Liquid Turbine Flow Meters

Flow Measurement Systems
Halliburton Liquid Turbine Flow Meters

Halliburton developed its first flow meter for oilfield applications in 1957. The meter incorporated a tungsten-carbide shaft and bearing to withstand the rugged conditions of the oilfield environment. Over the years, this flow meter has built an unsurpassed reputation for withstanding severe punishment while maintaining operational and measurement integrity.

Halliburton turbine flow meters indicate flow rate and measure total throughput of a liquid line. As liquid flows through the meter and over the rotor, the rotor turns at a speed that is directly proportional to the flow rate. A magnetic pickup senses the rotor blades as they pass and generates an electrical (sine wave) signal, then these electrical pulses are transmitted to the flow measurement readout equipment.

Inside Story Reveals First Class Design for First Class Performance

1. Permanent conduit connection is standard.
2. ROTOR is pitched and pre-calibrated for maximum accuracy.
3. END CONNECTIONS available, flanged or threaded, standard or special.
4. FLOW VANES increase performance at low rates.
5. FLOW VANE HUB supports rotor assembly.
6. ROTOR SHAFT, BEARINGS, AND THRUST BALL are tungsten carbide for long service without lubrication other than by the liquid being measured.
7. RETAINING RINGS make disassembly easy.
8. FLOW METER BODY is sturdy, one-piece construction, precision finished.

Applications

Halliburton offers turbine flow meters for applications in a variety of end connections and accuracy levels. Typical applications are:
- Water-injection measurement
- Heater Treaters
- Test and production separators
- Disposal wells
- CO₂ injection
- Steam generator fuel and feed water
- Food and beverage industry
- Metering liquid fertilizer
- Water, fuel, and chemical measurement in plant settings
- Chemical tank loading and unloading
- Measuring liquid propane
- Insitu mining and leaching

Specifications

Accuracy

Halliburton meters are classified as Standard Grade and Industrial Grade, based on the accuracy of the meter. The Standard Grade meter provides a cost-effective measurement solution for applications where higher accuracy is not required. For higher accuracy, an Industrial Grade meter can be used. Such meters can achieve even greater accuracy if the range of the flow through the meter is specified.

- Standard Grade ± 1% of reading
- Industrial Grade ± 0.5% of reading
- Enhanced Accuracy (Consult Factory)

Note: 3/8-in. Meters
- Standard Grade ± 2% of reading
- Industrial Grade ± 1% of reading
The meter will remain accurate at flow rates higher than its rating, but bearing wear and pressure drop across the meter can shorten the life span of the meter. Halliburton flow meters can be over-ranged by 10% for short periods without significant damage.

Installation

• The meter should be installed with the arrow on the meter body corresponding to flow direction of the line.
• A 10-diameter length of straight pipe must be upstream and a five-diameter length of straight pipe must be downstream of the flow meter. Both pipe sections should be the same nominal pipe size as the flow meter.
• Both pipe sections should be the same nominal pipe size as the flow meter end connections.
• Throttling/Control valves should be located downstream of the flow meter.

<table>
<thead>
<tr>
<th>Halliburton Turbine Flow Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit Thread Data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temp. Rating</th>
<th>250°F(121°C)</th>
<th>450°F(232°C)</th>
<th>850°F(454°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread Size</td>
<td>1&quot; NPT</td>
<td>1&quot; NPT</td>
<td>1.5&quot; NPT</td>
</tr>
</tbody>
</table>

End Connections

Halliburton flow meters are available in a variety of end connections.

Threaded (NPT) Connections

Threaded meter sizes range from 3/8-in. to 2-in. Meter sizes from 3/8-in. to 1-in. pipe all have 1-in. NPT end connections to simplify meter size changes. All meter sizes other than the 2-in. have male threads. The 2-in. meter is available in a 5,000-psi standard model and a 10,000-psi high-pressure model.

Grooved Connections

Flow meters with grooved end connections are available in 7/8-in. through 8-in.

Flanged Connections

Turbine flow meters with flanged end connections are available in both raised-face (RF) models and ring-type joint (RTJ) models. Flanged materials can be carbon steel or stainless steel. All flanged Halliburton meters are equipped with slip-on flanges, which are then welded to the outside of the meter rather than being welded to the end of the meter body. Thus, the flange never comes into contact with the fluid being measured.

Materials of Construction

<table>
<thead>
<tr>
<th>Meter Body and Vanes</th>
<th>Grade 316L stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor</td>
<td>CD-4MCu</td>
</tr>
<tr>
<td>Shaft and Bearings</td>
<td>Tungsten Carbide</td>
</tr>
</tbody>
</table>

Optional Materials

- Shaft: Binderless carbide for enhanced corrosion resistance to selected chemicals
  Silver brazing to withstand temperatures to 550°F and chemicals that attack epoxy bonding bearing materials

- Rotor: Duplex electroless nickel plating for enhanced corrosion resistance to selected chemicals (especially acids that corrode ferrous materials)

Benefits

- Accurate and repeatable measurement.
- An economical solution for turbine flow meter applications.
- Easy installation and a variety of end connections.
- Minimum maintenance required.
- Long service life even in severe applications.

Meter Size Selection

Flow meter size selection should be based on the instantaneous flow rate of the line into which the meter will be mounted. Meter size should not be based only on the nominal piping size of the installation. Refer to Linear Flow Range Chart for meter size selection.
**EZ-IN™ Connections**

Series BF Turbine Flow meters with EZ-IN connections provide a cost-effective alternative to typical flanged-meter applications. Series BF meters with EZ-IN connections offer the accuracy, rugged construction, and maintenance-free operation of conventional Halliburton flow meters plus the following advantages:

- Lower installation cost.
- Less expensive than a conventional, flanged meter.
- Spreader nuts enable easy removal and inspection.
- The raised-face EZ-IN meter will mate to any flange rated ANSI 150# to 1500#. The new ring-joint (RTJ) version will mate to ANSI 900#, 1500# or 2500# RTJ flange. Specify flange type when ordering.

**Tri-Clover Industrial Flow Meter**

Tri-clover end connections enable fast, easy removal of the meter from the line for cleaning and routine maintenance.

**Applications**

- Dairy industry
- Food processing
- Pharmaceutical industry

**Specifications Accuracy**

- ± 0.5% of reading
- ± 0.25% of reading (limited flow range)

**Materials of Construction**

- Body and vanes: 316L Stainless steel with electro-polished finish
- Rotor: Alloy CD-4MCu with nickel-plated finish
- Shaft: Tungsten carbide or 316 SS (user-specified)
- Bearings: Tungsten carbide

*Vanes in \( \frac{3}{8}\)-in. through \( \frac{7}{8}\)-in. size are nickel-plated.

**Specialized Flow Meters**

- High-pressure
- Nitrogen
- CO₂
- Cement-Slurry
- Corrosive-Service
- Drilling Fluids

Contact Halliburton Product Support for application assistance.

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### Linear Flow Range \(^{(1,2,3)}\)

<table>
<thead>
<tr>
<th>Flow Meter Size (^{(i)})</th>
<th>mm</th>
<th>GPM</th>
<th>m³/HR</th>
<th>BPD</th>
<th>Nominal (^{(2,3)}) Calibration Factor</th>
<th>Maximum Output Frequency (Pulses/Sec)</th>
<th>∆P at Maximum Flow (^{(i)}) psi</th>
<th>kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{3}{8} )</td>
<td>10</td>
<td>.3 - 3</td>
<td>0.068 - 0.68</td>
<td>10 - 100</td>
<td>22000 ((5812))</td>
<td>1100</td>
<td>4.0</td>
<td>28</td>
</tr>
<tr>
<td>( \frac{1}{2} )</td>
<td>13</td>
<td>.75 - 7.5</td>
<td>0.17 - 1.70</td>
<td>25 - 250</td>
<td>14500 ((3830))</td>
<td>1815</td>
<td>12.0</td>
<td>83</td>
</tr>
<tr>
<td>( \frac{3}{4} )</td>
<td>19</td>
<td>2 - 15</td>
<td>0.45 - 3.41</td>
<td>68 - 515</td>
<td>2950 ((780))</td>
<td>740</td>
<td>18.0</td>
<td>124</td>
</tr>
<tr>
<td>( \frac{7}{8} )</td>
<td>22</td>
<td>3 - 30</td>
<td>0.68 - 6.81</td>
<td>100 - 1000</td>
<td>2350 ((621))</td>
<td>1175</td>
<td>20.0</td>
<td>138</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
<td>5 - 50</td>
<td>1.14 - 11.36</td>
<td>170 - 1700</td>
<td>900 ((238))</td>
<td>750</td>
<td>20.0</td>
<td>138</td>
</tr>
<tr>
<td>1(-\frac{1}{2})</td>
<td>38</td>
<td>15 - 180</td>
<td>3.41 - 40.88</td>
<td>515 - 6000</td>
<td>325 ((86))</td>
<td>975</td>
<td>16.0</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>40 - 400</td>
<td>9.09 - 90.85</td>
<td>1300 - 13000</td>
<td>55 ((14.5))</td>
<td>365</td>
<td>22.0</td>
<td>152</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>60 - 600</td>
<td>13.63 - 136.28</td>
<td>2100 - 21000</td>
<td>57 ((15.2))</td>
<td>570</td>
<td>10.0</td>
<td>69</td>
</tr>
<tr>
<td>4</td>
<td>102</td>
<td>100 - 1200</td>
<td>22.71 - 272.55</td>
<td>3400 - 41000</td>
<td>30 ((7.9))</td>
<td>600</td>
<td>10.0</td>
<td>69</td>
</tr>
<tr>
<td>6</td>
<td>152</td>
<td>200 - 2500</td>
<td>45.43 - 567.82</td>
<td>6800 - 86000</td>
<td>7 ((1.8))</td>
<td>290</td>
<td>10.0</td>
<td>69</td>
</tr>
<tr>
<td>8</td>
<td>203</td>
<td>350 - 3500</td>
<td>79.49 - 794.94</td>
<td>12000 - 120000</td>
<td>3 ((.8))</td>
<td>175</td>
<td>6.0</td>
<td>41</td>
</tr>
</tbody>
</table>

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\(^{(1)}\) The linear flow range of liquids with non-lubricating characteristics is limited to the upper 60% of rating.

\(^{(2)}\) Based on water.

\(^{(3)}\) Consult factory for application involving liquids with viscosity above 5 centistokes.
**Face to Face Dimensions**

<table>
<thead>
<tr>
<th>Flanged Meters</th>
<th>Threaded</th>
<th>Grooved</th>
<th>EZ-IN 1&quot; Flg</th>
<th>EZ-IN 2&quot; Flg</th>
<th>3A Sanitary</th>
<th>Weco High Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>5.00 (127.0)</td>
<td>4.0 (102)</td>
<td>N/A</td>
<td>4.0 (102) 2.5 (63.5)</td>
<td>N/A</td>
<td>3.5 (88.9) N/A</td>
</tr>
<tr>
<td>1/2</td>
<td>5.00 (127.0)</td>
<td>4.0 (102)</td>
<td>N/A</td>
<td>4.0 (102) 2.5 (63.5)</td>
<td>N/A</td>
<td>3.5 (88.9) N/A</td>
</tr>
<tr>
<td>3/4</td>
<td>5.00 (127.0)</td>
<td>4.0 (102)</td>
<td>N/A</td>
<td>4.0 (102) 2.5 (63.5)</td>
<td>N/A</td>
<td>3.5 (88.9) N/A</td>
</tr>
<tr>
<td>1</td>
<td>6.00 (152.4)</td>
<td>4.0 (102)</td>
<td>4.0 (102)</td>
<td>4.0 (102) 2.5 (63.5)</td>
<td>3.5 (88.9)</td>
<td>4.0 (102) 8.00 (203.3)</td>
</tr>
<tr>
<td>1-1/2</td>
<td>7.00 (177.8)</td>
<td>6.0 (152)</td>
<td>6.0 (152)</td>
<td>N/A</td>
<td>2.5 (63.5)</td>
<td>3.5 (88.9) 5.5 (139.7) 8.60 (218.4)</td>
</tr>
<tr>
<td>2</td>
<td>8.50 (215.9)</td>
<td>10.0 (254)</td>
<td>10.0 (254)</td>
<td>N/A</td>
<td>2.5 (63.5)</td>
<td>3.5 (88.9) 8.5 (215.9) 9.00 (228.6)</td>
</tr>
<tr>
<td>3</td>
<td>10.00 (254.0)</td>
<td>N/A</td>
<td>12.5 (318)</td>
<td>N/A</td>
<td>4.25 (108)</td>
<td>4.25 (108) N/A 13.0 (330.2)</td>
</tr>
<tr>
<td>4</td>
<td>12.00 (304.8)</td>
<td>N/A</td>
<td>12.0 (304.8)</td>
<td>N/A</td>
<td>5.0 (127)</td>
<td>5.0 (127) N/A N/A</td>
</tr>
<tr>
<td>6</td>
<td>12.00 (304.8)</td>
<td>N/A</td>
<td>12.0 (304.8)</td>
<td>N/A</td>
<td>5.75 (146.1)</td>
<td>5.75 (146.05) N/A N/A</td>
</tr>
<tr>
<td>8</td>
<td>12.00 (304.8)</td>
<td>N/A</td>
<td>12.0 (304.8)</td>
<td>N/A</td>
<td>6.25 (158.8)</td>
<td>6.25 (158.75) N/A N/A</td>
</tr>
</tbody>
</table>

**Pressure Drop Curve for Halliburton Turbine Flow Meters**

![Pressure Drop Curve Graph](image)

**Warranty:**

The manufacturer warrants to the original purchaser of the product that the product will be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. The warranty period begins on the date of purchase and ends one year later. 

No warranty is given for the product's performance or for its fitness for any particular purpose. The warranty does not cover damage caused by misuse, abuse, or unauthorized modifications. The warranty does not apply to products that have been altered or repaired by persons other than those authorized by the manufacturer.

In the event of a warranty claim, the manufacturer will repair or replace the product at its discretion. If the product cannot be repaired or replaced, the manufacturer will refund the purchase price. 

**Limitation of Liability:**

In no event shall the manufacturer be liable for any incidental, consequential, or special damages, whether based on contract, warranty, or negligence, arising out of the use or inability to use the product. 

The warranty is void if the product is used in a manner that is not consistent with the manufacturer's instructions. 

The warranty is valid in the United States and Canada only.

H00097
## Flanged End Connection Flowmeters - ANSI B16.5 Pressure Ratings

<table>
<thead>
<tr>
<th>ANSI B16.5 Flange Rating</th>
<th>150*</th>
<th>300*</th>
<th>600*</th>
<th>900*</th>
<th>1500*</th>
<th>2500*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI B16.5 Flange Rating</td>
<td>1.1</td>
<td>2.2</td>
<td>1.1</td>
<td>2.2</td>
<td>1.1</td>
<td>2.2</td>
</tr>
</tbody>
</table>

### Design-Operating Temperature Range

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>psi</th>
<th>mPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20 to 100°F</td>
<td>285</td>
<td>1.96</td>
</tr>
<tr>
<td>-20 to 200°F</td>
<td>260</td>
<td>1.79</td>
</tr>
<tr>
<td>-20 to 400°F</td>
<td>200</td>
<td>1.38</td>
</tr>
<tr>
<td>-20 to 600°F</td>
<td>140</td>
<td>0.96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>psi</th>
<th>mPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 times maximum working pressure at -20 to 100°F</td>
<td>1.5 times maximum working pressure at -20 to 100°F (28.8 to 37.7°C)</td>
<td>1.5 times maximum working pressure at -20 to 100°F (28.8 to 37.7°C)</td>
</tr>
</tbody>
</table>

*Flange Rating 1.1 References Carbon Steel Flanges. Flange Rating 2.2 References Stainless Steel Flanges