mVX

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 platimum 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 Diganostics 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.

Vortex
In-line Flow Meter
Shown with
Wafer Mounting

Vortex
In-line Flow Meter
Shown with
Flange 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, wafers may be installed in-line by customer provided or built-in flanges. Key pad 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 52 - FUNCTIONAL SPECIFICATIONS

FLUID TYPES	Steam, Gas, Liquid.
MAXIMUM PRESSURE	69 bar (1000 psig) with wafer mount See Table 61 for flange mount.
FLUID TEMPERATURE	-20° to 232 °C std./to 260 °C opt. (-4° to 450 °F std./to 500 °F opt).
LOW FLOW CUT-OFF	Adjustable: Set @ min. per Tables 56 to 60.
HIGH FLOW CUT-OFF	Adjustable: Set @ max. per Tables 56 to 60.
VOLTAGE	15 to 30 VDC standard. 115 or 230 VAC optional.
FREQUENCY	50 /60 Hz.
OUTPUTS	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 isolat ed 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).
LINEAR RANGE	Reynolds number of >10,000.

TABLE 53 - PERFORMANCE SPECIFICATIONS

FLOW ACCURACY	± 1% of rate.
FLOW REPEATABILITY	± 0.25% of rate.
FLOW TURNDOWN RATIO	See Tables 56 to 60.
RESPONSE TIME	Adjustable based on NRF and Damping settings (minimum 1000 ms).
DAMPING	Adjustable: 1 to 99 sec.
VELOCITY RANGE	Liq.: 1.32 or $\frac{10000\mu}{\tilde{n}d \bullet 124}$ to 30 ft/sec. Steam & Gas: (144/ñ)1/3 to 250 ft/sec. ñ= density (lb/ft3). d= pipe diameter (in). µ= viscosity (cp).
AGENCY APPROVALS*	FM and CSA Class 1 Div 2 Groups B,C,D.
FLUID TEMPERATURE MEASUREMENT RANGE	20 to 260 °C (-4 to 500 °F).
TEMPERATURE ACCURACY (INCLUDING LINEARITY)	± 0.5 °C
FLUID PRESSURE MEASUREMENT RANGE	Can be ordered for the following options: 0-100 PSIA. 0-200 PSIA. 0-300 PSIA. 0- 500 PSIA. 0-750 PSIA. 0-1000 PSIA.
PRESSURE ACCURACY (INCLUDING LINEARITY)	± 0.5% of full scale.
FLUID PROOF PRESSURE	3 X F.S.
FLUID BURST PRESSURE	10 X F.S.

TABLE 54 - PHYSICAL SPECIFICATION

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

Figure 1

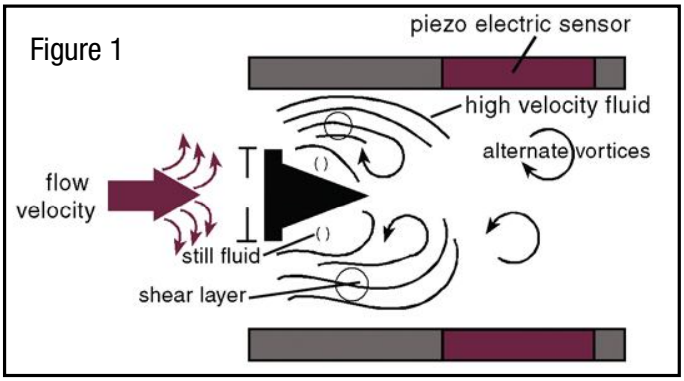


TABLE 55 - ELECTRONIC SPECIFICATIONS

AMBIENT TEMPERATURE	-12° to 65 °C (-15° to 149 °F).
TRANSMITTER	Microprocessor-based.
DISPLAY	Two lines, 16 alphanumeric characters each, programmable for different process variable rate and total.
FUNCTIONS	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.
OUTPUT SIGNAL	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).
ENCLOSURE PROTECTION	NEMA 4X.
ENCLOSURE APPROVALS	UL, CSA, FM Class I Groups B, C, D Class II Groups E, F, G KEMA/CENELEC EEx d IIB
POWER SUPPLY	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 56 - 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 57- 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 58 - 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 59 - 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 60 - 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	25.82	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 61 - FLOW METER PRESSURE RATING

MATERIAL	TEMP. °F				
	-100 to 100	200	300	400	500
304L SS/316L SS 150# RF	230	195	175	160	145
304L SS/316L SS 300# RF	600	505	455	415	380
304L SS/316L SS 600# RF	1000	1000	910	825	765

Ambient Temperature Range for Electronics

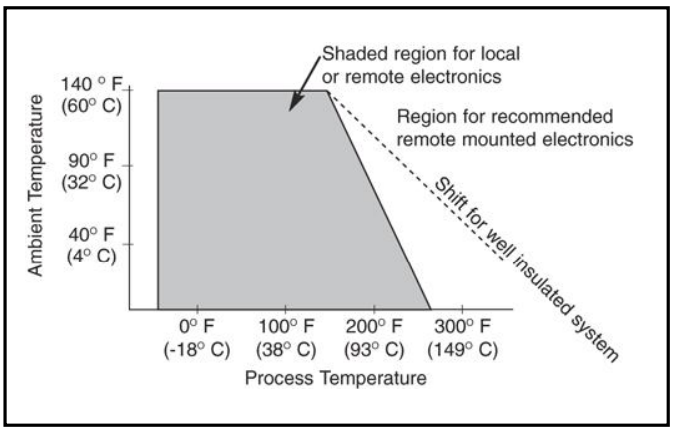
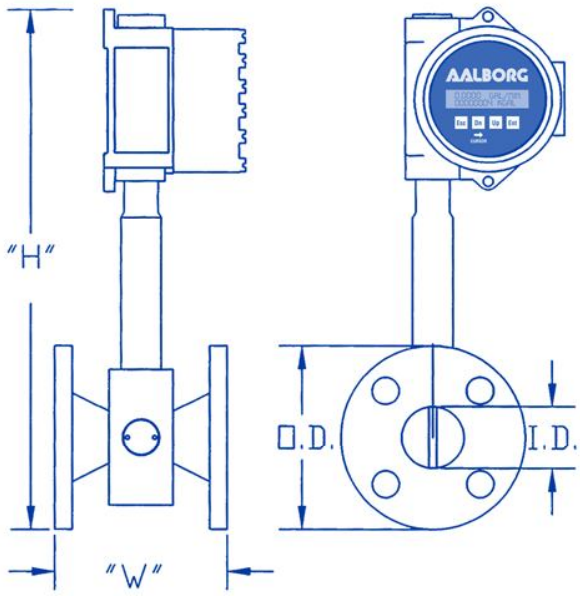


TABLE 62

Meter Size	Flange Rating	Bolt diameter	Bolts	I.D.	O.D.	"W"	"H"
in.	psi	in.	no.	in.	in.	in.	in.
3/4	150 300 600 900	1/2 5/8 5/8 7/8	4 4 4 4	0.742	3.875 4.625 4.625 5.125	FOR DIMENSIONS CONTACT AALBORG CUSTOMER SERVICE DEPARTMENT	9.75 10.125 10.125 10.375
1	150 300 600 900	1/2 5/8 5/8 1	4 4 4 4	0.957	4.25 4.875 4.875 5.875		9.95 10.27 10.27 10.76
1.5	150 300 600 900	1/2 3/4 3/7 1-1/8	4 4 4 4	1.50	5.00 6.125 6.125 7.00		10.35 10.91 10.91 11.35
2	150 300 600 900	5/8 5/8 5/8 1	4 4 4 4	1.937	6.00 6.50 6.50 8.50		10.875 11.125 11.125 12.125
3	150 300 600 900	5/8 3/4 3/4 1	4 8 8 8	2.900	7.50 8.25 8.25 9.50		11.60 11.98 11.98 12.60
4	150 300 600 900	5/8 3/4 7/8 1-1/4	4 8 8 8	3.826	9.00 10.00 10.75 11.50		12.37 12.87 13.25 13.62

Flange Mounting



Wafer Mounting

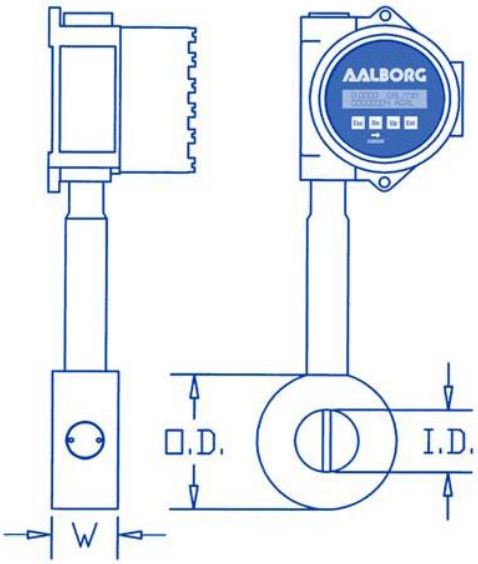


TABLE 63

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

ORDERING INFORMATION VORTEX MULTI-PARAMETER IN-LINE FLOW METERS

MODEL	
VX	

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
G	500 °F / 100 PSIA
H	500 °F / 200 PSIA
J	500 °F / 300 PSIA
K	500 °F / 500 PSIA
L	500 °F / 750 PSIA
M	500 °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

To allow us to confirm selection please return completed application data sheet found on Aalborg's web site at 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 56 to 60 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 62.
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.

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.

www.aalborg.com - e-mail ✉ info@aalborg.com - ☎ **845.770.3000** - fax 845.770.3010 - **Toll Free in U.S.A. and Canada 1.800.866.3837**

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