

**X-9400**  
**Revision 01**

# ***Oval Gear Meter*** ***Model 9400***

**Installation and Operation Manual**

**BRODIE**  
International<sup>™</sup>  
Engineering the Future



## Essential Instructions

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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 Meter Co., LLC products.

- Read all instructions prior to installing, operating, and servicing the product. If this instruction manual is not the correct manual, telephone 1-912-489-0200 and the requested manual will be provided. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brodie representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by the manufacturer. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.
- Before opening the flameproof enclosure in a flammable atmosphere, the electrical circuits must be interrupted.
- The ATEX approval applies to equipment without cable glands. When mounting the flameproof enclosure in a hazardous area, only flameproof cable glands certified to EN 50018 must be used.
- If replacement of screws that secure the gear housing, sensor housing, UMB, cover, or electric register is necessary, they must be replaced with M6-1 X 16 mm hex socket head cap screws. The screws must be made of 304 stainless steel and have a minimum tensile strength of 125 KSI.
- When installing this equipment, bolting must conform to the requirements of ASME B16.5 paragraph 5.3 and to the material requirements of ASME B16.5 Table 1B. Gaskets must conform to the requirements of ASME B16.20.
- It is the customer's responsibility to ensure that piping or other attachments connected to the BiRotor Meter do not place adverse stresses on the BiRotor Meter. The design of the BiRotor Meter has not been assessed for the effects of traffic, wind or earthquake loading.
- It is the customer's responsibility to provide fire prevention measures and equipment per local regulations.
- The Oval Meter has been designed without allowance for corrosion. The customer should implement a periodic inspection and maintenance program to ensure that no part of the Oval Meter's pressure-retaining components has been subjected to corrosion.
- Use of this equipment for any purpose other than its intended purpose may result in property damage and/or serious personal injury or death.

## Warning

***Do not exceed the maximum working pressure of equipment as stamped on the nameplates. It is the customer's responsibility to install this equipment in a system that provides adequate over-pressure protection.***

## NOTICE

***Lines should be flushed thoroughly to rid piping of potentially damaging foreign material such as welding bead, pipe scale, etc. before the equipment is placed in service. A strainer of proper size should be installed upstream of the valve to protect it from the introduction of foreign material.***

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**Brodie Meter Co., LLC  
Statesboro, Georgia, USA**

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## Brodie Meter Three-Piece Oval Flowmeter Model Number System

The model number consists of 12 numbers as designated in the table below. EX: 94 57 F B 7 C 1 A 3 A

<b>9400</b>	<b>BASIC MODEL NUMBER</b>			
<b>CODE</b>	<b>BASE METER BY SIZE: Includes register adaptor &amp; gear box with fixed adjustor</b>			
2	1/2"			
53	1"			
55	1"			
56	1- 1/2"			
57	2"			
59	3"			
<b>CODE</b>	<b>REVISION LEVEL</b>			
F	Three Piece Construction			
<b>CODE</b>	<b>CONNECTION TYPE</b>			
B	150 lb. ANSI RF Carbon Steel Flanges (Std.); Max. Working Pressure 285 psi at 100 F			
D	300 lb. ANSI RF Carbon Steel Flanges (Std.); Max. Working Pressure 740 psi at			
H	150 lb. Tri-clover with 125 reamed inlet and outlet - for CIP (Clean-in-place) food			
<b>CODE</b>	<b>COUPLING</b>			
7	Magnetic Type 7			
<b>CODE</b>	<b>HOUSING and COVER MATERIAL</b>			
C	316 Stainless Steel			
D	Carbon Steel			
F	Alloy 20			
<b>CODE</b>	<b>GEAR MATERIAL.</b>			
1	316 Stainless Steel (Not for use with Alloy 20 Housing and Cover)			
4	316 Stainless Steel (Voidless for Clean-in-place - For Stainless Steel Housing			
5	Alloy 20 (For 20 Housing and Cover only.)			
<b>CODE</b>	<b>GEAR ASSEMBLY CONSTRUCTION</b>			
	<b>BEARING</b>	<b>MAGNET</b>	<b>SHAFTS</b>	<b>TYPE</b>
A	Carbon	Ceramic	Stn. Stl.	Std. Viscosity (1)
B	Carbon	Ceramic	Stn. Stl.	Std. Viscosity (1) Class "C"
C	Carbon	Ceramic Encd	Stn. Sti.	Std. Viscosity (1)
L	Carbon	Ceramic	Stn. Stl.	High Viscosity (2)
M	Carbon	Ceramic	Stn. Stl.	High Viscosity (2) Class "C"
R	Waukesh	Ceramic	Chrom. Plt.	Std. Viscosity 0)
T	Waukesh	Ceramic	Chrom. Pit.	High Viscosity (2)
	(1) Standard Viscosity for products up to 300 centipoise.			
	(2) High Viscosity for products above 300 centipoise			
	Gears noted Class "C" are for process temperatures to 400F (204C).			
	If not noted, gears are Class "A" for process temperatures to 2301F (115C)			
<b>CODE</b>	<b>O-RINGS</b>			
2	Viton			
3	Teflon			
7	Silicon (FDA approved for clean-in-place service)			
8	EPR			
<b>CODE</b>	<b>VARIATIONS</b>			
A	None			
B	High Temperature to 4001F (204C), Class "C"			
E	Thermonized Class "A", to 230OF (115F)			
F	Thermonized Class "C", to 400OF (204C)			
R	Dual Magnets in Rotor and on Following Shaft			

## 1.0 Oval Flowmeter Series 9400

### 1.1 Purpose

Brodie Flowmeters, hereafter called flowmeters are positive displacement meters that accurately measure liquid flow. Total flow is indicated on a totalizing type register and, through the use of accessories, provides pulse and rate outputs.

### 1.2 Description

Flowmeters are of simple and rugged construction. Precision machined oval-shaped rotors are used as metering elements which ensure minimum slippage, high accuracy and virtual immunity to changes in viscosity.

### 1.3 Specifications

The following specifications apply to all Flowmeters. Where there is a difference between models, it will be so noted.

Pressure Ratings: See Table 1.2

### Warning

Do not use this meter in excess of these specified values. Failure to stay within values may result in personal injury and/or damage to the equipment.

### 1.4 Materials of Construction

See Table 1.1

#### Maximum Safe Working Temperature

For standard "Class A" construction 230°F (110°C) For higher temperatures, special clearance rotors, high temperature magnetic follower and register extension are required. Meters are available with optional high temperature trim for "Class C" construction 230° to 392°F (110° to 200° C). For high temperature trim, use all stainless steel meters.

#### Minimum Operating Temperature

0°F. (-18°C.). Lower temperature is possible. Consult factory.

#### Performance

Accuracy: ± 0.5% on viscosities from 0.2 to 5 centipoise and Class C.

± 0.25% for viscosities of 5 centipoise and above  
Repeatability: ±0.05%

Accuracy and Pressure Drop Curves: See Fig. 1-1 Capacities: See Table 1-4

Dimensions: See Figure 1.2

Strainer Specifications: See Table 1.3

Table 1.1 Materials of Construction

Housing	Rotors	Shafts	Bushings	O-rings
316 Stn. Stl.	316 Stn. Stl.	316 Stn. Stl.	Hard Carbon	Viton

Note: Available for Models 9402, 9453, 9455 and 9456 only. (316 Stainless Steel is alloy CF-8M Stainless Steel)

Table 1.2 Pressure Ratings

Materials of Construction	ANSI Conn. Flange	Pressure Rating at 100°F (38°C.)	
Steel	150 RF	285	1965
Steel	300 RF	740	5102
316 Stn. Steel	150 RF	275	1895
316 Stn. Steel	300 RF	720	4960

Table 1.3 Strainer Specifications

Connection Size	Model Number	Mesh	Microns
1" & 1-1/2"	9455 & 9456	60	250
2" & 3"	9457 & 9459	40	350
1/2" & 1"	9402 & 9453	80	150

Table 1.4 Flowrange

Capacities (USGPM) Refer to Tech Bulletin T-067 for comprehensive flow data

Conn. Size (in.)	Model No.	Cold Water	Hot Water 140-230T.	LPG 0.2 cP	Gasoline 0.3-0.7 cP	Kerosene 0.7-1.8 cP	Light Oil 2-4 cP	Heavy Oil 5-300 cP
1/2	9402	1.3-6.6	1.8-4.4	3.1-7.9	1.8-7.9	1.3-7.9	0.7-8.8	0.4-8.8
1	9453	2.7-13.2	3.1-8.8	4.8-15.9	3.1-15.9	2.4-15.9	1.2-17.6	0.7-17.6
1	9455	4.4-30.8	5.3-22	7.9-37.4	5.3-37.4	4.4-37.4	1.8-44	1.1-44
1 1/2	9456	8.8-61.6	11-44	15.4-74.9	11-74.9	8.8-74.9	4-88.1	2.6-88.1
2	9457	17.7-132.1	22-88.1	35.2-154.1	22-154.1	17.6-154.1	8.8-176.1	5.3-176.1
3	9459	35.2-264.2	44-176.1	66-308.2	11-308.2	35.2-308.2	26.4-396.3	17.6-396.3

Note: Intermittent Service, eight to ten hours per day. For continuous service on non-lubricating products, multiply maximum flow by 0.67. Capacities (Liters/Minute)

Capacities (Liters/Minute)

Conn. Size (in.)	Model No.	Cold Water	Hot Water 140-230T.	LPG 0.2 cP	Gasoline 0.3-0.7 cP	Kerosene 0.7-1.8 cP	Light Oil 2-4 cP	Heavy Oil 5-300 cP
1/2	9402	5-25	6.7-16.7	11.7-30	6.7-30	5-30	2.6-33.3	1.5-33.3
1	9453	9.2-50	11.7-33.3	18.3-60	11.7-60	9.2-60	4.5-66.7	2.6-66.7
1	9455	16.7-116.7	20-83.3	30-141.7	20-141.7	16.7-141.7	6.7-166.7	4.3-166.7
1-1/2	9456	33.3-233.3	41.7-167	58.3-283.3	41.7-283.3	33.3-283.3	15-33.3	10-333.3
2	9457	66.7-500	83.3-333.3	133.3-583.3	83.3-583.3	66.7-583.3	33.3-66.7	20-666.7
3	9459	133.3-1000	166.7-666.7	250-1166.7	166.7-1166.7	133.3-1166.7	100-1500	66.7-1500

Figure 1.1 Characteristics Accuracy and Pressure Drop Curves

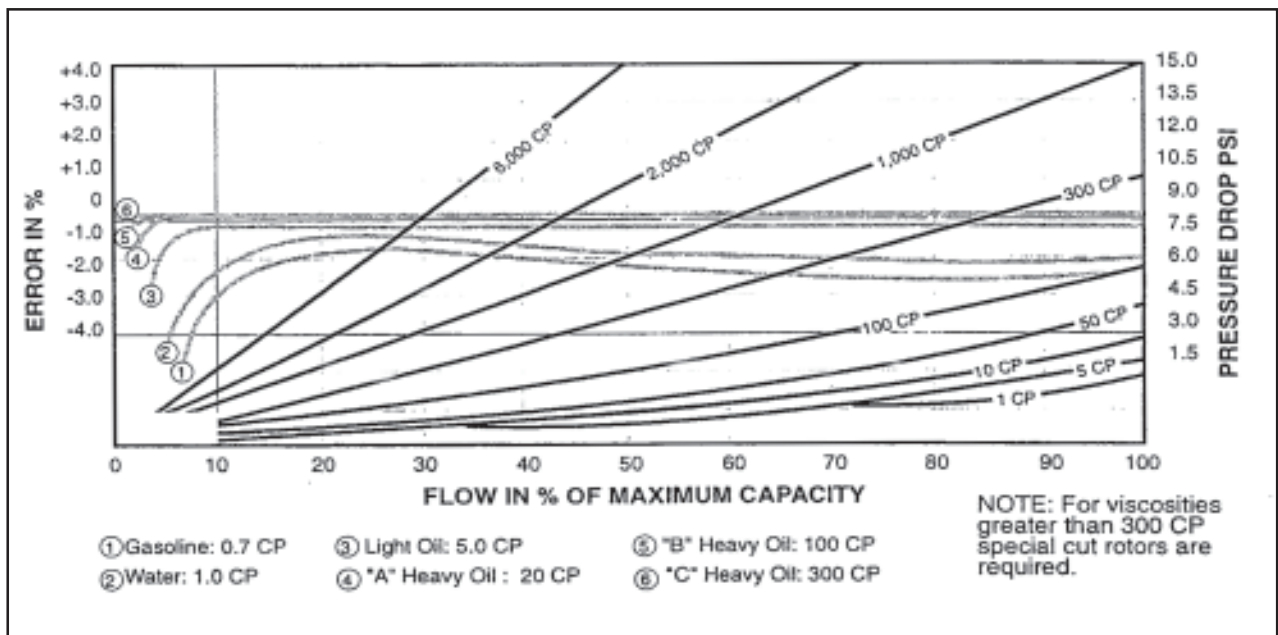




Figure 1.2 Dimensions for 9400 Models

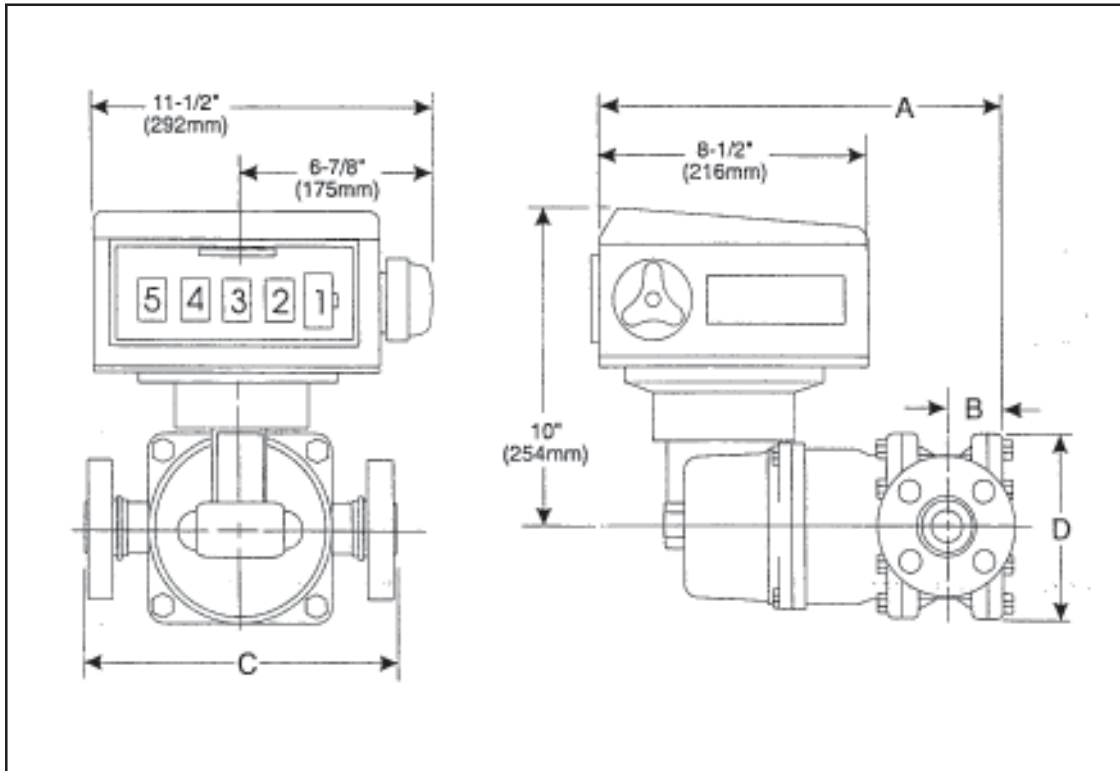


Table 1.5 Dimensions

MODEL	DIMENSIONS								STRAINER		SHIPPING WEIGHT		SHIPPING CUBE	
	A		B		C		D		Mesh Size	Microns Approx.	lbs.	kilo.	Ft3	M3
	Inches	mm	Inches	mm	Inches	mm	Inches	mm						
9402	12-1/16	307	1-1/4	31	4-13/16	222	4-13/16	122	80	150	33	14.97	1.58	0.045
9453	13	330	1-11/16	43	4-13/16	222	4-13/16	122	80	150	48	21.77	1.81	0.051
9455	13-5/8	347	2	51	6	222	6	152	60	250	64	29.03	1.93	0.054
9456	14-7/8	378	2-9/16	65	7-1/8	254	7-1/8	181	60	250	79	35.83	2.19	0.062
9457	16-1/4	413	3-1/2	89	9-15/16	349	9-15/16	252	40	350	159	72.12	2.99	0.085
9459	19-1/8	486	4-3/4	121	13-3/4	441	13-3/4	349	40	350	259	117.48	4.84	0.137

(For Certified Dimension Prints, consult factory)

## 2.0 Installation

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### 2.1 General

This section contains the procedures for the receipt and installation of the flowmeter.

### 2.2 Receipt of Equipment

When you receive your meter, inspect the outside of the packing case for damage which may have been incurred during shipping. Damage incurred during shipment is the responsibility of the carrier and is not part of the factory warranty. If the package is in good condition, remove the envelope containing the packing list and carefully remove the meter, and all components included in the shipment, from the packing case. Inspect for damaged or missing parts, referring to the packing list, prior to discarding the packing material. If items are missing from your shipment, contact your sales representative. Your sales order number will be required.

if the packing case is damaged, notify the local carrier immediately. If the meter must be returned to the factory for repair or replacement, a *Returned Materials Report (RMR) must be included with the meter or components*. RMR forms may be obtained from your sales Department. In addition to the RMR, a Material Safety Data Sheet and a Decontamination Statement must be included with items being returned to the factory.

A Decontamination Statement is included in the back of this manual for your convenience.

### 2.3 Return Shipment

To be able to process return 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, correction action, if any, to be taken, 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, P.O. Box 450, Highway 301 N., Statesboro, Georgia, 30459.

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.

*Equipment returned to the factory without proper documentation will be returned to sender at their expense.*

#### Ship the container to:

Brodie Meter Co., LLC  
Product Service Department  
19267 Hwy. 301 North  
Statesboro, GA 30458  
Telephone: 1 912 489 0200  
Fax: 912 489 0435

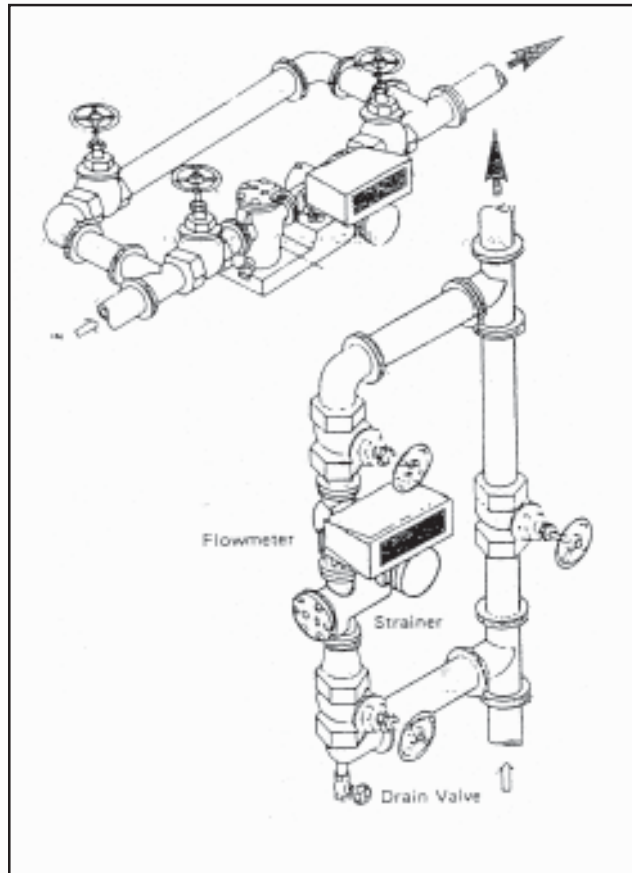
### 2.4 Recommended Procedures

Prior 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.
2. The flowmeter must be installed so the shafts of the rotors are horizontal, never vertical or "on end." (See Figures 2.1, and 3.2.) Severe damage to components may be the result.
3. A strainer should be installed upstream and adjacent to the flowmeter to protect it from foreign matter such as dirt, pipe scale or welding splatter. Refer to Table 1.3 for strainer data.
4. Valves should be installed to facilitate removal of the flowmeter and strainer.
5. Install flowmeter on the discharge side of a pump wherever possible.
6. Remove the protective covering from the flowmeter flanges before installation.
7. LDR counters can be rotated and secured in any of eight positions.

8. The flowmeter should be installed in an area that has a clean, dry atmosphere and is relatively free from excessive vibration.

Figure 2.1 Horizontal and Vertical Installations



## 2.5 Horizontal Installation

(See Figure 2.1)

When the flowmeter is installed in the main flow line it is recommended that a by-pass line and three valves be provided as shown in Figure 2.1. The by pass permits removal of the flowmeter and cleaning of the strainer without shutting down the system. Three valves are required as shown in Figure 2.1. The valves permit system start up when the flowmeter is used with high temperature liquids. The valves also control initial flow surges that could damage flowmeter components. This is especially important during start up when the lines are filled with air. Over speeding and/or running the flowmeter without liquid lubrication will damage flowmeter components.

## 2.6 Vertical Installation

(See Figure 2.1)

When the flowmeter is installed in a vertical pipeline, it is recommended that a by pass line and three valves be provided as shown in Figure 2.1.

The vertical installation has the advantage of reducing the amount of pipe scale or foreign matter than could pass through the flowmeter.

The valves permit system start up when the flowmeter is used with high temperature liquids. The valves also protect the flow meter from initial flow surges that could damage flowmeter components from thermal shock.

## 3.0 Operation

### 3.1 General

The flowmeter has been completely assembled, checked and calibrated at the factory. Under normal circumstances, no adjustments should be required. Since the flowmeter is calibrated as a complete unit, it is normal for the register to indicate other than zero. Do not attempt to start the system until the flowmeter has been permanently installed. It is extremely important that the start up procedures be followed in the exact sequence presented. Permanent damage to the flowmeter components may result unless the procedures are followed.

### 3.2 Principle of Operation

See Figure 3.1 and 3.2

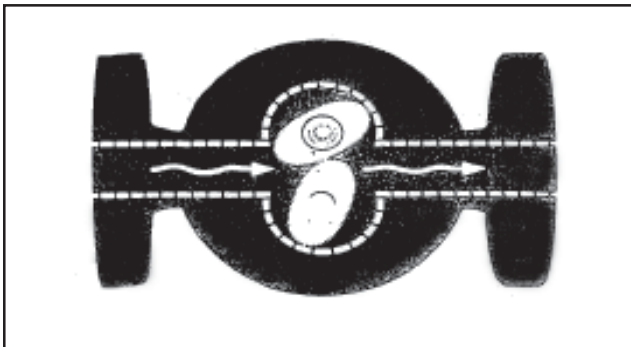
The Oval Flowmeter accurately measures liquid flow by using a slight pressure differential to rotate a pair of oval gears. The meshed gears seal the inlet from the outlet flow, developing the pressure differential. When in the position shown in Figure 3.1, Diagram 1, all of the driving torque resulting from the differential pressure is applied to Gear A. Gear B has zero driving torque since equal areas of gear surface on opposite sides of the axis of rotation are exposed to the higher inlet pressure. As the gears begin to rotate (see Diagram 2), the torque applied to Gear A decreases, but Gear B now has driving torque,

due to the increased area exposed to the high pressure. At the position shown in Diagram 3, all of the driving torque is exerted on Gear B and Gear A has decreased to zero. This alternate driving action provides a smooth rotation of almost constant torque without dead spots. Diagrams 4 through 9 illustrate this principle through a complete cycle bringing Gear A back to its original position.

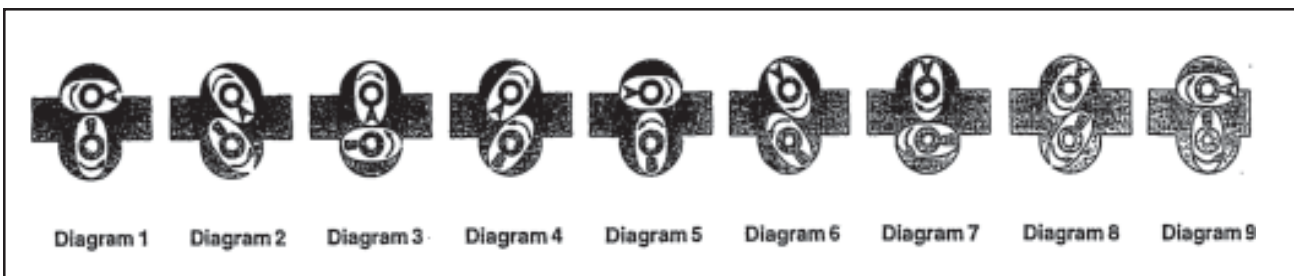
As the gears rotate, they trap precise quantities of liquid in the crescent shaped gaps of the measuring chamber. The total quantity of flow for one rotation of the pair of oval gears is four times that of the crescent shaped gap. The rate of flow is proportional to the rotational speed of the gears. Because the amount of slippage between the oval gears and the measuring chamber wall is minimal, the meter is essentially unaffected by changes in viscosity and lubricity of the liquids.

An output shaft is rotated in direct proportion to the oval gears by means of a powerful magnetic coupling. The output shaft drives a gear train that provides meter registration in engineering units of gallons, liters, pounds, etc.

**Figure 3.2**  
**Oval Gear Flowmeter, Pictorial Diagram**



**Figure 3.1 Principle of Operation**



### 3.3 Pre Operation Procedure

After the flowmeter has\* been installed as described in Section 2, slowly allow the liquid to flow in the by pass section of a horizontal installation or the main line of a vertical installation. This will clear the line of any foreign particles.

Caution must be taken so that flow rate, pressure and temperature are within recommended specifications. When the flowmeter is used with high temperature liquids, refer to special start up procedures in Paragraph 3 5. No other special operating procedures need to be observed, except to insure the metered liquid is clear of foreign particles which may damage the flowmeter.

### 3.4 Normal Start Up Procedure

After the lines have been cleared, proceed as follows:

- a. SLOWLY open the inlet valve.
- b. SLOWLY open the outlet valve.
- c. Completely close the by pass valve.
- d. Make sure that temperature, pressure and flow rate are within the recommended specifications.

### 3.5 Higher Temperature Start Up Procedure

On temperature service above 150°F. (based on ambient temperature of 70°F.), special start up procedures are required to prevent permanent damage to flowmeter components. The following equation may be used to determine the approximate flowmeter warm up time. A similar procedure should be followed on any thermal shock in excess of 80F.

$$\text{Warm Up Time (Hrs.)} = \frac{\text{Nom.Conn.Size} \times (\text{Oper.Temp. } ^\circ\text{F.} - 150)}{100}$$

- Valve No. 1 and Valve No. 2 must be tightly closed.
- Valve No. 3 should be opened in gradual steps until by-pass piping is stabilized at operating temperature and valve is fully open.
- With Valve No. 3 open and Valve No. 2 closed, very a slightly open Valve No. 1. Allow temperature to stabilize around the flowmeter. Open Valve No. 1.
- Open Valve No. 2 approximately 5%, just slightly admitting flow through the flowmeter.

**Caution**

If flowmeter rotors bind or make excessive noise at this time, DO NOT change valve positions. When temperature has fully stabilized within the flowmeter, normal operation will occur. Do not open Valve No.2 any further until flowmeter rotors are turning freely.

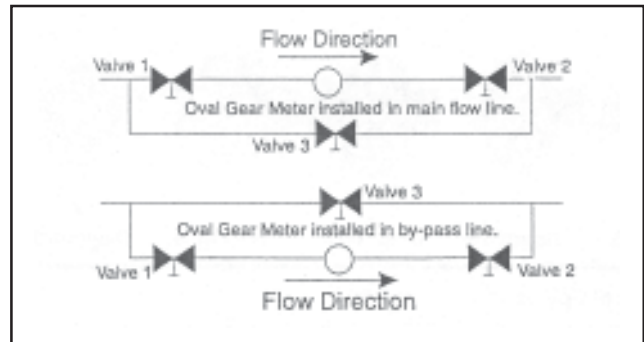
- With the flowmeter rotors operating normally, gradually open Valve No. 2 in small increments until the valve is fully open.
- Gradually close Valve No. 3.

**NOTE: The above procedure must be followed each time the flowmeter is started from ambient to operating temperatures above 150°F.**

### 3.6 Flowrate Determination

The flowrate may be determined without the use of test equipment. A stopwatch is the only aid required. The stopwatch is used to determine the elapsed time of a predetermined number of register pointer revolutions. The elapsed time should be sixty (60) seconds or more and the minimum number of register pointer revolutions should be three (3). A minimum of three runs should be made for greater accuracy. Using the following information as an example, solve the equation to derive actual flowrate.

**Figure 3.3 High Temperature Installation**



- Flowmeter maximum flowrate = 32 gpm
- Register pointer revolutions = 3
- Register Graduations = 1 revolution equals ten gallons
- Indicated Volume = 30 gallons
- Elapsed Time = 81.8 seconds

IF: Flowrate (Gal./Min.) =

$$\frac{\text{Indicated Volume (Gal.)} \times 60 \text{ Sec./Min}}{\text{Elapsed Time (Sec.)}}$$

THEN: Flowrate (Gal./Min.) =

$$\frac{30 \text{ Gallons} \times 60 \text{ (Sec./Min.)}}{81.8 \text{ (Sec.)}}$$

OR: Flowrate = 22 gpm

### 3.7 Accuracy Adjustor

Accuracy adjustment can be accomplished by using one of two methods. The standard accuracy adjustor is a fixed gear train in the new gear box. For calibration purposes, the fixed gear train can be easily removed for substitution of a different fixed gear train. In addition to the standard adjustor, an optional Model 4200 Adjustor is necessary for applications where various viscosity products will be measured through one meter or for fine adjustment.

### 3.8 Accessories

The Oval Meter may be mounted to the complete Brodie Meter line of accessories with the design of the new oval gear box. Reference Page 18 for the typical accessory combinations that may be applicable to your meter.

## 4.0 Maintenance

### 4.1 General

No routine maintenance, cleaning or lubrication is required on the flowmeter. The user should establish a schedule for periodic checking and cleaning of the strainer.

### 4.2 Manufacturer's Maintenance Recommendations

The following items apply to all flowmeters. Users must give careful consideration to the consequences that may be the result of failure to follow manufacturer's recommendations.

- No attempt should be made by the user to alter any physical dimension of the flowmeter or component part.
- Do not use force to assemble or disassemble any component of the flowmeter. All components are machined to exact tolerances.
- When an unserviceable flowmeter has been returned to the factory for rework, it must be understood that in extreme cases it may be economically impractical to repair the flowmeter.
- No attempt should be made by the user to replace the rotor bearings. Rotors and bearings are manufactured as a subassembly and are available as replacement or spare parts.

### 4.3 Disassembly

#### Warning

It is not necessary to remove the flow meter from the pipeline for disassembly. Read the ENTIRE procedure for disassembly before making ANY attempt to disassemble the meter. Serious personal injury or damage to the meter can result if it is improperly handled.

Before proceeding with any disassembly, be certain to:

- Close all valves and isolate the meter from line pressure or back pressure.
- If used at elevated temperatures, reduce the temperature of the meter, including internals, to ambient.

- Disconnect all electrical lines to or from the meter.
- CAUTION: If the meter has been used for corrosive, toxic or other dangerous liquids, follow the procedures outlined in Subpart I, Sections 1910.132 through 1910.140 of the Occupational Safety and Health Standards, Federal Register No. 202-Pt II-1, or subsequent changes thereto.**
- Reduce the pressure inside the meter to zero by completely draining that part of the process line which is isolated with the meter. It is recommended that product be removed through the strainer, drain plug or device other than the meter for this purpose. If pressure must be reduced through the flowmeter, very slowly and carefully loosen the hex screws of the bottom flange (Figure 6-2, Items 6 and 9) until the meter begins to drain and pressure is reduced to zero. **Refer to CAUTION in Item 4 above.**
- Drain the flowmeter completely by removing the bottom flange (Item 6). **CAUTION:**

Figure 4.1

Oval Gear Flowmeter With One Rotor Installed

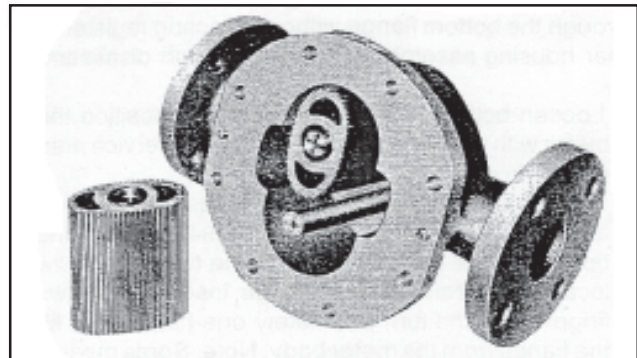
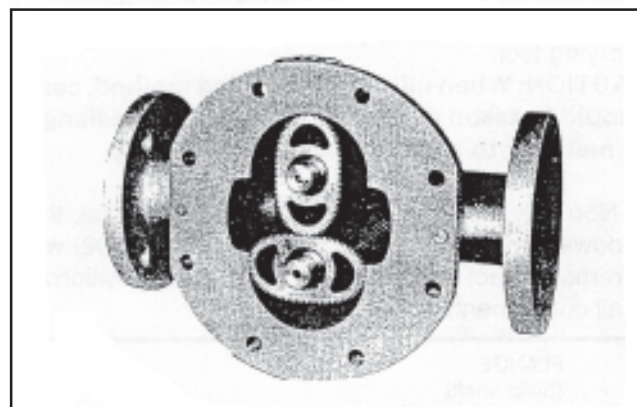


Figure 4.2

Oval Gear Flowmeter With Both Rotors Installed



**Extreme care should be taken as the crescent shaped pockets of the measuring chamber may still contain liquid.**

7. Disconnect all tubing and/or wiring from the meter mounted accessories.

#### 4.4 Procedure

### Caution

Never use any gripping tool or any internal component of the meter assembly. Do not drop any part of the meter as damage may occur. The meter is made up of sub-assemblies which can be serviced independent of the meter.

When disassembling the gear box or removing the register, avoid breaking the meter apart at the meter body and register adaptor, as reassembly requires the gear box to be separated from the register adaptor and an involved meshing of the idler gear with the output gear. Changing the register DOES NOT require the meter to be disassembled.

The meter can be disassembled in the line as

well as removed from the line with access to the bottom flange (Item 6). Utilizing the two jack screw locations on the face of the flange, insert cap screws finger tight and turn alternately one-half turn to lift the flange from the meter body.

Note: Some models may have slotted depressions for the flange removal. In such a case, gently pry the flange from the face of the meter body using an appropriate prying tool.

### Caution

When utilizing the prying method, care should be taken not to score the face of the flange or meter or to damage the sealing O-Ring.

3. Normally, upon removal of the bottom flange, the dowel pins (Item 4) and rotor shafts (Item 32) will remain intact with the meter body. Note position of all components.
4. DO NOT remove Oval Gear Rotors (Item 5)

from their shafts unless necessary as placement is critical to timing. If removal or replacement is required, note timing marks on the face of each rotor and mark clearly.

5. For complete measuring unit disassembly, re-move thrust washers (Item 35), oval gears (Item 5) and rotor shafts (Item 32) using a gentle rocking motion.

### Caution

Never use gripping tools on internal components of the measuring unit.

6. Inspect all internal parts for damage and wear.

For service or replacement of parts from the register adaptor side of the meter or to disassemble or disengage the register and register adaptor from the meter body (Reference Figure 6-2):

1. Loosen the three setscrews (Item 26) of the register adaptor assembly and lift straight out to disengage gearing. (Models 9453, 9455, 9456, 9457 and 9459.
2. Proceed to the meter for disassembly.
3. Remove cap screws (Item 10) from the driving rotor flange (Item 12). Remove and inspect O-Ring (Item 11).
4. The follower magnet shaft (Item 8) may be removed at this time.
5. Remove hex screws (Item 9) from the top/front flange (Item 31). Using jack screws or prying tool (when the meter body is recessed for flange removal), alternate sides and lift the end flange away from the meter body. (Reference Step 2, "Access Through Bottom Flange.")
6. For complete measuring unit disassembly, locate and clearly mark timing marks of the oval gears. Remove thrust washers (Item 35), oval gears (Item 5) and rotor shafts (Item 32) using a gentle rocking motion.
7. Inspect all internal parts for damage or wear.

#### Register Adaptor Disassembly

1. Remove hex screws from gear box assembly and lift straight out to disengage adaptor coupling (Item 21).
2. Remove roll pin (Item 20, coupling (Item 21) and crescent snap ring (Item 22) to dislodge transmission shaft assembly (item 24) from adaptor housing (Item 18).
3. To replace idle gear assembly (Item 25), remove self-locking nut (Item 19), washer (Item 17), idle shaft spacer (Item 16) and snap ring (Item 19).
5. Place the remaining rotor, having an internal magnet and one timing mark, on the hollow rotor shaft with the timing mark facing out in a horizontal (6 o'clock) position as shown in Figure 4-2 and 4-3. Check for proper rotor mesh by turning the rotors one or more complete revolutions. If the mesh is not proper, disengage one of the two oval rotors, rotate one tooth in either direction, re-engage and check for proper mesh. Continue this procedure until a proper mesh is established allowing free-turning rotors for one or more revolutions.

#### 4.5 Reassembly

It is recommended that new O-Rings be installed following each disassembly to protect integrity of the meter seal.

1. Orient the meter in such a way as to have the measuring cavity facing up and out.
2. Press the rotor shafts (Item 32) into the bores provided in the meter body using a lock-tight securing compound. Reference Figure 4-3 for proper Installation of the hollow rotor shaft and magnetic rotor. The flow arrow indicates the proper orientation. The open end of the hollow shaft is to face toward the register output shaft.
3. Install one thrust washer (Item 35) on each shaft.
4. Place the rotor (Item 5) with two timing marks facing out, on the solid rotor shaft (Item 32) in a vertical position (12 o'clock).
6. Install the two remaining thrust washers (Item 35), one on each shaft.
7. Place O-Ring (Item 34) into the bottom flange (Item 6). Lightly lubricate the O-Ring to assist in assembly.
8. Carefully line up blind holes in the flange face with the dowel pins in the meter body. Insert hex screws (Item 9) and alternately draw the bottom flange onto the dowel pins and flush with the meter body.

Figure 4.3 Timing Flowmeter Rotors

(view from bottom flange)

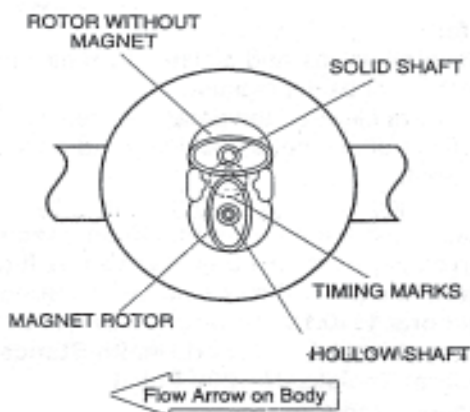
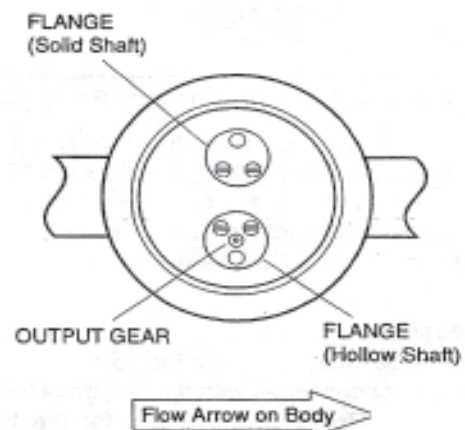


Figure 4.4 Rotor Position Check

(view from register)





**Continue for Reassembly of Meter/Register Adaptor**

9. Return the following magnet shaft (Item 8) to its original position.

10. Replace O-Ring (Item 11).

11. Secure driving rotor flanges (Item 12) to the face of the top flange using cap screws (Item 10) and replace the output gear assembly (Item 13) if originally removed.

12. Reassemble register adaptor, as required, by referencing Items 3, 2 and 1 of the Register/ Adaptor Disassembly procedure outlined above. Assure that all mechanical connections are fastened securely.

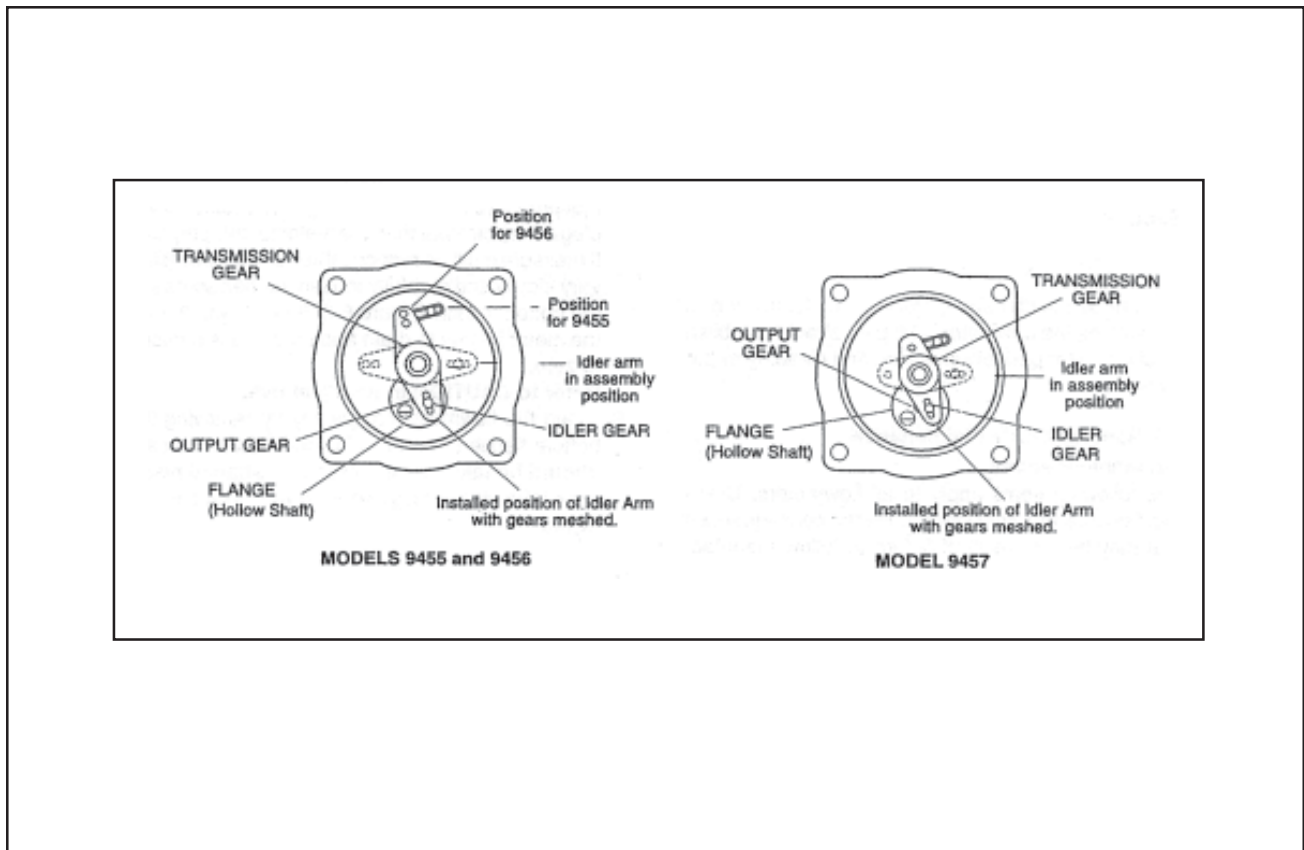
13. Align gearing to register adaptor and re-engage meter body. Secure in place using set screws (Item 26).

**NOTE: All gear meshes should be lubricated using a silicone base lubricating grease.**

**Table 4.1 Torque Value for End Flanges**

Model	Torque Value
9402	23.4 ft.-lbs.
9453	24 ft.-lbs.
9455	24 ft.-lbs.
9456	35 ft.-lbs.
9457	104 ft.-lbs.
9459	174 ft.-lbs.

**Figure 4.5 Register Adaptor Installation**



## 5.0 Troubleshooting

### 5.1 General

The troubleshooting table is presented as an aid in locating and correcting operational problems in the meter. The user must understand that every possible problem could not be listed. However, the table will provide adequate information for general field repairs.

### 5.2 Metering Error

The actual volumetric flowrate of the flowmeter may be determined in the field by the user. It must be noted that the accuracy depends on the type of test equipment and the method of performing the operation. If an error is noted, the following conditions may exist:

- a. Errors of measurement may be attributed to air in a pipeline before the flowmeter or evaporation of highly volatile liquid in the pipeline. Piping should be evaluated and redesigned if necessary.
- b. Errors in flow measurements caused by temperature differences between the liquid in the flowmeter and liquid in the prover. If there is any difference, it must be converted to a base temperature.
- c. When oil or caustic soda is measured, care must be exercised in weight conversion or temperature compensation.

## 6.0 Parts List

### 6.1 General

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

- a. Part number and description
- b. Model number of flowmeter
- c. Serial number of flowmeter
- d. 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.

- a. Item number and description
- b. Specific material of item
- c. Model number of flowmeter
- d. Serial number of flowmeter
- e. Quantity required

**Table 5.1 Troubleshooting**

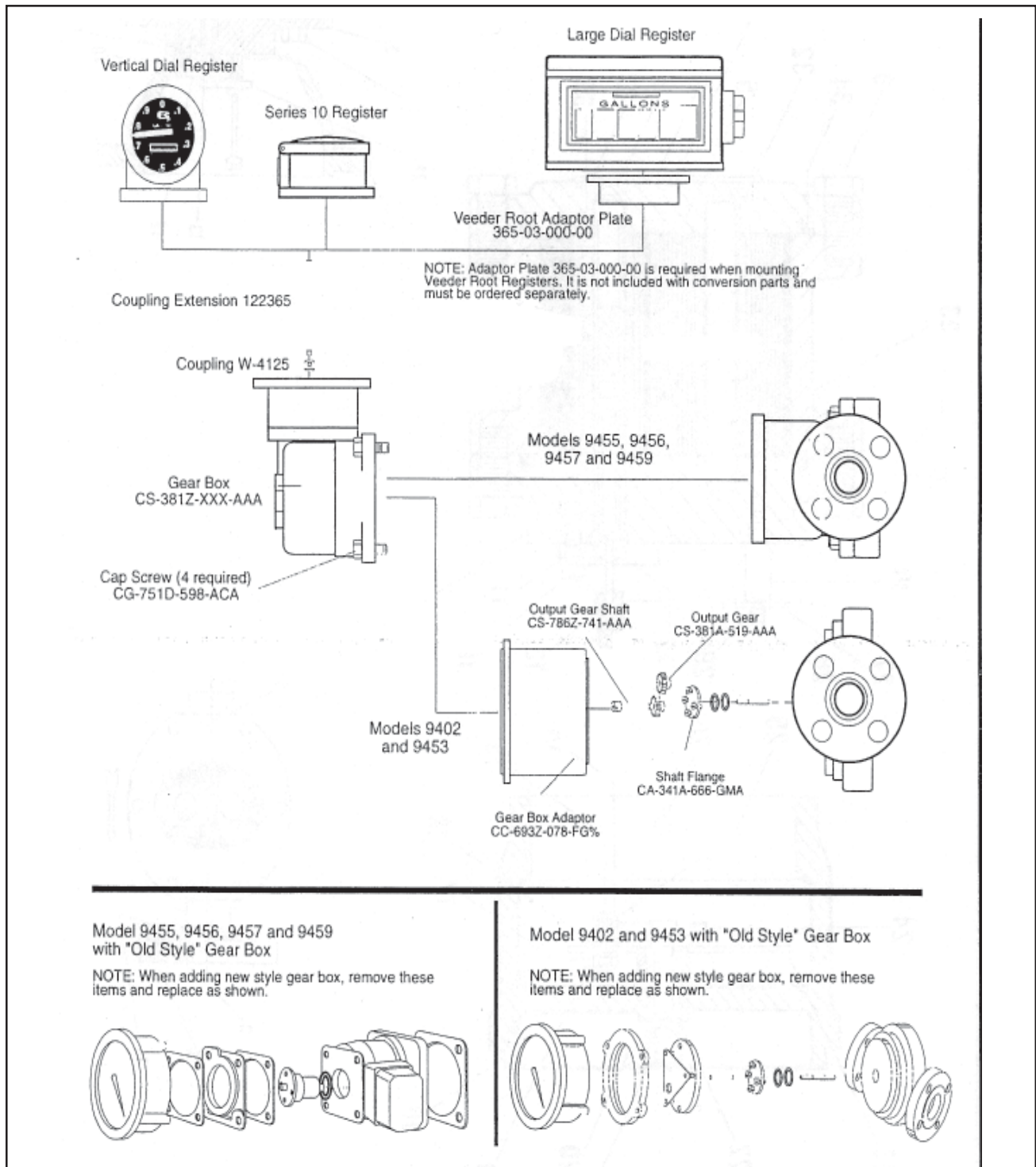
Symptom	Possible Cause	Service Required
No Flow through flowmeter or high pressure drop is noted.	1. Foreign particles or solidified matter in measuring chamber. 2. Inoperative rotors.	1. Flush chambers with suitable solvent. 2. Replace rotors.
Flow but no indication.	1. Inoperative gear box. 2. Inoperative accuracy adjustor. 3. Inoperative register drive assembly.	1. Replace gear box. 2. Replace accuracy adjustor. 3. Replace register drive assembly.
Flowmeter indicates low compared to actual flow.	1. Leaky by-pass valve. 2. Worn, chipped or corroded rotors or case. 3. Flow is below specified rate. 4. Magnetic coupling shaft assembly slipping or gear train intermittently binding.	1. Repair or replace defective valve. 2. Repair or replace rotors or case. 3. Increase flow rate. 4. Repair or replace magnetic coupling shaft assembly, rotors shafts.
Flowmeter indicates high compared to actual flow.	1. Air in line or in liquid. 2. Pulsating flow rate causes erratic electrical pulse output and indicates high. 3. Remote rate indicator defective.	1. Purge all air from line or liquid. 2. Reduce or eliminate pulsating flows. 3. Check zero and span adjustment. 4. Check transmitter.

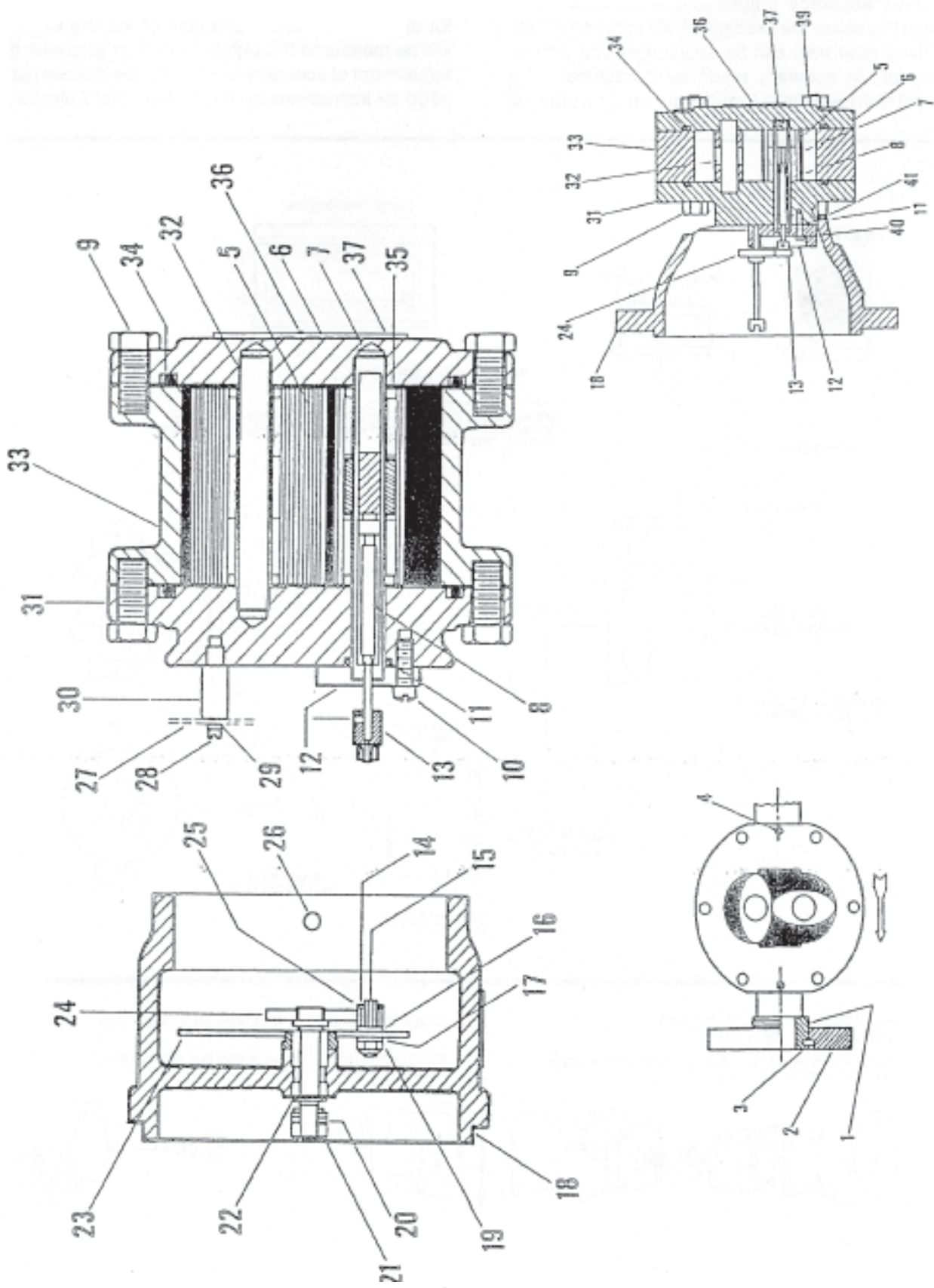
## 6.2 Basic Mechanical Registration

Standard accuracy adjustment is accomplished through the use of the fixed geartrain in the gear box. The fixed gear train can be easily removed and an adjustment in accuracy made by substitution of a different fixed geartrain. In

addition to this, an optional externally-mounted Model 4200 Adjustor is available for applications where products of varying viscosity will be measured through the meter or wherever fine adjustment of accuracy is desired. See Bulletin (S) X-4200 for instructions on the Model 4200 Adjustor.

**Figure 6.1 "New Gear Box" Conversion**





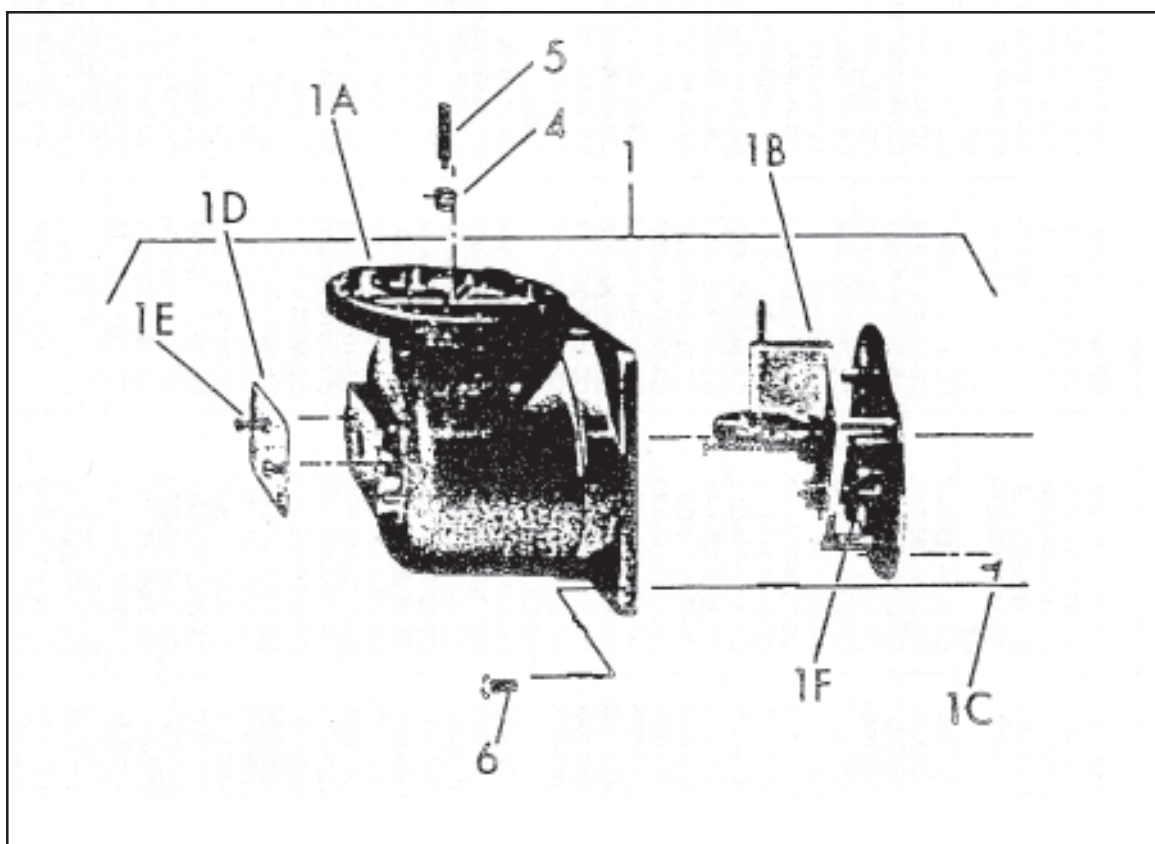
**Figure 6.2**  
**Meter Assembly**

**Table 6.1 Three-Piece Oval flowmeter Parts List**

Item	Description	9402	9453	9455	9456	9457	9459	Qty
1*	O-Ring	CF-37513-216-SUA	CF-37513-224-SUA	CF-37513-224-SUA	CF-37513-224-SUA	CF-3758-235-SUA	CF-3758-246-SUA	2
2	Split Ring Flange	CA-328C-040-HGC	CA-330C-040-HGC	CA-330C-040-HGC	CA-332C-028-HYC	CA-333C-047-HYC	CA-335C-021-HYC	2
3	Ring Half	CF-724J-016-BYA	CA-724J-019-BYA	CA-724J-019-BYA	CA-724J-020-BYA	CA-724J-023-BYA	CA-724J-022-BYA	4
4	Dowel Pin 1/4" x 1/2"	CF-597F-023-ACA	CF-597F-023-ACA	CF-597F-023-ACA	CF-597F-023-ACA	CF-597F-023-ACA	CF-597F-024-ACA	4
5*	Oval Gear Set							
	Standard "A" Carbon	CS-381 J-009-JYA	CS-381 L-012-JYA	CS-381 M-056-JYA	CS-381 N-060-JYA	CS-381 P-062-JYA	CS-381 R-006-JYA	1
	Standard "C" Carbon	CS-381 J-017-JYA	CS-381 L-020-JYA	CS-381 M-068-JYA	CS-381 N-070-JYA	CS-381 P-072-JYA	CS-381 R-015-JYA	1
	High Vise. "A" Carbon	CS-381 J-012-JYA	CS-381 L-014-JYA	CS-381 M-059-JYA	CS-381 N-063-JYA	CS-381 P-065-JYA	CS-381 R-009-JYA	1
	High Vise. "C" Carbon	CS-381 J-018-JYA	CS-381 L-079-JYA	CS-381 M-071-JYA	CS-381 N-072-JYA	CS-381 P-073-JYA	CS-381 R-067-JYA	1
	Standard "A" Waukesha <sup>2</sup>	CS-381 J-107-AWA	CS-381 L-104-RXA	CS-381 M-128-RXA	CS-381 N-136-RXA	CS-381 P-135-RXA	CS-381 R-076-RXA	1
	Standard "C" Waukesha <sup>2</sup>	CS-381 J-104-RXA	C/F	C/F	C/F	C/F	C/F	
6	Bottom Flange - Stn. Stl. Carbon Stl.	CC-341 A-776-BMT	CC-341 A-776-BMT	CC-341 A-765-BMT	CC-341 A-783-BMT	CD-341 A-773-BMT	CD-341 A-785-BMT	1
	Carbon Stl.	CC-341 A-776-DJA	CC-341 A-776-DJA	CC-341 A-765-DJA	CC-341 A-783-DJA	CD-341 A-773-DJA	CD-341 A-785-DJA	1
7*	Shaft Assembly - Stn. Stl. Chrome Plated	CS-786Z-890-BMT	CS-786Z-895-EMT	-786Z-886-BMT	CS-786Z-899-BMT	CS-786Z-889-BMT	CS-786Z-897-BMT	1
	Chrome Plated	CS-786Z-904-BMH	CS-786Z-905-BMH	CS-786Z-906-BMH	CS-786Z-907-BMH	CS-786Z-908-BMH	CS-786Z-909-BMH	1
8*	Following Magnet Assembly	CS-786Z-891-AWA	CS-786Z-893-AWA	CS-786Z-215-AWA	CS-786Z-900-AWA	CS-786Z-903-AWA	CS-786Z-898-AWA	1
9	Hex Screw	150765	150765	150766	150836	150829	150844	A/R
10	Cap Screw	CG-7538-322-ACA	CG-7538-322-ACA	CG-751A-508-ACA	CG-751A-508-ACA	CG-751 E-507-ACA	CG-755E-508-ACA	3
11 <sup>1</sup>	O-Ring	CF-3758-012-( )	CF-3758-012-( )	CF-3758-111-( )	CF-37513-113-( )	CF-3758-210-( )	CF-3758-213-( )	1
12	Flange/Driving Rotor	CA-341A-666-GMA	CA-341 A-666-GMA	CA-341 A-174-GMA	CA-341A-184-GMA	CA-341A-432-GMA	CA-341 A-470-GMA	1
13	Output Gear Assembly	CS-381 A-519-AWA	CS-381A-519-AWA	CS-381 B-236-AWA	CS-381 B-236-AWA	CS-381 B-237-AWA	CS-381 B-237-AWA	1
14	Snap Ring	...	...	CF-7248-006-GBA	CF-72413-006-GBA	CF-7248-006-GBA	CF-7248-006-GBA	1
15	Idle Gear Shaft	...	...	CA-786Z-440-BMA	CA-786Z-440-BMA	CA-786Z-440-BMA	CA-786Z-440-BMA	1
16	Idle Shaft Spacer	...	...	CG-810A-114-NCA	CG-810A-114-NCA	CG-810A-114-NCA	CG-810A-114-NCA	2
17	Flat Washer	...	...	CG-962A-008-AWA	CG-962A-008-AWA	CG-962A-008-AWA	CG-962A-008-AWA	1
18	Adapter Assembly	CC-693Z-083-FG%	CC-693Z-083-FG%	CC-693A-068-AWA	CC-693A-068-AWA	CC-693A-069-AWA	CC-693A-069-AWA	1
19	Self Locking Nut	...	...	CF-5730-053-ACK	CF-5730-053-ACK	CF-5730-053-ACK	CF-5730-053-ACK	1
20	Pin	...	...	153551	153551	153551	153551	1
21	Coupling	...	...	CA-21813-067-ADO	CA-2188-067-ADO	CA-2188-067-ADO	CA-2188-067-ADO	1
22	Crecent Ring	...	...	CF-7248-103-BQA	CF-7248-103-BQA	CF-7248-103-BOA	CF-7248-103-BOA	1
23	Idle Gear Arm Assembly	...	...	CS-106Z-847-AWA	CS-106Z-847-AWA	CS-106Z-848-AWA	CS-106Z-848-AWA	1
24	Trans. Shaft Assembly	CS-786Z-741-AWA	CS-786Z-741-AWA	CS-786Z-444-AWA	CS-786Z-444-AWA	CS-786Z-445-AWA	CS-786Z-445-AWA	1
25	Idle Gear Assembly	...	...	CS-381 8-479-LVA	CS-381 8-479-LVA	CS-381 8-481-LVA	CS-381 8-482-LVA	1
26	Set Screw	...	...	CG-756E-502-AWA	CG-756E-502-AWA	CG-756E-502-AWA	CG-756E-502-AWA	3
27	Idle Arm Bracket	...	...	CA-106Z-842-BBA	CA-106Z-842-BBA	CA-106Z-843-BBA	CA-106Z-843-BBA	1
28	Machine Screw	...	...	CG-753A-267-AWA	CG-753A-267-AWA	CG-753A-267-AWA	CG-753A-267-AWA	1
29	Lock Washer	...	...	CG-962D-006-AWA	CG-962D-006-AWA	CG-962D-006-AWA	CG-962D-006-AWA	1
30	Stand Off	...	...	CA-830D-236-CAA	CA-830D-236-CAA	CA-830D-284-CAA	CA-830D-284-CAA	1
31	Flange - Stn. Stl. Carbon Stl.	CC-341 A-777-BMT	CC-341 A-774-BMT	CC-341 A-768-BMT	CC-341 A-781-BMT	CD-341 A-771-BMT	CD-341 A-787-BMT	1
	Carbon Stl.	CC-341 A-777-DJA	CC-341 A-777-DJA	CC-341 A-768-DJA	CC-341 A-781-DJA	CD-341 A-771-DJA	CD-341 A-787-DJA	1
32*	Rotor Shaft - Stn. Stl. Chrome Plated	CA-786Z-055-BMT	CA-786Z-133-BMT	CA-786Z-711-BMT	CA-786Z-712-BMT	CA-786Z-713-BMT	CA-786Z-911-BMT	1
	Chrome Plated	CA-786Z-109-BMH	CA-786Z-136-BMH	CA-786Z-171-BMH	CA-786Z-733-BMH	CA-786Z-733-BMH	CA-786Z-910-BMH	1
33	Body - Stn. Stl. Carbon Stl.	CC-093C-044-BMT	CC-093M-046-BMT	CC-093F-072-BMT	CD-093G-055-BMT	CD-093P-008-BMT	CD-093K-025-BMT	1
	Carbon Stl.	CC-093C-044-DJA	CC-093M-046-DJA	CC-093F-072-DJA	CD-093G-055-DJA	CD-093P-008-DJA	CD-093K-025-DJA	1
34*	O-Ring	CF-3758-236-( )	CF-3758-236-( )	CF-3758-346-( )	CF-37513-354-	CF-3758-442-( )	CF-3758-449-( )	2
35*	Thrust Ring - Carbon Waukesha	...	...	CA-063F-041-NKA	CA-063F-030-NKA	CA-063F-001-NKA	CA-063F-036-NKA	4
	Carbon Stl.	CA-063F-041-RWA	CA-063F-041-RWA	CA-063F-027-RWA	CA-063F-030-RWA	CA-063F-001-RWA	CA-063F-036-RWA	4
36	Drive Screw	CF-752Z-004-AWA	CF-752Z-004-AWA	CF-752Z-004-AWA	CF-752Z-004-AWA	CF-752Z-004-AWA	CF-752Z-004-AWA	4
37	Name Plate	CA-502Z-154-AWA	CA-502Z-154-AWA	CA-502Z-154-AWA	CA-502Z-154-AWA	CA-502Z-154-AWA	CA-502Z-154-AWA	1
38	Name Plate	CA-502Z-339-AWA	CA-502Z-339-AWA	CA-502Z-339-AWA	CA-502Z-339-AWA	CA-502Z-339-AWA	CA-502Z-339-AWA	1
39	Hex Nut	...	...	...	...	...	...	4
40	Round Head Screw	CG-7538-321-ACA	CG-7538-321-ACA	...	...	...	...	3
41	Set Screw	CG-756A-502-AWA	CG-756A-502-AWA	...	...	...	...	3

\* Recommended Spare Parts 1. Additional Suffix ( ) for O-ring/Elastomer Material Viton-QTA, Kalrez, -TTA, Silicon,-TFA, Teflon-QMA, EPR-SYA 2. Consult factory for High Viscosity Waukesha Gear sets

**Figure 6.3 Gear Box Assembly**



**Table 6.2 Gear box and Register Adaptor Assembly - Parts List**

Item	Description	9402	9453	9455	9456	9457	9459
1	Gear Box Assembly						
	1 U.S.Gallon	CS-381Z-399-AAA	CS-381Z-409-AAA	CS-381Z-345-AAA	CS-381Z-369-AAA	NIA	NIA
	10 U.S. Gallons	NIA	GS-3812-379-AAA	CS-381L285-AAA-	CS-3812.3.10-AAA	CS-384Z-328-AAA.	CS-3812-355-AAA
	1000 U.S. Gallons	NIA	NIA	NIA	NIA	CS-381Z-270-AAA	CS-381Z-295-AAA
	1 Imperial Gallon	CS-381Z-394-AAA	CS-381Z-404-AAA	CS-381Z-340-AAA	CS-381Z-360-AAA	NIA	NIA
	10 Imperial Gallons	NIA	CS-381Z-374-AAA	CS-381Z-280-AAA	CS-381Z-300-AAA	CS-381Z-320-AAA	CS-381Z-350-AAA
	100 Imperial Gallons	NIA	N/A	NIA	NIA	CS-381Z-263-AAA	CS-381Z-290-AAA
	10 Liters	CS-381Z-384-AAA	CS-381Z-389-AAA	CS-381Z-315-AAA	CS-381Z-335-AAA	CS-381Z-365-AAA	N/A
	100 Liters	N/A	NIA	CS-381Z-258-AAA	CS-381Z-275-AAA	CS-381Z-305-AAA	CS-381Z-325-AAA
	1000 Liters	NIA	N/A	NIA	NIA	N/A	CS-381Z-269-AAA
A	Gear Box Housing	CD-441C-291-FD3	CD-441C-291-FD3	CD-441C-291-FD3	CD-441C-291-FD3	CD-441C-291-FD3	CD-441 C-291-FD3
B	Gear Train						
	1 U.S.Gallon	CS-381A-502-AAA	CS-381A-512-AAA	CS-381A-448-AAA	CS-381A-472-AAA	NIA	NIA
	10 U.S. Gallons	N/A	CS-381A-482-AAA	CS-381A-388-AAA	CS-381A-413-AAA	CS-381A-431-AAA	CS-381A-458-AAA
	100 U.S. Gallons	_NIA	NIA	N/A	NIA	CS-381A-373-AAA	CS-381A-398-AAA
	1 Imperial Gallon	CS-381A-497-AAA	CS-381A-507-AAA	CS-381A-443-AAA	CS-381A-463-AAA	NIA	NIA
	10 Imperial Gallons	NIA	CS-381A-477-AAA	CS-381A-383-AAA	CS-381A-403-AAA	CS-381A-423-AAA	CS-381A-453-AAA
	100 ImperialGallons	NIA_	N/A	NIA_	N/A	CS-381A-366-AAA	CS-381A-393-AAA
	10 Liters	CS-381A-487-AAA	CS-381A-492-AAA	CS-381A-418-AAA	CS-381A-438-AAA	CS-381A-468-AAA	NIA
	100 Liters	N/A	N/A	CS-381A-361-AAA	CS-381A-378-AAA	CS-381A-408-AAA	CS-381A-428-AAA
	1000 Liters	NIA	NIA	NIA	NIA	NIA	CS-381A-372-AAA
C	Screw (3)	150632	_150632	150632	150632	150632	0.15
D	Cover Plate (1)	CA-219Z-146-ENG	CA-219Z-146-ENG	CA-219Z-146-ENG	CA-219Z-146-ENG	CA-219Z-146-ENG	CA-219Z-146-ENG
E	Screw (2)	150529-419	150529-419	150529-419	150529-419	150529-419	150529-419
F	Set of 4 Calibration Gears	'575-06-3XX-XX	'575-06-3XX-XX	'575-06-3XX-XX	'575-06-3XX-XX	'575-06-3XX-XX	'575-06-3XX-XX

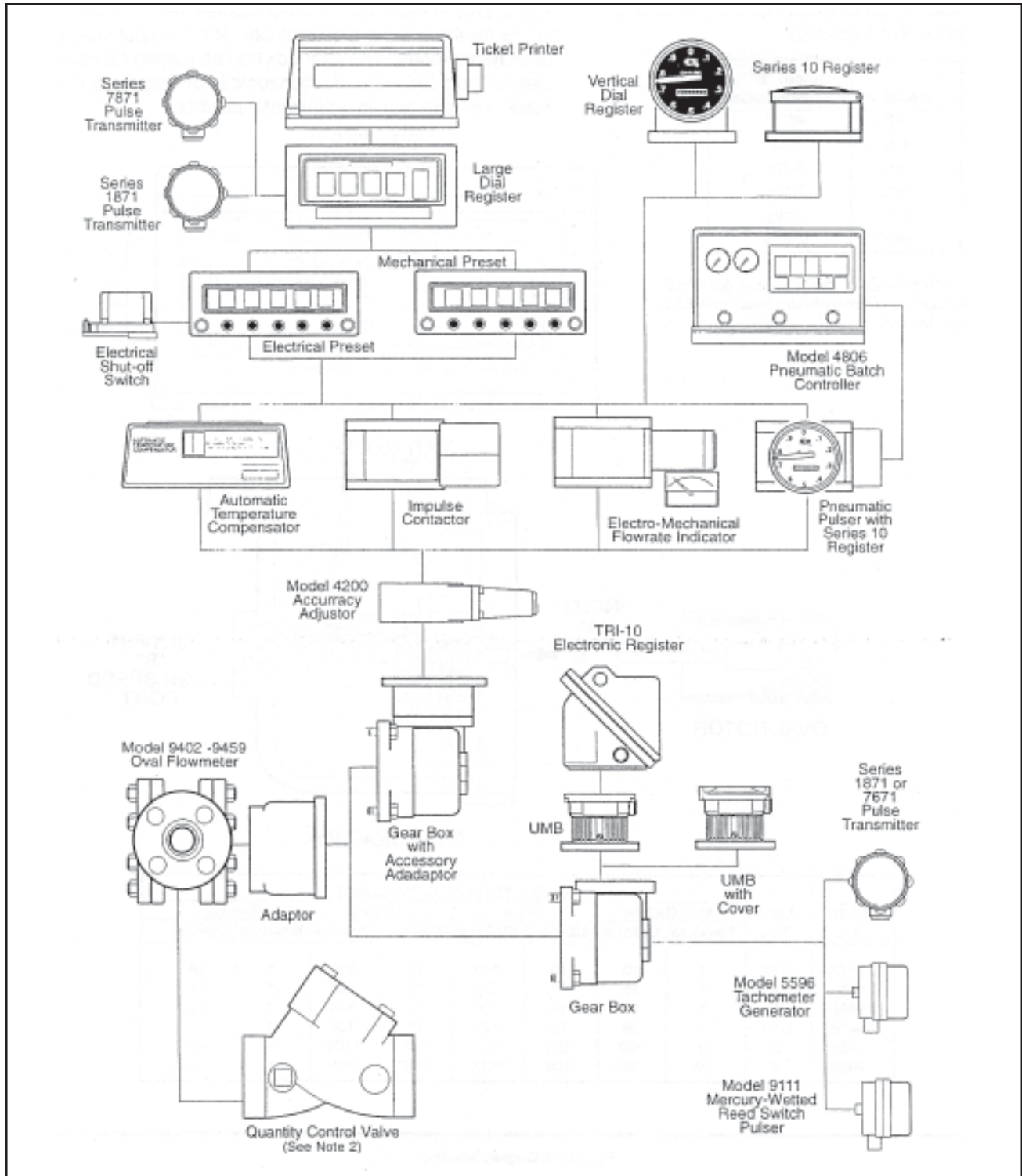
\*Calibration gears vary with individual meters and are installed based upon calibration of the meter. Must substitute "X's" with part numbers.

Typical Accessory Schematic for Brodie Three-Piece Oval Flowmeters with the new gear box part Number 381Z-XXX-AAA. All of these accessories will mount to Brodie Three-Piece Oval Flowmeters furnished with the new design Oval Register/Gear Box.

Notes:

1. Consult factory for torque capability when more than three accessories are required.
2. When mechanical preset is specified, the quantity control valve must also be specified.

**Figure 6.4 Typical Accessory Schematic**



## Brodie-Oval Meter Registration

Standard-U.S. Gallons

Optional: metric, Pounds, & Barrels

Refer to Tables below for volume per Revolution of Output shafts, "b" and "C"

(NA=Not Available)

The output "B" is exactly one quarter that of output "A" (the oval gear metering element). Output "C" is adjusted output that drives the registers in Engineering Units 1, 10, 100, or 1,000. Due to high rotation, in some models, refer to the chart below for the volume per revolution of the output shaft on each meter model. The gear box can be rotated for use on meters modified vertically, horizontally, or diagonally, if the meter rotors remain in horizontal position.

Model #	Output "B" Revolutions/Gal.
9402	48.75
9453	27.20
9455	6.775
9456	3.175
9457	1.195
9459	0.4525

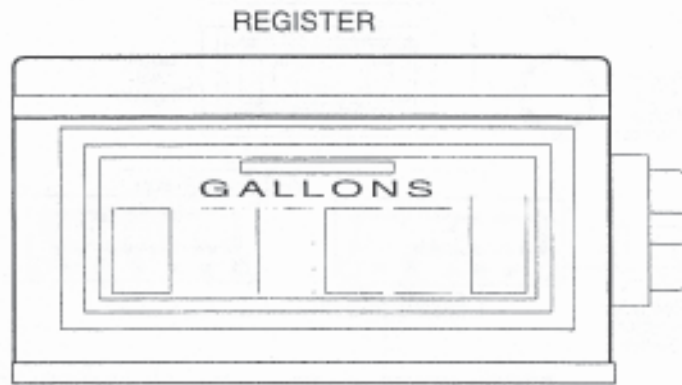
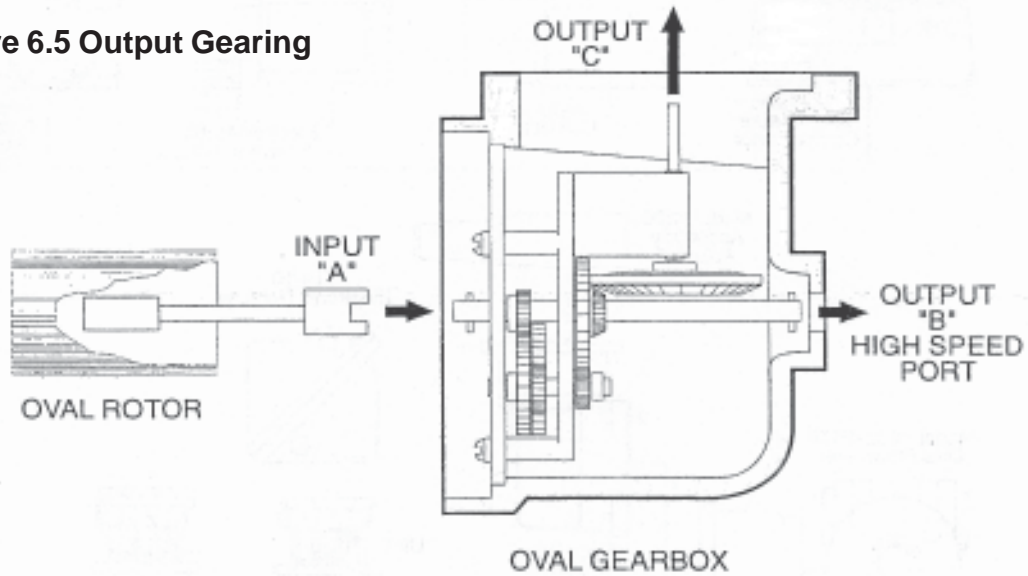


Figure 6.5 Output Gearing



Model #	Meter Size	Output "C" (Units per Revolution)							
		U.S. Gallons		Liters		Pounds		Barrels	
		Standard	Optional	Standard	Optional	Standard	Optional	Standard	Optional
9402	1/2"	1	10	10	100	10	100	0.1	NA
9453	1"	1	10	10	100	10	100	0.1	NA
9455	1"	1	10	10	100	10	100	0.1	NA
9456	1-1/2"	1	10	10	100	10	100	0.1	1
9457	2"	10	100	100	NA	100	1000	1	NA
9459	3"	10	100	100	1000	100	1000	1	10





## Brodie Meter Co., LLC

19267 Highway 301 North (30461)  
PO Box 450  
Statesboro, GA 30459-0450

Phone: (912) 489-0200  
Fax: (912) 489-0294  
www.brodiemeter.com

### Customer Problem Report

*For faster service, complete this form and return it along with the affected equipment to customer service at the address indicated below.*

Company Name: \_\_\_\_\_

Technical Contact: \_\_\_\_\_ Phone: \_\_\_\_\_

Repair PO#: \_\_\_\_\_ If Warranty, Unit S/N: \_\_\_\_\_

Invoice Address: \_\_\_\_\_

Shipping Address: \_\_\_\_\_

Return Shipping Method: \_\_\_\_\_

Equipment Model #: \_\_\_\_\_ S/N: \_\_\_\_\_ Failure Date: \_\_\_\_\_

Description of Problem: \_\_\_\_\_

What was happening at time of failure? \_\_\_\_\_

Additional Comments: \_\_\_\_\_

Report Prepared By: \_\_\_\_\_ Title: \_\_\_\_\_

If you require technical assistance, please contact the Product Service Department at:

Phone: (912) 489-0200

Fax: (912) 489-0294

[service@brodiemeter.com](mailto:service@brodiemeter.com)

**Reminder:**

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

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Fax: (912) 489-0294  
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### Decontamination Statement

RMA Number: \_\_\_\_\_

Item Being Returned: \_\_\_\_\_

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

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

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

Signature: \_\_\_\_\_

Name (Please Print): \_\_\_\_\_

Title: \_\_\_\_\_

Company Name: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

Reason for Return: \_\_\_\_\_

**Reminder:**

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

*Brodie Meter Co., LLC: Manufacturers of BiRotors, Oval Gear Meters, and Control Valves*

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