



Sea-Bird Electronics, Inc.  
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## SBE Pressure Test Certificate

Test Date: 11/23/2009 Description SBE-49 FastCat Sensor

Job Number: 56495 Customer Name Sea Research Foundation

### SBE Sensor Information:

Model Number: 49  
Serial Number: 0115

### Pressure Sensor Information:

Sensor Type: Kistler  
Sensor Serial Number: 2076577  
Sensor Rating: 10153

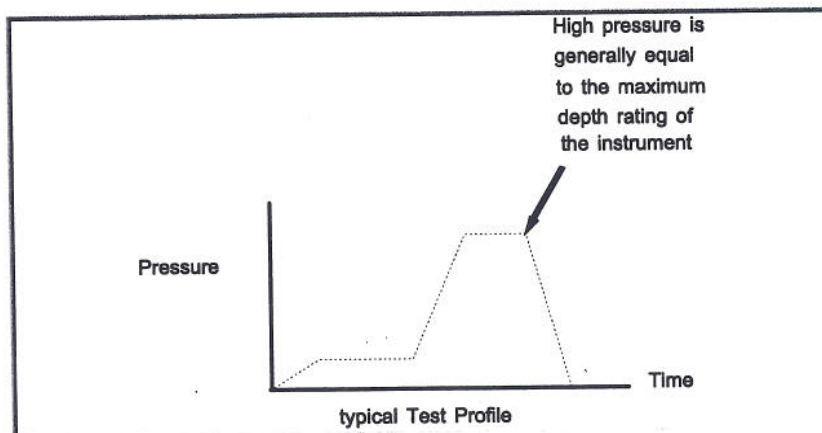
### Pressure Test Protocol:

Low Pressure Test: 40 PSI Held For 15 Minutes

High Pressure Test: 10000 PSI Held For 15 Minutes

Passed Test:

Tested By: VG



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SENSOR SERIAL NUMBER: 0115  
 CALIBRATION DATE: 19-Nov-09

-SBE 49 PRESSURE CALIBRATION DATA  
 10153 psia S/N 2076577

**COEFFICIENTS:**

PA0 = -1.662409e+000	PTCA0 = 5.241555e+005
PA1 = 3.025247e-002	PTCA1 = -7.235732e+000
PA2 = 1.873272e-009	PTCA2 = 1.997508e-001
PTEMPA0 = -8.974488e+001	PTCB0 = 1.017461e+002
PTEMPA1 = 4.325387e+001	PTCB1 = -7.429780e-003
PTEMPA2 = 8.599733e-001	PTCB2 = 0.000000e+000

**PRESSURE SPAN CALIBRATION**

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.48	524644.0	2.4	15.09	0.01
2014.95	590299.0	2.4	2012.57	-0.02
4015.01	655521.0	2.4	4012.95	-0.02
6015.07	720281.0	2.4	6015.00	-0.00
8015.25	784500.0	2.4	8015.90	0.01
10015.58	848120.0	2.4	10013.44	-0.02
8015.09	784548.0	2.4	8017.41	0.02
6014.99	720338.0	2.4	6016.79	0.02
4014.79	655589.0	2.4	4015.07	0.00
2014.77	590357.0	2.4	2014.36	-0.00
14.47	524671.0	2.4	15.89	0.01

**THERMAL CORRECTION**

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	2.68	524746.17
29.00	2.61	524726.62
24.00	2.50	524710.90
18.50	2.39	524703.66
15.00	2.31	524706.15
4.50	2.09	524742.22
1.00	2.02	524761.48

TEMP (ITS90)	SPAN (mV)
-5.73	101.79
34.00	101.49

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

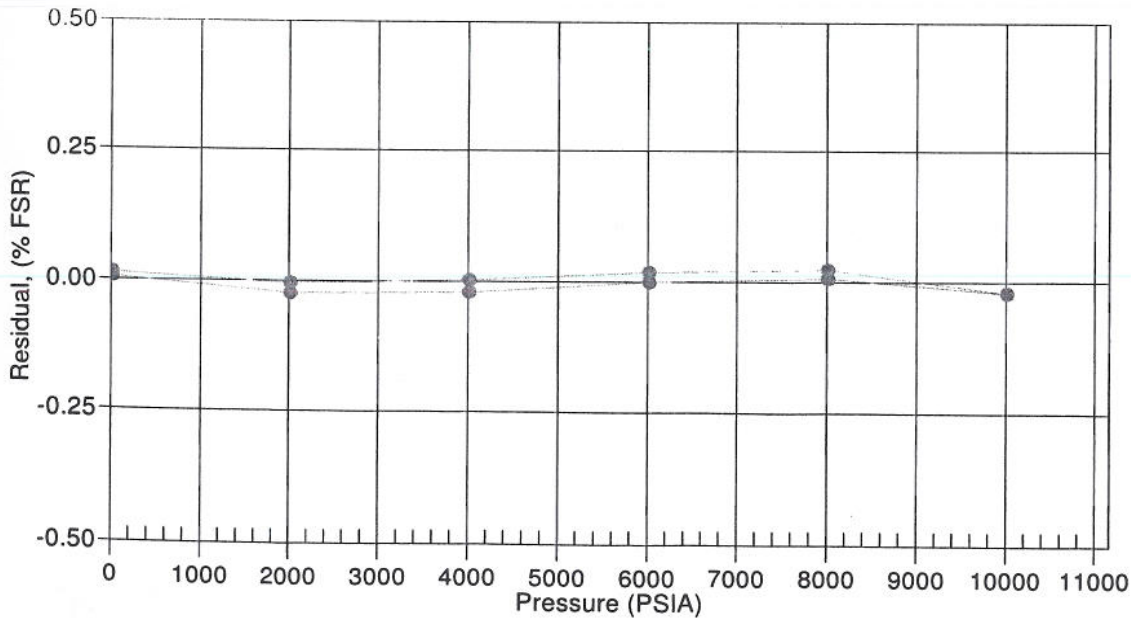
$x = \text{pressure output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$

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

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

Date, Avg Delta P %FS

● 19-Nov-09 0.00



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SENSOR SERIAL NUMBER: 0115  
 CALIBRATION DATE: 27-Nov-09

SBE 49 TEMPERATURE CALIBRATION DATA  
 ITS-90 TEMPERATURE SCALE

**ITS-90 COEFFICIENTS**

a0 = 8.364753e-004  
 a1 = 2.800022e-004  
 a2 = -1.899482e-006  
 a3 = 1.855098e-007

BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	753215.458	1.0001	0.0001
4.5000	667694.458	4.4998	-0.0002
15.0000	449872.627	15.0002	0.0002
18.5000	389988.661	18.4999	-0.0001
24.0000	307687.356	24.0000	-0.0000
29.0001	244248.881	29.0000	-0.0001
32.5001	205586.864	32.5002	0.0001

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

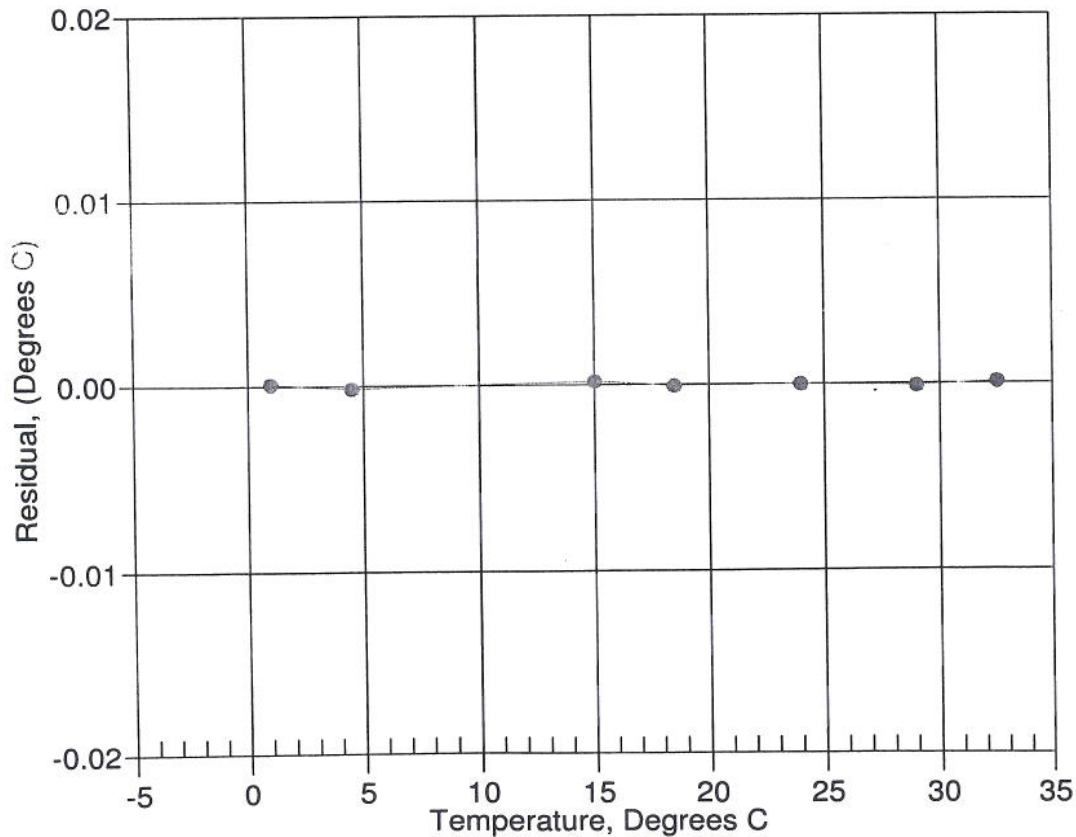
$$R = (MV * 2.295e+010 + 9.216e+008) / (6.144e+004 - MV * 5.3e+005)$$

$$\text{Temperature ITS-90} = 1 / \{a_0 + a_1[\ln(R)] + a_2[\ln^2(R)] + a_3[\ln^3(R)]\} - 273.15 \text{ (}^\circ\text{C)}$$

$$\text{Residual} = \text{instrument temperature} - \text{bath temperature}$$

Date, Delta T (mdeg C)

27-Nov-09 0.00





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SBE 49 CONDUCTIVITY CALIBRATION DATA  
 PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -9.897387e-001	CPcor = -9.5700e-008
h = 1.297445e-001	CTcor = 3.2500e-006
i = -2.106902e-004	
j = 3.571914e-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	2765.25	0.0000	0.00000
1.0000	34.6359	2.96201	5520.47	2.9620	0.00002
4.5000	34.6159	3.26767	5729.12	3.2677	-0.00001
15.0000	34.5726	4.24487	6349.43	4.2449	-0.00002
18.5000	34.5635	4.58844	6553.24	4.5884	0.00000
24.0000	34.5537	5.14386	6869.56	5.1439	0.00000
29.0001	34.5485	5.66338	7152.39	5.6634	0.00003
32.5001	34.5462	6.03420	7347.33	6.0342	-0.00002

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

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

t = temperature[°C]; p = pressure[decibars];  $\delta$  = CTcor;  $\epsilon$  = CPcor;

Residual = instrument conductivity - bath conductivity

Date, Slope Correction

27-Nov-09 1.0000000

