

Product Datasheet

DAN-LIQ-USM-DS-0306

March 2006

Liquid Ultrasonic Flow Meters

Daniel® Series 3800 Liquid Ultrasonic Flow Meter



DANIEL®

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EMERSON™
Process Management

Daniel® Series 3800

Liquid Ultrasonic Flow Meter

The Daniel Series 3800 Liquid Ultrasonic Flow Meters are designed to accurately measure liquid products in applications where reliable performance is critical. They help reduce lost and unaccounted liquid with exceptional repeatability and linearity throughout the flow range.

The Model 3804 Flow Meter is the first in the Daniel 3800 Series of liquid meters. The Model 3804 is a four-path, in-line ultrasonic meter that measures transit times of ultrasonic pulses passing through the liquid on four parallel planes. Each of the four paths has two integrally mounted ultrasonic transducers. The pair of transducers act alternately as transmitter and receiver, providing accurate measurement of both upstream and downstream transit times. The difference in transit times of the downstream-directed pulses and the upstream-directed pulses is directly proportional to the measured fluid velocity.

Applications

This technology can be applied to custody transfer, allocation measurement, and check metering applications such as:

- Offshore
 - Floating Production Storage and Off-loading (FPSO)
 - Offshore Platforms
 - Barges
- Pipelines
 - Crude Oil pipelines
 - Refined product pipelines
- Terminals
 - Loading and off-loading (ship, barge, truck, railcar, etc.)
 - Tank Farms
 - Cavern Storage



**Daniel Model 3804 Liquid
Ultrasonic Flow Meter**

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SPECIFICATIONS

Please consult the factory if your requirements are outside the specifications noted here. Improved performance and other product and material offerings may be available depending on the application.

Meter Type

- Number of Paths:
 - Four-Path (Eight Transducer) Chordal Design
- Ultrasonic Type:
 - Transit-Time Based Measurement
 - Spool Piece with Integral Mount Transducers

Meter Performance

- Linearity:
 - +/- 0.15% of measured value over a 40 to 4 fps (12.2 to 1.2 m/s) range
 - +/- 0.20% of measured value over a 40 to 2 fps (12.2 to 0.6 m/s) range
- Repeatability:
 - $\pm 0.02\%$ of measured value
- Velocity Range:
 - Nominal 40 to 2 fps (12.2 to 0.6 m/s) with over-range of up to 48 fps (14.6 m/s)

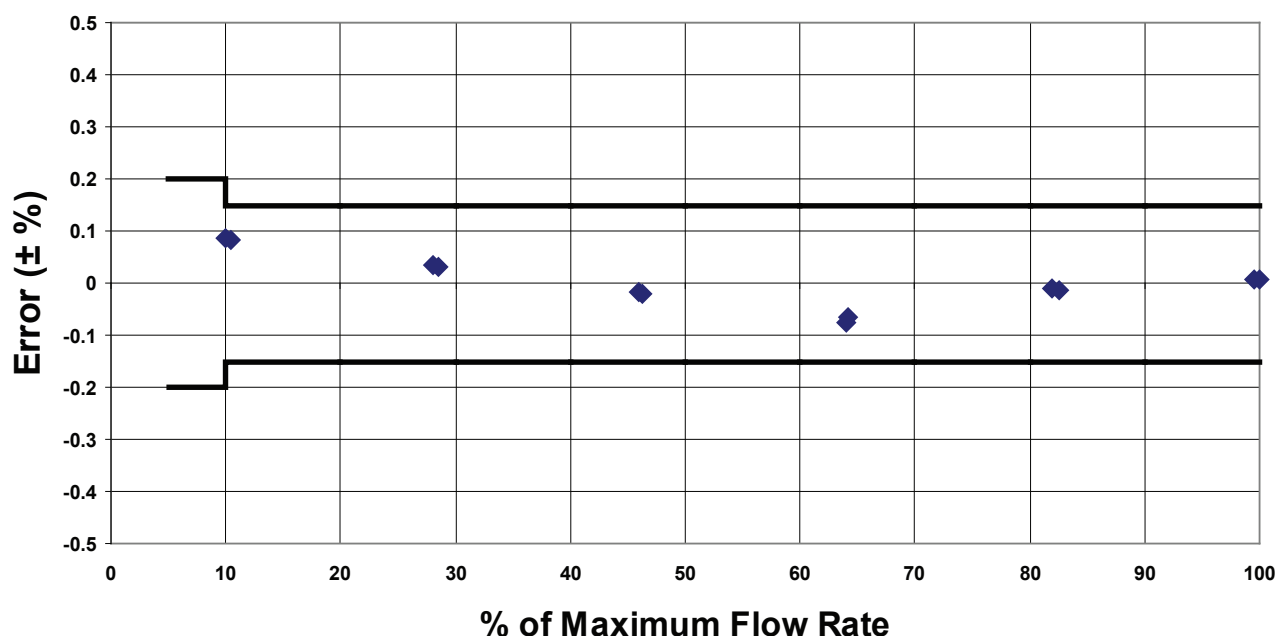
Process Parameters

- Process Product Temperature:
 - -50°F to +260°F (-45°C to +127°C) (Standard)
 - -58°F to +260°F (-50°C to +127°C) (Optional)
- Operating Viscosity Range:
 - 150 centipoise maximum
- Specific Gravity Range:
 - 0.35 to 1.50

Meter Capabilities

- Line Sizes:
 - 4 to 12 inch nominal bore (DN 100 to 300)
- Operating Pressure Range:
 - 0 to 2250 psig (0 to 155 Bar)
- Flanges:
 - Raised Face and Ring Type Joint (RTJ) for ANSI classes 150, 300, 600, 900 (PN 20, 50, 100, 150)
 - Higher ANSI ratings available upon request

Typical Performance Curve



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Materials of Construction

- Body and Flange Material
(sizes 4"- 12":
 - ASTM A352 Gr LCC Carbon Steel (Standard)
 - ASTM A351 Gr CF8M 316 SS (Optional)
 - ASTM A351 Gr CF3M 316L SS (Optional)
 - ASTM A995 Grade 4A Duplex SS (Optional)
- Transducer Housing Material:
 - 316L SS with proprietary matching layer material
- Transducer Cable Material:
 - TPE Jacket, Tinned Copper Braided Armor, Aluminum Foil Shield, 20 Gauge Twisted Pair
- Electronic Housing Material:
 - ASTM B26 grade A356.0 T6 Aluminum (Standard)

Paint Specifications

- Meter Body Paint Specification:
 - Carbon Steel Body Material:
 - 2 Coat Paint – Inorganic Zinc primer and Acrylic Lacquer Top Coat (Standard)
 - 3 Coat Epoxy: – Inorganic Zinc primer, Epoxy Midcoat, and Polyurethane Top Coat (Optional)
 - Stainless Steel or Duplex Body Material:
 - Unpainted
- Electronic Housing: Powder Coat

Table 1A: Model 3804 Body and Flange Pressure Ratings - English Units

Meter Size (in)	ANSI	Material Maximum Pressure Rating - psi			
		Carbon Steel	316 SS	316L SS	Duplex Stainless Steel
4 to 12	150	290	275	275	290
	300	750	720	720	750
	600	1,500	1,440	1,440	1,500
	900	2,250	2,160	2,160	2,250

Note: Pressure rating information is for -20° F to 100° F. Other temperatures may reduce the maximum pressure rating of the materials.

Table 1B: Model 3804 Body and Flange Pressure Ratings - Metric Units

Meter Size (DN)	PN	Material Maximum Pressure Rating - bar			
		Carbon Steel	316 SS	316L SS	Duplex Stainless Steel
100 to 300	20	19.8	19.0	19.0	20.0
	50	51.7	49.6	49.6	51.7
	100	103.4	99.3	99.3	103.4
	150	155.1	148.9	148.9	155.1

Note: Pressure rating information is for -29°C to 38°C. Other temperatures may reduce the maximum pressure rating of the materials.

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Typical Flow Ranges**Table 2A: Model 3804 Flow Range Table - English Units**

Nominal Meter Size (in)	Meter I.D. (in)	Pipe Schedule	Fluid Velocity (ft/s)			Flow rate (BPH)			Flow Rate (GPM)		
			Min	Max	Over- Range	Min	Max	Over- Range	Min	Max	Over- Range
4	4.026	Sch 40	2	40	48	113	2,267	2,721	79	1,587	1,905
6	6.065	Sch 40	2	40	48	257	5,146	6,175	180	3,602	4,322
8	7.981	Sch 40	2	40	48	446	8,910	10,692	312	6,237	7,485
10	10.020	Sch 40	2	40	48	702	14,045	16,853	492	9,831	11,797
12	11.938	Sch 40	2	40	48	997	19,936	23,923	698	13,955	16,746

Table 2B: Model 3804 Flow Range Table - Metric Units

Nominal Meter Size (DN)	Meter I.D. (mm)	Pipe Schedule	Fluid Velocity (m/s)			Flow Rate (m ³ /hr)		
			Min	Max	Over- Range	Min	Max	Over- Range
100	102.3	Sch 40	0.61	12.2	14.6	18	360	433
150	154.1	Sch 40	0.61	12.2	14.6	41	818	982
200	202.7	Sch 40	0.61	12.2	14.6	71	1,417	1,700
250	254.5	Sch 40	0.61	12.2	14.6	112	2,233	2,679
300	303.2	Sch 40	0.61	12.2	14.6	158	3,170	3,803

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Electronics Platform

- Power: 10.4 VDC – 36 VDC, 8 Watts maximum
- Ambient Temperature Range: -40°F to 149°F (-40°C to +65°C)
- Storage Temperature Range: -58°F to 185°F (-50°C to +85°C)
- Operating relative humidity: up to 95% non-condensing
- Six Conduit Ports (3/4" NPT or M20)
- Electronic Housing Options
 - Integral (standard)
 - Remote Mount - (optional)
 - 15ft (4.6 m) transducer cables
 - required above 149°F (65°C)

Hazardous Area Classifications

Note: Area Classifications and Approvals are based on the meter as a system including the meter body, electronics housing, and integral transducers

- UL / cUL Class 1, Division 1, Groups C and D, T4
- CE marked for compliance with the following EU Directives:
 - Directive 94/9/EC (ATEX)
 - Certified II 2 G EEx d ia IIB T4 to standards EN 50014, EN 50018, and EN 50020
 - Ambient Temperature Range: -40°F to 149°F (-40°C to 65°C)
 - Directive 89/336/EEC (EMC)
 - Directive 97/23/CE (PED)

Electronics Functionality

- Meter Body Expansion Correction
 - Fixed or live analog inputs for pressure and temperature
- Configuration Write Protection
 - Wire seal security available
- Archive Logging (Historical Record Retention)
 - Hourly and daily logs
 - Audit log (for configuration changes)
 - Alarm log
- Field-Upgradeable Firmware
 - Via serial or Ethernet port

Transducer Assembly

- Transducer Capsule:
 - Field Replaceable
 - Intrinsically Safe
- Wire Seal Security Available

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Input/Output

- One Ethernet Port (TCP/IP) (Up to 10 Mbps)
- Three Serial Ports

Port	Supports
A	RS-232 and RS-485 full and half duplex
B	RS-232 and RS-485 full and half duplex
C	RS-232 and RS-485 half duplex

- 1.2 to 115 kbps baud rate
- Modbus RTU/ASCII
- Two Isolated Frequency Pair Outputs
 - Individually configurable frequency range as 0-1000 Hz or 0-5000 Hz frequency range (frequency over-range 150% of full scale)
 - Individually configurable as forward, reverse, absolute, or bidirectional flow
 - Individually configurable for Open collector or TTL
- One 4-20 mA Analog Output for Volumetric Flow Rate
- Two 4-20 mA Analog Inputs for Pressure and Temperature
- One Digital Input for Flow Calibration Gating (contact closure)
- Four Digital Outputs
 - Individually configurable for data validity or flow direction
 - Individually configurable for Open Collector or TTL

Operation/Configuration Software

- Daniel CUI (Customer Ultrasonic Interface) Windows® - based software
- Daniel CUI is required for transmitter configuration
- Daniel CUI Standard Edition supplied with meter at no charge
- Daniel CUI Deluxe Edition available
- Daniel CUI requires RS-232, RS-485 full duplex, or Ethernet

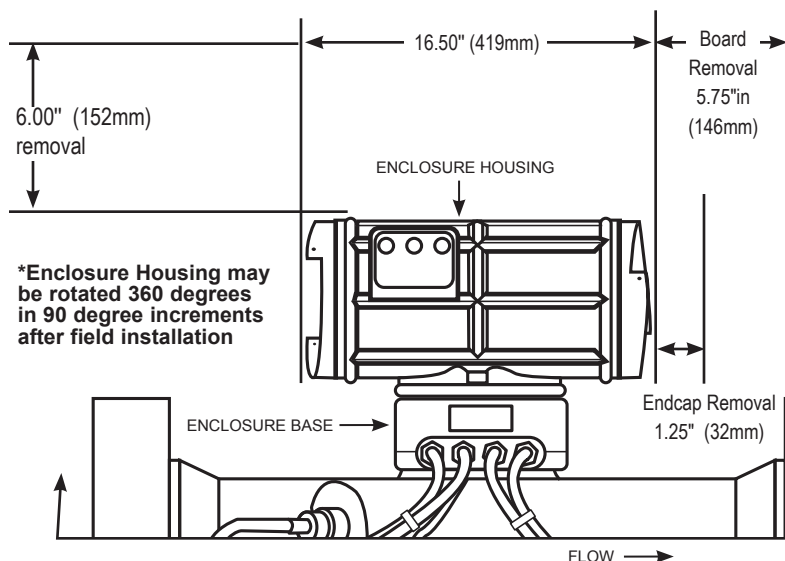


Figure 1: Factory installed position of enclosure housing for meter sizes 8" and greater.*

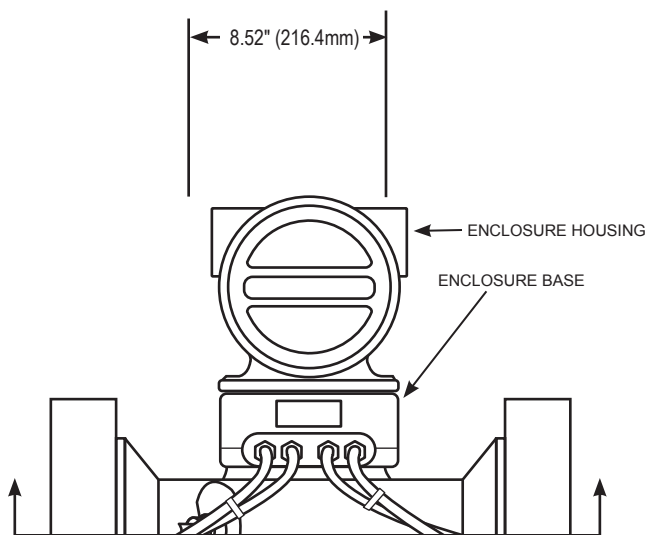


Figure 2: Factory installed position of 4" and 6" enclosure housing.*

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Weights and Dimensions

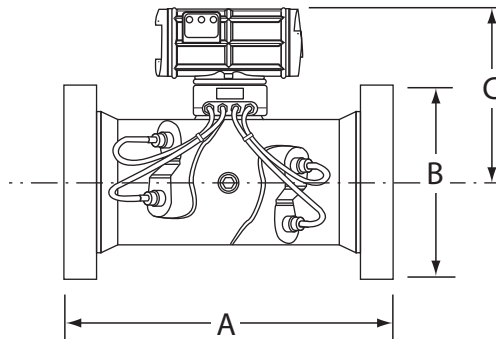


Table 3A: Model 3804 Weight and Dimensional Data - English Units (Inches)

		Nominal Line Size (in)				
		4	6	8	10	12
150 ANSI	A (in)	16.00	18.00	21.50	24.50	26.00
	B (in)	9.00	11.00	13.50	16.00	19.00
	C (in)	15.69	16.94	17.94	19.19	20.13
	Weight (lb)	234	328	451	649	838
300 ANSI	A (in)	16.00	18.00	21.50	24.50	26.00
	B (in)	10.00	12.50	15.00	17.50	20.50
	C (in)	15.69	16.94	17.94	19.19	20.13
	Weight (lb)	254	362	509	733	943
600 ANSI	A (in)	16.00	18.00	21.50	24.50	26.00
	B (in)	10.75	14.00	16.50	20.00	22.00
	C (in)	15.69	16.94	17.94	19.19	20.13
	Weight (lb)	274	419	580	877	1,054
900 ANSI	A (in)	16.50	18.50	27.50	30.50	34.50
	B (in)	11.50	15.00	18.50	21.50	24.00
	C (in)	15.69	16.94	18.44	19.44	20.94
	Weight (lb)	298	474	847	1,039	1,824

Note: This information is not intended for construction. Certified dimensional drawings are available. Please consult Daniel.

Table 3B: Model 3804 Weight and Dimensional Data - Metric Units (Millimeters)

		Nominal Line Size (DN)				
		100	150	200	250	300
PN20	A (mm)	406	457	546	622	660
	B (mm)	229	279	343	406	483
	C (mm)	399	430	456	487	511
	Weight (kg)	106	149	204	294	380
PN50	A (mm)	406	457	546	622	660
	B (mm)	254	318	381	445	521
	C (mm)	399	430	456	487	511
	Weight (kg)	115	164	231	332	428
PN100	A (mm)	406	457	546	622	660
	B (mm)	273	356	419	508	559
	C (mm)	399	430	456	487	511
	Weight (kg)	124	190	263	398	478
PN150	A (mm)	419	470	699	775	876
	B (mm)	292	381	470	546	610
	C (mm)	399	430	468	494	532
	Weight (kg)	135	215	384	471	827

Note: This information is not intended for construction. Certified dimensional drawings are available. Please consult Daniel.

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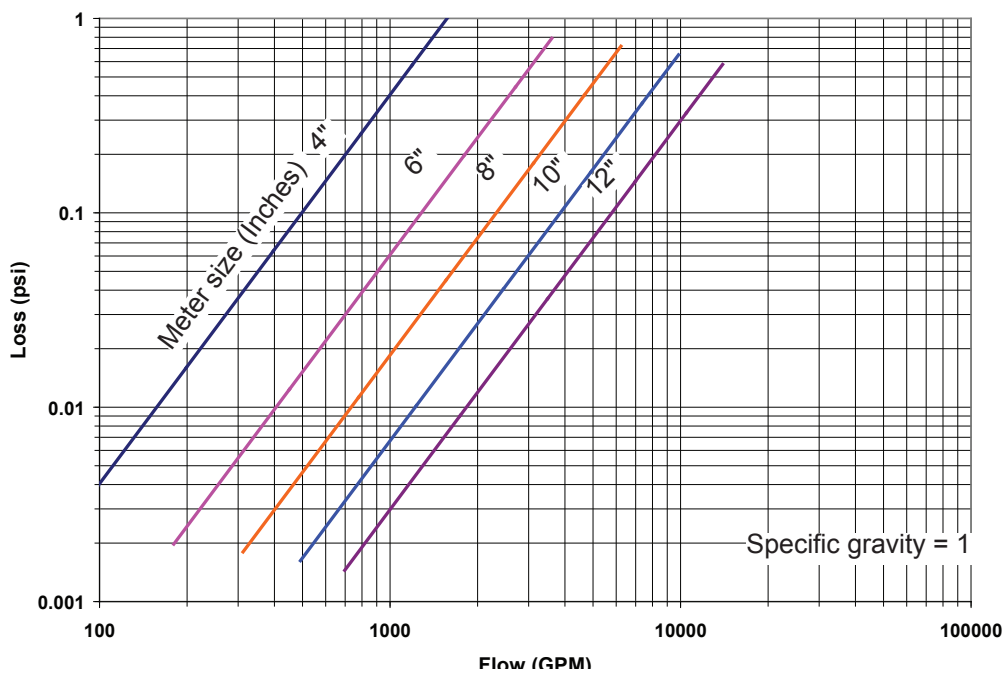
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Pressure Drop

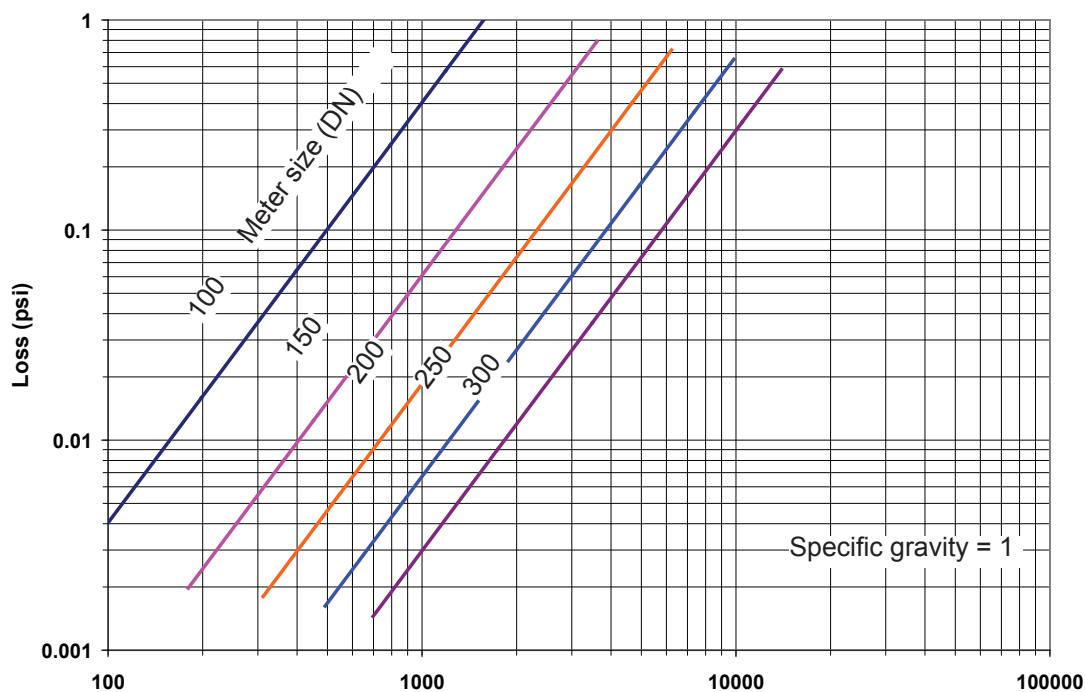
Pressure Drop Chart - English Units

LUSM Pressure Loss SG = 1



Pressure Drop Chart - Metric Units

LUSM Pressure Loss SG = 1



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Recommended Installation

The drawings below represent recommended installations of the Daniel 3804 flowmeter. If shorter lengths are used, there may be an increase in flow measurement uncertainty.

Figure 1: Daniel Piping Recommendation for Ultrasonic Meter with No Flow Conditioner

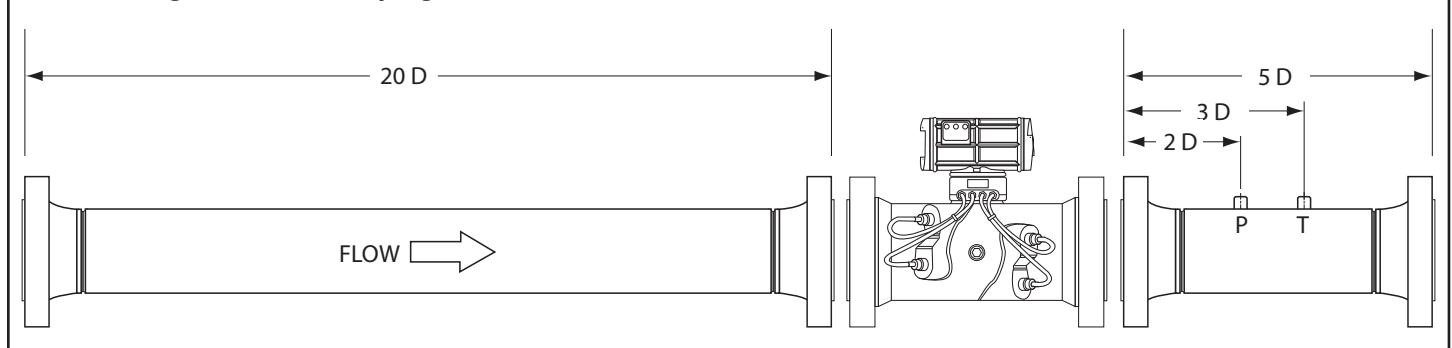


Figure 2: Daniel Piping Recommendation for Ultrasonic Meter with a Flow Conditioner

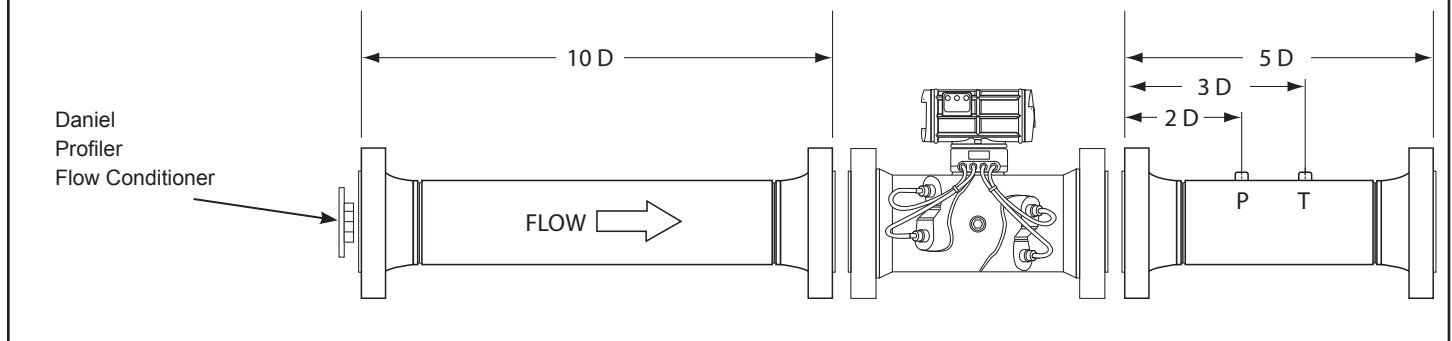
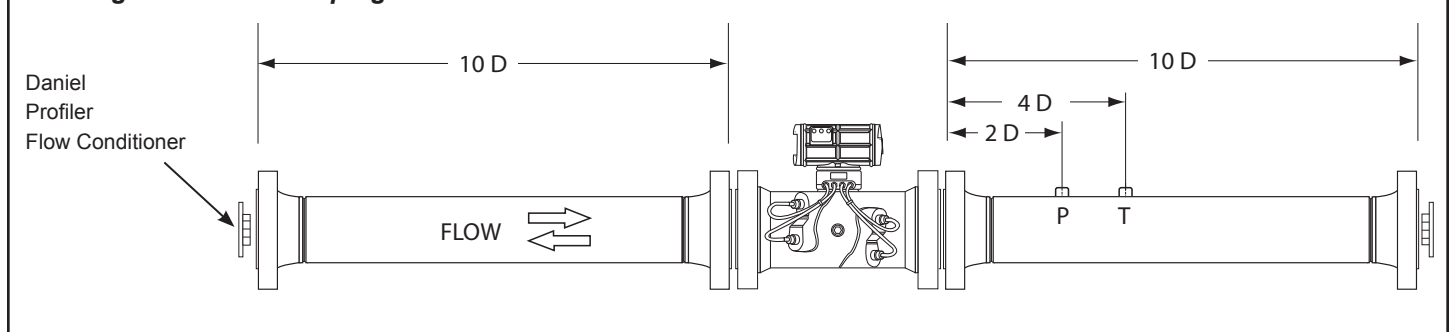


Figure 3: Daniel Piping Recommendation for Bi-Directional Ultrasonic Meter with Flow Conditioners



Notes:

1. All pipe lengths are minimum.
2. D = Nominal pipe size in inches (6" pipe size; $10D = 60$ in)
3. P = Pressure measurement location
4. T = Temperature measurement location

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3804 [X][X] [X][X] [X][X][X] [X][X] [X][X][X]-[X][X][X] [X][X][X] [X][X][X] [X][X][X]

1 10.4 VDC to 36 VDC input supply

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