

Effects of Tubing Changes

On calibration of SONOFLOW® ultrasonic flow sensors




TECHNICAL NOTE

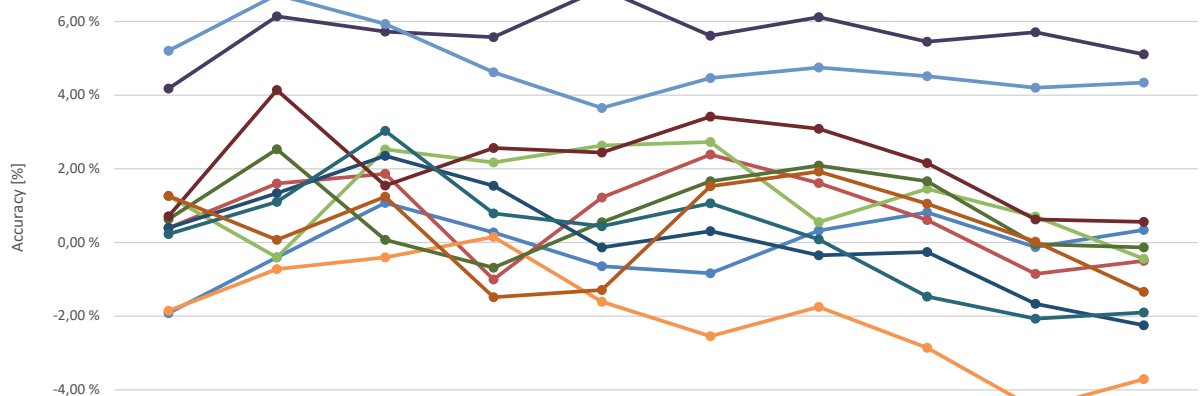
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The ultrasonic flow sensors SONOFLOW® CO.55 are factory calibrated to customer specific tubing to ensure the most accurate and reliable measurement results. The unique properties of the tubing, such as material of composition, inner diameter, and durometer affect the speed at which the ultrasound waves travel through the tubing and are accounted for during the calibration process. If the sensors are used with a tubing that differs from the tubing used for calibration, there will be a shift in the calibration causing potential inaccuracies in reported measurement. Tubing changes can be accounted for with adjustments using SONOFLOW® Software, or through factory recalibration. While SONOFLOW® CO.55 sensors can be accurately calibrated for most industry standard tubing, it is important to understand how tubing changes can affect the calibration and therefore the reported flow measurement.

Flow Sensor Set-Up

SENSOR	SONOFLOW® CO.55/080 V2.0 flow meter	
TUBING	Masterflex® PCS [3/8" OD x 1/4" ID]	
CALIBRATION	Standard calibration for Masterflex® PCS [water, 23 °C +/- 2 K, standard sensor flow range]	
COMPARISON	Tubing changed and compared to the baseline tube Masterflex® PCS [all other parameters remained constant]	

Comparison of Multiple Tubing Types Used on the SONOFLOW® sensor calibrated for Masterflex® PCS



	25	50	75	100	250	500	750	1000	1250	1500
Masterflex PCS LS17	-1,92%	-0,40%	1,07%	0,27%	-0,65%	-0,83%	0,32%	0,82%	-0,12%	0,34%
Masterflex PharmaPure 17	0,39%	1,60%	1,86%	-1,00%	1,22%	2,39%	1,61%	0,61%	-0,86%	-0,50%
AdvantaPure APST	1,26%	-0,41%	2,52%	2,17%	2,63%	2,72%	0,55%	1,45%	0,70%	-0,44%
Dow Corning APT	-1,86%	-0,72%	-0,40%	0,15%	-1,61%	-2,55%	-1,75%	-2,86%	-4,52%	-3,71%
Dow Corning Pharma-50	0,63%	2,53%	0,07%	-0,68%	0,55%	1,66%	2,09%	1,66%	-0,05%	-0,13%
Saint Gobain Tygon XL-60	0,40%	1,34%	2,35%	1,54%	-0,13%	0,31%	-0,35%	-0,26%	-1,66%	-2,25%
Saint Gobain C-Flex 374	0,71%	4,14%	1,54%	2,57%	2,44%	3,41%	3,08%	2,16%	0,63%	0,56%
Watson Marlow Pumpsil	4,18%	6,14%	5,72%	5,57%	6,90%	5,61%	6,11%	5,45%	5,71%	5,11%
TBL Platinum Cured Silicone	0,23%	1,10%	3,03%	0,79%	0,44%	1,06%	0,08%	-1,47%	-2,07%	-1,90%
PharMed BPT	1,26%	0,07%	1,24%	-1,48%	-1,29%	1,53%	1,93%	1,05%	0,02%	-1,34%
VENABio Pure ISO7	5,20%	6,73%	5,93%	4,62%	3,65%	4,46%	4,75%	4,51%	4,20%	4,34%



CONCLUSION Changing tubing will cause a calibration shift.

The sensor must be adjusted properly for the specific tubing type being used.

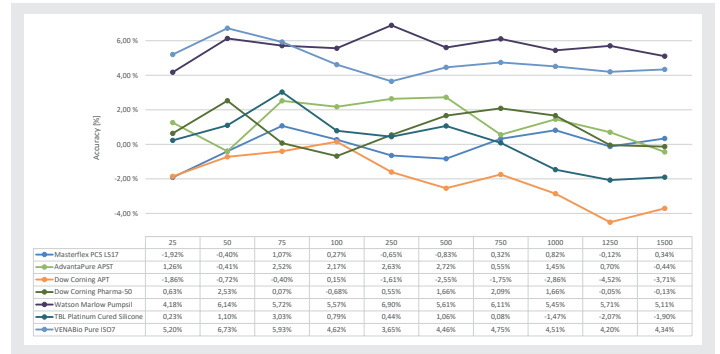
Tubing Comparison Test 1: Same Material, Different Manufacturer

Manufacturers have specific proprietary formulations for tubing materials which may alter the ultrasonic transmission. Two platinum cured silicone tubes from different manufacturers may perform differently in an ultrasonic sensor.

Using Masterflex® PCS as a baseline, the diagram shows the shift when changing from one PCS to another from a different manufacturer.

✓ CONCLUSION

Not all silicone is the same. The sensor must be adjusted if changing from one manufacturer's silicone tubing to another.



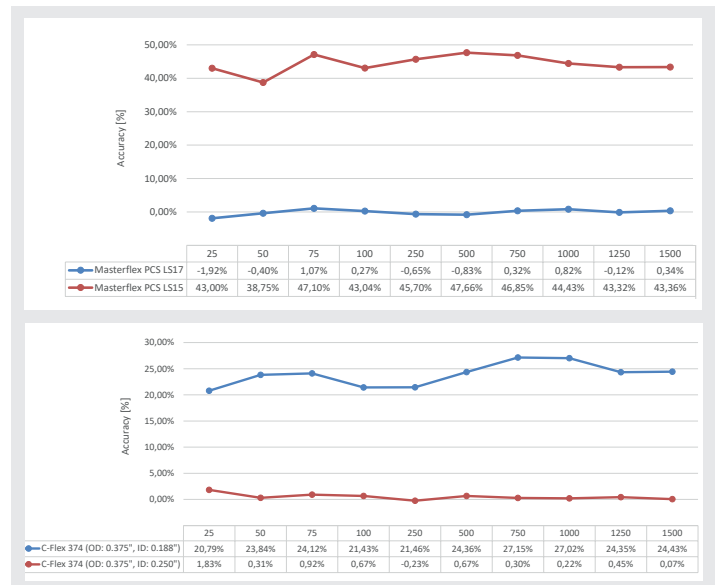
Tubing Comparison Test 2: Different Inner Diameter (ID)

The inner diameter of the tubing affects the cross-sectional area inside the tube, which is a contributing factor in the flow measurement calculation.

The two diagrams show how tubing from the same manufacturer with the same composition will differ in measurement calculation when the inner diameter of the tubing is not the same. The sensors were calibrated to Masterflex® PCS LS 17 and Saint-Gobain C-Flex® 374 (OD 0.375", ID 0.25"), respectively.

✓ CONCLUSION

The sensor must be adjusted when changing to a tubing with the same OD but different ID.



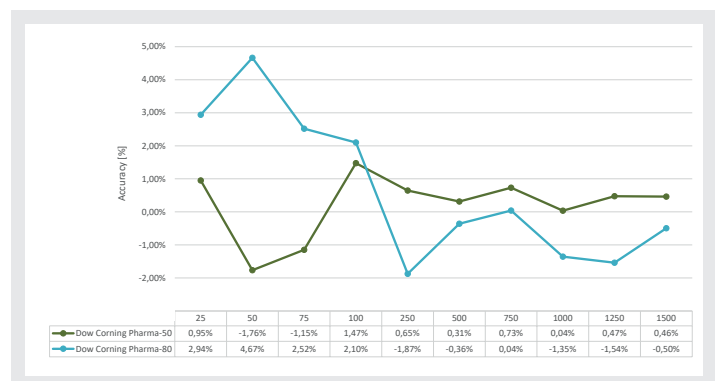
Tubing Comparison Test 3: Different Durometer

Durometer of the tubing will also affect the calibration because the ultrasound will travel at different speeds depending on durometer. In addition, tubes with differing durometers fit differently in the sensor, affecting the inner diameter measurement and area.

In this comparison, the sensor was calibrated on *Dow Corning®* Pharma-50 and compared to *Dow Corning®* Pharma-80.

✓ CONCLUSION

It is important to adjust the SONOFLOW® sensor when changing the tubing durometer.



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