

Density calibration

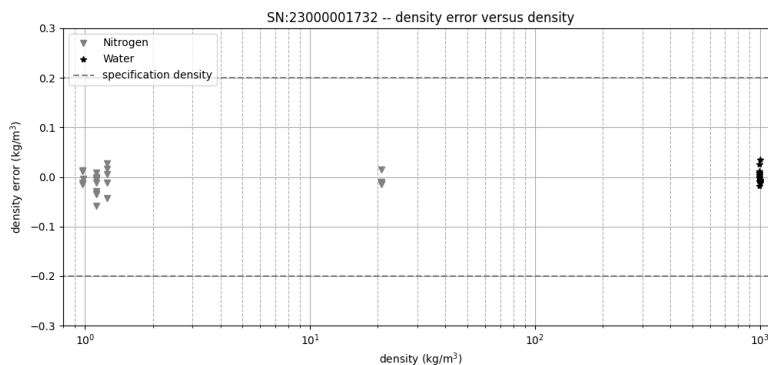
6243 VLO-M2-nonEX unpotted 23000001732 TDDCP-03
 Cal.Cert.No Sensor Serial No Calibration rig

$C_0 = -2.91390$ $C_1 = 2.39790 \times 10^9$ $C_2 = -1.04777 \times 10^5$ $C_{22} = -1.90847 \times 10^2$
 Density coefficients

$C_5 = 9.67142 \times 10^{-3}$ $C_7 = 7.66935 \times 10^{-7}$ $C_8 = 1.25580 \times 10^{-6}$
 Density coefficients

$T_A = -7.38504 \times 10^{-12}$ $T_B = 1.40857 \times 10^{-4}$ $T_C = -1.29521 \times 10^3$ $T_D = 2.56816 \times 10^{-19}$
 Temperature coefficients

Fluid	Reference Data			DUT Data			Error versus Specification (2K)			
	Press. (bar a)	Temp. (°C)	Density (kg/m ³)	Frequency (Hz)	Temp. (°C)	Density ¹ (kg/m ³)	Temp. (°C)	Spec. (°C)	Density ¹ (kg/m ³)	Spec. (kg/m ³)
Calibration with adjustment										
nitrogen	18.32	25.01	20.76	28 576.9	25.01	20.76	0.00	0.15	-0.00	0.20
nitrogen	0.99	25.01	1.12	28 667.5	25.01	1.12	0.00	0.15	-0.00	0.20
nitrogen	0.99	-4.80	1.25	28 682.9	-4.80	1.25	0.00	0.22	-0.00	0.30
nitrogen	0.99	69.68	0.98	28 640.3	69.68	0.98	0.00	0.34	-0.00	0.45
water	0.97	25.07	997.03	24 749.1	25.07	997.02	0.00	0.15	-0.01	0.20
water	18.23	25.03	997.82	24 750.3	25.03	997.83	0.00	0.15	0.01	0.20
Calibration without adjustment										
water	0.96	25.02	997.04	24 749.0	25.02	997.04	0.00	0.15	0.00	0.20
nitrogen	0.99	25.01	1.12	28 667.6	25.01	1.09	0.00	0.15	-0.03	0.20



Calibration method and metrological traceability: Deionized water (thermal conductivity $< 5 \times 10^{-1} \mu\text{S/cm}$ and specific gravity < 1.00001) and nitrogen purity 5.0 ($\text{N}_2 \geq 99.5\%$, $\text{O}_2 + \text{Ar} \leq 0.5\%$ and $\text{Ar} < 0.1\%$) are used for calibration. An unbroken chain of calibrations going back to international standards is established for the temperature and pressure reference sensors according to ISO 17025.

	Expanded measurement uncertainty of reference:	Specification sensor:
Pressure (bar)	$\pm < 0.02$	none
Temperature (°C)	$\pm < 0.05$	± 0.15 or $[0.0075 \times T - 25 \text{ °C}]$ if the value is > 0.15
Density (kg/m ³)	$\pm < 0.10$	± 0.20 or $[0.01 \times T - 25 \text{ °C}]$ if the value is > 0.20

¹ Note: Density measurement of the density sensor depends on pressure. If the actual measuring pressure is known, the pressure effect can be compensated. The listed calibration data shows measuring performance with active pressure compensation. By default, the pressure compensation is set to a fixed pressure, typically 1 bar (absolute). If the actual measuring pressure is higher than the fixed compensation pressure, the density sensor shows a density that is too low. For detailed information concerning specifications and pressure compensation, see the product documentation.

25.01.2024 09:16 C.Huber
 Date Time Calibrated by Signature

Calibration certificate



Viscosity calibration

6243 VLO-M2-nonEX unpotted 2300001732 TDVCP-01

Cal.Cert.No Sensor Serial No Calibration rig

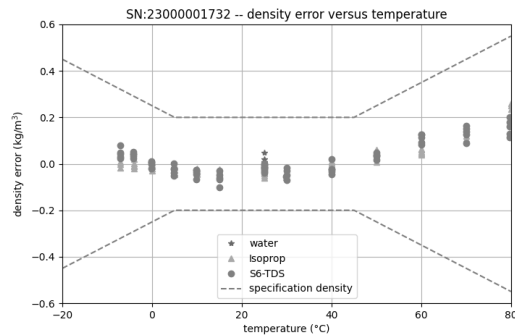
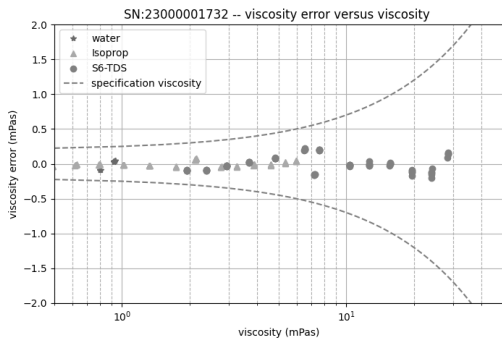
$$D_0 = 1.14234 \times 10^{-3} \quad D_1 = 5.12650 \times 10^{-3} \quad D_2 = 4.10861 \times 10^{-6}$$

Damping coefficients

$$A_0 = 4.59693 \times 10^1 \quad A_1 = 6.12800 \times 10^8 \quad A_2 = 0.0 \quad A_3 = 4.20 \times 10^{-1}$$

Viscosity coefficients

Fluid	Reference Data				DUT Data					Error versus Specification (2K)					
	Press. (bar a)	Temp. (°C)	Viscosity (mPa s)	Density (kg/m ³)	Frequency (Hz)	Damping	Temp. (°C)	Viscosity (mPa s)	Density (kg/m ³)	Temp. (°C)	Spec. ² (°C)	Viscosity (mPa s)	Spec. ² (mPa s)	Density (kg/m ³)	Spec. ² (kg/m ³)
water	0.97	25.07	0.89	997.03	24749.1	86.8	25.07	0.93	997.02	0.00	0.15	0.04	0.24	-0.01	0.20
water	18.23	25.03	0.89	997.82	24750.3	84.5	25.03	0.80	997.83	0.00	0.15	-0.09	0.24	0.01	0.20
water	0.96	25.02	0.89	997.04	24749.0	86.7	25.02	0.92	997.04	0.00	0.15	0.04	0.24	0.00	0.20
Isoprop	1.20	24.95	2.07	781.20	25461.5	146.2	24.93	2.14	781.15	-0.02	0.15	0.07	0.30	-0.04	0.20
Isoprop	1.20	14.90	2.80	789.52	25437.9	145.9	14.94	2.76	789.48	0.04	0.15	-0.05	0.34	-0.04	0.20
Isoprop	1.20	9.91	3.29	793.60	25426.3	147.5	9.94	3.25	793.57	0.03	0.15	-0.04	0.36	-0.03	0.20
Isoprop	1.20	4.91	3.89	797.65	25414.8	149.7	4.92	3.87	797.62	0.01	0.15	-0.01	0.39	-0.03	0.20
Isoprop	1.20	-0.11	4.62	801.64	25403.3	151.8	-0.07	4.61	801.63	0.04	0.19	-0.01	0.43	-0.01	0.25
Isoprop	1.20	-4.14	5.32	804.83	25394.2	153.9	-4.09	5.34	804.83	0.06	0.22	0.01	0.47	-0.00	0.29
Isoprop	1.20	-7.14	5.93	807.20	25387.3	155.5	-7.08	5.97	807.22	0.05	0.24	0.04	0.50	0.01	0.32
Isoprop	1.20	29.94	1.79	776.96	25473.6	142.9	29.91	1.74	776.91	-0.03	0.15	-0.04	0.29	-0.05	0.20
Isoprop	1.20	39.96	1.35	768.15	25498.5	142.6	39.94	1.32	768.15	-0.02	0.15	-0.03	0.27	-0.00	0.20
Isoprop	1.20	49.96	1.03	758.99	25524.6	143.0	49.93	1.02	759.02	-0.03	0.19	-0.02	0.25	0.03	0.25
Isoprop	1.20	59.97	0.80	749.35	25552.2	144.4	59.95	0.79	749.40	-0.01	0.26	-0.01	0.24	0.05	0.35
Isoprop	1.20	69.95	0.64	739.20	25581.4	146.4	69.95	0.62	739.33	-0.00	0.34	-0.02	0.23	0.13	0.45
Isoprop	1.20	79.93	0.53	728.45	25612.4	149.0	79.95	0.49	728.68	0.02	0.41	-0.04	0.23	0.23	0.55
Isoprop	1.20	24.95	2.07	781.18	25461.5	146.0	24.95	2.12	781.15	0.00	0.15	0.06	0.30	-0.03	0.20
S6-TDS	1.20	24.93	7.37	830.67	25291.7	194.5	24.94	7.57	830.65	0.01	0.15	0.20	0.57	-0.02	0.20
S6-TDS	1.20	14.94	10.40	837.36	25274.1	199.4	14.94	10.37	837.30	0.00	0.15	-0.02	0.72	-0.06	0.20
S6-TDS	1.20	9.92	12.65	840.73	25264.9	204.2	9.91	12.64	840.69	-0.01	0.15	-0.00	0.83	-0.04	0.20
S6-TDS	1.20	4.93	15.65	844.09	25255.8	209.6	4.89	15.65	844.06	-0.03	0.15	-0.00	0.98	-0.03	0.20
S6-TDS	1.20	-0.08	19.76	847.46	25246.4	215.2	-0.14	19.64	847.46	-0.06	0.19	-0.12	1.19	0.00	0.25
S6-TDS	1.20	-4.11	24.16	850.15	25238.8	219.9	-4.15	24.03	850.19	-0.04	0.22	-0.13	1.41	0.04	0.29
S6-TDS	1.20	-7.08	28.21	852.14	25233.2	223.5	-7.14	28.35	852.19	-0.06	0.24	0.14	1.61	0.04	0.32
S6-TDS	1.20	29.94	6.31	827.33	25300.6	192.3	29.92	6.52	827.29	-0.02	0.15	0.21	0.52	-0.04	0.20
S6-TDS	1.20	39.96	4.73	820.61	25318.0	187.5	39.97	4.81	820.59	0.01	0.15	0.08	0.44	-0.02	0.20
S6-TDS	1.20	49.97	3.66	813.89	25335.2	184.8	50.00	3.68	813.92	0.03	0.19	0.02	0.38	0.04	0.25
S6-TDS	1.20	59.97	2.96	807.20	25351.9	184.3	59.99	2.93	807.31	0.03	0.26	-0.03	0.35	0.11	0.35
S6-TDS	1.20	69.95	2.47	800.52	25368.7	185.1	69.97	2.37	800.65	0.02	0.34	-0.09	0.32	0.13	0.45
S6-TDS	1.20	79.67	2.04	794.05	25384.8	186.0	79.63	1.95	794.20	-0.03	0.41	-0.09	0.30	0.16	0.55
S6-TDS	1.20	24.94	7.37	830.65	25291.8	191.3	24.97	7.22	830.64	0.03	0.15	-0.15	0.57	-0.01	0.20



Calibration method and metrological traceability: Traceable Standard Reference Materials (SRM) or reference standards calibrated with certified measurement equipment are used for viscosity calibration.

	Expanded measurement uncertainty of reference:	Specification sensor:
Viscosity (mPa s)	± 0.5% of MV	± [5% of MV + 0.2]
Temperature (°C)	± 0.05	± 0.15 or [0.0075 × T - 25 °C] if the value is > 0.15
Density (kg/m ³)	± 0.10	± 0.20 or [0.01 × T - 25 °C] if the value is > 0.20

² Note: Specification = max permissible error: Includes specification of sensor and expanded measurements uncertainty of reference.

12.02.2024 10:02 C.Huber
 Date Time Calibrated by Signature