

SBE SEA-BIRD ELECTRONICS, INC.

13431 NE 20th St. Bellevue, Washington 98005 USA

Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Service

Report

RMA Number

75766

Customer Information:

Company University of Victoria, British Columbia

Date 2/19/2014

Contact Reece Hasanen

PO Number TBD

Serial Number 16P62761-6812

Model Number SBF 16Plus

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Company University of Victoria, British Columbia **Date** 2/19/2014

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Services Requested:

1. Evaluate/Repair Instrumentation.
2. Perform Routine Calibration Service.
3. Install wet-pluggable type connectors
4. Add NEW SBE 63 Oxygen Sensor
5. Convert Communication Protocol To RS-485

Problems Found:

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Services Performed:

1. Performed initial diagnostic evaluation.
2. Calibrated the pressure sensor.
3. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
4. Performed internal inspection and O-ring replacement.
5. Performed hydrostatic pressure test.
6. Upgraded firmware to most current revision (see special notes).*
7. SBE63, OPTICAL OXYGEN, ALACE, 7000m
8. Installed NEW data / I/O Y-cable.
9. Installed new 4-pin to 4-ping wet-pluggable interface cable.
10. Install NEW SBE 63 sensor mount kit / flow chamber for SEACATs, wet-pluggable MCBH connector
11. Performed complete system check and full diagnostic evaluation.
12. Installed NEW AF24173 Anti-foulant cylinder(s).

Special Notes:

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Upgraded to Wet-pluggable Style Connectors and RS-485 Protocol.

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SENSOR SERIAL NUMBER: 6812
CALIBRATION DATE: 14-Jan-14

SBE16plusV2 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.246262e-003
a1 = 2.572556e-004
a2 = -1.720709e-008
a3 = 1.354772e-007

BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	729576.364	1.0000	0.0000
4.5000	651893.400	4.5000	-0.0000
15.0000	454785.600	15.0000	0.0000
18.5000	400886.100	18.5000	-0.0000
24.0000	327116.700	24.0000	0.0000
29.0000	270552.800	29.0000	-0.0000
32.5000	236236.182	32.5000	0.0000

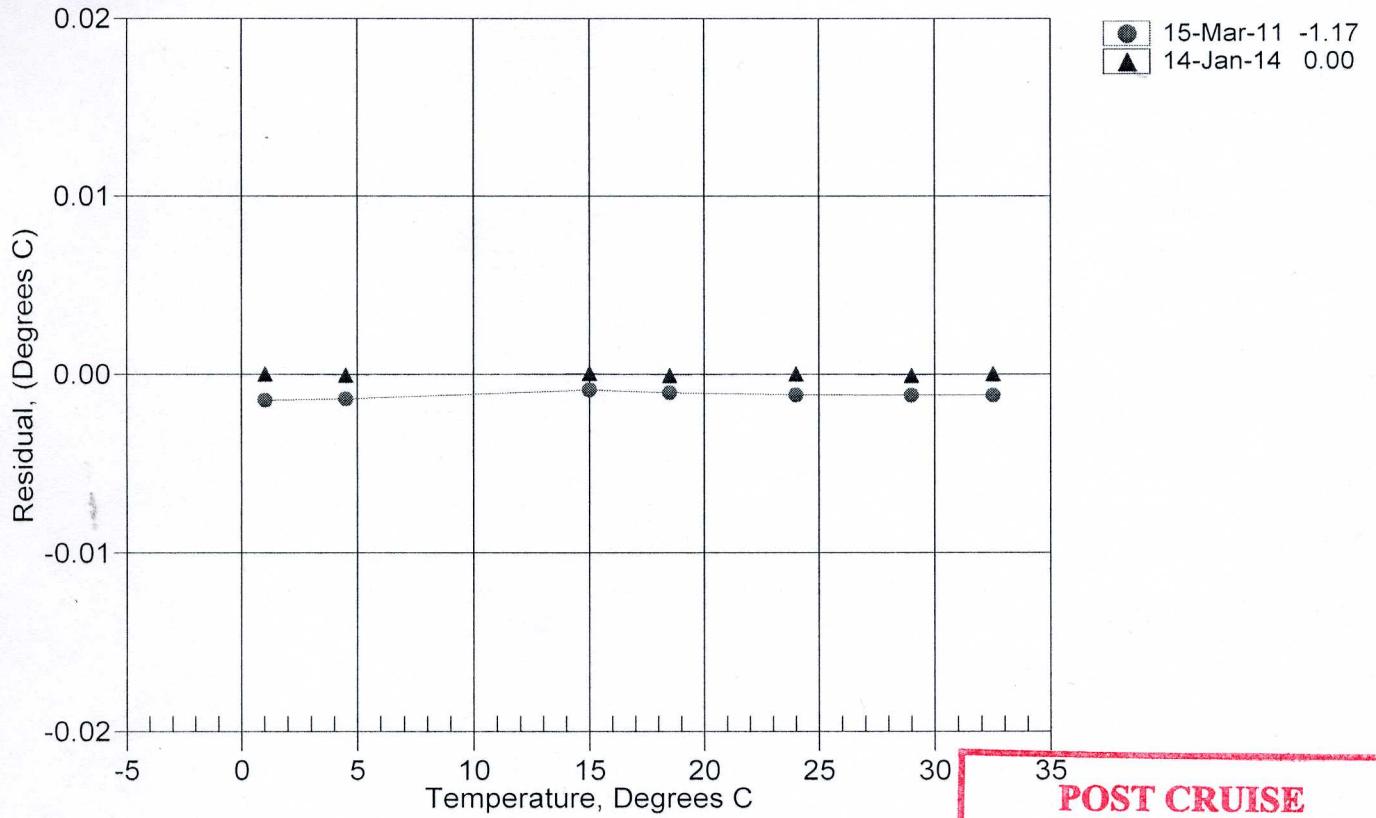
$$MV = (n - 524288) / 1.6e+007$$

$$R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)$$

$$\text{Temperature ITS-90} = 1/\{a0 + a1[\ln(R)] + a2[\ln^2(R)] + a3[\ln^3(R)]\} - 273.15 \text{ } (\text{°C})$$

Residual = instrument temperature - bath temperature

Date, Delta T (mdeg C)



POST CRUISE
CALIBRATION

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SENSOR SERIAL NUMBER: 6812
CALIBRATION DATE: 14-Jan-14

SBE16plusV2 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -1.025167e+000

CPcor = -9.5700e-008

h = 1.596713e-001

CTcor = 3.2500e-006

i = -2.443566e-004

j = 4.270503e-005

BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2536.61	0.0000	0.00000
1.0000	34.7048	2.96734	5002.88	2.9674	0.00002
4.5000	34.6857	3.27361	5190.64	3.2736	-0.00002
15.0000	34.6442	4.25273	5749.31	4.2527	-0.00002
18.5000	34.6356	4.59698	5933.02	4.5970	0.00001
24.0000	34.6263	5.15348	6218.26	5.1535	0.00003
29.0000	34.6206	5.67386	6473.32	5.6738	-0.00002

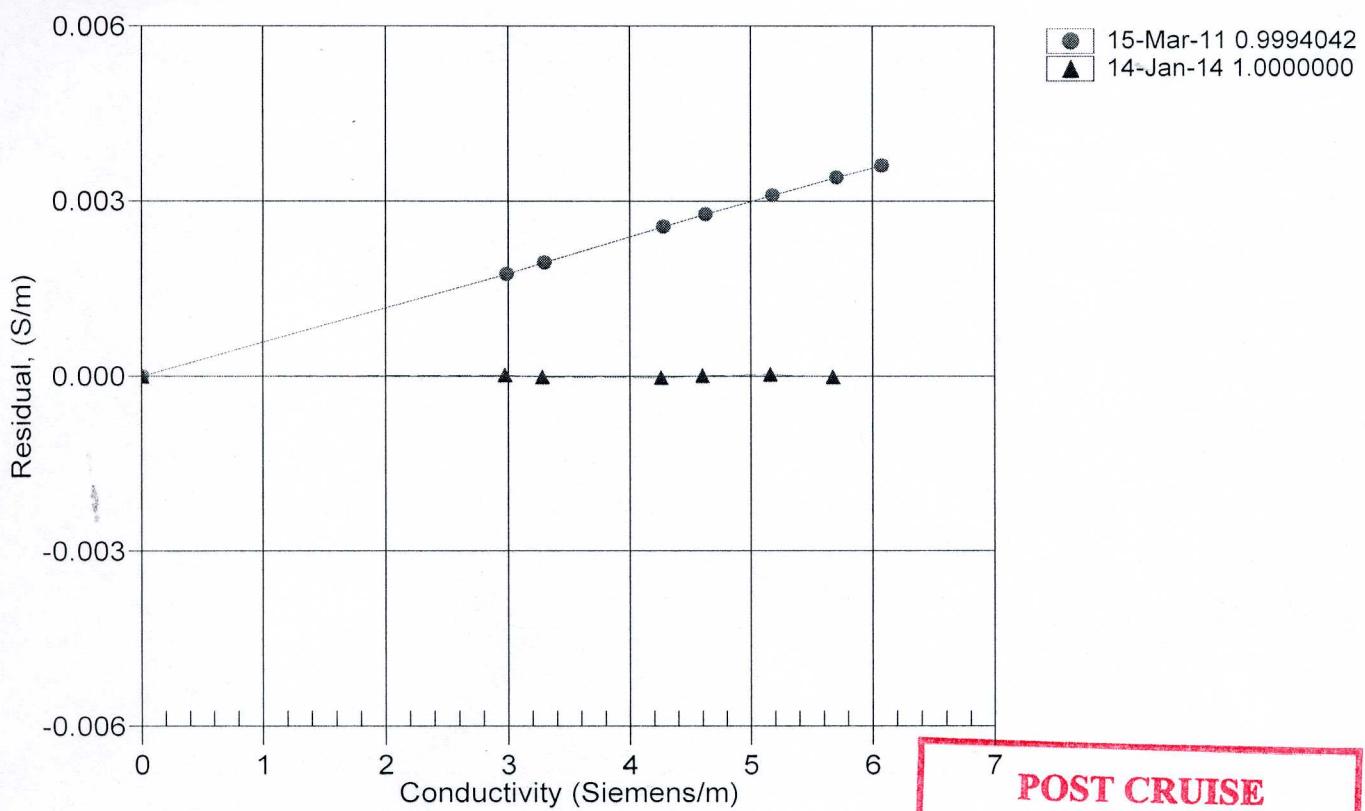
$$f = \text{INST FREQ} / 1000.0$$

$$\text{Conductivity} = (g + hf^2 + if^3 + jf^4) / (1 + \delta t + \epsilon p) \text{ Siemens/meter}$$

t = temperature[°C]; p = pressure[decibars]; δ = CTcor; ϵ = CPcor;

Residual = instrument conductivity - bath conductivity

Date, Slope Correction



POST CRUISE
CALIBRATION

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SENSOR SERIAL NUMBER: 6812
CALIBRATION DATE: 13-Jan-14

SBE16plusV2 PRESSURE CALIBRATION DATA
160 psia S/N 3220340

COEFFICIENTS:

PA0 =	3.392070e-002	PTCA0 =	5.248589e+005
PA1 =	4.897616e-004	PTCA1 =	9.025142e+000
PA2 =	-4.904618e-012	PTCA2 =	-2.777154e-001
PTEMPA0 =	-6.554898e+001	PTCB0 =	2.493125e+001
PTEMPA1 =	5.243771e+001	PTCB1 =	-5.500000e-004
PTEMPA2 =	-3.632060e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.84	555129.0	1.7	14.83	-0.01
30.12	586395.0	1.7	30.13	0.01
60.10	647640.0	1.7	60.09	-0.01
95.11	719320.0	1.7	95.10	-0.00
125.11	780836.0	1.7	125.10	-0.01
160.11	852711.0	1.7	160.12	0.00
125.12	780869.0	1.7	125.12	0.00
95.12	719382.0	1.7	95.13	0.01
60.11	647692.0	1.7	60.11	-0.00
30.13	586445.0	1.7	30.16	0.02
14.84	555141.0	1.7	14.83	-0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.90	555753.36
29.00	1.83	555774.28
24.00	1.73	555796.94
18.50	1.62	555817.35
15.00	1.55	555828.82
4.50	1.35	555788.82
1.00	1.28	555751.31
TEMP (ITS90)		SPAN (mV)
-5.00		24.93
35.00		24.91

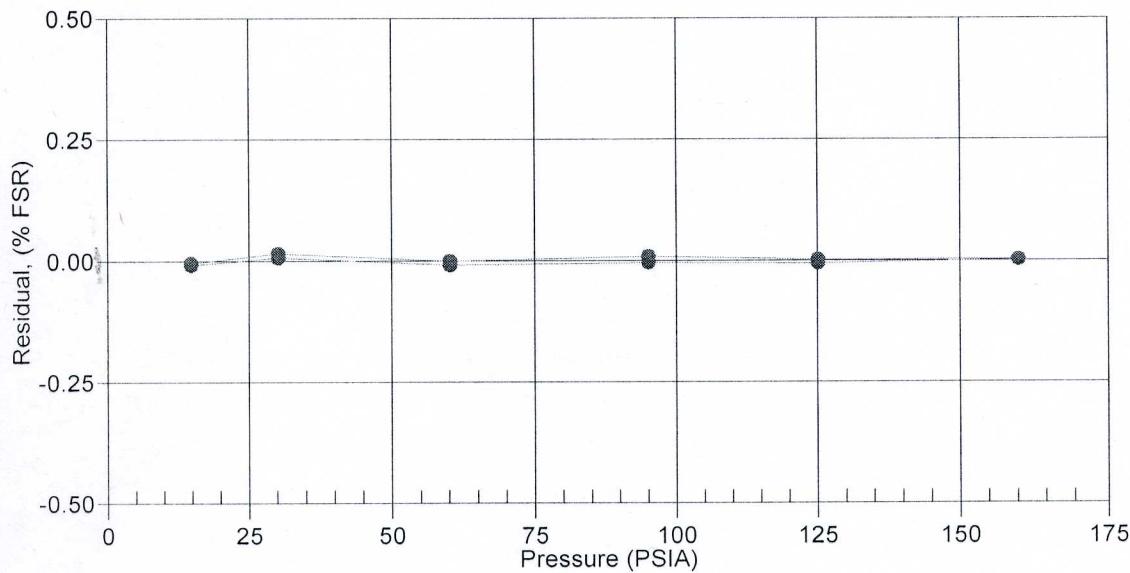
$$y = \text{thermistor output}; t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$$

$$x = \text{pressure output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$$

$$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$$

$$\text{pressure (psia)} = PA0 + PA1 * n + PA2 * n^2$$

Date, Avg Delta P %FS



13-Jan-14 -0.00



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Temperature Calibration Report

Customer:	University of Victoria, British Columbia		
Job Number:	75766	Date of Report:	1/14/2014
Model Number:	SBE 16Plus	Serial Number:	16P62761-6812

Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.

An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.

'AS RECEIVED CALIBRATION'

Performed Not Performed

Date: 1/14/2014

Drift since last cal: +0.00041 Degrees Celsius/year

Comments:

'CALIBRATION AFTER REPAIR'

Performed Not Performed

Date: []

Drift since Last cal: [] Degrees Celsius/year

Comments:



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Conductivity Calibration Report

Customer:	University of Victoria, British Columbia		
Job Number:	75766	Date of Report:	1/14/2014
Model Number:	SBE 16Plus	Serial Number:	16P62761-6812

Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.

An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.

'AS RECEIVED CALIBRATION'

Performed Not Performed

Date: 1/14/2014

Drift since last cal:

-0.00050

PSU/month*

Comments:

'CALIBRATION AFTER CLEANING & REPLATINIZING'

Performed Not Performed

Date: []

Drift since Last cal:

[]

PSU/month*

Comments:

*Measured at 3.0 S/m

Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.

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SENSOR SERIAL NUMBER: 0638
CALIBRATION DATE: 04-Feb-14

SBE 63 OXYGEN CALIBRATION DATA

COEFFICIENTS

A0 = 1.0513e+000	B0 = -2.3325e-001	C0 = 9.6232e-002	E = 1.1000e-002
A1 = -1.5000e-003	B1 = 1.6728e+000	C1 = 4.0705e-003	
A2 = 4.5212e-001		C2 = 5.4441e-005	

BATH OX (ml/l)	BATH TEMP ITS-90	BATH SAL PSU	INSTRUMENT OUTPUT(U)	INSTRUMENT OXYGEN(ml/l)	RESIDUAL (ml/l)
0.888	30.00	0.00	29.49	0.890	0.001
0.942	26.00	0.00	30.04	0.941	-0.001
0.976	20.00	0.00	31.28	0.975	-0.002
1.079	12.00	0.00	32.74	1.075	-0.003
1.139	6.00	0.00	34.03	1.140	0.001
1.266	2.00	0.00	34.54	1.271	0.005
2.364	30.00	0.00	22.07	2.371	0.006
2.481	26.00	0.00	22.70	2.486	0.005
2.644	20.00	0.00	23.81	2.646	0.001
3.172	12.00	0.00	24.75	3.168	-0.004
3.581	6.00	0.00	25.74	3.579	-0.002
3.855	30.00	0.00	18.31	3.859	0.005
3.909	2.00	0.00	26.46	3.905	-0.004
4.062	26.00	0.00	18.85	4.066	0.003
4.458	20.00	0.00	19.65	4.459	0.001
5.197	12.00	0.00	20.73	5.193	-0.004
5.331	30.00	0.00	16.02	5.324	-0.007
5.700	26.00	0.00	16.40	5.694	-0.006
5.970	6.00	0.00	21.53	5.971	0.001
6.493	20.00	0.00	16.84	6.497	0.005
6.574	2.00	0.00	22.15	6.570	-0.004
7.358	12.00	0.00	18.02	7.356	-0.002
8.447	6.01	0.00	18.76	8.450	0.004
8.952	2.00	0.00	19.63	8.954	0.003

$$V = U / 39.457071$$

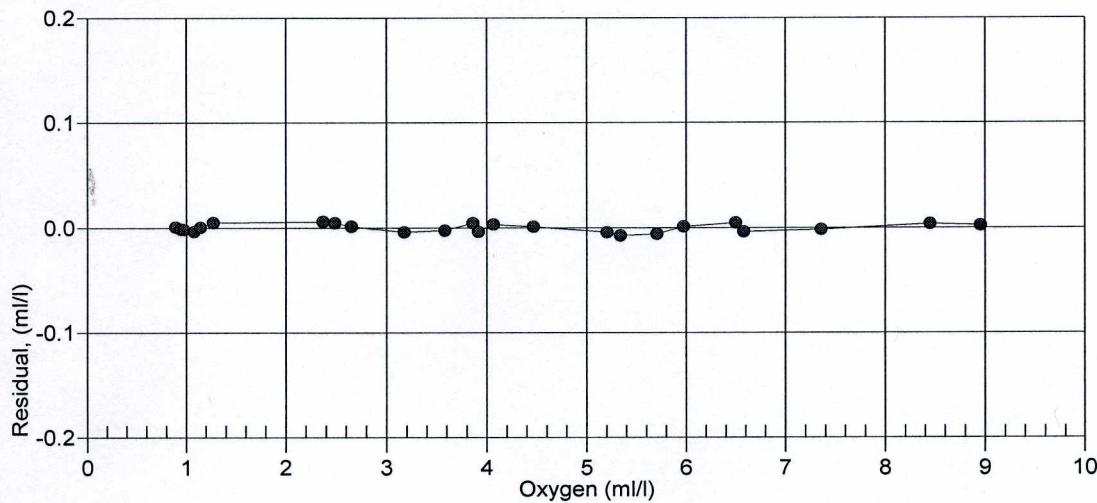
$$\text{Oxygen (ml/l)} = \{((A0 + A1 * T + A2 * V^2) / (B0 + B1 * V) - 1.0) / (C0 + C1 * T + C2 * T^2) \} * \exp(E * P / K)$$

T = temperature [deg C], K = temperature [Kelvin], P = pressure [dbar]

Residual = instrument oxygen - bath oxygen

Date, Delta Ox (ml/l)

04-Feb-14 1.0000



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SENSOR SERIAL NUMBER: 0638
CALIBRATION DATE: 04-Feb-14

SBE 63 OXYGEN CALIBRATION DATA

COEFFICIENTS

TA0 = 7.041184e-004 TA2 = 3.756086e-007
TA1 = 2.531937e-004 TA3 = 1.092564e-007

BATH TEMP (ITS-90)	INSTRUMENT OUTPUT	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.9999	1.12063	2.0005	0.00064
1.9999	1.12067	1.9993	-0.00059
2.0000	1.12066	1.9996	-0.00038
2.0001	1.12063	2.0005	0.00044
6.0000	0.99565	6.0000	-0.00003
6.0000	0.99565	6.0000	-0.00003
6.0000	0.99565	6.0000	-0.00003
6.0116	0.99531	6.0114	-0.00025
11.9999	0.82882	11.9997	-0.00018
12.0000	0.82881	12.0001	0.00010
12.0000	0.82880	12.0005	0.00049
12.0001	0.82881	12.0001	0.00000
19.9999	0.64423	19.9998	-0.00011
20.0000	0.64423	19.9998	-0.00021
20.0000	0.64423	19.9998	-0.00021
20.0001	0.64422	20.0003	0.00017
25.9998	0.53180	26.0000	0.00024
26.0000	0.53180	26.0000	0.00004
26.0000	0.53180	26.0000	0.00004
26.0001	0.53180	26.0000	-0.00006
29.9998	0.46780	30.0001	0.00030
29.9999	0.46781	29.9994	-0.00047
30.0000	0.46780	30.0001	0.00010
30.0001	0.46780	30.0001	-0.00000

$$\text{Temperature ITS-90} = 1 / (\text{TA0} + \text{TA1} * L + \text{TA2} * L^2 + \text{TA3} * L^3) - 273.15 \text{ (}^\circ\text{C)}$$

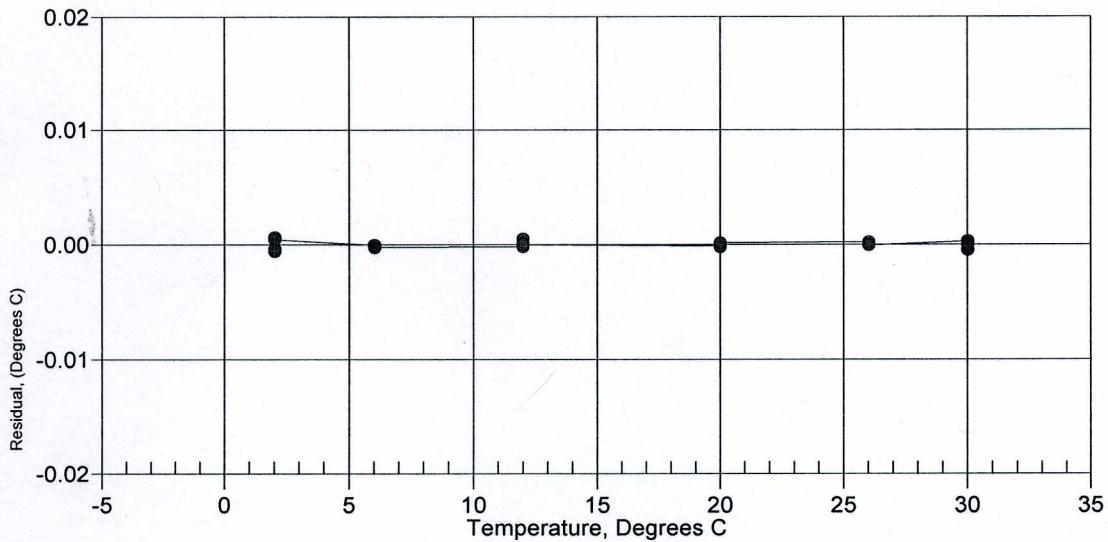
$$L = \ln(100000 * V / (3.3 - V))$$

V = thermistor voltage

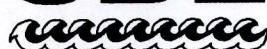
Residual = instrument temperature - bath temperature

Date, Delta Ox (ml/l)

04-Feb-14 -0.00



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Pressure Test Certificate

Customer University of Victoria, British Columbia

Job Number 75766

Date 1/13/2014

Technician JK

Serial Number 1662761-6812

Low Pressure (PSI) 50 PSI

Time (Minutes) 30 Minutes

High Pressure (PSI) - PSI

Time (Minutes) - Minutes

Pass

Fail

Comments

Installed all new wet-pluggable connectors. Replaced the main piston "O"-Rings. *The unit is not designed for high pressure applications.

High pressure is generally equal
to the maximum depth rating of
the instrument.

