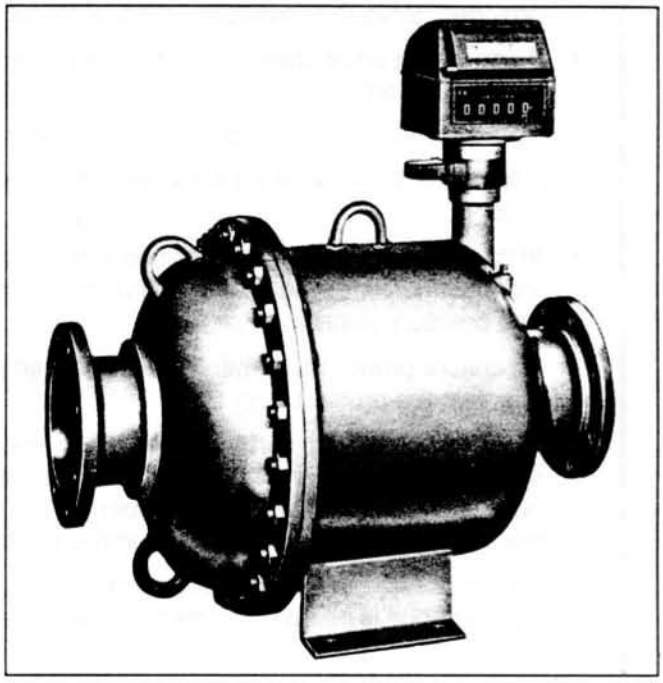
X-BA-103
Revision 03

Models BA-103 through BA-135 High Pressure BiRotor Meters



Brodie Meter Co., LLC
P.O. Box 450
19267 Highway North (30461)
Statesboro, GA 30459-0450
Phone: (912) 489-0200
Fax: (912) 489-0295
www.brodiemeter.com

Essential Instructions

Read this page before proceeding!

Brodie Meter Co., LLC designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brodie Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, telephone 1-912-764-5471 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 Meter Co., LLC 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 Brodie Meter Co., LLC. 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.

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Section 1 INTRODUCTION

1-1 General

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

1-2 Description - Measuring Unit

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.

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

1-3 Meter Model Number

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

1-4 Specifications

The following specifications apply to the meter unless otherwise noted.

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment.

Materials of Construction

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

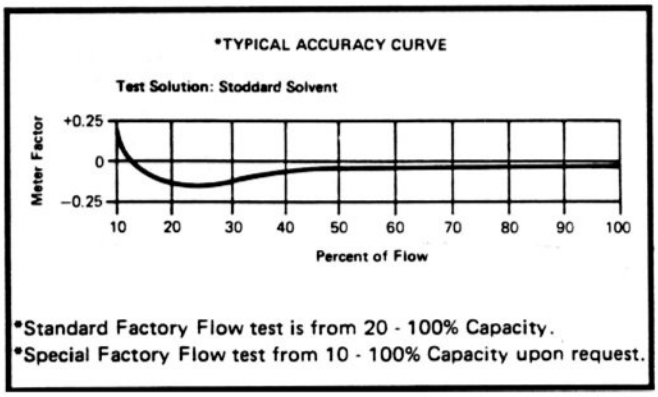
Measuring Unit: Rotors: Three lobe, nickel cast iron or four fluted, heat treated aluminum Rotor Shafts: ground and polished nitralloy Rotor Bearings: stainless steel Body and End Covers: nickel cast iron
Counter Base Plate:
Body: steel
O-ring: Viton ™ standard
Counter Base Drive Gears: stainless steel

Drive Shafts: stainless steel
Drive Shaft Ball Bearing: stainless steel

Connection: 8", 10", 12" or 16" ANSI Flange

Product Temperature Range: -20° to 150°F (-29° to 66°C)

Performance

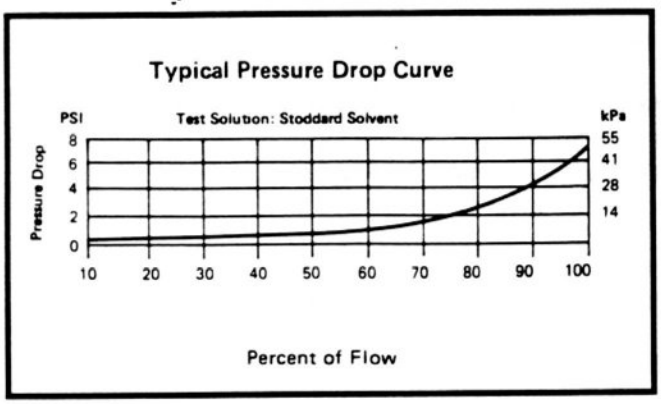


*Standard Factory Flow test is from 20 - 100% Capacity.
*Special Factory Flow test from 10 - 100% Capacity upon request.

Connections

Models	Flange (ANSI)	Maximum Safe Working Pressure
BA-103	8" 150 lb.	275 psi (1,896 kPa)
	8' 300 lb.	300 psi (2,068 kPa)
BA-104	8" 300 lb.	720 psi (4,964 kPa)
BA-105	8" 600 lb.	1,440 psi (9,928 kPa)
BA-113	10" 150 lb.	275 psi (1,896 kPa)
	10' 300 lb.	300 psi (2 068 kPa)
BA-114	10' 300 lb.	720 psi (4,964 kPa)
BA-115	10' 600 lb.	1,440 psi (9,928 kPa)
BA-123	12' 150 lb.	275 psi 1 896 kPa)
	12" 300 lb.	300 psi (2,068 kPa)
BA-124	12' 300 lb.	720 psi (4,964 kPa)
BA-131 BA-133	16' 150lb.	275 psi (1,896 kPa)
	16" 300 lb.	300 psi 2 068 kPa)
BA-134	16" 300 lb.	720 psi (4,964 kPa)
BA-135	16" 600 lb.	900 psi (6,205 kPa)

Pressure Drop



Capacities

Model	US GPM	IMP. GPM	Bbls/Hr.	Cubic Meter/Hr.
BA-103 BA-104 BA-105	150 to 1,500	125 to 1,249	214 to 2,143	34 to 340
BA-113 BA-114 BA-115	250 to 2,500	208 to 2,082	357 to 3,571	57 to 568
BA-123 BA 124	350 to 3,500	291 to 2,914	500 to 5,000	79 to 795
BA-133 BA-124 BA-135	875 to 8,750	729 to 7,290	1,250 to 12,500	199 to 1,986

Table 1-1 Dimensions

Model	Flange Size-lbs.	mm / Inches	Dimensions A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	S	Mounting Holes and Drain
BA-103	8"-150	mm	1,016	352	792	686	343	257	468	203	102	152	38	432	36	76	216	10	—	(4) Mounting Holes 22mm Dia. 7/8" 1-1/2" NPT Drain
		Inches	40	13-7/8	31-3/16	27	13-1/2	10-1/8	18-7/16	8	4	6	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
	8"-300	mm	1,035	352	792	686	343	257	478	203	102	152	38	432	36	76	216	10	—	
		Inches	40-3/4	13-7/8	31-3/16	27	13-1/2	10-1/8	18-13/16	8	4	6	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-104	8"-300	mm	1,137	378	810	730	365	246	527	203	102	127	38	432	36	76	216	10	—	
		Inches	44-3/4	14-7/8	31-7/8	28-3/4	14-3/8	9-11/16	20-3/4	8	4	5	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-105	8"-600	mm	1,194	375	806	737	368	208	521	203	102	108	38	432	36	76	216	10	—	
		Inches	47	14-3/4	31-3/4	29	14-1/2	8-3/16	20-1/2	8	4	4-1/4	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-113	10"-150	mm	1,067	352	792	686	343	257	468	203	102	152	38	432	36	76	216	10	—	
		Inches	42	13-7/8	31-3/16	27	13-1/2	10-1/8	18-7/16	8	4	6	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
	10"-300	mm	1,099	352	792	686	343	257	484	203	102	152	38	432	36	76	216	10	—	
		Inches	43-1/4	13-7/8	31-3/16	27	13-1/2	10-1/8	19-1/16	8	4	6	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-114	10"-300	mm	1,270	378	810	730	365	246	594	203	102	127	38	432	36	76	216	10	—	
		Inches	50	14-7/8	31-7/8	28-3/4	14-3/8	9-11/16	23-3/8	8	4	5	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-115	10"-600	mm	1,270	375	806	737	368	208	559	203	102	108	38	432	36	76	216	10	—	
		Inches	50	14-3/4	31-3/4	29	14-1/2	8-3/16	22	8	4	4-1/4	1-1/2	17	1-7/16	3	8-1/2	3/8	—	
BA-123	10"-150	mm	1,422	533	1,057	1,010	505	306	632	483	241	—	25	533	41	102	267	13	79	(4) Mounting Holes 29mm Dia. 1-1/8" 2"-11-1/2 NPT Drain
		Inches	56	21	41-5/8	39-3/4	19-7/8	12-1/16	24-7/8	19	9-1/2	—	1	21	1-5/8	4	10-1/2	1/2	3-1/8	
	10"-300	mm	1,454	533	1,057	1,010	505	306	648	483	241	—	25	533	41	102	267	13	79	
		Inches	57-1/4	21	41-5/8	39-3/4	19-7/8	12-1/16	25-1/2	19	9-1/2	—	1	21	1-5/8	4	10-1/2	1/2	3-1/2	
BA-124	12"-300	mm	1,549	533	1,099	1,016	508	319	660	432	216	0	25	533	41	102	267	13	—	
		Inches	61	21	43-1/4	40	20	12-9/16	26	17	8-1/2	0	1	21	1-5/8	4	10-1/2	1/2	—	
BA-131 BA-133	16"-150	mm	1,880	711	1,480	1,372	686	425	813	483	241	0	25	603	41	102	302	13	—	
		Inches	74	28	58-1/4	54	27	16-3/4	32	19	9-1/2	0	1	23-3/4	1-5/8	4	11-7/8	1/2	—	
	16"-300	mm	1,918	711	1,480	1,372	686	425	832	483	241	0	25	603	41	102	302	13	—	
		Inches	75-1/2	28	58-1/4	54	27	16-3/4	32-3/4	19	9-1/2	0	1	23-3/4	1-5/8	4	11-7/8	1/2	—	
BA-134	16"-300	mm	1,981	711	1,480	1,372	686	425	864	483	241	0	25	603	41	102	302	13	—	
		Inches	78	28	58-1/4	54	27	16-3/4	34	19	9-1/2	0	1	23-3/4	1-5/8	4	11-7/8	1/2	—	
BA-135	16"-600	mm	1,981	711	1,480	1,372	686	425	864	483	241	0	25	603	41	102	302	13	—	
		Inches	78	28	58-1/4	54	27	16-3/4	34	19	9-1/2	0	1	23-3/4	1-5/8	4	11-7/8	1/2	—	

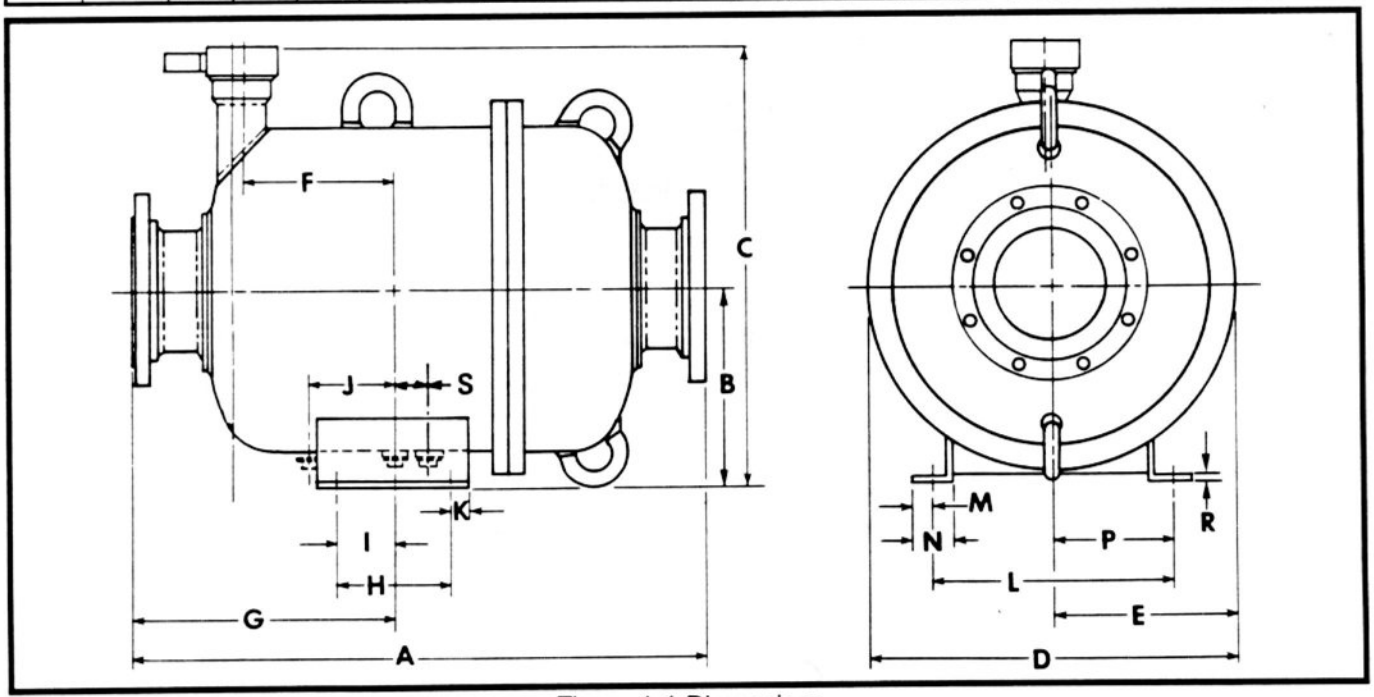


Figure 1-1 Dimensions

Shipping Weight and Volume

Model	Shipping Weight and Volume (Approximate)
BA-103	898 lb. 0 20.7 ft^3 407 kg 0 .58 M^3)
BA-104	1,275 lb. 0 23.1 ft^3 (578 kg 0 .65 M^3)
BA-105	1,766 lb. 0 24.1 ft^3 (801 kg 0 .68 M^3)
BA-113	1,368 lb. 0 24.5 ft^3 (620 kg 0 .69 M^3)
BA-114	1,623 lb. 0 27.6 ft^3 (736 kg 0 .78 M^3)
BA-115	2,475 1b. 0 29.7 ft^3 (1,122 kg 0 .84 M^3)
BA-123	3,154 lb. 0 48 ft^3 (1,430 kg 0 1.36 M^3)
BA-124	3,495 lb. 0 49 ft^3 (1,585 kg 0 1.38 M^3)
BA-131	8,500 lb. V 136 ft^3 (3,856 kg 0 3.85 M^3)
BA-133**	8,550 lb. V 136 ft^3 (3,878 kg 0 3.85 M^3)
BA-134	8,800 lb. 0 136 ft^3 (3,992 kg 0 3.85 M^3)
BA-135	8,900 lb. 0 136 ft^3 (4,037 kg 0 3.85 M^3)

* BA-133, 16- 150 lb. flanges
** BA-133, 16- 300 lb. flanges

Section 2 INSTALLATION

2-1 General

This section contains the procedures for receipt and installation of the meter. Specific instructions are provided for accessory equipment.

2-2 Receipt of Equipment

When the equipment is received, the outside of the packing case should be checked for any damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability.

A report should be submitted to the Product Service Department, Brodie Meter Co., LLC, Statesboro, Georgia 30458.

Remove the envelope containing the packing list. Carefully remove the equipment from the packing case. Make sure spare or replacement parts are not discarded with the packing material. Inspect for damaged or missing parts.

In many cases, the accessory items that form the "stackup" of the meter have not been shipped assembled to the meter. The "stack-up" assembly will be shipped as a complete unit where possible. If not, it will be broken apart into as few assemblies as is practical. Refer to the packing list for information as to what is supplied for your particular meter. In the event that any items are missing from your shipment, contact your local Brodie representative or sales office. Provide him with the serial number and sales order number.

2-3 Return Shipment

To be able to process returned goods quickly and efficiently, it is IMPORTANT that you provide essential information. Do not return any assembly or part without a Returned Materials Report (RMR) or a letter which describes the problem, correction action, if any, and the work that is to be performed at the factory. RMR forms can be obtained from Brodie sales offices or Service Department, Brodie Meter Co., LLC, Highway 301 North, Statesboro, Georgia 30458.

Place a copy of either of the above inside the shipping container and attach it physically to the material being returned. A copy of your packing list should be placed inside an envelope and attached to the outside of the shipping container or placed inside the container.

Failure to follow the above procedures could possibly result in considerable delay due to improperly or totally unidentified items.

2-4 Meter Installation, Storage and Shipment

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

Storage

A. Brodie meters are precision instruments and should be handled 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.

B. Flange covers must remain on the meter until it is ready for installation.

C. If extended storage is anticipated under harsh field conditions the meters should be stored in waterproof lined wooden boxes. Desiccant packs should be taped to the inside of the meter flanges to reduce the effects of humidity on the measuring element. **Caution must be used to insure the desiccant packs are removed prior to installation.**

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

Shipment

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

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

C. The meter should be securely mounted on a wooden skid for shipment. The original container supplied by Brodie or a solid wooden box should be used to protect the exterior of the meter.

Installation

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

A. The BiRotor meter should be mounted on a secure foundation. Considerations for placement of a right angle adaptor and meter weight must be made when vertical installation is required.
B. Care should be taken insure the drain plug remains accessible.
   1. 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 accidentally draining the meter.
   2. 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.
C. Skid foundations and process piping must be properly secured in order to minimize line vibration at the meter.
D. Process piping should not place undue strain on the meter.
E. Provisions should be made to insure that thermal expansion does not raise line pressure above the maximum pressure rating of the meter.
F. All process piping must be clean and free of debris to insure foreign material does not enter the meter. For continuous protection a strainer should be installed upstream of the meter.
G. 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.
H. If required, an air eliminator should be installed upstream of the meter.
I. 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.
J. 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.
K. 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 betaken not to damage the capillary tube on the temperature compensator if so equipped.
L 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.

Section 3 OPERATION

CAUTION: Do not operate this meter in excess of the values stated in Section 1-4 Specifications.

General

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

Starting Flow Through the Meter

A. 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.
B. Slowly introduce product into the meter. Open the upstream valve while the downstream valve remains closed.
C. Slowly bleed air from the system through the high point vent.
D. 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.
E. Do not close valves quickly. This can cause a pressure spike which can damage the meter.
F. 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.
G. 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.

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

Section 4 MAINTENANCE

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

4-1 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 given no 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 is 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/Brodie service bulletins 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.

4-2 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-rings 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 (Refer to Figure 6-1)

1. Remove drain plug (Item 18), drain meter and replace plug.
2. Remove all accessories, including adjuster (Item 10) and counter base plate (Item 6) by removing screws (Items 9 and 17).
3. Remove meter from line to allow for further disassembly.
4. Remove nuts and bolts (Items 2 & 3) to allow separation of housing end cover (Item 1) from the meter housing (Item 4).
5. Disconnect the measuring unit (Item 23) from the end cover (Item 1) by removing socket head screws (Item 24).
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.

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

4-3A Disassembly - 103505-030 and 123505-030 Measuring Units (Refer to Figure 6-2)

1. Position measuring unit assembly in a wooden support block with the gear box assembly downward.
2. Remove screws and washers (Items 8 and 38) then remove front bearing caps (Item 6).
3. Block rotors with a plastic or wooden rod as illustrated in Figure 4-1.
4. Remove screws or nuts (Items 17 or42) and bearing retainer (Item 18). Do not remove front end plate (Item 3) at this time.
5. Rotate measuring unit body (Item 2) so that front of housing rests on wooden support blocks and Gear box assembly (Item 5) is upward.
6. Remove gear box assembly (Item 5) by removing screws (Item 29).
7. Remove drive gears (Item 20 and 28) from each rotor shaft by removing jam nut (Item 30). 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 (Items 20 & 28). 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 (Item 27) used to separate the drive gears from the mounting plate (Item 23).
9. Remove screw (Item 26) and separate mounting plate (Item 23) from the end plate.
10. The rotors and gear box assembly (Item 5) 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 (Item 3) from measuring unit body (Item 2) by removing dowel screws (Item 4) and socket head screws (Item 22).

NOTE: It may be necessary to lightly tap the edge of the end plate (Item 3) to assist removal. Light tapping on opposite end of rotor shafts will assist removal of end plate.

12. Ball bearings (Item 12) can be removed from end plate (Item 3) by gently tapping or pressing on the inner race of the ball bearings from inside the end plate.
13. Remove the two rotors (Items 1 & 21) from the measuring unit body (Item 2).
14. To completely disassemble, rotate the body and remove ball bearings (Item 12). Remove screws (Items 4 & 22) and disassemble end plate (Item 3) from body.

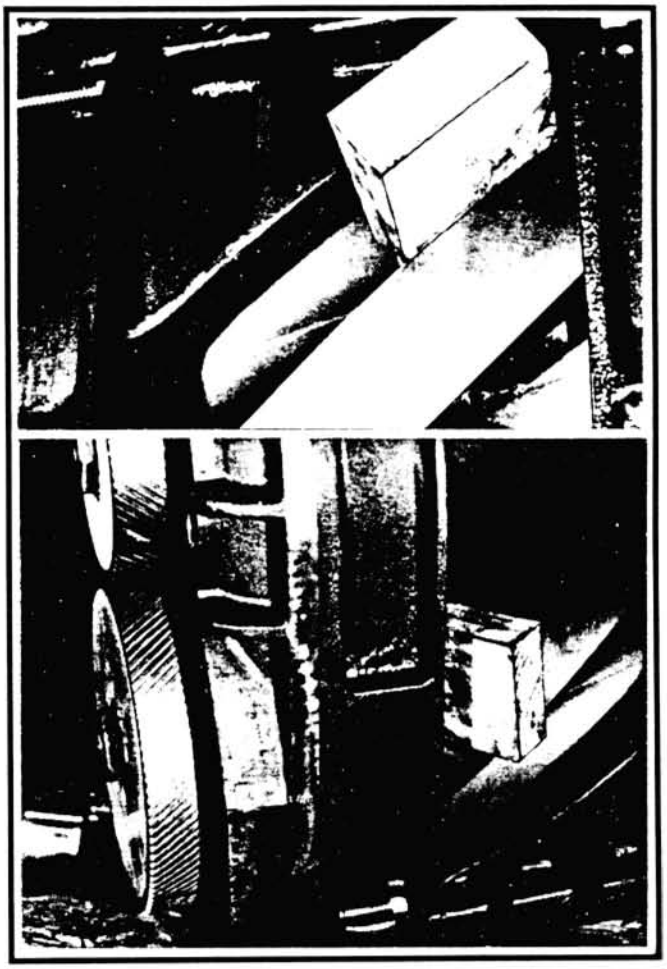


Figure 4-1 Blocking Rotors

4-313 Disassembly - 113505-030 and 133505-030 Measuring Units (Refer to Figure 6-3)

1. Position measuring unit assembly in a wooden support block with the gear box assembly (Item 5) upward.
2. Remove screws (Items 8 and 35), washers (Item 36) then remove front bearing caps (Item 6) and gear box assembly.
3. Block rotors with a plastic or wooden rod as illustrated in Figure 4-1.
4. Remove screws (Items 10,17 and/or42) and bearing retainer (Item 18). On the 113505-030 measuring unit, remove the drive adaptor (Item 11). Do not remove front end plate (Item 3) at this time.

5. Rotate measuring unit body (Item 2).
6. Remove screws (Item 29) and top gear cover (Item 25).
7. Remove jam nut (Item 30) and lock washer (Item 31) from each end of the rotor shaft.

8. Remove drive gears (Item 20 and 28) from each rotor shaft by tapping lightly on a flat surface with a plastic or rubber mallet.

NOTE: Avoid hitting the teeth of the gears (Items 20 & 28). 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 (Item27) used to separate the drive gears from the mounting plate (Item 23).
10. Remove screws (Item 26) and separate mounting plate (Item 23) from the end plate.

11. The rotors and gear box assembly (Item 5) 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 (Item 3) from measuring unit body (Item 2) by removing dowel screws (Item 4) and socket head screws (Item 22).

NOTE: It may be necessary to lightly tap the edge of the end plate (Item 3) to assist removal. Light tapping on opposite end of rotor shafts will assist removal of end plate.

13. Ball bearings (Item 12) can be removed from end plate (Item 3) by gently tapping or pressing on the inner race of the ball bearings from inside the end plate.
14. Remove the two rotors (Items 1 & 21) from the measuring unit body (Item 2).
15. To completely disassemble, rotate the body and remove ball bearings (Item 12). Remove screws (Items 4 & 22) and disassemble end plate (Item 3) from body.

4-4 Cleaning Measuring Unit (Refer to Figure 4-2)

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 (Item 3) to remove any burrs or high spots. Use fine sandpaper to remove corrosion and burrs from the surface of the bores

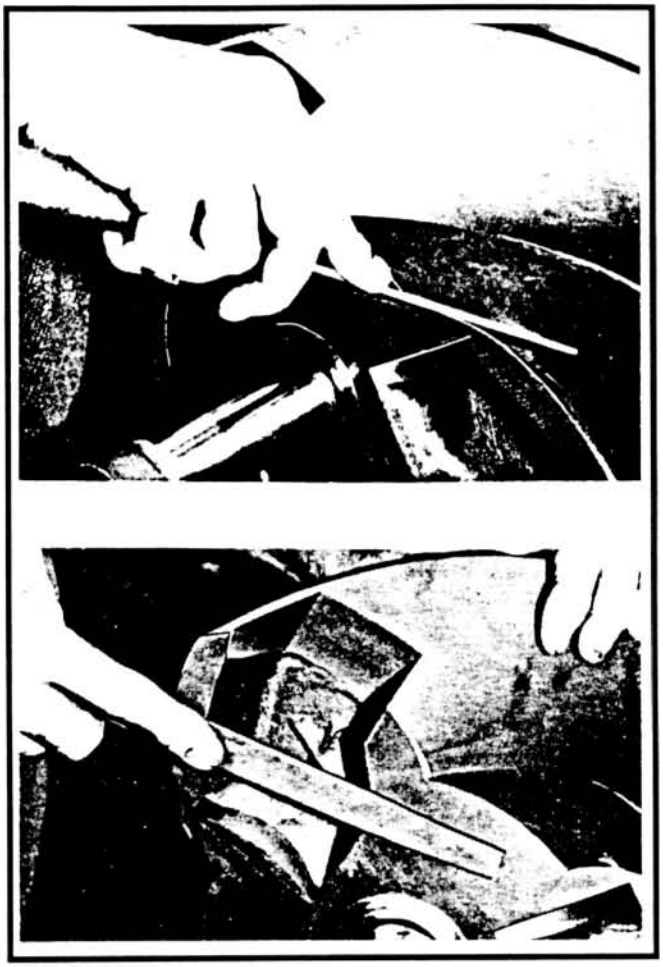


Figure 4-2 Filing Rotors

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 (Item 5) should be inspected. Check all O-rings for wear and replace if necessary.

4-5 Reassembly -Measuring Unit (Refer to Figures 6-2 or 6-3)

1. Lubricate all bearings and O-rings with a lightweight oil.
2. Oil dowel screws (Item 4) and replace front end plate (Item 3) on opposite end from timing gears. Replace screws (Item 22).
3. Rotate housing body (Item 2 and replace rotors (Item 1 & 21) in proper slots with the taper ends of the rotors up. (Figure 4-5 and 4-6)
4. Replace rear end plate (Item 3). Oil dowel screws (Item 4) and screws (Item 22) before replacing. (Figure 4-7).

5. Install bearings (Item 12) into bearing bore provided in end plate. (Figure 4-9)

NOTE: Slot on outer race of ball bearing must engage with roll pin (Item 14) in the end plate (See Figure 4-11).

6. Replace mounting plate (Item 23) and screws (Item 26).

NOTE: The wide end of the mounting plate (Item 23) mounts over the 4T Rotor (hem 21).

7. Replace rotor spacer (Item 27) and timing gears (Items 20 & 28).

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 4-13).

8. Replace lock washers (Item 31) and jam nuts (Item 30).

NOTE: Tab on washer (item 31) must seat into slot on timing gears. (Figure 4-12).

9. Rotate body (Item 2) and install the ball bearings (Item 12) into bearing bore in the end plate.

NOTE: Slot on outer race of ball bearing must engage with roll pin (Item 14) in the end plate.

10. Replace bearing retainer (Item 18). Measuring unit 113505-030 will use one bearing retainer and one drive adaptor (Item 11) on the three tooth rotor. The rest require two bearing retainers each.

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

11. Measuring unit 103505-030 will require two screws (Item 17) and two washers (Item 16) to hold bearing retainer in place.

    Measuring unit 113505-030 will require replacing one screw (Item 10) on the 3T Rotor and one screw (Item 17) and washer (Item 16) on the four tooth rotor.

    Measuring unit 123505-030 has two nuts (Item 42).

    Measuring unit 133505-030 has two different size screws. The four tooth rotor has four screws (Item 17) and washers (Item 16). Place two of (Items 17 & 16) opposite each other on the three tooth rotor. Now replace the two long screws (Item 47), drive keys (Item 46) and washers (Item 16).

4-6 Timing Gear Adjustment (See Figure 4-3)

Loosen the jam nut (Item 30) on the large timing gear (Item 28) 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.

4-7 Adjusting End Clearance on Measuring Unit (See Figure 4-4)

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

1. Loosen set screws (Item 15) in the bearing retainer and tighten screws or nuts (Items 10, 17, 42 or 47), pulling the rotors against the front end plate (Item 3).

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

2. Determine the clearance between the rotors and rear end cover (Item 3) with a feeler gauge. For example, .0008.

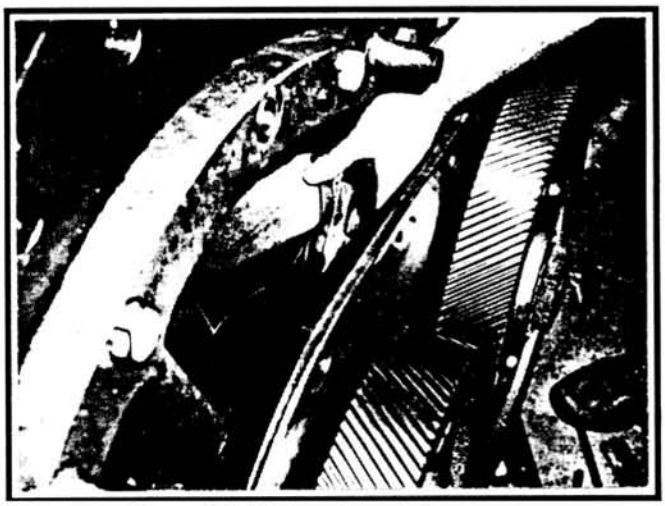


Figure 4-3 Timing Gear Adjustment

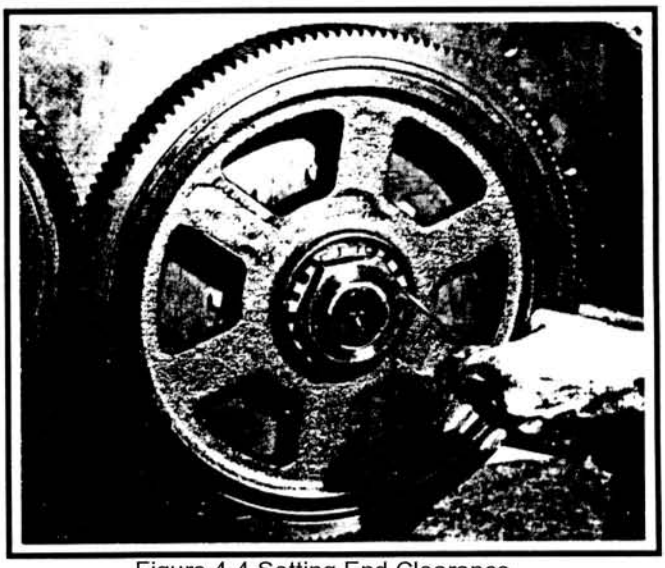


Figure 4-4 Setting End Clearance

Figure 4-5 Following assembly of front end plate to the measuring unit body, rotate and install the three tooth rotor into the proper cavity as illustrated.

Figure 4-6 Position the four tooth rotor and lower into appropriate cavity. Caution should be taken at this point to avoid scoring rotors.

Figure 4-7 Position Rear End Plate

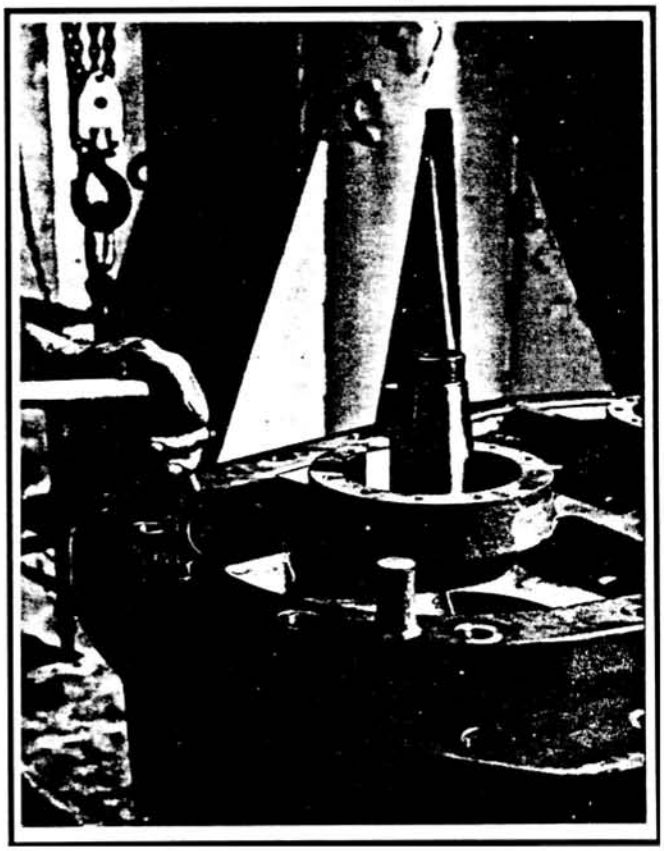


Figure 4-8 Oil and replace dowel screws following with the remaining screws.

Figure 4-9 Install bearings into bearing bores provided in end plate. **NOTE: slot on outer race of ball bearing must engage with roll pin in end plate.**

Figure 4-10 Replace mounting plate and screws. The wide end of the mounting plate fits over the four tooth

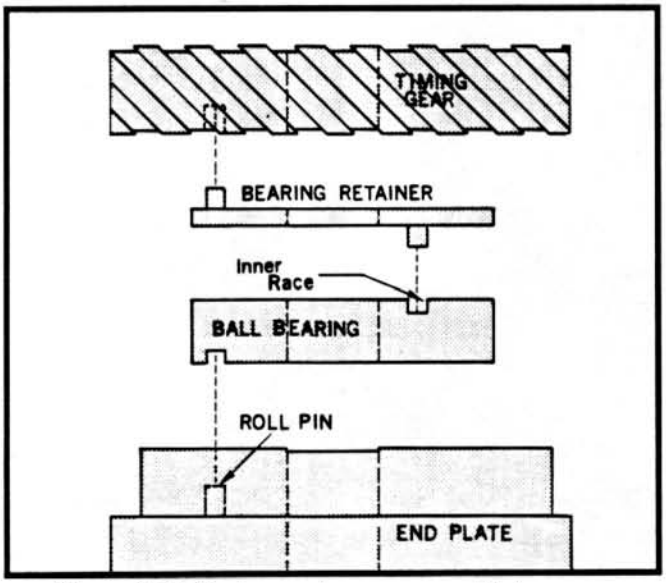


Figure 4-11 Replace rotor spacer and timing gears (large timing gear to the four tooth rotor shaft and small timing gear to the three tooth rotor shaft).

NOTE: The bearing dowel on the rots spacer fits on the Inner raw of the ball bearing and the outer dowel must seat into the slot located on the timing gear.

3. With timing gear jam nuts (Item 3) tight, tighten set screws (Item 37) in each timing gear unit until a clearance of .0004 is obtained between each rotor and rear end plate. (See Figure 4-4).

NOTE: The set screws on the 133505-030 measuring unit will be Item 15.

4. With bearing retainer screws or nuts (Items 10, 17, 42 or47) tight, tighten the set screws in the retainers to obtain a clearance of .0004 between each rotor and end plate.

NOTE: Measuring unit 113505-030 will have one retainer and one drive adaptor.

NOTE: Bend two tabs of lock washer (Item 31) against side of jam nut (Item 30) to secure jam nut.

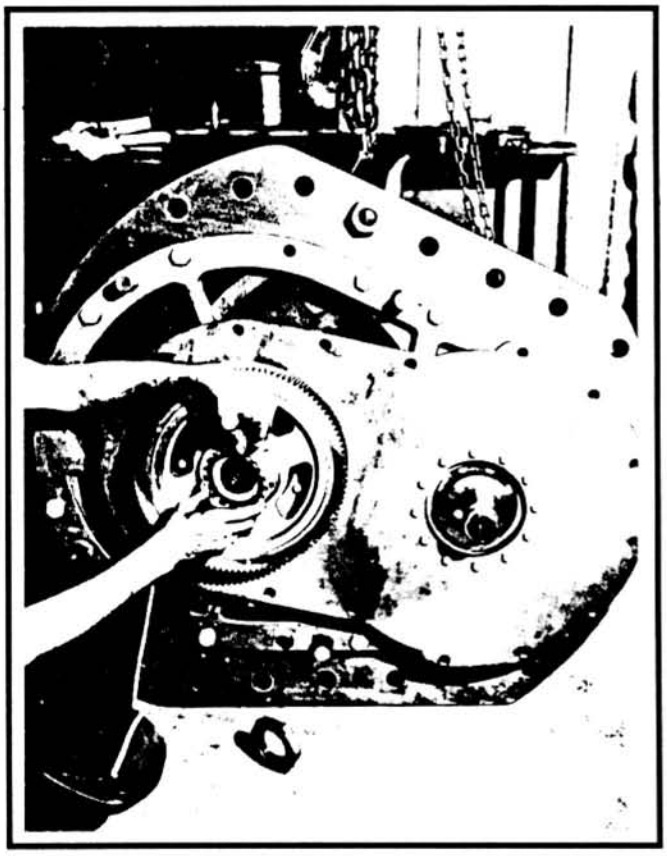


Figure 4-12 Replace lock washers. Tab on washer must seat into slot on timing gear.

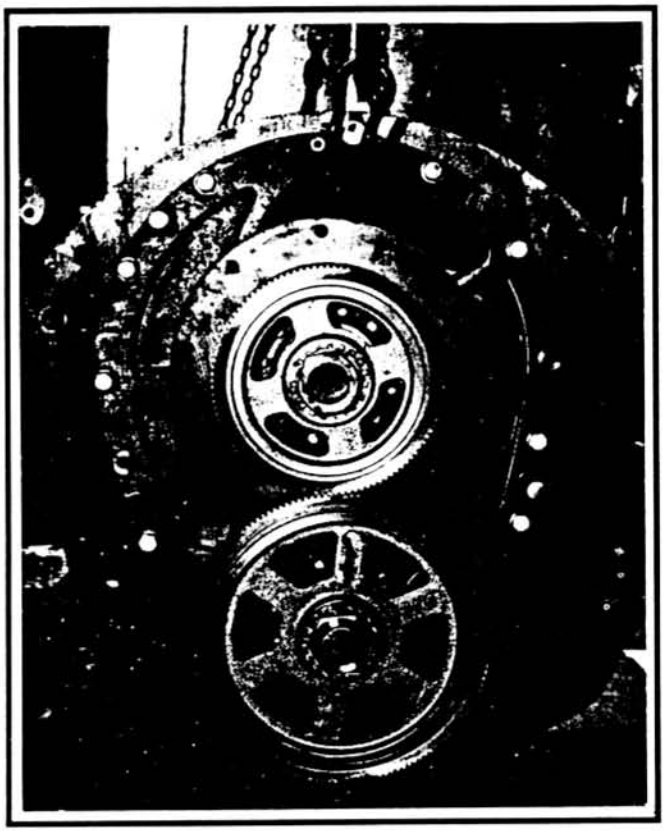


Figure 4-13 Replace jam nuts.

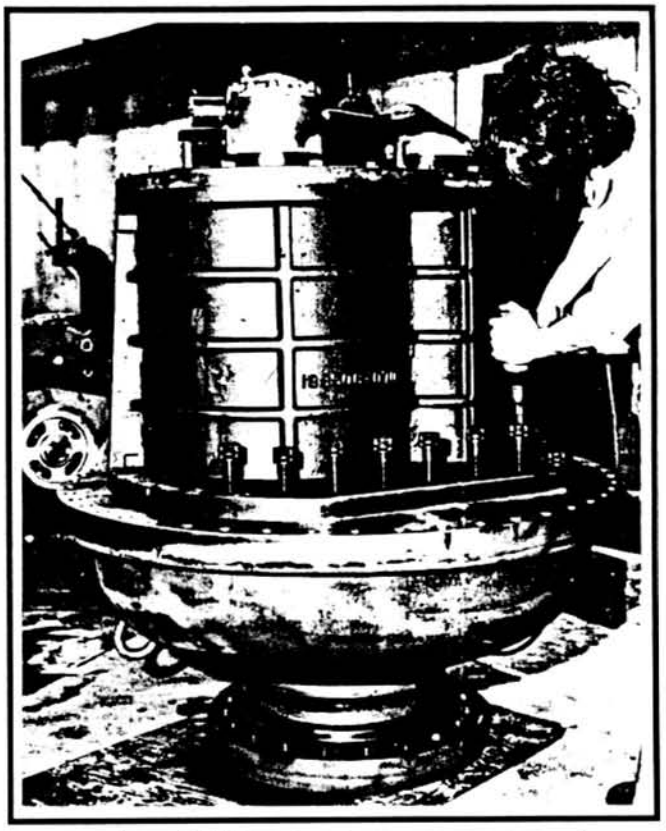


Figure 4-14 Mount and secure measuring unit assembly to end cover.

Figure 4-15 Position the meter body. Rotate the coupling tube on the pinion shaft assembly until the drive pin is positioned the same as the slat on the coupling jaw on the gear box

Figure 4-16 Tighten all nuts to their proper torque and mount accessories as desired.

4-8 Completion of Measuring Unit Reassembly and Installing Meter (See Figures 6-2 and 65-3)

1. Replace gear box assembly (Item 5).

NOTE: Roll pin on gear box assembly (Item 5) must engage with coupling jaw (Item 40) or the drive key (Item 46).

2. Replace front bearing caps (Item 6), washers (Item 38) and screws (Item 8). The 113505-030 and 133505-030 measuring units use screws (Figure 6-3, Item 35) on the four tooth rotor gearing cap.
3. Connect the measuring unit (Figure 6-1, Item 23) to the end cover (Item 1) with socket head screws (Item 24).
4. Replace meter housing (Item 4) and O-ring (Item 5).

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

5. Rotate the coupling tube on the pinion shaft assembly of the counter base plate assembly (Item 6) until the drive pin is positioned the same as the slot of the coupling jaw on the gear box assembly.
6. Reinstall other accessories.

4-9 Torque Specifications (BA-103 through BA-135) (See Table 4-1)

Section 5 TROUBLESHOOTING

General

Tables-1 has been provided to aid in basic troubleshooting. Disassembly procedures are covered in Section 4 Maintenance. If the flow meter is found to be in need of repair, it is recommended the user contact the nearest Brodie Service or Sales Office. It is important that servicing be performed by trained and qualified service

Table 4-1 Torque Specifications BA-103 through BA-135 (See Figure 6-1)

Meter BA-103	Meter BA-104	Meter BA-105	Meter BA-113	Meter BA-114	Meter BA-115	Meter BA-123	Meter BA-124	Meter BA-133	Meter BA-134	Meter BA-135
Item 2 Torque 110 ft/lbs.	Item 2 Torque 300 ft./lbs.	Item 2 Torque 800 ft/lbs.	Item 2 Torque 110 ft./lbs.	Item 2 Torque 300 ft./lbs.	Item 2 Torque 800 ft./lbs.	Item 2 Torque 235 ft/lbs.	Item 2 Torque 635 ft/lbs.	Item 2 Torque 300 ft./lbs.	Item 2 Torque 725 ft./lbs.	Item 2 Torque 900 ft./lbs.
Item 24 Torque 110 ft/lbs.	Item 24 Torque 110 ft./lbs.	Item 24 Torque 110 ft./lbs	Item 24 Torque 110 ft./lbs.	Item 24 Torque 110 ft./lbs.	Item 24 Torque 110 ft/lbs.	Item 24 Torque 400 ft./lbs.	Item 24 Torque 400 ft./lbs.	Item 24 Torque 1500 ft./lbs.	Item 24 Torque 1500 ft/lbs.	Item 24 Torque 1500 ft./lbs.

Table 5-1 Troubleshooting

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 see it output shaft on counter base plate rotates with metered fluid flow. If output shaft of counter base plate assembly rotates, then inspect the following: 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 4-6. If discrepancy is found, re-time rotors.
	Damaged rotors.	Remove rotors as described in Section 4-3A and 4-3B. If rotors are scored or galled, clean them as described in Section 4-4. If rotors are damaged beyond repair, replace with a new set. Install rotors as described in Section 4-5.
	Worn ball bearings.	Remove ball bearings as described in Section 4-3A and 4-3B. 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.

Section 6 PARTS LIST

General

This section contains the necessary parts required to makeup any standard unit that is covered in this manual. Each parts list also contains the recommended spare and replacement parts denoted by an asterisk. For items that are not listed or for additional information, consult factory. When ordering, the following information must be furnished:

1. Part number and description
2. Model number of flow meter
3. Serial number of flow meter
4. Quantity required

When ordering items of a material or special construction not included in the Parts List, furnish the following information so that the part number of the item can be determined:

1. Item number and description
2. Specific material of item
3. Model number of flow meter
4. Serial number of flow meter
5. Quantity required

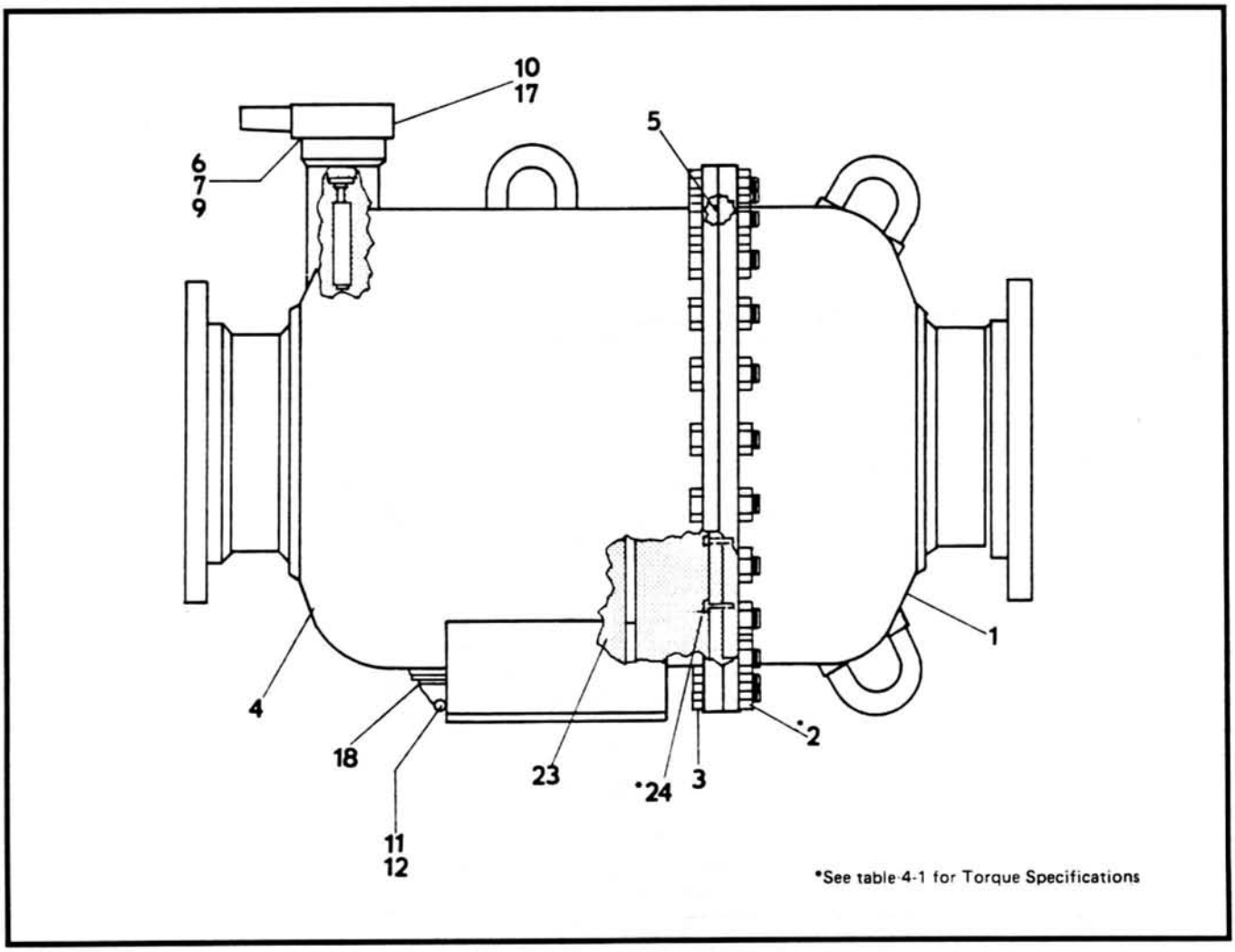


Figure 6-1 Complete Meter Assembly

Table 6-1 Models BA-103 through BA-105 - Complete Meter Parts List

		Model					
Item	Description	BA-103	Qty. Req.	BA-104	Qty. Req.	BA-105	Qty. Req.
1	150 lb. End Cover and Flange Assembly	103555-100	1	-	-	-	-
	300 lb. End Cover and Flange Assembly	103555-300	1	104555-300	1	-	-
	600 lb. End Cover and Range Assembly	-	-	-	-	105555 600	1
2	Nut	151558	24	151601	24	151576	24
3	Bolt	150848	24	150879	24	150881	24
4	150 lb. Meter Housing Assembly	103545-100	1	-	-	-	-
	300 lb. Meter Housing Assembly	103545300	1	104545-300	1	-	-
	600 lb. Meter Housing Assembly	-	-	-	-	105545-600	1
5*	O-ring	157311	1	157311	1	157311	1
6	Counter Base Plate (See Figure 6-8)	92150-500	1	94150	1	94150	1
7*	Counter Base Plate Gasket	51156	1	53156	1	53156	1
9	Screw	151251	9	151015	12	151015	12
10*	Adjuster	4200	1	4200	1	4200	1
11	Seal	151831	1	151831	1	151831	1
12	Seal Wire	155051	1	155051	1	155051	1
17	Screw	150565	4	150565	4	150565	4
18	Pipe Plug	154784-024	1	154784-024	1	154784-024	1
23	Measuring Unit	103505-030	1	103505-030	1	103505-030	1
24	Screws	151021	8	151021	8	151021	8
25	Pipe Plug (Not Shown)	154711-024	1	154711-024	1	154711-024	1

* Recommended Spare Parts

Table 6-2 Models BA-113 through BA-115 - Complete Meter Parts List

		Model					
Item	Description	BA-113	Qty. Req.	BA-114	Qty. Req.	BA-115	Qty. Req.
1	150 lb. End Cover and Flange Assembly	113555-100	1	-	-	-	-
	300 lb. End Cover and Flange Assembly	113555-300	1	114555-300	1	-	-
	600 lb. End Cover and Flange Assembly	-	-	-	-	115555-600	1
2	Nut	151558	24	151601	24	151576	24
3	Bolt	150848	24	150879	24	150881	24
4	150 lb. Meter Housing Assembly	113545-100	1	-	-	-	-
	300 lb. Meter Housing Assembly	113545-300	1	114545-300	1	-	-
	600 lb. Meter Housing Assembly	-	-	-	-	115545-600	1
5*	O-ring	157311	1	157311	1	157311	1
6	Counter Base Plate (See Figure 6-8)	92150-500	1	94150	1	94150	1
7*	Counter Base Plate Gasket	51156	1	53156	1	53156	1
9	Screw	151251	9	151015	12	151015	12
10*	Adjuster	4200	1	4200	1	4200	1
11	Seal	151831	1	151831	1	151831	1
12	Seal Wire	155051	1	155051	1	155051	1
17	Screw	150565	4	150565	4	150565	4
18	Pipe Plug	154784-024	1	154784-024	1	154784-024	1
23	Measuring Unit	113505-030	1	113505-030	1	113505-030	1
24	Screws	151021	8	151021	8	151021	8
25	Pipe Plug (Not Shown)	154711-024	1	154711-024	1	154711-024	1

*** Recommended Spare Parts**

Table 6-3 Models BA-123 and BA-124 - Complete Meter Parts List

		Model			
Item	Description	BA-113	Qty. Req.	BA-124	Qty. Req.
1	150 lb. End Cover and Flange Assembly	123555-100	1	-	-
	300 lb. End Cover and Flange Assembly	123555-300	1	124555-300	1
2	Nut	151560	32	151577	32
3	Bolt	150877	32	150880	32
4	150 lb. Meter Housing Assembly	123545-100	1	-	-
	300 lb. Meter Housing Assembly	123545-300	1	124545-300	1
5*	O-ring	157309	1	157309	1
6	Counter Base Plate (See Figure 6-8)	94150	1	94150-001	1
7*	Counter Base Plate Gasket	51156	1	53156	1
9	Screw	151251	9	151015	12
10*	Adjuster	4200	1	4200	1
11	Seal	151831	1	151831	1
12	Seal Wire	155051	1	155051	1
17	Screw	150565	4	150565	4
18	Pipe Plug	154782-024	1	154782-024	1
23	Measuring Unit	123505-030	1	123505-030	1
24	Screws	151099	10	151099	10
25	Pipe Plug (Not Shown)	154711-024	1	154711-024	1

* Recommended Spare Parts

Table 6-4 Models BA-131 through BA-135 - Complete Meter Parts List

		Model					
Item	Description	BA-133	Qty. Req.	BA-134	Qty. Req.	BA-135	Qty. Req.
1	150 lb. End Cover and Flange Assembly	133555-100	1	-	-	-	-
	300 lb. End Cover and Flange Assembly	133555-300	1	134555-300	1	-	-
	600 lb. End Cover and Flange Assembly	-	-	-	-	-	-
2	Nut	151560	48	151578	48	151578	48
3	Bolt	150888	48	151104	48	151104	48
4	150 lb. Meter Housing Assembly	133545-100	1	-	-	-	-
	300 lb. Meter Housing Assembly	133545-300	1	134545-300	1	-	-
5*	O-ring	157324	1	157324	1	157324	1
6	Counter Base Plate (See Figure 6-8)	94150-010	1	94150-010	1	94150-010	1
7*	Counter Base Plate Gasket	53156	1	53156	t	53156	1
9	Screw	151015	12	151015	12	151015	12
10*	Adjuster	4200	1	4200	1	4200	1
11	Seal	151831	1	151831	1	151831	1
12	Seal Wire	155051	1	155051	1	155051	1
17	Screw	150565	4	150565	4	150565	4
18	Pipe Plug	154782-024	1	154782-024	1	154782-024	1
23	Measuring Unit	133505-030	1	133505-030	1	113505-030	1
24	Screws	151103	16	151103	16	151103	16
25	Pipe Plug (Not Shown)	154711-024	2	154711-024	2	154711-024	2

*** Recommended Spare Parts**

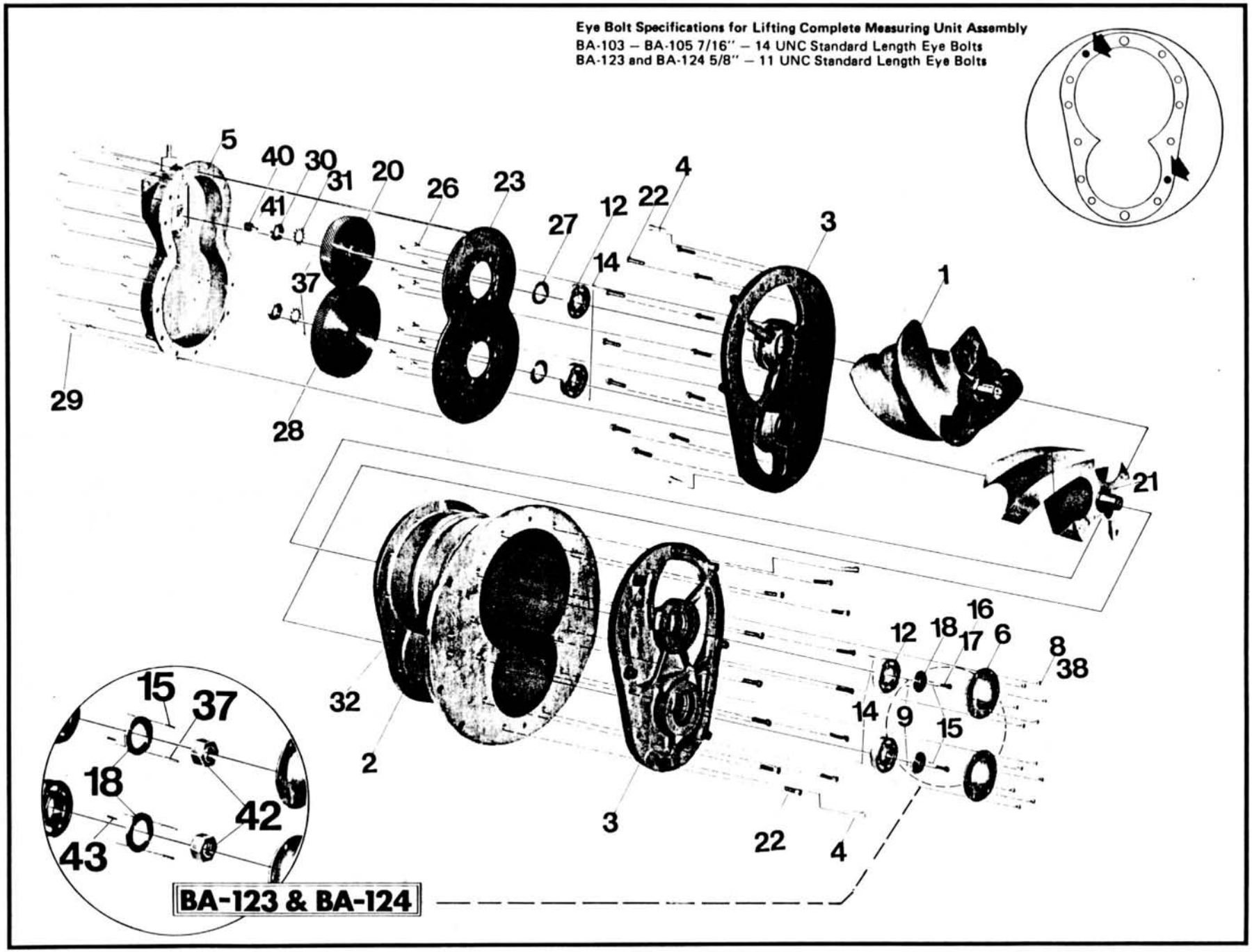


Figure 6-2 Complete Measuring Unit Assembly (103505-030 and 123505-030)

Table 6-5
BA-103 through BA-105 Measuring Unit Parts List

Item	Description	Part Number	Qty. Req.
1**	Three Tooth Rotor	102276-001	1
2	Body	103506	1
3	End Plate	103516	2
4	Dowel Screw	92567	4
5	Gear Box Assembly (See Fig. 6-4)	103655-015	1
6	Front Bearing Ca	92239-005	2
8	Hex Machine Screw	150725	12
9	Roll Pin	153524	2
10	Screw	-	-
11	Drive Adaptor	-	-
12*	Ball Bearing	154958	4
14	Roll Pin	153514	4
15	Set Screw	150989	4
16	Washer	152110	2
17	Socket Head Screw	151055-014	2
18	Bearing Retainer	202603-001	2
19	Spacer	-	-
20**	Drive Gear (Three Tooth)	202291	1
21**	Four Tooth Rotor	102286	1
22	Screw	151045	24
23	Base Gear Cover	103311	1
25	To Gear Cover	-	-
26	Screw	150354	12
27	Rotor Spacer	202295	2
28**	Drive Gear (Four Tooth)	202296	1
29	Screw	151042	18
30*	Jam Nut	92592	2
31*	Lock washer	92593	2
32	Pipe Plug	154708-019	3
33	Washer	-	-
34	Washer	-	-
35	Screw	-	-
36	Washer	-	-
37	Set Screw	150986	4
38	Washer	152108	12
40	Coupling Jaw	92279	1
41	Roll Pin	153523	1

* Recommended Spare Parts
** NOTE: Items 1 and 21 are supplied as a set.
Items 20 and 28 are supplied as a set.

Table 6-6
BA-123 through BA-124 Measuring Unit Parts List

Item	Description	Part Number	Qty. Req.
1**	Three Tooth Rotor	123276-001	1
2	Body	123506	1
3	End Plate	123516	2
4	Dowel Screw	123267	4
5	Gear Box Assembly (See Fig. 6-6)	123655-015	1
6	Front Bearing Ca	123339	2
8	Hex Machine Screw	150766	16
9	Roll Pin	-	-
10	Screw	-	-
11	Drive Adaptor	-	-
12*	Ball Bearing	155188	4
14	Roll Pin	153529	4
15	Set Screw	150990	2
16	Washer	-	-
17	Socket Head Screw	-	-
18	Bearing Retainer	223238	2
19	pacer	-	-
20**	Drive Gear (Three Tooth)	223291	1
21**	Four Tooth Rotor	123286	1
22	Screw	150837	28
23	Base Gear Cover	123311	1
25	To Gear Cover	-	-
26	Screw	150764	16
27	Rotor Spacer	123295	2
28**	Drive Gear (Four Tooth)	223296	1
29	Screw	150766	18
30`	Jam Nut	123292	2
31*	Lock washer	123293	2
32	Pipe Plug	154708-019	3
33	Washer	-	-
34	Washer	-	-
35	Screw	-	-
36	Washer	-	-
37	Set Screw	150987	6
38	Washer	152110	50
40	Coupling Jaw	92279	1
41	Roll Pin	153523	1
42	Nut	151713	2
43	Dowel	123268	2

* Recommended Spare Parts
** NOTE: Items 1 and 21 are supplied as a set.
Items 20 and 28 are supplied as a set.

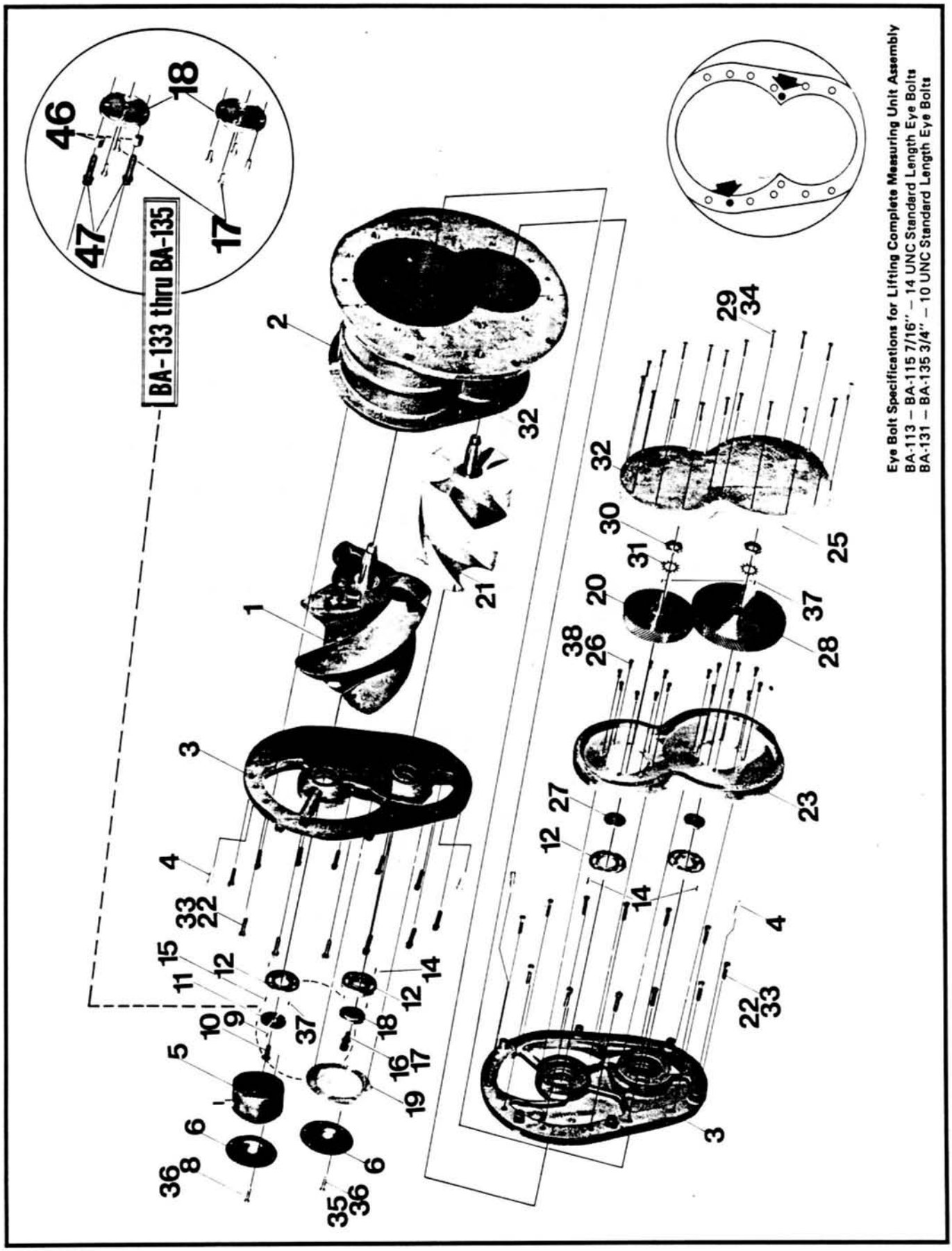


Figure 6-3 Complete Measuring Unit Assembly (113505-030 and 133505-030)

Table 6-7
BA-113 through BA-115 Measuring Unit Parts List

Item	Description	Part Number	Qty. Req.
1**	Three Tooth Rotor	112276-001	1
2	god	113506	1
3	End Plate	113516	2
4	Dowel Screw	92567	4
5	Gear Box Assembly (See Fig. 6-5)	113520	1
6	Front Bearing Ca	112239	2
8	Hex Machine Screw	150818	8
9	Roll Pin	153641	1
10	Screw	150958	1
11	Drive Adaptor	113508	1
12*	Ball Bearing	154959	4
14	Roll Pin	153622	4
15	Set Screw	150990	2
16	Washer	152111	1
17	Socket Head Screw	151022-014	1
18	Bearing Retainer	212238-005	1
19	Spacer	113507	1
20**	Drive Gear (Three Tooth)	212291	1
21**	Four Tooth Rotor	112286	1
22	Screw	150788	24
23	Base Gear Cover	113518	1
25	To Gear Cover	113519	1
26	Screw	151058	16
27	Rotor Spacer	112295-005	2
28**	Drive Gear (Four Tooth)	212296	1
29	Screw	150738	19
30*	Jam Nut	112292	2
31*	Lock washer	112293	2
32	Pipe Plug	154708-019	4
33	Washer	152112	24
34	Washer	152114	19
35	Screw	150748	8
36	Washer	152109	16
37	Set Screw	150987	6
38	Washer	-	-
40	Coupling Jaw	-	-
41	Roll Pin	-	-

* Recommended Spare Parts
** NOTE: Items 1 and 21 are supplied as a set.
Items 20 and 28 are supplied as a set.

Table ti-8
BA-131 through BA-135 Measuring Unit Parts List

Item	Description	Part Number	Qty. Req.
1**	Three Tooth Rotor	132276	1
2	Body	133506	1
3	End Plate	133516	2
4	Dowel Screw	132267	4
5	Gear Box Assembly (See Fig. 6-7)	133520	1
6	Front Bearing Ca	132233	2
8	Hex Machine Screw	150887	12
9	Roll Pin	-	-
10	Screw	-	-
11	Drive Adaptor	-	-
12*	Ball Bearing	155174	4
14	Roll Pin	153523	4
15	Set Screw	151208	8
16	Washer	152109	8
17	Socket Head Screw	151072	6
18	Bearing Retainer	133240	2
9	pacer	-	-
20**	Drive Gear (Three Tooth)	233291	1
21**	Four Tooth Rotor	132286	1
22	Screw	150847	32
23	Base Gear Cover	133311	1
25	To Gear Cover	233601	1
26	Screw	150766	24
27	Rotor Spacer	133295	2
28**	Drive Gear (Four Tooth)	223296	1
29	Screw	150845	16
30*	Jam Nut	132292	2
31*	Lock washer	132293	2
32	Pipe Plug	154708-019	3
33	Washer	-	-
34	Washer	-	-
35	Screw	150798	12
36	Washer	-	-
37	Set Screw	-	-
38	Washer	152110	48
40	Coupling Jaw	-	-
41	Roll Pin	-	-
42	Nut	-	-
43	Dowel	-	-
46	Drive Key	142241	2
47	Screw	151073	2
48	Ventilator	132235	3

* Recommended Spare Parts
** NOTE: Items 1 and 21 are supplied as a set.
Items 20 and 28 are supplied as a set.

Table 6-9
BA-103 through BA-105 Rear Gear Cover-Assembly

Item	Description	Part Number	Qty. Req.
1	Hex Head Screw	150712	4
2	Lock washer	152259	4
3	Roll Pin	153526	1
4	Mounting Plate Assembly	103320	1
5	Set Screw	151200	1
6	Gear Cover	103601	1
7	Bevel Gear and Coupling Assembly	103515	1
8	Shim	152541	A/R
9	Shaft, Driven Gear Assembly	103525	1
10	Bushing	155150	4
11	Shaft, Drive Gear Assembly	103540	1
12	Coner Spring Clip	153943	1
13	Washer	152542	1
14	pipe plug	1	
15	Dowel Pin	1	
	Shim		

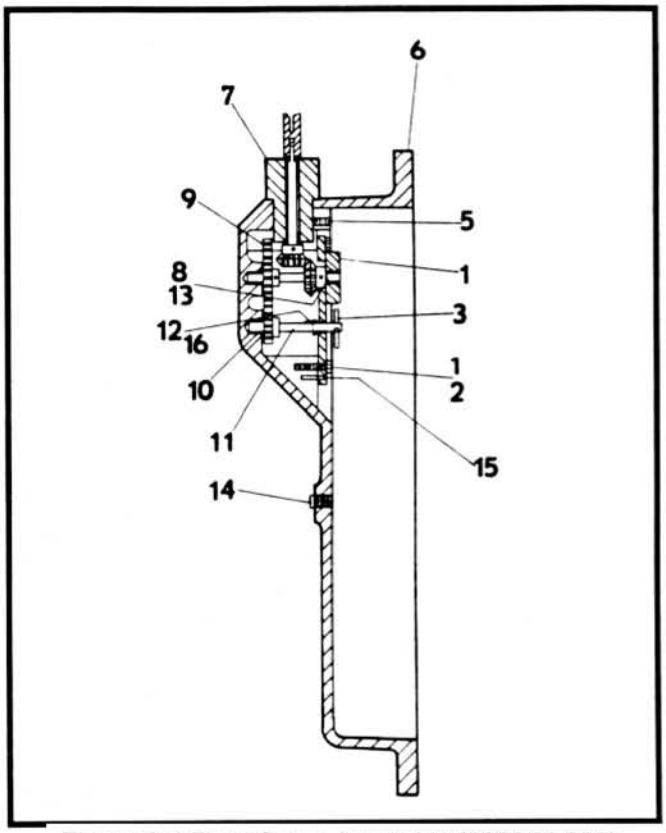


Figure 6-4 Rear Cover Assembly (103655-015)

Table 6-10
BA-113 through BA-115 Rear Gear Cover Assembly

Item	Description	Part Number	Qty. Req.
1	Output Shaft and Coupling Jaw Assy.	113535	1
2	Bushing Retainer	113521	1
4	Set Screw	151200	1
5	Output Gear Housing	113522	1
6	Mounting Plate	113523	1
7	Set Screw	150700	4
8	Shaft Drive Gear Assembly	113540	1
9	Bushing (Rulon)	155151	7
10	Spur/Pinion Gear Assembly	113525	1
11	Bevel Gear and Shaft Assembly	113530	1
12	Coupling	113524	1
13	Mounting Block	113561	1
14	Screw, Flat Head	150237	4
15	Washer	151891	1
16	Shim	152538	A/R
17	Shim	152539	AIR
18	Shim	152540	A/R

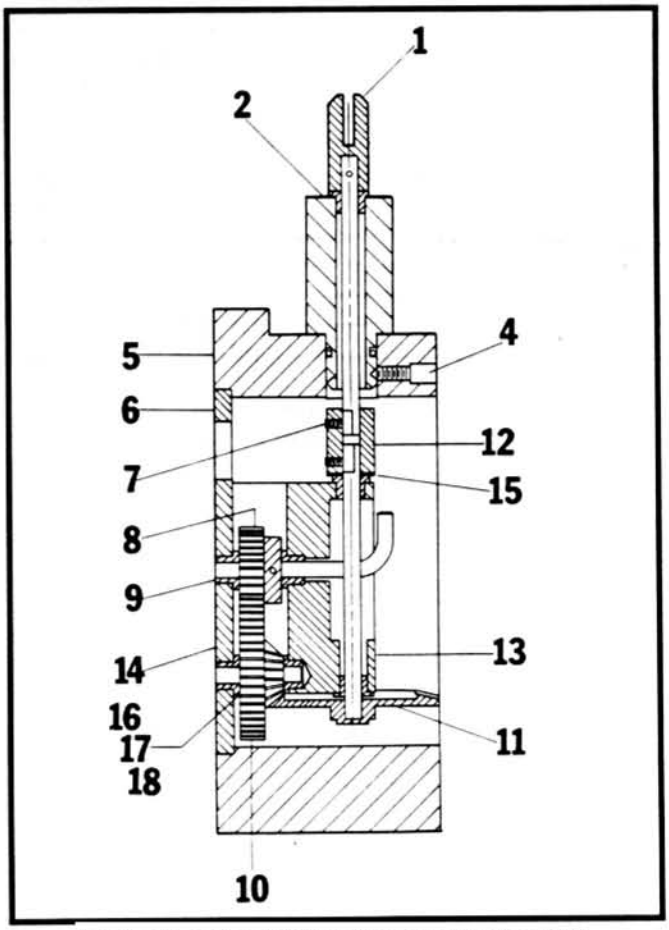


Figure 6-5 Rear Cover Assembly (113520)

Table 6-11
BA-123 through BA-124 Rear Gear Cover-Assembly

Item	Description	Part Number	Qty. Req.
1	Bevel Gear and Coupling	123515	1
2	Shim	152551	A/R
3	Gear Cover	123601	1
4	Driven Gear Assembly	123525	1
5	Set Screw	151200	1
6	Gear	51769-501	1
7	Shim	152552	A/R
8	Mounting Plate Assembly	123320	1
9	Dowel Pin	154096	2
10	Screw	150536	4
11	Washer	152259	4
12	Drive Gear Assembly	123540	1
13	Bushing	155151	2
14	Washer	151891	3
15	Clip	153942	1
16	Pipe Plug	154708-019	1

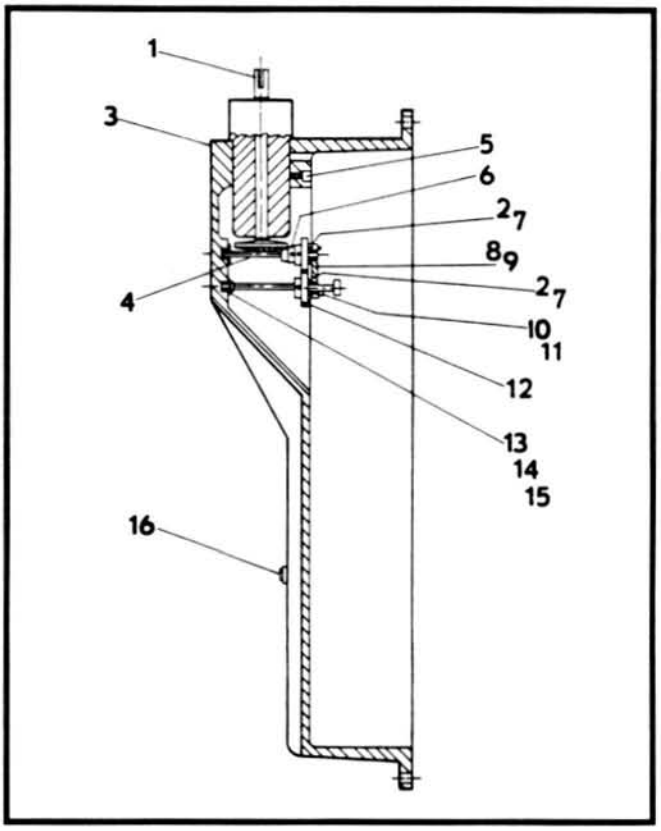


Figure 6-6 Rear Cover Assembly (123655-015)

Table 6-12
BA-131 through BA-135 Rear Gear Cover Assembly

Item	Description	Part Number	Qty. Req.
1	Output Shaft Assembly	133515	1
2	Nut	151532-019	4
3	Lock washer	152105-019	4
4	Bushing	155150	5
5	Driven Gear Assembly	133525-040	1
6	Drive Gear Assembly	133540-040	1
7	Retaining Ring	153943	2
8	Pillar	133307	4
9	Mounting Plate Assembly	133530	1
10	Roll Pin	153524	2
11	Output Gear Housing	133522	1
12	Shim	152541	A/R
13	Bearing Plate	133319	1
14	Thrust Washer	151901	6
15	Retaining Clip	133524	1
16	Screw	151043-019	1
17	Lock washer	152268	1
18	Compound Gear	133535	1
19	Bearing	155169	2
20	Mounting Plate Assembly	133550	1
21	Bearing	155109	1

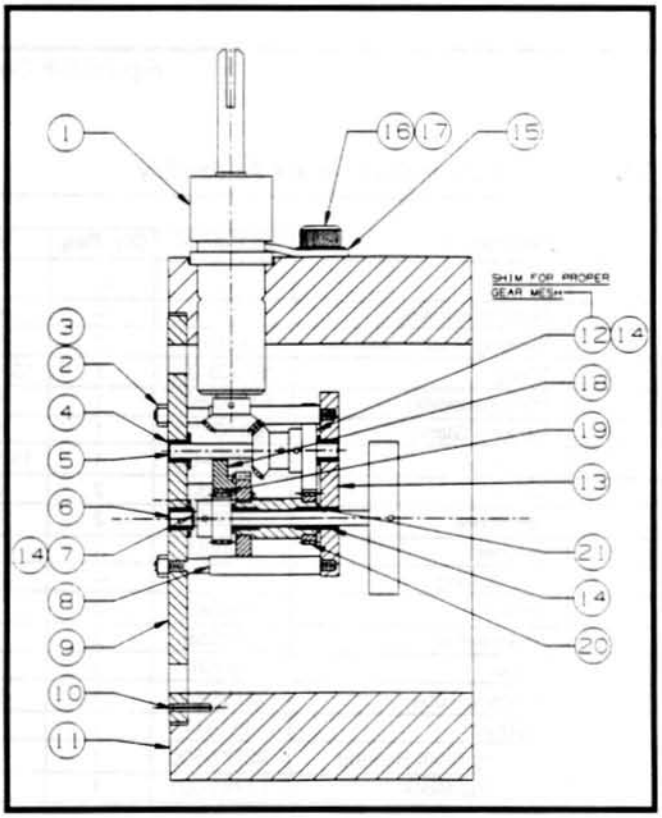


Figure 6-7 Rear Cover Assembly (133520)

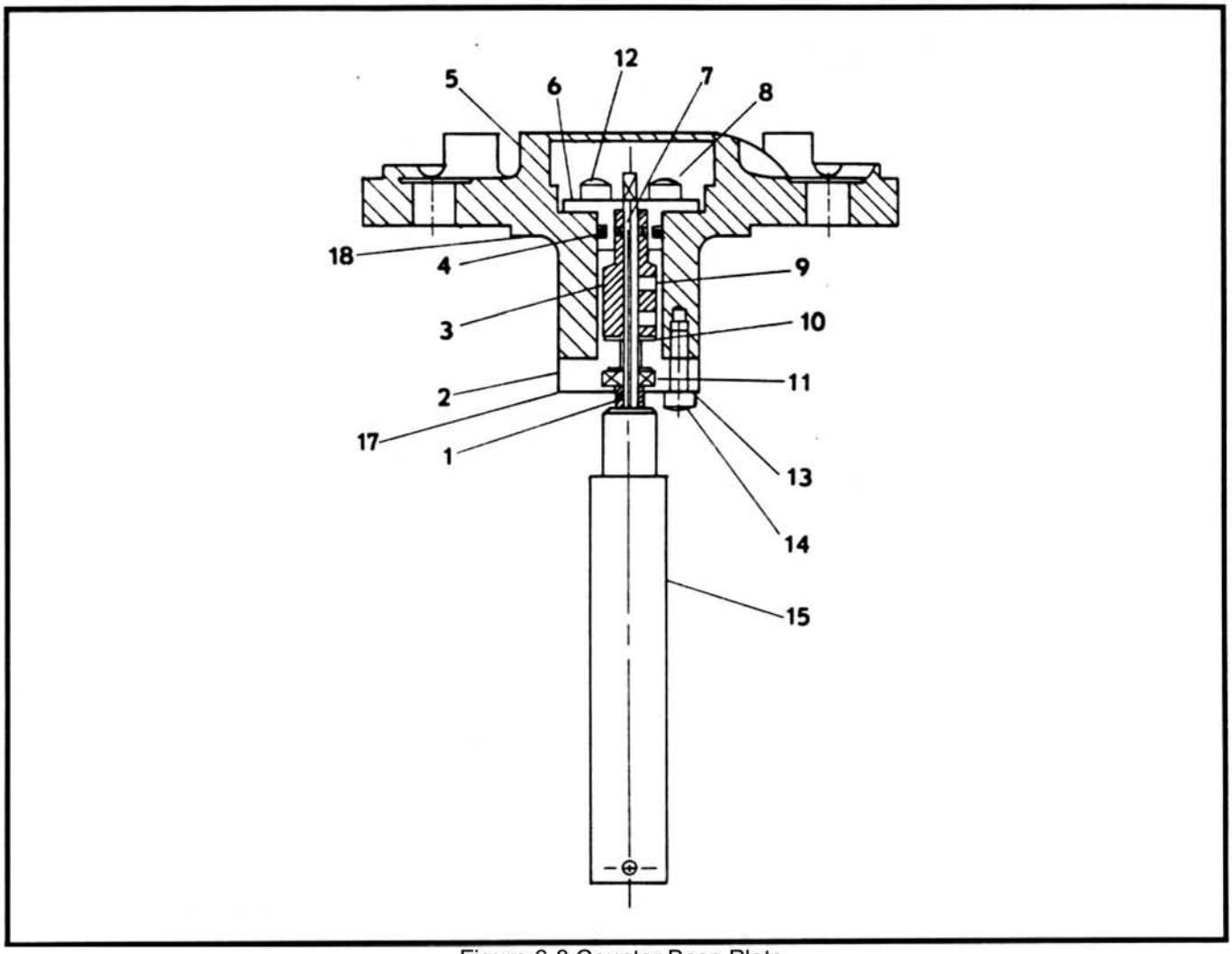


Figure 6-8 Counter Base Plate

Table 6-13 Counter Base Plate Assembly

		Part Number							
Item	Description	92150-500	Qty. Req.	94150	Qty. Req.	94150-001	Qty. Req.	94150-010	Qty. Req.
1	Spacer	-	-	74166	1	74166	1	74166	1
2	Bearing Housing	-	-	94177	1	94177	1	94177	1
3	Packing Shaft Positioner	92152	1	93152	1	93152	1	93152	1
4*	O-ring	157303-022	1	152070-022	1	152070-022	1	152070-022	1
5	Plate Assembly	51775-501	1	53151	1	53151	1	53151	1
6	Packing Gland	52153-011	1	43175	1	43175	1	43175	1
7*	0-ring	152064-022	1	152064-022	1	152064-022	1	152064-022	1
8	Screw	150533	2	151029	4	151029	4	151029	4
9	Set Screw	150969	2	150969	2	150969	2	150969	2
10	Washer	151891	1	151891	1	151891	1	151891	1
11*	Ball Bearin	-	-	155195	1	155195	1	155195	1
12	Screw	150529	2	-	-	-	-	-	-
13	Lock washer	152259	3	152259	3	152259	3	152259	3
14	Screw	150576	3	150537	3	150537	3	150537	3
15	Coupling Tube	92155-500	1	92155	1	92155-001	1	92155-010	1
16	Washer	151894	1	-	-	-	-	-	-
17	Packing Shaft Bearing	92777-500	1	-	-	-	-	-	-
18	Mounting Block	51761-301	1	-	-	- ~	- ~	- ~	-

*** Recommended Spare Parts**

GUARANTEE

If at any time, within one year after shipment but not thereafter, it is proved that any part of the equipment furnished by us was defective when shipped by us, we will repair or replace the same free of charge F.O.B. our plant. Notice of this claim must be made to us within one year after delivery. Our liability is limited to replacement of such defective parts or equipment. There are no guarantees or warranty expressed or implied other than those herein specifically mentioned.

Brodie Meter Co., LLC shall not, in any event, be liable for any consequential damages, secondary charges, expenses for erection or disconnecting or losses resulting from any alleged defect in the apparatus.

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