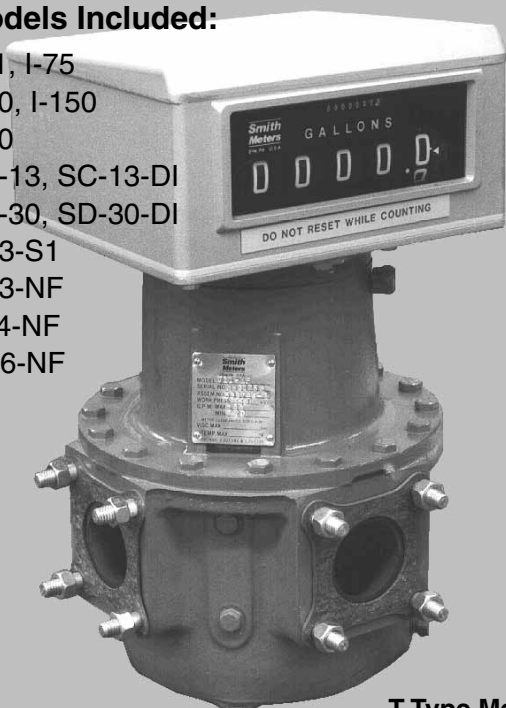
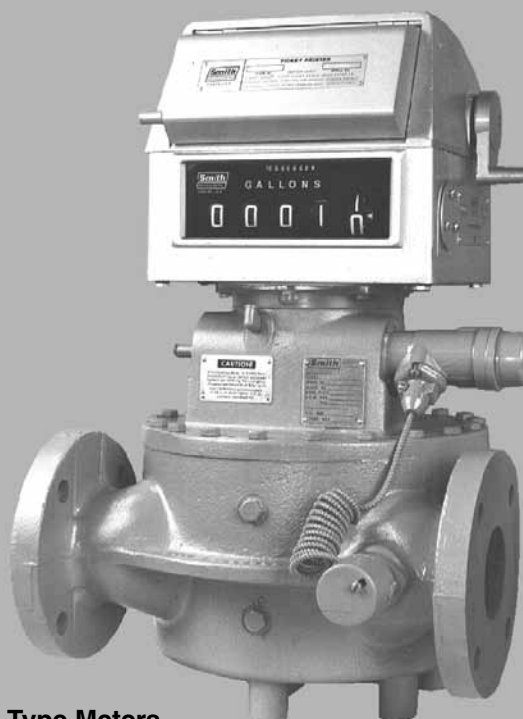


**Models Included:**

- T11, I-75
- T-20, I-150
- T-40
- SC-13, SC-13-DI
- SD-30, SD-30-DI
- SD3-S1
- SD3-NF
- SF4-NF
- SG6-NF



**T-Type Meters**



**S-Type Meters**

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## Section 1 – General Information and Description

It is suggested that a detailed record be maintained for each meter. Nameplate data, clearances, progressive totalizer readings, meter factor, parts used, and other similar information provide background material for scheduling a preventive maintenance program. An increase in meter factor drift against throughput can be used as the basis for making an inspection.

The time of the first inspection must be based on the operating conditions imposed by the installation. Flow rate, lubrication properties of the fluid, and the possibility of abrasive contaminants are points to consider. Then, at the time of inspection, the condition of the meter should indicate whether the inspection interval can be lengthened or shortened.

All parts, as they are removed, should be thoroughly washed and cleaned in solvent. Parts that are worn enough to affect operation or calibration should be replaced. All parts that are nicked, gouged, or have rough places on them, should be dressed with a fine file or crocus cloth, as conditions warrant.

Before any disassembly is performed on the meter, be sure that the trouble is in the meter.

1. Check that meter is being operated within the proper flow rate. Refer to the nameplate on the side of the meter.
2. If rotor does not turn freely, adjust end clearance. See *Adjusting Rotor End Clearances*, Page 9.
3. Check calibrator for proper operation.
4. Check air eliminator and strainer assembly.
5. Check valve operation.

After all other accessories have been checked and found to be operating normally, the meter should be checked.

### Description

Smith Meter® single-case rotary meters are of the positive displacement type. The metering mechanism is a rotor assembly set in the housing. Pipe connections are confined to the housing, which means the rotor assembly can be removed by taking off the cover assembly and lifting the rotor assembly out. Inspection, maintenance, and service is greatly simplified.

The measuring function is accomplished in a chamber of precise volume created by the moving blades, rotor, housing, and cover. There is a smooth flow of product through the meter. The blades rotate around a fixed cam which causes them to move out to, but not touch, the body of the meter. Four chambers per revolution are formed as the rotor and blades are turned by product flow.

FMC Technologies Measurement Solutions, Inc. provides a meter variation with tungsten carbide trim to resist the accelerated wear that can be caused by im-

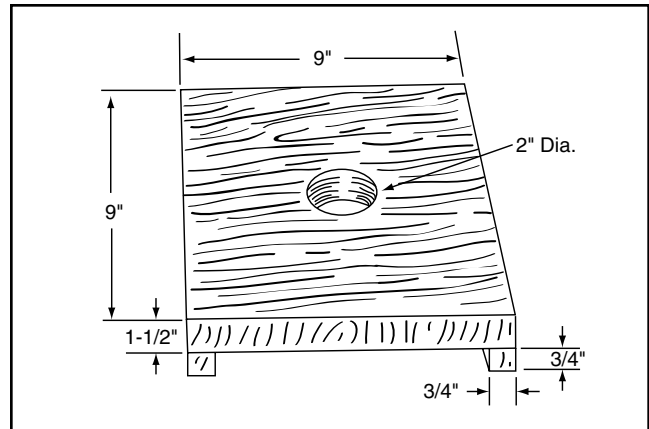


Figure 1



Figure 1A

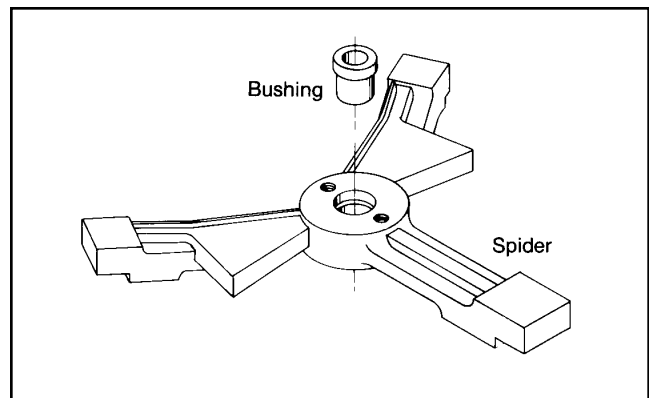


Figure 2 — Spider and Bushing

purities such as sand and iron sulfide and also by the low lubricity of condensates. This variation uses solid tungsten carbide journal rotor and thrust bearings. In addition, blade bearings' size and weight have been reduced to minimize the rotational inertia of the cam followers and the wear resistance of the bearings and cam have been substantially increased. Also, the rotor and jackshaft gear assemblies have been changed to hardened stainless steel.

1 Consists of feeler gauge soldered to 15" rod. An extension rod (22") and coupling is available as Part Number 515250.

**Suggested Tools and Fixtures**

In addition to ordinary hand tools, the following tools and equipment will facilitate work on the meter.

- Feeler gauges, leaf-type (see Table 1).
- Emery cloth.
- Wood block or equivalent (see Figure 1).

**Table 1 — Feeler Gauge Sizes**

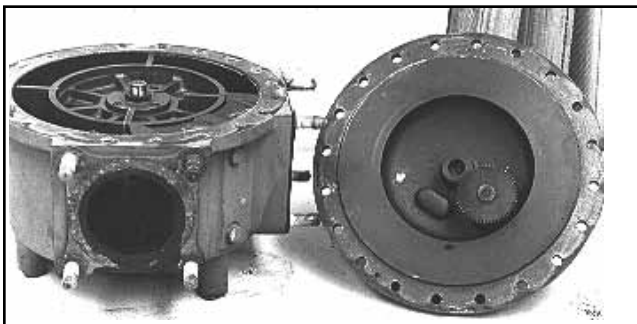
Part No. <sup>1</sup>	Thickness	Part No. <sup>1</sup>	Thickness
515252-001	.0015"	515252-011	.011"
515252-002	.002"	515252-012	.012"
515252-003	.003"	515252-013	.013"
515252-004	.004"	515252-014	.014"
515252-005	.005"	515252-015	.015"
515252-006	.006"	515252-016	.016"
515252-007	.007"	515252-017	.017"
515252-008	.008"	515252-018	.018"
515252-009	.009"	515252-019	.019"
515252-010	.010"	515252-020	.020"

- Spiders<sup>2</sup> (Figure 2).
- Cam Setting Bushing<sup>2</sup> (for T-11 and I-75 Meters only) - 552469-001, Figure 1A.
- Cam Setting Fixture<sup>2</sup> (for T-11 and I-75 Meters only) - 552469-002, Figure 1A.

**Disassembly of Model T-11 and I-75 Meters**

**Removing Rotor Assembly From Housing**

1. Remove all accessories from top of meter.
  - The calibrator does not have to be removed unless jackshaft and gear, pinion gear, or packing gland have to be replaced.
2. Remove meter housing cover, Figure 3.
  - Slots are provided around the perimeter of the cover to assist in prying the cover from the housing.



**Figure 3**

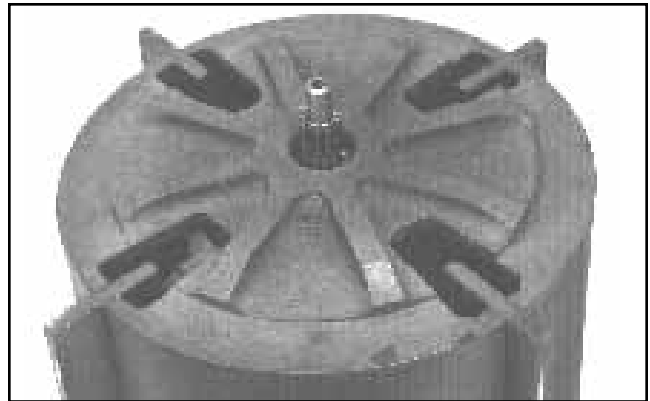
- When replacing cover, turn adjusting screw in bottom of housing to the extreme clockwise position. This will place the rotor assembly on the bottom of the housing and allow the cover to be firmly secured to the housing. If rotor assembly is not bottomed, it is possible to damage the cover when it is tightened to the housing.

<sup>2</sup> Available through Smith Parts Operation. Reference Form No. P1205.

- Before replacing cover, apply a thin layer of sealant (Master Gasket by Loctite is recommended) around the perimeter of the cover to form a seal between the housing and the cover. If a sealant is not used, fluid may leak out of the cover.

**NOTE: Meters with O-Rings DO NOT require a Master Gasket**

- At reassembly, care must be taken that the jackshaft gear, Figure 3, and rotor gear, Figure 4,

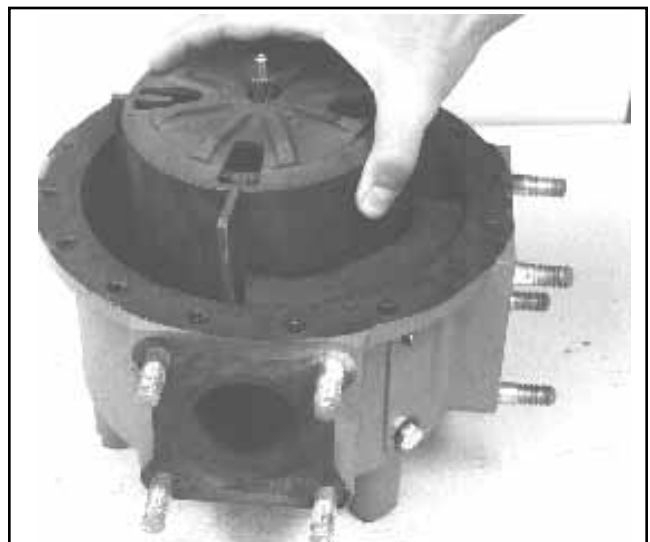


**Figure 4**

are properly meshed when the cover is assembled to the meter body.

This is accomplished by slowly rotating the calibrator output drive shaft as the cover is lowered onto the meter housing until the rotor and jackshaft gears mesh.

3. Remove rotor assembly, Figure 5, and clean rotor and housing interior.



**Figure 5**

- Lift straight up to prevent damage to the rotor blades.
- If the meter has been in service on crude oil or any other viscous liquid, a solvent should be used to dissolve the residue. Do not use water.

## Section 1 – General Information and Description (continued)

4. Turn rotor upside down and place on a wooden block or equivalent.

- The wooden block or metal plate must have a clearance hole in the center for the rotor shaft and high enough to allow shaft to clear the table. Refer to Figure 1, Page 2 for recommended block dimensions.

5. The block, Figure 5, can be separated from the housing by removing the two block retaining bolts in the side of the housing.

- **When replacing the block, a sealant must be applied to the two block retaining bolts (Master Gasket by Loctite is recommended). This will prevent leakage.**

### Removing Cam and Adjusting Mechanism

1. With rotor assembly removed, unscrew hold-down screws and lift cam straight up from housing center hub, Figure 6.



Figure 6

- Note locating pins on center hub.
- Refer to Pages 16 and 17 for information on cam replacement.

2. Lift thrust bearing and rotor bearing from hub, Figure 7.



Figure 7

- **When replacing the thrust bearing, indent side of thrust bearing plates must face outward from retainer and balls, Figure 8.**

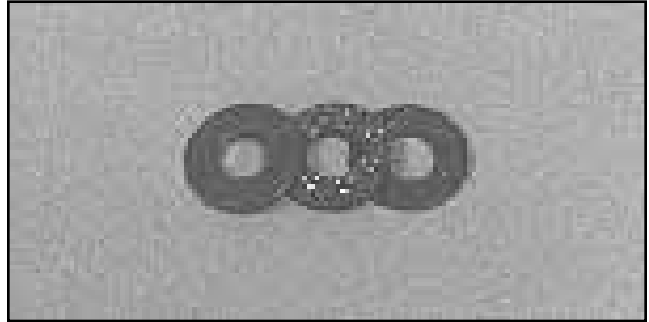


Figure 8

3. Remove plug from bottom of housing and use a 1/4" Allen wrench to remove the adjusting screw, Figure 9.

- Turn screw counterclockwise to remove.

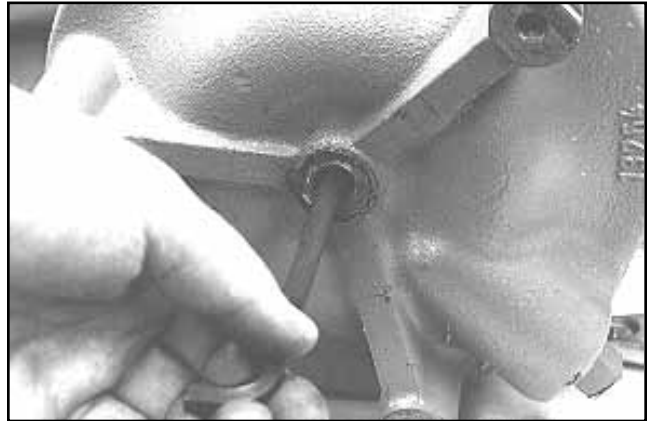


Figure 9

4. With adjusting screw removed, the adjusting collar and rotor spring, Figure 10, can be lifted from the housing.

- **When replacing spring and collar, slot in collar must line up with key pin in hub, Figure 10.**

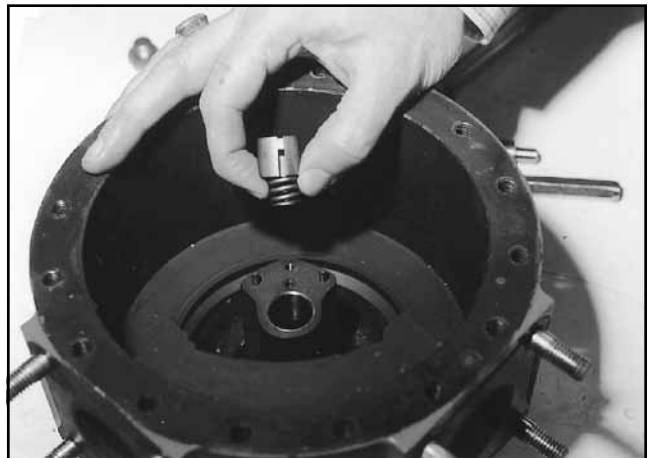


Figure 10

## Section 1 – General Information and Description (continued)

### Rotor Disassembly

1. Remove clamps and blade blocks, Figure 11, from rotor assembly.



Figure 11

2. Using two screwdrivers, pry rotor cover off rotor body, Figure 12.



Figure 12

- Slots are provided in the rotor cover to accept the screwdriver blades. With screwdrivers in slots, pry upward uniformly. **Do not pry downward with screwdrivers, as damage could occur to the bottom edge of the rotor body.**
- Note locating pins in rotor cover, Figure 13.

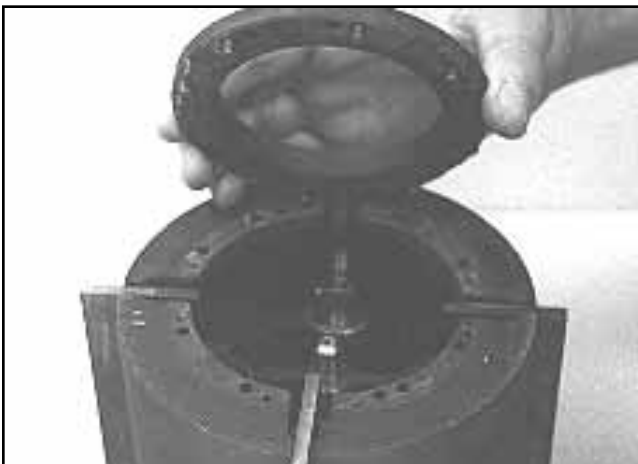


Figure 13

3. The blades are matched to their own slots during manufacturing. Therefore, before removing blades from the rotor, the blades and rotor slots must be matched-marked to eliminate the possibility of installing the blades in the wrong slots or 180° out of position.

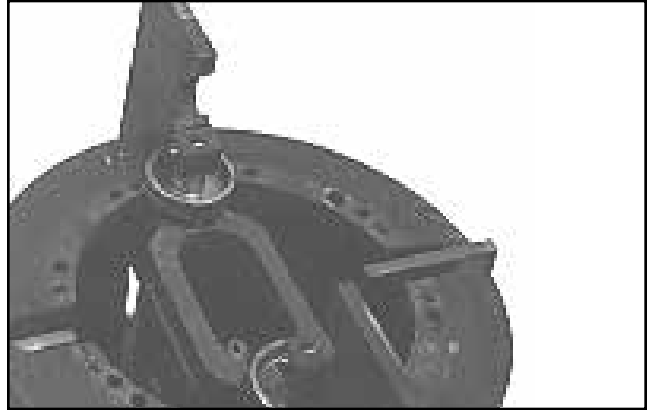


Figure 14

- Figure 14 shows one method of marking blades and rotor. Using a marker, make identical number of marks on the blade yoke and on an area of the rotor next to the blade slot. It is unnecessary to mark the opposite blade paddle for obvious reasons.
  - Do not mark outside edge of rotor.
4. The lower blade assembly can now be removed, Figure 15.

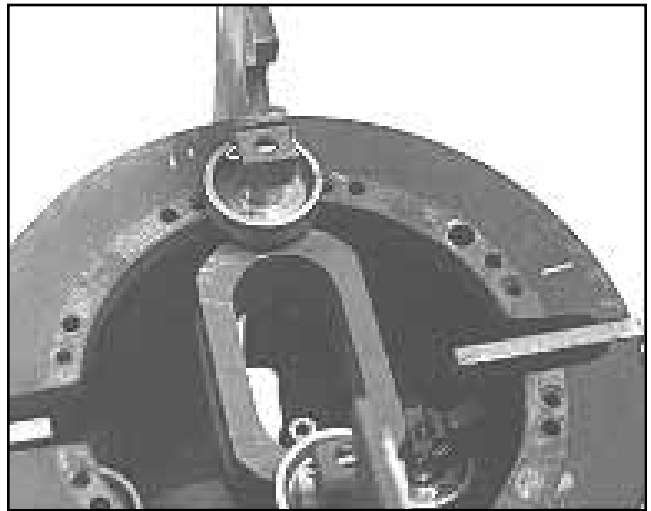


Figure 15

- Because of the position of the rollers, it will be necessary to maneuver the blade assembly out of the rotor.
  - Handle blade carefully so that the edges of the blades are not damaged.
5. Place identification marks on the upper blade yoke and rotor, Figure 15, and remove from rotor.
    - Use different set of marks than used on lower blade.

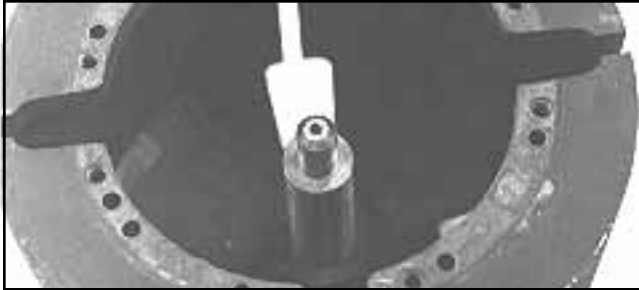


Figure 16

6. Figure 16 shows the rotor shaft inside the rotor body.
- The rotor body, shaft, and rotor cover (removed in Figure 12) are factory-assembled and matched as one integral piece. Therefore, if any one of these items is damaged, the complete assembly (body, shaft, and cover) must be replaced.

### **Disassembly of Model T-20, T-40, I-150, SC, SD, SF, and SG Meters**

#### **Removing Rotor Assembly From Housing**

1. Remove all accessories and calibrator from top of meter.
  - If difficulty is encountered in removing the calibrator, the adjusting stem assembly may have to be taken out of the meter cover. Refer to Page 14 for adjusting stem removal.
2. Remove meter housing cover, Figure 17.

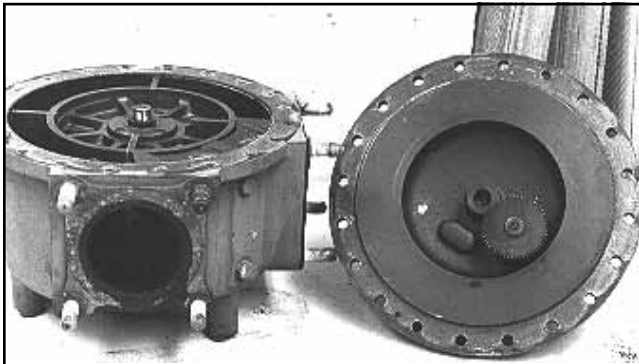


Figure 17

- Slots are provided around the perimeter of the cover to assist in prying the cover of the housing.
- When replacing cover, position adjusting screw so that bottom of screw is flush with bottom of shaft bearing hub, Figure 18. If adjusting screw is allowed to protrude too far into the cover bearing hub, damage to the cover could result when cover is secured to the housing.
- **Before replacing cover, apply a thin layer of sealant (Master Gasket by Loctite is recommended) around the perimeter of the cover to form a seal between the housing and cover. If a sealant is not used, fluid may leak out of the cover.**

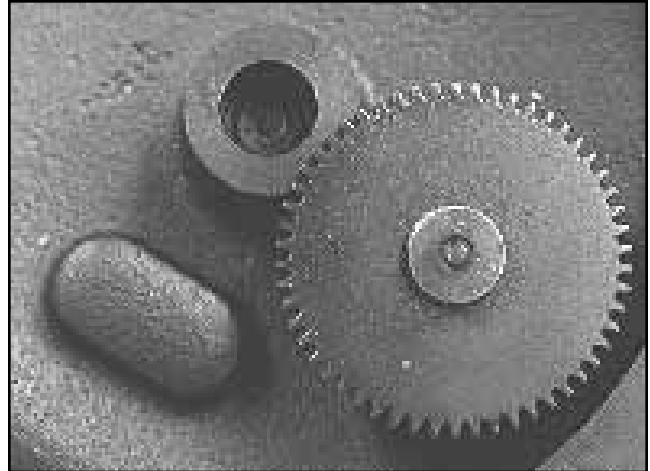


Figure 18

**NOTE: Meters with O-Rings DO NOT require a Master Gasket.**

3. Remove rotor assembly, Figure 19, and clean rotor and housing interior.

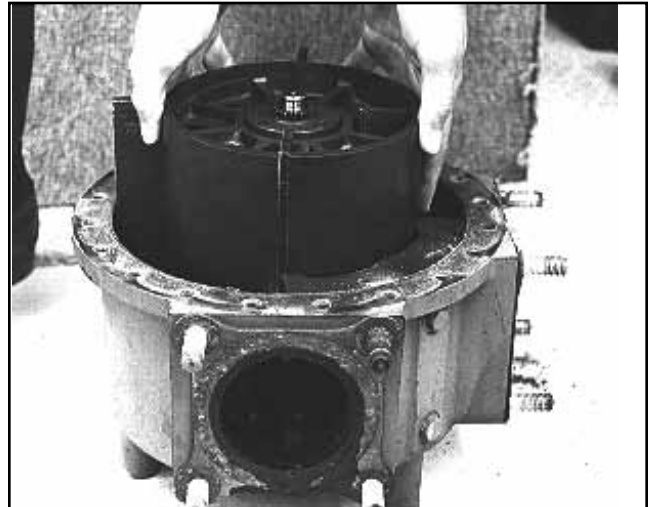


Figure 19

- Lift straight up to prevent damage to the rotor blades.
- If meter has been in service on crude oil or any other viscous liquid, a solvent should be used to dissolve the residue. Do not use water.
- **At reassembly, care must also be taken that jack-shaft gear and rotor gear, Figure 17, are properly meshed when cover is secured to housing. This can be accomplished by slowly turning single pinion gear, on top of cover, until rotor and jack-shaft gears mesh.**
- **At reassembly, the slot in the locating arm must be lined up with the locating arm pin in the bottom of the housing, Figure 20.**
- **Be sure adjusting spring, Figure 20, is reinstalled at time of reassembly.**

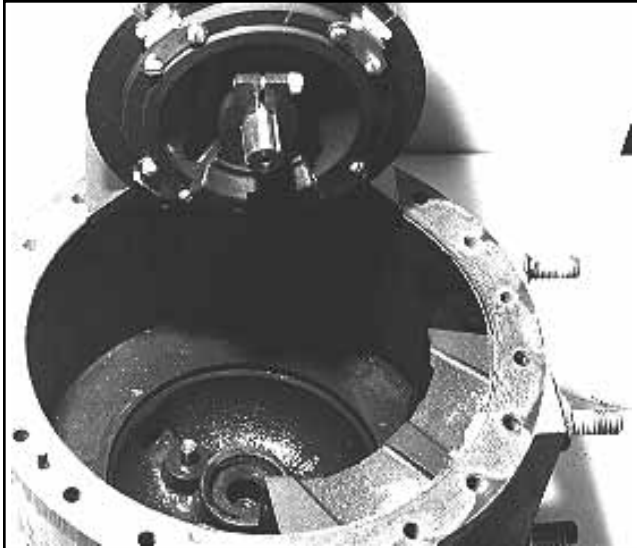


Figure 20

4. When rotor assembly is removed from the housing, turn it upside down and place it on a wooden block or metal plate.
  - The wooden block or plate must have a clearance hole in the center for the shaft and must be high enough to allow the shaft to clear the table. See Figure 1 for dimensions in constructing a wooden block.
  - If rotor assembly is to be set aside temporarily, it may be laid on its side. However, cardboard or other suitable cushion should be placed under it to protect the blades from damage.
5. The block, Figure 19, can be separated from the housing by removing the two bolts in the side of the housing.
  - **When replacing the block, a sealant must be applied to the two block retaining bolts (Master Gasket by Loctite is recommended). This will prevent leakage.**

#### **Rotor Disassembly**

1. Using an Allen wrench, loosen locating arm screw and pull locating arm from shaft, Figure 21.
2. Remove key and retaining ring from shaft, Figure 21.
3. Remove clamps and blade blocks, Figure 22, from assembly.
4. Using two screwdrivers, pry off rotor cover, Figure 23.
  - Slots are provided in the cover to accept the screwdriver blades. Place screwdrivers opposite each other and pry upward uniformly. **Do not pry downward with screwdrivers, as damage could occur to the top edge of the rotor body.**
  - Note locating pins in cover, Figure 24.
5. The rotor cover consists of the cover, Marcel ring, rotor bearing, and lower bearing shield, Figure 25. If replacement of tungsten carbide outer radial bearings is necessary, it is recommended that complete

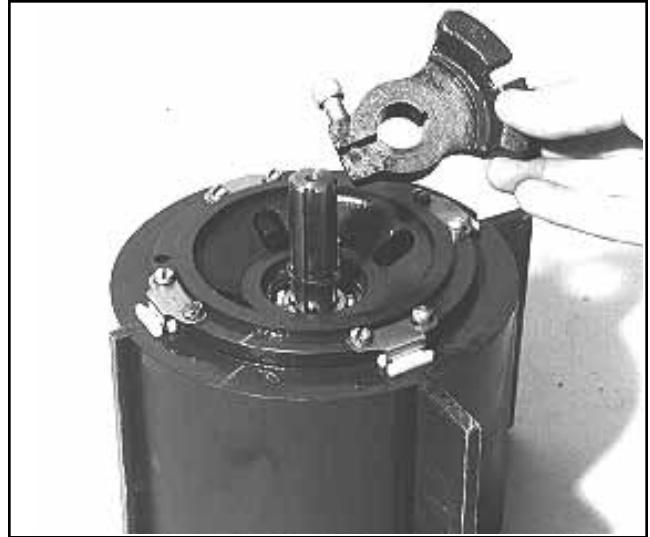


Figure 21



Figure 22

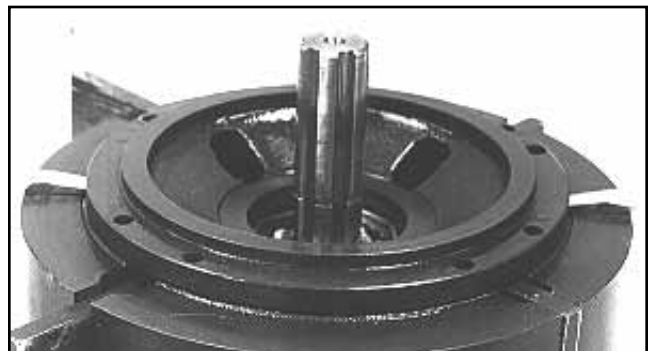
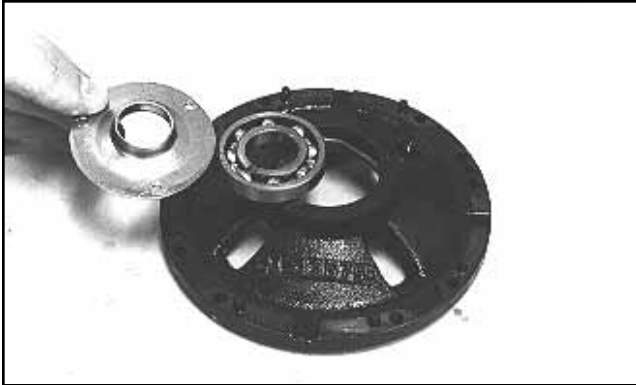


Figure 23



Figure 24

## Section 1 – General Information and Description (continued)



**Figure 25**

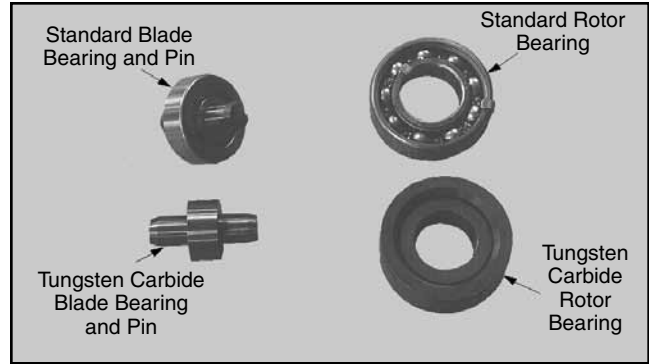
next level assemblies (rotor gear plate or rotor subassembly) be procured with bearings already installed, or capabilities must permit epoxying bearings in precise alignment.

- The blades are matched to their own slots. Therefore, before removing blades from the rotor, the blades and rotor slots must be matched-marked.
  - Figure 26 shows one method of marking blade and rotor. Using a marker, make identical notches (in this case, two) on the back end of the blade and on rotor area next to blade slot. It is unnecessary to mark opposite paddle of blade for obvious reasons.



**Figure 26**

- The lower blade assembly can now be removed.
  - Because of the position of the rollers, it will be necessary to maneuver the blade assembly out of the rotor.
  - Handle blade carefully so that edges of blades are not damaged.
  - If rollers require replacement, refer to Page 12 for replacement procedure.
  - See Figure 27 for alternate blade and rotor bearings.
- The cam and shaft assembly is lifted out of the rotor, Figure 28.
  - The cam is secured to the shaft by a key, Figure 28.



**Figure 27**



**Figure 28**



**Figure 29**

- Mark upper blade assembly and rotor and remove blade assembly.
  - Use different set of marks than used on lower blade.
  - Note bearing key on rotor bearing, Figure 29. This key is not bonded to the bearing and may fall off after shaft is removed. Be sure this key is in place when shaft is reinstalled. An application of vasoline will aid in keeping the key in position.
- Remove clamping ring, Figure 29, and rotor bearing.





Figure 30

11. Remove thrust bearing and snap ring, Figure 30.
  - See alternate bearings, Figure 31.
12. Turn the rotor over and remove gear plate, Figure 32.

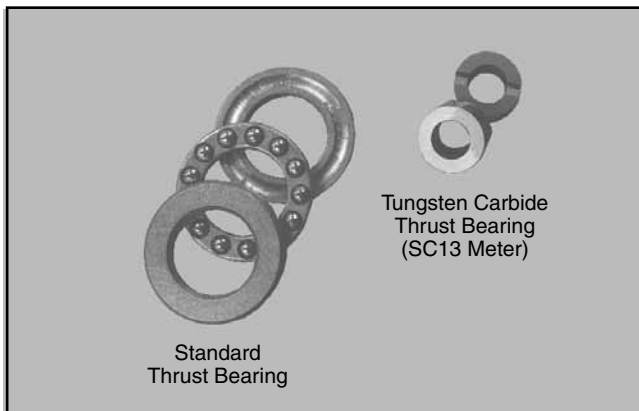


Figure 31



Figure 32

### Reassembly of Meters

Reassembly is essentially the reverse of the disassembly procedure. Be sure to observe the reassembly precautions noted **during teardown of unit**.

To assist in the reassembly of the meter, refer to the appropriate parts lists (see Related Publications).

Upon reassembling the meter, clearance checks are mandatory. Refer to Section 2 — Clearance Checks, Page 12.

### Adjusting Rotor End Clearances

**Caution:** Before any adjustments can be made, the meter must be removed from the line or drained.

#### T-11 or I-75 Meters Only

The T-11 or I-75 Meter can have the rotor and adjustments made without removing the calibrator on top of the meter. An access hole is available on the bottom of the meter for this adjustment, Figure 33.



Figure 33

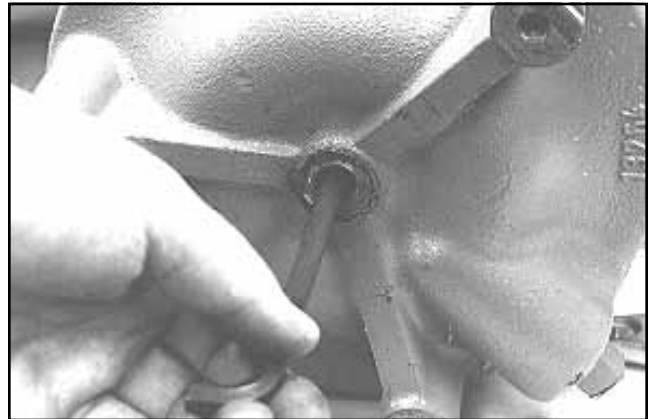


Figure 34

For purposes of illustration, the meter has been placed on its side for this series of pictures. However, when actually performing this adjustment, the meter must be in a vertical position.

1. With access plug removed, rotate rotor through either housing port and turn adjusting screw (using a 1/4" Allen wrench) counterclockwise until resistance is felt in the rotor rotation, Figure 34.
  - If rotor is already hard to turn, then turn adjusting screw clockwise until rotor just begins to rotate.
2. Rotor is now in the full top position. Mark this position on the hub of the meter (Point A), Figure 34.
  - Also mark Allen wrench for reference (Point B), Figure 34.

## Section 1 – General Information and Description (continued)



**Figure 35**

3. With rotor revolving, turn Allen wrench clockwise slowly until rotor again meets resistance, Figure 35.
4. Rotor is now in the full down position. Mark this position (Point C) on hub, Figure 35.
5. Turn Allen wrench counterclockwise until Points A and B are realigned as in Figure 35.



**Figure 36**

6. Now turn Allen wrench clockwise until Point B (on Allen wrench) is 1/3 distance from Point A, Figure 36.
  - Rotor should now rotate freely. If not, recheck all clearances.
7. Reinstall gasket and access plug in bottom of housing.
  - Check gasket for damage. Replace if necessary.

### **Procedure for Rotor End Adjustment and Application of Loctite**

The following procedure applies to the ASD-3V-NF.

1. Figure 37 shows the meter in an assembled state. The arrows point to two 5/16" bolts. Remove these two 5/16" bolts using a 1/2" wrench. When the bolts are removed the meter adapter can be removed (Figure 37A) allowing access to the rotor adjustment screw.

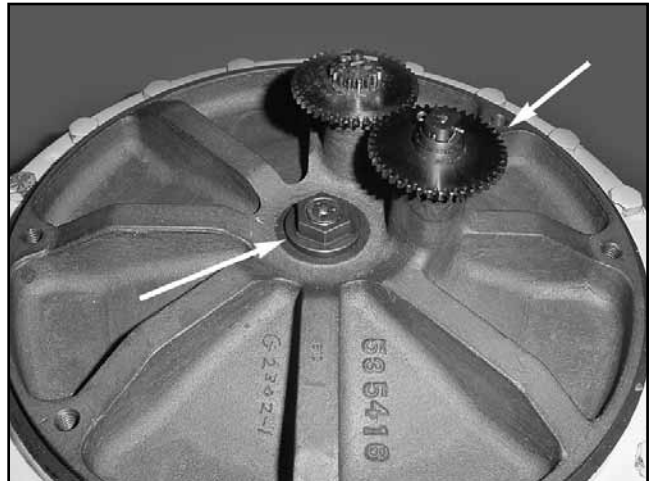


**Figure 37**

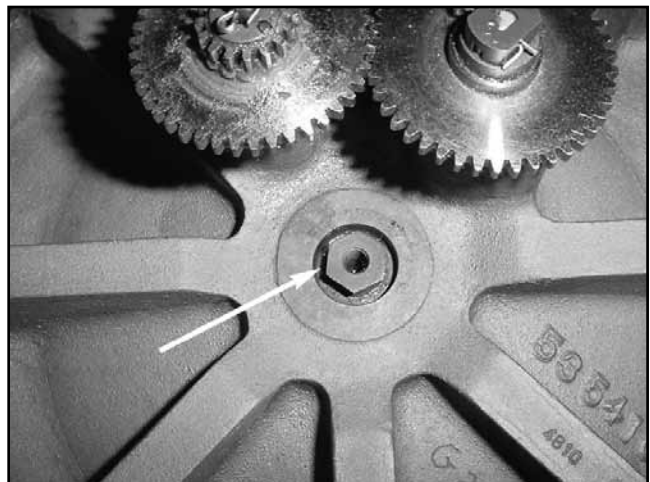


**Figure 37A**

2. Figure 38 illustrates the meter with the adapter removed. The arrow points to the locking mechanism for the rotor end adjustment and the Jack Shaft gear. Figure 39 shows the Adjusting Screw with the Adjusting Cap and Screw removed.



**Figure 38**



**Figure 39**

## Section 1 – General Information and Description (continued)

3. Remove the Adjusting Screw. Clean and apply LOCTITE 242. Figure 40 indicates where the LOCTITE is to be applied.
4. Figure 41 is a photo of the locking mechanism. SCREW (TOP), ADJUSTING CAP (MIDDLE) (NOTE: the arrows point to a gasket at the base of the Adjusting Cap and a brass gasket in the top of the Adjusting Cap. These gaskets need to be in place to create a leak proof seal.), AND ADJUSTING SCREW (BOTTOM). After the Adjusting Screw has the LOCTITE applied install it into the meter cover. Install the Adjusting Screw until it bottoms out. Install the Adjusting Cap on the Adjusting Screw.



Figure 40

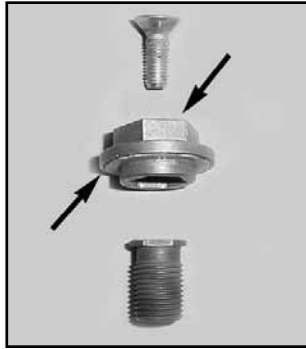


Figure 41

5. Use a 3/4" wrench to turn the Adjusting Cap and Adjusting Screw clockwise (Figure 42). Apply torque to the Jack Shaft Gear while turning the Adjusting Cap and Adjusting Screw clockwise. The Jack Shaft Gear will begin to spin as the rotor height is adjusted. When the rotor begins to spin mark a line and label the line "A" (Figure 43). The rotor is now in the up position.

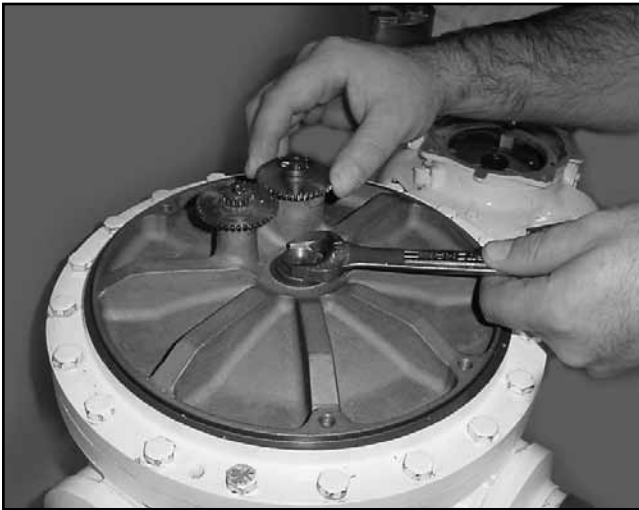


Figure 42

6. Continue to apply torque to the Jack Shaft gear while turning the Adjusting Cap. The rotor will begin to drag. When the rotor begins to drag stop turning the adjustment cap and put a line and label the line "B" as

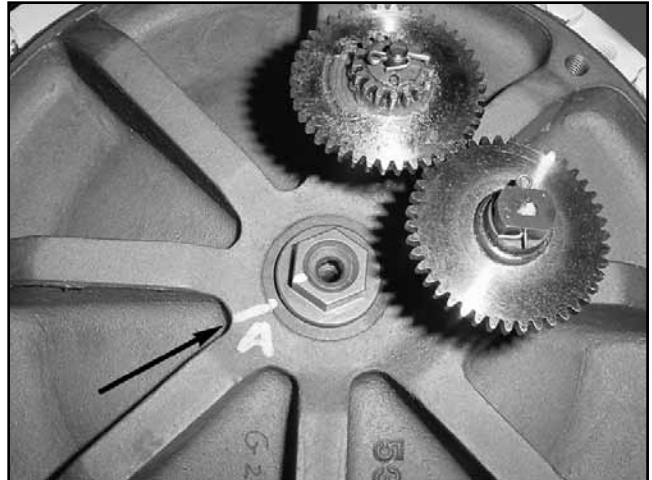


Figure 43

illustrated in Figure 44. The rotor is now in the down position. Rotate the Adjusting Cap counter clockwise until the line on the Adjusting Cap is approximately 1/3 of the distance from the line "A" as illustrated in Figure 45. Turn the Jack Shaft gear and check for the rotor to spin free. The Adjusting Cap may need to be adjusted slightly to ensure the rotor spins freely.

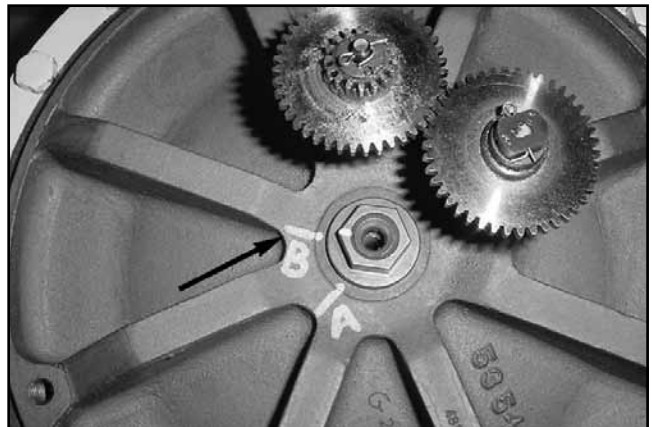


Figure 44

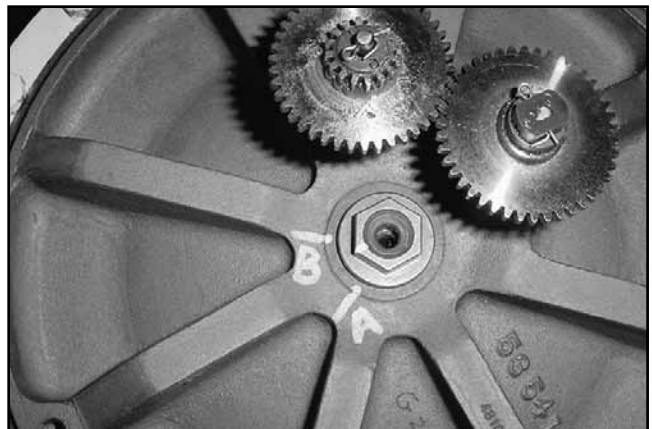
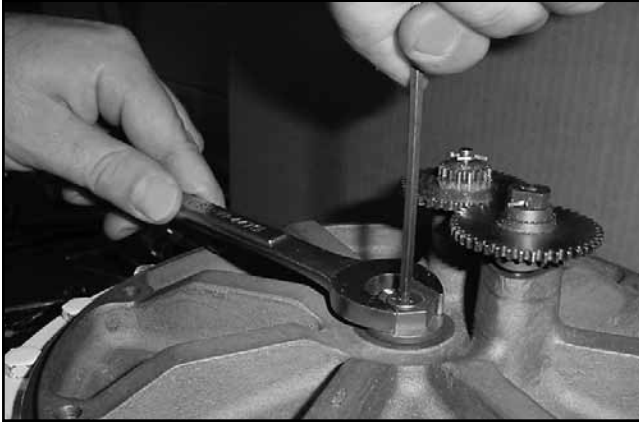


Figure 45

## Section 2 – Clearance Checks



**Figure 46**

7. Install the screw. Hold the Adjusting Cap with a  $\frac{3}{4}$ " wrench while tightening the screw with a  $\frac{5}{32}$ " Allen Head wrench (Figure 46). Take precaution not to move the Adjusting Cap when tightening the screw. The screw must be tight. After tightening the screw spin the Jack Shaft gear to check the free movement of the rotor. If the rotor does not move free the adjustment will need to be redone.

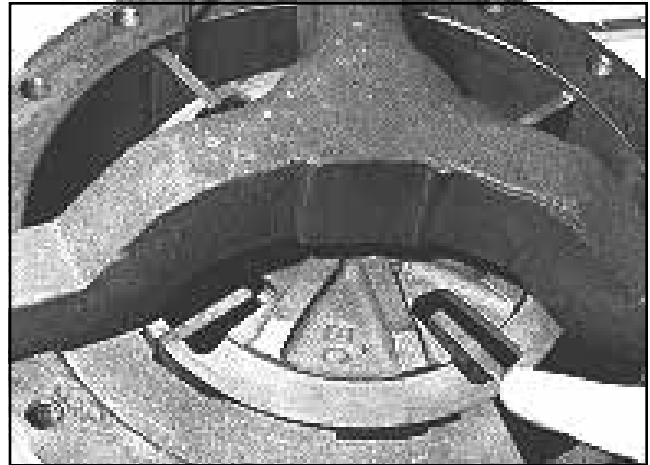
The rotor end adjustment is now complete. The Meter Adaptor can now be installed and the meter returned to service.

Rotor should now rotate freely. If not, recheck all clearances and repeat Steps 1 through 6.

8. Replace adjusting screw cap.

- Apply Master Gasket by Loctite sealant or equivalent to top of cover to provide a good seal between cap and cover.
- The adjusting screw cap has a hex indentation on the underside which will slip over the adjusting screw. When tightening down screw in cap, do not allow the cap to rotate, as this will change the adjustment.

The clearances listed in the Clearance Guide, Table 2, are standard clearances (see note) and are to be used



**Figure 47**

only as a guide in determining whether or not a part should be repaired or replaced. However, at no point should a clearance exceed 50% of the listed maximum.

The ability of the meter to obtain acceptable repeatability and linearity for the particular operating conditions, such as flow rate, viscosity, lubricity, abrasive contaminants, and intermittent or continuous duty, should be considered as a better guide rather than clearance alone.

The procedure for checking clearances on all meters covered by this manual are identical. For this reason, all illustrations are of the T-11 Meter.

In order to check the clearances in a meter, the rotor assembly must first be placed in the bottomed position using the following methods.

### ***T-11 or I-75 Meter***

#### ***Method No. 1:***

Turn adjusting screw on bottom of housing clockwise until rotor assembly meets friction and is hard to turn. At this point, the meter is resting on the bottom shelf of the housing. Then raise rotor just enough for it to be free of the base by turning same adjusting screw counterclockwise.

**Table 2 – Clearance Guide**

Meter Model No.	Rotor to Block	Rotor Adj. Total End Clearance (1)	Blade Slot (2)	Blade End to Rotor (3)	Blade Roller Over Natural Radius Portion of Cam (4)	Blade Tip Toward Housing (5)
T-11 or I-75	.002 - .004	.004 - .008	.0015 - .0040	.000 - .003	.001 - .005	.001 - .003
T-20 or I-150	.002 - .004	.005 - .009	.0015 - .0035	.000 - .003	.001 - .005	.0035 - .0055
T-40	.002 - .004	.006 - .010	.0015 - .0035	.000 - .005	.001 - .005	.0035 - .0050
SC-13	.002 - .004	.005 - .009	.001 - .004	.000 - .003	.001 - .005	.003 - .005
SD3-S1 or SD-30	.002 - .004	.006 - .010	.0015 - .0035	.000 - .005	.001 - .005	.0035 - .0050
SF4	.003 - .006	.005 - .011	.0015 - .0045	.000 - .004	.001 - .005	.004 - .006
SG6	.003 - .006	.007 - .013	.0015 - .0055	.000 - .004	.001 - .005	.006 - .008
SD-NF	.002 - .004	.006 - .010	.0015 - .0035	.000 - .005	.001 - .005	.0035 - .0050
T40-NF	.002 - .004	.006 - .010	.0015 - .0035	.000 - .005	.001 - .005	.0035 - .0055

**Note:** Standard clearances for temperatures less than 150°F and/or viscosities less than 400cP.

## Section 2 – Clearance Checks (continued)

Attach a spider, Figure 47, to top of meter housing so that the rotor assembly is centered in the housing and free to rotate. See Suggested Tools, Pages 2 and 3.

### **Method No. 2:**

If spider is not available, turn the adjusting screw on bottom of housing clockwise until rotor assembly meets friction and is hard to turn. At this point, the rotor is resting on bottom shelf of housing.

### **T-20 or I-150 Meter**

#### **Method No. 1:**

Attach a spider to top of meter housing. Turn adjusting screw in center of spider clockwise to force rotor assembly down until it bottoms on the base of the housing. Then turn adjusting screw counterclockwise until the rotor assembly is raised just enough for it to rotate freely.

#### **Method No. 2:**

If a spider is not available, lift rotor assembly from meter housing and remove adjusting spring from base of housing. Replace rotor assembly. Be sure that locking arm pin is fitted into the slot of the locking arm (see Figure 20). At this point, the rotor is resting on bottom shelf of housing.

With the rotor assembly in the bottomed position, the following clearance checks can now be made.

#### **Table 2 — Clearance Guide**

This clearance guide lists the recommended minimum and maximum fitting clearances for repair meters. Clearances may exceed the maximum shown, provided the meter proves within acceptable accuracy.

### **Blade Tip Toward Housing**

1. Rotate rotor until a blade is in measuring chamber, Figure 47.
  - If the spider is not used, the rotor assembly may be hard to turn.
2. With the blade in position, push blade toward wall, Figure 47, and check blade tip to housing clearance from top to bottom.
  - Record readings in “As Found” column of Meter Clearance Record Chart, Page 19.
3. Compare readings with Clearance Guide Table 2, Page 12. If readings are over maximum allowable clearance, replace blade assembly. If below minimum clearance, the rotor assembly must be removed and the blade end dressed down (see Page 17).
4. After desired clearance has been obtained, record measurements under “As Assembled” column of Meter Clearance Record Chart, Page 19.
5. Repeat above clearance checks (Steps 1 through 4) on remaining blades.



Figure 49

### **Rotor to Block**

1. Check rotor to block clearance as shown in Figure 42 and record finding in “As Found” column of Meter Clearance Record Chart, Page 19.
  - Clearance should be maintained the full length of the rotor.
2. Compare readings with Clearance Guide Table 2, Page 12. If readings are over maximum allowable clearance, replace block. If below minimum clearance, dress block faces with emery cloth until desired clearance is obtained. Record this new clearance in “As Assembled” column of Meter Clearance Record.

### **Blade Slot**



Figure 50

This clearance check may be made with the rotor assembly either in or out of the meter housing.

1. With blade positioned as shown in Figure 50, check clearances and record in “As Found” column of Meter Clearance Record Chart, Page 19.
2. Compare readings with Clearance Guide Table 2, Page 12. If slots are too wide, replace rotor. Refer to appropriate parts list for appropriate part number of rotor.
  - Record clearance in “As Assembled” column of Meter Clearance Record, Page 19, when acceptable clearances are obtained.
3. Repeat above procedure on other slots.

## Section 2 – Clearance Checks (continued)

### **Blade End to Rotor**

This check can be made with the rotor assembly in the meter housing or situated on a flat, even surface.

1. Place depth micrometer on the rotor over the blade end as shown in Figure 51 and check findings against Clearance Guide on Page 12.
  - If a depth micrometer is not available, a feeler gauge with a straight-edged block of metal may be used.
2. If blade extends over rotor, drop top end to meet clearance requirement.
3. If blade exceeds clearance requirement, replace.

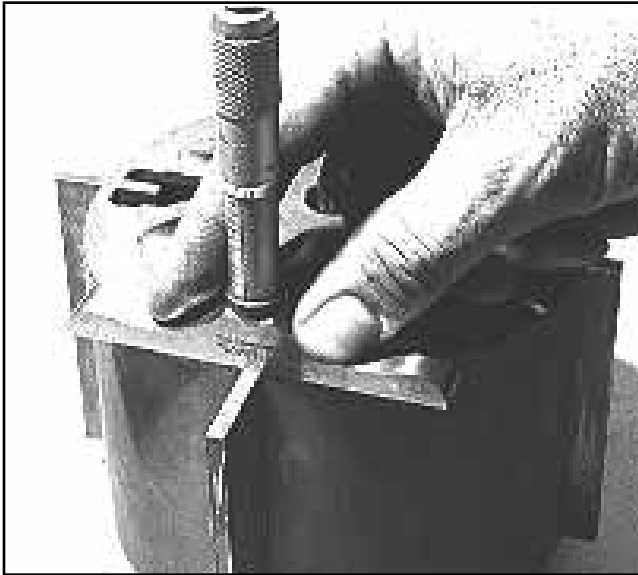


Figure 51

### **Blade Roller Over Radius Portion of Cam**

1. Rotate rotor until a blade is in Position No. 1 as shown in Figure 52.
2. Forcing blade against housing wall, check clearance between blade tip and housing wall from top to bottom. Note clearance.
3. Forcing blade away from wall, again check clearance.
  - The difference between these two clearance readings is the blade roller over radius portion of cam clearance in this position. Check against Clearance Guide Table 2, Page 12.
4. Rotate rotor assembly until this same blade is in the middle of the measuring chamber (Position No. 2), Figure 45.
5. Repeat Steps 2 and 3 and check findings against Clearance Guide Table 2, Page 12.
6. Again rotate rotor until blade is in Position No. 3, Figure 45, and repeat Steps 2 and 3. Check clearances against Clearance Guide, Table 2, Page 12.
7. Repeat Steps 1 through 6 with other blade assembly.
8. Record findings, if satisfactory, in Meter Clearance Record, Page 19.
9. If clearances on any portion of radius of cam do not fall within recommended limits as shown in Clearance Guide Table 2, Page 12, then check the following:
  - If tolerances are in excess of recommended clearances, determine if cam or blade roller is worn (normally, the cam will have the most wear). Replace worn parts and recheck clearances.
  - The roller in an integral part of the blade assembly in T-11 and I-75 Meters. In this case, the entire blade assembly would have to be replaced.

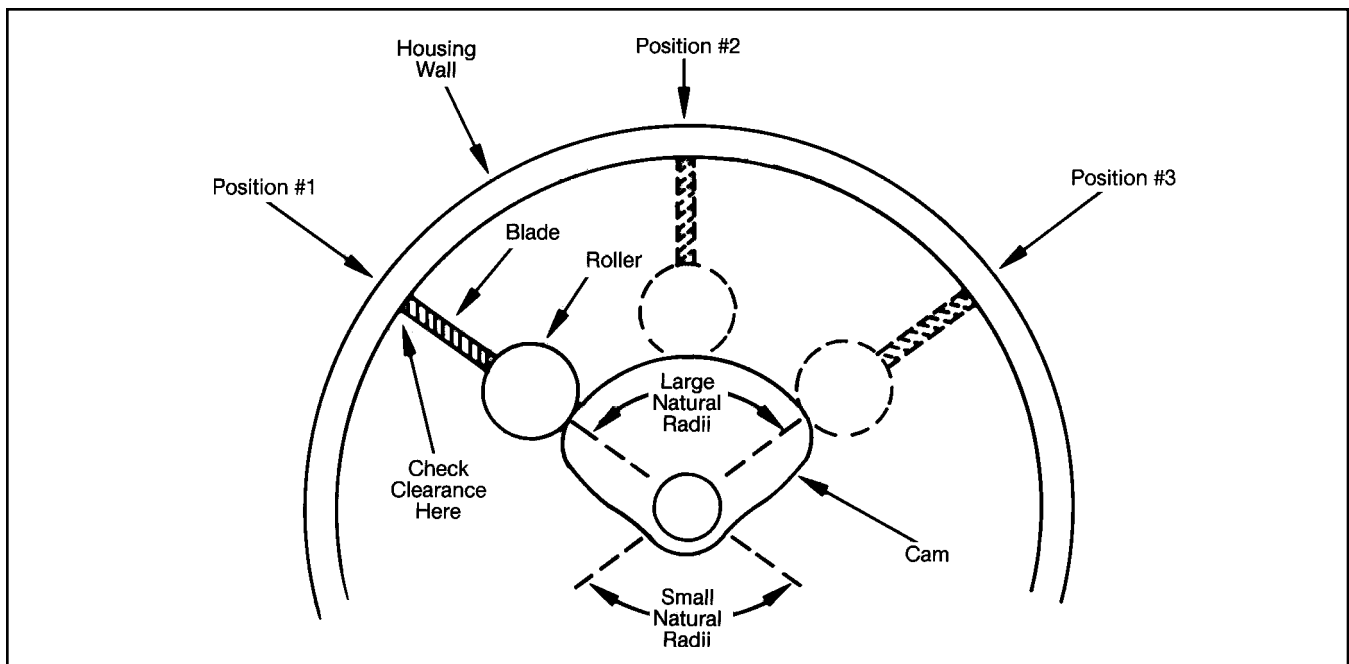


Figure 52

## Section 3 – Meter Repairs

### ***Replacing Adjusting Stem Assembly***

The adjusting stem assembly may be replaced as a unit or it may be disassembled and repaired. If disassembly of adjusting stem is desired, refer to Smith Parts List for part numbers of replaceable items. See Page 21 for applicable Parts List No. for each meter type.

To replace assembly:

1. Remove knob cover.
2. Unscrew the two screws securing adjusting stem assembly to meter cover and remove assembly, Figure 53.
  - Note adjusting stem adapter. Be sure this adapter is in position when new or repaired adjusting stem assembly is installed.

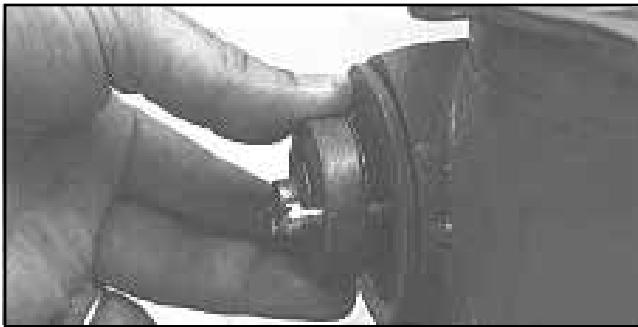


Figure 53

### ***Replacing Packing Gland***

**Note:** Meter must be drained and all pressure relieved before beginning this procedure.

The packing gland may be replaced without having to remove the meter cover. To replace packing gland:

1. Remove all accessories and calibrator from top of meter.
2. Remove cotter pin and drive washer, Figure 54.

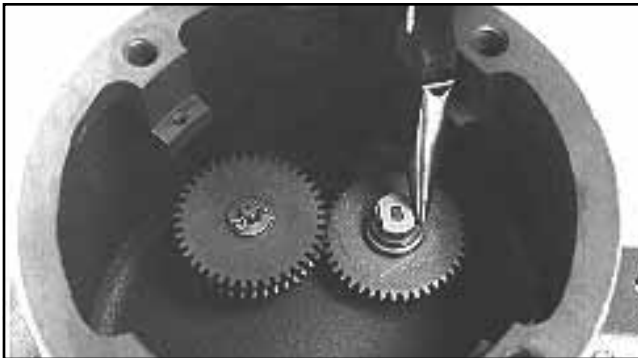


Figure 54

3. Lift single pinion gear from jackshaft, Figure 55, and remove packing gland flange.
4. Lift packing gland from cover, Figure 56.
  - If packing gland is difficult to remove with the fingers, use a pair of pliers as shown in Figure 56.

5. Install new packing gland and reassembled items removed in Steps 1, 2, and 3.

- Replace packing gland gasket, Figure 56, if required.



Figure 55

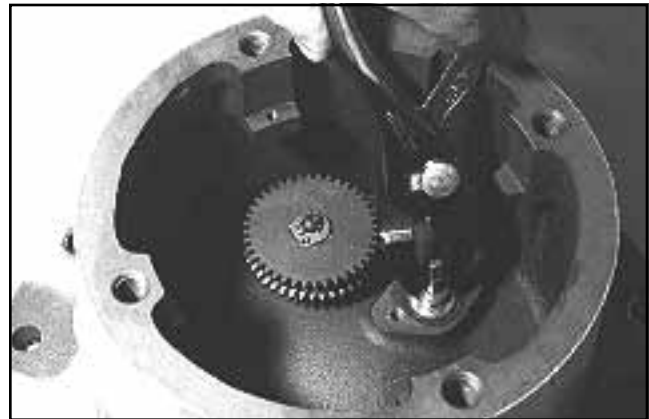


Figure 56

### ***Installing New Rotor***

Should it become necessary to replace a rotor assembly, refer to the Clearance Checks Section of this manual and perform all necessary checks to fit new rotor into housing. After rotor is fitted to housing, refer to Adjusting Rotor End Clearances, Page 9.

### ***Replacing Blade Assembly***

1. Install appropriate spider (see Suggested Tools and Fixtures, Page 2) and perform clearance checks as outlined in Clearance Check Section of this manual.
2. In most instances, clearances with new blades will be found to be too close. When this is the case, the complete rotor assembly must be removed and the blade ends dressed down.
  - Figure 57 shows the proper manner in which to accomplish this filing operation. Use a vise with soft jaws or otherwise properly protect the blade held by the vise.
  - A Vixen (babbit metal) file is recommended for aluminum blades. A mill coarse file should be used on cast iron blades.

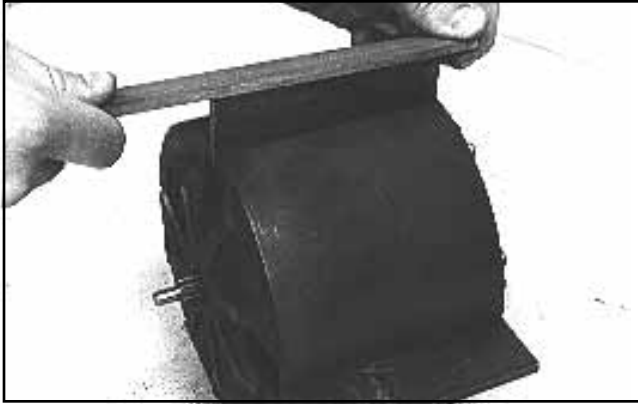


Figure 57

**Caution:** Care should be taken not to remove too much metal from the blade. Also, blades should have sharp, square, clean-cut edges.

3. After all the blade ends have been dressed down, reinstall rotor assembly back into the housing. Recheck clearances.
  - If not enough metal is removed the first time, the process must be repeated until the desired clearances are obtained.
4. Record these measurements as “As Assembled” clearances.
5. Adjust rotor end clearances after the meter is completely assembled, as outlined on Page 12.

### **Blade Roller Replacement (T-20, I-150, SC, SD, SF, and SG Meters)**

Remove rotor assembly from housing and disassemble as outlined on Page 2 or 6.

1. With blade assembly removed from the rotor, remove cotter pin and drive groove pin from blade assembly, Figure 58.
2. Slip roller out of slot in blade and install new roller.

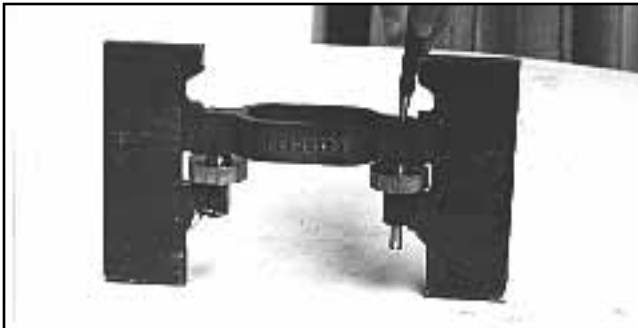


Figure 58

3. Reinstall groove pin and cotter pin.
4. Check companion roller on blade for wear or damage. Replace if necessary.
5. Reinstall blade assembly into rotor and reassemble meters, observing all clearance checks.

### **Cam Replacement (T-11 or I-75 Meters Only)**

Disassemble meter following Steps 1 through 4 under Disassembly of Model T-11 and I-75 Meters, Page 2 and 3, and proceed as follows:

1. With rotor assembly removed, unscrew hold-down screws and lift cam straight up from housing center hub, Figure 59.
2. Replace locating pins as necessary. (Pins may remain pressed into the cam. Be sure to press new pins into the housing center hub.)



Figure 59

3. Place cam setting bushing (see Suggested Tools and Fixtures, Page 2) in center hub.
4. Position new cam on center hub by placing it over top of cam setting bushing as shown in Figure 60.

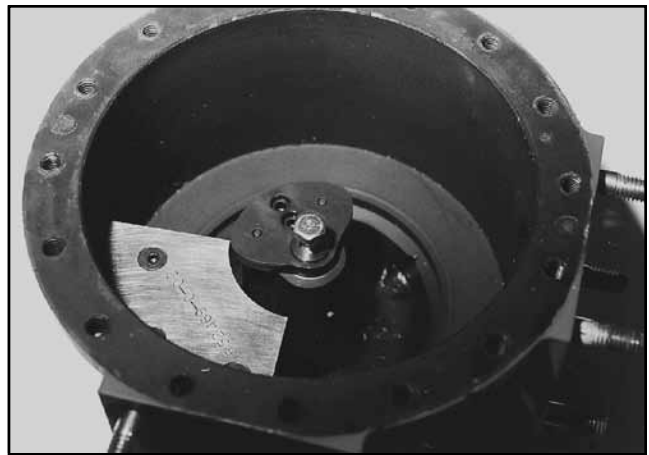


Figure 60

5. Tighten cam hold-down screws.
6. Place cam setting fixture (see suggested Tools and Fixtures, Page 2) on bottom shelf, Figure 60, and slide between cam face and measuring chamber wall.



## Section 3 – Meter Repairs (continued)

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**Figure 61**

7. If fixture does not pass through cleanly, see Figure 61, then remove hold-down screws and cam. Check housing for distortion in area of dwell on cam.
8. If fixture passes, but a gap is noticed between the fixture and cam face:
  - a. Reinstall blade assembly into rotor and reassemble meter, observing specifically the Blade Tip Toward Housing (see Page 12). If clearance is acceptable, finish the reassembly. If blade tip clearance is excessive, consider possible worn blade and replace if necessary.

**Note:** Be sure to tighten the two hold-down screws before reassembling the meter.

## Section 4 – Troubleshooting Table

Problem	Cause	Remedy
Over-registration (registering more volume than passing through meter).	Air passing through meter.	Check air eliminator.
	Calibrator out of adjustment.	Readjust calibrator. See MN01028, Pg. 4.
	Leaky valve in prover system (during test run).	Repair prover valve and rerun test.
Under-registration (registering less volume than passing through meter).	Mechanical friction in meter.	Check all meter clearances. See Pgs. 12 through 13. Check bearings for tightness.
	Binding or misalignment in driven accessories.	Inspect accessories. Repair or replace.
	Loose gear train or slipping drives.	Repair or replace.
	Calibrator out of adjustment.	Readjust calibrator. See MN01028, Pg. 4.
	Oversize clearances in meter.	Check meter clearances. See Pg. 12.
	Product being eliminated through vent line.	See below.
Product being eliminated through vent line.	Air eliminator cylinder seal damaged.	Replace cylinder seal.
	Air eliminator float ruptured.	Replace float.
	Foreign particles on cylinder sealing surfaces.	Clean sealing surfaces.
System fails to shut off properly after delivering preset quantity.	Linkage out of adjustment between set-stop counter and valve.	Adjust linkage correctly.
	Improper setting of "Minimum Setting" in set-stop counter.	See Pushbutton Set-Stop Counter Service Manual.
	Mechanical obstruction in valve.	Disassemble and remove obstruction. Inspect valve internals for damage.
	Defective pushbutton set-stop counter.	See Troubleshooting Section in Pushbutton Set-Stop Counter Service Manual.
	Plugged orifice.	Check orifice in upper piston of P-2 or PG-2 Valve (pressure system only).
Restricted product flow through meter.	Strainer clogged.	Clean strainer. Replace if necessary.
	Butterfly valve in air eliminator restricting flow.	Repair or replace.
	Back pressure or manual valves do not open.	Disassemble and inspect for foreign particles and/or defects. Repair.
	Mechanical obstruction in meter.	Disassemble and remove obstruction. Inspect meter internals for damage.
	Pump not operating (pressure system).	Inspect pump for mechanical or electrical defects. Replace if necessary.
	No product.	Supply product.
	Air being eliminated from product.	Normal - product flow automatically is restricted during air elimination.
	Pump undersized.	Replace with pump of sufficient capacity.
	Pump not operating properly.	Check pump.
System leaks after shutdown.	Linkage out of adjustment.	Adjust linkage correctly.
	Defective main seat seal in valve.	Replace seal.
	Foreign matter holding main valve seat open.	Disassemble valve and remove foreign matter. Check seal for damage.
Large numeral counter or ticket printer not operating satisfactorily.	Drive coupling defective.	Replace.
	Internal problems.	See Veeder Root Service Manual.

## Meter Clearance Record

Meter & Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Item	Date	As Found	As Assembled	Date	As Found	As Assembled	Date	As Found	As Assembled
Rotor to Block									
Blade Adj. Total End Clearance									
Blade Shot									
Blade End to Rotor									
Blade Roller Over Radius Portion of Cam									
Blade Tip Toward Housing									
Item	Date	As Found	As Assembled	Date	As Found	As Assembled	Date	As Found	As Assembled
Rotor to Block									
Blade Adj. Total End Clearance									
Blade Shot									
Blade End to Rotor									
Blade Roller Over Radius Portion of Cam									
Blade Tip Toward Housing									

## Section 5 – Related Publications

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The following literature can be obtained from FMC Technologies Measurement Solutions, Inc. Literature Fulfillment at [Measurement.Fulfillment@fmcti.com](mailto:Measurement.Fulfillment@fmcti.com) or online at [www.fmctechnologies.com/measurementsolutions](http://www.fmctechnologies.com/measurementsolutions). When requesting literature from Literature Fulfillment, please reference the appropriate bulletin number and title.

	<b>Specifications</b>	<b>Parts Lists (Form No.*)</b>
T-11/I-75 .....	Bulletin SS01003	P0565
T-20/I-150 .....	Bulletin SS01002	P0566
T-40.....	Bulletin SS01029	P0567
SC-13 .....	Bulletin SS01005	P0538
SD3-S1 .....	Bulletin SS01007	P0539
SD3-NF.....	Bulletin SS01009	P0540
SF4-NF.....	Bulletin SS01009	P0541
SG6-NF .....	Bulletin SS01009	P0542
Installation/Operation (All Models).....		Bulletin MN01028

\*The latest edition is indicated by a 2-digit postscript (e.g., .01, .02, etc.).

Revisions included in MN01029 Issue/Rev. 0.5 (6/11):  
Page 12: Adjusted Clearance Guide Measurements in Table

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.  
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