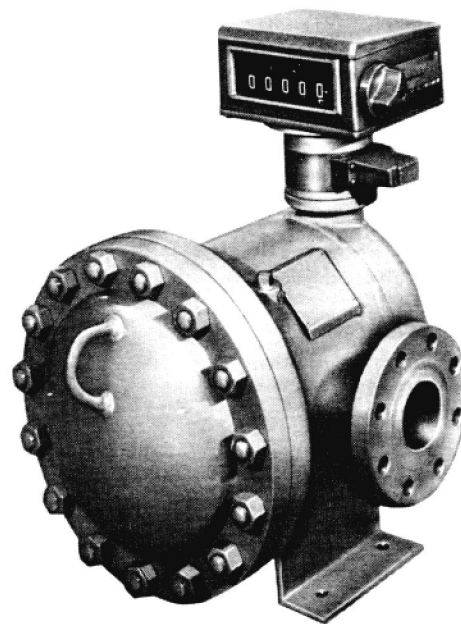


BRODIE

INSTRUCTIONS

INSTALLATION AND OPERATING INSTRUCTIONS

High Pressure BiRotor Meters
Models B-63DEB thru B-95DEB



WARNING

This publication must be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Should this equipment require repair or adjustment, contact the nearest Brodie Sales Office. It is important that servicing be performed only by trained and qualified service personnel. If this equipment is not properly serviced, serious personal injury and/or damage to the equipment could result.



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.brodiameter.com

TABLE OF CONTENTS

	Paragraph Number	Page Number
Section 1 INTRODUCTION		
General	1-1	3
Description - Measuring Unit	1-2	3
Meter Model Number	1-3	3
Specifications	1-4	3
Section 2 INSTALLATION		
General	2-1	4
Receipt of Equipment	2-2	4
Return Shipment	2-3	4
Recommended Procedures	2-4	4
Section 3 OPERATION		
General	3-1	5
Section 4 MAINTENANCE		
General	4-1	6
Disassembly - Meter	4-2	6
Disassembly - Measuring Unit	4-3	7
Removing Timing Gears and Rotors	4-4	7
Cleaning Measuring Unit	4-5	7
Reassembly - Measuring Unit	4-6	7
Setting End Clearance	4-7	8
Timing Gear Adjustment	4-8	8
Completion of Measuring Unit Reassembly and Installing into Meter	4-9	8
Section 5 TROUBLESHOOTING		
General	5-1	9
Section 6 PARTS LIST		
General	6-1	9

LIST OF ILLUSTRATIONS

Figure Number		Page Number
1-1	Dimensions	5
4-1	Proper Method for Blocking Rotors	7
4-2	End Plate, Bearing, Spacer, Retainer and Timing Gear Alignment Detail	8
4-3	Proper Method for Setting Rotor Clearance	8
4-4	Proper Method for Setting Rotor End Clearance	8
6-1	Complete Meter Assembly	10
6-2	Complete Measuring Unit Assembly	13
6-3	Counter Base Plate Assembly	16

LIST OF TABLES

Table Number		Page Number
1-1	Dimensions	5
4-1	Torque Specifications(B-63DEB-B-95DEB)	9
5-1	Troubleshooting	9
6-1	Complete Meter Assembly Parts List Models B-63DEB - B-65DEB	11
6-2	Complete Meter Assembly Parts List Models B-73DEB - B-75DEB	11
6-3	Complete Meter Assembly Parts List Models B-83D EB - B-85D EB	12
6-4	Complete Meter Assembly Parts List Models B-93DEB - B-95DEB	12
6-5	Measuring Unit Assembly Parts List Models B-63DEB - B-65DE8	14
6-6	Measuring Unit Assembly Parts List Models B-73DEB - B-75DE8	14
6-7	Measuring Unit Assembly Parts List Models B-83DEB - B-85DEB	15
6-8	Measuring Unit Assembly Parts List Models B-93DEB - B-95DEB	15
6-9	Counter Base Plate Assembly Parts List	16

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 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 specifically mentioned.

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

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

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 usually consists of a measuring unit installed in an outer housing or case, an adjustor 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 flowing stream. The segments are counted and the results are transferred to a totalizing counter or other flow recording device by means of a gear train.

It 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 adjustor, located on the output shaft of the counter drive gearing, permits the operator at the time of installation, to adjust output of the measuring unit to read in an exact number of units of volume. Thus, the accuracy adjustor 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 $\pm 3\%$ of meter throughput. Registers are available with or without ticket printers.

The meter may be supplied with any of several accessory items. Such as, two-stage electric valve and preset counter, high frequency pulse generator, impulse contactor, etc. These units provide various functions for local and/or remote control and local and/or remote readout.

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

1-4 Specifications

The following specifications apply to the meter unless otherwise noted.

CAUTION: Do not use this meter in excess of the specified values.

Materials of Construction: (Standard Meters)

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

Measuring Unit:

Rotors - heat treated aluminum

On Models B-93DEB, B-94DEB and B-95DEB

3 Lobe Rotor - nickel cast iron

4 Fluted Rotor - 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

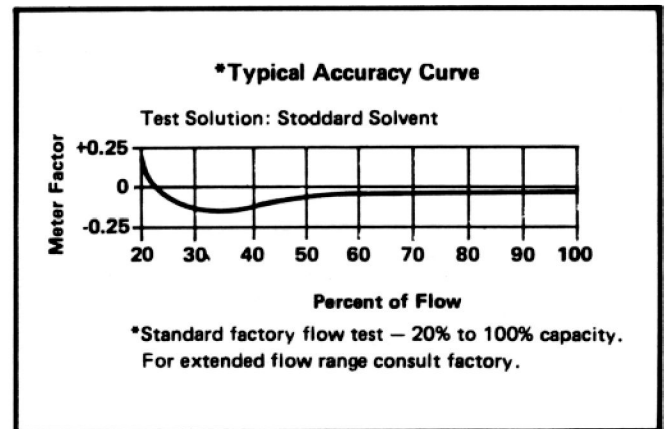
Ratings

Product Temperature Range:

Standard: -20OF to 150OF (-290C to 660C)

Optional: 150OF to 325OF (660C to 1630C)

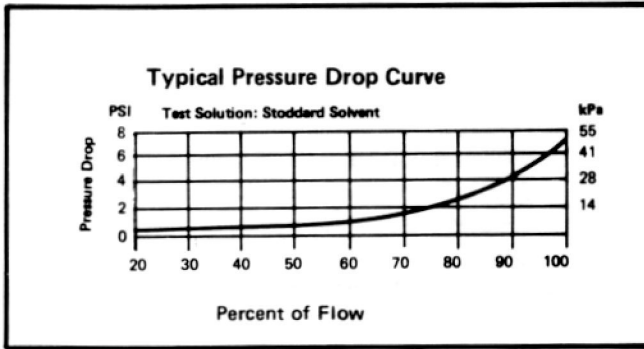
Performance



Connections and Maximum Safe Working Pressures

Model	Flanges (ANSI)	Maximum Safe Working Pressure
B-63DEB	3" 300 lb.	300 PSI (2068 kPa)
	3" 150 lb.	275 PSI (1896 kPa)
B-64DEB	3" 300 lb.	720 PSI (4964 kPa)
B-65DEB	3" 600 lb.	1440 PSI (9928 kPa)
B-73DEB	3" 150 lb.	275 PSI (1896 kPa)
	3" 300 lb.	300 PSI (2068 kPa)
B-74DEB	3" 300 lb.	720 PSI (4964 kPa)
B-75DEB	3" 600 lb.	1440 PSI (9928 kPa)
B-83DEB	4" 150 lb.	275 PSI (1896 kPa)
	4" 300 lb.	300 PSI (2068 kPa)
B-84DEB	4" 300 lb.	720 PSI (4964 kPa)
B-85DEB	4" 600 lb.	1440 PSI (9928 kPa)
B-93DEB	6" 150 lb.	275 PSI (1896 kPa)
B-94DEB	6" 300 lb.	720 PSI (4964 kPa)
B-95DEB	6" 600 lb.	1440 PSI (9928 kPa)

Pressure



Capacities

Model	US GPM	IMP. GPM	Bbls/Hr.	Liters/Min.
B-63DEB	25	21	36	95
B-64DEB	to	to	to	to
B-65DEB	250	208	357	946
B-73DEB	42	35	61	161
B-74DEB	to	to	to	to
B-75DEB	425	354	607	1609
B-83DEB	60	50	86	227
B-84DEB	to	to	to	to
B-85DEB	600	500	857	2271
B-93DEB	100	83	143	378
B-94DEB	to	to	to	to
B-95DEB	1000	833	1493	3785

Dimensions (Reference Figure 1-1, Table 1-1)

Shipping Weight and Volume

Model	Shipping Weight and Volume (Approximate)
B-63DEB	210 lb. @ 5.1 ft.3 95 kg @.14m3
B-64DEB	285 lb. @ 7.3 ft.3 129 kg @ .21 M3
B-65DEB	452 lb. @ 7.6 ft.3 205 kg @ .22 M3
B-73DEB	215 lb. @ 5.1 ft.3 97 kg @ .145 M3
B-74DEB	325 lb. @ 7.3 ft.3 147 kg @ .21 M3
B-75DEB	455 lb. @ 7.6 ft.3 206 kg @ .22 M3
B-83DEB	450 lb. @ 9.78 ft.3 204 kg @ .28 M3
B-84DEB	739 lb. @ 14.05 ft.3 335 kg @ .4 M3
B-85DEB	960 lb. @ 15 ft.3 435 kg @ .42 M3
B-93DEB	758 lb. @ 21.4 ft.3 344 kg @.38M3
B-94DEB	1393 lb. @ 27.7 ft.3 632 kg @ .78 M3
B-95DEB	1495 lb. @ 30 ft.3 678 kg @ .85 M3

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 "stack-up" 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 an "R.M.R." (Returned Materials Report) or a letter which describes the problem, corrective action (if any) and the work that is to be performed at the factory. "R.M.R." forms can be obtained from Brodie Sales Offices or the 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 Recommended Procedures

Prior to installation of the meter, the following items of general information and recommendations should be considered:

1. On new installations, the lines should be flushed thoroughly to rid the pipe of welding bead, pipe scale, etc., before the meter is placed in service. This can be done by using a spool-piece in place of the meter, or by removing measuring unit from meter during flushing operation.
2. It is recommended that the meter be mounted in a position that will allow sufficient clearance for removal of the measuring element.

This area left blank intentionally.

3. All counters can be rotated and secured in any of eight positions.
4. Flow direction is marked on the meter case, near the inlet flange.
5. Install a strainer ahead of the inlet of the meter.
6. The meter may be mounted either horizontally or vertically, but should be level for proper and specified operation. The rotors in the measuring element must be in a horizontal position.
7. Shut-off or control valves should be located downstream of the meter.
8. Do not use guide wires or stabilizing ropes on any part of the stack-up. Some stack-ups will require support by use of support blocks and brackets secured to structural members.

9. Block valves located upstream and downstream of the meter are recommended to isolate the meter from fluid flow.

Section 3 OPERATION

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

3-1 General

1. When the meter is first put into operation, or at any time the meter has been drained, it should be started slowly until all air has been exhausted from the outer housing.

2. To prevent high shock pressures or surges, care should be exercised in opening or closing valves when starting or stopping flow through the meter.
3. On new installations, the lines should be flushed thoroughly to rid the pipe of welding bead, pipe scale, etc., before the meter is placed in service. This can be done by using a spool-piece in place of the meter.
4. If the meter has been installed before the flushing operation, then the measuring unit should be removed from the outer housing while the meter is being flushed.

NOTE: Failure to perform the above procedures could result in serious damage to the meter.

Water should NEVER be used as a flushing medium through this meter. Always use a flushing medium that is compatible with the metallurgy of the meter and its internal parts and similar to the product for which this meter was intended. See Materials of Construction, Page 3.

5. A strainer of proper size should be installed upstream of the meter to protect it from the entrance of foreign material which might damage the measuring unit.
6. A regular schedule should be set up to clean the strainer basket to prevent it from filling and rupturing the screen. Pressure gauges installed on either side of the strainer will show the differential pressure across the strainer. High differential pressure may cause the basket to rupture, permitting large quantities of foreign matter to enter the meter suddenly. This would result in stoppage of the meter and require it to be disassembled and cleaned.

Section 4 MAINTENANCE

CAUTION: 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 materially accelerates wear.

Meters that are given even a little attention regularly will deliver better performance and have a longer life than those that are given no attention until they have failed.

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 chamber 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 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.
9. Meter should be drained as much as possible. The design of these meters makes it possible to completely disassemble and reassemble without removing from line.

4-2 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 Complete Meter Assembly Parts Drawings)

1. Remove all accessories.
2. Remove drain plug (item 22), drain meter and replace plug.
3. Remove adjustor (item 31) and counter base plate assembly (item 27) by removing screws (items 35 and 28).
4. Remove nuts (item 16) to allow separation of housing cover (item 4) from meter housing (item 20).

NOTE: Use care not to damage front dome gasket (item 19) when separating the front dome (item 4) from the meter housing (item 20).

5. Remove screws (item 3), washer (item 42) and seal washer (item 43) attaching measuring unit assembly (item 1) to meter housing (item 201).
6. Lift measuring unit assembly (item 1) out of the meter housing.
7. The measuring unit may now be inspected. In some cases, a thorough washing in cleaning solvent or kerosene will be sufficient to free the rotors of corrosion of foreign material and the unit may be re-installed without further disassembly. In the event the rotors are blocked with solid matter, it will be necessary to remove the rotors and rear end cover assembly for further cleaning.

CAUTION: Extreme care must be exercised when the measuring unit assembly (item 1) 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 these parts while servicing.

4-3 Measuring Unit Disassembly

1. Place measuring unit in wooden cradle as illustrated in Figure 4-1. Orient measuring unit with front end cover (item 4) upward.
2. Remove the two bearing retainer caps (items 46 or 48), screws (item 8) and bearings (item 6).

NOTE: Do not remove front end cover (item 4).

3. Rotate the measuring unit and remove screws (items 1 and 381). This will enable removing the rear gear cover assembly (item 21).
4. Remove screws (item 5) and separate rear end cover (item 15) from body (item 3).
5. The rotors and rear end cover 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.

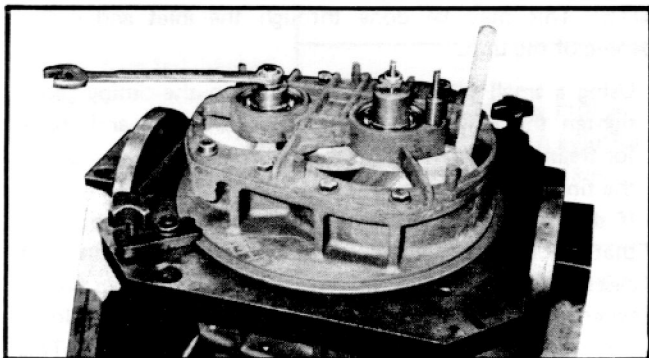


Figure 4-1 Proper Method for Blocking Rotors

4-4 Removing Timing Gears and Rotors

Severe scoring of the rotors or grit in the bearings may necessitate removing the rotors from the rear end cover.

1. Remove screw (item 43) and locknut retainer (item 421).
2. Place a small piece of rubber between the timing gears (items 17 and 32) and remove locknuts (items 19 and 41) and lock washer (item 40).
3. Timing gears are taper fitted to the shafts and can be removed one at a time by striking the face of the gear

inside the teeth with a plastic hammer. Be careful not to damage the rotor shaft threads when removing the timing gears.

4. Remove bearings retainer (item 11) and bearings (item 6) from rear end cover.

NOTE: Ball bearings (item 6) can be removed from end covers by gently tapping or pressing on the inner race of the ball bearings from inside the end covers.

5. Separate rotors (items 13 and 33) and rear end cover (item 15). Be careful when removing rotor spacing springs (item 34).

NOTE: Rotor spacing springs (item 34) used on B-63DEB thru B-83DEB Meters ONLY.

6. Remove front end cover (item 4) and bearings (item 6).

4-5 Cleaning Measuring Unit

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 crows cloth and wash carefully in solvent or kerosene to remove all particles of grit or metal.
3. File lightly the end covers (items 4 and 15) 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.
5. All gears and shafts in rear gear cover assembly (item 2) should be inspected. Check all o-rings and gaskets for wear and replace where necessary.

NOTE: Wash all parts thoroughly in solvent, light fuel oil or kerosene. Dry thoroughly with compressed air and/or with lint free wipers.

4-6 Assembly - Measuring Unit

1. Lubricate all bearings and o-rings with a light weight oil.
2. Position measuring unit body (item 3) in wooden cradle and attach front end plate (item 4) by installing screws (items 5 and 12).
3. Rotate measuring unit body in cradle and replace rotors (items 13 and 331 in proper slots with the tapered end of the rotors upward).
4. Slide on rotor spacing springs (item 34) over the taper shaft of the rotors and attach rear end plate (item 15) by installing screws (item 5).

NOTE: Rotor spacing spring (item 34) are not used on the 92205 Measuring Unit.

5. Install ball bearings (item 6) within the bearing bore of the rear end plate (item 151).

NOTE: Slot in outer race of ball bearing (item 6) must align with roll pin (item 45) in bottom of bearing bore.

6. Position a bearing retainer (item 11) over each ball bearing (item 6) and attach by installing lock washers (item 9) and screws (item 101). The above items are not carried by the 92205 Measuring Unit.
7. Replace spacer key (item 16), timing gears (items 17 and 321, locknut retainer (item 42), lock washer (item

44) and screw (item 43). The large timing gear fits on the 4T rotor.

NOTE: Short tab on the spacer key fits in the inner race of the ball bearings and the long tab seats into slot on the timing gears.

8. Replace lock washer (item 40) and locknuts (items 19 and 41).

NOTE: Tab on washer (item 40) must seat into slot on timing gears.

9. Rotate body and install bearings (item 6), bearing key (item 36), snap ring (item 7), lock washer (item 37) and screws (item 8) onto front end cover (item 4).

NOTE: Tab on bearing key (item 36) must seat into slot on inner race of ball bearing.

10. Measuring Unit must have rotor clearance as described in Sections 4-7 and 4-8.

freely with the meter in any position. If rotors fail to spin freely, repeat procedure for setting end clearance.

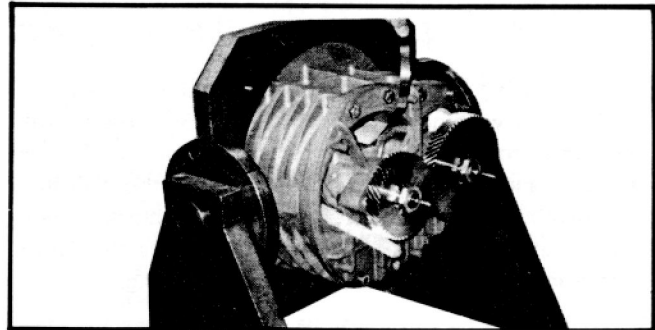


Figure 4-3 Proper Method for Timing Rotors

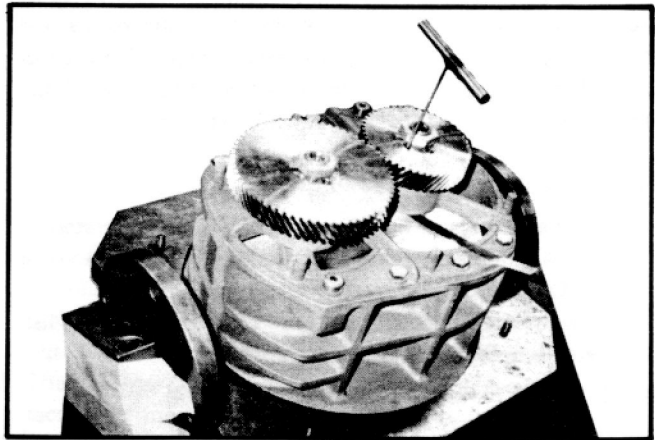


Figure 4-4 Proper Method for Setting Rotor End Clearance

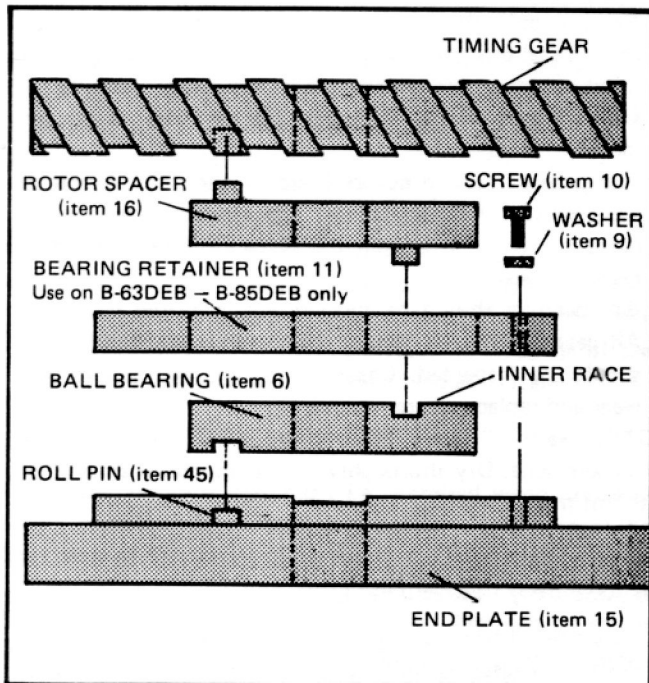


Figure 4-2 End Plate, Bearing, Spacer, Retainer and Timing Gear Alignment Detail

4-7 Setting End Clearance (Reference Figure 4-4)

1. Adjust the 2 set screws located on each of the drive gears (items 17 and 32) until both rotors (items 13 and 33) are flush with the backside of the rear end plate (item 15).
2. (See Figure 4-2) Insert a shim into the outlet port located on the front end plate (item 4) and determine the total distance between the backside of the front end plate and the 3T Rotor (item 131). Repeat this procedure for the 4T rotor (item 331).
3. Adjust the 2 set screws located on the small drive gear (item 17) until the distance between the backside of the front end plate (item 4) and the 3T Rotor is half of the total distance determined. Repeat this procedure for the large drive gear (item 32) and the 4T rotor (item 331).
4. If end clearance is adjusted properly, rotors will spin

4-8 Timing Gear Adjustment

1. Loosen the jam nut (item 41) on the large timing gear (item 32) and with feeler gauges or shims, carefully centralize a lobe of the 3T rotor in a flute of the 4T rotor. Determine the total distance between the lobe and flute of the two rotors and shim the rotors half of the determined distance between them.

NOTE: This may be done through the inlet and outlet opening of the unit.

2. Using a small piece of rubber between the timing gears, tighten the jam nut (item 41), remove shim and check for freeness of operation. If the rotors contact one another, the timing must be repeated.
3. 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. When rotor timing is completed, bend one tab of lock washer (item 40) against side of locknut (item 41). This will secure locknut.

4-9 Completion of Measuring Unit Reassembly and Installing Into Meter

1. Replace rear gear cover assembly (item 2).

NOTE: Slot on pinion shaft assembly (rear gear cover) must align with slot on locknut (item 19).

2. Position measuring unit into meter, as shown in Figure 6-1, so that inlet on measuring unit couples with inlet on meter housing.

3. Replace screws (item 31), washer (item 42) and seal washer (item 43) attaching measuring unit to meter housing (item 20).
4. Replace housing cover (item 4) and front dome gasket (item 19).

NOTE: A light film of grease will aid in holding front dome gasket in place.

5. Rotate the coupling tube on the pinion shaft assembly of the counter base plate assembly (item 27) until the drive pin is positioned the same as the slot of the coupling jaw on the counter drive gear train.
6. Re-install other accessories.

Table 4-1 Torque Specification Models B-63DEB Thru B-95DEB (Reference Figure 6-1)

Meter	Item No.	Torque
B-63DEB	16	47 Ft./Lbs.
B-64DEB	16	220 Ft./Lbs.
B-65DEB	16	378 Ft./Lbs.
B-73DEB	16	20 Ft./Lbs.
B-74DEB	16	130 Ft./Lbs.
B-75DEB	16	375 Ft./Lbs.
B-83DEB	16	50 Ft./Lbs.
B-84DEB	16	220 Ft./Lbs.
B-85DEB	16	675 Ft./Lbs.
B-93DEB	16	75 Ft./Lbs.
B-94DEB	16	400 Ft./Lbs.
B-95DEB	16	727 Ft./Lbs.

Section 5 TROUBLESHOOTING

5-1 General

Table 5-1 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 personnel.

Section 6 PARTS LIST

6-1 General

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

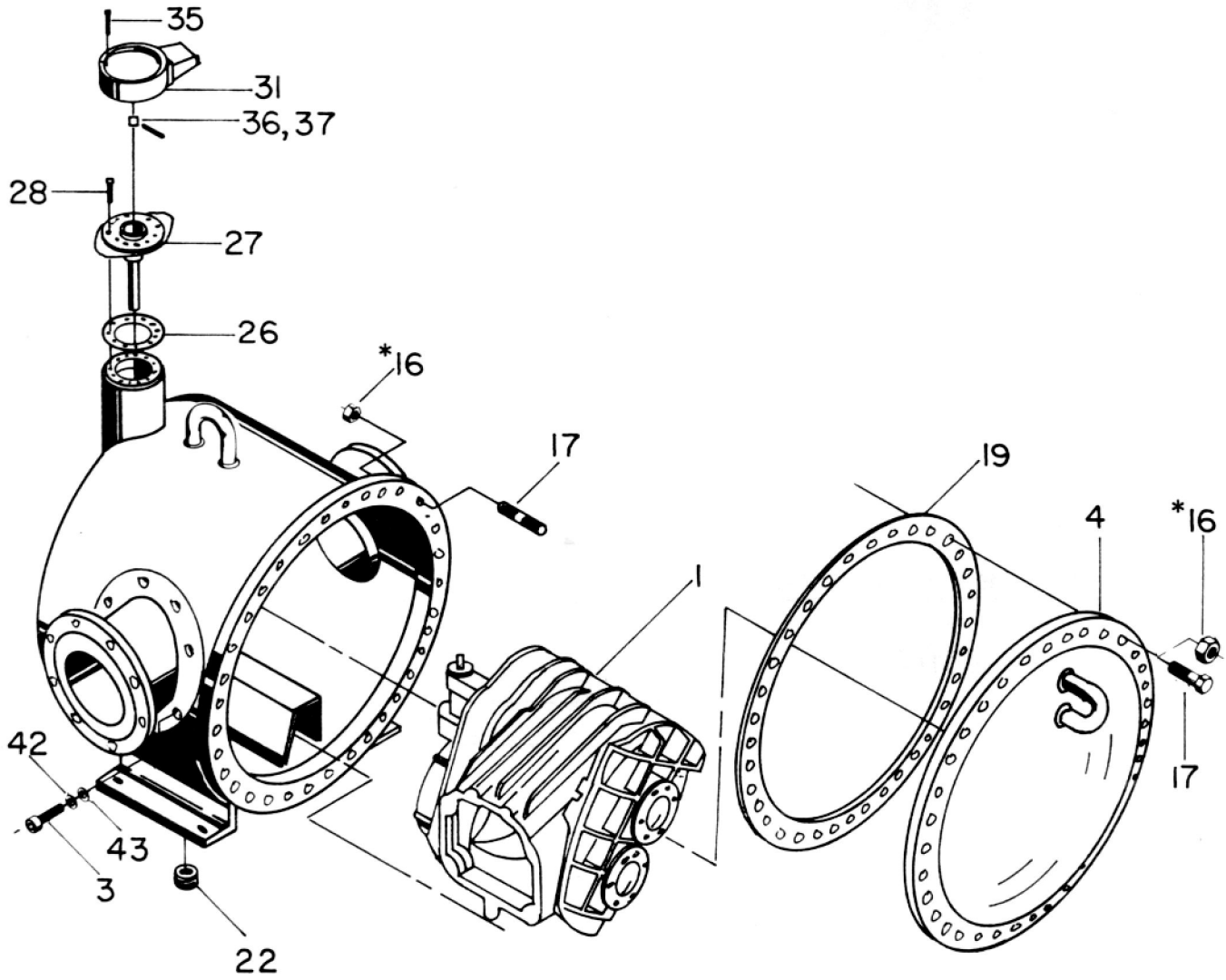
1. Part number and description.
2. Model number of flow meter.
3. Serial number of flow meter.
4. Quantity required.

When ordering items of a material or special construction not indicated in the Parts List, 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.

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 adjustor rotates with metered fluid flow. If output shaft on adjustor rotates, replace register.
	Faulty register or broken coupling between adjustor and counter base plate.	Remove adjustor and see if output shaft on counter base plate rotates with metered fluid flow. If output shaft of counter base plate assembly rotates, then inspect the following: Check coupling on input shaft of adjustor to see if it's broken. If broken, replace coupling. 2. If coupling is not broken, replace adjustor.
Meter runs but is noisy.	Meter is not timed properly.	Check rotor clearances as described in Section 4-8. If discrepancy is found, retime rotors.
	Damaged Rotors.	Remove rotors as described in Section 4-4. If rotors are scored or galled, clean them as described in Section 4-5. If rotors are damaged beyond repair, replace with a new set. Install rotors as described in Section 4-6.
	Worn Ball Bearings.	Remove ball bearings as described in Sections 4-3 and 4-4. Check to see if ball bearings turn freely with no free play. If discrepancy is found, replace ball bearings and install as described.
	Damaged gears in counter base plate assembly.	Disassemble counter base plate assembly. Check gears for worn or damaged gears. Replace gears as necessary and assemble counter base plate assembly.



*REFERENCE TABLE 4-1 FOR TORQUE SPECIFICATIONS.

Figure 6-1 Complete Meter Assembly

Table 6-1 Complete Meter Parts List - Models B-63DEB, B-64DEB and B-65DEB

Item	Description	Qty. Req.	Models			
			B-63DEB	B-64DEB	B-65DEB	
	Complete Meter Assembly	1 GPR	63000-000	-	-	
		10 GPR	63000-010	64000-010	65000-010	
		10 LPR	63000-022	-	-	
		HTT-325°F	10 GPR	63000-312	64000-310	65000-310
		1 GPR	63000-308	-	-	
1	Measuring Unit	1 GPR	62105-000	-	-	
		10 GPR	62105-010	62105-010	62105-010	
		10 LPR	62105-020	-	-	
		HTT-3250F	10 GPR	62105-310	62105-310	62105-310
		HTT-3250F	1 GPR	62105-300	-	-
3	Screw	4	151026	151053	151053	
4	Housing Cover	1	73430	74430	75430	
16	Nut	24	151555	-	-	
		15	-	155159	155159	
17	Stud	24	151386	-	-	
		15	-	151393	151393	
*19	Gasket	1	73434	74434	75434	
20	Housing Assembly	1	73815	74815	75815	
22	Pipe Plug	1	154784-024	154784-024	154784-024	
*26	Gasket	1	53156	53156	53156	
27	Counter Base Plate Assembly	1	174150	174150	174150	
28	Screw	12	151015	151015	151015	
*31	Adjustor	1	4200	4200	4200	
35	Screw	4	150565	150565	150565	
*36	Coupling with Item No. 37	1	W-4125	W-4125	W-4125	
37	Cotter Pin	1	153901	153901	153901	
42	Washer	4	151882	151882	151882	
*43	Seal Washer	4	152034	152034	152034	
44	Pipe Plug (Not Shown)	1	154711-024	154711-024	154711-024	

*Asterisk indicates this item is recommended spare parts.

Table 6-2 Complete Meter Parts List - Models B-73DEB, B-74DEB and B-75DEB

Item	Description	Qty. Req.	Models			
			B-73DEB	B-74DEB	B-75DEB	
	Complete Meter Assembly	10 GPR	73000-010	74000-010	75000-010	
		10 LPR	73000-022	-	-	
		HTT-150 - 3250F	10 GPR	73000-310	-	-
		10 GPR	72105-010	72105-010	72105-010	
1	Measuring Unit	10 LPR	72105-020	-	-	
		FHTT-150 - 3250F	10 GPR	72105-310	-	-
3	Screw	4	151026	151053	151053	
4	Housing Cover	1	73430	74430	75430	
16	Nut	24	151555	-	-	
		15	-	155159	155162	
17	Stud	24	151386	-	-	
		15	-	151393	151396	
*19	Gasket	1	73434	74434	75434	
20	Housing Assembly	1	73815	74815	75815	
22	Pipe Plug	1	154784-024	154784-024	154784-024	
*26	Gasket	1	53156	53156	53156	
27	Counter Base Plate Assembly	1	174150	174150	174150	
28	Screw	12	151015	151015	151015	
*31	Adjustor	1	4200	4200	4200	
35	Screw	4	150565	150565	150565	
*36	Coupling with Item No. 37	1	W-4125	W-4125	W-4125	
37	Cotter Pin	1	153901	153901	153901	
j 42	Washer	4	151882	151882	151882	
*43	Seal Washer	4	152034	152034	152034	
44	Pipe Plug (Not Shown)	1	154711-024	154711-024	154711-024	

*Asterisk indicates this item is recommended spare parts.

Table 6-3 Complete Meter Parts List - Models B-83DEB, B-84DEB and B-85DEB

Item	Description		Qty. Req.	Models		
				B-83DEB	B-84DEB	B-85DEB
	Complete Meter Assembly	10 GPR		83000-010	84000-010	85000-010
		10 LPR		83000-022	-	-
		HTT-150 - 325°F		83000-310	-	-
1	Measuring Unit	10 GPR	1	82105-010	82105-010	82105-010
		10 LPR	1	82105-020	-	-
		HTT-150 - 3250 F	10 GPR	1	82105-310	-
3	Screw		4	151023	151047	151047
4	Housing Cover		1	83430	84430-001	85430
16	Nut		22	151551	-	-
			20	-	151559	151562
17	Stud		22	151389	-	-
			20	-	150892	151397
*19	Gasket		1	83434	157326	85434
20	Housing Assembly		1	83815	84815	85815
22	Pipe Plug		1	154784-024	154784-024	154784-024
*26	Gasket		1	53156	53156	53156
27	Counter Base Plate Assembly		1	174150	174150	174150
28	Screw		12	151015	151015	151015
*31	Adjustor		1	4200	4200	4200
35	Screw		4	150565	150565	150565
*36	Coupling with Item No. 37		1	W-4125	W-4125	W-4125
37	Cotter Pin		1	153901	153901	153901
42	Washer		4	151872	151872	151872
*43	Seal Washer		4	152033	152033	152033
44	Pipe Plug (Not Shown)		1	154711-024	154711-024	154711-024

"Asterisk indicates this item is recommended spare parts.

Table 6-4 Complete Meter Parts List - Models B-93DEB, B-94DEB and B-95DEB

Item	Description		Qty. Req.	Models		
				B-93DEB	B-94DEB	B-95DEB
	Complete Meter Assembly ~	10 GPR		93400-010	94400-010	95400-010
		1 BPR		93400-030	94400-030	95400-030
		HTT-150 - 325°F		-	-	95400-310
1	Measuring Unit	10 GPR	1	92205-010	92205-010	92205-010
		1 BPR	1	92205-030	92205-030	92205-030
		HTT-150 - 3250 F	10 GPR	1	-	-
3	Screw		7	151054	151100	151054
4	Housing Cover		1	93430	94430-001	95430
			20	-	151560	-
16	Nut		26	-	-	151563
			32	151558	-	-
			20	-	150891	-
17	Stud		26	-	-	151399
			32	151391	-	-
19	Gasket (O-Ring)		1	93434	157307	95434
20	Housing Assembly		1	93415	94415	95415
22	Pipe Plug		1	154784-024	154784-024	154784-024
*26	Gasket		1	53156	53156	53156
27	Counter Base Plate Assembly		1	94150	94150	94150
28	Screws		12	151015	151015	151015
*31	Adjustor		1	4200	4200	4200
35	Screw		4	150565	150565	150565
*36	Coupling with Item No. 37		1	W-4125	W-4125	W-4125
37	Cotter Pin		1	153901	153901	153901
42	Washer		7	151903	151903	151903
*43	Seal Washer		7	152031	152031	152031
44	Pipe Plug (Not Shown)		1	154711-024	154711-024	154711-024

"Asterisk indicates this item is recommended spare parts.

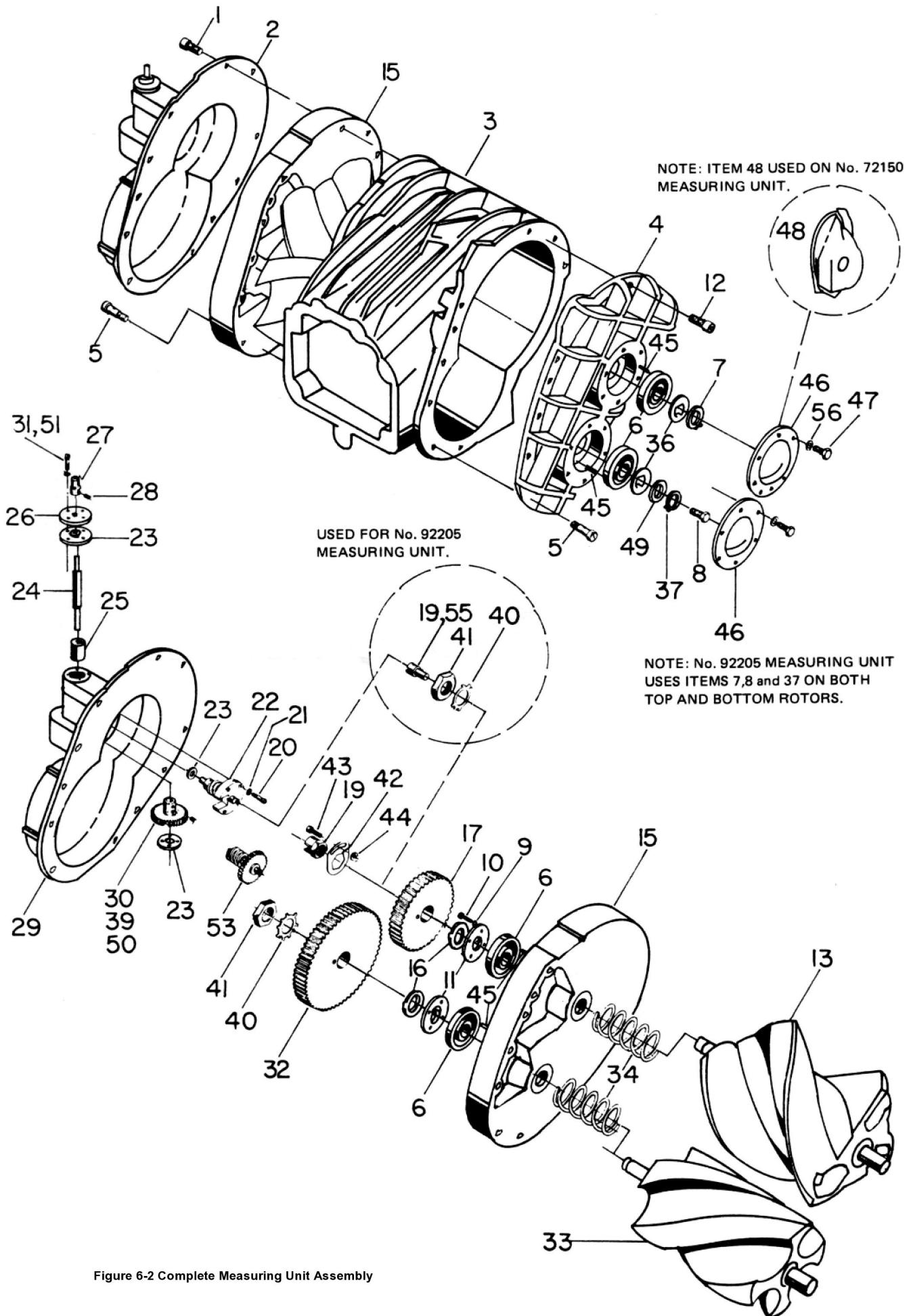


Figure 6-2 Complete Measuring Unit Assembly

Table 6-5 Measuring Unit Parts List - Models B-63DEB, B-64DEB and B-65DEB

Item	Description	Part No.	Req.	Item	Description	Part No.	Req.				
1	Screw	151068	6	28	Set Screw	150975	6				
2	Rear Gear Cover Assy.	1 GPR	62655-005	1	29	Rear Gear Cover	1 GPR	62656-005	1		
		10 GPR	62655-006	1			10 GPR	62656	1		
		10 LPR	62655-007	1			10 LPR	62656	1		
		10 GPR	62655-310	1			30	Worm Wheel	1 GPR	172686-005	1
		1 GPR	62655-305	1					10 GPR	172686	1
			10 LPR	172686-005	1						
3	Meter Body	62212	1								
4	Front End Cover	60130-005	1								
5	Dowel Screw	51567	6								
*6	Ball Bearing	154953	4	31	Screw	150537	4				
7	Retaining Ring	153953	1	**32	Drive Gear (4T)	60596-029	1				
8	Screw	150156	1	**33	Rotor (4T)	63286	1				
9	Lock washer	152254	8								
10	Screw	150943	8								
11	Bearing Retainer	60238-005	2	34	Rotor Spacing Spring	60299-005	2				
12	Allen Head Screw	151010	4	35	Groove Pin	153636-019	1				
**13	Rotor (3T)	63276	1	36	Bearing Key	60238	2				
				37	Lock washer	152270-019	1				
				38	Screw	151034	2				
14	Stub Shaft	51579-005	1	39	Bearing	155169	3				
15	Rear End Cover	60166-005	1	*40	Lock washer	51593	1				
16	Bearing Spacer Key	60294	2	41	Locknut	60592	1				
**17	Drive Gear (3T)	60591-029	1	42	Locknut Retainer	172274	1				
*19	Locknut	172279	1	43	Screw	151029	1				
20	Screw	150536	4	44	Lock washer	152259	1				
21	Lock washer	152259	10	45	Roll Pin	153547	4				
22	Drive Shaft Assy.	1 GPR	62630-005	1	46	Bearing Caps	60539-015	2			
		10 GPR	62630-006	1	47	Screw	150103	7			
		10 LPR	62630-007	1	50	Bushing	172659	1			
		1 GPR	62630-305	1	52	Dowel Pin	153687	1			
		10 GPR	62630-006	1	53	Worm Shaft Assembly	1 GPR	62665-005	1		
23	Washer	151901	5			10 GPR	62665-006	1			
24	Worm Wheel Shaft	172689	1			10 LPR	62655-007	1			
25	Spacer	172691	1			10 GPR	62665-310	1			
26	Gland Assembly	172660	1			1 GPR	62665-305	1			
27	Coupling Jaw	92663	1	56	Lock washer	152253	7				

* Recommended Spare Parts
 **Note: Items 13 and 33 are supplied as a set.
 Items 17 and 32 are supplied as a set.

Table 6-6 Measuring Unit Parts List - Models B-73DEB, B-74DEB and B-75DEB

Item	Description	Part No.	Req.	Item	Description	Part No.	Req.		
1	Screw	151073	5	29	Rear Gear Cover	10 GPR	172601	1	
2	Rear Gear Cover	10 GPR	72655-006	1			10 LPR	172601	1
		10 LPR	72655-007	1	30	Worm Wheel	10 GPR	172 646	1
		10 GPR	72655-315	1			10 LPR	172686-005	1
			10 GPR	172646-003			1		
3	Meter Body	72211	1						
4	Front End Cover	72635-001	1	31	Screw	150537	4		
5	Dowel Screw	51567	6	**32	Drive Gear (4T)	70296-029	1		
*6	Ball Bearing	154952	4	**33	Rotor (4T)	73286	1		
7	Retainer Ring	156474	1						
8	Screw	150156	1						
9	Lock washer	152254	12	34	Rotor Spacing Ring	70299-005	2		
10	Screw	150943	12	36	Bearing Key	72238	2		
11	Bearing Retainer	70238-005	2	37	Lock washer	152270-019	1		
12	Screw	151037	5	38	Dowel Screw	51567	6		
**13	Rotor (3T)	73276	1	39	Bearing	155169	3		
				*40	Lock washer	51593	1		
				41	Locknut	60592	1		
15	Rear End Cover	70166-005	1	42	Locknut Retainer	172274	1		
16	Bearing Spacer Key	72295	2	43	Screw	151029	1		
**17	Drive Gear QT)	70291-029	1	44	Lock washer	152259	1		
*19	Locknut	172279	1	45	Roll Pin	153548	4		
20	Screw	150536	5	46	Front Bearing Cap	72819	1		
21	Lock washer	152259	11	47	Screw	156012	8		
22	Drive Shaft Assembly	10 GPR	172615-006	1	48	Front Bearing Cap	72133	1	
		10 LPR	172615-007	1	49	Washer	151902	1	
23	Washer	151901	5	50	Bushing	172659	1		
24	Worm Wheel Shaft	172689	1	52	Dowel Pin	153687	1		
25	Spacer	172691	1	53	Worm Shaft Assembly	10 GPR	172610-006	1	
26	Gland Assembly	172260	1			10 LPR	62665-005	1	
27	Coupling Jaw	92663	1			10GPR	172610-315	1	
28	Set Screw	150975	6						

* Recommended Spare Parts
 **Note: Items 13 and 33 are supplied as a set.
 Items 17 and 32 are supplied as a set.

Table 8-7 Measuring Unit Parts List - Models B-83DEB, B-84DEB and B-85DEB

Item	Description	Part No.	Req.	Item	Description	Part No.	Req.
1	Screw	151074	11	25	Spacer	172691	1
2	Rear Gear Cover	10 GPR	82655-006	1	26	Gland Assembly	172660
		10 LPR	82655-007	1	27	Coupling Jaw	92663
		HTT-150 - 325°F	10 GPR	82855-306	1	28	Set Screw
3	Meter Body	82816	1	29	Rear Gear Cover	182601	1
4	Front End Cover	80230	1	30	Worm Wheel	10 GPR	182626 -006
5	Dowel Screw	92567	6			10 LPR	102686-001
*6	Ball Bearing	154951	4			HTT-150 - 325°F	10 GPR
7	Snap Ring	156475	1	31	Screw	150537	4
8	Screw	150766	1	**32	Drive Gear (4T)	80296-029	1
9	Lock washer	152258	12	**33	Rotor OT)	83286	1
10	Screw	150611	12		HTT-150-325°F	82286-300	1
11	Bearing Retainer	80288	2	34	Rotor Spacing Spring	80299-009	2
12	Screw	151017	6	36	Bearing Key	82238	2
**13	Rotor (3T)	83276	1	37	Lock washer	152110	1
		HTT-150-325°F	82276-300	1	39	Bearing	155169
15	Rear End Cover	80176	1	*40	Lock washer	82593	1
16	Bearing Spacer Key	82295	2	41	Locknut	82592	1
**17	Drive Gear (3T1)	80291-029	1	42	Locknut Retainer	182274	1
*19	Locknut	182279	1	43	Screw	151029	1
20	Screw	150538	4	44	Lock washer	152259	1
21	Lock washer	152259	10	45	Roll Pin	153539	4
22	Drive Shaft Assembly	10 GPR	18262-r006	1	46	Front Bearing Cap	82817
		10 LPR	182625-007	1	47	Screw	156012
23	Washer	92669	1	49	Washer	151883	1
24	Worm Wheel Shaft	182689	1	50	Bushing	182659	1

* Recommended Spare Parts
 **Note: Items 13 and 33 are supplied as a set.
 Items 17 and 32 are supplied as a set.

Table 8-8 Measuring Unit Parts List - Models B-93DEB, B-94DEB and B-95DEB

Item	Description	Part No.	Req.	Item	Description	Part No.	Req.
1	Screw	151044	11	23	Washer	92669	1
2	Rear Gear Cover	10 GPR	92655-010	1	24	Worm Wheel Shaft	92689
		1 BPR	92675	1	26	Gland Assembly	92660
		HTT-150-3250F	10GPR	92655-310	1	27	Coupling Jaw
3	Meter Body	92211	1	28	Set Screw	150975	6
4	Front End Cover	92231-006	1	29	Rear Gear Cover	92656	1
5	Dowel Screw	92567	6	30	Worm Wheel	10 GPR	92686-006
*6	Ball Bearings	154957	4			1 BPR	92676
7	Snap Ring	92238	2			HTT-150-325°F	10GPR
8	Screw	150766	2	31	Screw	150538	8
12	Screw	151040	6	**32	Drive Gear (4T)	92296	1
**13	Rotor QT)	92276-001	1	**33	Rotor (4T)	92286	1
		HTT150-3250F	92276-301	1		HTT-150-3250F	92286-300
15	Rear End Cover	92266-006	1	37	Lock washer	152110	2
16	Bearing Spacer Key	92295	2	*40	Lock washer	92593	2
**17	Drive Gear (3T)	92291	1	41	Locknut	92592	2
*19	Locknut	92279	1	46	Front Bearing Cap	92239	2
20	Screw	150538	8	47	Screw	1507 6	1
21	Lock washer	152259	10	50	Bushing	92657	2
22	Drive Shaft Assembly	10 GPR	92665-006	1	54	Bearing Dowel	102268
		1 BPR	92680	1	55	Roll Pin	153523
		HTT-150 - 325°F	10 GPR	92665-006	1	56	Lock washer

* Recommended Spare Parts
 **Note: Items 13 and 33 are supplied as a set.
 Items 17 and 32 are supplied as a set.

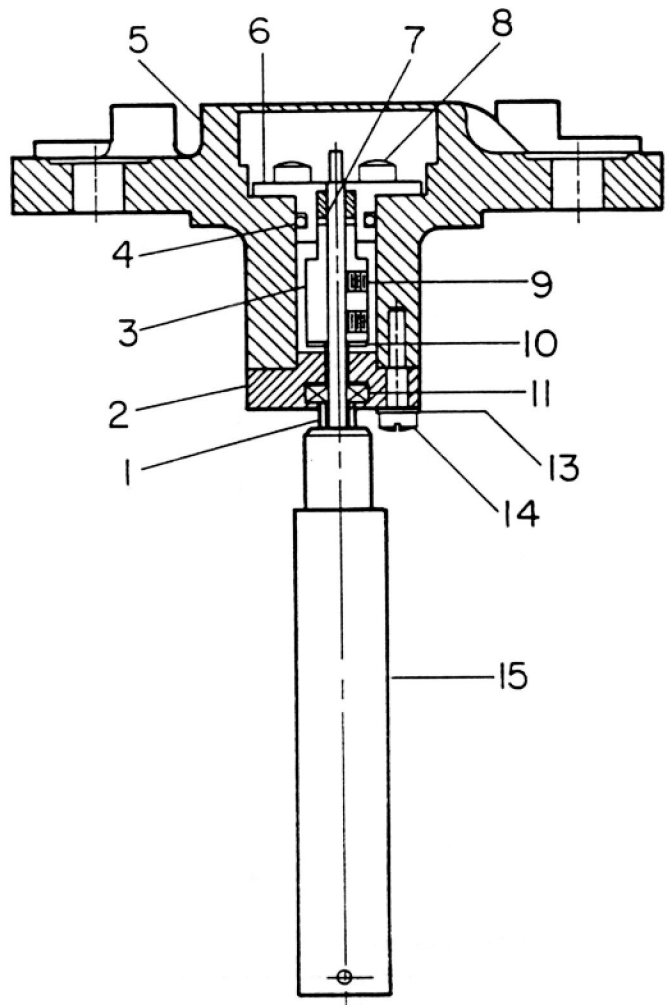


Figure 6-3, Table 6-9 - Counter Base Plate Assembly

Item	Description	Req.	Part Number	
			94150	174150
1	Spacer	1	74166	74166
2	Bearing Housing	1	94177	94177
3	Packing Shaft Positioner	1	93152	93152
4	O-Ring	1	152070-022	152070-022
5	Counter Base Plate	1	53151	53151
6	Packing Gland Assembly	1	43175	43175
7	O-Ring	1	152064-022	152064-022
8	Screw	4	151029	151029
9	Set Screw	2	150969	150969
10	Washer	1	151891	151891
11	Ball Bearing	1	155195	155195
13	Lockwasher	3	152259	152259
14	Screw	3	150537	150537
15	Coupling Tube Assembly	1	92155	173155