

## SEA-BIRD ELECTRONICS, INC.

1808 - 136th Place Northeast, Bellevue, Washington 98005 USA Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

## Conductivity Calibration Report

Customer:	ExplorOcean	71-71-				
Job Number:	29758R	Da	te of Re	eport:	23	3-Jul-02
Model Number:	SBE 04C	Ser	ial Nui	nber:	0	41912
sensor drift. If the content of the conductivity. Users a confliction duration confliction duration confliction of the confl	alibration identifies a p k is completed. The 'as tomer request. bration certificate is pro nust choose whether th ring deployment. In SI lows small corrections j	d 'as received', without clear problem or indicates cell clear received' calibration is not ovided, listing the coefficient is received' calibration EASOFT enter the chosen of for drift between calibration	eaning is t perform nts used or the pr coefficien ns (consu	necessary, the sens to convert sens evious calibrate using the p	ten a secon for is dama asor freque ation better program Si	nd calibration is iged or non- ency to represents the EACON. The
coefficients obtained 'AS RECEIVED' (		ing apply only to subseque		erformed	⊹⊟ M	ot Performed
Date: 19-Jul-(	02	Drift since last ca	d:	0001	0	PSU/month
Comments: CALIBRATION A	IFTER CLEANING	& REPLATINIZING'	□ pe	rformed	<b>☑</b> No	ot 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.

1808 136th Place N.E., Bellevue, Washington 98005 **USA** Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 19-Jul-02s

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

#### **GHIJ COEFFICIENTS**

= -4.16212062e+00h 5.36713913e-01 = -7.86598365e-046.80295512e-05

CPcor = -9.57e-08 (nominal) CTcor = 3.25e-06 (nominal)

#### ABCDM COEFFICIENTS

4.05489283e-07 5.33927267e-01 c = -4.15327127e+00d = -1.01626355e-04m =

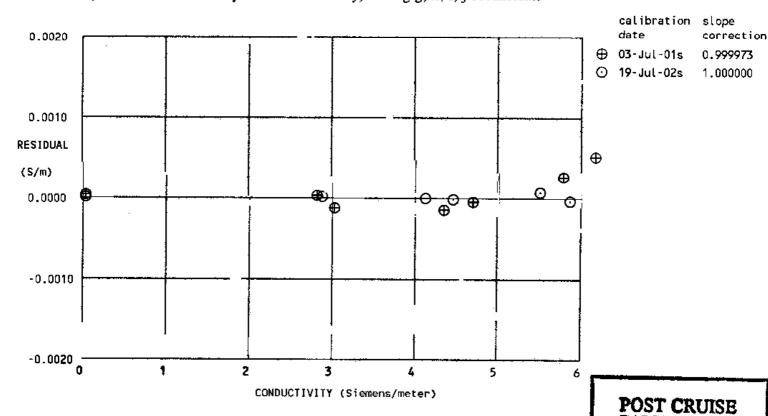
5.6

CPcor = -9.57e-08 (nominal)

CALIBRATION

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78908	-0.00000	-0.00000
0.9998	33.1901	2.84980	7.81531	2.84981	0.00001
14.9998	33.1920	4.09279	9.17870	4.09278	-0.00001
18.4998	33.1925	4.42550	9.50992	4.42548	-0.00002
28.9998	33.1923	5.46536	10.47636	5.46543	0.00007
32.4999	33.1915	5.82374	10,78870	5.82370	-0.00004

Conductivity =  $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter t = temperaure [deg C]; p = pressure [decibars];  $\delta$  = CTcor;  $\epsilon$  = CPcor; Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



1808 136th Place N.E., Bellevue, Washington Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 03-Jul-01s

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

#### GHII COEFFICIENTS

-4.15735241e+00 5.35433598e-01 i = -5.20267488e - 045.37516311e-05 CPcor = -9.57e-08 (nominal) CTcor = 3.25e-06 (nominal)

#### ABCDM COEFFICIENTS

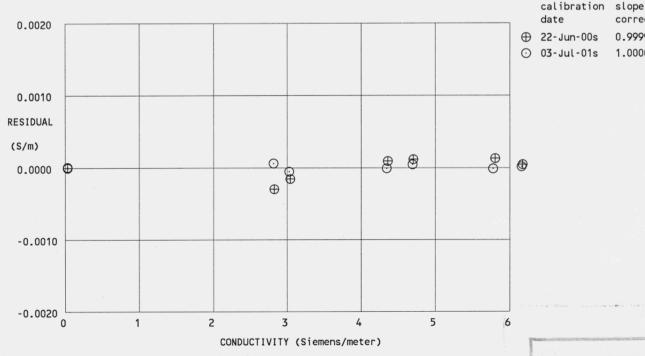
1.84247967e-06 5.33689095e-01 c = -4.15196342e+00d = -8.34682636e - 055.0 CPcor = -9.57e-08 (nominal)

BATH TEMP (IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78917	-0.00000	-0.00000
-1.4213	35.0258	2.78410	7.73645	2.78415	0.00005
1.0394	35.0285	2.99578	7.98753	2.99572	-0.00006
15.2077	35.0298	4.31511	9.40118	4.31509	-0.00002
18.6889	35.0296	4.66219	9.73849	4.66223	0.00004
29.1152	35.0295	5.74482	10.72092	5.74480	-0.00002
32.6810	35.0247	6.12693	11.04632	6.12694	0.00001

Conductivity =  $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^{m} + bf^{2} + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter

t = temperaure [deg C]; p = pressure [decibars];  $\delta$  = CTcor;  $\epsilon$  = CPcor;

Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



date correction ⊕ 22-Jun-00s 0.999997 ○ 03-Jul-01s 1.000000

# SBE

## BE SEA-BIRD ELECTRONICS, INC.

1808 - 136th Place Northeast, Bellevue, Washington 98005 USA Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

## Conductivity Calibration Report

Customer:	British Antarctic Sur	vey					
Iob Number:	26329R	Da	ite of	Report:	09-	Jul-01	
Model Number:	SBE 04C	Se	rial N	umber:	04	1912	
sensor drift. If the coperformed after wor, functional, or by cus An 'as received' calicanductivity. Users to sensor condition due coefficient 'slope' al	are normally calibrated alibration identifies a property is completed. The 'as restomer request.  bration certificate is provenust choose whether the bring deployment. In SEA lows small corrections for lafter a repair or cleaning	oblem or indicates cell of eceived' calibration is no idea, listing the coefficities received' calibration as of the chosen of the chosen of the calibration of the chosen of the chosen of the chosen calibration.	eleaning of perfo	g is necessary, the sensormed if the sensored to convert sensored to convert sensored to contact the sensored the provious the property the SEASO	en a second or is damage sor frequence tion better is program SE.	cy to represents the ACON. The	f
'AS RECEIVED'		g upply only to subsequ		Performed	□ Not	t Performed	
Date: 03-Jul-	01	Drift since last o	al:	0		PSU/month	*
Comments: 'CALIBRATION	AFTER CLEANING &	. REPLATINIZING'		performed	<b>✓</b> No	t Performed	
Date:		Drift since last ca	l:			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.

## SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 22-Jun-00s CONDUCTIVITY CALIBRATION DATA PSS 1978: C(35,15,0) = 4.2914 Signers/meter

#### GHIJ COEFFICIENTS

g = -4.16390422e+00 h = 5.36973955e-01 i = -8.02788477e-04 j = 6.71130207e-05 CPcor = -9.57e-08 (nominal)

CPcor = -9.57e-08 (nominal) CTcor = 3.25e-06 (nominal)

#### ABCDM COEFFICIENTS

a = 3.79038239e-07 b = 5.34024350e-01 c = -4.15388528e+00 d = -7.71306709e-05

m = 5.6

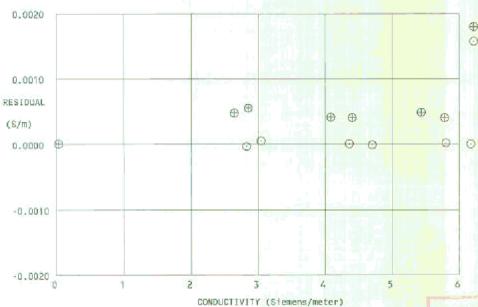
CPcor = -9.57e-08 (nominal)

(IPTS-68 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	(Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.78913	0.00000	0.00000
-1.3777	35.1134	2.79412	7.74809	2.79408	-0.00004
1.1617	35.1132	3.01301	8.00750	3.01306	0.00005
15.2815	35.1132	4.33159	9.41757	4.33159	0.00000
18.7194	35.1128	4.67514	9.75090	4.67512	-0.00002
29.2630	35.1102	5.77235	10.74483	5.77236	0.00001
32.7023	35.1055	6.14175	11.05876	6.14174	-0.00001

Conductivity =  $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter

 $t = temperaure [deg C]; p = pressure [decibars]; \delta = CTcor; \epsilon = CPcor;$ 

Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



calibration slope date correction

⊕ 22-Jun-99s 0.999903 ⊙ 22-Jun-00s 1.000000



\*Measured at 3.0 S/m

Customer:

British Antarctic Survey

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## Conductivity Calibration Report

Job Nu	mber:	23157R		Date of Rep	ort:	26-J	un-00
Model	Number:	SBE 04C	S	erial Num	ber:	041	1912
sensor di performe	rift. If the calibra	ntion identifies a p completed. The 'as i	d 'as received', without of roblem or indicates cell received' calibration is i	cleaning is n	ecessary, the	en a second	calibration is
conducti sensor co coefficies coefficies	vity. Users must condition during a nt 'slope' allows s	choose whether the deployment. In SE small corrections fo a repair or cleaning	vided, listing the coeffic 'as received' calibration ASOFT enter the chose or drift between calibration on apply only to subsequent	m or the prev in coefficients tions (consult uent data.	ious calibrat using the pi	ion better 1 rogram SEA FT manual)	represents the ACON. The
Date:	22-Jun-00		Drift since last		+.00020		PSU/month*
Comme	ents:				F- 4-1		
'CALIB	RATION AFTE	ER CLEANING &	& REPLATINIZING	□ perj	formed	✓ Not	Performed
Date:			Drift since last ca	ıl:			PSU/month*
Comme	ents:						

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.

SBE SEA-BIRD ELECTRONICS, INC TELEPHONE 206 643-9866 FAX 206 643-9954 1808-136th Place Northeast, Bellevue, Washington 98005 USAslex 292915 SBEI UR

## Conductivity Calibration Report

Date of report: 23 June 1999

Customer: ExplorOcean

SBE Job Number: 21241R

calibration using the replacement cell.

SBE M	odel Number:	4C	Se	erial Number:0	41912
'as rece If calib replatir	rived', i.e, withou pration uncovers lize the cell electr	rise and if received intact (not t cleaning or other processing problems with the sensor o odes, a second calibration w	that would preven r demonstrates the ill be performed a	at determination of the se e need to clean the co fter the necessary wor	sensor's drift history. conductivity cell and k is finished.
		ion certificate listing the coef judge whether the 'as receive			
represe	nt the condition of	of the sensor at the time of ON). Calibration coefficients	deployment (those	using SEASOFT sho	uld enter the chosen
		with data collected subseque			and replantizing the
'AS RI	CEIVED CALIB	RATION'		(x) Performed	() Not Performed
Date: _	22 Jun 99	Drift since last cal:	.00050	2	[PSU]/month!
Comme	ents:				
POST	CLEANING/REI	PLATINIZING CALIBRATI	ON,	() Performed	(x) Not Performed
Date: _		Drift since initial cal: <sup>2</sup>			[PSU]/month <sup>2</sup>
Comme	ents:				
<sup>1</sup> Measu	red at 3.0 S/m				
in post of the s	cleaning/replatini ensor interface ci	ng tend to 'reset' the conduct zing calibration is an indicate rcuits. 'Drift since initial ca	or of geometric sta l' is the total drift	ability of the cell and t from date of the senso	he electrical stability or's initial calibration
cat time	e or manuracture)	except where the cell has b	een repraced in w	mich case the drift is	referenced to the 1st

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SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 22-Jun-99s

= -4.15963737e+00

i = -6.52854797e-04

5.36060167e-01

6.04284482e-05

BATH SAL

0.0000

32.6323

32.6328

32.6325

32.6297

32.6290

32.6247

(PSU)

GHIJ COEFFICIENTS

BATH TEMP

0.0000

-1.3982

15.2601

18.6976

29.2409

32.6804

1.1410

(IPTS-58 °C)

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

ABCDM COEFFICIENTS

6.57219895e-07 5.33832392e-01 c = -4.15294552e+00

d = -8.76614983e-05

CPcor = -9.57e-08 (nominal)CTcor = 3.25e-06 (nominal)

(Siemens/m)

0.00000

2.61258

2.81792

4.05467

4.37665

5.40620

5.75284

BATH COND

2.78913

7.52682

7.77744

9.14027

9.46241

10.42446

10.72837

(kHz)

5.4

2.61254

2.81797

4.05465

CPcor = -9.57e-08 (nominal)

RESIDUAL

INST COND

(Siemens/m)

INST FREO (Siemens/m)

-0.00000

-0.00000 -0.00004 0.00005

-0.00002

-0.00002 0.00006

calibration

date

0

⊕ 20-Aug-98s

22-Jun-99s

slope

correction

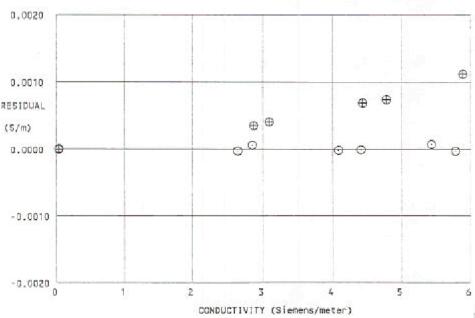
0.999827

1.000000

4.37663 5.40626 5.75280 -0.00004

Conductivity =  $(g + hf^2 + if^3 + if^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter  $t = \text{temperature [deg C]}; p = \text{pressure [decibars]}; \delta = \text{CTcor}; \epsilon = \text{CPcor};$ 

Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



CALGRATIO:

SEA-BIRD ELECTRONICS, INC TELEPHONE 206 643-9866 FAX 206 643-9954 SBE 1808-136th Place Northeast, Bellevue, Washington 98005 USA Telex 292915 SBEI UR Conductivity Calibration Report **ExplorOcean** Customer:

SBE Job Number: 18993R Date of report: 21 August 1998 SBE Model Number: 4C Serial Number: 041912 Unless instructed otherwise and if received intact (not broken) and functional, conductivity sensors are calibrated

'as received', i.e., without cleaning or other processing that would prevent determination of the sensor's drift history. If calibration uncovers problems with the sensor or demonstrates the need to clean the conductivity cell and replatinize the cell electrodes, a second calibration will be performed after the necessary work is finished. An 'as received' calibration certificate listing the coefficients used to convert sensor frequency to conductivity will

be provided. Users may judge whether the 'as received' or previously determined coefficients are more likely to represent the condition of the sensor at the time of deployment (those using SEASOFT should enter the chosen coefficients using SEACON). Calibration coefficients obtained after a repair or after cleaning and replatinizing the

cell should only be used with data collected subsequent to the calibration. 'AS RECEIVED CALIBRATION'

(x) Performed ( ) Not Performed [PSU]/month1

Date: 23 Jul 98 Drift since last cal: .00050

Comments: The conductivity cell was accidently damaged during the C&P process.

'POST REPAIR CALIBRATION' (x) Performed () Not Performed Date: 20 August 98 Drift since initial cal: 2 N/A [PSU]/month<sup>2</sup> Comments: Replaced conductivity cell.

Measured at 3.0 S/m

<sup>2</sup>Cleaning and replatinizing tend to 'reset' the conductivity sensor to its original condition. Therefore, lack of drift in post cleaning/replatinizing calibration is an indicator of geometric stability of the cell and the electrical stability

of the sensor interface circuits. 'Drift since initial cal' is the total drift from date of the sensor's initial calibration (at time of manufacture) except where the cell has been replaced in which case the drift is referenced to the 1st calibration using the replacement cell.

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SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 23-Jul-98s

-4.10035725e+00

-5.01656489e-04

5.27756359e-01

5.05619988e-05

CPcor = -9.57e - 08 (nominal)

GHU COEFFICIENTS

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

#### ABCDM COEFFICIENTS

1.68967579e-06

5.26031426e-01 c = -4.09475384e+00

-8.02851481e-05 5.0

CPcor = -9.57e - 08(nominal)

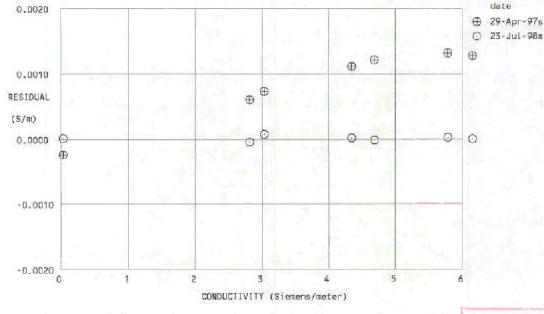
CTcor = 3.25e-06 (nominal) BATH TEMP BATH SAL BATH COND INST FREQ INST COND

RESIDUAL (IPTS-68 °C) (PSU) (Siemens/m) (kHz) (Siemens/m) (Siemens/m) 0.0000 0.0000 0.00000 2.79003 0.00000 0.00000 -1.409935.0069 2.78370 7.78528 2.78365 -0.00005 1.1279 35,0083 3.00192 8.04644 3.00198 0.00006 15.2469 35.0085 4.31663 9.46587 4.31664 0.00001 18.6850 35.0069 4.65909 9.80134 4.65906 -0.00003 29.2277 35.0041 5.75312 10.80207 5.75314 0.00002 32.6677 35.0018 6.12193 11,11860 6.12192 -0.00001

Conductivity =  $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^{m} + bf^{2} + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter

 $t = temperaure [deg C]; p = pressure [decibars]; \delta = CTcor; \epsilon = CPcor;$ 

Residual = (instrument conductivity - bath conductivity) using g, h, i, i coefficients



calibration

stope

correction

0.999768

1.000000

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SENSOR SERIAL NUMBER = 1912 CALIBRATION DATE: 20-Aug-98s

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

#### GHIJ COEFFICIENTS

q = -4.15856853e+00h = 5.35866120e-01i = -6.20046081e-04i = 5.81708310e-05

CPcor = -9.57e-08 (nominal) CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.07033713e-06b = 5.33694920e-01c = -4.15151133e+00

d = -8.08604607e - 05

m = 5.2

CPcor = -9.57e-08 (nominal)

	1200 00 1110	mario I	OL COL -	3.376 00	(HOMITHAL)
BATH TEMP	BATH SAL	BATH COND	INST FREQ	INST COND	RESIDUAL
(IPTS-68 °C)	(PSU)	(Siemens/m)	(kHz)	(Siemens/m)	(Siemens/m)
0.0000	0.0000	0.00000	2.78909	0.00000	0.00000
-1.4115	35.7596	2.83778	7.80155	2.83777	-0.00001
1.1279	35.7612	3.06022	8.06328	3.06023	0.00001
15.2467	35.7608	4.39937	9.48535	4.39939	0.00002
18.6843	35.7598	4.74823	9.82141	4.74821	-0.00002
29.2275 32.6669	35.7590 35.7539	5.86296 6.23816	10.82401	5.86297 6.23816	0.00001

Conductivity =  $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$  Siemens/meter Conductivity =  $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$  Siemens/meter  $t = \text{temperature [deg C]}; p = \text{pressure [decibars]}; \delta = \text{CTcor}; \epsilon = \text{CPcor};$ Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients

0.0020 ⊕ 20-Aug-98s 0.0010 RESIDUAL (S/m)0.0000 0 -0.0010 -0.0020 b 2 6 3 CONDUCTIVITY (Siemens/meter)

calibration date



SEA - BIRD ELECTRONICS, INC. 1808 136th Place N.E., Bellevue, Washington 98005 USA Telephone: (206) 643-9866 Telex: 292915 SBEI UR Fax: (206)643-9954

PRI	<u> </u>	KE IES	I CE	KIIFI	CATE	
Date: 28 Jul 98						
Job # 18993R						
Model # 4C	_, 1'.					
S/N 041912						
Pressure test results:						
Low pressure (psi) Time (minutes)	50 15	psi min				
High pressure (psi) Time (minutes)	10000 30	psi min				
Pass						
Fail						
Comments:						
Replace	d Cell					
	al est	76 may 5				7
Tested by:CPE_						
				High pres generally to the ma depth rat the instru	equal aximum ting of	
Pres	ssure		/T 2			

Time

typical Test Profile