

FLOWTRAK[™]

FlowTrak Flow Conditioning Plates

For use with BioTrak 645i, 645S, TM100, and TM500 Insertion Thermal Mass Flow Meters



DATA SHEET





FlowTrak Benefits

- Significantly reduces upstream and downstream pipe requirements
- Creates proper gas flow profile from irregularities caused by elbows, valves, expansions, reductions
- Minimal pressure drop
- Maximizes flow measurement accuracy in constrained piping environments
- Easily Installation
 - Easy to center in the pipe by aligning the outer edge of the flow conditioner with the outer edge of the flange
- Rugged 316 SS material
- Precision laser cut-design
- For use with BioTrak 645i, BioTrak 645S, TM100 Insertion, and TM500 Insertion thermal flow meters only
- Available in thirteen sizes for Schedule 40 pipes: 1.5", 2", 2.5", 3", 4", 6", 8", 10", 12", 14", 16", 18", and 20"

Optimizing Flow Profiles for Precision Accuracy

Achieving a uniform flow profile near the center of the pipe is crucial for ensuring flow meter accuracy. Sierra Instruments' FlowTrak™ flow conditioning plates for BioTrak and TM Series Insertion thermal mass flow meters are a cost-effective solution to common problems associated with monitoring flow installations where long, straight runs of piping are not available. The FlowTrak flow conditioning plates effectively eliminate velocity profile distortions, swirl, and temperature stratification in the gas stream.

Sierra's FlowTrak flow conditioners create a uniform velocity profile. Designed to work in schedule 40 pipe with 150# flanges, the FlowTrak is sandwiched between two 150# flanges, along with two gaskets. Easily center the FlowTrak in the pipe easily by aligning the outer edge of the flow conditioner with the outer edge of the flange.

Straight Pipe Run Solutions

In application installations where there isn't enough available space for the required upstream or downstream straight pipe, FlowTrak flow plates are a viable solution alongside an insertion-style flow meter. Insertion thermal mass flow meters are easy to install and require minimal straight pipe runs. In the past, the only option to reducing straight pipe runs for very tight spaces was to order flow meters with a flow body and built-in flow conditioner. To give customers more flexibility, Sierra Instruments has developed the FlowTrak flow conditioner for use with its BioTrak and TM Series insertion-style flow meters. Each flow meter is calibrated with the flow conditioner 2D upstream as shown in Figure 2 to ensure the highest accuracy.

Figure 1A: Fully Developed Laminar Flow

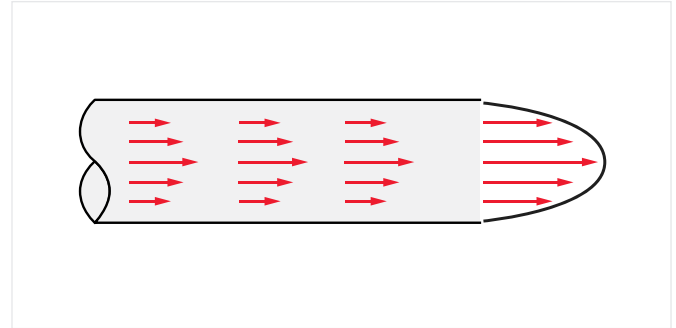


Figure 1B: Fully Developed Turbulent Flow

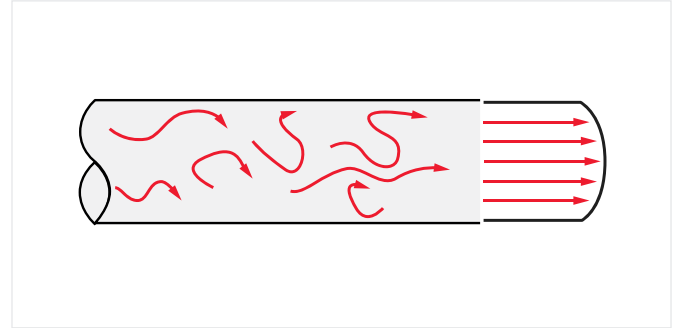
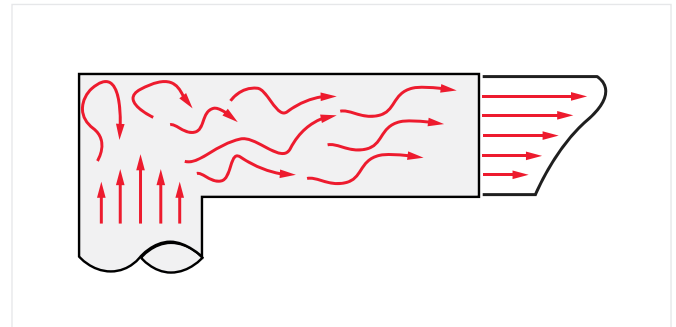


Figure 1C: Irregular/Distorted Flow Profile



Installation

Lateral placement

To determine where to install the FlowTrak flow conditioner, the pipe size is important. FlowTraks require 5 diameters (5D) of upstream straight pipe. Also, the flow meter's sensor should be 5D before any downstream disturbances. The distance between the FlowTrak flow conditioner and the flow meter's sensor is 2D. The relationship between pipe size and pipe diameters is illustrated in Figure 2 with lengths listed in Table 1 below. If more total straight pipe run than the minimum is available, most of it should be used upstream. The pressure drop can be minimized when the flow profile requires less correction.

Physical Specs

Sizing

FlowTraks are available in 13 sizes for Schedule 40 pipes:

1.5", 2", 2.5", 3", 4", 6", 8", 10", 12", 14", 16", 18", and 20".

For smaller pipe sizes, an inline flow meter is recommended.

Figure 2: Straight Pipe Run Requirements

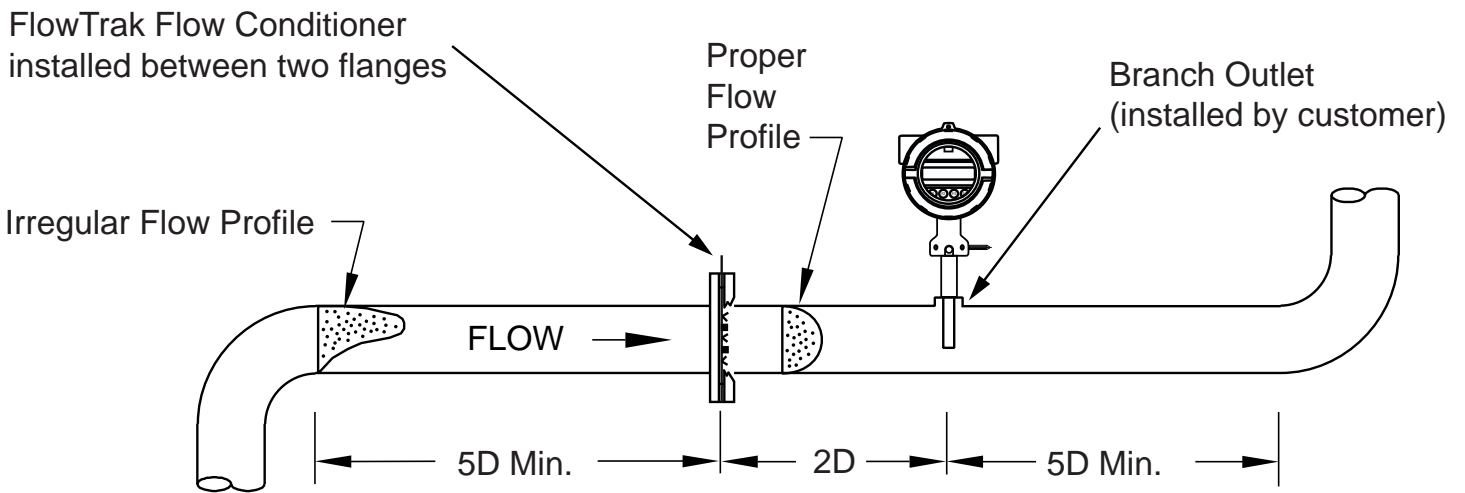


Table 1: Straight Pipe Run Requirements 1.5" - 8"

Schedule 40 Pipe Size Inch	2D Inch (mm)	5D Min. Up/Downstream Inch (mm)
1.5	3.22 (82)	8 (203)
2	4.14 (105)	10 (254)
2.5	4.94 (125)	12 (305)
3	6.14 (156)	15 (381)
4	8.06 (205)	20 (508)
6	12.13 (308)	30 (762)
8	15.96 (405)	40 (1016)

Table 1.1: Straight Pipe Run Requirements 10" - 20"

Schedule 40 Pipe Size Inch	2D Inch (mm)	5D Min. Up/Downstream Inch (mm)
10	20.04 (509)	50 (1270)
12	23.88 (607)	60 (1524)
14	26.24 (666)	66 (1676)
16	30.00 (762)	75 (1905)
18	33.75 (857)	84 (2133)
20	37.62 (956)	94 (2389)

Performance Specs

Table 2: Air Pressure Drop Data - Sizes 1.5" to 6" (1.61 to 6.065 Pipe ID)

Flow Rate		FlowTrak Sizes and Pipe Inner Diameters (Schedule 40 Pipes) in Inches (1.5"-6")											
		1.5" (1.61 ID)		2" (2.067 ID)		2.5" (2.469 ID)		3" (3.068 ID)		4" (4.026 ID)		6" (6.065 ID)	
m ³ /Hr	Ft ³ /Min	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O
5	3	0.65	0.26										
10	6	0.68	0.27	0.65	0.26								
15	9	0.74	0.30	0.67	0.27	0.65	0.26						
20	12	0.83	0.33	0.71	0.28	0.27	0.27	0.65	0.26				
30	18	1.07	0.43	0.79	0.32	0.71	0.29	0.67	0.27	0.65	0.26		
40	24	1.40	0.56	0.92	0.37	0.77	0.31	0.69	0.28	0.65	0.26		
50	29	1.84	0.74	1.08	0.43	0.85	0.34	0.73	0.29	0.67	0.27		
60	35	2.37	0.95	1.27	0.51	0.95	0.38	0.77	0.31	0.68	0.27		
70	41	2.99	1.20	1.50	0.60	1.06	0.43	0.81	0.33	0.69	0.28	0.65	0.26
80	47	3.71	1.49	1.77	0.71	1.19	0.48	0.87	0.35	0.71	0.29	0.65	0.26
90	53	4.53	1.82	2.07	0.83	1.34	0.54	0.93	0.37	0.73	0.29	0.65	0.26
100	59	5.45	2.19	2.41	0.97	1.50	0.60	1.00	0.40	0.76	0.30	0.66	0.26
150	88	11.46	4.60	4.62	1.85	2.56	1.04	1.46	0.58	0.91	0.37	0.69	0.28
200	118	19.88	7.98	7.72	3.10	4.11	1.65	2.09	0.84	1.13	0.45	0.73	0.29
300	177	43.94	17.64	16.57	6.65	8.46	3.40	3.92	1.57	1.74	0.70	0.85	0.34
400	235	77.62	31.16	28.97	11.63	14.55	5.84	6.47	2.60	2.60	1.05	1.02	0.41
500	294			44.91	18.03	22.38	8.99	9.76	3.92	3.71	1.49	1.23	0.49
600	353			64.39	25.85	31.95	12.83	13.77	5.53	5.06	2.03	1.49	0.60
700	412			87.41	35.09	43.26	17.37	18.51	7.43	6.66	2.68	1.80	0.72
800	471					56.31	22.61	23.99	9.63	8.51	3.42	2.16	0.87
900	530					71.10	28.54	30.19	12.12	10.60	4.26	2.57	1.03
1000	589					87.63	35.18	37.12	14.90	12.94	5.19	3.02	1.21
1500	883							33.73	33.21	28.32	11.37	6.01	2.41
2000	1177									49.85	20.01	10.19	4.09
3000	1766											22.14	8.89
4000	2354											38.86	15.60
5000	2943											60.36	24.23

Performance

Equation

$$dP = 0.01786 * KE + 0.6343$$

Error for 95% Confidence Interval: +/-25%

The pressure drop can be minimized when the flow profile requires less correction.

Term Definitions

dP = Pressure Differential [mBar]

D = Actual Density [kg/m³]

V = Actual Average Velocity [m/s]

KE = Kinetic Energy = 0.5*D*V²

Installation

FlowTrak Orientation

Every FlowTrak has "UPSTREAM" etched into a tab extending out from the flow conditioner. This marker should be positioned parallel to the probe with the "UPSTREAM" etching facing toward the upstream portion of the pipe.

The FlowTrak is installed between 150lb flanges. Gaskets (supplied by customer) should be placed on both sides of the flow conditioner to ensure a seal.

See Figure 3 on the next page for proper installation orientation.

Please refer to the FlowTrak Quick Install Guide for BioTrak, TM100, and TM500 Series for further installation instructions.

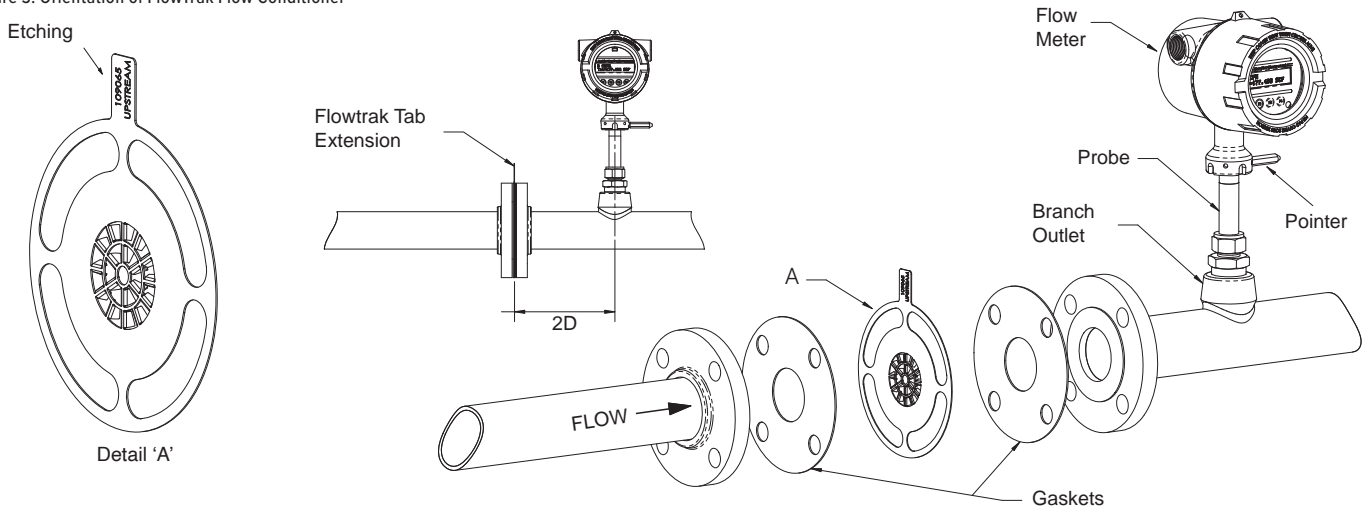
Performance Specs

Table 2.1: Air Pressure Drop Data - Sizes 8" to 20" (7.981" to 18.81" Pipe ID) continued

Flow Rate		FlowTrak Sizes and Pipe Inner Diameters (Schedule 40 Pipes) in Inches (8"-20")													
		8" (7.981 ID)		10" (10.02 ID)		12" (11.94 ID)		14" (13.12 ID)		16" (15.00 ID)		18" (16.87 ID)		20" (16.87 ID)	
m ³ /Hr	Ft ³ /Min	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O	mBar	inH2O
150	88	0.65	0.26												
200	118	0.67	0.27	0.65	0.26										
300	177	0.71	0.28	0.66	0.27	0.65	0.26								
400	235	0.76	0.31	0.69	0.28	0.66	0.26	0.65	0.26						
500	294	0.83	0.33	0.71	0.29	0.67	0.27	0.66	0.27	0.65	0.26				
600	353	0.92	0.37	0.75	0.30	0.69	0.28	0.67	0.27	0.66	0.26	0.65	0.26		
700	412	1.02	0.41	0.79	0.30	0.71	0.29	0.69	0.28	0.67	0.27	0.65	0.26	0.65	0.26
800	471	1.14	0.46	0.84	0.34	0.73	0.29	0.70	0.28	0.68	0.27	0.66	0.26	0.65	0.26
900	530	1.28	0.51	0.89	0.36	0.76	0.31	0.72	0.29	0.69	0.28	0.67	0.27	0.66	0.26
1000	589	1.43	0.57	0.95	0.38	0.79	0.32	0.74	0.30	0.70	0.28	0.67	0.27	0.66	0.27
1500	833	2.43	0.97	1.36	0.54	0.99	0.40	0.88	0.35	0.78	0.31	0.72	0.29	0.69	0.28
2000	1177	3.82	1.53	1.92	0.77	1.26	0.50	1.07	0.42	0.89	0.36	0.79	0.32	0.74	0.30
3000	1766	7.81	3.13	3.52	1.41	2.04	0.82	1.61	0.63	1.21	0.49	0.99	0.40	0.87	0.35
4000	2354	13.38	5.37	5.77	2.31	3.13	1.26	2.38	0.93	1.66	0.66	1.27	0.51	1.05	0.42
5000	2943	20.55	8.25	8.65	3.47	4.53	1.82	3.36	1.31	2.23	0.90	1.63	0.65	1.28	0.51
6000	3531	29.31	11.77	12.18	4.89	6.25	2.51	4.45	1.77	2.93	1.18	2.07	0.83	1.56	0.63
7000	4120	39.68	15.93	16.35	6.56	8.27	3.32	5.97	2.32	3.76	1.51	2.59	1.04	1.90	0.76
8000	4709	51.63	20.73	21.16	8.49	10.61	4.26	7.60	2.93	4.72	1.90	3.19	1.28	2.29	0.92
9000	5207	65.17	26.16	26.61	10.68	13.26	5.32	9.46	3.67	5.81	2.33	3.86	1.55	2.73	1.09
10000	5886	80.31	32.24	32.70	13.13	16.22	6.51	11.52	4.47	7.02	2.82	4.62	1.85	3.22	1.29
15000	8829			72.79	29.22	35.71	14.34	25.14	9.73	15.00	6.02	9.60	3.85	6.44	2.59
20000	11772					62.99	25.29	44.20	17.10	26.18	10.51	16.58	6.65	10.96	4.40
30000	17657							98.65	39.60	58.10	23.33	36.50	14.66	23.87	9.58
40000	23543									102.80	41.27	64.40	25.86	41.93	16.84
50000	29429											100.27	40.26	65.17	26.16
60000	35315													93.56	37.56

Installation

Figure 3: Orientation of FlowTrak Flow Conditioner





Measurably Different™

Sierra Instruments

North America

20 Ryan Ranch Rd, Suite 109
Monterey, California 93940
+1.831.373.0200 • sierrainstruments.com

EMEA

Bijlmansweid 2
1934RE Egmond aan den Hoef • The Netherlands
+31 72 5071400

Asia

Second Floor Building 5 • Senpu Industrial Park • 25 Hangdu
Road Hangtoun Town • Pu Dong New District • Shanghai, P.R.
China 201316 • +8621 5879 8521/22