TRI-FLO TECH, INC.
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Los Angeles, CA 90023
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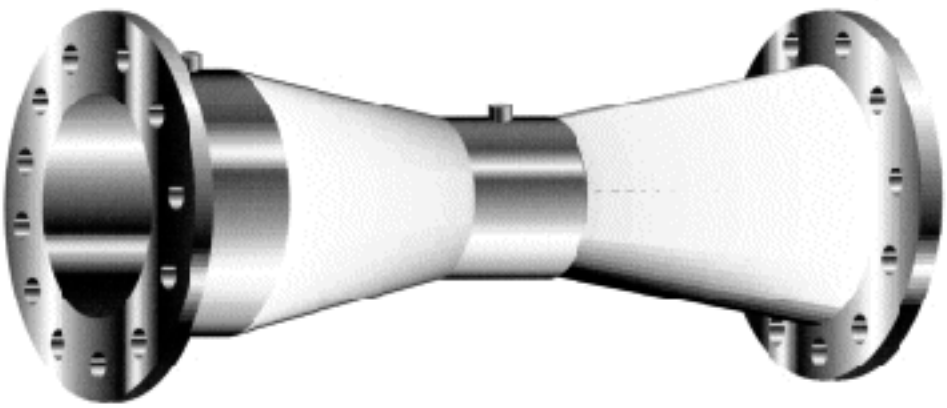
www.triflotech.com
sales@triflotech.com

ASME Type

VENTURI TUBES



**DESIGNED TO BE ECONOMICAL:
LIGHT WEIGHT: VERSATILE: NON-CORROSIVE:
AND ACCURATE TO MEET THE CUSTOMER'S
FLOW REQUIREMENTS**

*CUSTOM CRAFTED
FLOW ELEMENTS*

ASME TYPE VENTURI

A Complete line of differential pressure ASME Herschel type venturis are manufactured by Tri-Flo. This type of flow elements have been universally accepted as the most efficient primary devices available. No other type of venturi or flow tube design has been more thoroughly researched, tested and proven than the ASME type.

Tri-Flo Venturis have been in operation in petrochemical, refining, gas pipeline, water, sewage and power plants. They are used whenever low pressure loss, high accuracy, short straight piping or fluid containing solids are encountered.

OPTIMIZED DESIGN

Each Tri-Flo Venturi is designed and manufactured for a specific beta ratio or throat diameter necessary to produce the desired differential pressure consistent with minimum pressure loss, piping requirements, and best accuracy of measurement, also a new approach is used to attach up and down stream cones to the throat to manage the best possible velocity profile in the throat.

HIGHEST ACCURACY

The completeness of published research data permits Tri-Flo to provide the venturis with 3/4% accuracy without the need of laboratory flow calibration. This high accuracy is sustained indefinitely since there are no sharp edge protrusions to wear. Laboratory calibration to obtain 1/4% accuracy is also available.

LOW PERMANENT PRESSURE LOSS

Figure 1 shows the permanent pressure loss as percent of differential pressure for orifice plates, flow nozzles and venturis. Due to the low pressure loss, a venturi saves the user many dollars and frequently pays for itself in one year of continuous operation by greatly reducing pumping cost. If lower pressure loss is required please consider the flow tube or our TA2% low loss design.

PRESSURE LOSS CURVES

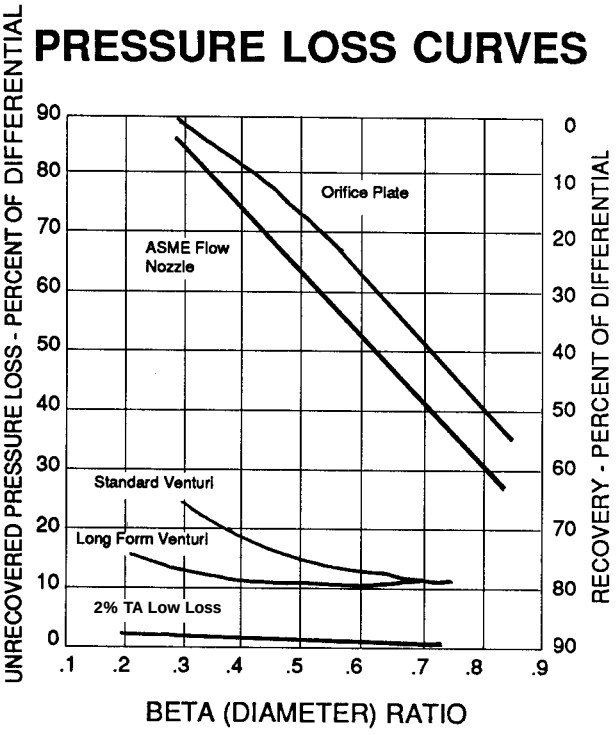


Figure 1.

LIGHT WEIGHT

The fabricated venturi is more durable than cast venturi yet weighs considerably less, which results in a lower shipping cost and easier installation.

MATERIALS OF CONSTRUCTION

Tri-Flo Venturis are built of carbon steel, chrome-moly steel, stainless steel, monel, nickel, bronze, hastelloy, fiberglass, PVC and other materials to suit specific applications.

PIEZOMETER RING OR AVERAGE ANNULUS

ASME Fluid Meters has recommended the required straight pipe lengths preceding the venturi tubes to insure accurate flow measurement. If it is impossible to meet the recommended lengths, with or without the use of straightening vanes, Tri-Flo Venturis utilizing a piezometer ring or averaging annulus can be provided to reduce the measurement error.

CUSTOM CRAFTED FLOW ELEMENTS

ORDERING INFORMATION

For all fluids specify:
Model number _____
Type of end fittings and rating _____

Materials of construction:
Throat _____
Body _____
Flanges
Pipe I.D. _____
Line size _____ & Pipe Schedule _____
Fluid _____
Units of flow _____
Max flow _____ Normal flow _____
Specific gravity:
Operating _____ Base _____
Temperature:
Operating _____ Base _____
Pressure: Operating _____
if liquid specify:
Viscosity @ Operating Temperature _____

If gas specify:
Molecular weight _____
Base pressure _____
Gas composition _____
Specific heat ratio _____
Compressibility ratio (Z_f) _____

Standard (Short) Form:
15% included angle outlet cone.

Long Form:
7% included angle outlet cone.

Any included angle between 7° and 15°.

CLEANOUT RODS

For fluid containing solids, such as sewage or slurry, Tri-Flo Venturis can be equipped with cleanout rods on the pressure taps as shown in Figure 2 for periodic cleaning when required.

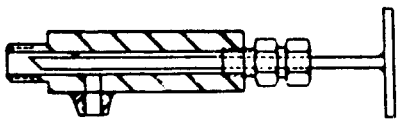
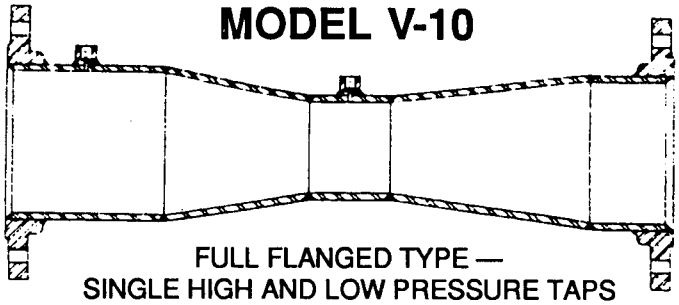


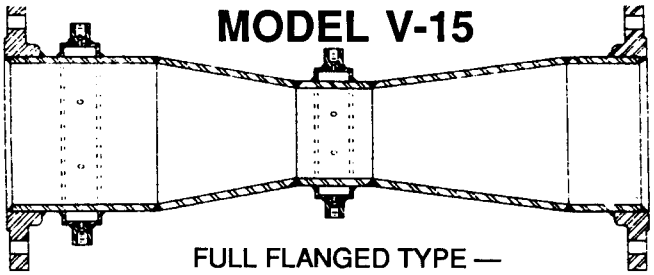
Figure 2.

MODEL V-10



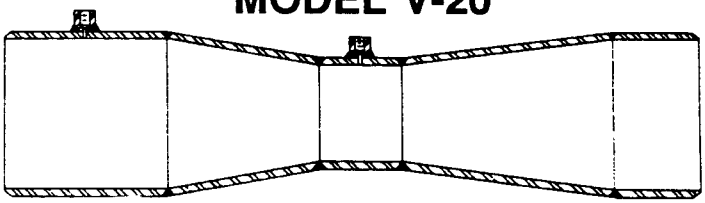
FULL FLANGED TYPE —
SINGLE HIGH AND LOW PRESSURE TAPS

MODEL V-15



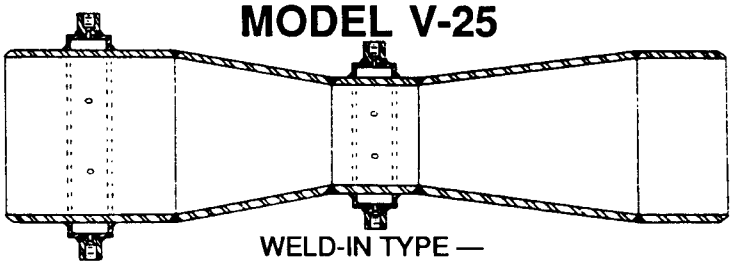
FULL FLANGED TYPE —
MULTIPLE HIGH AND LOW PRESSURE TAPS WITH PRESSURE AVERAGING PIEZOMETER RING

MODEL V-20



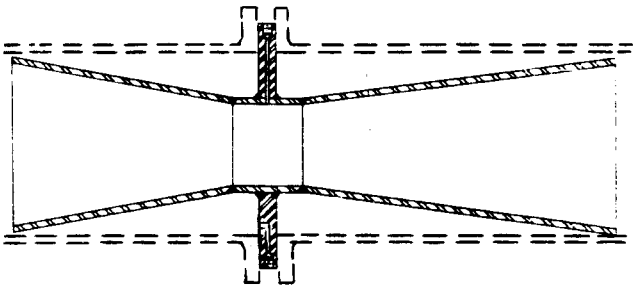
WELD-IN TYPE —
SINGLE HIGH AND LOW PRESSURE TAPS

MODEL V-25



WELD-IN TYPE —
MULTIPLE HIGH AND LOW PRESSURE TAPS WITH PRESSURE AVERAGING PIEZOMETER RING

MODEL VI-30



INSERT TYPE (TO FIT BETWEEN FLANGES) —
SINGLE HIGH AND LOW PRESSURE TAPS

CUSTOM CRAFTED FLOW ELEMENTS

UTAH STATE UNIVERSITY
UTAH WATER RESEARCH LABORATORY
LOGAN, UTAH 84322-8200

Tests by W. Rahmeyer
February 7, 1991

36" VENTURI FLOWMETER

Job No: V-3107

Meter Size:	36-inch
Test Fluid:	Water 45 deg F
Pipe I.D. (in)	36.0000
Throat I.D. (in)	15.8880
Beta	0.4413
Flow range	8314 gpm to 19635 gpm

beta = throat I.D./pipe I.D. Qgpm = Qcfs x 448.831
Qcfs = Ao C SQRT (2g dH ft.)/SQRT (1-beta^4)
Qgpm = Cd SQRT (dHin./S.G. of fluid)
Cd = 1039.765 Ao C / SQRT(1-beta^4)

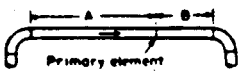
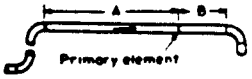
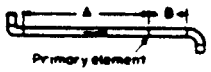
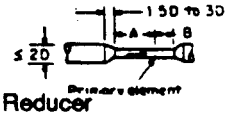
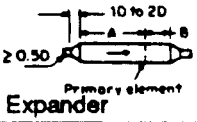
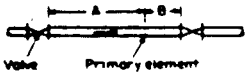
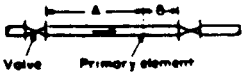
CALIBRATION DATA

RUN	SONIC Hz	FLOW gpm	Re pipe	R1=R2	dH in. H2o	Cd	C
1	833.33	8,314	5.2E+05	7.45M	36.92	1368.27	0.9375
2	1043.55	10,422	6.6E+05	11.95M	59.22	1354.24	0.9279
3	1167.13	11,661	7.4E+05	14.80M	73.35	1361.55	0.9329
4	1385.11	13,846	8.7E+05	21.10M	104.57	1354.04	0.9278
5	1529.50	15,294	9.6E+05	25.40M	125.88	1363.15	0.9340
6	1643.55	16,438	1.0E+06	29.70M	147.19	1354.87	0.9283
7	1962.44	19,635	1.2E+06	42.30M	209.64	13356.11	0.9292

MEAN Cd	=	1358.89	Plus Scatter	=	0.69 %
MEAN C	=	0.9311	Minus Scatter	=	-0.36%
			% STND DEV	=	0.38%

Meter calibrated against a secondary flowmeter
Flow Coefficient C is from ASME
"Fluid Meters" 6th Ed., sect. 1-5-12

CUSTOM CRAFTED FLOW ELEMENTS

Upstream disturbance	Dimension	Device	β 0.2	0.3	0.4	0.5	0.6	0.7	0.75
	A	Orifices Nozzles	14	16	18	20	26	28	36
Single elbow		Venturis		0.5	0.5	1.5	3	4	4.5
	A	Orifices Nozzles	14	16	18	20	26	36	42
Two elbows in same plane		Venturis		1.5	1.5	2.5	3.5	4.5	4.5
	A	Orifices Nozzles	34	34	36	40	48	62	70
Two elbows in different planes		Venturis		0.5	0.5	8.5	17.5	27.5	29.5
	A	Orifices Nozzles	5	5	5	6	9	14	22
Reducer		Venturis		0.5	2.5	5.5	8.5	10.5	11.5
	A	Orifices Nozzles	16	16	16	18	22	30	38
Expander		Venturis		1.5	1.5	2.5	3.5	5.5	6.5
	A	Orifices Nozzles	18	18	20	22	26	32	36
Globe valve, fully open		Venturis							
	A	Orifices Nozzles	12	12	12	12	14	20	24
Gate valve, fully open		Venturis		1.5	2.5	3.5	4.5	5.5	5.5
Downstream length for all pictured disturbances	B	Orifices Nozzles	4	5	6	6	7	7	8
		Venturis		4d	4d	4d	4d	4d	4d

NOTES:
1. For upstream and downstream lengths equal to one-half the values shown, /add = -.5 percent to the accuracy valves.
2. Any flow conditioner shall be installed in the straight lengths between the primary element and the upstream distubrance, or the fitting closest to the element. The straight length between fitting and conditioner shall be at least 20D, and the length betwen conditioner and element shall be at least 22D.
3. Interpolate pipe diameters for intermediate beta ratios.

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ENGINEERING SPECIFICATION:
MODEL V-10
MODEL V-15

LOW HEAD LOSS FABRICATED FLANGED VENTURI V-10 AND V-15

A differential producing primary flow element(s) shall be installed in the flanged schedule_____, _____ type, _____inch piping as shown on the plans and specifications and in accordance with the manufacturer's recommendations. The flow element shall be of the concentric type, short form, low head loss as manufactured by Tri-Flo Inc. Kennedale, Texas.

The flow element shall be constructed of an entrance section, throat and holding flange section with a recovery cone. The entrance section shall be fabricated from (CS) - (304SS) (316SS) with a continuous radius into the throat section provided by Tri-Flo Inc. to maintain upstream shear forces within boundary layer for maximum efficiency. The high pressure tap shall be located within this section. There shall not be any protrusion or exposed edges to allow solids to accumulate.

The throat section shall be fabricated from (304SS) (316SS) and shall have (One set) (Two sets) low pressure tap. Throat section **shall not** be mechanically attached or inserted into the body of the Venturi tube. The high and low pressure metering taps shall be made a part of the holding flange and shall not require any drilling or tapping of the external pipeline.

The flanges shall be so designed as to allow mounting between standard_____lb. flanges and be of (CS) - (304SS) (316SS) material.

The recovery cone section shall be fabricated from (CS) - (304SS) (316SS) designed to minimize permanent pressure loss. The primary element shall have the capability of being designed with any beta ratio in the range of 0.35 to 0.85 and maintain a permanent pressure loss to 7% or less of the maximum differential pressure. The flow element shall be designed to monitor_____with_____lbs. of pressure over a flow range of _____ to_____. The accuracy of the uncalibrated primary element shall be within 0.5% of actual flow or 0.25% for a calibrated device over the flow range specified.

MODEL SV - 10

MODEL V-10 and V-15 can be provided in **ALL STAINLESS STEEL (304) (316)** Wetted Parts.

The flanges shall be so designed as to allow mounting between standard _____lb. flanges and be of (CS) - (304SS) (316SS) material.

In case of Carbon steel end flanges, there shall be no contact between the end flanges and the media (ALL Stainless Steel wetted parts).

Flanges to be (Primed) (Epoxy coated per AWWA C207).

CUSTOM CRAFTED FLOW ELEMENTS

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ENGINEERING SPECIFICATION:

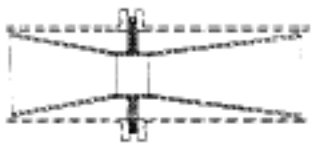
MODEL VI-30

LOW HEAD LOSS FABRICATED FLANGED VENTURI VI-30

A differential producing primary flow element(s) shall be installed in the schedule_____, _____ type, _____inch piping as shown on the plans and specifications and in accordance with the manufacturer's recommendations. The flow element shall be of the concentric type, short form, low head loss as manufactured by Tri-Flo Inc. Kennedale, Texas.

The flow element shall be constructed of an entrance section, throat and holding flange section with a recovery cone. The entrance section shall be fabricated from (CS) - (304SS) (316SS) with a continuous radius into the throat section provided by Tri-Flo Inc. to maintain upstream shear forces within boundary layer for maximum efficiency. The high pressure tap shall be located within this section. There shall not be any protrusion or exposed edges to allow solids to accumulate.

The throat section shall be fabricated from (304SS) (316SS) and shall have (One set) (Two sets) low pressure tap. Throat section **shall not** be mechanically attached or inserted into the body of the Venturi tube. The high and low pressure metering taps shall be made a part of the holding flange and shall not require any drilling or tapping of the external pipeline.



The holding flange section shall be so designed as to allow mounting between standard_____lb. flanges and be of (CS) - (304SS) (316SS) material.

The recovery cone section shall be fabricated from (CS) - (304SS) (316SS) designed to minimize permanent pressure loss. The primary element shall have the capability of being designed with any beta ratio in the range of 0.35 to 0.85 and maintain a permanent pressure loss to 7% or less of the maximum differential pressure. The flow element shall be designed to monitor_____with_____lbs. of pressure over a flow range of _____ to_____. The accuracy of the uncalibrated primary element shall be within 0.5% of actual flow or 0.25% for a calibrated device over the flow range specified.

CUSTOM CRAFTED FLOW ELEMENTS

DIMENSIONS & CAPACITY TABLES
FOR ASME TYPE SHORT FORM VENTURIS

Note 1 Any beta ratio, pipe diameter or differential may be specified as required.
Any flange rating or type of end termination, may be specified as required.
Venturis are available in line size larger and small than those listed below.

Note 2 Upstream straight pipe requirements for ASME type Venturis are less than those of Proprietary Flow Tubes providing a shorter overall "laying length".

Note 3 Weld-in and Insert Venturis weigh approximately 30% less than Model V-10 with 150 lb. flanges as listed.
To obtain capacity for a design differential other than 100", multiply capacity at 100" by $\sqrt{\frac{\text{differential desired}}{100}}$

NOM. LINE SIZE	BETA RATIO Note 1	THROAT DIA. d Note 1	STD. PIPE DIA. D Note 1	LENGTH Note 2		APPROX. WT. BL Note 3	FLOW RATES IN GPM OF WATER @ 60· F. P IN INCHES OF W.C.			
				FLANGE TYPE	INSERT TYPE		20"	50"	100"	200"
2	0.50	1.034	2.067	11	8	40	27.4	43.3	61.3	86.7
	0.60	1.240		10	7		40.9	64.8	91.6	103
	0.75	1.550		8	5		72	113	160	226
3	0.50	1.534	3.068	15	11	65	60	95	135	190
	0.60	1.841		14	10		90	143	202	286
	0.75	2.301		11	7		160	250	355	500
4	0.50	2.013	4.026	20	16	90	105	165	232	330
	0.60	2.416		18	13		156	245	347	491
	0.75	3.020		14	10		274	433	612	865
6	0.50	3.033	6.065	28	23	130	235	370	525	740
	0.60	3.639		25	20		351	553	785	1110
	0.75	4.549		20	15		620	985	1390	1970
8	0.50	3.991	7.981	38	31	175	410	645	915	1290
	0.60	4.789		33	26		613	964	1370	1930
	0.75	5.986		26	19		1075	1700	2405	3400
10	0.50	5.010	10.020	46	38	250	645	1020	1440	2040
	0.60	6.012		41	32		964	1525	2155	3050
	0.75	7.515		32	24		1695	2680	3790	5360
12	0.50	6.000	12.000	54	45	330	925	1460	2065	2920
	0.60	7.200		47	38		1385	2185	3085	4365
	0.75	9.000		38	29		2435	3845	5440	7690
14	0.50	6.625	13.250	59	49	460	1125	1780	2520	3560
	0.60	7.950		52	42		1680	2260	3766	5320
	0.75	9.938		42	32		2965	4690	6630	9380
16	0.50	7.625	15.250	68	57	600	1490	2360	3335	4720
	0.60	9.150		60	49		2230	3530	4984	7055
	0.75	11.440		48	36		3930	6215	8790	12430
18	0.50	8.625	17.250	77	64	700	1910	3020	4270	6040
	0.60	10.350		68	55		2855	4515	6380	9030
	0.75	12.940		54	41		5025	7950	11240	15900
20	0.50	9.625	19.250	86	72	860	2375	3755	5310	7510
	0.60	11.550		76	62		3550	5615	7940	11220
	0.75	14.440		60	46		6260	9900	14000	19800
24	0.50	11.625	23.250	102	86	1100	3465	5480	7750	10960
	0.60	13.950		90	74		5180	8190	11580	16380
	0.75	17.550		71	55		9125	14470	20420	28940

Table 0.1: ISO Standard 5167 Required Straight Lengths for orifice, Nozzle, ISA Venturi Nozzle, and Venturi in Multiples of Pipe Diameter *D*

CUSTOM CRAFTED FLOW ELEMENTS