

### Design Features

- No moving parts to wear or fail.
- Electronics can be remotely mounted up to 30.5 m (100 ft).
- No fluid to sensor contact.
- No holes to clog.
- Aalborg's proprietary DSP algorithm accurately filters vortex frequency.
- High flow turndown ratio up to 10:1.
- Dual signal processing technology improves accuracy at low flows.
- Accuracy of 1% of rate.
- Noise cancellation technology.
- Extensive Diagnostics.
- Password protected data entry.
- Volumetric and mass flow information simultaneously displayed.
- Selectable engineering units.
- On board computer calculates density and mass flow.
- Two programmable totalizers.

### Principles of Operation

Vortices are created when a fluid passes around a bluff body as shown in Figure 1. Vortices are alternately shed on each side of the body, 180 degrees out of phase to each other, resulting in an oscillating pressure gradient. As flow increases the frequency of vortices increases in proportion to the increased flow thereby creating a linear relationship.

### General Description

Constructed of type 316 stainless steel, wafers may be installed in-line by customer provided or built-in flanges. Keypad or communication interface functionalities include measuring units, programmable flow alarm, two programmable totalizers, programmable flow rate pulse output, two programmable optically isolated outputs, battery backed real time clock (RTC), digital communication interface (RS-232 or RS-485), programmable diagnostic events log and register with date and time stamp, programmable process variable log with date stamp, calibration and flowing fluid parameters adjustment, extensive diagnostics.

Our exclusive dual signal processing technology independently measures each vortex on either side of the bluff body and filters out non-flow noise. This results in less noise and higher accuracy throughout the flow range. Aalborg's proprietary DSP algorithm accurately filters vortex frequency, improving the quality of flow measurements.

Local 2x16 LCD readout provides flow rate and total flow volume reading in selectable engineering units, diagnostic events indication and feature a password protected access to the process parameters to ensure against tampering or resetting.

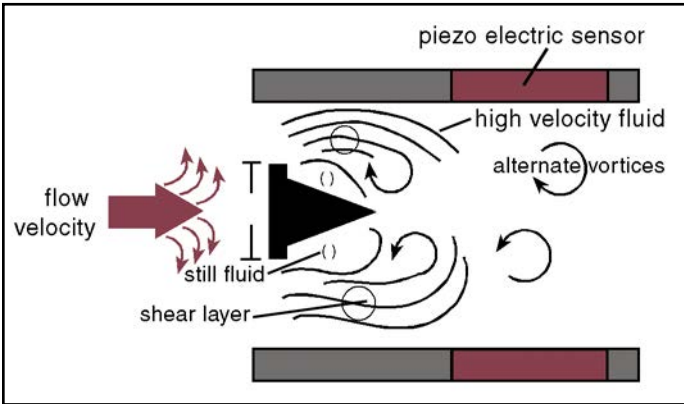


Vortex In-line Flow Meter Shown with Wafer Mounting

Vortex In-line Flow Meter Shown with Flange Mounting

#### TABLE 54 - FUNCTIONAL SPECIFICATIONS

|                          |   |
|--------------------------|---|
| <b>FLUID TYPES</b>       | Steam, Gas, Liquid.   |
| <b>MAXIMUM PRESSURE</b>  | 69 bar (1000 psig) with wafer mount<br>See Table 63 for flange mount.   |
| <b>FLUID TEMPERATURE</b> | -20° to 232 °C.<br>-4° to 450 °F.   |
| <b>LOW FLOW CUT-OFF</b>  | Adjustable: Set @ min. per Tables 58 to 62.   |
| <b>HIGH FLOW CUT-OFF</b> | Adjustable: Set @ max. per Tables 58 to 62.   |
| <b>VOLTAGE</b>           | 15 to 30 Vdc standard. 115 or 230 VAC optional.   |
| <b>FREQUENCY</b>         | 50 /60 Hz.  |
| <b>OUTPUTS</b>           | Two user programmable analog 4-20 mA outputs (600 Ohms or less load), two sets of user-programmable optically isolated outputs, one user programmable optically isolated flow pulse output, RS-232 or RS-485 Digital Interface with Multi-Drop Capability of up to 255 units (RS-485 option). |
| <b>LINEAR RANGE</b>      | Reynolds number of >10,000.   |



**TABLE 55 - PERFORMANCE SPECIFICATIONS**

|                            |  |
|----------------------------|--|
| <b>FLOW ACCURACY</b>       | 1% of rate.  |
| <b>FLOW REPEATABILITY</b>  | 0.25% of rate.   |
| <b>FLOW TURNDOWN RATIO</b> | See Tables 58 to 62.   |
| <b>RESPONSE TIME</b>       | Adjustable based on NRF and Damping settings (minimum 1000 ms).  |
| <b>DAMPING</b>             | Adjustable: 1 to 99 sec.   |
| <b>VELOCITY RANGE</b>      | Liq.: 1.32 or to 30 ft/sec.<br>Steam & Gas: $(144/\bar{\rho})^{1/3}$ to 250 ft/sec.<br>$\bar{\rho}$ = density (lb/ft <sup>3</sup> ).<br>d = pipe diameter (in).<br>$\mu$ = viscosity (cp). |
| <b>AGENCY APPROVALS*</b>   | FM and CSA Class 1 Div 2 Groups B,C,D.   |

**TABLE 56 - PHYSICAL SPECIFICATION**

|   |   |
|---|---|
| <b>** MATERIALS OF CONSTRUCTION</b>       |   |
| <b>SHEDDER BAR</b>                        | 316 SS.                                   |
| <b>ELECTRODES</b>                         | 316 SS encapsulated ceramic.              |
| <b>METERING TUBE</b>                      | 316 SS.                                   |
| <b>FLANGES</b>                            | 316L SS.                                  |
| <b>ELECTRONICS HOUSING</b>                | Epoxy coated aluminum.                    |
| <b>CONNECTIONS AND MOUNTINGS</b>          |   |
| <b>MOUNTING POSITION</b>                  | Vertical, horizontal, angle.              |
| <b>TYPICAL STRAIGHT PIPE REQUIREMENTS</b> | Upstream: 20 x D.<br>Downstream: 5 x D.   |
| <b>TEMPERATURE TAP (BY CUSTOMER)</b>      | Downstream: 3.5 x D.                      |
| <b>PRESSURE TAP (BY CUSTOMER)</b>         | Upstream: 3.5 x D.                        |
| <b>PROCESS CONNECTIONS</b>                | ANSI Class 150 RF, 300 RF, 600 RF, Wafer. |
| <b>ELECTRICAL CONNECT</b>                 | 3/4" FNPT.                                |

**TABLE 57 - ELECTRONIC SPECIFICATIONS**

|                             |   |
|-----------------------------|---|
| <b>AMBIENT TEMPERATURE</b>  | -12° to 65 °C (-15° to 149 °F).   |
| <b>TRANSMITTER</b>          | Microprocessor-based.   |
| <b>DISPLAY</b>              | Two lines, 16 alphanumeric characters each, programmable for different process variable rate and total.   |
| <b>FUNCTIONS</b>            | Measuring Units, Programmable Flow Alarm, Two Programmable Totalizers, Programmable Flow Rate Pulse Output, Two Programmable Optically Isolated Outputs, Two Programmable analog 4-20 mA outputs, Battery Backed Real Time Clock [RTC], Digital communication interface (RS-232 or RS-485), Programmable Diagnostic events Log and register with date and time stamp, Programmable Process Variable Data Log (total 15872 records) with date and time stamp, Calibration and Flowing Fluid parameters adjustment, Extensive Diagnostic. |
| <b>OUTPUT SIGNAL</b>        | Two programmable analog 4-20 mA into 600 Ohms or less load, two programmable digital optically isolated (UCE @ 40Vdc, ICE @ 150 mA), one programmable optically isolated flow pulse output (UCE @ 60Vdc, ICE @ 50 mA).  |
| <b>ENCLOSURE PROTECTION</b> | NEMA 4X.  |
| <b>ENCLOSURE APPROVALS</b>  | UL, CSA, FM<br>Class I Groups B, C, D<br>Class II Groups E, F, G<br>KEMA/CENELEC<br>EEX D IIB   |
| <b>POWER SUPPLY</b>         | 15-30 Vdc standard 115 or 230 VAC (optional).   |

\* Designed to meet.  
Contact Aalborg for status of the agency approval.

\*\*The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

## Flow Ranges

Minimum and maximum flow rates to achieve accuracy in gal/min, L/min. Pipe ID based on schedule 80 steel.

**TABLE 58 - WATER FLOW RATES AT 60 °F**

| SIZE (INCH) | 3/4" |       | 1"  |       | 1.5" |       | 2"  |        | 3"  |        | 4"  |        |
|-------------|------|-------|-----|-------|------|-------|-----|--------|-----|--------|-----|--------|
|             | min  | max   | min | max   | min  | max   | min | max    | min | max    | min | max    |
| gal/min     | 4    | 40.4  | 7   | 67.2  | 17   | 164.9 | 28  | 276.0  | 62  | 617.6  | 107 | 1075.3 |
| L/min       | 15   | 152.9 | 25  | 254.3 | 62   | 624.4 | 104 | 1044.9 | 238 | 2337.9 | 407 | 4070.4 |

Minimum and maximum flow rates to achieve accuracy lb/hr. Pipe ID based on schedule 80 steel.

**TABLE 59 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| SIZE (INCH) | 3/4"  |        | 1"    |        | 1.5"   |         | 2"     |         | 3"     |         | 4"     |         |
|-------------|-------|--------|-------|--------|--------|---------|--------|---------|--------|---------|--------|---------|
|             | min   | max    | min   | max    | min    | max     | min    | max     | min    | max     | min    | max     |
| 10          | 16.4  | 163.8  | 27.2  | 272.4  | 66.9   | 669.3   | 111.8  | 1118.3  | 250.2  | 2501.6  | 435.4  | 4354.1  |
| 25          | 25.5  | 255.3  | 42.5  | 424.7  | 104.3  | 1043.4  | 174.4  | 1743.5  | 390    | 3900.1  | 678.8  | 6788.4  |
| 50          | 40.4  | 403.6  | 67.1  | 671.4  | 165    | 1649.5  | 275.6  | 2756.3  | 616.5  | 6165.4  | 1073.1 | 10731.4 |
| 75          | 54.9  | 549.2  | 91.4  | 913.5  | 224.4  | 2244.3  | 375    | 3750.2  | 838.9  | 8388.7  | 1460.1 | 14601.1 |
| 100         | 69.3  | 693.2  | 115.3 | 1153.1 | 283.3  | 2832.8  | 473.4  | 4733.6  | 1058.8 | 10588.3 | 1843   | 18429.8 |
| 125         | 83.6  | 836.2  | 139.1 | 1391   | 341.7  | 3417.4  | 571.1  | 5710.5  | 1277.4 | 12773.6 | 2223.3 | 22233.4 |
| 150         | 97.9  | 978.7  | 162.8 | 1628   | 400    | 3999.7  | 668.3  | 6683.4  | 1495   | 14949.9 | 2602.1 | 26021.4 |
| 200         | 126.3 | 1262.8 | 210.1 | 2100.6 | 516.1  | 5160.7  | 862.4  | 8623.5  | 1929   | 19289.7 | 3357.5 | 33575.2 |
| 250         | 154.7 | 1546.9 | 257.3 | 2573.2 | 632.2  | 6321.6  | 1056.3 | 10563.3 | 2362.9 | 23628.6 | 4112.8 | 41127.5 |
| 300         | 182.1 | 1821.1 | 302.9 | 3029.3 | 744.2  | 7442.1  | 1243.6 | 12435.7 | 2781.7 | 27817.1 | 4841.8 | 48417.8 |
| 350         | 211.7 | 2116.5 | 352.1 | 3520.7 | 865    | 8649.5  | 1445.3 | 14453.3 | 3233   | 32330   | 5627.3 | 56273   |
| 400         | 241.3 | 2413.1 | 401.4 | 4014.2 | 986.2  | 9861.8  | 1647.9 | 16478.9 | 3686.1 | 36861.2 | 6416   | 64159.9 |
| 450         | 271   | 2710.2 | 450.8 | 4508.3 | 1107.6 | 11075.8 | 1850.8 | 18507.6 | 4139.9 | 41399   | 7505.8 | 75058.2 |
| 500         | 300.8 | 3007.5 | 500.3 | 5002.9 | 1229.1 | 12290.7 | 2053.8 | 20537.6 | 4594   | 45940   | 7996.2 | 79962.2 |
| 550         | 330.5 | 3305.2 | 549.8 | 5498.1 | 1350.7 | 13507.3 | 2257.1 | 22570.6 | 5048.7 | 50487.4 | 8787.7 | 87877.4 |
| 600         | 360.4 | 3603.8 | 599.5 | 5994.9 | 1472.8 | 14727.8 | 2461   | 24609.9 | 5504.9 | 55049.2 | 9581.7 | 95817.5 |



Minimum and maximum flow rates to achieve accuracy in (kg/hr) Pipe ID based on schedule 80 steel.

**TABLE 60 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (METRIC)**

| Size (mm) | 20    |        | 25    |        | 40    |        | 50     |         | 80     |         | 100    |         |
|-----------|-------|--------|-------|--------|-------|--------|--------|---------|--------|---------|--------|---------|
|           | min   | max    | min   | max    | min   | max    | min    | max     | min    | max     | min    | max     |
| 1         | 4.6   | 45.6   | 7.6   | 75.8   | 18.6  | 186.2  | 31.1   | 311.2   | 69.6   | 696.1   | 121.2  | 1211.6  |
| 2         | 8.7   | 87.4   | 14.6  | 145.5  | 35.7  | 357.4  | 59.7   | 597.1   | 133.6  | 1335.7  | 232.5  | 2324.9  |
| 4         | 16.7  | 167.4  | 27.8  | 278.4  | 68.4  | 683.9  | 114.3  | 1142.8  | 255.6  | 2556.3  | 445    | 4449.5  |
| 6         | 24.5  | 245.2  | 40.8  | 407.8  | 100.2 | 1001.9 | 167.4  | 1674.2  | 374.5  | 3744.9  | 651.8  | 6518.3  |
| 10        | 39.8  | 398.2  | 66.2  | 662.4  | 162.7 | 1627.3 | 271.9  | 2719.3  | 608.3  | 6082.6  | 1058.7 | 10587.3 |
| 14        | 55    | 549.9  | 91.5  | 914.7  | 224.7 | 2247.2 | 375.5  | 3755.1  | 840    | 8399.6  | 1462   | 14620.2 |
| 18        | 70.1  | 701.4  | 116.7 | 1166.7 | 286.6 | 2866.4 | 479    | 4789.7  | 1071.4 | 10713.9 | 1864.9 | 18648.5 |
| 22        | 84.9  | 849.3  | 141.3 | 1412.8 | 347.1 | 3470.8 | 580    | 5799.6  | 1297.3 | 12972.9 | 2258.1 | 22580.5 |
| 26        | 100.7 | 1007.1 | 167.5 | 1675.3 | 411.6 | 4115.7 | 687.7  | 6877.3  | 1538.4 | 15383.6 | 2677.6 | 26776.4 |
| 28        | 108.6 | 1086.2 | 180.7 | 1806.9 | 443.9 | 4439.2 | 741.8  | 7417.8  | 1659.3 | 16592.6 | 2888.1 | 28880.7 |
| 30        | 116.6 | 1165.5 | 193.9 | 1938.7 | 476.3 | 4762.9 | 795.9  | 7958.7  | 1780.3 | 17802.6 | 3098.7 | 30986.9 |
| 32        | 124.5 | 1244.7 | 207.1 | 2070.5 | 508.7 | 5086.8 | 850    | 8499.9  | 1901.3 | 19013.2 | 3309   | 33094   |
| 34        | 132.4 | 1324   | 220.2 | 2202.4 | 541.1 | 5410.8 | 904.1  | 9041.3  | 2022.4 | 20224.2 | 3520.2 | 35201.9 |
| 36        | 140.3 | 1403.3 | 233.4 | 2334.4 | 573.5 | 5735   | 958.3  | 9583    | 2143.6 | 21436   | 3731.1 | 37311.1 |
| 38        | 148.3 | 1482.7 | 246.7 | 2466.5 | 606   | 6059.5 | 1012.5 | 10125.3 | 2264.9 | 22649   | 3942.3 | 39422.5 |
| 40        | 156.2 | 1562.3 | 259.9 | 2598.8 | 638.5 | 6384.6 | 1066.9 | 10668.5 | 2386.4 | 23864.1 | 4153.7 | 41537.4 |

Minimum and maximum flow rates to achieve accuracy in CFPM (14.7 psia 70 °F) CFM at actual process temperature = min. or max values below \*530/ (Actual Temp. (°F) + 460) Pipe ID based on schedule 80 steel. Flow Temp. 70 °F.

**TABLE 61 - AIR FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| Size (inch)      |                 | 3/4" |       | 1"  |        | 1.5" |        | 2"  |        | 3"   |         | 4"   |         |
|------------------|-----------------|------|-------|-----|--------|------|--------|-----|--------|------|---------|------|---------|
| Density (lb/ft3) | Pressure (psig) | min  | max   | min | max    | min  | max    | min | max    | min  | max     | min  | max     |
| 0.076            | 0               | 5    | 45.0  | 8   | 74.9   | 18   | 183.8  | 31  | 307.5  | 69   | 688.1   | 120  | 1197.9  |
| 0.103            | 5               | 6    | 60.3  | 10  | 100.3  | 25   | 246.3  | 41  | 412.1  | 92   | 922.1   | 160  | 1605.3  |
| 0.128            | 10              | 8    | 75.6  | 13  | 125.8  | 31   | 308.8  | 52  | 516.7  | 116  | 1156.1  | 201  | 2012.8  |
| 0.180            | 20              | 11   | 106.2 | 18  | 176.7  | 43   | 433.8  | 73  | 725.9  | 162  | 1624.2  | 283  | 2827.7  |
| 0.232            | 30              | 14   | 136.8 | 23  | 227.6  | 56   | 558.8  | 94  | 935.1  | 209  | 2092.2  | 364  | 3642.6  |
| 0.284            | 40              | 17   | 167.4 | 28  | 278.5  | 68   | 683.8  | 114 | 1144.2 | 256  | 2560.3  | 446  | 4457.5  |
| 0.336            | 50              | 20   | 198.1 | 33  | 329.4  | 81   | 808.8  | 135 | 1353.4 | 303  | 3028.4  | 527  | 5272.4  |
| 0.388            | 60              | 23   | 228.7 | 38  | 380.4  | 93   | 933.8  | 156 | 1562.6 | 350  | 3496.4  | 609  | 6087.3  |
| 0.440            | 70              | 26   | 259.3 | 43  | 431.3  | 106  | 1058.8 | 177 | 1771.8 | 396  | 3964.5  | 690  | 6902.2  |
| 0.493            | 80              | 29   | 289.9 | 48  | 482.2  | 118  | 1183.8 | 198 | 1981.0 | 443  | 4432.5  | 718  | 7717.1  |
| 0.545            | 90              | 32   | 320.5 | 53  | 533.1  | 131  | 1308.8 | 219 | 2190.2 | 490  | 4900.6  | 853  | 8532.0  |
| 0.596            | 100             | 35   | 351.1 | 58  | 584.0  | 143  | 1433.8 | 240 | 2399.3 | 537  | 5368.7  | 935  | 9346.9  |
| 0.649            | 110             | 38   | 381.7 | 64  | 635.0  | 156  | 1558.8 | 261 | 2608.5 | 584  | 5836.7  | 1016 | 10161.8 |
| 0.700            | 120             | 41   | 412.3 | 69  | 685.9  | 168  | 1683.8 | 282 | 2817.7 | 630  | 6304.8  | 1098 | 10976.7 |
| 0.752            | 130             | 44   | 443.0 | 74  | 736.8  | 181  | 1808.8 | 303 | 3026.9 | 677  | 6772.8  | 1179 | 11791.6 |
| 0.804            | 140             | 47   | 473.6 | 79  | 787.7  | 193  | 1933.8 | 324 | 3236.1 | 724  | 7240.9  | 1261 | 12606.5 |
| 0.856            | 150             | 50   | 504.2 | 84  | 838.6  | 206  | 2058.8 | 344 | 3445.3 | 771  | 7709.0  | 1342 | 13421.4 |
| 1.116            | 200             | 66   | 657.2 | 109 | 1093.2 | 268  | 2683.8 | 449 | 4491.2 | 1005 | 10049.3 | 1750 | 17495.9 |
| 1.636            | 300             | 96   | 963.4 | 160 | 1602.4 | 393  | 3933.8 | 658 | 6583.0 | 1473 | 14729.9 | 2564 | 25644.8 |

Minimum and maximum flow rates to achieve accuracy in M3/min (°C, 1.013 bar). M3/min at actual process temperature = minimum or maximum values below x 273 (actual temp (°C) + 273). Pipe ID based on schedule 80 steel. Flow Temp 0 °C.

**TABLE 62 - AIR FLOW RATES AT SELECTED PROCESS PRESSURES (Metric)**

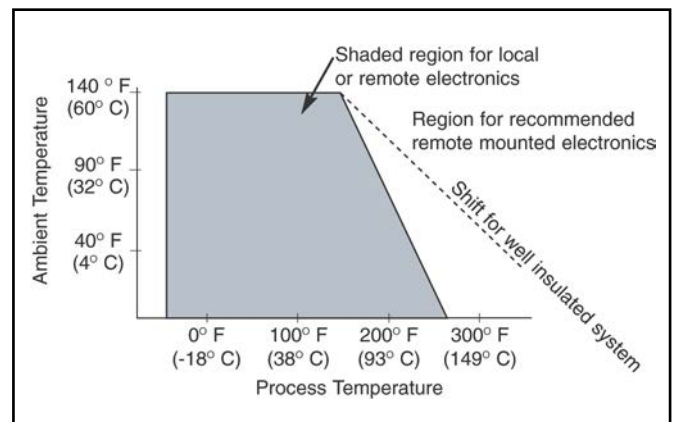
| Size (mm)       |                 | 20  |       | 25  |       | 40   |        | 50   |        | 80   |        | 100  |        |
|-----------------|-----------------|-----|-------|-----|-------|------|--------|------|--------|------|--------|------|--------|
| Density (kg/m3) | Pressure (barg) | min | max   | min | max   | min  | max    | min  | max    | min  | max    | min  | max    |
| 1.293           | 0               | 0.1 | 1.28  | 0.2 | 2.10  | 0.5  | 5.21   | 0.9  | 8.69   | 1.9  | 19.48  | 3.4  | 33.92  |
| 1.93            | 0.5             | 0.2 | 1.91  | 0.3 | 3.14  | 0.8  | 7.78   | 1.3  | 12.97  | 2.9  | 29.08  | 5.1  | 50.66  |
| 2.568           | 1               | 0.3 | 2.54  | 0.4 | 4.18  | 1.0  | 10.35  | 1.7  | 17.26  | 3.9  | 38.69  | 6.8  | 67.39  |
| 3.844           | 2               | 0.4 | 3.81  | 0.6 | 6.25  | 1.5  | 15.49  | 2.6  | 25.8   | 5.8  | 57.90  | 10.1 | 100.85 |
| 5.12            | 3               | 0.5 | 5.07  | 0.8 | 8.33  | 2.0  | 20.64  | 3.4  | 34.39  | 7.7  | 77.11  | 13.4 | 134.31 |
| 6.39            | 4               | 0.6 | 6.33  | 1.0 | 10.40 | 2.6  | 25.78  | 4.3  | 42.96  | 9.6  | 96.32  | 16.8 | 167.77 |
| 7.67            | 5               | 0.8 | 7.59  | 1.2 | 12.48 | 3.1  | 30.92  | 5.2  | 51.53  | 11.6 | 115.54 | 20.1 | 201.24 |
| 8.95            | 6               | 0.9 | 8.86  | 1.5 | 14.55 | 3.6  | 36.06  | 6.0  | 60.10  | 13.5 | 134.75 | 23.5 | 234.70 |
| 10.22           | 7               | 1.0 | 10.12 | 1.7 | 16.62 | 4.1  | 41.20  | 6.9  | 68.67  | 15.4 | 153.96 | 26.8 | 268.16 |
| 11.5            | 8               | 1.1 | 11.38 | 1.9 | 18.70 | 4.6  | 46.34  | 7.7  | 77.24  | 17.3 | 173.17 | 30.2 | 301.63 |
| 12.77           | 9               | 1.2 | 12.64 | 2.1 | 20.77 | 5.1  | 51.48  | 8.6  | 85.80  | 19.2 | 192.38 | 33.5 | 335.09 |
| 14.05           | 10              | 1.4 | 13.91 | 2.3 | 22.85 | 5.7  | 56.62  | 9.4  | 94.37  | 21.2 | 211.59 | 36.9 | 368.55 |
| 15.32           | 11              | 1.5 | 15.17 | 2.5 | 24.92 | 6.2  | 61.76  | 10.3 | 102.94 | 23.0 | 230.81 | 40.2 | 402.01 |
| 16.6            | 12              | 1.6 | 16.43 | 2.7 | 27.00 | 6.7  | 66.91  | 11.1 | 111.51 | 25.0 | 250.02 | 43.5 | 435.48 |
| 17.88           | 13              | 1.8 | 17.70 | 2.9 | 29.07 | 7.2  | 72.05  | 12.0 | 120.08 | 26.9 | 269.23 | 46.9 | 468.94 |
| 19.15           | 14              | 1.9 | 18.96 | 3.1 | 31.15 | 7.7  | 77.19  | 12.9 | 128.65 | 28.8 | 288.44 | 50.2 | 502.40 |
| 22.98           | 17              | 2.2 | 22.75 | 3.7 | 37.37 | 9.3  | 92.61  | 15.4 | 154.35 | 34.6 | 346.08 | 60.3 | 602.79 |
| 26.81           | 20              | 2.6 | 26.54 | 4.4 | 43.59 | 10.1 | 108.04 | 18.0 | 180.06 | 40.4 | 403.71 | 70.3 | 703.18 |

ANSI Flange Pressure - Temperature Ratings.  
Maximum Pressure in psig.

**TABLE 63 - FLOW METER PRESSURE RATING**

| MATERIAL        | TEMP. °F    |      |     |     |     |
|-----------------|-------------|------|-----|-----|-----|
|                 | -100 to 100 | 200  | 300 | 400 | 500 |
| 316L SS 150# RF | 230         | 195  | 175 | 160 | 145 |
| 316L SS 300# RF | 600         | 505  | 455 | 415 | 380 |
| 316L SS 600# RF | 1000        | 1000 | 910 | 825 | 765 |

ANSI Flange Pressure - Temperature Ratings.

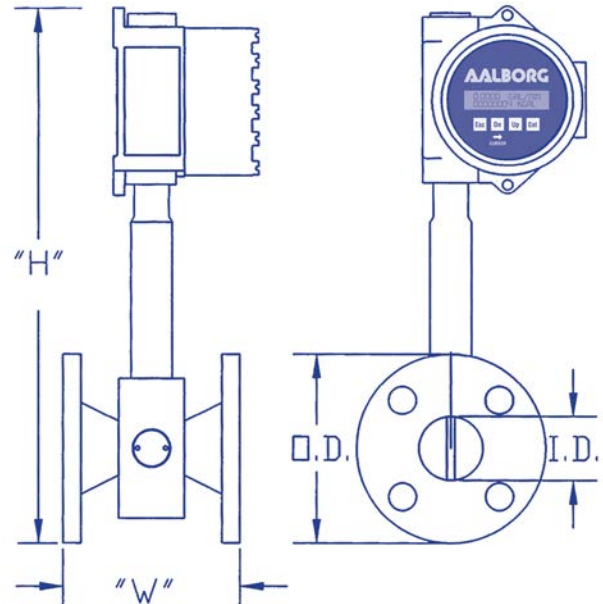




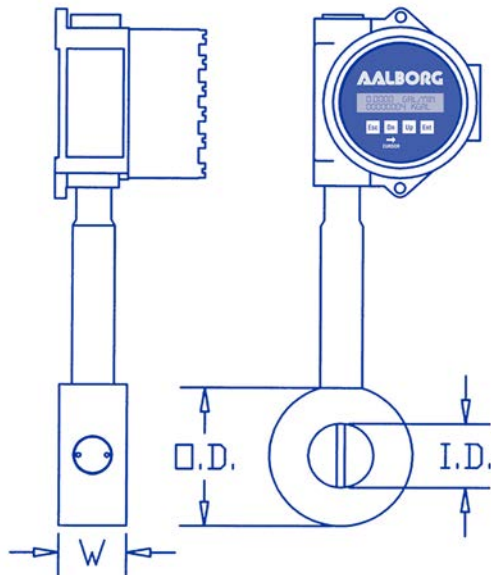
**TABLE 64**

| Meter Size | Flange Rating | Bolt diameter | Bolts | I.D.  | O.D.  | "W"    | "H"    |
|------------|---------------|---------------|-------|-------|-------|--------|--------|
| in.        | psi           | in.           | no.   | in.   | in.   | in.    | in.    |
| 3/4        | 150           | 1/2           | 4     | 0.742 | 3.875 | 5.88   | 9.75   |
|            | 300           | 5/8           | 4     |       | 4.625 | 6.25   | 10.125 |
|            | 600           | 5/8           | 4     |       | 4.625 | 6.25   | 10.125 |
|            | 900           | 7/8           | 4     |       | 5.125 | 7.25   | 10.375 |
| 1          | 150           | 1/2           | 4     | 0.957 | 4.25  | 6.13   | 9.95   |
|            | 300           | 5/8           | 4     |       | 4.875 | 6.63   | 10.27  |
|            | 600           | 5/8           | 4     |       | 4.875 | 6.63   | 10.27  |
|            | 900           | 1             | 4     |       | 5.875 | 7.5    | 10.76  |
| 1.5        | 150           | 1/2           | 4     | 1.50  | 5.00  | 6.63   | 10.35  |
|            | 300           | 3/4           | 4     |       | 6.125 | 7.13   | 10.91  |
|            | 600           | 3/7           | 4     |       | 6.125 | 7.25   | 10.91  |
|            | 900           | 1-1/8         | 4     |       | 7.00  | 8.25   | 11.35  |
| 2          | 150           | 5/8           | 4     | 1.937 | 6.00  | 6.75   | 10.875 |
|            | 300           | 5/8           | 4     |       | 6.50  | 7.25   | 11.125 |
|            | 600           | 5/8           | 4     |       | 6.50  | 7.50   | 11.125 |
|            | 900           | 1             | 4     |       | 8.50  | 9.75   | 12.125 |
| 3          | 150           | 5/8           | 4     | 2.900 | 7.50  | 7.25   | 11.60  |
|            | 300           | 3/4           | 8     |       | 8.25  | 8.00   | 11.98  |
|            | 600           | 3/4           | 8     |       | 8.25  | 8.25   | 11.98  |
|            | 900           | 1             | 8     |       | 9.50  | 9.75   | 12.60  |
| 4          | 150           | 5/8           | 4     | 3.826 | 9.00  | 8.25   | 12.37  |
|            | 300           | 3/4           | 8     |       | 10.00 | 9.00   | 12.87  |
|            | 600           | 7/8           | 8     |       | 10.75 | 10.25  | 13.25  |
|            | 900           | 1-1/4         | 8     |       | 11.50 | 11.285 | 13.62  |

## Flange Mounting



## Wafer Mounting



**TABLE 65**

| Meter Size | Flange Rating | Bolt diameter | Bolts | I.D.  | O.D.  | "W" | "H"   |
|------------|---------------|---------------|-------|-------|-------|-----|-------|
| in.        | psi           | in.           | no.   | in.   | in.   | in. | in.   |
| 3/4        | 150           | 1/2           | 4     | 0.742 | 2.370 | 2   | 9.00  |
|            | 300           | 5/8           | 4     |       |       |     |       |
|            | 600           | 5/8           | 4     |       |       |     |       |
| 1          | 150           | 1/2           | 4     | 0.957 | 2.740 | 2   | 9.20  |
|            | 300           | 5/8           | 4     |       |       |     |       |
|            | 600           | 5/8           | 4     |       |       |     |       |
| 1.5        | 150           | 1/2           | 4     | 1.500 | 3.500 | 2   | 9.60  |
|            | 300           | 3/4           | 4     |       |       |     |       |
|            | 600           | 3/4           | 4     |       |       |     |       |
| 2          | 150           | 5/8           | 4     | 1.937 | 4.250 | 2   | 10.00 |
|            | 300           | 5/8           | 8     |       |       |     |       |
|            | 600           | 5/8           | 8     |       |       |     |       |
| 3          | 150           | 5/8           | 4     | 2.900 | 5.497 | 2   | 10.60 |
|            | 300           | 3/4           | 8     |       |       |     |       |
|            | 600           | 3/4           | 8     |       |       |     |       |
| 4          | 150           | 5/8           | 8     | 3.826 | 6.997 | 2.5 | 11.37 |
|            | 300           | 3/4           | 8     |       |       |     |       |
|            | 600           | 7/8           | 8     |       |       |     |       |

## Configure and Order Online: [VX Wafer Style Vortex Flow Meter](#)

To allow us to confirm selection please return completed application data sheet found on Aalborg's web site at [www.aalborg.com](http://www.aalborg.com).

1. Select style (wafer or flange).
2. Select meter size to match internal pipe diameter
3. Confirm minimum and maximum flow ranges to maintain stated accuracy from liquid, steam, or air from Tables 59 to 63 are within your requirements.
4. For other gas applications consult factory.
5. Select fluid type.
6. Select maximum temperature capability.
7. Select desired \*\*Material of Construction.
8. Select mounting connection.
9. Confirm maximum pressure capability of flange/meter rating with process conditions and select flange rating from Table 64 to 66.
10. Confirm suitability of standard local mounted electronics.
11. Select desired transmitter power.
12. Provide: Fluid, Fluid Viscosity, Minimum & Maximum Operating Pressure, Minimum & Maximum Operating Temperature, Density/Specific Gravity or Specific Volume.
13. Provide minimum and maximum flow range.

Options: Remote mount electronics up to 100 ft. (30.5 m).

† = Wafer and Flange Style for Alignment Ring Selection.

\*\* = The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

|    |        |
|----|--------|
| VX | MODEL  |
|    | STYLE  |
| U  | Wafer  |
| W  | Wafer  |
| E  | Flange |
| F  | Flange |

| SIZE: WAFER or FLANGE |              |
|-----------------------|--------------|
| 07                    | 3/4" (20mm)  |
| 10                    | 1.0" (25mm)  |
| 15                    | 1.5" (40mm)  |
| 20                    | 2.0" (50mm)  |
| 30                    | 3.0" (80mm)  |
| 40                    | 4.0" (100mm) |

| FLUID TYPE |        |
|------------|--------|
| G          | Gas    |
| L          | Liquid |
| S          | Steam  |

| MAX TEMP. |        |
|-----------|--------|
| 4         | 450 °F |

| MATERIAL |        |
|----------|--------|
| 6        | 316 SS |

| MOUNTING CONNECTION |                               |
|---------------------|-------------------------------|
| A                   | Wafer. Using Customer Flanges |
| B                   | Flange Mounting               |
| F                   | Other                         |

| FLANGE RATING† |   |
|----------------|---|
| A              | 150# ANSI RF (Alignment Rings Not Required for Wafer Style) |
| B              | 300# ANSI RF (Wafer Style Includes Alignment Rings)         |
| C              | 600# ANSI RF (Wafer Style Includes Alignment Rings)         |
| D              | Other   |
| N              | None  |

| DISPLAY |                   |
|---------|-------------------|
| L2      | Local with RS232  |
| R2      | Remote with RS232 |
| L4      | Local with RS485  |
| R4      | Remote with RS425 |

| POWER |        |
|-------|--------|
| 04    | 24VDC  |
| 12    | 120VAC |
| 22    | 220VAC |

VX W — 10 L — 4 6 A B — L2 22

### EXAMPLE: VXW-10L-44AB-L222

*SPECIFY: FLUID NAME or MEASURING DENSITY, FLOW RATE, TEMPERATURE and PRESSURE (STEAM, GASES).*

Vortex meter, Wafer style, 10" diameter size, Liquid at maximum 450 °F, 316 stainless steel, Customer flanges, Flange 300# ANSI RF, Local display with RS232, 220V power.

## Design Features

- Temperature, pressure, density, volumetric and mass flow measurements.
- No moving parts to wear or fail.
- Electronics can be remotely mounted up to 30.5 m (100 ft).
- No fluid to sensor contact.
- No holes to clog.
- High flow turndown ratio up to 10:1.
- Dual signal processing technology improves accuracy at low flows.
- Accuracy of 1% of rate.
- Noise cancellation technology.
- Built in platinum RTD and solid state pressure sensor.
- On board computer calculates density, volumetric and mass flow.
- Aalborg's proprietary DSP algorithm accurately filters vortex frequency.
- Extensive Diagnostics log with date and time register.
- Password protected data entry.
- Volumetric and mass flow information simultaneously displayed.
- Selectable engineering units.
- Two programmable totalizers.
- Digital communication interface: RS-232 or RS-485.

## Principles of Operation

Vortices are created when a fluid passes around a bluff body as shown in Figure 1. Vortices are alternately shed on each side of the body, 180 degrees out of phase to each other, resulting in an oscillating pressure gradient. As flow increases the frequency of vortices increases in proportion to the increased flow thereby creating a linear relationship.

## General Description

Constructed of type 316 stainless steel, wafers may be installed in-line by customer provided or built-in flanges. Keypad or communication interface functionalities include measuring units, programmable flow alarm, two programmable totalizers, programmable flow rate pulse output, two programmable optically isolated outputs, battery backed real time clock (RTC), digital communication interface (RS-232 or RS-485), programmable diagnostic events log and register with date and time stamp, programmable process variable log with date stamp, calibration and flowing fluid parameters adjustment, extensive diagnostics.

Our exclusive dual signal processing technology independently measures each vortex on either side of the bluff body and filters out non-flow noise. This results in less noise and higher accuracy throughout the flow range. Aalborg's proprietary DSP algorithm accurately filters vortex frequency, improving the quality of flow measurements.

Local 2x16 LCD readout provides flow rate and total flow volume reading in selectable engineering units, diagnostic events indication and feature a password protected access to the process parameters to ensure against tampering or resetting.



**TABLE 66 - FUNCTIONAL SPECIFICATIONS**

|                          |   |
|--------------------------|---|
| <b>FLUID TYPES</b>       | Steam, Gas, Liquid.   |
| <b>MAXIMUM PRESSURE</b>  | 69 bar (1000 psig) with wafer mount<br>See Table 75 for flange mount.   |
| <b>FLUID TEMPERATURE</b> | -20 °F to 232 °C.<br>-4 °F to 450 °F.   |
| <b>LOW FLOW CUT-OFF</b>  | Adjustable: Set @ min. per Tables 70 to 74.   |
| <b>HIGH FLOW CUT-OFF</b> | Adjustable: Set @ max. per Tables 70 to 74.   |
| <b>VOLTAGE</b>           | 15 to 30 Vdc standard. 115 or 230 VAC optional.   |
| <b>FREQUENCY</b>         | 50 /60 Hz.  |
| <b>OUTPUTS</b>           | Two user programmable analog 4-20 mA outputs (600 Ohms or less load). Each can be assigned to one of the following process variables: volumetric flow, mass flow, temperature or pressure. Two sets of user programmable digital optically isolated outputs to actuate user supplied equipment when various diagnostic or system events occurs. One user programmable optically isolated flow pulse output, RS-232 or RS-485 Digital Interface with Multi-Drop Capability of up to 255 units (RS-485 option). |
| <b>LINEAR RANGE</b>      | Reynolds number of >10,000.   |

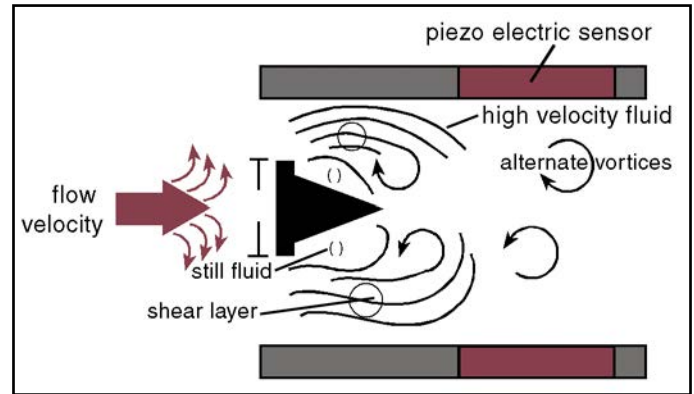


**TABLE 67 - PERFORMANCE SPECIFICATIONS**

|   |   |
|---|---|
| <b>FLOW ACCURACY</b>                              | 1% of rate.   |
| <b>FLOW REPEATABILITY</b>                         | 0.25% of rate.  |
| <b>FLOW TURNDOWN RATIO</b>                        | See Tables 70 to 74.  |
| <b>RESPONSE TIME</b>                              | Adjustable based on NRF and Damping settings (minimum 1000 ms).   |
| <b>DAMPING</b>                                    | Adjustable: 1 to 99 sec.  |
| <b>VELOCITY RANGE</b>                             | Liq.: 1.32 or $\frac{10000\mu}{\bar{n}d \cdot 124}$ to 30 ft/sec.<br>Steam & Gas: $(144/\bar{n})^{1/3}$ to 250 ft/sec.<br>$\bar{n}$ = density (lb/ft <sup>3</sup> ).<br>d= pipe diameter (in).<br>$\mu$ = viscosity (cp). |
| <b>AGENCY APPROVALS*</b>                          | FM and CSA Class 1 Div 2 Groups B,C,D.  |
| <b>FLUID TEMPERATURE MEASUREMENT RANGE</b>        | 20 to 260 °C (-4 to 450 °F).  |
| <b>TEMPERATURE ACCURACY (INCLUDING LINEARITY)</b> | 0.5 °C.   |
| <b>FLUID PRESSURE MEASUREMENT RANGE</b>           | Can be ordered for the following options:<br>0-100 PSIA. 0-200 PSIA. 0-300 PSIA.<br>0- 500 PSIA. 0-750 PSIA. 0-1000 PSIA.   |
| <b>PRESSURE ACCURACY (INCLUDING LINEARITY)</b>    | 0.5% of full scale.   |
| <b>FLUID PROOF PRESSURE</b>                       | 3 X F.S.  |
| <b>FLUID BURST PRESSURE</b>                       | 10 X F.S.   |

**TABLE 68 - PHYSICAL SPECIFICATION**

|   |   |
|---|---|
| <b>**MATERIALS OF CONSTRUCTION</b>        |   |
| <b>SHEDDER BAR</b>                        | 316 SS.                                   |
| <b>ELECTRODES</b>                         | 316 SS encapsulated ceramic.              |
| <b>METERING TUBE</b>                      | 316 SS.                                   |
| <b>FLANGES</b>                            | 316 SS.                                   |
| <b>ELECTRONICS HOUSING</b>                | Epoxy coated aluminum.                    |
| <b>CONNECTIONS AND MOUNTINGS</b>          |   |
| <b>MOUNTING POSITION</b>                  | Vertical, horizontal, angle.              |
| <b>TYPICAL STRAIGHT PIPE REQUIREMENTS</b> | Upstream: 20 x D.<br>Downstream: 5 x D.   |
| <b>PROCESS CONNECTIONS</b>                | ANSI Class 150 RF, 300 RF, 600 RF, Wafer. |
| <b>ELECTRICAL CONNECT</b>                 | 3/4" FNPT.                                |



**TABLE 69 - ELECTRONIC SPECIFICATIONS**

|                             |  |
|-----------------------------|--|
| <b>AMBIENT TEMPERATURE</b>  | -12F to 65 °C (-15F to 149 °F).  |
| <b>TRANSMITTER</b>          | Microprocessor-based.  |
| <b>DISPLAY</b>              | Two lines, 16 alphanumeric characters each, programmable for different process variable rate and total.  |
| <b>FUNCTIONS</b>            | Measuring Units, Programmable Flow, Temperature and Pressure Alarms, Two Programmable Totalizers, Programmable Flow Rate Pulse Output, Two Programmable Optically Isolated Outputs, Two Programmable analog 4-20 mA outputs, Battery Backed Real Time Clock [RTC], Digital communication interface (RS-232 or RS-485), Programmable Diagnostic events Log and register with date and time stamp, Programmable Process Variable Data Log (total 15872 records) with date and time stamp, Calibration and Flowing Fluid parameters adjustment, Extensive Diagnostic. |
| <b>OUTPUT SIGNAL</b>        | Two programmable analog 4-20 mA into 600 Ohms or less load, two programmable digital optically isolated (UCE @ 40Vdc, ICE @ 150 mA), one programmable optically isolated flow pulse output (UCE @ 60Vdc, ICE @ 50 mA).   |
| <b>ENCLOSURE PROTECTION</b> | NEMA 4X.   |
| <b>ENCLOSURE APPROVALS</b>  | UL, CSA, FM Class I Groups B, C, D<br>Class II Groups E, F, G<br>KEMA/CENELEC<br>EEx d IIB   |
| <b>POWER SUPPLY</b>         | 15-30 Vdc standard 115 or 230 VAC (optional).  |

\* Designed to meet.  
Contact Aalborg for status of the agency approval.

\*\*The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

## Flow Ranges

Minimum and maximum flow rates to achieve accuracy in gal/min, L/min. Pipe ID based on schedule 80 steel.

**TABLE 70 - WATER FLOW RATES AT 60 °F**

| SIZE (INCH) |    | 3/4"  |     | 1"    |     | 1.5"  |     | 2"     |     | 3"    |        | 4"  |        |
|-------------|----|-------|-----|-------|-----|-------|-----|--------|-----|-------|--------|-----|--------|
|             |    | min   | max | min   | max | min   | max | min    | max | min   | max    | min | max    |
| gal/min     | 4  | 40.4  | 7   | 67.2  | 17  | 164.9 | 28  | 276.0  | 62  | 617.6 | 617.6  | 107 | 1075.3 |
| L/min       | 15 | 152.9 | 25  | 254.3 | 62  | 624.4 | 104 | 1044.9 | 238 | 337.9 | 2337.9 | 407 | 4070.4 |

Minimum and maximum flow rates to achieve accuracy lb/hr. Pipe ID based on schedule 80 steel.

**TABLE 71 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| SIZE (INCH)     | 3/4"  |        | 1"    |        | 1.5"   |         | 2"     |         | 3"     |         | 4"     |         |
|-----------------|-------|--------|-------|--------|--------|---------|--------|---------|--------|---------|--------|---------|
| PRESSURE (psig) | min   | max    | min   | max    | min    | max     | min    | max     | min    | max     | min    | max     |
| 10              | 16.4  | 163.8  | 27.2  | 272.4  | 66.9   | 669.3   | 111.8  | 1118.3  | 250.2  | 2501.6  | 435.4  | 4354.1  |
| 25              | 25.5  | 255.3  | 42.5  | 424.7  | 104.3  | 1043.4  | 174.4  | 1743.5  | 390    | 3900.1  | 678.8  | 6788.4  |
| 50              | 40.4  | 403.6  | 67.1  | 671.4  | 165    | 1649.5  | 275.6  | 2756.3  | 616.5  | 6165.4  | 1073.1 | 10731.4 |
| 75              | 54.9  | 549.2  | 91.4  | 913.5  | 224.4  | 2244.3  | 375    | 3750.2  | 838.9  | 8388.7  | 1460.1 | 14601.1 |
| 100             | 69.3  | 693.2  | 115.3 | 1153.1 | 283.3  | 2832.8  | 473.4  | 4733.6  | 1058.8 | 10588.3 | 1843   | 18429.8 |
| 125             | 83.6  | 836.2  | 139.1 | 1391   | 341.7  | 3417.4  | 571.1  | 5710.5  | 1277.4 | 12773.6 | 2223.3 | 22233.4 |
| 150             | 97.9  | 978.7  | 162.8 | 1628   | 400    | 3999.7  | 668.3  | 6683.4  | 1495   | 14949.9 | 2602.1 | 26021.4 |
| 200             | 126.3 | 1262.8 | 210.1 | 2100.6 | 516.1  | 5160.7  | 862.4  | 8623.5  | 1929   | 19289.7 | 3357.5 | 33575.2 |
| 250             | 154.7 | 1546.9 | 257.3 | 2573.2 | 632.2  | 6321.6  | 1056.3 | 10563.3 | 2362.9 | 23628.6 | 4112.8 | 41127.5 |
| 300             | 182.1 | 1821.1 | 302.9 | 3029.3 | 744.2  | 7442.1  | 1243.6 | 12435.7 | 2781.7 | 27817.1 | 4841.8 | 48417.8 |
| 350             | 211.7 | 2116.5 | 352.1 | 3520.7 | 865    | 8649.5  | 1445.3 | 14453.3 | 3233   | 32330   | 5627.3 | 56273   |
| 400             | 241.3 | 2413.1 | 401.4 | 4014.2 | 986.2  | 9861.8  | 1647.9 | 16478.9 | 3686.1 | 36861.2 | 6416   | 64159.9 |
| 450             | 271   | 2710.2 | 450.8 | 4508.3 | 1107.6 | 11075.8 | 1850.8 | 18507.6 | 4139.9 | 41399   | 7505.8 | 75058.2 |
| 500             | 300.8 | 3007.5 | 500.3 | 5002.9 | 1229.1 | 12290.7 | 2053.8 | 20537.6 | 4594   | 45940   | 7996.2 | 79962.2 |
| 550             | 330.5 | 3305.2 | 549.8 | 5498.1 | 1350.7 | 13507.3 | 2257.1 | 22570.6 | 5048.7 | 50487.4 | 8787.7 | 87877.4 |
| 600             | 360.4 | 3603.8 | 599.5 | 5994.9 | 1472.8 | 14727.8 | 2461   | 24609.9 | 5504.9 | 55049.2 | 9581.7 | 95817.5 |

Minimum and maximum flow rates to achieve accuracy in (kg/hr) Pipe ID based on schedule 80 steel.

**TABLE 72 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (Metric)**

| Size (mm)       | 20    |        | 25    |        | 40    |        | 50     |         | 80     |         | 100    |         |
|-----------------|-------|--------|-------|--------|-------|--------|--------|---------|--------|---------|--------|---------|
| Pressure (bara) | min   | max    | min   | max    | min   | max    | min    | max     | min    | max     | min    | max     |
| 1               | 4.6   | 45.6   | 7.6   | 75.8   | 18.6  | 186.2  | 31.1   | 311.2   | 69.6   | 696.1   | 121.2  | 1211.6  |
| 2               | 8.7   | 87.4   | 14.6  | 145.5  | 35.7  | 357.4  | 59.7   | 597.1   | 133.6  | 1335.7  | 232.5  | 2324.9  |
| 4               | 16.7  | 167.4  | 27.8  | 278.4  | 68.4  | 683.9  | 114.3  | 1142.8  | 255.6  | 2556.3  | 445    | 4449.5  |
| 6               | 24.5  | 245.2  | 40.8  | 407.8  | 100.2 | 1001.9 | 167.4  | 1674.2  | 374.5  | 3744.9  | 651.8  | 6518.3  |
| 10              | 39.8  | 398.2  | 66.2  | 662.4  | 162.7 | 1627.3 | 271.9  | 2719.3  | 608.3  | 6082.6  | 1058.7 | 10587.3 |
| 14              | 55    | 549.9  | 91.5  | 914.7  | 224.7 | 2247.2 | 375.5  | 3755.1  | 840    | 8399.6  | 1462   | 14620.2 |
| 18              | 70.1  | 701.4  | 116.7 | 1166.7 | 286.6 | 2866.4 | 479    | 4789.7  | 1071.4 | 10713.9 | 1864.9 | 18648.5 |
| 22              | 84.9  | 849.3  | 141.3 | 1412.8 | 347.1 | 3470.8 | 580    | 5799.6  | 1297.3 | 12972.9 | 2258.1 | 22580.5 |
| 26              | 100.7 | 1007.1 | 167.5 | 1675.3 | 411.6 | 4115.7 | 687.7  | 6877.3  | 1538.4 | 15383.6 | 2677.6 | 26776.4 |
| 28              | 108.6 | 1086.2 | 180.7 | 1806.9 | 443.9 | 4439.2 | 741.8  | 7417.8  | 1659.3 | 16592.6 | 2888.1 | 28880.7 |
| 30              | 116.6 | 1165.5 | 193.9 | 1938.7 | 476.3 | 4762.9 | 795.9  | 7958.7  | 1780.3 | 17802.6 | 3098.7 | 30986.9 |
| 32              | 124.5 | 1244.7 | 207.1 | 2070.5 | 508.7 | 5086.8 | 850    | 8499.9  | 1901.3 | 19013.2 | 3309   | 33094   |
| 34              | 132.4 | 1324   | 220.2 | 2202.4 | 541.1 | 5410.8 | 904.1  | 9041.3  | 2022.4 | 20224.2 | 3520.2 | 35201.9 |
| 36              | 140.3 | 1403.3 | 233.4 | 2334.4 | 573.5 | 5735   | 958.3  | 9583    | 2143.6 | 21436   | 3731.1 | 37311.1 |
| 38              | 148.3 | 1482.7 | 246.7 | 2466.5 | 606   | 6059.5 | 1012.5 | 10125.3 | 2264.9 | 22649   | 3942.3 | 39422.5 |
| 40              | 156.2 | 1562.3 | 259.9 | 2598.8 | 638.5 | 6384.6 | 1066.9 | 10476.7 | 2386.4 | 23864.1 | 4153.7 | 41537.4 |

Minimum and maximum flow rates to achieve accuracy in CFPM (14.7 psia 70 °F) CFM at actual process temperature = min. or max values below \*530/ (Actual Temp. (°F) + 460) Pipe ID based on schedule 80 steel. Flow Temp. 70 °F.

**TABLE 73 - AIR FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| Size (inch)      |                 | 3/4" |       | 1"  |        | 1.5" |        | 2"  |        | 3"   |         | 4"   |         |
|------------------|-----------------|------|-------|-----|--------|------|--------|-----|--------|------|---------|------|---------|
| Density (lb/ft3) | Pressure (psig) | min  | max   | min | max    | min  | max    | min | max    | min  | max     | min  | max     |
| 0.076            | 0               | 5    | 45.0  | 8   | 74.9   | 18   | 183.8  | 31  | 307.5  | 69   | 688.1   | 120  | 1197.9  |
| 0.103            | 5               | 6    | 60.3  | 10  | 100.3  | 25   | 246.3  | 41  | 412.1  | 92   | 922.1   | 160  | 1605.3  |
| 0.128            | 10              | 8    | 75.6  | 13  | 125.8  | 31   | 308.8  | 52  | 516.7  | 116  | 1156.1  | 201  | 2012.8  |
| 0.180            | 20              | 11   | 106.2 | 18  | 176.7  | 43   | 433.8  | 73  | 725.9  | 162  | 1624.2  | 283  | 2827.7  |
| 0.232            | 30              | 14   | 136.8 | 23  | 227.6  | 56   | 558.8  | 94  | 935.1  | 209  | 2092.2  | 364  | 3642.6  |
| 0.284            | 40              | 17   | 167.4 | 28  | 278.5  | 68   | 683.8  | 114 | 1144.2 | 256  | 2560.3  | 446  | 4457.5  |
| 0.336            | 50              | 20   | 198.1 | 33  | 329.4  | 81   | 808.8  | 135 | 1353.4 | 303  | 3028.4  | 527  | 5272.4  |
| 0.388            | 60              | 23   | 228.7 | 38  | 380.4  | 93   | 933.8  | 156 | 1562.6 | 350  | 3496.4  | 609  | 6087.3  |
| 0.440            | 70              | 26   | 259.3 | 43  | 431.3  | 106  | 1058.8 | 177 | 1771.8 | 396  | 3964.5  | 690  | 6902.2  |
| 0.493            | 80              | 29   | 289.9 | 48  | 482.2  | 118  | 1183.8 | 198 | 1981.0 | 443  | 4432.5  | 718  | 7717.1  |
| 0.545            | 90              | 32   | 320.5 | 53  | 533.1  | 131  | 1308.8 | 219 | 2190.2 | 490  | 4900.6  | 853  | 8532.0  |
| 0.596            | 100             | 35   | 351.1 | 58  | 584.0  | 143  | 1433.8 | 240 | 2399.3 | 537  | 5368.7  | 935  | 9346.9  |
| 0.649            | 110             | 38   | 381.7 | 64  | 635.0  | 156  | 1558.8 | 261 | 2608.5 | 584  | 5836.7  | 1016 | 10161.8 |
| 0.700            | 120             | 41   | 412.3 | 69  | 685.9  | 168  | 1683.8 | 282 | 2817.7 | 630  | 6304.8  | 1098 | 10976.7 |
| 0.752            | 130             | 44   | 443.0 | 74  | 736.8  | 181  | 1808.8 | 303 | 3026.9 | 677  | 6772.8  | 1179 | 11791.6 |
| 0.804            | 140             | 47   | 473.6 | 79  | 787.7  | 193  | 1933.8 | 324 | 3236.1 | 724  | 7240.9  | 1261 | 12606.5 |
| 0.856            | 150             | 50   | 504.2 | 84  | 838.6  | 206  | 2058.8 | 344 | 3445.3 | 771  | 7709.0  | 1342 | 13421.4 |
| 1.116            | 200             | 66   | 657.2 | 109 | 1093.2 | 268  | 2683.8 | 449 | 4491.2 | 1005 | 10049.3 | 1750 | 17495.9 |
| 1.636            | 300             | 96   | 963.4 | 160 | 1602.4 | 393  | 3933.8 | 658 | 6583.0 | 1473 | 14729.9 | 2564 | 25644.8 |

Minimum and maximum flow rates to achieve accuracy in M3/min (°C, 1.013 bar). M3/min at actual process temperature = minimum or maximum values below x 273 (actual temp (°C) + 273). Pipe ID based on schedule 80 steel. Flow Temp 0 °C.

**TABLE 74 - AIR FLOW RATES AT SELECTED PROCESS PRESSURES (Metric)**

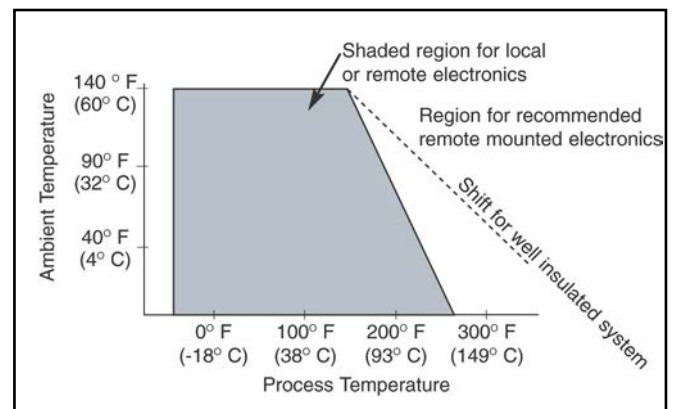
| Size (mm)        |                 | 20  |       | 25  |       | 40   |        | 50   |        | 80   |        | 100  |        |
|------------------|-----------------|-----|-------|-----|-------|------|--------|------|--------|------|--------|------|--------|
| Density (lb/ft3) | Pressure (psig) | min | max   | min | max   | min  | max    | min  | max    | min  | max    | min  | max    |
| 1.293            | 0               | 0.1 | 1.28  | 0.2 | 2.10  | 0.5  | 5.21   | 0.9  | 8.69   | 1.9  | 19.48  | 3.4  | 33.92  |
| 1.93             | 0.5             | 0.2 | 1.91  | 0.3 | 3.14  | 0.8  | 7.78   | 1.3  | 12.97  | 2.9  | 29.08  | 5.1  | 50.66  |
| 2.568            | 1               | 0.3 | 2.54  | 0.4 | 4.18  | 1.0  | 10.35  | 1.7  | 17.26  | 3.9  | 38.69  | 6.8  | 67.39  |
| 3.844            | 2               | 0.4 | 3.81  | 0.6 | 6.25  | 1.5  | 15.49  | 2.6  | 25.82  | 5.8  | 57.90  | 10.1 | 100.85 |
| 5.12             | 3               | 0.5 | 5.07  | 0.8 | 8.33  | 2.0  | 20.64  | 3.4  | 34.39  | 7.7  | 77.11  | 13.4 | 134.31 |
| 6.39             | 4               | 0.6 | 6.33  | 1.0 | 10.40 | 2.6  | 25.78  | 4.3  | 42.96  | 9.6  | 96.32  | 16.8 | 167.77 |
| 7.67             | 5               | 0.8 | 7.59  | 1.2 | 12.48 | 3.1  | 30.92  | 5.2  | 51.53  | 11.6 | 115.54 | 20.1 | 201.24 |
| 8.95             | 6               | 0.9 | 8.86  | 1.5 | 14.55 | 3.6  | 36.06  | 6.0  | 60.10  | 13.5 | 134.75 | 23.5 | 234.70 |
| 10.22            | 7               | 1.0 | 10.12 | 1.7 | 16.62 | 4.1  | 41.20  | 6.9  | 68.67  | 15.4 | 153.96 | 26.8 | 268.16 |
| 11.5             | 8               | 1.1 | 11.38 | 1.9 | 18.70 | 4.6  | 46.34  | 7.7  | 77.24  | 17.3 | 173.17 | 30.2 | 301.63 |
| 12.77            | 9               | 1.2 | 12.64 | 2.1 | 20.77 | 5.1  | 51.48  | 8.6  | 85.80  | 19.2 | 192.38 | 33.5 | 335.09 |
| 14.05            | 10              | 1.4 | 13.91 | 2.3 | 22.85 | 5.7  | 56.62  | 9.4  | 94.37  | 21.2 | 211.59 | 36.9 | 368.55 |
| 15.32            | 11              | 1.5 | 15.17 | 2.5 | 24.92 | 6.2  | 61.76  | 10.3 | 102.94 | 23.0 | 230.81 | 40.2 | 402.01 |
| 16.6             | 12              | 1.6 | 16.43 | 2.7 | 27.00 | 6.7  | 66.91  | 11.1 | 111.51 | 25.0 | 250.02 | 43.5 | 435.48 |
| 17.88            | 13              | 1.8 | 17.70 | 2.9 | 29.07 | 7.2  | 72.05  | 12.0 | 120.08 | 26.9 | 269.23 | 46.9 | 468.94 |
| 19.15            | 14              | 1.9 | 18.96 | 3.1 | 31.15 | 7.7  | 77.19  | 12.9 | 128.65 | 28.8 | 288.44 | 50.2 | 502.40 |
| 22.98            | 17              | 2.2 | 22.75 | 3.7 | 37.37 | 9.3  | 92.61  | 15.4 | 154.35 | 34.6 | 346.08 | 60.3 | 602.79 |
| 26.81            | 20              | 2.6 | 26.54 | 4.4 | 43.59 | 10.1 | 108.04 | 18.0 | 180.06 | 40.4 | 403.71 | 70.3 | 703.18 |

*ANSI Flange Pressure - Temperature Ratings.  
Maximum Pressure in psig.*

**TABLE 75 - FLOW METER PRESSURE RATING**

| MATERIAL        | TEMP. °F    |      |     |     |     |
|-----------------|-------------|------|-----|-----|-----|
|                 | -100 to 100 | 200  | 300 | 400 | 500 |
| 316L SS 150# RF | 230         | 195  | 175 | 160 | 145 |
| 316L SS 300# RF | 600         | 505  | 455 | 415 | 380 |
| 316L SS 600# RF | 1000        | 1000 | 910 | 825 | 765 |

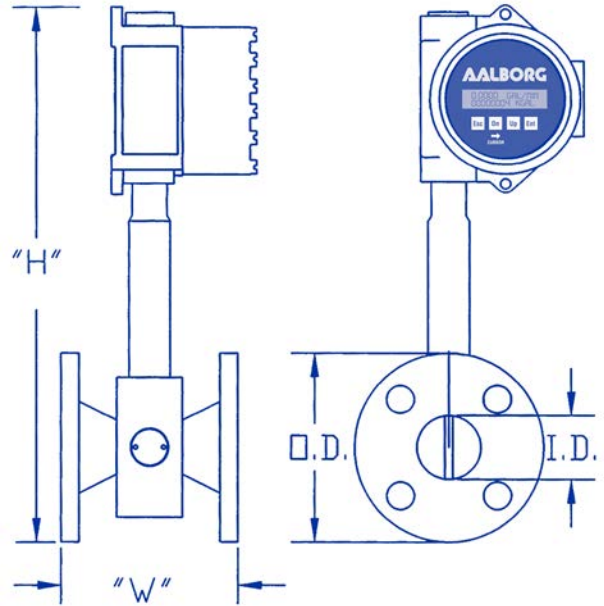
**Ambient Temperature Range for Electronics**



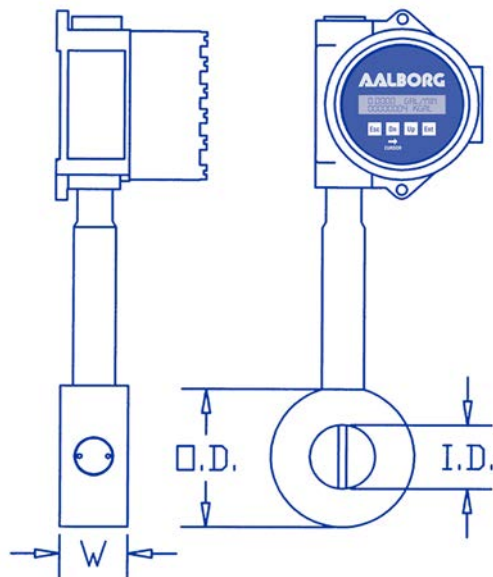
**TABLE 76**

| Meter Size | Flange Rating | Bolt diameter | Bolts | I.D.  | O.D.  | "W"  | "H"    |
|------------|---------------|---------------|-------|-------|-------|--|--------|
| in.        | psi           | in.           | no.   | in.   | in.   | in.  | in.    |
| 3/4        | 150           | 1/2           | 4     | 0.742 | 3.875 | FOR DIMENSIONS CONTACT AALBORG CUSTOMER SERVICE DEPARTMENT | 9.75   |
|            | 300           | 5/8           | 4     |       | 4.625 |  | 10.125 |
|            | 600           | 5/8           | 4     |       | 4.625 |  | 10.125 |
|            | 900           | 7/8           | 4     |       | 5.125 |  | 10.375 |
| 1          | 150           | 1/2           | 4     | 0.957 | 4.25  |  | 10.35  |
|            | 300           | 5/8           | 4     |       | 4.875 |  | 10.91  |
|            | 600           | 5/8           | 4     |       | 4.875 |  | 10.91  |
|            | 900           | 1             | 4     |       | 5.875 |  | 11.35  |
| 1.5        | 150           | 1/2           | 4     | 1.50  | 5.00  |  | 10.875 |
|            | 300           | 3/4           | 4     |       | 6.125 |  | 11.125 |
|            | 600           | 3/7           | 4     |       | 6.125 |  | 11.125 |
|            | 900           | 1-1/8         | 4     |       | 7.00  |  | 12.125 |
| 2          | 150           | 5/8           | 4     | 1.937 | 6.00  | 11.60  |        |
|            | 300           | 5/8           | 4     |       | 6.50  | 11.98  |        |
|            | 600           | 5/8           | 4     |       | 6.50  | 11.98  |        |
|            | 900           | 1             | 4     |       | 8.50  | 12.60  |        |
| 3          | 150           | 5/8           | 4     | 2.900 | 7.50  | 12.37  |        |
|            | 300           | 3/4           | 8     |       | 8.25  | 12.87  |        |
|            | 600           | 3/4           | 8     |       | 8.25  | 13.25  |        |
|            | 900           | 1             | 8     |       | 9.50  | 13.62  |        |
| 4          | 150           | 5/8           | 4     | 3.826 | 9.00  |  |        |
|            | 300           | 3/4           | 8     |       | 10.00 |  |        |
|            | 600           | 7/8           | 8     |       | 10.75 |  |        |
|            | 900           | 1-1/4         | 8     |       | 11.50 |  |        |

## Flange Mounting



## Wafer Mounting


**TABLE 77**

| Meter Size | Flange Rating | Bolt Diameter | Bolts | I.D.  | O.D.  | "W"  | "H"   |
|------------|---------------|---------------|-------|-------|-------|--|-------|
| in.        | psi           | in.           | no.   | in.   | in.   | in.  | in.   |
| 3/4        | 150           | 1/2           | 4     | 0.742 | 2.370 | FOR DIMENSIONS CONTACT AALBORG CUSTOMER SERVICE DEPARTMENT | 9.00  |
|            | 300           | 5/8           | 4     |       |       |  |       |
|            | 600           | 5/8           | 4     |       |       |  |       |
| 1          | 150           | 1/2           | 4     | 0.957 | 2.740 |  | 9.20  |
|            | 300           | 5/8           | 4     |       |       |  |       |
|            | 600           | 5/8           | 4     |       |       |  |       |
| 1.5        | 150           | 1/2           | 4     | 1.500 | 3.500 |  | 9.60  |
|            | 300           | 3/4           | 4     |       |       |  |       |
|            | 600           | 3/4           | 4     |       |       |  |       |
| 2          | 150           | 5/8           | 4     | 1.937 | 4.250 |  | 10.00 |
|            | 300           | 5/8           | 8     |       |       |  |       |
|            | 600           | 5/8           | 8     |       |       |  |       |
| 3          | 150           | 5/8           | 4     | 2.900 | 5.497 | 10.60  |       |
|            | 300           | 3/4           | 8     |       |       |  |       |
|            | 600           | 3/4           | 8     |       |       |  |       |
| 4          | 150           | 5/8           | 8     | 3.826 | 6.997 | 11.37  |       |
|            | 300           | 3/4           | 8     |       |       |  |       |
|            | 600           | 7/8           | 8     |       |       |  |       |





**Configure and Order Online: [mVX Multi-Parameter Vortex Flow Meter](#)**

To allow us to confirm selection please return completed application data sheet found on Aalborg's web site at [www.aalborg.com](http://www.aalborg.com).

1. Select style (wafer or flange).
2. Select meter size to match internal pipe diameter.
3. Confirm minimum and maximum flow ranges to maintain stated accuracy from liquid, steam, or air from Tables 71 to 75 are within your requirements.
4. For other gas applications consult factory.
5. Select fluid type.
6. Select maximum temperature capability.
7. Select desired \*\*Material of Construction.
8. Select mounting connection.
9. Confirm maximum pressure capability of flange/meter rating with process conditions and select flange rating from Table 76 to 78.
10. Confirm suitability of standard local mounted electronics.
11. Select desired transmitter power.
12. Provide: Fluid, Fluid Viscosity, Minimum & Maximum Operating Pressure, Minimum & Maximum Operating Temperature, Density/Specific Gravity or Specific Volume.
13. Provide minimum and maximum flow range.

† = Flange and Wafer Style for Alignment Ring Selection.

\*\* = The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

|    |       |
|----|-------|
| VX | MODEL |
|----|-------|

| STYLE |                                       |
|-------|---------------------------------------|
| S     | Wafer - SCH 40 Pressure, Temperature  |
| T     | Wafer - SCH 80 Pressure, Temperature  |
| C     | Flange - SCH 40 Pressure, Temperature |
| D     | Flange - SCH 80 Pressure, Temperature |

| SIZE: WAFER or FLANGE |              |
|-----------------------|--------------|
| 07                    | 3/4" (20mm)  |
| 10                    | 1.0" (25mm)  |
| 15                    | 1.5" (40mm)  |
| 20                    | 2.0" (50mm)  |
| 30                    | 3.0" (80mm)  |
| 40                    | 4.0" (100mm) |

| FLUID TYPE |        |
|------------|--------|
| G          | Gas    |
| L          | Liquid |
| S          | Steam  |

| MAX TEMP. / PRESSURE |                    |
|----------------------|--------------------|
| A                    | 450 °F / 100 PSIA  |
| B                    | 450 °F / 200 PSIA  |
| C                    | 450 °F / 300 PSIA  |
| D                    | 450 °F / 500 PSIA  |
| E                    | 450 °F / 750 PSIA  |
| F                    | 450 °F / 1000 PSIA |

| MATERIAL |        |
|----------|--------|
| 6        | 316 SS |

| MOUNTING CONNECTION |                               |
|---------------------|-------------------------------|
| A                   | Wafer. Using Customer Flanges |
| B                   | Flange Mounting               |
| F                   | Other                         |

| FLANGE RATING† |   |
|----------------|---|
| A              | 150# ANSI RF (Alignment Rings Not Required for Wafer Style) |
| B              | 300# ANSI RF (Wafer Style Includes Alignment Rings)         |
| C              | 600# ANSI RF (Wafer Style Includes Alignment Rings)         |
| D              | Other   |
| N              | None  |

| DISPLAY |                  |
|---------|------------------|
| L2      | Local with RS232 |
| L4      | Local with RS485 |

| POWER |        |
|-------|--------|
| 04    | 24VDC  |
| 12    | 120VAC |
| 22    | 220VAC |

VX D 10 L F 6 A B L2 22

**EXAMPLE: VXD-10L-46AB-L222**

**SPECIFY: FLUID NAME OR MEASURING DENSITY, FLOW RATE, TEMPERATURE AND PRESSURE (STEAM, GASES).**

Vortex meter, Flange style, 1.0" diameter size, Liquid at maximum 450 °F, 1000 PSIA, 316 stainless steel, Customer flanges, Flange 300# ANSI RF, Local display with RS232, 220V power.

## Design Features

- Wide range of available insertion inside diameter applications.
- Installation by porting into piping without need to lengthening line.
- Optional installation and servicing removal of meter without shutting off line.
- No moving parts to wear or fail
- Electronics can be remotely mounted up to 30.5 m (100 ft).
- No holes to clog.
- Aalborg's proprietary DSP algorithm accurately filters vortex frequency.
- High flow turndown ratio up to 10:1.
- Dual sensor signal processing technology improves accuracy at low flows.
- Accuracy of 1% of rate.
- Noise cancellation technology.
- Extensive Diagnostics.
- Password protected data entry.
- Volumetric and mass flow information simultaneously displayed.
- Selectable engineering units.
- On board computer calculates density and mass flow.
- Two programmable totalizers.

Vortex Insertion  
Flow Meter Shown  
with Fixed Mounting



Vortex Insertion  
Flow Meter Shown  
with Retractable Mounting



## Principles of Operation

Vortices are created when a fluid passes around a bluff body as shown in Figure 1. Vortices are alternately shed on each side of the body, 180 degrees out of phase to each other, resulting in an oscillating pressure gradient. As flow increases the frequency of vortices increases in proportion to the increased flow thereby creating a linear relationship.

## General Description

Constructed of type 316 stainless steel, Vortex meters may be inserted into pipe conduits carrying gases, liquids or steam. Insertion applications facilitate inside diameters from 4" to 12 feet!

By porting directly into piping, conduit lines need not be lengthened. Optional isolation valve permits installation, servicing, or removal of vortex meters without having to shut gas, liquid or steam processing operations.

Keypad or communication interface is provided to access the following parameters: measuring units; programmable flow alarm; two programmable totalizers; programmable flow rate pulse output; two programmable optically isolated outputs; battery backed real time clock (RTC); digital communication interface (RS-232 or RS-485); programmable diagnostic events log and register with date/time stamp; programmable process variable log with date/time stamp; calibration and flowing fluid parameters adjustment; extensive diagnostics.

Our exclusive dual signal processing technology independently measures each vortex on either side of the bluff body and filters out non-flow noise. This results in less noise and higher accuracy throughout the flow range. Aalborg's proprietary DSP algorithm accurately filters vortex frequency, improving the quality of flow measurements.

User preset temperature and pressure information processed by an on board computer to calculate density and mass flow. Local 2x16 LCD readout provides simultaneous volumetric and mass flow readings, total flow volume reading in selectable engineering units, diagnostic events indication, and password protected - user entered parameters.

**TABLE 78 - FUNCTIONAL SPECIFICATIONS**

|                          |   |
|--------------------------|---|
| <b>FLUID TYPES</b>       | Steam, Gas, Liquid.   |
| <b>MAXIMUM PRESSURE</b>  | 69 bar (1000 psig) with wafer mount<br>See Table 82 for flange mount.   |
| <b>FLUID TEMPERATURE</b> | -20 °F to 232 °C.<br>-4° to 450 °F.   |
| <b>LOW FLOW CUT-OFF</b>  | Adjustable: Set @ min. per Tables 83 to 86.   |
| <b>HIGH FLOW CUT-OFF</b> | Adjustable: Set @ max. per Tables 83 to 86.   |
| <b>VOLTAGE</b>           | 15 to 30 Vdc standard. 115 or 230 VAC optional.   |
| <b>FREQUENCY</b>         | 50 /60 Hz.  |
| <b>OUTPUTS</b>           | Two user programmable analog 4-20 mA outputs (600 Ohms or less load), two sets of user-programmable optically isolated outputs, one user programmable optically isolated flow pulse output, RS-232 or RS-485 Digital Interface with Multi-Drop Capability of up to 255 units (RS-485 option). |
| <b>LINEAR RANGE</b>      | Reynolds number of >10,000.   |

*\*Designed to meet.  
Contact Aalborg for status of the agency approval.*

**TABLE 79 - PHYSICAL SPECIFICATIONS**

**\*\*MATERIALS OF CONSTRUCTION**

|                            |                              |
|----------------------------|------------------------------|
| <b>SHEDDER BAR</b>         | 316 SS.                      |
| <b>ELECTRODES</b>          | 316 SS encapsulated ceramic. |
| <b>METERING TUBE</b>       | 316 SS.                      |
| <b>FLANGES</b>             | 316L SS.                     |
| <b>ELECTRONICS HOUSING</b> | Epoxy coated aluminum.       |

**CONNECTIONS AND MOUNTINGS**

|   |   |
|---|---|
| <b>MOUNTING POSITION</b>                  | Vertical, horizontal, angle.                            |
| <b>TYPICAL STRAIGHT PIPE REQUIREMENTS</b> | Upstream: 20 x D.<br>Downstream: 5 x D.                 |
| <b>PROCESS CONNECTIONS</b>                | MNPT, ANSI Class 150 RF, 300 RF, 600 RF, Welded Flange. |
| <b>ELECTRICAL CONNECT</b>                 | 3/4" FNPT.  |

*\*\*The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.*

**TABLE 80 - PERFORMANCE SPECIFICATIONS**

|                            |  |
|----------------------------|--|
| <b>FLOW ACCURACY</b>       | ±1% of rate.   |
| <b>FLOW REPEATABILITY</b>  | ±0.25% of rate.  |
| <b>FLOW TURNDOWN RATIO</b> | See Tables 83 to 86.   |
| <b>RESPONSE TIME</b>       | Adjustable based on NRF and Damping settings (minimum 1000 ms).  |
| <b>DAMPING</b>             | Adjustable: 1 to 99 sec.   |
| <b>VELOCITY RANGE</b>      | Liq.: 1.32 or to 30 ft/sec<br>Steam & Gas: $(144/\bar{n})^{1/3}$ to 250 ft/sec<br>$\bar{n}$ = density (lb/ft <sup>3</sup> )<br>d= pipe diameter (in)<br>$\mu$ = viscosity (cp) |
| <b>AGENCY APPROVALS*</b>   | FM and CSA Class 1 Div 2 Groups B,C,D.   |

**TABLE 81 - ELECTRONIC SPECIFICATIONS**

|                             |  |
|-----------------------------|--|
| <b>AMBIENT TEMPERATURE</b>  | -12° to 65 °C (-15 °F to 149 °F).  |
| <b>TRANSMITTER</b>          | Microprocessor-based.  |
| <b>DISPLAY</b>              | Two lines, 16 alphanumeric characters each, programmable for different process variable rate and total.  |
| <b>FUNCTIONS</b>            | Measuring Units, Programmable Flow Alarm, Two Programmable Totalizers, Programmable Flow Rate Pulse Output, Two Programmable Optically Isolated Outputs, Two Programmable analog 4-20 mA outputs, Battery Backed Real Time Clock [RTC], Digital communication interface (RS-232 or RS-485*), Programmable Diagnostic events Log and register with date and time stamp, Programmable Process Variable Data Log (total 15872 records) with date and time stamp, Calibration and Flowing Fluid parameters adjustment, Extensive Diagnostic. |
| <b>OUTPUT SIGNAL</b>        | Two programmable analog 4-20 mA into 600 Ohms or less load, two programmable digital optically isolated (UCE @ 40Vdc, ICE @ 150 mA), one programmable optically isolated flow pulse out put (UCE @ 60Vdc, ICE @ 50 mA).  |
| <b>ENCLOSURE PROTECTION</b> | NEMA 4X.   |
| <b>ENCLOSURE APPROVALS</b>  | UL, CSA, FM<br>Class I Groups B, C, D<br>Class II Groups E, F, G<br>KEMA/GENELEC<br>Ex d IIB   |
| <b>POWER SUPPLY</b>         | 15-30 Vdc standard, 115 or 230 VAC (optional).   |

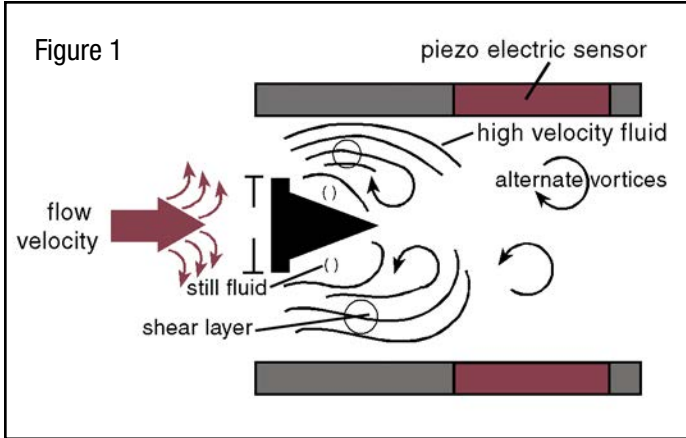
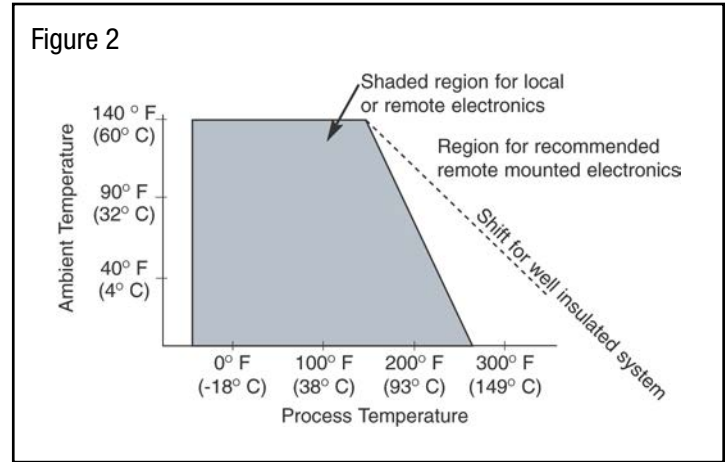


Figure 1  
Dual signal processing technology independently measures each vortex providing increased accuracy and turndown.

## Ambient Temperature Range for Electronics



## Flow Meter Pressure Rating

ANSI Flange Pressure - Temperature Ratings. Maximum Pressure in psig.

TABLE 82 - FLOW METER PRESSURE RATING

| MATERIAL        | TEMP. °F    |      |     |     |     |     |
|-----------------|-------------|------|-----|-----|-----|-----|
|                 | -100 to 100 | 200  | 300 | 400 | 500 | 600 |
| 316L SS 150# RF | 230         | 195  | 175 | 160 | 145 | 140 |
| 316L SS 300# RF | 600         | 505  | 455 | 415 | 380 | 360 |
| 316L SS 600# RF | 1000        | 1000 | 910 | 825 | 765 | 720 |

## Flow Ranges

Minimum and maximum flow rates to achieve accuracy. Pipe ID based on schedule 40 steel.

TABLE 83 - WATER FLOW RATES AT 70 °F

|         | 4"  |        | 5"  |        | 6"   |         | 8"   |         | 10"  |         | 12"  |         | 14"  |         |
|---------|-----|--------|-----|--------|------|---------|------|---------|------|---------|------|---------|------|---------|
|         | min | max    | min | max    | min  | max     | min  | max     | min  | max     | min  | max     | min  | max     |
| gal/min | 119 | 1190.3 | 187 | 1871.6 | 270  | 2701.1  | 468  | 4675.0  | 737  | 7372.0  | 1047 | 10466.3 | 1265 | 12648.9 |
| L/min   | 451 | 4505.6 | 708 | 7084.7 | 1022 | 10224.3 | 1770 | 17696.4 | 2791 | 27905.4 | 3962 | 39618.1 | 4788 | 47880.1 |

|         | 16"  |         | 18"  |         | 20"  |         | 24"   |          | 30"   |          | 36"   |          |
|---------|------|---------|------|---------|------|---------|-------|----------|-------|----------|-------|----------|
|         | min  | max     | min  | max     | min  | max     | min   | max      | min   | max      | min   | max      |
| gal/min | 1652 | 16524.1 | 2091 | 20915.1 | 2599 | 25994.0 | 3760  | 37595.4  | 5965  | 59648.2  | 8740  | 87397    |
| L/min   | 6255 | 62549.0 | 7917 | 79169.9 | 9840 | 98395.3 | 14231 | 142310.1 | 22579 | 225786.9 | 33083 | 330833.6 |



Minimum and maximum flow rates to achieve accuracy in (lb/hr).  
Pipe ID based on schedule 40 steel.

**TABLE 84 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| Pressure<br>(psig) | 4"   |       | 6"    |        | 8"    |        | 10"   |       | 12"    |        | 14"   |        | 16"    |         | 18"    |         | 20"    |         |
|--------------------|------|-------|-------|--------|-------|--------|-------|-------|--------|--------|-------|--------|--------|---------|--------|---------|--------|---------|
|                    | min  | max   | min   | max    | min   | max    | min   | max   | min    | max    | min   | max    | min    | max     | min    | max     | min    | max     |
| 10                 | 482  | 4821  | 1094  | 10942  | 1895  | 18947  | 2986  | 4239  | 42392  | 42392  | 5124  | 51241  | 6693   | 66927   | 8472   | 84715   | 10527  | 105266  |
| 25                 | 752  | 7517  | 1706  | 17058  | 2954  | 29539  | 4656  | 6609  | 66090  | 66090  | 7989  | 79887  | 10434  | 104342  | 13207  | 132073  | 16411  | 164114  |
| 50                 | 1188 | 11883 | 2697  | 26967  | 4670  | 46696  | 7360  | 10448 | 104479 | 104479 | 12629 | 126289 | 16495  | 164949  | 20879  | 208788  | 25944  | 259440  |
| 75                 | 1617 | 16168 | 3669  | 36691  | 6354  | 63535  | 10015 | 14215 | 142154 | 142154 | 17183 | 171828 | 22443  | 224429  | 28408  | 284077  | 35299  | 352993  |
| 100                | 2041 | 20407 | 4631  | 46312  | 8020  | 80195  | 12641 | 17943 | 179430 | 179430 | 21689 | 216885 | 28328  | 283279  | 35857  | 358567  | 45556  | 455555  |
| 125                | 2462 | 24619 | 5587  | 55870  | 9675  | 96746  | 15249 | 21646 | 216461 | 216461 | 26165 | 261647 | 34174  | 341742  | 43257  | 432569  | 53751  | 537510  |
| 150                | 2881 | 28813 | 6539  | 65389  | 11323 | 113228 | 17848 | 25334 | 253340 | 253340 | 30622 | 306224 | 39997  | 399966  | 50627  | 506268  | 62909  | 629087  |
| 200                | 3718 | 37177 | 8437  | 84371  | 14610 | 146098 | 23029 | 32688 | 326883 | 326883 | 39512 | 395119 | 51607  | 516074  | 65323  | 653233  | 81171  | 811707  |
| 250                | 4554 | 45540 | 10335 | 103349 | 17896 | 178961 | 28208 | 40041 | 400411 | 400411 | 48400 | 483995 | 63216  | 632157  | 80017  | 800169  | 99429  | 994289  |
| 300                | 5361 | 53612 | 12169 | 121688 | 21068 | 210683 | 33209 | 47139 | 471388 | 471388 | 56979 | 569789 | 74421  | 744214  | 94201  | 942008  | 117054 | 1170538 |
| 350                | 6242 | 62417 | 14141 | 141407 | 24486 | 244864 | 38596 | 54786 | 547864 | 547864 | 62223 | 622229 | 86495  | 864953  | 109484 | 1094836 | 136044 | 1360441 |
| 400                | 7104 | 71043 | 16123 | 161226 | 27918 | 279183 | 44006 | 62465 | 624650 | 624650 | 75504 | 755044 | 98618  | 986180  | 124828 | 1248282 | 155111 | 1551114 |
| 450                | 7979 | 79789 | 18107 | 181074 | 31355 | 313551 | 49223 | 70155 | 701547 | 701547 | 84799 | 847993 | 110758 | 1107582 | 140195 | 1401950 | 174206 | 1742061 |

Minimum and maximum flow rates to achieve accuracy in (kg/hr).  
Pipe ID based on schedule 40 steel.

**TABLE 85 - SATURATED STEAM FLOW RATES AT SELECTED PROCESS PRESSURES (English)**

| Pressure<br>(psig) | 100mm |       | 150mm |       | 200mm |        | 250mm |        | 300mm |        | 350mm |        | 400mm |        | 450mm |        | 500mm |        |
|--------------------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|
|                    | min   | max   | min   | max   | min   | max    | min   | max    | min   | max    | min   | max    | min   | max    | min   | max    | min   | max    |
| 1                  | 134   | 1342  | 305   | 3045  | 527   | 5272   | 831   | 8310   | 1180  | 11796  | 1426  | 14259  | 1862  | 18624  | 2357  | 23574  | 2929  | 29292  |
| 2                  | 257   | 2574  | 584   | 5842  | 1012  | 10116  | 1595  | 15946  | 2264  | 22635  | 2736  | 27360  | 3574  | 35735  | 4523  | 45232  | 5621  | 56206  |
| 4                  | 493   | 4927  | 1118  | 11181 | 1936  | 19361  | 3052  | 30518  | 4332  | 43319  | 5236  | 52362  | 6839  | 68391  | 8657  | 86568  | 10757 | 107569 |
| 6                  | 722   | 7218  | 1638  | 16380 | 2836  | 28364  | 4471  | 44708  | 6346  | 63461  | 7671  | 76709  | 10019 | 100191 | 12682 | 126819 | 15759 | 157586 |
| 10                 | 1172  | 11723 | 2661  | 26605 | 4607  | 46069  | 7262  | 72616  | 10308 | 103076 | 12459 | 124593 | 16273 | 162734 | 20599 | 205985 | 25596 | 255956 |
| 14                 | 1619  | 16189 | 3674  | 36739 | 6362  | 63618  | 10028 | 100276 | 14234 | 142340 | 17205 | 172052 | 22472 | 224722 | 28445 | 284447 | 35345 | 353453 |
| 18                 | 2065  | 20649 | 4686  | 46861 | 8115  | 81146  | 12791 | 127905 | 18156 | 181558 | 21946 | 219458 | 28664 | 286639 | 36282 | 362821 | 45084 | 450841 |
| 22                 | 2500  | 25003 | 5674  | 56742 | 9826  | 98256  | 15487 | 154874 | 21984 | 219840 | 26573 | 265730 | 34708 | 347077 | 43932 | 439321 | 54590 | 545899 |
| 26                 | 2965  | 29649 | 6729  | 67286 | 11651 | 116514 | 18365 | 183653 | 26069 | 260690 | 31511 | 315109 | 41157 | 411571 | 52096 | 520956 | 64734 | 647339 |
| 28                 | 3198  | 31979 | 7257  | 72574 | 12567 | 125670 | 19809 | 198086 | 28118 | 281178 | 33987 | 339873 | 44392 | 443916 | 56190 | 561898 | 69821 | 698213 |
| 30                 | 3431  | 34311 | 7787  | 77866 | 13484 | 134835 | 21253 | 212531 | 30168 | 301683 | 36466 | 364658 | 47629 | 476289 | 60287 | 602874 | 74913 | 749131 |



Minimum and Maximum Flow Rates to achieve Accuracy in CFPM (14.7 PSIA and 70 °F).  
PipeID Based on Schedule 40 Steel.

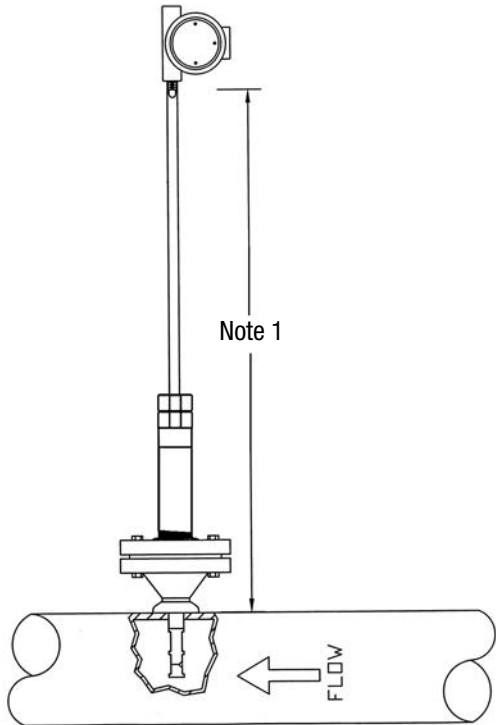
**TABLE 86 - AIR FLOW RATES AT 60 °F CONDITIONS**

| Density<br>(lb/ft <sup>3</sup> ) | Pressure<br>(PSIG) | 4"   |         | 6"   |       | 8"    |        | 10"   |        | 12"   |        | 14"   |        |
|----------------------------------|--------------------|------|---------|------|-------|-------|--------|-------|--------|-------|--------|-------|--------|
|                                  |                    | min  | max     | min  | max   | min   | max    | min   | max    | min   | max    | min   | max    |
| 0.076                            | 0                  | 120  | 1197.9  | 271  | 2715  | 521   | 5211   | 821   | 8214   | 1166  | 11659  | 1409  | 14093  |
| 0.103                            | 5                  | 161  | 1605.3  | 364  | 3638  | 698   | 6983   | 1101  | 11007  | 1563  | 15625  | 1889  | 18887  |
| 0.128                            | 10                 | 201  | 2012.8  | 456  | 4562  | 876   | 8756   | 1380  | 13802  | 1959  | 19591  | 2368  | 23681  |
| 0.180                            | 20                 | 283  | 2827.7  | 641  | 6409  | 1230  | 12301  | 1939  | 19389  | 2752  | 27523  | 3327  | 33268  |
| 0.232                            | 30                 | 364  | 3642.6  | 826  | 8256  | 1585  | 15846  | 2498  | 24977  | 3545  | 35454  | 4286  | 42855  |
| 0.284                            | 40                 | 446  | 4457.5  | 1010 | 10103 | 1939  | 19391  | 3056  | 30564  | 4339  | 43386  | 5244  | 52443  |
| 0.336                            | 50                 | 527  | 5272.4  | 1195 | 11950 | 2294  | 22936  | 3615  | 36152  | 5132  | 51317  | 6203  | 62030  |
| 0.388                            | 60                 | 604  | 6037.3  | 1380 | 13797 | 2648  | 26481  | 4174  | 41740  | 5925  | 59249  | 7162  | 71618  |
| 0.440                            | 70                 | 690  | 6902.2  | 1564 | 15644 | 3003  | 30026  | 4733  | 47328  | 6718  | 67181  | 8121  | 81205  |
| 0.493                            | 80                 | 772  | 7717.1  | 1749 | 17490 | 3357  | 33571  | 5292  | 52915  | 7511  | 75113  | 9079  | 90792  |
| 0.545                            | 90                 | 853  | 8532.0  | 1934 | 19337 | 3712  | 37116  | 5850  | 58504  | 8304  | 83044  | 10038 | 100379 |
| 0.596                            | 100                | 935  | 9346.9  | 2118 | 21184 | 4066  | 40661  | 6409  | 64091  | 9098  | 90976  | 10977 | 109967 |
| 0.649                            | 110                | 1016 | 10161.8 | 2303 | 23031 | 4421  | 44206  | 6998  | 69979  | 9891  | 98907  | 11955 | 119554 |
| 0.700                            | 120                | 1098 | 10976.7 | 2488 | 24878 | 4775  | 47751  | 7527  | 75266  | 10684 | 106839 | 12914 | 129142 |
| 0.752                            | 130                | 1179 | 11791.6 | 2673 | 26725 | 5130  | 51296  | 8084  | 80854  | 11477 | 114771 | 13873 | 138729 |
| 0.804                            | 140                | 1261 | 12606.5 | 2857 | 28572 | 5484  | 54841  | 8644  | 86442  | 12270 | 122703 | 14832 | 148317 |
| 0.856                            | 150                | 1342 | 13421.4 | 3042 | 30419 | 5839  | 58386  | 9203  | 92030  | 13063 | 130634 | 15790 | 157904 |
| 1.116                            | 200                | 1749 | 17495.9 | 3965 | 39654 | 7611  | 76111  | 11997 | 119968 | 17029 | 170293 | 20884 | 208841 |
| 1.636                            | 300                | 2564 | 25644.8 | 5812 | 58123 | 11156 | 111560 | 17585 | 175846 | 24961 | 249609 | 30171 | 301714 |

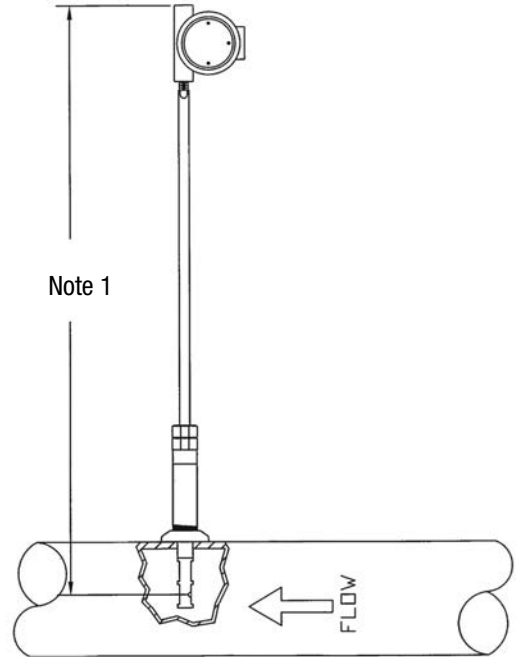
| Density<br>(lb/ft <sup>3</sup> ) | Pressure<br>(PSIG) | 16"   |        | 18"   |        | 20"   |        | 24"   |        | 30"    |         | 36"    |         |
|----------------------------------|--------------------|-------|--------|-------|--------|-------|--------|-------|--------|--------|---------|--------|---------|
|                                  |                    | min   | max    | min   | max    | min   | max    | min   | max    | min    | max     | min    | max     |
| 0.076                            | 0                  | 1841  | 18407  | 2330  | 23300  | 2895  | 28953  | 4187  | 41875  | 6999   | 69995   | 9738   | 97377   |
| 0.103                            | 5                  | 2467  | 24669  | 3122  | 31225  | 3880  | 38800  | 5612  | 56118  | 9380   | 93803   | 13050  | 130498  |
| 0.128                            | 10                 | 3093  | 30930  | 3915  | 39150  | 4865  | 48648  | 7037  | 70362  | 11761  | 117611  | 16362  | 163620  |
| 0.180                            | 20                 | 4345  | 43452  | 5500  | 55000  | 6834  | 68344  | 9885  | 98848  | 16523  | 165227  | 22986  | 229863  |
| 0.232                            | 30                 | 5597  | 55974  | 7085  | 70851  | 8804  | 88039  | 12733 | 127335 | 21284  | 212843  | 29611  | 296106  |
| 0.284                            | 40                 | 6850  | 68497  | 8670  | 86701  | 10773 | 107735 | 15582 | 155821 | 26046  | 260459  | 36235  | 362348  |
| 0.336                            | 50                 | 8101  | 81019  | 10255 | 102552 | 12743 | 127431 | 18431 | 184308 | 30807  | 308075  | 42860  | 428591  |
| 0.388                            | 60                 | 9354  | 9354   | 11840 | 118402 | 14713 | 147127 | 21279 | 212794 | 35569  | 355691  | 49483  | 494834  |
| 0.440                            | 70                 | 10606 | 106063 | 13425 | 134253 | 16682 | 166822 | 24128 | 241281 | 40331  | 403307  | 56108  | 561077  |
| 0.493                            | 80                 | 11859 | 118586 | 15010 | 150103 | 18652 | 186518 | 26977 | 269767 | 45092  | 450923  | 62732  | 627320  |
| 0.545                            | 90                 | 13111 | 131108 | 16595 | 165953 | 20621 | 206214 | 29825 | 298254 | 49854  | 498539  | 69350  | 693503  |
| 0.596                            | 100                | 14363 | 143630 | 18180 | 181804 | 22591 | 225909 | 32674 | 326741 | 54615  | 546155  | 75981  | 759806  |
| 0.649                            | 110                | 15615 | 156152 | 19765 | 197654 | 24560 | 245605 | 35523 | 355227 | 59377  | 593771  | 82605  | 826048  |
| 0.700                            | 120                | 16869 | 168675 | 21350 | 213505 | 26530 | 265301 | 38371 | 383713 | 64139  | 641387  | 89229  | 892291  |
| 0.752                            | 130                | 18120 | 181197 | 22935 | 229355 | 28500 | 284996 | 41220 | 412200 | 68900  | 689003  | 95853  | 958534  |
| 0.804                            | 140                | 19372 | 193719 | 24521 | 245205 | 30470 | 304692 | 44069 | 440687 | 73662  | 736619  | 104278 | 1042777 |
| 0.856                            | 150                | 20624 | 206242 | 26106 | 261056 | 32439 | 324387 | 46917 | 469173 | 78423  | 784235  | 109102 | 1091020 |
| 1.116                            | 200                | 26885 | 268853 | 34037 | 340307 | 44287 | 442866 | 61161 | 611606 | 102232 | 1022315 | 142223 | 1422234 |
| 1.636                            | 300                | 39408 | 394076 | 49881 | 498812 | 61982 | 619823 | 89647 | 896471 | 149847 | 1498474 | 208466 | 2084663 |



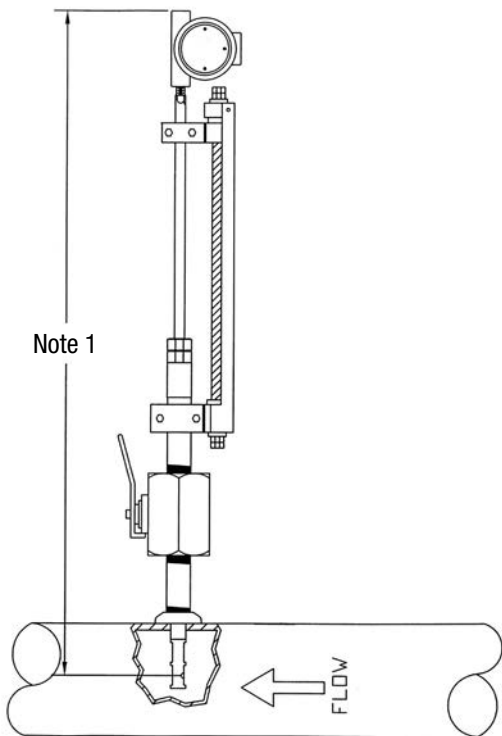
Flanged Insertion Meter



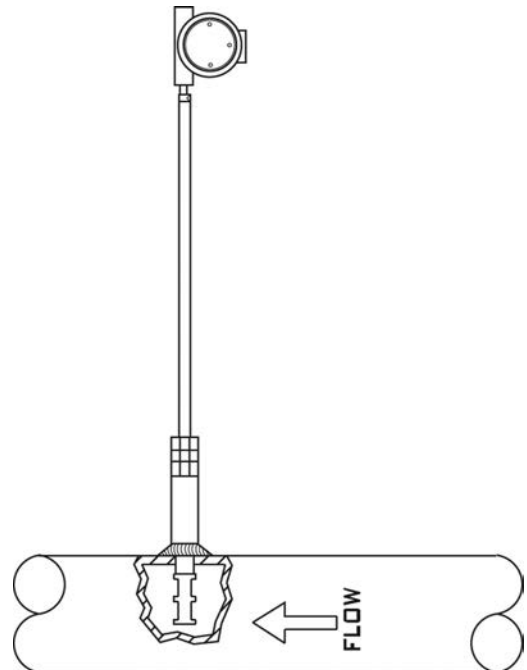
1-1/2" MNPT Insertion Meter



1-1/2" insertion Meter Assembly with Insertion Tool and Ball Valve



1-1/2" Welded Insertion Meter



**Note 1:** Length dependent on pipe diameter, thickness, and mounting.

Configure and Order Online: [iVX Insertion Vortex Flow Meter](#)

To allow us to confirm selection please return completed application data sheet found on Aalborg's web site at [www.aalborg.com](http://www.aalborg.com).

|       |           |
|-------|-----------|
| VX    | MODEL     |
| STYLE |           |
| I     | Insertion |

| SIZE: PIPE I.D. / MAX. INSERTION DEPTH * |                |
|--|----------------|
| 12                                       | 4"-24" / 12"   |
| 24                                       | 25"-36" / 18"  |
| 36                                       | 37"-72" / 24"  |
| 48                                       | 73"-144" / 36" |

| FLUID TYPE |        |
|------------|--------|
| G          | Gas    |
| L          | Liquid |
| S          | Steam  |

| MAX TEMP. |        |
|-----------|--------|
| 4         | 450 °F |

| MATERIAL |        |
|----------|--------|
| 6        | 316 SS |

| MOUNTING CONNECTION |                                  |
|---------------------|----------------------------------|
| C                   | Insertion with Flange.           |
| D                   | Insertion. With 1.5 MNPT Thread. |
| E                   | Insertion, Welded.               |
| F                   | Other.                           |

| FLANGE RATING† |              |
|----------------|--------------|
| A              | 150# ANSI RF |
| B              | 300# ANSI RF |
| C              | 600# ANSI RF |
| D              | Other        |
| N              | None         |

| DISPLAY |                   |
|---------|-------------------|
| L2      | Local with RS232  |
| R2      | Remote with RS232 |
| L4      | Local with RS485  |
| R4      | Remote with RS425 |

| POWER |        |
|-------|--------|
| 04    | 24Vdc  |
| 12    | 120Vac |
| 22    | 220Vac |

| ACCESSORIES   |                                |
|---------------|--------------------------------|
| MODEL NO.     | DESCRIPTION                    |
| VTX330600     | Insertion Tool Long            |
| VTX330601     | Insertion Tool Short           |
| VTX76-F107-01 | Ball Valve 1.5 NPT 304 SS      |
| VTX77-107-01  | Ball VLV 1.5 NPTF Bronze       |
| VTX83-100-01  | Ball VLV 1.5 NPTF Carbon Steel |

1. Style Insertion.
2. Select meter size to match internal pipe diameter (for insertion style select pipe diameter).
3. Confirm minimum and maximum flow ranges to maintain stated accuracy from liquid, steam, or air from Tables 84 to 87 are within your requirements.
4. For other gas applications consult factory.
5. Select fluid type.
6. Select maximum temperature capability.
7. Select desired \*\*Material of Construction.
8. Select mounting connection.
9. Confirm maximum pressure capability of flange/meter rating with process conditions and select flange rating from Table 83.
10. Confirm suitability of standard local mounted electronics.
11. Select desired transmitter power.
12. Provide: Fluid, Fluid Viscosity, Minimum & Maximum Operating Pressure, Minimum & Maximum Operating Temperature, Density/Specific Gravity or Specific Volume.
13. Provide minimum and maximum flow range.

Options: Remote mount electronics up to 100 ft. (30.5 m).

† = Insertion Style for Alignment Ring Selection.

\* = Depends on pipe wall thickness and mounting.

\*\* = The selection of materials of construction, is the responsibility of the customer. The company accepts no liability.

VX I — 12 L — 5 6 E N — L2 22

## EXAMPLE: VXI-12L-54EB-L222

**SPECIFY: FLUID NAME OR MEASURING DENSITY, FLOW RATE, TEMPERATURE AND PRESSURE (STEAM, GASES).**

Vortex meter, Insertion style, 10" diameter size, Liquid at maximum 500 °F, 316 stainless steel, Insertion Welded Mounting Connection, Flange 300# ANSI RF, Local display with RS232, 220V power.