



Rob Stutz  
Construction Engineer

AC36 Oil Lateral Test Procedure  
1/4/14  
Rev. 0

**AC36 LATERAL TEST PROCEDURE  
GREELEY MAJOR PROJECTS  
1/4/14**

1	1/4/14	Procedure Issued	RES	RES		
0	1/4/14	Procedure Issued for Review	RES	RES	N/A	N/A
Rev.	Date	Description	Author	Review	Approve	Approve

Revision History			
Rev #	By (Initials)	Section	Description of Revision
1	RES	Procedure	Testing Procedure for the AC36 Lateral

HOLD Log	
Section	Description of Revision

Quality Control			
Revision History			
<u>Code</u>	<u>Description</u>	<u>Control Requirements</u>	
A,B,C, etc.	Alphabetical revision identification should be used for document development.	Review: Engineer Approval: Document Owner	
0	Revision zero indicates "Approved for Use". Note that once the document is issued revision zero, the revision history should be cleared.	Review: Engineer Approval: Document Owner Approval: Manager	
1,2,3, etc.	Numeric revision identification should be used to indicate that a document has changed after it has been issued revision zero and indicates "Approved for Use" going further.	Review: Engineer Approval: Document Owner Approval: Manager	
Control Assignments			
(The assignments need to be identified at document conception. If assignments change, a revision to the document is required and the change needs to be recorded in the revision history.)			
<u>Identifier</u>	<u>Date</u>	<u>Name</u>	<u>Title</u>
Document Owner	1/4/14	Rob Stutz	Construction Engineer
Engineer	1/4/14	Rob Stutz	Construction Engineer
Manager			

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## 1. Purpose/Scope

- 1.1. This procedure addresses the leak pressure test of AC20 Lateral This procedure does not cover leak testing for pipe and does not apply to facilities built by other teams in the Greeley field office.

## 2. Responsibilities of Key Participants

- 2.1. Noble Construction Engineer is responsible for scheduling, supervising and accepting the pressure test. Foreman is responsible for making sure all valves are in the correct position per attached P&ID prior to leak test initiation. The foremen may delegate this responsibility as deemed appropriate.
- 2.2. Noble Construction Engineer is responsible for providing up to date P&IDs showing correct valve orientation during leak test

## 3. General Requirements

- 3.1. Communicate relevant procedures to Noble personnel and contractors as necessary.
- 3.2. Complete JSA before beginning work.
- 3.3. Notify all personnel on location prior to starting the pressure test.
- 3.4. All bleed and drain valves must be closed prior to starting the test.
- 3.5.

## 4. References

- 4.1. Marked up P&IDs will be available. Refer to the P&IDs for the correct valve orientation prior to starting the leak test. Valves highlighted in **RED** will be closed during the test. Valves marked in **GREEN** will be open during the test. Pipe and fittings marked in **GREEN** will be exposed to test pressure.
- 4.2. Picture of Standard Wellhead Tree-up and Oil Lift Piping.

## 5. AC36 Oil Lateral Test Procedure

### 5.1. Testing – Leak Test – 8hrs

- 5.1.1. Set equipment for testing at the AC36 Lateral Launcher Location
- 5.1.2. Verify that all valves and flanges will be inspected to ensure they are the proper rating.
- 5.1.3. Test will be conducted with high pressure Nitrogen (N2) compressed by a remote mobile contract trailer.
- 5.1.4. The test trailer will be located at the AC36 Facility Pipeline valve Setting with the operator remaining on the outside of the equipment for protection.



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- 5.1.5. The location will be cordoned off from 0600 until complete depressurization, with a vehicle monitoring all entrances in manned areas.
- 5.1.6. Ensure the Test Monitors Certifications are Current
- 5.1.7. Install pressure recorder to a 1/2" NPT connection at the Oil Meter Inlet
- 5.1.8. Verify all flanges have the correct Flexitolic Olets and are tightened to specifications
- 5.1.9. Verify valves and blinds are in correct position according to the agreed P&ID

## **5.2. Testing Alignment**

### **5.2.1. Loop the following connections for the HP Pneumatic Test**

- 5.2.1.1. There will be no looping of systems necessary on this test

### **5.2.2. Align the following valves for test as follows**

- 5.2.2.1. Close the AC36 Facility Oil Inlet Valves
- 5.2.2.2. Open AC36 Oil Pig Launcher Valves
- 5.2.2.3. Open AC36 Oil Pig Launcher Bypass Valve
- 5.2.2.4. Open AC36 Oil Valve Setting Valves x3
- 5.2.2.5. Close the AC36 Oil Inlet Valves to the CPF

## **5.3. Test Recorder Locations**

- 5.3.1.1. 1" Vent Valve of the AC36 Oil Line Valve Settings. One on each side of the Isolation valve on the first setting. Downstream of the Isolation Valve on the Remaining 2 Settings.

## **5.4. Test Procedure**

### **5.4.1. Test Fill**

- 5.4.1.1. Load piping with Nitrogen thru the Vent valve on the First Valve Setting
- 5.4.1.2. Pressure up to 250 psi
- 5.4.1.3. Once pressure reaches a minimum pressure of 300 psi, stop injecting nitrogen and allow pipe to equalize for 10 minutes.
- 5.4.1.4. Check for Leaks
- 5.4.1.5. Isolate Sections 1 and 5 (Section 1 is from the Crow Creek Facility to the first valve setting. Section 5 is from Valve Setting north of the CPF to the West Valve Setting.
- 5.4.1.6. Remain isolated until end of work day.
- 5.4.1.7. Sections 1 and 5 will continue filling following work day
- 5.4.1.8. Pressure up to 500 psi
- 5.4.1.9. Once pressure reaches a minimum pressure of 500 psi, stop injecting nitrogen and allow pipe to equalize for 10 minutes.
- 5.4.1.10. Do not exceed 600 psi.
- 5.4.1.11. Check for Leaks
- 5.4.1.12. Pressure up to 750 psi

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- 5.4.1.13. Once pressure reaches a minimum pressure of 750 psi, stop injecting nitrogen and allow pipe to equalize for 10 minutes.
- 5.4.1.14. Do not exceed 800 psi.
- 5.4.1.15. Check for Leaks
- 5.4.1.16. Once pressure reaches a minimum pressure of 950 psi, stop injecting nitrogen and allow pipe to equalize for 10 minutes.
- 5.4.1.17. Do not exceed 1000 psi.
- 5.4.1.18. Check for Leaks
- 5.4.1.19. Once the system is stable. Isolate the Valve Setting Valves thereby creating 4 Test Systems
- 5.4.1.20. Once pipeline is equalized and stable, start test clock and start.
- 5.4.1.21. The isolation of the test systems from one and another will be the responsibility of Rob Stutz Construction Engineer
- 5.4.1.22. Record pressure readings for 8 hr, every 30 minutes at the Wells Ranch AC20 Pig Launcher Location using a calibrated recorder with certifications.

## **5.5. Depressurizing**

- 5.5.1. Once the Pressure Test is complete commence depressurizing
- 5.5.2. Depressurized piping by bleeding nitrogen to atmosphere

## **6. Pressure Testing**

### **6.1. General Info**

- 6.1.1. Pressure testing to insure the integrity of all piping joints shall be required of all piping, except as modified herein. Pressure testing will be accomplished in the field and must be satisfactorily completed prior to insulating the piping joints, and, prior to any chemical cleaning that may be required. The witnessing of any or all testing is the prerogative of the NOBLE representative.
- 6.1.2. Test pressures, as determined by the requirements of this Standard, shall be shown on line summary or rating sheets (or the equivalent) for all piping. These shall be submitted to NOBLE well in advance of construction for review. No test pressure shall be revised without the expressed approval of NOBLE. Any component that is inspected by other means, in lieu of pressure testing, shall be as directed or approved by NOBLE.
- 6.1.3. System testing through equipment is generally not acceptable if the test pressure would be limited by the equipment to levels below those specified herein. This requirement can only be waived by NOBLE.
- 6.1.4. In general, piping designed to this standard shall be hydrotested to the test pressure of the flanges, unless the pipe wall thickness would limit the test pressure to a lower value. If it can be shown that a significant savings can be realized in certain piping systems, the test

pressures may be lowered with NOBLE's approval, provided the applicable code or legal requirements are met.

## **6.2. Test Temperature and Water**

- 6.2.1. No piping (unless of austenitic steel or of steel which has been impact tested to 15 ft. lbs. charpy-type test at the lower test temperature) shall be tested at metal temperatures below 60oF. If testing is necessary under winter conditions, a method of recirculation of heated glycol mixture or similar fluid shall be submitted for NOBLE approval.
- 6.2.2. The use of salt or brackish water is not allowed. Test water shall be free of sediment and corrosive substances. Hydrostatic testing of austenitic stainless steels shall be done with potable quality water containing less than 50 ppm chlorides. Alternate test fluids may be used with NOBLE approval.

## **6.3. Hydrostatic Testing**

- 6.3.1. Hydrostatic test pressure for piping not covered by ASME/ANSI Codes B31.1, B31.3, B31.4 and B31.8 will be established by NOBLE Engineering Services
- 6.3.2. Pneumatic testing may be substituted, with NOBLE's approval, when hydrostatic testing is impractical.
- 6.3.3. Gravity lines shall be tested by filling with water.

## **6.4. Pneumatic Testing**

- 6.4.1. Compressed air and Inert Gas lines may be pneumatically tested at 110% of design pressure. Procedures for safe testing shall be followed as specified in ASME/ANSI B31.3, Section 345.5.
- 6.4.2. Instrument air lines shall be tested to at least the operating pressure with dry instrument air or with nitrogen.
- 6.4.3. Fuel Oil lines designed below 90 psig shall be pneumatically tested at 100 psig. Fuel Oil lines designed for 90 psig and above shall be hydrostatically tested.
- 6.4.4. The hazards of pneumatic testing, especially of large volume systems, shall be recognized and provision must be made to minimize the exposure of personnel to these hazards.
- 6.4.5. A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus 50 psi or 10% of the test pressure, per ASME B31.3 345.5.2.



**6.5. Extent of Testing-** Existing piping and connections thereto are generally tested. Temporary isolation by test blinds or welded **enclosures shall** be provided to permit the complete testing of new piping. For convenience, existing piping or portions thereof may be included in the piping hydrotest with the approval of NOBLE. ASME/ANSI B31.3, paragraph 345.9, allows radiography of welded joints in lieu of hydrotest under certain conditions. Any alternative testing or substitution of NDE in lieu of required hydrotesting requires NOBLE approval.

**6.6. Items Excluded from Field Piping Pressure Testing-** The following items shall not be subjected to the pressure tests or test fluids during field piping tests:

- a. Lines normally open to atmosphere, such as open drains beyond the final valve, relief valve discharge stacks, etc.
- b. Control valves and all instruments, without NOBLE approval
- c. Pumps, turbines, and compressors
- d. Rupture discs, relief valves, and flame arresters
- e. Package filters and expansion joints that have been shop tested, without NOBLE approval
- f. Heater coils and manifolds which are a part of the heater, such as crossovers, etc. which are included in a separate heater test, without NOBLE approval.
- g. Any equipment or device which cannot withstand the test pressure or test fluid
- h. Any other equipment which may be designated by NOBLE



**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 3-Feb-14  
**By:** RES  
**Approved:** RES

### PNEUMATIC TEST(AC36 PF Lateral Section 1)

Wells Ranch AC36 Lateral	CLIENT: Noble Energy
TEST MEDIUM: Nitrogen	xxxxx
TEST PRESSURE: 925 PSIG	DESIGN PRESSURE: 740 PSIG
TEST DURATION: 8 HRs	START TIME: 09:37
TEST PERFORMED BY: PSI	STOP TIME: 15:15

TEST EQUIPMENT				
TYPE	MAKE	MODEL	SER#	CAL DATE
RECORDER	NV	10KPSI	354371	17-Apr-12
SCALE				
TEMP GAUGE				
PRESS GAUGE				

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
9:37			0	Started to fill flowlines
11:46			251	Leveled of to allow for settling
13:00			247	Began refill after inspection of connections
13:36			308	Leveled of to allow for settling
13:46			308	Pressure held at 1st stage until completion of work day
14:00			328	Begin Steady Fill Slow Climb during work day
15:00			359	Begin Steady Fill Slow Climb during work day
16:00			367	Begin Steady Fill Slow Climb during work day
17:00			372	Begin Fill
17:35			434	Leveled of to allow for settling
18:00			436	Minor Changes due to filling CPF Stage 5
18:30			434	
19:00			436	
19:15			453	Begin Steady Fill
20:14			501	Leveled of to allow for settling
20:30			500	Begin Steady Fill

16-Feb-14

DATE

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**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

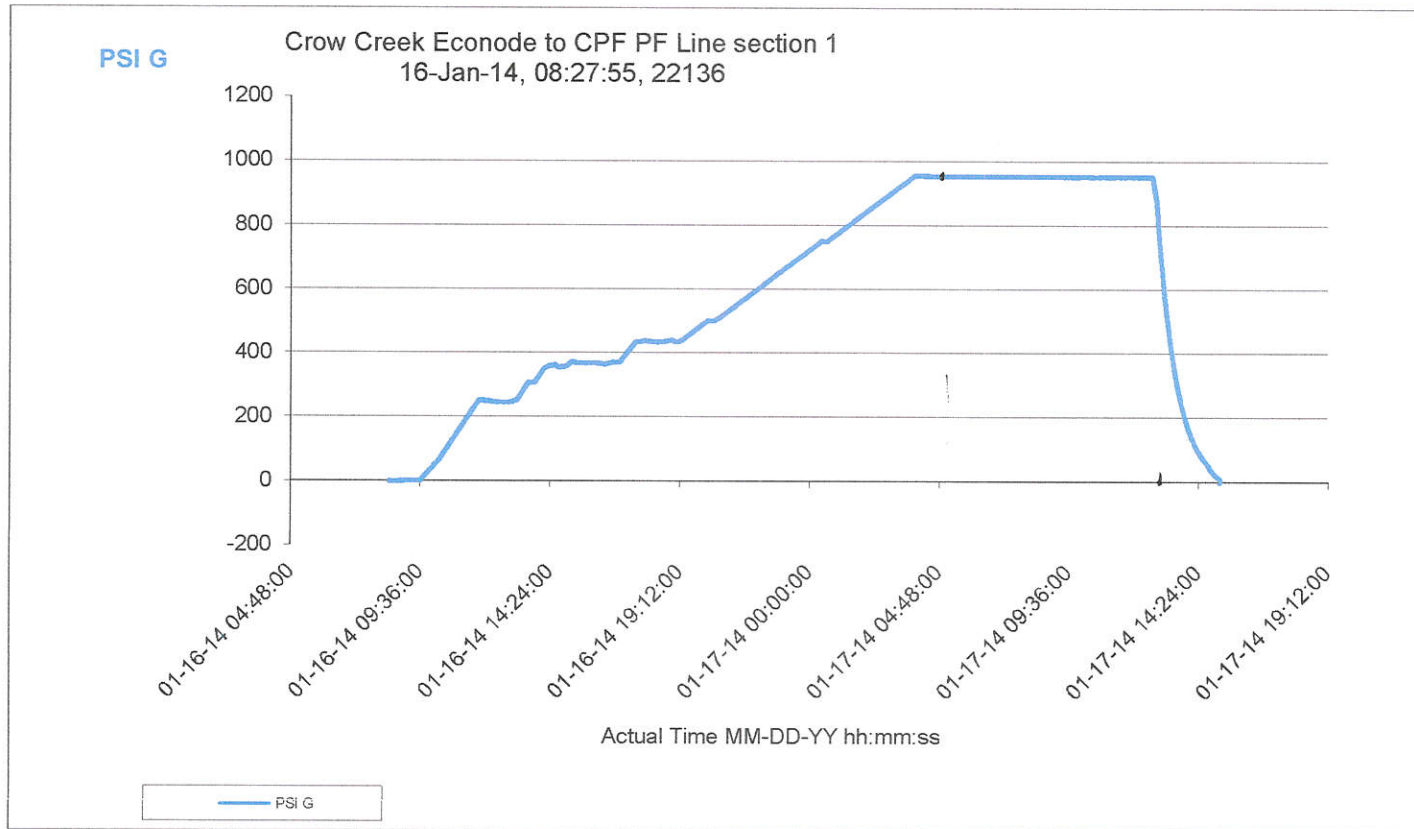
**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 27-Jan-14  
**By:**  
**Approved:** RES

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
0:25			750	Leveled of to allow for settling
0:39			749	Begin Steady Fill
x 3:54			955	
4:00			954	Set Test
4:30			953	
5:00			953	
5:30			953	
6:00			952	
6:30			952	
7:00			952	
7:30			952	
8:00			952	
8:30			952	
9:00			952	
9:30			952	
10:00			952	
10:30			951	
11:00			951	
11:30			952	
12:00			952	
12:30			952	
x 12:41			952	Good Test
15:15			0	

## Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	356134	354371	
Datatype		Lower	
Units		PSI G	

Lower





**Client:** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 3-Feb-14  
**By:** RES  
**Approved:** RES

### PNEUMATIC TEST(AC36 PF Lateral Section 2)

Wells Ranch AC36 Lateral	CLIENT: Noble Energy
TEST MEDIUM: Nitrogen	xxxxx
TEST PRESSURE: 925 PSIG	DESIGN PRESSURE: 740 PSIG
TEST DURATION: 8 HRs	START TIME: 10:22
TEST PERFORMED BY: PSI	STOP TIME: 15:29

TEST EQUIPMENT				
TYPE	MAKE	MODEL	SER#	CAL DATE
RECORDER	NV	10KPSI	251525	19-Apr-13
SCALE				
TEMP GAUGE				
PRESS GAUGE				

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
10:22			0	Began Fill into Sections 2 and 3
13:12			220	Leveled of to allow for inspection
13:33			247	Began refill of sections 1-3
13:46			308	Pressure minimized on 1st stage until completion of work day
15:31			374	Pressure Steady as Sec 4 added
16:00			369	Pressure Steady as Sec 4 added
16:21			375	Began Fill into Sections 5
17:00			372	Pressure Steady as Sec 5 added
17:30			429	Pressure Steady as Sec 5 added
18:00			438	Pressure Steady as Sec 5 added
18:30			436	Pressure Steady as Sec 5 added
19:00			437	
19:15			440	Begin Steady Fill all sections balanced
20:14			503	Leveled of to allow for settling
20:30			503	Begin Steady Fill
22:00			597	Begin Steady Fill
23:00			662	

16-Feb-14

DATE

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AUTHORIZATION





**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

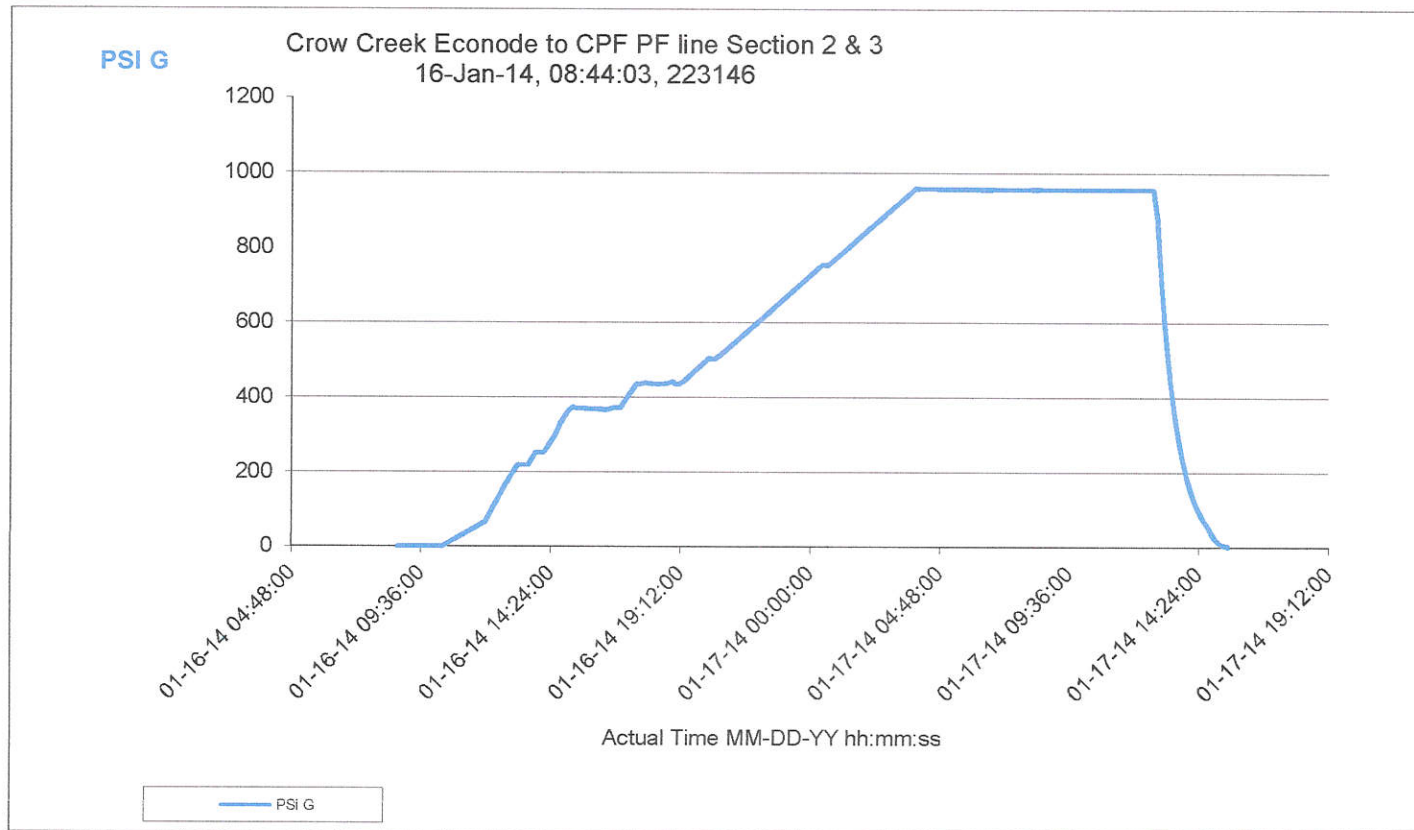
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**Rev:** 0  
**Rev. Date:** 27-Jan-14  
**By:**  
**Approved:** RES

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
0:25			754	Leveled of to allow for settling
0:39			752	Begin Steady Fill
3:54			959	
4:00			958	Set Test
4:30			958	
5:00			957	
5:30			957	
6:00			957	
6:30			957	
7:00			956	
7:30			956	
8:00			956	
8:30			956	
9:00			956	
9:30			956	
10:00			956	
10:30			956	
11:00			956	
11:30			956	
12:00			956	
12:30			956	
12:41			956	Good Test
15:29			0	Broke Test

## Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	255771	251525	
Datatype		Lower	
Units		PSI G	

Lower







**Client:** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 3-Feb-14  
**By:** RES  
**Approved:** RES

### PNEUMATIC TEST(AC36 PF Lateral Section 3)

Wells Ranch AC36 Lateral	CLIENT: Noble Energy
TEST MEDIUM: Nitrogen	xxxxx
TEST PRESSURE: 925 PSIG	DESIGN PRESSURE: 740 PSIG
TEST DURATION: 8 HRs	START TIME: 10:22
TEST PERFORMED BY: PSI	STOP TIME: 15:29

TEST EQUIPMENT				
TYPE	MAKE	MODEL	SER#	CAL DATE
RECORDER	NV	10KPSI	251525	19-Apr-13
SCALE				
TEMP GAUGE				
PRESS GAUGE				

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
10:22			0	Began Fill into Sections 2 and 3
13:12			220	Leveled of to allow for inspection
13:33			247	Began refill of sections 1-3
13:46			308	Pressure minimized on 1st stage until completion of work day
15:31			374	Pressure Steady as Sec 4 added
16:00			369	Pressure Steady as Sec 4 added
16:21			375	Began Fill into Sections 5
17:00			372	Pressure Steady as Sec 5 added
17:30			429	Pressure Steady as Sec 5 added
18:00			438	Pressure Steady as Sec 5 added
18:30			436	Pressure Steady as Sec 5 added
19:00			437	
19:15			440	Begin Steady Fill all sections balanced
20:14			503	Leveled of to allow for settling
20:30			503	Begin Steady Fill
22:00			597	Begin Steady Fill
23:00			662	

16-Feb-14

DATE

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AUTHORIZATION



**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

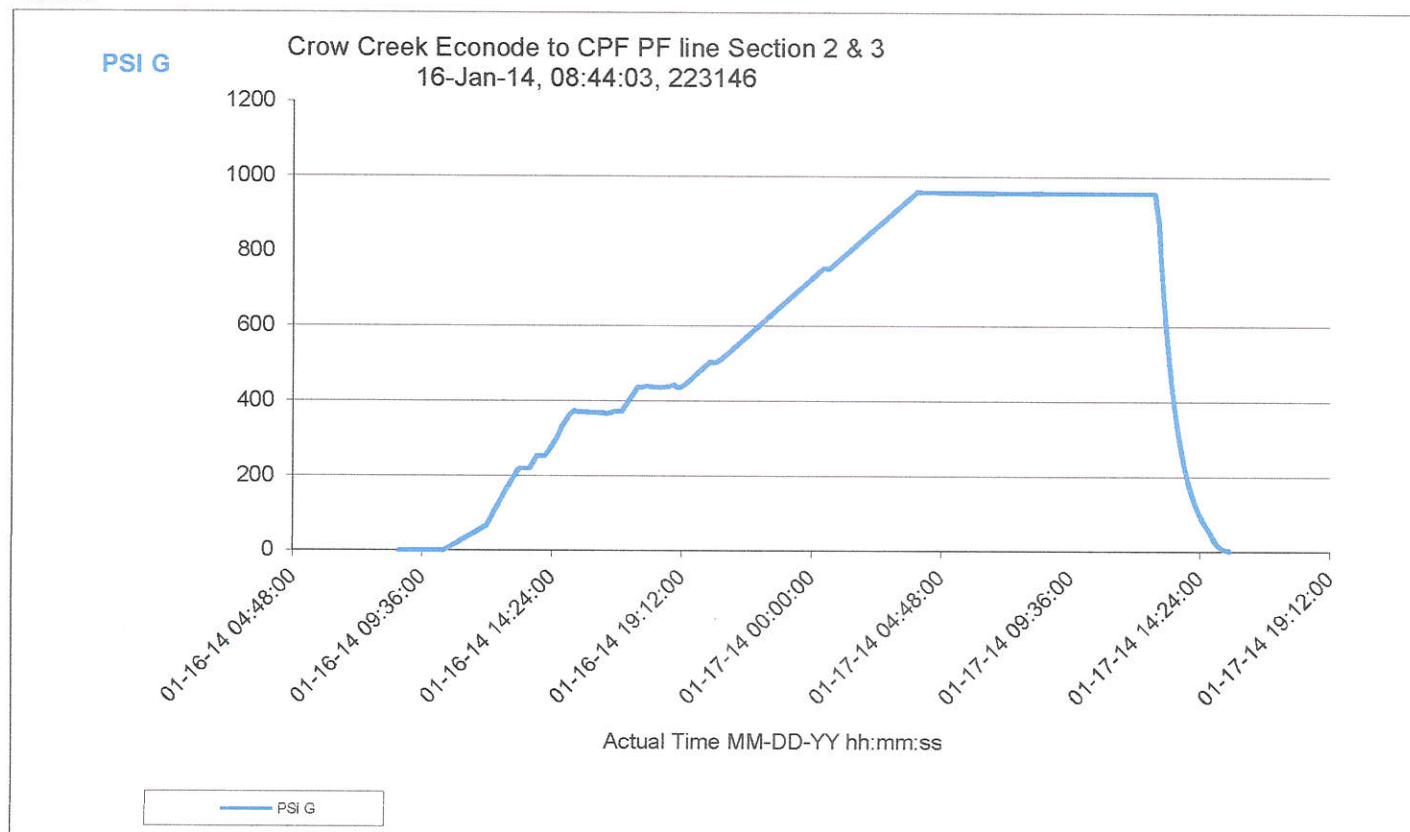
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**Rev:** 0  
**Rev. Date:** 27-Jan-14  
**By:**  
**Approved:** RES

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
0:25			754	Leveled of to allow for settling
0:39			752	Begin Steady Fill
3:54			959	
4:00			958	Set Test
4:30			958	
5:00			957	
5:30			957	
6:00			957	
6:30			957	
7:00			956	
7:30			956	
8:00			956	
8:30			956	
9:00			956	
9:30			956	
10:00			956	
10:30			956	
11:00			956	
11:30			956	
12:00			956	
12:30			956	
12:41			956	Good Test
15:29			0	Broke Test

## Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	255771	251525	
Datatype		Lower	
Units		PSI G	

Lower







**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 3-Feb-14  
**By:** RES  
**Approved:** RES

### PNEUMATIC TEST(AC36 PF Lateral Section 4)

Wells Ranch AC36 Lateral	CLIENT: Noble Energy
TEST MEDIUM: Nitrogen	xxxxx
TEST PRESSURE: 925 PSIG	DESIGN PRESSURE: 740 PSIG
TEST DURATION: 8 HRs	START TIME: 10:22
TEST PERFORMED BY: PSI	STOP TIME: 15:28

TEST EQUIPMENT				
TYPE	MAKE	MODEL	SER#	CAL DATE
RECORDER	NV	10KPSI	251542	11-May-13
SCALE				
TEMP GAUGE				
PRESS GAUGE				

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
15:00			0	Start Filling Section 4
15:30			42	
16:00			86	
16:21			128	Leveled of to allow for inspection
16:35				Begin Steady Fill
17:00			151	Leveled of to allow for inspection
17:35			149	Begin Steady Fill
18:00			218	
18:30			310	
19:00			397	
19:15			440	Begin Steady Fill all sections balanced
19:30			454	
20:00			487	Begin Steady Fill all sections balanced
20:14			502	Leveled of to allow for settling
20:30			502	Begin Steady Fill
22:00			596	Begin Steady Fill
23:00			660	

16-Feb-14  
 DATE

*Rob Stutz*  
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**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 27-Jan-14  
**By:**  
**Approved:** RES

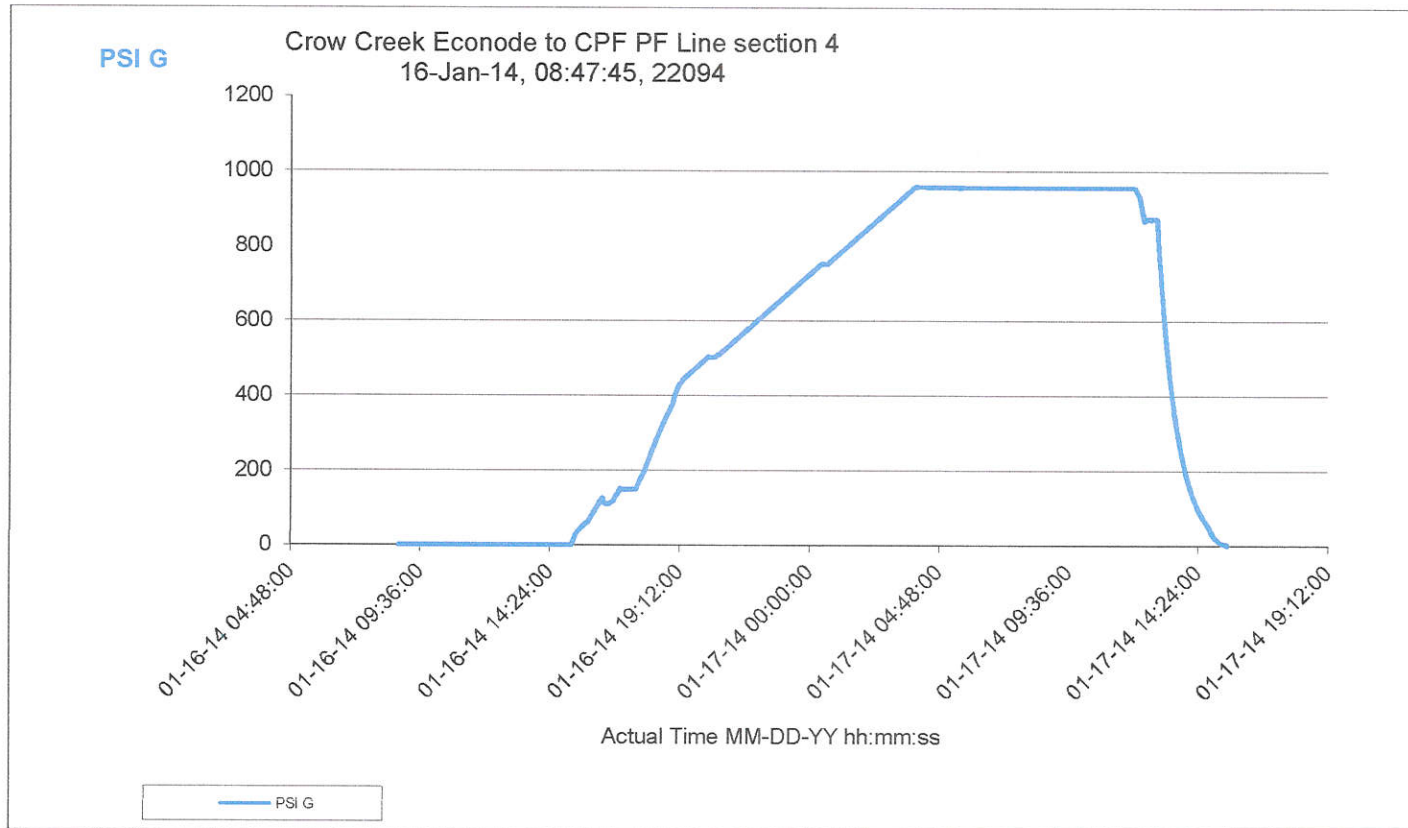
TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
0:25			753	Leveled of to allow for settling
0:39			752	Begin Steady Fill
3:54			959	
4:00			958	Set Test
4:30			958	
5:00			957	
5:30			957	
6:00			956	
6:30			956	
7:00			956	
7:30			956	
8:00			956	
8:30			956	
9:00			956	
9:30			956	
10:00			956	
10:30			956	
11:00			956	
11:30			956	
12:00			956	Good Test
12:02			956	
15:28			0	Broke Test



## Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	255774	251542	
Datatype		Lower	
Units		PSI G	

Lower





**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 3-Feb-14  
**By:** RES  
**Approved:** RES

### PNEUMATIC TEST(AC36 PF Lateral Section 5)

Wells Ranch AC36 Lateral	CLIENT: Noble Energy
TEST MEDIUM: Nitrogen	xxxxx
TEST PRESSURE: 925 PSIG	DESIGN PRESSURE: 740 PSIG
TEST DURATION: 8 HRs	START TIME: 16:16
TEST PERFORMED BY: PSI	STOP TIME: 13:50

TEST EQUIPMENT				
TYPE	MAKE	MODEL	SER#	CAL DATE
RECORDER	NV	10KPSI	254006	11-Jun-13
SCALE				
TEMP GAUGE				
PRESS GAUGE				

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
16:16			0	Start Filling Section 5
16:30			95	
17:00			151	Leveled of to allow for inspection
17:35			150	Begin Steady Fill
18:00			219	
18:30			312	
19:00			395	
19:15			440	Begin Steady Fill all sections balanced
18:30			310	
19:00			397	
19:15			437	Begin Steady Fill all sections balanced
0:00			454	
20:00			488	Begin Steady Fill all sections balanced
20:14			504	Leveled of to allow for settling
20:30			504	Begin Steady Fill
22:00			598	Begin Steady Fill
23:00			662	

16-Feb-14  
 DATE

*Rob Stutz*  
 AUTHORIZATION



**Client** Noble Energy  
**Project:** AC36 Lateral  
**Location:** Gill, Co  
**Project No.:** 0

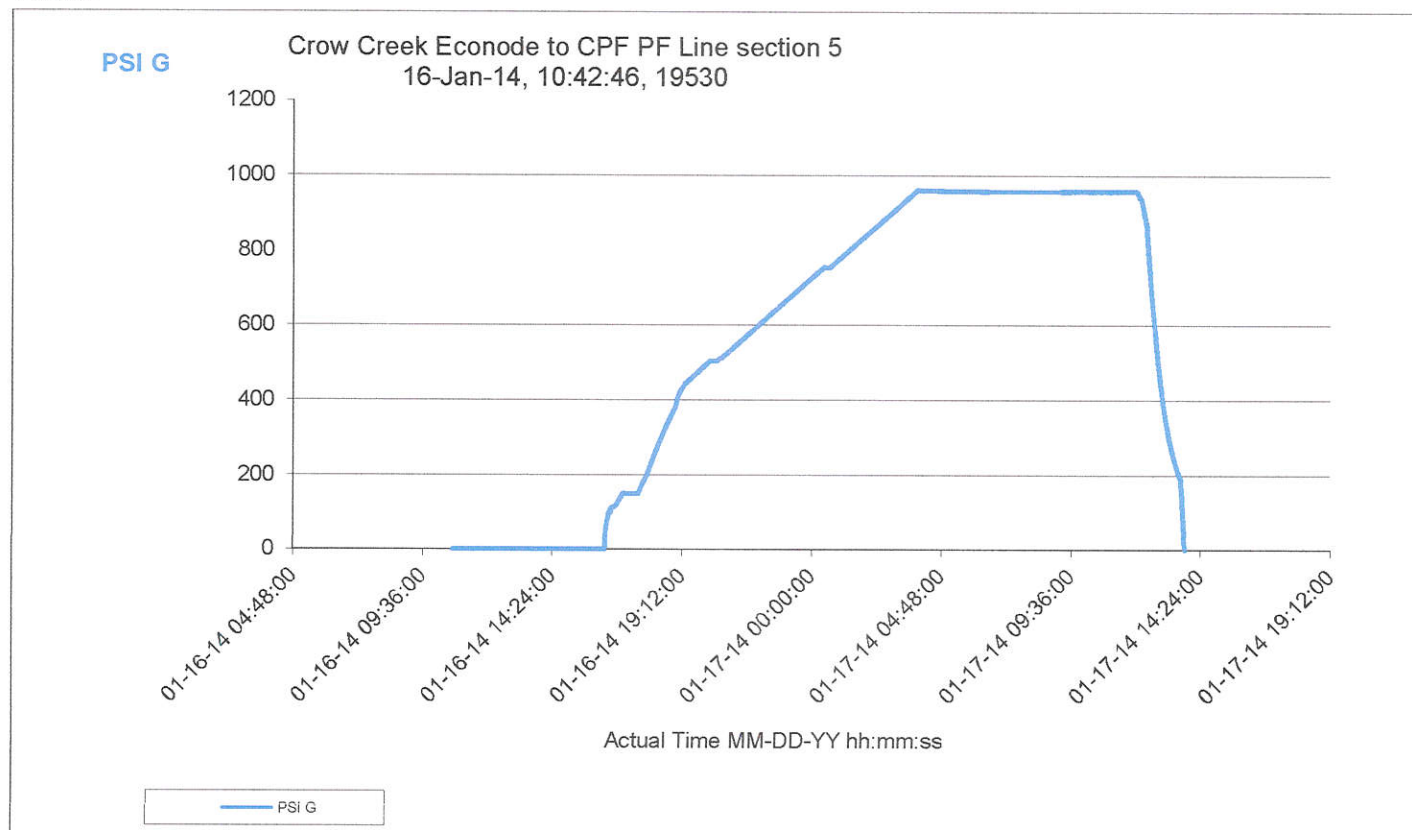
**Issue:** 1  
**Rev:** 0  
**Rev. Date:** 27-Jan-14  
**By:**  
**Approved:** RES

TIME	TEMP	AMBIENT	PRESSURE	COMMENTS
0:25			755	Leveled of to allow for settling
0:39			754	Begin Steady Fill
3:54			960	
4:00			960	Set Test
4:30			960	
5:00			959	
5:30			959	
6:00			959	
6:30			958	
7:00			958	
7:30			958	
8:00			958	
8:30			958	
9:00			958	
9:30			959	
10:00			959	
10:30			959	
11:00			959	
11:30			959	
12:00			959	Good Test
12:02			956	Broke Test
13:50			0	

## Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	256545	254006	
Datatype		Lower	
Units		PSI G	

Lower







**APEX**  
INSTRUMENTS

7200 E. Dry Creek Rd. C-102  
Centennial, Co. 80112  
303-804-0667  
cal.lab@apex-instruments.com

Silverline Services  
1287 Diamond Drive  
Windsor, CO 80550

Page 1

# CALIBRATION CERTIFICATE: 4276

Jan 30 2014

## Device Information:

Model  
Manufacturer  
Serial Number

DUT  
nVision  
Crystal Engineering  
354371

Reference  
RPM4-E-DWT  
DH Instruments  
1709

Pressure Range  
Tolerance  
Data Acquisition Mode  
Date of Calibration  
Calibration Due

0.000 to 10000.000  
0.03 %FS + 0.1 %Rdg  
RS232  
Jan 30 2014  
Jan 30 2015

0.000 to 10000.000  
0.01 %Span  
RS232  
Sep 17 2013  
Sep 17 2014

## Test Information

Test Label 10,000PSI  
Date Jan 30 2014  
Time 10:30:50 AM  
Operator Mark  
Station ID APEXCALLAB-HP

## Conditions

Ambient Pressure  
Ambient Temperature 23° +/- 3.0° C  
Ambient Relative Humidity 20% - 60%

## As Received Data:

Test Point	Reference Pressure	DUT Pressure	DUT Raw Output	Abs. Error	"% Span" Error	DUT Tolerance	Status
	psi	psi	psi	psi	%	psi	
1	0	-0.027	-0.027	-0.027	-0.0003	3.000	Pass
2	2132	2130.830	2130.830	-1.170	-0.0076	5.131	Pass
3	4032	4030.360	4030.360	-1.640	-0.0158	7.030	Pass
4	6065	6063.608	6063.608	-1.392	-0.0163	9.064	Pass
5	8149	8146.995	8146.995	-2.005	-0.0222	11.147	Pass
6	10020	10018.265	10018.265	-1.735	-0.0221	13.018	Pass
7	8136	8133.131	8133.131	-2.869	-0.0259	11.133	Pass
8	6051	6049.611	6049.611	-1.389	-0.0180	9.050	Pass
9	3961	3959.183	3959.183	-1.817	-0.0141	6.959	Pass
10	2138	2136.344	2136.344	-1.656	-0.0136	5.136	Pass
11	0	0.000	0.000	0.000	0.0000	3.000	Pass

As Received First Order Fit:  $y = 1.000188E00x + 5.613003E-01$

## As Left Data:

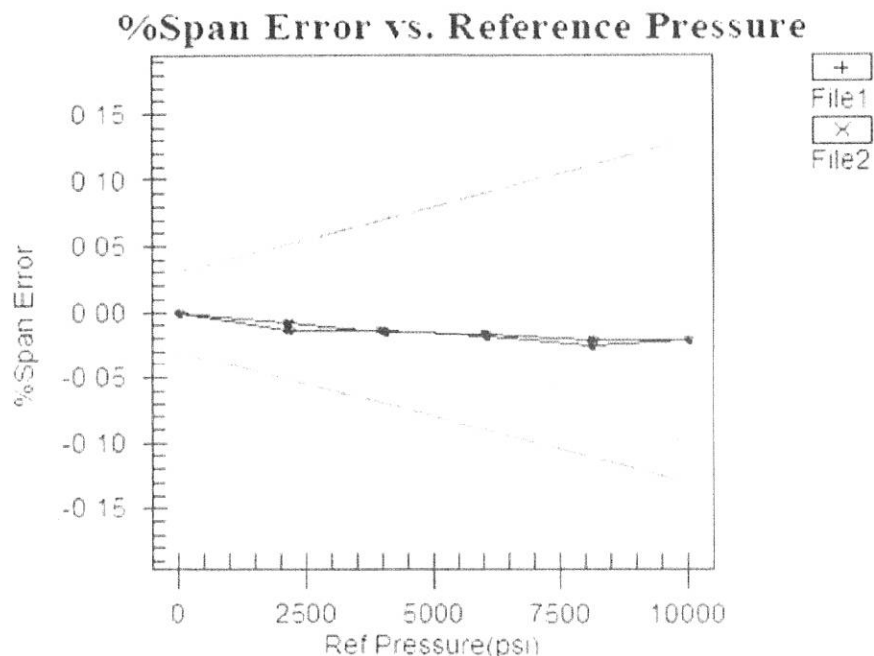
Test Point	Reference Pressure	DUT Pressure	DUT Raw Output	Abs. Error	"% Span" Error	DUT Tolerance	Status
	psi	psi	psi	psi	%	psi	
1	0	-0.027	-0.027	-0.027	-0.0003	3.000	Pass



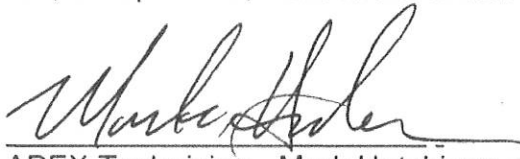
2	2132	2130.830	2130.830	-1.170	-0.0076	5.131	Pass
3	4032	4030.360	4030.360	-1.640	-0.0158	7.030	Pass
4	6065	6063.608	6063.608	-1.392	-0.0163	9.064	Pass
5	8149	8146.995	8146.995	-2.005	-0.0222	11.147	Pass
6	10020	10018.265	10018.265	-1.735	-0.0221	13.018	Pass
7	8136	8133.131	8133.131	-2.869	-0.0259	11.133	Pass
8	6051	6049.611	6049.611	-1.389	-0.0180	9.050	Pass
9	3961	3959.183	3959.183	-1.817	-0.0141	6.959	Pass
10	2138	2136.344	2136.344	-1.656	-0.0136	5.136	Pass
11	0	0.000	0.000	0.000	0.0000	3.000	Pass

As Left First Order Fit:  $y = 1.000188E00x + 5.613003E-01$

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 APEX Technician - Mark Hutchison

This Instrument has been calibrated using standards with accuracies traceable to the National Institute of Standards and Technology, derived from natural physical constants, derived from ratio measurements or compared consensus standards.

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Report number 148490

Calibrations comply with ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994

Module	Serial Number	Calibration Date	Verification Date
10KPSI	251525	09 March 2012	19 April 2012

As Received Condition: New

As Left Condition: In Tolerance

Definitions:	Temperature	Measured temperature of Device Under Test (DUT) during data collection.
	Reference Reading	True value according to our reference standards.
	Indicated Reading	Displayed reading from test unit.
	Condition	Pass or Fail.
	Difference	Indicated reading minus reference reading.
	Relative Difference	$(\text{Difference} / \text{reference reading}) \times 100$
	Allowable Tolerance	$\pm$ according to manufacturer's specifications.
	Water column	Referenced at 4° C and 1 atmosphere.
	Pressure Medium	Nitrogen.

Laboratory ambient conditions throughout this calibration were: Temperature 19 to 23° C  
Humidity 20 to 60% RH


Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States (NIST), through the listed report numbers.

System expanded uncertainty evaluation includes the calibration reference used and device under test and is calculated in accordance with ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainties reported represent expanded uncertainties using a coverage factor  $k=2$  to approximate a 95% confidence level. In Tolerance or pass conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. Test methods defined by COI-054. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

Manufacturer	Calibration Reference Used	Serial Number	Report Number	Due Date	System Expanded Uncertainty
DHI	PG7202 w/ 1 MPa/kg PC	875	1316761880	23 September 2012	0.0035% of Reading + 5.1 kPa

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Laboratory Representative  
Troy Burns

  
Quality Representative  
Bruce Hitt

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ILAC (International Laboratory Accreditation Cooperation) - MRA (Multilateral Recognition Arrangement)  
ISO 9001:2000 Quality Management System Certified by Bureau Veritas, Certificate No. 191559



# Test Results

Report number 148490

Serial Number 251525

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## As Left Test Results

From 0 to 10000 psi

Temperature (Celsius)	Reference Reading ( psi)	Indicated Reading ( psi)	Condition	Difference ( psi)	Relative Difference (% of reading)	Allowable Tolerance ( psi)
-20	0.0	0	Pass	0.0		3.0
-20	2501.0	2501	Pass	0.0	0.000	3.0
-20	5003.1	5003	Pass	-0.1	-0.002	5.0
-20	7502.5	7503	Pass	0.5	0.007	7.5
-20	9943.7	9944	Pass	0.3	0.003	9.9
-20	10002.2	10003	Pass	0.8	0.008	10.0
-20	10147.6	10149	Pass	1.4	0.014	10.1
-20	7502.6	7503	Pass	0.4	0.005	7.5
10	0.0	0	Pass	0.0		3.0
10	2501.0	2501	Pass	0.0	0.000	3.0
10	5003.1	5003	Pass	-0.1	-0.002	5.0
10	7502.6	7503	Pass	0.4	0.005	7.5
10	9943.7	9945	Pass	1.3	0.013	9.9
10	10002.3	10003	Pass	0.7	0.007	10.0
10	10147.6	10149	Pass	1.4	0.014	10.1
10	7502.6	7504	Pass	1.4	0.019	7.5
20	0.0	0	Pass	0.0		3.0
20	2501.0	2501	Pass	0.0	0.000	3.0
20	5003.1	5003	Pass	-0.1	-0.002	5.0
20	7502.6	7503	Pass	0.4	0.005	7.5
20	9943.8	9944	Pass	0.2	0.002	9.9
20	10002.3	10003	Pass	0.7	0.007	10.0
20	10147.6	10148	Pass	0.4	0.004	10.1
20	7502.6	7503	Pass	0.4	0.005	7.5
30	0.0	0	Pass	0.0		3.0
30	2501.0	2501	Pass	0.0	0.000	3.0
30	5003.1	5003	Pass	-0.1	-0.002	5.0
30	7502.6	7503	Pass	0.4	0.005	7.5
30	9943.8	9944	Pass	0.2	0.002	9.9
30	10002.3	10003	Pass	0.7	0.007	10.0
30	10147.6	10148	Pass	0.4	0.004	10.1
30	7502.6	7503	Pass	0.4	0.005	7.5
50	0.0	0	Pass	0.0		3.0
50	2501.0	2501	Pass	0.0	0.000	3.0
50	5003.1	5003	Pass	-0.1	-0.002	5.0
50	7502.6	7503	Pass	0.4	0.005	7.5
50	9943.8	9944	Pass	0.2	0.002	9.9
50	10002.3	10003	Pass	0.7	0.007	10.0
50	10147.6	10148	Pass	0.4	0.004	10.1
50	7502.6	7503	Pass	0.4	0.005	7.5

Span multiplier: 1.00000

Manufacturer's specifications: 0-30% of Full Scale:  $\pm 0.03\%$  of Full Scale; 30-100% of Full Scale:  $\pm 0.10\%$  of Reading

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## Certificate of Calibration



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Report number 149659

Calibrations comply with ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994

Module	Serial Number	Calibration Date	Verification Date
10KPSI	251542	09 March 2012	11 May 2012

As Received Condition: New

As Left Condition: In Tolerance

Definitions:	Temperature	Measured temperature of Device Under Test (DUT) during data collection.
	Reference Reading	True value according to our reference standards.
	Indicated Reading	Displayed reading from test unit.
	Condition	Pass or Fail.
	Difference	Indicated reading minus reference reading.
	Relative Difference	$(\text{Difference} / \text{reference reading}) \times 100$
	Allowable Tolerance	$\pm$ according to manufacturer's specifications.
	Water column	Referenced at 4° C and 1 atmosphere.
	Pressure Medium	Nitrogen.

Laboratory ambient conditions throughout this calibration were: Temperature 19 to 23° C  
Humidity 20 to 60% RH

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States (NIST), through the listed report numbers.

System expanded uncertainty evaluation includes the calibration reference used and device under test and is calculated in accordance with ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainties reported represent expanded uncertainties using a coverage factor  $k=2$  to approximate a 95% confidence level. In Tolerance or pass conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. Test methods defined by COI-054. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

Manufacturer	Calibration Reference Used	Serial Number	Report Number	Due Date	System Expanded Uncertainty
DHI	PG7202 w/ 1 MPa/kg PC	875	1316761880	23 September 2012	0.0035% of Reading + 5.1 kPa

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Laboratory Representative  
Jeremy Daniel

Quality Representative  
Bruce Hilt

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ILAC (International Laboratory Accreditation Cooperation) - MRA (Multilateral Recognition Arrangement)  
CEC is ISO 9001:2000 Quality Management System Certified by Bureau Veritas, Certificate No. 191559.





## Test Results

Report number 149659  
Serial Number 251542

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### As Left Test Results

From 0 to 10000 psi

Temperature (Celsius)	Reference Reading (psi)	Indicated Reading (psi)	Condition	Difference (psi)	Relative Difference (% of reading)	Allowable Tolerance (psi)
-20	0.0	0	Pass	0.0		3.0
-20	2501.0	2501	Pass	0.0	0.000	3.0
-20	5003.1	5003	Pass	-0.1	-0.002	5.0
-20	7502.5	7503	Pass	0.5	0.007	7.5
-20	9943.7	9945	Pass	1.3	0.013	9.9
-20	10002.2	10003	Pass	0.8	0.008	10.0
-20	10147.6	10149	Pass	1.4	0.014	10.1
-20	7502.6	7503	Pass	0.4	0.005	7.5
10	0.0	0	Pass	0.0		3.0
10	2501.0	2501	Pass	0.0	0.000	3.0
10	5003.1	5003	Pass	-0.1	-0.002	5.0
10	7502.6	7503	Pass	0.4	0.005	7.5
10	9943.7	9945	Pass	1.3	0.013	9.9
10	10002.3	10003	Pass	0.7	0.007	10.0
10	10147.6	10149	Pass	1.4	0.014	10.1
10	7502.6	7504	Pass	1.4	0.019	7.5
20	0.0	0	Pass	0.0		3.0
20	2501.0	2501	Pass	0.0	0.000	3.0
20	5003.1	5003	Pass	-0.1	-0.002	5.0
20	7502.6	7503	Pass	0.4	0.005	7.5
20	9943.8	9945	Pass	1.2	0.012	9.9
20	10002.3	10003	Pass	0.7	0.007	10.0
20	10147.6	10149	Pass	1.4	0.014	10.1
20	7502.6	7504	Pass	1.4	0.019	7.5
30	0.0	0	Pass	0.0		3.0
30	2501.0	2501	Pass	0.0	0.000	3.0
30	5003.1	5003	Pass	-0.1	-0.002	5.0
30	7502.6	7503	Pass	0.4	0.005	7.5
30	9943.8	9945	Pass	1.2	0.012	9.9
30	10002.3	10003	Pass	0.7	0.007	10.0
30	10147.6	10149	Pass	1.4	0.014	10.1
30	7502.6	7503	Pass	0.4	0.005	7.5
50	0.0	0	Pass	0.0		3.0
50	2501.0	2501	Pass	0.0	0.000	3.0
50	5003.1	5003	Pass	-0.1	-0.002	5.0
50	7502.6	7503	Pass	0.4	0.005	7.5
50	9943.8	9945	Pass	1.2	0.012	9.9
50	10002.3	10003	Pass	0.7	0.007	10.0
50	10147.6	10148	Pass	0.4	0.004	10.1
50	7502.6	7504	Pass	1.4	0.019	7.5

Span multiplier: 1.00000

Manufacturer's specifications: 0-30% of Full Scale:  $\pm 0.03\%$  of Full Scale; 30-100% of Full Scale:  $\pm 0.10\%$  of Reading



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Report number 151337

Calibrations comply with ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994

Module	Serial Number	Calibration Date	Verification Date
10KPSI	254006	18 April 2012	11 June 2012

As Received Condition: New

As Left Condition: In Tolerance

Definitions:	Temperature	Measured temperature of Device Under Test (DUT) during data collection.
	Reference Reading	True value according to our reference standards.
	Indicated Reading	Displayed reading from test unit.
	Condition	Pass or Fail.
	Difference	Indicated reading minus reference reading.
	Relative Difference	(Difference / reference reading) x 100
	Allowable Tolerance	± according to manufacturer's specifications.
	Water column	Referenced at 4° C and 1 atmosphere.
	Pressure Medium	Nitrogen.


Laboratory ambient conditions throughout this calibration were: Temperature 19 to 23° C  
 Humidity 20 to 60% RH

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States (NIST), through the listed report numbers.

System expanded uncertainty evaluation includes the calibration reference used and device under test and is calculated in accordance with ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainties reported represent expanded uncertainties using a coverage factor k=2 to approximate a 95% confidence level. In Tolerance or pass conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. Test methods defined by COI-054. The recommended calibration interval for this instrument is 12 months from the date of verification. Your particular quality assurance requirements may supersede this recommendation.

Manufacturer	Calibration Reference Used	Serial Number	Report Number	Due Date	System Expanded Uncertainty
DHI	PG7202 w/ 1 MPa/kg PC	875	1316761880	23 September 2012	0.0035% of Reading + 5.1 kPa

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 Laboratory Representative  
 Troy Burns

  
 Quality Representative  
 Bruce Hitt

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 ILAC (International Laboratory Accreditation Cooperation) - MRA (Multilateral Recognition Arrangement)  
 CEC is ISO 9001:2000 Quality Management System Certified by Bureau Veritas, Certificate No. 191559



# Test Results

Report number 151337  
Serial Number 254006

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## As Left Test Results

From 0 to 10000 psi

Temperature (Celsius)	Reference Reading ( psi)	Indicated Reading ( psi)	Condition	Difference ( psi)	Relative Difference (% of reading)	Allowable Tolerance ( psi)
-20	0.0	0	Pass	0.0		3.0
-20	2501.0	2501	Pass	0.0	0.000	3.0
-20	5003.1	5003	Pass	-0.1	-0.002	5.0
-20	7502.6	7503	Pass	0.4	0.005	7.5
-20	9943.8	9944	Pass	0.2	0.002	9.9
-20	10002.3	10003	Pass	0.7	0.007	10.0
-20	10147.6	10148	Pass	0.4	0.004	10.1
-20	7502.6	7503	Pass	0.4	0.005	7.5
10	0.0	0	Pass	0.0		3.0
10	2501.0	2501	Pass	0.0	0.000	3.0
10	5003.1	5003	Pass	-0.1	-0.002	5.0
10	7502.6	7503	Pass	0.4	0.005	7.5
10	9943.8	9945	Pass	1.2	0.012	9.9
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20	0.0	0	Pass	0.0		3.0
20	2501.0	2501	Pass	0.0	0.000	3.0
20	5003.1	5003	Pass	-0.1	-0.002	5.0
20	7502.6	7503	Pass	0.4	0.005	7.5
20	9943.8	9944	Pass	0.2	0.002	9.9
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30	5003.1	5003	Pass	-0.1	-0.002	5.0
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50	2501.0	2501	Pass	0.0	0.000	3.0
50	5003.1	5003	Pass	-0.1	-0.002	5.0
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