WEST ENGINEERING SERVICES

Shear Certificate Packet

For

ENSCO 82

VR 214 B-3 ST1

Job Number: 4931

17 October 2011

P.O. Box 577
Brookshire, TX 77423
U.S.A

WEST ENGINEERING SERVICES

ISO 9001 Certified

Tel: (281) 375-5515
Fax: (281) 934-1600
west@westengineer.com

Mr. Albert Hebert
Rig Manager
Ensco

17 October 2011

Subject: *ENSCO 82*, VR 214 B-3 ST1
Reference: Shear Verification per 30 CFR §250.416(e)

Dear Mr. Hebert:

Please find attached the Blind-Shear Ram Certificate and related documents for the *ENSCO 82*. The calculations were carried out according to Cameron EB702 D Rev B10 and utilize both the Dimensional and PPF methods. Background equations used for the calculations are shown on each shear calculation spreadsheet near the required shear pressure output cells. Additionally, relevant shear test documentation is included. Should you have any questions or concerns, please feel free to contact us.

Based on the client supplied input data, actual shear test report values and WEST shear calculations, the certified pipe is the hardest pipe to shear in this well program; therefore, the certified pipe also qualifies the other pipe sizes. WEST has used the submitted MASP for calculations and also considers this certification valid for any MASP of lower value.

Sincerely,

Originally sent via email

Raleigh Williamson,
for WEST Engineering Services, Texas Registration No. F-4672

WEST Job Number: 4931

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10. Letter Attesting No Violation of Law
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Blind-Shear Ram Certificate

In accordance with 30 CFR §250.416(e), **Verification that Blind-shear Rams will Shear Pipe in the Hole,** this certificate verifies that, based on cited calculation method, data provided to WEST Engineering, and actual testing, the equipment listed below is capable of shearing the specified pipe.

NOTE – Certification is only valid for fully functional equipment maintained according to manufacturers and API requirements and operated within design and testing standards as specified within API Specification 16A. This certification assumes the same BOP equipment (i.e., blind-shear rams of the same make, model, and size as proposed for the operation) is utilized in all cases. Calculations are based on client Input Data Sheet found as Section 5.

Client:	Ensco
West Job Number:	4931
Rig:	Ensco 82
Operator:	Chevron
Contractor:	Ensco
Well Name:	VR 214 B-3 ST1
EQUIPMENT / CALCULATION INFORMATION	
BOP:	Cameron 13-5/8" – 10K U BOP
Type of Shear Operator:	LBT (Large bore Shear Bonnet equipped with booster assembly)
Type of Shear Ram:	ISR (Interlocking Shear Ram)
Hydraulic Pressure Supplied to Operator:	3,000 psi
Maximum Wellbore Pressure at BOP (MASP):	5,000 psi (Production MASP = 4,691 psi)
Tested Pipe: See Section 4	5" OD, 0.362" wall, S-135
Certified Pipe: See Section 3	4" OD, 0.33" wall, S-135
Certified Pipe Nominal Yield Strength:	135,000 psi
Certified Pipe Theoretical Shear Pressure Corrected for Wellbore Pressure:	1,939 psi
Calculation Method:	Cameron EB 702 D, Rev B10 Dimensional & PPF Methods

Calculations Performed by: Jon Heerensperger Date: 17 October 2011

Calculations Approved by: Covey Hall Date: 17 October 2011

Certificate Approval: Date: 17 October 2011

Raleigh Williamson,
for WEST Engineering Services,
Texas Registration No. F-4672

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Section 3

Theoretical Results obtained by stated calculation method,
corrected for MASP
Source: Client Input Data Sheet; Section 5

Summary Table of Calculated Theoretical Results:

Pipe	MASP [psi]	Shear Pressure [psi]	Comment
5” OD, 0.362” wall, S-135	5,000	2,536	Tested, but not certified
4” OD, 0.33” wall, S-135	5,000	1,939	Certified Pipe
3.5” OD, 0.368” wall, S-135	5,000	1,832	Qualified by certified pipe
2.875” OD, 0.362” wall, S-135	5,000	1,507	Qualified by certified pipe
2.875” OD, 0.217” wall, L-80	5,000	916	Qualified by certified pipe
2.375” OD, 0.19” wall, L-80	5,000	740	Qualified by certified pipe

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Section 4

Tested Pipe Results obtained from Shear Test Report,
corrected for MASP
Source: Shear Test Report; Section 7

Summary of Table of Tested Pipe Results:

Tested Pipe:	5” OD, 0.362” wall, S-135
Tested Pipe Nominal Yield Strength:	135,000 psi
Tested Pipe Actual Shear Pressure:	2,200 psi
Tested Pipe Actual Shear Pressure Corrected for Wellbore Pressure:	2,491 psi
Tested Pipe Theoretical Shear Pressure Corrected for Wellbore Pressure:	2,536 psi

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Shear Calculation Input Data

WEST is preparing to perform shear verification as required by NTL No. 2010-N05.
Please input information where indicated in the template below and return to WEST Engineering Services via email:
ntl@westengineer.com

- Please enter data carefully, as any subsequent changes may have cost & schedule impact.
- If the requested data is not relevant, please enter "N/A" for Not Applicable.
- Please return a separate sheet for each situation (e.g. pipe size & MASP) to be calculated.

Equipment	
BOP Original Equipment Manufacturer (Shaffer, Cameron, etc.)	Cameron
Ram BOP Model Designation (U, TL, SL, etc.)	Type U
BOP Size and Pressure Rating (18 3/4" - 15K, etc.)	13 5/8" 10K
Shear Operator Configuration or Bonnet Size (SBT, LBT, etc.)	LBT
Shear Ram Type (Ram Design)	Interlocking shear rams
Shear Operator Hydraulic Area (if non-Cameron) [sq. inches]	N/A
Shear Operator Closing Ratio (if non-Cameron)	N/A
Hydraulic Pressure Supplied to Operator [psi]	3,000

Tubular Information Required

No.	Pipe OD [in]	Pipe ID [in]	Wall Thickness [in]	Pipe Weight per Foot [ppf]	Pipe Grade (e.g. S-135)	Yield Strength (Nominal) [psi]	Comments
1	5	4.276	0.362	19.5	S-135	135,000	Tested Pipe
2	4	3.34	0.33	14.4	S-135	135,000	Same Shear Calc @ 5,000 psi for all DP; Same MASP for all DP
3	3.5	2.764	0.368	13.3	S-135	135,000	Same Shear Calc @ 5,000 psi for all DP; Same MASP for all DP
4	2.875	2.151	0.362	10.4	S-135	135,000	Same Shear Calc @ 5,000 psi for all DP; Same MASP for all DP
5	2.875	2.441	0.217	6.5	L-80	80000	Same Shear Calc @ 5,000 psi for all DP; Same MASP for all DP
6	2.375	1.995	0.19	4.7	L-80	80000	Same Shear Calc @ 5,000 psi for all DP; Same MASP for all DP

Well Information	
Existing West Job # or New Purchase Order No. (if new job) *	FR#103519 OEA/ **WEST Job# 4931**
Rig Name	ENSCO 82
Drilling Contractor (rig owner)	ENSCO
Operator (oil company)	Chevron
Well Name	VR 214 B-3 ST1
MASP (Maximum Anticipated Surface Pressure) [psi]	4,691

* - FR# if PO# is unavailable

Coon Hebert — Information provided by (please print name above)

10/9/2011 — Date

Requested Delivery Date for Shear Certification: 10/16/2011

Date

Please note that subsequent changes to input data are likely to delay certification.

Rev - 20100812cw

Section 6.a.1
Test Pressure Compensated for Wellbore Pressure
Cameron 13 5/8" - 10K U BOP, LBT, ISR
5" OD, 0.362" wall , S-135

Increased Shear Pressure due to Pressure in the Wellbore

WEST Engineering Services

P_a - Actual Shear Pressure from Test

MASP - Maximum Anticipated Surface Pressure (in BOP)

C_r - BOP Closing Ratio (from table)

P_i - Increased Shear Pressure due to Pressure in the Wellbore

$= MASP / C_r$

P_t - Total Shear Pressure $= P_a + P_i$

P_a [psi]	2,200		
MASP [psi]	5,000		
C_r	17.2		
Increase in Shear Press., P_i	291	psi	Input
Total Shear Pressure, P_t	2,491	psi	Output

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	135
Tubular PPF:	19.5
Calculated Highest Shear Pressure [psi]	
2536	

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	5	0.362	4.276	224	13	0.19	19.5	135000	2246	2536

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.19	19.5	135000	2233	2523

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	135
Tubular PPF:	14.4
Calculated Highest Shear Pressure [psi]	
1939	

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	4	0.33	3.34	224	13	0.19	14.4	135000	1620	1910

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.19	14.4	135000	1649	1939

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

WEST ENGINEERING SERVICES

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	135
Tubular PPF:	13.3
Calculated Highest Shear Pressure [psi]	**1832**

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	3.5	0.368	2.764	224	13	0.19	13.3	135000	1542	1832

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.19	13.3	135000	1523	1813

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	135
Tubular PPF:	10.4
Calculated Highest Shear Pressure [psi]	
1507	

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	2.875	0.362	2.151	224	13	0.19	10.4	135000	1217	1507

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.19	10.4	135000	1191	1481

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	80
Tubular PPF:	6.5
Calculated Highest Shear Pressure [psi]	
916	

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	2.875	0.217	2.441	224	13	0.26	6.5	80000	626	916

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.26	6.5	80000	604	894

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

EB 702 D, Rev B10
SHEARING CAPABILITIES OF CAMERON SHEAR RAMS

EQUIPMENT AND TUBULAR DATA	
BOP Type:	13-3M/10M U
Ram Type:	ISR
Operator Type:	LBT
Wellbore Pressure [psi]:	5000
Tubular Yield [ksi]:	80
Tubular PPF:	4.7
Calculated Highest Shear Pressure [psi]	
740	

P_{shear} = Calculated required operator shear pressure (psi)
P_w = Wellbore pressure at time of shear (psi)
σ_{yield} = Minimum yield strength of the tubular material
ppf = Nominal weight of the tubular (pounds per foot)
C_1 = Operator constant corresponding to the piston closing area
C_2 = Operator constant corresponding to the piston rod opening area
C_3 = Constant corresponding to shear ram type / pipe grade

DIMENSIONAL METHOD - To be used if the shear pressure calculations require the pipe outside and inside diameter.

	OD	Wall	ID	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	2.375	0.19	1.995	224	13	0.26	4.7	80000	450	740

PPF METHOD - Calculates using the nominal weight of the tubular (pounds per foot).

	C1	C2	C3	PPF	Yield	Req. shear pressure with no wellbore pressure (psi)	Req. shear pressure for wellbore pressure (psi)
Tubular Shear Data	224	13	0.26	4.7	80000	436	727

Equations	PPF Method	Dimensional Method
No Wellbore Pressure (psi)	Pshear=[C3*ppf x σ_{yield}]/C1	Pshear=[(C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92]/C1
Including Wellbore Pressure (psi)	Pshear=[(C3 x ppf x σ_{yield})+(Pw x C2)]/C1	Pshear=[((C3 x σ_{yield}) x (pipeOD^2-pipeID^2) x 2.92)+(Pw x C2)]/C1

Howard & Associates International, Inc.

Lafayette, Louisiana

DATE: July 12, 2010

TO: Sean O'Connor
Gary Faciane
ENSCO INTERNATIONAL, INC.

FROM: Steven P. Howard, President
Charlie Kibbe, P.E., Senior Staff Consultant
Jeremy Hebert, Staff Consultant
HOWARD & ASSOCIATES INTERNATIONAL, INC.

SUBJECT: ON-SITE SURVEILLANCE OF BOP SHEAR RAM TESTING AT T3 ENERGY - *TEST EO133-3*

1. INTRODUCTION

On June 29, 2010, representatives from Howard & Associates International, Inc. witnessed a series of blowout preventer (BOP) shear ram tests at the T3 Energy facility in Houma, Louisiana. Five different drill pipe configurations were tested in a Cameron 13 5/8" – 10,000 psi Type DBLE U blowout preventer fitted with Cameron ISR (Interlocking Shear Rams) Rams.

2. REFERENCES

2.1 Documents

See *Appendix A for test data, photographs, and test equipment information and Appendix B* for Howard & Associates International, Inc. independent third party qualifications.

2.2 Glossary

Shear Pressure – The pressure at which the BOP rams sheared the pipe was determined by monitoring an analog pressure gage and examining the pressure recorded on the chart recorder. Representatives from T3 Energy, Ensco, West Engineering and Howard & Associates reviewed each shear test pressure chart.

3. TEST PROCEDURE

Shear testing was performed in accordance with the Ensco BOP Shear Test Work Scope.

1416 S. Hugh Wallis Rd., Lafayette, LA 70508 **Ph (337) 264-1199**
e-mail: s.howard@hai-inc.com **Fax (337) 237-8124**

A Cameron Type DBLE U 13-5/8" – 10,000 psi BOP was used to perform the shear testing. The accumulators were set to a target pressure of 3,000 psi.

The shear testing procedure consisted of suspending the test joint within the BOP bore, charging accumulators, and closing the shear rams on the test joints. The pipe extended through the top of the BOP body, which was open to atmosphere. This procedure was repeated for each of the test joints.

4. TEST JOINTS – DESCRIPTION OF

Table 1 - Pipe Properties Summary

Shear Sample No.	*Pipe Diameter (in)*	*Nominal Wall Thickness (in)*	*Weight (lb/ft)*	*Grade*	*Joint Identification*	*Ultimate Tensile Strength (psi)*	*Yield Strength (psi)*	*Charpy Values Avg. (ft-lb) 3/4 size @ -4F*
1	3-1/2"	0.449	15.50	S-135	Heat No. 393831	156,000	140,000	65.7
2	5"	0.362	19.50	S-135	GP No. NAD51898	156,000	141,820	67.0
3	5"	0.500	25.60	S-135	GP No. 109D40	160,606	150,000	33.0
4	5-1/2"	0.415	24.70	S-135	Heat No. 488595	154,000	139,000	68.0
5	5-7/8"	0.361	23.40	S-135	Heat No. 9300239	157,000	140,000	70.3

5. TEST EQUIPMENT AND FACILITIES

5.1 BOP Assembly

Make:	Cameron	Main Bonnet:	13-1/2"
Type:	DBLE U	Booster:	11"
Bore:	13-5/8"	Assembly No.:	046432-08-01-30
Serial No.:	96-1321933-1	Product Description	
Wkg Pressure:	10,000 psi	Code:	CAM 5026

5.2 Ram Assembly

Make:	Cameron
Type:	ISR
Upper Ram:	2164773-02 Rev 03
	4501316685-03-06
	NC/55310
	HT/1 –MT-
Lower Ram:	2164774-02 Rev 02
	4501193534-03-13

NC/55310
HT/2 –MT-

5.3 Test Facilities

All testing was performed at the T3 Energy facility located in Houma, Louisiana. See **Photographs 1 through 3** for visual of test setup and BOP.

5.4 Test Instrumentation Calibration

All instruments used during the BOP shear test were found to be in calibration. **Table 2** below provides details on the instruments used and the calibration dates recorded. Note that "Chart Recorder #1" was used for tests C1 and C2. This recorder broke during test C2 and was subsequently replaced for the remaining tests shown in this report by "Chart Recorder 2."

Table 2 - Test Instrument Summary

Instrument	***Manufacturer***	***Serial Number***	***Range***	***Calibration Due Date***
Chart Recorder 1	ITT Barton	PI431	0-5,000 psi	09-15-2010
Chart Recorder 2	Reynolds	PI280	0-10,000 psi	02-10-2011
Gage 1 (Shear)	McDaniel Controls Inc.	PI649	0-10,000 psi	10-14-2010
Gage 2 (Accumulator)	McDaniel Controls Inc.	Reference	0-6,000 psi	N/A
Digital Caliper	Mitutoyo	07360593	0-6 inch	02-01-2011
OD Micrometer	Starrett	HAI4364	3-4 inch	4-28-2011
OD Micrometer	Scherr Tumico	HAI012	5-6 inch	4-28-2011
Wall Micrometer	Starrett	HAI222-1	0-1 inch	4-28-2011

6. TEST RESULTS

6.1 Test Dates

Testing was performed on June 29, 2010.

7. TEST WITNESSES

Witness	***Title***
Steve Labat	Operations Manager, T3 Energy
James Joseph	Test Stand Operator, T3 Energy
Sean O'Connor	Engineering Manager, Ensco
Gary Faciane	Senior Engineer, Ensco
Mike Guillory	Equipment Specialist, Ensco
Derrick Bordelon	Engineering Technologist, Howard & Associates
Charlie Kibbe	Senior Consultant, Howard & Associates
Jeff Bevers	Surveyor, West Engineering
Sammy Viola	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)
Justin Ledet	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)
Jerry Freeman	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)
James Richard	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)

If you have additional questions, please let us know. We appreciate this opportunity to work with you and Ensco International.

Best regards,

Steven P. Howard, President

Charlie Kibbe, P.E.

Jeremy Hebert

Attachments

Photograph 35 (5", 19.5 lb/ft Test Joint)

Test C4

Photograph 36 (5", 19.5 lb/ft Test Joint)

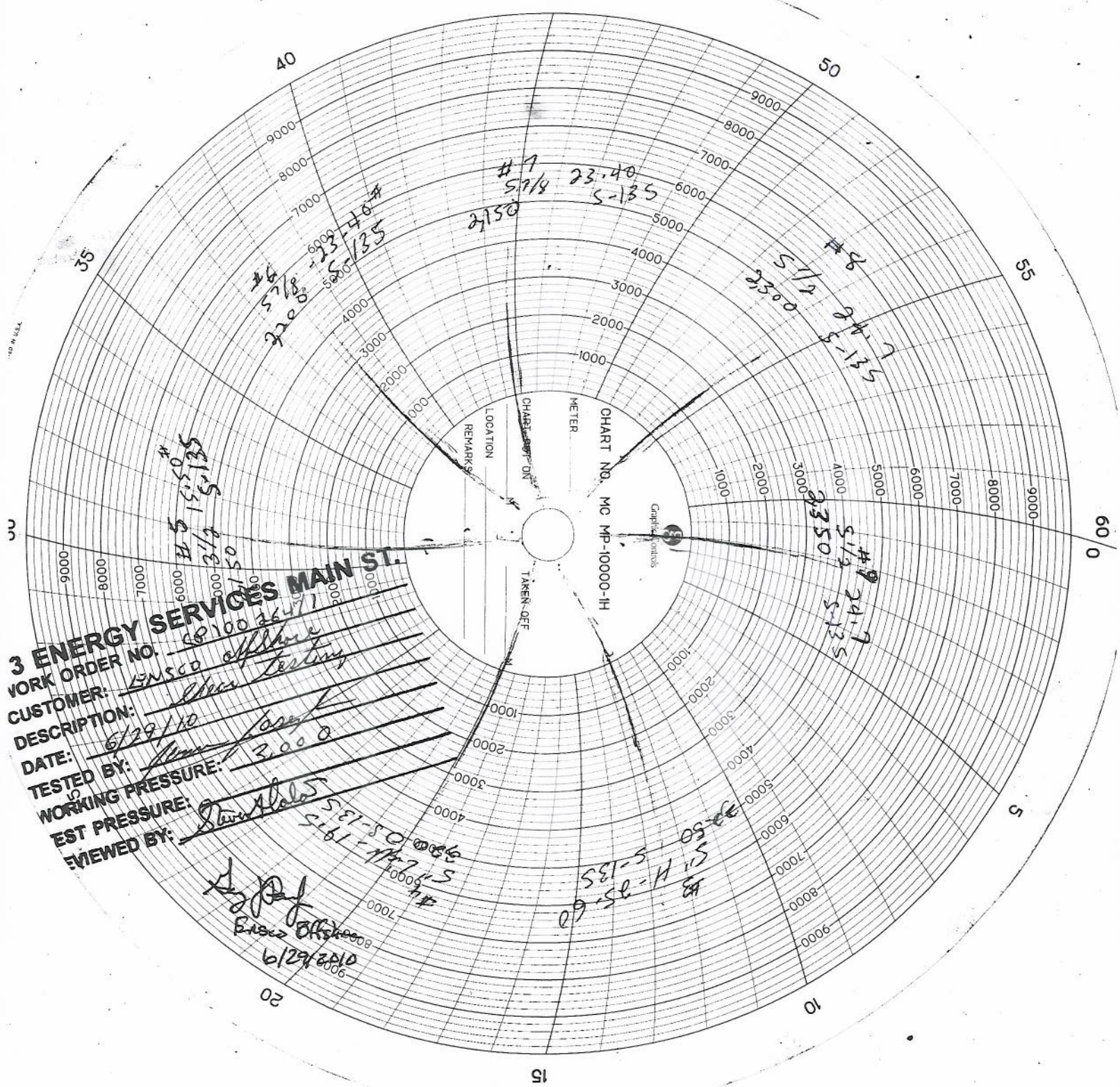
Test C4 (Bottom)

Photograph 37 (5", 19.5 lb/ft Test Joint)

Test C4 (Top)

Photograph 38 (5", 19.5 lb/ft Test Joint)

Test C12



C.I.W. 13-5/8" BOP

WITH ISR RAMS

P.O. Box 577
Brookshire, TX 77423
U.S.A

WEST ENGINEERING SERVICES
ISO 9001 Certified

Tel: (281) 375-5515
Fax: (281) 934-1600
west@westengineer.com

STATEMENT OF QUALIFICATIONS

Introduction

The Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) issued revisions to 30 CFR Part 250 to implement certain safety measures for Lessees regarding energy development on the OCS. Some include having an independent third party verify and/or certify specific capabilities of BOP and well control systems.

Qualifications

Per 30 CFR 250.416(g1); "*The independent third party must be a… licensed professional engineering firm capable of providing the verification required with this part.*" (See Items 1 - 13).

WEST:

1. is a registered Engineering firm in the state of Texas. A copy of our license is included. (See Section 9)
2. is a Well Control Equipment verification company, established in 1984, that places emphasis on technical excellence.
3. has conducted over 3700 surveys on WCE over the last 27 years for Operators and Contractors.
4. has 13 degreed engineers and 6 licensed professional engineers on staff.
5. draws upon the collective experience of a team of approximately 70 drilling equipment and BOP surveyors, each with an average field experience level of 19 years.
6. performs Failure Modes, Effects, and Criticality Analyses on a wide variety of drilling equipment ranging from Top Drives to Blow-Out Preventers and their control systems.
7. has created a database of Inspection and Test Procedures (ITPs) and Acceptance Test Procedures (ATPs) that detail procedures to ensure fitness-for-purpose.
8. maintains a database of Original Equipment Manufacturer product/engineering bulletins called RigLore, which serves as a single resource for manufacturer engineering history and record of design changes.
9. maintains continuously updated databases for drilling equipment anomalies and lessons learned. WEST also has a searchable failure database.
10. conducted 7 major technical studies over the past 15 years concerning WCE on topics including shear ram capabilities, secondary intervention methods in well control, high pressure high temperature BOP elastomer performance, BOP reliability, BOP multiplex control systems, and applicability of API recommended practices in US regulations. These studies help position WEST on the forefront of best available and safest technology (BAST).
11. provides specialized training and seminars on Well Control Equipment.
12. engineers participate in API standards committees. In this capacity, WEST is involved in revising API standards to meet the latest technological developments in drilling equipment.
13. engineers author and present SPE papers in peer reviewed events on a wide range of topics involving advanced drilling technology, the vast majority of which have been on BOP topics.

Per 30 CFR 250.416 (g2); …"*the firm you are using is reputable, the firm and its employees hold appropriate licenses to perform the verification in the appropriate jurisdiction, the firm carries industry standard levels of professional liability insurance, and the firm has no record of violations of applicable law.*" (See Items 14 – 15).

WEST:

14. is a sufficiently capitalized, insured (limited to a maximum of $1 million per incident), licensed professional engineering firm with no record of violations of applicable law (or ethical guidelines) and is willing to sign a certification under penalty of perjury. (See Sections 9, 10 & 11)
15. is an ISO 9001 certified company.

Jeffry P. Sattler, P.E.
Sr. Vice President, Engineering

6.2 Shear Test Summary

Three shear tests were performed per test joint listed in **Table 1**. Fifteen shears were completed successfully. All testing was witnessed by client representatives. Additionally, representatives from the Bureau of Ocean Energy Management, Regulation, and Enforcement observed shears C7 thru C14. See **Photographs 4 through 53** for images of the sheared test joints.

Table 3 - Shear Pressure Summary

Size	*Joint Description*	*Test Number*	*Shear Pressure (psi)*	*Accumulator Pressure (psi)*
5-7/8”	23.4 lb/ft, S-135, 0.361 wall	C1	2200	3000
5-7/8”	23.4 lb/ft, S-135, 0.361 wall	C6	2200	3000
5-7/8”	23.4 lb/ft, S-135, 0.361 wall	C7	2150	3000
5-1/2”	24.7 lb/ft, S-135, 0.415 wall	C2	2400	3000
5-1/2”	24.7 lb/ft, S-135, 0.415 wall	C8	2300	3100
5-1/2”	24.7 lb/ft, S-135, 0.415 wall	C9	2350	3000
5”	25.6 lb/ft, S-135, 0.500 wall	C3	2250	3100
5”	25.6 lb/ft, S-135, 0.500 wall	C10	2200	3000
5”	25.6 lb/ft, S-135, 0.500 wall	C11	2300	3000
5”	19.5 lb/ft, S-135, 0.362 wall	C4	2200	3000
5”	19.5 lb/ft, S-135, 0.362 wall	C12	2150	3000
5”	19.5 lb/ft, S-135, 0.362 wall	C13	2200	3000
3-1/2”	15.5 lb/ft, S-135, 0.449 wall	C5	2150	3000
3-1/2”	15.5 lb/ft, S-135, 0.449 wall	C14	2200	3000
3-1/2”	15.5 lb/ft, S-135, 0.449 wall	C15	2200	3000

6.3 Post-Shear Ram Inspection

After the shear tests, the rams were removed from the BOP and visually inspected. Visual inspection of the rams found mechanical damage on both upper and lower blades. Magnetic particle inspection of both the upper and lower rams found longitudinal and transverse cracking near the edge of the rams that contacted the pipe during the shearing operations. See **Photographs 54 through 58.**

Texas Board of Professional Engineers
CERTIFICATE OF REGISTRATION

This acknowledges that

WEST HOU, INC.
DBA: WEST ENGINEERING SERVICES

has fulfilled the requirements of the Texas Board of Professional Engineers to offer and perform engineering services in the state of Texas.

Registration Number	Expiration Date
F-4672	3/31/2012

P.O. Box 577
Brookshire, TX 77423
U.S.A

WEST ENGINEERING SERVICES

Tel: (281) 375-5515
Fax: (281) 934-1600
west@westengineer.com

ISO 9001 Certified

02 August 2011

To Whom It May Concern:

As regards to the use of WEST's engineering professional status in commercial transactions, WEST states that no prior or present violation of applicable law has been charged by others.

Please contact us if you require any additional information.

Sincerely,

Jeffry P. Sattler,

For WEST Engineering Services, Texas Registration No. F-4672

Section 11

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 7/27/2011

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER

Frank Crystal & Co of TX, Inc.
2000 West Loop S., Suite 1800
P.O. Box 27723
Houston TX 77227-7723

CONTACT NAME:
PHONE (A/C, No, Ext):
FAX (A/C, No):
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Axis Insurance Company	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED

WESTEN1

West Hou, Inc.
DBA West Engineering Services
P. O. Box 577
Brookshire TX 77423

COVERAGES **CERTIFICATE NUMBER:** 571748096 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	CLAIMS-MADE / OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
							GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	POLICY / PRO-JECT / LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS / NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB / OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB / CLAIMS-MADE						AGGREGATE	$
	DED / RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY						WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A					E.L. EACH ACCIDENT	$
							E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
A	Professional Liability (Claims Made)			ECN000069801001	8/5/2010	8/5/2011	Limit of Liability Retention	$1,000,000 $100,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

"To Whom It May Concern"

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Frank Crystal & Co. of Tex. Inc.

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