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

WEST ENGINEERING SERVICES

ISO 9001:2008 Certified

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

Mr. Ken Armagost
Technology Project Leader
BP

17-Nov-2010

Subject: GSF Development Driller III, MC 252 #2
Reference: Shear Verification per 30 CFR §250.416(e),
formerly BOEM NTL No. 2010-N05 (Part I)

Dear Mr. Armagost:

Please find attached the Blind-Shear Ram Certificate and related documents for the GSF Development Driller III. The calculations were carried out according to the Distortion Energy Method detailed in Shear Ram Capabilities Study No. 3-4025-1001 for the U.S. Minerals Management Service. 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 input data and 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. This statement 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.

Summary Table of Test Results:

Pipe	MASP [psi]	Shear Pressure [psi]	Comment
5.875", 0.500" wall, S-135	0	1,875	Actual Net Shear Test pressure
5.875", 0.500" wall, S-135	5,700	2,124	Actual Net Shear Test pressure corrected for MASP

Summary Table of Calculated Theoretical Results:

Pipe	MASP [psi]	Shear Pressure [psi]	Comment
5.875", 0.500" wall, S-135	5,700	2,291	Tested and Certified

Sincerely,

Original sent via email

Charles N. White
for WEST Engineering Services, Texas Registration No. F-4672

WEST Job Number: 4058

Table of Contents

Packet Sections:

1. Blind-Shear Ram Certificate
   a. 5.875”, 0.500” wall, S-135 Drill Pipe Shear Certificate
2. WEST Qualifications
   a. Statement of Qualifications
   b. Texas State PE Certificate
3. Shear Calculations Input Data
4. Shear Calculations
   a. Test results from pipe requiring highest shear pressure
   b. Calculations of shearing capability of all pipe to be used in the well, including correction for MASP
5. Shear Test Reports (including chart recorder graph)
   a. from Shear Test report HO05-011 Test #2 on 5.875”, 0.500” wall, S-135

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

WEST ENGINEERING SERVICES
ISO 9001:2008 Certified

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

Blind-Shear Ram Certificate

In accordance with 30 CFR §250.416(e), formerly BOEM NTL 2010-N05 (Part I) **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.

Client:	BP
West Job Number:	4058
Rig:	GSF Development Driller III
Operator:	BP
Contractor:	Transocean
Depth (ft):	5,134
EQUIPMENT / CALCULATION INFORMATION	
BOP:	Hydril 18-15M RBOP
Type of Shear Operator:	22" Operator
Type of Shear Ram:	BSR (Blind Shear Ram)
Hydraulic Pressure Supplied to Operator:	3,000 psi
Tubular:	5.875", 0.500" wall, S-135
Tubular Nominal Yield Strength:	135,000 psi
Maximum Wellbore Pressure at BOP:	5,700 psi
Actual Shear Pressure from Test:	1,875 psi
Actual Shear Pressure from Test, corrected for wellbore pressure and hydrostatic effects:	2,124 psi
Calculated Pressure Required to Shear, corrected for wellbore pressure and hydrostatic effects:	2,291 psi
Calculation Method:	Distortion Energy Method detailed in *Shear Ram Capabilities Study* No. 3-4025-1001 for the MMS

Calculations Performed by: Jon Heerensperger JH Date: 17 Nov 2010

Calculations Approved by: Eric Deutsch ED Date: 17 Nov 2010

Certificate Approval: Date: 17 Nov 2010

Charles N. White,
for WEST Engineering Services, Texas Registration No. F-4672

NOTE – Certification is only valid for fully functional equipment maintained according to manufacturers' requirements.

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

WEST ENGINEERING SERVICES

ISO 9001:2008 Certified

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

SECTION 2

STATEMENT OF QUALIFICATIONS

Introduction

The BOEMRE (formerly the MMS) issued a Notice to Lessees regarding increased safety measures for energy development on the OCS. To comply with NTL No. 2010-N05 operators must complete various activities. Some include having an independent third party verify and/or certify specific capabilities of BOP and well control systems.

Qualifications

The NTL requires verification documents and certificates be accompanied by a description of the qualifications of the independent third party. To that end, WEST submits the following for your use in that capacity. WEST

- is a sufficiently capitalized, insured, 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.
- assures that an official representative of the BOEMRE (formerly MMS) is allowed access upon request to the place where tests and inspections take place, to verify the information submitted in the application, or to witness tests and inspections.
- is a registered Professional Engineering firm in the state of Texas. A copy of our license is included.
- is a Well Control Equipment (WCE) verification company, established in 1984, that places emphasis on technical excellence.
- has conducted over 3700 surveys on WCE over the last 25 years for Operators and Contractors.
- has 13 degreed engineers and 3 licensed professional engineers on staff.
- 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).
- provides specialized training and seminars on Well Control Equipment.
- is an ISO 9001:2008 certified company.
- 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.
- 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.
- maintains up-to-date BOP history for all surveyed rigs, including ram cavity measurements, anomalies, and survey records.
- draws upon the collective experience of a team of approximately 70 drilling equipment and BOP surveyors, each with an average field experience level of 29 years.
- 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.
- has created a database of Inspection and Test Procedures (ITPs) and Acceptance Test Procedures (ATPs) that detail procedures to ensure fitness-for-purpose.
- 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.
- maintains continuously updated databases for drilling equipment anomalies and lessons learned. WEST also has a searchable failure database.
- creates and distributes periodic Technical Alerts on unexpected failure modes observed during field operations.

I attest that WEST Engineering Services is a Licensed Professional Engineering firm and the information on this Statement of Qualifications is accurate.

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

Texas Board of Professional Engineers
CERTIFICATE OF REGISTRATION

This acknowledges that

WEST ENGINEERING SERVICES INC

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	3/31/2011

WEST ENGINEERING SERVICES

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.)	Hydril
Ram BOP Model Designation (U, TL, SL, etc.)	RBOP
BOP Size and Pressure Rating (18 3/4" - 15K, etc.)	18 3/4 - 15K
Shear Operator Configuration or Bonnet Size (SBT, LBT, etc.)	22"
Shear Ram Type (Ram Design)	BSR
Shear Operator Hydraulic Area (if non-Cameron) [sq. inches]	380.13
Shear Operator Closing Ratio (if non-Cameron)	14.64:1
Hydraulic Pressure Supplied to Operator [psi]	3000

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	5.875	4.875	0.5	23.4	S-135	135	**Shear Test #2: HO 05-011**

Well Information	
Existing West Job # or New Purchase Order No. (if new job) *	WBS Element Z4-005C8-E:PA2 - P&A MC252#2
Rig Name	Developmental Driller III
Drilling Contractor (rig owner)	Transocean
Operator (oil company)	BP
Well Name	DC314 ST01 BP00
MASP (Maximum Anticipated Surface Pressure) [psi]	5,700

* - FR# if PO# is unavailable

Kenneth Armagost — Information provided by (please print name above)

11/10/2010 — Date

Requested Delivery Date for Shear Certification: 11/17/2010

Date

Your service request will be picked up as soon as team member availability allows. However, you should not expect turn around for shear verification requests within less than 7 days.
Also, please note that subsequent changes to input data are likely to delay certification.

Rev - 20100910cw

Section 4.a.1
Hydril 18-15M BOP BSR, 22" Operator
Test Pressure Corrected for MASP & Hydrostatic
5.875", 0.500" wall , S-135

Change in Shear Pressure due to MASP & Hydrostatic Effects

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

$= MASP / C_r$

ΔP_{hyd} - Change in Shear Pressure due to Hydrostatic Effects**

P_t - Total Shear Pressure $= P_r + P_i + \Delta P_{hyd}$

P_a [psi]	1875	
MASP [psi]	5700	
C_r	14.64	
Increase in Shear Press., P_i	389	psi
Hydrostatic Effect, ΔP_{hyd}	-141	
Total Shear Pressure, P_t	2,124	psi

Input

Output

* Stated Yield Strength is the client-reported pipe yield stress, generally the nominal yield stress corresponding to pipe grade (135 ksi for S-135).

Section 4.b.1
Hydril 18-15M BOP BSR, 22" Operator
5.875", 0.500", S-135

Maximum/Theoretical Drill Pipe Shear Pressure

WEST Engineering Services

$F_v = (1.18)(0.577)A_g\sigma_y$

A_g - Pipe Cross-Sectional Area = $(OD^2 - ID^2) \times 3.14 / 4$

σ_y - Stated Yield Strength*

$P_r = F_v / A_c$

	Closing Area, A_c	380	in^2		
Pipe	OD [in]	5.875	A_g =	8.443	in^2
	Wall [in]	0.5			
	σ_y [ksi]	135			
	Required Force, F_v =	776	kips	Input	
	Required Pressure, P_r =	2,042	psi	Output	

Increased Shear Pressure due to Pressure in the Wellbore

WEST Engineering Services

P_r - Required Shear Pressure (calculated above)

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

$= MASP / C_r$

ΔP_{hyd} - Change in Shear Pressure due to Hydrostatic Effects**

P_t - Total Shear Pressure = $P_r + P_i + \Delta P_{hyd}$

MASP [psi]	5700		Input
C_r	14.64		Output
Increase in Shear Press., P_i	389	psi	
Hydrostatic Effect, ΔP_{hyd}	-141	psi	
Total Shear Pressure, P_t	2,291	psi	

* Stated Yield Strength is the client-reported pipe yield stress, generally the nominal yield stress corresponding to pipe grade (135 ksi for S-135).

** Calculations shown on a separate sheet

Section 4.c

Change in Closing Pressure due to Hydrostatic Head of Control Fluid & Seawater

WEST Engineering Services

Variable	Description	Formula	Value	Units
At	Tailrod Area		0.00	in^2
Ac	Closing Area		380.00	in^2
Ar	Ramshaft Area	Ac/Cr	25.96	in^2
Ao	Opening Area	(Ac + At) - Ar	354.04	in^2
Cr	Closing Ratio		14.640	
Gcf	Control Fluid Pressure Gradient		0.442	psi/ft
Hcf	Height of Control Fluid Column		5134	ft
Gsw	Seawater Pressure Gradient		0.445	psi/ft
Hsw	Height of Seawater Column (water depth to BOP)		5134	ft
Pcf	Pressure due to Hydrostatic Head of Control Fluid	Gcf * Hcf	2,269	psi
Psw	Pressure due to Hydrostatic Head of Seawater	Gsw * Hsw	2,285	psi
F_{Osw}	Opening Force due to Seawater Head on Operator	Psw * Ao	808,859	lb
F_{Ccf}	Closing Force due to Control Fluid Head on Operator	Pcf * Ac	862,307	lb
F_{Ctr}	Closing Force due to Seawater Head on Tailrod	Psw * At	0	lb
ΔP_{hyd}	Change in Closing Pressure due to Hydrostatics	$(F_{Osw} - F_{Ccf} - F_{Ctr}) / Ac$	-141	psi

Input
Output

Shear Tests for BP Atlantis
Schlumberger SenTREE-7 and
GSF DDII Tubulars

Report: HO05-011 Rev A1 **Test Date: 08-Mar-2005**

Prepared by: David E. Wendt
Senior Engineer, Pressure Control

Approved by: Mike Berckenhoff, PE
Lead Engineer, Pressure Control

HYDRIL® is a registered trademark and service mark of Hydril Company LP

©2005 Hydril Company LP
All rights reserved

Access 2

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

Table Of Contents

1. Scope 4

2. References 4

2.1 Documents 4
2.2 Glossary 4

3. Test Procedure 4

4. Test Articles – Description of 5

5. Test Results 5

5.1 Test Dates 5
5.2 Shear Test Summary 5

6. Test Equipment and Facilities 6

6.1 BOP Assembly 6
6.2 Ram Assemblies 6
6.3 Test Facilities 6
6.4 Test Instrument Calibration 6

7. Test Witnesses 7

8. Shear Test Data 8

Appendix B 16

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

List of Figures

Figure 1 Shear No. 1 Closing Pressure. Schlumberger SenTREE 7 w/ Control Hoses 8
Figure 2 Shear No. 1 Wellbore Pressure. Schlumberger SenTREE 7 w/ Control Hoses 9
Figure 3 Shear No.2 - Operator Closing Pressure, 5 7/8" 32.25 lb/ft S135 10
Figure 4 Shear No.2 Wellbore Pressure Test, 5 7/8" 32.25 lb/ft S135 11
Figure 5 Shear No.3 - Operator Closing Pressure, 6 5/8" 39.4 lb/ft S135 Pipe 12
Figure 6 Shear No.3 Wellbore Pressure Test, 6 5/8" 39.4 lb/ft S135 Pipe 13
Figure 7 Shear No.4 - Operator Closing Pressure, 6 5/8" 56.5 lb/ft S135 Pipe 14
Figure 8 Shear No.4 Wellbore Pressure Test, 6 5/8" 56.5 lb/ft S135 Pipe 15
Figure 9 Shear No.1 Schlumberger SenTREE 7, Upper Half 17
Figure 10 Shear No.1 Schlumberger SenTREE 7, Upper Half 17
Figure 11 Shear No.1 Schlumberger SenTREE 7 17
Figure 12 Shear No.2 Upper Half 17
Figure 13 Shear No.2 Lower Half 18
Figure 14 Shear No.3 Upper Half 18
Figure 15 Shear No.3 Lower Half 18
Figure 16 Shear No.4 Upper Half 18
Figure 17 Shear No.4 Lower Half 18
Figure 18 Upper Shear Ram & Blade 18
Figure 19 Lower Shear Ram & Blade 19

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

1. Scope

This document is the Final Report on the results of a series of four shear tests for the BP Atlantis Project.

The objective of testing was to provide data for the customer to validate shearing performance for the supplied test articles with the Hydril 18 ¾" – 15000 psi Compact Ram BOP fitted with Blind/Shear Rams.

2. References

2.1 Documents

Hydril Drawing 3123133 Rev NC, "QTP Casing Shear Rams 18 ¾ - 15,000 Ram BOP"

Hydril Drawing 3112106 Rev F1, "Qualification Test Procedure, Ram Blowout Preventer"

API Specification 16A, "Specification for Drill Through Equipment," Second Edition.

2.2 Glossary

Opening Pressure – the pressure measured on the opening side of the operator piston.

Closing Pressure - the pressure measured on the closing side of the operator piston.

Net Closing Pressure - a calculated value computed by subtracting the pressure on the opening side of the circuit from the pressure applied to the closing side. The pressure on the opening side is a function of operator piston velocity, outlet orifice size, and outlet backpressure. The Closing Pressure will always be higher than Net Closing Pressure when the operator is in motion.

3. Test Procedure

Shear testing was performed in accordance with Hydril Qualification Test Procedure 3112106

A Hydril 18 3/4 - 15,000 psi Ram BOP with 22 inch operators and blind/shear rams was used to perform the shear testing. The operator regulators were set to 3000 psi.

The shear testing procedure consisted of suspending the test article within the wellbore, charging the accumulators, setting the regulator, closing the shear rams on the test articles, the performing a wellbore pressure test. This procedure was repeated for each of the test articles.

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

4. Test Articles – Description of

Table 1 Pipe Properties Summary of Client Furnished Data

Shear Sample No.	*PIPE DIA*	*WALL THICK NESS (IN)*	*WEIGHT (lb/ft)*	*GRADE*	*DESCRIPTION OF SHEAR SAMPLE.*	*ULTIMATE TENSILE STRENGTH (PSI)*	*% ELONG*
1	7 1/8”	.688	47.2	n/a	Sentree7 Latch Mandrel w/ Control Hoses	n/a	n/a
2	5 7/8”	.500	28.7	S-135	Grant Prideco Vœst Alpine Heat No.443372	157145	27.1
3	6 5/8”	.415	27.5	S-135	Grant Prideco Vœst Alpine Heat No.444619	153446	24.5
4	6 5/8”	.813	50.4	S-135	Grant Prideco Tenaris Heat No.19987	154490	21.3

5. Test Results

5.1 Test Dates

Testing was performed on the 8th of March, 2005

5.2 Shear Test Summary

Four shears were successfully completed on each of the different configurations listed in Table 2. Test results are plotted in Figure 1 through Figure 8.

The first shear test was performed on the Schlumberger SenTREE-7 Latch Mandrel and Hose assembly. The pipe sheared completely but some of the hoses did not. Some hoses were pinched but not severed. The pinched hoses prevented the lateral t-seal from sealing, thus the Wellbore Low Pressure test failed. The rams were cycled open and closed. Again the Wellbore Low Pressure test failed. The rams were opened and the upper half of the latch mandrel was removed from the BOP. The Wellbore Low Pressure Test passed, holding 300 psi for 3 minutes.

The next three shears and subsequent wellbore pressure tests were successful.

All testing was witnessed by client representatives.

Table 2 Max Closing Pressure Summary

TEST DATE	*TEST DESCRIPTION*	*SHEAR ARTICLE DESCRIPTION*	*MAX SHEAR PRESSURE*	*DATA FILE NAME*
19-Jan-05	Shear No. 1:	7.125 in. OD x 5.75 in. ID SenTREE-7 Latch Mandrel w/ Control Hoses	2441	CJY1
19-Jan-05	Shear No. 2:	Vœst Alpine 5 7/8" OD .500” wall S135	2133	CJY2
19-Jan-05	Shear No. 3:	Vœst Alpine 6 5/8" OD .415” wall S135	1895	CJY3
19-Jan-05	Shear No. 4:	Tenaris 6 5/8" OD .813” wall S135	2564	CJY4

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

6. Test Equipment and Facilities

6.1 BOP Assembly

Hydril 18 3/4 - 15,000 Light Weight Ram BOP PN: 3121063

6.2 Ram Assemblies

Table 3 provides the part numbers and serial numbers of the replaceable ram components used in the shear test.

Table 3 Replaceable Ram Components

REPLACEABLE RAM COMPONENTS	*PART NO.*	*SERIAL NO.*
Upper Carrier	3118551	L8852
Lower Carrier	3116838	8916-3
Upper Blade	3120904	L9636-5
Lower Blade	3117591	L9559-9

6.3 Test Facilities

All testing was performed at the Hydril Test and Demonstration Facility; Hydril Technology Center; Houston, Texas.

6.4 Test Instrument Calibration

Hydril lab instruments were calibrated in accordance with HTC Quality Control Instructions QI 29-115 and its attachments A and B. Table 4 below provides details on the pressure transducers used in the test.

Table 4 Test Instrument Summary

INSTRUMENT	*MFGR*	*MODEL*	*RANGE*
Pressure Transducer Regulator Pressure, PR	Stellar	GT1650-5000G-104	0 to 5000 PSIG
Pressure Transducer Closing Pressure, PC	Stellar	GT1650-5000G-104	0 to 5000 PSIG
Pressure Transducer Opening Pressure, PO	Stellar	GT1650-5000G-104	0 to 5000 PSIG

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

7. Test Witnesses

Witness	*Title*
Marvin Morrison	Schlumberger SenTREE 7
Johnathan Gulick	Senior Drilling Engineer, BP America, Inc.
Mahiram Sankar	Atlantis Wellsite Leader, BP Exploration & Production, Inc.
GA Knowles	Fishing Tool Supervisor, Smith Services
David Wendt	Senior Engineer, Hydril Company LP.
Dennis Colvin	Senior Test Lab Operator, Hydril Company LP.
Jeff Yeager	Senior Test Lab Operator, Hydril Company LP.

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

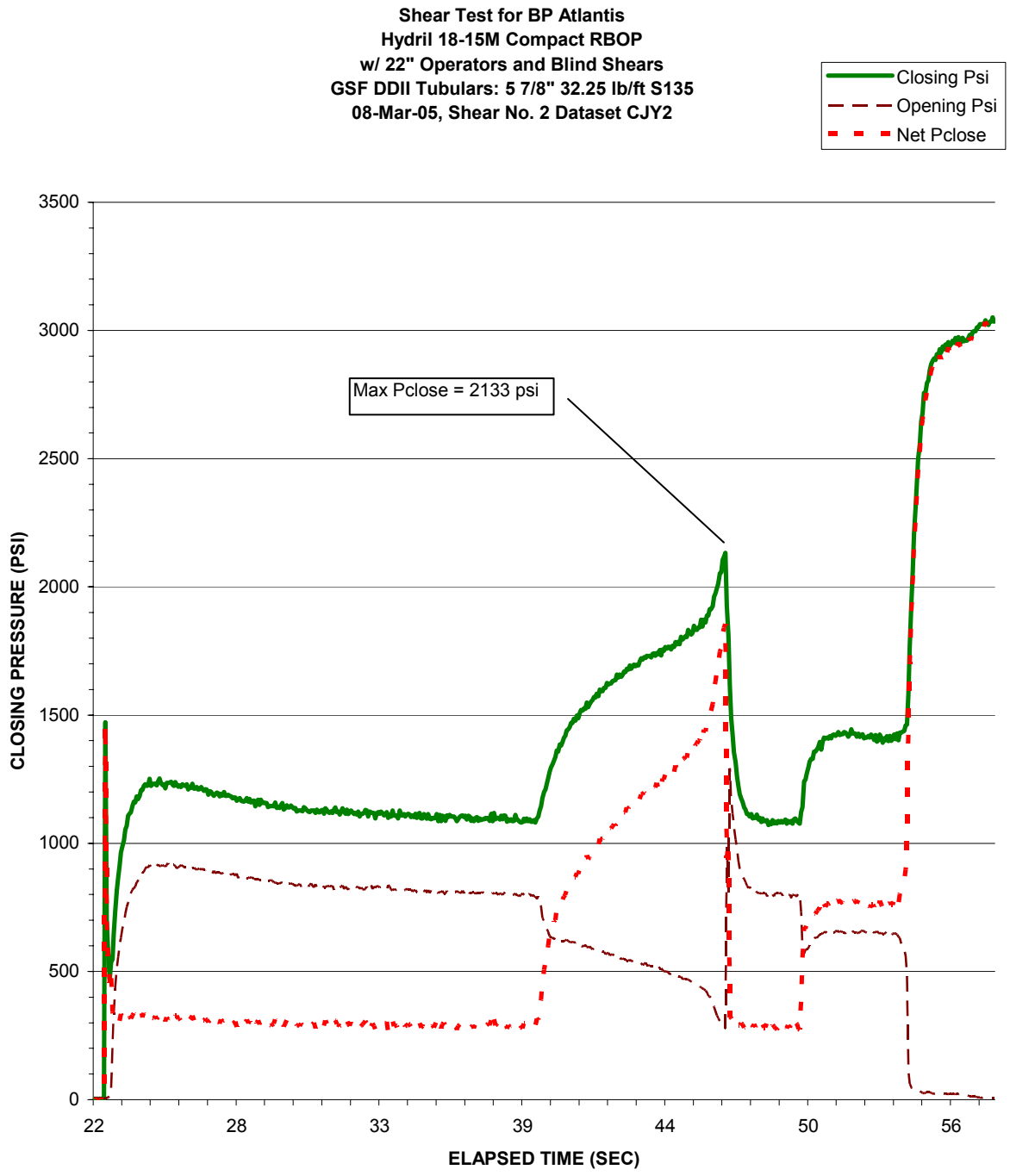


Figure 3 Shear No.2 - Operator Closing Pressure, 5 7/8" 32.25 lb/ft S135

LATEST REVISION Printed on : Wed Jun 02 15:53:34 CDT 2010 GE Oil & Gas

FOR REFERENCE ONLY

NOV Grant Prideco™

Drill Pipe Performance Characteristics ©

Version 2009.1.7.4 - Engineering Release

Pipe Size and Weight: 5-7/8" 0.500"wt XR™ IEU
Pipe Grade: S-135
Range: 2
Tool Joint: 7.000 X 4.250 XTM57

Pipe

	New	Premium		New	Premium
OD (in)	5.875	5.675	Torsional strength (ft-lbs)	135,900	106,100
Wall thickness (in)	0.500	0.400	Tensile strength (lbs)	1,139,800	894,900
ID (in)	4.875	4.875			
Calculated plain end weight (lbs/ft)	28.703	22.535	80% Torsional strength (ft-lbs)	108,700	84,900

Note: Premium properties are calculated based on uniform OD and wall thickness.

Cross sectional area pipe body (in²)	8.443	6.629	Pressure capacity (psi)	20,106	18,383
Cross sectional area OD (in²)	27.109	25.294	Collapse capacity (psi)	21,023	14,824
Cross sectional area ID (in²)	18.665	18.665			
Section modulus (in³)	10.470	8.172			
Polar section modulus (in³)	20.939	16.344			

Tool Joint (120000 material Yield Strength)

XTM57

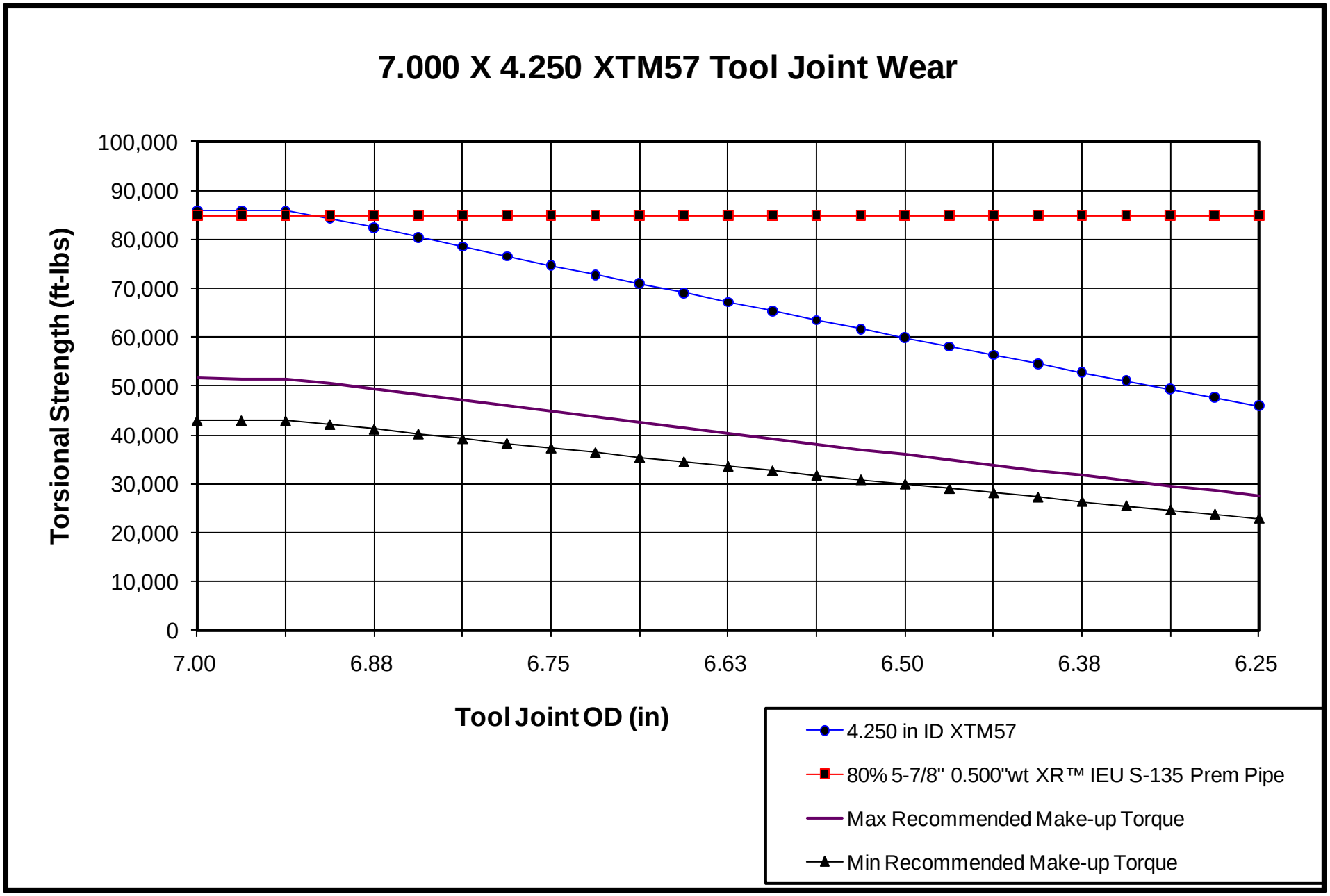
OD (in)	7.000
ID (in)	4.250
Smooth Edge OD (in)	7.188
Pin tong length (in)	16.0
Box tong length (in)	17.0
Torsional Strength (ft-lbs)	86,000
Max Recommended Make-up Torque (ft-lbs)	51,600
Min Recommended Make-up Torque (ft-lbs)	43,000
Balance OD (in)	6.930
Tensile strength (lbs)	1,200,500
Tool joint/Drill pipe torsional ratio (New pipe)	0.63
Tool joint/Drill pipe torsional ratio (Prem pipe)	0.81
Minimum OD for Premium	6.915

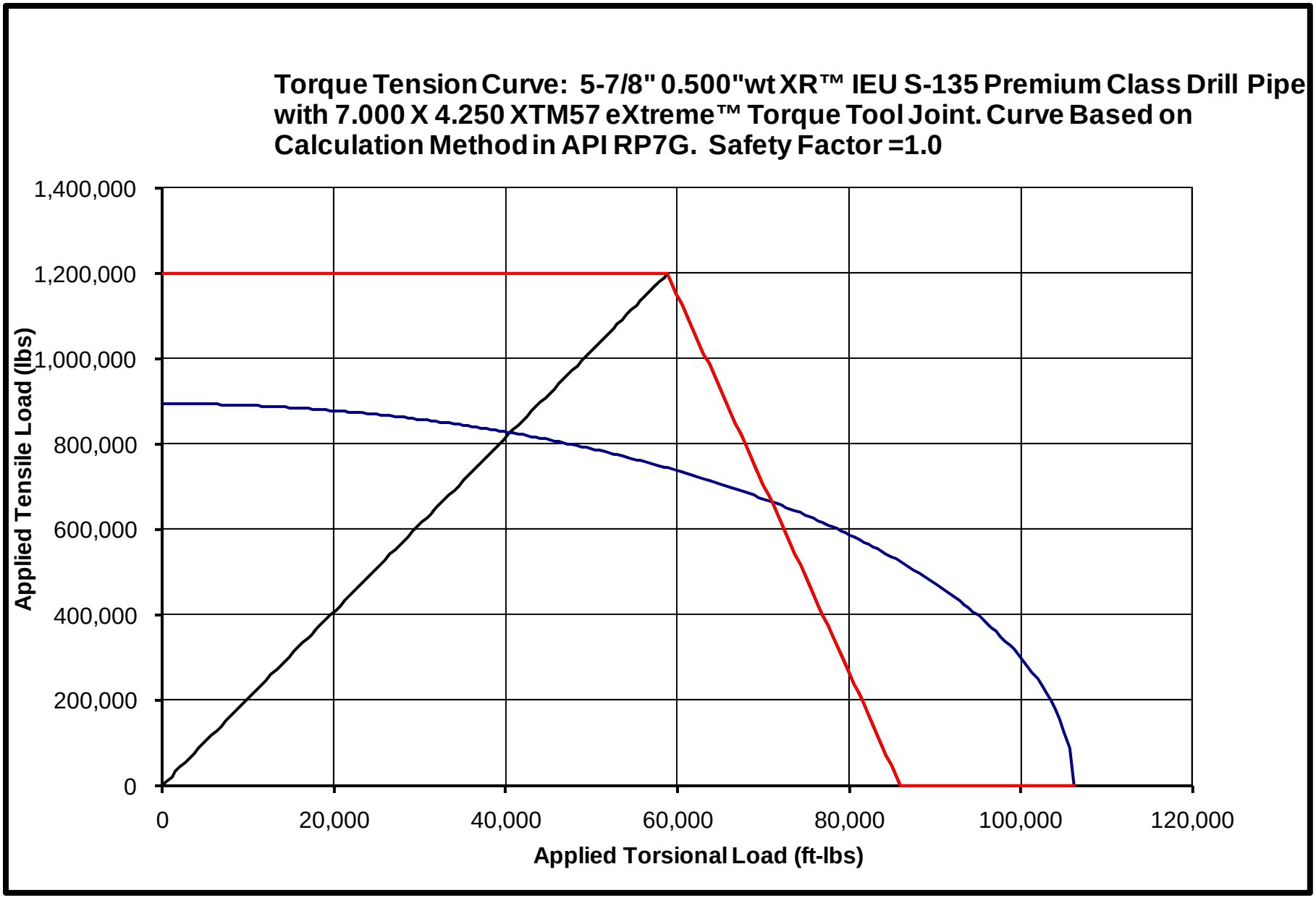
Minimum make-up is based on shoulder separation caused by bending.

Drill Pipe assembly with Grant Prideco XTM57 eXtreme™ Torque Connection

Adjusted weight (lbs/ft)	34.14
Approximate length (ft)	32.52
Fluid displacement (gal/ft)	0.522
Fluid capacity (gal/ft)	0.940
Drift size (in)	4.125

CWL 5/3/2010


7.000 X 4.250 XTM57 Tool Joint Wear
Torsional Strength (ft-lbs)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
7.00
6.88
6.75
6.63
6.50
6.38
6.25
Tool Joint OD (in)
4.250 in ID XTM57
80% 5-7/8" 0.500"wt XR™ IEU S-135 Prem Pipe
Max Recommended Make-up Torque
Min Recommended Make-up Torque


Torque Tension Curve: 5-7/8" 0.500"wt XR™ IEU S-135 Premium Class Drill Pipe with 7.000 X 4.250 XTM57 eXtreme™ Torque Tool Joint. Curve Based on Calculation Method in API RP7G. Safety Factor =1.0
Applied Tensile Load (lbs)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
0
20,000
40,000
60,000
80,000
100,000
120,000
Applied Torsional Load (ft-lbs)