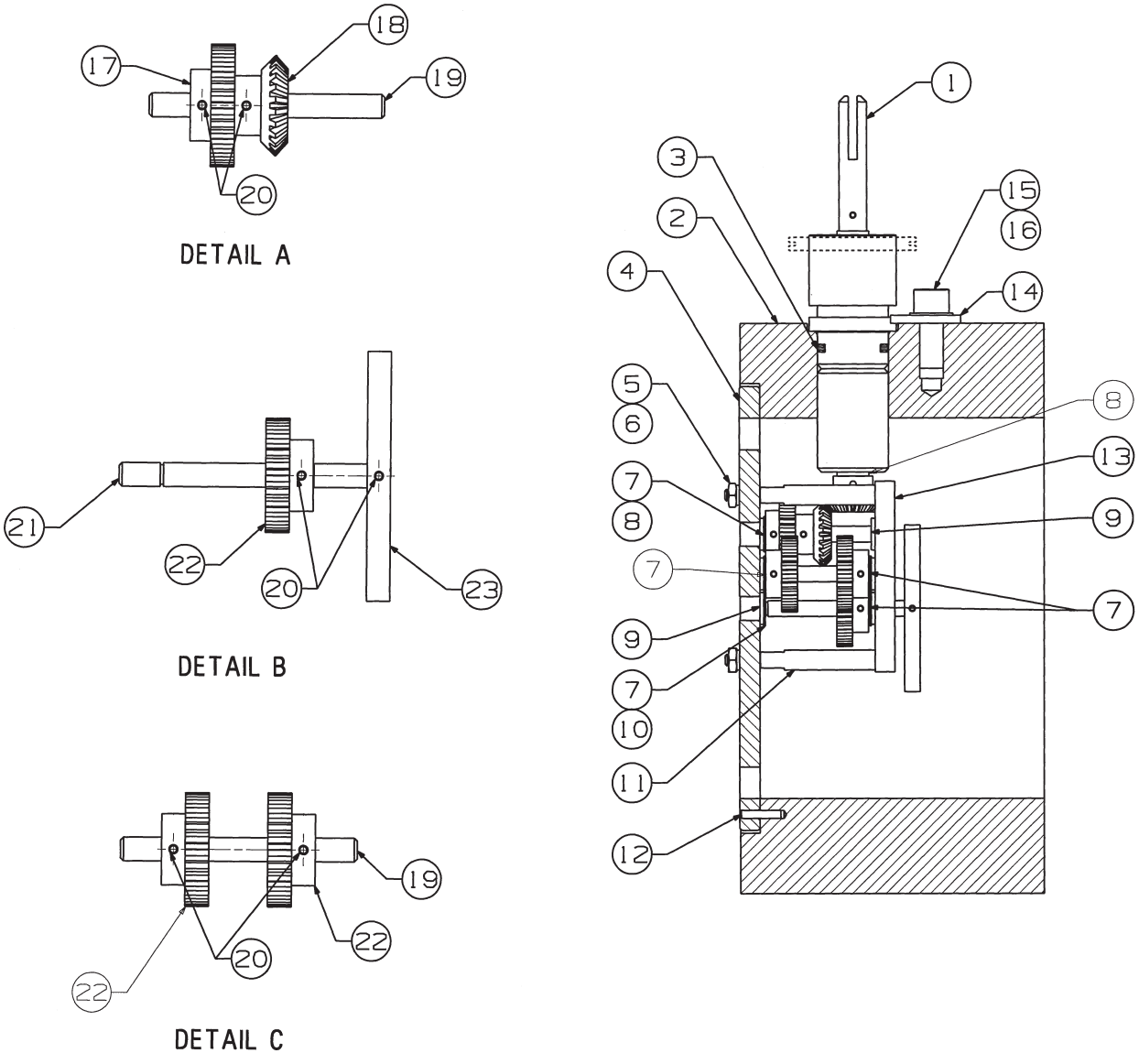


Table: Gear Box Assembly (1BBL/Rev) Parts List

Item	Part Number	Description	Quantity
1	133515	Output Shaft Assembly	1
2	133522-001	Gear Housing	1
4	133523	Mounting Plate	1
5	152105-019	Lockwasher CS	4
6	151532-019	Hex Nut SS	4
7	151901	Flat Washer SS	5
8	152541	Shim SS	A/R
9	155150	Rulon Bearing	6
10	153943	Spring Clip SS	1
11	133307-001	Pillar	4
12	153524	Roll Pin CS	2
13	133319	Bearing Plate	1
14	133524	Retaining Clip	1
15	151043-019	Allen Head Screw CS	1
16	152268	Lockwasher CS	1
17	133526	Drive Gear 30T	2
18	72731-003	Driving Gear	1
19	133527-001	Driven Shaft	2
20	153511	Roll Pin SS	6
21	133542-001	Drive Shaft	1
22	133541	Drive Gear 27T	1
23	133543	Drive Dog	1
24	133541-002	Drive Gear 42T	1

Figure: Measuring Unit Assembly

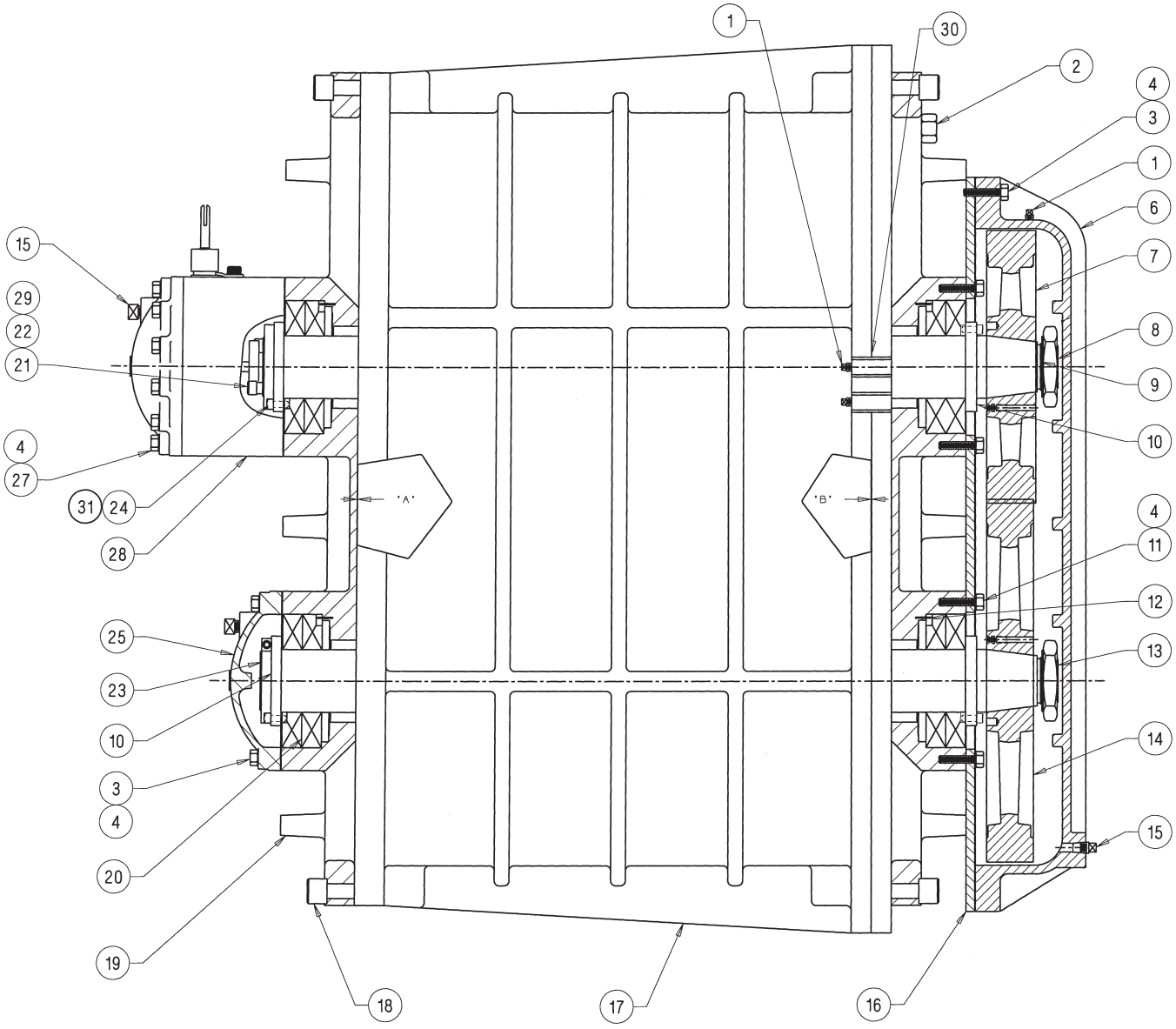


Table: Measuring Unit Assembly Parts List

Item	Part Number	Description	Quantity
1	154708-019	Pipe Plug Square Head, CS	3
2	150847	Hex Head Cap Screw 3/4-10x 2-3/4", CS	32
2	150847M	Hex Head Cap Screw 3/4-10 x 2-3/4", CS	32
3	150815	Hex Head Cap Screw 3/8-16x 2", CS	44
4	152110	Lock Washer, CS, Hel. Spring	80
6	233601	Rear Gear Cover	1
7	233291	Drive Gear for 3T Rotor	1
8	133276	3T Rotor (Cast Iron)	1
9	132293	Lockwasher	2
10	132292	Adjustment Nut	4
11	150766M	Hex Head Cap Screw 3/8-16x 1", CS	24
12	153530	Roll Pin CS	8
13	133286	4T Rotor (Aluminum)	1
14	233296	Drive Gear for 4T Rotor	1
15	132235	Ventilator	3
16	133311-600	Cover Plate	1
17	133506	Measuring Unit Body	1
18	132267	Dowel Screw	4
19	133516-001	End Plate	2
20	159796	Ball Bearing	4
21	133547	Drive Screw	2
22	152109	Lock Washer, CS, Hel. Spring	2
23	133291	Collar	2
24	133296	Drive Screw	2
25	132233	Front Bearing Cap	2
27	150820	Hex Head Cap Screw 3/8-16x 6-1/2", CS	12
28	133520-XXX	Gear Box (Specify Output Required)	1
29	133548	Spacer	2
30	133407	Insert	2
31	133296-100	Drive Screw	2

13.0 Warranty Claim Procedures

1. Limited Warranty:

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

2. Limitation Of Remedy And Liability:

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

Decontamination Statement

RMA Number: _____

Item Being Returned: _____

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

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

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

Signature: _____

Name (Please Print): _____

Title: _____

Company Name: _____

Phone Number: _____

Fax: _____

E-mail: _____

Reason for Return: _____

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

BRODIE™ International

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

This page left blank intentionally.

Notes

Notes

BRODIE™
International
Engineering the Future

Brodie International
19267 Highway 301 North • Statesboro, GA 30461
Phone: 001.912.489.0200 • Fax: 001.912.489.0294
A Brodie Meter Co., LLC Company
www.brodieintl.com