Panametrics

Datasheet

PanaFlow HT

Panametrics ultrasonic SIL flow meter for liquids

PanaFlow HT is a SIL-rated flow meter used for flow measurement of liquids in either nominal or extremely high or low process temperatures. It is the first ultrasonic flow meter to receive SIL (Safety Integrity Level) certification. As a safety flow meter, or coker flow meter, the PanaFlow HT SIL flow meter is designed for use in safety-critical applications where reliability ensures reduction in risk to personnel, to plant assets, to the environment and to corporate reputation.

PANA027DS Rev. 9

PanaFlow gives you confidence in your flow measurement

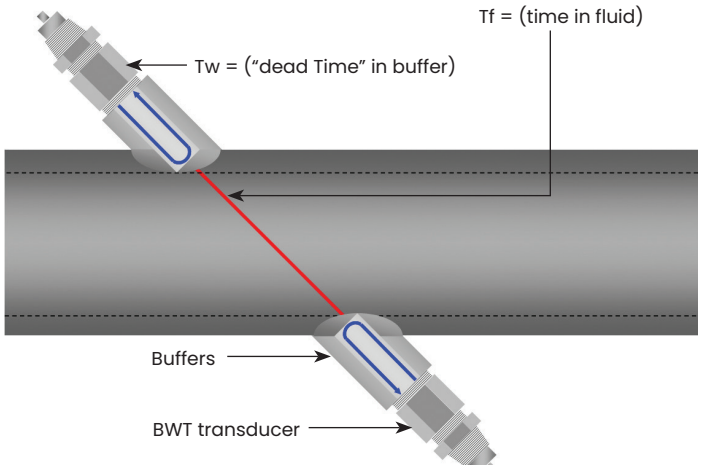
PanaFlow HT is a wetted ultrasonic flow meter that is SIL certified (IEC61508) by design to give you confidence in your flow measurement and to provide reliable flow meter operation for both safety and process control systems. It is the first SIL-rated ultrasonic flow meter on the market.
In addition to the peace of mind that SIL certification brings, PanaFlow HT also has all the advantages of ultrasonic flow measurement over other traditional technologies—no measurement drifting, no periodic calibration requirement, no restriction in the pipe, minimal pressure drop, no maintenance, and no moving parts.

Fast and easy installation

Wetted systems typically provide higher accuracy than clamp-on systems, but installation can be complicated and difficult. If these systems are not installed with precision and close attention to detail, reliability and accuracy may not meet the product specifications. With the PanaFlow HT system, we do the assembly work at the factory. The necessary components are already installed, so all you need to do is bolt the end flanges into place.

Transit-time flow measurement

In this measurement method, two transducers serve as both ultrasonic signal generators and receivers. They are in acoustic communication with each other, meaning that the second transducer can receive ultrasonic signals transmitted by the first transducer and vice versa.
In operation, each transducer functions as a transmitter, generating a certain number of acoustic pulses, and then as a receiver for an identical number of pulses. The time interval between transmission and reception of the ultrasonic signals is measured in both directions. When the liquid in the pipe is not flowing, the transit-time downstream equals the transit-time upstream. When the liquid is flowing, the transit-time downstream is less than the transit-time upstream.
The difference between the downstream and upstream transit times is proportional to the velocity of the flowing liquid, and its sign indicates the direction of flow.



Features and benefits

- No drifting flow measurement
- No periodic calibration required
- No maintenance
- No restriction in the pipe
- Reliable measurement by design— (IEC61508 certification)
- Flow measurement in extremely high-process temperature (600°C/1112°F) applications
- Flow measurement in extremely low-process temperature (-200°C/-328°F) applications
- Bi-directional measurement

Applications

It also brings advantages to any non-safety critical application where reliable ultrasonic flow measurement is required.

- Coker crude distillation
- Vacuum distillation
- Crackers
- Hydrotreaters
- Visbreakers
- Crude oil
- Liquefied natural gas (LNG)

Active temperature compensation

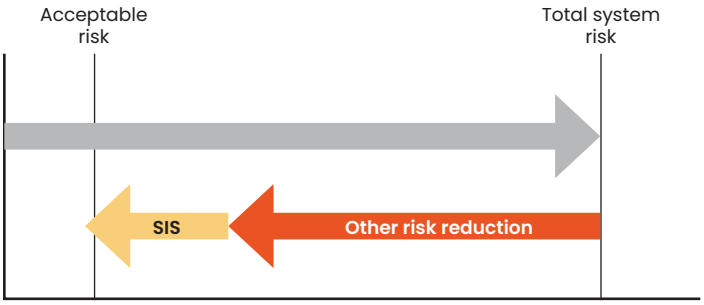
Ultrasonic flow meters use transit time to determine the liquid or gas flow in a pipeline. Measured transit time consists not only of the time the ultrasonic signal spends in a fluid, but also of a portion of "dead time," which is the time that the electrical signal is converted into an acoustical signal and the time the acoustic signal travels inside the buffer.
To allow for the utmost accuracy, PanaFlow HT uses pulse echo technique to actively measure the dead time. By sending a pulse and measuring its reflection, the dead time is measured in real time rather than using a preset value.
As a result of this GE invention, PanaFlow HT maintains its accuracy as process temperature conditions dynamically change.

What is the PanaFlow HT system?

The PanaFlow HT system consists of the new XMT1000 electronics, BWT transducer system, and meter body.
The Panametrics XMT1000 is our latest transmitter and it combines state-of-the-art flow measurement capability with rigorous IEC61508 software and hardware testing.
The Bundle Waveguide Transducer (BWT) system is field-proven to give accurate, drift-free, obstruction-less flow measurement in the most difficult liquid applications, while allowing access to the transducers at any time. The system consists of buffer assemblies and transducers.
The buffer assemblies use waveguide bundles to efficiently concentrate a greater amount of the transducer ultrasonic signal into the process. At the same time, the bundles act as buffers to protect the transducers from extreme temperatures to ensure their unlimited life. This innovative design greatly expands the range of possible applications.
The ultrasonic signal transmitted through the buffer assemblies is powerful enough to penetrate all liquids, including high-viscosity, high–molecular weight liquids and liquids. The meter body comes in various configurations for pipe sizes up to 16 in (400 mm) standard and up to 72 in (1800 mm) upon request. Also, the meter body is available in several materials and finishes.

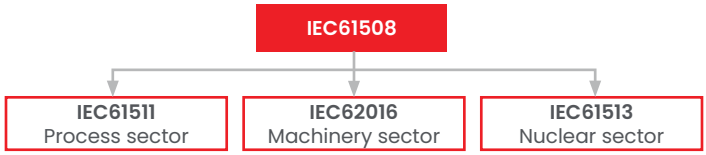
Safety terminology

Overall safety is defined as the freedom from unacceptable risk of physical injury or of damage to the health of people, either directly, or indirectly as a result of damage to property or to the environment.
Functional safety is the dependency on a system or piece of equipment under control to operate correctly and it is just one part of overall safety.
The goal of functional safety is to design, build, operate, and maintain systems in such a way as to prevent dangerous failures, or at the very least, to control them when they arise.
A risk-based approach must be used to determine the required performance of safety systems.



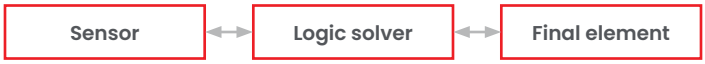
IEC61508 standards

The common use of electronic control systems and their impact on equipment safety led to the development of the IEC 61508 family of standards, which focuses on the functional safety of electrical/electronic/programmable safety-related systems.
These international standards, introduced in 1998, led to the development of further standards (IEC61511 for Process Industry, as an example).



Safety Instrumented System (SIS)

A Safety Instrumented System (or Safety Related System per IEC61508) is used to implement one or more Safety Instrumented Functions (SIFs).
SIF refers to a specific single set of actions and the corresponding equipment needed to identify a single hazard and act to return a system to a safe state. In a typical SIF, sensors identify a hazard, a logic solver determines the appropriate action, and final elements perform the actions.



SIS automatically takes an industrial process to a safe state when specified conditions are violated. It permits a process to move forward ina safe manner when specified conditions allow.

How does PanaFlow HT fit with functional safety?

PanaFlow HT is a SIL2 ultrasonic flow meter (sensor) with the capability of a SIL3 system achievable in a redundant design configuration.
It is IEC61508 certified through a complete design validation from a third party organization. By achieving a third party certification, we have proven the required design rigor through the product safety lifecycle and functional safety management. This rigor makes PanaFlow HT the optimal ultrasonic flow meter for your safety or process control system.

Technical **Specifications**

Overall operation and performance

Fluid types	Liquids: acoustically conductive fluids, including most clean liquids, and many liquids with small amounts of entrained solids or gas bubbles
Flow measurement	Patented Correlation Transit-Time™ mode
Meter sizes	3 in to 16 in (80 mm to 600 mm) standard Optional: sizes up to 72 in (1800 mm) are available upon request
Accuracy	• ±0.5% of reading » 3 in to 4 in (80 mm to 100 mm) meter sizes, range: 7 to 40 ft/s (2.13 to 12.19 m/s) » 6 in to 36 in (150 mm to 900 mm) meter sizes, range: 3 to 40 ft/s (0.91 to 12.19 m/s) • ±0.9% of reading » 3 in to 4 in (80 mm to 100 mm) meter sizes, range: 3 to 7 ft/s (0.91 to 2.13 m/s) Final installation assumes a fully developed flow profile (typically 10 diameters upstream and 5 diameters downstream of straight pipe run) and single phase fluids. Applications with piping arrangements that induce swirl (e.g., two out-of-plane elbows) may require additional straight run or flow conditioning. Larger meter sizes are available upon request.
Repeatability	• ±0.25% of reading » 3 in to 4 in (80 mm to 100 mm) meter sizes, range: 7 to 40 ft/s (2.13 to 12.19 m/s) » 6 in to 36 in (150 mm to 900 mm) meter sizes, range: 3 to 40 ft/s (0.91 to 12.19 m/s) • ±0.5% of reading » 3 in to 4 in (80 mm to 100 mm) meter sizes, range: 3 to 7 ft/s (0.91 to 2.13 m/s)
Range (bidirectional)	0.1 to 40 ft/s (0.03 to 12.19 m/s)
Rangeability (overall)	400:1
SIL certification	• IEC61508 certified • SIL2 certification with single design system • SIL3 certification with redundant design system
Configurations	• 1P1R - one path, one electronics • 2P1R - two path, one electronics • 1P2R - one path, two redundant electronics • 1P3R - one path, three redundant electronics • 1P4R - one path, four redundant electronics • 2P4R - two path, four redundant electronics • Other designs available upon request

Meter body/transducer

Meter body materials	• Carbon steel (ASTM A106 Gr. B - ASTM A105 • Stainless steel (ASTM A312 Gr 316/316L - A182 Gr. 316/316L) • 9Cr-1Mo (ASTM A335 Gr. P9 - ASTM A182 Gr. F9) • Optional: other materials available upon request
Transducer system and material	• Bundle Waveguide Technology™ (BWT) System transducer and holder316L stainless steel • Optional: Other alternative buffer materials are available upon request
Transducer temperature ranges	• Normal temperatures: -310°F to 600°F (-190°C to 315°C) • Liquids, high temperatures: –310°F to 1112°F (–190°C to 600°C)
Pressure range	• Up to ANSI 600 class pressure rating based on material of construction • Optional: Up to ANSI 2500 class maximum allowable flange operating pressure at temperature in either ANSI or DIN designs
Transducer classifications	Explosion-proof Class I, Division 1, Groups B, C, & D ATEX: Flameproof II 2 G Ex d IIC T6 IECEx: Flameproof Ex d IIC T6

Bundle Waveguide Technology™ system, FTPA normal and high temperature buffers

Electronics

Enclosures	Powder coated aluminum (copper free) or stainless steel (SS316), IP66/IP67)
Electronics certifications	• Explosion-proof Class I, Division 1, Groups B, C, and D • ATEX - Flameproof II 2 G Ex d IIC T6 Gb • IECEx - Flameproof Ex d IIC T6 Gb • ROHS compliance (Category 9 exemption • CE • WEEE compliance
Electronics mounting	Remote mounting
Channels	One or two (two channels for two-path averaging) three path measurement available upon request
Display languages	English
Keypad	Built-in magnetic, six-button keypad, for full functionality operation
Inputs/outputs	• Standard » One 4 to 20 mA isolated output, 600 Ohm maximum load, NAMUR NE43 » One additional output, may be configured as either a pulse or frequency output • Optional input/output » One 4 to 20 mA (SIL) isolated output, 600 Ohm maximum load, NAMUR NE43 (required for SIL installation) » Two additional 4 to 20 mA isolated outputs, 600 Ohm maximum load, NAMUR NE43 » One or two 4 to 20 mA isolated inputs, 24-VDC loop power, NAMUR NE43 » One or two isolated, three-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum » One or two isolated, four-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum
Digital interfaces	• Standard: RS485/Modbus® • Optional: HART® 7.0 protocol, with four dynamic variables, includes one additional 4 to 20 mA analog output NAMUR NE43 • Optional: Foundation Fieldbus® FISCO, LAS capable NAMUR NE107 with five AI blocks and a PID block
Power supplies	• Standard: 100-240 VAC (50/60 Hz) Optional: 12-28 VDC
Wiring connection	• ¾" NPT • M20
Operating temperature	-40°F to 149°F (-40°C to 65°C)* *Maximum ambient temperature of 140°F (60°C) with foundation fieldbus option selected.
Storage temperature	-40°F to 158°F (–40°C to 70°C)
Data logging	XMT1000 meter logging Vitality software logging

Panametrics XMT1000 transmitter

Ordering information

A	–	B	C	D	E	F	G	–	H	–	I	J	K	L	–	M	–	Z

Model

PFHT1P1R	PFHT meter body system (1P,1R)
PFHT2P1R	PFHT meter body system (2P,1R)
PFHT1P2R	PFHT meter body system (1P,2R)
PFHT1P3R	PFHT meter body system (1P,3R)
PFHT1P4R	PFHT meter body system (1P,4R)
PFHT2P4R	PFHT meter body system (2P,4R)

Meter body size

03	3in (80mm)
04	4in (100mm)
06	6in (150mm)
08	8in (200mm)
10	10in (250mm)
12	12in (300mm)
14	14in (350mm)
16	16in (400mm)
S	Special size

Meter body flange

15	150# Flange
30	300# Flange
60	600# Flange
S	Special flange

Meter body material

CS	Carbon steel
SS	Stainless steel
9C	9Cr-1Mo
S	Special material

Meter body paint

A	No paint
B	Standard gray epoxy paint
C	Gray high temp Tmax=400°C
S	Custom paint

Meter body design

A	ASME B31.3 and NACE MR0103
P	PED compliant and NACE MR0103

Meter body NDE

1	NDE: MPI, X-ray, and hydro
2	NDE: MPI, X-ray, hydro and PMI
3	NDE: LPI, X-ray, and hydro
4	NDE: LPI, X-ray, hydro and PMI

Transducer cable (select seperately)

R	Remote cable (select separately)

Transducers and buffers

HT05	0.5 MHz HT (-200 to 600°C)
NT05	0.5 MHz NT (-200 to 315°C)
HT02	0.2 MHz HT (-200 to 600°C)
NT02	0.2 MHz NT (-200 to 315°C)

Junction boxes

UX	Explosion proof AL enclosure
UXSS	Explosion proof 316 SS enclosure

Certification

1	Div 1,Class 1, Group B,C,D
2	ATEX II 2 G hazardous location
3	IECEx hazardous locations

Certifications

03A	3IN,2-pt cal
04A	4IN,2-pt cal
06A	6IN,2-pt cal
08A	8IN,2-pt cal
10A	10IN,2-pt cal
12A	12IN,2-pt cal
14A	14IN,2-pt cal
16A	16IN,2-pt cal
03B	3IN,2-pt cal (ISO17025)
04B	4IN,2-pt cal (ISO17025)
06B	6IN,2-pt cal (ISO17025)
08B	8IN,2-pt cal (ISO17025)
10B	10IN,2-pt cal (ISO17025)
12B	12IN,2-pt cal (ISO17025)
14B	14IN,2-pt cal (ISO17025)
16B	16IN,2-pt cal (ISO17025)
S	Special calibration

System transmitters (select seperately)

A	XMT1000 (1) (select separately)
B	XMT1000 (2) (select separately)
C	XMT1000 (3) (select separately)
D	XMT1000 (4) (select separately)
E	XMT1000 SIL (1) (select separately)
F	XMT1000 SIL (2) (select separately)
G	XMT1000 SIL (3) (select separately)
H	XMT1000 SIL (4) (select separately)
I	XMT1000 (1), XMT1000 SIL (1) (select separately)
J	XMT1000 (1), XMT1000 SIL (2) (select separately)
K	XMT1000 (1), XMT1000 SIL (3) (select separately)
S	Special configuration

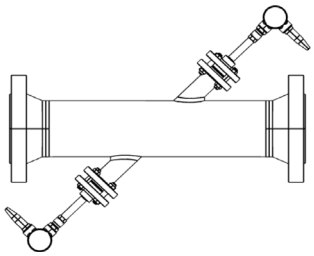
Special

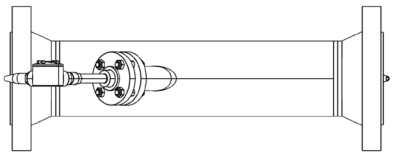
0	None
S	Special

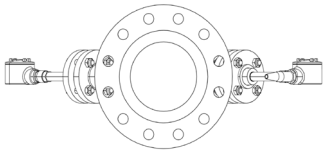
PFHT1P1R	**–**	**03**	**15**	**CS**	**A**	**A**	**1**	**–**	**R**	**–**	**HT05**	**UX**	**1**	**03A**	**–**	**A**	**–**	**0**	**(Example part number)**

1P1R design

"Nominal Pipe Size in (mm)"	150#			300#			600#		
	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	36 (914.4)	38 (965.2)	7.48 (190)	36 (914.4)	38 (965.2)	8.26 (210)	36 (914.4)	38 (965.2)	8.25 (209.55)
4 (100)	36 (914.4)	39 (990.6)	9.05 (230)	38 (965.2)	39 (990.6)	10.04 (255)	38 (965.2)	39 (990.6)	10.75 (273.05)
6 (150)	40 (1016)	42 (1066.8)	11.02 (280)	40 (1016)	42 (1066.8)	12.59 (320)	40 (1016)	42 (1066.8)	14 (355.6)
8 (200)	42 (1066.8)	43 (1092.2)	13.58 (345)	42 (1066.8)	43 (1092.2)	14.96 (380)	44 (1117.6)	43 (1092.2)	16.5 (419.1)
10 (250)	44 (1117.6)	45 (1143)	15.94 (405)	44 (1117.6)	45 (1143)	17.52 (445)	46 (1168.4)	45 (1143)	20 (508)
12 (300)	46 (1168.4)	47 (1193.8)	19.09 (485)	48 (1219.2)	47 (1193.8)	20.47 (520)	48 (1219.2)	47 (1193.8)	22 (558.8)
14 (350)	48 (1219.2)	48 (1219.2)	21.06 (535)	48 (1219.2)	48 (1219.2)	23.03 (585)	50 (1270)	48 (1219.2)	23.75 (603.25)
16 (400)	50 (1270)	50 (1270)	23.42 (595)	50 (1270)	50 (1270)	25.59 (650)	52 (1320.8)	50 (1270)	27 (685.8)

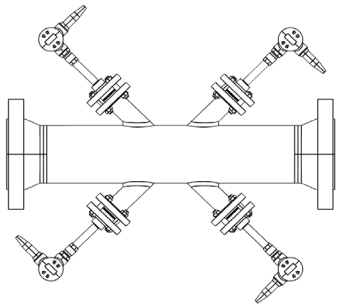


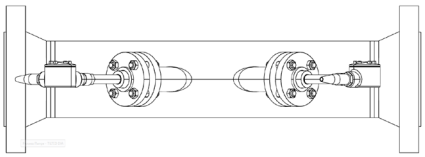


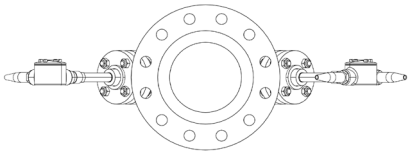


2P1R design

"Nominal Pipe Size in (mm)"	150#			300#			600#		
	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	36 (914.4)	40 (1016)	7.48 (190)	36 (914.4)	40 (1016)	8.27 (210)	36 (914.4)	40 (1016)	8.25 (209.55)
4 (100)	36 (914.4)	42 (1066.8)	9.05 (230)	38 (965.2)	42 (1066.8)	10.04 (255)	38 (965.2)	42 (1066.8)	10.75 (273.05)
6 (150)	40 (1016)	44 (1117.6)	11.02 (280)	40 (1016)	44 (1117.6)	12.6 (320)	40 (1016)	44 (1117.6)	14 (355.6)
8 (200)	42 (1066.8)	45 (1143)	13.58 (345)	42 (1066.8)	45 (1143)	14.96 (380)	44 (1117.6)	45 (1143)	16.5 (419.1)
10 (250)	44 (1117.6)	47 (1193.8)	15.94 (405)	44 (1117.6)	47 (1193.8)	17.52 (445)	46 (1168.4)	47 (1193.8)	20 (508)
12 (300)	44 (1117.6)	47 (1193.8)	19.09 (485)	46 (1168.4)	47 (1193.8)	20.47 (520)	46 (1168.4)	47 (1193.8)	22 (558.8)
14 (350)	46 (1168.4)	42 (1066.8)	21.06 (535)	48 (1219.2)	42 (1066.8)	23.03 (585)	48 (1219.2)	42 (1066.8)	23.75 (603.25)
16 (400)	48 (1219.2)	42 (1066.8)	23.42 (595)	50 (1270)	42 (1066.8)	25.59 (650)	50 (1270)	42 (1066.8)	27 (685.8)

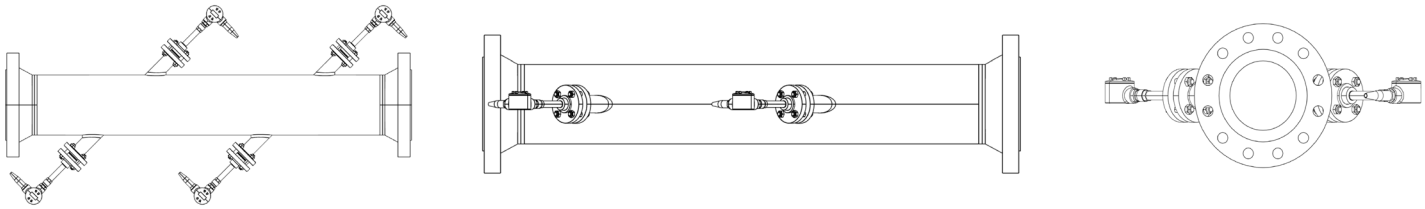






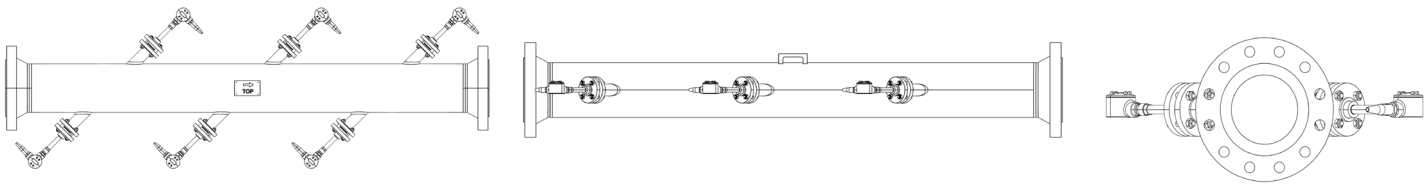
1P2R design

"Nominal Pipe Size in (mm)"	150#			300#			600#		
	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	50 (1270)	38 (965.2)	7.48 (190)	52 (1320.8)	38 (965.2)	8.27 (210)	52 (1320.8)	38 (965.2)	8.25 (209.55)
4 (100)	56 (1422.4)	39 (990.6)	9.05 (230)	58 (1473.2)	39 (990.6)	10.04 (255)	58 (1473.2)	39 (990.6)	10.75 (273.05)
6 (150)	70 (1778)	42 (1066.8)	11.02 (280)	70 (1778)	42 (1066.8)	12.6 (320)	70 (1778)	42 (1066.8)	14 (355.6)
8 (200)	82 (2082.8)	43 (1092.2)	13.58 (345)	82 (2082.8)	43 (1092.2)	14.96 (380)	84 (2133.6)	43 (1092.2)	16.5 (419.1)



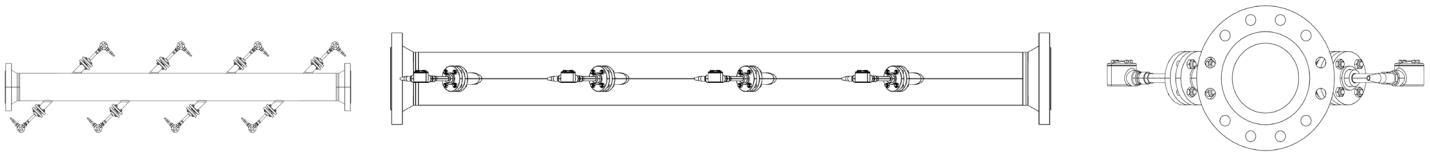
1P3R design

"Nominal Pipe Size in (mm)"	150#			300#			600#		
	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	66 (1676.4)	38 (965.2)	7.48 (190)	66 (1676.4)	38 (965.2)	8.27 (210)	66 (1676.4)	38 (965.2)	8.25 (209.55)
4 (100)	76 (1930.4)	39 (990.6)	9.05 (230)	78 (1981.2)	39 (990.6)	10.04 (255)	78 (1981.2)	39 (990.6)	10.75 (273.05)
6 (150)	100 (2540)	42 (1066.8)	11.02 (280)	100 (2540)	42 (1066.8)	12.6 (320)	100 (2540)	42 (1066.8)	14 (355.6)
8 (200)	122 (3098.8)	43 (1092.2)	13.58 (345)	122 (3098.8)	43 (1092.2)	14.96 (380)	122 (3098.8)	43 (1092.2)	16.5 (419.1)



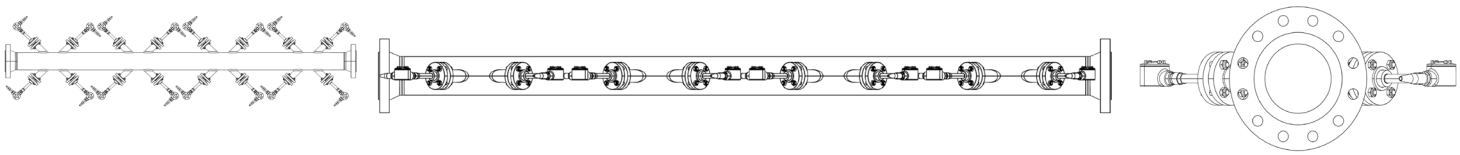
1P4R design

"Nominal Pipe Size in (mm)"	150#			300#			600#		
	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	82 (2082.8)	38 (965.2)	7.48 (190)	82 (2082.8)	38 (965.2)	8.27 (210)	82 (2082.8)	38 (965.2)	8.25 (209.55)
4 (100)	98 (2489.2)	39 (990.6)	9.05 (230)	98 (2489.2)	39 (990.6)	10.04 (255)	98 (2489.2)	39 (990.6)	10.75 (273.05)
6 (150)	129 (3276.6)	42 (1066.8)	11.02 (280)	129 (3276.6)	42 (1066.8)	12.6 (320)	129 (3276.6)	42 (1066.8)	14 (355.6)
8 (200)	160 (4064)	43 (1092.2)	13.58 (345)	160 (4064)	43 (1092.2)	14.96 (380)	160 (4064)	43 (1092.2)	16.5 (419.1)



2P4R design

	150#			300#			600#		
"Nominal Pipe Size in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"	"FTF length in (mm)"	"Width in (mm)"	"Height in (mm)"
3 (80)	88 (2235.2)	38 (965.2)	7.48 (190)	88 (2235.2)	38 (965.2)	8.27 (210)	88 (2235.2)	38 (965.2)	8.25 (209.55)
4 (100)	100 (2540)	39 (990.6)	9.05 (230)	100 (2540)	39 (990.6)	10.04 (255)	100 (2540)	39 (990.6)	10.75 (273.05)
6 (150)	132 (3352.8)	42 (1066.8)	11.02 (280)	132 (3352.8)	42 (1066.8)	12.6 (320)	132 (3352.8)	42 (1066.8)	14 (355.6)
8 (200)	164 (4165.6)	43 (1092.2)	13.58 (345)	164 (4165.6)	43 (1092.2)	14.96 (380)	164 (4165.6)	43 (1092.2)	16.5 (419.1)



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