

DANIEL UMB TURBINE METER

INSTALLATION AND OPERATIONS MANUAL

**DANIEL MEASUREMENT AND CONTROL, INC.
AN EMERSON PROCESS MANAGEMENT COMPANY
HOUSTON, TEXAS**

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IMPORTANT INSTRUCTIONS

Daniel Measurement and Control, Inc. (Daniel) 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 Daniel products, including Daniel UMB Turbine Meters

- **Read all instructions prior to installing, operating and servicing the product.** If this instruction manual is not the correct manual, telephone 1-713-467-6000 (24-hour response number for both Service and Sales Support) 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 Daniel 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 personal injury.
- **ALWAYS READ AND FOLLOW THE DANIEL UMB TURBINE METER MANUAL AND ALL PRODUCT WARNINGS AND INSTRUCTIONS.**
- Use of this equipment for any purpose other than its intended purpose may result in property damage and/or serious personal injury or death.
- 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.

CAUTION

DAMAGE TO ELECTRONIC COMPONENTS

Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.

Failure to properly handle the instrument can damage electronic components that are susceptible to static electricity.

Handling Procedure:

5. Power to unit must be removed.
6. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
7. Printed circuit cards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

CAUTION

DAMAGE TO ELECTRONIC COMPONENTS

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.).

Failure to properly handle the instrument can damage or destroy electronic components that are susceptible to even small amounts of static electricity. The components will exhibit early failure even though they appear to function properly

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1.0 INTRODUCTION

1.1 General

This manual is designed to assist in the installation and operation of the Universal Mounting Box (UMB)[™] Turbine Flowmeter. To assure proper installation and startup it is important to read this manual in its entirety.

1.2 Description

The UMB[™] Turbine Flowmeter is a volumetric flow metering and transmitting device used extensively in the petroleum industry for the accurate measurement of hydrocarbon and other related process fluids. The meter's clean lines and simple configuration assures higher flow rates, extended flow range and sustained performance capability. It is designed for use within the guidelines of API Standards, Chapter 5.3, formerly Standard 2534 (The Measurement of Liquid Hydrocarbons by Turbine Meter Systems) and the test procedures of API Standards, Chapter 4 (Prover Systems).

The UMB provides explosion proof, weather resistant housing for both single or dual pick-offs as well as the preamplifier board. It serves as the mechanical mounting connection necessary for local and remote accessories.

The UMB Turbine is ideal for applications requiring high frequency resolution. Applications may include the Brooks Tri-10 Electronic Register, the Model 300 Batcher or any component of the PetroCount family of petroleum management equipment.

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2.0 SPECIFICATIONS



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Do not exceed specifications listed below.

Failure to heed this warning could result in serious injury and/or damage to the equipment.

Meter Performance

Linearity: $\pm 0.15\%$

Repeatability: $\pm 0.02\%$

Preamplifier Type

Dual Channel preamplifier

Single or dual, non-wetted, reluctance pick-offs

Preamplifier Performance**Inputs**

Supply voltage: 10-30 Vdc
Sensor Type: Reluctance
Signal: Sine Wave
Preamp Sensitivity: 40 mV peak to peak minimum

Outputs

Powered Pulse Output

Type: Square Wave
Frequency Range: 0 to 5 kHz
Amplitude: 0 to 5 V
1000 Ohm internal pull-ups, 20 mA, max.

Variable Voltage Output

Type: Square Wave
Frequency Range: 0 to 5 kHz
Amplitude: 0 to Supply Voltage
1000 Ohm internal pull-ups, 70 mA, max.

Open Collector Output (per Channel)

Type: Square Wave
Frequency Range: 0 to 5 kHz
Max. Voltage: 30 Vdc
Max. Current: 125 mA
Max. Power: 0.5 Watts

Transmission Distance

Without Preamp: 20 ft. (6.1 meters)

With Preamp: 3,000 ft. (914 meters)

Belden 88442 or equivalent up to 20 ft.

Materials of Construction

Meter Body (All sizes): Steel, Std.

Options: Steel flanges/ Stainless Steel flowtube, all Stainless Steel

Internal Components - Standard

Sizes 3" and 4": Stainless Steel

Sizes 6" and larger: Stainless Steel and Aluminum

Internal Components - Optional

All Stainless Steel. Consult factory for other materials.

Bearings: Tungsten Carbide

UMB Housing: Aluminum

Rotor Shroud: Standard 6" and larger (3 & 4" optional when metering products with viscosities of 10 cst and above.)

Ratings

The maximum working pressure for the UMB Turbine Meter is based on the temperature /pressure rating of the ANSI B16.5 flanges. The following chart lists the maximum working pressure of both 304 stainless steel and carbon steel flanges at 100° and 180° Fahrenheit (the maximum operating temperature for the standard meter). For maximum working pressures at intermediate temperatures, and for other materials, refer to ANSI B16.5.

Pressure/Temperature	Carbon Steel	Stainless Steel
150# ANSI / -20 to 100°F	285 psig WP	275 psig WP
150# ANSI / 180°F	265 psig WP	239 psig WP
300# ANSI / -20 to 100°F	740 psig WP	720 psig WP
#300 ANSI / 180°F	688 psig WP	624 psig WP
600# ANSI / -20 to 100°F	1480 psig WP	1440 psig WP
600# ANSI / 180°F	1376 psig WP	1248 psig WP

Pressure: ANSI pressure/temperature rating corresponding to flanges used.

Temperature: -20 to 180°F (-29 to 82°C)

Optional Temperature: -30 to 400°F (-34 to 204°C)

Pressure Drop: 5 psi (34.5 kPa) at maximum flow rate (based on gasoline meter only).

Mechanical Connections:



Standard: 150, 300, and 600 lb. ANSI R.F. flanges

Approvals

Electrical: Class I, Division 1, Groups C & D, UL, and cUL

Environmental: NEMA 4

Weights & Measures: NTEP Certificate # 90-118A4

 0539  II 2G
 DEMKO 03 ATEX 130946
 EEx d IIB T6

3.0 INSTALLATION

3.1 General

This section contains specific instructions for receipt and installation of the meter.

3.2 Receipt of Equipment

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

A report should be submitted to the Product Service Department, Daniel Measurement and Control, 11100 Brittmoore Park Drive, Houston, Texas, 77041.

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

Compare the packing list to the items in the shipping container. In the event that any items are missing from your shipment, contact your local Daniel Measurement and Control representative or Sales Office. The serial number of your meter and sales order number should be supplied at this time.

3.3 Return Shipment

To process returned goods quickly and efficiently, it is **IMPORTANT** that you provide essential information. All returned assemblies or parts must have an "RMA" (Returned Materials Authorization), or a letter which describes the problem, corrective action, if any, to be taken, and the work that is to be performed at the factory.

RMA forms can be obtained from Daniel Measurement and Control Sales Offices or the Product Service Department, Daniel Measurement and Control, 11100 Brittmoore Park Drive, Houston, Texas, 77041, phone (713) 467-6000.

Physically attach the RMA or letter to the material for return, and put both inside the shipping container. Include a copy of the packing list and a copy of the completed Instrument Decontamination Statement (from the back of this manual).

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. Also include a copy of the Instrument Decontamination Statement (from the back of this manual).

3.4 Flow Considerations

A properly designed flow system will do two basic things towards maintaining the linearity of the turbine meter. It will properly condition the incoming flow such that it is homogeneous throughout its cross section and it will provide proper back pressure so that cavitation will not originate inside the meter.

Linearity can be defined as the total range of deviation of accuracy, expressed as a curve, between minimum and maximum flow rates. The ideal accuracy curve of a volumetric meter, such as the turbine, is a straight line denoting a constant meter factor.

Cavitation is the formation and collapse of vapor-filled cavities that result from a sudden decrease and increase in pressure.

CAUTION

MECHANICAL EQUIPMENT DAMAGE

Provide unobstructed upstream piping.

Flowing liquid encountering a restriction or change of direction may result in damage to adjacent surfaces in meters, valves, pumps and pipes.

Turbine meter performance depends on the incoming fluid being devoid of swirls and excessive turbulence. These conditions can be avoided by providing unobstructed piping upstream of the meter. Pipe fittings such as elbows and tees, and piping components such as valves and strainers should be located far enough upstream as to allow as to dissipate any flow disturbance before it reaches the meter. Use of flow straighteners or flow conditioning plate greatly influence meter performance.

A. Specific Gravity

The turbine meter is affected by specific gravity and may influence performance. The effect of specific gravity on the turbine meter may be evidenced when specific gravity drops below 0.66. As specific gravity decreases, the lift forces on the turbine blade decreases. Likewise as velocity decreases, lift forces decrease. These reduced lift forces are overtaken by bearing friction as low rates are approached. Subsequently, linearity deteriorates at low flow rates while measuring light fluids.

To compensate for separate meter factors at low flow rates electronic monitoring equipment is used. This has been proven to enhance the overall measuring accuracy at the load rack. As low flow startup and shutoff flow rate is encountered, an established meter factor for that rate is applied. During the time that the high flow rate is used to load the bulk of the measured volume, a meter factor established for high flow rate is applied.

B. Viscosity

Turbine meters are viscosity sensitive in that as the metered fluid increases in viscosity, meter linearity begins to suffer. This effect on linearity is primarily due to a change in the fluid's velocity profile and skin friction between the fluid and the rotor blades.

In order to maintain turbine meter linearity on viscous hydrocarbons, a high ratio of inertial to viscous forces, known as the Reynolds number must be obtained. It should be noted that the turbine meter typically performs best in turbulent flow conditions as opposed to laminar flow. A high Reynolds number is one of the factors needed to maintain turbulent conditions.

The Reynolds number is a dimensionless number defined as $Re = \frac{DV\rho}{\mu}$

where:

- D = inside diameter of the pipe
- V = mean flow velocity
- ρ = density of the fluid
- μ = dynamic viscosity

all in consistent units.

C. Seasonal Changes

For optimal performance in loading rack applications, where fuel oils are metered and where there is a large temperature swing from summer to winter, it is recommended that a new meter factor be established as seasons change. This is recommended since temperature affects the viscosity of fuel oil and viscosity affects turbine meter performance.

Generally speaking, viscosities of 3 centipoise or less give no cause for concern. Above this viscosity, all influential factors should be considered. By properly anticipating the flow system's viscosity, maximum flow rate, flow range and desired linearity, the user can properly apply the turbine meter to the required application.

3.5 Installation and Equipment

Figure 3-1, Typical Installation has been provided as a guide in establishing optimum performance of the meter. Prior to installation, consider the general information listed below.

1. Note the direction of flow indicated on the plate near the inlet flange and install accordingly.
2. New Installations - Lines should be flushed thoroughly to rid piping of potentially damaging foreign material such as welding bead, pipe scale, etc. before the meter is placed into service.

NOTICE

A spool piece installed in place of the meter is recommended for this procedure.

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 Product do not place adverse stresses on the Product.

The design of the Product 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.

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

The Product has been designed with a minimum of 1.5mm (.059 inches) corrosion allowance. The customer should implement a periodic inspection and maintenance program to ensure that no part of the Product's pressure-retaining components has corrosion or erosion exceeding this amount.

3. Products to be measured -

NOTICE

Water should NEVER be used as a flushing medium through the turbine meter. Always use a flushing medium that is compatible with the metallurgy of the meter and its internal components and similar to the product for which the meter is intended.

4. Always install the meter downstream of pumps.

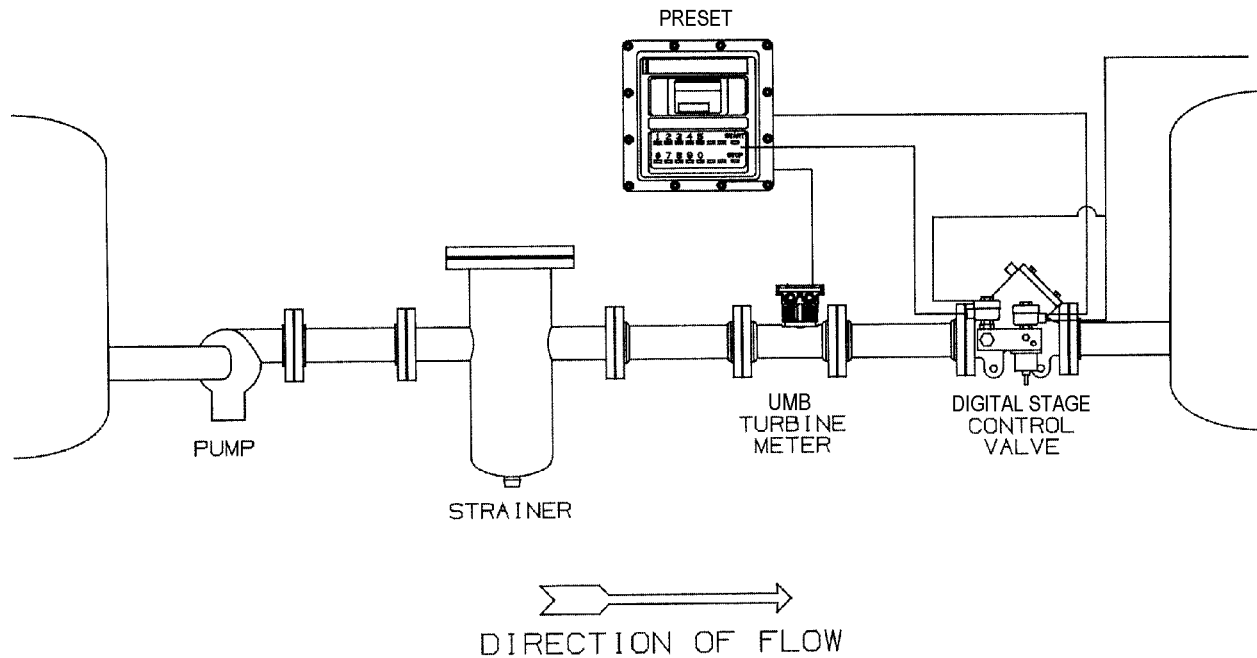


Figure 3-1. Typical Installation

A. Valves

The metering system should have a flow rate control valve located at a convenient distance downstream of all measurement equipment. The function of the control valve is to limit and maintain system pressure on the meter. This avoids cavitation.

When a loading rack meter is being calibrated with a displacer type prover (using a piston or sphere) a back pressure valve should also be used downstream of the proving device. This valve can be a simple manual valve that is partially closed. A minimum pressure of 12 to 15 psi (83 to 103 kPa) should be maintained downstream of the prover.

1. Valves should be capable of rapid, smooth opening and closing with positive shut-off.
2. When used for intermittent flow, valves should be fast acting and shock-free.
3. Spring loaded or self-closing valves should be of the type which will open to admit air when hydraulic hammering or vacuum conditions occur.
4. Bypass lines should be equipped with blind or positive shutoff devices.
5. Shut-off or control valves should be located downstream of the meter.

B. Flow Straightening

For proper operation of the meter, a flow conditioning plate, flow straightener (designed for the meter), or a straight run of pipe (20 pipe diameters long) is required. All piping must be the same diameter as the meter. Flow straightening devices must be installed directly upstream of the meter and should contain no flow restricting devices which could cause reversal of the flow straightening effect.

C. Flow Conditioning Plate

The flow conditioning plate is available for all standard UMB Turbine meters, sizes 3" - 8" and is designed to eliminate product flow characteristics such as liquid swirl and non-uniform velocity profiles (induced by piping configurations and other elements of the system) that may impede proper measurement within the turbine meter run. The plate is installed directly into the inlet of the meter. Due to the flow conditioning influence on the incoming product, this reduces the requirement for upstream flow straightening piping. It is recommended that a minimum of five pipe diameters be maintained upstream of the meter and two pipe diameters downstream of the meter to assure proper operation. Actual length will be determined by piping requirements specific to the application.

D. Strainers

A strainer of proper size should be installed upstream of the meter to protect it from the introduction of foreign material which might damage the meter. Recommended mesh sizes include: 40 mesh for refined products, and 10 to 20 mesh for crude products (depending on the product being measured).

Strainer Monitoring:

1. Recommended procedures dictate that regular, scheduled cleaning of the strainer basket be conducted to prevent filling and rupturing of the screen.
2. Pressure gauges installed on both sides of the strainer will indicate differential pressure across the strainer. High pressure differential caused by filling of the basket or occlusion of foreign material can cause strainer basket rupture resulting in possible meter damage.

3.6 Pick-off Coils and Electrical Connections

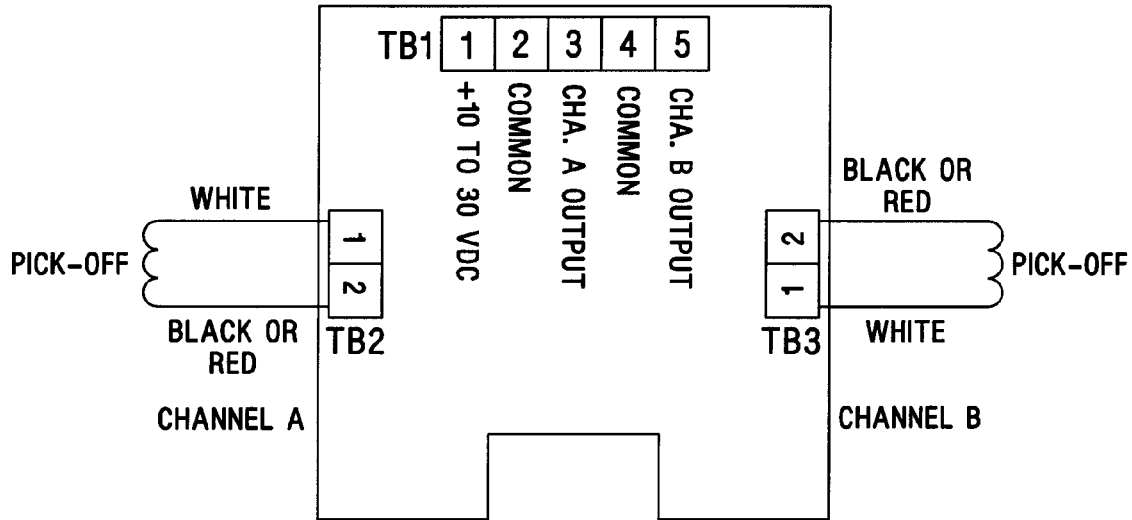
A. Pick-off Coils

The UMB Turbine has the capacity for single or dual pick-off coils mounted 90 electrically out of phase. Each pick-off produces a low level sine wave signal which varies in amplitude (mV) and frequency (Hz), proportional to the velocity of the turbine blades. This signal information is coupled to the input terminals of the preamplifier.

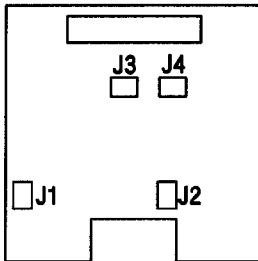
B. Electrical Connections

Pick-off input signal connections are made at terminal strip connection TB2 for Channel A, and TB3 for Channel B. Power supply and output signal connections are made at terminal strip TB1. Reference Figure 3-2. For single channel wiring use Belden 8770, or equivalent. Earth ground shield at one end only. Terminate shield and insulate it at the other end. For dual channel wiring use Belden 8770, or equivalent for power and channel A signal. Use Belden 8219, or equivalent for channel B. Connect both shields to earth ground at one end of cables and terminate and insulate shields at the other end. UMB housing should be at earth ground.

**DUAL CHANNEL PREAMP
TERMINAL IDENTIFICATION
CUSTOMER CONNECTIONS**



PREAMP JUMPER CONFIGURATIONS



JUMPER	JUMPER POSITIONS		
	A	B	OUT
J1-CHAN. A INPUT	N/A	40mV. PP MIN	N/A
J2-CHAN. B INPUT	N/A	40mV. PP MIN	N/A
J3-CHAN. A OUTPUT	5V.PULSE	SUP. VOLT. PULSE (10-30 VDC)	O.C.
J4-CHAN. B OUTPUT	5V.PULSE	SUP. VOLT. PULSE (10-30 VDC)	O.C.

Figure 3-2. UMB Wiring

C. Induced Interference

The Turbine meter should be located as far as possible from any electrical equipment such as motors, solenoids or relays which could induce an interference signal into the turbine meter pick-off coil. High amplitude interference introduced into the preamplifier can result in interference with the flow signal.

Proper shielding and an earth grounded UMB housing will greatly reduce the possibility of induced interference. See B, Electrical Connections.

D. Accessory Hookup

General considerations: It is important that the appropriate service manual be referenced before attempting to use accessories or instrumentation with the UMB Turbine. If service manuals for instrumentation were not received at the time of purchase or delivery, please contact the factory or nearest Daniel Measurement and Control sales and service office.

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4.0 OPERATION

4.1 General

This section contains the operating procedures for the UMB Turbine Flowmeter. Reference Section 3-4 for general flow considerations that may effect meter performance. The UMB Turbine Meter is a volumetric flow measuring and transmitting device that produces an output signal proportional to the rate-of-flow of the liquid being measured. The primary output is a single or dual high resolution signal that is amplified and shaped by an integral amplifier mounted within an explosion proof housing. This wave pulse can be fed directly to remote totalizing counters, digital readout devices or control instrumentation.

4.2 Pre-start Checks

1. Inspect all electrical connections to assure compliance to electrical codes and safety regulations.
2. All bolts used to secure the meter in line should be inspected to assure that proper mounting procedures have been followed and that flange connections are leak free.
3. Evaluate the system setup to assure that all components are in the proper sequence for accurate product measurement: isolation valve, strainer, flow straightener, meter, downstream section, control valve, etc.
4. Ensure that the supply voltage to the preamp is within the range of 10-30 VDC.

4.3 Operation

Flow and pressure information is stamped on the nameplate located on the outside of the meter.

**WARNING****PERSONAL INJURY AND/OR EQUIPMENT DAMAGE**

Never subject the meter to flow or pressure ranges above those specified in Section 2 Specifications, or those stamped on the meter.

Exceeding the meter specifications could result in serious injury and/or damage to the equipment.

1. Back pressure at the outlet of the meter must be sufficient for proper operation. Consider the following equation when determining back pressure for the meter.
2. Minimum Back Pressure $(2 \times \text{PressureDrop}) + (1.5 \times \text{Vapor Pressure})$
3. Valves should be opened slowly in such a way as to prevent system shock.
4. Care should be taken to protect the UMB housing and components from external impact of any kind. Note temperature limitations, Section 2 when selecting meter location.

5.0 MAINTENANCE

Reference Figure 7-1, 7-2, 7-3 and 7-4 Exploded Parts Drawing.

NOTICE

Item numbers reference actual engineering drawings and are not meant to be consecutively numbered.

5.1 General

The UMB Turbine is designed to operate for extended periods of time without evidence of wear or loss of precision. All meter adjustments were completed at the factory during liquid calibration and should not require field setup. However, should inspection of internal components be required or should field requirements change, information contained in this document must be read and understood before attempting any maintenance procedure.

If the UMB Turbine is found to be in need of repair, it is recommended the user contact the nearest Daniel Measurement and Control Sales or Service Office. It is important that servicing be performed by trained and qualified service personnel.

5.2 Maintenance Considerations

1. Label all parts or place parts in labeled containers during disassembly.
2. Use no metal clamping devices in direct contact with any meter part or surface.
3. Rotor blades determine proper flow measurement and should be handled with extreme care. Bending or altering the blades in any way can effect meter accuracy.

5.3 Disassembly Procedures - Internal Components

A. All sizes

1. Before removing the meter from the system the following precautions must be taken:
 - a. Disconnect all power to the meter.



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Disconnect power to the meter.

Failure to disconnect power to the meter could result in serious personal injury and/or damage to the equipment.

- b. Relieve all line pressure.



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Relieve pressure at this time.

Failure to relieve line pressure at this time could result in serious personal injury and/or damage to the equipment.

2. Disconnect conduit connections to the UMB Turbine. (Reference Figure 7-1)
 - a. Remove screws (item 52) and top cover (item 16) of the UMB.
 - b. Disconnect conduit connections from terminal board TB1 (assembly item 56).

B. Internal Components Sizes 3 through 8" (Reference Figure 7-2)

1. Remove the internal assembly from the meter body.
 - a. Set the meter in the vertical position with the inlet diffuser facing up.
 - b. Remove the snap ring (item 5).
 - c. Remove the flow conditioning plate (item 28 if used).
 - d. Holding the internal mechanism by the support fins of the inlet diffuser (item 2) carefully lift straight up until the assembly is clear of the meter body. Place the internal assembly on a clean dry surface resting on the inlet diffuser with the rotor assembly facing up.

1. Remove the cotter pin (item 22).
2. Remove nut (item 21), diffuser washer (item 20) and thrust washer (item 7) from the diffuser assembly.
3. Carefully pull or twist the outlet diffuser (item 2) from the rotor assembly. Direction of the pull must be straight and along the axis of the assembly.

CAUTION

METER PERFORMANCE WILL BE AFFECTED.

Handle the rotor with care.

Improper handling of the rotor assembly may cause distortion to the rotor blades.

4. Carefully remove the rotor assembly (item 3), and thrust washer (item 7).
5. Remove the shaft sleeve (item 8) prior to thrust washer location bottom of rotor.

C. Internal Components Sizes 10 through 16" (Reference Figure 7-3)

1. To remove the internal assembly from the meter body:
 - a. Set the meter in the vertical position with the inlet diffuser facing up.
 - b. Remove the socket head screws (item 33) from the meter assembly.
 - c. Holding the internal mechanism by the support fins of the inlet diffuser, carefully lift straight up until the assembly is clear of the meter body. It is recommended that a sling or other mechanical lifting device be used when removing the internal assembly. Lift only by the support fins or shaft of the inlet diffuser avoiding any contact with the rotor blades.
2. To completely disassemble the rotor assembly:
 - a. Set the internal assembly in the vertical position with the upstream diffuser cap (item 2) facing up. The assembly should rest entirely on the diffuser (item 2).

CAUTION

METER PERFORMANCE WILL BE AFFECTED.

Keep the internal assembly vertical.

Laying the internal assembly in a horizontal position could cause distorted rotor blades.

- b. Loosen the socket head cap screws (item 30) from the diffuser support plate (item 39) as required to remove the diffuser cap (item 37).
- c. Remove castellated nut (item 21) and lockwasher (item 25) from the rotor shaft assembly.
- d. Remove diffuser support plate (item 39), thrust washer (item 7), socket head screws (item 33) and bushing retainer (item 31) from the rotor shaft assembly.
- e. Carefully remove the bushing (item 29) and shaft sleeve (item 8) from the rotor assembly (item 3).
- f. Remove the rotor assembly (item 3) and thrust washer (item 7) from the shaft assembly (item 38). Note the orientation of the rotor. The tapered blade edge is always downstream.

CAUTION

METER PERFORMANCE WILL BE AFFECTED.

Handle the rotor with care.

Improper handling of the rotor assembly may cause distortion to the rotor blades.

- g. Remove the shaft assembly (item 38) from the inlet diffuser (item 2) by removing the socket head cap screws (item 33).
- h. The diffuser cap may be separated from the diffuser assembly on 10", 12", and 16" sizes by first removing the socket head screws (item 40).

5.4 Reassembly of Internal Components

In all cases reassembly is the reverse of disassembly. Caution must be taken at all times to protect the rotor blades from rough handling as blade position is critical to meter performance (Reference Figure 7-2).

See table for proper torque values for the castellated nut (item 21).

Meter Size	Torque Value
3"	minimum of 25 IN. LBS.
4"	minimum of 25 IN. LBS.
6"	minimum of 10 FT. LBS.
8"	minimum of 10 FT. LBS.
10"	minimum of 20 FT. LBS.
12"	minimum of 20 FT. LBS.
16"	N/A

On all meters 6" and larger, use PERMA-LOK #LM113 or equivalent on the socket-head screws (item 33) (see Figure 7-3).

5.5 Field Retrofittable Dual Pick-off

In the event that a second pick-off is required for equipment originally supplied with a single pick-off, or should field service or replacement of existing pick-offs be necessary, the following procedure is recommended.

See Figures 7-1 and 7-2.

1. Disconnect all power to the meter.



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Disconnect power to the meter.

Failure to disconnect power to the meter could result in serious injury and/or damage to the equipment.

2. Remove retaining screws (item 52) and cover (item 16) of the UMB housing assembly.
3. Disconnect terminal connects at TB1, TB2 and TB3.
4. Loosen retaining screws of preamplifier board (item 56) and lift out.
5. Care should be taken not to jar or disrupt terminal board components.
6. Remove retaining plate (item 49, Figure 7-2) and screw, (item 52).
7. Insert second pick-off (item 13) into the pick-off cavity of the UMB and secure with retaining plate (item 49) and screw, (item 52).
2. Mount the preamplifier board in its original position and secure using spring loaded retaining screws.
3. Attach electrical output wiring from both pick-offs to terminal connection TB2 and TB3 as shown in Figure 5-2.
4. Attach electrical output wiring from electrical accessories (conduit wiring) to terminal connection TB1, number 3 for channel A, and number 5 for channel B.
5. Secure all electrical wiring.
6. Return UMB cover and secure using original retaining screws.

6.0 TROUBLESHOOTING

6.1 General

This information has been provided as an aid in basic troubleshooting. Disassembly procedures have been outlined in Section 5 of this manual. If the UMB Turbine is found to be in need of repair, it is recommended the user contact the nearest Daniel Measurement and Control Sales or Service Office. It is important that servicing be performed by trained and qualified service personnel.

6.2 Conditions

Condition	Probable Cause	Correction
No output pulses from amplifier module.	<ol style="list-style-type: none"> 1. Input voltage to amplifier below minimum required for operation. 2. Damaged amplifier module. 3. Receiver unit not operating Meter rotor not turning. 	<ol style="list-style-type: none"> 1. Replace pick-off 2. Replace amplifier module. 3. Refer to instruction manual on defective unit. 4. Troubleshoot internal assembly.
Turbine meter rotor not turning.	<ol style="list-style-type: none"> 1. Defective rotor shaft bushing or sleeve. 2. Rotor damaged by foreign material passing through meter. 	<ol style="list-style-type: none"> 1. Return rotor assembly to factory for replacement or repair. 2. Return rotor assembly to factory for replacement or repair.
Inaccurate readout.	<ol style="list-style-type: none"> 1. Foreign material on rotor blades. 2. Rotor blades are bent. 3. Defective accessory equipment. 	<ol style="list-style-type: none"> 1. Check and clean blades. 2. Return to factory for replacement or repair. 3. Troubleshoot equipment.

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7.0 PARTS LIST

This section contains the necessary parts required to make up any standard unit covered in this manual. Recommended spare or replacement parts have been denoted by an asterisk.

NOTICE

Item numbers reference actual engineering drawings and are not meant to be consecutively numbered.

When ordering, the following information must be supplied:

- Serial number
- Part number
- Part description
- Quantity required

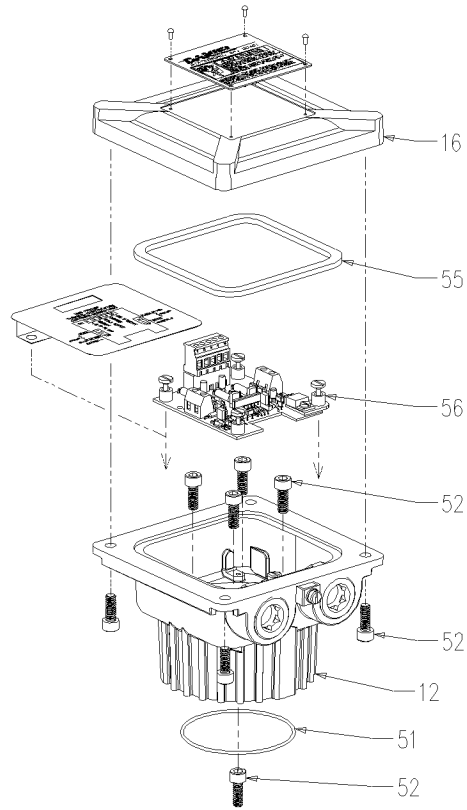


Figure 7-1. UMB Assembly - All Sizes (Reference Table 7-1)

Table 7-1. UMB Assembly - All Sizes (Reference Figure 7-1)

Item Number	Description	Part Number	Quantity Required
12	UMB Housing	899-00-100-00	1
16	UMB Cover	899-00-101-00	1
51	O-Ring (Viton A)	1500093-022	2
52*	Screw - Hex Socket Head	151496	9
55	Gasket	CA-375Z-259-XXA	1
56	Dual Channel Pre-amp	230-00-300-00	1

* Note: All item 52 - Torque 55 in. lbs., min.

DANIEL UMB TURBINE METER

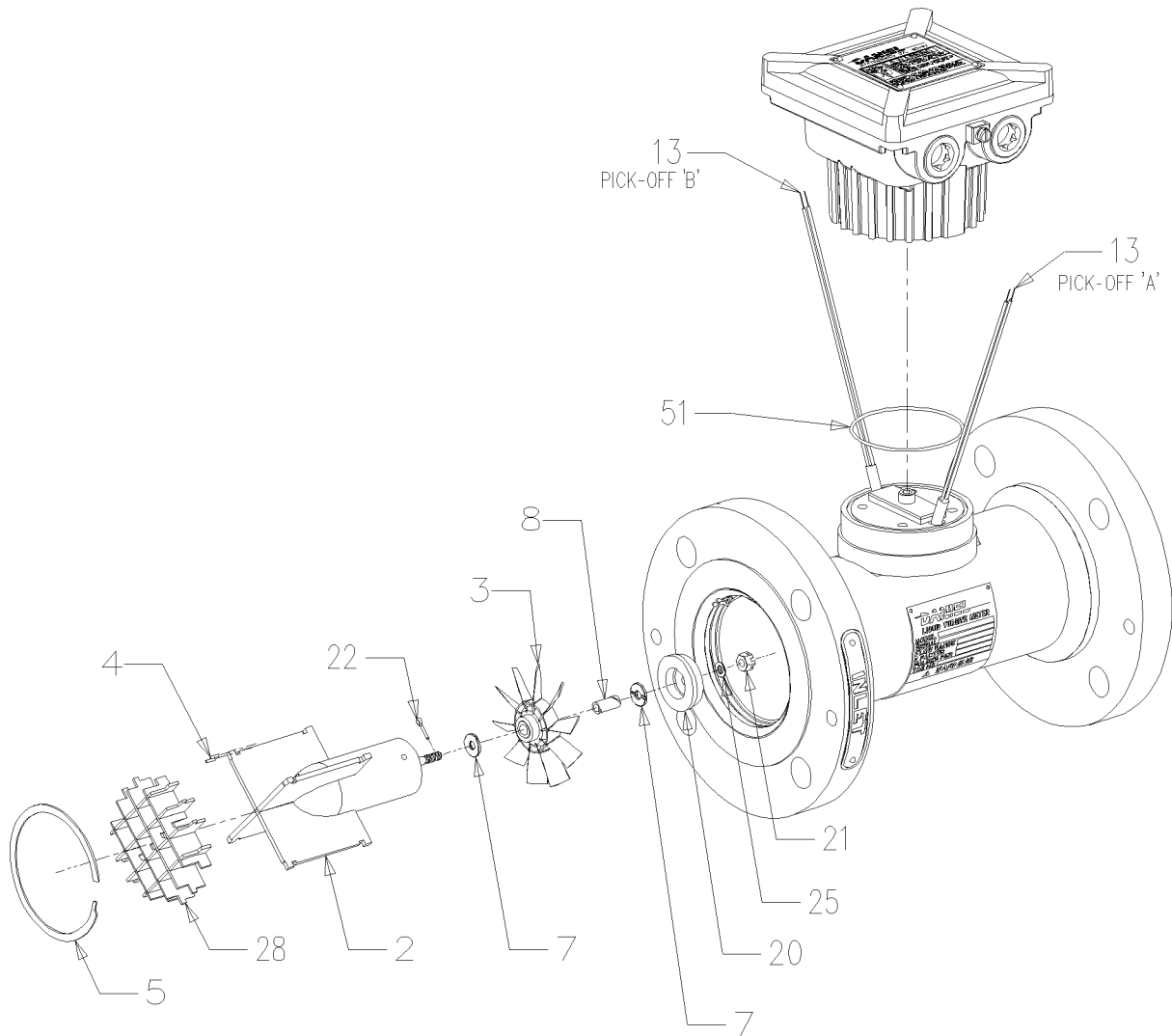


Figure 7-2. Meter Assembly - Sizes 3" and 4" (Reference Table 7-2)

Table 7-2. Meter Assembly - Sizes 3" and 4" (Reference Figure 7-2)

Item Number	Description	Part Number 3" and 4"	Quantity Required
2	Inlet Diffuser Assembly	894-20-390-00 (4") 894-22-390-00	1
* 3	Rotor Assembly	(3") 894 20-319-00 (4") 894-22-319-00	1
4	Roll Pin	153548	2
5	Snap Ring	(3") 156505 (4") 156504	1
* 7	Thrust Washer	894-22-062-00	2
* 8	Shaft Sleeve	894-22-073-00	1
* 13	Pick-off (Standard) Pick-off (High Temp.)	899-00-200-00 899-00-200-01	A/R A/R
20	Diffuser Washer	(3") 894-20-013-00 (4") 894-22-013-00	1
21	Castellated Nut	151650	1
22	Cotter Pin	153930	1
25	Belleville Washer	1500442	2
28	Flow Conditioning Plate	(3") 893-20-301-01 (4") 893-22-301-01	1
51	O-Ring(Viton A)	1500093-022	2

* Recommended spare parts

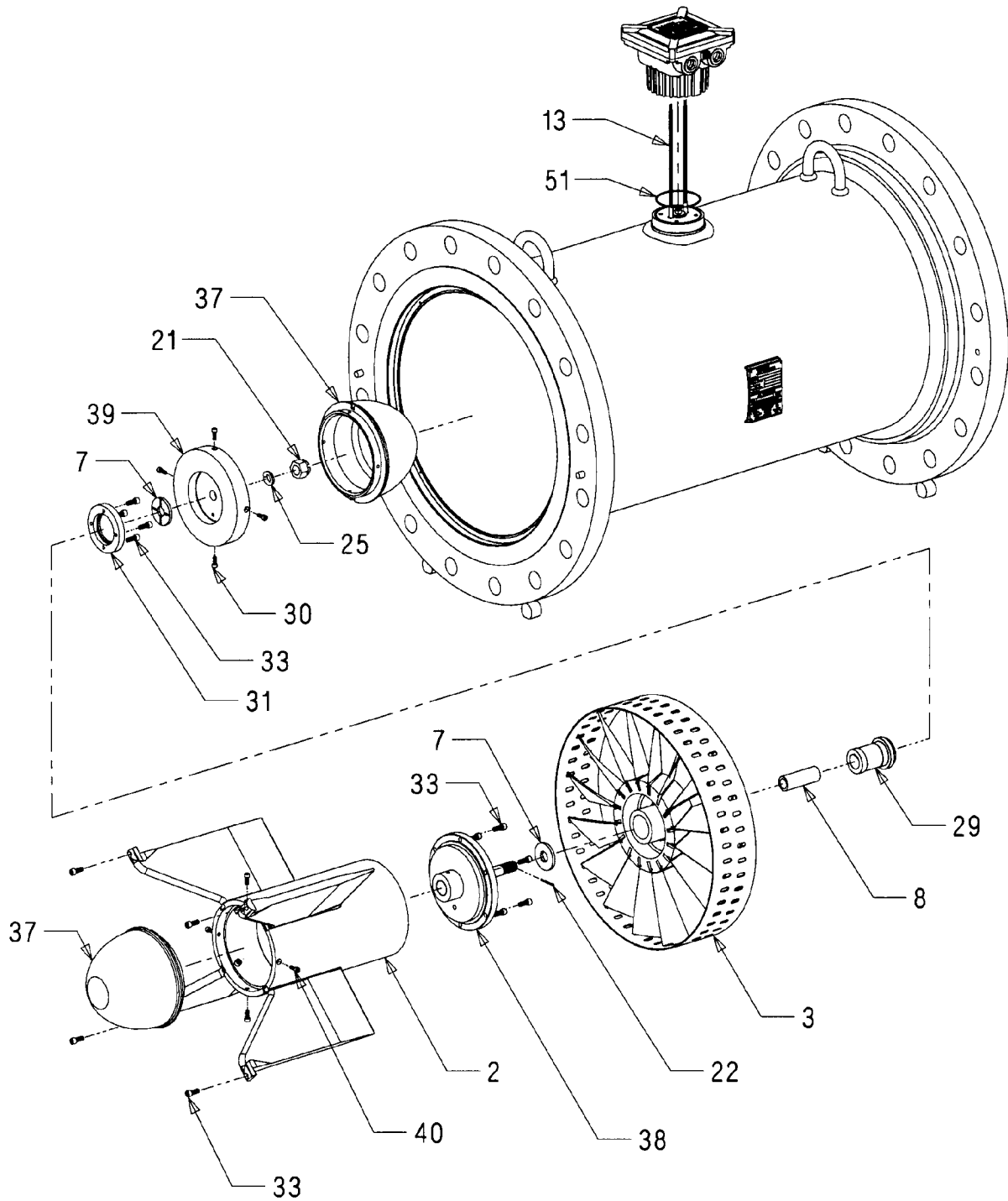


Figure 7-3. Meter Assembly - Sizes 6" through 16" (Reference Table 7-3)

Table 7-3. Meter Assembly - Sizes 6" through 16" (Reference Figure 7-3)

Item No.	Description	Part Number 6 and 8"	Part Number 10"	Part Number 12"	Part Number 16"	Qty. Req.
2	Diffuser Assy (Std.) Stn. Stl. Diffuser Assy	(6")894-24-390-00 (8")894-26-390-00 (6")894-24-390-02 (8")894-26-390-01	894-29-390-00 894-29-390-01	894-31-390-00 894-31-390-01	894-33-390-00	1
* 3	Rotor Assembly (Std.) Stn. Stl. Rotor Assy	(6")899-24-319-00 (8")899-26-319-00 (6")899-24-319-60 (8")899-26-319-60	899-29-319-00 899-29-319-60	899-31-319-00 899-31-319-60	899-33-319-00	1
* 7	Thrust Washer	894-26-062-00	894-29-062-00	894-29-062-00	894-33-062-00	1
* 8	Shaft Sleeve	894-26-073-00	894-29-073-00	894-29-073-00	894-33-073-00	1
* 13	Pick-off (Std.) Pick-off (High Temp.)	899-00-200-00 899-00-200-01	899-00-200-00 899-00-200-01	899-00-200-00 899-00-200-01	899-00-200-00 899-00-200-01	A/R A/R
21	Castellated Nut	151657	151656	151656	151653	1
22	Cotter Pin	153931	153918	153918	153918	1
25	Belleville Washer	1500443	152125	152125	152125	1
* 29	Bushing	894-26-127-00	894-29-127-00	894-29-127-00	894-33-127-00	1
30	Socket Head Screw	151086	151089-419	151089-419	151001-019	4
31	Bushing Retainer	894-24-065-00	894-29-065-00	894-29-065-00	894-33-065-00	1
33	Socket Head Screw	151086	151087	151087	151010-019	6
37	Inlet Diffuser Cap Inlet Diffuser - Stn. Stl.	Not Required	894-29-018-00 894-29-018-01	894-29-018-00 894-29-018-01	894-33-018-00	2 2
38	Shaft Assembly (Std.) Shaft Assy (Stn. Stl.)	Not Required	894-29-309-00 894-29-309-01	894-31-309-00 894-31-309-01	894-33-309-00	1
39	Diffuser Support Plate Stn. Stl.	Not Required	894-29-029-00 894-29-029-01	894-29-029-00 894-29-029-01	894-33-029-00	1
40	Socket Head Screw	Not Required	151087	151087	151001-019	4
51	O-Ring-Viton	1500093-022	1500093-022	1500093-022	1500093-022	1

* Recommended spare parts

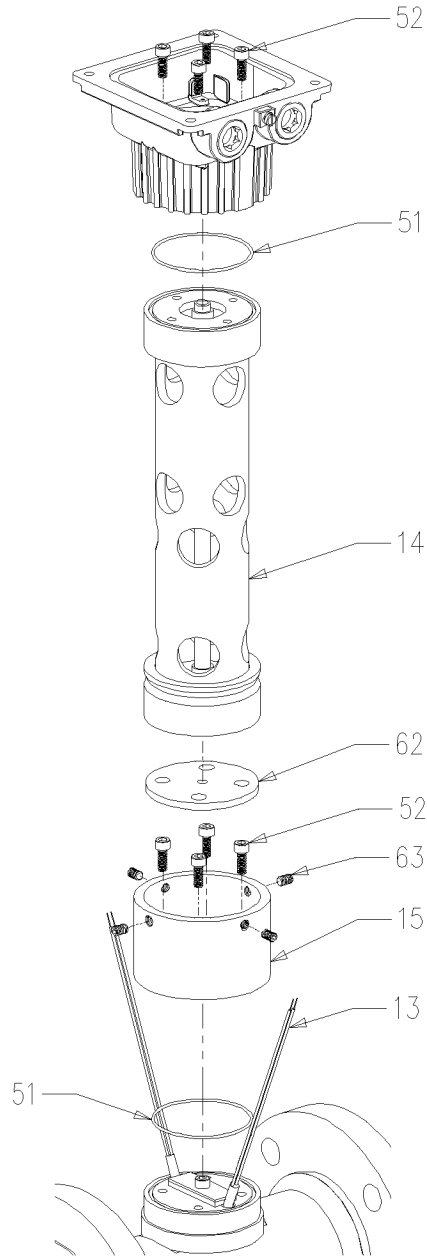


Figure 7-4. UMB High Temperature Extension - All Sizes (Reference Table 7-4)

Table 7-4. High Temperature Extension - All Sizes (Reference Figure 7-4)

Item Number	Description	Part Number	Quantity Required
* 13	High Temperature Pick-off	899-00-200-01	A/R
14	High Temp. Extension	899-00-600-03	1
15	High Temp. Adaptor Collar	899-00-600-01	1
* 51	O-Ring (Viton A)	1500093-022	2
**52	Screw - Hex Socket Head	151496	A/R
62	High Temp. Ext. Insulator	899-00-600-02	1
63	Set Screw	150982	4

Notes:

* Recommended spare parts

** All item 52 - Torque 55 in. lbs., min.

GUARANTEE

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

Daniel Measurement and Control shall not, in any event, be liable for any consequential damages, secondary charges, expenses for erection or disconnecting or losses resulting from any alleged defect in the apparatus.

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

NOTES

NOTES

**DANIEL MEASUREMENT AND CONTROL, INC.
INSTRUMENT DECONTAMINATION STATEMENT**

RMA Number _____
Item Being Returned _____

List all chemicals, process fluids, and gases that have come in contact with the equipment, including cleaning agents. Attach additional pages 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
Gas or 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 risk due to contamination.

Signature _____
Name (Please print) _____
Title _____
Company Name _____
Phone Number _____
Fax or TLX Number _____
Reason for Return _____

Reminder

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

WARRANTY CLAIM PROCEDURES

To make a warranty claim, you, the Purchaser, must:

1. Provide Daniel with proof of the Date of Purchase and proof of the Date of Shipment of the product in question.
2. Return the product to Daniel within twelve (12) months of the date of original shipment of the product, or within eighteen (18) months of the date of original shipment of the product to destinations outside of the United States. The Purchaser must prepay any shipping charges. In addition, the Purchaser is responsible for insuring any product shipped for return, and assumes the risk of loss of the product during shipment.
3. To obtain Warranty service or to locate the nearest Daniel office, sales, or service center call (713) 467-6000, Fax (713) 827-3880 write to:

Daniel Measurement Services
11100 Brittmoore Park Drive
Houston, Texas 77041

Or contact Daniel via following site:

www.emersonprocess.com/daniel

4. When contacting Daniel for product service, the Purchaser is asked to provide information as indicated on the following page entitled "Customer Repair Report".
5. For product returns from locations outside the United States, it will be necessary for you to obtain the import consignment address so that Daniel's customs broker can handle the importation with the U.S. Customs Service.
6. Daniel Measurement Services offers both on call and contract maintenance service designed to afford single source responsibility for all its products.
7. Daniel reserves the right to make changes at any time to any product to improve its design and to insure the best available product.

**DANIEL MEASUREMENT AND CONTROL, INC.
CUSTOMER REPAIR REPORT**

FOR 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 P. O. #: _____ 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 FAX OR WRITE THE CUSTOMER SERVICE DEPARTMENT AT:

DANIEL MEASUREMENT SERVICES
ATTN: CUSTOMER SERVICE
11100 BRITTMOORE PARK DRIVE
HOUSTON, TEXAS 77041

PHONE: (713) 467-6000
FAX: (713) 827-3880

**FOR FASTEST SERVICE CONTACT DANIEL VIA OUR WEBSITE:
www.emersonprocess.com/daniel**

The sales and service offices of Daniel Measurement and Control are located throughout the United States and in major countries overseas.
Please contact Daniel Measurement Services at
11100 Brittmoore Park Drive, Houston, Texas 77041, or phone (713) 467-6000
for the location of the sales or service office nearest you.
Daniel Measurement Services offers both on-call and contract
maintenance service designed to provide single-source
responsibility for all Daniel products.

Daniel Measurement and Control, Inc. and Daniel Measurement Services, Inc.,
Divisions of Emerson Process Management,
reserves the right to make changes to any of its products or services
at any time without prior notification in order to improve that product or service
and to supply the best product or service possible.
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