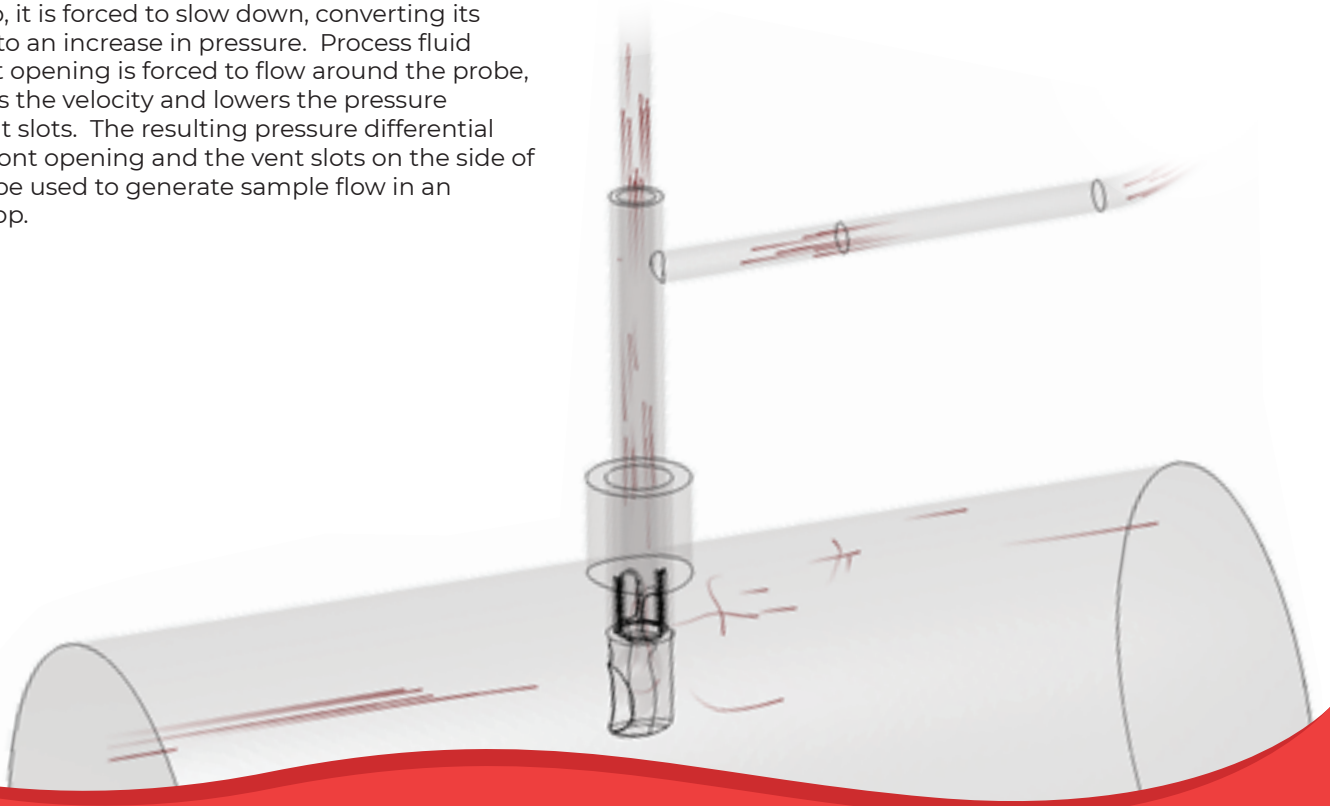
INSIGHT ANALYTICAL

Scoop Probe

The Insight Analytical Liquid Fast Loop probe creates a differential pressure from moving process fluid, driving flow in an external fast loop for analysis; eliminating the requirement for pumps or low pressure vents.

The Insight Analytical Liquid Fast Loop probe design exploits modern technologies including CFD (Computational Fluid Dynamics) and metal 3D printing to produce an optimized solution for creating closed loop flow in analytical fast loops, without the need for additional pumps or venting the process fluid after analysis. This probe is an ideal solution for applications requiring fast analysis response time and sample return to the process, including composite samplers, moisture measurement, densitometers, and GC, NIR or Raman compositional measurements.

Flowing process fluid has kinetic energy proportional to the density and the square of the velocity. When the moving process fluid encounters the scooplike opening at the front of the probe tip, it is forced to slow down, converting its kinetic energy to an increase in pressure. Process fluid above the front opening is forced to flow around the probe, which increases the velocity and lowers the pressure around the vent slots. The resulting pressure differential between the front opening and the vent slots on the side of the probe can be used to generate sample flow in an external fast loop.



insight-analytical.com
sales@insight-analytical.com
3202 12th Ave. NE, Calgary, Alberta
1(403)910-6280
1(866)910-6280

Making Measurements Matter.

The induced sample velocity and flow rate in the fast loop depends on several factors including process fluid velocity, fluid density, fluid viscosity, and the length, inside diameter and total flow resistance of the fast loop. If there are components like filter elements, low Cv valves, or small bore measuring cells in the fast loop, this can reduce the flow significantly. One possible strategy to work with restrictions in the loop such as restrictive measuring cells, is to include a parallel bypass loop around the flow restriction. A general guideline is to use ¾" diameter tubing for fast loops longer than 3 m (12 ft), and either ½" or ¾" diameter tubing for fast loops with shorter length.

Probes are custom made to order after receiving required application details including type of process fluid, viscosity, density, pipe size and schedule, pipe orientation, flange location, flange size and orientation, materials requirements, and the distance from the mounting flange face to the inside wall of the process pipe.

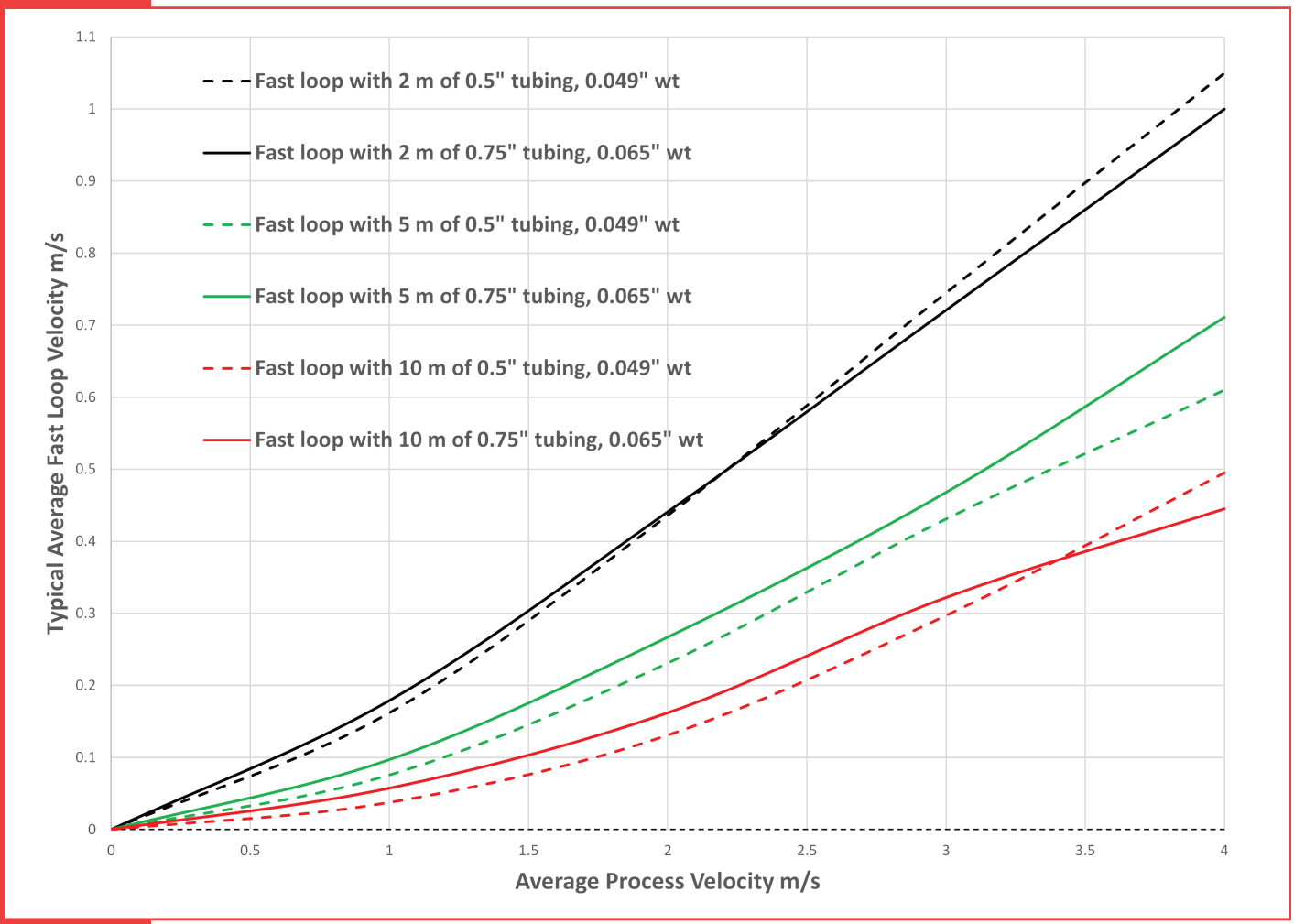


Figure 1 – Typical Fast Loop Velocities for a 5 cP/830 kg/m3 Light Crude Oil

Figure 1 shows the typical fast loop velocities for a light crude oil with a viscosity of 5 cP and density of 830 kg/m3, over a range of 1 to 4 m/s (3.3 to 13.1 ft/s) process velocity, for both 3/4" diameter 0.065" wall thickness tubing and 1/2" diameter 0.049" wall thickness tubing for 2, 5, and 10 m long fast loop lengths. The average fast loop velocity values shown in this graph are with no added flow restriction in the fast loops, which would lower the velocity, if present. These results show that using larger diameter tubing for the fast loop will typically give higher average velocity and flowrate, except for very short loop lengths.

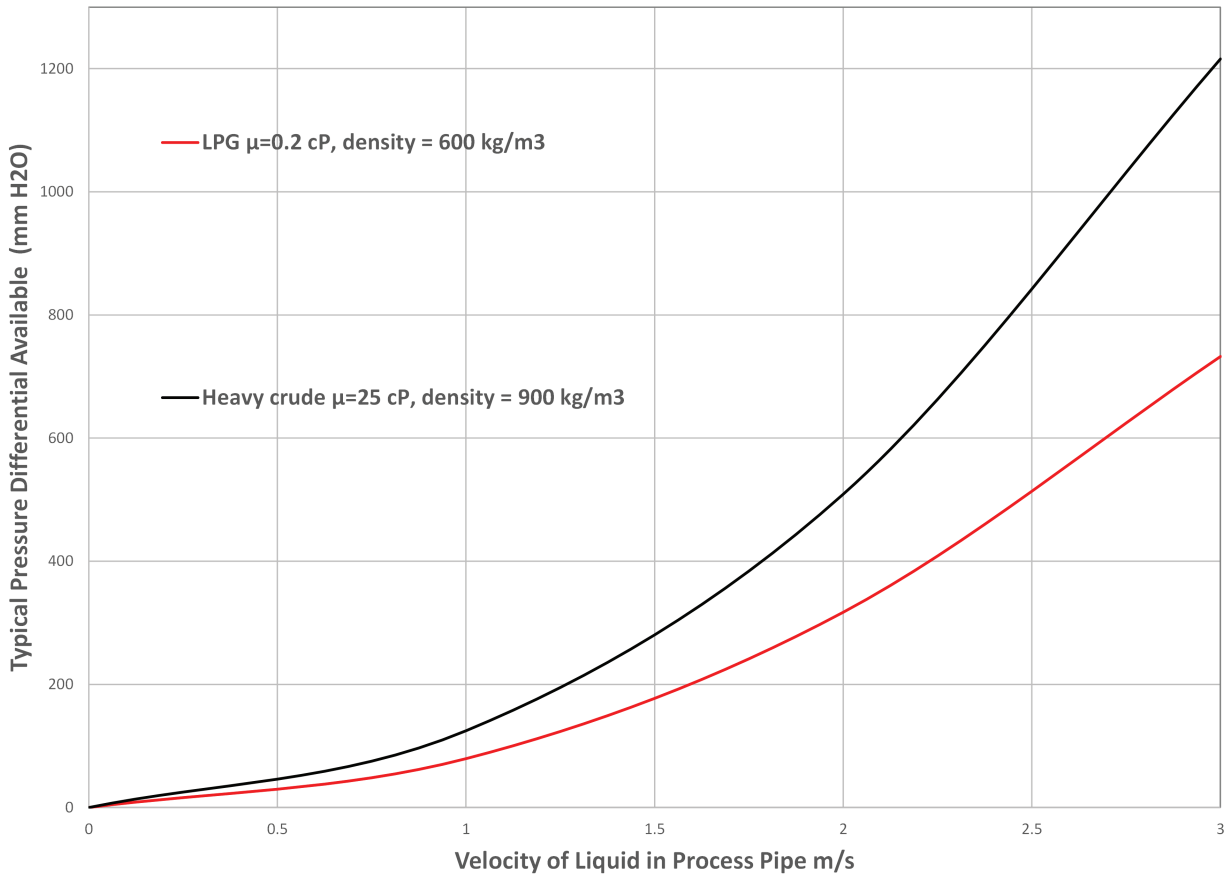
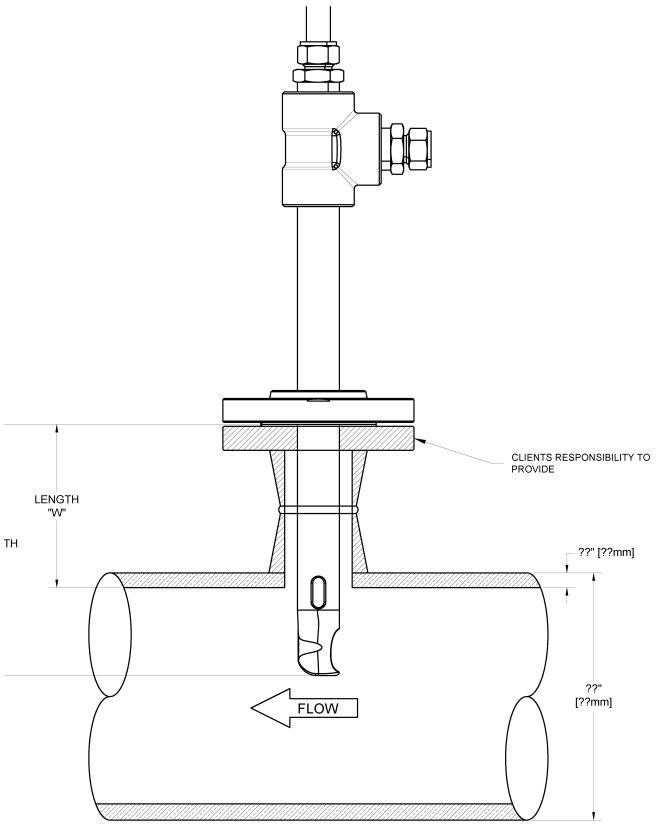


Figure 2 – Differential Pressure Generated at Different Process Velocities

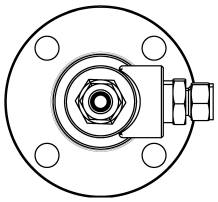
Figure 2 shows the pressure differential created in the probe by liquids with densities of 650 kg/m3 and 900 kg/m3, over a range of 1 to 4 m/s (3.3 to 13.1 ft/s) process velocity, shown in units of mmH2O. The pressure differentials that are generated are fairly small, so it is important to minimize height changes in the fast loop for it to be self-priming. Horizontal probe mounting is recommended where possible. For applications with low process velocities or significant height changes in the fast loop, it may be necessary to manually prime the fast loop using a 3-way valve located at the probe sample return connection.

Technical Specifications

Maximum Pressure Rating	Class 150, 300 or 600.
Temperature Range	-29°C to 149°C (-20°F to 300°F)
Process Pipe Size Range	NPS 4 and larger (DN100 and larger)
Mounting Location Recommendations	Horizontal mounting recommended and/or minimizing height changes between probe and loop.
Process Connection Size	1-1/2” or larger flange size
Return Port Size	1” FNPT typically supplied with Swagelok SS-1210-1-16BT fitting for ¾” tubing connection, but ½” tubing optional.
Wetted Materials	316/316L Stainless Steel
NACE compliance	NACE MR0175/ISO 15156 and MR0103 Compliant.
Compliance with ASME PTC 19.3 TW-2010	Passes calculations for process velocities up to 10 m/s and maximum density of 1500 kg/m^3 for 8” (200 mm) length.



SAMPLE PROBE INSTALLED



PROBE TOP VIEW

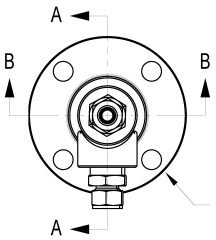
PROBE DETAILS							
TAG	DESCRIPTION	FLANGE	PIPE DIA.	FLOW DIRECTION	FLANGE FACE ORIENTATION	PIPE ORIENTATION	FLANGE LOCATION
AE-XXXX	TBD	2" #150	TBD	RIGHT TO LEFT	STRADDLE TDC *	HORIZONTAL	TOP OF PIPE

PROBE DETAILS				
"L" LENGTH	"W" LENGTH	QUILL DIA.	QUILL SCHED.	DESIGN CONDITION
L = W + 3.35" (85mm)	TBD	1" PIPE	SCH 40	XXXX kPag @ -XX°C to XX°C

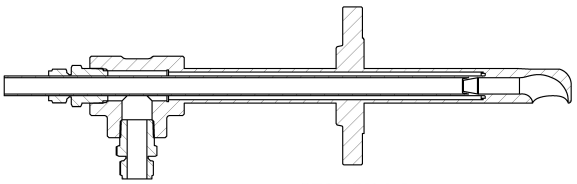
PROBE DETAILS						
VISCOSITY (Cp)	TEMP. (C)	PRESS. (kPag)	MAX. VELOCITY (m/s)	FLOW RATE (m^3/hr)	FLUID STATE	DENSITY (Kg/m3)
TBD	TBD	TBD	TBD	TBD	TBD	TBD

- STATED CONDITIONS ARE DESIGN, ACTUAL CONDITIONS MAY VARY.

* FLANGE ORIENTATION ASSUMED TO BE STRADDLE TDC UNLESS NOTED OTHERWISE.

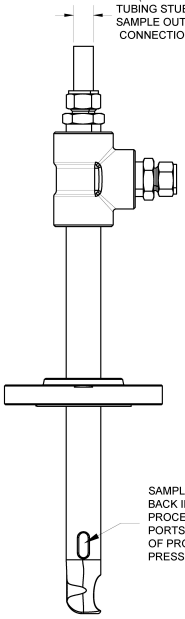


STRADDLE FLANGE ORIENTATION ASSUMED UNLESS NOTED OTHERWISE

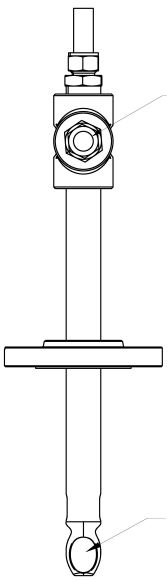


SECTION A-A

3/4" (19.05 mm) 0.065" WT TUBING STUB FOR SAMPLE OUTLET CONNECTION

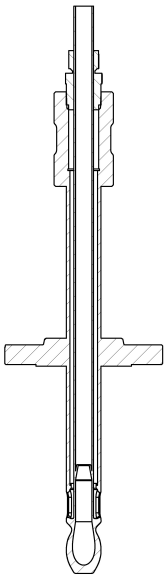


SAMPLE VENTS BACK INTO PROCESS THRU PORTS ON SIDES OF PROBE WHERE PRESSURE IS LOWEST

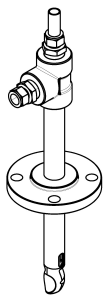


SWAGELOK SS-1210-1-16BT FITTING PROVIDED AS STANDARD FOR 3/4" TUBE SAMPLE RETURN CONNECTION

SAMPLE FLOW IS FORCED INTO THIS OPENING IN THE PROBE BY HIGH PRESSURE CREATED BY CONVERTING SAMPLE KINETIC ENERGY INTO PRESSURE



SECTION B-B



NOTES:
1-1/2" MINIMUM FLANGE SIZE CLASS 150, 300 OR 600.
SHOWN WITH 2" TO 1" REDUCING SLIP-ON FLANGE.
ALL MATERIAL 316/316L STAINLESS STEEL
SHOWN WITH 3/4" FAST LOOP TUBING CONNECTIONS, WHICH ARE RECOMMENDED FOR FAST LOOP LENGTHS LONGER THAN 12 FT (3 m). ALSO AVAILABLE WITH 1/2" FAST LOOP TUBING CONNECTIONS FOR SHORTER FAST LOOP LENGTHS.