

APPLICATION NOTE
USE OF SONOFLOW CO.55 FLOW SENSORS
WITH REINFORCED TUBING

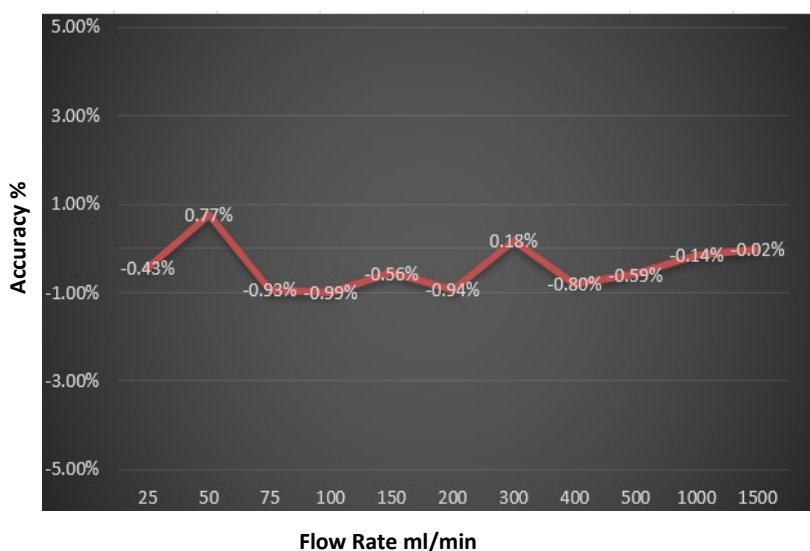


Ultrasonic clamp-on flow sensors have traditionally had limited use in applications which include reinforced tubing materials. It is common in bioprocess applications with operating pressures over 60 PSI to use tubing that has been reinforced with Polyester mesh. Air trapped between the fibers of the mesh can attenuate the ultrasound signal making this type of measurement difficult or impossible. SONOFLOW CO.55 sensors can be used successfully with AdvantaPure®'s AdvantaSil™ APSH Braid Reinforced Silicone hose, allowing the use of Sonotec's non-invasive flow measurements in high pressure applications.



Accuracy of SONOFLOW CO.55/100 Sensor on AdvantaSil™ APSH-P-0188 Tubing

Average accuracy of SONOFLOW sensor on Advantasil™ tubing was better than 1% when calibrated for this tubing type. Sensor was calibrated using SONOFLOW Monitor Software, Masterflex L/S Pump and referenced to a calibrated Sartorius Entris 6202-1S scale.



Target	Sensor	Reference	Accuracy
ml/min	ml/min	ml/min	%
25	24.892	25	-0.43%
50	50.383	50	0.77%
75	74.305	75	-0.93%
100	99.013	100	-0.99%
150	176.384	177.37	-0.56%
200	212.685	214.7	-0.94%
300	326.387	325.8	0.18%
400	427.502	430.95	-0.80%
500	535.04	538.23	-0.59%
1000	1209.696	1211.44	-0.14%
1500	1884.352	1884.65	-0.02%

Clamp to Clamp Repeatability of SONOFLOW CO.55/100 Sensor with AdvantaSil™ APSH Tubing

Two different repeatability tests were performed with AdvantaSil™ APSH tubing.

Clamp to Clamp Repeatability			
Accuracy when sensor is reclamped and moved to a different location on tube			
Serial #: 10046			
Distance between clamps for this tube: 2"			
Target (ml/min)	Flow (Sensor)	Reference(Scale)	Accuracy of Flow Sensor
300	304.511	302.22	0.76%
300	300.753	302.72	-0.65%
300	300.925	302.02	-0.36%
300	303.308	302.12	0.39%
300	300.507	303.08	-0.85%
300	298.314	302.7	-1.45%
300	302.709	302.44	0.09%
300	304.415	304.22	0.06%
300	298.776	304.18	-1.78%
300	298.652	303.6	-1.63%
300	298.555	303.54	-1.64%

10 Point Repeatability			
10 runs with sensor in a set location on tube at same flow rate			
Serial #: 10046			
Target (ml/min)	Flow (Sensor)	Reference(Scale)	Accuracy of Flow Sensor
300	298.247	300.66	-0.80%
300	297.254	300.6	-1.11%
300	297.987	300.92	-0.97%
300	299.267	301.32	-0.68%
300	297.666	300.74	-1.02%
300	301.904	300.38	0.51%
300	305.59	302.62	0.98%
300	297.853	301.92	-1.35%
300	297.637	301.96	-1.43%
300	297.427	302.24	-1.59%
300	300.185	300.64	-0.15%

How SONOFLOW SENSORS WORK ON REINFORCED TUBING

SONOFLOW CO.55 flow sensors use a patented algorithm to adjust power levels to compensate for the braiding in the tubing. The proprietary piezo-ceramic composites used on the flow sensors provide precise focus of the ultrasonic wave, allowing it to pass through the Polyester fiber braiding of the silicone hose with little to no attenuation of the signal. An advanced receiving amplifier allows the sensors to detect the smallest amounts of signal and generate consistent results.

AvantaSil™ APSH Sizes compatible with SONOFLOW CO.55 Flow Sensors

APSH Part Number	Nominal I.D.		Wall (in.) (mm)		O.D. (in.) (mm)		Working Pressure		Burst Pressure		SONOTEC SENSOR
	at 70°F (21.1°C)						at 70°F (21.1°C)				
	PSI	Bar					PSI	Bar			
APSH-P-0188	0.188	4.76	0.13	3.3	0.462	11.73	170	11.72	650	44.82	CO.55/100
APSH-P-0250	0.25	6.35	0.125	3.17	0.5	12.7	140	9.65	550	37.92	CO.55/120
APSH-P-0375	0.375	9.53	0.125	3.17	0.625	15.88	140	9.65	550	37.92	CO.55/140
APSH-P-0500	0.5	12.7	0.187	4.75	0.875	22.22	105	7.24	420	28.96	CO.55/190
APSH-P-0625	0.625	15.88	0.17	4.32	0.99	25.15	100	6.9	400	27.58	CO.55/230
APSH-P-0750	0.75	19.05	0.175	4.45	1.125	28.58	90	6.21	350	24.13	CO.55/260
APSH-P-0875	0.875	22.23	0.18	4.57	1.26	32	65	4.48	250	17.24	CO.55/260
APSH-P-1000	1	25.4	0.19	4.83	1.405	35.69	60	4.14	225	15.51	CO.55/340

SONOFLOW CO.55 Clamp-On flow sensors can be used directly on AdvantaSil™ APSH tubing in the sizes on the chart above, without the need to splice in a section of non-reinforced tubing. This eliminates concerns over pressure drop or leakage due to poor Tri-Clamp® connections and allows continuity of the tubing throughout the application.

Use of SONOFLOW CO.55 flow sensors on AdvantaSil™ APSH tubing allows implementation of non-invasive ultrasonic flow measurements in high pressure applications without time consuming redesigns of the original application set-up. Sonotec sensors work with the existing reinforced tubing, saving time and reducing engineering costs generally associated with the use of clamp-on ultrasonic sensors in these applications.



Low volatile grade, **platinum-cured silicone hose** is clean room produced for critical pharmaceutical, biopharm, cosmetic, and food applications. Polyester yarn braiding inside the wall enhances the pressure capabilities. AdvantaSil™ APSH has undergone extensive physical, chemical, and biological testing and meets USP Class VI, FDA CFR 177.2600, ISO 10993, European Pharmacopoeia 3.1.9, and 3-A