OIL STATES INDUSTRIES (UK) LTD

OIL STATES TEST LABORATORY

Trials Data Report
For the
6" Pikotek Flange Assembly
Torsion and Bending Trials
For
Pikotek (UK) Ltd

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For
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DISTRIBUTION

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UKAS TESTING
1042

SUMMARY

Oil States Industries (UK) Ltd UKAS (NAMAS) Accredited Test Laboratory successfully completed torsion, static and cyclic bending tests on a 6" Pikotek flange assembly for Pikotek (UK) Ltd. The trials were conducted in accordance with Pikotek test procedure ref: Piko 3.

The flange assembly performed well by completing a static bend and torsion test, then completing a total of 2500 dynamic reverse bending cycles at a stress range of +/- 17500psi (50% SMYS). The connector successfully past 500 and 1000v resistance tests following each part of the test programme.

The trials were witnessed part time by Lloyds representative Clinton Platt.

"Opinions and interpretations expressed herein are outside the scope of UKAS (NAMAS) accreditation".

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 The main objective of these trials was to test the 6" flange Pikotek gasket insulation set for insulation resistance and dielectric strength following mechanical testing.

1.2 One 6" class 1500 flange assembly was assembled with a Pikotek gasket set and tensioned to 30% bolt stress. One side of the flange was electrically isolated from the other by way of a non-metallic gasket and bolt sleeve/washer set.
The following tests were carried out:

1. Static Bend Tests to 75% PBYS.
2. Torsion Test to 5% PBYS.
3. Cyclic Bending, Initially 500 cycles at (50% PBYS).
4. Further 2000 Bend Cycles (50% PBYS).

Resistance testing at 500 and 1000V was carried between tests and 5000V dielectric (DC and AC) testing was carried out on completion of the test programme.

1.3 This report defines the manner in which the trials were carried out, the tabulated data, photographs and an assessment of the results obtained.

2.0 TRIALS OBJECTIVES

2.1 The overall objective was to test the electrical resistance and dielectric strength of the 6" Pikotech flange assembly following mechanical tests.

2.2 To subject the flange to a static bend test to 75% of the PBYS then measure the electrical resistance (500 and 1000V) between the two sides of the flange.

2.3 To subject the flange to a torsion test to 5% of the PBYS then measure the electrical resistance (500 and 1000V) between the two sides of the flange.

2.4 To subject the flange to 500 dynamic bend cycles to 50% PBYS then measure the electrical resistance (500 and 1000V) between the two sides of the flange

2.5 To continue with the dynamic bending cycles until a maximum of 2500 cycles are complete. Test electrical resistance after each 500 cycles.

2.6 To remove the flange assembly from the test rig and test the dielectric strength to 5000V DC between the two sides of the flange.

2.7 To disassemble the flange and inspect the gasket and insulation sleeves.

3.0 TRIALS VENUE AND DATE

3.1 The trials were carried out at Oil States Industries (UK) Ltd, UKAS, (NAMAS) Accredited Test Facility, Aberdeen, December 2001.

4.0 HARDWARE TESTED

4.1 The hardware tested comprised one 6" class 1500 Flange and Pikotek insulating gasket and sleeve set, assembled with B7 stud bolts and tensioned to produce 30% bolt stress. The flanges were welded to two 6" diameter x 5ft pup joints, grade ASTM 333, and welded to two Oil States rig adapters.

5.0 TEST EQUIPMENT

The following test equipment was utilised.

5.1 Bolt Tensioning Equipment

The flange was assembled/disassembled using hydraulic tensioners. The 12 off stud bolts were tension to 30% bolt stress.

5.2 Bending Equipment

The bend was carried out in our 300ton test rig using a four point bending arrangement. A 60tonf hydraulic actuator was used to apply the bending load and 4 bi-axial strain gauges were bonded to the casing and used to monitor the axial stress due to bending.

5.3 Torsion Equipment

The torsion test was also carried out in our 300t test rig using two 10ton hydraulic rams at 1ft moment arm to produce the necessary force. Torsional strain was monitored using a tri-axial strain gauge that was bonded to one of the casing pups that was furthest away from the applied load.

5.4 Bend Fatigue Equipment

A Dartec Fatigue actuator was mounted on top of our 300t test rig to carry out the dynamic bending cycles. This actuator is rated for 60 tonf and can apply bending loads well in excess of the structural capabilities of the 300t test rig. The actuator can be adapted to suit various test rigs within the Test Laboratory.

6.0 INSTRUMENTATION

A stress analysis computer system was used to monitor the readings from all strain gauges and pressure transducers. This is a Measurements Group System 4000 Data Acquisition Computer, incorporating a 4220 Controller Unit, a 4270 (20 channels) strain gauge scanners, one 4280 (10 channels) universal scanner for transducers, a flexible disc drive, printer and PC.

Yokogama LR4120E, 4 point Chart Recorder Serial No.

Strain gauges:	Micro measurement CEA Rosettes
Pressure transducers:	Dynisco Type
Budenberg dead weight tester:	Serial No. 18704/380

All transducer information data was recorded on floppy disk and all back up information on continuous chart recorders.
All strain gauges were calibrated and checked with a Vishay 1300 tester and strain indicator type 1550A as recognised by the British Society of Strain Measurement.
Pressure transducers were calibrated by a Budenberg dead weight tester.
All instrumentation was calibrated by calibration equipment traceable to NPL UKAS (NAMAS) National standards.
Microsoft 2000 software was utilised to produce any tabulations and/or stress/strain graphs that may be required.

7.0 TRIALS LOGIC

Description	Date Completed
Static Bend Test	06-Dec-2001
Followed by 500 and 1000V Electrical Test	
Static Torsion	06-Dec-2001
Followed by 500 and 1000V Electrical Test	
500 Dynamic Bend Cycles	06-Dec-2001
Followed by 500 and 1000V Electrical Test	
Additional 2000 Bend cycles	06-Dec-2001
Dielectric 5000V AC/DC	11-Dec-2001

8.0 TRIALS PROCEDURE AND DISCUSSION

Prior to the installation of the test assembly into the 300t test rig four bi-axial strain gauge rosettes were applied to the casing to record the bending stress, two applied at zero degree position and two applied 180° opposite. One tri-axial strain gauge was applied at 90° to the other strain gauges to measure the torsional strains.

8.1 Assembly of the Flange

8.1.1 The flange was assembled with the Pikotek gasket and sleeve set then12-0ff B7 stud bolts were tensioned to 30% bolt stress.

8.1.2 Following a satisfactory assembly the flange was subjected to electrical resistance tests of 500 and 1000V. The flange assembly was then installed into the 300t test frame and secured with ACME nuts.

8.2 Static Bend Test

8.2.1 The bend test was carried out using a 60t hydraulic actuator in a four-point bend arrangement. (See Photographs)

8.2.2 The bend was applied in 5 increments using the strain gauges to monitor the pipe axial stress. The bend was applied to produce 75% PBYS 26250psi at the top surface, held for a minute then removed in 5 decrements.

8.2.3 All data was recorded on system 4000 data acquisition computer and down loaded to Lotus Excel spreadsheets.

8.2.4 Following the bend test a repeat electrical resistance test was performed to check that there was no insulation breakdown between the two halves of the flange. The result was satisfactory and can be found in Appendix E. Calculations are presented in Appendix D.

8.3 Torsion Test

8.3.1 Following the bend test a torsion test to 5% PBYS was performed. Torsion was applied via two 10t hydraulic cylinders (See Photographs). Torsion was applied to produce 1750psi direct stress measured at 45° to the principal axis.

8.3.2 The load was removed and again the insulation resistance was measured to test the insulation. The result was satisfactory. Calculations are presented in Appendix D.

8.4 Cyclic Bend Tests

8.4.1 The hydraulic actuator was re assembled to the casing using encircled clamps to enable upward and downward stroke of the hydraulic actuator.

8.4.2 Starting at the mean or neutral axis position a static load was applied in 5 equal increments up to 50% PBYS 17500psi, first in the positive direction then in the negative direction.

8.4.3 Once the cycling limits had been established bend cycling was commenced at a cycle rate of approximately 0.25Hz, 1 cycle every 4 seconds.

8.4.4 The cycling continued until 500 cycles were complete, then the cycling was stopped and electrical resistance tests were carried out as before.

8.4.5 Bend cycling continued until a further 4 sets of 500 cycles were complete, all with electrical resistance testing between sets.

8.4.6 All the electrical resistance testing carried out produced satisfactory results with the insulation sleeves and washers showing no signs of deterioration.

8.5 Dielectric Tests

8.5.2 Following a successful test programme the Flange Assembly was completely removed from the test rig and a 5000V DC flash test was performed. The reading after 1 minute was 0.15MA.

8.5.3 Finally a 5000 V DC test was performed at WYKO Premise, Aberdeen. Two tests were carried out the first test failed at 4700V and the second failed at 3200V.

9.0 CONCLUSIONS

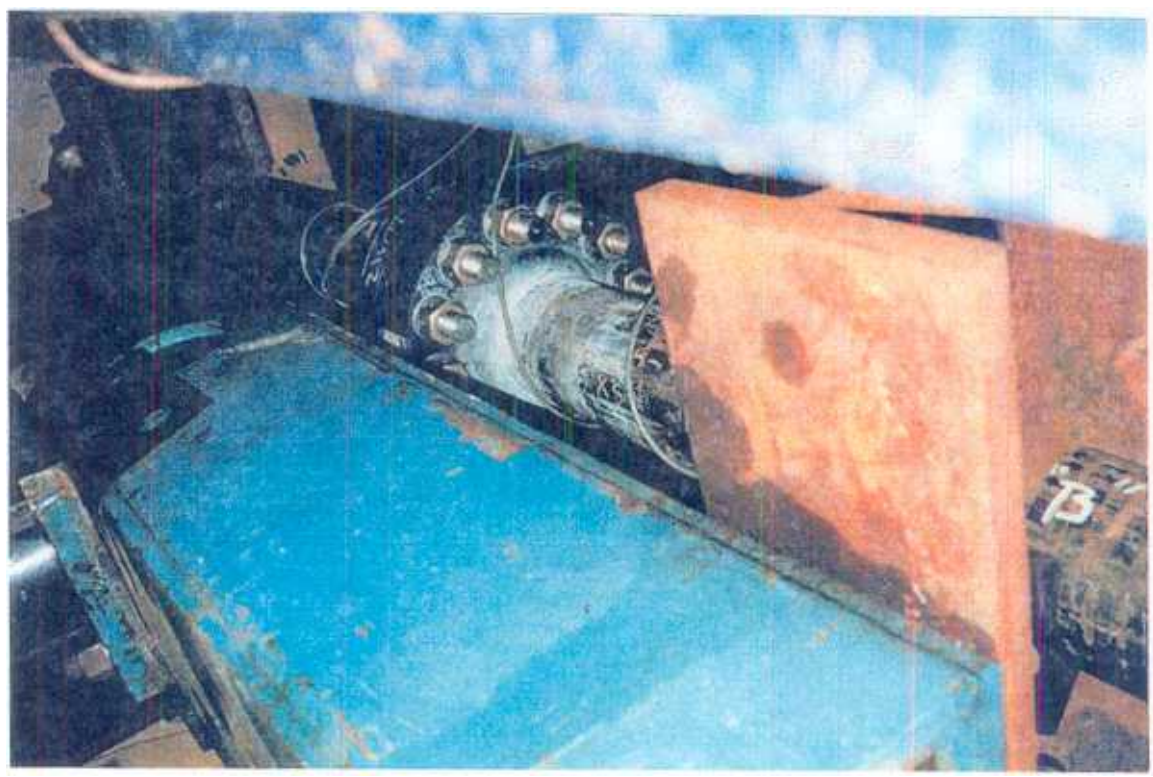
Oil States Industries (UK) Ltd UKAS (NAMAS) Accredited Test Laboratory successfully completed torsion, static and cyclic bending tests on a 6" Pikotek flange assembly for Pikotek (UK) Ltd. The trials were conducted in accordance with Pikotek test procedure ref: Piko 3.

The 6" Pikotech Flange Assembly performed well and showed no signs of any wear or deterioration on any of the insulation sleeves, washers or gasket. The Flange is considered fit for purpose.

TRIALS PHOTOGRAPHS

FATIGUE ACTUATOR USED FOR STATIC AND DYNAMIC BENDING TRIALS

HYDRAULIC ARRANGEMENT USED FOR TORSION TEST



6" PIKOTECH FLANGE TESTING FOR FLEXITALLIC

Record No.	Rosette 2 Max Strain ue	Rosette 2 Min Strain ue	Rosette 2 Max Stress psi ch 23	Rosette 2 Min Stress psi ch 24	Rosette 3 Max Strain ue	Rosette 3 Min Strain ue	Rosette 3 Max Stress psi ch 25	Rosette 3 Min Stress psi ch 26	Rosette 4 Max Strain ue
35	-1	0	-32	-9	0	0	0	0	0
36	119	-35	3560	17	-128	21	-4019	-573	116
37	227	-67	6827	35	-245	41	-7663	-1070	226
38	322	-95	9682	50	-345	57	-10792	-1516	323
39	464	-136	13958	101	-488	82	-15293	-2130	469
40	581	-170	17463	130	-604	101	-18916	-2654	589
41	7	-3	197	-30	7	-1	214	29	15
42	-122	35	-3689	-54	145	-25	4533	623	-117
43	-235	68	-7075	-79	267	-45	8365	1158	-232
44	-349	101	-10494	-112	387	-65	12105	1683	-347
45	-466	134	-14041	-184	506	-85	15840	2189	-467
46	-588	169	-17698	-229	624	-105	19516	2695	-589
47	-12	6	-329	80	3	1	107	65	-25

6" PIKOTECH FLANGE TESTING FOR FLEXITALLIC

Record No.	Rosette 4 Min Strain ue	Rosette 4 Max Stress psi ch 27	Rosette 4 Min Stress psi ch 28	Rosette 5 Max Strain ue	Rosette 5 Min Strain ue	Rosette 5 Max Stress psi ch 29	Rosette 5 Min Stress psi ch 30	COMMENTS
1	-10	99	-265	-25	-1	-846	-278	
2	-12	273	-273	-34	2	-1107	-266	**Bend Test**
3	3	-165	40	7	-2	206	2	Zero scan
4	50	-5126	-36	170	-49	5134	70	5000psi stress
5	96	-10032	-125	334	-96	10062	137	10000psi stress
6	139	-14967	-310	490	-141	14752	194	15000psi stress
7	170	-21279	-1282	669	-194	20138	220	20000psi stress
8	211	-26780	-1692	858	-248	25836	309	26250psi stress
9	154	-21205	-1730	653	-189	19670	229	75% bend stress applied
10	107	-16212	-1645	485	-141	14591	147	
11	65	-11654	-1541	338	-98	10172	111	
12	17	-6541	-1450	173	-51	5212	34	
13	-34	-1199	-1381	2	-2	45	-45	Load removed
14	1	9	32	0	0	0	0	Zero scan
15	1	-23	23	0	1	9	32	
16	1	-23	23	0	0	0	0	
17	1	9	32	0	0	0	0	**Torsion Test**
18	1	9	32	-1	1	-23	23	
19	2	19	64	-1	1	-23	23	
20	2	51	74	-1	1	-23	23	
21	2	19	64	-1	1	-23	23	
22	2	19	64	-2	1	-55	13	
23	2	19	64	-2	1	-55	13	
24	2	19	64	-2	1	-55	13	
25	2	19	64	-2	2	-45	45	Torsion applied
26	2	51	74	-2	2	-45	45	
27	2	51	74	-2	1	-55	13	
28	1	42	42	-2	1	-55	13	
29	1	74	51	-2	1	-55	13	
30	1	74	51	-2	1	-55	13	
31	1	74	51	-2	1	-55	13	
32	0	64	19	-2	1	-55	13	
33	0	64	19	-1	1	-23	23	
34	0	64	19	-1	1	-23	23	Torsion removed

6" PIKOTECH FLANGE TESTING FOR FLEXITALLIC

Record No.	Rosette 4 Min Strain ue	Rosette 4 Max Stress psi ch 27	Rosette 4 Min Stress psi ch 28	Rosette 5 Max Strain ue	Rosette 5 Min Strain ue	Rosette 5 Max Stress psi ch 29	Rosette 5 Min Stress psi ch 30	COMMENTS
35	0	0	0	0	1	9	32	**Statics prior to cycling**
36	-33	3485	54	-124	36	-3745	-43	
37	-65	6818	92	-242	70	-7284	-85	
38	-93	9739	127	-344	99	-10355	-135	
39	-134	14146	216	-487	140	-14665	-198	
40	-168	17750	275	-602	172	-18158	-284	50% PBYS Bend stress +ve
41	-3	454	45	8	-2	238	11	
42	35	-3498	1	147	-42	4428	68	
43	69	-6974	-20	269	-77	8119	124	
44	101	-10436	-96	391	-113	11767	139	
45	135	-14072	-165	511	-148	15393	177	
46	168	-17750	-275	628	-181	18909	241	50% PBYS Bend stress -ve
47	10	-710	85	26	-13	746	-162	

APPENDIX D
ELECTRICAL RESISTANCE AND DIELECTRIC TEST RESULTS

Wyko Industrial Services

WYKO INDUSTRIAL SERVICES
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Engineer's Report

Wyko Reference: ABF37439 Site: Oil States Workshop

Customer Reference: For the Attention of: Scott Pattilo

Equipment: Date: 4th-7th December 2001

Carry out Electrical Insulation Resistance Tests
In accordance with British Gas Spec GBE DA730
Across Pipe Connection

Test Date: 04/12/01

Test No. 1 At 500V for 30 sec Reading 5000MΩ
At 1000V for 30 sec Reading 5000MΩ

Test Date 06/12/01 Bend Test

Test No. 2 At 500V for 30 sec Reading 140GΩ
At 1000V for 30 sec Reading 140GΩ

Test Date 06/12/01 Torsion Test

Test No. 3 At 500V for 30 sec Reading 140GΩ
At 1000V for 30 sec Reading 140GΩ

Test Date 07/12/01 Reverse Bend at 500 Cycles

Test No. 4 At 500V for 30 sec Reading 15000MΩ
At 1000V for 30 sec Reading 15000MΩ

Test Date 07/12/01 Reverse Bend at 1000 Cycles

Test No. 5 At 500V for 30 sec Reading 5000MΩ
At 1000V for 30 sec Reading 5000MΩ

Test Date 07/12/01 Reverse Bend at 1500 Cycles

Test No. 6 At 500V for 30 sec Reading 60GΩ
At 1000V for 30 sec Reading 60GΩ

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Greenwell Road
East Tullos Industrial Estate
Aberdeen AB12 3AX
Telephone: 01224 289400
Facsimile: 01224 899627
E-mail: wems@wyko.co.uk

A division of Wyko Industrial Services Limited
Registered office: Amber Way, Halesowen
West Midlands B62 8WG
Registered number: 3142338

Test Date 07/12/01 Reverse Bend at 2000 Cycles

Test No. 7 At 500V for 30 sec Reading 20000MΩ
At 1000V for 30 sec Reading 20000MΩ

Test Date 10/12/01 Reverse Bend at 2500 Cycles

Test No. 8 At 500V for 30 sec Reading 50GΩ
At 1000V for 30 sec Reading 40GΩ

Test No. 9 Finaly flash test at 5000V for 1 min
Reading after 1 min 0.15MA

Test No.10 5000V A.C. Flash test at Wyko Workshop 11/12/01
1st Test failed at 4700V
2nd Test failed at 3200V

Test Equipment Used

1 No. 5000V Insulation Tester type Chaovinarnoux 5002
Ser no. GR1915NKR, Calibration due 21/05/02

1 No. 30kv Flash Tester type T&R PT30-10
Ser no. 22TE0169, Calibration due 30/11/02

Tested By Peter Paxton

Signature: P.P. Alan Burnett

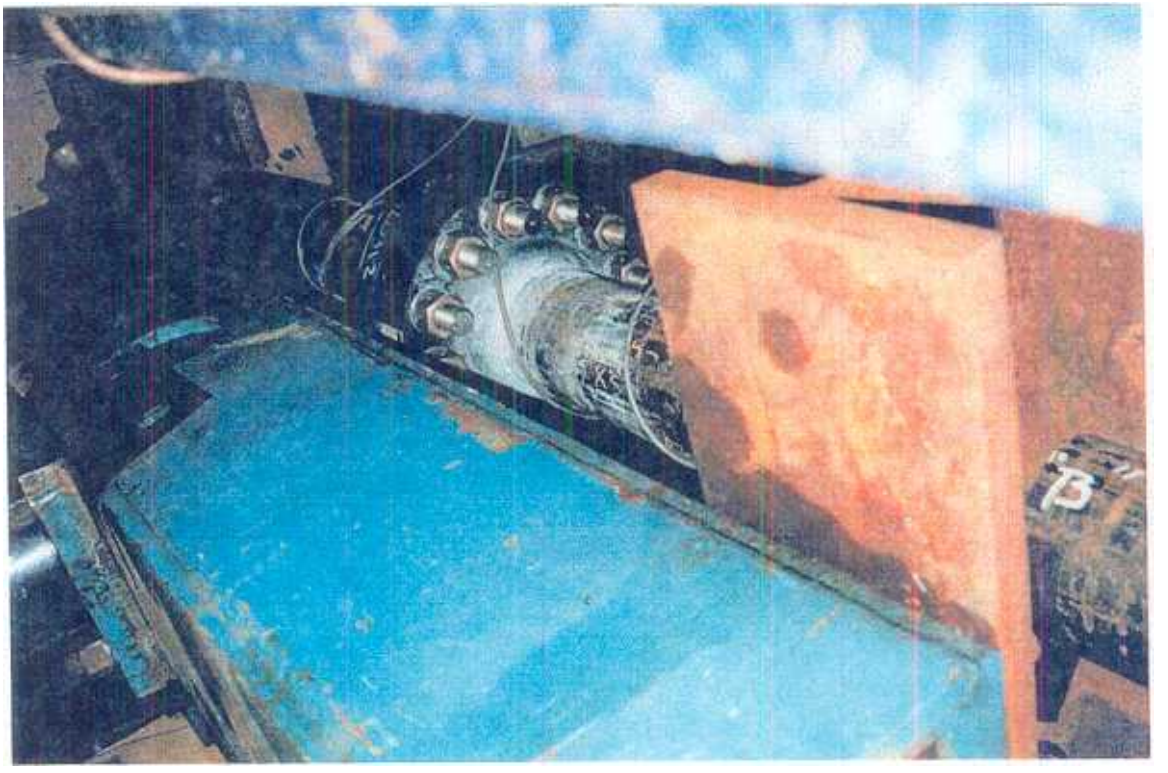


FIGURE 1
GA 300 TON TEST RIG

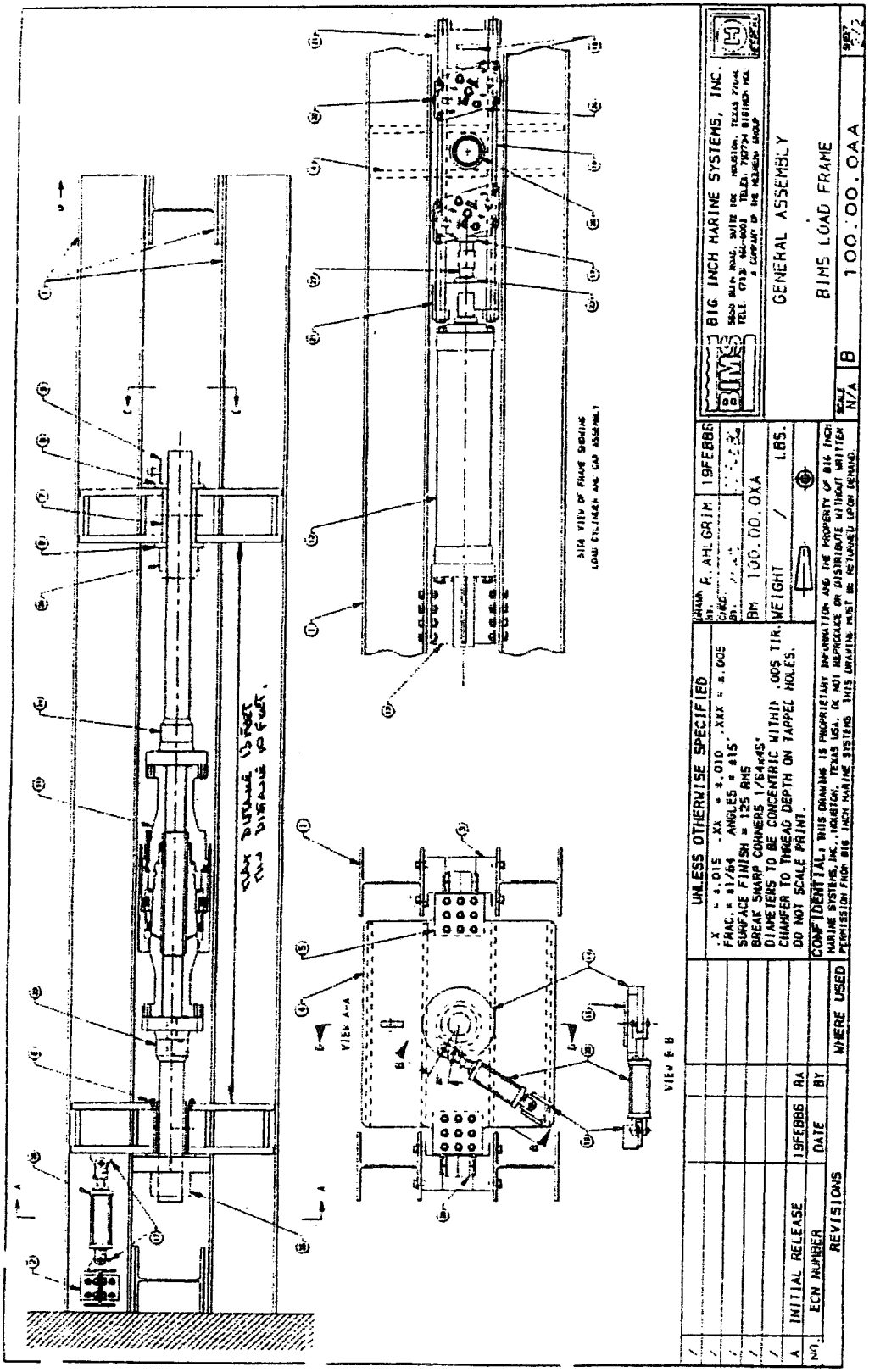
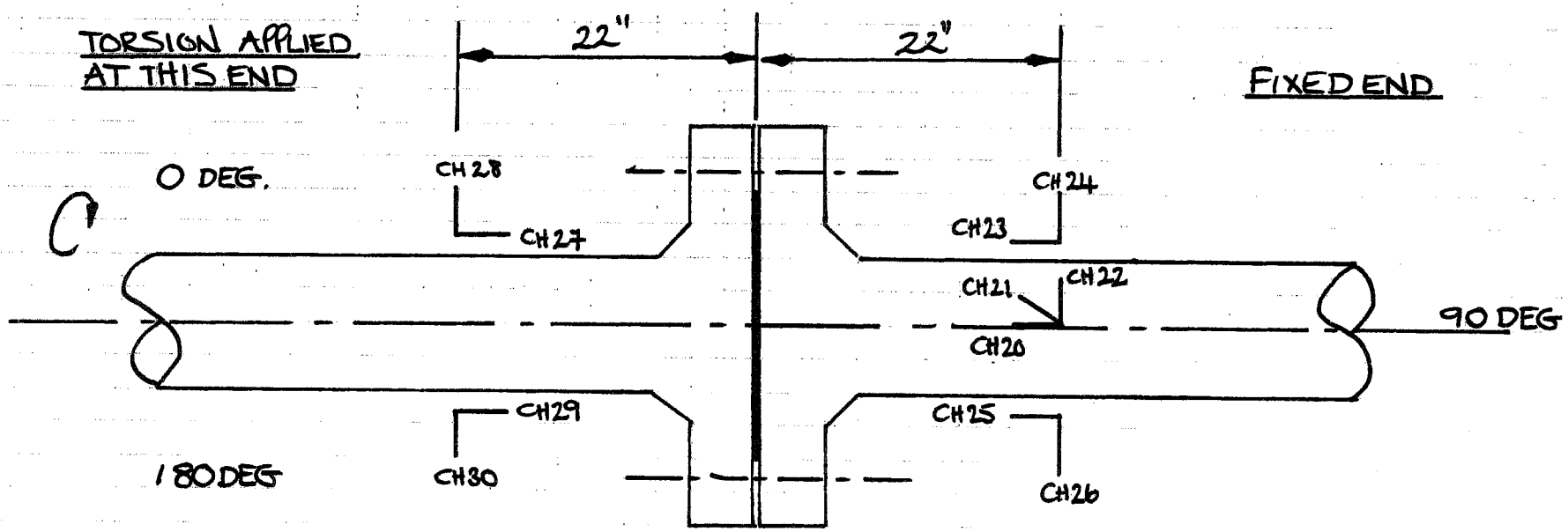


Fig 5

General Arrangement diagram of Oilstates' 300 Tonne Load Frame

FIGURE 2
STRAIN GAUGE POSITIONS FOR BEND AND TORSION

STRAIN GAUGE POSITIONS FOR BEND & TORSION



REVISION	DATE	BY	CHECK
0	20/2/02.		20/2/02

States

DOCUMENT NO. 6" PIKOTECH FLANGE TESTS

OIL STATES JOB NO. 520912

PAGE 1 OF 1

Record No.	Scan Date	Time	Chan 20 ue	Chan 21 ue	Chan 22 ue	Chan 23 ue	Chan 24 ue	Chan 25 ue	Chan 26 ue
35	06-Dec-01	2:41:28 PM	0	0	0	-1	0	0	0
36	06-Dec-01	2:47:12 PM	7	0	1	119	-34	-128	20
37	06-Dec-01	2:48:14 PM	12	0	1	227	-66	-245	39
38	06-Dec-01	2:48:52 PM	18	1	2	322	-93	-345	55
39	06-Dec-01	2:49:27 PM	37	-2	6	464	-133	-489	79
40	06-Dec-01	2:50:04 PM	49	-3	7	581	-167	-604	97
41	06-Dec-01	2:53:18 PM	22	-8	4	7	-3	7	-1
42	06-Dec-01	2:54:55 PM	29	-11	9	-122	34	145	-24
43	06-Dec-01	2:56:30 PM	33	-14	12	-235	67	267	-43
44	06-Dec-01	2:57:05 PM	34	-16	15	-349	99	387	-62
45	06-Dec-01	2:57:34 PM	32	-17	19	-466	131	507	-82
46	06-Dec-01	2:58:32 PM	26	-17	22	-588	166	624	-101
47	07-Dec-01	9:23:53 AM	-2	3	-12	-12	6	3	1

6" PIKOTECH FLANGE TESTING FOR FLEXITALLIC

Record No.	Chan 27 ue	Chan 28 ue	Chan 29 ue	Chan 30 ue	Chan 50 psi	Rosette 1 Max Strain ue	Rosette 1 Min Strain ue	Rosette 1 Max Stress psi ch 20	Rosette 1 Min Stress psi ch 22
1	6	-10	-25	-1	-120	-5	-11	-280	-414
2	12	-12	-34	2	11	10	-64	-319	-2022
3	-6	3	7	-2	111	5	0	169	48
4	-170	49	170	-48	111	1	-5	-12	-161
5	-333	94	334	-94	111	2	-7	-2	-215
6	-496	136	490	-138	111	4	-10	37	-297
7	-697	166	669	-190	109	6	-14	64	-410
8	-876	206	858	-243	111	7	-20	37	-600
9	-690	150	653	-185	111	2	-17	-86	-521
10	-524	104	485	-138	111	1	-14	-108	-456
11	-373	63	338	-96	111	1	-6	-25	-192
12	-204	16	173	-50	109	3	-2	90	-47
13	-26	-34	2	-2	111	1	0	38	5
14	0	1	0	0	57	0	0	0	0
15	-1	1	0	1	57	9	-18	125	-515
16	-1	1	0	0	57	10	-30	36	-903
17	0	1	0	0	57	12	-42	-28	-1273
18	0	1	-1	1	59	11	-55	-195	-1713
19	0	2	-1	1	57	13	-70	-256	-2171
20	1	2	-1	1	59	15	-81	-322	-2539
21	0	2	-1	1	57	18	-94	-355	-2940
22	0	2	-2	1	57	19	-105	-401	-3284
23	0	2	-2	1	57	20	-115	-480	-3596
24	0	2	-2	1	57	22	-127	-531	-3978
25	0	2	-2	2	57	21	-124	-539	-3884
26	1	2	-2	2	57	17	-104	-460	-3268
27	1	2	-2	1	57	16	-94	-422	-2960
28	1	1	-2	1	57	13	-83	-394	-2597
29	2	1	-2	1	57	11	-70	-345	-2213
30	2	1	-2	1	57	9	-59	-300	-1868
31	2	1	-2	1	57	6	-49	-276	-1545
32	2	0	-2	1	57	4	-37	-222	-1165
33	2	0	-1	1	57	1	-18	-129	-564
34	2	0	-1	1	57	2	-13	-58	-419

Record No.	Chan 27 ue	Chan 28 ue	Chan 29 ue	Chan 30 ue	Chan 50 psi	Rosette 1 Max Strain ue	Rosette 1 Min Strain ue	Rosette 1 Max Stress psi ch 20	Rosette 1 Min Stress psi ch 22
35	0	0	0	1	11	0	0	0	0
36	116	-32	-124	35	11	9	-1	291	56
37	226	-64	-242	68	11	15	-2	483	81
38	323	-91	-344	97	11	22	-2	718	150
39	469	-131	-487	137	11	49	-7	1558	263
40	589	-165	-602	168	11	65	-10	2059	326
41	15	-3	8	-2	11	37	-10	1103	25
42	-117	34	147	-41	11	50	-13	1533	71
43	-232	68	269	-75	11	60	-16	1835	73
44	-347	99	391	-111	11	66	-18	2008	74
45	-467	132	511	-145	11	69	-18	2085	83
46	-589	165	628	-177	11	66	-18	2009	73
47	-24	10	26	-13	13	4	-19	-40	-567

APPENDIX C
TABULATIONS AND GRAPHICAL PLOTS

6" PIKOTECH FLANGE TESTING FOR FLEXITALLIC

Record No.	Scan Date	Time	Chan 20 ue	Chan 21 ue	Chan 22 ue	Chan 23 ue	Chan 24 ue	Chan 25 ue	Chan 26 ue
1	06-Dec-01	8:39:23 AM	-10	-6	-6	6	-13	-18	-8
2	06-Dec-01	8:47:17 AM	-3	0	-52	18	-16	-28	-30
3	06-Dec-01	10:22:49 AM	3	0	2	-5	1	5	11
4	06-Dec-01	10:24:06 AM	-5	-1	1	-167	46	169	-18
5	06-Dec-01	10:24:45 AM	-7	-3	2	-327	91	330	-46
6	06-Dec-01	10:25:37 AM	-10	-4	4	-479	134	485	-70
7	06-Dec-01	10:31:33 AM	-14	-5	6	-667	183	673	-118
8	06-Dec-01	10:33:38 AM	-20	-6	7	-852	233	864	-142
9	06-Dec-01	10:35:09 AM	-16	-5	2	-662	182	659	-90
10	06-Dec-01	10:35:19 AM	-13	-3	0	-499	137	493	-64
11	06-Dec-01	10:35:31 AM	-6	-3	1	-347	95	343	-39
12	06-Dec-01	10:35:48 AM	-1	-2	2	-177	47	175	-12
13	06-Dec-01	10:36:23 AM	0	1	1	-1	-3	3	16
14	06-Dec-01	11:19:52 AM	0	0	0	0	0	0	0
15	06-Dec-01	11:22:19 AM	9	-3	-18	-3	1	2	0
16	06-Dec-01	11:22:57 AM	9	-4	-30	-3	0	2	0
17	06-Dec-01	11:25:22 AM	9	-4	-40	-3	1	2	0
18	06-Dec-01	11:25:46 AM	4	-3	-49	-3	1	2	0
19	06-Dec-01	11:26:15 AM	4	-3	-61	-3	0	1	1
20	06-Dec-01	11:27:28 AM	4	-4	-71	-2	0	0	1
21	06-Dec-01	11:27:45 AM	5	-4	-82	-2	-1	0	1
22	06-Dec-01	11:27:53 AM	5	-4	-92	-2	0	0	1
23	06-Dec-01	11:28:02 AM	4	-5	-100	-1	0	-1	1
24	06-Dec-01	11:30:03 AM	4	-5	-110	-1	0	-1	1
25	06-Dec-01	11:30:56 AM	3	-5	-107	-1	-1	-2	1
26	06-Dec-01	11:32:00 AM	2	-4	-90	0	-1	-1	1
27	06-Dec-01	11:32:17 AM	1	-3	-80	0	-1	-1	1
28	06-Dec-01	11:32:33 AM	0	-3	-70	0	-1	-1	1
29	06-Dec-01	11:32:44 AM	-1	-2	-59	1	-1	-2	1
30	06-Dec-01	11:32:52 AM	-2	-1	-49	1	-1	-2	1
31	06-Dec-01	11:32:55 AM	-3	-1	-40	1	-2	-2	1
32	06-Dec-01	11:33:05 AM	-4	0	-29	1	-2	-2	1
33	06-Dec-01	11:33:21 AM	-6	1	-10	1	-2	-2	1
34	06-Dec-01	11:33:30 AM	-7	2	-4	2	-2	-2	1

Record No.	Rosette 2 Max Strain ue	Rosette 2 Min Strain ue	Rosette 2 Max Stress psi ch 23	Rosette 2 Min Stress psi ch 24	Rosette 3 Max Strain ue	Rosette 3 Min Strain ue	Rosette 3 Max Stress psi ch 25	Rosette 3 Min Stress psi ch 26	Rosette 4 Max Strain ue
1	6	-13	70	-362	-18	-8	-655	-428	6
2	18	-16	428	-345	-28	-30	-1220	-1252	12
3	-5	1	-151	-15	5	11	269	416	-6
4	-167	47	-5055	-103	168	-19	5359	1034	-171
5	-327	93	-9862	-162	330	-48	10402	1688	-333
6	-479	137	-14431	-210	484	-73	15251	2387	-496
7	-667	188	-20132	-414	673	-122	20961	2614	-696
8	-852	239	-25728	-558	863	-147	27007	3681	-876
9	-662	186	-19981	-399	659	-95	20777	3386	-690
10	-499	140	-15078	-312	492	-67	15563	2647	-524
11	-347	97	-10467	-222	343	-42	10879	2014	-373
12	-177	48	-5367	-165	175	-14	5639	1285	-204
13	-1	-3	-60	-106	3	16	248	545	-26
14	0	0	0	0	0	0	0	0	0
15	-3	1	-87	4	2	0	64	19	-1
16	-3	0	-96	-28	2	0	64	19	-1
17	-3	1	-87	4	2	0	64	19	0
18	-3	1	-87	4	2	0	64	19	0
19	-3	0	-96	-28	1	1	38	28	0
20	-2	0	-64	-19	0	1	5	18	1
21	-2	-1	-74	-51	0	1	5	18	0
22	-2	0	-64	-19	0	1	5	18	0
23	-1	0	-32	-9	-1	1	-27	9	0
24	-1	0	-32	-9	-1	1	-27	9	0
25	-1	-1	-42	-42	-2	1	-59	0	0
26	0	-1	-9	-32	-1	1	-21	27	1
27	0	-1	-9	-32	-1	1	-27	9	1
28	0	-1	-9	-32	-1	1	-21	27	1
29	1	-1	23	-23	-2	1	-59	0	2
30	1	-1	23	-23	-2	1	-59	0	2
31	1	-2	13	-55	-2	1	-59	0	2
32	1	-2	13	-55	-2	1	-59	0	2
33	1	-2	13	-55	-2	1	-59	0	2
34	2	-2	45	-45	-2	1	-59	0	2

APPENDICIES

APPENDIX A
PIKOTEK TEST PROCEDURE

Electrical Isolation Test Required piko2

Rig 6 inch 1500# pressure class

Test Required.

1. Manufacture flange test piece comprising 6 NPS class 1500# Flanges, c/w adjoining pipe, nuts, bolting, metal washers and appropriate end fixtures for oil fields test equipment. Pipe Schedule XXS.
2. Make up the assembly with free issue gasket, sleeves and insulation washers. Tension assembly to predetermined Torque figures.
3. Carry out electrical resistance test in accordance with British Gas Spec GBE DAT 30 across the connection.
4. Conduct hydrostatic pressure test to assembly, equivelent to flange rating of material.
5. Carry out resistance test to the assembly.
6. Conduct a Torsion test across the assembly.
7. Check the joint for permanent distortion of the joint, including any relative rotation of the flanges, carry out resistance test across the joint after the torsion test.
8. Conduct a bending test with and without internal pressure.
9. Check the joint forany permanent distortion of the joint and carry out electrical resistance test.
10. Provide a report of the testing.

If the electrical resistance test fails at any point in the testing of 3,4,6 or 8 the rig to be split and all sleeves and insulating washers to be replaced with free issue, before proceding to next test.

The resistance test using a 500Volt insulation tester shall be greater than 5MΩ.

This RT to be repeated to 1000Volt and with a minimum resistance of 60MΩ.

A dielectric test of 5000V AC to be applied for 1 minute . Maximum allowable leakage rate is 5milliAmperes.This test to be quoted separate as option to take up will be made.

The joint shall be loaded to an internal pressure of flange rating together with an external bending load sufficient to induce a bending stress of 75% of the specified minimum yield of the adjourning pups.

APPENDIX B
BEND AND TORSION CALCULATIONS

Oil States	REVISION					
	DATE	03/12/01				
DOCUMENT NO. FLEXITALLIC TORSION TESTS	BY	JP.				
OIL STATES JOB NO. 520912 / PAGE OF 2	CHECK					

TORSION STRESS τ = 5% of SMYS.

$= 0.05 * 35000$

$\tau = \underline{1750 \text{ PSI}}$

TO FIND TORQUE

$D = 6.625"$

$d = 4.893"$

T = TORQUE AT RAD 'R'

$\frac{T}{J} = \frac{\tau}{R}$

$\therefore T = \frac{J \cdot \tau}{R}$

J = PSMA

$= \frac{\pi(D^4 - d^4)}{32} = \underline{132.9 \text{ in}^4}$

$R = \underline{3.312 \text{ in}}$

$= \frac{132.9 \times 1750}{3.312}$

$= \underline{70221} \text{ lb.in.}$

$= \underline{5851} \text{ lb.ft.}$

RAM TORSION PRESSURE.

2-off RAMS AT 1ft M.A.

RAMS = 22400 lbs AT 10KPSI

RAM FORCE $= T/2$

$= 5851/2 = \underline{2925 \text{ lbs}}.$

RAM PRESSURE $= \frac{\text{RAM FORCE}}{\text{RAM CAPACITY}} * 10000 = \underline{1305 \text{ PSI}}$

Oil States		REVISION	0			
		DATE	03/14/01			
DOCUMENT NO. FLEX. TENSIONER TOOL		BY	SP.			
OIL STATES JOB NO. 520912.	PAGE 2 OF 2	CHECK				

30 ~~000~~
30 000 PSI

BENDING STRESS.

75% of SMYS
$= 0.75 \times 35000$
$= \underline{26250 \text{ PSI}}$

FOR CYCLIC BENDING

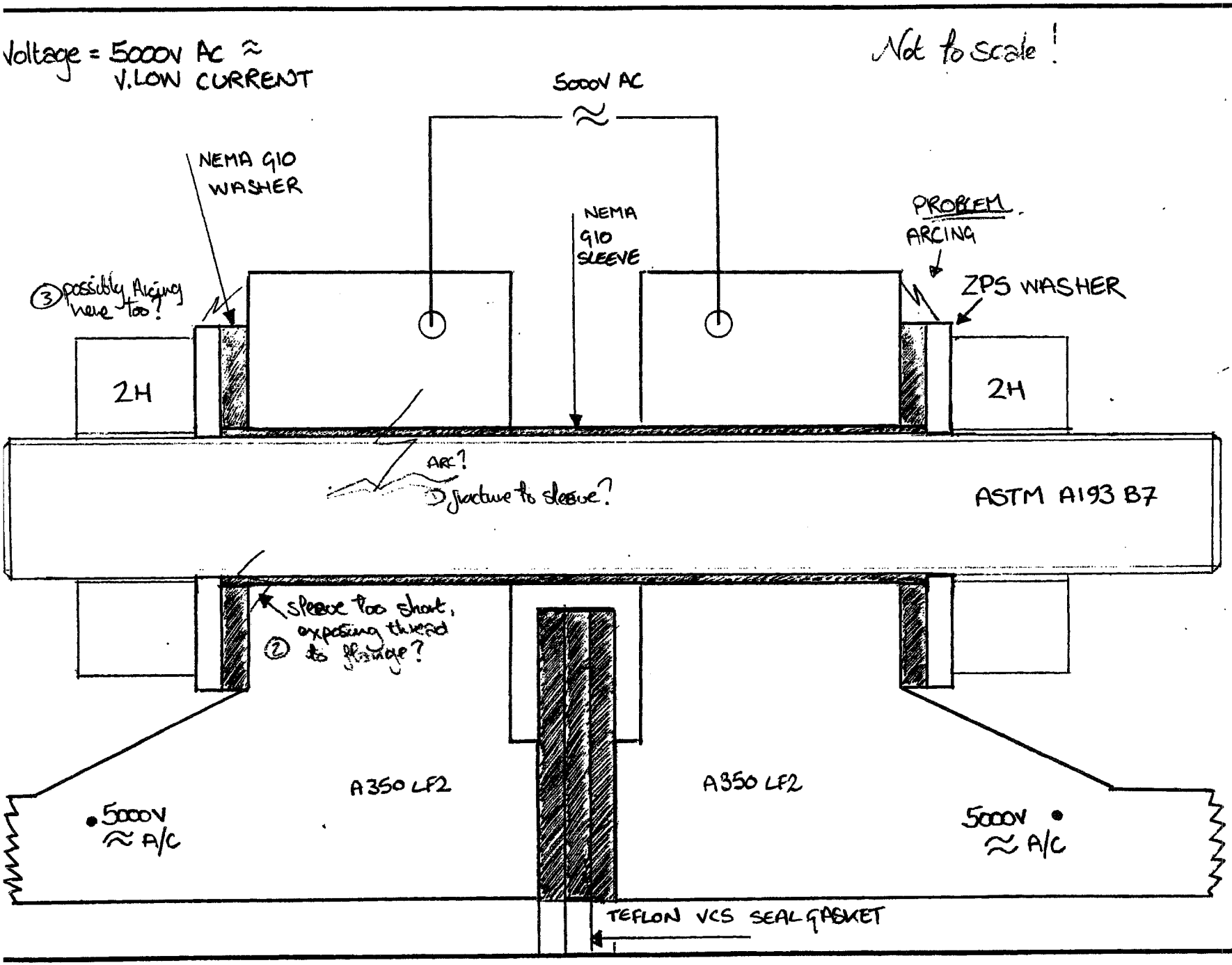
50% of SMYS
$= 0.5 \times 35000$
$= \underline{17500 \text{ PSI}}$

TENSIONER BOLT STRESS.

BOLT TO YIELD = 123211 lbs.

BOLT σ REQ'D = $0.3\ (30\%) \times 123211$
$= 36963$ PSI.

Pump P $= \frac{\sigma}{H.A} = \frac{36963}{4.58}$
$= \underline{8070 \text{ PSI}}$.



DOCUMENT NO.	Extension Mast
OIL STATES JOB NO.	52C912
PAGE OF	1 / 1

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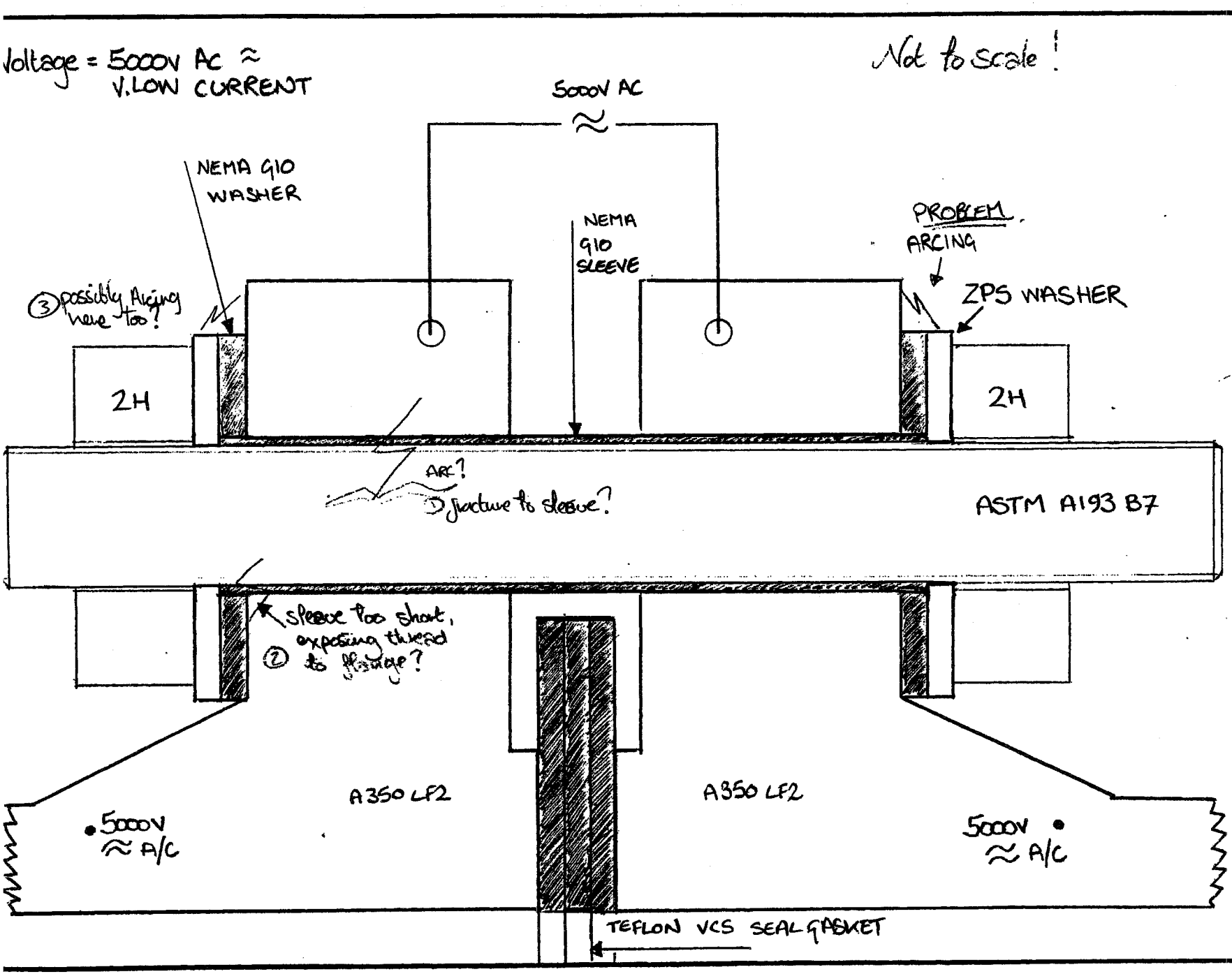


DOCUMENT NO.	REVISION
Excitation Board.	0

OIL STATES JOB NO. 520912

PAGE 1 OF 1

CHECK	BY	DATE
	ADH	11/2/01

APPENDIX E
CALIBRATION CERTIFICATES

United Kingdom Accreditation Service

CERTIFICATE OF CALIBRATION

Issued by **Scotia Calibration Laboratory**

Date of Issue **25 January 2002** Certificate Number **09570**

UKAS CALIBRATION 0208

Scotia Instrumentation Ltd

Campus 1 Aberdeen Science and Technology Park
Balgownie Road Bridge of Don Aberdeen AB22 8GT
Tel 01224-222888 Fax 01224-826299
eMail calibrations@scotia-instrumentation.com

Device Serial Number	**R979 c/w 7030**
Instrument Description	Budenberg Fig 380H Piston c/w weight set
Range of Instrument	100 to 16000 psig
Calibration Standards Used	Budenberg Fig 380 with piston R991 blue Budenberg Fig 380 with piston R991 red
Customer	OIL STATES INDUSTRIES UK LTD Blackness Road, Altens, ABERDEEN AB123 3SY.
Customer Reference	54836
Laboratory Temperature	22.0°C ± 2°C
Job Reference	130238/R
Date Received	16 January 2002
Date of Calibration	25 January 2002
Calibration Uncertainty	See below

Approved Signatories

Mr J Thom
Mr B McLaren

1) The above device was calibrated against standards which are traceable to the National Physical Laboratory.
2) The device was held in the calibration laboratory for a minimum of 24 hours prior to calibration.
3) The ambient temperature of the laboratory was held within 2°C of the indicated temperature.
4) The above device was not adjusted before calibration.
5) The pressure medium was Shell Tellus T22.
6) The device was cycled to full scale prior to starting calibration.
7) The temperature of the piston under test was monitored by a contact temperature sensor attached to the piston.
8) The piston cylinder and mass set provided were cleaned and inspected prior to calibration.
9) The piston fall rate was determined before calibration. This was found to be acceptable.
10) The device was calibrated while held in a vertical position.
11) As far as possible oil escaping past both standard and test pistons was mopped away from the bleed hole. This ensured no extra head of oil was created.
12) The results are expressed at a temperature of 20 °C and at a standard gravity of 9.80665 ms-2 in air of density 1.2 kgm-3.
13) The temperature coefficient (c) used for this piston is 0.000023°C-1.
14) The uncertainties associated with these measurements were;

up to 60 barg was 0.008% of reading + 0.4 mbarg,
up to 600 barg was 0.007% of reading + 0.4 mbarg &
up to 1200 barg was 0.009% of reading + 0.4 mbarg.

The temperature scale in use in this laboratory is ITS90
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

CERTIFICATE OF CALIBRATION

Issued by **Scotia Calibration Laboratory**

UKAS ACCREDITED CALIBRATION LABORATORY No. 0208

Certificate Number **09570**

Device Serial Number **R979 c/w 7030**

Device Description **Budenberg Fig 380H Piston c/w weight set**

The PCU was loaded with each of the groups of weights as specified in the results page. A UKAS calibrated PCU was loaded with weights until it balanced the pressure generated by the PCU under test. The balance point was measured using a differential cell and indicator.

The masses were rotated in a clockwise direction at speeds between 10 and 60 rpm.

The values of generated pressure given in the table correspond to the values which will be generated when the piston is floating in equilibrium at mid-stoke and loaded with the specified group of weights under the specified conditions.

For use under conditions other than those stated on this certificate, the generated pressure is given by the flowing expression;

$$P = \frac{P_a * g_a * (1-C * (T-20))}{g_s}$$

where

- P = Actual pressure obtained
- P_a = Applied pressure from certificate
- g_a = Gravity at your location
- C = temperature coefficient ($°C^{-1}$)
- T = Temperature of the piston in location (°C)
- g_s = Standard gravity (9.80665 ms^{-2})

Pressure measurements were referenced to the datum levels marked on the piston. The heights were determined using a cathetometer.

In this certificate the True Pressure is that which was generated on the laboratory piston and the Device Pressure is the sum of the pressure values stamped on the masses used and the piston under test. Device Masses Applied is the masses on the piston under test.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

CERTIFICATE OF CALIBRATION

Issued by **Scotia Calibration Laboratory**

UKAS ACCREDITED CALIBRATION LABORATORY No. 0208

Certificate Number
09570

Device Serial Number **R979 c/w 7030**

Device Description **Budenberg Fig 380H Piston c/w weight set**

True Pressure	Device Pressure	Device Masses Applied
psig	psig	
Blue Range		
99.98190	100	A
199.9694	200	AB
299.9540	300	ABC
404.9394	405	ABCHJKLM
499.9214	500	ABCDHJKL
599.9014	600	ABCDEHJKL
699.8816	700	ABCDEFHJKL
799.8586	800	ABCDEFGHJKL

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

CERTIFICATE OF CALIBRATION

Issued by **Scotia Calibration Laboratory**

UKAS ACCREDITED CALIBRATION LABORATORY No. 0208

Certificate Number
09570

Device Serial Number **R979 c/w 7030**

Device Description **Budenberg Fig 380H Piston c/w weight set**

True Pressure	Device Pressure	Device Masses Applied
psig	psig	
Red Range		
2000.229	2000	A
4000.424	4000	AB
6000.303	6000	ABC
8099.940	8100	ABCHJKLM
9999.514	10000	ABCDHJKL
11998.71	12000	ABCDEHJKL
13997.74	14000	ABCDEFHJKL
15996.50	16000	ABCDEFGHJKL

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

APPENDIX F
OSI UKAS(NAMAS) TEST LABORATORY SCHEDULE

United Kingdom Accreditation Service

TESTING LABORATORY
No. 1042

SCHEDULE

Address of permanent laboratory	**Category 0** **Permanent Laboratory** Testing performed in a permanent laboratory accredited by UKAS
Oil States Industries (UK) Ltd Test Laboratory Blackness Road Altens Industrial Estate Aberdeen AB9 8SY Telephone : + 44 (0) 1224 290051 Fax: +44 (0) 1224 290110 EMail :	Laboratory contact: Mr P F Jaques Issue No: 8 Date: 15 September 1999

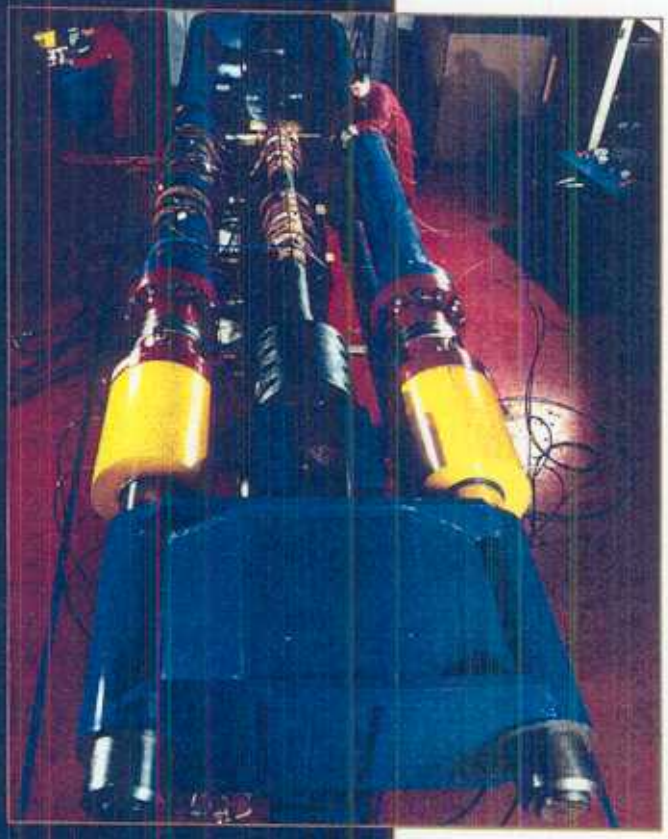
Materials/Products Tested	Type of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used
METALS, ALLOYS and METAL PRODUCTS	<u>Mechanical Tests</u>	
Metal beams and tubular sections	Static structural tests to determine yield strength, failure strength and stress-strain response. a) Tensile (Forces up to 20,000 kN) b) Compression (Forces up to 20,000 kN) c) Torsion (Torque up to 110,000 Nm) d) Bending (Moment up to 5 x 10^6 Nm)	Documented In-House Methods and customer specified methods.
	Fatigue - constant programmed or random stressing under force or displacement control Axial tension - compression Reversed bending (Forces up to ± 2600 kN)	Documented In-House Methods based on BS 3518:Part 1:1993 BS 3518:Part 3:1963(1990) BS 3518:Part 5:1966(1984)
	Continued on Sheet 2	

Oil States

Oil States Industries (UK) Ltd

Structural Test Laboratory

Oil States Industries' structural test laboratory offers an extensive range of facilities to third pa clients. The laboratory has the capability to sim typical and extreme service loadings on a variet structures, for the purposes of product assessmer prototype development, generation of design da and validation of analytical models.



2000 ton tension/1000 ton compression test rig. The only one of its kind in the UK for API 5C5 testing.

Comprehensive Facilities

The Test Laboratory offers comprehensiv services including bending, tension, comp fatigue, impact, torque, internal static and pressure and combined loadings. A full ca summary is shown overleaf.

On-site Data Acquisition

Trouble-shooting and commissioning eng available around the clock, using portable acquisition equipment for a variety of tas including structural load monitoring. Dat promptly analysed by Oil States' stress er to solve problems and reduce downtime.

Third Party Witnessing

Oil States can arrange for the witnessing test by approved authorities such as Lloy Register, Det Norske Veritas or the Amer Bureau of Shipping.

UKAS (NAMAS) Accredited

NAMAS

TESTING NO. 1042

Testing Capability Summary

Tension and Compression
2¾" (60mm) to 30" (760mm) diameter specimens
2000 ton.f (19,730Kn) maximum load

Bend Rigs
Up to 30" (760mm) diameter specimens
3,650,000 ft.lbs (4950Knm) maximum moment

Pressure Testing (Hydrostatic and Gas)
Maximum Internal Pressure 50,000 psi (345 N/mm²)
Maximum External Pressure 20,000 psi (290 N/mm²)

Fatigue Rigs
Axial tension / compression
± 200 ton.f (2000 Kn) maximum dynamic load cyclic bending
± 1,000,000 ft.lb (1350 Knm) moment
BS3518 Part 1; Part 3; Part 5

API 6A Testing
Wellhead equipment

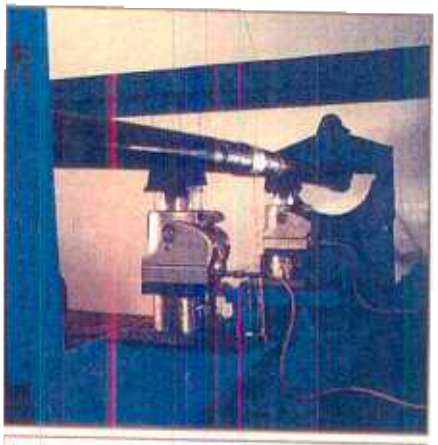
API 6D Testing
Pipeline valves

Strain Gauge Monitoring Service
Offshore and onshore

API 5C5 Testing
Performance evaluation of high pressure casing and tubing

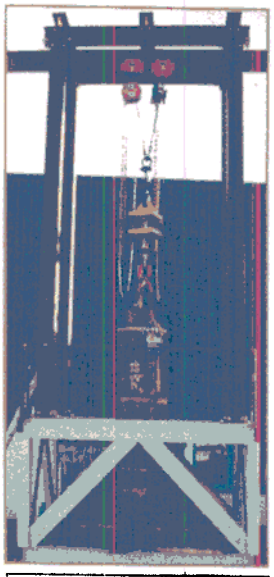
Impact Testing
Simulated trawler board pipeline impact trials
Pipeline code BS 8010

Testing at elevated and subzero temperatures.



Bending test on a 3rd party client's connection. This bending fixture can apply a maximum moment of 3,650,000ft ft-lb to tubulars as large as 30" in diameter.

Combined load with external pressure trial on Kongsberg work-over riser.



Pipeline impact trials.

Oil States Industries (UK) Ltd • Blackness Road • Altens Industrial Estate • Aberdeen • AB12 3LH
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United Kingdom Accreditation Service

TESTING LABORATORY No. 1042	**Category 0** **Permanent Laboratory** Issue No: 8
SCHEDULE	Date: 15 September 1999

Materials/Products Tested	Type of Test/Properties Measured Range of Measurement	Standard Specifications Equipment/Techniques Used
METALS, ALLOYS and METAL PRODUCTS (cont'd)	Mechanical Tests	
Metal valves, tubular sections and flanges, Wellhead equipment, pipeline valves, closures, connectors and swivels	Pressure cycling and endurance tests (Hydrostatic up to 340 MPa) (Pneumatic up to 280 MPa) (Temperatures from ambient to 523K)	Documented In-House Methods using hot oil or heating elements based on - API SPEC 6A - 17th edition API SPEC 6D - 21st edition API SPEC 17D - 1st edition
METALLIC and NON-METALLIC COMPONENTS and ASSEMBLIES	Mechanical Tests	
Tubular sections and assemblies	Combined tension or compression with torque and bend, internal or external pressure, with or without thermal cycling (Axial forces up to 7000 kN) (Bending moments up to 2 x 10^5 Nm) (Torque up to 16,000 Nm) (Hydrostatic pressure up to 340 MPa) (Pneumatic pressure up to 280 MPa) (Temperatures from ambient to 523K)	Documented In-House Methods based on API RP 5C5 - 2nd edition
	END	